MECHANICAL SYMBOLS

THIS IS A MASTER LEGEND AND NOT ALL SYMBOLS OR ABBREVIATIONS ARE USED. V2.01

STANDARD MOUNTING HEIGHT

THERMOSTATS (USER ADJUSTABLE)(TOP OF DEVICE)	48"
CONTROLS (TOP OF DEVICE)	48"

USE THE DEFAULT MOUNTING HEIGHTS SHOWN ABOVE UNLESS NOTED OTHERWISE IN THE SPECIFICATIONS OR ELSEWHERE. MOUNTING HEIGHTS LISTED ARE ABOVE FINISHED FLOOR (AFF) OR ABOVE FINISHED GRADE (AFG) TO TOP OF DEVICE. ALL DEVICES SHALL BE INSTALLED IN COMPLIANCE WITH CURRENT ADA AND LOCAL REQUIREMENTS.

ANNOTATION

- 1 — MECHANICAL PLAN NOTE CALLOUT
- CU / 1 — MECHANICAL EQUIPMENT DESIGNATION (CONTRACTOR FURNISHED AND INSTALLED UNLESS NOTED OTHERWISE)
- CONNECTION POINT OF NEW WORK TO EXISTING
- 1 / M1 — DETAIL REFERENCE. UPPER NUMBER INDICATES DETAIL NUMBER LOWER NUMBER INDICATES SHEET NUMBER
- 1 / M1 — SECTION CUT DESIGNATION

ABBREVIATIONS

A/C	AIR CONDITIONING
ACCU	AIR COOLED CONDENSING UNIT
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHJ	AUTHORITY HAVING JURISDICTION
AHU	AIR HANDLING UNIT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
AP	ACCESS PANEL
APD	AIR PRESSURE DROP
AWG	AMERICAN WIRE GAUGE
BAS	BUILDING AUTOMATION SYSTEM
BB	BACKBONE
BD	BACKDRAFT DAMPER
BD	BLOWDOWN
BFC	BELOW FINISHED CEILING
BFF	BELOW FINISHED FLOOR
BHP	BRAKE HORSEPOWER
BI	BINARY INPUT
BO	BINARY OUTPUT
BOD	BOTTOM OF DUCT
BOS	BOTTOM OF STRUCTURE
BTU	BRITISH THERMAL UNIT
CFM	CUBIC FEET PER MINUTE
CLG	COOLING
CP	CONDENSATE PUMP
CPT	CONTROL POWER TRANSFORMER
CV	CONTROL VALVE
CWP	CONDENSER WATER PUMP
CU	CONDENSING UNIT
CHWP	CHILLED WATER PUMP
DB	DECIBELS
DBA	DECIBEL AVERAGE
DDC	DIRECT DIGITAL CONTROL
DI	DIGITAL INPUT
DISC	DISCONNECT
DN	DOWN
DS	DUCT SILENCER
DX	DIRECT EXPANSION
(E)	EXISTING
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
ED	EXHAUST DUCT
EDB	ENTERING DRY BULB
EF	EXHAUST FAN
EFF	EFFICIENCY
EMS	ENERGY MANAGEMENT SYSTEM
ESP	EXTERNAL STATIC PRESSURE
ETR	EXISTING TO REMAIN
EWB	ENTERING WET BULB
EWT	ENTERING WATER TEMPERATURE
FCU	FAN COIL UNIT
FF	FINISHED FLOOR
FPI	FINS PER INCH
FPM	FEET PER MINUTE
GC	GENERAL CONTRACTOR
GPM	GALLONS PER MINUTE
HP	HORSEPOWER
HTG	HEATING
HWP	HEATING WATER PUMP
IN WC	INCHES OF WATER COLUMN
L	LOUVER
LAT	LEAVING AIR TEMPERATURE
LDB	LEAVING DRY BULB
LP	LOW PRESSURE
LWB	LEAVING WET BULB
LWT	LEAVING WATER TEMPERATURE
MAX	MAXIMUM
MBH	1000 BTU PER HOUR
MD	MOTORIZED DAMPER
MFR	MANUFACTURER
MIN	MINIMUM
N/A	NOT APPLICABLE
N/C	NORMALLY CLOSED
N/O	NORMALLY OPEN
NOM	NOMINAL
NC	NOISE CRITERIA
NF	NON-FUSED
NIC	NOT IN CONTRACT
OA	OUTSIDE AIR
PICV	PRESSURE INDEP. CONTROL VALVE
PROVIDE	FURNISH AND INSTALL
QTY	QUANTITY
RA	RETURN AIR
RC	ROOM CRITERIA
RD	RETURN DUCT
REA	RELIEF AIR
RF	RETURN FAN
RFR	REFRIGERANT
RH	RELATIVE HUMIDITY
RH	ROOF HOOD
RPM	REVOLUTIONS PER MINUTE
RTU	ROOFTOP UNIT
SA	SUPPLY AIR
SD	SMOKE DUCT DETECTOR
SD	SUPPLY DUCT
SF	SUPPLY FAN
SH	SENSIBLE HEAT CAPACITY
SOW	SCOPE OF WORK
SP	STATIC PRESSURE
ST	STEAM TRAP
STM	STEAM
TBD	TO BE DETERMINED
TC/C	TEMPERATURE CONTROLS CONTRACTOR
TCP	TEMPERATURE CONTROL PANEL
TF	TRANSFER FAN
TH	TOTAL HEAT CAPACITY
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
UH	UNIT HEATER
UNO	UNLESS NOTED OTHERWISE
VAV	VARIABLE AIR VOLUME
VEL	VELOCITY
VFD	VARIABLE FREQUENCY DRIVE
VRF	VARIABLE REFRIGERANT FLOW
W/	WITH
W/O	WITHOUT
WB	WET BULB
WC	WATER COLUMN
WPD	WATER PRESSURE DROP

HVAC DUCTWORK AND ACCESSORIES

- LINEAR SLOT DIFFUSER
- INSULATED FLEXIBLE DUCT (MAX. 5'-0" LONG)
- BRANCH DUCT WITH 45° RECTANGLE-ROUND BRANCH FITTING AND MANUAL VOLUME DAMPER
- ELBOW WITH TURNING VANES
- BRANCH DUCT WITH BELL-MOUTH FITTING & MANUAL VOLUME CONTROL DAMPER
- RETURN, EXHAUST, OR OUTSIDE AIR DUCT UP
- RETURN, EXHAUST, OR OUTSIDE AIR DUCT DOWN
- SUPPLY AIR DUCT UP
- SUPPLY AIR DUCT DOWN
- EQUIPMENT WITH FLEXIBLE DUCT CONNECTION
- 10" (NECK SIZE) CSD-1 (TYPE) 300 CFM (CFM OF SUPPLY DIFFUSER)
- 24x24 (NECK SIZE) CEG-1 (TYPE) 800 CFM (CFM OF EXHAUST GRILLE)
- MANUAL VOLUME DAMPER
- SQUARE TO ROUND TRANSITION
- RD — DUCT MOUNTED SMOKE DETECTOR (SD=SUPPLY/RD=RETURN)
- # — RISER DESIGNATION
- FD — FIRE DAMPER
- FSD — FIRE SMOKE DAMPER
- SD — SMOKE DAMPER
- VD — VOLUME DAMPER
- MD — MOTORIZED DAMPER
- BD — BACKDRAFT DAMPER

ALL DUCT DIMENSIONS SHOWN ON DRAWINGS ARE INSIDE DIMENSIONS. REFER TO DUCTWORK SPECIFICATIONS FOR DUCTWORK INSULATION AND LINER INFORMATION.

HVAC CONTROL DEVICES

- H — HUMIDISTAT
- T — THERMOSTAT
- SP — STATIC PRESSURE SENSOR
- TS — TEMPERATURE SENSOR
- CO — CARBON MONOXIDE SENSOR
- CO2 — CARBON DIOXIDE SENSOR
- DP — DIFFERENTIAL PRESSURE SENSOR
- FS — FLOW SWITCH
- HS — HUMIDITY SENSOR
- PS — PULL STATION

PIPING SYMBOLS

- DIRECTION OF FLOW
- CONTROL VALVE
- THREE-WAY CONTROL VALVE
- SHUTOFF VALVE
- CHECK VALVE
- BALANCING VALVE WITH PRESSURE PORTS
- TRIPLE DUTY VALVE WITH PRESSURE PORTS
- STRAINER
- STRAINER WITH BLOWDOWN VALVE
- RELIEF / SAFETY VALVE
- SOLENOID VALVE
- PRESSURE REDUCING VALVE
- GAS PRESSURE REGULATOR
- THERMOSTATIC MIXING VALVE
- PA — PIPE ANCHOR
- EJ — EXPANSION JOINT
- PIPE GUIDE
- PIPING SUPPORT
- F & T TRAP
- BUCKET TRAP
- THERMOSTATIC TRAP
- BACKFLOW PREVENTER
- PRESSURE GAUGE
- THERMOMETER
- PRESSURE AND TEMPERATURE TEST PLUG
- UNION
- FLANGE CONNECTION
- VACUUM RELIEF VALVE
- AV — AUTOMATIC AIR VENT
- MV — MANUAL AIR VENT
- PRESSURE / VACUUM SWITCH
- CLEANOUT
- CAP
- ELBOW UP
- ELBOW DOWN
- TEE UP
- TEE DOWN
- ELBOW UP WITH SHUT-OFF VALVE (SOV)
- ELBOW DOWN WITH SHUT-OFF VALVE (SOV)
- TEE UP WITH SHUT-OFF VALVE (SOV)
- TEE DOWN WITH SHUT-OFF VALVE (SOV)
- REDUCER
- RECIRCULATION PUMP
- P-TRAP
- GAS COCK
- TOP BEAM CLAMP
- TRAPEZE HANGER

PIPING LINETYPES

CD	CONDENSATE DRAIN (CD)
ACD	AUXILIARY CONDENSATE DRAIN (ACD)
NPW	NON-POTABLE WATER (NPW)
G	NATURAL GAS (G)
G	NATURAL GAS ON ROOF (G)
MPG	MEDIUM PRESSURE NATURAL GAS (MPG)
MPG	MED. PRESSURE NAT. GAS ON ROOF (MGP)
FOS	FUEL OIL SUPPLY (FOS)
FOR	FUEL OIL RETURN (FOR)
FOV	FUEL OIL VENT (FOV)
LPG	LIQUEFIED PETROLEUM GAS (LPG)
BFW	BOILER FEED WATER (BFW)
HPS	HIGH PRESSURE STEAM SUPPLY (HPS)
HPC	HIGH PRESSURE STEAM CONDENSATE (HPC)
MPS	MEDIUM PRESSURE STEAM SUPPLY (MPS)
MPC	MED. PRESSURE STEAM CONDENSATE (MPC)
LPS	LOW PRESSURE STEAM SUPPLY (LPS)
LPC	LOW PRESSURE STEAM CONDENSATE (LPC)
PD	CONDENSATE PUMP DISCHARGE (PD)
HWS	HEATING HOT WATER SUPPLY (HWS)
HWR	HEATING HOT WATER RETURN (HWR)
CHWS	CHILLED WATER SUPPLY (CHWS)
CHWR	CHILLED WATER RETURN (CHR)
HCS	HOT / CHILLED WATER SUPPLY (HCS)
HCR	HOT / CHILLED WATER SUPPLY (HCR)
CWS	CONDENSER WATER SUPPLY (CWS)
CWR	CONDENSER WATER RETURN (CWR)
HPWS	HEAT PUMP WATER SUPPLY (HPWS)
HPWR	HEAT PUMP WATER RETURN (HPWR)
RL	REFRIGERANT LIQUID (RL)
RD	REFRIGERANT DISCHARGE (HOT GAS) (RD)
RS	REFRIGERANT SUCTION (RS)
RDB	REFRIGERANT DISCHARGE BYPASS (RDB)
RV	REFRIGERANT VENT (RV)

LINETYPE LEGEND

THROUGHOUT THE DRAWINGS DIFFERENT LINETYPES ARE USED IN COMBINATION WITH THE SYMBOLS TO INDICATE THE STATUS OF ITEMS AS EXISTING, TO BE DEMOLISHED, TO BE INCLUDED AS PART OF NEW WORK AND/OR ITEMS WHICH ARE ANTICIPATED TO BE PROVIDED IN THE FUTURE. THE STATUS OF ITEMS USING THESE LINETYPES ARE RELATIVE TO THE VIEW IN WHICH THEY APPEAR. PHASING SHOWN IN DRAWINGS IS NOT INTENDED TO FULLY DESCRIBE ALL NECESSARY CONSTRUCTION PHASING, WHICH IS DETERMINED BY THE CONTRACTOR AS PART OF THEIR RESPONSIBILITIES. ANY SUCH PHASES DESCRIBED IN THE CONSTRUCTION DOCUMENTS ARE GENERAL AND ONLY INTENDED TO INDICATE A BROAD ORDER FOR THE SAKE OF DESCRIBING THE PROJECT. THE FOLLOWING LINETYPES MAY BE USED ON ANY DEVICE, EQUIPMENT, NOTE, LINE, SHAPE, ETC.

EXISTING	NEW
DEMOLISH	FUTURE

COMMISSIONING / FUNCTIONAL TESTING:

CONTRACTOR'S BID SHALL INCLUDE PROVISIONS TO PROVIDE ALL SERVICES RELATED TO THE CODE REQUIRED BUILDING SYSTEMS COMMMISSIONING INCLUDING A COMMISSIONING PLAN, FUNCTIONAL TESTING, AND RELATED DOCUMENTATION, REPORTS, AND OWNER TRAINING. THIS INCLUDES RETAINING THE SERVICES OF A 3RD PARTY REGISTERED DESIGN PROFESSIONAL OR APPROVED AGENCY. REFER TO THE LATEST ADOPTED EDITION OF THE APPLICABLE ENERGY CODE FOR MORE INFORMATION. CONTRACTOR SHALL COMPLETE ALL RELATED COMMISSIONING REQUIREMENTS PRIOR TO FINAL INSPECTIONS IN ACCORDANCE WITH THE CONSTRUCTION DOCUMENTS, CODE, AND MANUFACTURER'S INSTRUCTIONS.

APPLICABLE MECHANICAL CODES:

NOTE: PROJECT IS DESIGNED IN COMPLIANCE WITH THE FOLLOWING CODES. THIS IS NOT AN EXHAUSTIVE LIST. PROJECT SHALL COMPLY WITH ALL APPLICABLE CODES, STANDARDS AND LOCAL REQUIREMENTS. REFER TO THE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

MECHANICAL CODE: **2018 INTERNATIONAL MECHANICAL CODE**
BUILDING CODE: **2018 INTERNATIONAL BUILDING CODE**
ENERGY CODE: **2018 INTERNATIONAL ENERGY CONSERVATION CODE**

NOTE: GENERAL NOTES SHOWN HERE SHALL GOVERN FOR ALL ELECTRICAL SHEETS.

MECHANICAL GENERAL NOTES:

1. PRIOR TO SUBMITTING BID, VISIT THE JOB SITE AND BECOME FULLY ACQUAINTED WITH THE EXISTING CONDITIONS OF THE PROJECT. REVIEW THE GENERAL NOTES, SPECIFICATIONS AND OTHER DRAWINGS FOR ADDITIONAL REQUIREMENTS WHICH MAY NOT BE SPECIFICALLY CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY ARCHITECT, ENGINEER AND/OR OWNER OF CONFLICTS OR DISCREPANCIES PRIOR TO SUBMISSION OF BID.
2. PROVIDE SEISMIC RESTRAINTS AS NEEDED FOR THE MECHANICAL SYSTEMS IN THE PROJECT BASED ON THE SEISMIC ANALYSIS REQUIRED BY THE SPECIFICATIONS.
3. EXISTING CONDITIONS WERE TAKEN FROM ORIGINAL DRAWINGS AND SITE VISITS AND MAY NOT REFLECT EXACT "AS-BUILT" CONDITIONS. FIELD VERIFY EXISTING CONDITIONS PRIOR TO SUBMITTING FINAL BIDS. COORDINATE NEW WORK AND DEMOLITION WITH OTHER DISCIPLINES AND EXISTING CONDITIONS PRIOR TO CONSTRUCTION.
4. COORDINATE THE INSTALLATION OF THE MECHANICAL SYSTEMS WITH OTHER TRADES TO ENSURE A NEAT AND ORDERLY INSTALLATION. INSTALL DUCTWORK AND PIPING AS TIGHT TO STRUCTURE AS POSSIBLE. COORDINATE WITH OTHER TRADES TO AVOID CONFLICTS. COORDINATE INSTALLATION OF DUCTWORK AND PIPING TO AVOID CONFLICTS WITH ELECTRICAL PANELS, LIGHTING FIXTURES, ETC. ANY MODIFICATIONS REQUIRED DUE TO LACK OF COORDINATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR AT NO EXTRA COST TO THE OWNER.
5. WHERE SHUTDOWN OF EXISTING SYSTEMS IS REQUIRED DURING NEW WORK, COORDINATE SHUTDOWN TIME AND DURATION WITH THE OWNER TO MINIMIZE DOWNTIME. NOTIFY OWNER SEVEN (7) DAYS PRIOR TO INTERRUPTION OF SERVICE.
6. DURING INSTALLATION OF NEW WORK, AVOID DAMAGING EXISTING SURFACES AND EQUIPMENT TO REMAIN. REPAIR DAMAGE CAUSED DURING CONSTRUCTION AT NO EXTRA COST TO THE OWNER.
7. PROVIDE TEMPORARY BARRIERS TO CONTAIN DUST AND DEBRIS RESULTING FROM THE PERFORMANCE OF THE WORK TO THE AREA WHERE WORK IS BEING PERFORMED.
8. ALL MECHANICAL EQUIPMENT SHOWN ON THE MECHANICAL PLANS SHALL BE PROVIDED BY DIVISION 23 UNLESS OTHERWISE NOTED.
9. NEW MECHANICAL EQUIPMENT, DUCTWORK AND PIPING ARE SHOWN AT APPROXIMATE LOCATIONS. FIELD MEASURE FINAL DUCTWORK AND PIPING LOCATIONS PRIOR TO FABRICATION AND MAKE ADJUSTMENTS AS REQUIRED TO FIT THE DUCTWORK AND PIPING WITHIN THE AVAILABLE SPACE. VERIFY THAT FINAL EQUIPMENT LOCATIONS MEET MANUFACTURER'S RECOMMENDATIONS REGARDING SERVICE CLEARANCE AND PROPER AIRFLOW CLEARANCE AROUND EQUIPMENT.
10. REFER TO ARCHITECTURAL DRAWINGS FOR RELATED CONSTRUCTION DETAILS AS APPLICABLE TO THE HVAC SYSTEM. VERIFY CHASES AND PENETRATIONS SHOWN ON ARCHITECTURAL DRAWINGS THAT ARE INTENDED FOR DUCTWORK AND PIPING MEET REQUIREMENTS.
11. COORDINATE LOCATION OF ROOF MOUNTED HVAC EQUIPMENT AND ROOF PENETRATIONS WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS.
12. INDOOR AIR QUALITY MEASURES: PROTOTECT INSIDE OF (INSTALLED AND DELIVERED) DUCTWORK AND HVAC UNITS FROM EXPOSURE TO DUST, DIRT, PAINT AND MOISTURE. REPLACE INSULATION THAT HAS BECOME WET AT ANY TIME DURING CONSTRUCTION. DRYING THE INSULATION IS NOT ACCEPTABLE. SEAL ANY TEARS OR JOINTS OF INTERNAL FIBERGLASS INSULATION. REMOVE DEBRIS FROM CEILING/RETURN AIR PLENUM INCLUDING DUST. AN INDEPENDENT, PROFESSIONAL DUCT CLEANING COMPANY SHALL VACUUM CLEAN ANY DUCTWORK CONNECTED TO HVAC UNITS THAT WERE OPERATED DURING THE CONSTRUCTION PERIOD AFTER NEW FILTERS ARE INSTALLED AND PRIOR TO TURNING SYSTEM OVER TO THE OWNER. THE INTERNAL SURFACES AND ASSOCIATED COILS OF ANY HVAC UNITS THAT WERE OPERATED SHALL ALSO BE CLEANED.
13. INSTALL DUCTWORK AND PIPING PARALLEL TO BUILDING COLUMN LINES UNLESS OTHERWISE SHOWN OR NOTED.
14. OVERHEAD HANGERS AND SUPPORTS FOR EQUIPMENT, DUCTWORK AND PIPING SHALL BE FASTENED TO BUILDING JOISTS OR BEAMS. DO NOT ATTACH HANGERS AND SUPPORTS TO THE ABOVE FLOOR SLAB OR ROOF EXCEPT WHERE CONCRETE INSERTS IN CONCRETE SLABS ARE ALLOWED BY THE SPECIFICATIONS.
15. COORDINATE LOCATION OF EQUIPMENT SUPPORTS WITH LOCATION OF EQUIPMENT ACCESS PANELS/DOORS TO ENABLE SERVICE OF EQUIPMENT AND/OR FILTER REPLACEMENT.
16. COORDINATE THE EXACT MOUNTING SIZE AND FRAME TYPE OF DIFFUSERS, REGISTERS AND GRILLES WITH THE SUPPLIER TO MEET THE CEILING, WALL AND DUCT INSTALLATION REQUIREMENTS.
17. ADJUST LOCATION OF CEILING DIFFUSERS, REGISTERS AND GRILLES AS REQUIRED TO ACCOMMODATE FINAL CEILING GRID AND LIGHTING LOCATIONS.
18. LOCATE AND SET THERMOSTATS AND SENSORS AT LOCATIONS SHOWN ON PLANS. VERIFY EXACT LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION. INSTALL DEVICES WITH TOP OF DEVICE AT MAXIMUM 48" AFF TO MEET ADA REQUIREMENTS UNLESS NOTED OTHERWISE ON PLANS. PROVIDE INSULATED BACKING FOR THERMOSTATS MOUNTED ON EXTERIOR BUILDING WALLS. INSTALL WIRING IN CONDUIT PROVIDED BY DIVISION 26. AT A MINIMUM, PROVIDE CONDUIT IN THE WALL FROM THE JUNCTION BOX TO 6" ABOVE THE CEILING.
19. COORDINATE THE LOCATION AND ELEVATION OF WALL-MOUNTED DEVICES WITH PRESENTATION BOARDS, DISPLAY CABINETS, SHELVES OR OTHER COMPONENTS SHOWN ON THE ARCHITECTURAL DRAWINGS THAT ARE TO BE INSTALLED UNDER OTHER DIVISIONS. CONTRACTOR WILL NOT BE REIMBURSED FOR RELOCATION OF WALL-MOUNTED DEVICES CAUSED BY A LACK OF COORDINATION.
20. PROVIDE A MANUAL BALANCING DAMPER IN EACH DUCT TAKEOFF FROM SUPPLY, RETURN, OUTDOOR AND EXHAUST AIR DUCTS.
21. PROVIDE A PREFABRICATED 45 DEGREE, HIGH EFFICIENCY, RECTANGULAR/ROUND BRANCH DUCT TAKEOFF FITTING FOR BRANCH DUCT CONNECTIONS AND TAKE-OFFS TO INDIVIDUAL DIFFUSERS, REGISTERS AND GRILLES. PROVIDE WITH INTEGRAL MANUAL BALANCING DAMPER AND LOCKING QUADRANT WHERE INDICATED ON PLANS.
22. BRANCH DUCTWORK TO AIR OUTLETS SHALL BE SAME SIZE AS OUTLET NECK SIZE UNLESS OTHERWISE NOTED.
23. REFER TO SPECIFICATIONS FOR DUCTWORK AND PIPING INSULATION REQUIREMENTS. DUCT SIZES ON MECHANICAL PLANS INDICATE CLEAR INSIDE AIRFLOW DIMENSIONS, INCREASE SHEET METAL SIZES ACCORDINGLY TO ACCOUNT FOR THICKNESS OF DUCT LINER.
24. FLEXIBLE DUCTWORK SHALL NOT EXCEED 5'-0" IN LENGTH AND SHALL BE INSTALLED AND SUPPORTED TO AVOID SHARP BENDS AND SAGGING. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
25. RIGIDLY SUSPEND UNIT HEATER FROM STRUCTURE WITH SUPPORTING ANGLES AND ALL-THREAD HANGING RODS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
26. PROVIDE A NEW SET OF AIR FILTERS IN UNITS PRIOR TO TESTING, ADJUSTING AND BALANCING AND BEFORE TURNING SYSTEM(S) OVER TO OWNER.

MECHANICAL DEMOLITION GENERAL NOTES:

1. COORDINATE ALL DEMOLITION WITH WHAT IS SHOWN ON ARCHITECTURAL PLANS. NOTIFY ARCHITECT OF ANY DISCREPANCIES.
2. PRIOR TO SUBMITTING BID, VISIT THE JOB SITE AND BECOME FULLY ACQUAINTED WITH THE EXISTING CONDITIONS OF THE PROJECT. REVIEW GENERAL NOTES, SPECIFICATIONS AND OTHER DRAWINGS FOR ADDITIONAL REQUIREMENTS THAT MAY NOT BE SPECIFICALLY CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY ARCHITECT, ENGINEER OR OWNER, AS DEFINED IN BID DOCUMENTS, OF CONFLICTS OR DISCREPANCIES PRIOR TO SUBMISSION OF BID.
3. OWNER RETAINS RIGHTS OF SALVAGE FOR EQUIPMENT AND FIXTURES TO BE REMOVED. COORDINATE WITH OWNER THE EQUIPMENT AND FIXTURES TO BE SALVAGED AND THE LOCATION FOR STORAGE. AVOID DAMAGE TO SALVAGED EQUIPMENT, FIXTURES AND DEVICES DURING DEMOLITION WORK AND DURING TRANSPORT TO OWNER'S DESIGNATED STORAGE LOCATION.
4. REMOVE ITEMS SHOWN HEAVY-LINED DASHED, AND/OR NOTED TO BE REMOVED.
5. AVOID DAMAGING EXISTING SURFACES AND EQUIPMENT TO REMAIN FOR NEW INSTALLATION. REPAIR DAMAGE CAUSED DURING WORK AT NO EXTRA COST TO THE OWNER.
6. SEAL PENETRATIONS THROUGH FLOORS, WALLS, CEILINGS AND ROOFS WHERE MECHANICAL COMPONENTS ARE REMOVED AND WHERE THE EXISTING PENETRATION IS NOT USED FOR THE NEW INSTALLATION. REPAIR DAMAGED SURFACES TO MATCH ADJACENT AREAS OR AS INDICATED ON THE ARCHITECTURAL DRAWINGS.
7. REMOVE HANGERS AND SUPPORTS WHERE DUCTWORK, PIPING AND/OR EQUIPMENT ARE REMOVED AND THE EXISTING HANGERS AND SUPPORTS ARE NOT USED FOR THE NEW INSTALLATION.
8. INSTALL PERMANENT CAPS WHERE DUCTWORK AND PIPING IS REMOVED AND THE EXISTING TAPS ARE NOT USED FOR THE NEW INSTALLATION. WHERE DUCTWORK AND PIPING ARE REMOVED AND THE EXISTING TAPS WILL BE USED FOR THE NEW INSTALLATION, INSTALL TEMPORARY CAPS TO PROTECT THE INTERIOR SURFACES UNTIL NEW DUCTWORK AND PIPING ARE INSTALLED.
9. INSPECT EXISTING EQUIPMENT TO REMAIN TO VERIFY THAT EQUIPMENT IS OPERATING PROPERLY. NOTIFY OWNER OF DAMAGED AND/OR MALFUNCTIONING COMPONENTS.
10. WHERE SHUTDOWN OF EXISTING SYSTEMS IS REQUIRED DURING DEMOLITION, COORDINATE SHUTDOWN TIME AND DURATION WITH OWNER TO MINIMIZE DOWNTIME. NOTIFY OWNER SEVEN (7) DAYS PRIOR TO INTERRUPTION OF SERVICE.
11. CEASE WORK AND IMMEDIATELY NOTIFY THE OWNER SHOULD ANY HAZARDOUS MATERIALS BE ENCOUNTERED DURING THE PERFORMANCE OF THE WORK.
12. REMOVAL, RECOVERY, RECYCLING, AND DISPOSAL OF REFRIGERANT, CONTAINED IN ANY EQUIPMENT TO BE REMOVED, SHALL BE PERFORMED IN STRICT ACCORDANCE WITH CURRENT EPA GUIDELINES.

MECHANICAL EMS NOTES:

1. COORDINATE ALL CONTROLS, EQUIPMENT ACCESSORIES, AND ASSOCIATED WORK WITH EMS VENDOR PRIOR TO ALL EQUIPMENT PURCHASES AND INSTALLATION.
2. GENERAL CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH EMS VENDOR TO PROVIDE A FULLY FUNCTIONAL SYSTEM AT START-UP. FAILURE TO COORDINATE CONTROLS AND REQUIRED EQUIPMENT ACCESSORIES RESULTING IN MODIFICATIONS SHALL BE RESPONSIBILITY OF THE CONTACTOR AT NO EXTRA COST TO THE OWNER.
3. PROVIDE CARRIER ROOFTOP UNITS, AS APPLICABLE, WITH FACTORY INSTALLED BACNET OPEN BOARD CONTROLLER WITH SUPPLY AND OUTSIDE AIR TEMPERATURE SENSORS.
4. THERMOSTATS AND SENSORS SHALL BE FURNISHED BY EMS VENDOR AND INSTALLED BY DIVISION 26 CONTRACTOR UNLESS NOTED OTHERWISE.
5. PROVIDE ALL MOTORIZED DAMPERS ON PLAN, AS APPLICABLE, TO BE ABLE TO CONNECT TO ACTUATOR PROVIDED BY EMS VENDOR. MOTORIZED DAMPERS SHALL BE ACCESSIBLE FROM WITHIN SPACE VIA DUCT ACCESS PANELS. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
6. OUTDOOR SENSOR ASSEMBLY FOR ECONOMIZER CONTROL IS PROVIDED BY EMS VENDOR. PROVIDE CHASE LARGE ENOUGH FOR 1/4" POLY TUBE AND (2) WIRE PULLS FOR EMS CONTROLS.

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brr

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TEMPLATE ISSUE DATE: 11/28/2018

Fixture Package:

CLEARANCE

Stamp:

EXPIRES ON: 06/30/2024
CERTIFICATE 66286 JUSTIN M. OLDER Registered Professional Engineer ARIZONA U.S.A.
09/30/2022

Issued For:

CONSTRUCTION

Issue Date:

02/22/2022

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PROJECT MANAGER:
MK

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Project Number:

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MECHANICAL LEGENDS AND GENERAL NOTES

Sheet Number:

M0.0

JUSTIN M. OLDER

COM*check* Software Version 4.1.5.3

Mechanical Compliance Certificate

Project Information

Energy Code:	2018 IECC
Project Title:	Nike Value Store - Clearance - Tucson, AZ
Location:	Tucson, Arizona
Climate Zone:	2b
Project Type:	Alteration

Construction Site:
5325 S Calle Santa Cruz
Tucson, AZ 85706

Owner/Agent:
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Designer/Contractor:
Henderson Engineers Inc.
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Lenexa, AZ 66214
913-742-5000

Mechanical Systems List

Quantity System Type & Description

1 RTU-1 (Single Zone):
Single Package Heat Pump
Heating Mode: Capacity = 43 kBtu/h,
Proposed Efficiency = 8.30 HSPF, Required Efficiency = 8.00 HSPF
Cooling Mode: Capacity = 37 kBtu/h,
Proposed Efficiency = 16.20 SEER, Required Efficiency: 14.00 SEER
Fan System: RTU-1 -- Compliance (Motor nameplate HP method) : Passes

Fans:
FAN 1 Supply, Constant Volume, 1500 CFM, 0.7 motor nameplate hp, 0.0 fan efficiency grade

1 RTU-2 (Single Zone):
Single Package Heat Pump
Heating Mode: Capacity = 82 kBtu/h,
Proposed Efficiency = 3.40 COP, Required Efficiency = 3.30 COP
Cooling Mode: Capacity = 78 kBtu/h, , Air Economizer
Proposed Efficiency = 12.10 EER, Required Efficiency: 11.00 EER + 12.0 IEER
Fan System: RTU-2 -- Compliance (Motor nameplate HP method) : Passes

Fans:
FAN 2 Supply, Constant Volume, 2250 CFM, 1.0 motor nameplate hp, 0.0 fan efficiency grade

4 RTU-3,4,5,6 (Single Zone):
Single Package Heat Pump
Heating Mode: Capacity = 99 kBtu/h,
Proposed Efficiency = 3.50 COP, Required Efficiency = 3.30 COP
Cooling Mode: Capacity = 93 kBtu/h, , Air Economizer
Proposed Efficiency = 12.30 EER, Required Efficiency: 11.00 EER + 12.0 IEER
Fan System: RTU-3,4,5,6 -- Compliance (Motor nameplate HP method) : Passes

Fans:
FAN 3 Supply, Constant Volume, 3000 CFM, 1.7 motor nameplate hp, 0.0 fan efficiency grade
FAN 4 Relief, Constant Volume, 3000 CFM, 1.7 motor nameplate hp, 0.0 fan efficiency grade

1 RTU-7 (Single Zone):
Single Package Heat Pump
Heating Mode: Capacity = 87 kBtu/h,
Proposed Efficiency = 3.40 COP, Required Efficiency = 3.30 COP

Quantity System Type & Description

Cooling Mode: Capacity = 89 kBtu/h, , Air Economizer
Proposed Efficiency = 12.00 EER, Required Efficiency: 11.00 EER + 12.0 IEER
Fan System: RTU-7 -- Compliance (Motor nameplate HP method) : Passes

Fans:
FAN 11 Supply, Constant Volume, 3750 CFM, 2.1 motor nameplate hp, 0.0 fan efficiency grade
FAN 12 Relief, Constant Volume, 3750 CFM, 2.1 motor nameplate hp, 0.0 fan efficiency grade

1 WH-1:
Electric Storage Water Heater, Capacity: 30 gallons w/ Circulation Pump
Proposed Efficiency: 1.20 SL, %/h (if > 12 kW), Required Efficiency: 1.20 SL, %/h (if > 12 kW)

Mechanical Compliance Statement

Compliance Statement: The proposed mechanical alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2018 IECC requirements in COM*check* Version 4.1.5.3 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Isaac Brethour
Name - Title

Isaac Brethour
Signature

10/07/2021
Date

COM*check* Software Version 4.1.5.3

Inspection Checklist

Energy Code: 2018 IECC

Requirements: 100.0% were addressed directly in the COM*check* software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 [PR2]^{1}	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical systems and equipment and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C103.2 [PR3]^{1}	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the service water heating systems and equipment and document where exceptions to the standard are claimed. Hot water system sized per manufacturer's sizing guide.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C403.12.2, C403.12.3 [FO9]^{3}	Snow/ice melting system and freeze protection systems have sensors and controls configured to limit service for pavement temperature and outdoor temperature. future connection to controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

Additional Comments/Assumptions:

Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5, C404.5.1, C404.5.2 [PL6]^{3}	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.5, C404.5.1, C404.5.2 [PL6]^{3}	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.5, C404.5.1, C404.5.2 [PL6]^{3}	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.5, C404.5.1, C404.5.2 [PL6]^{3}	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.5, C404.5.1, C404.5.2 [PL6]^{3}	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C404.6.1, C404.6.2 [PL3]^{1}	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C404.6.3 [PL7]^{3}	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.6.3 [PL7]^{3}	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.6.3 [PL7]^{3}	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.6.3 [PL7]^{3}	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.6.3 [PL7]^{3}	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.7 [PL8]^{3}	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.7 [PL8]^{3}	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.7 [PL8]^{3}	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.7 [PL8]^{3}	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.7 [PL8]^{3}	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 [ME41]^{3}	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-3.5.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.8.4 [ME142]^{2}	Motors for fans that are not less than 1/12 hp and less than 1 hp are electronically commutated motors or have a minimum motor efficiency of 70 percent. These motors have the means to adjust motor speed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.8.4 [ME142]^{2}	Motors for fans that are not less than 1/12 hp and less than 1 hp are electronically commutated motors or have a minimum motor efficiency of 70 percent. These motors have the means to adjust motor speed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.8.4 [ME142]^{2}	Motors for fans that are not less than 1/12 hp and less than 1 hp are electronically commutated motors or have a minimum motor efficiency of 70 percent. These motors have the means to adjust motor speed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.8.4 [ME142]^{2}	Motors for fans that are not less than 1/12 hp and less than 1 hp are electronically commutated motors or have a minimum motor efficiency of 70 percent. These motors have the means to adjust motor speed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.8.5 [ME143]^{2}	Each DX cooling system > 65 kBtu and chiller water/evaporative cooling system with fans > 1/4 hp are designed to vary the indoor fan airflow as a function of load and comply with detailed requirements of this section.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.8.5 [ME143]^{2}	Each DX cooling system > 65 kBtu and chiller water/evaporative cooling system with fans > 1/4 hp are designed to vary the indoor fan airflow as a function of load and comply with detailed requirements of this section.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.8.5 [ME143]^{2}	Each DX cooling system > 65 kBtu and chiller water/evaporative cooling system with fans > 1/4 hp are designed to vary the indoor fan airflow as a function of load and comply with detailed requirements of this section.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.8.5 [ME143]^{2}	Each DX cooling system > 65 kBtu and chiller water/evaporative cooling system with fans > 1/4 hp are designed to vary the indoor fan airflow as a function of load and comply with detailed requirements of this section.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.12.1 [ME71]^{2}	Systems that heat outside the building envelope are radiant heat systems controlled by an occupancy sensing device or timer switch.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.3 [ME55]^{2}	HVAC equipment efficiency verified.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Mechanical Systems list for values.*

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.5.5 [ME113]^{2}	Fault detection and diagnostics installed with air-cooled unitary DX units having economizers.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5.5 [ME113]^{2}	Fault detection and diagnostics installed with air-cooled unitary DX units having economizers.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5.5 [ME113]^{2}	Fault detection and diagnostics installed with air-cooled unitary DX units having economizers.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.2 [ME59]^{1}	Natural or mechanical ventilation is provided in accordance with International Mechanical Code Chapter 4. Mechanical ventilation has capability to reduce outdoor air supply to minimum per IMC Chapter 4.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.7.1 [ME59]^{1}	Demand control ventilation provided for spaces >500 ft2 and >25 people/1000 ft2 occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >3,000 cfm.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.7.2 [ME115]^{3}	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.7.6 [ME141]^{3}	HVAC systems serving guestrooms in Group R-1 buildings with > 50 guestrooms: Each guestroom is provided with controls that automatically manage temperature setpoint and ventilation (see sections C403.7.6.1 and C403.7.6.2).	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.7.4 [ME57]^{1}	Exhaust air energy recovery on systems meeting Table C403.7.4(1) and C403.7.4(2).	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Where the largest exhaust source is less than 75% of the design outdoor airflow.
C403.7.5 [ME116]^{3}	Kitchen exhaust systems comply with replacement air and conditioned supply air limitations, and satisfy hood rating requirements and maximum exhaust rate criteria.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.11.1, C403.11.2 [ME60]^{2}	HVAC ducts and plenums insulated in accordance with C403.11.1 and constructed in accordance with C403.11.2, verification may need to occur during Foundation Inspection.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5, C403.5.1, C403.5.2 [ME62]^{1}	Air economizers provided where required, meet the requirements for design capacity, control signal, ventilation controls, high-limit shut-off, integrated economizer control, and provide a means to relieve excess outside air during operation.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

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TEMPLATE ISSUE DATE: 11/28/2018

Fixture Package:

CLEARANCE

Stamp:

EXPIRES ON: 06/30/2024
66286
JUSTIN M. OLDER
09/30/2022

Issued For:

CONSTRUCTION

Issue Date:

02/22/2022

Revisions:

NO.	REASON	DATE

PROJECT MANAGER:
MK
CHECKED BY:
DRAWN BY:
Author

Project Number:

62301432

Sheet Title:

MECHANICAL ENERGY COMPLIANCE

Sheet Number:

M5.0

JUSTIN M. OLDER

PROJECT DESIGN CONDITIONS

CLIMATE CONDITONS

WEATHER STATION:		TUCSON INTL, AZ, USA					
CLIMATE ZONE:		2B					
HEATING (DB):	99.6%	31.8	°F				
DESIGN HEATING CONDITIONS (DB):		23.4	°F				
HUMIDIFICATION (DP/ HR/ MCDB):	99.6%	-1.0	°F/	5.7	gr/lb	61.2	°F
COOLING (DB/MCWB):	0.4%	105.8	°F	66.0	°F		
DESIGN ENTHALPY CONDITIONS (DB/h):	0.4%	87.7	°F	37.8	°F		
DEHUMIDIFICATION (DP/ HR/ MCDB):	0.4%	69.3	°F/	118.2	gr/lb	76.3	°F

BUILDING OPERATING HOURS:

MONDAY - FRIDAY	TBD BY OWNER
SATURDAY	TBD BY OWNER
SUNDAY	TBD BY OWNER
HOLIDAY	TBD BY OWNER

UNIT / SPACE DESCRIPTION	SET POINTS											SPACE OPERATING HOURS OCCUPIED / UNOCCUPIED			NOTES
	COOLING / DE-HUMIDIFICATION				HEATING		HUMIDIFICATION		ZONE VENTILATION RESET						
	OCC °F	UNOCC °F	MAX RH %	MIN RH %	OCC °F	UNOCC °F	MIN RH %	MAX RH %	CONTROL METHOD	BASE PPM	MAXIMUM PPM	M-F	SAT	SUN	
RTU-1 BACK OF HOUSE	72	77	60%	NA	70	60	NA	NA	CO2	400	750	TBD	TBD	TBD	A - D
RTU-2 STOCKROOM	72	77	60%	NA	70	60	NA	NA	CO2	400	750	TBD	TBD	TBD	A - D
RTU-3,4,5,6 SALES FLOOR	72	77	60%	NA	70	60	NA	NA	CO2	400	750	TBD	TBD	TBD	A - D
RTU-7 SOLAR ZONE	72	77	60%	NA	70	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	B - D

NOTES:
A. ZONE LEVEL VENTILATION RESET / DEMAND CONTROL VENTILATION (DCV) CONTROL METHOD: CARBON DIOXIDE SENSOR (CO2).
B. ZONE LEVEL SET POINT CONDITIONS SHALL BE AS SCHEDULED UNLESS OTHERWISE SCHEDULED OR NOTED ON THE DRAWINGS FOR ROOM SPECIFIC SPACE CONDITIONS.
C ZONE LEVEL OCCUPANCY HOUR SCHEDULE SHALL BE PER BUILDING OPERATING HOURS UNLESS OTHERWISE SCHEDULED.
D. ZONE LEVEL CONTROLS SHALL BE CAPABLE OF OPERATING WITH INDEPENDENT OCCUPANCY SCHEDULES.

ROOFTOP UNIT CONTROL MATRIX

CONTROL FEATURE	UNITS	RTU-1 SETPOINT OR Y/N	RTU-2 SETPOINT OR Y/N	RTU-3,4,5,6 SETPOINT OR Y/N	RTU-7 SETPOINT OR Y/N	POINT TYPE INTERFACE WITH DDC (READ/WRITE)	NOTES
BUILDING AUTOMATION SYSTEM (BAS)							
ENERGY MANAGEMENT SYSTEM INTERFACE		Y	Y	Y	Y	BACNET	A
SETPOINTS							
COOLING - EFFECTIVE OCCUPIED COOLING SETPOINT	°F	72	72	72	72	READ/WRITE	
COOLING - EFFECTIVE UNOCCUPIED COOLING SETPOINT	°F	77	77	77	77	READ/WRITE	
COOLING - MINIMUM COOLING SUPPLY AIR TEMPERATURE (SAT) SETPOINT	°F	50	50	50	50	READ/WRITE	F
COOLING - LOCKOUT TEMPERATURE SETPOINT	°F	55	55	55	55	READ/WRITE	
DEAD BAND - MINIMUM HEATING AND COOLING TEMPERATURE SETPOINT DIFFERENCE	°F	2	2	2	2		
HEATING - EFFECTIVE OCCUPIED HEATING SETPOINT	°F	70	70	70	70	READ/WRITE	
HEATING - EFFECTIVE UNOCCUPIED HEATING SETPOINT	°F	60	60	60	60	READ/WRITE	
HEATING - MAXIMUM HEATING SUPPLY AIR TEMPERATURE (SAT) SETPOINT	°F	120	120	120	120	READ/WRITE	F
HEATING - LOCKOUT TEMPERATURE SETPOINT	°F	55	55	55	55	READ/WRITE	
PROGRAMMED CONTROL FEATURES							
DEMAND CONTROL VENTILATION (DCV) HIGH ALARM SETPOINT - CO2 SENSOR FEEDBACK	PPM	750	750	750	N/A	READ/WRITE	
EQUIPMENT ACCESSORIES AND CONTROL MODULES							
OUTSIDE AIR DAMPER - MOTOR OPERATED (MODULATING)		Y	Y	Y	Y	READ/WRITE	M
INTEGRATED ECONOMIZER - DIFFERENTIAL DRY BULB AND DIFFERENTIAL ENTHALPHY		Y	Y	Y	Y	READ/WRITE	G, H
ECONOMIZER FAULT DETECTION AND DIAGNOSTICS (FDD) SYSTEM		Y	Y	Y	Y	READ	O
RELIEF - BAROMETRIC DAMPER		Y	Y	Y	Y		
RELIEF - CONSTANT VOLUME POWERED EXHAUST FAN		N	N	Y	Y	READ STATUS	N, O
HEAT PUMP COIL WITH REVERSING VALVE		Y	Y	Y	Y	READ STATUS	E, F, K
SUPPLY FAN CONTROL METHOD							
ON DURING OCCUPIED HOURS		Y	Y	Y	Y		B
CYCLE WITH LOADS DURING UNOCCUPIED HOURS		Y	Y	Y	Y		B
UNIT START AND FAN OFF DELAY		Y	Y	Y	Y		B
OPTIMUM START SEQUENCE		Y	Y	Y	Y		O
VARIABLE VOLUME - 2-SPEED FAN CONTROL		Y	Y	Y	Y	READ STATUS	C
SAFETIES, INTERLOCKS, AND ALARMS							
SUPPLY AIR SMOKE DETECTOR - FIRE SAFETY SHUTDOWN		Y	Y	Y	Y	READ	D
RETURN AIR SMOKE DETECTOR - FIRE SAFETY SHUTDOWN		Y	Y	Y	Y	READ	D
SAFETY CHAIN - SAFETY SHUTDOWN		Y	Y	Y	Y	READ	D
SAT ALARM - SAFETY SHUTDOWN		Y	Y	Y	Y	READ	D
SPT ALARM - SAFETY SHUTDOWN		Y	Y	Y	Y	READ	D

EMS VENDOR SHALL PROVIDE CONTROL PANEL, RELAYS, THERMOSTATS, TEMPERATURE SENSORS, HUMIDTY SENSORS, AND/OR CO2 SENSORS WHERE SHOWN ON THE DRAWINGS AND AS REQUIRED TO FACILITATE THE SCHEDULED SEQUENCE OF OPERATION. EACH UNIT SHALL CONTROL BASED ON ITS OWN INTERNAL SAFETIES, TIME DELAYS, AND SEQUENCES UNLESS NOTED OTHERWISE. COORDINATE WITH OWNER FINAL BUILDING AND EQUIPMENT SCHEDULES DURING STARTUP.

NOTES:
A. EMS SHALL PROVIDE REMOTE SETPOINT ADJUSTMENT, SCHEDULING, AND MONITORING OF THE POINTS LISTED IN THE SCHEDULE FOR EACH UNIT. THE RTU SHALL BE SCHEDULED WITH A MINIMUM OF AN OCCUPIED AND UNOCCUPIED SCHEDULE. ADDITIONAL UNIT SCHEDULES SHALL BE AVAILABLE FOR REMOTE IMPLEMENTATION IF REQUIRED.
B. THE SUPPLY FAN SHALL RUN CONTINUOUSLY IN OCCUPIED MODE AND SHALL CYCLE ON AND OFF IN UNOCCUPIED MODE. A UNIT START DELAY IS USED WHEN TRANSITIONING FROM UNOCCUPIED TO OCCUPIED. FAN OFF DELAY ALLOWS THE SUPPLY FAN TO CONTINUE TO OPERATE AFTER HEATING AND COOLING STOPS.
C. VIA FACTORY VFD, THE CARRIER RTU OPEN BOARD SHALL DETERMINE FAN SPEED REQUIRED FOR HEATING AND COOLING. FACTORY VFD SHALL CONTROL TO 2 FAN SPEEDS. LOW SPEED SHALL NOT EXCEED 66% OF FULL SPEED AND SHALL DRAW NO MORE THAN 40% OF FAN POWER AT FULL SPEED. DURING FAN ONLY OR SINGLE STAGE COOLING, SUPPLY FAN SHALL OPERATE AT LOW SPEED. DURING HEATING, SECOND STAGE COOLING, DEHUMIDIFICATION OR FULL ECONOMIZER OPERATION, FAN SHALL OPERATE AT HIGH SPEED.
D. IF A LOCAL UNIT CONTROL ALARM IS ACTIVE, THE SUPPLY FAN TURNS OFF IMMEDIATELY REGARLESS OF OCCUPANY STATE OR DEMAND.
E. COOLING STAGES ARE CONTROLLED BY THE CARRIER RTU OPEN COOLING CONTROL PID LOOP AND COOLING STAGES CAPACITY ALGORITHM. THEY CALCULATE THE REQUIRED NUMBER OF STAGES NEEDED TO SATISFY THE SPACE BY COMPARING THE SPACE TEMPERATURE TO THE EFFECTIVE OCCUPIED COOLING SETPOINT IN OCCUPIED MODE AND THE EFFECTIVE UNOCCUPIED COOLING SETPOINT IN UNOCCUPIED MODE. THE FOLLOWING CONDITIONS MUST BE TRUE FOR THE COOLING ALGORITHM TO OPERATE:
- THE OUTDOOR AIR TEMPERATURE IS GREATER THAN THE COOLING LOCKOUT TEMPERATURE SETPOINT.
- THE SUPPLY FAN HAS BEEN ON FOR AT LEAST 30 SECONDS.
- THE UNIT HAS A VALID SUPPLY AIR TEMPERATURE INPUT.
- THE UNIT HAS A VALID SPACE TEMPERATURE INPUT.
- HEATING MODE IS NOT ACTIVE AND THE TIME GUARD BETWEEN MODES HAS EXPIRED.
- ECONOMIZER IS UNAVAILABLE OR ECONOMIZER IS ACTIVE AND THE FOLLOWING ARE TRUE: (1) ECONOMIZER IS GREATER THAN 85% OPEN, (2) SUPPLY AIR TEMPERATURE IS GREATER THAN 5 DEGREES ABOVE THE MINIMUM COOLING SAT SETPOINT, AND (3) SPACE TEMPERATURE IS GREATER THAN 0.5 DEGREES ABOVE THE EFFECTIVE OCCUPIED TEMPERATURE SETPOINT.

WHEN THE COOLING ALGORITHM PRECONDITIONS ARE MET, THE COMPRESSORS ARE ENERGIZED IN STAGES, AS APPLICABLE. ANTI-RECYCLE TIMERS ARE EMPLOYED TO PROTECT THE EQUIPMENT FROM SHORT-CYCLING. THERE ARE FIXED THREE-MINUTE MINIMUM ON-TIMES AND FIVE-MINUTE OFF-TIMES FOR EACH COMPRESSOR OUTPUT.

F. DURING COMPRESSOR OPERATION, THE RTU OPEN CONTROL LOGIC MAY REDUCE THE NUMBER OF ACTIVE STAGES IF THE SUPPLY AIR TEMPERATURE FALLS BELOW THE MINIMUM COOLING SAT SETPOINT. A COMPRESSOR STAGED OFF IN THIS FASHION MAY BE STARTED AGAIN AFTER THE NORMAL TIME-GUARD PERIOD HAS EXPIRED IF THE SUPPLY AIR TEMPERATURE HAS INCREASED ABOVE THE MINIMUM COOLING SAT SETPOINT.
G. THE SYSTEM SHALL UTILIZE THE FACTORY MODULATING ECONOMIZER FOR FREE COOLING WHEN OUTDOOR AIR CONDITIONS ARE SUITABLE. FOR THE ECONOMIZER TO OPERATE DURING OCCUPIED HOURS, THE FOLLOWING CONDITIONS MUST BE TRUE:
- OUTDOOR AIR TEMPERATURE IS LESS THAN THE SPACE TEMPERATURE AND LESS THAN THE ECONOMIZER HIGH OAT LOCKOUT SETPOINT.
- THE INDOOR FAN HAS BEEN ON FOR AT LEAST 30 SECONDS.
- THE UNIT HAS A VALID SUPPLY AIR TEMPERATURE INPUT.
- THE UNIT HAS A VALID SPACE TEMPERATURE INPUT.
- OUTDOOR AIR ENTHALPY IS LESS THAN THE SPACE ENTHALPY. (ENTHALPY STATUS SHALL READ "LOW".)

IF ANY OF THE PRECEDING CONDITIONS ARE NOT TRUE AND THE SUPPLY FAN IS ON HIGH SPEED, THE ECONOMIZER SHALL BE SET TO THE DCV MINIMUM OUTDOOR AIR DAMPER POSITION (TBD BY TAB CONTRACTOR). IF ANY OF THE PRECEDING CONDITIONS ARE NOT TRUE AND THE SUPPLY FAN IS ON LOW SPEED, THE ECONOMIZER SHALL BE SET TO THE LOW FAN ECONOMIZER MINIMUM DAMPER POSITION (TBD BY TAB CONTRACTOR). IF ALL OF THE PRECEDING CONDITIONS ARE TRUE, THE ECONOMIZER PID LOOP SHALL MODULATE THE DAMPER. THE ECONOMIZER POSITION SHALL BE REDUCED AS THE SUPPLY AIR TEMPERATURE FALLS TO WITHIN 5 DEGREES OF THE MINIMUM COOLING SAT SETPOINT, BUT SHALL NEVER CLOSE BELOW THE DCV MINIMUM OUTDOOR AIR DAMPER POSITION.

H. DURING UNOCCUPIED HOURS, UNOCCUPIED FREE COOLING SHALL BE ENABLED. THE ECONOMIZER SHALL REMAIN CLOSED UNLESS THE FOLLOWING CONDITIONS ARE TRUE:
- OUTDOOR AIR TEMPERATURE IS BELOW THE ECONOMIZER HIGH OAT LOCKOUT SETPOINT.
- OUTDOOR AIR TEMPERATURE IS LESS THAN THE SPACE TEMPERATURE
- OUTDOOR AIR ENTHALPY IS LESS THAN THE SPACE ENTHALPY. (ENTHALPY STATUS SHALL READ "LOW".)

IF ALL OF THE PRECEDING CONDITIONS ARE TRUE AND THE SPACE TEMPERATURE RISES 1 DEGREE ABOVE THE EFFECTIVE UNOCCUPIED COOLING SETPOINT, THE SUPPLY FAN SHALL START AND THE ECONOMIZER DAMPER SHALL OPEN AS NECESSARY TO COOL THE SPACE. THE DAMPER SHALL REMAIN OPEN UNTIL THE SPACE IS SATISFIED OR THE PRECEDING CONDITIONS ARE NO LONGER TRUE. IF ANY OF THE PRECEDING CONDITIONS ARE NOT TRUE, THE ECONOMIZER SHALL CLOSE COMPLETELY.

K. DURING HEATING OPERATION, THE RTU OPEN CONTROL LOGIC MAY REDUCE THE NUMBER OF ACTIVE STAGES IF THE SUPPLY AIR TEMPERATURE EXCEEDS THE MAXIMUM HEATING SAT SETPOINT. A HEAT STAGE TURNED OFF IN THIS FASHION MAY BE STARTED AGAIN AFTER THE NORMAL TIME-GUARD PERIOD HAS EXPIRED IF THE SUPPLY AIR TEMPERATURE HAS DECREASED BELOW THE MAXIMUM HEATING SAT SETPOINT.
M. THE SYSTEM SHALL UTILIZE A CO2 SENSOR FOR THE SALES AREA, FITTING ROOM, STOCKROOM AND EACH OFFICE (HIGHEST READING WILL BE TAKEN FOR OFFICE DCV CONTROL). DCV IS CONTROLLED BY THE INDOOR AIR CO2 ALGORITHM. THE ALGORITHM CALCULATES THE CO2 MINIMUM DAMPER POSITION USING A PID LOOP. THE CALCULATED CO2 MINIMUM DAMPER POSITION IS THEN COMPARED AGAINST THE DCV MINIMUM POSITION SETPOINT AND THE GREATEST VALUE BECOMES THE FINAL MINIMUM DAMPER POSITION. DURING OCCUPIED HOURS, THE INDOOR AIR CO2 SEQUENCE SHALL BE ENABLED. THE FOLLOWING CONDITIONS MUST BE TRUE FOR THE INDOOR AIR CO2 ALGORITHM TO OPERATE:
-THE SUPPLY FAN HAS BEEN ON FOR AT LEAST 30 SECONDS.
-THE UNIT HAS A VALID CO2 SNESOR READING.

IF ALL OF THE PRECEDING CONDITIONS ARE TRUE, THE FACTORY OUTDOOR AIR DAMPER SHALL MODULATE BETWEEN ITS MINIMUM (ABS. MIN. O/A) AND MAXIMUM (MIN. O/A CFM) POSITION (TBD BY TAB CONTRACTOR). THE SYSTEM SHALL START TO MODULATE THE DAMPER OPEN WHEN CO2 LEVEL RISES TO 100 PPM (ADJUSTABLE) ABOVE AMBIENT CO2 LEVEL (400 PPM) AND SHALL CONTINUE TO OPEN TO ITS MAXIMUM POSITION AS CO2 LEVEL RISES TO AND ABOVE THE DCV HIGH ALARM SETPOINT. AS THE CO2 LEVEL DROPS, THE DAMPER SHALL START TO MODULATE TO ITS MINIMUM POSITION. DURING UNOCCUPIED HOURS, THE INDOOR AIR CO2 SEQUENCE SHALL BE DISABLED.

N. POWERED EXHAUST FAN SHALL STAGE ON AND OFF ACCORDING TO DAMPER POSITION.
O. DEVICE SHALL BE FACTORY MOUNTED AND PRE-WIRED FOR OPERATION SUBJECT TO THE RTU OPEN CONTROLLER.

OUTSIDE AIR REQUIREMENTS, IMC-2018 (IP)

SYSTEM DESIGNATION	SYSTEM TYPE:	SINGLE-ZONE SYSTEMS: VENTILATION ZONE ASSOCIATED WITH SYSTEM	SINGLE-ZONE SYSTEMS: WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS [Ez]	MULTI-ZONE SYSTEMS: SYSTEM VENTILATION EFFICIENCY [Ev]	FLOOR AREA SERVED BY SYSTEM [As] (SF)	SYSTEM AVERAGED AREA-BASED OUTDOOR AIR RATE (CFM/SF)	SYSTEM POPULATION [Ps] (PEOPLE)	SYSTEM AVERAGED PEOPLE-BASED OUTDOOR AIR RATE (CFM/P)	REQUIRED OA INTAKE FLOW [Vot] (CFM)	REQUIRED DCV OA INTAKE FLOW [Vot] (CFM)	DESIGN OA INTAKE FLOW [Vot] (CFM)	DESIGN DCV OA INTAKE FLOW [Vot] (CFM)	NOTES
RTU-1	MULTI-ZONE	-	-	0.60	1,187	0.052	16.00	5.0	237	103	250	125	ALL
RTU-2	MULTI-ZONE	-	-	0.89	4,814	0.119	1.51	10.0	657	640	700	640	ALL
RTU-3,4,5,6,7	SINGLE-ZONE	SALES FLOOR	1.00	--	13,392	0.120	200.88	7.5	3,114	1,607	3,200	1820	ALL
								TOTALS	4,066	2,380	4,150	2,425	

NOTES:
A. VENTILATION CALCULATIONS BASED ON 2018 INTERNATIONAL MECHANICAL CODE.
B. SYSTEM POPULATIONS BASED ON MAX SEATING AND/OR CODE MAXIMUM VALUES.
C. MULTI-ZONE RECIRCULATING SYSTEMS: CALCULATOR TAKES THE MAXIMUM OUTSIDE AIRFLOW REQUIRED BY IMC ON A SYSTEM LEVEL. THE CALCULATION USED TO DETERMINE VENTILATION AIRFLOW IN COMPLIANCE WITH VRP AND SECTION 404.0. VENTILATION RATE SHOWN IS ACTUAL CALCULATED WITH CORRECTION FACTORS INCLUDED. EACH ZONE IS CALCULATED WITH ITS WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS (HEATING/COOLING) AS PART OF CALCUALTIONS TO FIND Ev.

ROOFTOP UNIT SCHEDULE (DX HEAT PUMP)

MARK	MANUFACTURER	MODEL	NOMINAL TONS	SUPPLY FAN CFM	SUPPLY FAN ESP (IN)	SUPPLY FAN BHP	SUPPLY FAN VFD (Y/N)	COOLING COIL TH (MBH)	SH (MBH)	EAT (°F DB)	EAT (°F WB)	LAT (°F DB)	LAT (°F WB)	REFR TYPE	MIN EFF (EER)	MIN EFF (IEER)	MIN NO STAGES	HEAT PUMP HEATING COIL MIN OUT (MBH)	AMBIENT (°F DB)	EAT (°F DB)	LAT (°F DB)	MIN EFF (COP)	MIN O/A CFM	ABS MIN O/A	ELECTRICAL V/PH	MCA	MOCP	WEIGHT (LBS)	NOTES
RTU-1	CARRIER	50GCQN05A	4	1,500	0.9	0.65	N	37.2	27.8	74.6	63.1	56.2	54.5	R-410A	--	16.2	2	35.2	25	62.0	85	3.7	250	125	208/3	27	30	900	A - E, H - Y
RTU-2	CARRIER	50HCQD08D	7.5	2,250	1.0	0.82	Y	77.5	57.5	76.4	64.1	53.6	53.3	R-410A	12.1	13.7	2	69.2	25	57.9	85	3.4	700	640	208/3	44	50	1300	A - V, Z
RTU-3	CARRIER	50HCQD12D	10	3,000	1.2	1.72	Y	93.2	63.3	76.5	64.5	55.6	53.8	R-410A	12.3	13.6	2	81.6	25	58.3	85	3.5	800	455	208/3	53	60	1900	A - V, Z
RTU-4	CARRIER	50HCQD12D	10	3,000	1.2	1.72	Y	93.2	63.3	76.5	64.5	55.6	53.8	R-410A	12.3	13.6	2	81.6	25	58.3	85	3.5	800	455	208/3	53	60	1900	A - V, Z
RTU-5	CARRIER	50HCQD12D	10	3,000	1.2	1.72	Y	93.2	63.3	76.5	64.5	55.6	53.8	R-410A	12.3	13.6	2	81.6	25	58.3	85	3.5	800	455	208/3	53	60	1900	A - V, Z
RTU-6	CARRIER	50HCQD12D	10	3,000	1.2	1.72	Y	93.2	63.3	76.5	64.5	55.6	53.8	R-410A	12.3	13.6	2	81.6	25	58.3	85	3.5	800	455	208/3	53	60	1900	A - V, Z
RTU-7	CARRIER	50HCQD08D	7.5	3,750	1.0	2.09	Y	88.7	84.4	74.0	57.7	51.9	48.9	R-410A	12.0	13.8	2	65.0	25	68.0	85	3.4	0	0	208/3	48	60	1300	A - U, Z

MODEL NUMBERS AND NOMINAL TONS LISTED SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER, MODEL NUMBERS, OR NOMINAL TONS ONLY. REVIEW THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS TO DETERMINE THE EXACT MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.

NOTES:
A. REFER TO ROOFTOP UNIT CONTROL MATRIX FOR CONTROL FEATURES, MODULES, AND ACCESSORIES THAT SHALL BE PROVIDED WITH THE EQUIPMENT.
B. EQUIPMENT SIZED FOR 25°F AMBIENT TEMPERATURE DURING HEATING MODE AND 115°F AMBIENT TEMPERATURE DURING COOLING MODE.
C. PROVIDE 2 INCH MERV 13, EFFICIENT PLEATED THROWAWAY AIR FILTERS.
D. PROVIDE FACTORY MOUNTED DISCONNECT INSTALLED ON SERVICE SIDE OF UNIT.
E. STARTERS FOR ALL MOTORS SHALL BE FURNISHED INTEGRAL WITH UNIT.
F. PROVIDE FACTORY MOUNTED VARIABLE FREQUENCY DRIVE OR 2-SPEED MOTOR TO FACILITATE STAGED FAN SPEED CONTROL.
G. PROVIDE SHAFT GROUNDING SYSTEM ON MOTOR. REFER TO MOTOR SPECIFICATION FOR ADDITIONAL INFORMATION.
H. PROVIDE SINGLE POINT POWER CONNECTION.
J. COORDINATE SIZE OF CONDUCTOR TERMINATION LUGS WITH CONDUCTOR SIZES SHOWN ON ELECTRICAL DRAWINGS.
K. PROVIDE 125 VAC, 20 AMP DUPLEX CONVENIENCE RECEPTACLE MOUNTED TO UNIT READY FOR FIELD WIRING WITH A COVER UL LISTED FOR WET AND DAMPER LOCATIONS WHEN IN USE.
L. SPECIFIED FAN ESP ACCOUNTS FOR DUCT LOSSES EXTERNAL TO UNIT.
M. PROVIDE MOTOR HORSEPOWER TO OVERCOME INTERNAL UNIT STATIC PRESSURE DROP PLUS SPECIFIED EXTERNAL STATIC PRESSURE DROP. NOMINAL MOTOR HP SHALL BE NO LARGER THAN THE FIRST AVAILABLE NOMINAL MOTOR SIZE GREATER THAN THE REQUIRED BHP.
N. DIVISION 23 SHALL PROVIDE ROOF CURB ADAPTER FROM EXISTING CURB PENETRATION TO NEW UNIT. COORDINATE CURB ADAPTER TYPE WITH EXISTING CURB CONDITIONS AND EQUIPMENT MANUFACTURER.
Q. SCHEDULED WEIGHT IS THE MAXIMUM ALLOWABLE OPERATING WEIGHT OF THE EQUIPMENT AND CURB ADAPTER.
R. COOLING COIL LAT IS LEAVING AIR TEMPERATURE OF THE UNIT.
S. PROVIDE GUARDS TO PROTECT CONDENSER COIL FROM HAIL OR OTHER DAMAGE.
T. TOTAL HEAT PUMP HEATING COIL CAPACITY AT THE AMBIENT DRY BULB TEMPERATURE LISTED. HEAT PUMP HEATING COIL MINIMUM EFFICIENCY IS CALCULATED AT 47°F.
U. SELECT EQUIPMENT FOR ELEVATION OF 2500 FEET ABOVE SEA LEVEL.
V. ABS. MIN. O/A IS THE ABSOLUTE MINIMUM OUTSIDE AIR CFM USING VENTILATION RESET OR DEMAND CONTROL VENTILATION.
X. PROVIDE UNIT WITH FACTORY INSTALLED UNIT CONTROLLER WITH SUPPLY AND OUTSIDE AIR TEMPERATURE SENSORS. UNIT MOUNTED CONTROLLED SHALL BE ABLE TO INTERFACE WITH EMS CONTROLS AND BE BACNET MSTP COMPATBILE. COORDINATE ALL CONTROLS WITH EMS VENDOR PRIOR TO PURCHASE.
Y. PROVIDE WITH DUCT SMOKE DETECTOR KIT. SMOKE DETECTORS SHALL SHUT DOWN UNIT UPON ALARM.
Z. PROVIDE UNIT WITH FACTORY INSTALLED BACNET OPEN BOARD CONTROLLER WITH SUPPLY AND OUTSIDE AIR TEMPERATURE SENSORS. COORDINATE ALL CONTROLS WITH EMS VENDOR PRIOR TO PURCHASE.

CARRIER NATIONAL ACCOUNT CONTACT
MATT MURPHY
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FAN SCHEDULE

MARK	SERVICE DESCRIPTION	MANUFACTURER	MOUNTING	MODEL	CFM	ESP (IN)	BHP	NOM HP	FAN RPM	DRIVE (BELT/DIRECT)	VFD (Y/N)	ELECTRICAL V/PH	WEIGHT (LBS)	NOTES
EF-1	RESTROOM	GREENHECK	ROOF	G-080-VG	325	0.5	0.05	1/10	1548	DIRECT	N	120/1	30	B, C, D, F, G, H, L
EF-2	IT CLOSET	GREENHECK	INLINE	SQ-100-VG	1000	0.3	0.13	1/4	1385	DIRECT	N	120/1	45	A, E, F, G, H, K

MODEL NUMBERS SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER AND MODEL NUMBERS ONLY. REVIEW THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS TO DETERMINE THE EXACT MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.

NOTES:
A. INSTALL FAN WITHIN 16'-0" ABOVE FLOOR OR WITHIN 12" OF CEILING FOR SERVICEABILITY. COORDINATE LOCATION WITH STRUCTURE, LIGHTS, PIPING, AND DUCTWORK SUCH THAT FAN IS FULLY ACCESSIBLE.
B. CONTRACTOR SHALL PROVIDE BIRDSCREEN AND MOTORIZED DAMPER CAPABLE OF ACCEPTING ACTUATOR PROVIDED BY EMS VENDOR. COORDINATE CONNECTIONS WITH EMS VENDOR PRIOR TO INSTALLATION.
C. PROVIDE INSULATED ROOF CURB WITH MINIMUM HEIGHT REQUIRED TO MAINTAIN BOTTOM OF EQUIPMENT A MINIMUM OF 16 INCHES ABOVE FINISHED ROOF SURFACE. PROVIDE SLOPED CURB IF NEEDED TO MATCH ROOF SLOPE. COORDINATE WITH ROOF INSULATION THICKNESS AND ROOF TAPER AT INSTALLED LOCATION. COORDINATE CURB TYPE WITH DRAWINGS.
D. INSTALL EXHAUST FAN OR EXTERIOR DUCT TERMINATION TO MAINTAIN A MINIMUM OF 15'-0" FROM AIR INTAKES.
E. PROVIDE WITH RUBBER IN SHEAR ISOLATION AND ALL-THREAD HANGING RODS.
F. PROVIDE WITH FACTORY-MOUNTED STARTER AND DISCONNECT SWITCH.
G. PROVIDE WITH FACTORY-MOUNTED CONTROL POWER TRANSFORMER CAPABLE OF ACCEPTING A 24V RELAY FROM EMS.
H. PROVIDE WITH MANUFACTURER'S ELECTRONICALLY COMMUTATED (EC) MOTOR. CONTRACTOR SHALL USE FAN POTENTIOMETER FOR BALANCING PURPOSES.
K. INTERLOCK FAN OPERATION WITH SPACE TEMPERATURE SENSOR. 24V RELAY FURNISHED BY EMS VENDOR.
L. INTERLOCK FAN OPERATION WITH EMS. 24V RELAY FURNISHED BY EMS VENDOR.

GRILLE, REGISTER, AND DIFFUSER SCHEDULE

MARK	MANUFACTURER	SERVICE	MODEL	CONSTRUCTION TYPE	FACE TYPE	MOUNTING LOCATION	BORDER TYPE	FACE SIZE (IN)	MAX. NC	MAX. PRESS. DROP (IN. W.C.)	NOTES
CEG1	TITUS	EXHAUST	OMNI	STEEL	PLAQUE	CEILING	--	12x12	25	0.1	B, C, F - H
CEG2	TITUS	EXHAUST	PAR	STEEL	PERFORATED	CEILING	--	12x12	25	0.1	B, C, F - H
CRG1	TITUS	RETURN	PAR	STEEL	PERFORATED	CEILING	--	24x24	25	0.1	B, C, F - H
CRG2	TITUS	RETURN	PAR	STEEL	PERFORATED	CEILING	--	12x24	25	0.1	B, C, F - H
CSD1	PRICE	SUPPLY	PRODIGY	STEEL	PLAQUE	CEILING	--	24x24	25	0.1	A - C, F - H, J
CSD2	TITUS	SUPPLY	OMNI	STEEL	PLAQUE	CEILING	--	24x24	25	0.1	A - C, F - H
CSD3	TITUS	SUPPLY	OMNI	STEEL	PLAQUE	CEILING	--	12x12	25	0.1	A - C, F - H
CSD4	TITUS	SUPPLY	R-OMNI	STEEL	PLAQUE	CEILING	--	18"Ø	25	0.1	A - C, F - H
WTG1	TITUS	TRANSFER	350RL	STEEL	LOUVERED	WALL	--	REFER TO PLANS	25	0.1	B - D, G, H

MODEL NUMBERS SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER AND MODEL NUMBERS ONLY. REVIEW THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS TO DETERMINE THE EXACT MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.

NOTES:
A. 4-WAY THROW PATTERN UNLESS OTHERWISE INDICATED BY FLOW ARROWS ON DRAWINGS.
B. NECK SIZE SHOWN ON DRAWINGS. PROVIDE BRANCH DUCT TO MATCH NECK SIZE UNLESS OTHERWISE SHOWN ON DRAWINGS.
C. BAKED ENAMEL FINISH, COLOR TO MATCH WALL, DUCT, AND/OR CEILING COLOR. COORDINATE WITH ARCHITECT PRIOR TO ORDERING.
D. FRONT BLADES PARALLEL TO LONG DIMENSION. INSTALL WALL GRILLE HIGH ON WALL WITH AIR BLADES POINTED UPWARD. COORDINATE EXACT LOCATIONS PRIOR TO INSTALLATION.
F. PROVIDE WITH RAPID MOUNT FRAMING OPTION FOR LAY-IN TYPE DIFFUSERS INSTALLED IN A HARD CEILING.
G. FRAME TYPE TO MATCH CEILING/WALL CONSTRUCTION. COORDINATE WITH ARCHITECTURAL REFLECTED CEILING/WALL PLAN.
H. PROVIDE DIFFUSERS AND GRILLES WITH NO EXPOSED MOUNTING SCREWS.
J. VARIABLE VOLUME DIFFUSER TO BE INTERLOCKED WITH SPACE MOUNTED THERMOSTAT. MAXIMUMM AIRFLOW SHALL BE AS NOTED ON PLANS. MINIMUM AIRFLOW SHALL BE 30% OF MAXIMUM AIRFLOW. PROVIDE PRESSURE RELIEF COLLAR WITH DIFFUSER. DIFFUSER SHALL BE FURNISHED BY EMS VENDOR, INSTALLED BY MECHANICAL CONTRACTOR.

CARRIER UNIT STARTUP REQUIREMENTS

INSTALLING CONTRACTOR SHALL COMPLETE THE PRE-START CHECKLIST AND EMAIL JENNIFER.TYE@COMFORTSYSTEMSUSA.COM TWO WEEKS PRIOR TO SCHEDULING EQUIPMENT STARTUP.

COORDINATE EQUIPMENT STARTUP WORK WITH COMFORT SYSTEMS USA
EMAIL: JENNIFER.TYE@COMFORTSYSTEMSUSA.COM, OFFICE: (317) 246-5176

DEPARTMENT MANAGER
EMAIL: KLORI.KARAMDAD@COMFORTSYSTEMSUSA.COM, OFFICE: 317-246-4656

TECHNICAL SUPPORT
EMAIL: RICK.FARRIS@COMFORTSYSTEMSUSA.COM, MOBILE: 317-638-5363 X4454

PRE-START CHECKLIST (VERIFY FOR ALL UNITS)
- ☐ VERIFY ALL ITEMS ON THE EQUIPMENT ORDER RECEIVED.
- ☐ VERIFY ALL PACKAGING MATERIAL REMOVED FROM THE UNIT.
- ☐ VERIFY CURB GASKETS PROPERLY INSTALLED.
- ☐ VERIFY ROOFTOP UNIT INSTALLED LEVEL AND PROPERLY ALIGNED WITH CURB.
- ☐ VERIFY DUCTWORK/FABRIC DUCT COMPLETELY INSTALLED PER MECHANICAL PLANS.
- ☐ VERIFY OA HOOD INSTALLED. AIR INLET SCREEN INSTALLED.
- ☐ VERIFY POWER EXHAUST ACCESSORY INSTALLED. (IF APPLICABLE)
- ☐ VERIFY CLEAN PLEATED FILTERS INSTALLED, MINIMUM MERV 8 RATING.
- ☐ VERIFY CONDENSATE DRAIN LINE INSTALLED. MINIMUM 2" DEEP TRAP. DRAIN PAN CHECK/LEVEL.
- ☐ VERIFY SUPPLY FAN ROTATES FREELY IN THE HOUSING.
- ☐ VERIFY PULLEYS ALIGNED AND BELT TENSION CORRECT.
- ☐ VERIFY SMOKE DETECTORS INSTALLED IN DUCTWORK, CLEANED AND TESTED.
- ☐ VERIFY JOBSITE POWER SUPPLY MATCHES THE VOLTAGE ON THE UNIT DATA PLATE.
- ☐ VERIFY ELECTRIC POWER CONNECTED TO UNIT VIA THE ACCESS PROVIDED. IF NOT, DATE POWER WILL BE AVAILABLE ___________
- ☐ VERIFY NO WIRES TOUCHING REFRIGERANT LINES OR SHARP EDGES.
- ☐ VERIFY ELECTRIC CONNECTORS AND TERMINALS TIGHT.
- ☐ VERIFY THRU-THE-CURB UTILITY CONNECTIONS COMPLETE.
- ☐ VERIFY UNIT TRANSFORMER PRIMARY TAPPED FOR JOBSITE VOLTAGE.
- ☐ VERIFY VENSTAR THERMOSTAT INSTALLED IN THE RETURN AIR DUCT DROP AND WIRED FOR TEMPORARY UNIT OPERATION.

EMS INSTALLATION CHECKLIST

ITEMS ON EMS CHECK-OFF LIST MUST BE COMPLETED PRIOR TO EMS AND GBS COMMISSIONING AT THE END OF THE JOB. SOME ITEMS LISTED BELOW MAY NOT BE APPLICABLE.

COORDINATE EQUIPMENT STARTUP WORK WITH COMFORT SYSTEMS USA.
EMAIL: PAUL.SAWYER@COMFORTSYSTEMSUSA.COM
OFFICE: 317-246-5170

EMS CHECKLIST
- ☐ REVIEW EMS PRINT SET AND INSTALL EMS OPUS PANEL AND LCP AS DESCRIBED IN THE EMS PRINT SET.
- ☐ REVIEW EMS PRINT SET AND PULL ALL WIRE AND TERMINATE ON DEVICES AS DESCRIBED IN THE EMS PRINT SET.
- ☐ REVIEW EMS PRINT SET AND INSTALL ALL EMS HVAC CONTROLS AS DESCRIBED IN THE EMS PRINT SET.
- ☐ REVIEW EMS PRINT SET AND INSTALL ALL EMS LIGHTING CONTROLS AS DESCRIBED IN THE EMS PRINT SET.
- ☐ REVIEW EMS PRINT SET AND WATTSTOPPER SUBMITTAL AND INSTALL THE WATTSTOPPER LIGHTING SYSTEM AND PULL ALL WIRE AS DESCRIBED IN THE EMS PRINT SET AND WATTSTOPPER SUBMITTAL.

SEQUENCE OF OPERATION

A. ROOFTOP UNIT CONTROL (RTU-1,2,3,4,5,6,7)

Refer to Rooftop Unit Control Matrix for sequence of operations.

B. VAV DIFFUSER CONTROL (CSD1)

In occupied mode, the VAV diffuser shall modulate airflow to maintain the room temperature setpoint (adjustable). Set VAV diffuser minimum position to maintain 30% of the maximum airflow.

The room occupancy sensor, upon sensing the space to be vacant for 15 minutes (adjustable), shall signal the diffuser through the EMS to maintain an unoccupied temperature setpoint (adjustable). When occupancy is detected, the EMS shall direct the diffuser to control to the room temperature setpoint.

The room CO2 sensor, upon reading a CO2 level above 100 PPM (adjustable) above ambient CO2 level (400 PPM), shall signal the diffuser through the EMS to modulate the zone damper between its minimum and maximum position. The system shall start to modulate the damper open when CO2 level rises 100 PPM above ambient CO2 level and continue to open to its maximum position as CO2 level rises to and above 700 PPM (adjustable) above ambient CO2 levels. As the CO2 level drops, the system shall start to modulate the dampers to the minimum position.

In unoccupied mode, VAV diffuser control shall be disabled unless occupancy is detected. When occupancy is detected, the EMS shall direct the diffuser to control at the room temperature setpoint.

C. MOTORIZED DAMPER CONTROL SERVING IT ROOM (MD)

When RTU-2 is in heating mode, the motorized damper shall be closed.

When RTU-2 is in cooling mode and the supply air temperature drops below 65 degrees Fahrenheit (adjustable), the motorized damper shall open.

A damper end switch shall prove if the motorized damper is open when called. If failure to open occurs, an alarm shall be generated to the EMS.

D. RESTROOM EXHAUST FAN CONTROL (EF-1)

In occupied mode, the exhaust fan shall be enabled and the motorized damper shall open.

In unoccupied hours, the exhaust fan shall be disabled and the motorized damper shall be closed.

A damper end switch shall prove if the motorized damper is open when called. If failure to open occurs, the fan shall not be enabled and an alarm shall be generated to the EMS.

E. IT ROOM EXHAUST FAN CONTROL (EF-2)

The exhaust fan shall be enabled when the space temperature rises 1 degree above the cooling setpoint (75 degrees Fahrenheit, adjustable) and shall continue to operate until the space temperature drops to 1 degree below the cooling setpoint.

EMS CONTROLS:
CONTRACTORS ARE RESPONSIBLE FOR COORDINATING ALL EQUIPMENT CONTROLS WITH EMS VENDOR PRIOR TO PURCHASE AND INSTALLATION. CONTRACTORS SHALL COORDINATE WITH EMS VENDOR TO PROVIDE ALL NECESSARY EQUIPMENT AND ACCESSORIES FOR A FULLY FUNCTIONING SYSTEM.

JUSTIN M. OLDER

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TEMPLATE ISSUE DATE: 11/28/2018

Fixture Package: CLEARANCE

Stamp:

EXPIRES ON: 06/30/2024
Registered Professional Engineer (Mechanical)
CERTIFICATE NO. 66286
JUSTIN M. OLDER
Date Signed
ARIZONA U.S.A.
09/30/2022

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Sheet Title: MECHANICAL SCHEDULES AND CONTROLS

Sheet Number: M3.0

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.5, C403.5.1, C403.5.2 [ME62][1]	Air economizers provided where required, meet the requirements for design capacity, control signal, ventilation controls, high-limit shut-off, integrated economizer control, and provide a means to relieve excess outside air during operation.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5, C403.5.1, C403.5.2 [ME62][1]	Air economizers provided where required, meet the requirements for design capacity, control signal, ventilation controls, high-limit shut-off, integrated economizer control, and provide a means to relieve excess outside air during operation.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5.3.3 [ME124][1]	Air economizers automatically reduce outdoor air intake to the design minimum outdoor air quantity when outdoor air intake will not reduce cooling energy usage. See Table C403.5.3.3 for applicable device types and climate zones.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5.3.3 [ME124][1]	Air economizers automatically reduce outdoor air intake to the design minimum outdoor air quantity when outdoor air intake will not reduce cooling energy usage. See Table C403.5.3.3 for applicable device types and climate zones.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5.3.3 [ME124][1]	Air economizers automatically reduce outdoor air intake to the design minimum outdoor air quantity when outdoor air intake will not reduce cooling energy usage. See Table C403.5.3.3 for applicable device types and climate zones.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5.3.4 [ME125][1]	System capable of relieving excess outdoor air during air economizer operation to prevent overpressurizing the building. The relief air outlet located to avoid recirculation into the building.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5.3.4 [ME125][1]	System capable of relieving excess outdoor air during air economizer operation to prevent overpressurizing the building. The relief air outlet located to avoid recirculation into the building.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5.3.4 [ME125][1]	System capable of relieving excess outdoor air during air economizer operation to prevent overpressurizing the building. The relief air outlet located to avoid recirculation into the building.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5.3.5 [ME126][1]	Return, exhaust/relief and outdoor air dampers used in economizers have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Reference section C403.7.7 for details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.5.3.5 [ME126][1]	Return, exhaust/relief and outdoor air dampers used in economizers have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Reference section C403.7.7 for details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5.3.5 [ME126][1]	Return, exhaust/relief and outdoor air dampers used in economizers have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Reference section C403.7.7 for details.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.4.1.4 [ME63][2]	Heating for vestibules and air curtains with integral heating include automatic controls that shut off the heating system when outdoor air temperatures > 45F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint <= 60F and cooling setpoint >= 80F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C408.2.2.1 [ME53][3]	Air outlets and zone terminal devices have means for air balancing.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.5, C403.5.1, C403.5.2 [ME123][3]	Refrigerated display cases, walk-in coolers or walk-in freezers served by remote compressors and remote condensers not located in a condensing unit, have fan-powered condensers that comply with Sections C403.5.1 and refrigeration compressor systems that comply with C403.5.2..	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.6 [EL26][2]	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C405.7 [EL27][2]	Electric motors meet the minimum efficiency requirements of Tables C405.7(1) through C405.7(4). Efficiency verified through certification under an approved certification program or the equipment efficiency ratings shall be provided by motor manufacturer (where certification programs do not exist).	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C405.8.2, C405.8.2.1 [EL28][2]	Escalators and moving walks comply with ASME A17.1/CSA B44 and have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C405.9 [EL29][2]	Total voltage drop across the combination of feeders and branch circuits <= 5%.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C303.3, C408.2.5.3 [FI8][3]	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.2 [FI27][3]	HVAC systems and equipment capacity does not exceed calculated loads.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1 [FI47][3]	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1 [FI47][3]	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1 [FI47][3]	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1 [FI47][3]	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1.1 [FI42][3]	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.4.1.1 [FI42][3]	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.4.1.1 [FI42][3]	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.4.1.1 [FI42][3]	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.4.1.2 [FI38][3]	Thermostatic controls have a 5 °F deadband.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.1.3 [FI20][3]	Temperature controls have setpoint overlap restrictions.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C403.2.4.2 [FI39][3]	Each zone equipped with setback controls using automatic time clock or programmable control system.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.2.1, C403.2.4.2.2 [FI40][3]	Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.2.3 [FI41][3]	Systems include optimum start controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.2.3 [FI41][3]	Systems include optimum start controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.2.3 [FI41][3]	Systems include optimum start controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.2.3 [FI41][3]	Systems include optimum start controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C404.3 [FI11][3]	Heat traps installed on supply and discharge piping of non-circulating systems.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C404.4 [FI25][2]	All piping insulated in accordance with section details and Table C403.11.3.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C404.6.1 [FI12][3]	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank. System return pipe is a dedicated return pipe or a cold water supply pipe.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.1.1 [FI57][1]	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building, equipment and systems are intended to be installed, maintained, and operated.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.1 [FI28][1]	Commissioning plan developed by registered design professional or approved agency.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C408.2.3.1 [FI31][1]	HVAC equipment has been tested to ensure proper operation.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.3.2 [FI10][1]	HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.3.3 [FI32][1]	Economizers have been tested to ensure proper operation.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.4 [FI29][1]	Preliminary commissioning report completed and certified by registered design professional or approved agency.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.5.1 [FI7][3]	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.5.3 [FI43][1]	An air and/or hydronic system balancing report is provided for HVAC systems.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C408.2.5.4 [FI30][1]	Final commissioning report due to building owner within 90 days of receipt of certificate of occupancy.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

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TEMPLATE ISSUE DATE: 11/28/2018

Fixture Package:

CLEARANCE

Stamp:

EXPIRES ON: 06/30/2024
66286
JUSTIN M.
OLDER

09/30/2022

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MK

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Author

Project Number:

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MECHANICAL
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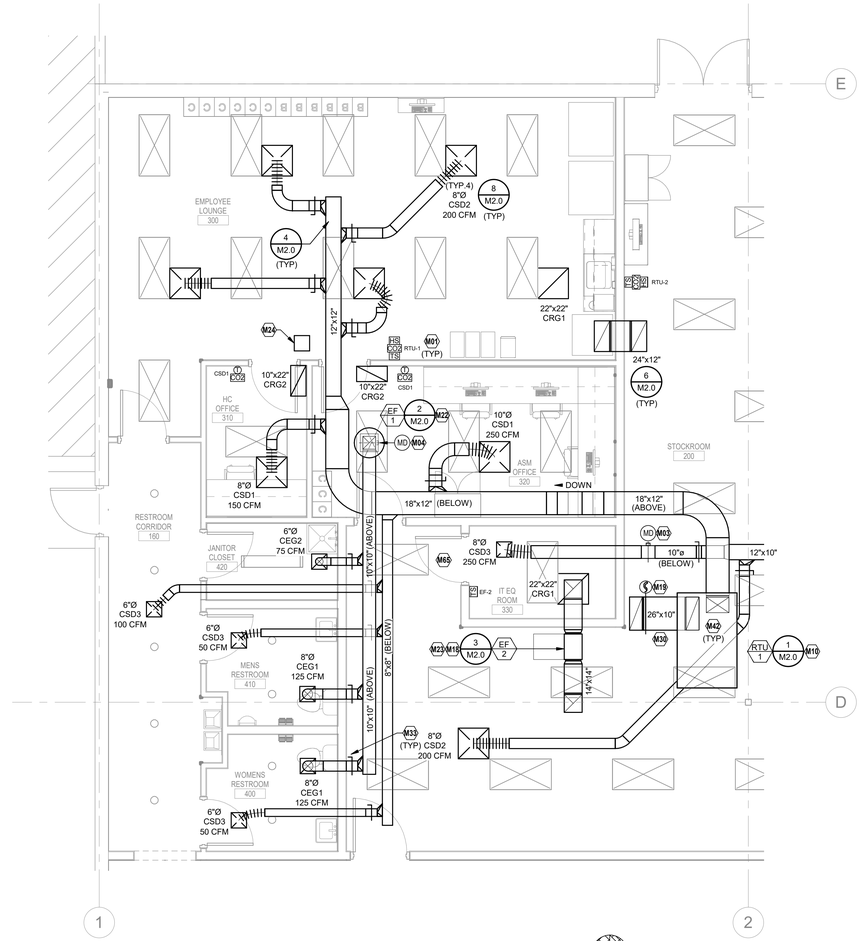
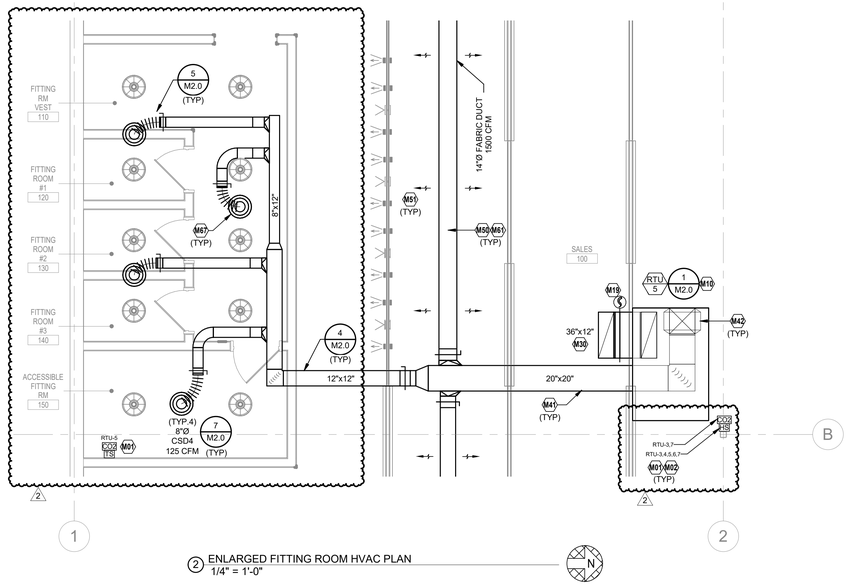
Sheet Number:

M5.1



1 ENLARGED BACK OF HOUSE HVAC PLAN
1/4" = 1'-0"



2 ENLARGED FITTING ROOM HVAC PLAN
1/4" = 1'-0"

KEYNOTES ARE PROTOTYPICAL. MISSING KEYNOTE NUMBERS INDICATE A PROTOTYPICAL NOTE IS NOT USED OR REMOVED.

MECHANICAL PLAN NOTES

M01 ALL THERMOSTATS AND SENSORS ARE FURNISHED BY EMS VENDOR AND INSTALLED BY DIVISION 26, UNLESS NOTED OTHERWISE.

M02 DO NOT INSTALL SENSORS ON WALL GRAPHICS. CONFIRM LOCATIONS OF SENSORS WITH PM PRIOR TO INSTALLATION.

M03 INSTALL DAMPER AND ACTUATOR IN LOCATION INDICATED. DAMPER FURNISHED BY DIVISION 23. ACTUATOR FURNISHED BY EMS VENDOR.

M04 MOTORIZED DAMPER SHALL BE ACCESSED THROUGH FAN ON ROOF AND IS SHOWN ON PLAN FOR REFERENCE ONLY. REFER TO MECHANICAL SCHEDULES FOR MORE INFORMATION.

M10 PROVIDE NEW ROOFTOP UNIT AS SCHEDULED WITH NEW CURB ADAPTER FROM EXISTING CURB. PROVIDE A NEW SET OF MERV 13 AIR FILTERS IN UNIT BEFORE TURNING SYSTEM OVER TO OWNER. COORDINATE CONDENSATE PIPING WITH DIVISION 25.

M18 ACCESS TO HVAC EQUIPMENT SHALL BE FROM LAY-IN CEILING. NO CEILING DEVICES SHALL BE PLACED IN THIS LOCATION. COORDINATE FINAL INSTALLED LOCATION SUCH THAT THE HVAC EQUIPMENT REMAINS ACCESSIBLE. VERIFY NO OTHER PIPING, ELECTRICAL CONDUIT, STRUCTURE, AND/OR CEILING SUPPORTS IMPEDE ACCESS IN ANY WAY. INSTALL HVAC EQUIPMENT WITHIN 24" ABOVE CEILING FOR SERVICEABILITY.

M19 SMOKE DETECTORS AND WIRING IN RETURN AIR DUCTS SHALL BE PROVIDED BY DIVISION 28 CONTRACTOR. SMOKE DETECTORS SHALL SHUT-DOWN UNIT UPON ALARM.

M22 PROVIDE NEW ROOF-MOUNTED EXHAUST FAN AS SCHEDULED FOR GENERAL RESTROOM EXHAUST.

M23 EXHAUST FAN SERVES TO PROVIDE TRANSFER AIR ONLY AND SHALL DISCHARGE AIR INTO THE STOCKROOM PLENUM.

M24 INSTALL VAV POWER MODULE FOR CONTROL OF OFFICE VAV DIFFUSERS IN AN ACCESSIBLE LOCATION ABOVE THE CEILING. DIVISION 26 CONTRACTOR SHALL PROVIDE 120V POWER TO MODULE. REFER TO ELECTRICAL DRAWINGS FOR DETAILS.

M30 ROUTE SHEET METAL RETURN AIR DUCT AS SHOWN WITH TERMINATION DIRECTED UPWARD. SIZE PLENUM FULL SIZE OF RETURN AIR INLET. PROVIDE DUCT LINER IN RETURN AIR DUCTWORK FOR SOUND ATTENUATION. COVER INLET WITH 1/2"x1/2" BIRD SCREEN.

M33 EXHAUST AIR DAMPERS SHALL BE ACCESSIBLE FROM STOCKROOM LAY-IN CEILING. COORDINATE FINAL INSTALLED LOCATION SUCH THAT THE DAMPERS REMAIN ACCESSIBLE.

M41 COORDINATE DUCT ROUTING WITH LIGHTS AND STRUCTURE. ROUTE ALL SALES DUCTWORK AT SAME ELEVATION BELOW STRUCTURE AND ABOVE LIGHTING.

M42 ROUTE SUPPLY AND RETURN DUCTWORK TO ROOF CURB DUCT CONNECTIONS AND TRANSITION DUCTWORK IN RISER AS NECESSARY.

M50 INSTALL FABRIC DUCT ABOVE ARCHITECTURAL LIGHTING GRID. REFER TO BOXED NOTES FOR ADDITIONAL INFORMATION.

M51 ARROWS INDICATE DIRECTION AND DISPERSION OF AIRFLOW VOLUME. PROVIDE VENTS ON FABRIC DUCT TO DIRECT AIRFLOW AS SHOWN ON PLAN.

M61 SUPPORT FABRIC DUCTWORK WITH MANUFACTURER'S DOUBLE-CABLE CROSS BRACING SUPPORTS. COORDINATE REQUIREMENTS WITH FABRIC DUCT MANUFACTURER.

M65 LOUVERED DOOR FOR MAKEUP AIR BY GENERAL CONTRACTOR. REFER TO ARCHITECTURAL DRAWINGS FOR MORE INFORMATION.

M67 COORDINATE LOCATION OF FITTING ROOM DIFFUSERS WITH LIGHTS, SPRINKLERS, SPEAKERS, AND OTHER CEILING DEVICES FOR A NEAT AND ORDERLY INSTALLATION. INSTALL CEILING DEVICES IN-LINE WITH EACH OTHER WHERE POSSIBLE.

INSTALL DUCTWORK AND PIPING AS TIGHT TO STRUCTURE AS POSSIBLE. COORDINATE WITH OTHER TRADES TO AVOID CONFLICTS. COORDINATE INSTALLATION OF DUCTWORK AND PIPING TO AVOID CONFLICTS WITH ELECTRICAL PANELS, LIGHTING FIXTURES, ETC. DO NOT INSTALL DUCTWORK BELOW THE BOTTOM OF THE LIGHT FIXTURES. NOTIFY CONSTRUCTION PROJECT MANAGER OF CONFLICTS.

FABRIC DUCT GENERAL NOTES:
PROVIDE FABRIC DUCT THROUGHOUT THE SPACE AS SHOWN ON PLAN. FABRIC DUCT SHALL NOT REPLACE RECTANGULAR DUCT DROPS OR EXHAUST DUCTS. BASIS OF DESIGN SHALL BE "PRIHODA", "NMT" NONPOROUS FABRIC WITH "PERFORATIONS" (AIR OPENINGS) WITH ADJUSTABLE FLOW DEVICES (I.E. AFD'S) AT OPENINGS, AND ONE ROW, GALVANIZED CABLE. INTERNAL HOOP SUPPORT SYSTEM SHALL BE PROVIDED ON ALL FABRIC DUCT UNLESS NOTED OTHERWISE. INCLUDE ALL COMPONENTS AND ACCESSORIES REQUIRED TO MAKE A COMPLETE SYSTEM AS RECOMMENDED BY PRIHODA DURING BID PHASE, INCLUDING HANGING STRAPS AND CLIPS, END-CAPS, CONNECTIONS TO METAL DUCTS, ETC. PRIHODA FABRIC DUCT SHALL BE SIZED PER FACTORY RECOMMENDATIONS TO PROVIDE MINIMUM AIRFLOWS IN BRANCH DUCTS AS SHOWN. CONFIRM FABRIC DUCT COLOR WITH ARCHITECT PRIOR TO ORDERING ON ALL PROJECTS. (FOR UNITE FIXTURE PACKAGE, WHITE IS BASIS OF DESIGN) (FOR GLOBAL 3.0 FIXTURE PACKAGE, PANTONE 420 - LIGHT GREY IS BASIS OF DESIGN). CONTACT PRIHODA SALES DEPARTMENT (E-MAIL: SALES@PRIHODA-NA.COM, PHONE: 1-855-774-4632) FOR PRICING INFORMATION.

FABRIC DUCT DESIGN GUIDELINE:
DISTRIBUTE AIRFLOW EVENLY ALONG FABRIC DUCT IN THE DIRECTION OF FLOW ARROWS. ORIENT AND SIZE FABRIC DUCT DIFFUSER OPENINGS TO PROVIDE A 50 FPM THROW VELOCITY HALF WAY TO THE NEAREST ADJACENT FABRIC DUCT OR TO THE NEAREST PARTITION/DEMISING WALL AS APPLICABLE. VENTS ON FABRIC DUCT SHALL BE LOCATED AT 22.5 DEGREES BELOW HORIZONTAL UNLESS NOTED OTHERWISE.

FABRIC DUCT COORDINATION NOTE:
DURING THE FIRST WEEK OF THE PROJECT, THE GENERAL CONTRACTOR'S SUPERINTENDENT, MECHANICAL SUB-CONTRACTOR, AND A REPRESENTATIVE FROM "PRIHODA" SHALL MEET AT THE PROJECT SITE FOR CONFIRMATION OF ALL FIELD DIMENSIONS AND POTENTIAL OBSTRUCTIONS. THIS EVENT MUST PRECEDE THE ORDERING OF ANY MATERIALS FROM "PRIHODA". CHANGE ORDERS AND EXPEDITING FEES WILL NOT BE APPROVED DUE TO LACK OF ON-SITE COLLABORATION AND/OR MEASUREMENT DURING SITE MEETING AT PROJECT COMMENCEMENT.

FABRIC DUCT INSTALLATION NOTE:
INSTALL FABRIC DUCT ABOVE ARCHITECTURAL LIGHTING SYSTEM. COORDINATE FABRIC DUCT INSTALLATION WITH GENERAL CONTRACTOR AND DIVISION 26. GENERAL CONTRACTOR SHALL VERIFY FABRIC DUCT IS INSTALLED SUCH THAT IT DOES NOT CLASH WITH ARCHITECTURAL LIGHTING SYSTEM, INCLUDING LIGHT FIXTURES, ARCHITECTURAL LIGHTING SYSTEM GRID AND SUSPENSION CABLES, OR ANY OTHER SUSPENDED FIXTURES WHEN DEFLATED.

THE DUCTWORK LAYOUT INDICATED ON THE DRAWINGS IS SCHEMATIC AND SHOWS DESIGNED INTENT ONLY. PRIOR TO FABRICATION AND INSTALLATION OF DUCTWORK, DIVISION 23 SHALL HAVE A QUALIFIED, EXPERIENCED SKETCHER PREPARE AND SUBMIT SHEET METAL SHOP DRAWINGS. SHOP DRAWINGS SHALL TAKE INTO ACCOUNT ALL EXISTING CONDITIONS, INCLUDING BUT NOT LIMITED TO, STRUCTURAL MEMBERS, CONDUITS AND PIPING TO REMAIN. SHOP DRAWINGS SHALL ALSO TAKE INTO ACCOUNT ALL NEW DESIGN CONDITIONS, INCLUDING BUT NOT LIMITED TO, STRUCTURAL MEMBERS, PIPING, CEILINGS, SOFFIT HEIGHTS, AND LIGHT FIXTURES.

SHOP DRAWINGS SHALL INDICATE ALL REVISIONS TO THE LAYOUT REQUIRED TO ACCOMMODATE THE EXISTING CONDITIONS AND/OR MAINTAIN THE CEILING HEIGHTS AND CLEARANCES REQUIRED. NOTIFY THE ARCHITECT AND ENGINEER OF ANY LOCATION WHERE THE DESIGN INTENT CANNOT BE MET PRIOR TO FABRICATION AND INSTALLATION OF DUCTWORK. REVISIONS TO DUCTWORK, EQUIPMENT, CONDUIT AND/OR PIPING REQUIRED BY CONTRACTOR'S FAILURE TO SUBMIT PROPERLY PREPARED SHOP DRAWINGS SHALL BE THE RESPONSIBILITY OF DIVISION 23 AT NO ADDITIONAL COST TO THE CLIENT OR DELAY TO THE PROJECT SCHEDULE.

GENERAL CONTRACTOR IS RESPONSIBLE FOR PROVIDING TO ARCHITECT, ENGINEER, LANDLORD, AND BUILDING OFFICIAL/INSPECTOR A FINAL TEST AND BALANCE REPORT PER THE SPECIFICATIONS. PROVIDE TEST AND BALANCE REPORT TO ARCHITECT, ENGINEER, AND LANDLORD PRIOR TO THE FINAL BUILDING INSPECTION.

LANDLORD REQUIREMENTS:
LANDLORD APPROVED ROOFING CONTRACTOR SHALL BE RESPONSIBLE FOR MAKING ALL CUTS THROUGH THE EXISTING ROOF, MODIFYING EXISTING OPENINGS, AND/OR ALTERING CURB FLASHING AT GENERAL CONTRACTOR'S EXPENSE. COORDINATE WITH GENERAL CONTRACTOR.

EMS CONTROLS:
CONTRACTORS ARE RESPONSIBLE FOR COORDINATING ALL EQUIPMENT CONTROLS WITH EMS VENDOR PRIOR TO PURCHASE AND INSTALLATION. CONTRACTORS SHALL COORDINATE WITH EMS VENDOR TO PROVIDE ALL NECESSARY EQUIPMENT AND ACCESSORIES FOR A FULLY FUNCTIONING SYSTEM.

TEMPERATURE CONTROLS:
EMS VENDOR SHALL FURNISH SENSORS AND CONTROL COMPONENTS AS INDICATED ON PLANS AND AS NECESSARY TO ACCOMPLISH THE INTENT OF THE DRAWINGS. ALL CONTROLS SHALL BE TIED INTO THE EMS SYSTEM UNLESS NOTED OTHERWISE.

GENERAL CONTRACTOR SHALL INSTALL CARRIER FURNISHED TEMPORARY THERMOSTATS AND FEED THE WIRING DOWN INTO THE SPACE FOR START UP AND CONTROL OF RTU(S) UNTIL THE EMS SYSTEM IS OPERABLE. REFER TO M3.0 FOR CARRIER CONTACT INFORMATION.

PROVIDE RFID DUCTWORK MESH OVER TRANSFER GRILLS BELOW 15'-0" AFF BETWEEN THE STOCKROOM AND THE SALES FLOOR, IF APPLICABLE. COORDINATE REQUIREMENTS WITH CONSTRUCTION PROJECT MANAGER.

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TEMPLATE ISSUE DATE: 11/28/2018

Fixture Package:

CLEARANCE

Stamp:

EXPIRES ON: 06/30/2024
Registered Professional Engineer (Mechanical) CERTIFICATE NUMBER 66286 JUSTIN M. OLDER Date Signed ARIZONA U.S.A.

09/30/2022

Issued For:

CONSTRUCTION

Issue Date:

02/22/2022

Revisions:

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MK
CHECKED BY:
DRAWN BY:
Author

Project Number:

62301432

Sheet Title:

MECHANICAL ENLARGED PLANS

Sheet Number:

M1.1

JUSTIN M. OLDER

Division 23: HEATING, VENTILATING, AND AIR CONDITIONING

1. GENERAL INSTRUCTIONS

A. GENERAL REQUIREMENTS

All requirements under Division 01 and the general and supplementary conditions of these specifications apply to this section and division. Where the requirements of this section and division exceed those of Division 01, this section and division take precedence. Become thoroughly familiar with all its contents as to requirements that affect this division, section, or both. Work required under this division includes all material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate the function of each system as implied by the design and the equipment specified.

The specifications and drawings for the project are complementary, and any portion of work described in one shall be provided as if described in both. In the event of discrepancies, notify the Engineer and request clarification prior to proceeding with the work involved.

Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They convey the scope of work, indicating the intended general arrangement of the systems without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

B. DEFINITIONS

Division: References contained in this specification follow the numbering system defined in the Construction Specifications Institute (CSI) MasterFormat 2004 Edition. Specification Divisions 01 through 13 provided with this project may reference the CSI MasterFormat 1995 Edition. The corresponding division references between the 2004 Edition and 1995 Edition are as follows:

	2004 Edition	1995 Edition
1.	Division 21 - Fire Suppression	Division 15
2.	Division 22 - Plumbing	Division 15
3.	Division 23 - HVAC	Division 15
4.	Division 26 - Electrical	Division 16
5.	Division 27 - Communications	Division 16
6.	Division 28 - Electronic Safety and Security	Division 16

Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

Install: "to perform all operations at the project site including, but not limited to, the actual unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."

Provide: "to furnish and install."

Furnished by Owner (or Owner-Furnished) or Furnished by Others: "an item furnished by the Owner or under other divisions or contracts, and installed under the requirements of this division, complete and ready for intended use, including all items and services incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division."

Engineer: Where referenced in this division, "Engineer" is the Engineer of Record and the Design Professional for the work under this division, and is a consultant to, and an authorized representative of the Architect, as defined in the General and/or Supplementary Conditions. When used in this division, Engineer means increased involvement by and obligations to the Engineer, in addition to involvement by and obligations to the Architect.

AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the work.

NRTL: Nationally recognized testing laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project. Nationally recognized testing laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ and standards that meet the specified criteria.

Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.
1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

C. PREBID SITE VISIT

Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to comply with this requirement shall not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

D. MATERIAL AND WORKMANSHIP

Provide new material, equipment, and apparatus under this contract unless otherwise stated herein, of best quality normally used for the purpose in good commercial practice, and free from defects. Install material and equipment in accordance with the manufacturer's installation instructions. Model numbers listed in the specifications or shown on the drawings are not necessarily intended to designate the required trim, written descriptions of the trim govern model numbers.

Pipe, pipe fittings, pipe specialties and valves shall be manufactured in plants located in the United States or certified to meet the specified ASTM and ANSI standards.

Work performed under this contract shall provide a neat and "workmanlike" appearance when completed, to the satisfaction of the Architect and Engineer. Workmanship shall be the finest possible by experienced mechanics. Installations shall comply with applicable codes and laws.

The complete installation shall function as designed and intended with respect to efficiency, capacity, noise level, etc. Abnormal noise caused by rattling equipment, piping, ducts, air devices, and squeaks in rotating components shall not be acceptable. Materials and equipment shall be of commercial specification grade in quality. Light duty and residential grade equipment shall not be accepted unless otherwise indicated.

Remove from the premises waste material present as a result of work, including cartons, crating, paper, stickers, and/or excavation material not used in backfilling, etc. Clean equipment installed under this contract to present a neat and clean installation at the termination of the work.

Repair or replace public and private property damaged as a result of work performed under this contract to the satisfaction of authorities and regulations having jurisdiction. Provide all safety lights, guards, and warning signs required for the performance of the work and for the safety of the public.

E. MANUFACTURERS

In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.

Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

F. COORDINATION

Coordinate work with that of other trades so that the various components of the systems are installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Components which are installed without regard to the above shall be relocated at no additional cost to the Owner.

Unless otherwise indicated, the General Contractor shall provide chases and openings in building construction required for installation of the systems specified herein. Contractor shall furnish the General Contractor with information where chases and openings are required. Contractor shall keep informed as to the work of other trades engaged in the construction of the project and shall execute work in a manner as to not interfere with or delay the work of other trades.

Figured dimensions shall be taken in preference to scale dimensions. Contractor shall take his own measurements at the building, as variations may occur. Contractor shall be held responsible for errors that could have been avoided by proper checking and inspection.

Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers listed in the specifications or shown on the drawings are not intended to designate the required trim.

G. ORDINANCES AND CODES

Work performed under this contract shall, at a minimum, be in conformance with applicable national, state and local codes having jurisdiction. Equipment furnished and associated installation work performed under this contract shall be in strict compliance with current applicable codes adopted by the local AHJ, including any amendments and standards as set forth by the following:
1. National Electrical Code (NEC)
2. National Fire Protection Association (NFPA)
3. Underwriters Laboratories (UL)
4. Occupational Safety and Health Administration (OSHA)
5. American Society of Mechanical Engineers (ASME)
6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
7. American National Standards Institute (ANSI)
8. American Society of Testing and Materials (ASTM)
9. Other national standards and codes where applicable.

Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent.

Promptly bring all conflicts observed between codes, ordinances, rules, regulations, referenced standards, and these documents to the attention of the Architect and Engineer for final resolution. Contractor will be held responsible for any violation of the law.

Procure and pay for permits and licenses required for the accomplishment of the work herein described. Where required, obtain, pay for,
and furnish certificates of inspection to Owner.

H. PROTECTION OF EQUIPMENT AND MATERIALS

Store and protect from damage equipment and materials delivered to job site. For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastic as required to protect from plaster, dust, dirt, paint, water, or physical damage. Replace insulation that has become wet at any time during construction. Drying the insulation is not acceptable. Seal any tears or joints of internal fiberglass insulation. Equipment and material damaged by construction activities shall be rejected and Contractor shall furnish new equipment and material of a like kind at his own expense.

Keep premises broom clean of foreign material created during work performed under this contract. Piping, equipment, etc. shall have a neat and clean appearance at the termination of the work. Remove debris from ceiling/return air plenum, including dust.

Plug, seal, or cap open ends of ductwork and piping systems while stored and installed during construction when not in use to prevent the entrance of debris into the systems. Remove temporary protection prior to starting equipment and turning the system over to the owner.

I. SUBSTITUTIONS

Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications. To request a substitution, request the Substitution Request Form from the Architect or Engineer. Complete and send the Substitution Request Form for each material, product, equipment, or system that is proposed to be substituted. The burden of proof of the merit of the proposed substitution is upon the proposer.

Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:
1. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects unless stated otherwise in the substitution request.
2. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
3. Proposed substitution has received necessary approvals of authorities having jurisdiction.
4. Same warranty will be furnished for proposed substitution as for specified Work.
5. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
6. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation. No substitution will be considered prior to receipt of bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of bids.

If the proposed substitution is approved prior to receipt of bids, such approval will be stated in an addendum. Bidders shall not rely upon approvals made in any other way. Verbal approval will not be given. No substitutions will be considered after the contract is awarded unless specifically provided in the contract documents.

J. SUBMITTALS

Assemble and submit for review shop drawings, material lists, manufacturer product literature for equipment to be furnished, and items requiring coordination between contractors under this contract. Provide submittals in sufficient detail so as to demonstrate compliance with these contract documents and the design concept. Prior to transmitting submittals, verify that the equipment submitted is mutually compatible and suitable for the intended use, will fit the available space, and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location or configuration, submit a shop drawing showing the proposed layout.

Transmit submittals as early as required to support the project schedule. Allow for two weeks Engineer review time, plus to/from mailing time via the Architect, plus a duplication of this time for resubmittal, if required. Only resubmit those sections requested for resubmittal.

Submittals shall contain the project name, applicable specification section, submittal date, equipment identification acronym as used on the drawings, and the Contractor's stamp. The stamp shall certify that the submittal has been checked by the Contractor, complies with the drawings and specifications, and is coordinated with other trades. Manufacturer product literature shall include shop drawings, product data, performance sheets, samples and other submittals required by this division. Highlight, mark, list, or indicate the materials, performance criteria, and accessories that are being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, refer to paragraph "Electronic Drawing Files" for procedures to be used.

Separate submittals according to individual specification sections. Illegible submittals will be rejected and returned without review. Catalog data shall be properly bound, identified, indexed and tabbed in a 3-ring binder. Each item or model number shall be clearly marked and accessories indicated. Label the catalog data with the equipment identification acronym or number as used on the drawings and include performance curves, capacities, sizes, weights, materials, finishes, wiring diagrams, electrical requirements and deviations from specified equipment or materials. For equipment with motor starters or VFDs, include short circuit current ratings. Mark out inapplicable items. Shop drawings will be returned without review if the above mentioned requirements are not met.

Provide the quantity of submittals required by Division 01. If not indicated and hard-copy sets are provided, submit a minimum of six (6) copies. Refer to Division 01 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the submittals have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, user name, and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the designated representatives of the Architect and Engineer. Contractor shall allow for the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal.

The checking and subsequent acceptance of submittals by the Engineer and/or Architect shall not relieve the Contractor from responsibility for deviations from the drawings and specifications, errors in dimensions, details, size of members, or quantities, omissions of components or fittings; coordination of electrical requirements; and not coordinating items with actual building conditions and adjacent work. Proceed with the procurement and installation of equipment only after receiving approved shop drawings relative to each item.

K. ELECTRONIC DRAWING FILES

In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format on CD-ROM disk, DVD disk, flash drive or direct download, as desired, from the Engineer for a shipping and handling fee of $200 for a drawing set up to 12 sheets and $15 per sheet for each additional sheet. Contact the Architect for written authorization and Engineer for the necessary release agreement form and to specify shipping method and drawing format. In addition to payment, the written authorization from the Architect and release agreement form from the Engineer must be received before electronic drawing files will be sent.

L. RECORD DRAWINGS (AS-BUILT DRAWINGS)

During progress of the work in this division, Contractor shall maintain an accurate record of all changes made during the installation of the system. Upon completion of the work, accurately transfer all record information to three identical sets of the approved shop drawings. Insert one set into each copy of the manual described below.

See Division 01 and General Conditions for additional information.

M. OPERATION AND MAINTENANCE INSTRUCTIONS

During the course of construction, collect and compile a complete brochure of equipment furnished and installed on this project. Include operational and maintenance instructions, manufacturer's catalog sheets, wiring diagrams, parts lists, approved submittals and shop drawings, warranties, and descriptive literature as furnished by the equipment manufacturer. Include an inside cover sheet that lists the project name, date, Owner, Architect, Engineer, General Contractor, Sub-Contractor, and an index of contents.

Submit three copies of literature bound in approved binders with index and tabs separating equipment types to the Architect, for Engineer's review, at the termination of the work. Paper clips, staples, rubber bands, loose-leaf binding, and mailing envelopes are not considered approved binders. Final approval of systems installed under this contract shall be withheld until this equipment brochure is received and deemed complete by the Architect and Engineer. Instruct workmen to save required literature shipped with the equipment itself for inclusion in this brochure.

Include Record Drawings as described above.

Refer to Division 01 for acceptance of electronic manuals for this project. For electronic manuals, refer to paragraph "Submittals" for requirements.

N. SPARE PARTS

Furnish to Owner, with receipt, the following spare parts for the equipment furnished for this project:
1. One set of spare filters of each type required for each unit. In addition to the spare set of filters, install new filters prior to testing, adjusting, and balancing work and before turning system over to Owner.
2. Furnish one complete set of belts for each fan.
3. Furnish three operating keys for each type of air outlet and inlet that require them.

O. TRAINING

At a time mutually agreed upon between the Owner and Contractor, provide the services of a factory trained and authorized representative to train Owner's designated personnel on the operation and maintenance of the equipment provided for this project.

Provide training to include, but not be limited to, an overview of the system and/or equipment as it relates to the facility as a whole; operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance and appropriate operator intervention; and review of data included in the operation and maintenance manuals.

Submit a certification letter to the Architect stating that the Owner's designated representative has been trained as specified herein. Letter shall include date, time, attendees and subject of training. The Contractor and the Owner's representative shall sign the certification letter indicating agreement that the training has been provided.

Schedule training with Owner with at least 7 days advance notice.

P. WARRANTIES

Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in the construction documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.

Warranties shall include labor and material. Where an equipment manufacturer warrants material only, the mechanical contractor shall warrant labor for a period of 12 months from date of substantial completion and make repairs or replacements without any additional costs to the Owner.

Perform the remedial work promptly, upon written notice from the Engineer or Owner.

At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period and any actions the Owner must take in order to maintain warranty status. Each warranty instrument shall be addressed to the Owner and state the commencement date and term.

2. GENERAL MATERIALS AND INSTALLATION

A. BUILDING OPERATION

Comply with the schedule of operations as outlined in the architectural portions of this specification. Accomplish work requiring interruption of building operation at a time when the building is not in operation and only with written approval of building Owner and/or tenant. Coordinate interruption of building operation with the Owner and/or tenant a minimum of seven (7) days in advance of work.

B. EXISTING EQUIPMENT REUSE AND REMOVAL

Remove all unused equipment, ductwork, piping, and associated supports. Cap ductwork and piping at mains and seal air and water tight.

Provide items of HVAC systems modification required because of building remodeling, as noted on the drawings or necessary for proper operation. Match existing materials and construction techniques when modifying existing systems unless specified otherwise. Coordinate additional requirements with General Contractor and Architect.

C. COINCIDENTAL DAMAGE

Repair streets, sidewalks, drives, paving, walls, finishes, and other facilities damaged in the course of the work. Repair materials shall match existing construction. Repair work shall meet all requirements of the Owner, local authorities having jurisdiction, and meet the satisfaction of the Architect.

D. CUTTING AND PATCHING

Conform to the requirements in Division 01. Cut walls, floors, ceilings, and other portions of the facility as required to install work under this division. Obtain permission from the Architect prior to cutting. Do not cut or disturb structural members without prior approval from the Architect and Structural Engineer. For post-tension slabs, x-ray slab and closely coordinate all core drill locations with Architect and Structural Engineer prior to performing any work. Obtain approval from Architect and Structural Engineer for all core drills and penetrations at least four days prior to performing work. Penetrations shall be made as small as possible while maintaining required clearances between the building element penetrated and the system component. Patch around openings to match the adjacent construction including fire ratings, if applicable. Repair and refinish areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

E. ROUGH-IN

Coordinate without delay all roughing-in with other divisions. Conceal piping, conduit, and rough-in except in unfinished areas and where otherwise shown.

F. STRUCTURAL SUPPORT SYSTEMS

Structural steel used for support of equipment, ductwork and piping shall be new, clean, and conform to ASTM Designation A-36.

Support mechanical components from the building structure. Do not support mechanical components from ceilings, other mechanical or electrical components, and other non-structural elements.

G. PRE-ENGINEERED ROOF EQUIPMENT SUPPORTS AND CURBS

Provide prefabricated equipment support rails and roof curbs manufactured by AES Industries, Custom Curb, Inc., Pate Company, Thybar or approved equal. Provide with fully mitered raised cant and step to match roof insulation thickness, welded, minimum 18 gauge galvanized steel shell, internally reinforced to load bearing factors of equipment being supported, minimum 1-1/2 inch thick, 3 pound rigid insulation internal to shell to maintain continuous roof insulation where required, factory installed wood nailer, and minimum 18 gauge jacket with counterflashing where equipment does not fully cover the equipment support. Provide sloped roof equipment supports to enable level installation. Provide rigid backing material behind cant to maintain cant slope. Provide multiple support rails to uniformly support the equipment. Attach to roof structure according to manufacturer's installation instructions.

Attach equipment directly to pre-engineered roof equipment support using one of the following methods:
1. Roof Curbs: Secure each corner of the equipment to the curb nailer using a minimum of 4 lag screws, located along the length of the equipment. Alternatively, Secure equipment to the curb using hold-down brackets. Provide minimum 6 inch long, 14 gauge galvanized steel brackets sized to wrap around top of curb and under equipment base rail with sufficient horizontal offset to cover overlap gap between the equipment rail and curb. Secure bracket to equipment and curb nailer using a minimum of 8 points of connection per bracket. Provide one bracket at each corner along the length of the unit.

H. PENETRATIONS

Seal elevated floor, exterior wall and roof penetrations watertight and weathertight with non-shrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of 1/2 inch of sealant.

Seal around penetrations of fire rated assemblies. Coordinate fire ratings and locations with the architectural drawings. Refer to architectural specifications for fire stoppings. Provide a product schedule for UL listing, location, wall or floor rating and installation drawing for each penetration fire stop system.

Provide prefabricated roof curbs where pipes and or ductwork penetrate elevated slabs or the roof to the exterior. Provide cover over curb of weather-resistant material and seal duct or pipe penetrations through the cover. Provide pipe collar of weather-resistant material with stainless steel pipe clamps for piping penetrations.

I. EQUIPMENT FURNISHED BY OTHERS

Provide necessary equipment and accessories that are not provided by the equipment supplier or Owner to complete installation of equipment furnished by others in locations as indicated on the drawings, specified herein, or both. Equipment and accessories not provided by the equipment supplier may include, but not be limited to flues, vents, intakes, associated roof jacks and caps to outdoors, dampers, in-line fans, roof fans, and control interlocks, etc. as required for proper operation of the complete system in accordance with the manufacturer's instructions.

Contractor shall be responsible for correct rough-in dimensions and shall verify them with Architect and/or equipment supplier prior to service installations.

J. SYSTEM TESTING, ADJUSTING, AND BALANCING

Upon completion of each phase of the installation, test each system in conformance with local code requirements and as noted below. Furnish labor and equipment required to test each system installed under this contract. Assume all costs involved in making the tests and repairing and/or replacing any damages resulting therefrom.

Final system testing, balancing and adjustments (TAB) shall be performed by a Contractor certified by the National Environmental Balancing Bureau (NEBB), Associated Air Balance Council (AABC), or Testing, Adjusting and Balancing Bureau (TABB). TAB shall be performed in accordance with the most current edition of the certified agencies procedural standard for testing, adjusting and balancing and shall comply with the strictest interpretation of that standard for execution and reporting of all TAB work.

Test, adjust, and balance equipment and systems included in the scope of work. Prepare testing and balancing report log using forms equivalent with the standard forms available from the TAB certification standard being followed. Adjust equipment to deliver specified flow amounts on the drawings. For air systems, include airflow supply quantities, entering and leaving temperatures, and pressures at design flow. For hydronic systems, include entering and leaving temperatures and pressures at design flow. Include fan and unit test readings, motor voltage and amp draws, etc., and submit six copies of the final compilation of data to the Architect for evaluation and approval before final inspection of the project.

Balance air systems to within plus or minus 10 percent for terminal devices and branch lines and plus or minus 5 percent for main ducts and air handling equipment of the amount of air shown on the drawings. TAB Contractor shall record space temperatures and make adjustments in airflow to each diffuser to obtain uniform temperature (no greater than +/- 3 F) in spaces. Document temperatures and adjustments in tab report. Balance hydronic systems to provide flow rates within plus or minus 5 percent of flow specified on drawings or as required for proper system operation. Adjust equipment to operate as intended by the specification. TAB report shall include a 'report summary/remarks' section in accordance with the procedural standard that provides both system set up and a summary of deficiencies as defined by the procedural standard.

TAB Contractor shall be responsible to calibrate, set, and adjust automatic temperature control sensors, actuators and control devices. Check proper sequencing of interlock systems, and operation of safety controls, adjust thermostats, and control setpoints, limits and time based adjustment to operate in accordance with the performance requirements of the Construction Documents. Adjust pumps, fans, etc. for proper and efficient operation. Certify to Architect that adjustments have been made and that system is operating satisfactorily. Calibrate, set, and adjust automatic temperature controls. Check proper sequencing of interlock systems, and operation of safety controls.

Division 23 contractor shall align bearings and replace bearings that have dirt or foreign material in them with new bearings without additional cost to the Owner.

K. VIBRATION ISOLATION

Provide vibration isolation equipment and materials by a single manufacturer. If type and deflection for specific equipment is not specified within the contract documents, reference ASHRAE Handbook "HVAC Applications" or provide per manufacturer's recommendations. Approved manufacturers include Caldyn, Kinetics Noise Control, Mason Industries, Inc., Vibration Eliminator Co., Inc., Vibration Mounting and Controls, or Vibro-Acoustics, provided their systems are in compliance with the specified design and performance requirements.

General Requirements: Select vibration isolators by the weight distribution to produce uniform deflection. Vibration isolators shall have either known un-deflected heights or calibration markings so that, after adjustment, the static deflection can be verified, thus determining that the load is within the proper range of the isolator. Isolators shall operate in the linear portion of their load versus deflection curves. Spring isolators shall have 50 percent excess capacity without becoming coil bound. Coat vibration isolators with factory-applied paint. Coat vibration isolators exposed to weather and other corrosive environments with factory-applied corrosion resistance protection. Install and adjust vibration isolators in accordance with manufacturers written instructions.

Pipe connections. Provide flexible connectors for piping system connections on equipment side of shutoff valves for all pumps, mechanical equipment supported or suspended by spring isolators, and where indicated on drawings. Fabricate flexible piping connectors from stainless steel or rubber materials as suitable for system fluid. Flexible piping connectors shall be bellows, spherical or braided hose type as recommended by the manufacturer for the application.

K. VIBRATION ISOLATION (CONT.)

1. Type CMB (Curb Mounted Base): Curb mounted base for roof_mounted equipment shall be a pre-engineered structural steel frame mounted directly to the structure with an upper floating section on adjustable steel springs. The upper frame shall provide continuous support for the equipment. Steel springs shall rest on minimum 1/4 inch thick elastomeric pads and have a minimum static deflection of 2 inches unless otherwise specified. All_directional elastomeric snubber bushings shall be minimum 1/4 inch thick. All hardware shall be cadmium or zinc electroplated to provide a rust resistant finish. Provide continuous galvanized flexible counterflashing nailed over the lower curb's waterproofing and joined at the corners by elastomeric bellows. All spring locations shall have access ports with removable waterproof covers to allow for adjustment or replacement of springs. Lower curbs shall have provision for 2 inches insulation. Duct connections shall be made using a length of flexible duct dimensioned to match the equipment opening, using a foam rubber gasket to seal against the unit bottom. Provide Mason Industries Type RSC or equal. For equipment support bases installed on the roof, coordinate with the pre-engineered roof equipment support manufacturer to determine the quantity and size of hold-down brackets, isolators, and fasteners, with installation instructions, for each equipment to meet the design requirements specified under Article, "PRE-ENGINEERED ROOF EQUIPMENT SUPPORTS AND CURBS."

2. Type NR (Neoprene Bushing): Provide neoprene, rubber-in-shear bushings for lightweight (less than 100 pounds), suspended equipment supported from structure with all thread rod and angle iron or Unistrut. Select for a maximum durometer of 50 and designed for 15 percent strain, with a static deflection of 0.15 inches. Provide Mason Industries Type HMIB or equal.

L. AIR FILTERS

Provide AP-Thirteen, pleated, throwaway type filters, minimum MERV 13, or similar as manufactured by Air Filter, Inc., American Air Filter, Flanders, or approved equal, unless otherwise indicated.

Temporary filters used to protect openings in ductwork and inside equipment when permanent HVAC equipment is used during the construction period shall be pleated, throwaway type filters, minimum MERV 6.

M. REFRIGERANT AND OIL

Provide full refrigerant and oil charge in new air conditioning refrigeration systems, and maintain it for full term of the guarantee.

N. IDENTIFICATION

Provide stenciled signs for equipment identification at Contractor's option or where distance of required identification requires lettering larger than 1 inch height. Stencil paint shall be exterior type, oil-based, alkyd enamel, minimum 1-1/4 inch height or greater as required for long distance identification, white or black color for best contrast.

Provide duct markers or provide stenciled signs and arrows indicating ductwork service and flow direction in black or white lettering for best contrast with duct or insulation color. Locate markers maximum 50 feet along each duct side and within 5 feet of all control and balancing dampers or branch ducts more than 25 feet length and within 5 feet on each side of wall, floor, and ceiling penetrations. Provide additional markers in congested areas or at multiple duct runs as required for clarity.

3. DUCT INSULATION, DUCTWORK, ACCESSORIES, AND FANS

A. DUCT INSULATION

Provide fiberglass duct liner with fibers firmly bonded together with a thermosetting resin. Liner surface shall serve as a barrier against infiltration of dust and dirt, shall meet ASTM C1338 for fungi resistance, and shall be cleanable using duct cleaning methods and equipment outlined by North American Insulation Manufacturers Association (NAIMA) duct cleaning guide. Install with liner adhesive and mechanical fasteners in accordance with manufacturer's instructions and recommendations. Ductwork sizes shown on drawings are inside clear dimensions. Increase sheet metal by liner thickness in both directions where liner is installed.

Provide rectangular liner conforming to ASTM C1071, Type I or II that is 1 inch thick, 1-1/2 pound density, minimum R-4.2 Certainteed Corp. "Toughgard" or equivalent, Johns Manville, Owens-Corning, or Knauf.

Provide round liner that is 1 inch thick, 4 pound density, minimum R-4.3 Johns Manville "Spiracoustic Plus" or equivalent, Certainteed or Owens-Corning.

Provide liner on the following interior air ducts and where specified on the drawings:

1. Exposed round and rectangular supply ductwork and the first 15 feet of duct downstream of equipment outlets or 5 feet past first elbow, whichever is greater
2. All return ductwork.

At interface of lined and wrapped ductwork, overlap lined ductwork at least 2 feet beyond wrapped insulation.

Cover concealed, rigid ductwork with ASTM C553, Type II flexible fiberglass insulation. Installed insulation shall be 1-1/2 inch thick, 3/4 pound density, minimum R-4.2 duct wrap, Certainteed or equivalent Johns Manville, Owens-Corning, or Knauf with heavy-duty foil-scrim-kraft facing, and with joints taped with 3 inch wide foil tape as follows:

1. Unlined supply and return air ductwork.
2. Round and rectangular outside air ductwork.
3. Round and rectangular exhaust and relief air ductwork within 10 feet of exterior discharge.

Cover Outdoor air, Exhaust air and Relief air plenums connected to exterior louvers with 1-1/2 inch thick, 1.5 pound density, rigid fiberglass insulation conforming to ASTM C612, Class 2.

Insulating materials, adhesives, coatings, etc., shall not exceed flame spread rating of 25 and smoke developed rating of 50 per ASTM E84. Containers for mastics and adhesives shall have U.L. Label.

B. PLENUM INSULATION

Provide Fyrewrap 0.5 plenum insulation or ETS Schaefer Plenumshield blanket to encapsulate combustible materials located within a fire-rated return air plenum where permitted by AHJ. Plenum insulation shall be 1/2 inch thick, 6 to 8 PCF density, consisting of a high temperature bio-soluble material with aluminum foil encapsulating material and fiberglass reinforcing scrim covering. Plenum insulation shall be rated and certified per UL 1887 (modified), ASTM E136 for non-combustibility and ASTM E84/UL 723 for surface burning characteristics. Provide minimum 1 inch overlap at all seams and joints and secure insulation with stainless steel banding at locations and intervals per manufacturer's instructions.

C. DUCTWORK

Provide galvanized steel ductwork and housings as shown on drawings. Construct ductwork including fittings and transitions in conformance with current SMACNA standards relative to gauge, bracing, joints, etc. Minimum thickness of duct shall be 26-gauge sheet metal. Reinforce housings and ductwork over 30 inches with 1-1/4 inch angles not less than 5'-6" on centers, and closer if required for sufficient rigidity to prevent vibration. Support horizontal runs of duct from strap iron hangers on centers not to exceed 8'-0". Do not support ceiling grid, conduits, pipes, equipment, etc. from ductwork. Coordinate routing of ductwork with other contractors such that piping, electrical conduit, and associated supports are not routed through the ductwork.

Provide pre-engineered roof duct supports supports by Cooper B-Line, Elite Components, ERICO, FNW, Miro, PHD Manufacturing, PHP Systems, Roof Top Blox, Unistrut (Atkore), Zsi Foster, or approved equal. Support ductwork on the roof with pre-engineered roof duct supports that rest on top of the roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with embedded support fixtures as required to support the duct. Provide steel pedestal type supports with minimum 18x18 inch thermoplastic or rubber base or 4 inch wide closed-cell polyethylene block with length as required. Maintain minimum 6 inches clearance under duct to finished roof surface.

Construct non-VAV supply ducts to meet SMACNA positive pressure of 2 inches w.g. Construct Return, Outdoor and Exhaust ductwork upstream of fans to meet SMACNA negative pressure of 1 inch w.g. Construct exhaust ductwork downstream of fans to meet SMACNA positive pressure of 1 inch w.g.

Construct VAV primary supply air ducts (upstream of terminal boxes) to meet SMACNA positive pressure of 4 inches w.g. Construct VAV secondary supply air ducts (downstream of terminal boxes) to meet SMACNA positive pressure of 2 inches w.g.

Provide mill phosphatized or galvanealed finish for exposed ductwork to be field painted. Shop treated sheet metal shall have galvanized metal primer applied in the shop after fabrication and prior to shipping.

Seal ductwork with heavy liquid sealant, Hardcast Irongrip 601, Design Polymer DP 1010 , United Mcgill duct sealer or approved equal, applied according to sealant manufacturer's instructions. Seal all longitudinal and transverse ductwork joints airtight to meet SMACNA Seal Class A. Tapes and mastics shall be listed and labeled in accordance with UL 181A.

Provide radius elbows, turns, and offsets with a minimum centerline radius of 1-1/2 times the duct width. Where space does not permit full radius elbows, provide short radius elbows with a minimum of two continuous splitter vanes. Vanes shall be the entire length of the bend. Provide mitered elbows where space does not permit radius elbows, where shown on the drawings, or at the option of the contractor with the engineer's approval. Mitered elbows less than 45 degrees shall not require turning vanes. Mitered elbows 45 degrees and greater shall have single thickness turning vanes of same gauge as ductwork, rigidly fastened with guide strips in ductwork. Vanes for mitered elbows shall be provided in all supply and exhaust ductwork and in return and outside air ductwork that has an air velocity exceeding 1000 fpm. Do not install vanes in grease ductwork. The use of square throat, radius heel elbows is prohibited. Remove and replace all installed elbows of this type with an approved elbow at no additional cost to the owner.

Connect ducts to vibrating equipment and when transitioning between two different metallic duct materials (e.g., aluminum to galvanized steel) by means of flexible connectors. Flexible connectors shall be neoprene coated glass cloth canvas connections, Duro-Dyne, Elgen, Ventfabric or equal. Flexible connectors shall have a flame spread of 25 or less and smoke developed rating not higher than 50. Make airtight joints and install with minimum 1-1/2 inches slack.

Provide balancing dampers, manufactured by Cesco, Greenheck, Louvers & Dampers, Nailor Industries, Pottorff, Ruskin, Tamco, or approved equal, where shown on drawings and wherever necessary for complete control of air flow. Splitter dampers shall be controlled by locking quadrants; provide Young Regulator or Ventlok end bearings for the damper rod. Rectangular volume dampers shall be opposed blade interlocking type. Round volume dampers shall be single-blade type consisting of circular blade mounted to a shaft. Provide Flexmaster model STO or equal 45 degree rectangular/round side takeoff fitting with model BO3 damper with locking quadrant and insulation build out for round ductwork branch takeoffs to individual air devices. Omit damper at takeoff fitting when damper is located downstream of takeoff.

Where access to dampers through a hard ceiling is required, provide a concealed, remote cable-operated, butterfly-type volume damper assembly with external worm gear operator. Damper assembly shall include duct casing with rolled bead stiffeners, reinforced blade, self-lubricating bearing, and remote operator mounting plate. External operator shall attach to damper as a single piece with no linkage adjustment required. Damper shall be adjustable through the diffuser frame with standard 1/4 inch nutdriver or flat screwdriver. Provide positive, direct, two-way damper control with no sleeves, springs or screw adjustments to come loose after installation. Provide cable length to span the distance from the damper to the remote operator location. Install damper in branch duct. Do not install in diffuser neck. Install remote operator on the back of the diffuser frame or side of a slot diffuser plenum. Support cable assembly to avoid bends and kinks in cable at manufacturer recommended intervals. Where approved by architect, a ceiling cup with cover plate may be used for access to cable operator. Provide round dampers by Metropolitan Air Technology model RT-250, Young's Regulator model 5020-1200, or approved equal. Provide rectangular dampers by Metropolitan Air Technology model RT-200, Young's Regulator model 820-1200, or approved equal. Provide remote cable control by Metropolitan Air Technology model RT-WGA, Young's Regulator model 270-275, or approved equal.

C. DUCTWORK (CONT.)

Round or oval ductwork shall be FlaktGroup Semco, United, Hercules Industries or equal, sheetmetal, with smooth interior surface, with low pressure (duct pressure class up to and including 2 inches w.g.) Round ductwork gauges per the following table (reference SMACNA HVAC duct construction standards for gauges when pressures exceed 2 inches w.g.):

Size	Duct Gauge	Fitting Gauge
14" & under	26	24
15" thru 26"	24	22

Lewis & Lambert, Linx Industries Lindab Safe, or approved equal factory-manufactured round ductwork and fittings may be substituted for specified round branch ductwork, at Contractors option. Heavy liquid joint sealant may be omitted on factory-manufactured round ductwork.

Low pressure (duct pressure class up to and including 2 inches w.g.) Fittings 24 inches in diameter and less shall be prefabricated, spot-welded and internally sealed. Continuously weld fittings larger than 24 inches in diameter. Fitting gauge shall be 22 gauge for 36 inch fittings and under, 20 gauge for larger sizes. 90 degree tees shall be conical type. Seal longitudinal and transverse ductwork joints airtight with heavy liquid sealant applied according to manufacturer's instructions. Provide gauge thickness in medium pressure (duct pressure class 3 inches to 6 inches w.g.) ductwork as recommended by SMACNA.

If permanent HVAC equipment is used during the construction period, provide temporary filters at all openings in the ductwork and inside equipment to protect the system from dust, dirt, paint, and moisture. Replace and maintain filters when needed, but not less than every month. On the day of Substantial Completion, clean the unit and ductwork and provide a new set of filters in the unit. Refer to section "Air Filters" for filter requirements.

An independent, professional duct cleaning company shall vacuum clean all internal surfaces of equipment, coils, and ductwork connected to permanent HVAC units that are operated during the construction period. Conduct cleaning after new air filters are installed and prior to turning the system over to the owner.

D. FABRIC DUCT

Fabric duct shall be Prihoda NMI with perforations and adjustable flow devices at openings or approved equal fabric air dispersion system. Fabric shall be a coated, woven, and fire retardant. Fabric shall be 100% polyester and colored white or as specified on the drawings. Coating shall be a non-air permeable coating. Fabric and coating must weight 7.7 oz/square yard per ASTM D3776 and provide an air permeability of 0 cfm/square foot per ASTM D737. Fabric and coating shall have a temperature range of 0 to 180 degrees Fahrenheit and shall be classified by Underwriters Laboratories in accordance with the flame spread/smoke developed requirements of NFPA 90A and UL 2518.

Fabric ducts shall be suspended using Prihoda internal aluminum rings support. Hardware shall include cable, eye bolts, thimbles, cable clamps, and turnbuckles as required. Fabric duct attachment shall be made to support using nylon cable clips spaced at 24 inches. Install chosen suspension system in accordance with the requirements of the manufacturer.

Clean air handling equipment and ductwork prior to installing fabric ductwork. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing. Ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation shall be covered with polyethylene film or other covering to keep the system clean until installation of fabric duct is completed. If fabric duct becomes soiled during installation, it should be removed and cleaned following the manufacturer's standard terms of laundry.

E. FLEXIBLE DUCT

Low pressure (duct pressure class up to and including 2 inches w.g.) and medium pressure (duct pressure class 2.1 inch to 6 inches w.g.) flexible duct shall be Flexmaster type 8B, Thermaflex type G-KM, M-KE, JPL type Silver Jacket, or equal (fire retardant polyethylene) protective vapor barrier, U.L.181 Class 1, acoustical insulated duct, R-4.2 fiberglass insulation. Provide CPE liner with steel wire helix mechanically locked or permanently bonded to the liner.

Flexible duct runs shall not exceed 5 feet in length, and shall be installed fully extended and straight as possible avoiding tight turns. Install flexible duct in accordance with manufacturer's instructions. Support flexible duct at maximum 5 feet on center and within 6 inches of bends. Bends shall not exceed a centerline radius of one duct diameter. Duct sag shall not exceed 1/2 inch. Supporting material in direct contact with the duct shall not be less than 1-1/2 inches in width.

Connect flexible duct to rigid metal duct or air devices as recommended by the manufacturer. At a minimum, install two wraps of duct tape around the inner core connection and a metallic or non-metallic clamp over the tape and two wraps of duct tape or a clamp over the outer jacket. Duct clamps shall be labeled in accordance with UL-181B and marked 181B-C. Duct tape shall be labeled in accordance with UL 181B and marked 181B-FX.

F. AIR DEVICES

Provide air devices as scheduled on drawings, manufactured by E.H. Price or Titus. VAV diffusers shall be by E.H. Price only. All other air devices shall be by Titus. No substitutions are permitted. Select air devices to limit room noise level to no higher than NC-30 unless otherwise shown. Provide devices with a soft plastic gasket to make an airtight seal against the mounting surface. Coordinate final location, frame, and mounting type of air devices with architectural reflected ceiling plans.

Submit complete shop drawings including information on noise level, pressure drop, throw, CFM for each air device, styles, borders, etc. Clearly marked with specified equipment number. Submit samples of each air device as requested by the Engineer.

Provide wall return air grilles and exhaust air registers with horizontal 35 or 45 degree angle vision-proof bars. Provide concealed fasteners for wall mounted registers and grilles. Provide floor supply air registers of aluminum heavy duty type with 0 degree deflection.
Provide opposed blade dampers for supply air registers and exhaust air registers unless indicated otherwise.

Provide ceiling mounted air devices of lay-in or surface mounted type as required to be compatible with ceiling construction. Provide ceiling diffusers and grilles with white enamel finish unless noted otherwise.

G. CONTROL DAMPERS

Motorized dampers used for ventilation air intake, exhaust air, or relief air shall have leakage rates not to exceed 4.0 CFM/square foot in full closed position at 1 inch W.G. pressure differential across the damper.

Provide dampers as manufactured by Greenheck, CESCO, Pottorff, Nailor, or Ruskin. Reference manufacturer with model number is Ruskin CD-35 constructed of galvanized steel.

Coordinate with Comfort Systems to provide damper operator for each automatic damper with sufficient capacity to operate the damper under all conditions and to guarantee tight close-off of dampers against system pressure encountered. Each operator shall be provided with spring-return for normally closed or normally open position for fail safe operation to account for fire, low temperatures, or power interruption as required by the sequence of operation.

H. SMOKE DETECTORS

Duct-mounted smoke detectors shall be provided by Division 28. For Carrier Rooftop Units provided with SystemVu controls, units shall have factory-furnished, field-installed smoke detector kits. Coordinate smoke detector scope with Carrier and Division 28. Smoke detectors shall shut down unit upon alarm.

I. SCREENS

Provide screens on louvers, ducts, hoods, fans, and openings to the outdoors as scheduled and/or noted on the drawings. Insect screens shall be 0.009 thickness, 1/4 inch mesh, stainless steel wire. Bird screens shall be 0.047 inch, 1/2 inch mesh stainless steel wire.
Provide motorized control dampers or backdraft dampers where shown on the drawings.

J. EXHAUST AIR SYSTEMS

Provide roof mounted exhaust fans as scheduled on the drawings, or equal ACME, Carnes, Cook, Greenheck, Pennbarry, or Twin City Fans complete with aluminum housing, aluminum centrifugal wheel, motor with integral thermal overload protection, disconnect switch mounted inside the housing, birdscreen, integral motorized damper, fan speed controller and pate prefabricated roof curb.

Provide in-line (duct) mounted exhaust fans as scheduled on the drawings, ACME, Carnes, Cook, Greenheck, Pennbarry, or Twin City Fans complete with isolated blower unit and ceiling grille. Provide backdraft damper, discharge duct, and vibration isolation as scheduled or shown on the drawings.

4. HVAC EQUIPMENT

A. ROOFTOP UNITS (HEAT PUMP) 3-20 TONS

Provide package rooftop heat pump units as scheduled on the drawings, manufactured by Aaon, Carrier, Daikin, Lennox, Johnson Controls, Trane, or York, with features as scheduled in the RTU Control Matrix, and complete with factory installed direct-drive hermetic compressors with internal spring vibration isolation, built-in motor thermal overload protection, crankcase heater, and low pressure switches; direct expansion evaporating and condensing coils with1 inch factory installed flexible elastomeric insulation around the suction and liquid lines not directly located above a condensate drain pan and protective UV coating on any insulation exposed to sunlight, minimum SEER or EER rating (cooling) and minimum HSPF or COP rating (heating) as required by the applicable energy code or greater if scheduled on the drawings; centrifugal evaporator blower; air filter rack; propeller type condenser fan; [electric supplemental heat modules constructed of heavy-duty nickel chromium elements (UL listed) with code required integral safety features and controls including automatic reset high limit]; complete factory installed micro-processor controls including anti-short cycle timers, time delay relays and minimum "on" time controls; built-in thermal overload protection on motors and compressors; reversing valve, suction line accumulator, flow control check valve, and solid state defrost control utilizing thermistors; outdoor air damper; relief; weathertight housing constructed of zinc coated, heavy gauge, galvanized steel with weather-resistant baked enamel finish; pre-engineered roof curb with minimum height as scheduled on the drawings if unit is equipped with internal vibration isolators; Type CMB if unit is not equipped with internal vibration isolators; single point electrical power connection. Provide guards or louvered panels to protect the condenser coil from hail or other damage. Provide a 125 VAC, 20 amp duplex convenience receptacle mounted to unit ready for field wiring with a cover UL listed for wet and damp locations when in use. Provide electronic programmable type thermostat. Provide unit complete with manufacturer's one year guarantee on components plus an additional four year guarantee on the compressors. For units equipped with an economizer assembly, the assembly shall be covered with minimum 5 year manufacturer warranty, certified to operate through 60,000 damper opening and closing cycles, and certified to meet leakage requirements specified under the section, "Control Dampers."

5. TEMPERATURE CONTROLS

A. GENERAL REQUIREMENTS

Coordinate with Comfort Systems USA to provide a complete system of temperature controls including thermostats, temperature sensors, humidity sensors, carbon dioxide (CO2) sensors, relays, and outdoor sensor assembly where indicated on the drawings and as specified by Comfort Systems USA.

Comfort Systems USA shall submit shop drawings of equipment provided for temperature control. Submit operation and maintenance data, including trouble-shooting maintenance guide, step-by-step procedures indexed for each controller and thermostat function, inspection period, cleaning methods and materials, and calibration tolerances.

Comfort Systems USA shall provide integrated wiring diagrams showing interconnections between field installed equipment and package wiring furnished with the HVAC equipment. Control wiring shall be sized to accommodate the voltage drop associated with the distance between the control device and the controller.

Comfort Systems USA shall provide supervision and on-job checkout service as required to ensure that installation and operation of the temperature control system meets requirements of the drawings, specifications, and sequences of operation. The system shall be guaranteed for a period of one year following the acceptance of the system by the Architect/Engineer. Correct defects occurring during this period at no additional cost to the Owner.

Division 26 shall install control devices with top of device at 48 inches AFF to meet ADA requirements unless otherwise noted on the plans.

B. BUILDING AUTOMATION CONTROL EQUIPMENT

Control protocol shall be based upon BACnet protocol complying with ASHRAE Standard 135. Physical/Data Link communication bus between controllers shall be EIA 485 twisted cable pair according to Master Slave/Token Passing (MS/TP) protocol or Ethernet according to ISO 8802-2 protocol.

Controller shall have the following features: Microprocessor with sufficient memory to support the controller's operating system, database, and programming requirements; real-time clock for scheduling; self-diagnostics; capability of standalone operation if network communication is lost; logging capability; service communication port for local connection to a portable operator's terminal; local keypad and display for interrogating and editing controller data; diagnostic LEDs for power, communication and processor; non-volatile memory which is capable of maintaining all BIOS and programming information for a minimum of 72 hours; power and noise immunity; and surge and transient protection.

Controller software shall support the following applications: System security restricting modification without password; object scheduling with daily, weekly, annual, holiday, and exception events; alarm reporting via text message or email and logging; maintenance management; sequencing; PID control characteristics; staggered starting of equipment; anti-short cycling; on-off control with differential; trending; run-time, pulse, and event totalization.

Provide front end controller for supervisory control of HVAC system through EMS. Controller shall provide integrated control, supervision, data logging, alarming and scheduling with a power input of 24 VAC.

Provide control panels listed according to UL 508A and NEMA rated according to its installation location. Provide common keying for all panels.

C. WIRING

Refer to Division 26 drawings for electrical and control wiring.

D. THERMOSTATS, SENSORS AND RELAYS

Provide general-purpose type elements for use in input and output sensors. Provide transmitters or transducers with sensor as required, compatible with the controllers used, with range suitable for the systems encountered. Transmitters and transducers shall have offset and span adjustments, temperature compensation, shock and vibration immunity, and zeroing capability. Accuracy requirements shall include the combined effects of linearity, hysteresis, repeatability, and the transmitter.

Dry-bulb temperature sensors at a minimum shall be accurate to +/- 2 degrees Fahrenheit over the range of 40 to 80 degrees Fahrenheit. Wet-bulb temperature shall be calculated using dry-bulb temperature and humidity and shall be accurate to +/- 2 degrees Fahrenheit. Enthalpy shall be calculated using dry-bulb temperature and humidity and shall be accurate to +/- 3 BTU/lb over the range of 20 to 36 BTU/lb. Humidity sensors at a minimum shall be accurate within +/- 3 percent full range between 20 and 95 percent, with drift less than 1 percent full scale per year. Pressure transmitters at a minimum shall be accurate to +/- 1 percent full scale with drift less than 1 percent full scale per year.

Provide occupied/unoccupied combination thermostat with temperature sensor for VAV diffusers as indicated on the drawings. Thermostat shall be Price LCD thermostat (PIC-TS-LCD).

Provide wall mounted temperature sensor as indicated on the drawings with a stainless steel plate. Space temperature sensor shall have a 10KΩ resistance rating at 77 degrees Fahrenheit (Type II).

Provide wall mounted humidity sensor as indicated on the drawings. Humidity sensor shall provide a 4-20mA selectable output signal and a 0-100% RH measurement range.

Provide outdoor sensor assembly with temperature sensor, humidity sensor and light sensor as indicated on the drawings. Humidity sensor shall provide a 4-20mA selectable output signal and a 0-100% RH measurement range. Temperature sensor shall have 4-20mA selectable output signal and a 0-100% RH measurement range.

Provide wall mounted Carbon Dioxide (CO2) sensor where indicated on the drawings. Carbon Dioxide sensors shall measure total percentage of CO2 in PPM. Sensor shall have an accuracy of ± 75 PPM at a 600 and 1000 ppm concentration and certified by the manufacturer to require calibration no more frequently than once every 5 years. Sensors shall provide a 0-5 VDC, 0-10 VDC or 4-20mA selectable output signal with a measurement range of 0 to 2,000 PPM and a 24 VAC or 24 VDC power input.

Smoke detectors furnished and installed as indicated in this section or as scheduled on the plans (or heat detectors, if permitted by code) shall shut down each associated unit supply fan upon activation where required by code. Provide remote visual and audible alarm device in an approved location if smoke detectors are not connected to a fire alarm panel and label device as "Air Duct Detector Trouble".

Provide relays with contact rating, configuration, and coil voltage that is suitable for the application. Relay shall be general purpose, enclosed plug-in type and protected by a heat and shock resistant duct cover. Number of contacts and operational function shall be as required. Transient suppression shall be provided as an integral part of the relay. Contactors shall be single coil, electrically operated, mechanically held, double-break, silver-to-silver type protected by arcing contacts. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Operating and release times shall be 100 milliseconds or less.

6. ALTERNATES

A. DESCRIPTION

Refer to the architectural portion of the specification for list of alternates. Applicable sections of the base specifications shall apply to all work required by the alternate unless otherwise specified. Determine whether or not and how each alternate affects work. Include labor, materials, equipment, and transportation services necessary for and incidental to the completion of work under each particular alternate. Furnish separate bid for each alternate applicable to work, stating the amount to be added or deducted from the base bid.

END OF SECTION 23

JUSTIN M. OLDER

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brr

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TEMPLATE ISSUE DATE: 11/28/2018

Fixture Package:
CLEARANCE

Stamp:

EXPIRES ON: 06/30/2024
Registered Professional Engineer (Mechanical)
CERTIFICATE NO. 66286
JUSTIN M. OLDER
Date Signed
ARIZONA U.S.A.

09/30/2022

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CONSTRUCTION

Issue Date:
02/22/2022

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Author

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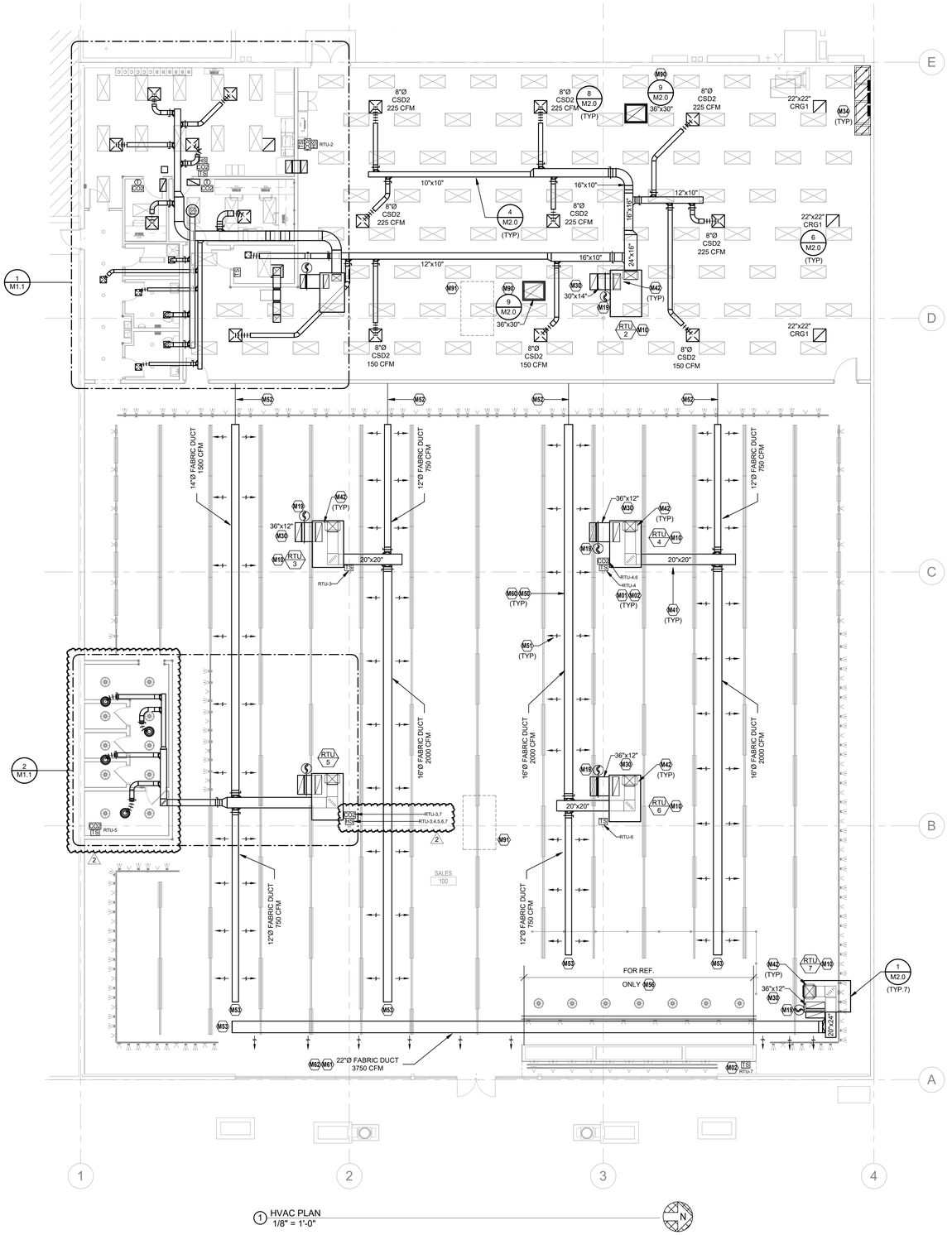

KEYNOTES ARE PROTOTYPICAL. MISSING KEYNOTE NUMBERS INDICATE A PROTOTYPICAL NOTE IS NOT USED OR REMOVED.

MECHANICAL PLAN NOTES

M01 ALL THERMOSTATS AND SENSORS ARE FURNISHED BY EMS VENDOR AND INSTALLED BY DIVISION 26, UNLESS NOTED OTHERWISE.

M02 DO NOT INSTALL SENSORS ON WALL GRAPHICS. CONFIRM LOCATIONS OF SENSORS WITH PM PRIOR TO INSTALLATION.

M10 PROVIDE NEW ROOFTOP UNIT AS SCHEDULED WITH NEW CURB ADAPTER FROM EXISTING CURB. PROVIDE A NEW SET OF MERV 13 AIR FILTERS IN UNIT BEFORE TURNING SYSTEM OVER TO OWNER. COORDINATE CONDENSATE PIPING WITH DIVISION 25.

M19 SMOKE DETECTORS AND WIRING IN RETURN AIR DUCTS SHALL BE PROVIDED BY DIVISION 28 CONTRACTOR. SMOKE DETECTORS SHALL SHUT-DOWN UNIT UPON ALARM.

M30 ROUTE SHEET METAL RETURN AIR DUCT AS SHOWN WITH TERMINATION DIRECTED UPWARD. SIZE PLENUM FULL SIZE OF RETURN AIR INLET. PROVIDE DUCT LINER IN RETURN AIR DUCTWORK FOR SOUND ATTENUATION. COVER INLET WITH 1/2"x1/2" BIRD SCREEN.

M34 DO NOT ROUTE DUCTWORK OVER ELECTRICAL EQUIPMENT. NOTIFY ENGINEER OF CONFLICTS IN FIELD.

M41 COORDINATE DUCT ROUTING WITH LIGHTS AND STRUCTURE. ROUTE ALL SALES DUCTWORK AT SAME ELEVATION BELOW STRUCTURE AND ABOVE LIGHTING.

M42 ROUTE SUPPLY AND RETURN DUCTWORK TO ROOF CURB DUCT CONNECTIONS AND TRANSITION DUCTWORK IN RISER AS NECESSARY.

M50 INSTALL FABRIC DUCT ABOVE ARCHITECTURAL LIGHTING GRID. REFER TO BOXED NOTES FOR ADDITIONAL INFORMATION.

M51 ARROWS INDICATE DIRECTION AND DISPERSION OF AIRFLOW VOLUME. PROVIDE VENTS ON FABRIC DUCT TO DIRECT AIRFLOW AS SHOWN ON PLAN.

M52 EXTEND AND TIGHTEN HANGING CABLE TO WALL. GENERAL CONTRACTOR TO PROVIDE 2X WOOD BACKING. COORDINATE REQUIREMENTS WITH FABRIC DUCT MANUFACTURER.

M53 FIELD FABRICATE L-BRACKET FOR SUPPORTING END OF FABRIC DUCT. COORDINATE REQUIREMENTS WITH FABRIC DUCT MANUFACTURER.

M56 DO NOT INSTALL AIR VENTS ON FABRIC DUCT ADJACENT TO BACKWRAP WALL. DIMENSION SHOWN FOR REFERENCE ONLY.

M60 PROVIDE FABRIC DUCT WITH AIRFLOW PERFORATIONS AT AN ANGLE OF 22.5° FROM HORIZONTAL TOWARDS THE SALES FLOOR.

M61 SUPPORT FABRIC DUCTWORK WITH MANUFACTURER'S DOUBLE-CABLE CROSS BRACING SUPPORTS. COORDINATE REQUIREMENTS WITH FABRIC DUCT MANUFACTURER.

M62 PROVIDE FABRIC DUCT WITH AIRFLOW PERFORATIONS AT AN ANGLE OF 45° FROM HORIZONTAL TOWARDS THE SALES FLOOR POINTED TOWARD GLAZING.

M90 SMOKE/HEAT VENT IS PROVIDED BY DIVISION 21. DO NOT INSTALL DUCTWORK, PIPING, SUPPORTS, OR EQUIPMENT BELOW VENT LOCATION. COORDINATE EXACT LOCATION PRIOR TO CONSTRUCTION.

M91 DASHED LINE REPRESENTS LOCATION OF EXISTING ROOFTOP UNIT TO BE DEMOLISHED. UNIT ROOF CURB SHALL BE COMPLETELY CAPPED AND SEALED. REFER TO ARCHITECTURAL DETAILS FOR ADDITIONAL INFORMATION.

INSTALL DUCTWORK AND PIPING AS TIGHT TO STRUCTURE AS POSSIBLE. COORDINATE WITH OTHER TRADES TO AVOID CONFLICTS. COORDINATE INSTALLATION OF DUCTWORK AND PIPING TO AVOID CONFLICTS WITH ELECTRICAL PANELS, LIGHTING FIXTURES, ETC. DO NOT INSTALL DUCTWORK BELOW THE BOTTOM OF THE LIGHT FIXTURES.

FABRIC DUCT GENERAL NOTES:
PROVIDE FABRIC DUCT THROUGHOUT THE SPACE AS SHOWN ON PLAN. FABRIC DUCT SHALL NOT REPLACE RECTANGULAR DUCT DROPS OR EXHAUST DUCTS. BASIS OF DESIGN SHALL BE "PRIHODA", "NM" NONPOROUS FABRIC WITH "PERFORATIONS" (AIR OPENINGS) WITH ADJUSTABLE FLOW DEVICES (I.E. AFD'S) AT OPENINGS, AND ONE ROW, GALVANIZED CABLE, INTERNAL HOOP SUPPORT SYSTEM SHALL BE PROVIDED ON ALL FABRIC DUCT UNLESS NOTED OTHERWISE. INCLUDE ALL COMPONENTS AND ACCESSORIES REQUIRED TO MAKE A COMPLETE SYSTEM AS RECOMMENDED BY PRIHODA DURING BID PHASE, INCLUDING HANGING STRAPS AND CLIPS, END-CAPS, CONNECTIONS TO METAL DUCTS, ETC. PRIHODA FABRIC DUCT SHALL BE SIZED PER FACTORY RECOMMENDATIONS TO PROVIDE MINIMUM AIRFLOWS IN BRANCH DUCTS AS SHOWN. CONFIRM FABRIC DUCT COLOR WITH ARCHITECT PRIOR TO ORDERING ON ALL PROJECTS. (FOR GLOBAL 3.0 FIXTURE PACKAGE, PANTONE 420 - LIGHT GREY IS BASIS OF DESIGN). CONTACT PRIHODA SALES DEPARTMENT (E-MAIL: SALES@PRIHODA-NA.COM, PHONE: 1-855-774-4632) FOR PRICING INFORMATION.

FABRIC DUCT DESIGN GUIDELINE:
DISTRIBUTE AIRFLOW EVENLY ALONG FABRIC DUCT IN THE DIRECTION OF FLOW ARROWS. ORIENT AND SIZE FABRIC DUCT DIFFUSER OPENINGS TO PROVIDE A 50 FPM THROW VELOCITY HALF WAY TO THE NEAREST ADJACENT FABRIC DUCT OR TO THE NEAREST PARTITION/DEMISING WALL AS APPLICABLE. VENTS ON FABRIC DUCT SHALL BE LOCATED AT 22.5 DEGREES BELOW HORIZONTAL UNLESS NOTED OTHERWISE.

FABRIC DUCT COORDINATION NOTE:
DURING THE FIRST WEEK OF THE PROJECT, THE GENERAL CONTRACTOR'S SUPERINTENDENT, MECHANICAL SUB-CONTRACTOR, AND A REPRESENTATIVE FROM "PRIHODA" SHALL MEET AT THE PROJECT SITE FOR CONFIRMATION OF ALL FIELD DIMENSIONS AND POTENTIAL OBSTRUCTIONS. THIS EVENT MUST PRECEDE THE ORDERING OF ANY MATERIALS FROM "PRIHODA". CHANGE ORDERS AND EXPEDITING FEES WILL NOT BE APPROVED DUE TO LACK OF ON-SITE COLLABORATION AND/OR MEASUREMENT DURING SITE MEETING AT PROJECT COMMENCEMENT.

FABRIC DUCT INSTALLATION NOTE:
INSTALL FABRIC DUCT ABOVE ARCHITECTURAL LIGHTING SYSTEM. COORDINATE FABRIC DUCT INSTALLATION WITH GENERAL CONTRACTOR AND DIVISION 26. GENERAL CONTRACTOR SHALL VERIFY FABRIC DUCT IS INSTALLED SUCH THAT IT DOES NOT CLASH WITH ARCHITECTURAL LIGHTING SYSTEM, INCLUDING LIGHT FIXTURES, ARCHITECTURAL LIGHTING SYSTEM GRID AND SUSPENSION CABLES, OR ANY OTHER SUSPENDED FIXTURES WHEN DEFLATED.

THE DUCTWORK LAYOUT INDICATED ON THE DRAWINGS IS SCHEMATIC AND SHOWS DESIGNED INTENT ONLY. PRIOR TO FABRICATION AND INSTALLATION OF DUCTWORK, DIVISION 23 SHALL HAVE A QUALIFIED, EXPERIENCED SKETCHER PREPARE AND SUBMIT SHEET METAL SHOP DRAWINGS. SHOP DRAWINGS SHALL TAKE INTO ACCOUNT ALL EXISTING CONDITIONS, INCLUDING BUT NOT LIMITED TO, STRUCTURAL MEMBERS, CONDUITS AND PIPING TO REMAIN. SHOP DRAWINGS SHALL ALSO TAKE INTO ACCOUNT ALL NEW DESIGN CONDITIONS, INCLUDING BUT NOT LIMITED TO, STRUCTURAL MEMBERS, PIPING, CEILINGS, SOFFIT HEIGHTS, AND LIGHT FIXTURES.

SHOP DRAWINGS SHALL INDICATE ALL REVISIONS TO THE LAYOUT REQUIRED TO ACCOMMODATE THE EXISTING CONDITIONS AND/OR MAINTAIN THE CEILING HEIGHTS AND CLEARANCES REQUIRED. NOTIFY THE ARCHITECT AND ENGINEER OF ANY LOCATION WHERE THE DESIGN INTENT CANNOT BE MET PRIOR TO FABRICATION AND INSTALLATION OF DUCTWORK. REVISIONS TO DUCTWORK, EQUIPMENT, CONDUIT AND/OR PIPING REQUIRED BY CONTRACTOR'S FAILURE TO SUBMIT PROPERLY PREPARED SHOP DRAWINGS SHALL BE THE RESPONSIBILITY OF DIVISION 23 AT NO ADDITIONAL COST TO THE CLIENT OR DELAY TO THE PROJECT SCHEDULE.

GENERAL CONTRACTOR IS RESPONSIBLE FOR PROVIDING TO ARCHITECT, ENGINEER, LANDLORD, AND BUILDING OFFICIAL/INSPECTOR A FINAL TEST AND BALANCE REPORT PER THE SPECIFICATIONS. PROVIDE TEST AND BALANCE REPORT TO ARCHITECT, ENGINEER, AND LANDLORD PRIOR TO THE FINAL BUILDING INSPECTION.

LANDLORD REQUIREMENTS:
LANDLORD APPROVED ROOFING CONTRACTOR SHALL BE RESPONSIBLE FOR MAKING ALL CUTS THROUGH THE EXISTING ROOF, MODIFYING EXISTING OPENINGS, AND/OR ALTERING CURB FLASHING AT GENERAL CONTRACTOR'S EXPENSE. COORDINATE WITH GENERAL CONTRACTOR.

EMS CONTROLS:
CONTRACTORS ARE RESPONSIBLE FOR COORDINATING ALL EQUIPMENT CONTROLS WITH EMS VENDOR PRIOR TO PURCHASE AND INSTALLATION. CONTRACTORS SHALL COORDINATE WITH EMS VENDOR TO PROVIDE ALL NECESSARY EQUIPMENT AND ACCESSORIES FOR A FULLY FUNCTIONING SYSTEM.

TEMPERATURE CONTROLS:
EMS VENDOR SHALL FURNISH SENSORS AND CONTROL COMPONENTS AS INDICATED ON PLANS AND AS NECESSARY TO ACCOMPLISH THE INTENT OF THE DRAWINGS. ALL CONTROLS SHALL BE TIED INTO THE EMS SYSTEM UNLESS NOTED OTHERWISE.

GENERAL CONTRACTOR SHALL INSTALL CARRIER FURNISHED TEMPORARY THERMOSTATS AND FEED THE WIRING DOWN INTO THE SPACE FOR START UP AND CONTROL OF RTU(S) UNTIL THE EMS SYSTEM IS OPERABLE. REFER TO M3.0 FOR CARRIER CONTACT INFORMATION.

PROVIDE RFID DUCTWORK MESH OVER TRANSFER GRILLS BELOW 15'-0" AFF BETWEEN THE STOCKROOM AND THE SALES FLOOR, IF APPLICABLE. COORDINATE REQUIREMENTS WITH CONSTRUCTION PROJECT MANAGER.

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Fixture Package:
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Registered Professional Engineer (Mechanical) CERTIFICATE NO. 66286 JUSTIN M. OLDER State of ARIZONA U.S.A.
09/30/2022

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DRAWN BY: Author

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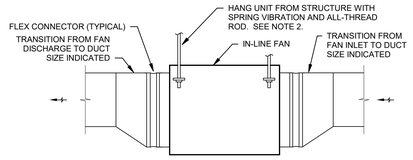
MECHANICAL PLAN

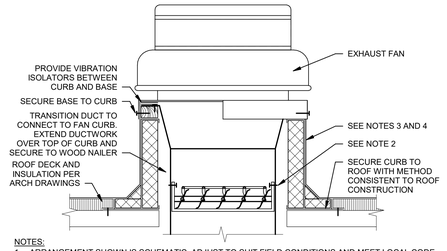
Sheet Number:
M1.0

JUSTIN M. OLDER



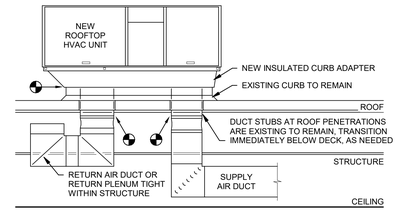
NOTES:
1. ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS AND MEET LOCAL CODE REQUIREMENTS.
2. FOR FANS 1 HP AND LESS, PROVIDE NEOPRENE RUBBER MOUNT HANGER (NR). FOR FANS LARGER THAN 1 HP, PROVIDE SPRING VIBRATION ISOLATION HANGER (SPNH).

3 IN-LINE DUCT-MOUNTED FAN DETAIL
NTS



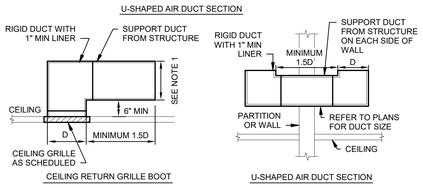
NOTES:
1. ARRANGEMENT SHOWN IS SCHEMATIC. ADJUST TO SUIT FIELD CONDITIONS AND MEET LOCAL CODE.
2. IF DAMPER IS SPECIFIED IN EQUIPMENT SCHEDULE, INSTALL DAMPER AT BASE OF CURB AND SECURE FROM ABOVE TO ALLOW SERVICE THROUGH TOP OF CURB.
3. PREFABRICATED INSULATED ROOF CURB WITH TREATED WOOD NAILER. CANT, AND STEP AS REQUIRED TO ACCOMMODATE ROOF INSULATION. FRAME AND SECURE CURB TO ROOF WITH METHOD CONSISTENT WITH ROOF CONSTRUCTION. ROOF CURB SHALL BEAR ON ROOF STRUCTURE. REFER TO ARCHITECTURAL DRAWINGS AND CURB MANUFACTURER'S DETAILS FOR MORE INFORMATION.
4. FOR SLOPED ROOFS, PROVIDE CURB WITH DIMENSIONS CAPABLE OF COMPENSATING ROOF SLOPE TO ENSURE FAN IS INSTALLED LEVEL.

2 ROOF-MOUNTED DOWNBLAST FAN DETAIL
NTS



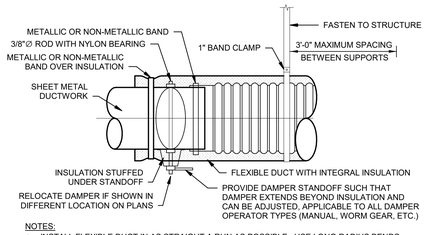
NOTES:
1. CURB ADAPTER SHALL INCLUDE ALL REQUIRED SUPPLY AND RETURN DUCT TRANSITIONS TO ENABLE THE NEW ROOFTOP TO BE INSTALLED WITHOUT NECESSITATING DUCT MODIFICATIONS BELOW THE ROOF.
2. INSTALL ADAPTER CURB AND ROOFTOP UNIT IN A MANNER THAT ENSURES A WEATHER TIGHT INSTALLATION.

1 ROOFTOP UNIT - CURB ADAPTER DETAIL
NTS



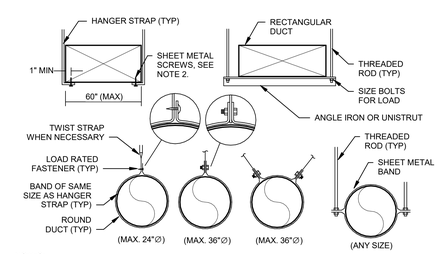
NOTES:
1. REFER TO FLOOR PLAN FOR OUTLET DEPTH. WHEN NO DEPTH IS SHOWN, MINIMUM DEPTH SHALL BE AS REQUIRED TO LIMIT AIR VELOCITY TO 500 FPM WITH A MINIMUM SIZE OF 0.5D.

6 RETURN/TRANSFER AIR DUCT DETAIL
NTS



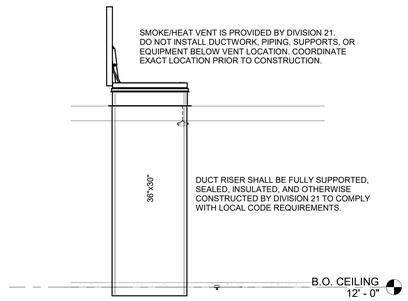
NOTES:
1. INSTALL FLEXIBLE DUCT IN AS STRAIGHT A RUN AS POSSIBLE. USE LONG RADIUS BENDS WHERE POSSIBLE. PULL DUCT TIGHT AT BOTH ENDS AND SECURE BOTH INNER LINER & OUTER INSULATION SKIN WITH TAPE & METAL CLAMPS.
2. EXTEND DAMPER ROD TO ACCOMMODATE INSULATION IF APPLICABLE. PULL ROD END TO EDGE OF DUCTWORK AS REQUIRED AND SEAL TO MAINTAIN VAPOR BARRIER.
3. INSTALL LOCKING QUADRANT TO HANDLE ON BOTTOM OF DUCT FOR EASE OF SERVICE.
4. FLEXIBLE DUCTWORK SHALL NOT EXCEED 5'-0" IN LENGTH AND SHALL HAVE NO MORE THAN ONE 90 DEGREE ELBOW.
5. DUCT SHALL EXTEND STRAIGHT FOR 6" FROM A CONNECTION BEFORE BENDING.

5 DAMPER AND FLEX DUCTWORK CONNECTION DETAIL
NTS

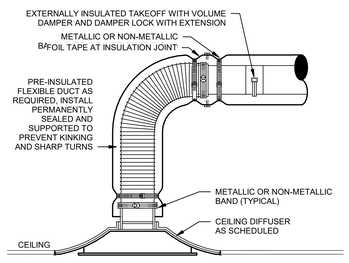


NOTES:
1. USE THREADED ROD FOR RECTANGULAR DUCTS LARGER THAN 60" WIDE.
2. OMIT SHEET METAL SCREWS IF HANGER STRAP IS CONTINUOUS AND LOOPS UNDER ENTIRE DUCT.
3. FOR ROUND DUCTS LARGER THAN 36"∅, USE TWO HANGER RODS TO SUPPORT DUCT FROM EACH SIDE.
4. HANGERS MUST NOT DEFORM DUCT SHAPE.

4 DUCT HANGER - LOWER ATTACHMENT DETAILS
NTS

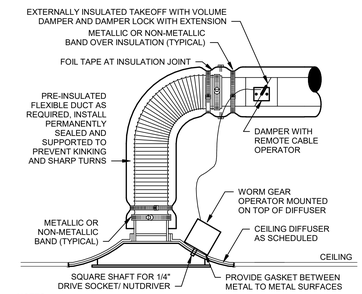


9 SMOKE/HEAT VENT DETAIL
NTS



NOTES:
1. FLEXIBLE DUCT LENGTH MAY NOT EXCEED 5'-0". EXTEND RIGID DUCT AS REQUIRED.
2. DUCT SHALL EXTEND STRAIGHT FOR 6" FROM A CONNECTION BEFORE BENDING.

8 LAY-IN CEILING DIFFUSER DETAIL
NTS



NOTES:
1. FLEXIBLE DUCT LENGTH MAY NOT EXCEED 5'-0". EXTEND RIGID DUCT AS REQUIRED.
2. DUCT SHALL EXTEND STRAIGHT FOR 6" FROM A CONNECTION BEFORE BENDING.

7 HARD CEILING DIFFUSER DETAIL
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