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	IN WC	INCHES OF WATER COLUMN
ACCU	AIR COOLED CONDENSING UNIT	LAT	LEAVING AIR TEMPERATURE
AFC	ABOVE FINISHED CEILING	LDB	LEAVING DRY BULB
AFF	ABOVE FINISHED FLOOR	LP	LOW PRESSURE
AFG	ABOVE FINISHED GRADE	LWB	LEAVING WET BULB
AHJ	AUTHORITY HAVING JURISDICTION	LWT	LEAVING WATER TEMPERATURE
AHU	AIR HANDLING UNIT	MAX	MAXIMUM
AP	ACCESS PANEL	MBH	1000 BTU PER HOUR
APD	AIR PRESSURE DROP	MD	MOTORIZED DAMPER
AWG	AMERICAN WIRE GAUGE	MFR	MANUFACTURER
B	BOILER	MIN	MINIMUM
BAS	BUILDING AUTOMATION SYSTEM	N/A	NOT APPLICABLE
BB	BACKBONE	NOM	NOMINAL
BD	BACKDRAFT DAMPER	NC	NOISE CRITERIA
BHP	BRAKE HORSEPOWER	NF	NON-FUSED
BI	BINARY INPUT	NIC	NOT IN CONTRACT
BO	BINARY OUTPUT	OA	OUTSIDE AIR
BOD	BOTTOM OF DUCT	PICV	PRESSURE INDEP. CONTROL VALVE
BOS	BOTTOM OF STRUCTURE	PROVIDE	FURNISH AND INSTALL
BTU	BRITISH THERMAL UNIT	QTY	QUANTITY
CFM	CUBIC FEET PER MINUTE	RA	RETURN AIR
CLG	COOLING	RC	ROOM CRITERIA
CP	CONDENSATE PUMP	RD	RETURN DUCT
CPT	CONTROL POWER TRANSFORMER	REA	RELIEF AIR
CT	COOLING TOWER	RF	RETURN FAN
CV	CONTROL VALVE	RFR	REFRIGERANT
CU	CONDENSING UNIT	RH	RELATIVE HUMIDITY
DB	DECIBELS	RPM	REVOLUTIONS PER MINUTE
DBA	DECIBEL AVERAGE	RTU	ROOFTOP UNIT
DDC	DIRECT DIGITAL CONTROL	SA	SUPPLY AIR
DI	DIGITAL INPUT	SD	SMOKE DUCT DETECTOR
DISC	DISCONNECT	SD	SUPPLY DUCT
DN	DOWN	SF	SUPPLY FAN
DX	DIRECT EXPANSION	SH	SENSIBLE HEAT CAPACITY
(E)	EXISTING	SOW	SCOPE OF WORK
EA	EXHAUST AIR	SP	STATIC PRESSURE
EAT	ENTERING AIR TEMPERATURE	TBD	TO BE DETERMINED
ED	EXHAUST DUCT	TCP	TEMPERATURE CONTROL PANEL
EDB	ENTERING DRY BULB	TF	TRANSFER FAN
EF	EXHAUST FAN	TFA	TO FLOOR ABOVE
EFF	EFFICIENCY	TFB	TO FLOOR BELOW
EMS	ENERGY MANAGEMENT SYSTEM	TH	TOTAL HEAT CAPACITY
ESP	EXTERNAL STATIC PRESSURE	TSP	TOTAL STATIC PRESSURE
ETR	EXISTING TO REMAIN	TYP	TYPICAL
EWB	ENTERING WET BULB	UH	UNIT HEATER
EWT	ENTERING WATER TEMPERATURE	UNO	UNLESS NOTED OTHERWISE
FCU	FAN COIL UNIT	VAV	VARIABLE AIR VOLUME
FPI	FINS PER INCH	VEL	VELOCITY
FPM	FEET PER MINUTE	VFD	VARIABLE FREQUENCY DRIVE
GC	GENERAL CONTRACTOR	W/	WITH
GPM	GALLONS PER MINUTE	W/O	WITHOUT
HP	HORSEPOWER	WB	WET BULB
HTG	HEATING	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 OR REGISTER)
- 24x24 (NECK SIZE) CEG-1 (TYPE) 800 CFM (CFM OF EXHAUST GRILLE)
- MANUAL VOLUME DAMPER
- SQUARE TO ROUND TRANSITION
- RD Y — DUCT MOUNTED SMOKE DETECTOR (SD=SUPPLY/RD=RETURN)
- 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
- CO2 — CARBON DIOXIDE SENSOR
- DP — DIFFERENTIAL PRESSURE SENSOR
- HS — HUMIDITY SENSOR

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	MEDIUM PRESSURE NATURAL 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	MEDIUM 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

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. 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.
5. PROVIDE ALL VARIABLE FREQUENCY DRIVES ON PLAN, AS APPLICABLE, TO BE ABLE TO ACCEPT A 0-10VDC SPEED SIGNAL AND START/STOP SIGNAL FROM THE EMS. VARIABLE FREQUENCY DRIVES SHALL BE FACTORY PROVIDED AND WALL MOUNTED.
6. THERMOSTATS AND SENSORS SHALL BE FURNISHED BY EMS VENDOR AND INSTALLED BY DIVISION 26 CONTRACTOR UNLESS NOTED OTHERWISE.

MECHANICAL DEMOLITION GENERAL NOTES:

1. ALL GENERAL NOTES SHOWN HERE SHALL GOVERN ALL MECHANICAL SHEETS.
2. COORDINATE ALL DEMOLITION WITH WHAT IS SHOWN ON ARCHITECTURAL PLANS. NOTIFY ARCHITECT OF ANY DISCREPANCIES.
3. 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.
4. 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.
5. REMOVE ITEMS SHOWN HEAVY-LINED DASHED, AND/OR NOTED TO BE REMOVED.
6. AVOID DAMAGING EXISTING SURFACES AND EQUIPMENT TO REMAIN FOR NEW INSTALLATION. REPAIR DAMAGE CAUSED DURING WORK AT NO EXTRA COST TO THE OWNER.
7. 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.
8. 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.
9. 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.
10. INSPECT EXISTING EQUIPMENT TO REMAIN TO VERIFY THAT EQUIPMENT IS OPERATING PROPERLY. NOTIFY OWNER OF DAMAGED AND/OR MALFUNCTIONING COMPONENTS.
11. 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.
12. CEASE WORK AND IMMEDIATELY NOTIFY THE OWNER SHOULD ANY HAZARDOUS MATERIALS BE ENCOUNTERED DURING THE PERFORMANCE OF THE WORK.
13. 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 GENERAL NOTES:

1. ALL GENERAL NOTES SHOWN HERE SHALL GOVERN ALL MECHANICAL SHEETS.
2. 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.
3. PROVIDE SEISMIC RESTRAINTS AS NEEDED FOR THE MECHANICAL SYSTEMS IN THE PROJECT BASED ON THE SEISMIC ANALYSIS REQUIRED BY THE SPECIFICATIONS.
4. 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.
5. 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.
6. 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.
7. 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.
8. PROVIDE TEMPORARY BARRIERS TO CONTAIN DUST AND DEBRIS RESULTING FROM THE PERFORMANCE OF THE WORK TO THE AREA WHERE WORK IS BEING PERFORMED.
9. ALL MECHANICAL EQUIPMENT SHOWN ON THE MECHANICAL PLANS SHALL BE PROVIDED BY DIVISION 23 UNLESS OTHERWISE NOTED.
10. 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.
11. 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.
12. COORDINATE LOCATION OF ROOF MOUNTED HVAC EQUIPMENT AND ROOF PENETRATIONS WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS.
13. INDOOR AIR QUALITY MEASURES: PROTECT 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.
14. INSTALL DUCTWORK AND PIPING PARALLEL TO BUILDING COLUMN LINES UNLESS OTHERWISE SHOWN OR NOTED.
15. 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.
16. COORDINATE LOCATION OF EQUIPMENT SUPPORTS WITH LOCATION OF EQUIPMENT ACCESS PANELS/DOORS TO ENABLE SERVICE OF EQUIPMENT AND/OR FILTER REPLACEMENT.
17. SEAL PENETRATIONS THROUGH THE BUILDING COMPONENTS IN ACCORDANCE WITH THE CONTRACT SPECIFICATIONS. FIREPROOF PENETRATIONS THROUGH FIRE RATED COMPONENTS IN ACCORDANCE WITH U.L. REQUIREMENTS.
18. DRAIN, FLUSH, AND REFILL ALL PIPING SYSTEMS NECESSARY TO PERFORM THE WORK. REFERENCE SPECIFICATIONS FOR FLUSHING PERFORMANCE REQUIREMENTS AND SUBMIT FLUSHING PLAN TO ENGINEER FOR REVIEW. PROVIDE CHEMICAL TREATMENT FOR ALL PIPING SYSTEMS AFTER FLUSHING AND REFILLING THE SYSTEM.
19. 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.
20. ADJUST LOCATION OF CEILING DIFFUSERS, REGISTERS AND GRILLES AS REQUIRED TO ACCOMMODATE FINAL CEILING GRID AND LIGHTING LOCATIONS.
21. DUCTWORK CROSSING FIRE RATED WALLS OR OTHER FIRE RATED ASSEMBLIES SHALL BE MINIMUM 26 GAUGE SHEET METAL.
22. PROVIDE FIRE OR FIRE/SMOKE DAMPERS, AS APPLICABLE, IN DUCTWORK AT CEILINGS AND WALLS AT LOCATIONS SHOWN ON THE PLANS. FIRE AND FIRE/SMOKE DAMPERS SHALL CONFORM TO NFPA AS APPLICABLE. COORDINATE SLEEVE LENGTH WITH REQUIREMENTS OF INSTALLED LOCATION.
23. PROVIDE WALL OR DUCT ACCESS PANELS OR DOORS FOR ACCESS TO FIRE AND FIRE/SMOKE DAMPERS. ACCESS PANEL OR DOOR SHALL BE MINIMUM SIZE OF 10" BY 10" AND SHALL BE INSTALLED WITHIN 12" OF DAMPER. PROVIDE A REMOVABLE DUCT SECTION WHERE DUCT SIZE IS TOO SMALL FOR A 10" BY 10" ACCESS DOOR.
24. LOCATE AND SET THERMOSTATS AND HUMIDISTATS 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.
25. 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.
26. PROVIDE A MANUAL BALANCING DAMPER IN EACH DUCT TAKEOFF FROM SUPPLY, RETURN, OUTDOOR AND EXHAUST AIR DUCTS.
27. 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.
28. BRANCH DUCTWORK TO AIR OUTLETS SHALL BE SAME SIZE AS OUTLET NECK SIZE UNLESS OTHERWISE NOTED.
29. 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.
30. 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.
31. PROVIDE WALL MOUNTED LOUVERS AND DAMPERS WITH SUITABLE MOUNTING FRAME TO MATCH WALL CONSTRUCTION. COORDINATE WITH ARCHITECTURAL DRAWINGS.
32. PROVIDE A NEW SET OF AIR FILTERS IN UNITS PRIOR TO TESTING, ADJUSTING AND BALANCING AND BEFORE TURNING SYSTEM(S) OVER TO OWNER.

COMMISSIONING / FUNCTIONAL TESTING:

CONTRACTOR'S BID SHALL INCLUDE PROVISIONS TO PROVIDE ALL SERVICES RELATED TO THE CODE REQUIRED BUILDING SYSTEMS COMMISSIONING 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 AND LOCAL REQUIREMENTS. REFER TO THE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

MECHANICAL CODE: **2018 INTERNATIONAL MECHANICAL CODE**
BUILDING CODE: **2018 INTERNATIONAL BUILDING CODE**
ENERGY CODE: **2012 INTERNATIONAL ENERGY CONSERVATION CODE**

NIKE INC.
ONE BOWERMAN DRIVE
BEAVERTON, OR 97005

DMD
Do
960
Ala
Tel

MBH PROJECT: 55391

HENDERSON ENGINEERS
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EXPIRES 12/31/2022

Date	No.	Description
03/14/2022		75% SET
04/14/2022		PERMIT/BID/LL SET

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF PRELIMINARY SUBMITTAL BRADLEY E. CHAMBON LICENSE # 028603

IT IS NOT TO BE USED FOR CONSTRUCTION PURPOSES

BRADLEY E. CHAMBON
LICENSE # 028603

NIKE BY KANSAS CITY

COUNTRY CLUB PLAZA
450 NICHOLS RD,
KANSAS CITY, MO 64112

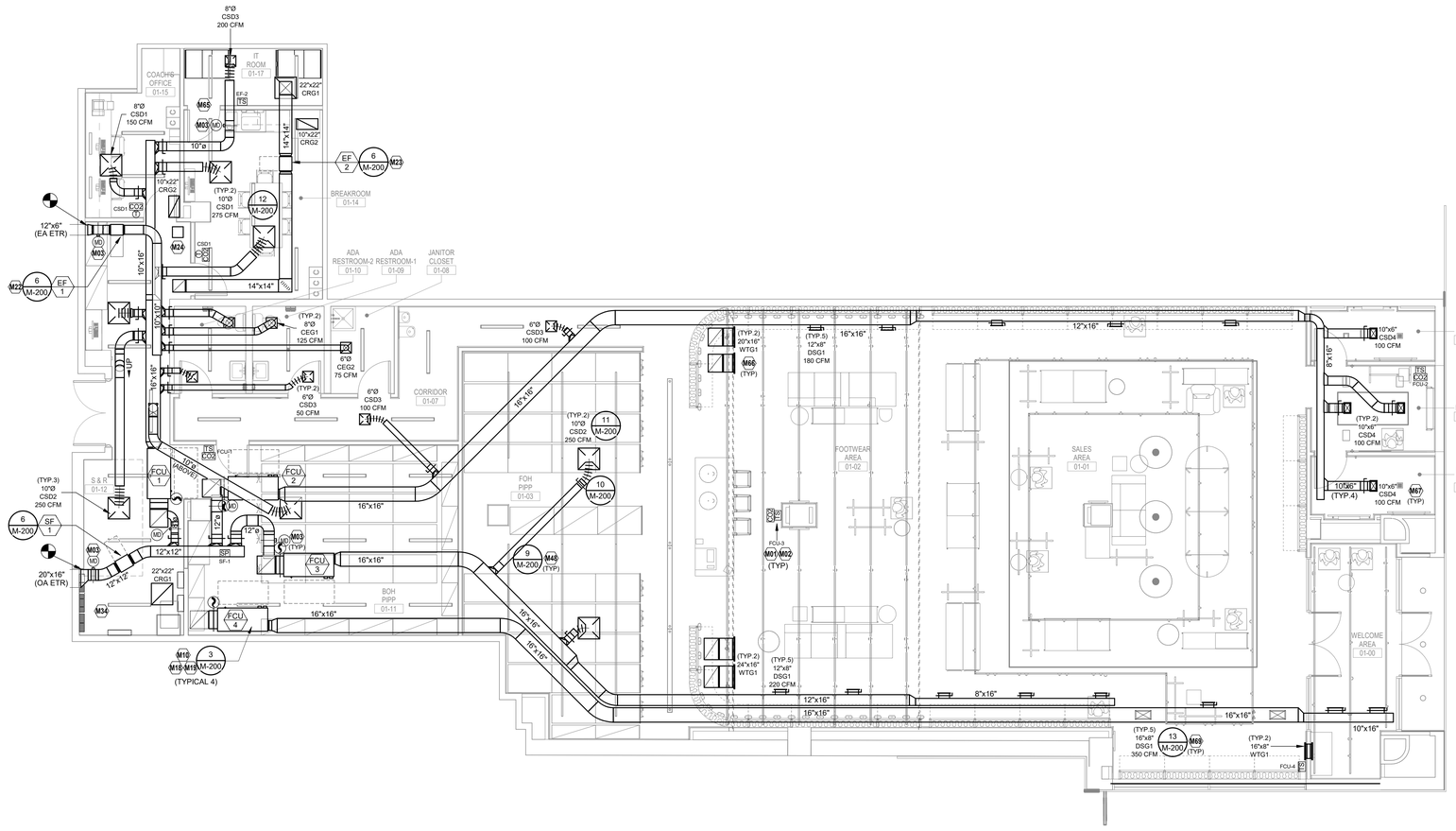
Project Number

Config:	R/L
Drawn By	HENDERSON
Checked By	HENDERSON

MECHANICAL LEGENDS AND GENERAL NOTES

M-000

BRADLEY E. CHAMBON



1 HVAC PLAN
3/16" = 1'-0"

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.

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.

M10 PROVIDE NEW DX SPLIT SYSTEM UNITS AS SCHEDULED SUPPORTED FROM STRUCTURE ABOVE. 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 IN-LINE EXHAUST FAN AS SCHEDULED FOR GENERAL RESTROOM EXHAUST. INSTALL NEAR EXISTING EXHAUST DUCT PENETRATION TO LEASE SPACE. COORDINATE EXACT LOCATION PRIOR TO CONSTRUCTION.

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.

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

M48 COORDINATE DUCTWORK WITH EXISTING STRUCTURE, LANDLORD PIPES, AND OTHER OBSTACLES PRIOR TO CONSTRUCTION. DUCTWORK SHALL BE ROUTED WITHIN BEAMS AT THE SAME HEIGHT AS THE EXISTING DUCTWORK, TRANSITION AS NEEDED TO AVOID CONFLICTS AND RELOCATE OBSTACLES WHEREVER FEASIBLE.

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

M66 PROVIDE GRILLE ON WALL FOR TRANSFER AIR. MOUNT AS HIGH AS POSSIBLE WITHIN STRUCTURE AND INSTALL WITH BLADES ANGLED UP TOWARDS STRUCTURE FOR REDUCED VISIBILITY.

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.

M69 INSTALL DUCT-MOUNTED DIFFUSERS WITH BLADES ANGLED AT 45° TOWARDS THE SALES FLOOR. DUCT-MOUNTED DIFFUSERS SHALL HAVE INTEGRAL DAMPER ADJUSTABLE FROM FACE OF DEVICE.

INSTALL DUCTWORK AND PIPING AS TIGHT TO STRUCTURE AS POSSIBLE. COORDINATE WITH OTHER TRADES TO AVOID CONFLICTS. COORDINATE NSTALLATION OF DUCTWORK AND PIPING TO AVOID CONFLICTS WITH ELECTRICAL PANELS, LIGHTING FIXTURES, ETC. NOTIFY CONSTRUCTION PROJECT MANAGER OF CONFLICTS.

NIKE INC.
ONE BOWERMAN DRIVE
BEAVERTON, OR 97005

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Do
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MBH PROJECT: 55391

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LENEXA, KS 66214
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WWW.HENDERSONENGINEERS.COM
2150003353
MO. CORPORATE NO. E-556D
EXPIRES 12/31/2022

Date	No.	Description
03/14/2022		75% SET
04/14/2022		PERMIT/BID/LL SET

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BRADLEY E. CHAMBON
LICENSE # 028603

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NIKE BY KANSAS CITY

COUNTRY CLUB PLAZA
450 NICHOLS RD,
KANSAS CITY, MO 64112

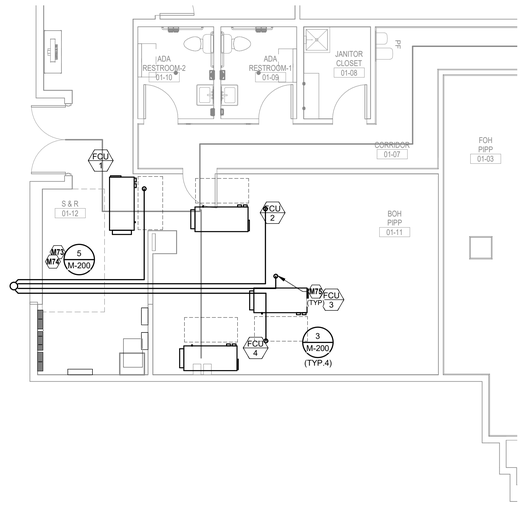
Project Number

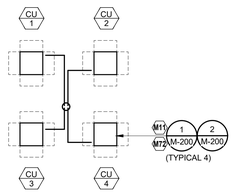
Config:	R/L
Drawn By	HENDERSON
Checked By	HENDERSON

MECHANICAL HVAC PLAN

M-100

BRADLEY E. CHAMBON





1 PIPING PLAN
3/16" = 1'-0"

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

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LANDLORD REQUIREMENTS:
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EMS CONTROLS:
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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.

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MECHANICAL PLAN NOTES

M11 COORDINATE LOCATION OF NEW ROOF-MOUNTED HVAC EQUIPMENT WITH LANDLORD PRIOR TO CONSTRUCTION. LANDLORD SHALL CONFIRM ADEQUATE ACCESS AND CLEARANCES ARE PROVIDED FOR ALL ROOF-MOUNTED HVAC EQUIPMENT.

M72 ROUTE REFRIGERANT PIPING FROM EXTERIOR CONDENSING UNIT TO NEW PIPE RISERS AND ROUTE TO ASSOCIATED FCU. ROUTE PIPING IN A NEAT AND ORDERLY FASHION. COORDINATE ROOF-MOUNTED PIPE ROUTING PRIOR TO INSTALLATION.

M74 DIVISION 23 CONTRACTOR SHALL COORDINATE LIQUID/SUCTION REFRIGERANT PIPE SIZE AND ROUTING WITH MANUFACTURER PRIOR TO CONSTRUCTION.

M75 PROVIDE ALL NECESSARY ACCESSORIES, CONNECTIONS, AND PIPE SUPPORTS FOR CONNECTION TO HVAC EQUIPMENT. TRANSITION PIPE SIZE FOR EQUIPMENT CONNECTION, AS NECESSARY.

INSTALL DUCTWORK AND PIPING AS TIGHT TO STRUCTURE AS POSSIBLE. COORDINATE WITH OTHER TRADES TO AVOID CONFLICTS. COORDINATE NSTALLATION OF DUCTWORK AND PIPING TO AVOID CONFLICTS WITH ELECTRICAL PANELS, LIGHTING FIXTURES, ETC. NOTIFY CONSTRUCTION PROJECT MANAGER OF CONFLICTS.

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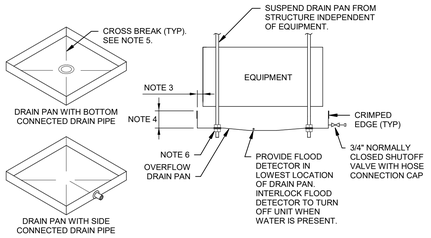
KANSAS CITY, MO 64112

Project Number	
Config:	R/L
Drawn By	HENDERSON
Checked By	HENDERSON

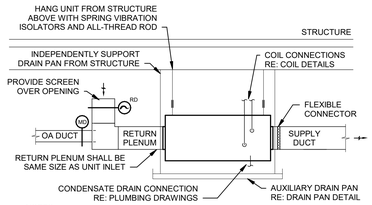
MECHANICAL PIPING PLAN

M-101



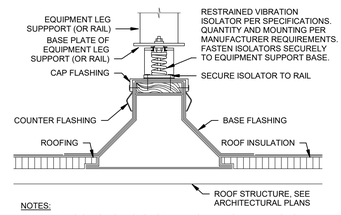
NOTES:
1. SOLDER ALL JOINTS TO MAKE DRAIN PAN LEAK TIGHT.
2. FABRICATE DRAIN PAN FROM 20 GAUGE GALVANIZED SHEET METAL.
3. DRAIN PAN SHALL EXTEND MINIMUM 3" BEYOND EQUIPMENT ON ALL SIDES.
4. HEIGHT OF DRAIN PAN TO BE MINIMUM 1/2" GREATER THAN DIAMETER OF SIDE-CONNECTED DRAIN PIPEFLANGE OR 1-1/2" , WHICHEVER IS GREATER.
5. CROSS BREAK BOTTOM OF SHEET METAL DRAIN PAN TO PROVIDE SLOPED DRAINAGE TO OUTLET.
6. SEAL DRAIN PAN WITH NEOPRENE WASHERS AT SUPPORT RODS.

④ CONDENSATE OVERFLOW DRAIN PAN
NTS



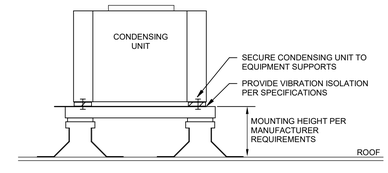
NOTES:
1. ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS AND MEET LOCAL CODE REQUIREMENTS.

③ HORIZONTAL FAN COIL UNIT DETAIL
NTS



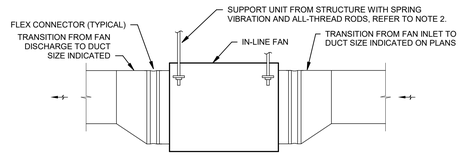
NOTES:
1. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS FOR EQUIPMENT SUPPORTS, ANCHORING AND SEISMIC/WIND RESISTANCE.

② ROOF SUPPORT RAIL - VIBRATION ISOLATION DETAIL
NTS



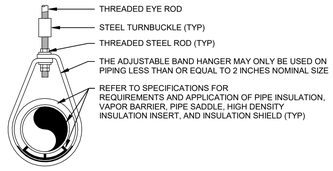
NOTES:
1. SUPPORT AND ANCHOR OUTDOOR UNITS IN COMPLIANCE WITH LOCAL SEISMIC AND WIND RESTRAINT REQUIREMENTS.
2. SEE MECHANICAL EQUIPMENT ANCHORS AND SUPPORT SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
3. MOUNT OUTDOOR UNIT WITH A BOTTOM ELEVATION HEIGHT EQUAL TO THE AVERAGE ANNUAL SNOWFALL IN INCHES PLUS 20 INCHES IN COMPLIANCE WITH MANUFACTURER'S INSTALLATION REQUIREMENTS.

① CONDENSING UNIT SUPPORT DETAIL
NTS

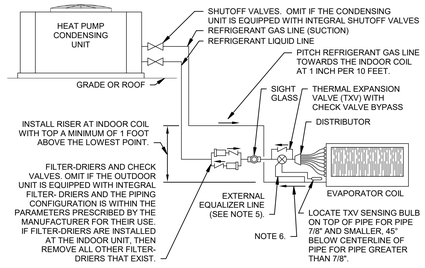


NOTES:
1. ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS AND MEET LOCAL CODE REQUIREMENTS.
2. FOR FANS 1 HP AND LESS, PROVIDE NEOPRENE RUBBER MOUNT HANGER (NR). FOR FANS LARGER THAN 1 HP, PROVIDE SPRING VIBRATION ISOLATION HANGER (SPNH).

⑥ IN-LINE DUCT-MOUNTED FAN DETAIL
NTS

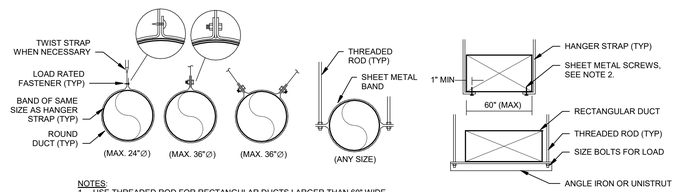


⑤ ADJUSTABLE PIPE HANGER DETAIL
NTS



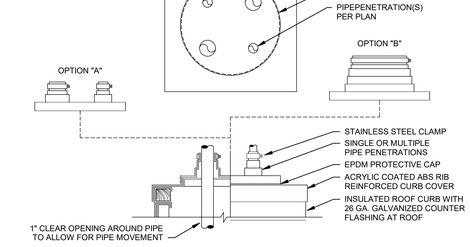
NOTES:
1. INSTALL REFRIGERANT PIPING AND COMPONENTS IN STRICT CONFORMANCE WITH ALL MANUFACTURER'S RECOMMENDATIONS AND REQUIREMENTS, WHICH SHALL TAKE PRECEDENT OVER INFORMATION PRESENTED IN THIS DETAIL.
2. ALL COMPONENTS INSTALLED SHALL BE THE EXACT MODEL RECOMMENDED BY THE MANUFACTURER.
3. CONSULT THE MANUFACTURER REGARDING THE NEED TO INSTALL A SOLENOID VALVE IN THE LIQUID LINE BETWEEN THE FILTER-DRIER AND SITE GLASS.
4. INSTALL REFRIGERATION PIPE SIZES RECOMMENDED BY THE MANUFACTURER AND CONSULT THE MANUFACTURER REGARDING THE NEED FOR INTERMEDIATE TRAPS BASED ON THE RECOMMENDED PIPE SIZES AND PIPING CONFIGURATION.
5. INSTALL THERMAL EXPANSION VALVE WITH BALANCED PORT CONSTRUCTION AND EXTERNAL EQUALIZER LINES FOR ALL EVAPORATOR COILS EQUIPPED WITH A REFRIGERANT DISTRIBUTOR.
6. PITCH REFRIGERANT GAS LINE AWAY FROM INDOOR COIL AT 1 INCH PER 10 FEET.
7. FILTER- DRIER MAY BE OMITTED IF NOT REQUIRED BY MANUFACTURER.
8. SIGHT GLASS MAY BE OMITTED IF NOT REQUIRED BY MANUFACTURER AND SYSTEM IS LESS THAN 5 TONS.

⑦ SPLIT SYSTEM PIPING DETAIL
NTS

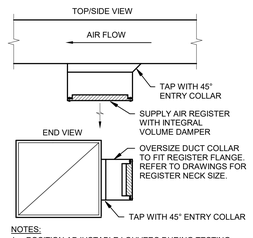


NOTES:
1. USE THREADED ROD FOR RECTANGULAR DUCTS LARGER THAN 60" WIDE.
2. OMIT SHEET METAL SCREWS IF HANGER STRAP IS CONTINUOUS AND LOOPS UNDER ENTIRE DUCT.
3. FOR ROUND DUCTS LARGER THAN 36"∅, USE TWO HANGER RODS TO SUPPORT DUCT FROM EACH SIDE.
4. HANGERS MUST NOT DEFORM DUCT SHAPE.

⑨ DUCT HANGER - LOWER ATTACHMENT DETAILS
NTS

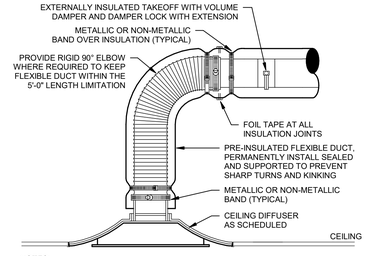


⑧ PIPE PORTAL ROOF PENETRATION DETAILS
NTS



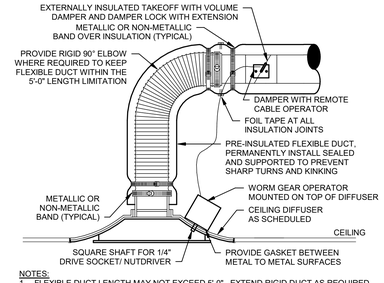
NOTES:
1. POSITION ADJUSTABLE LOUVERS DURING TESTING AND BALANCING FOR OCCUPANT COMFORT AND TO DECREASE DRAFTS IN THE SPACE.

⑬ REGISTER MOUNTING TO RECTANGULAR DUCT DETAIL
NTS



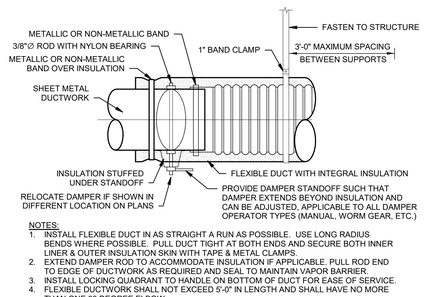
NOTES:
1. FLEXIBLE DUCT LENGTH MAY NOT EXCEED 5'-0". EXTEND RIGID DUCT AS REQUIRED.
2. DUCT SHALL EXTEND STRAIGHT FOR 6" FROM A CONNECTION BEFORE BENDING.

⑫ 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.

⑪ HARD CEILING DIFFUSER 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.

⑩ DAMPER AND FLEX DUCTWORK CONNECTION DETAIL
NTS

NIKE INC.
ONE BOWERMAN DRIVE
BEAVERTON, OR 97005

DMD
Do
960
Ala
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MBH PROJECT: 55391

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NIKE BY KANSAS CITY

COUNTRY CLUB PLAZA
450 NICHOLS RD,
KANSAS CITY, MO 64112

Project Number

Config:	R/L
Drawn By	HENDERSON
Checked By	HENDERSON

MECHANICAL DETAILS

M-200

BRADLEY E. CHAMBON

PROJECT DESIGN CONDITIONS

CLIMATE CONDITONS

WEATHER STATION:		KANSAS CITY WHEELER, MO, USA						
CLIMATE ZONE:		4A						
HEATING (DB):	99.6%	5.8	°F					
DESIGN HEATING CONDITIONS (DB):		-4.0	°F					
HUMIDIFICATION (DP/ HR/ MCDB):	99.6%	-5.2	°F/	4.3	gr/lb	9.2	°F	
COOLING (DB/MCWB):	0.4%	97.2	°F	76.4	°F			
DESIGN COOLING CONDITIONS (DB/ MCWB):		97.2	°F	76.4	°F			
DEHUMIDIFICATION (DP/ HR/ MCDB):	0.4%	75.8	°F/	138.7	gr/lb	87.0	°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	
FCU-1 BACK OF HOUSE	72	77	60%	NA	70	60	NA	NA	CO2	400	750		TBD	TBD	TBD	A-D
FCU-2 STOCKROOM	72	77	60%	NA	70	60	NA	NA	CO2	400	750		TBD	TBD	TBD	A-D
FCU-3 SALES FLOOR	72	77	60%	NA	70	60	NA	NA	CO2	400	750		TBD	TBD	TBD	A-D
FCU-4 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.

SPLIT SYSTEM CONTROL MATRIX

CONTROL FEATURE	UNITS	AHU-1 SETPOINT OR Y/N	AHU-2 SETPOINT OR Y/N	AHU-3 SETPOINT OR Y/N	AHU-4 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 - OCCUPIED SETPOINT	°F	72	72	72	72	READ/WRITE	
COOLING - UNOCCUPIED SETPOINT	°F	77	77	77	77	READ/WRITE	
DEAD BAND - MINIMUM HEATING AND COOLING TEMPERATURE SETPOINT DIFFERENCE	°F	5	5	5	5		
HEATING - OCCUPIED SETPOINT	°F	70	70	70	70	READ/WRITE	
HEATING - UNOCCUPIED SETPOINT	°F	60	60	60	60	READ/WRITE	
HEATING - SUPPLY AIR TEMPERATURE SETPOINT	°F	90	90	90	90	READ/WRITE	
PROGRAMMED CONTROL FEATURES							
REMOTE TEMPERATURE SENSOR		Y	Y	Y	Y	READ	B
DEMAND CONTROL VENTILATION - CO2 SENSOR FEEDBACK	PPM	750	750	750	N/A	READ/WRITE	B
EQUIPMENT ACCESSORIES AND CONTROL MODULES							
OUTSIDE AIR DAMPER - MOTOR OPERATED (MODULATING)		Y	Y	Y	N	READ POSITION	L
HEAT PUMP - REVERSING VALVE		Y	Y	Y	Y	READ STATUS	N
AUXILIARY HEAT KIT (ELECTRIC)		Y	Y	Y	Y	READ STATUS	J
SUPPLY FAN CONTROL METHODS							
ON DURING OCCUPIED HOURS		Y	Y	Y	Y		
CYCLE WITH LOADS DURING UNOCCUPIED HOURS		Y	Y	Y	Y		
OPTIMUM START SEQUENCE		Y	Y	Y	Y		R
CONSTANT VOLUME FAN CONTROL		Y	Y	Y	Y	READ STATUS	
SAFETIES, INTERLOCKS, AND ALARMS							
RETURN AIR SMOKE DETECTOR - UNIT SHUTDOWN		Y	Y	Y	Y	READ	D
AUXILIARY DRAIN PAN FLOOD DETECTOR - UNIT SHUTDOWN		Y	Y	Y	Y	READ	B
DIFFERENTIAL PRESSURE SWITCH - FILTER CHANGE ALARM		Y	Y	Y	Y	READ	G

DIV. 23 CONTRACTOR SHALL PROVIDE CONTROL PANEL(S), WIRING, THERMOSTAT(S), TEMPERATURE SENSOR(S), HUMIDISTAT(S), AND/OR CO2 SENSOR(S) WHERE SHOWN ON THE DRAWINGS AND AS REQUIRED TO FACILITATE THE SCHEDULED CONTROL MODULES AND SEQUENCES 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. REFERENCE DIVISION SPECIFICATIONS FOR INDIVIDUAL DEVICE REQUIREMENTS.

NOTES:
A. PROVIDE UNIT WITH TERMINAL STRIP TO RECEIVE CONTROL INPUT(S) COMMUNICATED FROM A CENTRAL DDC CONTROLLER. EMS SHALL PROVIDE REMOTE SETPOINT ADJUSTMENT, SCHEDULING, AND MONITORING OF THE POINTS LISTED IN THE SCHEDULE FOR EACH UNIT. LISTED IN THE SCHEDULE FOR EACH UNIT.
B. DIVISION 23 CONTRACTOR SHALL PROVIDE DEVICE.
D. DIVISION 28 CONTRACTOR SHALL PROVIDE DEVICE.
G. DEVICE SHALL BE FACTORY MOUNTED AND PRE-WIRED FOR OPERATION SUBJECT TO THE ONBOARD CONTROLLER.
J. MODULATE AND/OR CYCLE SUPPLY FAN SPEED SETTING AND COIL CAPACITY STAGES SUBJECT TO THE INTERNAL SAFETIES AND SEQUENCES TO MAINTAIN SCHEDULED SETPOINTS.
L. DIVISION 23 SHALL PROVIDE MODULATING DAMPER AND EMS CONTRACTOR SHALL PROVIDE CONTROLS CAPABLE OF ADJUSTING THE DAMPER POSITION TO MAINTAIN THE SCHEDULED OUTSIDE AIR ON THE DRAWINGS. EMS CONTRACTOR SHALL PROGRAM MULTIPLE DAMPER POSITION SETPOINTS IN THE FIELD DURING TESTING AND BALANCING TO MAINTAIN MINIMUM PROGRAM MULTIPLE DAMPER POSITION SETPOINTS IN THE FIELD DURING TESTING. DAMPER SHALL ADJUST BASED ON DEMAND CONTROL VENTILATION.
N. 480/3 HEAT KIT PROVIDED BY DIVISION 23. CYCLE COIL CAPACITY STAGES FOR MORNING DEFROST AND AS SUPPLEMENTAL HEATING TO MAINTAIN SCHEDULED SETPOINTS.
R. DURING OPTIMUM START SEQUENCE, THE UNIT SHALL SUPPLY THE LESSER OF THE MINIMUM RATE OF OUTDOOR AIR OR SUPPLY 3 COMPLETE AIR CHANGES DURING THE 1-HOUR PERIOD BEFORE NORMAL OCCUPIED MODE.

HVAC UNIT STARTUP REQUIREMENTS

INSTALLING CONTRACTOR SHALL COMPLETE THE PRE-START CHECKLIST AND EMAIL JENNIFER.TYE@COMFORTSYSTEMSUSA.COM MINIMUM OF TWO (2) 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, IF APPLICABLE.
- ☐ VERIFY HVAC UNIT(S) INSTALLED AND PROPERLY SUPPORTED PER MECHANICAL PLANS.
- ☐ VERIFY DUCTWORK/FABRIC DUCT COMPLETELY INSTALLED PER MECHANICAL PLANS.
- ☐ VERIFY OA HOOD INSTALLED, IF APPLIABLE. VERIFY AIR INLET SCREEN INSTALLED.
- ☐ VERIFY POWER EXHAUST ACCESSORY INSTALLED, IF APPLICABLE.
- ☐ VERIFY CLEAN PLEATED FILTERS INSTALLED, MINIMUM MERV 13 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 GAS METER INSTALLED AND GAS AVAILABLE FROM THE UTILITY. GAS PIPING COMPLETED, CHECKED FOR LEAKS AND PURGED, IF APPLICABLE.
- ☐ VERIFY GAS PIPING DRIP LEG INSTALLED PROPERLY (DOWNSTREAM OF SHUTOFF VALVE AND NO INTERFERENCE WITH ACCESS DOOR), IF APPLICABLE.
- ☐ VERIFY FLUE HOOD INSTALLED, IF APPLICABLE.
- ☐ 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, IF APPLICABLE.
- ☐ VERIFY UNIT TRANSFORMER PRIMARY TAPPED FOR JOBSITE VOLTAGE.

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.

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.

OUTSIDE AIR REQUIREMENTS, IMC-2018 W/ AMENDMENTS (IP)

SYSTEM DESIGNATION	SYSTEM TYPE:	SINGLE-ZONE SYSTEMS		MULTI-ZONE SYSTEMS	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)	CODE REQUIREMENTS		DESIGN VALUES		NOTES
		VENTILATION ZONE ASSOCIATED WITH SYSTEM	WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS [Ez]	SYSTEM VENTILATION EFFICIENCY [Ev]					REQUIRED O/A INTAKE FLOW [Vot] (CFM)	REQUIRED DCV O/A INTAKE FLOW [Vot] (CFM)	MIN O/A INTAKE FLOW [Vot] (CFM)	ABS MIN O/A INTAKE FLOW [Vot] (CFM)	
FCU-1	MULTI-ZONE	-	-	0.84	1,297	0.086	8.12	5.1	182	133	200	140	ALL
FCU-2,3,4	MULTI-ZONE	-	-	0.52	3,674	0.113	38.42	7.5	732	434	800	450	ALL
								TOTALS	1,541	936	**1,000**	**590**	

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.
D. THE ABSOLUTE MINIMUM OUTSIDE AIRFLOW (ABS MIN O/A) DESIGN VALUE IS THE DEMAND CONTROL VENTILATION (DCV) DESIGN AIRFLOW VALUE.

HEAT PUMP FAN COIL UNIT SCHEDULE (W/ AUX ELECTRIC HEATING)

MARK	MANUFACTURER	MODEL	SUPPLY FAN			COOLING COIL							TOTAL	HEAT PUMP COIL				AUXILIARY HEAT KIT					MIN	ABS	ELECTRICAL			WEIGHT	NOTES
			CFM	ESP	NOM	TH	SH	EAT		LAT		REFR	CAP	MIN OUT	EAT	LAT	MIN NO	MIN OUT	NOM	EAT	LAT	MIN NO	O/A	MIN O/A	V/PH	MCA	MOCP	(LBS)	
				(IN)	HP	(MBH)	(MBH)	(°F DB)	(°F WB)	(°F DB)	(°F WB)	TYPE	(MBH)	(MBH)	(°F DB)	(°F DB)	STAGES	(MBH)	(KW)	(°F DB)	(°F DB)	STAGES	(CFM)	(CFM)					
FCU-1	CARRIER	FV4CNB006	1,750	0.90	3/4	44.2	36.7	74.9	63.4	55.8	54.9	R-410A	200	45	60	90	2	40	5	60	90	2	200	160	480/3	12	15	200	ALL
FCU-2	CARRIER	FV4CNB006	1,600	1.10	3/4	52.6	36.8	78.8	66.3	56.4	54.9	R-410A	300	40	60	90	2	40	5	60	90	2	300	175	480/3	12	15	200	ALL
FCU-3	CARRIER	FV4CNB006	1,600	1.10	3/4	52.6	36.8	78.8	66.3	56.4	54.9	R-410A	300	40	60	90	2	40	5	60	90	2	300	175	480/3	12	15	200	ALL
FCU-4	CARRIER	FV4CNB006	1,750	0.90	3/4	42.1	40.2	72.0	59.5	50.9	50.8	R-410A	300	40	70	90	2	40	5	70	90	2	300	175	480/3	12	15	200	ALL

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. ASSOCIATED CONDENSING UNIT SHALL BE BY THE SAME MANUFACTURER.
B. EQUIPMENT SIZED FOR 105°F AMBIENT TEMPERATURE.
C. PROVIDE 2" MERV 13, PLEATED THROWAWAY AIR FILTERS.
D. PROVIDE WITH BACK INLET CONNECTION.
E. PROVIDE WITH FRONT OUTLET CONNECTION.
F. PROVIDE WITH 7-DAY PROGRAMMABLE THERMOSTAT WITH STAGED HEATING AND COOLING CAPABILITY AS REQUIRED FOR OPERATION OF AUXILIARY HEATING AND COOLING CONTROLS.
G. PROVIDE FACTORY MOUNTED DISCONNECT INSTALLED ON SERVICE SIDE OF UNIT.
H. SPECIFIED FAN ESP ACCOUNTS FOR DUCT LOSSES EXTERNAL TO UNIT. FILTER LOSS IS AT A MAXIMUM OF 400 FPM FACE VELOCITY.
J. 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.
K. DIVISION 23 CONTRACTOR SHALL PROVIDE SMOKE DETECTORS IN RETURN AIR DUCT(S).
L. PROVIDE WITH SPRING VIBRATION ISOLATION AND ALL-THREAD HANGING RODS.
M. PROVIDE SEPARATE ELECTRIC HEAT KIT BY WARREN TECHNOLOGY, MODEL NUMBER WFK[KW]05A, OR EQUIVALENT. ELECTRIC HEAT KIT SHALL PROVIDE A SINGLE-POINT 480/3 POWER CONNECTION FOR THE ELECTRIC HEATER AND FAN COIL UNIT. NOMINAL KW IS BASED ON LISTED MANUFACTURER'S STANDARD PRODUCT. COORDINATE EQUIPMENT POWER SUPPLY WITH ELECTRICAL CONTRACTOR IF DIFFERENT FROM THAT SCHEDULED.
N. PROVIDE AUXILIARY DRAIN PAN WITH FLOOD DETECTOR SWITCH TO SHUT OFF UNIT WHEN WATER IS PRESENT IN DRAIN PAN.

CARRIER NATIONAL ACCOUNT CONTACT
MATT MURPHY
STRATEGIC ACCOUNT MANAGER
CARRIER CORPORATION
MOBILE: 630.235.1615
EMAIL: MATT.MURPHY@CARRIER.COM

SEQUENCE OF OPERATION

A. DX SPLIT SYSTEM UNIT CONTROL (FCU/CU-X)

Refer to Split System 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 SERVING IT ROOM CONTROL (MD)

When FCU-1 is in heating mode, the motorized damper shall be closed.

When FCU-1 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 associated motorized damper shall open.

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

A damper end switch shall prove if the associated 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.

F. OUTSIDE AIR SUPPLY FAN CONTROL (SF-1)

In occupied mode, the supply fan shall be enabled and the associated motorized damper shall open. Fan potentiometer control shall modulate fan speed to maintain duct static pressure setpoints, to be determined and measured during system testing and balancing. Coordinate setpoints with EMS vendor.

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

A damper end switch shall prove if the associated 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.

EMS vendor shall provide S/S signal and a 0-10VDC control signal for input to fan's electrically commutated motor and potentiometer subject to combined Fan Coil Unit minimum outside air requirements and Demand Control Ventilation requirements.

HEAT PUMP CONDENSING UNIT SCHEDULE

MARK	SERVICE	MANUFACTURER	MODEL	REFR TYPE	TH (MBH)	MIN NO OF STAGES	NO OF CIRCUITS	MIN EFF (EER)	MIN EFF (IEER)	MIN EFF (HSPF)	ELECTRICAL V/PH	ELECTRICAL MCA	ELECTRICAL MOCP	WEIGHT (LBS)	NOTES
CU-1	FCU-1	CARRIER	25HCE448	R-410A	44.3	1	1	12.5	15	8.5	480/3	8.5	15	200	ALL
CU-2	FCU-2	CARRIER	25HCE460	R-410A	52.6	1	1	11.5	14	8.2	480/3	10.5	15	225	ALL
CU-3	FCU-3	CARRIER	25HCE460	R-410A	52.6	1	1	11.5	14	8.2	480/3	10.5	15	225	ALL
CU-4	FCU-4	CARRIER	25HCE448	R-410A	42.1	1	1	12.5	15	8.5	480/3	8.5	15	200	ALL

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. ASSOCIATED FAN COIL UNIT SHALL BE BY THE SAME MANUFACTURER.
B. PROVIDE LOW AMBIENT CONTROL TO 25°F.
C. EQUIPMENT SIZED FOR 105°F AMBIENT TEMPERATURE.
D. COORDINATE WITH THE MANUFACTURER THE HORIZONTAL AND VERTICAL REFRIGERANT PIPE ROUTING TO DETERMINE PIPE SIZES FOR THE REFRIGERANT PIPING. MANUFACTURER SHALL PROVIDE DETAILED REFRIGERANT PIPING DIAGRAMS INCLUDING DIMENSIONAL DATA FOR ALL REFRIGERANT PIPING DEVICES. THE MANUFACTURER SHALL SIZE AND LOCATE THE ASSOCIATED REFRIGERANT TRAPS BASED ON THE ACTUAL ROUTING AND PROVIDE OTHER APPURTENANCES TO PROVIDE A FULLY FUNCTIONAL AND OPERATIONAL SYSTEM. COORDINATE WITH THE MANUFACTURER LOCATIONS FOR ALL REFRIGERANT PIPING DEVICES TO MAINTAIN SERVICEABILITY AND ACCESSIBILITY.
E. PROVIDE LIQUID LINE FILTER DRYER AND SIGHT GLASS.
F. PROVIDE PRE-ENGINEERED ROOF EQUIPMENT SUPPORTS WITH MINIMUM HEIGHT REQUIRED TO MAINTAIN BOTTOM OF EQUIPMENT A MINIMUM OF 8 INCHES ABOVE FINISHED ROOF SURFACE. COORDINATE WITH ROOF INSULATION THICKNESS AND ROOF TAPER AT INSTALLED LOCATION.
G. PROVIDE FACTORY MOUNTED DISCONNECT INSTALLED ON SERVICE SIDE OF UNIT.
H. STARTERS FOR ALL MOTORS SHALL BE PROVIDED INTEGRAL WITH UNIT.
J. COORDINATE SIZE OF CONDUCTOR TERMINATION LUGS WITH CONDUCTOR SIZES SHOWN ON ELECTRICAL DRAWINGS.
K. PROVIDE CONDENSER COIL HAIL GUARDS.

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	ARIA	SUPPLY	DRYWALL PRO	DRYWALL	PLAQUE	CEILING	--	6"x10"	25	0.1	A - C, F - H, K
DSG1	TITUS	SUPPLY	301RL	STEEL	LOUVERED	DUCT SIDEWALL	--	REFER TO PLANS	25	0.1	B, C, E, 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.
E. FRONT BLADES PARALLEL TO LONG DIMENSION. PROVIDE OPPOSED BLADE DAMPER ADJUSTABLE FROM FACE OF DEVICE. AIR BLADES SHALL BE DIRECTED AT [22.5°][45°] TOWARDS THE FINISHED FLOOR.
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. COORDINATE WITH MANUFACTURER FOR NECESSARY MOUNTING BRACKETS OR ACCESSORIES.
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.
K. COORDINATE DIFFUSER INSTALLATION IN DRYWALL WITH ARCHITECT PRIOR TO INSTALLATION. COORDINATE EXACT LOCATION WITH OTHER CEILING DEVICES FOR AN ORDERLY CEILING CONSTRUCTION.

FAN SCHEDULE

MARK	SERVICE DESCRIPTION	MANUFACTURER	MOUNTING	MODEL	CFM MIN	CFM MAX	ESP (IN)	BHP	NOM HP	FAN RPM	DRIVE (BELT/DIRECT)	VFD (Y/N)	ELECTRICAL V/PH	WEIGHT (LBS)	NOTES
EF-1	RESTROOM	GREENHECK	INLINE	SQ-080-VG	325	325	0.5	0.05	1/10	1548	DIRECT	N	120/1	45	A - G, J
EF-2	IT CLOSET	GREENHECK	INLINE	SQ-100-VG	1000	1000	0.3	0.13	1/4	1385	DIRECT	N	120/1	45	A, D - H
SF-1	OUTSIDE AIR	GREENHECK	INLINE	SQ-120-VG	450	1000	0.8	0.55	3/4	1402	DIRECT	N	120/1	85	A - F, K - L

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. VERIFY EXHAUST FAN OR EXTERIOR DUCT TERMINATION TO MAINTAIN A MINIMUM OF 15'-0" FROM AIR INTAKES.
D. PROVIDE WITH RUBBER IN SHEAR ISOLATION AND ALL-THREAD HANGING RODS.
E. PROVIDE WITH FACTORY-MOUNTED STARTER AND DISCONNECT SWITCH.
F. PROVIDE WITH FACTORY-MOUNTED CONTROL POWER TRANSFORMER CAPABLE OF ACCEPTING A 24V RELAY FROM EMS.
G. PROVIDE WITH MANUFACTURER'S ELECTRONICALLY COMMUTATED (EC) MOTOR. CONTRACTOR SHALL USE FAN POTENTIOMETER FOR BALANCING PURPOSES.
H. INTERLOCK FAN OPERATION WITH SPACE TEMPERATURE SENSOR. 24V RELAY FURNISHED BY EMS VENDOR.
J. INTERLOCK FAN OPERATION WITH EMS. 24V RELAY FURNISHED BY EMS VENDOR.
K. INTERLOCK FAN OPERATION WITH DUCT STATIC PRESSURE SENSOR. REFER TO M3.1 FOR MORE INFORMATION.
L. PROVIDE WITH MANUFACTURER'S ELECTRONICALLY COMMUTATED (EC) MOTOR. FAN SHALL BE CAPABLE OF ACCEPTING 0-10VDC FOR FAN SPEED CONTROL.

BRADLEY E. CHAMBON

NIKE INC.
ONE BOWERMAN DRIVE
BEAVERTON, OR 97005

Do
960
Ala
Tel

MBH PROJECT: 55391

HENDERSON ENGINEERS
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MO. CORPORATE NO: E-556D
EXPIRES 12/31/2022

Date	No.	Description
03/14/2022		75% SET
04/14/2022		PERMIT/BID/LL SET

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF PRELIMINARY SUBMITTAL
BRADLEY E. CHAMBON
LICENSE # 028603

IT IS NOT TO BE USED FOR CONSTRUCTION PURPOSES

BRADLEY E. CHAMBON
LICENSE # 028603

NIKE BY KANSAS CITY

COUNTRY CLUB PLAZA
450 NICHOLS RD,
KANSAS CITY, MO 64112

Project Number

Config: R/L

Drawn By HENDERSON

Checked By HENDERSON

MECHANICAL SCHEDULES & CONTROLS

M-300

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. Rail Equipment Supports: Secure each equipment support leg to the rail with a minimum of 4 points of connection per leg.
2. 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

Provide sleeves for pipes passing through above grade concrete or masonry walls, concrete floor or roof slabs. Sleeves are not required for core drilled holes in existing masonry walls, concrete floors or roofs. Provide 10 gauge galvanized steel sleeves for sleeves 6 inches and smaller. Provide galvanized sheet metal sleeves for larger than 6 inches. Schedule 40 PVC sleeves are acceptable for installation in areas without return air plenums.

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.

Extend pipe insulation for insulated pipe through floor, wall and roof penetrations, including fire rated walls and floors. The vapor barrier shall be maintained. Size sleeve for a minimum of 1 inch annular clear space between inside of sleeve and outside of insulation.

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.

Provide box frames for rectangular openings welded 12 gauge galvanized steel attached to forms and of a maximum dimension established by the Architect. Notify the General Contractor or Architect before installing any box openings not shown on the Architectural or Structural drawings.

Seal concrete or masonry exterior wall penetrations below grade with "wall pipes" and mechanical sleeve seals. Provide cast iron "wall pipes" with integral waterstop ring manufactured by Jay R. Smith, Josam, Wade, Watts or Zurn. Provide modular mechanical sleeve seals, manufactured by Calpico, Metraflex, or Thunderline / Link Seal.

Seal elevated concrete slab with water proof membrane penetrations with "wall pipes" and water proof sealant. Secure waterproof membrane flashing between "wall pipe" clamping flange and clamping ring. Provide cast iron "wall pipes" with integral waterstop ring manufactured by Jay R. Smith, Josam, Wade, Watts or Zurn.

Provide sleeves for horizontal pipe passing through or under foundation. Sleeves shall be cast iron soil pipe two nominal pipe sizes larger than the pipe served.

Provide Schedule 40 PVC pipe sleeves for vertical pressure pipe passing through concrete slab on grade. Sleeves shall be one nominal pipe size larger than the pipe served and two pipe sizes larger than pipe served for ductile iron pipes with restraining rods. Seal water-tight with silicone caulk.

Provide 1/2 inch thick cellular foam insulation around perimeter of non-pressure pipe passing thru concrete slab on grade. Insulation shall extend to 2 inches above and below the concrete slab.

I. FIRESTOPPING

Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with UL 2079 or ASTM E 814, or other NRTL acceptable to AHJ.

Manufacturers: Hilti, RectorSeal, Specified Technologies Inc., United States Gypsum Company, or 3M corp.

Through and Membrane Penetration Firestopping Systems Product Schedule: Provide UL listing, location, wall or floor rating, and installation drawing for each penetration fire stop system.

Where project conditions require modification to qualified testing and inspecting agency's illustrations for a particular firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Include qualifications data for testing agency.

J. 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.

K. 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.

L. 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.

M. VIBRATION ISOLATOR TYPES

1. Type SPNH (Spring and Neoprene Hangers): Provide a steel hanger box containing a laterally stable, double-deflecting neoprene isolator in series with a steel spring. Design springs so the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 80 percent of the compressed height of the spring at rated load. Loaded springs shall operate within the linear portion of their load versus deflection curve over a deflection range of not less than 50 percent above design deflection. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc. Include a neoprene bushing to prevent contact between the lower hanger rod and hanger box and short-circuiting the isolating function. The neoprene element shall have a maximum durometer of 50 and designed for 15 percent strain, with a static deflection of not less than 0.4 inches. Unless otherwise specified, the static deflection of SPNH hangers shall be 2 inches. Provide SPNH hangers with 1 inch static deflection for water source heat pumps and fan-powered VAV terminal units. When installed, do not cock the spring element and do not allow the hanger box to rotate through a full 360 degree arc without encountering obstructions. Provide Mason Industries Type 30N or equal.

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 8.

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 manufacturer's standard pre-printed, semi-rigid snap-on or permanent adhesive, pressure-sensitive vinyl pipe markers. Color code pipe markers to comply with ANSI A13.1.

Install pipe markers on each HVAC piping system and include arrows to show normal direction of flow.

Locate pipe markers and color bands wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

Provide plastic laminate or brass valve tag on every valve, cock and control device in each HVAC piping system; exclude check valves, valves within factory-fabricated equipment units, and shut-off valves at HVAC terminal devices and similar rough-in connections of end-use fixtures and units.

Provide manufacturer's standard laminated plastic, color coded equipment markers. Conform to the following color code: Green for Cooling; Yellow for Heating; Yellow/Green for combination Cooling and Heating; Brown for Energy Reclamation; Blue for other equipment types. Conform to ANSI A13.1 for Hazardous Equipment.

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.

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. 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.

E. AIR DEVICES

Provide air devices as scheduled on drawings, manufactured by Price or Titus. VAV diffusers shall be Price Prodigy models 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.

F. 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.

G. SMOKE DAMPERS

Provide smoke dampers where shown on drawings, and as required by Code enforcing authority. Damper ratings shall be as required to maintain the smoke ratings noted on the Architectural drawings. Dampers shall meet UL 555S classification of leakage class II smoke damper; damper shall bear a UL label attesting to these classifications. Rate smoke damper for a minimum velocity of 2,000 FPM and pressure of 4 inches W.G. Provide manufacturer recommended steel sleeve of length as required to meet the installed location. Provide a qualified 120 volt electric actuator installed by the manufacturer at time of damper fabrication. Actuators shall be rated for a minimum of 20,000 cycles of operation, shall comply with the locally adopted building code and shall open in 15 seconds or less and close in 15 seconds or less after alarm or smoke detection has occurred. Provide stainless steel spring loaded leakage seals in sides of casing, and Terminal block for connection to the building fire alarm system. [Provide factory mounted and wired smoke detector for actuation of smoke damper.] Damper shall be manufactured by Air Balance, Cesco, Greenheck, Nailor Industries, Ruskin, or United Air.

Provide access door, sized per SMACNA with minimum size of 10 inch by 10 inch, in duct for inspection and service to smoke damper and actuator. Provide duct access door(s) within 12 inches of the device to allow for testing and maintenance. Label each door (with minimum 1 inch lettering) indicating which damper type is served. Door should be capable of being fully opened or provide removable door. Provide removable section of duct where duct size is too small for 10 inch by 10 inch access door. Provide access door in ceiling or wall as required to access damper.

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. CONDENSING UNITS

Provide split system, air cooled condensing units as scheduled on the drawings, manufactured by Carrier, Daikin, Lennox, Trane, or York, complete with factory installed hermetic or semi-hermetic motor/compressor assembly with internal spring vibration isolation, built-in thermal overload protection, and crankcase heater; top discharge condenser fan and motor; low ambient head pressure controls for operation to temperature as scheduled; anti-short cycle timers; time delay relays; high and low pressure switches; full refrigerant holding charge; and weathertight housing constructed of zinc coated, heavy gauge, galvanized steel with weather-resistant baked enamel finish and factory installed condenser coil hail guards. For units greater than 5 tons, provide liquid line drier and refrigerant sight glass. Provide a five year guarantee on the compressor and refrigerant circuit, and a one year guarantee on the remaining components. Provide refrigerant piping sized as recommended by equipment manufacturer with foamed plastic insulation on the suction line as specified in this section. For heat pump units provide reversing valve, suction line accumulator, flow control check valve, and solid state defrost/timed-off control. Provide concrete bases for units located on grade. Provide pre-engineered roof equipment support rails for units located on roof with Type WP continuous along support. Securely attach units to rail.

B. FAN COIL UNITS (DIRECT EXPANSION, 1.5-5 TONS)

Provide split system, fan coil units as scheduled on the drawings, manufactured by Carrier, Daikin, Lennox, Trane, or York, with configuration as scheduled, complete with zinc coated, heavy gauge, galvanized steel cabinet with weather-resistant baked enamel finish; internally insulated; access doors; direct expansion cooling coil section of aluminum/copper construction; condensate drain pan; statically and dynamically balanced centrifugal fan section with built-in motor thermal overload protection; factory installed and wired controls and single point electrical power connection; magnetic motor starters and contactors as required; air filter rack with 1 inch thick throwaway filters. Division 28 contractor shall provide UL listed duct type smoke detectors as required by code to shut down fan coil unit upon detection of smoke. Provide spring vibration isolators and all-thread hanging rods for horizontally suspended installations. For units scheduled with auxiliary/supplemental electric heating, provide separate separate Electric Heat Kit manufactured by Warren Technologies for single-point power connection at 480v/3ph and coordinate power with manufacturer and Division 26. Provide an auxiliary drain pan for suspended units with flood detector switch to shut off unit when water is detected in auxiliary drain pan. Flood detector switch shall be Diversitech wet switch or equivalent. Detector shall shut system down when water comes in contact with the hydrophilic pad of the detector. Place detector in the lowest location in the auxiliary drain pan. Wire detector to remote alarm, Diversitech universal alarm or equivalent.

5. PIPING AND PIPING SPECIALTIES

A. REFRIGERANT PIPING AND INSULATION

Copper Tubing: ASTM B280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

Refrigerant Line Kits: Soft-annealed copper tubing with pipe diameters as recommended by the manufacturer and of length as required for the installation. Tubing shall be factory or field insulated with flexible unicellular insulation with thickness as specified below.

Fittings: wrought-copper fittings: ANSI B16.22, streamlined pattern.

Solder filler metals: ASTM B32, 95-5 Tin-Antimony.

Brazing filler metals:
1. AWS A5.8, Classification BAg-5: Silver (Ag) 44.0-46.0 percent, Zinc (Z) 23.0-27.0 percent, and Copper (Cu) 29.0-31.0 percent.
2. AWS A5.8, Classification BCuP-5: Phosphorus (P) 4.8-5.2 percent, Silver (Ag) 14.5-15.5 percent, and Copper (Cu) remainder.

Braze mechanical joints. Solder joints connecting to refrigerant valves and specialties. Continuously purge the pipe and fittings during brazing with an inert gas per manufacturer's recommendation (e.g., dry nitrogen) to prevent formation of scale. Maintain purge until the joint is cool to the touch. Provide temporary cap or cover on completed joints with open ends to prevent entry of contaminating materials.

Insulate refrigerant lines with flexible elastomeric insulation, Armeflex or equal. Insulate suction and liquid lines between the expansion valve, evaporator, and compressor with 1/2 inch thick insulation on pipes less than 1 inch in size and 1 inch thick for pipes 1 inch and larger. Insulate hot gas and liquid lines between the compressor condenser, and expansion valve with 1 inch thick insulation on pipes less than 1-1/2 inch and 1-1/2 inch thick for pipes 1-1/2 inch and larger. Piping insulation shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Coat insulation that is exposed to the elements with a protective sealer. Install and support piping to keep noise and vibration to a minimum. Support and secure piping to Unistrut type supports so that no vibration passes to the building structure. Pipe attachments shall be copper-plated or have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing. Install a support within one foot of each change of direction. Mount pipe hangers around the outside of the insulation with saddles to prevent hangers from rupturing the insulation. Replace insulation that is cut or broken by the hangers.

Run refrigerant lines parallel and perpendicular to wall and floor lines and to appear straight and in good order. Pitch suction lines down slightly (1 inch in 20 feet) towards the compressor. Provide oil traps at the base of vertical suction risers over 6 feet high. Install liquid line sight glasses in liquid lines nearest the expansion valve. Factory mount expansion valves with the sensing bulbs shipped loose. Field mount expansion valve bulb after refrigerant piping is complete (damage may occur if bulbs come in contact with heat).

For systems of 5 ton capacity and smaller, the contractor shall have the option to provide copper refrigerant tubing line set sized as recommended by equipment manufacturer and of length as required for the installation. Provide quick-connect flare tubing compression fittings, solder connections, or brazed connections as recommended by the manufacturer to match the connections of the condensing unit and evaporator coil.

B. SYSTEM EVACUATION AND CHARGING

Blow out refrigeration lines with dry nitrogen at a suitable pressure before making final connection at the condensing unit or coil to ensure against dirt, scale, or other foreign material being in the lines. Draw a vacuum to 29 inches of mercury. Break this vacuum by charging dry refrigerant gas into the system, raising the pressure to 0 PSIG. Repeat the latter two steps for a triple evacuation before the final evacuation is started. Make final evacuation by reducing the system absolute pressure to a maximum of 0.5 millimeters (500 microns) and allowing the pump to run at this pressure for a minimum of two hours.

Repeat the proper amount of refrigerant charge per the manufacturer's recommendations. Record the amount of refrigerant by weight charged into the system for each circuit recorded to the nearest 1/4 pound on tags and attach tags to the liquid line near the condensing unit. Refrigerant shall be supplied by the HVAC Contractor.

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.

7. 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 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.

8. COMMISSIONING

Provide commissioning that verifies and documents the commissioned building systems have been designed, installed, and function according to the owner's project requirements, construction documents, and to minimum code requirements. Retain the services of a third-party registered design professional or approved agency that is regularly engaged in conducting commissioning to develop a commissioning plan, supporting documentation, and reports. Refer to the latest adopted edition of the applicable energy code for more information. Complete all related commissioning requirements prior to final inspections. Submit final TAB report and final commissioning report to the Engineer and Owner within 90 days of the date of receipt of the certificate of occupancy.

ASHRAE 90.1 Commissioning Requirements: Test control systems to ensure the control elements are calibrated, adjusted, and in proper working condition. Commission systems according to ASHRAE Guideline 1.1 "HVAC&R Technical Requirements for the Commissioning Process", most current edition.

IECC Commissioning Requirements: Provide commissioning of all mechanical systems included in the scope of work, except for packaged equipment not equipped with an economizer. Packaged equipment includes unitary air conditioners and condensing units, unitary air-cooled and water-cooled heat pumps, and packaged terminal air conditioning units. Contract the third-party registered design professional or approved agency to develop a commissioning plan, preliminary commissioning report, and final commissioning report.

Commissioning plan shall include the following:

6. Narrative description of activities and personnel required during commissioning.
7. List of equipment and systems to be tested with description of tests to be performed.
8. List of functions to be tested, including calibration and economizer controls.
9. List of conditions under which the tests shall be performed.
10. List of measurable criteria for performance.

Submit a copy of the preliminary commissioning report to the AHJ. Preliminary commissioning report shall include the following:

1. Results of preliminary functional performance tests. Organize equipment and components specified by other Divisions in separate sections for independent review.
2. List of functional performance testing procedures used during commissioning, including measurable criteria for test acceptance.
3. Completed Commissioning Compliance Checklist. Refer to energy code for the form.
4. Itemization of deficiencies found during testing that have not been corrected at the time of preliminary commissioning report preparation.
5. List of deferred tests that cannot be performed at the time of preliminary commissioning report preparation because of climatic conditions.
6. List of climatic conditions required for the performance of the deferred tests.

Final commissioning report shall include the following:

7. Results of final functional performance tests. Organize equipment and components specified by other Divisions in separate sections for independent review.
8. List of functional performance testing procedures used during commissioning, including measurable criteria for test acceptance.
9. Itemization of resolved deficiencies found during preliminary commissioning.
10. List of deferred tests that cannot be performed at the time of final commissioning report preparation because of climatic conditions.

Conduct functional performance tests on equipment, controls, and economizers. Functional performance tests shall demonstrate the following:

11. The operation, function, and maintenance serviceability for each commissioned equipment, component, and system is confirmed according to the approved plans and specifications.
12. The sequence of operations, including modes, backup modes (if applicable), alarms, and mode of operation upon a loss of power and restoration of power for each control device, equipment, component, and system.
13. Control devices, components, equipment, and systems are calibrated, adjusted, and operate in accordance with the approved plans and specifications.
14. Air economizers operated in accordance with manufacturer's specifications and specified sequence of operation.

END OF SECTION 23

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Date	No.	Description
03/14/2022		75% SET
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NIKE BY KANSAS CITY
COUNTRY CLUB PLAZA
450 NICHOLS RD,
KANSAS CITY, MO 64112

Project Number

Config: R/L

Drawn By HENDERSON

Checked By HENDERSON

MECHANICAL SPECIFICATIONS

M-400

COM*check* Software Version 4.1.5.3

Mechanical Compliance Certificate

Project Information

Energy Code:	2012 IECC
Project Title:	Nike Live - Kansas City
Location:	Kansas City, Missouri
Climate Zone:	4a
Project Type:	Alteration

Construction Site:	Owner/Agent:	Designer/Contractor:
COUNTRY CLUB PLAZA 450 NICHOLS RD KANSAS CITY, MO 64112	Nike 1 Bowerman Dr Beaverton, OR 97005 503-671-6453	Henderson Engineers 8345 Lenexa Dr Suite 300 Lenexa, KS 66214 913-742-5000

Mechanical Systems List

Quantity	System Type & Description
1	FCU-1/CU-1 (Single Zone): Split System Heat Pump Heating Mode: Capacity = 40 kBtu/h, Proposed Efficiency = 8.50 HSPF, Required Efficiency = 7.70 HSPF Cooling Mode: Capacity = 44 kBtu/h, Proposed Efficiency = 15.00 SEER, Required Efficiency: 13.00 SEER Fan System: FCU-1 -- Compliance (Motor nameplate HP method) : Passes Fans: FAN 1 Supply, Constant Volume, 1750 CFM, 0.8 motor nameplate hp
1	FCU-2/CU-2 (Single Zone): Split System Heat Pump Heating Mode: Capacity = 50 kBtu/h, Proposed Efficiency = 8.50 HSPF, Required Efficiency = 7.70 HSPF Cooling Mode: Capacity = 52 kBtu/h, Proposed Efficiency = 15.00 SEER, Required Efficiency: 13.00 SEER Fan System: FCU-2 -- Compliance (Motor nameplate HP method) : Passes Fans: FAN 2 Supply, Constant Volume, 1600 CFM, 0.8 motor nameplate hp
1	FCU-3/CU-3 (Single Zone): Split System Heat Pump Heating Mode: Capacity = 50 kBtu/h, Proposed Efficiency = 8.50 HSPF, Required Efficiency = 7.70 HSPF Cooling Mode: Capacity = 52 kBtu/h, Proposed Efficiency = 15.00 SEER, Required Efficiency: 13.00 SEER Fan System: FCU-3 -- Compliance (Motor nameplate HP method) : Passes Fans: FAN 3 Supply, Constant Volume, 1600 CFM, 0.8 motor nameplate hp
1	FCU-4/CU-4 (Single Zone): Split System Heat Pump Heating Mode: Capacity = 40 kBtu/h, Proposed Efficiency = 8.50 HSPF, Required Efficiency = 7.70 HSPF Cooling Mode: Capacity = 44 kBtu/h,

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Quantity	System Type & Description
	Proposed Efficiency = 15.00 SEER, Required Efficiency: 13.00 SEER Fan System: FCU-4 -- Compliance (Motor nameplate HP method) : Passes Fans: FAN 4 Supply, Constant Volume, 1750 CFM, 0.8 motor nameplate hp
1	WH-1: Electric Storage Water Heater, Capacity: 20 gallons w/ Circulation Pump No minimum efficiency requirement applies

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 2012 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	Isaac Brethour	04/12/2022
Name - Title	Signature	Date

COM*check* Software Version 4.1.5.3

Inspection Checklist

Energy Code: 2012 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:

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

Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C403.2.4.5 [FO9][3]	Freeze protection and snow/ice melting system sensors for future connection to controls.	☐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	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.3 [PL5][3]	Temperature controls installed on service water heating systems (110 F for dwelling units and lavatories in public restrooms and 90 F for other occupancies.)	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C404.4 [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.

Additional Comments/Assumptions:

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
C403.2.3 [ME55][2]	HVAC equipment efficiency verified.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Mechanical Systems list for values.*
C403.2.5.1 [ME59][1]	Demand control ventilation provided for spaces >500 sq.ft. and >25 people/1000 sq.ft. 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.
C403.2.7 [ME60][2]	HVAC ducts and plenums insulated. Where ducts or plenums are installed in or under a slab, verification may need to occur during Foundation Inspection.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.8 [ME61][2]	HVAC piping insulation thickness. Where piping is installed in or under a slab, verification may need to occur during Foundation Inspection.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.8 [ME61][2]	HVAC piping insulation thickness. Where piping is installed in or under a slab, verification may need to occur during Foundation Inspection.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.8 [ME61][2]	HVAC piping insulation thickness. Where piping is installed in or under a slab, verification may need to occur during Foundation Inspection.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.8 [ME61][2]	HVAC piping insulation thickness. Where piping is installed in or under a slab, verification may need to occur during Foundation Inspection.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.8.1 [ME7][3]	Piping Insulation exposed to weather is protected from damage (due to sun, moisture, wind, etc.).	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.8 [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.
C403.3.1.a [NA][0]	Total cooling capacity without economizers must be less than %varMaxKBtuPerH%.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.7 [ME10][2]	Ducts and plenums sealed based on static pressure and location.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.7.1.3 [ME11][3]	Ductwork operating >3 in. water column requires air leakage testing.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

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

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Date	No.	Description
03/14/2022		75% SET

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Project Number	
Config:	R/L
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Checked By	HENDERSON

MECHANICAL
ENERGY CODE
COMPLIANCE

M-500

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Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.2.7.1.3 [ME11]^{3}	Ductwork operating >3 in. water column requires air leakage testing.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.7.1.3 [ME11]^{3}	Ductwork operating >3 in. water column requires air leakage testing.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.7.1.3 [ME11]^{3}	Ductwork operating >3 in. water column requires air leakage testing.	☐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.
C403.4.2 [ME66]^{2}	VAV fan motors >=7.5 hp to be driven by variable speed drive, have a vane-axial fan with variable pitch blades, or have controls to limit fan motor demand.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.4.2 [ME66]^{2}	VAV fan motors >=7.5 hp to be driven by variable speed drive, have a vane-axial fan with variable pitch blades, or have controls to limit fan motor demand.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.4.2 [ME66]^{2}	VAV fan motors >=7.5 hp to be driven by variable speed drive, have a vane-axial fan with variable pitch blades, or have controls to limit fan motor demand.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.4.2 [ME66]^{2}	VAV fan motors >=7.5 hp to be driven by variable speed drive, have a vane-axial fan with variable pitch blades, or have controls to limit fan motor demand.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.4.2 [ME66]^{2}	VAV fan motors >=7.5 hp to be driven by variable speed drive, have a vane-axial fan with variable pitch blades, or have controls to limit fan motor demand.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.6 [ME57]^{1}	Exhaust air energy recovery on systems meeting Table C403.2.6	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Where the largest exhaust source is less than 75% of the design outdoor airflow.
C403.2.11 [ME71]^{2}	Unenclosed spaces that are heated use only radiant heat.	☐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	Final Inspection	Complies?	Comments/Assumptions
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.
C403.2.4.2 [FI38]^{3}	Thermostatic controls have a 5 °F deadband.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.2 [FI20]^{3}	Temperature controls have setpoint overlap restrictions.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C403.2.4.3 [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.
C403.2.4.3 [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.
C403.2.4.3.3 [FI41]^{3}	Systems include optimum start controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.4.3.3 [FI41]^{3}	Systems include optimum start controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.4.3.3 [FI41]^{3}	Systems include optimum start controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
C403.2.4.3.3 [FI41]^{3}	Systems include optimum start controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

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

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C403.2.4.1.1 [FI42]^{3}	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	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	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	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	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.
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.
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.
C408.2.3.2 [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.
C404.3 [FI11]^{3}	Public lavatory faucet water temperature <=110°F.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C404.5 [FI25]^{2}	All piping in circulating system insulated	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
C404.6 [FI12]^{3}	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank.	☐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.
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
C408.2.4 [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.
C408.2.5.4 [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.
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.

Additional Comments/Assumptions:

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