ABBREVIATIONS

GENERAL

A	COMPRESSED AIR
AD	ACCESS DOOR
ADD'L	ADDITIONAL
AF	AIR FOIL
AFF	ABOVE FINISHED FLOOR
AFR	ABOVE FINISHED ROOF
ALT	ALTITUDE OR ALTERNATE
AMP	AMPERE
AP	ACCESS PANEL
APD	AIR PRESSURE DROP
ARCH	ARCHITECT
AS	AIR STREAM
ATC	AUTOMATIC TEMPERATURE CONTROL
ATM	ATMOSPHERE
AVE	AVERAGE
BHP	BRAKE HORSEPOWER
BI	BACKWARDS INCLINED
BLDG	BUILDING
BOD	BOTTOM OF DUCT
BSMT	BASEMENT
BTU	BRITISH THERMAL UNIT
BTUH	BTU PER HOUR
C TO C	CENTER TO CENTER
CENT	CENTRIFUGAL
CF	CUBIC FEET
CFM	CUBIC FEET PER MINUTE
CL	CENTERLINE
CLG	CEILING OR COOLING
CO	CARBON MONOXIDE
COL	COLUMN
CONC	CONCRETE
CONN	CONNECTION
CONTR	CONTRACTOR
D	DRAIN OR DEPTH
DB	DRY BULB TEMPERATURE
DEG	DEGREE
DDC	DIRECT DIGITAL CONTROL
DIA	DIAMETER
DIM	DIMENSION
DN	DOWN
DP	DIFFERENTIAL PRESSURE
EA	EACH OR EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EFF	EFFICIENCY
ELEC	ELECTRICAL
ELEV	ELEVATION
EMER	EMERGENCY
EMS	ENERGY MANAGEMENT SYSTEM
ENT	ENTER
ESP	EXTERNAL STATIC PRESSURE
EWT	ENTERING WATER TEMPERATURE
EXH	EXHAUST
EXIST.	EXISTING
EXT	EXTERNAL
EXP	EXPANSION
F	FAHRENHEIT
FA	FREE AREA
FC	FLEXIBLE CONNECTION
FLA	FULL LOAD AMPS
FLEX	FLEXIBLE
FLRDR	FLOOR DRAIN
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FRP	FIBERGLASS REINFORCED PLASTIC
FS	FLOW SWITCH
FT	FEET
G	GAS
GA	GAUGE
GAL	GALLONS
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GFU	GLYCOL FEED UNIT
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GRD	GRADE
GWB	GYPSUM WALL BOARD
HB	HOSE BIBB CONN.
HD	HEAD
HGT	HEIGHT
HP	HORSEPOWER OR HIGH POINT
HR	HOUR
HTG	HEATING
HZ	HERTZ (FREQUENCY, CYCLES PER SECOND)
ID	INSIDE DIAMETER
IN	INCHES
KW	KILOWATT
L	LENGTH
LAT	LEAVING AIR TEMPERATURE
LB	POUND
LF	LINEAR FEET
LP	LOW POINT
LRA	LOCKED ROTOR AMPS
LUVR	LOUVER
LVDR	LOUVERED DOOR
LVG	LEAVING
LWT	LEAVING WATER TEMPERATURE
MAX	MAXIMUM
MBH	THOUSAND BTUH
MCA	MINIMUM CIRCUIT AMPS
MECH	MECHANICAL
MEZZ	MEZZANINE
MF'R	MANUFACTURER
MIN	MINIMUM
MU	MAKE-UP WATER
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED OR NOISE CRITERIA
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
No.	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OAI	OUTSIDE AIR INTAKE
OC	ON CENTER
OD	OUTSIDE DIAMETER
ODP	OPEN DRIP PROOF
OV	OUTLET VELOCITY
PCF	POUNDS PER CUBIC FOOT
PD	PRESSURE DROP
PH	PHASE
PBG	PLUMBING
POS	PROVIDED BY OTHER SECTION
PPM	PARTS PER MILLION
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSID	POUNDS PER SQUARE INCH DIFFERENTIAL
PSIG	POUNDS PER SQUARE INCH GAUGE
PVC	POLYVINYL CHLORIDE
QTY	QUANTITY
R	RADIUS
RA	RETURN AIR
RET	RETURN
REQ'D	REQUIRED
RH	RELATIVE HUMIDITY
RLA	RUNNING LOAD AMPS
RLF	RELIEF
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
SCH	SCHEDULE
SCR	SCREEN
SCT	SATURATED CONDENSING TEMPERATURE
SDET	SMOKE DETECTOR
SEN	SENSIBLE
SHC	SENSIBLE HEAT CAPACITY
SP	STATIC PRESSURE
SPECS	SPECIFICATIONS
SQ	SQUARE
SF	SQUARE FEET
SS	STAINLESS STEEL
STL	STEEL
SUP	SUPPLY
T	TEMPERATURE
TA	THROWAWAY
TEL	TELEPHONE
TEFC	TOTALLY ENCLOSED FAN COOLED
TEMP	TEMPERATURE
TSTAT	THERMOSTAT
TON	12,000 BTUH COOLING CAPACITY
TOT	TOTAL
TYP	TYPICAL
UC	UNDERCUT DOOR
V	VOLTS (ELECTRICAL)
VEL	VELOCITY
W	WIDTH OR WATT
W/	WITH
WB	WET BULB TEMPERATURE
WC	WATER COLUMN
WG	WATER GAUGE
W/O	WITHOUT
WPD	WATER PRESSURE DROP
WTD	WATER TEMPERATURE DIFFERENCE
X	EXISTING EQUIPMENT TO BE REMOVED
XM	EXISTING EQUIPMENT TO REMAIN
XN	NEW LOCATION OF RELOCATED EQUIPMENT
XR	EXISTING EQUIPMENT TO BE RELOCATED

DUCT

ACD	AUTOMATIC CONTROL DAMPER
AFMS	AIR FLOW MEASURING STATION
AL	ACOUSTICAL DUCT LINER
BDD	BACKDRAFT DAMPER
BOD	BOTTOM OF DUCT
CD	CEILING DIFFUSER
CV	CONSTANT VOLUME SUPPLY AIR TERMINAL
CVE	CONSTANT VOLUME EXHAUST AIR TERMINAL
DD	DUAL DUCT SUPPLY AIR TERMINAL
DIFF	DIFFUSER
EA	EXHAUST AIR
EG	EXHAUST GRILLE
ER	EXHAUST REGISTER
FBD	FLAT BOTTOM DUCT
FD	FIRE DAMPER (W/ ACCESS DOOR)
LD	LINEAR DIFFUSER
MD	MOTOR OPERATED DAMPER
MUA	MAKE-UP AIR
OA	OUTSIDE AIR
OAI	OUTSIDE AIR INTAKE
OED	OPEN END DUCT
PAD	PRIMARY AIR DAMPER
RA	RETURN AIR
RG	RETURN GRILLE
RR	RETURN REGISTER
SA	SUPPLY AIR
SD	SMOKE DAMPER
SE	SMOKE EXHAUST
SFD	COMBINATION AUTOMATIC SMOKE/FIRE DAMPER WITH ACCESS DOOR
SG	SUPPLY GRILLE
SGD	SLIDE GATE DAMPER
SR	SUPPLY REGISTER
TA	THROW AWAY OR TRANSFER AIR
TG	TRANSFER GRILLE
TOD	TOP OF DUCT
TR	TRANSFER
TSP	TOTAL STATIC PRESSURE (IN. WG)
TV	TURNING VANES
VD	VOLUME DAMPER
VAV	VARIABLE AIR VOLUME SUPPLY AIR TERMINAL
VVE	VARIABLE AIR VOLUME EXHAUST AIR TERMINAL
WMS	WIRE MESH SCREEN

EQUIPMENT

AC	AIR CONDITIONING OR AIR CONDITIONING UNIT
ACC	AIR COOLED CONDENSING UNIT
ACU	AIR CONDITIONING UNIT
AF	AIR FILTER OR AIR FOIL
AHU	AIR HANDLING UNIT
CACU	COMPUTER ROOM AIR CONDITIONING UNIT
CC	COOLING COIL
CDP	CONDENSATE DRAIN PUMP
CSF	CHEMICAL SHOT FEEDER
CUH	CABINET UNIT HEATER
DC	DRY COOLER
DDC	DIRECT DIGITAL CONTROL
DDCFP	DIRECT DIGITAL CONTROL FIELD PANEL
DH	DEHUMIDIFIER
DU	DEAERATOR UNIT
DWDI	DOUBLE WIDTH DOUBLE INLET
DX	DIRECT EXPANSION
ECH	ELECTRIC CABINET HEATER
EF	EXHAUST FAN
EHC	ELECTRICAL HEATING COIL
ET	EXPANSION TANK
EUH	ELECTRIC UNIT HEATER
F	FAN
FB	FAN BOX
FCU	FAN COIL UNIT
FTR	FINNED TUBE RADIATION
GRV	GRAVITY RELIEF VENT
H	HUMIDIFIER
HC	HEATING COIL
HP	HEAT PUMP
HRU	HEAT RECOVERY UNIT
HWC	HOT WATER HEATING COIL
HV	HEATING & VENTILATING UNIT
HX	HEAT EXCHANGER
MCC	MOTOR CONTROL CENTER
MUA	MAKE-UP AIR UNIT
PAC	PACKAGE AIR CONDITIONING UNIT
P	PUMP
PHC	PREHEAT COIL
PHX	PLATE HEAT EXCHANGER
PRV	PRESSURE REDUCING VALVE
REG	REGISTER
RF	RETURN FAN
RHC	REHEAT COIL
RTU	ROOF TOP UNIT
SA	SOUND ATTENUATOR
SF	SUPPLY FAN
SWSI	SINGLE WIDTH SINGLE INLET
TF	TRANSFER FAN
TD	TRANSFER DUCT
UH	UNIT HEATER
UV	UNIT VENTILATOR
VAV	VARIABLE AIR VOLUME TERMINAL UNIT
VFD	VARIABLE FREQUENCY DRIVE
VFM	VENTURI FLOW METER
WAC	WINDOW AIR CONDITIONER

DUCTWORK

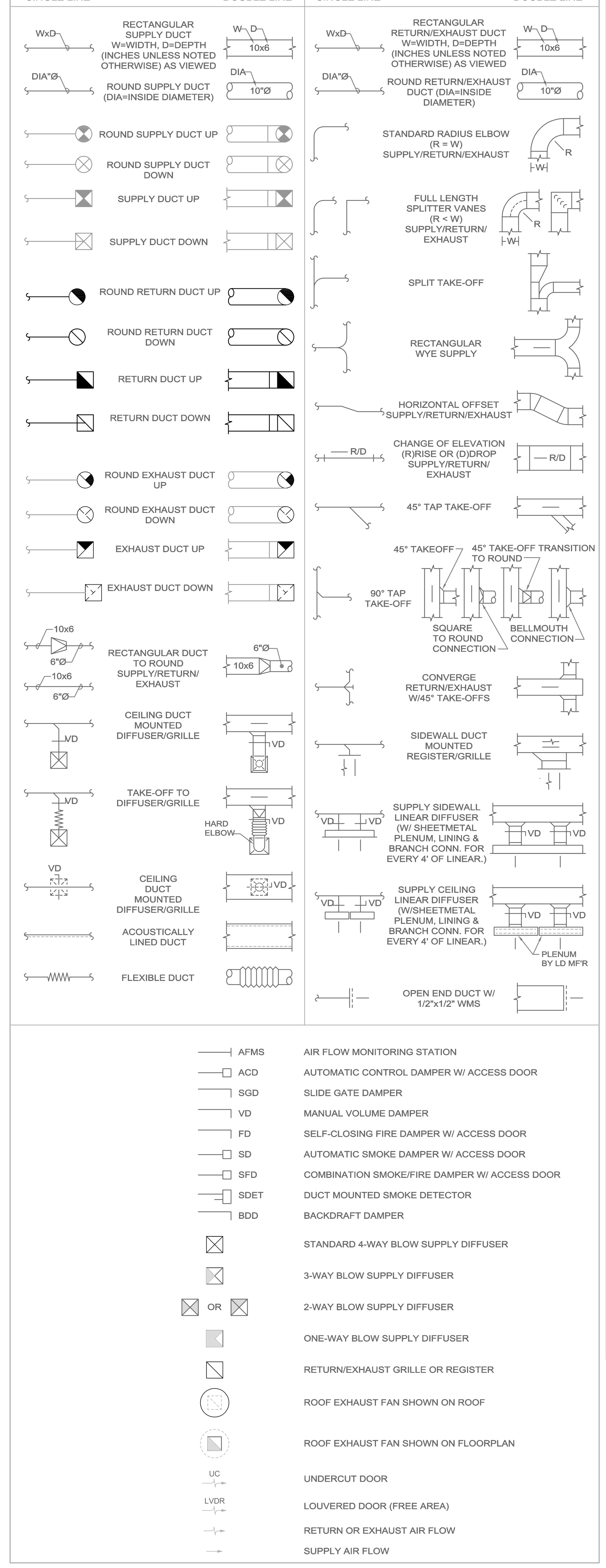
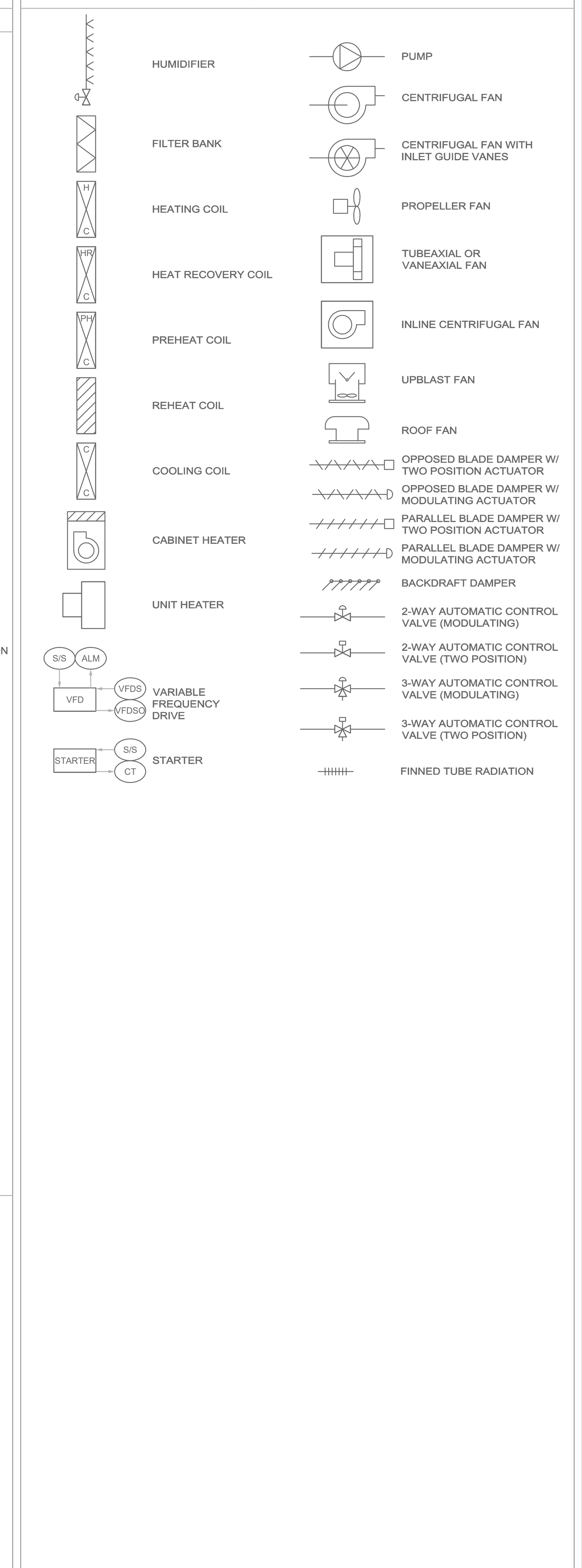


DIAGRAM EQUIPMENT SYMBOLS



CONTROL POINT DESCRIPTOR LEGEND

TAG (oval)	ATC CONTRACTOR PROVIDED DDC POINT AND HARDWARE
TAG (triangle) ELEC PLBG	CONTROL DEVICE FURNISHED BY ELECTRICAL OR PLUMBING CONTRACTOR BUT INTERFACED TO DDC SYSTEM BY ATC CONTRACTOR
TAG (box)	ATC CONTRACTOR INTERFACE TO EQUIPMENT MANUFACTURER'S HARDWARE
TAG (circle)	ATC CONTRACTOR PROVIDED LOCAL CONTROL POINT

CONTROL ABBREVIATIONS

ACD	AUTOMATIC CONTROL DAMPER
ACV	AUTOMATIC CONTROL VALVE
AFMS	AIR FLOW MEASURING STATION
ALM	ALARM
ATC	AUTOMATIC TEMPERATURE CONTROL
BCV	BASEBOARD CONTROL VALVE
BDD	BACKDRAFT DAMPER (ADJUSTABLE COUNTERWEIGHT)
BIBO	BAG-IN BAG-OUT
BV	BYPASS VALVE
C	CARBON DIOXIDE SENSOR
CAP	CAPACITY CONTROL
%CAP	PERCENT OF FULL LOAD CAPACITY
CCLT	COOLING COIL LEAVING AIR TEMPERATURE SENSOR
CHRT	CHILLED WATER RETURN TEMPERATURE SENSOR
CHST	CHILLED WATER SUPPLY TEMPERATURE SENSOR
CHWRT	CHILLED WATER RESET TEMPERATURE
CO	CARBON MONOXIDE SENSOR
CRT	CONDENSER WATER RETURN TEMPERATURE SENSOR
CST	CONDENSER WATER SUPPLY TEMPERATURE SENSOR
CT	CURRENT TRANSFORMER (STATUS FEEDBACK)
CV	COOLING COIL CONTROL VALVE
DAT	DISCHARGE AIR TEMPERATURE SENSOR
DDC	DIRECT DIGITAL CONTROL
DDCFP	DIRECT DIGITAL CONTROL FIELD PANEL
DL	DEMAND LIMIT
DPS	DIFFERENTIAL PRESSURE SWITCH
DPT	DIFFERENTIAL PRESSURE SENSOR/TRANSMITTER
DPV	DIFFERENTIAL PRESSURE BYPASS VALVE
DSP	DISCHARGE STATIC PRESSURE SENSOR
DWDI	DOUBLE WIDTH DOUBLE INLET
EAD	EXHAUST AIR DAMPER
EHRET	EXHAUST HEAT RECOVERY COIL ENTERING AIR TEMPERATURE SENSOR
EHRLT	EXHAUST HEAT RECOVERY COIL LEAVING AIR TEMPERATURE SENSOR
EHRV	EXHAUST HEAT RECOVERY COIL CONTROL VALVE
ES	END SWITCH
FA	FAULT ALARM
FID	FAN ISOLATION DAMPER
FMT	FLOW METER/TRANSMITTER
FS	FLOW SWITCH
FZ	FREEZESTAT
H	HUMIDITY SENSOR
HALM	HOOD ALARM
HCLT	HEATING COIL LEAVING AIR TEMPERATURE SENSOR
HEGA	HIGH EFFICIENCY GAS ABSORBER FILTER
HEPA	HIGH EFFICIENCY PARTICULATE AIR FILTER
HGB	HOT GAS BYPASS
HHL	HIGH HUMIDITY LIMIT SENSOR
HIV	HUMIDIFIER ISOLATION VALVE
HLH	HIGH/LOW HUMIDITY LIMIT SENSOR
HOA	HANDS-OFF AUTOMATIC SWITCH
HR	HUMIDITY SENSOR (ROOM)
HRET	HEAT RECOVERY COIL ENTERING AIR TEMPERATURE SENSOR
HRLT	HEAT RECOVERY COIL LEAVING AIR TEMPERATURE SENSOR
HRT	HEAT RECOVERY LOOP TEMPERATURE SENSOR
HRCV	HEAT RECOVERY COIL CONTROL VALVE
HRV	HEAT RECOVERY LOOP CONTROL VALVE
HS	HAND SWITCH
HSPS	HIGH STATIC PRESSURE SWITCH
HSS	HOOD SASH SWITCH
HUV	HUMIDIFIER CONTROL VALVE
HV	HEATING COIL CONTROL VALVE
HWRT	HOT WATER RETURN TEMPERATURE SENSOR
HWST	HOT WATER SUPPLY TEMPERATURE SENSOR
IFBD	INTEGRAL FACE & BYPASS DAMPER
IGV	INLET GUIDE VANES
LAT	LEAVING AIR TEMPERATURE SENSOR
LSPS	LOW STATIC PRESSURE SWITCH
LS	LEVEL SENSOR OR LIGHT SWITCH INTERFACE
LSHA	LEVEL SENSOR HIGH ALARM
LSHS	LEVEL SENSOR HIGH SWITCH
LSLA	LEVEL SENSOR LOW ALARM
LSLS	LEVEL SENSOR LOW SWITCH
MAT	MIXED AIR TEMPERATURE SENSOR
MUWV	MAKE-UP WATER VALVE
MD	MOTION DETECTOR
NC	NORMALLY CLOSED (ON LOSS OF POWER)
NO	NORMALLY OPEN (ON LOSS OF POWER)
OAD	OUTSIDE AIR DAMPER
OAH	OUTSIDE AIR HUMIDITY SENSOR (FOR WET BULB READING)
OAT	OUTSIDE AIR TEMPERATURE SENSOR (DRY BULB)
PAD	PRIMARY AIR DAMPER
PCHRT	PRIMARY CHILLED WATER RETURN TEMPERATURE SENSOR
PCHST	PRIMARY CHILLED WATER SUPPLY TEMPERATURE SENSOR
PR	PRESSURE SENSOR (ROOM)
RAD	RETURN AIR DAMPER
RAH	RETURN AIR HUMIDITY SENSOR
RAT	RETURN AIR TEMPERATURE SENSOR
RV	REHEAT CONTROL VALVE
RH	RELATIVE HUMIDITY
RI	RUN INDICATOR
RSID	RETURN SMOKE ISOLATION DAMPER
S	SWITCH
SAD	SUPPLY AIR DAMPER
SCHRT	SECONDARY CHILLED WATER RETURN TEMPERATURE
SCHST	SECONDARY CHILLED WATER SUPPLY TEMPERATURE
SCLAT	STEAM COIL LEAVING AIR TEMPERATURE SENSOR
SCV	STEAM COIL VALVE
SD	SMOKE DAMPER
SDET	SMOKE DETECTOR
SFD	SMOKE/FIRE DETECTOR
SP	STATIC PRESSURE SENSOR
SPD	SPEED CONTROL
S/S	START/STOP
S/S_H	START/STOP HIGH SPEED/CAPACITY
S/S_L	START/STOP LOW SPEED/CAPACITY
SSID	SUPPLY SMOKE ISOLATION DAMPER
SSP	SUCTION STATIC PRESSURE SENSOR
T	TEMPERATURE SENSOR/THERMOSTAT
TR	TEMPERATURE SENSOR/THERMOSTAT (ROOM)
VFDS	VARIABLE FREQUENCY DRIVE SPEED
VFDO	VARIABLE FREQUENCY DRIVE SPEED OUTPUT (FEEDBACK)
VS	VIBRATION SWITCH
WC	WATER COLUMN
X	REMOVE EXISTING ITEM

CALLOUT SYMBOLS

CONNECT NEW TO EXISTING

LIMIT OF DEMOLITION

A / H2.0 — SECTION DESIGNATION; SHEET NUMBER

1 — REVISION NUMBER

T — TEMPERATURE SENSOR OR THERMOSTAT

H — HUMIDITY SENSOR OR HUMIDISTAT

REMOVE EXISTING ITEM

SA(100) — S = SUPPLY A = SCHEDULED DIFFUSER. (100) = CFM TO BALANCE TO

RA(100) — R = RETURN A = SCHEDULED GRILLE. (100) = CFM TO BALANCED TO

EA(100) — E = EXHAUST A = SCHEDULED REGISTER/GRILLE (100) = CFM TO BALANCED TO

TA(100) — T = TRANSFER A = SCHEDULED REGISTER/GRILLE (100) = CFM TO BALANCED TO

EQUIPMENT REQUIRING ELECTRICAL SERVICE,
SEE SCHEDULE FOR PERFORMANCE REQUIREMENTS:

TAG 3.1 (XXX, XXX, XXX)

SCHEDULED EQUIPMENT UNIT NUMBER

FIRST DIGIT(S) = LEVEL WHERE UNIT IS LOCATED:
- SB = SUB-BASEMENT
- B = BASEMENT
- LL = LOWER LEVEL
- G = GROUND FLOOR
- 1 = FIRST FLOOR
- 2 = SECOND FLOOR
- 3 = THIRD FLOOR, ETC
- M = MEZZANINE
- A = ATTIC
- PH = PENTHOUSE
- R = ROOF

SECOND DIGIT(S):
- 1 = FIRST UNIT OF THIS EQUIPMENT TYPE ON THIS LEVEL.
- 2 = SECOND UNIT OF THIS EQUIPMENT TYPE ON THIS LEVEL.
- 3 = THIRD UNIT OF THIS EQUIPMENT TYPE ON THIS LEVEL, ETC.
- (DUE TO EDITING NOT ALL NUMBERS MAY BE USED)

UNIT CAPACITY INFORMATION (IF APPLICABLE-DATA VARIES DEPENDING ON TYPE OF EQUIPMENT)
i.e. FOR FAN POWERED VAV BOXES:
FIRST NUMBER = MAX. CFM
SECOND NUMBER = MIN. CFM OR PERCENT OF MAX. CFM
THIRD NUMBER = COIL GPM OR KW

EQUIPMENT NOT REQUIRING ELECTRICAL SERVICE,
SEE SCHEDULE FOR PERFORMANCE REQUIREMENTS:

TAG 3.1 (XXX, XXX, XXX) — REFER TO EQUIPMENT REQUIRING ELECTRICAL SERVICE SYMBOL ABOVE FOR TAG AND DATA INFORMATION.

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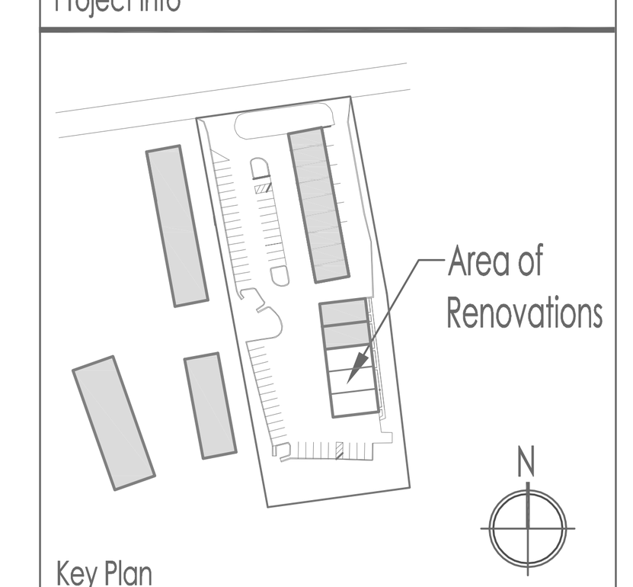
Seal

charles river
Charles River Microbial Solutions
Processing Facility Renovations
Harwich, MA

Project info



Key Plan

No.	Description	Date
15		
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1	ISSUED FOR CONSTRUCTION	02-28-2022

Drawn By:
Checked By:
Approved By:
Scale: NONE
Project No.: 0220068.00
Drawing Title: HVAC LEGEND, NOTES & ABBREVIATIONS
Drawing No.: H-000
Owner's Drawing No.:

HVAC GENERAL NOTES

1. GENERAL NOTES APPLY TO ALL DRAWINGS.
2. THIS PROJECT INVOLVES CONSTRUCTION INSIDE AN EXISTING STRUCTURE. CONTRACTORS, BY SUBMITTING A BID, ARE DEEMED TO BE COMPLETELY FAMILIAR WITH THE EXISTING CONDITION OF THE BUILDING AS IT INFLUENCES THE WORK DESCRIBED. ABSOLUTELY NO CLAIMS FOR EXTRA COMPENSATION WILL BE CONSIDERED FOR EXISTING CONDITIONS VISIBLE OR REASONABLY INFERABLE FROM A CAREFUL EXAMINATION OF THE EXISTING BUILDING.
3. THIS CONTRACTOR SHALL INSPECT THE EXISTING FIELD CONDITIONS AT THE SITE AND THE "AS-BUILT" BASE BUILDING CONTRACT DOCUMENTS PRIOR TO THE START OF ANY WORK TO DETERMINE WHAT EFFECT THE EXISTING CONDITIONS WILL HAVE ON HIS WORK. POTENTIAL PROBLEM AREAS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT AND/OR ENGINEER IMMEDIATELY.
4. THIS CONTRACTOR SHALL CONNECT HIS WORK TO VARIOUS EXISTING PIPING, DUCTWORK, AND CONTROL SYSTEMS IN THE BASE BUILDING. THE NEW WORK SHALL BE COMPATIBLE WITH THE EXISTING SYSTEMS. LOCATION OF EQUIPMENT OR THE ROUTING OF THE VARIOUS SYSTEMS AS WELL AS OPENINGS IN FLOOR SLABS OR WALLS SHALL BE GOVERNED BY THE EXISTING CONDITIONS AS THEY APPEAR IN THE FIELD OR ON THE "AS-BUILT" DRAWINGS.
5. CARE SHALL BE TAKEN DURING THE INSTALLATION TO NOT DAMAGE OR INTERRUPT BUILDING SYSTEMS AND SERVICES THAT ARE ALREADY INSTALLED. DAMAGE TO SUCH SYSTEMS OR EQUIPMENT CAUSED BY THIS CONTRACTOR DURING INSTALLATION SHALL BE REPAIRED AND/OR REPLACED AT THIS CONTRACTOR'S EXPENSE TO THE COMPLETE SATISFACTION OF THE BUILDING OWNER.
6. SHUTDOWN OF EXISTING SYSTEMS FOR CONNECTION TO EXISTING SERVICES SHALL BE COORDINATED WITH THE CONSTRUCTION MANAGER OR GENERAL CONTRACTOR AND BUILDING OWNER. THIS CONTRACTOR SHALL SUBMIT REQUESTS, WHERE THEY AFFECT THE OPERATION OF THE BUILDING SYSTEMS, AT LEAST ONE WEEK IN ADVANCE OF ANY REQUIRED SHUTDOWN. THE ACTUAL SHUTDOWN PERIOD SHALL BE AS SHORT AS POSSIBLE AND AT A TIME MUTUALLY AGREEABLE TO THE BUILDING OWNER AND THE CONSTRUCTION MANAGER/GENERAL CONTRACTOR.
7. DRAWINGS ARE DIAGRAMMATIC, THEREFORE DETERMINE EXACT LOCATIONS OF SYSTEMS AND COMPONENTS IN FIELD.
8. ALL WORK SHALL BE COORDINATED WITH ALL TRADES INVOLVED. OFFSETS IN PIPING AND DUCTS (INCLUDING DIVIDED DUCTS) AND TRANSITIONS AROUND OBSTRUCTIONS SHALL BE PROVIDED AT NO ADDITIONAL COST TO THE OWNER.
9. VERIFY ALL EQUIPMENT CONNECTIONS WITH MANUFACTURER'S CERTIFIED DRAWINGS. VERIFY AND PROVIDE DUCT AND/OR PIPE TRANSITIONS TO FURNISHED EQUIPMENT. FIELD VERIFY AND COORDINATE ALL DIMENSIONS BEFORE FABRICATION.
10. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF AIR TERMINAL DEVICES.
11. ALL MATERIALS AND EQUIPMENT UNLESS SPECIFICALLY INDICATED AS REUSED, SHALL BE NEW.
12. DUCTWORK SHALL NOT RUN ALONG FULL HEIGHT PARTITIONS.
13. ACCESS PANELS SHALL BE PROVIDED TO ALLOW FOR CLEANING OF COILS AND SERVICING OF DAMPERS, HEATERS, VALVES, AND ALL CONCEALED MECHANICAL EQUIPMENT.
14. THE INSIDE OF ALL DUCTWORK VISIBLE THROUGH A GRILLE OR DIFFUSER SHALL BE PAINTED FLAT BLACK.
15. EXISTING ROOM THERMOSTATS AND SENSORS SHALL BE PROTECTED DURING CONSTRUCTION AND RELOCATED AS INDICATED ON THE DRAWINGS. INSTALL NEW AND RELOCATED ROOM THERMOSTATS AND SENSORS 4 FEET AFF OR AS DIRECTED OTHERWISE BY ARCHITECT.
16. WHEN SECTION OF DUCTWORK IS NOT LABELED FOR SIZE, THE LARGER SIZE INDICATED ON THE CONNECTED DUCT SHALL PREVAIL. SIZE OF DUCT RUN-OUTS TO DIFFUSER SHALL EQUAL DIFFUSER NECK SIZE.
17. CONTRACTOR SHALL PROVIDE THE FOLLOWING SERVICES, AS APPLICABLE, ON ALL EXISTING HVAC EQUIPMENT INDICATED TO BE REUSED: 1) FILTER CHANGES, 2) BALANCING, 3) LUBRICATION. CONTRACTOR SHALL REPORT ANY EQUIPMENT DEFICIENCIES FOUND TO THE ARCHITECT AND/OR ENGINEER.
18. THE FIRE PROOFING OF THE BUILDING STRUCTURE IS NOT TO BE REMOVED FOR THE INSTALLATION OF HANGERS, SUPPORTS, DUCTWORK, ETC. IF FIRE PROOFING IS DAMAGED, IT SHALL BE REPAIRED AT THE EXPENSE OF THE TRADE.
19. CONTRACTOR SHALL TEST AND CALIBRATE ALL CONTROLS AND VERIFY ALL ARE FULLY FUNCTIONAL AND SUBMIT DOCUMENTATION. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
20. CONTRACTOR SHALL PROVIDE AND SUBMIT DOCUMENTATION FOR TESTING AND BALANCING OF ALL AIR AND WATER SYSTEMS, DUCT AND PIPING PRESSURE AND LEAKAGE TESTS, OPERATING AND MAINTENANCE MANUALS, AND AS BUILT DRAWINGS. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
21. REFER TO THE PROJECT SPECIFICATIONS FOR FURTHER REQUIREMENTS. SPECIAL ATTENTION IS DIRECTED TO THE PART 1 PROJECT SCOPE IN REGARDS TO THE DIV. 23 CONTRACTOR PROVIDING A "MAXIMUM SPACE SOUND PRESSURE LEVEL REPORT" AND COORDINATING THIS INFORMATION WITH ALL IMPACTED SUB-CONTRACTORS AND EQUIPMENT MANUFACTURERS PRIOR TO SUBMITTING SHOP DRAWINGS.
22. MANY EQUIPMENT SCHEDULES DO NOT LIST QUANTITIES. CONTRACTOR SHALL REFER TO ALL DRAWINGS AND PROVIDE THE REQUIRED QUANTITIES FOR ALL COMPONENTS.
23. THESE DRAWINGS ARE NOT COMPLETE AND THERE WILL BE REVISIONS ISSUED.

HVAC SPECIFICATIONS

HVAC SPECIFICATIONS

PART 1 - GENERAL

1. GENERAL PROVISIONS: DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF WORK IN CONTRACT.
2. SCOPE: PERFORM WORK AND PROVIDE NEW MATERIAL AND EQUIPMENT AS SHOWN ON DRAWINGS AND AS SPECIFIED IN THIS SECTION OF THE SPECIFICATIONS. PROVIDE ALL COMPONENTS AND MATERIALS, WHETHER SPECIFICALLY SHOWN OR NOT, THAT ARE NECESSARY TO MAKE THE SYSTEMS COMPLETE AND FULLY OPERATIONAL AS INTENDED IN THE CONSTRUCTION DOCUMENTS. WORK SHALL INCLUDE, BUT NOT BE LIMITED TO: 1) THE DESIGN INTENT AS ILLUSTRATED ON THESE DRAWINGS, AND 2) ALL TESTING, COMMISSIONING, AND CERTIFICATIONS NECESSARY FOR COMPLIANCE INCLUDING ANY REQUIRED REMEDIAL ACTIONS AND RETESTING DUE TO FAILURE.
3. SITE VISIT: VISIT AND CAREFULLY EXAMINE SITE TO IDENTIFY EXISTING CONDITIONS THAT MAY AFFECT WORK OF THIS SECTION BEFORE SUBMITTING BID. NO EXTRA PAYMENT WILL BE ALLOWED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY DISCERNED BY AN EXPERIENCED OBSERVER.
4. RELATED WORK: THE FOLLOWING WORK IS NOT INCLUDED IN THIS SECTION AND WILL BE PROVIDED UNDER OTHER SECTIONS: 1) TEMPORARY HEAT FOR USE DURING CONSTRUCTION AND TESTING UNLESS SPECIFICALLY NOTED IN OTHER SPECIFICATION SECTIONS, 2) PAINTING, EXCEPT AS SPECIFIED, 3) ELECTRICAL POWER WIRING TO ALL EQUIPMENT OTHER THAN AUTOMATIC TEMPERATURE CONTROL PANELS AND COMPONENTS, AND 4) DUCT MOUNTED SMOKE DETECTORS SHALL BE FURNISHED BY OTHERS FOR MOUNTING AND WIRING TO THE ATC SYSTEM UNDER THIS SECTION.
5. CODES, STANDARDS, AUTHORITIES AND PERMITS: CODES, LAWS AND ORDINANCES PROVIDE A BASIS FOR THE MINIMUM INSTALLATION CRITERIA. THESE DRAWINGS AND SPECIFICATIONS ILLUSTRATE THE SCOPE REQUIRED FOR THIS PROJECT, WHICH MAY EXCEED MINIMUM CODE, LAW AND STANDARDS CRITERIA. GIVE NOTICES, FILE PLANS, OBTAIN PERMITS AND LICENSES, PAY FEES AND BACKCHARGES AND OBTAIN NECESSARY APPROVALS FROM AUTHORITIES HAVING JURISDICTION AS REQUIRED FOR THE EXECUTION OF ALL WORK ASSOCIATED WITH THIS PROJECT. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITIONS OF: 1) THE STATE BUILDING, ELECTRICAL, MECHANICAL, AND ENERGY CODES, 2) SMACNA, NFPA, ANSI/ASHRAE, ASME, UL, AND NEMA STANDARDS, 3) ALL OTHER APPLICABLE CODES, REGULATIONS, STANDARDS AND LAWS OF LOCAL, STATE AND FEDERAL GOVERNMENT AND OTHER AUTHORITIES HAVING JURISDICTION, AND 4) APPLICABLE BASE BUILDING STANDARDS AND SPECIFICATIONS.
6. INTERPRETATIONS OF DOCUMENTS: WHERE DRAWINGS OR SPECIFICATIONS DO NOT COINCIDE WITH MANUFACTURER'S RECOMMENDATIONS, OR ARE UNCLEAR AS TO INTENT, OR REQUIRED MATERIAL QUALITY, ADVISE THE ENGINEER IN WRITING BEFORE PROCEEDING WITH THE WORK. ALL COST FOR REWORK NECESSARY TO RESOLVE DISCREPANCIES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
7. REQUESTS FOR INFORMATION: ANY RFI FOR RESOLVING AN APPARENT CONFLICT OR UNCLARITY, OR A REQUEST FOR ADDITIONAL DETAIL, SHALL INCLUDE A SKETCH OR EQUIVALENT DESCRIPTION OF CONTRACTOR'S PROPOSED SOLUTION.
8. SUBMITTALS: PROVIDE SPECIFIED ITEMS AND EQUIPMENT UNLESS "EQUAL" OR "APPROVED EQUAL" IS EXPLICITLY INDICATED ON THE DRAWINGS. DEVIATIONS TO SPECIFIED ITEMS SHALL BE AT THE SOLE RISK OF THE CONTRACTOR, WHO SHALL BE RESPONSIBLE FOR ALL ASSOCIATED CHANGES TO THIS AND OTHER TRADES. REVIEW OF THE SHOP DRAWINGS BY THE ENGINEER SHALL NOT ABSOLVE THE CONTRACTOR FROM MEETING THE FULL DESIGN INTENT OF THE ASSOCIATED SYSTEM(S). SUBMITTALS SHALL INDICATE PRIOR REVIEW AND APPROVAL BY THE RESPONSIBLE CONTRACTOR. SUBMIT FOR REVIEW (6) SETS OF MANUFACTURER'S PRODUCT DATA FOR THE FOLLOWING ITEMS: 1) AIR DISTRIBUTION LAYOUT DRAWINGS AND DETAILS, 2) PIPING DISTRIBUTION LAYOUT DRAWINGS, COMPONENTS, AND DETAILS, 3) ALL EQUIPMENT, 4) CONTROL SCHEMATICS, COMPONENTS, AND SEQUENCES, INCLUDING TIE-IN TO THE EXISTING BUILDING CONTROL OR MANAGEMENT SYSTEM, 5) BALANCING REPORTS, 6) ALL TEST REPORTS, AND 7) ALL CERTIFICATES. ALLOW ENGINEER A MINIMUM OF 10 WORKING DAYS FOR PROCESSING AND REVIEW OF EACH SUBMISSION.
9. OPERATION AND MAINTENANCE DATA: SUBMIT (3) SETS OF OPERATING AND MAINTENANCE MANUALS PRIOR TO THE COMPLETION OF THE PROJECT. PROVIDE ON-SITE DEMONSTRATION OF ALL SYSTEMS TO OWNER AFTER SYSTEMS ARE FULLY OPERATIONAL. O&M MANUALS SHALL INCLUDE ALL COMPONENTS (DIFFUSERS, VALVES, ETC.) AS WELL AS SYSTEM DESCRIPTIONS OF ALL SYSTEMS WITH FLOW DIAGRAMS, WIRING DIAGRAMS, WRITTEN WARRANTEES, RECOMMENDED SPARE PARTS AND ROUTINE MAINTENANCE REQUIREMENTS WITH RECOMMENDED INTERVALS FOR ALL MOVING EQUIPMENT AND CONTROLS.
10. RECORD DRAWINGS: CAD RECORD DRAWING FILES SHALL BE SUBMITTED AT THE COMPLETION OF THE PROJECT SHOWING THE “AS-BUILT” CONDITION INCLUDING WORK INSTALLED AND ALL MODIFICATIONS OR ADDITIONS TO ORIGINAL DESIGN. OBTAIN THE AUTOCAD FILES FOR PREPARATION OF AS-BUILT DRAWINGS FROM THE ARCHITECT. THE ARCHITECT AND ENGINEER ARE NOT GRANTING ANY OWNERSHIP OR PROPERTY INTEREST IN THE CAD DRAWINGS BY THE DELIVERY OF THE CAD FILES. THE USE OF THE CAD FILES AND DRAWINGS ARE LIMITED FOR THE SOLE PURPOSE OF ASSISTING IN THE CONTRACTOR'S PERFORMANCE IN ITS CONTRACTUAL OBLIGATIONS WITH RESPECT TO THIS PROJECT. ANY REUSE AND/OR OTHER USE BY THE CONTRACTOR WILL BE AT THE CONTRACTOR'S SOLE RISK AND WITHOUT LIABILITY TO THE ARCHITECT AND ENGINEER.
11. WARRANTIES: WARRANTY INSTALLATION IN WRITING FOR ONE YEAR FROM DATE OF OWNER'S ACCEPTANCE OF CERTIFICATE OF SUBSTANTIAL COMPLETION. WHERE INDIVIDUAL EQUIPMENT SECTIONS SPECIFY LONGER WARRANTEES, PROVIDE THE LONGER WARRANTEE. REPAIR, REPLACE OR PROVIDE TEMPORARY ACCOMMODATIONS FOR DEFECTIVE MATERIALS, EQUIPMENT, WORKMANSHIP AND INSTALLATION THAT DEVELOP WITHIN 24 HOURS OF NOTIFICATION. WARRANTY SHALL INCLUDE A CONTACT PERSON (NAME AND 24 HOUR TELEPHONE NUMBER) FOR SERVICE REQUESTS. CORRECT DAMAGE CAUSED WHILE MAKING NECESSARY REPAIRS AND REPLACEMENTS UNDER WARRANTY PERIOD AT NO ADDITIONAL COST.
12. COORDINATION: CONFER WITH ALL OTHER TRADES RELATIVE TO LOCATION OF ALL APPARATUS AND EQUIPMENT TO BE INSTALLED AND SELECT LOCATIONS SO AS NOT TO CONFLICT WITH OR HINDER THE PROGRESS OF THE WORK OF OTHER SECTIONS. WORK INSTALLED THAT CREATES INTERFERENCE OR RESTRICTS ACCESS REQUIRED BY CODE (INCLUDING CLEARANCES TO ELECTRICAL COMPONENTS) OR TO CONDUCT MAINTENANCE AND/OR ADJUSTMENTS SHALL BE MODIFIED AT NO ADDITIONAL COST TO THE OWNER.
13. SUPPORTS: INCLUDE ALL STRUCTURAL STEEL SUPPORTS, HANGER BRACKETS, ETC., REQUIRED FOR THE EXECUTION OF THE WORK OF THIS SECTION. THE WELDS AND EDGES OF ALL BRACKETS SHALL BE FILED OR GROUND SMOOTH FOR PAINTING. HANGERS SHALL BE STEEL ANGLE IRON, CHANNEL OR STEEL ROD USED WITH APPROVED CLAMPS, INSERTS, ETC. ALL HANGERS SHALL BE GALVANIZED OR PAINTED WITH TWO COATS OF RUSTOLEUM PAINT BEFORE INSTALLATION. APPLY TOUCH-UP PAINT (ZINC GALVANIZING FOR GALVANIZED STEEL) AFTER INSTALLATION. SUPPORTS INSTALLED IN EXTERIOR LOCATIONS SHALL BE PVC COATED STEEL, GALVANIZED STEEL, OR STAINLESS STEEL WITH STAINLESS STEEL HARDWARE.
14. CUTTING AND PATCHING: INCLUDE ALL CORING, CUTTING, PATCHING AND FIREPROOFING NECESSARY FOR THE EXECUTION OF THE WORK OF THIS SECTION. STRUCTURAL ELEMENTS SHALL NOT BE CUT WITHOUT WRITTEN APPROVAL OF THE ARCHITECT. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR TAKING ALL PRECAUTIONS REQUIRED TO IDENTIFY HIDDEN PIPING, CONDUITS, ETC. BEFORE ANY CORE DRILLING AND/OR CUTTING OF SLABS COMMENCES, INCLUDING X-RAYING THE AFFECTED SLABS. REPAIR AND PATCH AROUND THE WORK SPECIFIED HEREIN TO MATCH THE EXISTING ADJACENT SURFACES TO THE SATISFACTION OF THE ARCHITECT. FILL AND PATCH ALL OPENINGS OR HOLES LEFT IN THE EXISTING STRUCTURES BY THE REMOVAL OF EXISTING EQUIPMENT THAT IS PART OF THIS SECTION OF THE SPECIFICATIONS. PATCH AND SEAL ALL EXISTING OPENINGS IN DUCTWORK AND PIPING NOT UTILIZED FOR NEW LAYOUT. PROVIDE FIRE STOPPING TO MAINTAIN THE FIRE RATING OF THE FIRE RESISTANCE-RATED ASSEMBLY. ALL PENETRATIONS AND ASSOCIATED FIRE STOPPING SHALL BE INSTALLED IN ACCORDANCE WITH THE FIRE STOPPING MANUFACTURER'S LISTED INSTALLATION DETAILS AND BE LISTED BY UL OR FM.
15. HOISTING, SCAFFOLDING AND PLANKING: INCLUDE THE FURNISHING, SET-UP AND MAINTENANCE OF ALL HOISTING MACHINERY, CRANES, SCAFFOLDS, STAGING AND PLANKING AS REQUIRED FOR THE EXECUTION OF WORK FOR THIS SECTION.
16. SAFETY PRECAUTIONS: LIFE SAFETY AND ACCIDENT PREVENTION SHALL BE A PRIMARY CONSIDERATION. COMPLY WITH ALL OF THE SAFETY REQUIREMENTS OF THE OWNER AND OSHA THROUGHOUT THE ENTIRE CONSTRUCTION PERIOD OF THE PROJECT. FURNISH, PLACE AND MAINTAIN PROPER GUARDS AND ANY OTHER NECESSARY CONSTRUCTION REQUIRED TO SECURE SAFETY OF LIFE AND PROPERTY.
17. ACCESSIBILITY: ALL WORK PROVIDED UNDER THIS SECTION OF THE SPECIFICATION SHALL BE INSTALLED SO THAT PARTS REQUIRING PERIODIC INSPECTION, MAINTENANCE AND REPAIR ARE READILY ACCESSIBLE. WORK OF THIS TRADE SHALL NOT INFRINGE UPON CLEARANCES REQUIRED BY EQUIPMENT OF OTHER TRADES.
18. PROTECTION OF WORK AND PROPERTY: THIS CONTRACTOR SHALL BE RESPONSIBLE FOR THE CARE AND PROTECTION OF ALL WORK INCLUDED UNDER THIS SECTION UNTIL THE COMPLETION AND FINAL ACCEPTANCE OF THIS PROJECT. PROTECT ALL EQUIPMENT AND MATERIALS FROM DAMAGE FROM ALL CAUSES INCLUDING, BUT NOT LIMITED TO, FIRE, VANDALISM AND THEFT. ALL MATERIALS AND EQUIPMENT DAMAGED OR STOLEN SHALL BE REPAIRED OR REPLACED WITH EQUAL MATERIAL OR EQUIPMENT AT NO ADDITIONAL COST TO THE OWNER. PROTECT ALL EQUIPMENT, OUTLETS AND OPENINGS, AND ROOF PENETRATIONS WITH TEMPORARY PLUGS, CAPS AND COVERS. PROTECT WORK AND MATERIALS OF OTHER TRADES FROM DAMAGE THAT MIGHT BE CAUSED BY WORK OR WORKMEN UNDER THIS SECTION AND MAKE GOOD DAMAGE THUS CAUSED. DAMAGED MATERIALS ARE TO BE REMOVED FROM THE SITE; NO SITE STORAGE OF DAMAGED MATERIALS WILL BE ALLOWED. ANY DAMAGE TO EXISTING SYSTEMS AND EQUIPMENT CAUSED BY THIS CONTRACTOR DURING INSTALLATION SHALL BE REPAIRED AND/OR REPLACED AT THIS CONTRACTOR'S EXPENSE TO THE COMPLETE SATISFACTION OF THE BUILDING OWNER.
19. SEISMIC RESTRAINT REQUIREMENTS: PROVIDE SEISMIC RESTRAINTS AS REQUIRED IN ACCORDANCE WITH THE STATE BUILDING CODE. A REGISTERED PROFESSIONAL STRUCTURAL ENGINEER, LICENSED IN THE APPLICABLE STATE FOR THE PROJECT LOCATION, SHALL PREPARE THE SEISMIC RESTRAINT DESIGN AND CERTIFY THAT THE DESIGN IS IN COMPLIANCE WITH THE STATE BUILDING CODE REQUIREMENTS.

PART 2 - PRODUCTS

1. DUCTWORK: MATERIAL, CONSTRUCTION, AND INSTALLATION SHALL MEET REQUIREMENTS OF MOST RECENT EDITIONS OF SMACNA HVAC DUCT CONSTRUCTION STANDARDS, EXCEPT FOR MORE STRINGENT REQUIREMENTS SPECIFIED OR SHOWN ON DRAWINGS. SEE “DUCTWORK PRESSURE CLASS AND SEAL CLASS” DETAIL FOR CONSTRUCTION REQUIREMENTS. PROVIDE FLEXIBLE CONNECTION ON ALL DUCTS CONNECTING TO FANS AND ROTATING EQUIPMENT. ALL DUCTS SHALL BE GROUNDED ACROSS FLEXIBLE CONNECTION WITH FLEXIBLE COPPER GROUNDING STRAPS. MAXIMUM LENGTH OF FLEXIBLE RUN-OUT TO DIFFUSERS SHALL BE 6 FEET. FOR LONGER RUN-OUTS, ADD RIGID DUCT. DUCTS SHALL BE CONSTRUCTED OF GALVINIZED STEEL UNLESS OTHERWISE NOTED.
2. VOLUME DAMPERS: PROVIDE MANUAL ADJUSTABLE VOLUME DAMPERS, WITH EXTENDED MOUNT, INDICATING AND LOCKING QUADRANTS ON EACH TAKE-OFF TO REGISTER, GRILLE, OR DIFFUSER (NOT ALL MAY BE SHOWN ON DRAWINGS).
3. DIFFUSERS, REGISTERS, AND GRILLES: PROVIDE DIFFUSERS, REGISTERS AND GRILLES FOR SUPPLY, RETURN, AND EXHAUST OUTLETS, OF SIZE, TYPE, AND DESIGN SHOWN ON DRAWINGS. DIFFUSER SIZES SHOWN ARE NECK SIZES; REGISTER AND GRILLE SIZE ARE NOMINAL. ACCEPTABLE MANUFACTURERS: TITUS, ANEMOSTAT, KRUEGER, TUTTLE & BAILEY, PRICE, OR METALAIRE. SOUND PRESSURE LEVELS ARE NOT TO EXCEED NC 30.
4. DUCT INSULATION (EXTERNAL): INSULATION SHALL BE CERTAIN-TEED, KNAUF, MANVILLE, OR OWENS CORNING. MATERIALS SHALL MEET REQUIREMENTS OF ADHESIVE AND SEALANT COUNCIL STANDARDS AND SMACNA. MINIMUM DUCTWORK INSULATION THICKNESS SHALL BE AS REQUIRED TO MEET THE R-VALUES LISTED IN THE “DUCT INSULATION R-VALUES” DETAIL. FOR CONCEALED INSULATION, USE FIBROUS GLASS DUCT WRAP, WITH FOIL-KRAFT FLAME RESISTANT VAPOR BARRIER. EXPOSED INSULATION SHALL BE RIGID FIBERGLASS INSULATION WITH ALUMINUM VAPOR BARRIER. DUCTWORK THAT IS RUN OUTDOORS SHALL BE PITCHED FOR DRAINAGE AND INSULATED WITH AT LEAST 2" THICK INSULATION AND ADDITIONALLY COVERED WITH LIGHT COLOR WEATHERPROOF ROOFING MATERIALS.
5. EQUIPMENT INSULATION: INSULATION SHALL BE CERTAIN-TEED, KNAUF, MANVILLE, OR OWENS CORNING AND SHALL BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. INSULATE THE FOLLOWING EQUIPMENT: 1) DUCT-MOUNTED COILS, 2) DRAIN PANS, 3) AIR SEPARATORS, 4) PUMPS, 5) HEAT EXCHANGERS, 6) EXPANSION TANKS. INSULATION SHALL BE 1" THICK FIBROUS GLASS RIGID BLOCK OR SEMI-RIGID BOARD RATED FOR TEMPERATURE INTENDED. INSULATION SHALL BE FORMED OR FABRICATED TO FIT EQUIPMENT AND HAVE REMOVABLE SECTIONS FOR SERVICING.
6. MOTORS, STARTERS, AND WIRING: PROVIDE PREMIUM EFFICIENCY MOTORS. STARTERS AND/OR VFD'S SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR UNLESS PART OF PACKAGED EQUIPMENT. PROVIDE CONTROL AND OTHER RELATED WIRING INCLUDING INTERLOCKS. MOTORS FOR USE WITH VARIABLE FREQUENCY DRIVES (VFD) SHALL BE INVERTER DUTY RATED, AND SHALL HAVE AEGIS™ OR APPROVED EQUAL SHAFT GROUND RINGS (TO PREVENT ELECTRICAL BEARING DAMAGE FROM CAPACITIVELY COUPLED SHAFT VOLTAGES) INSTALLED AND REGISTERED PER MANUFACTURERS REQUIREMENTS FOR 15 YEAR BEARING WARRANTEE.
7. FANS: ALL FANS SHALL HAVE THEIR AIR PERFORMANCE RATED IN ACCORDANCE WITH AMCA AND SHALL BE LICENSED TO BEAR THE AMCA SEAL. ALL MOTORS 1 HP AND LARGER SHALL BE PREMIUM EFFICIENCY. ACCEPTABLE MANUFACTURERS OF ROOF EXHAUSTERS, TRANSFER FANS, AND CEILING EXHAUST FANS SHALL BE: PENN, GREENHECK, OR COOK. ACCEPTABLE MANUFACTURERS FOR CENTRIFUGAL FANS SHALL BE: BUFFALO, CHICAGO, TRANE, PEERLESS, OR BARRY. ACCEPTABLE MANUFACTURERS FOR AXIAL FANS SHALL BE: JOY, WOODS, HARTZELL, AEROVENT, CHICAGO, OR BUFFALO. ACCEPTABLE MANUFACTURERS FOR UTILITY SETS SHALL BE: TRANE, BUFFALO, PEERLESS, COOK, GREENHECK, OR BARRY.
8. VIBRATION ISOLATION: PROVIDE VIBRATION ISOLATION FOR EACH PIECE OF ROTATING OR PISTON DRIVEN HVAC EQUIPMENT SHOWN ON THE DRAWINGS. ISOLATION MAY BE INTERNAL OR EXTERNAL TO THE EQUIPMENT AND SHALL PROVIDE AT LEAST 90% ISOLATION EFFICIENCY. ISOLATE THE FIRST THREE PIPE HANGER LOCATIONS FROM EQUIPMENT WITH 1" DEFLECTION COMBINATION SPRING AND NEOPRENE, NAI (NOVIA ASSOCIATION) MODEL "SNH" OR EQUIVALENT BY MASON INDUSTRIES OR KINETICS. INSTALLATION PRACTICES SHALL BE IN STRICT ACCORDANCE WITH THE RECOMMENDATIONS OF THE VIBRATION ISOLATION MANUFACTURER.
9. ELECTRIC COILS: PROVIDE ELECTRIC HEATING COILS BY INDECCO, Q-MARK, OR BRASCH OF CAPACITIES SHOWN ON THE SCHEDULES. COILS SHALL BE UL LISTED AND BE PROVIDED WITH REQUIRED AIRFLOW PROVING SWITCHES, THERMAL CUTOUTS, DOOR DISCONNECTS AND ALL OTHER REQUIRED SAFETY AND OPERATING CONTROLS.
10. AUTOMATIC TEMPERATURE CONTROLS: PROVIDE COMPLETE SYSTEM OF AUTOMATIC TEMPERATURE CONTROLS BY ANDOVER, INVENSYS BUILDING SYSTEMS, HONEYWELL, JOHNSON, OR SIEMENS. CONTROL SYSTEM SHALL BE CAPABLE OF PERFORMING ALL SEQUENCES OF OPERATION SHOWN ON THE DRAWINGS OR DESCRIBED IN THESE SPECIFICATIONS. INDIVIDUAL CONTROL COMPONENTS MAY NOT BE SHOWN ON CONTRACT DOCUMENTS, BUT ATC CONTRACTOR SHALL SUPPLY ALL COMPONENTS, CONTROL WIRING (INCLUDING POWER WIRING TO ALL PANELS, CONTROLLERS, TRANSFORMERS, ACTUATORS, ETC.), AND PNEUMATIC TUBING NECESSARY FOR A COMPLETE OPERABLE SYSTEM. COORDINATE WITH ELECTRICAL CONTRACTOR FOR LOCATION OF LINE VOLTAGE JUNCTION BOX IN EACH MECHANICAL AREA. ATC CONTRACTOR SHALL EXTEND WIRING FROM THESE BOX(ES) TO ALL CONTROL COMPONENTS AND SHALL BE RESPONSIBLE FOR ALL SYSTEM COMPONENTS, WHETHER HE SUBCONTRACTS ELECTRICAL AND OTHER WORK OR NOT. WIRING BETWEEN FIRE ALARM SYSTEM AND TEMPERATURE CONTROL SYSTEM, EXCEPT FOR DUCT MOUNTED SMOKE DETECTORS (FURNISHED BY THE ELECTRICAL CONTRACTOR), SHALL BE BY THE ATC CONTRACTOR.
11. AUTOMATIC TEMPERATURE CONTROL WIRING, CONDUITS AND CABLE
    - A. ALL WIRING SHALL BE COPPER AND MEET THE REQUIREMENTS OF THE NEC
    - B. RACEWAYS AND CONDUIT: RIGID GALVANIZED STEEL CONDUIT (RGSC) SHALL BE UTILIZED FOR ALL EXTERIOR LOCATIONS WITH THREADED FITTINGS. ELECTRICAL METALLIC TUBING (EMT) SHALL BE UTILIZED INDOORS WITH SET SCREW TYPE FITTINGS. EMT WITH COMPRESSION FITTINGS SHALL BE USED FOR INTERIOR DAMP LOCATIONS. PROVIDE CONDUIT EXPANSION FITTINGS WITH EXTERNAL BONDING JUMPERS EQUAL TO OZ GEDNEY TYPE EX FOR RGSC AND TYPE TX FOR EMT WHEN CROSSING EXPANSION JOINTS. UL LISTED LIQUID TIGHT FLEXIBLE METAL CONDUIT (LFMC) AND FLEXIBLE METAL CONDUIT (FMC) SHALL BE USED FOR FINAL CONNECTIONS TO EQUIPMENT WHERE FLEXIBILITY OR VIBRATION ISOLATION ARE REQUIRED. LFMC SHALL BE UV RESISTANT WHEN INSTALLED IN AN EXTERIOR LOCATION. ALL RACEWAYS, WHICH PASS THROUGH BUILDING EXPANSION JOINTS, SHALL BE EQUIPPED WITH EXPANSION FITTINGS. ALL CONDUITS SHALL BE SUPPORTED IN AN APPROVED MANNER TO THE BUILDING STRUCTURE. SUPPORT FROM CONDUITS, DUCTWORK, PIPING, ETC. WILL NOT BE PERMITTED.
        1. CONDUIT IN FINISHED AREAS SHALL BE CONCEALED IN CEILING CAVITY SPACES, PLENUMS, FURRED SPACES AND WALL CONSTRUCTION. EXCEPTION; METALLIC SURFACE RACEWAY MAY BE USED IN FINISHED AREAS ON MASONRY WALLS. ALL SURFACE RACEWAY IN FINISHED AREAS MUST BE COLOR MATCHED TO THE EXISTING FINISH WITHIN THE LIMITATIONS OF STANDARD MANUFACTURED COLORS.
        2. CONDUIT, IN NON-FINISHED AREAS WHERE POSSIBLE, SHALL BE CONCEALED IN CEILING CAVITY PACES, PLENUMS, FURRED SPACES, AND WALL CONSTRUCTION. EXPOSED CONDUIT WILL RUN PARALLEL TO OR AT RIGHT ANGLES TO THE BUILDING STRUCTURE.
    - C. ALL EXPOSED RACEWAY THAT IS EXPOSED TO MOISTURE OR LOCATED OUTDOORS SHALL BE INSTALLED IN RIGID METAL CONDUIT WITH FLEXIBLE CONNECTIONS TO ALL MECHANICAL EQUIPMENT UTILIZING LIQUID TIGHT FLEXIBLE METAL CONDUIT NOT TO EXCEED 18”. ALL PENETRATIONS OF WEATHER TIGHT BOXES SHALL UTILIZE WEATHERPROOF HUBS. ALL CONDUIT SUPPORTS SHALL BE HOT DIPPED GALVANIZED. EXPOSED HORIZONTAL RUNS SHALL BE MINIMIZED. ALL FASTENERS, MISCELLANEOUS SUPPORTS (UNISTRUT OR EQUAL) AND HARDWARE UTILIZED FOR THE WIRING INSTALLATION SHALL BE STAINLESS STEEL. ALL ROOF PENETRATIONS SHALL BE IN ACCORDANCE WITH THE ROOFING MANUFACTURER'S INSTRUCTIONS TO MAINTAIN THE INTEGRITY AND ANY REMAINING WARRANTEE ON THE ROOFING SYSTEM.
    - D. FLEXIBLE METALLIC CONDUIT (MAX. 3 FEET) SHALL BE USED FOR CONNECTIONS TO ACTUATOR MOTORS, CONTROLLERS, AND SENSORS MOUNTED ON VIBRATION PRODUCING EQUIPMENT. LIQUID-TIGHT FLEXIBLE CONDUIT SHALL BE USE IN EXTERIOR LOCATIONS AND INTERIOR LOCATIONS SUBJECT TO MOISTURE
    - E. JUNCTION BOXES SHALL BE PROVIDED AT ALL CABLE SPLICES, EQUIPMENT TERMINATION, AND TRANSITIONS FROM EMT TO FLEXIBLE CONDUIT. INTERIOR DRY LOCATION J-BOXES SHALL BE GALVANIZED PRESSED STEEL, NOMINAL FOUR-INCH SQUARE WITH BLANK COVER. EXTERIOR AND DAMP LOCATION JH-BOXES SHALL BE CAST ALLOY FS BOXES WITH THREADED HUBS AND GASKETED COVERS.
    - F. WHERE THE SPACE ABOVE THE CEILING IS A SUPPLY OR RETURN AIR PLENUM, THE WIRING SHALL BE PLENUM RATED. TEFLON WIRING CAN BE RUN WITHOUT CONDUIT ABOVE SUSPENDED CEILINGS. EXCEPTION: ANY WIRE RUN IN SUSPENDED CEILINGS THAT IS USED TO CONTROL OUTSIDE AIR DAMPERS OR TO CONNECT THE SYSTEM TO THE FIRE MANAGEMENT OR SMOKE CONTROL SYSTEMS SHALL BE IN CONDUIT.
    - G. COAXIAL CABLE SHALL CONFORM TO RG62 OR RG59 RATING. PROVIDE PLENUM RATED COAXIAL CABLE WHEN RUNNING IN RETURN AIR PLENUMS.
    - H. ETHERNET 10/100 BASE -T NETWORK WIRING SHALL BE EQUIVALENT TO OWNER'S PREMISE WIRING OR, AS A MINIMUM, CATEGORY 5E OR 6 CABLING UP TO 300' MAXIMUM RUN.
    - I. FIBER OPTIC CABLE SHALL BE USED FOR RUNS OVER 300' AND SHALL INCLUDE THE FOLLOWING SIZES; 50/125, 62.5/125 OR 100/140. ONLY GLASS FIBER IS ACCEPTABLE, NO PLASTIC. FIBER OPTIC CABLE SHALL ONLY BE INSTALLED AND TERMINATED BY AN EXPERIENCED CONTRACTOR. THE BAS CONTRACTOR SHALL SUBMIT TO THE ENGINEER THE NAME OF THE INTENDED CONTRACTOR OF THE FIBER OPTIC CABLE WITH HIS SUBMITTAL DOCUMENTS.
    - J. CABLES SHALL BE ATTACHED TO THE BUILDING PROPER AT REGULAR INTERVALS SUCH THAT THERE IS NO DROOP GREATER THAN 2 INCHES BETWEEN SUPPORTS. CABLES SHALL NOT TO BE AFFIXED TO OR SUPPORTED BY PIPES, CONDUITS (UNLESS SPECIFICALLY ALLOWED BY THE NEC), DUCTS, ETC. WIRES SHALL BE KEPT A MINIMUM OF THREE (3) INCHES FROM ALL PIPING.
    - K. WHERE SENSOR WIRES LEAVE THE CONDUIT SYSTEM, THEY ARE TO BE PROTECTED BY A NON-METALIC BUSHING.
    - L. WIRING SHALL NOT BE ALLOWED TO RUN THROUGH ELEVATOR, TELEPHONE EQUIPMENT, AND ELECTRIC ROOMS.

14. PACKAGED DX ROOFTOP UNIT: PROVIDE PACKAGED DX ROOFTOP UNIT BY CARRIER, TRANE, YORK, MAMMOTH, OR MCQUAY. UNIT SHALL HAVE COOLING AND HEATING AS SCHEDULED AND MICROPROCESSOR BASED DISCHARGE AIR, AND ALL COMPONENTS REQUIRED TO MEET THE SEQUENCES SHOWN ON THE DRAWINGS. FANS SHALL BE STATICALLY AND DYNAMICALLY BALANCED AND RATED IN ACCORDANCE WITH THE LATEST EDITION OF ARI STANDARD 430. PROVIDE PREMIUM EFFICIENCY, VFD COMPATIBLE MOTORS, SIZED TO BE NON-OVERLOADING THROUGHOUT FAN CURVE. COILS SHALL BE RATED IN ACCORDANCE WITH ARI STANDARD 410. ELECTRIC COILS SHALL BE RATED BY UL AND NEC. PROVIDE ALL NECESSARY FILTERS AND ACCESSORIES. PROVIDE PREFABRICATED VIBRATION ISOLATION TYPE (UNLESS ALL ROTATING EQUIPMENT HAS INTERNAL VIBRATION ISOLATORS) ROOF CURBS. PROVIDE ALL NECESSARY SAFETY CONTROLS FOR FURNACE OR ELECTRIC COILS. PROVIDE THE SCHEDULED NUMBER OF STAGES (AT LEAST ONE PER COMPRESSOR) OF CAPACITY CONTROL. PROVIDE THE FOLLOWING ACCESSORIES: 1) FULL ECONOMIZER CONTROL, 2) SINGLE POINT ELECTRICAL CONNECTION STARTERS/VFD'S AND DISCONNECT SWITCH.

PART 3 - EXECUTION

1. DEMOLITION: THE EXISTING FACILITY WILL CONTINUE TO OPERATE DURING ALL PHASES OF THE DEMOLITION WORK AND SUBSEQUENT CONSTRUCTION. NO INTERRUPTION OF THE SYSTEMS WILL BE PERMITTED WITHOUT PRIOR APPROVAL OF THE OWNER'S REPRESENTATIVE. SUBMIT PROPOSED METHODS AND SEQUENCE OF OPERATIONS FOR THE SELECTIVE DEMOLITION WORK TO THE OWNER'S REPRESENTATIVE FOR REVIEW PRIOR TO THE START OF THE WORK. ANY DEMOLITION SHALL BE COORDINATED WITH OWNER, ARCHITECT, CM/GC, AND ENGINEER. PERFORM ALL DEMOLITION WHILE ENSURING MINIMUM INTERFERENCE WITH ADJACENT OCCUPIED AREAS.
2. INSTALLATION OF EQUIPMENT: INSTALL ALL ITEMS SPECIFIED UNDER PART 2 - PRODUCTS, ACCORDING TO THE MANUFACTURER'S REQUIREMENTS, SHOP DRAWINGS, AND DETAILS AS SHOWN ON THE DRAWINGS AND AS SPECIFIED. INSTALL ALL WORK SO THAT PARTS REQUIRING INSPECTION, REPLACEMENT, MAINTENANCE AND REPAIR SHALL BE READILY ACCESSIBLE. MINOR DEVIATIONS FROM THE DRAWINGS MAY BE MADE TO ACCOMPLISH THIS, BUT ANY SUBSTANTIAL CHANGE SHALL NOT BE MADE WITHOUT PRIOR WRITTEN OWNER APPROVAL.
3. IDENTIFICATION: ALL EQUIPMENT, PIPING, VALVES, DUCTWORK, AND FIRE, SMOKE, AND FIRE/SMOKE DAMPERS PROVIDED UNDER THIS SECTION OF THE SPECIFICATIONS SHALL BE MARKED FOR EASE OF IDENTIFICATION PER OWNER'S OR INDUSTRY STANDARDS.
4. PIPE EXPANSION: THE EXPANSION OF SUPPLY AND RETURN PIPES SHALL BE PROVIDED FOR BY CHANGES IN THE DIRECTION OF THE RUN OF PIPE, BY EXPANSION LOOPS, OR BY EXPANSION JOINTS AS REQUIRED.
5. CLEANING: DUCTS SHALL BE THOROUGHLY CLEANED SO THAT NO DIRT OR DUST SHALL BE DISCHARGED FROM DIFFUSERS, REGISTERS, OR GRILLES, WHEN SYSTEM IS OPERATED. AFTER ALL WATER, STEAM, AND CONDENSATE PIPING SYSTEMS HAVE BEEN PRESSURE TESTED AND APPROVED FOR TIGHTNESS, CLEAN AND FLUSH PIPING. AFTER COMPLETION OF PROJECT, CLEAN EXTERIOR SURFACES OF ALL EQUIPMENT INCLUDED IN THIS SECTION, INCLUDING REMOVAL OF CONCRETE RESIDUE. AFTER COMPLETION OF PROJECT, REMOVE ALL CONSTRUCTION DEBRIS, TEMPORARY FACILITIES AND EQUIPMENT FROM WORK AREA. CLEAN WORK AREA TO PERMIT OCCUPATION.
6. TESTING AND INSPECTION: PROVIDE QUALIFIED PERSONNEL, EQUIPMENT, APPARATUS, AND SERVICES FOR TESTING AND INSPECTION OF MECHANICAL SYSTEMS. DO NOT COVER OR CONCEAL WORK BEFORE TESTING AND INSPECTION AND OBTAINING APPROVAL. MEDIUM PRESSURE DUCTWORK SHALL BE LEAKAGE TESTED WHERE CALLED FOR ON THE DUCT CONSTRUCTION AND LEAKAGE CLASS SCHEDULE. ALL WATER PIPING SHALL BE HYDROSTATICALLY TESTED AT 125% OF DESIGN PRESSURE (125 PSIG MINIMUM). ALL STEAM AND STEAM CONDENSATE PIPING SHALL BE TESTED AT 125% OF DESIGN PRESSURE (50 PSIG MINIMUM). TESTS SHALL BE FOR A FOUR-HOUR DURATION, DURING WHICH TIME PIPING SHALL SHOW NO LEAKS AND DURING WHICH TIME NO SEALING OF LEAKS WILL BE PERMITTED. ANY EQUIPMENT NOT CAPABLE OF WITHSTANDING TEST PRESSURES SHALL BE SUITABLY ISOLATED FROM THE TEST PRESSURE. AFTER ALL COMPONENTS OF THE REFRIGERANT SYSTEMS HAVE BEEN INSTALLED AND THE PIPING CONNECTED, THE SYSTEM SHALL BE SUBJECTED TO A REFRIGERANT LEAKAGE TEST. THE REFRIGERANT LEAKAGE TEST SHALL BE DONE BEFORE ANY REFRIGERANT PIPE IS INSULATED OR COVERED. HIGH AND LOW SIDE OF THE REFRIGERANT SYSTEM SHALL BE TESTED FOR THE MINIMUM REFRIGERANT LEAKAGE TEST PRESSURE SPECIFIED IN ASHRAE 15, FOR THE REFRIGERANT USED. SYSTEM SHALL BE PROVED TIGHT AND FREE OF LEAKS BY ALLOWING THE REFRIGERANT LEAKAGE TEST PRESSURE TO REMAIN ON THE SYSTEM FOR 24 HOURS WITH NO DROP IN PRESSURE. LEAKS, DAMAGE, AND DEFECTS DISCOVERED OR RESULTING FROM TESTING SHALL BE REPAIRED OR REPLACED TO LIKE-NEW CONDITION WITH ACCEPTABLE MATERIALS. TESTS SHALL BE CONTINUED UNTIL SYSTEMS OPERATE WITHOUT LEAKS OR REPAIRS. REPORT ON INDUSTRY STANDARD REPORTING FORMS, SUBMITTED FOR APPROVAL IN ADVANCE. SUBMIT SIX COPIES OF TESTING REPORTS FOR APPROVAL. CONTRACTOR SHALL FURNISH ALL TEST MEDIUMS AND DISPOSE OF ALL TEST MEDIUMS AT AN APPROVED OFF SITE LOCATION AFTER TESTING IS COMPLETE.
7. START UP AND BALANCING: PROVIDE NEBB, AABC, TABB OR NBC CERTIFIED PERSONNEL, EQUIPMENT, APPARATUS, AND SERVICES FOR START-UP AND BALANCING OF MECHANICAL SYSTEMS TO PERFORMANCE DATA SHOWN IN SCHEDULES AND ON DRAWINGS, AS SPECIFIED, AND AS REQUIRED BY CODES, STANDARDS, REGULATIONS, AND AUTHORITIES HAVING JURISDICTION INCLUDING CITY INSPECTORS. AIR AND WATER FLOWS SHALL BE BALANCED TO +/- 10% OF DESIGN. LEAKS, DAMAGE, AND DEFECTS DISCOVERED OR RESULTING FROM START-UP AND BALANCING SHALL BE REPAIRED OR REPLACED TO LIKE-NEW CONDITION WITH ACCEPTABLE MATERIALS. TESTS SHALL BE CONTINUED UNTIL SYSTEM OPERATES WITHOUT ADJUSTMENTS OR REPAIRS. REPORT DATA ON INDUSTRY STANDARD NEBB, AABC, OR NBC REPORTING FORMS. AIR TERMINAL UNIT DATA SHALL INCLUDE ALL PRIMARY AIRFLOWS (MAXIMUM, MINIMUM AND HEATING). FAN POWERED BOXES SHALL INCLUDE ALL PRIMARY AIRFLOWS, FAN AIRFLOW, AND MOTOR DATA. SUBMIT SIX COPIES OF START-UP AND BALANCING REPORTS TO ARCHITECT FOR APPROVAL. PRIOR TO THE START OF DEMOLITION, THE TESTING AND BALANCING CONTRACTOR SHALL TAKE CFM AND STATIC PRESSURE READINGS AT AREAS DESIGNATED ON THE CONTRACT DRAWINGS. READINGS SHALL BE SUBMITTED PRIOR TO START OF NEW WORK.

PART 4 - PROJECT CLOSEOUT

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ITEMS ASSOCIATED WITH PROJECT CLOSEOUT. ALLOW SUFFICIENT TIME IN THE CONSTRUCTION SCHEDULE TO ENSURE THAT THE INSTALLATION IS SUBSTANTIALLY COMPLETE AND ALL REQUIRED TESTING AND ACCURATELY COMPLETED DOCUMENTATION IS DELIVERED TO THE ENGINEER AT LEAST TWO WEEKS PRIOR TO ENGINEER'S SUBSTANTIAL COMPLETION SITE VISIT. FAILURE TO ADEQUATELY PLAN OR SUBMISSION OF INCOMPLETE/INCORRECT DOCUMENTATION WILL RESULT IN BACK CHARGES OF ALL COSTS ASSOCIATED WITH ADDED WORK PERFORMED BY RDK ENGINEERS.
2. PROVIDE THE CONTRACTOR CERTIFICATE OF COMPLETION IN ACCORDANCE WITH 780CMR 107.6.3 INDICATING THAT THE INSTALLATION IS IN CONFORMANCE WITH THE CONSTRUCTION DOCUMENTS AND ALL APPLICABLE LOCAL, STATE AND FEDERAL STATUTES AND CODES. PROVIDE CERTIFICATION FROM BOTH THE GENERAL CONTRACTOR AND ASSOCIATED TRADE CONTRACTOR FOR COMPLIANCE WITH 780CMR CHAPTERS 1, 9 & 13.
3. PROVIDE CERTIFICATES OF INSPECTIONS FROM EQUIPMENT MANUFACTURERS FOR ALL COMPRESSORIZED EQUIPMENT, BOILERS AND FLUES, AND EQUIPMENT WITH MOTORS 5 HP AND LARGER STATING THAT THE AUTHORIZED FACTORY REPRESENTATIVES HAVE INSPECTED AND TESTED THE OPERATION OF THEIR RESPECTIVE EQUIPMENT AND FOUND THE EQUIPMENT TO BE IN SATISFACTORY OPERATING CONDITION AND INSTALLED PER THE MANUFACTURERS INSTALLATION INSTRUCTIONS AND REQUIREMENTS.
4. PROVIDE BACKUP DOCUMENTATION TO VERIFY THAT ALL FIRE DAMPERS AND SMOKE/FIRE DAMPERS HAVE BEEN INSTALLED PER MANUFACTURER'S REQUIREMENTS AND THAT ALL FUNCTION PROPERLY.
5. PROVIDE BACKUP DOCUMENTATION TO VERIFY THAT ALL SEQUENCES OF OPERATIONS AND CONTROLS HAVE BEEN INCORPORATED AND ALL SYSTEMS AND EQUIPMENT ARE WORKING PER THE SPECIFIED SEQUENCES OF OPERATIONS.
6. PROVIDE BACKUP DOCUMENTATION THAT ALL DUCT AND PIPING LEAKAGE AND PRESSURE TESTS HAVE BEEN CONDUCTED AND THAT ALL SYSTEMS HAVE PASSED. PROVIDE START-UP AND BALANCING REPORTS FOR ALL AIR AND WATER SYSTEMS. AIR BALANCING REPORT SHALL VERIFY THE DESIGN OUTDOOR AIR IS BEING SUPPLIED TO THE BUILDING.

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Seal

charles river

Charles River Microbial Solutions
Processing Facility Renovations
Harwich, MA

Project info

Key Plan

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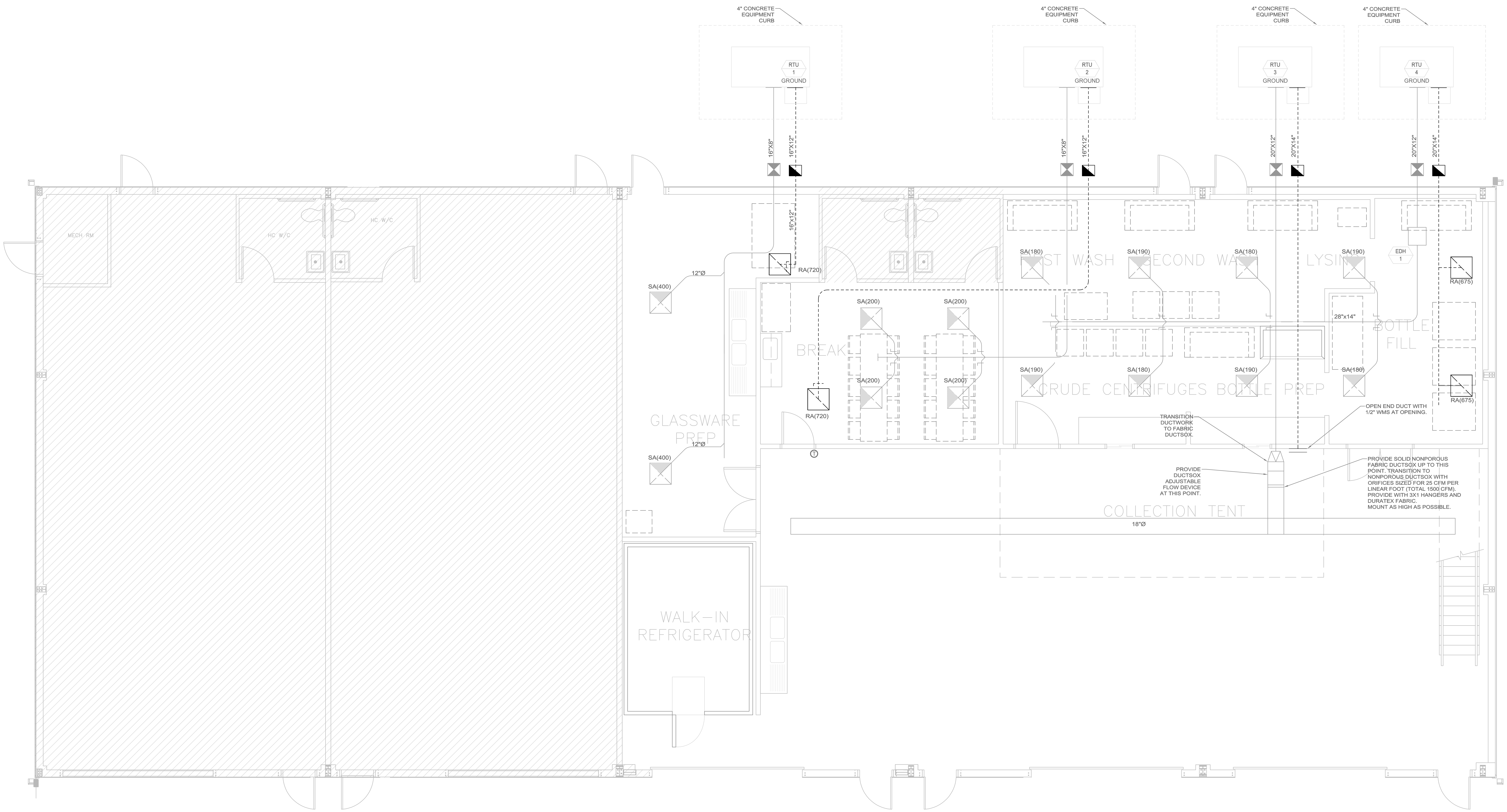
1	ISSUED FOR CONSTRUCTION	02-28-2022
No.	Description	Date

Drawn By:
Checked By:
Approved By:
Scale: NONE
Project No.: 0220068.00
Drawing Title:
HVAC SPECIFICATIONS

Drawing No.:
H-001

Owner's Drawing No.:



1 FIRST FLOOR PLAN - NEW WORK
1/4" = 1'-0"

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Seal

charles river

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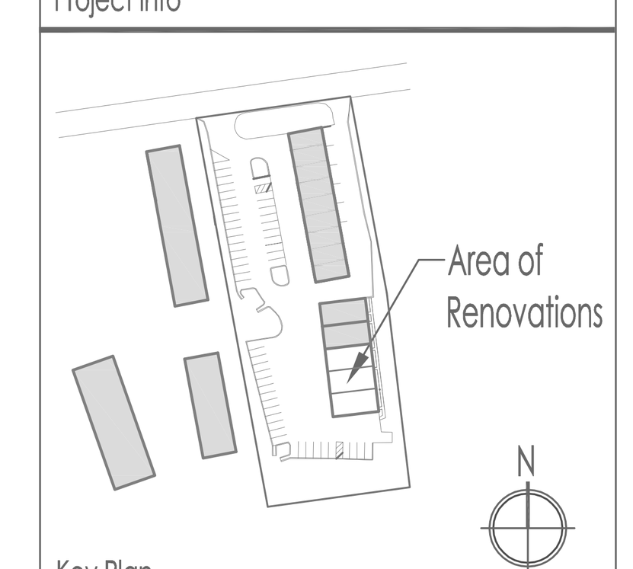
Project info



Key Plan

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1	ISSUED FOR CONSTRUCTION	02-28-2022

Drawn By:
Checked By:
Approved By:
Scale: AS NOTED
Project No.: 0220068.00

Drawing Title:
HVAC FIRST FLOOR
NEW WORK PLAN

Drawing No.:
H-210

Owner's Drawing No.:

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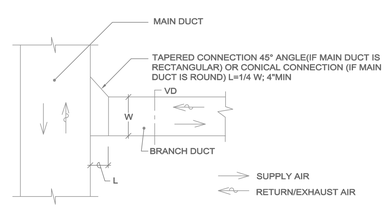
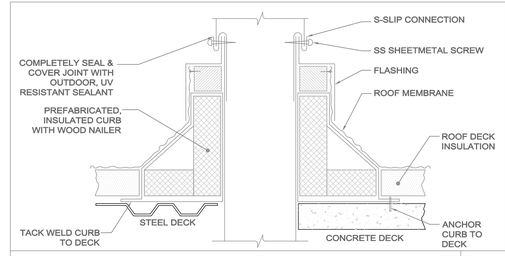
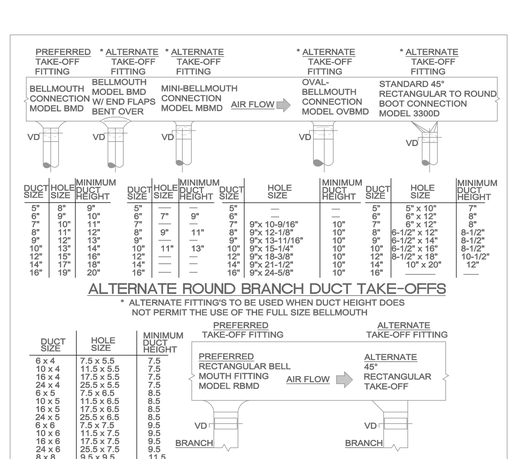


DUCT TAKE-OFF

RDK BRANCH TAKE-OFFS H1501



RDK DUCT PENETRATION THRU ROOF H905



DUCT SIZE	HOLE SIZE	MINIMUM DUCT HEIGHT
5"	8"	9"
6"	9"	10"
7"	10"	11"
8"	11"	12"
9"	12"	13"
10"	13"	14"
12"	15"	16"
14"	17"	18"
16"	19"	20"

DUCT SIZE	HOLE SIZE	MINIMUM DUCT HEIGHT
5"	7"	9"
6"	8"	10"
7"	9"	11"
8"	9"	11"
9"	10"	12"
10"	11"	13"
12"	12"	14"
14"	13"	16"
16"	14"	18"

DUCT SIZE	HOLE SIZE	MINIMUM DUCT HEIGHT
5"	—	—
6"	—	—
7"	9"x 10-9/16"	10"
8"	9"x 12-1/8"	10"
9"	9"x 13-1/16"	10"
10"	9"x 15-1/4"	10"
12"	9"x 18-3/8"	10"
14"	9"x 21-1/2"	10"
16"	9"x 24-5/8"	10"

DUCT SIZE	HOLE SIZE	MINIMUM DUCT HEIGHT
5"	5" x 10"	7"
6"	6" x 12"	8"
7"	6" x 12"	8"
8"	6-1/2" x 12"	8-1/2"
9"	6-1/2" x 14"	8-1/2"
10"	6-1/2" x 16"	8-1/2"
12"	8-1/2" x 18"	10-1/2"
14"	10" x 20"	12"
16"	———	———

ALTERNATE ROUND BRANCH DUCT TAKE-OFFS

* ALTERNATE FITTING'S TO BE USED WHEN DUCT HEIGHT DOES NOT PERMIT THE USE OF THE FULL SIZE BELLMOUTH

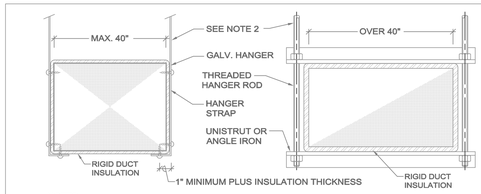
DUCT SIZE	HOLE SIZE	MINIMUM DUCT HEIGHT
6 x 4	7.5 x 5.5	7.5
10 x 4	11.5 x 5.5	7.5
16 x 4	17.5 x 5.5	7.5
24 x 4	25.5 x 5.5	7.5
6 x 5	7.5 x 6.5	8.5
10 x 5	11.5 x 6.5	8.5
16 x 5	17.5 x 6.5	8.5
24 x 5	25.5 x 6.5	8.5
6 x 6	7.5 x 7.5	9.5
10 x 6	11.5 x 7.5	9.5
16 x 6	17.5 x 7.5	9.5
24 x 6	25.5 x 7.5	9.5
8 x 8	9.5 x 9.5	11.5
16 x 8	17.5 x 9.5	11.5
24 x 8	25.5 x 9.5	11.5
10 x 10	11.5 x 11.5	13.5
16 x 10	17.5 x 11.5	13.5
24 x 10	25.5 x 11.5	13.5

ALTERNATE RECTANGULAR BRANCH DUCT TAKE-OFF

NOTES:
ALL ROUND AND RECTANGULAR BELLMOUTH FITTINGS SHALL BE INCLUDED WITH THE FOLLOWING STANDARD FEATURES:

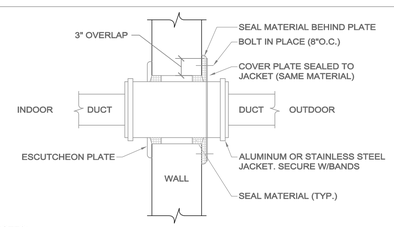
1. NEOPRENE GASKET TO MINIMIZE AIR LEAKAGE.
2. PRE-DRILLED HOLES FOR QUICK MOUNTING.
3. CONSTRUCTED OF HEAVY GALVANIZED STEEL.
4. 26 GAUGE GALV. QUADRANT VOLUME DAMPER W/ TIGHT FITTING GASKETING TO MINIMIZE LEAKAGE AT DAMPER PIVOT POINTS. (FOR LOW PRESSURE DUCTWORK)

RDK TYPICAL DUCT TAKE-OFF H1521



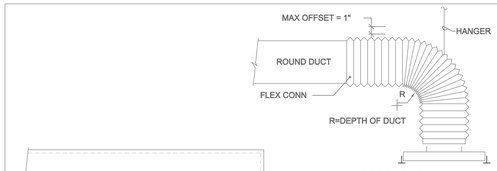
NOTES:
1. CUTTING AND PATCHING SHALL BE LIMITED TO A MINIMUM AS REQUIRED FOR PROPER INSTALLATION.
2. SUPPORTS SHALL BE SPACED AND SIZED AS PER SMACNA.

RDK DUCT HANGER SUPPORT H1508



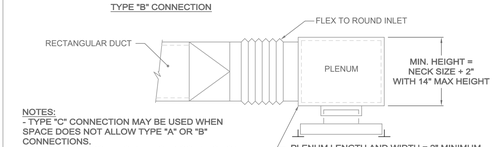
NOTES:
1. INSULATION NOT SHOWN FOR CLARITY, PROVIDE AS REQUIRED PER CONTRACT DOCUMENTS.

RDK EXTERIOR WALL DUCT PENETRATION H911



NOTE:
TYPE "B" CONNECTION MAY BE USED WHEN SPACE DOES NOT ALLOW TYPE "A" CONNECTION.

TYPE "B" CONNECTION

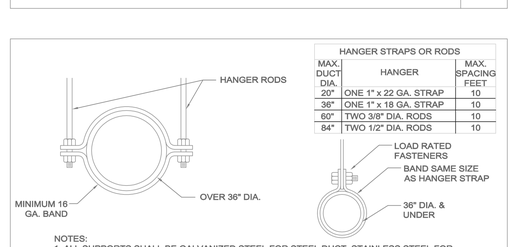


NOTES:
- TYPE "C" CONNECTION MAY BE USED WHEN SPACE DOES NOT ALLOW TYPE "A" OR "B" CONNECTIONS.
- BUCKLEY ASSOCIATES DIFFUSER CONNECTION BOOT TRANSITION DCBTR MAY BE USED.

TYPE "C" CONNECTION

NOTES:
1. THESE DETAILS ALLOW DUCTWORK TO BE PROVIDED BEFORE CEILING GRID IS INSTALLED THEN DIFFUSER/REGISTER CAN BE POSITIONED INTO GRID.
2. PROVIDE INSULATED TRANSITION ROUND TO SQUARE IF REQUIRED AT DIFFUSER.
3. PROVIDE NYLON TY-WRAP TOOL OR REUSABLE SS DRAW BAND PER SPECS.
4. FLEX DUCT SHALL NOT HAVE MORE TMAN 1/2" SAG PER FOOT.
5. LENGTH OF FLEX DUCT SHALL NOT EXCEED 6'-0".
6. PROVIDE DUCT MOUNTED VOLUME DAMPER WHENEVER POSSIBLE. TRY TO AVOID NECK DAMPERS.

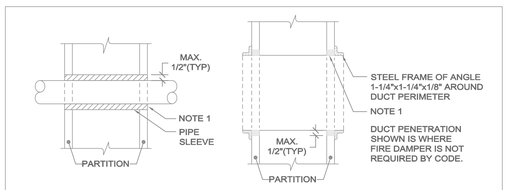
RDK TYPICAL SUPPLY DIFFUSER/ REGISTER DUCTWORK & CONNECTION H1517



HANGER STRAPS OR RODS		
MAX. DUCT DIA.	HANGER	MAX. SPACING FEET
20"	ONE 1" x 22 GA. STRAP	10
36"	ONE 1" x 18 GA. STRAP	10
60"	TWO 3/8" DIA. RODS	10
84"	TWO 1/2" DIA. RODS	10

NOTES:
1. ALL SUPPORTS SHALL BE GALVANIZED STEEL FOR STEEL DUCT, STAINLESS STEEL FOR STAINLESS STEEL DUCT, OR ALUMINUM FOR ALUMINUM DUCT.
2. HANGERS MUST NOT DEFORM DUCT SHAPE.
3. ATTACHMENTS TO STRUCTURE SHALL BE PER SMACNA.

RDK ROUND METAL DUCT HANGERS H008



NOTES:
1. AT FIRE RATED PARTITIONS ADD ADDITIONAL LAYER OF FIRE SAFING INSULATION AROUND PENETRATIONS SO AS TO FILL CAVITY.
2. DUCT AND PIPE PENETRATIONS THROUGH CORRIDOR WALLS ABOVE THE CEILING ARE TO BE FIRE STOPPED AROUND THE PENETRATION.

RDK DUCT & PIPE PENETRATIONS H901

Seal

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Charles River Microbial Solutions
Processing Facility Renovations
Harwich, MA

Project info

Key Plan

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1	ISSUED FOR CONSTRUCTION	02-28-2022

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Approved By:
Scale: NONE
Project No.: 0220068.00

Drawing Title:
HVAC SCHEDULES AND CONTROLS

Drawing No.:
H-600

Owner's Drawing No.:

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PACKAGED DX GROUND MOUNTED ROOFTOP AIR HANDLING UNIT SCHEDULE

TAG	SERVICE	LOCATION	REFRIGERANT		SUPPLY FAN								COOLING CAP. (MBH)		HEATING CAP @ 17°F	FACE VELOCITY (FPM)	*UNIT LAT (°F)			EER MIN EFF.	ROWS	FINS PER FT.	ELECTRIC SERVICE						FILTER	MANUFACTURER AND MODEL NUMBER	REMARKS
			TYPE	CHARGE (LBS)	CFM TOTAL	CFM DESIGN. O.A.	STATIC PRESS. (IN.WG) EXTERNAL	STATIC PRESS. (IN.WG) TOTAL W/ DIRTY FILTERS	OUTLET VELOCITY (FPM)	WHEEL DIA. (IN.)	WHEEL TYPE	MOTOR HP	TOTAL	SENS.	MBH		DB	WB	P.D. (IN.WG)				MCA	MOCP	V	PH	HZ	MIN. AIC RATING			
RTU-1	GLASSWARE	GROUND MOUNTED	R410A	-	800	80	1	1.1	-	-	FC	1.5	36	23.9	19	-	50.8	49.3	-	11	-	-	19.5	25	208	3	60	-	MERV 8	FRAZER JOHNSTON XN036	1-6
RTU-2	BREAK	GROUND MOUNTED	R410A	-	800	80	1	1.1	-	-	FC	1.5	36	23.9	19	-	50.8	49.3	-	11	-	-	19.5	25	208	3	60	-	MERV 8	FRAZER JOHNSTON XN036	1-6
RTU-3	STAGING	GROUND MOUNTED	R410A	-	1550	150	1.0	1.1	-	-	FC	1.5	53.5	39.6	30	-	55	54.9	-	11	-	-	27.7	35	208	3	60	-	MERV 8	JOHNSON CONTROLS XN060C00B1C5CCA2A1	1-6
RTU-4	LAB	GROUND MOUNTED	R410A	-	1550	150	1.0	1.1	-	-	FC	1.5	53.5	39.6	30	-	55	54.9	-	11	-	-	27.7	35	208	3	60	-	MERV 8	JOHNSON CONTROLS XN060C00B1C5CCA2A1	1-4,6-7

NOTES:

1) REFER TO SPECIFICATIONS, DETAILS, AND CONTROL DRAWINGS FOR ADDITIONAL INFORMATION.
2) FIXED OUTSIDE AIR PERCENTAGE OF 10%.
3) PROVIDE ECONOMIZER WITH BAROMETRIC RELIEF.
4) PROVIDE GROUND MOUNTED CONCRETE HOUSEKEEPING PAD.
5) PROVIDE WITH 7-DAY PROGRAMMABLE THERMOSTAT.
6) PROVIDE WITH PHENOLIC COATING ON CONDENSER COIL. UNIT TO BE PROVIDED WITH OCEAN/BEACH CORROSION PROTECTION PACKAGE.
7) PROVIDE WITH 7 DAY PRGRAMMABLE THERMOSTAT WITH RELATIVE HUMIDITY SENSOR AND WITH DEHUMIDIFICATION CONTROL OPTION FOR REMOTE DUCT HEATER.

DIFFUSER, GRILLE & REGISTER SCHEDULE

TAG	SELECTION RANGE (CFM)	NECK SIZE (IN.)	OVERALL SIZE (IN.)	SERVICE	MOUNTING	ACCESSORIES	MANUFACTURER AND MODEL NUMBER (AS STANDARD)	NC OR AIR PRESSURE DROP NOT TO EXCEED	REMARKS
SA	50 - 400	SEE PLANS	24x24	SUPPLY	CEILING	VD	TITUS OMNI AA	30	1,3
SB	0-780	SEE PLANS	18x10	RETURN	SURFACE	VD	TITUS 355 FL	30	1,2
RA	0-1880	SEE PLANS	24x24	RETURN	CEILING	VD	TITUS 355 FL	30	1,2
EA	0-400	SEE PLANS	12x12	EXHAUST	CEILING	VD	TITUS 355 FL	30	1,2,3
TA	0-780	SEE PLANS	12x6	TRANSFER	SURFACE		TITUS 355 FL	30	1

NOTES:

1 REFER TO SPECIFICATIONS AND DETAILS FOR ADDITIONAL INFORMATION.
2 PROVIDE WITH VD
3 COORDINATE FINISH, FRAME AND MOUNTING WITH ARCHITECT.
4. REFER TO DUCT SIZES ON PLANS FOR DIFFUSER NECK SIZE.

ELECTRIC DUCT HEATER SCHEDULE

TAG	LOCATION	CFM	INPUT (kW)	MAX OUTPUT (MBH)	SIZE	ELECTRIC SERVICE			MANUFACTURER AND MODEL NUMBER (AS STANDARD)	REMARKS
						V	PH	HZ		
EDH-1	LAB	1500	7.5	25.6	20"X12"	208	3	60	INDEECO QUZ	1

NOTES:

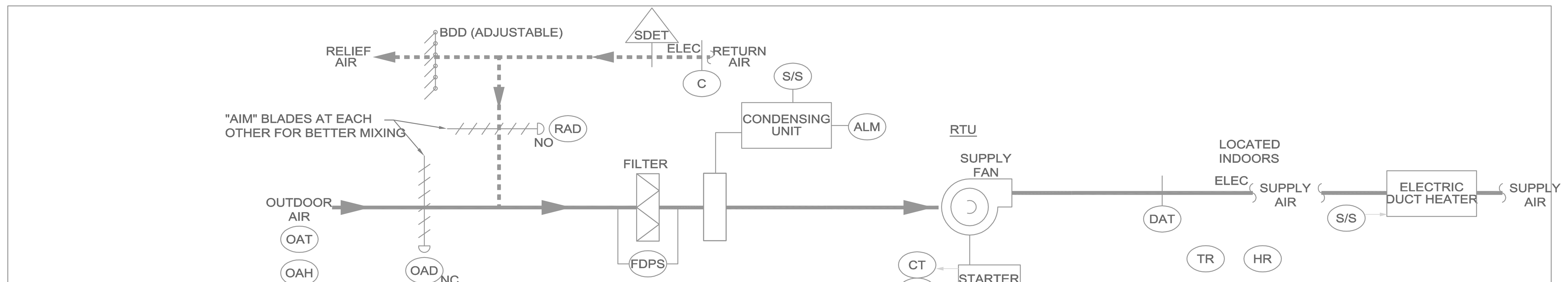
1 PROVIDE WITH MODULATING CONTROLLER. THERMOSTAT TO BE ABLE TO CONTROL ON TEMPRATURE OR HIGH HUMIDITY CALL.

MINIMUM DUCT INSULATION R-VALUES (IECC - 2018 AND ASHRAE 90.1-2016 COMPLIANCE)

LOCATION	SUPPLY	RETURN
ATTIC TYPE SPACE (EXPOSED ROOF ABOVE)	R-12	R-12
OUTDOORS	R-12	R-12
BELOW GRADE	R-6	R-6
UNCONDITIONED SPACE (SHAFT OR CEILING WITH DUCTED RETURN AIR)	R-6	R-6

NOTES: (SEE SPECIFICATIONS FOR R-VALUES OF VARIOUS DUCT INSULATION AND LINERS).

1. R-VALUES SHOWN MAY BE OBTAINED BY ADDING THE R-VALUES OF BOTH THE LINING (WHERE SHOWN OR USED) AND EXTERNAL DUCT INSULATION.
2. R-VALUES SHOWN ARE AS INSTALLED. USE R-VALUES FOR 25% COMPRESSION FOR NON-RIGID INSULATION.
3. REFER TO SPECIFICATIONS AND DETAILS FOR ADDITIONAL INFORMATION.



ROOFTOP UNIT CONTROL SEQUENCES (CV, <15,000 CFM)

ROOF TOP UNIT CONTROLS

GENERAL

1. ROOFTOP UNIT SHALL BE STARTED AND STOPPED VIA PROGRAMMABLE THEROMSTAT. COORDINATE OCCUPIED AND UNOCCUPIED SCHEDULES WITH OWNER. ALL SETPOINTS SHALL BE ADJUSTABLE. ALL ACTUATORS SHALL BE ELECTRONIC.
2. LOCAL HAND-OFF-AUTOMATIC SWITCH (H-O-A) FOR FANS SHALL OVERRIDE DDC START/STOP (S/S) COMMANDS. ALL HARDWIRED SAFETIES SHALL BE ACTIVE IN BOTH "H" AND "A" POSITIONS.
3. ALL TEMPERATURES LISTED ARE FAHRENHEIT.
4. ALL TEMPERATURE SENSORS IN THE UNIT AND DUCTWORK SHALL BE AVERAGING TYPE.
5. PROVIDE APPROPRIATE ANTI-RECYCLE TIME DELAYS AND SAFETIES ON COMPRESSOR AND GAS HEATER STAGING.

FAN CONTROL

1. WHILE IN UNOCCUPIED MODE (OR OFF ON SAFETY OR MANUAL DISCONNECT) THE SUPPLY FAN SHALL BE OFF WITH THE OUTSIDE AIR DAMPER (OAD) AND EXHAUST AIR DAMPER (EAD) CLOSED, THE CONDENSING UNIT AND ELECTRIC HEATER OFF, AND THE RETURN AIR DAMPER (RAD) OPEN.
2. WHEN STARTED IN OCCUPIED MODE, THE SUPPLY FAN SHALL START IN RECIRCULATION MODE, THEN THE OAD AND RAD SHALL OPEN TO THE MINIMUM OUTDOOR AIR POSITION.

OCCUPIED COOLING CONTROL

1. UPON A RISE IN ROOM TEMPERATURE ABOVE THE ROOM COOLING SETPOINT OF 75°F, THE COOLING CYCLE SHALL BE ACTIVATED.
2. THE FIRST MEANS OF COOLING SHALL BE ACTIVATION OF THE ECONOMIZER. IF THE OUTSIDE AIR ENTHALPY IS BELOW THE ROOM ENTHALPY, THE OUTSIDE AND RETURN AIR DAMPERS SHALL BE PROPORTIONALLY MODULATED UP TO 100% OUTDOOR AIR TO MAINTAIN SPACE TEMPERATURE SETPOINT. DAT SHALL OVERRIDE, IF REQUIRED, TO LIMIT SUPPLY AIR TEMPERATURE TO 55°F MINIMUM DURING ECONOMIZER COOLING (LIMIT SHALL NOT RESULT IN REDUCTION OF THE MINIMUM OUTDOOR AIRFLOW). IF ADDITIONAL COOLING IS REQUIRED, THE CONDENSING UNIT'S COMPRESSORS SHALL BE STAGED ON AS REQUIRED. FOR LOW LOAD OPERATION, HGB SHALL BE USED. THE REVERSE SHALL OCCUR ON A DROP IN SPACE TEMPERATURE BELOW COOLING SETPOINT.
3. IF THE OUTSIDE AIR ENTHALPY RISES ABOVE THE ROOM AIR ENTHALPY THE ECONOMIZER SHALL BE POSITIONED TO PROVIDE MINIMUM OUTDOOR AIRFLOW AND THE CONDENSING UNIT STAGED TO MAINTAIN ROOM COOLING SETPOINT TEMPERATURE. DAT SHALL LIMIT SUPPLY AIR TO 48°F MINIMUM, DURING MECHANICAL COOLING.

OCCUPIED/UNOCCUPIED HEATING CONTROL

1. UPON A DROP IN ROOM TEMPERATURE BELOW THE ROOM HEATING SETPOINT OF 70°F, HEAT PUMP/ELECTRIC HEAT SHALL BE STAGED TO MAINTAIN THE SPACE TEMPERATURE SETPOINT. THE REVERSE SHALL OCCUR ON A RISE IN SPACE TEMPERATURE.
2. DISCHARGE AIR TEMPERATURE SENSOR DAT SHALL STAGE THE HEAT PUMP/ELECTRIC HEAT TO MAINTAIN A MINIMUM TEMPERATURE OF 50°F DURING THE HEATING SEASON.

DEHUMIDIFICAITON CONTROL

1. IF THE THERMOSTAT DETECTS THE RH OF THE SPACE IS GREATER THAN 58%, THE THERMOSTAT SHALL SEND A COOLING CALL TO THE RTU AND A HEATING CALL TO THE DUCT MOUNTED HEATER. THE DEHUMIDIFICATION CALL SHALL CONTINUE UNTIL THE RH OF THE SPACE IS LOWER THAN 55% RH. ONCE THE RH IS BELOW 55% THE DEHUMIDIFCATION CALL SHALL END AND THE THERMOSTAT SHALL RESUME NORMAL HEATING AND COOLING MODES.

UNOCCUPIED CONTROL

1. IF, WHEN THE UNIT IS OFF, THE ROOM TEMPERATURE FALLS BELOW 56°F, THE UNIT SHALL START WITH RAD OPEN AND OAD CLOSED AND GAS HEATER SHALL BE CONTROLLED BY DAT TO SUPPLY 90°F AIR. WHEN ROOM TEMPERATURE RISES ABOVE 60°F, THE UNIT SHALL SHUT DOWN. EF SHALL REMAIN OFF WITH EAD CLOSED.
2. BUTTON ON TR SHALL ALLOW 2-HOUR OVERRIDE FROM UNOCCUPIED TO OCCUPIED CONTROL.

SAFETIES

1. THE FOLLOWING SAFETIES EACH WITH ITS OWN MANUAL RESET BUTTON, SHALL SHUT DOWN THE UNIT VIA HARDWARE BEFORE H-O-A.

a. WHEN ANY SMOKE DETECTOR (SDET) IS ACTIVATED THE UNIT SHALL SHUT DOWN.

ALARMS

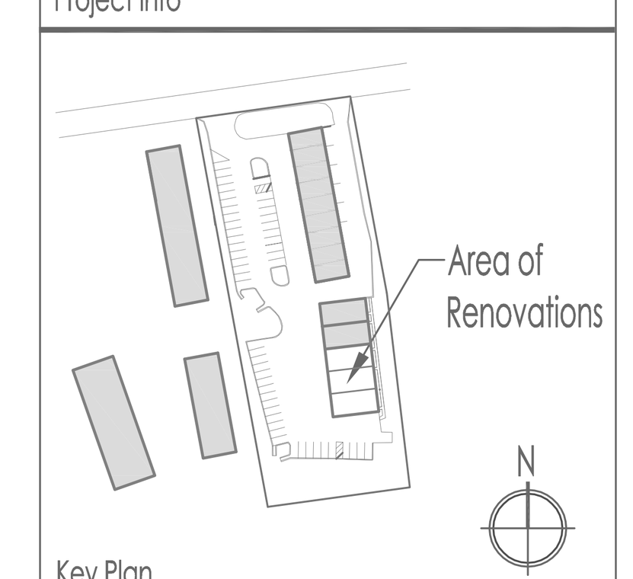
1. IF THE SUPPLY FAN FAILS OR IF ANY SAFETY IS TRIPPED, THE DDC CONTROLLER SHALL GIVE AN ALARM SIGNAL.
2. IF FILTER PRESSURE DROP EXCEEDS SETPOINT (INITIALLY 0.6") FOR 10 MINUTES, THE DDC CONTROLLER SHALL GIVE AN ALARM SIGNAL.

ROOFTOP UNIT CONTROL SEQUENCES (CV, <15,000 CFM) — HC002

Seal

charles river
Charles River Microbial Solutions
Processing Facility Renovations
Harwich, MA

Project info



Key Plan

No.	Description	Date
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1	ISSUED FOR CONSTRUCTION	02-28-2022

Drawn By:
Checked By:
Approved By:
Scale: NONE
Project No.: 0220068.00
Drawing Title:
HVAC SCHEDULES AND CONTROLS

Drawing No.:
H-600

Owner's Drawing No.: