	ABBREVI	ATI	ONS		
AAV ABV	AUTOMATIC AIR VENT ABOVE	HW HWR	HOT WATER HW RECIRC/HEATING WATER RETURN	1 [GENERAL MECHANICAL REQUIREMENTS
AC	AIR CURTAIN	HWS	HEATING WATER SUPPLY		1 Materials, equipment, and systems shall me
ACO	ABOVE FINISHED FLOOR	HX	HEAT EXCHANGER		Laboratory (UL), the American Society for Tes
AHU @	AIR HANDLING UNIT	HZ IFFR	HERIZ		Heating, Refrigeration and Air-Conditioning Er Conditioning Contractors National Association
AFMS	AIR FLOW MEASURING STATION	IN W.C.	INCHES WATER COLUMN		National Fire Protection Association (NFPA)an the latest adopted edition of state and local of
AS	AIR SEPARATOR	ISP	INTERNAL STATIC PRESSURE		including the most stringent of health and sa
ATG AV	ADC TRANSFER GRILL AUTOMATIC AIR VENT	IRH	INFRARED RADIANT TUBE HEATER		to the following: "international plumbing, build
В	BOILER	KH	KITCHEN EXHAUST FAN		applicable local and municipal codes and or
BAS BC	BUILDING AUTOMATION SYSTEM	KW	KILOWATT		2. Bidders shall be licensed contractors in acco
BDD	BACKDRAFT DAMPER (GRAVITY)	L			3. Bidders shall thoroughly acquaint themselves
BDR	BASEBOARD RADIATOR	LAT	POUNDS		way dependent upon, and bring any discrepa
BEL	BELOW	LBS/HR	POUNDS PER HOUR		drawings to the owner's attention before subr measurements.
BHP	BRAKE HORESPOWER	LF	LINEAR FOOT		4. The systems shown on the drawings shall be
BLDG	BUILDING	LG I PR	LENGTH LOW PRESSURE STEAM RETURN		areas within the Contract Limit Lines as set for
BOD	BOTTOM OF DUCT	LPS	LOW PRESSURE STEAM SUPPLY		apply to this section. Systems shall include a
BUP	BRITISH THERMAL UNITS PER HOUR	LWT	LEAVING WATER TEMPATURE		controls necessary for the intended service.
СА	COMPRESSED AIR	MAT Mali	MIXED AIR TEMPERATURE		5. All permits and fees required for this work sh contractor and included in bid price.
CC	COOLING COIL	MAV	MANUAL AIR VENT		6 Anything drawn or specified on these plans s
CD CFM	CUBIC FEET PER MINUTE	MAX	MAXIMUM		municipal or state law, regulation or ordinance
СН	CHILLER	MBH	THOUSANDS OF BTU PER HOUR		or related work. where any portion of the sys applicable laws, ordinances, regulations and
CHR	CHILLED WATER RETURN	MIN	MINIMUM		required by the enforcing authorities in a ma cost to the owner. Where plan requirements a
CHS	CHILLED WATER SUPPLY	M.O.D.	MOTOR OPERATED DAMPER		be in accordance with the plans.
¢	CENTER LINE	MOCP	MAXIMUM OVERCURRENT PROTECTION		7. Where job conditions require changes from the
COND	CONDENSATE	N.C.	NOISE URITERIA NORMALLY CLOSED		scope of installation or nature of work require additional cost to the owner. No other change
COP	COEFFICIENT OF PERFOMANCE	NIC	NOT IN CONTRACT		owner.
CU	CONDENSING UNIT	N.O.	NORMALLY OPEN		8. All equipment shall be new and unused, UON
CUH	CABINET UNIT HEATER	NTS OA	NOT TO SCALE		where these specifications require a higher of
CV	CONSTANT VOLUME / CONTROL VALVE	OBD	OPPOSED BLADE DAMPER		shall be made available at the job site.
CW CR	CONDENSER WATER RETURN	OED	OPEN END DUCT		9. All installed systems, devices and related ite
CS	CONDENSER WATER SUPPLY	P	PUMP		and all contractor-supplied defective devices
DB	DRY BULB TEMPATURE	PD	PRESSURE DROP		owner for resolution.
DC °F	DRY COOLER DEGREE FAHRENHEIT	PDH	POOL ROOM DEHUMIDIFIER		10. Contractor shall guarantee all work for which
DH	DEHUMIDIFIER	PH ddm	PHASE		all factory assembled equipment for which no and all work in connection with installing mar
DN	DOWN	PPM PRV	PRESSURE RELIEF VALVE		contractor's guarantee shall exist for a period
DOAS	DEDICATED OUTDOOR AIR SYSTEM	PS	PRESSURE SWITCH		any kind.
DX	DX COOLING COIL	PSI	POUNDS PER SQUARE INCH		11. Contractor shall replace at contractor's own e
EA	EXHAUST AIR	PSIA PSIG	POUNDS PER SQUARE INCH ABSOLUTE POUNDS PER SQUARE INCH GAUGE		equipment, and related items that fail or are
EA.		PTAC	PACKAGED TERMINAL AIR CONDITIONER		12. Arrange for chases, slots, and openings in ot installations. Coordinate the installation of re-
EAT	ENTERING AIR TEMPERATURE ENERGY EFFICIENT RATIO	RA	RETURN AIR		poured in place concrete and other structura
EF	EXHAUST FAN	RF RG	RETURN AIR FAN / RELIEF AIR RETURN GRILLE (LESS DAMPER)		equipment and materials.
EFF		RH	RELATIVE HUMIDITY		13. Sequence, coordinate, and integrate installati
EG	ELEVATION	RHC	REHEAT COIL		efficient flow of the Work. Give particular atte to closing-in the building.
ER	EXHAUST REGISTER	RLA RDM	RUNNING LOAD AMPS		14. Coordinate mechanical equipment and mater
ERV	ENERGY RECOVERY VENTILATOR	RLFA	RELIEF AIR		Coordinate the installation of mechanical ma
ESP FT	EXTERNAL STATIC PRESSURE	RM.	ROOM		suspension system, light fixtures, and other i
EUH	ELECTRIC UNIT HEATER	RR	RETURN REGISTER (WITH DAMPER)		15. Equipment locations, roof & wall openings ar G.C., equipment supplier, and owner. Provide
EWH	ELECTRIC WALL HEATER	RX	ROOFTOP AIR HANDLING UNIT REMOVE EXISTING		required and around wall opening(s) where re
EWT fy	ENTERING WATER TEMPERATURE	SA	SUPPLY AIR		16. Do not endanger or damage installed Work th
EXT	EXTERNAL	SAF	SUPPLY AIR FAN		patering. Arrange for repairs required to rest result of mechanical installations.
FCU	FAN COIL UNIT	SD Sefr	SUPPLY DIFFUSER/SMOKE DAMPER		17. Where mounting heights are not detailed or c
FD		SF	SQUARE FOOT		overhead equipment to provide the maximum
FLA FL	FLOOR	SPEC.	PROJECT SPECIFICATIONS		18. Install mechanical equipment to facilitate ma
FLEX	FLEXIBLE	SPF	STAIR PRESSURIZATION FAN SUPPLY GRITTF		minimum of interference with other installatio
FO	FLAT OVAL	SR	SUPPLY REGISTER		19. For all air systems: adjust fans, supply regist
г РМ FPMR	FAN POWERED MIXING BOX	STRUCT.	STRUCTURAL		to balance all systems to match listed airflow Replace fan drive if required to achieve desig
FSD	FIRE SMOKE DAMPER	ILMP TF	IEMPERATURE TRANSFER FAN		independent AABC or NEBB certified firm. Sur final airflow data, and shall include a list of d
FT	FEET	TOD	TOP OF DUCT		20 For all water evetame: adjust ball values bal
FTF	SQUARE FEET FINNED TUBE RADIATOR	TOP	TOP OF PIPE		piping to match GPM and pressure and temp
GAL	GALLON	TSP	THERMOSTAT		certified firm. Summary report shall include o
GC	GENERAL CONTRACTOR	TYP	TYPICAL		include a list of deficiencies.
GIH GPM	GRAVITY INTAKE HOOD GALLONS PER MINUTE	UH	UNIT HEATER		21. The entire installation, including the gauges of SMACNA standards, except where these spec
GR	GLYCOL RETURN	UUN UV	UNLESS UTHERWISE NUTED		System is 1" pressure class, UON. All ducts s
GRH	GAS RADIANT HEATER	V	VOLT		or 181B certified.
GS GUH	GLYCOL SUPPLY GAS UNIT HEATER	VAC	VOLTS ALTERNATING CURRENT		22. All 90 degree turns in supply and return duct
GV	GRAVITY VENTILATOR	VAV VD	VARIABLE AIR VOLUME TERMINAL VOLUME DAMPER		turning vanes at 2" spacing extended in the or radius-to-width ratio of 1.0 or greater. Mitered
H HC	HUMIDIFIER HEATING COIL	VEH	VEHICLE EXHAUST		radiused-heel elbows, and radiused-throat sq
HCWR	DUAL TEMPERATURE RETURN	VFD	VARIABLE FREQUENCY DRIVE		transitions shall be should (30 degree taper
HCWS HGRH	DUAL TEMPERATURE SUPPLY HOT GAS REHEAT	VP Vrf	VELOCITY PRESSURE		
HP	HEAT PUMP / HORSEPOWER	W	WATTS		
HPR HPS	HIGH PRESSURE STEAM RETURN	W/	WITH		
HR	HOUR	W/O WR	WITHOUT WET BUI B		
HRC HRV	HEAT RECOVERY COIL HEAT RECOVERY VENTILATOR	WG	WATER GAUGE		
		WSHP	WATER SOURCE HEAT PUMP		

shall meet all pertinent requirements of the Underwriters ty for Testing Materials (ASTM), American Society of ioning Engineers (ASHRAE), Sheet Metal and Air sociation (SMACNA), American Gas Association (AGA), (NFPA)and other nationally recognized agencies as well as nd local code procedures, methods, and requirements, h and safety standards as required and as interpreted by plicable codes and standards include, but are not limited wing, building, energy, mechanical, and fuel gas codes" s and ordinances.

in accordance with local and state laws.

emselves with the conditions under which the work is to be ervices, equipment, surfaces, etc., which this work is in any discrepancies determined or omissions found in the fore submitting bid. Verify all dimensions by field

shall be provided to serve all fixtures, equipment, and as set forth by the Architectural solution for the project. hts, general requirements, and general provisions shall include all equipment, appurtenances, safety devices, and

work shall be secured and paid for by the mechanical

e plans shall not be construed to conflict with any local, ordinance which governs the installation of any mechanical the systems is not installed as in accordance with ons and codes, this contractor shall make all changes in a manner approved by the owner and without additional ements are more stringent than code, the installation shall

s from the contract documents that do not change the k required, the contractor shall make such changes without r changes may be made without written permission of the

sed, UON, and shall bear the label of an approved agency. trict conformance to manufacturer's instructions, except higher quality installation than recommended by nent shall be provided with installation instructions, which

lated items shall be tested in place on site. Replace any devices, items or systems at contractor's own expense ort any problems with existing to remain (ETR) items to

r which materials are furnished, fabricated or field erected, which no specific manufacturer's guarantee is furnished, ing manufacturer's guaranteed equipment. This a period of one (1) year from the date of final owner ly to defects in material and to defective workmanship of

's own expense any contractor-supplied materials, I or are found to be defective within the guarantee period. Ings in other building components to allow for mechanical

on of required supporting devices and sleeves to be set in tructural components, as they are constructed. Coordinate components to accommodate installation of mechanical

installations of mechanical materials and equipment for sular attention to large equipment requiring positioning prior

d materials installation with other building components. ical materials and equipment above ceilings with I other installations.

nings are approximate: verify size and coordinate with Provide steel framing around roof opening(s) where where required.

d Work through procedures and processes of cutting and d to restore other work, because of damage caused as a

led or dimensioned, install mechanical services and naximum headroom possible.

tate maintenance and repair or replacement of equipment onnect equipment for ease of disconnecting, with stallations.

bly register dampers, and duct volume dampers as needed ad airflows (+/- 10%), and provide a written summary report. eve design airflows. Air balance shall be performed by an firm. Summary report shall include design, preliminary and list of deficiencies.

ves, balance valves, pumps, etc, as needed to balance all nd temperature ranges shown, and provide a written ce shall be performed by an independent AABC or NEBB include design, preliminary and final flow data, and shall

gauges of ductwork, shall be in strict compliance with ese specifications require a stricter installation standard. Il ducts shall be sealed to meet SMACNA Class A d at intervals not exceeding 10'. Sealant shall be UL-181A

turn ductwork shall be mitered elbows with single wall d in the direction of airflow, or smooth radius elbows with a r. Mitered elbows without turning vanes, square-throat throat square-heel elbows are NOT acceptable. All duct ree taper maximum), not abrupt.

- 23. All supply and return and outside air ducts inside the building thermal envelope shall be insulated with 1.5" fiberglass duct insulation. All supply and return ductwork outside the building thermal envelope shall be insulated with 3" fiberglass duct insulation (minimum R-8 "installed" value). Insulation shall be fiberglass wrap with scrim-reinforced foil backing. Seal all joints and punctures to preserve vapor barrier.
- 24. Duct smoke detectors and accessories shall be UL tested and listed. Equipment and installation shall meet all pertinent requirements of the mechanical code and NFPA 72. Duct smoke detectors located more than 10 ft above the finished floor, or located such that the detector's alarm indicator is not visible to responding personnel, shall be provided with remote alarm indicators. Each remote indicator shall be clearly labeled as to function and air handling unit served, with an acrylic engraved nameplate.
- 25. All curtain-type fire dampers shall be UL 555 listed and dynamic rated, except that static rated fire dampers shall be permitted where the air handling system is automatically shut down in the event of fire. Provide and install duct access panel with acrylic engraved nameplate for each fire damper.
- 26. All diffusers and grilles shall be factory finished white, unless otherwise noted.
- 27. All mechanical equipment shall have vibration isolators, as well as flexible duct connectors. Flexible connectors shall be UL 181 tested and labeled, and shall not exceed 14' in length. Mechanical fasteners and sealants shall be used to connect ducts to mechanical equipment.
- 28. All duct coverings, linings, tape and vibration isolation connectors shall have a maximum flame spread rating of 25, and a maximum smoke generation rating of 50.
- 29. All duct dimensions listed on plans are inside clear dimensions. Where internally lined ductwork is specified, adjust sheet metal dimensions to accommodate liner.
- 30. Flexible ducts shall not exceed 6' in length, nor shall they be installed where they must be flattened. Flexible ducts shall be UL 181 tested and labeled, and must be fastened per SMACNA standards. If job conditions do not permit proper installation of flexible duct, rectangular galvanized steel duct with equal free area shall be used instead. Flexible ducts shall not be used where exposed, or where concealed above drywall or plaster ceilings.
- 31. Provide volume dampers at each branch off of a trunk duct to a supply diffuser.
- 32. Ductwork is shown in schematic form. All required duct risers and drops to allow general routing depicted may not be shown. Provide offsets as required to meet space requirements and to avoid interference with other trades and field conditions. Exact location of the ductwork may vary according to the coordinated space requirements. Each trade shall be totally responsible for coordination with other trades. Notify engineer of conditions representing significant changes to the designed routing
- 33. Coordinate size, quantity, and location of all openings required for duct and pipe penetrations through walls, floors, and roofs, with contractor responsible for rough framing. Coordinate location of air intakes with exhaust and plumbing vents so that intakes are a minimum of 10 feet from exhaust openings or plumbing vents
- 34. Install ducts in longest length possible and fewest possible joints. Install fabricated fittings for changes in directions, changes in size and shape, and connections
- 35. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs unless specifically indicated on drawings
- 36. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated
- 37. All mechanical equipment with the exception of air handling units, supported from floor structure shall be mounted on 4" thick concrete housekeeping pads unless noted otherwise. air-handling units shall be mounted on 6" thick concrete housekeeping pads to accommodate proper trapping of the condensate drain.
- 38. Air filters shall be replaced in all air handling equipment employing such prior to final completion and owner occupancy
- 39. Basis of design mechanical equipment is as scheduled on the drawings. Contractor assumes responsibility for coordinating physical space requirements of equivalent capacity mechanical equipment deemed acceptable by the engineer
- 40. Mechanical equipment factory finish damaged during the course of construction shall be restored to original condition prior to final acceptance
- 41. Coordinate mechanical ceiling devices such as diffusers and registers with light fixtures, speakers, sprinkler heads, etc.
- 42. Electrical equipment spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures. Avoid routing ductwork directly above electrical equipment unless specifically indicated on the mechanical drawings
- 43. Non-Fire-Rated Partition Penetrations: where ducts pass through interior partitions and are exposed to view in mechanical rooms, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. overlap opening on four sides by at least 1-1/2 inches unless indicated otherwise
- 44. Fire-Rated Partition Penetrations: where ducts pass through interior partitions, install appropriately rated fire damper. Fire damper installation must strictly adhere to manufacturer's written instructions
- 45. All air handlers, condensers, control devices and other mechanical apparatus shall be clearly marked for easy identification and owner Use black plastic or bakelite name plate engraved with white letters 1/4" high. Punched tape is not acceptable.
- 46. Mechanical contractor shall furnish record set of drawings with any deviations marked in red ink, within 90 days of system acceptance.
- 47. Mechanical contractor shall furnish manuals for all new equipment within 90 days of system acceptance, including, at a minimum: equipment input and output capacity and required maintenance actions, O&M manuals, controls maintenance and calibration information (including wiring diagrams and controls set points), and a complete written narrative of how each system is intended to operate. Systems shall be tested to ensure that controls are calibrated, adjusted, and in proper working condition.
- 48. All submittals shall be sent in pdf format, hard copies will not be reviewed. Submittals shall be highlighted or redlined to indicate equipment ID from schedules, model number, performance data, electrical data, dimensions, weights, options and accessories, and shall be emailed to the Architect.
- 49. Ductwork systems in areas with drywall ceilings/bulkheads shall be balanced prior to closing of the ceiling. All air devices mounted in drywall ceiling to have trim panels. Where access to manual balancing dampers will not be easily accessible, provide cable controlled damper at neck of diffuser or at duct main takeoff. Metropolitan air technology "roto-twist" model RT-150 or equal.

20x12	RECTA
<u>↓ 10"Ø</u>	ROUNE
<u>12x8</u> Φ	FLAT
	VOLUN
FD FD	FIRE [
SD AD	SMOK
SP SP	STATI
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NOTE:	
ALL SYMBOLS ARE S USED, AS WELL AS ADDITIONAL INFORM	HOWN FO NOT ALL 1ATION.
DRAWI	NG
	WORK - H
EXIST	'ING TO F
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SYMBOL

N	(
ALL CONTR. WORK SITE DIFFER FRC ARCHITECT MAY BE ISS CONTRACT( THE CONTR	

١	MECHANICAL SY	'MBOL	S LIST					
	DESCRIPTION	SYMBOL	DESCRIPTION					
<b>_</b>	RECTANGULAR DUCT	$\boxtimes$	4- WAY BLOW SUPPLY AIR DIFFUSER					
<b>`</b>	ROUND DUCT	-+-	NON-4 WAY DIFFUSER AIR PATTERN					
<b>_</b>	FLAT OVAL DUCT		LINEAR SUPPLY AIR DIFFUSER					
		$\bigotimes$	ROUND SUPPLY AIR DIFFUSER					
~	VOLUME DAMPER		RETURN AIR GRILLE					
<b>_</b>	FIRE DAMPER W/ACCESS DOOR		EXHAUST AIR REGISTER					
<b>_</b>	SMOKE DAMPER W/ ACCESS DOOR		CEILING EXHAUST FAN					
_	STATIC PRESSURE SENSOR	<del>&lt;1</del> _	DIRECTION OF AIR FLOW					
	MOTOR OPERATED DAMPER		DEMOLISH TO THIS LOCATION					
		Ō	THERMOSTAT					
>	FLEXIBLE CONNECTION	(D _R	REVERSE ACTING THERMOSTAT					
<b>_</b>	SOUND LINED DUCTWORK	Θ	HUMIDISTAT					
	CAPPED DUCTWORK	S	SENSOR					
1	CAPPED DUCTWORK	9	SMOKE DETECTOR					
	DUCTWORK TRANSITIONS	P	PRESSURE SENSOR					
		©	GAS DETECTOR SENSOR					
-	ROUND TO RECTANGULAR TRANSITION	\$	ON/OFF SWITCH					
>	DUCTWORK TRANSITION	\$ ^v	VARIABLE SPEED SWITCH					
<b>_</b>	RISE AND DROP IN DUCTWORK	¢	CUBIC FEET PER MINUTE (CFM)					
>	RISE AND DROP IN DUCTWORK	ø	DIAMETER FLAT OVAL					
		(1)	DRAWING NOTE					
	TORNING VANES	$(\underline{\cdot})$	REVISION SYMBOL					
	RADIUS ELBOW	<u> </u>	1" UNDERCUT DOOR					
	SUPPLY DUCT DOWN	€⁄	DOOR LOUVER					
	SUPPLY DUCT UP	$\langle 1 \rangle$	EQUIPMENT IDENTIFIER					
	RETORN DOCT DOWN							
	RETURN DUCT UP							
	EXHAUST DUCT DOWN							
	EXHAUST DUCT UP							
-	AIR TITE FITTING W/INTEGRAL VOLUME DAMPER							
)	TOP AIR TITE FITTING CONNECTION							
	DOUBLE LINE FLEXIBLE DUCT							
	SINGLE LINE FLEXIBLE DUCT							

ARE SHOWN FOR REFERENCE ONLY. CONTRACTOR SHALL NOTE THAT NOT ALL SYMBOLS MAY BE LL AS NOT ALL SYMBOLS USED MAY BE LISTED. REFER TO PROJECT SPECIFIC NOTES FOR

## WING CONVENTIONS

NEW WORK - HEAVY AND SOLID LINES EXISTING TO REMAIN - LIGHT AND SOLID LINES REMOVE EXISTING - HEAVY AND DASHED LINES

## OTICE TO CONTRACTORS

ACTORS PRIOR TO BID SUBMISSION PROCESS SHALL VISIT PROPOSED AND FIELD VERIFY ALL EXISTING CONDITIONS. ANY CONDITIONS THAT OM THAT SHOWN ON THESE PLANS SHALL BE REPORTED TO VENGINEER SO THAT NEW AND REVISED BID DRAWINGS OR INFORMATION SUED. MODIFICATIONS TO SCOPE OF WORK WHICH RESULT FROM ORS NEGLECT TO VISIT THE SITE PRIOR TO SUBMITTING BID, SHALL BE RACTORS SOLE RESPONSIBILITY.





# MECHANICAL MEZZANINE PLAN - DEMOLITION SCALE: 1/8" = 1'-0"



SCALE: 1/8" = 1'-0"

## DRAWING NOTES 1#

- 1. REMOVE EXISTING FLOOR MOUNTED AIR HANDLING UNIT AND ALL ASSOCIATED APPURTENANCES.
- 2. REMOVE EXISTING OUTDOOR GRADE MOUNTED CONDENSING UNIT AND ALL ASSOCIATED APPURTENANCES.
- 3. REMOVE EXISTING RS & RL PIPING FROM INDOOR UNITS TO OUTDOOR UNITS.
- REMOVE EXISTING SUPPLY AIR DUCTWORK AND ALL ASSOCIATED DUCTWORK BACK TO LOCATION SHOWN ON DRAWING.
- 5. REMOVE EXISTING RETURN AIR DUCTWORK AND ALL ASSOCIATED DUCTWORK BACK TO
- LOCATION SHOWN ON DRAWING.
- LOCATION SHOWN ON DRAWING.
- SHOWN (TYPICAL).
- 9. REMOVE EXISTING EXHAUST AIR LOUVER AND PATCH PENETRATION.
- 11. REMOVE EXISTING CEILING MOUNTED EXHAUST FAN AND ALL ASSOCIATED DUCTWORK
- AND APPURTENANCES. 12. REMOVE EXISTING INTAKE AIR LOUVER AND PATCH PENETRATION.
- 13. REMOVE EXISTING HEATER.





## 125 (E) SERVICE SHOP VENTILATION ANALYSIS:

0.75 CFM/SQ.FT. OF "MECHANICAL" EXHAUST IS REQUIRED BY THE 2018 INTERNATIONAL MECHANICAL CODE, SECTION 403, DURING OCCUPIED TIMES. 1 CFM/SQ.FT. OF VENTILATION EXHAUST IS REQUIRED BY THE N.E.C. CODE, SECTION 511, DURING OCCUPIED TIMES, IN ORDER TO "DE-CLASSIFICATION" THE SPACE.

TOTAL FLOOR AREA = 6,120 SQ.FT.

THEREFORE: A MECHANICAL EXHAUST SYSTEM WILL BE DESIGNED PROVIDING (4) FANS AT 1,530 CFM EACH OF VENTILATION, INTERLOCKED WITH GAS DETECTION SYSTEM.

TOTAL VENTILATION PROVIDED: 6,120 CFM = 1 CFM/SQ.FT.

127 SERVICE SHOP VENTILATION ANALYSIS:

0.75 CFM/SQ.FT. OF "MECHANICAL" EXHAUST IS REQUIRED BY THE 2018 INTERNATIONAL MECHANICAL CODE, SECTION 403, DURING OCCUPIED TIMES.

1 CFM/SQ.FT. OF VENTILATION EXHAUST IS REQUIRED BY THE N.E.C. CODE, SECTION 511, DURING OCCUPIED TIMES, IN ORDER TO "DE-CLASSIFICATION" THE SPACE.

TOTAL FLOOR AREA = 4,950 SQ.FT.

THEREFORE: A MECHANICAL EXHAUST SYSTEM WILL BE DESIGNED PROVIDING 3) FANS AT 1,650 CFM EACH OF VENTILATION, INTERLOCKED WITH GAS DETECTION SYSTEM. TOTAL VENTILATION PROVIDED: 4,950 CFM = 1 CFM/SQ.FT.

THE VEHICLE EXHAUST SYSTEM WILL BE DESIGNED AND INSTALLED BY THE OWNERS VENDOR UNDER A SEPERATE PERMIT SUBMISSION

## DRAWING NOTES 1# 1.PHOTOELECTRIC DUCT MOUNTED SMOKE DETECTOR WITH 12"x12" ACCESS DOOR FOR TUBE

- INSPECTION. UNIT SHALL BE SYSTEM SENSOR INNOVAIRFLEX SERIES, PHOTOELECTRIC MODEL D4120 (4 WIRE) OR APPROVED EQUAL. PROVIDE WALL MOUNTED SYSTEM SENSOR MODEL APA151 OR APPROVED EQUAL WITH REMOTE AUDIBLE/VISUAL ALARM DEVICE NEXT TO THERMOSTAT (TYPICAL). 2. RETURN AIR DUCTWORK SUPPORTED FROM STRUCTURE ABOVE CEILING (TYPICAL).
- 3. MANUAL BALANCING DAMPER (TYPICAL).
- 4. SUPPLY AIR DUCTWORK SUPPORTED FROM STRUCTURE ABOVE CEILING (TYPICAL). 5. EXHAUST AIR DUCTWORK SUPPORTED FROM STRUCTURE ABOVE CEILING (TYPICAL).
- 6.FULL SIZE OPEN END SOUND LINED RETURN AIR DUCTWORK WITH ELBOW AND 1"x1" WIRE MESH TO COVER OPENING. 7. DUCTWORK UP THRU ROOF. TRANSITION IN VERTICAL AS REQUIRED FOR CONNECTION TO
- UNIT CURB OPENING. 8.LINX ROUND SPIRAL SUPPLY AIR DUCTWORK SUPPORTED FROM STRUCTURE ABOVE WITH AIR CRAFT CABLING OR AS RECOMMENDED BY MANUFACTURER. DUCTWORK SHALL BE DOUBLE WALL, INSULATED WITH SELF-SEALING/GASKETED CONNECTIONS.
- 9. SUPPLY AIR REGISTER MOUNTED IN SIDE/BOTTOM OF ROUND DUCTWORK WITH NECK SIZE AND AIR QUANTITY INDICATED. LINX RGS-3 OR APPROVED EQUAL WITH INTEGRAL VOLUME CONTROL AND DOUBLE DEFLECTION LOUVERS SET AT 30° LEFT/RIGHT. 10. 24"x24" CEILING MOUNTED SUPPLY AIR DIFFUSER WITH NECK SIZE AND AIR QUANTITY INDICATED (TYPICAL). PROVIDE RIGID/FLEXIBLE DUCTWORK BACK TO MAIN WITH AIR-TITE
- FITTING AND MANUAL VOLUME DAMPER. 11.24"x24" CEILING MOUNTED RETURN AIR GRILLE WITH NECK SIZE AND AIR QUANTITY INDICATED (TYPICAL). PROVIDE RIGID/FLEXIBLE DUCTWORK BACK TO MAIN WITH AIR-TITE FITTING AND MANUAL VOLUME DAMPER.
- 12.10"x10" CEILING MOUNTED EXHAUST AIR REGISTER WITH AIR QUANTITY INDICATED (TYPICAL).
- 13. AIR TRANSFER OPENING IN WALL 12" ABOVE FLOOR, SIZE AS INDICATED, WITH FULL SIZE SLEELVE AND 1"x1" WIRE MESH TO COVER OPENINGS ON BOTH SIDES.. 14. EXHAUST AIR DUCTWORK UP THRU ROOF TO FAN.
- 15. WALL MOUNTED THERMOSTAT MOUNTED 48" ABOVE FLOOR WITH LOCKABLE COVER AND INTERLOCKED WITH UNIT INDICATED. 16.12"x12" CEILING MOUNTED AIR TRANSFER GRILLES WITH 8"Ø CONNECTING DUCTWORK (TYPICAL).
- 17. EXHAUST AIR DUCTWORK DROPPING DOWN FROM HIGH ABOVE, THRU WALL TO HIGH IN AIR/OIL ROOM CEILING. 18. EXHAUST DUCTWORK SUPPORTED HIGH AND UP THRU ROOF TO FAN WITH LOW-LEAKAGE
- MOTORIZED DAMPER. EXTEND DUCTWORK DOWN ALONG WALL TO 12" ABOVE FLOOR WITH 1"x1" WIRE MESH OVER OPENING. COORDINATE ALL DROPS WITH EXISTING PIPING IN THE

- AREA. 19. MAKEUP AIR DUCTWORK UP THRU ROOF TO GOOSENECK WITH LOW-LEAKAGE MOTORIZED DAMPER. EXTEND DOWN TO 24" BELOW BOTTOM OF ROOF STRUCTURE WITH 1"x1" WIRE MESH OVER OPENING.
- 20. ELECTRIC UNIT HEATER SUPPORTED FROM STRUCTURE AT 8'-0" ABOVE FLOOR. INTERLOCK WITH REVERSE-ACTING THERMOSTAT MOUNTED ON WALL 48" ABOVE FLOOR, SET AT 60°F. REFER TO SCHEDULE. 21. WALL MOUNTED ELECTRIC HEATER INTERLOCKED WITH THERMOSTAT, REFER TO SCHEDULE.
- 22. GAS DETECTOR MAIN CONTROL PANEL MOUNTED ON WALL 48" ABOVE FLOOR WITH MANUAL OVERRIDE SWITCH. INTERLOCK PANEL WITH REMOTE CO SENSORS, MAKEUP DAMPER AND EXHAUST SYSTEM FANS/DAMPER. REFER TO CONTROL SEQUENCE OF OPERATION.
- 23. REMOTE CARBON MONOXIDE AND TOXIC/EXPLOSIVE GAS SENSORS MOUNTED ON WALL 48" ABOVE FLOOR AND INTERLOCKED WITH GAS CONTROL PANEL (TYPICAL). 24. EXHAUST DUCTWORK SUPPORTED HIGH, EXTEND OVER THRU WALL AND UP THRU ROOF TO FAN. EXTEND DOWN TO 10'-0" ABOVE FLOOR WITH OPEN END AND 1"x1" WIRE MESH TO COVER OPENING. REFER TO FAN SCHEDULE FOR MORE INFORMATION.
- 25. SUPPLY AIR DUCTWORK SUPPORTED AS HIGH AS POSSIBLE EXPOSED, WITH 1" INTERNAL LINING AND NO EXTERNAL DUCT WRAP. 26. SUPPLY AIR REGISTER MOUNTED IN SIDE AND/OR BOTTOM OF DUCTWORK WITH NECK SIZE AND AIR QUANTITY INDICATED (TYPICAL). REGISTER SHALL HAVE DOUBLE DEFLECTION LOUVERS WITH OPPOSED BLADE DAMPER.
- 27. SUPPLY AIR DUCTWORK EXTENDED OUT TO GRILLE ON FACE OF WALL, SIZE AS INDICATED.
- 28. DOOR LOUVER, SIZE AS INDICATED. 29. WALL MOUNTED DUCTLESS SPLIT SYSTEM SEE SCHEDULE AND DETAIL FOR MORE
- INFORMATION. 30. EXTEND RS & RL PIPING FROM INDOOR UNITS TO OUTDOOR UNITS. CONTRACTOR SHALL ROUTE PIPING IN THE FIELD. SIZE AND TRAP PER MANUFACTURERS RECOMMENDATIONS. 31.24"x24" CEILING MOUNTED RETURN AIR GRILLE WITH FULL SIZE NECK (TYPICAL).





$\underline{A} = (1) \underline{E} \underline{E} \underline{E} \underline{E} \underline{E} \underline{E} \underline{E} \underline{E}$		EF-5	t 20x20 20x20 3	EF-8	
	4	EF-6		EF-Z	

# MECHANICAL - ROOF PLAN SCALE: 1/8" = 1'-0"



















AIR-TITE SIZE CHART											
DUCTSIZE	CONNECTION RING	DUCTSIZE	CONNE RING								
5"	8"	9"	1								
6"	9"	10"	1								
7"	10"	11"	1								
8"	11"	12"	1								
NOTE:											



Project	Information			
Energy Co	de:	2018 IECC		
Project Titl	e:			
Location: Climate Zo	one:	Winchester, Virginia 4a		
Project Typ	be:	New Construction		
Construction	on Site:	Owner/Agent:	Designer/Contractor:	
Additior Credits: 1	nal Efficiency Packa .0 Required 0.0 Propose	age(s) ad		
Mechan	ical Systems List			
uantity	System Type & Des RTU-1 (Single Zone):	cription		
	Heating: 1 each - Centr Proposed Efficiency Cooling: 1 each - Single Proposed Efficiency Fan System: RTU-1   S	al Furnace, Gas, Capacity = 144 kBtu/h = 80.00% Et, Required Efficiency: 80.00 % B e Package DX Unit, Capacity = 96 kBtu/h, Ai = 12.00 EER, Required Efficiency: 11.00 EE Showroom Compliance (Motor nameplate h	Et or 80% AFUE Cooled Condenser, Air Economizer R + 12.6 IEER HP method) : Passes	
	Fans: FAN 1 Supply, Cons	tant Volume, 3000 CFM, 2.4 motor nameplat	e hp, 0.0 fan efficiency grade	
1	RTU-2 (Single Zone): Heating: 1 each - Centr Proposed Efficiency Cooling: 1 each - Single Proposed Efficiency Fan System: RTU-2   S	al Furnace, Gas, Capacity = 100 kBtu/h = 80.00% Et, Required Efficiency: 80.00 % B e Package DX Unit, Capacity = 74 kBtu/h, Ai = 12.00 EER, Required Efficiency: 11.00 EE Showroom and Office Compliance (Motor r	Et or 80% AFUE ^-Cooled Condenser, Air Economizer R + 12.6 IEER nameplate HP method) : Passes	
	Fans: FAN 2 Supply, Cons	tant Volume, 2600 CFM, 2.9 motor nameplat	e hp, 0.0 fan efficiency grade	
1	RTU-3 (Single Zone): Heating: 1 each - Centr Proposed Efficiency Cooling: 1 each - Single Proposed Efficiency Fan System: RTU-3	al Furnace, Gas, Capacity = 90 kBtu/h = 80.00% Et, Required Efficiency: 80.00 % B e Package DX Unit, Capacity = 27 kBtu/h, Aii = 15.00 SEER, Required Efficiency: 14.00 S Compliance (Motor nameplate HP method) :	Et or 80% AFUE ^-Cooled Condenser, Air Economizer EER Passes	
	Fans: FAN 3 Supply, Single	e-Zone VAV, 1200 CFM, 2.4 motor nameplat	e hp, 0.0 fan efficiency grade	
1	RTU-4 (Single Zone): Heating: 1 each - Centr Proposed Efficiency Cooling: 1 each - Single Proposed Efficiency Fan System: RTU-4	al Furnace, Gas, Capacity = 90 kBtu/h = 80.00% Et, Required Efficiency: 80.00 % E e Package DX Unit, Capacity = 41 kBtu/h, Ai = 15.00 SEER, Required Efficiency: 14.00 S Compliance (Motor nameplate HP method) :	Et or 80% AFUE ^-Cooled Condenser, Air Economizer iEER Passes	
	Fans:			

	<ul> <li>RTU-5 (Single Zone):</li> <li>Heating: 1 each - Central Furnace, Gas, Capacity = 90 kBtu/h Proposed Efficiency = 80.00% Et, Required Efficiency: 80.00 % Et or 80% AFUE</li> <li>Cooling: 1 each - Single Package DX Unit, Capacity = 65 kBtu/h, Air-Cooled Condenser, Air Economizer Proposed Efficiency = 15.00 EER, Required Efficiency: 11.00 EER + 12.6 IEER</li> <li>Fan System: RTU-5 Compliance (Motor nameplate HP method) : Passes</li> </ul>												
	Fans: FAN 5 Supply, Constant Volum	e, 2000 CFM, 2.9 motor nameplate hp, 0.0 fan ef	ficiency grade										
1	<ul> <li>RTU-6 (Single Zone):</li> <li>Heating: 1 each - Central Furnace Proposed Efficiency = 80.00%</li> <li>Cooling: 1 each - Single Package Proposed Efficiency = 12.00 EF</li> <li>Fan System: RTU-6 Compliance</li> </ul>	e, Gas, Capacity = 176 kBtu/h Et, Required Efficiency: 80.00 % Et or 80% AFU DX Unit, Capacity = 130 kBtu/h, Air-Cooled Cond ER, Required Efficiency: 11.00 EER + 12.6 IEER ee (Motor nameplate HP method) : Passes	E denser, Air Economizer S										
	Fans: FAN 6 Supply, Constant Volum	e, 4000 CFM, 5.0 motor nameplate hp, 0.0 fan ef	ficiency grade										
1	RTU-7 (Single Zone): Heating: 1 each - Central Furnace Proposed Efficiency = 80.00% Cooling: 1 each - Single Package Proposed Efficiency = 12.00 EF Fan System: RTU-7 Compliance	e, Gas, Capacity = 144 kBtu/h Et, Required Efficiency: 80.00 % Et or 80% AFU DX Unit, Capacity = 114 kBtu/h, Air-Cooled Cond ER, Required Efficiency: 11.00 EER + 12.6 IEER ce (Motor nameplate HP method) : Passes	E denser, Air Economizer S										
	Fans: FAN 7 Supply, Constant Volum	e, 3400 CFM, 3.7 motor nameplate hp, 0.0 fan ef	ficiency grade										
<ul> <li>AHU-1 (Single Zone):</li> <li>Heating: 1 each - Central Furnace, Electric, Capacity = 19 kBtu/h</li> <li>No minimum efficiency requirement applies</li> <li>Cooling: 1 each - Packaged Terminal Unit, Capacity = 18 kBtu/h, Air-Cooled Condenser, Unknown Economizer</li> <li>Proposed Efficiency = 16.00 EER, Required Efficiency: 9.50 EER</li> <li>Fan System: AHU-1 Compliance (Motor nameplate HP method) : Passes</li> </ul>													
<b>Mechan</b> i Complian	cal Compliance Statement ce Statement: The proposed m ions, and other calculations sub	echanical design represented in this docum mitted with this permit application. The pro	nent is consistent with the building plans,										
specificat designed requireme	to meet the 2018 IECC requirer ents listed in the Inspection Che	ecklist.	comply with any applicable mandatory										
specificat designed requireme Name - Ti	to meet the 2018 IECC requirer ents listed in the Inspection Che tle	Signature	Date										
Name - Ti	to meet the 2018 IECC requirer ents listed in the Inspection Che tle	Signature	Date										
Project Tit	to meet the 2018 IECC requirer ents listed in the Inspection Che tle	Signature	Date										

							GAS	s firi	ED RO	OFT	ΟP	UN]	IT SC	HEDU	JLE						
		NOMINAI	FAN DATA				R-	R-410A COOLING DATA (BTUH)				HEATING DATA (BTUH)				ELECTRICAL		WEIGHT			
ITEM#	AREA SERVED	TONS	C.F.M.	OUTSIDE AIR	H.P.	E.S.P.	TYPE	TOTAL	SENSIBLE	ENTERI DB°F	ING AIR WB°F	EER/ SEER	INPUT	OUTPUT	TEMP. RISE °F	NO. STAGES	VOLTS/ PHASE	MCA/ FUSE	(LBS.)	MODEL # MANUF	
RTU-1	SHOWROOM	7.5	3,000	633	2.4	1.0	BELT	96,400	67,200	77.3	65.3	12.0	180,000	144,000	44.4	2	460V/3Ø	22.8/25	1085	ZYG08E4B3AB1C321A4	J
RTU-2	SHOWROOM AND PARTS	6.0	2,600	370	2.9	1.0	BELT	74,300	53,600	75.7	64.3	12.0	125,000	100,000	35.6	2	460V/3Ø	18.8/25	909	ZYGA7E4B1AB1C321A2	J
RTU-3	PARTS DEPT	3.0	1,200	210	2.4	1.0	BELT	40,600	26,700	76.9	64.9	15.0	112,000	90,000	69.4	2	230V/3Ø	23.9/30	627	ZYG04E2C1AB1C321A4	J
RTU-4	NEW CAR DELIVERY	3.0	1,200	360	2.4	1.0	BELT	41,000	27,500	78.7	66.1	15.0	112,000	90,000	69.4	2	460V/3Ø	12.9/15	627	ZYG04E2C1AB1C321A4	J
RTU-5	CUSTOMER AREA	5.0	2,000	520	2.9	1.0	BELT	64,600	45,900	78.7	66.5	15.0	112,000	90,000	41.7	2	460V/3Ø	16.5/20	736	ZYG06E4C1AB1C321A4	J
RTU-6	SERVICE	10.0	4,000	948	5.0	1.0	BELT	129,600	96,100	80.2	66.6	12.0	220,000	176,000	40.7	2	460V/3Ø	27.8/30	1113	ZYG12E4C3AB1C321A3	J
RTU-7	SERVICE	8.5	3,400	747	3.7	1.0	BELT	113,900	85,600	79.8	66.2	12.0	180,000	144,000	39.2	2	460V/3Ø	23.5/25	1085	ZYG09E4C3AB1C321A2	J
NOTES:																					

	EXHAUST FAN SCHEDULE													
ITEM#	AREA SERVED	C.F.M.	SONES	H.P./ WATTS	FAN TYPE	E.S.P.	DRIVE TYPE	R.P.M.	ELECTRICAL DATA	CONTROL	WEIGHT (LBS.)	MODEL #	MANUFACTUR	
EF-1	134 AIR / OIL	540	8.5	1/6 H.P.	ROOF	0.25"	BELT	1,412	115V/1Ø	24/7	40	80ACEB	СООК	
EF-2,3,4	127 SHOP VENTILATION	1,650	10.7	1/4 H.P.	ROOF	0.25"	BELT	1,574	115V/1Ø	GAS PANEL	75	135ACEB	СООК	
EF-5,6,7,8	125 SHOP VENTILATION	1,530	8.1	1/4 H.P.	ROOF	0.25"	BELT	1,725	115V/1Ø	GAS PANEL	75	135ACEB	СООК	
EF-9	TECH RESTROOMS	530	8.5	1/6 H.P.	ROOF	0.25"	BELT	1,412	115V/1Ø	24/7	40	80ACEB	СООК	
EF-10	CUSTOMER RESTROOMS	300	8.5	1/6 H.P.	ROOF	0.25"	BELT	1,412	115V/1Ø	24/7	40	70ACEB	СООК	
EF-11	133 EV STORAGE	200	7.1	1/6 H.P.	ROOF	0.25"	BELT	1,257	115V/1Ø	24/7	40	70ACEB	СООК	

ITEM#	AREA S
DSS-1	IT ROO
NOTES: 1) RATEI 2) INDOC 3) MAXII 4) PROV 5) PROV 6) ELEC 7) THERI 8) PROV	D CAPACITY IS B W UNITS SHALL MUM REFRIGERAN IDE CONDENSATE IDE WALL MOUNT TRICAL DISCONN MAL OVERLOAD S IDE ALL REFRIGE

	ELECTRIC HEATER SCHEDULE													
	AREA SERVED	TYPE		FAN DATA		HEATING DATA				ELECTRICAL	WEIGHT	MOUNTING		
IIEM#			C.F.M.	H.P.	R.P.M.	втин	KW	TEMP. RISE °F	NO. STAGES	DATA	(LBS.)	HEIGHT	MUDEL #	MANUFACTURER
EH-1	135 SPRINKLER	WALL	100	1/100	-	16,378	4.8	27.0	1	277V/1Ø	25	8" A.F.F.	AWH4507F	BERKO
EH-2	134 AIR/OIL	UNIT	350	1/100	1,600	17,065	5.0	45.1	1	277V/1Ø	25	8'-0"	HUHAA527	BERKO
NOTE:					TTRANSFOR									

UNIT SHALL BE COMPLETE WITH FAN AND SAFTEY CONTROLS, 24-VOLT TRANSFORMER AND WALL MOUNTED THERMOSTAT.

		R	EFLECTOR DA	ТА	HEAT	ING DATA (B	TUH)	INTAKE/	С		ES TO COM	1BUSTIBL	ES	ELECTRICAL	WEIGHT	MINIMUM		
IIEIM#	AREA SERVED	OVERALL LENGTH	TUBE LENGTH	TUBE DIA.	NO. STAGES	INPUT (HIGH)	INPUT (LOW)	FLUE SIZE	SIDES	ABOVE	BELOW	ENDS	REAR (45°)	DATA	(LBS.)	HEIGHT	MODEL #	MANUFACTURER
IRH-1	SERVICE DRIVE LANES	22'-3"	20'-0"	4"Ø	2	75,000	50,000	4"Ø/4"Ø	24"	6"	60"	15"	12"	115V/1Ø	75	13'-0"	LTS-75	SPACE-RAY

<u>NOTES:</u> 1) FLUE/INTAKE PIPING SHALL BE CATEGORY III, TYPE 'B', WITH WALL CAP. 2) UNITS SHALL BE COMPLETE WITH TWO STAGE GAS VALVE AND 2-STAGE THERMOSTAT. 3) ALL UNITS SHALL BE COMPLETE WITH LIMIT SAFTEY CONTROLS, BLOCKED VENT SHUTOFF, 24-VOLT TRANSFORMER AND ENERGY CUT-OFF DEVICE.

							SPLIT	SYS	TEM	HEA	AT F	PUMP	AIR	HANDI	_INC	G UN	IT SCHE	EDULE						
				FAN DATA	۱.			DX COOLING	DATA (R41	.0A)		HEAT PUMF DA ⁻	P HEATING TA			INDC	OOR UNIT				(	UTDOOR UN	ſΤ	
ITEM #	AREA SERVED	CEM	FSP	НР	RPM	C.F.M.	TOTAL	SENS.	# COIL	ENTER	ING AIR	HEAT @ 4	47 O.A.T.	ELECTRICAL	MCA/	WEIGHT	MODEL	MANUFACTURER	SEER	ELECTRICAL	MCA/	WEIGHT	MODEL #	MANUFACTI
		0.1 .1 1.	L.0.1 .			0.A.	BTU/HR.	BTU/HR.	ROWS	DB°F	WB°F	BTU/HR.	H.S.P.F	DATA	MOP	(LBS.)	TIODEL			DATA	MOP	(LBS.)		
AHU-1/CU-1	TECH AREA	531	0.15	-	MEDIUM	75	18,000	17,100	-	80	67	18,800	9.5	208V/1Ø	1 / 15	84	DHR18NDB21S	JCI	16.0	208V/1Ø	17 / 25	115	DHR18CSB21S	JCI

<u>NOTES:</u> 1) "H.V.A.C." TIME CLOCK SHALL ALLOW FAN TO RUN CONTINUOUSLY DURING OCCUPIED TIMES. 2) REVERSE-ACTING THERMOSTAT SHALL ENERGIZE FAN WHEN AMBIENT TEMPERATURE RISES ABOVE 85°F (ADJUSTABLE). 3) FANS <u>EF-1,2,3,4,5,6</u> SHALL BE INTERLOCKED WITH CO SENSOR/GAS CONTROL PANEL AND MANUAL ON/OFF OVERRIDE SWITCH.

## DUCTLESS SPLIT SYSTEM HEAT PUMP SCHEDULE

				INDOOR UNI	Т					OUTDOOR	UNIT	
A SERVED	TOTAL COOLING (MBH)	TOTAL HEATING (MBH)	FAN MAX CFM	WEIGHT (LBS)	MODEL #	MANUFACTURER	SEER	ELEC DATA	MCA/MOP	WEIGHT (LBS)	MODEL #	MANUFACTUR
ROOM 107	12	12	425	29	PKA-A12HA7	MITSUBISHI	18.5	208/1	11/28	99	PUZ-A12NKA7	MITSUBISH

### Y IS BASED ON INDOOR EAT OF 80°F DB/67°F WB. HALL BE POWERED FROM OUTDOOR UNITS WITH A SINGLE POINT CONNECTION. GERANT PIPING LENGTH SHALL BE 100'.

INSATE PUMP OPTION. MOUNTED REMOTE TEMPERATURE CONTROLLER, BY MANUFACTURER AND ASSOCIATES CONTROL WIRING BETWEEN INDOOR AND OUTDOOR UNITS.

CONNECT BY EC. OAD SWITCH FAN, HIGH PRESSURE SWITCH, OVER CURRENT PROTECTION INVERTER CIRCUIT. FRIGERANT VALVES, FILTERS AND ALL PIPING ACCESSORIES AS REQUIRED BY MANUFACTURER.

## ED INFRA-RED RADIANT TUBE HEATER SCHEDULE



		2018 INT	ERNATIO	NAL MECH	HANICAL	CODE - VE		N CHART -	<u>RTU-1</u>			
SPACE NAME	A _z (FT ² )	Ra AREA OUTDOOR AIR RATE (CFM/FT ² )	R _a A _z AREA OUTDOOR AIR (CFM)	OCCUPANT LOAD RATE (# PEOPLE / 1,000FT ² )	Pz TOTAL # OF PEOPLE	Rp OCCUPANT OUTDOOR AIR RATE (CFM/ PERSON)	R _p P _z OCCUPANT OUTDOOR AIR (CFM)	V _{bz} BREATHING ZONE OUTDOOR AIR (CFM)	Ez ZONE AIR DISTRIBUTION EFFECTIVENESS	V _{oz} ZONE OUTDOOR AIR	V _{pz} TOTAL SUPPLY AIR TO SPACE	Z _p OUTDOOR AIR FRACTION
112 Showroom & Sales	2150	0.12	258	15	33	7.5	247.5	506	0.8	633	3000	0.22
TOTAL	2150		258		33		247.5	506		633	3000	0.22
NOTES:						-		System	Ventilation Effici	ency $E_v =$	0.93	
1) * OCCUPANCY LOAD IS HIG	HER THEN	MINIMUM OCCL	IPANT LOAD	).				Uncorr	ected Outdoor Ai	r Intake =	505.5	
2) THE ROOFTOP UNIT WILL	BE SET AT	635 CFM OUTS	IDE AIR.					Total	required Outdoo	or Air V _{ot} =	544	CFM

		2018 INT	ERNATIC	NAL MECH	ANICAL	CODE - VE	NTILATION	N CHART -	RTU-2			
SPACE NAME	A _z (FT ² )	R _a AREA OUTDOOR AIR RATE (CFM/FT ² )	R _a Az AREA OUTDOOR AIR (CFM)	OCCUPANT LOAD RATE (# PEOPLE / 1,000FT ² )	Pz TOTAL # OF PEOPLE	R _p OCCUPANT OUTDOOR AIR RATE (CFM/ PERSON)	R _P Pz OCCUPANT OUTDOOR AIR (CFM)	V _{bz} BREATHING ZONE OUTDOOR AIR (CFM)	Ez ZONE AIR DISTRIBUTION EFFECTIVENESS	V _{oz} ZONE OUTDOOR AIR	V _{PZ} TOTAL SUPPLY AIR TO SPACE	Zp outdoor air fraction
101 Showroom & Sales	1100	0.12	132	15	17	7.5	127.5	260	0.8	325	2300	0.15
102 F&I	125	0.06	8	5	1	5	5	13	0.8	17	150	0.12
103 F&I	108	0.06	7	5	1	5	5	12	0.8	15	100	0.15
105 Closet	30	0.12	4	Θ	Θ	Θ	Θ	4	0.8	5	Θ	O
106 Hall	91	0.06	6	Θ	Θ	Θ	Θ	6	0.8	8	50	0.16
TOTAL	1454		157		19		137.5	295		370	2600	0.16
NOTES:	•		-			-	•	System	Ventilation Effici	ency $E_v =$	0.99	
1) * OCCUPANCY LOAD IS HIG	HER THEN	MINIMUM OCCL	IPANT LOAD	).				Uncorre	ected Outdoor Ai	r Intake =	294.5	
2) THE ROOFTOP UNIT WILL	BE SET AT	<u>370 CFM</u> OUTS	IDE AIR.					Total	required Outdoo	or Air V _{ot} =	298	CFM

		2018 INT	ERNATIC	NAL MECH	ANICAL	CODE - VE	NTILATION	I CHART -	<u>RTU-3</u>			
SPACE NAME	A _z (FT ² )	Ra AREA OUTDOOR AIR RATE (CFM/FT ² )	RaAz AREA OUTDOOR AIR (CFM)	OCCUPANT LOAD RATE (# PEOPLE / 1,000FT ² )	Pz TOTAL # OF PEOPLE	R _P OCCUPANT OUTDOOR AIR RATE (CFM/ PERSON)	R _p Pz OCCUPANT OUTDOOR AIR (CFM)	V _{bz} BREATHING ZONE OUTDOOR AIR (CFM)	Ez ZONE AIR DISTRIBUTION EFFECTIVENESS	Voz ZONE OUTDOOR AIR	V _{pz} TOTAL SUPPLY AIR TO SPACE	Zp outdoor Air fraction
109 Storage	137	0.06	9	Θ	$\odot$	Ο	Θ	9	0.8	12	70	0.18
119 Retail Parts Counter	50	0.06	3	5	1	5	5	8	0.8	10	100	0.1
120 Mens Restroom	145	0	Θ	0	$\odot$	Θ	0	$\odot$	0.8	$\odot$	80	0
121 Womens Restroom	145	0	Θ	$\odot$	$\odot$	Θ	Θ	$\odot$	0.8	$\odot$	80	Θ
122 Parts Department	1055	0.12	127	$\odot$	$\odot$	Θ	Θ	127	0.8	159	600	0.27
123 Parts Manager	107	0.06	7	5	1	5	5	12	0.8	15	120	0.13
124 Tech Counter Parts	100	0.06	6	5	1	5	5	11	0.8	14	150	0.1
TOTAL	1739		152		3		15	167		210	1200	0.27
NOTES:								System	Ventilation Effici	ency E _v =	0.88	
1) * OCCUPANCY LOAD IS HIG	HER THEN	MINIMUM OCCU	PANT LOAD	).				Uncorre	ected Outdoor Ai	r Intake =	167	
2) THE ROOFTOP UNIT WILL	BE SET AT	<u>210 CFM</u> OUTS	IDE AIR.					Total	required Outdoc	or Air V _{ot} =	190	CFM

		2018 INT	ERNATIO	NAL MECH	ANICAL	CODE - VE	NTILATION	N CHART -	RTU-4			
SPACE NAME	A _z (FT ² )	Ra AREA OUTDOOR AIR RATE (CFM/FT ² )	RaAz AREA OUTDOOR AIR (CFM)	OCCUPANT LOAD RATE (# PEOPLE / 1,000FT ² )	Pz TOTAL # OF PEOPLE	R _P OCCUPANT OUTDOOR AIR RATE (CFM/ PERSON)	R _P Pz OCCUPANT OUTDOOR AIR (CFM)	V _{bz} BREATHING ZONE OUTDOOR AIR (CFM)	Ez ZONE AIR DISTRIBUTION EFFECTIVENESS	V _{oz} ZONE OUTDOOR AIR	V _{PZ} TOTAL SUPPLY AIR TO SPACE	Z _P OUTDOOR AIR FRACTION
104 New Car Delivery	610	0.12	74	15	10	7.5	75	149	0.8	187	1200	0.16
TOTAL	610		74		10		75	149		187	1200	0.16
NOTES:								System	Ventilation Effici	ency E _v =	0.99	
1) * OCCUPANCY LOAD IS HIG	HER THEN	MINIMUM OCCU	PANT LOAD	).				Uncorre	ected Outdoor Ai	r Intake =	149	
2) THE ROOFTOP UNIT WILL	BE SET AT	<u>360 CFM</u> OUTS	IDE AIR.					Total	required Outdoo	or Air V _{ot} =	151	CFM



1) * OCCUPANCY LOAD IS 2) THE ROOFTOP UNIT W

SPACE NAME 127 Service Departmen TOTAL NOTES:

1) * OCCUPANCY LOAD IS 2) THE ROOFTOP UNIT WI

		2010 1			,	0082 121			• ±			
SPACE NAME	A _z (FT ² )	R _a AREA OUTDOOR AIR RATE (CFM/FT ² )	R _a A _z AREA OUTDOOR AIR (CFM)	OCCUPANT LOAD RATE (# PEOPLE / 1,000FT ² )	Pz TOTAL # OF PEOPLE	R _p OCCUPANT OUTDOOR AIR RATE (CFM∕ PERSON)	R _p Pz OCCUPANT OUTDOOR AIR (CFM)	V _{bz} BREATHING ZONE OUTDOOR AIR (CFM)	E _z Zone Air Distribution Effectiveness	V _{oz} ZONE OUTDOOR AIR	V _{pz} TOTAL SUPPLY AIR TO SPACE	Z _p OUTDOOR AIR FRACTION
128 Hall	74	0.06	Б	Θ	Θ	0	Θ	5	0.8	7	20	0.35
129 Womens Tech RR	169	Θ	Θ	0	Θ	$\odot$	0	Θ	0.8	0	50	0
130 Tech Break Room *	225	0.06	14	30	8	5	40	54	0.8	68	215	0.32
131 Tech Lockers	177	Θ	Θ	Θ	Θ	5	Θ	Θ	0.8	0	50	Θ
132 Mens Tech RR	218	Θ	Θ	Θ	Θ	Θ	Θ	Θ	0.8	0	55	Θ
TOTAL	863		19		8		40	59		75	390	0.35
OTES:								System	NVentilation Effic	iency E _v =	0.8	
) * OCCUPANCY LOAD IS HIG	HER THEN N	MINIMUM OCCU	PANT LOAD	•				Üncor	rected Outdoor A	ir Intake =	59	
) THE AIR HANDLING UNIT W	ILL BE SET	AT <u>??? CFM</u> 0	UTSIDE AIF	<u></u> .				Tot	<u>al required Outdo</u>	or Air V _{ot} =	74	CFM

2018 INTERNATIONAL MECHANICAL CODE - VENTILATION CHART - <u>RTU-5</u>														
A _z (FT ² )	Ra AREA OUTDOOR AIR RATE (CFM/FT ² )	RaAz AREA OUTDOOR AIR (CFM)	OCCUPANT LOAD RATE (# PEOPLE / 1,000FT ² )	Pz Total # Of People	Rp OCCUPANT OUTDOOR AIR RATE (CFM/ PERSON)	R _p Pz OCCUPANT OUTDOOR AIR (CFM)	V _{bz} BREATHING ZONE OUTDOOR AIR (CFM)	Ez ZONE AIR DISTRIBUTION EFFECTIVENESS	V _{oz} ZONE OUTDOOR AIR	V _{PZ} TOTAL SUPPLY AIR TO SPACE	Zp OUTDOOR AIR FRACTION			
Conf/Break Room*         405         0.06         25         30         16         5         80         105         0.8         132         420         0.32           0 General Manager         114         0.06         7         5         1         5         5         12         0.8         15         80         0.19														
Conf/Break Room*         405         0.06         25         30         16         5         80         105         0.8         132         420         0.32           General Manager         114         0.06         7         5         1         5         5         12         0.8         15         80         0.19           Conf/Break Room*         405         0.06         7         5         1         5         5         12         0.8         15         80         0.19           Conf/Break Room*         14         0.06         7         5         1         5         5         12         0.8         15         80         0.19           Conf/Break Room*         12         0.6         12         0.6         16         0.19														
D General Manager       114       0.06       7       5       1       5       5       12       0.8       15       80       0.19         .1 Sales Manager*       206       0.06       13       5       3       5       15       28       0.8       35       225       0.16														
111 Sales Manager*2060.061353515280.8352250113 Warranty1080.0675155120.815110														
437	0.06	27	30	14	5	70	97	0.8	122	350	0.35			
294	0.06	18	5	4	5	20	38	0.8	48	360	0.14			
96	0.06	6	5	1	5	5	11	0.8	14	100	0.14			
507	0.06	31	30	16	5	80	111	0.8	139	355	0.4			
2167		134		56		280	414		520	2000	0.4			
							System	Ventilation Efficie	ency E _v =	0.75				
HER THEN	MINIMUM OCCU	PANT LOAD	).				Uncorre	ected Outdoor Air	Intake =	414				
BE SET AT	<u>555 CFM</u> OUTS	IDE AIR.					Total	required Outdoo	r Air V _{ot} =	552	CFM			
	Az (FT ² ) 405 114 206 108 437 294 96 507 <b>2167</b> HER THEN BE SET AT	2018 INT         Az (FT ² )         Age A         OUTDOOR AIR         RATE         (CFM/FT ² )         405       0.06         114       0.06         206       0.06         108       0.06         437       0.06         294       0.06         507       0.06         2167       Image: Comparison of the second sec	Ra         RaAz           AZ (FT ² )         Ra         RaAz           AZ (FT ² )         OUTDOOR AIR         OUTDOOR           ADD         OUTDOOR AIR         OUTDOOR           A05         0.06         25           114         0.06         7           206         0.06         13           108         0.06         7           294         0.06         18           96         0.06         31           2167         134	Ra AREA       RaAz AREA       OCCUPANT LOAD RATE (CFM/FT²)       OCCUPANT LOAD RATE (UTDOOR AIR (CFM)       OCCUPANT LOAD RATE (# PEOPLE / 1,000FT²)         405       0.06       25       30         405       0.06       7       5         206       0.06       13       5         108       0.06       7       5         437       0.06       27       30         294       0.06       18       5         96       0.06       31       30         2167       134	Ra AREA OUTDOOR AIR (CFM/FT2)       RaA AREA OUTDOOR AIR (CFM/FT2)       RaAz AREA OUTDOOR AIR (CFM)       OCCUPANT LOAD RATE (# PEOPLE / 1,000FT2)       Pz TOTAL # OF PEOPLE         405       0.06       25       30       16         114       0.06       7       5       1         206       0.06       13       5       3         108       0.06       7       5       1         437       0.06       27       30       14         294       0.06       18       5       4         96       0.06       31       30       16         2167       134       56       1       56	Ra AREA OUTDOOR AIR (CFM/FT2)       RaAz AREA OUTDOOR AIR (CFM/FT2)       OCCUPANT AREA OUTDOOR AIR (CFM)       OCCUPANT LOAD RATE (# PEOPLE / 1,000FT2)       Pz TOTAL # OUTDOR OF OF PEOPLE (CFM/ PERSON)         405       0.06       25       30       16       5         114       0.06       7       5       1       5         206       0.06       13       5       3       5         108       0.06       27       30       14       5         294       0.06       18       5       4       5         96       0.06       31       30       16       5         507       0.06       31       30       16       5         134       56       1       5       56       1	Ra AREA OUTDOOR AIR (CFM/FT ² )       RaAz AREA OUTDOOR AIR (CFM/FT ² )       OCCUPANT AREA OUTDOOR AIR (CFM)       OCCUPANT LOAD RATE (# PEOPLE / 1,000FT ² )       Pz TOTAL # OF 	Ra AREA OUTDOOR AIR (CFM/FT ² )       RaAz AREA OUTDOOR AIR (CFM)       OCCUPANT LOAD RATE (PEOPLE / 1,000FT ² )       Pz TOTAL # OF PEOPLE       Rp OCCUPANT OUTDOOR AIR RATE (CFM)       Vbz BREATHING OUTDOOR AIR AIR (CFM)         405       0.06       25       30       16       5       80       105         114       0.06       7       5       1       5       5       12         206       0.06       13       5       3       5       15       28         108       0.06       7       5       1       5       5       12         437       0.06       27       30       14       5       70       97         294       0.06       18       5       4       5       20       38         96       0.06       31       30       16       5       80       111         2167       134       56       280       414       5       5       11         507       0.06       31       30       16       5       80       111         2167       134       56       280       414       5       5       11	Ra         RaAREA         OCCUPANT         Pz         OCCUPANT         OUTDOOR         AREA         OUTDOOR         AREA         OCCUPANT         OCCUPANT         OUTDOOR         AREA         OUTDOOR         ARATE         CFM/         PEOPLE         OUTDOOR         ARATE         CFM/         PERSON         OUTDOOR         ARA         Ez         ZONE         DISTRIBUTION         EFFECTIVENESS           405         0.06         25         30         16         5         80         105         0.8         0.8           114         0.06         7         5         1         5         5         12         0.8           206         0.06         13         5         3         5         15         28         0.8	2018 INTERNATIONAL MECHANICAL CODE - VENTILATION CHART - RTU-5         Az       Ra AREA OUTDOOR AIR CFM'       Ra AREA OUTDOOR AIR (CFM')       Ra AREA OUTDOOR AIR (CFM)       OCCUPANT DOAD RATE (PEOPLE / 1,000FT2)       Pz TOTAL # OF PEOPLE       Ra OCCUPANT OUTDOOR AIR RATE (CFM'       Vbz BREATHING OUTDOOR AIR (CFM)       Ez ZONE AIR OUTDOOR AIR (CFM)       Voz ZONE OUTDOOR AIR (CFM)         405       0.06       25       30       16       5       80       105       0.8       132         114       0.06       7       5       1       5       5       12       0.8       15         206       0.06       13       5       3       5       15       28       0.8       15         206       0.06       7       5       1       5       5       12       0.8       15         206       0.06       13       5       3       5       15       28       0.8       15         204       0.06       13       5       4       5       70       97       0.8       122         294       0.06       18       5       4       5       20       38       0.8       14         507       0.06       31       30	Ra         Ra/AREA         OCCUPANT         Pz         OCCUPANT         Pz         OCCUPANT         OUTDOOR         Vbz         Ez         Voz         Voz			

		2018 I	NTERNAT	IONAL MECH	HANICAL	CODE - VEN	TILATION	CHART - <mark>RT</mark>	<u>U-6</u>						
	A _z (FT ² )	R _a AREA OUTDOOR AIR RATE (CFM/FT ² )	R _a A _z AREA OUTDOOR AIR (CFM)	OCCUPANT LOAD RATE (# PEOPLE / 1,000FT ² )	Pz Total # Of People	R _p OCCUPANT OUTDOOR AIR RATE (CFM∕ PERSON)	R _p P _z OCCUPANT OUTDOOR AIR (CFM)	V _{bz} BREATHING ZONE OUTDOOR AIR (CFM)	Ez ZONE AIR DISTRIBUTION EFFECTIVENESS	V _{oz} ZONE OUTDOOR AIR	V _{pz} TOTAL SUPPLY AIR TO SPACE	Z _p OUTDOOR AIR FRACTION			
	6120         0.12         735         0         0         0         0         735         0.8         919														
	187	0.12	23	Θ	$\odot$	Θ	Θ	23	0.8	29	225	0.13			
	6307		758		0		Θ	758		948	4000	0.25			
								System	Ventilation Effici	ency E _v =	0.9				
IS HIGI	HER THEN M	INIMUM OCCU	PANT LOAD	•				Uncor	rected Outdoor Ai	r Intake =	758				
WILL B	e set at <u>9</u>	<u>50 CFM</u> OUTSI	DE AIR.					Tot	al required Outdoo	or Air V _{ot} =	843	CFM			

## 2018 INTERNATIONAL MECHANICAL CODE - VENTILATION CHART - RTU-7

	A _z (FT ² )	R _a AREA OUTDOOR AIR RATE (CFM/FT ² )	R _a A _z AREA OUTDOOR AIR (CFM)	OCCUPANT LOAD RATE (# PEOPLE / 1,000FT ² )	Pz Total # Of People	R _p OCCUPANT OUTDOOR AIR RATE (CFM/ PERSON)	R _p P _z OCCUPANT OUTDOOR AIR (CFM)	V _{bz} BREATHING ZONE OUTDOOR AIR (CFM)	E _z ZONE AIR DISTRIBUTION EFFECTIVENESS	V _{oz} ZONE OUTDOOR AIR	V _{pz} TOTAL SUPPLY AIR TO SPACE	Zp OUTDOOR AIR FRACTION
ent	4970	0.12	597	Θ	$\odot$	0	Θ	597	0.8	747	3400	0.22
	4970		597		0		Θ	597		747	3400	0.22
								System	NVentilation Effici	ency E _v =	0.93	
S HIGI	S HIGHER THEN MINIMUM OCCUPANT LOAD.											
VILL B	<u>e set at 7</u>	<u>'50 CFM</u> OUTSI	de Air.					Tot	al required Outdoo	or Air V _{ot} =	642	CFM

2018 INTERNATIONAL MECHANICAL CODE - VENTILATION CHART - AHU-1





SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

- 1. The work of each of the following sections includes furnishing and installing the material, equipment and systems complete as specified and/or indicated on the drawings. The installations, when finished, shall be complete and coordinated, ready for satisfactory service.
- 2. All work under this contract shall be done in strict accordance with all applicable municipal, state, county, NFPA, International and local codes that govern each particular trade.
- 3. The contractor shall make applications and pay all charges for all necessary permits, licenses and inspections as required under the above codes. Upon completion of the work, the customary certifications of approval shall be furnished. The contractor shall also coordinate and make all required submissions to the local utility companies as required.
- 4. No materials or equipment shall be used in the work until approved. Before submission of the shop drawings, and not more than thirty (30) days after award of the contract, the contractor shall submit for approval, a complete list of all materials and equipment which he intends to furnish, giving manufacturer and catalog numbers. A complete list of proposed sub-contractors shall also be submitted.
- 5. The contractor shall examine all drawings and specifications and shall visit the site and inspect the existing conditions in person. Certain areas may have been in-accessible at the time of the engineers survey and may only be visible during or after the demolition phase; therefore, those H.V.A.C. systems and coordination of those systems, shall become the responsiblity of the contractors. Failure to comply with this requirement shall not relieve the contractors of their responsibilities for complying with the intent of the contract documents.
- 6. The drawings indicate the general arrangement of the mechanical installations. Details of proposed departures due to actual field conditions or other causes shall be submitted for approval prior to installation. Reworking of completed items due to improper field coordination shall be at the contractor's expense.
- 7. Provide sufficient access and clearance for all items of equipment requiring servicing and maintenance, such as valves, dampers, controls, drives, drains, vents, starters, switches, filters, traps and major items of equipment.
- 8. The contractor shall perform all necessary cutting and patching as required to complete the installation of the all mechanical work. Patching of walls, floors, ceilings, roof, etc. shall match the adjacent surfaces.
- 9. The contractor shall prepare three (3) copies of a record and information booklet. The booklet shall be bound in a three ring loose-leaf binder. Provide the following data in the booklet:
- 9.1. Catalog data on each piece of equipment furnished
- 9.2. Approved shop drawings on each piece of equipment furnished 9.3. Maintenance, operation and lubrication instruction on each piece of
- eauipment furnished
- 9.4. Simplified temperature control diagrams of all H.V.A.C. systems 9.5. Manufacturer's and contractor's guarantees
- 9.6. Air balancing reports
- 9.7. Commissioning reports as required 9.8. Schedule/description of all service work/maintenance inspections required by the paragraphs of this section
- 10. All parts of the heating, ventilating, air conditioning and exhaust systems shall be adjusted, checked, balanced and tested by an independent A.A.B.C. or N.E.B.B. certified testing and balancing contractor approved by the owner. The contractor shall put all systems and equipment into full operation, and shall test and balance all devices to within ten (10) percent of capacities indicated on the drawings. Submit copies of the balancing reports to the architect. Permanently mark the position of each balancing damper.
- 11. Upon completion of the mechanical installations, the contractor shall provide a complete set of prints of the contract drawings which shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of as-built drawings.
- 12. All new installations, including all materials and labor shall be guaranteed for a period of one (1) year from date of owner acceptance. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of guarantee shall be delivered to the owner.
- 13. Contractor shall also provide one (1) year free service to keep the equipment in operating condition. This service shall be provided and rendered upon request when notified of any equipment malfunction.
- 14. In addition to the first year warranty period, the contractor shall provide, at no additional cost to the owner, a minimum of four (4) service calls and maintenance inspections. A complete outline of the required maintenance and the proposed schedule shall be included in a "record and information booklet", for review and acceptance by the owner/representative and engineer. The inspections are to be performed at three (3) month intervals for a total of four (4) service calls and inspections during the first year warranty period plus the original system start-up commissioning. The service work and inspections shall include, but not be limited to the following:
- 14.1. Replace all H.V.A.C. air filters before occupancy
- 14.2. Lubricate all motor and fan bearings as required 14.3. Clean drain pans and drain lines
- 14.4. Check and tighten all electrical connections as required
- 14.5. Inspect all belts for adjustment and condition, replace as required
- 14.6. Check operating pressures and refrigerant charge
- 14.7. Inspect all controls for correct operation and calibrate as required 14.8. Perform all maintenance as outlined in the equipment manufacturers operation and maintenance manuals. Upon completion of each scheduled inspection, the contractor shall deliver to the building owner or owners representative, within (48) hours of completion, two(2) copies of the completed inspection report for record purposes.
- 15. The service contractor shall, at the ninth month, advise the owner of the termination date of the above services. This contractor shall also provide the owner with a detailed proposal, reflecting annual escalation, for the continuation of the services and inspections described above.

## MECHANICAL SPECIFICATIONS

### SECTION 15250 - MECHANICAL INSULATION

1. All rectangular supply and return air ductwork shall be insulated with fiberglass insulation. All insulation shall be noncombustible or shall have a flame spread index of not more then 25 and a smoke-developement index of not more then 50 when tested in accordance with ASTM E84.

2. Ductwork shall be wrapped with nominal 2" thick glass fiber blanket insulation with "installed" thermal conductivity 'K' value of 0.25 at 75°F mean temperature and thermal resistance 'R' value of 6.0 at 1-1/2" compressed thickness. Owens Corning "SOFTR" fiberglass type 100 with foil faced vapor barrier. Insulation shall be neatly installed and suitable for 40°F-250°F duct temperatures.

3. All exposed spiral supply air ductwork shall be Linx, double wall with standard 1" inner wall fiberglass insulation and self-sealing/gasketed joints, or approved equal.

4. All refrigerant suction piping shall have 1" of armaflex insulation. Liquid line piping shall not require insulation. All insulation exposed to weather shall be 100% coated with a "UV" inhibitor for protection from solar radiation.

5. All internal duct lining shall be as specified under section 15880. All interior rectangular ductwork exposed within condition spaces may be provided with internal lining only, with no external duct wrap. Refer to drawings for additional notes. Internal lining shall not be used for ductwork system conveying wet/moist air (ie: shower rooms, dishwasher hoods, etc.).

SECTION 15500 - HEATING, VENTILATING & AIR CONDITIONING (HVAC)

A. The work to be performed shall include all labor, materials and equipment necessary to furnish and install complete, all H.V.A.C. mechanical equipment as shown on drawings and/or hereinafter specified. It is the intent that the systems be installed complete with all items necessary to provide satisfactory service.

B. All existing H.V.A.C. units serving the project areas shall be fully serviced including but not limited to: check/charge refrigerant, check/replace belts, change filters, check/clean heating and cooling coils, lubricate, rebalance, etc. and verify proper operation to ensure maximum capacity.

C. All heating, ventilating and air conditioning equipment which contains compressors shall be provided with extended warranties covering the compressors for a minimum of four (4) years.

### D. Packaged Rooftop Heating/Cooling Units:

All rooftop units shall be factory assembled, piped, internally wired and fully charged with R-410A refrigerant. Cooling and heating capacities shall be rated in accordance with AHRI standards and unit design shall be certified by the American Gas Association (AGA), specifically for outdoor applications using natural gas. All cooling units shall be Underwriters' Laboratory listed. All units shall be designed for outdoor rooftop level installation. Exterior surfaces of all units shall be phosphatized, zinc-coated steel with epoxy resin primer and baked enamel finish.

All casing panels shall be 20 gauge steel, gasketed and insulated with one (1) inch, one (1) pound density foil-faced glass fiber. Insulation shall be on the heat exchanger and evaporation section. Cabinet construction shall allow for all maintenance on one side of the unit.

Refrigeration cycle controls shall include condenser fan, evaporator fan and compressor contractor. Compressor shall be equipped with a combination internal winding thermostat/current overload. Internal high pressure relief shall also be provided. All units shall have direct drive, hermetic sealed compressors. Compressors shall be equipped with over temperature, over current and high pressure controls. Crank case heaters shall be standard on all models.

Evaporator coil shall be seamless copper tubing mechanically bonded to aluminum fins and shall be factory pressure and leak tested at 225 psig.

Both evaporator and condenser coil shall have drain pans. Evaporator pan shall be internally sealed and insulated. Threaded drain connection shall be provided in evaporator section with a drain opening in condensing section.

Condenser coil shall be seamless copper tubing mechanically bonded to aluminum fins. Each coil shall be factory pressure and leak tested at 425 psig.

Indoor air fan shall be belt/direct drive, forward curved, centrifugal type. Motor shall have thermal overload protection and permanently lubricated fan and motor bearings. Motor/blower assembly shall be isolated from unit with rubber mounts. Fans shall be capable of 2-speeds.

Condenser fan shall be direct-drive, statically and dynamically balanced, upflow propeller type. Weatherproofed permanent split capacitor fan motor shall have built-in thermal overload and permanently lubricated sleeve bearings.

Gas-fired heating section shall be completely assembled, wired and piped. Design shall be certified by AGA, specifically for outdoor application.

Electronic ignition system shall light pilot each time the thermostat calls for heat. Flame sensor shall prove pilot flame and turn on main burners. Should a loss of pilot flame occur the main valve shall close and the spark shall reoccur within 0.8 seconds. When the thermostat is satisfied, both pilot and main burner shall be extinguished.

Forced combustion blower shall insure flame stability under varying wind conditions and shall provide higher combustion efficiency and location flexibility.

Heat exchanger shall be aluminized steel. Heat exchanger shall be factory tested for leaks, stress relieved and of free floating design. Heat exchanger shall be located upstream of the cooling coil for minimum condensation. Design shall be certified by AGA specifically for outdoor application. Burners shall be stamped and seam-welded with 20 gauge aluminized steel.

Low ambient temperature operation shall be standard down to 40 degree F.

Each rooftop unit shall be complete with a factory supplied supply and return bottom discharge casing, full roof curb, convience outlet and enthalpy-controlled low-leakage economizer with barometer relief damper.

Units shall be as manufactured by York, Trane, Carrier or approved equal.

### . Electric wall heaters:

Wall heater shall be as manufactured by Berko or approved equal. Refer to drawings for capacities. Heater shall be complete with automatic reset thermal protection, metal sheath element, heavy duty concealed thermostat with disconnect, shaded 2-pole motor, anodized aluminum frame and shall be U.L. listed.

### F. Electric unit heaters:

Unit heater shall be as manufactured by Berko or approved equal. Heaters shall be complete with automatic reset thermal protection, metal sheath element, heavy duty concealed thermostat with disconnect, shaded 2-pole motor, anodized aluminum frame and shall be U.L. Listed.

### Smoke detectors

Detectors shall be installed in the supply and return air ductwork for all system supplying equal or greater then 2,000 cfm of air and shall be U.L. 268A, NFPA 90A, NFPA 72 and FM approved and listed. They shall contain an photoelectruc type detector and air sampling chamber with sampling tubes extending through the width of the air duct. Unit shall be System Sensor InnovairFlex series, photoelectric model D4120 (4 wire) or approved equal, with an ionization type detector and self-contained control unit.

Contractor shall provide and install a wall/ceiling mounted remote audible/visual alarm device with red trouble light and green power light, located in a public and visable location near the general area of the rooftop unit, which shall be System Sensor model APA151 or approved equal and compatible with smoke detector provided.

In areas where smoke detector maintenance and inspection is not easily accessible, contractor shall also provide a wall/ceiling mounted remote test/reset device (with key). Device shall be System Sensor model RTS151KEY or approved equal and compatible with smoke detector provided.

Coordinate installation of all detection devices with the controls contractor. Detectors connected to the building fire alarm system specified in Division 16-Electrical, shall be coordinated with the voltage and signal contact configuration.

SECTION 15880 - AIR DISTRIBUTION

- A. Furnish all labor and materials necessary to complete the sheet metal work associated with the heating, ventilating, air conditioning and exhaust systems, and other miscellaneous items shown and required.
- B. All supply, return, make-up air and exhaust ductwork shall be constructed and installed in accordance with the sheet metal and air conditioning contractors national association (SMACNA) standards and ASHRAE standards.
- C. Flexible ductwork shall be Hart & Cooley type F216 or approved equal. Flexible duct shall comply with NFPA bulletin 90A and shall be U.L. Listed as class 1 air duct and connector, standard 181, with R-6 value insulation and microbial resistant. Maximum length of runout shall not exceed 6'-0".
- D. Support horizontal ducts with hangers spaced not more than six (6) feet apart. Use strap hangers for ducts up to thirty (30) inches wide, angle hangers or rods for ducts over thirty (30) inches wide. Strap hangers to be one (1) inch wide, 20 gauge minimum; fasten to sides and bottom of duct with sheet metal screws.
- E. Ducts shall be straight and smooth on the inside, with joints neatly finished. Ducts shall be suspended from the construction and shall be free from vibration. Curved elbows shall have a center radius equal to one and one-half (1-1/2) times the width of the duct. All square turns shall be vaned. Vanes consisting of curved metal blades shall permit the air to make abrupt turns without turbulence.
- F. All joints, seams and connections in the heating, ventilating, and air conditioning and exhaust system ductwork shall be sealed air tight. Sealant shall be as manufactured by Hard Cast Inc. or approved equal and shall consist of a mineral impregnated woven fiber tape and an actuator adhesive. Sealant shall be SMANCA and U.L. approved, with a flame spread of 10 and a smoke developed of 0, non-toxic and non-flammable. Sealant shall be approved for operating temperatures from 0 degrees F. to 200 degrees F. Sealant system shall be installed in strict accordance with the manufacturer's recommendations and when applied shall provide a permanent seal without any deterioration.
- G. All rectangular supply and return air ductwork within fifteen (15) feet of each air handling unit shall be lined on the interior for sound attenuation. Lining shall have a one (1) inch thickness and shall be glued with one hundred (100) percent coverage and additionally secured with pins. Increase duct sizes indicated two (2) inches direction to accommodate the interior lining. Dimensions shown on drawings are clear inside dimensions. Liner shall be a non-fibrous elastomeric thermal (and acoustical) material, closed cell, moisure resistant with anti-microbial agent. Material shall meet ASTM E84 25/50 fire rating (NFPA 90A & 90B), ASTM G 21 & 22, VOC guidelines, ASTM C 518, etc.. Lining shall be Nomaco K-Flex Gray, Evonikfoams Solcoustic or approved equal.
- H. Supply air diffusers shall have all steel construction with louvered face and finished with #26 off-white enamel. Titus model TMS. Metal-Aire, Krueger or approved equal.
- I. Supply air registers shall have all steel construction with 3/4" spaced, double deflection louvers, opposed blade damper and finished with #26 off-white enamel. Titus model 300F, Metal-Aire, Krueger or approved equal.
- J. Exposed spiral supply air ductwork registers shall have all steel construction supply air registers with 3/4" spaced, double deflection louvers, internal volume damper and finished with #26 off-white enamel. Linx model RGS-3 or approved equal.
- K. Return air grilles shall have all steel construction with 1/2" spaced louvers, 35 degree deflection and finished with #26 off-white enamel. Titus model 355R, Metal-Aire, Krueger or approved equal.
- L. Exhaust air registers shall have all steel construction with 1/2" spaced louvers, 35 degree deflection, opposed blade damper and finished with #26 off-white enamel. Titus model 355R, Metal-Aire, Krueger or approved equal.
- M. Motorized control dampers shall be low leakage extruded aluminum airfoil with a maximum of 3 cfm/sq.ft. leakage rate at 1" static pressure and shall be AMCA listed as a Class 1A damper. Damper shall be Ruskin CD-50 or approved equal. Actuator shall be 120 VAC, with fail safe spring return and brushless DC motor
- N. Roof mounted exhaust fans shall be designed for roof mounted applications with factory curb. Housing shall be spun aluminum with a non overloading backward inclined wheel. Motors shall be located out of air stream with positive cooling by ambient air. Unit shall be complete with disconnect switch, roof curb, back draft damper, starter and vibration isolators for entire motor and drive assembly. Unit shall be as manufactured by Cook or approved equal.

### SECTION 15950 - CONTROLS

- A. The controls contractor under this heading shall furnish and install all wiring and equipment necessary for a complete operational system including: automatic temperature controls, ventilation systems, exhaust systems, economizer systems, etc. as indicated on the drawings. The system shall include all necessary thermostats, relays, switches, transformers, contactors, etc. required for successful operation of all equipment as described in the sequence operations. Electrical work in connection with all control systems shall be performed by the controls contractor and coordinated with the electrical contractor as needed to provide a full and complete package.
- B. Each rooftop unit shall be controlled by a wall mounted Honeywell model T-7350 heating/cooling thermostat with a (7) day/(24) hour program clock capable of (2) occupied/ non-occupied periods, with (2) heating/(2) cooling setpoints, remote temperature sensor capability (up to 9) and auxillary contact for Honeywell econonmizer controls. Thermostat assembly shall be compatible with the air handling unit's economizer and/or accessory package as specified under section 15500. Coordinate control requirements with the proposed equipment. Dual heating/ cooling thermostats shall have a minimum 5 degree deadband.
- C. The controls contractor shall be responsible for the commissioning of the project (aS required) to assure a fully functional, fine-tuned H.V.A.C. system upon occupancy. The commissioning of the project shall be performed in accordance with ASHRAE guidelines and shall be defined as verification of the proper operation of all equipment, alarms, safeties, controls and any energy management systems serving the mechanical systems installed or modified on this project. Proper operation is defined as the activation of all controls, field or factory installed, to assure the correct sequencing of equipment and systems, including activation of all operating and safety controls, as hereinbefore described. The controls contractor shall report all system deficiencies to the general contractor, who shall instruct the proper trade to correct any deficiencies.

SECTION 15990 - TESTING, ADJUSTING AND BALANCING

- A. Perform testing, adjusting, and balancing, using the services of an independent testing and balancing agency regularly engaged in the testing and balancing of air and water systems and associated equipment and piping systems. The agency selected shall be a certified member of the Associated Air Balance Council (AABC). The agency shall be independent of the installing personnel or equipment supplier for this project.
- B. Work shall be performed in accordance with the agenda specified herein. Procedures and methods specified herein shall be followed and, if not specifically specified herein, shall be performed in accordance with the AABC MN-1; NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems; SMACNA HVAC Systems Testing, Adjusting and Balancing; ASHRAE Handbook, HVAC Applications; and ASHRAE Handbook, HVAC Systems and Equipment.
- C. Prior to beginning work, submit to Engineer the following. 1. Instrument Calibration Data showing instruments to be used in TAB work and date calibrated. Instruments shall be calibrated within 12 months of beginning work. 2. Sample forms if those being used are not standard forms of NEBB or AABC.
- 3. Certification certificates of NEBB or AABC certified professional signing the TAB report. D. Projects involves existing equipment and conditions. Contractor shall visit the site before beginning work to investigate issues with existing work.
- E. Prior to beginning TAB work, each piece of equipment shall be cleaned and filters replaced. Testing and balancing shall not begin until each system has been completed and is in full working order. Put all heating, ventilating, and air-conditioning systems and equipment, including controls, into full operation and continue the operation of the systems during each working day of testing and balancing.
- F. Prior to beginning TAB work, inspect HVAC system installation. Note any issues or deficiencies that would prevent successful Testing, Adjusting, and Balancing of the HVAC systems and notify the Engineer.
- G. Airflows for supply air and return systems shall be adjusted to within +/- 10%. Airflows for outside air and Exhaust systems shall be adjusted to within -5% to +10%. Water flows for water systems shall be balanced to +/- 5%. Other quantities being adjusted shall be per NEBB or AABC standards.
- H. The TAB report shall be submitted to the engineer for approval. The report shall include, at a minimum, the following information:
- 1. Deficiencies found during Testing, Adjusting, and Balancing 2. Equipment
- a. Installation Date For new equipment
- b. Equipment Tag/Name c. Capacity
- d. Model Number and Serial Number
- e. Electrical Data Voltage, Amperage, Horsepower f. Area in Building Served
- q. Airflow h. Total Static Pressure / External Static Pressure
- RPM
- Brake Horsepower / Amperes k. Entering Air Temperature
- l. Leaving Air Temperature m. Outdoor Air Temperature
- 3. Air outlets
- a. Plan with outlet identification marked up b. Room served
- c. Outlet identification
- d. Design and recorded velocities e. Design and recorded CFM's
- I. TAB Contractor shall assist in resolving deficiencies identified in TAB work and Engineer's review of TAB report.
- J. Following final approval of Certified Reports by the Engineer, the settings of all
- valves, dampers, and other adjustment devices shall be permanently marked by the Contractor so that adjustment can be restored if disturbed at any time Devices shall not be marked until after final acceptance.

