GENERAL MECHANICAL SYMBOLS

- REVISION NUMBER - SHOWN ON PLANS
- POINT WHERE NEW CONNECTS TO EXISTING
- NUMBER OF DETAIL ON SHEET / NUMBER OF SHEET WHERE DETAIL APPEARS
- KEYNOTE
- CONTINUATION SYMBOL
- Room 5 — ROOM NAME AND NUMBER
- ITEM TO BE DEMOLISHED
- AREA NOT IN CONTRACT
- 2" — PIPE SIZE TAG (DIAMETER)
- ABOVE GROUND PIPING
- 1/8" / 12" SLOPE — PIPE SLOPE TAG
- BELOW GROUND PIPING
- INVERT: -105'-1" — PIPE INVERT ELEVATION TAG
- (E) — EXISTING PIPE TAG
- PIPING BEING DEMOLISHED

ABBREVIATIONS

Ø	ROUND
ABV	ABOVE
AC	AIR CONDITIONING
AD	AREA DRAIN
ADD	ADDENDUM
AFF	ABOVE FINISHED FLOOR
AFUE	ANNUAL FUEL UTILIZATION EFFICIENCY
ALT	ALTERNATE
AP	ACCESS PANEL
ARCH	ARCHITECT/ARCHITECTURAL
BFF	BELOW FINISHED FLOOR
BLW	BELOW
BTU	BRITISH THERMAL UNITS
BTUH	BRITISH THERMAL UNITS PER HOUR
CAP	CAPACITY
CB	CATCH BASIN
CFM	CUBIC FEET PER MINUTE
CLG	CEILING
CO	CLEAN OUT
CW	COLD WATER
D	DEGREE
DB	DRY BULB
DIA	DIAMETER
DN	DOWN
DW	DISTILLED WATER
EA	EACH
EAT	ENTERING AIR TEMPERATURE
ELEC	ELECTRICAL
EQUIP	EQUIPMENT
EWC	ELECTRIC WATER COOLER
EWT	ENTERING WATER TEMPERATURE
EA	EXHAUST AIR
EXIST	EXISTING
F	DEGREES FAHRENHEIT
FCO	FLOOR CLEAN OUT
FD	FLOOR DRAIN
FDC	FIRE DEPARTMENT CONNECTION
FL	FLOOR
FO	FUEL OIL
FOV	FUEL OIL VENT
FOR	FUEL OIL RETURN
FOS	FUEL OIL SUPPLY
FPM	FEET PER MINUTE
FS	FLOOR SINK
FT	FOOT/FEET
FTR	FIN TUBE RADIATION
GAL	GALLON
GF	GAS-FIRED
GC	GENERAL CONTRACTOR
GPM	GALLONS PER MINUTE
GW	GREASE WASTE
HB	HOSE BIB
HP	HORSE POWER
HTG	HEATING
HTR	HEATER
HW	HOT WATER
HYD	HYDRANT
ID	INDIRECT
IN	INCH
INV	INVERT
LB	POUND
LB/HR	POUNDS PER HOUR
LAT	LEAVING AIR TEMPERATURE
LP	LOW PRESSURE
LPG	LIQUEFIED PETROLEUM GAS
LVR	LOUVER
LWT	LEAVING WATER TEMPERATURE
M/A	MIXED AIR
MAX	MAXIMUM
MBH	ONE THOUSAND BTU PER HOUR
MCF	ONE THOUSAND CUBIC FEET
MD	MOTORIZED DAMPER
MECH	MECHANICAL
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
MTR	MOTOR
MU/A	MAKE-UP/AIR
NC	NOISE CRITERIA
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NUMBER
NO	NORMALLY OPEN
NTS	NOT TO SCALE
O	OXYGEN
O/A	OUTSIDE AIR
ORD	OVERFLOW ROOF DRAIN
PD	PRESSURE DROP
PIV	POST INDICATOR VALVE
PLBG	PLUMBING
PRESS	PRESSURE
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
PWR	POWER
R	DUCT RISER
R/A	RETURN AIR
RCP	RADIANT CEILING PANEL
RD	ROOF DRAIN
REC	RECESSED
RED	REDUCER
RH	RELATIVE HUMIDITY
RL/A	RELIEF AIR
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
RW	RAIN WATER
SF	SQUARE FOOT
S/A	SUPPLY AIR
SAN	SANITARY
SF	SQUARE FOOT
SD	SMOKE DAMPER
SM	SURFACE MOUNT
SP	STANDPIPE
SP	STATIC PRESSURE
STM	STEAM
T	THERMOSTAT
TD	TEMPERATURE DROP
TDR	TRENCH DRAIN
TEMP	TEMPERATURE
TYP	TYPICAL
UG	UNDERGROUND
VAC	VACUUM
V	VENT
VAV	VARIABLE AIR VOLUME
VENT	VENTILATION
VTR	VENT THROUGH ROOF
W	WASTE
WB	WET BULB
WCO	WALL CLEAN OUT
WH	WALL HYDRANT

EQUIPMENT ABBREVIATIONS

AC	AIR CONDITIONING UNIT
ACCU	AIR COOLING CONDENSING UNIT
AHU	AIR HANDLING UNIT
AS	AIR SEPARATOR
B	BOILER
CH	CHILLER
CT	COOLING TOWER
CUH	CABINET UNIT HEATER
CHWP	CHILLED WATER PUMP
DBP	DOMESTIC WATER BOOSTER PUMP
DC	DUCT MOUNTED COIL
DCP	DOMESTIC WATER CIRCULATING PUMP
EF	EXHAUST FAN
EDC	ELECTRIC DUCT COIL
ET	EXPANSION TANK
EWH	ELECTRIC WATER HEATER
FCU	FAN COIL UNIT
FP	FIRE PUMP
GI	GREASE INTERCEPTOR
GRV	GRAVITY ROOF VENTILATOR
HWP	HEATING WATER PUMP
HRU	HEAT RECOVERY UNIT
PRV	POWER ROOF VENTILATOR
RE	RETURN/EXHAUST FAN
RTU	ROOFTOP UNIT
SP	SUMP PUMP
UH	UNIT HEATER
WH	WATER HEATER

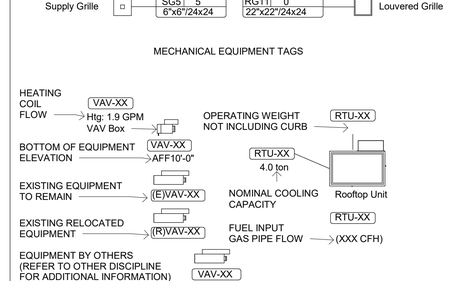
* NOTE *

ALL OF GENERAL NOTES ON THIS SHEET ARE TO BE APPLIED TO ALL OTHER DRAWINGS IN THIS SET. THE SYMBOLS AND ABBREVIATIONS SHOWN ON THIS SHEET MAY OR MAY NOT BE USED IN THIS SET OF DRAWINGS.

HVAC SYMBOLS

- 18"x12" — SQUARE DUCT SIZE TAG (WIDTH x HEIGHT)
- 18"/12" — OVAL DUCT SIZE TAG (WIDTH / HEIGHT)
- 18"Ø — ROUND DUCT SIZE TAG (DIAMETER)
- (E) — EXISTING DUCT TAG
- DUCT BEING DEMOLISHED
- 18"x18" S/A — SUPPLY AIR
- 18"x18" S-O/A — CONDITIONED OUTSIDE AIR
- 18"x18" O/A — OUTSIDE AIR
- 18"x18" R/A — RETURN AIR
- 18"x18" T/A — TRANSFER AIR
- 18"x18" E/A — EXHAUST AIR
- 18"x18" L/A — RELIEF AIR
- 18"x18" GE/A — GREASE EXHAUST AIR
- 18"x18" CE/A — CONDENSATE EXHAUST AIR
- 18"x18" SE/A — SMOKE EXHAUST AIR
- 6'Ø FLUE — EXHAUST GAS FLUE
- 6"Ø C/A — COMBUSTION AIR
- DROP — RECTANGULAR SUPPLY/OUTSIDE AIR DUCT RISE
- DROP — ROUND SUPPLY/OUTSIDE AIR DUCT RISE
- DROP — RECTANGULAR RETURN/TRANSFER AIR DUCT RISE
- DROP — ROUND RETURN/TRANSFER AIR DUCT RISE
- DROP — RECTANGULAR EXHAUST/RELIEF AIR DUCT RISE
- DROP — ROUND EXHAUST/RELIEF AIR DUCT RISE

GRILLES, REGISTERS & DIFFUSERS TAG



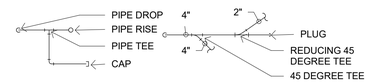
MECHANICAL EQUIPMENT TAGS

DAMPER TAGS

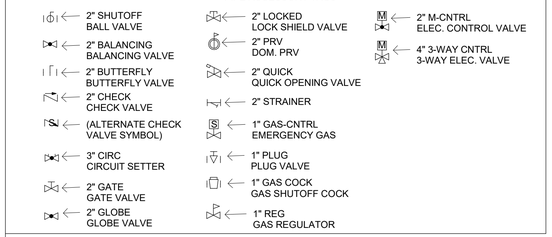
- SD — Smoke Damper
- FD — Fire Damper
- FSD — Comb. Fire/ Smoke Damper
- B — Manual Damper
- M — Motorized Damper
- BDD — Backdraft Damper

PIPING SYMBOLS

- CHWR — CHILLED WATER RETURN
- CHWS — CHILLED WATER SUPPLY
- CD — CONDENSATE DRAINAGE
- CWR — CONDENSER WATER RETURN
- CWS — CONDENSER WATER SUPPLY
- GWR — GEOTHERMAL WATER RETURN
- GWS — GEOTHERMAL WATER SUPPLY
- HWR — HEATING WATER RETURN
- HWS — HEATING WATER SUPPLY
- G — NATURAL GAS
- PG — PROPANE GAS
- REF-L — REFRIGERANT-LIQUID
- REF-S — REFRIGERANT-SUCTION
- REF-HG — REFRIGERANT-HOT GAS
- STM — STEAM
- CDR — CONDENSATE RETURN



PIPE ACCESSORY TAGS



HVAC GENERAL NOTES

A. COORDINATE ALL WORK WITH OTHER TRADES AND EXISTING CONDITIONS AS REQUIRED TO PROPERLY INSTALL ALL SYSTEMS AS INTENDED, WITHIN THE CONFINES OF THE SPACES AVAILABLE, AND WITHOUT INTERFERENCES.

B. THIS CONTRACTOR SHALL PERFORM ALL WORK INDICATED AND/OR AS REQUIRED FOR THE PROPER INSTALLATION AND OPERATION OF THE MECHANICAL SYSTEMS.

C. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF DIFFUSERS.

D. INSTALL ALL DUCT, PIPE, ETC. AS HIGH AS POSSIBLE.
DUCT SIZES SHOWN ARE ACTUAL SHEET METAL SIZES AND INCLUDE AN ALLOWANCE FOR DUCT LINER WHERE APPLICABLE.

D. PROVIDE FLEXIBLE CONNECTION BETWEEN DUCTWORK AND ROOFTOP UNITS, EXHAUST FANS, AND OTHER MOTORIZED EQUIPMENT.

E. NO DUCT SHALL BE ROUTED OVER THE TOP OF ELECTRICAL PANELS.

F. ALL MATERIALS WITHIN PLENUMS SHALL BE NONCOMBUSTIBLE OR SHALL HAVE A FLAME SPREAD INDEX OF NOT MORE THAN 25 AND A SMOKE-DEVELOPED INDEX OF NOT MORE THAN 50 WHEN TESTED IN ACCORDANCE WITH ASTM E 84.

G. ALL MECHANICAL SYSTEMS SHALL BE BALANCED BY A CERTIFIED BALANCING CONTRACTOR. REFER TO SPECIFICATIONS FOR DETAILS.

Mechanical Sheet Schedule

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4/4/25
STATE OF TEXAS
ERIK BRADLEY KNUDSEN
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a new restaurant for:
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Beaumont, TX 77706

date
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drawn by
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BC PROJECT # 24972
TEXAS PE COA #F-15978

BC ENGINEERS INCORPORATED
5720 Reeder Shawnee, KS 66203 (913)262-1772

sheet number
M-00

drawing type
permit

project number
23006-31

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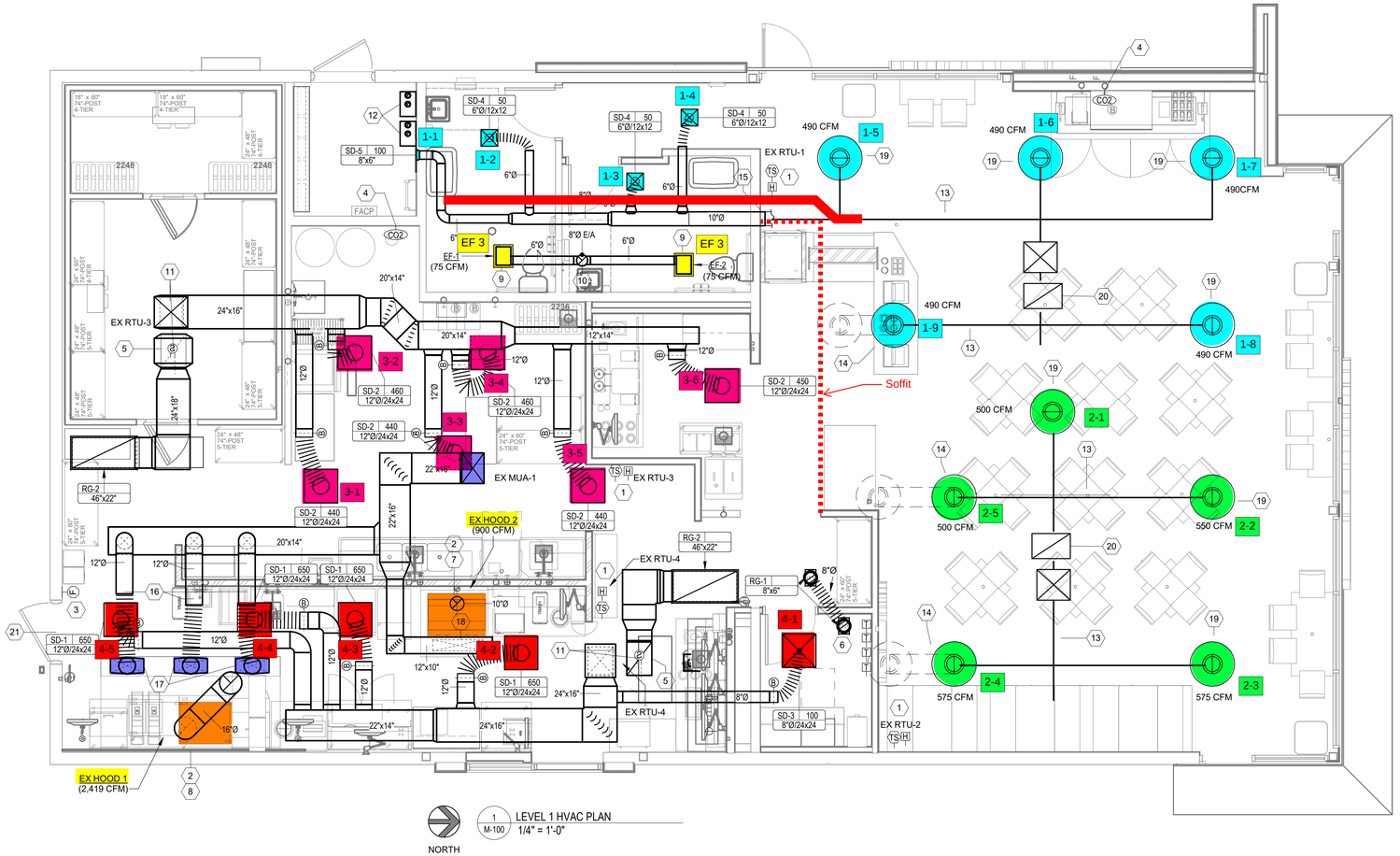


1 M-100 LEVEL 1 HVAC PLAN
1/4" = 1'-0"

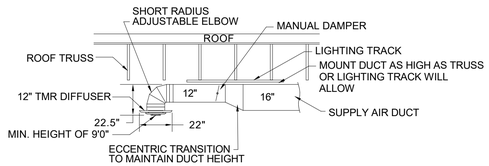
AIR BALANCE SCHEDULE

SUPPLY AIR UNIT	OUTSIDE AIRFLOW (CFM)	RETURN AIRFLOW...	SUPPLY AIRFLOW (CFM)	OA/SA (%)	EXHAUST AIR UNIT	EXHAUST AIRLFOW (CFM)
EX RTU-1	515	2,185	2,700	19.1%	EX EF-1	2,419
EX RTU-2	595	2,105	2,700	22.0%	EX EF-2	900
EX RTU-3	205	2,495	2,700	7.6%		
EX RTU-4	140	2,560	2,700	5.2%	EF-1, EF-2	150
EX MUA-1	2,565	0	2,565	100.0%		
TOTAL	4020	9,345	13,365	30.1%	TOTAL	3,469
				RESULTING BUILDING PRESSURIZATION (CFM)		551

THE BUILDING HVAC SYSTEM SHALL BE BALANCED BY NATIONAL TAB HIRED BY THE OWNER. CONTACT Dan Hertenstein - National TAB at: 816-215-1593 - DAN@NATIONALTAB.COM

MECHANICAL PLAN NOTES

1. LOCATION OF REMOTE TEMPERATURE AND HUMIDITY SENSOR FOR RTU. INSTALL AT 9' AFF.
2. EXISTING EXHAUST HOOD TO BE RELOCATED AS SHOWN ON PLANS. INSTALLED BY THIS CONTRACTOR PER THE MANUFACTUERERS INSTRUCTIONS. EXHAUST HOODS ONCE RELOCATED SHALL BE BROUGHT UP TO THE LATEST NFPA REQUIREMENTS INCLUDING BUT NOT LIMITED TO ADDING TEMPERATURE SENSOR FOR AUTOMATIC START OF FAN. GREASE FILTERS, ANSUL FIRE SUPPRESSION. ALL EXISTING HOODS AND INTEGRAL SUPPRESSION SYSTEMS SHALL BE RETROFIT BY A LICENSED SERVICER SPECIFIC TO THE NEW RESTAURANT EQUIPMENT.
3. LOCATION OF MANUAL PULL STATION. INSTALL PER THE MANUFACTURERS REQUIREMENTS. CONFIRM LOCATION WITH LOCAL FIRE MARSHAL PRIOR TO INSTALLATION.
4. PROVIDE MACURCO #CD-6B CARBON DIOXIDE MONITOR AND EXTERNAL HORN STROBE PER REQUIREMENTS FOR AUDIBLE AND VISUAL ALARM. 24V LOW VOLTAGE. THREE ALARM LEVEL RELAYS, AMBER COLOR HORN STROBE. 0-5% BY VOLUME RANGE. SEE CARBON DIOXIDE ALARM SCHEDULE ON SHEET M-200. COORDINATE INSTALLATION WITH ELECTRICAL CONTRACTOR AS REQUIRED.
5. LOCATION OF DUCT MOUNTED SMOKE DETECTOR IN RETURN OF RTU. PROVIDE REMOTE ENUNCIATOR AUDIO/VISUAL. VERIFY LOCATION WITH FIRE MARSHAL PRIOR TO INSTALLATION. REFER TO SPEC SHEET MP0 FOR ADDITONAL INFORMATION.
6. LOCATION OF RTU THERMOSTATS. GC TO LABEL EACH THERMOSTAT.
7. TRANSITION AND CONNECT 10" DIAMETER GREASE DUCT TO EXHAUST HOOD. ROUTE DUCT UP AND CONNECT TO EXHAUST FAN. OFFSET AS NECESSARY TO MISS ROOF STRUCTURE, AND TO MAINTAIN 10'-0" CLEARANCE FROM ALL OUTDOOR AIR INTAKES AND 5'-0" FROM PARAPET WALLS. ALL GREASE DUCT IS TO BE INSTALLED WITH DUCT WRAP. AS DETAILED AND PER THE MANUFACTURERS REQUIREMENTS FOR 0" CLEARANCE TO COMBUSTIBLES. REFER TO ROOF PLAN M-101 FOR CONTINUATION.
8. TRANSITION AND CONNECT 16" DIAMETER GREASE DUCT TO EXHAUST HOOD. ROUTE DUCT UP AND CONNECT TO EXHAUST FAN. OFFSET AS NECESSARY TO MISS ROOF STRUCTURE, AND TO MAINTAIN 10'-0" CLEARANCE FROM ALL OUTDOOR AIR INTAKES AND 5'-0" FROM PARAPET WALLS. ALL GREASE DUCT IS TO BE INSTALLED WITH DUCT WRAP AND ACCESS DOORS AS DETAILED AND PER THE MANUFACTURERS REQUIREMENTS FOR 0" CLEARANCE TO COMBUSTIBLES. REFER TO ROOF PLAN M-101 FOR CONTINUATION.
9. SUPPORT EXHAUST FAN FROM STRUCTURE AS REQUIRED BY THE MANUFACTURER.
10. ROUTE 8" EXHAUST DUCT UP THROUGH ROOF TO ROOF CAP. MAINTAIN 10'-0" CLEARANCE TO ALL OUTDOOR AIR INTAKES. SEAL PENETRATION WEATHERTIGHT.
11. DUCT UP THROUGH ROOF, SEE SHEET M101 FOR CONTINUATION. OPENING TO BE CUT BETWEEN TRUSSES AS REQUIRED. TRANSITION DUCT SIZES AS REQUIRED TO MISS EXISTING STRUCTURE. FIELD VERIFY EXACT LOCATION PRIOR TO CUTTING THE ROOF. SEAL PENETRATION WEATHERTIGHT AS REQUIRED.
12. PROVIDE 3" PVC FLUE AND COMBUSTION AIR INTAKE PIPE FOR HOT WATER HEATER THROUGH ROOF. PROVIDE MANUFACTURERS TERMINATION KIT. SEAL PENETRATION WEATHERTIGHT. VERIFY 10'-0" CLEARANCE FROM ALL OUTDOOR AIR INTAKES.
13. EXISTING DUCTWORK IN THE DINING ROOM TO REMAIN (TYP).
14. RELOCATE EXISTING DIFFUSER AS SHOWN. CLEAN AS REQUIRED FOR REUSE. REBALANCE TO CFM SHOWN ON PLAN.
15. CONNECT SUPPLY DUCT TO EXISTING DUCT BRANCH IN DINING ROOM AS REQUIRED.
16. BRANCH DUCT TO BE ROUTED BETWEEN TRUSSES ABOVE SUPPLY DUCTS BELOW.
17. PROVIDE VOLUME DAMPER AT EACH DROP TO HOOD AND TRANSITION TO HOOD CONNECTION SIZE AS REQUIRED. BALANCE EACH DROP TO 645 CFM.
18. PROVIDE VOLUME DAMPER IN DROP TO HOOD AND TRANSITION TO HOOD CONNECTION SIZE AS REQUIRED. BALANCE DROP TO 630 CFM.
19. CLEAN EXISTING DIFFUSER AS REQUIRED FOR REUSE. REBALANCE TO CFM SHOWN ON PLAN.
20. CLEAN/REPLACE EXISTING RETURN GRILLES AS REQUIRED.
21. EXISTING AIR CURTAIN TO REMAIN. CLEAN AS REQUIRED FOR REUSE.



2 M-100 DINING ROOM DIFFUSER DETAIL
NO SCALE

BC PROJECT # 24972
TEXAS PE COA #F-15978

BC ENGINEERS INCORPORATED
5720 Reeder Shawnee, KS 66203 (913)262-1772

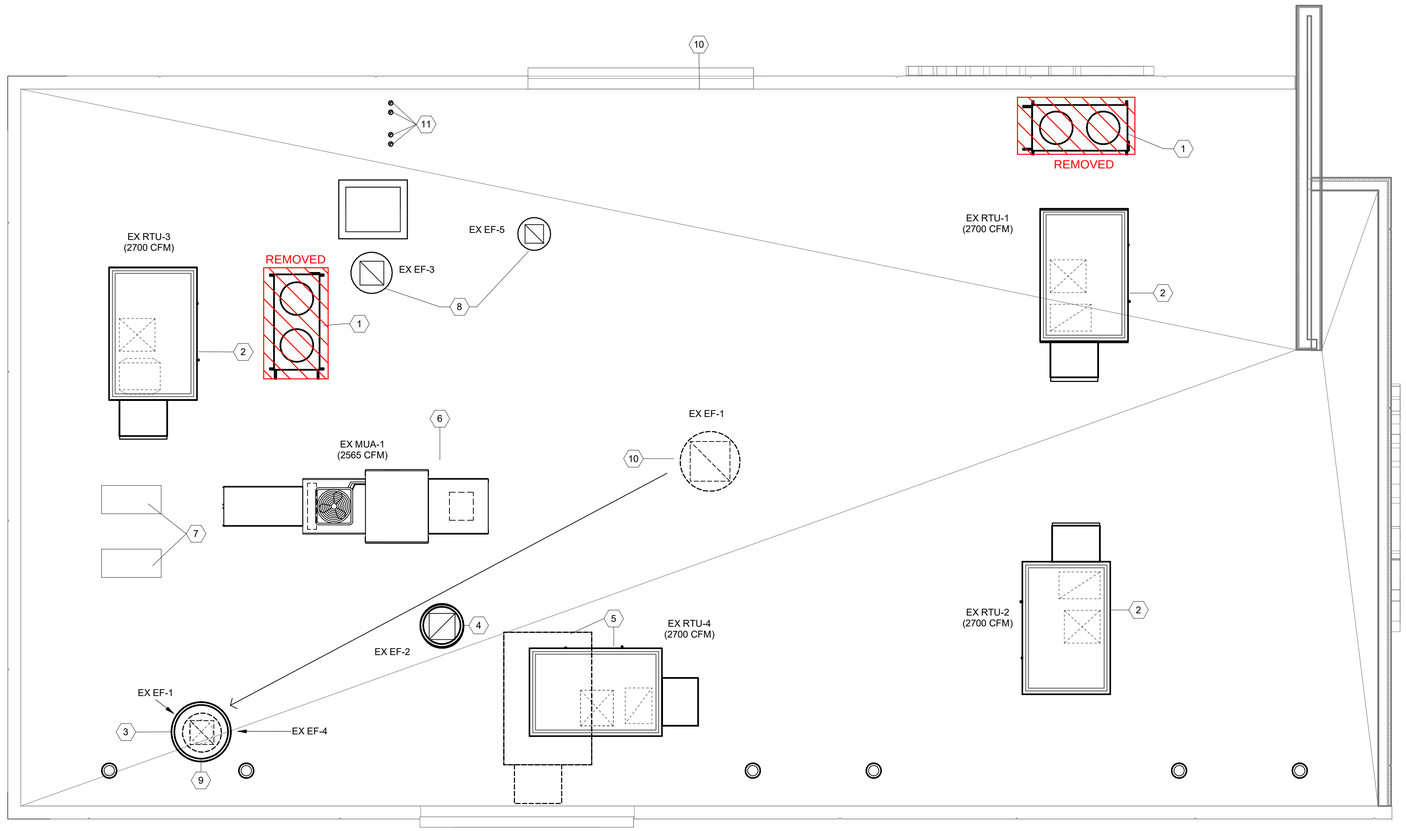
a new restaurant for:
Freddy's
4490 Crow Rd
Beaumont, TX 77706

date
04.04.2025
drawn by
AK/FO
checked by
DS/EK
revisions

sheet number
M-100

drawing type
permit

project number
23006-31



1 M-101 MECHANICAL ROOF PLAN
1/4" = 1'-0"

NORTH

MECHANICAL PLAN NOTES

1	~~MOUNT CONDENSING UNIT ON ROOF AS DETAILED AND AS REQUIRED BY THE MANUFACTURER. CONNECT REFRIGERANT PIPING TO EVAP COIL AS REQUIRED BY THE MANUFACTURER. SEE SHEET M000 FOR MOUNTING DETAIL. CONNECT TO ROOF STRUCTURE PER THE STRUCTURAL DRAWINGS.~~
2	EXISTING RTU TO REMAIN. VERIFY EXACT LOCATION PRIOR TO INSTALLATION OF ANY DUCTWORK. BALANCE OUTDOOR AIR DAMPER TO REQUIRED OUTDOOR AIR CFM SHOWN ON OUTDOOR AIR CALCULATIONS. REFER TO SHEET M-200.
3	EXISTING TYPE 1 EXHAUST FAN AND CURB TO BE RELOCATED AS SHOWN. UTILIZE EXISTING ROOF PENETRATION. CONNECT 16" DIAMETER EXHAUST DUCT FROM EXHAUST HOOD UP TO FAN ON ROOF. PATCH ROOF AS REQUIRED AND SEAL ALL PENETRATIONS WEATHERTIGHT. SUPPORT EXHAUST FAN FROM STRUCTURE AS REQUIRED BY THE MANUFACTURER.
4	EXISING TYPE I EXHAUST FAN TO REMAIN. CONNECT 10" DIAMETER EXHAUST DUCT FROM EXHAUST HOOD UP TO FAN ON ROOF.
5	EXISTING RTU-4 TO BE RELOCATED AS SHOWN. PROVIDE NEW 14" ROOF CURB. COORDINATE WITH STRUCTURE TO RUN NEW DUCT DROPS AS REQUIRED. PATCH EXISTING ROOF PENETRATIONS WEATHERTIGHT AS REQUIRED. BALANCE OUTDOOR AIR DAMPER TO REQUIRED OUTDOOR AIR CFM SHOWN ON OUTDOOR AIR CALCULATIONS. REFER TO SHEET M-200. MAINTAIN MINIMUM 10' CLEARANCE FROM ALL EXHAUST OUTLETS.
6	EXISTING MUA TO REMAIN. VERIFY EXACT LOCATION PRIOR TO INSTALLATION OF ANY DUCTWORK.
7	EXISTING CONDENSERS FOR WALK-IN COOLER TO REMAIN.
8	UNUSED EXISTING EXHAUST FAN TO REMAIN.
9	REMOVE EXISTING EXHAUST FAN (EF-4) AND HAUL OFF SITE. ROOF PENETRATION TO BE USED FOR RELOCATED EXISTING EF-1.
10	EXISTING TYPE 1 EXHAUST FAN AND CURB TO BE RELOCATED AS SHOWN. PATCH ROOF WEATHERTIGHT AS REQUIRED.
11	PROVIDE MANUFACTURER'S CONCENTRIC TERMINATION VENT KIT SERVING HOT WATER HEATER BELOW. INSTALL IN STRICT ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS. ENSURE AT LEAST 10'-0" DISTANCE BETWEEN OUTDOOR AIR INTAKES.

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OUTDOOR AIR CALCULATIONS

UNIT	Area (sqft)	OCCUPANCY CLASSIFICATION	Occupant Density #/1000 sqft	People outdoor airflow rate in breathing zone, (Rp) cfm/person	Area outdoor airflow rate in breathing zone, (Ra) cfm/sqft	Exhaust airflow rate cfm/sqft	Breathing zone outdoor airflow (Vbz)	Zone air distribution effectiveness (Ez)	Zone outdoor airflow (cfm)
EX RTU-1	574	Dining rooms	70	7.5	0.18		405	0.8	506
	115	Corridors	0	0	0.06		7	0.8	9
								Total	514
UNIT	Area (sqft)	OCCUPANCY CLASSIFICATION	Occupant Density #/1000 sqft	People outdoor airflow rate in breathing zone, (Rp) cfm/person	Area outdoor airflow rate in breathing zone, (Ra) cfm/sqft	Exhaust airflow rate cfm/sqft	Breathing zone outdoor airflow (Vbz)	Zone air distribution effectiveness (Ez)	Zone outdoor airflow (cfm)
EX RTU-2	667	Dining rooms	70	7.5	0.18		470	0.8	588
	56	Office spaces	5	5	0.06		5	0.8	6
								Total	594
UNIT	Area (sqft)	OCCUPANCY CLASSIFICATION	Occupant Density #/1000 sqft	People outdoor airflow rate in breathing zone, (Rp) cfm/person	Area outdoor airflow rate in breathing zone, (Ra) cfm/sqft	Exhaust airflow rate cfm/sqft	Breathing zone outdoor airflow (Vbz)	Zone air distribution effectiveness (Ez)	Zone outdoor airflow (cfm)
EX RTU-3	606	Kitchens (cooking)	20	7.5	0.12	0.7	164	0.8	205
								Total	205
UNIT	Area (sqft)	OCCUPANCY CLASSIFICATION	Occupant Density #/1000 sqft	People outdoor airflow rate in breathing zone, (Rp) cfm/person	Area outdoor airflow rate in breathing zone, (Ra) cfm/sqft	Exhaust airflow rate cfm/sqft	Breathing zone outdoor airflow (Vbz)	Zone air distribution effectiveness (Ez)	Zone outdoor airflow (cfm)
EX RTU-4	415	Kitchens (cooking)	20	7.5	0.12	0.7	112	0.8	140
								Total	140

EXISTING ROOFTOP UNIT SCHEDULE

MARK	MANUFACTURER	MODEL NO.	EVAP CFM	EXT. STATIC P. IN. WG.	COOLING				HOT GAS REHEAT	HEATING (GAS)		ELECTRICAL				SEER	TOTAL WEIGHT (LBS)
					TOTAL	SENSIBLE	AMB	EVAP.EAT DB/WB		INPUT	OUTPUT	VOLT/PH/HZ	BLOWER MOTOR	MCA	MOCP		
EX RTU 1-4	YORK	ZR090N18D	2700	0.600	93 Btu/h	69 Btu/h	105.0 °F	80.0 °F / 67.0 °F	Yes	180 Btu/h	146 Btu/h	208 V / 3 / 60 Hz	2.00 hp	43.0 A	50.0 A	11.2	1160 lb

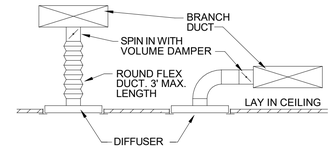
PREVENTATIVE MAINTENANCE CHECK-UP LIST

ALL EXISTING HVAC UNITS SHOULD HAVE A PREVENTATIVE MAINTENANCE CHECK-UP TO INCLUDE THE FOLLOWING CRITERIA

1. CHANGE ALL FILTERS.
2. CLEAN ALL CONDENSATE DRAIN PANS AND FLUSH ALL CONDENSATE DRAIN LINES.
3. CLEAN ALL EVAPORATOR AND CONDENSER COILS WITH A NON-ACID CLEANER.
4. CHECK REFRIGERANT CHARGE (GUAGES OR RETURN/SUPPLY TEMPERATURE VARIANCE).
5. PROVIDE COMPLETE LUBRICATION OF ALL SHAFTS AND BEARINGS THAT HAVE LUBRICATION ZERKS.
6. THE REPLACEMENT OF ALL BELTS, HOSES AND FABRIC/RUBBER COATED ITEMS THAT ARE SUBJECT TO WEAR.
7. CHECK AMPS OF THE INDOOR, OUTDOOR MOTORS, AND COMPRESSORS
8. TURN UNIT POWER OFF - TIGHTEN ALL ELECTRICAL CONNECTIONS, CONTACTORS, ETC.
9. EXAMINE AND REPAIR ALL ELECTRICAL WIRING, CONTROLS, STARTERS, RELAYS, CAPACITORS AND LIKE ITEMS THAT TEND TO DETERIORATE OVER TIME OR BECOME NON-OPERATIONAL. THIS INCLUDES SMOKE DETECTORS.
10. GREASE ALL FITTINGS
11. CHECK DUCTWORK CONNECTIONS AND REPAIR AS NEEDED.
12. NOTIFY GENERAL CONTRACTOR OF ANY REQUIRED PARTS OR REPAIRS NOT INCLUDED IN THIS LIST. ALL UNITS SHALL BE FUNCTIONING AND COOLING PROPERLY AT COMPLETION OF JOB.
13. CHECK THE ECONOMIZER FOR PROPER FUNCTION AND CORRECT OPERATION OF THE SYSTEM WHEN A CALL FOR COOLING COMES FROM THE THERMOSTAT. REPAIR AND ADJUST AS NEEDED.
14. VERIFY ANY WORK REQUIRED BY THE LANDLORD PRIOR TO BID.
15. ALL FINDINGS AND VALUES TO BE NOTED AND PROVIDED TO TENANT'S CONSTRUCTION MANAGER & OR TENANT'S MAINTENANCE DIRECTOR.

ECONOMIZER MAINTENANCE
The following items should be checked at least annually to ensure the air economizer is operating properly:

- Setting and operation of the outdoor thermostat or enthalpy control;
- Condition of the outdoor thermostat or enthalpy control;
- Proper setting and operation of the economizer mixed air thermostat;
- Proper damper operation and lubrication;
- Minimum damper position adjustment;
- Correct operation of the system when a call for cooling comes from the thermostat;
- Function and condition of the economizer damper motor; and
- Condition of the wiring and electrical terminations.



6 M-200 DIFFUSER DETAIL
NO SCALE

CARBON DIOXIDE ALARM SCHEDULE

Type Mark	Manufacturer	Model Number	System Voltage	Notes
CO2	Macurco	CD-6B	24 V	1,2

1. PROVIDE BOTH AUDIBLE AND VISUAL ALARM PER CODE REQUIREMENTS
2. PROVIDE MACURCO EXTERNAL HORN STROBE, AMBER COLOR

FAN SCHEDULE

ID	MANUFACTURER	MODEL NO.	TYPE	FAN						VOLT	PH	REMARKS
				DESIGN AIRFLOW	ESP	DRIVE TYPE	MOTOR					
							POWER	RPM	ECM			
EF-1	Greenheck	SP-A200-390	Premium (Constant Cfm)	75	0.250	Direct	0.08 hp	900	Yes	120 V	1	SEE NOTE 1.
EF-2	Greenheck	SP-A200-390	Premium (Constant Cfm)	75	0.250	Direct	0.08 hp	900	Yes	120 V	1	SEE NOTE 1.

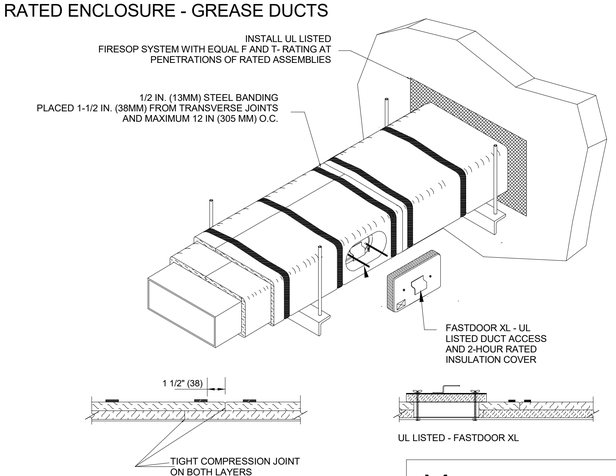
NOTES: 1. PROVIDE CEILING GRILLE, INTEGRAL BACKDRAFT DAMPER, AND ROOF CAP.

GRILLES, REGISTERS AND DIFFUSERS SCHEDULE

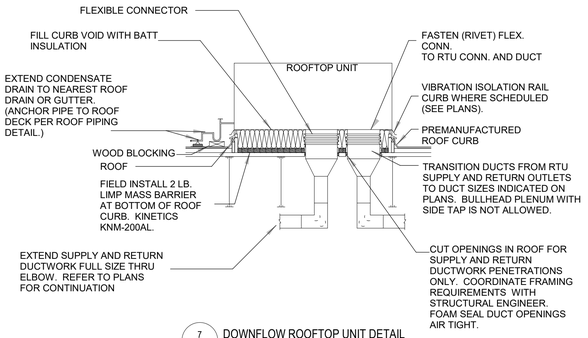
ID	MANUFACTURER	MODEL	MATERIAL	FINISH	NECK			NOTES
					DIAMETER	WIDTH	HEIGHT	
RG-1	Titus	350RL	Steel	White Enamel	0"	8"	6"	PROVIDE RECTANGULAR TO ROUND TRANSITION
RG-2	Titus	PAR	Steel	White Enamel	0"	46"	22"	
SD-1	Titus	PAR	Steel	White Enamel	12"	0"	0"	NO DEFLECTOR
SD-2	Titus	TMS-AA	Aluminum	White Enamel	12"	0"	0"	
SD-3	Titus	T3SQ-4	Steel	White Enamel	8"	0"	0"	THERMAL VAV DIFFUSER
SD-4	Titus	TMS	Steel	White Enamel	6"	0"	0"	WITH O.B. DAMPER AND TRM KIT
SD-5	Titus	300RL	Steel	White Enamel	0"	8"	6"	PROVIDE RECTANGULAR TO ROUND TRANSITION

FIRE RATED ENCLOSURE - GREASE DUCTS

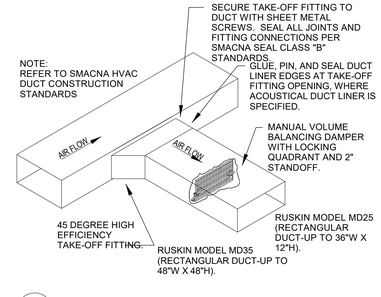
1. THERMAL CERAMICS FIREMASTER FASTWRAP XL IS TESTED TO ASTM E2336 AND UL LISTED PER HNKT.G18 TO PROVIDE ZERO CLEARANCE TO COMBUSTIBLES AND TO PROVIDE A 1- OR 2- HOUR ENCLOSURE. THROUGH PENETRATIONS FIRESTOP SYSTEMS ARE TESTED IN ACCORDANCE WITH ASTM E 814 (UL 1479). ICC-ES APPROVAL PER REPORT ESR 2213 OR ESR 2832.
2. COMPLIANT TO THE FOLLOWING CODES:
   NFPA 96
   INTERNATIONAL MECHANICAL CODES
   UNIFORM MECHANICAL CODE.
   CALIFORNIA MECHANICAL CODE
3. INSULATION APPLIED IN TWO LAYERS WITH TIGHT COMPRESSION JOINT ON BOTH LAYERS AT ALL JOINTS.
4. MINIMUM 16 GAUGE CARBON STEEL (OR 18 GAGE STAINLESS STEEL) RECTANGULAR OR ROUND GREASE EXHAUST DUCT
5. INSTALL UL LISTED AND LIQUID TIGHT THERMAL CERAMICS FASTDOOR XL ACCESS DOORS AT ALL CHANGES IN DIRECTION AND AT MINIMUM EVERY 20 FT ON HORIZONTAL RUNS.
6. SUPPORT HANGER SYSTEMS DO NOT NEED TO BE WRAPPED PROVIDED THE HANGER RODS ARE MINIMUM OF 3/8 IN. DIAMETER AND SUPPORTS ARE MINIMUM 2 X 2 X 1/8 IN. STEEL ANGLE OR SMACNA EQUIVALENT SUPPORT SYSTEM.
7. THERMAL CERAMICS DUCT WRAP SHALL BE INSTALLED DIRECTLY ONTO THE DUCT AND APPLIED FROM THE HOOD CONNECTION TO THE CONNECTION TO THE FAN.
8. THERMAL CERAMICS DUCT ENCLOSURE SYSTEM SHALL BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS AND UL LISTINGS.



Morgan ThermalCeramics
P.O. Box 923
Augusta, Georgia 30903-0923
Phone: (706) 560-4038



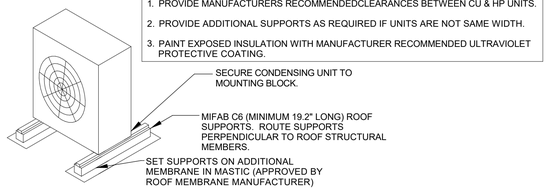
7 M-200 DOWNFLOW ROOFTOP UNIT DETAIL
NO SCALE



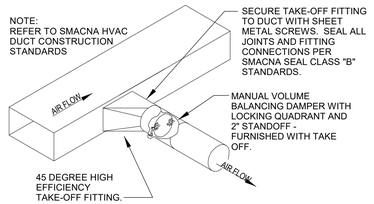
9 M-200 RECTANGULAR DUCT TAKE OFF DETAIL
NO SCALE

NOTES:

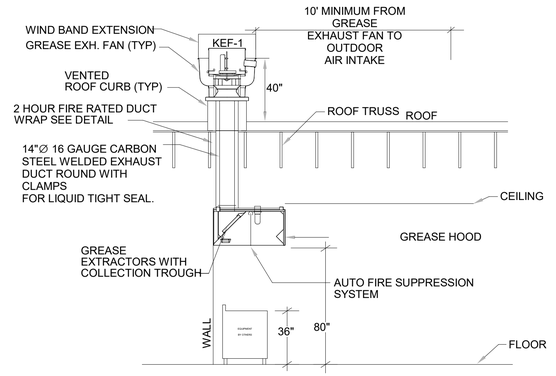
1. PROVIDE MANUFACTURERS RECOMMENDEDCLEARANCES BETWEEN CU & HP UNITS.
2. PROVIDE ADDITIONAL SUPPORTS AS REQUIRED IF UNITS ARE NOT SAME WIDTH.
3. PAINT EXPOSED INSULATION WITH MANUFACTURER RECOMMENDED ULTRAVIOLET PROTECTIVE COATING.



5 M-200 ROOFTOP CONDENSING UNIT DETAIL
NO SCALE



8 M-200 ROUND DUCT TAKE OFF DETAIL
NO SCALE



4 M-200 GREASE HOOD DETAIL
NO SCALE

BC PROJECT # 24972
TEXAS PE COA #F-15978

BC ENGINEERS INCORPORATED
5720 Reeder Shawnee, KS 66203 (913)262-1772

a new restaurant for:
Freddy's
4490 Crow Rd
Beaumont, TX 77706

date
04.04.2025
drawn by
AK/FO
checked by
DS/EK
revisions

sheet number
M-200

drawing type
permit
project number
23006-31

EQUIPMENT SEQUENCE OF OPERATIONS

A. <u>EXISTING ROOFTOP UNITS</u>

1. PROVIDE AN OVERRIDE CONTROL TO OPERATE THE UNIT DURING UNOCCUPIED HOURS. THIS CONTROL SHALL BE PART OF THE PROGRAMMABLE THERMOSTAT. OVERRIDE SWITCH ALLOWS THE UNIT TO OPERATE FOR TWO HOURS (ADJUSTABLE).

2. OCCUPIED MODE: BASED ON THE ROOFTOP UNIT'S HOURS OF OCCUPANCY, START THE UNIT AT THE BEGINNING OF OCCUPANCY AND SHUT DOWN THE UNIT AT THE END OF OCCUPANCY (NOTE: OUTSIDE AIR DAMPER WITHIN THE RTU SHALL OPEN AND THEN THE RTU SHALL START). THE UNIT SHALL START EARLIER AS DETERMINED BY THE PROGRAM FOR EARLY WARM-UP OR COOL DOWN. ON A SYSTEM STARTUP, THE RTU FAN SHALL START AND RUN CONTINUOUSLY. BASED ON THE SPACE TEMPERATURE SENSOR, THE UNIT SHALL CYCLE THE HEATING/COOLING TO MAINTAIN THE SPACE TEMPERATURE SETPOINT.

   2.1. ECONOMIZER MODE: WHEN THE TEMPERATURE OF THE OUTSIDE AIR IS BELOW 55° OR HAS AN ENTHALPY BELOW 28 BTU/LB, ECONOMIZER MODE SHALL BE ENABLED. ECONOMIZER MODE SHALL LINEARLY MODULATE OUTDOOR AIR CFM FROM MINIMUM OA CFM TO 100% BASED ON ENTHALPY READINGS.

   2.2. HUMIDITY CONTROL: UPON DETECTION OF RELATIVE HUMIDITY ABOVE 55%, THE UNIT SHALL CYCLE INTO DEHUMIDIFICATION MODE IF NOT ALREADY IN COOLING AND MODULATE THE COMPRESSORS AND HOT GAS REHEAT VALVE TO SUPPLY SPACE NEUTRAL DEHUMIDIFIED AIR UNTIL THE RELATIVE HUMIDITY DROPS BELOW 55% RH.

3. UNOCCUPIED MODE: THE RTU INTERNAL OA DAMPERS SHALL REMAIN CLOSED WHEN THE BUILDING IS NOT OCCUPIED. THE RTU SHALL STOP HEATING/COOLING AND THE FAN SHALL STOP. BASED ON THE SPACE TEMPERATURE SENSOR, THE UNIT SHALL CYCLE THE HEATING/COOLING TO MAINTAIN THE SPACE TEMPERATURE SETPOINT.

4. UPON DETECTION OF SMOKE BY UNIT SMOKE DETECTOR ALL RTUS SHALL SHUT DOWN AND AN ALARM SHALL BE SENT TO THE FIRE ALARM CONTROL PANEL (WHERE APPLICABLE). LOCAL REMOTE ANNUNCIATORS SHALL ALSO BE ACTIVATED.

B. <u>KITCHEN HOOD EXHAUST FAN (EX KEF-1, AND EX KEF-2)</u>

1. THE KITCHEN HOOD EXHAUST FAN SHALL BE ENABLED WHEN ANY COOKING APPLIANCE LOCATED UNDER ITS RESPECTIVE HOOD, IS IN USE.

C. <u>EX EF-1, EX EF-2</u>

1. EXHAUST FAN SHALL RUN WHEN THE RESTROOM IS OCCUPIED.

D. EX <u>MUA-1</u>

1. THE MAKE UP AIR UNIT SHALL BE ENABLED WHEN THE KITCHEN HOOD EXHUAST FANS (KEF-1 AND KEF-2) ARE ENERGIZED.

2. UPON DETECTION OF SMOKE BY UNIT SMOKE DETECTOR ALL RTUS SHALL SHUT DOWN AND AN ALARM SHALL BE SENT TO THE FIRE ALARM CONTROL PANEL (WHERE APPLICABLE). LOCAL REMOTE ANNUNCIATORS SHALL ALSO BE ACTIVATED.

E. <u>ANSUL SYSTEM ACTIVATION</u>

1. UPON ACTIVATION OF ANSUL SYSTEM, SHUT DOWN EXSITING ROOFTOP UNITS. PROVIDE RELAYS CONTACTS, INTERLOCKS, TRANSFORMERS AND ALL ASSOCIATED WIRING TO ACCOMPLISH SEQUENCE.

F. <u>EXISTING ROOFTOP UNITS WIRING AND CONTROL</u>

1. WIRE THE REMOTE TEMPERATURE SENSOR FOR EACH RTU TO THE THERMOSTAT LOCATED IN THE OFFICE. SET THERMOSTAT FOR REMOTE SENSOR OPERATION.

2. WIRE THE REMOTE HUMIDITY SENSOR DIRECTLY TO THE HUMIDITY TERMINALS ON THE RTU CONTROL PANEL PER THE MANUFACTURERS REQUIREMENTS.

3. PROGRAM THE RTU TO OPERATE THE HOT GAS REHEAT CONTROLS BASED ON THE REMOTE SENSOR TO CONTROL HUMIDITY IN THE SPACE.

4. REFER TO THE RTU SEQUENCE OF OPERATIONS FOR UNIT OPERATION.

BC PROJECT # 24972
TEXAS PE COA #F-15978

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4/4/25
STATE OF TEXAS
ERIK BRADLEY KNUDSEN
117553
LICENSED PROFESSIONAL ENGINEER

a new restaurant for:
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4490 Crow Rd
Beaumont, TX 77706

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MECHANICAL/PLUMBING SPECIFICATIONS

1. GENERAL PROVISIONS:

A. PROVIDE ALL LABOR, MATERIALS, EQUIPMENT, NECESSARY FOR THE COMPLETE INSTALLATION OF THE PLUMBING AND MECHANICAL SYSTEMS OUTLINED.

B. OBTAIN ALL PERMITS, FEES, LICENSES, INSPECTIONS, AND CERTIFICATES OF COMPLIANCE OR APPROVAL AS REQUIRED BY THE AUTHORITIES.

C. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH ALL APPLICABLE LAWS, CODES AND REGULATIONS OF THE GOVERNMENTAL BODIES HAVING JURISDICTION OVER THE SITE.

D. ALL TESTING REQUIRED BY AUTHORITIES SHALL BE CONSIDERED PART OF THIS WORK.

E. DURING CONSTRUCTION, ALL FIXTURES, EQUIPMENT, PIPE, DUCT, ETC. SHALL BE COVERED, PLUGGED, OR CAPPED AS REQUIRED TO KEEP CLEAN AND UNDAMAGED. ALL DAMAGED ITEMS SHALL BE RESTORED TO ORIGINAL CONDITION OR REPLACED. ALL PROTECTIVE COVERING SHALL BE REMOVED BEFORE FINAL ACCEPTANCE.

F. PROVIDE ALL NECESSARY CUTTING AND PATCHING OF WALLS, FLOORS, CEILINGS, AND ROOFS AS NECESSARY. PATCH AROUND ALL OPENINGS SHALL MATCH ADJACENT AREA. COORDINATE ALL ROOFING WORK WITH OWNER OR RESPONSIBLE PARTY, SO THAT THE EXISTING ROOFING WARRANTY WILL BE MAINTAINED.

G. CONTRACTOR SHALL GUARANTEE ALL WORK AND MATERIALS AGAINST DEFECTS FOR A PERIOD OF ONE YEAR FROM FINAL ACCEPTANCE.

2. OPERATION AND MAINTENANCE MANUALS:

A. DURING THE COURSE OF CONSTRUCTION, COLLECT AND COMPILE OPERATING INSTRUCTIONS, WIRING DIAGRAMS, CATALOG CUTS, LUBRICATION AND PREVENTIVE MAINTENANCE INSTRUCTIONS, PARTS LISTS, ETC. FOR ALL EQUIPMENT FURNISHED UNDER THIS CONTRACT.

B. ALL LITERATURE AND INSTRUCTIONS SHIPPED WITH THE EQUIPMENT SHALL BE SAVED FOR INCLUSION IN THE OPERATION AND MAINTENANCE MANUALS.

C. ALL LITERATURE LISTED ABOVE AND ALL PAPERS LISTING WARRANTIES, ETC. SHALL BE BOUND IN A 3-RING BINDER AND LABELED WITH THE PROJECT NAME, ADDRESS, ARCHITECT, ENGINEER, CONTRACTORS, ETC.

3. MANUFACTURERS:

A. MANUFACTURERS, MODEL NUMBERS, ETC. INDICATED OR SCHEDULED ON THE DRAWINGS SHALL BE INTERPRETED AS HAVING ESTABLISHED A STANDARD OF QUALITY AND SHALL NOT BE CONSTRUED AS LIMITING COMPETITION. ARTICLES, FIXTURES, ETC. OF EQUAL QUALITY BY MANUFACTURERS SHALL BE ACCEPTABLE, SUBJECT TO STRUCTURAL AND ELECTRICAL CONSTRAINTS OF THE PROJECT DESIGN, UNLESS NOTED OTHERWISE.

4. MOTORS:

A. PROVIDE THERMAL OVERLOAD PROTECTION FOR EACH MOTOR PROVIDED BY THIS WORK.

5. TESTING, BALANCING, AND CLEANING:

A. ALL PIPING SHALL BE TESTED FOR LEAKS BEFORE BEING CONCEALED IN WALL CONSTRUCTION OR COVERED WITH INSULATION.

B. SEWER AND VENT PIPING SHALL BE HYDROSTATICALLY TESTED WITH NO LESS THAN 10 FEET OF HEAD FOR A PERIOD OF NOT LESS THAN 15 MINUTES, PER THE LOCAL PLUMBING CODE, WITH NO LEAKS.

C. DOMESTIC WATER PIPING SHALL BE HYDROSTATICALLY TESTED AT A PRESSURE OF NOT LESS THAN 1-1/2 TIMES THE OPERATING PRESSURE, BUT NOT LESS THAN 60 PSI, FOR A PERIOD OF NOT LESS THAN 2 HOURS, WITH NO LEAKS.

D. NATURAL GAS PIPING SHALL BE PNEUMATICALLY TESTED AT A PRESSURE OF NOT LESS THAN 1-1/2 TIMES THE OPERATING PRESSURE, BUT NOT LESS THAN 50 PSI, FOR A PERIOD OF NOT LESS THAN 2 HOURS, WITH NO LEAKS.

E. DUCTWORK AND PIPING SHALL BE BALANCED BY QUALIFIED INDEPENDENT BALANCING PERSONNEL WHO HAVE PREVIOUS EXPERIENCE WITH BALANCING PROCEDURES AND ARE CERTIFIED BY THE ASSOCIATED AIR BALANCE COUNCIL (AABC) OR NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB).
   1. BALANCING SHALL INCLUDE THE BALANCING OF THE EQUIPMENT AND AIR DISTRIBUTION SYSTEMS TO PROVIDE DESIGN QUANTITIES INDICATED AND VERIFICATION OF PERFORMANCE OF ALL EQUIPMENT AND AUTOMATIC CONTROLS.
   2. WITH IN 30 DAYS OF THE COMPLETION OF THE TESTING AND BALANCING WORK, SUBMIT THE TEST AND BALANCING REPORT BEARING THE SIGNATURE OF THE TEST AND BALANCE ENGINEER. THE REPORTS SHALL BE CERTIFIED PROOF THAT THE SYSTEMS HAVE BEEN TESTED, ADJUSTED, AND BALANCED IN ACCORDANCE WITH THE REFERENCED STANDARDS; ARE AN ACCURATE REPRESENTATION OF HOW THE SYSTEMS HAVE BEEN INSTALLED AND ARE OPERATING. REPORTS SHALL BE BOUND IN A VINYL BINDER AND THE BINDER LABELED OR MAY BE AN ELECTRONIC PDF SUBMITTAL.

F. GREASE DUCT SHALL BE TESTED PRIOR TO USE OR CONCEALMENT OF ANY PORTION OF THE GREASE DUCT SYSTEM. DUCTS SHALL BE CONSIDERED TO BE CONCEALED WHEN INSTALLED IN SHAFTS OR COVERED BY DUCT WRAP INSULATION THAT PREVENTS THE DUCTWORK FROM BEING VISUALLY INSPECTED FROM ALL SIDES. THE PERMIT HOLDER SHALL BE RESPONSIBLE TO PROVIDE THE NECESSARY EQUIPMENT AND PERFORM THE GREASE DUCT LEAKAGE TEST PER NFPA 96 AND ALL LOCAL CODES.

G. BEFORE DOMESTIC WATER PIPING IS PLACED IN SERVICE, ALL DOMESTIC WATER DISTRIBUTION SYSTEMS, INCLUDING THOSE FOR COLD WATER AND HOT WATER SYSTEMS, SHALL BE FLUSHED, STERILIZED AND CHLORINATED IN ACCORDANCE WITH HEALTH DEPARTMENT REGULATIONS. THE SYSTEMS SHALL BE THOROUGHLY FLUSHED OF ALL DIRT AND FOREIGN MATTER, THEN FILLED WITH WATER TREATED WITH 50 PPM OF CHLORINE. DURING THE FILLING PROCESS, VALVES AND FAUCETS SHALL BE OPENED SEVERAL TIMES TO ASSURE TREATMENT OF THE ENTIRE SYSTEM. THE TREATED WATER SHALL BE LEFT IN THE SYSTEM FOR 24 HOURS AFTER WHICH TIME THE SYSTEM SHALL BE FLUSHED; IF THE RESIDUAL CHLORINE IS NOT LESS THAN 10 PPM, THE FLUSHING SHALL BE REPEATED. AFTER STERILIZATION, SAMPLES OF WATER IN THE SYSTEM SHALL BE APPROVED BY THE BOARD OF HEALTH.

6. PLUMBING:

A. PROVIDE AN APPROVED WATER HAMMER ARRESTOR FOR EACH PLUMBING FIXTURE SUPPLY AS REQUIRED BY FIXTURE MANUFACTURER.

B. ALL EXPOSED WASTE PIPE SHALL BE CHROME PLATED BRASS PIPE, NO FERROUS PIPE.

C. PROVIDE CLEANOUTS AT EACH CHANGE OF DIRECTION AND AT 100 FOOT INTERVALS IN STRAIGHT RUNS.

D. PROVIDE ACCESS PANELS FOR ALL CONCEALED VALVES AND TRAPS.

E. CLEANOUTS:
   1. VINYL TILE FLOOR: JR SMITH #4140, OR EQUAL.
   2. QUARRY TILE FLOOR: JR SMITH #4200, OR EQUAL.
   3. CARPETED FLOOR: JR SMITH #4020-Y, OR EQUAL.
   4. UNFINISHED FLOOR: JR SMITH #4020, OR EQUAL.
   5. WALL: JR SMITH #4472, OR EQUAL, 24" ABOVE THE FLOOR.
   6. GRADE: JR SMITH #4256, OR EQUAL, WITH HEAVY DUTY CAST IRON BODY AND COVER.

F. PROVIDE DIELECTRIC UNIONS WITH APPROPRIATE END CONNECTIONS TO MATCH THE PIPE SYSTEM IN WHICH INSTALLED (SCREWED, SOLDERED, OR FLANGED). PROVIDE DIELECTRIC UNIONS ON ALL PIPING CONNECTIONS TO HOT WATER HEATERS AND EXPANSION TANKS.

G. WATER HEATERS:
   1. EVERY WATER HEATER SHALL HAVE AN APPROVED MEANS INSTALLED ON THE COLD WATER SUPPLY LINE ABOVE THE EQUIPMENT TO PREVENT SIPHONING OF A STORAGE WATER HEATER OR TANK.
   2. BOTTOM FED WATER HEATERS AND TANKS CONNECT TO WATER HEATERS SHALL HAVE A VACCUM RELIEF VALVE INSTALLED. ANSI Z21.22.
   3. STORAGE HEATERS OPERATING ABOVE ATMOSPHERIC PRESSURE SHALL HAVE AN APPROVED PRESSURE RELIEF VALVE AND/OR TEMPERATURE RELIEF VALVE.

H. ALL SEWER PIPING LOCATED INSIDE THE BUILDING SHALL BE INSTALLED WITH THE FOLLOWING SLOPES.
   1. INSTALL 2-1/2" AND SMALLER PIPE AT 1/4" PER FOOT FALL.
   2. INSTALL 3" AND LARGER PIPE AT 1/8" PER FOOT FALL.
   3. INSTALL ALL GREASE WASTE PIPING AT 1/4" PER FOOT FALL.

7. PIPING:

A. DOMESTIC COLD, HOT, AND HOT WATER RECIRCULATING (ABOVEGROUND).
   1. TYPE L HARD DRAWN COPPER TUBING, ASTM B-88.
      a. WROUGHT COPPER SOLDERED FITTINGS, ASTM B75 ALLOY C12200. ANSI B16.22. MSS SP-104.
      b. MECHANICAL PRESS COPPER FITTINGS FOR USE IN PLUMBING OR MECHANICAL APPLICATIONS. ASME B16.22, ASME B16.51, or ASME B16.18. MECHANICAL PRESS COPPER FITTINGS SHALL CONFORM TO IAPMO PS-117 OR ASME B16.51.
   2. PEX, HIGH-DENSITY CROSS-LINKED POLYETHYLENE TUBING SHALL BE MANUFACTURED TO THE REQUIREMENTS OF ASTM F876 AND MEET THE STANDARD GRADE HYDROSTATIC PRESSURE RATINGS FROM PLASTIC PIPE INSTITUTE IN ACCORDANCE WITH TR-4/03. (MUST BE INSTALLED PER THE MANUFACTURERS REQUIREMENTS FOR PLENUM USE)
      a. PEX-A AND PEX-B MEETING ANSI/NSF61 AND ANSI/NSF372 STANDARDS FOR POTABLE WATER SAFETY AND LEAD-FREE STANDARDS AND MUST BE MARKED WITH “PW-G”, “NSF-61-G” OR OTHER NSF-APPROVED MARKING. ASTM F2023 FOR USE WITH CHLORINATED WATER. (MUST BE INSTALLED PER THE MANUFACTURERS REQUIREMENTS FOR PLENUM USE)
      b. PEX MECHANICAL, CRIMP/INSERT OR EXPANSION FITTINGS INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. PIPE SIZES GIVEN ON THE DRAWINGS ARE NOMINAL COPPER PIPE SIZE, INCREASE PEX PIPING SIZE TO EQUAL OR EXCEED COPPER PIPE INSIDE DIAMETER FOR SUPPLY MAINS. (MUST BE INSTALLED PER THE MANUFACTURERS REQUIREMENTS FOR PLENUM USE)
   3. VALVES
      a. TO BE INSTALLED ON THE FIXTURE SUPPLY TO EACH PLUMBING FIXTURE.
      b. TO BE INSTALLED ON THE WATER SUPPLY SIDE TO EACH APPLIANCE OR MECHANICAL EQUIPMENT.
      c. TYPES:
         1. GATE VALVE: JOMAR T/S-301G OR EQUAL. LEAD-FREE NSF 61, ANSI B1.20.1.
         2. GLOBE VALVE: JOMAR TGG OR EQUAL.
         3. BALL VALVE: JOMAR JP100PxP OR EQUAL COMPACT LEAD FREE BRASS BALL VALVE. UL842, CSA 3371-12 & 3371-92, FM, CALIFORNIA CODE AB1953, NSF61 ANNEX G APPROVED.
         4. BALL VALVE: JOMAR T-100NE OR EQUAL. UL842, FM, CSA, NSF 61-8, MSS SP-110

B. LEAD CONTENT OF WATER SUPPLY PIPE AND FITTINGS:
   1. PIPE AND PIPE FITTINGS, INCLUDING VALVES AND FAUCETS, UTILIZED IN THE WATER SUPPLY SYSTEM SHALL NOT HAVE MORE THAN 8% LEAD CONTENT.
   2. PIPE, PIPE FITTINGS, JOINTS, VALVES, FAUCETS, AND FIXTURE FITINGS UTILIZED TO SUPPLY WATER FOR DRINKING OR COOKING PURPOSES SHALL COMPLY WITH NSF 372 AND SHALL HAVE A WEIGHTED AVERAGE LEAD CONTENT OF 0.25% OR LESS.

C. SANITARY SEWER, GREASE WASTE, AND VENTS. (UNDERGROUND, INTERIOR TO THE BUILDING).
   1. ABS SCHEDULE 40 CELLULAR CORE (FOAM CORE) PIPE AND DWV FITTING SYSTEM: PIPE AND FITTINGS SHALL BE MANUFACTURED FROM ABS COMPOUND WITH A CELL CLASS OF 42222 FOR PIPE AND 32222 FOR FITTINGS AS PER ASTM D 3965 AND CONFORM WITH NATIONAL SANITATION FOUNDATION (NSF) STANDARD 14. PIPE SHALL BE IRON PIPE SIZE (IPS) CONFORMING TO ASTM F 628 FITTINGS SHALL CONFORM TO ASTM D 2661. SOLVENT CEMENTS SHALL CONFORM TO ASTM D 2235.
   2. PVC SCHEDULE 40 CELLULAR CORE (FOAM CORE) PIPE AND DWV FITTING SYSTEM: PIPE AND FITTINGS SHALL BE MANUFACTURED FROM PVC COMPOUND WITH A CELL CLASS OF 11432 PER ASTM D 4396 FOR PIPE AND 12454 PER ASTM D 1784 FOR FITTINGS AND CONFORM WITH NATIONAL SANITATION FOUNDATION (NSF) STANDARD 14. PIPE SHALL BE IRON PIPE SIZE (IPS) CONFORMING TO ASTM F 891. INJECTION MOLDED FITTINGS SHALL CONFORM TO ASTM D 2665. FABRICATED FITTINGS SHALL CONFORM TO ASTM F 1866. SOLVENT CEMENTS SHALL CONFORM TO ASTM D 2564.
   3. PVC SCHEDULE 40 SOLID WALL PIPE AND DWV FITTING SYSTEM: PIPE AND FITTINGS SHALL BE MANUFACTURED FROM PVC COMPOUND WITH A CELL CLASS OF 12454 PER ASTM D 1784 AND CONFORM WITH NATIONAL SANITATION FOUNDATION (NSF) STANDARD 14. PIPE SHALL BE IRON PIPE SIZE (IPS) CONFORMING TO ASTM D 1785 AND ASTM D 2665. INJECTION MOLDED FITTINGS SHALL CONFORM TO ASTM D 2665. FABRICATED FITTINGS SHALL CONFORM TO ASTM F 1866. SOLVENT CEMENTS SHALL CONFORM TO ASTM D 2564.
   4. HUBLESS CAST IRON SOIL PIPE AND FITTINGS: HUBLESS CAST IRON PIPE AND FITTINGS SHALL BE MANUFACTURED FROM GRAY CAST IRON AND SHALL CONFORM TO ASTM A 888 AND CISPI STANDARD 301. HUBLESS COUPLINGS SHALL CONFORM TO CISPI STANDARD 310 AND BE CERTIFIED BY NSF ® INTERNATIONAL.
   5. HUB AND SPIGOT CAST IRON SOIL PIPE AND FITTINGS: HUB AND SPIGOT CAST IRON PIPE AND FITTINGS SHALL BE MANUFACTURED FROM GRAY CAST IRON AND SHALL CONFORM TO ASTM A 74.

D. SANITARY SEWER, GREASE WASTE, AND VENTS. (ABOVE GROUND, INTERIOR TO THE BUILDING).
   1. ABS SCHEDULE 40 CELLULAR CORE (FOAM CORE) PIPE AND DWV FITTING SYSTEM: PIPE AND FITTINGS SHALL BE MANUFACTURED FROM ABS COMPOUND WITH A CELL CLASS OF 42222 FOR PIPE AND 32222 FOR FITTINGS AS PER ASTM D 3965 AND CONFORM WITH NATIONAL SANITATION FOUNDATION (NSF) STANDARD 14. PIPE SHALL BE IRON PIPE SIZE (IPS) CONFORMING TO ASTM F 628 FITTINGS SHALL CONFORM TO ASTM D 2661. SOLVENT CEMENTS SHALL CONFORM TO ASTM D 2235. (NOT FOR USE IN A RETURN AIR PLENUM)
   2. PVC SCHEDULE 40 CELLULAR CORE (FOAM CORE) PIPE AND DWV FITTING SYSTEM PIPE AND FITTINGS SHALL BE MANUFACTURED FROM PVC COMPOUND WITH A CELL CLASS OF 11432 PER ASTM D 4396 FOR PIPE AND 12454 PER ASTM D 1784 FOR FITTINGS AND CONFORM WITH NATIONAL SANITATION FOUNDATION (NSF) STANDARD 14. PIPE SHALL BE IRON PIPE SIZE (IPS) CONFORMING TO ASTM F 891. INJECTION MOLDED FITTINGS SHALL CONFORM TO ASTM D 2665. FABRICATED FITTINGS SHALL CONFORM TO ASTM F 1866. SOLVENT CEMENTS SHALL CONFORM TO ASTM D 2564. (NOT FOR USE IN A RETURN AIR PLENUM)
   3. PVC SCHEDULE 40 SOLID WALL PIPE AND DWV FITTING SYSTEM: PIPE AND FITTINGS SHALL BE MANUFACTURED FROM PVC COMPOUND WITH A CELL CLASS OF 12454 PER ASTM D 1784 AND CONFORM WITH NATIONAL SANITATION FOUNDATION (NSF) STANDARD 14. PIPE SHALL BE IRON PIPE SIZE (IPS) CONFORMING TO ASTM D 1785 AND ASTM D 2665. INJECTION MOLDED FITTINGS SHALL CONFORM TO ASTM D 2665. FABRICATED FITTINGS SHALL CONFORM TO ASTM F 1866. SOLVENT CEMENTS SHALL CONFORM TO ASTM D 2564. (WHERE APPROVED BY LOCAL JURISDICTIONS) (NOT FOR USE IN A RETURN AIR PLENUM)
   4. HUBLESS CAST IRON SOIL PIPE AND FITTINGS: HUBLESS CAST IRON PIPE AND FITTINGS SHALL BE MANUFACTURED FROM GRAY CAST IRON AND SHALL CONFORM TO ASTM A 888 AND CISPI STANDARD 301. HUBLESS COUPLINGS SHALL CONFORM TO CISPI STANDARD 310 AND BE CERTIFIED BY NSF ® INTERNATIONAL.
   5. HUB AND SPIGOT CAST IRON SOIL PIPE AND FITTINGS: HUB AND SPIGOT CAST IRON PIPE AND FITTINGS SHALL BE MANUFACTURED FROM GRAY CAST IRON AND SHALL CONFORM TO ASTM A 74.

E. CONDENSATE DRAINS & INDIRECT WASTE (ABOVEGROUND).
   1. DWV, WROUGHT COPPER, ANSI B-16.29 (CONDENSATE INSIDE BUILDING).
   2. POLYVINYLCHLORIDE (PVC) DWV PIPE, SCHEDULE 40, SOLVENT JOINT (CONDENSATE ON ROOF).
   3. POLYVINYLCHLORIDE (PVC) DWV PIPE, SCHEDULE 40, SOLVENT JOINT (INDIRECT WASTE).
   4. DWV, WROUGHT COPPER, ANSI B-16.29 (WATER HEATER T&P , INDIRECT WASTE FROM DISHWASHER/SINKS).

F. REFRIGERANT.
   1. ASTM B 280, TYPE ACR, HARD-DRAWN STRAIGHT LENGTHS, AND SOFT-ANNEALED COILS, SEAMLESS COPPER TUBING.
   2. WROUGHT COPPER, ANSI B16.22, STREAMLINED PATTERN, FITTINGS. BRAZED JOINTS, AWS A 5.8, CLASSIFICATION BAG-1 (SILVER).
   3. TUBING SHALL BE FACTORY CLEANED, READY FOR INSTALLATION, AND HAVE ENDS CAPPED TO PROTECT CLEANLINESS OF PIPE INTERIORS PRIOR TO SHIPPING.
   4. SIZE AND INSTALLATION OF PIPE SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

G. NATURAL GAS.
   1. BLACK STEEL PIPE, SCHEDULE 40, ASTM A53.
      a. PIPE 3" AND SMALLER; 150 LB. MALLEABLE IRON, THREADED FITTINGS.
      b. PIPE 4" AND SMALLER; VIEGA MEGAPRESS G FOR WATER AND GAS. CSA LC4, TSSA/ASME B31 FOR USE WITH ASTM A53 SCHEDULE 40 BLACK IRON PIPE.
      c. PIPE 2-1/2" AND LARGER, WELDED.
      d. PLUG VALVE: ROCKWELL NORDSTROM FIGURE NO. 142 OR 143.
      e. BALL VALVE: JOMAR T-100NE. APPROVALS- UL842, FM, CSA, NSF 61-8, MSS SP-110
   2. GAS PIPING LABELING:
      a. ALL ELEVATED PRESSURE GAS PIPING SHALL BE LABELED EVERY 40 FEET WITH SIGNS INDICATING "ELEVATED PRESSURE".
   3. GAS PIPING PAINTING:
      a. ALL BLACK STEEL GAS PIPING LOCATED EXTERIOR TO THE BUILDING SHALL BE PRIMED AND PAINTED TO EITHER MATCH ADJACENT EXTERIOR WHERE LOCATED ON OR NEAR EXTERIOR WALL AND PAINTED SAFETY YELLOW WHERE LOCATED ON THE ROOF.

H. ALL PIPE HANGERS AND SUPPORTS SHALL BE STANDARD PRODUCTS OF GRINNELL, FEE AND MASON, OR ELCEN. HANGER SPACING SHALL BE IN ACCORDANCE WITH MSS-SP-69.

I. SLEEVES
   1. PROVIDE, SET, AND PROPERLY LOCATE PIPE SLEEVES AS REQUIRED FOR THIS WORK. ALL SLEEVES SHALL BE OF SUFFICIENT SIZE TO PERMIT PIPE MOVEMENT DUE TO EXPANSION AND CONTRACTION AND TO ACCOMMODATE PIPE INSULATION.
   2. INTERIOR PARTITIONS: 16 GAGE GALVANIZED STEEL, PACK BETWEEN PIPE AND SLEEVE WITH FIRE SAFING AND CAULK AT EACH END WITH FIRE RESISTANT SEALANT.
   3. ROOF: PROSET OR EQUAL, MANUFACTURED PVC SCHEDULE 40 PIPE SLEEVE WITH WATERPROOF SEAL. COORDINATE WITH ROOFING CONTRACTOR AND FLASH AS REQUIRED TO MAINTAIN ROOF WARRANTY.
   4. PROTECTION AGAINST CONTACT: METALLIC PIPING, EXCEPT FOR CAST IRON, DUCTILE IRON AND GALVANIZED STEEL SHALL NOT BE PLACED IN DIRECT CONTACT WITH STEEL FRAMING MEMBERS, CONCRETE, OR CINDER WALLS AND FLOORS OR OTHER MASONRY. METALLIC PIPING SHALL NOT BE PLACED IN DIRECT CONTACT WITH CORROSIVE SOIL. SHEATHING USED TO PREVENT DIRECT CONTACT SHALL HAVE A THICKNESS OF GREATER THAN .008: AND THE SHEATHING SHALL BE MADE OF PLASTIC. ANY PIPE THAT PASSES THROUGH A FOUNDATION WALL OR FOOTING SHALL BE PROVIDED WITH A RELIEVING ARCH, OR A PIPE SLEEVE SHALL BE BUILT INTO THE FOUNDATION WALL. THE SLEEVE SHALL BE TWO SIZES GREATER THAN THE PIPE PASSING THOUGH THE WALL OR FOOTING.
   5. PLUMBING VENTS: FLASH ROOF VENT INTO ROOFING SYSTEM AS REQUIRED BY THE ROOFING CONTRACTOR TO MAINTAIN EXISTING ROOF WARRANTY. ALL PLUMBING VENT TERMINALS SHALL TERMINATE A MINIMUM OF 12" ABOVE ROOF OR EQUAL TO HEIGHT OF PARAPET, WHICHEVER IS GREATER.

J. PROVIDE CHROME PLATED ESCUTCHEONS ON ALL PIPE ENTERING FINISHED AREAS.

8. WATER HEATERS

A. COMMERCIAL, HIGH EFFICIENCY, DIRECT-VENT, GAS-FIRED, INSTANTANEOUS, DOMESTIC-WATER HEATERS:
   1. STANDARD: ANSI Z21.10.3/CSA 4.3 FOR GAS-FIRED, INSTANTANEOUS, DOMESTIC-WATER HEATERS FOR INDOOR APPLICATION
   2. CONSTRUCTION: COPPER PIPING OR TUBING COMPLYING WITH NSF 61 AND NSF 372 BARRIER MATERIAL FOR POTABLE WATER, WITHOUT STORAGE CAPACITY.
      a. PRESSURE RATING: 150 PSIG.
      b. HEAT EXCHANGER: STAINLESS STEEL.
      c. INSULATION: COMPLY WITH ASHRAE/IES.
      d. JACKET: METAL, WITH ENAMELED FINISH, OR PLASTIC.
      e. BURNER: FOR USE WITH TANKLESS, DOMESTIC-WATER HEATERS AND NATURAL-GAS FUEL.
      f. AUTOMATIC IGNITION: MANUFACTURER'S PROPRIETARY SYSTEM FOR AUTOMATIC, GAS IGNITION.
      g. TEMPERATURE CONTROL: ADJUSTABLE THERMOSTAT.
   3. DIRECT-VENT SYSTEM: THROUGH- ROOF OR WALL, COAXIAL- OR DOUBLE-CHANNEL VENT ASSEMBLY WITH DOMESTIC-WATER HEATER MANUFACTURER'S OUTSIDE INTAKE/EXHAUST SCREEN.
   4. SUPPORT: BRACKET FOR WALL MOUNTING.

B. DOMESTIC-WATER EXPANSION TANKS:
   1. DESCRIPTION: STEEL, PRESSURE-RATED TANK CONSTRUCTED WITH WELDED JOINTS AND FACTORY-INSTALLED, BUTYL-RUBBER DIAPHRAGM. INCLUDE AIR PRECHARGE TO MINIMUM SYSTEM-OPERATING PRESSURE AT TANK.
   2. CONSTRUCTION:
      a. TAPPINGS: FACTORY-FABRICATED STEEL, WELDED TO TANK BEFORE TESTING AND LABELING. INCLUDE ASME B1.20.1 PIPE THREAD.
      b. INTERIOR FINISH: COMPLY WITH NSF 61 AND NSF 372 BARRIER MATERIALS FOR POTABLE-WATER TANK LININGS, INCLUDING EXTENDING FINISH INTO AND THROUGH TANK FITTINGS AND OUTLETS.
      c. AIR-CHARGING VALVE: FACTORY INSTALLED.
   3. CAPACITY AND CHARACTERISTICS:
      a. WORKING-PRESSURE RATING: 150 PSIG .

9. INSULATION AND DUCT LINING:

A. ALL INSULATIONS AND ACCESSORIES SHALL HAVE A FIRE HAZARD CLASSIFICATION WITH A FLAME SPREAD RATING OF NOT OVER 25, A FUEL CONTRIBUTION RATING OF NOT OVER 50, AND A SMOKE DEVELOPED RATING OF NOT OVER 50, IN ACCORDANCE WITH NFPA.

B. PIPE INSULATION - ABOVE GRADE:
   1. THE PIPING INSULATION USED SHALL HAVE A THERMAL CONDUCTIVITY OF 0.27 Btu PER in/hr*sqft*F° OR LESS.
   2. FIBERGLASS INSULATION WITH FACTORY APPLIED VAPOR BARRIER, ASJ JACKET, FACTORY APPLIED PRESSURE SEALING LONGITUDE LAP JOINT, NO STAPLES, ZESTON PREMOLDED PVC FITTING COVERS. INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
   3. FLEXIBLE CLOSED CELL ELASTOMERIC THERMAL INSULATION, UNSLIT OR PRESLIT WITH PRESSURE SENSITIVE ADHESIVE SYSTEM FOR CLOSURE AND VAPOR SEALING, EQUAL TO ARMSTRONG AP ARMAFLEX OR ARMAFLEX 2000.
   4. FOR NON CIRCULATING SYSTEMS, THE FIRST 8 FEET OF INLET AND OUTLET PIPING BETWEEN THE TANK AND THE HEAT TRAP (INCLUDING THE HEAT TRAP) MUST BE INSULATED.
   5. FOR CIRCULATING SYSTEMS, ALL HOT WATER PIPING IN THE CIRCULATION LOOP MUST BE INSULATED AS SPECIFIED BELOW.
   6. INSULATION SCHEDULE:

a.	DOMESTIC COLD WATER	1/2"
b.	DOMESTIC HOT WATER	1" FOR PIPING UP TO 1-1/4"∅, & 1-1/2" FOR PIPING 1-1/2"∅ AND LARGER
c.	HOT WATER RECIRCULATING	1"
d.	CONDENSATE DRAINS INSIDE BUILDING	1/2"
e.	REFRIGERANT SUCTION	3/4" FOR PIPING UP TO 1-1/4"∅, & 1" FOR PIPING 1-1/2"∅ AND LARGER

C. EQUIPMENT INSULATION:
   1. FLEXIBLE FIBERGLASS: GLASS FIBER INSULATION, ASTM C 553, TYPE 1, CLASS B-4, SEMI-RIGID BOARD, WITH FACTORY LAMINATED KRAFT ALUMINUM FOIL (ALL SERVICE JACKET), VAPOR BARRIER, OWENS/CORNING PIPE AND TANK INSULATION.

D. DUCTWORK: ACOUSTICAL INSULATION.
   1. DUCT LINING: 2 LB/CF, THICKNESS AS SCHEDULED, AIR STREAM SIDE COATED, INSTALL PER SMACNA STANDARDS.
      a. DUCT LINING SCHEDULE:
         1. RECTANGULAR SUPPLY DUCT — 1/2" : THROUGHOUT THE FIRST 10 FEET OF DUCT.
         2. RETURN AIR DUCT — 1/2" : THROUGHOUT THE FIRST 10 FEET OF DUCT.

E. DUCTWORK: THERMAL INSULATION. (WHERE CONCEALED ABOVE CEILING)
   1. DUCT COVERING: 3/4 LB/CF, FIBERGLASS BLANKET WITH FACTORY APPLIED VAPOR BARRIER AND FACING, THICKNESS AS SCHEDULED, INSTALLATION IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
      a. DUCT COVERING SCHEDULE: MINIMUM R-6
         1. ROUND SUPPLY DUCT — 2"
         2. RECTANGULAR SUPPLY DUCT — 2"
         3. RETURN AIR DUCT — 2"
   2. EXPOSED SPIRAL DUCT.
      a. SPIRAL DUCT LINING: JOHNS MANVILLE SPIRACOUSTIC PLUS ROUND DUCT LINER SYSTEM, VSD, SD, AND LD SIZES, 8"∅ AND UP. MEETS ASTM E 84 25/50 FLAME AND SMOKE, ASHRAE 62, MEA#237-86-M, SMACNA APPLICATION STANDARDS FOR DUCT LINERS, NAIMA FIBERBLASS DUCT LINER STANDARD. 1" THICKNESS, AIR STREAM SIDE COATED, INSTALL PER SMACNA STANDARDS.

10. DUCTWORK:

A. ALL DUCTWORK, UNLESS OTHERWISE INDICATED, SHALL BE FABRICATED FROM GALVANIZED SHEET STEEL COMPLYING WITH ASTM A 527, LOCKFORMING QUALITY, WITH G 90 ZINC COATING IN ACCORDANCE WITH ASTM A 525; AND MILL PHOSPHATIZED FOR EXPOSED LOCATIONS.

B. WHERE DUCTWORK IS INDICATED TO BE EXPOSED TO VIEW IN OCCUPIED SPACES, PROVIDE MATERIALS WHICH ARE FREE FROM VISUAL IMPERFECTIONS INCLUDING PITTING, SEAM MARKS, ROLLER MARKS, STAINS AND DISCOLORATIONS, AND OTHER IMPERFECTIONS, INCLUDING THOSE WHICH WOULD IMPAIR PAINTING.

C. DUCTWORK, METAL GAUGES, REINFORCING, ETC. SHALL BE CONSTRUCTED IN ACCORDANCE WITH SMACNA "HVAC DUCT CONSTRUCTION STANDARDS," LATEST EDITION FOR A 2 INCH WATER GAUGE STATIC PRESSURE.
   1. RECTANGULAR DUCT:
      a. ELBOWS, UNLESS INDICATED OTHERWISE SHALL BE CONSTRUCTED WITH CENTERLINE RADIUS OF NOT LESS THAN 1.5 DUCT WIDTH OR SQUARE ELBOW WITH DOUBLE WALL STREAMLINE VANES.
      b. RETURN AIR ACOUSTICAL ELBOWS AND SOUND BOOTS SHALL BE A SQUARE ELBOW WITH NO TURNING VANES.
      c. SLOPES FOR TRANSITIONS OR OTHER CHANGES IN DIMENSIONS SHALL BE MINIMUM 1 TO 3.
   2. ROUND AND OVAL SPIRAL SEAM DUCT:
      a. PROVIDE RADIUS TYPE FITTINGS FABRICATED OF MULTIPLE SECTIONS WITH MAXIMUM 15 DEGREE CHANGE OF DIRECTION PER SECTION. UNLESS SPECIFICALLY DETAILED OTHERWISE, USE 45 DEGREE LATERALS FOR BRANCH TAKEOFF CONNECTIONS. WHERE 90 DEGREE BRANCHES ARE INDICATED PROVIDE CONICAL TYPE TEES.
      b. SLOPES FOR TRANSITIONS OR OTHER CHANGES IN DIMENSIONS SHALL BE MINIMUM 1 TO 3.
      c. AS AN OPTION, PROVIDE FACTORY-FABRICATED DUCT AND FITTINGS, IN LIEU OF SHOP-FABRICATED DUCT AND FITTINGS.
         1. ELBOWS: ONE PIECE CONSTRUCTION FOR 90 DEGREES AND 45 DEGREE ELBOW 14" AND SMALLER. PROVIDE MULTIPLE GORE CONSTRUCTION FOR LARGER DIAMETERS WITH STANDING SEAM CIRCUMFERENTIAL JOINT.
         2. DIVIDED FLOW FITTINGS: 90 DEGREE TEES, CONSTRUCTED WITH SADDLE TAP SPOT WELDED AND BONDED TO DUCT FITTING BODY.
      d. ROUND LONGITUDINAL SEAM DUCT. USE FOR RIGID METAL DUCT ON LEAVING SIDE OF DUCT IN CONCEALED LOCATIONS FOR EXTENSION TO FLEX FOR DIFFUSERS, UNLESS OTHERWISE INDICATED.

D. DUCT SIZES SHOWN ON THE DRAWINGS ARE SHEETMETAL SIZES, ALLOWANCE FOR DUCT LINER HAS BEEN MADE WHERE APPLICABLE.

E. INSTALLATION OF METAL DUCTWORK:
   1. GENERAL: ASSEMBLE AND INSTALL DUCTWORK IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES WHICH WILL ACHIEVE AIR-TIGHT SYSTEMS (MAXIMUM 5% LEAKAGE), WITH NO OBJECTIONABLE NOISE, AND CAPABLE OF PERFORMING INDICATED SERVICE. INSTALL EACH RUN WITH MINIMUM NUMBER OF JOINTS. ALIGN DUCTWORK ACCURATELY WITH INTERNAL SURFACES SMOOTH. SUPPORT DUCTS RIGIDLY WITH SUITABLE STRAPS, BRACES, HANGERS AND ANCHORS IN ACCORDANCE WITH SMACNA "HVAC DUCT CONSTRUCTION STANDARDS" LATEST EDITION. DUCT HANGERS SHALL BE OF THE TYPE WHICH WILL HOLD DUCTS TRUE-TO-SHAPE AND TO PREVENT BUCKLING. SUPPORT VERTICAL DUCTS AT EVERY FLOOR.
   2. AUXILIARY STEEL: PROVIDE AUXILIARY STEEL AS REQUIRED TO ADEQUATELY SUPPORT DUCTWORK.
   3. ROUTING: LOCATE DUCTWORK RUNS, EXCEPT AS OTHERWISE INDICATED, VERTICALLY AND HORIZONTALLY AND AVOID DIAGONAL RUNS WHEREVER POSSIBLE. LOCATE RUNS AS INDICATED BY DIAGRAMS, DETAILS AND NOTATIONS OR, IF NOT OTHERWISE INDICATED, RUN DUCTWORK IN SHORTEST ROUTE WHICH DOES NOT OBSTRUCT USABLE SPACE OR BLOCK ACCESS FOR SERVICING BUILDING AND ITS EQUIPMENT. HOLD DUCTS CLOSE TO WALLS, OVERHEAD CONSTRUCTION, COLUMNS, AND OTHER STRUCTURAL AND PERMANENT ENCLOSURE ELEMENTS OF BUILDING. WHEREVER POSSIBLE IN FINISHED AND OCCUPIED SPACES, CONCEAL DUCTWORK FROM VIEW, BY LOCATING IN MECHANICAL SHAFTS, HOLLOW WALL CONSTRUCTION OR ABOVE SUSPENDED CEILINGS. DO NOT ENCASE HORIZONTAL RUNS IN SOLID PARTITIONS, EXCEPT AS SPECIFICALLY SHOWN. COORDINATE LAYOUT WITH SUSPENDED CEILING AND LIGHTING LAYOUTS AND SIMILAR FINISHED WORK.
   4. DO NOT ROUTE DUCTWORK THROUGH ELECTRICAL EQUIPMENT SPACES AND ENCLOSURES, UNLESS INDICATED OTHERWISE.
   5. PENETRATIONS:
      a. WHERE DUCTS PASS THROUGH INTERIOR PARTITIONS OR EXTERIOR WALLS, AND ARE EXPOSED TO VIEW, CONCEAL SPACE BETWEEN OPENING AND DUCT OR DUCT INSULATION WITH SHEET METAL FLANGES OF SAME GAGE AS DUCT. OVERLAP OPENING ON 4 SIDES BY AT LEAST 1-1/2". FASTEN TO DUCT AND WALL.
      b. WHERE DUCTS PASS THROUGH FIRE-RATED FLOORS, WALLS, OR PARTITIONS, PROVIDE FIRESTOPPING BETWEEN DUCT AND WALL.
   6. COORDINATION: COORDINATE DUCT INSTALLATIONS WITH INSTALLATION OF ACCESSORIES, DAMPERS, COIL FRAMES, EQUIPMENT, CONTROLS, AND OTHER ASSOCIATED WORK OF THE DUCTWORK SYSTEM.
   7. INSTALLATION: INSTALL METAL DUCTWORK IN ACCORDANCE WITH SMACNA "HVAC DUCT CONSTRUCTION STANDARDS", LATEST EDITION.

F. EQUIPMENT CONNECTIONS:
   1. CONNECT METAL DUCTWORK TO EQUIPMENT AS INDICATED, PROVIDE FLEXIBLE CONNECTION FOR EACH DUCTWORK CONNECTION TO EQUIPMENT MOUNTED ON VIBRATION ISOLATORS, AND/OR EQUIPMENT CONTAINING ROTATING MACHINERY. PROVIDE ACCESS DOORS AS REQUIRED.

G. SEAL ALL CONCEALED DUCTWORK JOINTS WITH NON-HARDENING, NON-MIGRATING MASTIC SEALANT, AS RECOMMENDED FOR SEALING SEAMS AND JOINTS IN DUCTWORK. OIL BASE CAULKING AND GLAZING COMPOUNDS SHALL NOT BE ACCEPTABLE. DUCTS SHALL BE SEALED TO THE CLASS LEVEL LISTED BELOW.

		SUPPLY ≤ 2" W.C.	SUPPLY > 2" W.C.	EXHAUST	RETURN
1.	UNCONDITIONED SPACES	CLASS B	CLASS A	CLASS C	CLASS B
2.	CONDITIONED SPACES (PLENUM)	CLASS C	CLASS B	CLASS B	CLASS C

11. GREASE HOOD AND EXHAUST DUCT:

A. HOOD SHALL BE CONSTRUCTED OF 18 GAUGE STEEL OR 20 GAUGE STAINLESS STEEL IN ACCORDANCE WITH NFPA 96 AND LOCAL CODES.
   1. GREASE FILTERS SHALL BE UL LISTED ALUMINUM GREASE EXTRACTORS.
   2. PROVIDE A COMPLETE AUTOMATIC WET CHEMICAL FIRE EXTINGUISHING SYSTEM FOR THE HOOD AND DUCT AS REQUIRED BY NFPA AND LOCAL CODES. ALL COOKING EQUIPMENT UNDER THE HOOD SHALL BE INTERLOCKED WITH THE SYSTEM, TO SHUTDOWN IN AN ALARM CONDITION.
      a. THE GREASE HOOD FIRE SUPPRESSION SYSTEM SHALL BE EQUAL TO AMEREX KP SERIES PRE-ENGINEERED , WET CHEMICAL, STORED-PRESSURE TYPE WITH A FIXED NOZZLE AGENT DISTRIBUTION SYSTEM. THE SYSTEM SHALL BE UL LISTED AND TESTED TO UL STANDARD 300.
      b. THE SYSTEM SHALL UTILIZE AN AGENT EQUAL TO AMEREX KP LIQUID FIRE SUPPRESSANT, A POTASSIUM ACETATE BASED SOLUTION THAT SUPPRESSES COOKING GREASE FIRES, SHALL HAVE A PH OF 9 OR LESS, AND SHALL NOT HARM STAINLESS STEEL SURFACES.
      c. THE SYSTEM SHALL BE PROVIDED WITH A MANUAL "DUAL ACTION" TYPE PULL STATION. PULL STATION SHALL BE LOCATED NOT LESS THAN 10 FEET AND A MAXIMUM OF 20 FEET FROM THE GREASE HOOD AND IN THE PATH OF EGRESS. THE MANUAL ACTUATION SHALL REQUIRE A MAXIMUM FORCE OF 40 POUNDS AND A MAXIMUM MOVEMENT OF 14 INCHES TO ACTUATE THE FIRE SUPPRESSION SYSTEM.
      d. PROVIDE A GAS SHUT OFF VALVE FOR MOUNTING IN THE GAS PIPE THAT WILL SHUT OFF GAS FLOW TO EQUIPMENT UNDER THE HOOD IN AN ALARM CONDITION. PROVIDE AN ELECTRICAL SWITCH WHICH SHALL BE CAPABLE OF DE-ENERGIZING ALL ELECTRICAL DEVICES AND EQUIPMENT UNDER THE HOOD IN AN ALARM CONDITION.

B. GREASE DUCT SHALL BE CONSTRUCTED OF 16 GAUGE CARBON STEEL OR 18 GAUGE STAINLESS STEEL IN ACCORDANCE WITH NFPA 96 AND LOCAL CODES.
   a. JOINTS, SEAMS AND PENETRATIONS OF GREASE DUCTS SHALL BE MADE WITH A CONTINUOUS LIQUID TIGHT WELD OR BRAZE MADE ON THE EXTERNAL SURFACE OF THE DUCT SYSTEM.
   b. DUCT JOINTS SHALL BE BUTT JOINTS, WELDED FLANGE JOINTS WITH A MAXIMUM FLANGE DEPTH OF 1/2" OR OVERLAPPING DUCT JOINTS OF EITHER THE TELESCOPING OR BELL TYPE. OVERLAPPING JOINTS SHALL BE INSTALLED TO PREVENT LEDGES AND OBSTRUCTIONS FROM COLLECTING GREASE OR INTERFERING WITH GRAVITY DRAINAGE TO THE INTENDED COLLECTION POINT.
   c. DUCT TO HOOD CONNECTIONS SHALL BE MADE WITH LISTED AND LABELED DUCT TO HOOD COLLAR CONNECTIONS THAT ARE INSTALLED PER THE TERMS OF THEIR APPROVAL AND PER THE MANUFACTURERS INSTALLATION INSTRUCTIONS.
   d. DUCT TO EXHAUST FAN CONNECTIONS SHALL BE FLANGED AND GASKETED AT THE BASE OF THE FAN FOR VERTICAL DISCHARGE FANS, OR SHALL BE FLANGED, GASKETED AND BOLTED TO THE INLET OF THE FAN FOR SIDE INLET UTILITY FANS. GASKET SEALING MATERIALS SHALL BE RATED FOR A MINIMUM CONTINUOUS DUTY TEMPERATURE OF 1,500°F.

12. FLEXIBLE DUCT:

A. ATCO #086 (R-6), OR EQUAL.
B. FACTORY APPLIED INSULATION AND VAPOR BARRIER, 1-1/2" THICK.
C. MAXIMUM LENGTH OF 5'-0".

13. FLUES AND ACCESSORIES:

A. FLUE FOR GAS FIRED CONDENSING WATER HEATER OR FURNACE SHALL BE AS RECOMMENDED BY THE GAS APPLIANCE MANUFACTURER. FLUES SHALL BE SCHEDULE 40, PVC OR CPVC PIPE PER THE MANUFACTURERS INSTALLATION REQUIREMENTS.

B. PROVIDE MANUFACTURER'S STANDARD ACCESSORY ITEMS INCLUDING BIRD PROOF TOP, STORM COLLAR, ROOF THIMBLE, ETC. AS REQUIRED FOR A COMPLETE INSTALLATION. ROOF THIMBLES THROUGH THE BUILDING ROOF SHALL BE SUITABLE FOR USE WITH THE ROOF PROVIDED.

14. EXHAUST FANS:

A. CENTRIFUGAL TYPE FAN WITH CHARACTERISTICS AND CAPACITY AS SCHEDULED, ELECTRICALLY POWERED, SUITABLE FOR MOUNTING ON ROOF CURB, DIRECT OR BELT DRIVEN, HEAVY GAUGE SPUN-ALUMINUM WEATHERPROOF HOUSINGS OF THE HOODED DOME OR UPBLAST TYPE. PROVIDE PERMANENT SPLIT-CAPACITOR TYPE MOTOR FOR DIRECT DRIVEN FANS, AND CAPACITOR-START, INDUCTION-RUN TYPE MOTOR FOR BELT DRIVEN FANS.

B. CENTRIFUGAL CEILING EXHAUSTERS SHALL BE ELECTRICALLY POWERED CENTRIFUGAL TYPE FAN SUITABLE FOR MOUNTING IN THE CEILING WITH A PERFORATED OFF-WHITE METAL GRILLE WITH A THUMBSCREW ATTACHMENT FOR EASY ACCESS TO FAN HOUSING. UNIT SHALL CONSIST OF A GALVANIZED STEEL HOUSING LINED WITH ACOUSTICAL INSULATION AND SHALL INCLUDE AN INTEGRAL BACKDRAFT DAMPER ON FAN DISCHARGE. MOTOR SHALL BE A PERMANENT SPLIT-CAPACITOR TYPE MOTOR, PERMANENTLY LUBRICATED, WITH THERMAL OVERLOAD PROTECTION. PROVIDE DISCONNECT SWITCH OR OTHER MEANS OF DISCONNECT AT MOTOR IN FAN HOUSING.

15. CONTROL WIRING:

A. ELECTRICAL WIRING AND WIRING CONNECTIONS REQUIRED FOR THE INSTALLATION OF THE TEMPERATURE CONTROL SYSTEM, SHALL BE PROVIDED BY THIS CONTRACTOR, UNLESS SPECIFICALLY SHOWN ON THE ELECTRICAL DRAWINGS OR SPECIFICATIONS.

B. INSTALL CONTROL WIRING, WITHOUT SPLICES BETWEEN TERMINAL POINTS, COLOR CODED. INSTALL IN NEAT WORKMANLIKE MANNER, SECURELY FASTENED. INSTALL IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE AND THE ELECTRICAL SPECIFICATIONS.
   1. INSTALL CIRCUITS OVER 25 VOLT WITH COLOR CODED NUMBER 12 WIRE.
   2. INSTALL CIRCUITS UNDER 25 VOLT WITH COLOR CODED NUMBER 18 WIRE WITH 0.031 INCH HIGH TEMPERATURE 105 DEGREES F PLASTIC INSULATION ON EACH CONDUCTOR AND PLASTIC SHEATH OVER ALL.
   3. INSTALL ELECTRONIC CIRCUITS WITH COLOR CODED NUMBER 22 WIRE WITH 0.023 INCH POLYETHYLENE INSULATION ON EACH CONDUCTOR WITH PLASTIC JACKETED COPPER SHIELD OVER ALL.
   4. INSTALL LOW VOLTAGE CIRCUITS, LOCATED IN CONCRETE SLABS AND MASONRY WALLS, OR EXPOSED IN OCCUPIED AREAS, IN ELECTRIC CONDUIT.
   5. ALL WIRING IN AREAS USED AS AIR PLENUMS SHALL BE IN ELECTRIC CONDUIT EXCEPT THAT LOW VOLTAGE WIRING MAY BE TEFLON COATED, ALUMINUM SHEATHED CABLE OR OTHER WIRE SPECIFICALLY APPROVED FOR INSTALLATION IN AIR PLENUMS, WHERE ACCEPTABLE BY LOCAL CODES.
   6. ALL WIRING IN AREAS NOT USED FOR AIR MOVEMENT SHALL BE IN ELECTRIC METALLIC TUBING EXCEPT LOW VOLTAGE WIRING MAY BE IN APPROVED SIGNAL CABLE WHERE ACCEPTED BY LOCAL CODES.

C. THERMOSTATIC CONTROLS TO HAVE A 5°F DEADBAND AND SETPOINT OVERLAP RESTRICTIONS.
   1. TEMPERATURE CONTROLS SETBACK TO BE 55°F (HEAT) AND 85° (COOL), 2-HOUR OCCUPANT OVERRIDE, 10-HOUR BACKUP.

16. REMODELING WORK:

A. DEMOLITION: DISCONNECT, DEMOLISH, AND REMOVE ABANDONED MECHANICAL MATERIALS AND EQUIPMENT INDICATED TO BE REMOVED AND NOT INDICATED TO BE SALVAGED OR REMAIN.

B. EQUIPMENT TO BE SALVAGED:
   1. DISCONNECT AND REMOVE, EXISTING MECHANICAL EQUIPMENT INDICATED TO BE REMOVED AND SALVAGED. DELIVER EQUIPMENT TO THE LOCATION DESIGNATED BY THE OWNER FOR STORAGE.
   2. ALL MATERIALS AND EQUIPMENT DESIGNATED TO BE REUSED OR RELOCATED SHALL BE CAREFULLY REMOVED, AND STORED UNTIL NEEDED FOR REMODELING WORK. ALL ITEMS SHALL BE RESTORED TO "LIKE NEW" CONDITION WITH RUST OR CORROSION REMOVED, SURFACE PAINT TOUCHED UP OR REPAINTED AS REQUIRED TO MATCH NEW CONSTRUCTION, AND THOROUGHLY CLEANED AND INSPECTED. ANY ITEMS WHICH BECOME DAMAGED BEYOND REPAIR AS A RESULT OF CONSTRUCTION OR DEMOLITION ACTIVITY SHALL BE REPLACED WITH NEW MATERIAL EQUIVALENT IN EVERY RESPECT.

C. DISPOSAL AND CLEANUP: REMOVE FROM THE SITE AND LEGALLY DISPOSE OF DEMOLISHED MATERIALS AND EQUIPMENT NOT INDICATED TO BE SALVAGED.

D. PROTECT ADJACENT MATERIALS INDICATED TO REMAIN. INSTALL AND MAINTAIN DUST AND NOISE BARRIERS TO KEEP DIRT, DUST, AND NOISE FROM BEING TRANSMITTED TO ADJACENT AREAS. REMOVE PROTECTION AND BARRIERS AFTER REMODELING OPERATIONS ARE COMPLETE.

E. LOCATE, IDENTIFY, AND PROTECT MECHANICAL SERVICES PASSING THROUGH REMODELING AREA AND SERVING OTHER AREAS OUTSIDE THE REMODELING LIMITS. MAINTAIN SERVICES TO AREAS OUTSIDE REMODELING LIMITS. WHERE MECHANICAL SERVICES ARE LOCATED IN A WALL, ETC. TO BE DEMOLISHED, REROUTE PIPING TO NEW OR EXISTING CONSTRUCTION TO MAINTAIN CONTINUITY OF THE SYSTEM. WHEN SERVICES MUST BE INTERRUPTED, INSTALL TEMPORARY SERVICES FOR AFFECTED AREAS.

F. REMOVE ALL PIPING TO BE DEMOLISHED BACK TO PIPE MAIN OR EDGE OF PROJECT AREA, AND CAP PIPE.

G. PIPING AND DUCTS EMBEDDED IN FLOORS, WALLS, AND CEILINGS MAY REMAIN IF SUCH MATERIALS DO NOT INTERFERE WITH NEW INSTALLATIONS. PIPING AND DUCTS TO REMAIN SHALL BE APPROVED BY THE ARCHITECT. REMOVE MATERIALS ABOVE ACCESSIBLE CEILINGS. DRAIN AND CAP PIPING AND DUCTS ALLOWED TO REMAIN ABOVE CEILING OR BELOW FLOOR, CONCEALED FROM VIEW, EXCEPT AS OTHERWISE NOTED. PATCH FLOOR TO MATCH EXISTING.

H. PIPE AND DUCT SHALL BE CONCEALED WITH NEW OR EXISTING CONSTRUCTION WHENEVER POSSIBLE, UNLESS INDICATED OTHERWISE.

BC PROJECT # 24972
TEXAS PE COA #F-15978

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COMMISSIONING SPECIFICATIONS

1.01 INTRODUCTION

A. THE DEVELOPER/OWNER DIRECTLY CONTRACTS A COMMISSIONING AGENT FOR THIS PROJECT. THIS SPECIFICATION DETAILS THE ROLES AND RESPONSIBILITIES OF EACH PROJECT TEAM MEMBER AS THEY APPLY TO COMMISSIONING. EACH CONTRACTOR SHOULD REVIEW THIS PROCEDURE AND INCLUDE ADEQUATE TIME IN THEIR PROPOSAL.

1.02 RELATED DOCUMENTS

A. CONTRACT DRAWINGS AND SPECIFICATIONS, GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS, MECHANICAL PROVISIONS AND DIVISION-1 SPECIFICATION SECTIONS APPLY TO WORK OF THIS SECTION.

1.03 DESCRIPTION OF WORK

A. THE PURPOSE OF THE COMMISSIONING PROCESS IS TO PROVIDE THE OWNER/OPERATOR OF THE FACILITY WITH A HIGH LEVEL OF ASSURANCE THAT THE MECHANICAL SYSTEMS HAVE BEEN INSTALLED IN THE PRESCRIBED MANNER, AND OPERATE WITHIN THE PERFORMANCE GUIDELINES SET IN THE DESIGN INTENT DOCUMENTS (DID). THE CXA SHALL PROVIDE THE OWNER WITH AN UNBIASED, OBJECTIVE VIEW OF THE SYSTEM'S DESIGN, INSTALLATION, OPERATION, AND PERFORMANCE. THIS PROCESS IS NOT INTENDED TO TAKE AWAY OR REDUCE THE RESPONSIBILITY OF THE DESIGN TEAM OR INSTALLING CONTRACTORS TO PROVIDE A FINISHED PRODUCT. COMMISSIONING IS INTENDED TO ENHANCE THE QUALITY OF SYSTEM START-UP AND AID IN THE ORDERLY TRANSFER OF SYSTEMS FOR BENEFICIAL USE BY THE OWNER. THE CXA WILL BE A MEMBER OF BOTH THE DESIGN AND CONSTRUCTION TEAM. DURING THE DESIGN PHASE, THE CXA WILL ASSIST THE OWNER IN DEVELOPMENT OF THE OWNER'S PROJECT REQUIREMENTS, REVIEW THE BASIS OF DESIGN, PRODUCE A DESIGN PHASE COMMISSIONING PROCESS PLAN, AND DEVELOP PROJECT-SPECIFIC COMMISSIONING SPECIFICATIONS. DURING THE CONSTRUCTION PHASE, THE CXA WILL ADMINISTER AND COORDINATE COMMISSIONING ACTIVITIES WITH THE DESIGN TEAM, CONSTRUCTION MANAGER, SUBCONTRACTORS, MANUFACTURERS AND EQUIPMENT SUPPLIERS WHICH WILL INCLUDE COMMISSIONING COORDINATION MEETINGS, EQUIPMENT INSTALLATION INSPECTIONS, FUNCTIONAL PERFORMANCE TESTING, ISSUES RESOLUTION, AND DOCUMENTATION OF ALL AFOREMENTIONED TASKS AND ACTIVITIES.

1.04 REFERENCES

A. ASHRAE GUIDELINE 0 - 2013
B. ASHRAE GUIDELINE 1-2007
C. ACG COMMISSIONING GUIDELINE - 2005
D. CHAPTER 4 OF THE 2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC).

1.05 ROLES AND RESPONSIBILITIES OF THE COMMISSIONING AGENCY

A. MISSION: THE PRIMARY POINT OF RESPONSIBILITY IS TO INFORM THE GENERAL CONTRACTOR, THE OWNER AND DESIGN TEAM ON THE STATUS, INTEGRATION, AND PERFORMANCE OF MECHANICAL AND ELECTRICAL SYSTEMS WITHIN THE FACILITY.
B. INFORMATION: THE CXA SHALL FUNCTION AS A CATALYST AND INITIATOR TO DISSEMINATE INFORMATION AND ASSIST THE DESIGN AND CONSTRUCTION TEAMS IN IMPLEMENTING COMPLETION OF THE CONSTRUCTION PROCESS. THIS SHALL INCLUDE SYSTEM VERIFICATION, FUNCTIONAL PERFORMANCE TESTING, AND CONFORMANCE WITH THE INTENDED DESIGN OF EACH SYSTEM. SERVICES INCLUDE DOCUMENTING CONSTRUCTION OBSERVATIONS, VERIFICATION AND FUNCTIONAL PERFORMANCE TESTING, AND DOCUMENTING PROPER DISTRIBUTION OF PERFORMANCE AND OPERATING INFORMATION TO THE OWNERS O&M STAFF.
C. QUALITY ASSURANCE: ASSIST THE RESPONSIBLE PARTIES TO MAINTAIN A HIGH QUALITY LEVEL OF INSTALLATION BY MEETING OR EXCEEDING PREVAILING STANDARDS AND SPECIFICATIONS.
D. OBSERVATION OF TESTS: THE CXA SHALL OBSERVE AND COORDINATE TESTING AS REQUIRED TO ASSURE SYSTEM PERFORMANCE MEETS THE DESIGN INTENT.
E. DOCUMENTATION OF TESTS: THE CXA SHALL DOCUMENT THE RESULTS OF THE PERFORMANCE TESTING DIRECTLY AND/OR ASSURE THAT THE APPROPRIATE TECHNICIANS DOCUMENT TESTING PER THE REQUIREMENTS OF SECTION C408 OF THE 2021 IECC. THE CXA SHALL COMPILE FORMS TO BE USED BY THE COMMISSIONING TEAM FOR CONSISTENCY OF APPROACH AND TYPE OF INFORMATION TO BE RECORDED.
F. DEFICIENCIES: THE CXA SHALL PROVIDE TECHNICAL EXPERTISE TO FACILITATE AND VERIFY THE CORRECTION OF DEFICIENCIES FOUND DURING THE COMMISSIONING PROCESS.
G. RESOLUTION OF DEFICIENCIES: THE CXA IS TO REMAIN AN INDEPENDENT PARTY WITH SPECIFIC TECHNICAL KNOWLEDGE OF THE PROJECT. THE CXA SHALL INVESTIGATE THE SCOPE AND EXTENT OF PROBLEMS AND FACILITATE COMMUNICATION TO DETERMINE RESPONSIBILITIES BY DELINEATING SPECIFICATIONS. THE CXA SHALL MONITOR RESOLUTION FOR CONFORMANCE WITH DESIGN INTENT AND PREVAILING INDUSTRY STANDARDS.
H. ACCEPTANCE: THE CXA SHALL DOCUMENT THE DATE OF ACCEPTANCE AS DETERMINED BY THE GENERAL CONTRACTOR, OWNER AND DESIGN TEAM.
I. CERTIFICATE(S) OF INSTALLATION, CERTIFICATE(S) OF ACCEPTANCE AND FUNCTIONAL PERFORMANCE TEST RESULTS MAY BE USED IN DETERMINING THE START OF THE WARRANTY PERIOD FOR HVAC AND LIGHTING SYSTEMS AND SUBSYSTEMS.
J. O&M MATERIAL: THE CXA WILL REVIEW OPERATION AND MAINTENANCE MATERIALS FOR HVAC SYSTEMS, INDOOR LIGHTING SYSTEMS, WATER HEATING SYSTEMS AND COVERED PROCESSES.

1.06 ROLES AND RESPONSIBILITIES OF THE OWNER

A. ASSIGN FACILITIES PERSONNEL AND SCHEDULE THEM TO PARTICIPATE IN THE VARIOUS MEETINGS, TRAINING SESSIONS AND INSPECTIONS AS FOLLOWS:
16. IT IS IN THE OWNER'S BEST INTEREST TO HAVE FACILITIES STAFF ATTEND THE FOLLOWING MEETINGS:
a. OWNERS TRAINING SESSION(S).
b. CONTRACTORS' COMMISSIONING KICK-OFF MEETING
1) AT THE KICKOFF MEETING, THE OWNER WILL INDICATE TO GC WHETHER FACILITIES STAFF WILL ATTEND ANY OF THE MEETINGS DETAILED BELOW.
17. IT IS AT THE OWNER'S DISCRETION TO HAVE FACILITIES STAFF ATTEND THE FOLLOWING CX MEETINGS:
a. EQUIPMENT START-UP EVENTS.
b. PIPING AND DUCTWORK TESTING AND ACCEPTANCE.
c. FUNCTIONAL PERFORMANCE TESTING OF HVAC, LIGHTING AND WATER HEATING EQUIPMENT.

1.07 ROLES AND RESPONSIBILITIES OF THE DESIGN TEAM

A. PROVIDE BASIS OF DESIGN NARRATIVE.
B. VERIFY ADEQUATE MAINTENANCE ACCESSIBILITY FOR EACH PIECE OF EQUIPMENT IN SHOP DRAWINGS AND ACTUAL INSTALLATION. VISIT SITE PERIODICALLY AND INSPECT CONSTRUCTION.
C. REVIEW TAB REPORT FROM CONTRACTOR AGAINST DESIGN REQUIREMENTS AND ISSUE RESPONSE TO ENTIRE COMMISSIONING TEAM.

1.08 ENVELOPE SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS

1. THERMAL ENVELOPE
1. ROOF INSULATION - CONTINUOUS RIGID R-25 (EPS) INSULATION ABOVE ROOF DECK.
2. UNDER SLAB INSULATION AT BUILDING PERIMETER
3. CONTINUOUS RIGID INSULATION AT CMU WALLS
4. DOOR AND WINDOW FRAMING AND GLAZING
2. AIR BARRIER
C402.5.1.5 - BUILDING ENVELOPE PERFORMANCE VERIFICATION. THE INSTALLATION OF THE CONTINUOUS AIR BARRIER SHALL BE VERIFIED BY THE *APPROVED* AGENCY IN ACCORDANCE WITH THE FOLLOWING:
1. A REVIEW OF THE CONSTRUCTION DOCUMENTS AND OTHER SUPPORTING DATA SHALL BE CONDUCTED TO ASSESS COMPLIANCE WITH THE REQUIREMENTS IN SECTION C402.5.1.
2. INSPECTION OF CONTINUOUS AIR BARRIER COMPONENTS AND ASSEMBLIES SHALL BE CONDUCTED DURING CONSTRUCTION WHILE THE AIR BARRIER IS STILL ACCESSIBLE FOR INSPECTION AND REPAIR TO VERIFY COMPLIANCE WITH THE REQUIREMENTS OF SECTIONS C402.5.1.3 AND C402.5.1.4.
3. A FINAL COMMISSIONING REPORT SHALL BE PROVIDED FOR INSPECTIONS COMPLETED BY THE *APPROVED* AGENCY. THE COMMISSIONING REPORT SHALL BE PROVIDED TO THE BUILDING OWNER OR OWNER'S AUTHORIZED AGENT AND THE *CODE OFFICIAL*. THE REPORT SHALL IDENTIFY DEFICIENCIES FOUND DURING THE REVIEW OF THE CONSTRUCTION DOCUMENTS AND INSPECTION AND DETAILS OF CORRECTIVE MEASURES TAKEN.

1.09 MECHANICAL SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS.

1. EXISTING RTU-1 THROUGH RTU-4, ROOFTOP PACKAGE UNITS, DX COOLING, GAS FIRED HEATING, DRY BULB ECONOMIZER WITH FAULT DETECTION. AND DIAGNOSTICS REPORTING.
2. EXISTING KITCHEN EQUIPMENT TO BE BALANCED BY NATIONAL TAB PER SHEET M-100: EX MUA-1, EX EF-1, EX EF-2, EX HOOD 1, EX HOOD 2.
3. EF-1 THROUGH EF-2; RESTROOM EXHAUST FANS.
4. TESTING AND BALANCING OF THE DUCT SYSTEMS PER SPECIFICATION SECTION 230593.

1.10 PLUMBING SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS.

1. WH-1 THROUGH WH-2 NATURAL GAS TANKLESS WATER HEATER.

1.12 LIGHTING CONTROLS SHALL BE COMMISSIONED IN ACCORDANCE WITH THIS SECTION.

D. OCCUPANT SENSORS
D.1. IT SHALL BE VERIFIED THAT THE FUNCTIONAL TESTING IN ACCORDANCE WITH SECTION C405.2 OF THE INTERNATIONAL ENERGY CONSERVATION CODE HAS BEEN PERFORMED.

E. AUTOMATIC DAYLIGHT CONTROLS
E.1. AUTOMATIC DAYLIGHT CONTROLS SHALL BE COMMISSIONED IN ACCORDANCE WITH ALL OF THE FOLLOWING:
E.1.1. IT SHALL BE VERIFIED THAT THE PLACEMENT AND ORIENTATION OF EACH SENSOR IS CONSISTENT WITH THE MANUFACTURER'S INSTRUCTIONS. IF NOT, THE SENSOR SHALL BE RELOCATED OR REPLACED.
E.1.2. CONTROL SYSTEMS SHALL BE INITIALLY CALIBRATED TO MEET SETTINGS AND DESIGN INTENT ESTABLISHED IN THE CONSTRUCTION DOCUMENTS.
E.1.3. PRIOR TO CALIBRATION OF SYSTEMS CONTROLLING DIMMABLE LUMINAIRES, ALL LAMPS SHALL BE SEASONED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE LAMP MANUFACTURER.
E.1.4. WHERE LOCATED INSIDE BUILDINGS, CALIBRATION OF OPEN-LOOP DAYLIGHT CONTROLS, WHICH RECEIVE ILLUMINATION FROM NATURAL LIGHT ONLY, SHALL NOT OCCUR UNTIL FENESTRATION SHADING DEVICES SUCH AS BLINDS OR SHADES HAVE BEEN INSTALLED AND COMMISSIONED.
E.1.5. CALIBRATION OF CLOSED-LOOP DAYLIGHT CONTROLS, THAT RECEIVE ILLUMINATION FROM BOTH NATURAL AND ARTIFICIAL LIGHT, SHALL NOT OCCUR UNTIL FURNITURE SYSTEMS AND INTERIOR FINISHES HAVE BEEN INSTALLED, AND ANY FENESTRATION SHADING DEVICES SUCH AS BLINDS OR SHADES HAVE BEEN INSTALLED AND COMMISSIONED.
E.1.6. CALIBRATION PROCEDURES SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

F. TIME SWITCH AND PROGRAMMABLE SCHEDULE CONTROLS
F.1. LIGHTING CONTROLS SHALL BE PROGRAMMED. SCHEDULING SHALL INCORPORATE WEEKDAY, WEEKEND AND HOLIDAY OPERATING TIMES, INCLUDING LEAP YEAR AND DAYLIGHT SAVINGS TIME CORRECTIONS. IT SHALL BE VERIFIED THAT SYSTEM OVERRIDES WORK AND ARE LOCATED IN COMPLIANCE WITH SECTION C405.2 OF THE INTERNATIONAL ENERGY CONSERVATION CODE.

G. DIMMING SYSTEMS WITH PRESET SCENES
G.1. FOR PROGRAMMABLE DIMMING SYSTEMS, IT SHALL BE VERIFIED THAT AUTOMATIC SHUTOFF AND MANUAL OVERRIDES ARE WORKING AND THAT PROGRAMMING IS COMPLETE. PRIOR TO PROGRAMMING, ALL LAMPS SHALL BE SEASONED IN ACCORDANCE WITH NEMA LSD 23.

H. POST-COMMISSIONING DOCUMENTATION
H.1. THE FOLLOWING DOCUMENTATION SHALL BE PROVIDED TO THE BUILDING OWNER.
H.1.1. SETTINGS DETERMINED DURING COMMISSIONING ACTIVITIES OUTLINED ABOVE
H.1.2. A NARRATIVE DESCRIBING THE INTENT AND FUNCTIONALITY OF ALL CONTROLS INCLUDING ANY CAPABILITY FOR USERS TO OVERRIDE A SCHEDULE OR MASTER COMMAND.
H.1.3. SPECIFICATION SHEETS FOR ALL LIGHTING EQUIPMENT AND CONTROLS.
H.1.4. OPERATION MANUALS FOR EACH LIGHTING CONTROL DEVICE. REQUIRED MAINTENANCE AND MAINTENANCE SCHEDULES SHALL BE CLEARLY IDENTIFIED. DOCUMENTATION AND INSTRUCTIONS NECESSARY FOR BUILDING MAINTENANCE PERSONNEL TO MAINTAIN AND RECALIBRATE LIGHTING SYSTEMS AND CONTROLS.
H.1.5. AN ANNUAL INSPECTION SCHEDULE FOR LIGHTING CONTROLS.
H.1.6. TROUBLESHOOTING INFORMATION FOR FLUORESCENT DIMMING SYSTEMS AND THE REMEDIATION OF SWITCHING ISSUES SUCH AS FALSE-ONS AND FALSE-OFFS.

I. POST-OCCUPANCY RECOMMISSIONING
I.1. THE COMMISSIONING ACTIVITIES IN THIS SECTION SHALL BE REPEATED 18 TO 24 MONTHS AFTER ISSUANCE OF THE CERTIFICATE OF OCCUPANCY. CONTROL DEVICES THAT ARE NOT FUNCTIONING PROPERLY SHALL BE REPAIRED OR REPLACED. ADJUSTMENTS TO CALIBRATION SETTINGS SHALL BE DOCUMENTED. THIS DOCUMENTATION SHALL BE PROVIDED TO THE BUILDING OWNER.

1.13 HVAC AND ELECTRICAL COMMISSIONING PLAN

A. COMMISSIONING TEAM
1. THE COMMISSIONING TEAM (CT) SHALL CONSIST OF KEY PARTIES INVOLVED IN DESIGN, CONSTRUCTION AND TESTING OF THIS FACILITY. IT IS NECESSARY FOR EACH AGENCY TO APPOINT TEAM MEMBERS THAT WILL HAVE LONG-TERM COMMITMENTS TO THIS PROJECT. SWITCHING TEAM MEMBERS DURING THE PROJECT WILL REDUCE THE ABILITY OF THE CT TO PROVIDE CONTINUITY AND ACCEPTABLE RESULTS TO THE BUILDING OWNER. TEAM MEMBERS MUST MAINTAIN AN ONGOING SUPERVISORY POSITION ON THIS PROJECT. ONE TEAM MEMBER SHALL BE PROVIDED BY EACH OF THE PARTIES LISTED BELOW:
a. PROGRAM MANAGER/OWNER (PRM)
b. COMMISSIONING AGENT (CXA)
c. DESIGN TEAM (DT)
d. GENERAL CONTRACTOR (GC)
e. MECHANICAL CONTRACTOR (MC)
f. CONTROLS CONTRACTOR (CC)
g. TESTING, ADJUSTING AND BALANCING CONTRACTOR (TAB)
h. ELECTRICAL CONTRACTOR (EC)

B. DESIGN INTENT DOCUMENT
1. THE DESIGN INTENT DOCUMENT (DID) REPRESENTS A COMPOSITE OF DESIGN DRAWINGS, PROJECT SPECIFICATIONS, SUBMITTALS, CHANGE ORDERS AND INDUSTRY STANDARDS, PREPARED BY THE DESIGNER OF RECORD, THAT DESCRIBE THE SYSTEMS OF THIS FACILITY. REFERENCES TO DESIGN INTENT WILL BE TAKEN FROM THE DID. THE DID IS AN EVOLVING MANUSCRIPT MAINTAINED BY THE DESIGN PROFESSIONAL TO TRACK AND INCORPORATE DESIGN ALTERATIONS THAT OCCUR THROUGHOUT THE CONSTRUCTION PROCESS. ANY INDUSTRY STANDARDS USED FOR THIS PROJECT WILL BE SPECIFICALLY NOTED WHEN REFERENCED.
2. THE CXA WILL REVIEW THE DID DOCUMENTS FOR COMMISSIONING PROVISIONS, FUNCTIONAL PERFORMANCE, OPTIMIZATION OF PERFORMANCE, ACCESSIBILITY, TAB PROVISIONS, AND O&M CONSIDERATIONS.

C. COMMISSIONING MEETINGS
1. COMMISSIONING MEETINGS WILL BE HELD IN CONJUNCTION WITH PROGRESS MEETINGS WHEN POSSIBLE AND AS NECESSARY.
2. COMMISSIONING MEETINGS WILL BE USED TO ADDRESS ANY PROBLEMS THAT ALTER THE DESIGN INTENT OR AFFECT THE COMMISSIONING PROCESS. THESE MEETINGS PROVIDE AN OPEN FORUM FOR EXCHANGE OF IDEAS BETWEEN CONTRACTORS, VENDORS, DESIGNERS, USERS AND OWNERS.

D. RESOLUTION TRACKING FORMS (RTF)
1. THE USE OF RESOLUTION TRACKING FORMS IS A METHOD EMPLOYED BY THE CXA TO MONITOR AND RECORD PROBLEMS, THEIR CAUSES, AND SOLUTIONS. THE USE OF THESE LISTS PROMOTES COMMUNICATION BETWEEN THE INSTALLING CONTRACTORS, DESIGN TEAM, COMMISSIONING AGENT, AND OWNER, IN ORDER TO EXPEDITE THEIR RESOLUTION IN A TIMELY MANNER.
2. THE CXA WILL REGULARLY SUBMIT RTF'S TO THE CT IN ORDER TO DOCUMENT AND RESOLVE DEFICIENCIES AS QUICKLY AS POSSIBLE. THE FREQUENCY OF RTF SUBMISSION WILL BE ADJUSTED AS PROJECT CONDITIONS DICTATE.

E. CERTIFICATE(S) OF INSTALLATION/ MANUFACTURER'S CHECKLISTS
1. IF REQUESTED, COPIES OF THE CERTIFICATE(S) OF INSTALLATION SHALL BE PROVIDED TO THE CXA WITHIN 7 DAYS OF REQUEST.
2. IF REQUESTED, COPIES OF THE MANUFACTURER'S STARTUP FORMS SHALL BE PROVIDED TO THE CXA WITHIN 7 DAYS OF REQUEST.

F. START-UP
1. THE CXA WILL WITNESS START-UP OF MAJOR SYSTEMS WHEN APPLICABLE. THE SYSTEMS TO BE WITNESSED WILL BE IDENTIFIED AND DISCUSSED DURING THE CX CONSTRUCTION KICKOFF MEETING. THE APPROPRIATE CONTRACTORS AND/OR MANUFACTURER'S REPRESENTATIVE WILL BE REQUIRED ON SITE TO PERFORM START-UP.
2. THE INSTALLING CONTRACTOR SHALL NOTIFY THE CXA NO LATER THAN 7 DAYS PRIOR TO STARTUP OF EQUIPMENT.

G. FUNCTIONAL PERFORMANCE TESTS (FPT)
1. THE CXA WILL WRITE FPT'S BASED ON THE DESIGN INTENT DOCUMENT. THESE TESTS WILL BE CREATED FOR SYSTEMS AND SUBSYSTEMS. SEE SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS ABOVE.
2. EACH MAJOR SYSTEM WILL BE TESTED. A RANDOM SAMPLE OF EACH SUBSYSTEM WILL BE TESTED. THIS WILL BE COORDINATED AND WITNESSED BY THE CXA.
3. NO FPT'S WILL BE PERFORMED UNTIL THE SYSTEM AND RELATED SUBSYSTEMS HAVE BEEN STARTED, THE TAB REPORT HAS BEEN SUBMITTED AND REVIEWED, AND THE COMPLETION OF THE CONTROL SYSTEM HAS BEEN DOCUMENTED THROUGH POINT-TO-POINT CHECKLISTS AND OTHER DOCUMENTATION.
4. THE FUNCTIONAL PERFORMANCE TESTS SHALL INCLUDE HVAC, INDOOR LIGHTING, WATER HEATING AND COVERED PROCESSES. SEE SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS ABOVE FOR MORE DETAIL. THE CXA WILL MAKE EVERY EFFORT TO NOT HAVE CONTRACTORS REPEAT WORK. HOWEVER, SOME OF THE FUNCTIONAL PERFORMANCE TESTS MAY REPEAT THE REQUIRED CERTIFICATE(S) OF ACCEPTANCE FORMS. FOR EXAMPLE, IF MULTIPLE AIR HANDLERS HAVE AIR SIDE ECONOMIZERS, THE CXA WILL REVIEW ALL OF THE ACCEPTANCE FORMS AND REQUEST THE CONTRACTOR RESPONSIBLE FOR COMPLETING THE CERTIFICATE OF ACCEPTANCE FORM REPEAT ONE OR MORE UNIT'S ECONOMIZER TESTS.
a. FAN COIL UNITS WILL BE TESTED UNDER RELEVANT OPERATING CONDITIONS.
b. ROOFTOP PACKAGED UNITS WILL BE TESTED FOR CONFORMANCE TO DID.
c. EXHAUST FANS WILL BE TESTED FOR CONFORMANCE TO DID.
d. CONTROL SYSTEMS WILL BE TESTED AS NECESSARY TO ACHIEVE DID CONFORMANCE.
e. HVAC SYSTEMS WILL BE TESTED TO ASSURE THAT THE BUILDING AS AN INTEGRATED SYSTEM OPERATES PROPERLY, AND TO VERIFY THAT INTERLOCKS AND INTERACTIONS BETWEEN NEW AND EXISTING EQUIPMENT AND SYSTEMS FUNCTION ACCORDING TO DESIGN INTENT.
f. THE EC WILL DEMONSTRATE TO THE CXA: LUMINAIRE/LAMP COMBINATIONS BY INSPECTION, OPERATIONAL TESTS FOR LIGHTING CONTROL/DIMMING SYSTEMS, ILLUMINATION LEVEL MEASUREMENTS IN UP TO 20% OF THE BUILDING AREA, AND INTERIOR LIGHTING CONTROL PERFORMANCE, INCLUDING OPERATION OF OCCUPANCY SENSORS, AUTOMATIC TIME CONTROLS, ENERGY MANAGEMENT CONTROL OVERRIDE TIMERS, MANUAL DIMMING CONTROL, MULTI-LEVEL SWITCHING, AND OTHER SPECIFIED LIGHTING CONTROLS.
g. OPPOSITE-SEASON TESTING WILL BE IMPLEMENTED AS NECESSARY TO ASSURE CONFORMANCE WITH THE DID. INSTALLING CONTRACTORS WILL BE EXPECTED TO PARTICIPATE AS REQUIRED BY THE PROJECT SPECIFICATIONS. THIS TESTING WILL OCCUR WITHIN THE FIRST YEAR OF OCCUPANCY.
h. OPPOSITE SEASON TESTING WILL OCCUR IF FULL COOLING, FULL HEATING, AND ANY OTHER WEATHER DEPENDENT SYSTEM FUNCTIONALITY CANNOT BE VERIFIED DURING THE CONSTRUCTION PHASE.

5. CONDITIONS OF TEST
a. THE ACCEPTANCE OF EACH PIECE OF EQUIPMENT SHALL BE BASED ON THE SUCCESSFUL COMPLETION OF BOTH THE CERTIFICATE(S) OF ACCEPTANCE AND THE CXA'S FUNCTIONAL PERFORMANCE TEST.
1) EACH MAJOR SYSTEM WILL BE SUBJECT TO FUNCTIONAL PERFORMANCE TESTING.
2) EACH SUBSYSTEM WILL BE SUBJECT TO SAMPLING OF UP TO 10% OF THE SUBSYSTEM EQUIPMENT.

H. BUILDING TURN-OVER / OWNER ORIENTATION / USER TRAINING
1. THE CXA MAY REVIEW O&M MANUALS, TO ENSURE SPECIFICITY AND COMPLETENESS.
2. THE CXA WILL REVIEW AS-BUILT DRAWINGS, TO ENSURE SPECIFICITY AND COMPLETENESS.
3. THE INSTALLING CONTRACTOR OR MANUFACTURER'S REPRESENTATIVE WILL PROVIDE THE TRAINING. THIS TRAINING SHOULD INCLUDE BOTH CLASSROOM TRAINING AND HANDS-ON OPERATIONAL TRAINING. THE OWNER MAY CHOOSE TO VIDEOTAPE THIS TRAINING FOR FUTURE USE.
4. THE CXA WILL ASSIST IN THE COORDINATION OF OFF-SEASON TESTING, CALIBRATING, AND SERVICING AS SPECIFIED IN THE CONTRACT DOCUMENTS.

I. TRAINING OF OWNER'S OPERATORS
1. THE OWNER'S FACILITY STAFF SHALL BE GIVEN COMPREHENSIVE TRAINING IN THE UNDERSTANDING OF THE SYSTEMS AND THE OPERATION AND MAINTENANCE OF EACH MAJOR PIECE OF EQUIPMENT.
2. THE GC WILL BE RESPONSIBLE FOR SCHEDULING THE TRAINING WHICH SHALL START WITH CLASSROOM SESSIONS IF NECESSARY FOLLOWED BY HANDS ON TRAINING ON EACH PIECE OF EQUIPMENT. HANDS ON TRAINING SHALL INCLUDE START-UP, OPERATION IN ALL MODES POSSIBLE, SHUT-DOWN AND ANY EMERGENCY PROCEDURES.
3. THE MANUFACTURER'S REPRESENTATIVE SHALL PROVIDE THE INSTRUCTIONS ON EACH MAJOR PIECE OF EQUIPMENT. THESE SESSIONS SHALL REVIEW SAFE AND PROPER OPERATING REQUIREMENTS AND PREVENTATIVE MAINTENANCE.
4. TRAINING WILL BE INCLUDED FOR ALL MAJOR PIECES OF EQUIPMENT INCLUDING , HOT WATER HEATERS, HEAT REJECTION EQUIPMENT, AIR CONDITIONING UNITS, AIR HANDLING UNITS, FANS, AIR TERMINALS, AND CONTROLS.
5. EACH CLASSROOM TRAINING SESSION SHALL BE FOLLOWED BY EXPLANATION AND DEMONSTRATION OF THE EQUIPMENT. THE START-UP AND SHUT-DOWN MODES OF OPERATION SHALL BE DEMONSTRATED.
6. THE GC SHALL ATTEND ALL SESSIONS AND SHALL ADD TO EACH SESSION ANY SPECIAL INFORMATION RELATING TO THE DETAILS OF INSTALLATION OF THE EQUIPMENT AS IT MIGHT IMPACT THE OPERATION AND MAINTENANCE.
8. THE CXA SHALL CONDUCT TRAINING OF THE PROJECT'S SYSTEMS MANUAL.

J. OPERATION AND MAINTENANCE (O&M) MANUALS
1. QUANTITY: PROVIDE FOUR (4) HARD COPIES OF THE MANUAL AND ONE (1) ELECTRONIC COPY IN PDF FORMAT.
2. FORMAT: 3" THICK, 8-1/2" X 11 LOOSE LEAF BINDERS. PROVIDE AS MANY AS REQUIRED. BINDERS SHALL NOT BE OVERLOADED.
3. DETAILED PREPARATION REQUIREMENTS
a. THE COVER SHEET SHALL LIST: PROJECT NAME, LOCATION, NAMES OF THE PROJECT MANAGER, ARCHITECT, STRUCTURAL ENGINEER, MECHANICAL ENGINEER AND ELECTRICAL ENGINEER, NAME OF THE FIRMS, ADDRESS AND TELEPHONE NUMBER.
b. EACH MAJOR HEADING IN THE TABLE OF CONTENTS SHALL HAVE A LARGE DISTINCTIVE, CLEARLY MARKED, NON-ERASABLE, PLASTIC ENCASED TAB.
c. EACH SECTION SHALL HAVE THE FOLLOWING SUB-TABS. SUB-TABS SHALL BE SIMILAR TO THE MAIN TABS BUT OF A DIFFERENT COLOR.
d. CONTENT, AT A MINIMUM:
1) COVER SHEET
2) TABLE OF CONTENTS (AS FOLLOWS):
3) DESCRIPTION OF SYSTEMS
4) DESIGN PARAMETERS.
(a) THE DESIGN PARAMETERS WILL BE PROVIDED BY THE ENGINEER OF RECORD. IT WILL BE A DETAILED LISTING OF THE DESIGN CRITERIA ON A ROOM-BY-ROOM AND SYSTEM-BY-SYSTEM BASIS USED AS THE BASIS FOR THE DESIGN.
(1) MECHANICAL AND ELECTRICAL SPECIFICATIONS
(2) WIRING AND CONTROL DIAGRAMS, WITH DATA TO EXPLAIN DETAILED OPERATION AND CONTROL OF EACH COMPONENT.
(3) CONTROL SEQUENCES DESCRIBING START-UP, ALL MODES OF OPERATION, AND SHUTDOWN.
(4) INSTALLATION INSTRUCTIONS
(5) OPERATING INSTRUCTIONS
(6) PREVENTATIVE MAINTENANCE INSTRUCTIONS
(7) MAINTENANCE AND OVERHAUL INSTRUCTIONS
(8) LUBRICATING SCHEDULE INCLUDING TYPE, GRADE, TEMPERATURE, AND FREQUENCY RANGE.
(9) CORRECTED SHOP DRAWINGS AND SUBMITTAL DATA.
(10) PRODUCT INFORMATION IDENTIFYING ALL PERFORMANCE CURVES, RATING DATA, FEATURES, AND OPTIONS ON ALL INSTALLED EQUIPMENT
(11) COPIES OF APPROVED CERTIFICATIONS AND TEST REPORTS.
(12) COPIES OF WARRANTIES.
(13) TEST PROCEDURES
(14) PARTS LIST
(15) INCLUDING SOURCE OF SUPPLY AND RECOMMENDED SPARE PARTS.
(16) CONTACT INFORMATION
(17) NAME, ADDRESS, AND 24-HOUR TELEPHONE NUMBER OF EACH SUBCONTRACTOR WHO INSTALLED EQUIPMENT AND SYSTEMS AND LOCAL REPRESENTATIVE FOR EACH TYPE OF EQUIPMENT FOR EACH SYSTEM.
(18) FINAL APPROVAL OF THE O&M MANUAL SHALL BE BY THE OWNER.

K. SYSTEMS MANUAL
1. SYSTEMS MANUAL SHALL BE PROVIDED BY THE CXA
2. TRAINING OF THE CONTENT OF THE SYSTEMS MANUAL SHALL BE PROVIDED BY THE CXA.
3. CONTENT OF THE SYSTEMS MANUAL SHALL BE, AT A MINIMUM, AS FOLLOWS:
g. SITE INFORMATION
h. SITE CONTACT INFORMATION
i. GENERAL SITE OPERATING PROCEDURES
j. MAJOR SYSTEMS DESCRIPTION
k. SITE EQUIPMENT INVENTORY AND MAINTENANCE
l. MISCELLANEOUS REFERENCES AND DOCUMENTATION

L. PARTS LIST:
1. PARTS LISTS SHALL BE PROJECT-SPECIFIC AND EDITED TO OMIT REFERENCE TO ITEMS WHICH DO NOT APPLY TO THIS INSTALLATION.

M. EQUIPMENT SUPPLIER:
1. THIS SECTION SHALL INCLUDE THE NAME, ADDRESS AND TELEPHONE NUMBER OF THE MANUFACTURER'S AGENT AND/OR SERVICE AGENCY SUPPLYING OR INSTALLING AND STARTING UP OF THE EQUIPMENT.

O. SUBMITTAL REQUIREMENT:
1. THE O&M MANUALS FOR EACH PIECE OF EQUIPMENT SHALL BE SUBMITTED TO THE GC AT THE EQUIPMENT PLACEMENT COMPLETION STAGE, WHICH SHALL BE DEFINED AS THAT TIME IN THE PROJECT WHEN THE PIECE OF EQUIPMENT HAVE BEEN SET IN PLACE READY FOR CONNECTION TO PIPING AND DUCT SYSTEMS.

1.14 RESPONSIBILITIES OF INSTALLING CONTRACTORS

A. GENERAL CONTRACTOR (GC)
1. INCLUDE COMMISSIONING REQUIREMENTS IN THE MECHANICAL, ELECTRICAL, AND CONTROLS CONTRACTS, AS WELL AS OTHER SUBCONTRACTS, TO ASSURE FULL COOPERATION OF ALL PARTIES IN THE COMMISSIONING PROCESS.
2. ASSURE ACCEPTABLE REPRESENTATION, WITH THE MEANS AND AUTHORITY TO PREPARE AND COORDINATE EXECUTION OF THE COMMISSIONING PROGRAM AS DESCRIBED IN THE CONTRACT DOCUMENTS.
3. ASSURE THAT THE CXA SHALL RECEIVE A COPY OF ALL CONSTRUCTION DOCUMENTS, ADDENDA, CHANGE ORDERS AND APPROPRIATE SUBMITTALS AND SHOP DRAWINGS FOR REVIEW AND USE IN DEVELOPMENT OF THE COMMISSIONING PLAN AND FUNCTIONAL PERFORMANCE TESTS.
a. THE GC SHALL PROVIDE THE CXA WITH THE SUBMITTAL LOG.
b. THE CXA WILL IDENTIFY THE EQUIPMENT AND/OR SYSTEMS THE CXA NEEDS TO REVIEW AND WILL RETURN THE MARKED UP SUBMITTAL LOG TO THE GC.
c. THE GC SHALL ENSURE ALL SUBMITTALS FOR EQUIPMENT/SYSTEMS IDENTIFIED ARE DELIVERED TO THE CXA FOR REVIEW.
d. COMMENTS AND/OR QUESTIONS ASSOCIATED WITH EACH SUBMITTAL WILL BE DIRECTED TO THE DESIGN TEAM FOR INCLUSION/EXCLUSION OF THE DESIGN TEAM'S COMMENTS.
e. COORDINATE INCLUSION OF COMMISSIONING ACTIVITIES IN THE CONSTRUCTION SCHEDULE.
f. ISSUE A STATEMENT THAT TAB WORK HAS BEEN COMPLETED, AND THAT THE FINAL TAB REPORT HAS BEEN SUBMITTED FOR REVIEW.
g. ISSUE A STATEMENT THAT CONTROL SYSTEMS HAVE BEEN COMPLETELY INSTALLED AND CALIBRATED
h. COORDINATE OWNER TRAINING ACTIVITIES WITH THE OWNER AND EACH TRADE'S RESPECTIVE CONTRACTOR.
i. FACILITATE RESOLUTION OF DEFICIENCIES IDENTIFIED BY OBSERVATION OR PERFORMANCE TESTING.
j. ENSURE, IF REQUIRED, THAT ALL CONTRACTORS IDENTIFIED AS THE CONTRACTOR RESPONSIBLE FOR ACCEPTANCE TESTING AND COMPLETION OF THE TITLE 24 CERTIFICATE(S) OF ACCEPTANCE ARE CERTIFIED BY THE STATE OF CALIFORNIA OR ITS DESIGNATED BODY TO CONDUCT EACH RESPECTIVE TEST.

B. MECHANICAL CONTRACTOR (MC)
1. INCLUDE COST FOR COMMISSIONING REQUIREMENTS IN THE CONTRACT PRICE.
2. INCLUDE REQUIREMENTS FOR SUBMITTAL DATA (INCLUDING PARTIAL LOAD DATA), O&M DATA, AND TRAINING IN EACH PURCHASE ORDER OR SUB-CONTRACT.
3. ASSURE PARTICIPATION OF MAJOR EQUIPMENT MANUFACTURERS IN APPROPRIATE STARTUP, TRAINING, AND TESTING ACTIVITIES.
4. ATTEND COMMISSIONING MEETINGS SCHEDULED BY THE CXA.
5. ASSIST THE CXA IN SYSTEM VERIFICATION AND PERFORMANCE TESTING.
6. PREPARE PRELIMINARY SCHEDULE FOR HVAC SYSTEM INSPECTIONS, O & M MANUAL SUBMISSION, TRAINING SESSIONS, PIPE AND DUCT SYSTEM TESTING, FLUSHING AND CLEANING, EQUIPMENT START-UP, SYSTEM VERIFICATION, PERFORMANCE TESTING, AND SYSTEM COMPLETION FOR USE BY THE CXA. UPDATE SCHEDULE AS APPROPRIATE THROUGHOUT THE CONSTRUCTION PERIOD AND PROVIDE UPDATED SCHEDULE TO THE COMMISSIONING TEAM.
7. COMPLETE MANUFACTURER'S PRE-STARTUP CHECKLISTS PRIOR TO SCHEDULING STARTUP OF HVAC EQUIPMENT.
a. RETAIN CERTIFICATE(S) OF INSTALLATION IN A 3-RING BINDER IN AN ORGANIZED FASHION. BINDER IS TO REMAIN ON THE JOB SITE
b. MAKE CERTIFICATE(S) OF INSTALLATION AVAILABLE FOR CXA REVIEW UPON REQUEST.
c. RETAIN CALIBRATION RECORDS FOR EQUIPMENT PROVIDED WITH MANUFACTURER CALIBRATED SENSORS IN THE CERTIFICATE(S) OF INSTALLATION BINDER.
d. WHERE APPLICABLE, COMPLETE THE CERTIFICATE(S) OF ACCEPTANCE PER THE CONTRACT DOCUMENTS.
1) RETAIN CERTIFICATE(S) OF ACCEPTANCE IN A 3-RING BINDER IN AN ORGANIZED FASHION. BINDER IS TO REMAIN ON THE JOB SITE
2) PROVIDE COPIES OF ALL CERTIFICATE(S) OF ACCEPTANCE TO THE CXA.
3) CERTIFICATE(S) OF ACCEPTANCE SHALL BE CONDUCTED BY COMPANIES WHO ARE CERTIFIED AS A MECHANICAL ACCEPTANCE TEST TECHNICIAN EMPLOYER AND ONLY COMPLETED BY THOSE EMPLOYEES OF SAID COMPANY WHO ARE CERTIFIED TO COMPLETE THE RESPECTIVE ACCEPTANCE TEST.
e. MONITOR AND RESPOND TO RESOLUTION TRACKING FORMS DISTRIBUTED BY THE CXA IN ORDER TO EXPEDITE CORRECTIVE ACTIONS NECESSARY TO ACHIEVE DESIGN INTENT.
f. NOTIFY THE CXA A MINIMUM OF ONE WEEK IN ADVANCE OF SCHEDULED SYSTEM START-UP.
g. UPDATE DRAWINGS TO AS-BUILT CONDITION AND REVIEW WITH THE CXA THROUGHOUT THE CONSTRUCTION PROCESS.
h. SCHEDULE VENDOR AND SUBCONTRACTOR PROVIDED TRAINING SESSIONS AS REQUIRED BY PROJECT SPECIFICATIONS.
i. PROVIDE WRITTEN NOTIFICATION TO THE GC AND CXA THAT THE FOLLOWING WORK HAS BEEN COMPLETED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS, AND THAT THE EQUIPMENT, SYSTEMS AND SUBSYSTEMS ARE OPERATING IN ACCORDANCE WITH DESIGN INTENT.
1) HVAC EQUIPMENT INCLUDING FANS, AIR HANDLING UNITS, DEHUMIDIFICATION UNITS, DUCTWORK, DAMPERS, TERMINAL DEVICES, ETC.
j. PARTICIPATE IN THE FUNCTIONAL PERFORMANCE TESTS AS REQUIRED TO ACHIEVE DESIGN INTENT.
k. PARTICIPATE IN O&M TRAINING AS REQUIRED BY PROJECT SPECIFICATIONS.
l. PROVIDE A COMPLETE SET OF AS-BUILT DRAWINGS AND O&M MANUALS OF EQUIPMENT INSTALLED BY THE MC TO THE GC FOR INCLUSION IN THE PROJECT DOCUMENTATION.

C. ELECTRICAL CONTRACTOR (EC)
1. INCLUDE COST FOR COMMISSIONING REQUIREMENTS IN THE CONTRACT PRICE.
2. INCLUDE REQUIREMENTS FOR SUBMITTAL DATA, O&M DATA, AND TRAINING IN EACH PURCHASE ORDER OR SUB-CONTRACT.
3. ASSURE PARTICIPATION OF MAJOR EQUIPMENT MANUFACTURERS IN APPROPRIATE STARTUP, TRAINING, AND TESTING ACTIVITIES.
4. ATTEND COMMISSIONING MEETINGS SCHEDULED BY THE CXA.
5. ASSIST THE CXA IN SYSTEM VERIFICATION AND PERFORMANCE TESTING.
6. PREPARE PRELIMINARY SCHEDULE FOR ELECTRICAL AND LIGHTING SYSTEM INSPECTIONS, O & M MANUAL SUBMISSION, TRAINING SESSIONS, EQUIPMENT START-UP, SYSTEM VERIFICATION, PERFORMANCE TESTING, AND SYSTEM COMPLETION FOR USE BY THE CXA. UPDATE SCHEDULE AS APPROPRIATE THROUGHOUT THE CONSTRUCTION PERIOD AND PROVIDE UPDATED SCHEDULE TO THE COMMISSIONING TEAM.
7. COMPLETE MANUFACTURER'S PRE-STARTUP CHECKLISTS PRIOR TO SCHEDULING STARTUP OF ELECTRICAL EQUIPMENT.
a. RETAIN CERTIFICATE(S) OF INSTALLATION IN A 3-RING BINDER IN AN ORGANIZED FASHION. BINDER IS TO REMAIN ON THE JOB SITE
b. MAKE CERTIFICATE(S) OF INSTALLATION AVAILABLE FOR CXA REVIEW UPON REQUEST.
c. RETAIN CALIBRATION RECORDS FOR EQUIPMENT PROVIDED WITH MANUFACTURER CALIBRATED SENSORS IN THE CERTIFICATE(S) OF INSTALLATION BINDER.
d. WHERE APPLICABLE, COMPLETE THE CERTIFICATE(S) OF ACCEPTANCE PER THE CONTRACT DOCUMENTS.
1) RETAIN CERTIFICATE(S) OF ACCEPTANCE IN A 3-RING BINDER IN AN ORGANIZED FASHION. BINDER IS TO REMAIN ON THE JOB SITE
2) PROVIDE COPIES OF ALL CERTIFICATE(S) OF ACCEPTANCE TO THE CXA.
3) CERTIFICATE(S) OF ACCEPTANCE SHALL BE CONDUCTED BY COMPANIES WHO ARE CERTIFIED AS A ELECTRICAL ACCEPTANCE TEST TECHNICIAN EMPLOYER AND ONLY COMPLETED BY THOSE EMPLOYEES OF SAID COMPANY WHO ARE CERTIFIED TO COMPLETE THE RESPECTIVE ACCEPTANCE TEST.
e. MONITOR AND RESPOND TO RESOLUTION TRACKING FORMS DISTRIBUTED BY THE CXA IN ORDER TO EXPEDITE CORRECTIVE ACTIONS NECESSARY TO ACHIEVE DESIGN INTENT.
f. NOTIFY THE CXA A MINIMUM OF ONE WEEK IN ADVANCE OF SCHEDULED SYSTEM START-UP.
g. UPDATE DRAWINGS TO AS-BUILT CONDITION AND REVIEW WITH THE CXA THROUGHOUT THE CONSTRUCTION PROCESS.
h. SCHEDULE VENDOR AND SUBCONTRACTOR PROVIDED TRAINING SESSIONS AS REQUIRED BY PROJECT SPECIFICATIONS.
i. PROVIDE WRITTEN NOTIFICATION TO THE GC AND CXA THAT THE FOLLOWING WORK HAS BEEN COMPLETED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS, AND THAT THE EQUIPMENT, SYSTEMS AND SUBSYSTEMS ARE OPERATING IN ACCORDANCE WITH DESIGN INTENT.
1) ELECTRICAL EQUIPMENT INCLUDING XXXXXXXXXXXXXX DEVICES, ETC.
j. PARTICIPATE IN THE FUNCTIONAL PERFORMANCE TESTS AS REQUIRED TO ACHIEVE DESIGN INTENT.
k. PARTICIPATE IN O&M TRAINING AS REQUIRED BY PROJECT SPECIFICATIONS.
l. PROVIDE A COMPLETE SET OF AS-BUILT DRAWINGS AND O&M MANUALS OF EQUIPMENT INSTALLED BY THE EC TO THE GC FOR INCLUSION IN THE PROJECT DOCUMENTATION.

BC PROJECT # 24972
TEXAS PE COA #F-15978

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