

BASIS OF HVAC DESIGN (CAL GREEN COMPLIANCE)

1. HVAC SYSTEM:
- 1.1 NARRATIVE DESCRIPTION OF SYSTEM:
- a. THE BUILDING'S AIR CONDITIONING SYSTEM CONSISTS OF A TWO CHILLERS, ON THE ROOF RATED AT APPROXIMATELY 200 TONS EACH WITH TWO PRIMARY & TWO SECONDARY PUMPS AND TWO COOLING TOWERS WITH TWO CONDENSING UNITS. THE HEATING SYSTEM CONSISTS OF TWO GAS FIRED BOILERS RATED AT APPROXIMATELY 1779 MBH EACH. MERV 8 FILTERS ARE PROVIDED FOR EACH UNIT AND OUTSIDE AIR IS BROUGHT FROM OUTSIDE THROUGH A DUCT TO THE RETURN AIR SIDE OF THE FAN COIL UNITS. FOR THE PUBLIC CORRIDORS, 100% OUTSIDE AIR HEATING AND COOLING UNITS ARE UTILIZED WITH 100% EXHAUST FOR THE CORRIDORS TO COMPLY WITH REQUIREMENTS FOR SMOKE CONTROL. FOR THE RETAIL AND PUBLIC AREAS, WATER SOURCE HEAT PUMPS ARE OR WILL BE PROVIDED WITH A MINIMUM EER OF 15, OUTSIDE AIR DUCTED FROM LOUVERS AT THE EXTERIOR OF THE BUILDING AND A MINIMUM OF MERV 8 FILTERS.
- b. ALL SYSTEMS MEET THE REQUIREMENTS OF THE OPR BY PROVIDING ENERGY EFFICIENT SYSTEMS TO THE TENANTS AND BY UTILIZING SYSTEMS THAT WILL BE METERED ELECTRICALLY FOR EACH OF THE APARTMENTS, THEREBY INCREASING EFFICIENCIES OF USE.
- 1.2 LOAD CALCULATIONS:
- a. LOAD CALCULATIONS WERE PERFORMED UTILIZING ENERGY PRO SOFTWARE.
- b. SUMMER OUTDOOR DESIGN CONDITIONS: 78°F DRY BULB, 67°F WET BULB (NOTE FOR COOLING TOWER SELECTION, 74°FWB IS USED).
- c. WINTER OUTDOOR DESIGN CONDITIONS: 44°F DRY BULB.
- d. INDOOR DESIGN CONDITIONS: 75°F, 50%RH COOLING; 70°F HEATING.

- 1.3 SEQUENCE OF OPERATIONS:
- a. THE CHILLER WATER SYSTEM IS A PRIMARY/SECONDARY DESIGN CONSISTING OF TWO CHILLERS, TWO PRIMARY CHILLED WATER PUMPS, TWO SECONDARY CHILLED WATER PUMPS, AND TWO CONDENSER WATER PUMPS. ALL SUGGESTED SET POINTS AND SETTINGS ARE ADJUSTABLE.

CHILLER CONTROL
SELECTION OF THE LEAD/LAG CHILLER SHALL BE EVALUATED ON A WEEKLY BASIS TO EQUALIZE EQUIPMENT RUNTIME. THE CHILLER WITH THE LEAST RUNTIME SHALL BE DESIGNATED AS LEAD AT 7:00AM ON EVERY WEDNESDAY. IF THE LEAD CHILLER GOES INTO ALARM, THE LAG STARTS AND AN ALARM IS GENERATED.

THE CHILLER WATER SUPPLY TEMPERATURE SET POINT IS SET TO THE CHILLER PLANT DESIGN TEMPERATURE AND CAN BE MANUALLY ADJUSTED UPWARD BY THE OPERATOR.

THE CHILLED WATER SYSTEM ENABLE POINT IS CONTROLLED EITHER MANUALLY BY THE OPERATOR OR BY A PROGRAM FUNCTION (I.E., TIME-OF-DAY). IF THE CHILLED WATER SYSTEM ENABLE POINT IS ON AND THERE IS A CALL FOR COOLING (INDICATED BY ONE OR MORE SELECTED COOLING COIL VALVES BEING OPEN MORE THAN 35%) AND THE OUTSIDE AIR TEMPERATURE IS ABOVE 55°F (13°C), THE LEAD CHILLER START SEQUENCE IS ACTIVATED.

THE CHILLER START SEQUENCE FIRST OPENS THE CHILLED WATER AND CONDENSER WATER ISOLATION VALVES. AFTER A TIME DELAY, THE CONDENSER AND PRIMARY CHILLED WATER PUMPS ARE ENABLED. AFTER ANOTHER TIME DELAY, THE CHILLER START/STOP POINTS TURN ON. AFTER FLOW IS PROVEN, THE CHILLER OPERATES UNDER ITS OPERATING AND SAFETY CONTROLS.

- AFTER ANY CHILLER(S) ARE COMMANDED, THE PROGRAM WAITS FOR 15 MINUTES BEFORE ISSUING ANY OTHER COMMANDS.
- b. RESIDENTIAL UNITS WILL BE OPERATED FROM A PROGRAMMABLE THERMOSTAT IN EACH RESIDENCE BASED ON TENANT PREFERENCE.
- c. PUBLIC AREAS (EXCLUDING CORRIDORS) WILL BE OPERATED FROM LOCAL PROGRAMMABLE THERMOSTATS BASED ON OPERATING HOURS OF EACH SPACE.

2. CODES AND STANDARDS
- A. BUILDING CODES ENFORCED BY THE AUTHORITY HAVING JURISDICTION IN:
- 2010 CALIFORNIA MECHANICAL CODE (CMC) BASED 2009 UNIFORM MECHANICAL CODE (UMC) WITH STATE AMENDMENTS.
 - 2010 CALIFORNIA PLUMBING CODE (CPC) BASED 2009 UNIFORM PLUMBING CODE (UPC) WITH STATE AMENDMENTS.
 - 2008 TITLE 24, PART 6 CALIFORNIA ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL STANDARDS.
- B. AMERICANS WITH DISABILITIES ACT, (ADA)

3. OUTDOOR DESIGN CONDITIONS
- A. SUMMER: 84°F DB/67°F WB (ASHRAE 0.5% LOS ANGELES, CA)
- B. WINTER: 42°F (ASHRAE 0.8% LOS ANGELES, CA)
- C. DESIGN WET BULB: 69°F (ASHRAE 0.5% LOS ANGELES, CA)
- D. LATITUDE: 33.9°N
- E. ELEVATION: 97 FT
- F. CALIFORNIA CLIMATE ZONE: 6
4. INDOOR DESIGN CONDITIONS

DEFINED SPACES	TEMPERATURE		HUMIDITY	
	SUMMER	WINTER	SUMMER	WINTER
RESIDENCE AREAS	75°F.	70°F.	50%	N/A
PUBLIC COMMON OCCUPIED AREAS	72°F.	70°F.	50%	N/A
PUBLIC LOBBY	75°F.	72°F.	50%	N/A
ELEVATOR EQUIPMENT ROOM	85°F ±2°F	45°F.	AMBIENT	N/A
U.N.O. BY EQUIPMENT SUBMITAL				
TELEPHONE EQUIPMENT ROOM	95°F.	AMBIENT	AMBIENT	N/A
ENCLOSED PARKING AREAS		VENTILATION ONLY	AMBIENT	N/A
MECHANICAL ROOM		VENTILATION ONLY	AMBIENT	N/A
STAIRWELLS		AMBIENT	AMBIENT	N/A

- B. ALL OTHER NON DEFINED FOR EXAMPLE LEASING OFFICE AREAS, FUTURE RETAIL:
- COOLING 74°F ±2°F
 - HEATING 70°F ±2°F

- C. EXCEPTIONS:
- ELECTRICAL ROOMS: U.N.O. BY EQUIPMENT SUBMITAL, COOLING ONLY, 78°F ±2°F
 - DATA/SERVER ROOMS: U.N.O. BY EQUIPMENT SUBMITAL, COOLING ONLY, 75°F ±2°F

5. VENTILATION CRITERIA:
- OFFICES – 0.25 CFM/SQ.FT.
 - LOBBIES – 7.5 CFM/OCC.
 - CORRIDORS, ELEVATORS, RESTROOMS, STAIRS, VESTIBULES, STORAGE – 0.25 CFM/SQ.FT.
 - MECHANICAL, ELECTRICAL, DATA – 0.25 CFM/SQ.FT.
 - UTILITY ELECTRICAL VAULT – U.N.O. BY UTILITY COMPANY FOR VENTILATION REQUIREMENTS: 3 CFM/KW.
 - POSITIVELY SUPPLIED AMBIENT AIR.
 - TRASH ROOM: (UNLESS NOTED OTHERWISE FOR CONDITIONED AIR CIRCULATION) 1.5 CFM/SQ.FT.

6. TOILET AND BATHROOM MECHANICALLY EXHAUST TO OUTDOOR PER ASHRAE STANDARD 62 CRITERIA:
- COMMON AREA TOILET ROOMS: 1.5 CFM/FT² OR, 6 AIR CHANGES PER HOUR WHICHEVER PROVIDE HIGHER EXHAUST
 - RESIDENTIAL BATHROOM: MINIMUM 50 CFM/FT² INTERMITTENT (LOCALIZED BATHROOM EXHAUST FAN).

7. ENCLOSED GARAGE MECHANICALLY VENTILATION TO OUTDOOR PER CRITERIA:
- A MECHANICALLY VENTILATED BASED ON 2.5 PERCENT OF NUMBER OF CARS IN MOTION AT 14000 CFM PER VEHICLE.
 - GARAGE EXHAUST AND MAKE AIR OPERATIONS ARE BY CARBON MONOXIDE CONTROL SYSTEM. (2010 UMC, 403.B.2.2)

8. BUILDING ENVELOPE
- A. GLAZING:
- EXTERIOR – U-VALUE = 0.26 (INCLUDING FRAME), SOLAR HEAT GAIN COEFFICIENT = 0.29
 - IT IS REQUIRED THAT ALL GLAZING ASSEMBLIES (GLASS AND FRAMING COMBINED) ON THIS EXISTING BUILDING

- B. WALL CONSTRUCTION:
- EXTERIOR
a. DESCRIPTION: 8" CONCRETE WITH R-11 INSULATION
 - OVERALL U-VALUE: 0.11

- C. ROOF:
- DESCRIPTION: WOOD FRAME WITH R-19 INSULATION
 - OVERALL U-VALUE: 0.051

9. INTERNAL HEAT GAIN

SPACE	LIGHTING LOAD	PLUG LOAD	OCCUPANT LOAD	INFILTRATION LOAD	OTHERS
GUEST RM.	3.0 W/FT²	4.5 W/FT²	150 FT²/OCC.	0	N/A
LEASING	1.0 W/FT²	2.0 W/FT²	60 FT²/OCC.	0	N/A
GYM, ETC.	1.0 W/FT²	2.0 W/FT²	60 FT²/OCC.	0	N/A
RETAIL	1.6 W/FT²	2.0 W/FT²	100 FT²/OCC.	0	N/A

- B. RECEPTACLE POWER:
- OFFICES – 1.5 W/SQ.FT.
 - LOBBIES – 0.5 W/SQ.FT.
 - CORRIDORS, ELEVATORS, RESTROOMS, STAIRS, VESTIBULES, STORAGE – 0.2 W/SQ.FT.
 - MECHANICAL, ELECTRICAL, DATA – 2 W/SQ.FT. (UNLESS NOTED OTHERWISE BASED ON GIVEN HEAT DISSIPATION OF THE EQUIPMENT.

- C. OCCUPANTS:
- OFFICES – 255 BTUH SENSIBLE/255 BTUH LATENT
 - LOBBIES – 255 BTUH SENSIBLE/255 BTUH LATENT
 - CORRIDORS, ELEVATORS, RESTROOMS, STAIRS, VESTIBULES, STORAGE – 255 BTUH SENSIBLE/255 BTUH LATENT
 - MECHANICAL, ELECTRICAL, DATA – 0 BTUH SENSIBLE/0 BTUH LATENT
 - ELECTRICAL TRANSFORMERS: 3.5% LOSS LOSS/50% DIVERSITY

- D. OCCUPANCY CRITERIA
- OFFICES – 1 PERSON/100 SQ.FT. LOBBIES – 1 PERSON/15 SQ.FT.
 - LOBBIES – 1 PERSON/15 SQ.FT.
 - CORRIDORS, ELEVATORS, RESTROOMS, STAIRS, VESTIBULES, STORAGE – 0 PEOPLE
 - MECHANICAL, ELECTRICAL, DATA – 0 PEOPLE

11. DUCTWORK DESIGN CRITERIA
- ALL DUCTWORK: 0.8" W.G./100 FT. MAX
 - MEDIUM PRESSURE SUPPLY
1. 1500 FPM MAX ABOVE CEILING
2. 2200 FPM MAX IN SHUT
 - RETURN VELOCITY: 1500 FPM MAX.
 - EXHAUST VELOCITY: 1500 FPM MAX.

12. PIPE-WORK DESIGN CRITERIA
- A. MAX. PRESSURE DROP: 4 FT. W.G./100 FT.
 - B. MAX VELOCITY:
1. 8 FT/SEC MAX IN OCCUPIED AREAS
2. 10 FT/SEC MAX IN MECHANICAL ROOMS
3. 8" DIAMETER AND LARGER: 10 FT/SEC
4" DIAMETER THROUGH 6" DIAMETER: 6 FT/SEC
2" DIAMETER THROUGH 3" DIAMETER: 4 FT/SEC
2" DIAMETER AND SMALLER: 2.5 FT/SEC

13. CENTRAL PLANT SYSTEMS TEMPERATURES SERVING THIS BUILDING:

- A. BOILER (HEAT PUMP APPLICATION):
- ENTERING WATER TEMPERATURE (EWT): 125°F
 - LEAVING WATER TEMPERATURE (LWT): 150°F
- B. WATER SOURCE HEAT PUMP CLOSED LOOP CONDENSER:
- ENTERING WATER TEMPERATURE (EWT): 100°F
 - LEAVING WATER TEMPERATURE (LWT): 85°F

14. ACOUSTICAL
- A. PER ACOUSTICAL ASHRAE STANDARDS
 - B. PER ACOUSTICAL PRACTICE IN THE TABLE BELOW

15. SEISMIC
- A. SEISMIC ZONE/FACTOR: 4 / 0.40
 - B. SEISMIC IMPORTANCE FACTOR: 1.0
 - C. SEISMIC HAZARD EXPOSURE GROUP: GROUP II
 - D. SYSTEM SEISMIC COEFFICIENT: 2.0

TABLE 6–D Insulation of Ducts				
DUCT LOCATION	INSULATION TYPES MECHANICALLY COOLED	HEATING ZONE	INSULATION TYPES HEATING ONLY	
On roof on exterior of building	C, V ^a and W	I II III	A and W HEATING ONLY C and W	
Attics, garages and crawl spaces	A and V ^a	I II III	A A B	
In walls, ^a within floor–ceiling ceiling spaces ^a	A and V ^a	I II III	A A B	
Within the conditioned space or in basements; return ducts in air plenums	None required		None required	
Cement slab or within ground	None required		None required	

Note: Where ducts are used for both heating and cooling, the minimum insulation shall be as required for the most restrictive condition.

- Heating degree days:
Zone I below 4500 D.D.
Zone II 4500 D.D.
Zone III over 8001 D.D.
- Vapor retarders shall be installed on supply ducts in spaces vented to the outside in geographic areas where the average summer dew point temperature based on the 2–1/2 percent column of dry-bulb and mean coincident wet-bulb temperature exceeds 60°F (15.6°C).
- Insulation may be omitted on that portion of a duct which is located within a wall– or a floor–ceiling space where:
a. Both sides of the space are exposed to conditioned air.
b. The space is not ventilated.
c. The space is not used as a return plenum.
d. The space is not exposed to unconditioned air.
e. Ceilings which form plenums need not be insulated.

INSULATION TYPES:

- A. A material with an installed conductance of 0.042 [0.72 W/(m²K)] or the equivalent thermal resistance of 2.1 [0.92 (m²K)/W]. Example of materials capable of meeting the above requirements: 1–inch (25.4 mm), 0.80 lb./cu. ft. (0.6 kg/m³) mineral fiber blankets, rock, slag or glass blankets; 1/2–inch (12.7 mm), 1.5 to 3 lb./cu. ft. (24.0 to 48.1 kg/m³) mineral fiber blanket duct liner.
- B. A material with an installed conductance of 0.24 [1.36 W/(m²K)] or the equivalent thermal resistance of 4.2 [0.235 (m²K)/W]. Example of materials capable of meeting the above requirements: 2–inch (50.8 mm), 0.80 lb./cu. ft. (0.6 kg/m³) mineral fiber blankets, 1–inch (25.4 mm), 1.5 to 3 lb./cu. ft. (24.0 to 48.1 kg/m³) mineral fiber blanket duct liner, 1–inch (25.4 mm), 5 to 10 lb./cu. ft. (80.1 to 160.2 kg/m³) mineral fiber board.
- C. A material with an installed conductance of 0.16 [1.36 W/(m²K)] or the equivalent thermal resistance of 6.3 [1.1 (m²K)/W]. Example of materials capable of meeting the above requirements: 3–inch (76.2 mm), 0.60 lb./cu. ft. (0.6 kg/m³) mineral fiber blankets, 1–1/2 inch (38.1 mm), 1.5 to 3 lb./cu. ft. (24.0 to 48.1 kg/m³) mineral fiber blanket duct liner, 1/12 inch (2.1 mm), 3 to 10 lb./cu. ft. (80.1 to 160.2 kg/m³) mineral fiber board.

- V. Vapor Retarders: Material with a perm rating not exceeding 0.5 perm (29 ng/ps.s.m.). All joints to be sealed.
- W. Approved weatherproof barrier.
4. The example of materials listed under each type is not meant to limit other available thickness and density combinations with the equivalent installed conductance or resistance based on the insulation only.

DUCT INSTALLATION NOTES

- ALL DUCTWORK SHALL BE INSTALLED, SEALED AND INSULATED PER 2005 CALIFORNIA ENERGY EFFICIENCY STANDARDS. R-VALUE AND CONDUCTANCE OF THERMAL VALUES SHALL BE TESTED IN ACCORDANCE WITH ASTM AND ICC COMPLIANT.
- PRESSURE SENSITIVE DUCT TAPE IS RESTRICTED TO DUCTS OPERATING AT E.S.P. OF 1" W.G. OR LESS.
- DUCTS SHALL BE INSULATED IN COMPLIANCE WITH CURRENT CMC CODE.
- INSULATION APPLIED TO THE EXTERIOR SURFACE OF DUCTS LOCATED IN BUILDINGS SHALL HAVE A FLAME SPREAD RATING OF NOT MORE THAN 25 AND A SMOKE DENSITY NOT EXCEEDING 50 WHEN TESTED AS A COMPOSITE INSTALLATION, INCLUDING INSULATION, FASTENING MATERIALS, TAPES AND ADHESIVES AS NORMALLY APPLIED.
- FAZED INSULATION INTENDED FOR INSTALLATION ON THE EXTERIOR OF DUCTS SHALL BE LEGIBLY PRINTED WITH NAME OF THE MANUFACTURER, NOMINAL THICKNESS OF INSULATION AND FLAME SPREAD AND SMOKE DEVELOPED RATINGS OF THE COMPOSITE MATERIAL.
- ALL DUCTWORK, FITTINGS AND COMPONENTS UTILIZED FOR SMOKE CONTROL SYSTEM SHALL BE RATED FOR 250°F TEMPERATURE TO COMPLY WITH 2001 CMC 604.2.
- MINIMUM THERMALPERFORMANCE AND SOUND ABSORPTION CHART

THICKNESS (in.)	R-VALUE	CONDUCT.	SOUND ABSORPTION COEFF. (in.)	APPLICATION
1"	4.2	0.24	0.08	1000
1–1/2"	6.3	1.11	0.1	1000
2"	8.0	1.41	0.25	1000

* UNLESS NOTED OTHERWISE.

DESIGN GUIDELINES FOR MAXIMUM AIR VELOCITIES IN DUCTS (FPM)				
NOISE CRITERION – NC	45	40	35	30
MAIN DUCT LOOP ABOVE SUSPENDED CEILING [RECTANGULAR DUCT]	2000	1800	1500	1300
BRANCH DUCT WITHIN 10 TO 20 FEET OF SUPPLY DIFFUSER/RETURN GRILLE	900/1000	850/950	800/900	700/800
DUCT WITHIN 0 TO 10 FEET OF SUPPLY DIFFUSER/RETURN GRILLE	700/800	650/750	600/700	500/600
SUPPLY DIFFUSER – "FREE" VELOCITY	550	500	450	400
RETURN GRILLE – "FREE" VELOCITY	650	600	550	500
OPEN RETURN DUCT ABOVE CEILING	850	750	650	–

SUBJECT TO SOUND CONSULTANT REVIEW AND APPROVAL FOR FUTURE T1 APPLICATION

TABLE 6–E Duct Supports Part I – Vertical Ducts			
MAXIMUM SIDE OF RECTANGULAR DUCTS	METAL STRAP OR ANGLE BRACKET	MAXIMUM DIAMETER OF ROUND DUCTS	STRAP
24"	1" x 1/8" Strap ^a	10"	0.047" (No. 16 gage) galvanized steel
36"	1" x 1 x 1/8" Angle ^a	20"	0.058" (No. 16 gage) galvanized steel 2" side ^a
48"	1–1/8" x 1–1/8" x 1/8" Angle ^a	40"	1/8" steel x 1–1/2"
60"	1–1/2" x 1–1/2" x 1/8" Angle ^a	60"	1/8" steel x 2"
48"	2" x 2" x 1/8" Angle ^a	over 60"	3/16" steel x 2"

Part II – Horizontal Ducts			
18"	1" x 18" Gage ^a	10"	Same gage as galvanized steel duct, 1" wide on (No. 16 gage galvanized steel wire) on 10" centers
30"	1" x 18" Gage ^a		
48"	1" x 1/8"	20"	Same gage as galvanized steel duct, 1" wide on (No. 6 gage galvanized steel wire) tied to 1" galvanized steel band around duct on 10" centers
60"	1" x 1/8"	40"	
60"	1" x 1/8"	60"	Same gage as galvanized steel duct, 1–1/2" wide on 6" centers
		over 60"	Same gage as galvanized steel duct, 1–1/2" wide on 4" centers

Part III – Horizontal Ducts – Trapeze–Type Supports			
MAXIMUM DIAMETER OF ROUND DUCT OR SIDE OF RECTANGULAR DUCT	HORIZONTAL SUPPORT ANGLE ^a	HANGER	
36"	1–1/2" x 1–1/2" x 1/8"	1/4" round rod or 1" x 1" x 1/8" angle	
48"	2" x 2 x 1/8"	1/4" round rod or 1" x 1" x 1/8" angle	
60"	2" x 2 x 1/8"	5/16" round rod or 1" x 1" x 1/8" angle	
84"	2" x 2 x 1/8"	3/8" round rod or 1" x 1" x 1/8" angle	

- Spaced vertically not more than 12 feet on centers.
- Spaced horizontally not more than 10 feet on centers.
- Spaced not more than 8 feet on centers.

WARRANTY INFORMATION

- MECHANICAL CONTRACTOR SHALL GUARANTEE THE ENTIRE HEATING, VENTILATING AND AIR CONDITIONING SYSTEM FOR A PERIOD OF ONE (1) YEAR. DURING THIS PERIOD, ANY MATERIALS OR EQUIPMENT PROVE DEFECTIVE OR ANY PART OF THE SYSTEM FAILS TO FUNCTION PROPERLY, CONTRACTOR SHALL PROVIDE PARTS AND LABOR TO RECTIFY PROBLEMS WITHOUT EXPENSE TO OWNER.
- ALL A/C COMPRESSORS, INCLUDING A/C UNITS OVER 15 TONS SIZE SHALL HAVE FULL 5 YEAR NON-EXTENDED WARRANTY FOR REPLACEMENT WITH NEW COMPRESSORS. ALL A/C UNITS HEAT EXCHANGERS SHALL BE WARRANTED AGAINST DEFECTS FOR A TEN (10) YEAR PERIOD. PROVIDE ANTI-SHORT CYCLING FEATURE FOR COMPRESSORS.
- FURNISH OWNER WITH ALL MANUFACTURERS WRITTEN GUARANTEES OF MATERIAL AND EQUIPMENT AS CONDITION OF FINAL PAYMENT.

MECHANICAL CONTRACTOR IS RESPONSIBLE TO PROVIDE PROOF OF PERFORMANCE OF DUCT LEAKAGE TESTING TO VERIFY A TOTAL LEAKAGE RATE OF LESS THAN 6 PERCENT OF THE TOTAL FAN FLOW IN ACCORDANCE WITH CAL GREEN CODES AND LOCAL JURISDICTION. FOR ADDITIONAL INFORMATION REFER TO CAL GREEN REQUIREMENTS.

FIRE/SMOKE DAMPERS.

FIRE/SMOKE DAMPERS ARE REQUIRED AT THE FOLLOWING LOCATIONS:

- DUCT PENETRATING AREA SEPARATION WALLS OR OCCUPANCY SEPARATIONS.
- DUCT PENETRATING HORIZONTAL EXIT WALLS.
- DUCT PENETRATING FIRE-RATED CORRIDORS HAVING OPENING INTO THE CORRIDOR.
- DUCT PENETRATING SHAFT (STEEL EXHAUST SUB DUCTS MAY COMPLY WITH THE EXCEPTION TO ITEM 1 IF FULLY DETAILED ON THE PLANS.)
- DUCT PENETRATING AREA OF REFUGE.

ADDITIONAL FIRE DAMPERS ARE REQUIRED AT:

- DUCTS PENETRATING THE CEILING OF FIRE-RESISTIVE FLOOR–CEILING OR ROOF–CEILING ASSEMBLIES.

ADDITIONAL SMOKE DAMPERS ARE REQUIRED AT:

- DUCT PENETRATING SMOKE BARRIERS.
- DUCT PENETRATING ELEVATOR LOBBIES.

LOCATION OF ALL REQUIRED FIRE DAMPERS SHALL BE CLEARLY DEFINED ON THE PLANS

GENERAL NOTES

- THE WORK IN THIS SECTION SHALL BE INSTALLED IN STRICT ACCORDANCE WITH PROJECT BOOK SPECIFICATION, THE 2010 CMC, CAL GREEN, ALL APPLICABLE LOCAL CODES AND ORDINANCES, AND IN COMPLIANCE WITH MANUFACTURERS RECOMMENDATIONS.
- ARCHITECTURAL AND STRUCTURAL PLANS ARE CONSIDERED A PART OF THE DESIGN DRAWINGS AND SHALL BE USED TO DEFINE DETAIL CONFIGURATIONS INCLUDING, BUT NOT LIMITED TO, RELATIVE LOCATION OF MEMBERS, ELEVATION, LOCATION OF ALL OPENINGS, ETC.
- THE CONTRACTOR, WHEN NECESSARY, MAY REQUEST INFORMATION CONCERNING THE DESIGN, PROVIDED SUCH REQUEST IS DELIVERED IN A TIMELY FASHION THROUGH PROPER CHANNELS.
- SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW PRIOR TO PURCHASE/FABRICATION. MINIMUM ENGINEER REVIEW TIME IS 14 WORKING DAYS BEFORE RETURN TO THE GENERAL CONTRACTOR. SHOP DRAWINGS WILL BE REJECTED FOR INCOMPLETENESS, LACK OF CALCULATIONS (IF REQUIRED), OR CHANGES WITHOUT PRE-APPROVAL. DELAY IN PROCESSING SHOP DRAWINGS WILL BE THE RESPONSIBILITY OF THIS CONTRACTOR.
- GENERAL AND SUBCONTRACTORS SHALL REVIEW AND STAMP ALL SHOP DRAWINGS PRIOR TO REVIEW BY THE ENGINEER. SHOP DRAWINGS SHALL BE REVIEWED FOR COMPLETENESS AND COMPLIANCE TO THE DRAWINGS. CONTRACTOR SHALL CLEARLY FLAG ANY DEVIATION AND MAKE WRITTEN REQUEST TO THE ENGINEER FOR APPROVAL OF ANY MODIFICATION. ALL MODIFICATIONS MUST BE PRE-APPROVED BEFORE SHOP DRAWINGS ARE PROCESSED AND RESUBMITTED FOR FINAL APPROVAL.
- TIME SPENT BY ENGINEERING PERSONNEL AND STAFF IN REPLY TO REQUESTS FOR INFORMATION, THE ANSWERS FOR WHICH CAN BE FOUND IN THE CONTRACT DOCUMENTS, WILL BE CHARGED TO THE CONTRACTOR AND SUCH REQUEST FOR INFORMATION SHALL BE ACCOMPANIED BY A PURCHASE ORDER FOR THE SERVICE REQUESTED.
- COORDINATE LOCATION AND SIZE OF ACCESS PANELS SO THEY WILL PROVIDE USEFUL ACCESS TO SERVICE SYSTEM COMPONENTS.
- PROVIDE FIRE BLOCKING OR DAMPER, AS APPLICABLE, WHERE SYSTEM COMPONENTS PENETRATE FIRE RATED SEPARATIONS, BLOCKING/DAMPERS SHALL BE RATED IN ACCORDANCE WITH SEPARATION SERVED.
- PROVIDE CODE APPROVED FLEXIBLE CONNECTIONS FOR ALL MOVING AND VIBRATING EQUIPMENTS.
- THE ROOF CURBS WHERE REQUIRED SHALL BE DESIGNED FOR THE INTENDED EQUIPMENT AND SHALL PROVIDE SUPPORT AND COMPLETE WEATHERTIGHT INSTALLATION.
- PROVIDE FLASHING AND/OR COUNTERFLASHING AT ALL EXTERIOR PENETRATIONS TO ASSURE A WATER TIGHT CONSTRUCTION.
- DUCTS AND PIPES PASSING THRU FIRE RATED WALLS OR FLOORS SHALL BE SEALED ALL AROUND WITH FIRE RATED SEALANT.
- COORDINATE UNIT LOCATION AND ROOF PENETRATIONS WITH ALL TRADES TO ASSURE PROPER ROOF OPENING.
A. WITH EXCEPTION OF LAUNDRY DRYER VENT & KITCHEN HOOD, ALL OPENINGS, LOUVERS, AND ROOF VENT CAPS SHALL BE PROTECTED BY BIRD/INSECT PROOF MESH SCREEN.
- ALL MECHANICAL EQUIPMENT, APPARATUS, DUCTWORK, AND PIPING SHALL BE ANCHORED OR STRAPPED TO STRUCTURE PER CMC CODE, AND ANCHORAGE SHALL BE APPROVED BY STRUCTURAL ENGINEER.
- COORDINATE AND VERIFY FINAL LOCATION OF ALL THERMOSTATS AND CONTROL PANELS W/ARCHITECT AND OWNER BEFORE ROUGH-IN.
- TESTING, BALANCING AND CLEANING:
A. CLEAN JOBSITE REGULARLY OF CONSTRUCTION DEBRIS, AND COORDINATE WITH GENERAL CONTRACTOR FOR CLEAN UP.
B. CERTIFY THAT ALL A/C UNITS ARE INSTALLED LEVEL.
C. INITIALLY TEST AND BALANCE ALL DAMPERS, REGISTERS, VALVES AND AIR DISTRIBUTION DEVICES. SUBMIT "AS –BUILT" SHOP DRAWINGS TO INDEPENDENT TESTING AND BALANCING COMPANY TO PERFORM FINAL TESTING & BALANCING, AND PROVIDE A WRITTEN REPORT PER SPECIFICATION DOCUMENTS.
- UNLESS SMOKE DETECTORS ARE PROVIDED AS PART OF AN APPROVED FIRE ALARM SYSTEM, PROVIDE LINE VOLTAGE CIRCUITRY FOR DETECTORS AND AN INTERLOCKED SHUTDOWN CONTROL CIRCUIT AT ANY/ALL HVAC UNIT(S) 2000 CFM OR OVER AND SMOKE AND FIRE DAMPERS THAT ARE A PART OF THIS SYSTEM. REFER TO ELECTRICAL ENGINEERING DRAWING AND ARCHITECTURAL GENERAL NOTES, SHEET G1.01 AND G1.02.
- IF FIELD ALTERATIONS AND REROUTING OF DUCTWORK AND PIPING SYSTEMS HAVE TO BE MADE DUE TO JOBSITE CONDITIONS, THE CONTRACTOR SHALL PREPARE THEIR OWN SHOP DRAWINGS FOR SUCH MODIFICATION AND SUBMIT THEM FOR APPROVAL PRIOR TO FABRICATION AND INSTALLATION. THESE ALTERATIONS SHALL BE AT NO COST TO THE OWNER.
- THE CONTRACTOR SHALL FURNISH AND INSTALL ACCESS PANELS AND/OR ACCESS DOOR TO LOCATIONS AS NECESSARY TO SERVICE FIRE DAMPER CONTROLS AND EQUIPMENT. SHOP DRAWINGS OF ALL PANEL LOCATIONS SHALL BE REVIEWED AND APPROVED BY ARCHITECT PRIOR TO INSTALLATION.
- HANGER FOR SUSPENDED EQUIPMENT AND DUCTWORK SHALL BE SWAY BRACED IN TWO DIRECTIONS PER EQUIPMENT AND INSTALLATION. SHOP DRAWINGS SHALL BE REVIEWED AND APPROVED BY STRUCTURAL ENGINEER PRIOR TO INSTALLATION.
- APPROVED THROUGH PENETRATION FIRE STOP SYSTEMS IN ACCORDANCE WITH CBC SECTION 712 SHALL BE PROVIDED WHERE ALL MECHANICAL PIPING SYSTEMS ENTERS OR PASSES THROUGH FIRE RESISTANCE RATED WALLS, HORIZONTAL FLOOR/CEILING AND ROOF/CEILING ASSEMBLIES. THROUGH PENETRATION FIRE STOP SYSTEMS SHALL BE INSTALLED AND TESTED IN ACCORDANCE WITH ASTM E 814 OR UL 1479 WITH A MINIMUM POSITIVE PRESSURE DIFFERENTIAL OF 0.01 INCH (2.49) PA OF WATER. FIRE STOP SYSTEMS FOR USE AT PIPING PENETRATIONS OF WALLS SHALL HAVE AN F-RATING NOT LESS THEN THE REQUIRED FIRE RESISTANCE RATING OF THE WALL BEING PENETRATED. FIRE STOP SYSTEMS FOR USE AT PIPING PENETRATIONS OF HORIZONTAL ASSEMBLIES SHALL HAVE AN F-RATING AND A T-RATING NOT LESS THEN 1 HOUR BUT NOT LESS THEN THE REQUIRED RATING OF THE FLOOR BEING PENETRATED. (CBC 712.3.1.2 AND 712.4.1.1.2)"
- ALL ENVIRONMENTAL EXHAUST (KITCHEN AND BATHROOM EXHAUST) DUCTS SHALL TERMINATE A MINIMUM OF 3 FEET FROM OPENINGS INTO THE BUILDING. COORDINATE ALL EXTERIOR LOUVERS LOCATIONS WITH GENERAL CONTRACTOR PRIOR TO FABRICATION AND INSTALLATION OF ANY SHEET METAL DUCTWORK.
- THE CONTRACTOR IS ADVISED AND REMINDED THAT HIS BEST EFFORTS AND THAT OF THE CONTRACTOR'S ORGANIZATION AND PERSONNEL SHALL BE A PART OF THE COORDINATED EFFORT INTENDED TO PROVIDE THE PROJECT OWNER AND THE ULTIMATE USERS AND OCCUPANTS WITH A FINISHED PROJECT WHICH WILL SERVE ITS INTENDED PURPOSE. TO THIS END THE CONTRACTOR SHALL BRING HIS FULL QUALITY, EXPERTISE AND EXPERIENCE TO BEAR ON THE DAY-TO-DAY OPERATIONS AT THE CONSTRUCTION SITE.

SYMBOL	ABBR.	DESCRIPTION
		NEW DUCTWORK – FIRST FIGURE: SIDE SHOWN, SECOND FIGURE: SIDE NOT SHOWN
	(L)	DUCTWORK WITH INTERNAL ACOUSTIC LINING
		FLEX CONNECTION IN DUCT
		DUCT SIZE TRANSITION
		ROUND DUCT VERTICAL RISE OR DROP
		RECTANGULAR DUCT VERTICAL RISE OR DROP
		GRADUAL RISE (DROP) IN DUCT
		VERTICAL TAKE OFF UP
		VERTICAL TAKE OFF DOWN
		ROUND DUCT 90 DEGREE RADIUS ELBOW
		ROUND DUCT CONICAL 90 DEGREE TAKE OFF
		ROUND DUCT 45 DEGREE RADIUS ELBOW
		RECTANGULAR DUCT 90 DEGREE MITERED ELBOW
		90 DEGREE RECTANGULAR TAKE OFF WITH EXTRACTION DAMPER
		RECTANGULAR DUCT ANGLE TAKE OFF
		FIRE DAMPER / COMBINATION SMOKE AND FIRE DAMPER-WITH ACCESS DOOR & CEILING ACCESS
		MANUAL VOLUME DAMPER
		MOTORIZED DAMPER
		BACKDRAFT DAMPER (BDD)
		DUCT UNDER POSITIVE PRESSURE (SUPPLY AIR OR FAN DISCHARGE)
		DUCT UNDER NEGATIVE PRESSURE (RETURN, EXHAUST)
		STACK, VENT OR ROUND DUCT RISER
	CD	RECTANGULAR/ROUND CEILING DIFFUSER (TYPE 1, 400 CFM SUPPLY AIR – ARROWS INDICATE DIRECTION OF FLOW)
	RG ER	CEILING REGISTER/GRILLE (TYPE 2, 300 CFM RETURN AIR OR EXHAUST AIR)
	L/D	LOUVER IN DOOR, 1 S.F. MIN FREE AREA
	U/C	UNDERCUT DOOR
	POC POD	POINT OF CONNECTION / DISCONNECTION
	T	THERMOSTAT
	SD HD	SMOKE DETECTOR / HEAT DETECTOR
		EQUIPMENT IDENTIFICATION
	O.B.D.	OPPOSED BLADE DAMPER
	U.N.O.	UNLESS NOTED OTHERWISE
	CWS&R	CONDENSER WATER SUPPLY & RETURN RISER
		RISER NUMBER
		BY MECHANICAL CONTRACTOR
		BY ELECTRICAL CONTRACTOR
		SHUT OFF VALVE
		BALANCING VALVE
		CHECK VALVE, SWING OR LIFT
		RELIEF OR SAFETY VALVE
		TWO WAY AUTOMATIC VALVE
		THREE WAY AUTOMATIC CONTROL VALVE
		AUTOMATIC AIR VENT
		MANUAL AIR VENT
		THERMOMETER AND WELL
		PRESSURE GAUGE
		CONDENSER WATER SUPPLY
		CONDENSER WATER RETURN
	(EP)	EMERGENCY POWER