

SE 27th & Division Apts

MECHANICAL DRAWING LIST

M0.01	MECHANICAL LEGEND SCHEDULE AND NOTES
M2.00	MECHANICAL UNDERSLAB PLAN
M2.01	MECHANICAL PLAN LEVEL 1
M2.02	MECHANICAL PLAN LEVEL 2
M2.03	MECHANICAL PLAN LEVEL 3
M2.04	MECHANICAL PLAN LEVEL 4
M2.05	MECHANICAL PLAN LEVEL 5
M2.06	MECHANICAL ROOF PLAN
M6.00	MECHANICAL SCHEDULES
M6.01	MECHANICAL DETAILS
M6.02	MECHANICAL DETAILS
M6.03	MECHANICAL DETAILS

SYSTEM COMMISSIONING-VERIFICATION AND TESTING REQUIREMENTS:
ASHRAE 90.1-2019 REQUIREMENTS
SECTION 4.2.5 THROUGH 4.2.5.3

THE OWNER OR GC SHALL PROCURE A COMMISSIONING PROVIDER THAT MEETS ONE OF THE FOLLOWING.

- THE COMMISSIONING PROVIDER SHALL BE:
- A THIRD PARTY ENTITY NOT ASSOCIATED WITH THE BUILDING PROJECT
 - AN OWNER'S QUALIFIED EMPLOYEE.
 - AN INDIVIDUAL ASSOCIATED WITH THE DESIGN FIRM, BUT NOT DIRECTLY ASSOCIATED WITH THE DESIGN OR INSTALLATION OF THE BUILDING SYSTEMS.

- EXCEPTIONS:
- BUILDING IS LESS THAN 10,000 SQ FT

- CONTRACTOR RESPONSIBILITIES
- THE CONTRACTOR IS RESPONSIBLE FOR FOLLOWING ALL THE REQUIREMENTS OF ASHRAE 90.1-2019.
 - THE GENERAL CONTRACTOR OR OWNER SHALL HIRE AND UTILIZE AN APPROVED CX AGENT
 - THE CX AGENT SHALL
 - PREPARE A CX PLAN
 - OVERSEE THE TAB MEASUREMENTS
 - CONDUCT THE PR-FUNCTIONAL & FUNCTIONAL TESTS
 - PREPARE THE PRELIMINARY CX REPORT
 - REVIEW THE TAB REPORT
 - REVIEW THE O&M'S
 - PREPARE THE SYSTEMS MANUALS
 - SYSTEMS REQUIRED TO BE COMMISSIONED
 - SERVICE WATER HEATERS
 - MIXING VALVES & RECIRC SYSTEMS
 - ROOFTOP UNIT - HALLWAY VENTILATION
 - SPLIT SYSTEM FAN COILS
 - DWELLING UNIT EXHAUST FANS (SAMPLE SELECTION).
 - LIGHTING CONTROL SYSTEMS
 - OCCUPANCY SENSORS
 - THERMOSTAT OPERATIONS AND SET POINTS
 - FIRE PIT & BBQ TIMERS AND AUTO-SHUT OFF
 - FIRE PUMP AND DOMESTIC WATER BOOSTER PUMP.

MECHANICAL LEGEND

	SUPPLY AIR DIFFUSER	AFF	ABOVE FINISH FLOOR
	RETURN AIR GRILLE	AHU	AIR HANDLING UNIT
	EXHAUST AIR GRILLE	B.D.	BOTTOM OF DUCT
	PERFORATED RETURN AIR PANEL	BHP	BRAKE HORSEPOWER
	DIRECTIONAL AIR FLOW	BTU	BRITISH THERMAL UNITS
	MANUAL VOLUME DAMPER	CFM	CUBIC FEET PER MINUTE
	SUPPLY OR OUTSIDE AIR DUCT UP & DOWN	CONN.	CONNECTION
	RETURN AIR DUCT UP & DOWN	CONT.	CONTINUATION
	EXHAUST AIR DUCT UP & DOWN	CW	DOMESTIC COLD WATER
	SUPPLY OR OUTSIDE AIR DUCT UP & DOWN	DB	DRY BULB
	RETURN AIR DUCT UP & DOWN	DIA.	DIAMETER
	EXHAUST AIR DUCT UP & DOWN	DIST.	DISTRIBUTION
	SUPPLY OR OUTSIDE AIR DUCT UP & DOWN	EA	EXHAUST AIR
	RETURN AIR DUCT UP & DOWN	EDB	ENTERING DRY BULB TEMPERATURE
	EXHAUST AIR DUCT UP & DOWN	EWB	ENTERING WET BULB TEMPERATURE
	VAV TERMINAL UNIT	EWT	ENTERING WATER TEMPERATURE
	WT TERMINAL UNIT	FF	FINISH FLOOR
	EXISTING	FIXT.	FIXTURE
	CONNECT TO EXISTING	FPM	FEET PER MINUTE
	THERMOSTAT OR TEMP. SENSOR	FPS	FEET PER SECOND
	NOTE	FT.	FEET / FOOT
	EQUIPMENT DESIGNATOR	GA.	GAUGE
	BALL VALVE	GPM	GALLONS PER MINUTE
	GATE VALVE	H	HEIGHT
	CHECK VALVE	HP	HORSEPOWER
	BALANCING VALVE	I.D.	INSIDE DIAMETER
	THERMOMETER	IN.	INCHES
	DIRECTION OF FLOW	L	LENGTH
	PUMP	LBS.	POUNDS
	STRAINER	LDB	LEAVING DRY BULB
	PRESSURE GAUGE	LWB	LEAVING WET BULB
	PETE'S PLUG	LWT	LEAVING WATER TEMPERATURE
	DOUBLE CHECK ASSEMBLY	MAX.	MAXIMUM
	PRESSURE REDUCING VALVE	MBH	THOUSANDS OF BTUs PER HOUR
	UNION	MIN.	MINIMUM
	2-WAY CONTROL VALVE	NC	NOISE CRITERIA
	3-WAY CONTROL VALVE	N.C.	NORMALLY CLOSED
	CAP	N.I.M.	NOT IN MECHANICAL
	SMOKE DETECTOR	NO.	NUMBER
	MOTORIZED DAMPER	N.O.	NORMALLY OPEN
		O.A.	OUTSIDE AIR
		P	PERSON
		PSI	POUNDS PER SQUARE INCH
		P/T	PRESSURE / TEMPERATURE
		R.A.	RETURN AIR
		RECT.	RECTANGULAR
		REQ'D	REQUIRED
		S.A.	SUPPLY AIR
		S.P.	STATIC PRESSURE
		SQ.	SQUARE
		TEMP.	TEMPERATURE
		TYP.	TYPICAL
		VAV	VARIABLE AIR VOLUME
		W	WIDTH
		WB	WET BULB
		WPD	WATER PRESSURE DROP
		ø	DIAMETER
		(E)	EXISTING
		(D)	DEMOLISH
			NEW WORK
		HWS	(HWS) HEATING WATER SUPPLY
		HWR	(HWR) HEATING WATER RETURN
			FIRE DAMPER
			FIRE / SMOKE DAMPER
			SMOKE DAMPER
			SEISMIC BRACING
			LATERAL BRACING
			LONGITUDINAL BRACING
			LONGITUDINAL & LATERAL BRACING

GENERAL NOTES:

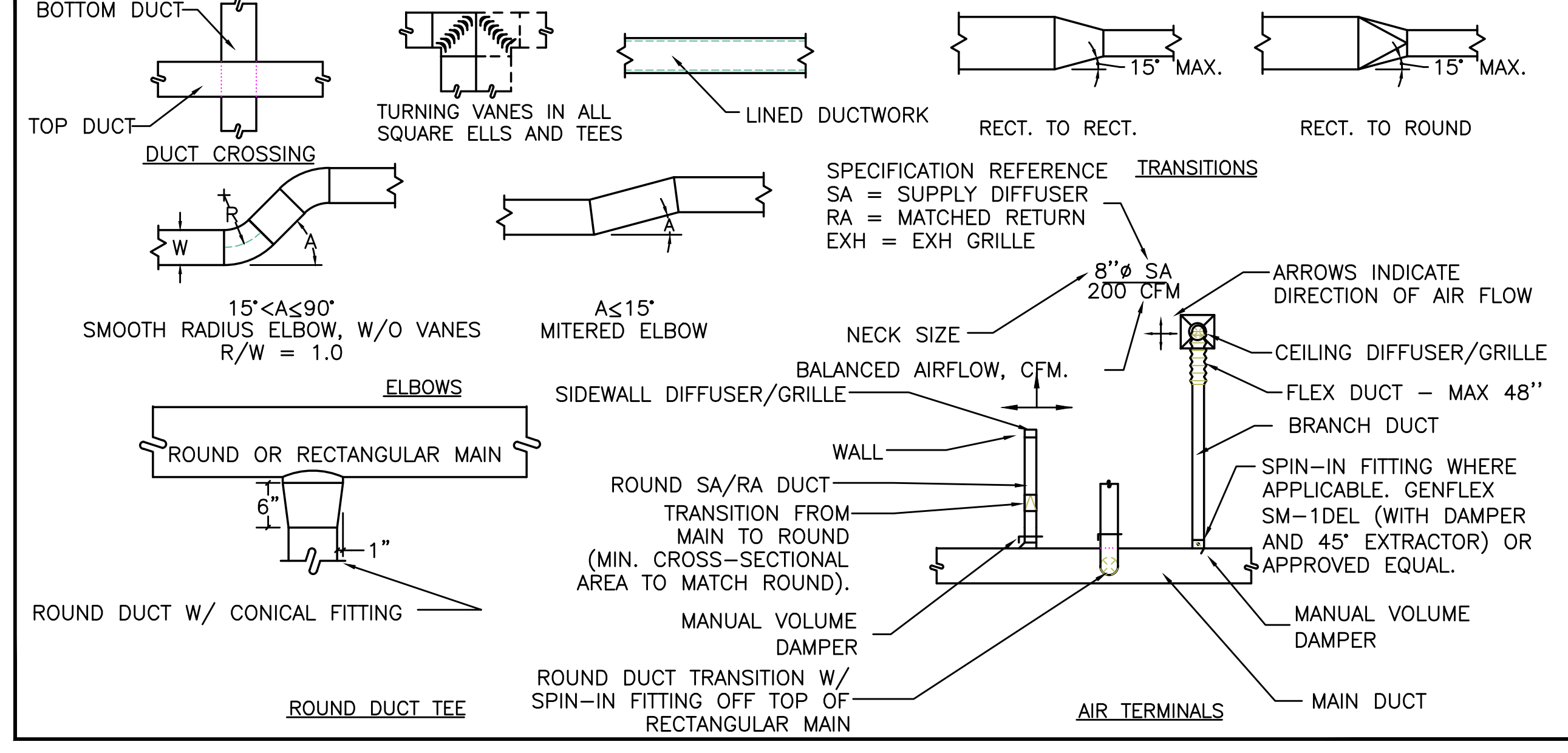
- FOR ADDITIONAL EQUIPMENT INFORMATION AND REQUIREMENTS, SEE SPECIFICATIONS & EQUIPMENT SUBMITTALS.
- MAINTAIN WALL ASSEMBLY FIRE RATING FOR INSTALLATION OF WALL HEATERS IN FIRE RATED WALLS. COORDINATE INSTALLATION WITH ARCHITECTURAL DRAWINGS.
- ALL ELECTRIC HEATERS PROVIDED AND INSTALLED BY ELECTRICAL CONTRACTOR, TYPICAL ALL UNITS.
- ALL DWELLING UNITS > 500SQ FT ARE VENTILATED BY ERV'S, ALL DWELLING UNITS < 500SQ FT ARE VENTILATED WITH NATURAL VENTILATION.
- ALL EQUIPMENT AND DUCTWORK IS LOCATED BELOW RATED ASSEMBLY.

DEFERRED SUBMITTALS - MECHANICAL

DEFERRED SUBMITTALS SHOWING THE ANCHOR DETAILS AND CALCULATIONS WILL BE PROVIDED TO THE CITY OF PORTLAND 30 DAYS PRIOR OT THE START OF WORK AND SHALL INCLUDE THE FOLLOWING EQUIPMENT

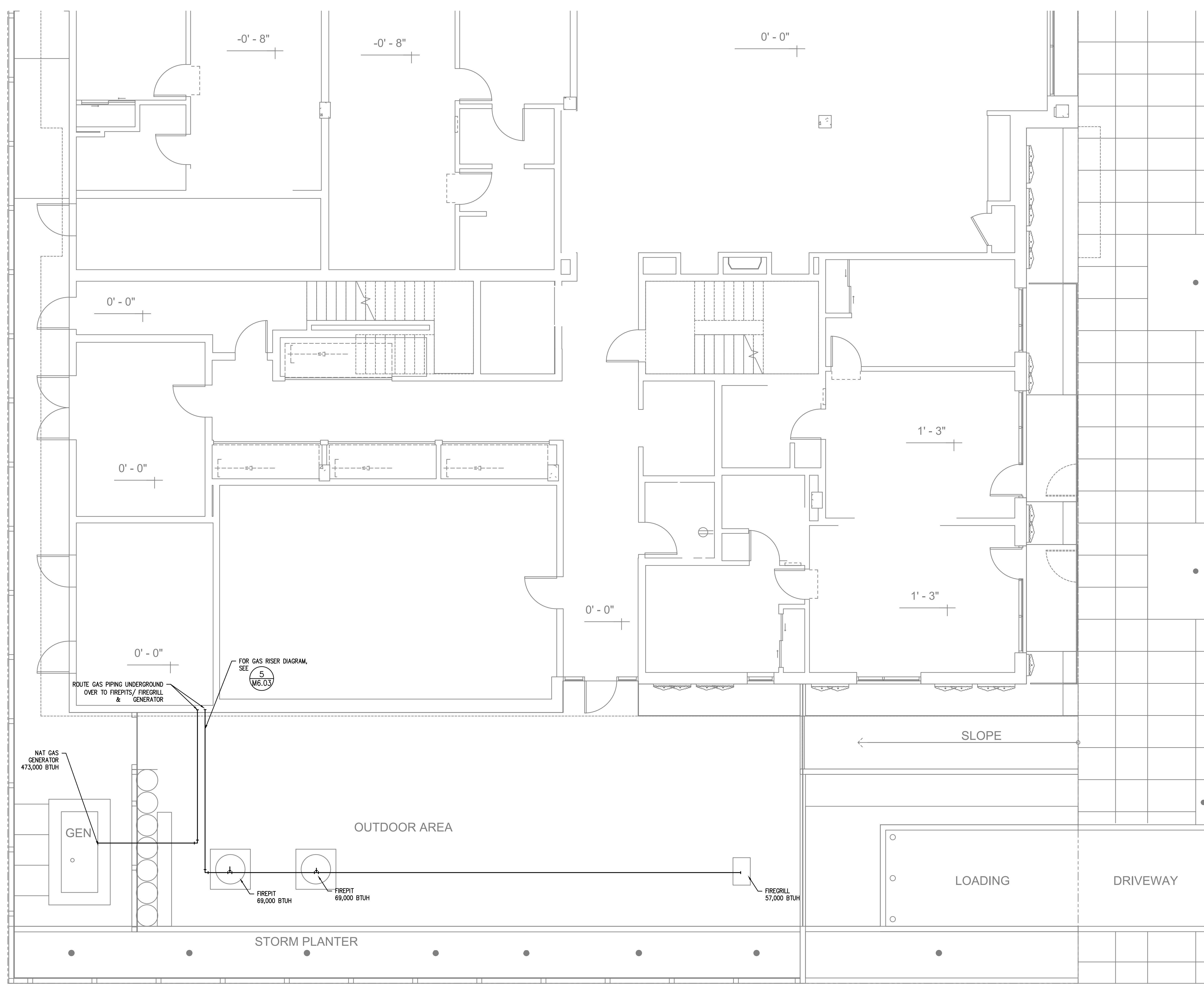
EQUIPMENT	DESCRIPTION	WEIGHT	SUBMITTED	INSPECTOR CHECK
RTU-1	ROOF TOP HVAC UNIT	1000 LBS		
HP-1,2,3&4	HEAT PUMP CONDENSER	160 LBS		
FC-2&3	HEAT PUMP FAN COIL	125 LBS		
WH-1,2, 3	WATER HEATER	1350 LBS		
BP-1	BOOSTER PUMP	425 LBS		

AIR DISTRIBUTION DETAILS



Duct Pressure Drop Calcs (worst case unit)

Size inches		cfm	Duct Length ft	# Elbows	Pressure Elbows inches/h20	Termination Fitting(s) inches of h20	Total EQ Length	Friction in/100'	Total Pressure Drop of EQ length "H20	Total with Fittings "H20
4	Bath Fan	80	57	3	0.029864486	0.09	57	0.4	0.228	0.40759346
6	ERV	40	15	0	0.013273105	0.15	15	0.06	0.009	0.159
7	Range	200	45	3	0.019901365	0.09	45	0.14	0.063	0.2127041



KEY NOTES:

- (A) PANASONIC WHISPERGREEN CEILING FAN WITH 4" DUCT TO ROOF OR EXTERIOR WALL TERMINATION VIA SOFFIT(S) PROVIDED. BACK DRAFT DAMPER INTEGRAL TO FAN, FAN TO OPERATE AT LOW SPEED CONTINUOUS (30 CFM) AND INCREASE TO 80 CFM WHEN BUILT-IN MOTION SENSOR IS ACTIVATED. INSULATED FINAL 5' OF DUCTWORK. NO DUCTWORK SHALL PENETRATE RATED ASSEMBLY. SEE 1 (M6.01) AND 1 (EF)
- (B) 6" HOOD DUCT TO ROOF/EXTERIOR WALL TERMINATION VIA SOFFIT(S) PROVIDED. BACK DRAFT DAMPER INTEGRAL TO HOOD. INSULATED FINAL 5' OF DUCTWORK. NO DUCTWORK SHALL PENETRATE RATED ASSEMBLY. HOOD FAN TO OPERATE INTERMITTENTLY.
- (C) FOR 4" UL FIRE PENETRATION DETAIL, SEE 5 (M6.03)
- (D) FOR 6" FIRE PENETRATION DETAIL, SEE 3 (M6.03)
- (E) 4" BATH EXHAUST AND 6" RANGE EXHAUST UP TO TO ROOF.
- (F) LINE SETS FROM SPLIT SYSTEM CONDENSERS ON ROOF TO FAN COILS ON ALL FLOORS.
- (G) 1.5KW WALL HEATER QMARK AWH4404F OR EQUAL. EQUIPMENT BY ELECTRICAL CONTRACTOR. SHOWN FOR REFERENCE ONLY.
- (H) 3/4" CONDENSATE DRAIN ROUTED TO WASHER BOX, SEE PLUMBING FOR DOUBLE WIDE CONDENSATE DRAIN WITH RECEIVER FUNNEL
- (I) FOR REFRIGERANT ROOF PENETRATION, SEE 3 (M6.01)
- (J) FOR ROOFTOP OUTLET HOOD SEE 5 (M6.01)
- (K) FOR CORRIDOR SHAFT SIZE, SEE BELOW CHARTS
- (L) SUPPLY AIR OR RETURN GRILLE, SIZED FOR BOTH FREE AREA AND FOR ACTUATOR ACCESS, SEE 1 (M6.02) FOR GRILLE INSTALLATION, AND SEE 2 (M6.02) FOR TYPICAL F/S INSTALLATION AND CONTROLS.
- (M) CONDENSING DRYERS - NO VENTING REQUIRED.
- (N) 1.5KW CADET WALL HEATERS FOR LIVING UNIT BEDROOMS, 120V. EQUIPMENT BY ELECTRICAL CONTRACTOR. SHOWN FOR REFERENCE ONLY. PROVIDE WALL MOUNTED T-STAT.
- (O) EXTERIOR EXHAUST PLENUM - SEE 4 (M6.02) MAINTAIN 36" CLEAR TO OPERABLE WINDOWS AND DOORS.
- (P) 3/4" - 2 SLOT LINEAR DIFFUSER, 50 CFM/FT, 4 LINEAR FEET.

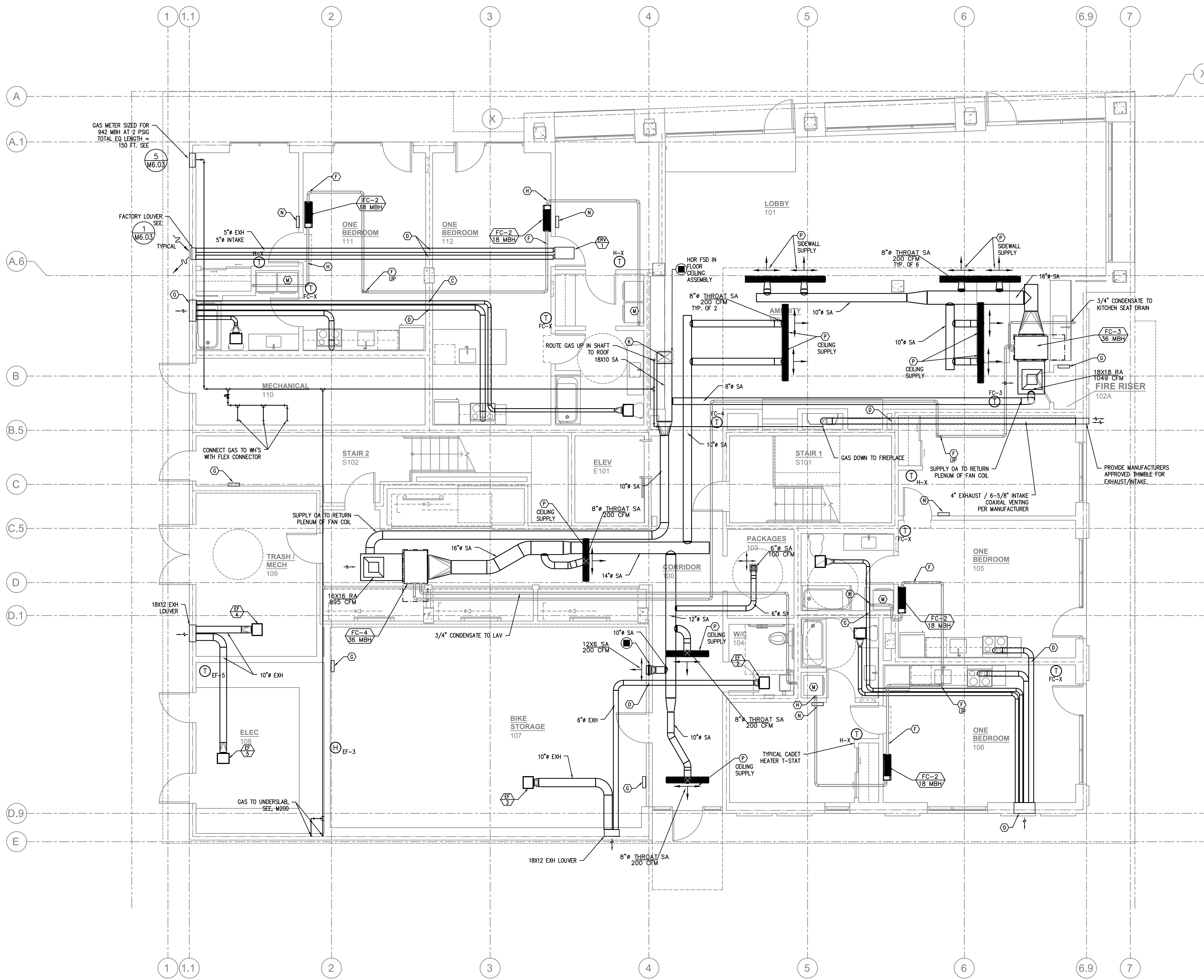
VENTILATION CALCULATIONS:

ALL DWELLING UNITS ARE VENTILATED BY NATURAL VENTILATION (SEE ARCH FOR CALCS) WITH OPERABLE WINDOWS (NO LIMITERS), BATHROOM EXHAUST FANS RUN CONTINUOUSLY (SIZED PER ASHRAE 62.2).

COMMON SPACES AND HALLWAYS ARE VENTILATED BY RTU'S SIZED TO EXCEED THE MINIMUM 0.06 CFM/SQ FT REQUIREMENT

SEE VENTILATION SCHEDULES FOR OTHER UNITS

1 MECHANICAL PLAN - UNDERSLAB
SCALE: 1/4" = 1'-0"



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- (F) LINE SETS FROM SPLIT SYSTEM CONDENSERS ON ROOF TO FAN COILS ON ALL FLOORS.
- (G) 1.5KW WALL HEATER QMARK AWH4404F OR EQUAL. EQUIPMENT BY ELECTRICAL CONTRACTOR. SHOWN FOR REFERENCE ONLY.
- (H) 3/4" CONDENSATE DRAIN ROUTED TO WASHER BOX, SEE PLUMBING FOR DOUBLE WIDE CONDENSATE DRAIN WITH RECEIVER FUNNEL
- (I) FOR REFRIGERANT ROOF PENETRATION, SEE (M6.01)
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- (L) SUPPLY AIR OR RETURN GRILLE, SIZED FOR BOTH FREE AREA AND FOR ACTUATOR ACCESS, SEE (M6.02) FOR GRILLE INSTALLATION, AND SEE (M6.02) FOR TYPICAL F/S INSTALLATION. (M6.02) AND CONTROLS.
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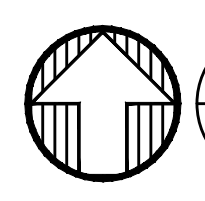
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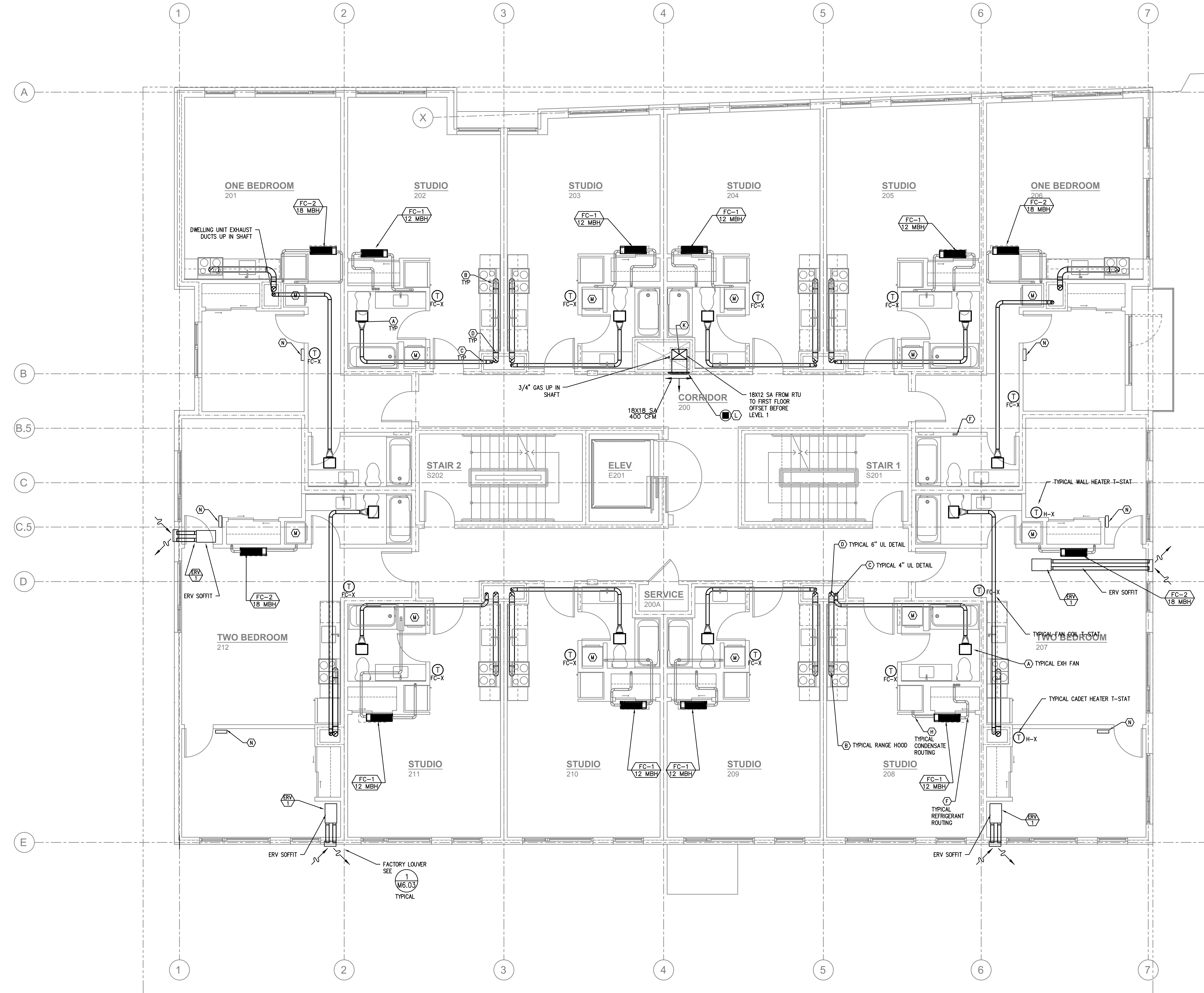
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SHAFT DUCT SIZES				
FLOOR	SUPPLY AIR	CFM	CFM	UNIT
ATTIC	18 X 18	2000	0	RTU-1
5TH	18 X 18	2000	0	RTU-1
4TH	18 X 18	1600	0	RTU-1
3RD	18 X 16	1200	0	RTU-1
2ND	18 X 16	800	0	RTU-1
1ST	18 X 10	400	0	RTU-1

 **1** MECHANICAL PLAN LEVEL 1
M2.01 SCALE: 1/4" = 1'-0"



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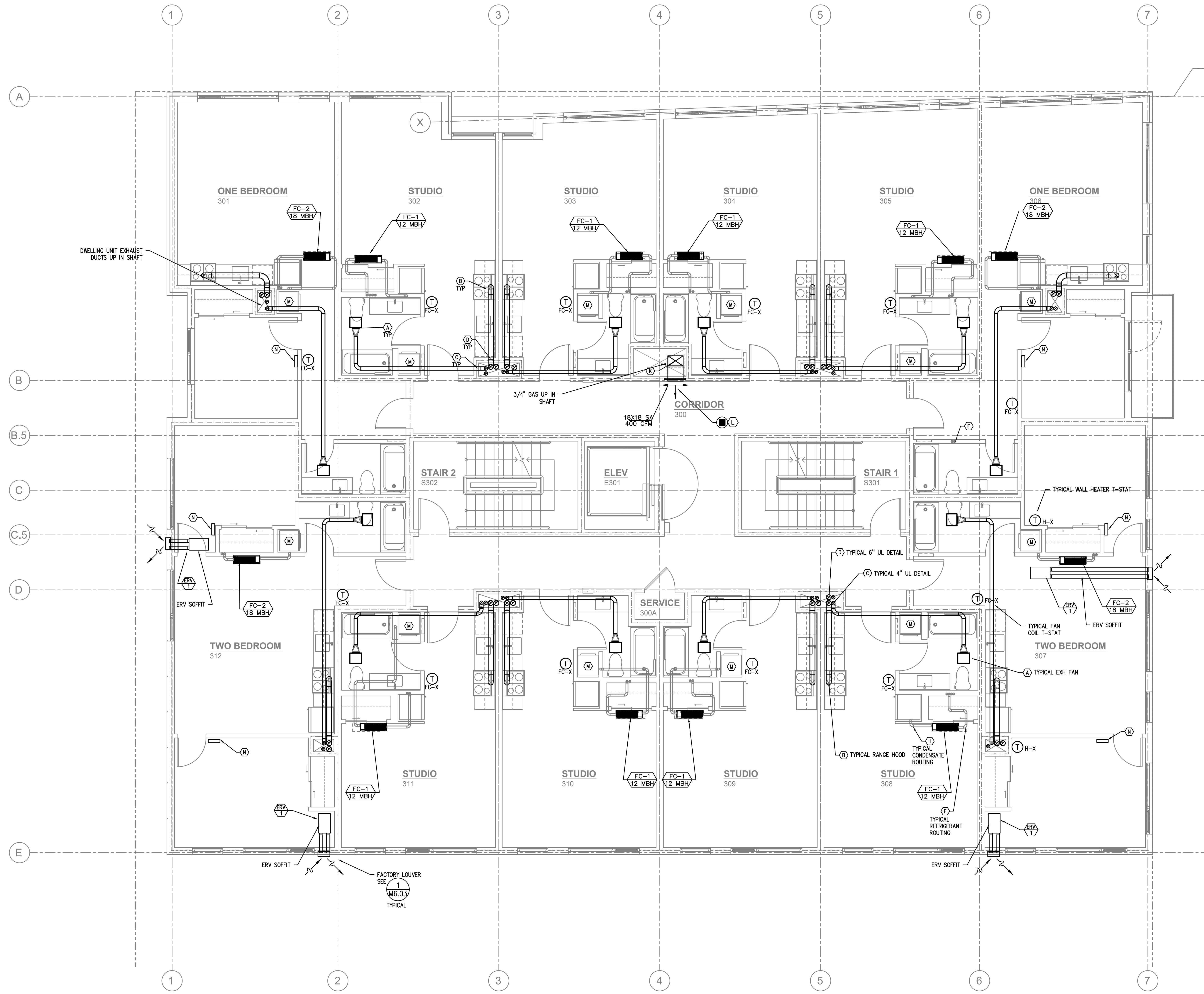
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3RD	18 X 16	1200	0	RTU-1
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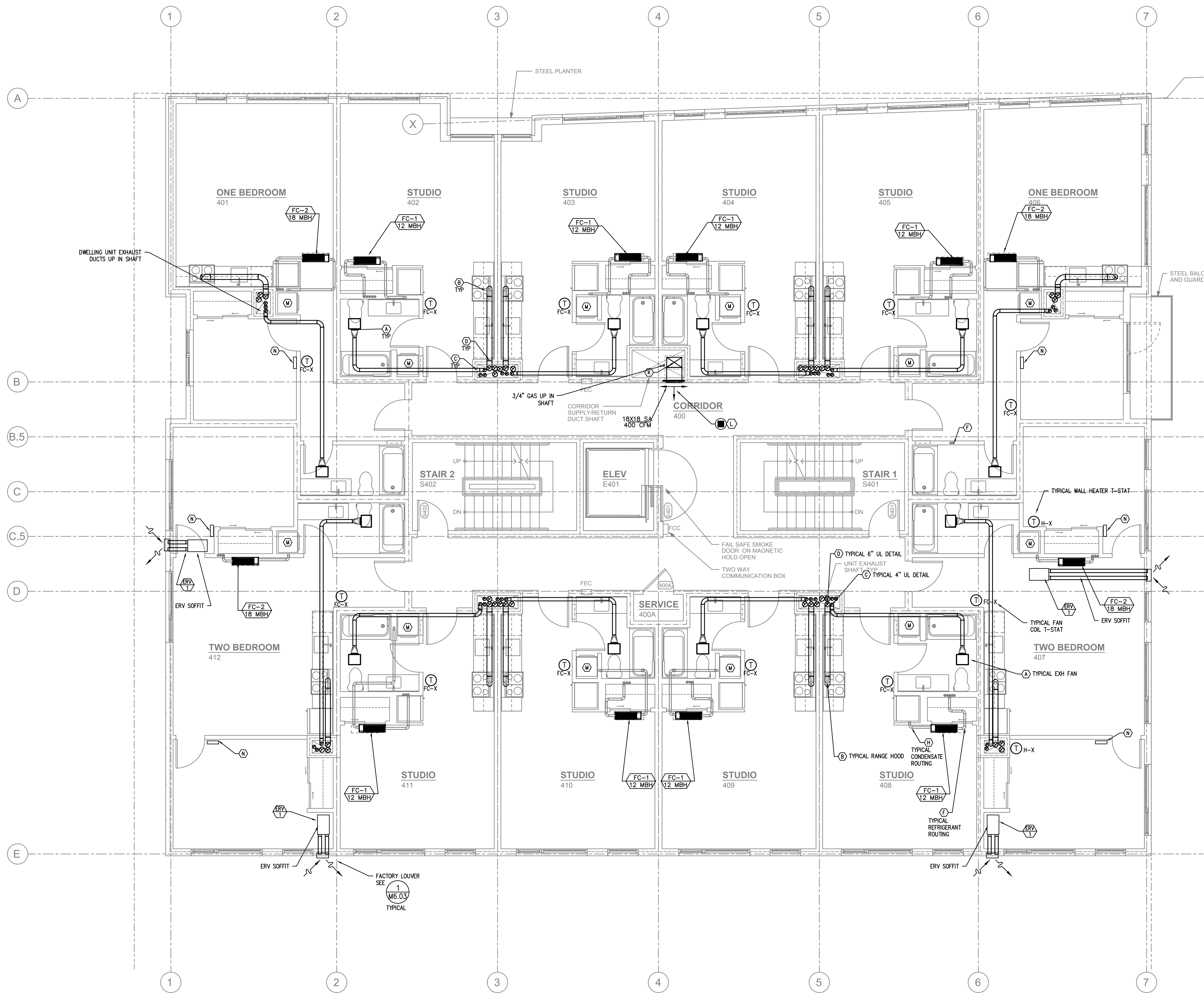
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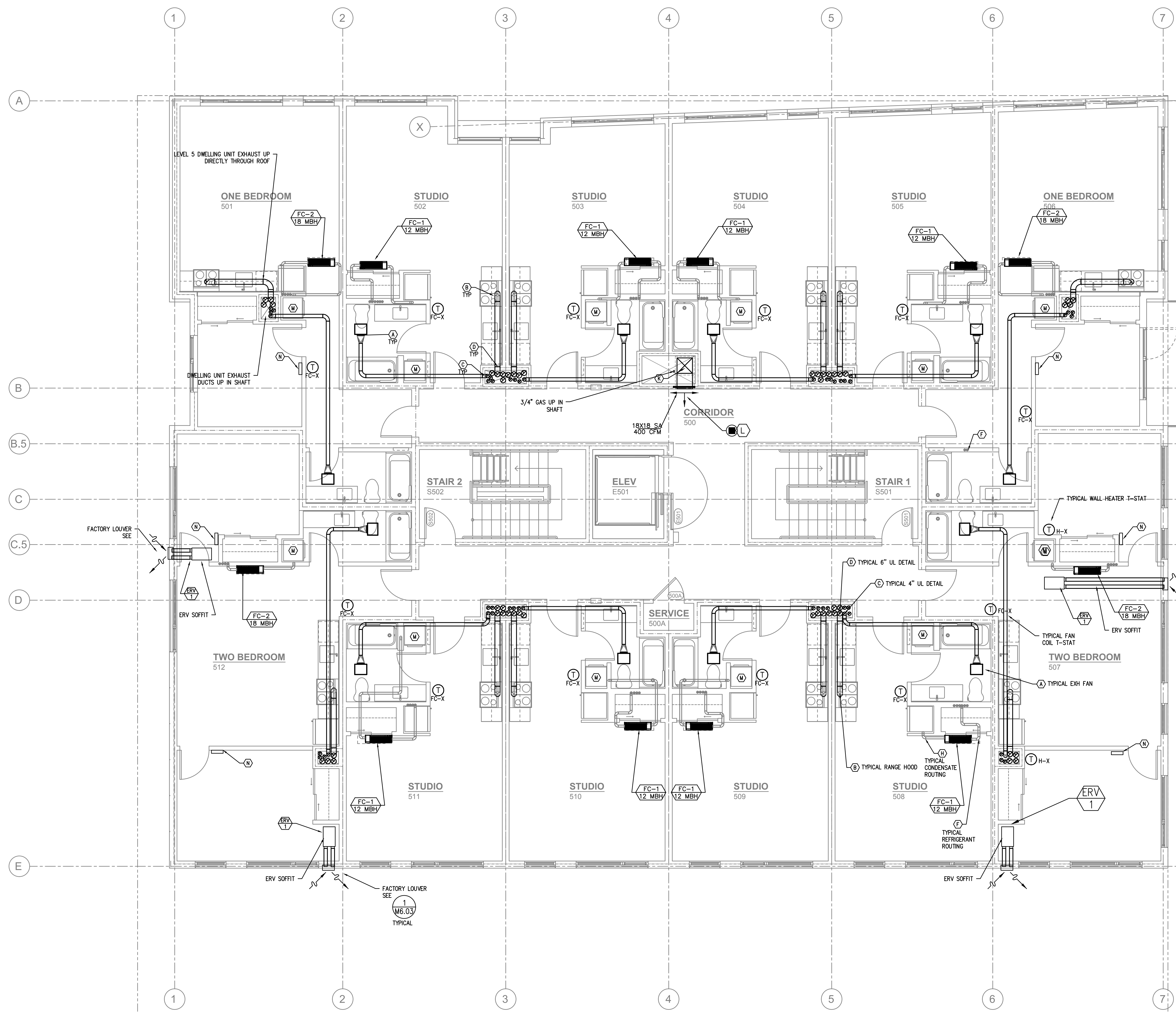
COMMON SPACES AND HALLWAYS ARE VENTILATED BY RTU'S SIZED TO EXCEED THE MINIMUM 0.06 CFM/SQ FT REQUIREMENT

SEE VENTILATION SCHEDULES FOR OTHER UNITS

SHAFT DUCT SIZES

FLOOR	SUPPLY AIR	CFM	CFM	UNIT
ATTIC	18 X 18	2000	0	RTU-1
5TH	18 X 18	2000	0	RTU-1
4TH	18 X 18	1600	0	RTU-1
3RD	18 X 16	1200	0	RTU-1
2ND	18 X 16	800	0	RTU-1
1ST	18 X 10	400	0	RTU-1

1 MECHANICAL PLAN LEVEL 4
M2.04 SCALE: 1/4" = 1'-0"



- KEY NOTES:**
- (A) PANASONIC WHISPERGREEN CEILING FAN WITH 4" DUCT TO ROOF OR EXTERIOR WALL TERMINATION VIA SOFFIT(S) PROVIDED. BACK DRAFT DAMPER INTEGRAL TO FAN, FAN TO OPERATE AT LOW SPEED CONTINUOUS (30 CFM) AND INCREASE TO 80 CFM WHEN BUILT-IN MOTION SENSOR IS ACTIVATED. INSULATED FINAL 5' OF DUCTWORK. NO DUCTWORK SHALL PENETRATE RATED ASSEMBLY. SEE 1 (M6.01) 1 (EF)
 - (B) 6" HOOD DUCT TO ROOF/EXTERIOR WALL TERMINATION VIA SOFFIT(S) PROVIDED. BACK DRAFT DAMPER INTEGRAL TO HOOD. INSULATED FINAL 5' OF DUCTWORK. NO DUCTWORK SHALL PENETRATE RATED ASSEMBLY. HOOD FAN TO OPERATE INTERMITTENTLY.
 - (C) FOR 4" UL FIRE PENETRATION DETAIL, SEE 5 (M6.03)
 - (D) FOR 6" FIRE PENETRATION DETAIL, SEE 3 (M6.03)
 - (E) 4" BATH EXHAUST AND 6" RANGE EXHAUST UP TO TO ROOF.
 - (F) LINE SETS FROM SPLIT SYSTEM CONDENSERS ON ROOF TO FAN COILS ON ALL FLOORS.
 - (G) 1.5KW WALL HEATER QMARK AWH4404F OR EQUAL. EQUIPMENT BY ELECTRICAL CONTRACTOR. SHOWN FOR REFERENCE ONLY.
 - (H) 3/4" CONDENSATE DRAIN ROUTED TO WASHER BOX, SEE PLUMBING FOR DOUBLE WIDE CONDENSATE DRAIN WITH RECEIVER FUNNEL
 - (I) FOR REFRIGERANT ROOF PENETRATION, SEE 3 (M6.01)
 - (J) FOR ROOFTOP OUTLET HOOD SEE 5 (M6.01)
 - (K) FOR CORRIDOR SHAFT SIZE, SEE BELOW CHARTS
 - (L) SUPPLY AIR OR RETURN GRILLE, SIZED FOR BOTH FREE AREA AND FOR ACTUATOR ACCESS, SEE 1 FOR GRILLE INSTALLATION, AND SEE 2 FOR TYPICAL F/S INSTALLATION. (M6.02) (M6.02)
 - (M) CONDENSING DRYERS -- NO VENTING REQUIRED.
 - (N) 1.5KW CADET WALL HEATERS FOR LIVING UNIT BEDROOMS, 120V. EQUIPMENT BY ELECTRICAL CONTRACTOR. SHOWN FOR REFERENCE ONLY. PROVIDE WALL MOUNTED T-STAT.
 - (O) EXTERIOR EXHAUST PLENUM -- SEE 4 (M6.02) MAINTAIN 36" CLEAR TO OPERABLE WINDOWS AND DOORS.
 - (P) 3/4" - 2 SLOT LINEAR DIFFUSER, 50 CFM/FT, 4 LINEAR FEET.

VENTILATION CALCULATIONS:

ALL DWELLING UNITS ARE VENTILATED BY NATURAL VENTILATION (SEE ARCH FOR CALCS) WITH OPERABLE WINDOWS (NO LIMITERS), BATHROOM EXHAUST FANS RUN CONTINUOUSLY (SIZED PER ASHRAE 62.2).

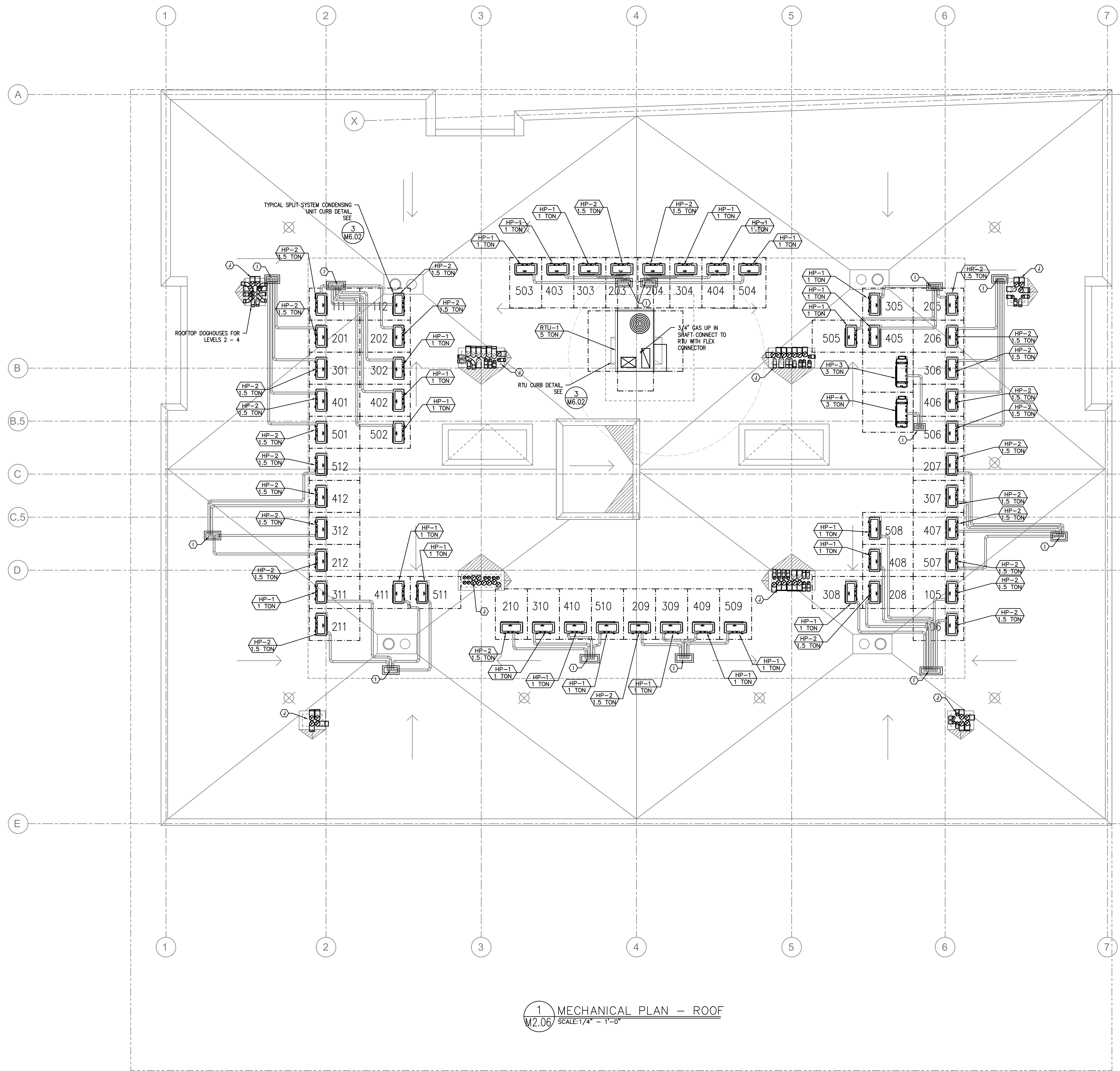
COMMON SPACES AND HALLWAYS ARE VENTILATED BY RTU'S SIZED TO EXCEED THE MINIMUM 0.06 CFM/SQ FT REQUIREMENT

SEE VENTILATION SCHEDULES FOR OTHER UNITS

SHAFT DUCT SIZES

FLOOR	SUPPLY AIR	CFM	CFM	UNIT
ATTIC	18 X 18	2000	0	RTU-1
5TH	18 X 18	2000	0	RTU-1
4TH	18 X 18	1600	0	RTU-1
3RD	18 X 16	1200	0	RTU-1
2ND	18 X 16	800	0	RTU-1
1ST	18 X 10	400	0	RTU-1

1 MECHANICAL PLAN LEVEL 5
M2.05 SCALE: 1/4" = 1'-0"



- KEY NOTES:**
- (A) PANASONIC WHISPERGREEN CEILING FAN WITH 4" DUCT TO ROOF OR EXTERIOR WALL TERMINATION VIA SOFFIT(S) PROVIDED. BACK DRAFT DAMPER INTEGRAL TO FAN, FAN TO OPERATE AT LOW SPEED CONTINUOUS (30 CFM) AND INCREASE TO 80 CFM WHEN BUILT-IN MOTION SENSOR IS ACTIVATED. INSULATED FINAL 5' OF DUCTWORK. NO DUCTWORK SHALL PENETRATE RATED ASSEMBLY. SEE (1) (EF) (1)
 - (B) 6" HOOD DUCT TO ROOF/EXTERIOR WALL TERMINATION VIA SOFFIT(S) PROVIDED. BACK DRAFT DAMPER INTEGRAL TO HOOD. INSULATED FINAL 5' OF DUCTWORK. NO DUCTWORK SHALL PENETRATE RATED ASSEMBLY. HOOD FAN TO OPERATE INTERMITTENTLY.
 - (C) FOR 4" UL FIRE PENETRATION DETAIL, SEE (5) (M6.03)
 - (D) FOR 6" FIRE PENETRATION DETAIL, SEE (3) (M6.03)
 - (E) 4" BATH EXHAUST AND 6" RANGE EXHAUST UP TO TO ROOF.
 - (F) LINE SETS FROM SPLIT SYSTEM CONDENSERS ON ROOF TO FAN COILS ON ALL FLOORS.
 - (G) 1.5KW WALL HEATER QMARK AWH4404F OR EQUAL. EQUIPMENT BY ELECTRICAL CONTRACTOR. SHOWN FOR REFERENCE ONLY.
 - (H) 3/4" CONDENSATE DRAIN ROUTED TO WASHER BOX, SEE PLUMBING FOR DOUBLE WIDE CONDENSATE DRAIN WITH RECEIVER FUNNEL
 - (I) FOR REFRIGERANT ROOF PENETRATION, SEE (3) (M6.01)
 - (J) FOR ROOFTOP OUTLET HOOD SEE (5) (M6.01)
 - (K) FOR CORRIDOR SHAFT SIZE, SEE BELOW CHARTS
 - (L) SUPPLY AIR OR RETURN GRILLE, SIZED FOR BOTH FREE AREA AND FOR ACTUATOR ACCESS, SEE (1) FOR GRILLE INSTALLATION, AND SEE (2) FOR TYPICAL F/S INSTALLATION, (M6.02) AND CONTROLS. (M6.02)
 - (M) CONDENSING DRYERS -- NO VENTING REQUIRED.
 - (N) 1.5KW CADET WALL HEATERS FOR LIVING UNIT BEDROOMS, 120V. EQUIPMENT BY ELECTRICAL CONTRACTOR. SHOWN FOR REFERENCE ONLY. PROVIDE WALL MOUNTED T-STAT.
 - (O) EXTERIOR EXHAUST PLENUM -- SEE (4) (M6.02) MAINTAIN 36" CLEAR TO OPERABLE WINDOWS AND DOORS.
 - (P) 3/4" - 2 SLOT LINEAR DIFFUSER, 50 CFM/FT, 4 LINEAR FEET.

VENTILATION CALCULATIONS:

ALL DWELLING UNITS ARE VENTILATED BY NATURAL VENTILATION (SEE ARCH FOR CALCS) WITH OPERABLE WINDOWS (NO LIMITERS), BATHROOM EXHAUST FANS RUN CONTINUOUSLY (SIZED PER ASHRAE 62.2).

COMMON SPACES AND HALLWAYS ARE VENTILATED BY RTU'S SIZED TO EXCEED THE MINIMUM 0.06 CFM/SQ FT REQUIREMENT

SEE VENTILATION SCHEDULES FOR OTHER UNITS

SHAFT DUCT SIZES

FLOOR	SUPPLY AIR	CFM	CFM	UNIT
ATTIC	18 X 18	2000	0	RTU-1
5TH	18 X 18	2000	0	RTU-1
4TH	18 X 18	1600	0	RTU-1
3RD	18 X 16	1200	0	RTU-1
2ND	18 X 16	800	0	RTU-1
1ST	18 X 10	400	0	RTU-1

1 MECHANICAL PLAN - ROOF
SCALE: 1/4" = 1'-0"

ROOFTOP HVAC UNITS

MARK NUMBER	RTU-1 5 TON
SYSTEM	CORRIDORS
TYPE	C.V.
DISCHARGE	VERTICAL
TOTAL CFM	2000
ECONOMIZER	YES***
MIN. OSA	2000
MAX OSA (FULL OCCUPANCY)	2000
CO2 CONTROL	NA
EXTERNAL SP. ("H2O)	.35
TOTAL SP. ("H2O)	---
RPM	2071
WHEEL TYPE/ SIZE	F.C. --- (DIRECT)
MOTOR HP.	0.95
POWER EXH FAN/ACCESSORY	NONE
MIN FILTER SIZE	2-16X25
FILTER TYPE	MERV 8
GAS INPUT/OUTPUT (MBH)	150 / 20
EFF. (AFUE)	80.0%
STAGES/TYP	2-S.S HIGH HEAT
TOTAL CLG. (TONS)	5.0
SENSIBLE CLG. (MBH)	62.75
ENT. EVAP AIR TEMP (DB/WB.)	90/67
LVG. EVAP AIR TEMP (DB/WB.)	55/54
AMBIENT AIR (°F)	95
EER/SEER	14 SEER
REFRIGERANT	410A
REFRIGERANT CHARGE	XX
DESIGN WEIGHT (LBS.)	1000
SMOKE DETECTOR (SUPPLY DUCT)	YES
SPRING ISOLATION ROOF CURB	YES
CONVENIENCE OUTLET - ALWAYS POWERED	NO
VOLTAGE/PHASE - ***	208/1
MCA/MOCP - ***	41/60 AMPS
BASIS OF DESIGN - CARRIER MODEL	48FCRA06A2A3

* - UNIT TO RUN CONTINUOUSLY
** - PROVIDE STAINLESS STEEL HEAT EXCHANGER.
***- ELECTRICAL DATA LISTED FOR REFERENCE ONLY, COORDINATE WITH ELECTRICAL DESIGN BUILD CONTRACTOR FOR VOLTAGE AND PHASE REQUIREMENTS

EXHAUST FANS

MARK NUMBER	EF 1	EF 2	EF 3	EF 4	EF 5
TYPE	CEILING CABINET	CEILING CABINET	CEILING CABINET	CEILING CABINET	CEILING CABINET
SYSTEM	BATHROOM	RESTROOM	BIKE STORAGE 107	TRASH/MECH 109	ELEC 108
CFM	30/80	100	300	200	200
TOTAL SP. (IN H2O)	0.20	0.125	0.125	0.125	0.125
RPM	1062/1146	1250	2500	740	740
TIP SPEED (FPM)	NA	---	---	---	---
MOTOR WATTS OR HP	5/11.7 W	100 W	135 W	127 W	127 W
CONTROLLED BY	**	LIGHTS	CONTINUOUS	CONTINUOUS	T-STAT
INTERLOCK WITH	MOTION SENSOR	NONE	NONE	NONE	NONE
FAN SPEED CONTROLLER	YES	NO	YES	YES	YES
WHEEL TYPE	BI	FC	BI	BI	BI
BACK DRAFT DAMPER	YES	GRAVITY	GRAVITY	GRAVITY	GRAVITY
ISOLATION	RUBBER	RUBBER	RUBBER	RUBBER	RUBBER
DESIGN WEIGHT (LBS)	25	25	25	23	23
MAX. SONES	0.3/0.6	1.5	4.5	1.7	1.7
MAX AMPS - ***	0.27	1.3	1.34	1.8	1.8
POWER (VOLTS/PHASE/HZ) - ***	120/1/60	120/60/1	120/60/1	120/60/1	120/60/1
BASIS OF DESIGN:	PANASONIC * FV-05-11VKSL2	BROAN L100	GREENHECK SP-A390	BROAN L200	BROAN L200

* - FAN TO RUN AT LOW SPEED CONTINUOUSLY, AND INCREASE TO HIGH SPEED UPON ACTIVATION OF THE MOTION SENSOR.
***- ELECTRICAL DATA LISTED FOR REFERENCE ONLY, COORDINATE WITH ELECTRICAL DESIGN BUILD CONTRACTOR FOR VOLTAGE AND PHASE REQUIREMENTS

INDOOR UNITS - *

MARK NUMBER	FC-1 12 MBH	FC-2 18 MBH	FC-3 36 MBH	FC-4 36 MBH
SYSTEM	STUDIO	1&2 BDRM UNITS/LVL 1&2	LOBBY 101/CORR. 100	AMENITY/CORR/BIKE/PACK
TYPE	WALL MOUNTED	WALL MOUNTED	DUCTED	DUCTED
EFFICIENCY	SEE OUTDOOR UNIT	SEE OUTDOOR UNIT	SEE OUTDOOR UNIT	SEE OUTDOOR UNIT
NOMINAL COOLING CAPACITY	12,000 BTUH	18,000 BTUH	36,000 BTUH	36,000 BTUH
HEATING CAPACITY	12,000 BTUH	18,000 BTUH	36,000 BTUH	36,000 BTUH
TOTAL SUPPLY CFM	397	680	1233	1233
OSA CFM	---	---	---	---
EXTERNAL SP. ("H2O)	0.20	0.40	0.64	0.64
VOLTS/PHASE	---	---	---	---
MCA/MOP	SEE OUTDOOR UNIT	SEE OUTDOOR UNIT	SEE OUTDOOR UNIT	SEE OUTDOOR UNIT
WEIGHT			106.48	106.48
BASIS OF DESIGN	CARRIER 40MAQB12B--3	CARRIER 40MAQB18B--3	CARRIER 40MBDQ36---3	CARRIER 40MBDQ36---3
OUTDOOR UNIT	HP-1 1.5 TON	HP-2 1.5 TON	HP-3 3 TON	HP-4 3 TON

* - PROVIDE ALL UNITS THAT CANNOT BE DRAINED BY GRAVITY WITH CONDENSATE PUMP, ROUTE ALL CONDENSATE LINES HIDDEN WITHIN STRUCTURE TO AN APPROVED LOCATION PROVIDED BY THE PLUMBER.

OUTDOOR UNITS - SPLIT SYSTEM HEAT PUMP

MARK NUMBER	HP-1 1 TON	HP-2 1.5 TON	HP-3 3 TON	HP-4 3 TON
SYSTEM	STUDIO	1&2 BDRM UNITS/LVL 1&2	LOBBY 101/CORR. 100	AMENITY/CORR/BIKE/PACK
TYPE	1-PORT HEAT PUMP	1-PORT HEAT PUMP	1-PORT HEAT PUMP	1-PORT HEAT PUMP
NORMAL COOLING CAPACITY	12,000 BTUH	16,500 BTUH	36,000 BTUH	36,000 BTUH
NORMAL HEATING CAPACITY	12,000 BTUH	19,000 BTUH	40,000 BTUH	40,000 BTUH
EFFICIENCY SEER/EER	22.5/13	20.0/12.5	16.7/9.0	16.7/9.0
EFFICIENCY HSPF/COP	12.0/3.56	10.3/3.14	11.5/3.37	11.5/3.37
REFRIGERANT	410 A	410 A	410 A	410 A
REFRIGERANT CHARGE	3.31 LBS	4.30 LBS	7.05 LBS	7.05 LBS
MAX OPERATING TEMPS	-13/122	-13/122	-13/122	-13/122
MAX PIPING LENGTH	82 FT	98 FT	213 FT	213 FT
MAX PIPING HEIGHT	32 FT	65 FT	98 FT	98 FT
VOLTS-PHASE - **	208/230-1 PHASE	208/230-1 PHASE	208/230-1 PHASE	208/230-1 PHASE
MCA/MOP - **	9.0/15.0	15.0/20.0	30.0/45.0	30.0/45.0
COMPRESSOR	VARIABLE SPEED	VARIABLE SPEED	VARIABLE SPEED	VARIABLE SPEED
WEIGHT	100	105	155.42	155.42
BASIS OF DESIGN	CARRIER 38MAQB12R--3	CARRIER 38MAQB18R--3	CARRIER 38MBRBQ36AA3	CARRIER 38MBRBQ36AA3

** - ELECTRICAL DATA LISTED FOR REFERENCE ONLY, COORDINATE WITH ELECTRICAL DESIGN BUILD CONTRACTOR FOR VOLTAGE AND PHASE REQUIREMENTS.

VENTILATION AIR SCHEDULE - FC-1

ROOM NUMBER AND NAME	AREA (SQ. FT.)	OCCUPANT LOAD (#/1000 SQ. FT.)	NUMBER OF OCCUPANTS	OUTSIDE AIR REQUIREMENT (CFM/P)	OUTSIDE AIR REQUIREMENT (CFM/SQ FT.)	OUTSIDE AIR REQUIRED (CFM)	ZONE OSA (CFM)	SUPPLY AIR (CFM)	PRIMARY OSA FRACTION	RETURN AIR (CFM)	EXHAUST AIR (CFM)	Zone Ventilation Efficiency	Corrected OSA CFM	AIR SYSTEMS
	Az		Pz	Rp	Ra	Vbz	Ez	Voz	Vpz	Zp		Evz		
LOBBY 101	731	0	0	0	0.06	44	0.8	55	400	0.14	0	0.99	55.56	FC-1
AMENITY 102	250	30	8	7.5	0.06	75	0.8	94	800	0.12	1049	1.01	95.01	FC-1
TOTAL	981		8			119		149	1200		1049	0.99	151	
						Voz		Vps				Ev		
CORRECTED TOTAL OUTDOOR AIR FLOW RATE										151	CFM	Corrected OSA Fraction	Zs =	0.13

VENTILATION AIR SCHEDULE - FC-2

ROOM NUMBER AND NAME	AREA (SQ. FT.)	OCCUPANT LOAD (#/1000 SQ. FT.)	NUMBER OF OCCUPANTS	OUTSIDE AIR REQUIREMENT (CFM/P)	OUTSIDE AIR REQUIREMENT (CFM/SQ FT.)	OUTSIDE AIR REQUIRED (CFM)	ZONE OSA (CFM)	SUPPLY AIR (CFM)	PRIMARY OSA FRACTION	RETURN AIR (CFM)	EXHAUST AIR (CFM)	Zone Ventilation Efficiency	Corrected OSA CFM	AIR SYSTEMS
	Az		Pz	Rp	Ra	Vbz	Ez	Voz	Vpz	Zp		Evz		
CORRIDOR 100	490	0	0	0	0.06	29	0.8	37	300	0.12	0	1.11	47.96	FC-2
BIKE STORAGE 107	623	0	0	0	0.12	75	0.8	93	200	0.47	0	0.77	121.95	FC-2
PACKAGES 103	60	0	0	0	0.12	7	0.8	9	100	0.09	0	1.14	11.74	FC-2
AMENITY 102	258	30	8	7.5	0.06	75	0.8	94	400	0.24	695	1.00	123.12	FC-2
TOTAL	1431		8			187		234	1000		695	0.77	305	
						Voz		Vps				Ev		
CORRECTED TOTAL OUTDOOR AIR FLOW RATE										305	CFM	Corrected OSA Fraction	Zs =	0.30

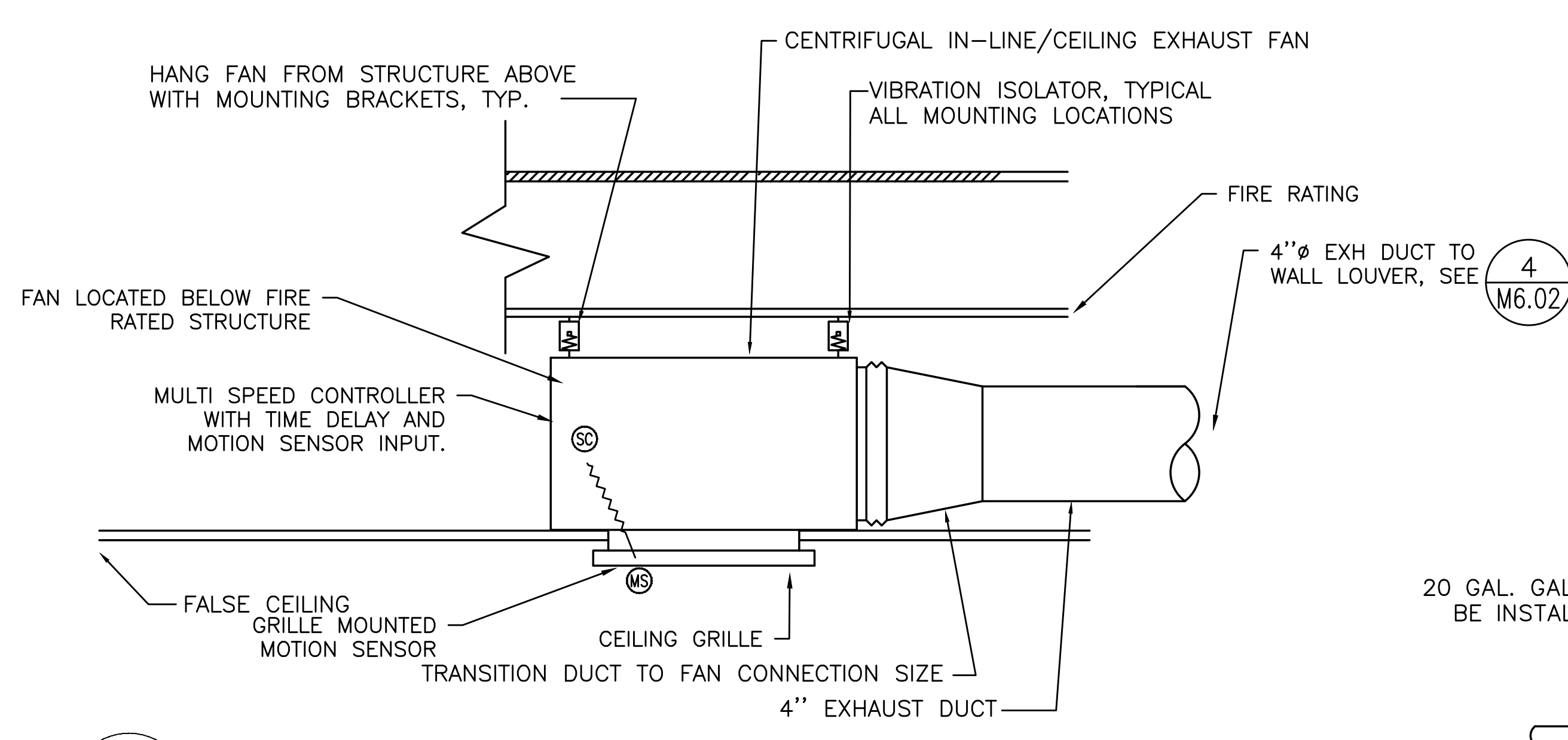
VENTILATION AIR SCHEDULE - LEVELS 2-6

ROOM NUMBER AND NAME	AREA (SQ. FT.)	OCCUPANT LOAD (#/1000 SQ. FT.)	NUMBER OF OCCUPANTS	OUTSIDE AIR REQUIREMENT (CFM/P)	OUTSIDE AIR REQUIREMENT (CFM/SQ FT.)	OUTSIDE AIR REQUIRED (CFM)	ZONE OSA (CFM)	SUPPLY AIR (CFM)	PRIMARY OSA FRACTION	RETURN AIR (CFM)	EXHAUST AIR (CFM)	Zone Ventilation Efficiency	Corrected OSA CFM	AIR SYSTEMS
	Az		Pz	Rp	Ra	Vbz	Ez	Voz	Vpz	Zp		Evz		
CORRIDOR LEVELS 2 TO 6	597	0	0	0	0.06	36	0.8	45	400	0.11	0	1.00	44.78	RTU-1
TOTAL	597		0			36		45	400		0	1.00	45	
						Voz		Vps				Ev		
CORRECTED TOTAL OUTDOOR AIR FLOW RATE										45	CFM	Corrected OSA Fraction	Zs =	0.11

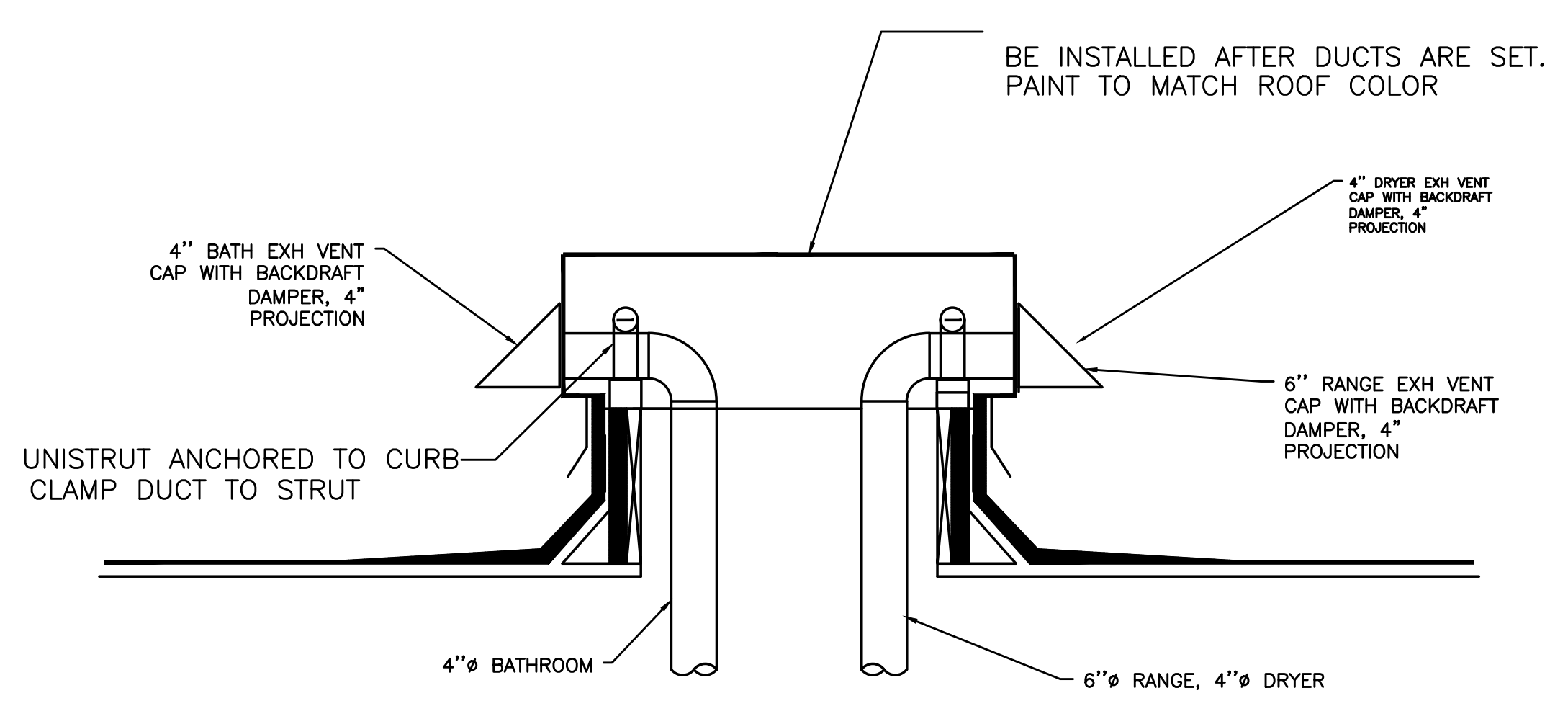
ENERGY RECOVERY VENTILATOR

MARK NUMBER	ERV 1 2 W6.03
SYSTEM	UNITS >500 SQ FT
CFM	40 EXH/30 SA CFM
SOUND -NOISE LEVEL	0.8 SONES
CORE TYPE	ENTHALPY PLATE
CONTROL	CONTINUOUS
HEAT	---
VOLTS-PHASE	120/1
AMP RATING	.15
ESP ("H2O)	0.1
TOTAL COOL EFF/SENSIBLE HEAT EFF	36% / 66%
POWER (WATTS)***	23
DUCT CONNECTION	4"Ø
CONCENTRIC VENT KIT	YES
WEIGHT	30 LBS
BASIS OF DESIGN	PANASONIC FV-04VE1

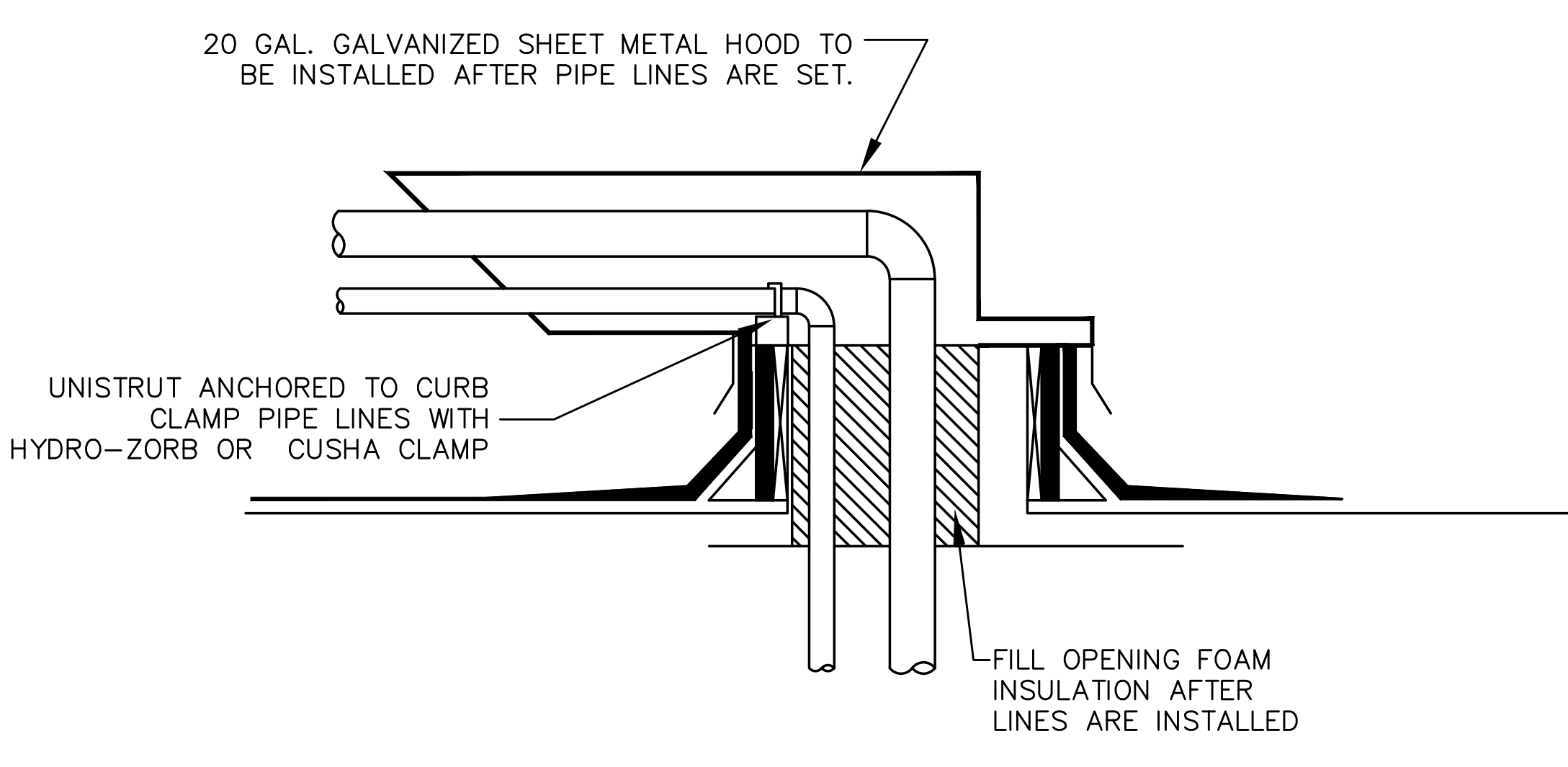
***- ELECTRICAL DATA LISTED FOR REFERENCE ONLY, COORDINATE WITH ELECTRICAL DESIGN BUILD CONTRACTOR FOR VOLTAGE AND PHASE REQUIREMENTS



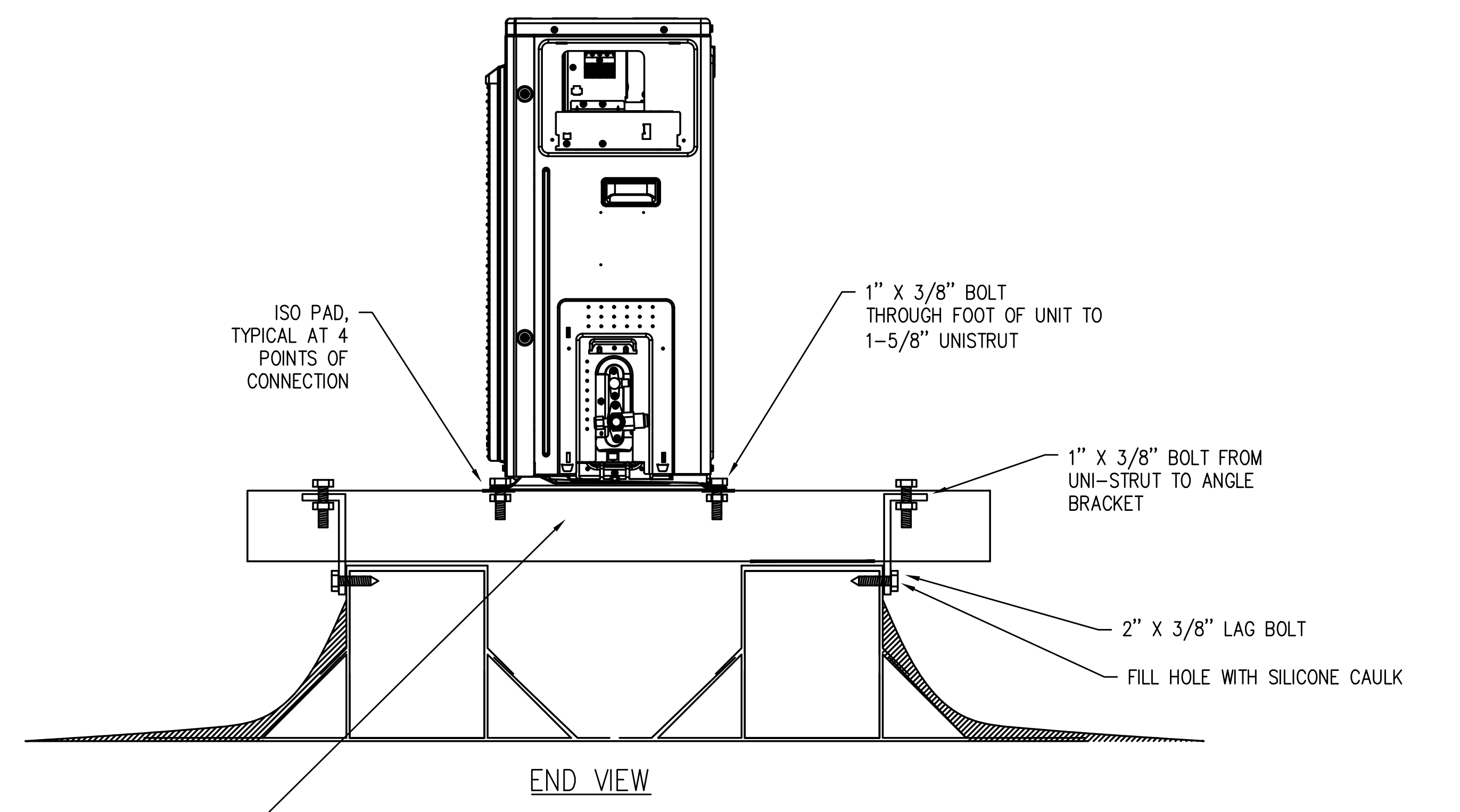
1 RESTROOM EXHAUST FAN
M6.01 SCALE:DETAIL



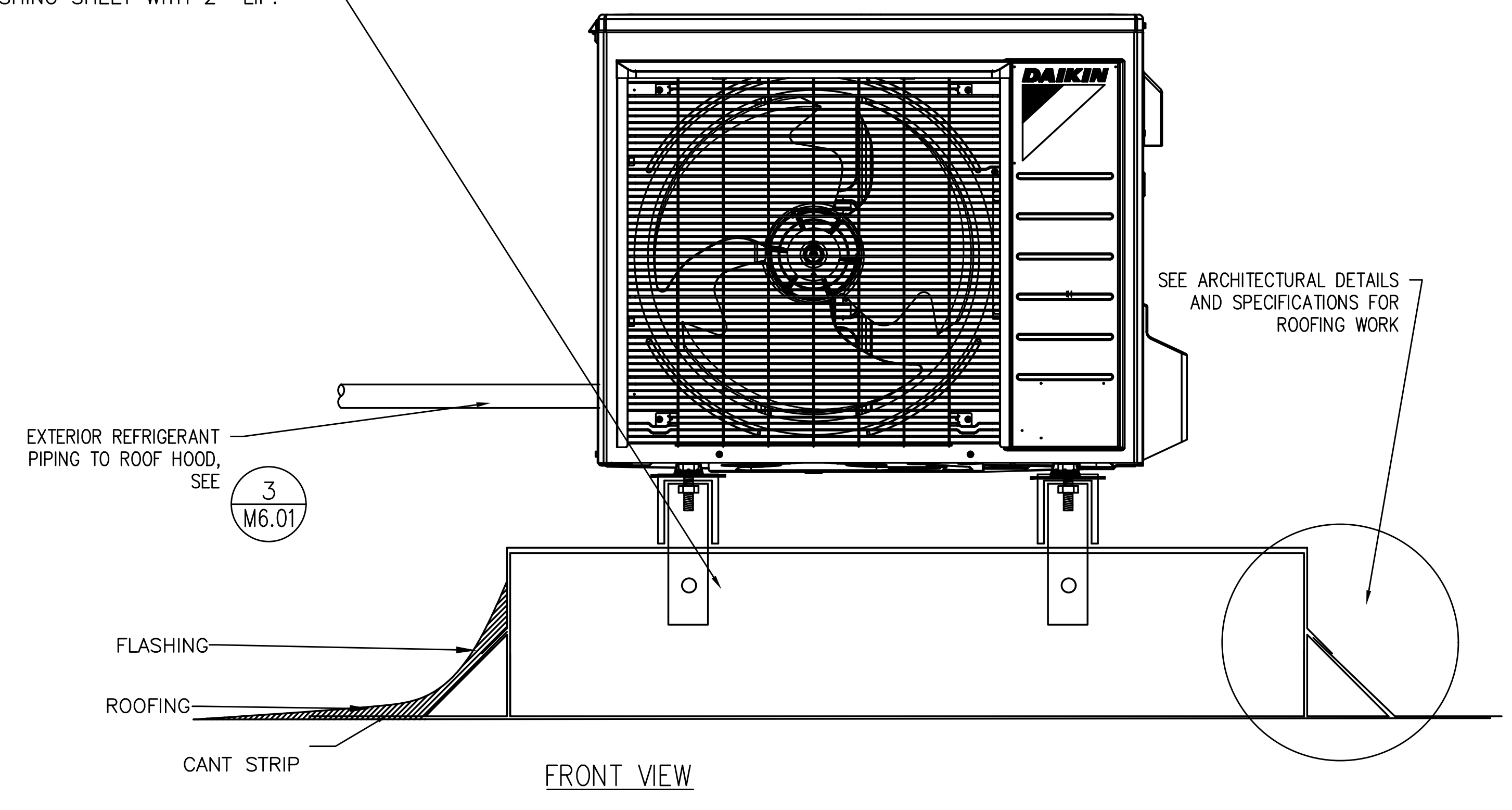
2 ROOFTOP OUTLET HOOD
M6.01 NOT TO SCALE



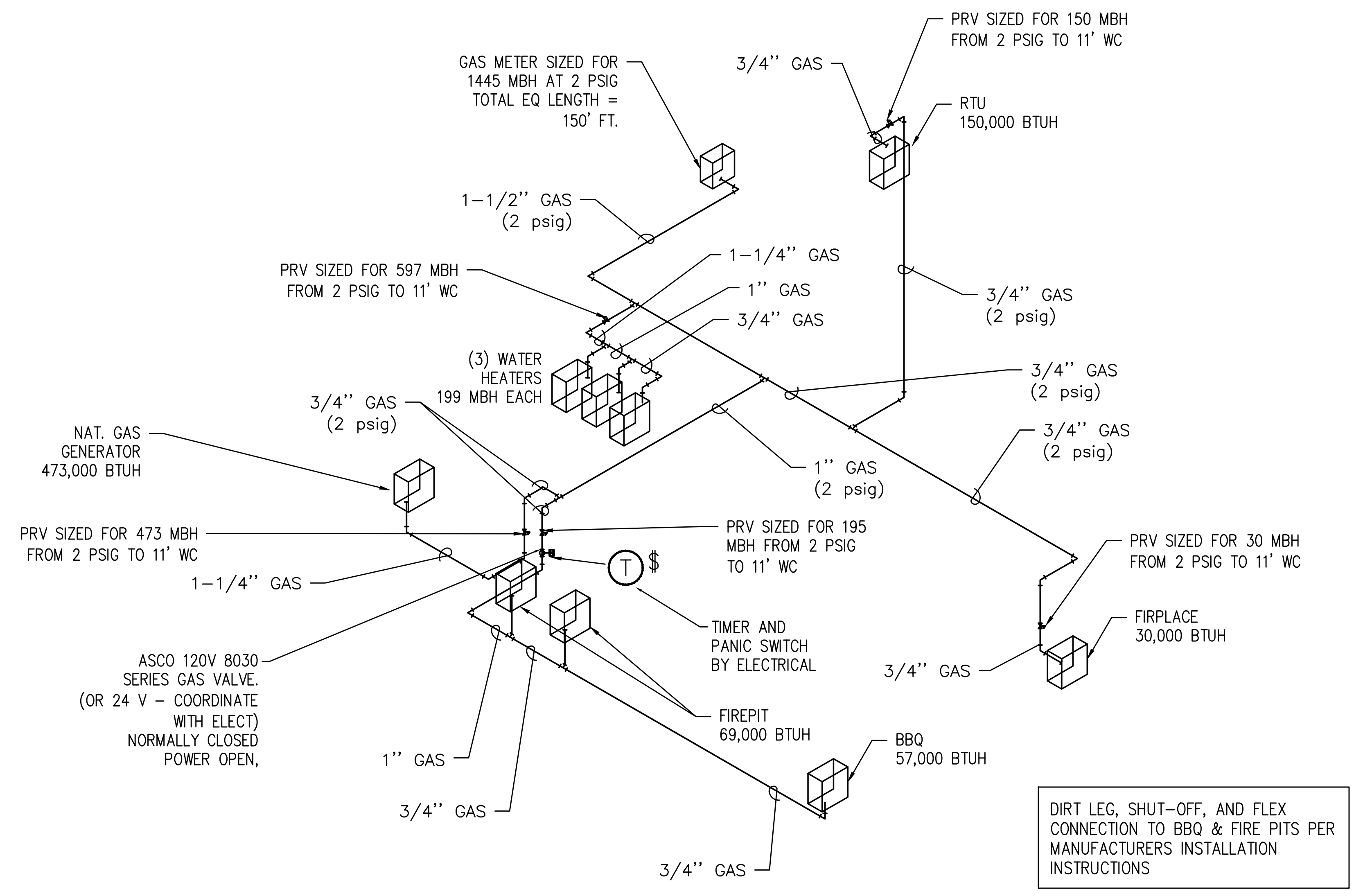
3 REFRIGERANT ROOF PENETRATIONS
M6.01 DETAIL



SLEEPER BASE CONSTRUCTED OF P.T. 4X4 AND COVERED WITH 26 GA. GALVANIZED FLASHING SHEET WITH 2\"/>

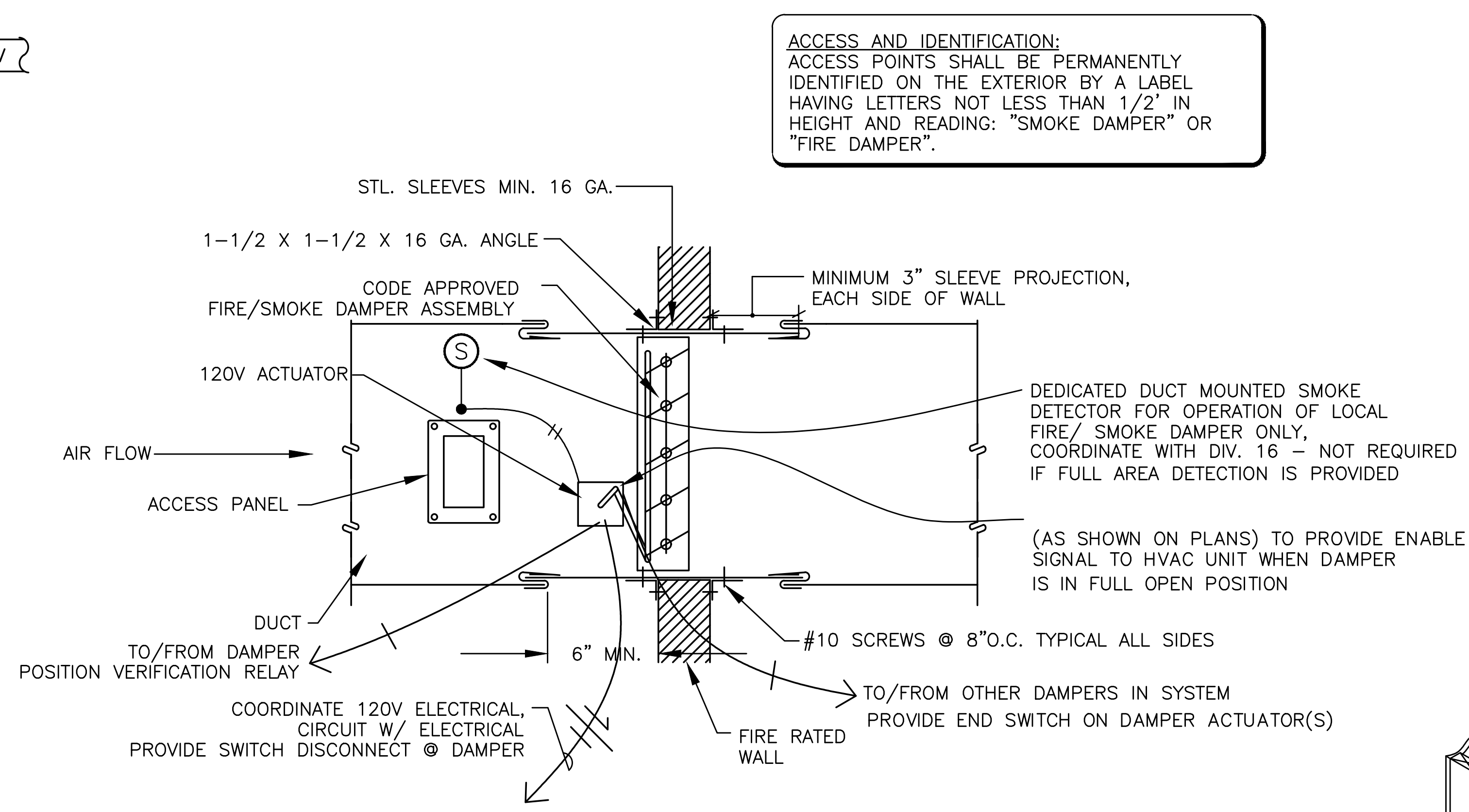
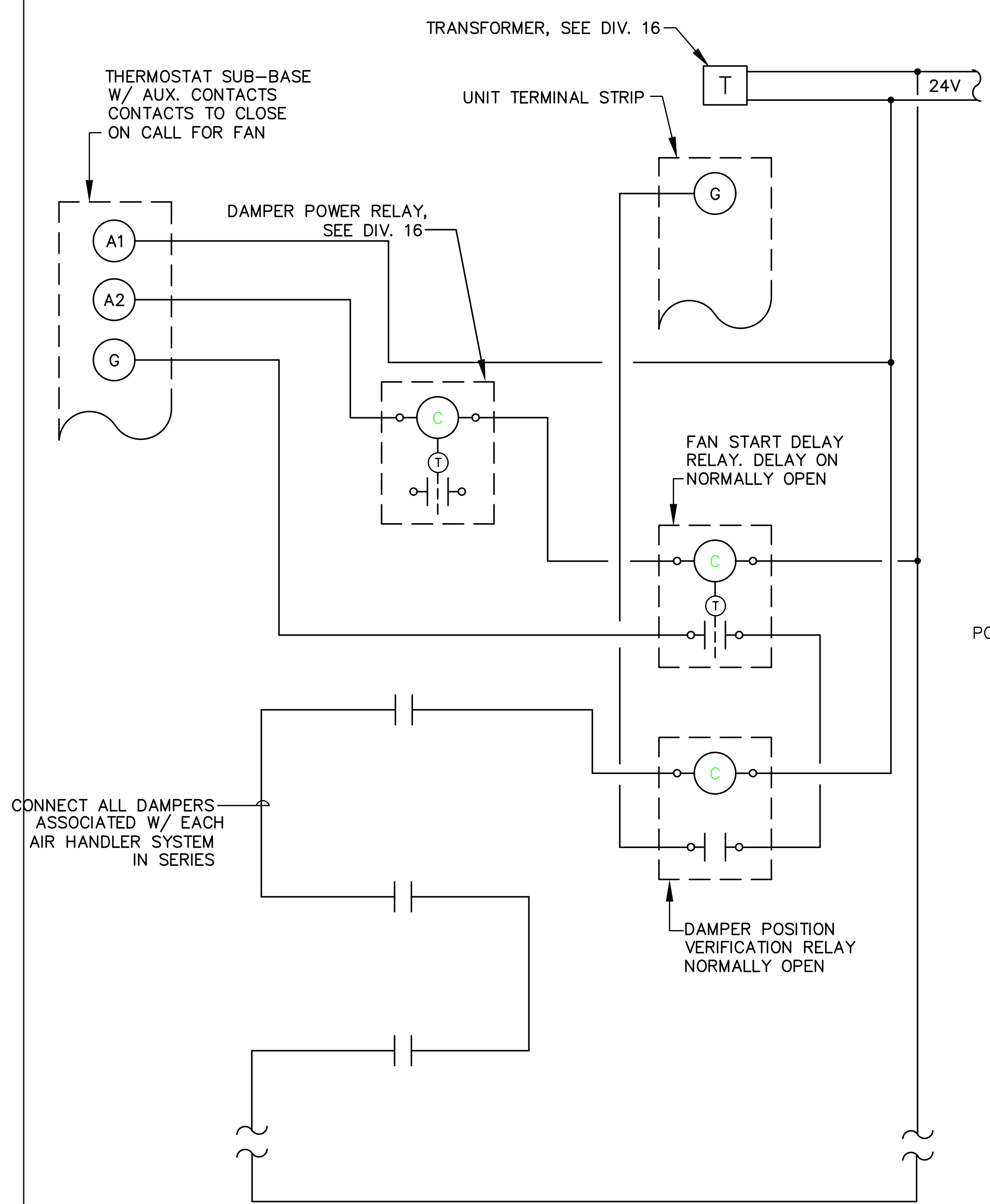


4 HEAT PUMP CURB
M6.01 DETAIL



5 GAS RISER DIAGRAM
M6.01 NOT TO SCALE

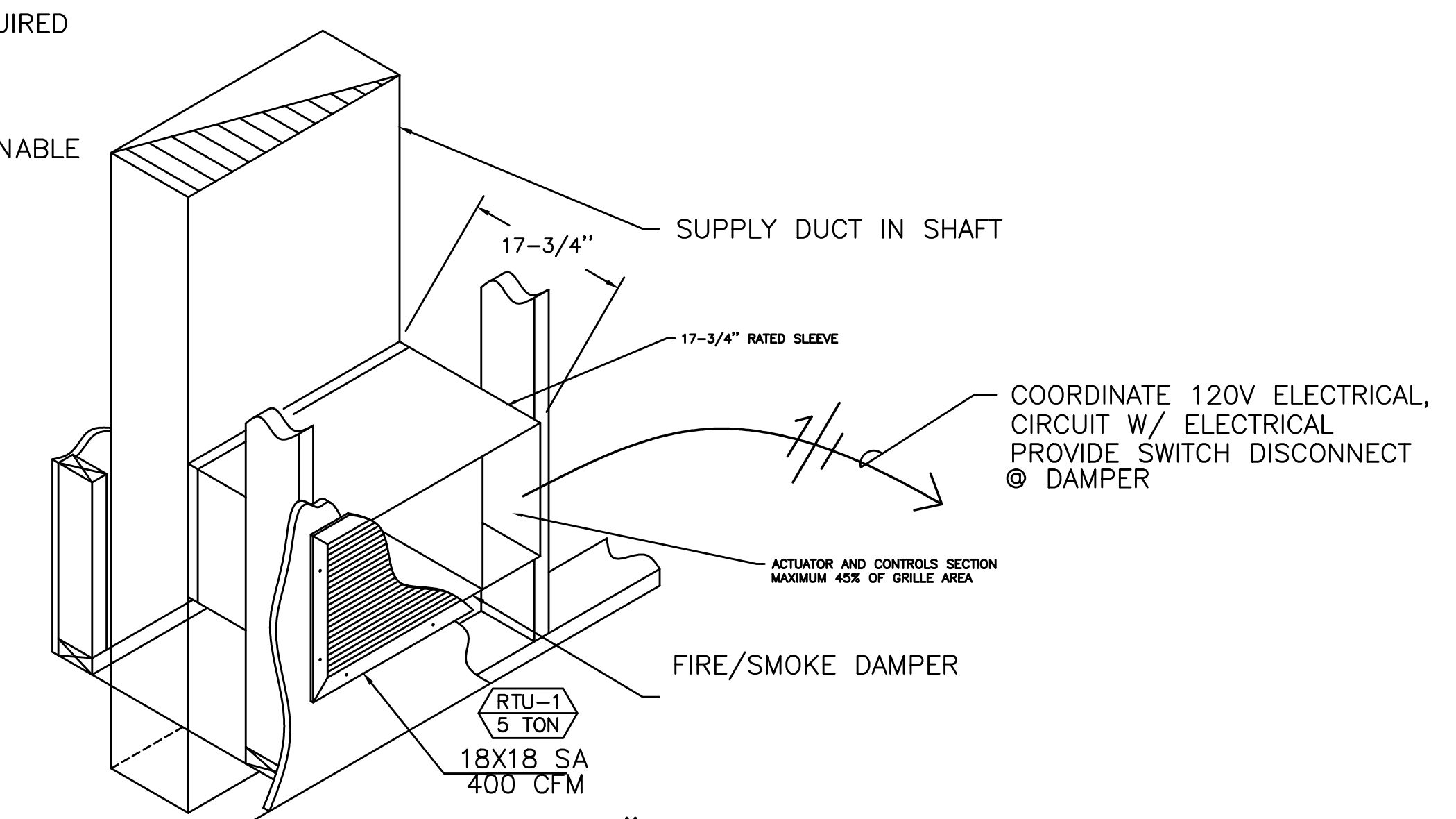
DIRT LEG, SHUT-OFF, AND FLEX CONNECTION TO BBQ & FIRE PITS PER MANUFACTURERS INSTALLATION INSTRUCTIONS



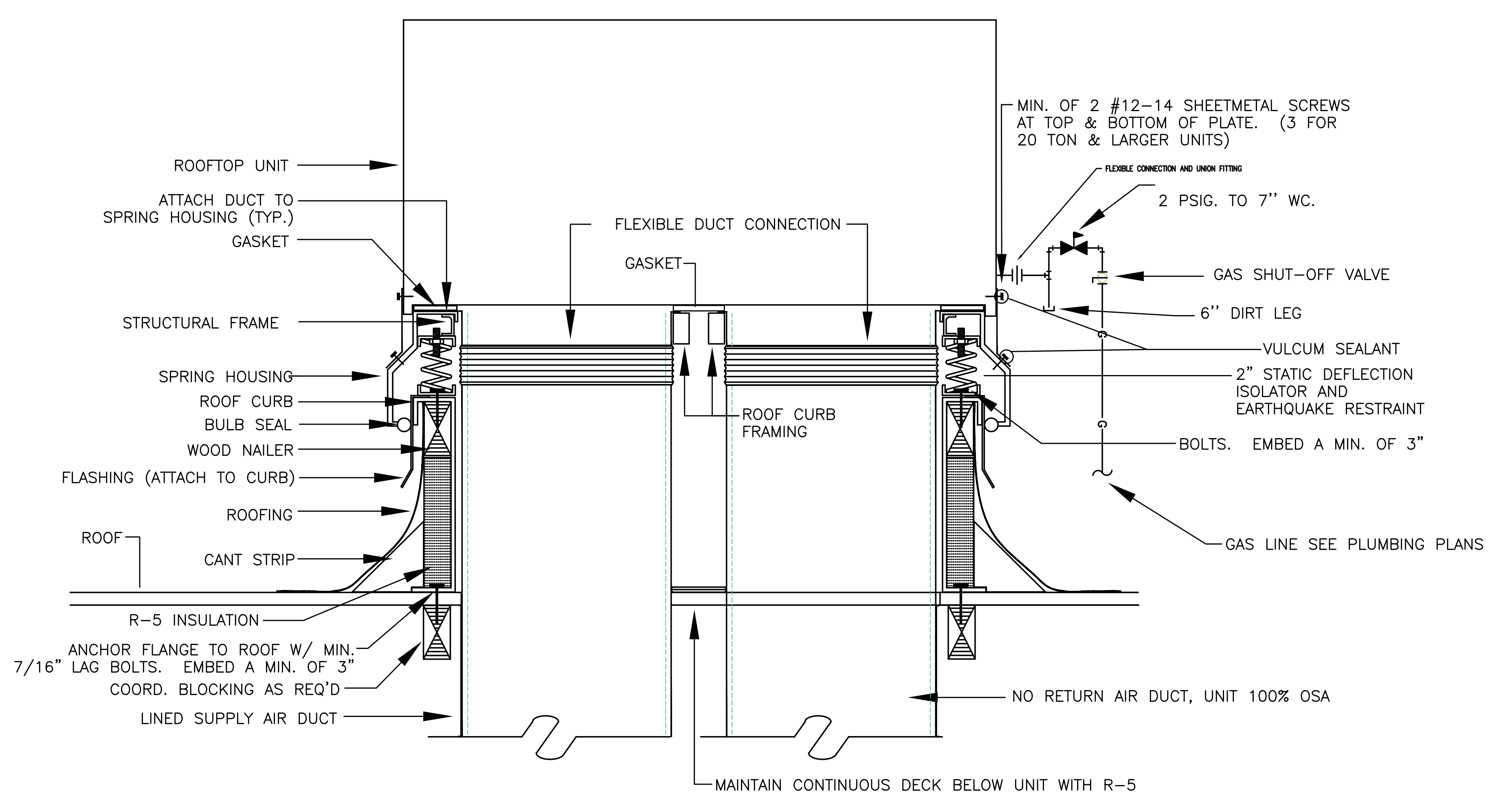
2 FIRE/SMOKE DAMPER W/SMOKE DETECTOR
M6.02 NOT TO SCALE

NOTE:
 PROVIDE ALL REQUIRED CONTROL WIRING TO ACCOMPLISH:
FIRE/SMOKE DAMPER - FIRE/SMOKE DAMPER TO CLOSE UPON ACTIVATION OF LOCAL SMOKE DETECTOR
EXHAUST DUCTS/FANS - FIRE/SMOKE DAMPER TO CLOSE UPON SHUTDOWN OF ASSOCIATED EXHAUST FAN.
SUPPLY OR RETURN DUCTS/FANS - FIRE/SMOKE DAMPER TO CLOSE UPON SHUTDOWN OF ASSOCIATED AIR HANDLING UNIT.

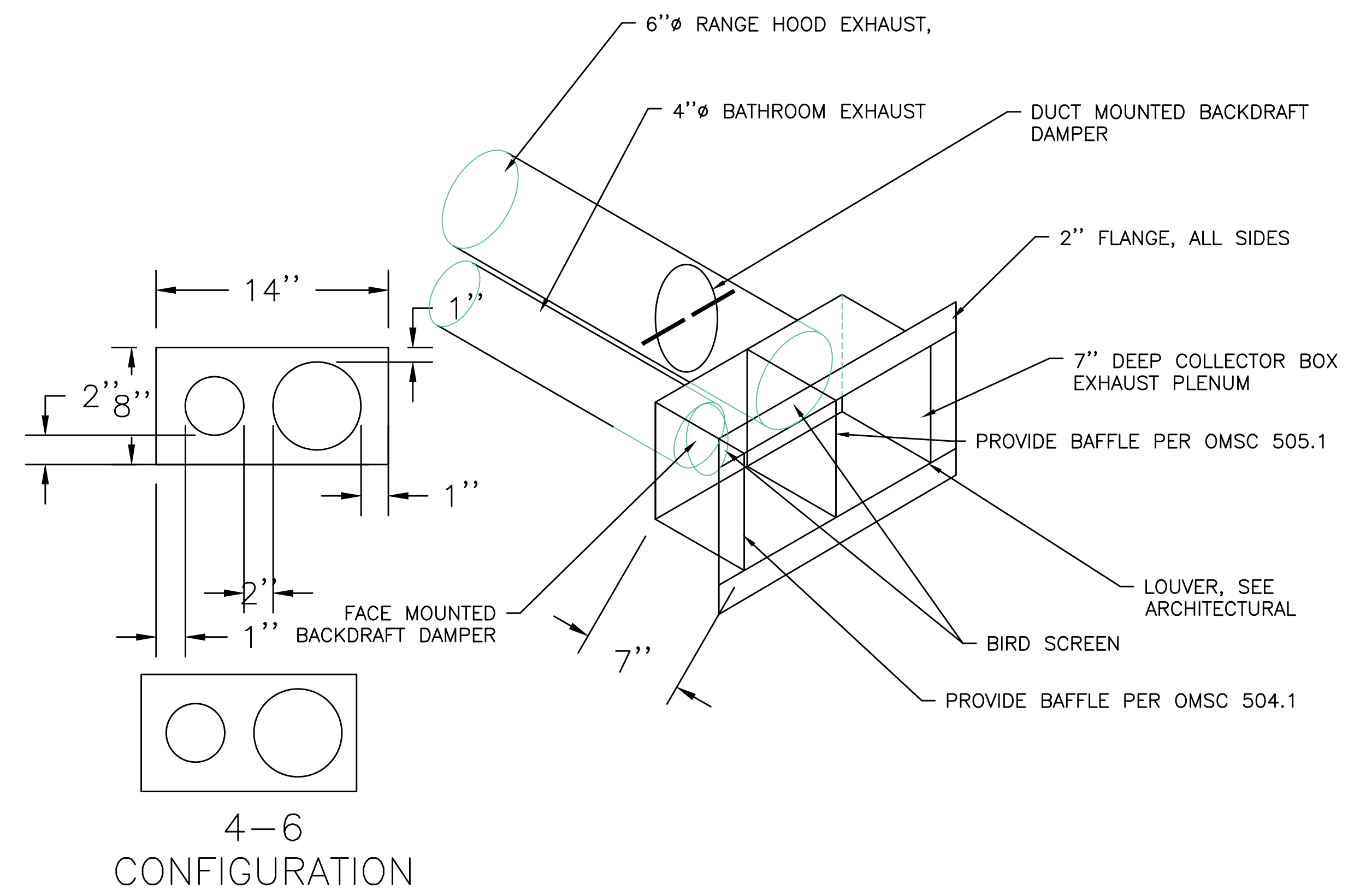
GENERAL NOTES:
 PROVIDE ACCESS IN CEILING OR WALL FOR DAMPER AND SMOKE DETECTOR
 SEE ELECTRICAL DRAWINGS FOR WIRING INSTALLATION



1 HIGH SUPPLY W/ FIRE/SMOKE DAMPER
M6.02 SCALE: DETAIL



3 ROOF TOP UNIT W/ VIBRATION ISOLATION CURB
M6.02 SCALE: DETAIL

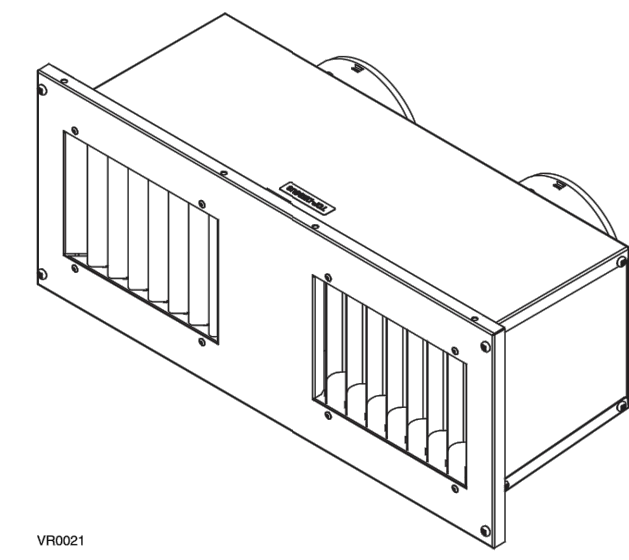


4 SIDE WALL DWELLING UNIT VENTING
M6.02 NOT TO SCALE

BRQAN

Metal Tandem Hood

Part no.: V14695

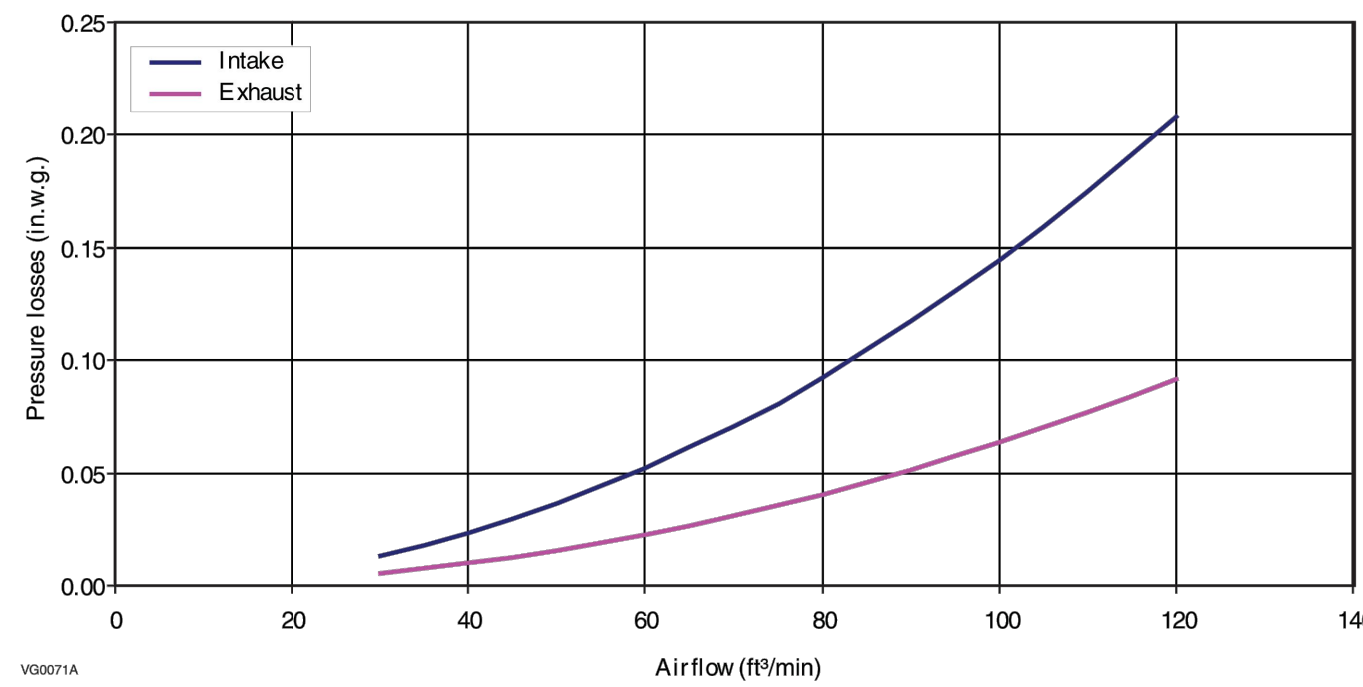


ONE OUTDOOR PORT FOR DOUBLE USAGE

More than ever, today's builders and contractors are aiming to optimize material, manpower and time. One way to achieve this goal when installing a ventilation system is to install our new metal tandem hood. This new device simplifies the installation not only because only one hole is required on the exterior wall. In fact, every installer knows that locating efficiently one outdoor port is easier (and faster) than locating two. Moreover, there is hardly any intercontamination!

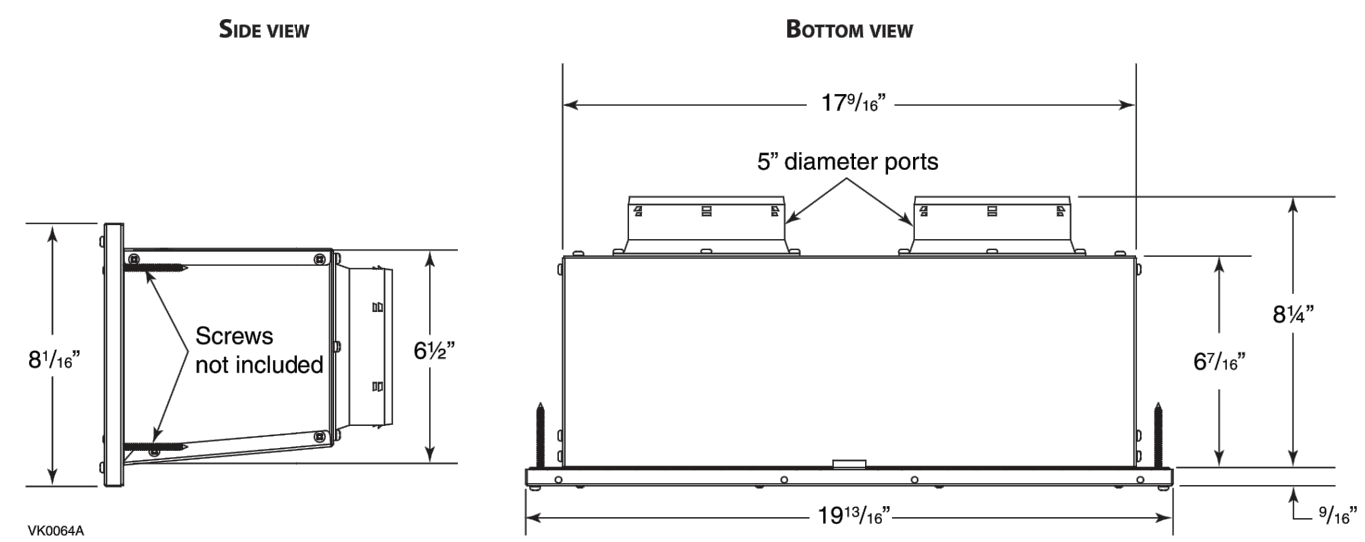
- Galvanized satin steel cover grille (ready to be painted by the HVAC contractor to match building's color).
- One 7" x 18" hole in the exterior wall.
- Tandem box eliminates the need of a tandem transition.
- Intake and exhaust ducts connection can be performed either on left or right port, for more convenience.
- Outdoor connection performed in half time.
- Suitable for ventilation unit producing an airflow lower than 120 CFM (for higher airflow capacity, please confirm that the overall pressure losses of the ventilation system is suitable for the unit used). See chart below.

Pressure Drops (Intake and Exhaust)

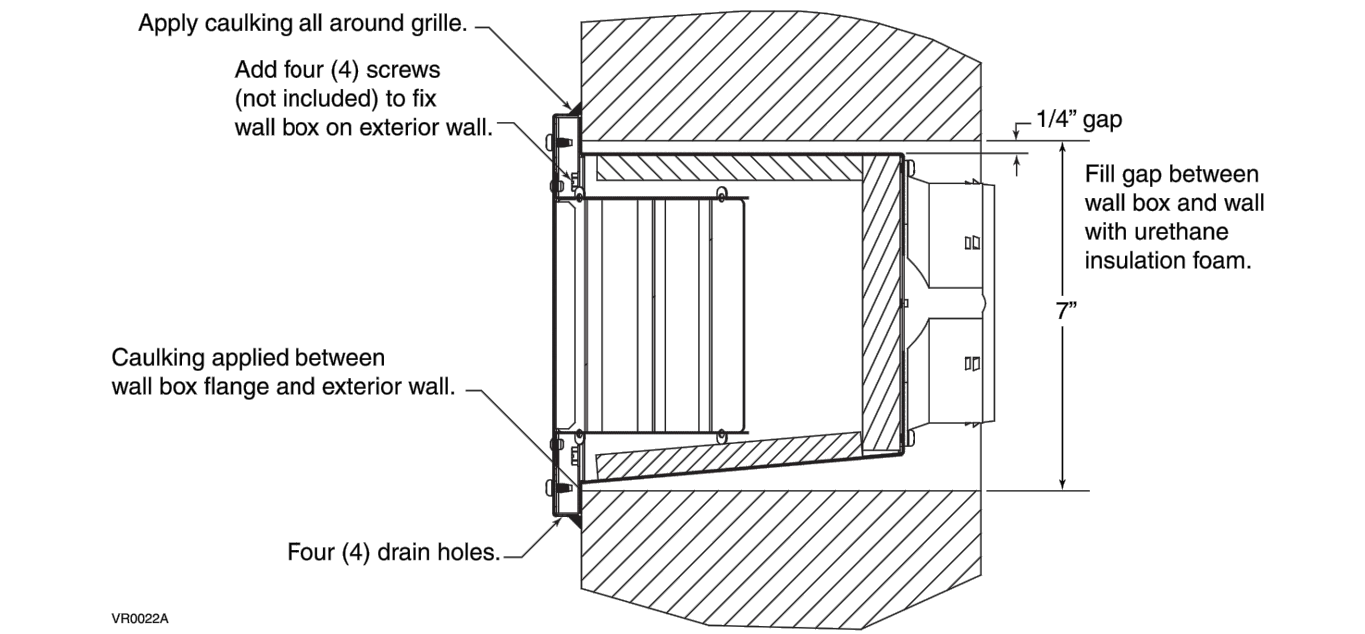


Available at:

Metal Tandem Hood Dimensions



Installation Details



Submitted by:	Date:	Project:
Quantity:	Model No.:	Location:
	Remarks:	Architect:
		Engineer:
		Contractor:

BRQAN
 Broan-NuTone LLC, 926 West State Street, Hartford, WI 53027 (1-877-862-7626)
V14695D161108

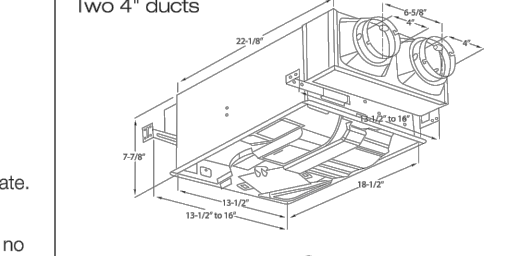
WhisperComfort Energy Recovery Ventilator

Specification Submittal Data / Panasonic Ventilation FV-04VE1

Description: UL listed ceiling or wall mount Energy Recovery Ventilator provides a tempered air supply, humidity control, and a balanced amount of exhaust to help maintain neutral pressure throughout the home. WhisperERV shall not be installed in a bathroom. Only one unit is needed for a 1700 sq. ft. 2 bedroom home to meet the ASHRAE 62.2 ventilation requirement.

Motor/Blowers: Fully enclosed AC condenser motor rated for continuous run. Power rating shall be 120 volts and 60 Hz. Two highly efficient blowers obtain cooling on single motor for lower power consumption and decreased noise. Motor equipped with thermal cut-off fuse control.

Heating: Dual pre-heat paint, galvanized steel body. Dual 4" intake and exhaust ducts. Built in backdraft damper on exhaust duct. Filter on supply and exhaust air extend the life of the ERV core. Expandable mounting bracket up to 16" on center.



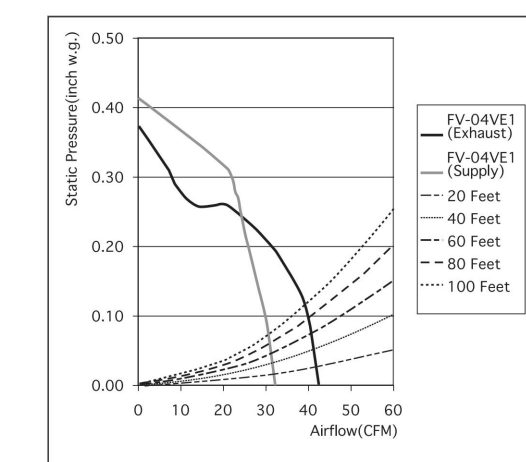
Grille: Attractive design using ABS material. Attaches directly to housing with torsion springs.

Warranty: 2-yr Parts; 5-yr labor from original purchase date.

Architectural Specifications: ERV shall be ceiling or wall mount type with no less than 40 CFM on the exhaust port, 30 CFM on the supply port, and no more than 0.8 gpm as tested in accordance with HW 915 and 916 standards at 0.1 static pressure in inches water gauge. Power consumption shall be no greater than 23 watts. Apparent Sensible Effectiveness for heating shall be no less than 65% at 30 CFM net air flow under 20°F (0°C) air tested in accordance with CSA-C439. Total Recovery Effectiveness for cooling shall be no less than 30% at 30 CFM net air flow under 80°F (26.7°C). The supply port damper shall close below 20°F (-7°C) to prevent freezing of the core. The motor shall be totally enclosed, AC condenser type engineered to run continuously. Power rating shall be 120V/60Hz. Duct diameter shall be no less than 4". ERV can be used to comply with ASHRAE 62.2, LEED, and California Title-24, and WA Ventilation Code.

Specifications: WhisperComfort FV-04VE1	40 CFM	30 CFM	10 CFM
Static Pressure in inches w. g.	0.1	0.1	0.1
Exhaust Air Volume (CFM)	40	30	10
Supply Air Volume (CFM)	30	20	10
Noise (dBA)	0.8	<0.3	N/A
Power Consumption (watts)	23	21	17
Speed (RPM)	1479	1262	1066
Current (amps)	0.15	0.10	0.09
Power Rating (VA/Hz)	120/60		
Apparent Sensible Effectiveness for Heating	65% at 30 CFM and 20°F (0°C)		
Total Recovery Efficiency for Cooling	30% at 20 CFM and 80°F (26.7°C)		

ERV Core Technology: Indoor and outdoor air passes through Panasonic's catalytic core technology. This process tempers supply air while transferring moisture and energy. Built in Frost Prevention Mode prevents the core from freezing. Frost Prevention Mode is free of interaction and operates without intervention.



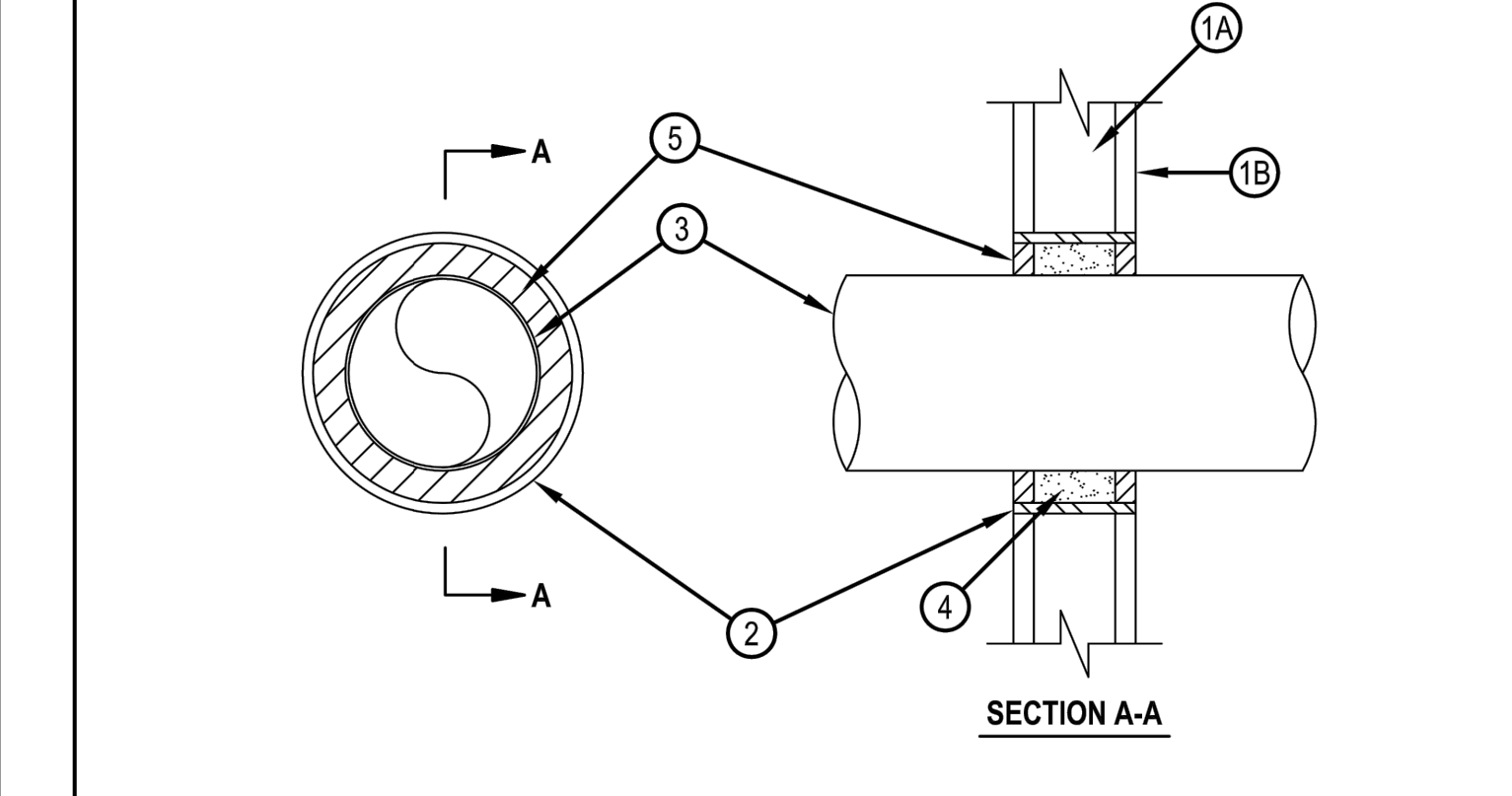
For complete installation instructions visit us.panasonic.com/ventilators

Model	Quantity	Comments	Project:
			Location:
			Architect:
			Engineer:
			Contractor:
			Submitted by:
			Date:

Panasonic Life Solutions Company of America
 540 Division Two Riverport Plaza
 Newark, NJ 07102
us.panasonic.com/ventilators
 402500107

System No. W-L-7017

ANSI/UL1479 (ASTM E814)	CANULC S115
F Rating — 1 Hr	F Rating — 1 Hr
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Rating — 1 Hr
	FTH Rating — 0 Hr



- Wall Assembly — The fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
 - Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to consist of 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
 - Gypsum Board — One layer of nom 5/8 in. (16 mm) thick gypsum board, as specified in the individual Wall and Partition Design. Max diam of opening is 6-5/8 in. (219 mm).
- Metallic Sleeve — Nom 5 in. (203 mm) diam (or smaller) Schedule 40 (or heavier) steel sleeve cast into wall assembly with joint compound and installed flush with wall surface.
- Air Duct — Nom 6 in. (152 mm) diam (or smaller) prefabricated No. 28 MSG galv sheet metal duct. A min 1/2 in. (13 mm) to max 1-1/2 in. (38 mm) annular space is required within the firestop system. Duct to be rigidly supported on both sides of wall assembly.
- Forming Material — Foamed plastic forming material foamed into opening as a permanent form. Forming material to be recessed from both surfaces of wall as required to accommodate the required thickness of fill material. HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CF812 or CF-AS C/P Foam Sealant.
- Fill, Void or Cavity Material — Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant.

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

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 January 26, 2015

1 ERV INTAKE/EXHAUST TERMINATION
 M6.03 DETAIL

2 ERV SUBMITTAL
 M6.03 DETAIL

3 FIRE PENETRATION DETAIL — 6" DUCTS
 M6.03 DETAIL

System No. F-C-7057

ANSI/UL1479 (ASTM E814)	CANULC S115
F Rating — 1 Hr	F Rating — 1 Hr
T Rating — 1 Hr	FT Rating — 1 Hr
	FH Rating — 1 Hr
	FTH Rating — 1 Hr

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 Page: 1 of 2

System No. F-C-7057

- Floor-Ceiling Assembly — The 1 hr fire-rated solid or trussed lumber joist floor-ceiling assembly shall be constructed of the materials and in the manner specified in the individual L500 Series Floor-Ceiling Designs in the UL Fire Resistance Directory. The general construction details of the floor-ceiling assembly are summarized below:
 - Flooring System — Lumber or plywood subfloor with finish floor of lumber, plywood or Floor Topping Mixture as specified in the individual Floor-Ceiling Design. Max area of floor opening is 150 in.2 (0.098 m2) with a max 1.5 in. (38 mm) annular space between duct and framing members.
 - Wood Joists — Nom 10 in. (254 mm) deep (or deeper) lumber, steel or combination lumber and steel joists, trusses or Structural Wood Members with bridging as required and with ends firestopped. Additional framing members installed to form a square enclosure around the perimeter of the opening in the floor and ceiling.
 - Furring Channels — (Where Required - Not Shown) — Resilient galv steel furring installed perpendicular to wood joists between gypsum board and wood joists as specified in the individual Floor-Ceiling Design. Furring channels spaced max 24 in. (610 mm) OC. If furring channels are used within the assembly, additional furring channels to be installed along the periphery of the opening.
 - Gypsum Board — Nom 4 1/2 in. (114 mm) wide by 5/8 in. (16 mm) thick as specified in the individual Floor-Ceiling Design. Gypsum board secured to wood joists or furring channels as specified in the individual Floor-Ceiling Design. Max area of ceiling opening is 150 in.2 (0.098 m2) with a max 1.5 in. (38 mm) annular space between duct and framing members.
- Steel Air Duct — Max 7 in. (178 mm) diam by min 0.0157 in. (0.40 mm) or 0.40 mm thick galv steel air duct to be centered within the opening. Max one steel air duct to be installed within opening. Steel duct to be rigidly supported on top side of floor-ceiling assembly.
- Steel Air Duct — Max 10 by 4 in. (254 by 102 mm) rectangular by min 0.022 in. (0.26 gauge) or 0.56 mm thick galv steel air duct to be centered within the firestop system. Max one steel air duct to be installed within opening. Steel duct to be rigidly supported on top side of floor-ceiling assembly.
- Firestop System — The firestop system shall consist of the following:
 - Packing Material — Min 9-7/8 in. (251 mm) thickness of unfauced duct wrap material compressed min 25 percent into opening as a permanent form between the insulated steel duct and the periphery of the opening. Packing material to be installed flush with bottom surface of ceiling and recessed from top surface of floor to accommodate the required thickness of fill material.
 - Fill, Void or Cavity Material — Sealant — Min 3/4 in. (19 mm) thickness of fill material applied within annulus on top surface of floor. SPECIFIED TECHNOLOGIES INC — SpecSeal Series SSS Sealant or SpecSeal LCI Sealant. EGS NELSON FIRESTOP — ES1389 Sealant. HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant. TREMCO INC — Fyre-Sil Sealant. DAP PRODUCTS INC — DAP Fire Stop Fire-Rated Silicone Sealant. 3M COMPANY 3M FIRE PROTECTION PRODUCTS — FB-1000 NS Sealant. NUOCO INC — Self Seal GG-200.
 - Duct Wrap Materials — Nom 1/2 in. (13 mm) thick, 8 pcf (128 kg/m3) or nom 1-1/2 in. (38 mm) thick, 6 pcf (96 kg/m3) with foil-scrim facers. The steel duct shall be wrapped with one layer of duct wrap installed in accordance with Ventilation Assembly No. V-32. The duct wrap is secured with min No. 18 Gauge (0.040 in. or 1 mm) galvanized steel wire formed into a loop on one end, with the other end passed through the loop, pulled hand tight and bent over. Tie wires spaced a max 12 in. (305 mm) OC. See Ventilation Duct Assemblies in Vol. 2 of the Fire Resistance Directory. The annular space between the insulated steel duct and the periphery of the opening shall be a nom 1-1/2 in. (38 mm). A min 1/2 in. high collar consisting of an additional layer of 1/2 in. (13 mm) thick, 8 pcf (128 kg/m3) or nom 1-1/2 in. (38 mm) thick, 6 pcf (96 kg/m3) duct wrap, installed over the duct wrap flush with the top surface of the floor and extending upward. All seams and edges shall be sealed with min 3 in. (76 mm) wide pressure sensitive aluminum foil tape. UNIFRAX I L L C — FyreWrap DPS or FyreWrap Elite 1.5.

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

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 Page: 2 of 2

System No. W-L-5143

ANSI/UL1479 (ASTM E814)	CANULC S115
F Rating — 1 and 2 Hr (See Items 1 and 5)	F Rating — 1 and 2 Hr (See Items 1 and 5)
T Rating — 1/2 Hr	FT Rating — 1/2 Hr
	FH Rating — 1 and 2 Hr (See Items 1 and 5)
	FTH Rating — 1/2 Hr

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 Page: 1 of 2

System No. W-L-5143

- Wall Assembly — As an alternate to the above wall assembly, the 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
 - Studs — Wall framing may consist of either wood studs or steel channel studs. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC.
 - Gypsum Board — Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max diam of opening is 4 in. (102 mm).
- The hourly F, FH Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.
- Metallic Sleeve — Max 4 in. (102 mm) diam cylindrical sleeve fabricated from min 0.016 in. (0.4 mm) thick (28 gauge) galv sheet steel and having a min 1 in. (25 mm) lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall. Sleeve installed by coiling the sheet steel to a diam smaller than the through opening, inserting the coil through the opening and releasing the coil to let it uncoil against the circular cutouts in the gypsum board layers. Sleeve may also be formed of No. 8 steel wire mesh having a min 1 in. (25 mm) lap along the longitudinal seam.
- Through Penetrants — One metallic pipe or tube to be installed either concentrically or eccentrically within the firestop system. Pipe or tubing to be rigidly supported on both sides of the wall assembly. The following types and sizes of metallic pipes or tubing may be used:
 - Copper Tubing — Nom 1 in. (25 mm) diam (or smaller) Type L copper tubing.
 - Copper Pipe — Nom 1 in. (25 mm) diam (or smaller) Regular (or heavier) copper pipe.
- Tube Insulation — Plastics — Nom 3/4 in. (19 mm) thick acrylonitrile butadiene styrene (ABS) or polyurethane (PU) flexible foam furnished in the form of tubing. The annular space between the insulated pipe and the periphery of the steel sleeve shall be min 1/4 in. (6 mm) and max 1-1/8 in. (28.6 mm).
- Firestop System — The firestop system shall consist of the following:
 - Packing Material — Min 1-5/8 or 2-1/4 in. (41 or 57 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into sleeve on one side of the wall as a permanent form for 1 and 2 hr walls, respectively. Packing material to be recessed from the room side of wall as required to accommodate the required thickness of fill material. In alternate wall assembly, packing material to be flush with either side of the wall and be recessed from the other side of the wall to accommodate the required thickness of fill material.
 - Fill, Void or Cavity Material — Sealant — Min 1-1/2 in. (38 mm) thickness of fill material applied within sleeve, flush with room surface of wall or other wall surface in the alternate wall assembly. HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant.

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 Page: 2 of 2

4 FIRE PENETRATION DETAIL — 6" DUCTS — HORIZONTAL
 M6.03 DETAIL

5 FIRE PENETRATION DETAIL — 4" DUCTS
 M6.03 DETAIL