



JOB NUMBER E11-520



DUCTING DN CURB INCLUDE FDS AT PENITR.

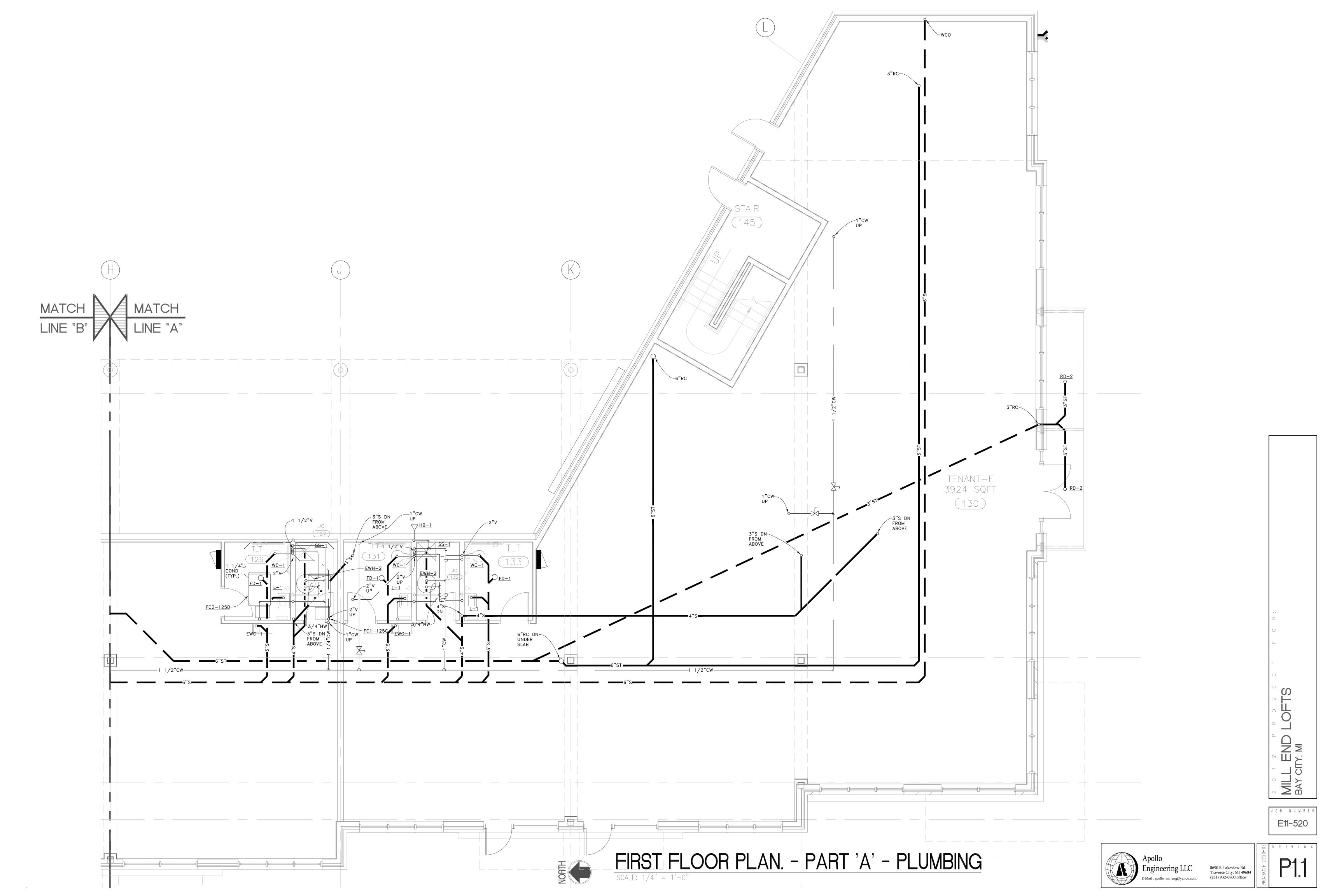
-24/20 ABOVE ROOF

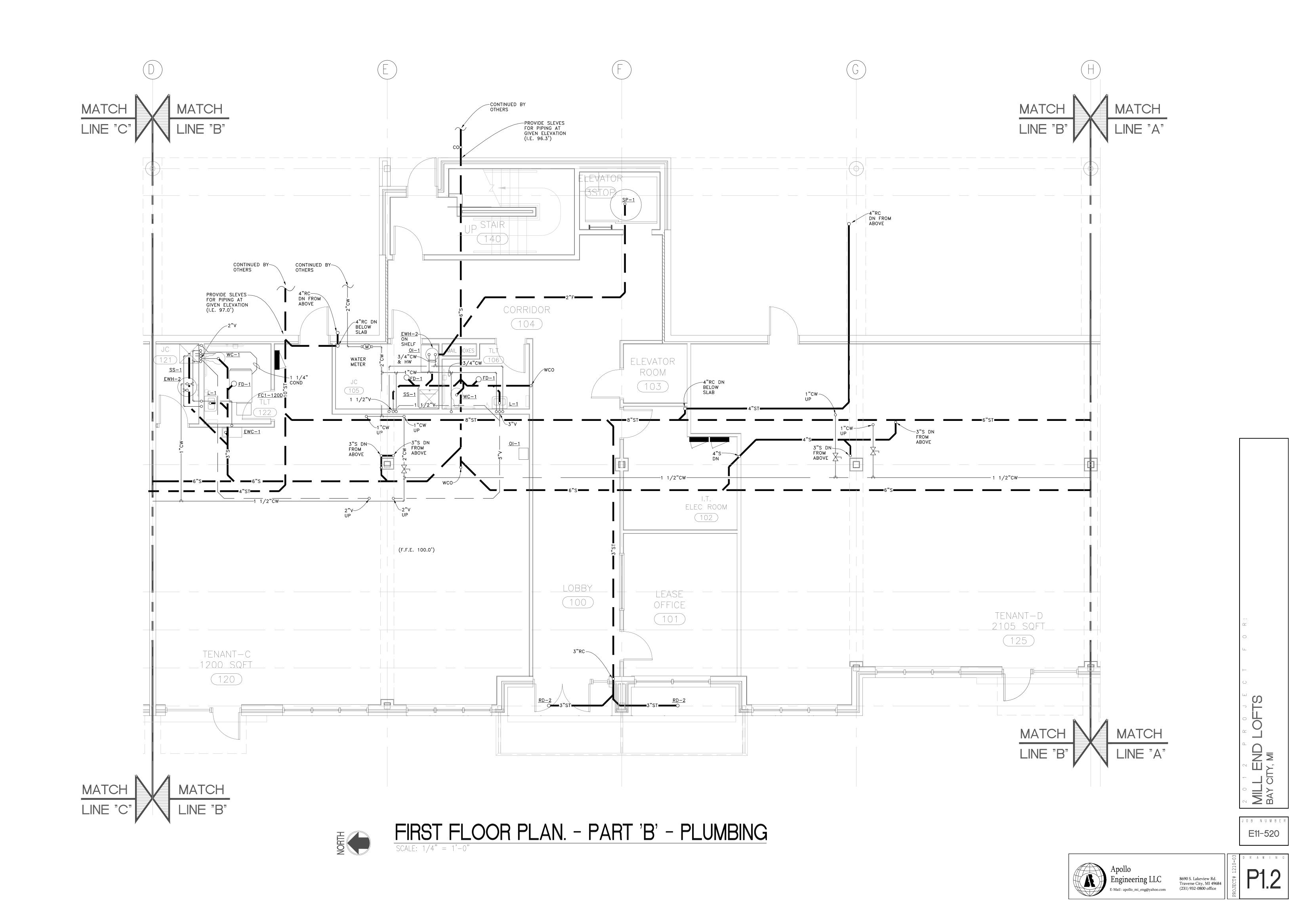
-26/20 ABOVE ROOF

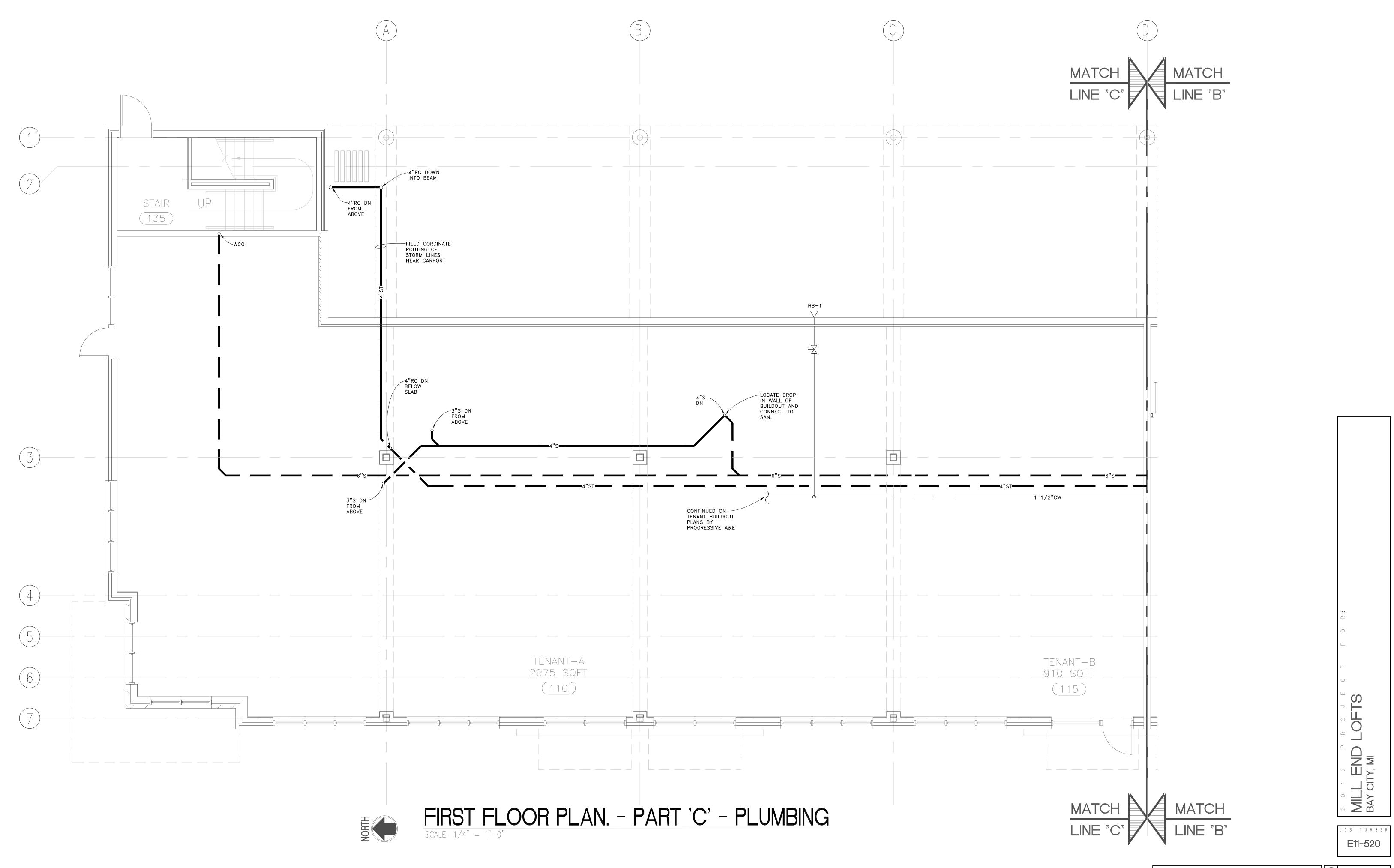
16/16—— ABOVE ROOF

18/16 —— ABOVE ROOF

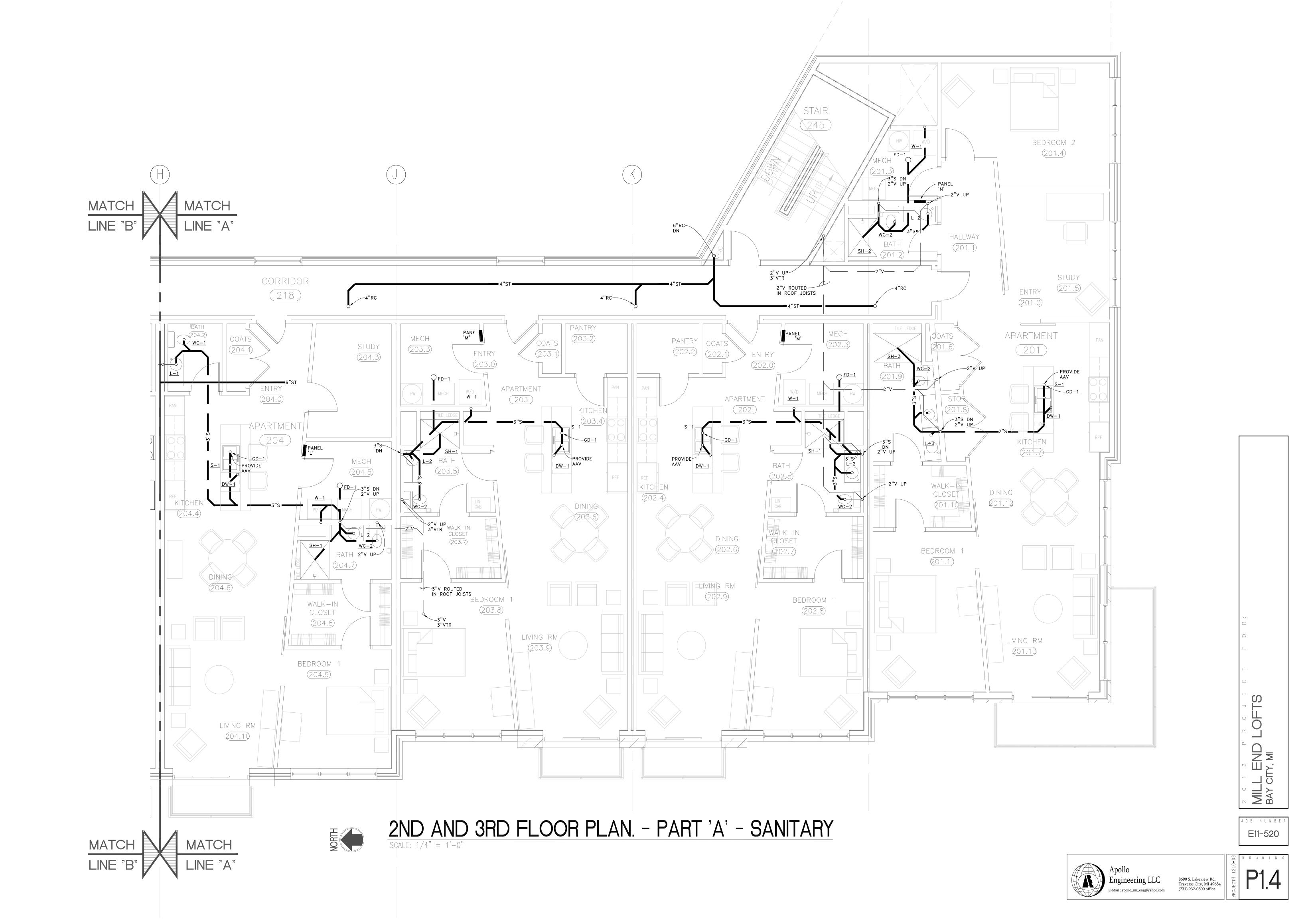


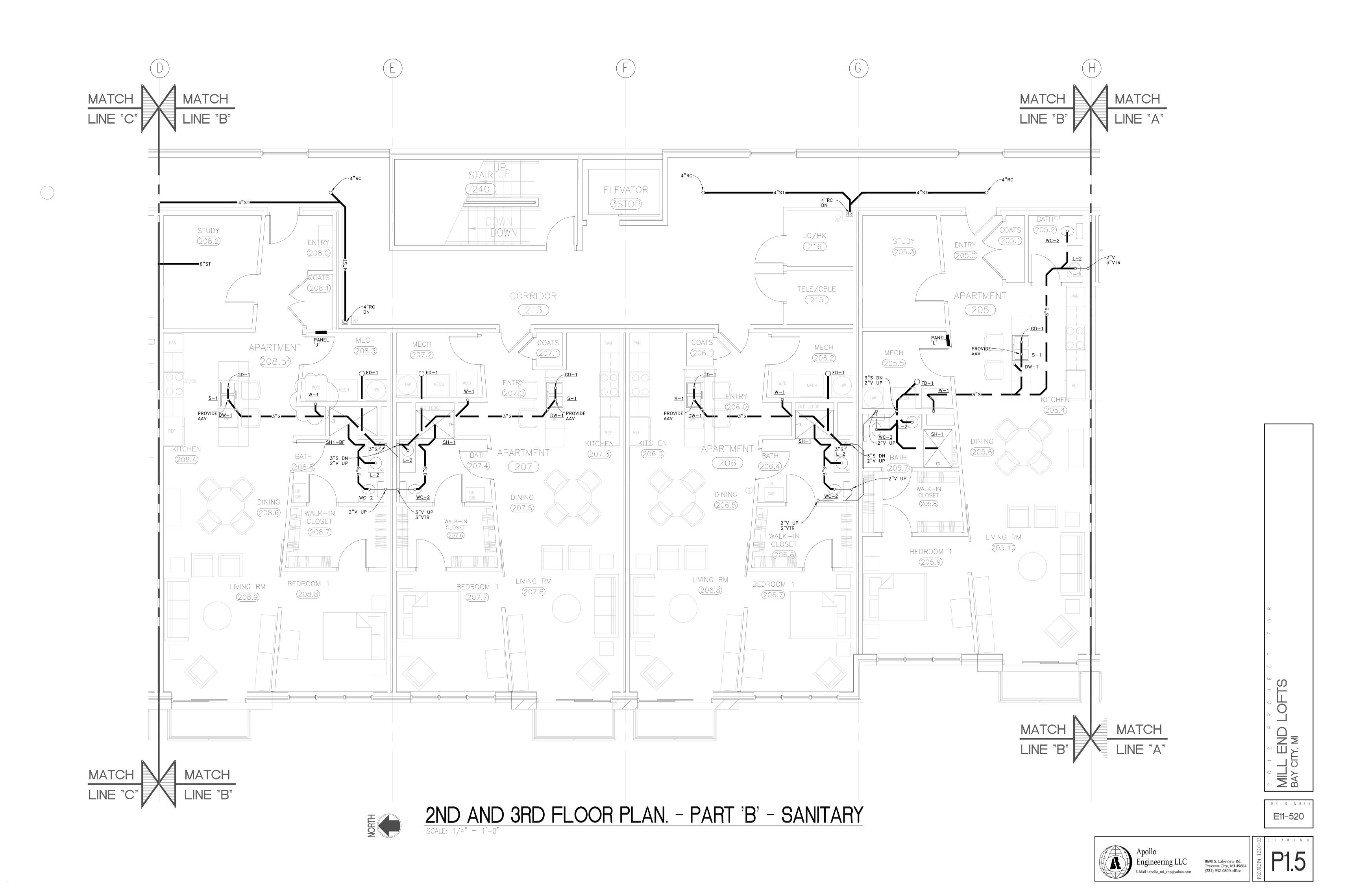


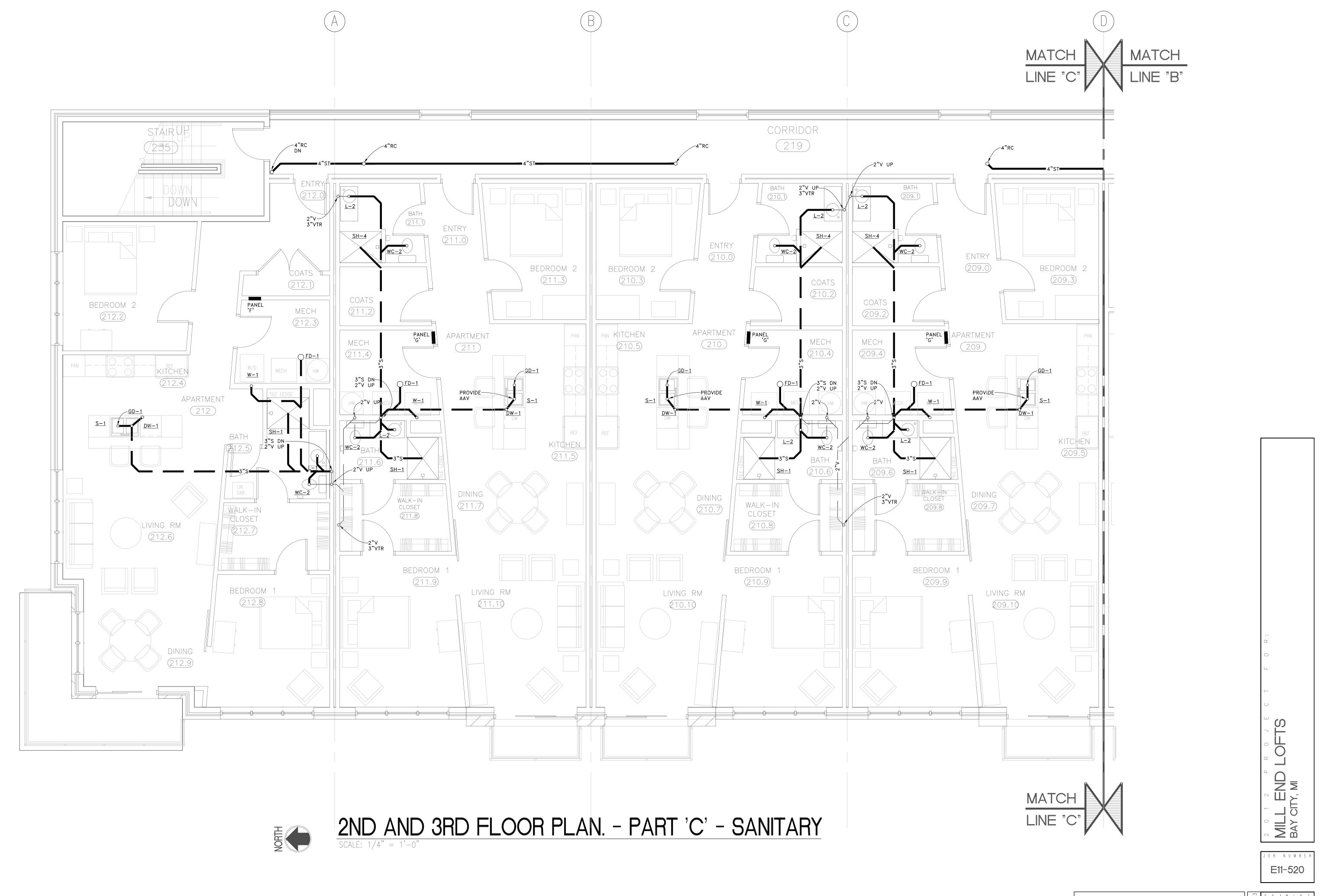






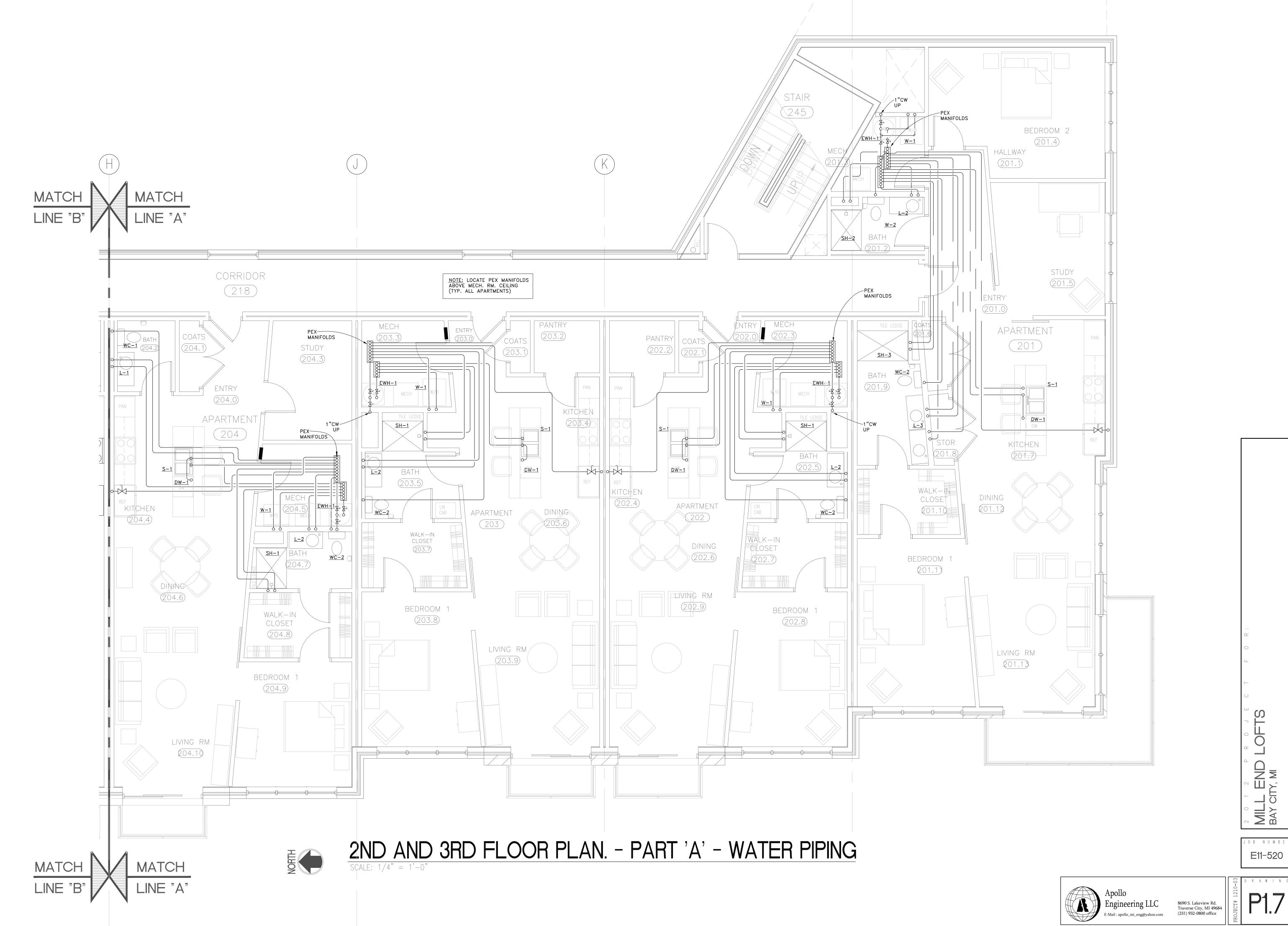


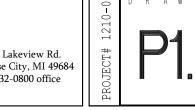


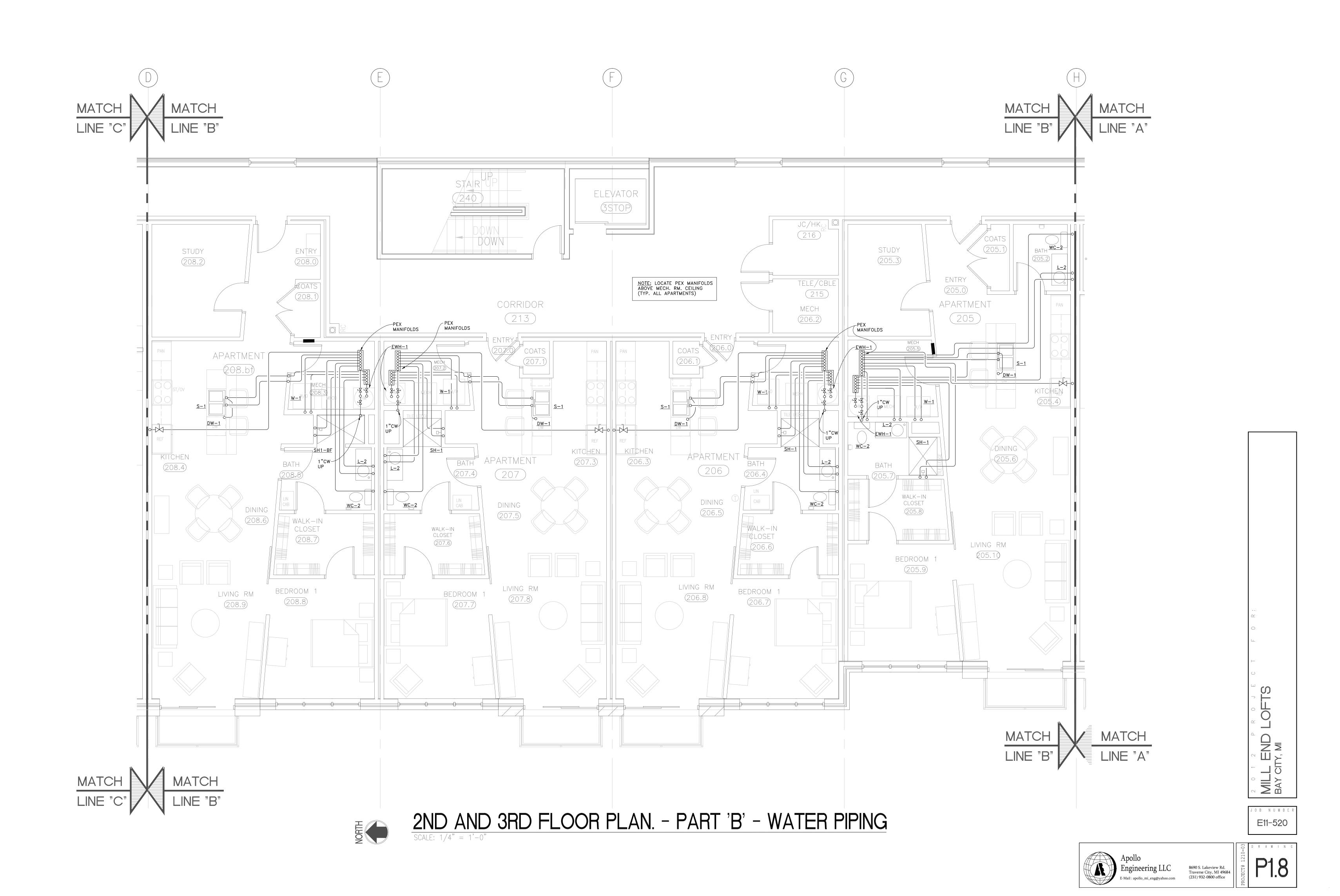


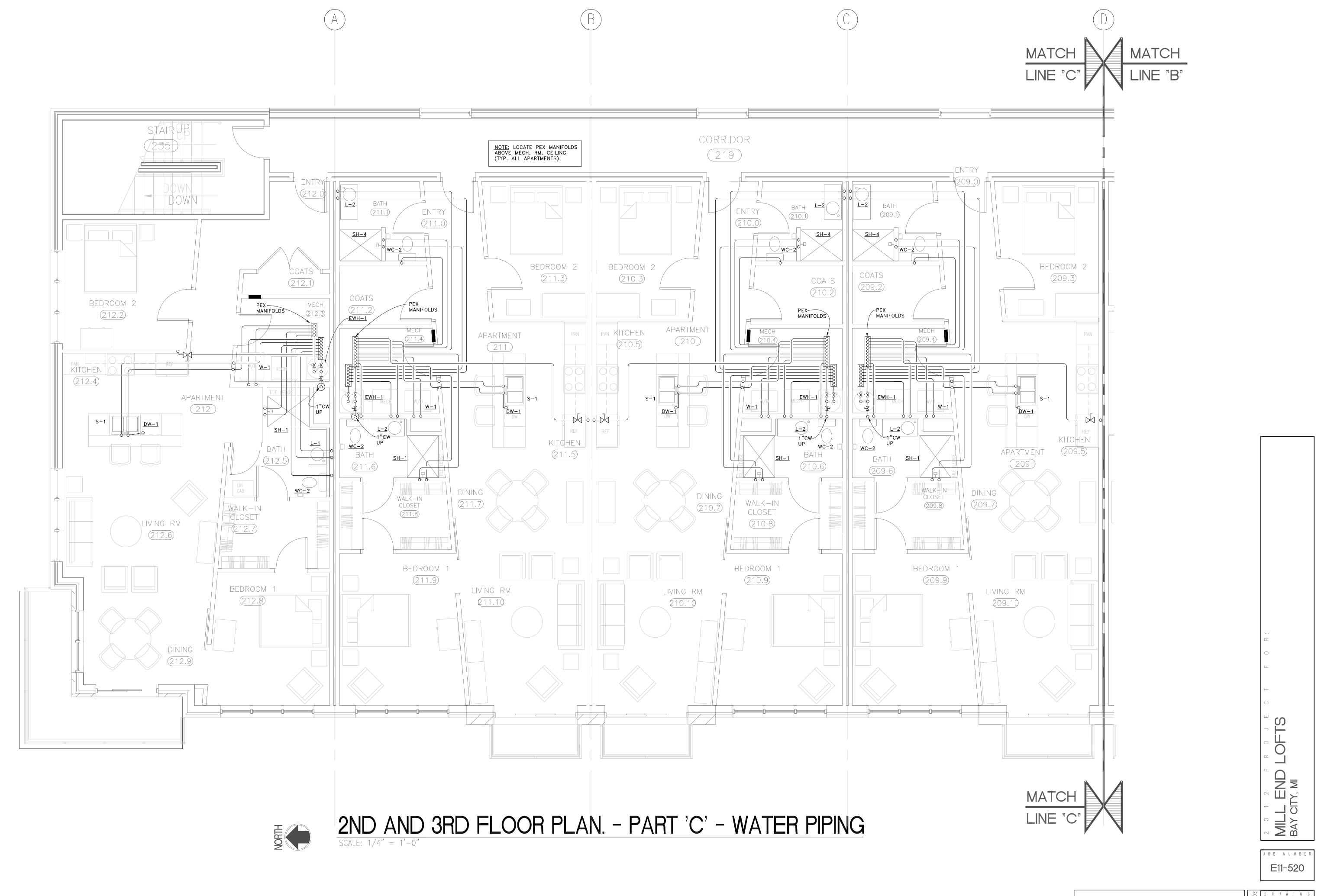
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Respond to the control of the control of









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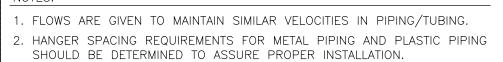
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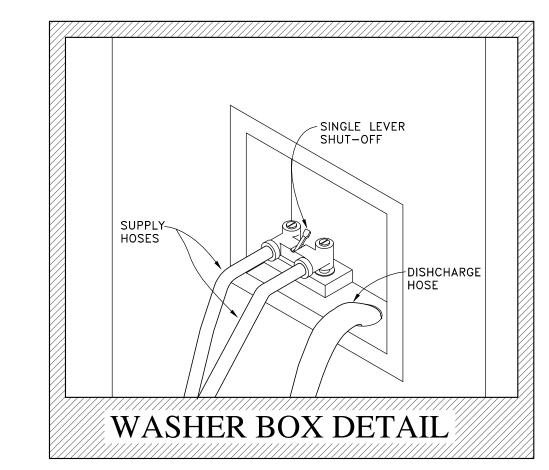
	PLUMBING FIXTURE SCHEDULE											
MARK	FIXTURE	MANU.	MODEL	SAN.	нот	COLD	REMARKS					
WC-1	WATER CLOSET	KOHLER	K-3531-0	3"	_	3/4"	17" HEIGHT, W/ KOHLER #K-4731-C-0					
WC-2	WATER CLOSET	KOHLER	K-3723-0	3"	_	3/4"	16" HEIGHT, W/ KOHLER #4664-0					
L-1	LAVATORY	KOHLER	K-2005	1 1/2"	1/2"	1/2"	W/ SYMMONS #SLS-3510 FAUCET, NO POP-UP DRAIN, SEE NOTES #3 & #4					
L-2	LAVATORY	IKEA	901-873.57	1 1/2"	1/2"	1/2"	W/ SYMMONS #SLS-3510 FAUCET, W/ POP-UP DRAIN, SEE NOTES #3 & #4					
L-3	LAVATORY	IKEA	801.483.28	1 1/2"	1/2"	1/2"	W/ SYMMONS #SLS-3510 FAUCET, W/ POP-UP DRAIN, SEE NOTES #3 & #4					
S-1	SINK	KOHLER	K-3822-1	1 1/2"	1/2"	1/2"	W/ DELTA 1159LF-AR					
SH-1	SHOWER	AKER	SP-3648	1 1/2"	1/2"	1/2"	W/ SYMMONS 3501-CYL-B SHOWER HEAD AND VALVE					
SH-1F	SHOWER	AM. STD.	6032SF.LDF	1 1/2"	1/2"	1/2"	W/ SYMMONS 3503-H321-V-CYL-B HAND HELD SHOWER, VALVE, AND BAR					
SH-2	SHOWER	AKER	SHLS/RS-48	1 1/2"	1/2"	1/2"	W/ SYMMONS 3501-CYL-B SHOWER HEAD AND VALVE					
SH-3	SHOWER	AKER	SP-3660-141074 (PAN)	1 1/2"	1/2"	1/2"	W/ SYMMONS 3501-CYL-B SHOWER HEAD AND VALVE					
SH-4	SHOWER	AKER	SHLS/RS-48	1 1/2"	1/2"	1/2"	W/ SYMMONS 3501-CYL-B SHOWER HEAD AND VALVE					
EWC-1	ELECTRIC WATER COOLER	ELKAY	EZSTL8LC	1 1/2"	_	1/2"	DUAL UNIT, ONE AT ADA HEIGHT, THE OTHER AT STANDARD HEIGHT					
W-1	WASHER	BY OTHERS	-	1 1/2"	1/2"	1/2"	-					
EWH-1	ELECTRIC WATER HEATER	AO SMITH	ECT-52	-	3/4"	3/4"	50 GAL., 4.5KW, 208V-1ø					
EWH-2	ELECTRIC WATER HEATER	AO SMITH	EFC-10	_	3/4"	3/4"	10 GAL., 1650W, 120V-1ø					
FD-1	FLOOR DRAIN	ZURN	ZA-415-5B	3"	-	_	WITH TYPE "B" SQUARE STRAINER, NICKEL BRONZE TOP, SEE NOTE #5					
RD-1	ROOF DRAIN	ZURN	Z-105-C	3"	_	_	W/ UNDERDECK CLAMP					
HB-1	HOSE BIB	WOODFORD	MODEL 65	_	_	3/4"	FREEZLESS WITH VACUUM BREAKER					
OI-1	FLOOR DRAIN	ZURN	Z-1186-800	3"	-	-	SIZE 800					
GD-1	GARBAGE DISPOSAL	INSINKERATOR	EVOLUTION ESSENTIAL	2"	_	_	3/4 HP, 120V					

NOTES:

- 1. SEE ARCHITECTURAL DRAWINGS FOR ALL ROUGH—IN LOCATIONS OF PLUMBING FIXTURES.
- 2. VERIFY COLOR WITH ARCHITECT BEFORE ORDERING.
- 3. INSULATE ALL EXPOSED SANITARY AND DOMESTIC HOT AND COLD WATER PIPING TO LAVATORIES.
- 4. PROVIDE A POWERS 480 MIXING VALVE AT EACH LAV.
- 5. PROVIDE A 1/2" TRAP PRIMER TO FLOOR DRAIN FROM NEAREST SINK DRAIN, OR THROUGH A ZURN Z1022 TRAP PRIMER VALVE CONNECTED TO NEAREST WATER LINE.

NOMINAL SIZE	COPPER PIPE FLOW RANGE (GPM)	STEEL TUBING FLOW RANGE (GPM)	PEX TUBING FLOW RANGE (GPM)
1/2"	0.5-4.0	0.5-5.0	0.5-2.0
3/4"	5.0-8.0	6.0-9.0	2.1-6.5
1"	9.0-16.0	10.0-16.0	6.6-11.0
1 1/4"	17.0-22.0	17.0-28.0	12.0-19.0
1 1/2"	23.0-32.0	29.0-40.0	20.0-31.0
2"	33.0-60.0	41.0-62.0	32.0-48.0
2 1/2"	61.0-95.0	63.0-90.0	N/A
3"	96.0-140.0	91.0-150.0	N/A
4"	N/A	151.0-250.0	N/A
5"	N/A	251.0-400.0	N/A
6"	N/A	401.0-550.0	N/A
8"	N/A	551.0-900.0	N/A





PLUMBING NOTES

GENERAL NOTES

- 1. ALL CONSTRUCTION AND MATERIALS SHALL CONFORM TO ALL APPLICABLE FEDERAL, STATE AND LOCAL CODES AND REGULATIONS.
- 2. EACH CONTRACTOR SHALL BE THOROUGHLY KNOWLEDGEABLE OF REGULATIONS GOVERNING HIS PRODUCT AND SERVICE AND SHALL ASSUME RESPONSIBILITY OF INSTALLATION IN ACCORDANCE WITH THOSE REGULATIONS.
- CONTRACTORS TO VERIFY ALL DIMENSIONS RELATIVE TO THEIR SPECIFIC WORK AND SHALL BE THOROUGHLY FAMILIAR WITH EXISTING CONDITIONS PRIOR TO INITIATING THEIR WORK. DISCREPANCIES SHALL BE REPORTED TO THE GENERAL CONTRACTOR OR TO HIS ON—SITE REPRESENTATIVE.
- 4. FAILURE TO DETECT INFERIOR WORK, OR WORK NOT IN ACCORDANCE WITH THESE CONSTRUCTION DOCUMENTS, SHALL NOT BE CONSTRUED AS ACCEPTABLE OF SUCH WORK.
- 5. ANY PENETRATIONS THROUGH FIRE—RATED ASSEMBLIES FOR MECHANICAL OR PLUMBING SYSTEMS, ETC. SHALL BE FIRE—STOPPED AND DRAFT—STOPPED WITH NON—COMBUSTIBLE MATERIALS PER CODE REQUIREMENTS TO MAINTAIN STRUCTURAL AND FIRE RESISTIVE INTEGRITY
- 6. DRAWINGS ARE DIAGRAMMATIC ONLY, FIELD VERIFY EXISTING CONDITIONS.
- 7. PRIOR TO SUBMITTING A PROPOSAL, BIDDER SHALL HAVE VISITED THE CONSTRUCTION SITE. HE SHALL BE FAMILIAR WITH THE EXISTING CONDITIONS UNDER WHICH HE WILL HAVE TO OPERATE AND WHICH WILL IN ANY WAY AFFECT THE WORK UNDER THIS CONTRACT. NO SUBSEQUENT ALLOWANCE WILL BE MADE IN THIS CONNECTION ON BEHALF OF THE CONTRACTOR FOR ANY ERROR OF NEGLIGENCE ON HIS PART.

- 8. PLUMBING CONTRACTOR SHALL OBTAIN ALL PERMITS, PAY ALL FEES, INCLUDING COSTS ASSESSED BY THE MECHANICAL UTILITY COMPANIES, AND ARRANGE FOR ALL INSPECTIONS FOR HIS WORK. AT THE COMPLETION OF PLUMBING WORK, THE PLUMBING CONTRACTOR SHALL FURNISH THE OWNER WITH ALL CERTIFICATES OF FINAL INSPECTION AND APPROVALS.
- 9. PLUMBING CONTRACTOR SHALL GUARANTEE ALL WORK INSTALLED UNDER HIS CONTRACT TO BE FREE FROM DEFECTIVE WORKMANSHIP AND MATERIALS FOR A PERIOD OF ONE YEAR AFTER THE ACCEPTANCE OF THE BUILDING BY THE OWNER. SHOULD DEFECTS OCCUR WITHIN THIS PERIOD, REPAIR AND/OR REPLACE DEFECTIVE ITEMS AT NO EXPENSE TO THE OWNER.
- 10. PLUMBING CONTRACTOR SHALL COORDINATE LOCATIONS OF HIS EQUIPMENT AND WORK WITH OTHER BUILDING TRADES TO AVOID ANY INTERFERENCE'S BETWEEN HIS WORK AND OTHER BUILDING TRADES. IF ANY DISCREPANCIES OCCUR, CONSULT WITH THE GENERAL CONTRACTOR OR HIS ON—SITE REPRESENTATIVE.
- 11. THE CONTRACTOR SHALL BE HELD FULLY RESPONSIBLE FOR THE PROPER RESTORATION OF ALL EXISTING SURFACES REQUIRING PATCHING, PLASTERING, PAINTING AND/OR OTHER REPAIR DUE TO THE INSTALLATION OF MECHANICAL WORK UNDER THE TERMS OF THIS SPECIFICATION. CLOSE ALL OPENINGS, REPAIR ALL SURFACES, ETC. AS REQUIRED.
- THE CONTRACTOR SHALL EMPLOY QUALIFIED AND EXPERIENCED WORKMEN FOR THIS WORK.
- 13. THE PLUMBING CONTRACTOR SHALL PERIODICALLY REMOVE FROM THE SITE ALL DEBRIS AND RUBBISH ACCUMULATING AS A RESULT OF THE MECHANICAL INSTALLATION. UPON COMPLETION OF THE PROJECT, HE SHALL DISPOSE OF ALL DEBRIS AND RUBBISH AND SHALL LEAVE ALL AREAS CLEAN.
- 14. ALL PLUMBING LINES TO BE INCORPORATED IN TGI'S OR HELD TIGHT TO DECK.

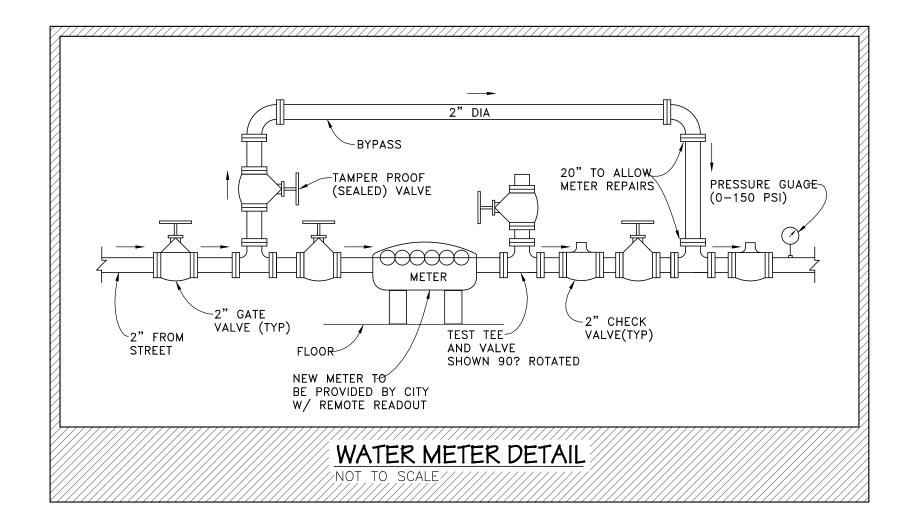
PLUMBING CONSTRUCTION NOTES

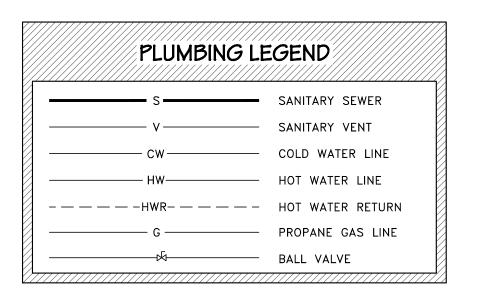
<u>GENERAL</u>

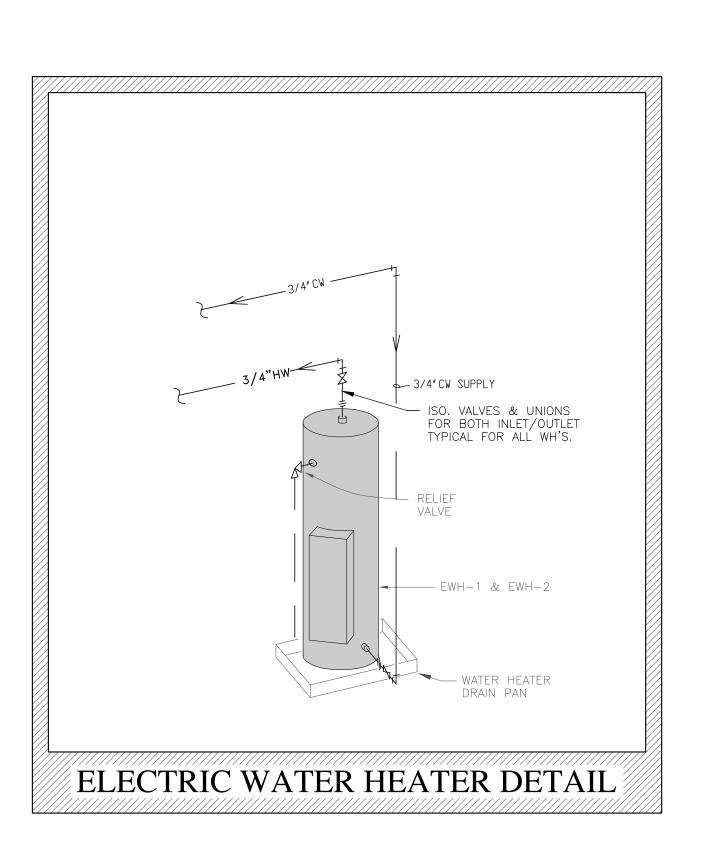
- REFERENCE ARCHITECTURAL DRAWINGS FOR ALL ROUGH-IN DIMENSIONS, <u>BOTH FIXTURES AND WALLS.</u>
- 2. ALL VALVES SHALL BE ACCESSIBLE.
- 3. WATER HAMMER ARRESTORS SHALL BE INSTALLED AND SHALL BE. ACCESSIBLE.
- 4. PLUMBING CONTRACTOR TO EXTEND WATER AND SANITARY LINES AND MAKE UTILITY CONNECTIONS.

SPECIFICATIONS

1. PLUMBING DESIGN PER 2009 MICHIGAN PLUMBING CODES.





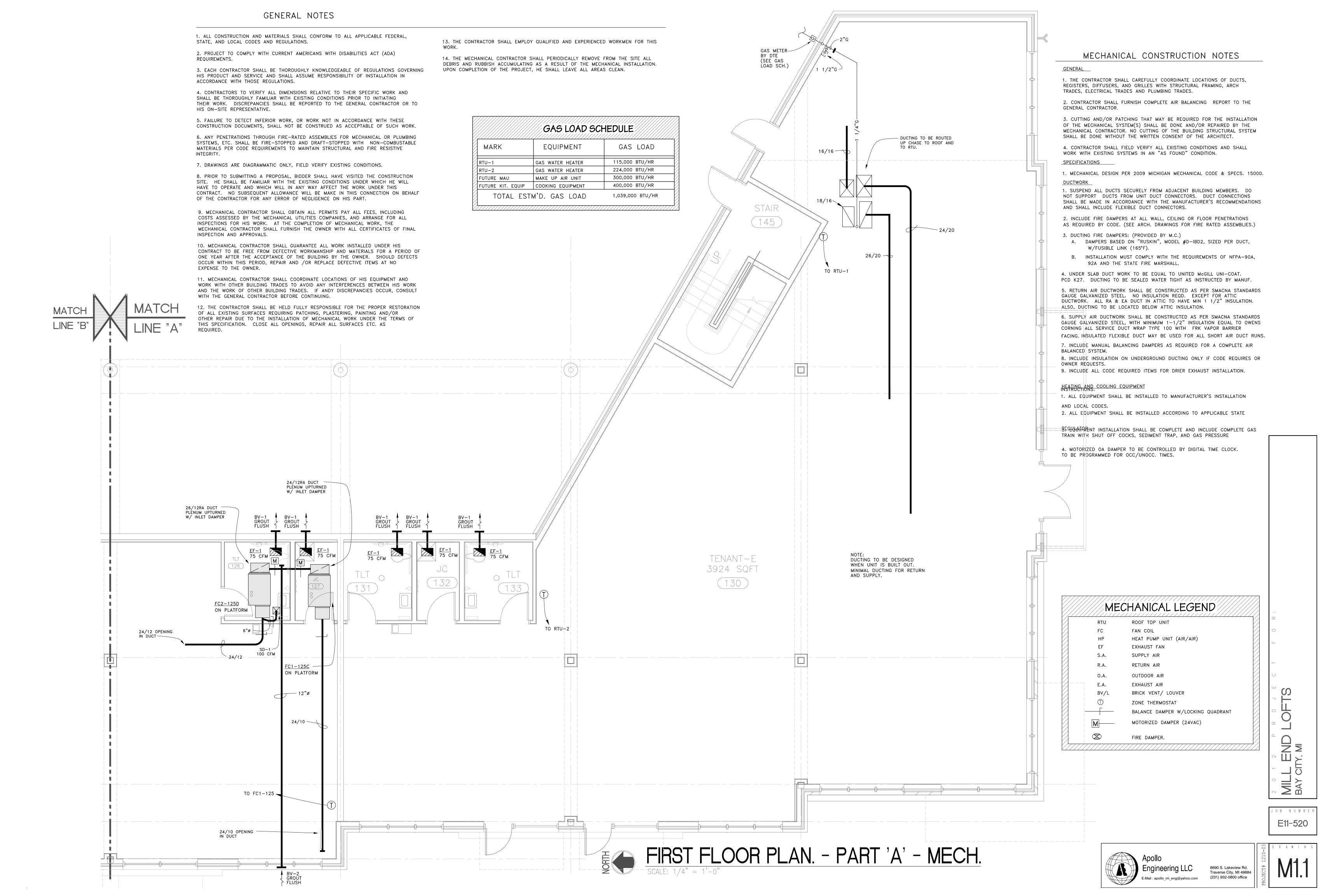


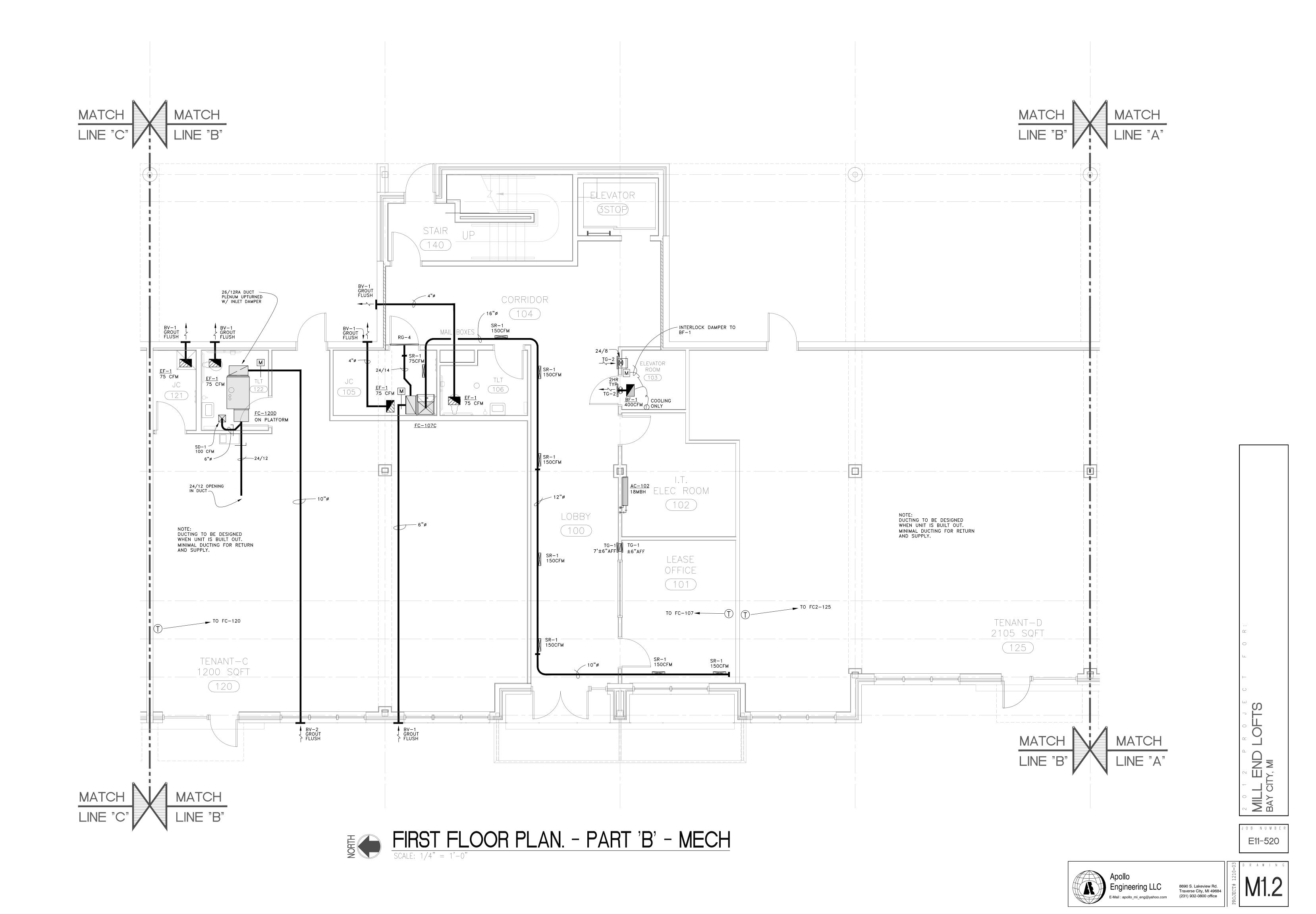


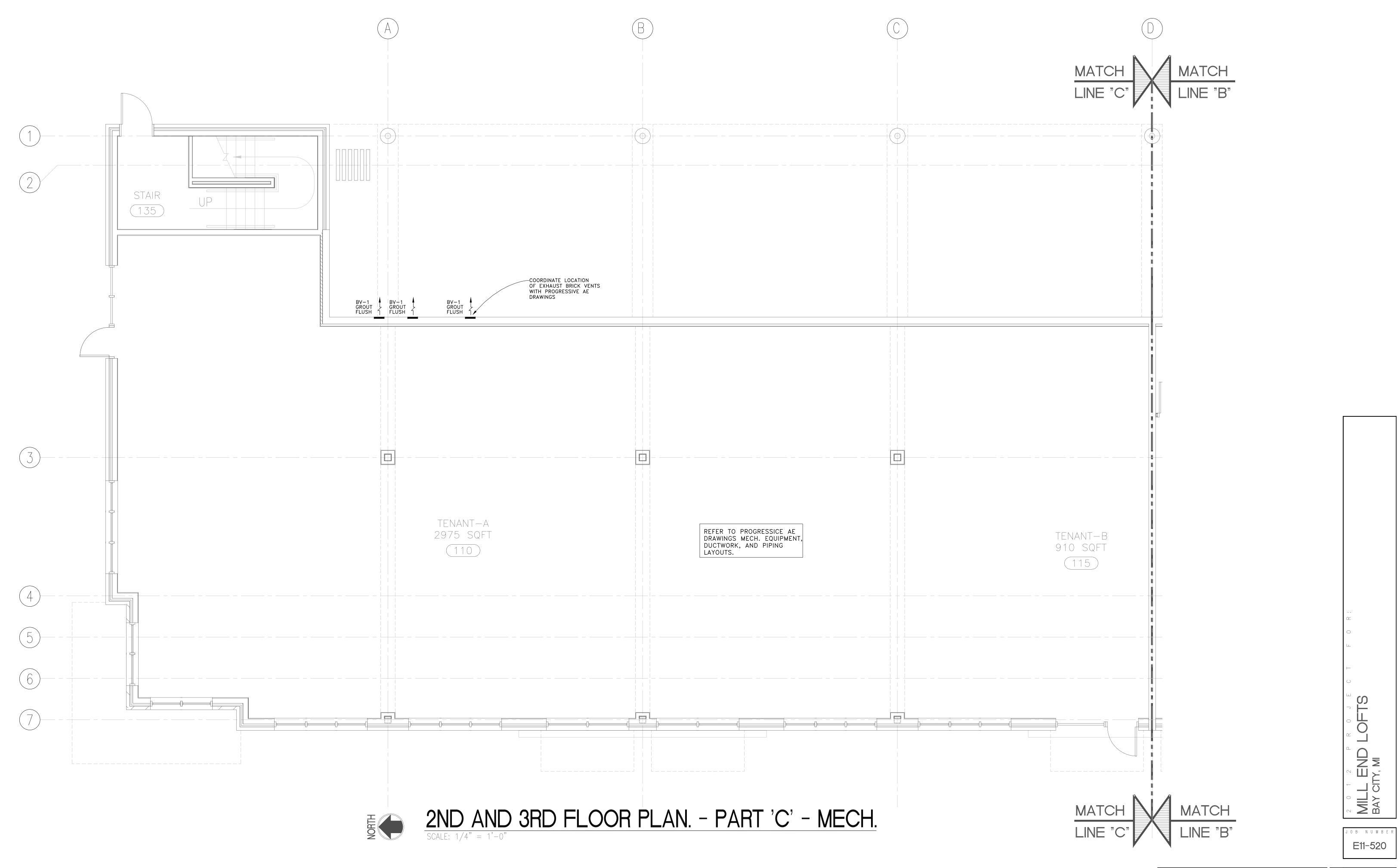
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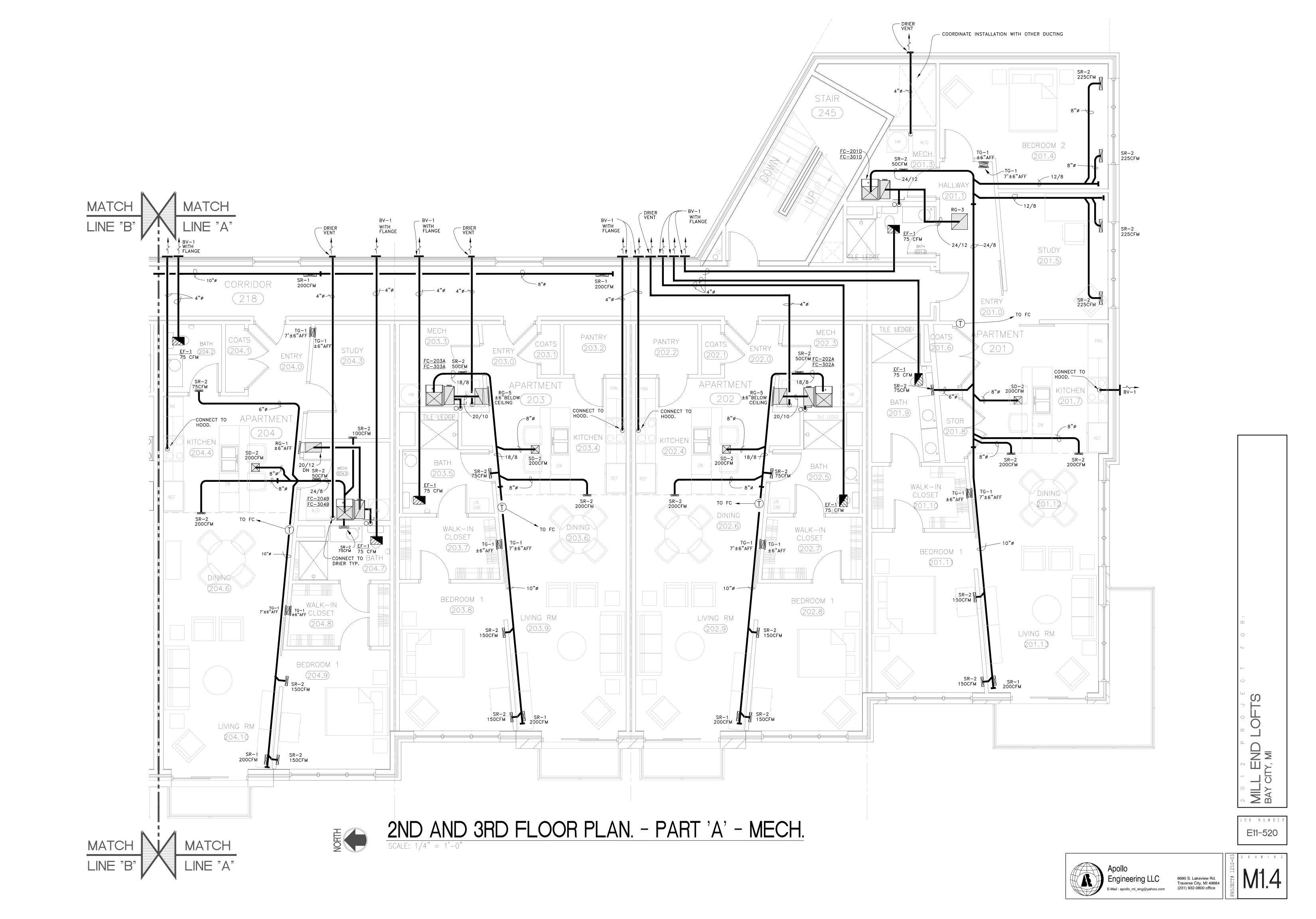


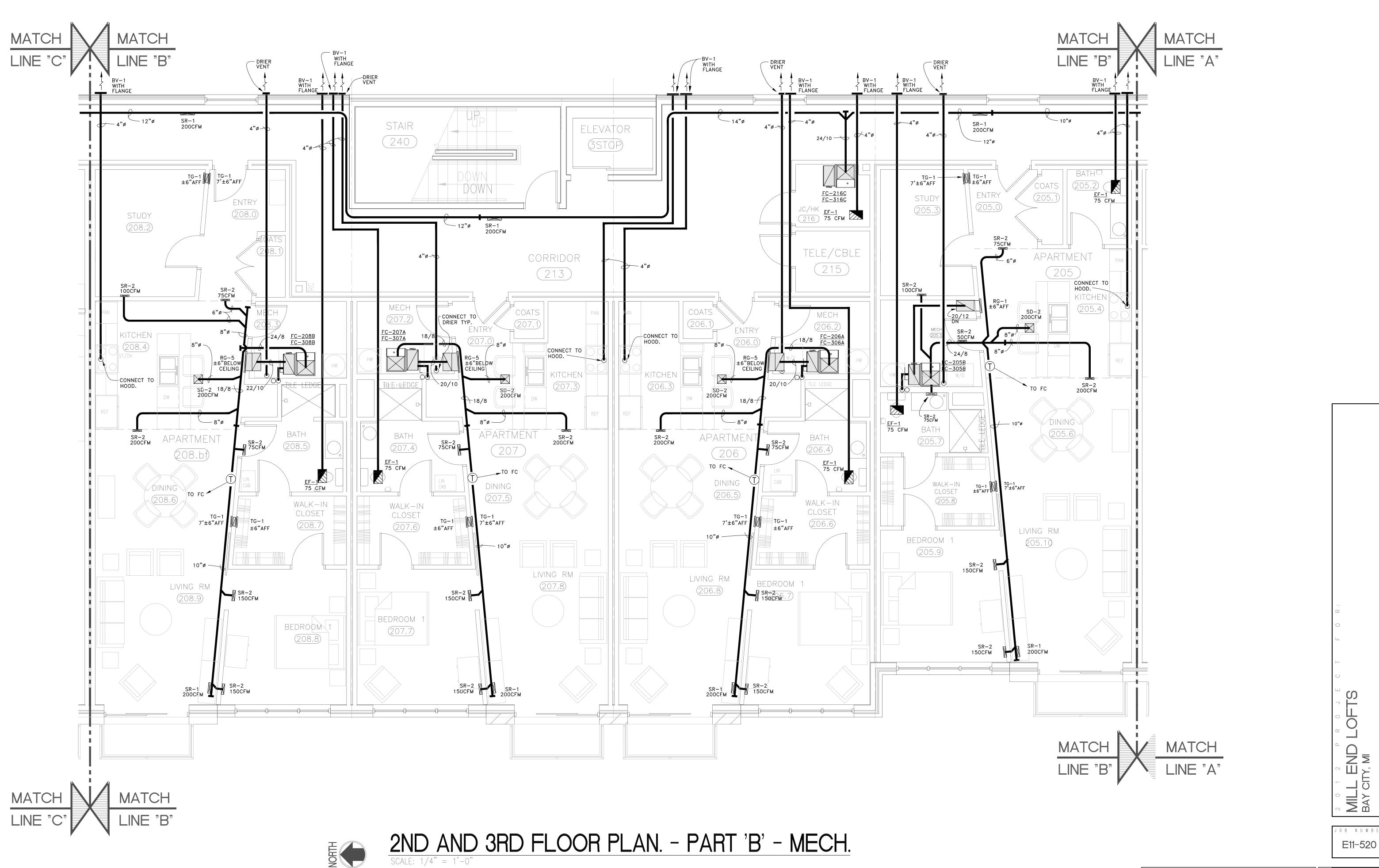




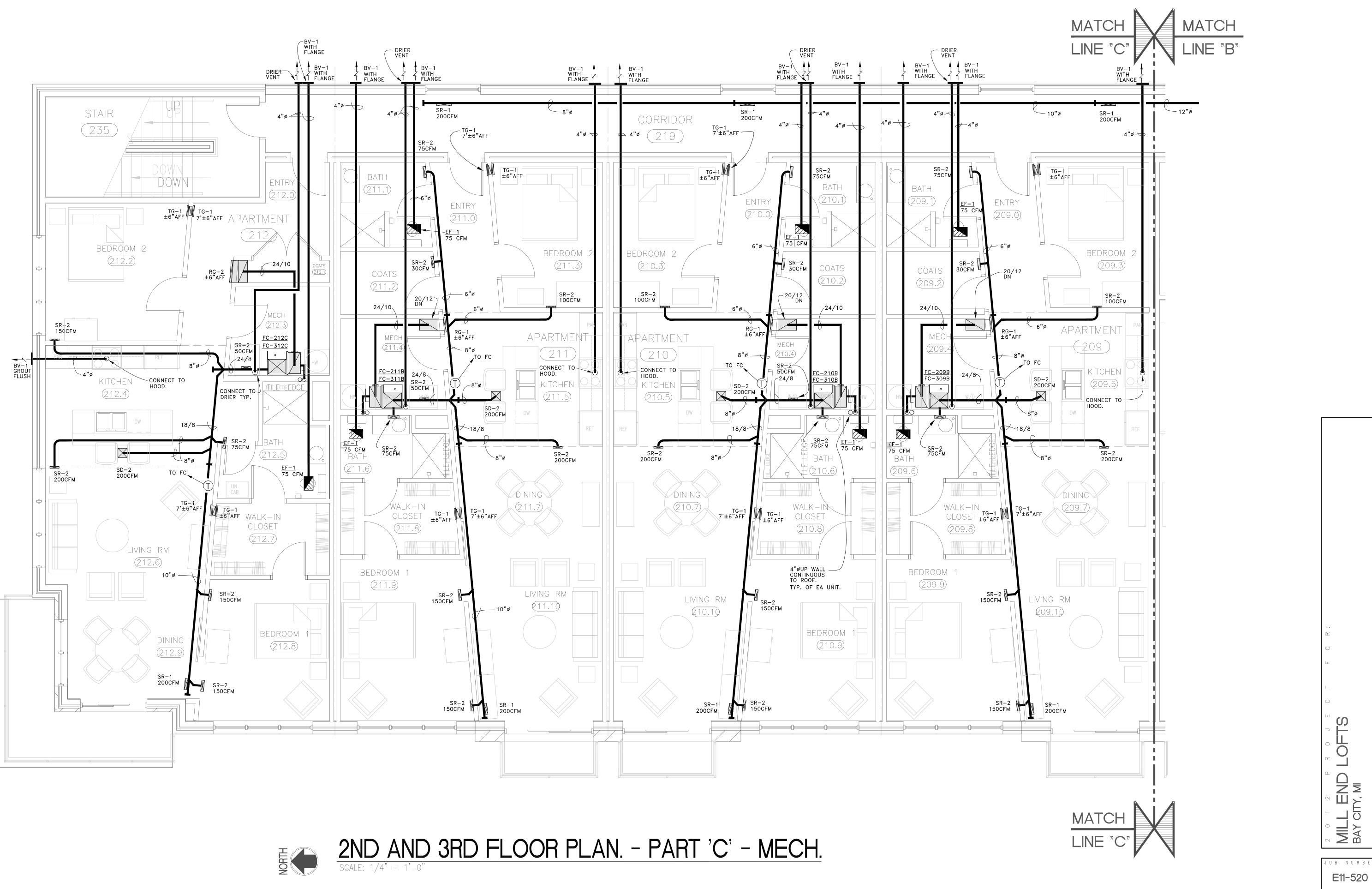












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1. BASED ON, CARRIER, (McQUAY & TRANE MAY BE BID AS EQUAL).

2. PROVIDE ECONOMIZER W/ ENTHALPY SENSOR, 14" ROOF CURB AND AUTO-CHANGE OVER THERMOSTAT.

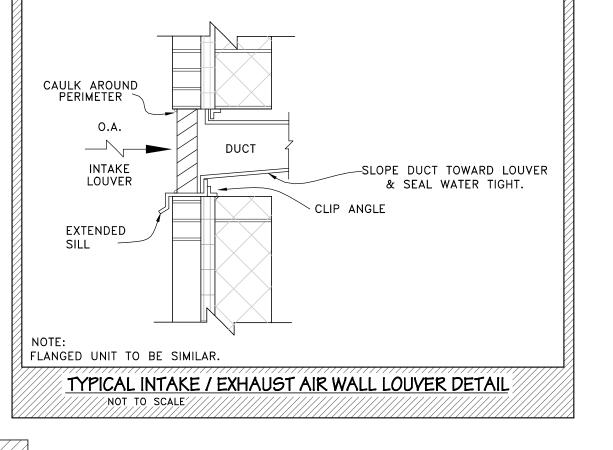
3. PROVIDE DUCT MOUNTED SMOKE DETECTOR IN R.A. AS REQUIRED BY CODE TO SHUT DOWN UNIT UPON DETECTION OF SMOKE. (2000 CFM OR MORE).

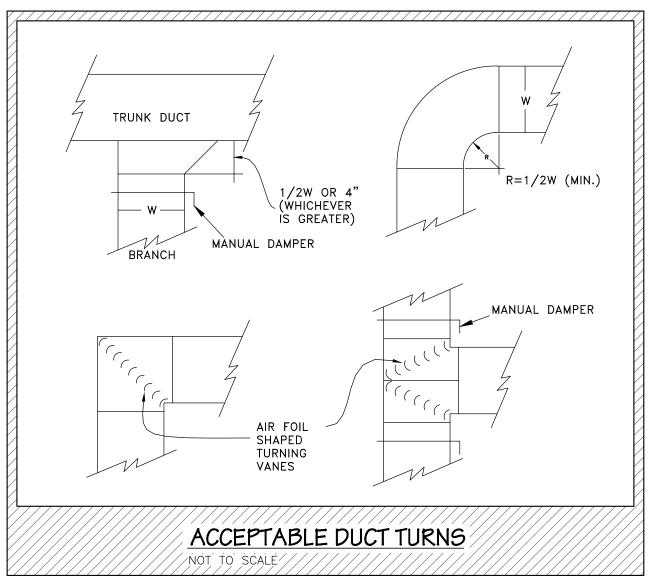
4. HEAT EXCHANGERS TO BE STAINLESS STEEL.

5. UNITS TO HAVE MULTIPLE STAGE HEAT AND COOL (RTU-2 ONLY). RTU-2 TO HAVE 2-SPEED FAN

6. UNITS TO HAVE FUSED DISCONNECT, POWERED GFI SERVICE RECEPTACLE

7. UNITS ARE NATURAL GAS FIRED.





— 1 1/2"INSULATED

ROOF TOP UNIT-

ROOF TOP UNIT'S CURB CAP

INSULATED CURB —

2"x2"x1/4" ANGLE IRON AROUND PERIMETER OF ROOF TOP UNIT'S

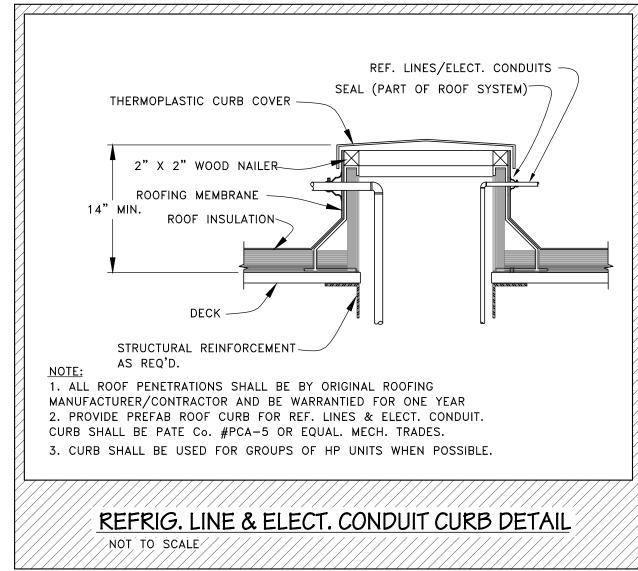
CURB CAP. ANGLE IRON TO SPAN

PREFAB ROOF CURB FOR SUPPLY/RETURN AIR DUCT DROPS. CURBS SHALL BE EQUAL

TO PATE Co. #PSC-5, BY MECH. TRADE.

ROOF DECK INSULATION

FROM CURB TO CURB.—



			HEATP	UMP F	AN COIL	SCHE	DUL	E						
MARK	MANU.	MODEL No.	ORENTAION	CLG. NOM.	HTG. @0°F HIGH/LOW	HEATING ELEC.	CFM	MAX. O.A.CFM	ESP	VOLTAGE	MIN. CIR. AMPACITY	MAX. FUSE SIZE	WT.	REMARKS
FC-XXXA	CARRIER	FE4ANB003-010	VERT./HORZ	24.0	17.0/10.0	7.5KW	900	65	0.50	208v/1ø	4.3	15 CKT B	150	SEE NOTES.
FC-XXXB	CARRIER	FE5ANB004-015	VERT./HORZ	36.0	20.0/10.0	11.3KW	1100	65	0.50	208v/1ø	4.3	25 CKT B	172	SEE NOTES.
FC-XXXC	CARRIER	FE4ANB006-015	VERT./HORZ	48.0	31.0/19.0	11.3KW	1600	65	0.50	208v/1ø	4.3	25 CKT B	200	SEE NOTES.
FC-XXXD	CARRIER	FE4ANB006-015	VERT./HORZ	60.0	33.0/19.0	11.3KW	1990	65	0.50	208v/1ø	6.8	25 CKT B	207	SEE NOTES.
		!												

- 1. BASED ON CARRIER. (BRYANT & TRANE, MAY BE BID AS AN EQUAL)
- 2. UNITS TO DELIVER NOT LESS THAN 15% CFM LESS THEN STATED VALUES.
- 3. UNITS TO HAVE AN ECM FAN MOTOR.
- 4. UNITS TO HAVE "INFINITY" CONTROLS.
- 5. UNITS TO INTERCONNECT TO ROOF MOUNTED HEAT PUMP UNIT. ELECTRIC HEAT TO BE USED AS BACK UP.
- 6. UNITS TO HAVE DUAL STAGE ELECTRIC HEAT. NOTE: TWO POWER SUPPLIES L1,2 AND L3,4. BLOWER FED FROM CIRCUIT "B".

 1_																
7	$\overline{//}$	7,	$\overline{//}$	//	//	//	//	//	$\overline{//}$	$\overline{/}$	$\overline{/}$	/	//	7	7,	7

			HEA	T PUMP	PUNIT SO	CHEDUL	E//			
	MARK	UNIT SERVED	MODEL No.	NOMINAL CLG. CAP.	NOMINAL HTG. CAP.H/L	ELECT OPERATING	RICAL AMPACITY	MOCPD	WEIGHT	REMARKS
//	HP-XXXA	FC-XXXA	25VNA024A0030	25.2/19.2	10.0/17.0	208V, 1ø	23.5A	30A	324	SEE NOTES
/	HP-XXXB	FC-XXXB	25VNA036A0030	35.0/23.2	10.0/20.0	208V, 1ø	23.5A	40A	324	SEE NOTES
//	HP-XXXC	FC-XXXC	25VNA048A0030	47.5/34.8	19.0/31.0	208V, 1ø	36.6A	50A	334	SEE NOTES
//	HP-XXXD	FC-XXXD	25VNA060A0030	56.0/38.0	19.0/33.0	208V, 1ø	36.6A	50A	334	SEE NOTES
/										

MARK	UNIT SERVED	MODEL No.	NOMINAL	NOMINAL ,	ELECT	1	WEIGHT		REMARKS	
	01111 0211125	1110022 1101	CLG. CAP.	HTG. CAP.H/L	OPERATING	AMPACITY	MOCPD	***************************************		
HP-XXXA	FC-XXXA	25VNA024A0030	25.2/19.2	10.0/17.0	208V, 1ø	23.5A	30A	324	SEE NOTES	
HP-XXXB	FC-XXXB	25VNA036A0030	35.0/23.2	10.0/20.0	208V, 1ø	23.5A	40A	324	SEE NOTES	
HP-XXXC	FC-XXXC	25VNA048A0030	47.5/34.8	19.0/31.0	208V, 1ø	36.6A	50A	334	SEE NOTES	
HP-XXXD	FC-XXXD	25VNA060A0030	56.0/38.0	19.0/33.0	208V, 1ø	36.6A	50A	334	SEE NOTES	
NOTES:										
	,	MOST CURRENT).	(BRYANT &	TRANE, MAY BE	BID AS AN	EQUAL)				
	2-STAGE COMPRES			0. LOW AT 15		NIT				
		TED AT HIGH 47DE(F AMBIANT	& LOW AT 15	DEG F AMBIA	INI.				
	FILIZE PURON (410 FILIZE "INFINITY" C	•								
J. GIVIT 10 0	TILIZE IIVI IIVITT C	ONTROLS.								
/////////		///////////////////////////////////////	/////////	////////////		////////	//////	///////	///////////	

		EXHAUST FAN SCHEDULE									
И	MADIC	MODEL No	CEM	FCD	MAX.		ELECTRICAL	DEMARKS			
	MARK	MODEL No.	CFM	ESP	SONES	VOLT., PHASE, POWER	CONTROL	REMARKS			
	EF-1	FV-08VQC5	75	0.15"	0.3	120V, 1ø 15.6W	WALL SWITCH CONTROL W/ MOTION AND HUMIDITY	BACKDRAFT DAMPER AND WALL CAP.			
	BF-1	BN-640	400	0.25"	3.4	120V, 1ø 1/3HP	T-STAT. CONTROL COOLING ONLY.	BACKDRAFT DAMPER AND CEILING GRILLE			

BALANCING | COLOR

REMARKS

NO WHITE BORDER TYPE 1

. EF-1 BASED ON PANISONIC. BF-1 BASED ON LORREN COOK. GREENHECK MAY BE BID AS EQUAL.

2. PROVIDE BACKDRAFT DAMPER, CEILING GRILLE, AND STD, INTERNAL CONTROLS.

	ROOFING MATERIAL
	SUPPORTS BY STRUCTURAL TRADE NOTES: INSTALL UNIT AS PER CODES. MAINTAIN REQUIRED CLEARANCE TO COMBUSTIBLES. PROVIDE GUARD RAILS AND PLATFORM AS REQUIRED BY CODE.
	CURB SECTION DETAIL NOT TO SCALE
WALL LOUVE	R SCHEDULE

			WA	ALL LOL	VER SCHE	DIJI F				
MARK	MODEL No.	UNIT SERVED	TYPE	CFM	SIZE W x H	REMARKS				
BV-1	BV100	UNIT EXAUST	EXHAUST	68-100	8" x 8"	SEE NOTES				
BV-2	BV100	UNIT INTAKE	INTAKE	120-300	16" x 8"	SEE NOTES				
L-1	ELF-211	FC-110	INTAKE	675	24" x 12"	SEE NOTES				
NOTES:										
1. BASED ON RUSKIN. (AMERICAN WARMING MAY BE BID AS EQUAL.) 2. PROVIDE FLANGE, BIRD SCREEN AND BAKED ENAMEL FINISH.										

	SD-1	TDC	125-200	9"x9", 8"ø NECK	YES	WHITE	BORDER TYPE 1, SEE NOTE #4
	SR-1	S300FL	100-250	12"x6", MATCH DUCT Ø	YES	WHITE	SEE NOTES
	SR-2	300FL	100-250	12"x6"	YES	WHITE	SEE NOTES
	RG-1	33RS	900-1600	12"Wx42"H	NO	WHITE	BORDER TYPE 1
	RG-2	33RL	1600	24"x24"	NO	WHITE	BORDER TYPE 1
	RG-3	50F	2000	24"×24"	NO	WHITE	BORDER TYPE 1
	RG-4	33RL	1600	36"x18"	NO	WHITE	BORDER TYPE 1
	RG-5	33RL	900	24"x12"	NO	WHITE	BORDER TYPE 1
	TG-1	355FL	100-400	14"x14"	NO	WHITE	BORDER TYPE 1
1/							ľ

DIFFUSER / GRILLE SCHEDULE

TG-2 355FL

MARK | MODEL No

- . BASED ON TITUS. (PRICE OR KRUGER MAY BE BID EQUALS.)
- 2. REVIEW COLOR W/ARCHITECT BEFORE ORDERING.
- 3. ALL SUPPLY REGISTERS ON SPIRAL DUCTWORK TO HAVE AIR SCOOP AND TO BE PAINTED TO MATCH DUCTING. 4. ALL SUPPLY AIR DIFFUSERS SHALL HAVE A 4-WAY AIR PATTERN UNLESS OTHERWISE INDICATED (SEE PLANS).
- 5. PROVIDE ALL DUCT COLLARS, TRANSITIONS, CONNECTIONS AND SUPPORTS.

400 24"x8"

6. PAINT INSIDE OF DUCT BEHIND REGISTERS AND GRILLES FLAT BLACK.

SPLIT SYSTEM HEAT PUMP UNIT DESCRIPTION

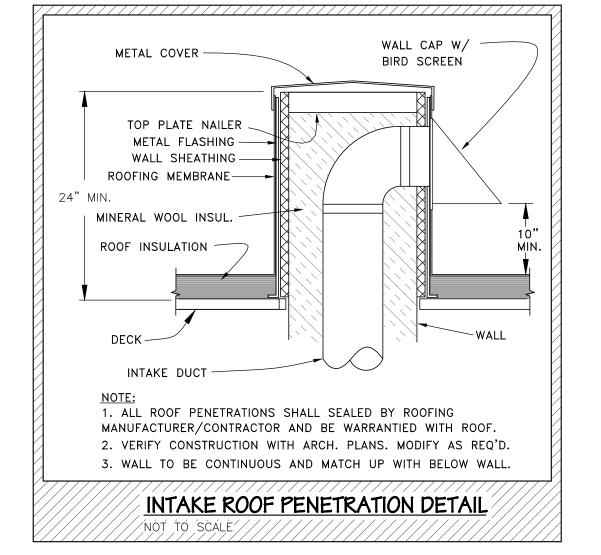
AIR CONDITIONING

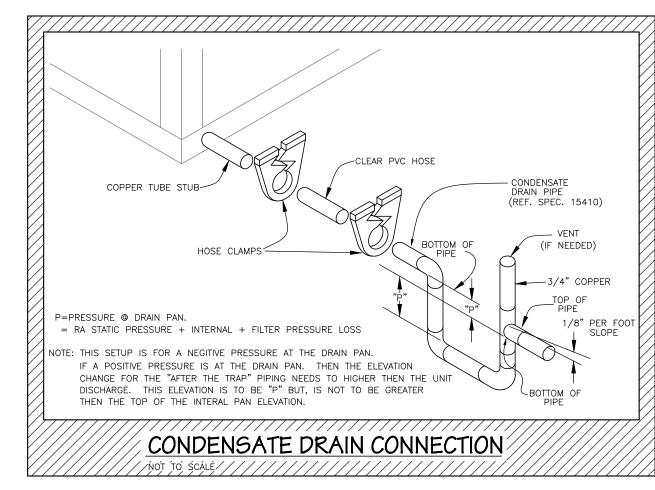
DUCTLESS SPLIT HEAT PUMP, EQUAL TO MITSUBISHI PKA-A18HA4, 1 1/2 NOMINAL TONS AT 425 CFM, 24VDC.

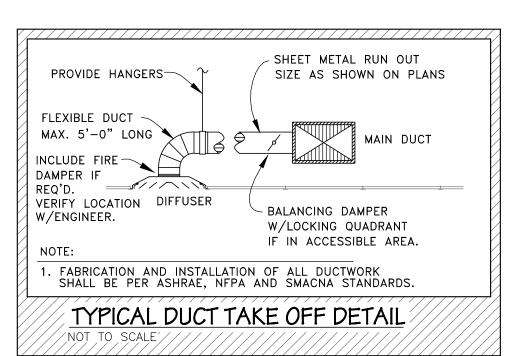
WEIGHT 29 LBS.

3. REVIEW COLOR W/ARCHITECT BEFORE ORDERING.

<u>AC-102</u> HEAT PUMP UNIT, EQUAL TO MITSUBISHI PUZ-A18NHA4 COMP. UNIT 8-18MBH COOLING/ 8-20MBH HEATING, 208V, 1PH, <u>HP-102</u> 13.0A MCA, OPD = 20. WEIGHT = 91 LBS.











PART 1 - GENERAL 1.01 DESCRIPTION OF WORK

A. This Division includes all labor, materials, equipment, tools, supervision, start-up services, Owner's Instructions, including all incidental and related items necessary to complete installation and successfully test and start up and operate in a practical and efficient manner the Mechanical Systems indicated on Drawings and described in each Section of Division 15 Specifications and conforming with all Contract Documents

B. Bidding: the Contractor shall bid the project in strict accordance with the plans and Specifications. Alternative methods or materials, beyond those indicated as "Base Bid", proposed by the Contractor shall be in the form of a voluntary alternate, with all details indicated, and a separate add or deduct price for these changes submitted with the Contractor's bid. (Reference General Requirements - Product Substitutions)

C. Mechanical systems complete and in place, shall include the following: SECTION 15.000 MECHANICAL GENERAL PROVISIONS

ECTION 15.050 BASIC MECHANICAL MATERIALS AND METHODS SECTION 15.140 SUPPORTS AND ANCHORS SECTION 15.260 THERMAL INSULATION

SECTION 15.410 PLUMBING PIPING ECTION 15.430 PLUMBING SPECIALTIES SECTION 15.890 DUCTING SECTION 15.985 SEQUENCE OF OPERATION

SECTION 15.990 TESTING, ADJUSTING AND BALANCING

D. The General Provisions of this Contract, including General and Supplementary Conditions and other General requirements Sections, apply to the Work specified

E. This Section is not intended to supersede, but to clarify the definitions in Division 1, General Requirements and Supplementary Conditions.

F. <u>Drawings and Specification</u>

. Drawings and Specifications are intended to complement each other, and all work specified and not shown or work shown and not specified shall be provided as though mentioned in both specifications and drawings.

2. Minor items and accessories or devices reasonably inferable as necessary to the complete and proper operation of any system shall be provided by the Contractor or Subcontractor for such system, whether or not they are specifically called for by the specifications or drawing

3. Drawings are diagrammatic and indicate general arrangement of systems and work included in the Contract, and shall serve only as design drawings, to represent design intent for general layout of various equipment and systems and not intended to be scaled for rough-in measurements or to service as measured shop drawings.

4. If directed by the Engineer, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work. (Refer to General Requirements for co-ordination between 1.02 RELATED WORK

A. Section 16000 - Electrical General Provisions B. All building construction documents

1.03 COORDINATION OF WORK

A. Responsibility

1. The Mechanical Contractor shall be responsible for his Sub-Contractors and Suppliers, and include in his bid all materials, labor, and equipment involved and install in accordance with all local customs, codes, rules, regulations, jurisdictional awards, and decisions; and secure compliance of all parts of the Specifications and Drawings regardless of Sectional inclusion in these Specifications.

2. The Mechanical Contractor and Sub-Contractor shall be responsible for all tasks applicable to their trades as directed by the General Contractor, in accordance with the Specifications. Drawings, and code requirements, and shall be responsible for coordinating locations and arrangements of their work to give best results with all other relevant Mechanical, Architectural, Structural and Electrical Contractors' Specifications, Drawings and shop drawings.

Coordinate work so that sprinkler heads, lights, diffusers, etc. are coordinated into Project and are installed per the architectural reflected ceiling plan.

B. Site and Project Document Examination 1. Submission of a proposal is considered evidence that the Contractor has visited site and acquainted themselves with all existing conditions, made all

necessary measurements, examined the Drawings and Specifications of all trades, including Mechanical, Architectural, Structural, and Electrical, and has fully informed himself with all Project and site conditions, and is proficient, experienced and knowledgeable of all standards, codes, ordinances, permits and regulations which affect the installation of his respective trade, and that all costs are included in his proposal 2. No allowance shall subsequently be made in his behalf for extra expense incurred due to failure or neglect on his part to make this visit and examination.

3. The Mechanical Contractor and/or Sub-Contractor shall obtain all required permits and assessments have been obtained prior to starting work. Contractor shall verify requirement to include privilege fees and permits as part of his formal bid, as described in General and Supplementary Conditions. 4. It is the responsibility of the Contractor to notify the Engineer, prior to submitting his bid, of any potential problems that he has identified during his site

C. General Supports: 1. Provide all necessary angle and channel brackets or supplementary steel as required for adequate support for all piping, specialties, and equipment which is hung or mounted above floor. No trade shall hang equipment from work of another trade (such as sprinkler lines hanging from heating lines or electrical conduit). Secure approval from Architect, in writing, before welding or bolting to steel framing or anchoring to concrete structure.

2. Where piping or equipment is suspended from concrete construction, set approved concrete inserts in formwork to receive hanger rods, such as Unistrut or Powerstrut, and where installed in metal deck, use Ramset or Welds as required.

1. No valve, trap, control, fire damper, duct access opening, etc., shall be installed in inaccessible locations without access panels. Any subcontractor have items requiring access shall also include access panels for same unless Drawings indicate otherwise. Contractor shall be responsible for quantities of panels and receive approval for locations of panels from Architect/Engineer before installation.

2. Any wall, ceiling, or floor access panels required shall be equal to Milcor with hinged door and latch. Those in walls or floor shall be type to accept finished

3. Removable ceilings or sections of ceilings are acceptable as access panels. Panels in rated construction shall have U.L. label and proper rating and construction to match partition, ceiling, or roof assemblies in which they occur.

4. Purchase proper access panel, coordinate location, have General Contractor install access panel, and reimburse for installation. This trade is to coordinate the access panel manufacturer with the architectural access panels. E. <u>Field Changes</u>: 1. This Contractor shall not make any field changes which affect timing, costs, or performance without written approval from the Architect/Engineer in the form

of a Change Order, Field Change Order, or a Supplemental Instruction. In special circumstances, verbal approvals pending paperwork may be acceptable.

The Contractor assumes liability for any additional costs for changes made without such instruction or approval. Should any unauthorized change be determined by the Architect/Engineer as lessening the value of the project, a credit will be determined and issued as a change to the contract in accordance

with the General Requirements. $1.04 \; \underline{\text{STANDARDS}}, \, \underline{\text{CODE AND PERMITS}}$

A. Refer to General Requirements and Supplementary Conditions

B. All work installed under Mechanical Sections shall comply with latest edition of applicable standards and codes of following: ADAG Americans with Disability Act Guidelines Title III

American Standards Association American Society of Mechanical Engineers SMACNA Sheet Metal & Air Conditioning Contractor Association

ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers American Society of Treating, Reingeral American Society of Testing Materials American National Standards Institute

American Gas Association American Water Works Association

Institute of Boiler and Radiator Manufacturers Underwriter's Laboratories

NEMA National Electric Manufactures Association NESC. National Electric Safety Code (H13)

American Refrigeration Association Occupational Safety and Health Ac American Boiler Manufacturers Associ

BOCA Mechanical and Plumbing Code as Amended by State of Michigan CAGI Compressed Air and Gas Institute

C. All work shall be provided and tested in accordance with all applicable local, county, and state laws, ordinances, codes, rules, and regulations

D. Contractor shall give all notices, file all drawings, obtain necessary approvals, obtain all permits, pay all fees, deposits, and expenses required for installation of

E. No work shall be covered or enclosed until work is tested in accordance with applicable codes and regulations, and successful tests witnessed and approved by authorized inspection authority. Written approvals shall be secured by Contractor and kept on file for inspection by the Engineer. F. In general, all material, where applicable, shall be labeled or listed by Underwriters' Laboratories, Inc.

G. In the event that plans and specifications conflict with any rules, regulations, or codes applying, said rules, regulations, and codes shall govern the Contractor.

1.05 SUBMITTALS A. Shop Drawings 1. After a schedule of Sub-Contractors is approved by the Engineer, submit six (6) neatly bound copies of shop drawings (or number as directed by General

nts) with one device or fixture of each type clearly identified (high-lighted, bolded, underlined, etc.) in each set on equipment and materials indicated on drawings or in the specifications

2. Submit complete manufacturer's shop drawings of all equipment, plumbing fixtures, accessories, and controls, including dimensions, weights, capacities, construction details, installation, control methods, wiring diagrams, motor data, etc. 3. Engineer's approval of shop drawings is for general application only, and is a service that is not considered as a guarantee of total compliance with, or that relieves the Contractor of basic responsibilities under all Contract Documents, and does not approve changes in time or cost.

4. After approval, each Contractor is responsible for expeditiously providing information to all other trades involved in, or affected by, installation of his

B. Operating and Maintenance Instructions and Manuals:

1. Each Contractor shall provide for all major items of equipment two (2) copies, in 3-ring notebooks, of indexed sets of operating and maintenance instructions to Engineer for approval. After approval, manuals will be given to Owner by Engineer.

2. Manuals shall include a complete set of shop drawings submitted, repair parts lists, manufacturer's standard equipment manuals, valve tag schedule, and automatic control diagrams, all indexed with tabs for each section. Typewritten instructions regarding the starting and operating of all equipment and accessories. Operating instructions shall be encased in plastic and

mounted in mechanical room. Provide additional copies of above materials in 3-ring notebooks. Operating instructions within notebooks shall als ude locations of temperature control devices, switches, and equipment (including air handlers, pumps, etc.). Also, include steps of trouble-shooting

Provide a list of all mechanical contractors and subcontractors, including contact person and day/night telephone numbers. Upon completion of work controls, etc.

PART 2 - PRODUCTS 2.01 MATERIALS AND EQUIPMENT

A. Standards:

1. All products shall be provided by established manufacturers regularly engaged in making the type of materials to be provided and shall be complete with all parts, accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

1. Contractor and/or Equipment Supplier may propose alternate equipment or materials of equal quality, function, durability, and appearance as described and permitted in Specification Section 15000, 1.01.B. The substitution will take the form of an "Add-Deduct" at the time of bid submittal. It is the submitter's responsibility to provide sufficient material for review as may be required by the Engineer's office. Acceptance and approval is the responsibility of the

2. No substitutions will be accepted, except as authorized in a Project Addendum.

3. Contractor and/or Equipment Supplier is liable for any added costs to himself or others, and is responsible for verifying dimensions, clearance, and roughing-in requirements, when product not specifically named or described as the basis of design is used. The Contractor is responsible for advising other contractors of variations and, if requested, submitting revised drawing layout for approval of the Engineer C. Explanation of Scheduled Manufacturers:

 Base Bid. This term designates that this equipment will be the product which the contractor generates his bid from. It is usually a component that is critical to maintaining the design intent. No other equipment suppliers will be allowed to bid as an equal. 2. Based On. This term designates that the equipment is designed around a certain product. Products of equal status are listed and may be bid as if they were the basis of design. The based on equipment shall serve as the standard to which equals will be judged.

2.02 ELECTRI CAL REQUIREMENTS

A. Motor Starters and Controls 1. Electrical Contractor shall provide all manual or magnetic motor starters as required for motors as indicated on the Electrical Drawings and specified in

Mechanical Contractor shall provide factory installed motor starters and/or safety switches, integral with packaged equipment, containing thermal over current protection in ungrounded conductors with heater coils selected for specific motor usage for motors. B. "Package equipment" shall be defined as Mechanical, Architectural, Civil, or other Trade's equipment, and which is specified in other divisions of this specification, and which shall be furnished and installed complete with all associated electrical components by those trades.

Other Trades providing package equipment shall also provide both integral and remotely located devices if necessary for a complete system, ready for operation except for a single incoming power source. These devices may include main disconnect switches, heavy duty disconnect switches, starters, control transformers, interlocks, relays, fuses, terminal blocks, capacitors, wire, wire and devise identification, conduit, and other necessary components. Any special work to be provided under this division of the specifications outside the definition of package equipment shall be as noted on the drawings anying these specifications, or as specially noted after the package equipment list entry hereinafte

B. Electrical Wiring and Controls:

1. Mechanical Contractor shall provide all motors, drives, and controllers integral to packaged equipment and factory mounted controls for all mechanical equipment. When pre-wired equipment is used, control circuit shall be separately fused at control transformer, and shall always revert to a fail-safe

2. Mechanical Contractor shall provide electrical devices requiring mechanical/electrical connections, such as pressure switches, limit switches, float switches,

3. Electrical Contractor shall install power wiring and conduit to motors and/or factory mounted control panels as indicated on Drawings or in specifications. 4. All electrical wiring work by Mechanical Contractor shall be in accordance with Division 16 requirements.

PART 3 - EXECUTION

3.01 CONNECTIONS AND SERVICES

A. Connections to Existing Lines Within Building: 1. Where existing lines are indicated on Drawings, connection shall be on an "as found" basis. Include all necessary costs to make proper connection.

2. Locate, identify, maintain, and protect existing mechanical services passing through demolition area and serving other areas outside the demolition limits Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas. B. Connecting Into Existing Facility and Street Lines:

 Connection into existing service and street lines shall be on an "as found" basis. All service interruption shall be coordinated with Owner and public utility.
No interruption of utilities shall be made without prior arrangement with Owner.
 Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations. Continuity of all existing utility services in building shall be maintained throughout construction period. Where new services are to be tied into existing services, it shall be done when and as directed by Owner, General Contractor, or Engineer.

3.02 CLOSEOUT

Final acceptance and payment will only be made after the final check list completion and receipt at Engineer's office of: Test Reports

Operating and Maintenance Instruction Manuals (2) Record Drawings (As-Built) Certificates of Inspection Lubrication and Valve Charts

Maintenance Contracts, if required Spare Parts (i.e. filters, etc.) Test and Balance Reports - Air and Hydronic

B. Certificates of Inspection and Test Reports The Contractor is to provide the Engineer with evidence that the installation has been inspected and approved by municipal or state inspector having jurisdiction over that phase of work involved, i.e., plumbing, heating, boiler, fire protection, refrigeration, etc.

C. Guarantees and Warranties: 1. During the one year guarantee period (except if General Requirements specify a longer warranty period), make two complete inspections (at approximate B months and 10 months) of all systems, fixtures, equipment, safety devices, and controls to ensure that the equipment is operating properly, and report to the Engineer in writing. The visits are to be coordinated with the owner.

1. Maintain a white-print set of Mechanical Contract Drawings in clean, undamaged condition for mark-up of actual installation on Contract Drawings, which

1. Provide instruction of Owner's personnel in operation and maintenance procedures for all systems equipment such as boilers, HVAC equipment, temperature controls, etc.

2. Provide the Owner with instructions on the location of hand valves, and other concealed items, etc.

vary substantially (i.e. location of piping, ductwork, size changes, etc.) from the work as shown

F. Placing Systems into Operation: 1. Mechanical Contractor shall be responsible for all start-up procedures, system checks and balancing, and coordinating work of other Contractors and

3. Permanent equipment may be operated during construction only with adequate protection from damage and dirt by filtering of air using minimum 30% efficient filters or straining of fluids, and replacing as often as necessary to keep mechanical systems reasonably clean and dust free and replacement at

2. All equipment shall be installed, tested and operated in accordance with the manufacturer's recommendations at normal operating conditions

4. Place all systems into operation, when weather or other considerations require their use. Perform repair, adjustment and balancing operations as often as required to assure satisfactory operation before final acceptance. 5. Check, test and adjust pressure reducing and relief valves, thermometers, gauges, meters, safety controls and devices, and other instruments and controls

a. Make necessary tests to provide leak-proof and code-tested system under operation. Make tests before work is concealed or covered and perform all necessary repairs as required or as otherwise indicated by test results. b. See subsequent trade sections for additional requirements.

c. Soil, waste, and vent piping shall be closed and tested with water at head equal to highest fixture. d. Domestic hot and cold water piping and all heating lines shall be tested at 125 PSI. Gas piping shall be tested at 125 PSI with soap bubbles.

Standards. Balancing must be completed and report submitted before Engineer completes final check list

1. Subsequent to the installation of the heating, piping, and air distribution systems and upon the beginning of operation, the Contractor shall make all necessary adjustments to equipment, control dampers, fans, and any other equipment installed by him under this Contract so as to ensure proper operati of the same. The Contractor shall be responsible for balancing the air system to deliver the air quantities shown on the Plans. This shall include changing fan speeds, belts, drive, sheaves, and drive guards as required to properly balance these systems. The Contractor shall be responsible for balancing the hydronic system to deliver the flow required to service each device as shown on the plans. This shall include changing impellers, pumps, auto flow control valves and circuit setters, as required to properly balance these systems. The Contractor shall have an independent AABC or NEBB subcontractor submit (copies of his balancing work sheets indicating preliminary and final results. All balancing shall be performed as specified in the SMACNA Manual and ADC

A. All labor, materials and equipment shall be guaranteed by Contractor and/or warranted by the Manufacturer for one year after acceptance date and/or one <u>normal continuous complete season's operation</u> applicable to equipment or system except where specified longer for special equipment. such warranty from all Suppliers or the Contractor will assume the warranty and issue an Insurance Policy to the owner. B. Acceptance date of substantial completion shall be Owner occupancy as determined by Architect/Engineer.

with Drawings and Specifications at no cost to Owner. The Contractor shall repeat as often as necessary to give satisfactory system in opinion of Engineer. D. Repair or replacements made under guarantee shall bear further one year guarantee from date of acceptance of repair or replacement

A. All services and requirements of the commissioning agent (CA) shall be completed in a timely manor. B. All reports, training, and TAB services shall be completed as required in construction documents.

SECTION 15 050

PART 1 - GENERAL

This Specification is intended to describe general mechanical systems' methods and materials.

1.01 RELATED WORK A. Section 15000 - Mechanical General Provision B. Section 16000 - Electrical General Provisions

1.03 PIPES AND PIPE FITTINGS

BASIC MECHANICAL MATERIALS AND METHODS

1.02 WORKMANSHIP

A. Install work in accordance with best practice of trade.

1. Install new piping and ductwork straight and true with no unnecessary offsets and parallel with walls, beams, floors, or ceilings. 2. Install new piping so as to be completely drainable. Provide drain cocks and capped hose adapters at all low points in piping system

3. Provide for expansion and contraction of piping at bends or risers. Install piping so as to be free from pockets due to sagging. 4. Where no elevation is indicated, piping and ducts suspended above and/or below ceilings shall be hung as high as possible.

5. No piping shall be installed in a manner which will interfere with necessary passage or head room, with operation of any doors or windows, with ductwork, lay-in ceiling panels, lighting outlets or fixtures, or Owner's equipment. 6. No piping over electrical equipment, elevator machine rooms, electrical rooms, and telephone rooms without prior approval from Architect/Enginee

 $1. \ \ Coordinate with work of other trades. \ \ Piping shall not be supported from ductwork or piping of other trades.$

10. Install sectionalizing valves at main branch lines where branch connects into mains.

Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection

2. Support piping from structure using approved hangers; pipe straps shall not be permitted. 3. Allow for adequate expansion and contraction while maintaining alignment. Provide expansion joints or loops as required.

4. Use reducing fittings when changing pipe sizes. Bushings and "Orange Peeling" shall not be permitted 5. Terminate piping to fixtures and equipment furnished by others including stop valves. 6. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.

7. Install unions adjacent to each valve, and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.

8. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged) which effectively isolate dissimilar metals, to prevent galvanic action, and stop corrosion. 9. Install flanges in piping 2-1/2" and larger, adjacent to each valve, at the final connection to each piece of equipment, and elsewhere as indicated.

 $11.\mbox{Fit}$ all openings in piping with temporary plugs and caps during construction. 12. Insulating couplings shall be installed at all locations where copper piping connects to other metals and in gas piping at meter connections. 13.If leak occurs, pipe or fitting shall be replaced with new length or fitting. Ream out all pipe ends. Clean out debris and excess oil before installing. Use

approved lubricant for all threaded joints. Do not stop leaks by adding caulking to joints 14. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade of floors, unless indicated otherwise.

17.Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2" with reinforced top.

18. Drip Pan Installation: Locate drip pans under piping, passing over or within 3" horizontally of electrical equipment, under roof relief vents, and elsewhere as indicated. Hang from structure with rods and building attachments, attach rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1"

15.Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves. 16. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained. Refer to ral Drawings or Plans indicating walls, floors, or ceilings requiring ratings and the amount of rating.

drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

L. Piping passing through concrete and masonry walls and floors shall be sleeved; wall sleeves shall be cut back 3/8" from face of wall

2. Sleeves shall be fabricated from sections of steel pipe, 1/2" to 1" larger than pipe or insulation. 3. Sleeves passing through floors shall extend 3/8" above floor. Void between sleeve and pipe shall be caulked water tight. Use fire-rated sealants at rated

4. Sleeves shall be permanently mortared in. 5. Where pipes pass through exterior walls, seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal. Pipe to be sealed with 100% Silicone caulking to create an air tight seal.

6. Wherever pipes are exposed and pass through walls, floors, partitions, or ceilings, they shall be fitted with chromium plated escutcheons, held in place by internal spring tension. Escutcheons shall be large enough to fit over insulation on insulated pipes. 7. Plumbing vent stacks passing through roofs shall have a vent collar/seal installed.

C. Pipe Joints:

a. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Apply pipe joint lubricant or sealant suitable for the service

b. Pipe Larger than 2": Weld pipe joints for steel pipe (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31. 2. Brazed and Solder Joints: For copper tube and fitting, braze joints in accordance with ANSI B31.1.0 - Standard Code for: a. Pressure Piping, Power Piping; ANSI B9.1 - Standard Code for Mechanical Refrigeration

b. Solder: Type of solder shall conform to following schedule:

Hot and cold water and recirculating lines - lead free solder. Heating piping - lead free solder.

Drain piping - lead free material if possible.

Condensate drain piping - lead free solder

Refrigerant hot gas and liquid lines - silver braze. Refrigerant suction lines - silver braze.

a. Qualifications: Welders shall be qualified according to provisions of ASME Standard Qualifications for Welding Procedures, Welders and Welding perators, or ASME Boiler and Pressure Vessel Code for class of piping being welded. Submit welding qualifications for all welders on project when

requested by Engineer. b. Welding Procedure: Preparation of base metals and welding procedures shall conform to ASME American Standard Code for Pressure Piping. c. Filler Material: Conform to ASTM Specifications compatible with base metal being welded.

d. Field Fabricated Fittings: Mitered or segmental elbows, swages, orange-peel, bull plugs, or similar construction will not be permitted. e. Branch Connections: Welding of branch connections directly to run will be permitted in lieu of tees, laterals, or crosses when branch sizes are less than 1/2 of main size unless detailed otherwise. Branch pipe shall not project beyond inside of main. Failure to comply with accepted standards of

a. Provide thick ring of oakum tightly into hub of pipe, pour hub full of non-lead material and caulk. Connections between steel and cast iron pipe shall be caulked with oakum and non-lead material.

b. Tyler "XH" extra heavy TY-Seal Gaskets may be used in lieu of caulked joints for buried cast iron pipe.

5. Mechanical Joints or Shove-On Joints: Follow manufacturer's recommendations for joint assembly. Provide socket clamps with tie rods at all dead ends, run outs, direction changes, and similar locations where other means of anchoring are not provided. D. <u>Pipe</u>:

workmanship in making weld-in branch lines shall require that these connections be removed and replaced with ASA B 16.9 fittings.

 Highest quality, mild steel. b. Manufacturer's name shall be stamped or rolled into each length of pipe.

2. Black Steel Pipe: a. Pipe: Schedule 40, ASTM-A-120 Use: Above ground gas piping.

Steel Pipe:

b. Screwed Fittings:Use: 2" and under accessible locations.

i. Type: 150# malleable iron-banded. ii. Unions: Ground bronze to iron seat with extra heavy body and nuts.

iii. Nipples: Same as pipe, except use Schedule 80 for short and close nipples. Use: Over 2" and non-accessible locations.

i. Type: 150# W.P. - conforming to ASTM A234 Grade WAPB, and U.S.A.S. B 16.9 butt weld. iii. Unions: Companion flanges, 150# raised face, slip-on conforming to U.S.A.S. and ASTM specifications; use welding neck flanges at pump connections.

3. <u>Galvanized Pipe</u>: Schedule 40, ASTM A-120. Screwed fittings for waste, drain, and vent piping.

E. Sanitary Pipe and Storm Water Pipe and Fittings:

2. PVC Pipe:

b. Fittings: ABS

1. ABS Pipe: a. Santary Sewer and Storm Water Piping, Buried Beyond 5 Feet of Building: ABS pipe: Schedule 40 ASTM F 628 or ASTM D 2282 - 99(2005). Fittings:

b. Sanitary Sewer and Storm Water Piping Above Grade (In Exposed Areas): ABS pipe: If used in exposed areas, piping must be covered with minimum 1"

fiberglass insulation with approved fire resistance rating. NOTE: Exposed is defined as a pipe that is exposed to view or installed above an accessible ceiling inside a building. Not approved for vertical runs in interior walls.

a. Sanitary Sewer and Storm Water Piping, Buried Beyond 5 Feet of Building: PVC pipe: ASTM D3033 or D3034, SDR 35. Fittings: PVC. Joints: ASTM

b. <u>Sanitary Sewer and Storm Water Piping, Buried and Above Grade, but Concealed Within Building</u>: PVC pipe: ASTM D2665, D3034. Fittings: PVC. Joints: ASTM D2855, solvent weld. NOTE: Concealed is defined as a pipe that is contained within a wall or in a fire rated chase. . Sanitary Sewer and Storm Water Piping Above Grade (In Exposed Areas): PVC pipe: ASTM D2665, D3034. Fittings: PVC. Joints: ASTM D2855, plyent weld. <u>If used in exposed areas, piping must be covered with minimum 1" fiberglass insulation with approved fire resistance rating.</u> NOTE: sposed is defined as a pipe that is exposed to view or installed above an accessible ceiling inside a building. d. Not approved for vertical runs in interior walls.

a. Sanitary Sewer and Storm Water Piping Above Grade (In Exposed Areas): Cast iron ASTM A74; C1SP1 301. Fittings: ASME B16.4; ASME B16.12. NOTE: Exposed is defined as a pipe that is exposed to view or installed above an accessible ceiling. b. All vertical runs of Sanitary Sewer and Storm Water are to be run in Cast Iron.

 $4. \ \underline{Chrome\ Plated\ Drain\ Lines} \colon \ \text{Use\ chrome\ plated\ drain\ lines\ for\ all\ exposed\ piping\ under\ sinks,\ etc.}$ F. Copper Pipe and Fitting (Domestic Water - Above Ground/Underslab & Heating): 1. Pipe: Conform to ASTM Specifications. Pipe shall be color coded or marked at factory for identification. Tubing shall conform to following:

a. Above Ground: Type L hard drawn, ASTM B-88. b. Buried: Type K, annealed temper, ASTM B-88. c. Refrigeration: Type ACT, hard drawn, ASTM B-280.

d. Drainage: Type DWV, ASTM B-306. e. Exposed: Use chrome plated piping for all exposed domestic water piping for sinks, toilets, urinals, etc.

a. General Service: Sweat type, wrought copper (cast fittings permitted only where wrought copper is not manufactured). Long radius elbows b. Drainage: Sweat type, wrought copper, drainage pattern. Specialty items such as closet elbows may be cast brass.

G. Plastic Pipe and Fittings (Domestic Water - Underslab): a. Pipe: Schedule 80 ABS - conform to ASTM D2282-99(2005) and MIL-STD-129, 160 psi working pressure

1. Pipe: Schedule 10 ASTM A-120 with factory supplied roll grooves that meet grooved coupling manufacturers latest specification. All field roll grooves mus neasured with a pi-tape and meet specification prior to coupling assembly. Note: This assembly method is important and joints will be randomly field

2. <u>Gaskets:</u> Gaskets must be Grade E with a Flushseal center leg design as provided by Victaulic Company of America or engineer approved equal. All product submittals must be approved prior to bidding. All gaskets must be lubricated with a non-petroleum based lubricant compatible with the grooved coupling manufacturers gasket. Approved grooved coupling manufacturers: <u>Victaulic only</u>.

3. Fittings: All grooved fittings must be domestic and of one manufacturer. All grooved fittings must be manufactured of ASTM A-536 Ductile Iron. Approved 4. Couplings: All grooved couplings must be domestic and of one manufacturer. All couplings shall be Zero-Flex rigid design. All couplings must be installed grooved pipe systems. Three (3) flexible grooved Style 77 or 75 couplings may be used at all pumps in lieu of flex connectors

a. All grooved butterfly and check valves must be of one domestic manufacturer and shall be rated to 300 PSI. All grooved valves shall have an internal and external PPS coating and the disc liner must be consistent with that of the grooved coupling gasket and be compatible for the service. All grooved butterfly valves must have a blowout proof stem. The disc and stem must be of a one piece ductile iron construction. b. Butterfly Valves 2" - 6" must have a 10 position lever lock handle and valves above 6" must have a gear operator.

c. Tour & Anderson circuit balancing valves series 787 threaded, series 786 solder end & 789 grooved end arc are approved for heating services. 6. <u>Straining Devices:</u> Victaulic S/730 Tee strainer & 731 Suction Diffuser are approved for heating services. A. All valves shall be of same manufacturer.

B. Where grooved piping system is specified, groove end butterfly valves equal to Victaulic. C. Valves are rated for 125 PSI service. Provide higher rated (250) PSI valves per system requirements. D. Valves shall be submitted with shop drawings for various uses

E. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers. F. Install globe valves for throttling, bypass, or manual flow control service G. Provide spring loaded check valves on discharge of water pumps.

b. Flanged or Grooved: For piping 2-1/2" and larger.

1.05 PIPING SPECIALTIES A. General: All piping systems shall be complete with all specialties and appurtenances required for complete operating system. B. Expansion Loop Guides: Two installed on each side of loops, securely anchored to building structure

C. Expansion Joints: Iron body, internal guides, stainless steel bellows. Piping shall be properly guided at all expansion joints and at intermediate locations as D. Mechanical Type Couplings: Victaulic. E. Insulating Couplings: Install at all locations where copper tubing connects to galvanized iron pipe and gas piping at meter connections.

1. Strainers: Strainers shall be Y pattern, 125# W.P. iron body for general use and 250 p.s.i. WSP for high pressure process and hydraulic use. a. Screwed: For piping 2" and smaller.

preventers shall be of reduced pressure, dual, spring loaded, check; intermediate vacuum breaker.

1. At each heating return line balancing valve that occurs in return main where two or more heat users return water to it.

c. Screens: Monel, cylindrical, reinforced ends. 20 mesh for water; 40 mesh for air, gas. G. Vacuum Breakers and Backflow Preventers 1. General: Vacuum breakers and backflow preventers shall be installed in accordance with all applicable codes and as specified.

a. Domestic Service: Vacuum breakers shall be provided on all flush valves, hose faucets, laboratory sinks, chemical vats, laundries, swimming pools process equipment, fittings, and fixtures covered by codes. Vacuum breakers shall be chrome plated where located exposed in finished portions of b. Installation: Vacuum breakers shall be installed above highest fixture they are protecting in such manner that it will preclude back pressure. Vacuum

breakers shall be installed where they will be accessible for periodic testing and where spillage will not be objectionable. backflow such as heating and cooling system make-up water, lawn sprinklers, and all areas designated by local codes as health hazard. Backflow preventers may serve more than one piece of equipment or system as long as cross contamination between systems is not objectionable. Backflow

b. Installation: Backflow preventers shall be installed in horizontal position in open accessible for maintenance and periodic inspections and testin Backflow preventers shall be piped with drain line to nearest floor drain. Drain shall terminate at floor drain with minimum of 12" air gap and in area not subject to flooding or freezing. c. Drain Pan: Install dalvanized drain pan under all backflow preventers installed above ceilings, pipe 3/4" copper line from drain pan to nearest floor drain or mop sink. Pan shall be 3" wider and longer than backflow preventer size. Depth of drain pan shall be 1-1/2'

1.06 GAUGES AND THERMOMETERS A. Gauges: Provide 4-1/2" face glass, aluminum body pressure gauges with adjustable pointer, gauge cocks, and shock reducing snubber. Each qauge shall be labeled to indicate units in "PSI" or "FT-HD" on gauge face. Gauge pressure shall be selected to give approximately two (2) times pressure that gauge will encounter constantly. (Example: 15 PSI steam gauge range 0 to 30 PSI.) Install at following locations or as indicated on prints. 1. All heating pumps' inlets and outlets

3. Cold water supply at meter outlet or connecting point where cold water supply for new addition connects to old line (if in exposed location). B. Thermometers: Thermometers shall be installed on water side and set so that they do not restrict or obstruct fluid flow. Install at following locations or as indicated on prints.

4. At inlet and outlet of hot water heating coils At boiler inlet and outlet.

2. At all three ports of 3-way valves.

2. All domestic hot water pumps' inlets and outlets

3. At domestic hot water tank supply and return pipes, near pump.

L. <u>Before proceeding with fabrication and installation of ductwork, inspect the contract documents, site conditions and truss shop drawings and determine that the location of work does not interfere with other work.</u> In case of interference, notify the Engineer.

2 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of организа и застоть мнеге тершее о ассониноваес внегнолнеетs ана controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

3. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities 4. Connect diffusers or troffer boots to low pressure ducts with 5 feet maximum length of flexible duct only in accessible areas where a ceiling is installed. Hold

5. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork

6. Where ductwork, structure, etc. can be seen behind grilles, registers, diffusers, etc. apply flat black paint to all visual surfaces. B. Ductwork:

1. General: Non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.

1.08 SUPPORTS AND ANCHORS

a. 3/4" to 2" pipe on 8' centers with 3/8" rod.

3. Attachment to Structure:

b. 2-1/2" to 3" pipe on 10' centers with 1/2" rod

lag screws for piping 1-1/2" and smaller.

2. Steel Rectangular Ducts: ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per square feet for each side

3. Insulated Flexible Ducts: Flexible duct wrapped with flexible glass fiber insulation, enclosed by seamless aluminum pigmented plastic vapor barrier jacket; maximum 0.23 K value at 75 degrees F.

4. Round Spiral Ducts: ASTM A-527-71, galvanized steel, spiral locking seam equal to United McGill Uni-Seal. For underslab ductwork, use United McGill 5. Internal Insulated Round Spiral Ducts: ASTM A-527-71, galvanized steel, spiral locking seam equal to United McGill Uni-Rib k-27. 6. Stainless Steel Ducts: ASTM A167, type 304.

A. General: Furnish and install all necessary pipe hangers, rollers, and duct hangers required for all systems. Hanger rod shall be all-thread carbon steel type. Rod shall conform to ASA B1/1960 Class 2A fit. B. <u>Ductwork</u>: Supports and hangers for ductwork and appurtenances shall conform to Manual of Sheet Metal and Air Conditioning Contractors Associated est edition of American Society of Heating. Refrigeration, and Air Conditioning Engineers Handbook Ducts 36" x 12", or equivalent, and larger, shall be supported by trapeze type hangers.

C. <u>Pipe Hangers</u>: First two piping supports away from new mechanical equipment supporting 1" diameter pipe or larger shall be isolated from structure by means of vibration and noise isolators. This piping shall be isolated with Type "H" Hangers. Floor mounted piping shall be isolated with Type "S" Spring Mounts for first two supports. Flexible members shall be incorporated in piping adjacent to all reciprocating equipment. Where steel supports contact copper lines, isolate copper from support with PVC sleeve to prevent galvanic corrosion.

a. Wall mounted support spacing shall be on not more than 12' centers. Wall support shall be electro-galvanized pipe clamp with at least 12" of electro-galvanized 1-5/8" x 1-5/8" 12 gauge steel channel anchored to wall with at least two 1/4" Ramset plated threaded fasteners with 1" or more wal b. Vertical pipes through floors shall be supported at each floor. Support shall consist of riser clamp. In addition to clamp, attach 1/2" dia. by 1/2" long

stud to pipe just above clamp to prevent slipping of pipe. Stud shall be of same material as suppor 2. Horizontal Piping: Clevis hangers blacksteel or approved equal with threaded rods and jamb nuts. Maximum pipe hanger spacing for Schedule 40 steel pipe shall be as follows:

c. 4" on 14' centers with 5/8" rod. d. 6" to 8" pipe on maximum of 17' centers with 3/4" rod. (Use maximum 10' centers on precast plank.) e. 8" pipe - 19' span with 7/8" rod.

pipe and larger) attach to upper or lower webb of joists as conditions require and only at panel joints, with two "C" clamps, and two rods, and two clevis hangers so that joist is symmetrically loaded. Line sizes 1-1/2" and smaller may be hung with only one hanger. b. Steel Beam Attachment: Grinnell #87 malleable iron "C" clamp (2" pipe and smaller) with lock nut and retainage clips. Grinnell #229 and #292 (2-1/2' pipe and larger) attach to either upper or lower flange as field conditions require with one hange c. Wood Beams and Purlins (for piping under 4" only): Grinnell #142 1/2" diameter lag screws with bolt thread head of black steel. Length shall penetrate

a. Steel Joist Attachment: Grinnell #87 malleable iron "C" clamp (2" pipe and smaller) with lock nut and retaining clips. Grinnell #229 and #292 (2-1/2"

d. Wood Trusses: Suspend piping from the building structure using one of the following methods: . Piping Under 2" Only: Install Grinnell #142 1/2" diameter lag screws with bolt thread head of block steel. Length shall penetrate not less than two-thirds of member depth. Use welded eye rods such as Grinnell #287 black steel of rod diameter specified above. Use 3/8" diameter lag screws for piping 1-1/2" and smaller.

ii. Piping 2" and Larger: Install uni-strut (trapeze) anchored to the top side of the roof truss bottom chord and then suspend down to a trapeze bar and/or

not less than two-thirds of member depth. Use welded eye rods such as Grinnell #287 black steel of rod diameter specified above. Use 3/8" diameter

e. Concrete and Masonry Surfaces: Attachment to horizontal poured concrete surfaces shall be by concrete inserts or expansion sleeves. Attachment to vertical poured concrete surfaces or masonry surfaces shall be by concrete inserts, expansion sleeves, and Ramset or Hilte fasteners. Attachment to precast concrete construction shall be by use of rod passing through plank on joints and with plate not less than six times diameter of rod by 1/4" thick f. Rooftop: Use prefabricated curb pipe support. Unit shall be built of not less than 18 gauge galvanized steel and constructed for use on the specific roof

i. Unless indicated otherwise on Drawings, roof-mounted equipment shall set on prefabricated equipment support rails. Support rails shall be of monolithic construction, 18 gauge galvanized steel, continuous mitred and welded corner seams, integral base plate, factory installed 2 x 4 wood nailer, and 18 ii. Support height shall be selected so that support rails bear on metal or concrete roof deck and project minimum of 8" above top surface of roof, or as

i. Anchor all pipes as required and/or where indicated in Contract Documents. Anchors shall properly distribute expansion and shall be securely attached to supporting construction to satisfaction of Architect's Field Representative. ii. Provide semi-steel spider and guiding cylinder pipe alignment guides on all piping in all areas. Pipe alignment guides shall be spaced as required according to manufacturer's design criteria and recommendations (minimum of two guides on each side of expansion joints and loops). Pipe alignment guides shall serve to guide expanding pipe to move freely from anchor points to expansion joints, loops, or bends. Guides shall be of same manufacturer

specified on drawings, and at least one foot beyond edge of equipment which it supports. See Drawings for possible additional requirements

A. General: Pumps shall be sized and selected to provide specified flow rate at specified pressure difference. If pumps installed cannot provide both design inditions of flow rate and pressure difference, make any or all changes to pumps to achieve design conditions at no additional cost to Owner. This change by include, but is not necessarily limited to the following; change impeller size, change motor size, or change entire pump. If motor size is increased, resulting in electrical changes, Mechanical Contractor shall compensate Electrical Contractor for cost of change.

B. Piping connections to pumps shall be same size as pump connection or larger with reducing fittings installed as close as possible to pump connection

D. Elbows shall occur at least 7 pipe diameters from pump suction. (When used instead of suction diffuser.) E. Piping shall be supported by other means than pump connections. Piping shall be properly supported before connections are made.

F. Avoid air pockets in suction piping; horizontal piping shall pitch up to pun

G. Suction and discharge piping shall be provided with pressure gauges and needle valves.

H. Hot Water Circulating, and Miscellaneous Pumps 1. Furnish and install pumps of size, type and capacity as indicated 2. Pumps shall be complete with motors, pump base, couplers, seals, tapped gauge openings, etc. for complete assembly. In-line pumps may be installed

3. Pumps shall be installed, aligned, and started in accordance with manufacturer's recommendations. Pump suction sizes shall not be less than those indicated in Schedule. Pumps shall be selected for and designed for quiet operation. 1.10 MOTORS

A. Ratings: Motors shall meet NEMA Standards and shall be capable of operating at rated load with voltage variation of plus or minus 10%, rated frequency variation of plus or minus 5%, or combined variation of 10% without damage to motor.

B. Selection: Motors shall be selected for type of service involved and shall be selected at minimum of 15% above required rating of equipment served. Provide "quiet rated" motors where required. 1.11 BELT AND SHAFT GUARDS

s. Requirements: All open drives on fans, pumps, compressors, and other similar drives shall be provided with guards in accordance with MIOSHA and all safety

B. <u>Belt Drives</u>: Compressors, fans, and equipment with sheave and pulley drives shall be provided with guards in accordance with MIOSHA and all safety and construction codes.

D. Extended Shafts: Equipment with extended shafts for dual bearings shall be provided with guards to cover entire shaft. $E. \ \ \underline{Walk\text{-}In} \ \underline{Equipment} : \ \ \underline{Equipment} \ \ \underline{Equipment}$

. Guards: Guards shall be constructed of extra heavy gauge metal, formed to fit over protected items and securely fastened to equipment or floor. Provisions shall be made for access at test openings and allowance for motor adjustments. Guards shall allow for ample clearance of pulley, drives, and couplings. Guards shall be prime coated and finished in enamel to match their respective equipment. 1.12 ACCESS DOORS: Steel access doors and frames, factory-fabricated and assembled, complete with attachment devices and fasteners for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime

1. For installation in masonry, ceramic tile, or wood paneling: 1-inch wide exposed perimeter flange and adjustable metal masonry anchors. 3. For full-bed plaster applications; galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

A. Frames: 16-gage steel, with a 1-inch wide exposed perimeter flange.

13 MECHANICAL IDENTIFICATION (also refer to Spec. 15.190)

for sound and vibration.

Flexible Connections:

nector. See Victaulic TS-5000 for details.

1. Label all pipes with stencil labeler (1-1/2" characters), this includes flow arrows.

C. Coupling Drives: Direct motor coupling drives shall be provided with guards. Guards shall be extended to include shafts

1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism 2. Locking Devices: Flush, screwdriver-operated cam locks.

A. General: All system components shall be identified to allow proper operation and maintenance. B. <u>Valve Identification</u>: Label valves with brass tags on chain (1/2" letters). Prepare typewritten valve tag schedule indicating label, size, type, and function of each valve for inclusion in operation and maintenance manual. Also, mount plastic-encased copy of same in mechanical room.

2. Label all pipes where they are exposed, at change of piping direction, and every 50 feet at long straight run

a. Locations: Floating slabs, fans, compressors, and all motor driven equipment subject to noise transmission

D. Pipe and Duct Identification: All pipe covering, insulation work, and piping installed, except concealed or metal and aluminum foil jacketed work, shall be 1.14 MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL A. General: Entire mechanical system shall be installed to provide quiet and vibration free environment in occupied spaces. Contractor shall replace or repai

ipment and/or provide additional sound and vibration control equipment if Architect/Engineer deems system or its components do not meet design criteria

1. All mechanical equipment over 1 horsepower, unless otherwise noted, shall be isolated from structure by means of resilient vibration and noise isolators supplied by single manufacturer. Where isolator type and required deflection are not shown or tabulated, equipment shall be isolated in accordance with latest version of ASHRAE Systems Handbook. Isolator manufacturer's submittal shall include complete design for supplementary bases, tabulation of design data on isolators, including outside diameter, free, operating, and solid heights of springs, free and operating heights of neoprene, or fiberglass isolators

D. <u>Vibration I solation and Expansion Compensation</u>: Furnish and install all vibration isolators, flexible connections, expansion joints, and expansion loops required to reduce noise transmissions and stress on equipment and piping.

b. <u>Deflection</u>: Selection to be made in conjunction with equipment manufacturers to assure workable system. 2. Expansion Joints: a. <u>General</u>: Install piping for adequate movement without stress or damage. Provide sufficient expansion loops, changes in direction and within stress limits of ASME code. Where deflection cannot be employed to absorb expansion and contraction expansion joints should be employed. b. Installation: Joints shall be properly anchored and guided in compliance with recommendations of manufacturer of expansion joint. Refer to Paragraph 1.06.C.4.g for anchors and guides.

 $a. \ \underline{General}; \ \ \text{All equipment subject to vibration and noise transmission shall be provided with flexible connections.}$ c. Pumps: Braided steel or bronze. When using the Victaulic pipeline system, three Victaulic Style 75 or 77 flexible couplings may be used in lieu of a flex ${\bf d.} \ \ \underline{Duct\ Connections\ to\ Air\ Moving\ Equipment} : \ \ \text{Neoprene\ coated\ flame-proof\ fabric\ minimum\ 2"\ side.}$

E. Spin Balance: All new rotating equipment shall be factory balanced, both statically and dynamically. If any equipment is determined by Architect/Engineer to after installation, equipment shall be electronically in-place spin balanced according to balancing criteria as set forth in latest Systems Edition of ASHRAE Handbook. Before and after readings shall be submitted in writing for Architect/Engineer's review.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL - PIPING

A. <u>Installation</u>: 1. Establish elevations of buried piping outside the building to ensure not less than minimum cover by code $2. \ \ \text{Establish invert elevations, slopes for drainage to 1/8" per foot, one percent minimum. Maintain gradients.}$

3. Install valves with stems upright or horizontal, not inverted. 4. Install unions downstream of valves and at equipment or apparatus connection

5. Install brass male adaptors each side of valves in copper piped system. Sweat solder adaptors to pipe. 6. Install nail stoppers at all pipe/wall stud intersections (both sides). Nail stoppers to be equal to Simpson "Strong-Tie" Model "NS". B. Testing: Refer to individual piping system specification sections for testing specifications. If testing specifications are not given in individual section, test

1. Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each section of each piping system independently, but do not use piping system valves to isolate sections where test pressure

exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time

b. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure

c. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure. d. Record date of each test and results in a log which shall be turned over to Architect/Engineer at completion of Project. 2. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome

leakage. Do not use chemicals, stop-lead compounds, mastics, or other temporary repair methods. C. <u>Disinfection of Domestic Water Piping System</u>:

A. Installation:

1. Prior to starting work, verify system is complete, flushed, and clean. 2. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

3. Inject disinfectant - free chlorine in liquid, powder, tablet, or gas form - throughout system to obtain 50 to 80 mg/L residual. 4. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

5. Maintain disinfectant in system for 24 hours 6. If final disinfectant residual tests less than 25 mg/L, repeat treatment

7. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

8. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C601. 3.02 FIELD QUALITY CONTROL - DUCTWORK

1. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Use

2. Provide fire dampers or combination fire and smoke dampers at locations where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings, and hinges ${\tt 3. \ Demonstrate \ re-setting \ of \ fire \ dampers \ to \ authorities \ having \ jurisdiction \ and \ Owner's \ representative}$ 4. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated

5. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. $6. \ \ Provide \ support for \ all \ diffusers/grilles \ in \ any \ ceiling \ structure \ with \ a \ non-exposed-to-view \ support \ system. \ \ System \ is \ to \ support \ diffusers/grille \ and \ \ and \ \ support \ \ support \ \ system.$ B. <u>Duct Sealants</u>: 1. Duct systems, including all seams, joints, fastener penetrations and connections, shall be effectively sealed in accordance with SMACNA Seal Class A

followed before pressure testing is begun. Any additional paint or coatings must conform to manufacturer's specifications.

 $\textbf{4. } \underline{\textbf{Sealant Manufacturer}}; \ \ \textbf{AMF Safecoat Dynoflex, United Duct Sealer (Water based Uni-Mastic 181)}$

requirements, and leak tested with total allowable leakage from high and medium pressure (4" W.C. or greater) ducts not to exceed one (1) percent of the total system design airflow rate. Joint sealants shall have fire and smoke hazard rating as tested by ASTM D-2202 Exterior mastic sealant shall be certified to pass 500 hours QUV. Sealants shall also comply with ASTM freeze/thaw standard C731 and D2202. 2. Manufacturer, upon request shall be able to properly document an established record of experience and success in the specialized formulation of duct

3. All duct work shall be suitably cleaned and prepared, and sealant applied in strict accordance with manufacturer's recommendations for cure time shall be

3.03 SELECTIVE DEMOLITION A. Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved. Where noted or indicated to be removed, that portion of the existing mechanical systems are to be disconnected, taken down, removed from Owner's property and properly disposed of by the Contracto

B. <u>Materials and Equipment to be Salvaged</u>: Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.

1. Where noted or indicated to be removed and turned over to the Owner, that portion of the existing mechanical systems are to be disconnected, taken down and moved to a location where the Owner wants it stored . Where noted or indicated to be removed and reused, that portion of the existing mechanical systems are to be disconnected, taken down, stored in a clean, dry location by the Contractor until such time as the Contractor shall reinstall. The portions of the reused mechanical system which can be cleaned of rust sludge, etc. shall be cleaned before reinstalling. If existing surfaces are painted, such surfaces shall be touch-up painted or repainted after reinstallation.

1. While the drawings indicate certain existing mechanical systems or other materials are to be reused or removed, Contractor shall not consider these notations as showing all items in the area. The notations are general in nature and are to establish the intent and nature of work and apply to all mechanical items in the area.

2. Certain mechanical materials that must be removed are concealed in walls or ceilings are not shown but shall be removed when walls are removed at no

d in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Remove materials abo

3. If the existing occupied facility is to stay in operation throughout the entire remodeling period, mechanical services for the occupied facility shall be completely operable and shall function continuously while remodeling work is completed

a. Inactive and obsolete HVAC equipment, piping, fittings and specialties, equipment, ductwork, controls, fixtures, and insulation

4. Mechanical Materials and Equipment: Demolish, remove, demount, and disconnect the following items:

accessible ceilings. Drain and cap piping and ducts allowed to remain . Installation and Removal: Where walls are to be removed and existing piping or ductwork is uncovered which must be reused to serve a section of the building other than this remodeling area, it shall be this Contractor's responsibility to reroute and provide permanent piping to replace that which is removed. Unused piping and ductwork shall be removed to 2" below disturbed surfaces and capped.

END OF SECTION

OB NUMBE

8690 S. Lakeview Rd Traverse City, MI 49684 (231) 932-0800 office

H. Field Applied Jackets B. Over 2 Inches: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle. PART 2 - PRODUCTS SECTION 15.140 SUPPRORTS AND ANCHORS 2.01 CONTROL COMPONENT Connections: Tacks, pressure sensitive color matching vinyl tape A. Up to 2 Inches: Bronze body, bronze tapered plug non-lubricated, Teflon packing, threaded ends. 2. Canvas Jacket: UL Listed fabric, 6 oz./sq. yd., plain weave cotton treated with dilute fire retardant lagging adhesive. PART 1 GENERAL B. Over 2 Inches: Cast iron body and plug, non-lubricated, Teflon packing, flanged ends. 3. Aluminum Jacket: 0.016 inch thick sheet finish, with longitudinal slip joints and 2 inch laps, die shaped fitting covers with factory applied moisture barrier PART 3 - EXECUTION 1.01 WORK INCLUDED 2.13 SWING CHECK VALVES 3.01 Roof Top Units 4. Stainless Steel Jacket: Type 304 stainless steel, 0.010 inch. A. Pipe, duct, and equipment hangers, supports, and associated anchors. A. Up to 2 Inches: Bronze 45 degree swing disc, screwed ends. I. Hydrous Calcium Silicate meeting ASTM C 533, Type I; rigid molded pipe; asbestos-free color coded throughout material thickness. B. Sleeves and seals. B. Over 2 Inches: Iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends. 1. K Value: 0.42 at 300 F Mean Temperature as tested in accordance with ASTM C 335. C. Flashing and sealing equipment and pipe stacks. 2.14 SPRING LOADED CHECK VALVES
 A. Iron body, bronze trim, spring loaded, renewable composition disc, screwed, wafer, or flanged ends. Occupied Mode 2. Maximum Service Temperature: 1200 F. 1.02 RELATED WORK B. Over 2 Inches: Cast iron body, bronze fitted, elastomer diaphragm and seat disc, flanged. 3. Non-combustible as determined by test following ASTM E 136. A. Section 15121 - Expansion Compensation 4. Tie Wire: 16 gage stainless steel with twisted ends on maximum 12 inch centers. 2.15 ACCEPTABLE MANUFACTURERS B. Section 15260 _ Thermal Insulation A. Nibbco, Red and White, Grinnell, and Substitutions: Under provisions of Section 15000. PART 3 - EXECUTION 1.03 <u>REFERENCES</u> 3.01 PREPARATION A. Conformance with ANSI/ASME B31.1 $_$ Power Piping. 2.16 ACCEPTABLE MANUFACTURERS - RELIEF VALVES A. Install materials after piping or ductwork has been tested and approved. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and B. Conformance with $\,$ NFPA 13 $_$ Standard for the Installation of Sprinkler Systems. C. Conformance with Manufacturer's Standardization Society MSS SP-90. B. Substitutions: Under provisions of Section 15000 3.02 INSTALLATION A. Install materials in accordance with manufacturer's instructions, building codes and industry standards. 2.17 RELIEF VALVES b. Fan to cycle. A. Submit product data under provisions of Section 15000. A. Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled. B. Continue insulation with vapor barrier through penetrations 3.02 Heat Pump Unit B. Indicate hanger and support framing and attachment methods C. Exterior insulated piping shall be jacketed with .016" aluminum jacket, banded on 18" centers and sealed watertight with mastic. Sealing not required if Type B insulation (elastomeric foam) is installed per manufacturers instructions (entire insulation system is air/water tight, vapor barrier). PART 2 - PRODUCTS D. All fittings and valves shall be insulated with corresponding pipe insulation. Domestic hot water line valves, mechanized fittings and joints (i.e., unions, etc.) may be uninsulated if 3.01 PREPARATION 2.01 PIPE HANGERS AND SUPPORTS A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe. A. Hangers for Pipe Sizes 1/2 to 2 Inch: Malleable iron carbon steel, adjustable swivel, split ring. E. Unions and flanges on insulated cold water piping shall be insulated, but on other systems shall not be insulated. Terminate insulation neatly at each side of union and/or flange with B. Remove scale and dirt, on inside and outside. insulating cement, so unions and flanges may be taken apart without disturbing insulation B. Hangers for Pipe Sizes 2-1/2 to 4 Inches and Cold Pipe Sizes 6 Inches and Over: Carbon steel, adjustable, clevis. F. Rigid board insulation shall be impaled over Mechanical fasteners, (SMACNA fastener standard), on 12 in. x 18 in. centers. Use a minimum of two rows of fasteners per side. C. Prepare piping connections to equipment with unions C. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hange D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for hot pipe sizes 6 inches and over mechanical fasteners on the bottom of the duct to prevent possible sagging. Mechanical fasteners and spacing shall be as specified for rigid board insulatio A. Provide non-conducting dielectric connections wherever jointing dissimilar metals. E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook. H. Acoustical duct liner shall be adhered to the sheet metal with 100% coverage of adhesive, and all exposed leading edges and all transverse joints coated with adhesive. Duct liner shall also be secured using mechanical fasteners which shall compress the liner sufficiently to hold it firmly in place. B. Provide access where valves and fittings are not exposed. {Coordinate size and location of access doors with Section 15000}. F. Wall Support for Pipe Sizes to 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over. G. Vertical Support: Steel riser clamp. I. Cover exterior insulated rectangular ducts with .016" thick aluminum jacket secured watertight with mechanical fasteners, bands or screws. H. Floor Support for Pipe Sizes to 4 Inches and all Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support. D. Establish elevations of buried piping outside the building to ensure not less than minimum cover by code J. Cover exterior insulated round ducts with .016" thick aluminum jacket with moisture barrier I. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel suppo 3.03 INSULATION SCHEDULE E. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. J. Copper Pipe Support: Carbon steel ring, adjustable, copper plated. F. Prepare pipe, fittings, supports, and accessories not finished, ready for finish painting. Refer to Section 15000 SERVI CE INSULATION TYPE & K. Shield for Insulated Piping 2 Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180 degree segments, minimum 12 inches long at pipe support G. Establish invert elevations, slopes for drainage to 1/8 inch per foot one percent minimum. Maintain gradients. END OF SECTION DOMESTIC HOT WATER UP THRU 1-1/2" TYPE A, 1" or TYPE B, 1/2" L. Shield for Insulated Piping 2-1/2 Inches and Larger (Except Cold Water Piping): Pipe covering protective saddle H. Install bell and spigot pipe with bell end upstream SECTION 15.990 DOMESTIC HOT WATER TYPE A, 1-1/2" or TYPE B, 3/4 M. Shields for Insulated Cold Water Piping 2-1/2 Inches and Larger: Hard block non-conducting saddles in 90 segments, 12 " minimum length, block thickness same as insulation Testing, Adjusting and Balancing I. Install valves with stems upright or horizontal, not inverted DOMESTIC COLD WATER ALL SIZES TYPE A, 1" or TYPE B, 1/2" PART 1 - GENERAL 3.03 APPLICATION 2.02 HANGER RODS STORM ALL SIZES TYPE A, 1" or TYPE B, 1/2" A. Use grooved mechanical couplings and fasteners only in accessible locations. A. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded. TYPE A, 1" or TYPE B, 1/2" ROOF DRAINS ALL SIZES B. Install unions downstream of valves and at equipment or apparatus connections. solely and exclusively as their primary source of busines REFRIG. LINES THRU 4" TYPE B, LINE TEMP +10F or C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe. LINE TEMP +10F or A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers. E. Install globe valves for throttling, bypass, or manual flow control services ALL SIZES 2.04 FLASHING F. Provide spring loaded check valves on discharge of water pumps. ALL ROUND OUTSIDE A. Metal Flashing: 26 gauge galvanized steel. AIR (MAKE-UP & COMBUSTION) & RELIEF AIR DUCTS 3.04 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM B. Flexible Flashing: 47 mil thick sheet compatible with roofing. Exhaust Fans TYPE D, 2" or TYPE B, 3/4" Zone Branch and Main Ducts A. Prior to starting work, verify system is complete, flushed and clean. C. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements Diffusers, Registers and Grille ALL RECTANGULAR B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric) OUTSIDE AIR (MAKE-UP 8 1.02 RELATED SECTIONS RELIEF AIR DUCTS TYPE C, 1-1/2" or TYPE B, 3/4" C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual. A. Sleeves for Pipes Through Non_fire Rated Beams, Walls, Footings, and Floors: Form with steel pipe or 18 gauge galvanized steel A. Section 15.000 - Mechanical General Provisions D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets. B. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated sleeves including seals, UL listed. B. Section 15.050 - Basic Mechanical Materials and Methods. WITHIN 10' OF OUTSIDE TYPE D, 2", or TYPE B, 3/4" TERMINATION ALL SIZES C. Sleeves for Round Ductwork: Form with galvanized steel C. Section 15.985 - Sequence of Operation F. If final disinfectant residual tests less than 25 mg/L, repeat treatment. SPIRAL SUPPLY AIR D. Sleeves for Rectangular Ductwork: Form with galvanized steel or wood. ALL SIZES TYPE D, 2", or TYPE B, 3/4" G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L E. Fire Stopping Insulation: Glass fiber, type, foam or cement type to be equal or greater than rating of structure being penetrated F. Caulk: Acrylic sealant. H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C601 SUPPLY AND TYPE E, 1", OR TYPE B, 3/4" RETURN AIR (Armstrongs self-adhering, END OF SECTION DUCTS (ASSOCIATED WITH non-fibrous, Armaflex duct A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping. SECTION 15.430 WITHIN 10' OF MECHANICA B. Design hangers without disengagement of supported pipe ALL SIZES SHOWN ON PLANS PART 1 - GENERAL 1.01 WORK INCLUDED ALL DUCTWORK A. Floor Drains. 1.04 ALLOWANCES A. Prime coat or factory galvanize exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered (i.e. ATTIC OR SOFFIT B. Cleanouts. INSTALLATIONS) ALL SIZES TYPE D, 2" or Type B, 11/2" PART 3 EXECUTION C. Backflow Preventers 1.05 BALANCING AGENCY QUALIFICATIONS ALL DUCTWORK EXPOSED TO OUTDOOR D. Water Hammer Arrester A. Provide inserts for placement in concrete formwork (i.e. ROOF MOUNTED B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. INSTALLATIONS) ALL SIZES TYPE B, 11/2", Reference 3.02.I F. Hose Bibs Hydrants. C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches. 1.02 RELATED WORK TYPE E, 1" OR TYPE B, 3/4" D. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface. A. Section 15050 - Materials and Method 10' LENGTH AHEAD OF (Armstrongs self-adhering, E. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut flush with top of slab FAN (UPSTREAM) B. Section 15410 - Plumbing Piping. WATER STORAGE TANKS ALL SIZES TYPE G, 2" THICK 3.02 PIPE HANGERS AND SUPPORTS 1.03 QUALITY ASSURANCE 2 Great Lakes Balancing, Grand Rapids, MI, Phone 616-813-7384 3 Hi Tech Balance. MI & THERMAL BUFFER TANKS A. Support horizontal piping as follows A. ANSI/ASSE 1012 - Backflow Preventers with immediate Atmospheric Vent. Round spiral exposed ducts are not required to be insulated PIPE SIZE MAX. HANGER SPACING HANGER DIAMETER B. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers. 1/2 thru 1_1/4 inch C. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle END OF SECTION E. ANSI A112.21.1 - Floor Drains. PLUMBING PIPING PVC (All Sizes) 1.06 SUBMITTALS C.I. Bell and Spigot PART 1 - GENERAL F. ANSI A112.26.1 - Water Hammer Arresters. 1.01 WORK INCLUDED G. PDI WH-201 Water Hammer Arrester B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work. A. Pipe and pipe fittings 1.04 QUALITY ASSURANCE 1.07 TAB PREPARATION AND COORDINATION C. Place a hanger within 12 inches of each horizontal elbow. A. Manufacturer: For each product specified, provide components by same manufacturer throughout. B. Valves. D. Use hangers with 1_1/2 inch minimum vertical adjustment C. Sanitary sewer piping syster E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers. A. Submit shop drawings and product data under provisions of Section 15000. D. Domestic water piping systen F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub. E. Natural gas piping system B. Include component sizes, rough-in requirements, service sizes, and finishes. ${\sf G.} \ \ {\sf Where \ several \ pipes \ can \ be \ installed \ in \ parallel \ and \ at \ same \ elevation, \ provide \ multiple \ or \ trapeze \ hangers.}$ 1.02 RELATED WORK Project drawings and specification. A. Architectual - Earth Work. 2.01 ACCEPTABLE MANUFACTURERS - FLOOR DRAINS H. Support riser piping independently of connected horizontal piping. B. Section 15260 - Piping Insulation. A. Wade, Zurn, Jay R. Smith. 3.03 EQUIPMENT BASES AND SUPPORTS A. Provide equipment bases of concrete type specified by architect or on drawings. C. Section 15430 - Plumbing Specialties B. Substitutions: Under provisions of Section 15000 B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment 2.02 FLOOR DRAINS 1.03 QUALITY ASSURANCE 1.08 MECHANICAL CONTRACTOR RESPONSIBILITES A. ANSI A112.21-1: Cast iron two piece body with double flange, weep holes, reversible clamping collar, and adjustable strainer: Model Z-415 manufactured by Zurn C. Construct support of steel members. Brace and fasten with flanges bolted to structure. A. Valves: Manufacturer's name and pressure rating marked on valve body. D. Provide rigid anchors for pipes after vibration isolation components are installed B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations. A. Wade, Zurn, Jay R. Smith 3.04 FLASHING C. Welders Certification: In accordance with [ANSI/ASME Sec 9.] [ANSI/AWS D1.1.] A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs. B. Substitutions: Under provisions of Section 15000. 1.04 SUBMITTALS B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipe through outside walls, turn flanges back into wall and caulk, metal counter flash and seal. 2.04 CLEANOUTS A. Submit product data under provisions of Section 15000. A. Interior Finished Floor Areas: Cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable nickel-bronze strainer, round with C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device. scoriated cover in service areas. Model Z-1400 manufactured by Zurn PART 2 - PRODUCTS D. Seal floor, shower, and mop sink drains watertight to adjacent materials $2.05\ \underline{ACCEPTABLE\ MANUFACTURERS\ -\ BACKFLOW\ PREVENTERS}$ 2.01 SANITARY SEWER AND STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacture's instructions for sound contro A. Chicago, Watts, Wilkins (Zurn) A. PVC Pipe: ASTM D3033 or D3034, SDR 35. Fittings: PVC. Joints: ASTM F477, elastomeric gaskets. B. Substitutions: Under provisions of Section 15000. F. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface (or as indicated on drawings). Flexible sheet flash and counter flash with sheet metal 2.02 SANITARY SEWER AND STORM WATER PIPING, BURIED AND ABOVE GRADE, BUT CONCEALED WITHIN BUILDING 2.06 BACKFLOW PREVENTERS A. PVC Pipe: ASTM D2665, D3034. Fittings: PVC. Joints: ASTM D2855, solvent weld. A. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013; bronze body with bronze and plastic internal parts and stainless steel springs; two independently operating, spring loader A. Set sleeves in position in formwork. Provide reinforcing around sleeves. check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; 2.03 SANITARY SEWER AND STORM WATER PIPING, ABOVE GRADE (In Exposed Areas) non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks; Series 909 manufactured by Watts. B. Extend sleeves through floors one inch above finished floor level. Caulk sleeves full depth and provide floor plate. A. <u>Provide an Alternate only.</u> PVC Pipe: ASTM D2665, D3034. Fittings: PVC. Joints: ASTM D2855, solvent weld. <u>If used in exposed areas, piping must be covered with minimum 1' fiberglass insulation with approved fire resistance rating. NOTE: Exposed is defined as a pipe that is exposed to view or installed above an accessible ceiling.</u> B. Double Check Valve Assemblies: ANSI/ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration B. Cast iron pipes (in exposed areas & on vertical installations): ASTM A74; C1SP1 301.
NOTE: Exposed is defined as a pipe that is exposed to view or installed above an accessible ceiling. 2.07 WATER HAMMER ARRESTERS

A. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range -100 degrees F to +300 degrees F and maximum 250 psig working

1.10 REPORTS D. Install chrome plated steel escutcheons at finished surfaces. END OF SECTION 2.04 WATER PIPING, BURIED 2.08 ACCEPTABLE MANUFACTURERS - THERMOSTATIC MIXING VALVES A. Copper Tubing: ASTM B75 or B88 or B251, Type K, annealed temper. Fittings: ANSI/ASME B16.23, cast brass, or ANSI/ASME B16.29, wrought copper. Joints: 95.5% tin, 4% copper, .5% silver "lead free" solder. A. Lawler, Leonard, Powersza. B. Forms shall include the following information 2.05 WATER PIPING, ABOVE GRADE B. Substitutions: Under provisions of Section 15000. PART 1 - GENERAL Title Page A. Cooper Tubing (DISTRIBUTION AND COMMERCIAL SPACES):1"-3"DIA, ASTM B75 or B88 or B251, Type L, hard drawn. Fittings: ANSI/ASME B16.23, cast brass, or ANSI/ASME 2.09 THERMOSTATIC MIXING VALVES 1.01 WORK INCLUDED B16.29, wrought copper. Joints: 95.5% tin, 4% copper, .5% silver "lead free" solder.

B. Manifolded (in appartments) PEX Piping: ¼ inch through 1 inch nominal pipe size 2. Air Moving Equipment A. Provide thermostatic mixing valve, with check valve, volume control shut-off valve on outlet, stem type thermometer on outlet, strainer stop check on inlet. A. Piping insulation, jackets and accessories 1. SDR9 crosslinked polyethylene manufactured using the Engel method (PEX-a) b. Manufacturer a. Minimum degree of cross-linking shall be between 70-89% when tested in accordance with ASTM D2765, Method B.

2. Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent, third-party agency. 2.10 ACCEPTABLE MANUFACTURERS - HOSE BIBS/HYDRANTS B. Ductwork insulation, jackets and lining A. Woodford, Wade, Zurn. e. Air flow, specified and actua a. Piping to have a minimum material designation of PEX 5106 3. Potable water piping shall comply with NSF 14 and NSF 61 and bear the "NSF-pw" marking f. Return air flow, specified and actual B. Substitutions: Under provisions of Section 15000 g. Outside air flow, specified and actual 4. Temperature and pressure requirements in accordance with PPI TR-3: 73.4°F at 80psi, 180°F at 100psi and 200°F at 80psi. 1.02 QUALITY ASSURANCE 2.11 HOSE BIBS/HYDRANTS A. Applicator: Company specializing in piping insulation application with three years minimum experience. 2.06 NATURAL GAS PIPING ,BURIED BEYOND 5 FEET OF BUILDING Inlet pressure A. Bronze or brass, replaceable hexagonal disc, hose thread spout, with vacuum breaker in conformance with ANSI/ASSE 1011. Woodford Model 65 B. Insulation materials shall be 100% asbestos free k. Discharge pressure A. Gas Company to install and furnish material to bring gas service to building. Fan and motor RPM, design and actual 1.03 SUBMITTALS 2.07 NATURAL GAS PIPING, ABOVE GRADE PART 3 - EXECUTION A. Steel Pipe: ASTM A53 or A120, Schedule 40 black. Fittings: ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type. Joints: Screwed for pipe two inches and under; ANSI/AWS D1.1, welded, for pipe over two inches, welded in concealed locations for all sizes. A. Submit product data for approval 3.01 PREPARATION 3. Exhaust Fan Data: a. Locationb. Manufacturer B. Include product description, list of materials and thickness for each service or equipment scheduled, and locations. Provide manufacturers installation instruction $\hbox{A. \ \ } \hbox{Coordinate forming of floor construction to receive drains to required invert elevations.}$ B. Test Criteria: Gas piping shall be tested with air or an inert gas. System to be tested to a pressure of 1-1/2 times the system working pressure, but not less than 3 psi. Piping system PART 2 - PRODUCTS 3.02 INSTALLATION AND APPLICATION d. Air flow, specified and actual 2.01 ACCEPTABLE MANUFACTURERS C. Piping in concealed locations shall not have unions, fittings, or threads. A. Install specialties in accordance with manufacturer's instructions to permit intended performance. f. Inlet pressure A. Owens Corning, Manville, Armstrong, Certain Teed, Knauf or substitutions under provisions of Section 15000. g. Discharge pressureh. Fan and motor RPM, design and actual 2.08 FLANGES, UNIONS, AND COUPLINGS B. Extend cleanouts to finished floor surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system. 2.02 MATERIALS A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints. C. Install water hammer arresters complete with accessible isolation valve. A. Type A: Fiberglass pipe insulation equal to Owens Corning Fiberglass ASJ/SSL-II Pipe Insulation with a "k" value of 0.25 @ 75 F, ASTM C547, Class 1, including vapor barrier. B. Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; neoprene gaskets for gas service; 1/16 inch thick preforme END OF SECTION 5. Return Air/Outside Air Data Vapor Retarder Jacket: White kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or jacket with outward a. Identification/location
 b. Design combined air flow
 c. Actual combined air flow **SECTION 15.985** C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; "C" shape composition sealing gasket; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe B. Type B: Closed-Cell, Elastomeric foam rubber insulation equal to Armstrong AP Armaflex . (Pipe and/or sheet insulation in accordance with ASTM C-534; with a K value not to exceed d. Design return air flow PART 1 - GENERAL .27 @ 75 F), max flame spread 25, max smoke developed 50. D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier. e. Actual return air flow f. Design outside air flow
 g. Actual outside air flow 1.01 SECTION INCLUDES C. Type C: Rigid board duct, class 1, insulation equal to Owens Corning type 703 with a maximum thermal conductivity of .22 @ 75 F, and FRK vapor barrier facing, ASTM C612, Class 1. 2.09 GATE VALVES A. Heat Pump. D. Type D: Flexible duct insulation equal to Owens Corning all service duct wrap type 100 with a maximum thermal conductivity of .27 @ 75 F, and FRK vapor barrier facing ASTM C553,

A. Up to 2 Inches: Bronze body, rising stem and handwheel, inside screw, double wedge or disc, solder. 6. Electric Motors: a. Manufacturer B. Exhaust fans b. HP/BHP B. Over 2 Inches: Iron body, bronze trim, rising stem and handwheel, OS&Y, double wedge, flanged ends. E. Type E: Acoustical duct liner equal to Owens Corning Aeroflex duct liner type 150 with a maximum thermal conductivity of .28 @ 75 F. Ductwork dimensions indicated are inside . Phase, voltage, amperage; nameplate, actual. C. Roof Top HVAC Units d. RPM, nameplate and actual dimensions required for air flow. For applications involving indoor air quality concerns, use Armstrongs self-adhering, non-fibrous, Armaflex duct liner (3/4" thick). 2.10 GLOBE VALVES e. Service factor F. Type F: Rigid foam glass with Pit wrap. f. Starter size, rating, heater elements A. Up to 2 Inches: Bronze body, rising stem and handwheel, inside screw, renewable composition disc, solder screwed ends, with backseating capacity. 1-1/2" thickness up to 2" pipe dia g. Motor sheave size, manufacturer number, number of turns open-actua A. This Section defines the manner and method by which controls function. Requirements for each type of system operation. Equipment, devices, and system components required for 2" thickness above 2" pipe dia. B. Over 2 Inches: Iron body, bronze trim, rising stem and handwheel, OS&Y, plug-type disc, flanged ends systems are specified in other Sections or must be provided as required to meet Sequence of Operation System zone/branch
 Duct size G.. Type G: Semi-rigid fiberglass board insulation, factory jacketed with a laminated Kraft aluminum foil All Service Jacket (ASJ) vapor barrier. Maximum thermal conductivity of 0.27 @ 1.03 <u>RELATED SECTIONS</u> Insulation shall be equal to Owens Corning pipe and tank insulation. A. Section 15.000 MECHANICAL GENERAL PROVISIONS
 B. Section 15.050 BASIC MECHANICAL MATERIALS AND MET
 C. Section 15.990 TESTING, ADJUSTING AND BALANCING A. Up to 2 Inches: Bronze body, stainless steel ball, Teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union. d. Design air flow

2.03 INSERTS

2.07 FINISH

3.01 INSERTS

(or No-Hub)

3.05 SLEEVES

SECTION 15.260

A. Provide all necessary system components (i.e. thermostats, valves, dampers, actuators, transformers, relays, control wiring and tubing, etc.) for a complete operable system. A. RTU-182 (Kitchen and Dining) - Pre-set outside air quantity, gas fired heating with 2-Stage unit module, controlled from discharge air temperature sensor. Integral Packaged DX 1.11 DEFICIENCIES A. Any deficiencies in the installation or performance of a system or component observed by the TAB Company shall be brought to the attention of the construction manager or his on a. The supply air fan shall run continuously. The gas fired heating section shall stage to maintain a space temperature. Supply fan shall adjust to maintain proper Delta I b. Cooling shall utilize Unit control to stage DX to maintain discharge air temp. and proper operation. B. The work necessary to correct items on the deficiency listing shall be performed and verified by the affected contractor before the TAB Company returns to retest. Unresolved c. Space temperature shall be controlled by a wall programmable T-Sta PART 2 - EXECUTION d. OA Ventilation damper shall be 2-Possition (minimum, economizer) base on ventilation needs. 2.01 GENERAL e. Relief damper shall be mechanically opened to accommodate ventilation mode. A. The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting, and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with standards set forth in section 1.03 a. During the non-Occupied mode, the unit shall be off and cycle to maintain set back temperature. B. Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final C. All information necessary to complete a proper TAB project and report shall be per the standards in section 1.03, unless otherwise noted. The descriptions for work required, as listed in this section, are a guide to the minimum information needed. A. HP-X (Apts.) - Integral variable speed supply fan (ECM) to modulate inconjunction with the HP unit which shall modulate from 40%-100%. Controlled from Infinity space T-Stat. 3.02 EXAMINATION A. Before commencing work, verify that systems are complete and operable. Ensure the following: a. The supply fan shall run continuously. The speed of the SA fan shall be modulated by unit controls and operate at a reduced rate when not heating or cooling. b. The Heat Pump unit shall modulate its capacity to match the space load. Unit shall utilize the Infinity controls to maintain the required capacity. Unit controls and maintain c. Units to utilize Elec. Resistance Heat if ambient temp. is below normal operating parameters of HP failure. d. In Tenant spaces the Motorized damper associated with OA shall open The SA fan shall run continuously at reduced speed and maintain set back temperatures. Motorized damper associated with O.A. shall be closed. A. EF-1s shall be operated in conjunction with the bath wall switch. Kitchen Hood fans shall also run as dictated by associated unit switch. B. Other fans associated with Kitchen and restaurant operations shall be coordinated with buildout A. The M.C. shall contract with an independent testing, adjusting, and balancing (TAB) agency to test, adjust, and balance the HVAC systems. This contractor shall perform TAB work B. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting, and balancing the HVAC and Hydronic systems, as described in these specifications and/or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results. C. The items requiring testing, adjusting, and balancing are described in detail in section 1.06 and generally include the following 1.03 <u>DEFINITIONS</u>, <u>REFERENCES</u>, <u>STANDARDS</u>

A. The following is a list of standards that this work shall be performed and submitted in accordance with. It is the responsibility of this contractor to adhere to the more stringent specifications of these different standards to meet the requirements this section B. AABC National Standards for Total System Balance (2002 Edition C. ASHRAE _ 1989 Systems Handbook: Chapter 37, Testing, Adjusting and Balancing. D. SMACNA HVAC Systems Testing, Adjusting & Balancing (Third Edition - August, 2002) E. TABB-Testing, Adjusting, and Balancing Bureau (Current Edition F. NEBB _ Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems (1998, Sixth Edition). A. Installation is included as part of this Section and is to be included in the Contract Sum A. An impartial, independent Test & Balancing Company will provide the TAB services required for this project. This contractor shall specialize in performing TAB work solely and ively as their primary source of business. This Company shall have performed TAB work on projects similar in size and scope and shall be prepared to provide documented proof B. Agency Qualifications: The TAB Company shall be a current and certified member of a Test & Balance institution that offers comprehensive training and certification of its members or they shall be a TAB company specializing in this type of work with a minimum of 5 years documented work experience. The TABB company shall be prepared to submit records of experience in the field of air and hydronic system balancing or any other data as requested by the Engineer. C. Final Approval: Note that the Owner, Architect, and Engineer shall select and make the FINAL APPROVAL of the TABB Contractor for this project 1. Integrity Test & Balance, Inc.Traverse City, MI, Phone-231-929-0940, Fax-231-929-0949 D. Procedures and Agenda: The TAB Company shall submit the TAB procedures and agenda proposed to be used. E. Sample Forms: The TAB Company shall submit sample forms, which shall include the minimum data required as set forth in these specification F. Provide bound reports with a cover page, letter size, manuals, complete with index page and/or tabs. A. Submit name of independent adjusting and balancing agency for approval, see Specification Section 15000. B. Submit test reports as a submittal under provisions of Section 15000. A. It will be necessary for the TABB Company to perform his services in close coordination with the Mechanical Contractor on a critical path network. It is the TABB Companies iate this continuing coordination to determine his schedule for final testing and balancing services and periodic inspections required during cor B. Shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work shall be provided by the lechanical Contractor or General Contractor to the TAB Company no later than 60 days prior to the start of TAB work. This information shall include but not necessarily limited to the 2. Approved construction revisions pertaining to the HVAC systems. 3. Approved submittal data on HVAC and Hydronic equipment and systems to be installed by the mechanical contractor. A. The Mechanical Contractor shall complete the installation and start-up of all HVAC systems to ensure they are working properly and shall perform all other items as described hereinafter to assist the TABB Company in performing the testing and balancing of the HVAC and Hydronic systems. 1. Verify installation for conformity to design, manufacturer guidelines and industry standards. 3. Ensure that all volume, splitter, extractor and fire dampers are properly located, functional and open. Volume dampers found to be non-functional or obstructed for properly adjustment shall be repaired/replaced by this mechanical contractor. Dampers serving outside, return, and relief air shall provide for tight closure and full opening, with smooth free 4. All volume damper handles and manual locking quadrants shall be freely visible and exposed for identification and use. These devices found to be covered over by duct installation shall require the mechanical contractor and/or the insulation contractor to survey all of the installed volume dampers and correct such measures at no additional cost to the owner. 5. Verify that all supply, return, exhaust and transfer grilles, registers, diffusers and high pressure terminal units are open and installed for proper operation. 6. Ensure that all HVAC units and associated apparatus, such as heating and cooling coil line penetrations , filter sections, mixing box sections, access doors etc., are blanked and/or 7. Ensure that all fans (supply, return, relief and exhaust) are operating and free of vibration and drives packages are checked for proper rotation and belt tension. Overload protection devices shall be of proper sizing and rating as verified by Electrical Contractor and confirmed to the Mechanical Contract 8. Make any necessary changes to the fan sheaves, belts, and dampers as required by the TABB Company at no additional cost. 9. Insure that all HVAC units have newly installed and clean air filters prior to commencing with the air balance. A. Final TAB Report - The TAB Company shall submit the final TAB report for review by the engineer. All outlets, devices, HVAC equipment, etc. shall be identified, along with a umbering system corresponding to report unit identification. The TAB company shall submit an Project Performance Certification and Guaranty, assuring that the project system were tested, adjusted, and balanced in accordance with the project specifications h. Total static pressure and external static pressure, specified and actual
i. Component (coils, filters, air blenders etc.) static pressure drop, specified and actual n. Belt size, manufacturer and center distance from motor shaft to fan shaft. e. Total static pressure (total external), specified and actual j. Belt size, manufacturer and center distance from motor shaft to fan shaft.

1. Equipment is operable and in a safe and normal condition 2. Temperature control systems are installed complete and operable 3. Proper thermal overload protection is in place for electrical equipmen 4. Final filters are clean and in place. If required, install temporary media in addition to final filters 5. Duct systems are clean of debris. 7. Fire and volume dampers are in place and open 8. Coil fins have been cleaned and combed. 9. Access doors are closed and duct end caps are in place Air outlets are installed and connected. 11.Duct system leakage has been minimized. B. Report any defects or deficiencies noted during performance of services to the Engineer C. Promptly report abnormal conditions in mechanical systems or conditions which prevent system balance D. If, for design reasons, system cannot be properly balanced, report as soon as observed E. Beginning of work means acceptance of existing conditions. A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing B. Provide additional balancing devices as required. A. Adjust air handling systems to plus or minus 10 percent for supply systems and plus or minus 10 percent for return and exhaust systems from figures indicated. 3.05 ADJUSTING A. Adjust work under provisions of Section 15000 B. Recorded data shall represent actually measured, or observed condition C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops. D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified. E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings. F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner. 3.06 AIR SYSTEM PROCEDURE A. General: 1. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities 2. Make air quantity measurements in ducts by Pitot-tube traverse of entire cross sectional area of duct. 3. Measure air quantities at air inlets and outlets. 4. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise 5. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters 6. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation. 7. Provide system schematic with required and actual air quantities recorded at each outlet or inlet 8. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of 10. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating. 11. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive B. Specific: 1. The TAB Company shall perform the following TAB procedures in accordance with the following: a. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor. b. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main supply and return ducts, as applicable to obtain total CFM. c. Outside Air on applicable equipment using a Pitot-tube traverse. If a traverse is not practical, use the mixed-air temperature method if the inside and outside temperature difference is at least 20 degrees F., or use the difference between Pitot-tube traverses of the supply and return air ducts. d. Static Pressure - Test and record system static profile of each supply fan. Fan Speeds - Test and adjust fan RPM to achieve maximum or design CFM. o. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor . Pitot-Tube Traverse - Perform a Pitot-tube traverse of main exhaust ducts to obtain total CFM. e. Static Pressure - Test and record system static profile of each exhaust fan. For Zone, Branch and Main Ducts: a. Adjust ducts to within design CFM requirements. As applicable, at least one zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely oper or Diffusers, Registers, and Grilles: a. Tolerances - Test, adjust, and balance each diffuser, grille, and register to within 10% of design requirements. Minimize drafts. b. Identification - Identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets a. Air Temperature - Once air flows are set to acceptable limits, take differential pressure readings across coils and take wet bulb and dry bulb air temperatures on the entering and END OF SECTION NOTE: THESE SPECIFICATIONS ARE THE PROPERTY OF THE ENGINEER AND ARE NOT TO BE REUSED OR REPRODUCED WITHOUT WRITTEN PERMISSION. THIS 8690 S. Lakeview Rd. Traverse City, MI 49684 (231) 932-0800 office

f. Test air flow

8. Air Distribution Test Sheet

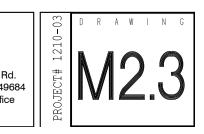
. Design air flow

a. Air terminal number

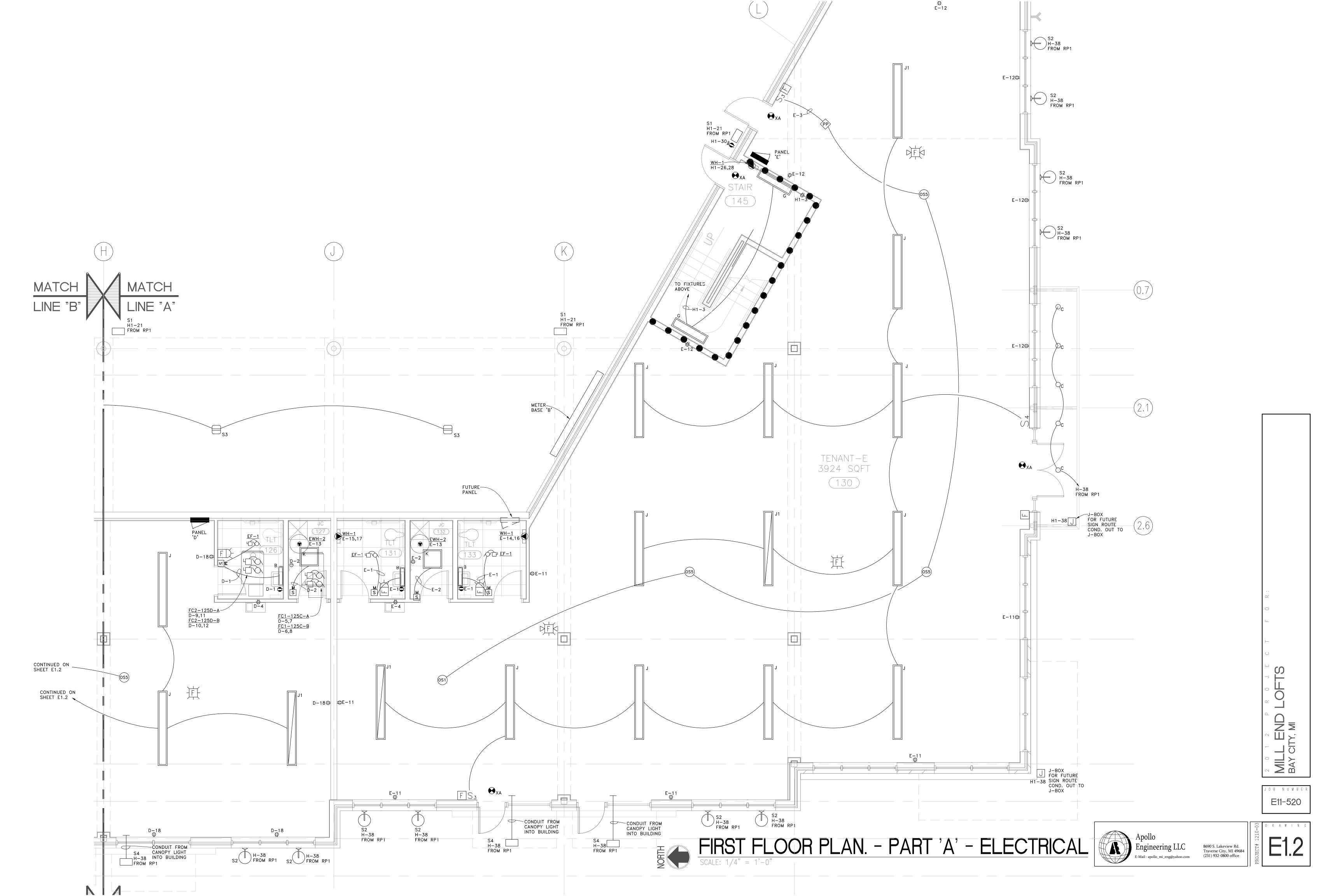
. Room number/location

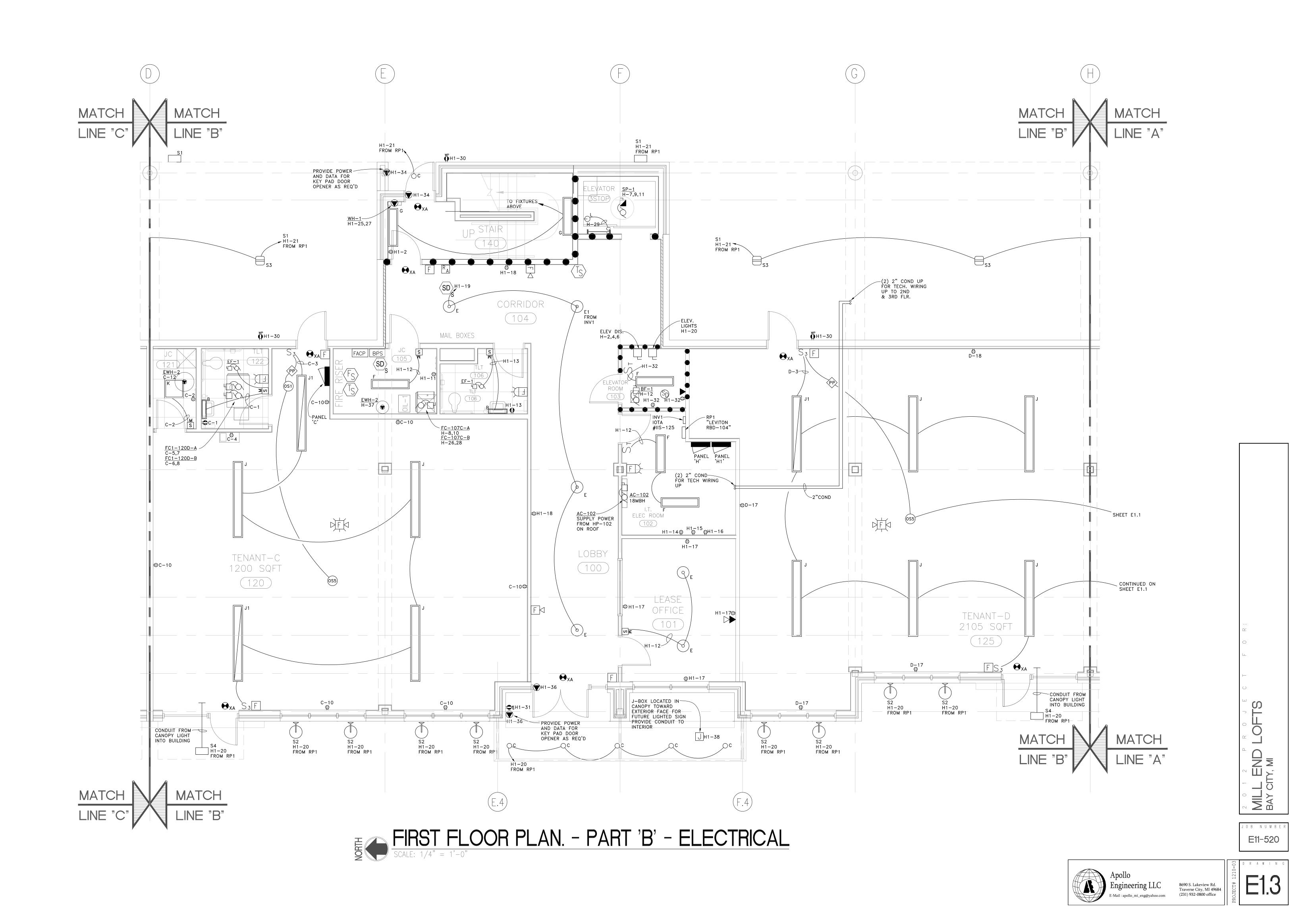
e. Area factor if flow hood is not used

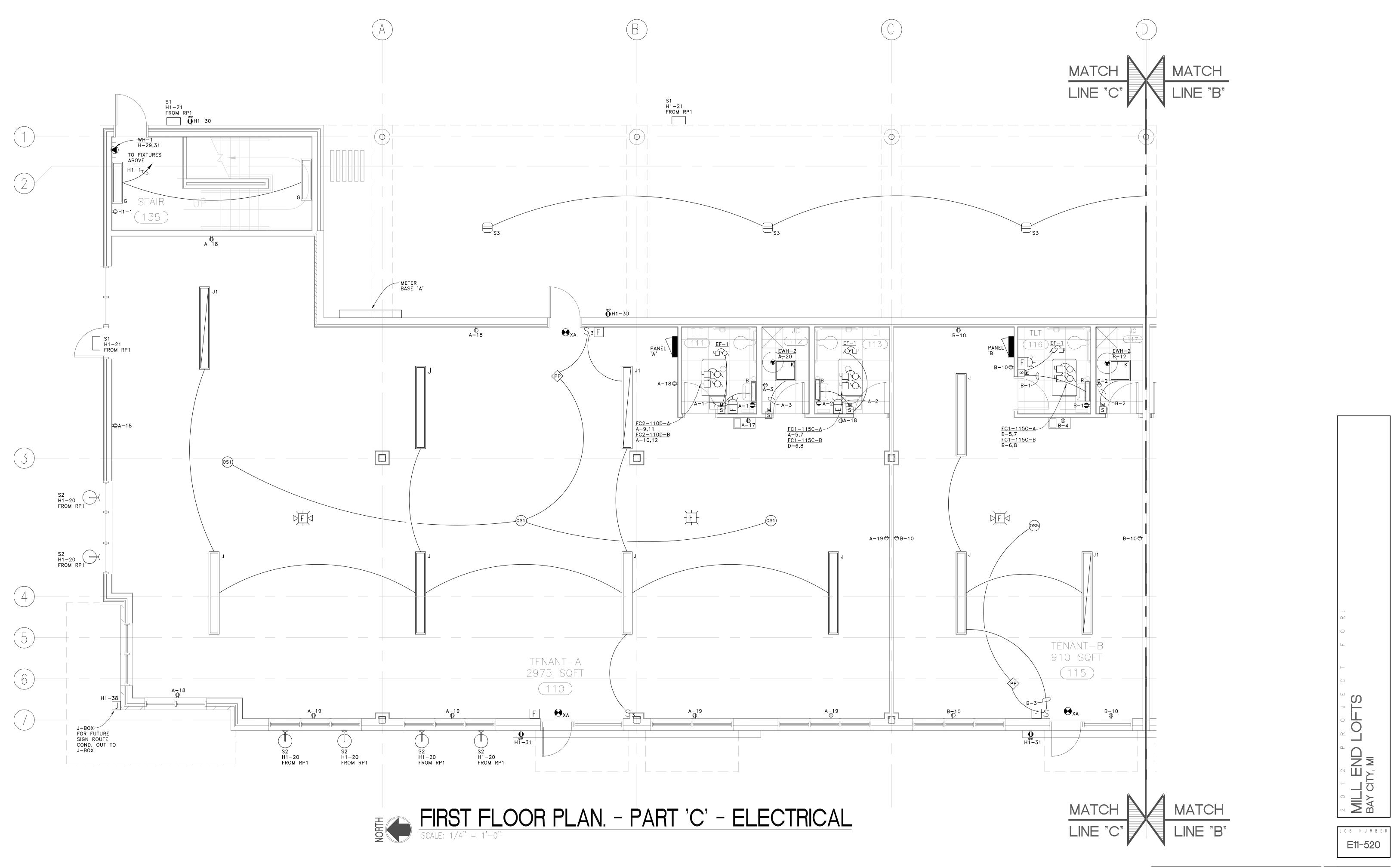
g. Test (final) velocity/air volume



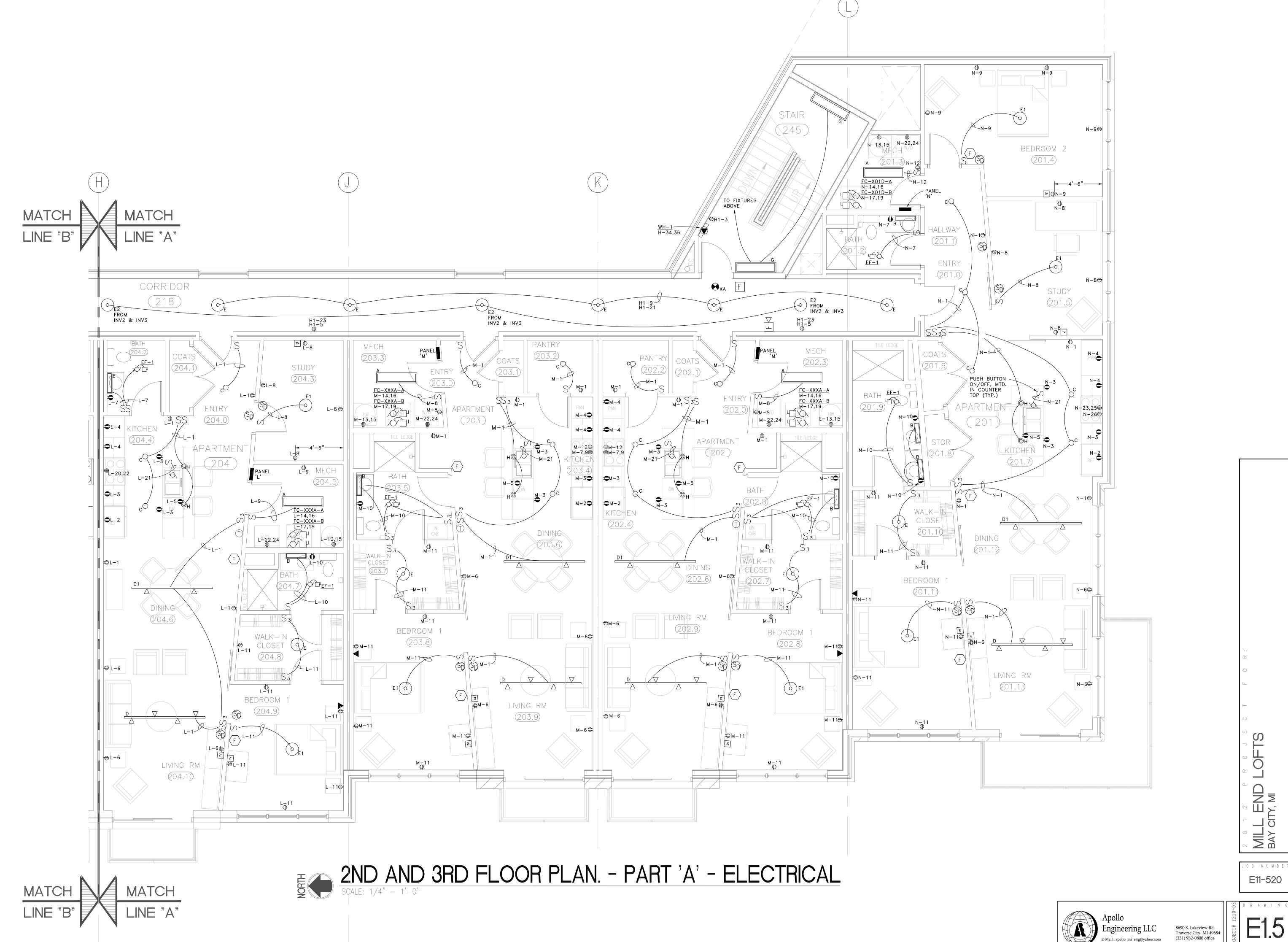
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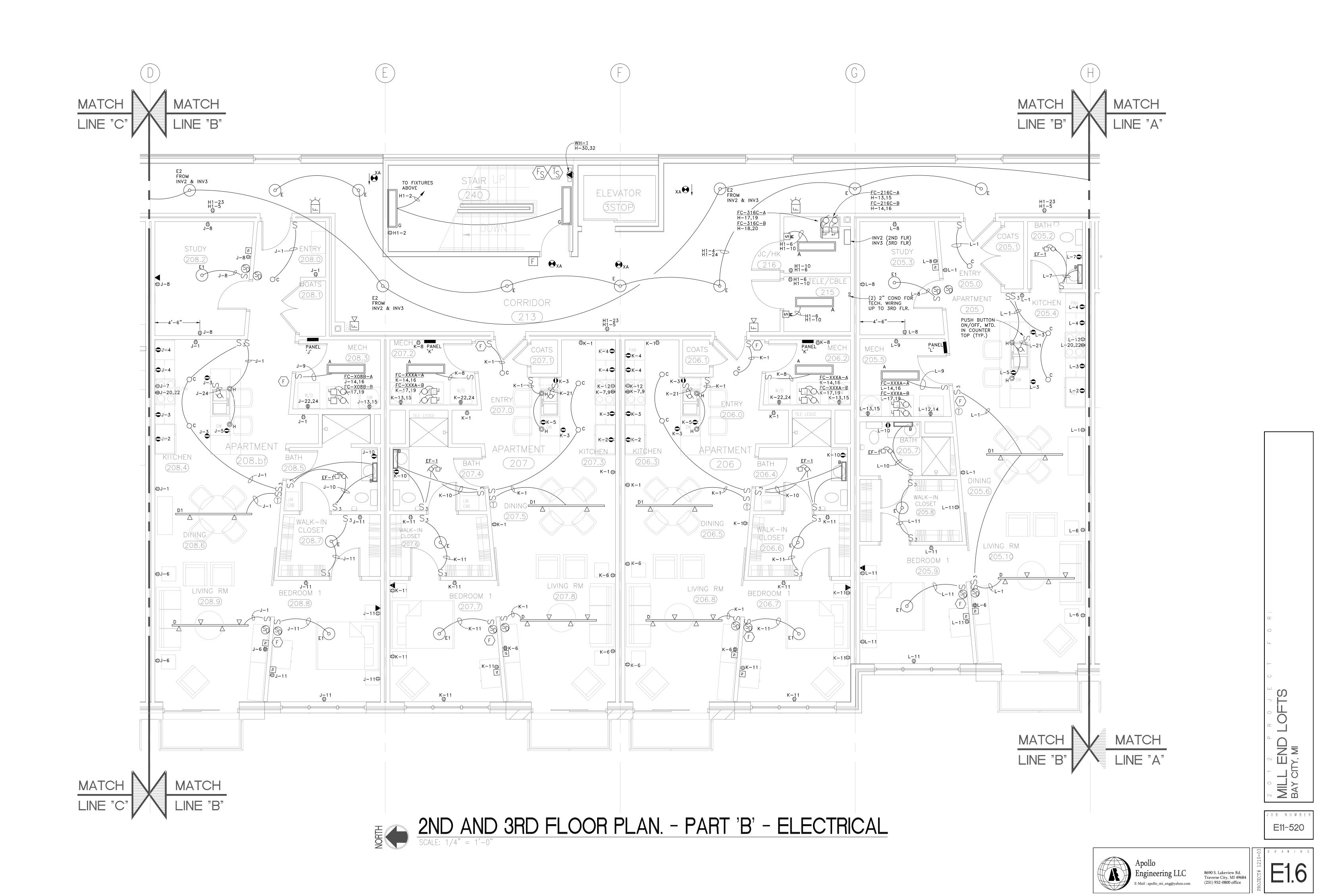


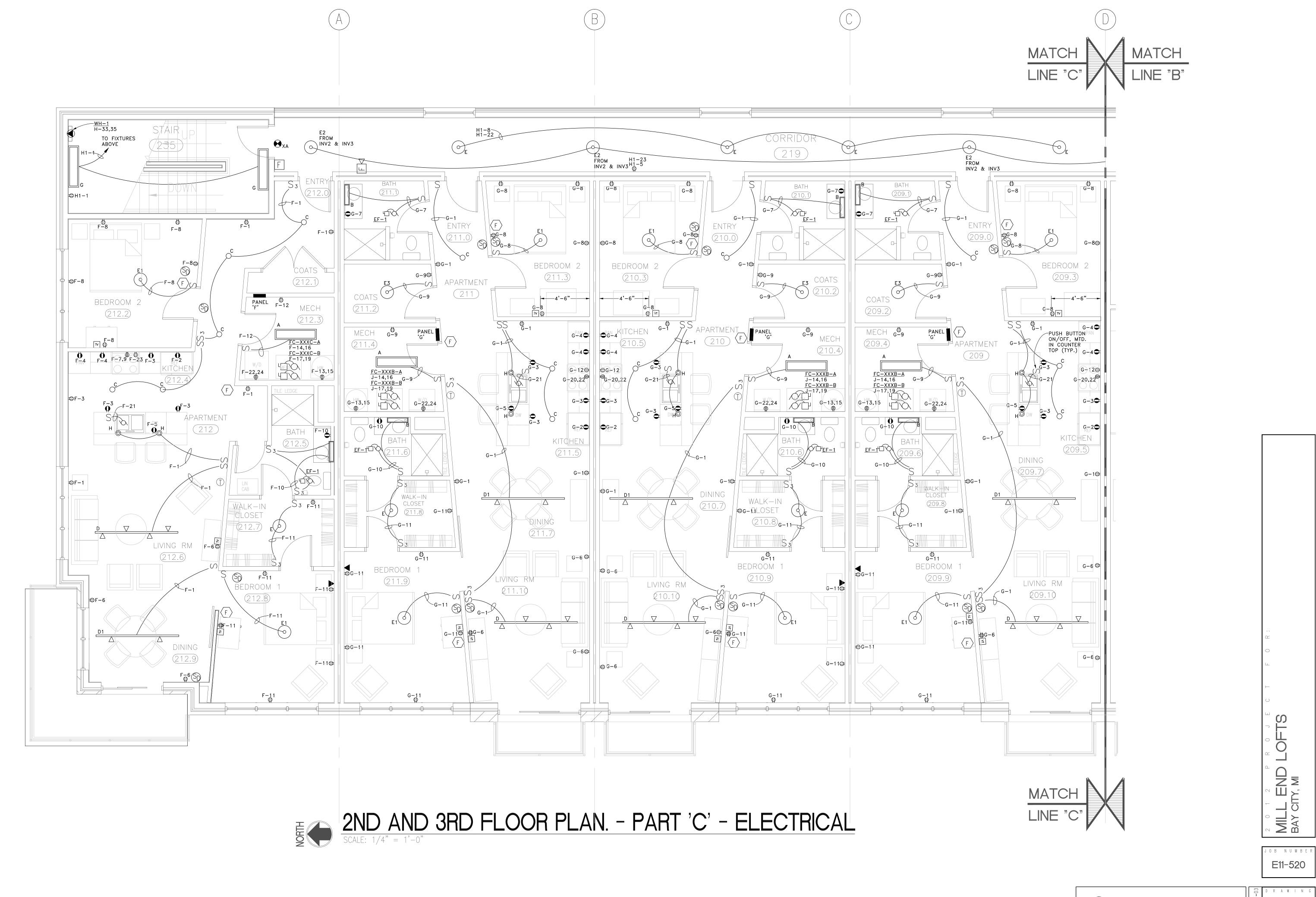






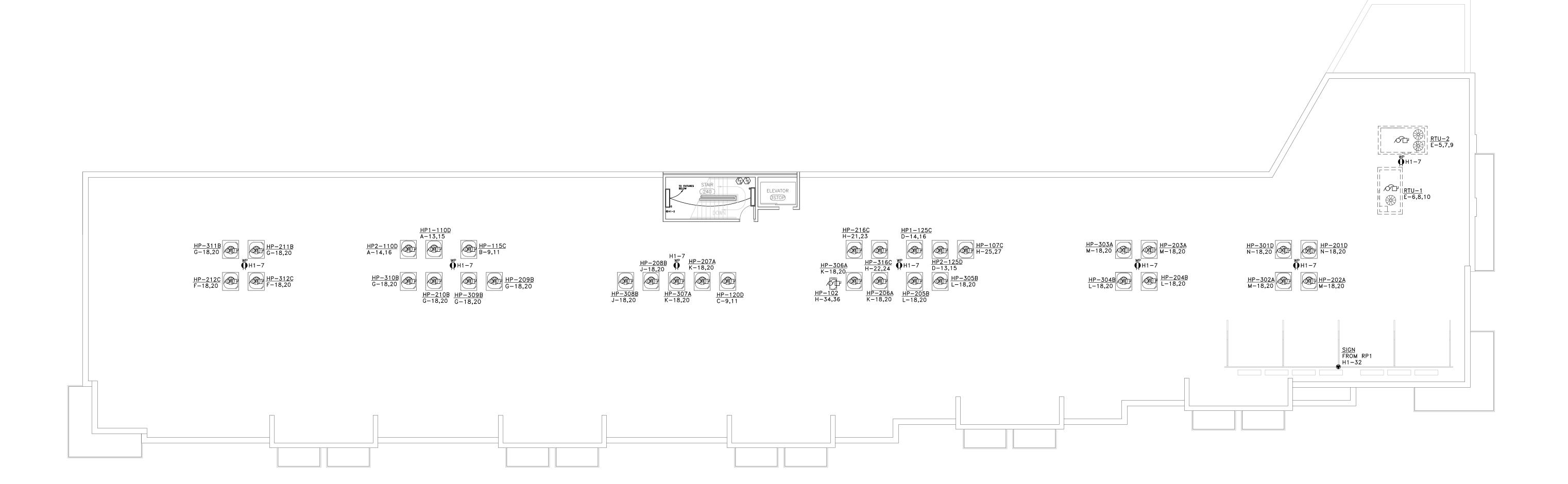






Apollo
Engineering LLC
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Traverse City, MI 49684
(231) 932-0800 office





J O B N U M B E

E11-520



ELECTRICAL NOTES

- PRIOR TO SUBMITTING A PROPOSAL, BIDDER SHALL HAVE VISITED THE CONSTRUCTION SITE. HE SHALL BE FAMILIAR WITH THE EXISTING CONDITIONS UNDER WHICH HE WILL HAVE TO OPERATE AND WHICH WILL IN ANY WAY AFFECT THE WORK UNDER THIS CONTRACT. NO SUBSEQUENT ALLOWANCE WILL BE MADE IN THIS CONNECTION ON BEHALF OF THE CONTRACTOR FOR ANY ERROR OR NEGLIGENCE ON HIS
- ELECTRICAL WORK SHALL COMPLY WITH THE LATEST ENFORCEABLE EDITION OF THE N.E.C., LOCAL AND STATE CODES, ORDINANCES, REGULATIONS, INCLUDING THE OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA), AND ADA GUIDELINES WITH THE LOCAL CODE AUTHÒRITIES HAVING JURISDICTION.
- ELECTRICAL CONTRACTOR SHALL OBTAIN ALL PERMITS, PAY ALL FEES, INCLUDING COSTS ASSESSED BY THE ELECTRIC UTILITY COMPANIES, AND ARRANGE FOR ALL INSPECTIONS FOR HIS WORK. AT THE COMPLETION OF ELECTRICAL WORK, THE ELECTRICAL CONTRACTOR SHALL FURNISH THE OWNER WITH ALL CERTIFICATES OF FINAL INSPECTION AND APPROVALS.
- 4. ELECTRICAL MATERIALS SHALL BE NEW, AND BEAR THE "UL" LABEL
- BRANCH CIRCUIT WIRE FOR LIGHTING, RECEPTACLE AND SMALL POWER SHALL BE COPPER, RATED 75 DEGREES C, MINIMUM SIZE #12 AWG, AND BE TYPE "THHN", AND BE INSTALLED IN EMT. UNLESS OTHERWISE NOTED OR REQUIRED BY CODE. FEEDERS AND SECONDARY SERVICE CONDUCTORS SHALL BE STRANDED COPPER WITH 600 VOLT INSULATION, RATED 90 DEGREES C, TYPE "THHN", AND BE INSTALLED IN EMT OR PVC CONDUIT, MINIMUM SIZE 1/2" UNLESS OTHERWISE NOTED OR REQUIRED BY CODE. ALL WIRE AND CABLE SHALL BE NEW AND SHALL BE DELIVERED TO PROJECT IN UNBROKEN AND UNDAMAGED CARTONS AND REELS.
- FUSES SHALL BE "UL" LISTED, DUAL AS MANUFACTURED BY BUSMAN CO., OR APPROVED EQUAL (200,000 ERIC).
- 7. PLATES FOR SWITCHES AND RECEPTACLES SHALL BE BRUSHED SMOOTH STAINLESS STELL.
- FLUORESCENT FIXTURE BALLAST VOLTAGE RATING SHALL BE AS NOTED, NON, HIGH POWER FACTOR, ENERGY SAVING, CLASS P. "A" SOUND RATED. HIGH DISCHARGE (HID) BALLAST SHALL BE NON, HIGH POWER FACTOR, CONSTANT WATTAGE AUTO TRANSFORMER TYPE, WITH STARTING CURRENT NOT EXCEEDING THE OPERATING CURRENT.
- 9. PANEL BOARDS SHALL BE RATED 120/208V, 3 PHASE, 4W, OR AS NOTED WITH PLUG TYPE BRANCH CIRCUIT BREAKERS RATED A MINIMUM 10,000 A.I.C. PANEL BOARDS SHALL BE SIMILAR TO SQUARE D, TYPE QO AND I-LINE, OR EQUAL BY WESTINGHOUSE/ CHALLENGER, E.T.A.., OR GENERAL ELECTRIC.
- 10. ELECTRICAL CONTRACTOR SHALL VERIFY EXACT ELECTRIC UTILITY COMPANIES SERVICE POINTS AND PRIMARY SERVICE CONDUIT, ROUTING, AND SIZE WITH UTILITY COMPANY SERVICE PLANNERS PRIOR TO BEGINNING WORK.
- 11. ELECTRICAL CONTRACTOR SHALL GUARANTEE ALL WORK INSTALLED UNDER HIS CONTRACT TO BE FREE FROM DEFECTIVE WORKMANSHIP AND MATERIALS FOR A PERIOD OF ONE YEAR AFTER THE ACCEPTANCE OF THE BUILDING BY THE OWNER. SHOULD DEFECTS OCCUR WITHIN THIS PERIOD, REPAIR AND/OR REPLACE DEFECTIVE ITEMS AT NO EXPENSE
- 12. ELECTRICAL CONTRACTOR SHALL COORDINATE LOCATIONS OF HIS EQUIPMENT AND WORK WITH OTHER BUILDING TRADES TO AVOID ANY INTERFERENCE'S BETWEEN HIS WORK AND THE WORK OF OTHER BUILDING TRADES. IF ANY DISCREPANCIES OCCUR, CONSULT WITH THE ARCHITECT AND/OR OWNER BEFORE CONTINUING.
- 13. LAMPS ALL LAMPS SHALL BE CLASSIFIED "ENERGY SAVING", AND BE PROVIDED BY E.C.
- 14. THE CONTRACTOR SHALL BE HELD FULLY RESPONSIBLE FOR THE PROPER RESTORATION OF ALL EXISTING SURFACES REQUIRING PATCHING, PLASTERING, PAINTING AND/OR OTHER REPAIR DUE TO THE INSTALLATION OF ELECTRICAL WORK UNDER THE TERMS OF THIS SPECIFICATION. CLOSE ALL OPENINGS, REPAIR ALL SURFACES,
- 15. THE ELECTRICAL CONTRACTOR SHALL PERIODICALLY REMOVE FROM THE SITE ALL DEBRIS AND RUBBISH ACCUMULATING AS A RESULT OF THE ELECTRICAL INSTALLATION. UPON COMPLETION OF THE PROJECT, HE SHALL DISPOSE OF ALL DEBRIS AND RUBBISH AND SHALL LEAVE ALL AREAS CLEAN. THE INTERIORS OF ALL CABINETS, PULL BOXES, AND EQUIPMENT ENCLOSURES SHALL BE FREE OF ANY DEBRIS.
- 16. UNDERGROUND CONDUIT TO BE SCHEDULE 40 PVC.

MODEL #

SY950-2-32-B11-PSN-UNV

V8AWMSC225MV W/2-F025T8

R8BL (1) R38BL (1) R533BL (4)

R8BL (1) R38BL (1) R533BL (4)

H-15118-91-CB8-91-LCGU-FR-91

H-15118-91-FSMC-91/LCGU-FR-91

H-15118-91-FSMC-91/LCGU-FR-91

MDL-4-A-W-2D+1-32T8-E-PSN-U

H-15112-91-CB8-91-GCU-FR-9

IE-232-EL53-A-B11-PSN-41-UNV

H-15118-91-B-2-91-LSGU-FR

IC22W/TCP LED14DR630K

IE-21-32-A-B11-PNS-UNV

TY-242-217-B11-PSN-UNV

IE-2232-B11-PSN-UNV

DT-A032-4K-UN-BL

VXBR1F26

GLED52N

N5WHSDCR

DLC-2-G-W

TYPE BRAND

A SIMKAR

C JUNO

ONUL | a '

D1 JUNO

E HI-LITE

E1 | HI-LITE

E2 | HI-LITE

E3 RAB

F SIMKAR

G SIMKAR

H HI-LITE

J SIMKAR

J1 SIMKAR

K SIMKAR

L RAB

S1 JUNO

S3 RAB

S2 | HI-LITE

S4 NAVILITE

XA SIMKAR

B AMERICAN FLUORESCENT

- 17. ELECTRICAL JOINTS WILL BE PERMITTED ONLY IN JUNCTION AND OUTLET BOXES. ALL JOINTS SHALL BE FIRMLY BONDED TOGETHER AND TAPED OR SHALL BE MADE WITH MECHANICAL CONNECTORS.
- 18. ALL LOCATIONS OF DEVICES TO BE COORDINATED WITH ARCHITECT BEFORE ROUGH-IN.

					EATER SO	CHEDULE		
MARK	MANU.	MODEL No.	BTU/HR.	WATTS	ELECTRICAL	REMARKS		
WH-1	MARKEL	J3425T	17,065	5000	208v/1ø, 5000W	BUILT IN THERMISTAT& CIRCUIT BREAKER		
NOTES: 1. UNITS BASED ON MARKEL. (Q-MARK & ELECTROMODE MAY BE BID AS EQUAL).								

LIGHTING FIXTURE SCHEDULE

(2) F32/T8/35K

(2) F25/T8/35K

HPXPPAR30-30-25-4 65W

HPXPPAR30-30-25-4 28W

630LM/3K/LED

(2) F32/T8/35K

(2) F54/T5/H0

(4) F32/T8/35K

(4) F32/T8/35K

(2) F17/T8/35K

1) F26/T8/35K

LED LIGHT BAR (51)

F32/TTT

F32/TTT

F32/TTT

F32/TTT

LED LAMP

24 LED/41K

LED

LED

(1) LED

30W

52W

52W

97W

20W

128W

128W

34W

34W

51W

24W

l 6W

MOUNTING TYPE

SURFACE

SURFACE

RECESSED

SURFACE

SURFACE

SURFACE

SURFACE

PENDENT

CHAIN HUNG

CHAIN HUNG

RECESSED

WALL MTD.

WALL MTD.

BASE

CEILING

SURFACE

SURFACE

TRACK

TRACK

TOTAL FIXTURE POWER VOLTAGE NOTES:

120V

120V

120V

120V

120V

UNV

UNV

120V

120V

120V

120V

120V

120V

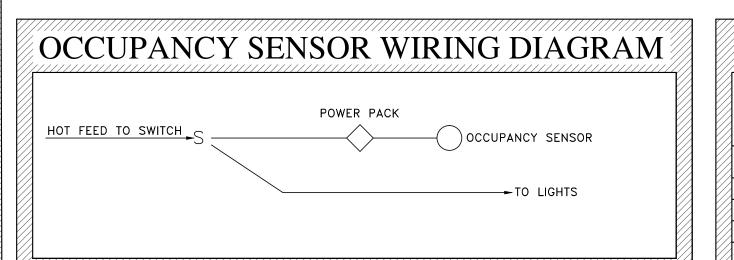
120V

120V | -

ELECTRICAL SYMBOL LEGEND SYMBOL DESCRIPTION NOTES SINGLE POLE SWITCH MOUNT @ 44" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED THREE WAY SWITCH MOUNT @ 44" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED 2'x2' FIXTURE, TYPE X SEE LIGHTING FIXTURE SCHEDULE FOR TYPES \bigcirc X CAN FIXTURE SEE LIGHTING FIXTURE SCHEDULE FOR TYPES 1'x4' FIXTURE, TYPE X --SEE LIGHTING FIXTURE SCHEDULE FOR TYPES EXIT SIGN, TYPE X SEE LIGHTING FIXTURE SCHEDULE FOR TYPES MOUNT @ 24" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED DUPLEX OUTLET - 20 AMP QUADPLEX OUTLET - 20 AMP MOUNT @ 24" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED DUPLEX OUTLET - GROUND FAULT MOUNT @ 24" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED DUPLEX OUTLET - WEATHER PROOF COVER MOUNT @ 24" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED SPECIAL PURPOSE OUTLET, AS NOTED REFER TO SHOP DRAWINGS FOR CONNECTION REQUIREMENTS MOTOR, AS SPECIFIED REFERENCE SPECIFICATIONS FOR REQUIREMENTS REFER TO GENERAL ELECTRICAL NOTES AND ONE-LINE DIAGRAM. FUSED DISCONNECT REFERENCE SPECIFICATIONS FOR REQUIREMENTS STARTER/DISCONNECT PROVIDE ALL LINE VOLTAGE WIRING AND CONDUIT FOR VFD INSTALL. FUSED DISCONNECT FOR VFD CONNECTION (CONTROLS CONTRACTOR WILL PROVIDE VFD UNIT.) LIGHTING/BRANCH CIRCUIT PANELS REFER TO GENERAL ELECTRICAL NOTES AND ONE-LINE DIAGRAM MOUNT @ 24" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED, EC TO DATA OUTLET PROVIDE SINGLE GANG BOX WITH 1"C STUBBED IN ATTIC SPACE. VOIP OUTLET MOUNT @ 24" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED, EC TO PROVIDE SINGLE GANG BOX WITH 1"C STUBBED IN ATTIC SPACE MECHANICAL THERMOSTAT PROVIDE CONDUIT AND BACKBOX MECHANICAL SENSOR PROVIDE CONDUIT AND BACKBOX ARC-FAULT CIRCUIT INTERRUPTER PROTECTION INSTALL ARC FAULT RECEPTACLES AS CALLED FOR IN PANEL SCHEDULES TAMPER RESISTANT RECEPTACLES INSTALL TAMPER RESISTANT RECEPTACLES AS CALLED FOR IN PANEL SCHEDULES

		OCC	CUPANCY LEGEND
SYMBOL	BRAND	MODEL #	DESCRIPTION
, M S	LEVITON	OSSMT-MDW	WALLBOX MOUNTED MULTI-TECHNOLOGY OCCUPANCY SENSOR
10 S	LEVITON	ODS10-IDW	WALLBOX MOUNTED PIR OCCUPANCY SENSOR
(OS1)	LEVITON	OSC10-MOW	CEILING MOUNTED MULTI-TECHNOLOGY OCCUPANCY SENSOR (1000 SQ. FT)
<u>0</u> S2	LEVITON	OSC05-MOW	CEILING MOUNTED ULTRASONIC OCCUPANCY SENSOR (500 SQ. FT)
0\$3	LEVITON	OSW12-MOW	WALL/CORNER MTD. MULTI-TECHNOLOGY OCCUPANCY SENSOR (1200 SQ. FT)
OS4	LEVITON	OSC20-U0W	CEILING MOUNTED ULTRASONIC OCCUPANCY SENSOR (2000 SQ. FT)
0\$5	LEVITON	OSC20-MOW	CEILING MOUNTED MULTI-TECHNOLOGY OCCUPANCY SENSOR (2000 SQ. FT)
PP	LEVITON	OSP20-ODO	POWER PACK FOR 120VAC SYSTEM
Šτ	LEVITON	6212H	WALLBOX MOUNTED 5-BUTTON TIMER SWITCH UP TO 12 HOURS
	///////////////////////////////////////		

	/////////////	/ERTEI			- : : / / / / / / / / / / / / / / / / /	////
		////////	///////			/
IRCUIT #	MODEL #	LOAD	VOLTAGE	OUTPUT	DESCRIPTION	/
NV1	IIS-125-SM	105W	120V	20A/1P	1ST FLOOR CORRIDOR	/
NV2	IIS-350-SM	330W	120V	20A/1P	2ND FLOOR CORRIDOR	/
NV3	IIS-350-SM	330W	120V	20A/1P	3RD FLOOR CORRIDOR	/
						/
VERTER T	O BE BASED ON	IOTA	· · · · · ·			/
////////	///////////////////////////////////////	///////////////////////////////////////	/////////	///////		/,



	WII	RE S	IZE	REC	UIR	EMI	ENT	S	
	-	BASED ON WIRES FO	r runs ove	ER 100'-0"	E: T DROP (5% SHALL BE 5% DROP AL	DETERMINED	CIRCUITS. ON THIS		
BRANCH CIRCUIT AMPS		LENGT	H OF RUN -	- FROM PAN	IEL TO FIRS	T CONNECTION	ON - FEET		
AMPS	50'	60'	70'	80'	90'	100'	110'	120'	130'
15	#12	#12	#12	#12	#12	#12	#10	#10	#10
20	#12	#12	#12	#10	#10	#10	#10	#10	#8
30	#10	#10	#10	#10	#8	#8	#8	#8	#6

CIR NO.	AMP/ POLES		DESCRIPTION	LOAD	LOAD		DESCRIPTION	AMP/ POLES	CIR NO.
1				4488	8640				2
3]100/3	PANEL 'H1'	(ELECT. 102)	4488	8640	ELEVATOR	(ELEV. RM. 103)	100/3	4
5				4488	8640				6
7				828	3764	FC-107C-A	(FIRE 107)	60/2	8
9	_ 20/2	SP-1	(ELEV. PIT)	828	3764	10 10/0 //	(, -	10
11				828	300	BF-1	(FIRE 107)	20/1	12
13	60/2	FC-216C-A	(JC 216)	3764	1882	FC-216C-B	(JC 216)	25/2	14
15	00, 2	10 2100 A	(30 210)	3764	1882	10 2100 B	(00 210)	23/2	16
17	60/2	FC-316C-A	(JC 316)	3764	1882	FC-316C-B	(JC 316)	25/2	18
19	100,2		(00 010)	3764	1882	10 0100 2		20, 2	20
21	50/2	HP-216C	(ROOF)	3806	3806	HP-316C	(ROOF)	50/2	22
23	100,2		(1.001)	3806	3806	111 0100	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	00, 2	24
25	50/2	HP-107C	(ROOF)	3806	1882	FC-107C-B	(FIRE 107)	25/2	26
27	100,2		(1.001)	3806	1882	10 1070 2	(11112 107)	20,2	28
29	30/2	WH-1	(STAIR 135)	2500	2500	 WH−1	(STAIR 240)	30/2	30
31	150, -		(21/111/ 1997	2500	2500			55, 2	32
33	30/2	WH-1	(STAIR 235)	2500	1352	HP-102	(ROOF)	20/2	34
35			(3.7 200)	2500	1352	102			36
37	20/1	EWH-2	(JC 105)	1650	600	LIGHTS	(EXTERIOR)		
39	20/1	SPARE				SPARE		20/1	40
41		SPACE				SPACE			42

F	ANE	iL H1					00 AMPS M.L.O. 120,	/208V-3	3ø-4W
CIR NO.	AMP/ POLES	DESCRIPTION		LOAD	LOAD	DESCR	IPTION	AMP/ POLES	CIR NO.
1	20/1	LIGHTS & RECEPTACLES (STAIRS	135)	924	924	LIGHTS & RECEPTACLES	(STAIRS 140)	20/1	2
3	20/1	LIGHTS & RECEPTACLES (STAIRS	145)	924	506	LIGHTS	(CORRIDOR 213)	20/1	4
5	20/1	RECEPTACLES (CORRIDORS 2ND	FL)	1080	506	LIGHTS & RECEPTACLES	(JAN 216)	20/1	6
7	20/1	RECEPTACLES (R	00F)	1080	512	LIGHTS	(CORRIDOR 219)	20/1	8
9	20/1	LIGHTS (CORRIDOR	218)	512	506	LIGHTS & RECEPTACLES	(JC 316)	20/1	10
11	20/1	RECEPTACLES (JC, FIRE	107)	360	200	LIGHTS	(JC, FIRE 107)	20/1	12
13	20/1	LIGHTS & RECEPTACLES (TOILET	106)	300	360	RECEPTACLES	(IT 102)	20/1	14
15	20/1	RECEPTACLES (IT	102)	360	360	RECEPTACLES	(IT 102)	20/1	16
17	20/1	RECEPTACLES (LEASE OFFICE	101)	720	360	RECEPTACLES	(LOBBY 100)	20/1	18
19	20/1	LIGHTS (CORRIDOR	104)	165	180	ELEV. LIGHTS	(ELEV. ROOM)	20/1	20
21	20/1	LIGHTS (CORR	318)	522	512	LIGHTS	(CORRIDOR 319)	20/1	22
23	20/1	RECEPTACLES (CORRIDORS 3RD	FL.)	1080	512	LIGHTS	(CORRIDOR 313)	20/1	24
25	30/2	WH-1 (STAIR	140)	2500	2500	 WH-1	(STAIR 145)	30/2	26
27	0072	WII 1 (STAIK	140)	2500	2500	1111 1	(317/11/ 140)	00, 2	28
29	20/1	LIGHT (ELEV.	PIT)	100	1260	RECEPTACLES	(EXTERIOR)	20/1	30
31		SPACE			1000	SIGN (VERIFY W/ SIGN I	PROVIDER) (ROOF)	35/1	32
33	30/2	WH-1 (STAIR	140)	2500	500	DOOR OPENER	(ROOF)	20/1	34
35	33/2	WIT 1	1 70/	2500	500	DOOR OPENER	(EXTERIOR)	•	36
37	20/1	J-BOX (EXTER	RIOR)	500	500	J-BOX	(EXTERIOR)		38
39	20/1	SPARE				SPARE		20/1	40
41		SPACE				SPACE			42

120V W/ LR30/25/30K/14W/800/GY LAMP

120V | W/ LR30/25/30K/14W/800/GY LAMP

MOUNT BELOW BELCONIES, BATTERY BACKUP LIGHTS AT ENTRANCES

120V MT. NEAR CEILING

MT @ ±8' A.F.F.

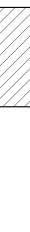
W/ EMERGENCY

| W / EMERGENCY

CLEAR GLOGE & CAGE

PAN 'A'	NEL PANEL	PANEL F	F'	NOTE: METERS TO BE PROVI BY BAY CITY ELECTRI ELECTRICAL CONTRACT PROVIDE METER BASE METERS AND INSTALL	C LIGHT & POWER. FOR TO S TO HOUSE	, _M ,	PANEL PANE	2 PARALLEL RUN	PANEL 'H'		SMALL APLIANCE – (DRYERS – (RANGES – (REFRIGERATORS – (1,250 SQFT) (3VA) = 3.8 KW 1500)(2) = 3.0 KW 6240)(1) = 6.2 KW 7900)(1) = 7.9 KW .75KW)(1) = 0.8 KW
	PANEL PA	NEL PANEL 'G'	PANEL 'F'	3#3/0 MCM 1#6 GND. 2 1/2"C (TYP.) BASE A	3#3/0 MCM 1#6 GND. 2 1/2"C (TYP.)	PANEL 'M'	PANEL !	PANEL 1#1 GND. 2 1/2"C METER BASE B	PAN 'E'		MICROWAVES — (WATER HEATER — (DISPOSAL — (SUB TO FIRST REMAINDER GI	.5KW)(1) = 0.5 KW 1.0KW)(1) = 1.0 KW 4.5KW)(1) = 4.5 KW .9KW)(1) = 0.9 KW .9TAL CONN. LOAD = 28.6 KW .10 KVA @ 100% = 10.0 KW .10 KVA @ 40% = 7.4 KW .10 CONN. LOAD = 17.4 KW
M) 3P225 M) 3P225 M M	M 2P200 2	M 2P200 2P2 M 2P200 2P2 M 2P200 2P2 M M	1200A MAIN C BREAKE 120/20	CIRCUIT	2 0 2 0	M M	2P200 00 2P200 00 2P200 00 M	1600A MAIN CIRCUIT BREAKER. 120/208V—3PH—4W	M 3P400 M 3P400 M		HEAT PUMP & SUPP. - (12.3 SQFT) + (TOTAL CO TOTAL LOAD - 32.5 H	11.1)(.25) = 15.1 KW NN. LOAD = 17.4 KW 32.5 KW
3P225 0 0-	M) 2P200 2	2P200 2P2 M M 2P200 2P2	00		o	P200 2P20 M M M P200 2P20) M 00 2P200		3P225 0 0-	P	RANSFORMER ROVIDED AND INSTALL	ED BY UTILITY
4#4/0 1#4 GN 2 1/2' (TYP.)	PANEL PA 'C' PANEL ''C PANEL	PANEL F	PANEL 'G'		3#3/0 MCM 1#6 GND. 2 1/2"C (TYP.)	PANEL PANEL	PANEL F M' PANE M' PANE	PANEL	PANEL 'D'	#4/0 MCM #4 GND. 1/2"C TYP.) 4 PARALLEL RUNS C 4#600 MCM 4"C	3 PAF	PRIMARY SERVICE RALLEL RUNS OF MCM
				3/0 COPPER) 400 COPF	PER	0	4/0) COPPER			
LIGHTS SMALL DRYERS RANGES REFRIG DISHWA MICROV WATER DISPOS EQUIP	APLIANCE - S - S - GERATORS - 'ASHER - WAVES - R HEATER - SAL -	(3000)(12) (6240)(12) (7900)(12) (.75KW)(12) (.5KW)(12) (1.0KW)(12) (4.5KW)(12) (.9KW)(12) (126.1KW) TABLE 22	= + (15.0KW)(20.84 (12 A) FT) (3VA)=	PARTMENT) (478.4)(.4 62,800/1000	= 62.8 KW		=	#6 COPF	DRYERS RANGES REFRIGE DISHWA: MICROW WATER DISPOSA EQUIP	REC - (14,564 SC) APLIANCE - (3000)(12) - (6240)(12) - (7900)(12) CRATORS - (.75KW)(12) SHER - (.5KW)(12) AVES - (1.0KW)(12) HEATER - (4.5KW)(12) - (141.6 KW) TABLE 2))) + (15.0KW)(.25) 20.84 (12 APARTMENT	1000 = 36.0 KW = 74.9 KW = 94.8 KW = 9.0 KW = 6.0 KW = 12.0 KW = 54.0 KW = 10.8 KW = 145.4 KW 486.5 KW
EQUIP WATER	_	· (36.9KW) + · (1.7KW)(3)	(15.0KW)(.2	25)	= 40.7KW = 5.0 KW 108.5 KW	400 COP	PER	#4 COPPER	WATER	& REC - (13,444 SC - (111.8KW) KITCHEN - (89.1KW)(E HEATER - (1.7KW)(2) -OAD - 447.7KW - 124		= 115.5 KW = 115.5 KW = 89.1 KW = 3.3 KW 248.3 KW
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ONE-LINE DIAGRAM







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MILL BAY CI

OBNUMBE

CIR NO.	AMP/ POLES	DESCRIPTION		LOAD	LOAD	DESCRIF	PTION	AMP/ POLES	CIR NO.
1	15/1	LIGHTS & REC AF,TP	(LIVING)	720	750	REFRIGERATOR	(KITCHEN)	20/1	2
3	20/1	RECEPTACLES - TP	(KITCHEN)	540	360	RECEPTACLES - TP	(KITCHEN)	20/1	4
5	20/1	DISHWASHER	(KITCHEN)	500	540	RECEPTACLES - AF,TP	(LIVING ROOM)	15/1	6
7	50/2	RANGE	(KITCHEN)	4500	510	LIGHTS & REC AF,TP	(BEDROOM 2)	15/1	8
9	30/2	RANGE	(KIICHEN)	4500	219	LIGHTS & REC.	(BATHROOM)	15/1	10
11	15/1	LIGHTS & REC. – AF,TP	(BEDROOM)	507	252	LIGHTS & REC.	(MECH)	15/1	12
13	30/2	EWH-1	(MECH.)	2250	3764	FC-X12C-A	(MECH)	60/2	14
15]30/2	EWH-1	(MECH.)	2250	3764	7 FC-X12C-A	(MECH)	00/2	16
17	25/2	FC-X12C-B	(MECH.)	1882	3806	HP-X12C	(ROOF)	50/2	18
19	723/2	FC-X12C-B	(MECH.)	1882	3806	7 HP-X12C	(ROOF)	30/2	20
21	20/1	GARBAGE DISPOSAL	(KITCHEN)	972	3120	w/b	(BATHROOM)	40 /2	22
23	20/1	MICROWAVE	(KITCHEN)	1000	3120	W/D	(BAIRKOOM)	40/2	24
25	20/1	SPARE				SPARE		20/1	26
27		SPACE				SPACE			28
29		SPACE				SPACE			30
31		SPACE				SPACE			32
33		SPACE				SPACE			34
35		SPACE				SPACE			36
37		SPACE				SPACE			38
39		SPACE				SPACE			40
41		SPACE				SPACE			42

CIR NO.	AMP/ POLES	DESCRIPTION		LOAD	LOAD	DESCRIPT	ΓΙΟΝ	AMP/ POLES	CIR NO.
1	15/1	LIGHTS & REC AF,TP	(LIVING)	720	750	REFRIGERATOR	(KITCHEN)	20/1	2
3	20/1	RECEPTACLES - TP	(KITCHEN)	540	360	RECEPTACLES - TP	(KITCHEN)	20/1	4
5	20/1	DISHWASHER	(KITCHEN)	500	540	RECEPTACLES - AF,TP	(LIVING ROOM)	15/1	6
7	20/1	LIGHTS & REC.	(BATHROOM)	212	510	LIGHTS & REC AF,TP	(BEDROOM 2)	15/1	8
9	20/1	LIGHTS & REC. — AF	(MECH)	488	219	LIGHTS & REC.	(BATHROOM)	15/1	10
11	15/1	LIGHTS & REC. – AF,TP	(BEDROOM)	507	1000	MICROWAVE	(KITCHEN)	20/1	12
13	30/2	EWH-1	(MECH.)	2250	3764	FC-XXXB-A	(MECH)	60 /2	14
15	30,2	LWII I	(MECII.)	2250	3764	FC-XXXB-A	(WLCII)	0072	10
17	25/2	FC-XXXB-B	(MECH.)	1882	2444	HP-XXXB	(ROOF)	40/2	18
19	23/2	TO AXAB B	(WEOTI.)	1882	2444	TII -XXXD	(1001)	40, 2	20
21	20/1	GARBAGE DISPOSAL	(KITCHEN)		3120	w/D	(ROOF)	40/2	2:
23	20/1	SPARE			3120	W/ D	(1001)	40, 2	2.
25		SPACE				SPARE		20/1	20
27		SPACE				SPACE			28
29		SPACE				SPACE			30
31		SPACE				SPACE			3:
33		SPACE				SPACE	·		3.
35		SPACE				SPACE			30
37		SPACE				SPACE			38
39		SPACE				SPACE			40
41	1	SPACE			II	SPACE			4

CIR NO.	AMP/ POLES	DESCRIPT	ION	LOAD	LOAD	DESCRI	PTION	AMP/ POLES	CIR NO.
1	20/1	LIGHTS & RECEPTACLES	(TLT 12	6) 200	200	LIGHTS & RECEPTACLES	(JC 128)		2
3	20/1	LIGHTS	(TENENT-D 12		500	EWC-1	(TENENT-D 125)		4
5		F04 4050 A	(TENENT D 40	3764	1882		(75)(5)(7,5)	05.70	6
7	60/2	FC1-125C-A	(TENENT-D 12	3764	1882	FC1-125C-B	(TENENT-D 125)	25/2	8
9	60/2	FC2 12ED A	/TENENT D 10	3764	1882	CO2 125D D	(TENENT-D 125)	25 /2	10
11	700/2	FC2-125D-A	(TENENT-D 12	3764	1882	- FC2-125D-B	(TENENT-D 125)	25/2	12
13	E0 /0	LIDO 40ED	(500	3806	3806	HP1-125C	(ROOF)	50/2	14
15	50/2	HP2-125D	(ROC	3806	3806	7 11-1230	(KOOF)	30/2	16
17	20/1	RECEPTACLES	(TENENT-D 12	5) 720	720	RECEPTACLES	(TENENT-D 125)	20/1	18
19	20/1	EWH-2	(JC 12	8) 1650		SPARE		20/1	20
21	20/1	SPARE				SPACE			22
23		SPACE				SPACE			24
25		SPACE				SPACE			26
27		SPACE				SPACE			28
29		SPACE				SPACE			30
31		SPACE				SPACE			32
33		SPACE				SPACE			34
35		SPACE				SPACE			36
37		SPACE				SPACE			38
39		SPACE				SPACE			40
41		SPACE				SPACE			42

LOAD | LOAD

(TENENT-C 120) 200 | 500 | EWC-1

(TENENT-C 120) 200 300 EWC-1

(TENENT-C 120) 3764 1882 FC1-120D-B

3764 1882 FC1-120D-B

3806 1260 RECEPTACLES

3806 1650 EWH-2

--- SPACE

--- SPACE

--- SPACE

(TLT 122) 200 200 LIGHTS & RECEPTACLES

--- SPACE

--- SPACE
--- SPACE

--- SPACE

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--- SPACE --- SPACE

--- SPACE
--- SPACE
--- SPACE

225 AMPS M.C.B. 120/208V-3ø-4W

DESCRIPTION

(TENENT-C 120) 25/2 6 8

(TENENT-C 120) 25/2 6 8

(TENENT-C 120) 20/1 10

(JC 121) 20/1 12

20/1 14

-- 16

-- 18

-- 20

-- 22

-- 24

-- 26

-- 28

-- 30

-- 32

-- 34

-- 36

-- 38

-- 40

-- 42

PANEL C

5 7 60/2 FC1-120D-A

9 50/2 HP-120D 11 20/1 SPARE

15 -- SPACE

17 -- SPACE 19 -- SPACE 21 -- SPACE

23 -- SPACE

25 -- SPACE
27 -- SPACE
29 -- SPACE
31 -- SPACE

33 -- SPACE
35 -- SPACE
37 -- SPACE
39 -- SPACE
41 -- SPACE

1 20/1 LIGHTS & RECEPTACLES
3 20/1 LIGHTS (T

DESCRIPTION

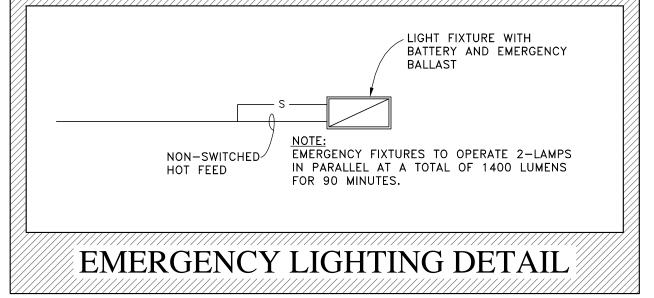
CIR NO.	AMP/ POLES	DESCRIPTION		LOAD	LOAD	DESCRIP.	ΓΙΟΝ	AMP/ POLES	CIR NO.
1	15/1	LIGHTS & REC AF,TP	(LIVING)	720	750	REFRIGERATOR	(KITCHEN)	20/1	2
3	20/1	RECEPTACLES - TP	(KITCHEN)	540	360	RECEPTACLES - TP	(KITCHEN)	20/1	4
5	20/1	DISHWASHER	(KITCHEN)	500	540	RECEPTACLES - AF,TP	(LIVING ROOM)	15/1	6
7	20/1	MICROWAVE	(KITCHEN)	1000	510	LIGHTS & REC AF,TP	(STUDY)	15/1	8
9	15/1	LIGHTS & REC.	(MECH)	4500	219	LIGHTS & REC.	(BATHROOM)	15/1	10
11	15/1	LIGHTS & REC. – AF, TP	(BEDROOM)	507	972	GARBAGE DISPOSAL	(KITCHEN)	20/1	12
13	30/2	EWH-1	(MECH.)	2250	3764	FC-X08B-A	(MECH)	60/2	14
15	30/2	LWII-1	(MLCII.)	2250	3764	rc-xuob-a	(MECH)	00/2	16
17	25/2	FC-X08C-B	(MECH.)	1882	2444	HP-X08B	(ROOF)	40/2	18
19	25/ 2	1 C X00C B	(WLC11.)	1882	2444	Hr -XUOB	(1001)	10/2	20
21	20/1	SPARE			3120	w/D	(BATH)	40/2	22
23		SPACE			3120	"/ "	(BATTI)	10/ 2	24
25		SPACE				SPARE		20/1	26
27		SPACE				SPACE			28
29		SPACE				SPACE			30
31		SPACE				SPACE			32
33		SPACE			l	SPACE			34
35		SPACE				SPACE			36
37		SPACE				SPACE			38
39		SPACE				SPACE			40
41		SPACE				SPACE			42

P	ANE	iL K				2	00 AMPS M.C.B. 120,	/208V-	1ø-3W
CIR NO.	AMP/ POLES	DESCRIPTION		LOAD	LOAD	DESCRI	PTION	AMP/ POLES	CIR NO.
1	15/1	LIGHTS & REC AF,TP	(LIVING)	720	750	REFRIGERATOR	(KITCHEN)	20/1	2
3	20/1	RECEPTACLES - TP	(KITCHEN)	540	360	RECEPTACLES - TP	(KITCHEN)	20/1	4
5	20/1	DISHWASHER	(KITCHEN)	500	540	RECEPTACLES - AF,TP	(LIVING ROOM)	15/1	6
7	50/2	RANGE	(KITCHEN)	4500	219	LIGHTS & REC.	(MECH)	15/1	8
9	00, 2	NANGE	(KITOTIEN)	4500	219	LIGHTS & REC.	(BATHROOM)	15/1	
11	15/1	LIGHTS & REC. — AF,TP	(BEDROOM)	507	1000	MICROWAVE	(KITCHEN)	20/1	12
13	30/2	EWH-1	(MECH.)	2250	5595	FC-XXXA-A	(MECH)	60/2	14
15	00, 2		(MEOII.)	2250	5595	TO AAAA A	(₩2011)	00, 2	16
17	15/2	FC-XXXA-B	(MECH.)	561	2444	HP-XXXA	(ROOF)	30/2	18
19	10, 2	TO MAKE	(11120111)	561	2444	TII AAAA	(1.001)	00, 2	20
21	20/1	GARBAGE DISPOSAL	(KITCHEN)	972	3120	W/D	(MECH)	40/2	22
23		SPACE			3120	", "	(2011)	, _	24
25		SPACE				SPACE			26
27		SPACE				SPACE			28
29		SPACE				SPACE			30
31		SPACE				SPACE			32
33		SPACE				SPACE			34
35		SPACE				SPACE			36
37		SPACE				SPACE			38
39		SPACE				SPACE			40
41		SPACE			ll	SPACE			42

CIR NO.	AMP/ POLES	DESCRIPTION		LOAD	LOAD	DESCRIPT	ION	AMP/ POLES	CIR NO.
1	15/1	LIGHTS & REC AF,TP	(LIVING)	720	750	REFRIGERATOR	(RESTROOMS)	20/1	2
3	20/1	RECEPTACLES - TP	(KITCHEN)	540	360	RECEPTACLES - TP	(KITCHEN)	20/1	4
5	20/1	DISHWASHER	(KITCHEN)	500	540	RECEPTACLES - AF,TP	(LIVING ROOM)	15/1	6
7	15/1	LIGHTS & REC.	(BATHROOM)	219	510	LIGHTS & REC AF,TP	(STUDY)	15/1	8
9	15/1	LIGHTS & REC.	(MECH)	219	219	LIGHTS & REC.	(BATHROOM)	15/1	10
11	15/1	LIGHTS & REC AF,TP	(BEDROOM)	507	1000	MICROWAVE	(KITCHEN)	20/1	12
13	30/2	EWH-1	(MECH.)	2250	3764	FC-XXXB-A	(MECH)	60/2	14
15	30, 2		(MEOII.)	2250	3764	I C-XXXD-A	(WEOTT)	00, 2	16
17	25/2	FC-XXXB-B	(MECH.)	1882	2444	HP-XXXB	(ROOF)	40/2	18
19	20, 2	TO XXXB B	(11120111.)	1882	2444	TII AAAD	(1.001)	10, 2	20
21	20/1	GARBAGE DISPOSAL	(KITCHEN)	972	3120	 w/D	(MECH)	40/2	22
23	20/1	SPARE			3120	117.0	(WEOTT)	10, 2	24
25		SPACE				SPARE		20/1	26
27		SPACE				SPACE			28
29		SPACE				SPACE			30
31		SPACE				SPACE			32
33		SPACE				SPACE			34
35		SPACE				SPACE			36
37		SPACE				SPACE			38
39		SPACE				SPACE			40
41		SPACE				SPACE			42

P	ANE	L M					200 AMPS M.C.B. 120,	/208V-	1ø-3W
CIR NO.	AMP/ POLES	DESCRIPTION		LOAD	LOAD		DESCRIPTION	AMP/ POLES	CIR NO.
1	15/1	LIGHTS & REC AF,TP	(LIVING)	720	750	REFRIGERATOR	(KITCHEN)	20/1	2
3	20/1	RECEPTACLES - TP	(KITCHEN)	540	360	RECEPTACLES -	TP (KITCHEN)	20/1	4
5	20/1	DISHWASHER	(KITCHEN)	500	540	RECEPTACLES -	AF,TP (LIVING ROOM)	15/1	6
7	50/2	RANGE	(KITCHEN)	3950	244	LIGHTS & REC.	(MECH)	15/1	8
9	30/2	KANGE	(KITCHEN)	3950	219	LIGHTS & REC.	(BATHROOM)	15/1	10
11_	15/1	LIGHTS & REC. — AF,TP	(BEDROOM)	507	1000	MICROWAVE	(KITCHEN)	20/1	12
13	30/2	EWH-1	(MECH.)	2250	5595	FC-XXXA-A	(MECH)	60/2	14
15	00,2		(#/2011.)	2250	5595	TO XXXA A	(MESIT)	00, 2	16
17	15/2	FC-XXXA-B	(месн.)	561	2444	HP-XXXA	(ROOF)	30/2	18
19	10,2	TO AXAA B	(#/2011.)	561	2444	III XXXA	(1001)	00, 2	20
21	20/1	GARBAGE DISPOSAL	(KITCHEN)	972	3120	w/D	(BATHROOM)	40/2	22
23	20/1	SPARE			3120	"75	(BATTINGOW)	10, 2	24
25		SPACE				SPARE		20/1	26
27		SPACE				SPACE			28
29		SPACE				SPACE			30
31		SPACE				SPACE			32
33		SPACE				SPACE			34
35		SPACE				SPACE			36
37		SPACE				SPACE			38
39		SPACE				SPACE			40
41		SPACE				SPACE			42

CIR AMP/ NO. POLES DES		DESCRIPTION	IPTION LOAD		LOAD	DESCRIPTION		AMP/ POLES	CIR NO.
1	15/1	LIGHTS & REC. – AF,TP	(LIVING)	720	750	REFRIGERATOR	(KITCHEN)	20/1	2
3	20/1	RECEPTACLES - TP	(KITCHEN)	540	360	RECEPTACLES - TP	(KITCHEN)	20/1	4
5	20/1	DISHWASHER	(KITCHEN)	500	540	RECEPTACLES - AF.TP	(LIVING ROOM)	15/1	6
7	15/1	LIGHTS & REC.	(BATHROOM)	219	510	LIGHTS & REC AF,TP	(STUDY)	15/1	8
9	15/1	LIGHTS & REC. — AF,TP	(BEDROOM 2)	507	219	LIGHTS & REC.	(BATHROOM)	15/1	10
11	15/1	LIGHTS & REC. — AF,TP	(BEDROOM)	507	252	LIGHTS & REC.	(MECH)	15/1	12
13	30/2	EWH-1	(MECH.)	2250	3764	FC-X01D-A (MECH	60/2	14	
15]30/2	EWN-1		2250	3764	FC=X0TD=A (MECH)		16	
17	25/2	FC-X01D-B	(MECH.)	1882	3806	HP-X01D (ROOF	1 50/2	18	
19	23/2	16-2010-6		1882	3806		30/2	20	
21	20/1	GARBAGE DISPOSAL	(KITCHEN)	972	3120	——— W/D (MECH		40/2	22
23	50/2	RANGE	(KITCHEN)	3950	3120				24
25	30, 2	KANGE		3950	1000	MICROWAVE	(KITCHEN)	20/1	26
27	20/1	SPARE				SPARE		20/1	28
29		SPACE				SPACE			30
31		SPACE				SPACE			32
33		SPACE				SPACE			34
35		SPACE				SPACE			36
37		SPACE				SPACE			38
39		SPACE				SPACE			40
41		SPACE				SPACE			42



FIRE	FIRE ALARM & FIRE PROTECTION KEY						
SYMBOL	DESCRIPTION	PART NO.					
FACP	FIRE ALARM CONTROL PANEL	EST iO64GD					
RA	REMOTE ANNUNCIATOR	EST RLCD-C					
BPS	BOOSTER POWER SUPPLY	EST BPS-10A					
F	MANUAL PULL STATION	EST SIGA-270					
Sp	PHOTOELECTRIC SMOKE DETECTOR	EST SIGA-PS					
	DETECTOR BASE	EST SIGA-SB					
F)	STROBE DEVICE	EST G1R-VM					
F⊲	HORN STROBE DEVICE	EST G1R-HDVM					
草	CEILING MOUNTED STROBE	EST GC-VM					
弹	CEILING MOUNTED HORN STROBE	EST GC-HDVM					
T _S	TAMPER SWITCH						
(F _S)	FLOW SWITCH						

LOCAL EST REPRESENTITVE IS CENTRAL FIRE PROTECTION. CONTACT DENNIS SARGENT AT (231) 941-6405

MILL END BAY CITY, MI

JOB NUMBER E11-520







A. Standards:

B. Substitution and Changes:

C. Explanation of Scheduled Manufacturers:

specified within this Specification.

2.02 EQUIPMENT REQUIREMENTS AND CONNECTIONS

B. Electrical Wiring and Controls:

Certificates of Inspection Test Reports

Record Drawings (As-Builts)

Lighting and Controls

Fire Alarm/Life Safety System

perating and Maintenance Instruction Manuals (2)

Operation/Maintenance Supervisor to schedule site inspection.

END OF SECTION

a. Wiring Devices and Switches. b. Specialty Wiring Devices.

f. Transient Voltage Surge Suppressio g. Lighting fixtures and controls.

Amendment 6. Use of non-rigid plastic bushings is prohibited.

K. All neutral runs including feeders shall be white full length of conductor

A. A standard galvanized or plastic outlet box shall be installed for each and every outlet shown

including cost of any cutting and patching the work of other trades as may be required by such relocation.

D. Ceiling outlet boxes shall be 4" octagon, minimum 1-1/2" deep, with fixture hickey, and supported to withstand 80 pounds.

C. Each outlet shall be rigidly supported from the building construction (independent of the raceway system).

2.03 WIRE CONNECTORS AND JOINTS

minimum deep box shall be used.

2.05 JUNCTION BOXES AND PULL BOXES

2.04 OUTLET BOXES

Guarantees/Warranties

3. Mechanical Contractor or Temperature Control Contractor shall provide Class 2 and 3 wiring, conduit, boxes for their associated equipment unless otherwise noted.

months) of all systems, fixtures, equipment, safety devices and controls to ensure equipment operating properly, and report to Engineer in writing. Contact the Owner's

Branch panelboards, distribution panels, transformers, and switchboards shall be identified as to designation and voltage characteristics. All identification shall be done with

and receptacle runs in walls. Conduit or tubing shall be installed in a manner which complies with all applicable provisions of the National Electrical Coc

not less than 3/4" from normal in all directions and shall be complete with tinned flexible copper braid bonding jumper protected by neoprene sleeve at for grounding continuity through joint. Fittings shall be O.Z./Gedney Electric Company, type "DX" or similar fittings by another approved manufactures

F. Wire for general interior, exterior, and control use, sizes #14 AWG through 500 MCM, shall be single conductor, insulated for a minimum of 75 degrees C, THHN, THWN, or XHHW,

1. Branch circuit wiring shall be color coded, red, black, blue for phase wiring, and white neutral. Bonding conductors shall be green or bare. Phase color coding shall be consistent

A. Conductors #6 AWG and smaller shall be joined with electrical spring connectors with vinyl insulating cap. Conductors larger than #6 shall be joined by compression type connectors.

B. Set boxes squarely with faces flush to finished surfaces. The exact location of all outlets shall be approved by the Architect/Engineer before same are placed and Contractor shall consult

Architect/Engineer at all times relative to the location of outlets. No outlets shall be placed behind plumbing or heating pipes or where they will interfere with ducts, pipes, equipment

or other work. Outlets not located in accordance with these instructions shall be relocated when so directed by the Architect or General Contractor by this Contractor at his expense

E. Convenience outlet and switch boxes shall be a minimum of 2-1/8" deep. When installed in poured walls, 2-1/2" minimum deep box shall be used; when installed in masonry, 3-1/2"

, and be rated 600 volts. Where required ampacities can only be satisfied by conductor sizes larger than 500 MCM, parallel conductors shall be

G. Wire for final connection at HID and incandescent lighting fixture sockets shall be NEC type SF-2 fixture wire rated 200 degrees C, 600 volts.

H. Wire for use in fluorescent fixture wiring channels shall conform to NEC Types THHN or XHHW, rated 90 degrees C, 600 volts.

I. Ground wire for interior use shall be green insulated, stranded copper. and shall meet requirements of wire for general interior use

conduit terminations until wire is installed. If, in the opinion of the Engineer, conduit or tubing has become damaged or contains unremovable foreign matter, it shall be replaced at the Contractor's expense. Aluminum conduit is not acceptable in this contract.

tting plastic molded and locked into bushing ring. Plastic bushings shall be thermosetting phenolic insulating type conforming to Federal Specification W-F-406 and

Each system drawing shall show location, size and conductor fill for conduits, junction boxes and outlets. Specification changes shall also be submitted.

Electrical subcontractor shall furnish and wire duct type smoke detectors. Duct type smoke detectors shall be installed by Mechanical Trades.

control wiring or remote power supplied by the equipment to remote units shall be provided by the Owner.

from the work as shown. These drawings are to be available for inspection by the Engineer on a weekly basis

5. Electrical wiring work by Mechanical Contractor and Temperature Control Contractor shall be in accordance with Division 16 requirements. 3.01 CLOSEOUT A. Final Acceptance: Final acceptance and payment will only be made after final punch list completion and receipt at Engineer's office of: B. Certificates of Inspection and Test Reports: 2. Submit as-built record drawings consisting of separate plans and riser diagrams for following systems: E. Operating and Maintenance Instructions: 1. Provide instruction of Owner's personnel in operation and maintenance procedures for all systems equipment. 1. Electrical Contractor shall be responsible for all start-up procedures, system checks and balancing associated with his equipment 2. Equipment shall be installed, tested and operated in accordance with manufacturer's recommendations at normal operating conditions. 3. Permanent electrical equipment operated during construction periods shall be cleaned, and damaged equipment replaced. G. Adjustments and Balancing: 3.02 GUARANTEES AND WARRANTIES shipment date), or Contractor to assume warranty. B. Acceptance date of substantial completion shall be Owner occupancy as determined by Architect/Engineer. C. Contractor shall make necessary alterations, repairs, adjustments, replacements during guarantee periods as directed by Architect/Engineer to comply with Drawings and Specifications D. Repair or replacements made under guarantee bear further one year guarantee from date of acceptance of repair or replacement. PART 1 - GENERAL 1.01 SECTION INCLUDES A. Shop drawing submittals B. Raceways, wire & cables, outlet boxes, wiring devices, motor starters & panels C. Installation methods A. Service switches, motor disconnects, controllers, etc., whether or not furnished under this Division shall be marked to identify the equipment served and the origin of the power source. engraved plastic plates, black with white letters. A. Provide each panel with a typewritten index. Insert index into a transparent plastic holder secured to the inside of the panel door 1.04 SUBMITTALS A. Shop Drawings 1. Submit shop drawings for the following: PART 2 - PRODUCTS 2.01 RACEWAYS A. Wiring shall be installed in approved raceways where required by code and be a minimum size of 3/4" for homeruns unless otherwise noted. 1/2" conduit will be permitted for switch Exposed runs shall be supported by hangers, clamps, or straps secured by toggle bolts in hollow construction or expansion bolts or inserts in poured or brick walls C. Every precaution shall be taken to protect the conduit from damage and from water, dirt, concrete, etc., getting into the system during construction. Capped bushings shall be used on D. Intermediate metallic conduit (IMC) shall be hot dipped galvanized steel, and shall be used on all runs above 2-1/2" unless otherwise noted. Intermediate metallic conduit may be used in all poured construction, fill, outside masonry walls, areas exposed to weather, under drives and walks, and in areas where tubing may become damaged. E. Cast and threaded fittings for IMC shall be used on exposed conduit installed on walls below 8"-0" and on conduit exposed to weather. F. Plastic conduit shall be high strength smooth inner with polyvinyl chloride, heavy wall type equal to Carlon Schedule 40 for use as direct burial without concrete encasement, except as required by code. Couplings shall be the solvent welded type. <u>Circuits run in PVC conduit require a separate grounding conductor.</u> G. Electric-metallic-tubing (thinwall conduit) shall be standard weight with manufacturer's name and Underwriters' Label on each length. Maximum permissible size tubing shall be 2-1/2". H. Tubing may be used for feeders and branch circuits above suspended accessible ceilings; for switch and receptacle legs which terminate above suspended accessible ceilings and for concrete-tight and/or rain-tight where required. Conduit bodies shall be malleable iron or aluminum cover gaskets exposed to weather. 3. Locknuts: malleable iron or steel. Bushings shall be malleable iron or steel, or plastic. Malleable iron or steel bushings shall be zinc or cadmium plated and shall have insulating K. Flexible metallic conduit shall have separate grounding conductor L. Space around conduits at wall penetrations shall be filled with mortar, or other approved filler, maintaining the rating of wall/ceiling construction as required. 2.02 WIRES AND CABLES A. Wiring:
1. Shall be THHN stranded copper, single conductor, and shall be installed in conduit or tubing unless specified otherwise (areas required: garage, mechanical & electrical rooms and 2. May be aluminum SER cable, single conductor, and shall be installed in conduit or tubing unless specified otherwise (areas required: garage, mechanical & electrical rooms and B. Romex shall be acceptable in wood frame construction as directed by NEC C. M.C. Cable shall be acceptable in steel stud construction as directed by NEC. D. Conductors shall be continuous between outlets or junction boxes with splice made only within such boxes. PART 2 - PRODUCTS E. No wire smaller than #12 may be used unless specified under descriptions of special systems. Control wiring may be #14 AWG or smaller as indicated, and shall be stranded. 2.01 MATERIALS AND EQUIPMENT E. Cables for smoke detection systems or for use in plenums without conduit shall be UL listed, UL Style 1330, meeting ASTM D-2116 and ICEA color codes.

1. Products shall be of established manufacturers regularly engaged in making type of materials to be provided and complete with all parts, accessories, trim, finish, safety guards and

1. Contractor and/or Equipment Supplier may propose alternate equipment or materials of equal quality, function, durability and appearance as described and permitted in Specification

Section 16000, 1.01.B. The substitution will take the form of an "Add-Deduct" to the bid proposal. It is the submitter's responsibility to provide sufficient material for review as required by Engineer's office. Acceptance and approval is the responsibility of the Engineer.

3. Contractor and/or Equipment Supplier is liable for any added costs to himself or others and is responsible for verifying dimensions, clearance and roughing-in requirements, when

1. "Base Bid". This term designates that this equipment will be the product which the contractor generates his bid from. It is usually a component that is critical to maintaining the design intent. No other equipment suppliers will be allowed to bid as an "equal".

2. "Based On". This term designates that the equipment is designed around a certain product. Products of equal status are listed and may be bid as if they were the basis of design.

1. Electrical Contractor shall provide manual or magnetic motor starters as required for motors not provided by Mechanical Trades and as indicated on Electrical Drawings and as

Mechanical Contractor shall provide factory installed motor starters integral with packaged equipment containing thermal overcurrent protection in ungrounded conductors with heater coils selected for specific motor usage for motors, unless otherwise shown on electrical drawings.

product not named as the basis of design is used and the Contractor is responsible for advising other Contractors of variations and, if requested, submit revised drawing layout for approval by the Engineer.

other devices and details needed for a complete installation and for the intended use and effect.

2. No substitutions will be accepted, except as authorized in a Project Addendum

The "based on" equipment shall serve as the standard to which equals will be judged.

A. When used, pull boxes and junction boxes shall be galvanized and have flat steel covers fastened with screws and set flush with the finished surface and located in an accessible area. 1. Mechanical Contractor shall provide motors, drives, controllers and safety switches integral to packaged equipment and factory mounted controls for mechanical equipment as ed in damp locations, gaskets and seals shall be provided. Junction boxes shall be sized to meet N.E.C. Standards based on conduit and conductors. Provide identifying 2. Mechanical Contractor or Temperature Control Contractor shall provide electrical devices requiring mechanical connections, and/or electrical connections, such as pressure switches, 2.06 WIRING DEVICES limit switches, float switches, solenoid valves, motor operated valves, motor operated dampers, fire stats, freeze stats, thermostats, override timers, E.P.'s, P.E.'s, temperature A. Receptacles 1. Receptacles shall be mounted approximately 1'-4" above floor to bottom or at other heights indicated on Drawings. 2. Contractor shall be responsible for masking receptacles for protection from painting, plastering, etc. 3. Receptacles shall be commercial specification grade as manufactured by Hubbell, Leviton, or General Electric. 4. Electrical Contractor shall install power wiring and conduit to motors and/or factory mounted control panels as indicated on Drawings or as indicated in other sections of the a. 20 Amp, 125 Volt, duplex, ground fault, (NEMA 5-20R), Hubbell GF-5352-W series, with #CWP26H outdoor weatherproof cover for exterior use. b. 20 Amp, 125 Volt, duplex (NEMA 5-20R), Hubbell CBR20W series. c. 20 Amp, 125 Volt, duplex with isolated ground (NEMA 5-20R), Hubbell IG5362 series. 1. Electrical Contractor is to provide power wiring, conduit, starters and safety switches on equipment as indicated on the drawings. Make final power connections to equipment. Any d. 30 Amp, 125/250 Volt (NEMA 10-30R), Hubbell 9350 series e. 50 Amp, 125/250 Volt (NEMA 10-50R), Hubbell 7962 series. NOTE: GFCI receptacles must meet UL 2003 Standards. 1. Wall switches shall be mounted approximately 4'-0" above floor to top unless they interfere with wainscoting or trim. Switches shall be commercial specification grade, totally enclosed molded composition, silent type, spring action silver contacts, and rated at 120/277 volts A.C. Switches shall be binding screw type, side and back wired ty 2. Contractor shall be responsible for masking switches for protection from painting, plastering, etc 3. Contractor shall confirm door swings with Building Trades Contractor before installing switches. 4. Switches shall be rated at 20 Amp, white in color, Hubbell CSB120 series, Leviton, or General Electric., or P & S switches of equivalent grade or as noted on construction drawings. Switches shall be single pole, double pole, three-way, keyed (master), or other type as indicated. 1. Wall plates shall be installed plumb and level with all edges in contact with attaching surface. Plates shall be brushed smooth stainless steel. Provide blank cover plates for all The Contractor shall submit to the Engineer's Office evidence that installation has been inspected and approved by municipal or state electrical inspector and/or the authority having data and telephone outlet boxes shown on plans. Plates used on exposed surface mounted outlets shall be the raised pressed metal type, stainless steel finish, to accommodate the device and cover the outlet box, without fillers of any kind. Mounting screws shall be metal with same finish as plate and with countersunk head. Plates shall be single, ganged, or combination, to accommodate arrangement indicated on drawings. Arrow-Hart, Leviton, General Electric, Hubbell, or P & S plates of equivalent grade will be acceptable. 1. During the one year period of continuous operation (except if General Requirements specify a longer warranty period), make two complete inspections (one at 3 months and one at 6 2.07 SPECIALTY WIRING DEVICES For each of the thermostats/sensors shown, a single gang box with a 1/2" conduit in new areas, or a single gang box with wiremold (to match existing) in existing areas, stubbed to the unit being controlled. Up to accessible ceiling or from controller to unit in non-accessible ceilings. Box mounted at 44" A.F.F. B. Smoke Sensors for HVAC units 2000 cfm or more (Reference Mech. Plans):

It shall be required that the E.C. provide and install the necessary code required alarming/signaling equipment as related to the smoke sensors for HVAC units 2000 Cfm or more. 1. Maintain a white-print set of Electrical Contract Drawings in clean, undamaged condition for mark-up of actual installation on Electrical Contract Drawings which vary substantially 2.08 MAGNETIC STARTERS - COMBINATION TYPE; THREE-PHASE MOTORS A. In general, the magnetic starters shall be of the minimum NEMA 0, combination type consisting of a circuit protective device, switch and fuse type, and a NEMA size starter as required. ircuit protective device shall be a fused type "A" safety switch. The motor starter shall comprise of NEMA size contactors, overload relays, heaters, interlocks, etc. The hinged cover shall be so interlocked that it may not be opened when the switch is in the "ON" position, except that the interlock shall be tool-releasable by a qualified person. Starters shall have provisions for padlock. The motor starter shall include phase loss and phase unbalance protection, or auxiliary devices shall be installed to accommodate these types of protection. B. Each combination starter unit shall be furnished with HAND-OFF-AUTO selector switch, green running light, and with individual control transformers, with fused secondary, rated 120 volts. Starters shall be supplied with two N.O. contact C. Starters shall be by Square D. General Electric or Cutler Hammer maybe bid as alternates 2.10 SINGLE PHASE MOTOR STARTERS A. Manual starters for fractional horsepower single phase motors shall be single or double pole with pilot lights and thermal overload relay elements. Enclosure shall be NEMA 1, surface or flush mounted as indicated with provision for padlocking unless described otherwise on drawings. Thermal overload elements shall be sized on basis of motor rating and starter manufacturer's instructions. Units shall be General Electric "Type CR-101." Square D "Class 2510." or Cutler Hammer. 2.11 FUSESTATS A. Fusestats shall provide overload protection and may be used for permanently wired motors rated up to 1/2 HP, 125 Volt A.C. only. B. Fusestat base shall be constructed of pre-galvanized steel plate with a hood of galvanized steel and fit on a standard double gang 4" square box 1. Subsequent to beginning operation of the electrical power and distribution systems, the Contractor shall make all necessary adjustments to equipment installed or connected by him under this contract so as to ensure proper operation of the same. The Contractor shall measure, phase balance and make necessary adjustments to any portion of the electrical system that is substantially out of balance. C. Fusestat shall consist of a fused outlet and switch and be by Steel City, Catalog No. F8-S, or equal by other approved manufacturer. 2.12 PANELBOARDS A. Labor, materials and equipment shall be guaranteed by Contractor and/or warranted by manufacturer for one year after acceptance date and/or one normal continuous complete season's operation applicable to equipment or system except where specified longer for special equipment. Contractor shall secure such warranty from Suppliers (not one year from installing contractor's responsibility to guaranty that the requirements are $\operatorname{\mathsf{met}}$. shall meet Federal Specifications W-P-115A.

A. Panelboards shall be of the circuit breaker type with main lugs or main breaker as indicated on Drawings. Use full size plug-in/bolt-on type branch circuit breakers (tandem type are not

B. Branch circuit panelboards shall be Square "D" type QO 'Load Center', NQOD, NF, I-line. General Electric or Cutler Hammer, may submit voluntary alternates of equal quality. All panels A. Fuses 600 Amperes and Less: Dual element, current limiting, time delay, one_time fuse, 250 or 600 volt as required, UL Class J.

B. Interrupting Rating: 200,000 rms amperes. 2.14 SAFETY SWITCHES

BASIC ELECTRICAL MATERIALS AND METHODS

Page 1 of 6

B. Safety switches shall be NEMA heavy duty type "HD", fusible or non-fusible as indicated, and Underwriter's Laboratory approved. Switches shall be furnished in NEMA-1 enclosures unless otherwise shown on drawings. Weatherproof switches shall be NEMA-3R (raintight). C. Switches shall be Square D, or equal by General Electric or Cutler Hammer.

2.15 SUPPORTS AND HANGERS A. Provide and install necessary steel brackets, rods, clamps, etc., for support of work under this contract. Supports shall be plated or painted and shall be secured to structural members 2.16 SLEEVES AND INSERTS

A. This Contractor shall be responsible for the proper location on all sleeves, chases, openings and inserts for the installation of his equipment. B. Holes through walls, floors, or structural members for electrical conduit and equipment shall be drilled in a work-like manner and be located only where permitted by the Architect or

3.01 PREPARATION A. Conduits shall be cut, bent, joined, and installed per manufacturer's instructions, U.L. General Information, and the N.E.C. B. Outdoor and underground encased coupling and conduit threads shall be treated with mastic or similar compound to prevent entry of water. 3.02 INSTALLATION METHODS

 $A. \ \ Conduit\ runs\ shall\ be\ placed\ neatly\ and\ orderly\ at\ parallel\ or\ perpendicular\ lines\ to\ building\ walls.$ B. Conduit runs parallel to or crossing uninsulated hot water or steam pipes shall be separated from same by 12" if parallel, or 7" if crossing. Where hot water or steam pipe lines are insulated, conduit shall clear insulation surface by 2". Conduits shall not be installed directly under cold water pipes C. No more than two concealed conduits shall cross over at same point in a poured slab

D. Conduit and pull boxes shall be installed mechanically secure to permit pulling in or pulling out of cable proposed for same. Double locknuts and bushing shall be used for termination of conduit at boxes and equipment. E. Joints of conduits shall be tight, low resistance connections F. <u>A #6 pullcord shall be provided for new empty conduits</u>. Pullcord shall be wax impregnated, nylon, or other synthetic material resistant to moisture and mildew to prevent deterioration.

 $3.03\,\underline{FAULT\,CURRENT\,REQUIREMENTS}$ A. Every effort shall be made by the installing contractor to guaranty that all distribution panels, panelboards and safety switches will be able to safely clear (interrupt) the amount of short circuit amps that could flow on a bolted phase to phase faul B. All stated fault currents within the bid documents shall be verified to be correct by the installing contractor.

C. If an error is found in the fault current stated, the contractor shall install the proper devices to maintain required levels

END OF SECTION

SECTION 16.400 SERVICE AND DISTRIBUTION PART 1 - GENERAL 1.01 RELATED DOCUMENTS

B. Related Work:

PART 3 - EXECUTION

A. Applicable provisions of Bidding Requirements, Project Guidelines and General Requirements (Division 1) apply to the work specified in this Section 1.02 <u>DESCRIPTION</u> A. Work Included:

I. Metal conduit and EMT fittings should be galvanized malleable iron, steel, aluminum, or zinc die-cast. Connectors and couplings shall be threaded, set-screw, or compression type, and 1. This Section includes all labor, materials, equipment, tools, supervision, start-up services and Owner's instructions, including all incidental and related items necessary to complete nstallation and successfully test, start-up and operate in a practical and efficient manner all services and distribution work indicated on the drawing 1. Expansion Fittings: cast or malleable iron bodies, with threaded end caps for receiving fixed and moveable conduits, metallic pressure packing, and copper bonding jumper assembly. Fittings shall provide for minimum 2" of movement of conduit in either direction. Fittings shall be Appleton type "XJ" or similar fittings by another approved manufacturer. 2. In general, this shall include, but not be limited to: 2. Expansion-Deflection Fittings: neoprene sleeve secured to silicon bronze threaded couplings by means of stainless steel bands. Fitting shall be designed to provide for movement of a. Temporary Power

Flexible metal conduit shall be used for connections to the following equipment: Motors and mechanical equipment. Maximum length of flexible metallic conduit shall be 6'-0". Minimum C. Quality Assurance: size shall be 1/2". Flexible metal conduit used for lighting fixture connections shall be "Greenfield" type. Fittings shall be insulated throat, flex-steel connectors. Flexible metal conduit used for equipment other than lighting fixtures shall be similar to "Greenfield" except jacketed with a plastic outer cover and terminated with appropriate factory-installed fittings, UL a. All service and distribution work shall be performed by licensed electricians.

> a. Installation methods shall conform to manufacturer's standards for each piece or item of equipment 1.03 TEMPORARY POWER

shall be equipped with temporary lighting so that work may proceed. Provide power outlets where requested by the various trades. (Note: This shall not be construed as indicating that the Electrical Contractor is to provide any and all voltages at any and all capacities to run heavy power tools, mixers, electric dryers, etc. Normal, 120/208 volt, single-phase power will be provided.) Comply with OSHA Lighting Standard Subpart D, Rule 1926.56(a) and (b). Provide maintenance service for power and lighting facilities, including lamp B. Extensions and/or Extension Cords:

1. The applicable requirements from other Sections for related work shall form a part of the service and distribution work and this Contractor shall consult them in detail for general and

1. If any Contractor requires an extension cord, it shall be provided by that Contractor. Should he require lighting or power in addition to that described in A above, he shall provide it in order to complete his own work. Such additional loads must be coordinated with the Electrical Contractor so that cables and/or circuits are not overloade 1. The Electrical Contractor shall provide temporary connections for the testing or operation of permanent or temporary motors, pumps, burners, unit heaters or similar units when

D. Use of Permanent Lighting System: 1. After the installation of the permanent lighting system, it may be used for construction lighting as required. Refer to Section 16500. E. Codes:

1. Complete temporary power and lighting distribution system shall be in complete accordance with all applicable codes. 1.04 SERVICE A. New Electrical Service (See Plans):

1.05 <u>DISTRIBUTION</u>

1. The building shall be fed by a completely new electrical service as herein described and as shown on the drawings. 2. The Electrical Contractor shall furnish and install a new 120/208 volt, three-phase, four-wire service entrance main switchboard. This switchboard shall be located in the Mech Room. Refer to the One Line Diagram for type and size.

1. This Contractor shall furnish and install a new distribution system for the building as shown on the drawings and the One Line Diagram. 2. All feeders shall be run continuously without splices, and be type THHN or THWN, unless otherwise noted

END OF SECTION

temporary heat or ventilation is required during construction.

SECTION 16.450

PART 1 - GENERAL

1.01 <u>SCOPE</u> A. The grounding system shall be in accordance with the drawings, specifications and with the National Electrical Code, NEMA, USASI and IEEE Standards, latest editions, where these standards apply. The ground bar of the main service disconnect enclosure shall be bonded to water mains, structural steel, and driven ground rods, by grounding electrode conductor, and as indicated on the drawings. Methods in accordance with good accepted practice for this type of work which cover conditions not indicated on the drawings or described in these specifications and which meet with the approval of the Engineer shall be used in order to secure a good substantial and permanent grounding system. Maximum ground resistance to be

B. All interconnections, risers, cables, etc. shall be provided and installed for grounding transformers, main switchboard, panelboards and other equipment. Bonding jumpers shall be copper, equal in cross section to the corresponding ground connectors and attached by solder less lugs, compression connections, or clamps. All ground connectors shall have brazed connections, unless otherwise indicated, such as Cadwell, Burndy, Thomas and Betts or equal as approved. C. Ground cables shall be protected by sleeves where the cable extends through a concrete surface. Ground inserts shall be used where ground cables extending through the surface

would be exposed to mechanical damage during or after construction. D. Where ground cables are installed in rigid metal conduit, the cables shall be bonded to the conduit at both ends of the run.

E. Welds on ground cables shall be cleaned and painted with an asphalt base paint where buried underground or imbedded in concrete. F. Miscellaneous and special systems shall be properly grounded in accordance with the requirements of each system.

D. Circuits run in PVC conduit will require a separate grounding conductor, provided and installed at no additional cost

A. Provide a #12AWG green grounding wire in each conduit in addition to the circuit wires (phase and neutral wires). The grounding wire shall be connected to grounding terminal bars (to be furnished with each distribution panel) in panelboards, and these bars shall be grounded to the system master ground at switchbo B. All equipment, fixtures, receptacles, etc. shall be grounded by means of a separate green ground wire. These wires shall be connected to the respective distribution panel grounding

C. All isolated ground receptacles require a separate #12AWG ground wire from the receptacle to the isolated ground bus within the panel.

E. All isolated ground circuits shall be connected to a separate ground bar. A separate ground conductor shall be installed for the additional ground bar and be grounded by a separate method from the panel grounding bar.

END OF SECTION

PART 1 - GENERAL

SECTION 16,470

1.01 RELATED DOCUMENTS A. The other Contract Documents complement the requirements of this section. The General Requirements apply to the work of this section.

1.02 QUALITY ASSURANCE A. Panelboards shall be UL label and nameplate, and shall conform to latest NEMA and NEC standards.

PART 2 - PRODUCTS 2.01 PANELBOARDS

A. Panelboards shall be factory assembled and conform to following: 1. Flush or surface mounted galvanized steel cabinet as indicated.

2. Hinged and lockable door with trims on circuit breaker panelboards Individual hinged and lockable doors on fusible type power distribution panelboards. Locks keved alike.

5. Manufacturer's standard prime paint and factory finish. 6. Heavy plastic covered typewritten directories.

7. Voltage, phase and capacity as indicated on schedules. 8. Internal assembly of circuit breakers or switch and fuse units as indicated

15. Panelboards shall be by Square D, type QO 'Load Center', NQO, I-Line.

9. Circuit breakers and switch and fuse characteristics as specified.

 $10. \\ Ground fault circuit interrupter type circuit breakers where indicated on the panelboard schedules.$ 11. Approved terminal grounding bar for general branch circuit equipment grounding conductors.

12. Approved isolated grounding bar for isolated ground receptacle grounding conductors.

13.Interrupting capacity of a minimum 10,000 A.I.C. (amperes rms symmetrical) for branch circuit breakers and a minimum 22,000 A.I.C. for main breakers in distribution or branch 14. Panelboards used for service entrance shall be so labeled and listed for such use and shall have separately barriered provisions for connection of emergency circuit loads. Non-linear load type panels shall be required for designated computer equipment panel

PART 3 - EXECUTION

A. Practice of drilling and tapping or drilling and using self-tapping fasteners in aluminum conductor bars for making electrical or mechanical support connections is prohibited in panelboard construction. Connections may be made by use of through-bolts with lock washers, Belleville washers, steel nuts or steel inserts. Steel helical inserts are not acceptable

B. Manufacturers who cannot or prefer not to use such methods, shall provide copper bus bars. Copper shall also be provided where required by local or state ordinances.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this section. The General Requirements apply to the work of this section. B. The Electrical contractor shall be responsible for all smoke sensor related work as required by codes for the required shut down processes contained in the latest Michigan mechanical

PART 2 - PRODUCTS

NOT APPLICABLE

3.01 FIELD QUALITY CONTROL

current with "artificial" tripping will not be permitted.

A. Test all circuits as soon as conductors are installed and make final tests when all work is complete. If circuits are not properly controlled and insulated at time of such final tests, the ecessary extra repairs and tests shall be made at the Contractor's expens B. All 240 and 208 volt wiring systems, sizes No. 4 AWG and larger, shall be given an insulation resistance test between conductors and between a single conductor and ground.

Resistance shall not be less than 40 megohms. Measurements shall be made with all panelboards, overcurrent devices, etc., in place, and with circuit breakers or disconnect switches in

the open position. C. Lighting and control wiring shall be tested for shorts or opens and shall be given a complete operational test.

D. After installation is complete and properly adjusted, the various equipments and systems shall be demonstrated to operate in accordance with the requirements of the drawings and E. Tests, inspections and work shall be performed in the presence of and approved by the Owner's Representative before energizing the system.

F. Power circuit breaker shall be tested and calibrated with results entered in the forms specified. G. Circuit breakers, including those equipped with static trip units, shall be tested by the use of a "Multi-Amp" or similar piece of equipment. Long-time delays shall be tested by placing three times the rated current of the trip unit through the breaker. Instantaneous tripping shall be tested by placing the full value of current through the breaker. Lesser amounts of

 $3.02\,\underline{\text{FIRE ALARM AND SMOKE DETECTION SYSTEM (For Smoke System as required by code)}}$ A. Include services of a manufacturer's certified representative to provide final testing, adjusting, and commissioning and instructing the Owner's Representative in the operation and maintenance of the system as listed herein.

B. Test heads by using manufacturer's recommended detector tester with halogenated type gas and sensitivity tester when adjustable detectors are used. The manufacturer's certified technician shall evaluate the installation and operation of the system. C. Submit eight copies of test and evaluation reports to the Architect/Engineer

D. Control wiring shall be tested for shorts or opens and system shall be given a complete operational test.

E. After installation and adjusting the Smoke Detection System, the various equipment and systems shall be demonstrated to operate in accordance with the requirements of the drawings

F. The whole system shall be tested and left in operating conditions. Testing shall be performed as directed by the Owner or Owner's Representative. Final test and inspection shall be performed with the Fire Marshall's Representative and Electrical Inspection Bureau Representative and done during Owner's normal working hour G. The Contractor or its representative and the equipment manufacturer's representative shall be present at all inspections and be prepared to perform certain test functions and answer questions related to the equipment.

H. Noise test shall be performed by the Contractor to ensure that the audible sound is heard everywhere and of a level acceptable to the Fire Marshall's Office. If the Fire Marshall's Office indicates that the sound level is too low from a device, the contractor shall replace the device at no cost to the owner. END OF SECTION

NOTE: THESE SPECIFICATIONS ARE THE PROPERTY OF THE ENGINEER AND ARE NOT TO BE REUSED OR REPRODUCED WITHOUT WRITTEN PERMISSION. THIS

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