REPLACEMENT OF HEATING AND COOLING SYSTEM BROOKHILL INDUSTRIES, INC.

7989 STATE ROUTE 108 OTTAWA, OH 45875

DRAWING INDEX

CODE COMPLIANCE DATA, PROJECT DESCRIPTION, SITE LOCATION MAP

MECHANICAL FLOOR PLAN
MECHANICAL DEMO AND ENLARGED PLANS

MECHANICAL DETAILS AND SCHEDULES
MECHANICAL SPECIFICATIONS

ELECTRICAL OVERALL FLOOR
ELECTRICAL ENLARGED PLAN AND POWER

ELECTRICAL SPECIFICATIONS



LOCATION

OTTAWA, OH SITE LOCATION MAP NO SCALE



IT SHALL BE THE RESPONSIBILITY OF PRIME CONTRACTOR TO THOROUGHLY REVIEW THE ENTIRE SET OF DRAWINGS AND PROJECT MANUAL (OR SPECIFICATIONS) IN ORDER TO FAMILIARIZE THEMSELVES WITH ITEMS BEING PROVIDED BY AND WORK BEING PERFORMED BY ALL OTHER TRADES IN ADDITION TO ITEMS BEING PROVIDED BY AND WORK BEING PERFORMED BY HIS/HER RESPECTIVE TRADE.

ALL CONTRACTORS SHALL COORDINATE WORK BETWEEN TRADES.

THE EXISTING FLOOR PLAN, STRUCTURE, OCCUPANCY AND PLUMBING SYSTEMS WILL NOT BE ALTERED IN THIS PROJECT.

THE EXISTING MECHANICAL EQUIPMENT PROVIDING HEATING, VENTILATION, AND AIR CONDITIONING TO THE OFFICE AREA AND WORKSHOP ARE BEING REMOVED AND REPLACED WITH A NEW CONSIST OF ONE 20 TON AIR COOLED CONDENSER AND ONE INDOOR AIR HANDLING UNIT. THE SECOND CONSIST OF ONE 6 TON AIR COOLED CONDENSER AND ONE INDOOR AIR HANDLING UNIT, AND ONE 6 TON PACKAGED AIR CONDITIONING UNIT. THE NEW UNITS WILL CONNECT TO EXISTING SUPPLY AND RETURN DUCTWORK. THE OUTSIDE AIR INTAKE WILL BE BROUGHT INTO NEW UNITS DIRECTLY. EXISTING CONTROLS WILL BE ALTERED AS NECESSARY FOR EQUIPMENT BEING REMOVED AND NEW EQUIPMENT BEING ADDED.

THE ELECTRICAL SYSTEM WILL BE ALTERED AS REQUIRED TO ACCOMMODATE NEW AIR CONDITIONING EQUIPMENT AND WILL NOT BE ALTERED IN REGARDS TO OTHER ELECTRICAL

AS NECESSARY, CONTRACTOR SHALL PROVIDE TEMPORARY HEAT FOR WORK AREA 122. ANY PORTABLE SPACE HEATERS SHALL BE PROTECTED WITH A PORTABLE FENCE ENCLOSURE. IF TEMPORARY HEATING UNITS REQUIRE A FUEL SOURCE OTHER THAN ELECTRICAL SERVICE, THE CONTRACTOR SHALL PAY FOR ALL FUEL.

SEE MECHANICAL AND ELECTRICAL DRAWINGS IN THIS SET FOR FURTHER INFORMATION.

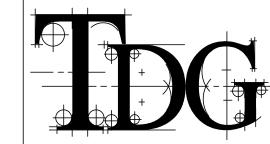
THE EXECUTIVE CONTROLLER FOR THE EXISTING NOVAR CONTROL SYSTEM SHALL BE UPGRADED TO A NEW BUILDING CONTROLLER UTILIZING AN OPEN PROTOCOL NIAGARA N4 SUPERVISORY SOFTWARE FOR A GRAPHICAL USER INTERFACE. CONTRACTOR SHALL ENSURE THAT ALL EXISTING EQUIPMENT CONTROLLED BY REMOVED EXISTING SYSTEM SHALL REMAIN CONTROLLED BY NEW SYSTEM, AND SHALL UPGRADE CONTROLLERS, WIRING, AND OTHER COMPONENTS AS NECESSARY TO INTERFACE WITH NEW OPEN PROTOCOL FRONT END. CONTRACTOR CAN REUTILIZE EXISTING CONTROLLERS, WIRING, AND OTHER COMPONENTS WHERE POSSIBLE. THE SYSTEM UPGRADE SHALL ALLOW FOR IMPLEMENTATION OF ENHANCED CONTROL STRATEGIES, USER INTERFACE GRAPHICS,

THE EXISTING CONTROLS OF THE VAV BOXES, BOILER, PUMPS, RELIEF FANS, ETC. SHALL BE MODIFIED AND/OR REPLACED AS NECESSARY FOR NEW OPEN PROTOCOL FRONT END SYSTEM.

	2017 OBC CODE CO	MPLIANCE DATA
	NAME	BROOKHILL INDUSTRIES, INC.
		124 PUTNAM PARKWAY
OWNER	ADDRESS	OTTAWA, OHIO 45875
OWNER		
	PHONE	419-876-3932
	FAX	419-876-3931
	EMAIL	BROOKHILL@TDS.NET
	NAME	TECHNICON DESIGN GROUP, INC.
		1800 NORTH PERRY ST.
	ADDRESS	SUITE 102
		OTTAWA, OHIO 45875
SUBMITER	PHONE	419-523-5323
	FAX	419-523-9441
	EMAIL	info@technicondesigngroup.com
	OHIO REGISTRATION NUMBER	OHIO REGISTRATION NO. 69299
DESIGNER TYPE	o ARCHITECT • ENGIN	NEER o CERTIFIED DESIGNER
	TYPE OF CONSTRUCTION	2A
	CURRENT USE GROUP	B,F-1
	PROPOSED USE GROUP	B,F-1
	BUILDING HEIGHT	18'-8"
	NUMBER OF STORIES	1
DESIGN CRITERIA	OCCUPANT LOAD	163
ORTERIA	STORAGE HEIGHT	N/A
	STORAGE AISLE WIDTH	N/A
	MIXED USE GROUP	N/A
	SEPARATED	N/A
	NON-SEPARATED	N/A
	EXISTING BUILDING AREA	19,579
	ADDITION BUILDING AREA	0
	TOTAL BUILDING AREA	19,579
	AREA OF ALTERATION	0
BUILDING	TABULAR AREA	N/A
AREA	OPEN AREA INCREASE	N/A
	FIRE SUPPRESSION INCREASE	N/A
	TOTAL ALLOWABLE AREA	N/A
	SPECIAL INSPECTIONS	NOT REQUIRED

ARCHITECT/ENGINEER

TECHNICON DESIGN GROUP, INC. 1800 N. PERRY ST., SUITE 102 **OTTAWA, OHIO 45875** PHONE: (419) 523-5323 FAX: (419) 523-9441 CONTACT: SCOTT BIRKEMEIER, PROJECT ENGINEER



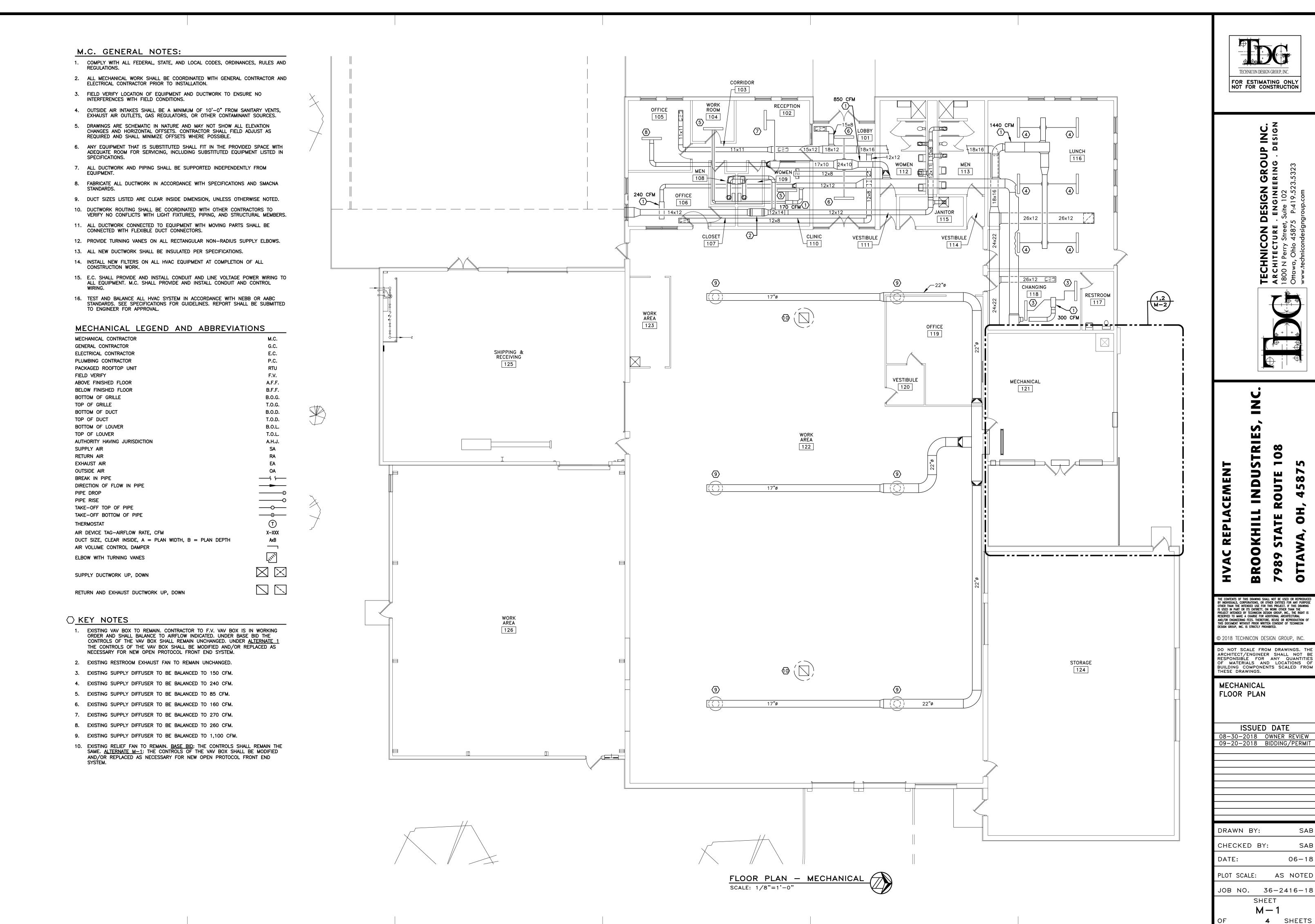
TECHNICON DESIGN GROUP INC. ARCHITECTURE . ENGINEERING . DESIGN

1800 N Perry Street, Suite 102 Ottawa, Ohio 45875 P:419.523.5323 www.technicondesigngroup.com

TECHNICON DESIGN GROUP, INC.
FOR ESTIMATING ONL NOT FOR CONSTRUCTIO

ISSUED DATE

08-30-2018 OWNER REVIEW 09-20-2018 BIDDING/PERMIT



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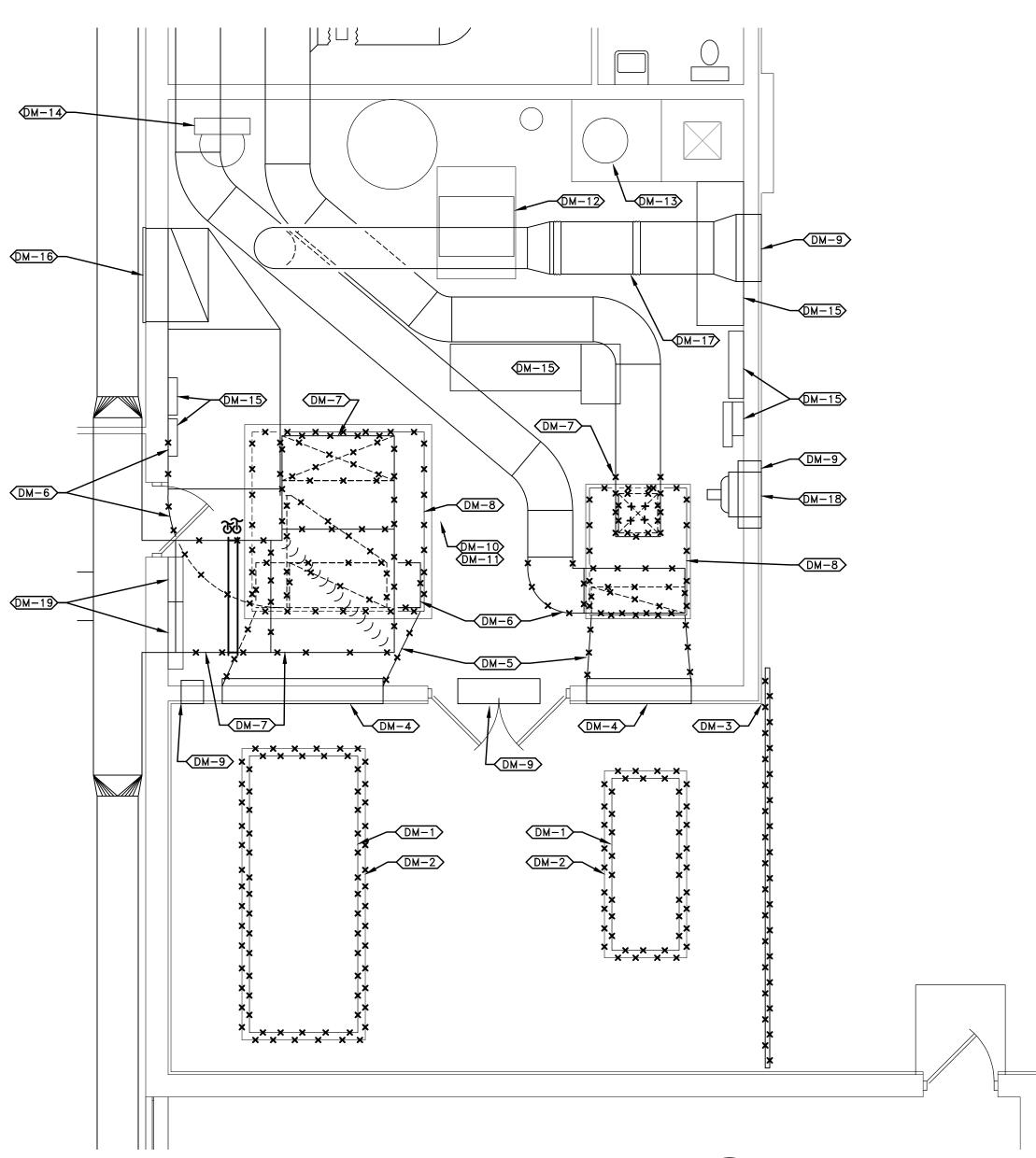
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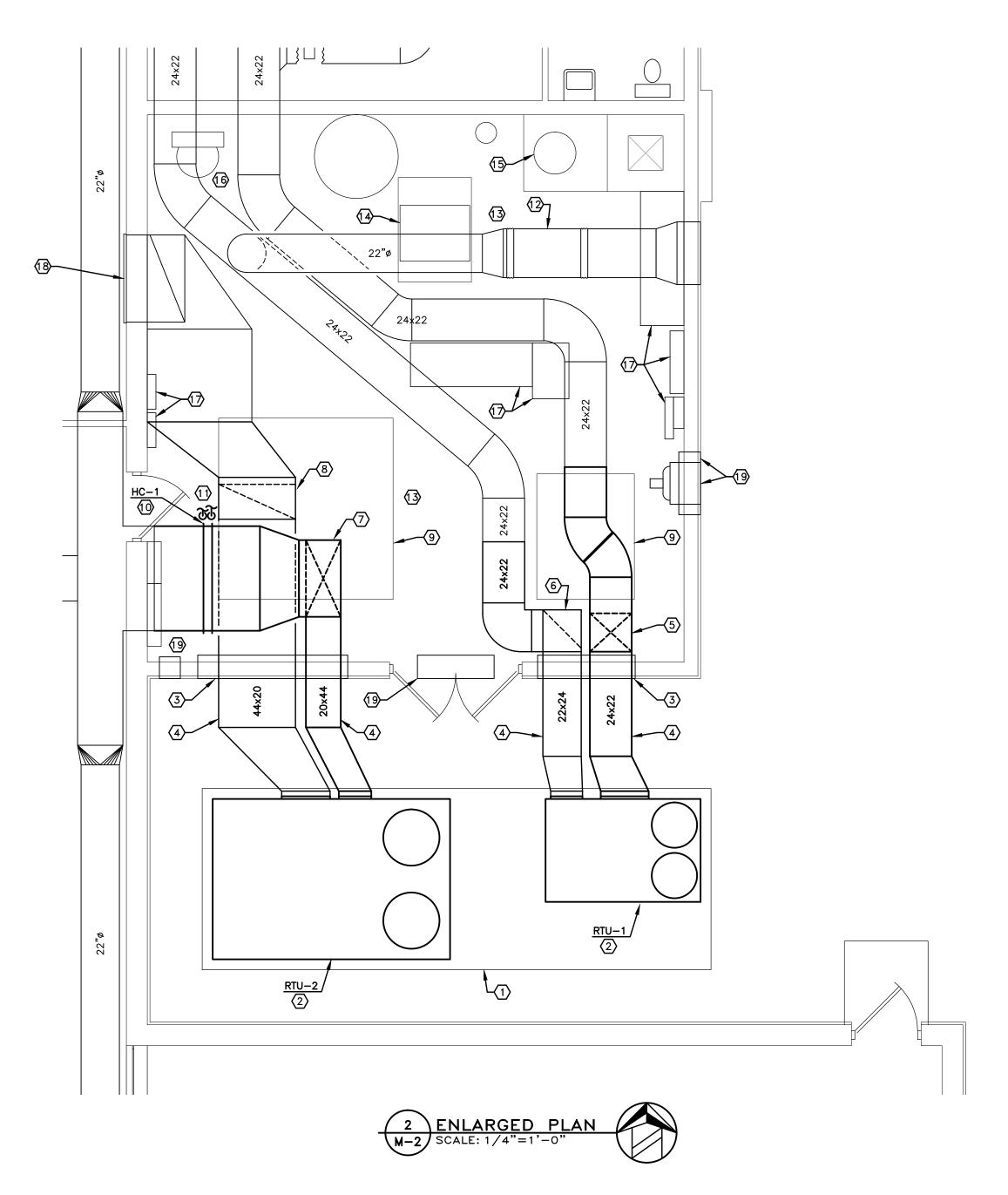
06-18





MECHANICAL DEMOLITION PLAN NOTES

- EXISTING AIR COOLED CONDENSER TO BE REMOVED INCLUDING THE REMOVAL OF ANY AND ALL ASSOCIATED PIPING OR CONTROL WIRING, M.C. SHALL PUMP DOWN AND LEGALLY DISPOSE OF REFRIGERANT IN THE SYSTEM. E.C. TO REMOVE ANY ASSOCIATED POWER WIRING AS INDICATED ON ELECTRICAL DRAWINGS.
- 2. EXISTING CONCRETE HOUSEKEEPING PAD TO BE REMOVED AND DISPOSED OF.
- 3. EXISTING FENCE TRACK TO BE REMOVED AND DISPOSED OF.
- 4. EXISTING OUTSIDE AIR INTAKE LOUVER TO BE REMOVED AND DISPOSED OF.
- 5. EXISTING OUTSIDE AIR DUCT TO BE REMOVED.
- 6. EXISTING RETURN AIR DUCT TO BE REMOVED AS SHOWN AND AS NECESSARY FOR REMOVAL OF UNIT AND RECONNECTION TO NEW PACKAGED UNITS UNITS.
- 7. EXISTING SUPPLY AIR DUCT TO BE REMOVED AS SHOWN AND AS NECESSARY FOR REMOVAL OF UNIT AND RECONNECTION TO NEW PACKAGED UNITS UNITS.
- 8. EXISTING AIR HANDLING UNIT TO BE REMOVED INCLUDING THE REMOVAL OF ANY AND ALL ASSOCIATED PIPING OR CONTROL WIRING. E.C. TO REMOVE ANY ASSOCIATED POWER WIRING AS INDICATED ON ELECTRICAL DRAWINGS.
- 9. EXISTING LOUVER TO REMAIN.
- 10. EXISTING HEATING WATER PIPING SHALL BE DISCONNECTED FROM COIL AND SHALL BE REMOVED AS NECESSARY FOR REMOVAL OF EXISTING AHU AND INSTALLATION OF NEW HEATING WATER COIL, PIPING SHALL BE RECONNECTED TO NEW HEATING COIL. SEE ENLARGED PLAN '2' ON SHEET M-2.
- 11. EXISTING HEATING WATER PUMP TO REMAIN.
- 12. EXISTING BOILERS TO REMAIN.
- 13. EXISTING DOMESTIC WATER HEATER TO REMAIN.
- 14. EXISTING AIR COMPRESSOR TO REMAIN.
- 15. EXISTING ELECTRICAL EQUIPMENT. SEE ELECTRICAL DRAWINGS.
- 16. EXISTING RETURN GRILLES TO REMAIN UNCHANGED.
- 17. EXISTING RELIEF FAN TO REMAIN. <u>BASE BID</u>: THE CONTROLS SHALL REMAIN THE SAME. <u>ALTERNATE M-1</u>: THE CONTROLS OF THE VAV BOX SHALL BE MODIFIED AND/OR REPLACED AS NECESSARY FOR NEW OPEN PROTOCOL FRONT END SYSTEM.
- 18. EXISTING BOILER ROOM VENTILATION FAN TO REMAIN.
- 19. EXISTING CONTROL SYSTEM. <u>BASE BID:</u> THE CONTROLS ARE TO BE MODIFIED AS NECESSARY TO ACCOMMODATE EQUIPMENT INDICATE TO BE REMOVED OR MODIFIED, AND TO CONTROL NEW PACKAGED UNITS BEING ADDED TO THE SYSTEM. ALTERNATE M-1: FRONT END OF CONTROL SYSTEM SHALL BE REPLACED WITH BACNET OPEN PROTOCOL SYSTEM. MODIFY AND/OR REPLACE OTHER CONTROLS COMPONENTS THROUGHOUT SYSTEM AS NECESSARY TO ENSURE SYSTEM FUNCTIONALITY AND DESIRED OPERATION.



- 1. 9'-0" x 24'-6" x 4" THICK CONCRETE SLAB W/ #3 BARS @ 18" O.C. EACH WAY OVER 6" MIN. COMPACTED STONE BASE. CONTRACTOR SHALL VERIFY PAD DIMENSIONS AND ADJUST SIZE TO ACCOMMODATE PACKAGED EQUIPMENT SUPPLIED. PAD SHALL EXTEND 6" BEYOND EDGE OF EQUIPMENT IN ALL DIRECTIONS AND SHALL BE A MINIMUM OF 3" ABOVE ADJACENT GRADE. SEE EQUIPMENT PAD DETAILS '3' ON SHEET M-3.
- PROVIDE AND INSTALL HORIZONTAL DISCHARGE PACKAGED AIR CONDITIONING UNIT ON CONCRETE HOUSEKEEPING PAD AT GRADE. PAD TO BE INSTALLED BY G.C. INSTALL CONDENSATE TRAP AND ROUTE TO GRADE. SEE PACKAGED AIR CONDITIONING UNIT SCHEDULE ON SHEET M-3. SEE SPECIFICATIONS ON SHEET M-4.
- EXISTING LOUVER TO BE REMOVED. SEE DEMOLITION PLAN ON THIS SHEET. CONTRACTOR TO ROUTE NEW SUPPLY AND RETURN DUCTWORK THRU EXISTING OPENING AS SHOWN. CONTRACTOR TO FILL IN THE REMAINDER OF THE OPENING WITH DOUBLE WALL INSULATED SHEET METAL. CONTRACTOR TO INSURE THE OPENING
- 4. EXTERIOR DUCTWORK TO BE INSULATED AND WEATHERIZED PER SPECIFICATIONS ON SHEET M-4. MAINTAIN A MINIMUM OF 6" GROUND CLEARANCE AND PROVIDE DUCT SUPPORTS AS NECESSARY.

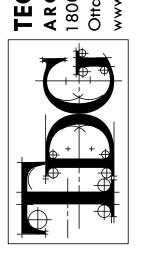
6. 22x24 RETURN DUCT TO BE ROUTED IN THRU EXISTING LOUVER OPENING, ROUTED

- 5. 24x22 SUPPLY DUCT TO BE ROUTED IN THRU EXISTING LOUVER OPENING, ROUTED UP VERTICALLY, AND THEN HORIZONTALLY TO EXISTING MAIN. TRANSITION AS NECESSARY AND CONNECT TO EXISTING MAIN. ELBOWS SHALL BE CONSTRUCTED WITH
- UP VERTICALLY, AND THEN HORIZONTALLY TO EXISTING MAIN. TRANSITION AS NECESSARY AND CONNECT TO EXISTING MAIN. 7. 20x44 SUPPLY DUCT TO BE ROUTED IN THRU EXISTING LOUVER OPENING, ROUTED
- UP VERTICALLY, AND THEN HORIZONTALLY TO NEW HEATING COIL AND EXISTING MAIN. TRANSITION AS NECESSARY AND CONNECT TO COIL AND EXISTING MAIN. ELBOWS SHALL BE CONSTRUCTED WITH TURNING VANES.
- 8. 44x20 RETURN DUCT TO BE ROUTED IN THRU EXISTING LOUVER OPENING, ROUTED UP VERTICALLY, AND THEN HORIZONTALLY TO EXISTING MAIN. TRANSITION AS NECESSARY AND CONNECT TO EXISTING MAIN.
- 9. EXISTING CONCRETE HOUSEKEEPING PAD TO REMAIN. M.C. SHALL CLEAN EXISTING CONCRETE HOUSEKEEPING PAD AND PAINT EDGE OF PAD WITH REFLECTIVE YELLOW
- 10. HYDRONIC HEATING COIL TO BE INSTALLED IN NEW SUPPLY DUCTWORK. COIL SHALL HAVE FLANGED CONNECTION AND SHALL BE INSTALLED PER MANUFACTURER'S REQUIREMENTS. INSTALL DRAIN PAN UNDER COIL, AND ROUTE DRAIN TO EXISTING

- 11. CONNECT 1 1/2" HWS AND HWR FROM EXISTING BRANCH SERVING REMOVED AHU COIL AND CONNECT TO NEW HEATING WATER COIL MOUNTED IN DUCTWORK. SEE HEATING WATER COIL PIPING DIAGRAM '1' ON SHEET M-3. EXISTING PUMP AND CONTROL VALVE SHALL REMAIN.
- 12. EXISTING RELIEF FAN TO REMAIN. <u>BASE BID</u>: THE CONTROLS SHALL REMAIN THE SAME. <u>ALTERNATE M-1</u>: THE CONTROLS OF THE VAV BOX SHALL BE MODIFIED AND/OR REPLACED AS NECESSARY FOR NEW OPEN PROTOCOL FRONT END SYSTEM.
- 13. EXISTING HEATING WATER PUMP TO REMAIN.
- 14. EXISTING BOILER TO REMAIN.
- 15. EXISTING DOMESTIC WATER HEATER TO REMAIN.
- 16. EXISTING AIR COMPRESSOR TO REMAIN. 17. EXISTING ELECTRICAL EQUIPMENT. SEE ELECTRICAL DRAWINGS.
- 18. EXISTING RETURN GRILLES TO REMAIN UNCHANGED.
- 19. EXISTING BOILER ROOM VENTILATION FAN TO REMAIN.
- 20. EXISTING CONTROL SYSTEM. <u>BASE BID:</u> THE EXISTING CONTROLS ARE TO BE MODIFIED AS NECESSARY TO ACCOMMODATE EQUIPMENT INDICATED TO BE REMOVED

OR MODIFIED, AND TO CONTROL NEW PACKAGED UNITS BEING ADDED TO THE SYSTEM. WORK ON EXISTING CONTROLS SHALL BE COMPLETED BY MANUFACTURER CERTIFIED SERVICE PERSONNEL. ALTERNATE M-1: FRONT END OF CONTROL SYSTEM SHALL BE REPLACED WITH BACNET OPEN PROTOCOL SYSTEM. MODIFY AND/OR REPLACE OTHER CONTROLS COMPONENTS THROUGHOUT SYSTEM AS NECESSARY TO ENSURE SYSTEM FUNCTIONALITY AND DESIRED OPERATION.





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MECHANICAL DEMO AND ENLARGED PLANS

ISSUED DATE 08-30-2018 OWNER REVIEW 09-20-2018 BIDDING/PERMIT

DRAWN BY: CHECKED BY: SAB DATE: 06 - 18

PLOT SCALE: AS NOTED JOB NO. 36-2416-18SHEET

M-2**4** SHEETS

						PA	CK	AGE	D AI	R	CO	ND	ITIC	INC	NG	UNIT	SC	HE	EDULE			
TAG	LOCATION		CC	OOLING	G				HEATING	}		F.	AN	MO.	TOR	ELECTRI			MINIMUM	MAKE	MODEL	REMARKS
IAG	LOCATION	TOTAL (MBH)	SENSIBLE ((MBH)	REFRIGERANT	EER	IEER	INPUT	OUTPUT	FUEL	EFF	CFM	ESP	HP	RPM	POWER	MCA	MOP	OUTSIDE AIR	MANE	MODEL	REMARKS
RTU-1	GRADE	87.1	60.8		R410A	11.2	13.1					3000	0.6	3		460/3/60	21.2	25	400	JOHNSON CONTROLS	J07ZFC00R4B2BCA2A2	NOTE 1
RTU-2	GRADE	245.1	162.6	3	R410A	10.0	12.5					6600	0.7	5		460/3/60	51.5	60	1015	JOHNSON CONTROLS	J20ZFC00P4B2BCA4A1	NOTE 1
		TH TWO STAGE															CONO	MIZER	WITH BAROMET	TRIC RELIEF, BACNET	CONTROLLER,	

					VENTI	LATION	SCHE	DULE					
		NET ROOM			TLATION (OMC				VENTILATION (OMC				
ROOM NUMBER	ROOM	AREA [Az] (SQ FT)	ACTUAL OCCUPANCY [Pz]	REQUIRED OPERABLE AREA (SQ FT)	PERCENT	ACTUAL OPERABLE AREA (SQ FT)	AREA OUTDOOR AIR RATE [Ra] (CFM/SQ FT)	PEOPLE OUTDOOR AIR RATE [Rp] (CFM/PERSON)	BREATHING ZONE OUTDOOR AIRFLOW [Vbz] (CFM)	ZONE AIR DISTRIBUITION EFFECTIVENESS [Ez]	ZONE OUTDOOR AIRLOW [Voz]	ACTUAL OUTSIDE AIRFLOW (CFM)	REMARKS
101	LOBBY	268	0				0.06	0	16	0.8	20	20	NOTE 1
102	RECEPTION	180	1				0.06	5	16	0.8	20	20	NOTE 1
103	CORRIDOR	44	0				0.06	0	3	0.8	3	3	NOTE 1
104	WORK ROOM	71	1				0.06	5	9	0.8	12	12	NOTE 1
105	OFFICE	181	1				0.06	5	16	0.8	20	20	NOTE 1
106	OFFICE	189	1				0.06	5	16	0.8	20	20	NOTE 1
107	CLOSET	20	0				0.12	0	2	0.8	3	3	NOTE 1
108	MEN	38	1				0	70	70	1.0	70		NOTE 3
109	WOMEN	38	1				0	70	70	1.0	70		NOTE 3
110	CLINIC	142	1				0.06	5	14	0.8	17	17	NOTE 1
111	VESTIBULE	21	0				0.06	0	1	0.8	2	2	NOTE 2
112	WOMEN	176	2				0	70	140	1.0	140		NOTE 3
113	MEN	176	3				0	70	210	1.0	210		NOTE 3
114	VESTIBULE	22	0				0.06	0	1	0.8	2	2	NOTE 2
115	JANITOR	78	0				0.06	0	5	0.8	6		NOTE 3
116	LUNCH	880	30				0.06	5	203	0.8	254	254	NOTE 1
117	RESTROOM	78	1				0	70	70	1.0	70		NOTE 3
118	CHANGING	227	2				0.06	5	24	0.8	30	30	NOTE 1
119	OFFICE	369	3				0.06	5	37	0.8	46	465	NOTE 2
120	VESTIBULE	63	0				0.06	0	4	0.8	5	5	NOTE 2
121	MECHANICAL	672	0				0.06	0	40	0.8	50		NOTE 3
122	WORK AREA	7522	60				0.06	5	751	0.8	939	939	NOTE 2
123	WORK AREA	147	1				0.06	5	14	0.8	17	17	NOTE 2
124	STORAGE	2202	0	88.1	4.0%	1	0.06	0	132	0.8	165		NOTE 3
125	SHIPPING/RECEIVING	1916	3	76.6	4.0%	1	0.06	0	115	0.8	144		NOTE 3
126	WORK AREA	2806	4	112.2	4.0%	1	0.06	5	188	0.8	235		NOTE 3

VENTILATION OF THIS SPACE IS BY RTU-1.

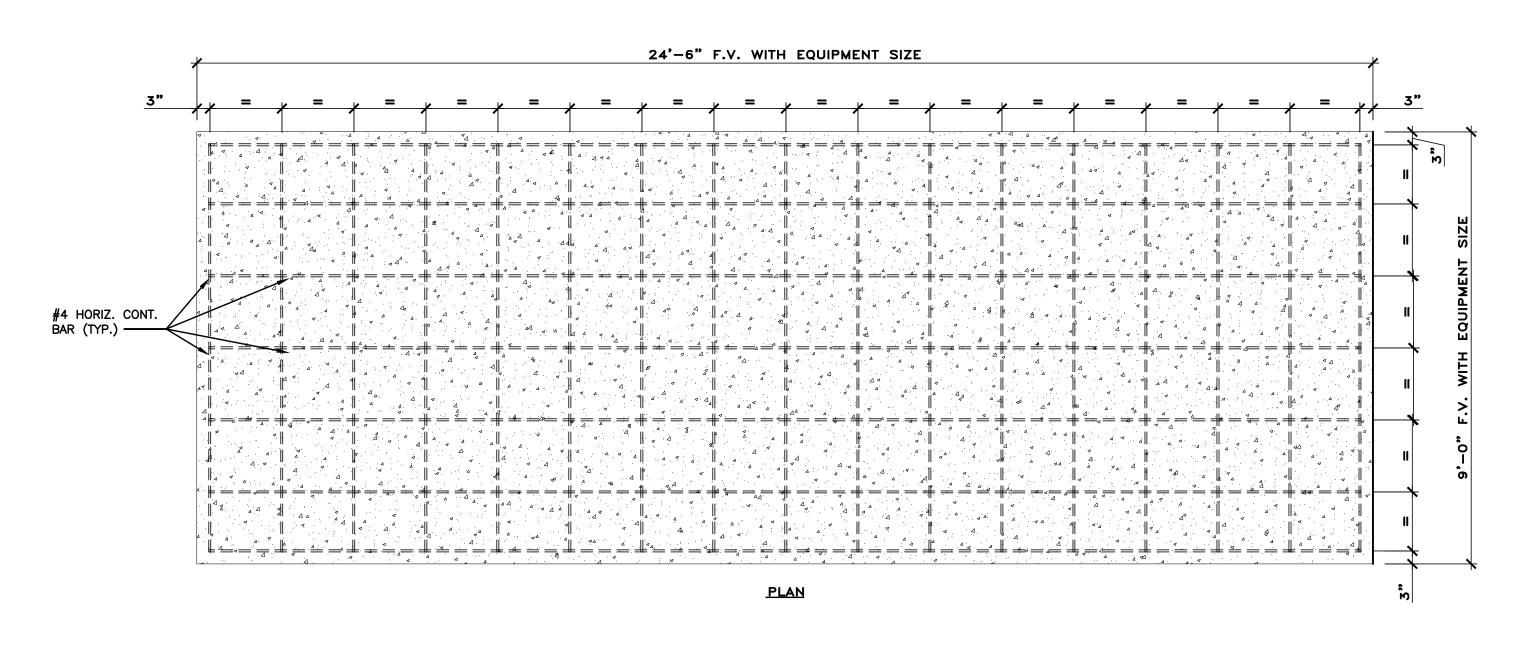
VENTILATION OF THIS SPACE IS BY RTU-2. VENTILATION OF THIS SPACE IS BY EXISTING EXHAUST SYSTEM. NO CHANGE TO THIS SPACE/SYSTEM.

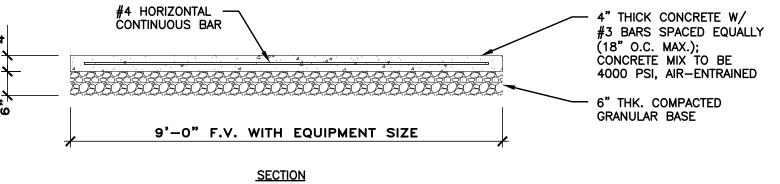
4. VENTILATION OF THIS SPACE IS BY EXHAUST FAN, F-2

5. VENTILATION OF THIS SPACE IS BY AHU-1 VENTILATION OF THIS SPACE IS BY RTU-1

7. SPACE IS NOT OCCUPIED.

								COIL	_ SC	HEC)ULE				
TAG					AIR					WATER		DIMENSIONS	MAKE	MODEL	REMARKS
IAG	CFM	EAT (°F)	LAT (°F)	TOTAL (MBH)	SENSIBLE (MBH)	APD	FACE VEL. (FPM)	GPM	EWT (°F)	LWT (°F)	WPD (FT HD)	DIMENSIONS	MANE	MODEL	REMARKS
HC-1	6600	55.0	85.1	215.4		0.19	660	22	180	160	3.1	60x24	GREENHECK	HW58S01H10-24x60-RH	

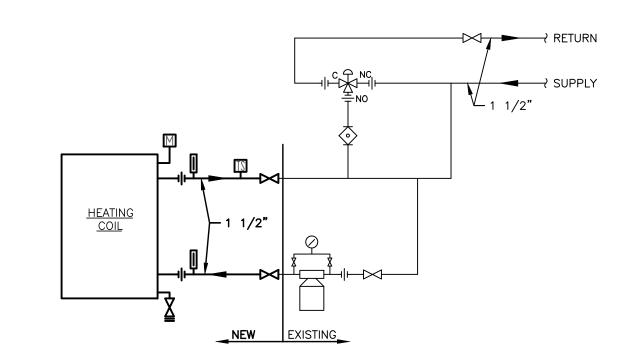




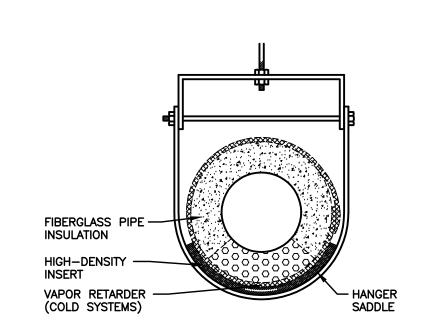
ALL REINFORCING SHALL BE

LOCATED AT MID DEPTH OF

SCALE: 1/2"=1'-0"

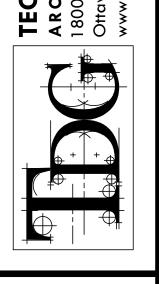






2 CLEVIS HANGER DETAIL M-3/SCALE: NONE





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MECHANICAL DETAILS AND SCHEDULES

ISSUED DATE 08-30-2018 OWNER REVIEW 09-20-2018 BIDDING/PERMIT

DRAWN BY:

CHECKED BY: SAB DATE: 06-18 PLOT SCALE: AS NOTED

JOB NO. 36-2416-18 SHEET M-3

<u>DIVISION 23 - MECHANICAL SPECIFICATIONS</u>

- SCOPE OF WORK: WORK COVERED BY THIS SPECIFICATION AND DESIGN DRAWINGS SHALL INCLUDE ALL LABOR, MATERIALS, EQUIPMENT AND SERVICES NECESSARY FOR AND REASONABLY INCIDENTAL TO COMPLETE THE INSTALLATION OF THE HEATING. COOLING AND VENTILATION SYSTEM, INCLUDING LOW VOLTAGE CONTROLS, WIRING AND NECESSARY CONDUIT REQUIRED FOR THE COMPLETE AND OPERABLE TEMPERATURE CONTROL SYSTEM. NOTE: REFERENCE TO CONTRACTOR (OR M.C.) ON ALL MECHANICAL DRAWINGS AND WITHIN THIS SPECIFICATION COVERS WORK FOR HEATING, COOLING AND VENTILATING CONTRACTORS AND THEIR SUBCONTRACTORS.
- PERMITS AND CODES: THE ENGINEER SHALL BE RESPONSIBLE FOR OBTAINING AND PAYING FOR ALL NECESSARY PERMITS INCLUDING FIRE SUPPRESSION. CONTRACTOR IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH ANY INSPECTIONS, TAXES AND INSURANCE. ALL WORK SHALL BE INSTALLED TO CONFORM WITH ALL FEDERAL, STATE AND LOCAL CODES AND ORDINANCES INCLUDING, BUT NOT LIMITED TO, NFPA, OMC 2017, ASHRAE, ASTM, ASME, ANSI, UL, NEC, AMCA AND SMACNA.
- QUALITY REQUIREMENTS: THE CONTRACTOR SHALL MONITOR QUALITY CONTROL OVER SUPPLIERS, MANUFACTURERS, PRODUCTS, SERVICES, SITE CONDITIONS, AND WORKMANSHIP, TO PRODUCE WORK OF SPECIFIED QUALITY. THE CONTRACTOR SHALL COMPLY WITH MANUFACTURERS' INSTRUCTIONS, INCLUDING EACH STEP IN SEQUENCE. SHOULD MANUFACTURERS' INSTRUCTIONS CONFLICT WITH CONTRACT DOCUMENTS, REQUEST CLARIFICATION FROM ENGINEER BEFORE PROCEEDING. THE CONTRACTOR SHALL COMPLY WITH SPECIFIED STANDARDS AS MINIMUM QUALITY FOR THE WORK EXCEPT WHERE MORE STRINGENT TOLERANCES, CODES, OR SPECIFIED REQUIREMENTS INDICATE HIGHER STANDARDS OR MORE PRECISE WORKMANSHIP. THE CONTRACTOR SHALL HAVE WORK PERFORMED BY PERSONS QUALIFIED TO PRODUCE REQUIRED AND SPECIFIED QUALITY. THE CONTRACTOR SHALL VERIFY THAT FIELD MEASUREMENTS ARE AS INDICATED ON SHOP DRAWINGS OR AS INSTRUCTED BY THE MANUFACTURER. THE CONTRACTOR SHALL SECURE PRODUCTS IN PLACE WITH POSITIVE ANCHORAGE DEVICES DESIGNED AND SIZED TO WITHSTAND STRESSES, VIBRATION, PHYSICAL DISTORTION, AND DISFIGUREMENT.
- CONTRACT DRAWINGS: IN GENERAL, DRAWINGS ARE SCHEMATIC IN NATURE AND ARE INTENDED AS A GUIDE FOR THE CONTRACTOR, BUT DO NOT NECESSARILY SHOW ALL DETAILS, OFFSETS, ELEVATION CHANGES, ETC. THE CONTRACTOR'S WORK SHALL CONFORM TO THE INFORMATION CONTAINED IN THIS SPECIFICATION AND/OR AS INDICATED IN THE LATEST REVISION OF THE DRAWINGS REFERRED TO HEREIN. THE CONTRACTOR SHALL CONSULT WITH THE ENGINEER REGARDING ALL QUESTIONS PRIOR TO PROCEEDING WITH FABRICATION OF THE WORK IN QUESTION, THE CONTRACTOR SHALL PREPARE ALL ADDITIONAL DETAIL OR FIELD INSTALLATION DRAWINGS NECESSARY AT THEIR OWN EXPENSE. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS INDICATED ON THE ENGINEER'S LAYOUT DRAWINGS AND DETERMINE IF ANY CHANGES ARE REQUIRED IN CONDUITS. PIPING RUNS. DRAINS. ETC. TO AVOID INTERFERENCE. MAJOR CHANGES SHALL NOT BE MADE WITHOUT THE APPROVAL OF THE ENGINEER. THE CONTRACTOR HAS THE RIGHT TO VARY THE RUN OF CONDUITS, PIPING AND/OR DUCTS AS MAY BE FOUND NECESSARY OR DESIRABLE TO AVOID INTERFERENCES. MAJOR REVISIONS SHALL BE VERIFIED WITH THE
- VERIFICATION: BEFORE RUNNING ANY DUCTS, PIPING, ETC., WITHIN THE BUILDING. THE CONTRACTOR SHALL ASSURE HIMSELF THAT THEY CAN BE INSTALLED AS CONTEMPLATED WITHOUT TRAPPING OR INTERFERING WITH COLUMNS, BEAMS, PIPING, FIXTURES, ETC. ANY NECESSARY MAJOR DEVIATION SHALL BE REFERRED TO THE OWNER FOR ADJUSTMENT BEFORE LINES ARE RUN, AT NO INCREASE IN CONTRACT PRICE. OPENINGS. SUPPORTING STEEL, FIELD-BUILT CURBS. ELECTRICAL DATA. SPACE REQUIREMENTS. ETC.. WERE DESIGNED AROUND SPECIFIC PARAMETERS. WHEN THE CONTRACTOR DETERMINES THE MAKE OF EQUIPMENT TO BE PROVIDED FOR THE JOB, IT SHALL BE THEIR RESPONSIBILITY TO VERIFY AND COORDINATE UNIT DIMENSIONS WITH THE GENERAL CONTRACTOR AND ALL OTHER INTERESTED CONTRACTORS ON THE JOB. IT SHALL ALSO BECOME THE CONTRACTOR'S RESPONSIBILITY TO CHANGE AS NECESSARY, THROUGH THE ARCHITECT AND ENGINEER, ALL REQUIRED DIMENSIONS SO THAT OPENINGS, SUPPORTING STEEL, CURBS, ELECTRICAL DATA, ETC., WILL FIT THE EQUIPMENT SUPPLIED. ANY ADDITIONAL COST WILL BE THE SOLE RESPONSIBILITY OF THIS CONTRACTOR. IN ADDITION, ELECTRICAL POWER, INTERLOCK AND CONTROL DIAGRAMS AND PIPING ARRANGEMENTS WERE DESIGNED AROUND ONE SPECIFIC MANUFACTURER. IF ADDITIONAL WIRING PIPING CONTROLS, ETC. ARE REQUIRED FOR OTHER EQUIPMENT, THE CONTRACTOR SHALL INCLUDE THE COST OF THE SAME IN HIS PRICE. DIMENSIONS, ELEVATIONS AND RELATIVE LOCATIONS OF EXISTING EQUIPMENT, SEWERS, PIPES, DUCTS, CONDUITS, ETC., IN PLACE AS SHOWN ON THE DRAWINGS, ARE TAKEN FROM AS-BUILT AND/OR RECORD DRAWINGS AND ARE DEEMED RELIABLE ONLY IN SO FAR GENERAL LAYOUT IS CONCERNED. SUCH DIMENSIONS SHALL NOT BE USED FOR LAYOUT DRAWINGS NOR DETAILING OF COMPONENTS. THE RESPONSIBILITY FOR CHECKING IN PLACE ITEMS WILL BE THE CONTRACTORS. ALL MEASUREMENTS, THE EXACT DETERMINATION OF RELATIVE ELEVATIONS OR LOCATIONS, THE ASCERTAINING OF ACCURACY OF ALL GIVEN ELEVATIONS AND THE OBTAINING OF ALL NECESSARY ADDITIONAL INFORMATION TO INSURE THE PROPER FIT AND COORDINATION OF ALL CONDUIT, EQUIPMENT, DUCTS, AND PIPING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL CAREFULLY EXAMINE THE GENERAL BUILDING PLANS AND ALL MECHANICAL PLANS AND CARRY ON HIS WORK SO AS NOT TO DELAY OR INTERFERE WITH THE WORK OF OTHER TRADES. THE CONTRACTOR SHALL COORDINATE HIS WORK WITH OTHER TRADES.
- AS BUILT DRAWINGS: THE CONTRACTOR SHALL NOTE CHANGES FROM CONTRACT DRAWINGS AND SPECIFICATIONS. THE CONTRACTOR SHALL NEATLY AND CORRECTLY ENTER IN COLORED PEN ANY DEVIATIONS ON DRAWINGS AFFECTED AND SHALL KEEP DRAWINGS AVAILABLE FOR INSPECTION. AN EXTRA SET OF DRAWINGS WILL BE FURNISHED FOR THIS PURPOSE. THE CONTRACTOR SHALL GIVE THE DRAWINGS TO THE OWNER AT PROJECT COMPLETION AND LABEL THEM "AS BUILT DRAWINGS -
- SITE VISITS: THE CONTRACTOR SHALL VISIT THE SITE (OR BUILDING) AND EXAMINE THE AREA OF WORK AND COMPARE IT WITH DRAWINGS AND SPECIFICATIONS, AND BE SATISFIED AS TO CONDITION OF PREMISES. SUCH AS OBSTRUCTIONS. ACTUAL LEVELS AND OTHER NECESSARY REQUIREMENTS FOR CARRYING OUT THE WORK. ALL BIDDERS SHALL REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO SUBMITTING THEIR BID OR PROPOSAL. NO ADDITIONAL COMPENSATION WILL BE GIVEN AFTER THE BIDS OR PROPOSALS HAVE BEEN SELECTED.
- SUBMITTALS: SUBMIT TO THE ENGINEER FOR REVIEW FOR THE LIMITED PURPOSE OF CHECKING FOR CONFORMANCE WITH INFORMATION GIVEN AND THE DESIGN CONCEPT EXPRESSED IN THE CONTRACT DOCUMENTS THREE COPIES OF ALL PRODUCT DATA AND SHOP DRAWINGS FOR ALL SCHEDULED EQUIPMENT. CLEARLY IDENTIFY ALL SUBMITTALS WITH NAME SHOWN IN THE SCHEDULES. APPLY CONTRACTOR'S STAMP, SIGNED OR INITIALED CERTIFYING THAT REVIEW, APPROVAL, VERIFICATION OF PRODUCTS REQUIRED, FIELD DIMENSIONS, ADJACENT CONSTRUCTION WORK, AND COORDINATION OF INFORMATION IS IN ACCORDANCE WITH THE REQUIREMENTS OF THE WORK AND CONTRACT DOCUMENTS. IDENTIFY VARIATIONS FROM CONTRACT DOCUMENTS AND PRODUCT OR SYSTEM LIMITATIONS WHICH MAY BE DETRIMENTAL TO SUCCESSFUL PERFORMANCE OF THE COMPLETED WORK. DISTRIBUTE COPIES OF REVIEWED SUBMITTALS AS APPROPRIATE. INSTRUCT PARTIES TO PROMPTLY REPORT ANY INABILITY TO COMPLY WITH REQUIREMENTS.
- PRODUCT SUBSTITUTION: MANUFACTURERS SPECIFIED IN THE EQUIPMENT SCHEDULES BY NAMING ONE OR MORE MANUFACTURERS ARE INCLUDED AS A BASIS OF DESIGN WITH A PROVISION FOR SUBSTITUTIONS. SUBMIT A REQUEST FOR SUBSTITUTION FOR ANY MANUFACTURER NOT NAMED. DOCUMENT EACH REQUEST WITH COMPLETE DATA SUBSTANTIATING COMPLIANCE OF PROPOSED SUBSTITUTION WITH CONTRACT DOCUMENTS. A REQUEST FOR SUBSTITUTION CONSTITUTES A REPRESENTATION THAT THE SUBMITTER HAS INVESTIGATED PROPOSED PRODUCT AND DETERMINED THAT IT MEETS OR EXCEEDS THE QUALITY LEVEL OF THE SPECIFIED PRODUCT AND THAT IT WILL PROVIDE THE SAME WARRANTY FOR THE SUBSTITUTION AS FOR THE SPECIFIED PRODUCT. THE CONTRACTOR SHALL COORDINATE INSTALLATION AND MAKE CHANGES TO OTHER WORK WHICH MAY BE REQUIRED FOR THE WORK TO BE COMPLETED WITH NO ADDITIONAL COST TO THE OWNER. THE CONTRACTOR WAIVES CLAIMS FOR ADDITIONAL COSTS OR TIME EXTENSION WHICH MAY SUBSEQUENTLY BECOME APPARENT AND WILL REIMBURSE THE OWNER. ARCHITECT AND/OR ENGINEER FOR REVIEW OR REDESIGN SERVICES ASSOCIATED WITH RF-APPROVAL BY ALITHORITIES SUBSTITUTIONS WILL NOT BE CONSIDERED WHEN THEY ARE INDICATED OR IMPLIED ON SHOP DRAWING OR PRODUCT DATA SUBMITTALS, WITHOUT SEPARATE WRITTEN REQUEST, OR WHEN ACCEPTANCE WILL REQUIRE REVISION TO THE CONTRACT DOCUMENTS.
- 10. <u>WARRANTY:</u> THE MECHANICAL CONTRACTOR SHALL PROVIDE WRITTEN GUARANTEE TO THE OWNER THAT WORK HEREIN SHALL BE FREE FROM DEFECTS IN WORKMANSHIP AND MATERIALS. THAT APPARATUS WILL DEVELOP CAPACITIES AND CHARACTERISTICS REQUIRED ON DRAWINGS. AND THAT IF DURING A PERIOD OF ONE YEAR AFTER DATE OF CERTIFICATE OF COMPLETION AND ACCEPTANCE OF PROJECT, ANY SUCH DEFECTS APPEAR. HE SHALL REMEDY SAME WITHOUT ANY COST TO THE OWNER. OBTAIN AND SUBMIT TO THE OWNER ALL MANUFACTURERS' WARRANTIES FOR EQUIPMENT INSTALLED AS PART OF THE CONTRACT.
- 11. <u>CLOSE-OUT:</u> CONTRACTOR SHALL PROVIDE FIELD TESTING, CHECK-OUT AND SYSTEM DEMONSTRATIONS TO OWNER TO ASSURE PROPER PERFORMANCE AND ADJUSTMENT OF ITEMS PROVIDED UNDER THE CONTRACT. REMOVE ALL DEBRIS CREATED BY THE CONSTRUCTION WORK AND CLEAN ALL EQUIPMENT, AIR DEVICES, ETC., INSIDE AND OUTSIDE. PROVIDE THREE BOUND COPIES OF OPERATION AND MAINTENANCE MANUALS WHICH INCLUDES: COPIES OF EACH APPROVED SHOP DRAWING, MAINTENANCE PROCEDURES, OPERATION AND INSTRUCTION MANUALS, LITERATURE SUPPLIED WITH PLUMBING EQUIPMENT, AND A LIST OF ALL CONTRACTOR'S PURCHASE ORDERS WITH SUPPLIERS, NAMES, ADDRESSES AND PHONE NUMBERS, FOR ALL MATERIALS. PROVIDE INSTRUCTION TO PERSONNEL SELECTED BY THE OWNER. TO FAMILIARIZE THEM WITH THE LOCATION OF SIGNIFICANT EQUIPMENT, TRAIN THEM ON EQUIPMENT FUNCTIONS, REVIEW MAINTENANCE PROCEDURES AND COORDINATE INFORMATION AVAILABLE IN THE BINDER.

- 12. MATERIALS GENERAL: THE MANUFACTURERS REFERENCED THROUGHOUT THESE OUTLINE SPECIFICATION ARE INCLUDED AS A BASIS OF DESIGN. SUBMISSION OF ALTERNATE MANUFACTURERS OF SIMILAR EQUIPMENT IS SUBJECT TO ENGINEERS APPROVAL. UNITS OF EQUIPMENT, OTHER THAN THOSE LISTED AS THE BASIS OF DESIGN. MUST BE PROVEN TO BE PHYSICALLY ACCEPTABLE, IN ADDITION TO MEETING ALL PERFORMANCE AND EQUIPMENT SPECIFICATIONS. LIABILITY OF NON-CONFORMANCE SHALL LIE ON CONTRACTOR/SUBMITTER.
- 13. ICC COMPLIANCE: ALL FIXTURES, EQUIPMENT, CONTROLS AND DEVICES SHALL BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF AMERICANS WITH DISABILITIES ACT (ADA), ICC A117.1, STATE BUILDING CODE, AND LOCAL CODES MAY

14. <u>DUCTWORK:</u>

- A. SHEET METAL DUCTWORK SHALL BE FABRICATED AND INSTALLED IN ACCORDANCE WITH THE LATEST ASHRAE AND SMACNA RECOMMENDATIONS AND IN THE BEST PRACTICES OF GOOD WORKMANSHIP. ALL DUCTWORK SHALL BE CONSTRUCTED OF PRIME HOT DIP GALVANIZED SHEET STEEL, EXCEPT AS
- B. SHEET METAL DUCTWORK SHALL BE HOT-DIPPED GALVANIZED STEEL SHEET WITH G60/Z180 COATING OF THE LOCKED SEAM TYPE. GAUGE AND REINFORCMENT TYPE SHALL COMPLY WITH SMACNA "HVAC DUCT CONSTRUCTION STANDARDS" AND ASTM A653/A653M/A924.
- C. CONSTRUCT RECTANGULAR ELBOWS WITH RADIUS OF NOT LESS THAN 1-1/2 TIMES WIDTH OF DUCT ON CENTERLINE. WHERE NOT POSSIBLE AND RADIUS IS LESS OR WHERE MITERED ELBOWS MUST BE USED, PROVIDE AND INSTALL SINGLE THICKNESS TURNING VANES WITH 4 1/2" RADIUS SPACED EVENLY NOT EXCEEDING 3" ON CENTER.
- INCREASE AND DECREASE DUCT SIZES GRADUALLY, CONVERGE OR DIVERGE AT 15° DIVERGENCE WHERE POSSIBLE; MAXIMUM 30° CONVERGING (DECREASING) IN THE DIRECTION OF AIRFLOW AND 20° DIVERGING (INCREASING) IN THE DIRECTION OF AIRFLOW.
- E. DUCT SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS. FOR LINED DUCTS, MAINTAIN INTERNAL DIMENSIONS.
- SEAMS IN SHEET METAL DUCTWORK SHALL BE SEALED WITH HARDCAST "FLEX GRIP" WATER BASED SEALANT COMPLYING ASTM C731 AND D2202 REQUIREMENTS.
- G. LOCATE DUCTS WITH SUFFICIENT SPACE AROUND EQUIPMENT TO ALLOW NORMAL
- H. DURING CONSTRUCTION PROVIDE TEMPORARY CLOSURES OF METAL OR TAPED POLYETHYLENE ON OPEN DUCTWORK TO PREVENT CONSTRUCTION DUST FROM ENTERING DUCTWORK SYSTEM.

15. <u>DUCT ACCESSORIES</u>:

- A. VOLUME DAMPERS SHALL BE CONSTRUCTED OF 20 GAUGE (MINIMUM) GALVANIZED STEEL WELDED TO A SQUARE STEEL OPERATING ROD SET IN END BEARINGS, ADJUSTABLE WITH KEY OPERATED REGULATOR HAVING DIAL INDICATOR. DAMPERS ON INSULATED DUCT SHALL HAVE RAISED BASE TO DEPTH OF INSULATION. EXCEPT IN ROUND DUCTS 12 INCHES AND SMALLER, PROVIDE END BEARINGS. PROVIDE OIL-IMPREGNATED NYLON OR SINTERED BRONZE BEARINGS ON MULTIPLE BLADE DAMPERS.
- B. ACCESS DOORS SHALL BE RIGID AND CLOSE-FITTING CONSTRUCTED OF GALVANIZED STEEL WITH SEALING GASKETS AND QUICK FASTENING LOCKING DEVICES. FOR INSULATED DUCTS, INSTALL MINIMUM 1 INCH THICK INSULATION WITH SHEET METAL COVER. PROVIDE DUCT ACCESS DOORS FOR INSPECTION AND CLEANING BEFORE AND AFTER FILTERS, COILS, FANS, AUTOMATIC DAMPERS, AT FIRE DAMPERS, COMBINATION FIRE AND SMOKE DAMPERS, AND ELSEWHERE
- C. FLEXIBLE DUCT CONNECTORS SHALL BE INSTALLED WHERE SHEET METAL DUCTWORK IS ATTACHED TO MECHANICAL EQUIPMENT WITH MOVING PARTS. FLEXIBLE DUCT CONNECTORS SHALL BE CONSTRUCTED OF WOVEN GLASS FIBER COATED IN NEOPRENE WITH EDGES CRIMPED INTO METAL EDGING STRIPS. EDGING STRIPS SHALL BE 3" WIDE. 24 GAUGE GALVANIZED METAL. FABRIC SHALL BE FIRE RETARDENT, UL LISTED, AND COMPLY WITH NFPA 90A. CONNECTORS SHALL HAVE A FLAME SPREAD OF LESS THAN 25 AND SMOKE SPREAD LESS THAN 50.
- DAMPER OPERATORS SHALL PROVIDE SMOOTH PROPORTIONAL CONTROL WITH SUFFICIENT POWER FOR AIR VELOCITIES 20 PERCENT GREATER THAN MAXIMUM DESIGN VELOCITY AND TO PROVIDE TIGHT SEAL AGAINST MAXIMUM SYSTEM PRESSURES. PROVIDE SPRING RETURN FOR TWO POSITION CONTROL AND FOR
 - 1. PROVIDE SUFFICIENT NUMBER OF OPERATORS TO ACHIEVE UNRESTRICTED MOVEMENT THROUGHOUT DAMPER RANGE.
- 2. ELECTRIC OPERATORS: SPRING RETURN, ADJUSTABLE STROKE MOTOR HAVING OIL IMMERSED GEAR TRAIN.

16. <u>DUCT INSULATION</u>:

- A. SURFACE BURNING CHARACTERISTICS: FLAME SPREAD/SMOKE DEVELOPED INDEX OF 25/50, MAXIMUM, WHEN TESTED IN ACCORDANCE WITH ASTM E 84, NFPA 255. OR UL 723.
- INSULATION SHALL BE APPLIED PER MANUFACTURER RECOMMENDATIONS, AND SHALL BE INSTALLED IN A MANNER TO PROVIDE A VAPOR SEAL AT SEAMS AND

C. GLASS FIBER, FLEXIBLE

- 1. INSULATION: ASTM C 553; FLEXIBLE, NONCOMBUSTIBLE BLANKET.
- 2. VAPOR BARRIER JACKET: KRAFT PAPER WITH GLASS FIBER YARN AND BONDED TO ALUMINIZED FILM. MOISTURE VAPOR PERMEABILITY: 0.02 PERM

- 1. INCOMBUSTIBLE GLASS FIBER COMPLYING WITH ASTM C 1071; FLEXIBLE BLANKET, RIGID BOARD, AND PREFORMED ROUND LINER BOARD; IMPREGNATED SURFACE AND EDGES COATED WITH POLY VINYL ACETATE POLYMER, OR ACRYLIC POLYMER SHOWN TO BE FUNGUS AND BACTERIA RESISTANT BY TESTING TO ASTM G 21.
- 2. LINER FASTENERS: GALVANIZED STEEL, SELF-ADHESIVE PAD WITH INTEGRAL
- E. SUPPLY AND RETURN DUCTS 10'-0" ON EACH SIDE OF SUPPLY FAN: INSULATE WITH 1" INTERNAL DUCT LINER.
- SUPPLY AND RETURN DUCTWORK: INSULATE WITH 2", 1 1/2 POUND PER CUBIC FOOT FLEXIBLE FIBER BLANKET EQUAL TO JOHNS MANVILLE MICROLITE EQ FSK. THERMAL CONDUCTIVITY (K) SHALL NOT EXCEED 0.24 BTUH SQUARE FOOT F/INCH. INSULATION SHALL BE APPLIED PER MANUFACTURER'S RECOMMENDATIONS AND IN A MANNER AS TO PROVIDE VAPOR SEAL AT ALL SEAMS AND JOINTS. FOR EXTERIOR DUCTWORK SEE ITEM G BELOW.
- G. EXTERIOR DUCTWORK SHALL BE INSULATED WITH 2" THICK, 3 POUND DENSITY FIBER BOARD IMPALED OVER WELD PINS OR ADHERED PINS AT 12" CENTERS WITH A MINIMUM OF TWO ROWS PER SIDE. COVER INSULATION WITH A .016 THICK ALUMINUM JACKET WITH A 3" OVERLAP AT ALL TRANSVERSE AND LONGITUDINAL JOINTS. LAPS OF JACKETS SHALL BE POSITIONED TO SHED WATER. SECURE IN PLACE WITH 3/4" x 0.020" STAINLESS STEEL BANDING ON 18" CENTERS MINIMUM. ON DUCT OVER 48" WIDE PROVIDE STIFFENER AS REQUIRED TO PREVENT SAGGING OF INSULATION. GUARANTEE WEATHER-PROOFING FOR 3 YEARS.
- 17. <u>PIPING GENERAL</u>: ALL PIPING SHALL BE INSTALLED PARALLEL WITH OR AT RIGHT ANGLES TO THE BUILDING WALLS AND WITH A PITCH OF ACCEPTED PIPING STANDARDS. ALL PIPING SHALL BE INSTALLED WITHOUT FORCING AND SHALL CLEAR ALL DOORS, DUCTWORK, AND OTHER BUILDING OBSTRUCTIONS.

18. <u>HVAC CONDENSATE PIPING</u>:

A. PIPE SHALL BE SCHEDULE 40 PVC TYPE 1 COMPLYING WITH ASTM D1784 AND D-1785. PIPE SHALL BE ASSEMBLED WITH SCHEDULE 40 PVC SOLVENT WELD FITTINGS CONFORMING TO ASTM D-2466. INSTALLATION SHALL FOLLOW GUIDELINES IN ASTM D 2564-80 AND D 2665-82.

19. <u>HEATING WATER PIPING</u>:

TEMPERATURE OF 1160°F.

A. ABOVE FLOOR PIPE, FITTINGS, AND VALVES - 2" AND SMALLER

PIPING 2" AND SMALLER SHALL BE TYPE L HARD DRAWN COPPER PIPE CONFORMING TO ASTM B-88 WITH WROUGHT COPPER SOLDER JOINT FITTINGS. JOINTS SHALL BE MADE IN ACCORDANCE WITH THE METHODS OF ASTM B-828. SOLDER SHALL BE A NON-LEAD BEARING TYPE CONFORMING TO ASTM B-32. TEE JOINTS IN COPPER PIPING MAY BE MECHANICALLY FORMED IN A CONTINUOUS OPERATION CONSISTING OF DRILLING A PILOT HOLE AND DRAWING OUT THE TUBE SURFACE TO FORM A COLLAR HAVING A HEIGHT OF NOT LESS THAN THREE TIMES THE THICKNESS OF THE TUBE WALL. THE COLLARING DEVICE SHALL BE FULLY ADJUSTABLE AS TO INSURE PROPER TOLERANCE AND

PROVIDE DIELECTRIC INSULATING UNIONS WHERE STEEL AND COPPER PIPES ARE JOINED. DIELECTRIC UNIONS SHALL BE EQUAL TO CS SERIES AS MANUFACTURED BY CAPITOL MANUFACTURING COMPANY.

ACCORDANCE WITH THE COPPER DEVELOPMENT ASSOCIATION COPPER TUBE

COMPLETE UNIFORMITY OF THE JOINT. JOINTS SHALL BE BRAZED IN

HANDBOOK USING A SILVER BRAZING ALLOY WITH A MINIMUM MELTING

JOINTS BETWEEN COPPER PIPE AND FLANGED EQUIPMENT MAY BE MADE WITH A COPPER COMPANION FLANGE ADAPTER KIT AS MANUFACTURED BY CTS FABRICATIONS CONSISTING OF A LOOSE STEEL FLANGE AND A SWEAT COPPER FLANGE. THE STEEL FLANGE SHALL BE DRILLED TO ANSI B16.25 STANDARD FOR 125 LB. FLANGES AND SHALL INCLUDE AN EPDM INSULATING MATERIAL TO PREVENT CONTACT WITH THE COPPER PIPE. THE COPPER FLANGE SHALL MEET THE STANDARDS OF ASME B16.24

MANUAL VALVES 1-1/2" AND SMALLER TO BE SIMILAR TO NIBCO #S-580, TWO PIECE, BRONZE BALL VALVE, WITH BLOW-OUT PROOF STEM, AND SOLDER JOINT CONNECTIONS. VALVE SHALL BE RATED FOR 400 PSI COLD WATER SERVICE.

MANUAL VALVES 2" AND LARGER TO BE SIMILAR TO NIBCO #S-590, THREE PIECE BRONZE BALL VALVE WITH BLOW OUT PROOF STEM, CONVENTIONAL PORT, BRONZE TRIM, AND SOLDER JOINT CONNECTIONS. BALL VALVES 2" AND LARGER SHALL BE DISASSEMBLED PRIOR TO SOLDERING TO PREVENT DAMAGE TO VALVE SEATS. RE-ASSEMBLE VALVE AFTER SOLDER JOINTS ARE COOL.

CHECK VALVES 2" AND SMALLER TO BE SIMILAR TO NIBCO #S-413, HORIZONTAL SWING BRONZE CHECK VALVE WITH RENEWABLE DISC AND SOLDER JOINT CONNECTIONS.

20. <u>PIPING SPECIALTIES</u>:

STRAINERS SHALL BE EQUAL TO MUELLER MODEL 758 AND SHALL CONSIST OF A CAST IRON BODY RATED FOR 125 PSIG SERVICE AND A PERFORATED

STAINLESS STEEL SCREEN. BODY SHALL COMPLY WITH ASTM A126-B.

B. PRESSURE AND TEMPERATURE TEST PORTS

SUPPLY AND INSTALL WHERE INDICATED ON FLOW DIAGRAMS AND DETAILS "PETE'S PLUG II" TEST PORT AS MANUFACTURED BY PETERSON ENGINEERING COMPANY CONSISTING OF A 1/4" MPT FITTING TO RECEIVE 1/8" TEMPERATURE OR PRESSURE PROBES. FITTING SHALL BE SOLID BRASS FOR COPPER PIPING AND STAINLESS STEEL FOR FERROUS PIPING. FITTINGS SHALL HAVE TWO VALVE CORES OF NEOPRENE FOR SERVICE AT 500 PSI AND A COLOR-CODED CAP WITH GASKET RATED AT 1000 PSI. PROVIDE THE EXTRA LONG MODEL FOR ANY PIPING THAT IS WRAPPED WITH INSULATION.

PROVIDE TWO PRESSURE GAUGE ADAPTERS WITH 1/8" OD PROBE ONE RANGING FROM 0 TO 30" W.C. VACUUM AND ONE 0 TO 100 PSI. PROVIDE TWO 5" STEM TESTING THERMOMETERS ONE WITH A RANGE OF 25°F TO 125°F, AND ONE WITH A RANGE OF 0°F TO 220°F.

THERMOMETERS

THERMOMETER SHALL BE WEISS MODEL 9VU35, VARIABLE ANGLE, MERCURY FILLED THERMOMETER WITH SEPARABLE BRASS WELL MODEL E35-75BS. TEMPERATURE RANGE SHALL BE 0°F - 160°F.

D. PRESSURE GAUGES

PRESSURE GAUGES SHALL BE WEISS MODEL 4CTS, 4-1/2" DIAL PRESSURE GAUGE, RANGE 0-60 PSI COMPLETE WITH WEISS MODEL PSN-B SNUBBER AND WEISS MODEL 25NVBR NEEDLE VALVE.

E. AUTOMATIC AIR VENTS

AUTOMATIC AIR VENT SHALL BE EQUAL TO TACO MODEL 400-3 AND RATED FOR A MAXIMUM TEMPERATURE OF 240°F, AND MAXIMUM PRESSURE OF 150 PSI. INSTALL A GATE VALVE UPSTREAM OF INLET TO AIR VENT.

F. MANUAL AIR VENT

MANUAL AIR VENT SHALL BE EQUAL TO HOFFMAN SPECIALTY MODEL 508, AND RATED FOR A MAXIMUM TEMPERATURE OF 230°F, AND MAXIMUM PRESSURE OF 50 PSI IN HOT WATER AND A MAXIMUM PRESSURE OF 15 PSI IN STEAM. VALVE SHALL HAVE A 1/8" NPT MALE CONNECTION, AND A DISC-TYPE VENT DESIGNED FOR VENTING SYSTEMS EITHER MANUALLY OR AUTOMATICALLY.

G. FLEXIBLE PIPE CONNECTORS

FLEXIBLE PIPE CONNECTORS SHALL BE EQUAL TO TWIN CITY HOSE MODEL TCH-FLG. FLEXIBLE PIPE CONNECTOR SHALL BE STAINLESS STEEL BRAIDED HOSE WITH FLANGED CONNECTIONS. FLEXIBLE PIPE CONNECTOR SHALL BE 9" IN LENGTH UP TO 4"Ø, 11" IN LENGTH FOR 6"Ø, AND 12" IN LENGTH FOR 8"Ø.

- 21. PIPE INSULATION: ALL INSULATION, UNLESS OTHERWISE NOTED, SHALL HAVE A OMPOSITE RATING INCLUDING INSULATION ADHESIVES, JACKET, ETC. AS FOLLOWS. THE COMPOSITE ASSEMBLY SHALL HAVE A FLAME SPREAD RATING NOT OVER 25 AND A SMOKE DEVELOPED RATING NOT HIGHER THAN 50.
 - INSULATION SHALL BE MANUFACTURED BY OWENS-CORNING, KNAUF, JOHNS MANVILLE. OR ARMSTRONG AND THERMALLY EQUIVALENT TO THE OWENS-CORNING MATERIALS SPECIFIED.
- B. THE PIPING INSTALLATION MATERIAL SHALL BE A UL-RATED, NON COMBUSTIBLE PIPING INSULATION RECOMMENDED FOR BOTH HOT AND COLD PIPING. INSULATION SHALL BE HEAVY DENSITY SECTIONAL PIPE INSULATION JACKETED WITH AN EMBOSSED VAPOR BARRIER LAMINATED ALL-SERVICE JACKET WITH SELF-SEALING LAP ADHESIVE. LAP AND SEAL ALL JOINTS TO INSURE VAPOR BARRIER THERMAL CONDUCTIVITY (K) SHALL NOT EXCEED 0.24 BTUH SQUARE FOOT F/INCH. INSULATION SHALL EQUAL OWENS-CORNING FIBERGLASS 25 ASJ/SSL. THICKNESS AS PER TABLES IN OTHER SECTIONS OF THESE SPECIFICATIONS. IF STAPLES ARE USED ON COLD WATER LINES, APPLY WHITE VAPOR BARRIER MASTIC OVER STAPLES. AT HANGERS, PROVIDE GALVANIZED SHIELD EXTENDING 12" ON EACH SIDE OF HANGER.
- WHERE FIBERGLASS INSULATION ON PIPING IS USED, PIPE FITTINGS SHALL BE COVERED WITH INSULATING CEMENT OF A THICKNESS EQUAL TO ADJACENT PIPE INSULATION AND WRAPPED WITH GLASS CLOTH.
- D. IN LIEU OF BUILDING UP A FITTING WITH INSULATING CEMENT, A PRE FORMED INSULATING FITTING COVER SUCH AS ZESTON 25/50 RATED PVC INSULATED FITTING COVER WITH FIBERGLASS INSERT MAY BE USED.
- E. SEE PIPING INSULATION SCHEDULE ON SHEET M-3 FOR INSULATION THICKNESS.

22. PACKAGED AIR CONDITIONING HEATING AND COOLING:

- SELF-CONTAINED FACTORY-ENGINEERED AND ASSEMBLED, PRE-WIRED PACKAGED ROOFTOP UNITS; UL LISTED.
- 1. HEATING: NATURAL GAS FIRED.
- 2. COOLING: DIRECT EXPANSION, REFRIGERANT R-410A
- B. EFFICIENCY: ENERGY EFFICIENCY RATING (EER) NOT LESS THAN REQUIREMENTS OF ASHRAE STD 90.1; SEASONAL EFFICIENCY TO ASHRAE STD 103.
- CABINET: CONSTRUCTED OF HEAVY GAUGE, ZINC COATED, GALVANIZED STEEL WITH WEATHER RESISTANT BAKED ENAMEL FINISH, EASILY REMOVED AND SECURED WATER AND AIR TIGHT ACCESS DOORS WITH SAFETY INTERLOCK SWITCHES, EXPOSED VERTICAL PANELS AND TOP SHALL BE INSULATED WITH A CLEANABLE, FOIL FACED, CLOSED CELL INSULATION. TOP SHALL BE ONE PIECE CONSTRUCTION WITH RIBS FOR ADDED STRENGTH AND TO PREVENT POOLING OF WATER.
- COMPRESSOR: ARI 520; DIRECT DRIVE, HERMETICALLY SEALED, SCROLL COMPRESSORS WITH CENTRIFUGAL TYPE OIL PUMPS, WITH POSITIVE LUBRICATION, CRANKCASE HEATER, HIGH PRESSURE CONTROL (WITH MANUAL RESET SWITCH). MOTOR OVERLOAD PROTECTION. SERVICE VALVES AND DRIER. PROVIDE TIME DELAY CONTROL TO PREVENT SHORT CYCLING AND RAPID SPEED CHANGES.

- 3. SUPPLY FAN: FORWARD CURVED, BELT DRIVEN, CENTRIFUGAL FAN WITH ADJUSTABLE MOTOR SHEAVES, AND MOUNTED ON RUBBER ISOLATORS.
- 4. AIR FILTERS: 2 INCH THICK PLEATED THROWAWAY INSTALLED AT FACTORY. FILTER SHALL HAVE A MERV RATING OF 13 OR HIGHER.
- 5. EVAPORATOR AND CONDENSER COILS: COPPER TUBE ALUMINUM FIN ASSEMBLY, COILS SHALL BE LEAK AND PRESSURE TESTED AT FACTORY, EVAPORATOR SHALL HAVE A REMOVABLE/REVERSIBLE POLYMER DOUBLE
- SLOPED DRAIN PAN, DRAIN CONNECTION. GAS HEATING SECTION: TUBULAR NATURAL GAS HEAT EXCHANGER WITH
- STAINLESS STEEL BURNERS AND CORROSION RESISTANT STEEL, INDUCED DRAFT COMBUSTION BLOWER, DIRECT SPARK IGNITION, PRE-IGNITION PURGE CYCLE, MANUAL RESET AFTER THREE UNSUCCESSFUL IGNITION ATTEMPTS.
- 7. CONDENSER FAN: DIRECT DRIVEN, STATICALLY AND DYNAMICALLY BALANCED, VERTICAL DISCHARGE, MOTOR SHALL BE PERMANENTLY LUBRICATED WITH BUILT-IN THERMAL OVERLOAD PROTECTION.
- REFRIGERANT CIRCUIT: THERMOSTATIC EXPANSION VALVE, SERVICE PRESSURE PORTS. REFRIGERANT LINE FILTER DRIER.
- D. ACCESSORIES: WIRED FOR SINGLE POWER CONNECTION WITH CONTROL TRANSFORMER, ELECTRIC DISCONNECT, BELT DRIVEN FAN, COMPARATIVE ENTHALPY ECONOMIZER, CARBON DIOXIDE SENSOR (DEMAND VENTILATION), RETURN AIR SMOKE DETECTOR, ANTI-SHORT CYCLE TIMER, FROSTAT, THRU BASE GAS AND ELECTRIC CONNECTIONS, LOW PRESSURE SWITCH (AUTOMATIC RESET), AND POWERED EXHAUST.
- E. APPROVED MANUFACTURER'S:

EQUIPMENT: JOHNSON CONTROLS, TRANE, CARRIER, MCQUAY AND YORK CONTROLS: HONEYWELL, INVENSYS, WHITE ROGERS, TRANE AND CARRIER.

23. TEMPERATURE CONTROL SYSTEM AND SEQUENCE OF OPERATION:

BASE BID: THE EXISTING BAS CONTROL SYSTEM SHALL REMAIN. THE EXISTING SYSTEM SHALL BE ALTERED TO ELIMINATE ALL EQUIPMENT BEING REMOVED FROM THE SYSTEM. THE EXISTING SYSTEM SHALL ALSO BE ALTERED AS NECESSARY TO CONTROL NEW PACKAGED EQUIPMENT. <u>ALTERNATE M-1</u>:

THE EXECUTIVE CONTROLLER FOR THE EXISTING NOVAR CONTROL SYSTEM SHALL BE LIPGRADED TO A NEW BUILDING CONTROLLER LITHIZING AN OPEN PROTOCOL NIAGARA N4 SUPERVISORY SOFTWARE FOR A GRAPHICAL USER INTERFACE. CONTRACTOR SHALL ENSURE THAT ALL EXISTING EQUIPMENT CONTROLLED BY REMOVED EXISTING SYSTEM SHALL REMAIN CONTROLLED BY NEW SYSTEM, AND SHALL UPGRADE CONTROLLERS, WIRING, AND OTHER COMPONENTS AS NECESSARY TO INTERFACE WITH NEW OPEN PROTOCOL FRONT END. CONTRACTOR CAN REUTILIZE EXISTING CONTROLLERS, WIRING, AND OTHER COMPONENTS WHERE POSSIBLE. THE SYSTEM UPGRADE SHALL ALLOW FOR IMPLEMENTATION OF ENHANCED CONTROL STRATEGIES, USER INTERFACE GRAPHICS, AND SCHEDULING

- B. THE INTENT OF THIS SPECIFICATION IS TO DESCRIBE THE DESIRED ACTIONS OF THE HVAC EQUIPMENT SPECIFIED HEREIN FOR THIS FACILITY. THE CONTRACTOR SHALL FAMILIARIZE HIMSELF WITH THESE WRITTEN SEQUENCES. WHETHER OR NOT EXPLICITLY SHOWN ON THE DRAWINGS, ALL DEVICES AND ITEMS REQUIRED FOR THE EXECUTION OF THESE SEQUENCES ARE THE RESPONSIBILITY OF THE CONTRACTOR. M.C. SHALL PROVIDE ANY REQUIRED TRANSFORMERS. M.C. SHALL COORDINATE WITH SUBCONTRACTORS AS REQUIRED.
- ALL ELECTRICAL WIRING SHALL BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. THE M.C. IS RESPONSIBLE FOR ALL CONTROL AND INTERLOCK WIRING REQUIRED FOR THE COMPLETE INSTALLATION.
- D. THE M.C. IS RESPONSIBLE FOR ALL POWER WIRING FOR THE COMPLETE CONTROL SYSTEM. THIS SHALL INCLUDE POWER WIRING FOR DEDICATED 120 VOLT, 20 AMP CIRCUIT(S) FOR CONTROL PANELS, ETC. ALL 120 VOLT CIRCUITS SHALL BE FROM THE NEAREST RECEPTACLE PANEL WITH THE MAXIMUM LOAD ON ANY SINGLE CIRCUIT BEING 1400 WATTS.
- E. ALL EXPOSED TEMPERATURE CONTROL AND INTERLOCK WIRING AND ALL POWER WIRING REGARDLESS OF VOLTAGE, SHALL AT A MINIMUM BE RUN IN EMT. CONDUIT SYSTEM IN MECHANICAL AND ELECTRICAL ROOMS BELOW EIGHT FEET ABOVE FLOOR SHALL BE RIGID IN LIEU OF EMT. SEE ELECTRICAL SPECIFICATIONS FOR ADDITIONAL CONDUIT REQUIREMENTS. CONCEALED LOW VOLTAGE WIRING. SUCH AS COMMUNICATION WIRE, THERMOSTAT WIRE, ETC. SHALL BE PLENUM GRADE, FASTENED SECURELY TO BUILDING STRUCTURE. LOW VOLTAGE WIRING SHALL NOT BE LAID DIRECTLY ON THE CEILING OR BE ATTACHED TO ANY OTHER FLECTRICAL CONDUITS.
- F. ON COMPLETION OF THE JOB, THE M.C. SHALL COMPLETELY ADJUST AND READY FOR USE, ALL THERMOSTATS, VALVES, DAMPERS, DAMPER MOTORS AND RELAYS PROVIDED. THE M.C. SHALL PROVIDE A COMPLETE INSTRUCTION MANUAL COVERING THE FUNCTION AND OPERATION OF ALL CONTROL COMPONENTS OF THE JOB. THIS MANUAL SHALL BE FURNISHED TO THE OWNER'S OPERATING PERSONNEL AND A COMPETENT TECHNICIAN SHALL BE PROVIDED FOR INSTRUCTION PURPOSES AFTER THE SYSTEM IS SUBSTANTIALLY COMPLETE AND READY FOR OPERATION.
- G. THERMOSTATS AND TEMPERATURE SENSORS INSTALLED FOR USE BY BUILDING OCCUPANTS SHALL BE MOUNTED PER ANSI 117.1 REQUIREMENTS. THERMOSTATS ARE TO BE LOCATED WHERE SHOWN ON THE DRAWINGS.

H. PACKAGED AIR CONDITIONING UNIT. RTU-1 AND RTU-2:

CONDITIONING UNIT.

- PROVIDE ALL NECESSARY CONTROL, SENSORS, AND INTERCONNECTING WIRING BETWEEN UNIT AND REMOTELY LOCATED CONTROLS SUPPLIED WITH UNIT.
- 2. BAS SHALL PROVIDE OCCUPIED-UNOCCUPIED OPERATION OF AIR
- 3. DURING UNOCCUPIED PERIODS, COOLING SYSTEMS SHALL CYCLE AS REQUIRED TO MAINTAIN THE TEMPERATURE SETTINGS OF SPACE. THE HEATING VALVES SHALL MODULATE AT THE DUCT MOUNTED HEATING COIL ON A DEMAND FOR HEAT BY AN "UNOCCUPIED" SETBACK SPACE THERMOSTAT. EVAPORATOR FAN SHALL CYCLE IN CONJUNCTION WITH THE HEATING AND
- COOLING SYSTEMS. THE OUTSIDE AIR DAMPERS ARE CLOSED. 4. DURING OCCUPIED PERIODS. THE UNIT'S BLOWER SHALL OPERATE CONTINUOUSLY. ROOM TEMPERATURE SHALL BE MAINTAINED BY HEATING/COOLING THERMOSTATS WITH A DEAD BAND BETWEEN THE HEATING AND COOLING CYCLES:
- A. ON A CALL FOR HEATING, THE HEATING VALVE AT DUCT MOUNTED COIL SHALL MODULATE TO MAINTAIN SPACE TEMPERATURE.
- B. ON A CALL FOR COOLING WITH OUTDOOR TEMPERATURES OF 60°F OR ABOVE, THE OUTSIDE AIR DAMPER SHALL BE AT ITS MINIMUM POSITION, AND THE MECHANICAL COOLING SHALL OPERATE ONLY WHEN MAIN BLOWER IS OPERATING.
- C. ON A CALL FOR COOLING WITH OUTDOOR TEMPERATURES BELOW 60°F, THE OUTSIDE AIR AND RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN ROOM TEMPERATURE. A DISCHARGE AIR THERMOSTAT SHALL OVERRIDE THE ROOM THERMOSTAT TO PREVENT UNIT'S DISCHARGE TEMPERATURE FROM DROPPING BELOW 60°F.
- PROVIDE A MANUAL RESET SAFETY LOW LIMIT IN THE SUPPLY AIR DUCTWORK, UPSTREAM OF THE HEATING COILS, TO DE-ENERGIZE THE UNIT IF THE AIR TEMPERATURE DROPS BELOW 35°F (ADJUSTABLE).
- 6. EACH SPACE SENSOR OR CONTROLLER SHALL HAVE THE ABILITY TO SENSE HUMIDITY AND FORCE THE UNIT ON TO PROVIDE DEHUMIDIFICATION. FURNISH SMOKE DETECTORS IN THE RETURN AIR DUCT PRIOR TO RELIEF
- AIR FAN TO DE-ENERGIZE THE UNIT UPON ALARM.
- WHENEVER UNIT IS OFF, THE OUTSIDE AIR DAMPERS SHALL BE CLOSED, AND HEATING VALVES SHALL BE OPEN TO FULLY FLOW THROUGH COILS.
- 10. THIS CONTRACTOR SHALL VERIFY THE ABOVE SEQUENCE OF CONTROL WITH THE UNIT MANUFACTURER AND SHALL RECEIVE FROM SAME, ALL NECESSARY WIRING DIAGRAMS DETAILING ITS INSTALLATION.

I. <u>EXISTING BOILER</u>:

CONTRACTOR SHALL PROVIDE ALL NECESSARY SENSORS, FITTINGS AND LABOR TO INSTALL INTO EXISTING PIPING REQUIRED FOR THE FOLLOWING SEQUENCE OF OPERATIONS. WIRE ALL CONTROLS INTO BOILER CONTROL CIRCUIT AS RECOMMENDED BY THE BOILER MANUFACTURER.

EACH HEATING WATER BOILER SHALL BE CONTROLLED FROM THE DDC CONTROL SYSTEM UTILIZING AN INPUT/OUTPUT MODULE. THE HEATING WATER BOILERS SHALL BE PROGRAMMED TO MAINTAIN THE PRIMARY HOT WATER TEMPERATURE AND SHALL ALSO UTILIZE A LEAD/LAG CONTROL STRATEGY.

TWO MINUTES (ADJUSTABLE) AFTER THE HEATING WATER PUMPS HAVE PROVEN TO BE IN OPERATION, THE DDC CONTROL SYSTEM SHALL ENABLE THE 'LEAD' HEATING WATER BOILER TO MAINTAIN THE PRIMARY HOT WATER SUPPLY TEMPERATURE SETPOINT OF 180°F. (ADJUSTABLE)

THE DDC CONTROL SYSTEM SHALL MONITOR AND PROVIDE THE FOLLOWING PRIMARY HOT WATER SUPPLY AND RETURN TEMPERATURES. SECONDARY HOT WATER SUPPLY AND RETURN TEMPERATURES. INDIVIDUAL HW BOILER ALARM STATUS, TO INCLUDE THE FOLLOWING: LOW WATER. FLAME FAILURE. LOW TEMPERATURE

K. EXISTING HEATING WATER PRIMARY PUMPS:

HIGH TEMPERATURE.

EXISTING HEATING WATER BOILER PRIMARY PUMP SHALL OPERATE WHENEVER THE BOILER IS ENERGIZED. BOILER SHALL NOT FIRE UNLESS WATER FLOW HAS BEEN PROVEN.

L. EXISTING HEATING WATER SECONDARY PUMP:

THE HEATING WATER PUMPS SHALL BE CONTROLLED FROM THE DDC CONTROL SYSTEM AND SHALL BE PROGRAMMED TO ENERGIZE AND RUN CONTINUOUSLY WHENEVER OUTDOOR AMBIENT IS BELOW 65°F (ADJUSTABLE).

24. <u>TESTING. ADJUSTING. AND BALANCING</u>:

- A. VERIFY THAT SYSTEMS ARE COMPLETE AND OPERABLE BEFORE COMMENCING WORK. ENSURE THE FOLLOWING CONDITIONS:
 - START AND OPERATE ALL HVAC SYSTEMS TO ENSURE SYSTEMS ARE SAFE AND OPERATE PROPERLY.
 - VERIFY TEMPERATURE CONTROL SYSTEMS ARE INSTALLED COMPLETE AND 3. CHECK THAT PROPER THERMAL OVERLOAD PROTECTION IS IN PLACE FOR
 - ELECTRICAL EQUIPMENT. REPLACE ALL FILTER MEDIA AFTER CONSTRUCTION IS COMPLETED AND PRIOR TO OWNER OCCUPANCY.
 - 5. ENSURE DUCT SYSTEMS ARE CLEAN OF DEBRIS.
 - 6. VERIFY FANS ARE ROTATING CORRECTLY.
 - 7. CHECK THAT FIRE AND VOLUME DAMPERS ARE IN PLACE AND OPEN.
 - 8. ENSURE ACCESS DOORS ARE CLOSED AND DUCT END CAPS ARE IN
 - 9. VERIFY AIR OUTLETS ARE INSTALLED AND CONNECTED.
- B. ENSURE ACTUAL MEASURED AND OBSERVED CONDITIONS ACCOMPLISH THE CONDITIONS SET FORTH ON DRAWINGS AND IN SPECIFICATIONS.
- 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,
- RESTORING THERMOSTATS TO SPECIFIED SETTINGS. F. ADJUST AIR HANDLING AND DISTRIBUTION SYSTEMS TO PROVIDE REQUIRED OR DESIGN SUPPLY. RETURN. AND EXHAUST AIR QUANTITIES. VARY TOTAL SYSTEM AIR QUANTITIES BY ADJUSTMENT OF FAN SPEEDS. PROVIDE ALL DRIVE CHANGES

CLOSING ACCESS DOORS, CLOSING DOORS TO ELECTRICAL SWITCH BOXES, AND

- G. MEASURE AIR QUANTITIES AT AIR INLETS AND OUTLETS. TRAVERSE DUCTWORK
- H. USE VOLUME CONTROL DEVICES TO REGULATE AIR QUANTITIES ONLY TO THE EXTENT THAT ADJUSTMENTS DO NOT CREATE OBJECTIONABLE AIR MOTION OR SOUND LEVELS.

REQUIRED. VARY BRANCH AIR QUANTITIES BY DAMPER REGULATION.

- CONTRACTOR SHALL PROVIDE FOR APPROVAL BALANCING REPORTS, PRIOR TO FINAL ACCEPTANCE. REPORTS SHALL INCLUDE INDIVIDUAL AIR FLOW MEASUREMENT AT ALL OUTLETS, TOTAL AIR QUANTITY, INDIVIDUAL WATER FLOW AT EQUIPMENT, TOTAL WATER FLOW AT PUMPS, NAMEPLATE MOTOR AMPERAGE AND VOLTAGE, ACTUAL MOTOR AMPERAGE AND VOLTAGE, AND A STATEMENT THAT THE CONTROL SYSTEM HAS BEEN CHECKED AND VERIFIED FOR
- J. CONTRACTOR SHALL USE AN N.E.B.B. OR A.A.B.C. CERTIFIED BALANCING CONTRACTOR TO PERFORM THESE SERVICES.

25. OPERATING INSTRUCTIONS:

WHERE NECESSARY.

A. CONTRACTOR SHALL PROVIDE FOUR (4) COMPLETE MANUALS IN HARDBACKED BINDERS, EACH CONTAINING ALL OPERÁTING, SERVICING, LUBRICATION, ETC. INFORMATION AND PARTS LISTS FOR ALL EQUIPMENT INSTALLED UNDER THIS CONTRACTOR'S CONTRACT. MATERIAL SHALL BE GROUPED TOGETHER BY TRADES, EACH ITEM MARKED WITH A TAB, AND AN INDEX SHALL BE PROVIDED. WHERE DIAGRAMS ARE TOO LARGE FOR THE BINDER, ARRANGE FOLDER POCKETS WITH REINFORCED HOLES TO HOLD FOLDED DRAWINGS. MANUALS TO BE SUBMITTED FOR APPROVAL AT LEAST THIRTY (30) DAYS BEFORE

COMPLETION OF THE WORK.

- B. <u>MANUALS TO INCLUDE</u>: STEP-BY-STEP PROCEDURES FOR START-UP AND SHUT-DOWN OF EACH
- SYSTEM AND PIECE OF EQUIPMENT. 2. NORMAL EQUIPMENT OPERATING CHARACTERISTICS.
- 3. PERFORMANCE DATA, CURVES, RATINGS.
- 4. WIRING DIAGRAMS. 5. MANUFACTURER'S DESCRIPTIVE LITERATURE.
- 6. AUTOMATIC CONTROLS WITH DIAGRAMS AND WRITTEN DESCRIPTION OF OPERATION
- 7. SPARE PARTS AND REPLACEMENT LIST FOR EACH PIECE OF EQUIPMENT.

8. NAME OF SERVICE AGENCY, INSTALLER AND SUPPLIERS, AND THEIR

- TELEPHONE NUMBERS. 9. FINAL REVIEWED SHOP DRAWINGS.
- 10. BALANCE REPORT.
- 11. CERTIFICATES OF TESTS AND APPROVALS.

BY THE OWNER.

- 12. MECHANICAL IDENTIFICATION LISTS. C. EACH FAN OR EQUIPMENT ROOM SHALL HAVE ALL TEMPERATURE CONTROL DIAGRAMS APPLICABLE TO THE EQUIPMENT THEREIN PERMANENTLY SEALED TO DURABLE TRANSPARENT PLASTIC AND POSTED WHERE DIRECTED.
- D. CONTRACTOR SHALL ARRANGE FOR TECHNICAL INSTRUCTION OF THE OWNER'S MAINTENANCE PERSONNEL BY QUALIFIED INSTRUCTORS FOR SUCH TIME AS IS REASONABLY REQUIRED TO INSTRUCT THEM IN THE OPERATION AND MAINTENANCE OF ALL MECHANICAL SYSTEMS. INSTRUCTION PERIOD SHALL BE AFTER ALL SYSTEMS ARE IN OPERATION, AND HAVE BEEN TESTED, BALANCED AND ADJUSTED. CONTRACTOR SHALL VIDEO ALL TRAINING SESSIONS. COPY OF VIDEO SHALL BE INCLUDED WITH CLOSEOUT MATERIALS FOR FUTURE REFERENCE
- E. CONTRACTOR SHALL BUILD A HEAVY GAUGE SHEET METAL BOX WITH LOCK STAPLE, HINGES AND HASP, OF SUFFICIENT SIZE, 30"x12"x12" MINIMUM, TO HOLD THE FOLLOWING ITEMS: A COMPLETE SET OF CONTRACT DRAWINGS, SPECIFICATIONS AND THE ABOVE MENTIONED MAINTENANCE BOOK. INSTALL BOX AS DIRECTED.



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SPECIFICATIONS

MECHANICAL

ISSUED DATE

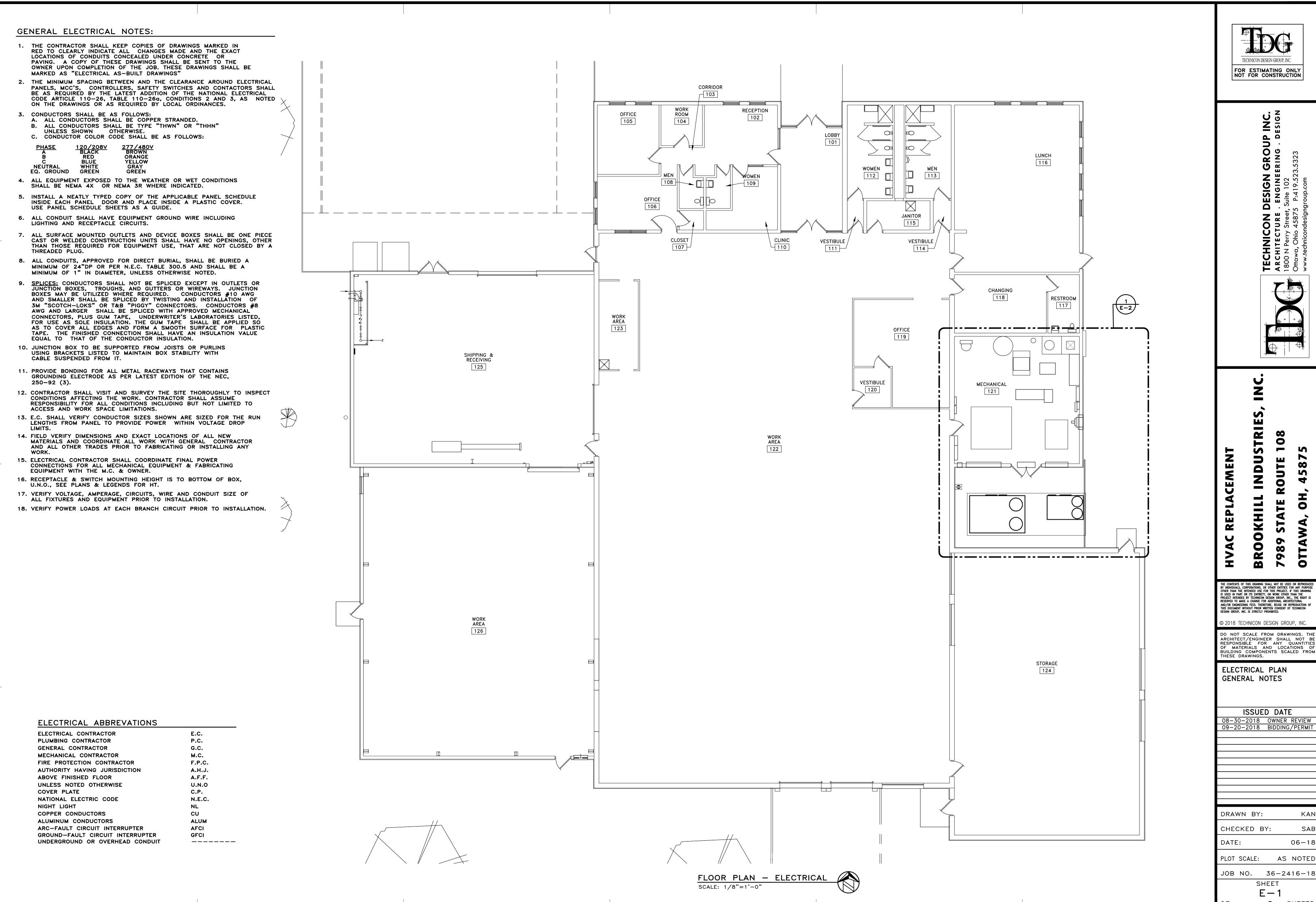
08-30-2018 OWNER REVIEW

09-20-2018 BIDDING/PERMIT

DRAWN BY: CHECKED BY: SAB DATE: 06 - 18

AS NOTED PLOT SCALE: JOB NO. 36-2416-18SHEET

M-4**4** SHEETS

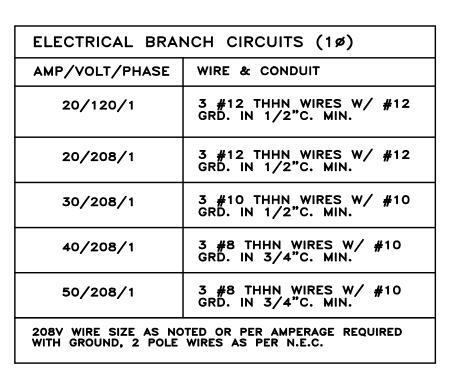




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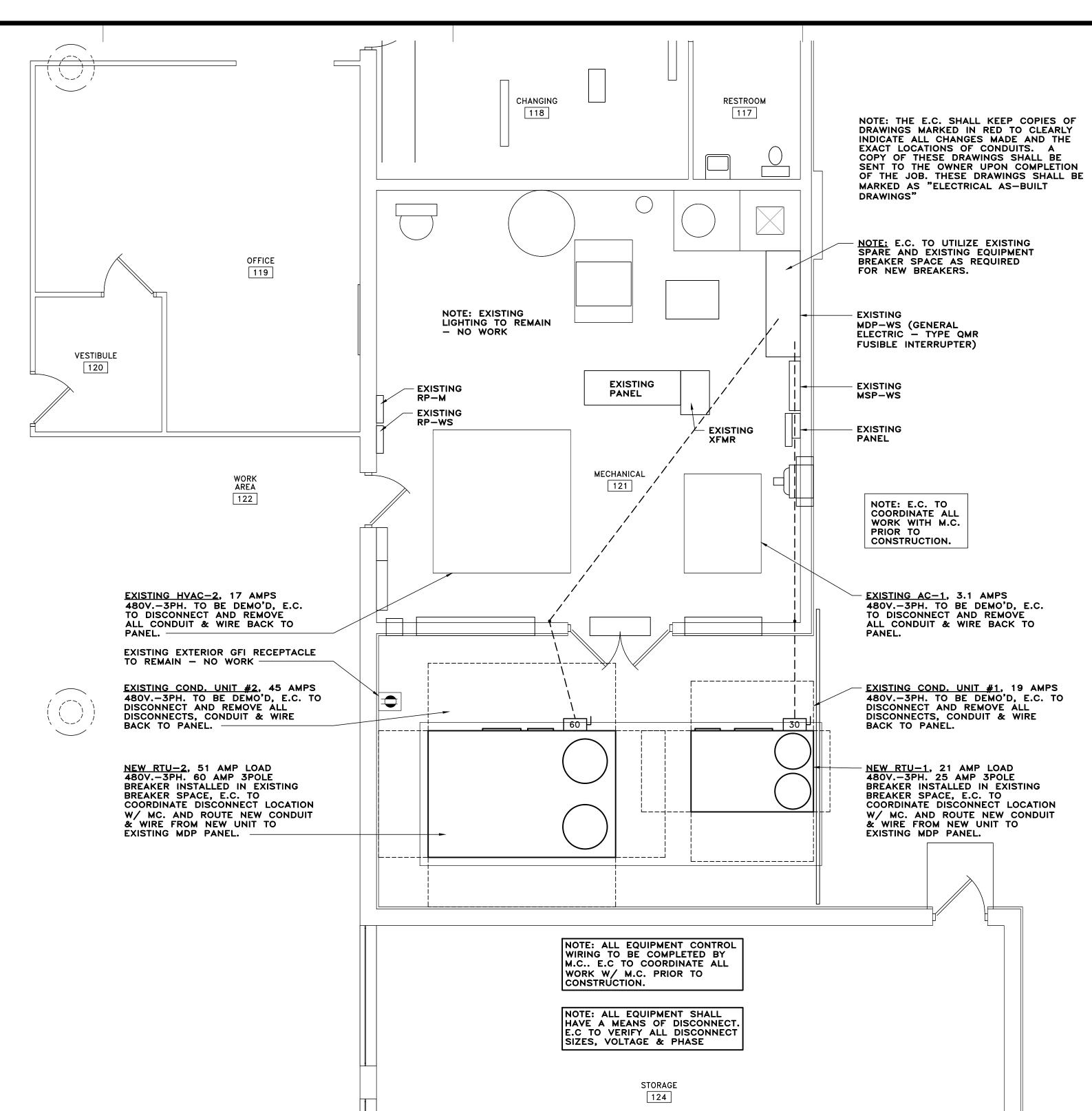
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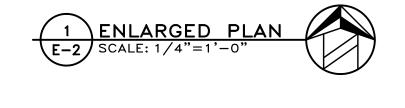
JOB NO. 36-2416-18



ELECTRICAL I	BRANCH CIRCUITS (3ø)
AMP/VOLT/PHASE	WIRE & CONDUIT
40/208/3	4 #8 THHN WIRES W/ #10 GRD. IN 3/4"C. MIN.
50/208/3	4 #8 THHN WIRES W/ #10 GRD. IN 3/4"C. MIN.
60/208/3	4 #6 THHN WIRES W/ #8 GRD. IN 1"C. MIN.
70/208/3	4 #4 THHN WIRES W/ #8 GRD. IN 1 1/4"C. MIN.
80/208/3	4 #4 THHN WIRES W/ #8 GRD. IN 1 1/4"C. MIN.
208V WIRE SIZE AS NO WITH GROUND, 3 POLE	OTED OR PER AMPERAGE REQUIRED WIRES AS PER N.E.C.

ELECTRICAL BRA	NCH CIRCUITS 480V (3ø)
AMP/VOLT/PHASE	WIRE & CONDUIT
20/480/3	4 #12 THHN WIRES W/ #12 GRD. IN 1/2"C. MIN.
30/480/3	4 #10 THHN WIRES W/ #10 GRD. IN 1/2"C. MIN.
40/480/3	4 #8 THHN WIRES W/ #10 GRD. IN 3/4"C. MIN.
50/480/3	4 #8 THHN WIRES W/ #10 GRD. IN 3/4"C. MIN.
60/480/3	4 #6 THHN WIRES W/ #8 GRD. IN 1"C. MIN.
480V. WIRE SIZE AS N WITH GROUND, 3 POLE	OTED OR PER AMPERAGE REQUIRED WIRES AS PER N.E.C.





	Power Legend													
TYPE	Description	MFR	Model	Mounting Height (A.F.F.)	Cover Plate Color	V	PH	Amps	Nema	NOTES				
	Heavy Duty Safety Switch	Square D							1R/3R	1				
	G.F.I. Receptacle	Hubbell	GF5362W	44"	White	120	1	20		2				
P	Thermostat			48" to Top						3				
J	Junction Box			See Plan	Blank					4				
OTES	LEGEND													
1	E.C. to verify size w/ equipment & mount	per N.E.C.												

2 E.C. to verify NEMA configuration w/ equipment

3 M.C. to fumish & install, See mechanical drawings

4 Wiring and/or conduit from J-box to panel

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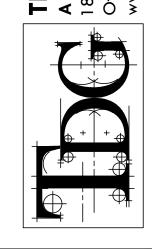
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ELECTRICAL PLAN POWER LEGEND

ISSUED DATE 08-30-2018 OWNER REVIEW 09-20-2018 BIDDING/PERMIT

DRAWN BY: KAN

CHECKED BY: SAB DATE: 06-18 PLOT SCALE: AS NOTED

JOB NO. 36-2416-18 SHEET E-2

1) General Scope:

(A) The Contractor or E.C. referred to in this section shall be the Electrical Contractor. The Contractor shall furnish all labor, materials, tools and other equipment necessary to install a complete electrical system in the building in accordance with the drawings and these specifications. All electrical work will comply with the requirements the latest editions of Article 27 of OBC and the National Electrical Code (NEC) NFPA 70 and is subject to approval of the governing agencies and the electrical inspector assigned.

(B) All Contractors bidding the work shall visit the site and acquaint themselves with existing conditions and thoroughly examine the project site & its conditions before submitting their bid. The Contractor shall verify and secure all measurements of the site. All bidders shall report any discrepancies to the Architect prior to submitting their bid. Failure to report such discrepancies or conditions shall be deemed as acceptable existing conditions. No additional compensation will be given after the bids have been selected and the contract awarded.

(C) Verification: before running any conduits, ducts, piping, etc., Within the building, this Contractor shall assure himself that they can be installed as contemplated without trapping or interfering with columns, beams, piping, fixtures, etc. Any necessary major deviation shall be referred to the Architect for adjustment before lines are run, at no increase in contract price. Of necessity, openings, supporting steel, field—built curbs, electrical data, space requirements, etc., were designed around specific parameters. When the Contractor determines the make of equipment to be provided for the job, it shall be his responsibility to verify and coordinate unit dimensions with the General Contractor and all other interested Contractors on the job. It shall also become the Contractor's responsibility to change as necessary, through the Architect, all required dimensions so that openings, supporting steel, curbs, electrical data, etc., Will fit the equipment supplied. Any additional cost will be the sole responsibility of this Contractor. In addition, electrical power, interlock and control diagrams and piping arrangements were designed around one specific manufacturer. If additional wiring, piping controls, etc., Are required for other equipment, this contractor shall include the cost of the same in his price. Dimensions, elevations and relative locations of existing equipment, sewers, pipes, ducts, conduits, etc., In place as shown on the drawings, are taken from as—built and record drawings and are deemed reliable only in so far general layout is concerned. Such dimensions shall not be used for layout drawings nor detailing of components. The responsibility for checking in place items will be the contractors. All measurements, the exact determination of relative elevations or locations, the ascertaining of accuracy of all given elevations and the obtaining of all necessary additional information to insure the proper fit and coordination of all conduit equipment, ducts, and piping shall be the responsibility of the Contractor. The Contractor shall carefully examine the general building plans and all mechanical plans and carry on his work so as not to delay or interfere with the work of other trades. He shall obtain in writing from the Contractors, such data as necessary to coordinate his work with other branches.

(D) As—built Drawings: The Contractor shall note changes made from contract drawings and specifications. Underground service & feeders shall be located by dimension to assist with location of such in the future. Also include branch circuit numbering, conduit routing, equipment sizes, single line diagram, etc. He/she shall neatly and correctly enter in colored crayon any deviations on drawings affected and shall keep drawings available for inspection. Extra set of drawings will be furnished for this purpose. Give to Owner at completion and be marked "as built drawings-electrical."

(E) Cutting & Patching: Provide cutting and patching of all materials necessary for the installation as indicated or specified. Neatly remove and legally dispose of electrical components and items no longer in use. Protect the structure, furnishings, finishes and materials adjacent to the area of cutting and patching. Patch existing finished surfaces and equipment using new materials and methods, to match adjacent work, utilizing experienced installers. Patching of fire rated partitions, ceilings and other assemblies, shall match the rating of the rated barrier with materials listed and identified for such use, and shall comply with applicable requirements of the general trades specifications. As the work nears completion, all cutting and patching shall be authorized by the Architect prior to starting work.

(F) Submittals: Prior to ordering any materials, the Contractor shall submit for the Owner's review, detailed drawings, equipment cut sheets indicating physical size, ratings, capacities, rough—in sizes, etc. for all materials to be used under this contract. Multiple components intended to function together, shall be coordinated & submitted as one item.

(G) Equals: Where the phrase "or an approved equal" appears, it shall refer to the approval of the Architect and/or Owner on the material or equipment involved. Equipment of similar types shall be of the same manufacturer, except where specifically indicated otherwise. Where the Contractor elects to substitute materials or equipment approved by the Architect and/or Owner for those specified, the Contractor will be held responsible for all structural, mechanical and electrical changes required for the installation of the substituted materials, at no additional cost to the Owner.

(H) Permits: The Architect shall procure all necessary permits from the governing agency having jurisdiction. The Contractor shall arrange for all tests required on any and all parts of his work by local authorities and paying any additional charges including reinspection fees. Also obtain all certificates of inspection and approval from all required authorities and the underwriters. Underwriters certificates in duplicate shall be urnished to the Owner at the completion of the project if requested.

(I) Codes: Nothing contained in these specifications or shown on the drawings shall be so construed as to conflict with any local, municipal or state laws or regulations governing the installation of electric or other work specified herein, and all such ordinances and regulations, including the National Electric Code (NEC) are hereby incorporated and made a part of these specifications. All such requirements shall be satisfied by the Contractor and at no additional expense to the Owner. The final electrical inspection sign off forms from the authority having jurisdiction shall be submitted to the Owner and/or Architect at the completion of the project.

(J) Equipment Wiring: Provide power wiring connections and terminations to equipment provided by others. All necessary starters and controls will be furnished with the equipment unless noted otherwise. Wiring and connections shall be as required by the equipment manufacturer and shall not be performed in a manner which modifies the equipment, or degrades it's function or warranty. Where not furnished with equipment, provide a local disconnect within sight of each motor and appliance. All control wiring, devices, systems and required interlocks will be provided by others. Furnish and install power wiring for the automatic powered door operators furnished complete with a prewired control package. Powered door remote control devices shall be furnished by the equipment supplier, and installed and connected by the E.C. per the supplier's wiring diagrams. All outlet requirements and locations for the laundry equipment (if any) shall be verified with the supplier prior to rough—in electrical requirements of the electric heat tracing (furnished and installed by others; if any) shall be field verified and shall be provided with a 30 milliamp GFCI type breaker for the branch circuit serving the heat

(K) Close—out: Contractor shall provide field testing, check—out and system demonstrations to owner to assure proper performance and adjustment of items provided under the contract. Remove all debris created by the electrical work and clean all fixtures, panels, boxes, etc., inside and outside. Provide a binder which includes: copies of all shop drawings, maintenance procedures, operation and instruction manuals, literature supplied with electrical equipment, and a list of all contractor's supplier's names, addresses and phone numbers, for all materials. Provide instruction to personnel selected by the Owner, to familiarize them with the location of significant equipment, train them on equipment functions, review maintenance procedures and coordinate information available in the binder.

 $\overline{}(\mathsf{L})$ Chases & Openings: The General Contractor will provide chases and openings in walls, floors, ceilings and partitions of new construction to receive conduits, ducts and other equipment in so far as it is possible to predetermine the exact size and location of same. The Electrical Contractor shall advise the General Contractor of the exact size and location of all chases and openings required for the installation of his work, and shall check the size and location of all such chases and openings provided by the General Contractor.

(M) Sleeves: Electrical Contractor shall furnish and place all sleeves required for conduits and ducts passing through floors, beams, walls and ceilings before such new general construction work is built into place. The Electrical Contractor shall place all inserts required for hangers and supports, as general construction progresses, so that unnecessary cutting of construction work will be eliminated.

(N) Materials: The materials used throughout shall be new, and the best of their respective kinds and shall be labeled or listed by underwriters laboratories where such standards have been established. All work shall be executed in a neat and workmanlike manner skilled in the particular branch of work assigned to them.

(O) Drawings & Specifications: All electrical work shown on the drawings and not specifically referred to in the specifications or visa versa shall be considered a part of the contract work. These specifications are to be used as a guide for the quality of workmanship and materials, capacities, quantities, etc., And are intended to cover all parts of the system, but the omission of express mention, either in the specifications or on the drawings of items which are obviously necessary for the proper functioning of the system, shall not relieve the electrical contractor from responsibility for providing same and the necessary labor and installation.

(P) Discrepancies: Electrical Contractor shall check all drawings included under this contract, and drawings included under other contracts and shall report to the Architect any discrepancies.

(Q) Disposal: Upon completion of the work, all waste materials and rubbish resulting from the contract work shall be removed from the building and premises and properly disposed of.

(R) Tests & Inspections: When the installation is reported in writing by the Contractor to be complete and ready for acceptance, tests and inspection shall be made by the Contractor in the presence of the Architect, to ascertain whether it complies with the specifications and contract, and upon its failure to do so, the Contractor shall at once remedy all defects and shortcomings, and any additional tests that may be required shall be entirely at the contractor's expense. All of the testing work shall be done when and as directed by the Architect before the system is accepted.

(S) Schematic Drawings: Electrical layouts are schematic and exact locations shall be determined by structural and other conditions. The Contractor shall make minor changes as required, as long as the changes are in accordance with N.E.C. and approved by the assigned electrical inspector. Due to the small scale of the drawings, it is not possible to indicate all conduits, conductor, fittings, boxes, switches and similar parts which may be required. The drawings are generally indicative of the work to be installed. The Contractor shall investigate the structural and finish conditions affecting the work, and arrange all work accordingly furnishing such parts and equipment as may be required to

(T) Layout of Work: This Contractor shall layout his work from dimensions of architectural and structural drawings and actual dimensions of equipment being installed layouts in congested area should not be scaled from mechanical and electrical drawings.

(U) Temporary Electrical Services: During construction (If Required), Electrical Contractor shall arrange and provide temporary service (coordinate w/ utility company), lighting and power outlets. This includes all incidentals such as light bulbs, fixtures, and other miscellaneous items. The Owner (E.C. to verify w/ owner)shall pay electrical demand services for temporary service. Otherwise utilize existing 120v. receptacles protected by G.F.I. for Construction.

(V) Line & Low Voltage: All Line voltage wiring (120/208/240/480v), low and Line voltage conduit, boxes, etc. To be furnished and installed by the Electrical Contractor. All system control equipment for the heating and/or fire alarm systems shall be as noted or required in HVAC and/or fire alarm specifications. It is the responsibility of the Electrical. Mechanical and Fire Alarm Contractors to coordinate the work between themselves and no compensation will be made equipment or labor not included.

(W) Branch Circuits: Branch circuit wiring shall correspond to the circuit numbering shown on the plans, but the Contractor will be permitted minor changes to optimize the piping required. The quantity of circuits shall not be reduced, nor shall separate circuits be combined. Routing shall be at the discretion of the contractor but the installation shall meet all other specified criteria. In general, 1—pole 120V. branch circuits shall be provided with individual neutrals. To eliminate the requirement for multiple breakers (See NEC 210.43) the quantity of current carrying conductors in a conduit shall be limited to nine. The ampacity of branch circuits routed across roofs or otherwise exposed to sunlight, shall be properly upsized as required to meet the derating factors of NEC 310.15(B)(2). Where "home runs" are shown on plan, the quantity of these runs shall be maintained as a minimum.

(X) Renovations: Rework the existing electrical installation as required to accommodate the finished and operating systems as indicated on the plans. New raceways shall be concealed in finished spaces wherever practically possible. Existing boxes and enclosures shall not be rendered inaccessible due to the new work of any trade. Panel directories in renovated areas shall be neatly updated interruptions to existing systems shall be performed at off hours, unless scheduled otherwise with the Owner.

(Y) Telephone/Data: (If Any Indicated) Furnish and install the raceway as indicated for the Owner's telephone/Data system. Provide a pull string in each empty raceway for future use. All metal raceways stubbed at backboards shall be terminated with bushings and bonded together and to the building grounding system. Telephone, terminations, receptacles, jacks, handsets, switching equipment, and cross—cuts will be provided by

(Z) Supports: Furnish and install all required miscellaneous steel supports for mounting of panels, raceways, fixtures, cabinets, boxes, etc. All equipment shall be rigidly supported from the building structure, with components rated for twice the actual load or weight. all interior supports shall be painted steel strut with matching fittings and hardware, plated threaded rod, and auxiliary structural steel. Exterior supports shall be galvanized strut with matching fittings and stainless steel hardware. Field cut galvanized supports shall be coated with Z.R.C. cold galvanizing spray or other rust—inhibiting material after installation. Provide a 4 inch high concrete housekeeping pad for all floor mounted equipment.

2) Description Of Work The work to be performed under this section and accompanying drawings consists of the

(A) A complete wiring system for light and power including cable from main distribution panels, sub-panels, switches, panels feeders, ducts, conduit, branch circuit wiring to each and every new outlet as indicated on the plans including the lighting units on the exterior of the building. The system shall include all lighting fixtures shown on the drawings, including lamps.

(B) Labels: provided an engraved plastic laminate nameplates, securely fastened to equipment, for all new panels, large full boxes, and major components. Nameplates shall be 1" x 3", minimum black letter on white field.

3) Excavation And Backfill (A) Electrical Site Work: Coordinate all exterior work with affected utilities and the General Contractor. Provide the excavation, backfill, compaction and testing, necessary to install the underground raceways, handholes, and equipment foundations shown on the plans. All paving shall be sawcut prior to removal. Repair all lawns, plantings, pavement, and other exterior finishes to match the adjacent areas at the completion of the project.

(B) Underground ducts shall be installed below finish grade not less than the requirements of table 300.5 NEC. Ducts shall be installed at depth required to properly

(C) After the underground ducts are installed and tested, the Contractor shall backfill all excavation with selected earth placed in layers not exceeding 6 inches in thickness, with each layer thoroughly compacted. Compaction to be in accordance with compaction requirements listed in other sections of the specifications.

(D) All surfaces shall be restored to their original conditions, including paved or unpaved streets, roadway and turf, to the satisfaction of the Owner.

4) Electrical System Grounds

(A) Grounding: Ground and bond all metal raceways, boxes, fixtures, enclosures, etc., per NEC Article 250. New services and separately derived systems shall be bonded to the grounding electrode system, including the concrete encased reinforcing steel on grade where at least 20 feet of #4 bar is installed. Grounding conductors in PVC raceway shall be extended to the building structural steel, incoming point of the interior metal water line, and supplemental ground rod(s). Bonding conductors shall also be extended to the interior metal gas piping system, interior water lines, and main telephone/data backboard. All feeders and branch circuits shall include an insulated equipment grounding conductor, routed with the circuit, sized per NEC 250.122.

5) Lighting And Power Panels: (A) Panelboards: (If Any Indicated) Panels shall be dead front, and equipped with bolted type, thermal-magmetic molded case circuit breakers as indicated. Unless noted otherwise, enclosures shall be of code gauge steel, with galvanized tub, nominal 5 3/4"deep by 20" wide, NEMA 1, with concealed trim clamp design, surface or flush trim as indicated, hinged and locking door, and copper or aluminum bus, ampere rating as indicated. Panels shall be bear a U.L. rating indicating the maximum number of breaker poles permitted. Panels exceeding 42 useable poles shall be permitted only where the manufacturer's nameplate reflects this listing. Provide grouping of multi-wire branch circuits as required by NEC 210.4(D), where lighting circuits are controlled only from the panel breakers, provide "switching duty" rated breakers. Provide HACR, GFP and shunt trip rated breakers where noted or required. Receptacle panels shall be rated for 120/208 or 120/240 volts, with breakers rated; Square D Co. NQOD series or equal by Siemens, General Electrical, or Cutler—Hammer.

B) Distribution Panels: (If Any Indicated) Panels shall be heavy duty circuit breaker type, rated for 120/208, 277/480 volt three phase four wire, complete with the number and rating of bolted type, thermal—magnetic molded case circuit breakers as indicated. Breakers shall be rated as required for KAIC rating, minimum at 240 volts. Verify with short circuit fault current rating for panel. Posting of short circuit fault current at service equipment shall be according to 2014 NEC, Article 110.24. Enclosures shall be of code gauge steel, with galvanized tub, nominal 8" deep by 30" wide, NEMA 1, with door, wall mounted with copper or aluminum bus, ampere rating as indicated. Provide nameplates on each branch breaker. Distribution panels shall be Square D Co. I-Line Series or equal by Siemens, General Electric, or Cutler—Hammer.

C) Service Entrance: Selected panels or safety switches, as indicated, shall be utilized and be U.L. rated as service entrance equipment. These shall be complete with an insulated solid neutral assembly, removable bonding link, external ground lugs for intersystem bonding connections, and internal ground lugs for the conductors shown or required. Provide grounding bushings as required, and additional labeling to denote service entrance usage.

(D) Furnish a printed or typewritten directory behind plastic on the inside of each panel door showing "As installed" circuit numbers, load descriptions, a complete description of all outlets and fixtures on each circuit.

6) Safety Switches & Motor Starters (A) Disconnects: Safety switches shall be heavy duty, H.P. Rated, 250 or 600 volts AC rated to match the circuit shown, with ground lug, rejection style fuse clips and NEMA 1 enclosure indoors or NEMA 3R enclosure outdoors; as manufactured by Square D, Siemens, General Electric, or Cutler—Hammer.

(B) Fuses: Fuses shall be dual-element, time-delay, rejection style, Class RK-5 for fuses 12) Lighting Fixtures up to 600 amperes; Bussmann type "FRN" (250 bolt) or type "FRS" (600 volt). Larger fuses shall be Class L, bolt—in style; Bussmann "Hi—cap". Equal fuses manufactured by Chase—Shawmut or Littlefuse, will be acceptable. Provide one set of three spare fuses for each size and type installed.

(C) Starters: (If any Indicated) Provide a manual starter, with overload, pilot light, toggle switch operator, and NEMA I enclosure (Flush mounted wherever possible), for each fractional horsepower, single phase, motor. Locate starters where shown, or adjacent to motor. Manual starters shall be Square D Class 2510, or equal by Allen-Bradley, Siemens, General Electric, or Cutler—Hammer. Provide a combination fusible switch & magnetic starter, complete with NEMA I enclosure, pilot light, H—O—A control and fused C.P.T., for each three phase motor larger than 1/2 H.P. Combination starters shall be Square D Class 8538, or equal by Allen-Bradley, Siemens, General Electric, or Cutler-Hammer.

7) Outlet Boxes

(A) Boxes: Flush device boxes shall be deep, galvanized, stamped steel boxes, with plaster rings where required. Exposed device boxes shall be cast malleable iron type FD with threaded hubs. Interior pull and junction boxes shall be NEMA 1 galvanized or painted stamped steel with screw covers. In fire rated walls and ceilings, boxes shall be two-gang maximum, and carefully located to maintain fire ratings; I.E. no more than 100 square inches of boxes in 100 square feet of wall/ceiling with boxes on opposite sides of wall separated by 24 horizontal inches minimum, unless wrapped with fire proofing putty. Small exterior boxes shall be cast type with gasketed covers, or NEMA 4X stainless steel for larger boxes. Flush-in-grade exterior boxes shall be non-metallic, 12"x12" x12" minimum, with matching cover, Quazite PC Series, Synertech S Series, or equal.

(B) Boxes for telephone and cable TV system shall be of type approved by the respected

8) Wiring Devices

(A) Wiring Devices: Devices shall be commercial grade, complete with thermoplastic face or handle, of the type, rating, and configuration as indicated on the drawings. Devices shall be supplied from a single manufacturer, wherever possible, to standardize on color and replacements. Device color shall be as selected by the Architect/Owner, to match the building finishes. Cover plates shall be smooth high impact matching plastic in office areas provide galvanized coverplates in industrial or storage areas, and gasketed, flap—type plastic "In—use" type in outdoor areas. Wiring devices and cover plates shall be as manufactured by Hubbell, Pass & Seymour, Leviton, Cooper, or Slater

(B) The approximate location of ceiling, switch and other outlets is given on the drawings. The exact locations shall be determines at the building as the work progresses.

(C) Any outlet installed by the Contractor in such a location as to be out of proper relation to beams, walls or other details of the building, shall be corrected by and at the expense of the Contractor.

(D) Unless otherwise indicated, outlet boxes in walls shall be located as indicated on drawings to bottom of box. If no elevations are noted, the following elevations above finished floor: wall switches: 44" A.F.F. min., except if height is noted on drawings or directed differently by Owner. Power receptacles: See schedule or plan for height. E.C. shall verify all receptacles, switches, controls, etc. with Architect and/or Owner for location and height prior to installation.

(E) These heights may be changed to meet building condition, in which case the contractor shall use new dimensions given him/her by the Architect and/or Owner.

9) Conductors And Feeders

1.Conductors for lighting, power, and receptacle circuits, and for panel and equipment feeders, shall be No. 12 AWG minimum. All conductors shall be stranded copper, annealed and uncoated, in accordance with the physical and electrical properties indicating in the ICEA standards.

2.Conductors No. 2 AWG and larger installed in dry locations shall have 600 volt, 75 degree C., cross-linked polyethylene XLP or XHHW insulation. Conductors No. 2 and larger installed in wet locations or underground ducts, shall have 600 volt, 75 degree C, RHW/USE type insulation.

3. Conductors smaller than No. 2 AWG shall have 600 volt, 75 degree C, type THHN/THWN or XHHW type insulation.

4. All wiring installed in lighting fixture channels used for raceways shall be wired with 90 degree C insulation on all circuit wiring within the raceways. Insulation may be type RHH or THHN.

5. Where conductors are located in ambient temperatures regularly exceeding 60 Degrees C, Type FEPB insulation shall be used.

6. All branch circuit wiring, including motor leads shall be No. 12 minimum. Where the circuit length exceeds 100 feet (for 120 Volts), or 200 feet (for 277 Volts), from the panel to the farthest device, utilize #10AWG minimum or larger where so indicated.

7. All 120 volt control wiring shall be No. 14 AWG minimum

(E) Conductors shall be as manufactured by the General Cable, Triangle, Colonial, Essex or

(F) Each bundle of cable shall bear the maker's name and the underwriters label, together with the grade, size, length and manufacturing date. Similar information shall be included on the insulation jacket of the conductors. Conductors shall comply with N.E.C. 310.

(G) Wiring: Furnish and install all wire, terminations and connection devices as shown or required. Unless otherwise noted, all line voltage circuits shall be stranded, copper, 600 volt insulated: (75 degrees C THHN/THWN), Conductors #3/0 AWG and larger may be stranded electrical grade compact aluminum conductors w/ 90° C. rated XHHW insulation, properly upsized for the ampacity equivalent to copper conductors shown. Branch circuit wiring shall be #12 AWG minimum. Where the circuit length exceeds 100 feet, from the panel to the farthest device, utilize #10 AWG minimum. Phase conductors for 240 volt (and lower) systems shall be red. black & blue; associated neutrals white. Phase conductors for 480 volt system shall be brown, orange & yellow; associated neutral gray Connections and taps for wire #4 AWG and larger shall be made with solderless pressure type connectors and lugs. All low voltage cable shall be multi-conductor, copper, with wire size, shield, jacket, color—coded insulation, terminations, etc. as recommended by the system supplier. Insulating and jacket materials shall be suitable for the installation environment (I.E. underground, plenum, high ambient temperature, etc.). See "Conductors & Feeders" on this page for further specifications.

(H) Raceways: Unless noted otherwise, all new line voltage wiring shall be installed in specified raceways. Raceways shall be installed, concealed within new construction, unless noted otherwise. Raceways installed underground, cast in concrete, within exterior walls, exposed outdoors or exposed indoors below six feet AFF, shall be rigid, metal conduit, schedule 40, hot—dipped galvanized, 3/4" trade size minimum, installed per NEC 344, complete with threaded fittings, double lock—nuts and bushings at boxes and cabinets. In dry interior locations as described above, conduit may be intermediate metal conduit, installed per NEC 342, complete with threaded fittings, double lock—nuts and bushings at boxes and cabinets. Field cut threads shall be coated with Z.R.C. cold galvanizing spray or other rust—inhibiting material after installation. Interior conduit in trade sizes 1/2" thru 4" Dia., shall be electrical metallic tubing, installed per NEC 358, complete with steel compression or set—screw fittings. Underground, exterior and interior, under—slab conduit may be schedule 40 PVC per NEC 352, in trade sizes 3/4" thru 4"ø., complete with insulated ground wire, and RGS elbows where riser is exposed. Utilize schedule 80 PVC or RGS where subject to abuse. Connections to recessed fixtures, and other items subject to vibration or occasional motion, shall be made with flexible metal, zinc-coated steel conduit, complete with steel fittings, in lengths not to exceed 6 feet, installed per NEC 348. For pumps, kitchen equipment, or where subject to dampness or oily environments, flexible conduit shall be neoprene jacketed, complete with approved fittings. Raceways entering refrigerated spaces or penetrating exterior walls, shall be sealed to reduce the passage of moisture and condensation.

(I) Flexible Cable: Where approved by the local inspection authority having jurisdiction, overhead fighting branch circuit wiring #12 AWG thru #10 AWG, may be installed using type "MC" cable, installed per NEC 330, complete with integral ground wire. Terminations of flexible cable shall include properly listed fittings at each enclosure. Drops to wall mounted devices, outlets or panels shall be concealed where possible and routed in conduit.

(A) All splicing shall be done in outlet boxes, junction boxes, etc. And not in the conduit. The splices shall be made according to the requirements of the NEC. The Contractor splices may be made with solderless connectors and then insulated as required or covered by composition insulation covers. Pressure connectors shall be used at motor-operated equipment an other vibrating equipment. Solderless connectors shall be as manufactured by 3m Scotchlok, Ideal Industries, Inc., Buchanan, or equal as approved by the Architect.

11) Surface Metal Raceways (A) Where specifically noted (If any Indicated), or approved by the Architect, interior conduit may be surface mounted metal raceway with ivory painted finish, installed per NEC 386, complete with matching elbows, boxes, fittings, and accessories, for a complete, grounded raceway system; Wiremold V700 Series or Hubbell 750—IV Series minimum size or approved equal. Such raceways shall be supported on 5' centers, and routed as neatly and inconspicuously as possible.

(A) Fixture numbers in the specifications have been taken from the catalogs of fixture manufacturers listed on the drawings. Fixture numbers and descriptions are intended to denote a standard of quality and type. Fixtures of other manufacturers may be used, Provided a complete comparable schedules is submitted to the Architect for review before proceeding with the order.

(B) Light Fixtures: (If Any Indicated) Furnish and install the light fixtures as indicated or the plans and schedules. Fixtures shall be complete with lamps, sockets, canopies, suspension accessories, reflectors, ballasts, lenses, louvers, plaster frames, etc. Prismatic lenses shall be 100% acrylic, one-eighth inch nominal thickness. Fluorescent tube sockets shall be twist and lock. Fluorescent ballasts shall be universal voltage, electronic, high power factor, minimum 90% ballast factor, 10% THD maximum, instant start for T5, as manufactured by General Electric, Sylvania/Osram, Phillips, or Advance. Fluorescent fixtures controlled by occupancy sensor switches shall be complete with programmed start ballast. Fluorescent fixture controlled by only timers or photocells may have an instant start ballast. Electronic LED drivers and power supplies shall be rated for long life and matched to the LED array supplied. Lamps shall be as manufactured General Electric, Sylvania, Phillips, Venture or Eye Lighting. Self—contained emergency lighting units shall include built—in batteries, charger, transfer relay; such unit equipment shall be connected to the normal or night light circuit in the space, but ahead of any local switches, lighting contactors or relays. Fixtures shall not rely entirely on the ceiling suspension system for mounting, but shall also be supported from the structure. Provide a separate power connection for each fixture or continuous and contiguous

fixture row (through—wiring not permitted). Exterior fixtures shall also be provided with the anchor bolts, grounding, low temperature ballasts, etc., as noted or required.

Openings around conduits or in sleeves for conduits penetrating fire-rated floor slabs, walls, partitions, ceilings, or smoke partitions, shall be sealed at both sides of the penetration. Insulation shall not extend through sleeves. Pack openings with calcium silicate block, Dow Corning 3-6548 RTV silicon foam. 3M CP25 caulk, or 303 putty fire barrier system or material having the same fire—rating as the floor or wall penetrated. Fiberglass is not acceptable.

(A) The Contractor guarantees by his acceptance of the contract that all work will be free from defects in workmanship and/or materials and that all apparatus will develop capacities and characteristics specified for a period of one year after date of Substantia Completion. Should any defects in workmanship, and/or materials require redesign of any part of the electrical, mechanical, plumbing, or architectural layout. All such redesign and all new drawings and detailing required thereof shall, with the approval of the Architect, be prepared by the Contractor at his own expense. Where such approved deviation required a different quantity and arrangement of ductwork, piping, wiring, conduit and/or equipment from that specified or detailed on the drawings, with the approval of the Architect, the Contractor shall furnish and install all such materials and/or equipment required by the system at no additional cost to the owner.

16) Connections To Existing Work

(A) Plan the installation of new work and connections to existing work to insure minimum interference with the regular operation of the existing facilities. Submit to the Architect, for his approval, a progress schedule indication all necessary temporary shutdowns of existing services. All shutdowns shall be made as such times as will not interfere with regular operation of the existing facilities and only after written approval from the

(A) Unless otherwise noted, all work indicated throughout these drawings shall be considered to be new work and shall be included as an integral part of this contract.

(B) Contractor is responsible for coordinating with other trades the placement of new plumbing and mechanical equipment, piping, ductwork, meters, and fixtures to avoid possible conflicts.

(C) E.C. is responsible for saw cutting and patching to match existing.

(D) Contractor shall not install any work knowingly in error. All work shall be in accordance with all local and state codes and requirements.

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ELECTRICAL SPECIFICATIONS

ISSUED DATE 08-30-2018 OWNER REVIEW 09-20-2018 BIDDING/PERMIT

DRAWN BY: KAN CHECKED BY: SAB DATE: 06 - 18

AS NOTED PLOT SCALE: JOB NO. 36-2416-18 SHEET E-3