PRINCE ELEMENTARY SCHOOL

125 E Prince Rd, Tucson, AZ 85705

BUILDING C - EAST WING
COOLING COIL REPLACEMENT

Construction Documents

November 30, 2022

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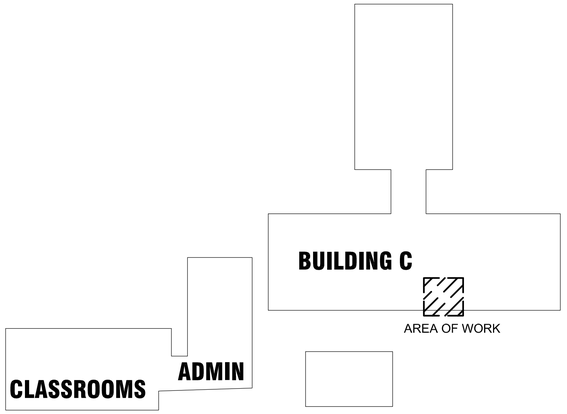
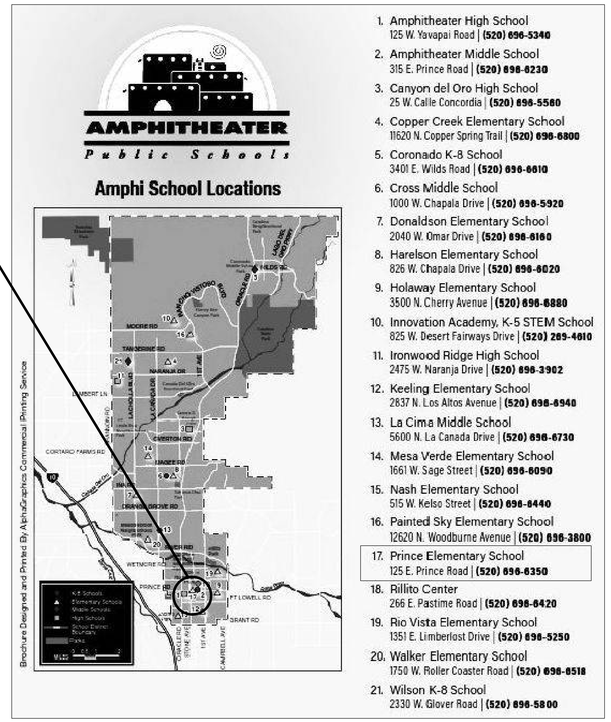
CODES
2018 INTERNATIONAL BUILDING CODE
2018 INTERNATIONAL PLUMBING CODE
2018 INTERNATIONAL MECHANICAL CODE
2018 INTERNATIONAL ENERGY CONSERVATION CODE
2018 INTERNATIONAL FUEL GAS CODE
2018 INTERNATIONAL FIRE CODE
2011 NATIONAL ELECTRICAL CODE
AND ALL LOCAL AMENDMENTS



CAMPUS SITE PLAN

NOT TO SCALE

NORTH



LOCATION MAP (AMPHI SCHOOLS)

NOT TO SCALE

NORTH

OWNER

AMPHITHEATER PUBLIC SCHOOLS
701 W. WETMORE ROAD
TUCSON, ARIZONA 85705
www.amphi.com

STRUCTURAL ENGINEER

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Contact: David Gibbens, P.E., S.E.

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KELLY, WRIGHT & ASSOCIATES, PC
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Contact: Donovan Kelly, P.E.

PRINCE ELEMENTARY SCHOOL
BUILDING C EAST WING - COOLING COIL REPLACEMENT
CONSTRUCTION DOCUMENTS

GENERAL STRUCTURAL NOTES

(APPLY UNLESS NOTED OTHERWISE)

DESIGN CRITERIA:

2018 EDITION OF THE INTERNATIONAL BUILDING CODE, WITH LOCAL AMENDMENTS.
RISK CATEGORY II.

LOADS:

ROOF LIVE LOAD = 20 PSF
ROOF DEAD LOAD = 10 PSF

GENERAL:

1. THE STRUCTURAL CONSTRUCTION DOCUMENTS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE METHOD OR SEQUENCE OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR AND PROVIDE ALL MEASURES NECESSARY TO PROTECT THE STRUCTURE DURING CONSTRUCTION. SUCH MEASURES SHALL INCLUDE, BUT NOT BE LIMITED TO, BRACING, SHORING FOR LOADS DUE TO CONSTRUCTION EQUIPMENT, ETC. THE STRUCTURAL ENGINEER SHALL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S MEANS, METHODS, TECHNIQUES, SEQUENCES FOR PROCEDURE OF CONSTRUCTION, OR THE SAFETY PRECAUTIONS AND THE PROGRAMS INCIDENT THERETO (NOR SHALL OBSERVATION VISITS TO THE SITE INCLUDE INSPECTION OF THESE ITEMS).

2. WHERE REFERENCE IS MADE TO VARIOUS TEST STANDARDS FOR MATERIALS, SUCH STANDARDS SHALL BE THE LATEST EDITION AND/OR ADDENDA.

3. OPTIONS ARE FOR CONTRACTOR'S CONVENIENCE. IF AN OPTION IS CHOSEN, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL NECESSARY CHANGES AND SHALL COORDINATE ALL DETAILS WITH ALL TRADES.

4. NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL STRUCTURAL NOTES AND TYPICAL DETAILS. WHERE NO DETAILS ARE SHOWN, CONSTRUCTION SHALL CONFORM TO SIMILAR WORK ON THE PROJECT. FOR BIDDING PURPOSES, WHERE ANY MEMBER IS SHOWN BUT NOT CALLED OUT, THE LARGEST SIMILAR MEMBER SHALL BE UTILIZED.

5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF ALL DIMENSIONS PRIOR TO START OF CONSTRUCTION.

6. ALL DETAILS SHALL BE INCORPORATED INTO THE PROJECT AT ALL APPROPRIATE LOCATIONS, WHETHER SPECIFICALLY CUT OR NOT. TYPICAL DETAILS MAY NOT NECESSARILY BE CUT ON PLANS, BUT APPLY UNLESS NOTED OTHERWISE. FOR CLARITY, DETAILS MAY SHOW ONLY ONE SIDE OF FRAMING CONDITION.

7. WHERE DISCREPANCIES OCCUR BETWEEN PLANS, DETAILS, GENERAL STRUCTURAL NOTES AND SPECIFICATIONS, THE GREATER REQUIREMENTS SHALL GOVERN.

8. ANY ENGINEERING DESIGN, PROVIDED BY OTHERS AND SUBMITTED FOR REVIEW, SHALL BEAR THE SEAL OF AN ENGINEER REGISTERED IN THE STATE IN WHICH THE PROJECT OCCURS.

EXISTING STRUCTURES:

1. THESE PLANS HAVE BEEN PREPARED BASED ON LIMITED VISUAL OBSERVATIONS AND/OR LIMITED AS-BUILT DOCUMENTS. CERTAIN CHANGES MAY BE REQUIRED BECAUSE OF POSSIBLE AMBIGUITIES OR INCONSISTENCIES IN RECORD DRAWINGS.

2. IF FIELD CONDITIONS DIFFER FROM THOSE DEPICTED, NOTIFY THE STRUCTURAL ENGINEER PRIOR TO PROCEEDING. THE CONTRACTOR (INCLUDING ALL SUBCONTRACTORS) SHALL REPORT ALL DIFFERENCES AND DEFECTS PROMPTLY.

3. VERIFY EXISTING CONDITIONS PRIOR TO CONSTRUCTION.

4. THE CONTRACTOR SHALL HAVE APPROPRIATE CONTINGENCIES TO ACCOUNT FOR BOTH DESIGN AND CONSTRUCTION CONDITIONS THAT MAY ARISE FROM THE DISCOVERY OF CONCEALED OR UNKNOWN CONDITIONS IN THE EXISTING STRUCTURE.

TABLE 1: REQUIRED STRUCTURAL SPECIAL INSPECTIONS (CONTINUED)

891.4–IBC18

SYSTEM OR MATERIAL	INSPECTION				REMARKS
	IBC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY		
			CONTINUOUS	PERIODIC	
1. POST–INSTALLED ANCHORS					
INSTALLATION IN HARDENED CONCRETE AND COMPLETED MASONRY	1705.3 1909.1	ACI 318, 3.8.6, 8.1.3, 21.2.8 ICC EVALUATION REPORT		X	SPECIAL INSPECTIONS APPLY TO ANCHOR PRODUCT NAME, TYPE, AND DIMENSIONS, HOLE DIMENSIONS, COMPLIANCE WITH DRILL BIT REQUIREMENTS, CLEANLINESS OF THE HOLE AND ANCHOR, ADHESIVE EXPIRATION DATE, ANCHOR/ADHESIVE INSTALLATION, ANCHOR EMBEDMENT, AND TIGHTENING TORQUE

INTERPRETATION OF DRAWINGS

ABBREVIATIONS

A.B.C.	AGGREGATE BASE COURSE
A.F.F.	ABOVE FINISHED FLOOR
ALT	ALTERNATE
A.B.	ANCHOR BOLT
B.F.F.	BELOW FINISHED FLOOR
B.O.B.	BOTTOM OF BEAM
B.O.D.	BOTTOM OF DECK
B.O.F.	BOTTOM OF FOOTING
B.O.S.	BOTTOM OF STEEL
BOT	BOTTOM
BRG	BEARING
C.I.P.	CAST IN PLACE
C.F.S.	COLD FORMED STEEL
CL	CENTERLINE
CLR	CLEAR
CONC	CONCRETE
CONC. C.J.	CONCRETE CONTROL JOINT
C.M.U.	CONCRETE MASONRY UNIT
CONN	CONNECTION
CONT	CONTINUOUS
D.L.	DEAD LOAD
DIA	DIAMETER
DN	DOWN
DWG(S)	DRAWING(S)
(E)	EXISTING
E.F.	EACH FACE
E.O.S.	EDGE OF SLAB
EQ	EQUAL
EQUIP	EQUIPMENT
EXP. BOLT	EXPANSION BOLT
E.J.	EXPANSION JOINT
E.W.	EACH WAY
FDN	FOUNDATION
F.F.E.	FINISHED FLOOR ELEVATION
GA	GAGE
GALV	GALVANIZED
G.S.N.	GENERAL STRUCTURAL NOTES
G.L.B. (GLULAM)	GLUED–LAMINATED BEAM
HORIZ	HORIZONTAL
I.B.C.	INTERNATIONAL BUILDING CODE
I.C.C.	INTERNATIONAL CODE COUNCIL
I.C.F.	INSULATED CONCRETE FORM
K(KIP)	1000 POUNDS
L.L.	LIVE LOAD
LBS	POUNDS
L.L.H.	LONG LEG HORIZONTAL
L.L.V.	LONG LEG VERTICAL
MFR('S)	MANUFACTURER('S)
M.C.J.	MASONRY CONTROL JOINT
MECH	MECHANICAL
(N)	NEW
N/A	NOT APPLICABLE
N.I.C.	NOT IN CONTRACT
N.F.S.	NON–FROST SUSCEPTIBLE
N.T.S.	NOT TO SCALE
O.C.	ON CENTER
OPP	OPPOSITE (MIRRORED)
P.A.F.	POWDER ACTUATED FASTENER
P.C.	PRECAST CONCRETE
P.C.F.	POUNDS PER CUBIC FOOT
P.L.F.	POUNDS PER LINEAR FOOT
PREFAB	PREFABRICATED
P.S.F.	POUNDS PER SQUARE FOOT
P.S.I.	POUNDS PER SQUARE INCH
REINF	REINFORCING
SCH	SCHEDULE
SIM	SIMILAR
S.I.P.	STRUCTURAL INSULATED PANEL
S.L.R.S.	SEISMIC LOAD RESISTING SYSTEM
SP	SPACES
STD	STANDARD
T & B	TOP AND BOTTOM
T.L.	TOTAL LOAD
T.O.B.	TOP OF BEAM
T.O.C.	TOP OF CONCRETE
T.O.D.	TOP OF DECK
T.O.F.	TOP OF FOOTING
T.O.L.	TOP OF LEDGER
T.O.M.	TOP OF MASONRY
T.O.PL.	TOP OF PLATE
T.O.S.	TOP OF STEEL
T.O.W.	TOP OF WALL
TYP	TYPICAL
U.N.O.	UNLESS NOTED OTHERWISE
VERT	VERTICAL
W.S.P.	WOOD STRUCTURAL PANEL
W.W.F.	WELDED WIRE FABRIC
W/ (W/O)	WITH (WITHOUT)

PLAN LEGEND

SYMBOL	DESCRIPTION	REMARKS
101	DETAIL CUT ON PLANS	FOUNDATION DETAILS ARE 100 SERIES NUMBERS FRAMING DETAILS ARE 200 SERIES NUMBERS BRACED FRAME DETAILS ARE 300 SERIES NUMBERS STAIR DETAILS ARE 400 SERIES NUMBERS
1	KEYNOTE ON PLAN	
	8" MASONRY WALL U.N.O.	SEE PLANS AND SCHEDULES FOR REINFORCING
	12" MASONRY WALL U.N.O.	SEE PLANS AND SCHEDULES FOR REINFORCING
	CONCRETE WALL U.N.O.	SEE PLANS AND SCHEDULES FOR SIZE AND REINFORCING
	STEEL STUD WALL U.N.O.	SEE PLANS AND SCHEDULES FOR SIZE
	WOOD STUD WALL U.N.O.	SEE PLANS AND G.S.N. FOR SIZE
SW	SHEAR WALL	SEE PLANS FOR LOCATION, SIZE AND TYPE
SW / SW	TWO–SIDED SHEAR WALL	SEE PLANS FOR LOCATION, SIZE AND TYPE
H	HOLDOWN ANCHOR	SEE PLANS AND SCHEDULES FOR SIZE AND LOCATIONS
M.C.J.	MASONRY CONTROL JOINT	SEE PLANS FOR LOCATION
P.J.	PANEL JOINT	SEE PLANS FOR LOCATION
C.J.	CONTROL JOINT	SEE PLANS FOR LOCATION
	DIRECTION OF SLOPE	VERIFY SLOPE WITH ARCHITECTURAL AND/OR MECHANICAL DRAWINGS
	SLAB DEPRESSION/ CHANGE IN ELEVATION	VERIFY DEPTH WITH ARCHITECTURAL DRAWINGS
	RIGID (MOMENT) CONNECTION	
	SIMPLE BEAM SPLICE CONNECTION	
100'–0"	ELEVATION TARGET	
1	REVISION SYMBOL	
	OPENING	
	MECHANICAL EQUIPMENT	VERIFY SIZE AND LOCATION WITH ARCHITECTURAL AND/OR MECHANICAL DRAWINGS
	APPLIED LOAD OR POINT OF SUPPORT/SHORING	

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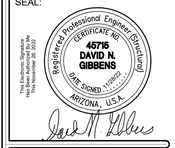
435 East 9th Street | Tucson, AZ 85705 | 520.512.8183 | www.sastructural.com

Project Number: 122263

Amphitheater Public Schools

BLDG C - EAST WING
COOLING COIL REPLACEMENT
Prince Elementary School
125 E Prince Rd, Tucson, AZ 85705

SEAL:



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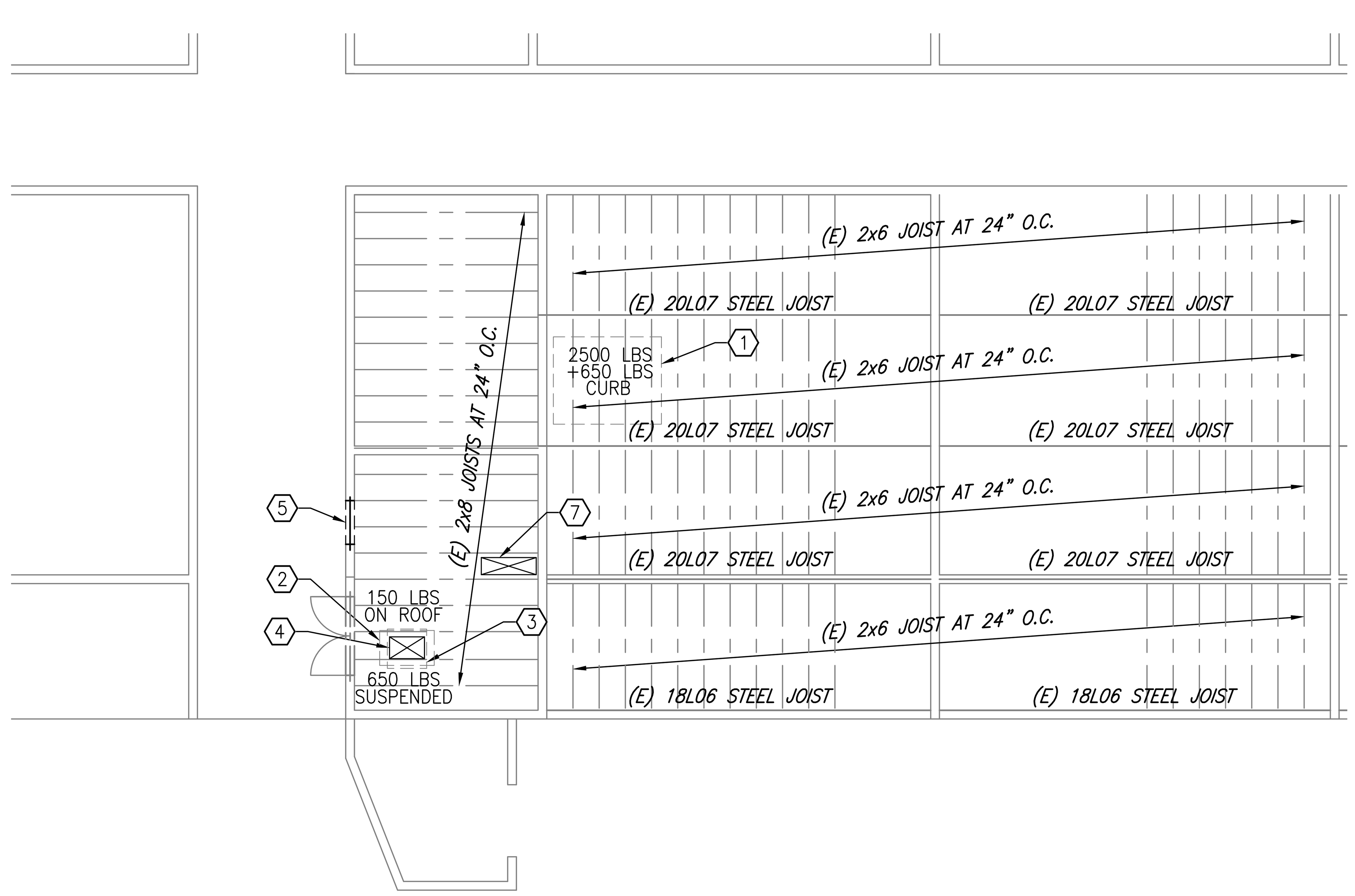
KWA PROJECT NO: 21045
DATE: November 23, 2022
DRAWN BY: MPG
DESIGNED BY: RR
CHECKED BY: DNG

SHEET CONTENTS:
GENERAL STRUCTURAL NOTES

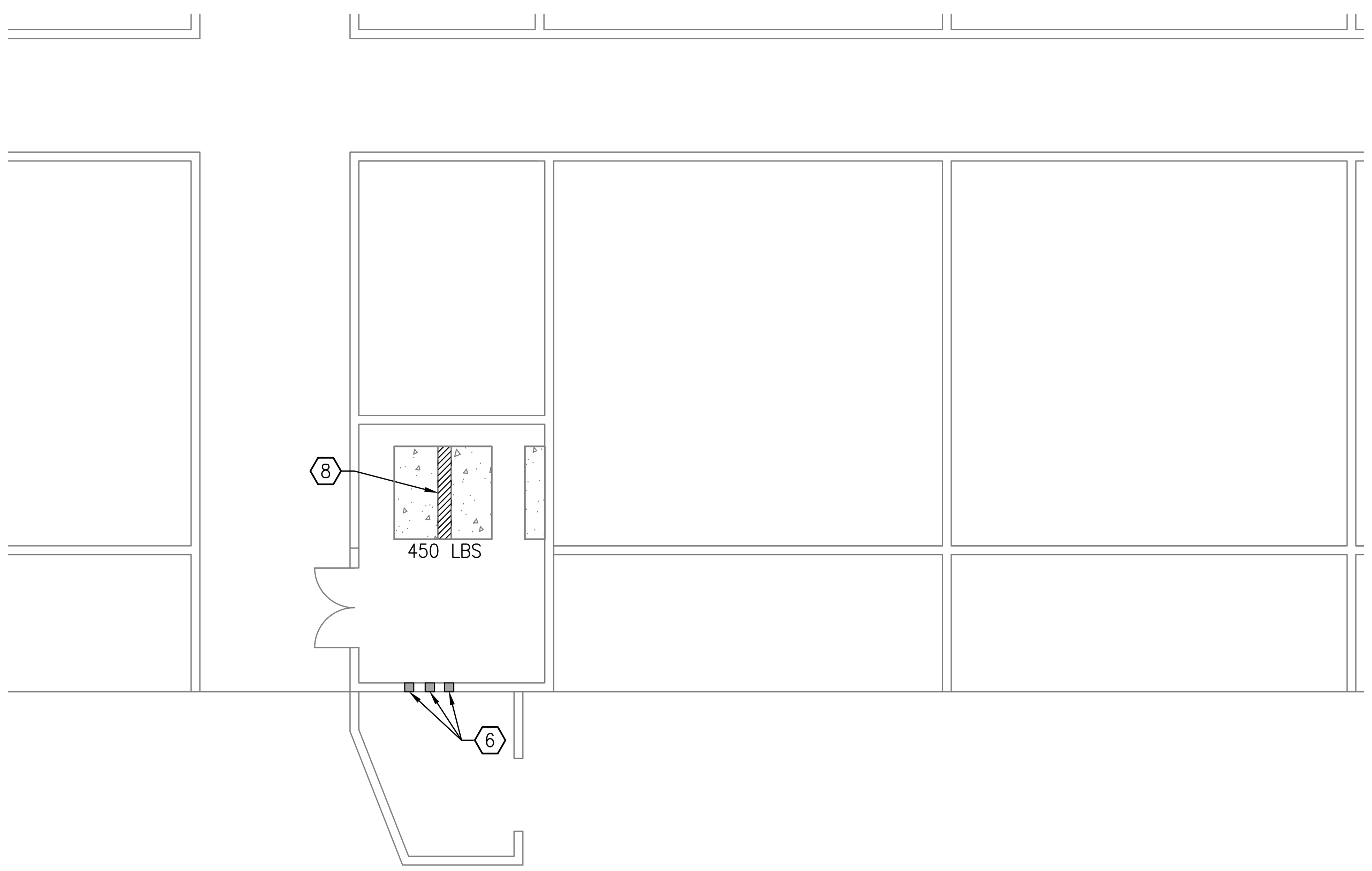
SHEET
S1.0
OF
Prince ES - Bldg C East Wing

FOUNDATION /FRAMING KEYNOTES:

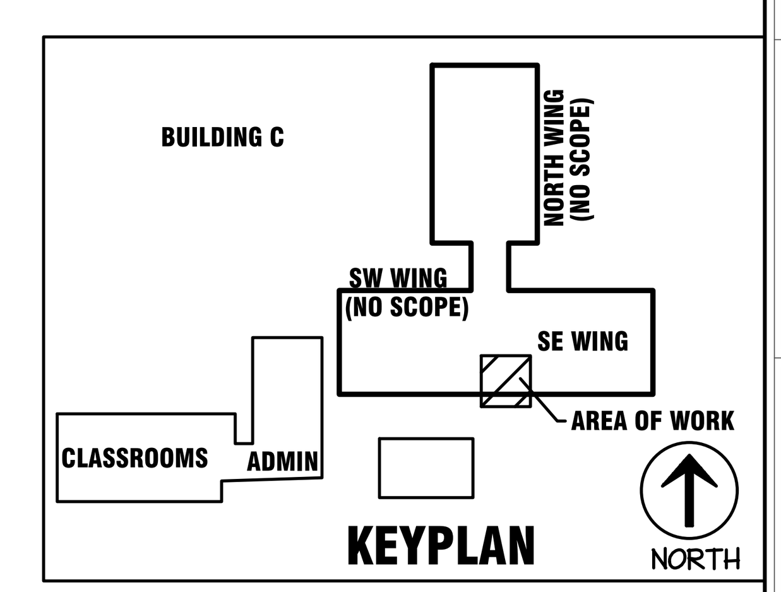
1. NEW MECHANICAL EQUIPMENT ON NEW ROOF CURB. WEIGHTS AND LOCATIONS SHOWN ARE APPROXIMATE. SEE MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION. REFER TO DETAIL 01 FOR CURB CONSTRUCTION.
2. NEW MECHANICAL EQUIPMENT ON EXISTING ROOF. WEIGHTS AND LOCATIONS SHOWN ARE APPROXIMATE. SEE MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION. MAXIMUM WEIGHT OF 150 LBS.
3. SUSPENDED MECHANICAL EQUIPMENT ON EXISTING WOOD JOISTS. WEIGHTS AND LOCATIONS SHOWN ARE APPROXIMATE. SEE MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION. MAXIMUM WEIGHT OF 650 LBS. REFER TO DETAIL 02.
4. MECHANICAL ROOF OPENING. COORDINATE SIZE AND LOCATION WITH MECHANICAL DRAWINGS. REFER TO DETAIL 03.
5. NEW WALL OPENING AT EXISTING CMU WALL. REFER TO DETAIL 04 FOR LINTEL CONSTRUCTION.
6. CMU WALL INFILL.
7. MECHANICAL ROOF OPENING WITH CURB. COORDINATE SIZE AND LOCATION WITH MECHANICAL DRAWINGS. REFER TO DETAIL 03.
8. NEW MECHANICAL EQUIPMENT ON EXISTING CONCRETE MAT ON GRADE. SEE MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION.



2 PARTIAL ROOF FRAMING PLAN - EAST WING
SCALE: APPROX 1/8"=1'-0"
NORTH



1 PARTIAL FOUNDATION PLAN - EAST WING
SCALE: APPROX 1/8"=1'-0"
NORTH



SCHNEIDER STRUCTURAL ENGINEERS
CREATING ELEGANT SOLUTIONS
435 East 9th Street | Tucson, AZ 85705 | 520.512.8183 | www.sastructural.com
Project Number: 122263

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Amphitheater Public Schools

BLDG C - EAST WING
COOLING COIL REPLACEMENT
Prince Elementary School
125 E Prince Rd, Tucson, AZ 85705

SEAL:
Registered Professional Engineer (Structural) 45715 DAVID N. GIBBENS ARIZONA, U.S.A.

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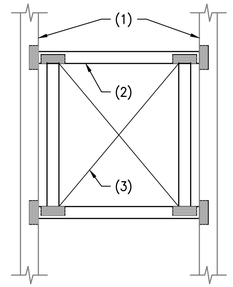
KWA PROJECT NO:	21045
DATE:	November 23, 2022
DRAWN BY:	MPG
DESIGNED BY:	RR
CHECKED BY:	DNG

SHEET CONTENTS:
PARTIAL FOUNDATION AND FRAMING PLANS

SHEET
S2.0
OF
Prince ES - Bldg C East Wing

NOTES:

1. EXISTING WOOD JOIST.
2. 2x6 WITH SIMPSON FN TYPE HANGERS – TYPICAL.
3. OPEN.

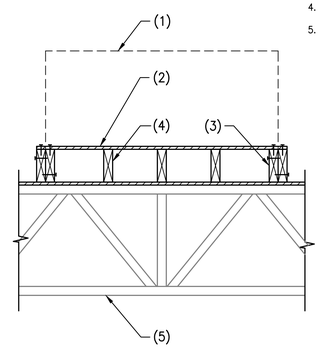


NOTE:
SHEATHING NOT SHOWN FOR CLARITY.

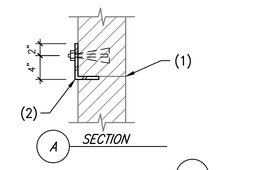
03 *TYPICAL ROOF OPENING*
SCALE: NOT TO SCALE 122263-S3.0-SE-03

NOTES:

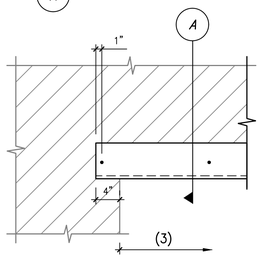
1. LINE OF MECHANICAL UNIT.
2. 1/2" SHEATHING.
3. DOUBLE 2x6 WITH 16d NAILS AT 12" O.C. STAGGERED.
4. 2x6 AT 16" O.C. – TWO SPAN MINIMUM – TYPICAL.
5. EXISTING STEEL TRUSS.



01 *MECHANICAL UNIT PLATFORM*
SCALE: NOT TO SCALE 122263-S3.0-SE-01



A *SECTION*



NOTES:

1. EXISTING 8" MASONRY WALL.
2. L6x4x5/16 WITH 1/2" DIA. EXPANSION BOLTS AT ENDS AND AT 24" O.C.
3. OPENING NOT TO EXCEED 6'-0".

INSTALLATION PROCEDURE:

INSTALL STEEL ANGLE LINTEL INTO EXISTING MORTAR JOINT OR SAW CUT 3/8" HORIZONTAL CUT TO ALLOW PLACEMENT OF HORIZONTAL LEG.

INSTALL EXPANSION BOLTS.

REMOVE MASONRY FOR OPENING.

NOTE:
IF CELL IS NOT GROUTED USE ANCHOR BOLT AND GROUT OR DRY PACK CELL AT ANCHOR BOLT.

04 *STEEL ANGLE LINTEL AT EXISTING MASONRY WALL*
SCALE: NOT TO SCALE 122263-S3.0-SE-04

NOTES:

1. EXISTING SHEATHING.
2. 250 LBS MAXIMUM LOAD PER JOIST.
3. SAMMY'S WOOD SIDEWINDER MODEL SWG20 CONNECTOR OR EQUIVALENT.
4. EXISTING WOOD JOIST.
5. TYPICAL: 3/8" DIA. MIN HANGER HANGER ROD.

02 *TYPICAL SUSPENDED MECHANICAL EQUIPMENT WITH SIDE CONNECTORS AT WOOD JOISTS*
SCALE: NOT TO SCALE 122263-S3.0-SE-02

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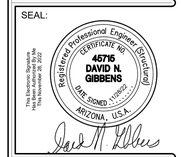

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CHECKED BY:	DNG

SHEET CONTENTS:
DETAILS

SHEET
S3.0
OF
Prince ES - Bldg C East Wing

REFRIGERANT PIPING NOTES

1. REFRIGERANT PIPING SHALL BE SIZED AND INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. PROVIDE ALL ACCESSORIES AS REQUIRED BY THE MANUFACTURER AND TO RENDER A COMPLETE INSTALLATION.
2. REFRIGERANT PIPING LAYOUT SHOWN IS DIAGRAMMATIC – FIELD VERIFY ROUTING. COORDINATE LOCATIONS WITH WORK OF OTHER TRADES. MINIMIZE LENGTHS OF RUNS AND AMOUNT OF RISE AND FALL IN PIPING.
3. PROVIDE REPLACEABLE FILTER / DRIER IN ACCESSIBLE LOCATION IN EACH SYSTEM. HEAT PUMP SYSTEMS SHALL USE REVERSIBLE TYPE.
4. UNITS WITH REFRIGERANT LINE RUNS OVER 50 FEET SHALL INCLUDE EXPANSION VALVE AND SOLENOID VALVE.
5. INSULATE ALL REFRIGERANT PIPING (BOTH LINES ON DUCTLESS SYSTEMS) PER SPECIFICATIONS. INCLUDES INSULATION JACKETING AS REQUIRED PER SPECS. PROVIDE INSERTS AT ALL CLAMP LOCATIONS, REFER TO DETAILS AND SPECIFICATIONS.
6. VALVES AND ACCESSORIES USED IN REFRIGERANT PIPING SYSTEMS SHALL BE COMPATIBLE WITH REFRIGERANT AND OPERATING PRESSURES / TEMPERATURES.
7. TESTING: PIPE PRESSURE TESTING, EVACUATION, SYSTEM CHARGING AND STARTUP TESTING SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS. THE USE OF 95/5 HYDROGEN TRACER GAS TESTING IS ADVISED. TESTING SHALL BE AS FOLLOWS UNLESS MANUFACTURER'S REQUIREMENTS ARE MORE STRINGENT:
   - 7.1. PRESSURE TEST PIPING AT 1.5 TIMES MAXIMUM SYSTEM OPERATING PRESSURE – HOLD TEST FOR 1 HOUR WITH NO DROP IN PRESSURE ALLOWED.
   - 7.2. PERFORM TRIPLE EVACUATION TO 500 MICRONS OR LESS. HOLD EACH TEST FOR MINIMUM 1 HOUR. BREAK VACUUM WITH DRY NITROGEN (EXCEPT FOR FINAL WHICH USES REFRIGERANT).
   - 7.3. SATISFACTORY TESTING & EVACUATION SHALL BE COMPLETE PRIOR TO INSULATING PIPING.
8. RECOVER 100% OF REFRIGERANT PRIOR TO MODIFYING ANY PORTION OF THE REFRIGERATION SYSTEMS. CHARGE SYSTEMS AFTER WORK IS COMPLETE. ADD REFRIGERANT AS REQUIRED TO COMPLY WITH MANUFACTURER'S SETTINGS. ADDITIONAL REFRIGERANT SHALL BE INCLUDED AT NO COST TO THE OWNER.
9. UNDER NO CIRCUMSTANCES SHALL REFRIGERANT BE DISCHARGED INTO THE ATMOSPHERE.

DUCT CONSTRUCTION NOTES

SMACNA DUCT PRESSURE CLASS	2"
APPLICABLE SYSTEM(S)	• SUPPLY AND RETURN A/C DUCTS
SEALING REQUIREMENTS (ALL DUCTS)	SEAL CLASS A
	ALL JOINTS, SEAMS, TAPS, AND DUCT WALL PENETRATIONS INCLUDING BUT NOT LIMITED TO ROTATING SHAFTS. DUCT CONNECTIONS TO FLANGES SHALL BE MECHANICALLY FASTED AND SEALED.

NOTES:
- SUPPLY DUCTS SHALL BE RATED AT SMACNA CLASS FOR POSITIVE PRESSURE DUCTS; RETURN AND EXHAUST SYSTEMS SHALL BE RATED AS NEGATIVE PRESSURE.
- SPIRAL LOCK SEAMS ARE NOT REQUIRED TO BE SEALED.
- TAPES AND SEALANTS USED FOR METAL AND FLEX DUCTS SHALL COMPLY WITH UL–181B & MARKED 181B–FX (TAPE) OR 181B–M (MASTIC).
- MECHANICAL FASTENERS USED WITH FLEX DUCTS SHALL COMPLY WITH UL–181B AND MARKED 181B–C.

PROJECT MECHANICAL COMMISSIONING (Cx) NOTES

ABBREVIATIONS: Cx = COMMISSIONING CxA = COMMISSIONING ADMINISTRATOR

THIS PROJECT WILL BE COMMISSIONED BY THE DESIGN PROFESSIONAL (SERVING AS CxA). EQUIPMENT SHALL BE TESTED TO CONFIRM ALL CONTROLS AND SEQUENCES WORKING AS INTENDED. MULTIPLE CONSTRUCTION TEAM MEMBERS AND OWNER STAFF WILL BE REQUIRED TO PARTICIPATE IN THE Cx PROCESS.

COMMISSIONING PROCESS OVERVIEW:
1. THE CxA WILL PROVIDE A Cx PLAN AFTER PROJECT CONSTRUCTION AWARD. THE Cx PLAN WILL DOCUMENT THE Cx ACTIVITIES INCLUDING DETAILS ON WHICH EQUIPMENT WILL BE TESTED AND FOR WHAT IN WHICH MODES, ETC.
   - 1.1. IN GENERAL ALL HVAC EQUIPMENT ON THIS PROJECT IS EXPECTED TO BE TESTED TO PROVE ALL SEQUENCE OF OPERATIONS FUNCTION AS INTENDED.
2. TEAM MEETING WITH CONTRACTORS, OWNER REPRESENTATIVE(S) AND CxA.
3. TEAM SCHEDULING
4. CONTRACTOR START UP
5. Cx WEB MEETING TO REVIEW SEQUENCE OF OPERATIONS
6. CONTRACTOR VERIFICATION OF FUNCTIONAL PERFORMANCE TESTING (FPT) READINESS
7. TAB & Cx REVIEW OF TAB REPORT
8. Cx FUNCTIONAL PERFORMANCE TESTING (FPT)
   - 8.1. A MAXIMUM OF TWO FPT ON–SITE TEAM EFFORTS WILL BE PROVIDED BY THE CxA AT NO ADDITIONAL CHARGE. ADDITIONAL FPT AS A RESULT OF THE CONTRACTOR'S LACK OF READINESS WILL BE BILLED TO THE CONTRACTOR.
9. CxA REVIEW PROPOSED TRAINING PLAN AND ACCEPT PRIOR TO ANY INSTRUCTION.
10. FINAL REPORT

CONTRACTOR RESPONSIBILITIES ARE HIGHLIGHTED IN THE FOLLOWING TABLE.

TRAINING:
TRAINING IS REQUIRED AS PART OF THE Cx PROCESS. CONTRACTOR IS RESPONSIBLE FOR CREATING THE TRAINING PLAN, SUBMITTING IT FOR APPROVAL, SCHEDULING WITH THE OWNER, AND PROVIDING TRAINING. TRAINING SHALL COVER ALL MECHANICAL AND CONTROLS AND INCLUDE, AT A MINIMUM: OVERVIEW, MAINTENANCE, TROUBLESHOOTING & DIAGNOSTICS. SUBMIT TRAINING REPORTS AND RECORDS TO SHOW THAT TRAINING WAS CONDUCTED.

Cx RESPONSIBILITIES MATRIX

TEAM MEMBER	GENERAL DESCRIPTION OF TASKS
GENERAL / PROJECT MANAGER / SUPERINTENDENT	• ENSURES ACCESS TO AREAS OF WORK • COORDINATES CONSTRUCTION TEAM SCHEDULES AND ATTENDANCE • ENSURE FPT PREP IS COMPLETE PRIOR TO CxA FPT ACTIVITY • OWNER TRAINING OVERSIGHT AND DOCUMENTATION • COMBINE DATA FROM ALL TRADES AND SUBMIT REPORTS • PROVIDE ALL CLOSE OUT DOCUMENTS
CONTROLS CONTRACTOR	• VERIFY UNDERSTANDING OF SEQUENCE OF OPS WITH CxA PRIOR TO FINAL PROGRAMMING • ENSURES PRE–FTP REQUIREMENTS ARE MET • PARTICIPATE IN FTP • PROVIDE OWNER TRAINING. • MODIFY PROGRAMMING AND/OR INSTALL TO CORRECT DEFICIENCIES • COORDINATE WITH EQUIPMENT FACTORY INSTALLED CONTROLS • SET UP AND RECORD TRENDS. TREND DATA IS REQUIRED TO ILLUSTRATE COMPLIANCE WITH THE SEQUENCE AND DESIGN INTENT. • PROVIDE HARD DRIVE(S) AS NECESSARY TO ACCOMMODATE ALL THE NECESSARY TREND DATA • PROVIDE TREND DATA IN EXCEL FORMAT AND GRAPHS
MECHANICAL CONTRACTOR	• OPENS EQUIPMENT. • MAKE CORRECTIONS ASSOCIATED WITH NON–CONTROL ITEMS. • PROVIDES OWNER TRAINING • ENSURES PRE–FTP REQUIREMENTS ARE MET
ELECTRICAL CONTRACTOR	ENSURE POWER AND CONDUIT INSTALL IS COMPLETE PRIOR TO START–UP.
MANUFACTURER'S REPRESENTATIVE	• ASSISTS CONTROLS CONTRACTOR TO ACHIEVE SEQUENCE OF OPERATIONS WHERE EQUIPMENT HAS FACTORY CONTROLS. • ASSIST WITH OWNER TRAINING MATERIALS AND/OR PRESENTATION
OWNER	• REVIEW Cx PLAN PRIOR TO Cx PLAN BEING ISSUED TO CONSTRUCTION TEAM • APPROVE OWNER TRAINING PLAN ALONG WITH CxA • SCHEDULE OWNER TRAINING • ACCEPT FINAL REPORT

MECHANICAL SYMBOLS AND ABBREVIATIONS

ABV	– ABOVE	SA	– SUPPLY AIR
AFF	– ABOVE FINISHED FLOOR	SFRO	– SHOWN FOR REFERENCE ONLY
AHJ	– AUTHORITY HAVING JURISDICTION	SIM	– SIMILAR
BFP	– BACKFLOW PREVENTER	TAB	– TEST AND BALANCE
BLW	– BELOW	TRANS	– TRANSITION
CFM	– CUBIC FEET PER MINUTE	TYP	– TYPICAL
CLG	– COOLING	U.N.O.	– UNLESS NOTED OTHERWISE
CONC	– CONCRETE	VAR	– VARIABLE
CONN	– CONNECTION	VERT	– VERTICAL
CONT	– CONTINUATION	VTR	– VENT TROUGH ROOF
COORD	– COORDINATE	W/	– WITH
DEMO	– DEMOLITION		– SUPPLY DUCT UP
DN	– DOWN		– SUPPLY DUCT DOWN
DTR	– DUCT THROUGH ROOF		– RETURN DUCT UP
(E)	– EXISTING		– RETURN DUCT DOWN
EA or EXH	– EXHAUST AIR		– EXHAUST DUCT UP
EMCS	– ENERGY MONITORING CONTROL SYSTEM		– EXHAUST DUCT DOWN
EQUIP	– EQUIPMENT	SD	– RETURN AIR DUCT SMOKE DETECTOR
FA	– FIRE ALARM	©	– SPACE CO2 SENSOR
FLEX	– FLEXIBLE		– DEMO DUCTWORK
FLR	– FLOOR		
GA	– GAUGE		
G.C.	– GENERAL CONTRACTOR		
HTG	– HEATING		
MERV	– MINIMUM EFFICIENCY REPORTING VALUE		
MIN	– MINIMUM		
OA	– OUTSIDE AIR		
OH	– OVERHEAD		
PL	– PLACES		
POC	– POINT OF CONNECTION		
POD	– POINT OF DISCONNECTION		
RA	– RETURN AIR		
REF	– REFERENCE		
REQD	– REQUIRED		
RND	– ROUND SHEET METAL DUCTWORK		

DUCT SMOKE DETECTOR NOTES

1. UNIT (E)AHU–1E SHALL BE FITTED WITH A DUCT SMOKE DETECTOR IN ACCORDANCE WITH 2018 IMC, SECTION 606 REQUIREMENTS. DUCT SMOKE DETECTORS ARE PROVIDED BY ELECTRICAL. SAMPLING TUBES AND ACCESS PANELS SHALL BE INSTALLED IN RETURN AIR DUCTS OR PLENUM UPSTREAM OF FILTERS, EXHAUST AIR CONNECTIONS, AND OUTSIDE AIR CONNECTIONS BY HVAC CONTRACTOR. DETECTORS WILL THEN BE INSTALLED AND WIRED BY ELECTRICAL. COORDINATE WITH ELECTRICAL.
2. ENSURE THAT ACCESS AND IDENTIFICATION OF ALL SMOKE DETECTORS IS PROVIDED – SIMILAR TO DAMPER IDENTIFICATION REQUIREMENTS PER IMC 2018, SECTION 607.4.
3. ENSURE FIRE ALARM AND SHUTDOWN CONNECTIONS ARE MAINTAINED.

REFURBISH EXISTING EQUIPMENT NOTES

1. REFURBISH EXISTING A/C EQUIPMENT TO REMAIN. REFURBISH SHALL INCLUDE, BUT NOT LIMITED TO THE FOLLOWING: (FOLLOW MANUFACTURER'S INSTRUCTIONS FOR EACH, AS APPLICABLE)
   - A. CLEAN INTERIOR OF CABINETS AND REPLACE DAMAGED INSULATION AS REQUIRED;
   - B. CLEAN CONDENSATE PANS AND VERIFY PROPER DRAINAGE & OPERATION OF EXISTING CONDENSATE TRAP;
   - C. LUBE / REPACK BEARINGS;
   - D. VERIFY DRIVE ALIGNMENT & BELT TENSION & REPLACE BELT(S);
   - E. CLEAN HEATING COILS (ALL THE WAY THRU) AND COMB FINS ON BOTH SIDES OF EACH;
   - F. REPLACE FILTER(S) WITH SPECIFIED;
   - G. REPLACE SUPPLY FAN MOTOR WITH INVERTER DUTY
   - H. REPLACE FAN SHAFT BEARINGS
   - I. CLEAN SUPPLY FAN BLOWER WHEEL
   - J. ADJUST ALL DOOR HINGES AND HANDLES/LOCKS
   - K. SEAL ALL SUPPLY DUCT JOINTS THAT ARE ACCESSIBLE IN THE MECHANICAL ROOM.
   - L. REPLACE RA DAMPER IN FLOOR AND PROVIDE ACTUATOR. SEE FLOOR PLANS.
2. ANY DEFICIENCIES FOUND SHALL BE REPORTED TO THE OWNER IN WRITING. ANY PARTS FOUND TO BE WORN, DAMAGED, OR INOPERATIVE SHALL BE REPORTED TO THE OWNER IN WRITING.
3. EQUIPMENT SHALL BE TURNED OVER TO OWNER IN PROPER WORKING ORDER.

CARBON DIOXIDE SENSOR

1. PROVIDE CARBON–DIOXIDE SENSOR AND TRANSMITTER, EQUIVALENT TO VAISALA GMW80 SERIES THAT IS COMPATIBLE WITH EQUIPMENT MANUFACTURER AND PROTOCOL: SINGLE DETECTORS, USING SOLID–STATE INFRARED SENSORS, WITH CONTINUOUS OR AVERAGED READING. WALL OR DUCT MOUNTED. COMPLETE WITH VANDAL RESISTANT DECORATIVE ENCLOSURE. UL LISTED. SENSORS MOUNTED IN PUBLIC AREAS SHALL NOT DISPLAY CO2 CONCENTRATION.
2. MINIMUM PERFORMANCE CRITERIA:
   - 2.1. UL LISTED WALL OR DUCT MOUNTED AS NECESSARY FOR THE INTENDED APPLICATION.
   - 2.2. WALL SENSORS: COMPLETE WITH VANDAL RESISTANT DECORATIVE ENCLOSURE. SENSORS MOUNTED IN PUBLIC AREAS SHALL NOT DISPLAY CO2 CONCENTRATION.
   - 2.3. BUILT–IN INTERNAL REFERENCE MEASUREMENT.
   - 2.4. REPLACEABLE CO2 SENSING MODULE (5–YEAR LIFE SPAN).
   - 2.5. MEASURING RANGE: 0–2000 PPM,
   - 2.6. ACCURACY: +/– 30 PPM + 3% OF READING FOR 68 TO 86 DEG F,
   - 2.7. NON–LINEARITY: MAXIMUM 1% OF FULL SCALE,
   - 2.8. ANNUAL DRIFT: MAXIMUM 20 PPM,
   - 2.9. AMBIENT TEMPERATURE RATINGS: OPERATING = 32 TO 122 DEG F, STORAGE = –4 TO 158 DEG F,
   - 2.10. 0–95% RH NON–CONDENSING,
   - 2.11. LONG TERM STABILITY OF LESS THAN 5% OF FULL SCALE OVER 5 YEARS,
   - 2.12. POWER CONSUMPTION, MAXIMUM: 1W AT 30VAC OR 45MA AT 18 VDC
   - 2.13. 4 TO 20 MA OR 0 TO 10 VDC OUTPUT.
   - 2.14. AUTO–CALIBRATING. ACCURACY SHALL BE MAINTAINED WITHIN TOLERANCE FOR A MINIMUM OF 5 YEARS WITHOUT MANUAL CALIBRATION. CERTIFIED TO COMPLY WITH CALIFORNIA TITLE 24, SECTION 121(C) AND 4(F).

Amphitheater Public Schools

BLDG C - EAST WING
COOLING COIL REPLACEMENT
Prince Elementary School
125 E Prince Rd, Tucson, AZ 85705

SEAL:

REGISTERED Professional Engineer – CERTIFICATE NO. 35960 – DONOVAN F. KELLY – 30 NOV 2022 – REGISTERED – ARIZONA U.S.A.

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KWA PROJECT NO: 21045
DATE: November 30, 2022
DRAWN BY: MB
DESIGNED BY: MB
CHECKED BY: DFK

SHEET CONTENTS:
HVAC NOTES AND LEGEND

SHEET
M0.1

MECHANICAL SPECIFICATIONS

1. ALL WORK SHALL BE INSTALLED IN ACCORDANCE WITH ALL CODES, LAWS, RULES, AND REGULATIONS OF ALL NATIONAL, COUNTY, STATE AND LOCAL AUTHORITIES HAVING JURISDICTION OVER THE PREMISES. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO THE 2018 INTERNATIONAL CODES (ICC), "COPPER PIPE INSTALLATION STANDARDS", NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) STANDARDS. IN CASE OF DIFFERENCES, THE MOST STRINGENT SHALL GOVERN. HOWEVER, THIS SHALL NOT BE CONSTRUED TO RELIEVE THIS CONTRACTOR FROM COMPLYING WITH REQUIREMENTS OF THE CONSTRUCTION DOCUMENTS WHICH MAY BE IN EXCESS OF CODE REQUIREMENTS.

2. EXISTING CONDITIONS SHOWN ARE BASED ON LIMITED OBSERVATIONS AND EXISTING DRAWINGS. THIS INFORMATION IS SHOWN FOR REFERENCE ONLY. EXISTING CONDITIONS HAVE NOT BEEN THOROUGHLY VERIFIED. PRIOR TO ANY WORK, FIELD VERIFY ALL EXISTING CONDITIONS. INCLUDING BUT NOT LIMITED TO: SIZES & LOCATIONS OF ALL EQUIPMENT, UTILITIES, PIPING, DUCTWORK, CONTROLS. FIELD VERIFY ALL STRUCTURAL, ARCHITECTURAL, AND SPATIAL CONDITIONS. DOCUMENT ANY FOUND CONFLICTS TO THE ENGINEER IN WRITING.

3. ALL ITEMS SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S INSTALLATION REQUIREMENTS. INSTALL ITEMS PLUMB, LEVEL, SQUARE, AND FREE FROM WARP AND TWIST. MAINTAIN DIMENSIONAL TOLERANCES AND ALIGNMENT WITH SURROUNDING CONSTRUCTION AND ADJACENT SURFACES.

4. ASBESTOS CONTAINING BUILDING MATERIAL (ACBM) SHALL NOT BE USED.

5. ALL ITEMS SHALL BE RATED AND/OR CERTIFIED FOR THE DESIGN OR OPERATING (WHICHEVER IS GREATER) TEMPERATURE & PRESSURE RANGES, AND BE COMPATIBLE WITH THE FLUID(S) BEING CONVEYED AS WELL AS THE INSTALLED ENVIRONMENT.

6. MAINTAIN MINIMUM 10 FOOT CLEAR BETWEEN OUTSIDE AIR INTAKES AND EXHAUST AIR TERMINATIONS OR PLUMBING VENTS.

7. THE DRAWINGS ARE DIAGRAMMATIC AND ARE INTENDED TO SHOW THE APPROXIMATE LOCATION OF OUTLETS, FIXTURES, DUCTWORK, CONTROL DEVICES, EQUIPMENT AND PIPING. FINAL CONNECTION LOCATIONS SHALL BE COORDINATED WITH ACTUAL FIELD CONDITIONS.

8. NOT ALL DISCIPLINES TO BE INSTALLED IN THE BUILDING HAVE BEEN DEPICTED WITH SPECIFIC LOCATION OR ELEVATION INFORMATION IN THE CONSTRUCTION DOCUMENTS AND THEREFORE COORDINATION WITH ALL THE TRADES WILL BE NECESSARY AND IS REQUIRED.

9. PROVIDE MATERIALS, CONNECTORS, FITTINGS, ETCETERA, SPECIFICALLY MENTIONED OR NOT, AS REQUIRED TO RENDER A COMPLETE INSTALLATION. TRANSITION TO EXISTING AS REQUIRED. UTILIZE MATERIALS COMPATIBLE WITH EXISTING.

10. THE CONTRACTOR IS RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, SAFETY PRECAUTIONS AND PROCEDURES.

11. FURNISH ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, FEES, PERMITS, CERTIFICATES OF INSPECTION, ETC., NECESSARY OR REASONABLE, REQUIRED FOR THE COMPLETE INSTALLATION OF ALL WORK.

12. PRIOR TO ANY WORK, EXAMINE THE PREMISES AND EXISTING CONDITIONS. DETERMINE, IN ADVANCE, THE METHODS OF INSTALLING AND CONNECTING THE APPARATUS AND BE FULLY INFORMED AS TO THE SCOPE OF WORK. COORDINATE WITH OTHER DISCIPLINES AS REQUIRED INCLUDING, BUT NOT LIMITED TO:

12.1. VERIFY MEANS AND METHODS OF INSTALLING ALL NEW WORK.

12.2. ENSURE ADEQUATE SPACE IS PROVIDED FOR ROUTINE MAINTENANCE & ALL REQUIRED CLEARANCES.

12.3. COORDINATE LOCATIONS OF ACCESS TO OVERHEAD EQUIPMENT (NEW AND EXISTING) WITH FIXED BUILDING AND FURNITURE ITEMS THAT MAY PREVENT SET UP OF A LADDER.

12.4. COORDINATE ALL UNIT LOCATIONS, DUCT & PIPE ROUTING WITH STRUCTURE & WORK OF OTHER TRADES.

12.5. COORDINATE WITH STRUCTURAL, THE LOCATIONS AND WEIGHTS OF ALL EQUIPMENT.

12.6. COORDINATE THE POWER REQUIREMENTS OF ALL EQUIPMENT WITH ELECTRICAL.

12.7. COORDINATE LOCATIONS OF ALL WALL MOUNTED MECHANICAL ITEMS (INCLUDING BUT NOT LIMITED WALL SENSORS AND THERMOSTATS) WITH WALL FINISHES AND FURNITURE.

12.8. IF CONFLICTS ARE FOUND, THE CONTRACTOR SHALL NOTIFY THE ENGINEER, IN WRITING

13. COORDINATE WITH THE GENERAL CONTRACTOR FOR REQUIRED OPENINGS THROUGH THE BUILDING. ENSURE WATERPROOF MEMBRANES ARE MAINTAINED. EXPANDING FOAM IS NOT ALLOWED.

14. UTILIZE MACHINE SAW CUTTING FOR CUTTING OF CONCRETE AND MASONRY. HOLES SHALL BE MADE USING CORE-DRILLING EQUIPMENT.

15. REPAIR AREAS DAMAGED OR AFFECTED BY THIS SCOPE OF WORK. RESTORE ALL AREAS TO THE ORIGINAL CONDITION.

15.1. SLOPE REPAIRED AREAS TO ENSURE POSITIVE DRAINAGE TO EXISTING DRAINAGE POINTS.

16. STORE MATERIALS PER MANUFACTURER'S REQUIREMENTS. AT A MINIMUM PRODUCTS SHALL BE STORED ON A SOLID, LEVEL AND FLAT AREA, WELL SUPPORTED ABOVE GRADE AND PROTECTED FROM SUNLIGHT AND ENTRY OF DEBRIS.

17. CONNECTIONS TO UTILITIES SHALL BE MADE WITH MINIMAL SHUT-DOWN TIME. SCHEDULE ALL SHUT-DOWNS WITH OWNER.

18. THE SYSTEMS IN THIS CONSTRUCTION DOCUMENT HAVE BEEN DESIGNED AROUND THE MAKES AND SIZES OF THE PRODUCTS NAMED ON THE DRAWINGS OR ELSEWHERE IN THE SPECIFICATIONS. OTHER MAKES OF PRODUCTS NAMED IN THE SPECIFICATIONS, SHOWN ON THE DRAWINGS, OR APPROVED BY THE OWNER, MAY BE FURNISHED AT THE CONTRACTOR'S OPTION. ALTERNATE EQUIPMENT FURNISHED MUST HAVE EQUIVALENT CAPACITY, THE SAME ELECTRICAL CHARACTERISTICS, SUBSTANTIALLY THE SAME PHYSICAL DIMENSIONS, AND CAN BE INSTALLED IN THE SPACE AVAILABLE WITH AMPLE WORKING SPACE AROUND IT. ANY EXTRA COSTS (INCLUDING BUT NOT LIMITED TO DESIGN FEES) RESULTING FROM PRODUCT SUBSTITUTION SHALL BE PAID BY THE CONTRACTOR - AT NO COST TO THE OWNER. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR ANY NECESSARY CHANGES/FIELD MODIFICATIONS AS A RESULT OF SUBSTITUTION OF SPECIFIED EQUIPMENT OR MATERIALS.

19. PRIOR APPROVALS. PRIOR TO THE END OF THE PRIOR APPROVAL PERIOD DURING THE BIDDING PHASE, PRIOR APPROVALS MAY BE SUBMITTED. PRIOR APPROVALS SHALL BE SUBMITTED NO LATER THAN 10 DAYS (UNLESS A LONGER PERIOD IS STATED IN THE IFB DOCUMENTS) PRIOR TO THE BID DATE. SUBMITTALS RECEIVED AFTER THE DEADLINE MAY NOT BE REVIEWED. PRIOR APPROVAL ITEMS INCLUDE: PRODUCT, MATERIAL, SYSTEM, PIECE OF EQUIPMENT, OR SERVICE FROM A SOURCE DIFFERENT FROM THOSE SOURCES IDENTIFIED IN THE CONSTRUCTION DOCUMENTS. THE APPLICATION FOR APPROVAL OF A PROPOSED SOURCE MUST BE ACCOMPANIED BY INFORMATION AND TECHNICAL DATA WHICH THE APPLICANT DESIRES TO SUBMIT IN SUPPORT OF THE APPLICATION.

19.1. PROPOSED ALTERNATES SHALL MEET OR EXCEED CRITERIA DEFINED IN THE CONSTRUCTION DOCUMENTS AND BID DOCUMENTS. SUBMITTALS SHALL INCLUDE CONFIRMATION FROM THE MANUFACTURER THAT ALL CRITERIA SPECIFIED WILL BE MET OR THE MANUFACTURER MUST SPECIFICALLY IDENTIFY ALL DIFFERENCES. SUBMITTALS SHALL INCLUDE ALL THE CONSTRUCTION FEATURES, LISTINGS, RATINGS, ETC. OF EACH TYPICAL ITEM BEING PROPOSED. SUBMITTALS MUST ALSO INCLUDE THE LIST OF ANY ITEMS (CONSTRUCTION FEATURE, OPTION, DESIGN REQUIREMENT, ETC.) THAT DO NOT MEET THE REQUIREMENTS AND DESCRIBE WHAT ALTERNATE IS BEING PROPOSED. IT IS THE DUTY OF THE MANUFACTURER TO POINT OUT ALL DISCREPANCIES / DIFFERENCES. SUBMITTALS WILL NOT BE REVIEWED FOR PROJECT ACCEPTANCE, BUT WITH THE INTENT THAT THE MANUFACTURER CAN PROVIDE ITEMS WHICH WILL MEET THE REQUIREMENTS OR ARE APPROVED (IN WRITING AS PART OF THIS PROCESS) TO BE ACCEPTABLE WITH DEFINED DIFFERENCES.

19.2. THE APPLICATION FOR APPROVAL OF A PROPOSED SOURCE MUST BE ACCOMPANIED BY A SCHEDULE OR OTHER MEANS TO CLEARLY DEFINE ANY DIFFERENCES, DEFICIENCIES, OR BENEFITS THE SUBMITTED ITEM FOR CONSIDERATION DIFFER FROM THE REQUIREMENTS DEFINED IN THE CONSTRUCTION DOCUMENTS AND/OR BID DOCUMENTS. IT IS THE RESPONSIBILITY OF THE SUBMITTER TO ILLUSTRATE ALL DIFFERENCES. SUBMITTALS WITH INSUFFICIENT INFORMATION TO PROVIDE COMPARISON MAY BE RETURNED WITHOUT REVIEW. THE BURDEN OF PROOF OF THE MERIT OF THE PROPOSED SUBSTITUTION IS UPON THE PROPOSER.

19.3. APPROVAL, IF GRANTED, SHALL NOT BE EFFECTIVE UNTIL PUBLISHED IN AN ADDENDUM TO THE BID DOCUMENTS

20. THE CONTRACTOR IS RESPONSIBLE FOR ACCURACY AND COMPLETENESS OF DETAILS SUCH AS QUANTITIES AND DIMENSIONS AND FOR SUBSTANTIATING INSTRUCTIONS FOR THE INSTALLATION AND PERFORMANCE OF EQUIPMENT AND SYSTEMS.

21. SUBMITTALS: DESIGN BASED ON MANUFACTURERS LISTED IN SCHEDULES. PROVIDE SCHEDULED MAKE AND MODEL OR APPROVED EQUIVALENT. SUBMITTALS SHALL BE ELECTRONIC AND FREE OF VIRUSES.

21.1. SUBMIT FOR APPROVAL COPIES OF SHOP DRAWINGS AND/OR CURRENT MANUFACTURER'S LITERATURE TO ILLUSTRATE COMPLIANCE WITH THE SPECIFICATIONS. EACH SUBMITTAL SHALL INCLUDE ANNOTATIONS BY THE CONTRACTOR TO TAG EACH ITEM TO MATCH THE DRAWINGS AND HIGHLIGHT WHICH SPECIFIC ITEMS / FEATURES ARE BEING SUBMITTED.

21.2. PDFs SHALL BE CLEAR AND MINIMAL IN FILE SIZE. DO NOT SUBMIT THE ENTIRE CATALOG - ONLY RELEVANT INFORMATION SHALL BE SUBMITTED. A MINIMUM OF APPROXIMATELY 10 DAYS SHALL BE ALLOTTED BY THE CONTRACTOR FOR EACH SUBMITTAL REVIEW.

21.3. <u>SUBMIT ALL PRODUCT DATA IN ONE SUBMITTAL</u> - DO NOT SUBMIT IN BATCHES. ONLY 2 SUBMITTAL REVIEWS WILL BE PROVIDED AT NO ADDITIONAL COST TO THE CONTRACTOR. CONTRACTOR WILL BE INVOICED FOR ADDITIONAL REVIEWS. PROVIDE SUBMITTALS FOR REVIEW ON THE ALL EQUIPMENT PRIOR TO ANY WORK:

21.3.1. LOUVERS AND ROOF HOODS (INCLUDING ROOF CURBS)

21.3.2. EXHAUST FANS

21.3.3. COOLING COILS AND CONDENSING UNITS

21.3.4. VARIABLE FREQUENCY DRIVES

21.3.5. INSULATION AND JACKETING; INCLUDING NARRATIVE DESCRIBING SCOPE

21.3.6. IDENTIFICATION PRODUCTS; INCLUDING NARRATIVE DESCRIBING SCOPE

21.3.7. TAB CONTRACTOR CREDENTIALS & UNDERSTANDING OF SCOPE OF WORK

21.3.8. CONTROLS SCHEMATICS, DATA SHEETS, ETC. - REFER TO CONTROLS DRAWING

21.3.9. SUBMIT CLOSE-OUT DOCUMENTS PER THE CLOSE OUT PARAGRAPH OF THESE SPECIFICATIONS

21.4. THE DESIGN IS BASED ON THE MANUFACTURERS, MODELS AND SPECIFICATIONS PROVIDED IN THE CONSTRUCTION DOCUMENTS. AS SUCH, WHEN SUBSTITUTING ALTERNATE MANUFACTURERS OR MODELS, THE BURDEN OF PROOF TO SHOW EQUIVALENCY IS UPON THE PROPOSER.

22. <u>PIPING:</u>

22.1. VALVES AND UNIONS SHALL BE NO SMALLER THAN LINE-SIZES SHOWN ON PLANS UNLESS SPECIFICALLY NOTED OTHERWISE.

22.2. REFRIGERANT PIPING SHALL BE TYPE 'ACR' (HARD OR ANNEALED) COMPLIANT WITH ASTM B 280. FACTORY CLEANED AND CAPPED, WROUGHT COPPER FITTINGS.

22.3. METAL PIPING JOINTS:

22.3.1. BRAZE JOINTS PER "COPPER PIPE STANDARDS". PURGE LINES WITH DRY NITROGEN GAS DURING BRAZING. VALVES AND ACCESSORIES USED IN REFRIGERANT PIPING SYSTEMS SHALL BE COMPATIBLE WITH REFRIGERANT AND OPERATING PRESSURES / TEMPERATURES.

22.4. CONTRACTOR OPTION (MECHANICAL COUPLINGS): AS MANUFACTURERED BY REFRIGERANT COUPLING SYSTEMS, INC OR EQUAL. INSTALLER SHALL BE FACTORY TRAINED AND USE MANUFACTURER APPROVED TOOLS.

22.4.1. COPPER TUBE: STRAIGHT LENGTH SHALL BE ASTM B 75, ASTM B 280, UNS C12200, H55 TEMPER (LIGHT DRAWN), ACR BENDING QUALITY; CLEANED, EDDY CURRENT TESTED, AND PLUGGED PER ASTM B 280.

22.4.2. MECHANICALLY ATTACHED FITTINGS SHALL BE BRASS BODY MECHANICALLY ATTACHED FITTINGS, ETL LISTED, PER UL-207 WITH AN ALLOWABLE WORKING PRESSURE OF 1,167 PSI.: MANUFACTURER'S COUPLINGS, REDUCERS, AND FLARE FITTINGS. THE PRIMARY SEAL SHALL BE METAL TO METAL SEAL. USE OF O-RING SEALS IS NOT PERMITTED. FIELD BENDS (ALL ANGLES): ASME B31.5. UTILIZE MANUFACTURER'S APPROVED TOOLS.

22.4.3. SERVICE VALVES: BODY: FORGED BRASS WITH BRASS CAP; CORE: REMOVABLE BALL-TYPE CHECK VALVE WITH STAINLESS-STEEL SPRING; SEAT: POLYTETRAFLUOROETHYLENE; END CONNECTIONS: STRAIGHT ENDS. WORKING PRESSURE RATING: 700 PSIG; MAXIMUM OPERATING TEMPERATURE 250 DEG. F; VALVES MUST BE SPECIFICALLY RATED FOR R-410A.

22.5. REFER TO REFRIGERANT PIPING NOTES ON DRAWINGS.

22.6. PROVIDE SHALLOW ONE-PIECE CHROME PLATED ESCUTCHEONS FOR ALL PIPE PENETRATIONS THROUGH FINISHED WALLS. PIPING THRU EXTERIOR WALLS SHALL UTILIZE STAINLESS STEEL ESCUTCHEONS.

22.7. PIPING SHALL NOT BE EMBEDDED IN CONCRETE OR MASONRY CONSTRUCTION.

22.8. UN-INSULATED COPPER TUBING & PIPING SHALL BE ISOLATED FROM CONTACT WITH STEEL CLAMPS AND HANGERS, CONCRETE, MASONRY, ETC. THROUGH USE OF HALF-LAPPED 10 MIL. TAPE, FACTORY PLASTIC HANGER INSERTS, OR 20 MIL PLASTIC SLEEVE. NOTE THAT COATED OR COPPER-PLATED SUPPORTS SHALL NOT BE CONSIDERED AS APPROVED SUBSTITUTES FOR TAPE, INSERTS OR SLEEVE TYPE ISOLATION.

22.9. OVERHEAD PIPING SHALL BE SUPPORTED BY SYSTEMS UTILIZING CARBON STEEL ADJUSTABLE CLEVIS STYLE HANGERS SUPPORTED FROM STRUCTURE ABOVE WITH APPROPRIATE CLAMPS, STRUT AND THREADED RODS. TRAPEZE SUPPORTS WITH EQUIVALENT ISOLATION MAY BE USED AT CONTRACTOR'S OPTION.

22.9.1. STRAP OR "PLUMBER'S TAPE" SHALL NOT BE USED.

23. <u>PIPE INSULATION</u>: COMPLETELY INSULATE THE PIPING SYSTEMS PER THESE SPECIFICATIONS AND SCHEDULE BELOW. DO NOT INSULATE UNTIL PIPING HAS PASSED ALL QUALITY CONTROL REVIEWS AND TESTS. ALL INSULATION SHALL COMPLY WITH THE SPECIFICATIONS BELOW.

23.1. VAPOR-RESISTANT, MAX 0.08 PERM IN PER ASTM E 96. WATER ABSORPTION LESS THAN 0.5% BY VOLUME PER ASTM C209.

23.2. PLENUM RATED PER ASTM E84.

23.3. SERVICE TEMPERATURES: MINIMUM -200°F, MAXIMUM +220°F.

23.4. ASTM C518 CERTIFIED THERMAL CONDUCTIVITY VALUE NOT EXCEEDING 0.24 BTU-IN/(HxFT2x°F) AT 100°F MEAN TEMPERATURE.

23.5. <u>PIPE INSULATION</u>: ELASTOMERIC EQUAL TO ARMACELL "AP ARMAFLEX BLACK LAPSEAL". REFER TO SCHEDULE BELOW FOR APPLICATION

23.6. ELASTOMERIC INSULATION SHALL BE JOINED USING MFGR'S LOW VOC CONTACT ADHESIVE - TAPE IS NOT ALLOWED.

23.7. ELASTOMERIC PIPE INSULATION SHALL INCLUDE FACTORY INSERTS EQUAL TO "ARMAFLEX IPH" AT PIPE HANGERS AND CLAMPS TO MAINTAIN A CONTINUOUS VAPOR BARRIER. JOIN ENDS OF INSERTS TO INSULATION WITH MFGR'S ADHESIVES.

23.8. MAINTAIN CONTINUOUS INSULATION WITH VAPOR BARRIER (THRU SUPPORTS, WALLS, ETC.) ON SYSTEMS WHICH MAY CONDENSE (CONVEY FLUIDS BELOW DEWPOINT).

23.9. INSULATION SHALL BE APPLIED IN A NEAT AND WORKMANLIKE MANNER. CONTRACTOR SHALL BE REQUIRED TO REMOVE AND REPLACE ALL INSULATION NOT APPLIED IN STRICT ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS, NAIMA STANDARDS, AND/OR NOT PRESENTING A NEAT APPEARANCE.

23.10. ANY INSULATION WHICH HAS BEEN WET OR SHOWING SIGNS OF MOLD SHALL BE DISCARDED IN AN APPROVED MANNER AND REPLACED WITH NEW.

23.11. DO NOT EXPOSE INSULATION TO THE WEATHER. PROTECT DURING STORAGE AND INSTALL AS REQUIRED.

23.12. LOCATE INSULATION AND COVER SEAMS IN LEAST VISIBLE LOCATIONS. INSTALL TO SHED WATER FROM ABOVE - LAP OVER.

23.13. WHEREVER POSSIBLE, LOCATE JOINTS IN HORIZONTAL INSULATION AT 3 AND / OR 9 O'CLOCK (HORIZONTAL) WITH SEAM LAP FROM TOP OVER LOWER PORTION.

23.14. THE INNER DIAMETER OF ALL INSULATION PRODUCTS SHALL MATCH THE OUTSIDE DIAMETER OF THE PIPING IT COVERS (I.E. INSULATION COVERING STEEL PIPE SHALL BE MADE TO FIT STEEL PIPE NOT COPPER).

23.15. INSULATED PIPING EXPOSED TO THE WEATHER SHALL BE COMPLETELY COVERED WITH 0.016" THICK EMBOSSED ALUMINUM JACKETING SECURED WITH ALUMINUM OR STAINLESS STEEL BANDS INSTALLED OVER THE INSULATION. FITTING COVERS SHALL BE ALUMINUM OR STAINLESS STEEL. FLASH EDGES TO MAKE WEATHERTIGHT. SEAL JOINTS & SEAMS WITH 25 YEAR CLEAR SILICONE. ENTIRE ASSEMBLY SHALL BE WEATHER-TIGHT. RIVETS, SCREWS AND SIMILAR FASTENERS THRU THE ALUMINUM JACKET ARE NOT ALLOWED.

23.16. <u>PIPING INSULATION APPLICATION AND THICKNESS REQUIREMENTS:</u>

23.16.1. EXTERIOR PIPING: INSULATION THICKNESS AS INDICATED BELOW + ALUMINUM JACKETING AND ALUMINUM FITTING COVERS AS SPECIFIED ABOVE

23.16.2. REFRIGERANT PIPING (BOTH LINES WHERE REQUIRED BY MANUFACTURER): MINIMUM 3/4" THICK ELASTOMERIC

24. <u>DUCTWORK:</u> MATERIALS, GAUGES, SEALING, INSTALLATION METHODS, HANGING AND SUPPORT, AND INSULATION INSTALLATION SHALL COMPLY WITH SMACNA STANDARDS.

24.1. AIR CONDITIONING DUCTWORK SHALL BE FABRICATED OF ASTM A527, G90 GALVANIZED LOCK-FORMING QUALITY STEEL SHEETS.

24.2. MINIMUM 24 GAUGE

24.3. LONGITUDINAL SEAMS SHALL BE PITTSBURG CONSTRUCTION.

24.4. SEAL ALL JOINTS USING LOW VOC, UL 181A OR 181B LISTED DUCT MASTIC SEALANT OR APPROVED ROLLED ELASTOMERIC SEALANT. SEAL ALL JOINTS, LONGITUDINAL & TRANSVERSE SEAMS AND CONNECTIONS.

24.5. SEALANT USED FOR EXPOSED DUCTWORK SHALL BE INSTALLED ON THE INTERIOR WHERE POSSIBLE AND SHALL MATCH DUCT COLOR AS CLOSE AS POSSIBLE. INSTALL TO MINIMIZE EXCESS FOR CLEAN APPEARANCE.

24.5.1. CONTRACTOR OPTION: PROVIDE ROLLED MASTIC SEALING SYSTEM. PROVIDE CARLISLE HARDCAST FOIL-GRIP 1403-181BFX OR FOIL-GRIP 1402.

24.6. 90 DEGREE ELBOWS SHALL BE LONG SWEEP DESIGN (SMACNA TYPE RE-1 WITH MINIMUM 1.5 RADIUS). IF LONG SWEEP ELBOWS CANNOT BE INSTALLED DUE TO SITE CONDITIONS, ELBOWS MAY BE SMACNA TYPE RE-2 WITH "SMALL" TURNING VANES (2" RADIUS).

24.7. TRANSITIONS SHALL BE MADE AS LONG AS PRACTICAL. MAXIMUM ANGLE FROM THE DUCT SIDE SHALL BE: DIVERGENCE = MAXIMUM 30°, CONVERGENCE = MAX 45°. 15 DEGREES IS PREFERRED.

24.8. DUCTWORK SHALL BE STORED IN A CLEAN DRY LOCATION. TEMPORARILY COVER ALL OPENINGS TO PREVENT ENTRY OF DUST, MOISTURE, AND GENERAL CONSTRUCTION DIRT/DEBRIS. USE DUCTMATE "PROGUARD" PROTECTANT WRAP, OR APPROVED EQUIVALENT.

25. <u>DAMPERS:</u>

25.0.1. MULTIPLE BLADE DAMPERS SHALL HAVE BLADES PARALLEL TO THE SHORT DIRECTION.

25.0.2. <u>BACKDRAFT DAMPERS:</u> GRAVITY TYPE, EXTRUDED ALUMINUM, VERTICAL OR HORIZONTAL MOUNTING, INTAKE OR EXHAUST AS REQUIRED, TESTED PER AMCA 500D AT 1"WG FOR LEAKAGE NOT EXCEEDING 20 CFM / SF WHERE NOT LESS THAN 24" IN EITHER DIMENSION AND 40 CFM / SF WHERE LESS THAN 24" IN EITHER DIMENSION. PROVIDE ADJUSTABLE COUNTERBALANCE WHERE INDICATED AND FOR ALL BUILDING PRESSURIZATION CONTROL DAMPERS. MANUFACTURED BY: POTTORFF, GREENHECK, RUSKIN, OR EQUAL.

25.0.3. <u>AIRFLOW CONTROL DAMPERS (RETURN AND OUTSIDE AIR DUCTS):</u> OPPOSED BLADE ACTION; ALUMINUM FRAME WITH JAMB SEALS; 4" DEEP ALUMINUM AIRFOIL BLADES WITH EDGE SEALS; ALL BLADES SHALL BE SYMMETRICALLY PIVOTED. SYNTHETIC BEARINGS. 1/2" AXLES AND CONTROL SHAFT; COMPLETE LINKAGE HARDWARE, ALL PARTS SHALL BE ZINC-PLATED STEEL OR ALUMINUM. DAMPERS SHALL BE CUSTOM MADE TO REQUIRED SIZE, WITH BLADE STOPS NOT EXCEEDING 1.25" IN HEIGHT. AMCA RATED FOR LEAKAGE CLASS 1 [MAX LEAKAGE OF 4 CFM/SF AT 1 IN. W.G.]. COMPLETE WITH ACTUATORS AS REQUIRED FOR EACH DAMPER SIZE AND PRESSURE CONDITIONS. COORDINATE WITH CONTROLS. EQUAL TO POTTORFF CD-54 NARROWLINE SERIES.

26. <u>DUCT INSULATION</u>: ALL AIR CONDITIONING DUCTWORK SHALL BE INSULATED WITH LINER PER SPECIFICATIONS BELOW. MATCH EXISTING CONDITIONS (I.E. EXISTING WRAPPED DUCTS GET NEW WRAP, NOT LINER). ENSURE DUCTS WITH LINER ARE INCREASED IN SIZE TO ACCOMMODATE THE LINER - DO NOT RESTRICT THE AIRFLOW AREA. THICKNESS REQUIREMENTS:

26.1. DUCTS LOCATED WITHIN THE BUILDING INSULATION ENVELOPE: MINIMUM R-6 REQUIRED: 1-1/2" THICK LINER OR 2-1/8" THICK FLEXIBLE WRAP OR 1-1/2" RIGID BOARD.

27. <u>DUCT LINER:</u> FIBERGLASS, ACOUSTICAL, MAT FACE, FLAME RETARDANT, BONDED WITH A THERMOSETTING RESIN AND MEET ASTM C1071. MAXIMUM VELOCITY ON MAT COATED AIR-SIDE = 5,000 FT/MIN. APPLY WITH UL LISTED WATERPROOF TYPE ADHESIVE AND GALVANIZED STEEL PINS, WELDED OR MECHANICALLY FASTENED. EQUIVALENT TO CERTAINTEED "TOUGHGARD R" DUCT LINER WITH ENHANCED SURFACE

28. <u>FLEX CONNECTORS</u>: PROVIDE AT ALL DUCT-TO-UNIT CONNECTIONS. UL LISTED FIRE-RETARDANT COATED WOVEN GLASS FIBER FABRIC TO NFPA 90A, MINIMIM DENSITY 22 OZ. PER SQ. YARD, MINIMUM 3" WIDE, 24 GAUGE GALVANIZED SHEETMETAL CONNECTORS PERMANENTLY ATTACHED TO THE FLEXIBLE MATERIAL, MILDEW RESISTANT, WATER-RESISTANT. UV-RESISTANT, RATED FOR THE SYSTEM TEMPERATURE AND PRESSURE AS MANUFACTURED BY DURO-DYNE (MODEL 'EXCELON' FOR INTERIOR USE, MODEL 'DUROLON' FOR EXTERIOR USE) OR APPROVED EQUIVALENT. PROVIDE FLEXIBLE CONNECTIONS AT ALL DUCT-TO-UNIT CONNECTIONS.

29. <u>AIRFLOW STATION, FLOW SENSING ELEMENTS MOUNTED IN A FACTORY CONSTRUCTED FRAME:</u> THE FLOW SENSING ELEMENT SHALL BE CONSTRUCTED OF 316 SS. SENSORS SHALL BE FACTORY MOUNTED IN AN AIRFLOW STATION CONSTRUCTED OF 14 GA. GALVANIZED STEEL, 8" DEEP CASING WITH 90° CONNECTING FLANGES AND A GALVANIZED EXPANDED METAL SHEET. THE AIRFLOW STATION SHALL HAVE THE FLOW ELEMENTS MANIFOLDED TOGETHER WITH 1/4" SS TUBING AND 1/4" COMPRESSION FITTINGS FOR FIELD INSTALLATION. THE REFERENCE AIRFLOW TEMPERATURE SENSOR SHALL BE MOUNTED IN THE AIRFLOW STATION. THE AIRFLOW STATION SHALL BE THE AIR MONITOR OAM II - AFS TYPE.

30. <u>PIPE SUPPORTS:</u> PIPING ON ROOF SHALL BE SUPPORTED USING FACTORY FABRICATED ASSEMBLIES OF SOLID BASE POLYCARBONATE, HIGH DENSITY POLYPROPYLENE PLASTIC, RECYCLED TIRE RUBBER, GALVANIZED, OR STAINLESS STEEL. COMPLETE WITH ALL HARDWARE AND ACCESSORIES NECESSARY TO RENDER A COMPLETE INSTALLATION - COORDINATE WITH PLANS AND DETAILS. SUPPORT ASSEMBLIES SHALL BE VERTICALLY ADJUSTABLE TO ACCOMMODATE SLOPE AND REQUIREMENTS OF THE PROJECT. COORDINATE WITH MANUFACTURER'S REPRESENTATIVE FOR SELECTIONS. FIELD VERIFY PIPING MATERIALS, SIZES, DUTY, LOCATIONS, AND ROOF TYPE. PROVIDE LOOSE-FITTING PIPE CLAMPS AT EACH PIPE SUPPORT; CLAMPS SHALL NOT RESTRICT MOVEMENT OF PIPING. SPACING SHALL BE IN ACCORDANCE WITH NOTES ON THESE DRAWINGS, CODE, AND AHJ REQUIREMENTS (WHICHEVER IS MORE STRINGENT). APPROVED MANUFACTURERS: C-PORT/MIFAB (MIFAB.COM), MAPA (MAPAPRODUCTS.COM), MIRO (MIROIND.COM), PPH (PORTABLEPIPEHANGERS.COM). WOOD SUPPORTS, ERICO "PIPE PIER" (OR SIMILAR FOAM CONSTRUCTION SUPPORTS), DURA-BLOK ARE NOT ACCEPTABLE. SUBJECT TO OWNER & ENGINEER APPROVAL, INTERIOR PIPING MAY BE SUPPORTED BY STRUT OR FABRICATED STEEL ASSEMBLIES ATTACHED TO STRUCTURE. ASSEMBLIES MUST BE PAINTED. COORDINATE INTENT WITH OWNER PRIOR TO INSTALL.

31. <u>EQUIPMENT TAGS</u>: PROVIDE ENGRAVED NAMEPLATES OR UTILIZE OUTDOOR-RATED PAINT AND FACTORY FABRICATED STENCILS FOR EACH PIECE OF EQUIPMENT. NAMEPLATES SHALL BE MINIMUM 4x6 WITH 1/4" TALL LETTERING. STENCILS MINIMUM 2" TALL WITH MOUNTING HOLES AND ADHESIVE BACKING. PERMANENTLY FASTEN TO UNIT. INCLUDE MARK, INSTALL DATE AND SAFETY OR EMERGENCY PRECAUTIONS. COORDINATE IDENTIFICATION REQUIREMENTS AND NUMBERING SEQUENCE WITH EXISTING CONDITIONS, OWNER AND EMCS CONTRACTOR. FOR OUTDOOR APPLICATIONS, LOCATE ON NORTH SIDE OF EQUIPMENT WHENEVER POSSIBLE.

31.1. WHERE USED OUTDOORS, NAMEPLATES SHALL BE UV-RESISTANT, LASER-ETCHED ALUMINUM AND PERMANENTLY SECURED TO THE EQUIPMENT WITH RIVETS - PRODUCT EQUIVALENT TO BRIMAR LASER-ETHCED ALUMINUM NAMEPLATES.

32. <u>PIPE IDENTIFICATION</u>: PROVIDE PIPE IDENTIFICATION ON ALL IN MECHANICAL SPACES SUCH AS MECHANICAL ROOM, ROOF, ETC. PROVIDE PRE-MANUFACTURED SNAP-ON PLASTIC WRAP-AROUND TYPE SIZED TO COVER THE ENTIRE CIRCUMFERENCE OF PIPING AND INSULATION. EACH IDENTIFICATION LOCATION SHALL INCLUDE ARROWS INDICATING FLOW POINTING AWAY FROM THE TEXT. COLORS AND INSTALL PER ANSI STANDARD A13.1. LOCATE AT MAXIMUM 20 FOOT CENTERS, AT PENETRATIONS THRU WALLS, AND CHANGES IN DIRECTION.

33. <u>PAINTING</u>: ALL ITEMS WHICH REQUIRE PAINTING SHALL BE PREPPED AND PRIMED IN ACCORDANCE WITH THE PAINT MANUFACTURER'S INSTRUCTIONS. OBTAIN COLOR REQUIREMENTS FROM OWNER IN WRITING.

33.1. TOUCH UP DAMAGED FACTORY FINISHES WITH FACTORY APPROVED PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

33.2. PAINT DUCTWORK VISIBLE BEHIND AIR DEVICES FLAT BLACK. INCLUDES WELD-PIN WASHERS.

33.3. PAINT STEEL PIPE SUPPORTS / STANDS.

34. <u>TESTING AND BALANCING</u>: HVAC SYSTEMS SHALL BE TESTED, ADJUSTED AND BALANCED BY A CERTIFIED TEST AND BALANCE CONTRACTOR. TESTING AND BALANCING SHALL BE PER AABC STANDARDS. SUBMIT COPIES OF FINAL REPORTS, COMPLETE WITH TECHNICIAN'S OBSERVATIONS, FOR APPROVAL. COORDINATE QUANTITY AND SUBMITTAL FORMAT REQUIREMENTS WITH OWNER.

34.1. BALANCE SUPPLY AND RETURN AND RELIEF / EXHAUST AIR FLOW RATES TO + OR - 10% OF THE SCHEDULED VALUES IN EACH MODE OF OPERATION (NORMAL, DCV).

34.1.1. BALANCE OUTSIDE AIR TO 0 TO +10% OF THE SCHEDULED VALUES IN EACH MODE OF OPERATION.

34.1.2. BALANCE EACH ZONE (AT AHU VIA TRAVERSE IS ACCEPTABLE)

34.1.3. RELIEF FAN PRESSURE READING & WORK WITH CONTROLS CONTRACTOR TO SETUP CONTROL SETTINGS

34.2. TEST COIL TEMPERATURES OF EACH SYSTEM.

34.3. VERIFY CORRECT OPERATION OF CO2 CONTROL SYSTEMS (DCV).

34.4. VERIFY CORRECT OPERATION OF DAMPERS.

34.1. WHERE AIR FLOW MONITORS AR USED, DOCUMENT DATA FROM ASSOCIATED FACTORY CONTROLLER INCLUDING AIR TEMPERATURES, CFM'S, VELOCITY AND HUMIDITY.

35. <u>CLEAN-UP & STORAGE:</u> MAINTAIN THE AREA OF WORK AND STORAGE IN AN ORGANIZED AND TIDY CONDITION AT ALL TIMES.

35.1. ALL INSTRUCTIONS ISSUED BY THE OWNER IN REGARD TO STORAGE OF MATERIALS, PROTECTIVE MEASURES, CLEANING OF DEBRIS ETC., SHALL BE EXPLICITLY FOLLOWED.

35.2. AT THE COMPLETION OF EACH DAY'S WORK, LEAVE AREAS DIRECTLY AFFECTED BY WORK BROOM CLEAN.

35.3. UPON COMPLETION OF THE WORK, THOROUGHLY CLEAN ALL MACHINERY, PIPING, ETC. TURN OVER TO OWNER IN A LIKE-NEW CONDITION.

36. <u>CONSTRUCTION ADMINISTRATION PHASE:</u> THE CONTRACTOR SHALL PROVIDE DETAILED SCHEDULE FOR ALL MAJOR ACTIVITIES PRIOR TO ANY WORK. NOTE ALL UTILITY SHUT-DOWNS AND ANY ITEMS REQUIRING OWNER INVOLVEMENT. INDICATE MILESTONES FOR DESIGNER REVIEW OF INSTALLED WORK. RFI's, PAY APPS, CHANGE ORDER REQUESTS, AND OTHER CA-PHASE ITEMS WHICH REQUIRE OWNER AND/OR DESIGN REVIEW WILL BE PROCESSED IN A MINIMUM OF APPROXIMATELY 10 WORKING DAYS. RFI's SHALL BE COMPLETE WITH THE CONTRACTOR'S PROPOSED SOLUTION SUFFICIENT ENOUGH TO PERMIT THE ENGINEER TO MAKE A REASONABLE DETERMINATION WITHOUT EXCESSIVE RESEARCH OR CREATION OF DRAWINGS OR SPECIFICATIONS.

37. <u>O&M</u>: SUBMIT OPERATION AND MAINTENANCE MANUALS PER OWNER AND AHJ REQUIREMENTS.

37.1. INCLUDE MANUFACTURER'S OPERATION, MAINTENANCE, WIRING AND WARRANTY INFORMATION AS WELL AS SUGGESTED WEEK, MONTH AND YEARLY SCHEDULED MAINTENANCE ITEMS FOR EACH PIECE OF EQUIPMENT.

37.2. MANUFACTURER'S EQUIPMENT MANUALS SHALL INCLUDE THE EQUIPMENT TAGS USED ON THIS PROJECT AS WELL AS BE EDITED AND HIGHLIGHTED SO AS TO INDICATE WHICH MODEL WAS INSTALLED, WHICH FACTORY OPTIONS WERE USED (STRIKE-THRU ANY THAT WERE NOT USED); INCLUDING VOLTAGE.

37.3. MANUALS SHALL INCLUDE COMPANY NAMES, PHONE NUMBERS, ADDRESSES, ETC. FOR EACH CONTRACTOR AND SUPPLIERS OF MANUFACTURERS USED.

37.4. MANUALS SHALL INCLUDE ALL EQUIPMENT FACTORY START-UP REPORTS; SIGNED AND DATED BY THE MANUFACTURER'S TRAINED REPRESENTATIVE AND CONTACT INFORMATION.

38. <u>WARRANTY</u>: PARTS AND LABOR SHALL BE GUARANTEED FOR THE PERIOD REQUIRED BY THE OWNER, MINIMUM OF 2 YEARS FROM THE DATE OF SUBSTANTIAL COMPLETION AS AGREED UPON BY THE OWNER. GUARANTEE APPLIES TO CONTRACTOR AND ANY AND ALL SUBCONTRACTORS HIRED BY THE CONTRACTOR. EACH CONTRACTOR SHALL PROVIDE A SIGNED, DATED, AND NOTARIZED WARRANTY LETTER. INCLUDE COPIES OF ALL WARRANTIES IN O&M MANUALS.

38.1. COMPLETE AND FURNISH A WRITTEN GUARANTEE INDICATING THAT THE SYSTEMS HAS BEEN INSTALLED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, NOTING ANY CHANGES MADE DURING CONSTRUCTION.

38.2. REPLACE MATERIALS OR EQUIPMENT WHICH REQUIRES EXCESSIVE MAINTENANCE DURING THE GUARANTEE PERIOD.

38.3. SERVICE CALLS, REPAIRS, ADJUSTMENTS, AND REPLACEMENTS DURING THE GUARANTEE PERIOD SHALL BE MADE WITHOUT COST TO THE OWNER.

38.4. CONNECTIONS MADE TO OWNER PROVIDED EQUIPMENT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE INCLUDED IN THE GUARANTEE.

38.5. FACTORY WARRANTIES SHALL BE PROVIDED ON ALL EQUIPMENT FURNISHED AND EVIDENCE OF SAME SHALL BE INCLUDED IN EACH O & M MANUAL.

38.6. PROVIDE WARRANTY CERTIFICATES FOR ALL ITEMS WITH WARRANTIES THAT ARE IN EXCESS OF THE PROJECT GUARANTEE.

38.6.1. ENSURE TO DOCUMENT THE DATE, OF EACH SUBMITTED ITEM, OF WHEN THE WARRANTY PERIOD BEGINS; OTHERWISE, THE DATE OF SUBSTANTIAL COMPLETION FOR THE PROJECT WILL BE USED FOR THIS PURPOSE.

39. <u>AS-BUILTS</u>: DOCUMENT ALL CHANGES ON "AS-BUILT" DRAWINGS MAINTAINED AT THE PROJECT SITE. MAKE NOTE OF ANY CHANGES MADE IN LAYOUT, ALL FOUND CONDITIONS, RFI'S, ADDENDUMS, ETC. UNDERGROUND ITEMS SHALL BE NOTED WITH DEPTH AND REFERENCED FROM AT LEAST THREE PERMANENT ABOVE GROUND REFERENCE POINTS. INCORPORATE ALL INFORMATION INTO ONE CLEAN SET OF DRAWINGS AND MARK "AS-BUILT" WITH CONTRACTOR NAME AND DATE ON EACH. ALL CHANGES SHALL BE CLOUDED AND DATED. SUBMIT FINAL COPIES TO THE OWNER AT THE CLOSE OF THE PROJECT. COORDINATE QUANTITY AND FORMAT REQUIREMENTS WITH OWNER.

40. <u>CLOSE-OUT DOCUMENTATION</u>: SUBMIT PDF ELECTRONIC FORMAT, CLOSE-OUT DOCUMENTS PER OWNER AND AHJ REQUIREMENTS; PROVIDE HARD COPIES, USB DRIVE AND/OR DVD AS REQUIRED BY OWNER. QUANTITIES AS SPECIFIED BY OWNER. ASSEMBLE INTO A SINGLE ELECTRONICALLY INDEXED FILE. CLOSE-OUT DOCUMENTATION SHALL INCLUDE, BUT NOT LIMITED TO, THE FOLLOWING DOCUMENTS. REFER TO SPECIFICATIONS ABOVE FOR REQUIREMENTS.

40.1. ALL TESTING REPORTS SUCH AS PRESSURE TESTS, ETC.;

40.2. EQUIPMENT START UP LOGS

40.3. PROJECT AND EQUIPMENT WARRANTIES. INCLUDE WARRANTIES IN EXCESS OF THE PROJECT LIMITS;

40.4. OPERATION AND MAINTENANCE MANUALS;

40.5. CONTROLS POINT-TO-POINT VERIFICATION LOGS AND COMMISSIONING WITH TECHNICIAN'S NOTES - REFER TO EMCS NOTES;

40.6. AS-BUILT DRAWINGS;

40.7. TEST AND BALANCE REPORTS WITH TECHNICIAN'S NOTES;

40.8. COPIES OF FIELD OBSERVATION REPORTS WITH WRITTEN RESPONSES FROM THE CONTRACTOR.

Amphitheater Public Schools

BLDG C - EAST WING
COOLING COIL REPLACEMENT
Prince Elementary School
125 E Prince Rd, Tucson, AZ 85705

SEAL:
Registered Professional Engineer (Mechanical)
CERTIFICATE NO. 35960
DONOVAN F. KELLY
DATE SIGNED 30 NOV 2022
ARIZONA U.S.A.

KELLY WRIGHT & ASSOCIATES · PC
HVAC·PLUMBING·FIRE PROTECTION
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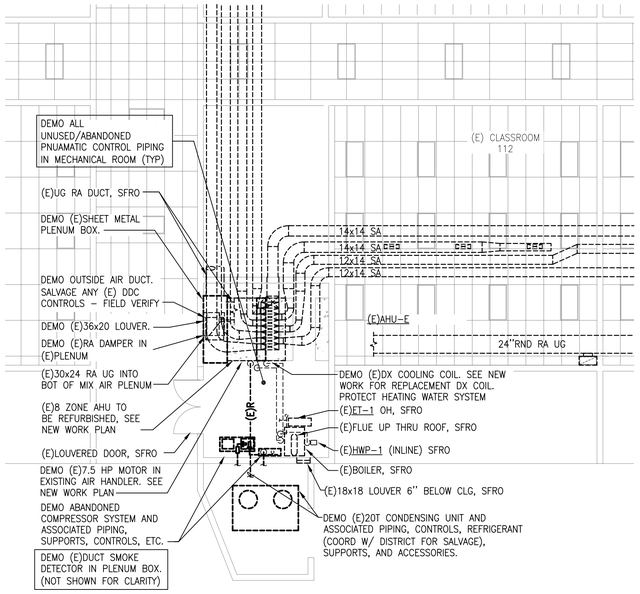
KWA PROJECT NO:	21045
DATE:	November 30, 2022
DRAWN BY:	MB
DESIGNED BY:	MB
CHECKED BY:	DFK

SHEET CONTENTS:

HVAC SPECIFICATIONS

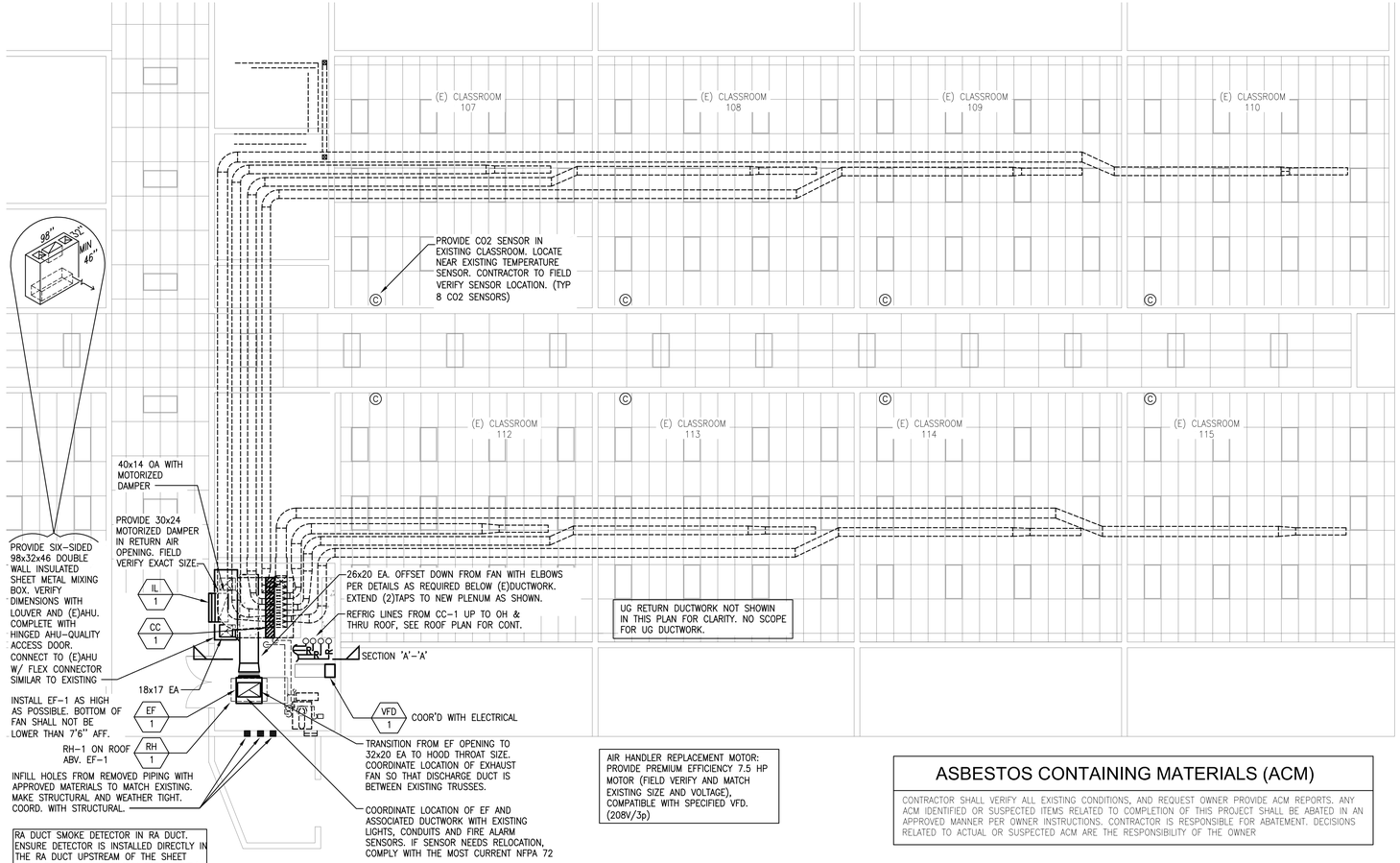
SHEET

M0.2



3 DEMO HVAC FLOOR PLAN - EAST WING

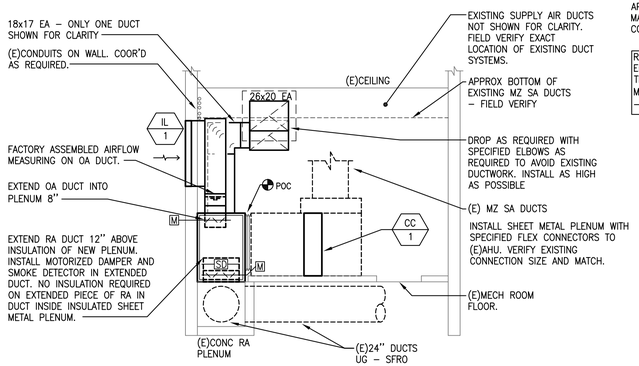
SCALE: APPROX 1/8"=1'-0" 0 1' 2' 4' 8' 16' 32' NORTH



AIR HANDLER REPLACEMENT MOTOR: PROVIDE PREMIUM EFFICIENCY 7.5 HP MOTOR (FIELD VERIFY AND MATCH EXISTING SIZE AND VOLTAGE), COMPATIBLE WITH SPECIFIED VFD. (208V/3p)

ASBESTOS CONTAINING MATERIALS (ACM)

CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS, AND REQUEST OWNER PROVIDE ACM REPORTS. ANY ACM IDENTIFIED OR SUSPECTED ITEMS RELATED TO COMPLETION OF THIS PROJECT SHALL BE ABATED IN AN APPROVED MANNER PER OWNER INSTRUCTIONS. CONTRACTOR IS RESPONSIBLE FOR ABATEMENT. DECISIONS RELATED TO ACTUAL OR SUSPECTED ACM ARE THE RESPONSIBILITY OF THE OWNER

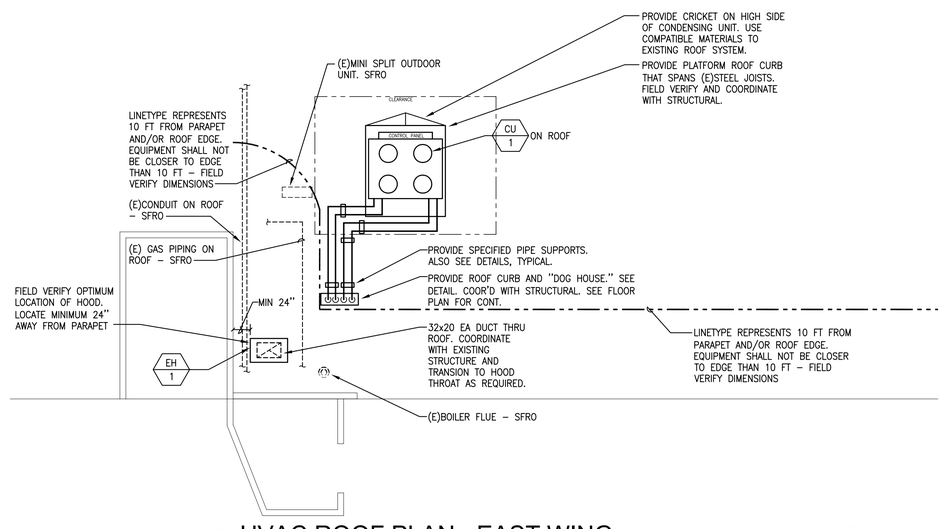


4 SECTION 'A'-'A'

SCALE: APPROX 1/4"=1'-0" 0 0.5' 1' 2' 4' 8' 16'

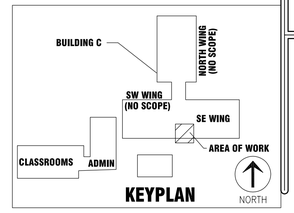
1 HVAC FLOOR PLAN - EAST WING

SCALE: APPROX 1/8"=1'-0" 0 1' 2' 4' 8' 16' 32' NORTH



2 HVAC ROOF PLAN - EAST WING

SCALE: APPROX 1/8"=1'-0" 0 1' 2' 4' 8' 16' 32' NORTH



Amphitheater Public Schools

BLDG C - EAST WING
COOLING COIL REPLACEMENT
Prince Elementary School
125 E Prince Rd, Tucson, AZ 85705

SEAL:

KELLY WRIGHT & ASSOCIATES · PC
HVAC • PLUMBING • FIRE PROTECTION
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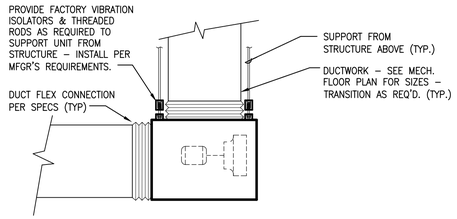
WWW.KWMECH.COM

KWA PROJECT NO: 21045
DATE: November 30, 2022
DRAWN BY: MB
DESIGNED BY: MB
CHECKED BY: DFK

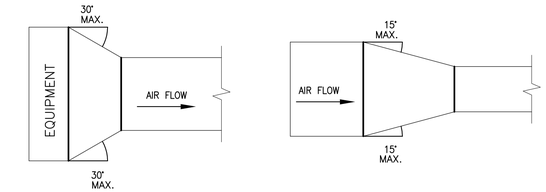
SHEET CONTENTS:
DEMO AND RENOVATION MECHANICAL PLANS

SHEET
M1.0
6 OF 11
Prince ES - Bldg C East Wing



8 INLINE EXHAUST FAN DETAIL

SCALE: NONE



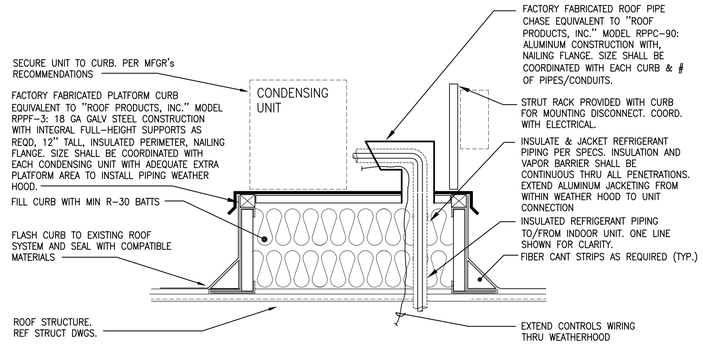
TYP. DUCT TO EQUIP. TRANSITION PLAN OR SIDE VIEW

TYP. DUCTWORK TRANSITION PLAN OR SIDE VIEW

4 TYP DUCTWORK TRANSITION DETAIL

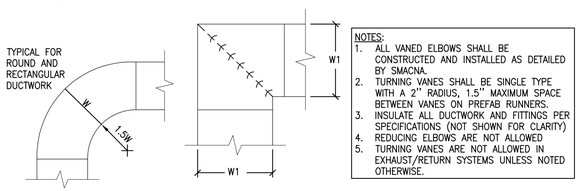
SCALE: NONE

NOTES FOR ROOFTOP EQUIPMENT CURB DETAIL:
1. CURBS SHALL ACCOMMODATE ROOF TYPE & SLOPE, APPLICATION, UNIT DIMENSIONS AND OPERATING WEIGHT FOR EACH UNIT AS REQUIRED TO ALLOW EQUIPMENT TO BE INSTALLED LEVEL & PLUMB.
2. SECURE CURBS TO STRUCTURE IN APPROVED MANNER.
3. COORD FLASHING & ROOFING WORK WITH THE DISTRICT'S ROOFING REQUIREMENTS.
4. ENSURE ANY EXISTING ROOF WARRANTY IS MAINTAINED. PROVIDE MATERIALS COMPATIBLE WITH EXISTING ROOFING. COORDINATE WITH OWNER FOR EXISTING WARRANTY INFO.
5. COORDINATE CURB LENGTH SO THAT IT SPANS TWO EXISTING STEEL JOISTS APPROXIMATELY 10 FT APART. FIELD VERIFY EXACT DISTANCE PRIOR TO ORDERING CURB. COORDINATE WITH STRUCTURAL DRAWINGS.
6. FIELD CONSTRUCTED CURB PER STRUCTURAL IS ACCEPTABLE, BUT PROVIDE FLASHING, SEALING, INSULATION, ETC. PER THIS DETAIL.



1 CONDENSING UNIT ON PLATFORM CURB DETAIL

SCALE: NONE



NOTES:
1. ALL VANED ELBOWS SHALL BE CONSTRUCTED AND INSTALLED AS DETAILED BY SMACNA.
2. TURNING VANES SHALL BE SINGLE TYPE WITH A 2" RADIUS, 1.5" MAXIMUM SPACE BETWEEN VANES ON PREFAB RUNNERS.
3. INSULATE ALL DUCTWORK AND FITTINGS PER SPECIFICATIONS (NOT SHOWN FOR CLARITY)
4. REDUCING ELBOWS ARE NOT ALLOWED
5. TURNING VANES ARE NOT ALLOWED IN EXHAUST/RETURN SYSTEMS UNLESS NOTED OTHERWISE.

LONG RADIUS ELBOW

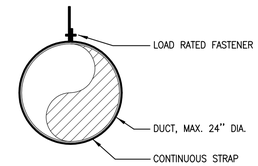
MITERED WITH TURNING VANES

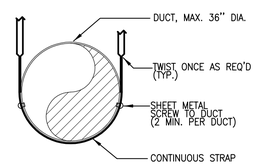
RADIUS ELBOWS ARE PREFERRED. PROVIDE MITERED TYPE ELBOWS, PER THIS DETAIL ONLY IF RADIUS ELBOWS DO NOT FIT.

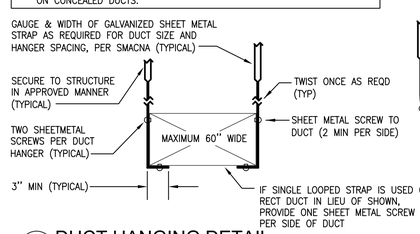
5 TYP DUCT SQUARE ELBOW WITH TURNING VANES DETAIL

SCALE: NONE

GENERAL NOTES:
- COORDINATE WITH HVAC AND ARCHITECTURAL DRAWINGS FOR DUCT MOUNTING ELEVATIONS.
- ALL SPACING AND HANGER SIZES (ROD & STRAP) SHALL COMPLY WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE, LATEST EDITION.
- HANGERS SHALL NOT DEFORM DUCT SHAPE.
- DO NOT EXCEED ALLOWABLE LOAD LIMITS.
- COORDINATE AIR DEVICE LOCATIONS AND SIZES WITH MECHANICAL DRAWINGS.
- TRAPEZE SUPPORTS PER SMACNA MAY BE USED AT CONTRACTOR'S OPTION ON CONCEALED DUCTS.

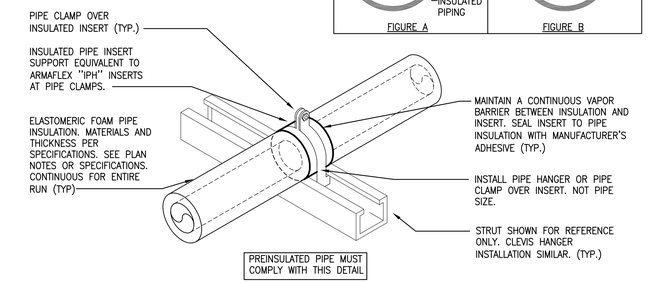






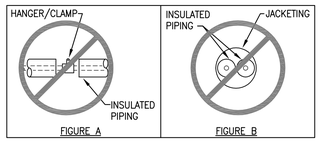
2 DUCT HANGING DETAIL

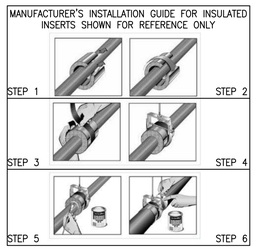
SCALE: NONE



PREINSULATED PIPE MUST COMPLY WITH THIS DETAIL

FOR PIPES WITH ALUMINUM JACKETING:
- PIPE CLAMP SHALL BE INSTALLED ON EXTERIOR OF JACKETING. DO NOT CUT INTO JACKETING. REFERENCE SPECIFICATIONS FOR JACKETING REQUIREMENTS (TYP.) SEE FIGURE A.
- PROVIDE JACKETING FOR EACH INDIVIDUAL INSULATED PIPE. DO NOT JACKET MORE THAN ONE PIPE IN A SINGLE JACKET CASING. SEE FIGURE B.

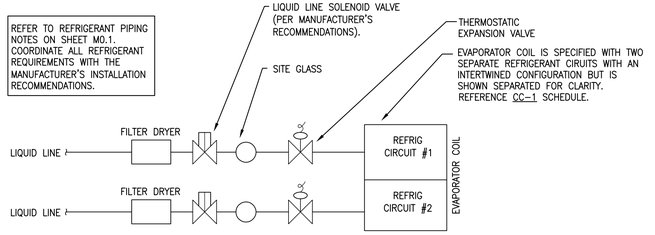




9 TYP REFRIGERANT PIPE INSULATION DETAIL

SCALE: NONE

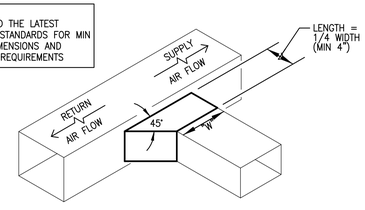
REFER TO REFRIGERANT PIPING NOTES ON SHEET M0.1. COORDINATE ALL REFRIGERANT REQUIREMENTS WITH THE MANUFACTURER'S INSTALLATION RECOMMENDATIONS.



6 REFRIGERANT PIPING DIAGRAM

SCALE: NONE

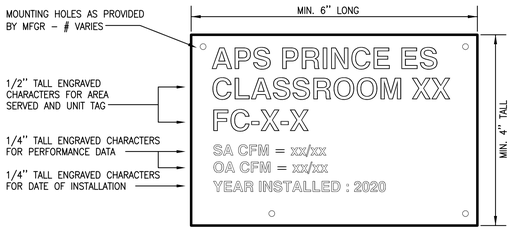
NOTE:
REFER TO THE LATEST SMACNA STANDARDS FOR MIN REQD DIMENSIONS AND SEALING REQUIREMENTS



3 TYPICAL BRANCH DUCT TAKE-OFF DETAIL

SCALE: NONE

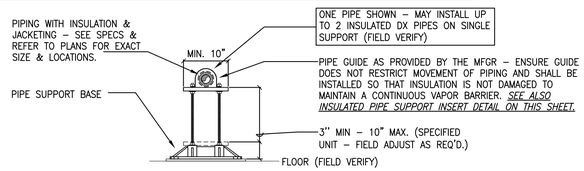
NOTES:
- COORDINATE UNIT TAG DESIGNATIONS AND CONFIGURATION WITH THE OWNER AND EQUIPMENT SCHEDULES PRIOR TO ORDERING.
- SECURE LABELS TO EQUIPMENT PER MFGR'S RECOMMENDATIONS.
- INDOOR NAMEPLATES MAY BE ENGRAVED PLASTIC IN LIEU OF ANODIZED ALUMINUM, AS SPECIFIED OF OUTDOOR APPLICATIONS.
- REFER ALSO TO SPECIFICATIONS.



10 TYPICAL UNIT TAG DETAIL

SCALE: NONE

PIPE SUPPORT SPECIFICATIONS:
- EQUIVALENT TO PORTABLE PIPE HANGERS MODEL #SS8C WITH STRUT AND PIPE GUIDE. UV RESISTANT, HIGH DENSITY, POST CONSUMER POLYPROPYLENE PLASTIC BASE WITH TWO 1/2" ALL–THREAD HOT DIPPED GALVANIZED ROD RISERS. USE MIN. 14 GA. STRUT AND MFGR. PROVIDED HARDWARE FOR FIELD ASSEMBLY. MAX. WEIGHT LOADING = 2.5 LBS. PER SQ. IN. OF BASE. 8x10 BASE SHOWN = 200 LBS. MAX. LOADING. PROVIDE SUBMITTAL – CONTACT: PHP 1.714.465.7606.
- EQUIVALENT MANUFACTURERS : CLEARLINE "C–PORT" MODEL #CE10–8; MIRO INDUSTRIES MODEL #2.5 CONDUIT SUPPORT–12



SUPPORT SPACING NOTES:
THE MIN. SUPPORT SPACING, AS REQ'D. PER CODE, IS PROVIDED HERE. HOWEVER, ADDITIONAL SUPPORTS ARE REQ'D. AT ALL CHANGES IN DIRECTION, NEAR ROOF PENETRATIONS & TERMINATION LOCATIONS, AND AS REQUIRED TO ELIMINATE SAGGING. ADDITIONAL SUPPORTS MAY BE REQ'D. FOR EVEN WEIGHT DISTRIBUTION DEPENDING ON PIPE LOCATION, SIZE, MATERIAL AND SERVICE. COORDINATE WITH THE MANUFACTURER FOR APPLICATION SPECIFIC PIPE SPACING REQUIREMENTS.

PIPE SUPPORT SPACING	
PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING
COPPER TUBING 1–1/4" AND SMALLER	6 FEET
COPPER TUBING 1–1/2" AND LARGER	10 FEET

NOTES:
1. SPACING BASED ON 2018 IMC TABLE 305.4

7 TYP. PIPE SUPPORT DETAIL

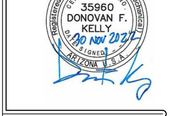
SCALE: NONE

(ADJUSTABLE STRUT SUPPORT – 2" DIA. MAX)

Amphitheater Public Schools

BLDG C - EAST WING
COOLING COIL REPLACEMENT
Prince Elementary School
125 E Prince Rd, Tucson, AZ 85705

SEAL:



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WWW.KWMECH.COM

KWA PROJECT NO:	21045
DATE:	November 30, 2022
DRAWN BY:	MB
DESIGNED BY:	MB
CHECKED BY:	DFK

SHEET CONTENTS:
HVAC DETAILS

SHEET
M2.0

7 OF 11
Prince ES - Bldg C East Wing

ROOFTOP HOOD SCHEDULE

MARK	MFGR	MODEL	DUTY	HOOD STYLE	CURB SIZE	THROAT SIZE	FREE AREA (SQ. FT.)	DESIGN CFM	DESIGN VELOCITY (FPM)	MAX. STATIC PRESSURE DROP (IN. W.C.)	OPERATING WEIGHT	DAMPER	SYSTEM/AREA SERVED	REMARKS / SYSTEM COMPLETE WITH:
EH 1	WESTERN VENT & CURBS	AVR	EXHAUST	LOW-PROFILE	37.5x25.5	32x20	4.4 (SQ. FT.)	4430 CFM	1007 (FPM)	0.11"	150 LB	YES	EF-1	LOCKED RIB RELIEF HOOD WITH 5" TALL BASE; 8" THROAT HEIGHT; ALUM. HOUSING & CURB CAP; ALUM. BIRDSCREEN; HINGED CURB CAP & SEAL; 14" HIGH FACTORY INSULATED ROOF CURB. AMCA 500D RATED GRAVITY COUNTERBALANCED BACKDRAFT DAMPER

NOTES:
1. INSTALL & SEAL ROOF HOODS IN ACCORDANCE WITH MANUFACTURERS STANDARD DETAILS – COORDINATE WITH G.C.
2. PROVIDE WESTERN VENT & CURBS, COOK, GREENHECK OR APPROVED EQUIVALENT.

T.A.B. EXISTING AHU-1E SCHEDULE

MFGR	MODEL	NOM. TONS	SYSTEM CONFIG.	SA CFM	OA CFM	SA ESP (INCHES W.G.)	HEATING COIL				ELECTRICAL	
							CFM	GPM	LAT DB °F	EAT DB °F	BLOWER MOTOR V/ϕ	BLOWER MOTOR HP
CARRIER	NOTE #2 39EB26	40	MULTIZONE	NOTE #1 9480	4430 CFM / 1900 CFM	NOTE #1 0.70	NOTE #1 9480	NOTE #1 UNKNOWN	ASSUME 95	NOTE #3 51	NOTE #1 208/3	NOTE #1 7.5

NOTES:
1. INFORMATION BASED ON AS BUILT DRAWINGS BY BLANTON & COLE, 1961.
2. INFORMATION BASED ON SITE VERIFICATION.
3. BASED ON MIXED AIR CALCULATION.

CONDENSING UNIT SCHEDULE - AIR COOLED

MARK	MANUFACTURER	MODEL	REFRIGERANT	NOM. TONS	COOLING PERFORMANCE (EFFICIENCY AT FULL-LOAD & DESIGN)						ELECTRICAL		OPERATING WEIGHT	SYSTEM SERVED	LOCATION	REMARKS / SYSTEM COMPLETE WITH:
					AMBIENT TEMP.	CAPACITY (MBH)	DESIGN SST AT C.U.	EFF	CONDENSER STEPS	CONDENSER CIRCUITS	V/ϕ	MCA/MROPD				
CU 1	DAIKIN	RCS040D	R-410A	40	115 °F	358.5 TOTAL	42.0 °F	11.3 EER 14.9 IEER	4 STEPS	2	460/3	80.6/90	UNIT = 2500 LBS CURB = 650 LBS TOTAL = 3150 LBS	CC-1 IN (E)AHU	ROOF	4 SCROLL COMPRESSORS; PROVIDE FILTER, ACCESS PORTS, PROVIDE ANY OTHER REQUIRED VALVES IN ACCORDANCE WITH MFGR'S. REQUIREMENTS, SEE REFRIGERANT PIPING NOTES ON SHEET M0.1.; MINIMUM SCCR = 10 kAIC. OPTIONS: VANDALISM GUARDS; HOT GAS BYPASS (ALLOWS TURN DOWN TO 10%); VFD CONTROLLED HEAD PRESSURE CONTROL; REFRIGERANT SERVICE VALVES: ONE DISCHARGE VALVE FOR EACH REFRIGERANT CIRCUIT; LOCATED BETWEEN THE COMPRESSORS AND CONDENSER. ONE SUCTION VALVE FOR EACH REFRIGERANT CIRCUIT; LOCATED BETWEEN THE COMPRESSORS AND THE EVAPORATOR. PROVIDE MINIMUM 12" TALL REINFORCED ROOF CURB THAT SPANS APPROXIMATELY 10 FT. COORDINATE WITH EXISTING CONDITIONS AND STRUCTURAL ENGINEER.

NOTES:
1. 2018 IECC: TABLE C403.3.2 (1) MIMIMUM EFFICIENCY IS 10.0 EER. SCHEDULED UNIT EXCEEDS EER RATING BY MORE THAN 10%. PER 2018 IECC, TABLE C403.5(2), ECONOMIZER IS NOT REQUIRED.
2. PROVIDE SUPPLY AND RETURN AIR TEMPERATURE SENSORS AT THE EVAPORATOR AND WIRE BACK TO CONDENSING UNIT. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. VERIFY ADDITIONAL SENSORS AS REQUIRED BY MANUFACTURER FOR PROPER OPERATION.

SST = SATURATED SUCTION TEMPERATURE

REPLACEMENT DX COOLING COIL SCHEDULE

MARK	MANUFACTURER	MODEL	CFM		DIMENSIONS (INCHES)		COOLING COIL (OA °F DB/WB = 110/67; RA °F DB/WB = 80/62)								DRY WEIGHT	SYSTEM SERVED	REMARKS / SYSTEM COMPLETE WITH:
			SA	OA	W x H x D (BOD)	W x H (FINNED)	ROWS	FPI	MBH TOT/SENS	EAT DB/WB °F	LAT DB/WB °F	MAX. AIR P.D.	SUCT TEMP	LIQ. TEMP	MAX. REFRIG P.D.			
CC 1	TEMTROL	4DX-6-35x69.75x6-11 AL	9480	4430	81" x 35" x 10"	35" x 69.75"	6	11	416.1 / 411.4	94.0/64.3	48.0/46.9	0.66 IN WG	40.0°F	110.0°F	2.4 PSI	450 LB	CC-1 IN (E)AHU	DIRECT EXPANSION DUAL CIRCUIT (INTERTWINED), GALVANIZED CASING, R410A REFRIGERANT; COPPER TUBE WITH .020" WALL THICKNESS AND 5/8" OUTSIDE DIAMETER; ALUMINUM FINISH MATERIAL; .008" THICK; 1.50x1.299 TUBE SPACING WITH SMOOTH SURFACE. 16 GAUGE CASING
		SEE NOTE 1			SEE NOTE 1				SEE NOTE 1		SEE NOTE 1				SEE NOTE 1			

NOTES:
1. DIMENSIONS AND PERFORMANCE PROVIDED AS BASIS OF DESIGN WITH INTENT TO PROVIDE MAXIMUM FINNED AREA POSSIBLE. CONTRACTOR TO FIELD VERIFY EXACT DIMENSIONS OF COIL PRIOR TO ORDERING. PROVIDE CAPACITIES AND PRESSURE DROPS AS CLOSE TO SCHEDULED AS POSSIBLE. PROVIDE SUBMITTAL.
2. COIL PERFORMANCE DATA SHALL BE CERTIFIED IN ACCORDANCE WITH ARI 410.
3. COORDINATE PIPING CONNECTIONS WITH FLOOR PLAN AND EXISTING CONDITIONS.

EXHAUST FAN SCHEDULE

MARK	SYSTEM SERVED	LOCATION	MANUFACTURER	MODEL	CONFIG	CFM (MAX/MIN)	E.S.P. (MAX/MIN)	FRPM	SONES	ELECTRICAL V/ϕ	ELECTRICAL HP	ELECTRICAL SPEED	OPERATING WEIGHT	DAMPER	CONTROLS	FACTORY COMPLETE WITH:	PROVIDE COMPLETE WITH OPTIONS:
EF 1	AHU-1E RELIEF	MECHANICAL ROOM	COOK	225SQNH17D (VF2)	INLINE DIRECT DRIVE	4430/2530	0.3/0.1	934 AT MAX	10.5/12.8 (INLET / OUTLET)	460/3	1.5	VAR	650 LBS	YES - AMCA 500D RATED	INTERLOCK WITH AHU-1E	ALUMINUM WHEEL; GALVANIZED STEEL HOUSING, THREE REMOVEABLE ACCESS DOORS; NEOPRENE GASKET; INLET/DISCHARGE COLLARS; PERMANENTLY LUBRICATED EC MOTOR	FACTORY INSTALLED OPTIONS: VARI-FLOW EC MOTOR W/ VARI-FLOW PRESSURE CONTROLLER AND AIR BALANCE KIT; GALVANIZED BIRDSCREEN; LORENIZED FAN FINISH FIELD INSTALLED OPTIONS: AMCA 500D RATED BACKDRAFT DAMPER.

1. PROVIDE FACTORY DISCONNECT SWITCHES. COORDINATE WITH ELECTRICAL AND G.C.
2. ALL FANS CONTROLLED BY EMCS UNLESS NOTED OTHERWISE. COORDINATE INTERLOCKS NOTED HEREIN WITH CONTROLS CONTRACTOR.
3. PROVIDE COOK, GREENHECK, TWIN CITY FANS OR PRIOR APPROVED EQUIVALENT.
4. FAN IS INTENDED TO BE BALANCED AS NEEDED TO MAINTAIN POSITIVE PRESSURE WITH RESPECT TO OUTDOORS. PROVIDE FAN CURVE IN SUBMITTAL THAT FAN CAN OPERATE AT MAX AND MIN CFM.

LOUVER SCHEDULE

MARK	MANUFACTURER	MODEL	DUTY	MATERIAL	FINISH	DIMENSIONS W x H x D (SEE NOTE #3)	DESIGN CFM	FREE AREA (SQ. FT.)	SCREEN TYPE	CORRECTED FREE AREA, (SQ. FT.) [3]	ESTIMATED DESIGN VELOCITY (FPM) [4]	ESTIMATED STATIC PRESSURE 4 DROP (IN. W.C.)	SYSTEM/AREA SERVED	REMARKS / PROVIDE SYSTEM COMPLETE WITH:
IL 1	POTTORFF	EFD-435	INTAKE	HEAVY ALUMINUM	SEE NOTE #2	36" x 44" x 4"	4430	6.0	BIRD	5.4	820	.09	(E)AHU OA INTAKE	AMCA TESTED (1,250 FPM PERFORMANCE AT BEGINNING POINT OF WATER PENETRATION); MILL FINISH EXTRUDED ALUMINUM; 35° HORIZONTAL FIXED BLADES; FLANGE FRAME; HEAD AND SILL FLASHING; HIDDEN VERTICAL MULLIONS; ALUMINUM INSECT SCREEN ON INSIDE FACE.

NOTES:
1. INSTALL & SEAL LOUVERS IN ACCORDANCE WITH MANUFACTURERS STANDARD DETAILS FOR METAL BUILDING CONSTRUCTION – COORDINATE WITH G.C.
2. COORDINATE FINISH & COLOR OF LOUVERS WITH THE OWNER PRIOR TO ORDERING – PROVIDE FINISH & COLOR INFORMATION FOR SUBMITTAL REVIEW.
3. IT IS ASSUMED THAT THE INSECT SCREEN WILL REDUCE THE FREE AREA BY 25% AND BIRD SCREEN WILL REDUCE THE FREE AREA BY 10%.
4. CALCULATED BASED ON THE CORRECTED FREE AREA.

VARIABLE FREQUENCY DRIVE SCHEDULE

MARK	MANUFACTURER	MODEL	DUTY	ENCLOSURE	COMPLETE WITH BYPASS?	MANUAL MOTOR PROTECTOR?	LOCATION	ELECTRICAL V / ϕ	ELECTRICAL HP	CONTROLS PROTOCOL	REMARKS / COMPLETE WITH:
VFD 1	ABB	ACH580-VCR	FAN MOTOR	NEMA 12 (INDOOR INSTALLATION)	√	YES	INSIDE MECHANICAL ROOM REFER TO PLANS	208/3	7.5	BACnet	VARIABLE SPEED DRIVE ASSEMBLY DESIGNED FOR HVAC PUMPS AND FANS. COMPLETE WITH APPROPRIATE ENCLOSURE FOR THE INSTALLED CONDITION. INCLUDE HIGH AMBIENT AND/OR LONG LINE LENGTH DERATE AS NECESSARY. INTEGRAL INPUT REACTOR = 5% IMPEDANCE; AC TRANSIENT PROTECTION SYSTEM CONSISTING OF (4)MOV'S; INPUT EMI / RFI FILTER; 100,000 AIC RATING; 250MA 24VDC AUXILIARY POWER SUPPLY; REAL TIME CLOCK; BACNET INTERFACE; PROGRAMMABLE (2) ANALOG INPUTS, (6) DIGITAL INPUTS, (2) ANALOG OUTPUTS; (3) FORM C RELAYS, EXPANDABLE TO (6); 2-CONTACTOR ELECTRONIC BYPASS WITH DRIVE ONLY ISOLATION SERVICE FUSING; DOOR INTERLOCKED CIRCUIT BREAKER; ELECTRONIC MOTOR OVERLOAD SELECTABLE MANUAL OR AUTOMATIC TRANSFER BYPASS; COMMON START / STOP CIRCUIT FOR DRIVE & BYPASS FROM A REMOTE CONTACT; UNDERVOLTAGE PROTECTION CIRCUIT; DRIVE BYPASS KEYPAD AND LED INDICATING LIGHTS THAT INDICATE THE STATUS OF BOTH THE BYPASS AND THE DRIVE; HARMONIC MITIGATION BELOW IEEE519 LIMITS; COMPLETE WITH: FACTORY CERTIFIED START-UP INCLUDING LABOR, PARTS, AND TRAVEL; TRAINING (COORD. WITH Cx SCOPE); 40 MONTH WARRANTY. PROVIDE I/O EXTENSION MODULE AS REQUIRED, COORD. WITH CONTROLS.

NOTES:
1. VERIFY HP RATINGS OF DRIVES WITH EQUIPMENT SCHEDULES. HP LISTED IN EQUIPMENT SCHEDULES TAKE PRECEDENCE TO THIS SCHEDULE.
2. VFDs SHALL BE PROGRAMMED TO SKIP THE FAN CRITICAL SPEED, OR MULTIPLES THEREOF, DURING NORMAL OPERATION. COORDINATE WITH TOWER MANUFACTURER.
3. COORDINATE SETTINGS WITH CONTROLS CONTRACTOR AND TAB FINAL SETTINGS.
4. ENSURE DRIVES ARE SIZED TO HANDLE AMPS IN ADDITION TO NOMINAL HORSEPOWER LISTED.
5. PROVIDE SPECIFIED ABB OR APPROVED EQUIVALENT. PROVIDE PRIOR APPROVALS PRIOR TO BIDDING.

MINIMUM MECHANICAL VENTILATION REQUIREMENTS

ZONE INFORMATION					EXHAUST AIR				OUTDOOR AIR					
SYSTEM: ZONE NAME	OCCUPANCY CLASSIFICATION	AREA (Az, sf)	ZONE POPULATION (Pz)	ZONE MAX/MIN SUPPLY AIRFLOW (Vpz/Vpzm, CFM)	CFM/AREA	CFM/UNIT	NUMBER OF UNITS	ZONE CFM	AIR DISTRIBUTION EFFECTIVENESS (Ez)	OCCUPANT DENSITY (#/1000sf)	CFM/PERSON (Rp)	CFM/AREA (Ra)	PRIMARY FRACTION (Zp)	ZONE CFM (Voz)
AHU – EAST WING: CLASSROOM 107	CLASSROOMS (AGE 9 PLUS)	903	29	1,170 / 1,170	–	–	–	–	0.8	35	10	0.12	0.43	498.0
AHU – EAST WING: CLASSROOM 108	CLASSROOMS (AGE 9 PLUS)	903	29	1,170 / 1,170	–	–	–	–	0.8	35	10	0.12	0.43	498.0
AHU – EAST WING: CLASSROOM 109	CLASSROOMS (AGE 9 PLUS)	903	29	1,170 / 1,170	–	–	–	–	0.8	35	10	0.12	0.43	498.0
AHU – EAST WING: CLASSROOM 110	CLASSROOMS (AGE 9 PLUS)	903	29	1,170 / 1,170	–	–	–	–	0.8	35	10	0.12	0.43	498.0
AHU – EAST WING: CLASSROOM 112	CLASSROOMS (AGE 9 PLUS)	903	29	1,170 / 1,170	–	–	–	–	0.8	35	10	0.12	0.43	498.0
AHU – EAST WING: CLASSROOM 113	CLASSROOMS (AGE 9 PLUS)	903	29	1,170 / 1,170	–	–	–	–	0.8	35	10	0.12	0.43	498.0
AHU – EAST WING: CLASSROOM 114	CLASSROOMS (AGE 9 PLUS)	903	29	1,170 / 1,170	–	–	–	–	0.8	35	10	0.12	0.43	498.0
AHU – EAST WING: CLASSROOM 115	CLASSROOMS (AGE 9 PLUS)	903	29	1,170 / 1,170	–	–	–	–	0.8	35	10	0.12	0.43	498.0
		7,224	Ps : 232	9,360 / 9,360								AHU – EAST WING OUTDOOR AIR CFM (Vot/Votm):		4,426 / 1,204

NOTES:
1. VENTILATION REQUIREMENTS ARE BASED ON THE 2018 INTERNATIONAL MECHANICAL CODE (IMC), SECTION 403. ZONES WITH AN OCCUPANCY CLASSIFICATION MARKED WITH AN ASTERISK (*) ARE BASED ON ASHRAE STANDARD 62.1–2016.
2. MINIMUM OUTDOOR AIRFLOW (Votm) REPRESENTS VENTILATION AIRFLOW REQUIRED WHEN ZERO OCCUPANTS ARE IN THE ASSOCIATED SYSTEM.
3. VALUES SHOWN FOR OUTDOOR AIRFLOWS (Vot), MINIMUM OUTDOOR AIRFLOWS (Votm), AND EXHAUST AIRFLOWS ARE THE MINIMUM VALUES REQUIRED TO MEET CODE. FOR ACTUAL DESIGN CFM VALUES REFER TO EQUIPMENT SCHEDULES.
4. OCCUPANCY CALCS: (TIME AVERAGING STRATEGY PER ASHRAE 62.1–2016 SECTION 6.2.6.2)
   4.1. OCCUPIED FOR 50 MIN OUT OF EACH HOUR
   4.2. (PzAVG):((34 PEOPLE X 50 MIN.) + (1 PERSON X 10 MIN.)/60 MIN. = 29 PEOPLE PER HOUR AVERAGE

Amphitheater Public Schools

BLDG C - EAST WING
COOLING COIL REPLACEMENT
Prince Elementary School
125 E Prince Rd, Tucson, AZ 85705

SEAL:

35960
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DESIGNED BY: MB
CHECKED BY: DFK

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Prince ES - Bldg C East Wing

SEQUENCE OF OPERATIONS

1.1 EXISTING MULTIZONE, CONSTANT-VOLUME, AIR-HANDLING UNIT CONTROL SEQUENCE

A. FAN CONTROL: PER EXISTING. VFD USED FOR SOFT START AND TAB; FAN RUNS AT CONSTANT VOLUME.

B. FREEZE PROTECTION: TEMPERATURE READING, LOCATED BEFORE SUPPLY FAN, SIGNALS ALARM, STOPS FAN, AND CLOSES OUTSIDE-AIR DAMPERS WHEN TEMPERATURE FALLS BELOW 37 DEG F.

C. OUTSIDE-AIR CONTROL:

1. SYSTEM MODULATES OUTSIDE-AIR AND RETURN-AIR DAMPERS. SEPARATE RELIEF / EXHAUST FAN MODULATES TO RELIEVE EXCESS AIR FROM THE AHU MIXED AIR PLENUM FOR BUILDING PRESSURIZATION CONTROL.
2. AFMS MEASURES OUTSIDE AIR AND REPORTS REAL TIME VALUE IN CFM. AFMS ALSO REPORTS TEMPERATURE AND HUMIDITY.
3. CLOSE OUTSIDE AIR DAMPER WHEN FAN IS OFF.
4. SYSTEM SHALL OPEN OA DAMPER TO MINIMUM POSITION (PER TAB) DURING ALL OCCUPIED PERIODS.
5. AT FRONT END, PROVIDE MANUAL ADJUSTMENT OF OUTSIDE AIR DAMPER POSITION FOR OWNER-SELECTED SETTING BETWEEN THE MINIMUM AND MAXIMUM SETTINGS (PER TAB). WHEN THIS ADJUSTMENT IS MADE, DCV IS DEACTIVATED.
6. PROVIDE 100% OUTSIDE AIR PRE-OCCUPANCY PURGE MODE WHICH DRIVES OUTSIDE AIR DAMPER TO FULL OPEN AND RUNS FAN WITHOUT ACTIVATING HEATING OR COOLING SYSTEMS. ALLOW FOR MANUAL OPERATION BY OWNER VIA FRONT END AS WELL AS SCHEDULE WITH TEMPERATURE LIMITS TO PREVENT PURGE MODE WHEN OUTSIDE AIR IS TOO HOT, TOO COLD OR TOO HUMID.
7. DURING UNOCCUPIED PERIODS, OUTSIDE AIR DAMPER REMAINS CLOSED.
8. AT FRONT END, PROVIDE MODE SELECTION TO ALLOW OWNER TO CHOSE TO USE DCV OR NOT.
9. DCV MODE: WHEN SYSTEM IS IN DCV MODE, IF ALL MEASURED CO2 CONCENTRATIONS ARE BELOW THE CO2 SETPOINT (1,000PPM – ADJUSTABLE), OA DAMPER SHALL REMAIN AT MINIMUM SETTINGS. IF ANY CO2 READING EXCEEDS THE CO2 SETPOINT, THE OSA DAMPER SHALL BE MODULATED OPEN VIA PROPORTIONAL-INTEGRAL CONTROL LOOP (ACCOUNTING FOR LEVEL OF CO2 & RATE OF CHANGE OF CO2) TO SATISFY CO2 SETTINGS.

G. HYDRONIC HEATING SYSTEM: EXISTING. SEQUENCE UNCHANGED.

H. COOLING COIL:

1. DURING OCCUPIED PERIODS, WHEN FAN IS RUNNING, SYSTEM OPERATES COOLING SYSTEM TO MAINTAIN SUPPLY-AIR TEMPERATURE [55°F].
2. SYSTEM SHALL HAVE ADJUSTABLE START-TO-STOP AND START-TO-START TIME4RS FOR EACH COMPRESSOR. SHOW ON FRONT END.
3. DURING UNOCCUPIED PERIODS, WHEN FAN IS ON, ENABLE COOLING BUT WITH UNOCCUPIED SETPOINT.
4. RESET SUPPLY AIR TEMPERATURE SETPOINT BASED ON DEMAND

H. MULTIZONE DAMPER CONTROL: EXISTING. SEQUENCE UNCHANGED

1. MAP NEW TEMPERATURE SENSORS FOR EACH ZONE INTO EMCS AND MODIFY GRAPHICS.

I. RELIEF AIR:

1. SYSTEM STARTS AND STOPS FAN
2. SYSTEM VERIFIES OPERATION OF FAN
3. FACTORY FAN CONTROLS MODULATE FAN TO MAINTAIN PRESSURE SETTING IN MIXED AIR PLENUM [ADJUSTABLE AND TO BE DETERMINED BY TAB]. PRESSURE WILL VARY DUE TO DCV SO SETUP MUST INCLUDE VARIABLE OUTSIDE AIR FLOWS – COORDINATE WITH TAB.

J. OPERATOR STATION DISPLAY AT A MINIMUM: INDICATE THE FOLLOWING ON OPERATOR WORKSTATION DISPLAY TERMINAL. ** SHOW ALL POINTS IN SEQUENCE AND SHOWN IN SCHEMATIC **

1. SYSTEM GRAPHIC.
2. SYSTEM ON-OFF INDICATION.
3. SYSTEM OCCUPIED/UNOCCUPIED MODE.
4. SYSTEM FAN ON-OFF INDICATION.
5. DCV MODE (ACTIVE OR INACTIVE)
6. OUTSIDE-AIR-TEMPERATURE INDICATION.
7. OUTSIDE AIR CFM INDICATION
8. OUTSIDE AIR RH INDICATION
9. OUTSIDE AIR DAMPER POSITION (FEEDBACK FROM ACTUATOR OF ACTUAL POSITION)
10. RETURN AIR DAMPER POSITION (FEEDBACK FROM ACTUATOR OF ACTUAL POSITION)
11. MIXED-AIR-TEMPERATURE INDICATION.
12. HOT-DECK AIR-TEMPERATURE INDICATION.
13. HOT-DECK AIR-TEMPERATURE SET POINT.
14. HEATING-COIL CONTROL-VALVE POSITION.
15. COLD-DECK AIR-TEMPERATURE INDICATION.
16. COLD-DECK AIR-TEMPERATURE SET POINT.
17. CU-1 STATUS OF EACH COMPRESSOR AND FAN, ALARMS, SETPOINTS, COMPRESSOR TIMERS, ETC.
18. SUPPLY AIR TEMPERATURE FOR EACH ZONE
19. SPACE TEMPERATURE AND CO2 READING FOR EACH ZONE
20. RELIEF FAN ON/OFF AND STATUS

AIRFLOW MEASURING STATION (AFMS) NOTES

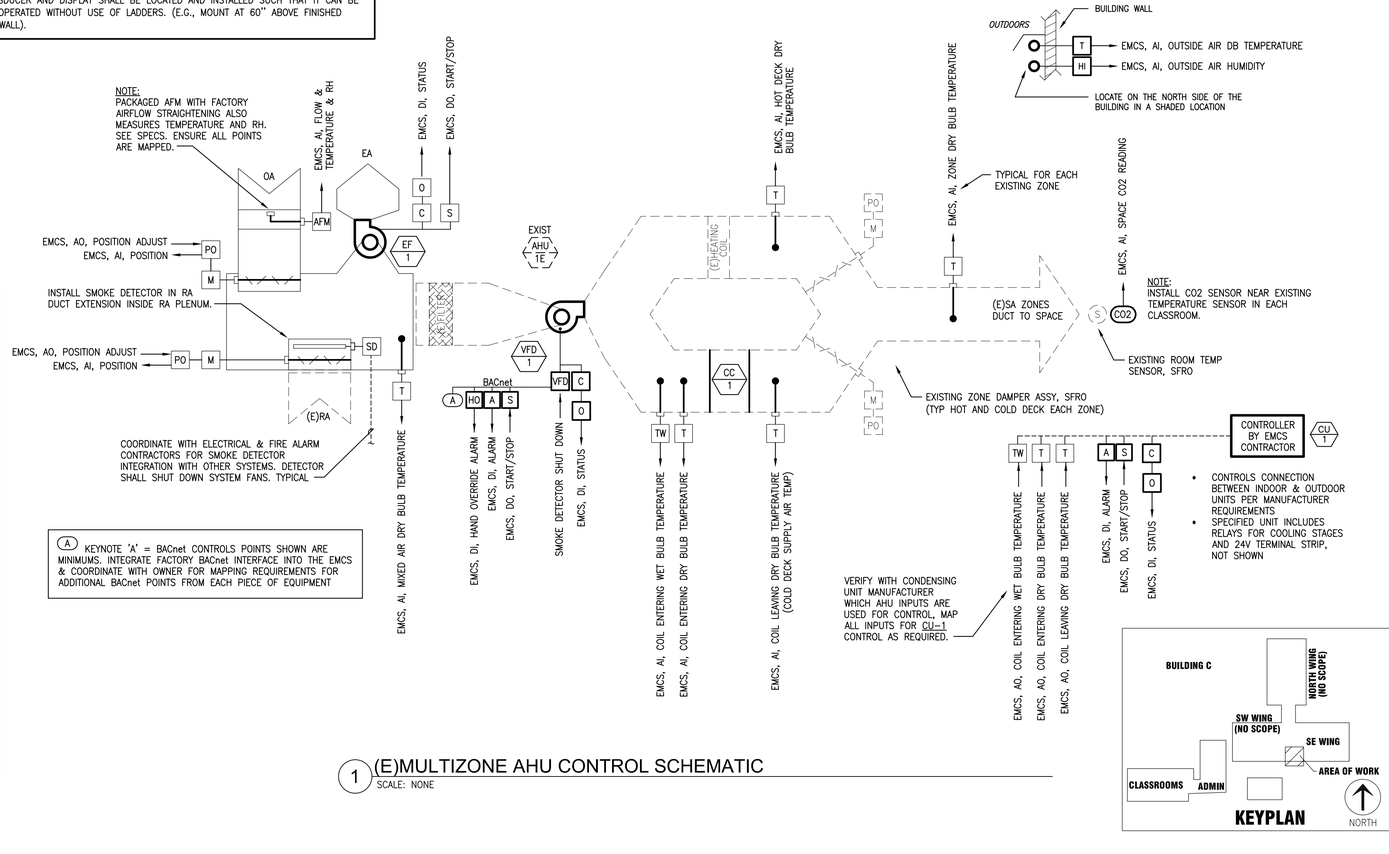
1. PROVIDE MOUNTING HARDWARE, BACNET TRANSMITTER & CABLES AS REQ'D TO RENDER A COMPLETE AND FULLY FUNCTIONAL INSTALLATION.
2. FOR DUCT MOUNTED INSTALLATIONS, COORD W/ MECHANICAL TO INSTALL WITH STRAIGHT DUCT UP AND DOWNSTREAM AS REQUIRED BY MANUFACTURER.
3. VERIFY THE LOCATION OF ALL THE AFMS'S WITH THE MFGR'S REP. PRIOR TO INSTALLATION.
4. AFMS TRANSDUCER AND DISPLAY SHALL BE LOCATED AND INSTALLED SUCH THAT IT CAN BE READ AND OPERATED WITHOUT USE OF LADDERS. (E.G., MOUNT AT 60" ABOVE FINISHED FLOOR ON WALL).

CONTROLS GENERAL NOTES

1. PROVIDE ALL NECESSARY HARDWARE, SOFTWARE, ENGINEERING, INSTALLATION, SUPERVISION, LABOR, CALIBRATIONS, PROGRAMMING, AND COMMISSIONING NECESSARY FOR A COMPLETE AND FULLY OPERATIONAL NETWORKED BACnet DDC CONTROL SYSTEM (AKA EMCS). PROVIDE DE-COMMISSIONING AND SALVAGE OF REUSED DEVICES OR DEMO OF UNUSED DEVICES AS REQUIRED. CONTROLS DEVICES, WIRING, INSTALLATION, ENGINEERING, ETC. SHALL BE FULLY COMPATIBLE AND INTEGRATED INTO THE EXISTING EMCS. FIELD VERIFY EXISTING CONDITIONS AND REQUIREMENTS.
2. INSTALLERS SHALL BE CERTIFIED AS A "TRIDIUM BUSINESS PARTNER". INSTALLERS SHALL HAVE SUCCESSFULLY COMPLETED THE 'NIAGARA TECHNICAL TRAINING COURSE APROPRIATE FOR THE SYSTEM AT THIS CAMPUS.
4. EXISTING CONDITIONS: THE DISTRICT HAS AN EXISTING KMC/NIAGARA DDC CONTROL SYSTEM SERVING MANY OF THE DISTRICT'S CAMPUSES. FIELD VERIFY CAPACITY, NAMING CONVENTIONS, CONNECTION STANDARDS, ETC.
5. INTENT: THE GENERAL INTENT OF THIS PROJECT IS TO REPLACE THE COOLING COIL AND ASSOCIATED CONDENSING UNIT WHILE KEEPING THE EXISTING CONTROLS AND SEQUENCE OF OPERATIONS, EXCEPT FOR THE ADDITION OF DEMAND CONTROL VENTILATION. ADDITIONAL EQUIPMENT ADDED UNDER THIS PROJECT SHALL BE COMPATIBLE WITH AND INTEGRATED INTO THE DISTRICT'S KMC/NIAGARA EMCS.
   5.1. SYSTEM SHALL INCLUDE ALL NECESSARY HARDWARE INCLUDING BUT NOT LIMITED TO: CONTROLLERS, PRESSURE SENSORS, DUCT TEMPERATURE SENSORS, ROOM TEMPERATURE AND CO2 SENSORS, ACTUATORS, BYPASS DAMPER, ETC. PROVIDE ADDITIONAL EMCS COMPONENTS AS NECESSARY TO IMPLEMENT THE SEQUENCE OF OPERATIONS. INTEGRATE THE NEW EQUIPMENT INTO THE (E) EMCS TO RENDER A COMPLETE AND FULLY FUNCTIONAL NETWORKED DDC CONTROL SYSTEM.
   5.2. IMPLEMENT DCV CONTROL OF OUTSIDE AIR DAMPER.
   5.3. COMMISSION AND CALIBRATE ALL DAMPER POSITIONS AND TEMPERATURE SENSORS IN EMCS TO TESTED RESULTS.
6. PROVIDE POWER AND TRANSFORMERS AS REQUIRED FOR ANY EMCS ITEM. POWER SHALL BE TAKEN FROM THE NEAREST ELECTRICAL PANEL WITH SPARE CAPACITY OR FROM THEIR RESPECTIVE UNIT'S POWER SUPPLY IF APPROVED BY THE MANUFACTURER AND ELECTRICAL. OBTAIN APPROVAL FROM ELECTRICAL PRIOR TO MAKING ANY CONNECTIONS. COORDINATE WITH ELECTRICAL FOR LINE VOLTAGE WIRING AND CONDUIT. PROVIDE TRANSFORMERS AND LOW VOLTAGE WIRING, CONDUIT, AND ENCLOSURES AS REQUIRED (TYPICAL).
7. PROVIDE ALL NECESSARY COMPONENTS, CONDUIT, PANELS, ENCLOSURES, J-BOXES, ETC. TO RENDER A COMPLETE INSTALLATION.
   7.1. WIRING SHALL BE RUN IN CONDUIT. CONDUIT SUBJECT TO PHYSICAL DAMAGE SHALL BE RMC (RIGID METAL CONDUIT); OTHERWISE EMT OR IMC IS ALLOWED. UL-360 LFMC (LIQUID TIGHT FLEXIBLE METALLIC CONDUIT) WITH METALLIC CONNECTIONS MAY BE USED AT EQUIPMENT TERMINATIONS, NOT TO EXCEED 3 FEET. UTILIZE COMPRESSION TYPE CONNECTIONS FOR ALL CONDUIT. RACEWAY SYSTEMS EXPOSED TO THE WEATHER SHALL BE WP TYPE.
   7.2. CONTROLS WIRING SHALL NOT BE RUN IN DUCTWORK.
   7.3. MAKE CONNECTIONS AT EQUIPMENT PER MANUFACTURER'S REQUIREMENTS IN LOCATIONS WHICH DO NOT RESTRICT ACCESS OR IMPEDE SERVICE.
   7.4. SUPPORT CONDUIT AS REQUIRED BY CODE AND AS NECESSARY TO PREVENT SAGGING.
8. CONTROLLERS SHALL INCLUDE NON-VOLITILE MEMORY AND CAPABILITY TO OPERATE SYSTEM STAND ALONE, BASED ON THE ACTIVE MODE WHEN COMM IS LOST. LOCATE CONTROLLERS, PANELS, INTERFACE DEVICES, ETC. THAT REQUIRE REGULAR INSPECTION OR THAT SERVE MULTIPLE HVAC SYSTEMS IN MECHANICAL ROOMS OR OTHER APPROVED LOCATIONS. ENSURE ADEQUATE SPACE IS PROVIDED FOR SERVICE.
9. IDENTIFICATION: PROVIDE PERMANENT IDENTIFICATION ON ALL EMCS PANELS, CONDUIT, AND CABLING. IDENTIFICATION SHALL BE ENGRAVED NAMEPLATES, FACTORY STICKERS, OR SIMILAR. SHARPIE OR SIMILAR IS NOT ACCEPTABLE.
10. DEVICES AND ENCLOSURES SHALL BE RATED FOR THE ANTICIPATED WORST-CASE ENVIRONMENT OF THE INSTALLATION LOCATION. PROVIDE HEATING AND/OR AIR CONDITIONING SYSTEMS FOR ENCLOSURES PER THE MANUFACTURER'S REQUIREMENTS OF ITEMS CONTAINED WITHIN THE ENCLOSURE.
11. COORDINATE ALL SENSOR LOCATIONS WITH EXISTING CONDITIONS. ALL SENSORS SHALL BE LOCATED IN ACCESSIBLE LOCATIONS. AVOID INSTALLATION ON EXTERIOR WALLS & CONFLICTS WITH FURNITURE. COMPLY WITH LATEST EDITION OF THE D.O.J. "ADA STANDARDS FOR ACCESSIBLE DESIGN" REQUIREMENTS (48" MAX HIGH, DEPENDING ON OBSTRUCTIONS).
13. COORDINATE WITH OWNER'S IT PERSONNEL FOR CONNECTION OF EMCS TO THE INTERNET OR INTRANET AS DICTATED BY THE OWNER. THIS CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE CORRECT TERMINATION TYPE AND LOCATION AS DICTATED BY THE OWNER. CONTROL SYSTEM SHALL BE VERIFIED AS 100% COMPLETE AND FUNCTIONAL PRIOR TO REQUESTING CONNECTION TO THE OWNER'S NETWORK.
14. FRONT END: MODIFY FRONT-END GRAPHICS AND DATABASE AS NECESSARY FOR COMPLETE INTEGRATION OF THE EQUIPMENT INTO THE (E) EMCS. COORDINATE ALL WORK AT THE DISTRICT'S FRONT END WORKSTATION WITH THE OWNER. GRAPHICS AND PAGE LAYOUT SHALL MATCH EXISTING EXAMPLES OF EXISTING SIMILAR SYSTEMS. ADD DISPLAY POINTS TO COMPLY WITH THE SEQUENCE OF OPERATIONS.
15. FUNCTIONAL PERFORMANCE TESTING: VERIFY BY TESTING THE SYSTEM IN ALL POSSIBLE MODES THAT THE SYSTEM IS FUNCTIONING AS INTENDED. PERFORM POINT-TO-POINT COMMISSIONING OF ALL POINTS. VERIFY FUNCTION OF EACH STEP IN EACH SEQUENCE OF OPERATION. VERIFY TREND LOGS FUNCTION AS INTENDED.
   15.1. ISSUE SUMMARY OF TESTING PROCEDURE MINIMUM 2 WEEKS PRIOR TO TESTING.
   15.2. ISSUE REPORT OF COMPLETE TESTING RESULTS – FOR APPROVAL BY OWNER & ENGINEER.
16. COMPLY WITH MECHANICAL SPECIFICATIONS INCLUDING BUT NOT LIMITED TO: WARRANTY, SUBMITTALS, AS-BUILTS, O&Ms. IN ADDITION TO THESE REQUIREMENTS SUBMITTALS SHALL INCLUDE LOGIC DIAGRAMS / FLOW DIAGRAMS SHOWING EACH CONTROLLED EQUIPMENT WITH ALL CONTROL FEATURES INDICATING PARTS REQUIRED AND CONNECTIVITY.
17. DOCUMENTATION TO THE OWNER SHALL INCLUDE ALL PASSWORDS, ACCESS CODES, IP ADDRESSES RELEVANT TO THE SYSTEM, DEVICE ADDRESSES, SOFTWARE BACKUPS, SOFTWARE LICENSES, OPERATING MANUALS, TRAINING GUIDES, ETC.

CONTROLS LEGEND

AFM	– AIRFLOW (AND TEMP) MONITOR – SEE SPECS	AFM	–	AIRFLOW MEASURING DEVICE, SEE SPECS
AHU CNTRLR	– AHU CONTROLLER (BACnet)			
DB	– DRY BULB	HA	–	HAND / AUTO MODE INDICATION
(E)	– EXISTING	HI	–	HUMIDITY INDICATION, ANALOG MEASURMENT
EA	– EXHAUST AIR	HL	–	HIGH LIMIT
EMCS	– ENERGY MONITORING & CONTROL SYSTEM	M	–	ELECTRIC DAMPER or VALVE ACTUATOR
MA	– MIXED AIR	O	–	ON/OFF INDICATION
OA	– OUTSIDE AIR	P	–	PRESSURE SWITCH
RA	– RETURN AIR	PI	–	PRESSURE INDICATION, ANALOG
RH	– RELATIVE HUMIDITY	PO	–	POSITION INDICATION AND ADJUSTMENT (VFD FREQUENCY)
SA	– SUPPLY AIR	S	–	START / STOP INTERFACE
SCHEM	– SCHEMATIC	SD	–	SMOKE DETECTOR
WB	– WET BULB	SP	–	SETPOINT INDICATION AND ADJUSTMENT (ANALOG)
(S)	– SPACE TEMPERATURE SENSOR W/ OVERRIDE BUTTON & TEMP. ADJUSTMENT	T	–	TEMPERATURE INDICATION
(CO2)	– CARBON DIOXIDE SENSOR	TW	–	TEMPERATURE INDICATION (WET BULB)
A	– ALARM	VFD	–	VARIABLE FREQUENCY DRIVE
C	– CURRENT SWITCH	---	–	WIRING, SCHEMATIC
CI	– CURRENT INDICATION			
DP	– DIFFERENTIAL PRESSURE SWITCH			



1 (E)MULTIZONE AHU CONTROL SCHEMATIC
SCALE: NONE

Amphitheater Public Schools

BLDG C - EAST WING
COOLING COIL REPLACEMENT
Prince Elementary School
125 E Prince Rd, Tucson, AZ 85705

SEAL:
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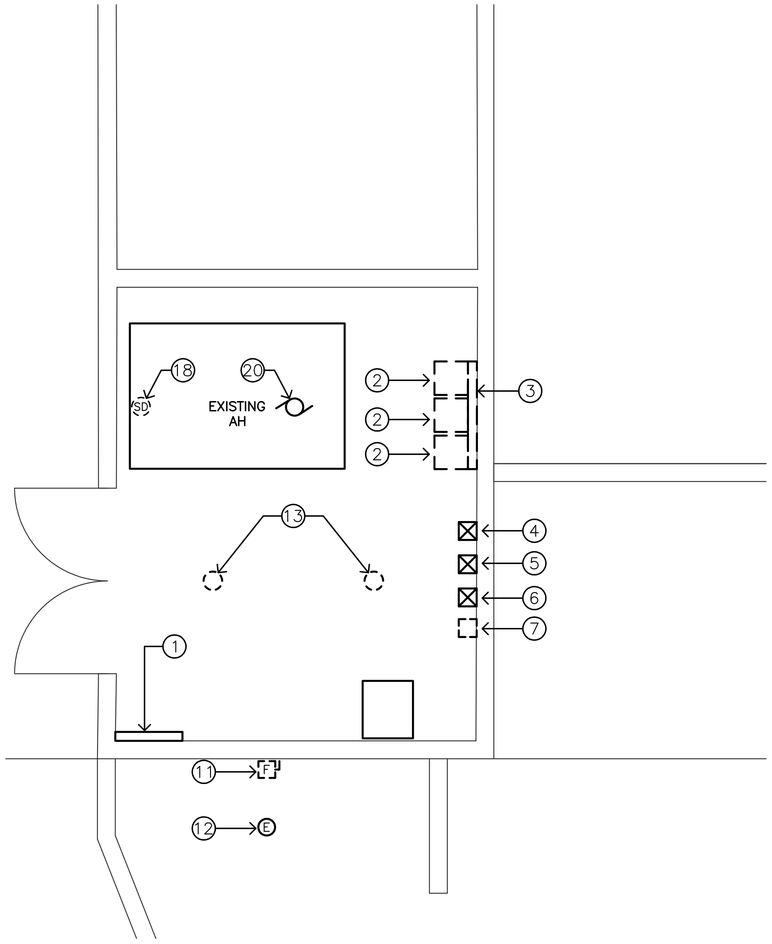
KWA PROJECT NO: 21045
DATE: November 30, 2022
DRAWN BY: MB
DESIGNED BY: MB
CHECKED BY: DFK

SHEET CONTENTS:
HVAC CONTROLS

SHEET
M4.0
9 OF 11
Prince ES - Bldg C East Wing



1 ELECTRICAL DEMOLITION PLAN

SCALE: APPROX. 3/8"=1'-0"

0 1' 2' 4' 8' NORTH

○ KEYNOTES:

1. EXISTING 400A, 480V, 3ø FUSED SWITCH TO REMAIN.
2. EXISTING 480V–1ø TO 240V–1ø TRANSFORMER TO BE REMOVED.
3. EXISTNG WIREWAY AND DISCONNECT SWITCHES TO BE REMOVED.
4. EXISTING BLOWER STARTER TO BE REPLACED WITH NEW VFD. REFER TO MECHANICAL DRAWINGS.
5. EXISTING PUMP STARTER TO REMAIN.
6. EXISTING FAN STARTER TO REMAIN.
7. EXISTNG CONDENSER CIRCUIT BREAKER TO BE REMOVED.
8. NEW PANEL "ML",
9. NEW TRANSFORMER "TM".
10. NEW PANEL "MH".
11. EXISTING CONDENSER DISCONNECT SWITCH TO BE REMOVED.
12. EXISTING CONDENSER TO BE DISCONNECTED. REMOVE ALL ASSOCIATED CONDUIT/WIRE/BOXES INSIDE AND OUTSIDE.
13. EXISTING LIGHT FIXTURE TO BE REMOVED,
14. EXISTING LIGHTING CIRCUIT TO REMAIN.
15. NEW SURFACE MOUNTED LED LIGHT FIXTURE. 12"x48", 2000 LUMENS, 3500K, 90 CRI.
16. 100A/3P, 600V, WEATHER PROOF FUSED DISCONNECT SWITCH ON ROOF ON UNISTRUT SUPPORTS.
17. NEW DUCT SMOKE DETECTOR AS CLOSE AS POSSIBLE TO FLOOR RA DUCT. COORDINATE WITH MECHANICAL.
18. EXISTING DUCT SMOKE DETECTOR TO BE REMOVED.
19. NEW NEMA 1 STARTER WITH HOA SWITCH AND FUSES TO MATCH EF NAMEPLATE DATA.
20. EXISTING MOTOR TO BE DISCONNECTED.
21. NEW MOTOR TO BE RECONNECTED TO EXISTING FEEDER.
22. REROUTE CONDUIT AS REQUIRED. COORDINATE WITH MECHANICAL.
23. NEW EQUIPMENT CONNECTION.

ELECTRICAL GENERAL NOTES

a. VERIFY EXACT LOCATIONS AND MOUNTING HEIGHTS OF ALL MECHANICAL EQUIPMENT PRIOR TO ROUGH IN. CAREFULLY REVIEW MECHANICAL DRAWINGS TO AVOID CONFLICTS.

b. VERIFY ELECTRICAL RATINGS AND LOCATIONS OF HVAC EQUIPMENT AND CONFIRM ALL REQUIRED CLEARANCES PRIOR TO START OF WORK. COMPLETELY CONNECT ALL EQUIPMENT FOR A COMPLETE FUNCTIONAL INSTALLATION.

c. ALL PIPING AND CONDUIT SHALL BE COORDINATED WITH MECHANICAL PIPING ROUTING PRIOR TO THE START OF ANY WORK. PIPING OR CONDUIT SHALL RUN PARALLEL TO MECHANICAL PIPING WHERE REQUIRED BY SPACE LIMITATIONS.

d. ALL PENETRATIONS THROUGH EXTERIOR WALL AND ROOFS SHALL BE SLEEVED, FLASHED AND SEALED WATERPROOF. PROVIDE ESCUTCHEON PLATES WHERE WALL PENETRATIONS ARE EXPOSED.

e. THE WORK COVERED ON THESE DRAWINGS SHALL INCLUDE THE FURNISHING OF ALL LABOR, MATERIALS, TRANSPORTATION, TOOLS, APPLIANCES, FEES, AND PERMITS REQUIRED FOR THE INSTALLATION OF A COMPLETE AND OPERATING ELECTRICAL SYSTEM. DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE NOT INTENDED TO SHOW EVERY DETAIL. THE CONTRACTOR SHALL PROVIDE BOXES, ACCESS PANELS, ETC. AS REQUIRED BY CODE AND INDUSTRY PRACTICE.

f. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING THIS PHASE OF THE WORK WITH ALL EXISTING CONDITIONS AND WITH OTHER TRADES.

g. ALL WORK SHALL COMPLY WITH THE APPLICABLE RULES OF THE NATIONAL ELECTRICAL CODE, LOCAL ELECTRICAL CODES AND ORDINANCES.

h. ALL MATERIALS SHALL BE NEW AND BEAR THE U.L. SEAL. MATERIALS SHALL CONFORM TO REQUIREMENTS OF THE 2017 N.E.C., WHERE APPLICABLE.

i. ALL EXPOSED ELECTRICAL CONDUITS ACCESSIBLE TO UNQUALIFIED PERSONAL SHALL BE GRC 8'AFF OR LOWER OR IMC 8'AFF ABOVE CONDUIT. PAINT ALL VISIBLE CONDUIT TO MATCH EXISTING SURFACES.

j. ALL CONDUCTORS SHALL BE STRANDED SOFT–DRAWN ANNEALED COPPER WITH XHHW INSULATION. MINIMUM WIRE SIZE SHALL BE #12 UNLESS OTHERWISE NOTED.

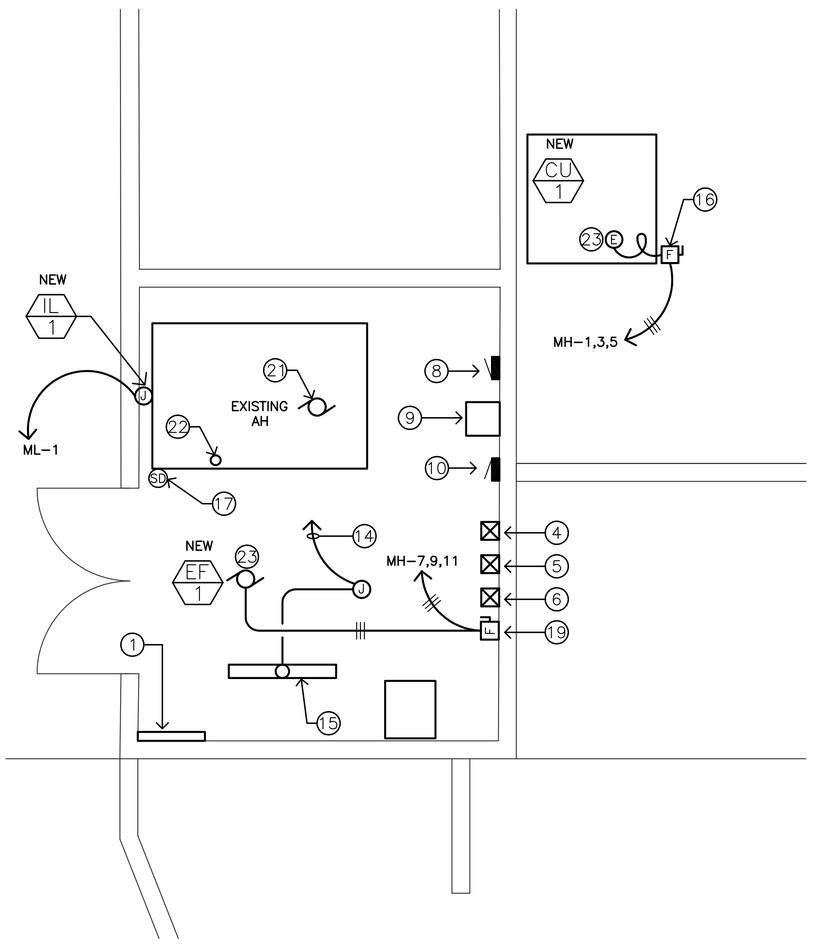
k. THE COMPLETE ELECTRICAL SYSTEM SHALL BE GROUNDED IN ACCORDANCE WITH N.E.C. ART. 250. PROVIDE GROUNDING WIRE IN ALL CONDUITS.

l. CONTRACTOR SHALL VISIT THE SITE AND FAMILIARIZE HIMSELF WITH ALL EXISTING CONDITIONS PRIOR TO SUBMITTAL OF BID. VERIFY ALL EXISTING CIRCUITS TO BE REUSED PRIOR TO CONNECTIONS.

m. THE ELECTRICAL CONTRACTOR SHALL GUARANTEE AGAINST DEFECTS IN MATERIALS, EQUIPMENT, OR WORKMANSHIP FOR A PERIOD OF TWO (2) YEARS UPON OWNER'S FINAL ACCEPTANCE. CONTRACTOR SHALL REPAIR OR REPLACE ANY DEFECTS TO THE SATISFACTION OF THE OWNER AT NO ADDITIONAL COST.

n. COORDINATE THE DISPOSITION OF DEMOLISHED ELECTRICAL EQUIPMENT WITH THE OWNER PRIOR TO REMOVAL FROM THE SITE.

o. PROVIDE PERMANENT NAME PLATES TO ALL EQUIPMENT. EXTERIOR NAMEPLATES SHALL BE WP/UV PROOF TYPE.



2 ELECTRICAL PLAN

SCALE: APPROX. 3/8"=1'-0"

0 1' 2' 4' 8' NORTH

PANEL MH 480 / 277 VOLTS, 3 PHASE, 4 WIRE
TYPE 14,000 MINIMUM A.I.C. RATING
200 A. BUS 200 A. MAIN LUGS ONLY MOUNTING FLUSH ☐
LOCATION SURFACE ☒
ENCLOSURE: NEMA 1

	SERVES	BKR	WIRE	COND	LOAD KVA A	LOAD KVA B	LOAD KVA C	COND	WIRE	BKR	SERVES	
1	NEW CONDENSER	100/3	2	1-1/4"	19.0	6.5		1-1/4"	2	100/3	NEW XMFR "TM"	2
3						19.0	6.0					4
5							19.0	6.0				6
7	NEW EFI	20/3	12	1/2"	1.0					20/1	SPACE	8
9						1.0						10
11							1.0					12
13	SPACE	20/1										14
15												16
17												18
19												20
21												22
23												24
● CONTINUOUS LOAD X 1.25								REMARKS:				
NON–CONTINUOUS LOAD X 1					25.5	25	25					
#								TOTAL CONNECTED LOAD = 76 KVA				
DEMAND KVA/PHASE					25.5	25	25	DEMAND LOAD = 76 KVA				
DEMAND AMPS/ PHASE					92	91	91					

PANEL ML 120 / 208 VOLTS, 3 PHASE, 4 WIRE
TYPE 10,000 MINIMUM A.I.C. RATING
100 A. BUS 100 A. MAIN CIRCUIT BREAKER MOUNTING FLUSH ☐
LOCATION SURFACE ☒
ENCLOSURE: NEMA 1

	SERVES	BKR	WIRE	COND	LOAD KVA A	LOAD KVA B	LOAD KVA C	COND	WIRE	BKR	SERVES	
1	IL–1	20/1	12	1/2"	0.5	4.0		1"	6	60/3	EXIST BLOWER	2
3	SPARE					4.0						4
5							4.0					6
7					0.8			1/2"	12	20/3	EXIST PUMP	8
9						0.8						10
11							0.8					12
13	SPACE				1.2					20/3	EXIST FAN	14
15						1.2						16
17							1.2					18
19										20/1	SPACE	20
21												22
23												24
● CONTINUOUS LOAD X 1.25								REMARKS:				
NON–CONTINUOUS LOAD X 1					6.5	6	6					
#								TOTAL CONNECTED LOAD = 18.5 KVA				
DEMAND KVA/PHASE					6.5	6	6	DEMAND LOAD = 18.5 KVA				
DEMAND AMPS/ PHASE					54	50	50					

LOCKOUT - TAGOUT - TESTOUT
MONRAD ENGINEERING INC
CONSULTING ELECTRICAL ENGINEERS
1926 East Ft. Lowell Road, Suite 200
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(520) 884-0045 M22003B

Amphitheater Public Schools

BLDG C - EAST WING
HVAC DUCTWORK RENOVATION
Prince Elementary School
125 E Prince Rd, Tucson, AZ 85705

SEAL:
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CERTIFICATE NO.
23911
FERNANDO GALVEZ
Date Signed 11/28/22
ARIZONA U.S.A.
EXPIRES 12–31–23

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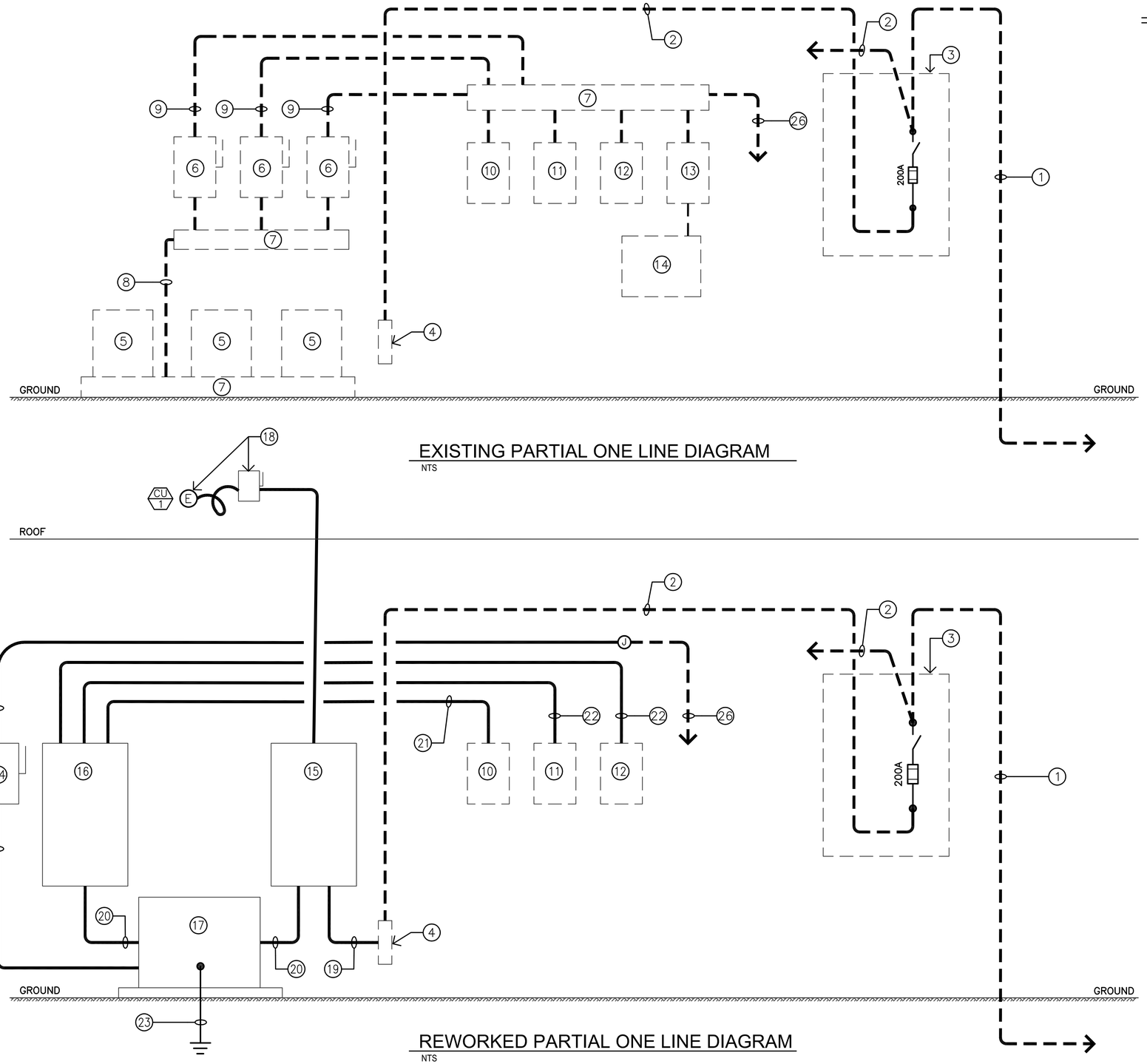
KWA PROJECT NO: 21045
DATE: November 29, 2022
DRAWN BY: ND
DESIGNED BY: ND
CHECKED BY: FG

SHEET CONTENTS:
Electrical Plans

SHEET
E1.0B
OF
Prince ES - Bldg C East Wing



EXISTING PARTIAL ONE LINE DIAGRAM
NTS

REWORKED PARTIAL ONE LINE DIAGRAM
NTS

KEYNOTES:

1. EXISTING 400A FEEDER TO REMAIN.
2. EXISTING 200A FEEDER TO REMAIN.
3. EXISTING 400A/3P FUSED DISCONNECT SWITCH TO REMAIN.
4. EXISTING PULLBOX TO REMAIN.
5. EXISTING 480V–1ø TO 240V–1ø TRANSFORMER TO BE REMOVED.
6. EXISTNG FUSED DISCONNECT SWITCH TO BE REMOVED.
7. EXISTING WIREWAY TO BE REMOVED.
8. EXISTING TRANSFORMER FEEDER TO BE REMOVED.
9. EXISTING BRANCH FEEDER TO BE REMOVED.
10. EXISTING BLOWER STARTER TO BE REPLACED WITH NEW VFD. REFER TO MECHANICAL DRAWINGS.
11. EXISTING PUMP STARTER TO REMAIN.
12. EXISTING FAN STARTER TO REMAIN.
13. EXISTNG CONDENSER CIRCUIT BREAKER TO BE REMOVED.
14. EXISTING CONDENSER PULL BOX TO BE REMOVED.
15. NEW PANEL "MH".
16. NEW PANEL "ML".
17. NEW TRANSFORMER "TM" 75KVA, 480V–3ø TO 120/208V–3ø–4W.
18. SEE ELECTRICAL PLAN SHEET E1.0B
19. NEW 4#3/0 CU., 1#6 CU. GRD., 2"C.
20. NEW 3#2 CU., 1#8 CU. GRD., 1–1/4"C.
21. NEW 4#6 CU., 1#10 CU. GRD., 1"C.
22. NEW 3#12 CU., 1#12 CU. GRD., 1/2"C.
23. NEW #4 CU. GRD. TO EXISTING TRANSFORMER GRD. WIRE.
24. NEW 100A/2P FUSED DISCONNECT SWITCH.
25. NEW 2 #3/0 CU, 1 #6 CU GRD., 2"C.
26. EXISTING 200A FEEDER TO EXISTING PANEL 73 TO REMAIN.

LOCKOUT - TAGOUT - TESTOUT
MONRAD ENGINEERING INC
CONSULTING ELECTRICAL ENGINEERS
1926 East Ft. Lowell Road, Suite 200
Tucson, Arizona 85719-2391
(520) 884-0045 M22003B

Amphitheater Public Schools

BLDG C - EAST WING
HVAC DUCTWORK RENOVATION
Prince Elementary School
125 E Prince Rd, Tucson, AZ 85705

SEAL:
Registered Professional Engineer CERTIFICATE NO. 23911 FERNANDO GALVEZ Date Signed 11/28/22 ARIZONA U.S.A.
EXPIRES 12–31–23

KELLY & WRIGHT ASSOCIATES • PC
HVAC • PLUMBING • FIRE PROTECTION
7337 E. TANQUE VERDE RD.
TUCSON, ARIZONA 85715
(520) 887.1919 FAX (520) 696.0280
WWW.KWMECH.COM

KWA PROJECT NO:	21045
DATE:	November 29, 2022
DRAWN BY:	ND
DESIGNED BY:	ND
CHECKED BY:	FG

SHEET CONTENTS:
Electrical
One Line Diagram

SHEET
E2.0B

____ OF ____
Prince ES - Bldg C East Wing