MECHANICAL LEGEND

MISC. DRAWING SYMBOLS

- CONSTRUCTION NOTE
- DEMOLITION NOTE
- REVISION NOTE
- XX/XX — EQUIPMENT TYPE / EQUIPMENT NUMBER
- XX/XX — DETAIL NUMBER / REFERENCED DRAWING
- XX/XX — SECTION NUMBER / REFERENCED DRAWING
- POINT OF CONNECTION NEW TO EXISTING
- EXTENT OF DEMOLITION
- EX. — EXISTING TO REMAIN
- (R) — EXISTING TO BE REMOVED
- (ER) — EXISTING TO BE RELOCATED
- (F) — FUTURE
- (N) — NEW
- SQUARE FOOT
- ø — DIAMETER

PIPING

—— XXX ——

C	CONDENSATE DRAIN
CHS	CHILLED WATER SUPPLY
CHR	CHILLED WATER RETURN
CWR	CONDENSER WATER RETURN
CWS	CONDENSER WATER SUPPLY
HWS	HEATING WATER SUPPLY
HWR	HEATING WATER RETURN
LPC	LOW PRESSURE STEAM CONDENSATE
LPS	LOW PRESSURE STEAM
MPS	MEDIUM PRESSURE STEAM
MPS	MEDIUM PRESSURE STEAM CONDENSATE
R	REFRIGERANT
RD	REFRIGERANT DISCHARGE
RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUCTION
STM	STEAM
V	VENT

- NEW PIPE
- EXISTING PIPE
- EXISTING PIPE TO BE REMOVED
- AIR VENT HIGH CAPACITY
- AIR VENT LOW CAPACITY
- AUTOMATIC CONTROL 2-WAY VALVE
- AUTOMATIC CONTROL 3-WAY VALVE
- AUTOMATIC CONTROL BUTTERFLY VALVE
- BALANCING VALVE
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- GAS COCK
- GATE VALVE
- GLOBE VALVE
- GLOBE STYLE CHECK VALVE
- RELIEF VALVE
- TRIPLE DUTY VALVE
- SOLENOID VALVE
- WYE STRAINER W/ BLOWDOWN VALVE AND HOSE END CONNECTION
- WYE STRAINER
- BREAK LINE
- DIRECTION OF FLOW
- CAP PIPE
- FLANGED CONNECTION
- FLEXIBLE CONNECTION
- INSERTION PLUG FOR TEMPERATURE/PRESSURE GAUGE
- PIPE BRANCH OFF BOTTOM
- PIPE DROP
- PIPE RISE
- REDUCER/INCREASER CONCENTRIC
- REDUCER/INCREASER ECCENTRIC
- UNION
- PRESSURE GAUGE W/ ISOLATION VALVE
- PUMP
- SUCTION DIFFUSER W/ DRAIN VALVE AND HOSE END CONNECTION
- THERMOMETER W/ THERMOWELL

EQUIPMENT

- FAN
- PUMP

ABBREVIATIONS

AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
AFS	AIR FLOW MONITOR STATION
AHU	AIR HANDING UNIT
AS	AIR SEPARATOR
ASC	AIR SCOOP
BAS	BUILDING AUTOMATION SYSTEM
BDD	BACKDRAFT DAMPER
BHP	BRAKE HORSEPOWER
BOD	BOTTOM OF DUCT
BTU	BRITISH THERMAL UNIT
BTUH	BRITISH THERMAL UNIT PER HOUR
C	CONDENSATE DRAIN
CC	COOLING COIL
CD	CEILING DIFFUSER
CFM	CUBIC FEET PER MINUTE
CH	CHILLER
CO	CLEAN OUT
CONN	CONNECTION
CSF	CHEMICAL SHOT FEEDER
CUH	CABINET UNIT HEATER
CV	COEFFICIENT, VALVE FLOW
CVB	CONSTANT VOLUME BOX
DB	DRY BULB TEMPERATURE
DEG	DEGREES (FAHRENHEIT)
DIA	DIAMETER
EAT	ENTERING AIR TEMPERATURE
EC	ELECTRICAL CONTRACTOR
EF	EXHAUST FAN
EG	EXHAUST GRILLE
ELEV	ELEVATION
ER	EXHAUST REGISTER
EWT	ENTERING WATER TEMPERATURE
EX	EXISTING
EXH	EXHAUST
EXT	EXPANSION TANK
F	FAHRENHEIT
FC	FLEXIBLE CONNECTION
FCU	FAN COIL UNIT
FD	FIRE DAMPER
FMS	FACILITIES MANAGEMENT SYSTEM
FOB	FLAT ON BOTTOM
FOT	FLAT ON TOP
FPI	FINS PER INCH
FPU	FAN POWERED UNIT
FSD	FIRE SMOKE DAMPER
FT	FIN TUBE RADIATION
GA	GAUGE
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GPM	GALLONS PER MINUTE
HP	HORSEPOWER
HZ	HERTZ
IN.WG.	INCHES WATER GAUGE
LAT	LEAVING AIR TEMPERATURE
LD	LINEAR DIFFUSR
LVR	LOUVER
LWT	LEAVING WATER TEMPERATURE
MBH	THOUSAND BTU PER HOUR
MC	MECHANICAL CONTRACTOR
MOD	MOTORIZED OPERATED DAMPER
MUA	MAKE UP AIR
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NK	NECK
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OAI	OUTSIDE AIR INTAKE
PH	PHASE
PSI	POUNDS PER SQUARE INCH
RA	RETURN AIR
RAD	RADIATION
RF	RETURN FAN
RG	RETURN GRILLE
RH	REHEAT COIL
RR	RETURN REGISTER
SA	SOUND ATTENUATOR
SCD	SMOKE CONTROL DAMPER
SD	SMOKE DETECTOR
SF	SUPPLY FAN
SG	SUPPLY GRILLE
SP	STATIC PRESSURE
SR	SUPPLY REGISTER
TEMP	TEMPORARY
TG	TRANSFER GRILLE
UH	UNIT HEATER
V	VOLTS
VD	VOLUME DAMPER
VF	VERIFY IN FIELD
VFD	VARIABLE FREQUENCY DRIVE
W/	WITH
WB	WET BULB TEMPERATURE
WMS	WIRE MESH SCREEN

DEVICES

DPS	DIFFERENTIAL PRESSURE SENSOR
FS	FLOW SENSOR
PG	PRESSURE GAUGE
TS	TEMPERATURE SENSOR

NOTE: THIS IS A GENERAL MECHANICAL LEGEND, ALL SYMBOLS, ABBREVIATIONS AND LINE DESIGNATIONS MAY NOT APPEAR ON THE DRAWINGS. SEE EQUIPMENT SCHEDULES FOR EQUIPMENT DESIGNATIONS.

GENERAL NOTES

ALL OF THE FOLLOWING NOTES ARE GENERAL AND SOME MAY NOT APPLY TO THIS SPECIFIC PROJECT.

1. THE SUBMISSION OF A PROPOSAL BY THE CONTRACTOR IS NOTIFICATION THAT THE CONTRACTOR HAS TOTALLY FAMILIARIZED HIMSELF WITH THE CONTRACT DOCUMENTS AND EXISTING SITE CONDITIONS AND HAS AGREED TO PROVIDE THE NECESSARY LABOR AND MATERIAL FOR THE COMPLETE INSTALLATION OF EACH SYSTEM IN A NEAT AND WORKMANLIKE MANNER IN ACCORDANCE WITH ALL AUTHORITIES HAVING JURISDICTION.
2. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, SIZES, CLEARANCES AND LOCATIONS PRIOR TO THE START OF CONSTRUCTION AND ADVISE THE ENGINEER AND THE OWNER OF ANY DISCREPANCIES BEFORE PERFORMING THE WORK.
3. THE DRAWINGS INDICATE ARRANGEMENTS AND APPROXIMATE SIZES AND RELATIVE LOCATIONS OF PRINCIPLE APPARATUS, EQUIPMENT, DEVICES AND SERVICES TO BE PROVIDED. DRAWINGS ARE DIAGRAMMATIC AND ARE A GRAPHIC REPRESENTATION OF THE CONTRACT REQUIREMENTS TO BEST AVAILABLE STANDARDS AT THE SCALE INDICATED.
4. LAYOUT OF EQUIPMENT INDICATED ON THE DRAWINGS SHALL BE CHECKED AND COMPARED AGAINST ALL DRAWINGS AND SPECIFICATIONS OF ALL TRADES AND EXACT LOCATIONS DETERMINED USING APPROVED SHOP DRAWINGS OF SUCH EQUIPMENT. WHERE PHYSICAL INTERFERENCE OCCURS, CONSULT WITH ENGINEER AND PREPARE DATED, DIMENSIONED DRAWINGS COORDINATED WITH ALL OTHER TRADES. OBTAIN WRITTEN APPROVAL OF THE ENGINEER FOR SUCH DRAWINGS AND DISTRIBUTE SAME AS REQUIRED.
5. CONTRACTOR SHALL COORDINATE ALL WORK WITH THE OWNER AND ALL OTHER CONTRACTORS. CONTRACTOR SHALL ALSO SCHEDULE HIS WORK IN ACCORDANCE WITH THE CONSTRUCTION SCHEDULE SO THAT ALL OF HIS WORK CAN BE INSTALLED WITHOUT DELAYING THE PROJECT.
6. ALL WORK SHALL COMPLY AND BE INSTALLED IN ACCORDANCE WITH ALL APPLICABLE CODES, THE UNIFORM CONSTRUCTION CODE STATUTE, THE APPLICABLE INTERNATIONAL CODES (E.G. THE INTERNATIONAL MECHANICAL CODE, THE INTERNATIONAL BUILDING CODE) AS AMENDED AND ADOPTED BY THE LOCAL JURISDICTION, AS WELL AS ALL APPLICABLE STATE AND LOCAL CODES AND REGULATIONS (CURRENT EDITIONS), THE NATIONAL ELECTRIC CODE, BUILDING STANDARDS, NFPA AND ALL OTHER AGENCIES AND AUTHORITIES HAVING JURISDICTION. REFER TO THE CODES AND STANDARDS TABLE FOR VERSIONS OF CODES.
7. CONTRACTOR SHALL SECURE AND PAY ALL FEES AND PERMITS PERTAINING TO THE CONTRACT. GIVE ALL NOTICES, OBTAIN ALL PERMITS, AND PAY ALL GOVERNMENTAL TAXES, FEES, AND COSTS; FILE NECESSARY PLANS AND OBTAIN APPROVALS OF ALL GOVERNMENT DEPARTMENTS HAVING JURISDICTION; OBTAIN CERTIFICATES OF INSPECTION FROM AN NFPA APPROVED AGENCY FOR THE WORK AND DELIVER THE SAME TO THE OWNER WITH REQUEST FOR FINAL PAYMENT.
8. ALL EQUIPMENT SHALL BE INSTALLED IN STRICT COMPLIANCE WITH THE MANUFACTURERS' WRITTEN INSTRUCTIONS.
9. ANY ITEM DEEMED NECESSARY OR RECOMMENDED, OR REQUIRED BY CODE, BY THIS TRADE CONTRACTOR TO ACHIEVE THE FUNCTION SHOWN, BUT NOT INDICATED HEREIN, SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO BIDDING IN WRITTEN "RFI" FORMAT. FAILURE TO IDENTIFY ITEMS DEEMED NECESSARY PRIOR TO BIDDING SHALL INDICATE TO THE ENGINEER AND OWNER THAT SAID ITEMS ARE INCLUDED IN THE CONTRACT PRICE.
10. ANY EXISTING POTENTIALLY HAZARDOUS MATERIALS ENCOUNTERED IN THE COURSE OF THE WORK SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER FOR REMOVAL AND DISPOSAL.
11. CONTRACTOR SHALL BE RESPONSIBLE FOR WORKMEN'S IDENTIFICATION AND BADGING, SAFETY AND FIRE PROTECTION, BARRICADES, WARNING SIGNS, TRASH REMOVAL, CUTTING AND PATCHING.
12. SMOKING AT THE JOB SITE IS NOT ALLOWED.
13. ALL WORK AND SCHEDULING TO BE COORDINATED WITH OWNER. CONTRACTOR SHALL SCHEDULE ALL SHUTDOWNS THAT AFFECT UTILITIES AND PORTIONS OF THE BUILDING THAT MUST REMAIN IN OPERATION WITH THE OWNER. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
14. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL RIGGING, HANDLING AND PROTECTION OF MATERIALS. ALL EQUIPMENT AND MATERIALS SHALL BE NEW AND WITHOUT BLEMISH OR DEFECT.
15. CONTRACTOR SHALL PROVIDE LABOR TO RECEIVE, UNLOAD, STORE, PROTECT AND TRANSFER TO POINT OF INSTALLATION OF OWNER FURNISHED ITEMS.
16. FLAMMABLE MATERIALS MAY NOT BE STORED OR ALLOWED TO REMAIN OVERNIGHT WITHIN THE BUILDING. THIS INCLUDES, BUT IS NOT LIMITED TO, PAINTS, THINNERS, CLEANING AND RESTORATION PRODUCTS, RAGS OR BRUSHES, AND ANY TOOL THAT IS CAPABLE OF PRODUCING FLAME. SAWDUST, SCRAP LUMBER, SOAKED RAGS, AND OTHER FLAMMABLE CONSTRUCTION DEBRIS MUST BE COLLECTED AT THE END OF EACH DAY AND DISPOSED OF PROPERLY OUTSIDE OF THE BUILDING.
17. MAINTAIN SUITABLE FIRE PROTECTION EQUIPMENT AT BUILDING SITE. AT MINIMUM, TYPE ABC FIRE EXTINGUISHERS SHALL BE PROVIDED WHERE WORK IS BEING PERFORMED WITH OPEN FLAME OR USING FLAMMABLE MATERIALS AND AN ADDITIONAL FIRE EXTINGUISHER SHALL BE PROVIDED TO THE WORKER PERFORMING THE WORK. TRAIN ALL WORKERS IN THE USE OF FIRE PROTECTION EQUIPMENT.
18. ALL FIRE SAFETY REQUIREMENTS LISTED ABOVE ARE TO BE CONSIDERED MINIMUMS. CONTRACTOR IS RESPONSIBLE FOR TAKING OTHER MEASURES DEEMED NECESSARY BY THE CONTRACTOR TO PROTECT THE BUILDING.
19. CONTRACTOR SHALL SUBMIT SCHEDULE OF SUBMITTALS PRIOR TO SUBMITTING ANY SHOP DRAWINGS. THIS SCHEDULE SHALL IDENTIFY ALL PRODUCT DATA, DRAWINGS, ETC TO BE SUBMITTED FOR THIS PROJECT, INCLUDING THE ANTICIPATED DATE OF EACH SUBMISSION. CONTRACTOR SHALL SUBMIT (6) SETS OF SHOP DRAWINGS AND EQUIPMENT CUTS TO THE ENGINEER FOR APPROVAL PRIOR TO PURCHASING EQUIPMENT OR STARTING ANY WORK. CONTRACTOR SHALL SUBMIT (3) PRINTS AND (1) REPRODUCIBLE OF ALL PIPING, DUCTWORK, FIRE PROTECTION, CONDUIT, AND CABLE TRAY FIELD INSTALLATION DRAWINGS FOR EACH SYSTEM TO BE INSTALLED. ANY WORK INSTALLED OR EQUIPMENT PURCHASED PRIOR TO RECEIPT OF ENGINEER-APPROVED SHOP DRAWINGS THAT REQUIRES CHANGES SHALL BE REPLACED AT THE EXPENSE OF THE CONTRACTOR.
20. SUBMIT CATALOG INFORMATION, FACTORY ASSEMBLY DRAWINGS AND FIELD INSTALLATION DRAWINGS AS REQUIRED FOR A COMPLETE EXPLANATION AND DESCRIPTION OF ALL ITEMS TO BE PROVIDED. THE CONTRACTOR SHALL REVIEW AND APPROVE ALL SHOP DRAWINGS. NO SUBMISSION WILL BE ACCEPTED WITHOUT THE SIGNED APPROVAL OF THE CONTRACTOR. THE CONTRACTOR SHALL CHECK AND VERIFY ALL FIELD MEASUREMENTS.
21. INSTALLED SYSTEMS SHALL OPERATE UNDER ALL CONDITIONS OF LOAD WITHOUT SOUND OR VIBRATION THAT IS OBJECTIONABLE TO THE ENGINEER OR OWNER. OBJECTIONABLE SOUND OR VIBRATION CONDITIONS SHALL BE CORRECTED IN AN APPROVED MANNER BY THE CONTRACTOR AT HIS EXPENSE.
22. FURNISH ACCESS DOORS AS REQUIRED FOR OPERATION AND MAINTENANCE OF CONCEALED EQUIPMENT, VALVES, CONTROLS, DAMPERS, ETC. ALL ACCESS DOORS SHALL BE COORDINATED WITH THE OWNER AND SHALL MATCH THE FIRE RATING OF THE PENETRATION AS REQUIRED.
23. ALL WORK FURNISHED UNDER THE CONTRACT SHALL BE GUARANTEED AGAINST ANY AND ALL DEFECTS IN WORKMANSHIP AND MATERIALS FOR A PERIOD OF NOT LESS THAN ONE (1) YEAR FROM THE DATE OF FINAL ACCEPTANCE. ANY DEFECTS OF WORKMANSHIP DEVELOPING DURING THIS PERIOD SHALL BE REMEDIED AND ANY DEFECTIVE MATERIAL SHALL BE REPLACED WITHOUT ADDITIONAL COST TO THE OWNER.
24. CONTRACTOR SHALL NOTIFY ENGINEER OF ESTIMATED DATE OF COMPLETION OF ROUGH-IN WORK AND DATE OF BOTH WALL AND CEILING INSTALLATION. NOTIFICATION SHALL BE A MINIMUM OF ONE WEEK PRIOR TO DATE TO ENABLE ENGINEER TO SCHEDULE PRELIMINARY PUNCHLIST INSPECTION. CONTRACTOR SHALL SIMILARLY NOTIFY ENGINEER OF COMPLETION OF ALL WORK, INDICATING THE CONTRACTOR IS READY FOR THE ENGINEER TO PERFORM THE FINAL PUNCHLIST INSPECTION.
25. UPON COMPLETION OF ALL UNFINISHED OR FAULTY WORK NOTED IN ENGINEER'S FINAL PUNCHLIST, THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER IN WRITING A LETTER OF COMPLETION CERTIFYING THAT ALL PUNCHLIST ITEMS HAVE BEEN COMPLETED AND ALL AS-BUILT PLANS, MANUALS, ETC. HAVE BEEN SUBMITTED.
26. ALL CHANGES MADE BY THE CONTRACTOR WHICH ARE NOT APPROVED BY THE DESIGN ENGINEER SHALL BE DONE AT THE LIABILITY OF THE CONTRACTOR.
27. CONTRACTOR SHALL RESTORE EXISTING SYSTEMS, DEVICES, FINISHES, ETC. DAMAGED OR ALTERED BY WORK TO ACCEPTABLE CONDITION AS DETERMINED BY THE OWNER OR ENGINEER.
28. EXISTING WORK THAT IS TO BE REMOVED SHALL BE TURNED OVER TO THE OWNER OR DISPOSED OF AT THE OWNER'S DIRECTION. ALL WORK TO BE DISPOSED OF SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE PROMPTLY REMOVED FROM THE SITE. ALL EQUIPMENT TO BE TURNED OVER TO THE OWNER SHALL BE DELIVERED TO ON SITE CENTRAL RECEIVING LOCATION DESIGNATED BY THE OWNER.
29. PROVIDE ALL NECESSARY REMOVAL OF EXISTING CEILING TILES AND REINSTALLATION OF CEILING TILES OR REPLACEMENT AS NEEDED TO ACCOMPLISH NEW WORK. PERFORM ALL NECESSARY CEILING WORK INCLUDING BUT NOT LIMITED TO REMOVAL, REINSTALLATION AND PROVIDING NEW CEILING TILES, CEILING GRID, T-BARS SUPPORTS, AND ALL APPURTENANCES.
30. GENERAL MECHANICAL NOTES PERTAIN TO ALL MECHANICAL DRAWINGS.
31. ALL WORK SHALL BE INSTALLED IN A NEAT AND WORKMAN-LIKE MANNER.
32. REFERENCE ARCHITECTURAL, ELECTRICAL, PLUMBING AND STRUCTURAL DRAWINGS FOR COORDINATION.
33. PERFORM ALL RIGGING REQUIRED TO COMPLETE ALL WORK UNDER THIS CONTRACT. IF REQUIRED, THE CONTRACTOR SHALL DISASSEMBLE EQUIPMENT OR ITEMS FOR RIGGING AND/OR ACCESS INTO THE BUILDING. AFTER RIGGING IS COMPLETE, THE CONTRACTOR SHALL REASSEMBLE THE EQUIPMENT OR ITEMS.
34. THE CONTRACTOR SHALL REVIEW THE SITE AND ALL CLEARANCES TO VERIFY THE NEW EQUIPMENT CAN BE INSTALLED IN THE LOCATION SHOWN ON DRAWINGS. PROVIDE ANY NECESSARY SHIPPING SPLITS ON UNITS TO ALLOW THEM TO BE INSTALLED IN THE LOCATION SHOWN. REMOVE ANY NECESSARY OBSTRUCTIONS TO ALLOW FOR INSTALLATION OF EQUIPMENT AND REPAIR/REPLACE ONCE INSTALLATION IS COMPLETE.
35. PROVIDE MANUFACTURER DESIGNATED CLEARANCES FOR EQUIPMENT MAINTENANCE AND REPAIR.
36. MECHANICAL CONTRACTOR SHALL COORDINATE RELOCATION OF SPRINKLER AND PIPING WITH SPRINKLER CONTRACTOR AS REQUIRED FOR INSTALLATION OF NEW HVAC EQUIPMENT AND DUCTWORK.

ADD ALTERNATES:

1. ALTERNATE #1: PROVIDE O2 TRIM COMPONENTS AND ALL ACCESSORIES AS LISTED IN SCHEDULE.
2. ALTERNATE #2: REPLACE EXISTING GAS TRAIN AND ALL ACCESSORIES.

CODES AND STANDARDS

COMMONWEALTH OF PA - DEPT. OF LABOR & INDUSTRY - UNIFORM CONSTRUCTION CODE	
2018	INTERNATIONAL BUILDING CODE WITH AMENDMENTS
2018	INTERNATIONAL PLUMBING CODE WITH AMENDMENTS
2018	INTERNATIONAL FUEL GAS CODE
2018	INTERNATIONAL MECHANICAL CODE
2017	NATIONAL ELECTRICAL CODE - NFPA 70
2018	INTERNATIONAL ENERGY CONSERVATION CODE WITH AMENDMENTS
2018	INTERNATIONAL EXISTING BUILDING CODE WITH AMENDMENTS
2018	INTERNATIONAL FIRE CODE (IBC 2018 CHAPTER 35, REFERENCE TO IFC.)
2021	ACCESSIBLE & USABLE BLDS & FACILITIES - IBC - CHAPTER 11 / A117.1

GENERAL DEMOLITION NOTES

ALL OF THE FOLLOWING NOTES ARE GENERAL AND SOME MAY NOT APPLY TO THIS SPECIFIC PROJECT.

1. DEMOLITION/RELOCATIONS: EACH TRADE CONTRACTOR SHALL BE RESPONSIBLE FOR DEMOLITION AND RELOCATIONS OF SERVICES, EQUIPMENT AND MATERIAL RELATING TO THEIR RESPECTIVE TRADE.
2. THE CONTRACTOR SHALL REMOVE ALL WORK AS NOTED ON THE DRAWINGS. WHERE IT IS NOTED TO REMOVE EXISTING EQUIPMENT, DUCTWORK AND PIPING, ALL ASSOCIATED VALVES, FITTINGS, HANGERS, SUPPORTS, INSULATION, CONTROLS, ELECTRICAL WORK, AND APPURTENANCES SHALL ALSO BE REMOVED. ADEQUATELY SUPPORT EXISTING DUCTWORK AND PIPING TO REMAIN. PROVIDE TEMPORARY CAPS ON EXISTING PIPING ENDS/DUCT OPENINGS WHERE SYSTEMS WILL REMAIN IN SERVICE PRIOR TO INSTALLATION OF NEW WORK. CAP AND SEAL EXISTING OPENINGS WHERE NOT REUSED AND PATCH INSULATION TO MATCH EXISTING. THE CONTRACTOR SHALL RELOCATE EXISTING WORK AS REQUIRED TO INSTALL NEW WORK.
3. WHERE EXISTING WALLS, FLOORS OR CEILINGS ARE REMOVED, ALL HVAC SHALL BE PROTECTED FROM DAMAGE AND SUPPORTED AS REQUIRED. REPAIR ANY DAMAGE TO EXISTING TO REMAIN EQUIPMENT.
4. PRIOR TO DEMOLITION, THE CONTRACTOR SHALL REVIEW WITH THE OWNER ALL MATERIALS TO BE REMOVED. SHOULD THE OWNER OPT TO KEEP ANY MATERIALS, THE CONTRACTOR SHALL REMOVE AND DELIVER THE PARTS TO THE OWNER ON THE SITE WHERE DIRECTED. OTHERWISE, ALL DEMOLISHED OR REMOVED MATERIALS SHALL BECOME THE PROPERTY OF THE CONTRACTOR, SHALL BE REMOVED FROM THE SITE, AND BE DISPOSED OF IN A LEGAL MANNER.
5. DEMOLITION SHALL INCLUDE REMOVAL OF ALL PARTS AND PIECES IN THEIR ENTIRETY BACK TO THE POINTS INDICATED OR IF NOT INDICATED BACK TO THEIR POINT OF SOURCE. WHERE CONDITIONS PROHIBIT TOTAL REMOVAL OF THE WORK, THE REMAINING PORTION SHALL BE CUT FLUSH WITH THE SURROUNDING SURFACE (CAPPED OR TERMINATED AS NOTED) BE REFINISHED IN AN APPROVED MANNER.
6. MAINTAIN EXISTING UTILITIES INDICATED OR WHERE REQUIRED TO REMAIN, KEEP IN SERVICE, AND PROTECT AGAINST DAMAGE DURING DEMOLITION OPERATIONS. DO NOT INTERRUPT EXISTING UTILITIES SERVING OCCUPIED OR USED FACILITIES, EXCEPT WHEN SCHEDULED WITH THE OWNER.
7. DO NOT REMOVE EXISTING STRUCTURAL WORK. DO NOT REMOVE OPERATIONAL ELEMENTS AND SAFETY-RELATED COMPONENTS IN A MANNER RESULTING IN A REDUCTION OF CAPACITIES TO PERFORM IN THE MANNER INTENDED OR RESULTING IN DECREASED OPERATIONAL LIFE, INCREASED MAINTENANCE, OR DECREASED SAFETY.
8. REMOVALS, DISCONNECTIONS, AND RELOCATIONS SHALL BE PERFORMED BY WORKMEN SKILLED IN THE TRADE INVOLVED AND SHALL BE EMPLOYED BY A CONTRACTOR LICENSED IN THE TRADE INVOLVED. ALL WORK SHALL BE DONE IN ACCORDANCE WITH ACCEPTED TRADE PRACTICES.
9. PROVIDE ADEQUATE TEMPORARY SUPPORT FOR WORK TO REMAIN TO PREVENT FAILURE. DO NOT ENDANGER OTHER WORK.
10. PROTECTION: PROVIDE ADEQUATE PROTECTION WHERE REQUIRED FOR THE PRESENT BUILDING AND ITS CONTENTS. TEMPORARY DUSTPROOF BARRIERS AND BARRICADES SHALL BE ERECTED WHERE REQUIRED FOR PROTECTION OF PERSONNEL, PROTECTION FROM DUST AND DIRT, FOR SECURITY, FIRE AND WEATHER PROTECTIVE REASONS. CONTRACTOR SHALL TAKE EVERY PRECAUTION AGAINST FIRE BY EMPLOYING FIRE DEPARTMENT TYPE HOSES AND PORTABLE FIRE EXTINGUISHERS AS REQUIRED BY OSHA AND/OR THE OWNER'S INSURANCE UNDERWRITER. COMPLY WITH GOVERNING REGULATIONS PERTAINING TO ENVIRONMENTAL PROTECTION.
11. ALL EXISTING EQUIPMENT REQUIRED TO BE REUSED SHALL BE CLEANED. IN ALL INSTANCES WHERE CONTRACTOR FINDS THAT EXISTING EQUIPMENT IS DEFECTIVE TO THE POINT WHERE IT CANNOT BE PROPERLY RESTORED AND WILL NOT OPERATE PROPERLY, THEY SHALL REPORT THE SPECIFIC INSTRUMENTS OR EQUIPMENT TO THE DESIGN PROFESSIONAL FOR DIRECTIONS.
12. EXTREME CARE SHALL BE EXERCISED FOR ALL EXISTING ITEMS THAT ARE TO REMAIN IN SERVICE UNTIL NEW ITEMS ARE INSTALLED FOR THE SAME SERVICE. ALL SHUTDOWNS OF ANY SYSTEM SHALL BE COORDINATED WITH THE OWNER.
13. ALL WORK TO BE DEMOLISHED REQUIRING DISRUPTION TO EXISTING AREAS ON FLOORS ABOVE BELOW, OR ADJACENT TO THE CONTRACT AREA; EACH CONTRACTOR SHALL SCHEDULE EACH DISRUPTION WITH THE OWNER. WHERE DEMOLITION WORK WILL REQUIRE TEMPORARY REMOVAL OF EXISTING PIPING WHICH ARE TO REMAIN, THE OWNER SHALL DIRECT AND DEFINE PROCEDURES. NO WORK SHALL PROCEED WITHOUT OWNER'S AUTHORIZATION.
14. REMOVE AND REROUTE BY OFFSETTING AS REQUIRED ANY EXISTING PIPING RISERS, STACKS OR LATERAL PIPING TO REMAIN IN SERVICE AND BECOME EXPOSED DUE TO NEW FLOOR PLAN AND OR NEW CEILING LAYOUT.
15. WHERE DRAWINGS INDICATE THE DEMOLITION OF PIPING OR DUCTWORK, THE CONTRACTOR SHALL REMOVE ALL ABANDONED HANGERS AND SUPPORTS. PIPING AND/OR DUCTWORK SHALL BE CAPPED AND INSULATED WITH MATERIALS TO MATCH EXISTING.
16. THE CONTRACTOR SHALL REPAIR ALL PENETRATIONS OF ROOFS, WALLS AND FLOORS TO MATCH EXISTING OF WHICH ITEMS HAVE BEEN DEMOLISHED.
17. UNLESS NOTED OTHERWISE, THE CONTRACTOR SHALL REMOVE EQUIPMENT PADS/CURBS/ SUPPORTS FOR ALL FLOOR OR ROOF MOUNTED EQUIPMENT INDICATED TO BE REMOVED. REPAIR FLOORS AND ROOFS AS REQUIRED TO MATCH EXISTING. REMOVE HANGERS AND SUPPORTS FOR ALL SUSPENDED EQUIPMENT INDICATED TO BE REMOVED.
18. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, THE CONTRACTOR SHALL REMOVE ALL DISCONNECTS, DRIVES, STARTERS, CONTACTORS, SWITCHES, CONTROLLERS, SENSORS, ACTUATORS, ETC. REMOVE EQUIPMENT POWER FEED WIRING AND CONDUIT COMPLETE BACK TO DISTRIBUTION PANEL. ALL CONTROLS CONDUIT, WIRING AND/OR PNEUMATIC TUBING SHALL BE REMOVED BACK TO A REASONABLE EXTENT.

GENERAL CONSTRUCTION NOTES

ALL OF THE FOLLOWING NOTES ARE GENERAL AND SOME MAY NOT APPLY TO THIS SPECIFIC PROJECT.

1. THE CONTRACTOR SHALL SUBMIT DRAWINGS SHOWING COORDINATION OF ALL TRADES, INCLUDING, BUT NOT LIMITED TO: DUCTS, PIPING, CONDUIT, EQUIPMENT, FIXTURES, STRUCTURE, FRAMING AND ANY ITEMS PENETRATING THE CEILING AND ROOF. THE CONTRACTOR SHALL INCUR ALL EXPENSES RELATED TO A LACK OF COORDINATION BETWEEN TRADES.
2. ALL MECHANICAL DRAWINGS ARE DIAGRAMMATIC AND SHOW DESIGN INTENT ONLY. THE EXACT LOCATION AND SIZES OF ALL EQUIPMENT SHALL BE VERIFIED BY THE CONTRACTOR AND COORDINATED WITH THE DESIGN PROFESSIONAL AND ALL OTHER TRADES. DUCTWORK AND PIPING SHALL BE SET UP AND DOWN AND OFFSET AS REQUIRED TO SUIT FIELD CONDITIONS.
3. MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR REVIEWING ALL CONTRACT DOCUMENTS RELATED TO THIS PROJECT. THERE MAY BE WORK REQUIRED OF THIS TRADE SHOWN ON OTHER TRADE DRAWINGS.
4. THE CONTRACTOR TO PROVIDE A FUNCTIONAL INSTALLATION AS INTENDED BY THE DESIGN PROFESSIONAL.
5. MECHANICAL CONTRACTOR SHALL ENSURE MINIMUM NEC CLEARANCES IN FRONT OF ALL ELECTRICAL PANELS AND GEAR.
6. ALL FLOOR MOUNTED HVAC EQUIPMENT SHALL BE INSTALLED ON 4" HIGH REINFORCED CONCRETE HOUSEKEEPING PADS PROVIDED BY THE G.C. UNLESS NOTED OTHERWISE. HOUSEKEEPING PAD SHALL BE MINIMUM 4" LARGER THAN EQUIPMENT ON ALL SIDES. UNLESS OTHERWISE REQUIRED BY EQUIPMENT MANUFACTURER.
7. MECHANICAL SCHEDULES DO NOT NECESSARILY INDICATE EQUIPMENT QUANTITIES.
8. MECHANICAL CONTRACTOR SHALL PROVIDE FLEXIBLE CONNECTIONS AT ALL DUCTWORK-TO-EQUIPMENT CONNECTIONS.
9. FLEXIBLE DUCTWORK SHALL NOT EXCEED 5'-0" FROM POINT OF RIGID DUCT CONNECTION TO AIR TERMINAL. THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DEVIATIONS FROM THE CONTRACT DRAWINGS THAT ARE NOT APPROVED BY THE DESIGN PROFESSIONAL.
10. MECHANICAL CONTRACTOR SHALL COORDINATE THE LOCATION OF ALL WALL MOUNTED THERMOSTATS AND HUMIDISTATS WITH THE DESIGN PROFESSIONAL AND/OR OWNER.
11. MECHANICAL CONTRACTOR SHALL COORDINATE THE EXACT LOCATION, MOUNTING STYLE AND FINISH OF ALL GRILLES, REGISTERS, DIFFUSERS, ETC. WITH THE DESIGN PROFESSIONAL.
12. ALL SUSPENDED AND FLOOR MOUNTED EQUIPMENT SHALL BE FURNISHED WITH VIBRATION ISOLATION AS PER MECHANICAL SPECIFICATIONS.
13. DUCT MOUNTED SMOKE DETECTORS ARE FURNISHED BY THE ELECTRICAL CONTRACTOR AND INSTALLED BY THE MECHANICAL CONTRACTOR. THE MECHANICAL CONTRACTOR SHALL PROVIDE ALL CONTROL WIRING FROM THE SMOKE DETECTOR'S ON-BOARD RELAY(S) TO THE EQUIPMENT CONTROLLERS/STARTERS/VFD'S FOR SHUTTING DOWN THE ASSOCIATED MECHANICAL EQUIPMENT AND ACTIVATION OF REQUIRED FIRE/SMOKE DAMPERS. THE SMOKE DETECTOR SHALL BE TIED INTO THE FIRE ALARM SYSTEM AND REMOTE TEST STATIONS BY THE ELECTRICAL CONTRACTOR. THE DUCT DETECTOR SHALL BE SUPPLIED WITH THE APPROPRIATE SAMPLING TUBES TO FIT THE INSTALLATION. COORDINATE INSTALL OF SMOKE DETECTORS WITH ELECTRICAL CONTRACTOR.
14. DUCT SIZES SHOWN ON PLANS REFER TO CLEAR INSIDE DIMENSIONS (CID) UNLESS NOTED OTHERWISE.
15. DIELECTRIC COUPLINGS SHALL BE USED WHERE DISSIMILAR METALS ARE JOINED.
16. PROVIDE INSULATED BLANK-OFF/CAPS PANELS FOR ALL UNUSED PORTIONS OF LOUVERS, EQUIPMENT RETURNS/SUPPLIES, DUCTWORK, AIR TERMINALS, ETC.
17. PROVIDE ALL DUCTWORK AND PIPING TRANSITIONS/REDUCERS TO EQUIPMENT, COILS, ETC. AS REQUIRED THAT MAY NOT NECESSARILY APPEAR ON PLANS.
18. MECHANICAL CONTRACTOR SHALL INSULATE ALL DUCTWORK AND PIPING PER MECHANICAL SPECIFICATIONS, UNLESS OTHERWISE NOTED ON PLANS.
19. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SLAB OPENINGS, WALL OPENINGS, ROOF PENETRATIONS, BEAM PENETRATIONS AND CORING AS IT RELATES TO HIS WORK. CONTRACTOR SHALL SUBMIT SIZE AND LOCATION TO THE STRUCTURAL ENGINEER FOR REVIEW AND APPROVAL.
20. ALL DUCTWORK AND PIPING PENETRATIONS OF FIRE RATED PARTITIONS, BARRIERS OR WALLS SHALL BE PROTECTED PER THE LATEST INTERNATIONAL MECHANICAL CODE (IMC). PROVIDE FIRE RATED SLEEVES AND SEALANT AS REQUIRED FOR ALL FIRE RATED PIPING PENETRATIONS. PROVIDE "UL" LISTED FIRE DAMPERS FOR ALL DUCTWORK PENETRATIONS OF FIRE RATED SURFACES AS SHOWN ON DRAWINGS. PROVIDE DUCTWORK SLEEVING AND CAULKING PER THE LATEST IMC AT FIRE RATED PENETRATIONS NOT PROTECTED BY A FIRE DAMPER.
21. PROVIDE P-TRAP OF SUFFICIENT SEAL DEPTH TO OVERCOME UNIT STATIC PRESSURE ON ALL AC CONDENSATE CONNECTIONS. EXTEND AC CONDENSATE PIPING FROM UNIT TO SPILL DIRECTLY INTO NEAREST HUB DRAIN, FLOOR DRAIN, AND/OR EXISTING ROOF DRAIN. SEE SPECIFICATIONS AND AC CONDENSATE DRAIN DETAIL. VERIFY LOCATION IN FIELD.
22. CONTRACTOR IS RESPONSIBLE FOR MATCHING PRESSURE RATINGS FOR ALL FLANGES, JOINTS, VALVES, EQUIPMENT AND ACCESSORIES REQUIRED FOR PIPING SYSTEMS TO THE PRESSURE CLASS OF THE EXISTING BUILDING SYSTEM.
23. PROVIDE LABELING OF ALL DEVICES AND EQUIPMENT.
24. PROVIDE ACCESS PANELS FOR ALL EQUIPMENT LOCATED ABOVE HARD CEILINGS.
25. PROVIDE LINTELS AT ALL RECTANGULAR PENETRATIONS IN MASONRY BY DUCTWORK. PROVIDE SLEEVES FOR ROUND DUCTWORK.
26. ALL HOT WORK SHALL BE PERFORMED IN ACCORDANCE WITH NFPA 51B.

GENERAL SPECIFICATIONS

1. GENERAL

   REFER TO GENERAL NOTES, GENERAL DEMOLITION NOTES AND GENERAL CONSTRUCTION NOTES FOR ADDITIONAL REQUIREMENTS.

2. SCOPE OF WORK

   A. THE SCOPE OF WORK TO BE PERFORMED UNDER THIS CONTRACT SHALL CONSIST OF FURNISHING ALL LABOR AND FURNISHING AND INSTALLING ALL MATERIAL, EQUIPMENT, AND APPURTENANCES FOR THE MECHANICAL WORK ASSOCIATED WITH THE REVISIONS AS INDICATED ON THE DRAWINGS & SPECIFIED HEREIN, INCLUDING:
   - PIPING
   - PUMPS
   - INSULATION
   - VALVES & HYDRONIC SPECIALTIES
   - BALANCING OF WATER SYSTEM
   - CONTROL PANELS AND EQUIPMENT
   - PIPING, VALVES AND HYDRONIC SPECIALTIES

   B. THE CONTRACTOR SHALL SUBMIT A PROPOSED SEQUENCE OF CONSTRUCTION PRIOR TO PERFORMING ANY WORK. THE SEQUENCE OF CONSTRUCTION WILL BE REVIEWED BY THE OWNER FOR THEIR COMMENTS.

3. CONCURRENT WORK BY THE OWNER

   A. THE OWNER RESERVES THE RIGHT TO HAVE OTHER CONTRACTORS PERFORM WORK IN OTHER AREAS OF THE COMPLEX SIMULTANEOUSLY WHILE THIS CONTRACTOR IS ENGAGED TO DO WORK. THIS CONTRACTOR AND THEIR PERSONNEL SHALL COOPERATE AND COORDINATE THE WORK TO BE PERFORMED WITH ALL OTHER CONTRACTORS WITH WHO THEY COMES IN CONTACT. IN NO WAY SHALL THIS CONTRACTOR INTERFERE WITH THE PROGRESS OF THE WORK.

4. DEFINITIONS

   THE WORD 'PROVIDE' WHEN USED IN THE SPECIFICATION AND DRAWINGS SHALL MEAN "FURNISH AND INSTALL".

5. VISIT THE SITE

   A. VISIT THE SITE AND VERIFY ALL CONDITIONS BEFORE SUBMITTING A PROPOSAL FOR THE WORK.

   B. THE CONTRACTOR SHALL CAREFULLY EXAMINE ALL DRAWINGS, SPECIFICATIONS, CONTRACT DOCUMENTS, AND THE SITE BEFORE SUBMITTING PROPOSAL FOR THIS WORK. THEY SHALL COMPARE THE SITE WITH DRAWINGS, SPECIFICATIONS, AND CONTRACT DOCUMENTS FOR ALL OTHER BRANCHES OF THE WORK AND INCLUDE IN THEIR BID ALL NECESSARY WORK TO COMPLETE THE INSTALLATION OF THE SYSTEMS DESCRIBED HEREIN.

6. COORDINATION

   A. THE SCHEDULING OF ANY WORK AFFECTING EXISTING INSTALLATIONS OR FACILITIES, SHALL BE COORDINATED WITH THE OWNERS' REPRESENTATIVE. SHUT-DOWN OF UTILITIES OR EQUIPMENT AFFECTING OPERATIONS OF ANY EXISTING PART OF THE BUILDING WILL NOT BE PERMITTED EXCEPT AS PROVIDED BELOW. ANY PREMIUM TIME OR ADDITIONAL COST TO COMPLY SHALL BE AT THE EXPENSE OF THE CONTRACTOR AND CONSIDERED TO BE INCLUDED IN THE BID. SHUT-DOWN OF ANY OPERATING FACILITY OR SERVICES INCLUDING PLUMBING, REFRIGERATION, HEATING, AIR CONDITIONING, ELECTRICAL, OR OTHER INSTALLATIONS SHALL BE PRECEDED BY A WRITTEN REQUEST AT LEAST SEVEN CALENDAR DAYS PRIOR TO THE SHUT-DOWN.

   B. ALL REQUIRED SHUT-DOWNS UNLESS OTHERWISE INSTRUCTED, SHALL BE DURING NIGHTS, HOLIDAYS, OR ON WEEKENDS. ANY TESTS WHICH ARE TO BE CARRIED OUT ON THE BUILDING FACILITIES AND ANY CONNECTIONS TO BE MADE IN THE BUILDING FACILITY WHICH WOULD INVOLVE A CHANGE IN THE SYSTEM OR LIABILITY TO THE SYSTEM OR INVOLVE A SHUT-DOWN IN LIGHT OR POWER, THE CONTRACTOR SHALL NOT PROCEED WITH SUCH OPERATIONS UNTIL HE HAS RECEIVED WRITTEN PERMISSION FROM THE OWNER.

   C. FABRICATE AND PREFAB AS MUCH OF THE NEW WORK AS POSSIBLE IN ORDER THAT ANY REQUIRED SHUT-DOWNS WILL BE KEPT AT A MINIMUM.

7. GUARANTEE

   GUARANTEE ALL MATERIAL AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF ACCEPTANCE BY THE OWNER.

8. SHOP DRAWINGS

   SUBMIT TO OWNER, FOR APPROVAL, SHOP DRAWINGS OF ALL EQUIPMENT, MATERIALS, AND ACCESSORIES, INCLUDING:
   - PUMPS
   - PIPING
   - INSULATION
   - AUTOMATIC TEMPERATURE CONTROLS
   - BALANCING REPORT

9. AS-BUILT DRAWINGS

   THE CONTRACTOR SHALL MAINTAIN AS-BUILT DRAWINGS OF THE WORK PERFORMED. AT THE COMPLETION OF THE INSTALLATION, EACH TRADE WILL INCORPORATE ALL FIELD CHANGES ON THE AUTOCAD DATA BASE AND SUBMIT THREE (3) SETS OF PLOTTED PRINTS & A DATA DISK FOR RECORD PURPOSES.

10. PROTECTION

    A. CONTRACTOR SHALL PROPERLY PROTECT ALL WORK AND EQUIPMENT TO PREVENT OBSTRUCTION, DAMAGE, OR LOSS. ALL CONDUIT OPENINGS SHALL BE CLOSED WITH CAPS OR PLUGS DURING INSTALLATION. ALL EQUIPMENT SHALL BE TIGHTLY COVERED WITH APPROVED MATERIAL AND PROTECTED AGAINST DIRT, WATER OR MECHANICAL INJURY. AT FINAL COMPLETION, ALL WORK SHALL BE THOROUGHLY CLEANED AND DELIVERED IN PERFECT, UNBLEMISHED CONDITION.

    B. PROVIDE BARRICADES AND LIGHTS (IF REQUIRED) AROUND ALL WORK AREAS TO PROTECT PEDESTRIAN TRAFFIC AND TO PREVENT UNAUTHORIZED PEDESTRIAN ACCESS. PROTECTION SHALL MEET THE REQUIREMENTS OF THE LOCAL AND STATE REGULATIONS AND GOVERNMENT BODIES.

    C. ALL DAMAGE TO THE BUILDINGS, THEIR MECHANICAL AND ELECTRICAL SYSTEMS OR SURROUNDINGS, RESULTING FROM CONTRACTOR'S FAILURE TO ADEQUATELY PROTECT THE WORK, SHALL BE REPAIRED OR REPLACED AS DIRECTED, AT NO ADDITIONAL COST OWNER, INCLUDING ANY WORK DAMAGED IN ORDER TO MAKE GOOD SUCH DEFECTS.

11. DEMOLITION – REFER TO GENERAL DEMOLITION NOTES

12. RIGGING

    A. THE CONTRACTOR SHALL PERFORM ALL RIGGING REQUIRED TO COMPLETE ALL WORK UNDER THIS CONTRACT.

    B. THE CONTRACTOR SHALL PROVIDE REQUIRED TEMPORARY SUPPORTS, EQUIPMENT, ETC. REQUIRED FOR THE RIGGING OPERATIONS AND REMOVE SAME AFTER THE RIGGING IS COMPLETED.

    C. DISCONNECT AND REMOVE ANY PIPING, EQUIPMENT, LIGHT FIXTURES, ETC. REQUIRED TO INSTALL THE NEW WORK AND REINSTALL SAME AFTER THE WORK IS COMPLETED.

    D. PROTECT ALL FINISHED FLOOR SURFACES DURING THE RIGGING OPERATIONS.

13. CUTTING AND PATCHING

    A. THE CONTRACTOR SHALL PERFORM ANY CUTTING AND PATCHING REQUIRED FOR THE INSTALLATION OF THE WORK.

    B. ALL HOLES FOR THE NEW PIPING AND CONDUIT SHALL BE CORE BORED.

    C. ALL PATCHING SHALL BE DONE TO MATCH THE ADJOINING SURFACES IN MATERIALS, TEXTURE, AND FINISH.

    D. THE CONTRACTOR SHALL PATCH AND SEAL ALL WALLS, FLOORS, AND CEILING (DRYWALL, LAY-IN, ETC.) WHERE EXISTING ITEMS SUCH AS PIPING, HANGERS, SUPPORTS, ETC. ARE REMOVED UNDER THIS CONTRACT.

    E. CONTRACTOR SHALL LEAVE THEIR WORK AT ALL TIMES IN A SAFE AND CLEAN CONDITION READY FOR OPERATION.

14. SLEEVES

    A. THE CONTRACTOR SHALL PROVIDE SLEEVES FOR ALL NEW PIPING THROUGH WALLS AND FLOORS.

    B. PIPE SLEEVES SHALL BE SCHEDULE 40 STEEL PIPE. SLEEVES SHALL BE ONE INCH (1") LARGER THAN THE DIAMETER OF THE PIPING OR INSULATED PIPING.

    C. SLEEVES THROUGH FLOORS SHALL EXTEND 1" ABOVE THE FINISHED FLOOR SURFACE.

    Q.

15. FIRE RATED SEALANT

    A. UNLESS OTHERWISE INDICATED, THE CONTRACTOR SHALL IN ALL LOCATIONS NEW AND EXISTING CAULK THE SPACE BETWEEN THE SLEEVES AND THE PIPING (INSULATED OR NON-INSULATED) WITH UL APPROVED FIRESTOP SEALANTS AS MANUFACTURED BY HILTI CORPORATION, JOHNS MANVILLE, 3M, OR STI (SPECIFIED TECHNOLOGIES, INC.). SEALANT SHALL BE INTUMESCENT AND TESTED FOR USE IN UL TESTED SYSTEMS FOR FIRE AND SMOKE.

    B. ALL PRODUCTS SHALL BE INSTALLED IN STRICT COMPLIANCE WITH THE MANUFACTURER'S INSTRUCTIONS. SUBMIT CAULK MANUFACTURER'S PRODUCT DATA FOR APPROVAL.

16. BOLTS

    BOLT STUDS AND NUTS SHALL BE USED FOR ALL FLANGES AND FOR FLANGED EQUIPMENT CONNECTIONS. BOLT-STUDS AND HEX-NUTS SHALL BE MADE OF CARBON STEEL BOLTING ASTM A-325

17. WELDING

    A. ALL WELDING, SHOP OR FIELD, SHALL BE DONE BY A CERTIFIED LICENSED WELDER FOLLOWING STANDARD PRACTICES ESTABLISHED BY THE AMERICAN WELDING SOCIETY.

    B. DURING ALL FIELD WELDING A FIRE WATCH SHALL BE MAINTAINED DURING THE ENTIRE WELDING PROCEDURE AND FOR 2 HOUR AFTER END OF PROCEDURE.

18. MISCELLANEOUS STEEL WORK

    A. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY MISCELLANEOUS STEEL REQUIRED FOR THE INSTALLATION OF THE WORK UNDER THIS CONTRACT. WORK SHALL INCLUDE BUT NOT BE LIMITED TO SUPPORTS FOR PIPING, CLOSED CIRCUIT COOLER, ETC.

    B. UNLESS OTHERWISE INDICATED, ALL STRUCTURAL STEEL SHALL BE ASTM-A36 WITH HOT DIPPED GALVANIZED FINISH. WELDS SHALL BE FINISHED WITH TWO (2) COATS OF ZINC RICH PAINT.

19. RESTRICTIONS ON EARLY USE OF HVAC EQUIPMENT

    A. THE HVAC EQUIPMENT PROVIDED UNDER THIS CONTRACT SHALL NOT BE OPERATED PRIOR TO THE COMPLETION OF CONSTRUCTION OF THE BUILDING FOR REASONS OTHER THAN TESTING AND BALANCING OF THE SYSTEMS, UNLESS SPECIFICALLY DIRECTED AND/OR APPROVED BY THE OWNER. THIS SPECIFICALLY PROHIBITS USE OF PERMANENT EQUIPMENT FOR THE PURPOSES OF VENTILATING, HEATING AND DEHUMIDIFYING THE BUILDING WHILE UNDER CONSTRUCTION.

    B. SHOULD A CONTRACTOR CHOOSE TO USE ANY COMPONENT OF THE PERMANENT HVAC SYSTEM (I.E. CONDENSING UNITS, PUMPS, AIR HANDLERS, AIR CONDITIONERS, ETC.) FOR PURPOSES OTHER THAN STATED ABOVE, THEY SHALL ASSUME FULL RESPONSIBILITY FOR REPLACING OR REPAIRING ANY EQUIPMENT MATERIAL OR FINISHES, DAMAGED AS A RESULT OF THE USE AND PAY ALL COSTS ASSOCIATED WITH THE ACTION REQUIRED TO MAKE THE EQUIPMENT "LIKE NEW" CONDITIONS AT THE END OF THE PROJECT. THIS INCLUDES CLEANING OF DUCTS AND COILS, PROVIDE MERV 9 FILTERS IN THE AIR HANDLING EQUIPMENT DURING OPERATION, REPLACEMENT OF MOTORS, EXTENSION OF WARRANTIES, PAYMENT OF DESIGN PROFESSIONAL FEES REQUIRED TO INVESTIGATE AND ENFORCE THIS REQUIREMENT, AND THE CORRECTION OF ANY OTHER DETRIMENTAL CONDITIONS WHICH IS DETERMINED BY THE DESIGN PROFESSIONALS TO BE RELATED TO THE EARLY USE OF THE EQUIPMENT. PROVIDE FILTERS AT UNIT TURNOVER WITH MERV RATINGS AS SCHEDULED.

    C. SHOULD THE EARLY USE OF EQUIPMENT RESULT IN MANUFACTURER'S WARRANTY BEING VOID, THE CONTRACTOR SHALL ASSUME THE COST OF FURNISHING AN EQUIVALENT WARRANTY TO THE OWNER.

    D. SHOULD FAN MOTORS BE OPERATED DURING CONSTRUCTION, ANY MOTOR DETERMINED BY OWNER OR DESIGN PROFESSIONAL TO BE EXPOSED TO AIRBORNE CONSTRUCTION DUST, SUCH AS GENERATED BY DRYWALL SANDING, SHALL BE INSPECTED BY AN INDEPENDENT 3RD PARTY FOR DAMAGE. THE COSTS OF ALL REQUIRED CORRECTIVE ACTIONS SHALL BE BORNE BY THE CONTRACTOR RESPONSIBLE FOR THE OPERATION OF THE EQUIPMENT.

20. ELECTRICAL TECHNICAL PROVISIONS FOR MECHANICAL WORK

    ALL ELECTRICAL WORK ASSOCIATED WITH THE PROJECT SHALL BE BY ELECTRICAL CONTRACTOR. THE MECHANICAL CONTRACTOR SHALL COORDINATE REQUIREMENTS AND SCHEDULE WITH THE ELECTRICAL CONTRACTOR.

21. IDENTIFICATION

    A. ALL PIPING SYSTEMS SHALL BE LABELED TO COMPLY WITH OSHA AND ANSI/ASME A13.1-2007 COLOR CODE STANDARDS FOR THE IDENTIFICATION OF SYSTEMS.

    B. THE MARKING SYSTEM SHALL IDENTIFY THE CONTENTS, SIZE, DIRECTION OF FLOW, AND OPERATING CHARACTERISTICS (I.E. PRESSURE AND/OR TEMPERATURE).

    C. ALL VALVES AND CONTROLS SHALL BE LABELED USING PLASTIC I.D. TAGS SECURELY CONNECTED TO THE SPECIFIC ITEM USING BRASS CHAIN OR "S" HOOKS. THE CONTRACTOR SHALL PROVIDE A LIST OF EACH TAGGED ITEM AND ITS FUNCTION AND A VALVE CHART IN THE MAIN MECHANICAL ROOM.

    D. ALL EQUIPMENT MUST BE IDENTIFIED USING PHENOLIC NAMEPLATES AND LABELED IN ACCORDANCE WITH THE NOMENCLATURE USED ON THE DRAWINGS AND COMPATIBLE WITH THE MIMS SYSTEM.

    E. LABELS SHALL BE PUNCHED AND ATTACHED TO EQUIPMENT WITH MECHANICAL FASTENERS.

22. CLEANING AND FINAL CLEANUP

    A. CONTRACTOR SHALL, AT ALL TIMES, KEEP THE PREMISES FREE OF ALL WASTE OR SURPLUS MATERIALS, RUBBISH, AND DEBRIS WHICH IS CAUSED BY THEIR EMPLOYEES OR RESULTING FROM THEIR WORK. ALL AREAS SHALL BE BROOM SWEPT CLEAN AT THE END OF EACH WORK DAY.

    B. AFTER ALL EQUIPMENT HAS BEEN INSTALLED, CONTRACTOR SHALL REMOVE ALL STICKERS, RUST STAINS, LABELS, TEMPORARY COVERS, ETC.

    C. ALL FOREIGN MATTER SHALL BE BLOWN OUT OR FLUSHED OUT OF ALL DEVICES, CONDUITS, ETC.

    D. IDENTIFICATION PLATES ON ALL EQUIPMENT SHALL BE FREE OF PAINT AND SHALL BE POLISHED.

    E. CONTRACTOR SHALL CLEAN ALL CONDUIT, TUBING, EQUIPMENT, ETC. AT THE COMPLETION OF THEIR CONTRACT, AND ALL WORK SHALL BE TURNED OVER TO THE OWNER CLEAN AND IN PERFECT CONDITION, READY FOR SATISFACTORY SERVICE.

    F. DURING THE PROGRESS OF THE WORK, CONTRACTOR SHALL REMOVE ALL OF THEIR RUBBISH, CRATING AND PACKING MATERIALS, METAL SCRAP, AND ANY AND ALL DEBRIS FROM THE BUILDING, NOT ALLOWING IT TO ACCUMULATE AND CAUSE FIRE AND ACCIDENT HAZARDS.

23. INSTRUCTIONS TO OWNER, OPERATING MANUALS, CATALOGS

    A. THE CONTRACTOR SHALL FURNISH THREE SETS OF PRINTED OPERATING INSTRUCTIONS, MAINTENANCE INSTRUCTIONS, MAINTENANCE SERVICE SCHEDULES AND WIRING DIAGRAMS OF ALL CONTROL SYSTEMS. MOUNT AN ADDITIONAL COMPLETE SET OF OPERATING INSTRUCTIONS AND MAINTENANCE SERVICE SCHEDULES IN A METAL FRAME WITH A GLASS FRONT AND LOCATE IT ON THE WALL NEAR THE EQUIPMENT AS DIRECTED.

    B. THREE COPIES OF MANUFACTURER'S SPARE PARTS LIST COVERING EACH ITEM OF EQUIPMENT SHALL BE FURNISHED, OMITTING DUPLICATES.

    C. THE CONTRACTOR SHALL FURNISH THREE SETS OF BINDERS INCLUDING ALL CATALOG CUTS AND SHOP DRAWINGS OF EQUIPMENT INSTALLED. ALL SHOP DRAWINGS SHALL BE AS APPROVED BY THE ENGINEER. IN ADDITION, THREE SETS OF RECORD DRAWINGS SHALL BE FURNISHED SHOWING ALL WORK AS ACTUALLY INSTALLED WITH DIMENSIONS FROM FIXED LOCATIONS INCLUDING ANY UNDERGROUND SITE WORK, PIPES, DUCTS, CONDUITS, AND MANHOLES.

    D. THE CONTRACTOR SHALL FURNISH ONE SET OF ALL OF THE ABOVE IN ELECTRONIC FORMAT.

    E. THE CONTRACTOR SHALL GIVE INSTRUCTIONS TO THE OWNER'S PERSONNEL WHO WILL OPERATE THE EQUIPMENT. SUCH INSTRUCTION TO COVER A PERIOD OF NOT LESS THAN EIGHT (8) HOURS. EQUIPMENT MANUFACTURER'S REPRESENTATIVES SHALL BE PRESENT DURING THE INSTRUCTION PERIOD. ADDITIONAL TIME, IF REQUIRED, SHALL BE SPENT TO FULLY PREPARE THE OWNER TO OPERATE AND MAINTAIN THE MECHANICAL AND ELECTRICAL SYSTEMS. INSTRUCTION DAYS ARE TO BE SCHEDULED BY THE ENGINEER.

GENERAL WIRING METHODS

1. ALL CONDUCTOR INSULATION SHALL BE 90°C THHN/THWN. ALL FEEDERS AND BRANCH CIRCUITS SHALL BE COPPER.
2. ALL LUGS SHALL BE U.L. LISTED FOR USE WITH COPPER OR ALUMINUM CABLE WHOSE AMPACITY IS BASED ON 75°C CONDUCTOR TEMPERATURE RATING.
3. BRANCH CIRCUITS ARE DIAGRAMMATIC AND DO NOT REPRESENT ACTUAL PLACEMENT OF CONDUIT.
4. ALL JUNCTION BOX AND DEVICE COVER PLATES SHALL IDENTIFY CIRCUIT NUMBERS.
5. ALL DEVICES SHALL HAVE ADHESIVE LABELS ATTACHED TO FACEPLATE IDENTIFYING CIRCUIT NUMBER(S).
6. ALL NEW, RE-USED, OR SPARE SWITCHBOARD CIRCUIT BREAKERS SHALL BE PROVIDED WITH A MECHANICALLY ATTACHED ENGRAVED NAMEPLATE IDENTIFYING EQUIPMENT/AREA SERVED.
7. ALL DEVICES LOCATED ON NEW WALLS SHALL HAVE RECESSED BACKBOXES AND CONCEALED CONDUIT. .
8. GROUNDING SHALL BE DONE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE ARTICLE 250.
9. WIRE AND CABLE SHALL BE COPPER, 600 VOLT INSULATION TYPE THHN, UNLESS OTHERWISE NOTED. WIRE SIZES #10 AND SMALLER SHALL BE SOLID, #8 AND LARGER SHALL BE STRANDED. MINIMUM SIZE WIRE SHALL BE #12AWG. BRANCH CIRCUITS CONNECTED TO VIBRATING EQUIPMENT (MOTORS, AHU'S, FCU'S, CU'S ETC.) SHALL BE STRANDED.
10. ALL RACEWAYS SHALL BE U.L. APPROVED. MINIMUM SIZE CONDUIT AND EMT SHALL BE ¾"
11. INTERIOR WIRING METHODS
    - FEEDERS – ELECTRICAL METALLIC TUBING (EMT).
    - BRANCH CIRCUITS – ELECTRICAL METALLIC TUBING (EMT)
    - SECURITY/VIDEO – ELECTRICAL METALLIC TUBING (EMT).
    - FIRE ALARM – ELECTRICAL METALLIC TUBING (EMT) WHERE EXPOSED AND U.L. LISTED FIRE ALARM METAL CLAD CABLE WHERE CONCEALED IN WALLS AND ABOVE CEILINGS.
    - LOW VOLTAGE CONTROL WIRING – ELECTRICAL METALLIC TUBING (EMT).

21. USE LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC) FOR FINAL CONNECTION ALL INTERIOR AND EXTERIOR VIBRATING EQUIPMENT, AHU'S, ERU'S, PUMP MOTORS, TRANSFORMERS, ETC. MAXIMUM LENGTH OF LFMC SHALL BE AS FOLLOWS:
    - 3/4" TO 1-1/4" LFMC – 36 INCHES
    - 1-1/2" TO 2" LFMC – 48 INCHES
    - 2-1/2" TO 4" LFMC – 60 INCHES
22. FIELD MARK ELECTRICAL EQUIPMENT TO WARN QUALIFIED PERSONS OF POTENTIAL ELECTRIC ARC FLASH HAZARD IN ACCORDANCE WITH OWNER'S SPECIFIC REQUIREMENTS & STANDARDS.
23. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL BRANCH CIRCUITS, DISCONNECT SWITCHES, AND CONTROLS FOR THE MECHANICAL AND PLUMBING EQUIPMENT. REFERENCE MECHANICAL AND PLUMBING DRAWINGS FOR COORDINATION AND SCOPE OF WORK.

EXISTING PANELBOARDS

1. EXISTING PANELBOARD SCHEDULES ARE SHOWN FOR REFERENCE ONLY WITH INFORMATION OBTAINED FROM EXISTING CIRCUIT DIRECTORIES, ORIGINAL BUILDING DRAWINGS, AND PREVIOUS RENOVATION DRAWINGS. CONTRACTOR TO FIELD VERIFY EXISTING BRANCH CIRCUITS.
2. CONTRACTOR SHALL TRACE OUT AND IDENTIFY BRANCH CIRCUITS BEING MODIFIED, RE-USED, AND/OR EXTENDED. PROVIDE NEW "TYPED" PANEL SCHEDULES WITH ROOM/LOAD IDENTIFICATION FOR EACH AFFECTED PANEL.
3. PROVIDE NEW BRANCH CIRCUITS WHERE SHOWN. PROVIDE NEW CIRCUIT BREAKERS IN EXISTING PANELBOARDS FOR NEW BRANCH CIRCUITS.

GENERAL ELECTRICAL DEMOLITION NOTES

1. REMOVE CIRCUITS NOT REQUIRED IN THE AREA OF WORK BACK TO SOURCE OF POWER INCLUDING ALL HANGERS, SUPPORTS, CONDUITS, JUNCTION BOXES, ETC. ALL FEEDERS, CONDUIT, CIRCUITS, WIRING, AND CABLING PASSING THROUGH AREA OF WORK WHICH SERVES OTHER AREAS OF THE BUILDING SHALL BE RETAINED. RELOCATE AND RECONNECT AS REQUIRED FOR THE NEW CONSTRUCTION.
2. ALL WORK ON THE DRAWINGS AND IN THE SPECIFICATIONS SHALL BE PROVIDED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER. CONTRACTOR SHALL, PRIOR TO BIDDING, VISIT THE SITE AND REVIEW THE COMPLETE SET OF CONSTRUCTION DOCUMENTS FOR EACH TRADE, INCLUDING ADDENDUMS, TO VERIFY THE EXTENT OF EQUIPMENT, DEVICES, LIGHT FIXTURES, FEEDERS, JUNCTION/PULL BOXES, AND BRANCH CIRCUITS THAT MUST BE RELOCATED AND INCLUDE THIS COST IN THE BID PROPOSAL.
3. WHERE PARTS OF THE EXISTING WIRING SYSTEM ARE DISRUPTED, REWORK WIRING AS REQUIRED TO RE-ENERGIZE LOADS THAT ARE TO REMAIN IN OPERATION. CUT THE STRUCTURE ON EACH SIDE OF OUTLETS TO BE REMOVED, REMOVE EXISTING CONDUIT AND WIRING, PROVIDE NEW CONDUIT AND WIRING BETWEEN REMAINING OUTLETS, MAKE FINAL CONNECTIONS, AND PATCH STRUCTURE. WHERE OUTLETS ARE CUT OFF FROM AN EXISTING FEED, RE-FEED THEM FROM ANOTHER DIRECTION IF POSSIBLE, AND PROVIDE NEW CONDUIT AND WIRE IF NECESSARY.

VARIABLE FREQUENCY DRIVE SPECIFICATIONS

A. MANUFACTURER: ABB ACH580 / INPUT CB / VERTICAL "E" BYPASS / INTEGRATED SIEMENS BAS COMMUNICATIONS, OR SIEMENS BT300 SERIES EQUAL.

B. DISCONNECT: DOOR INTERLOCKED, PADLOCKABLE INVERSE-TIME THERMAL-MAGNETIC CIRCUIT BREAKER DISCONNECT SWITCH THAT WILL DISCONNECT ALL INPUT POWER FROM THE DRIVE AND ALL INTERNALLY MOUNTED OPTIONS.

C. U.L. LISTING: DRIVES SHALL BE UL LABELED AS A COMPLETE ASSEMBLY. THE BASE VFD SHALL BE UL LISTED FOR 100 KA SCCR WHEN INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S GUIDELINES.

D. INTERFACE: DIGITAL DISPLAY AND KEYPAD WITH HAND-OFF-AUTO SELECTIONS AND MANUAL SPEED CONTROL FOR EACH DRIVE. DRIVE MODE SELECTOR

E. CONTROL:
- MANUAL SPEED CONTROL (I.E., NO BAS INTERFACE)
- SPEED FEEDBACK SIGNAL TO BAS – ISOLATED ANALOG CURRENT/VOLTAGE LOOP, 4-20 ma / 0-10V □ LOOP POWER FROM VFD
- SPEED CONTROL SIGNAL FROM BAS – ISOLATED ANALOG CURRENT/VOLTAGE LOOP, 4-20 MA/0-10V □ LOOP POWER FROM BAS
- DRY CONTACT INPUTS (AS REQUIRED FOR): START/STOP, FORWARD/REVERSE, SPEED LIMIT PRESET. EXTERNAL TRIP, EXTERNAL TRIP RESET, REMOTE JOG, FIRE ALARM/SMOKE CONTROL OVERRIDE
- TWO (2) PROGRAMMABLE ANALOG INPUTS SHALL ACCEPT CURRENT OR VOLTAGE SIGNALS / TWO (2) PROGRAMMABLE ANALOG OUTPUTS / SIX (6) PROGRAMMABLE DIGITAL INPUTS. THREE (3) PROGRAMMABLE FORM-C RELAY OUTPUTS
- COORDINATE WITH THE BAS CONTRACTOR FOR SPECIFIC COMMUNICATIONS REQUIREMENTS.

F. INDICATING LIGHTS: POWER-ON (READY), RUN ENABLE (SAFETIES) OPEN, DRIVE RUNNING, DRIVE FAULT, H-O-A MODE, SAFETY OPEN.

G. ENCLOSURE: UL TYPE 1.

H. SERIAL COMMUNICATIONS: THE VFD SHALL HAVE A COMMUNICATIONS MODULE COMPATIBLE WITH THE NEW SIEMENS SYSTEM.

I. EMI/RFI FILTERS & SURGE PROTECTION: ALL VFD'S SHALL INCLUDE EMI/RFI FILTERS. COORDINATED AC TRANSIENT SURGE PROTECTION SYSTEM CONSISTING OF 4 MOVS, A CAPACITOR CLAMP, AND INTERNAL CHOKES. THE MOVS SHALL COMPLY WITH UL 1449 4TH EDITION.

J. MOTOR OVERLOADS: CLASS 20 OR 30 (SELECTABLE) ELECTRONIC MOTOR OVERLOAD PROTECTION SHALL BE INCLUDED.

K. OVERLOAD RATING: THE OVERLOAD RATING OF THE DRIVE SHALL BE 110% OF ITS NORMAL DUTY CURRENT RATING FOR 1 MINUTE EVERY 10 MINUTES, 130% OVERLOAD FOR 2 SECONDS EVERY MINUTE.

L. INPUT CURRENT RATING: THE INPUT CURRENT RATING OF THE DRIVE SHALL NOT BE GREATER THAN THE OUTPUT CURRENT RATING. PER NFPA 70 430.122, DRIVES WITH HIGHER INPUT CURRENT RATINGS MAY REQUIRE THE UPSTREAM WIRING, PROTECTION DEVICES, AND SOURCE TRANSFORMERS TO BE UPSIZED. ALL COSTS ASSOCIATED WITH UPSIZING THE ELECTRICAL SYSTEM IS THE RESPONSIBILITY OF THE CONTRACTOR.

M. INPUT LINE REACTORS: PROVIDE INTERNAL IMPEDANCE EQUIVALENT TO 5%. INPUT LINE REACTORS REQUIRED FOR BOILER COMBUSTION FAN MOTOR.

N. OUTPUT FILTERS: DV/DT OUTPUT FILTERS ARE NOT REQUIRED.

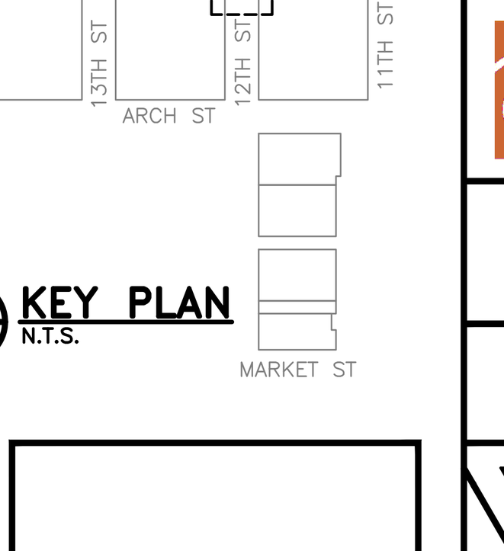
O. BYPASS: PROVIDE (2) CONTACTOR BYPASS, "VFD-OFF-BYPASS" SWITCH, AND ASSOCIATED INDICATING LIGHTS ON ALL DRIVES. BYPASS ONLY REQUIRED FOR PUMP MOTORS.

P. START-UP: START-UP SHALL BE PROVIDED FOR EACH DRIVE BY A FACTORY AUTHORIZED LOCAL SERVICE PROVIDER.

Q. WARRANTY: WARRANTY SHALL BE 30 MONTHS FROM THE DATE OF SHIPMENT FROM THE FACTORY BUT NO LESS THAN 24 MONTHS FROM THE DATE OF BENEFICIAL USE BY THE OWNER. THE WARRANTY SHALL INCLUDE: PARTS, ON-SITE LABOR, AND TRAVEL TIME AND TRAVEL COSTS, OR REPLACEMENT OF THE COMPLETE DRIVE AS DETERMINED BY THE DRIVE MANUFACTURER'S TECHNICAL SUPPORT.

GENERAL ELECTRICAL SPECIFICATIONS

1. ALL WORK SHALL COMPLY AND BE INSTALLED IN ACCORDANCE WITH ALL APPLICABLE CODES, THE LATEST UNIFORM CONSTRUCTION CODE STATUTE, THE INTERNATIONAL CODES AS AMENDED AND ADOPTED BY THE AUTHORITY HAVING JURISDICTION (COMMONWEALTH OF PENNSYLVANIA), REGULATIONS, THE 2014 NATIONAL ELECTRIC CODE, PCCA BUILDING STANDARDS, NFPA, AND ALL OTHER AGENCIES HAVING JURISDICTION.
2. GIVE ALL NOTICES, OBTAIN ALL PERMITS AND PAY ALL GOVERNMENTAL TAXES, FEES AND COSTS; FILE NECESSARY PLANS AND OBTAIN APPROVALS OF ALL GOVERNMENTAL DEPARTMENTS AND PUBLIC UTILITIES HAVING JURISDICTION; OBTAIN CERTIFICATES OF INSPECTION FROM AN NFPA APPROVED AGENCY FOR THE WORK AND DELIVER SAME TO THE OWNER WITH REQUEST FOR FINAL PAYMENT.
3. ALL ELECTRICAL EQUIPMENT, MATERIALS, DEVICES, AND APPLIANCES SHALL BE LABELED AND LISTED BY A CERTIFIED TESTING LABORATORY.
4. PROVIDE COMPLETE ELECTRICAL SYSTEMS AS INDICATED ON DRAWINGS AND SPECIFIED HEREIN. "PROVIDE" SHALL MEAN "FURNISH AND INSTALL". "OWNER" SHALL MEAN "PENNSYLVANIA CONVENTION CENTER AUTHORITY" OR THEIR REPRESENTATIVE. "DESIGN TEAM AND/OR ENGINEER" SHALL MEAN "DIMITRI J. VERVERELLI, INC.", ARCHITECT, OR THEIR REPRESENTATIVES.
5. REFERENCE MECHANICAL AND STRUCTURAL DRAWINGS FOR COORDINATION.
6. PROVIDE ALL MATERIALS AND LABOR FOR THE COMPLETE ELECTRICAL WORK AS SHOWN ON THE DRAWINGS AND AS SPECIFIED. ANY APPLIANCE, DEVICE OR WORK INCIDENTAL OR NECESSARY TO MAKE THE WORK COMPLETE SHALL BE PROVIDED WITHOUT ADDITIONAL EXPENSE TO THE OWNER.
7. VISIT THE SITE AND VERIFY ALL MEASUREMENTS AND FIELD CONDITIONS AFFECTING THE WORK, PRIOR TO SUBMITTING BID. IN SUBMITTING THE BID THE CONTRACTOR VERIFIES AND ASSERTS THAT HE HAS VISITED THE SITE AND NO ADDITIONAL COST TO THE OWNER WILL BE INCURRED DUE TO THE CONTRACTOR'S FAILURE TO VERIFY EXISTING CONDITIONS PRIOR TO SUBMITTING HIS BID. ANY DISCREPANCIES BETWEEN THE DRAWINGS AND FIELD CONDITIONS SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE ARCHITECT/ENGINEER.
8. WORK SHALL BE DONE IN A NEAT AND WORKMANLIKE MANNER BY SKILLED MECHANICS USING THE BEST TRADE METHODS.
9. SUBMIT SHOP DRAWINGS ACCORDING TO THE GENERAL CONDITIONS AND OBTAIN APPROVAL BEFORE PURCHASE OR INSTALLATION OF WORK. SUBMITTALS REQUIRED FOR LIGHTING, DISCONNECT SWITCHES, DEVICES, WIRING, CONDUIT/RACEWAYS, HANGERS/SUPPORTS, CONTROL DEVICES, FIRE ALARM.
10. COORDINATE ALL RIGGING ACTIVITIES AND POWER SHUTDOWNS WITH THE OWNER'S REPRESENTATIVE AND OTHER TRADES. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL STAGING, RIGGING, HOISTING AND SERVICES NECESSARY FOR THE ERECTION AND DELIVERY OF THE ELECTRICAL EQUIPMENT INTO THE BUILDING.
11. PRIOR TO FINAL ACCEPTANCE OF THE WORK SUBMIT A WRITTEN STATEMENT TO THE DESIGN PROFESSIONAL GUARANTEEING ALL EQUIPMENT AND WORK FOR ONE (1) YEAR FROM DATE OF ACCEPTANCE.
12. NOTE THAT CONSTRUCTION IS TO BE PERFORMED IN EXISTING FACILITIES AND THAT THE DRAWINGS GENERALLY SHOW ONLY NEW WORK THAT IS REQUIRED. THE DRAWINGS DO NOT SHOW IN DETAIL HOW THE NEW WORK IS TO BE INSTALLED BECAUSE UNKNOWN OBSTRUCTIONS TO ITS INSTALLATION MAY BE DISCLOSED AS THE WORK PROGRESSES. PERFORM THE WORK INDICATED, AND PERFORM SUCH ADDITIONAL WORK AS MAY BE REQUIRED BUT IS NOT SPECIFICALLY SHOWN. PERFORM THIS WORK IN SUCH A MANNER AS TO OVERCOME ALL OBSTRUCTIONS AND DIFFICULTIES THAT ARE ENCOUNTERED AT NO ADDITIONAL EXPENSE TO THE OWNER.
13. NEW AND EXISTING WIRING PASSING THROUGH FIRE RATED PARTITIONS, FLOORS, AND CEILINGS: CAULK THE SPACE BETWEEN THE OPENING AND SLEEVE OR WIRING/CONDUIT AND THE SPACE BETWEEN THE SLEEVE AND WIRING/CONDUIT WITH U.L. APPROVED FIRESTOP PRODUCT AS MANUFACTURED BY HILTI, 3M, OR STI TO OBTAIN A U.L. LISTED FIRE RATED ASSEMBLY. ALL PRODUCTS SHALL BE INSTALLED IN STRICT COMPLIANCE WITH THE MANUFACTURER'S INSTRUCTIONS. ALL EXISTING PENETRATIONS SHALL BE SEALED WITH A U.L. FIRE RATED ASSEMBLY.
14. CONTRACTOR SHALL PROPERLY PROTECT ALL WORK AND EQUIPMENT TO PREVENT OBSTRUCTION, DAMAGE, OR LOSS. ALL CONDUIT OPENINGS SHALL BE CLOSED WITH CAPS OR PLUGS DURING INSTALLATION. ALL EQUIPMENT SHALL BE TIGHTLY COVERED WITH APPROVED MATERIAL AND PROTECTED AGAINST DIRT, WATER, OR MECHANICAL INJURY. AT FINAL COMPLETION, ALL WORK SHALL BE THOROUGHLY CLEANED AND DELIVERED IN PERFECT, UNBLEMISHED CONDITION.
15. PROVIDE BARRICADES AND LIGHTS (IF REQUIRED) AROUND ALL WORK AREAS TO PROTECT PEDESTRIAN TRAFFIC AND TO PREVENT UNAUTHORIZED PEDESTRIAN ACCESS. PROTECTION SHALL MEET THE REQUIREMENTS OF THE LOCAL AND STATE REGULATIONS AND GOVERNMENT BODIES.
16. ALL DAMAGE TO THE BUILDING, MECHANICAL, PLUMBING, AND ELECTRICAL SYSTEMS OR SURROUNDINGS, RESULTING FROM CONTRACTOR'S FAILURE TO ADEQUATELY PROTECT THE WORK SHALL BE REPAIRED OR REPLACED AS DIRECTED, AT NO ADDITIONAL COST TO THE OWNER, INCLUDING ANY WORK DAMAGED IN ORDER TO MAKE GOOD SUCH DEFECTS.
17. ALL EQUIPMENT AND MATERIALS REMOVED AND NOT WANTED BY OWNER SHALL BECOME PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED IMMEDIATELY FROM THE SITE.
18. SEAL AND PATCH ALL REMAINING HOLES, OPENINGS, ETC. TO MATCH THE ADJOINING SURFACES IN MATERIALS, TEXTURES, AND FINISHES.
19. ANY EXISTING POTENTIALLY HAZARDOUS MATERIALS ENCOUNTERED IN THE COURSE OF THE WORK SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER FOR REMOVAL AND DISPOSAL.
20. FLAMMABLE MATERIALS MAY NOT BE STORED OR ALLOWED TO REMAIN OVERNIGHT WITHIN THE BUILDING. THIS INCLUDES, BUT IS NOT LIMITED TO, PAINTS, THINNERS, CLEANING AND RESTORATION PRODUCTS, RAGS OR BRUSHES, AND ANY TOOL THAT IS CAPABLE OF PRODUCING FLAME. SAWDUST, SCRAP LUMBER, SOAKED RAGS, AND OTHER FLAMMABLE CONSTRUCTION DEBRIS MUST BE COLLECTED AT THE END OF EACH DAY AND DISPOSED OF PROPERLY OUTSIDE OF THE BUILDING.
21. MAINTAIN SUITABLE FIRE PROTECTION EQUIPMENT AT BUILDING SITE. AT MINIMUM, TYPE ABC FIRE EXTINGUISHERS SHALL BE PROVIDED WHERE WORK IS BEING PERFORMED WITH OPEN FLAME OR USING FLAMMABLE MATERIALS AND AN ADDITIONAL FIRE EXTINGUISHER SHALL BE PROVIDED TO THE WORKER PERFORMING THE WORK. TRAIN ALL WORKERS IN THE USE OF FIRE PROTECTION EQUIPMENT.
22. SMOKING AT THE JOB SITE IS NOT ALLOWED. ALL FIRE SAFETY REQUIREMENTS LISTED ABOVE ARE TO BE CONSIDERED MINIMUM. CONTRACTOR IS RESPONSIBLE FOR TAKING OTHER MEASURES DEEMED NECESSARY BY THE CONTRACTOR TO PROTECT THE BUILDING.
23. THE CONTRACTOR SHALL MAINTAIN AS-BUILT DRAWINGS OF THE WORK PERFORMED. AT THE COMPLETION OF THE INSTALLATION, EACH TRADE WILL INCORPORATE ALL FIELD CHANGES ON THE AUTOCAD DATA BASE AND SUBMIT THREE (3) SETS OF PLOTTED PRINTS & A DATA DISK FOR RECORD PURPOSES.



KEY PLAN
N.T.S.

REV	DESCRIPTION	DATE
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0	ISSUED FOR BID	01/10/23

PENNSYLVANIA CONVENTION CENTER AUTHORITY
ONE CONVENTION CENTER PLACE
1101 ARCH STREET
PHILADELPHIA, PENNSYLVANIA 19107

PCCA EAST PLANT BOILERS
CONTROL PANEL & BLEND PUMP UPGRADES

MECHANICAL COVER SHEET

DIMITRI J. VERVERELLI, INC.
CONSULTING ENGINEERS
PHILADELPHIA, PENNSYLVANIA

DRAWN BY: JRL	SCALE: AS NOTED	DWG. NO.
CHECKED BY: JAV	PROJ. NO: 2206	MCS

DEMOLITION NOTES:

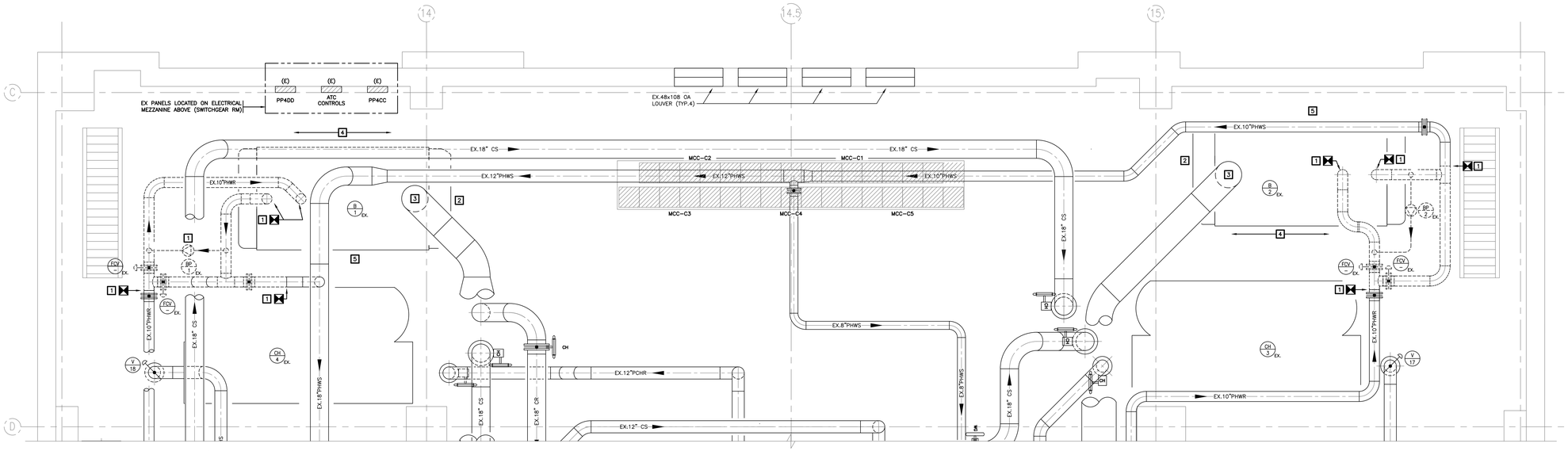
1. REMOVE EXISTING BLEND PUMP, CONTROL VALVES, PIPING, VALVES, INSULATION, AND ALL ACCESSORIES & APPURTENANCES BACK TO POINT INDICATED. REMOVE EXISTING BRANCH CIRCUIT BACK TO MCC.
2. REMOVE EXISTING CLEAVER BROOKS HAWK CONTROL PANEL, AND ALL ASSOCIATED ACCESSORIES AND APPURTENANCES.
3. ALTERNATE #1: REMOVE EXISTING O2 SENSOR & COMPONENTS.
4. REMOVE EXISTING COMBUSTION FAN MOTOR CONTROLLER (B1: STARTER / B2: VFD), WIRING, CONTACTOR, CONTROL STATION, AND LINE REACTOR. EXISTING FAN MOTOR AND BOILER POWER DISTRIBUTION/RELAY PANEL TO REMAIN. REFERENCE SINGLE LINE DIAGRAM.
5. ALTERNATE #2: REMOVE EXISTING GAS TRAIN, REMOVE ALL ASSOCIATED VALVES, SUPPORTS, & ACCESSORIES.

CONSTRUCTION NOTES:

1. PROVIDE NEW BLEND PUMP AND ALL ASSOCIATED VALVES AND ACCESSORIES AS DETAILED & SCHEDULED. PROVIDE NEW PIPING INTO EXISTING BOILER AS INDICATED. PROVIDE NEW CONTROL VALVES AS SPECIFIED AND WHERE INDICATED AND PROVIDE NEW BRANCH CIRCUITS. INTERLOCK VALVES TO MAINTAIN BOILER SUPPLY TEMPERATURE.
2. PROVIDE NEW SIEMENS PANEL WITH 12" TOUCHSCREEN HMI. PANEL SHALL ENCOMPASS NEW SIEMENS LMV52 COMBUSTION CONTROLLER WITH A2L DISPLAY, RELAYS FOR LWCO, 460/3 – 120/1 TRANSFORMER, AND ALL ACCESSORIES REQUIRED FOR PROPER OPERATION OF UPGRADED CONTROLS SCHEME. THE FOLLOWING ITEMS SHALL BE REPLACED AND WIRED TO NEW PANEL:
   - FLAME DETECTOR
   - GAS BUTTERFLY VALVE WITH ACTUATOR ASSEMBLY
   - AIR DAMPER ACTUATOR, ADAPTER COUPLING TO CONNECT TO EXISTING SHAFT
   - FGR ACTUATOR, WITH ADAPTER COUPLING TO CONNECT TO EXISTING SHAFT
   - TEMPERATURE SENSOR
   - STACK SENSOR
   - ALL OTHER ACCESSORIES & DEVICES LISTED IN SPECIFICATIONS.
3. PROVIDE NEW COMBUSTION AIR FAN MOTOR VFD WITH LINE SIDE DISCONNECT/CB, H-O-A CONTROL, BYPASS, AND LINE REACTOR. PROVIDE NEW BRANCH CIRCUITS AS SHOWN ON THE SINGLE LINE DIAGRAM. NEW VFD SHALL BE INTERFACED WITH THE NEW BOILER CONTROL PANEL. THE VFD SHALL BE INCLUDED IN THE BOILER RETROFIT PACKAGE.
4. PROVIDE ALL POWER AND CONTROL WIRING BETWEEN THE NEW BOILER CONTROL PANEL AND THE EXISTING BOILER POWER DISTRIBUTION/RELAY PANEL.PROVIDE 480V TO THE NEW 480:120V CONTROL PANEL TRANSFORMER OR DEDICATED 120V CIRCUIT FROM PANEL "ATC CONTROLS"
5. PROVIDE NEW BLEND PUMP VFD AND ASSOCIATED BRANCH CIRCUIT FROM MCC. MOUNT PUMP VFD NEXT TO BOILER COMBUSTION AIR FAN VFD. THE PUMP VFD IS IN ADDITION TO AND SEPARATE FROM THE VFD BEING PROVIDED WITH THE BOILER RETROFIT PACKAGE. REFERENCE SINGLE LINE DIAGRAM.
6. PROVIDE NEW 120V BRANCH CIRCUIT FROM EXISTING PANEL LABELED "ATC CONTROLS" LOCATED ON ELECTRICAL MEZZANINE ABOVE AND CONNECT TO NEW MOTOR ACTUATED VALVES. PROVIDE (2) NEW 20/1 BREAKERS IN PANEL.
7. REMOVE EXISTING MOTOR CONTROL CENTER (MCC) FULL VOLTAGE STARTER ASSEMBLY, INCLUDING BUCKET, PILOT LIGHTS, CONTROL DEVICES, TRANSFORMERS, MOTOR OVER-CURRENT CIRCUIT CIRCUIT PROTECTOR, CONTACTORS, OVERLOAD DEVICES, MOCP THRU-DOOR OPERATOR, DOOR, AND INTERNAL WIRING. PROVIDE NEW FEEDER THERMAL-MAGNETIC CIRCUIT BREAKER BUCKET ASSEMBLY COMPLETE WITH DOOR, OPERATOR, ETC. IN SAME LOCATION. PROVIDE BLANK COVERS IF NEW BUCKET IS SMALLER THAN EXISTING STARTER.

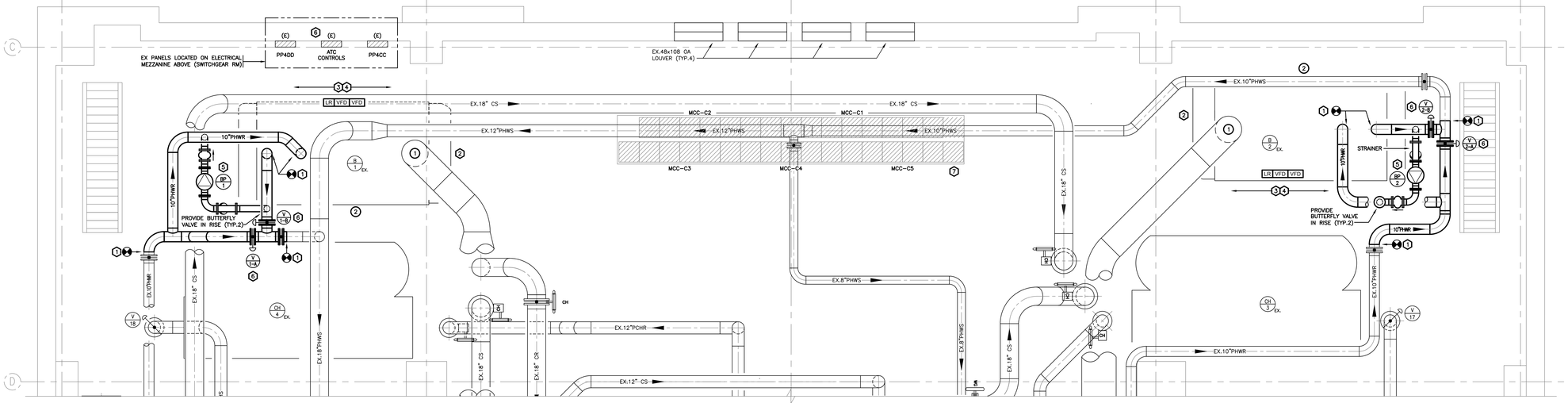
ADD ALTERNATES:

1. ALTERNATE #1: PROVIDE O2 TRIM COMPONENTS AND ALL ACCESSORIES AS LISTED IN SCHEDULE.
2. ALTERNATE #2: REPLACE ALL EXISTING GAS VALVES AND ALL ACCESSORIES PER BOILER MANUFACTURER'S RECOMMENDATIONS.



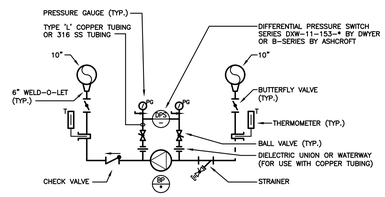
PARTIAL EAST MECHANICAL ROOM – DEMOLITION

SCALE: 1/8" = 1'-0"



PARTIAL EAST MECHANICAL ROOM – NEW WORK

SCALE: 1/8" = 1'-0"



BLEND PUMP DETAIL

N.T.S.

NOTES:
1. INTERLOCK BOILER BLEND HOT WATER CIRCULATING PUMPS TO OPERATE WITH RESPECTIVE BOILER.
2. PROVIDE INDEPENDENT SUPPORT OF NEW BOILER BLEND HOT WATER PUMPS FROM BUILDING STRUCTURE.

CONTROL VALVE SCHEDULE (V)

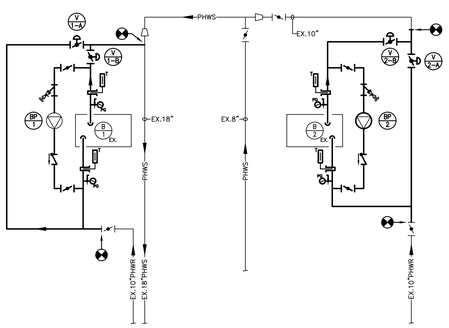
VALVE NO.	DESCRIPTION	ACTION	VALVE SIZE	VALVE TYPE	CV	GPM	MANUFACTURER & MODEL NO.	ELECTRIC ACTUATOR	DECLUTCHABLE MANUAL OVERRIDE	REMARKS
V-1A	BOILER 1 – HOT WATER	MODULATING	10"	BUTTERFLY	4,300	1,650	BRAY MKL2-C100	70-0301SV	YES	INTERLOCK VALVES
V-1B	BOILER 1 – HOT WATER	MODULATING	10"	BUTTERFLY	4,300	1,650	BRAY MKL2-C100	70-0301SV	YES	
V-2A	BOILER 2 – HOT WATER	MODULATING	10"	BUTTERFLY	4,300	1,650	BRAY MKL2-C100	70-0301SV	YES	INTERLOCK VALVES
V-2B	BOILER 2 – HOT WATER	MODULATING	10"	BUTTERFLY	4,300	1,650	BRAY MKL2-C100	70-0301SV	YES	

BLEND PUMP SCHEDULE (BP)

NO.	SERVICE	GPM	HD. IN. FT.	RPM	MOTOR HP	MOTOR V/PH/HZ	MOTOR TYPE	PUMP EFFICIENCY	IMPELLER DIAMETER (IN.)	MANUFACTURER SERIES & SIZE	NOTES
BP-1	BLEND PUMP FOR BOILER B-1	500	12	1140	2	460/3/60	NEW PREMIUM EFFICIENCY INVERTER DUTY	82%	6.625	B&G SERIES 80SC 6x6x7B	N/A
BP-2	BLEND PUMP FOR BOILER B-2	500	12	1140	2	460/3/60	NEW PREMIUM EFFICIENCY INVERTER DUTY	82%	6.625	B&G SERIES 80SC 6x6x7B	N/A

HOT WATER VALVE SCHEDULE (2½" & LARGER)

SERVICE	VALVE TYPE	RATING	BODY & BONNET	STEM	SEAT & PACKING SEALS	LATCH-LOCK LEVER & NUT	HANDWHEEL & WORMGEAR ACTUATOR	DISC OR BALL	PACKING	BRAND	MODEL OR FIGURE NO.
SHUTOFF	FLANGED FULL PORT BALL	ANSI CLASS 150	STAINLESS STEEL ASTM A351-CF8M OR A276 TYPE 316 (BODY/RETAINER/BALL)	ASTM A276 TYPE 316SS	RPTFE & PTFE	316SS LEVER FOR 2½" GALV STEEL PIPE HANDLE FOR 3"	GEAR OPERATOR AND HANDWHEEL FOR 4"	ASTM A276 TYPE 316	N/A	APOLLO VALVES	87A-20X-01-MG (FOR 4") SERIES
SHUTOFF	HIGH PERFORMANCE BUTTERFLY FLANGED	ANSI CLASS 150	ASTM A216 CARBON STEEL, LUG PATTERN	ASTM A564 TYPE 630 STAINLESS STEEL	VIRGIN TFE & TFE VEE	N/A	4" & LARGER	ASTM A351 CF8M STAINLESS STEEL	TFE VEE	CAMERON WKM MB-1 DYNACENTRIC	(SIZE)-BS-113-02-S02-11-WG
CHECK	FLANGED HIGH PERFORMANCE SWING CHECK	ANSI CLASS 150	WAFER STYLE. AST, A216 CARBON STEEL	N/A	EPDM	N/A	N/A	316 STAINLESS STEEL INCLUDING ARM & PIN	N/A	CRANE ENERGY FLOW SOLUTIONS-UNI CHECK	(SIZE)-15-A-0-3-4-1-3-0
CHECK	FLANGED GLOBE STYLE SILENT CHECK	ANSI CLASS 150	CARBON STEEL WCB A216	SPRING A276 302SS, BUSHING A240 316SS	CF8M 316SS W/ 316SS SEAT SOCKET HEAD BOLTS	N/A	N/A	CF8M 316SS	N/A	TITAN FLOW CONTROL, INC.	CV-51-CS



EAST BOILER PLANT – BOILER FLOW DIAGRAM

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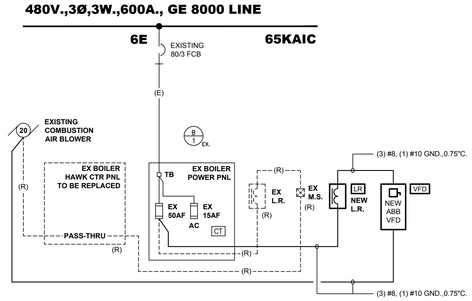
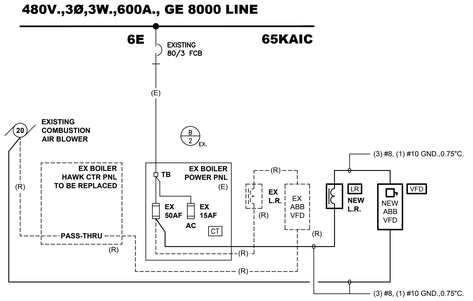
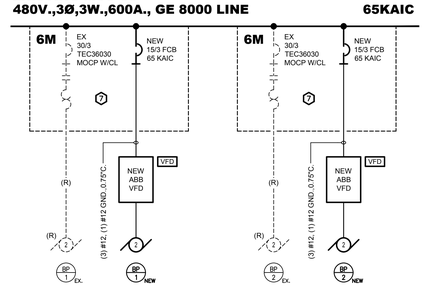
EXISTING MCC-C2
480V.,3Ø,3W.,600A., GE 8000 LINE



EXISTING MCC-C1
480V.,3Ø,3W.,600A., GE 8000 LINE



EXISTING MCC-C5
480V.,3Ø,3W.,600A., GE 8000 LINE



ELECTRICAL SINGLE LINE DIAGRAMS

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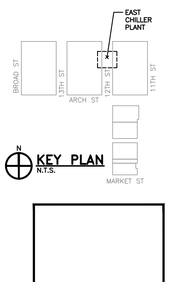

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REV	DESCRIPTION	DATE

PENNSYLVANIA CONVENTION CENTER AUTHORITY
ONE CONVENTION CENTER PLACE
1101 ARCH STREET
PHILADELPHIA, PENNSYLVANIA 19107

PCCA EAST PLANT BOILERS
CONTROL PANEL & BLEND PUMP UPGRADES

PARTIAL EAST MECHANICAL ROOM PLANS, DIAGRAM AND SCHEDULE

DIMITRI J. VERVERELLI, INC.
CONSULTING ENGINEERS
PHILADELPHIA, PENNSYLVANIA

DRAWN BY: JRL	SCALE: AS NOTED	DWG. NO. M-1.00
CHECKED BY: JAV	PROJ. NO: 2206	

LMV52 CONTROLLER
LMV52 CONTROL

PRODUCT DESCRIPTION:
THE LMV52 IS A MICROPROCESSOR–BASED BURNER MANAGEMENT SYSTEM WITH MATCHING SYSTEM COMPONENTS FOR THE CONTROL AND SUPERVISION OF FORCED DRAFT BURNERS. FUNCTIONALITY INCLUDES PRIMARY FLAME SAFETY CONTROL, INTEGRAL PARALLEL POSITIONING, O2 TRIM, VARIABLE SPEED DRIVE (VSD) CONTROL, & BURNER EFFICIENCY CONTROL TO MAINTAIN EXISTING NOx REQUIREMENTS.

1. THE BURNER MANAGEMENT SYSTEM (BMS) SHALL BE UL LISTED, FM APPROVED, CSA LISTED, AND SIL3 CERTIFIED.
2. THE MAJOR COMPONENTS OF THE BMS SHALL CONSIST OF:
   A. LMV52 CONTROLLER
   B. AZL52 OPERATOR INTERFACE DISPLAY
   C. SQM4 ACTUATORS FOR GAS, OIL, AIR, AND UP TO THREE (3) AUXILIARY ACTUATORS
   D. FACTORY ASSEMBLED GAS AND/OR OIL VALVE ASSEMBLIES
      a. FLAME SUPERVISION WITH FLAME ROD
   F. PRESSURE AND/OR TEMPERATURE SENSORS FOR PROCESS CONTROL AND THERMAL SHOCK PROTECTION.

3. THE FOLLOWING COMPONENTS SHALL BE OPTIONAL FOR THE BMS:
   A. VSD WITH SAFETY RATED SPEED FEEDBACK, AND CONTROL OF CLOSED LOOP COMBUSTION AIR BLOWER.
   B. ZIRCONIUM OXIDE OXYGEN SENSOR WITH MOUNTING KIT, COLLECTOR, AND ELECTRONICS MODULE
   C. EXHAUST STACK AND AMBIENT AIR TEMPERATURE SENSORS
   D. 6 OR 10 INCH TOUCHSCREEN INTERFACE.

4. ALL SAFETY AND COMBUSTION CONTROL RELATED COMPONENTS INCLUDING THE CONTROLLER, REMOTE DISPLAY, ACTUATORS, VALVE ASSEMBLIES, FLAME SCANNER(S), ALL TEMPERATURE, PRESSURE, OXYGEN TRIM, STACK, AND AMBIENT SENSORS SHALL BE FROM THE SAME MANUFACTURER. NON–SAFETY RELATED ITEMS, SUCH AS THE PLCS OR TOUCHSCREEN, CAN BE FROM VARIOUS MANUFACTURERS.

5. ALL ACTUATORS SHALL UTILIZE NON–CONTACT SHAFT POSITION SENSING FOR SAFETY RELATED FEEDBACK.
6. THE BMS SHALL HAVE THE FOLLOWING SAFETY FUNCTIONS:
   A. PRIMARY BURNER FLAME SAFEGUARD CONTROL
   B. PARALLEL POSITIONING FUEL–TO–AIR RATIO CONTROL
   C. GAS VALVE PROVING AND LEAK DETECTION VIA A PRESSURE SWITCH BETWEEN THE MAIN GAS SAFETY SHUTOFF VALVES
   D. GAS VALVE PROVING ON STARTUP, SHUTDOWN, OR BOTH
   E. NDEPENDENT INPUTS FOR PROOF OF CLOSURE (POC) SWITCHES ON THE MAIN GAS AND MAIN OIL SAFETY SHUTOFF VALVES
   F. ADJUSTABLE PRE–PURGE AND POST–PURGE TIMING BETWEEN 1 SECOND AND 63 MINUTES, WITHOUT REQUIRING A SEPARATE PURGE TIMER CARD
   G. PASSWORD PROTECTION FOR SERVICE AND OEM ACCESSIBLE CONFIGURATION PARAMETERS INCLUDING:
      a. PROGRAMMABLE PRE–PURGE TIME AFTER AN ALARM
      b. PROGRAMMABLE OVERLAP TIME OF THE IGNITION SPARK AND THE PILOT VALVE
      c. PROGRAMMABLE OVERLAP TIME OF THE PILOT VALVE AND THE MAIN GAS SAFETY SHUTOFF VALVES
      d. PROGRAMMABLE TIME FOR PILOT TRIAL FOR IGNITION, AND MAIN FLAME TRIAL FOR IGNITION
      e. PROGRAMMABLE SEQUENCE STOPS FOR THE FOLLOWING PHASES:
         - PRE–PURGE
         - PRE–IGNITION
         - PILOT IGNITION
         - MAIN FLAME
         - POST–PURGE

   H. INDEPENDENT PROGRAMMABLE ACTUATOR POSITIONS FOR PRE–PURGE, IGNITION, POST–PURGE, AND STANDBY CONDITIONS

   I. A CONSTANT, ALGORITHM–BASED CHECK OF EACH ACTUATOR'S POSITION THAT EVALUATES THE FOLLOWING:
      a. DEVIATION FROM THE REQUIRED POSITION ON THE FUEL–TO–AIR RATIO CURVE
      b. MAXIMUM TIME ALLOWED AT THE DEVIATED POSITION

   J. LOW VOLTAGE ACTUATORS UTILIZING DIGITAL CANBUS COMMUNICATIONS

   K. ADJUSTABLE ALARMS POINTS FOR HIGH BOILER WATER TEMPERATURE

   L. OPTIONAL FLAME SUPERVISION ON TWO SEPARATE CHANNELS VIA A FLAME ROD (FR). THE FOLLOWING OPTIONS ARE AVAILABLE FOR PILOT IGNITION, NORMAL OPERATION, AND POST–MAIN VALVE CLOSURE:

   M. THE FLAME FAILURE RESPONSE TIME SHALL BE PASSWORD PROTECTED, AND ADJUSTABLE BETWEEN 1 AND 4 SECONDS

7. THE BMS FUEL–TO–AIR RATIO CONTROL SHALL HAVE THE FOLLOWING FUNCTIONALITY:
   A. INDEPENDENT GAS AND OIL FUEL–TO–AIR RATIO CURVES
   B. CAPABILITY OF POSITIONING FIVE (5) ACTUATORS AND ONE VSD SIMULTANEOUSLY ON THEIR PROGRAMMED FUEL–TO–AIR RATIO CURVES WITH AND ACCURACY OF 0.1 DEGREE FOR ACTUATORS, AND 0.5% FOR THE VSD
   C. CAPABILITY OF FIFTEEN (15) PROGRAMMABLE POINTS FOR EACH FUEL–TO–AIR RATIO CURVE
   D. CAPABILITY OF PROGRAMMING FOUR (4) INDEPENDENT POSITIONS FOR EACH FUEL, INCLUDING PRE–PURGE, IGNITION, POST–PURGE, AND STANDBY CONDITIONS
   E. PROGRAMMABLE TIMING TO SET THE RAMP SPEED OF THE ACTUATORS AND VSD DURING NORMAL OPERATION, PRE–PURGE, AND POST–PURGE CONDITIONS
   F. INDEPENDENT, PROGRAMMABLE ACTUATOR POSITIONS FOR IGNITION AND LOW–FIRE
   G. CAPABILITY TO USE ONE OR TWO FUEL ACTUATORS FOR DUAL FUEL BURNERS

8. THE BMS LOAD CONTROLLER SHALL HAVE THE FOLLOWING FUNCTIONS:
   A. INTERNAL LOAD CONTROL (ILC) THAT ADJUSTS THE LOAD ACCORDING TO SETPOINT BY MONITORING TEMPERATURE OR PRESSURE DIRECTLY. THE ILC SHALL ALSO FEATURE:
      c. MODULATION CONTROL VIA A PID LOOP ALGORITHM
      d. AUTOMATIC PID LOOP ADAPTATION
      e. INDEPENDENT, PROGRAMMABLE OPERATING SETPOINTS TO CYCLE THE BURNER ON AND OFF
   B. EXTERNAL LOAD CONTROL, UTILIZING AN ANALOG INPUT SIGNAL, THAT WILL DIRECTLY CONTROL THE BURNER LOAD
   C. EXTERNAL LOAD CONTROL, VIA MODBUS COMMUNICATION, THAT WILL DIRECTLY CONTROL THE BURNER LOAD
   D. REMOTE SETPOINT VIA MODBUS COMMUNICATION
   E. REMOTE SETPOINT VIA ANALOG INPUT
   F. PROGRAMMABLE HIGH AND LOW LIMITS ON REMOTE SETPOINT
   G. INTERNAL SETPOINT SWITCHOVER BY DRY CONTACT CLOSURE
   H. CHANGEOVER TO INTERNAL LOAD CONTROL, FROM ANY LOAD CONTROL MODE, BY DRY CONTACT CLOSURE
   I. COLD START THERMAL SHOCK PROTECTION (CTSP) WITH THE FOLLOWING FEATURES:
      a. PROGRAMMABLE ACTIVATION AND DEACTIVATION VALUES
      b. LOAD RAMPING BASED ON PRESSURE, TEMPERATURE, AND/OR TIME
      c. TRUE LOW FIRE HOLD, WITH RELEASE BASED ON PROGRAMMABLE PRESSURE OR TEMPERATURE SETTINGS
   J. RETRANSMISSION OF THE BURNER LOAD AS AN ANALOG OUTPUT SIGNAL & NOx MONITORING

9. THE BMS SHALL HAVE THE FOLLOWING COMMUNICATION CAPABILITIES:
   A. MODBUS RTU SERIAL COMMUNICATION VIA AN RJ45 JACK
      a. LOSS OF MODBUS COMMUNICATION, BASED UPON A PROGRAMMABLE WATCHDOG TIMER, RESULTS IN "REVERT TO INTERNAL PID CONTROL AND LOCAL SETPOINT"
   B. INTERNAL REGISTERS HAVING BOTH READ AND WRITE CAPABILITIES
   C. SEPARATE NINE (9) PIN SERIAL CONNECTION AVAILABLE FOR DOWNLOADING SOFTWARE UPDATES AND CONFIGURING THE UNIT WITH A PC/LAPTOP
   D. ABILITY TO INTEGRATE WITH AN BMS COMMUNICATION VIA A PROTOCOL TRANSLATOR

10. THE BMS SHALL HAVE THE FOLLOWING ANNUNCIATION CAPABILITIES:
   A. A PLAIN TEXT AND ERROR CODE ANNUNCIATION OF EVERY DIGITAL INPUT
   B. A TIME STAMPED LOG OF THE LAST 9 LOCKOUTS
   C. LOG OF THE LAST 21 FAULTS
   D. PLAIN TEXT WARNINGS FOR NON–LOCKOUT EVENTS THAT MAY DISRUPT NORMAL OPERATION

11. THE OXYGEN TRIM AND MONITORING (OTM) FEATURE OF THE BMS SHALL HAVE THE FOLLOWING FUNCTIONS:
   A. THE ABILITY TO SET A MINIMUM O2 PERCENT AT EVERY POINT ON THE O2 ALARM CURVE
   B. THE ABILITY TO SET A TARGET O2 PERCENT AT EVERY POINT ON THE O2 TRIM CURVE, EXCEPT FOR POINT 1
   C. THE ABILITY TO SELECT WHICH ACTUATORS WILL BE USED FOR O2 TRIM, INCLUDING THE VSD
   D. THE ABILITY TO APPLY O2 TRIM WITH THE FOLLOWING FUELS:
      a. NATURAL GAS
      b. LIGHT OIL
      c. PROPANE
      d. USER–DEFINED FUEL
   E. THE ABILITY TO OPERATE THE BURNER ON THE DEFAULT RATIO CURVE IN THE EVENT TTHAT THE O2 SENSOR HAS NOT REACHED OPERATING TEMPERATURE, OR IF THERE IS A PROBLEM WITH THE O2 SENSOR
   F. THE ABILITY TO LOCKOUT THE BURNER IN THE EVENT THAT THE O2 SENSOR HAS NOT REACHED OPERATING TEMPERATURE, OR IF THERE IS A PROBLEM WITH THE O2 SENSOR
   G. THE ABILITY TO LOCKOUT THE BURNER IN THE EVENT THAT THE O2 SENSOR HAS NOT REACHED OPERATING TEMPERATURE, OR IF THERE IS A PROBLEM WITH THE O2 SENSOR
   H. DURING LOW O2 CONDITIONS, THE OTM WILL DEACTIVATE AND/OR LOCKOUT THE CONTROLLER, REQUIRING MANUAL REACTIVATION AND/OR CONTROLLER RESET
   I. THE ABILITY TO MONITOR O2 PERCENT WHEN O2 TRIM ISN'T ACTIVATED
   J. THE ABILITY TO COMPLETELY DEACTIVATE THE OTM WITH COMPONENTS STILL ATTACHED
   K. THE ABILITY TO CONDUCT A SELF–TEST OF THE O2 SENSOR DURING STARTUP AND NORMAL OPERATION
   L. THE O2 SENSOR SHALL HAVE NO MOVING PARTS THAT ARE IMMERSED IN THE FLUE GAS STREAM (IN–SITU), AND OPERATES WITHOUT A FILTER OR PUMP
   M. THE OTM SYSTEM SHALL BE CAPABLE OF MULTIPLE AMBIENT AIR TEMPERATURE COMPENSATION FUNCTIONS, INCLUDING ACTIVATION OF THE OTM ON START–UP BASED UPON AMBIENT AIR TEMPERATURE READINGS, COMPARED TO COMMISIONED VALUES

12. THE BMS SHALL HAVE A VARIABLE FREQUENCY DRIVE (VFD) FEATURE WITH THE FOLLOWING CAPABILITIES:
   A. THE SYSTEM SHALL UTILIZE AN ASYMMETRICAL SPEED WHEEL AND INDUCTANCE SENSOR MOUNTED TO THE BLOWER MOTOR SHAFT FOR CLOSED LOOP FEEDBACK OF THE COMBUSTION AIR FAN SPEED
   B. THE ASYMMETRICAL SPEED WHEEL SHALL ALSO ALLOW THE LMV52 TO DETERMINE THE DIRECTION OF ROTATION OF THE BLOWER MOTOR
   C. THE SYSTEM SHALL PROVIDE A PULSE FEEDBACK THAT WILL CONSTANTLY MONITOR THE SPEED OF THE BLOWER MOTOR
   D. THE SPEED SHALL BE CORRECTED IF A SMALL DEVIATION FROM THE PROGRAMMED CURVE OCCURS
      a. DEVIATION ABOVE A MAXIMUM LIMIT ON THE PROGRAMMED COMBUSTION CURVE SHALL RESULT IN A LOCKOUT
   E. THE BMS SHALL TRANMIT A 0–20MA ANALOG SIGNAL TO THE VSD
      a. THE VSD INCREASES OR DECREASES SPEED IN ACCORDANCE WITH THE ANALOG SIGNAL

13. THE BMS SHALL HAVE BURNER/BOILER EFFICIENCY MONITORING WITH THE FOLLOWING CAPABILITIES:
   A. AN EFFICIENCY CALCULATION USING AN OXYGEN SENSOR, STACK TEMPERATURE SENSOR, AND AMBIENT AIR TEMPERATURE SENSOR
   B. A FLUE GAS TEMPERATURE HIGH WARNING, WITH SEPARATE SETTINGS FOR GAS AND OIL

14. THE BMS SHALL HAVE CAPABILITIES TO INTERFACE EXTERNALLY VIA MODBUS RTU. DEVICES INCLUDE TOUCHSCREEN HMI, BUILDING MANAGEMENT SYSTEMS, PLCS, OR CHART RECORDERS THAT ARE CAPABLE OF ACTING AS A MODBUS MASTER. THE MODBUS INTERFACE ALLOWS MONITORING AND ADJUSTMENT OF ALL NONPASSWORD, NON–SAFETY RELATED, USER–ADJUSTABLE PARAMETERS SUCH AS:
   A. BURNER STATUS
   B. HOURS RUN ON SPECIFIC FUEL, AND THE NUMBER OF STARTS FOR EACH FUEL
   C. LOAD, BOILER PRESSURE/TEMPERATURE, STACK TEMPERATURE, AND AMBIENT TEMPERATURE
   D. PERCENT O2 BOILER EFFICIENCY, AND ACTUATOR POSITION
   E. FLAME SIGNAL
   F. REMOTE SETPOINTS
   G. FUEL FLOW FOR GAS OR OIL, IF FLOW METERS ARE CONNECTED
   H. ALARM STATUS
   I. FAULT HISTORY
   J. LOCKOUT HISTORY

15. THE ACTUATORS USED WITH THE BMS SHALL HAVE THE FOLLOWING FEATURES:
   A. ACTUATORS SHALL UTILIZE A HALL EFFECT SENSOR FOR NON–CONTACT BASED POSITIONING OF ACTUATORS. THE HALL EFFECT SENSOR SHALL NOT BE AFFECTED BY SMALL AMPLITUDE OR HIGH FREQUENCY TORSIONAL VIBRATIONS CAUSED BY AIR TURBULENCE
   B. INTERNAL PROTECTION FROM OVER–TORQUE AND OVER–TEMPERATURE CONDITIONS
   C. DIGITAL CANBUS COMMUNICATIONS
   D. HIGH ACCURACY STEPPER MOTOR WITH 900 MOTOR POSITIONS THROUGH 90 DEGREES OF ROTATION
   E. DIRECTION OF ROTATION IS ELECTRONICALLY SEALED AND DOES NOT REQUIRE RE–WIRING TO CHANGE DIRECTIONS
   F. ACTUATORS ARE FACTORY CALIBRATED AND DO NOT REQUIRE ON–SITE CALIBRATION
   G. DAISY CHAIN COMMUNICATIONS TO MINIMIZE ELECTRICAL WIRING AND SIMPLIFY INSTALLATION
   H. LOW VOLTAGE 24VAC POWER

16. THE BMS SHALL HAVE THE FOLLOWING SPECIAL FEATURES:
   A. PROGRAMMABLE HIGH/LOW GAS AND HIGH/LOW OIL PRESSURE SWITCH TIME BUFFER TO ALLOW PRESSURE SHOCKS TO BE IGNORED FOR A SPECIFIED, SHORT PERIOD OF TIME
   B. QUICK START CAPABILITY IF THERE IS DEMAND FOR HEAT DURING POST–PURGE. THE UNIT WILL BEGIN PRE–PURGE WITHOUT DE–ENERGIZING THE FAN MOTOR STARTER/VSD
   C. BLOWER AIR PRESSURE SWITCH EVALUATION, BEFORE EACH PRE–PURGE, WITHOUT DE–ENERGIZING THE FAN MOTOR STARTER/VSD
   D. GAS PILOT VALVE PROVING FOR DOUBLE PILOT VALVE APPLICATIONS
   E. THE ABILITIY TO RUN FULL MODULATION ON GAS, FULL MODULATION ON OIL, OR MULTI–STAGE ON OIL
   F. MASKING OF A SPECIFIED PROGRAMMABLE LOAD RANGE OF THE BURNER TO ASSIST IN MINIMIZING THE POTENTIAL FOR BURNER COMBUSTION HARMONICS AT CERTAIN FIRING RATES, SHOULD THEY EXIST
   G. THE ABILITY TO BACKUP THE ENTIRE COMMISIONED PARAMETER SET, AND STORE IT IN THE LOCAL OPERATOR INTERFACE DISPLAY, AZL52, FOR FUTURE DOWNLOADING
   H. A LAPTOP COMPUTER SHALL NOT BE REQUIRED TO COMMISION THE LMV52 CONTROLLER. HOWEVER, UTILIZING THE ACS450 SOFTWARE, THE COMPLETE PARAMETER SET CAN BE SAVED TO A PC FOR FUTURE DOWNLOADING. THE SOFTWARE ALSO PROVIDES THE ABILITY TO GENERATE A STARTUP REPORT DETAILING ALL COMPONENTS AND PARAMETER SETTINGS OF THE CONTROLLER
   I. THE FLUE GAS RECIRCULATION CONTROL ACTUATOR CAN BE HELD CLOSED ON STARTUP BASED UPON STACK TEMPERATURE SETPOINT OR A PRE–CONFIGURED DELAY TIME
   J. THE FUEL–TO–AIR RATIO CURVE CAN BE EASILY ADJUSTED AT ANY POINT IN THE FIRING RATE. ANY POINT CAN BE DELETED AS NECESSARY, AND ADDITIONAL POINTS, IF AVAILABLE, CAN BE ADDED AT ANY TIME

LMV52 RETROFIT COMPONENTS

		DESCRIPTION	SIEMENS COMBUSTION CONTROLS PART NUMBER
FLAME SCANNER & ACCESSORIES		FLAME DETECTOR, FORWARD VIEWING	QRI2A2.B180B
FLAME SCANNER & ACCESSORIES		¾" HOLDER FOR QRI2A2, FRONTAL VIEWING	AGG2.110
FLAME SCANNER & ACCESSORIES		CONDUIT ADAPTOR FOR QRI, ¾" NPSM THREAD	AGG2.120
GAS BUTTERFLY VALVE & ACTUATOR ASSEMBLY		SQM45.295B9 TO 4" VKG10	VA45.2–NF–400
CONTROL PANEL COMPONENTS	BASE UNIT	VFD/O2 TRIM/FUEL METER	LMV52.240B1
CONTROL PANEL COMPONENTS	TRANSFORMER	120V TO (3) 12V TRANSFORMER	AGG5.210
CONTROL PANEL COMPONENTS	DISPLAY UNIT	DISPLAY UNIT WITH MODBUS	AZL52.40B1
CONTROL PANEL COMPONENTS	PLUG SET	MAXIMUM SYSTEM PLUG SET	AGG5.7COMPLETE
CONTROL PANEL COMPONENTS	LMV5 MOUNTING BRACKETS (QTY.2)	FOR ELECTRICAL ENCLOSURE	BR–LMV5
CONTROL PANEL COMPONENTS	CONTROL PANEL SPARE PARTS	12V CANBUS FUSE	FUSE4.0A–SLOW
CONTROL PANEL COMPONENTS	CONTROL PANEL SPARE PARTS	TRANSFORMER PLUGS	AGG5.2PLUGS
CONTROL PANEL COMPONENTS	NOTES & ADD'L ACCESSORIES	24x24x10" NEMA 1 ENCLOSURE; INTERNAL LMV5 LOAD CONTROL; 6" SCHNEIDER TOUCHSCREEN; NO DRAFT CONTROL; NO PLC FEEDWATER OR CIRCULATING PUMP VFD CONTROL; NO ANNUNCIATION INPUTS; N2 METASYS, BACNET MS/TP, OR BACNET RTU BMS COMMUNICATION; 1 MAN RESET LWCO WARRICK RELAY AND NO HIGH WATER ALARM LIGHT; DUAL FUEL, GAS/OIL; 120/1/60 POWER SUPPLY	
ACTUATORS & ACCESSORIES	AIR DAMPER ASSEMBLY	180 IN–LB LMV5 ACTUATOR	SQM48.497B9
ACTUATORS & ACCESSORIES	AIR DAMPER ASSEMBLY	CB AIR DAMPER BRACKET KIT FOR SQM48	BR–48CBAIR
ACTUATORS & ACCESSORIES	OIL DAMPER ASSEMBLY	27 IN–LB LMV5 ACTUATOR WITH 10MM D SHAFT (STANDARD)	SQM45.295B9
ACTUATORS & ACCESSORIES	OIL DAMPER ASSEMBLY	BEARING BLOCK RETROFIT KIT FOR SQM45.295B9 TO CB FUEL OIL CONTROLLER	BR–45CBOIL
ACTUATORS & ACCESSORIES	FGR ACTUATOR & COUPLING	27 IN–LB LMV5 ACTUATOR WITH 10MM D SHAFT (STANDARD)	SQM45.295B9
ACTUATORS & ACCESSORIES	FGR ACTUATOR & COUPLING	COUPLING, 425 DEG F, 10MM D TO ½" ROUND, 150 IN–LB	CDM10DCA–E8RSA
ACTUATORS & ACCESSORIES	ACTUATOR ACCESSORIES	METAL CONDUIT ADAPTERS, M16 TO ½", QTY.5	ADP–M16XE500 (5)
ACTUATORS & ACCESSORIES	ACTUATOR ACCESSORIES	LONG METAL CONDUIT ADAPTERS, M16 TO ½", QTY.5	ADPM16XE500–LONG (5)
ACTUATORS & ACCESSORIES	ACTUATOR ACCESSORIES	95–100' OF UL/CSA CABLE FOR LMV5	AGG5.643 (100)
SPARE FUSES		5 PACK OF 4.0AMP, 250V 5x20MM SLOW–BLOW FUSES. LOW AMP FUSE FOR LMV5	FUSE4.0A–SLOW
SPARE FUSES		5 PACK OF 6.3AMP, 250V 5x20MM SLOW–BLOW FUSES. MAIN HIGH AMP FUSE IN LMV5, LME7	FUSE6.3A–SLOW
ALTERNATE #1: O2 TRIM COMPONENTS		OXYGEN TRIM MODULE, 110V	PLL52.110A100
ALTERNATE #1: O2 TRIM COMPONENTS		O2 SENSOR, 110V	QGO20.000D17
ALTERNATE #1: O2 TRIM COMPONENTS		WELDLESS FLUE GAS COLLECTOR FOR STACKS 18–36" IN DIAMETER	AGO20.002LDS–KT
ALTERNATE #1: O2 TRIM COMPONENTS		6–CONDUCTOR SHIELDED CABLE TO CONNECT THE O2 MODULE AND O2 SENSOR	C8120(35)
VFD COMPONENTS		20HP, 480/3/60 VFD	DR–480020–3B
VFD COMPONENTS		NEMA 1 KIT	DRN1–B6–1
VFD COMPONENTS		BRAKING RESISTOR FOR 20HP VFD	DRBKG–3848–3–20–1
VFD COMPONENTS		3% LINE REACTOR FOR 20HP VFD	DRLR–3848–3–20–1
VFD COMPONENTS		LMV ROTATIONAL SENSOR AND MOUNTING KIT FOR CONDUIT	AGG5.305

TOUCHSCREEN KIT
PRODUCT DESCRIPTION:
TOUCHSCREEN KITS (TSK) PROVIDE CENTRALIZED, LOCAL ANNUNCIATION, BMS CONNECTIVITY, DATA COLLECTION, TRANDING, EMAIL ACCESS, AND REMOTE ACCESS FOR ANY BURNER OR BOILER VIA A HUMAN MACHINE INTERFACE (HMI).

1. THE TSK SHALL BE COMPATIBLE WITH STEAM AND HYDRONIC SYSTEMS.
2. THE TSK SHALL BE CAPABLE OF MONITORING THE FOLLOWING EXPANSION OPTIONS VIA MODBUS RTU OR MODBUS TCP/IP:
   A. ECONOMIZERS
   B. OTHER USER–SPECIFIED ANALOG DEVICES

3. THE TSK SHALL BE CAPABLE OF PROVIDING DRAFT CONTROL FOR SEQUENCING, VIA AN EXPANSION OPTION.
4. THE STANDARD BMS COMMUNICATION INTERFACE SHALL BE VIA MODBUS TCP/IP. MODBUS RTU, LONWORKS, BACNET/IP, BACNET MS/TP, ETHERNET/IP, PROFINET, PROFIBUS, METASYS N2, OR ETHERNET/IP (ALLAN BRADLEY) SHALL BE AVAILABLE VIA AN OPTIONAL INTERFACE.
5. THE TSK SHALL BE COMPATIBLE WITH A LEAD/LAG MASTER PANEL.
6. THE TSK SHALL HAVE THE FOLLOWING STANDARD HMI COMPONENT OPTIONS:
   A. SCHNEIDER ELECTRIC HMISTU855 TOUCH PANEL:
      a. 5.7 INCH, 320X240 (QVGA) PIXEL TFT DISPLAY
      b. 8–BIT COLOR DEPTH
      c. NEMA 4X RATING
   B. HMIDT542/HMIDT642/HMIDT732 CHARACTERISTICS
      a. 16 MILLION COLORS
      b. NEMA 4X RATING
      c. CPU RISC 600MHZ
      d. 512 KB NVRAM (BACKUP MEMORY)
      e. 256 MB RAM (INTERNAL MEMORY)
      f. 1 GB SD CARD
      g. TWO (2) USB PORTS
      h. TWO (2) COM PORTS
      i. TWO (2) ETHERNET PORT
      j. 16 MILLION COLORS
      k. NEMA 4X RATING
      l. CPU RISC 600MHZ
      m. 512 KB NVRAM (BACKUP MEMORY)
      n. 256 MB RAM (INTERNAL MEMORY)
      o. 1 GB SD CARD
      p. TWO (2) USB PORTS
      q. TWO (2) COM PORTS
      r. TWO (2) ETHERNET PORT

7. SELECTED BOILER OPERATING DATA SHALL BE DISPLAYED ON THE HMI TO MONITOR BOILER OPERATION. THIS DATA INCLUDES:
   A. CURRENT SETPOINT
   B. ACTUAL PROCESS VALUE
   C. CURRENT FUEL
   D. STARTUP COUNTER
   E. HOUR COUNTER
   F. PHASE OF OPERATION
   G. FIRING RATE
   H. FLAME SIGNAL
   I. ACTUATOR POSITIONS
   J. VSD PERCENT
   K. BOILER SHELL TEMPERATURE
   L. AMBIENT AIR TEMPERATURE
   M. FLUE GAS TEMPERATURE
   N. EFFICIENCY
   O. O2 PERCENT
   P. LEAD/LAG STATUS

8. ADDITIONAL DATA THAT SHALL BE DISPLAYED:
   A. STATIC BURNER/BOILER CONTROL DATA, SUCH AS VERSION AND IDENTIFICATION NUMBERS
   B. FUEL STATISTICS
   C. DETAILED ANNUNCIATION OF BURNER/BOILER CONTROL INPUTS AND OUTPUTS
   D. LOCKOUT AND FAULT LOG HISTORY
   E. FEEDWATER STATUS ON STEAM SYSTEMS, WHEN OPTIONED
   F. FEEDWATER PID LOOP CONTROL ON STEAM SYSTEMS WITH EXPANDED ANNUNCIATION OPTION
      a. SINGLE OR THREE ELEMENT FEEDWATER CONTROL
   G. EXPANDED ANNUNCIATION STATUS, AVAILABLE ON EXPANDED ANNUNCIATION OPTION
   H. ANALOG INPUT DATA, AVAILABLE ON EXPANDED ANNUNCIATION OPTION
   I. CIRCULATING PUMP STATUS, AVAILABLE ON HYDRONIC SYSTEMS WITH EXPANDED ANNUNCIATION OPTION
   J. CIRCULATING PUMP PID LOOP CONTROL, AVAILABLE FOR HYDRONIC SYSTEMS OR STEAM COIL BOILERS WITH EXPANDED ANNUNCIATION OPTION

9. THE FOLLOWING FUNCTIONALITY SHALL BE POSSIBLE WITH A TABLET OR SMART PHONE, VIA REMOTE ACCESS:
   A. REMOTE SETPOINT OR OUTPUT OF THE LOAD CONTROLLER IS POSSIBLE VIA BMS
   B. A WATCHDOG TIMER SHALL BE PROVIDED SO THAT THE LOAD CONTROLLER WILL REVERT TO LOCAL OPERATION UPON LOSS OF COMMUNICATION
   C. A VIRTUAL HAND–OFF–AUTO SWITCH SHALL BE PROVIDED TO ALLOW AN OVERRIDE OF THE REMOTE CONTROL, OR TO PROVIDE AN OFF SIGNAL TO THE LOAD CONTROLLER
   D. DIRECT MANUAL FIRING RATE CONTROL SHALL BE POSSIBLE IN HAND POSITION

10. THE TSK SHALL HAVE A BASE EXPANDED ANNUNCIATOR OPTION. THE EXPANDED ANNUNCIATOR HARDWARE SHALL BE A SCHNEIDER ELECTRIC TM241C24T PLC, WITH A BUILT–IN TMES4 FOUR–PORT ETHERNET SWITCH:
   A. THE EXPANDED ANNUNCIATOR OPTION SHALL ALLOW UP TO THIRTEEN (13) INDIVIDUAL LIMIT POINTS TO BE LABELED AND MONITORED:
      a. EACH LIMIT POINT SHALL BE CONFIGURABLE TO ALARM AS A FIRST–OUT INPUT
      b. EACH ALARM SHALL BE CONFIGURABLE TO RESET AUTOMATICALLY OR MANUALLY
      c. THE CONFIGURATION DATA SHALL BE STORED IN NON–VOLATILE EEPROM, AND SHALL BE AVAILABLE VIA BMS AND LOCALLY ON THE HMI
   B. THE EXPANDED ANNUNCIATOR OPTION SHALL INCLUDE TWO (2) DIGITAL OUTPUTS, CONFIGURABLE TO MONITOR UP TO TWO (2) DATA POINTS EACH:
      a. EACH OUTPUT SHALL INCLUDE LOGIC AND TIMERS, PROGRAMMABLE FOR A VARIETY OF USER CONDITIONS
      b. DATA POINTS SHALL DUPLICATE THE MODBUS POINT LIST, AND SHALL BE AVAILABLE VIA BMS AND LOCALLY ON THE HMI
   C. THE EXPANDED ANNUNCIATOR OPTION SHALL OFFER AN OPTION TO MONITOR AN ECONOMIZER USING PT1000 OR LG–NI 1000 RTD INPUTS, WITH THE SCHNEIDER ELECTRIC TM3TI4 UNIVERSAL INPUT MODULE:
      a. THE STACK INPUT TEMPERATURE SOURCE SHALL BE CONFIGURABLE TO BE PROVIDED BY EITHER THE LOAD CONTROLLER OR VIA THE ANALOG INPUT
      b. THE CONFIGURATION DATA SHALL BE STORED IN NON–VOLATILE EEPROM, AND SHALL BE AVAILABLE VIA BMS AND LOCALLY ON THE HMI
   D. THE EXPANDED ANNUNCIATOR OPTION SHALL OFFER A DRAFT CONTROL OPTION TO INTERFACE WITH DRAFT DAMPERS AND ACTUATORS:
      a. THE DRAFT CONTROL SHALL INTERFACE DIRECTLY WITH THE LOAD CONTROL USING MODBUS RTU OR MODBUS TCP
      b. THE DRAFT CONTROL SHALL SEQUENCE BASED UPON THE BURNER CONTROL PHASE
      c. THE POSITION OF THE DAMPERS SHALL BE DISPLAYED GRAPHICALLY ON THE HMI
      d. MANUAL POSITION CONTROL SHALL BE POSSIBLE
      e. A VIRTUAL OPEN–AUTO SWITCH SHALL BE PROVIDED TO ALLOW AN OVERRIDE TO THE OPEN POSITION
      f. THE DATA SHALL BE AVAILABLE VIA BMS AND LOCALLY ON THE HMI
   E. THE EXPANDED ANNUNCIATOR OPTION SHALL BE CONFIGURABLE TO OPERATE AS A BURNER/BOILER CONTROL:
      a. CONNECTION OF A PROCESS VARIABLE TO ANY OF THE CONFIGURED ANALOG OR UNIVERSAL INPUTS
      b. CONNECTION OF AN ADDITIONAL SENSOR, FOR ALARM PURPOSES, TO ANY OF THE CONFIGURED ANALOG OR UNIVERSAL INPUTS
      c. ON AND OFF HYSTERESIS SETTINGS
      d. PROPORTIONAL, INTEGRAL, AND DERIVATIVE SETTINGS (PID)
      e. CONFIGURABLE THERMOSTAT AND ALARM OUTPUTS, AS PROGRAMMABLE DIGITAL OUTPUTS
   F. THE EXPANDED ANNUNCIATOR CONFIGURATION SHALL BE CAPABLE OF BEING BACKED UP TO A USB DRIVE FOR ARCHIVING OR MIGRATING TO SIMILAR INSTALLED TSKS:
      a. THE BACKUP FILE SHALL BE IN CSV FORMAT AND SHALL BE CAPABLE OF OFFLINE EDITING
   G. THE EXPANDED ANNUNCIATOR OPTION SHALL OFFER A CIRCULATING PUMP CONTROL FOR HYDRONIC SYSTEMS:
      a. THE CIRCULATING PUMP SHALL BE CONFIGURABLE TO RUN CONTINUOUSLY, OR TO CYCLE WITH THE BOILER. WHEN THE OPTION TO CYCLE WITH THE BOILER IS SELECTED, THE PUMP SHALL RUN FOR A SELECTABLE OFF–DELAY PERIOD FOLLOWING BOILER SHUTDOWN
      b. AN INPUT FOR PROVING PUMP OPERATION VIA CURRENT SWITCH, FLOW SWITCH, OR DIFFERENTIAL PRESSURE SWITCH SHALL BE AN OPTION. AN ALARM SHALL BE GENERATED BY THE TSK IF PUMP OPERATION IS NOT PROVEN WHEN A RUN COMMAND IS ISSUED
   H. THE EXPANDED ANNUNCIATOR OPTION SHALL BE CAPABLE OF SERIAL CONNECTION FOR UP TO TWO ADDITIONAL CONTROLS USING MODBUS RTU. A SCREEN ON THE HMI SHALL BE PROVIDED TO GRAPHICALLY REPRESENT THE CONTROLS.

11. THE TSK SHALL BE CONFIGURABLE TO MONITOR CONTROLS WHEN USED IN A FEEDWATER APPLICATION. A SCREEN SHALL BE PROVIDED TO GRAPHICALLY REPRESENT THE VESSEL AND THE PERCENTAGE OF FILL.

12. THE TSK SHALL BE CAPABLE OF SENDING CONFIGURATION DATA AND MONITORING A YASKAWA, DANFOSS, POWERFLEX, ABB, AND DELTA VARIABLE SPEED DRIVES (VSD), THIS DATA INCLUDES:
   A. REFERENCE PERCENT
   B. REFERENCE HERTZ
   C. OUTPUT PERCENT
   D. OUTPUT HERTZ
   E. RPM
   F. OUTPUT CURRENT
   G. MAXIMUM OUTPUT CURRENT
   H. OUTPUT VOLTAGE
   I. DC BUS VOLTAGE
   J. MAXIMUM DC BUS VOLTAGE
   K. OUTPUT POWER
   L. OUTPUT POWER TOTALIZATION
   M. CURRENT FAULT MESSAGE
   N. CURRENT ALARM MESSAGE
   O. ALARM, FAULT, READY, IDLE, RUNNING, AND SPEED AGREE INDICATORS
   P. CONFIGURABLE RAMP TIMES
   Q. CONFIGURABLE MOTOR NAMEPLATE DATA
   R. CONFIGURABLE BRAKING RESISTOR STATUS

13. THE TSK SHALL HAVE THE ABILITY TO GENERATE A GRAPHICAL COMBUSTION CURVE FOR THE AIR, FUEL, AUXILIARY 1 OR AUXILIARY 3 ACTUATORS, AND THE VSD:
   A. THE CURVE SHALL BE GENERATED AT LOAD INCREMENTS OF 10% ON THE 5.7 INCH TSK, AND 5% ON THE 10.4 12.1" AND THE 15" INCH TSK
   B. THE GRAPH DATA SHALL BE SAVED ON A USB DRIVE IN CSV FORMAT
   C. THE GRAPH DATA SHALL BE READABLE FROM ANY TEXT EDITOR OR SPREADSHEET APPLICATION
   D. WHEN EMAIL IS CONFIGURED, THE TSK SHALL BE CAPABLE OF EMAILING GRAPH DATA
   E. THE COMBUSTION DATA POINTS SHALL BE AVAILABLE VIA BMS

14. THE TSK SHALL INCLUDE FOUR (4) LOCAL TREND GRAPHS THAT ARE EACH CONFIGURABLE FOR UP TO TWO (2) DATA POINTS:
   A. THE DATA POINTS SHALL DUPLICATE THE MODBUS POINT LIST, AND SHALL BE AVAILABLE VIA BMS
   B. THE TIME BASE SHALL BE ADJUSTABLE IN PRE–DEFINED SETTINGS, RANGING FROM 10 SECONDS TO 60 MINUTES PER SAMPLE

15. THE TSK SHALL INCLUDE THE ABILITY TO DATALOG UP TO EIGHT (8) DATA POINTS:
   A. THE DATA POINTS SHALL DUPLICATE THE MODBUS POINT LIST, AND SHALL BE AVAILABLE VIA BMS
   B. THE TIME BASE SHALL BE ADJUSTABLE IN PRE–DEFINED SETTINGS, RANGING FROM 10 SECONDS TO 60 MINUTES PER SAMPLE
   C. THE DATALOG SHALL BE SAVED ON A USB DRIVE IN CSV FORMAT
   D. THE DATALOG SHALL BE READABLE FROM ANY TEXT EDITOR OR SPREADSHEET APPLICATION
   E. THE DATALOG FILE NAME SHALL INCLUDE THE DATE
   F. A NEW DATALOG FILE SHALL BE CREATED DAILY FOR ARCHIVING INFORMATION
   G. WHEN EMAIL IS CONFIGURED, THE TSK SHALL BE CAPABLE OF EMAILING THE DAILY DATALOG

16. THE TSK SHALL ANNUNCIATE THE PRESENCE OF LOCAL ALARMS ON THE HMI, WITH THE CAPABILITY TO STORE THE LATEST 250 ALARMS:
   A. THE NEWEST ALARM SHALL REPLACE THE OLDEST ALARM
   B. WHEN EMAIL IS CONFIGURED, THE TSK SHALL SEND CURRENT ALARMS VIA EMAIL
   C. DIFFERENT ALARM CATEGORIES SHALL BE COLOR–CODED
   D. THE CAPABILITY TO SAVE THE COMPLETE ALARM HISTORY ON A USB DRIVE

17. THE TSK SHALL BE CONFIGURABLE TO OPERATE IN CONJUNCTION WITH A LEAD/LAG MASTER PANEL:
   A. THE TSK SHALL BE UNIQUELY ADDRESSED BY BOILER NUMBER
   B. ALL CONFIGURATION AND CLOCK DATA SHALL COME FROM THE LEAD/LAG MASTER PANEL
   C. WHEN A COMMUNICATION FAILURE OCCURS, LOCAL BOILER OPERATION SHALL RESUME, AND AN ALARM SHALL BE GENERATED

18. WHEN NOT CONNECTED TO A LEAD/LAG MASTER PANEL OR PROTOCOL CONVERTER, THE IP ADDRESS SHALL BE CAPABLE OF BEING CHANGED AS NEEDED.

19. CLOCK DATA ENTERED INTO THE TSK SHALL AUTOMATICALLY BE SYNCHRONIZED TO ANY CONNECTED DEVICES WITH AN INTERNAL CLOCK.

20. TWO LEVELS OF SECURITY SHALL EXIST TO PROTECT CONFIGURATION AND OPERATION SETTINGS:
   A. THE FIRST LEVEL OF SECURITY SHALL ALLOW THE OPERATOR TO CHANGE SETTINGS REQUIRED FOR DAILY OPERATION
   B. THE SECOND LEVEL OF SECURITY SHALL ALLOW FIRST LEVEL ACCESS, AND ADDITIONALLY ALLOW CHANGES TO CONFIGURATION OPTIONS

21. THE TSK SHALL BE CAPABLE OF DISPLAYING ALL SCREENS IN EITHER ENGLISH OR SPANISH.

22. THE TSK SHALL INCLUDE MULTIPLE BURNER/BOILER DISPLAY OPTIONS.

23. THE TSK SHALL INCLUDE A SCREEN SAVER WITH MULTIPLE TIME OPTIONS, INCLUDING THE ABILITY TO DISABLE THE SCREEN SAVER ALTOGETHER.

24. THE SCREEN SAVER SHALL PROMINENTLY DISPLAY THE SETPOINT, ACTUAL VALUE, AND FIRING RATE, AS WELL AS GRAPHICALLY REPRESENT THE CURRENT PHASE.

25. THE TSK SHALL BE CAPABLE OF SENDING EMAIL TO A MAXIMUM OF SIX EMAIL ADDRESSES. A MACRO SHALL BE PROVIDED TO ALLOW MOBILE PHONES TO RECEIVE TEXT MESSAGES AS WELL.

26. EMAILS SHALL BE SENT FOR THE FOLLOWING:
   A. ANY ALARM CONDITIONS
   B. STATIC BURNER/BOILER CONTROL DATA
   C. FUEL STATISTICS
   D. LOCKOUT AND FAULT HISTORY
   E. SCREEN SNAPSHOTS
   F. DAILY DATALOG SUMMARIES
   G. COMBUSTION CURVE DATA

27. THE TSK SHALL BE CAPABLE OF CONNECTING TO A PROTOCOL CONVERTER TO ALLOW BACNET/RTU, BACNET MS/TP, OR METASYS N2 COMMUNICATIONS:
   A. BACNET/RTU:
      a. THE STATUS OF THE CONNECTION SHALL BE MONITORED. AN INACTIVE CONNECTION SHALL CAUSE LOCAL OPERATION TO BE FORCED ONTO THE BURNER/BOILER CONTROL
      b. THE IP ADDRESS AND DEVICE INSTANCE OF THE BACNET/RTU CONNECTION SHALL BE ADJUSTABLE VIA A STANDARD WEB BROWSER
   B. BACNET MS/TP:
      a. THE STATUS OF THE CONNECTION SHALL BE MONITORED. AN INACTIVE CONNECTION SHALL CAUSE LOCAL OPERATION TO BE FORCED ONTO THE BURNER/BOILER CONTROL
      b. THE MAC ADDRESS AND DEVICE INSTANCE OF THE BACNET MS/TP CONNECTION SHALL BE ADJUSTABLE VIA A STANDARD WEB BROWSER
      c. THE BAUD RATE OF THE BACNET MS/TP CONNECTION SHALL BE ADJUSTABLE FROM 9600 TO 76800, IN STANDARD INCREMENTS
   C. METASYS N2:
      a. THE NODE ADDRESS OF THE METASYS N2 CONNECTION SHALL BE ADJUSTABLE VIA A STANDARD WEB BROWSER

FAILURE OF ANY COMPONENT WITHIN THE TSK (TOUCHSCREEN OR PLC) WILL NOT RESULT IN LOSS OF BOILER OPERATION. OPERATION WILL REVERT TO LOCAL PID CONTROL, LOCATED IN THE RWF10/RWF55/LMV5, UTILIZING A PRE–PROGRAMMED LOCAL SETPOINT. HYDRONIC PUMP OUTPUTS, IF USED, WILL FAIL TO THE ON CONDITION.

PIPING SPECIFICATIONS
1. PIPING

   A. REFER TO THE PIPING MATERIALS SCHEDULE FOR PIPING MATERIALS FOR SPECIFIC SYSTEMS.

   B. COPPER PIPING 2 INCHES AND SMALLER SHALL BE HARD DRAWN TYPE L SEAMLESS COPPER TUBING PER ASTM B88. FITTINGS SHALL BE WROUGHT COPPER, PER ANSI B16.22.

   C. FITTINGS FOR COPPER PIPING SHALL BE MADE OF THE SAME WALL THICKNESS AND OF THE SAME MATERIAL AS THE PIPE TO WHICH THEY ARE ATTACHED. FITTINGS SHALL BE MADE FROM PURE COPPER MILL PRODUCTS PER ASTM B75 ALLOY C12200, MEETING DESIGN STANDARDS ANSI B16.22 AND MSS–SP–104. FITTINGS SHALL BE RATED FOR AN INTERNAL WORKING PRESSURE OF 250 PSI AT 200 DEGREES F. FITTINGS IN COPPER TUBING SHALL BE WROUGHT COPPER SOLDER JOINT FITTINGS OR PROPRESS PRESSURE FITTING SYSTEM AS MANUFACTURED BY VIEGA AS FOLLOWS:
      1) COPPER TUBING SHALL CONFORM TO ASTM B75 OR ASTM 88.
      2) COPPER AND COPPER ALLOY FITTINGS SHALL CONFORM TO MATERIAL REQUIREMENTS OF ASME B16.18 OR ASME B16.22 AND PERFORMANCE CRITERIA OF IAPMO PS117.
      3) SOLDER METAL SHALL CONFORM TO THE REQUIREMENTS OF ASTM B32. SOLDERING FLUXES SHALL CONFORM TO ASTM B813.
      4) PIPE THREADS SHALL CONFORM TO ASME B1.20.1.
      5) HANGERS AND SUPPORTS SHALL CONFORM TO MSS–SP–58.

   D. FOR WORK IN OCCUPIED SPACES ONLY, PROPRESS, PRESSURE FITTING SYSTEM AS MANUFACTURED BY VIEGA SHALL BE PERMITTED. SEALING ELEMENTS FOR PRESS FITTINGS SHALL BE EPDM. SEALING ELEMENTS SHALL BE FACTORY INSTALLED OR AN ALTERNATIVE SUPPLIED BY FITTING MANUFACTURER. PRESS END SHALL HAVE SC (SMART CONNECT) FEATURE DESIGN (LEAKAGE PATH). IN PRO PRESS ½ INCH TO 2 INCH DIMENSIONS, THE SMART CONNECT FEATURE SHALL ASSURE LEAKAGE OF LIQUIDS FROM INSIDE THE SYSTEM PAST THE SEALING ELEMENT OF AN UNPRESSED CONNECTION. THE FUNCTION OF THIS FEATURE SHALL BE TO PROVIDE THE INSTALLER QUICK AND EASY IDENTIFICATION OF CONNECTIONS WHICH HAVE NOT BEEN PRESSED PRIOR TO PUTTING THE SYSTEM INTO OPERATION.

   E. STEEL PIPING SHALL BE PER ANSI/ASME B31.1 CODE FOR PRESSURE PIPING, ASTM A–106 OR A–53 GRADE B, AND DIMENSION STANDARDS OF ANSI B36.10, SCHEDULE 40 ERW CARBON STEEL.

   F. FITTINGS FOR STEEL PIPING 2 INCH AND SMALLER SHALL BE SCREWED OR WELDED TYPE. FITTINGS FOR STEEL PIPING 2–1/2 INCH AND ABOVE SHALL BE WELDED OR FLANGED TYPE AND SHALL BE SHORT OR LONG PATTERN SEAMLESS BUTT WELDED FITTINGS OF THE SAME WALL THICKNESS AND OF THE SAME MATERIAL AS THE PIPE TO WHICH THEY ARE ATTACHED. STEEL FITTINGS SHALL HAVE PRESSURE RATINGS (PSI) AS INDICATED OR AS REQUIRED TO MEET SYSTEM OPERATING PRESSURES.

      1) SCREWED FITTINGS SHALL BE MALLEABLE CARBON STEEL; 150 LB. CLASS, BLACK, AND IN ACCORDANCE WITH ANSI B16.3, ANSI B1.20.1 AND ASTM A126 CLASS B.
      2) ALL SCREWED CONNECTIONS SHALL BE ASSEMBLED WITH LUBRICANT APPLIED TO THE MALE THREADS ONLY.
      3) FLANGED FITTINGS SHALL BE CAST IRON, SHORT BODY, CLASS 125 OR 250, BLACK AND IN ACCORDANCE WITH ANSI B16.1. GASKETS SHALL BE FULL FACE 1/8 INCH MINIMUM THICKNESS AS HERE–IN–AFTER SPECIFIED.
      4) ALL FLANGE BOLTING SHALL BE ASTM A307 GRADE B HEAVY HEX BOLTS AND STUD BOLTS WITH ASTM A563 GRADE A HEAVY HEX NUTS. BOLT AND STUD LENGTH SHALL BE IN ACCORDANCE WITH ASME B16.5, TABLE 8. ALL BOLT THREADS SHALL BE LUBRICATED WITH ANTI–SEIZE THREAD COMPOUND. NEITHER STUDS NOR THREADED ROD SHALL BE USED.
      5) ALL SLIP–ON FLANGES SHALL BE BACK–WELDED.
      6) WELD FITTINGS SHALL BE FORGED STEEL SCHEDULE 40 UP TO 10 INCHES, BLACK, CLASS 150, AND IN ACCORDANCE WITH ANSI B16.9, ANSI B16.25, ASTM A234, ANSI B16.5 , OR ANSI B16.11.

   G. ALL WELDING, SHOP AND FIELD, SHALL BE DONE BY A CERTIFIED LICENSED WELDER FOLLOWING STANDARD PRACTICES ESTABLISHED BY THE AMERICAN WELDING SOCIETY DURING ALL FIELD WELDING A FIRE WATCH SHALL BE MAINTAINED.

   H. WHERE CONNECTIONS ARE MADE BETWEEN STEEL PIPING OR FERROUS EQUIPMENT AND COPPER TUBING, PROVIDE A DIELECTRIC WATERWAY OR FLANGE WITH A GASKET OF INERT AND DI–ELECTRIC MATERIAL, TEFLON OR APPROVED EQUAL.

      a. DIELECTRIC WATERWAYS SHALL BE RATED AT 210 DEGREES F AT 250 PSI CONFORMING TO ANSI B16.39. PIPE THREADS SHALL CONFORM TO ANSI B2.1.

      b. FLANGED FITTINGS SHALL BE RATED AT 175 PSI CONFORMING TO ANSI B16.42 (IRON) OR B16.24 (BRONZE). BOLTS SHALL BE PROVIDED WITH BOLT INSULATORS. FOR PRESSURE ABOVE 175 PSI THE CONTRACTOR SHALL PROVIDE 250 PSI FLANGES TO MATCH PIPING MATERIAL, WITH DI–ELECTRIC GASKET AND BOLT INSULATORS.

      c. FITTINGS SHALL BE CERTIFIED TO WITHSTAND A MINIMUM OF 600 VOLTS ON A DRY LINE WITH NO FLASHOVER.

   I. DRAWINGS DO NOT INDICATE ALL PIPING OFFSETS THAT MAY BE REQUIRED. NO PIPING, VALVES, JOINTS, OR FITTINGS SHALL BE ERECTED OVER ANY MOTORS, PANEL BOARDS, OR OTHER ELECTRICAL EQUIPMENT.

   J. UNLESS OTHERWISE INDICATED, PROVIDE MANUAL AIR VENTS IN ALL HIGH POINTS OF THE NEW PIPING AND DRAIN VALVES AT ALL LOW POINTS. VENTS AND DRAINS SHALL CONSIST OF A BALL VALVE AND ¾" HOSE ADAPTER/CAP.

   K. WHEN CONNECTIONS ARE MADE TO EXISTING SYSTEMS PROVIDE ALL REQUIRED PIPING MODIFICATIONS, ADAPTERS, ETC.

   L. MISCELLANEOUS EXISTING PIPING WHICH IS REVISED SHALL BE DONE WITH MATERIALS THAT MATCH THE EXISTING.

   M. UNIONS FOR COPPER TUBING SHALL BE ANSI 125 LB. PATTERN, ALL BRONZE GROUND JOINT UNIONS WITH ENDS FOR SOLDERED JOINTS.

   N. PRESSURE TEST ALL EXISTING PIPING AND RISERS TO BE REUSED. REPAIR AND REPLACE AS NEEDED.

   O. ALL PIPING INSULATION SHALL BE AS SCHEDULED OR SPECIFIED.

   P. SPECIALITIES, AND APPURTENANCES FOR HYDRONIC SYSTEMS SHALL BE AS SCHEDULED OR SPECIFIED.

   Q. THE PIPE SYSTEMS UNLESS OTHERWISE INDICATED, SHALL NOT PITCH LESS THAN INDICATED ON THE SCHEDULE:

2. VALVES

   A. VALVES FOR THE VARIOUS PIPING SYSTEMS SHALL BE AN APPROVED EQUAL TO THE MANUFACTURER AND FIGURE NUMBERS SCHEDULED.

3. FLEXIBLE CONNECTIONS

   A. FLEXIBLE CONNECTIONS IN STEEL PIPING SHALL BE METRAFLEX TYPE MLP FLEXIBLE CONNECTION (OR APPROVED EQUAL) WITH TYPE 321 STAINLESS STEEL INNER CORRUGATED HOSE, TYPE 304 OUTER BRAID, ASA 150# FLANGED ENDS AND MINIMUM WORKING PRESSURE OF 200 PSI.

4. PRESSURE GAUGES

   A. PROVIDE AND INSTALL ALL PRESSURE GAGES IN SUCH A MANNER AS TO BE EASILY READ FROM NORMAL OBSERVATION POSITIONS

   B. PROVIDE AN ISOLATION VALVE FOR EACH GAUGE (REFER TO VALVE SCHEDULE).

   C. ALL PRESSURE GAUGES UTILIZED FOR STEAM SERVICE SHALL BE EQUIPPED WITH A COIL SYPHON CONSTRUCTED OF 316 STAINLESS STEEL OR SEAMLESS SCHEDULE 80 CARBON STEEL.

   D. SELECT RANGE IN SUCH A MANNER THAT THE OPERATING PRESSURE IS AT THE MID–POINT OF THE SCALE.

   E. PRESSURE GAUGES SHALL BE AS FOLLOWS:
      d. DIAL SIZE: 4–1/2 INCH.
      e. ACCURACY: 1/2% OF FULL SCALE, GRADE 2A, ASME B40.100.
      f. CASE: BLACK PHENOILC, SOLID FRONT.
      g. RING: THREADED REINFORCED BLACK POLYPROPYLENE.
      h. WINDOW: GLASS.
      i. POINTER: MICROMETER ADJUSTABLE.
      j. MOVEMENT: ROTARY, TYPE 400 SS, TEFLON–COATED PINION GEAR & SEGMENT.
      k. BOURDON TUBE & SOCKET: TYPE 316L STAINLESS STEEL.
      l. OPTIONAL FEATURES: PLUS! PERFORMANCE.
      m. MANUFACTURER: ASHCROFT.
      n. MODEL: 45–1279–SS–(CONNECTION SIZE & TYPE)–XLL–(PRESSURE RANGE).
      o. *ALTERNATE MANUFACTURER: TREICE.
      p. *ALTERNATE MODEL: 450SS–45–(CONNECTION SIZE)–(CONNECTION LOCATION)–A–(PRESSURE RANGE CODE)–SS(CODE FOR FLUID SELECTION FOR SNUBBER SCREW).
      q. *EACH GAUGE MUST BE SUPPLIED WITH A TREICE MODEL 870–13 OR 870–16 IMPULSE DAMPENER.

5. THERMOMETERS

   A. PROVIDE AND INSTALL ALL THERMOMETERS IN SUCH A MANNER AS TO BE EASILY READ FROM NORMAL OBSERVATION POSITIONS.

   B. STEM LENGTH SHALL PROVIDE SUFFICIENT INSERTION TO EXTEND THRU INSULATION THICKNESS AND INTO THE FULL DEPTH OF THE THERMOWELL. THE THERMOWELL SHALL EXTEND INTO THE PIPE LINES NOT LESS THAN 50 PERCENT OF THE INSIDE PIPE DIAMETER IN WHICH INSTALLED. THERMOWELLS SHALL BE 316SS, SUPPLIED WITH THREADED STEPPED SHANK.

   C. THERMOMETER SHALL BE AS FOLLOWS:
      r. DIAL SIZE: 5 INCH.
      s. ACCURACY: 1% OF FULL SCALE, GRADE A, ASME B40.3.
      t. STEM & CASE: TYPE 304 STAINLESS STEEL HERMETICALLY SEALED.
      u. STEM DIAMETER: 0.250 INCH.
      v. WINDOW: POLYCARBONATE.
      w. CONNECTION: 1/2 INCH NPT UNION.
      x. LOCATION: EVERYANGLE®.
      y. MANUFACTURER: ASHCROFT.
      z. MODEL: 50–EL–42–E–(STEM LENGTH CODE)–(RANGE CODE).
      aa. ALTERNATE MANUFACTURER: TREICE.
      ab. ALTERNATE MODEL: B856–(STEM LENGTH CODE)–(RANGE CODE)–SWV.

6. HANGERS

   A. SUPPORT COMPONENTS SHALL CONFORM TO MANUFACTURER'S STANDARDIZATION SOCIETY SPECIFICATIONS SP–58.

   B. PIPE HANGERS SHALL BE LOCATED NEAR OR AT CHANGES IN PIPING DIRECTION AND CONCENTRATED LOADS. ALL HANGERS SHALL BE CLEVIS TYPE AND ARE TO HAVE VERTICAL ADJUSTMENTS FOR MAINTAINING THE PITCH OF PIPING.

   C. HANGER ROD SIZES SHALL BE AS FOLLOWS:

PIPE SIZE	MIN. HANGER ROD DIAMETER
1–1/2 INCHES AND SMALLER	3/8 INCH
2 THROUGH 3 INCHES	1/2 INCH
4 THROUGH 5 INCHES	5/8 INCH
6 INCHES	7/8 INCH

   D. HANGER SPACING SHALL BE AS FOLLOWS:

PIPE SIZE	MIN. HANGER SPACING
1–1/2 INCHES AND SMALLER	NOT OVER 6 FEET
2 THROUGH 6 INCHES	NOT OVER 10 FEET

   E. HANGERS AND SUPPORTS SHALL BE THE FOLLOWING GRINNEL NUMBERS AND ON INSULATED PIPING SHALL BE SIZED TO FIT OUTSIDE INSULATION COVERING:

      1) FIG. 260 HANGER FOR INSULATED COPPER AND STEEL PIPING AND UNINSULATED STEEL PIPING

      2) FIG. 191 PIPE SUPPORT WITH ADJUSTABLE PIPE STANCHION SADDLE WITH U–BOLT.

7. GASKETS

   A. ALL GASKETS SHALL BE RING–TYPE OF 1/16" THICK NON–ASBESTOS SHEET MATERIAL SUITABLE FOR THE TEMPERATURES AND PRESSURES OF THE SERVICE INVOLVED.

   B. GASKETS SHALL NOT BE REUSED OR REPAIRED IN ANY WAY. THEY SHALL BE REPLACED IF:
      1) THEY ARE DAMAGED DURING INSTALLATION.
      2) IF A FITTING MUST BE DISASSEMBLED AFTER IT HAS BEEN TIGHTENED.
      3) IF THERE IS ANY LEAKAGE DURING A PRESSURE TEST (IF THE FITTING ITSELF IS SCORED OR DAMAGED, IT SHALL BE REPLACED),

   C. GASKET CEMENTS OR SEALERS SHALL NOT BE USED.

8. CLEANING AND TESTING

   A. TEST ALL NEW PIPING AT 1–1/2 TIMES THE SYSTEM'S OPERATING PRESSURE WITH A MINIMUM 150# HYDROSTATIC TEST WHICH SHALL HOLD TIGHT FOR A PERIOD OF TWO (2) HOURS. ALL LEAKS SHALL BE REPAIRED WITH NEW MATERIALS AND THEN RETESTED. SUBMIT TEST RECORDS FOR REVIEW.

   B. CLEAN AND FLUSH MODIFIED SECTIONS OF PIPING IN ACCORDANCE WITH RECOMMENDATIONS OF WATER TREATMENT CONTRACTOR. CLEAN AND REPLACE STRAINER SCREENS.

   C. FILL MODIFIED SECTIONS OF PIPING AND INTRODUCE WATER TREATMENT AS RECOMMENDED BY WATER TREATMENT CONTRACTOR.

9. IDENTIFICATION

   A. PROVIDE IDENTIFICATION AND FLOW ARROWS ON ALL NEW AND EXISTING PIPING. PIPE IDENTIFICATION SHALL BE BY SETON NAMEPLATE CORPORATION OR BRADY USA, INC. AND MANUFACTURED ON PRESSURE SENSITIVE VINYL SHEETS WITH SCREEN PRINTED LETTERS. COLORING SHALL BE PER ASME COLOR CODE.

   B. ALL EXISTING PIPING IN MECHANICAL ROOM SHALL BE PROVIDED WITH NEW LABELS ON OUTER JACKETING OF INSULATION INDICATING FLOW DIRECTION AND TYPE OF PIPING WHERE LABELING IS CURRENTLY MISSING (FIELD VERIFY LOCATIONS).

   C. PROVIDE DESCRIPTIVE ENGRAVED 1/16" THICK PLASTIC–LAMINATED LABEL WITH BLACK FACE AND WHITE LETTERS ON ALL EQUIPMENT BEING ADDED OR MODIFIED AND ON ALL NEW CIRCUIT BREAKERS.

   D. LABELS SHALL BE PUNCHED AND ATTACHED TO EQUIPMENT WITH MECHANICAL FASTENERS.

9. VALVE TAGS

   A. PROVIDE FOR EACH VALVE A 2" DIAMETER BRASS VALVE TAG ATTACHED TO THE VALVE WITH A BRASS HOOK AND JACK CHAIN. IDENTIFY EACH VALVE AND ADD SAME TO THE EXISTING VALVE CHARTS OR PROVIDE A NEW VALVE CHART WITH ALL VALVE DATA (VALVE NUMBER, SERVICE, SIZE, AND LOCATION).

PIPING MATERIALS SCHEDULE

SYSTEM	SIZE RANGE	PIPING	SLOPE
HEATING HOT WATER PIPING	UP TO 2"	COPPER	1" IN 50'
HEATING HOT WATER PIPING	2½" AND LARGER	SCHEDULE 40 STEEL	1" IN 50'

INSULATION SPECIFICATIONS
1. GENERAL

   REFER TO THE INSULATION SCHEDULE FOR INSULATION THICKNESS AND TYPE TO BE PROVIDED FOR SPECIFIC SYSTEMS AND LOCATIONS.

2. FIBERGLASS DUCT WRAP INSULATION
   A. PROVIDE MICROLITE XG FORMALDEHYDE FREE DUCT WRAP INSULATION. INSULATION SHALL BE A WHITE, LIGHTWEIGHT RESILIENT BLANKET MANUFACTURED FROM FIBERGLASS BONDED WITH THERMOSETTING ACRYLIC RESIN COMPLYING WITH ASTM C1290.
   B. INSULATION SHALL BE 1.5 POUNDS PER CUBIC FEET (PCF) WITH A FOIL–SCRIM–KRAFT (FSK) VAPOR BARRIER FACING COMPLYING WITH ASTM C1136S.
   C. INSULATION SHALL HAVE A FLAME SPREAD RATING OF NOT GREATER THAN 25 AND A SMOKE DEVELOPED RATING NOT GREATER THAN 50 WHEN TESTED IN ACCORDANCE WITH ASTM E84 AND UL 723 AND SHALL MEET NFPA 90A AND 90B STANDARDS.
   D. INSULATION SHALL BE GREEN BUILDING CERTIFIED FOR RECYCLED CONTENT, ENERGY STAR, LEED CREDITS, LEED–NC, AND SHALL MEET ES1350 REQUIREMENTS.
   E. INSULATION SHALL HAVE A THERMAL CONDUCTIVITY (K) OF 0.27 BTU PER INCH PER HOUR PER SQUARE FEET AT 75 DEGREES F. MEAN TEMPERATURE PER ASTM C518.

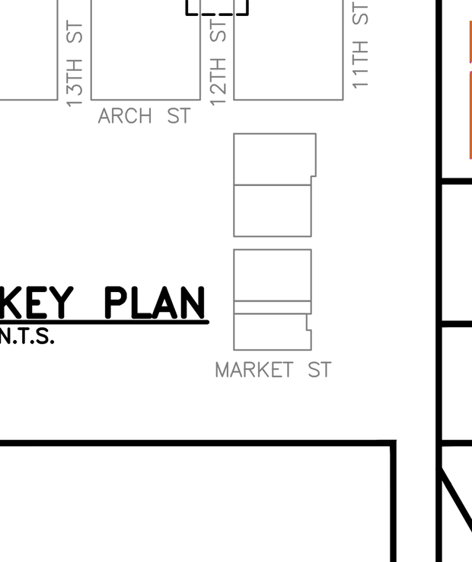
3. FIBERGLASS BOARD INSULATION
   A. PROVIDE 800 SERIES SPIN–GLAS FIBERGLASS BOARD INSULATION WITH AS INDICATED SURFACE. BOARD SHALL HAVE A DENSITY OF POUNDS PER CUBIC FEET (PCF) PER PARAGRAPH 3 BELOW. INSULATION SHALL COMPLY WITH ASTM C553 TYPE III AND ASTM C612 TYPES 1A AND 1B.
   B. INSULATION SHALL BE MANUFACTURED FROM INORGANIC GLASS FIBERS BONDED TOGETHER WITH THERMOSETTING RESIN. UNFACED INSULATION SHALL HAVE A MAXIMUM SYSTEM OPERATING TEMPERATURE OF 450 DEGREES F. AND FACED INSULATION SHALL HAVE A MAXIMUM SYSTEM OPERATING TEMPERATURE OF 150 DEGREES F.
   C. INSULATION SHALL BE PROVIDED WITH A PAINTABLE ALL PURPOSE (AP) FACING THAT SHALL BE A WHITE KRAFT PAPER BONDED TO ALUMINUM FOIL REINFORCED WITH FIBERGLASS YARN. THE KRAFT PAPER SHALL BE LAMINATED WITH A FIRE RESISTANT ADHESIVE TO MINIMIZE CORROSION OF THE FOIL.
   D. INSULATION SHALL HAVE A THERMAL CONDUCTIVITY (K) OF 0.22 TO 0.24 ZBTU PER INCH PER HOUR PER SQUARE FEET AT 75 DEGREES F. MEAN TEMPERATURE PER ASTM C518.

4. DUCTWORK JACKETING (WHERE SCHEDULED)
   A. DUCTWORK SHALL BE JACKETED WITH VENTURECLAD 1577CW OR EQUAL. JACKETING CHARACTERISTICS INCLUDE ZERO PERMEABILITY AND UV RESISTANT.
   B. INSTALL JACKETING WITH LONGITUDINAL SEAMS ON SIDES AND BOTTOM. LONGITUDINAL SEAMS ON TOP OF DUCTWORK IS NOT PERMITTED.
   C. INSTALL JACKETING IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

3. FIBERGLASS PIPING INSULATION
   A. FIBERGLASS PIPING SHALL CONSIST OF 1LB. DENSITY FIBERGLASS INSULATION HAVING AN OUTER JACKET OF KRAFT PAPER BONDED TO ALUMINUM FOIL REINFORCED WITH FIBERGLASS YARN. THE LONGITUDINAL SEAMS OF THE JACKET SHALL OVERLAP AND BE SEALED USING THE FACTORY APPLIED PRESSURE SENSITIVE ADHESIVE. STAPLES ARE PROHIBITED. INSULATION THICKNESS SHALL NOT BE LESS THAN THOSE RECOMMENDED IN 2009 INTERNATIONAL ENERGY CONSERVATION CODE FOR THE INTENDED SERVICE OF THAT REQUIRED TO PRESENT THE FORMATION OF CONDENSATION OF THE REQUIRED TO ASSURE A MAXIMUM SURFACE TEMPERATURE OF 80°F, WHICHEVER IS THE MOST STRINGENT. THE INSULATION SHALL HAVE A MAXIMUM THERMAL CONDUCTIVITY OF 0.23 BTU–IN./HR.–SQFT–°F AT A MEAN TEMPERATURE OF 75°F.
   B. ALL NON–SERVICE/MAINTENANCE RELATED FITTINGS (I.E. ELBOWS, TEE,S ETC.) SHALL BE INSULATED WITH PRE–MOLDED, LIGHT IMPACT, UV RESISTANT PVC COVERS. THE MINIMUM THICKNESS OF THE COVER WILL BE 30 MIL. FIBERGLASS INSULATION THICKNESS SHALL BE EQUAL TO THE REQUIRED THICKNESS OF THE ADJOINING PIPING. FOAM FILLED FITTINGS AND COVERS ARE PROHIBITED.
   C. FITTINGS REQUIRING SERVICE/MAINTENANCE ACCESS (I.E. UNIONS, SHUT–OFF VALVES, CHECK VALVES, BALANCING VALVES, ETC.) SHALL BE INSULATED WITH REMOVABLE, REUSABLE COVERS WHICH USE STRAPS AND BUCKLES TO SECURE THE COVER IN PLACE. PROVIDE THE INTERFACE BETWEEN THE REMOVABLE COVER AN THE ADJACENT PIPING INSULATION TO ASSURE A TIGHT INTERFACE WHICH PREVENTS HEAT LOSS AND THE FORMATION OF CONDENSATION. COVERS SHALL CONSIST OF INNER AND OUTER WALLS OF 304 SS 0.11" THICK MESH, NYLON COATED 204SS 0.15" THREADED SEAMS, 304SS ⅛" THICK X 1½" BUCKLES, PTFE/TEFLON BELTING AND 304SS I.D. TAGS.
   D. ALL INSULATION PROVIDE SHALL CONFORM TO ALL PERTINENT CODES INCLUDING ASTM E–84, UL 73 AND NFPA 255, AND SHALL NOT EXCEED A FLAME SPREAD OF 25, FUEL CONTRIBUTED 50 AND SMOKE DEVELOPED 50.
   E. PROVIDE AN 18LB. DENSITY MOLDED FIBERGLASS BLOCK, 1½"WIDEX6"LONG, AND SHEETMETAL SADDLE AT EACH PIPE SUPPORT AND/OR HANGER POINT.

HVAC THERMAL INSULATION SCHEDULE

DESCRIPTION	INSULATION TYPE	THICKNESS	COVERING/JACKET	HEAT TRACE
HEATING HOT WATER PIPING	RIGID FIBERGLASS JOHNS MANVILLE MICROLOK	2"	ASJ W/PVC FITTING COVERS	NO
MAKE–UP WATER PIPING	RIGID FIBERGLASS JOHNS MANVILLE MICROLOK	1½"	ASJ W/PVC FITTING COVERS	NO



N
KEY PLAN
N.T.S.

REV	DESCRIPTION	DATE
–	–	–
–	–	–
–	–	–
0	ISSUED FOR BID	01/10/23

PENNSYLVANIA CONVENTION CENTER AUTHORITY
ONE CONVENTION CENTER PLACE
1101 ARCH STREET
PHILADELPHIA, PENNSYLVANIA 19107

PCCA EAST PLANT BOILERS
CONTROL PANEL & BLEND PUMP UPGRADES

MECHANICAL SPECIFICATIONS

DIMITRI J. VERVERELLI, INC.
CONSULTING ENGINEERS
PHILADELPHIA, PENNSYLVANIA

DRAWN BY: JRL	SCALE: AS NOTED	DWG. NO.
CHECKED BY: JAV	PROJ. NO: 2206	M–2.00