ENERGY • WATER • COMMUNITY SERVICES

3505 MONTOPOLIS DRIVE

AUSTIN, TEXAS 78744

100% CONSTRUCTION DOCUMENTS

# ENVIRONMENTAL LAB CHILLER REPLACEMENT

DECEMBER 17, 2015


EEA CONSULTING ENGINEERS

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WWW.EEACE.COM - EEA PROJECT # 20114005B


## INDEX OF SHEETS




20114005B - LCRA ENVIRONMENTAL LAB CHILLER REPLACEMENT - 100% CONSTRUCTION DOCUMENTS - 12/17/15

## SYMBOLS

COLUMN REFERENCE GRID AND CENTERLINE DESIGNATION — 5

DRAWING TITLE

SECTION OR DETAIL NO. — 1 FLOOR PLAN, 1/8" = 1'-0"

SCALE OF SECTION, DETAIL OR DRAWING

DIRECTION OF CUTTING PLANE

LONGITUDINAL OR CROSS SECTION NO. — 4 / M-1

SHEET NO. ON WHICH SECTION IS DRAWN

SURFACE SHOWN IN ELEVATION

ELEVATION NO. — 3 / M2-1

SHEET ON WHICH ELEVATION IS DRAWN

DETAIL NO. — 4/M3-2

AREA OF ENLARGED DETAIL

SHEET ON WHICH ENLARGED DETAIL IS DRAWN

INDICATES PLAN NORTH — NORTH

NEW CONSTRUCTION KEYED NOTE — 1

REVISION NUMBER — 3

POINT OF CONNECTION TO EXISTING SYSTEM

## LINETYPE LEGEND

DEMOLITION

EXISTING TO REMAIN

NEW WORK

## MECHANICAL TWO-LINE DIAGRAM

DUCT SIZE, FIRST FIGURE IS SIDE SHOWN (DIMENSIONS ARE INSIDE CLEAR) — 24/12

SHORT ROUND ELBOW (45° & 90°) CENTERLINE RADIUS = 1.0 * WIDTH

LONG ROUND ELBOW (45° & 90°) CENTERLINE RADIUS = 1.5 * WIDTH

RECTANGULAR ELBOW (45° & 90°)

ROUND DUCT DOWN

ROUND DUCT UP

RECTANGULAR RETURN DUCT UP

RECTANGULAR RETURN DUCT DOWN

RECTANGULAR SUPPLY DUCT UP

RECTANGULAR SUPPLY DUCT DOWN

FLEXIBLE DUCT DIFFUSER DROP

CONCENTRIC REDUCER, DUCT TRANSITION (ROUND TO ROUND, SQUARE TO SQUARE)

ECCENTRIC REDUCER, DUCT TRANSITION (ROUND TO ROUND, SQUARE TO SQUARE)

DUCT TRANSITION (SQUARE TO ROUND)

DUCT CAP

90° RECTANGULAR TURNING VANE

SOUND ATTENUATOR

TRANSFER DUCT w/ INTERNAL LINING

SIDEWALL REGISTER TAP

BRANCH DUCT TAP (w/ SMACA 45° FITTING) — VD

SPIN-IN DUCT TAP — VD

CONICAL DUCT TAP

INTERNAL DUCT LINING

CHANGE OF ELEVATION (RISE OR DROP) IN DIRECTION OF AIRFLOW — R / D

ROOF MOUNTED EXHAUST — EF-X

## PIPING SPECIALITIES

AIR SEPARATOR — S

AIR VENT, AUTOMATIC W/SERVICE VALVE

AIR VENT, MANUAL

ALIGNMENT GUIDE (PIPE SLEEVE)

FILTER — F

FLEX CONNECTION

FLOW METER — FM

FLOW SWITCH — F

PITCH OF PIPE, RISE (R) OR DROP (D) — R / D

PRESSURE GAUGE AND COCK

PRESSURE SWITCH — P

PUMP SUCTION DIFFUSER — PSD

STRAINER

TEST PLUG

THERMOMETER

THERMOMETER IN WELL

THERMOMETER WELL ONLY

## PIPE FITTINGS

CAPPED TEE

BLIND FLANGE

PIPE CAP

INDICATES TIE-IN BETW. EXIST. AND NEW

ELBOW, TURN-DOWN

ELBOW, TURN-UP

FLANGE JOINT

REDUCER, CONCENTRIC

REDUCER, ECCENTRIC

UNION, SCREWED

UNION, FLANGED

CROSSING — HIGHER PIPE / LOWER PIPE

TEE

TEE, OUTLET DOWN

TEE, OUTLET UP

## VALVES

BALL

BUTTERFLY

GAUGE COCK

PRESSURE RELIEF

PRESSURE-TEMPERATURE RELIEF

BACK FLOW PREVENTER, DOUBLE CHECK TYPE — BP

BACK FLOW PREVENTER REDUCED PRESSURE ZONE TYPE — RPZ

CHECK

CONTROL VALVE (TYPE AS SPECIFIED FOR SIZE, OR AS INDICATED) — E

## ROOF COORDINATION NOTE

PATCHING, REPAIRING, FLASHING, ROOF CURBS, PENETRATIONS OR ANY SUCH WORK POTENTIALLY EFFECTING THE INTEGRITY OF THE ROOF SHALL BE COORDINATED WITH THE OWNER BEFORE COMMENCING ANY WORK.

## DEMOLITION NOTES

EACH CONTRACTOR SHALL VERIFY DEMOLITION SCOPE OF WORK WITH THE GENERAL CONTRACTOR FOR THE REMOVAL OF ANY EXISTING FIRE PROTECTION, PLUMBING FIXTURES, PIPING, HVAC UNITS, REFRIGERANT RECAPTURE, EXHAUST FANS, ETC. AND ASSOCIATED ROOF CURBS NOT BEING REUSED ON THIS PROJECT, UNLESS SPECIFICALLY NOTED OTHERWISE. CONTRACTOR MUST VERIFY WITH THE OWNER ALL PRESUMED ABANDONED EQUIPMENT, PIPES, AND DUCTWORK PRIOR TO REMOVAL. ROOF CURBS SHALL BE REMOVED AND THE ROOF PATCHED. ALL EXTRANEOUS ITEMS IN THE SPACE OR ON THE ROOF NOT APPLICABLE TO THE NEW WORK MUST BE REMOVED AND ROOF/WALL/FLOOR PATCHED/REPAIRED TO MATCH EXISTING STRUCTURE. EXISTING ABANDONED PIPES, DUCTS, OR EQUIPMENT IN THE FLOOR, EMBEDDED IN CONCRETE, OR OTHERWISE INACCESSIBLE ARE TO BE CUT OFF AND SEALED BELOW OR WITHIN FLOOR OR WALL LEVEL WHEN THEY ARE NOT TO BE REUSED IN THIS PROJECT. IF REQUIRED BY OWNER OR CODES, ABANDONED PIPING AND/OR DUCTWORK MUST BE REMOVED TO POINT OF ORIGIN. CONFIRM THE EXTENT OF DEMOLITION WITH THE GENERAL CONTRACTOR PRIOR TO BID AND INCLUDE IN BID PROPOSAL AS DIRECTED.



| Rev. | Date | Revision | By | Chkd. | Appd. | Appd. |
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LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
MECHANICAL SYMBOLS AND LEGENDS

DATE 12/17/15
SCALE NOT TO SCALE
DWG. NO. M001

STATE OF TEXAS — MICHAEL E. BEJROWSKI — 111281 — LICENSED PROFESSIONAL ENGINEER — 12/17/15

1 2 3 4 5 6 7 8

A B C D E F G H

## PUMP SCHEDULE

| MARK | SERVICE | LOCATION | TYPE | MAKE | MODEL | SIZE | DESIGN PERFORMANCE | | | | 50% FLOW PERFORMANCE | | | | MOTOR | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | FLOW (GPM) | HEAD (FTHD) | BHP | EFF. | FLOW (GPM) | HEAD (FTHD) | BHP | EFF. | POWER (HP) | SPEED (RPM) | V/PH | TYPE | | | |
| | | | | | | | | | | | | | | | | | | ODP | TEFC | INV. DUTY | |
| CHWP-1 | CHILLED WATER | OUTDOORS | VERTICAL IN-LINE | ARMSTRONG | 0308-007.5 | 3X3X8 | 200 | 65 | 4.39 | 74.9% | 100 | 35.8 | 1.1 | 62% | 7.5 | 1,800 | 480/3 | | X | X | |
| CHWP-2 | CHILLED WATER | OUTDOORS | VERTICAL IN-LINE | ARMSTRONG | 0308-007.5 | 3X3X8 | 200 | 65 | 4.39 | 74.9% | 100 | 35.8 | 1.1 | 62% | 7.5 | 1,800 | 480/3 | | X | X | |

**NOTES:**
1. PROVIDE MAKE AND MODEL SPECIFIED OR ENGINEER APPROVED EQUAL.
2. FURNISH WITH SUCTION GUIDE AND INTEGRAL LOW HARMONIC VFD AND BACNET NATIVE BMS CONTROLLER.
3. PROVIDE SELECTIONS FOR BOTH SENSORLESS AND NON-SENSORLESS OPTIONS.
4. COORDINATE INSTALLATION REQUIREMENTS WITH MANUFATURER.
5. REFER TO PUMP SPECIFICATON (23 21 23) FOR MORE INFORMATION.

## BUFFER TANK SCHEDULE

| MARK | SERVICE | CAPACITY (GAL.) | DIA. (IN.) | HEIGHT (IN.) | TYPE | MAKE | MODEL | TEMP. | PIPE CONNECTION | MAX. PRESSURE (PSI) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BT-1 | CHILLED WATER BUFFER TANK | 850 | 54 | 96 | VERTICAL | CEMLINE | CWB | 42°F | 6" - FLANGED | 125 | OUTDOOR LOCATION ASME CODE CONSTRUCTION |

**NOTES:**
1. INSTALL WITH FLEXIBLE PIPE CONNECTIONS AT ALL CONNECTIONS TO BUFFER TANK.
2. FACTORY INSULATE WITH 2" OF INSULATION AND JACKET FOR OUTDOORS WITH STUCCO-EMBOSSED ALUMINUM JACKET (0.016" THICK, 26 GA)
3. PROVIDE WITH AIR VENT.

## FAN SCHEDULE

GENERAL NOTE:
MARK SF=SUPPLY FAN
MARK EF=EXHAUST FAN
MARK RF=RETURN FAN

| MARK | SERVICE | TYPE | MAKE | MODEL | WHEEL DIA. | FAN PERFORMANCE | | | | | | MOTOR | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | FLOW (CFM) | FAN RPM | ESP (IN.WG.) | TSP (IN.W.G.) | POWER (HP) | MAX SONES | POWER (HP) | SPEED (RPM) | V/PH | DRIVE | | TYPE | | | |
| | | | | | | | | | | | | | | | BELT | DIRECT | ODP | TEFC | INV. DUTY | |
| EF-5 | RTU-1 RELIEF | ROOF CENTRIFUGAL DOWNBLAST | GREENHECK | GB-300 | 30.5 | 6,850 | 605 | 0.68 | 0.74 | 1.66 | 12.5 | 2 | 1,725 | 460/3 | X | | X | | X | |
| - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | |

**NOTES:**
1. PROVIDE MAKE AND MODEL SPECIFIED OR ENGINEER APPROVED EQUAL.
2. PROVIDE BELT DRIVE FANS WITH ADJUSTABLE FAN SHEAVES.
3. PROVIDE WITH THE FOLLOWING ACCESSORIES: NEMA PREMIUM EFFICIENCY MOTOR, INVERTER DUTY MOTOR WITH SHAFT GROUNDING RING, MOTOR WITH THERMAL OVERLOAD, 2 SETS OF SPARE BELTS, NEMA-4 TOGGLE SWITCH, ALUMINUM ROOF CURB, CURB SEAL, GRAVITY BACKDRAFT DAMPER, EXTENDED LUBE LINES, ALUMINUM BIRDSCREEN, BEARINGS WITH GREASE FITTINGS, BEARINGS WITH L10 LIFE OF 100,000 HRS.
4. PROVIDE ROOFTOP UNITS WITH FACTORY MANUFACTURED ROOF CURBS. ENTIRE ASSEMBLY SHALL BE DESIGNED TO WITHSTAND ALL IBC AND ASCE-7 WINDLOADING REQUIREMENTS FOR BUILDING LESS THAN 60' HIGH.
5. COORDINATE ROOFCURB REQUIREMENTS WITH OWNER.

## DUCT SCHEDULE

| DUCT WORK ID | SERVICE | MATERIAL TYPE AND | JOINT TYPE | INSULATION - JACKET TYPE | REMARKS |
|---|---|---|---|---|---|
| EA | GENERAL EXHAUST DUCT | GALVANIZED SHEET METAL PER SMACNA -2" W.G. | PER SMACNA | NONE | |

**NOTES:**
1. ALL DUCT SIZES INDICATE INSIDE CLEAR DIMENSIONS IN INCHES.
2. ALL DUCT SHALL BE CONSTRUCTED PER SMACNA STANDARDS. TAPE SHALL NOT BE ALLOWED AS METAL DUCT SEALANT. SEAL DUCTS PER SMACNA PRESSURE RATING INDICATED ABOVE.
3. ALL DUCT SHALL BE INSTALLED PER SMACNA RECOMMENDATIONS.
4. FURNISH AND INSTALL ALL MITERED ELBOWS WITH TURNING VANES. RADIUSED RECTANGULAR ELBOWS SHALL HAVE CENTER LINE RADIUS TO WIDTH RATIO (R/W) OF 1.5 UNLESS OTHERWISE SPECIFIED.
5. ALL DUCT SUPPORTS SHALL BE FURNISHED AND INSTALLED PER SMACNA HVAC DUCT CONTRUCTION STANDARDS.

## AIR COOLED CHILLER SCHEDULE

| MARK | MAKE | MODEL | TYPE | REF. | NOMINAL CAP. (TONS) | ACTUAL CAP. (TONS) | COND. TEMP (°F) | EFFICIENCY | | % MIN. LOAD (%) | # OF IND. REF. CIRCUITS | EVAPORATOR | | | | | | V-PH-HZ | MCA (AMPS) | MOCP (AMPS) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | FULL LOAD (KW/TON) | IPLV | | | CHW FLOW (GPM) | CHWS TEMP. (°F) | CHWR TEMP. (°F) | MAX P.D. (FT HD) | CONNECTION SIZE (IN) | CONNECTION TYPE | | | | |
| CH-1 | CARRIER | 30RB130 | SCROLL | R-410A | 130 | 115.1 | 105 | 1.41 | 16.81 | 15 | 2 | 197 | 42 | 56 | 5.6 | 6 | GROOVED COUPLING | 460-3-60 | 276.5 | 300 | |
| CH-2 | CARRIER | 30RB130 | SCROLL | R-410A | 130 | 115.1 | 105 | 1.41 | 16.81 | 15 | 2 | 197 | 42 | 56 | 5.6 | 6 | GROOVED COUPLING | 460-3-60 | 276.5 | 300 | |

**NOTES:**
1. PROVIDE CHILLERS WITH, LOW SOUND PACKAGE, CONDENSER MOTORS WITH VARIABLE SPEED DRIVES, SINGLE POINT POWER CONNECTION, NEMA 4 CONTROLS ENCLOSURE FACTORY MOUNTED CONTROL TRANSFORMER, FACTORY MOUNTED NON-FUSED DISCONNECT, LOW SOUND KIT FOR COMPRESSORS, HIGH AMBIENT KIT FOR OPERATION UP TO 125°F, LOUVERED CONDENSER ENCLOSURE PANELS, BACNET PROTOCOL BAS INTERFACE CARD, CHILLED WATER FLOW SWITCH.
2. PROVIDE CHILLERS WITH ONBOARD CONTROLS FOR SEQUENCING OF BOTH CHILLERS IN PARALLEL, AS A SINGLE SYSTEM.
3. PROVIDE CHILLERS WITH THE FOLLOWING ITEMS TO BE INSTALLED BY THE CONTRACTOR: VIBRATION ISOLATION AS RECOMMENDED BY MANUFACTURER, CONTAINERS OF LUBRICATING OIL.

## PIPE SCHEDULE

| PIPING ID | SERVICE | SIZE | MATERIAL TYPE | FITTING TYPE | JOINT TYPE | INSULATION LOCATION | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | INTERIOR | | EXTERIOR | |
| | | | | | | CONCEALED | EXPOSED | | |
| CHWS/R | CHILLED WATER | 2" AND UNDER | STD. WEIGHT CARBON STEEL ASTM A 53, TYPE S, GRADE A | 150 LB RATING ASME B16.3, MALLEABLE IRON THREADED | SCREWED | 1" GF-ASJ R=4.2 | 1" GF-PVC R=4.2 | 2" CG-ALJ R=6.9 | |
| | | 2-1/2" AND LARGER | STD. WEIGHT CARBON STEEL ASTM A 53, TYPE E GRADE A, PLAIN ENDS | 150 LB. RATING ASME B16.9 BEVELWELD ASME B16.5 FLANGED | BUTTWELD PER ASME 16.25 OR FLANGED PER ASME 16.5 | 1" GF-ASJ R=6.5 | 1" GF-PVC R=6.5 | 2" CG-ALJ R=6.9 | |

**NOTES:**
1. INSULATION TYPE: GF - GLASS FIBER, CG - CELLULAR GLASS. SEE PIPE INSULATION SCHEDULE FOR MORE INFORMATION.
2. JACKET TYPE: ASJ - ALL SERVICE JACKET, ALJ - ALUMINUM, PVC - POLYVINYL CHLORIDE. SEE PIPE JACKET SCHEDULE FOR MORE INFORMATION.
3. PROVIDE PRODUCT LISTED OR ENGINEER PRE-APPROVED EQUAL, APPLIES TO ALL PRODUCTS LISTED IN SCHEDULE.
4. REFER TO SPECIFICATION SECTION 23 05 03 AND ALL RELATED SECTIONS FOR MORE INFORMATION REGARDING VALVES, HANGERS, SUPPORTS, VIBRATION CONTROL, INSULATION, CLEANING AND FLUSHING, PIPING SPECIALTIES, UNIONS AND FLANGES, PIPE LABELING, ETC.

## PIPE INSULATION SCHEDULE

| INSULATION SYSTEM DESIGNATION | INSULATION | | | | | REMARKS |
|---|---|---|---|---|---|---|
| | DESCRIPTION | PRODUCTS | K | SERVICE | | |
| | | | | MIN | MAX | |
| GF | GLASS FIBER ASTM C547, RIGID MOLDED NONCOMBUSTABLE | OWENS CORNING FIBERGLAS PIPE INSULATION | 0.23 | -20 | 850 | |
| CG | CELLULAR GLASS ASTM C552, TYPE II PURE GLASS | PITTSBURG CORNING FOAMGLAS SUPER K | 0.29 | -20 | 900 | |

## PIPE JACKET SCHEDULE

| JACKET SYSTEM DESIGNATION | JACKET | | REMARKS |
|---|---|---|---|
| | DESCRIPTION | MANUFACTURER | |
| ASJ | ALL SERVICE JACKET - JACKET IS TO CONSIST OF A WHITE KRAFT PAPER FACING WITH AN ALUMINUM FOIL SUBSTRATE. WATER VAPOR PERMEANCE = 0.02 PERM. MAX PER ASTM E96 AND A PUNCTURE RESISTANCE OF 50 BEACH MAX PER ASTM D781. JACKETING SHALL BE FACTORY APPLIED OR APPLIED PER MANUFACTURER RECOMMENDATIONS. ASJ IS TO MEET ALL REQUIREMENTS UNDER ASTM C 1136. | OWENS-CORNING SSL II SELF-SEALING LAP JACKETING SYSTEM | |
| ALJ | ALUMINUM JACKET - JACKET IS TO BE 0.016 INCH THICK, TYPE 3003-H-14 ALUMINUM WITH A STUCCO EMBOSSED FINISH AND FACTORY APPLIED VAPOR BARRIER. APPLY JACKETING SYSTEM PER MANUFACTURER RECOMMENDATIONS. ALUMINUM JACKETING SYSTEM SHALL MEET ALL REQUIREMENTS UNDER ASTM B209. | CHILDERS / PREMETCO | |
| PVC | POLYVINYL CHLORIDE JACKET - JACKET IS TO BE HIGH IMPACT, ULTRA-VIOLET RESISTANT, 20-MIL-THICK, WHITE PVC. JACKET SHALL BE FACTORY APPLIED OR APPLIED PER THE MANUFACTURER RECOMMENDATIONS. PVC JACKETING SYSTEM SHALL MEET ALL OF THE REQUIREMENTS UNDER ASTM E84. | JOHN MANVILLE ZESTON 300 SERIES | PVC JACKETING IS NOT TO BE USED IN PLENUMS |

**NOTES:**
1. K-FACTOR UNITS ARE BTU*IN/HR*FT$^{2}$*°F TESTED AT 75 °F
2. PROVIDE PRODUCT LISTED OR ENGINEER PRE-APPROVED EQUAL, APPLIES TO ALL PRODUCTS LISTED IN SCHEDULE.
3. INSTALL ALL PRODUCTS PER THE MANUFACTURER'S RECOMMENDATIONS.
4. ALL INSULATING MATERIALS SHALL CONFORM TO ASTM E 84, HAVING A MAXIMUM FLAME SPREAD RATING OF 25 AND A MAXIMUM SMOKE DEVELOPMENT RATING OF 50.
5. FURNISH AND INSTALL PIPE LABELS ON ALL PIPING PER ASME AND ANSI A13.1.



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MICHAEL E. BEJROWSKI 111281 LICENSED PROFESSIONAL ENGINEER 12/17/15

LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

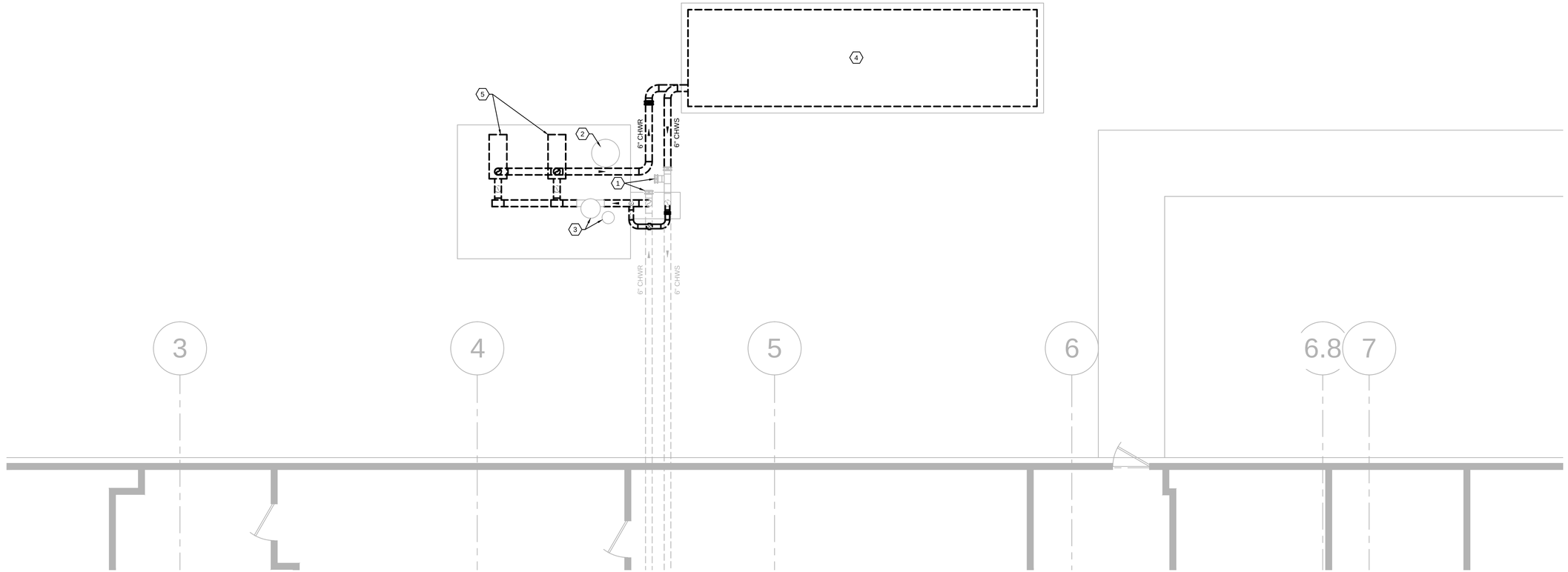
LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
MECHANICAL SCHEDULES

DATE 12/17/15
SCALE NOT TO SCALE
DWG. NO. M002

## KEYED NOTES: (X)

1. EXISTING CONNECTION POINTS FOR TEMPORARY CHILLED WATER CONNECTION. CONTRACTOR SHALL PROVIDE TEMPORARY CHILLED WATER TO SERVE THE BUILDING THROUGHOUT THE DURATION OF THE PROJECT, UNTIL INSTALLATION, START-UP AND COMMISSIONING OF THE NEW CHILLED WATER SYSTEM HAVE BEEN COMPLETED. THE TEMPORARY CHILLED WATER SYSTEM SHALL INCLUDE, BUT NOT BE LIMITED TO, CHILLED WATER GENERATION, EXPANSION TANK, AIR SEPARATOR, AND PUMPS REQUIRED TO SERVE THE BUILDING. THE CONTRACTOR SHALL PROVIDE AND COORDINATE ALL TEMPORARY PIPING AND ELECTRICAL REQUIRED.
2. EXISTING EXPANSION TANK SHALL BE RETAINED FOR INSTALLATION WITH THE NEW WORK.
3. EXISTING AIR SEPARATOR AND CHEMICAL SHOT FEEDER SHALL BE RETAINED FOR INSTALLATION WITH THE NEW WORK.
4. EXISTING CHILLER SHALL BE PROPERLY DECOMMISSIONED AND STAGED ON-SITE. COORDINATE EXACT LOCATION WITH THE OWNER. CONSULT THE MANUFACTURER REGARDING THE PROPER MEANS FOR DECOMMISSIONING AND STORAGE OF THE CHILLER. PROVIDE BUTTERFLY ISOLATION VALVES AND BLIND FLANGES FOR PROTECTION OF CHWS/R CONNECTION POINTS.
5. EXISTING PUMPS TO BE REMOVED.




1 MECHANICAL DEMOLITION PLAN
1/4" = 1'-0"



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TITLE
MECHANICAL DEMOLITION PLAN

DATE 12/17/15
SCALE 1/4" = 1'-0"
DWG. NO. M101D

STATE OF TEXAS
MICHAEL E. BEJROWSKI
111281
LICENSED
PROFESSIONAL ENGINEER
12/17/15

A B C D E F G H

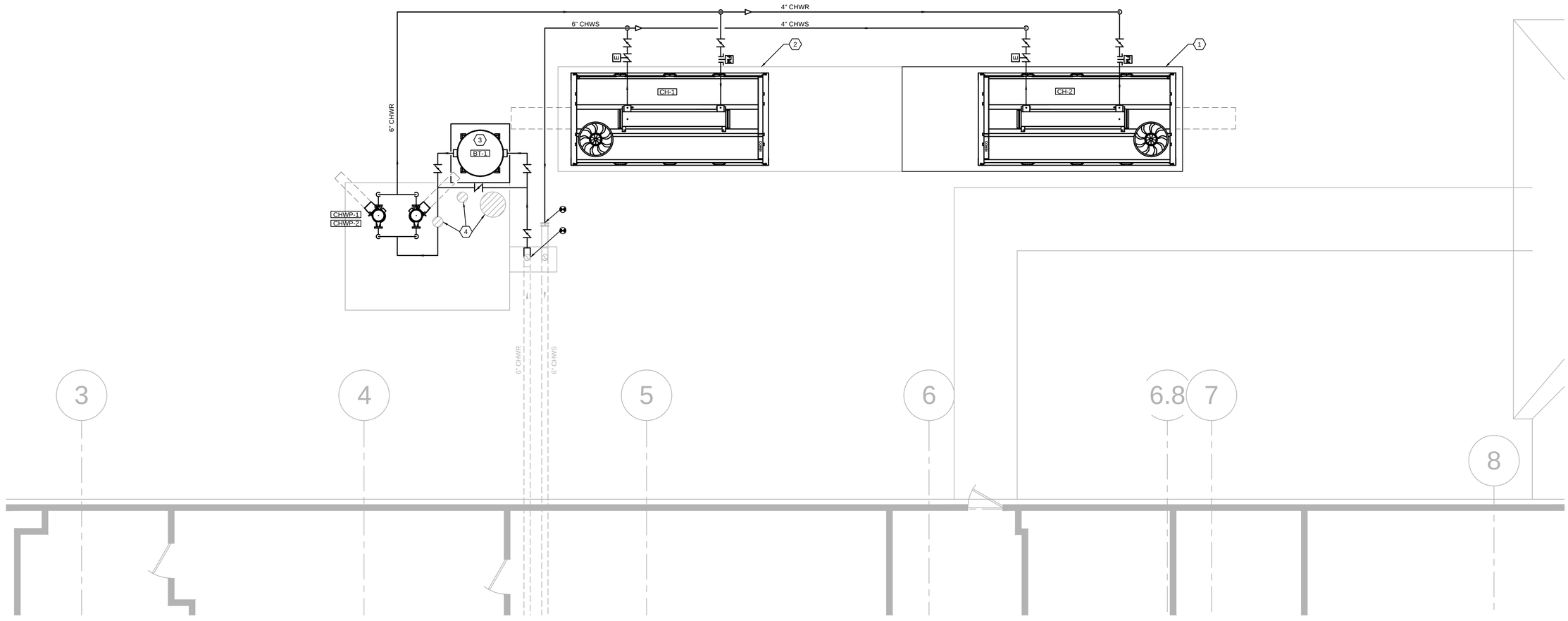
1 2 3 4 5 6 7 8

## GENERAL NOTES:

1. REFER TO DETAILS AND DIAGRAMS FOR DETAILED EQUIPMENT CONNECTION REQUIREMENTS.

## KEYED NOTES: ⟨X⟩

1. NEW CHILLER ON NEW CONCRETE PAD EXTENSION FROM EXISTING PAD. SEE 1/S501 FOR EQUIPMENT PAD REQUIREMENTS.
2. NEW CHILLER ON EXISTING CONCRETE PAD.
3. NEW BUFFER TANK ON NEW CONCRETE EQUIPMENT PAD. PROVIDE FLEXIBLE PIPE CONNECTORS AT INLET AND OUTLET. SEE 1/S501 FOR EQUIPMENT PAD REQUIREMENTS.
4. EXISTING/RE-USED EXPANSION TANK, AIR SEPARATOR, AND CHEMICAL SHOT FEEDER. PROVIDE WITH NEW INSULATION AND JACKETING AS SPECIFIED IN SECTION 23 07 00 - HVAC INSULATION.




1 MECHANICAL PLAN
1/4" = 1'-0"



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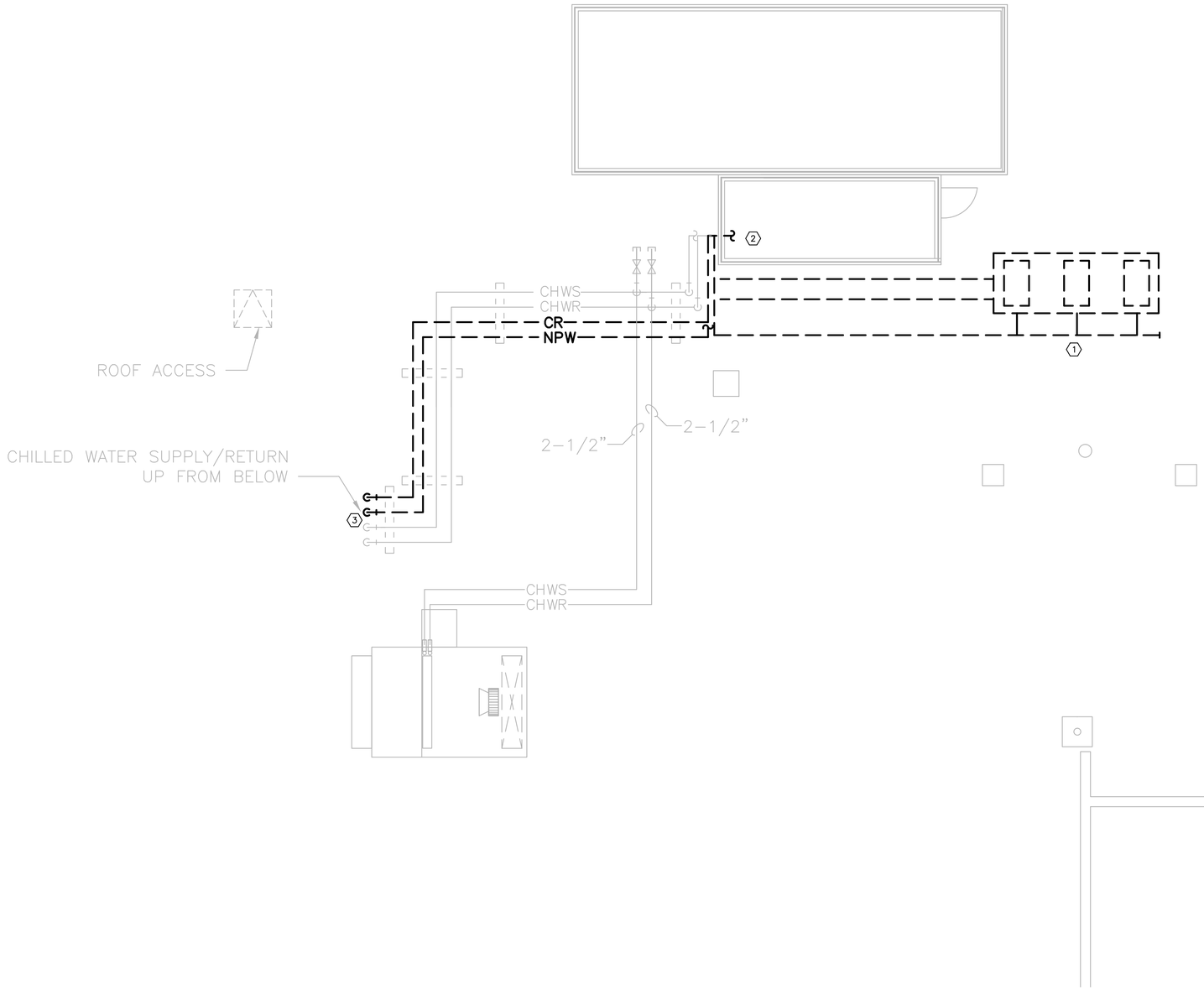
TITLE
MECHANICAL PLAN

DATE 12/17/15
SCALE 1/4" = 1'-0"
DWG. NO. M101

STATE OF TEXAS
MICHAEL E. BEJROWSKI
111281
LICENSED
PROFESSIONAL ENGINEER
12/17/15




## KEYED NOTES ⟨#⟩:

1. DEMOLISH EXISTING HUMIDIFIER UNITS, ASSOCIATED PIPING, AND HUMIDIFIERS' ENCLOSURE HOUSING. COORDINATE WITH OWNER REGARDING REPAIR OF ROOF.
2. DEMOLISH HUMIDIFIER DISPERSION ARRAY INSIDE EXISTING RTU.
3. DEMOLISH NON-POTABLE WATER AND CONDENSATE DRAIN LINE SERVING STEAM HUMIDIFIERS. CAP BELOW ROOF. PATCH ROOF. COORDINATE WITH OWNER REGARDING REPAIR OF ROOF.

1 MECHANICAL ROOF DEMOLITION PLAN
1/4" = 1'-0"



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DRAWN BY: DLC
CHKD. BY: MEB
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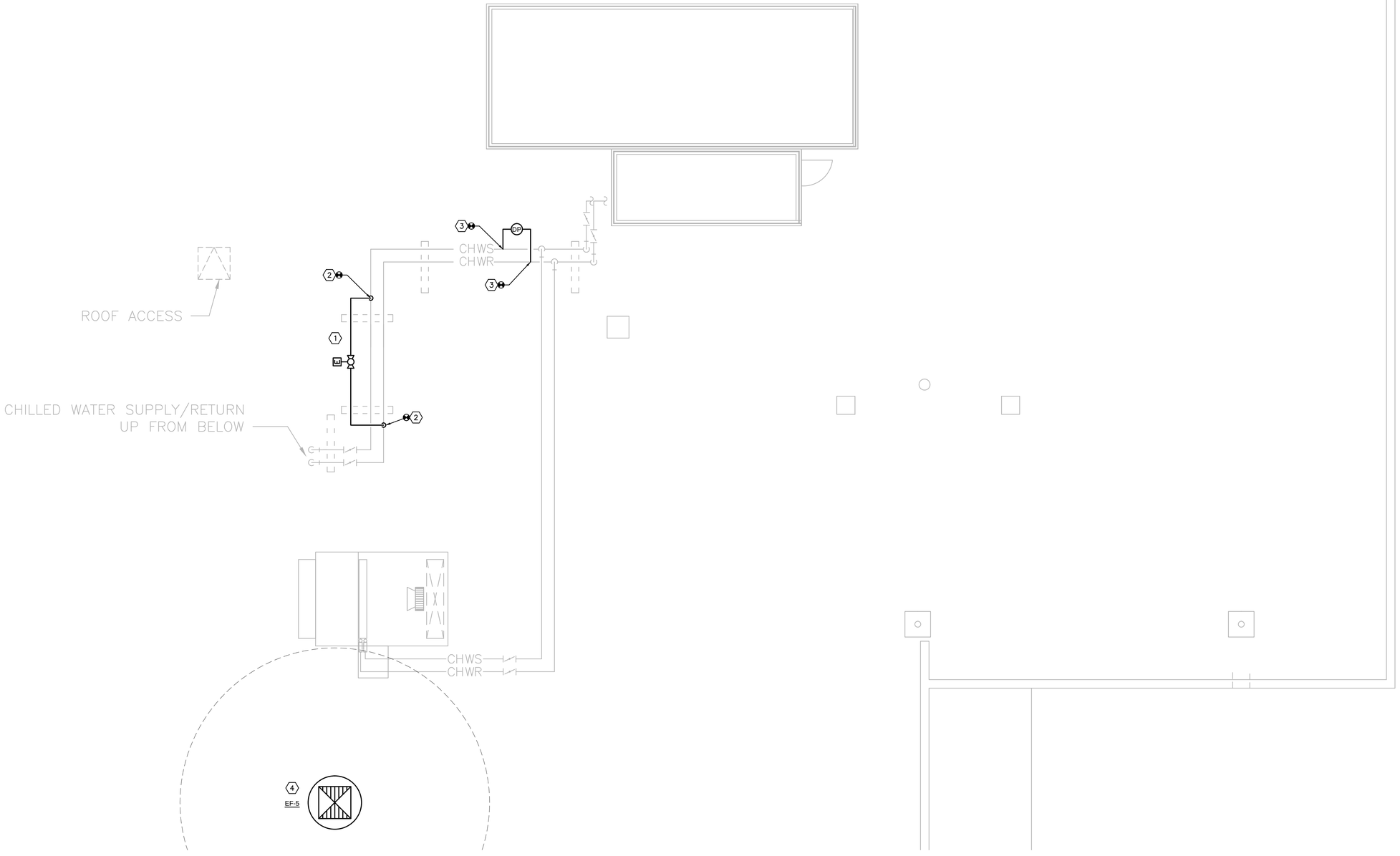
EEA Project No. 20114005B

LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
MECHANICAL ROOF DEMOLITION PLAN

DATE 12/17/15
SCALE 1/4"=1'-0"
DWG. NO. M102D




## KEYED NOTES ⟨#⟩:

1. NEW 3" CHILLED WATER BYPASS. PROVIDE NEW CHARACTERIZED BALL VALVE WITH ELECTRONIC ACTUATOR FOR CONTROL OF BYPASS FLOW RATE.
2. HOT TAP NEW 3" CHILLED WATER BYPASS TO EXISTING 6" CHWS/R.
3. RELOCATE EXISTING CHILLED WATER DIFFERENTIAL PRESSURE SENSORS.
4. NEW EXHAUST FAN (EF-5). INSTALL 10 FT. FROM RTU-1 OUTSIDE AIR INTAKE.

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



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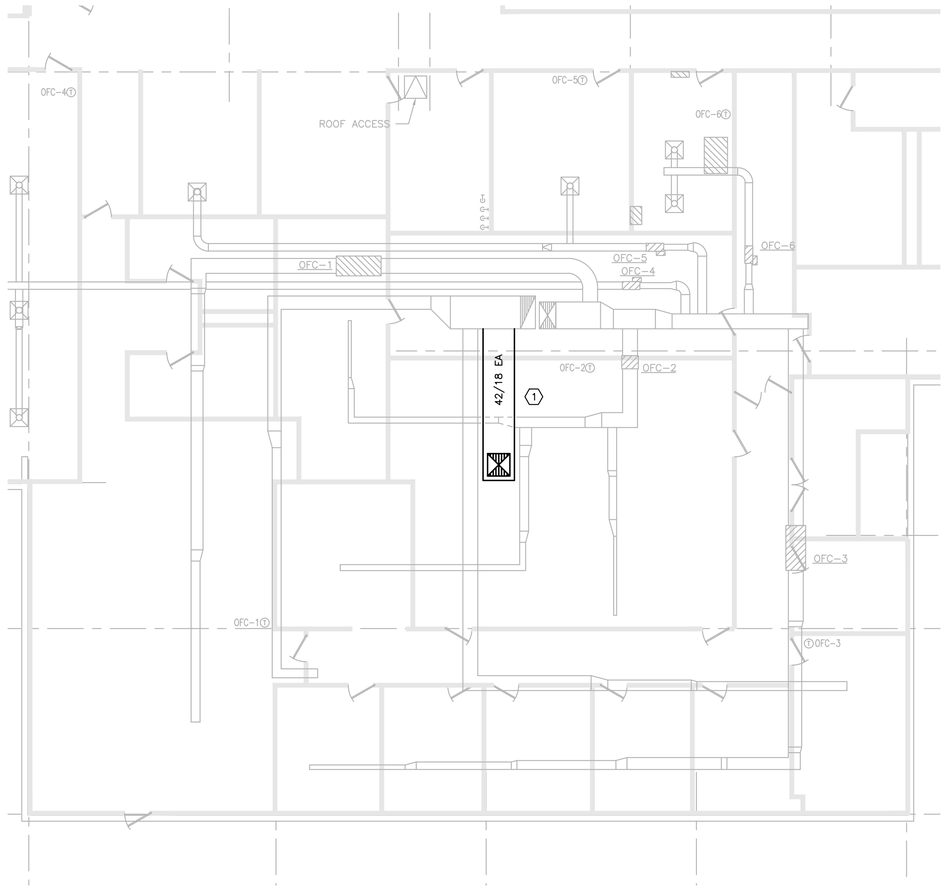
AUSTIN, TEXAS 78744

TITLE
MECHANICAL ROOF PLAN

DATE 12/17/15
SCALE 1/4"=1'-0"
DWG. NO. M102




## GENERAL NOTES:

1. TO BALANCE EF-5, TAB CONTRACTOR SHALL PLACE RTU-1 INTO ECONOMIZER MODE, SET THE SUPPLY FAN VFD TO 80% SPEED, AND BALANCE EF-5 TO MAINTAIN THE BUILDING LOBBY AT A POSITIVE PRESSURE OF 0.07" TO 0.10" W.C. RELATIVE TO THE OUTSIDE.

## KEYED NOTES ⟨#⟩:

1. CONNECT NEW 42/18 RELIEF DUCT TO EXISTING RETURN AIR DUCT. ROUTE 30/30 UP THROUGH ROOF TO NEW EXHAUST FAN EF-5.

## 1 PARTIAL MECHANICAL FLOORPLAN

1/8" = 1'-0"



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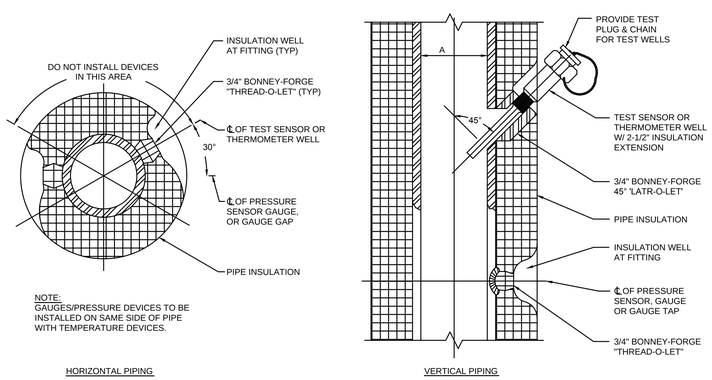
LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

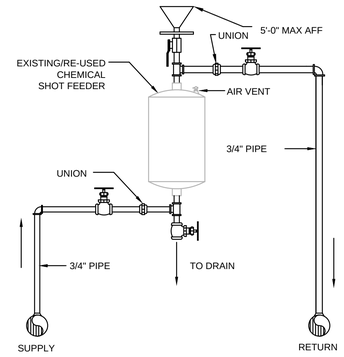
TITLE
PARTIAL MECHANICAL FLOOR PLAN

DATE 12/17/15
SCALE 1/8"=1'-0"
DWG. NO. M201

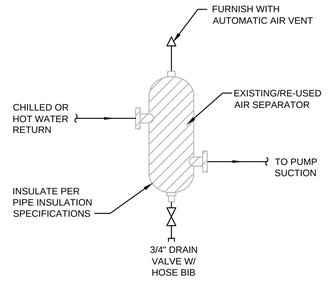



NOTE: ALL PLUGS, NIPPLES, VALVES, ETC., TO BE BRASS.

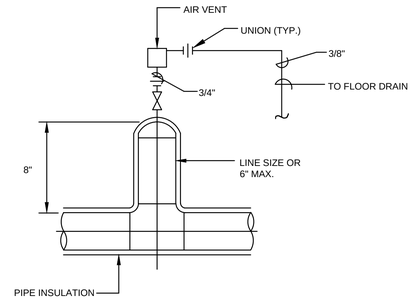
## 4 INSTRUMENT TAPS IN PIPE
NTS




## 3 CHEMICAL SHOT FEEDER DETAIL
SCALE: N.T.S.




## 2 AIR SEPARATOR DETAIL
SCALE: N.T.S.




## 1 AIR POCKET & VENT DETAIL
N.T.S.




| SIZE SECHEDULE | | | |
|---|---|---|---|
| A | B | C | D |
| 2-3" | 1" | 8" | 2" |
| 4-6" | 2" | 8" | 2" |
| 8-10" | 3" | 12" | 4" |
| 12" UP | 4" | 12" | 4" |

NOTE:
1. INSULATE BASE ELBOW SUPPORTS ON ALL LOW TEMPERATURE SERVICE.

## 8 BASE ELBOW SUPPORT DETAIL
N.T.S.




## 7 VERTICAL IN-LINE PUMP DETAIL
N.T.S.




NOTES:
1. SECURE FAN TO ROOF CURB.
2. SECURE ROOF CURB TO ROOF STRUCTURE.
3. RUN ELECTRIC LINES THRU CLEARANCE HOLE PROVIDED IN GRAVITY DAMPER, THEN THRU FAN ELECTRICAL CONDUIT GUIDE.

## 6 ROOF FAN INSTALLATION DETAIL
N.T.S.




| PIPE SIZE SCHEDULE. | | | | | |
|---|---|---|---|---|---|
| UNIT | SYSTEM | A | B | C | D |
| ET | TBD | 1/2" | 1" | 1" | 3/4" |

| UNIT | TANK CAPACITY GALLONS | FILL PRESS. PSIG. | PRESS. REG. SETTING PSIG. | RELIEF PRESS. PSIG. |
|---|---|---|---|---|
| ET | EXISTING | 12 | 12 | 45 |

## 5 MAKE-UP WATER AND EXPANSION TANK FOR HYDRONIC SYSTEMS DETAIL
SCALE: N.T.S.

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AUSTIN, TEXAS

LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
MECHANICAL DETAILS

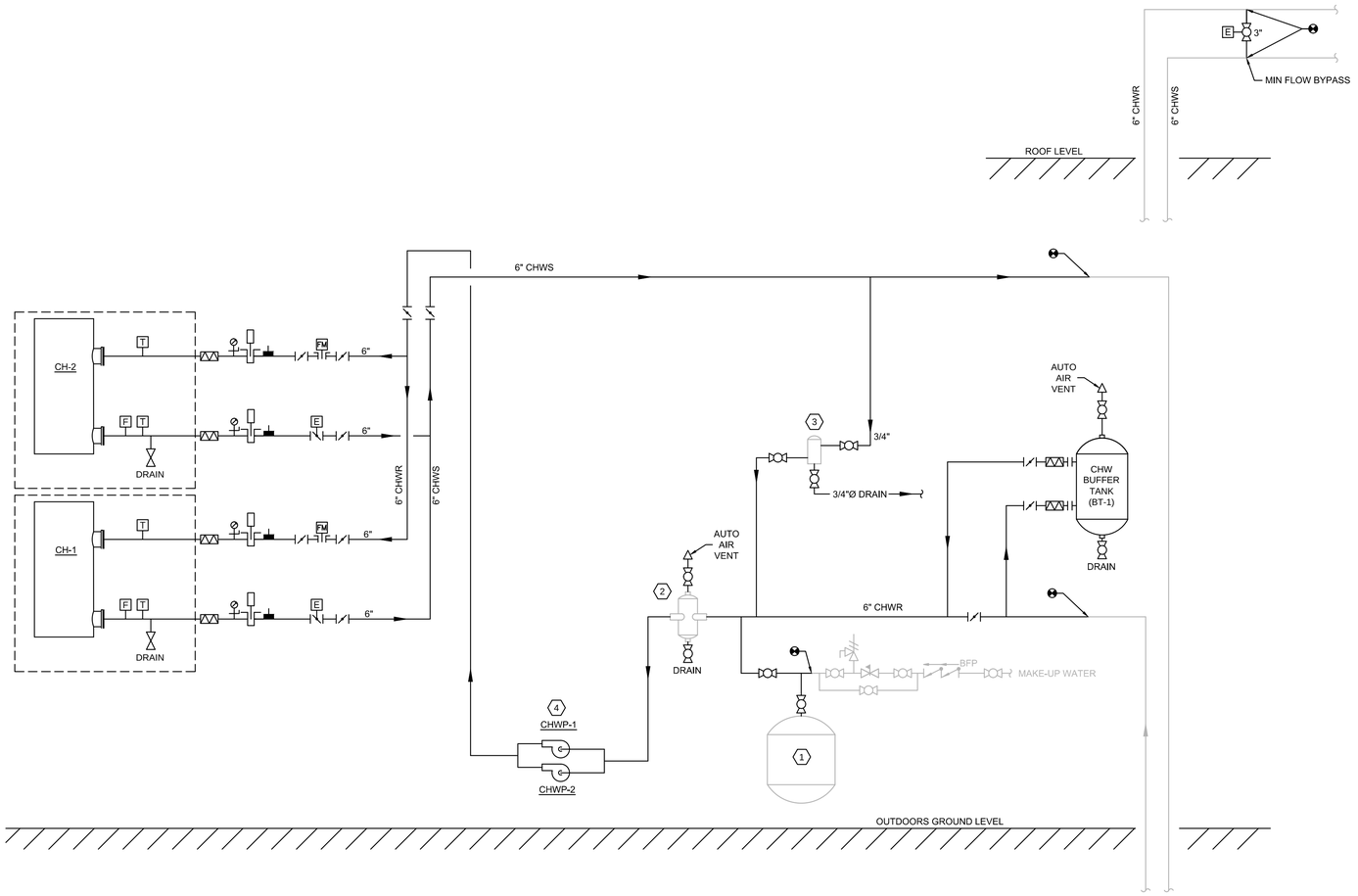
DATE 12/17/15
SCALE NOT TO SCALE
DWG. NO. M501

A B C D E F G H

1 2 3 4 5 6 7 8

## KEYED NOTES: (X)

1. EXISTING/RE-USED EXPANSION TANK.
2. EXISTING/RE-USED AIR SEPARATOR.
3. EXISTING/RE-USED CHEMICAL SHOT FEEDER.
4. SEE PUMP INSTALLATION DETAIL MORE INFORMATION.




1 CHILLED WATER PIPING DIAGRAM
N.T.S.



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AUSTIN, TEXAS 78744

TITLE
MECHANICAL PIPING DIAGRAM

DATE 12/17/15
SCALE NOT TO SCALE
DWG. NO. M601

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12/17/15

## GENERAL NOTES

1. THE SCOPE REQUIREMENT IS TO CONNECT TO THE EXISTING BUILDING AUTOMATION SYSTEM AND PROVIDE ALL DEVICES, PROGRAMMING, AND GRAPHICS TO IMPLEMENT THE SEQUENCES OUTLINED BELOW.
2. AT THE COMPLETION OF THE PROJECT THE CONTROLS CONTRACTOR SHALL PREPARE "AS-BUILT" CONTROL DRAWINGS SHOWING ALL COMPONENTS AND SEQUENCE OF OPERATION.
3. ALL CONTROLS WIRING IN MECHANICAL ROOM SHALL BE INSTALLED IN EMT CONDUIT SIZED ACCORDING TO NEC. ALL CONDUIT SHALL BE ROUTED IN A NEAT AND ORDERLY MANNER PARALLEL TO BUILDING LINES. INSTALL CONDUIT SO AS TO NOT OBSTRUCT ACCESS TO EQUIPMENT OR CREATE PERSONAL INJURY HAZARDS. CONTROLS WIRING ROUTED OUTSIDE OF MECHANICAL AREAS MAY BE ROUTED WITHOUT CONDUIT AS LONG AS PLENUM RATED CABLE IS USED.
4. CONTROL DEVICES ARE TO BE SUPPLIED BY CONTROLS CONTRACTOR AND INSTALLED INTO THE PIPING OR DUCT BY THE MECHANICAL CONTRACTOR. MECHANICAL CONTRACTOR TO PROVIDE ANY PIPE, FITTINGS AND REDUCERS AS REQUIRED TO FACILITATE INSTALLATION.
5. MECHANICAL AND ELECTRICAL CONTRACTORS ARE RESPONSIBLE FOR FULL COORDINATION WITH CONTROLS CONTRACTOR TO DETERMINE AND VERIFY THE LIMITS OF EACH DISCIPLINE'S SCOPE.
6. ELECTRICAL POWER LESS THAN 50V REQUIRED FOR CONTROLS COMPONENTS TO BE PROVIDED AND INSTALLED BY THE CONTROLS CONTRACTOR. REFER TO ELECTRICAL PLANS FOR LOCATION AND AVAILABILITY OF ELECTRICAL CIRCUITS. CONTROLS CONTRACTOR SHALL COORDINATE WITH THE ELECTRICAL CONTRACTOR FOR ANY ADDITIONAL 120V CIRCUITS NEEDED AND THIS SCOPE SHALL BE INCLUDED IN THE ELECTRICAL CONTRACTORS BID PRICE.
7. COORDINATE THE BUILDING OCCUPANCY SCHEDULE WITH THE OWNER.

## CONTROL SEQUENCES OF OPERATION

CHILLERS - GENERAL:

A. PROVIDED CHILLERS WITH FACTORY MOUNTED AND WIRED CHILLER CONTROL PANELS WITH BACnet COMMUNICATIONS FOR CONNECTION TO EXISTING BMS CONTROL SYSTEM.

B. CHILLERS SHALL HAVE DUAL CHILLER CONTROL FUNCTIONALITY FOR OPERATION OF PARALLEL CHILLERS AS A CHW SYSTEM. ALL ACCESSORIES REQUIRED FOR THIS OPTION SHALL BE PROVIDED WITH THE CHILLERS.

C. DURING START-UP, THE CHILLER CONTROL SHALL BE CONFIGURED FOR THE FOLLOWING FUNCTIONS. ALL ACCESSORIES AND PROGRAMMING REQUIRED FOR THESE FUNCTIONS SHALL BE SETUP AND VERIFIED BY CHILLER MANUFACTURER'S FIELD TECHNICIAN.

- DUAL CHILLER CONTROL
- AUTOMATIC CAPACITY CONTROL
- AUTOMATIC LEAD/LAG CIRCUIT AND COMPRESSOR ROTATION
- MINIMUM LOAD CONTROL FOR LOW LOAD TEMPERATURE CONTROL
- LEAD PULLDOWN TIME DELAY (20 MINUTES, ADJUSTABLE)
- LAG START DELAY (10 MINUTES, ADJUSTABLE)
- CHILLED WATER TEMPERATURE RESET BASED ON CHWS/R TEMPERATURE DIFFERENCE.

E. EACH CHILLER SHALL OPEN AND CLOSE ITS OWN ISOLATION VALVE. ISOLATION VALVES SHALL BE WIRED DIRECTLY TO EACH CHILLER'S PUMP OUTPUT.

F. THE BMS SHALL HAVE THE CAPABILITY TO ENABLE/DISABLE THE CHW SYSTEM. ENABLE WILL PUT THE CHILLERS INTO AUTOMATIC OPERATION. DISABLE WILL STOP THE CHILLER S.

G. THE BMS SHALL MONITOR A GENERAL FAULT SIGNAL FROM THE CHILLER CONTROL PANEL AND UPON A FAULT SIGNAL, SEND AN ALARM.

H. THE BMS SHALL MONITOR THE CHILLER CONTROL PANEL FOR STATUS. IF STATUS IS LOST AT ANY TIME DURING NORMAL OPERATION, SEND AN ALARM.

CHILLED WATER PUMPS - GENERAL:

A. THE CHILLED WATER PUMPS SHALL BE CAPABLE OF REMOTE MANUAL START/STOP OR AUTOMATIC START/STOP THROUGH THE BMS. START/STOP MAY ALSO BE OVERRIDDEN THROUGH LOCAL HAND/OFF/AUTO SWITCHES AT THE PUMP VFD.

B. PUMP STATUS

- ONE PUMP SHALL BE DESIGNATED AS "LEAD" WITH THE OTHER PUMP DESIGNATED AS "LAG".
- PUMP STATUS SHALL BE ROTATED MONTHLY (ADJUSTABLE).
- PUMP STATUS ROTATION SHALL BE SCHEDULED. SCHEDULING SHALL BE COORDINATED WITH THE OWNER.

C. PUMP SPEED CONTROL - ONCE ENABLED, PUMP SPEED SHALL BE MODULATED BY VFD TO MAINTAIN THE CHILLED WATER SYSTEM DIFFERENTIAL PRESSURE SETPOINT (INITIALLY 15 PSI, ADJUSTABLE). IF SYSTEM IS OFF BY +/- 5 PSI (ADJUSTABLE), SEND AN ALARM.

D. PUMP STAGING

- DURING NORMAL OPERATION, THE LEAD/LAG PUMPS SHALL OPERATE IN UNISON TO MAINTAIN THE CHILLED WATER DIFFERENTIAL PRESSURE SETPOINT.
- UPON PUMP SPEEDS DECREASING BELOW 20 HZ (ADJUSTABLE) FOR 5 MINUTES (ADJUSTABLE), THE LAG PUMP SHALL BE DISABLED.
- UPON THE LEAD PUMP SPEED INCREASING ABOVE 55 HZ (ADJUSTABLE) FOR 5 MINUTES (ADJUSTABLE), THE LAG PUMP SHALL BE ENABLED.

E. THE BMS SHALL MONITOR THE CHW PUMP VFD AUXILLIARY CONTACTS FOR PUMP STATUS. IF STATUS IS NOT ESTABLISHED WITHIN ONE MINUTE AFTER STARTING THE UNIT, OR IF STATUS IS LOST AT ANY TIME DURING NORMAL OPERATION, THE BMS SHALL SEND AN ALARM.

F. IF A CHILLED WATER PUMP FAILS, THE BMS SHALL AUTOMATICALLY START THE BACK-UP CHILLED WATER PUMP.

G. THE BMS SHALL MONITOR AND PROVIDE REMOTE INDICATION OF THE CHILLED WATER PUMP SPEED THROUGH AN ANALOG INPUT TIED TO THE VARIABLE SPEED DRIVE. THIS REMOTE INDICATION SHALL OPERATE IN EITHER THE AUTOMATIC DIFFERENTIAL PRESSURE SPEED CONTROL MODE OR THE MANUAL SPEED CONTROL MODE. THE BMS SHALL MONITOR A GENERAL FAULT SIGNAL FROM THE PUMP VFD AND UPON A FAULT SIGNAL.

CHILLED WATER SYSTEM OPERATION:

A. THE CHW SYSTEM SHALL BE ENABLED/DISABLED BY THE BMS.

B. THE LEAD CHILLER ISOLATION VALVE SHALL REMAIN OPEN AT ALL TIMES.

C. UPON BEING ENABLED, THE CHW SYSTEM SHALL OPERATE AS FOLLOWS.

1. UPON COMMAND TO ENABLE THE CHILLED WATER SYSTEM, THE CHILLED WATER PUMPS SHALL BE ENABLED BY THE BMS.
2. UPON PROOF OF FLOW (BY CHILLER INTEGRAL FLOW SWITCH), THE LEAD CHILLER SHALL OPERATE TO MAINTAIN THE COMMON CHILLED WATER SUPPLY TEMPERATURE SETPOINT. IF PROOF OF FLOW IS NOT MADE WITHIN 3 MINUTES (ADJUSTABLE), SEND AN ALARM.
3. AFTER 20 MINUTES (ADJUSTABLE) THE LAG CHILLER SHALL BE STARTED IF THE COMMON CHILLED WATER SUPPLY TEMPERATURE IS MORE THAN 3°F ABOVE SETPOINT.
4. UPON COMMAND TO START THE LAG CHILLER, THE LAG CHILLER SHALL COMMAND ITS ASSOCIATED ISOLATION VALVE OPEN.
5. UPON PROOF OF FLOW (BY CHILLER INTEGRAL FLOW SWITCH), THE LAG CHILLER SHALL BE STARTED AND BOTH CHILLERS SHALL OPERATE TO MAINTAIN THE COMMON CHILLED WATER SUPPLY TEMPERATURE SETPOINT. IF PROOF OF FLOW IS NOT MADE WITHIN 3 MINUTES (ADJUSTABLE), SEND AN ALARM.

C. DURING NORMAL OPERATION, WITH BOTH THE LEAD AND LAG CHILLERS OPERATING, THE LAG CHILLER SHALL BE ENABLED/DISABLED AS FOLLOWS.

1. UPON COMMAND TO DISABLE THE LAG CHILLER, THE LAG CHILLER SHALL SHUT DOWN.
2. ONCE SHUT DOWN, THE LAG CHILLER SHALL COMMAND ITS ASSOCIATED ISOLATION VALVE CLOSED.
3. UPON EXPIRATION OF THE LAG START DELAY AND UPON COMMAND TO ENABLE THE LAG CHILLER, THE LAG CHILLER SHALL OPEN ITS ASSOCIATED ISOLATION VALVE.
4. UPON PROOF OF FLOW (BY CHILLER INTEGRAL FLOW SWITCH), THE CHILLERS SHALL OPERATE TO MAINTAIN THE COMMON CHILLED WATER SUPPLY TEMPERATURE SETPOINT. IF PROOF OF FLOW IS NOT MADE WITHIN 3 MINUTES (ADJUSTABLE), SEND AN ALARM.

D. DURING NORMAL OPERATION, WITH BOTH THE LEAD AND LAG CHILLERS OPERATING, THE CHILLED WATER SYSTEM SHALL BE DISABLED AS FOLLOWS.

1. UPON COMMAND TO DISABLE THE CHILLED WATER SYSTEM, THE LAG CHILLER SHALL SHUT DOWN.
2. ONCE THE LAG CHILLER HAS SHUT DOWN, THE LAG CHILLER SHALL COMMAND ITS ASSOCIATED ISOLATION VALVE CLOSED.
3. UPON COMPLETION OF THE LAG CHILLER SHUT DOWN, THE LEAD CHILLER SHALL SHUT DOWN.
4. ONCE THE LEAD CHILLER HAS BEEN SHUT DOWN, THE CHILLED WATER PUMPS SHALL BE DISABLED BY THE BMS.

CHILLED WATER SUPPLY TEMPERATURE RESET :

A. THE CHILLED WATER SUPPLY TEMPERATURE SHALL BE RESET BASED ON THE DIFFERENCE BETWEEN THE COMMON CHILLED WATER SUPPLY TEMPERATURE AND THE CHILLED WATER RETURN TEMPERATURE.

B. THE CHILLERS' INTEGRAL CONTROL SYSTEMS SHALL HANDLE CHILLED WATER SUPPLY TEMPERATURE RESET.

C. THE MAXIMUM RESET OF 12°F (ADJUSTABLE) SHALL OCCUR WHEN THE TEMPERATURE DIFFERENCE IS 2°F (ADJUSTABLE) OR LESS.

D. NO RESET SHOULD BE APPLIED WHEN THE TEMPERATURE DIFFERENCE IS AT DESIGN (14°F OR MORE).

BYPASS VALVE OPERATION:

A. THE BYPASS VALVE SHALL BE LOCATED AS INDICATED IN THE PLANS.

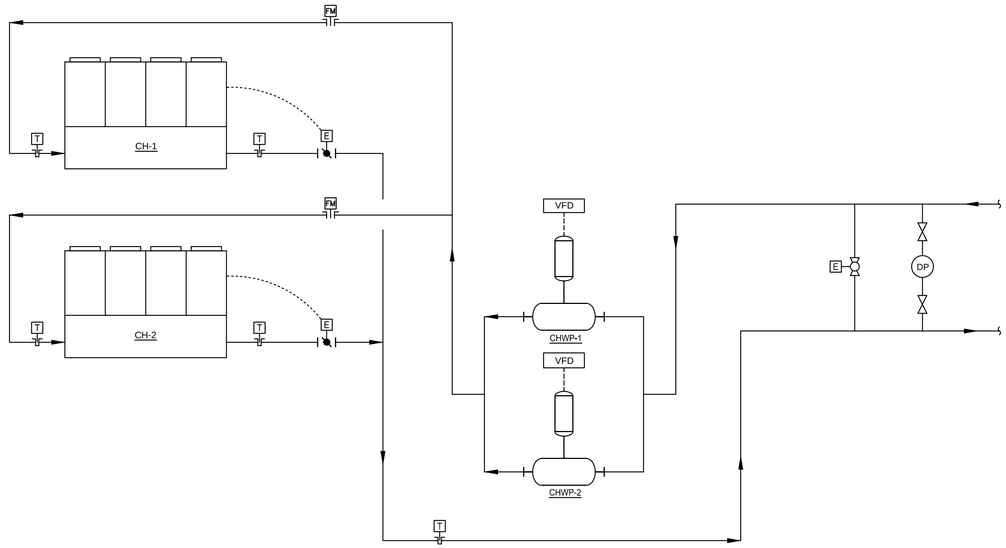
B. WITH THE LEAD CHILLER ENABLED/STARTED, THE BYPASS VALVE POSITION SHALL BE MODULATED TO MAINTAIN A MINIMUM CHILLED WATER SYSTEM FLOW RATE SETPOINT OF 160 GPM (ADJUSTABLE).

C. WITH THE LAG CHILLER ENABLED/STARTED, THE BYPASS VALVE POSITION SHALL BE MODULATED TO MAINTAIN A MINIMUM CHILLED WATER SYSTEM FLOW RATE SETPOINT OF 320 GPM (ADJUSTABLE).

RTU-1 RELIEF SEQUENCE:

A. WHEN RTU-1 IS IN ECONOMIZER MODE, EF-5 SHALL BE ENERGIZED.

B. IF FAN STATUS IS LOST DURING OPERATION, AN ALARM SHALL BE SENT AND RTU-1 SHALL BE TAKEN OUT OF ECONOMIZER MODE.




1 **CHW SYSTEM CONTROL DIAGRAM**
N.T.S.

**CONTROL POINTS**

| POINT DESCRIPTION | INPUTS ANALOG | INPUTS DIGITAL | OUTPUTS ANALOG | OUTPUTS DIGITAL | TOTAL | NOTES |
|---|---|---|---|---|---|---|
| **CHW SYSTEM** | | | | | | |
| CHW SYSTEM ENABLE/DISABLE | | | | 1 | 1 | FROM BMS TO CHILLER BACnet CONTROLLER |
| COMMON CHW SUPPLY TEMPERATURE | 1 | | | | 1 | PROVIDE ALARM FOR T > +/- 5°F. SEE NOTE 1 |
| COMMON CHW SUPPLY TEMPERATURE SETPOINT | | | | 1 | 1 | FROM BMS TO CHILLER BACnet CONTROLLER |
| CH-1 & 2 STATUS | | 2 | | | 2 | FROM BACnet, PROVIDE ALARM |
| CH-1 & 2 ALARM | | 2 | | | 2 | FROM BACnet, PROVIDE ALARM |
| CH-1 & 2 ENTERING WATER TEMPERATURE | 2 | | | | 2 | FROM BACnet |
| CH-1 & 2 LEAVING WATER TEMPERATURE | 2 | | | | 2 | FROM BACnet |
| CH-1 & 2 PERCENT CAPACITY | 2 | | | | 2 | FROM BACnet |
| CH-1 & 2 ISOLATION VALVE STATUS | | 2 | | | 2 | PROVIDE ALARM. SEE NOTE 2. |
| CHWP-1 & 2 START/STOP | | | | 2 | 2 | |
| CHWP-1 & 2 VFD COMMAND | | | 2 | | 2 | |
| CHWP-1 & 2 VFD FEEDBACK | 2 | | | | 2 | |
| CHWP-1 & 2 STATUS (VFD AUX CONTACTS) | | 2 | | | 2 | PROVIDE ALARM |
| CHW BYPASS CONTROL VALVE COMMAND | | | 1 | | 1 | |
| CHW BYPASS CONTROL VALVE STATUS | 1 | | | | 1 | PROVIDE ALARM |
| CHW SYSTEM DIFFERENTIAL PRESSURE | 1 | | | | 1 | PROVIDE ALARM |
| **EXHAUST FAN** | | | | | | |
| EF-5 ENABLE/DISABLE | | | | 1 | 1 | |
| EF-5 STATUS | | 1 | | | 1 | PROVIDE ALARM |
| | | | | | | |
| **OVERALL POINTS** | 11 | 9 | 3 | 5 | 28 | |

**NOTES:**
1. SENSOR PROVIDED BY CHILLER MANUFACTURER AND INSTALLED BY CONTRACTOR.
2. ISOLATION VALVE COMMAND FROM CHILLER PUMP OUTPUT RELAY.



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12/17/15

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LOWER COLORADO RIVER AUTHORITY
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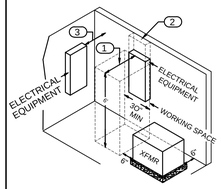
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
MECHANICAL CONTROLS

DATE 12/17/15
SCALE NOT TO SCALE
DWG. NO. M602

## NAMEPLATE REQUIREMENTS




KEYED NOTES:

1. 3' (0-150V TO GND), 3.5' (151V-600V TO GND), 4' (OVER 150V WITH EXPOSED LIVE PARTS ON OTHER SIDE).
2. DEDICATED EQUIPMENT SPACE SHALL BE KEPT CLEAR TO 6FT ABOVE EQUIPMENT OR TO STRUCTURE OF ALL BUT CONDUIT SERVING EQUIPMENT.
3. MIN OFF SET SHALL BE DEPTH OF EQUIPMENT ON PERPENDICULAR WALL

## NAMEPLATE REQUIREMENTS

ELECTRICAL PANELS

PANEL L1
208/120V, 3PH, 4W
225A, FED FROM H1
VIA XFMR T-L1

EQUIPMENT CONTROLS

CWP-VFD
208/120V, 3PH, 4W
5HP, FED FROM L1

RECEPTACLES

PNL - CKT #

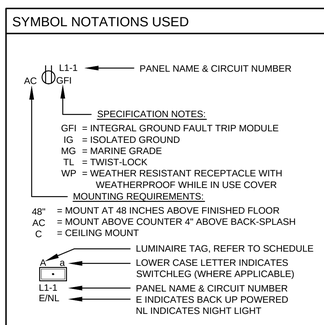
J-BOXES

| PWR | IT | FIRE |
|---|---|---|
| L1-1 120V | COM | FA NAC |
| NO PAINT | ORANGE COVER | RED COVER |

SPECIFICATIONS

1. NAMEPLATE: 1/16" PHENOLIC PLASTIC LAMINATE, TWO FLAT HEAD SCREWS
2. FINISHED AREA WIRING DEVICES: ADHESIVE LABELS, WHITE W/ BLACK TEXT
3. J-BOXES: USE PERMANENT INK MARKER AND PAINT AS NOTED
4. OUTDOOR AND HARSH ENVIRO WIRING DEVICES: MARKER ON INSIDE OF COVER
5. IN PUBLIC AREAS SUCH AS LOBBIES, CONF. ROOMS, ETC, LABEL INSIDE OF RECEPTACLE COVERS AND EXPOSED JBOX COVERS USING MARKER. PLACE A DOT OF PAINT ON OUTSIDE OF SPECIAL SYSTEMS BOXES

## SYMBOL NOTATIONS USED




## EQUIPMENT CONTROLLERS

DISCONNECTS AND OCPD

- CB — ENCLOSED CIRCUIT BREAKER
- DISCONNECT SWITCH
- $S_H$ — MOTOR RATED TOGGLE SWITCH
- $S_M$ — MANUAL MTR STARTER W/ OVERLOADS

SPECIFICATIONS

1. HEAVY DUTY
2. ALL ENCLOSED CBs, SWITCHES, AND DISCONNECTS SHALL HAVE INTEGRAL LOCK OUT DEVICES.
3. ENCLOSED CIRCUIT BREAKERS: OVERLOAD AND INSTANTANEOUS TRIP COMPONENTS, LOCK OUT PROVISIONS, AND INTEGRAL SHUNT TRIP MODULES
4. DISCONNECTS: QUICK-MAKE/BREAK LOAD INTERRUPTER KNIFE SWITCH, HINGED METAL ENCLOSURE, EXTERNAL OPERABLE HANDLE, LOCKABLE ON OR OFF.

MOTOR AND EQUIP CONTROLS

- MAGNETIC STARTER - FVNR U.N.O.
- COMBINATION STARTER & DISCONNECT
- VFD — VARIABLE FREQUENCY DRIVE
- EPO — EMERGENCY POWER OFF PUSHBUTTON
- HOA — "HAND-OFF-AUTO" CONTROL SELECTOR

SPECIFICATIONS

1. STARTERS: N.O. & N.C. AUXILLARY CONTACTS, FUSED CPT, ADJUSTABLE OVERLOAD, SIZED PER MOTOR HP, REMOTE START INPUT, HOA SWITCH
2. PROVIDE INTEGRAL DISCONNECT FOR STARTERS, VFDs, ETC, LOCKABLE ON OR OFF.
3. EMERGENCY POWER OFF PUSHBUTTON SHALL BE A RED MUSHROOM HEAD, LATCHING CONTACT, ENGRAVED.

## RECEPTACLES

RECEPTACLES

- DUPLEX RECEPTACLE
- SPECIAL PURPOSE RECEPTACLE

SPECIFICATIONS

1. 20A, 120V RATED
2. SCREW TYPE TERMINALS, W/ GND TERM.
3. NYLON COVER PLATE, WHITE UNO
4. STAINLESS COVER PLATE FOR DAMP/WET LOCATIONS
5. FINISHED AREAS: COMMERCIAL GRADE
6. LABS, HALLS, MECHANICAL ROOMS, ETC: HEAVY DUTY
7. DAMP LOCATIONS: GFCI TYPE
8. WET LOCATIONS: GFCI TYPE, WEATHERPROOF COVER.

## ELECTRICAL EQUIPMENT

MINIMUM REQUIREMENTS: SCH 40 PVC, XHHW

DISTRIBUTION EQUIPMENT

- ELECTRICAL BRANCH PANEL
- T — TRANSFORMER
- J — JUNCTION BOX

1. PANELS: COPPER PH, N, G BUSSING, HINGED DOOR, REMOVABLE FRONT COVE

## SITE ELECTRICAL

SITE WIRING

- CIRCUIT WIRING
- UNDERGROUND CIRCUIT WIRING
- UE — UNDERGROUND ELECTRICAL SERVICE
- OE — OVERHEAD ELECTRICAL SERVICE
- STUB UP / TURN DOWN

SPECIFICATIONS

1. ELECTRICAL BURIAL DEPTH: 24"
2. COMMUNICATIONS BURIAL DEPTH: 18"
3. PROVIDE 12" SEPARATION FROM UTILITIES.
4. ALL SITE UNDERGROUND RACEWAYS SHALL BE BEDDED IN SAND OR SELECT FILL, LARGE ROCKS SHALL BE REMOVED FROM BACKFILL.

EXTERIOR IN GRADE EQUIPMENT

- PB — IN GRADE 600V PULL BOX

SPECIFICATIONS

1. PULL BOX FOR 600V BRANCH CIRCUITS AND COMMUNICATIONS SHALL BE 24"L x 12"W x 18"D, POLYMER CONCRETE, UNO

EXTERIOR ABOVE GRADE EQUIPMENT

- EQUIPMENT MOUNTING RACK

SPECIFICATIONS

1. ENCLOSURES SHALL BE OUTDOOR RATED
2. EQUIPMENT MOUNTING RACKS SHALL BE GALVANIZED STEEL TUBE AND GALVANIZED SLOTTED U-CHANNEL.

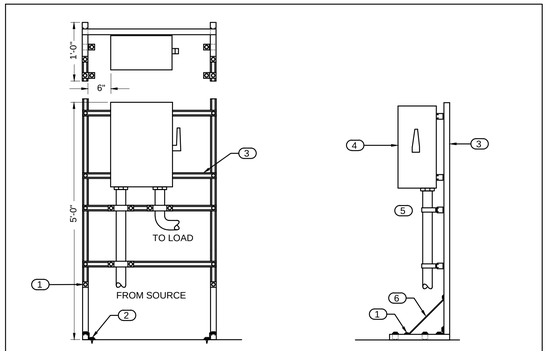
## ELECTRICAL ONE LINE

SITE WIRING

- MOLDED/INSULATED CASE BREAKER
- THERMAL OVERLOAD
- FUSED DISCONNECT SWITCH
- (X) — MOTOR, "X" INDICATING HORSE POWER

SPECIFICATIONS

1. CIRCUIT BREAKERS SHALL BE BOLT ON TYPE, WITH OVERLOAD AND INSTANTANEOUS TRIP COMPONENTS.
2. DISTRIBUTION BREAKERS SHALL HAVE DIGITAL TRIP UNITS WITH ADJUSTABLE LSIG TRIP SETTINGS.
3. CONTROL POWER TRANSFORMERS SHALL BE ENCLOSED/ENCAPSUALTED, MIN .5% ACCURACY




KEYED NOTES:

1. HEX NUT AND SCREW WITH SPRING CLAMP (TYP. ALL CONNECTIONS).
2. SECURE TO CONCRETE FLOOR WITH 1/2"Ø LAG BOLT AND LEAD ANCHOR (TYP. OF 4).
3. WEATHER RESISTANT METAL SLOTTED U-CHANNEL TYP.
4. ELECTRICAL EQUIPMENT: PROVIDE WITH PLASTIC ENGRAVED LABEL INDICATING CIRCUIT NUMBER, PANEL AND LOAD SERVED.
5. CONDUIT SUPPORT WITHIN 3' OF EQUIPMENT. PROVIDE A MINIMUM OF TWO (2).
6. ANGLED BRACING, (TYP. OF 2). TOP OF BRACE TO BE ⅓ THE HEIGHT OF THE RACK.

**1** — **EQUIPMENT RACK**

NTS

## LIGHTNING PROTECTION NOTES

THIS LIGHTING PROTECTION PLAN IS CONCEPTUAL AND SHOULD NOT BE USED FOR CONSTRUCTION. A CONTRACTOR SPECIALIZING IN THE DESIGN OF LIGHTNING PROTECTION (LP) SYSTEMS SHALL PROVIDE SHOP DRAWINGS SHOWING THE LOCATIONS AND INTERCONNECTIONS OF ALL AIR TERMINALS, THE LP CONDUCTOR, FASTENING LOCATIONS AND SPACING, INSTALLATION DETAILS FOR AIR TERMINALS CONNECTED TO THE ROOF STRUCTURE, TO ROOF MOUNTED EQUIPMENT THAT EXTENDS ABOVE THE ROOF STRUCTURE, AND ALL APPLICABLE CABLE CONNECTION DETAILS.

QUALIFICATIONS AND QUALITY ASSURANCE

1. UL COMPLIANT ROOF MOUNTED LIGHTNING PROTECTION (LP) SYSTEM EQUIPMENT AND DOWN CONDUCTORS SHALL BE PROVIDED BY QUALIFIED AND CERTIFIED LIGHTNING PROTECTION CONTRACTOR.
2. ALL COMPONENTS, MATERIALS DEVICES, AND ACCESSORIES SHALL BE UL 96 LISTED AND LABELED
3. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH NFPA 780 AND UL 96A
4. ROOF STRUCTURE IS LESS THAN 75 FT IN HEIGHT (CLASS 1). LIGHTNING PROTECTION CONTRACTOR SHALL MAINTAIN THE CURRENT LEVEL OF PROTECTION AS REQUIRED PER UL 96-96A/NFPA 780.
5. FURNISH NEW MASTER LABEL

COORDINATION

1. COORDINATE WORK WITH ROOFING AND EXTERIOR AND INTERIOR FINISH INSTALLATIONS.
2. BELOW GRADE GROUNDING COMPONENTS SHALLE BE INSTALLED BY ELECTRICAL CONTRACTOR. UL COMPLIANT ROOF MOUNTED LIGHTNING PROTECTION SYSTEM EQUIPMENT AND DOWN CONDUCTORS SHALL BE PROVIDED BY LIGHTNING PROTECTION(LP) CONTRACTOR. LP CONTRACTOR SHALL BE RESPONSIBLE FOR CONNECTING DOWN CONDUCTORS TO GROUNDING ELECTRODE SYSTEM.
3. COORDINATE DOWN CONDUCTOR, CONDUIT, AND SLEEVE INSTALLATION WITH BUILDING CONSTRUCTION SO THAT NO COMPONENTS OF THE DOWN CONDUCTORS ARE EXPOSED IN THE BUILDING INTERIOR OR EXTERIOR.

PRODUCTS

1. AIR TERMINALS AND LP CONDUCTORS SHALL BE COPPER UNLESS OWNER APPROVES THE USE OF ALUMINUM OR WHERE ATTACHING TO AN EXISTING ALUMINUM LP SYSTEM.
2. LP CONDUCTORS SHALL BE STRANDED, CLASS 1 EXCEPT THAT CLASS II SHALL BE USED FOR STRUCTURES ABOVE 75FT.
3. AIR TERMINALS: TAPERED, SOLID METAL, 10" LENGTH MIN, 3/8" DIA. FOR CLASS I, 1/2" FOR CLASS II
4. AIR TERMINAL BASE: USE UNIVERSAL, HORIZONTAL, VERTICAL, PARAPET, PIPE RAILING, RIDGE SADDLE, OR SWIVEL BASE AS REQUIRED, WITH METAL CABLE CLAMP WITH SECURING BOLT.
5. USE CONCEALED BASES WHERE LP CONDUCTOR IS NOTED TO BE ROUTED BELOW ROOF.
6. PROVIDE APPROPRIATE THROUGH ROOF CONNECTOR ASSEMBLY, COORDINATE WITH ROOFING CONTRACTOR.

INSTALLATION

1. LP CONTRACTOR SHOULD PROVIDE DISCHARGE UNITS OR LIGHTNING ARRESTORS FOR EACH SPECIAL SYSTEMS NETWORK OR COMPONENT (FIRE ALARM, TELEPHONE, ROOF MOUNTED ANTENNAS, ETC) CONNECTED TO THE LIGHTNING PROTECTION SYSTEM VIA THE LP CABLES (ROOF MOUNTED EQUIPMENT). LP CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH OTHER SPECIAL SYSTEMS CONTRACTOR TO INSURE THAT SPECIALIST CONTRACTORS PROVIDE ALL NECESSARY ARRESTORS FOR THEIR SPECIAL SYSTEMS NETWORKS THAT WILL BE CONNECTED TO THE LP SYSTEM VIA GROUDNING TO THE COUNTERPOISE. REFER TO ONE LINE DIAGRAM FOR SURGE AND LIGHTING ARRESTOR EQUIPMENT REQUIRED TO BE PROVIDED BY THE ELECTRICAL CONTRACTOR FOR THE POWER DISTRIBUTION SYSTEM.
2. LP CONTRACTOR TO DETERMINE LOCATIONS FOR ROOF AIR TERMINALS. FIELD VERIFY ALL METAL BODIES SUCH AS ANTENNAS, LADDERS, HATCHES, FLAG POLES, GAS PIPING, SANITARY VENTS, SUPPLY AND EXHAUST STACKS, HVAC EQUIPMENT, ETC AND BOND TO THE LP SYSTEM USING AIR TERMINALS AND/OR THE APPROPRIATE LUG, CLAMP, OR CAD WELD CONNECTION UNLESS SUCH ITEMS ARE LOCATED UNDER A ZONE OF PROTECTION' AS DEFINED BY NFPA 780.
3. ALL METAL BODIES WITHIN 6 FT OF A PRIMARY LP CABLE SHALL BE BONDED TO THE LP SYSTEM.
4. AT A MINIMUM, AIR TERMINALS SHALL BE LOCATED AT EDGES AND OUTSIDE CORNERS OF FLAT OR LOW SLOPE PORTIONS OF THE ROOF AND WITHIN 2 FT OF RIDGE ENDS, SPACE AT 20 FT O.C. MIN AROUND PERIMETER OF FLAT OR LOW SLOPE PORTIONS OF THE ROOF AND ALONG RIDGES.
5. AIR TERMINALS SHALL EXTEND 10 IN MIN ABOVE THE OBJECT BEING PROTECTED.
6. ALL LP CONDUCTORS SHALL BE FASTENED TO THE STRUCTURE AT 3 FT O.C. MAXIMUM INTERVALS AND INSTALLED COMPLETELY HORIZONTAL OR VERTICAL.
7. ALL LP CONDUCTORS BENDS SHALL HAVE A RADIUS OF GREATER THAN 8 IN AND LESS THAN 90°.
8. UNO, THE GROUNDING ELECTRODE SHALL BE A COUNTERPOISE INSTALLED AROUND THE PERIMETER OF THE BUILDING.
9. BOND THE GROUNDING ELECTRODE TO THE ELECTRICAL SYSTEM AND ALL LP DOWN CONDUCTORS. REFER TO GROUNDING SPECIFICATIONS, DETAILS, AND NOTES FOR ADDITIONAL GROUNDING SYSTEM REQUIREMENTS.
10. PROVIDE TEST WELL AT EACH CONNECTION BETWEEN THE GROUNDING ELECTRODE AND LP DOWN CONDUCTORS.
11. BOND ALL UG METAL PIPING ENTERING THE BUILDING TO THE GROUNDING ELECTRODE.



| Rev. | Date | Revision | By | Chkd. | Appd. | Appd. |
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EEA Project No. 20114005B

LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
ELECTRICAL LEGEND

DATE 12/17/15
SCALE NOT TO SCALE
DWG. NO. E001

STATE OF TEXAS
JARED C. WINN
116423
LICENSED
PROFESSIONAL ENGINEER
12/17/15

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A B C D E F G H

## GENERAL ELECTRICAL REQUIREMENTS

CODE REQUIREMENTS

1. THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE REQUIREMENTS OF LAWS, RULES, REGULATIONS, CODES STANDARDS, AND ORDINANCES OF FEDERAL, STATE, AND LOCAL AUTHORITIES HAVING JURISDICTION, AND ALL EQUIPMENT AND MATERIALS SHALL COMPLY WITH SAID AUTHORITIES WHETHER INDICATED ON THE CONTRACT DOCUMENTS OR NOT.
2. ALL WORK SHALL BE PERFORMED PER:
   - 2.1. 2014 NATIONAL ELECTRICAL CODE - NEC
   - 2.2. NATIONAL FIRE PROTECTION ASSOCIATION - NFPA
3. THE PUBLICATIONS AND STANDARDS OF THE FOLLOWING AUTHORITIES, IN ADDITION TO THOSE SPECIFIED IN RELATED SUPPLEMENTARY CONDITIONS, SHALL BE OBSERVED DURING CONSTRUCTION AND ARE REFERENCED IN THE DOCUMENTATION BY THE ABBREVIATIONS NOTED:
   - 3.1. UNITED STATES OF AMERICA STANDARDS INSTITUTE - USASI
   - 3.2. INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS - IEEE
   - 3.3. NATIONAL ELECTRICAL CODE - NEC
   - 3.4. NATIONAL FIRE PROTECTION ASSOCIATION - NFPA
   - 3.5. UNDERWRITER'S LABORATORY - UL
   - 3.6. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION - NEMA
   - 3.7. CERTIFIED BALLAST MANUFACTURERS - CBM
   - 3.8. AMERICAN SOCIETY FOR TESTING AND MATERIALS - ASTM
   - 3.9. OCCUPATIONAL SAFETY AND HEALTH ACT - OSHA
4. U.N.O., EQUIPMENT AND DEVICES SHALL BE MOUNTED PER ADA AND TAS REQUIREMENTS.
   - 4.1. OPERABLE DEVICES (SWITCHES, CARD READERS, ETC) AT OR BELOW 48" AFF
   - 4.2. RECEPTACLES, TELEPHONE AND DATA OUTLETS AT 18" AFF (15" MIN TO BOTTOM OF DEVICE), UNO

SCOPE OF WORK

1. THE SCOPE OF WORK SHALL INCLUDE COMPLETE PROVISIONS FOR ELECTRICAL POWER DISTRIBUTION TO ALL LIGHTING, DEVICES, APPLIANCES, AND EQUIPMENT SHOWN ON THE CONSTRUCTION DOCUMENTS.
   - 1.1. PROVISIONS INCLUDE, BUT ARE NOT LIMITED TO, ALL SUPPLIES, MATERIALS, EQUIPMENT, TOOLS AND LABOR.
   - 1.2. PROVISIONS ALSO INCLUDE ALL MISCELLANEOUS MATERIALS REQUIRED TO COMPLETE THE WORK SHOWN INCLUDING, BUT NOT LIMITED TO, SUPPORTS, HANGERS, RACEWAYS, BOXES, SLEEVES, SEALS, EQUIPMENT PADS, WIRING CONNECTORS, TERMINALS, LABELS, SIGNS, AND MARKERS.
   - 1.3. THE CONSTRUCTION DOCUMENTS INCLUDE ALL PLANS, ELEVATIONS, DETAILS, DIAGRAMS, SCHEDULES, AND NOTES ON THE DRAWINGS AND THE WRITTEN SPECIFICATIONS INCLUDING ANY ITEMS MENTIONED IN EITHER THE SPECIFICATIONS OR ON THE DRAWINGS BUT NOT IN THE OTHER.
   - 1.4. WHERE USED ON THE PLANS AND IN THE SPECIFICATIONS AND WHERE NOT SPECIFICALLY NOTED OTHERWISE, THE TERM "PROVIDE" AND THE TERM "INSTALL" SHALL MEAN FURNISH, INSTALL, CONNECT AND TEST.
   - 1.5. UNLESS EXPLICITLY NOTED "BY OTHERS" OR "EXISTING", ALL ITEMS SHOWN GRAPHICALLY OR SPECIFIED BY NOTES AND DETAILS ON THE PLANS SHALL BE FURNISHED, INSTALLED, CONNECTED, AND TESTED AS NEEDED.
2. ADDITIONALLY, THE SCOPE OF WORK SHALL INCLUDE
   - 2.1. INSPECTION AND PAYMENT OF ALL ASSOCIATED FEES.
   - 2.2. TESTING AND COMMISSIONING OF ELECTRICAL SYSTEMS.
   - 2.3. EQUIPMENT RENTAL.
   - 2.4. TEMPORARY CONSTRUCTION POWER AND LIGHTING.
   - 2.5. PROVISIONS FOR MAINTAINING THE FUNCTIONALITY OF EXISTING TO REMAIN BUILDING COMMUNICATIONS, FIRE ALARM, SECURITY/ACCESS CONTROL, PUBLIC ADDRESS, AND BELL SYSTEMS THAT WILL BE AFFECTED BY THE WORK.

SUBMITTALS

1. PRODUCT DATA: SUBMIT CATALOG DATA SHOWING MANUFACTURER'S NAME AND CONTACT INFORMATION, ALL STANDARD FEATURES, AMPERAGE, VOLTAGE, AIC RATINGS, DIMENSIONS, WEIGHTS, LISTINGS & PRODUCT LABELS, MATERIAL TYPES, FINISHES AND CLEARLY INDICATING WHICH OPTIONAL FEATURES WILL BE PROVIDED.
   - 1.1. WHERE MULTIPLE SIZES ARE LISTED, INDICATE SIZES TO BE USED.
   - 1.2. WHERE MULTIPLE PRODUCTS ARE SHOWN ON THE SAME PAGE, INDICATE WHICH PRODUCTS TO BE USED.
2. SHOP DRAWINGS (WHERE APPLICABLE): MANUFACTURER OR CONTRACTOR PREPARED DRAWINGS SHOWING ALL RELEVANT DIMENSIONS, WEIGHTS, ELECTRICAL & MECHANICAL CONNECTION REQUIREMENTS, CONDUIT ENTRY POINTS, ASSEMBLY REQUIREMENTS, LIFTING REQUIREMENTS, LIFTING POINTS, REQUIRED CLEARANCES. INCLUDE PLAN VIEWS & ELEVATIONS.
   - 2.1. INCLUDE ALL RELEVANT ELECTRICAL DIAGRAMS INCLUDING SCHEMATIC AND INTERCONNECTION DIAGRAMS FOR POWER, SIGNAL, AND CONTROL WIRING.

COORDINATION

1. ALL POWER OUTAGES SHALL BE COORDINATED IN WRITING WITH OWNER ONE (1) WEEK (MIN) PRIOR TO THE OUTAGE.
2. COOPERATE FULLY WITH THE OWNER OR HIS REPRESENTATIVE DURING CONSTRUCTION OPERATIONS TO MINIMIZE CONFLICTS AND TO FACILITATE OWNER USAGE SO AS NOT TO INTERFERE WITH THE OWNER'S OPERATIONS.
3. THE DRAWINGS ARE DIAGRAMMATIC. THEY DO NOT SHOW SWITCHES, POWER AND DATA OUTLETS, SPECIAL SYSTEMS COMPONENTS (FA, ACCESS CONTROL, A/V, ETC), ELECTRICAL EQUIPMENT, EQUIPMENT CONNECTIONS, REQUIRED RACEWAY, ETC. IN THEIR EXACT DIMENSIONED LOCATIONS. THE CONTRACTOR MUST CAREFULLY REVIEW THE ARCHITECTURAL, STRUCTURAL MECHANICAL, PLUMBING, FIRE PROTECTION, AND SPECIAL SYSTEMS PLANS TO IDENTIFY CONFLICTS AND AREAS THAT REQUIRE COORDINATION.
4. COORDINATE ELECTRICAL AND SPECIAL SYSTEMS EQUIPMENT ROUGH-IN WITH MECHANICAL AND PLUMBING SYSTEMS, SPRINKLER SYSTEMS, ARCHITECTURAL AND STRUCTURAL ELEMENTS, AND THE OWNER'S REPRESENTATIVE. MINOR CHANGES IN ELECTRICAL EQUIPMENT LOCATIONS AND LAYOUT THAT ARE REQUIRED BY SITE CONDITIONS OR ORDERED BY THE DESIGN TEAM PRIOR TO PERFORMANCE OF WORK SHALL BE MADE BY THE CONTRACTOR WITHOUT ADDITIONAL CHARGES TO THE OWNER,
5. MAINTAIN REQUIRED NEC WORKING SPACE AND DEDICATED EQUIPMENT SPACE AROUND ALL ELECTRICAL EQUIPMENT, CONTROLS PANELS, ETC THAT ARE SUBJECT TO MAINTENANCE, TESTING, OR USER INTERFACE. COORDINATE WITH OTHER TRADES. IF CLEARANCE CANNOT BE PROVIDED, THE CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO ROUGH-IN.
6. COORDINATE POWER REQUIREMENTS FOR HVAC CONTROLS, FIRE ALARM, SECURITY, AND OTHER SPECIAL SYSTEMS TO MAKE SURE THAT ALL WORK IS COVERED IN THE BID

QUALIFICATIONS

1. MANUFACTURER: COMPANY SPECIALIZING IN MANUFACTURING PRODUCTS SHOWN ON THE CONSTRUCTION DOCUMENTS WITH MINIMUM THREE YEARS DOCUMENTED EXPERIENCE
2. INSTALLER: A STATE LICENSED ELECTRICIAN WITH DOCUMENTED EXPERIENCE INSTALLING ALL EQUIPMENT SPECIFIED HERE IN SHALL DIRECTLY SUPERVISE ALL WORK. WHERE NOTED IN THE SPECIFICATIONS, REQUIRED BY CODE, OR REQUIRED BY THE MANUFACTURER, INSTALLER SHALL BE A MANUFACTURER TRAINED AND/OR CERTIFIED INSTALLER OF THE SPECIFIC PRODUCT TO BE INSTALLED.
3. WHERE TESTING IS REQUIRED BY THE CONSTRUCTION DOCUMENTS, EQUIPMENT MANUFACTURER, OR CODE; TESTING SHALL BE PERFORMED BY AN AGENCY WITH DOCUMENTED EXPERIENCE AND PROPERLY CALIBRATED, FULLY FUNCTIONING EQUIPMENT, THAT IS A MEMBER OF THE INTERNATIONAL ELECTRICAL TESTING ASSOCIATION, MANUFACTURER CERTIFIED, OR IS A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL), AND IS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION.

QUALITY ASSURANCE

1. UNLESS OTHERWISE APPROVED, ALL EQUIPMENT SHALL BE NEW, PROPERLY DESIGNED, FROM A REPUTABLE MANUFACTURER MEETING THE SPECIFICATION QUALIFICATIONS, IN COMPLIANCE WITH THE SPECIFICATION REQUIREMENTS, AND IN FULL WORKING ORDER.
2. WHERE TWO OR MORE ITEMS OF THE SAME CLASS OF EQUIPMENT ARE REQUIRED, THESE ITEMS SHALL BE PRODUCTS OF A SINGLE MANUFACTURER; HOWEVER, THE COMPONENT PARTS OF THE ITEM NEED NOT BE THE PRODUCTS OF THE SAME MANUFACTURER UNLESS STATED IN THE TECHNICAL SECTION.
3. LISTING AND LABELING: WHERE REQUIRED, ALL ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES SHALL BE LISTED AND LABELED AS DEFINED IN NFPA 70, ARTICLE 100, BY A TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION AND MARKED FOR THE INTENDED USE. TESTING AGENCY SHALL BE UL UNLESS NOTED OTHERWISE OR PRE-APPROVED BY OWNER AND AHJ.
4. ALL EQUIPMENT USED FOR TESTING SHALL BE IN FULL WORKING ORDER AND CALIBRATED PER THE MANUFACTURER'S RECOMMENDATIONS.

DELIVERY AND STORAGE

1. STORE ALL ELECTIRCAL/SPECIAL SYSTEMS EQUIPMENT/MATERIALS IN CLEAN, DRY SPACE LOCATED ABOVE GRADE. PROTECT FROM DIRT, WATER, CONSTRUCTION DEBRIS, TRAFFIC, FREEZE, AND DETERIORATION FROM SUN LIGHT.
2. MAINTAIN FACTORY WRAPPING OR PROVIDE APPROPRIATE COVER FOR ALL LARGE ELECTRICAL EQUIPMENT. FOLLOW ALL MANUFACTURER RECOMMENDATIONS FOR HUMIDITY AND MAX/MIN TEMPERATURES FOR STORING ELECTRICAL EQUIPMENT.

## GENERAL ELECTRICAL REQUIREMENTS (CONT'D)

IDENTIFICATION

1. PROVIDE APPROPRIATE LABELS AND WARNING SIGNS FOR ALL EQUIPMENT, WIRING DEVICES, CONDUCTORS, CABLES, BOX, AND ENCLOSURES. PROVIDE BURIED DETECTABLE WARNIGN TABLE FOR UNDERGROUND CONDUITS.
2. CONDUCTOR TAGGING: TAG ALL CONDUCTORS AT MOTOR CONTROLS, PANELS, TERMINAL CABINETS AND JUNCTION BOXES. TAG CIRCUITS WHICH PASS THROUGH OTHER DEVICES SUCH AS LIGHTING CONTACTORS.
3. PROVIDE A TYPED PANEL DIRECTORY FOR EACH PANEL PROVIDED OR MODIFIED FOR THIS PROJECT. DIRECTORY SHALL IDENTIFY THE CIRCUIT NUMBER, LOADS SERVED, AND LOCATION OF LOADS BY ROOM NUMBER. MOUNT ON INSIDE OF EACH PANEL AND FILE THEM WITH THE OWNER WHEN THE WORK IS COMPLETED.
4. PROVIDE EACH NEW PANEL WITH A MANUFACTURER PREPARED ARC FLASH HAZARD WARNING LABEL.
5. ALL ELECTRICAL EQUIPMENT SHALL BE IDENTIFIED BY MEANS OF 3"X1" (MIN)NAMEPLATES PERMANENTLY ATTACHED TO THE EQUIPMENT, PLATES SHALL BE METAL, PLASTIC, OR SIMILAR, BLACK WITH 1/4"h (MIN) ENGRAVED WHITE LETTERS.
6. JUNCTION AND PULL BOXES SHALL BE LABELED WITH PANEL NAME, CIRCUIT #, AND VOLTAGE.
7. RECEPTACLES SHALL BE LABELED WITH THE PANEL NAME AND CIRCUIT #, USE WHITE LABELS WITH BLACK TEXT.
8. FIRE ALARM, EMERGENCY/CRITICAL PWR, LIFE SAFETY LABELS, INCLUDING RECEPTACLES, SHALL BE COLOR CODED & ENGRAVED.

## INSTALLATION

GENERAL REQUIREMENTS

1. THE CONTRACTOR SHALL PROVIDE CONCRETE HOUSEKEEPING PADS FOR ALL FLOOR MOUNTED ELECTRICAL EQUIPMENT. THE CONCRETE SHALL PROTRUDE 3" PAST THE EDGE OF THE ELECTRICAL EQUIPMENT ON ALL SIDES. THE CONCRETE PAD SHALL BE 6" TALL AND CONTAIN A 1/2" CHAMFER ON ALL SIDES. PROVIDE A MINIMUM OF 3000 PSI CONCRETE AND #4 REBAR.
2. ALL TERMINALS, LUGS AND BUS JOINTS SHALL BE TIGHTENED PER THE MANUFACTURER'S TORQUE RECOMMENDATIONS.
3. NO FOREIGN SYSTEMS SUCH AS PIPING, DUCT WORK, ETC SHALL BE INSTALLED ABOVE ELECTRICAL EQUIPMENT.
4. PROVIDE SLEEVES FOR PENETRATIONS THROUGH WALLS/FLOORS. SEAL ALL OPENINGS. USE FIRE-RATED SEALANT FOR OPENINGS IN RATED WALLS.
5. PERFORM GROUND PENETRATING RADAR SCAN BEFORE CUTTING EXISTING STRUCTURES. COORDINATE LOCATIONS WITH STRUCTURAL ENGINEER/ARCHITECT.

CONDUCTORS AND CABLES

1. ALL BUILDING WIRING SHALL BE INSULATED COPPER CONDUCTORS RUN FROM LOAD TO SOURCE INSIDE RACEWAY, CONTINUOUS (WITHOUT SPLICES) BETWEEN JUNCTION AND PULL BOXES, AND EXPOSED INSIDE PANELS ONLY.
2. ALL SINGLE POLE CIRCUITS SHALL HAVE A DEDICATED NEUTRAL CONDUCTOR ROUTED TO THE SOURCE PANEL.
3. FIELD VERIFY WHETHER A NEUTRAL IS REQUIRED FOR ALL TWO AND THREE POLE CIRCUITS. FOR ALL LOADS EXCEPT MOTORS, A NEUTRAL IS ASSUMED TO BE REQUIRED UNLESS FIELD DETERMINED TO BE UNNECESSARY.
4. ALL POWER & CONTROL WIRING ROUTED THROUGH RETURN AIR PLENUMS SHALL BE PLENUM RATED.
5. UP TO 3-20A CIRCUITS MAY SHARE A RACEWAY FOR HOMERUNS WHERE SUITABLE & PER NEC CONDUIT FILL RULES.
6. 120V, 20A. HOME RUNS LONGER THAN 100' AND 277V, 20A. HOME RUNS LONGER THAN 150' SHALL BE #10 MIN.

GROUNDING AND BONDING

1. ALL RACEWAYS AND CIRCUITS SHALL BE PROVIDED WITH A NEC 250 COMPLIANT GREEN GROUND CONDUCTOR.
2. ALL EQUIPMENT SHALL BE PROPERLY BONDED.
3. UPON COMPLETION OF THE WORK, ALL PARTS OF THE ELECTRICAL INSTALLATION SHALL BE MEGGER TESTED AND PROVED TO BE FREE OF UNWANTED GROUNDS AND OTHER DEFECTS.

HANGERS AND SUPPORTS

1. SUPPORT RACEWAYS USING GALVANIZED STEEL OR MALLEABLE IRON STRAPS; CHANNEL OR PIPE CLAMPS AS APPROPRIATE.
2. PROVIDE SUPPORTS AT ALL BOXES, ELEC. EQUIP., LOADS, & AT CODE REQUIRED INTERVALS ALONG RACEWAYS.
3. GROUP RELATED RACEWAYS AND SUPPORT USING STEEL CHANNEL CONDUIT RACKS WITH 25% SPARE CAPACITY.
4. SUPPORT LTG, ELEC. EQUIP., RACEWAYS/BOXES, ETC. INDEPENDENTLY. DO NOT USE CEILING SUPPORT WIRES, PIPING SYSTEMS, ETC.

RACEWAY AND BOXES

1. PROVIDE COMPLETE RACEWAY SYSTEMS FROM SOURCE TO ALL LOADS WITH DEDICATED SUPPORTS FOR EACH RACEWAY ELEMENT.
2. PROVIDE ALL REQUIRED BOXES & SUPPORTS FOR WIRING DEVICES, TELECOMMUNICATIONS, FIRE ALARM, ACCESS CONTROL, CONTROLS EQUIPMENT, ALARMS, SENSORS, ETC.
3. PROVIDE PULL BOXES AT APPROPRIATE LOCATIONS FOR ALL POWER AND SPECIAL SYSTEMS RACEWAYS WHETHER SHOWN ON PLANS OR NOT. INSTALL IN CONCEALED, ACCESSIBLE LOCATIONS.
4. DO NOT INSTALL RACEWAY WITH MORE THAN THE EQUIVALENT OF THREE NINETY DEGREE BENDS BETWEEN PULL POINTS.
5. THE CONDUIT ROUTING SHOWN ON THESE PLANS IS DIAGRAMMATIC.
6. COORDINATE INTERIOR ROUTING WITH OTHER TRADES; STRUCTURE; NEW AND EXISTING UTILITIES, DUCTWORK, PIPING; AND OTHER EXISTING CONDITIONS AS REQUIRED FOR A COMPLETE, CONFLICT FREE INSTALLATION.
7. COORDINATE SITE ROUTING WITH OTHER TRADES; STRUCTURE; NEW AND EXISTING BURIED UTILITIES, PAVED AREAS, CONDUIT SLEEVES, AND LANDSCAPING BEFORE DIGGING TO AVOID CONFLICTS, DAMAGE, AND TO ALLOW FOR FUTURE INSTALLATIONS.
8. ROUTE RACEWAYS PARALLEL AND PERPENDICULAR TO WALLS, FLOORS, AND CEILINGS.
9. ROUTE EXPOSED CONDUIT PARALLEL AND TIGHT TO STRUCTURAL ELEMENTS. FOLLOW ALL SURFACE CONTOURS; DO NOT ROUTE IN FREE AIR FROM POINT TO POINT.
10. INSTALL RACEWAYS SO THAT IT DRAINS TO JUNCTION AND PULL BOXES TO AVOID MOISTURE TRAPS AT LOW POINTS; INSTALL JUNCTION BOX WITH DRAIN FITTING AT LOW POINTS IN CONDUIT SYSTEM.
11. INSTALL FITTINGS TO ACCOMMODATE EXPANSION AND DEFLECTION WHERE RACEWAY CROSSES SEISMIC, CONTROL, AND EXPANSION JOINTS.
12. INSTALL SUITABLE PULL STRING OR CORD IN EACH EMPTY RACEWAY, LABEL, AND CAP.
13. CLOSE ENDS AND UNUSED OPENINGS IN SURFACE RACEWAYS, WIREWAY, BOXES, AND ENCLOSURES.
14. WHERE POSSIBLE, ALL CONDUIT ROUTED THROUGH ROOF STRUCTURE SHALL SHARE COMMON PENETRATIONS AS MECHANICAL DUCTWORK OR PIPING. COORDINATE WITH MECHANICAL CONTRACTOR.
15. ALL ROOF AND WALL PENETRATIONS SHALL BE FLASHED AND SEALED TO MAINTAIN THE FIRE RATING AND WATERPROOFING OF THE STRUCTURE PER THE MANUFACTURER OF THE MATERIAL'S RECOMMENDED PRACTICES.
16. USE MULTI-GANG BOXES IN ALL POSSIBLE LOCATIONS.
17. PAINT EXPOSED RACEWAYS AND BOXES TO MATCH THE SURFACE TO WHICH THEY ARE ATTACHED.
18. ALL CONDUIT SHALL HAVE AN NEC COMPLIANT GROUND AND AN INSULATED THROAT BUSHING IN PLACE FOR PULLING CONDUCTORS.
19. ALL CONNECTIONS TO MOTORS, INSTRUMENTS, MACHINES, AND EQUIPMENT SUBJECT TO MOVEMENT OR VIBRATION SHALL BE MADE USING LIQUID-TIGHT, FLEXIBLE METAL CONDUIT (LFMC), (3FT MAX).

WIRING DEVICES

1. DUPLEX RECEPTACLES MOUNTED ON OPPOSITE SIDES OF A COMMON WALLS SHALL BE A MINIMUM OF 12" APART. (NO BACK TO BACK OUTLETS) TO REDUCE NOISE TRANSFER, JUNCTION BOXES IN ADJACENT ROOMS SHALL NOT BE INSTALLED IN THE SAME WALL CAVITY. SEPARATE ALL JUNCTION BOXES BY AT LEAST ONE FRAMING MEMBER.
2. PROVIDE GFI RECEPTACLES WITH DEDICATED NEUTRALS INDEPENDENT OF OTHER LOADS ON THE CIRCUIT.

ENCLOSED SWITCHES AND CONTACTORS

1. TO FACILITATE SAFE REPAIR AND REPLACEMENT OF EQUIPMENT, PROVIDE ALL STARTERS AND DISCONNECTS WITH LOTO PROVISIONS.
2. MOUNT STARTERS AND DISCONNECTS SERVING HVAC EQUIPMENT TO STRUCTURE ADJACENT TO EQUIPMENT SERVED RATHER THAN MOUNTING DIRECTLY TO THE EQUIPMENT. THIS INCLUDES U-CHANNEL SUPPORT AND 120V MAINTENANCE RECEPTACLE FOR ROOF MOUNTED EQUIPMENT. PROVIDE WORKING SPACE PER NEC REQUIREMENTS.

## PRODUCT SPECIFICATIONS

GENERAL REQUIREMENTS

1. COMPLIANCE WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS SHALL NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY OF PROVIDING EQUIPMENT THAT IS NEW, PROPERLY DESIGNED, FROM A REPUTABLE MANUFACTURER, AND IN FULL WORKING ORDER.
2. IF CONFLICTS BETWEEN THE SPECIFICATIONS AND DRAWINGS OCCUR, THE HIGHER QUALITY OR QUANTITY SHALL BE PROVIDED AND INSTALLED. WHEN CONFLICTS EXIST, CONTRACTOR SHALL PROVIDE A WRITTEN REQUEST FOR CLARIFICATION FROM THE ENGINEER. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY ADDITIONAL EXPENSES INCURRED AS A RESULT OF THE CONTRACTOR'S FAILURE TO OBTAIN CLARIFICATION.
3. ALL ELECTRICAL EQUIPMENT ENCLOSURES SHALL BE 16 GAUGE SHEET METAL (MIN). PROVIDED WITH MANUFACTURER'S CORROSION RESISTANT PAINT SYSTEM, PROVIDED WITH CONTINUOUSLY HINGED, LATCHING DOORS (UNO).
4. EQUIPMENT TO BE INSTALLED OUTDOORS SHALL HAVE NEMA 3R ENCLOSURES MIN. EQUIPMENT IN CORROSIVE OR HAZARDOUS ENVIRONMENTS SHALL BE RATED FOR THE INTENDED USE.

CONDUCTORS AND CABLES

1. THHN/THWN SOFT DRAWN, STRANDED COPPER, XHHW FOR UG, USE SOLID COPPER FOR #10 & SMALLER, MIN SIZE #12

RACEWAY AND BOXES

1. RACEWAY AND BOX SPECIFICATIONS ARE BY LOCATION.

PANELBOARDS

1. PROVIDE ALL PANELS WITH COPPER PHASE, NEUTRAL, GROUND BUSES; 42 PROVISIONS BREAKER MOUNTING SPACES (MIN).
2. ALL BRANCH CIRCUIT BREAKERS SHALL BE BOLT ON TYPE THERMAL MAGNETIC WITH COMMON TRIP HANDLE FOR MULTIPLE POLES, HACR RATED FOR MECHANICAL LOADS.
3. PROVIDE ADJUSTABLE TRIP SETTINGS FOR DISTRIBUTION BREAKERS. UNO: LI 600 TO 900A, LSIG 1000A & ABOVE.
4. PROVIDE CONTINUOUSLY HINGED DOOR AND FRONT COVER, LATCH AND KEY LOCK, METAL DIRECTORY FRAME.

WIRING DEVICES

1. WIRING DEVICES SHALL BE COMMERCIAL GRADE (MIN), GROUNDING, AND RATED FOR LOAD (20A MIN). NOTE THAT SOME LOCATIONS REQUIRE WEATHER RATED, INDUSTRIAL OR HEAVY DUTY, AND HOSPITAL GRADE DEVICES.
2. SURFACE MOUNTED RACEWAY FOR RECEPTACLES AND DATA OUTLETS SHALL BE DUAL CHANNEL, METAL RACEWAYS, TWO PIECE DESIGN WITH METAL BASE AND SNAP-ON METAL COVER. ASSEMBLED BASE AND COVER SHALL BE A MINIMUM OF 4" WIDE BY 1.5" DEEP. DEVICE BRACKETS AND COVER PLATES THAT WILL ACCEPT DUPLEX RECEPTACLES AND STANDARD DATA JACK MOUNTING PLATES WITHOUT FIELD CUTTING MUST BE AVAILABLE FROM THE RACEWAY MANUFACTURER.

ENCLOSED SWITCHES AND CONTACTORS

1. DISCONNECTS SHALL BE QUICK MAKE/BREAK LOAD INTERRUPTING KNIFE SWITCHES WITH EXTERNAL HANDLE LOCKABLE IN ON AND OFF POSITIONS, FULLY HINGED DOOR THAT IS LOCKED WHEN ENERGIZED AND PROVIDED WITH A DEFEATER MECHANISM TO OPEN ENCLOSURE WHEN ENERGIZED.
2. ENCLOSED MOTOR STARTERS SHALL HAVE REMOTE START SIGNAL INPUT, FULL SIZED OVERLOADS, CONTROL XFMR WITH PRIMARY & SECONDARY FUSING, HAND-OFF-AUTO SELECTOR SWITCH, (2) NORMALLY OPEN AND (2) NORMALLY CLOSED AUX. DRY CONTACTS. COORDINATE CPT VOLTAGE WITH CONTRACTOR PROVIDING EQUIPMENT TO BE CONTROLLED.

## RACEWAY AND BOX SPECIFICATIONS BY LOCATION

GENERAL REQUIREMENTS

1. PROVIDE RACEWAY AND BOXES AS SPECIFIED BELOW FOR POWER, LIGHTING, COMMUNICATIONS, FIRE ALARM, ACCESS CONTROL/SECURITY, CONTROLS, AND OTHER SPECIAL SYSTEMS.
2. PROVIDE RACEWAY AND BOXES FOR ALL EQUIPMENT; LIGHTING; WIRING DEVICES; COMMUNICATIONS EQUIPMENT AND OUTLETS; FIRE ALARM EQUIPMENT, APPLIANCES, AND DEVICES; ACCESS CONTROL/SECURITY POINTS; CONTROLS POINTS; AND OTHER SPECIAL SYSTEMS SHOWN ON PLANS.
3. PROVIDE RACEWAY BOXES AT OTHER LOCATIONS AS REQUIRED FOR SPLICES, TAPS, WIRE PULLING, EQUIPMENT CONNECTIONS, AND COMPLIANCE WITH REGULATORY REQUIREMENTS. RACEWAY AND BOXES ARE SHOWN IN APPROXIMATE LOCATIONS UNLESS DIMENSIONED. PROVIDE RACEWAY TO COMPLETE WIRING SYSTEM.
4. PROVIDE COMPRESSION CONNECTIONS FOR ALL METAL RACEWAYS.

UNDERGROUND:

1. PROVIDE WRAPPED RIGID STEEL CONDUIT WHERE ENTERING/EXITING SLABS OR GRADE; FOR ELBOWS 1" AND LARGER.
2. PROVIDE THICKWALL NONMETALLIC CONDUIT FOR STRAIGHT RUNS THAT ARE BURIED AND/OR IN CONCRETE.
3. PROVIDE CAST METAL BOXES OR POLYMER CONCRETE BOXES. COORDINATE WITH ENGINEER.
4. PROVIDE BOXES FOR UTILITY SERVICE CONDUIT OR CABLING PER UTILITY PROVIDER'S SPECIFICATIONS
5. NONMETALLIC HANDHOLES MAY BE USED FOR SITE LIGHTING AND CONTROLS CIRCUITS
6. PROVIDE RIGID STEEL CONDUIT WITHIN 5 FT OF BUILDING FOUNDATION.

IN CONCRETE

1. PROVIDE WRAPPED RIGID STEEL CONDUIT WHERE ENTERING OR EXITING CONCRETE; FOR ELBOWS 1" AND LARGER.
2. PROVIDE THICKWALL NONMETALLIC CONDUIT FOR STRAIGHT RUNS IN CONCRETE.
3. PROVIDE CAST METAL BOXES. NONMETALLIC MAY BE USED ONLY WITH ENGINEER APPROVAL.
4. USE CONCRETE TIGHT, MASONRY RATED BOXES AND FITTINGS WHERE INSTALLED IN CONCRETE, STONE, BRICK, CMU.

EXTERIOR ABOVE GRADE AND WET/DAMP INTERIOR LOCATIONS:

1. PROVIDE RIGID STEEL CONDUIT AND FITTINGS.
2. PROVIDE CAST METAL OUTLET, JUNCTION, AND PULL BOXES, GASKETED, RATED NEMA 3R MIN.

CONCEALED DRY INTERIOR LOCATIONS:

1. PROVIDE RIGID STEEL CONDUIT, INTERMEDIATE METAL CONDUIT, OR ELECTRICAL METALLIC TUBING.
2. PROVIDE SHEET-METAL BOXES.

EXPOSED DRY INTERIOR LOCATIONS:

1. PROVIDE RIGID STEEL CONDUIT BELOW 10 FEET, AND RIGID STEEL, INTERMEDIATE METAL, OR ELECTRICAL METALLIC TUBING ABOVE 10 FEET.
2. PROVIDE SHEET-METAL BOXES.

## DEMOLITION NOTES

1. THE CONTRACTOR SHOULD COORDINATE WITH THE ENGINEER OR OWNER FOR THE DISPOSITION OF ANY EQUIPMENT FOUND IN THE FIELD BUT NOT MENTIONED ON THESE PLANS THAT WILL BE AFFECTED BY OR SHOULD BE DEMOLISHED ALONG WITH THE OTHER DEMOLITION WORK REQUIRED FOR THIS PROJECT.
2. THOUGH THE TERM DEMOLISHED IS USED IN THESE DOCUMENTS, ALL EQUIPMENT SHALL BE REMOVED IN AN ORDERLY, SAFE, CLEAN, NON-DESTRUCTIVE MANNER.
3. ALL CONDUIT EMBEDDED IN CONCRETE OR BURIED SHALL BE ABANDON IN PLACE. THE ABANDON CONDUIT SHALL BE CUT OFF FLUSH WITH SURFACE AND CAPPED.
4. THE OWNER SHALL HAVE FIRST RIGHT OF REFUSAL FOR ALL DEMOLISHED EQUIPMENT. DISPOSAL OF ALL DEMOLISHED EQUIPMENT NOT REQUESTED BY THE OWNER SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
5. THE CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR THE DISPOSAL OF HAZARDOUS MATERIALS SUCH AS PCBs AND MERCURY CONTAINING FLUORESCENT LAMPS FOLLOWING ALL LOCAL, STATE, AND FEDERAL GUIDELINES AND PROVIDE DOCUMENTATION OF DISPOSAL TO THE OWNER.
6. ANY EXISTING EQUIPMENT THAT IS CALLED OUT ON THE PLANS TO BE REUSED BUT IS FIELD DETERMINED TO BE DAMAGED IN ANY WAY SHOULD BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
7. REMOVE ALL ELECTRICAL EQUIPMENT SUCH AS RACEWAYS (CONDUIT), CONDUCTORS, DISCONNECTS, SUPPORTS, ETC. THAT IS ASSOCIATED WITH DEMOLISHED RECEPTACLES, LIGHTING, HVAC EQUIPMENT, ETC . REMOVE FROM THE ELECTRICAL PANEL TO THE LOAD SERVED UNLESS NOTED TO BE USED FOR NEW EQUIPMENT OR ALSO SERVING EXISTING TO REMAIN LOADS.
8. PATCH AND FIRE SEAL AS REQUIRED ALL PENETRATIONS IN STRUCTURES MADE BY DEMOLISHED ELECTRICAL EQUIPMENT, CONDUIT AND OTHER RACEWAYS, CABLE TRAY, ETC.
9. EXISTING TO REMAIN EQUIPMENT IS SHOWN GRAY SCALED ON THESE PLANS FOR REFERENCE. EQUIPMENT TO BE DEMOLISHED IS SHOWN BOLD AND/OR DASHED.
10. ALL MATERIALS SALVAGED TO OWNER SHALL BE STORED BY CONTRACTOR FOR REUSE UNTIL END OF PROJECT THEN RETURNED TO THE OWNER.
11. COORDINATE THE DEMOLITION OF IT CABLE AND EQUIPMENT WITH OWNER'S IT REPRESENTATIVE PRIOR TO WORK.
12. REFER TO DEMOLITION SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
13. REFER TO MECHANICAL AND PLUMBING DEMOLITION PLANS FOR EQUIPMENT THAT REQUIRES ELECTRICAL SERVICE TO BE REMOVED FROM LOAD TO SOURCE.


12/17/15



| Rev. | Date | Revision | By | Chkd. | Appd. | Appd. |
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| Rev. | Date | Revision | By | Chkd. | Appd. | Appd. |
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EEA Project No. 20114005B

LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
ELECTRICAL GENERAL NOTES

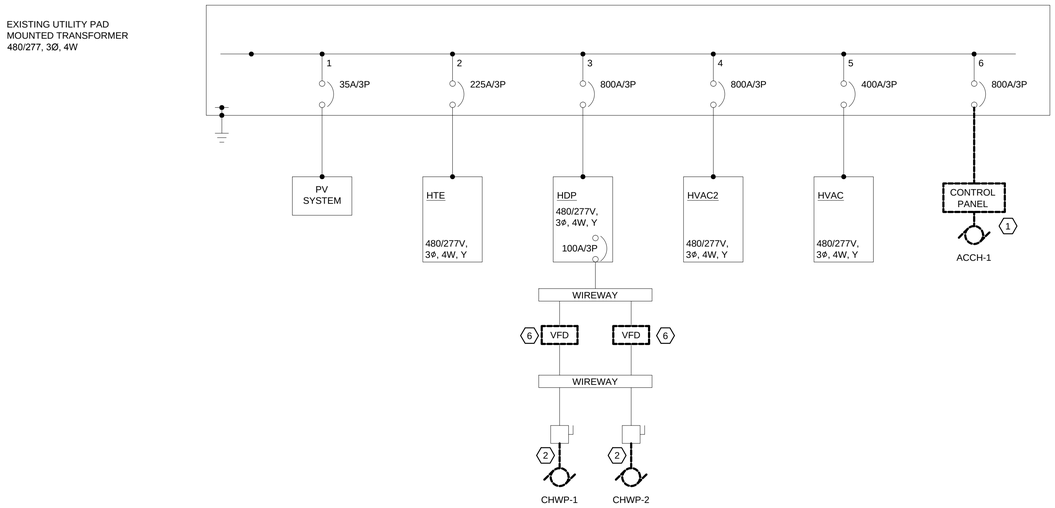
DATE 12/17/15
SCALE NOT TO SCALE
DWG. NO. E002

1 2 3 4 5 6 7 8

A B C D E F G H

## EXISTING MAIN SWITCHBOARD "MSB"

1600A, 480/277V, 3Ø, 4W, 65K A.I.C., W/ GROUNDED BUS, NEMA 3R

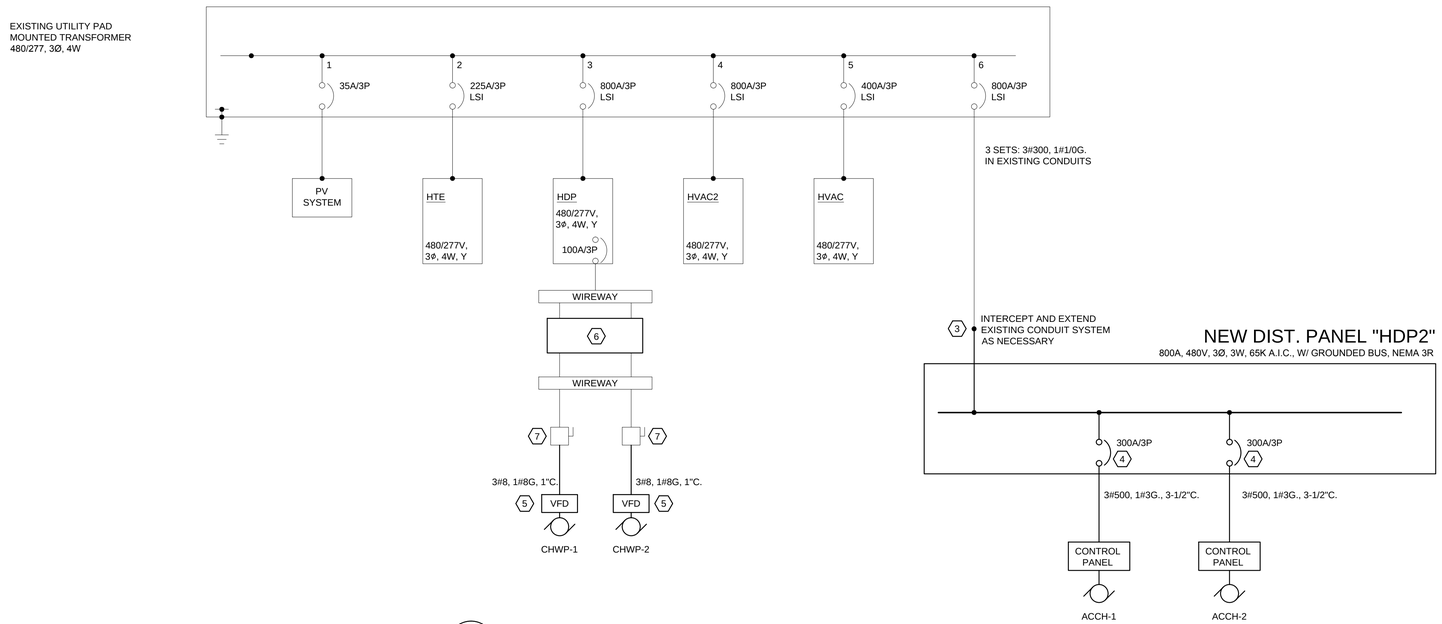



1 ONE LINE DIAGRAM - DEMO

NTS

## EXISTING MAIN SWITCHBOARD "MSB"

1600A, 480/277V, 3Ø, 4W, 65K A.I.C., W/ GROUNDED BUS, NEMA 3R




2 ONE LINE DIAGRAM - NEW

NTS

## GENERAL NOTES:

1. ELECTRICAL EQUIPMENT SHOWN GRAYSCALE IS EXISTING TO REMAIN.
2. NEW CIRCUITS AND CIRCUIT BREAKERS SERVING NEW OR MODIFIED EQUIPMENT ARE SHOWN IN BOLD ON THE ONE LINE AND PANEL SCHEDULES. IF A CIRCUIT SHOWN BOLD IS FIELD DETERMINED TO BE SERVING EXISTING LOADS, THE ELECTRICAL CONTRACTOR SHALL COORDINATE WITH THE ENGINEER TO FIND AN ALTERNATIVE CIRCUIT FOR THE NEW LOAD SHOWN IN BOLD PRIOR TO THE INSTALLATION OF CONDUIT.
3. ELECTRICAL CONTRACTOR SHALL FIELD VERIFY PANEL SCHEDULES AND AVAILABILITY OF REPLACEMENT PARTS FOR EXISTING PANELS PRIOR TO ORDERING NEW PARTS FOR EXISTING PANELS OR INSTALLING CONDUIT.
4. NEW CIRCUIT BREAKER SHALL MATCH THE AIC RATING OF THE EXISTING CIRCUIT BREAKERS IN THE PANEL.
5. ALL EXISTING FEEDER SIZES SHOWN WHERE TAKEN FROM THE EXISTING BASE BUILDING CONSTRUCTION PLANS.
6. EXISTING PANEL AND CIRCUIT BREAKER RATINGS SHOWN WHERE FIELD VERIFIED.
7. EXISTING LOADS WHERE TAKEN FROM THE EXISTING BASE BUILDING CONSTRUCTION PLANS.
8. NOT ALL EXISTING LOADS AND BRANCH CIRCUIT SIZES ARE DOCUMENTED. WHERE THE LOAD IS NOT KNOW, THE LOAD USED ON THE PANEL SCHEDULE AND LOAD ANALYSIS WAS ASSUMED TO BE 80% OF THE CIRCUIT BREAKER RATING.

## KEYED NOTES (X)

1. EXISTING CHILLER TO BE REMOVED BY OTHERS. TURN OFF CIRCUIT AND REMOVE EXISTING CONDUCTORS. RETAIN UNDERGROUND CONDUITS FOR REUSE.
2. EXISTING PUMPS TO BE REMOVED BY OTHERS TURN OFF CIRCUIT AND REMOVE EXISTING CONDUCTORS BACK TO DISCONNECT SWITCHES. RETAIN EXISTING DISCONNECTS.
3. NEW DISTRIBUTION PANEL SHALL BE FED FROM EXISTING 800A CIRCUIT BREAKER. PROVIDE NEW CONDUCTORS IN EXISTING UNDERGROUND CONDUITS FROM MSB TO NEW HDP2. PROVIDE NEW CONDUIT ABOVE GRADE TO PANEL.
4. PROVIDE PERMANENT MEANS FOR LOCKING NEW CHILLER CIRCUIT BREAKERS IN THE OFF POSITION.
5. VFD PROVIDED INTEGRAL WITH PUMP. PROVIDE NEW WIRING FROM FUSED DISCONNECT TO PUMP/VFD.
6. REMOVE EXISTING VFD LOCATED IN FILE SERV. 125 AND TURN OVER TO OWNER. PROVIDE NEW ENCLOSURE IN SPACE WITH TERMINAL BLOCKS TO MAINTAIN EXISTING CIRCUITING.
7. REPLACE EXISTING FUSES IN DISCONNECT SWITCH WITH NEW 20A FUSES. PROVIDE OWNER WITH ONE SPARE SET OF FUSES.

## LOAD SUMMARY

| | CONNECTED LOAD | DEMAND FACTOR | DEMAND LOAD |
|---|---|---|---|
| EXISTING DESIGN DEMAND LOAD | | | 1325.2 KVA |
| REMOVED LOADS | | | |
| CHILLER | -321.4 KVA | 100% | -321.4 KVA |
| HUMIDIFIER HU-2A | -102.0 KVA | 100% | -102.0 KVA |
| HUMIDIFIER HU-2B | -102.0 KVA | 100% | -102.0 KVA |
| HUMIDIFIER HU-2C | -102.0 KVA | 100% | -102.0 KVA |
| CHWP-1 & 2 | -22.4 KVA | 100% | -22.4 KVA |
| ADDED LOADS | | | |
| CHILLERS ACCH-1 & ACCH-2 | 325.4 KVA | 100% | 325.4 KVA |
| CWHP-1 & 2 | 9.1 KVA | 100% | 9.1 KVA |
| ROOF FAN | 1.3 KVA | 100% | 1.3 KVA |
| NEW TOTAL LOAD | | | 1011.2 KVA<br>1216.3 A |



STATE OF TEXAS
JARED C WINN
116423
LICENSED PROFESSIONAL ENGINEER
12/17/15

| Rev. | Date | Revision | By | Chkd. | Appd. | Appd. |
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| 0 | 12/17/15 | 100% CONSTRUCTION DOCUMENTS | JCW | - | - | - |

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EEA Project No. 20114005B

LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

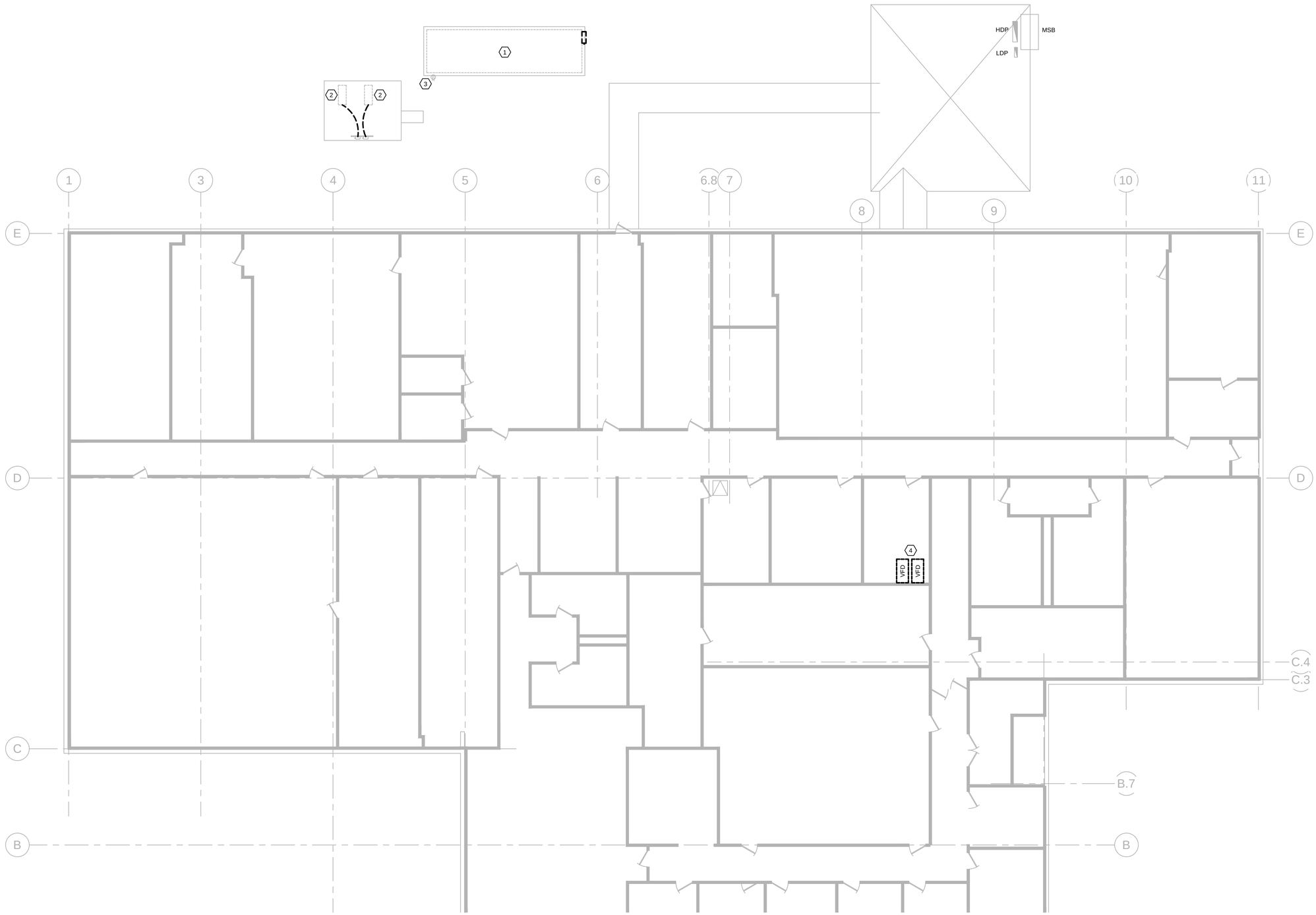
LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
ELECTRICAL ONE LINE DIAGRAMS

DATE 12/17/15
SCALE NOT TO SCALE
DWG. NO. E003

## KEYED NOTES (X)

1. EXISTING CHILLER TO BE REMOVED BY OTHERS. DISCONNECT EXISTING CIRCUIT AND REMOVE CONDUCTORS. RETAIN CONDUIT SYSTEM FOR REUSE WITH NEW PANEL AT THIS LOCATION.
2. EXISTING PUMPS TO BE REMOVED BY OTHERS. DISCONNECT EXISTING CIRCUIT AND REMOVE WIRING AND CONDUIT BACK TO DISCONNECT SWITCH. RETAIN CIRCUITING FROM DISCONNECT SWITCH BACK TO PANEL FOR REUSE WITH NEW EQUIPMENT AT THIS LOCATION.
3. MAINTENANCE RECEPTACLE IS EXISTING TO REMAIN.
4. REMOVE EXISTING VFD'S SERVING CHILLED WATER PUMPS AND TURN OVER TO OWNER.



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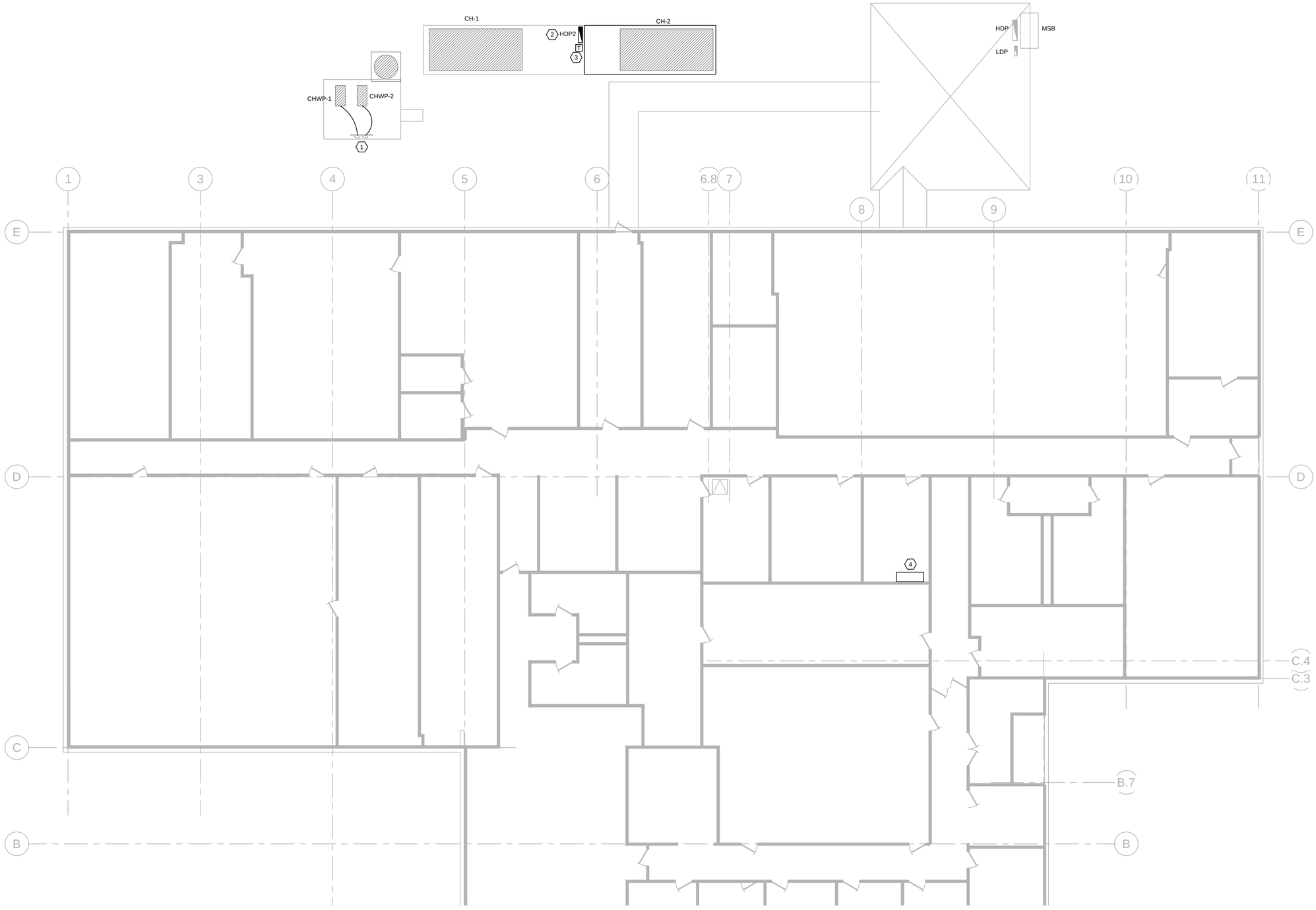
LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
ELECTRICAL DEMOLITION PLAN

| | |
|---|---|
| DATE | 12/17/15 |
| SCALE | 1/8" = 1'-0" |
| DWG. NO. | E101D |

STATE OF TEXAS
JARED C WINN
116423
LICENSED
PROFESSIONAL ENGINEER
12/17/15




## GENERAL NOTES:

1. REFER TO SPECIFICATIONS, SCHEDULES, DETAILS AND GENERAL NOTES SHEET FOR ADDITIONAL SITE REQUIREMENTS.
2. BURIED CONDUIT SHALL BE INSTALLED AT 24" BELOW FINISHED GRADE, UNO. 18 " MAY BE USED AT LOCATIONS NOT SUBJECT TO VEHICLE OR EQUIPMENT LOADING, BUT ONLY WITH ENGINEER APPROVAL.
3. SITE ELECTRICAL CONDUIT ROUTING IS DIAGRAMMATIC. EC MAY ADJUST PATHS AS REQUIRED PER SITE CONDITIONS AND WITHIN THE FOLLOWING LIMITATIONS: DO NOT ROUTE EXPOSED. DO NOT ROUTE UNDER EXISTING, NEW, OR FUTURE BUILDINGS OR STRUCTURES. ONLY ROUTE UNDER SIDEWALKS OR WITHIN THE DRIP LINE OF TREES WHERE UNAVOIDABLE.
4. VERIFY EXISTING BURIED UTILITY LOCATIONS PRIOR TO TRENCHING FOR CONDUIT OR BORING FOR LIGHT POLE FOUNDATIONS. USE GROUND PENETRATING RADAR SCAN.
5. REFER TO ONE LINE DIAGRAM AND PANEL SCHEDULES FOR CONDUIT AND CONDUCTOR SIZES NOT SHOWN.

## KEYED NOTES (X)

1. MOUNT NEW COMBINATION VFD/DISCONNECTS ON EXISTING RACK. PROVIDE NEW CONDUIT AND CONDUCTORS FROM VFD TO MOTOR. PROVIDE NEW 20A FUSES.
2. MOUNT NEW DISTRIBUTION PANEL HDP2 ON SLOTTED METAL U-CHANNEL RACK PROVIDED WITH NEC REQUIRED WORKING SPACE. ANCHOR TO CONCRETE USING A 1 FT (MIN) HORIZONTAL BASE PIECE AND 45° ANGLED BRACING PIECE. UTILIZE EXISTING UNDERGROUND CHILLER CONDUITS FOR NEW FEEDER TO PANEL.
3. PROVIDE 1500VA 480V:120V CONTROL TRANSFORMER IN NEMA 3R ENCLOSURE FOR 120V POWER FOR CONTROLS CONTRACTOR. TRANSFORMER SHALL BE PROVIDED WITH PRIMARY AND SECONDARY FUSING.
4. PROVIDE NEW NEMA 1 ENCLOSURE WITH TERMINAL BLOCKS TO MAINTAIN EXISTING CIRCUITING OF CHILLED WATER PUMPS.



| Rev. | Date | Revision | By | Chkd. | Appd. | Appd. |
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| 0 | 12/17/15 | 100% CONSTRUCTION DOCUMENTS | JCW | - | - | - |

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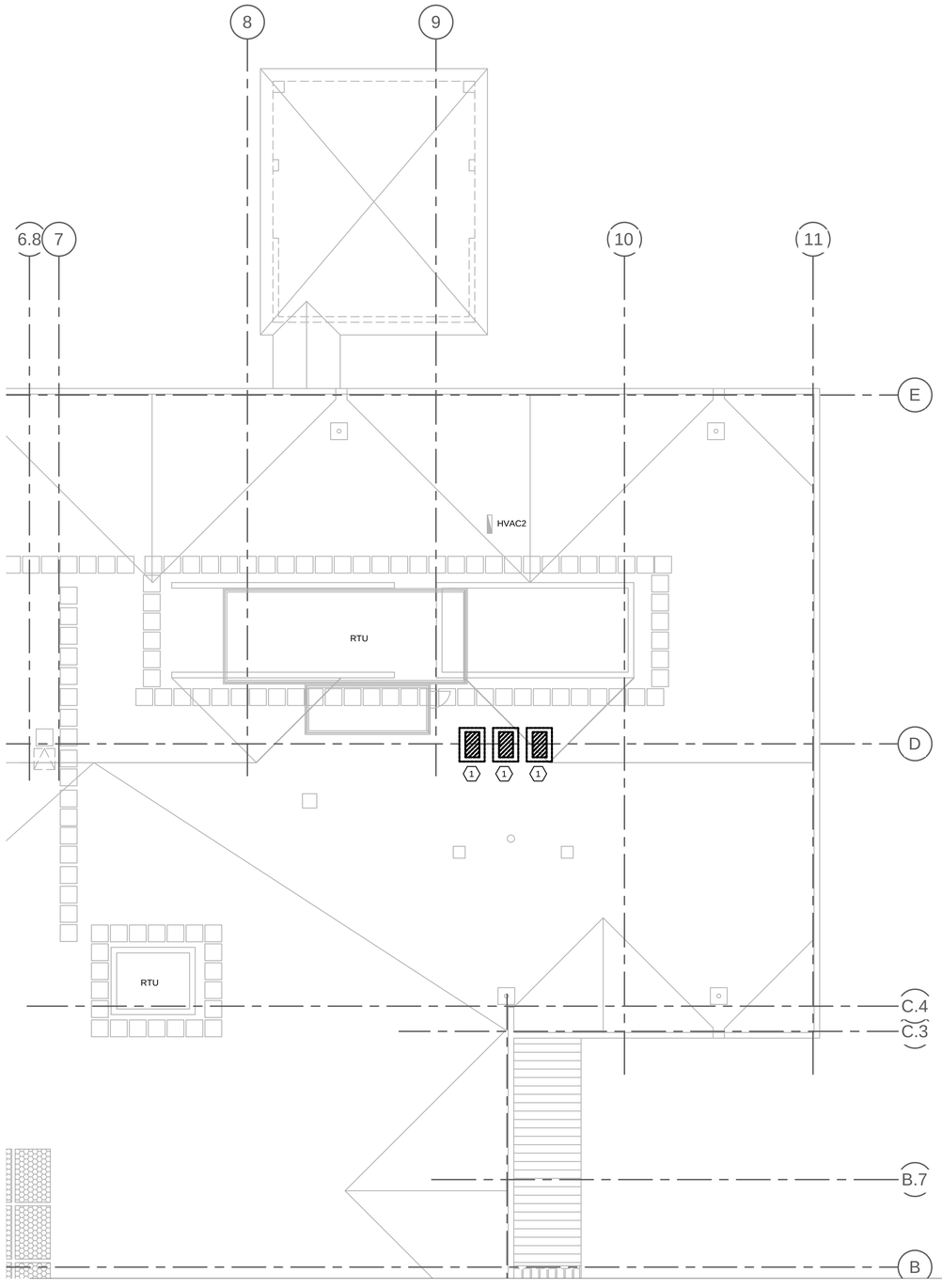
12/17/15

LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

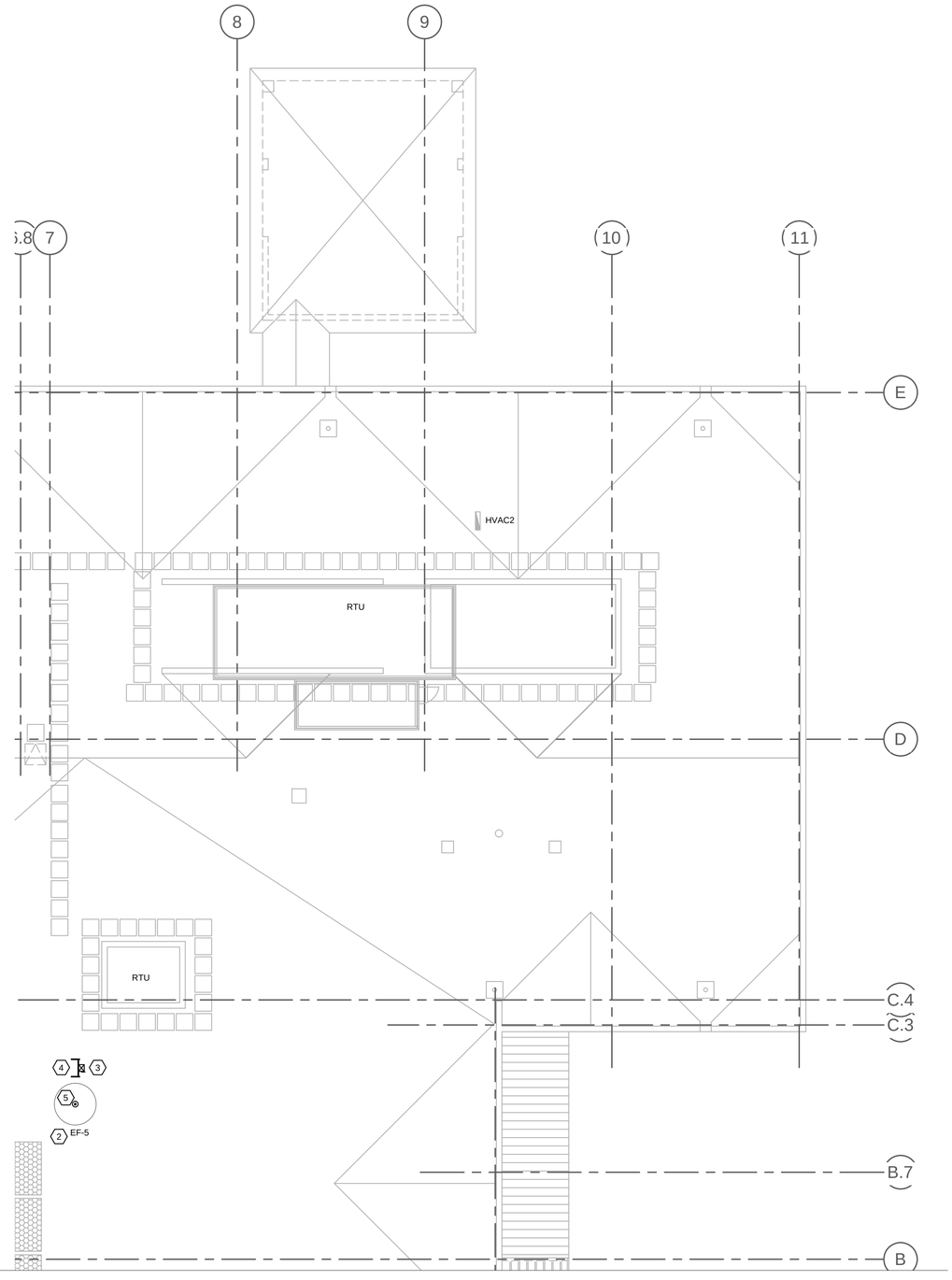
LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
ELECTRICAL PLAN

DATE 12/17/15
SCALE 1/8" = 1'-0"
DWG. NO. E101




1 ELECTRICAL ROOF PLAN - DEMOLITION
1/8"=1'-0"




2 ELECTRICAL ROOF PLAN -NEW WORK
1/8"=1'-0"

## GENERAL NOTES:

1. REFER TO SPECIFICATIONS, SCHEDULES, DETAILS AND GENERAL NOTES SHEET FOR ADDITIONAL SITE REQUIREMENTS.
2. ALL JUNCTION BOXES SHALL BE LABELED WITH THE BRANCH CIRCUIT NUMBERS AND THEIR PANEL ORIGINATIONS.

## KEYED NOTES ⟨X⟩

1. EXISTING HUMIDIFIERS TO BE REMOVED BY OTHERS. DISCONNECT EXISTING CIRCUIT AND REMOVE WIRING BACK TO PANEL. CAP AND SEAL EXISTING CONDUITS AT ROOF PENETRATION. TURN OFF CIRCUIT BREAKER AND MARK AS "SPARE".
2. PROVIDE POWER CONNECTION TO NEW FAN EF-5. CIRCUITING SHALL CONSIST OF 3#10, 1#10G., 3/4"C. PROVIDE NEW 15A/3P CIRCUIT BREAKER IN EXISTING PANEL HVAC2 TO FEED NEW FAN. UPDATE PANEL CIRCUIT DIRECTORY.
3. PROVIDE NEW COMBINATION STARTER DISCONNECT SWITCH, HEAVY DUTY WITH OVERLOADS SIZED PER MOTOR FLA, HAND OFF AUTO SWITCH AND 1NO, 1NC AUXILIARY CONTACT. (30A/3P/480V/NEMA SIZE 1/NEMA 3R ENCLOSURE) TO SERVE NEW EXHAUST FAN.
4. MOUNT COMBINATION STARTER DISCONNECT ON SLOTTED METAL U-CHANNEL RACK ADJACENT TO LOAD TO BE SERVED, AS LOW AS POSSIBLE, IN AN ACCESSIBLE LOCATION, AND PROVIDED WITH NEC REQUIRED WORKING SPACE. ANCHOR TO ROOF USING A 1 FT (MIN) HORIZONTAL BASE PIECE AND 45° ANGLED BRACING PIECE. COORDINATE WITH ROOFING CONTRACTOR.
5. PROVIDE NEW AIR TERMINAL FOR NEW EXHAUST FAN AND CONNECT TO EXISTING LIGHTNING PROTECTION SYSTEM. LIGHTNING PROTECTION CONTRACTOR SHALL FURNISH NEW MASTER LABEL.



STATE OF TEXAS
JARED C WINN
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LICENSED
PROFESSIONAL ENGINEER
12/17/15

| Rev. | Date | Revision | By | Chkd. | Appd. | Appd. |
|---|---|---|---|---|---|---|
| 0 | 12/17/15 | 100% CONSTRUCTION DOCUMENTS | JCW | - | - | - |

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EEA Project No. 20114005B

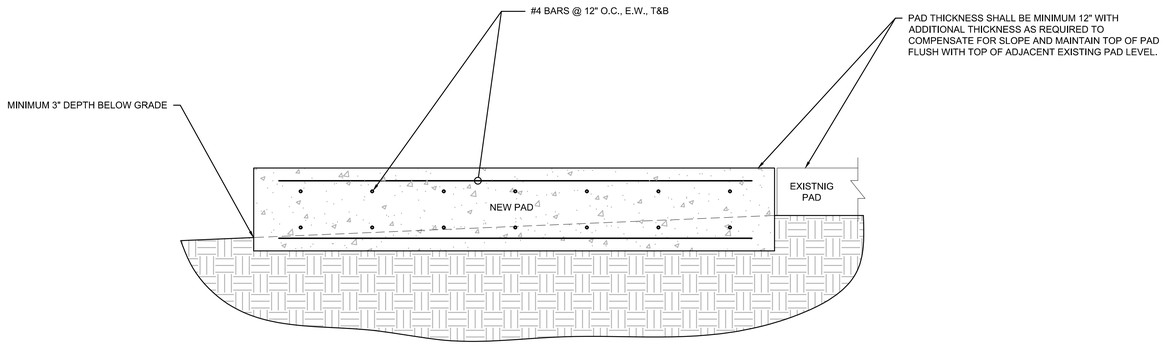
LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
ELECTRICAL ROOF PLANS

DATE 12/17/15
SCALE 1/8" = 1'-0"
DWG. NO. E102

1 2 3 4 5 6 7 8
A B C D E F G H




NOTES:

1. MINIMUM PAD WEIGHT 1-1/2 TIMES WEIGHT OF SUPPORTED EQUIPMENT
2. MINIMUM PAD SIZE - 4" LARGER ALL SIDES OF EQUIPMENT (WHERE SPACE ALLOWS, FIELD VERIFY)
3. INSTALL ANCHOR BOLTS IF REQUIRED AND WELD TO REBARS
4. REFER TO SPECS FOR ISOLATOR REQUIREMENTS

## 1 EQUIPMENT PAD
N.T.S.



STATE OF TEXAS
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12-17-15
REGISTERED PROFESSIONAL ENGINEER

| Rev. | Date | Revision | By | Chkd. | Appd. | Appd. |
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DRAWN BY: MEB
CHKD. BY: EDW
APPD. BY: -
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LOWER COLORADO RIVER AUTHORITY
AUSTIN, TEXAS

LOCATION
ENVIRONMENTAL LABS
3505 MONTOPOLIS DRIVE
AUSTIN, TEXAS 78744

TITLE
EQUIPMENT PAD DETAIL

DATE 12/17/15
SCALE NOT TO SCALE
DWG. NO. S501

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