

ELECTRICAL SYMBOLS

THIS IS A MASTER LEGEND AND NOT ALL SYMBOLS OR ABBREVIATIONS ARE USED

STANDARD MOUNTING HEIGHTS	
ANNUNCIATOR PANELS (DISPLAY)	60"
CONTROLS (CENTER OF DEVICE)	48"
EXIT SIGNS (SEE DRAWINGS)	105"
FIRE ALARM ANNUNCIATOR PANEL (DISPLAY)	60"
FIRE ALARM BELL (EXTERIOR) (CENTERLINE)	120"
FIRE ALARM CONTROL PANEL/UNIT (DISPLAY)	60"
FULL STATIONS (TOP OF DEVICE)	48"
RECEPTACLES (TO CENTER)	16"
RECEPTACLES (EXTERIOR)	24"
RECEPTACLES (GARAGES)	24"
RECEPTACLES (POOLS)	27"
RECEPTACLES (ABOVE COUNTER)	42"
RECEPTACLES IN EQUIPMENT ROOMS	48"
REMOTE INDICATING LIGHT (EQUIPMENT ROOMS)	44"
REMOTE INDICATING LIGHT (FINISHED AREAS)	48"
SAFETY SWITCHES (TOP OF DEVICE)	60"
STARTERS (TOP OF DEVICE)	60"
SWITCHES (TOP OF DEVICE)	48"
TELEPHONE, DATA OUTLETS	SAME AS ADJACENT DEVICE, UNO
TELEPHONE TERMINAL BOARD (BOTTOM)	REFER TO ARCH DRAWINGS
TELEVISION OUTLETS	84"
FIRE ALARM DEVICES (CENTERLINE)	84"

ABBREVIATIONS	
AF	AMPERE FRAME SIZE
AFC	ABOVE FINISHED CEILING
AFB	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHJ	AUTHORITY HAVING JURISDICTION
AHU	AIR HANDLING UNIT
AIC	AMPERE INTERRUPTING CAPACITY
AS	AMPERE SWITCH
AT	AMPERE TRIP SETTING
ATS	AUTOMATIC TRANSFER SWITCH
AV	AUDIO VISUAL
BAS	BUILDING AUTOMATION SYSTEM
BKR	BREAKER
C	CONDUIT
CAT	CATEGORY
CATV	CABLE TELEVISION SYSTEM
CCTV	CLOSED CIRCUIT TELEVISION
CD	CANDELA
CKT	CIRCUIT
CODE	APPLICABLE CODE ADOPTED BY JURISDICTION
CT	CURRENT TRANSFORMER
CTR	CENTER
CVD	CUMULATIVE VOLTAGE DROP
DEMO	DEMOLITION
DDPT	DOUBLE-POLE
DPST	DOUBLE-THROW
DPST	DOUBLE-THROW
(E)	EXISTING
EC	ELECTRICAL CONTRACTOR
EF	EXHAUST FAN
EM	EMERGENCY
EMS	ENERGY MANAGEMENT SYSTEM
ETR	EXISTING TO REMAIN
EWC	ELECTRIC WATER COOLER
FAAP	FIRE ALARM ANNUNCIATOR PANEL
FAC	FIRE ALARM CONTROL PANEL
FCA	FAULT CURRENT AMPS AVAILABLE
FCU	FAN COIL UNIT
FF	FINISHED FLOOR
FLA	FULL LOAD AMPS
FLR	FLOOR
GC	GENERAL CONTRACTOR
GEC	GROUNDING ELECTRODE CONDUCTOR
GES	GROUNDING ELECTRODE SYSTEM
GFR	GROUND FAULT RELAY
G	GROUND
IG	ISOLATED GROUND
ISC	SHORT CIRCUIT CURRENT
JBX-BOX	JUNCTION BOX
LF	LINEAR FEET
LRA	LOCKED ROTOR AMPS
LIGHTS	LIGHTING/LIGHTS
MAU	MAKE-UP AIR UNIT
MAX	MAXIMUM
MCA	MINIMUM CIRCUIT AMPACITY
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MFR	MANUFACTURER
MIN	MINIMUM
MLO	MAIN LUGS ONLY
MOC	MAXIMUM OVERCURRENT PROTECTION
MTD	MOUNTED
N/A	NOT APPLICABLE
NF	NON-FUSED
NL	NIGHT LIGHT (24HR ON)
NRTL	NATIONALLY RECOGNIZED TESTING LABORATORY (CSA, ETL, NSF, UL)
OS	OCCUPANCY SENSOR
P	POLE
PART	PARTIAL CIRCUIT
PHØ	PHASE
PNL	PANEL
PNLBD	PANELBOARD
PROVIDE	FURNISH AND INSTALL
PT	POTENTIAL TRANSFORMER
QTY	QUANTITY
RCP	RECEPTACLE
RELO	RELOCATE
RLA	RUNNING LOAD AMPS
RTU	ROOFTOP UNIT
SCCR	SHORT-CIRCUIT CURRENT RATING
SD	SMOKE DUCT DETECTOR
SF	SQUARE FEET
SPOT	SINGLE-POLE
SPST	SINGLE-THROW
ST	SHUNT TRIP
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
TBB	TELECOMMUNICATIONS BONDING BACKBONE
TBD	TELECOMMUNICATIONS
TGB	TELECOMMUNICATIONS
TL	GROUND BUS BAR
TMBG	TELECOMMUNICATIONS MAIN
TX	TRANSFORMER
TYP	TYPICAL
UF	UNDERFLOOR
UG	UNDERGROUND
UIS	UNDERSLAB
UH	UNIT HEATER
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTIBLE POWER SUPPLY
VD	VOLTAGE DROP
VFD	VARIABLE FREQUENCY DRIVE
W	WIRE
WTH	WITH
WP	WEATHER PROOF
WR	WEATHER RESISTANT
WT	WATERTIGHT
XP	EXPLOSION-PROOF

ANNOTATION	
1	ELECTRICAL OR FIRE ALARM PLAN NOTE CALLOUT
1	PLUMBING EQUIPMENT DESIGNATION (CONTRACTOR FURNISHED AND INSTALLED), REFER TO PLUMBING FIXTURE OR EQUIPMENT SCHEDULES
1	EQUIPMENT DESIGNATION (OWNER FURNISHED, CONTRACTOR INSTALLED)
CU	MECHANICAL EQUIPMENT DESIGNATION (CONTRACTOR FURNISHED AND INSTALLED UNLESS NOTED OTHERWISE)
1	DETAIL REFERENCE UPPER NUMBER INDICATES DETAIL NUMBER
1	LOWER NUMBER INDICATES SHEET NUMBER
1	SECTION CUT DESIGNATION

CIRCUITING & WIRING	
P1-3,5,7	HOMERUN TO PANELBOARD, INFORMATION AT ARROWS ARE CIRCUIT NUMBERS AND PANELBOARD FOR TERMINATION, REFER TO PANELBOARD SCHEDULES FOR BRANCH CIRCUIT CONDUCTOR SIZES.
	CIRCUIT CONTINUATION OR PARTIAL CIRCUIT
	CONDUIT CONCEALED
	CONDUIT IN/UNDER FLOOR/GROUND CONSTRUCTION
	EXPOSED CONDUIT
	LOW VOLTAGE CABLE
	CONDUIT TURNING DOWN
	CONDUIT TURNING UP

ABBREVIATIONS	
EXISTING	NEW
DEMOLISH	FUTURE

LINTYPE LEGEND	
THROUGHOUT THE DRAWINGS DIFFERENT LINE TYPES ARE USED IN COMBINATION WITH THE SYMBOLS TO INDICATE THE STATUS OF ITEMS AS EXISTING, TO BE DEMOLISHED, TO BE INCLUDED AS PART OF NEW WORK AND/OR ITEMS WHICH ARE ANTICIPATED TO BE PROVIDED IN THE FUTURE. THE STATUS OF ITEMS USING THESE LINTYPES ARE RELATIVE TO THE VIEW IN WHICH THEY APPEAR. PHASING SHOWN IN DRAWINGS IS NOT INTENDED TO FULLY DESCRIBE ALL NECESSARY CONSTRUCTION PHASING, WHICH IS DETERMINED BY THE CONTRACTOR AS PART OF THEIR RESPONSIBILITIES. ANY SUCH PHASING DESCRIBED IN THE CONSTRUCTION DOCUMENTS ARE GENERAL AND ONLY INTENDED TO INDICATE A BROAD ORDER FOR THE SAKE OF DESCRIBING THE PROJECT. THE FOLLOWING LINTYPES MAY BE USED ON ANY DEVICE, EQUIPMENT, NOTE, LINE, SHAPE, ETC.	

LIGHTING CONTROL DEVICES	
§	SINGLE POLE SWITCH (NO LETTER DESIGNATION)
§	SWITCH LETTER TYPE DESIGNATIONS AS FOLLOWS: 2 = TWO POLE 3 = THREE-WAY 4 = FOUR-WAY D = DIMMER DO = DIMMING OCCUPANCY SENSOR F = FAN SPEED CONTROL K = KEYS LV = LOW VOLTAGE O = OCCUPANCY SENSOR P = PILOT LIGHT V = VACANCY SENSOR WP = WEATHER PROOF
ALC	AUTOMATIC LOAD CONTROL RELAY
BTS	BRANCH CIRCUIT TRANSFER SWITCH
R#	RELAY OR CONTACTOR (# = SERIES)
◇	LIGHTING CONTROL PHOTOCCELL (SHADE INDICATES AIMING)
TS	TIME SWITCH
CU	CEILING OCCUPANCY SENSOR DESIGNATIONS: IR = INFRARED DT = DUAL-TECH US = ULTRASONIC MP = MICROPHONE

POWER EQUIPMENT & DEVICES	
	ELECTRICAL PANELBOARD (SURFACE OR FLUSH MOUNT)
	CONTROL SYSTEM CABINET (CONTROLS, SECURITY, A/V)
	PLYWOOD TERMINAL BOARD FOR TELEPHONE SYSTEM, UNO, SIZE AS NOTED
	SWITCHBOARD OR MOTOR CONTROL CENTER ON HOUSEKEEPING PAD
	ELECTRICAL DISTRIBUTION PANELBOARD
T	TRANSFORMER
⊖	MOTOR
2000/1500R	DISCONNECT SWITCH - "2000/1500R" DENOTES AMPERES/POLE/FUSE/NEMA ENCLOSURE RATING, NF= NON-FUSED, CB= CIRCUIT BREAKER (200/3CB), NO VALUE (200/3/150) FOR NEMA ENCLOSURE MEANS STANDARD NEMA 1 RATING
300/15/12R	COMBINATION DISCONNECT (SAFETY) SWITCH AND MOTOR STARTER "300/15/12R" DENOTES AMPERES/POLE/FUSE/NEMA STARTER SIZE/NEMA ENCLOSURE RATING, NF= NON-FUSED, CB= CIRCUIT BREAKER (300/3CB), NO VALUE (300/3/15) FOR NEMA ENCLOSURE MEANS STANDARD NEMA 1 ENCLOSURE RATING
M	MAGNETIC MOTOR STARTER, NEMA SIZE AS NOTED, 3-POLE, UNO
MS	MANUAL MOTOR STARTER DISCONNECT
VFD	VARIABLE FREQUENCY DRIVE
⊖	LOW-VOLTAGE PUSH-BUTTON (AUTO-OPENER / SECURITY)
⊖	BINDICATOR SWITCH/SENSOR
⊖	SONIC SCANNER SENSOR

LIGHTING (REFER TO LIGHT FIXTURE SCHEDULE FOR MORE INFO)	
⊖	LIGHT FIXTURE
⊖	⊖ = SWITCHED BY SWITCH "S"
⊖	A = LIGHT FIXTURE TYPE "A"
⊖	NL = NIGHT LIGHT FIXTURE
⊖	⊖ = WALL MOUNT
⊖	⊖ = ARROW INDICATES AIMING DIRECTION
⊖	LIGHT FIXTURE CIRCUITED ON BACK-UP POWER (NOT EGRESS)
⊖	EMERGENCY LIGHT FIXTURE WITH EMERGENCY LIGHTING BATTERY PACK OR CONNECTED TO LIFE-SAFETY GENERATOR CIRCUIT
⊖	NL = NIGHT LIGHT FIXTURE
⊖	LIGHT FIXTURE WITH DUAL BALLASTS CIRCUITED SEPARATELY (SHADING IMPLIES EMERGENCY LIGHT FIXTURE)
⊖	LIGHTING TRACK WITH LIGHT FIXTURE TYPES AS INDICATED
⊖	EXTERIOR SITE PARKING LOT LIGHT FIXTURE
⊖	EXTERIOR PEDESTRIAN POST TOP LIGHT FIXTURE
⊖	EXTERIOR LIT BOLLARD LIGHT FIXTURE
⊖	EXIT SIGN - CEILING / WALL MOUNTED, ARROWS AS INDICATED, FACE HATCHED
⊖	EMERGENCY LIGHTING UNIT EQUIPMENT WITH BATTERY PACK - CEILING/WALL MOUNTED

WIRING DEVICES & BOXES	
⊖	SIMPLEX RECEPTACLE - NEMA 5-20R, UNO
⊖	DUPLEX RECEPTACLE - NEMA 5-20R, UNO
⊖	DOUBLE DUPLEX RECEPTACLE - NEMA 5-20R, UNO
⊖	SPECIAL RECEPTACLE - NEMA TYPE AS NOTED
⊖	GFCI TYPE RECEPTACLE*
⊖	ISOLATED GROUND TYPE RECEPTACLE*
⊖	EMERGENCY RECEPTACLE*
⊖	RECEPTACLE INSTALLED ABOVE COUNTER OR BACKSPASH*
⊖	RECEPTACLE INSTALLED IN CEILING*
⊖	RECEPTACLE INSTALLED IN FLOOR*
⊖	RECEPTACLE INSTALLED VIA DROP CORD*
⊖	RECEPTACLE LETTER DESIGNATIONS AS FOLLOWS: C = AUTOMATICALLY CONTROLLED D = DEMOLISHED E = EXISTING EM = EMERGENCY POWER ER = EXISTING TO BE RELOCATED GFCI = GROUND FAULT CIRCUIT INTERRUPTER H = HORIZONTALLY MOUNTED IG = ISOLATED GROUND R = RELOCATED, NEW LOCATION S = MANUALLY SWITCHED TR = TAMPER RESISTANT TV = TELEVISION USB = USB/DUPLEX WR = WEATHER PROOF COVER WR = WEATHER RESISTANT
⊖	JUNCTION BOX/OUTLET BOX

TECHNOLOGY DEVICES & BOXES	
⊖	MULTI-OUTLET ASSEMBLY
⊖	TELEPHONE OUTLET
⊖	DATA OUTLET
⊖	MULTI-SERVICE OUTLET, TELEPHONE AND DATA
⊖	ABOVE COUNTER, TYP
⊖	WALL, TYP (W - HANGING PHONE)
⊖	FLOOR, TYP
⊖	MULTI-SERVICE POWER POLE WITH TELEPHONE, DATA AND POWER OUTLETS A = TYPE, REFER TO PLANS, SCHEDULES AND SPECIFICATIONS
⊖	MULTI-SERVICE FLOOR BOX WITH TELEPHONE, DATA AND POWER OUTLETS A = TYPE, REFER TO PLANS, SCHEDULES AND SPECIFICATIONS
⊖	POKE THROUGH, A = TYPE, REFER TO PLANS, SCHEDULES AND SPECIFICATIONS
⊖	THERMOSTAT
⊖	DATA/TECHNOLOGY JUNCTION BOX/OUTLET BOX
⊖	LOW-VOLTAGE CABLE JUNCTION BOX/OUTLET BOX
⊖	LOW-VOLTAGE CONTROL PANEL

ELECTRICAL ONE-LINE	
⊖	SWITCH (RATING AS INDICATED)
⊖	FUSED SWITCH (RATING, POLES AND FUSE TYPE AS INDICATED)
⊖	CIRCUIT BREAKER (RATINGS AS INDICATED)
⊖	PANELBOARD, SINGLE OR MULTI-SECTION (REFER TO SCHEDULES)
⊖	ISOLATED POWER PANELBOARD W/ INTEGRAL TRANSFORMER (REFER TO SCHEDULES)
⊖	TRANSFORMER (TYPE AND RATINGS AS INDICATED)
⊖	SHIELDED TRANSFORMER (TYPE AND RATINGS AS INDICATED)
⊖	AUTOMATIC TRANSFER SWITCH (RATINGS AS INDICATED)
⊖	AUTOMATIC TRANSFER SWITCH WITH BYPASS (RATINGS AS INDICATED)
⊖	GENERATOR (RATINGS AS INDICATED)
⊖	NON-SEPARATELY DERIVED SOURCE OR SEPARATELY DERIVED SOURCE
⊖	SWITCHGEAR, SWITCHBOARD AND/OR DISTRIBUTION PANELBOARD (TYPE, RATING, DEVICES AND ACCESSORIES AS INDICATED)
⊖	COMBINATION DIGITAL VOLT METER/AMMETER
⊖	CIRCUIT IDENTIFICATION (REFER TO CIRCUIT SCHEDULE)
⊖	GROUND FAULT RELAY
⊖	PHASE FAILURE RELAY
⊖	KIRK-KEY INTERLOCK
⊖	SHUNT-TRIP RELAY
⊖	AMMETER, RANGE AS SPECIFIED OR REQUIRED
⊖	VOLTMETER, RANGE AS SPECIFIED OR REQUIRED
⊖	UTILITY METER (AS REQUIRED BY UTILITY)
⊖	CURRENT TRANSFORMER RATING AS SPECIFIED OR REQUIRED
⊖	POTENTIAL TRANSFORMER RATING AS SPECIFIED OR REQUIRED
⊖	TRANSIENT VOLTAGE SURGE SUPPRESSOR
⊖	GROUND CONNECTION
⊖	GROUND CONNECTION WITH TEST WELL
⊖	GROUND CONNECTION AND GROUND ROD
⊖	OPEN / CLOSED CONTACTORS
⊖	HEATER
⊖	MOTOR
⊖	BLOCK LOAD KW OR KVA
⊖	FAULT POINT REFERENCED IN SHORT CIRCUIT CURRENT AND VOLTAGE DROP SPREADSHEET
⊖	CONNECTION POINT OR EQUIPMENT TERMINATION

PROJECT SCOPE	
THESE DRAWINGS HAVE BEEN PRODUCED TO ASSIST WITH THE ELECTRICAL SYSTEM INSTALLATION PROCESS BY CLARIFYING ALL POWER AND COMMUNICATION CONNECTION POINTS FOR MANUFACTURING AND STORAGE EQUIPMENT AS SCIENTEX INC. - PHOENIX. THESE DRAWINGS HAVE BEEN ENGINEERED AND DRAFTED BY BRETT LORENZEN, PE, LEED AP BDC. ALL NORMAL AND EGRESS LIGHTING IS EXISTING TO REMAIN, ALL OTHER DESIGN ELEMENTS ARE BY OTHERS. OPTIMIZED LIGHTING ENGINEERING AND DESIGN, BRETT LORENZEN, AND RELATED ENTITIES SHALL BE RELEASED FROM HARM ASSOCIATED WITH THE ACCURATE REPRESENTATION AND/OR CODE COMPLIANCE OF EXISTING SYSTEMS AND DESIGN ELEMENTS COMPLETED BY OTHERS.	

PROJECT NOTES	
1. PROVIDE ALL SUB-CONTRACTORS A COMPLETE SET OF FULL-SIZE CONSTRUCTION DOCUMENTS AND FULLY COORDINATE WORK WITH PROJECT TRADES.	
2. CONTRACTOR SHALL BE FAMILIAR WITH THE EXISTING CONDITIONS UNDER WHICH THEY WILL HAVE TO OPERATE AND WHICH MAY AFFECT THE WORK.	
3. CONTRACTOR SHALL REVIEW THE GENERAL NOTES, SPECIFICATIONS AND ALL CONSTRUCTION DOCUMENTS FOR ADDITIONAL REQUIREMENTS THAT MAY NOT BE SPECIFICALLY CALLED OUT IN THIS SECTION.	
4. ELECTRICAL DRAWINGS ARE DIAGRAMMATIC IN NATURE AND REPRESENT THE GENERAL SCOPE OF THE WORK AS IT PERTAINS TO THE ENGINEERED SYSTEMS AT HAND. NOTIFY THE ENGINEER OF ANY CONFLICTS OR DISCREPANCIES.	
5. PRIOR TO PURCHASING ANY PANELS, PROTECTIVE DEVICES, SWITCHES, STARTERS, FUSES, CONDUIT, WIRE, ETC. TO FEED ANY PIECE OF EQUIPMENT VERIFY THE VOLTAGE, PHASE, AND LOAD OF THAT ITEM IN THE FIELD AND CONTACT ENGINEER IF THERE ARE ANY INCONSISTENCIES.	
6. VERIFY EXACT LOCATIONS AND ELEVATION OF ALL EQUIPMENT IN THE FIELD WITH THE OWNER PRIOR TO ROUGH-IN. FINAL CONNECTIONS OF EQUIPMENT SHALL BE PER MANUFACTURERS RECOMMENDATIONS. ALL MATERIALS REQUIRED TO PROVIDE FINAL CONNECTION TO THE EQUIPMENT SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR.	
7. ALL WORK SHALL CONFORM TO THE LATEST EDITIONS OF LOCAL, STATE, AND NATIONAL CODES AND ORDINANCES. DRAWINGS AND SPECIFICATIONS GOVERN WHERE THEY EXCEED CODE REQUIREMENTS.	
8. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT ALL PEOPLE AND STRUCTURES FROM DAMAGE, HARM OR INJURY THROUGHOUT THE COURSE OF CONSTRUCTION.	
9. ANY SITE DAMAGES SHALL BE REPLACED IN KIND WITH NO COST TO THE OWNER.	
10. THE CONTRACTOR SHALL EMPLOY QUALIFIED AND EXPERIENCED TRADESPEOPLE FOR THIS WORK.	
11. FURNISH ALL LABOR, MATERIALS, TOOLS, ACCESSORIES, ETC. REQUIRED FOR A COMPLETE AND OPERABLE SYSTEM.	
12. ALL CIRCUITS SHALL BE PROVIDED WITH AN INSULATED GREEN GROUNDING CONDUCTOR.	
13. CABLE LENGTHS WHEN INDICATED ARE APPROXIMATE AND USED FOR ENGINEERING CALCULATIONS ONLY. CONTRACTOR SHALL NOT UTILIZE FOR MATERIAL TAKE-OFFS.	
14. MAINTAIN WORKING CLEARANCES AROUND ALL ELECTRICAL EQUIPMENT PER NEC ARTICLE 110.	
15. ALL EQUIPMENT DEFINED IN THIS SCOPE OF WORK IS NEW UNLESS OTHERWISE INDICATED.	
16. PROVIDE NAMEPLATE FOR EQUIPMENT CONTROL PANELS PER NEC ARTICLE 409.	
17. LABEL ALL ELECTRICAL EQUIPMENT, FEEDER BREAKERS, JUNCTION BOXES, AND DEVICES AS INDICATED WITHIN PROJECT SPECIFICATIONS.	
18. PERFORM ALL WORK AS TO MINIMIZE ELECTRICAL AND MANUFACTURING SYSTEM DOWNTIME. SCHEDULE ALL INTERRUPTIONS WITH OWNER AT LEAST 5 DAYS PRIOR.	

SHEET LIST	
E0.0	ELECTRICAL SYMBOLS, NOTES, AND ABBREVIATIONS
E1.0	ELECTRICAL POWER PLAN - OVERALL
E1.1	ELECTRICAL POWER PLAN - WEST
E1.2	ELECTRICAL POWER PLAN - EAST
E2.1	ELECTRICAL SCHEDULES AND DETAILS
E4.1	ELECTRICAL SPECIFICATIONS 1
E4.2	ELECTRICAL SPECIFICATIONS 2
E4.3	ELECTRICAL SPECIFICATIONS 3



Lighting | Engineering | Design
842 EAST ISABELLA AVE, MESA, AZ, 85204
WWW.OPTIMIZEDLED.COM | 602-699-6224
PROJECT: SC190317
EOR: BRETT LORENZEN
brett.lorenz@optimizedled.com
AZ 53437 FIRM 21458 | CA 22600 | CO 50367
PHOTO: COURTESY OF SCIENTEX INC. (PHOTOGRAPHY BY BRETT LORENZEN)
*THIS DOCUMENT IS THE PROPERTY OF OPTIMIZED LED. IT IS TO BE USED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREIN. IT IS NOT TO BE REPRODUCED, COPIED, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM. ANY UNAUTHORIZED USE OF THIS DOCUMENT IS STRICTLY PROHIBITED. © 2019 OPTIMIZED LED. ALL RIGHTS RESERVED.

STAMP:
This drawing is the professional intellectual property of Optimized LED and protected by Copyright. Usage of this drawing shall be restricted for use as a project example and shall not be reproduced, recreated, or utilized for any other purpose without express written consent of Optimized LED.

SCIENTEX INC. - PHOENIX
ELECTRICAL INSTALL DRAWINGS

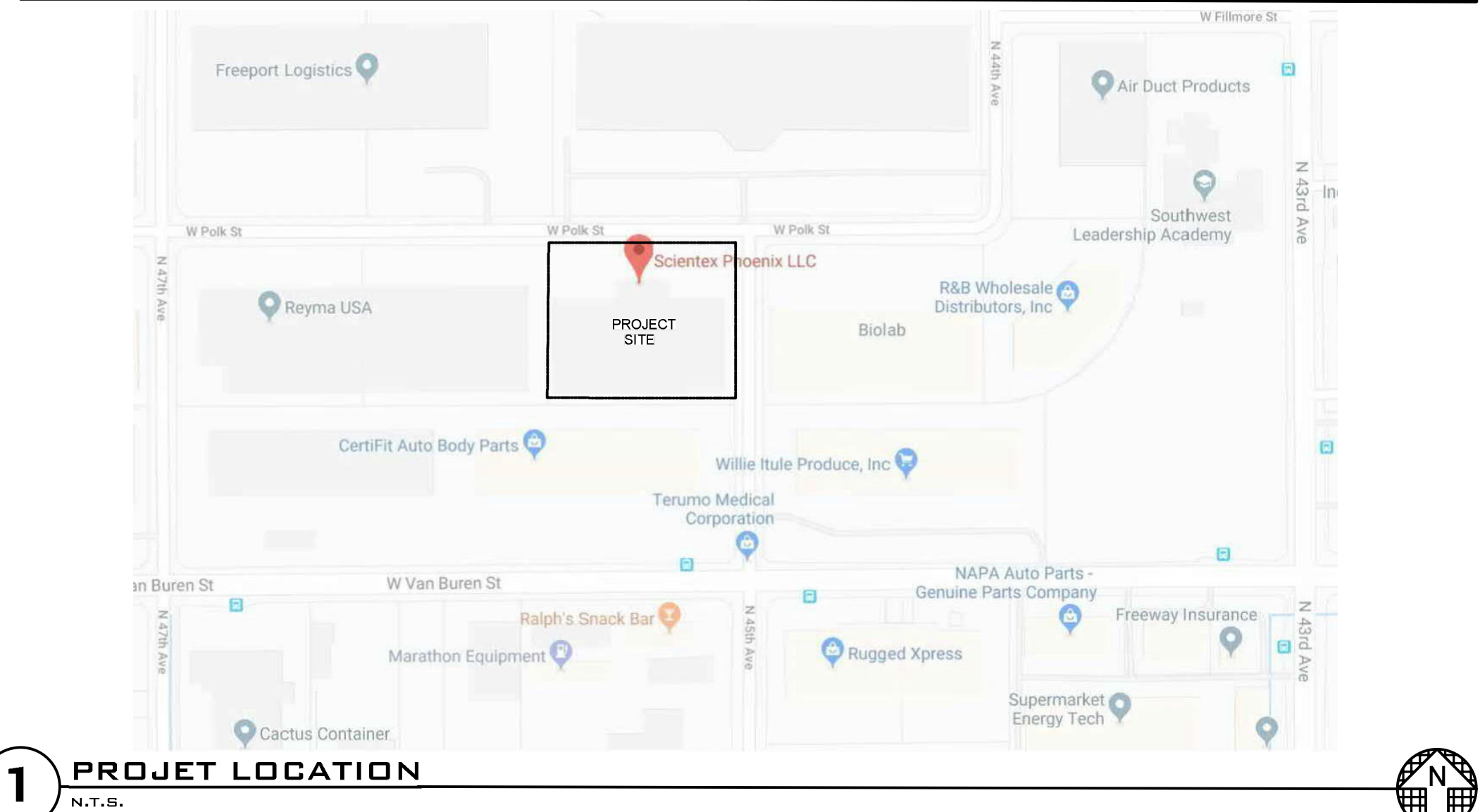
DRAWN:	CHECKED:	NUMBER:
B5L	B5L	5C1190117

DATE:	ISSUED FOR:
07/05/19	FOR PRICING

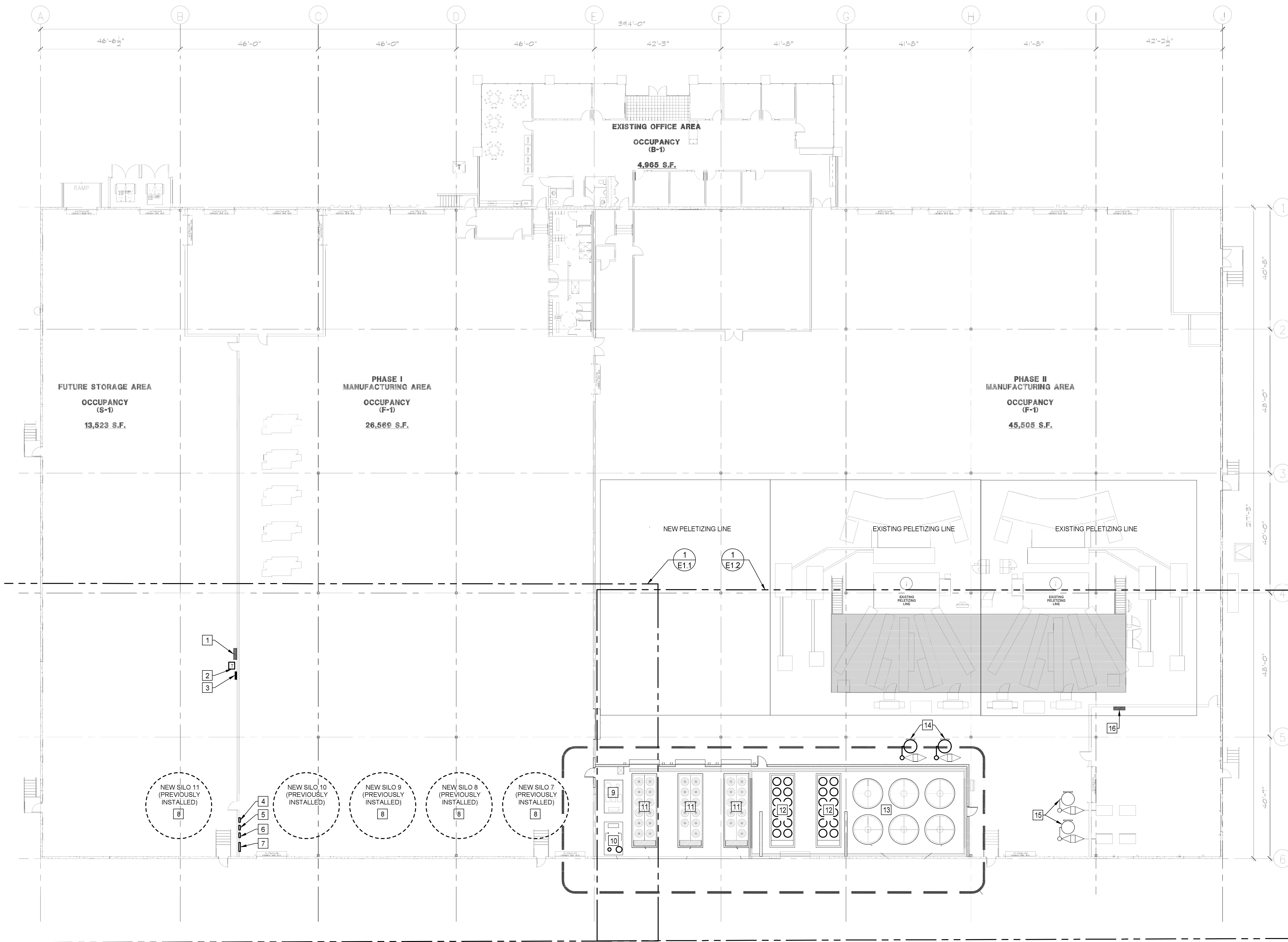
SHEET NAME
ELECTRICAL SYMBOLS, GENERAL NOTES, ABBREVIATIONS

SHEET NUMBER
E0.0

7/6/2019 4:39:05 PM



1 PROJECT LOCATION
N.T.S.



- GENERAL NOTES**
- A. REFER TO ELECTRICAL SYMBOLS, ABBREVIATIONS, AND GENERAL NOTES FOR ADDITIONAL INFORMATION BEFORE ESTIMATING OR CONSTRUCTION FROM THIS SHEET.
 - B. REFER PANELBOARD SCHEDULES, EQUIPMENT SCHEDULE, AND LOAD CALCULATIONS, FOR ADDITIONAL INFORMATION.
 - C. REFER TO SHEET E1.1 AND E1.2 FOR SPECIFIC INSTALLATION REQUIREMENTS.
 - D. REFERENCE CONAIR 'RESIN CONVEYING/STORING SYSTEM ELECTRICAL FLOW AND FIELD WIRING DIAGRAM' SHEET EC-6100347-E1 (BY OTHERS).
 - E. SEAL ALL WALL PENETRATIONS WITH APPROPRIATE SEALANT TYPE, PROVIDE FIRE-PROOFING WHERE REQUIRED.
 - F. PROTECT EXISTING EQUIPMENT, STRUCTURE, AND PERSONNEL FROM HARM.
 - G. COMPLY WITH ALL SPECIFICATIONS OUTLINED ON SHEET E4.1 - 4.3.
 - H. ALL LIGHTING IS EXISTING TO REMAIN.
 - I. PROVIDE NEW MELAMINE LABELS WITH WHITE BACKGROUND AND 3/8" BLACK TEXT MATCHING EXISTING FACILITY FORMAT.

- KEYED NOTES**
1. EXISTING 800A, 480V, DISTRIBUTION PANELBOARD 'DPH'.
 2. NEW 75KVA 480V - 208/120V TRANSFORMER 'T-PBLW'.
 3. NEW 225A, 208/120V PANELBOARD 'PBLW'.
 4. NEW SILO LEVEL INDICATOR PANEL.
 5. NEW CP-300 VALVE DIVERTER PANEL.
 6. NEW MV SCANNER SYSTEM MODULES.
 7. NEW TRANSFER LINE DIVERTER VALVES.
 8. NEW CST STORAGE SILOS ASSOCIATED WITH THIS WORK PREVIOUSLY INSTALLED BY CONAIR INC.
 9. EXISTING CHILLED WATER PUMP SKID FOR MANUFACTURER EXTRUDER PELETIZING MACHINES.
 10. NEW CHILLED WATER PUMP SKID FOR MANUFACTURER EXTRUDER PELETIZING MACHINES.
 11. EXISTING AIR-COOLED CHILLERS FOR CHILLED WATER TO MANUFACTURER EXTRUDER PELETIZING MACHINES.
 12. NEW AIR-COOLED CHILLERS FOR CHILLED WATER TO MANUFACTURER EXTRUDER PELETIZING MACHINES.
 13. EXISTING MATERIAL STORAGE SILOS.
 14. NEW TRANSFER SYSTEM VACUUM PUMPS.
 15. EXISTING RAIL-CAR UNLOADING SYSTEM PUMPS.
 16. EXISTING 800A, 480V, DISTRIBUTION BOARD 'DB-1'.

1 ELECTRICAL POWER PLAN - OVERALL
1/16" = 1'

OPTIMIZOD
Lighting | Engineering | Design
842 EAST ISABELLA AVE, MESA, AZ 85204
WWW.OPTIMIZEDLED.COM | 602-899-6224
PROJECT: SC190017
EOR: BRETT LORENZEN
brett.lorenzen@optimizedled.com
AZ 53437 FIRM 21458 (CA 22600) CO 55367
This drawing is the intellectual property of Optimized LED and is protected by Copyright. Usage of this drawing shall be restricted to use as a project example and shall not be reproduced, recreated, or utilized for any other purpose without express written consent of Optimized LED.

SCIENTEX INC. - PHOENIX
ELECTRICAL INSTALL DRAWINGS

DRAWN:	CHECKED:	NUMBER:
B5L	B5L	SC1190017

REVISIONS:

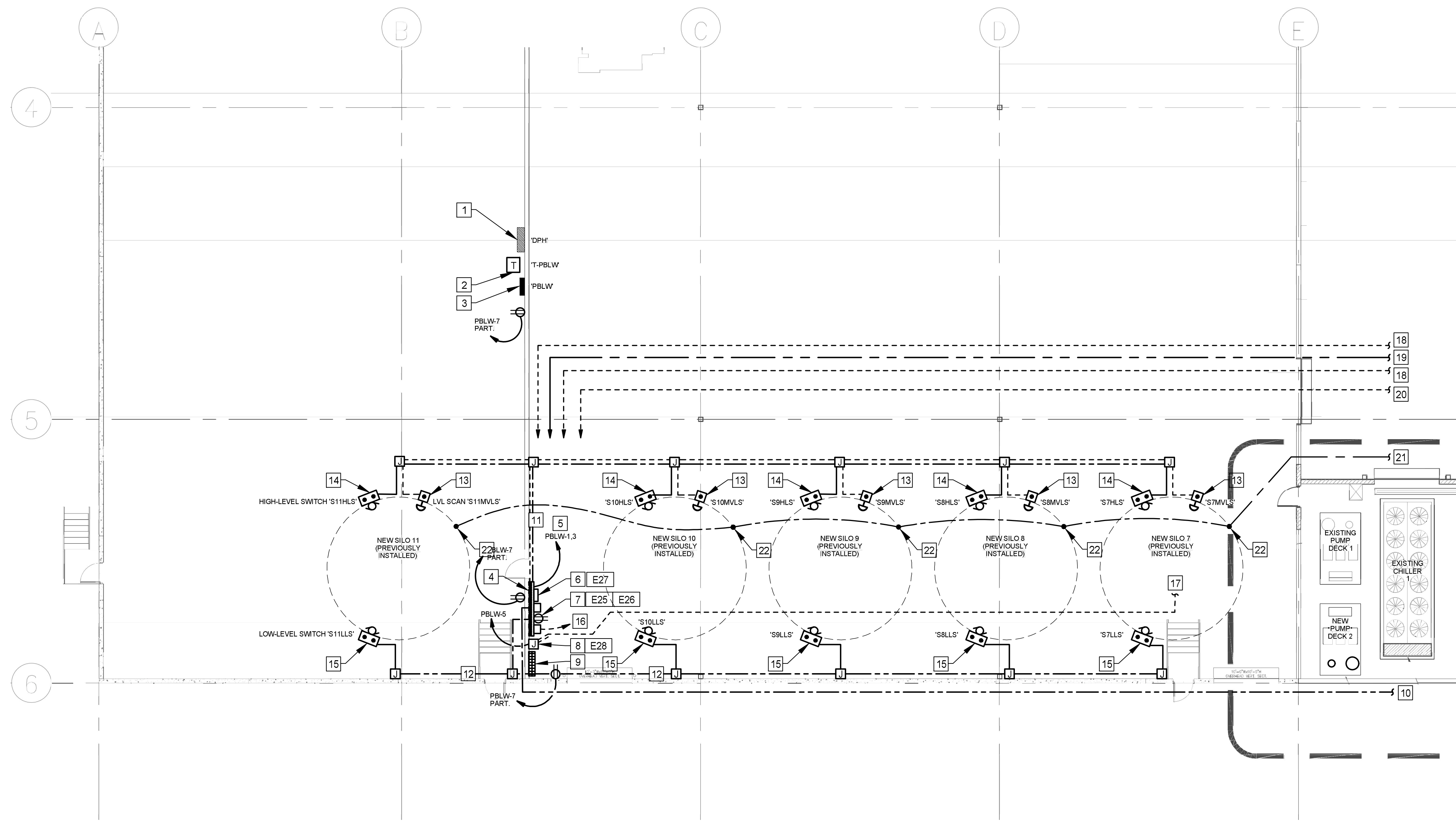
DATE: 07/05/19 ISSUED FOR: FOR PRICING

SHEET NAME
ELECTRICAL POWER PLAN
OVERALL

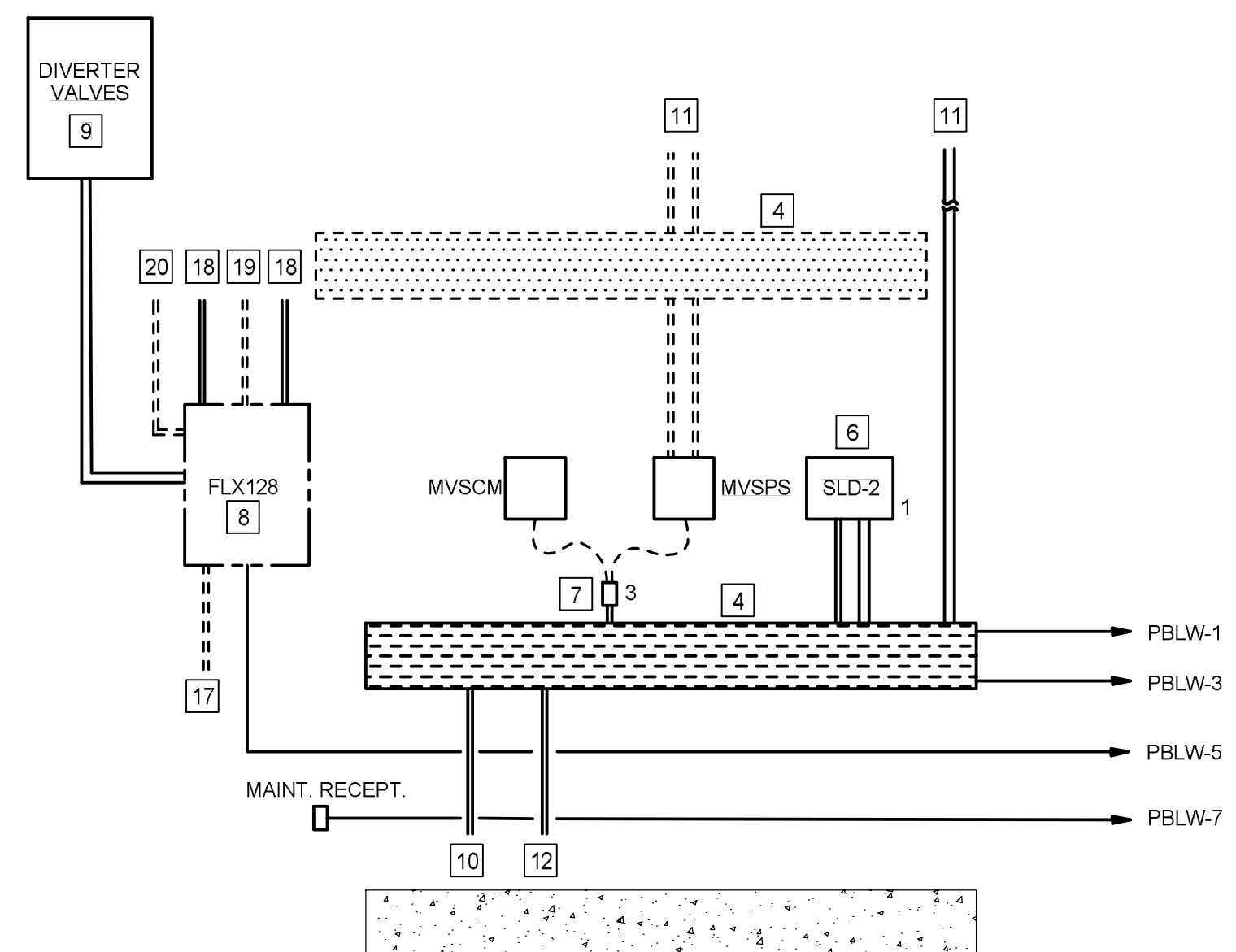
SHEET NUMBER

E1.0

7/6/2019 4:39:10 PM



1 ELECTRICAL POWER PLAN - OVERALL
3/32" = 1'



2 CONTROL WALL ELEVATION
1/2" = 1'

GENERAL NOTES

- A. REFER TO ELECTRICAL SYMBOLS, ABBREVIATIONS, AND GENERAL NOTES FOR ADDITIONAL INFORMATION BEFORE ESTIMATING OR CONSTRUCTION FROM THIS SHEET.
- B. REFER PANELBOARD SCHEDULES, EQUIPMENT SCHEDULE, AND LOAD CALCULATIONS, FOR ADDITIONAL INFORMATION.
- C. REFERENCE CONAIR 'RESIN CONVEYING/STORING SYSTEM ELECTRICAL FLOW AND FIELD WIRING DIAGRAM' SHEET EC-6100347-E1 (BY OTHERS).
- D. SEAL ALL WALL PENETRATIONS WITH APPROPRIATE SEALANT TYPE. PROVIDE FIRE-PROOFING WHERE REQUIRED.
- E. PROTECT EXISTING EQUIPMENT, STRUCTURE, AND PERSONNEL FROM HARM.
- F. COMPLY WITH ALL SPECIFICATIONS OUTLINED ON SHEET E4.1 - 4.3.
- G. ALL LIGHTING IS EXISTING TO REMAIN.
- H. PROVIDE NEW MELAMINE LABELS WITH WHITE BACKGROUND AND 3/8" BLACK TEXT MATCHING EXISTING FACILITY FORMAT.

KEYED NOTES

- 1. EXISTING DISTRIBUTION BOARD 'DB-1'. PROVIDE NEW FEEDER BREAKER TO 75KVA XFMR.
- 2. PROVIDE NEW 75KVA, 480V PRIMARY, 208/120V SECONDARY, DRY-TYPE TP-1 TRANSFORMER WITH 150 DEG RISE. PROVIDE #2 CU SEPARATELY DERIVED SYSTEM GROUND TO BUILDING STEEL.
- 3. PROVIDE NEW 225A, 208/120V PANELBOARD AND PROPERLY LABEL 'PBLW' AND FEED FROM SECONDARY OF T-PBLW INDICATED IN NOTE #2.
- 4. PROVIDE 8-FOOT 120V WIREWAY AT 3' AFF AND 8-FOOT LOW-VOLTAGE WIREWAY AT 8' AFF FOR FINAL CONNECTION TO SILO CONTROL EQUIPMENT.
- 5. PROVIDE (2) 120V CIRCUITS INDICATED TO 120V WIREWAY FOR EXTENSION TO SILO LEVEL. PROVIDE (1) 120V CIRCUIT TO MV SCANNER INDICATOR PANEL, AND DUPLEX RECEPTACLE FOR CONNECTION TO MV SCANNER SYSTEM.
- 6. PULL CIRCUIT 'PBLW-1' THROUGH WIREWAY AND STUB-UP THROUGH 3/4" CONDUIT 2' ABOVE WIREWAY FOR FINAL CONNECTION TO LEVEL INDICATOR 'SLD2' BY EQUIPMENT INSTALLER.
- 7. PULL CIRCUIT 'LP2A-3' THROUGH WIREWAY AND TERMINATE AT NEW DUPLEX RECEPTACLE INSTALLED 6' ABOVE WIREWAY FOR FINAL CONNECTION TO MV SCANNER MODULES MVSCM AND MVSPS.
- 8. APPROXIMATE LOCATION OF NEW LOADING SYSTEM CONTROL PANEL FLX128. PROVIDE JUNCTION BOX AT 60' AFF FOR FINAL CONNECTION TO CONTROL PANEL BY EQUIPMENT INSTALLER.
- 9. APPROXIMATE LOCATION OF DIVERTER VALVES ROUGHLY 12' AFF. PROVIDE (20) #18 CU CONDUCTORS IN 1" EMT CONDUIT TO LOAD SYSTEM CONTROL PANEL FLX128. FINAL TERMINATION BY EQUIPMENT MANUFACTURER. COORDINATE WITH OWNER AND/OR PLUMBING CONTRACTOR TO PROVIDE 3/4" PIPE FOR COMPRESSED AIR.
- 10. PROVIDE 3/4" RMC CONDUIT OUTSIDE ALONG RAILROAD UNLOADING PIPING OR 3/4" EMT CONDUIT INDOORS AT 12' AFF WITH (10) YELLOW #12 CU CONDUCTORS TO RAIL-CAR UNLOADING SYSTEM PANEL 'RCUS3'. SEE SHEET E1.2 FOR CONTINUATION.
- 11. PROVIDE 1-1/2" EMT CONDUIT WITH (31) #12 CU CONDUCTORS (10) BLACK, (10) WHITE, (10) YELLOW, #12 GROUND, 3/4" EMT CONDUIT WITH BELDEN #3105A COMMUNICATION CABLE, AND 3/4" EMT CONDUIT WITH ALPHA #1750 SLO05 24V POWER CABLE FROM WIREWAYS TO SENSORS. PROVIDE VOLTAGE SEPARATOR AT ALL JUNCTION BOXES.
- 12. PROVIDE 1-1/2" EMT CONDUIT WITH (20) #12 CU CONDUCTORS (10) BLACK, (10) WHITE, AND #12 GROUND FROM WIREWAY TO SENSORS.
- 13. SPLICE BELDEN #3105A AND ALPHA #1750 SLO05 LOW-VOLTAGE CABLES IN JUNCTION BOX AND EXTEND 3/4" EMT CONDUITS WITH LOW-VOLTAGE CABLES TO MV SCANNER LEVEL INDICATOR SENSOR INSTALLED BY EQUIPMENT MANUFACTURER.
- 14. EXTEND (2) #12 BLACK, (2) #12 WHITE, (2) #12 YELLOW, AND #12 GROUND COPPER CONDUCTORS IN 3/4" EMT CONDUIT TO HIGH-LEVEL SWITCH PROVIDED AND INSTALLED BY EQUIPMENT MANUFACTURER.
- 15. EXTEND (2) #12 BLACK, (2) #12 WHITE, (2) #12 YELLOW, AND #12 GROUND COPPER CONDUCTORS IN 3/4" EMT CONDUIT TO LOW-LEVEL SWITCH PROVIDED AND INSTALLED BY EQUIPMENT MANUFACTURER.
- 16. OWNER TO PROVIDE CAT-6 ETHERNET CABLE TO BUILDING INTERNET/NETWORK CONNECTION ROOM.
- 17. PROVIDE EMPTY 3/4" EMT CONDUIT WITH PULL-STRING FROM LOADING SYSTEM CONTROL PANEL FLX128 TO SILO 7 FOR FUTURE INSTALLATION OF CONAIR CABLE #2553310 PROVIDED AND INSTALLED BY EQUIPMENT MANUFACTURER.
- 18. PROVIDE 3/4" EMT CONDUIT WITH (10) #18 LOW-VOLTAGE COPPER CONDUCTORS FROM LOADING SYSTEM CONTROL PANEL FLX128 TO VACUUM PUMP CONTROL PANEL FOR CONTROL. SEE SHEET E1.2 FOR CONTINUATION.
- 19. PROVIDE 3/4" EMT CONDUIT WITH (3) #14 CU CONDUCTORS FROM LOADING SYSTEM CONTROL PANEL FLX128 TO VACUUM PUMP DUST COLLECTOR FOR CONTROL. SEE SHEET E1.2 FOR CONTINUATION.
- 20. PROVIDE 3/4" EMT CONDUIT WITH (2) #18 LOW-VOLTAGE COPPER CONDUCTORS FROM LOADING SYSTEM CONTROL PANEL FLX128 TO SURGE BIN TB1-SBLDR2.
- 21. PROVIDE #6 INSULATED GREEN COPPER BONDING CONDUCTOR. SEE SHEET E1.2 FOR CONTINUATION.
- 22. PROVIDE SOLID BOND WITH CONTRACTOR INSTALLED LUG BETWEEN SILO AND #6 INSULATED GREEN COPPER BONDING CONDUCTOR TO MAINTAIN EQUAL GROUND POTENTIAL THROUGHOUT MANUFACTURING SYSTEM. COORDINATE WITH OWNER TO DETERMINE IF CONDUIT IS REQUIRED.

OPTIMIZED
Lighting | Engineering | Design
842 EAST ISABELLA AVE., MESA, AZ, 85204
WWW.OPTIMIZEDLED.COM | 602-899-6224
PROJECT: SC190017
EOR: BRIETT LORENZEN
briett.lorenz@optimizedled.com
AZ 53437 FIRM 21458 (CA 22600) CO 55367
Optimized LED is an Equal Opportunity Employer. Minorities and women are encouraged to apply. All rights reserved. © 2019 Optimized LED. All rights reserved. No part of this document may be reproduced without the written permission of Optimized LED.

STAMP:
This drawing is the professional intellectual property of Optimized LED and protected by Copyright Usage of this drawing shall be restricted for use as a project example and shall not be reproduced, recreated, or utilized for any other purpose without express written consent of Optimized LED.

SCIENTEX INC. - PHOENIX ELECTRICAL INSTALL DRAWINGS

DRAWN:	CHECKED:	NUMBER:
B5L	B5L	SC1190017

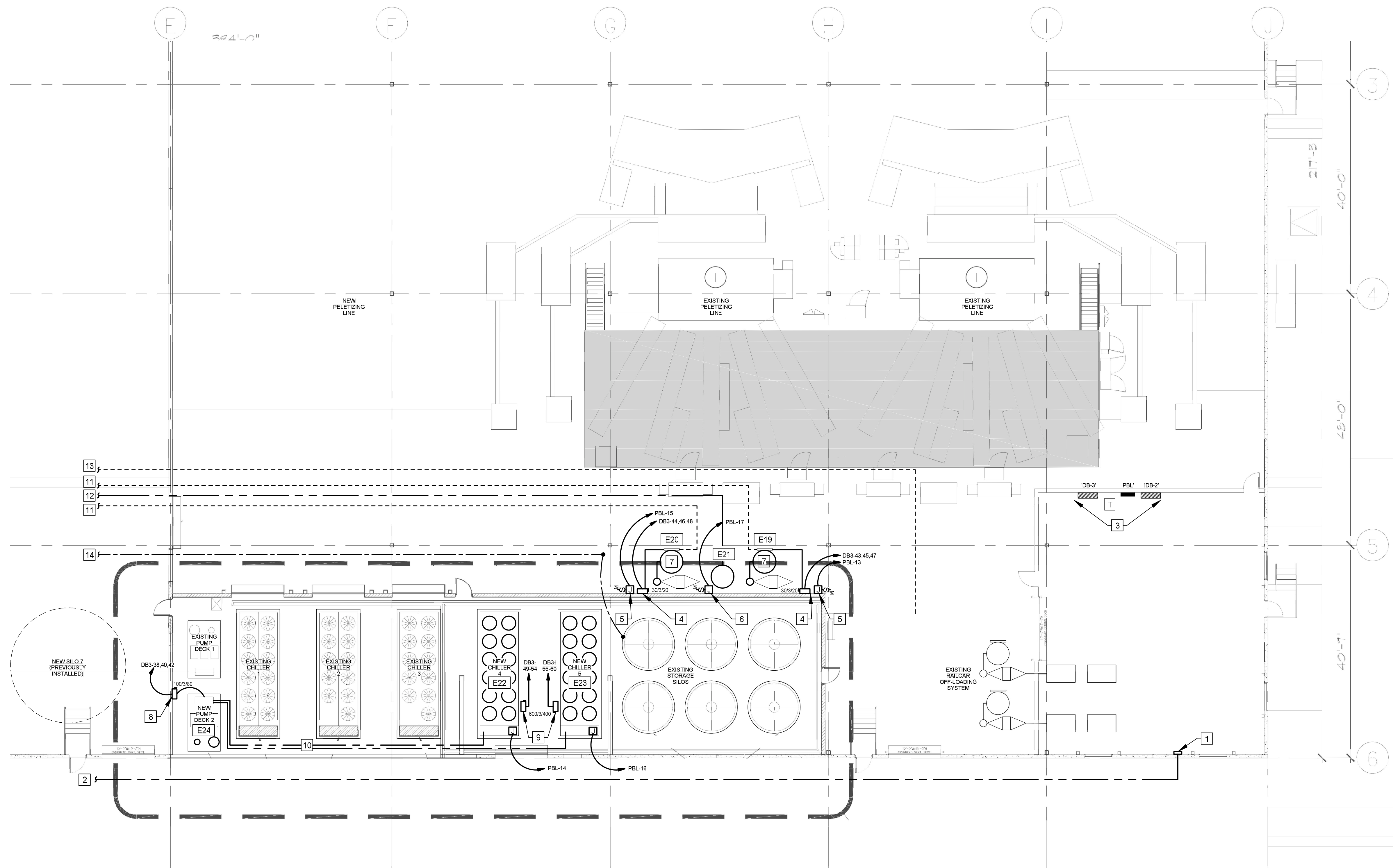
REVISIONS:

DATE:	ISSUED FOR:
07/05/19	FOR PRICING

SHEET NAME
ELECTRICAL POWER PLAN WEST

SHEET NUMBER

E1.1



1 ELECTRICAL POWER PLAN - EAST
3/32" = 1"

GENERAL NOTES

- A. REFER TO ELECTRICAL SYMBOLS, ABBREVIATIONS, AND GENERAL NOTES FOR ADDITIONAL INFORMATION BEFORE ESTIMATING OR CONSTRUCTION FROM THIS SHEET.
- B. REFER PANELBOARD SCHEDULES, EQUIPMENT SCHEDULE, AND LOAD CALCULATIONS, FOR ADDITIONAL INFORMATION.
- C. REFERENCE CONAIR 'RESIN CONVEYING/STORING SYSTEM ELECTRICAL FLOW AND FIELD WIRING DIAGRAM' SHEET EC-6100347-E1 (BY OTHERS).
- D. SEAL ALL WALL PENETRATIONS WITH APPROPRIATE SEALANT TYPE. PROVIDE FIRE-PROOFING WHERE REQUIRED.
- E. PROTECT EXISTING EQUIPMENT, STRUCTURE, AND PERSONNEL FROM HARM.
- F. COMPLY WITH ALL SPECIFICATIONS OUTLINED ON SHEET E4.1 - 4.3.
- G. ALL LIGHTING IS EXISTING TO REMAIN.
- H. PROVIDE NEW MELAMINE LABELS WITH WHITE BACKGROUND AND 3/8" BLACK TEXT MATCHING EXISTING FACILITY FORMAT.

KEYED NOTES

- 1. APPROXIMATE LOCATION OF RAILCAR UNLOADING SYSTEM PANEL 'RCUS3'.
- 2. PROVIDE 3/4" RMC CONDUIT OUTSIDE ALONG RAILROAD UNLOADING PIPING OR 3/4" EMT CONDUIT INDOORS AT 12' AFF TO RAIL-CAR UNLOADING SYSTEM PANEL 'RCUS3'. SEE SHEET E1.1 FOR CONTINUATION.
- 3. EXISTING ELECTRICAL EQUIPMENT FOR POWER CONNECTIONS TO EQUIPMENT INSTALLED UNDER THIS SCOPE OF WORK.
- 4. PROVIDE NEW FUSED DISCONNECT SWITCH AS INDICATED AND MAKE FINAL CONNECTION TO MANUFACTURER INSTALLED VACUUM PUMPS PER MANUFACTURER RECOMMENDATIONS.
- 5. PROVIDE 120V JUNCTION BOX AND MOTOR RATED DISCONNECT SWITCH FOR FINAL CONNECTION TO MANUFACTURER INSTALLED VACUUM PUMP IDLE-MODE.
- 6. PROVIDE 120V JUNCTION BOX AND MOTOR RATED DISCONNECT SWITCH FOR FINAL CONNECTION TO MANUFACTURER INSTALLED DUST COLLECTOR.
- 7. COORDINATE WITH OWNER AND/OR PLUMBING CONTRACTOR TO PROVIDE 3/4" PIPE FOR COMPRESSED AIR TO VACUUM PUMPS.
- 8. PROVIDE NEW FUSED DISCONNECT SWITCH AS INDICATED AND MAKE FINAL CONNECTION TO MANUFACTURER INSTALLED CHILLER UNIT. ENSURE 4' WORKING SPACE WHERE DISCONNECT SWITCH IS INSTALLED.
- 9. PROVIDE NEW FUSED DISCONNECT SWITCH AS INDICATED AND MAKE FINAL CONNECTION TO MANUFACTURER INSTALLED PUMP DECK. SEE PANELBOARD AND EQUIPMENT SCHEDULE ON SHEET E2.0 FOR FEEDER INFORMATION. ENSURE 4' WORKING SPACE WHERE DISCONNECT SWITCH IS INSTALLED.
- 10. PROVIDE NEW 3/4" EMT CONDUIT WITH (2) #14 CU CONDUCTORS FROM PUMP DECK CONTROL PANEL TO CHILLER UNIT FOR AUXILIARY ACTIVATION SIGNAL WIRE.
- 11. PROVIDE 3/4" EMT CONDUIT WITH (10) #18 LOW-VOLTAGE COPPER CONDUCTORS FROM LOADING SYSTEM CONTROL PANEL FLX128 TO VACUUM PUMP CONTROL PANEL FOR CONTROL. SEE SHEET E1.1 FOR CONTINUATION.
- 12. PROVIDE 3/4" EMT CONDUIT WITH (3) #14 CU CONDUCTORS FROM LOADING SYSTEM CONTROL PANEL FLX128 TO VACUUM PUMP DUST COLLECTOR FOR CONTROL. SEE SHEET E1.1 FOR CONTINUATION.
- 13. CONTINUE 3/4" EMT CONDUIT WITH (2) #18 LOW-VOLTAGE COPPER CONDUCTORS FROM LOADING SYSTEM CONTROL PANEL FLX128 TO SURGE BIN T81-SBDR2. COORDINATE LOCATION OF SURGE BIN WITH OWNER. SEE SHEET E1.1 FOR CONTINUATION.
- 14. CONTINUE #6 INSULATED GREEN COPPER BONDING CONDUCTOR TO ALL EQUIPMENT. SEE SHEET E1.1 FOR CONTINUATION.

OPTIMIZED
Lighting | Engineering | Design
842 EAST ISABELLA AVE, MESA, AZ, 85204
WWW.OPTIMIZED-LED.COM | 602-899-6224
PROJECT: SC1190017
EOR: BRETT LORENZEN
brett.lorenzen@optimized-led.com
AZ 53437 FIRM 21458 (CA 22600) CO 55367
Optimized LED is an Equal Opportunity Employer. Minorities and women are encouraged to apply. All qualified applicants will receive consideration for employment without regard to race, gender, religion, or national origin. All rights reserved. © 2019 Optimized LED. All rights reserved. All other trademarks are the property of their respective owners.

STAMP:
This drawing is the professional intellectual property of Optimized LED and protected by Copyright. Usage of this drawing shall be restricted for use as a project example and shall not be reproduced, recreated, or utilized for any other purpose without express written consent of Optimized LED.

SCIENTEX INC. - PHOENIX ELECTRICAL INSTALL DRAWINGS

DRAWN:	CHECKED:	NUMBER:
B5L	B5L	SC1190017

REVISIONS:

DATE:	ISSUED FOR:
07/05/19	FOR PRICING

SHEET NAME
ELECTRICAL POWER PLAN EAST

SHEET NUMBER

E1.2

PANELBOARD: DBH (EXISTING)										EQUIPMENT GROUND BUS									
BUS AMPS: 800A					A/C RATING: 65000 FULLY RATED					BUS AMPS: 800A					A/C RATING: 65000 FULLY RATED				
MAIN SIZE/TYPE: 800A MCB					SERVES: 0					MAIN SIZE/TYPE: MLO					SERVES: MANUFACTURING 2				
VOLTS/PHASE: 480Y/277V, 3PH, 4W					LOCATION: SURFACE					VOLTS/PHASE: 480Y/277V, 3PH, 4W					LOCATION: STORAGE AREA / NRG MACH.				
SECTION: 1										SECTION: 1									
CKT NO.	DESCRIPTION	VOLTAMPS/PHASE			WIRE NO.	BKR NO.	P	WIRE NO.	BKR NO.	P	VOLTAMPS/PHASE			DESCRIPTION	CKT NO.				
		A	B	C							A	B	C						
1	NRG MACHINE				70	3	3	125	#6G		960	480	265	PANELBOARD 'PBLW' VIA 75KVA XFMR	2				
3	BUSSED SPACE														4				
5	BUSSED SPACE														6				
7	BUSSED SPACE														8				
9	RECYCLER				30	3	3	30	EX					RECYCLER	10				
11	BUSSED SPACE														12				
13	BUSSED SPACE														14				
15	BUSSED SPACE														16				
17	BUSSED SPACE														18				
19	BUSSED SPACE														20				
21	BUSSED SPACE														22				
23	BUSSED SPACE														24				
25	BUSSED SPACE														26				
27	BUSSED SPACE														28				
29	BUSSED SPACE														30				
31	BUSSED SPACE														32				
33	BUSSED SPACE														34				
35	BUSSED SPACE														36				
37	BUSSED SPACE														38				
39	BUSSED SPACE														40				
41	BUSSED SPACE														42				
43	BUSSED SPACE														44				
45	BUSSED SPACE														46				
47	BUSSED SPACE														48				
49	BUSSED SPACE														50				
51	BUSSED SPACE														52				
53	BUSSED SPACE														54				
55	BUSSED SPACE														56				
57	BUSSED SPACE														58				
59	BUSSED SPACE														60				
61	BUSSED SPACE														62				
63	BUSSED SPACE														64				
65	BUSSED SPACE														66				
SUBTOTAL										SUBTOTAL									
TOTAL PHASE A - VA		960	LOAD		CONN. VA	DF	LOAD		CONN. VA	DF	TOTAL DEMAND								
AMPS		3	COOLING	1.00	REFRIG	1.00													
TOTAL PHASE B - VA		480	HEATING		0	SIGN/DISP	1.25												
AMPS		2	LIGHTING	1.25	KITCHEN	1.00													
TOTAL PHASE C - VA		265	RECEPTACLES		840	1.0/5	EXISTING		1.00	TOTAL DEMAND									
AMPS		1	MOTORS	1.00	LRG MOTOR	1.25													
TOTAL PNLBD - VA		1,705	SUPP HEAT		1.00	SHOW WNDW	1.25			TOTAL DEMAND		1,705 VA							
AMPS		2	MISC EQUIP	865	1.00	LTG TRACK	1.00					2 A							
PANELBOARD NOTES										PANELBOARD NOTES									
EX EXISTING TO REMAIN										SINGLE SECTION PANELBOARD									

PANELBOARD: DB-2 (EXISTING)										EQUIPMENT GROUND BUS									
BUS AMPS: 800A					A/C RATING: 65000 FULLY RATED					BUS AMPS: 800A					A/C RATING: 65000 FULLY RATED				
MAIN SIZE/TYPE: MLO					SERVES: MANUFACTURING 2					MAIN SIZE/TYPE: MLO					SERVES: MANUFACTURING 2				
VOLTS/PHASE: 480Y/277V, 3PH, 4W					LOCATION: SURFACE					VOLTS/PHASE: 480Y/277V, 3PH, 4W					LOCATION: STORAGE AREA / NRG MACH.				
SECTION: 1										SECTION: 1									
CKT NO.	DESCRIPTION	VOLTAMPS/PHASE			WIRE NO.	BKR NO.	P	WIRE NO.	BKR NO.	P	VOLTAMPS/PHASE			DESCRIPTION	CKT NO.				
		A	B	C							A	B	C						
1	E17 - CONTROL PANEL 1				175T	3	3	60T	EX				SPARE	2					
3	BUSSED SPACE													4					
5	BUSSED SPACE													6					
7	BUSSED SPACE													8					
9	E17 - CONTROL PANEL 2				175T	3	3	100T	EX				E10 - ROLL HANDLING	10					
11	BUSSED SPACE													12					
13	BUSSED SPACE													14					
15	BUSSED SPACE													16					
17	BUSSED SPACE													18					
19	BUSSED SPACE													20					
21	BUSSED SPACE													22					
23	BUSSED SPACE													24					
25	BUSSED SPACE													26					
27	BUSSED SPACE													28					
29	BUSSED SPACE													30					
31	BUSSED SPACE													32					
33	BUSSED SPACE													34					
35	BUSSED SPACE													36					
37	BUSSED SPACE													38					
39	BUSSED SPACE													40					
41	BUSSED SPACE													42					
43	BUSSED SPACE													44					
45	BUSSED SPACE													46					
47	BUSSED SPACE													48					
49	BUSSED SPACE													50					
51	BUSSED SPACE													52					
53	BUSSED SPACE													54					
55	BUSSED SPACE													56					
57	BUSSED SPACE													58					
59	BUSSED SPACE													60					
61	BUSSED SPACE													62					
63	BUSSED SPACE													64					
65	BUSSED SPACE													66					
SUBTOTAL										SUBTOTAL									
TOTAL PHASE A - VA		960	LOAD		CONN. VA	DF	LOAD		CONN. VA	DF	TOTAL DEMAND								
AMPS		3	COOLING	1.00	REFRIG	1.00													
TOTAL PHASE B - VA		480	HEATING		0	SIGN/DISP	1.25												
AMPS		2	LIGHTING	1.25	KITCHEN	1.00													
TOTAL PHASE C - VA		265	RECEPTACLES		840	1.0/5	EXISTING		1.00	TOTAL DEMAND									
AMPS		1	MOTORS	1.00	LRG MOTOR	1.25													
TOTAL PNLBD - VA		1,705	SUPP HEAT		1.00	SHOW WNDW	1.25			TOTAL DEMAND		1,705 VA							
AMPS		2	MISC EQUIP	865	1.00	LTG TRACK	1.00					2 A							
PANELBOARD NOTES										PANELBOARD NOTES									
EX EXISTING TO REMAIN										SINGLE SECTION PANELBOARD									

PANELBOARD: DB-3 (EXISTING)										EQUIPMENT GROUND BUS									
BUS AMPS: 1600A					A/C RATING: 65000 FULLY RATED					BUS AMPS: 1600A					A/C RATING: 65000 FULLY RATED				
MAIN SIZE/TYPE: MLO					SERVES: MANUFACTURING 1					MAIN SIZE/TYPE: MLO					SERVES: MANUFACTURING 1				
VOLTS/PHASE: 480Y/277V, 3PH, 4W					LOCATION: SURFACE					VOLTS/PHASE: 480Y/277V, 3PH, 4W					LOCATION: STORAGE AREA / NRG MACH.				
SECTION: 1										SECTION: 1									
CKT NO.	DESCRIPTION	VOLTAMPS/PHASE			WIRE NO.	BKR NO.	P	WIRE NO.	BKR NO.	P	VOLTAMPS/PHASE			DESCRIPTION	CKT NO.				
		A	B	C							A	B	C						
1	CHILLER 1				600F	3	3	600F	EX				CHILLER 1	2					
3	SINGLE BREAKER WITH 2,4,6				450T	3	3	450T	EX				SINGLE BREAKER WITH 1,3,5	4					
5	BUSSED SPACE													6					
7	CHILLER 2				600F	3	3	600F	EX				CHILLER 2	8					
9	SINGLE BREAKER WITH 8,10,12				450T	3	3	450T	EX				SINGLE BREAKER WITH 7,9,11	10					
11	BUSSED SPACE													12					
13	CHILLER 3				600F	3	3	600F	EX				CHILLER 3	14					
15	SINGLE BREAKER WITH 14,16,18				450T	3	3	450T	EX				SINGLE BREAKER WITH 13,15,17	16					
17	BUSSED SPACE													18					
19	E5 - AIR COMPRESSOR #1				200F	3	3	200F	EX				E6 - AIR COMPRESSOR 2	20					
21	BUSSED SPACE				200T	3	3	200T	EX					22					
23	BUSSED SPACE													24					
25	PNLBD PBL	2,580			125F			150F					A/C PANEL	26					
27	VA 75KVA XFMR	2,580	2,580		125T	3	3	150T	EX					28					
29	BUSSED SPACE							1,680						30					
31	E9 - CHILLER PUMP DECK				100F			100F					E8 - ROLL HANDLING	32					
33	BUSSED SPACE				100T	3	3	100T	EX					34					
35	BUSSED SPACE													36					
37	E7 - AIR DRYER				15AF			100F					CHILLER PUMP DECK 2 (NEW)	38					
39	BUSSED SPACE				15AT	3	3	100T	SCH					40					
41	BUSSED SPACE													42					
43	VACUUM PUMP - VP1 (NEW)	3,880						3,880	SCH	20	3	20	SCH	44					
45	BUSSED SPACE																		

GENERAL INSTRUCTIONS

A. GENERAL REQUIREMENTS

- All requirements under the original design documents and supplementary conditions apply to this section.
- Where the requirements of this section and division exceed those of the general and supplementary conditions, the requirements of this section take precedence
- Become thoroughly familiar with all of its contents as to requirements that affect this section.
- Work required under this section includes all material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications, or reasonable inferred to be necessary to facilitate the function of the system and design intent.
- The specifications and drawings for the project are complementary, and any portion of work described in one shall be provided as if described in both
- In the event of discrepancies between specifications and drawings, notify the engineer and request clarification prior to proceeding with the work involved.
- Limitations to drawings:
 - Drawings are graphic representations of the work upon which the contract is based.
 - Drawings show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They convey the scope of work, indicating the intended general arrangement of the systems without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements
 - Contractor shall use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system
 - Exact location of any component shall be confirmed and/or dimensioned by architect prior to rough-in

B. DEFINITIONS

- Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."
- Install: "to perform all operations at the project site including, but not limited to, the actual unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."
- Provide: "to furnish and install."
- Furnished by Owner (or Owner-Furnished) or Furnished by Others: "an item furnished by the Owner or under other divisions or contracts, and installed under the requirements of this division, complete, and ready for the intended use, including all items and services incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division.
- Engineer: Where referenced in this Division, "Engineer" is the Engineer of Record and the Design Professional for the work under this division, and is a consultant to, and an authorized representative of the Architect, as defined in the General and/or Supplementary Conditions. When used in this division, Engineer means increased involvement by and obligations to the Engineer, in addition to involvement by and obligations to the Architect.
- AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.
- Homerun: That portion of an electrical circuit originating at a junction box, termination box, receptacle, or switch with termination at an electrical panelboard. Note: Where MC cable is utilized for receptacle and/or lighting branch circuiting loads, the originating point of the homerun shall be at the first load in the circuit or at a junction box located in an accessible ceiling space as close as possible to the first load.

C. PRE-BID SITE VISIT

- Visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done

D. MATERIAL AND WORKMANSHIP

- Provide new material, equipment, and apparatus under this contract unless otherwise stated herein, of best quality normally used for the purpose in good commercial practice, and free from defects
- Model numbers listed in the specifications or shown on the drawings are not necessarily intended to designate the required trim, written descriptions of the trim govern model numbers.
- Provide markings or a nameplate for all material and equipment identifying the manufacturer and providing sufficient reference to establish quality, size, and capacity
 - Commercial specification grade:
- All workmanship shall be of the finest possible by experienced mechanics of the proper trade. In general, provide the following quality grade(s) for all materials and equipment.
 - Commercial specification grade:
- Furnish only material and equipment that are listed, labeled, certified, or all three, by an NRTL whenever any listing or labeling exists for the types of material and equipment specified.
- At a minimum, general work practices for electrical construction shall be in accordance with NECA 1 (latest edition), "Standard Practices for Good Workmanship in Electrical Construction".

E. MANUFACTURERS

- In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.
- Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.
- Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

F. COORDINATION

- Coordinate all work with other divisions and trades so that various components of the systems are installed at the proper time, fit the available space, and allow proper service access to those items requiring maintenance. Components which are installed without regard to the above shall be relocated at no additional cost to the Owner.
- Unless otherwise indicated, the General Contractor shall provide chases and openings in building construction required for installation of the systems specified herein. Contractor shall furnish the General Contractor with information where chases and openings are required.
- Contractor shall keep informed as to the work of other trades engaged in the construction of the project and shall execute work in a manner as to not interfere with or delay the work of other trades.
- Figured dimensions shall be taken in preference to scale dimensions. Contractor shall take his own measurements at the building, as variations may occur.
- Contractor shall be held responsible for errors that could have been avoided by proper checking and inspection.
- Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed.

G. ORDINANCES AND CODES

- Work performed under this contract shall, at a minimum, be in conformance with applicable national, state and local codes having jurisdiction.
- Equipment furnished and associated installation work performed under this contract shall be in strict

compliance with current applicable codes adopted by the local AHJ, including any amendments and standards as set forth by the following:

- National Fire Protection Association (NFPA)
- Underwriters Laboratories (UL)
- Occupational Safety and Health Administration (OSHA)
- American National Standards Institute (ANSI)
- American Society of Testing Materials (ASTM)
- Rules and regulations of public utilities and municipal departments affected by connection of services.
- Other national standards and codes where applicable.

- Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence.

- Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent.

- Promptly bring all conflicts observed between codes, ordinances, rules, regulations, referenced standards, and these documents to the attention of the Architect and Engineer for final resolution.

- Contractor will be held responsible for any violation of the law.

- Procure and pay for permits and licenses required for the accomplishment of the work herein described.

- Where required, obtain, pay for, and furnish certificates of inspection to Owner.

- Provide all safety lights, guards, and warning signs required for the performance of the work and for the safety of the public.

H. PROTECTION OF EQUIPMENT AND MATERIALS

- Store and protect from damage equipment and materials delivered to job site.
- For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces.
- For other materials and equipment, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage.
- Equipment and material damaged by construction activities shall be rejected, and Contractor shall furnish new equipment and material of a like kind at his own expense.
- Keep premises broom clean of foreign material created during work performed under this contract.
- Conduit, equipment, etc. shall have a neat and clean appearance at the termination of the work.
- Plug or cap open ends of conduits while stored and installed during construction when not in use to prevent the entrance of debris into the systems.

I. ELECTRONIC DRAWING FILES

- Electronic drawing files are the intellectual property of the design professional and are covered under United States Copyright laws.
- Requests for electronic drawing files will be considered on a case by case basis.
- Optimized-LED retains the rights to charge for additional usage of the company's intellectual property outside of the original contractual agreement.
- Request shall be made in writing to utilize electronic drawing files for any reason. Email is considered an acceptable form or written request.

L. RECORD DRAWINGS (AS-BUILT DRAWINGS)

- During progress of the work in this division, Contractor shall maintain an accurate record of all changes made during the installation of the system.
- Upon completion of the work, accurately transfer all record information to three identical sets of the approved

shop drawings.

M. OPERATION AND MAINTENANCE INSTRUCTIONS

- During the course of construction, collect and compile a complete brochure of equipment furnished and installed on this project.

- Include operational and maintenance instructions, manufacturer's catalog sheets, wiring diagrams, parts lists, approved submittals and shop drawings, warranties, and descriptive literature as furnished by the equipment manufacturer.

- Include an inside cover sheet that lists the project name, date, Owner, Architect, Engineer, General Contractor, Sub-Contractor, and an index of contents.

- Submit a copy of literature bound in approved binders with index and tabs separating equipment types to the Architect, for Engineer's review, at the termination of the work.

- Include Record Drawings as described above.

N. TRAINING

- At a time mutually agreed upon between the Owner and Contractor, provide the services of a factory trained and authorized representative to train Owner's designated personnel on the operation and maintenance of the equipment provided for this project.

- Provide training to include, but not be limited to, an overview of the system and/or equipment as it relates to the facility as a whole.

- Operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance and appropriate operator intervention

- Review of data included in the operation and maintenance manuals.

O. WARRANTIES

- Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a period of 12 months from date of Substantial Completion unless specific items are noted to carry a longer warranty in these construction documents or manufacturer's standard warranty exceeds 12 months.

- Remedy all defects occurring within the warranty period(s) as stated in the General Conditions and Division 01.

- Warranties shall include labor and material, including travel expenses.

- Make repairs or replacements without any additional costs to the Owner, and to the satisfaction of the Owner, Architect, and Engineer.

- Perform the remedial work promptly, upon written notice from the Engineer or Owner.

- Also warrant the following additional items:
 - All raceways are free from obstructions, holes, crushing, or breaks of any nature.
 - All raceway seals are effective.
 - The entire electrical system is free from all short circuits and unwanted open circuits and grounds.

- At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period and any actions the Owner must take in order to maintain warranty status.

- Each warranty instrument shall be addressed to the Owner and state the commencement date and term.

GENERAL MATERIALS AND INSTALLATION

A. COINCIDENTAL DAMAGE

- Repair streets, sidewalks, drives, paving, walls, finishes, and other facilities damaged in the course of this Work.

- Repair materials shall match existing construction. [Repair materials shall generally match existing construction.]

- Repair work shall meet all requirements of the Owner, local authorities having jurisdiction, and meet the satisfaction of the Architect.

- Repair work shall be thoroughly first class.

B. SUPPORT SYSTEMS

- Steel Slotted Support Systems (Slotted Channel): Comply with MFMA-3, factory-fabricated components for field assembly; 12-gauge, 1-5/8-inch by 1-5/8-inch.

- Finishes:
 - Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
 - Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane or polyester coating applied according to MFMA-3.
 - Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-3.
 - Stainless Steel: Type 304, per ASTM A240.

- Aluminum Slotted Support Systems (Slotted Channel):
 - Comply with MFMA-3, Type 6063-T6, per ASTM B221; factory-fabricated components for field assembly; 12-gauge, 1-5/8-inch by 1-5/8-inch.

- Manufacturers:
 - Cooper B-Line
 - ERICO International
 - Hilti, Power-Strut
 - Thomas and Betts
 - Unistrut.

C. EQUIPMENT FURNISHED BY OTHERS

- Provide necessary equipment and accessories that are not provided by the equipment supplier or Owner to complete installation of equipment furnished by others in locations as indicated on the drawings, specified herein, or both.

- Equipment and accessories not provided by the equipment supplier may include, but not be limited to, flexible cords and plugs as required for proper operation of the complete system, in accordance with the manufacturers' instructions.

- Contractor shall be responsible for correct rough-in dimensions, and verify them with Architect and/or equipment supplier prior to rough-in and service installations.

OPTIMIZED
Lighting | Engineering | Design
842 EAST ISABELLA AVE., MESA, AZ 85204
WWW.OPTIMIZED-LED.COM | 602-899-6224
PROJECT: SC190017
EOR: BRETT LORENZEN
brett.lorenzen@optimized-led.com
AZ 53437 FIRM 21456 | CA 22600 | CO 55367
Optimized-LED is an Equal Opportunity Employer. Minorities and women are encouraged to apply. All qualified applicants will receive consideration for employment without regard to race, gender, religion, or national origin. This document contains confidential information and is intended only for the individual named. If you are not the named individual you should not disseminate, distribute or copy this e-mail. Please notify the sender immediately by e-mail if you have not received this e-mail by mistake. Optimize-LED reserves the right to remove recipients who do not wish to receive this e-mail or who do not wish to receive e-mails from this organization. Reply to the sender in this e-mail if you believe this is a mistake. Thank you.

STAMP:
This drawing is the professional intellectual property of Optimized LED and protected by Copyright. Usage of this drawing shall be restricted for use as a project example and shall not be reproduced, recreated, or utilized for any other purpose without express written consent of Optimized LED.

SCIENTEX INC. - PHOENIX ELECTRICAL INSTALL DRAWINGS

DRAWN: B5L	CHECKED: B5L	NUMBER: 5C1190017
---------------	-----------------	----------------------

REVISIONS:	
-	-
-	-
-	-
-	-
-	-
-	-
-	-

DATE: 07/05/19	ISSUED FOR: FOR PRICING
--------------------------	-----------------------------------

SHEET NAME
ELECTRICAL
SPECIFICATIONS 1

SHEET NUMBER

E4.0

7/6/2019 4:40:14 PM

RACEWAYS

A. METALLIC CONDUIT AND TUBING

- Types:
 - Electrical Metallic Tubing, Couplings, and Fittings (EMT): ANSI C80.3, UL 797. Only steel products allowed. Reduced wall EMT is not allowed.
 - Flexible Metal Conduit (FMC): Zinc-coated steel or aluminum; UL 1. Reduced-wall FMC is not allowed.
 - Intermediate Metal Conduit (IMC): Hot-dip Galvanized Rigid Steel Conduit, ANSI C80.6, UL 1242.
 - Liquidtight Flexible Metal Conduit (LFMC): Flexible steel conduit with PVC jacket, UL 360; fittings: NEMA FB 1.
 - Hot-dip Galvanized Rigid Steel Conduit (GRS): ANSI C80.1, UL 6.
 - Plastic-Coated IMC, RMC, and Fittings: NEMA RN 1, NRTL listed. Coating thickness of 0.04 inches minimum.
 - IMC and RMC Fittings: NEMA FB 1; compatible with conduit type and material, NRTL listed.
- Manufacturers:
 - Western Tube and Conduit
 - Wheatland Tube
 - Tycos International
 - Allied Tube and Conduit
 - Republic Raceway

B. NON-METALLIC CONDUIT AND TUBING

- Types:
 - Rigid Nonmetallic Conduit (RNC): Schedule 40 PVC, 90 deg C rated.
 - Electrical Nonmetallic Tubing (ENT): NEMA TC 13, NRTL listed.
 - Liquidtight Flexible Nonmetallic Conduit (LFNC): UL 1660.
 - ENT and LFNC Fittings: Compatible with conduit/tubing type and material, NRTL listed.
- Fittings:
 - NEMA TC 3, TC 6, UL 651, compatible with conduit/tubing type and material, NRTL listed.
- Manufacturers:
 - Amco
 - Cantex
 - Certainteed
 - Prime Conduit
 - Raco,
 - Thomas and Betts.

RACEWAY INSTALLATION

A. GENERAL REQUIREMENTS

- Install raceways parallel and perpendicular to building lines.
- Install raceways to requirements of structure, other work on the project, and to clear all openings, depressions, pipes, ducts, reinforcing steel, and other immovable obstacles.
- Install raceways set in forms for concrete structure in such a manner that installation will not affect the strength of the structure.
- Install raceways continuous between connections to outlets, boxes, and cabinets with a minimum possible number of bends and not more than the equivalent of four 90-degree bends between connections. Use manufactured elbows for all 45- and 90-degree bends, unless approved by the Engineer in advance. Make other bends smooth and even and without flattening raceway or flaking galvanizing or enamel. Radii of bends shall be as long as possible and never shorter than the corresponding trade elbow.
- Use long radius elbows for all underground installations, where necessary, or where otherwise indicated.
- Securely fasten raceways in place with approved straps, hangers, and steel supports as required. Attach raceway supports to the building structure. Hang single raceways for feeders with supports spaced not more than 10 feet. Securely clamp vertical feeder raceways to structural steel members attached to structure. Install cable clamps for support of vertical feeders where required. Add raceway supports within 12 inches of all bends, on both sides of the bends.
- Do not support raceways from suspended ceiling components.
- Ream raceway ends, thoroughly clean raceways before installation, and keep clean after installation. Plug or cover openings and boxes as required to keep raceways clean during construction and fish all raceways clear of obstructions before pulling conductor wires.
- Provide raceways of ample size for pulling of wire, not smaller than code requirements and not less than 1/2-inch in size, unless indicated otherwise on Drawings.
- Homeworks containing more than one branch circuit shall not be less than 3/4-inch in size.
- Protect all raceway installations against damage during construction. Repair all raceways damaged or moved out of line after roughing-in to meet Engineer's approval without additional cost to the Owner.
- Align and install true and plumb all raceway terminations at panelboards, switchboards, motor control equipment, and junction boxes.
- Install approved expansion/deflection fittings where raceways pass through (if embedded) or across (if exposed) expansion joints, and when using RNC or RAC in exposed environments in accordance with NFPA 70 and expansion/contraction properties of RNC or RAC.
- Install a pull wire in each empty raceway that is left for installation of conductors or cables under other divisions or contracts. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 24 inches of slack at each end of pull wire.
- Make all joints and connections in a manner that will ensure mechanical strength and electrical continuity.

B. ABOVE GROUND RACEWAY USE:

- Install all circular raceways concealed above suspended ceilings or concealed in walls or floors wherever possible except where otherwise indicated.
- Provide GRS for all conduits exposed to any forms of damage, physical, chemical, or weather related.
- Unless noted otherwise, all other raceway may be EMT. Use compression type fittings for all conduit 2" and smaller. Use set-screw fittings for all conduit over 2".

C. UNDERGROUND RACEWAY USE:

- Provide GRS installed below grade with a corrosion-resistant bonded-plastic or approved mastic coating. This shall include the 90-degree elbow below grade and the entire vertical transition to above grade.
- RNC conduit may be used underground where permitted by local code and where not specifically restricted by these documents.

D. EQUIPMENT CONNECTIONS

- Use FMC or LFMC (liquid or vapor areas) for final connection to each motor, transformer, and any device that would otherwise transmit motion, vibration, or noise. Provide all FMC and LFMC with an insulated green or bare copper bonding ground conductor.
- Rigidly terminate conduits entering sheet metal enclosures to the enclosure with a bushing and locknut on the inside and a locknut or an approved hub on the outside. Conduit shall enter the enclosure squarely.
- Provide bushings and locknuts made of galvanized malleable iron with sharp, clean-cut threads.
- Where EMT enters a box, provide approved EMT compression connectors.
- Use insulated, grounding, or combination bushings wherever connection is subject to vibration or moisture, when required by NFPA 70.

E. BUSHINGS AND LOCKNUTS

- Rigidly terminate conduits entering sheet metal enclosures to the enclosure with a bushing and locknut on the inside and a locknut or an approved hub on the outside. Conduit shall enter the enclosure squarely.

CONDUCTORS AND CABLES

A. CONDUCTORS

- Annealed (soft) copper complying with ICEA S-95-658/NEMA WC70 and UL standards 44 or 83 as applicable.
- Copper Conductor Manufacturer:
 - General Cable
 - Southwire
 - US Wire and Cable
 - American Wire and Cable
 - Cable USA
 - Okonite
 - Advance Wire and Cable
 - Encore Wire
- Conductor Insulation Types: 90-degree C-rated, Type THHN/THWN-2 or XHHW-2 complying with ICEA S-95-658/NEMA WC70.
- Sizes of conductors and cables indicated or specified are in American Wire Gage (AWG - Brown and Sharpe).
- All feeder and branch circuit conductors No. 8 AWG and larger: Stranded.
- All conductors, No. 10 AWG and smaller: Solid copper.
- All Branch Circuit Wiring: Not smaller than No. 12 AWG.
- If no conductor size is indicated on the Drawings for a branch circuit, contact engineer.

B. TERMINATIONS

- Timed, mechanical type only; NRTL-listed for copper and aluminum conductors at 75 degrees C minimum.
- Where aluminum conductors terminate existing panelboards, switchboards or switchgear that utilize compression connections use hydraulic-compression type connectors with a zinc base, anti-oxidizing compound. Use compression tools of the type that will not release unless the correct pressure has been applied.

C. MC CABLE

- 600V, unjacketed; UL Standard 83, 1569, and 1685, NFPA 70 Article 330.
- Aluminum or galvanized steel interlocked armor
- THHN- or XHHW-insulated conductors
- MC Cable manufacturers:
 - AFC Cable Systems
 - Encore Wire Corporation
 - Southwire.
- May be used:
 - In lieu of flexible conduit and wiring from light fixtures located in accessible ceilings to junction boxes attached to building structure directly above the ceiling. Lengths may not exceed six feet.
 - For vertical drops in stud walls.
- May not be used (examples may include but are not limited to):
 - Homeruns to panelboards (refer to Section 26: Definitions).
 - Where exposed to view.
 - Where exposed to damage.
 - Hazardous locations.
 - Wet locations.
 - When restricted otherwise.
 - When specifically disallowed by the local AHJ.
 - When specifically disallowed by the landlord.
 - Circuits supplied by an emergency or standby power source.

CONDUCTORS AND CABLES INSTALLATION

A. GENERAL REQUIREMENTS

- Install all wiring in approved raceway and enclosures, except where specified or indicated for low-voltage wiring or where type MC cable is indicated or specified as acceptable.
- Install all conductors and cables in raceways continuous without taps or splices. Splice or tap only in approved boxes and enclosures with approved solderless connectors and keep to the minimum required. Insulate all splices, taps, and joints as required by codes.
- All materials used to terminate, splice, or tap conductors shall be NRTL listed for the specific application and conductors involved, and installed in strict accordance with the manufacturer's recommendations.
- In general, the direction of branch circuit "home run" routing is indicated on the drawings, complete with circuit numbers and panelboard designation. Continue all such "home run" wiring to the designated panelboard, as though "circuit runs" were indicated in their entirety.
- At contractor's discretion circuits may be combined to multi-wire branch circuits (i.e., shared neutral). In these instances, they shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point the branch circuit originates. Multi-pole breakers or 3 single-pole breakers with a handle tie are acceptable means.
- When multiple home runs are combined into a single raceway the total circuits shall not exceed three and total current carrying conductors including the neutral shall not exceed 4. Unless specifically indicated on the drawings.
- GFCI Circuits:
 - Provide a dedicated neutral and not be shared.
 - Limit the one-way conductor length to 100 feet between the panelboard and the most remote receptacle or load on the GFCI circuit.
- Label all conductors with vinyl stick-on circuit markers equating to the corresponding circuit number.
- Provide an equipment-grounding conductor or bonding jumper, as applicable, in all feeders and branch circuits, sized in accordance with NFPA 70 Tables 250.66 or 250.122.
- Voltage drop in branch circuits shall not exceed 3 percent.
- Cable Color:
 - Wiring shall have insulation of the proper color to match color code system in the table below unless there is a color system currently in use by the facility, in which case the colors are to match the existing system. In larger sizes where properly colored insulation is not available, use vinyl plastic electrical tape of the appropriate color around each conductor at all termination points, junctions, and pull boxes.
 - System Voltage:
 - 240V and under:
 - Phase A: Black
 - Phase B: Red
 - Phase C: Blue
 - Neutral: White
 - Equipment Ground: Green.
 - 480V and 480Y/277V:
 - Phase A: Brown
 - Phase B: Orange
 - Phase C: Yellow
 - Neutral: Gray
 - Equipment ground: green.

D. MC CABLE

- Secure and support cable per NFPA 70 Article 330. Secure cable within 12 inches of every box or fitting.
- Securing and supporting intervals shall not exceed six feet. Maintain consistent spacing to avoid derating due to bundling per NFPA 70 Section 310.15.
- Utilize steel cable hangers, Arlington SMC series or equivalent, to support wherever possible so cables can be routed in a neat and workmanship like manner.

ELECTRICAL BOXES AND CABINETS

A. GENERAL REQUIREMENTS

- Provide junction boxes, pull boxes, cabinets, and wireways wherever necessary for proper installation of various electrical systems according to NFPA 70 and where indicated on the drawings.
- Size as required for the specific function or as required by NFPA 70, whichever is larger. Construction shall be of a NEMA design suitable for the environment installed.
- Manufacturers:
 - Appleton
 - Cooper
 - Erikson Electrical
 - Hoffman
 - Killark Electric
 - Raco,
 - Robroy Industries
 - Thomas and Betts
 - Steel City

B. OUTLET BOXES

- Galvanized steel knockout boxes, suitable in design to the purpose they serve and the space they occupy.
- Size as required for the specific function or as required by NFPA 70, whichever is larger.
- Provide approved cast outlet boxes with hubs and weatherproof covers in all areas subject to damp, wet, or harsh conditions.
- Coordinate locations of outlet boxes prior to rough-in, consult architect for exact locations.
- Applications:
 - Light fixture
 - Switch
 - Receptacles

WIRING DEVICES

A. GENERAL REQUIREMENTS

- The catalog numbers listed for wiring devices are generally for 20A rated devices.
- Where 15A rated devices are indicated on the drawings or required for circuit rating limitations, provide wiring devices equivalent to those specified for 20A, but rated for 15A.
- All receptacles located outdoors or in damp or wet locations: Listed as 'weather Resistant', designated by a 'WR' on the faceplate.
- Minor changes relative to the location of electrical equipment may be made to comply with structural and building requirements as determined in the course of construction, but do not move more than 12" horizontally.
- Contractor shall provide all wiring devices of the same manufacturer and not mixed on the project, to the maximum extent possible. Provide color of toggles and receptacles as requested by the Engineer.

B. WIRING DEVICES

- Shall be commercial grade
- Manufacturers:
 - Cooper
 - Hubbell
 - Legrand
 - Leviton.

SWITCH AND OUTLET COVER PLATES

A. GENERAL REQUIREMENTS

- Contractor shall provide cover plates by the same manufacturer as the wiring devices, complying with NFPA 70 ARTICLES 406.9 (A) or (B).

B. INDOOR DRY APPLICATIONS

- Colored, smooth nylon
- By the same manufacturer as the wiring devices.
- Install groups of switches under one ganged-plate, usually horizontally, or, where required by details, vertically. Set all cover plates plumb, parallel, and finished flush with the wall.

C. OUTDOOR WET APPLICATIONS

- Provide GFCI receptacles for designated weatherproof receptacles, unless indicated otherwise on the drawings.
- In-use, NEMA 3R, recessed or flush mount, NRTL labeled plates molded from a clear high impact ultraviolet stabilized polycarbonate material for easy verification that cords are plugged in and that the GFCI is functioning.
- Back box must be suitable for conduit connecting. Coordinate back box with wall depth.
- Basis of Design:
 - Intermatic WP1000RC/HRC or equal.

ELECTRICAL WIRING DEVICE INSTALLATION REQUIREMENTS

A. GENERAL REQUIREMENTS

- Solidly mount all junction boxes to structural elements.
- Unless noted otherwise, install wiring devices vertically aligned at height indicated on construction drawings.

B. MOUNTING HEIGHTS

- Receptacles:
 - Unless indicated otherwise, install vertically with the ground slot mounted at the bottom.
 - Where installed horizontally, install with the neutral slot mounted at the top.
 - Above counter: mount vertically aligned.
 - Mechanical and electrical equipment rooms and janitors closets: mount vertically aligned.
 - Garages: mount vertically aligned.
 - Weatherproof exterior receptacles: vertically aligned.
 - GFCI receptacles: Same as general receptacles.
- Switches:
 - All switches shall be mounted at the same height throughout the project unless noted otherwise.
 - Above Counters: Same as for receptacles.
 - Walls with Wainscoting: 5 inches minimum above wainscoting, but not exceeding 48 inches above finished floor.

ELECTRICAL SERVICE AND GROUNDING

A. ELECTRICAL SERVICE

- See one-line diagram for the following information:
 - Equipment Type
 - Size
 - Voltage
 - Phase
 - NEMA Ratings
 - Existing or New Equipment

B. GROUNDING

- Permanently and effectively ground and bond the electrical installation in a thorough and efficient manner.
- All grounding shall meet or exceed the requirements of NFPA.
- Where grounding on plans indicates grounding above minimum code requirements, drawings shall take precedence.
- Use bare or green insulated conductors as specified herein, and other materials indicated on the Drawings.

DISTRIBUTION AND CONTROL EQUIPMENT

A. LIGHTING AND APPLIANCE PANELBOARDS

- Panelboards:
 - Complete with bolt-on thermal magnetic, molded case circuit breakers
 - Dead-front finished cabinet
 - Fully- [or] [Aeries-] rated and with the integrated short circuit current ratings indicated on the drawings
 - All two- and three-pole breakers shall be of the common trip type.
 - Typewriter card directory indicating exactly what each circuit breaker controls fully-[or] [series-] rated and with the integrated short circuit current ratings indicated on the drawings
- Type SWD Circuit Breakers:
 - Use when breaker serves as a switch for 120V or 277V lighting circuits.
- GFCI Circuit Breakers:
 - Single- and two-pole configurations with Class A ground-fault protection (6-mA trip). Use as indicated on drawings.
- Ground-Fault Equipment Protection (GFEPE) Circuit Breakers:
 - Class B ground-fault protection (30-mA trip). Use as indicated on drawings.
- Handle Clamp:
 - Loose attachment for holding circuit breaker handle in "on" position
 - Use for all circuits containing emergency lighting loads, fire alarm loads, and as indicated on drawings
 - Breakers serving fire alarm loads must have a permanently-affixed red label stating "FA" in white letters adjacent to the circuit breaker.
- Handle padlocking device:
 - Fixed attachment for locking circuit breaker handle in "on" or "off" position. Use as indicated on drawings.
- Manufacturers:
 - Square D
 - Eaton
 - G.E.
 - Siemens.

B. CIRCUIT BREAKERS IN EXISTING PANELBOARDS /SWITCHBOARDS

- Provide new circuit breakers for installation in existing panelboards/switchboards, of the same manufacturer and type as the existing panelboards/switchboard circuit breakers.
- Short circuit current interrupting rating of any new breaker shall be the larger of the existing panel rating or the available fault current indicated on the drawings.

FUSES

A. GENERAL REQUIREMENTS

- Provide each circuit and set of fuse clips throughout the work with sizes and types as required or indicated.

A. FUSE TYPES

- Fuses used to protect motors:
 - UL Class RK5, Bussmann Fusetron or equal.
- Fuses used to protect all other electrical equipment:
 - UL Class RK1, dual element, Bussmann LPS/LPN or equal.
- All fuses devices shall be labeled as to type and size of fuse required.

TRANSFORMERS

A. DRY-TYPE TRANSFORMERS

- Transformers:
 - General purpose, NRTL listed/labeled. Comply with NEMA ST 20 and UL 1561.
- Insulation Class:
 - NRTL-component-recognized insulation system replaces the UL 1446 insulation rating system that used letters.
 - For three-phase transformers less than 15 kVA and all single-phase:
 - 185 degrees C, NRTL-component-recognized insulation system with a maximum of 115 degree C rise above a 40 degree C ambient temperature.
 - For three-phase transformers 15 kVA and larger:
 - 220 degrees C, NRTL-component-recognized insulation system with a maximum of 150 degree C rise above a 40 degree C ambient temperature.
- Phases, Voltages, and Sizes:
 - As indicated on the drawings.
- Sound Level:
 - Not exceeding 3 dBA less than NEMA ST 20 standards for the sizes indicated when factory tested according to IEEE C57.12.91.
- Full-Capacity Primary Taps:
 - For three-phase below 25 kVA and all single-phase
 - One 5 percent tap above and one 5 percent tap below; 25 kVA to 500 kVA, six 2.5 percent taps (2 above, 4 below)
 - Above 500 kVA
 - Four 2.5 percent (2 above, 2 below).
- Transformer Core and Coil Assemblies:
 - Mounted on integral vibration-absorbing pads.
- Vibration Isolation Pads:
 - Pad shall be constructed of neoprene, rubber, glass fiber, or a combination thereof.
 - Pads shall be "ribbed" or "waffled" in texture. Pads shall be selected for smallest

- durometer (hardness), preferably less than 50.
- Deflection of pad shall be 0.25 inches static minimum. Stack pads until the desired deflection is achieved.
- Transformer Enclosures:
 - Removable front cover
 - Core and coil encapsulated within resin compound, drip-proof, fabricated of heavy gauge sheet steel construction.
 - Dry locations:
 - Ventilated, NEMA 250 Type 2.
 - Damp or wet locations:
 - Ventilated with weather shields, NEMA 250 Type 3R.
 - Corrosive locations:
 - Totally enclosed, non-ventilated, NEMA 250 Type 4X, stainless steel.

B. TRANSFORMER INSTALLATION

- Mounting:
 - Transformers 75 kVA and larger shall be floor mounted unless indicated otherwise.
 - Transformers 45 kVA and smaller shall be floor mounted or wall mounted where wall construction is suitable for the load.
 - Floor mounted transformers shall be securely bolted to a 4 inch house keeping pad with vibration isolation pads
 - Wall mounted or suspended transformers shall have a means of isolating vibration from the support.
 - Wall mounts shall be by same manufacturer as the transformer or designed by a structural engineer.
- Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturers.
- Make final conduit connections to transformers with flexible conduit, with at least 6 inches of slack in all directions. Minimum flexible conduit length shall be 2 feet.
- Testing
 - All manufacturer recommended testing.
 - NETA Acceptance Testing Specification
 - Remove and replace all units that fail tests and inspection.

SWITCHES AND MOTOR CONTROLLERS

A. DISCONNECT (SAFETY) SWITCHES

- Disconnect (Safety) Switches:
 - Heavy-duty, fused or non-fused (as indicated on drawings or required) NEMA KSI, externally operated, visible-blade safety switches
 - NEMA enclosure type indicated on the drawings or suitable for the environment in which installed.
 - Based on fusible switch and fuse sizes indicated, include Class R, J, or L fuse provisions as applicable.
 - Where indicated, provide fusible switches permanently labeled as suitable for use as service entrance equipment
 - Provide integral and separate neutral and ground assemblies, suitable for the sizes of conductors indicated
 - Do not double-lug any terminations not specifically listed as suitable for more than one conductor.
- Provide switches where not furnished with the starting equipment, at all other points required by NFPA 70, and where indicated on the drawings.
- Where indicated, provide the disconnect switch with an integral auxiliary switch, open when the main switch blades are open, and wire it into the [variable frequency drive] [controller] to disable the [drive] [motor] whenever the switch is OPEN
- Where indicated, provide shunt-trip disconnect switch, Bussmann power module switch or approved equal, with a fire protection interface relay and auxiliary contacts.
- Manufacturers:
 - Square D
 - Eaton
 - G.E.
 - Siemens.

B. MOTOR STARTING SWITCHES

- Motor starting switches shall consist of a toggle operated two- or three-pole switch
- Contacts shall be double break silver alloy, visible from both sides of the switch, and shall have a direct linkage to the operator for positive break
- Provide flush mounted units in finished areas and surface mounted units in unfinished areas. Starters shall have NEMA I general purpose enclosure, unless otherwise indicated, and be rated for the motor horsepower required. Provide handle guard with locking provisions.
- Integral horsepower manual controller manufacturers:
 - Square D Class 2510 Type K
 - Eaton 9115 series
 - G.E. TC2000 series
 - Siemens MS series
 - Westinghouse MST series.

OPTIMIZ³OD
Lighting | Engineering | Design

842 EAST ISABELLA AVE., MESA, AZ 85204
WWW.OPTIMIZED-LED.COM | 602-899-6224
PROJECT: SC19037

BOB BIRETTI, LICENSED ELECTRICAL ENGINEER
AZ 53437 FIRM 21458 [CA 22800] CO 55367
BOB.BIRETTI@OPTIMIZED-LED.COM

STAMP:
This drawing is the professional intellectual property of Optimized LED and protected by Copyright. Usage of this drawing shall be restricted for use as a project example and shall not be reproduced, recreated, or utilized for any other purpose without express written consent of Optimized LED.

SCIENTEX INC. - PHOENIX ELECTRICAL INSTALL DRAWINGS

DRAWN: B5L	CHECKED: B5L	NUMBER: 5C1190017
----------------------	------------------------	-----------------------------

REVISIONS:	
-	
-	
-	
-	
-	
-	
-	

DATE: 07/05/19	ISSUED FOR: FOR PRICING
--------------------------	-----------------------------------

SHEET NAME
ELECTRICAL
SPECIFICATIONS 2

SHEET NUMBER

E4.1

7/6/2019 4:40:20 PM