ELECTRICAL SYMBOLS

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

STANDARD MOUNTING HEIGHTS

ANNUNCIATOR PANELS (DISPLAY)	60"
CONTROLS (TOP OF DEVICE)	48"
EXIT SIGNS (WALL MOUNTED TO BOTTOM)	105"
FIRE ALARM ANNUNCIATOR PANEL (DISPLAY)	60"
FIRE ALARM BELL (EXTERIOR) (CENTERLINE)	120"
FIRE ALARM CONTROL PANEL/UNIT (DISPLAY)	60"
PULL STATIONS (TOP OF DEVICE)	48"
RECEPTACLES (TO BOTTOM)	16"
RECEPTACLES (EXTERIOR)	24"
RECEPTACLES (GARAGES)	24"
RECEPTACLES (POOLS)	27"
RECEPTACLES (ABOVE COUNTER)	42"
RECEPTACLES IN EQUIPMENT ROOMS	44"
REMOTE INDICATING LIGHT (EQUIPMENT ROOMS)	48"
REMOTE INDICATING LIGHT (FINISHED AREAS)	CEILING
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)	6"
TELEVISION OUTLETS	REFER TO ARCH DRAWINGS
FIRE ALARM DEVICES (CENTERLINE)	84"

USE THE DEFAULT MOUNTING HEIGHTS SHOWN ABOVE UNO IN THE CONSTRUCTION DOCUMENTS. MOUNTING HEIGHTS LISTED ARE ABOVE FINISHED FLOOR (AFF) OR ABOVE FINISHED GRADE (AFG) TO BOTTOM OF OUTLET BOX. ALL DEVICES SHALL BE INSTALLED IN COMPLIANCE WITH CURRENT ADA AND LOCAL REQUIREMENTS.

ABBREVIATIONS

AF	AMPERE FRAME SIZE
AFC	ABOVE FINISHED CEILING
AFF	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
DPDT	DOUBLE-POLE, DOUBLE-THROW
DPST	DOUBLE-POLE, SINGLE-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
FACP	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
JB/J-BOX	JUNCTION BOX
LF	LINEAR FEET
LRA	LOCKED ROTOR AMPS
LTG/LTS	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
MOCP	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
PH/Ø	PHASE
PNL	PANEL
PNLBD	PANELBOARD
PROVIDE	FURNISH AND INSTALL
PT	POTENTIAL TRANSFORMER
QTY	QUANTITY
RCPT	RECEPTACLE
RELO	RELOCATE
RLA	RUNNING LOAD AMPS
RTU	ROOFTOP UNIT
SCCR	SHORT-CIRCUIT CURRENT RATING
SD	SMOKE DUCT DETECTOR
SF	SQUARE FEET
SPDT	SINGLE-POLE, DOUBLE-THROW
SPST	SINGLE-POLE, SINGLE-THROW
ST	SHUNT TRIP
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
TBB	TELECOMMUNICATIONS BONDING BACKBONE
TBD	TO BE DETERMINED
TGB	TELECOMMUNICATIONS GROUND BUS BAR
TL	TWISTLOCK
TMGB	TELECOMMUNICATIONS MAIN GROUND BUS BAR
TX	TRANSFORMER
TYP	TYPICAL
U/F	UNDERFLOOR
U/G	UNDERGROUND
U/S	UNDERSLAB
UH	UNIT HEATER
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTIBLE POWER SUPPLY
VD	VOLTAGE DROP
VFD	VARIABLE FREQUENCY DRIVE
W	WIRE
W/	WITH
WP	WEATHER PROOF
WR	WEATHER RESISTANT
WT	WATERTIGHT
XP	EXPLOSION-PROOF

ANNOTATION

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

CIRCUITING & WIRING

- HOMERUN TO PANELBOARD. INFORMATION AT ARROWS ARE CIRCUIT NUMBERS AND PANELBOARD FOR TERMINATION. REFER TO PANELBOARD SCHEDULES FOR BRANCH CIRCUIT CONDUCTOR SIZES. (P1-3,5,7)
- CIRCUIT CONTINUATION OR PARTIAL CIRCUIT
- CONDUIT CONCEALED
- CONDUIT IN/UNDER FLOOR/GROUND CONSTRUCTION
- EXPOSED CONDUIT
- LOW VOLTAGE CABLE (NOT ROUTED IN CONDUIT)
- CONDUIT TURNING DOWN
- CONDUIT TURNING UP

LINETYPE LEGEND

THROUGHOUT THE DRAWINGS DIFFERENT LINETYPES 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 LINETYPES 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 PHASES DESCRIBED IN THE CONSTRUCTION DOCUMENTS ARE GENERAL AND ONLY INTENDED TO INDICATE A BROAD ORDER FOR THE SAKE OF DESCRIBING THE PROJECT. THE FOLLOWING LINETYPES MAY BE USED ON ANY DEVICE, EQUIPMENT, NOTE, LINE, SHAPE, ETC.

EXISTING	NEW
DEMOLISH	FUTURE

LIGHTING CONTROL DEVICES

- SINGLE POLE SWITCH (NO LETTER DESIGNATION)

SWITCH LETTER DESIGNATIONS AS FOLLOWS:
2 = TWO POLE
3 = THREE-WAY
4 = FOUR-WAY
D = DIMMER
F = FAN SPEED CONTROL
K = KEYED
LV = LOW VOLTAGE
OS = OCCUPANCY SENSOR
P = SPST PILOT LIGHT
VS = VACANCY SENSOR
WP = WEATHER PROOF

- AUTOMATIC LOAD CONTROL RELAY (ALC)
- BRANCH CIRCUIT TRANSFER SWITCH (BTS)
- RELAY OR CONTACTOR (# = QUANTITY OF RELAYS) (R#)
- LIGHTING CONTROL PHOTOCELL (SHADE INDICATES AIMING)
- TIME SWITCH (TS)

LOWER CASE LETTERS DESIGNATE ZONE TO BE CONTROLLED.

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
- TRANSFORMER (T)
- MOTOR
- 200/3/150/3R — DISCONNECT SWITCH - "200/3/150/3R" DENOTES AMPERES/POLE/FUSE/NEMA ENCLOSURE RATING, NF= NON-FUSED, CB= CIRCUIT BREAKER (200/3/CB), NO VALUE (200/3/150) FOR NEMA ENCLOSURE MEANS STANDARD NEMA 1 RATING
- 30/3/15/1/3R — COMBINATION DISCONNECT (SAFETY) SWITCH AND MOTOR STARTER "30/3/15/1/3R" DENOTES AMPERES/POLE/FUSE/NEMA STARTER SIZE/NEMA ENCLOSURE RATING. NF= NON-FUSED, CB= CIRCUIT BREAKER (30/3/CB/1), NO VALUE (200/3/150/1) FOR NEMA ENCLOSURE MEANS STANDARD NEMA 1 ENCLOSURE RATING
- MAGNETIC MOTOR STARTER, NEMA SIZE AS NOTED. 3-POLE, UNO
- MANUAL MOTOR STARTER DISCONNECT
- VARIABLE FREQUENCY DRIVE (VFD)
- RELAY OR CONTACTOR (# = QUANTITY OF RELAYS) (R#)
- LIGHTING CONTROL PHOTOCELL (SHADE INDICATES AIMING)
- TIME SWITCH (TS)
- LOW-VOLTAGE PUSH-BUTTON (AUTO-OPENER / SECURITY)
- STOP-START PUSH BUTTON CONTROL STATION
- EMERGENCY POWER OFF BUTTON
- OVERHEAD PADDLE FAN

LIGHTING (REFER TO LIGHT FIXTURE SCHEDULE FOR MORE INFO)

- LIGHT FIXTURE
  - a = SWITCHED BY SWITCH "a"
  - A = LIGHT FIXTURE TYPE "A"
  - NL = NIGHT LIGHT FITURE
  - = 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)
  - 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

ADDITIONAL LETTER DESIGNATIONS AS FOLLOWS:

D = DEMOLISHED
E = EXISTING
EM = EMERGENCY POWER
ER = EXISTING TO BE RELOCATED
R = RELOCATED, NEW LOCATION

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
- TWIST-LOCK TYPE RECEPTACLE
- GFCI OR GFCI — GFCI TYPE RECEPTACLE*
- ISOLATED GROUND TYPE RECEPTACLE*
- EM OR EM — EMERGENCY RECEPTACLE*
- RECEPTACLE INSTALLED ABOVE COUNTER OR BACKSPLASH*
- RECEPTACLE INSTALLED IN CEILING*
- RECEPTACLE INSTALLED IN FLOOR*
- RECEPTACLE INSTALLED VIA DROP CORD*
- WR/WP — 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
  - WP = WEATHER PROOF COVER
  - WR = WEATHER RESISTANT

*SYMBOL DEMONSTRATED WITH DUPLEX RECEPTACLE, WHEN USED IN COMBINATION WITH OTHER DEVICES MEANING IS SIMILAR FOR THOSE DEVICE TYPES.

TECHNOLOGY DEVICES & BOXES

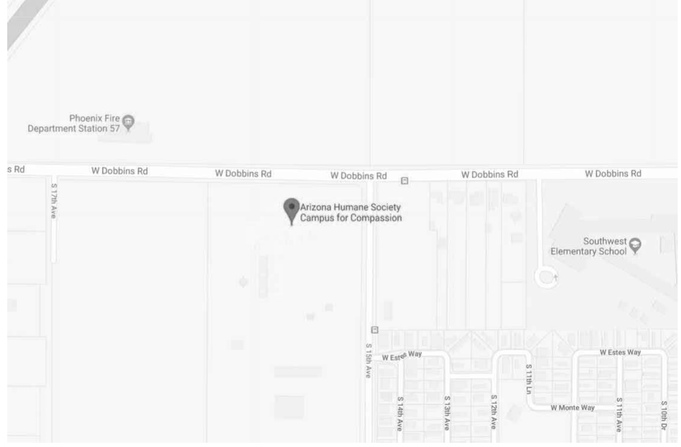
- MULTI-OUTLET ASSEMBLY
- TELEPHONE OUTLET
- DATA OUTLET
- MULTI-SERVICE OUTLET; TELEPHONE AND DATA
  - ABOVE COUNTER, TYP
  - WALL, TYP
  - FLOOR, TYP
- A — MULTI-SERVICE POWER POLE WITH TELEPHONE, DATA AND POWER OUTLETS A = TYPE. REFER TO PLANS, SCHEDULES AND SPECIFICATIONS
- A — MULTI-SERVICE FLOOR BOX WITH TELEPHONE, DATA AND POWER OUTLETS A = TYPE, REFER TO PLANS, SCHEDULES AND SPECIFICATIONS
- A — POKE THROUGH. A = TYPE, REFER TO PLANS, SCHEDULES AND SPECIFICATIONS
- THERMOSTAT (T)
- D W — JUNCTION BOX/OUTLET BOX

A NUMBER ADJACENT TO ANY TECHNOLOGY SYMBOL INDICATES TOTAL QUANTITY OF CABLES AND PORTS TO BE INSTALLED AT THAT LOCATION.

IF A HOME-RUN IS USED ON ANY FLOOR-BOX OR MULTI-OUTLET ASSEMBLY, IT INDICATES THAT POWER IS ALSO TO BE INSTALLED IN THIS DEVICE.

ELECTRICAL ONE-LINE

- 100A — SWITCH (RATING AS INDICATED)
- 60A NON-FUSED SWITCH — FUSED SWITCH (RATING, POLES AND FUSE TYPE AS INDICATED)
- 20A 1P — CIRCUIT BREAKER (RATINGS AS INDICATED)
- PANELBOARD, SINGLE OR MULTI-SECTION (REFER TO SCHEDULES)
- ISOLATED POWER PANELBOARD W/ INTEGRAL TRANSFORMER (REFER TO SCHEDULES)
- TYP — TRANSFORMER (TYPE AND RATINGS AS INDICATED)
- TYP — SHIELDED TRANSFORMER (TYPE AND RATINGS AS INDICATED)
- ATSP 200A — AUTOMATIC TRANSFER SWITCH (RATINGS AS INDICATED)
- ATSP (WITH BYPASS) 200A — AUTOMATIC TRANSFER SWITCH WITH BYPASS (RATINGS AS INDICATED)
- EMERGENCY GENERATOR — GENERATOR (RATINGS AS INDICATED)
  - NON-SEPARATELY DERIVED SOURCE OR SEPARATELY DERIVED SOURCE
- MDP (SWITCHBOARD, ELEC ROOM) 4000 AMPS, 480/277V, 3Ø 4W — SWITCHGEAR, SWITCHBOARD AND/OR DISTRIBUTION PANELBOARD (TYPE, RATING, DEVICES AND ACCESSORIES AS INDICATED)
- DIGITAL VOLT AMP — COMBINATION DIGITAL VOLT METER/AMMETER
- ### — CIRCUIT IDENTIFICATION (REFER TO CIRCUIT SCHEDULE)
- ST — SHUNT TRIP
- UTILITY METER — UTILITY METER (AS REQUIRED BY UTILITY)
- CURRENT TRANSFORMER RATING AS SPECIFIED OR REQUIRED
- POTENTIAL TRANSFORMER RATING AS SPECIFIED OR REQUIRED
- SPD — SURGE-PROTECTIVE DEVICE
- GROUND CONNECTION
- TEST WELL
- HEATER
- MOTOR
- ## — BLOCK LOAD KW OR KVA
- F# FP# — FAULT POINT REFERENCED IN SHORT CIRCUIT CURRENT AND VOLTAGE DROP SPREADSHEET
- CONNECTION POINT OR EQUIPMENT TERMINATION



1 PROJECT LOCATION N.T.S.

GENERAL NOTES

1. FULLY COORDINATE ALL WORK WITH ALL SUBCONTRACTORS ON PROJECT.
2. PROVIDE ALL CONTRACTORS A COMPLETE SET OF FULL-SIZE BID DOCUMENTS.
3. PRIOR TO SUBMITTING PROPOSAL, BIDDER SHALL EXAMINE ALL GENERAL CONSTRUCTION DRAWINGS AND SHALL HAVE HAD VISITED THE CONSTRUCTION SITE. CONTRACTOR SHALL BE FAMILIAR WITH THE EXISTING CONDITIONS UNDER WHICH THEY WILL HAVE TO OPERATE AND WHICH MAY AFFECT THE WORK.
4. ELECTRICAL DRAWINGS ARE DIAGRAMMATIC IN NATURE AND AND REPRESENT THE GENERAL SCOPE OF THE WORK AS IT PERTAINS TO THE ENGINEERED SYSTEMS AT HAND. REVIEW THE GENERAL NOTES, SPECIFICATIONS AND PLANS FOR ADDITIONAL REQUIREMENTS THAT MAY NOT BE SPECIFICALLY CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY THE ENGINEER OF ANY CONFLICTS OR DISCREPANCIES AND FOR EXACT LOCATION OF ANY SYSTEM COMPONENTS.
5. 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.
6. PROVIDE A SEPARATE CODE SIZED GREEN EQUIPMENT GROUND CONDUCTOR IN ALL CONDUITS AND RACEWAYS CONTAINING LINE VOLTAGE CIRCUITS. FOR ALL 20A CIRCUITS, EQUIPMENT GROUND CONDUCTOR SIZE SHALL MATCH PHASE CONDUCTOR SIZE. FOR CIRCUITS UPSIZED FOR VOLTAGE DROP INCREASE EQUIPMENT GROUNDING CONDUCTOR SIZE PER CODE.
7. THE CONTRACTOR SHALL EMPLOY QUALIFIED AND EXPERIENCED WORKMEN FOR THIS WORK.

OPTIMIZED Lighting Engineering Design
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MESA, AZ, 85204
602-699-6224
PROJECT: AHS180015B
EOR: BRETT LORENZEN
PE#: 53437

STAMP:

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BSL	BSL	AHS180015B

ARIZONA HUMANE SOCIETY
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1521 West Dobbins Road
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REVISIONS:
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DATE:	ISSUED FOR:
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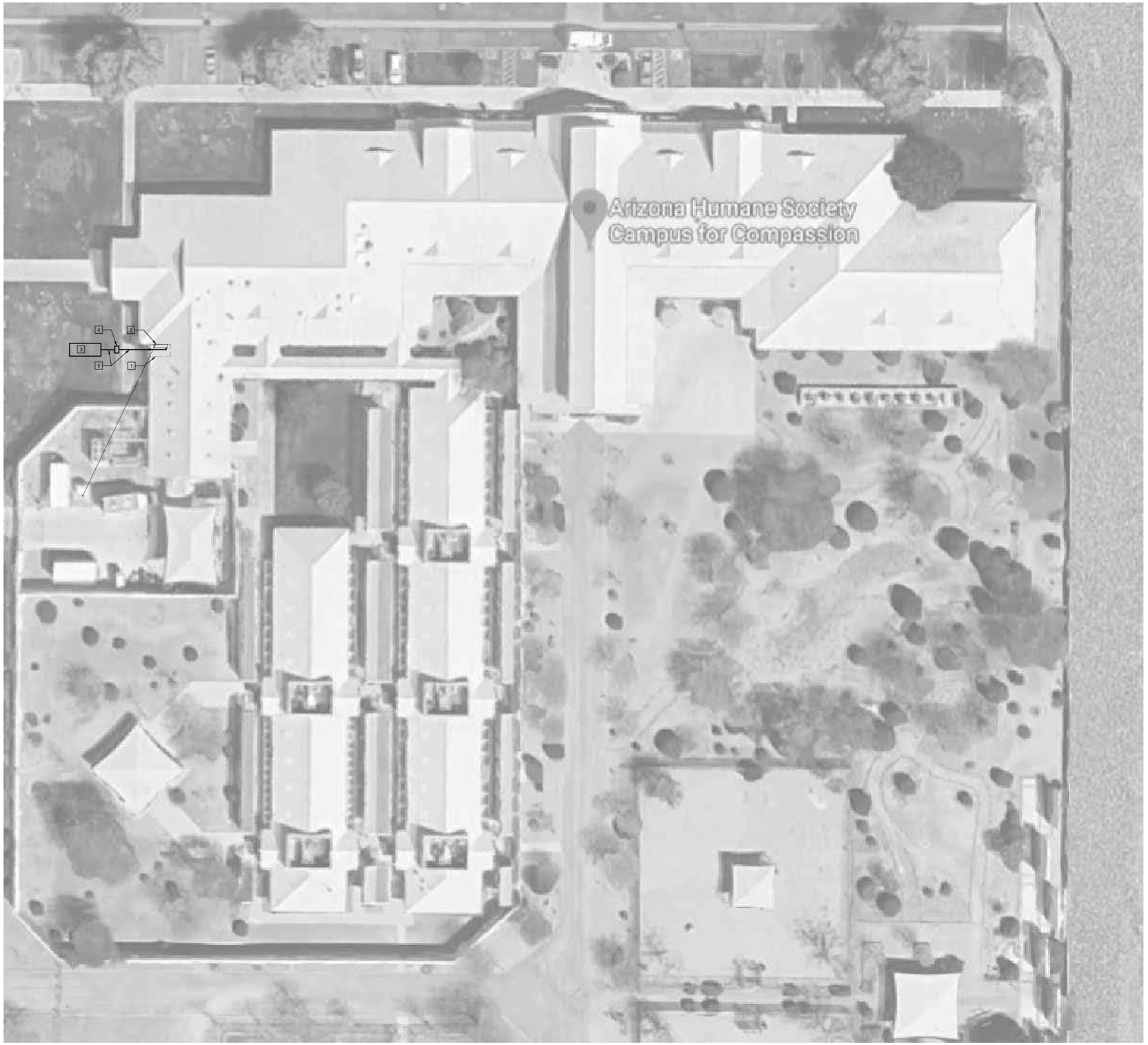
SHEET NAME
ELECTRICAL
SYMBOLS, ABBREVIATIONS, AND GENERAL NOTES

SHEET NUMBER
E1



1 ELECTRICAL POWER AND DISTRIBUTION PLAN
1" = 20'

GENERAL NOTES

A. SEE SHEET E1 FOR GENERAL NOTES, ONE-LINE DIAGRAM ON SHEET E3 FOR ONE-LINE DIAGRAM, CONDUIT, AND WIRE SIZES. SEE SHEET E5-E6 FOR ELECTRICAL SPECIFICATIONS.

B. CONTRACTOR SHALL PROVIDE SUBMITTALS FOR NEW GENERATOR SET, BREAKER, AND AUTOMATIC TRANSFER SWITCH.

C. ALL SERVICE GROUNDING CONDUCTORS SHALL BE COPPER AND AT LEAST #2/0 BARE OR GREEN INSULATED, ALL BONDS SHALL BE MADE USING EXOTHERMIC WELDS.

KEYED NOTES

1. EXISTING MAIN ELECTRICAL ROOM TO REMAIN. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR WORK TO BE PERFORMED IN THIS AREA.
2. EXISTING 1600A ELECTRICAL SERVICE ENTRANCE SECTION. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR WORK TO BE PERFORMED IN THIS AREA.
3. NEW 500KW PERMANENTLY INSTALLED GENERATOR SET. PROVIDE CONCRETE PAD DESIGNED BY A QUALIFIED STRUCTURAL ENGINEER TO SUPPORT THE GENERATOR. PROVIDE BARE COPPER GROUNDING CONDUCTOR BONDED TO STRUCTURAL STEEL. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR MORE INFORMATION.
4. NEW 800A AUTOMATIC TRANSFER SWITCH. PROVIDE NEW CONCRETE PAD DESIGNED BY A QUALIFIED STRUCTURAL ENGINEER TO SUPPORT THE TRANSFER SWITCH. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR MORE INFORMATION.

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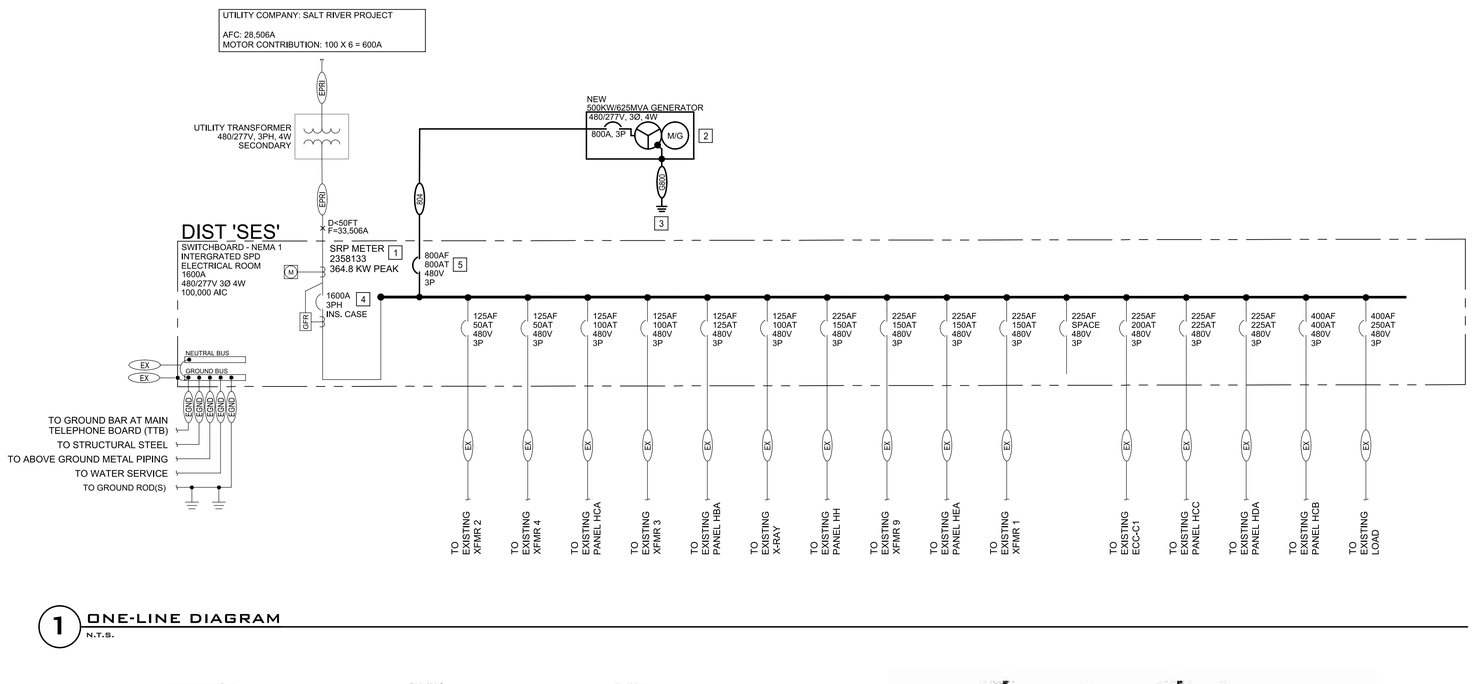
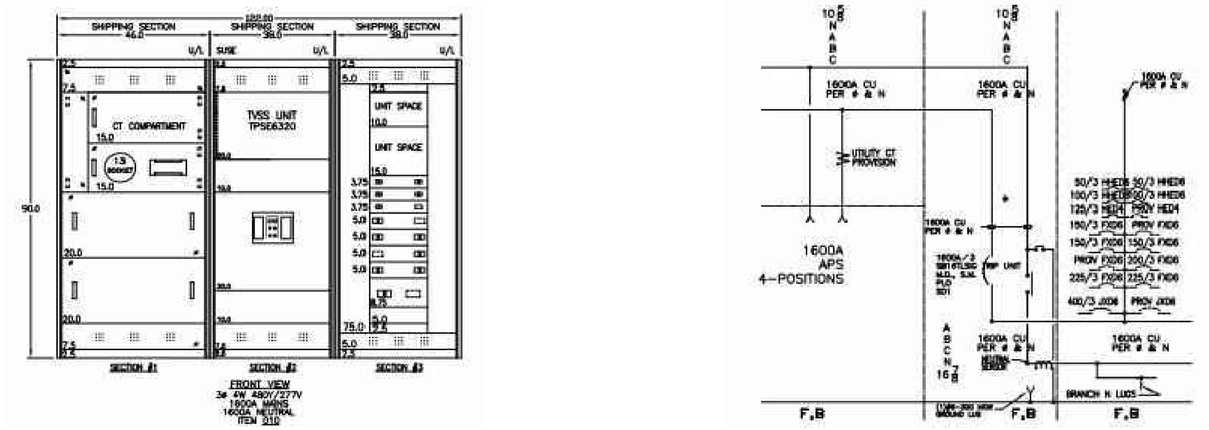
SHEET NAME
ELECTRICAL
SITE POWER AND
DISTRIBUTION PLAN

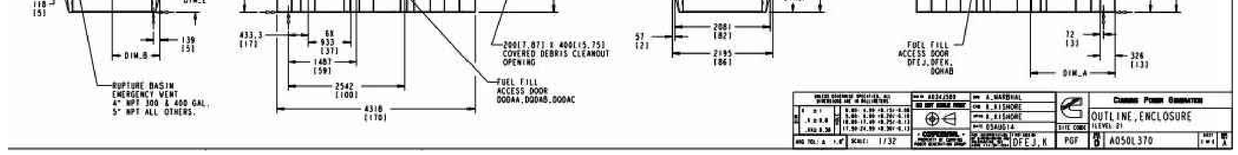
SHEET NUMBER
E2



1 ONE-LINE DIAGRAM
N.T.S.



2 ELECTRICAL SERVICE BUSSING DIAGRAM
N.T.S.



3 GENERATOR ENCLOSURE ELEVATIONS
N.T.S.

FEEDER LEGEND

EX	EXISTING FEEDER TO REMAIN
EGND	EXISTING SERVICE MAIN GROUNDING CONDUCTOR
EMBJ	EXISTING SERVICE MAIN BONDING JUMPER
EPRI	EXISTING ELECTRICAL UTILITY LATERAL
ESEC	EXISTING UTILITY SECONDARY SERVICE
4#4	3 SETS (4 300 KCMIL CU, 1 #1/0 CU GROUND, 3" CONDUIT)
G#2/0	#2/0 MAIN GROUNDING CONDUCTOR

KEYED NOTES

1. MAXIMUM LOAD ON ELECTRICAL SERVICE FOR THE PAST 12 MONTHS AT THE TIME OF DESIGN OCCURRED FOR THE MONTH OF JULY 2018. THE EMERGENCY ELECTRICAL SYSTEM WILL BE DESIGNED TO ACCOMODATE THIS LOAD.
2. CONTRACTOR SHALL PURCHASE AND INSTALL A NEW SELF-CONTAINED CUMMINS GENERATOR SET SIZED PER ONE-LINE DIAGRAM AND MEETING SPECIFICATIONS OUTLINED ON SHEET E6.
3. CONTRACTOR SHALL BOND NON-SEPARATELY DERIVED GENERATOR GROUND TO REINFORCEMENT WITHIN CONCRETE PAD AND 10' COPPER CLAD GROUND ROD. TEST TO ENSURE LESS THAN 5 OHMS RESISTANCE, IF GREATER PROVIDE ADDITIONAL OR CHEMICAL GROUND RODS.
4. PROVIDE KIRK-KEY INTERLOCK DEVICE ACCESSORY FOR INSULATED CASE MAIN CIRCUIT BREAKER, KEY SHALL BE INTERLOCKED WITH NEW GENERATOR INCOMING CIRCUIT BREAKER (KEYNOTE 5 ON THIS SHEET), SEE DETAIL 2 ON THIS SHEET FOR MORE INFORMATION.
5. PROVIDE NEW MOLDED CASE CIRCUIT BREAKER WITH KIRK-KEY INTERLOCK DEVICE ACCESSORY WITHIN DISTRIBUTION SECTION OF EXISTING ELECTRICAL SERVICE, KEY SHALL BE INTERLOCKED WITH MAIN CIRCUIT BREAKER (KEYNOTE 4 ON THIS SHEET). SEE DETAIL 2 ON THIS SHEET FOR MORE INFORMATION.

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SHEET NAME
ELECTRICAL
ONE-LINE DIAGRAM,
CALCS, PANEL SCHEDULES

SHEET NUMBER
E3

GENERAL INSTRUCTIONS

A. GENERAL REQUIREMENTS

1. Where the requirements of this section and division exceed those of industry standards and/or general conditions, the requirements of this section take precedence

2. Become thoroughly familiar with all of its contents as to requirements that affect this section.

3. 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.

4. 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

5. In the event of discrepancies between specifications and drawings, notify the engineer and request clarification prior to proceeding with the work involved.

6. Drawings are diagrammatic in nature:
   a. Drawings are graphic representations of the work upon which the contract is based.
   b. 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
   c. 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
   d. Exact location of any component shall be confirmed and/or dimensioned by architect prior to rough-in

B. DEFINITIONS

1. Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."

2. 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."

3. Provide: "to furnish and install."

4. 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.

5. 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.

6. AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.

7. NRTL: Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project. Nationally recognized testing laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ and standards that meet the specified criteria.

8. 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.

9. Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.

10. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, certified, or all three, by an NRTL, and acceptable to the AHJ over this project.

C. MATERIAL AND WORKMANSHIP

1. 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. Pre-owned equipment may be used upon engineers review and approval.

2. 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.

3. Provide markings or a nameplate for all material and equipment identifying the manufacturer and providing sufficient reference to establish quality, size, and capacity

4. All workmanship shall be of the finest possible by experienced mechanics of the proper trade. In general, provide commercial specification grade products.

5. Provide all hoists, scaffolds, staging, runways, tools, machinery, and equipment required for the performance of the electrical work. Store and maintain material and equipment in clean condition, and protected from weather, moisture, and physical damage.

6. 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.

7. 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

1. In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.

2. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

3. 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

1. 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.

2. 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.

3. Figured dimensions shall be taken in preference to scale dimensions. Contractor shall take his own measurements at the building, as variations may occur.

4. Contractor shall be held responsible for errors that could have been avoided by proper checking and inspection.

5. Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed.

6. Model numbers listed in the specifications or shown on the drawings are not intended to designate the required trim.

G. ORDINANCES AND CODES

1. Work performed under this contract shall, at a minimum, be in conformance with applicable national, state and local codes having jurisdiction.

2. 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:
   a. National Fire Protection Association (NFPA)
   b. Underwriters Laboratories (UL)
   c. Occupational Safety and Health Administration (OSHA)
   d. American National Standards Institute (ANSI)
   e. American Society of Testing Materials (ASTM)
   f. Rules and regulations of public utilities and municipal departments affected by connection of services.
   g. Other national standards and codes where applicable.

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

4. Where conflicts between various codes, ordinances, rules, and regulations exist, verify with the engineer.

5. 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.

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

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

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

9. 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

1. Store and protect from damage equipment and materials delivered to job site.

2. For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces.

3. 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.

4. 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.

5. Keep premises broom clean of foreign material created during work performed under this contract.

6. Conduit, equipment, etc. shall have a neat and clean appearance at the termination of the work.

7. 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. SUBSTITUTIONS

1. Materials, products, equipment, and systems described in the construction documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution.

2. To request a substitution, request the Substitution Request Form from the Architect or Engineer. Email a cut-sheet of the proposed equipment with all options and accessories highlighted and selected for review. Engineer will respond with a review form via email.

3. Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:
   a. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects unless stated otherwise in the substitution request.
   b. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
   c. Proposed substitution has received necessary approvals of authorities having jurisdiction.
   d. Same warranty will be furnished for proposed substitution as for specified Work.
   e. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
   f. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

J. SUBMITTALS

1. Assemble and submit for review shop drawings, material lists, manufacturer product literature for equipment to be furnished, and items requiring coordination between contractors under this contract.

2. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept.

3. Prior to transmitting submittals, verify that the equipment submitted is mutually compatible with and suitable for the intended use, will fit the available space, and maintain manufacturer recommended service clearances.

4. If the size of equipment furnished makes necessary any change in location or configuration, submit a shop drawing showing the proposed layout.

5. Transmit submittals as early as required to support the project schedule. While we strive for one-week review please allow two-weeks, plus a duplication of this time for resubmittals, if required.

6. Only resubmit those sections requested for resubmittal or that were modified in any other way.

7. Submittals shall contain:
   a. The project name
   b. Applicable specification section
   c. Submittal data
   d. Equipment identifications acronym as used on the drawings
   e. Contractors review stamp
   a. The stamp shall certify that the submittal has been checked by the Contractor, complies with the drawings and specifications, and is coordinated with other trades.

8. Requirements to prevent submittal rejection:
   a. Submittals and shop drawings shall not contain firm name, logo, the seal, or signature of the Engineer.
   b. They shall not be copies of the work product of the Engineer.
   c. Each item or model number shall be clearly marked and accessories indicated.
   d. Label the catalog data with the equipment identification acronym or number as used on the drawings and include performance curves, capacities, sizes, weights, materials, finishes, wiring diagrams, electrical requirements and deviations from specified equipment or materials.

9. Electronic Submittals:
   a. Contractor shall notify the Architect and Engineer that the submittals have been posted
   b. Contractor shall include the website, user name, and password information needed to access the submittals
   c. For submittals sent by e-mail, Contractor shall copy the designated representatives of the Architect and Engineer.
   d. Contractor shall allow two weeks for the Engineer review time as specified above.

10. The checking and subsequent acceptance of submittals by the Engineer and/or Architect shall not relieve the Contractor from responsibility for deviations from the drawings and specifications, errors in dimensions, details, sizes of equipment, or quantities, omissions of components or fittings, coordination of electrical requirements, and not coordinating items with actual building conditions and adjacent work. Contractor shall request and secure written acceptance from the Engineer and Architect prior to implementing any deviation.

K. ELECTRONIC DRAWING FILES

1. Electronic drawing files are the intellectual property of the design professional and are covered under United States Copyright laws.

2. Requests for electronic drawing files will be considered on a case by case basis.

3. Optimized-LED retains the rights to charge for additional usage of the company's intellectual property outside of the original contractual agreement.

4. Request shall be made in writing to utilize electronic drawing files for any reason. Email is considered an acceptable form of written request.

L. RECORD DRAWINGS (AS-BUILT DRAWINGS)

1. During progress of the work in this division, Contractor shall maintain an accurate record of all changes made during the installation of the system.

2. Upon completion of the work, accurately transfer all record information to three identical sets of the approved shop drawings.

M. OPERATION AND MAINTENANCE INSTRUCTIONS

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

2. 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.

3. Include an inside cover sheet that lists the Project Name, Date, Owner, Architect, Engineer, General Contractor, Sub-Contractor, and an index of contents.

4. Submit a copy of literature digitally to the owner.

5. Include Record Drawings as described above.

N. TRAINING

1. 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.

2. 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.

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

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

5. Notify Owner and Engineer two-weeks prior to the scheduled training date to provide the option of attendance on site.

6. Submit a certification letter with the following information to the Architect and Engineer stating that the Owner's designated representative has been trained as specified herein. Letter shall include:
   a. Date
   b. Time
   c. Attendees
   d. The Contractor and the Owner's representative shall sign the certification letter indicating agreement that the training has been provided.

O. WARRANTIES

1. 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.

2. 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.

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

GENERAL MATERIALS AND INSTALLATION

A. BUILDING OPERATION

1. Accomplish work requiring interruption of building operation at a time when the building is not in operation and only with written approval of building Owner and/or tenant.

2. Coordinate interruption of building operation with the Owner and/or tenant a minimum of seven (7) days in advance of work.

B. EXISTING EQUIPMENT REUSE AND REMOVAL

1. Remove all existing wiring, exposed conduits, and other electrical installations not reused prior to substantial completion of the work.

2. Cut, patch, and repair where required for new electrical installations, and patch and repair all surface damage resulting from this work.

3. Relocate all existing electrical systems required to be in operation at substantial completion of the contract, if required, as a result of work included under this contract, even if not specifically indicated in the drawings or specifications.

4. Existing service entrance conductors and feeder conductors may be reused if all of the following conditions are met:
   a. Conductor sizes meet or exceed the sizes specified on the drawings.
   b. Conductor insulation is in good or better condition.
   c. Conductor insulation is the correct type for the conditions.

C. EXCAVATION AND BACKFILLING

1. Trenching:
   a. Trenches shall be of sufficient width.
   b. Crib or brace trenches to prevent cave-in or settlement.
   c. Do not excavate trenches close to columns and walls of new building without prior consultation with the Architect.
   d. Use pumping equipment if required to keep trenches free of water.
   e. Backfill trenches in maximum 6-inch layers of well tamped dry earth in a manner to prevent future settlement.

2. Excavation:
   a. Excavation as specified herein shall be classified as common excavation.
   b. Common excavation shall comprise the satisfactory removal and disposition of material of whatever substances and of every description encountered, including rock, if any, within the limits of the work as specified and shown on the drawings.
   c. Excavation shall be performed to the lines and grades indicated on the drawings.
   d. Dispose of excavated materials that are considered unsuitable for backfill, and surplus of excavated material, which is not required for backfill, all to the satisfaction of the Engineer.

D. COINCIDENTAL DAMAGE

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

2. Repair materials shall match existing construction.

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

4. Repair work shall be thoroughly first class.

E. CUTTING AND PATCHING

1. Cut walls, floors, ceilings, and other portions of the facility as required to install work under this division.

2. Do not cut or disturb structural members without prior approval from the Architect.

3. Cut holes as small as possible.

4. Patch walls, floors, and other portions of the facility as required by work under this division.

5. Patching shall match the original material and construction including fire ratings, if applicable.

6. Repair and refinish areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

F. ROUGH-IN

1. Coordinate without delay all roughing-in with other divisions. Conceal all conduit and raceways except in unfinished areas and where otherwise indicated on the drawings.

G. CONCRETE BASES

1. Provide concrete bases for equipment where indicated on the drawings and as specified herein.

2. Concrete bases shall have chamfered edges.

3. Size of base shall be a minimum of 4 inches greater than the footprint of the equipment that it is supporting and shall have a minimum height of 3-1/2 inches.

4. Concrete:
   a. Minimum 28-day, 4000-psi concrete conforming to American Concrete Institute Standard Building Code for Reinforced Concrete (ACI 318) and the latest applicable recommendations of the ACI standard practice manual.
   b. Concrete shall be composed of cement conforming to ASTM C 150 Type I, aggregate conforming to ASTM C33, and potable water.
   c. Exposed exterior concrete shall contain 5 to 7 percent air entrainment.

5. Reinforcement:
   a. Unless otherwise specified or shown on the structural drawings, reinforce equipment bases with No. 4 reinforcing bars conforming to ASTM A615 or 6x6 - W2.9 x W2.9 welded wire mesh conforming to ASTM A185. Place reinforcing bars 24 inches on center with a minimum of two bars each direction.

6. Anchor bolts:
   a. Provide galvanized anchor bolts for equipment placed on concrete bases or on concrete slabs.
   b. Anchor bolts size, number, and placement shall be as recommended by the manufacturer of the equipment.

H. PENETRATIONS

1. Walls and Floors:
   a. Steel Pipe Sleeves for Raceways and Cables: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends, and drip rings.
   b. Cast Iron Pipe Sleeves for Raceways and Cables: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
   c. Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
   d. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052 [0.138] inch thickness and of length to suit application.

I. FIRESTOPPING

1. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with UL 2079 or ASTM E 814, or other NRTL acceptable to AHJ.

2. Manufacturers:
   a. Hilti
   b. RectorSeal
   c. Specified Technologies Inc
   d. United States Gypsum Company
   e. 3M corp.

3. Through and Membrane Penetration Firestopping Systems Product Schedule: Provide UL listing, location, wall or floor rating, and installation drawing for each penetration fire stop system.

4. Where project conditions require modification to qualified testing and inspecting agency's illustrations for a particular firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Include qualifications data for testing agency.

J. SYSTEM TESTING AND ADJUSTING

1. Adjust, align, and test all electrical equipment on this project provided under this division and all electrical equipment furnished by others for installation or wiring under this division for proper operation.

2. Test all systems and equipment according to the requirements in NETA ATS (latest edition) and all additional requirements specified in following sections.

K. EQUIPMENT IDENTIFICATION

1. Provide equipment identification nameplates:
   a. Switchboards
   b. Panelboards
   c. Equipment enclosures
   d. Access doors
   e. Transformers
   f. Disconnect switches
   g. Enclosed circuit breakers
   h. Motor starters
   i. Feeder devices in switchboards
   j. Distribution panelboards

2. Nameplates:
   a. Engraved, contrasting color, three-layer, laminated plastic, indicating the name of the equipment, load, or circuit as designated on the drawings and in the specifications:
   b. Field-applied permanent epoxy adhesive, compatible with the equipment finish.
   c. Self-adhering, with a permanent weatherproof adhesive.
   d. Attached with stainless steel screws and hardware.
   e. Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied.

3. Nameplate Color:
   a. Black background with white letters for Normal Power;
   b. Red background with white letters for Emergency Power.

4. Letter height:
   a. 3/8-inch minimum.

L. SYSTEM START UP

1. Perform the following prior to starting up the electrical systems:
   a. Check all components and devices and lubricate items accordingly.
   b. Tighten screws and bolts for connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
   c. Adjust taps on each transformer for rated secondary voltage when the transformer is at minimum load.
   d. Check and record building's service entrance voltage, grounding conditions, grounding resistance, and proper phasing.
   e. After all systems have been inspected and adjusted, confirm all operating features required by the drawings and specifications and make final adjustments as necessary.

OPTIMIZED Lighting Engineering Design
842 EAST ISABELLA AVE.
MESA, AZ, 85204
602-899-6224
PROJECT: AHS180015A
EOR: BRETT LORENZEN
PE#: 53437

STAMP:

NOT FOR CONSTRUCTION

RURAL ELECTRIC
John Colonna
480-850-3511
9502 East Main Street
Mesa, AZ, 85207

DRAWN:	CHECKED:	NUMBER:
BSL	BSL	AHS180015A

ARIZONA HUMANE SOCIETY
SUNNYSLOPE CAMPUS
GENERATOR ACCOMODATIONS
9226 North 13th Ave
Phoenix, AZ, 85021

REVISIONS:
-
-
-
-
-
-
-

DATE:	ISSUED FOR:
08/10/18	PERMIT/CONSTRUCTION

SHEET NAME
ELECTRICAL
SPECIFICATIONS 1

SHEET NUMBER
E4

RACEWAYS

A. METALLIC CONDUIT AND TUBING

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

2. Manufacturers:
   a. Western Tube and Conduit
   b. Wheatland Tube
   c. Tyco International
   d. Allied Tube and Conduit
   e. Republic Raceway

B. NON-METALLIC CONDUIT AND TUBING

1. Types:
   a. Rigid Nonmetallic Conduit (RNC): Schedule 40 PVC, 90 deg C rated,
   b. Electrical Nonmetallic Tubing (ENT): NEMA TC 13, NRTL listed,
   c. Liquidtight Flexible Nonmetallic Conduit (LFNC): UL 1660,
   d. ENT and LFNC Fittings: Compatible with conduit/tubing type and material, NRTL listed.

2. Fittings:
   a. NEMA TC 3, TC 6; UL 651, compatible with conduit/tubing type and material, NRTL listed,

3. Manufacturers:
   a. Amco
   b. Cantex
   c. Certainteed
   d. Prime Conduit
   e. Raco,
   f. Thomas and Betts.

RACEWAY INSTALLATION

A. GENERAL REQUIREMENTS

1. Install raceways parallel and perpendicular to building lines.

2. 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.

3. Install raceways set in forms for concrete structure in such a manner that installation will not affect the strength of the structure.

4. 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.

5. Use long radius elbows for all underground installations, where necessary, or where otherwise indicated.

6. 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.

7. 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.

8. 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.

9. 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.

10. Align and install true and plumb all raceway terminations at panelboards, switchboards, and junction boxes.

11. 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.

12. Make all joints and connections in a manner that will ensure mechanical strength and electrical continuity.

B. ABOVE GROUND RACEWAY USE:

1. Install all circular raceways concealed above suspended ceilings or concealed in walls or floors wherever possible except where otherwise indicated.

2. Provide GRS for all conduits exposed to any forms of damage, physical, chemical, or weather related.

3. 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:

1. RNC conduit may be used underground where permitted by local code and where not specifically restricted by these documents.

D. EQUIPMENT CONNECTIONS

1. Use FMC or LMFC (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.

E. BUSHINGS AND LOCKNUTS

1. 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.

2. Provide bushings and locknuts made of galvanized malleable iron with sharp, clean-cut threads.

3. Where EMT enters a box, provide approved EMT compression connectors.

4. Use insulated, grounding, or combination bushings wherever connection is subject to vibration or moisture, when required by NFPA 70.

CONDUCTORS AND CABLES

A. CONDUCTORS

1. Annealed (soft) copper complying with ICEA S-95-658/NEMA WC70 and UL standards 44 or 83 as applicable.

2. Aluminum conductor option (conductors 1/0 or larger):
   a. Compact stranded, aluminum alloy (AA-8000 series), complying with ICEA S-95-658/NEMA WC70.
   b. Increase the raceway size as required, at no additional cost to the Owner, to accommodate the increased size of the aluminum Conductors.
   c. Aluminum conductor size shall meet or exceed the ampere rating of the scheduled copper conductors at 75 degrees C.

3. Copper Conductor Manufacturer:
   a. General Cable
   b. Southwire
   c. US Wire and Cable
   d. American Wire and Cable
   e. Cable USA
   f. Okonite
   g. Advance Wire and Cable
   h. Encore Wire

4. Aluminum Conductor Manufacturer:
   a. General Cable

5. Conductor Insulation Types: 90-degree C-rated, Type THHN/THWN-2 or XHHW-2 complying with ICEA S-95-658/NEMA WC70.

6. Sizes of conductors and cables indicated or specified are in American Wire Gage (AWG - Brown and Sharpe).

7. All feeder and branch circuit conductors No. 8 AWG and larger: Stranded.

8. All conductors, No. 10 AWG and smaller: Solid copper.

9. All Branch Circuit Wiring: Not smaller than No. 12 AWG.

10. If no conductor size is indicated on the Drawings for a branch circuit, contact engineer.

11. Control Wiring:
    a. Stranded copper conductors, 600V insulation, of the proper type, size, and number as required to accomplish specified function. Minimum size: No. 14 AWG, unless noted otherwise.

B. TERMINATIONS

1. Tinned, mechanical type only; NRTL-listed for copper and aluminum conductors at 75 degrees C minimum.

2. 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.

3. Measure the temperature of all conductors at all splices and terminations. Make each test under typical building load Conditions after the building is occupied and in operation for a minimum of two weeks.
   a. Replace all joints or splices indicating excessive heating.
   b. Take measurements with a non_contact type infrared thermometer.

C. MC CABLE

1. Shall not be utilized on this project.

CONDUCTORS AND CABLES INSTALLATION

A. GENERAL REQUIREMENTS

1. 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.

2. 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.

3. 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.

4. 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.

5. Cable Color:
   a. 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.

   b. System Voltage:
      240V and under:
      Phase A: Black.
      Phase B: Red.
      Phase C: Blue.
      Neutral: White.
      Equipment Ground: Green.

B. MC CABLE

1. Shall not be installed on this project.

ELECTRICAL BOXES AND CABINETS

A. GENERAL REQUIREMENTS

1. 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.

2. 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.

3. Manufacturers:
   i. Appleton
   j. Cooper
   k. Erikson Electrical
   l. Hoffman
   m. Killark Electric
   n. Raco,
   o. Robroy Industries
   p. Thomas and Betts
   q. Steel City

EXISTING ELECTRICAL SERVICE AND GROUNDING

A. ELECTRICAL SERVICE

1. See one-line diagram for the following information:
   a. Equipment Type
   b. Size
   c. Voltage
   d. Phase
   e. NEMA Ratings
   f. Existing or New Equipment

2. Contractor shall provide and install all required raceways, terminations, and miscellaneous equipment as required for electrical and telephone services for connection by the serving utility.

3. Contractor shall become fully acquainted with serving utility installation guide and applicable codes in the jurisdiction and install in strict compliance.

4. Contractor shall fully understand the division of work between the installing contractor and the utility.

5. Contractor shall pay all applicable charges required by the serving electrical utility.

6. Contractor shall complete and provide necessary information to the utility company without delay. If concern about missing information arises contact the electrical engineer. Required information may include but is not limited to:
   a. Site Plan
   b. One-Line Diagram
   c. Load calculations
   d. Load calculation forms
   e. Load readings
   f. Submittal documentation

B. GROUNDING

1. Permanently and effectively ground and bond the electrical installation in a thorough and efficient manner.

2. All grounding shall meet or exceed the requirements of NFPA.

3. Where grounding on plans indicates grounding above minimum code requirements, drawings shall take precedence.

4. Use bare or green insulated conductors as specified herein, and other materials indicated on the Drawings.

DISTRIBUTION AND CONTROL EQUIPMENT

A. CIRCUIT BREAKERS IN EXISTING PANELBOARDS/SWITCHBOARDS

1. Provide new circuit breakers for installation in existing panelboards/switchboards, of the same manufacturer and type as the existing panelboard/switchboard circuit breakers.

2. 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.

B. DRY-TYPE TRANSFORMERS

1. Transformers:
   a. General purpose, NRTL listed/labeled. Comply with NEMA ST 20 and UL 1561.

2. Insulation Class:
   a. NRTL-component-recognized insulation system replaces the UL 1446 insulation rating system that used letters.
   b. For three-phase transformers less than 15 kVA and all single-phase:
   i. 185 degrees C, NRTL-component-recognized insulation system with a maximum of 115 degree C rise above a 40 degree C ambient temperature.
   c. For three-phase transformers 15 kVA and larger:
   i. 220 degrees C, NRTL-component-recognized insulation system with a maximum of 150 degree C rise above a 40 degree C ambient temperature.

3. Phases, Voltages, and Sizes:
   a. As indicated on the drawings.

4. Sound Level:
   a. Not exceeding 3 dBa less than NEMA ST 20 standards for the sizes indicated when factory tested according to IEEE C57.12.91.

5. Full-Capacity Primary Taps:
   a. For three-phase below 25 kVA and all single-phase
   i. 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)
   b. Above 500 kVA
   i. Four 2.5 percent (2 above, 2 below).

6. Transformer Core and Coil Assemblies:
   a. Mounted on integral vibration-absorbing pads.

7. Mounting:
   a. Transformers 75 kVA and larger shall be floor mounted unless indicated otherwise.
   b. Transformers 45 kVA and smaller shall be floor or wall mounted where construction is suitable for the load.
   c. Floor mounted transformers securely to a 4 inch house keeping pad with vibration isolation.
   d. Wall mounted or suspended transformers shall have a means of isolating vibration from the support.
   e. Wall mounts must be by same manufacturer as and provided with transformer

8. Transformer Enclosures:
   a. Removable front cover
   b. Core and coil encapsulated within resin compound, drip-proof, fabricated of heavy gauge sheet steel construction.
   c. Dry locations shall be ventilated, NEMA 250 Type 2.
   d. Damp or wet locations shall be ventilated with weather shields, NEMA 250 Type 3R.
   e. Corrosive locations shall be totally enclosed, non-ventilated, NEMA 250 Type 4X, stainless steel.

9. 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.

10. Provide energy-efficient transformers complying with federal regulation 10 CFR 431.192 thru 431.196 requirements.

11. Manufacturers:
    a. ACME
    b. Eaton
    c. G.E.
    d. Siemens
    e. Square D

EMERGENCY SYSTEM STANDBY EQUIPMENT

A. PACKAGED ENGINE GENERATORS

1. Submittals
   a. Detailed dimensioned drawings
   b. Features
   c. Wiring diagrams
   d. Vibration isolation
   e. Fuel tank
   f. Output breaker information
   g. Size and capacity
   h. Available fault current
   i. Testing procedures
   j. Warranty

2. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

3. Manufacturer shall agree to repair and or replace components and associated auxiliary components that fail in materials or workmanship for a period of at least 5 years from substantial completion.

4. Generator shall be of the proper size, phase, and assembly to provide the specified parameters on the one-line diagram in this set of drawings.

5. General Requirements
   a. Comply with ASME B15.1.
   b. Provide nameplates on each major system component.
   c. Fabricate on a mounting frame with attachments to resist generator movement during seismic activity.

6. Operating Conditions
   a. Ambient temperature of 120 deg
   b. Relative humidity of 90%
   c. Elevation of 2000ft

7. Parameters
   a. Diesel fuel.
   b. Oil lubricated.
   c. Closed loop liquid cooled with factory mounted radiator.
   d. Electric-immersion type factory installed coolant jacket heater complying with NFPA 110.
   e. Adjustable isochronous governor with speed sensing.
   f. Factory installed base mounted fuel-oil tank complying with UL2085.
   g. Fuel shall provide 24 hours at 100% of rated output power.
   h. Muffler and exhaust piping complying with ASTM A 53/A 53M
   i. Air intake with engine mounted replaceable dry -filter element.
   j. 35A continuous rated battery charging alternator
   k. Heavy duty cranking starter
   l. Current limiting automatic equalizing and float charging type battery charger in compliance with UL1236.
   m. Comply with NEMA MG1 performance requirements.

8. Enclosure
   a. Exterior rated to withstand wind up to 100mph.
   b. Access panels shall be lockable and operable without tools.
   c. Painted galvanized steel, metal-clad, integral structural steel frame on concrete pad.
   d. Sound attenuated.
   e. Louver ventilated panels with bird screens.
   f. Manufacturers standard enamel coating

9. Factory installed generator control panel and remote annunciator alarm panels shall be installed and supprt the following indicating and protective devices
   a. AC voltmeter
   b. AC ammeter
   c. AC frequency meter
   d. DC voltmeter
   e. Engine coolant temperature gauge
   f. Engine lubricating oil pressure
   g. Running time meter
   h. Ammeter-voltmeter phase selector
   i. Generator voltage adjustment
   j. Start/stop switch
   k. Over-speed shutdown device
   l. Coolant high-temperature shutdown
   m. Coolant low-temperature shutdown
   n. Oil low-pressure shutdown
   o. Generator overload
   p. Remote emergency shut-down switch

10. Factory installed generator control panel and remote annunciator alarm panel shall provide the following notifications and shall continue until alarm has been addressed:
    a. Engine high-temperature shutdown
    b. Lube-oil low-pressure shutdown
    c. Over-speed shutdown
    d. Remote emergency stop shutdown
    e. Engine high-temp pre-alarm
    f. Lube-oil low-pressure pre-alarm
    g. Fuel-low alarm
    h. Low coolant alarm
    i. Over-crank shutdown
    j. Coolant low temperature alarm
    k. Battery low-voltage alarm
    o. Fuel tank derangement alarm
    p. Fuel tank high-level shutdown alarm

11. Provide the following tests before shipment and comply with NFPA 110 and IEEE 115:
    a. Full-load run
    b. Maximum power
    c. Voltage regulation
    d. Transient and steady-state covering
    e. Single-step load pickup
    f. Safety shutdown

B. GENERATOR OUTPUT CIRCUIT BREAKER

1. Molded case, thermal-magnetic type, 100% rated compplying with NEMA AB1 and UL489.

2. Shall be specifically designed for use with generator assemblies.

3. Trip rating shall be set for generator rating.

4. Mount integral to generator enclosure.

5. Number of phases and ratings of switch and fuses shall be provided as indicated on the drawings.

6. Provide with integral and separate neutral and ground assemblies, suitable for the sizes of conductors indicated.

7. Do not double-lug any terminations not specifically listed as suitable for more than one conductor.

OPTIMIZED Lighting Engineering Design
842 EAST ISABELLA AVE.
MESA, AZ, 85204
602-699-6224
PROJECT: AHS180015A
EOR: BRETT LORENZEN
PE#: 53437

STAMP:

NOT FOR CONSTRUCTION

RURAL ELECTRIC
John Colonna
480-850-3511
9502 East Main Street
Mesa, AZ, 85207

DRAWN:	CHECKED:	NUMBER:
BSL	BSL	AHS180015A

ARIZONA HUMANE SOCIETY
SUNNYSLOPE CAMPUS
GENERATOR ACCOMODATIONS
9226 North 13th Ave
Phoenix, AZ, 85021

REVISIONS:
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DATE:	ISSUED FOR:
08/10/18	PERMIT/CONSTRUCTION

SHEET NAME
ELECTRICAL
SPECIFICATIONS 2

SHEET NUMBER
E5