



1 ELECTRICAL POWER AND DISTRIBUTION PLAN
1" = 20'

GENERAL NOTES

- A. SEE SHEET E1 FOR GENERAL NOTES, 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, MANUAL TRANSFER SWITCHES, KIRK-KEY OPERATORS, AND GENERATOR CONNECTION CABINETS.

OPTIMIZ^{3D}
Lighting Engineering & Design
842 EAST ISABELLA AVE.
MESA, AZ, 85204
602-699-6224
PROJECT: AHS 180015A
EOR: BRETT LORENZEN
PE#: 53437

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NOT FOR CONSTRUCTION

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

KEYED NOTES

1. EXISTING 'NORTH BUILDING' ELECTRICAL SWITCHBOARD. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR ADDITIONAL INFORMATION.
2. PROVIDE NEW MANUAL TRANSFER SWITCH WITH GENERATOR CONNECTION CAM-LOCKS AND (2) 200A OUTPUT CIRCUIT BREAKERS. CONNECT TO EXISTING SWITCHBOARD AS INDICATED ON THE ONE-LINE DIAGRAM ON SHEET E3.
3. PROVIDE NEW MANUAL TRANSFER SWITCH WITH GENERATOR CONNECTION CAM-LOCKS AND (2) 200A OUTPUT CIRCUIT BREAKERS. FEED WITH INCOMING ELECTRICAL SERVICE CONDUCTORS AND BACK-FEED OUTPUT TO EXISTING PANELBOARDS. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR MORE INFORMATION.
4. EXISTING '926 NORTH 13TH AVE.' NORTH METER SERVICE LINE-UP. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR MORE INFORMATION.
5. EXISTING '926 NORTH 13TH AVE.' SOUTH METER SERVICE LINE-UP. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR MORE INFORMATION.
6. PROVIDE NEW MANUAL TRANSFER SWITCH WITH GENERATOR CONNECTION CAM-LOCKS. FEED WITH INCOMING ELECTRICAL SERVICE CONDUCTORS AND BACK-FEED OUTPUT TO EXISTING PANELBOARDS. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR MORE INFORMATION.
7. PROVIDE NEW GENERATOR CONNECTION CABINET AND CONNECT TO EXISTING DISTRIBUTION PANELBOARD VIA A NEW BREAKER. PROVIDE A KIRK-KEY INTERLOCK DEVICE WITH THE EXISTING MAIN BREAKER. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR MORE INFORMATION.
8. EXISTING '926 NORTH 13TH AVE.' SOUTH BUILDING PANEL 1 ELECTRICAL SERVICE. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR MORE INFORMATION.
9. EXISTING '926 NORTH 13TH AVE.' SOUTH BUILDING PANEL 2 ELECTRICAL SERVICE. SEE ONE-LINE DIAGRAM ON SHEET E3 FOR MORE INFORMATION.

DRAWN:	CHECKED:	NUMBER:
B5L	B5L	AHS 180015A

**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
SITE POWER AND
DISTRIBUTION PLAN

SHEET NUMBER

E2

ANY CONTRACTOR, SUB-CONTRACTOR, AND/OR SUPPLIER IS HEREBY NOTIFIED THAT THIS PROJECT (CONTRACT FOR CONSTRUCTION) MUST COMPLY TO THE ARIZONA SENATE BILL SB1646, PROMPT PAYMENT LEGISLATION, AS IT MODIFIES THE ARIZONA REVISED STATUTES.

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SHEET NAME
ELECTRICAL
PANELBOARD SCHEDULES

SHEET NUMBER

E4

PANELBOARD: NB (EXISTING)										FED FROM: EQUIPMENT GROUND BUS											
BUS AMPS: 400A MAIN SIZE/TYPE: 250A MCB VOLTS/PHASE: 240D/120V, 3PH, 4W SECTION: 1										A/C RATING: CONTRACTOR TO VERIFY AND NOTIFY EOR SERVES: Hospital North MOUNTING: SURFACE LOCATION: Exterior Wall											
CKT NO	DESCRIPTION	VOLTAMPS/PHASE			WIRE NO	BKR AMP	P	BKR AMP	WIRE NO	DESCRIPTION	CKT NO	VOLTAMPS/PHASE			WIRE NO	BKR AMP	P	BKR AMP	WIRE NO	DESCRIPTION	CKT NO
		A	B	C								A	B	C							
1										2										4	
3	AC-G				EX	50	3	3	40	EX										4	
5	AMPS																			6	
7	AC-M				EX	30	2	2	60	EX										8	
9																				10	
11																				12	
13	AC-D				EX	45	3	2	80	EX										14	
15																				16	
17	RTU-1				EX	30	2	2	30	EX										18	
19																				20	
21	RTU-2				EX	30	2	2	100	EX										22	
23	SPACE																			24	
25	DOG KENNELS				EX	20	1	2	100	EX										26	
27	RTU-3				EX	30	2	3	40	EX										28	
29																				30	
31	RTU-4				EX	50	3	3	50	EX										32	
33																				34	
35	SODAMACHINE				EX	20	1	3	50	EX										36	
37	SPACE																			38	
39	EXHAUST FAN				EX	20	1	1	20	EX										40	
41	EXHAUST FAN				EX	20	1	1	20	EX										42	
SUBTOTAL										SUBTOTAL											
TOTAL PHASE A - VA		LOAD	CONN. VA	DF	LOAD		CONN. VA	DF			TOTAL DEMAND *										
TOTAL PHASE B - VA		COOLING		1.00	REFRIG			1.00													
TOTAL PHASE C - VA		HEATING		0	SIGN/DISP			1.25													
AMPS		LIGHTING		1.25	KITCHEN			1.00													
TOTAL PHASE C - VA		RECEPTACLES		1.0/5	EXISTING			1.00													
AMPS		MOTORS		1.00	LRG MOTOR			1.25													
TOTAL PNLBD - VA		SUPP HEAT		1.00	SHOW WNDW			1.25													
AMPS		MISC EQUIP		1.00	LTG TRACK			1.00													

PANELBOARD NOTES
EX EXISTING TO REMAIN
* DEMAND AMPS BASED ON HIGHEST PHASE VA

PANELBOARD: SA (EXISTING)										FED FROM: EQUIPMENT GROUND BUS											
BUS AMPS: 250A MAIN SIZE/TYPE: 200A MCB VOLTS/PHASE: 208Y/120V, 3PH, 4W SECTION: 1										A/C RATING: CONTRACTOR TO VERIFY AND NOTIFY EOR SERVES: DOG KENNELS MOUNTING: SURFACE LOCATION: EXTERIOR SOUTH YARD											
CKT NO	DESCRIPTION	VOLTAMPS/PHASE			WIRE NO	BKR AMP	P	BKR AMP	WIRE NO	DESCRIPTION	CKT NO	VOLTAMPS/PHASE			WIRE NO	BKR AMP	P	BKR AMP	WIRE NO	DESCRIPTION	CKT NO
		A	B	C								A	B	C							
1										2										4	
3	AC 2&3				EX	100	3	2	30	EX										6	
5																				8	
7	SPACE				EX	20	1	2	80	EX										10	
9	AC EAST				EX	30	2	2	30	EX										12	
11																				14	
13	LIGHTING				EX	20	1	1	20	EX										16	
15	SPACE																			18	
17	EXISTING LOAD				EX	60	2	2	30	EX										20	
19																				22	
21	SPACE				EX	1	1	1	1	EX										24	
23	EXISTING LOAD				EX	125	2	1	20	EX										26	
25																				28	
27	SPACE																			30	
29	EXISTING LOAD				EX	20	1	1	20	EX										32	
31																				34	
33	GENERATOR FEED BREAKER DOUBLE WIDE BREAKER				OL	200	3	3	200	OL										36	
35																				38	
37																				40	
39	LUG SPACE																			42	
41																				44	
SUBTOTAL										SUBTOTAL											
TOTAL PHASE A - VA		LOAD	CONN. VA	DF	LOAD		CONN. VA	DF			TOTAL DEMAND										
TOTAL PHASE B - VA		COOLING		1.00	REFRIG			1.00													
TOTAL PHASE C - VA		HEATING		0	SIGN/DISP			1.25													
AMPS		LIGHTING		1.25	KITCHEN			1.00													
TOTAL PHASE C - VA		RECEPTACLES		1.0/5	EXISTING			1.00													
AMPS		MOTORS		1.00	LRG MOTOR			1.25													
TOTAL PNLBD - VA		SUPP HEAT		1.00	SHOW WNDW			1.25													
AMPS		MISC EQUIP		1.00	LTG TRACK			1.00													

PANELBOARD NOTES
EX EXISTING TO REMAIN
OL SEE ONE-LINE DIAGRAM
KK KIRK-KEY INTERLOCK WITH MAIN DISCONNECT, SEE ONE-LINE DIAGRAM

PANELBOARD: A (EXISTING)										FED FROM: EQUIPMENT GROUND BUS											
BUS AMPS: 400A MAIN SIZE/TYPE: MLO VOLTS/PHASE: 240D/120V, 3PH, 4W SECTION: 1										A/C RATING: CONTRACTOR TO VERIFY AND NOTIFY EOR SERVES: HOSPITALSOUTH MOUNTING: SURFACE LOCATION: JANITOR CLOSET											
CKT NO	DESCRIPTION	VOLTAMPS/PHASE			WIRE NO	BKR AMP	P	BKR AMP	WIRE NO	DESCRIPTION	CKT NO	VOLTAMPS/PHASE			WIRE NO	BKR AMP	P	BKR AMP	WIRE NO	DESCRIPTION	CKT NO
		A	B	C								A	B	C							
1										2										4	
3	EXISTING LOAD				EX	100	3	3	50	EX										6	
5																				8	
7	SPACE																			10	
9	EXISTING LOAD				EX	20	1	3	50	EX										12	
11	EXISTING LOAD				EX	20	1													14	
13	SPACE																			16	
15	EXISTING LOAD				EX	20	1	1	20	EX										18	
17	EXISTING LOAD				EX	20	1	1	20	EX										20	
19	SPACE																			22	
21	EXISTING LOAD				EX	20	1	2	100	EX										24	
23	EXISTING LOAD				EX	20	1													26	
25	SPACE																			28	
27	EXISTING LOAD				EX	20	1	1	20	EX										30	
29	EXISTING LOAD				EX	20	1	1	20	EX										32	
SECTION: 2										SECTION: 2											
31	SPACE																			34	
33	EXISTING LOAD				EX	30	2	1	20	EX										36	
35																				38	
37																				40	
39	EXISTING LOAD				EX	50	3	1	20	EX										42	
41																				44	
43	SPACE																			46	
45	EXISTING LOAD				EX	20	1	1	20	EX										48	
47	EXISTING LOAD				EX	20	1	1	20	EX										50	
49	SPACE																			52	
51	EXISTING LOAD				EX	20	1	1	20	EX										54	
53	EXISTING LOAD				EX	20	1	1	20	EX										56	
55																				58	
57	SPACE																			60	
59																				62	
SUBTOTAL										SUBTOTAL											
TOTAL PHASE A - VA		LOAD	CONN. VA	DF	LOAD		CONN. VA	DF			TOTAL DEMAND *										
TOTAL PHASE B - VA		COOLING		1.00	REFRIG			1.00													
TOTAL PHASE C - VA		HEATING		0	SIGN/DISP			1.25													
AMPS		LIGHTING		1.25	KITCHEN			1.00													
TOTAL PHASE C - VA		RECEPTACLES		1.0/5	EXISTING			1.00													
AMPS		MOTORS		1.00	LRG MOTOR			1.25													

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
 - Certainfeed
 - 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.
- 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.
- 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, and junction boxes.
- 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:

- 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 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

- 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.

CONDUCTORS AND CABLES

A. CONDUCTORS

- Annealed (soft) copper complying with ICEA S-95-658/NEMA WC70 and UL standards 44 or 83 as applicable.
- Aluminum conductor option (conductors 1/0 or larger):
 - Compact stranded, aluminum alloy (AA-8000 series), complying with ICEA S-95-658/NEMA WC70.
 - Increase the raceway size as required, at no additional cost to the Owner, to accommodate the increased size of the aluminum Conductors.

- Aluminum conductor size shall meet or exceed the ampere rating of the scheduled copper conductors at 75 degrees C.
 - General Cable
 - Southwire
 - US Wire and Cable
 - American Wire and Cable
 - Cable USA
 - Okonite
 - Advance Wire and Cable
 - Encore Wire

- Aluminum Conductor Manufacturer:
 - General Cable
- 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.

- Control Wiring:
 - 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

- Tinned, 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.
- 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.
 - Replace all joints or splices indicating excessive heating.
 - Take measurements with a non-contact type infrared thermometer.

C. MC CABLE

- Shall not be utilized on this project.

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.
- 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.
- 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

B. MC CABLE

- Shall not be installed on this project.

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:
 - Applenton
 - Cooper
 - Erikson Electrical
 - Hoffman
 - Killark Electric
 - Raco,
 - Robroy Industries
 - Thomas and Betts
 - Steel City

EXISTING 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

- 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.
- Contractor shall become fully acquainted with serving utility installation guide and applicable codes in the jurisdiction and install in strict compliance.
- Contractor shall fully understand the division of work between the installing contractor and the utility.
- Contractor shall pay all applicable charges required by the serving electrical utility.
- 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:

- Site Plan
- One-Line Diagram
- Load calculations
- Load calculation forms
- Load readings
- Submittal documentation

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. SERVICE ENTRANCE SWITCH: FUSIBLE, 200A-400A

- Fusible Switch:
 - Number of phases and ratings of switch and fuses shall be provided as indicated on the drawings.
 - Permanently labeled as suitable for use as service entrance equipment.
 - Provisions for bolt-in fuses as appropriate for the fuses specified.
 - Provide an engraved nameplate that may withstand the elements for identification.
 - Provide with 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.
- 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 panelboard/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.

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

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

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

- Manufacturers:
 - ACME
 - Eaton
 - G.E.
 - Siemens
 - Square D

EMERGENCY SYSTEM STANDBY EQUIPMENT

A. PACKAGED ENGINE GENERATORS

- Submittals
 - Detailed dimensioned drawings
 - Features
 - Wiring diagrams
 - Vibration isolation
 - Fuel tank
 - Output breaker information
 - Size and capacity
 - Available fault current
 - Testing procedures

- Warranty
- Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
 - 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.
 - 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.
 - General Requirements
 - Comply with ASME B15.1.
 - Provide nameplates on each major system component.
 - Fabricate on a mounting frame with attachments to resist generator movement during seismic activity.

- Operating Conditions
 - Ambient temperature of 120 deg
 - Relative humidity of 90%
 - Elevation of 2000ft
- Parameters
 - Diesel fuel.
 - Oil lubricated.
 - Closed loop liquid cooled with factory mounted radiator.
 - Electric-immersion type factory installed coolant jacket heater complying with NFPA 110.
 - Adjustable isochronous governor with speed sensing.
 - Factory installed base mounted fuel-oil tank complying with UL2085.
 - Fuel shall provide 24 hours at 100% of rated output power.
 - Muffler and exhaust piping complying with ASTM A 53/A 53M
 - Air intake with engine mounted replaceable dry-filter element.
 - 35A continuous rated battery charging alternator
 - Heavy duty cranking starter
 - Current limiting automatic equalizing and float charging type battery charger in compliance with UL1236.
 - Comply with NEMA MG1 performance requirements.

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

- Factory installed generator control panel and remote annunciator alarm panels shall be installed and support the following indicating and protective devices
 - AC voltmeter
 - AC ammeter
 - AC frequency meter
 - DC voltmeter
 - Engine coolant temperature gauge
 - Engine lubricating oil pressure
 - Running time meter
 - Ammeter-voltmeter phase selector
 - Generator voltage adjustment
 - Start/stop switch
 - Over-speed shutdown device
 - Coolant high-temperature shutdown
 - Coolant low-temperature shutdown
 - Oil low-pressure shutdown
 - Generator overload
 - Remote emergency shut-down switch

- Factory installed generator control panel and remote annunciator alarm panel shall provide the following notifications and shall continue until alarm has been addressed:
 - Engine high-temperature shutdown
 - Lube-oil low-pressure shutdown
 - Over-speed shutdown
 - Remote emergency stop shutdown
 - Engine high-temp pre-alarm
 - Lube-oil low-pressure pre-alarm
 - Fuel-High alarm
 - Low coolant alarm
 - Over-crank shutdown
 - Coolant low temperature alarm
 - Battery low-voltage alarm
 - Fuel tank derangement alarm
 - Fuel tank high-level shutdown alarm

- Provide the following tests before shipment and comply with NFPA 110 and IEEE 115:
 - Full-load run
 - Maximum power
 - Voltage regulation
 - Transient and steady-state covering
 - Single-step load pickup
 - Safety shutdown

B. GENERATOR OUTPUT CIRCUIT BREAKER

- Molded case, thermal-magnetic type, 100% rated complying with NEMA AB1 and UL489.
- Shall be specifically designed for use with generator assemblies.
- Trip rating shall be set for generator rating.
- Mount integral to generator enclosure.
- Number of phases and ratings of switch and fuses shall be provided as indicated on the drawings.
- Provide with 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.

C. MANUAL TRANSFER SWITCH

- Description:
 - Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Manual transfer switch shall have main contacts and operating mechanism.
- Indicated Voltage and Current Ratings:
 - Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
 - Voltage ratings shall be consistent with applications from 115 volts AC to 600 volts and single or three phase as required by the application.
 - Current ratings and the number of poles shall be as indicated on the plans.
- Fault-Current Closing and Withstand Ratings:
 - Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

- Resistance to Damage by Voltage Transients:
 - Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41.
 - Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

- Comply with requirements for Level 1 equipment according to NFPA 110.

- Transfer switch shall include the following features:
 - Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
 - Transfer switch shall be constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.
 - Operation of the bypass/isolation switch shall be allowed regardless of the position of the transfer switch.
 - Switch operation shall provide for positive and complete sequencing of all contact motion and shall prevent any form of intermediate stop or delayed motion.

- Legend:
 - Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.

- Maintainability:
 - Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.
 - If the unit is constructed such that removal of components is not allowed, the transfer switch section shall be isolated from the Bypass Isolation Switch section by means of insulated barriers.

- Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches:
 - Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

- Switch Characteristics:
 - Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - Switch action shall be double throw; mechanically held in both directions.
 - Contacts shall be silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

- Factory Wiring:
 - Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. All factory wiring shall be accessible from the equipment front.
 - Designated terminals shall be pressure type, suitable for types and sizes of field wiring indicated.
 - Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated. Power terminals shall be rated for 90 degree C and copper or aluminum cable.
 - Control Wiring: Equipped with lugs suitable for connection to terminal strips.

- Enclosures:
 - General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

- Bus and Wiring:
 - All Bus and cable/control wire shall be copper.

- Cable Entry:
 - Cable entry shall be from the top.

- Generator Connection Receipts:
 - Provide in face of manual transfer switch CAM-lock connections for portable generator unit.
 - CAM locks shall be supplied in the proper quantity and type to support the full ampacity of the manual transfer switch rating.

- Transfer Switch Output Breakers
 - Provide output circuit breakers within manual transfer switch assembly to feed separate loads as indicated on construction drawings.

- Manufacturers:
 - Coffman; Steady Power
 - Caterpillar; Engine Div.
 - Eaton Electrical Inc.; Cutler-Hammer
 - Emerson; ASCO Power Technologies, LP.
 - GE Zenith Controls.
 - Kohler Power Systems; Generator Division.
 - Onan/Cummins Power Generation; Industrial Business Group.
 - Russelectric, Inc.
 - Spectrum Detroit Diesel.

- Installation
 - Floor-Mounting Switch: Anchor to floor by bolting.
 - Provide 4 inches high, reinforced concrete bases with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch.
 - Provide equipment label with Name, Voltage, and Ampacity.

- Connections
 - Ground equipment according to 'Grounding and Bonding.'
 - Connect wiring according to Low-Voltage Electrical Power Conductors and Cables.

- Factory Tests:
 - The Automatic Transfer Switch and Bypass Isolation Switch shall be factory tested to verify compliance with these specifications and ensure proper operation.

- Field Quality Control:
 - Perform tests and inspections and prepare test reports.
 - Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - Check for electrical continuity of circuits and for short circuits.
 - Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - Verify that manual transfer warnings are properly placed.
 - Perform manual transfer operation.

- Demonstration:
 - After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - Test bypass/isolation unit functional modes and related transfer switch operations.
 - Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.



RURAL ELECTRIC

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REVISIONS:

DATE:	ISSUED FOR:
08/19/18	PERMIT/CONSTRUCTION

SHEET NAME ELECTRICAL SPECIFICATIONS 2

SHEET NUMBER

E6