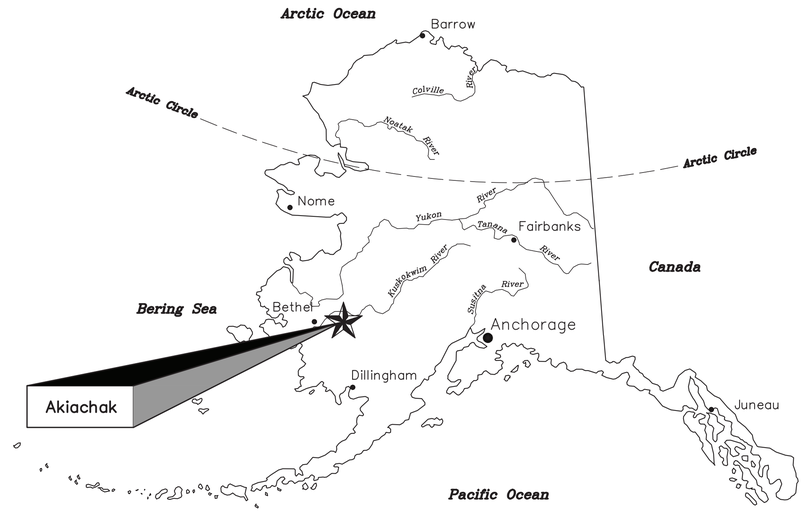
| 2023 DERA–RPSU PROJECT DRAWINGS – MECHANICAL | |
|---|---|
| M1.1 | LEGENDS, ABBREVIATIONS, & SCHEDULES |
| M2 | MECHANICAL DEMOLITION PLAN & NOTES |
| M3.1 | MECHANICAL NEW WORK PLAN & NOTES |
| M3.2 | SECTIONS & ELEVATIONS |
| M3.3 | GENSET FABRICATION DETAILS |
| M4.1 | ENGINE COOLING SYSTEM UPGRADE ISOMETRIC & DETAILS |
| M4.2 | ENGINE COOLING SYSTEM UPGRADE DETAILS |
| M5.1 | NEW FUEL FILTER INSTALLATION |
| M6.1 | CHARGE AIR SYSTEM MODIFICATIONS PLAN & DETAILS |
| M6.2 | CHARGE AIR SYSTEM MODIFICATIONS SECTIONS & DETAILS |
| M7.1 | EXHAUST & CRANKCASE VENT SYSTEM MODIFICATIONS |
| FS1 | FIRE SUPPRESSION ADDITIVE ALTERNATE #4 DETECTION & ALARM SYSTEM RENOVATION |
| FS2 | FIRE SUPPRESSION ADDITIVE ALTERNATE #5 HI–FOG FIRE SUPPRESSION SYSTEM |

| 2023 DERA–RPSU PROJECT DRAWINGS – ELECTRICAL | |
|---|---|
| E1.1 | ELECTRICAL LEGENDS & SCHEDULES |
| E2 | ELECTRICAL DEMOLITION PLAN & NOTES |
| E3.3 | ELECTRICAL NEW WORK PLAN & NOTES |
| M3.4 | ELEVATIONS & DETAILS |
| E6.1 | SWITCHGEAR MODIFICATIONS ONE–LINE DIAGRAM |
| E6.2 | SWITCHGEAR SETTING TABLE & SEQUENCE OF OPERATIONS SUMMARY |
| E6.3 | 24VDC ENGINE WIRING JUNCTION BOX |
| E7.1 | EXISTING FUEL SYSTEM CONTROL PANEL LOGIC MODIFICATIONS FOR FUEL POLISHING FUNCTION |
| E7.2 | EXISTING FUEL SYSTEM CONTROL PANEL ADD ALT #3 FUEL OIL COOLER FOC–1 VFD REPLACEMENT |
| E7.3 | EXISTING FUEL SYSTEM CONTROL PANEL ADD ALT #3 FUEL OIL COOLER FOC–1 VFD REPLACEMENT |

| 2008 POWER PLANT PROJECT REFERENCE DRAWINGS – MECHANICAL | |
|---|---|
| M1.1 | LEGEND & SCHEDULES |
| M1.2 | OVERALL SITE PLAN & DETAILS |
| M1.3 | EXCAVATION & GRADING PLANS |
| M1.4 | FUEL TANK PLAN & DETAILS |
| M1.5 | TANK FABRICATION DETAILS & SPECIFICATIONS |
| M1.6 | HEAT RECOVERY SITE PLAN, HEAT RECOVERY & FUEL TANK DETAILS |
| M1.7 | HEAT RECOVERY PLANS & DETAILS |
| M2 | MECHANICAL SPECIFICATIONS |
| M3 | EQUIPMENT LAYOUT PLAN, SECTION, & DETAILS |
| M4 | COOLANT PIPING PLAN, ISOMETRICS, & DETAILS |
| M5 | DIESEL FUEL & USED OIL PIPING PLAN & DETAILS |
| M6 | CHARGE AIR COOLER PLAN, SECTIONS, & DETAILS |
| M7 | EXHAUST SYSTEM PLAN, SECTIONS, & DETAILS |
| M8 | PIPING & SUPPORT DETAILS |
| M9 | VENTILATION SYSTEM PLAN, DETAILS, & SPECIFICATIONS |
| M10 | VENTILATION SYSTEM FABRICATION DETAILS |

| 2008 POWER PLANT PROJECT REFERENCE DRAWINGS – ELECTRICAL | |
|---|---|
| E1 | SITE PLAN, DETAILS, & SCHEDULE OF DRAWINGS |
| E2 | SPECIFICATIONS & EQUIPMENT SCHEDULE |
| E3.1 | UNDERFLOOR POWER & CONTROL PLANS & DETAILS |
| E3.2 | WIREWAY PLAN, DATA/COMMUNICATION PLAN, & DETAILS |
| E4 | LIGHTING/RECEPTACLE PLAN & DETAILS |
| E5 | STATION SERVICE PLAN, PANEL, & DETAILS |
| E6 | SWITCHGEAR DETAILS |
| E7 | FUEL SYSTEM CONTROL PANEL 3–LINE DIAGRAM & OIL BLENDER LOGIC |
| E8 | FUEL SYSTEM CONTROL PANEL VFD LOGIC |
| E9 | FUEL SYSTEM CONTROL PANEL DAY TANK FILL LOGIC |
| E10 | FUEL SYSTEM CONTROL PANEL LAYOUT & BILL OF MATERIALS |
| E11 | INTERMEDIATE TANK CONTROL PANEL |




# AKIACHAK 2023 DERA-RPSU PROJECT
# ISSUED FOR CONSTRUCTION
# MARCH 2023

| 2022 SWITCHGEAR UPGRADE RECORD DRAWINGS WITH REDLINES FOR 2023 CHANGES | | | |
|---|---|---|---|
| 6190–2101–D | COVER SHEET | 6190–5311–D | GENERATOR 4 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190–3101–D | SCHEMATIC LEGEND & NOTES | 6190–5312–D | GENERATOR 4 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190–4101–D | GENERATOR SWITCHGEAR ELEVATION VIEW | 6190–5313–D | MASTER DC CONTROL, SCHEMATIC DIAGRAM |
| 6190–4102–D | GENERATOR SWITCHGEAR PLAN VIEW, OUTLINE DIAGRAM | 6190–5314–D | MASTER DC CONTROL, SCHEMATIC DIAGRAM |
| 6190–5101–D | GENERATOR SINGLE LINE, SCHEMATIC DIAGRAM | 6190–5315–D | MASTER DC CONTROL, SCHEMATIC DIAGRAM |
| 6190–5201–D | GENERATOR 1 AC THREE LINE, SCHEMATIC DIAGRAM | 6190–5316–D | VFD DC CONTROL, SCHEMATIC DIAGRAM |
| 6190–5201–D | GENERATOR 1 AC THREE LINE, SCHEMATIC DIAGRAM | 6190–5317–D | VFD DC CONTROL, SCHEMATIC DIAGRAM |
| 6190–5202–D | GENERATOR 2 AC THREE LINE, SCHEMATIC DIAGRAM | 6190–5318–D | VFD DC CONTROL, SCHEMATIC DIAGRAM |
| 6190–5203–D | GENERATOR 3 AC THREE LINE, SCHEMATIC DIAGRAM | 6190–5319–D | VFD DC CONTROL, SCHEMATIC DIAGRAM |
| 6190–5204–D | GENERATOR 4 AC THREE LINE, SCHEMATIC DIAGRAM | 6190–5401–D | GENERATOR 1 & 2 BREAKER CONTROL, SCHEMATIC DIAGRAM |
| 6190–5205–D | MASTER AC THREE LINE, SCHEMATIC DIAGRAM | 6190–5402–D | GENERATOR 3 & 4 BREAKER CONTROL, SCHEMATIC DIAGRAM |
| 6190–5206–D | MASTER AC THREE LINE, SCHEMATIC DIAGRAM | 6190–5403–D | FEEDER 1 & 2 BREAKER CONTROL, SCHEMATIC DIAGRAM |
| 6190–5207–D | VFD AC THREE LINE, SCHEMATIC DIAGRAM | 6190–5501–D | PLC COMMUNICATION, SCHEMATIC DIAGRAM |
| 6190–5208–D | VFD AC THREE LINE, SCHEMATIC DIAGRAM | 6190–5502–D | PLC COMMUNICATION, SCHEMATIC DIAGRAM |
| 6190–5301–D | GENERATOR 1 DC CONTROL, SCHEMATIC DIAGRAM | 6190–5503–D | PLC COMMUNICATION, SCHEMATIC DIAGRAM |
| 6190–5302–D | GENERATOR 1 DC CONTROL, SCHEMATIC DIAGRAM | 6190–5601–D | COMMUNICATION NETWORK DIAGRAM |
| 6190–5303–D | GENERATOR 1 DC CONTROL, SCHEMATIC DIAGRAM | 6190–5602–D | COMMUNICATION NETWORK DIAGRAM |
| 6190–5304–D | GENERATOR 2 DC CONTROL, SCHEMATIC DIAGRAM | 6190–5702–D | HEATER, LIGHTING & FAN CONTROL, SCHEMATIC DIAGRAM |
| 6190–5305–D | GENERATOR 2 DC CONTROL, SCHEMATIC DIAGRAM | 6190–6101–D | CONTROL SWITCH TARGET DIAGRAM |
| 6190–5306–D | GENERATOR 2 DC CONTROL, SCHEMATIC DIAGRAM | 6190–6201–D | NAMEPLATE ENGRAVING SCHEDULE FABRICATION DIAGRAM |
| 6190–5307–D | GENERATOR 3 DC CONTROL, SCHEMATIC DIAGRAM | 6190–7101–D | INTERCONNECTION DIAGRAM |
| 6190–5308–D | GENERATOR 3 DC CONTROL, SCHEMATIC DIAGRAM | 6190–7102–D | INTERCONNECTION DIAGRAM |
| 6190–5309–D | GENERATOR 3 DC CONTROL, SCHEMATIC DIAGRAM | 21116–AKK–BOM | AKIACHAK SWITCHGEAR UPGRADE BILL OF MATERIALS |
| 6190–5310–D | GENERATOR 4 DC CONTROL, SCHEMATIC DIAGRAM | | |

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA–RPSU PROJECT

TITLE: SCHEDULE OF DRAWINGS

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

DRAWN BY: BCG | SCALE: NO SCALE
DESIGNED BY: BCG | DATE: 3/1/23
FILE NAME: AKCH DERA G1 | SHEET: G1
PROJECT NUMBER:

## EXISTING COOLANT/HEAT RECOVERY EQUIPMENT SCHEDULE

| | | |
|---|---|---|
| CAC-1<br>CAC-2 | GEN #1/#2 CHARGE AIR COOLER | SINGLE PASS, VERTICAL CORE COOLER, 4" FLANGED CONNECTIONS, 3HP MOTOR, 480V, 3PH, 10:1 TURNDOWN RATIO SUITABLE FOR VFD OPERATION. L&M MESABI PART # 115385, OFFSHORE COATING, NO SUBSTITUTES. |
| CAC-3<br>CAC-4 | GEN #3/#4 CHARGE AIR COOLER | SINGLE PASS, VERTICAL CORE COOLER, 4" FLANGED CONNECTIONS, 3HP MOTOR, 480V, 3PH, 10:1 TURNDOWN RATIO SUITABLE FOR VFD OPERATION. L&M MESABI PART # 116282, OFFSHORE COATING, NO SUBSTITUTES. |
| R-1<br>R-2 | REMOTE RADIATOR | SINGLE PASS, VERTICAL CORE RADIATOR, 3" FLANGED CONNECTIONS, 5HP MOTOR, 208V, 3PH, 10:1 TURNDOWN RATIO SUITABLE FOR VFD OPERATION. L&M MESABI PART # 116270, OFFSHORE COATING, NO SUBSTITUTES. |
| HX-1<br>HX-2 | POWER PLANT WATER PLANT HEAT EXCHANGER | 316 STAINLESS STEEL PLATES, ALL BRAZED CONSTRUCTION, 2" NPT PORTS, 250 MBH MIN CAPACITY. AMERIDEX X-10B-100 OR EQUAL.<br>PRIMARY: 50 GPM 195F EWT (50% ETHYLENE GLYCOL) 1.0 PSI MAX WPD<br>SECONDARY: 50 GPM 185F LWT (50% PROPYL. GLYCOL) 1.0 PSI MAX WPD |
| TV-1 | THERMOSTATIC VALVE | 4" ANSI 125# FLAT FACED FLANGES, CAST IRON BODY, FACTORY SET NON-ADJUSTABLE FIELD REPLACEABLE THERMOSTATIC ELEMENTS - 185F NOMINAL TEMPERATURE, FPE #A4010-185, NO SUBSTITUTES. |
| ET-1 | COOLANT EXP. TANK | 24 GALLON CAPACITY STEEL TANK FABRICATED IN ACCORDANCE WITH AEA STANDARD POWER PLANT TANK FABRICATION DETAILS. |
| ET-2 | HEAT RECOV. EXPANSION TANK | HORIZONTAL INSTALLATION BLADDER TYPE EXPANSION TANK, 68 GALLON TANK VOL, 34 GALLON ACCEPTANCE VOL, 100 PSIG WORKING PRES, 12 PSIG PRE-CHARGE. AMTROL AX-120 OR EQUAL. PROVIDE WITH SADDLES. |
| P-HR1 | HEAT RECOV. PRIMARY | 60 GPM AT 8' TDH, 1/3HP, 115V, 1ø. GRUNDFOS UPS 50-40/4, SPEED 3, NO SUBSTITUTES, WITH 2" NPT COMPANION FLANGES, GASKETS, & BOLTS. |
| P-HR2 | HEAT RECOV. SECONDARY | 65 GPM AT 15' TDH, 1/2HP, 115V, 1ø. GRUNDFOS UPS 40-80/4, SPEED 3, NO SUBSTITUTES, WITH 1-1/2" NPT COMPANION FLANGES, GASKETS, & BOLTS. |
| P-HR3 | CONTROL ROOM HEAT | 4 GPM AT 15' TDH, 1/25HP, 115V, 1ø. GRUNDFOS UPS15-58F, SPD 3, NO SUBSTITUTES, WITH 3/4" NPT COMPANION FLANGES, GASKETS, & BOLTS. |
| P-HR4 | SLAB HEAT | 4 GPM AT 15' TDH, 1/25HP, 115V, 1ø. GRUNDFOS UPS15-58F, SPD 3, NO SUBSTITUTES, WITH 3/4" NPT COMPANION FLANGES, GASKETS, & BOLTS. |
| P-HR5 | WATER PLANT HEAT RECOV. | 60 GPM AT 8' TDH, 1/3HP, 115V, 1ø. GRUNDFOS UPS 50-40/4, SPEED 3, NO SUBSTITUTES, WITH 2" NPT COMPANION FLANGES, GASKETS, & BOLTS. |

## EXISTING FUEL/OIL EQUIPMENT SCHEDULE

| | | |
|---|---|---|
| P-DF1 | DAY TANK FILL PUMP | ROTARY GEAR PUMP, 1/2" FPT INLET AND OUTLET, DUCTILE IRON CONSTRUCTION WITH STAINLESS STEEL SHAFT, BUNA-N LIP SEAL, CARBON BEARINGS, DIRECT FLEX COUPLED TO 1725 RPM ODP THERMALLY PROTECTED, AUTO RESET MOTOR, 1/3 HP, 115 V, 1 PH, 60 HZ, 6.6 GPM @ 20 PSID. PROVIDE WITH 40 PSID INTERNAL PRV. OBERDORFER C992M3E5QF50, NO SUBSTITUTES. |
| P-DF2<br>P-DF3<br>P-U01 | PUMP DOWN, DIESEL CIRC, & USED OIL DRAIN PUMPS | ROTARY GEAR PUMP, 1/2" FPT INLET AND OUTLET, BRONZE CONSTRUCTION WITH STAINLESS STEEL SHAFTS, BUNA-N SEAL, CARBON BEARINGS, DIRECT FLEX COUPLED TO 1150 RPM ODP THERMALLY PROTECTED, AUTO RESET MOTOR, 1/2 HP, 115 V, 1 PH, 60 HZ, 6.6 GPM @ 20 PSID. PROVIDE WITH 40 PSID INTERNAL PRV. OBERDORFER N994RH-J46, NO SUBSTITUTES. |
| P-U02 | USED OIL INJECTION PUMP | ROTARY GEAR PUMP, 1/8" FPT INLET AND OUTLET, STAINLESS STEEL CONSTRUCTION, PEEK GEARS, PTFE SEALS, MAGNETICALLY COUPLED TO 1750 RPM TEFC THERMALLY PROTECTED, AUTO RESET MOTOR, 1/20 HP, 115 V, 1 PH, 60 HZ., 1.2 GPH @ 15 PSID. MICROPUMP GA-V21.J8FS.A PUMP WITH #82130 MOTOR, NO SUBSTITUTES. |
| HAND PUMP | GLYCOL & DIESEL | DOUBLE ACTION PISTON HAND PUMP, ALUM HOUSING, SS PISTON SHAFT & LINER, BUNA-N SEALS, ANTI-SIPHONING VALVE. GPI MODEL HP-100 NO SUBSTITUTES. |
| FOC-1 | FUEL OIL COOLER | TWO PASS, HORIZONTAL CORE COOLER, 1-1/2" FLANGED CONNECTIONS, 1-1/2HP MOTOR, 208V, 3PH, 10:1 TURNDOWN RATIO SUITABLE FOR VFD OPERATION. L&M MESABI PART # 116224, STANDARD COATING, NO SUBSTITUTES. |

## EXISTING & NEW EQUIPMENT NOTES

1) ALL EQUIPMENT IN EXISTING SCHEDULES (SHOWN IN LIGHT TEXT) ARE PROVIDED FOR REFERENCE ONLY. SOME EXISTING ITEMS WILL BE DEMOLISHED AS INDICATED ON THE PAGES THAT FOLLOW. ALL OTHER EQUIPMENT TO REMAIN.
2) ALL EQUIPMENT IN NEW SCHEDULES (SHOWN IN BOLD TEXT) ARE TO BE INSTALLED UNDER THIS PROJECT. NOTE THAT ALL GENERATORS, RADIATORS R-1 AND R-2, AND CHARGE AIR COOLERS CAC-3 AND CAC-4 WILL BE OWNER FURNISHED AND CONTRACTOR INSTALLED. ALL OTHER EQUIPMENT WILL BE CONTRACTOR FURNISHED AND INSTALLED.
3) SPECIFIC PARTS MANUFACTURER AND MODEL SELECTED NOT ONLY TO MEET PERFORMANCE FUNCTION BUT ALSO TO COORDINATE AND INTERFACE WITH OTHER DEVICES AND SYSTEMS. APPROVED EQUAL SUBSTITUTIONS WILL BE ALLOWED ONLY BY ENGINEER'S APPROVAL. TO OBTAIN APPROVAL, SUBMITTALS MUST CLEARLY DEMONSTRATE HOW SUBSTITUTE ITEM MEETS OR EXCEEDS SPECIFIED ITEM QUALITY AND PERFORMANCE CHARACTERISTICS AND ALSO COMPLIES WITH MECHANICAL AND/OR ELECTRICAL CONNECTIONS AND PHYSICAL LAYOUT REQUIREMENTS.

## EXISTING WARNING SIGN SCHEDULE:

0.08" ALUMINUM, 3/16" HOLES IN ALL FOUR CORNERS. WHITE NON-REFLECTIVE VINYL BACKGROUND, 3M 3650-10, WITH 3M SERIES 225 HIGH PERFORMANCE VINYL LETTERS, COLOR AS INDICATED, ONE SIDE ONLY. 10"x14" UNLESS INDICATED OTHERWISE. WARNING LITES.

WARNING SIGNS - RED LETTERS ON WHITE BACKGROUND.

1. "DANGER - FLAMMABLE, NO SMOKING" (3" HIGH 1/2" STROKE LETTERS-24"x18")
11. "DANGER HIGH VOLTAGE, AUTHORIZED PERSONNEL ONLY"
12. "CAUTION HEARING & EYE PROTECTION REQUIRED"
13. "FUEL OIL DAY TANK ALARM"
14. "IN CASE OF FUEL SPILL CALL DEC 1-800-478-9300"
15. "INTERMEDIATE TANK ALARM"

INFORMATIONAL PLACARDS - BLACK LETTERS ON WHITE BACKGROUND.

16. "TO MANUALLY FILL DAY TANK IN CASE OF EMERGENCY:
    1) TURN OFF POWER TO THE DAY TANK CONTROL PANEL
    2) MANUALLY OPEN ACTUATOR VALVE AT INTERMEDIATE TANK USING A WRENCH
    3) OPEN NORMALLY CLOSED VALVE BY HAND PUMP
    4) OPERATE HAND PUMP WHILE MONITORING LEVEL GAUGE"
17. "TO CHANGE ENGINE OIL:
    1) LOCK & TAG GENERATOR OUT OF SERVICE
    2) OPEN NORMALLY CLOSED DRAIN VALVE AT GEN
    3) TURN ON PUMP TIMER & PUMP OUT ENGINE OIL
    4) CHANGE FILTER & PLACE OLD ONE IN HOPPER
    5) CLOSE DRAIN VALVE & REFILL ENGINE
    6) RUN ENGINE, SHUT OFF, & CHECK DIPSTICK
    7) TOP OFF & PLACE ENGINE BACK IN SERVICE"
18. "CHECK INTERMEDIATE TANK LEVEL DAILY, FILL WHEN BELOW 5'-0":
    1) GO TO TANK FARM & TURN ON CONTROL PANEL POWER
    2) VERIFY BULK TANK LEVELS & OPEN TANK VALVES
    3) GO TO INTERMEDIATE TANK & OPEN VALVE
    5) GO TO INTERMEDIATE TANK CONTROL PANEL & PRESS START BUTTON
    6) MONITOR TANK LEVELS CONTINUOUSLY (MAKE SURE BULK TANK AT TANK FARM DOES NOT RUN EMPTY DURING TRANSFER)
    7) WHEN INTERMEDIATE TANK LEVEL REACHES 8'-5" PRESS STOP BUTTON
    8) CLOSE & LOCK VALVE AT INTERMEDIATE TANK
    9) RETURN TO TANK FARM, CLOSE & LOCK VALVES, TURN CONTROL PANEL POWER OFF"

INSTALLATION - SECURE EACH SIGN TO WALL OR DOORS WITH STAINLESS STEEL SHEET METAL SCREWS.

## EXISTING VALVE TAG SCHEDULE:

VALVE TAGS - 3"x5"x.08" ALUMINUM, 3/16" HOLES IN ALL FOUR CORNERS, BLACK GERBER THERMAL TRANSFER FILM PRINTED LETTERS ON GERBER 220 HIGH PERFORMANCE VINYL BACKGROUND, COLOR AS INDICATED, ONE SIDE ONLY. WARNING LITES OR EQUAL.

GREEN (DIESEL FUEL)

21. "NORMALLY OPEN, CLOSE ONLY FOR EMERGENCIES & TEMPORARY MAINTENANCE OF DAY TANK & DEVICES"
22. "NORMALLY CLOSED, OPEN ONLY FOR HAND PRIMING DAY TANK"
23. "NORMALLY OPEN, CLOSE ONLY FOR TEMPORARY MAINTENANCE OF BLENDER"
24. "NORMALLY OPEN, CLOSE ONLY FOR TEMPORARY MAINTENANCE OF ENGINE"
25. "NORMALLY CLOSED, OPEN ONLY FOR TEMPORARY MAINTENANCE OF OIL COOLER"
26. "NORMALLY OPEN, CLOSE ONLY FOR TEMPORARY MAINTENANCE OF ACTUATOR VALVE"
27. "NORMALLY CLOSED, OPEN ONLY FOR FILLING INTERMEDIATE TANK"

BROWN (USED OIL)

41. "NORMALLY CLOSED, OPEN ONLY FOR ENGINE OIL CHANGE"
42. "FILTER #1, 10 MICRON HYDROSORB"
43. "FILTER #2, 10 MICRON HYDROSORB"
44. "FILTER #3, 2 MICRON PARTICULATE"

PINK (COOLING/ETHYLENE GLYCOL)

51. "NORMALLY CLOSED, OPEN ONLY FOR ADDING COOLANT - ETHYLENE GLYCOL ONLY"
52. "NORMALLY CLOSED, OPEN ONLY ON HIGH COOLANT TEMPERATURE ALARM"
53. "NORMALLY OPEN, CLOSE ONLY ON HIGH COOLANT TEMPERATURE ALARM"
54. "NORMALLY OPEN, RADIATOR PRE-HEAT"

GRAY (HEAT RECOVERY/PROPYLENE GLYCOL)

61. "NORMALLY CLOSED, OPEN ONLY FOR ADDING FLUID - PROPYLENE GLYCOL ONLY"
62. "NORMALLY OPEN, HEAT RECOVERY SUPPLY"
63. "NORMALLY OPEN, HEAT RECOVERY RETURN"
64. "NORMALLY OPEN, HEATING RETURN TO HX"
65. "NORMALLY OPEN, HX TO BOILER"

TOMATO RED (WARNING)

71. "CAUTION: THIS UNIT STARTS AUTOMATICALLY, LOCK & TAG OUT PRIOR TO SERVICE"

INSTALLATION - SECURE EACH TAG TIGHT TO VALVE, PIPE, OR DEVICE WITH STAINLESS STEEL CABLE TIES OR SAFETY WIRE THROUGH ALL FOUR CORNERS OR FASTEN TO ADJACENT WALL OR SECTION OF STRUT WITH SCREWS.

NOTE: FOR ALL VALVES NOT INDICATED WITH A SPECIFIC FUNCTION TAG PROVIDE 1-1/2"ø BRASS TAG LABELED "N.O." FOR NORMALLY OPEN VALVES AND 1"ø BRASS TAG LABELED "N.C." FOR NORMALLY CLOSED VALVES. SECURE TAGS TO VALVE OR ADJACENT PIPE WITH BEADED BRASS CHAIN.

## NEW ENGINE COOLING SYSTEM EQUIPMENT SCHEDULE

| SYMBOL | SERVICE/FUNCTION | DESCRIPTION | MANUFACTURER/MODEL |
|---|---|---|---|
| R-1<br>R-2 | GLYCOL RADIATOR | SINGLE PASS, 5 ROW, VERTICAL CORE, 3" FLANGED CONNECTIONS, GALVANIZED OR EPOXY COATING, EXPANDED METAL GUARD. 15,000 BTU/MIN AT 80°F AMBIENT, 70 GPM 50% ETHYLENE GLYCOL AT 200F IN, 0.5 PSI MAX GLYCOL PRESSURE DROP. 5 HP, 460 V, 3 PH MOTOR SUITABLE FOR VFD OPERATION AT 10:1 TURNDOWN RATIO. | DIESEL RADIATOR<br>PART NO. DR3734<br>(OWNER FURNISHED WITH GENSETS) |
| CAC-3<br>CAC-4 | GEN#3 & GEN#4 CHARGE AIR COOLER | SINGLE PASS, VERTICAL ALUMINUM CORE, 4" FLANGED TOP CONNECTIONS, EPOXY COATING, EXPANDED METAL GUARD. 1340 SCFM CHARGE AIR AT 395F IN AND 110F OUT AT 75F AMBIENT, 34" H2O MAX CHARGE AIR PRESSURE DROP. 5 HP, 460 V, 3 PH, MOTOR SUITABLE FOR VFD OPERATION AT 10:1 TURNDOWN RATIO. | DIESEL RADIATOR<br>PART NO. DR3376A<br>(OWNER FURNISHED WITH GENSETS) |
| TV-1 | COOLANT THERMOSTATIC VALVE | 4" ANSI 125# FLAT FACED FLANGES, CAST IRON BODY, FACTORY SET NON-ADJUSTABLE FIELD REPLACEABLE THERMOSTATIC ELEMENTS, 175F NOMINAL TEMPERATURE | FPE<br>PART NO. A4010-175 |

## NEW FUEL SYSTEM EQUIPMENT SCHEDULE

| SYMBOL | SERVICE/FUNCTION | DESCRIPTION | MANUFACTURER/MODEL |
|---|---|---|---|
| F-TR | TRIPLE FUEL FILTER | THREE FILTER BANK WITH INDIVIDUAL ISOLATION VALVES, IMPACT RESISTANT "SEE-THRU" BOWLS, 15 PSIG WORKING PRESSURE. INSTALL ONE COMPLETE SET OF 10 MICRON AQUABLOC FILTER ELEMENTS AND FURNISH ONE COMPLETE SPARE SET (6 ELEMENTS TOTAL). | RACOR TURBINE<br>79/1000FGV WITH<br>2020TM-OR ELEMENTS |
| F-SCR | SCREEN FOR EXISTING FILTER | REPLACE EXISTING FUEL FILTER BOWL AND ELEMENT WITH NEW BOWL, NEW GASKET, AND NEW 40 MESH STAINLESS STEEL SCREEN ELEMENT | GOLDENROD<br>495-4 BOWL<br>470-7 GASKET<br>470-15 SCREEN |

## NEW INSTRUMENTATION SCHEDULE

| SYMBOL | SERVICE/FUNCTION | DESCRIPTION | MANUFACTURER/MODEL |
|---|---|---|---|
| LCA | GLYCOL TANK LOW COOLANT ALARM | LOW COOLANT LEVEL ALARM FLOAT SWITCH, SEE MECHANICAL FOR INSTALLATION DETAILS | MURPHY EL-150-K1 |
| RTD | COOLANT RETURN TEMP SENSOR | RTD, 3-WIRE, 100 OHM, 1/4"ø BY 4" LONG STAINLESS STEEL PROBE, CAST IRON HEAD, SCREW TERMINALS, 1/2" THD PROCESS CONNECTION. WITH MATCHING 3/4" MPT THERMOWELL | OMEGA PR-12L RTD WITH SERIES 260S WELL |

## LEGEND

- GATE VALVE
- BALL VALVE
- CHECK VALVE
- HOSE END DRAIN VALVE
- GAUGE COCK
- AUTOMATIC AIR VENT
- DIGITAL THERMOMETER
- PRESSURE GAUGE
- TEMPERATURE SENSOR
- FLEXIBLE CONNECTOR
- FLANGED JOINT
- UNION
- ELBOW TURNED UP
- ELBOW TURNED DOWN
- PIPING CONNECTION (TEE)
- CHANGE OF PIPE SIZE
- DIRECTION OF FLOW

## ABBREVIATIONS

| | |
|---|---|
| ø | DIAMETER (PHASE) |
| A | AMPS |
| AFF | ABOVE FINISHED FLOOR |
| BTU | BRITISH THERMAL UNIT |
| DFR | DIESEL FUEL RETURN |
| DFS | DIESEL FUEL SUPPLY |
| EWT | ENTERING WATER TEMPERATURE |
| EXIST | EXISTING |
| ECR | ENGINE COOLANT RETURN |
| ECS | ENGINE COOLANT SUPPLY |
| FPT | FEMALE PIPE THREAD |
| GA | GAUGE |
| GALV | GALVANIZED |
| GPM | GALLONS PER MINUTE |
| GRC | GALVANIZED RIGID CONDUIT |
| HP | HORSEPOWER |
| HRR | HEAT RECOVERY RETURN |
| HRS | HEAT RECOVERY SUPPLY |
| ID | INSIDE DIAMETER |
| KW | KILOWATT |
| LT | LIQUID TIGHT |
| LWT | LEAVING WATER TEMPERATURE |
| MAX | MAXIMUM |
| MBH | THOUSAND BTU PER HOUR |
| MIN | MINIMUM |
| MPT | MALE PIPE THREAD |
| NC | NORMALLY CLOSED |
| NO | NORMALLY OPEN |
| OC | ON CENTER |
| OD | OUTSIDE DIAMETER |
| PRV | PRESSURE RELIEF VALVE |
| PSI | POUNDS/PER SQUARE INCH |
| PSID | PSI DIFFERENTIAL |
| PSIG | PSI GAUGE |
| SCH | SCHEDULE |
| TDH | TOTAL DEVELOPED HEAD |
| TYP | TYPICAL |
| UOR | USED OIL RETURN |
| V | VOLTS |
| W | WATTS |
| WG | WATER GAUGE |
| WPD | WATER PRESSURE DROP |

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
BRIAN C. GRAY ME 8210
REGISTERED PROFESSIONAL ENGINEER

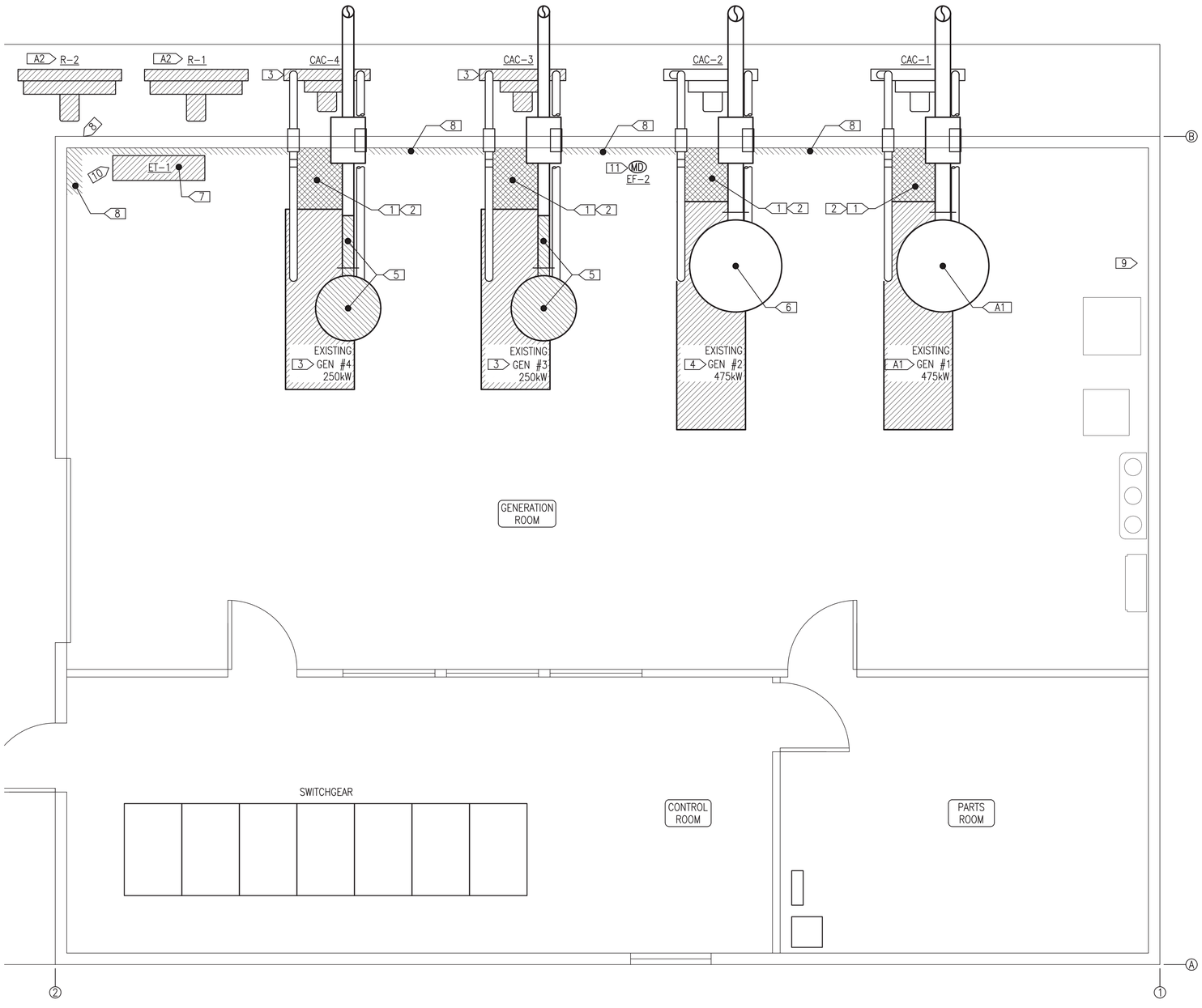
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: LEGEND, ABBREVIATIONS, & SCHEDULES

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

DRAWN BY: BCG | SCALE: AS NOTED
DESIGNED BY: BCG | DATE: 3/1/23
FILE NAME: AKCHDRA M1-7 | SHEET: M1.1
PROJECT NUMBER:




1 M2 MECHANICAL DEMOLITION PLAN
3/8"=1'

## DEMOLITION GENERAL NOTES:

1. THIS PLANT PROVIDES PRIME POWER TO THE COMMUNITY OF AKIACHAK. KEEP OUTAGES TO A MINIMUM AND COORDINATE ALL REQUIRED OUTAGES WITH THE UTILITY. SEE LIMITED POWER OUTAGE NOTES THIS SHEET.
3. ALL ITEMS TO REMAIN UNLESS SPECIFICALLY INDICATED FOR DEMOLITION OR TEMPORARY REMOVAL. EXISTING EQUIPMENT AND DEVICES TO BE REMOVED INDICATED BY HATCHING. SEE SPECIFIC NOTES FOR FINAL DISPOSITION OF EXISTING EQUIPMENT TO BE REMOVED WHETHER IT BE DEMOLITION FOR PERMANENT REMOVAL FROM PLANT OR TEMPORARY REMOVAL FOR FUTURE REINSTALLATION.
4. ONLY MAJOR DEMOLITION ITEMS AND AREAS SHOWN THIS SHEET. REMOVAL OF SMALL EQUIPMENT, COMPONENTS, AND FITTINGS AS REQUIRED FOR MISCELLANEOUS UPGRADES SHOWN WITH NEW WORK PLANS OR ON DETAILS.
5. TAKE ALL PRECAUTIONS TO MINIMIZE DAMAGE TO GENERATION EQUIPMENT BEING REMOVED DURING DEMOLITION EXCEPT ENGINE BLOCKS AS NOTED. TARP GENERATORS AND SEAL ALL EXPOSED CONNECTIONS PRIOR TO REMOVING FROM PLANT. TURN ALL REMOVED EQUIPMENT OVER TO THE UTILITY FOR FINAL DISPOSITION.
6. DRAIN ALL PIPING PRIOR TO DEMOLITION. DRAIN ENGINE BLOCKS PRIOR TO REMOVAL. TURN USED OIL AND GLYCOL OVER TO THE UTILITY FOR FINAL DISPOSITION.
7. TWO EACH EXISTING ENGINES (GEN#3 & GEN#4) WILL BE PERMANENTLY TAKEN OUT OF SERVICE UNDER DERA PROJECT SCOPE. RENDER THESE BLOCKS UNUSABLE BY CUTTING A MINIMUM 3"x3" HOLE IN ENGINE CRANK CASE. FILL OUT A CERTIFICATE OF DESTRUCTION FOR EACH ENGINE AND INCLUDE PHOTOGRAPHIC DOCUMENTATION OF THE HOLE AND THE ASSOCIATED ENGINE NAMEPLATE. GEN#2 WILL BE TAKEN OUT OF SERVICE UNDER BASE BID AND GEN#1 WILL BE TAKEN OUT OF SERVICE UNDER ADDITIVE ALTERNATE #1 BUT BOTH WILL BE RETAINED AS SPARES. DO NOT CUT HOLE IN GEN#2 & GEN #1 ENGINE CRANK CASES.

## DEMOLITION SPECIFIC NOTES (BASE BID):

1. EXISTING CRANK CASE VENTILATION HOSES RUN FROM ENGINE THROUGH THE EXTERIOR WALL. DEMOLISH ALL HOSES AND PATCH HOLES IN WALL.
2. DEMOLISH ALL EXISTING HOSES INCLUDING ENGINE COOLANT, PREHEAT, AND FUEL/OIL IN PREPARATION FOR REPLACEMENT WITH NEW. SEE SHEET M4.1 FOR ENGINE COOLANT CONNECTION MODIFICATIONS.
3. REMOVE EXISTING GEN#3/GEN#4. SALVAGE EXISTING GENERATOR STEEL SUPPORT PEDESTALS FOR REUSE (DO NOT SALVAGE EXISTING VIBRATION ISOLATORS). REMOVE GEN#3/GEN#4 FROM PLANT AND RENDER BLOCK UNUSABLE (SEE GENERAL NOTE 6) AND TURN OVER TO UTILITY FOR DISPOSAL. REMOVE CHARGE AIR COOLERS CAC-3/CAC-4 IN THEIR ENTIRETY. LEAVE EXISTING STEEL SUPPORT PEDESTALS IN PLACE FOR RE-USE. DEMOLISH PORTIONS OF CHARGE AIR TUBING. SEE SECTION 2/M3.2. COORDINATE WITH ELECTRICAL.
4. REMOVE EXISTING GEN#2 AND INTERIOR CHARGE AIR TUBING IN ITS ENTIRETY. EXISTING CHARGE AIR COOLER AND EXTERIOR CHARGE AIR TUBING TO REMAIN. SALVAGE EXISTING GENERATOR STEEL SUPPORT PEDESTALS FOR REUSE. REMOVE GEN#2 FROM PLANT AND TURN OVER TO UTILITY FOR STORAGE. DO NOT RENDER GEN#2 BLOCK UNUSABLE. SEE SECTION 1/M3.2. COORDINATE WITH ELECTRICAL.
5. CAREFULLY REMOVE EXISTING GEN#3/GEN#4 6" FLANGED MUFFLER, RISER PIPE, PIPE INSULATION, AND CEILING-MOUNTED STRUT SUPPORT RACK AND SAVE FOR REINSTALLATION. CUT EXISTING 6" HORIZONTAL PIPE BACK FOR NEW MUFFLER LOCATION. EXTERIOR PIPE AND WALL THIMBLE TO REMAIN. SEE SECTION 2/M3.2.
6. EXISTING GEN#2 8" MUFFLER, DISCHARGE PIPE, AND WALL THIMBLE TO REMAIN. DEMOLISH 8" MUFFLER RISER PIPE. SEE SECTION 1/M3.2.
7. DEMOLISH EXISTING GLYCOL EXPANSION TANK ET-1, APPURTENANCES, AND HOSES IN PREPARATION FOR REPLACEMENT WITH NEW, SEE PIPING ISOMETRIC 1/M4.1.
8. DEMOLISH EXISTING ENGINE CRANKCASE VENTILATION SYSTEM IN ITS ENTIRETY INCLUDING PLASTIC PIPE, ENGINE HOSE CONNECTIONS, WALL MOUNTED FAN, AND PIPE THROUGH WALL. PATCH HOLE IN WALL. COORDINATE WITH ELECTRICAL.
9. REMOVE EXISTING FILTER BOWL AND ELEMENT FOR INSTALLATION OF NEW BOWL AND SCREEN. REMOVE HOSES AS REQUIRED FOR INSTALLATION OF NEW WATER BLOCKING TRIPLE FILTER. SEE SHEET M5.1. SEE ELECTRICAL FOR RELATED TASKS.
10. REMOVE EXISTING 4" THERMOSTATIC VALVE IN PREPARATION FOR REPLACEMENT WITH NEW, SEE PIPING ISOMETRIC 1/M4.1.
11. REMOVE EXISTING EXHAUST FAN DISCHARGE DAMPER ACTUATOR IN PREPARATION FOR REPLACEMENT. COORDINATE WITH ELECTRICAL.
12. SEE ELECTRICAL
13. SEE ELECTRICAL
14. SEE ELECTRICAL
15. SEE ELECTRICAL
16. SEE ELECTRICAL

## DEMOLITION SPECIFIC NOTES (ADDITIVE ALTERNATES):

- A1 UNDER ADDITIVE ALTERNATE #1 REMOVE EXISTING GEN#1 AND INTERIOR CHARGE AIR TUBING IN ITS ENTIRETY. EXISTING CHARGE AIR COOLER AND EXTERIOR CHARGE AIR TUBING TO REMAIN. EXISTING 8" MUFFLER, DISCHARGE PIPE, AND WALL THIMBLE TO REMAIN. SALVAGE EXISTING GENERATOR STEEL SUPPORT PEDESTALS FOR REUSE. REMOVE GEN#1 FROM PLANT AND TURN OVER TO UTILITY FOR STORAGE. DO NOT RENDER GEN#1 BLOCK UNUSABLE. SEE INSTALLATION ELEVATION 1/M3.2. SEE ELECTRICAL FOR ADDITIONAL TASKS.
- A2 UNDER ADDITIVE ALTERNATE #2 REMOVE EXISTING RADIATORS AND TURN OVER TO UTILITY. EXISTING PIPING MANIFOLD AND PEDESTAL SUPPORTS TO REMAIN FOR REUSE. SEE SHEETS M4.1 AND M4.2. PLAN WORK TO AVOID AN OUTAGE USING VALVES TO ISOLATE AND REPLACE RADIATORS ONE AT TIME.
- A3 SEE ELECTRICAL.
- A4 FIRE SUPPRESSION DETECTION AND ALARM SYSTEM RENOVATION. SEE FIRE SUPPRESSION DRAWING FS1.
- A5 FIRE SUPPRESSION CLEAN AGENT SYSTEM. SEE FIRE SUPPRESSION DRAWING FS2.

## LIMITED POWER OUTAGE NOTES:

1) SCHEDULE ALL REQUIRED OUTAGES IN ADVANCE WITH THE UTILITY.
2) THIS PROJECT REQUIRES SUBSTANTIAL MODIFICATIONS TO THE EXISTING COOLANT SYSTEM PIPING, SEE SHEET M4.1 FOR SCOPE. PORTIONS OF THIS WORK CAN NOT BE ACCOMPLISHED WHILE THE POWER PLANT IS IN OPERATION BECAUSE SEVERAL TASKS REQUIRE THE ENGINE COOLING SYSTEM TO BE DRAINED. ALL TASKS REQUIRING THE COOLING SYSTEM TO BE DRAINED MUST BE SCHEDULED SIMULTANEOUSLY TO LIMIT TO ONE EXTENDED POWER OUTAGE. IN ORDER TO LIMIT OUTAGE DURATION, PLAN WORK AND PREFABRICATE PARTIAL ASSEMBLIES TO THE MAXIMUM EXTENT POSSIBLE. THE TOTAL SHUT DOWN MUST NOT EXCEED EIGHT HOURS INCLUDING DRAIN DOWN, ALL PIPING MODIFICATIONS, REFILLING THE SYSTEM, AND PLACING A GENERATOR BACK IN SERVICE.
3) OTHER TASKS MAY REQUIRE ADDITIONAL OUTAGES. KEEP THESE OUTAGES AS SHORT AS POSSIBLE.

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BRIAN C. GRAY
ME 8210
REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: MECHANICAL DEMOLITION PLAN & NOTES

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

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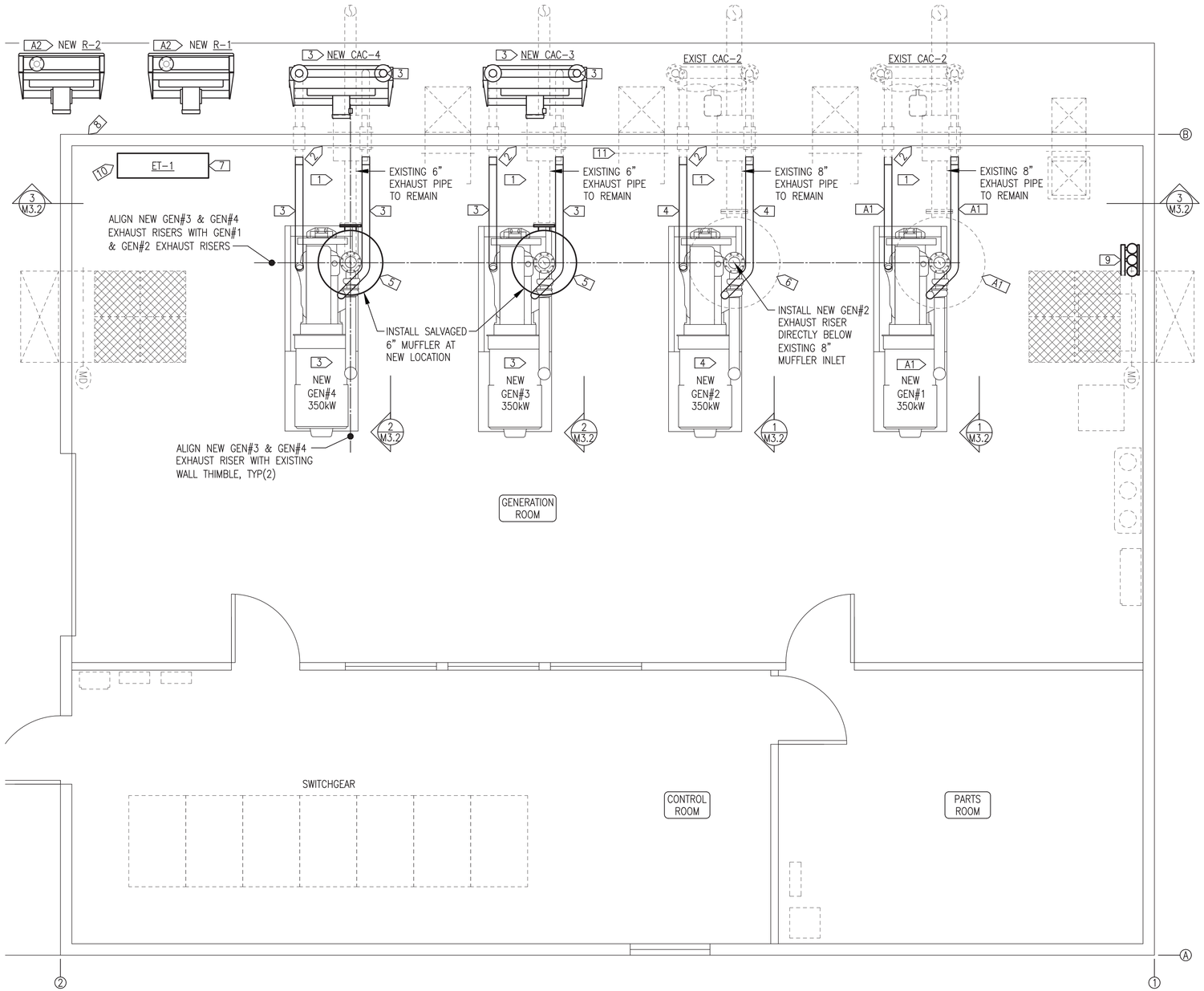
FILE NAME: AKCHDRA M1-7 | SHEET: M2
PROJECT NUMBER:




1 M3.1 EQUIPMENT LAYOUT & MECHANICAL NEW WORK PLAN
3/8"=1'

| NEW ENGINE-GENERATOR SCHEDULE | |
|---|---|
| GENSET | DESCRIPTION |
| GEN #1, #2 #3, & #4 | ENGINE – 500 HP, 350 eKW PRIME, MTU-DETROIT 6063TK35. 24 VDC STARTING & CONTROL. GENERATOR – MINIMUM 450 KW CONTINUOUS AT 105°C RISE, NEWAGE/STAMFORD HCI534D. |

## MECHANICAL NEW WORK GENERAL NOTES:

1. EXISTING EQUIPMENT & PIPING TO REMAIN IN SERVICE SHOWN WITH LIGHT DASHED LINES.
2. NEW/SALVAGED EQUIPMENT AND PIPING TO BE INSTALLED/RELOCATED SHOWN WITH DARK SOLID LINES.
3. NOT ALL EQUIPMENT AND PIPING SHOWN. SEE ATTACHED RECORD DRAWINGS OF ORIGINAL POWER PLANT CONSTRUCTION FOR ADDITIONAL DETAIL ON SYSTEMS NOT BEING MODIFIED.
4. NEW GEN#1, GEN#2, GEN#3, GEN#4, R-1, R-2, CAC-3, AND CAC-4 TO BE OWNER FURNISHED.
5. SEE SHEETS M3.1-M3.3 FOR GENERAL EQUIPMENT LAYOUT, BASE SUPPORT, FABRICATIONS, AND GENERATOR ASSEMBLY PLANS AND DETAILS.
6. SEE SHEETS M4.1-M4.2 FOR ENGINE COOLANT AND HEAT RECOVERY SYSTEM MODIFICATIONS.
7. SEE SHEET M5.1 FOR DIESEL FUEL AND USED OIL SYSTEM MODIFICATIONS.
8. SEE SHEETS M6.1-M6.2 FOR CHARGE AIR SYSTEM MODIFICATIONS.
9. SEE SHEET M7.1 FOR EXHAUST AND CRANK CASE VENTILATION SYSTEM MODIFICATIONS.

## MECHANICAL NEW WORK SPECIFIC NOTES (BASE BID):

1. INSTALL NEW CRANK VENT PIPING AND HOSE ON ALL FOUR GENSETS. SEE SHEETS M3.2 AND M7.1.
2. INSTALL NEW COOLANT HOSES ON ALL FOUR GENSETS AND MODIFY PIPING CONNECTIONS. SEE SHEET M4.1.
3. INSTALL NEW GEN#3/GEN#4. LOCATE NEW EXHAUST RISERS DIRECTLY UNDER RELOCATED MUFFLERS, SEE SPECIFIC NOTE 5. INSTALL NEW CHARGE AIR COOLER CAC-3/CAC-4, NEW INTERIOR CHARGE AIR TUBING, AND MODIFY EXTERIOR CHARGE AIR TUBING. SEE SECTION 2/M3.2 AND SHEETS M6.1-M7.1. COORDINATE WITH ELECTRICAL.
4. INSTALL NEW GEN#2. LOCATE NEW GEN#2 EXHAUST RISER DIRECTLY UNDER EXISTING MUFFLER, SEE SPECIFIC NOTE 6. INSTALL NEW INTERIOR CHARGE AIR TUBING. EXISTING CHARGE AIR COOLER CAC-2 AND EXTERIOR CHARGE AIR TUBING TO REMAIN. SEE SECTION 1/M3.2 AND SHEETS M6.1-M7.1. COORDINATE WITH ELECTRICAL.
5. INSTALL GEN#3/GEN#4 SALVAGED 6" MUFFLER AT NEW LOCATION. LOCATE SIDE-SIDE TO ALIGN CENTER WITH EXISTING PIPE OUT WALL. LOCATE FRONT-BACK TO ALIGN CENTER WITH ADJACENT GEN #2 CENTER. CONNECT TO EXISTING PIPE OUT WALL WITH NEW 6" SLIP-ON WELD FLANGE. FABRICATE NEW 6" EXHAUST RISER. INSTALL NEW AND SALVAGED PIPE INSULATION. SEE SECTION 2/M3.2 AND SHEET M7.1.
6. EXISTING GEN#2 8" MUFFLER TO REMAIN IN PRESENT LOCATION. FABRICATE NEW 6" EXHAUST RISER WITH 6"x8" INCREASER. INSTALL NEW PIPE INSULATION. SEE SECTION 2/M3.2 AND SHEET M7.1.
7. INSTALL NEW GLYCOL EXPANSION TANK ET-1, APPURTENANCES, AND PIPING, SEE PIPING ISOMETRIC 1/M4.1 AND SHEET M4.2. SEE ELECTRICAL FOR RELATED TASKS.
8. WHERE 4" CRANK VENT PIPE WAS REMOVED FILL HOLE WITH SPRAY FOAM INSULATION. COVER INSIDE AND OUTSIDE WITH 6" DIAMETER PIECE OF FLAT 18 GAUGE SHEET METAL SEALED TO WALL WITH POLYURETHANE CAULK ALL AROUND. COORDINATE WITH ELECTRICAL.
9. ON EXISTING FILTER INSTALL NEW SCREEN, BOWL, AND GASKET. INSTALL NEW WATER BLOCKING TRIPLE FILTER. SEE SHEET M5.1. SEE ELECTRICAL FOR ADDITIONAL TASKS.
10. INSTALL NEW 4" THERMOSTATIC VALVE. SEE PIPING ISOMETRIC 1/M4.1.
11. INSTALL NEW EXHAUST FAN DISCHARGE DAMPER ACTUATOR. BELIMO AFBUP OR APPROVED EQUAL. ADJUST TO PROVIDE ACTUATION FROM FULLY CLOSED (FAN OFF) TO FULLY OPEN (FAN RUNNING). COORDINATE WITH ELECTRICAL.
12. SEE ELECTRICAL
13. SEE ELECTRICAL
14. SEE ELECTRICAL
15. SEE ELECTRICAL
16. SEE ELECTRICAL
17. SEE ELECTRICAL

## MECHANICAL NEW WORK SPECIFIC NOTES (ADDITIVE ALTERNATES):

A1. UNDER ADDITIVE ALTERNATE #1 INSTALL NEW GEN#1 AND NEW INTERIOR CHARGE AIR TUBING. LOCATE NEW EXHAUST RISER DIRECTLY UNDER EXISTING MUFFLER AND FABRICATE NEW 6" EXHAUST RISER WITH 6"x8" INCREASER. INSTALL NEW INTERIOR CHARGE AIR TUBING. EXISTING CHARGE AIR COOLER CAC-1 AND EXTERIOR CHARGE AIR TUBING TO REMAIN. SEE SECTION 1/M3.2 AND SHEETS M6.1-M7.1. COORDINATE WITH ELECTRICAL.

A2. UNDER ADDITIVE ALTERNATE #2 INSTALL NEW RADIATORS R-1 AND R-2. MODIFY EXISTING PIPING CONNECTIONS AND ADD NEW STEEL CHANNEL SUPPORTS. SEE SHEETS M4.1 AND M4.2. PLAN WORK TO AVOID AN OUTAGE USING VALVES TO ISOLATE AND REPLACE RADIATORS ONE AT TIME.

A3. SEE ELECTRICAL.

A4. FIRE SUPPRESSION DETECTION AND ALARM SYSTEM RENOVATION. SEE FIRE SUPPRESSION DRAWING FS1.

A5. FIRE SUPPRESSION CLEAN AGENT SYSTEM. SEE FIRE SUPPRESSION DRAWING FS2.

ISSUED FOR CONSTRUCTION MARCH 2023

STATE OF ALASKA 49TH REGISTERED PROFESSIONAL ENGINEER BRIAN C. GRAY ME 8210

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: MECHANICAL NEW WORK PLAN & NOTES

Gray Stassel Engineering, Inc.
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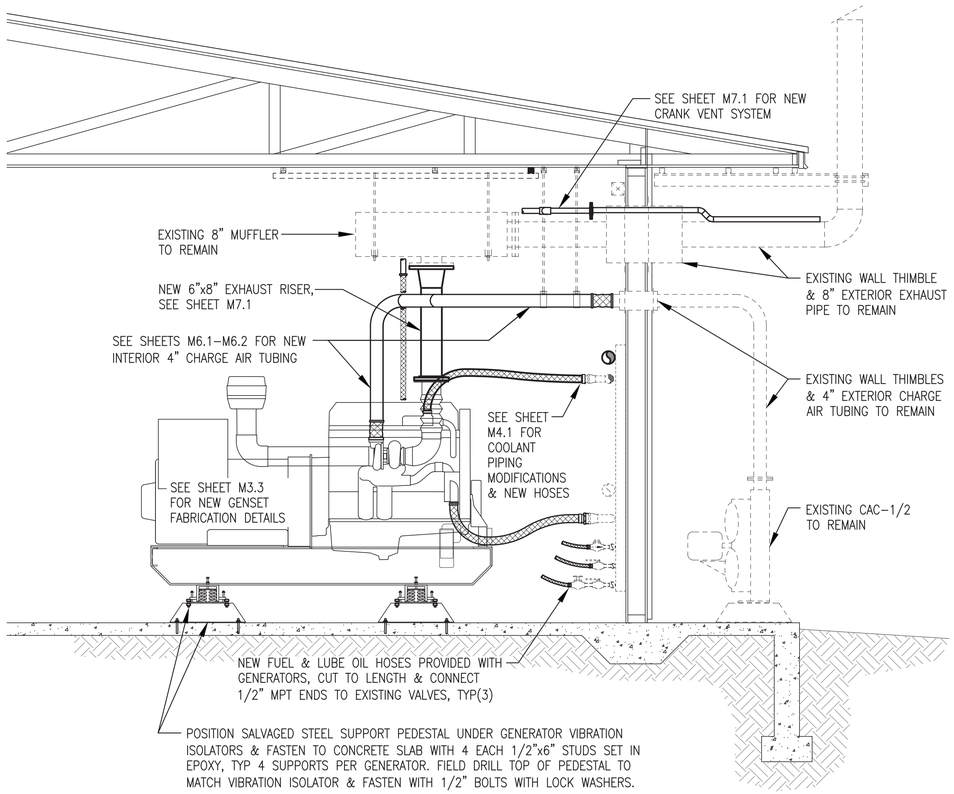
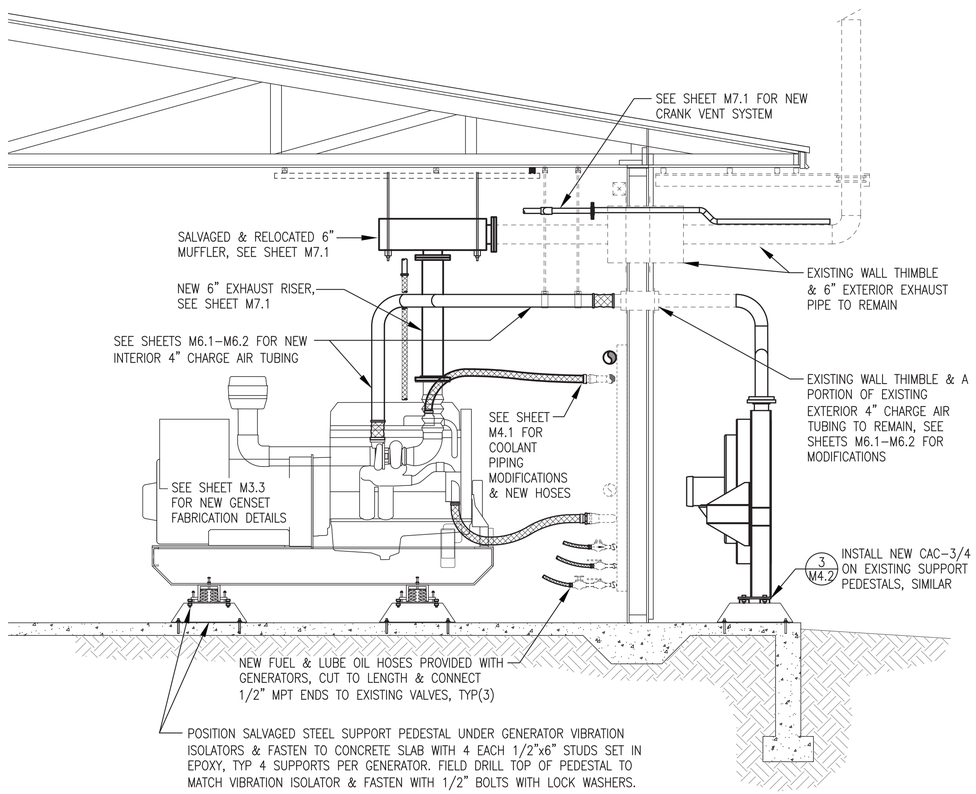
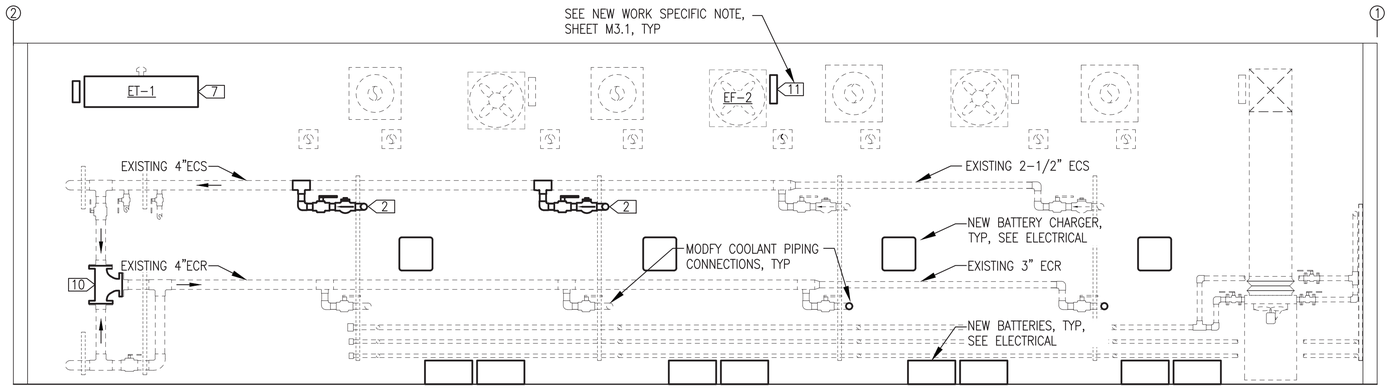



1 M3.2 SECTION THROUGH GEN#1(ADD ALT #1)/ GEN#2
1/2"=1'




2 M3.2 SECTION THROUGH GEN#3 / GEN#4
1/2"=1'




3 M3.2 BACK WALL NEW WORK ELEVATION
3/8"=1'

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TITLE: SECTIONS & ELEVATIONS

Gray Stassel Engineering, Inc.
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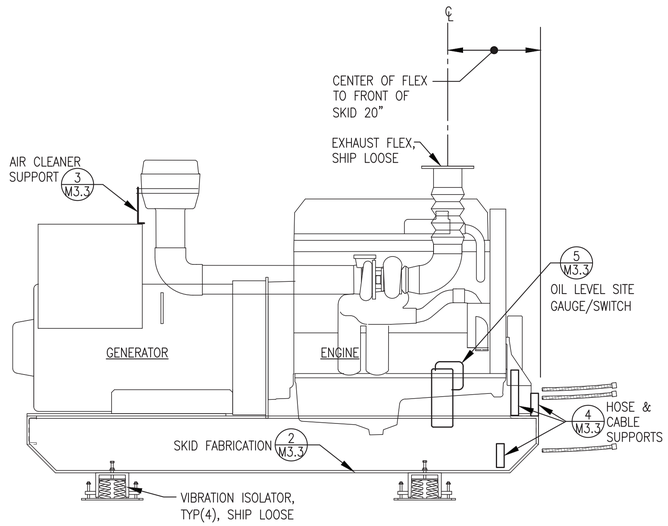
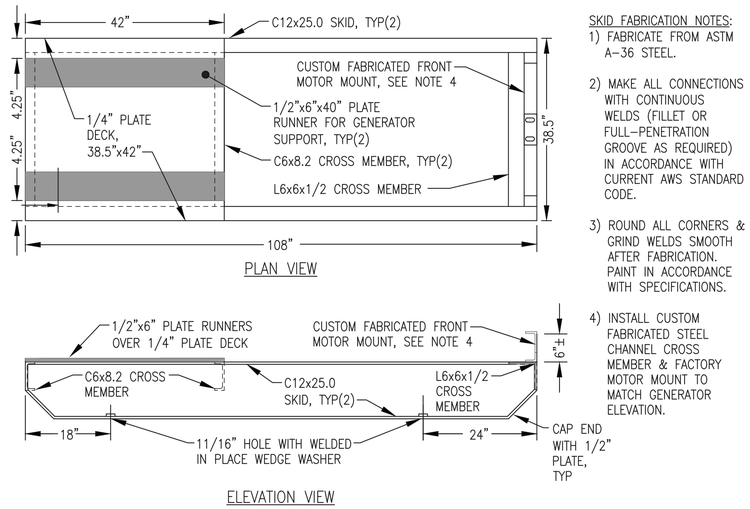
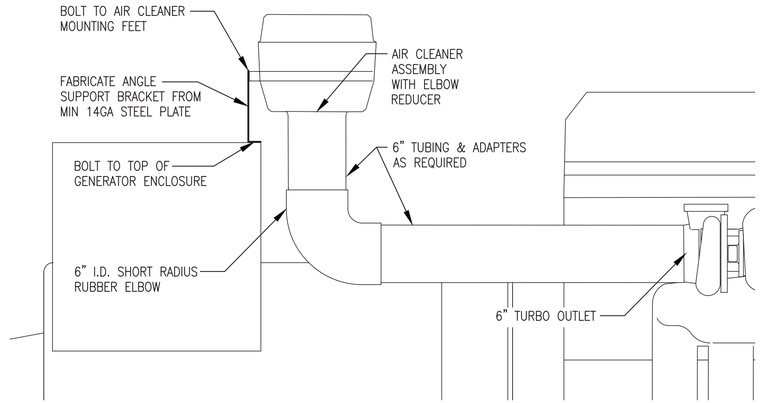



1 M3.3 TYPICAL GENERATOR ASSEMBLY
3/4"=1'-0"

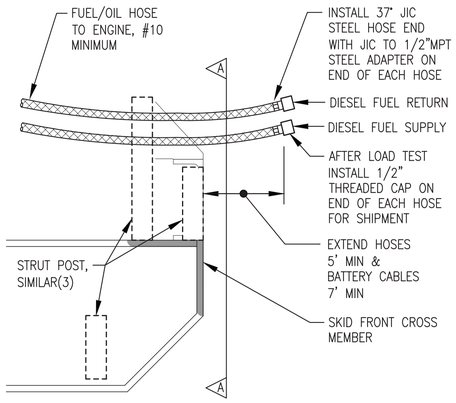



SKID FABRICATION NOTES:
1) FABRICATE FROM ASTM A-36 STEEL.
2) MAKE ALL CONNECTIONS WITH CONTINUOUS WELDS (FILLET OR FULL-PENETRATION GROOVE AS REQUIRED) IN ACCORDANCE WITH CURRENT AWS STANDARD CODE.
3) ROUND ALL CORNERS & GRIND WELDS SMOOTH AFTER FABRICATION. PAINT IN ACCORDANCE WITH SPECIFICATIONS.
4) INSTALL CUSTOM FABRICATED STEEL CHANNEL CROSS MEMBER & FACTORY MOTOR MOUNT TO MATCH GENERATOR ELEVATION.

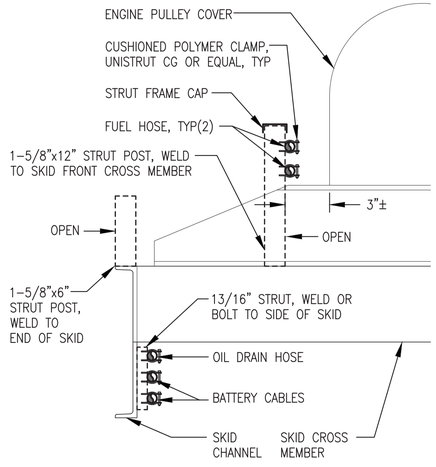
2 M3.3 TYPICAL GENERATOR SKID FABRICATION
3/4"=1'-0"




3 M3.3 TYPICAL GENERATOR AIR CLEANER INSTALLATION
1-1/2"=1'-0"

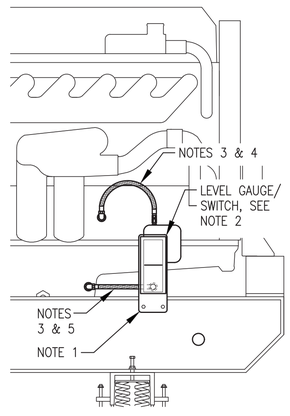



ELEVATION (SIDE) VIEW




SECTION A-A

4 M3.3 TYPICAL SKID FUEL/OIL HOSE & BATTERY CABLE SUPPORT
NO SCALE




NOTES:
1) 1/4" STEEL SUPPORT PLATE PRE-DRILLED TO MATCH GAUGE/SWITCH MOUNTS, CHANNEL SKID HOLES AND BOTTOM HOSE ENTRANCE. BOLT TO INSIDE (BACK) OF CHANNEL SKID AT HEIGHT AS REQUIRED TO CENTER GAUGE AT NORMAL FULL OIL LEVEL. ADJUST SWITCH CONTACTS 1/2" ABOVE & BELOW.
2) MOUNT OIL LEVEL GAUGE/SWITCH TO STEEL SUPPORT PLATE WITH RUBBER SHOCK MOUNTS.
3) #8 HOSE WITH 1/2" OR 3/8" NPT JIC SWIVEL ENDS AS REQUIRED.
4) CONNECT TOP (VENT) PORT TO ENGINE CRANK CASE WITH HOSE. ROUTE UPPER HOSE WITH HIGH POINT 4" MIN ABOVE TOP OF FLOAT SWITCH.
5) CONNECT BOTTOM PORT TO ENGINE OIL PAN WITH HOSE. DO NOT TEE INTO OIL DRAIN LINE. ROUTE LOWER HOSE BACK THROUGH PRE-DRILLED HOLE IN STEEL PLATE.

5 M3.3 TYPICAL OIL LEVEL GAUGE/SWITCH INSTALLATION
1"=1'-0"

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TITLE: GENSET FABRICATION DETAILS

Gray Stassel Engineering, Inc.
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| | |
|---|---|
| DRAWN BY: JTD | SCALE: AS NOTED |
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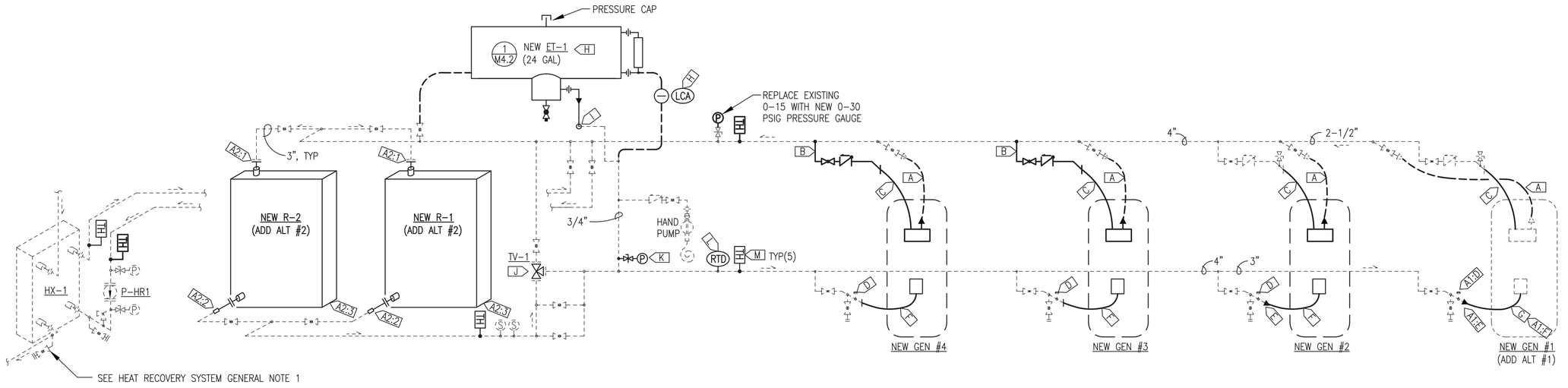



## 1 M4.1 COOLING SYSTEM PIPING ISOMETRIC

NO SCALE

### COOLING SYSTEM UPGRADES GENERAL NOTES:

1. EXISTING ENGINE COOLING SYSTEM PIPING AND DEVICES TO REMAIN UNCHANGED SHOWN WITH LIGHT DASHED LINES.
2. PIPING MODIFICATIONS AND NEW HOSES SHOWN WITH DARK SOLID LINES.
3. ALL EXISTING AND NEW COOLANT PIPING TYPE L COPPER TUBE WITH SOLDER JOINTS.
4. PERFORM TASKS AS INDICATED BY SPECIFIC NOTES.
5. PROVIDE A MINIMUM OF 3 CLEAN 55 GALLON DRUMS FOR DRAINING AND STORING COOLANT DURING PIPING MODIFICATIONS.
6. TASKS B , H , I , J , K , AND L WILL REQUIRE THE ENGINE COOLING SYSTEM TO BE DRAINED AND THEREFORE MUST BE SCHEDULED SIMULTANEOUSLY TO LIMIT POWER OUTAGES. SEE LIMITED POWER OUTAGE NOTE SHEET M2.
7. NEW GEN#1, GEN#2, GEN#3, GEN#4, R-1, AND R-2 WILL BE OWNER FURNISHED.

### COOLING SYSTEM BASE BID SPECIFIC NOTES:

A> REPLACE ENGINE VENT/PREHEAT HOSES WITH NEW 1/2" SILICONE HOSE AND CLAMPS. CONNECT ONE END TO EXISTING 3/4" BALL VALVE ON COOLING MANIFOLD WITH 3/4" MPT x 1/2" BARB BRASS KING NIPPLE. CONNECT OTHER END TO GAUGE COCK ON ENGINE WITH 1/2" BARB BRASS KING NIPPLE.

B> REPLACE GEN#3/GEN#4 DISCHARGE CONNECTION WITH NEW 2-1/2" PIPING CONNECTION, SEE DETAIL 2/M4.1.

C> INSTALL NEW 2-1/2" SILICONE DISCHARGE HOSE.

D> REMOVE COOLANT RETURN RTD AND INSTALL 1/2" PLUG IN INSTRUMENT WELL.

E> REMOVE EXISTING 3" KING NIPPLE. INSTALL 3"x2-1/2" REDUCING BUSHING AND 2-1/2" MPT KING NIPPLE.

F> INSTALL NEW 2-1/2" SILICONE SUCTION HOSE. SECURE HOSE TO STRUT POST ON ENGINE SKID, SEE DETAIL 4/M4.1.

G> INSTALL NEW 3" SILICONE SUCTION HOSE ON EXIST GEN#1.

H> INSTALL NEW EXPANSION TANK ET-1 WITH NEW APPURTENANCES, HOSES AND LOW COOLANT ALARM. SEE DETAIL 1/M4.2.

I> CUT EXISTING 3/4" COPPER TUBE FOR REMOVAL OF EXPANSION TANK AND RECONNECT NEW COPPER TUBE WITH 3/4" SOLDER ELBOW.

J> REMOVE EXISTING 4" THERMOSTATIC VALVE AND INSTALL NEW 4" THERMOSTATIC VALVE. PROVIDE NEW 4" FLANGE GASKETS AND BOLTS.

K> CUT NEW 3/4" SOLDER TEE IN EXISTING 3/4" COPPER TUBE AND INSTALL NEW 0-30 PSIG PRESSURE GAUGE. SEE DETAIL 3/M4.1.

L> REMOVE EXISTING PRESSURE GAUGE, VALVE, AND BUSHING. INSTALL NEW THERMO-WELL AND COOLANT RETURN TEMP SENSOR RTD IN EXISTING 3/4" FPT ADAPTER. COORDINATE WITH ELECTRICAL FOR RE-CONNECTION.

M> REMOVE EXISTING THERMOMETER AND WELL AND INSTALL NEW DIGITAL THERMOMETER IN NEW THERMO-WELL.

### COOLING SYSTEM ADDITIVE ALTERNATE SPECIFIC NOTES:

A1:D> UNDER ADDITIVE ALTERNATE #2 REMOVE COOLANT RETURN RTD AND INSTALL 1/2" PLUG IN INSTRUMENT WELL.

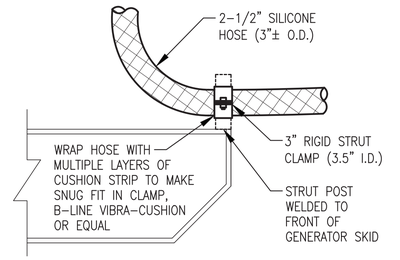
A1:E> UNDER ADDITIVE ALTERNATE #1 REMOVE EXISTING 3" KING NIPPLE. INSTALL 3"x2-1/2" REDUCING BUSHING AND 2-1/2" KING NIPPLE.

A1:F> UNDER ADDITIVE ALTERNATE #1 INSTALL NEW 2-1/2" SILICONE SUCTION HOSE. SECURE HOSE TO STRUT POST ON ENGINE SKID, SEE DETAIL 4/M4.1.

A2:1> UNDER ADDITIVE ALTERNATE #2 INSTALL NEW RADIATORS. POSITION TO ALIGN TOP CONNECTION WITH EXISTING PIPE FLANGE. CONNECT WITH NEW GASKETS AND BOLTS. SEE DETAIL 3/M4.2.

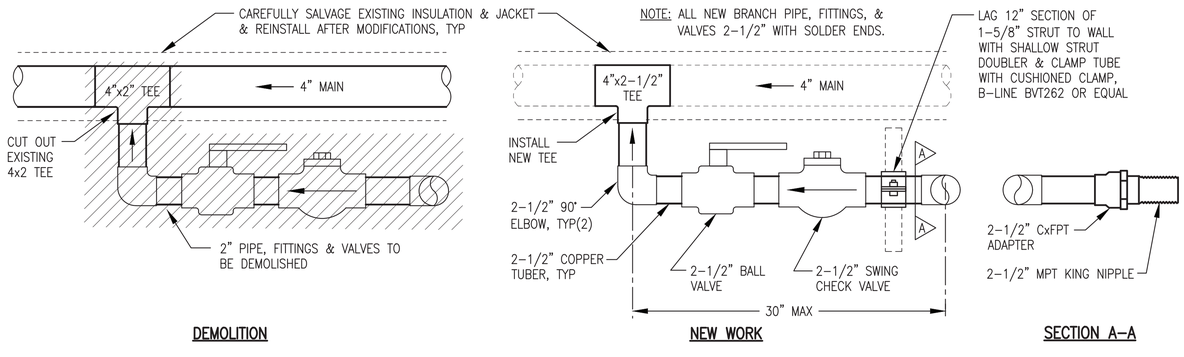
A2:2> UNDER ADDITIVE ALTERNATE #2 CUT EXISTING 3" COPPER TUBE RETURN, EXTEND 5"± WITH NEW TUBE & SOLDER COUPLING, AND INSTALL NEW SOLDER COMPANION FLANGE, GASKET, AND BOLTS.

A2:3> UNDER ADDITIVE ALTERNATE #2 NEW RADIATOR MUSE BE RAISED SLIGHTLY TO ALIGN WITH EXISTING PIPING. MODIFY EXISTING SUPPORTS FOR NEW RADIATOR. SEE DETAIL 3/M4.2.



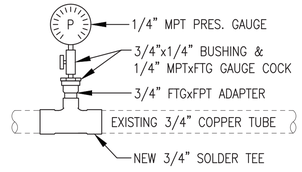

## 4 M4.1 SUCTION HOSE SUPPORT FROM SKID

NO SCALE




## 2 M4.1 GEN#3/GEN#4 DISCHARGE CONNECTION MODIFICATION

NO SCALE




## 3 M4.1 PRESSURE GAUGE INSTALLATION

NO SCALE

ISSUED FOR CONSTRUCTION MARCH 2023

STATE OF ALASKA 49TH BRIAN C. GRAY ME 8210 REGISTERED PROFESSIONAL ENGINEER

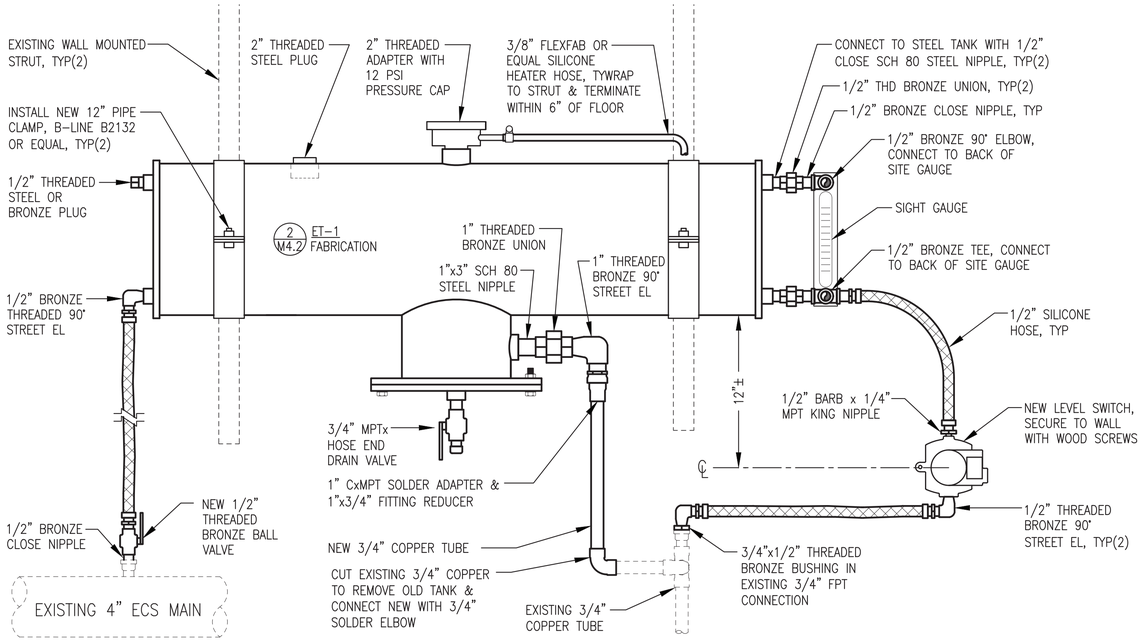
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: ENGINE COOLING SYSTEM UPGRADE ISOMETRIC & DETAILS

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

DRAWN BY: JTD | SCALE: AS NOTED
DESIGNED BY: BCG | DATE: 3/1/23
FILE NAME: AKCHDRA M1-7 | SHEET: M4.1
PROJECT NUMBER:




1 M4.2 NEW EXPANSION TANK ET-1 INSTALLATION
NO SCALE

## EXPANSION TANK GENERAL NOTES:

1) FABRICATE SINGLE WALL 24 GALLON NOMINAL CAPACITY GLYCOL EXPANSION TANK.

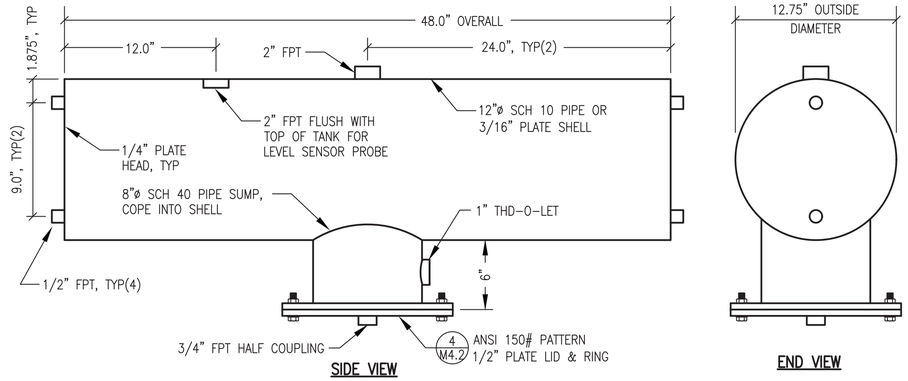
2) FABRICATE SHELL FROM MINIMUM 3/16" ASTM A-36 PLATE STEEL ROLLED AND WELDED OR 12"ø SCHEDULE 10 LIGHTWALL ASTM A53 STEEL PIPE. FABRICATE HEADS FROM 1/4" THICK ASTM A-36 PLATE STEEL. FABRICATE SUMP FROM 8"ø SCHEDULE 40 ASTM A53 STEEL PIPE. FABRICATE SUMP PLATE LID FROM 1/2" THICK ASTM A-36 PLATE STEEL. MAKE ALL JOINTS WITH CONTINUOUS FULL-PENETRATION WELDS.

3) PROVIDE WITH ALL OPENINGS INDICATED USING MINIMUM 3000# FORGED STEEL PIPE HALF COUPLINGS IN ACCORDANCE WITH U.L 142 FIGURE 7.1 #2.

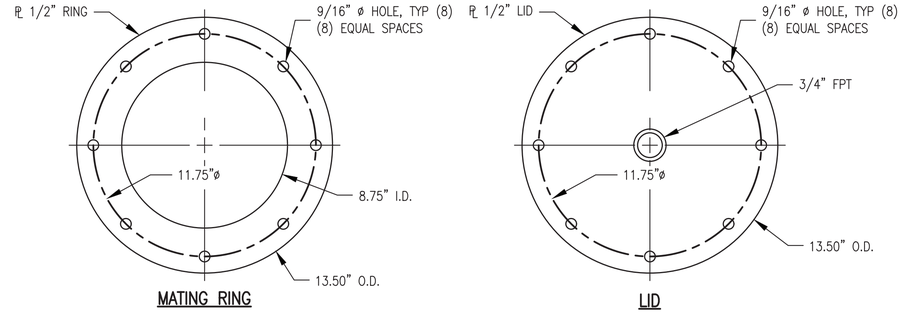
4) PRESSURE TEST COMPLETED ASSEMBLY TO 15 PSIG MINIMUM.

5) UPON COMPLETION OF FABRICATION, ROUND ALL CORNERS AND SHARP EDGES. SANDBLAST TANK EXTERIOR AND ALL ATTACHMENTS IN ACCORDANCE WITH SSPC-SP-6. PAINT WITH TWO COATS EPOXY, PPG AMERLOC 2 VOC OR APPROVED EQUAL, COLOR ANSI 61 GRAY.

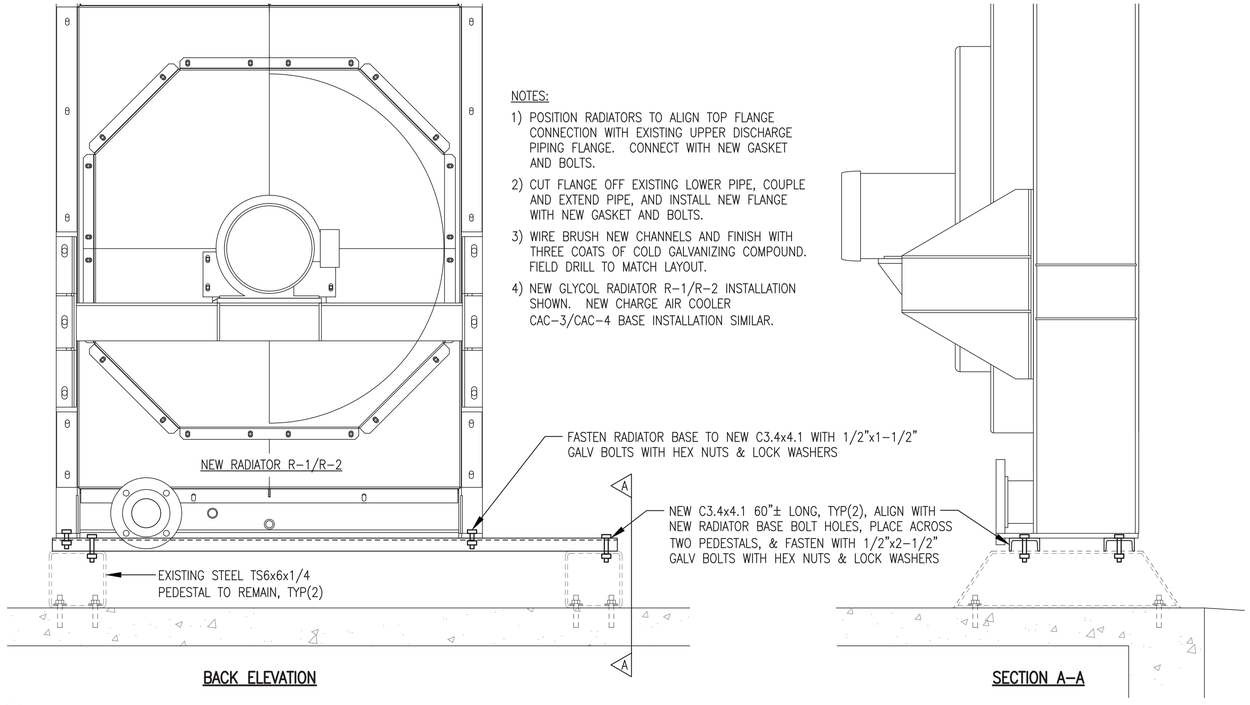
6) UPON COMPLETION FLUSH INTERIOR OF TANK TO REMOVE ALL DIRT AND DEBRIS, AIR DRY INTERIOR, AND SEAL ALL TANK OPENINGS WITH PLASTIC PLUGS.




2 M4.2 NEW EXPANSION TANK ET-1 FABRICATION
NO SCALE




4 M4.2 LID & MATING RING - PLAN VIEW
1/4" = 1"




3 M4.2 TYPICAL NEW RADIATOR SUPPORT (ADD ALT #2)
NO SCALE

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
BRIAN C. GRAY ME 8210
REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: ENGINE COOLING SYSTEM UPGRADE DETAILS

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

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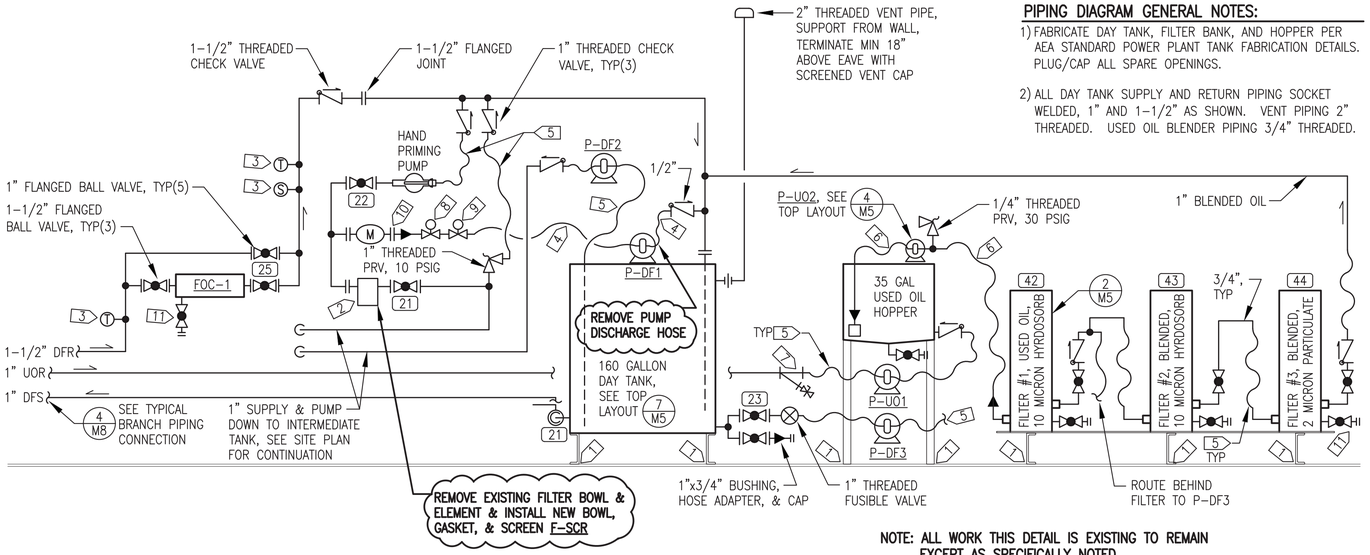
FILE NAME: AKCHDRA M1-7 | SHEET: M4.2
PROJECT NUMBER:




NOTE: ALL WORK THIS DETAIL IS EXISTING TO REMAIN EXCEPT AS SPECIFICALLY NOTED.

## PIPING DIAGRAM GENERAL NOTES:

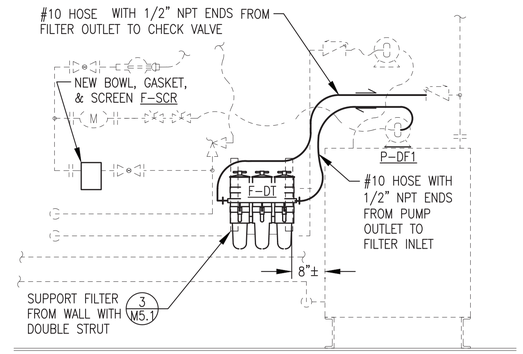
1) FABRICATE DAY TANK, FILTER BANK, AND HOPPER PER AEA STANDARD POWER PLANT TANK FABRICATION DETAILS. PLUG/CAP ALL SPARE OPENINGS.

2) ALL DAY TANK SUPPLY AND RETURN PIPING SOCKET WELDED, 1" AND 1-1/2" AS SHOWN. VENT PIPING 2" THREADED. USED OIL BLENDER PIPING 3/4" THREADED.

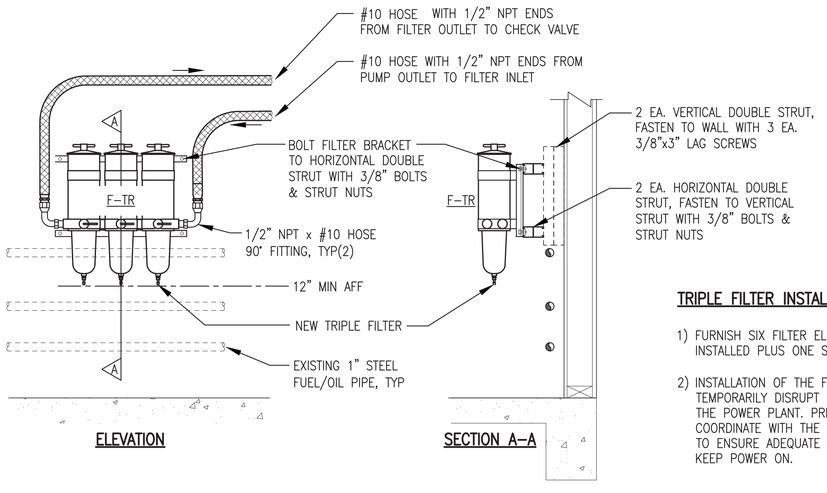
## PIPING DIAGRAM SPECIFIC NOTES:

1. FASTEN TO FLOOR WITH 3/8" SELF-TAPPING SCREWS.
2. 1" FILTER, REMOVE DRAIN VALVE & INSTALL 1/8"MxF DRAIN COCK.
3. TEMP SENSOR FOR FOC-1 VFD CONTROL OR 20-240°F THERMOMETER, INSTALL THERMAL WELL IN 3/4" THREAD-O-LET.
4. #10 HOSE WITH 1/2" NPT SWIVEL ENDS.
5. #12 HOSE WITH NPT SWIVEL ENDS, 1/2", 3/4", OR 1" AS RQD TO MATCH PIPING OR PUMPS.
6. #6 HOSE WITH 1/8" NPT SWIVEL ENDS.
7. 1" THREADED STRAINER WITH GAUGE COCK BLOW DOWN.
8. 1/2" NO SOLENOID VALVE.
9. 1/2" NC SOLENOID VALVE.
10. METER EQUIPPED WITH 300# FLANGED ENDS, PROVIDE 1" ANSI 300# SOCKET WELD FLANGES & GASKETS EACH SIDE FOR CONNECTION.
11. 3/4" THREADED BALL VALVE WITH HOSE ADAPTER & CAP, TYP(5).

1 M5.1 EXISTING DAY TANK PIPING DIAGRAM (MODIFY AS INDICATED)
NO SCALE




2 M5.1 NEW TRIPLE FILTER PIPING DIAGRAM
NO SCALE




## TRIPLE FILTER INSTALLATION NOTES:

1) FURNISH SIX FILTER ELEMENTS, ONE SET INSTALLED PLUS ONE SPARE SET.

2) INSTALLATION OF THE FILTER WILL TEMPORARILY DISRUPT FUEL SUPPLY TO THE POWER PLANT. PRIOR TO INSTALLING COORDINATE WITH THE PLANT OPERATOR TO ENSURE ADEQUATE FUEL SUPPLY TO KEEP POWER ON.

3 M5.1 NEW TRIPLE FILTER INSTALLATION
NO SCALE

ISSUED FOR CONSTRUCTION MARCH 2023

STATE OF ALASKA 49TH BRIAN C. GRAY ME 8210 REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: NEW FUEL FILTER INSTALLATION

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

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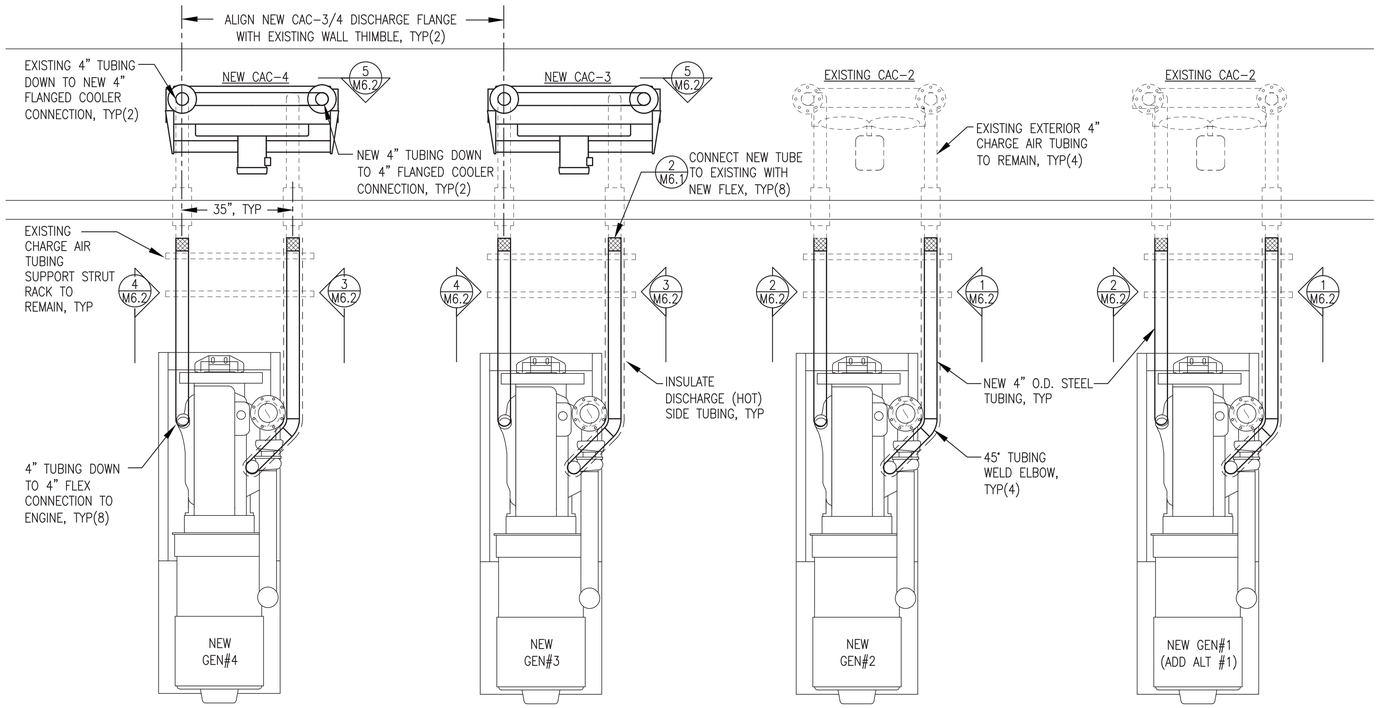
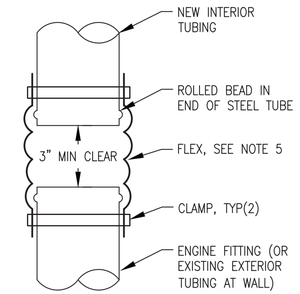
| PROJECT NUMBER: | |




1 M6.1 CHARGE AIR PLAN
1/2"=1'-0"

## CHARGE AIR SYSTEM GENERAL NOTES:

1) NEW GEN#1, GEN#2, GEN#3, GEN#4, CAC-3, AND CAC-4 TO BE OWNER FURNISHED.
2) ALL INTERIOR TUBING NEW FROM ENGINES TO WALL THIMBLES. ALL EXTERIOR TUBING EXISTING EXCEPT WERE SPECIFICALLY INDICATED NEW.
3) ALL TUBING TO BE LIGHT WALL CARBON STEEL O.D. TUBING. ALL ELBOWS TO BE LONG RADIUS FITTINGS TO MATCH TUBING. ALL JOINTS TO BE WELDED EXCEPT AS INDICATED.
4) MAKE NEW COOLER CONNECTIONS TO O.D. TUBE WITH ANSI 125# STEEL PLATE FLANGES, G.T. EXHAUST PART #41 OR EQUAL. INSTALL HIGH TEMPERATURE FULL FACE GASKETS, GARLOCK 4122-FC OR EQUAL.
5) REMOVE EXISTING FLEX CONNECTIONS AND INSTALL ALL NEW, HIGH TEMPERATURE DOUBLE HUMP SILICONE TURBO SLEEVES WITH RINGS, FLEXFAB 7715-0002 OR EQUAL. FASTEN WITH LINED STAINLESS STEEL CLAMPS, IDEAL 5364(3) OR EQUAL.
6) INSULATE INTERIOR CHARGE AIR DISCHARGE TUBING FROM FLEX TO FLEX WITH 3" WIDE FIBERGLASS PAD TAPE. SECURE ENDS WITH HOSE CLAMPS.
7) COAT ALL EXPOSED TUBING AND FLANGES, BOTH NEW AND EXISTING. WIRE BRUSH, WIPE DOWN WITH SOLVENT, AND PAINT WITH TWO COATS OF COLD GALVANIZING COMPOUND.




2 M6.1 TYPICAL CHARGE AIR FLEX
NO SCALE

ISSUED FOR CONSTRUCTION MARCH 2023

STATE OF ALASKA 49TH BRIAN C. GRAY ME 8210 REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: CHARGE AIR SYSTEM MODIFICATIONS PLAN & DETAILS

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

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| FILE NAME: AKCHDRA M1-7 | SHEET: M6.1 |
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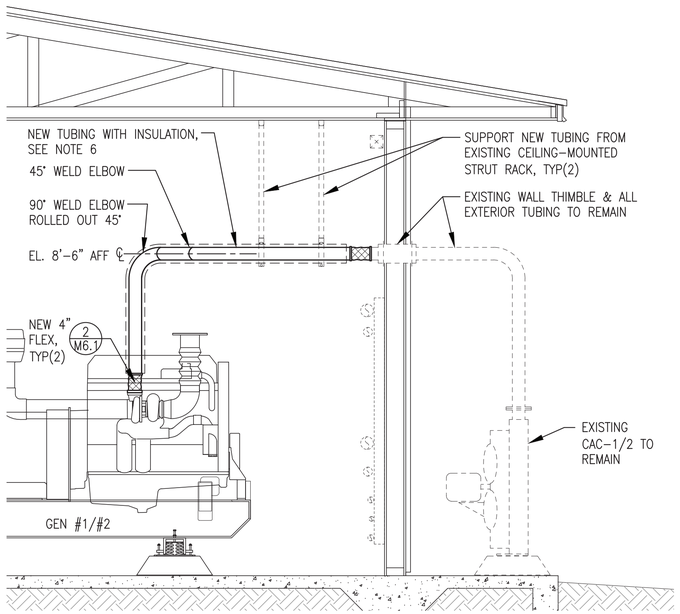
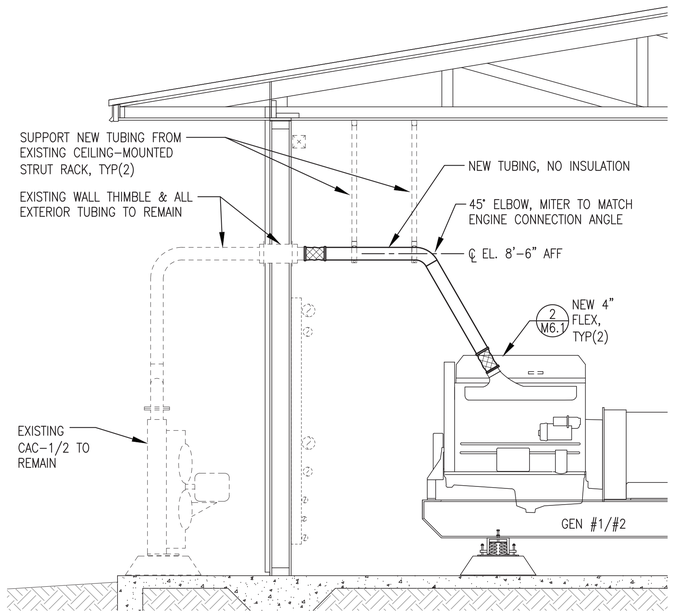


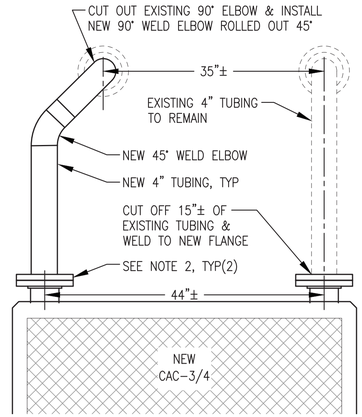

1 M6.2 GEN#1/GEN#2 CHARGE AIR RIGHT SIDE (DISCHARGE) INSTALLATION
1/2"=1'-0"



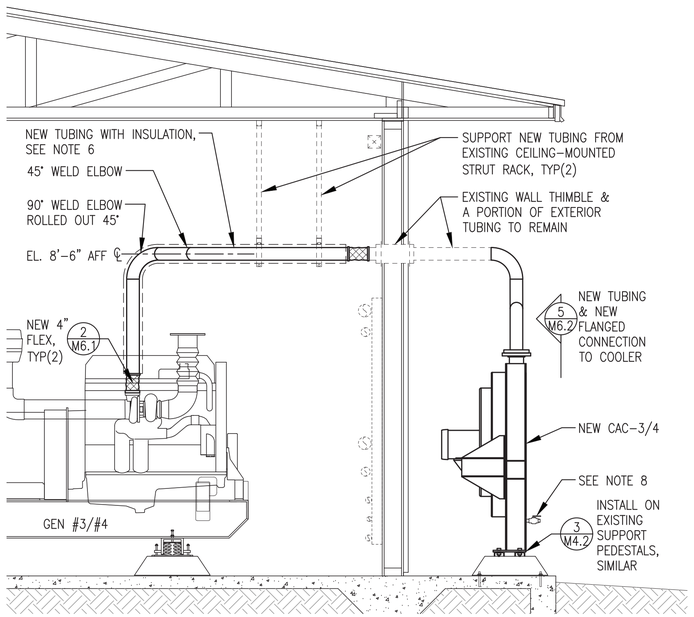

2 M6.2 GEN#1/GEN#2 CHARGE AIR LEFT SIDE (RETURN) INSTALLATION
1/2"=1'-0"

## CHARGE AIR SYSTEM GENERAL NOTES:

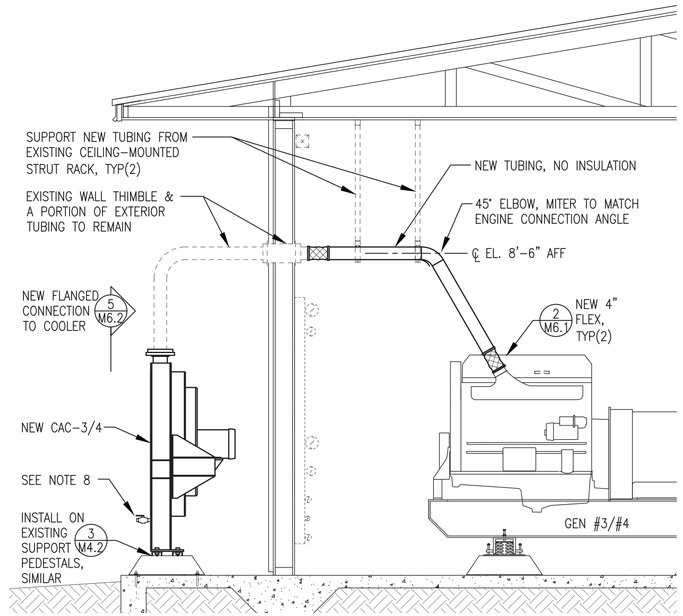
1) NEW GEN#1, GEN#2, GEN#3, GEN#4, CAC-3, AND CAC-4 TO BE OWNER FURNISHED.
2) ALL INTERIOR TUBING NEW FROM ENGINES TO WALL THIMBLES. ALL EXTERIOR TUBING EXISTING EXCEPT WERE SPECIFICALLY INDICATED NEW.
3) ALL TUBING TO BE LIGHT WALL CARBON STEEL O.D. TUBING. ALL ELBOWS TO BE LONG RADIUS FITTINGS TO MATCH TUBING. ALL JOINTS TO BE WELDED EXCEPT AS INDICATED.
4) MAKE NEW COOLER CONNECTIONS TO O.D. TUBE WITH ANSI 125# STEEL PLATE FLANGES, G.T. EXHAUST PART #41 OR EQUAL. INSTALL HIGH TEMPERATURE FULL FACE GASKETS, GARLOCK 4122-FC OR EQUAL.
5) REMOVE EXISTING FLEX CONNECTIONS AND INSTALL ALL NEW, HIGH TEMPERATURE DOUBLE HUMP SILICONE TURBO SLEEVES WITH RINGS, FLEXFAB 7715-0002 OR EQUAL. FASTEN WITH LINED STAINLESS STEEL CLAMPS, IDEAL 5364(3) OR EQUAL.
6) INSULATE INTERIOR CHARGE AIR DISCHARGE TUBING FROM FLEX TO FLEX WITH 3" WIDE FIBERGLASS PAD TAPE. SECURE ENDS WITH HOSE CLAMPS.
7) COAT ALL EXPOSED TUBING AND FLANGES, BOTH NEW AND EXISTING. WIRE BRUSH, WIPE DOWN WITH SOLVENT, AND PAINT WITH TWO COATS OF COLD GALVANIZING COMPOUND.
8) INSTALL 3/4" THREADED BALL VALVE AND PLUG FOR DRAIN, 2 PER COOLER.




5 M6.2 NEW CAC #3/#4 TUBING CONNECTIONS
1"=1'-0"




3 M6.2 GEN#3/#4 CHARGE AIR RIGHT SIDE (DISCHARGE) INSTALLATION
1/2"=1'-0"




4 M6.2 GEN#3/#4 CHARGE AIR LEFT SIDE (RETURN) INSTALLATION
1/2"=1'-0"

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
BRIAN C. GRAY ME 8210
REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: CHARGE AIR SYSTEM MODIFICATIONS SECTIONS & DETAILS

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

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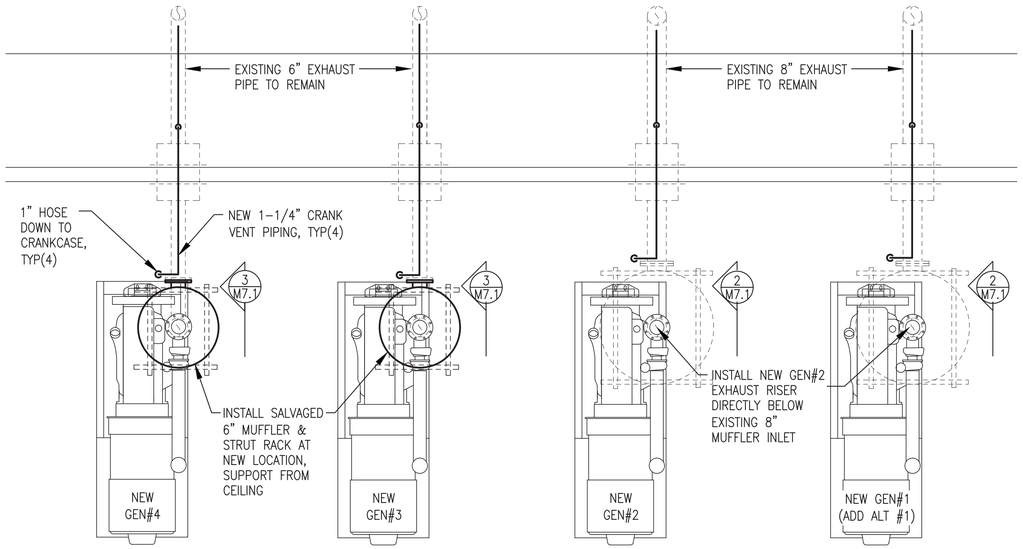
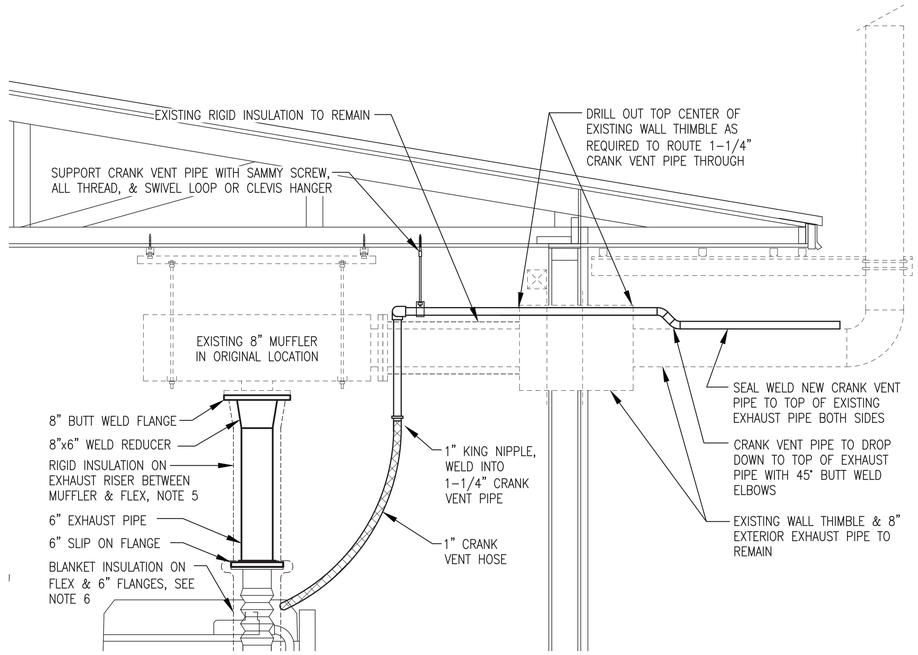
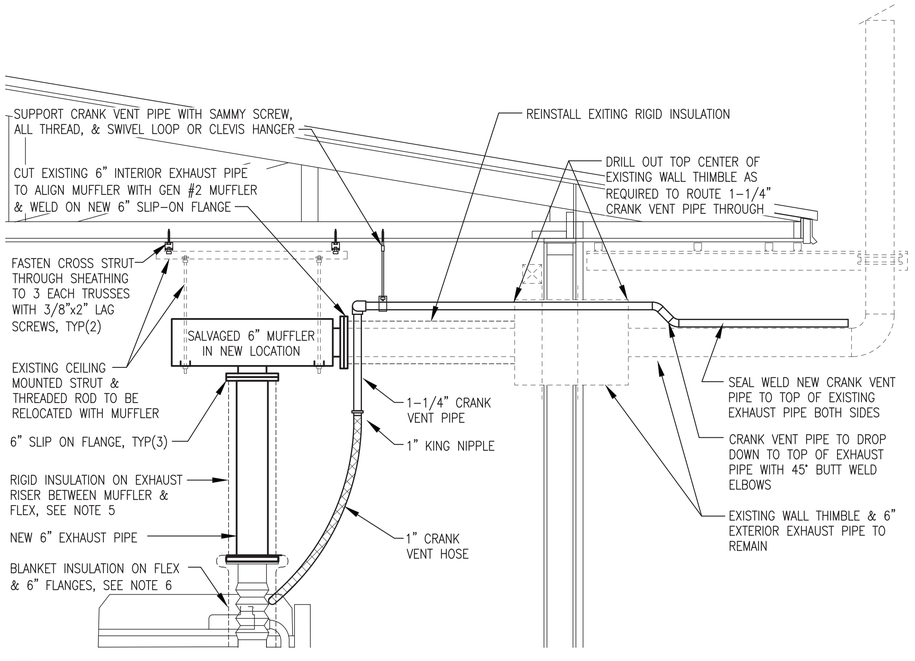
|---|---|
| DRAWN BY: JTD | SCALE: AS NOTED |
| DESIGNED BY: BCG | DATE: 3/1/23 |
| FILE NAME: AKCHDRA M1-7 | SHEET: M6.2 |
| PROJECT NUMBER: | |




1 M7.1 EXHAUST & CRANK VENT SYSTEM PLAN
3/8"=1'-0"




2 M7.1 GEN#1/2 EXHAUST & CRANK VENT ELEVATION
3/4"=1'-0"




3 M7.1 GEN #3/4 EXHAUST & CRANK VENT ELEVATION
3/4"=1'-0"

**EXHAUST AND CRANKCASE VENT SYSTEM GENERAL NOTES:**

1) SEE SHEET M3.1 FOR GENERATOR & EXHAUST RISER LAYOUT.

2) ALL MUFFLERS ARE EXISTING PACKED DISC STYLE, BOTTOM CENTER IN AND SIDE OUT, SIZE AS INDICATED.

3) NEW EXHAUST PIPE TO BE ASTM A53B SCH 20 (1/4 WALL) OR SCH 40 CARBON STEEL. NEW ALL FLANGES ANSI 150# FLAT FACED SLIP ON EXCEPT WHERE INDICATED BUTT WELD. INSTALL HIGH TEMPERATURE FULL FACE GASKETS, GARLOCK 4122-FC OR EQUAL.

4) CRANK VENT PIPING TO BE A106B SCHEDULE 40 SEAMLESS CARBON STEEL PIPE WITH SOCKET WELD JOINTS.

5) INSULATE NEW EXHAUST PIPE RISERS WITH 1-1/2" MEDIUM TEMPERATURE RIGID INSULATION WITH ALUMINUM JACKET. EXISTING INSULATION ON EXISTING PIPE FROM MUFFLERS TO THIMBLES TO REMAIN, CUT AND REINSTALL AS REQUIRED.

6) INSULATE EXHAUST FLEX INCLUDING FLANGES WITH HIGH TEMPERATURE BLANKET SYSTEM.

7) THE MAXIMUM EXHAUST TEMPERATURE FOR THE ENGINES IS LESS THAN 1400°F. THE EXHAUST SYSTEM LAYOUT PROVIDES MORE THAN 9" CLEARANCE TO COMBUSTIBLES IN ACCORDANCE WITH NFPA 37 8.3. PARAGRAPH 8.3.1. THE EXISTING INSULATED/VENTILATED WALL THIMBLES ARE LISTED FOR ZERO CLEARANCE TO COMBUSTIBLES.

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
BRIAN C. GRAY
ME 8210
REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: EXHAUST & CRANKCASE VENT SYSTEM MODIFICATIONS

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

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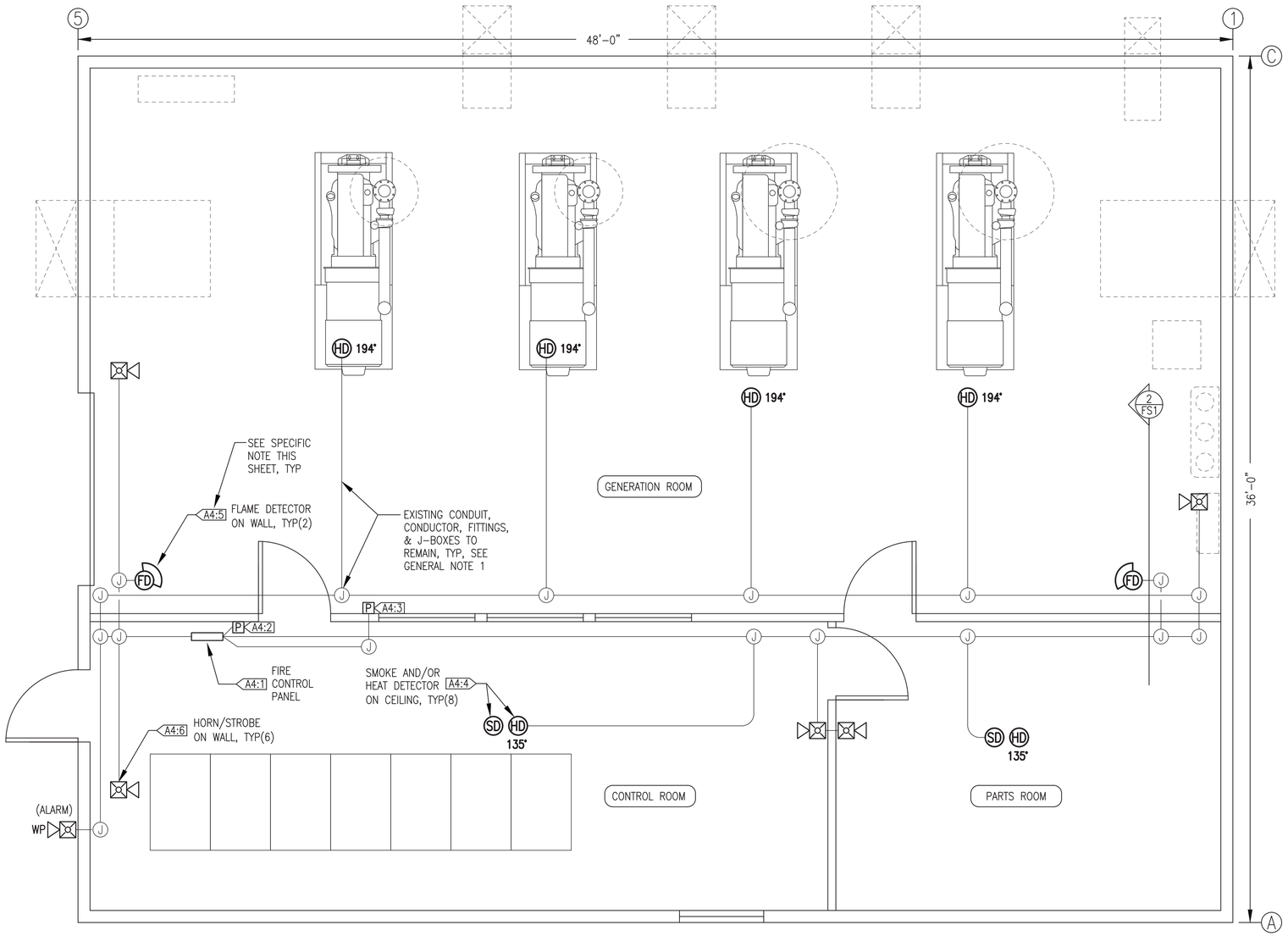
| FILE NAME: AKCHDRA M1-7 | SHEET: M7.1 |
| PROJECT NUMBER: | |




1 FS1 FIRE DETECTION & ALARM SYSTEM RENOVATION PLAN
3/8"=1'

## FIRE DETECTION & ALARM SYSTEM RENOVATION GENERAL NOTES (ADDITIVE ALTERNATE #4):

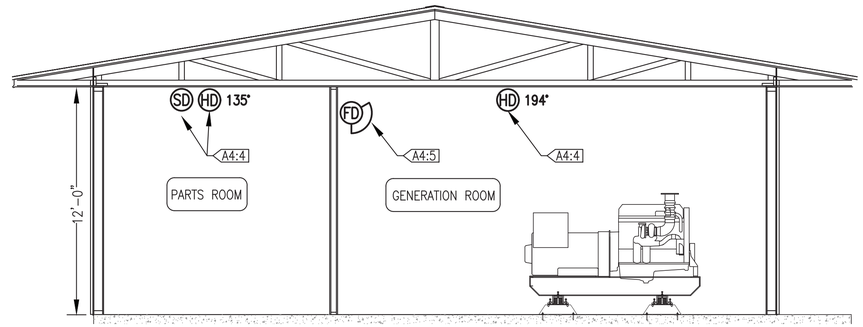
1. THE POWER PLANT IS EQUIPPED WITH AN EXISTING FIRE DETECTION AND ALARM SYSTEM THAT IS CURRENTLY INOPERABLE. THE SCOPE OF ADDITIVE ALTERNATE A4 IS TO REPLACE THE EXISTING FIRE CONTROL PANEL AS WELL AS ALL EXISTING DETECTION/ALARM COMPONENTS WITH NEW AND TO COMMISSION AND CERTIFY THE RENOVATED FIRE DETECTION & ALARM SYSTEM.
2. SEE SPECIFICATIONS FOR FULL DESCRIPTION OF NEW PANEL, COMPONENTS AND SEQUENCE.

## FIRE DETECTION & ALARM SYSTEM RENOVATION SPECIFIC NOTES (ADDITIVE ALTERNATE #4):

- A4:1 REMOVE EXISTING FIRE CONTROL PANEL AND REPLACE WITH NEW.
- A4:2 REMOVE EXISTING CONTROL ROOM PULL STATION AND REPLACE WITH NEW.
- A4:3 INSTALL MISSING GENERATION ROOM PULL STATION.
- A4:4 REMOVE ALL EXISTING CEILING MOUNTED SMOKE DETECTORS, NORMAL TEMPERATURE (135°) HEAT DETECTORS, AND HIGH TEMPERATURE (194°) HEAT DETECTORS AND REPLACE WITH NEW.
- A4:5 REMOVE ALL EXISTING WALL MOUNTED FLAME DETECTORS AND REPLACE WITH NEW.
- A4:6 ALL EXISTING WALL MOUNTED HORN/STOBES TO REMAIN. VERIFY PROPER FUNCTION.

## FIRE DETECTION & ALARM SYSTEM SYMBOL LEGEND

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| P | MANUAL PULL STATION | HD 135° | NORMAL TEMP. (135°F) DETECTOR |
| | INTERIOR ALARM HORN/STROBE | HD 194° | HIGH TEMP. (194°F) DETECTOR |
| WP | EXTERIOR ALARM HORN/STROBE | FD | FLAME (OPTICAL) DETECTOR |
| | | SD | SMOKE (IONIZATION) DETECTOR |




2 FS1 TYPICAL SECTION THROUGH POWER PLANT
1/4"=1'

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
BRIAN C. GRAY
ME 8210
REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: FIRE SUPPRESSION ADDITIVE ALTERNATE #4
DETECTION & ALARM SYSTEM RENOVATION

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

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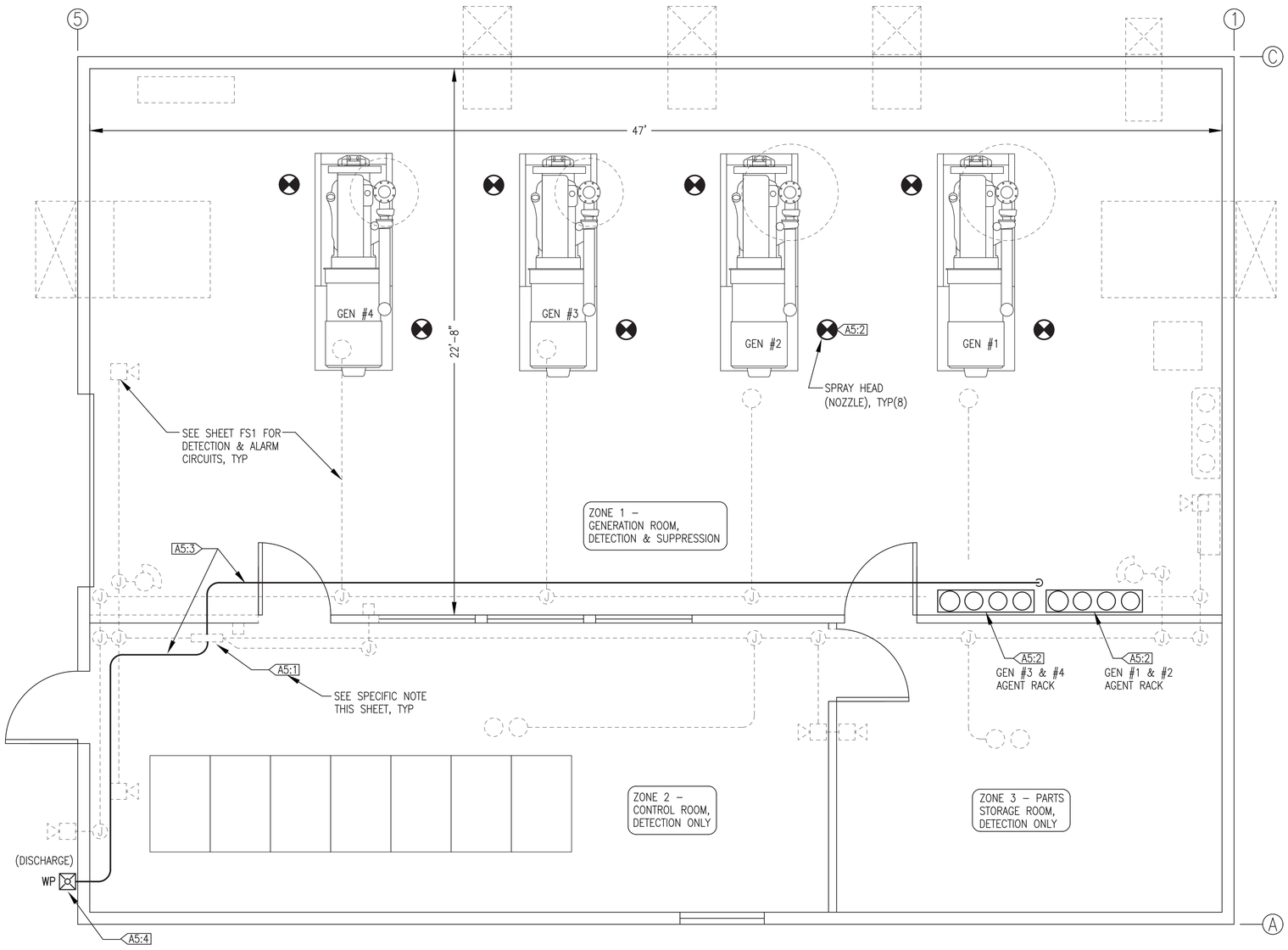
FILE NAME: AKCHDRA FS1-2 | SHEET: FS1
PROJECT NUMBER:




1 FS2 CLEAN AGENT FIRE SUPPRESSION SYSTEM PLAN
3/8"=1'

## CLEAN AGENT FIRE SUPPRESSION SYSTEM GENERAL NOTES (ADDITIVE ALTERNATE #5):

1. THE SCOPE OF ADDITIVE ALTERNATE #5 IS TO ADD FIRE SUPPRESSION CAPABILITY TO THE RENOVATED FIRE DETECTION AND ALARM SYSTEM (SEE ADDITIVE ALTERNATE #4).
2. INTERIOR FINISH OF ALL WALLS AND CEILINGS CLASS "A" FRP PANELING OVER PLYWOOD. ALL FLOORS ARE PAINTED CONCRETE. CEILING HEIGHT IN ALL ROOMS 12'–0" ABOVE FINISHED FLOOR.
3. ALL DOORS SELF–CLOSING WITH GASKETS. ALL BUILDING PIPING AND CONDUIT PENETRATIONS SEALED LIQUID TIGHT. ALL DUCT PENETRATIONS OF WALLS EQUIPPED WITH MOTORIZED DAMPERS THAT CLOSE ON GENERATOR SHUT DOWN.
4. SEE SPECIFICATIONS FOR FULL DESCRIPTION HI–FOG SUPPRESSION SYSTEM, COMPONENTS, AND SEQUENCE.

## CLEAN AGENT FIRE SUPPRESSION SYSTEM SPECIFIC NOTES (ADDITIVE ALTERNATE #5):

A5:1 RE–PROGRAM THE FIRE CONTROL PANEL TO ADD HI–GOG FIRE SUPPRESSION DISCHARGE FUNCTION. SEE SPECIFICATIONS FOR SEQUENCE.

A5:2 INSTALL HI–FOG RACKS, PIPING, AND NOZZLES.

A5:3 INSTALL NEW CONDUIT AND CONDUCTOR FOR FIRE SUPPRESSION SYSTEM DISCHARGE FUNCTION AND ALARM.

A5:4 INSTALL EXTERIOR FIRE SUPPRESSION AGENT DISCHARGE ALARM STROBE.

## FIRE SUPPRESSION SYSTEM SYMBOL LEGEND

| SYMBOL | DESCRIPTION |
|---|---|
| WP | EXTERIOR ALARM STROBE |

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
BRIAN C. GRAY
ME 8210
REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA–RPSU PROJECT

TITLE: FIRE SUPPRESSION ADDITIVE ALTERNATE #5
HI–FOG FIRE SUPPRESSION SYSTEM

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

DRAWN BY: JTD | SCALE: AS NOTED
DESIGNED BY: BCG | DATE: 3/1/23
FILE NAME: AKCHDRA FS1–2 | SHEET: FS2
PROJECT NUMBER:

## EXISTING ELECTRICAL EQUIPMENT SCHEDULE

| ITEM NO. | DESCRIPTION | MANUFACTURER |
|---|---|---|
| 1 | MULTI-TONE ALARM WITH STROBE, 115V, NEMA 3R, WEATHER RESISTANT SURFACE MOUNT BELL BOX | WHEELOCK MT4-115-WH-VNS |
| 2 | DAY TANK VERTICAL ACTION FLOAT SWITCH, REVERSIBLE 70VASPST NC/NO SWITCH, 1/8" NPT, 1"MAX ø BUNA-N FLOAT FOR S.G=.47, MINIMUM 60" LONG PVC COATED #20 AWG LEAD WIRES | INNOVATIVE COMPONENTS LS-12-111/2 |
| 3 | MODERATE TEMP RANGE, 3 WIRE, PLATINUM RTD, 100 OHMS +/- 0.12%, 0.00385 TEMP COEFFICIENT, 1/2" NPT REDUCED TIP TYPE 316 SS THERMOWELL, 2-1/2" IMMERSION. | MURPHY RTD-225-400-100 |
| 4 | LINE VOLTAGE HEATING/COOLING THERMOSTAT, 120V, 9.8 FLA, SPDT, 44F TO 86F RANGE. | HONEYWELL T651A3018 |
| 5 | EMERGENCY FIXTURE, WALL MOUNT, 20 GA STEEL ENCLOSURE, LEAD-CALCIUM BATTERY, 120V INPUT, 12VDC, 150W, DUAL 12W HALOGEN LAMPS | PATHWAY 12D150-2L-H12 NO SUBSTITUTES |
| 6 | EMERGENCY FIXTURE WITH EXIT SIGN, WALL MOUNT, 20 GA STEEL ENCLOSURE, LEAD-CALCIUM BATTERY, 120V INPUT, DUAL 6V LAMPS, OPTION M1 STYLE MOUNT WITH LIGHT BEHIND SIGN | PATHWAY LEP12X1CR-M1 NO SUBSTITUTES |
| 7 | SURFACE MOUNTED/SUSPENDED FLOURESCENT FIXTURE, SOLID TOP, WIDE DISTRIBUTION, 48" LONG, 3 TUBE F32WT8 LAMP, INSTANT START MULTI VOLTAGE ENERGY SAVING BALLAST | LITHONIA MS8-ST-3-32-WD MVOLT |
| 8 | 150W HIGH PRESSURE SODIUM WALL MOUNT FIXTURE, MULTI-TAP BALLAST. PROVIDE WITH 120V PHOTO CELL CONTROL AND TWO LAMPS (ONE SPARE) | LITHONIA TWH150STB |
| 9 | 0-5 MINUTE TIMER SWITCH, 120V, 20A, 1HP RATED, INSTALL IN 4"x4" PRESSED STEEL BOX WITH METAL COVER. | INTERMATIC FF5M |
| 10 | SINGLE POLE SNAP SWITCH, 120V, 20A, METAL, 1-1/2HP RATED, INSTALL IN 4"x4" PRESSED STEEL BOX WITH METAL COVER, IVORY. | HUBBELL 1221-I |
| 11 | SINGLE POLE SNAP SWITCH WITH RED PILOT LIGHT, 120V, 20A, 1-1/2HP RATED, INSTALL IN 4"x4" PRESSED STEEL BOX WITH METAL COVER | HUBBELL 1221-PL |
| 12 | DOUBLE POLE SNAP SWITCH WITH RED PILOT LIGHT, 240V, 30A, 2HP RATED, INSTALL IN 4"x4" PRESSED STEEL BOX WITH METAL COVER | HUBBELL 3032-PL |
| 13 | STATION SERVICE TRANSFORMER - ENERGY STAR COMPLIANT, ENCLOSURE TYPE 1, 15kVA, HV 480 DELTA, LV 208Y/120 | EGS ELECTRICAL GROUP CAT. NO. ET2H15S |
| 14 | STATION SERVICE PANELBOARD, 3-PHASE MAIN BREAKER WITH COPPER BUS, 4 WIRE, 120/208V, 150A, 42 CIRCUITS, BOLT-IN BREAKERS, SURFACE MOUNT, NEMA 1 | SIEMENS |
| 15 | SURFACE MOUNT 125V NEMA 5-20R RECEPTACLE. INSTALL IN 4"x4" PRESSED STEEL BOX WITH METAL COVER. | HUBBELL 5362I |
| 16 | 125V NEMA 5-20R RECEPTACLE. MOUNT IN CAST FDA BOX WITH WEATHERPROOF COVER. | HUBBELL 5362I WITH CROUSE HINDS WLRD-1 COVER |
| 17 | 24-VOLT 20-AMP AUTO-EQUALIZING BATTERY CHARGER FOR 120 VOLT AC INPUT POWER, WITH OPTIONAL HIGH/LOW VOLTAGE, AC POWER FAILURE, & REMOTE SUMMARY ALARM RELAYS | CHARLES INDUSTRIES MODEL AA2420-HLPR |
| 18 | TEMPERATURE TRANSMITTER, RTD, 20-240°F RANGE, 4-20mA OUTPUT, 1/2" NPT PIPING CONNECTION, 6mm DIAMETER BY 2.5" LONG STEM, HIRSCHMANN ELECTRICAL CONNECTION | NOSHOK 800-20/240-1-1-8-8-025-6 |
| 19 | PRESSURE TRANSMITTER, 0-60 PSIG RANGE, 4-20mA OUTPUT, 1/4" NPT PIPING CONNECTION, HIRSCHMANN ELECTRICAL CONNECTION | NOSHOK 100-60-1-1-2-7 |
| 20 | NON-FUSED LOCKABLE SAFETY SWITCH, NEMA 3R ENCLOSURE, 3PST, 600V, 30A, MIN 5HP RATED | SQUARE D HU361RB |
| 21 | EXTERIOR SLAB HEAT TEMPERATURE CONTROLLER, NEMA 1, SPDT, -30°F TO 212°F, 16A/120V | JOHNSON A419ABC-1C |
| 22 | 56" DIAMETER PADDLE FAN, CEILING MOUNTED WITH DOWN ROD, WHITE, 120V PROVIDE WITH VARIABLE SPEED CONTROL | GRAINGER 4C771 WITH LUTRON FS5EWH CONTROL |
| 23 | THREE POINT MAGNETIC FLOAT SWITCH. 2-1/2" ANSI 150# RF FLANGE MOUNT, 1/2" NPT CONDUIT ENTRY, EXPLOSION PROOF CONSTRUCTION, LISTED FOR CLASS I, DIV 1 & 2 LOCATIONS, 1/2" DIAMETER FIXED LENGTH STAINLESS STEEL STEM, 2" MAX. DIAMETER STAINLESS STEEL FLOATS FOR S.G.=0.68, 200VDC 500mA FORM A CONTACTS. 90-1/2" STEM LENGTH. ACTUATION LENGTHS - 11"(N.O.), 23"(N.O.), & 88"(N.C.). | ISE-MAGTECH MLS-4EX-C-6-2.5"150#-0.68-T-P 90.5"-11"-23"-88" |
| 24 | EXHAUST FAN CONTACTOR, IEC STYLE, 12A, 120V COIL, NEMA 1 ENCLOSURE | ALLEN BRADLEY 100C12D10 & 198EBA966 |

## NEW ELECTRICAL EQUIPMENT SCHEDULE

| SYMBOL | SERVICE/FUNCTION | DESCRIPTION | MANUFACTURER/MODEL |
|---|---|---|---|
| 17 | BATTERY CHARGER | 12/24-VOLT SOLID STATE 20-AMP AUTO-EQUALIZING BATTERY CHARGER FOR 120 VAC INPUT, WITH OPTIONAL HIGH/LOW VOLTAGE, AC POWER FAILURE, & REMOTE SUMMARY ALARM RELAYS | SENS NRG22-20-RCLS OR LEMARCHE ECSR-40/20-12/24V-AV1 |

## ELECTRICAL CONDUCTOR SCHEDULE

| SERVICE/FUNCTION | DESCRIPTION | MANUFACTURER/MODEL | NOTES: |
|---|---|---|---|
| GENERATOR LEADS (ENGINE STARTER CABLES SIMILAR) | HIGH TEMPERATURE, EXTRA FLEXIBLE CABLE, TIN COATED COPPER CONDUCTOR. THERMOSET EPDM INSULATION, UL 3340/3374, MINIMUM 600V, LISTED 150°C FOR NON-FLEXING | COBRA CABLE, BELDEN, OR OMINI | TERMINATE WITH COPPER COMPRESSION LUGS RATED FOR THE FULL AMPACITY OF THE CABLE AT 150°C. |
| GENERAL USE CONDUCTORS | CLASS B CONCENTRIC STRANDED, SOFT DRAWN COPPER. TYPE XHHW2 INSULATION, 600V AND 90C RATED. | | |
| SHIELDED/TWISTED INSTRUMENT & CONTROL & CANBUS CONDUCTORS | #18 AWG STRANDED TINNED COPPER CONDUCTORS, 600V POLYETHYLENE INSULATION, 100% COVERAGE ALUMINUM FOIL-POLYESTER TAPE SHIELD WITH STRANDED TINNED COPPER DRAIN WIRE & PVC OUTER JACKET | BELDEN PART #'S<br>SINGLE PAIR: #1120A<br>FOUR PAIR: #1049A<br>SINGLE TRIAD: #1121A | GROUND SHIELD DRAIN WIRE AT PANEL END ONLY. |

UNLESS INDICATED OTHERWISE ALL CONDUCTORS SHALL USE THE FOLLOWING COLOR CODE:
- 480-VOLT POWER (PHASE) CONDUCTORS
  - PHASE A: BROWN
  - PHASE B: ORANGE
  - PHASE C: YELLOW
- 120/208-VOLT POWER (PHASE) CONDUCTORS
  - PHASE A: BLACK
  - PHASE B: RED
  - PHASE C: BLUE
- NEUTRAL: WHITE, NO EXCEPTIONS
- GROUND: GREEN OR BARE, NO EXCEPTIONS
- 24 VOLT DC CONDUCTORS
  - +24VDC: RED or RED W/GRAY STRIPE
  - -24VDC: BLACK or BLACK W/GRAY STRIPE

CONTROL AND INSTRUMENT CONDUCTORS MAY BE COLOR CODED PER MANUFACTURER'S STANDARD

NOTES:

1) COLOR CODING FOR NO. 6 AWG AND SMALLER CONDUCTORS SHALL BE BY USING CONDUCTORS WITH CONTINUOUS COLOR EMBEDDED IN THE INSULATION.
2) COLOR CODING FOR CONDUCTORS LARGER THAN NO. 6, SHALL BE BY:
   A) CONTINUOUS COLOR EMBEDDED IN THE INSULATION, OR
   B) BLACK CABLE WITH SCOTCH 35 OR APPROVED EQUAL MARKING (PHASE) TAPE. AT EVERY ACCESSIBLE LOCATION A MINIMUM 3" LONG SECTION OF CONDUCTOR SHALL BE SPIRAL WRAPPED. NOTE THAT PHASE TAPE MAY NOT BE USED ON COLORED CABLE, BLACK CABLE ONLY.
3) GROUNDING - PROVIDE A SEPARATE GREEN INSULATED EQUIPMENT GROUNDING CONDUCTOR IN EACH RACEWAY. DO NOT USE THE CONDUIT AS AN EQUIPMENT GROUNDING CONDUCTOR. EQUIPMENT GROUNDING CONDUCTORS SHALL BE OF THE SAME TYPE AS THE PHASE CONDUCTORS AND SHALL BE SIZED AS INDICATED ON THE DRAWINGS. CONDUCTORS NOT INDICATED SHALL BE SIZED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.

## WIRING & DEVICE SYMBOL LEGEND

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| SS-## | HOME RUN TO PANEL & BREAKER(S) INDICATED. SHORT DASH INDICATES HOT CONDUCTOR, LONG DASH INDICATES NEUTRAL CONDUCTOR, CURVED DASH INDICATES GROUND CONDUCTOR. IF NOT SPECIFICALLY INDICATED, PROVIDE 2#12 AWG & 1#12 AWG GROUND. | | 125V, 20A, DUPLEX RECEPTACLE |
| | | T | LINE VOLTAGE THERMOSTAT |
| | | DT | DIGITAL THERMOSTAT, MODULATING |
| # | ELECTRICAL ITEM - SEE EQUIPMENT SCHEDULE | $ | SNAP SWITCH / SMALL MOTOR DISCONNECT |
| 1/4 | MOTOR (HORESPOWER INDICATED) | T$ | TIMER SWITCH |
| MD | MOTORIZED DAMPER - SEE MECHANICAL | | GROUND |

## EXISTING & NEW EQUIPMENT NOTES

1) ALL EQUIPMENT IN EXISTING SCHEDULES (SHOWN IN LIGHT TEXT) ARE PROVIDED FOR REFERENCE ONLY. SOME EXISTING ITEMS WILL BE DEMOLISHED AS INDICATED ON THE PAGES THAT FOLLOW. ALL OTHER EQUIPMENT TO REMAIN.
2) ALL EQUIPMENT IN NEW SCHEDULES (SHOWN IN BOLD TEXT) ARE TO BE FURNISHED AND INSTALLED UNDER THIS PROJECT.
3) SPECIFIC PARTS MANUFACTURER AND MODEL SELECTED NOT ONLY TO MEET PERFORMANCE FUNCTION BUT ALSO TO COORDINATE AND INTERFACE WITH OTHER DEVICES AND SYSTEMS. APPROVED EQUAL SUBSTITUTIONS WILL BE ALLOWED ONLY BY ENGINEER'S APPROVAL. TO OBTAIN APPROVAL, SUBMITTALS MUST CLEARLY DEMONSTRATE HOW SUBSTITUTE ITEM MEETS OR EXCEEDS SPECIFIED ITEM QUALITY AND PERFORMANCE CHARACTERISTICS AND ALSO COMPLIES WITH MECHANICAL AND/OR ELECTRICAL CONNECTIONS AND PHYSICAL LAYOUT REQUIREMENTS.

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
CLOIS W. VERSYP
EE 7802
REGISTERED PROFESSIONAL ENGINEER

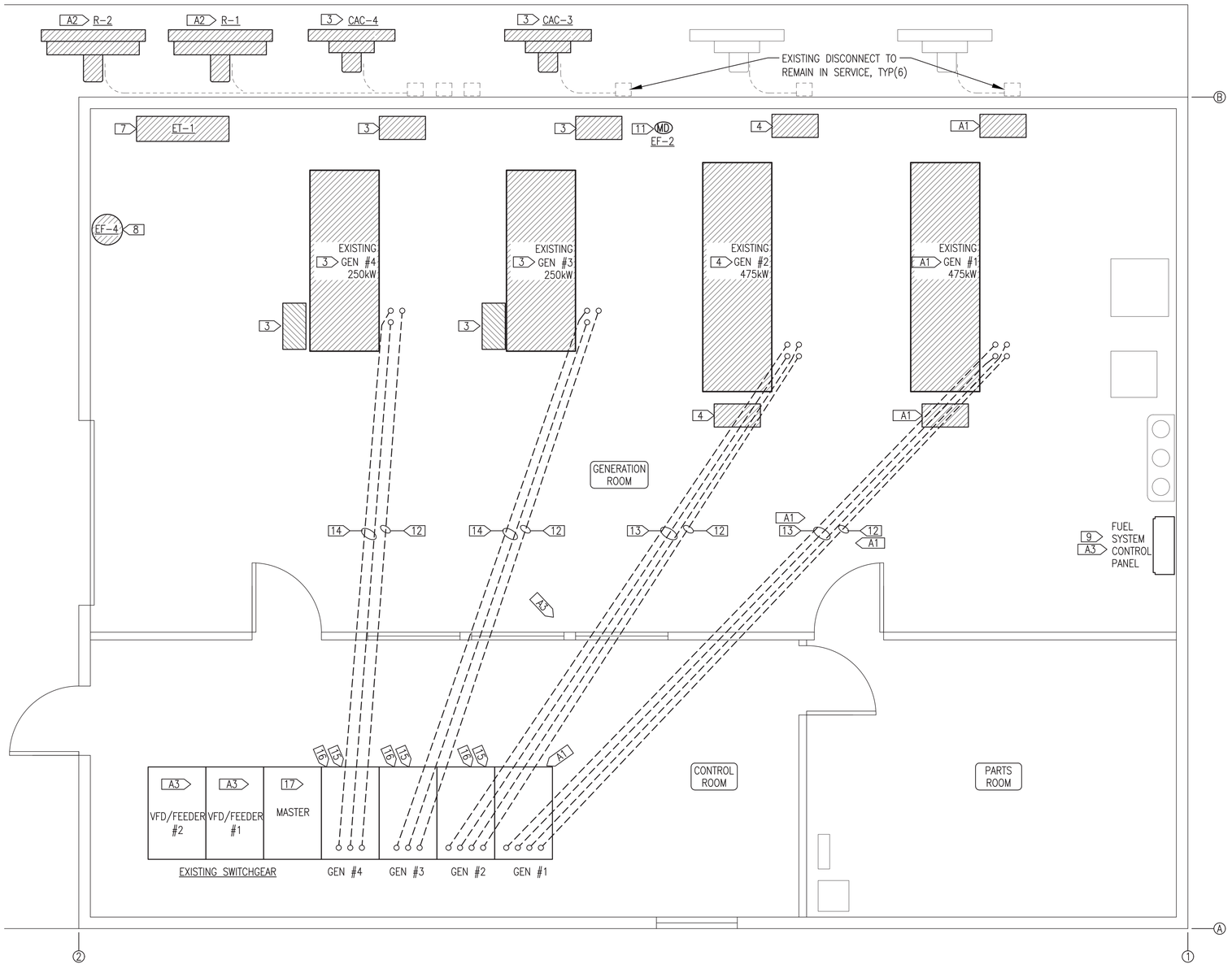
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: ELECTRICAL LEGENDS & SCHEDULES

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

DRAWN BY: BCG | SCALE: AS NOTED
DESIGNED BY: CWV/BCG | DATE: 3/1/23
FILE NAME: AKCHDRA E1-7 | SHEET: E1.1
PROJECT NUMBER:




1 E2 ELECTRICAL DEMOLITION PLAN
3/8"=1'

## ELECTRICAL DEMOLITION GENERAL NOTES:

1. THIS PLANT PROVIDES PRIME POWER TO THE COMMUNITY OF AKIACHAK. KEEP OUTAGES TO A MINIMUM AND COORDINATE ALL REQUIRED OUTAGES WITH THE UTILITY. SEE LIMITED POWER OUTAGE NOTES SHEET M2.
2. ALL ITEMS TO REMAIN UNLESS SPECIFICALLY INDICATED FOR REMOVAL. AREAS CONTAINING EXISTING EQUIPMENT TO BE REMOVED INDICATED BY HATCHING.
3. ONLY MAJOR DEMOLITION ITEMS AND AREAS SHOWN THIS SHEET. REMOVAL OF SMALL EQUIPMENT, DEVICES, AND CONDUIT AS REQUIRED FOR MISCELLANEOUS UPGRADES SHOWN WITH NEW WORK PLANS OR ON DETAILS.
4. ENSURE ALL EQUIPMENT AND CIRCUITS TO BE REMOVED ARE DE-ENERGIZED PRIOR TO BEGINNING DEMOLITION. LOCK AND TAG OUT ALL AFFECTED CIRCUIT BREAKERS AND DISCONNECTS.
5. TAKE ALL PRECAUTIONS TO MINIMIZE DAMAGE TO ELECTRICAL EQUIPMENT AND CONDUCTORS BEING SALVAGED FOR REUSE. TURN ALL REMOVED MATERIALS AND EQUIPMENT OVER TO THE UTILITY FOR FINAL DISPOSITION IF NOT REUSED.

## ELECTRICAL DEMOLITION SPECIFIC NOTES (BASE BID):

1 SEE MECHANICAL

2 SEE MECHANICAL

3 EXISTING GEN#3/GEN #4 AND ASSOCIATED ENGINE WIRING J-BOX, BATTERY CHARGER, AND CHARGE AIR COOLER TO BE REMOVED IN THEIR ENTIRETY. DISCONNECT GENERATOR, CHARGE AIR COOLER, AND BATTERY CHARGER POWER AND CONTROL CONDUCTORS, TAPE ENDS, AND TEMPORARILY COIL ALL CONDUCTORS IN SECURE LOCATION TO PROTECT FROM DAMAGE DURING GENERATOR REPLACEMENT. EXISTING CHARGE AIR COOLER CONDUIT, CONDUCTORS, AND DISCONNECTS TO REMAIN FOR CONNECTION TO NEW. COORDINATE WITH MECHANICAL.

4 EXISTING GEN#2 AND ASSOCIATED ENGINE WIRING J-BOX AND BATTERY CHARGER TO BE REMOVED IN THEIR ENTIRETY. DISCONNECT GENERATOR AND BATTERY CHARGER POWER AND CONTROL CONDUCTORS, TAPE ENDS, AND TEMPORARILY COIL ALL CONDUCTORS IN SECURE LOCATION TO PROTECT FROM DAMAGE DURING GENERATOR REPLACEMENT. EXISTING CHARGE AIR COOLERS TO REMAIN IN SERVICE. COORDINATE WITH MECHANICAL.

5 SEE MECHANICAL

6 SEE MECHANICAL

7 EXISTING COOLANT LEVEL SWITCH TO BE DEMOLISHED WITH EXPANSION TANK. REMOVE CONDUIT FROM LEVEL SWITCH TO WIREWAY. TAPE ENDS OF CONTROL CONDUCTORS AND TEMPORARILY COIL IN WIREWAY FOR RECONNECTION AT NEW LOCATION. SEE NEW WORK PLAN. COORDINATE WITH MECHANICAL.

8 EXISTING CRANK VENT EXHAUST FAN EF-4 TO BE DEMOLISHED. DISCONNECT AND REMOVE ALL CONDUCTORS BACK TO SOURCE. REMOVE ASSOCIATED RACEWAYS BACK TO WIREWAY AND PLUG UN-USED OPENINGS. COORDINATE WITH MECHANICAL.

9 REMOVE JUMPERS FROM EXISTING FUEL SYSTEM CONTROL PANEL AS REQUIRED TO PROVIDE ENHANCED WATER REMOVAL "POLISHING" FUNCTION. SEE ELECTRICAL NEW WORK PLAN AND SHEET E7.1. SEE MECHANICAL FOR RELATED TASKS.

10 SEE MECHANICAL

11 DISCONNECT CONDUCTORS AND CONDUIT FROM EXHAUST FAN EF-2 FAILED MOTORIZED DAMPER IN PREPARATION FOR REPLACEMENT. COORDINATE WITH MECHANICAL.

12 UNDER SLAB 1-1/2" GRC CONTROL CONDUIT, FLOOR PENETRATION FITTINGS, AND ASSOCIATED CONTROL CONDUCTORS TO REMAIN EXCEPT AS INDICATED ON NEW WORK PLAN.

13 THREE EACH UNDER SLAB 3" GRC POWER CONDUIT, FLOOR PENETRATION FITTINGS, AND ASSOCIATED POWER CONDUCTORS TO REMAIN FOR RECONNECTION AS INDICATED ON NEW WORK PLAN.

14 TWO EACH UNDER SLAB 3" GRC POWER CONDUIT AND FLOOR PENETRATION FITTINGS TO REMAIN. REMOVE EXISTING #2/0, #4G POWER CONDUCTORS FROM EXISTING CONDUIT.

15 REMOVE EXISTING GENERATOR BREAKER TRIP PLUGS AND CURRENT TRANSFORMERS AS REQUIRED FOR INSTALLATION OF NEW COMPONENTS. SEE SHEET E6.1.

16 REMOVE ENGINE MONITORING DEVICES AND WIRING. SEE SWITCHGEAR RECORD DRAWING REDLINES.

## ELECTRICAL DEMOLITION SPECIFIC NOTES (ADDITIVE ALTERNATES):

A1 UNDER ADDITIVE ALTERNATE #1 REMOVE EXISTING GEN#1 AND ASSOCIATED ENGINE WIRING J-BOX, BATTERY CHARGER, AND BATTERIES IN THEIR ENTIRETY. SEE NOTES 4, 12, AND 13 ABOVE. REMOVE BREAKER TRIP PLUG, CT's, AND ENGINE MONITORING DEVICES IN SWITCHGEAR, SEE NOTES 15 AND 16 ABOVE. DISCONNECT GENERATOR AND BATTERY CHARGER POWER AND CONTROL CONDUCTORS, TAPE ENDS, AND TEMPORARILY COIL ALL CONDUCTORS IN SECURE LOCATION TO PROTECT FROM DAMAGE DURING GENERATOR REPLACEMENT. EXISTING CHARGE AIR COOLER TO REMAIN IN SERVICE. COORDINATE WITH MECHANICAL.

A2 UNDER ADDITIVE ALTERNATE #2 REMOVE EXISTING RADIATORS R-1 AND R-2 IN THEIR ENTIRETY. DEMOLISH LIQUID TIGHT FLEX BETWEEN MOTOR AND WALL MOUNTED GRC. DEMOLISH CONDUCTORS FROM RADIATOR TO DISCONNECT. COORDINATE WITH MECHANICAL.

A3 UNDER ADDITIVE ALTERNATE #3 REMOVE EXISTING RADIATOR (2) AND CHARGE AIR COOLER (4) VFD's IN SWITCHGEAR AND FUEL COOLER VFD (1) IN FUEL SYSTEM CONTROL PANEL IN PREPARATION FOR REPLACEMENT, 7 VFD's TOTAL. SEE SHEETS E6.2, E7.2, AND E7.3.

A4 FIRE SUPPRESSION DETECTION AND ALARM SYSTEM RENOVATION. SEE FIRE SUPPRESSION DRAWING FS1.

A5 FIRE SUPPRESSION CLEAN AGENT SYSTEM. SEE FIRE SUPPRESSION DRAWING FS2.

ISSUED FOR CONSTRUCTION MARCH 2023

STATE OF ALASKA 49TH CLOIS W. VIERSYP EE 7802 REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: ELECTRICAL DEMOLITION PLAN & NOTES

Gray Stassel Engineering, Inc.
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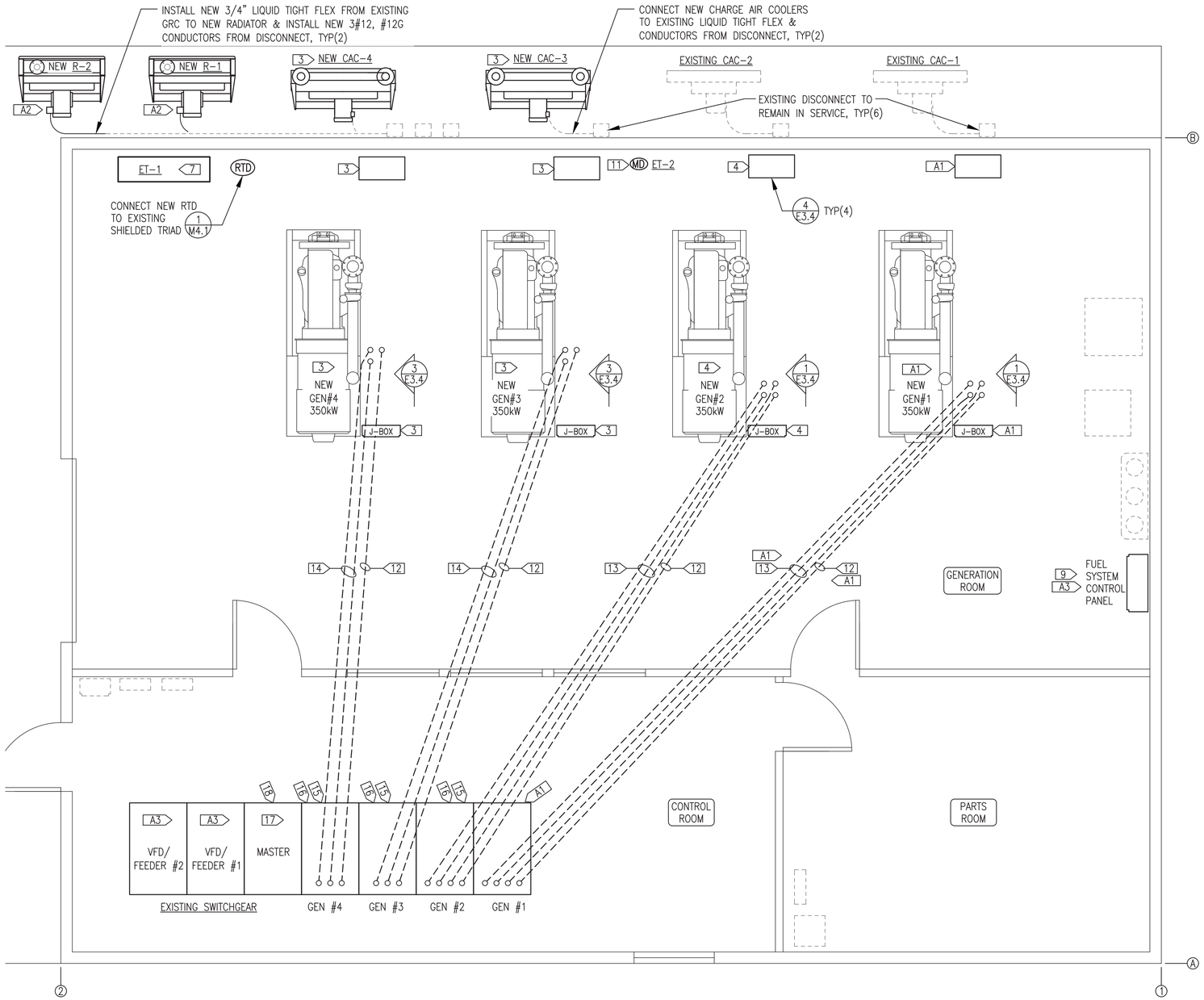
DRAWN BY: JTD | SCALE: AS NOTED
DESIGNED BY: CWV/BCG | DATE: 3/1/23
FILE NAME: AKCHDRA E1-7 | SHEET: E2
PROJECT NUMBER:




1 E3.3 EQUIPMENT LAYOUT & ELECTRICAL NEW WORK PLAN

3/8"=1'

| ENGINE-GENERATOR SCHEDULE | |
|---|---|
| GENSET | DESCRIPTION |
| GEN #1, #2 #3, & #4 | ENGINE – 500 HP, 350 eKW PRIME, MTU-DETROIT 6063TK35. 24 VDC STARTING & CONTROL. GENERATOR – MINIMUM 450 KW CONTINUOUS AT 105°C RISE, NEWAGE/STAMFORD HCI534D. |

## ELECTRICAL NEW WORK GENERAL NOTES:

1. EXISTING EQUIPMENT TO REMAIN IN SERVICE SHOWN WITH LIGHT DASHED LINES.
2. NEW EQUIPMENT TO BE INSTALLED AND EXISTING EQUIPMENT TO BE RELOCATED SHOWN WITH SOLID LINES.
3. NOT ALL EQUIPMENT, DEVICES, AND CONDUIT SHOWN. SEE ATTACHED RECORD DRAWINGS OF ORIGINAL POWER PLANT CONSTRUCTION FOR ADDITIONAL DETAIL ON SYSTEMS NOT BEING MODIFIED.
4. NEW GEN#1, GEN#2, GEN#3, GEN#4, R-1, R-2, CAC-3, AND CAC-4 TO BE OWNER FURNISHED.

## ELECTRICAL NEW WORK SPECIFIC NOTES (BASE BID):

1. SEE MECHANICAL
2. SEE MECHANICAL
3. INSTALL NEW GEN#3/GEN#4 WITH ASSOCIATED ENGINE WIRING J-BOX, BATTERY CHARGER, BATTERIES, AND CHARGE AIR COOLER. INSTALL NEW LIQUID TIGHT FLEX AND RE-CONNECT EXISTING POWER AND CONTROL CONDUCTORS. SEE SHEET E3.4 FOR DETAIL. COORDINATE WITH MECHANICAL.
4. INSTALL NEW GEN#2 WITH ASSOCIATED ENGINE WIRING J-BOX, BATTERY CHARGER, AND BATTERIES. EXISTING CHARGE AIR COOLER TO REMAIN. RE-CONNECT EXISTING LIQUID TIGHT FLEX AND POWER AND CONTROL CONDUCTORS. SEE SHEET E3.4 FOR DETAIL. COORDINATE WITH MECHANICAL.
5. SEE MECHANICAL
6. SEE MECHANICAL
7. CONNECT EXISTING CONDUCTORS TO NEW COOLANT LEVEL SWITCH INSTALLED WITH NEW EXPANSION TANK ET-1. COORDINATE WITH MECHANICAL.
8. SEE ELECTRICAL DEMOLITION
9. MODIFY EXISTING FUEL SYSTEM CONTROL PANEL WIRING AS REQUIRED TO PROVIDE ENHANCED WATER REMOVAL "POLISHING" FUNCTION. SEE SHEET E7.1. SEE MECHANICAL FOR RELATED TASKS.
10. SEE MECHANICAL
11. CONNECT EXISTING CONDUCTORS TO NEW MOTORIZED DAMPER ON EXISTING EXHAUST FAN EF-2. COORDINATE WITH MECHANICAL.
12. EXISTING 1-1/2" UNDER SLAB CONDUIT WITH EXISTING CONTROL CONDUCTORS TO REMAIN IN SERVICE FOR CONNECTION TO NEW GENERATOR WIRING J-BOX. CONFIRM THE FOLLOWING MINIMUM REUSABLE CONDUCTOR COUNT: 2#8, 2#14, AND 8#18 SHIELDED PAIRS. PULL IN NEW CONDUCTORS AS REQUIRED. EXISTING TYPE K CONDUCTOR TO BE PULLED OUT OR ABANDONED IN PLACE. SEE SHEET E6.3 FOR TERMINATIONS.
13. THREE EACH EXISTING 3" UNDER SLAB CONDUIT WITH 4#3/0, #4G 150° EX-FLEX GENERATOR POWER CONDUCTORS TO REMAIN IN SERVICE. RE-CONNECT TO NEW GEN#2. SEE SHEET E3.4.
14. TWO EACH EXISTING UNDER SLAB 3" GRC TO REMAIN IN SERVICE. PULL IN NEW 4#4/0, #2G 150°C EX-FLEX GENERATOR POWER CONDUCTORS FOR CONNECTION TO NEW GEN#3/GEN#4. SEE SHEET E3.4.
15. INSTALL NEW GENERATOR BREAKER TRIP PLUGS AND CURRENT TRANSFORMERS. SEE SHEET E6.1 AND SWITCHGEAR RECORD DRAWING REDLINES.
16. REVISE ENGINE MONITORING AND CONTROL WIRING. SEE SWITCHGEAR RECORD DRAWING REDLINES.
17. IN MASTER SECTION 24VDC CONTROL POWER INSTALL NEW CIRCUIT BREAKER AND DIODE. SEE SWITCHGEAR RECORD DRAWING REDLINES.
18. ON FACE OF MASTER SECTION ADD OIL CHANGE DECAL. SEE SHEET E6.1 AND SWITCHGEAR RECORD DRAWING REDLINES.

## ELECTRICAL NEW WORK SPECIFIC NOTES (ADDITIVE ALTERNATES):

- A1 UNDER ADDITIVE ALTERNATE #1 INSTALL NEW GEN#1 AND ASSOCIATED ENGINE WIRING J-BOX, BATTERY CHARGER, AND BATTERIES. SEE NOTES 4, 12, AND 13 ABOVE. EXISTING CHARGE AIR COOLER TO REMAIN. REPLACE BREAKER TRIP PLUG AND CT's AND MODIFY MONITORING/CONTROL WIRING IN SWITCHGEAR, SEE NOTES 15 AND 16 ABOVE. RE-CONNECT EXISTING LIQUID TIGHT FLEX AND POWER AND CONTROL CONDUCTORS. SEE SHEET E3.4 FOR DETAIL. COORDINATE WITH MECHANICAL.
- A2 UNDER ADDITIVE ALTERNATE #2 INSTALL NEW LIQUID TIGHT FLEX AND CONDUCTORS AND CONNECT NEW RADIATORS R-1 AND R-2 TO EXISTING EXTERIOR DISCONNECTS. COORDINATE WITH MECHANICAL.
- A3 UNDER ADDITIVE ALTERNATE #3 REPLACE RADIATOR (2) AND CHARGE AIR COOLER (4) VFD's IN SWITCHGEAR, 6 VFD's TOTAL. SEE SWITCHGEAR RECORD DRAWING REDLINES SHEETS. REPLACE FUEL COOLER VFD IN FUEL SYSTEM CONTROL PANEL, SEE SHEETS E7.2 AND E7.3.
- A4 FIRE SUPPRESSION DETECTION AND ALARM SYSTEM RENOVATION. SEE FIRE SUPPRESSION DRAWING FS1.
- A5 FIRE SUPPRESSION CLEAN AGENT SYSTEM. SEE FIRE SUPPRESSION DRAWING FS2.

ISSUED FOR CONSTRUCTION MARCH 2023

STATE OF ALASKA 49TH CLOIS W. VERSYP EE 7802 REGISTERED PROFESSIONAL ENGINEER

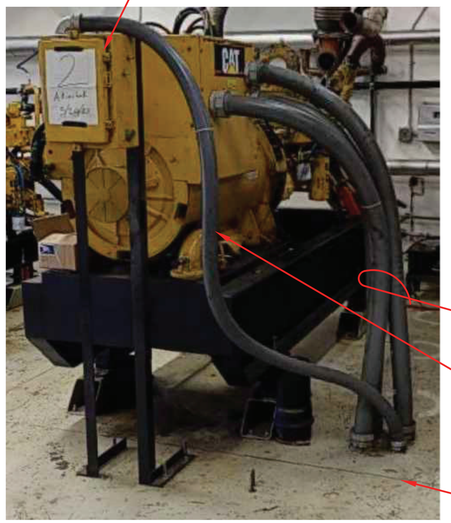
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

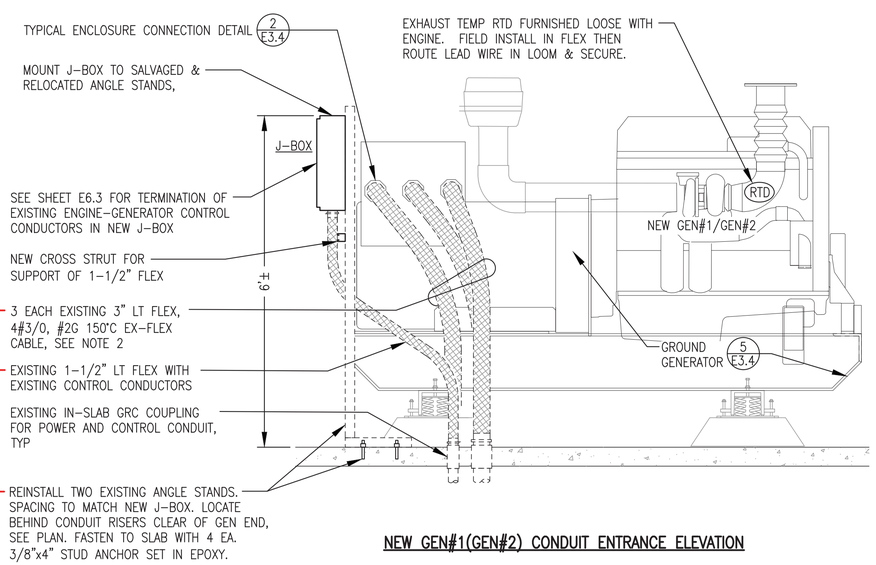
TITLE: ELECTRICAL NEW WORK PLAN & NOTES

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

| | |
|---|---|
| DRAWN BY: JTD | SCALE: AS NOTED |
| DESIGNED BY: CWV/BCG | DATE: 3/1/23 |
| FILE NAME: AKCHDRA E1-7 | SHEET: E3.3 |
| PROJECT NUMBER: | |




TYPICAL EXISTING GEN#1(GEN#2) PRIOR TO DEMOLITION




NEW GEN#1(GEN#2) CONDUIT ENTRANCE ELEVATION

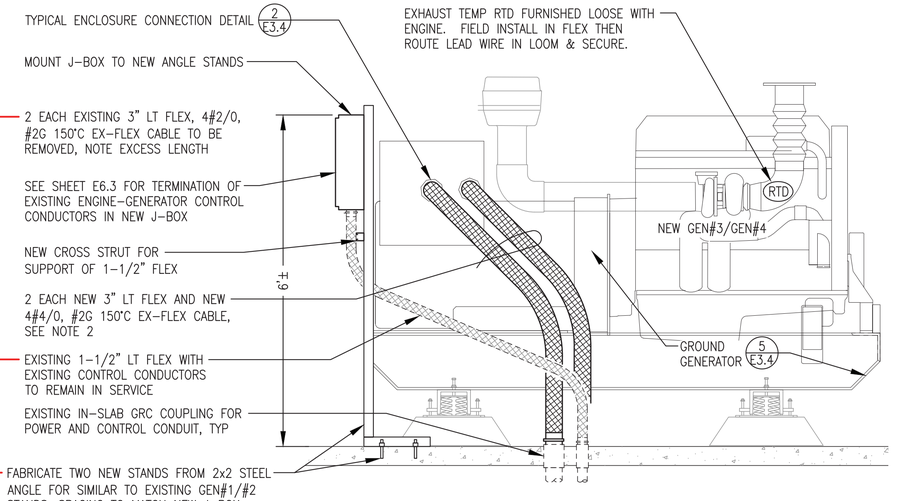
GEN#1/GEN#2 NOTES:

1. ALL EXISTING CONDUCTORS, UNDER FLOOR CONDUIT, ABOVE FLOOR CONDUIT, AND FITTINGS TO REMAIN IN SERVICE AND TO BE RECONNECTED TO NEW GENERATOR ENCLOSURE AND CONTROL WIRING J-BOX AS INDICATED.
2. DISTANCE FROM FLOOR FITTINGS TO NEW GEN#1/GEN#2 ENCLOSURE WILL BE SLIGHTLY LESS THAN EXISTING AND MAY REQUIRE THE EXISTING LIQUID TIGHT FLEX TO BE SHORTENED. SHORTEN FLEX TO MAKE NEAT ORDERLY RUNS WITHOUT EXCESS BEND THEN REMAKE ENDS.
3. THOROUGHLY CLEAN ALL EXISTING LIQUID TIGHT FLEX AND FITTINGS WITH DEGREASING COMPOUND PRIOR TO RECONNECTING.

## 1/E3.4 TYPICAL GEN#1/GEN#2 POWER & CONTROL CONDUIT ENTRANCES

3/4"=1'


TYPICAL EXISTING GEN#3/GEN#4 PRIOR TO DEMOLITION



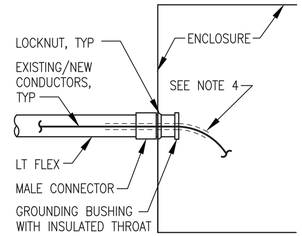

NEW GEN#3/GEN#4 CONDUIT ENTRANCE ELEVATION

GEN#3 & GEN#4 NOTES:

1. ALL EXISTING 1-1/2" AND 3" UNDER FLOOR CONDUIT TO REMAIN IN SERVICE. ALL EXISTING CONTROL CONDUCTORS IN 1-1/2" CONDUIT TO REMAIN IN SERVICE. ALL EXISTING POWER CONDUCTORS IN 3" CONDUIT ARE UNDERSIZED FOR NEW GENSETS AND ARE TO BE REMOVED AND REPLACED. ALL EXISTING 1-1/2" ABOVE FLOOR LT FLEX TO REMAIN IN SERVICE. ALL EXISTING 3" ABOVE FLOOR LT FLEX TO BE REMOVED AND REPLACED WITH NEW AS INDICATED.
2. DISTANCE FROM EXISTING FLOOR FITTINGS TO NEW GEN#3/GEN#4 ENCLOSURE WILL BE GREATER THAN EXISTING AND WILL REQUIRE THE EXISTING LIQUID TIGHT FLEX TO BE REPLACED WITH NEW LONGER 3" FLEX SECTIONS. CUT FLEX TO MAKE NEAT ORDERLY RUNS WITHOUT EXCESS BEND.
3. THOROUGHLY CLEAN ALL EXISTING 1-1/2" LIQUID TIGHT FLEX AND FITTINGS WITH DEGREASING COMPOUND PRIOR TO RECONNECTING.

## 3/E3.4 TYPICAL GEN#3/GEN#4 POWER & CONTROL CONDUIT ENTRANCES

3/4"=1'

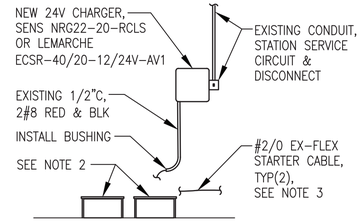



NOTES:
1) THIS DETAIL APPLIES TO CONNECTIONS TO NEW GENERATOR ENCLOSURES AND PANELS.
2) INSTALL GROUNDING BUSHING ON ALL GENERATOR POWER CONDUIT AND WHERE OTHERWISE INDICATED OR REQUIRED. BOND GROUNDING BUSHING TO EQUIPMENT GROUNDING CONDUCTOR.
3) INSTALL PLASTIC BUSHING WHERE GROUNDING BUSHING IS NOT REQUIRED.
4) ON GENERATOR ENCLOSURES PROTECT CABLES FROM WEAR BY INSTALLING A LAYER OF HEAVY WALL HEAT SHRINK, 12" LONG, CENTERED IN CONNECTOR.

## 2/E3.4 TYP ENCLOSURE CONNECTION

NO SCALE

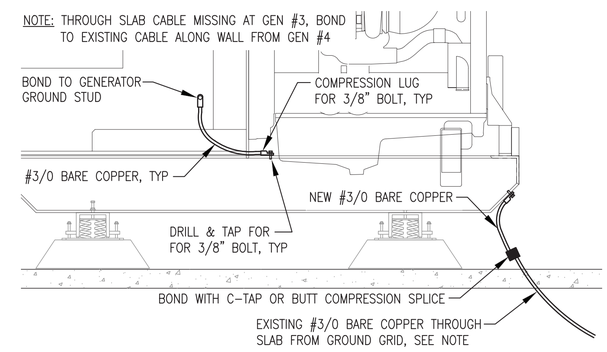
NEW CHARGER SETTINGS:
- AC LINE VOLTAGE SWITCH TO "115V".
- AUTO BOOST JUMPER TO "NORM".
- FLOAT VOLTAGE JUMPER TO "13.50/27.00" (GEL CELL).
- BATTERY RANGE JUMPER TO "24V".




NOTES:
1. FURNISH AND INSTALL NEW CHARGER AS SHOWN.
2. TWO EACH NEW BATTERIES WILL BE OWNER FURNISHED WITH GENSET. INSTALL IN EXISTING RACK.
3. #2/0 BATTERY CABLES WILL BE OWNER FURNISHED WITH GENSET. ROUTE FROM FRONT OF SKID DIRECTLY UNDER FUEL HOSES TO WALL AND TYWRAP TO FUEL PIPES ALONG WALL. CUT TO PROVIDE 6"± SERVICE LOOP FOR FINAL TERMINATION ON BATTERIES. CONNECT TO BATTERIES WITH STRAIGHT CRIMP TERMINAL FITTINGS AND TOP MOUNT TERMINAL COVERS, POLAR WIRE OR EQUAL.

## 4/E3.4 BATTERY, CHARGER & CABLES INSTALLATION

NO SCALE




## 5/E3.4 GENERATOR GROUNDING

NO SCALE

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
CLOIS W. VERSYP
EE 7802
REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: ELEVATIONS & DETAILS

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

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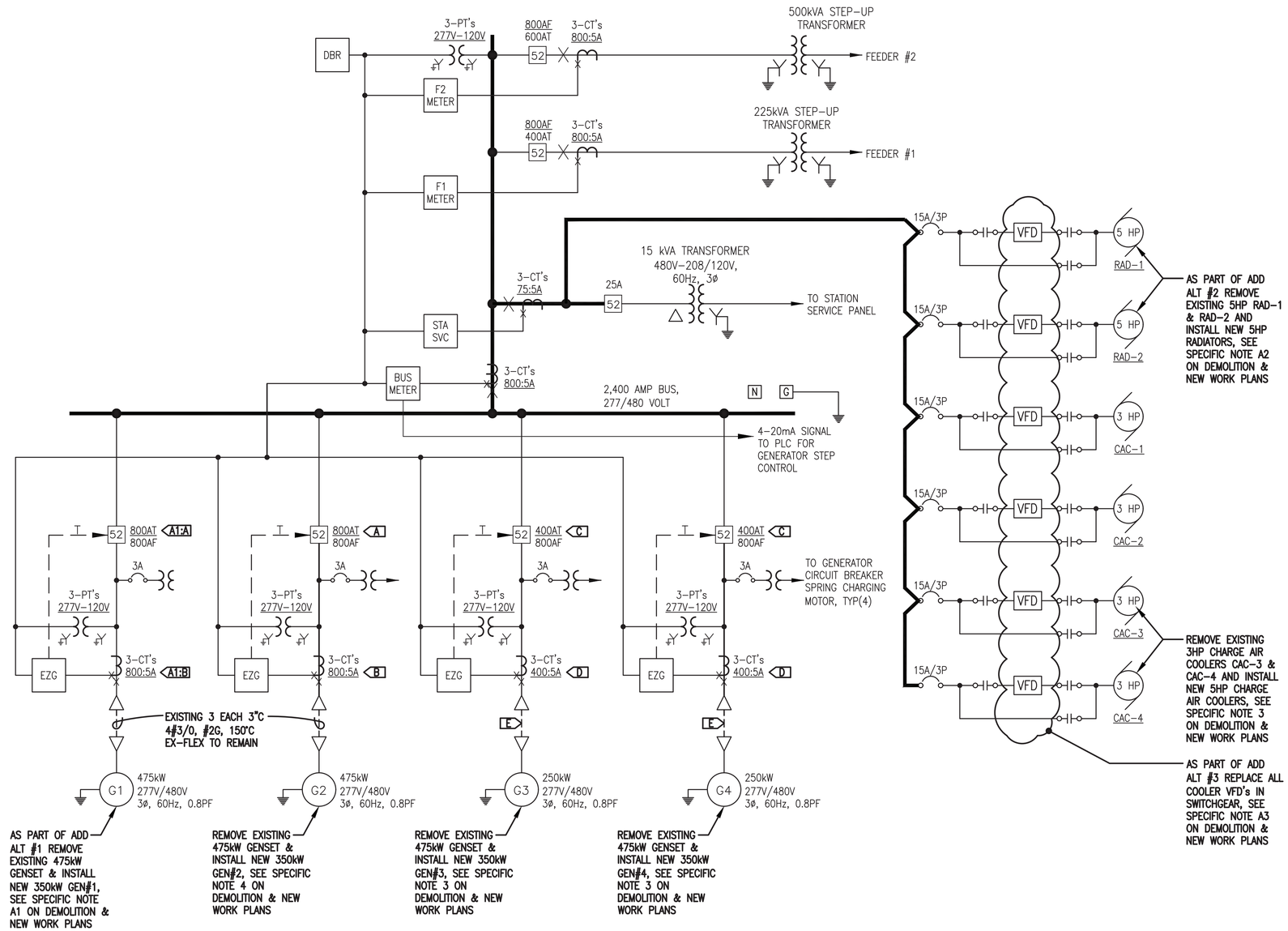
|---|---|
| DRAWN BY: JTD | SCALE: AS NOTED |
| DESIGNED BY: CWV/BCG | DATE: 3/1/23 |
| FILE NAME: AKCHDRA E1-7 | SHEET: E3.4 |
| PROJECT NUMBER: | |




## MASTER SECTION INFORMATIONAL PLACARD:

PROVIDE A DECAL FOR THE MASTER SECTION AS SPECIFIED BELOW. INSTALL ON THE FRONT DOOR BELOW CONTROLS AS SHOWN ON THE SWITCHGEAR RECORD DRAWING REDLINES.

DECALS TO BE WHITE NON-REFLECTIVE VINYL BACKGROUND, 3M 3650-10, WITH 3M SERIES 225 HIGH PERFORMANCE VINYL LETTERS, ONE SIDE ONLY, SELF ADHESIVE BACK. NOMINAL 4"x14". WARNING LITES OR EQUAL. APPLY DECAL DIRECTLY TO FACE OF DOOR. ENSURE SURFACE IS CLEAN AND DRY PRIOR TO APPLICATION.

"AT EACH OIL CHANGE SELECT A DIFFERENT LEAD UNIT TO ENSURE EQUAL RUN TIME FOR ALL ENGINES"

NOTE: THE SWITCHGEAR WAS UPGRADED IN THE SUMMER OF 2022 AND RECORD DRAWINGS OF THE UPGRADE ARE ATTACHED. THIS DRAWING SHOWS AN OVERVIEW OF MODIFICATIONS. THE SWITCHGEAR DRAWINGS HAVE REDMARKS INDICATING DETAILED CHANGES. REFER TO THE SWITCHGEAR DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL DETAIL.

## SWITCHGEAR MODIFICATION GENERAL NOTES:

1) ALL WORK THIS SHEET TO PERFORMED UNDER BASE BID EXCEPT AS SPECIFICALLY NOTED.
2) ALL ITEMS TO REMAIN UNLESS SPECIFICALLY INDICATED FOR REMOVAL OR REPLACEMENT.
3) ENSURE ALL EQUIPMENT AND CIRCUITS TO BE REMOVED ARE DE-ENERGIZED PRIOR TO BEGINNING DEMOLITION. LOCK AND TAG OUT ALL AFFECTED CIRCUIT BREAKERS AND DISCONNECTS.
4) SEE SPECIFICATIONS FOR ADDITIONAL TECHNICAL DATA ON NEW DEVICES AND EQUIPMENT.

## SWITCHGEAR MODIFICATION BASE BID SPECIFIC NOTES:

A> EXISTING GEN#2 BREAKER IS 800A FRAME G. E. MODEL SSD08B208 WITH 800A TRIP PLUG. REMOVE EXISTING TRIP PLUG AND INSTALL NEW 600A G. E. MODEL TR8B600. SEE SPECIFIC NOTE 15, SHEET E3.3.

B> REPLACE 3 EACH GEN#2 800:5 CT'S WITH NEW 600:5 RATIO RELAY CLASS 100 CT'S. ITI 110-601 OR APPROVED EQUAL. SEE SPECIFIC NOTE 15, SHEET E3.3.

C> EXISTING GEN#3/GEN#4 BREAKER IS 800A FRAME G. E. MODEL SSD08B208 WITH 400A TRIP PLUG. REMOVE EXISTING TRIP PLUG AND INSTALL NEW 600A G. E. MODEL TR8B600. SEE SPECIFIC NOTE 15, SHEET E3.3.

D> REPLACE 3 EACH GEN#3/GEN#4 400:5 CT'S WITH NEW 600:5 RATIO RELAY CLASS 100 CT'S. ITI 110-601 OR APPROVED EQUAL. SEE SPECIFIC NOTE 15, SHEET E3.3.

E> REMOVE EXISTING GEN#3/GEN#4 POWER CONDUCTORS AND INSTALL 2 EACH RUNS OF NEW 4#4/0, #2G 150C CONDUCTORS IN EXISTING 3" UNDER SLAB CONDUIT. SEE SPECIFIC NOTE 14, SHEET E3.3.

## SWITCHGEAR MODIFICATION ADD ALT SPECIFIC NOTES:

A1:A> EXISTING GEN#1 BREAKER IS 800A FRAME G. E. MODEL SSD08B208 WITH 800A TRIP PLUG. REMOVE EXISTING TRIP PLUG AND INSTALL NEW 600A G. E. MODEL TR8B600. SEE SPECIFIC NOTE 15, SHEET E3.3.

A1:B> REPLACE 3 EACH GEN#1 800:5 CT'S WITH NEW 600:5 RATIO RELAY CLASS 100 CT'S. ITI 110-601 OR APPROVED EQUAL. SEE SPECIFIC NOTE 15, SHEET E3.3.

1 E6.1 SWITCHGEAR AC POWER MODIFICATION ONE-LINE DIAGRAM
NO SCALE

ISSUED FOR CONSTRUCTION MARCH 2023

STATE OF ALASKA 49TH CLOIS W. VERSYP EE 7802 REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: SWITCHGEAR MODIFICATIONS ONE-LINE DIAGRAM

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

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|---|---|
| DRAWN BY: JTD | SCALE: AS NOTED |
| DESIGNED BY: CWV/BCG | DATE: 3/1/23 |
| FILE NAME: AKCHDRA E1-7 | SHEET: E6.1 |
| PROJECT NUMBER: | |

| Final (Permanent) Demand Control Table (PLC) | | | | |
|---|---|---|---|---|
| Demand Control | Generator(s) On Line | On-line kW (Overload) | Level Increase | Level Decrease |
| Level 1 | One Gen | 350 | 310 | --- |
| Level 2 | Two Gens | 700 | 620 | 280 |
| Level 3 | Three Gens | 1050 | 930 | 560 |
| Level 4 | All | 1400 | --- | 840 |
| Note: All generators are equal capacity. Manually select lead unit. | | | | |
| Temporary Demand Control for Commissioning Test Against Grid | | | | |
| Demand Control | Generator(s) On Line | On-line kW (Overload) | Level Increase | Level Decrease |
| Level 1 | One Gen | 200 | 180 | --- |
| Level 2 | Two Gens | 400 | 360 | 160 |
| Level 3 | Three Gens | 600 | 540 | 320 |
| Level 4 | All | 800 | --- | 480 |
| Note: Temporarily set to reduced values to test demand control on grid. | | | | |

| Engine-Generator Alarm Settings (EZGN Genset Controller) | | | |
|---|---|---|---|
| Function | Normal Range | Pre-Alarm | Shut Down |
| Overspeed | 1795-1805 | ---- | 1900 RPM |
| Oil Pressure | 30-50 PSI | 14.5 PSI | 10 PSI |
| Air Filter Vacuum | 1-10" H2O | 15" H2O | 20" H2O |
| Coolant Temp. | 180-200°F | 210°F | 215°F |
| Exhaust Temp. | 500-850°F | 900°F | ----- |
| Charge Air Temp. | 100-120°F | 140°F | 150°F |
| Under Frequency | 59.5-60.5 Hz | ---- | 58.2 Hz |
| Over Frequency | 59.5-60.5 Hz | ---- | 61.8 Hz |
| Under Voltage | 470-490 V | ---- | 432 V |
| Over Voltage | 470-490 V | ---- | 528 V |
| Reverse Power | 0 | ---- | 10% |

| Generator Breaker Settings (EZGN Genset Controller) | |
|---|---|
| Function | Setting |
| Gen Breaker Trip Setpoint (EZGN Rated Current) | 600 A |
| Gen Breaker Level 1 (100%) Time Over Current | 3 sec. |
| Gen Breaker Level 2 (120%) Time Over Current | 1 sec. |
| Gen Breaker Level 3 (250%) Time Over Current | 0.4 sec. |

| Radiator VFD Settings | |
|---|---|
| Function | Setting |
| Min PID Feedback | 20 |
| Max PID Feedback | 240 |
| rSL (Wake UP Threshold) | 1 |
| PID Reference Temperature | 175°F |
| Proportional Gain | 0.93 |
| Integral Gain | 0.3 |
| Derivative | 0 |
| Minimum Speed | 10 Hz. |
| Low Speed Timeout | 10 sec. |
| Loss of Phase | Ignore |

| Charge Air Cooler VFD Settings | |
|---|---|
| Function | Setting |
| Min PID Feedback | 20 |
| Max PID Feedback | 240 |
| rSL (Wake UP Threshold) | Not Used |
| PID Reference Temperature | 100°F |
| Proportional Gain | 0.2 |
| Integral Gain | 0.1 |
| Derivative | 0 |
| Minimum Speed | 10 Hz. |
| Low Speed Timeout | Not Used |
| Loss of Phase | Ignore |

POWER PLANT GENERATION SWITCHGEAR OPERATION

THIS POWER PLANT IS DESIGNED TO OPERATE IN AUTOMATIC MODE UNDER CONTROL OF THE PROGRAMMABLE LOGIC CONTROLLER (PLC). MONITORING AND CONTROL IS PRIMARILY DONE THROUGH THE OPERATOR INTERFACE UNIT (OIU). IN AN EMERGENCY SUCH AS A FAILURE OF THE PLC IT CAN ALSO BE OPERATED IN MANUAL MODE. EACH ENGINE IS CONTROLLED BY AN INDIVIDUAL EASYGEN (EZGN) GENSET CONTROLLER LOCATED IN EACH GENERATOR SECTION. FOLLOWING ARE INSTRUCTIONS FOR OPERATING THE SYSTEM. SEE SECTION 3.1 OF THE O&M MANUAL FOR DETAILED SEQUENCES.

AUTOMATIC OPERATION:

1) VERIFY THAT THE "SYSTEM MODE" SWITCH ON THE MASTER SECTION IS SET TO AUTO.
2) CHECK THE MASTER SECTION FOR ANY FAULTS AS INDICATED BY THE ALARM LAMPS. CORRECT THE CAUSE OF THE FAULT (EMERGENCY STOP, LOW COOLANT LEVEL, FEEDER BREAKER TRIPPED, ETC.) PRESS THE ALARM RESET BUTTON ON THE MASTER SECTION AND VERIFY THAT THE ALARMS CLEAR.
3) CHECK EACH GENERATOR SECTION FOR ANY FAULTS. FOR ENGINE-GENERATOR RELATED FAULTS CORRECT THE CAUSE OF THE FAULT (LOW OIL LEVEL, HIGH TEMPERATURE, CIRCUIT BREAKER TRIPPED, ETC.). TO CLEAR ANY ALARMS PRESS THE "ALARM RESET" BUTTON ON THE GENERATOR SECTION.
4) PLACE EACH AVAILABLE GENERATOR IN SERVICE BY PRESSING THE "AUTO" BUTTON. IF A GENERATOR IS OUT OF SERVICE FOR REPAIR, VERIFY THE STOP BUTTON IS ILLUMINATED.
5) THE PLC WILL AUTOMATICALLY START ALL GENERATORS IN AUTO AND PARALLEL THEM TO THE BUS. AS SOON AS THE BUS IS ENERGIZED THE STATION SERVICE POWER WILL TURN ON.
6) AFTER THE AVAILABLE GENERATORS ARE ON LINE, THE PLC WILL WAIT FOR A BRIEF INTERVAL (USUALLY 15 SECONDS) AND CLOSE THE FEEDER BREAKER TO ENERGIZE THE COMMUNITY. THE RED BREAKER CLOSED LAMP WILL ILLUMINATE.

DEMAND CONTROL OPERATION (AUTO MODE):

1) GENERATORS ARE CONSIDERED AVAILABLE FOR DEMAND CONTROL ONLY WHEN THEIR EZGN IS IN THE AUTO MODE AND THERE ARE NO ALARMS. THE DEMAND CONTROL SYSTEM WILL UTILIZE ALL AVAILABLE GENERATORS AS REQUIRED TO MEET THE LOAD ON THE SYSTEM.
2) ON INITIAL STARTUP THE DEMAND CONTROL IS ACTIVATED AFTER THE FEEDER BREAKER HAS BEEN CLOSED FOR ONE MINUTE. THIS ALLOWS THE PLC TIME TO DETERMINE THE POWER DEMAND ON THE SYSTEM. THE PLC MONITORS THE LOAD ON THE SYSTEM AND COMPARES IT TO THE CONNECTED GENERATING CAPACITY.
3) THE DEMAND CONTROL PROVIDES TWO TYPES OF CONTROL FOR INCREASING LOAD – INCREASE AND OVERLOAD. THE OVERLOAD SETPOINT IS TYPICALLY THE PRIME RATING OF THE GENSET AND THE INCREASE SETPOINT IS TYPICALLY 90% OF THE OVERLOAD SETPOINT. WHEN THE LOAD EXCEEDS THE INCREASE SETPOINT FOR A PRE-SET TIME DELAY (USUALLY 30 SECONDS) THE DEMAND CONTROL WILL SWITCH TO THE NEXT HIGHER LEVEL OF GENERATING CAPACITY. WHEN THE LOAD EXCEEDS THE OVERLOAD SETPOINT THE DEMAND CONTROL WILL IMMEDIATELY SWITCH TO THE NEXT HIGHER LEVEL OF GENERATING CAPACITY (NO TIME DELAY).
4) THE DEMAND CONTROL PROVIDES ONE TYPE OF CONTROL FOR DECREASING LOAD. THE DECREASE SETPOINT IS TYPICALLY 80% OF THE OVERLOAD SETPOINT. WHEN THE LOAD DROPS BELOW THE DECREASE SETPOINT FOR A PRE-SET TIME DELAY (USUALLY 2 MINUTES) THE DEMAND CONTROL WILL SWITCH TO THE NEXT LOWER LEVEL OF GENERATING CAPACITY.
5) NOTE THAT ALL GENERATORS ARE EQUAL CAPACITY AND THE OPERATOR MUST SELECT A LEAD UNIT USING THE SCADA SYSTEM.
6) SEE THE DEMAND CONTROL TABLE THIS SHEET FOR DEMAND LEVEL SETPOINTS AT THE TIME OF COMMISSIONING. ON THE SCADA SYSTEM GO TO THE DEMAND TAB TO VERIFY THE PRESENT SETPOINTS.

MANUAL OPERATION:

1) PLACE THE MASTER CONTROL "SYSTEM MODE" SWITCH IN THE MANUAL POSITION.
2) CHECK THE MASTER AND GENERATOR SECTIONS FOR ANY FAULTS AND CLEAR AS DESCRIBED UNDER AUTOMATIC OPERATION STEPS 2 AND 3.
3) TO PLACE A GENERATOR IN SERVICE, PRESS THE EZGN MAN BUTTON, THEN PRESS THE "I" (START) BUTTON. AFTER THE ENGINE STARTS AND STABILIZES, PRESS THE CONTACTOR CLOSE BUTTON ON THE EZGN. THE RED BREAKER CLOSED LAMP WILL ILLUMINATE.
4) REPEAT THIS PROCESS FOR AT LEAST ONE MORE GENERATOR.
5) WITH TWO GENERATORS ON LINE ROTATE THE FEEDER BREAKER CONTROL KNOB FOR FEEDER BREAKER #1 THEN AFTER FIFTEEN SECONDS REPEAT FOR FEEDER BREAKER #2. MONITOR THE LOAD ON THE SYSTEM FOR ONE MINUTE THEN SELECT THE APPROPRIATE GENERATOR(S) TO MATCH THE LOAD.
6) TAKE ANY GENERATOR(S) NOT NEEDED OFF LINE BY PRESSING THE RED EZGN STOP BUTTON. THE ENGINE WILL COOL DOWN FOR THREE MINUTES THEN SHUT OFF. NOTE THAT PRESSING THE RED STOP BUTTON TWICE WILL IMMEDIATELY SHUT DOWN THE GENERATOR.
7) TO MANUALLY ADD A SECOND GENERATOR TO MEET AN INCREASING LOAD, REPEAT STEP 3. TO MANUALLY REMOVE A SECOND GENERATOR TO MEET A DECREASING LOAD, REPEAT STEP 6.

SERVICE DUE / OIL CHANGE PROCEDURE:

NOTE THAT UNDER AUTOMATIC OPERATION, WHENEVER THE SERVICE TIME HAS BEEN EXCEEDED THE GENERATOR WILL AUTOMATICALLY BE TAKEN OFF LINE AS LONG AS ANOTHER GENERATOR IS AVAILABLE IN AUTO. AN "ENGINE SERVICE" MESSAGE WILL DISPLAY ON THE EZGN AND THE RED "ENGINE ALARM" LAMP WILL ILLUMINATE.

1) IF THE SWITCHGEAR IS IN MANUAL MODE, PERFORM MANUAL OPERATION STEPS 3 AND 6 ABOVE THEN CONTINUE AT STEP 3 BELOW (LOCK OUT).
2) IF THE SWITCHGEAR IS IN AUTOMATIC MODE, PRESS THE EZGN MAN BUTTON ON THE GENERATOR TO BE SERVICED. THE PLC WILL START ANOTHER GENERATOR. ONCE THE OTHER GENERATOR IS ON LINE, PRESS THE EZGN STOP BUTTON ON THE GENERATOR TO BE SERVICED. NOTE THAT IF THE STOP BUTTON IS PRESSED BEFORE ANOTHER UNIT IS ONLINE, AN OUTAGE WILL OCCUR.
3) LOCK THE UNIT OUT USING THE KEY SWITCH AND TAG OUT OF SERVICE.
4) SERVICE ENGINE (OIL CHANGE, FUEL FILTER, AIR FILTER, ETC.).
5) REMOVE TAG AND TURN THE GENERATOR LOCKOUT SWITCH TO RUN.
6) PRESS THE "SERVICE HOURS RESET" BUTTON AND HOLD FOR 10 SECONDS.
7) PRESS THE "ALARM RESET" BUTTON.
8) AFTER ALL ALARMS HAVE BEEN CLEARED PRESS THE "HOME" BUTTON.
9) START THE ENGINE BY PRESSING THE MAN BUTTON AND THEN "I" (START) BUTTON.
   a) AFTER THE ENGINE COMES UP TO SPEED VERIFY THAT THE ENGINE OIL PRESSURE IS IN THE NORMAL RANGE.
   b) CHECK THE OIL FILTER FOR LEAKS.
10) AFTER THE ENGINE RUNS FOR ONE MINUTE PRESS THE STOP BUTTON.
11) CHECK THE OIL LEVEL USING THE DIPSTICK AND ADD OIL AS REQUIRED.
12) PLACE THE GENERATOR BACK IN SERVICE BY PRESSING THE AUTO BUTTON ON THE EZGN.

ENGINE-GENERATOR PROTECTION ALARMS:

SEE THE TABLES THIS SHEET FOR ALARM LEVEL SETPOINTS AND BREAKER TRIP SETTINGS AT THE TIME OF COMMISSIONING.

ENGINE COOLING VARIABLE FREQUENCY DRIVES

CHARGE AIR COOLERS (CAC) – CAC FANS WILL OPERATE CONTINUOUSLY ANY TIME ASSOCIATED ENGINE RUNS AND STOP WHEN THE ENGINE STOPS. VARIABLE FREQUENCY DRIVES WILL OPERATE AT FULL SPEED FOR 30 SECONDS UPON STARTUP AND THEN WILL MODULATE FAN SPEED TO MAINTAIN ENGINE INTAKE MANIFOLD AIR TEMPERATURE OPERATING SETPOINT. SEE THE RADIATOR VFD SETTINGS TABLE THIS SHEET FOR SETPOINTS AT THE TIME OF COMMISSIONING.

RADIATORS – RADIATOR FAN MOTORS WILL OPERATE UNDER VARIABLE FREQUENCY DRIVE (VFD) CONTROL. WHEN THE COOLANT RETURN TEMP REACHES THE PID REFERENCE SETPOINT THE MOTOR WILL START AT MINIMUM SPEED AND RAMP UP TO THE REQUIRED SPEED. USING PID CONTROL, THE VFD WILL MODULATE THE FAN SPEED AS REQUIRED TO MAINTAIN COOLANT RETURN TEMP AT THE PID REFERENCE SETPOINT. AS THE COOLANT RETURN TEMP RISES, THE VFD WILL INCREASE THE SPEED OF THE FAN MOTOR UP TO 100%. ONCE THE FAN REACHES THE MINIMUM SPEED, THE VFD WILL MAINTAIN THAT SPEED UNTIL THE LOW SPEED TIME OUT EXPIRES. WHEN THE LOW SPEED TIME OUT EXPIRES THE MOTOR WILL STOP. THE MOTOR WILL REMAIN OFF UNTIL THE COOLANT RETURN TEMP RISES TO THE PID REFERENCE SETPOINT. SEE THE RADIATOR VFD SETTINGS TABLE THIS SHEET FOR SETPOINTS AT THE TIME OF COMMISSIONING.

**NOTE: THE SWITCHGEAR WAS UPGRADED IN THE SUMMER OF 2022 AND RECORD DRAWINGS OF THE UPGRADE ARE ATTACHED. THE SWITCHGEAR DRAWINGS HAVE REDMARKS INDICATING DETAILED CHANGES. THE SWITCHGEAR SPECIFICATIONS DESCRIBE CHANGES TO FUNCTION AND OPERATION AND LIST NEW EQUIPMENT. THIS DRAWING SHOWS AN OVERVIEW OF FINAL SETTINGS AND SEQUENCE. REVISE PROGRAMMING ON EXISTING PLC, REVISE SETTINGS ON EXISTING EASYGEN GENSET CONTROLLERS, AND PROGRAM NEW VARIABLE FREQUENCY DRIVES TO PERFORM ALL SEQUENCES LISTED ON THIS SHEET AS DETAILED IN THE SPECIFICATIONS.**

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
CLOIS W. VERSYP
EE 7802
REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA–RPSU PROJECT

TITLE: SWITCHGEAR SETTING TABLE & SEQUENCE OF OPERATIONS SUMMARY

Gray Stassel Engineering, Inc.
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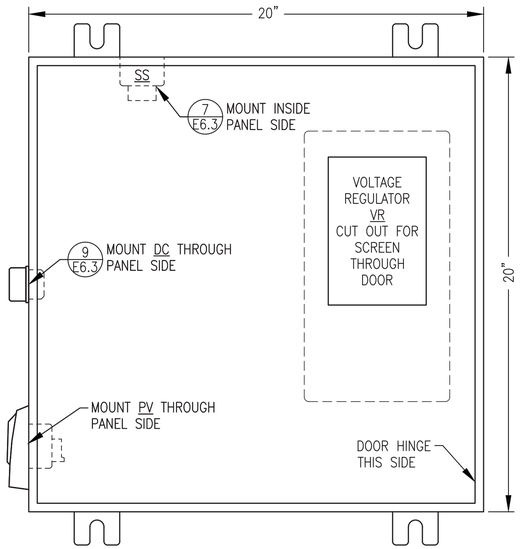
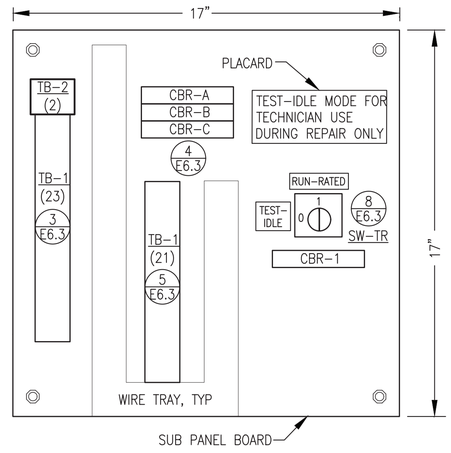
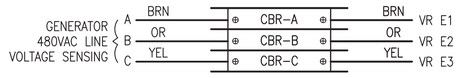
DRAWN BY: JTD | SCALE: AS NOTED
DESIGNED BY: CWV/BCG | DATE: 3/1/23
FILE NAME: AKCHDRA E1–7 | SHEET: E6.2
PROJECT NUMBER:




1 E6.3 JUNCTION BOX FRONT PANEL LAYOUT
NO SCALE




2 E6.3 JUNCTION BOX SUB PANEL LAYOUT
NO SCALE




4 E6.3 CIRCUIT BREAKER CONNECTIONS
NO SCALE

## BILL OF MATERIALS

| TAG | MANUFACTURER | MODEL | DESCRIPTION |
|---|---|---|---|
| CBR-A/B/C | ALLEN-BRADLEY | 1489-M1-C010 | RAIL MOUNT CIRCUIT BREAKER, 1P, 1A |
| CBR-1 | ALLEN-BRADLEY | 1489-M1-C050 | RAIL MOUNT CIRCUIT BREAKER, 1P, 5A |
| DC | DEUTSCH | HD10-9-1939P | DIAGNOSTIC CONNECTOR, 9-PIN, CAN-BUS |
| | DEUTSCH | HD18-009 | CONNECTOR STRAIN RELIEF |
| | DEUTSCH | HDC16-9 | CONNECTOR PROTECTIVE DUST CAP |
| | DEUTSCH | HD10-9-GKT | CONNECTOR GASKET |
| | DEUTSCH | JDL062397 | CONNECTOR LANYARD |
| ENCL. | HOFFMAN | A20H20ALP | 20x20x8" NEMA 12 |
| | HOFFMAN | A20P20 | BACK PANEL |
| PV | MURPHY | PV101-C | POWER VIEW (NON-TIER 4) WITH HARNESS |
| SS | JOHN DEERE | AT145341 | STARTER AUXILIARY SOLENOID, 24V |
| SW-TR | ALLEN-BRADLEY | 194L-A12-225-2 | CHANGEOVER SWITCH, 12A, 2P |
| | ALLEN-BRADLEY | 194L-HE-4A-175 | 90 DEGREE I-O HANDLE |
| TB-1 | IDEC | BNH15LW | 15A DIN RAIL-MOUNT TERMINAL BLOCK |
| TB-2 | IDEC | BNH50W | 50A DIN RAIL-MOUNT TERMINAL BLOCK |
| VR | BASLER | DECS-150 5NS1V1N1S | DIGITAL VOLTAGE REGULATOR |

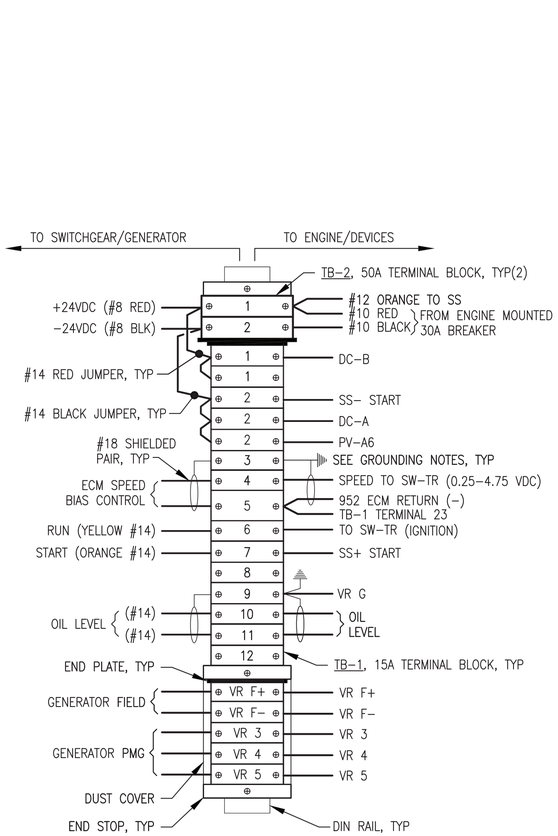
BRAND SPECIFIC NOTE: SPECIFIC PARTS MANUFACTURER AND MODEL SELECTED NOT ONLY TO MEET PERFORMANCE FUNCTION BUT ALSO TO COORDINATE AND INTERFACE WITH OTHER DEVICES AND SYSTEMS. APPROVED EQUAL SUBSTITUTIONS WILL BE ALLOWED ONLY BY ENGINEER'S APPROVAL. TO OBTAIN APPROVAL, SUBMITTALS MUST CLEARLY DEMONSTRATE HOW SUBSTITUTE ITEM MEETS OR EXCEEDS SPECIFIED ITEM QUALITY AND PERFORMANCE CHARACTERISTICS AND ALSO COMPLIES WITH MECHANICAL AND/OR ELECTRICAL CONNECTIONS AND PHYSICAL LAYOUT REQUIREMENTS.

## SHOP FABRICATION NOTES:

1) PROVIDE ASSEMBLY WITH ALL DEVICES AND WIRING INDICATED.
2) INSTALL IN A NEMA 12 ENCLOSURE WITH MOUNTING FLANGES AT BACK, A MIN 14 GAUGE INTERIOR BACK PANEL AND HINGED LOCKABLE DOOR. SIZE AS INDICATED.
3) PROVIDE DIN RAIL, TERMINAL END PLATES, TERMINAL END STOPS, TERMINAL DUST COVERS AND OTHER MISCELLANEOUS HARDWARE AS REQUIRED TO MATCH TERMINALS. LABEL ALL TERMINALS EXACTLY AS INDICATED ON THE DETAILS.
4) ALL WIRE #14AWG EXCEPT WHERE SPECIFICALLY INDICATED OTHERWISE. LABEL BOTH ENDS OF ALL JUMPERS WITH THE ENGINE PANEL TERMINAL NUMBER.
5) PROVIDE MECHANICAL GROUND LUGS FASTENED TO BACK PANEL AND GROUNDED TO ENGINE-GENERATOR. GROUND ALL SHIELD DRAIN WIRES TO LUGS AT BACK PANEL ONLY.
6) PROVIDE WIRING HARNESSES FOR CONNECTION TO GENERATOR AND TO ENGINE. INSTALL WIRES IN LIQUID TIGHT FLEX OR FLEXIBLE PLASTIC WIRE LOOM AND PROVIDE SERVICE LOOPS IN ACCORDANCE WITH SPECIFICATIONS.
7) SHOP TEST EACH NEW ENGINE-GENERATOR WITH ASSOCIATED JUNCTION BOX PERMANENTLY CONNECTED. UPON COMPLETION OF TESTING, COIL WIRING HARNESSES AND SECURE JUNCTION BOX TO GENERATOR FOR SHIPPING.

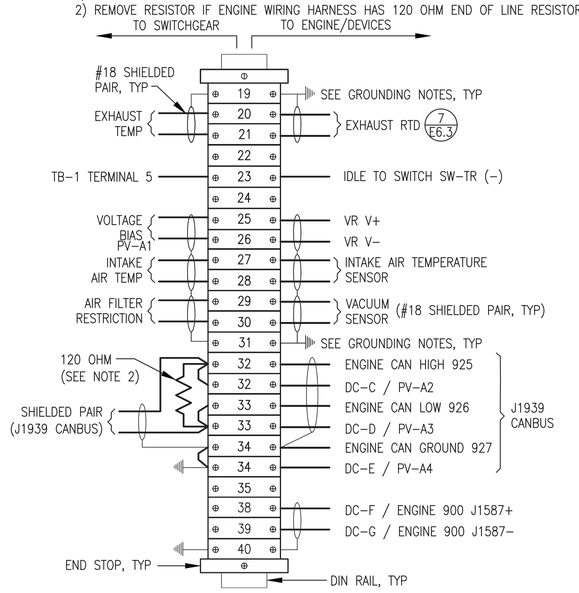
## FIELD INSTALLATION NOTES:

1) PERFORM ALL FIELD WIRING IN ACCORDANCE WITH SPECIFICATIONS. LABEL BOTH ENDS OF ALL FIELD WIRING WITH THE ENGINE PANEL TERMINAL NUMBER.
2) ON SHIELDED CONDUCTORS GROUND ALL SHIELD DRAIN WIRES AT ENGINE J-BOX ONLY. CLIP DRAIN WIRES AT OPPOSITE ENDS.

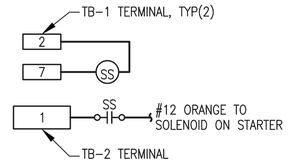



3 E6.3 TERMINAL STRIP CONNECTIONS
NO SCALE

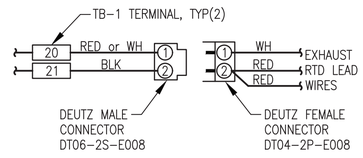
NOTES: 1) ALL RESISTORS 0.25W.
2) REMOVE RESISTOR IF ENGINE WIRING HARNESS HAS 120 OHM END OF LINE RESISTOR.



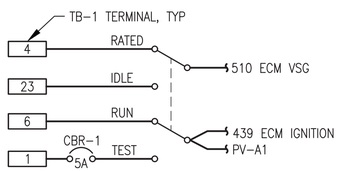

5 E6.3 TERMINAL STRIP CONNECTIONS
NO SCALE




6 E6.3 STARTER AUX SOLENOID SS WIRING
NO SCALE

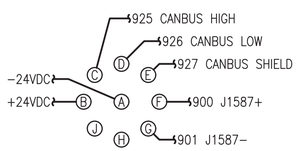



7 E6.3 EXHAUST RTD CONNECTOR
NO SCALE




8 E6.3 TEST-IDLE/RUN-RATED SWITCH SW-TR WIRING
NO SCALE

NOTE: THE ENGINE WIRING J-BOXES ARE INCLUDED AS PART OF THE OWNER FURNISHED ENGINE-GENERATORS. THIS DRAWING IS PROVIDED FOR FIELD INSTALLATION AND COORDINATION. NOTE THAT SOME OF THE TERMINALS ON THE ENGINE PANEL ARE NOT NUMBERED THE SAME AS THE CORRESPONDING TERMINALS ON THE SWITCHGEAR. REFER TO THE SWITCHGEAR DRAWING REDMARKS FOR ADDITIONAL DETAIL.




9 E6.3 DIAGNOSTIC CONNECTOR WIRING
NO SCALE

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
CLOIS W. VERSYP
EE 7802
REGISTERED PROFESSIONAL ENGINEER

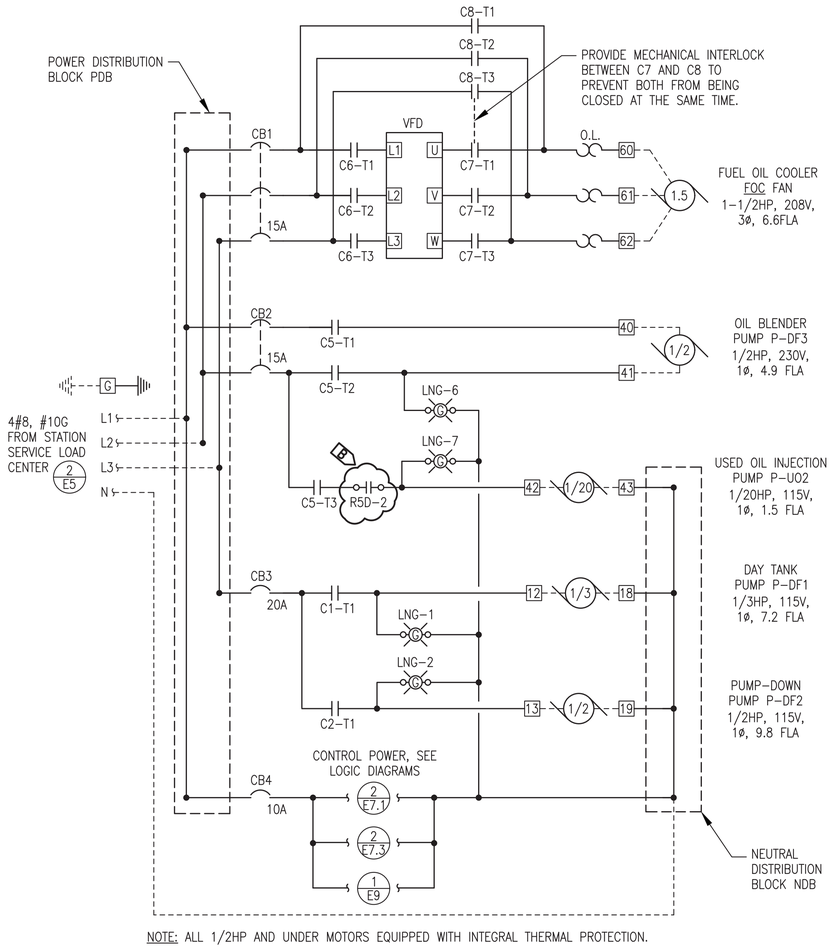
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: 24VDC ENGINE WIRING JUNCTION BOX

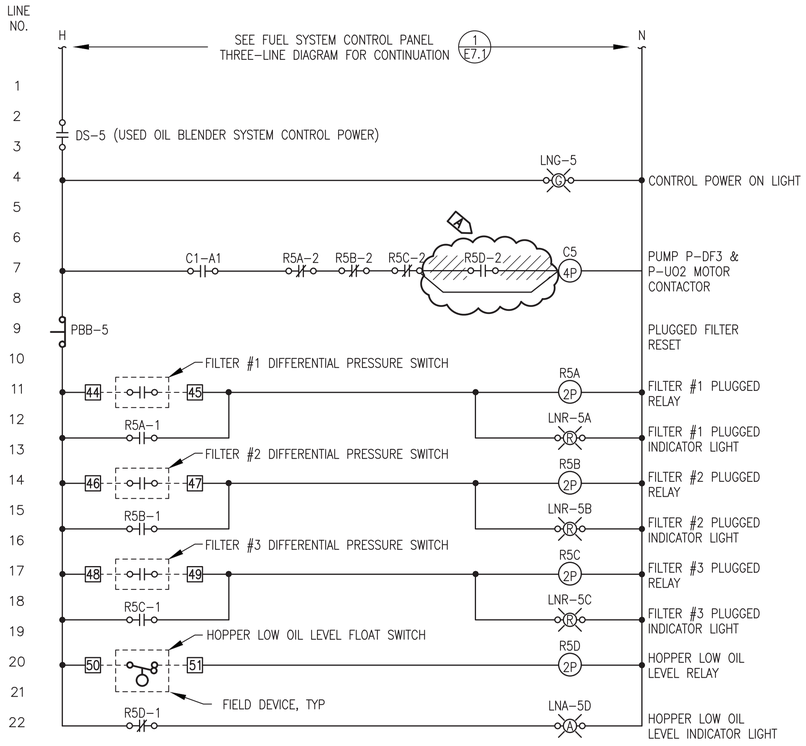
Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

| | |
|---|---|
| DRAWN BY: JTD | SCALE: AS NOTED |
| DESIGNED BY: CWV/BCG | DATE: 3/1/23 |
| FILE NAME: AKCHDRA E1-7 | SHEET: E6.3 |
| PROJECT NUMBER: | |




NOTE: ALL 1/2HP AND UNDER MOTORS EQUIPPED WITH INTEGRAL THERMAL PROTECTION.

1/E7.1 FUEL SYSTEM CONTROL PANEL THREE–LINE MODIFICATION DIAGRAM
NO SCALE




2/E7.1 USED OIL BLENDER SYSTEM LOGIC MODIFICATION DIAGRAM
NO SCALE

## GENERAL NOTES:

1. THE PURPOSE OF THE MODIFICATIONS IS TO ENABLE THE BLENDER TO ACT AS A DAY TANK FUEL "POLISHING" FILTER EVERY TIME THE DAY TANK FILLS. THE MODIFICATIONS WILL CHANGE THE PANEL FUNCTION SO ONLY PUMP P–UO2 STOPS ON A LOW HOPPER OIL LEVEL. P–DF3 WILL CONTINUE TO RUN WHEN THE HOPPER OIL LEVEL IS LOW
2. THIS WORK CONSISTS OF REMOVING EXISTING WIRE JUMPERS AND INSTALLING NEW WIRE JUMPERS AS INDICATED. ALL EXISTING CONTROL DEVICES TO REMAIN.
3. MODIFICATION AREAS ARE SHOWN CLOUDED WITH SPECIFIC NOTES INDICATED.

## FUEL SYSTEM CONTROL PANEL MODIFICATION SPECIFIC NOTES:

A REMOVE JUMPERS TO TAKE R5D N.O. CONTACT OUT OF C5 COIL CIRCUIT AND INSTALL NEW JUMPER TO CONNECT C5 COIL DIRECTLY TO R5C N.C. CONTACT.

B INSTALL NEW JUMPERS TO CONNECT R5D N.O. CONTACT BETWEEN C5–T3 AND PUMP P–UO2 MOTOR AND ASSOCIATED LAMP LNG–7.

ISSUED FOR CONSTRUCTION MARCH 2023

STATE OF ALASKA 49TH
CLOIS W. VERSYP
EE 7802
REGISTERED PROFESSIONAL ENGINEER

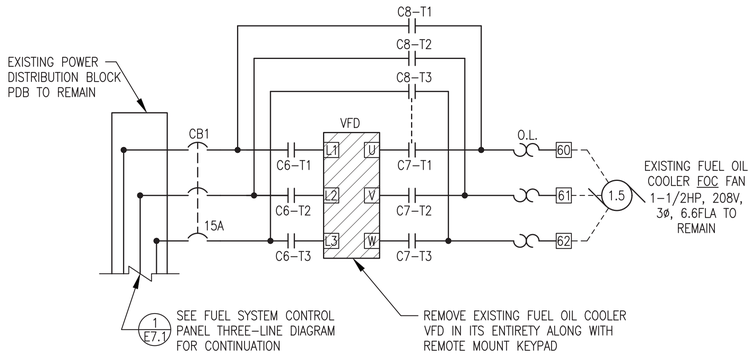
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA–RPSU PROJECT

TITLE: EXISTING FUEL SYSTEM CONTROL PANEL LOGIC MODIFICATIONS FOR FUEL POLISHING FUNCTION

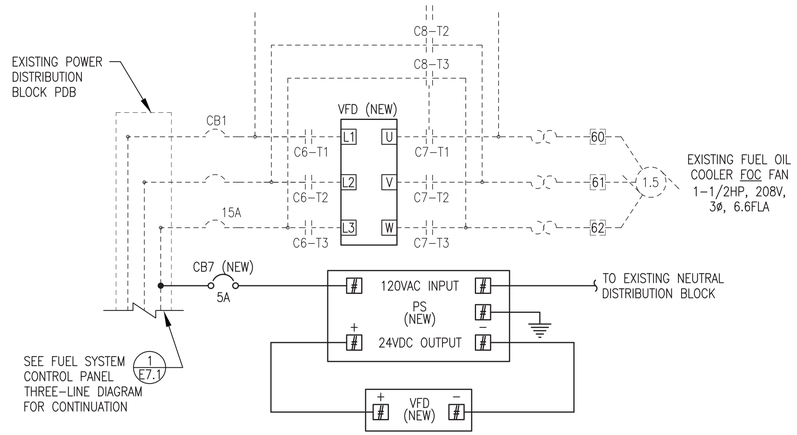
Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

DRAWN BY: JTD | SCALE: AS NOTED
DESIGNED BY: CWV/BCG | DATE: 3/1/23
FILE NAME: AKCHDRA E1–7 | SHEET: E7.1
PROJECT NUMBER:




## 1 E7.2 VFD REPLACEMENT DEMOLITION THREE–LINE DIAGRAM

NO SCALE




## 2 E7.2 VFD REPLACEMENT NEW WORK THREE–LINE DIAGRAM

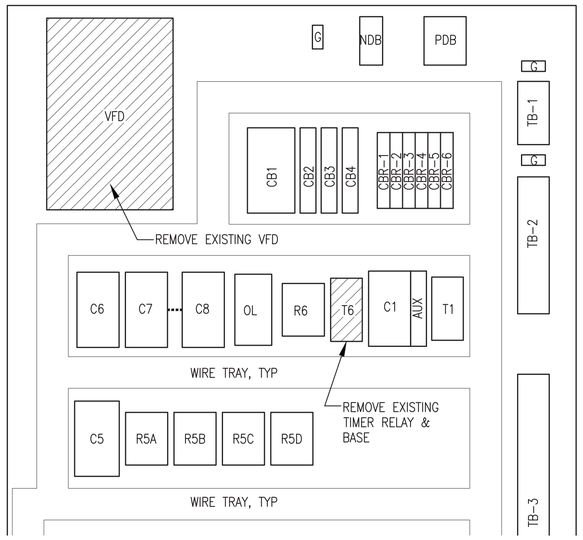
NO SCALE

**GENERAL NOTES:**

1. ALL ITEMS TO REMAIN UNLESS SPECIFICALLY INDICATED FOR REMOVAL. ON DEMOLITION DETAILS HATCHING INDICATES ITEMS TO BE REMOVED.
2. ON NEW WORK DETAILS EXISTING ITEMS TO REMAIN IN SERVICE SHOWN WITH LIGHT DASHED LINES AND NEW ITEMS TO BE INSTALLED SHOWN WITH SOLID LINES.

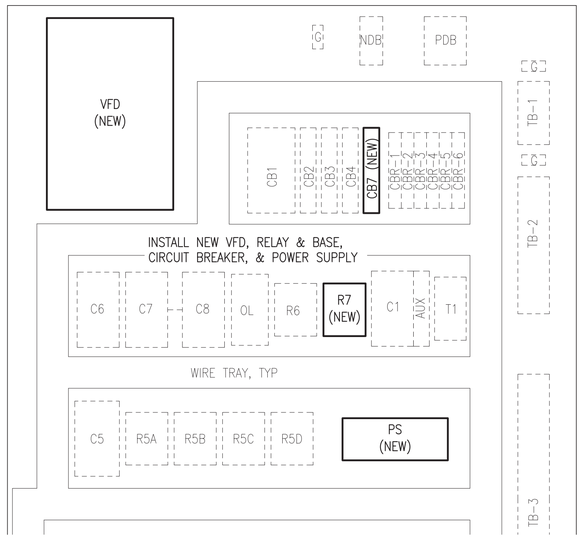
**NEW DEVICE BILL OF MATERIALS**

| TAG | MANUFACTURER | MODEL | DESCRIPTION |
|---|---|---|---|
| CB7 (NEW) | ALLEN–BRADLEY | 1489–M1C050 | 5A, 1P, RAIL MOUNT CIRCUIT BREAKER |
| PS (NEW) | PULS | CP.241–S1 | 5A, 120VAC/24VDC POWER SUPPLY |
| R7 (NEW) | ALLEN–BRADLEY | 700–HA32A1 | 2PDT RELAY, 8 PIN, 10A, 120V COIL |
| | ALLEN–BRADLEY | 700–HN100 | 8 PIN SOCKET BASE |
| VFD (NEW) | SQUARE D | ATV320U22M3C | ALTIVAR ATV320 3 HP, 208V, 3ø VFD |
| | SQUARE D | VW3A1101 | ALTIVAR ATV320 VFD DISPLAY |
| | SQUARE D | VW3A1102 | ALTIVAR ATV320 VFD DISPLAY MOUNT |
| | SQUARE D | VW3A3616 | ALTIVAR ATV320 VFD MODBUS TCP/IP CARD |



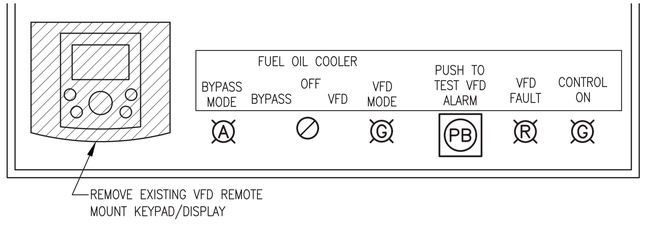

## 3 E7.2 PARTIAL SUB PANEL DEMOLITION LAYOUT

NO SCALE



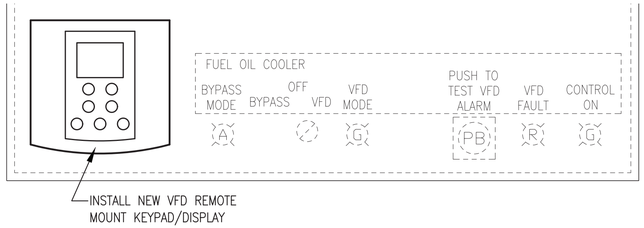

## 4 E7.2 PARTIAL SUB PANEL NEW WORK LAYOUT

NO SCALE




## 5 E7.2 PARTIAL FRONT PANEL DEMOLITION DETAIL

NO SCALE




## 6 E7.2 PARTIAL FRONT PANEL NEW WORK DETAIL

NO SCALE

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
CLOIS W. VERSYP
EE 7802
REGISTERED PROFESSIONAL ENGINEER

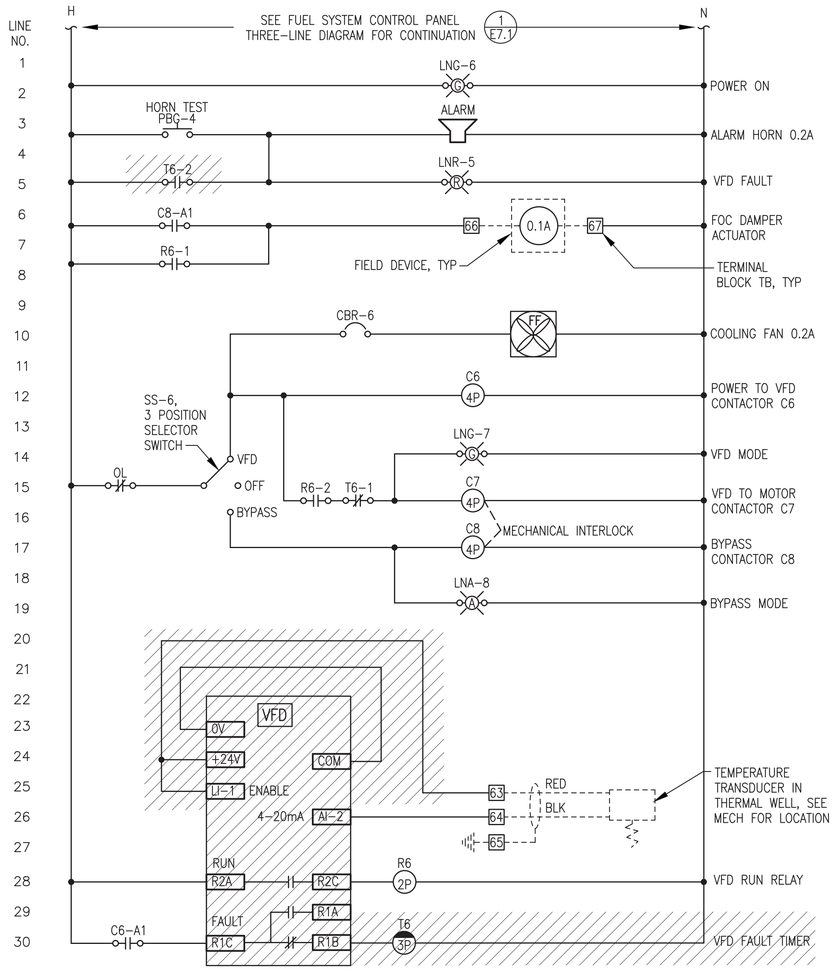
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA–RPSU PROJECT

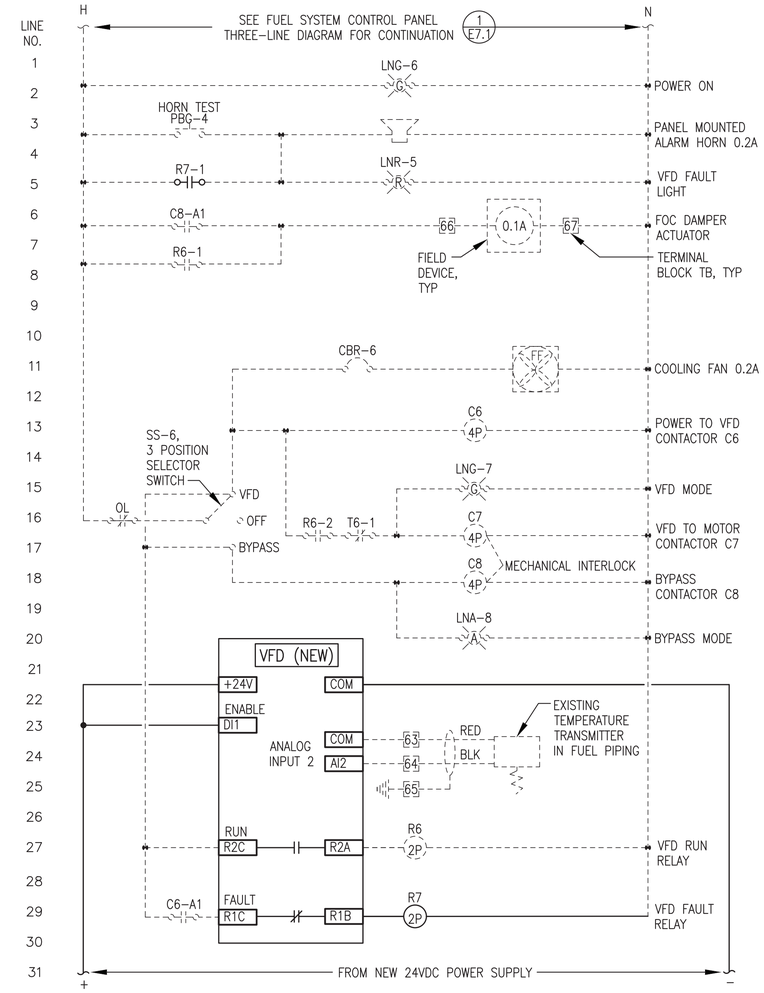
TITLE: EXISTING FUEL SYSTEM CONTROL PANEL
ADD ALT #3 FUEL OIL COOLER FOC–1 VFD REPLACEMENT

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

| | |
|---|---|
| DRAWN BY: JTD | SCALE: AS NOTED |
| DESIGNED BY: CWV/BCG | DATE: 3/1/23 |
| FILE NAME: AKCHDRA E1–7 | SHEET: E7.2 |
| PROJECT NUMBER: | |




1 E7.3 FUEL OIL COOLER VFD DEMOLITION LOGIC DIAGRAM
NO SCALE




2 E7.3 FUEL OIL COOLER VFD NEW WORK REVISION LOGIC DIAGRAM
NO SCALE

## FUEL OIL COOLER VFD SEQUENCE OF OPERATION:

1) WHEN THE CIRCUIT BREAKER IN STATION SERVICE PANEL "SS" AND THE INTERNAL BREAKER CB1 ARE CLOSED POWER IS PROVIDED TO ALL CONTROL DEVICES AND THE "POWER ON" LIGHT IS ON.

2) WHEN THE 3-POSITION SELECTOR SWITCH IS IN THE "OFF" POSITION, THE FAN WILL NOT OPERATE.

3) WHEN THE 3-POSITION SELECTOR SWITCH IS IN THE "BYPASS" MODE, THE FAN WILL OPERATE AT FULL SPEED AND THE "BYPASS MODE" LIGHT WILL BE ON. THE VFD WILL NOT BE IN SERVICE.

4) WHEN THE 3-POSITION SELECTOR SWITCH IS IN THE "VFD" POSITION, THE FAN WILL OPERATE UNDER CONTROL OF THE VFD AND THE "VFD MODE" LIGHT WILL BE ON. THE REMOTE TEMPERATURE SENSOR WILL SENSE FUEL RETURN TEMPERATURE AND SEND A 4-20MA SIGNAL TO THE VFD WHERE 20°F EQUALS 4 MA AND 240°F EQUALS 20 MA. USING ITS INTERNAL PROPORTIONAL CONTROL, THE VFD WILL MODULATE THE FAN SPEED AS REQUIRED TO MAINTAIN FUEL TEMPERATURE AT THE OPERATING SETPOINT. ONCE THE FAN SPEED REACHES A MINIMUM SPEED OF 10% (FIELD ADJUSTABLE), THE VFD WILL MAINTAIN THAT SPEED AS LONG AS THE FUEL TEMPERATURE IS ABOVE THE MINIMUM SETPOINT. AS THE COOLANT TEMPERATURE RISES, THE VFD WILL INCREASE THE SPEED OF THE FAN MOTOR UP TO 100%.

5) WHEN THE FUEL TEMPERATURE IS BELOW THE MINIMUM SETPOINT, THE MOTOR WILL STOP. THE MOTOR WILL REMAIN OFF UNTIL THE TEMPERATURE REACHES THE OPERATING SETPOINT. THE MOTOR WILL START AT MINIMUM SPEED AND RAMP UP TO THE REQUIRED SPEED.

6) THE FOC DAMPER WILL BE OPEN ANY TIME THE FOC FAN RUNS (BOTH VFD AND BYPASS MODES).

7) THE SPEED OF THE FAN MOTOR WILL BE DISPLAYED ON THE REMOTE DISPLAY/KEYPAD MOUNTED ON THE FRONT DOOR OF THE PANEL.

8) IN THE EVENT OF A FAILURE OF THE VFD, AFTER 30 SECONDS THE ALARM HORN WILL SOUND, THE RED "VFD FAULT" LAMP WILL ILLUMINATE, AND THE VFD WILL BE LOCKED OUT. THE FOC FAN CAN BE MANUALLY OPERATED IN BYPASS MODE.

### LEGEND

- R# — CONTROL RELAY
- T# — TIME DELAY RELAY
- C# — CONTACTOR
- [#] — TERMINAL BLOCK
- CB-# — CIRCUIT BREAKER
- R#-# — NORMALLY OPEN CONTACT
- SS-# — 2-POSITION SELECTOR SWITCH
- R#-# — NORMALLY CLOSED CONTACT
- O.L. — OVERLOADS
- PB-# — NORMALLY OPEN MOMENTARY PUSH BUTTON
- PB-# — NORMALLY CLOSED MOMENTARY PUSH BUTTON
- SW-# — NORMALLY OPEN FLOAT SWITCH
- SW-# — NORMALLY CLOSED FLOAT SWITCH
- SV# — SOLENOID VALVE
- ASL-# — ALARM & STROBE LIGHT
- PANEL WIRING
- FIELD WIRING

### GENERAL NOTES:

1. ALL ITEMS TO REMAIN UNLESS SPECIFICALLY INDICATED FOR REMOVAL. ON DEMOLITION DETAILS HATCHING INDICATES ITEMS TO BE REMOVED.
2. ON NEW WORK DETAILS EXISTING ITEMS TO REMAIN IN SERVICE SHOWN WITH LIGHT DASHED LINES AND NEW ITEMS TO BE INSTALLED SHOWN WITH SOLID LINES.

ISSUED FOR CONSTRUCTION
MARCH 2023

STATE OF ALASKA 49TH
CLOIS W. VERSYP
EE 7802
REGISTERED PROFESSIONAL ENGINEER

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK 2023 DERA-RPSU PROJECT

TITLE: EXISTING FUEL SYSTEM CONTROL PANEL
ADD ALT #3 FUEL OIL COOLER FOC-1 VFD REPLACEMENT

Gray Stassel Engineering, Inc.
P.O. 111405, Anchorage, AK 99511 (907)349-0100

| | |
|---|---|
| DRAWN BY: JTD | SCALE: AS NOTED |
| DESIGNED BY: CWV/BCG | DATE: 3/1/23 |
| FILE NAME: AKCHDRA E1-7 | SHEET: E7.3 |
| PROJECT NUMBER: | |

## LEGEND

- GATE VALVE
- BALL VALVE
- CHECK VALVE
- HOSE END DRAIN VALVE
- GAUGE COCK
- AUTOMATIC AIR VENT
- (T) THERMOMETER
- (P) PRESSURE GAUGE
- (S) TEMPERATURE SENSOR
- FLEXIBLE CONNECTOR
- FLANGED JOINT
- UNION
- ELBOW TURNED UP
- ELBOW TURNED DOWN
- PIPING CONNECTION (TEE)
- CHANGE OF PIPE SIZE
- DIRECTION OF FLOW

## ABBREVIATIONS

| | |
|---|---|
| ø | DIAMETER (PHASE) |
| A | AMPS |
| AFF | ABOVE FINISHED FLOOR |
| BTU | BRITISH THERMAL UNIT |
| DFR | DIESEL FUEL RETURN |
| DFS | DIESEL FUEL SUPPLY |
| EWT | ENTERING WATER TEMPERATURE |
| EXIST | EXISTING |
| ECR | ENGINE COOLANT RETURN |
| ECS | ENGINE COOLANT SUPPLY |
| FPT | FEMALE PIPE THREAD |
| GA | GAUGE |
| GALV | GALVANIZED |
| GPM | GALLONS PER MINUTE |
| GRC | GALVANIZED RIGID CONDUIT |
| HP | HORSEPOWER |
| HRR | HEAT RECOVERY RETURN |
| HRS | HEAT RECOVERY SUPPLY |
| ID | INSIDE DIAMETER |
| KW | KILOWATT |
| LT | LIQUID TIGHT |
| LWT | LEAVING WATER TEMPERATURE |
| MAX | MAXIMUM |
| MBH | THOUSAND BTU PER HOUR |
| MIN | MINIMUM |
| MPT | MALE PIPE THREAD |
| NC | NORMALLY CLOSED |
| NO | NORMALLY OPEN |
| OC | ON CENTER |
| OD | OUTSIDE DIAMETER |
| PRV | PRESSURE RELIEF VALVE |
| PSI | POUNDS/PER SQUARE INCH |
| PSID | PSI DIFFERENTIAL |
| PSIG | PSI GAUGE |
| SCH | SCHEDULE |
| TDH | TOTAL DEVELOPED HEAD |
| TYP | TYPICAL |
| UOR | USED OIL RETURN |
| V | VOLTS |
| W | WATTS |
| WG | WATER GAUGE |
| WPD | WATER PRESSURE DROP |

## COOLANT/HEAT RECOVERY EQUIPMENT SCHEDULE

| | | |
|---|---|---|
| CAC-1<br>CAC-2 | GEN #1/#2 CHARGE AIR COOLER | SINGLE PASS, VERTICAL CORE COOLER, 4" FLANGED CONNECTIONS, 3HP MOTOR, 480V, 3PH, 10:1 TURNDOWN RATIO SUITABLE FOR VFD OPERATION. L&M MESABI PART # 115385, OFFSHORE COATING, NO SUBSTITUTES. |
| CAC-3<br>CAC-4 | GEN #3/#4 CHARGE AIR COOLER | SINGLE PASS, VERTICAL CORE COOLER, 4" FLANGED CONNECTIONS, 3HP MOTOR, 480V, 3PH, 10:1 TURNDOWN RATIO SUITABLE FOR VFD OPERATION. L&M MESABI PART # 116282, OFFSHORE COATING, NO SUBSTITUTES. |
| R-1<br>R-2 | REMOTE RADIATOR | SINGLE PASS, VERTICAL CORE RADIATOR, 3" FLANGED CONNECTIONS, 5HP MOTOR, 208V, 3PH, 10:1 TURNDOWN RATIO SUITABLE FOR VFD OPERATION. L&M MESABI PART # 116270, OFFSHORE COATING, NO SUBSTITUTES. |
| HX-1<br>HX-2 | POWER PLANT WATER PLANT HEAT EXCHANGER | 316 STAINLESS STEEL PLATES, ALL BRAZED CONSTRUCTION, 2" NPT PORTS, 250 MBH MIN CAPACITY. AMERIDEX X-10B-100 OR EQUAL. PRIMARY: 50 GPM 195F EWT (50% ETHYLENE GLYCOL) 1.0 PSI MAX WPD SECONDARY: 50 GPM 185F LWT (50% PROPYL. GLYCOL) 1.0 PSI MAX WPD |
| TV-1 | THERMOSTATIC VALVE | 4" ANSI 125# FLAT FACED FLANGES, CAST IRON BODY, FACTORY SET NON-ADJUSTABLE FIELD REPLACEABLE THERMOSTATIC ELEMENTS - 185F NOMINAL TEMPERATURE, FPE #A4010-185, NO SUBSTITUTES. |
| ET-1 | COOLANT EXP. TANK | 24 GALLON CAPACITY STEEL TANK FABRICATED IN ACCORDANCE WITH AEA STANDARD POWER PLANT TANK FABRICATION DETAILS. |
| ET-2 | HEAT RECOV. EXPANSION TANK | HORIZONTAL INSTALLATION BLADDER TYPE EXPANSION TANK, 68 GALLON TANK VOL, 34 GALLON ACCEPTANCE VOL, 100 PSIG WORKING PRES, 12 PSIG PRE-CHARGE. AMTROL AX-120 OR EQUAL. PROVIDE WITH SADDLES. |
| P-HR1 | HEAT RECOV. PRIMARY | 60 GPM AT 8' TDH, 1/3HP, 115V, 1ø. GRUNDFOS UPS 50-40/4, SPEED 3, NO SUBSTITUTES, WITH 2" NPT COMPANION FLANGES, GASKETS, & BOLTS. |
| P-HR2 | HEAT RECOV. SECONDARY | 65 GPM AT 15' TDH, 1/2HP, 115V, 1ø. GRUNDFOS UPS 40-80/4, SPEED 3, NO SUBSTITUTES, WITH 1-1/2" NPT COMPANION FLANGES, GASKETS, & BOLTS. |
| P-HR3 | CONTROL ROOM HEAT | 4 GPM AT 15' TDH, 1/25HP, 115V, 1ø. GRUNDFOS UPS15-58F, SPD 3, NO SUBSTITUTES, WITH 3/4" NPT COMPANION FLANGES, GASKETS, & BOLTS. |
| P-HR4 | SLAB HEAT | 4 GPM AT 15' TDH, 1/25HP, 115V, 1ø. GRUNDFOS UPS15-58F, SPD 3, NO SUBSTITUTES, WITH 3/4" NPT COMPANION FLANGES, GASKETS, & BOLTS. |
| P-HR5 | WATER PLANT HEAT RECOV. | 60 GPM AT 8' TDH, 1/3HP, 115V, 1ø. GRUNDFOS UPS 50-40/4, SPEED 3, NO SUBSTITUTES, WITH 2" NPT COMPANION FLANGES, GASKETS, & BOLTS. |

## FUEL/OIL EQUIPMENT SCHEDULE

| | | |
|---|---|---|
| P-DF1 | DAY TANK FILL PUMP | ROTARY GEAR PUMP, 1/2" FPT INLET AND OUTLET, DUCTILE IRON CONSTRUCTION WITH STAINLESS STEEL SHAFT, BUNA-N LIP SEAL, CARBON BEARINGS, DIRECT FLEX COUPLED TO 1725 RPM ODP THERMALLY PROTECTED, AUTO RESET MOTOR, 1/3 HP, 115 V, 1 PH, 60 HZ, 4.0 GPM @ 20 PSID. OBERDORFER C992M3E5QF50, NO SUBSTITUTES. |
| P-DF2<br>P-DF3<br>P-UO1 | PUMP DOWN, DIESEL CIRC, & USED OIL DRAIN PUMPS | ROTARY GEAR PUMP, 1/2" FPT INLET AND OUTLET, BRONZE CONSTRUCTION WITH STAINLESS STEEL SHAFTS, BUNA-N SEAL, CARBON BEARINGS, DIRECT FLEX COUPLED TO 1150 RPM ODP THERMALLY PROTECTED, AUTO RESET MOTOR, 1/2 HP, 115 V, 1 PH, 60 HZ, 6.6 GPM @ 20 PSID. PROVIDE WITH 40 PSID INTERNAL PRV. OBERDORFER N994RH-J46, NO SUBSTITUTES. |
| P-UO2 | USED OIL INJECTION PUMP | ROTARY GEAR PUMP, 1/8" FPT INLET AND OUTLET, STAINLESS STEEL CONSTRUCTION, PEEK GEARS, PTFE SEALS, MAGNETICALLY COUPLED TO 1750 RPM TEFC THERMALLY PROTECTED, AUTO RESET MOTOR, 1/20 HP, 115 V, 1 PH, 60 HZ., 1.2 GPH @ 15 PSID. MICROPUMP GA-V21.J8FS.A PUMP WITH #82130 MOTOR, NO SUBSTITUTES. |
| HAND PUMP | GLYCOL & DIESEL | DOUBLE ACTION PISTON HAND PUMP, ALUM HOUSING, SS PISTON SHAFT & LINER, BUNA-N SEALS, ANTI-SIPHONING VALVE. GPI MODEL HP-100 NO SUBSTITUTES. |
| FOC-1 | FUEL OIL COOLER | TWO PASS, HORIZONTAL CORE COOLER, 1-1/2" FLANGED CONNECTIONS, 1-1/2HP MOTOR, 208V, 3PH, 10:1 TURNDOWN RATIO SUITABLE FOR VFD OPERATION. L&M MESABI PART # 116224, STANDARD COATING, NO SUBSTITUTES. |

## VALVE TAG SCHEDULE:

VALVE TAGS - 3"x5"x.08" ALUMINUM, 3/16" HOLES IN ALL FOUR CORNERS, BLACK GERBER THERMAL TRANSFER FILM PRINTED LETTERS ON GERBER 220 HIGH PERFORMANCE VINYL BACKGROUND, COLOR AS INDICATED, ONE SIDE ONLY. WARNING LITES OR EQUAL.

GREEN (DIESEL FUEL)

21 "NORMALLY OPEN, CLOSE ONLY FOR EMERGENCIES & TEMPORARY MAINTENANCE OF DAY TANK & DEVICES"
22 "NORMALLY CLOSED, OPEN ONLY FOR HAND PRIMING DAY TANK"
23 "NORMALLY OPEN, CLOSE ONLY FOR TEMPORARY MAINTENANCE OF BLENDER"
24 "NORMALLY OPEN, CLOSE ONLY FOR TEMPORARY MAINTENANCE OF ENGINE"
25 "NORMALLY CLOSED, OPEN ONLY FOR TEMPORARY MAINTENANCE OF OIL COOLER"
26 "NORMALLY OPEN, CLOSE ONLY FOR TEMPORARY MAINTENANCE OF ACTUATOR VALVE"
27 "NORMALLY CLOSED, OPEN ONLY FOR FILLING INTERMEDIATE TANK"

BROWN (USED OIL)

41 "NORMALLY CLOSED, OPEN ONLY FOR ENGINE OIL CHANGE"
42 "FILTER #1, 10 MICRON HYDROSORB"
43 "FILTER #2, 10 MICRON HYDROSORB"
44 "FILTER #3, 2 MICRON PARTICULATE"

PINK (COOLING/ETHYLENE GLYCOL)

51 "NORMALLY CLOSED, OPEN ONLY FOR ADDING COOLANT - ETHYLENE GLYCOL ONLY"
52 "NORMALLY CLOSED, OPEN ONLY ON HIGH COOLANT TEMPERATURE ALARM"
53 "NORMALLY OPEN, CLOSE ONLY ON HIGH COOLANT TEMPERATURE ALARM"
54 "NORMALLY OPEN, RADIATOR PRE-HEAT"

GRAY (HEAT RECOVERY/PROPYLENE GLYCOL)

61 "NORMALLY CLOSED, OPEN ONLY FOR ADDING FLUID - PROPYLENE GLYCOL ONLY"
62 "NORMALLY OPEN, HEAT RECOVERY SUPPLY"
63 "NORMALLY OPEN, HEAT RECOVERY RETURN"
64 "NORMALLY OPEN, HEATING RETURN TO HX"
65 "NORMALLY OPEN, HX TO BOILER"

TOMATO RED (WARNING)

71 "CAUTION: THIS UNIT STARTS AUTOMATICALLY, LOCK & TAG OUT PRIOR TO SERVICE"

INSTALLATION - SECURE EACH TAG TIGHT TO VALVE, PIPE, OR DEVICE WITH STAINLESS STEEL CABLE TIES OR SAFETY WIRE THROUGH ALL FOUR CORNERS OR FASTEN TO ADJACENT WALL OR SECTION OF STRUT WITH SCREWS.

NOTE: FOR ALL VALVES NOT INDICATED WITH A SPECIFIC FUNCTION TAG PROVIDE 1-1/2"ø BRASS TAG LABELED "N.O." FOR NORMALLY OPEN VALVES AND 1"ø BRASS TAG LABELED "N.C." FOR NORMALLY CLOSED VALVES. SECURE TAGS TO VALVE OR ADJACENT PIPE WITH BEADED BRASS CHAIN.

## WARNING SIGN SCHEDULE:

0.08" ALUMINUM, 3/16" HOLES IN ALL FOUR CORNERS. WHITE NON-REFLECTIVE VINYL BACKGROUND, 3M 3650-10, WITH 3M SERIES 225 HIGH PERFORMANCE VINYL LETTERS, COLOR AS INDICATED, ONE SIDE ONLY. 10"x14" UNLESS INDICATED OTHERWISE. WARNING LITES.

WARNING SIGNS - RED LETTERS ON WHITE BACKGROUND.

1 "DANGER - FLAMMABLE, NO SMOKING" (3" HIGH 1/2" STROKE LETTERS-24"x18")

11 "DANGER HIGH VOLTAGE, AUTHORIZED PERSONNEL ONLY"

12 "CAUTION HEARING & EYE PROTECTION REQUIRED"

13 "FUEL OIL DAY TANK ALARM"

14 "IN CASE OF FUEL SPILL CALL DEC 1-800-478-9300"

15 "INTERMEDIATE TANK ALARM"

INFORMATIONAL PLACARDS - BLACK LETTERS ON WHITE BACKGROUND.

16 "TO MANUALLY FILL DAY TANK IN CASE OF EMERGENCY:
1) TURN OFF POWER TO THE DAY TANK CONTROL PANEL
2) MANUALLY OPEN ACTUATOR VALVE AT INTERMEDIATE TANK USING A WRENCH
3) OPEN NORMALLY CLOSED VALVE BY HAND PUMP
4) OPERATE HAND PUMP WHILE MONITORING LEVEL GAUGE"

17 "TO CHANGE ENGINE OIL:
1) LOCK & TAG GENERATOR OUT OF SERVICE
2) OPEN NORMALLY CLOSED DRAIN VALVE AT GEN
3) TURN ON PUMP TIMER & PUMP OUT ENGINE OIL
4) CHANGE FILTER & PLACE OLD ONE IN HOPPER
5) CLOSE DRAIN VALVE & REFILL ENGINE
6) RUN ENGINE, SHUT OFF, & CHECK DIPSTICK
7) TOP OFF & PLACE ENGINE BACK IN SERVICE"

18 "CHECK INTERMEDIATE TANK LEVEL DAILY, FILL WHEN BELOW 5'-0":
1) GO TO TANK FARM & TURN ON CONTROL PANEL POWER
2) VERIFY BULK TANK LEVELS & OPEN TANK VALVES
3) GO TO INTERMEDIATE TANK & OPEN VALVE
5) GO TO INTERMEDIATE TANK CONTROL PANEL & PRESS START BUTTON
6) MONITOR TANK LEVELS CONTINUOUSLY (MAKE SURE BULK TANK AT TANK FARM DOES NOT RUN EMPTY DURING TRANSFER)
7) WHEN INTERMEDIATE TANK LEVEL REACHES 8'-5" PRESS STOP BUTTON
8) CLOSE & LOCK VALVE AT INTERMEDIATE TANK
9) RETURN TO TANK FARM, CLOSE & LOCK VALVES, TURN CONTROL PANEL POWER OFF"

INSTALLATION - SECURE EACH SIGN TO WALL OR DOORS WITH STAINLESS STEEL SHEET METAL SCREWS.

NOTE: SEE FIRE SUPPRESSION PLANS AND SPECIFICATIONS FOR ADDITIONAL PLACARDS TO BE PROVIDED WITH FIRE SUPPRESSION SYSTEM. INSTALL ALL SIGNS AS INDICATED.

## SCHEDULE OF DRAWINGS:



RECORD DRAWING

THESE DRAWINGS HAVE BEEN PREPARED FROM INFORMATION PROVIDED BY OTHERS. THERE IS NO GUARANTEE AS TO THE ACCURACY OR COMPLETENESS OF THE INFORMATION CONTAINED HEREIN.

DATE: 9/28/09

| REV. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| 1 | ADD PUMP P-HR5 & VALVE TAGS 64 & 65 FOR WATER PLANT (M1.7 COMPLETE) | 8/31/07 | BCG |

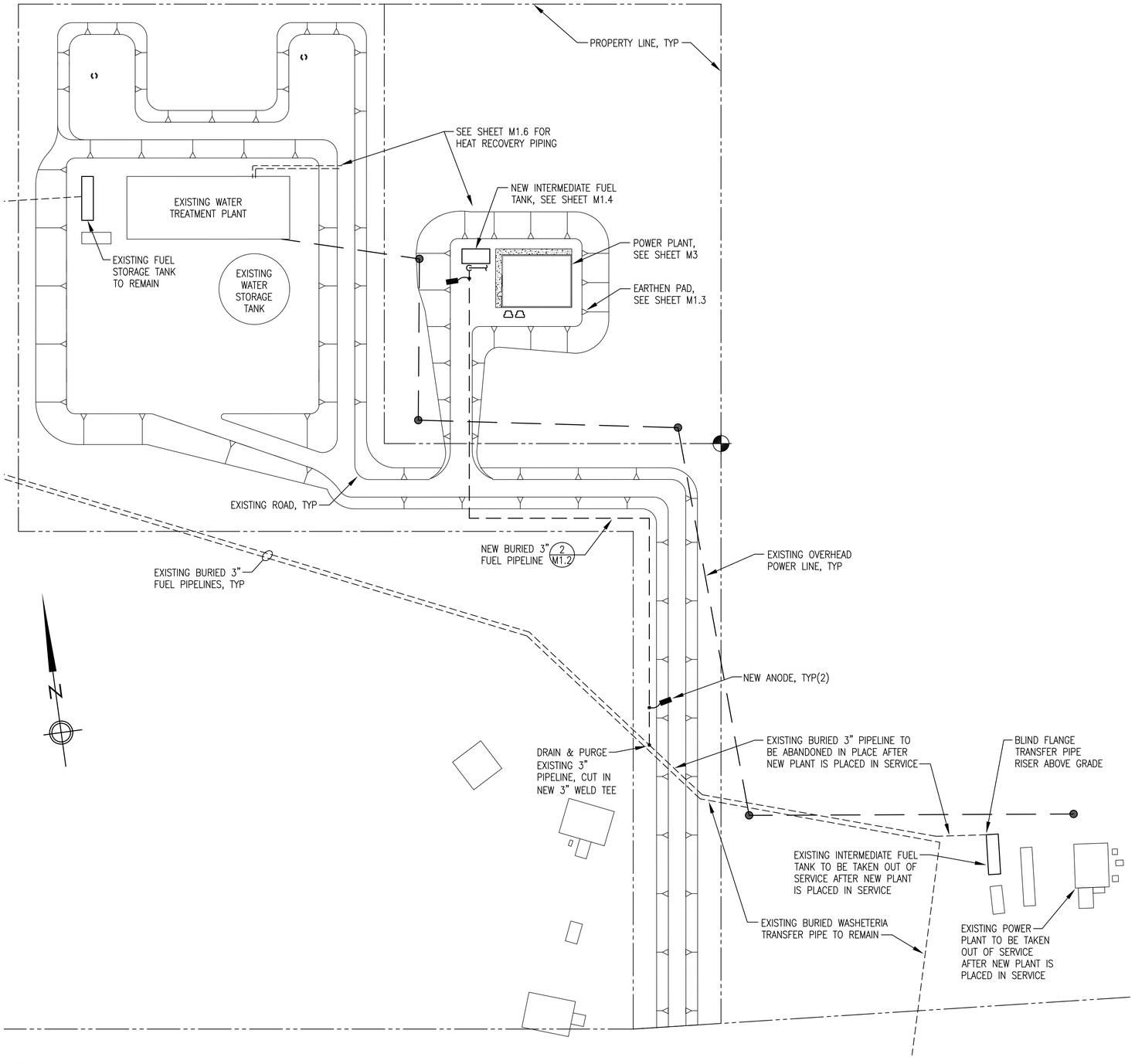

State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY


PROJECT: AKIACHAK POWER SYSTEM UPGRADE

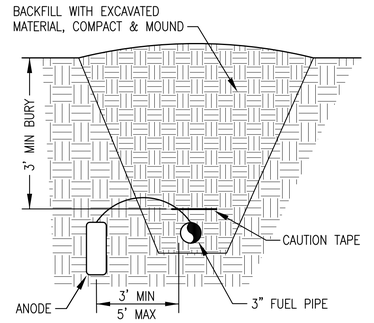
TITLE: LEGEND & SCHEDULES


ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100


| | | | |
|---|---|---|---|
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M1 | SHEET: M1.1 OF 10 |
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |




1 M1.2 OVERALL SITE PLAN
1"=40'




2 M1.2 BURIED FUEL PIPE INSTALLATION
NO SCALE

RECORD DRAWING

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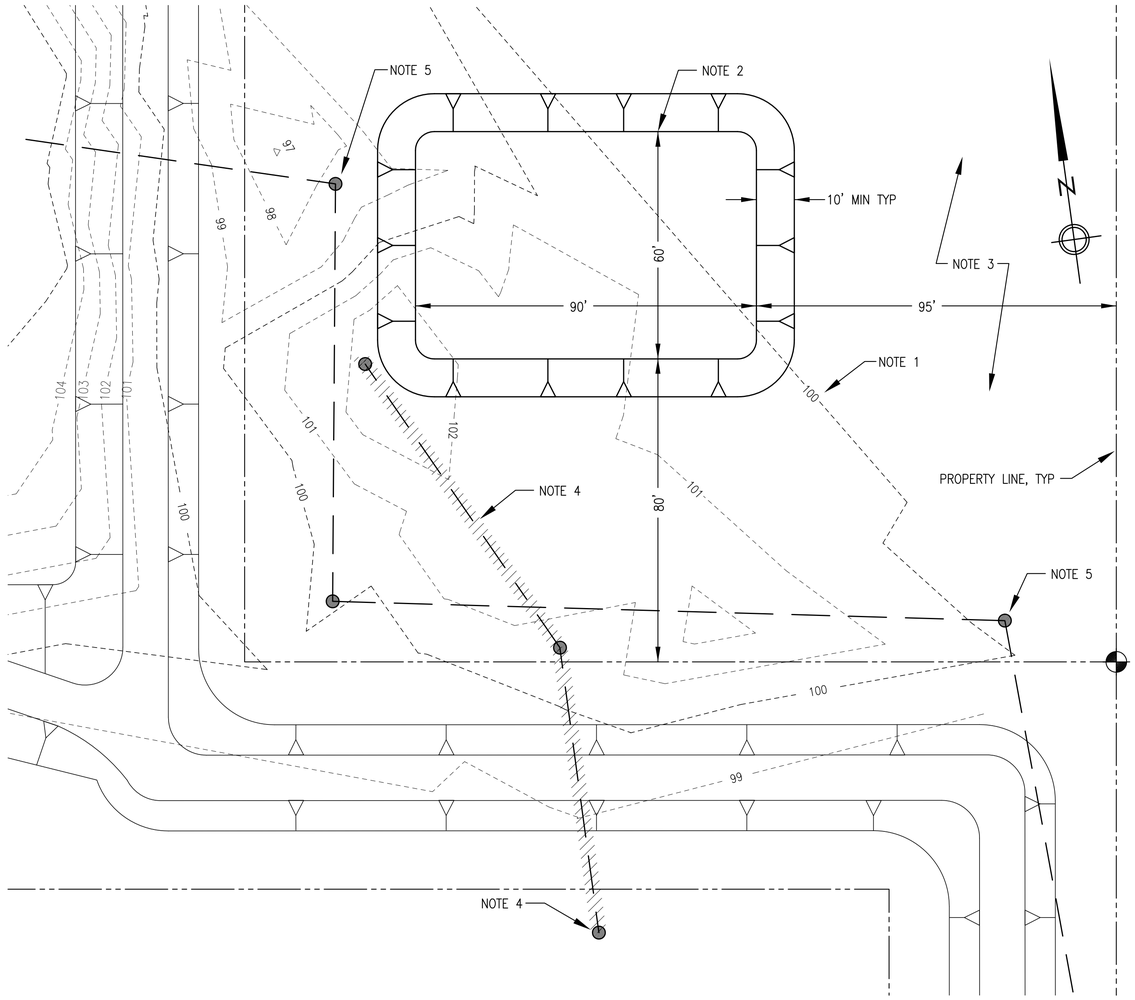
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY


PROJECT: AKIACHAK POWER SYSTEM UPGRADE

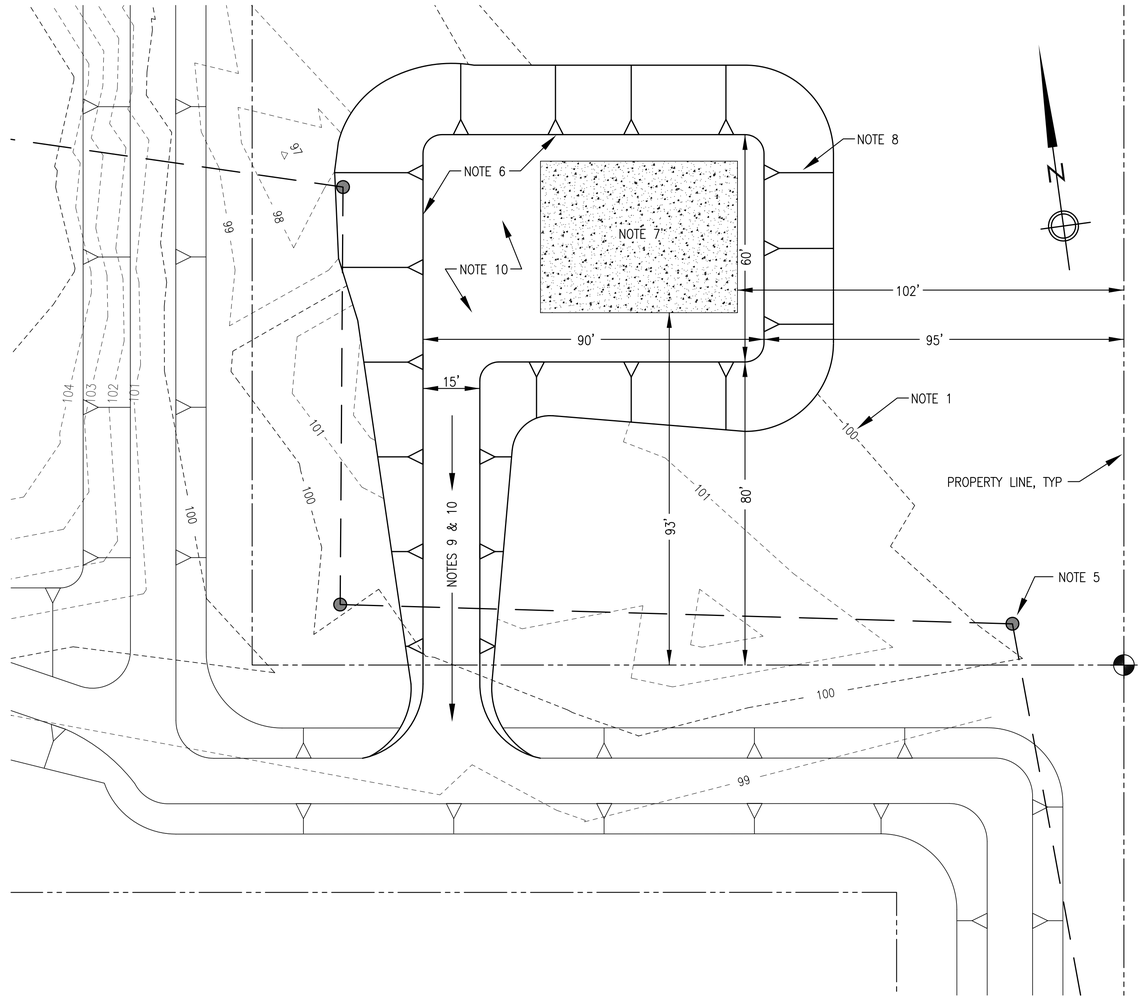
TITLE: OVERALL SITE PLAN & DETAILS


ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100


| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M1 | SHEET: M1.2 OF 10 |
|---|---|---|---|
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |




1 M1.3 SITE DEMOLITION & EXCAVATION PLAN
1"=20'




2 M1.3 GRADING PLAN
1"=20'

## NOTES:

1) EXISTING GROUND SURFACE ELEVATION CONTOUR, TYPICAL. PROJECT BENCH MARK, ELEV=101.25', COE SPIKE DRIVEN HORIZONTALLY INTO UTILITY POLE C26 APPROXIMATELY 200' DOWN RIVER AND ACROSS THE STREET FROM WASHETERIA. SPIKE LOCATED APPROXIMATELY 3" BELOW ROAD FINISH GRADE, AND 50" BELOW THE HIGH WATER MARK SIGN. COE RECOMMENDED BUILDING ELEVATION 107.33'.

2) EXCAVATE AREA INDICATED TO ELEVATION 96.0' TO REMOVE ALL ORGANIC SILT AND SEASONALLY FROST WORKED SILT. COMPACT BOTTOM OF EXCAVATION TO 95% DENSITY AND PLACE WOVEN GEOTEXTILE FABRIC ACROSS ENTIRE EXCAVATED AREA (INCLUDING SIDE SLOPES) PRIOR TO PLACING FILL.

3) TEMPORARILY STOCKPILE EXCAVATED MATERIAL THIS AREA FOR USE AS SURCHARGE ON COMPLETED PAD.

4) DEMOLISH ABANDONED OVERHEAD POWER LINE AND THREE POLES PRIOR TO BEGINNING EXCAVATION.

5) EXISTING OVERHEAD POWER LINE AND POLES TO REMAIN.

6) CONSTRUCT PAD FROM SILTY SAND THAT IS FREE OF ORGANICS. PLACE FILL IN MAXIMUM 12" LIFTS AND COMPACT TO 95% DENSITY. PLACE INTERMEDIATE LAYER OF WOVEN GEOTEXTILE AT APPROXIMATELY ELEVATION 102'. TEMPORARILY GRADE TOP OF PAD AT 107.5' IN FALL OF 2006, PLACE LAYER OF 6 MIL REINFORCED VISQUEEN OVER TOP, AND COVER WITH EXCAVATED MATERIAL TO PROVIDE SURCHARGE OVER WINTER. IN SUMMER 2007 REMOVE SURCHARGE AND VISQUEEN AND REGRADE CONSOLIDATED PAD TO 107.0.

7) 40'x52' CONCRETE SLAB, FINISHED GRADE 107.5'. SEE SHEET S2 FOR SLAB PLAN AND DETAILS.

8) GRADE SIDE SLOPES AT 2.5:1 AND PLACE VEGETATIVE MAT ALL AROUND FOR EROSION CONTROL.

9) GRADE ACCESS ROAD UNIFORMLY FROM TOP OF PAD DOWN TO EXISTING ROAD.

10) COVER ACCESS ROAD AND SOUTHWEST CORNER OF PAD IN FRONT OF PLANT WITH 6" OF GRAVEL.

RECORD DRAWING

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Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: EXCAVATION & GRADING PLANS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M1 | SHEET: M1.3 OF 10 |
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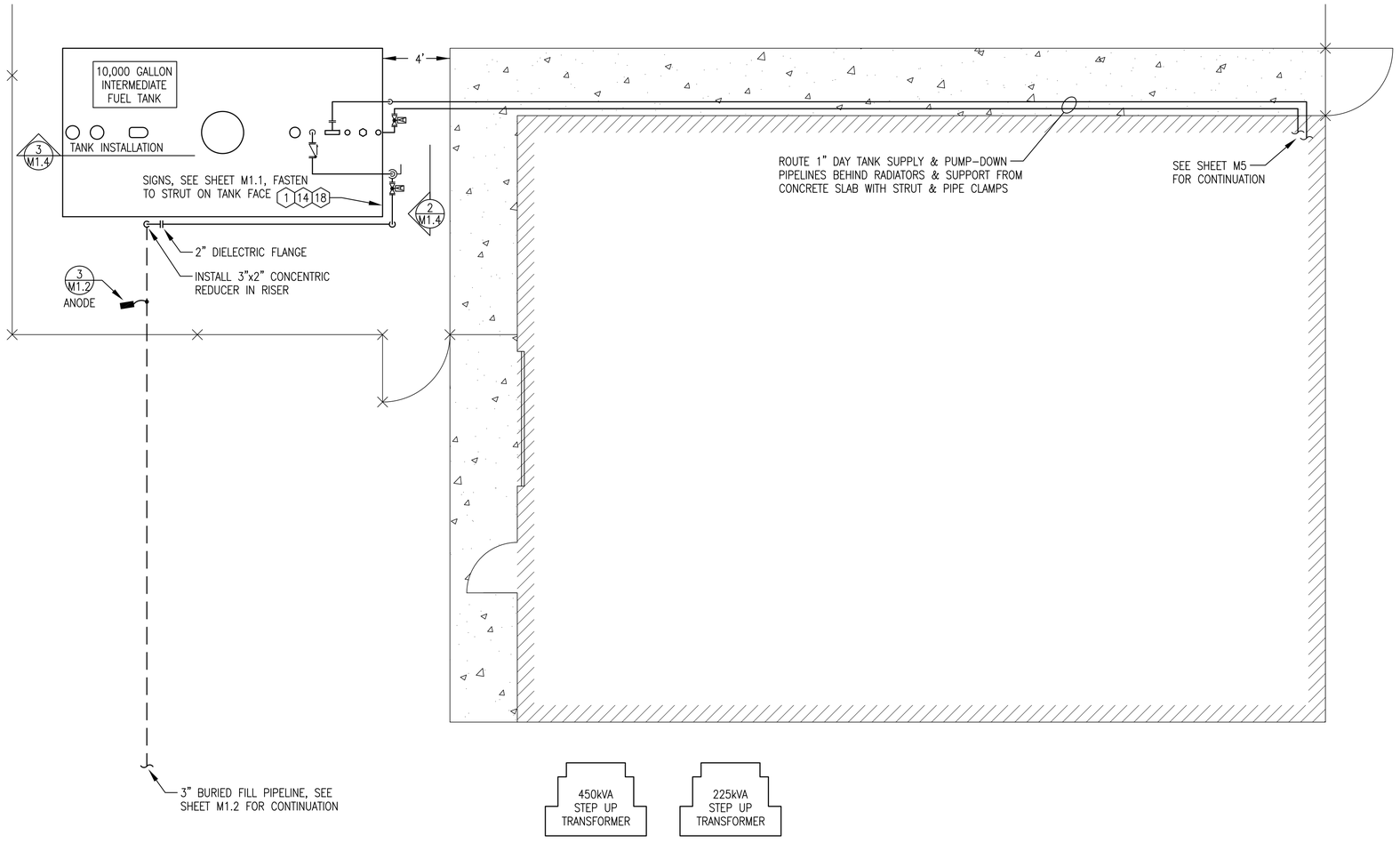
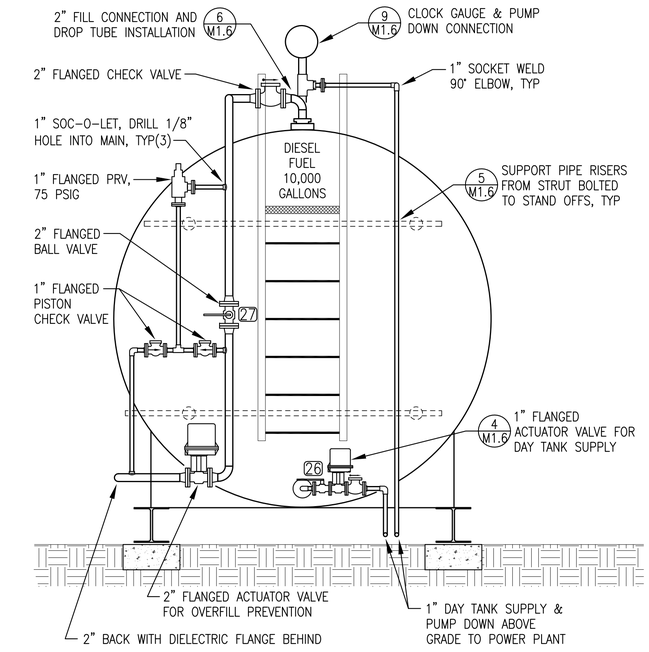
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |



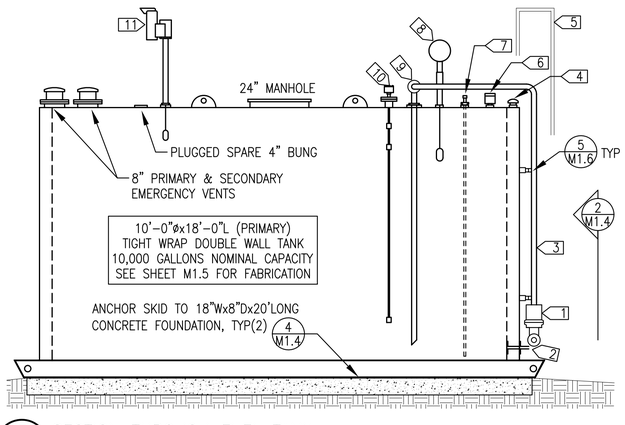

## 1 M1.4 FUEL TANK & PIPING SITE PLAN

1"=4'




## 2 M1.4 FUEL TANK END ELEVATION

1"=2'

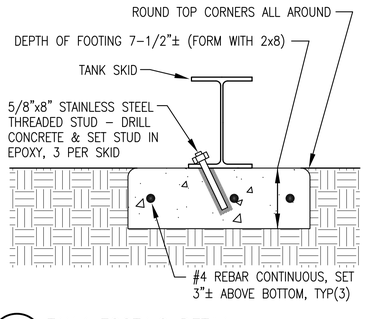



## 3 M1.4 SECTION THROUGH FUEL TANK

1"=3'

### SPECIFIC NOTES:

1. 2" ACTUATOR VALVE IN FILL PIPELINE.
2. 1" ACTUATOR VALVE IN DAY TANK SUPPLY PIPELINE BEHIND.
3. 2" FILL PIPELINE, 1" DAY TANK PUMP-DOWN PIPELINE BEHIND.
4. 2" SECONDARY TANK MONITOR PORT WITH VENT CAP.
5. SHOP FABRICATED BOLT-ON LADDER.
6. 2" FPT GAUGE HATCH ON 2"x4" NIPPLE.
7. 1" WATER DRAW, SEE INSTALLATION DETAIL 7/M1.6.
8. 2" CLOCK GAUGE WITH 1" PUMP DOWN CONNECTION, SEE INSTALLATION DETAIL 9/M1.6, SET RED ARROW AT 8'-5" ABOVE TANK BOTTOM (90% OF TANK CAPACITY) AND GREEN ARROW AT 5'-0" ABOVE TANK BOTTOM (50% OF TANK CAPACITY).
9. 2" FILL CONNECTION WITH FLANGED SWING CHECK VALVE AND DROP TUBE, SEE INSTALLATION DETAIL 6/M1.6.
10. THREE POINT LOW/FULL/OVERFILL LEVEL FLOAT SWITCH, 88" (25%), 23" (90%), AND 11" (95%) ACTUATION LENGTHS, SEE ELECTRICAL, MOUNT ON 2-1/2" FLANGE (FACE OF FLANGE 4" ABOVE PRIMARY TANK).
11. 2" PRESSURE/VACUUM VENT WITH WHISTLE ALARM, INSTALL IN 3" BUNG. SEE INSTALLATION DETAIL 8/M1.6. SET WHISTLE ALARM FLOAT HEIGHT AT 8'-5" ABOVE TANK BOTTOM (90% OF TANK CAPACITY).




## 4 M1.4 TANK FOOTING DETAIL

NO SCALE

RECORD DRAWING

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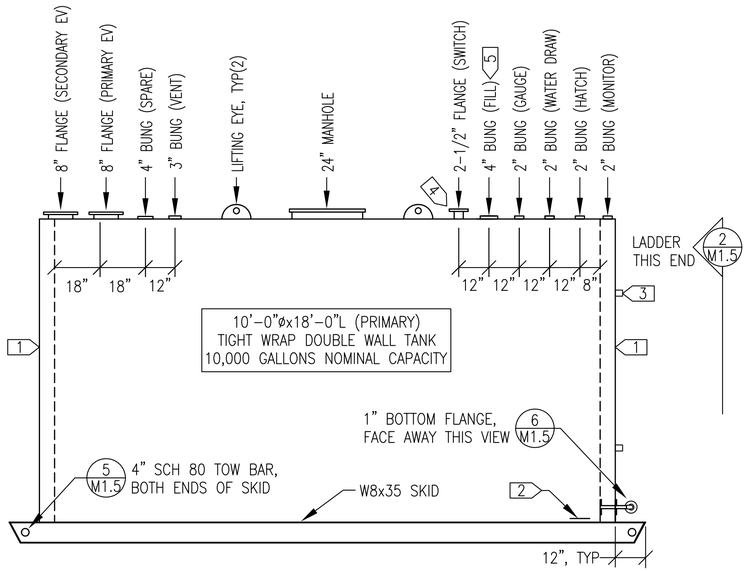
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: FUEL TANK PLAN & DETAILS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

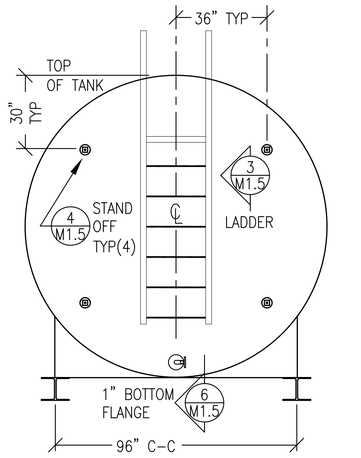
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M1 | SHEET: M1.4 OF 10 |
|---|---|---|---|
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |




1/M1.5 SECTION THROUGH TANK
NO SCALE

## SPECIFIC NOTES

1. 4" HIGH BLACK LETTERING x1/2" STROKE: "DIESEL FUEL 10,000 GALLONS"
2. SEAL WELD 1/4"x10"ø STRIKER PLATE TO TANK BOTTOM DIRECTLY BELOW GAUGE HATCH TOP BUNG. PLATE TO BE ROLLED TO MATCH DIAMETER OF TANK.
3. PIPE SUPPORT STAND OFF, 4 THIS END OF TANK, SEE 2/M1.5 FOR LOCATION & 4/M1.5 FOR FABRICATION.
4. TOP OF FLANGE 4" ABOVE TOP OF PRIMARY TANK.
5. PROVIDE 1/4"x8" DIAMETER DOUBLER PLATE.




2/M1.5 TANK FRONT ELEVATION
NO SCALE

## TANK FABRICATION SPECIFICATIONS

I. SUBMITTALS

PROVIDE SHOP DRAWINGS TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO STARTING FABRICATION. SHOP DRAWINGS TO INDICATE COMPLIANCE WITH ALL REQUIREMENTS OF DRAWINGS AND SPECIFICATIONS INCLUDING JOINT TYPE, CONSTRUCTION DETAILS, ATTACHMENTS, SURFACE PREPARATION, PAINTING, LABELING, ETC.

II. TANKS

PROVIDE SHOP FABRICATED TIGHT-WRAP DOUBLE WALL TANK OF CONFIGURATION, DIMENSION, AND CAPACITY AS INDICATED ON DRAWINGS.

TANK SHALL BE RATED FOR STORAGE OF DIESEL FUEL AT ATMOSPHERIC PRESSURE OVER A TEMPERATURE RANGE FROM -20F TO +80F. MANUFACTURE IN ACCORDANCE WITH U.L. STANDARD 142 AND PROVIDE WITH U.L. LABEL.

TANK SHELL JOINTS TO BE FULL PENETRATION BUTT WELDS OR DOUBLE WELDED FULL FILLET LAP JOINTS, U.L. 142 FIGURE 6.1 NUMBER 2 OR 3. HEAD TO SHELL JOINTS TO BE FULL PENETRATION BUTT WELDS OR DOUBLE WELDED FULL FILLET LAP JOINTS, U.L. 142 FIGURE 6.2 NUMBER 2 OR 6.

PROVIDE WITH INTEGRAL STEEL SADDLE AND SKID FOUNDATION ON ALL TANKS. SADDLES TO BE SEAL WELDED TO TANK - BOLT ON OR STRAP ON SADDLES WILL NOT BE ACCEPTED. PROVIDE MINIMUM 8" DEPTH STEEL "I-BEAM" SKID FOUNDATION OF MINIMUM WEIGHT AS INDICATED ON TANK ELEVATION. SKIDS TO EXTEND 12" BEYOND EACH END OF TANK AND BE PROVIDED WITH 4" DIAMETER SCHEDULE 80 STEEL PIPE TOWBAR AT EACH END. CUT ENDS OF SKIDS AT 45 DEGREE ANGLE AND CAP END WITH PLATE OF WIDTH TO MATCH BEAM FLANGE. COMBINATION SADDLE AND SKID FOUNDATION TO BE DESIGNED TO LIMIT HEIGHT OF TANK BOTTOM TO 10" MAXIMUM ABOVE BOTTOM OF SKIDS AND TO ALLOW DRAGGING OF THE TANK AND LIFTING FROM EITHER END.

PROVIDE WITH ALL OPENINGS AND ATTACHMENTS INDICATED. OPENINGS INDICATED AS FLANGES SHALL BE ANSI 150# PATTERN FLANGES WITH RAISED FACE EXCEPT ON FLOAT SWITCHES AND EMERGENCY VENTS PROVIDE FLAT FACED. OPENINGS INDICATED AS NOZZLES SHALL BE MALE PIPE THREAD, SCHEDULE 40 OR 80 AS INDICATED. OPENINGS INDICATED AS BUNGS SHALL BE FEMALE PIPE THREAD. PROVIDE 1/4" DOUBLER PLATES WHERE INDICATED. FLANGES AND NOZZLES SHALL EXTEND BEYOND TANK SHELL AS DIMENSIONED. MANHOLES SHALL BE 5/16" STEEL LID (SINGLE PUNCH), 1/4" MILD STEEL RING WITH 7" RISER HEIGHT, NOMINAL SIZE AS INDICATED.

INSTALL ALL FLANGES, NOZZLES, AND BUNGS PLUM, LEVEL AND SQUARE TO THE MAIN AXIS OF THE TANK IN ALL THREE PLANES. VERIFY BUNG ORIENTATION WITH PIPE NIPPLE. INSTALL FLANGES WITH BOLT PATTERN SQUARE TO TANK AXES. PIPING CONNECTIONS MORE THAN ONE DEGREE OUT OF ALIGNMENT SHALL BE CUT OUT AND RE-INSTALLED. VERIFY ALIGNMENT PRIOR TO PAINTING.

PROVIDE WITH LADDER AS SHOWN. SHOP FABRICATE LADDER; VERIFY FIT; REMOVE; SANDBLAST AND PAINT EQUIVALENT TO TANK; AND BAND TO PALLET FOR SHIPPING. FURNISH WITH ALL FASTENERS REQUIRED FOR FIELD INSTALLATION. ALL FASTENERS SHALL BE 316 STAINLESS STEEL.

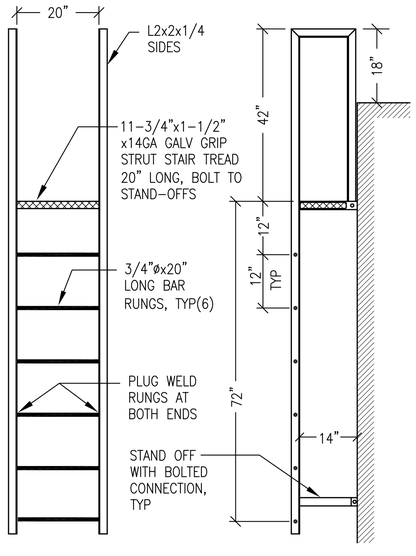
ATTACH ALL COMPONENTS PERMANENTLY WELDED TO THE TANKS, SEAL WELD ALL NON-STRUCTURAL SEAMS, AND ROUND CORNERS AND SHARP EDGES PRIOR TO SANDBLASTING AND PAINTING. REMOVE ALL DETACHABLE COMPONENTS PRIOR TO SANDBLASTING AND PAINTING TANKS AND SANDBLAST AND PAINT DETACHABLE COMPONENTS SEPARATELY.

SANDBLAST TANK AND ALL COMPONENTS IN ACCORDANCE WITH SSPC-SP-6. PAINT WITHIN 4 HOURS OF SANDBLASTING. PAINT WITH TWO COATS OF SELF-PRIMING EPOXY, DEVOE BAR-RUST 236, COLOR WHITE, TO 12 MILS DRY FILM THICKNESS. SUBSTITUTIONS OF PAINT WILL NOT BE ACCEPTED. PERFORM ALL PAINTING IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

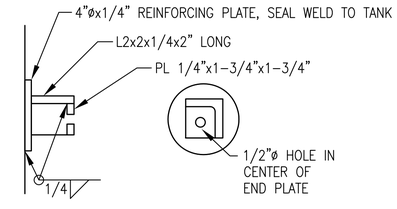
LABEL ENDS OF TANKS AS INDICATED ON TANK ELEVATIONS. LABEL ALL OPENINGS ON TOP OF TANKS WITH MINIMUM 1" HIGH BLACK LETTERS INDICATING FUNCTION AS LISTED IN PARENTHESES ON TANK ELEVATIONS. PROVIDE PERMANENT VINYL LETTERS OR STENCIL WITH POLYURETHANE PAINT.

UPON COMPLETION OF FABRICATION, CLEAN OUT TANK INTERIOR TO REMOVE ALL DEBRIS AND DIRT.

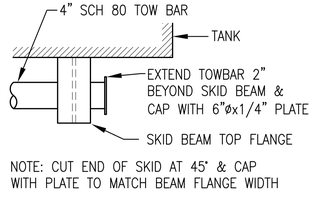
SEAL OPENINGS TO PREVENT ENTRANCE OF WATER AND DIRT PRIOR TO SHIPPING. INSTALL GASKETS ON MANHOLES AND BOLT LIDS TIGHT. BLIND FLANGE ALL FLANGED OPENINGS. PLUG ALL BUNGS WITH THREADED PIPE PLUGS EXCEPT AS NOTED. CAP ALL NOZZLES WITH THREADED PIPE CAPS. PROVIDE TEMPORARY VENTING TO ALLOW FOR NORMAL INTERNAL EXPANSION AND CONTRACTION DUE TO CHANGES IN TEMPERATURE DURING SHIPPING AND STAGING BY INSTALLING A 2-INCH VENT CAP IN A TOP BUNG IN EACH TANK COMPARTMENT, INCLUDING INTERSTITIAL SPACES. VENT CAPS SHALL NOT PROTRUDE ABOVE THE TOP OF THE MANHOLE LID.



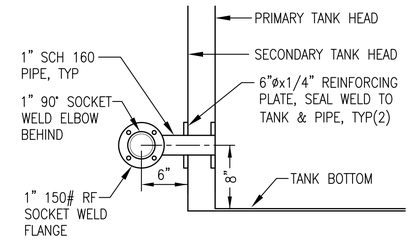

3/M1.5 LADDER FABRICATION
NO SCALE




4/M1.5 TYP. PIPE SUPPORT STAND OFF
NO SCALE




5/M1.5 END OF SKID (TOP VIEW)
NO SCALE




6/M1.5 1" 90° BOTTOM FLANGE
NO SCALE

RECORD DRAWING

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DATE: 9/28/09

State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: TANK FABRICATION DETAILS & SPECIFICATIONS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

| | | | |
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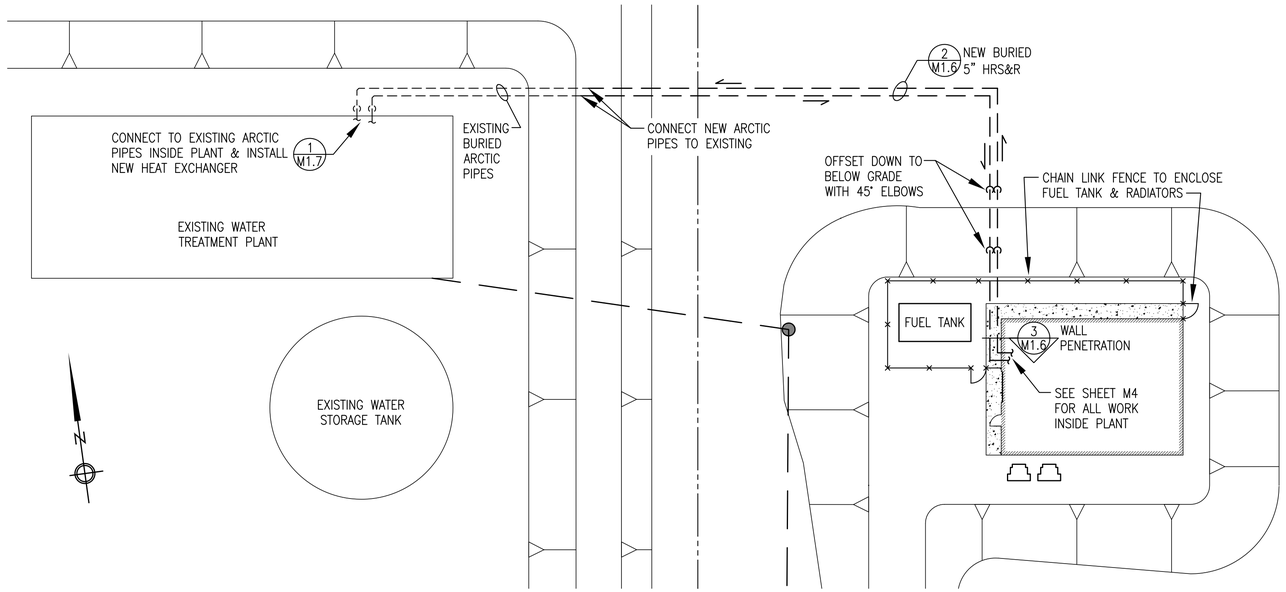
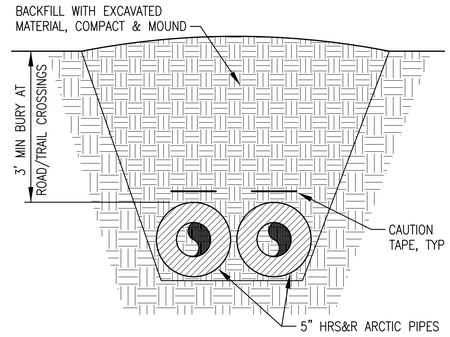
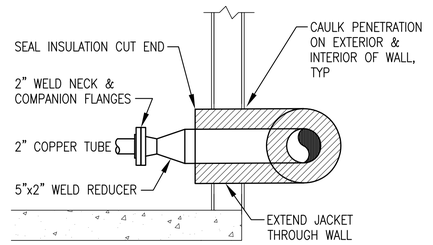
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M1 | SHEET: M1.5 OF 10 |
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |



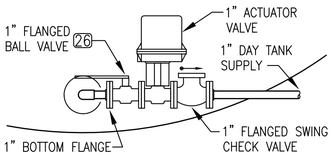

## 1 M1.6 HEAT RECOVERY SITE PLAN
1"=20'



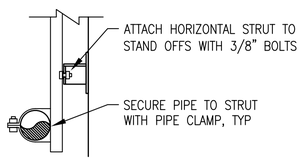

## 2 M1.6 BURIED ARCTIC PIPE INSTALLATION
NO SCALE



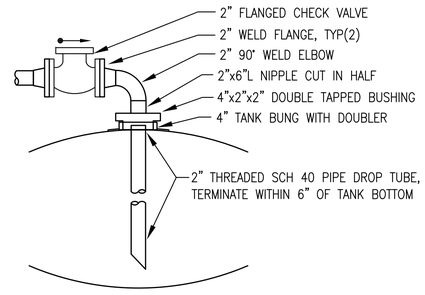

## 3 M1.6 ARCTIC PIPE BUILDING ENTRANCE
NO SCALE



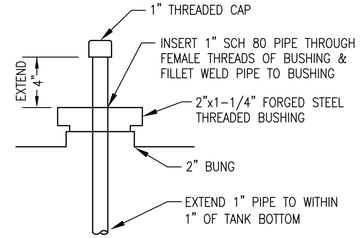

## 4 M1.6 ACTUATOR VALVE INSTALLATION
NO SCALE




## 5 M1.6 TANK HEAD PIPE SUPPORT
NO SCALE

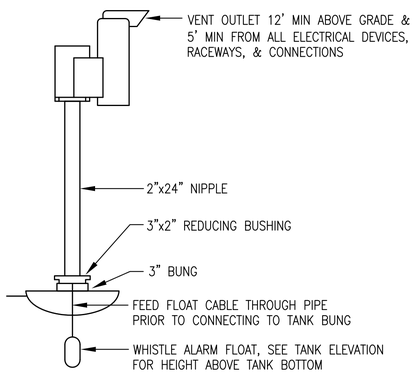



## 6 M1.6 FILL DROP TUBE INSTALLATION
NO SCALE

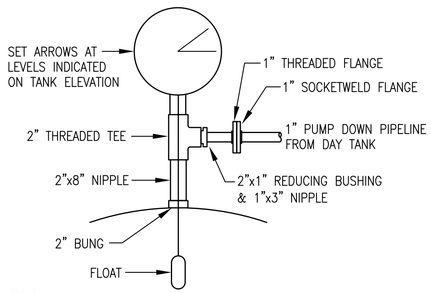



NOTE: TO USE WATER DRAW REMOVE CAP & THREAD BARREL PUMP ONTO PIPE.

## 7 M1.6 WATER DRAW INSTALLATION
NO SCALE




## 8 M1.6 PRESS/VAC/WHISTLE VENT INSTALLATION
NO SCALE




NOTES:
1) FEED FLOAT CABLE THROUGH NIPPLE PRIOR TO CONNECTING TO TANK.
2) GREASE FLOAT PRIOR TO INSTALLING IN TANK TO PREVENT FREEZING TO BOTTOM.
3) CALIBRATE GAUGE AFTER FILLING TANK AND VERIFY WITH MANUAL GAUGING ROD OR TAPE.
4) ENSURE THAT BACK COVER PLATE IS PROPERLY SEALED AFTER REASSEMBLY (ANY LOOSENESS OR RATTLING WHEN TAPPED INDICATES A POOR SEAL).

## 9 M1.6 CLOCK GAUGE INSTALLATION
NO SCALE

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Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: HEAT RECOVERY SITE PLAN, HEAT RECOVERY & FUEL TANK DETAILS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

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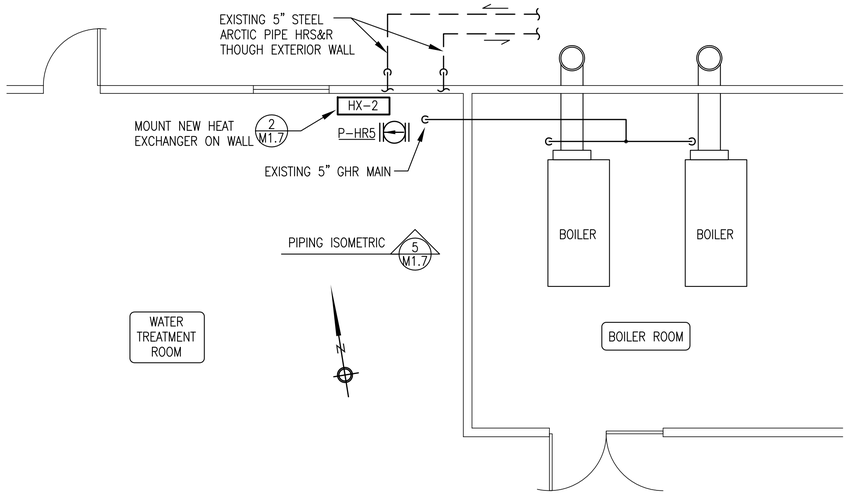
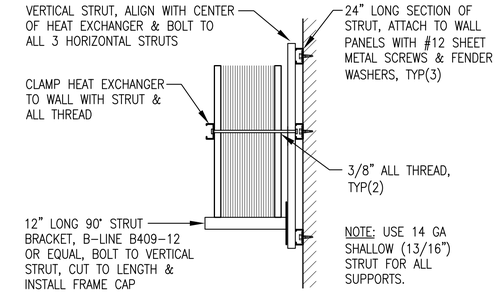
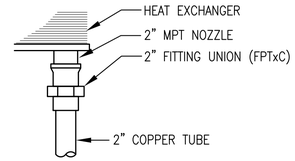
|---|---|---|---|
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |



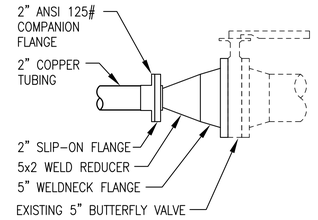

## 1 M1.7 WATER PLANT HEAT RECOVERY PIPING PLAN
1/4"=1'-0"



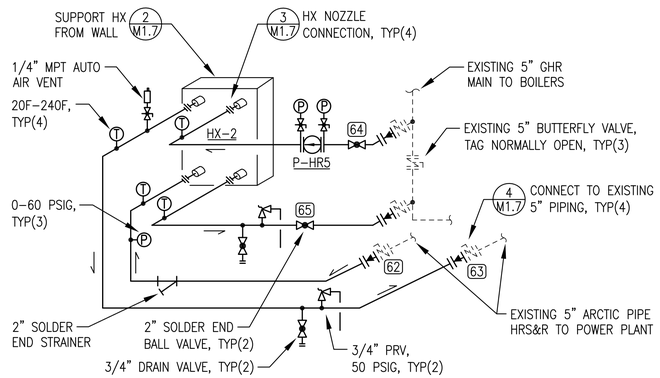

## 2 M1.7 HEAT EXCHANGER SUPPORT FROM WALL
NO SCALE




## 3 M1.7 TYPICAL HX CONNECTION
NO SCALE



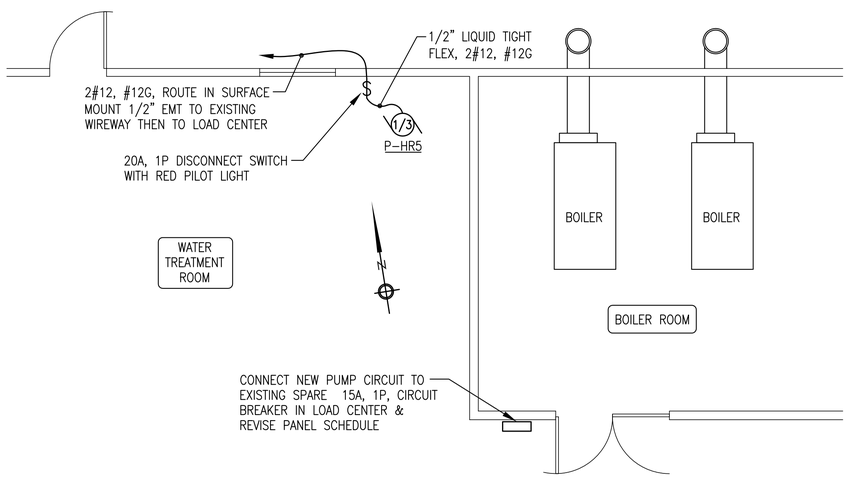

## 4 M1.7 TYPICAL 5" PIPE CONNECTION
NO SCALE




## 5 M1.7 WATER PLANT HEAT RECOVERY PIPING ISOMETRIC
NO SCALE

### NOTES:

1) ALL NEW PIPING TYPE "L" HARD DRAWN COPPER WITH SOLDER JOINTS. ALL PIPING 2"ø UNLESS NOTED OTHERWISE.
2) MAKE ALL CONNECTIONS FOR INSTRUMENTATION, VENTS, AND DRAINS WITH 3/4" T-DRILL TAP AND 3/4" FITTING ADAPTER (FTGxFPT). SEE DETAIL 4/M4 SIMILAR. INSTALL THREADED BRASS REDUCING BUSHINGS AS REQUIRED
3) INSTALL 3/4" NPT THERMAL WELLS FOR THERMOMETERS.




## 6 M1.7 HEAT RECOVERY PUMP POWER PLAN
1/4"=1'-0"

RECORD DRAWING

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813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: HEAT RECOVERY PLANS & DETAILS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

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| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M1 | SHEET: M1.7 OF 10 |
| DESIGNED BY: BCG | DATE: 8/31/07 | PROJECT NUMBER: 06-02-9551 | |

** GENERAL CONDITIONS **

PERFORM ALL WORK IN ACCORDANCE WITH THE LATEST ADOPTED EDITIONS OF THE INTERNATIONAL FIRE CODE AND THE INTERNATIONAL BUILDING CODE INCLUDING STATE OF ALASKA AMENDMENTS. COMPLY WITH ALL APPLICABLE STATE AND FEDERAL REGULATIONS.

THE DRAWINGS ARE DIAGRAMMATIC AND DO NOT NECESSARILY SHOW ALL FEATURES OF THE REQUIRED WORK. PROVIDE ALL EQUIPMENT AND MATERIALS REQUIRED FOR A COMPLETE SYSTEM. VERIFY EXISTING FIELD CONDITIONS PRIOR TO STARTING CONSTRUCTION. IMMEDIATELY CONTACT THE ENGINEER FOR CLARIFICATION OF QUESTIONABLE ITEMS OR APPARENT CONFLICTS.

ALL EQUIPMENT AND MATERIALS SHOWN ARE NEW UNLESS SPECIFICALLY INDICATED AS EXISTING. WHERE ADDITIONAL OR REPLACEMENT ITEMS ARE REQUIRED, PROVIDE LIKE ITEMS BY THE SAME MANUFACTURER TO THE MAXIMUM EXTENT PRACTICAL. INSTALL ALL MATERIALS IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS AND INSTRUCTIONS, UNLESS INDICATED OTHERWISE.

PROTECT ALL MATERIALS AND EQUIPMENT DURING THE ENTIRE DURATION OF CONSTRUCTION WORK AGAINST CONTAMINATION OR DAMAGE. REPLACE OR REPAIR TO ORIGINAL MANUFACTURED CONDITION ANY ITEMS DAMAGED DURING CONSTRUCTION. IMMEDIATELY REPORT TO THE ENGINEER ANY ITEMS FOUND DAMAGED PRIOR TO COMMENCING CONSTRUCTION.

PERFORM WORK WITH SKILLED CRAFTSMEN SPECIALIZING IN SAID WORK. INSTALL ALL MATERIALS IN A NEAT, ORDERLY, AND SECURE FASHION, AS REQUIRED BY THESE SPECIFICATIONS AND COMMONLY RECOGNIZED STANDARDS OF GOOD WORKMANSHIP.

DO NOT CUT, DRILL, OR NOTCH STRUCTURAL MEMBERS UNLESS SPECIFICALLY APPROVED BY THE ENGINEER. MINIMIZE PENETRATIONS AND DISRUPTION OF BUILDING FEATURES. WHERE PREVIOUSLY COMPLETED BUILDING SURFACES OR OTHER FEATURES MUST BE CUT, PENETRATED, OR OTHERWISE ALTERED, SUCH WORK SHALL BE CAREFULLY LAID OUT AND PATCHED TO ORIGINAL CONDITION. SEAL ALL EXTERIOR FLOOR AND WALL PENETRATIONS AS INDICATED.

CONTACT THE ENGINEER ONE-WEEK PRIOR TO COMPLETION OF ALL WORK TO SCHEDULE A SUBSTANTIAL COMPLETION INSPECTION. THE ENGINEER WILL GENERATE A PUNCH LIST OF CORRECTIVE ACTION ITEMS DURING THE INSPECTION. WORK WILL NOT BE CONSIDERED COMPLETE UNTIL ALL CORRECTIVE ACTION ITEMS IN THE ENGINEERS PUNCH LIST HAVE BEEN SATISFACTORILY COMPLETED AND PHOTOGRAPHIC OR OTHER POSITIVE DOCUMENTATION HAS BEEN PROVIDED TO THE ENGINEER.

PROVIDE ONE SET OF DRAWINGS CLEARLY MARKED UP WITH ALL AS-BUILT INFORMATION TO THE ENGINEER WITHIN TWO WEEKS OF COMPLETION.

** SPECIAL CONDITIONS **

ENSURE THAT APPROPRIATE SAFETY MEASURES ARE IMPLEMENTED AND THAT ALL WORKERS ARE AWARE OF THE POTENTIAL HAZARDS FROM ELECTRICAL SHOCK, BURN, ROTATING FANS, PULLEYS, BELTS, HOT MANIFOLDS, NOISE, ETC. ASSOCIATED WITH WORKING NEAR POWER GENERATION AND CONTROL EQUIPMENT.

** SUPPORTS AND FASTENERS **

SUPPORT PIPING AND EQUIPMENT AS SHOWN ON PLANS USING SPECIFIED SUPPORTS AND FASTENERS. IF NOT DETAILED ON PLANS, SUPPORT FROM STRUCTURAL MEMBERS WITH PIPE HANGERS, CLAMPS, OR PIPE STRAPS SPECIFICALLY INTENDED FOR THE APPLICATION. DO NOT SUPPORT PIPING FROM CONNECTIONS TO EQUIPMENT. INDEPENDENTLY SUPPORT PUMPS AND EQUIPMENT.

STRUT - COLD FORMED MILD STEEL CHANNEL STRUT, HOT DIPPED GALVANIZED FINISH AND SLOTTED BACK UNLESS SPECIFICALLY INDICATED OTHERWISE. STANDARD STRUT - 12 GA, 1-5/8" x 1-5/8", B-LINE B22-SH-GALV OR EQUAL. DOUBLE STRUT - 12 GA, 1-5/8" x 3-1/4", B-LINE B22A-SH-GALV OR EQUAL. SHALLOW STRUT - 14 GA, 1-5/8" x 13/16", B-LINE B54-SH-GALV OR EQUAL. WHERE STRUT IS WELDED TO TANKS OR STRUCTURES PROVIDE PLAIN (UN-FINISHED BLACK) SOLID BACK STRUT - 12 GAUGE, 1-5/8" x 1-5/8", B-LINE B22-PLN OR EQUAL.

FITTINGS AND ACCESSORIES - PROVIDE FITTINGS, BRACKETS, CHANNEL NUTS, AND ACCESSORIES DESIGNED SPECIFICALLY FOR USE WITH SPECIFIED CHANNEL STRUT. GALVANIZED OR ZINC-PLATED CARBON STEEL.

PIPE CLAMPS - TWO-PIECE PIPE CLAMP DESIGNED TO SUPPORT PIPE TIGHT TO STRUT. B-LINE B20## OR EQUAL. ZINC-PLATED CARBON STEEL.

PIPE STRAPS - CARBON STEEL TWO-HOLE PIPE STRAP. B-LINE B2400 OR EQUAL.

FASTENERS - ALL BOLTS, NUTS, AND WASHERS ZINC PLATED ZINC-PLATED EXCEPT WHERE SPECIFICALLY INDICATED AS STAINLESS STEEL.

CABLE TIES - TYPE 304 STAINLESS STEEL SELF-LOCKING TIES, 14" NOMINAL LENGTH, PANDUIT MLT4S-CP OR EQUAL.

** PAINTING **

PAINTING - PAINT ALL CARBON STEEL PIPE AND FABRICATIONS AND ALL COPPER PIPE THAT IS NOT INSULATED. AFTER COMPLETION OF FABRICATION, SANDBLAST OR WIRE BRUSH TO BARE METAL AND WIPE DOWN WITH SOLVENT. ETCH COPPER PIPE WITH ACID. PRIME WITH UNIVERSAL RED OXIDE PRIMER, DEVOE RUSTGUARD 4140 OR EQUAL, COLOR RED, TO 1.5 MILS DRY FILM THICKNESS. PAINT WITH TWO COATS OF ALKYD ENAMEL, DEVOE 4308 OR EQUAL, COLOR DC2534 MEDIUM GRAY EXCEPT WHERE INDICATED OTHERWISE.

TOUCH UP - FINISH ALL CUT ENDS AND DAMAGED SURFACES OF GALVANIZED AND ZINC PLATED SUPPORTS AND FASTENERS WITH SPRAY ON COLD GALVANIZING COMPOUND, ZRC OR EQUAL. TOUCH UP PAINT ON FABRICATED ITEMS TO MATCH ORIGINAL.

** INSULATION **

LOW TEMPERATURE INSULATION - INSULATE GLYCOL COOLANT PIPING MAINS AND CHARGE AIR COOLING SUPPLY TUBING WHERE INDICATED. INSTALL 1" PRE-FORMED RIGID FIBERGLASS PIPE INSULATION, JOHNS-MANVILLE MICRO-LOK OR EQUAL.

MEDIUM TEMPERATURE INSULATION - INSULATE EXHAUST PIPES WHERE INDICATED. INSTALL 1" PRE-FORMED RIGID MINERAL WOOL PIPE INSULATION, ROXUL TECHTON 1200 OR EQUAL.

JACKET - INSTALL ALUMINUM JACKET OVER ALL PIPE INSULATION. EXTERIOR GRADE CORRUGATED 0.016" THICK ALUMINUM JACKETING WITH PRE-FORMED ALUMINUM FITTING COVERS, PABCO OR EQUAL.

** OIL PIPING AND VALVES **

OIL PIPING (DFR, DFS, UOR) - ASTM A106B SCHEDULE 80 SEAMLESS BLACK STEEL PIPE. BUTT WELD JOINTS FOR ALL PIPE 2" DIAMETER AND LARGER. SOCKET WELD OR THREADED JOINTS FOR ALL PIPING SMALLER THAN 2" DIAMETER WITH MINIMUM 3000# FORGED STEEL FITTINGS. PERFORM PIPE WELDING WITH EXPERIENCED WELDER WITH CURRENT API OR EQUIVALENT CERTIFICATION FOR PIPE WELDING IN ALL POSITIONS. PROVIDE SPIRAL WOUND METALLIC GASKETS AND COAT WITH ANTI SEIZE COMPOUND PRIOR TO ASSEMBLING FLANGED JOINTS. REAM THREADED PIPE ENDS AND THOROUGHLY COAT MALE PIPE ENDS WITH HERCULES GRIPP PIPE JOINT COMPOUND PRIOR TO ASSEMBLING. TEST ALL FUEL OIL PIPING JOINTS WITH MINIMUM 50 PSIG AIR, WITH EACH JOINT SOAKED WITH A FOAMING SOAPY WATER SOLUTION, AND VISUALLY INSPECT EACH JOINT FOR LEAKS.

FLEXIBLE CONNECTORS - TYPE 321 STAINLESS STEEL CORRUGATED HOSE, TYPE 304 STAINLESS STEEL WIRE DOUBLE BRAIDED OUTER SHIELD. SCH 80 MPT OR 150# ANSI FLANGED ENDS (FIXED OR FLOATING AS INDICATED) 125 PSIG MINIMUM WORKING PRESSURE, DIAMETER AND LIVE (HOSE) OR OVERALL LENGTH AS INDICATED. PENFLEX PW 721 OR EQUAL. FURNISH WITH CERTIFICATION OF MINIMUM 125 PSIG PRESSURE TEST.

SMALL HOSES - FUEL RATED HOSE, EATON WEATHERHEAD H569 OR EQUAL. SIZE AS INDICATED ON DRAWINGS. PROVIDE RE-USABLE PLATED STEEL JIC SWIVEL ENDS, STRAIGHT OR 90° AS REQUIRED, WITH NPT ADAPTERS.

FLANGED BALL VALVES - REDUCED PORT CARBON STEEL UNI-BODY, ANSI 150# RF FLANGED ENDS, STAINLESS STEEL BALL AND TRIM, GLASS FILLED TEFLON SEAT, GRAPHITE SEALS, LOCKABLE HANDLE, 150 PSIG MINIMUM WORKING PRESSURE, NACE MR0175 CONFORMANCE, FIRE SAFE PER API 607. PBV C-5410-31-2236-FTNL, NO SUBSTITUTES.

THREADED BALL VALVES - CARBON STEEL BODY, THREADED ENDS, STAINLESS STEEL BALL AND TRIM, PTFE SEAT, GRAPHITE SEALS, LOCKABLE HANDLE, 150 PSIG MINIMUM WORKING PRESSURE, NACE MR0175 CONFORMANCE, FIRE SAFE PER API 607. PBV C-5312-38-2236-TL-NC OR S-5322-38-2236-TL-NC, NO SUBSTITUTES.

FLANGED SWING CHECK VALVES (2" AND LARGER) - CARBON STEEL BODY, ANSI 150# RF FLANGED ENDS, STEEL DISC AND TRIM, 150 PSIG MINIMUM WORKING PRESSURE. CRANE CLASS 150 NO. 147 OR EQUAL.

FLANGED SWING CHECK VALVES (SMALLER THAN 2") - CARBON STEEL BODY, ANSI 150# RF FLANGED ENDS, STAINLESS STEEL TRIM AND SEATS, 150 PSIG MINIMUM WORKING PRESSURE. BONNEY FORGE L1-61 OR EQUAL.

THREADED CHECK VALVES - BRONZE BODY, THREADED ENDS, SWING CHECK STYLE, 150 PSIG MINIMUM WORKING PRESSURE. MILWAUKEE 510-S OR HAMMOND EQUAL, DOMESTIC ONLY.

FLANGED PRESSURE RELIEF VALVES - STEEL BODY, ANSI 150# RAISED FACE FLANGE INLET AND OUTLET, 1/2" SOFT SEAT ORIFICE, CLOSED CAP, SIZE AND PRESSURE SETTING AS INDICATED. HYDROSEAL 1FLARV00 OR EQUAL.

THREADED PRESSURE RELIEF VALVES -
1" SIZE - STEEL BODY, MPT INLET X FPT OUTLET, CLOSED CAP, SIZE AND PRESSURE SETTING AS INDICATED, HYDROSEAL 4FRV00 OR EQUAL.
1/4" SIZE - BRONZE BODY, FPT INLET AND OUTLET, PRESSURE SETTING AS INDICATED, KINGSTON 112C OR EQUAL.

FUSIBLE LINK VALVES - BRASS BODY, FPT ENDS, 165F FUSIBLE HEAD. FIROMATIC 200F FOR 1/2", FIROMATIC 400F FOR 1", OR EQUAL.

SOLENOID VALVES- 1/2" THREADED END BRASS BODY, 1/2" NPT CONDUIT CONNECTION, 120VAC, SS CORE, MOLDED EPOXY COIL ENCLOSURE, INTERNAL PILOT OPERATED, 150 PSI DIFFERENTIAL OPENING PRESSURE, LIQUID TIGHT AND FULL MODULATION AT 0 PSI DIFFERENTIAL.
NORMALLY CLOSED - ASCO CAT. NO. 8210G94, NO SUBSTITUTES.
NORMALLY OPEN - ASCO CAT. NO. 8210G34, NO SUBSTITUTES.

ELECTRIC ACTUATOR VALVES - NUTRON LOW TEMP BALL VALVE, NO SUBSTITUTES. 1" SIZE - T3-R10R01LZ-06, 2" SIZE - T3-R20R01LZ-05. ELECTRIC ACTUATOR - NEMA 4 ENCLOSURE WITHOUT MANUAL OVERRIDE SHAFT EXTENSION, RCS, NO SUBSTITUTES. PTC SELF REGULATING HEATER, EXXON BEACON 325 SEVERE COLD LUBRICANT, 115 VAC, 350 IN-LBS TORQUE, 10 SECOND STROKE TIME, RATED TO -50 DEG F. 1" SIZE - MODEL SXR-0897, 2" SIZE - MODEL SXR-0994. ACTUATOR COUPLING BRACKET, SHAFT, AND FASTENERS - TYPE 304 STAINLESS STEEL. CONFIGURE COUPLING TO ALLOW WRENCH ACCESS FOR MANUAL OPERATION OF VALVE WITHOUT REMOVING ACTUATOR.

** DIESEL FUEL AND LUBE OIL EQUIPMENT AND SPECIALTIES **

DAY TANK - RECTANGULAR HEAVY GAUGE WELDED STEEL TANK MANUFACTURED IN ACCORDANCE WITH UL STANDARD 142 AND AEA STANDARD POWER PLANT TANK FABRICATION DETAILS, NOMINAL 100 GALLON CAPACITY. FURNISH COMPLETE WITH ALL CONTROLS AND ACCESSORIES AS INDICATED.

USED OIL/DIESEL FUEL BLENDING SYSTEM - FIELD ASSEMBLED SYSTEM FOR BLENDING USED LUBRICATING OIL WITH DIESEL FUEL, CAPABLE OF AUTOMATIC OPERATION, NOMINAL 0.5% USED OIL INJECTION RATE, 30 PSIG OPERATING PRESSURE, TESTED TO 50 PSIG. PROVIDE COMPLETE WITH: 1) 20 GALLON USED OIL HOPPER; 2) PUMPS AS INDICATED IN SCHEDULE; 3) THREE STAGE FILTER BANK WITH CIM-TEK TITAN I ELEMENTS, 10 MICRON HYDROSORB ELEMENTS CIM-TEK E-1300HS-10 FIRST AND SECOND STAGE, 2 MICRON PARTICULATE ELEMENT CIM-TEK E-1300-2 FINAL STAGE; 4) 0-15 PSID DIFFERENTIAL PRESSURE GAUGES WITH ADJUSTABLE SPDT SWITCH FOR EACH FILTER, ASHCROFT 25-1132-A-25S-XV6-15, NO SUBSTITUTES; 5) NEMA 1 RATED CONTROL PANEL WITH ALARM AND SHUTDOWN FUNCTIONS; 6) ALL ASSOCIATED PIPING, VALVES, AND HOSES AS INDICATED. FABRICATE HOPPER AND FILTER BANK IN ACCORDANCE AEA STANDARD POWER PLANT TANK FABRICATION DETAILS.

THREADED STRAINERS - "Y" TYPE BRONZE BODY, SCREWED ENDS, GASKETED CAP, 20 MESH STAINLESS STEEL SCREEN, 200 PSIG WORKING PRESSURE, MUELLER #351M OR EQUAL.

DAY TANK FILTERS - ZINC TOP, 1" FPT CONNECTIONS, IMPACT RESISTANT "SEE-THRU" BOWL, 150 PSIG WORKING PRESSURE, GOLDEN ROD MODEL NO. 495 - NO SUBSTITUTES. USE STANDARD 10 MICRON FILTER ELEMENT, NO. 470-5. PROVIDE WITH FUEL FILTER WRENCH NO. 491.

DAY TANK METER - 1" ANSI 300# FLANGE INLET AND OUTLET, ACCURATE TO +/-1% AT 20 GPH, O-RINGS AND SEALS COMPATIBLE WITH #1 DIESEL FUEL, DIRECT READ REGISTER. AMCO # 25, NO SUBSTITUTES. FURNISH FACTORY ASSEMBLED WITH WITH REED SWITCH PULSER ASSEMBLY.

** DIESEL FUEL AND LUBE OIL EQUIPMENT AND SPECIALTIES (CONTINUED) **

DAY TANK GAUGE - MAGNETIC OPERATED SPIRAL GAUGE FOR #1 DIESEL FUEL, DIE-CAST ZINC HEAD, 1-1/2" MPT CONNECTION, ZINC-PLATED STEEL GUIDE ROD, BRASS CENTER SHAFT, EPOXY COATED CORK FLOAT, HERMETICALLY SEALED SIDE-VIEW DIAL, 25 PSIG MAXIMUM OPERATING PRESSURE, GUIDE ROD (OPERATING) LENGTH AS INDICATED ON DRAWINGS. ROCHESTER MODEL 8660 WITH SIDE-VIEW DIAL #5025S00570.

GAUGE HATCH - BRASS CAP AND CHAIN, BUNA-N GASKET, 2" FPT CONNECTION. MORRISON FIGURE 307 OR EQUAL.

CLOCK-TYPE LIQUID LEVEL GAUGE - MORRISON FIGURE 818, NO SUBSTITUTES.

PRESSURE/VACUUM WHISTLE VENTS - MORRISON FIGURE 922, NO SUBSTITUTES.

EMERGENCY VENTS - MORRISON FIGURE 244-F OR EQUAL.

VENT CAPS - MORRISON FIGURE 155 OR EQUAL.

** GLYCOL PIPING, VALVES, AND SPECIALTIES **

GLYCOL PIPING (ECS, ECR, HRS, HRR) - PROVIDE COPPER PIPE AND FITTINGS. PROVIDE FLEXIBLE HOSE FOR CONNECTION TO ALL ENGINES. PROVIDE SMALL DIAMETER AEROQUIP HOSE WHERE INDICATED FOR INSTRUMENTATION AND BLEED LINES (SEE DIESEL FUEL PIPING SPECIFICATIONS). HYDROSTATICALLY TEST ALL PIPING AT 100 PSIG MINIMUM FOR ONE HOUR WITH NO NOTICEABLE WATER LEAKS OR PRESSURE DROP EXCEPT AS CAUSED BY TEMPERATURE CHANGE. ISOLATE ENGINES AND RADIATORS PRIOR TO PRESSURE TESTING. FLUSH PIPING WITH FRESH WATER PRIOR TO PLACING IN SERVICE.

COPPER PIPE - TYPE "L" HARD DRAWN COPPER TUBE WITH WROUGHT COPPER FITTINGS. ALL JOINTS SOLDERED WITH 95/5 TIN/ANTIMONY SOLDER OR SILVER SOLDER EXCEPT ON T-DRILL CONNECTIONS USE COPPER BRAZING ROD. REAM ALL CUT ENDS AND THOROUGHLY CLEAN PIPE ENDS AND FITTINGS PRIOR TO SOLDERING.

PROVIDE COPPER COMPANION FLANGES FOR TRANSITION TO STEEL PIPING OR FLANGED VALVES. INSTALL FULL FACED NITRILE RUBBER GASKETS, GARLOCK 9122 OR EQUAL.

ENGINE COOLANT HOSES - SIZE AS INDICATED ON DRAWINGS, SAE J 1527, USCG TYPE B-2, THERMOID BELLOWSFLEX #7910 OR EQUAL. INSTALL WITH STAINLESS STEEL T-BOLT CLAMPS. WHERE HOSE PASSES WITHIN 12" OF HOT EXHAUST COMPONENTS INSTALL HIGH TEMPERATURE SILICONE SLEEVES, EATON WEATHERHEAD A69## OR EQUAL.

BALL VALVES - THREADED OR SOLDER END BRONZE BODY, CHROME PLATED BRONZE OR BRASS BALL, TFE OR VITON PACKING AND SEAT RING, MINIMUM 200 PSIG WOG RATING. DOMESTIC ONLY, HAMMOND OR MILWAUKEE, NO SUBSTITUTES. ON 2" AND SMALLER VALVES PROVIDE FULL PORT BALL. ON VALVES LARGER THAN 2" PROVIDE LARGE PORT BALL.

SWING CHECK VALVES - THREADED OR SOLDER END BRONZE BODY, SWING CHECK STYLE, MINIMUM 200 PSIG WOG RATING. DOMESTIC ONLY, HAMMOND OR MILWAUKEE, NO SUBSTITUTES.

DRAIN VALVES - BRONZE BODY, 3/4" FPT BY 3/4" MALE HOSE ENDS WITH CAP AND JACK CHAIN. WATTS B6000CC, OR EQUAL. INSTALL AT ALL DRAIN AND FILL CONNECTIONS AND WHERE INDICATED.

GAUGE COCK - BRASS BODY, MPT BY FPT ENDS, T-HANDLE. LEGEND VALVE ITEM 101-531 (1/4") OR ITEM 101-532 (3/8"), OR EQUAL. INSTALL ON ALL AIR VENTS, PRESSURE GAUGES, SMALL HO

PRESSURE RELIEF VALVES - THREADED END BRONZE BODY, NON-FERROUS INTERNAL COMPONENTS, ASME LABELED, 3/4" NPT CONNECTIONS, 500 MBH MINIMUM CAPACITY, SETPOINT AS INDICATED. WATTS 174A OR EQUAL.

SOLDER END STRAINER - BRONZE BODY, SOLDER CUP ENDS, GASKETED CAP, 20 MESH STAINLESS STEEL SCREEN. MUELLER STEAM #358S OR EQUAL.

AUTOMATIC AIR VENTS - BRASS BODY, SELF-CLOSING FLOAT OPERATED VALVE, SCREW ON CAP, 1/4" NPT CONNECTION. MAID-O-MIST AUTO AIR VENT NO. 75 OR EQUAL. PROVIDE WITH BALL VALVE ISOLATION.

LIQUID LEVEL SIGHT GAUGE - BOROSILICATE GLASS TUBE, ALUMINUM BODY, BUNA N SEALS, 1/2" MPT CONNECTIONS, 9" CENTERS. LUBE DEVICES G607-09-A-1-4 OR EQUAL.

EXPANSION TANK CAP - 2-1/2 PSIG PRESSURE, 1-1/2 OZ. VACUUM, 2" NPT CONNECTION. CIM-TEK 60001 OR EQUAL.

** INSTRUMENTATION **

THERMOMETERS - 3" DIAL SIZE BIMETAL TYPE, STAINLESS STEEL CASE AND STEM, 1% OF FULL SCALE ACCURACY, ADJUSTABLE ANGLE AND SWIVEL HEAD, 20F TO 240F RANGE, 2-1/2" STEM LENGTH. PROVIDE WITH 3/4"NPT BRASS THERMOWELL. TEL-TRU AA-375R, NO SUBSTITUTES.

PRESSURE GAUGES - 4" DIAL SIZE, STAINLESS STEEL CASE AND WETTED PARTS, 1/4" NPT BOTTOM CONNECTION, DRY CASE.
0-15 PSI RANGE WIKA #9745378, NO SUBSTITUTES.
0-60 PSI RANGE WIKA #9745394, NO SUBSTITUTES.

DIFFERENTIAL PRESSURE GAUGES - 2-1/2" DIAMETER DIAL, BRASS BODY, 1/4" IN-LINE CONNECTION, SPDT SWITCH WITH TERMINAL STRIP, 0-15 PSID RANGE. FACTORY SET SWITCH TO ACTIVATE AT 7 PSID. ASHCROFT 25-1132-A-25S-XV6-15, NO SUBSTITUTES.

VACUUM GAUGES - 4" DIAL SIZE ZERO-CENTER PRESSURE/VACUUM GAUGE WITH TWO ADJUSTABLE SETPOINT SWITCHES WITH DPDT RELAYS, 1/8" NPT CONNECTION, -2" TO +2" WATER COLUMN RANGE. DWYER A3304, NO SUBSTITUTES.

** SYSTEM STARTUP **

ENGINE COOLANT PIPING - AFTER PRESSURE TESTING AND FLUSHING, FILL SYSTEM WITH A SOLUTION OF EXTENDED LIFE ETHYLENE GLYCOL, SHELL ROTELLA ELC, NO SUBSTITUTES, PREMIXED TO A RATIO OF 50% ETHYLENE GLYCOL TO 50% WATER.

FUEL OIL PIPING - AFTER PRESSURE TESTING PRIME ALL PIPING WITH HAND PRIMING PUMP, FILL FILTERS WITH DIESEL FUEL, AND BLEED OFF AIR PRIOR TO STARTING ELECTRIC PUMPS.

AS COOLING SYSTEM COMES UP TO NORMAL OPERATING TEMPERATURE VERIFY OPERATION OF THERMOSTATIC VALVE. SET VARIABLE FREQUENCY DRIVES TO SPECIFIED TEMPERATURES AND TEST LEAD AND BACKUP FUNCTION BY SHUTTING OFF LEAD RADIATOR. VERIFY OPERATING SETPOINTS BY READING THERMOMETERS IN PIPING MAINS.

VERIFY OPERATION OF ALL FUEL PUMP CONTROLS INCLUDING TIMER AND LEVEL ALARMS. VERIFY COOLER VFD OPERATION AND SETPOINT USING PIPING THERMOMETER.

CLEAN ALL SYSTEM STRAINERS AFTER FIRST 48 HOURS OR MORE OF OPERATION. MONITOR SYSTEM OPERATION FOR ONE WEEK MINIMUM BEFORE LEAVING SITE. CHANGE GLYCOL FILTER ELEMENTS AT TIME OF FIRST OIL CHANGE ON EACH ENGINE.

** SEQUENCE OF OPERATION **

COMBUSTION AIR INTAKE DAMPER WILL OPEN ANY TIME PLANT IS IN SERVICE (STATION SERVICE POWER ON). GENERATOR ROOM COOLING AIR INTAKE DAMPER WILL OPEN ON A CALL FOR COOLING THROUGH A LINE VOLTAGE THERMOSTAT TO MAINTAIN SPACE TEMPERATURE, 80F, ADJUSTABLE. EXHAUST FAN MOTORIZED DAMPERS WILL OPEN ANY TIME ASSOCIATED FAN OPERATES. ALL DAMPER MOTORS WILL BE NORMALLY CLOSED SPRING RETURN AND WILL CLOSE ON LOSS OF POWER (FIRE ALARM).

EXHAUST FANS EF-1, EF-2, AND EF-3 WILL OPERATE ON A CALL FOR COOLING THROUGH A LINE VOLTAGE THERMOSTAT TO MAINTAIN GENERATING ROOM TEMPERATURE, 75F, ADJUSTABLE.

CRANK VENT FAN EF-4 WILL OPERATE CONTINUOUSLY. WHEN THE VACUUM AT THE INTAKE TO EF-4 FALLS BELOW 0.25" W.C. AN ALARM WILL BE INDICATED AT THE SWITCHGEAR.

CONTROL ROOM HEAT PUMP P-HR3 WILL OPERATE ON A CALL FOR HEATING THROUGH A LINE VOLTAGE THERMOSTAT TO MAINTAIN CONTROL ROOM TEMPERATURE, 70F, ADJUSTABLE.

RADIATOR SLAB HEAT PUMP P-HR4 WILL OPERATE ON A CALL FOR HEATING THROUGH A LINE VOLTAGE TEMPERATURE CONTROLLER TO MAINTAIN BELOW GRADE SOIL TEMPERATURE, 35F, ADJUSTABLE.

RADIATOR VARIABLE FREQUENCY DRIVES WILL MODULATE FAN SPEED TO MAINTAIN ENGINE COOLANT RETURN TEMPERATURE OPERATING SETPOINT. FANS WILL OPERATE AT A MINIMUM SPEED OF 10%, ADJUSTABLE. FANS WILL SHUT OFF WHEN ENGINE COOLANT RETURN TEMPERATURE IS BELOW THE MINIMUM SETPOINT. NORMAL OPERATING SETPOINT FOR R-1=175F AND FOR R-2=180F. MINIMUM SETPOINT 20F BELOW OPERATING SETPOINT.

CHARGE AIR COOLER FANS WILL OPERATE CONTINUOUSLY ANY TIME ASSOCIATED ENGINE RUNS AND STOP WHEN ENGINE STOPS. VARIABLE FREQUENCY DRIVES WILL MODULATE FAN SPEED TO MAINTAIN ENGINE INTAKE MANIFOLD AIR TEMPERATURE OPERATING SETPOINT. FANS WILL OPERATE AT A MINIMUM SPEED OF 10%, ADJUSTABLE. NORMAL OPERATING SETPOINT 90F.

HEAT RECOVERY PUMPS P-HR1 AND P-HR2 WILL OPERATE CONTINUOUSLY UNDER MANUAL CONTROL. WHEN THE HEAT RECOVERY RETURN TEMPERATURE IS EQUAL TO OR GREATER THAN THE HEAT RECOVERY SUPPLY TEMPERATURE FOR A MINIMUM OF 1 HOUR, AN AMBER LAMP "NO LOAD ON HEAT RECOVERY" LOCATED IN THE SWITCHGEAR MASTER SECTION WILL ILLUMINATE. WHEN THE HEAT RECOVERY SUPPLY TEMPERATURE IS A MINIMUM OF 1°F GREATER THAN THE HEAT RECOVERY RETURN TEMPERATURE THE LAMP WILL TURN OFF.

WHEN THE SYSTEM PRESSURE IN THE RECOVERED HEAT PIPING DROPS BELOW 15 PSIG FOR A MINIMUM OF 15 MINUTES, A RED LAMP "HEAT RECOVERY LOSS OF PRESSURE" LOCATED IN THE SWITCHGEAR MASTER SECTION WILL ILLUMINATE.

WHEN THE FLOW RATE IN THE PIPING FALLS BELOW 10 GPM FOR A MINIMUM OF 15 MINUTES, A RED LAMP "HEAT RECOVERY LOSS OF FLOW" LOCATED IN THE SWITCHGEAR MASTER SECTION WILL ILLUMINATE.

DAY TANK WILL HAVE AUTOMATIC FILL CONTROLS WITH REDUNDANT HIGH AND LOW LEVEL ALARMS AND TIMERS. USED OIL/DIESEL FUEL BLENDER WILL RUN ANY TIME DAY TANK FILL PUMP RUNS. FUEL OIL COOLER VARIABLE FREQUENCY DRIVE WILL MODULATE FAN SPEED TO MAINTAIN DIESEL FUEL RETURN TEMPERATURE AT 100F, ADJUSTABLE. WHEN DIESEL RETURN TEMPERATURE IS BELOW SETPOINT, FAN WILL OPERATE AT MINIMUM SPEED OF 10%, ADJUSTABLE. FAN WILL SHUT OFF WHEN DIESEL RETURN TEMPERATURE IS MORE THAN 10F, ADJUSTABLE, BELOW SETPOINT. SEE CONTROL DRAWINGS FOR DETAILED SEQUENCE.

RECORD DRAWING

THESE DRAWINGS HAVE BEEN PREPARED FROM INFORMATION PROVIDED BY OTHERS. THERE IS NO GUARANTEE AS TO THE ACCURACY OR COMPLETENESS OF THE INFORMATION CONTAINED HEREIN.

DATE: 9/28/09

State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503

ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: MECHANICAL SPECIFICATIONS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

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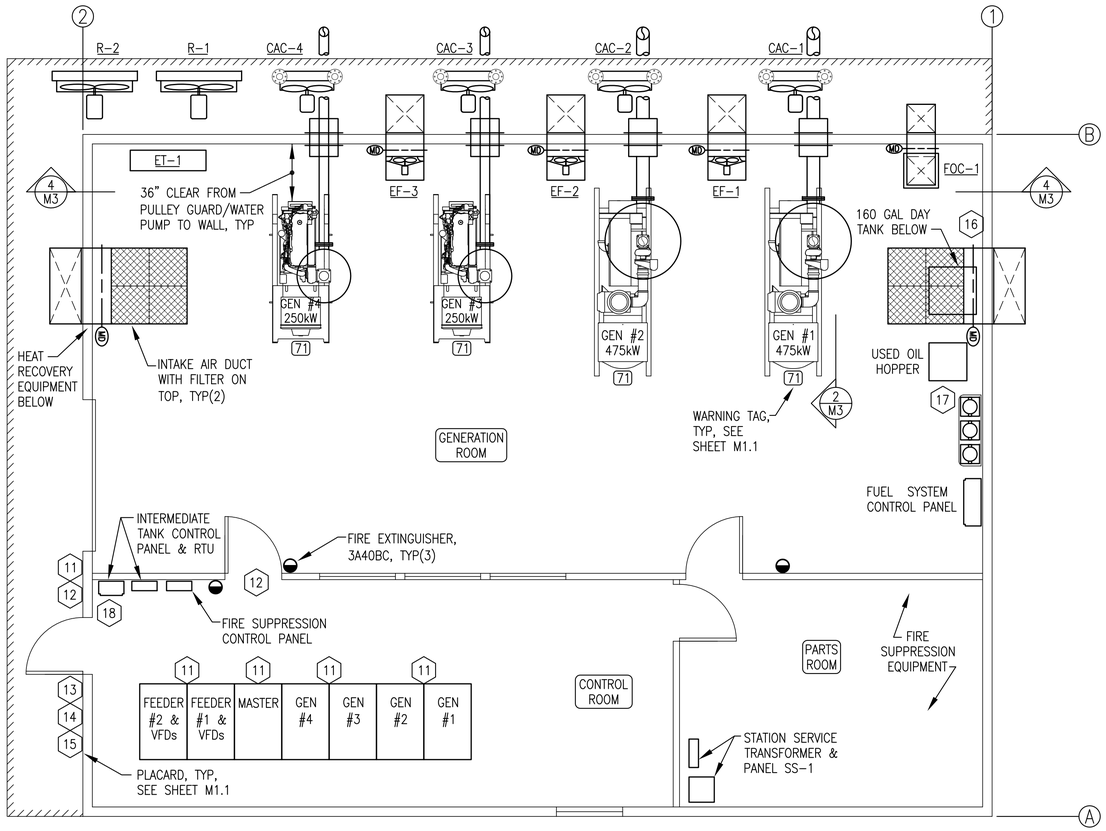
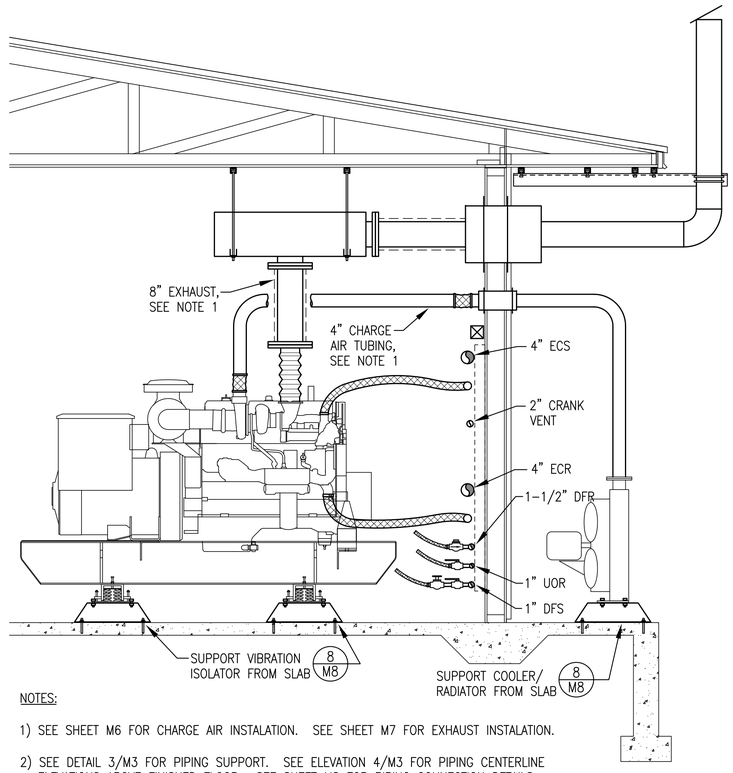
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M2-10 | SHEET: M2 OF 10 |
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |




1 M3 EQUIPMENT LAYOUT PLAN
1/4"=1'

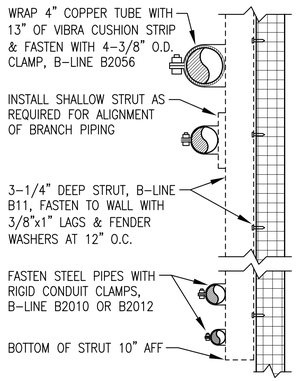



NOTES:

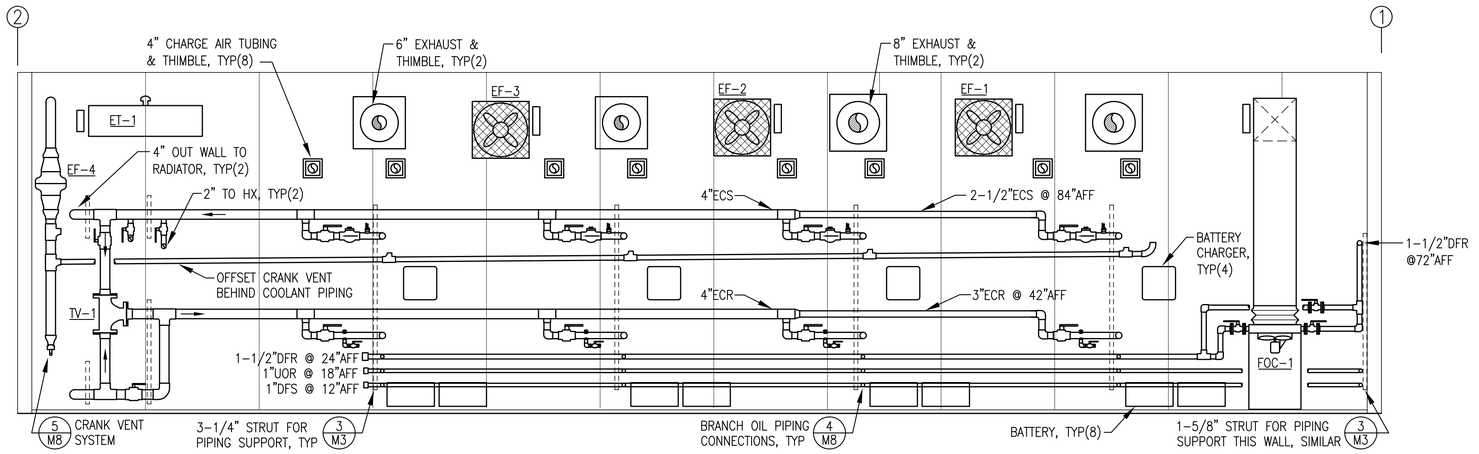
1) SEE SHEET M6 FOR CHARGE AIR INSTALATION. SEE SHEET M7 FOR EXHAUST INSTALLATION.

2) SEE DETAIL 3/M3 FOR PIPING SUPPORT. SEE ELEVATION 4/M3 FOR PIPING CENTERLINE ELEVATIONS ABOVE FINISHED FLOOR. SEE SHEET M8 FOR PIPING CONNECTION DETAILS.

2 M3 TYPICAL SECTION THROUGH GENERATOR
1/2"=1'




3 M3 PIPE SUPPORT
NO SCALE




4 M3 BACK WALL ELEVATION
3/8"=1'

RECORD DRAWING

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Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: EQUIPMENT LAYOUT PLAN, SECTION, & DETAILS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

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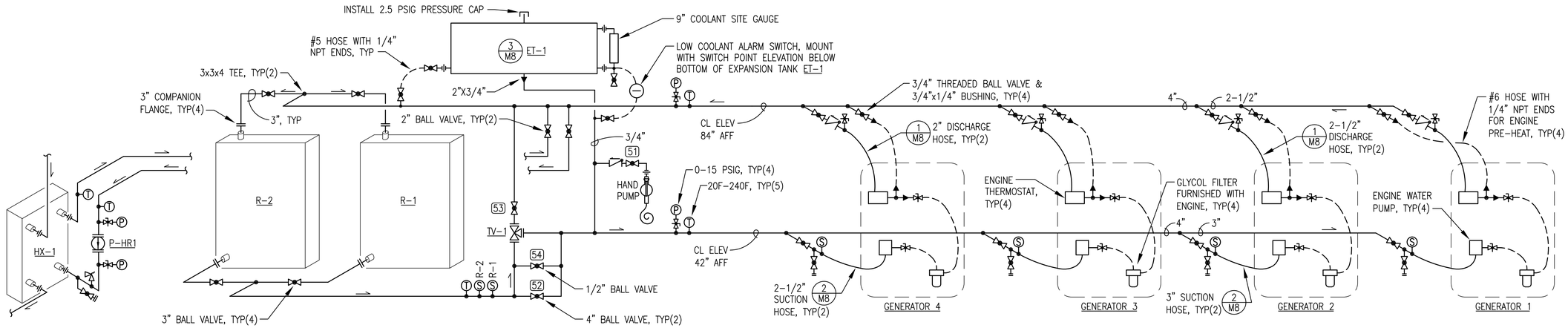
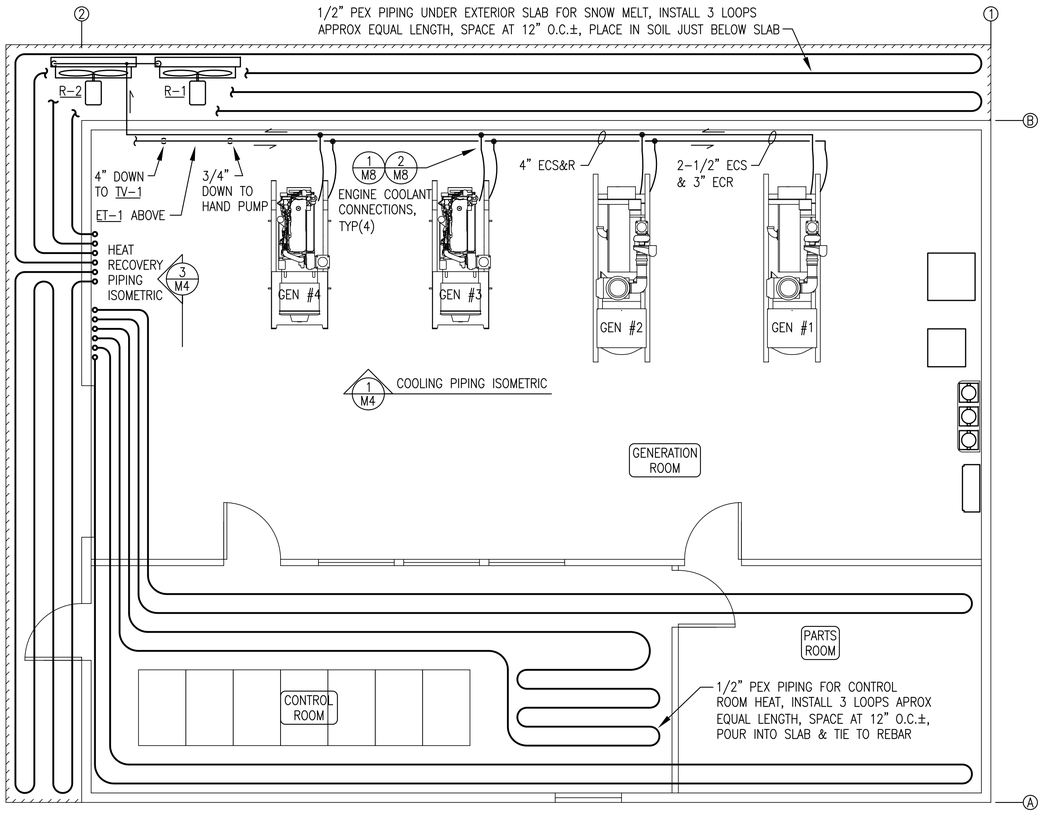
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | | |



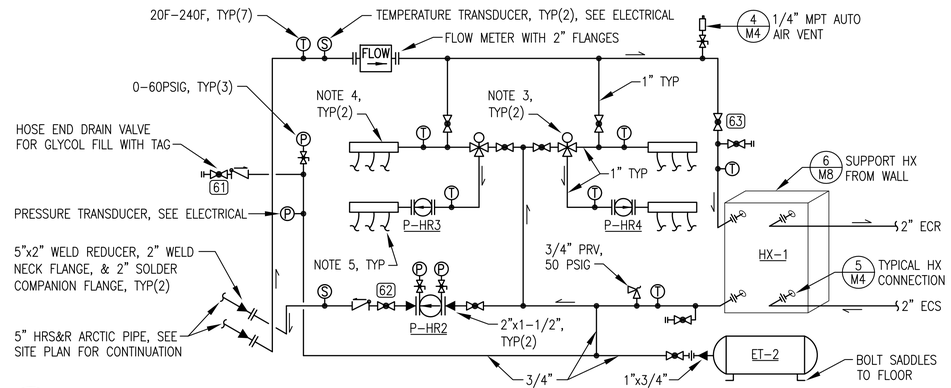

NOTES:

1) ALL COOLANT/HEAT RECOVERY PIPING TYPE "L" HARD DRAWN COPPER WITH SOLDER JOINTS.
2) ALL COOLANT PIPING 4"ø AND ALL HEAT RECOVERY PIPING 2"ø UNLESS SPECFICALLY INDICATED OTHERWISE.
3) UNLESS SPECIFIED OTHERWISE MAKE ALL CONNECTIONS FOR INSTRUMENTATION, VENTS, AND BLEED LINES WITH 3/4" T-DRILL TAP AND 3/4" FITTING ADAPTER (FTGxFPT). SEE DETAIL 4/M4 SIMILAR. INSTALL THREADED BRASS BUSHINGS AS REQUIRED.
4) ALL FLANGES ANSI 125# PATTERN BRONZE COMPANION WITH SOLDER ENDS.
5) UPON COMPLETION OF FABRICATION FLUSH INTERIOR OF PIPING TO REMOVE ALL DEBRIS AND RESIDUE.
6) INSULATE COOLANT PIPING MAINS FROM GENERATOR VALVES TO THERMOSTATIC VALVE WITH 1" LOW TEMPERATURE INSULATION. ALL OTHER PIPING NOT INSULATED.

## 1/M4 COOLING SYSTEM PIPING ISOMETRIC
NO SCALE



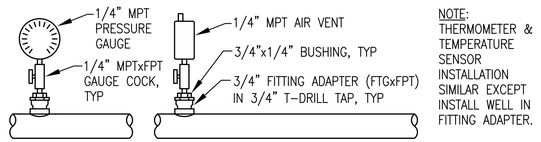

## 2/M4 COOLANT PIPING & SLAB HEAT PLAN
1/4"=1'




## 3/M4 HEAT RECOVERY PIPING ISOMETRIC
NO SCALE

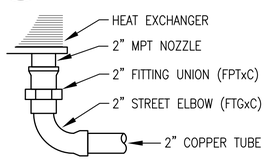
NOTES:

1) ALL HEAT RECOVERY PIPING TYPE "L" HARD DRAWN COPPER WITH SOLDER JOINTS, 2"ø UNLESS SPECFICALLY INDICATED OTHERWISE.
2) OPERATE ALL PUMPS ON SPEED 3.
3) 1" MIXING VALVE, 80-180F RANGE, SOLDER UNION CONNECTION. HONEYWELL AM102R-US-1.
4) COMBINATION SUPPLY & RETURN MANIFOLD FOR 3 ZONES OF 1/2" PEX TUBING COMPLETE WITH MANUAL AIR VENT. WIRSBO TRU-FLOW.
5) INSTALL 1/2" PEX TUBING INSIDE 1" PVC SWEEP AT SLAB PENETRATION.




NOTE: THERMOMETER & TEMPERATURE SENSOR INSTALLATION SIMILAR EXCEPT INSTALL WELL IN FITTING ADAPTER.

## 4/M4 TYP AIR VENT/GAUGE
NO SCALE




## 5/M4 TYPICAL HX CONNECTION
NO SCALE

RECORD DRAWING

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Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY


PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: COOLANT PIPING PLAN, ISOMETRICS, & DETAILS


ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100


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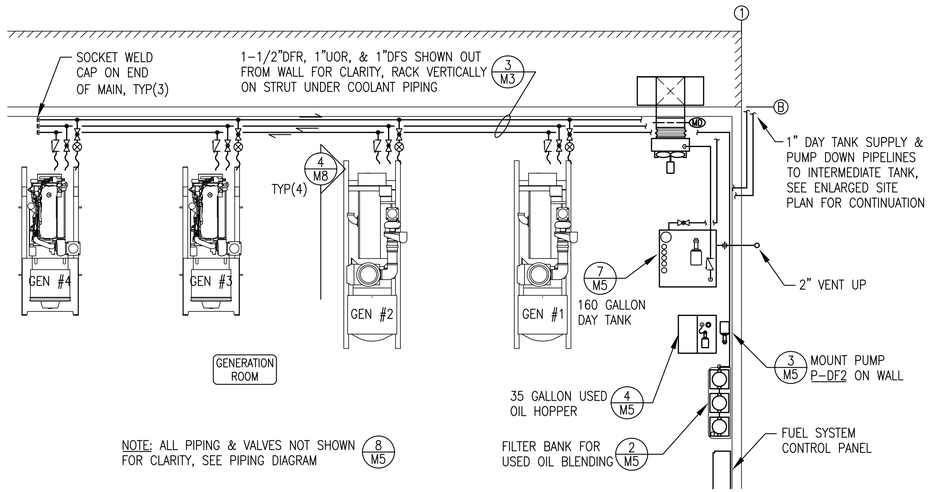
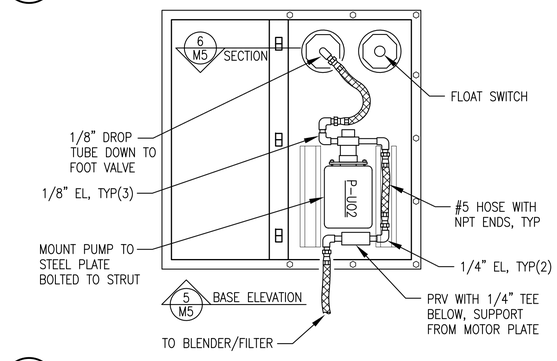
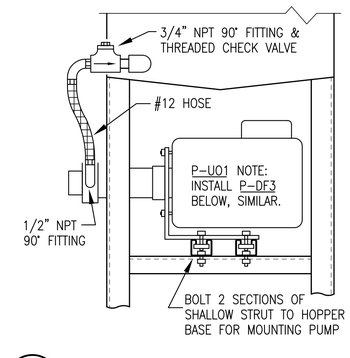


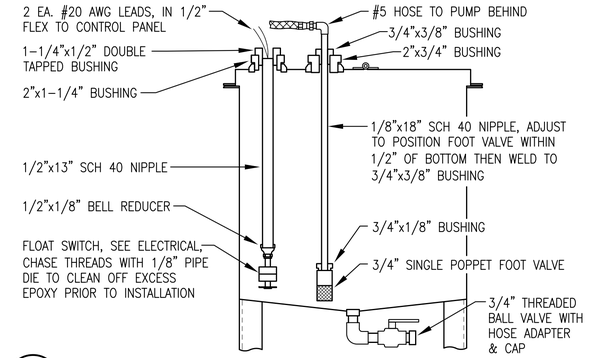

## 1 M5 DIESEL FUEL & USED OIL PIPING PLAN
1/4"=1'



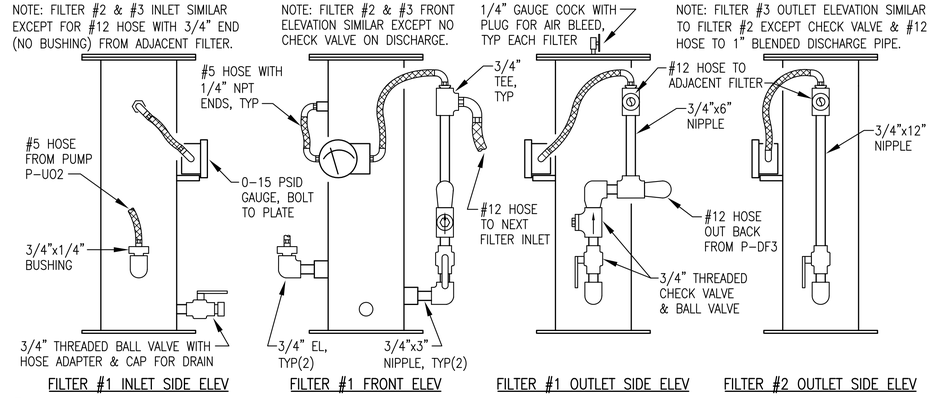

## 4 M5 TOP OF HOPPER – PLAN VIEW
NO SCALE



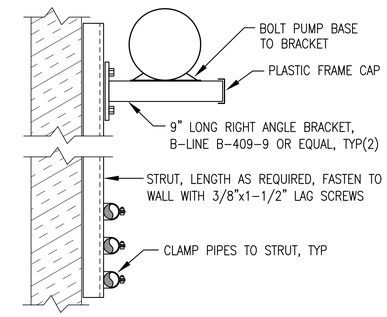

## 5 M5 HOPPER BASE ELEVATION
NO SCALE



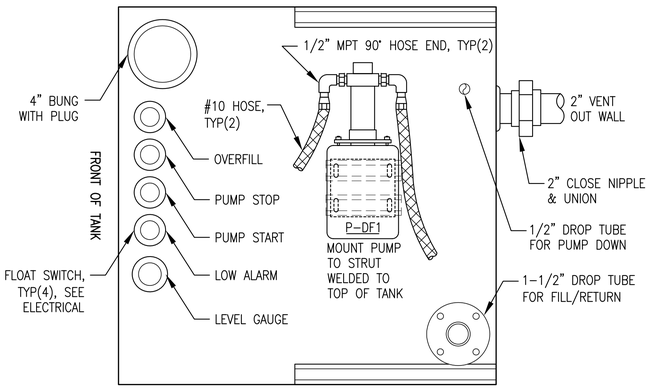

## 6 M5 SECTION THROUGH HOPPER
NO SCALE



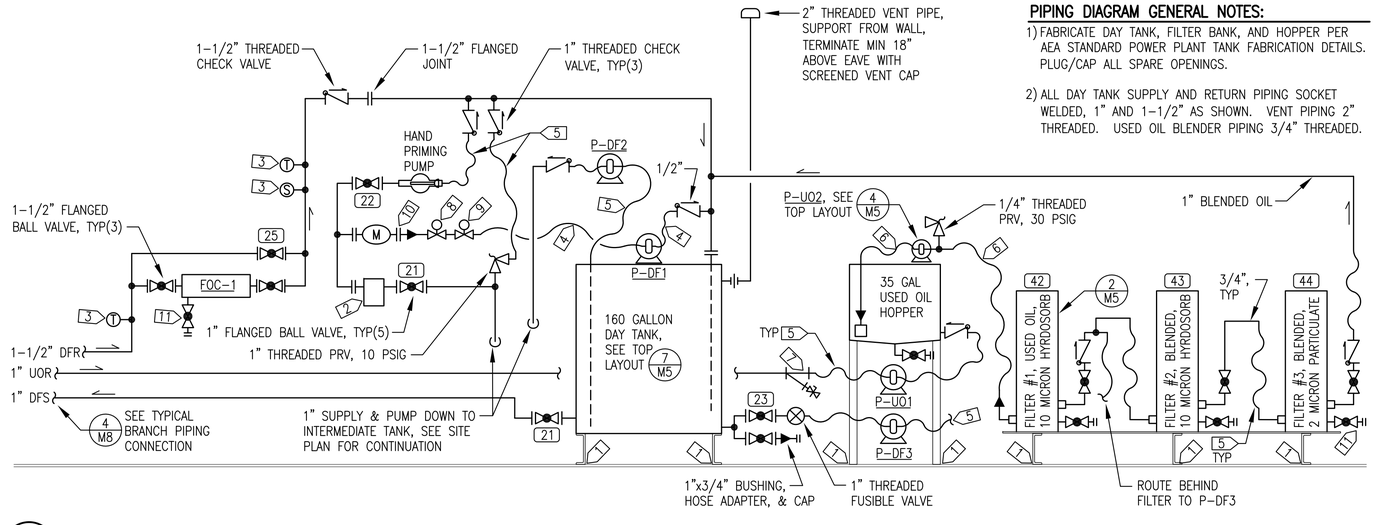

## 2 M5 FILTER PIPING ELEVATIONS
NO SCALE




## 3 M5 PUMP & PIPING SUPPORT
NO SCALE




## 7 M5 TOP OF DAY TANK – PLAN VIEW
NO SCALE




## 8 M5 DIESEL FUEL & USED OIL PIPING DIAGRAM
NO SCALE

### PIPING DIAGRAM GENERAL NOTES:

1) FABRICATE DAY TANK, FILTER BANK, AND HOPPER PER AEA STANDARD POWER PLANT TANK FABRICATION DETAILS. PLUG/CAP ALL SPARE OPENINGS.

2) ALL DAY TANK SUPPLY AND RETURN PIPING SOCKET WELDED, 1" AND 1-1/2" AS SHOWN. VENT PIPING 2" THREADED. USED OIL BLENDER PIPING 3/4" THREADED.

### PIPING DIAGRAM SPECIFIC NOTES:

1. FASTEN TO FLOOR WITH 3/8" SELF-TAPPING SCREWS.
2. 1" FILTER, REMOVE DRAIN VALVE & INSTALL 1/8"MxF DRAIN COCK.
3. TEMP SENSOR FOR FOC-1 VFD CONTROL OR 20-240°F THERMOMETER, INSTALL THERMAL WELL IN 3/4" THREAD-O-LET.
4. #10 HOSE WITH 1/2" NPT SWIVEL ENDS.
5. #12 HOSE WITH NPT SWIVEL ENDS, 1/2", 3/4", OR 1" AS RQD TO MATCH PIPING OR PUMPS.
6. #6 HOSE WITH 1/8" NPT SWIVEL ENDS.
7. 1" THREADED STRAINER WITH GAUGE COCK BLOW DOWN.
8. 1/2" NO SOLENOID VALVE.
9. 1/2" NC SOLENOID VALVE.
10. METER EQUIPPED WITH 300# FLANGED ENDS, PROVIDE 1" ANSI 300# SOCKET WELD FLANGES & GASKETS EACH SIDE FOR CONNECTION.
11. 3/4" THREADED BALL VALVE WITH HOSE ADAPTER & CAP, TYP(5).

**RECORD DRAWING**

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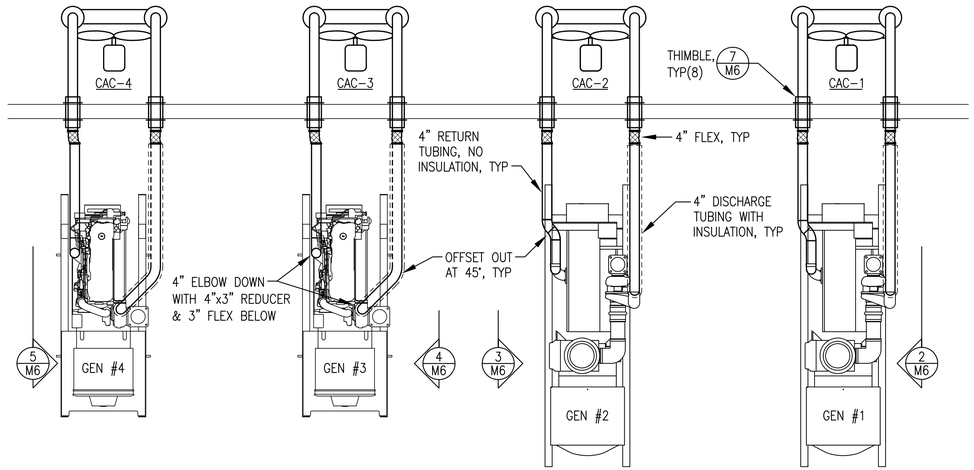
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY


PROJECT: AKIACHAK POWER SYSTEM UPGRADE

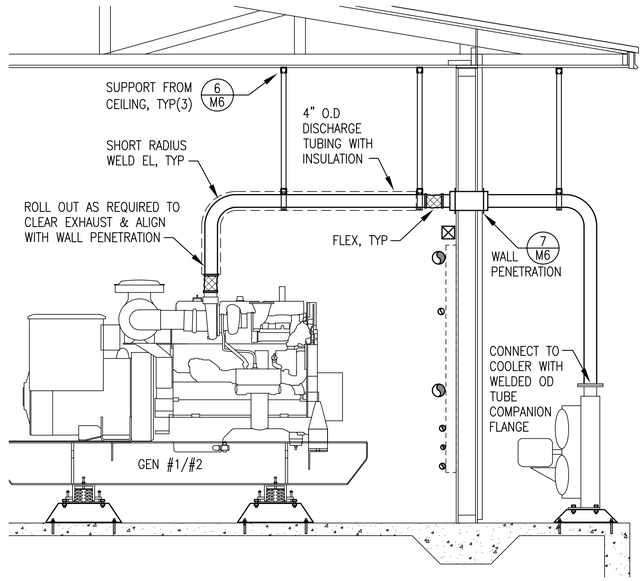
TITLE: DIESEL FUEL & USED OIL PIPING PLAN & DETAILS


ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

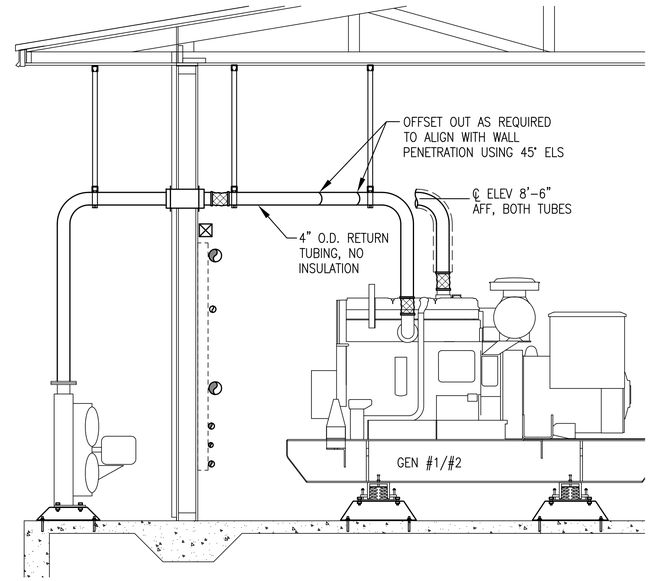

| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M2-10 | SHEET: M5 OF 10 |
|---|---|---|---|
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |



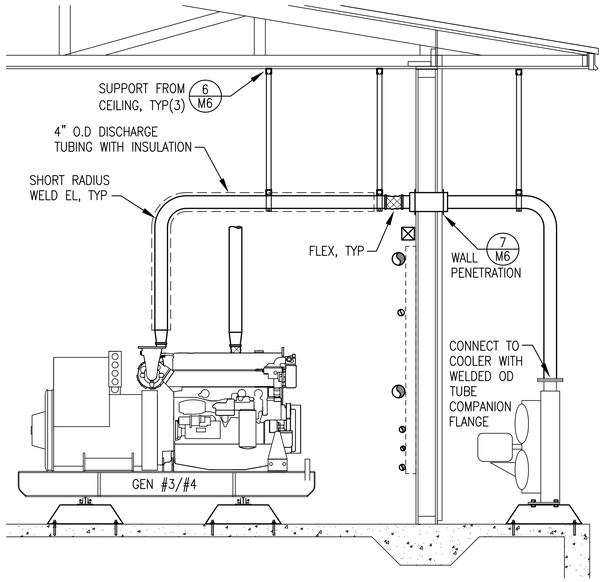

1 M6 CHARGE AIR COOLER PLAN
3/8"=1'



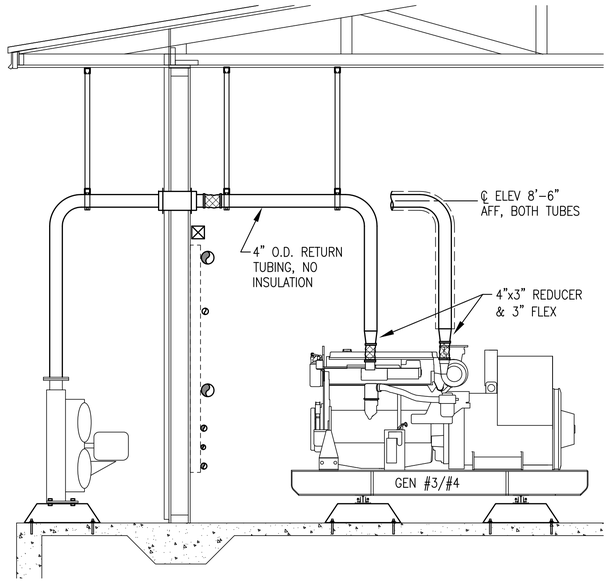

2 M6 GENERATOR #1 & #2 RIGHT SIDE ELEVATION
1/2"=1'



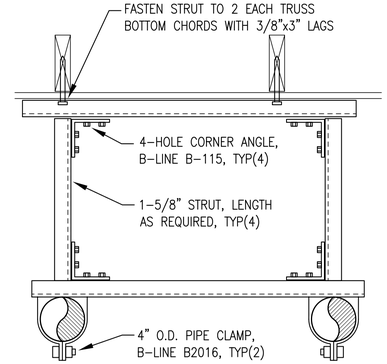

3 M6 GENERATOR #1 & #2 LEFT SIDE ELEVATION
1/2"=1'



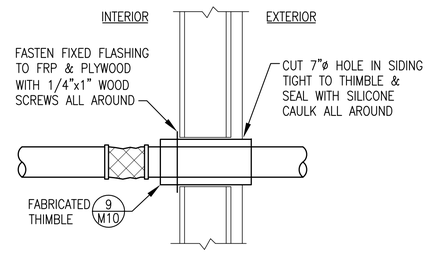

4 M6 GENERATOR #3 & #4 RIGHT SIDE ELEVATION
1/2"=1'




5 M6 GENERATOR #3 & #4 LEFT SIDE ELEVATION
1/2"=1'




6 M6 TUBING SUPPORT FROM CEILING
NO SCALE




7 M6 TUBING WALL PENETRATION
NO SCALE

## CHARGE AIR SYSTEM GENERAL NOTES:

1) ALL TUBING TO BE LIGHT WALL CARBON STEEL O.D. EXHAUST TUBING, G.T. EXHAUST OR EQUAL. ALL ELBOWS TO BE SHORT RADIUS FITTINGS TO MATCH TUBING. ALL JOINTS TO BE WELDED EXCEPT FOR FINAL CONNECTION TO ENGINES AND COOLERS.
2) MAKE ENGINE CONNECTIONS WITH HIGH TEMPERATURE SILICONE FLEX HOSE (TURBO SLEEVE) WITH FULL CIRCLE LINED STAINLESS STEEL CLAMPS.
3) MAKE COOLER CONNECTIONS WITH O.D. TUBE BY ANSI 125# MACHINED LIGHT FLANGES, G.T. EXHAUST PART #43 OR EQUAL. INSTALL HIGH TEMPERATURE FULL FACE STAINLESS STEEL AND GRAPHITE GASKETS, GARLOCK 312555 OR EQUAL.
4) INSULATE INTERIOR CHARGE AIR DISCHARGE TUBING WITH 1" LOW TEMPERATURE INSULATION FROM FLEX AT ENGINE TO FLEX AT WALL PENETRATION AS SHOWN.

**RECORD DRAWING**

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DATE: 9/28/09


State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY


PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: CHARGE AIR COOLER PLAN, SECTIONS, & DETAILS


ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100


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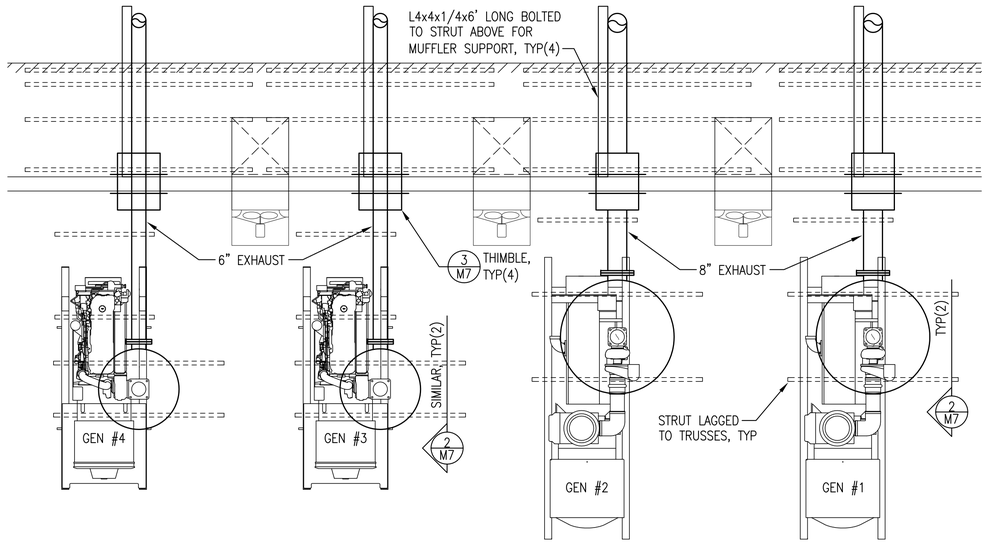
|---|---|---|---|---|---|
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M2-10 | SHEET: M6 | OF 10 |
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | | |




## 1/M7 EXHAUST SYSTEM PLAN

3/8"=1'

## EXHAUST SYSTEM GENERAL NOTES:

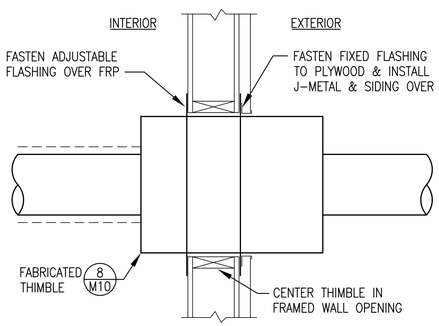
1) MUFFLERS AND FLEXES TO BE FURNISHED WITH GENERATORS. ALL OTHER EXHAUST SYSTEM COMPONENTS TO BE FURNISHED AND INSTALLED AS PART OF BUILDING MECHANICAL SYSTEM.

2) MUFFLERS TO BE CRITICAL GRADE WITH INTERNAL THERMAL INSULATION, EM PRODUCTS DCK2 OR EQUAL. THIMBLES TO BE STAINLESS STEEL, TRIPLE-WALL, INSULATED, VENTILATED, AND LISTED FOR ZERO CLEARANCE TO COMBUSTIBLES, HARCO WT-47 SERIES OR EQUAL.

3) ALL PIPE TO BE CARBON STEEL, LIGHTWALL (0.188" WALL THICKNESS), WITH WELDED JOINTS. ALL FLANGES TO BE ANSI 150# FLAT FACED, SLIP-ON EXCEPT WHERE INDICATED AS THREADED. INSTALL HIGH TEMPERATURE FULL FACE STAINLESS STEEL AND GRAPHITE GASKETS, GARLOCK 312555 OR EQUAL.

4) INSULATE INTERIOR EXHAUST PIPING WITH 1" MEDIUM TEMPERATURE INSULATION FROM FLEX TO MUFFLER AND FROM MUFFLER TO WALL PENETRATION AS SHOWN.

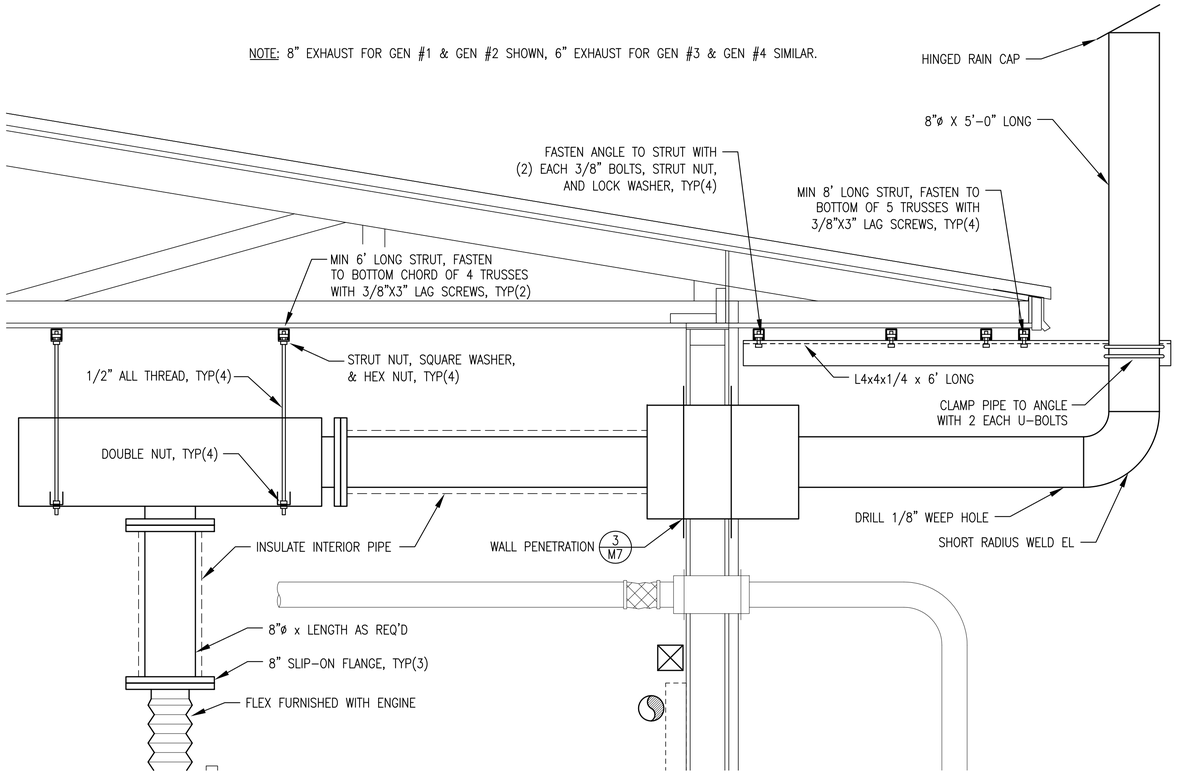
NOTE: SEAL BOTH FLASHINGS TO WALL SURFACES WITH SILICONE CAULK & FASTEN WITH 1/4"x1" WOOD SCREWS ALL AROUND.




## 3/M7 WALL THIMBLE INSTALLATION

NO SCALE

NOTE: 8" EXHAUST FOR GEN #1 & GEN #2 SHOWN, 6" EXHAUST FOR GEN #3 & GEN #4 SIMILAR.




## 2/M7 MUFFLER & EXHAUST PIPE INSTALLATION

1"=1'

RECORD DRAWING

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PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: EXHAUST SYSTEM PLAN, SECTIONS, & DETAILS

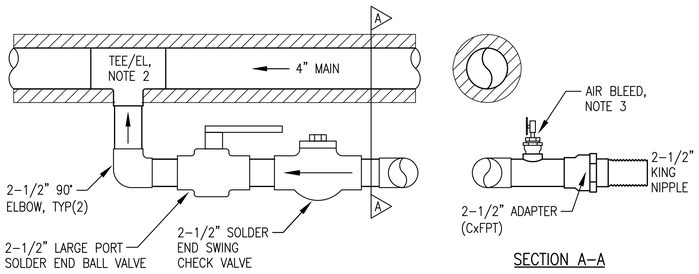
ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

| | | | |
|---|---|---|---|
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M2-10 | SHEET: M7 OF 10 |
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |

NOTES: 1) 2-1/2" PIPING & VALVES SHOWN FOR GEN #1 & #2. GEN #3 & #4 SIMILAR EXCEPT 2" PIPING, VALVES, & KING NIPPLE.

2) ON GEN #1 INSTALL 2-1/2" EL. ON GEN #2 INSTALL 4 x 2-1/2 x 2-1/2 TEE. ON GEN #3 & #4 INSTALL 4 x 4 x 2 TEE.

3) 3/4" FITTING ADAPTER (FTGxFPT) IN 3/4" T-DRILL TAP WITH BUSHING & 1/4" GAUGE COCK.

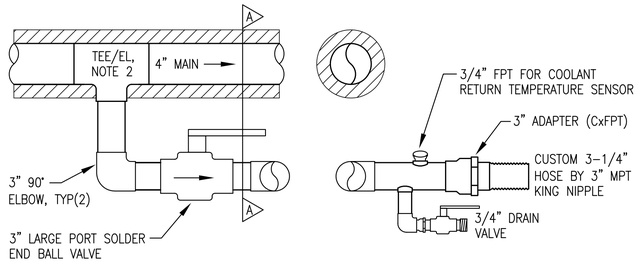



SECTION A-A

## 1 M8 TYPICAL GENERATOR DISCHARGE CONNECTION
NO SCALE

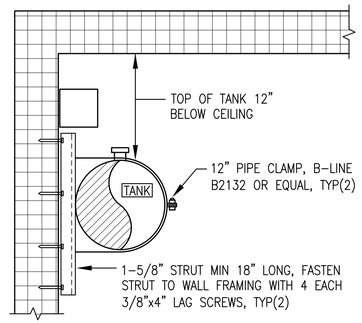
NOTES: 1) 3" PIPING & VALVES SHOWN FOR GEN #1 & #2. GEN #3 & #4 SIMILAR EXCEPT 2-1/2" PIPING, VALVES, & KING NIPPLE.

2) ON GEN #1 INSTALL 3" EL. ON GEN #2 INSTALL 4 x 3 x 3 TEE. ON GEN #3 & #4 INSTALL 4 x 4 x 2-1/2 TEE.




SECTION A-A

## 2 M8 TYPICAL GENERATOR SUCTION CONNECTION
NO SCALE

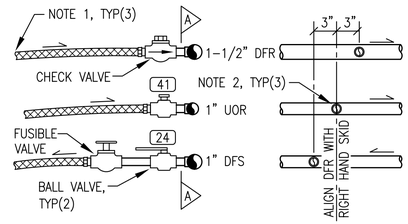



## 3 M8 EXPANSION TANK SUPPORT
NO SCALE

NOTES: 1) HOSES PROVIDED WITH ENGINE, SIZE VARIES PER ENGINE & PRODUCT. FIELD CUT TO LENGTH & INSTALL 1/2" MPT SWIVEL ENDS.

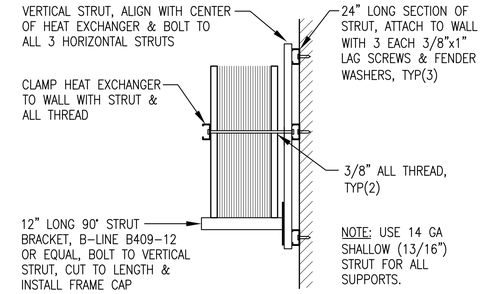
2) MAKE ALL CONNECTIONS TO MAINS WITH 1/2" THREAD-O-LET.

3) ALL VALVES 1/2" THREADED. ALL PIPE NIPPLES SCH 80.

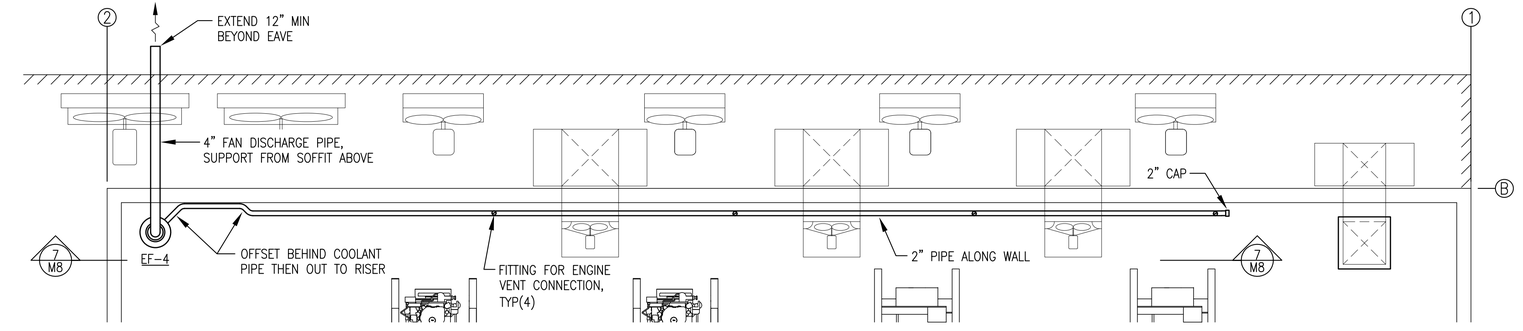



SIDE ELEVATION SECTION A-A

## 4 M8 TYPICAL ENGINE FUEL/OIL PIPING CONNECTION
NO SCALE




## 6 M8 HEAT EXCHANGER SUPPORT FROM WALL
NO SCALE




## 5 M8 CRANK VENT SYSTEM PLAN
3/8"=1'-0"

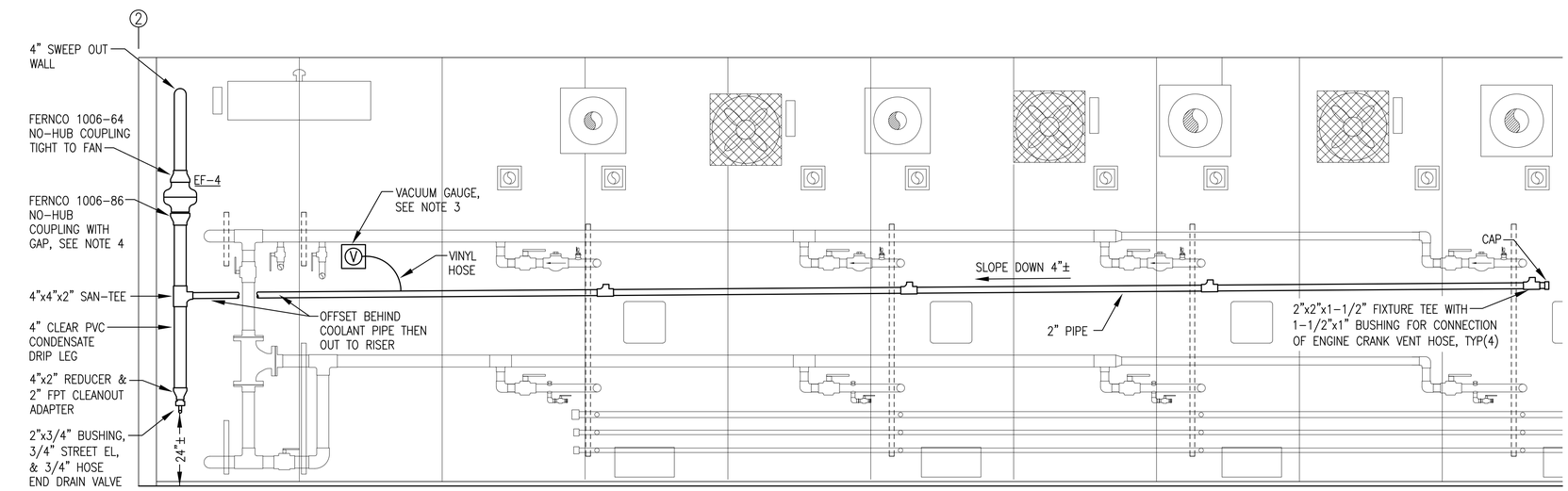
**CRANK VENT PIPING NOTES**

1) INSTALL SYSTEM TO DILUTE CRANKCASE FUMES WITH ROOM AIR AND VENT OUT OF BUILDING. FAN EF-4 TO RUN CONTINUOUSLY.

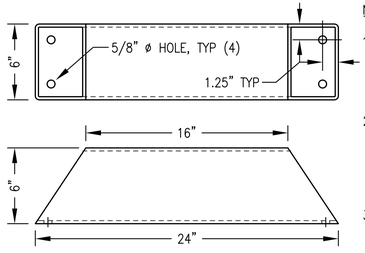
2) ALL PIPE SOLID CORE ABS WITH DRAINAGE FITTINGS. SLOPE TO DRAIN TO DRIP LEG AS SHOWN.

3) MOUNT VACUUM GAUGE IN NEMA 1 BOX ON WALL IN VICINITY OF FAN. SYSTEM DESIGNED TO MAINTAIN 0.75" WATER COLUMN VACUUM IN LINE. SET ALARM SWITCH TO ACTIVATE WHEN VACUUM FALLS BELOW 0.5".

4) INSTALL 6x4 ABS FLUSH BUSHING ON PIPE. SET NO-HUB COUPLING APPROXIMATELY 1/2" BELOW FAN INLET. ADJUST GAP TO PROVIDE 0.50" VACUUM IN LINE.




## 7 M8 CRANK VENT SYSTEM BACK WALL ELEVATION
1/2"=1'-0"




NOTES:

1) FABRICATE FROM TS 6x6x1/4. SHOP CUT AND DRILL AS INDICATED. PAINT UPON COMPLETION.

2) FIELD INSTALL ON CONCRETE PAD WITH 1/2"x6" STUDS SET IN EPOXY, 4 EACH ON GENERATORS AND 2 EACH ON COOLERS.

3) FIELD DRILL TOP TO MATCH VIBRATION ISOLATOR OR COOLER BASE AND FASTEN WITH (2) EACH 1/2" OR 5/8" BOLTS WITH LOCK WASHERS.

## 8 M8 GENERATOR/COOLER SUPPORT
NO SCALE

**RECORD DRAWING**

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ALASKA ENERGY AUTHORITY


PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: PIPING & SUPPORT DETAILS


ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100


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| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M2-10 | SHEET: M8 | OF 10 |
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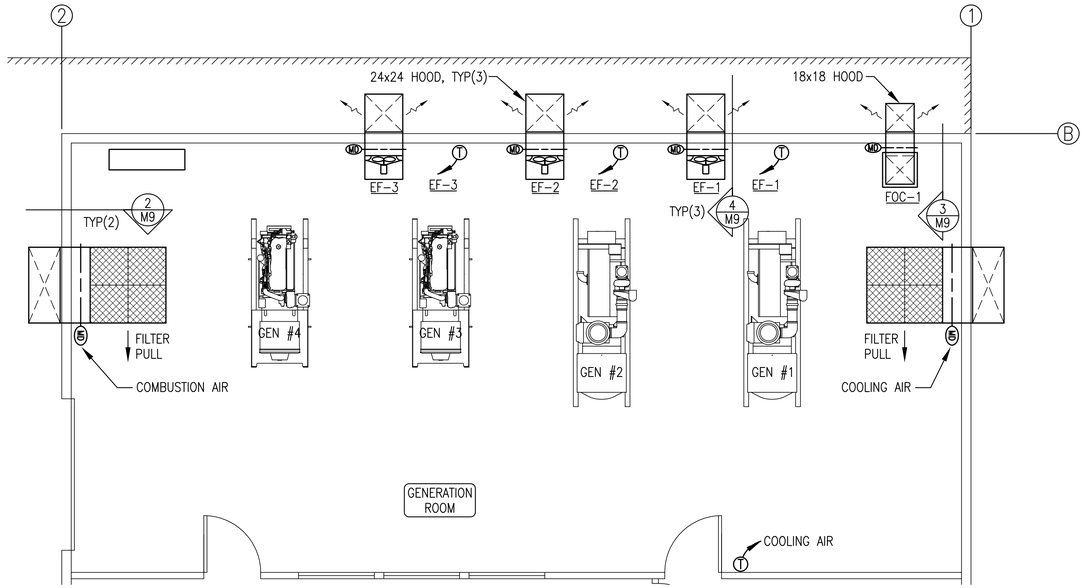
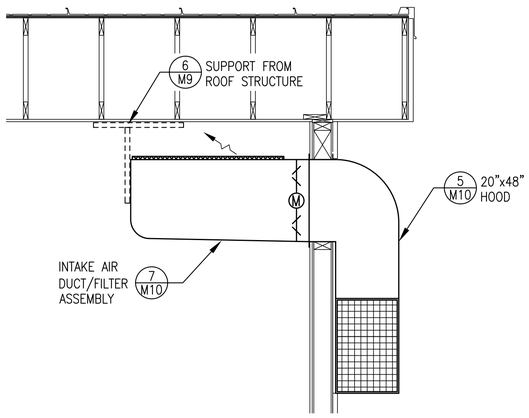
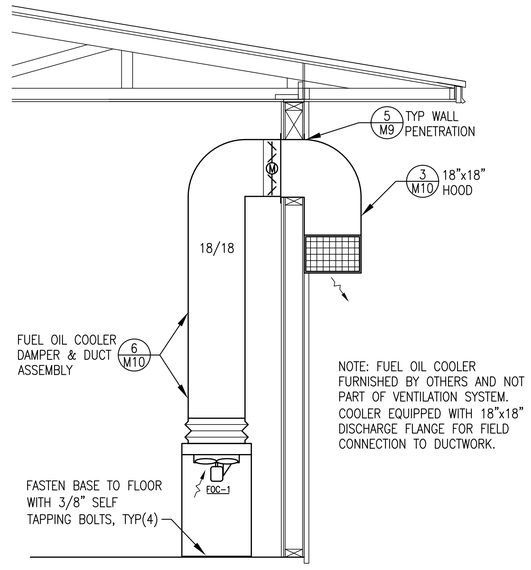


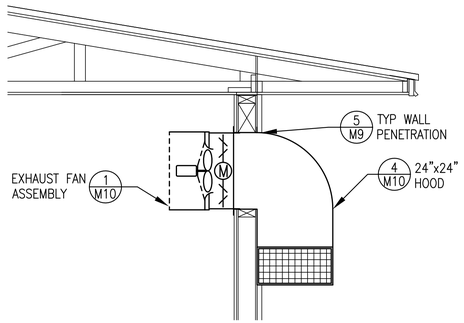

1 M9 VENTILATION PLAN
1/4"=1'




2 M9 TYPICAL INTAKE DUCT INSTALLATION
1/2"=1'

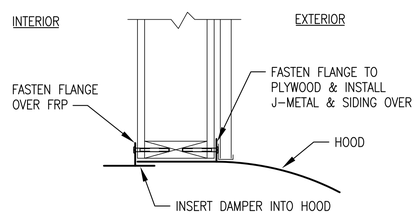



3 M9 FUEL OIL COOLER INSTALLATION
1/2"=1'

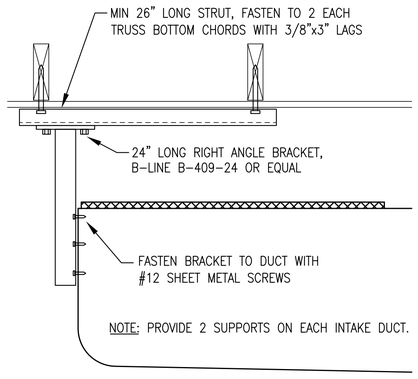



4 M9 TYPICAL EXHAUST FAN INSTALLATION
1/2"=1'

NOTE: SEAL BOTH FLANGES TO WALL SURFACES WITH SILICONE CAULK & FASTEN WITH 1/4"x3" WOOD SCREWS ALL AROUND.




5 M9 TYPICAL WALL PENETRATION
NO SCALE




6 M9 INTAKE DUCT SUPPORT
NO SCALE

## VENTILATION EQUIPMENT SPECIFICATIONS

GENERAL – PERFORM ALL WORK IN ACCORDANCE WITH THE LATEST ADOPTED EDITION OF THE INTERNATIONAL MECHANICAL CODE AND APPLICABLE SMACNA STANDARDS.

INTERIOR SHEET METAL FABRICATIONS – FABRICATE ALL DAMPER AND FAN ASSEMBLIES FROM MINIMUM 18 GAUGE GALVANIZED SHEET METAL USING STANDARD MECHANICAL JOINTS OR WELDED SEAMS. SEAL ALL JOINTS AIR TIGHT AND AS INDICATED.

EXTERIOR SHEET METAL FABRICATIONS – FABRICATE ALL HOODS AND INTAKE DUCTS FROM MINIMUM 16 GAUGE GALVANIZED SHEET METAL USING CONTINUOUS SEAL WELDS FOR ALL JOINTS. UPON COMPLETION OF FABRICATION WIRE BRUSH WELD AREAS AND FINISH WITH COLD GALVANIZING COMPOUND, ZRC OR EQUAL.

THIMBLES – FABRICATE ALL THIMBLES FROM MINIMUM 16 GAUGE TYPE 304 STAINLESS STEEL USING CONTINUOUS SEAL WELDS FOR ALL JOINTS.

INSTALLATION – EQUIPMENT INSTALLATION IS NOT PART OF THE FABRICATION SCOPE OF WORK. FAN AND DAMPER ASSEMBLIES AND HOODS WILL BE SHIPPED LOOSE FOR FIELD INSTALLATION BY OTHERS. FASTEN HOODS TO WALL FRAMING & FASTEN DAMPER ASSEMBLIES TO HOODS WITH #12 SHEET METAL SCREWS AT 6" ON CENTER ALL AROUND.

EXHAUST FANS EF-1, 2, & 3 – DIRECT DRIVE 18"ø PROPELLER SIDEWALL EXHAUST FAN, 3,059 CFM AT 0.50" SP, 1,750 RPM. GREENHECK SE2-18-421-A5, NO SUBSTITUTES. PROVIDE WITH SPECIAL 3/4 HP, 208 V, 1 PH MOTOR AND OSHA APPROVED GUARD.

EXHAUST FAN EF-4 – DIRECT DRIVE IN-LINE DUCT FAN, BACKWARD INCLINED CENTRIFUGAL WHEEL, EPOXY COATED STEEL HOUSING, 78 CFM AT 2.0" SP, 2,700 RPM, 115 V, 1 PH. CONTINENTAL FAN AXC200B OR EQUAL.

DAMPERS – OPPOSED BLADE LOW-LEAKAGE CONTROL DAMPER, GALVANIZED STEEL CONSTRUCTION, 304 STAINLESS STEEL BEARINGS AND JAMB SEALS, EPDM BLADE SEALS. GREENHECK VCD-23 NO SUBSTITUTES. SEE FABRICATION DETAILS FOR SIZES.

ACTUATORS – INSTALL 120V SPRING RETURN ACTUATOR, BELIMO, NO SUBSTITUTES. SEE FABRICATION DETAILS FOR MODEL NUMBER.

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TITLE: VENTILATION SYSTEM PLAN, DETAILS, & SPECIFICATIONS

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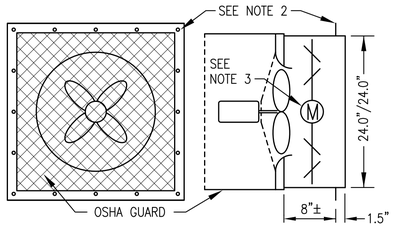



NOTES:

1) FABRICATE THREE IDENTICAL ASSEMBLIES COMPLETE WITH FAN AND DAMPER MOUNTED AND SEALED TO DUCT.

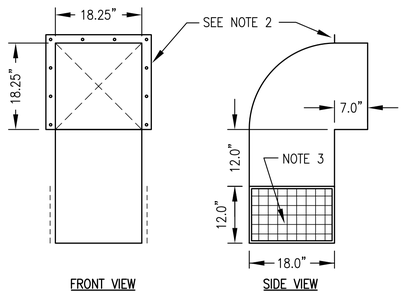
2) PROVIDE 2" WIDE MOUNTING FLANGE ALL AROUND WITH 5/16" HOLES AT 6.5"± O.C.

3) PROVIDE MIN 3" DAMPER ROD EXTENSION ON THE SAME SIDE FOR ALL ASSEMBLIES. INSTALL BELIMO LF-120-US ACTUATOR, NO SUBSTITUTES. FABRICATE SHEET METAL STAND-OFF BRACKET TO FULLY SUPPORT THE ACTUATOR FROM THE DAMPER FRAME.

## 1/M10 TYPICAL FAN/DAMPER ASSEMBLY
1"=1'-0"

NOT USED

## 2/M10 EF-4 ASSEMBLY
1"=1'-0"



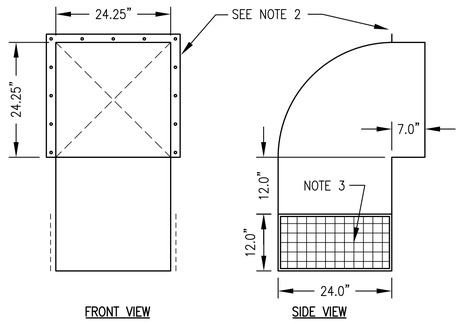

NOTES:

1) FABRICATE ONE ASSEMBLY.

2) PROVIDE 2" WIDE MOUNTING FLANGE ON TOP & SIDES WITH 5/16" HOLES AT 6"± O.C.

3) 1"x1" GALV WIRE MESH OVER OPENING, TYP BOTH SIDES

## 3/M10 18"x18" HOOD FABRICATION
3/4"=1'-0"



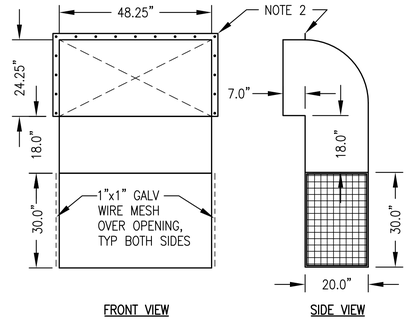

NOTES:

1) FABRICATE THREE IDENTICAL ASSEMBLIES.

2) PROVIDE 2" WIDE MOUNTING FLANGE ON TOP & SIDES WITH 5/16" HOLES AT 6"± O.C.

3) 1"x1" GALV WIRE MESH OVER OPENING, TYP BOTH SIDES

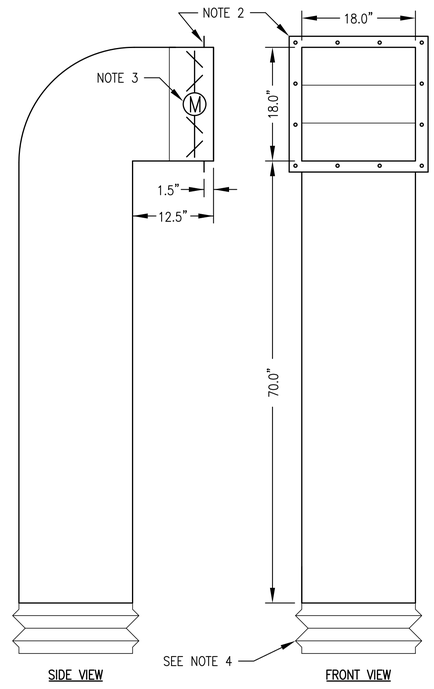
## 4/M10 24"x24" HOOD FABRICATION
3/4"=1'-0"




NOTES: 1) FABRICATE TWO IDENTICAL HOODS.

2) PROVIDE 2" WIDE MOUNTING FLANGE ON TOP & SIDES WITH 5/16" HOLES AT 6"± O.C.

## 5/M10 20"x48" HOOD FABRICATION
1/2"=1'-0"




NOTES:

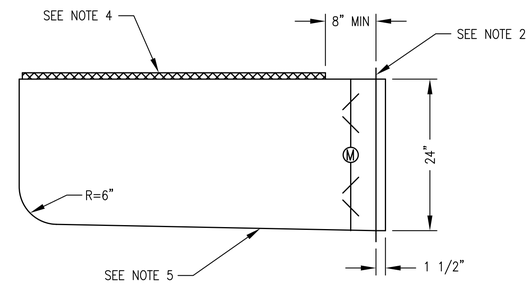
1) FABRICATE ONE 18"x18" OIL COOLER DAMPER ASSEMBLY.

2) PROVIDE 2" WIDE MOUNTING FLANGE ALL AROUND WITH 5/16" HOLES AT 6.5"± O.C.

3) PROVIDE MIN 3" DAMPER ROD EXTENSION ONE SIDE. INSTALL BELIMO LF-120-US ACTUATOR, NO SUBSTITUTES. FABRICATE SHEET METAL STAND-OFF BRACKET TO SUPPORT THE ACTUATOR FROM THE DAMPER FRAME.

4) PROVIDE 8" LONG 18/18 FABRIC FLEX DUCT WITH METAL EDGE BOTH ENDS. SHIP LOOSE FOR FIELD INSTALLATION BY OTHERS.

## 6/M10 FUEL OIL COOLER DAMPER ASSEMBLY
1"=1'-0"




NOTES:

1) FABRICATE TWO IDENTICAL FILTER/DAMPER ASSEMBLIES.

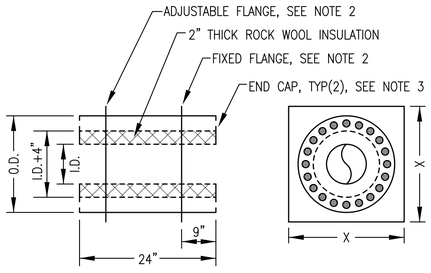
2) PROVIDE 2" WIDE MOUNTING FLANGE ALL AROUND WITH 5/16" HOLES AT 6"± ON CENTER.

3) PROVIDE MIN 3" DAMPER ROD EXTENSION ON ONE SIDE AND FABRICATE SHEET METAL STAND-OFF BRACKET TO FULLY SUPPORT THE ACTUATOR FROM THE DAMPER FRAME. INSTALL BELIMO AF-120-US ACTUATOR, NO SUBSTITUTES.

4) INSTALL FRAME FOR 4 EACH REMOVABLE 24"x24"x1" FURNACE FILTERS. FABRICATE FROM "C" CHANNEL THREE SIDES WITH LATCHING HINGED COVER ON FOURTH SIDE TO ALLOW FILTERS TO SLIDE OUT. SEE PLANS AND INSTALLATION DETAILS FOR DAMPER ACTUATOR AND FILTER PULL ORIENTATION.

5) SLOPE BOTTOM 1" MIN TO DRAIN TOWARD DAMPER AND SEAL JOINTS WATER TIGHT.

## 7/M10 INTAKE AIR DUCT/FILTER ASSEMBLY
1"=1'-0"




| NOMINAL PIPE SIZE | I.D. | O.D. | X | VENT HOLE QUANTITY |
|---|---|---|---|---|
| 4" | 4.7" | 14.3" | 20.0" | 16 |
| 5" | 5.7" | 14.3" | 20.0" | 16 |
| 6" | 6.8" | 16.3" | 22.0" | 16 |
| 8" | 8.9" | 17.3" | 24.0" | 20 |
| 10" | 11.0" | 20.5" | 28.0" | 20 |

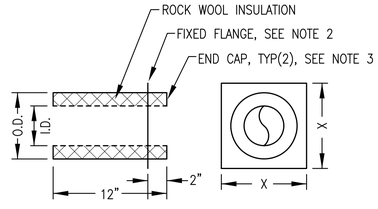
NOTES:

1) FABRICATE ENTIRE ASSEMBLY FROM MINIMUM 16 GAUGE TYPE 304 STAINLESS STEEL WITH ALL JOINTS SEAL WELDED.

2) FABRICATE TWO IDENTICAL SQUARE FLANGES. SEAL WELD FIXED FLANGE TO OUTER SHELL. ADJUSTABLE FLANGE TO SHIP LOOSE FOR FIELD INSTALLATION.

3) SEAL WELD END CAPS TO INNER AND OUTER SHELLS. PROVIDE 1"ø VENT HOLES IN BOTH ENDS, QUANTITY AS INDICATED, EQUALLY SPACED. ON EXTERIOR (FIXED FLANGE) END INSTALL 1/8" STAINLESS STEEL BUG SCREEN.

## 8/M10 EXHAUST PIPE THIMBLE FABRICATION
NO SCALE




| NOMINAL PIPE SIZE | I.D. | O.D. | X |
|---|---|---|---|
| 4" | 4.2" | 7.0" | 9.0" |

NOTES:

1) FABRICATE ENTIRE ASSEMBLY FROM MINIMUM 16 GAUGE TYPE 304 STAINLESS STEEL WITH ALL JOINTS SEAL WELDED.

2) FABRICATE ONE SQUARE FLANGE AND SEAL WELD TO OUTER SHELL.

3) SEAL WELD END CAPS TO INNER AND OUTER SHELLS.

## 9/M10 CHARGE AIR TUBING THIMBLE FABRICATION
NO SCALE

RECORD DRAWING

THESE DRAWINGS HAVE BEEN PREPARED FROM INFORMATION PROVIDED BY OTHERS. THERE IS NO GUARANTEE AS TO THE ACCURACY OR COMPLETENESS OF THE INFORMATION CONTAINED HEREIN.

DATE: 9/28/09

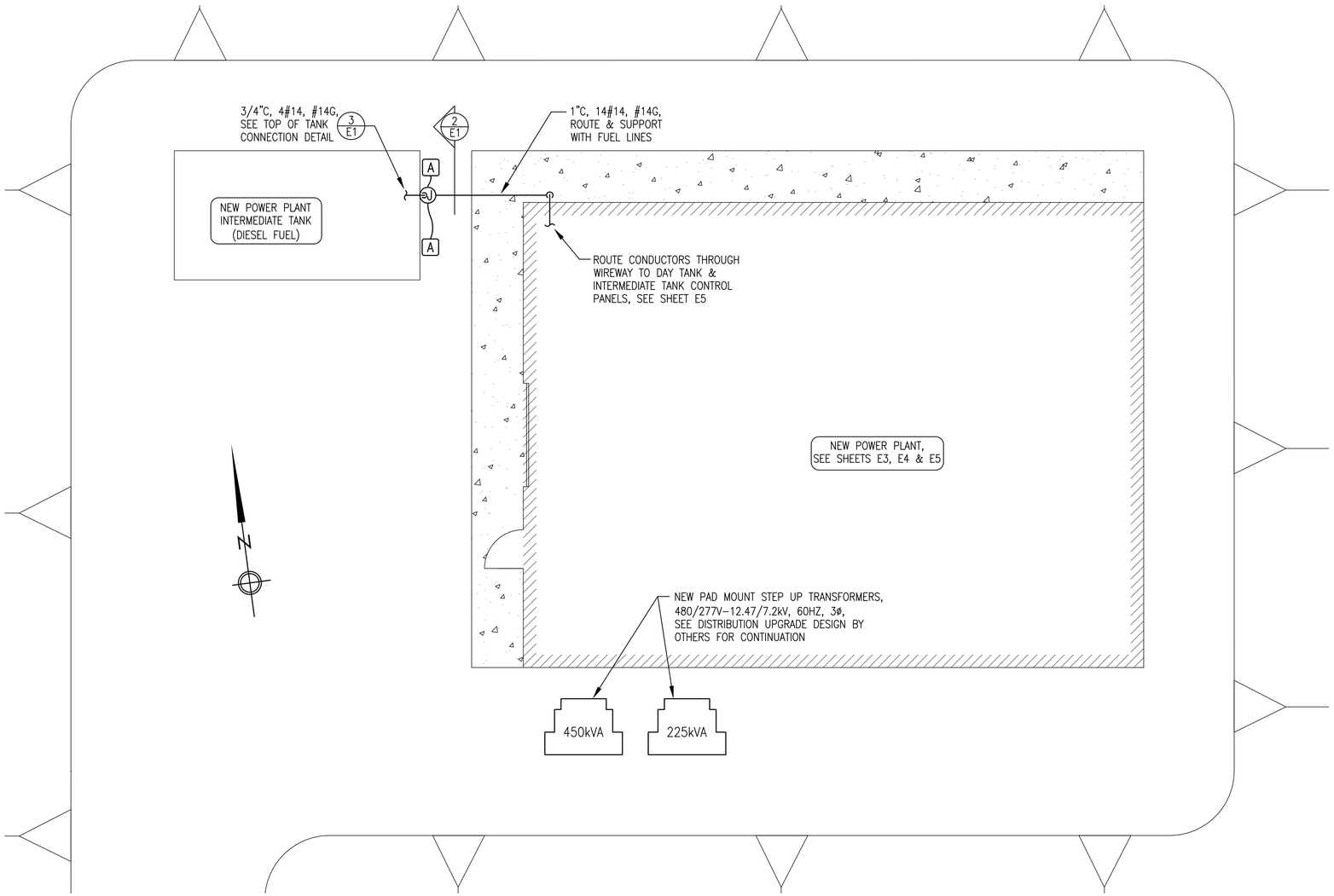
State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

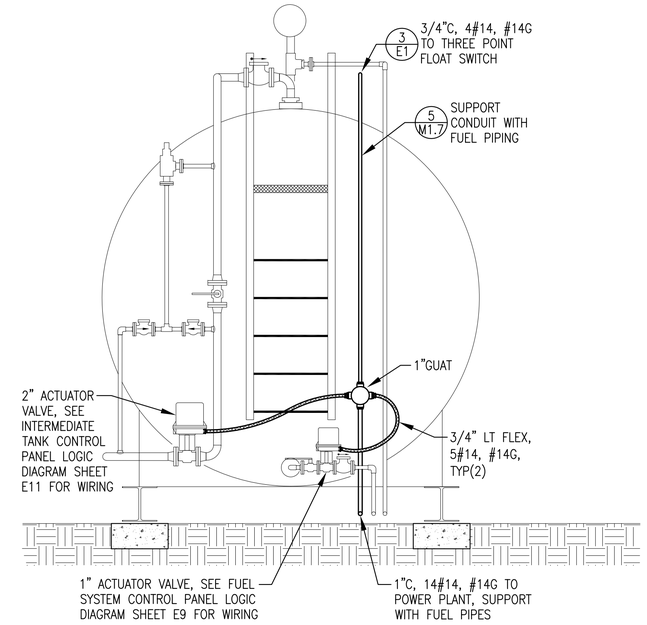
TITLE: VENTILATION SYSTEM FABRICATION DETAILS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

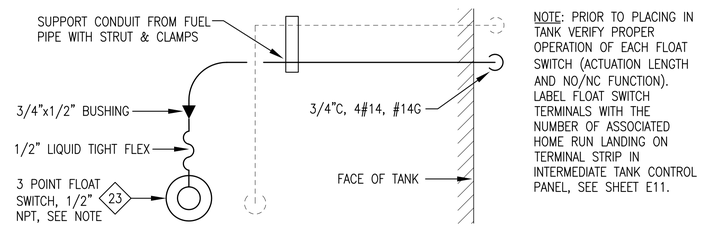
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH M2-10 | SHEET: M10 OF 10 |
|---|---|---|---|
| DESIGNED BY: BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |




1 E1 POWER PLANT SITE PLAN
1"=5'




2 E1 INTERMEDIATE TANK END VIEW
1"=2'




3 E1 TOP OF INTERMEDIATE TANK CONNECTION DETAIL
NO SCALE

**SCHEDULE OF DRAWINGS**



RECORD DRAWING

THESE DRAWINGS HAVE BEEN PREPARED FROM INFORMATION PROVIDED BY OTHERS. THERE IS NO GUARANTEE AS TO THE ACCURACY OR COMPLETENESS OF THE INFORMATION CONTAINED HEREIN.

DATE: 9/28/09


State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY


PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: SITE PLAN, DETAILS, & SCHEDULE OF DRAWINGS


ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100


| | | | | | |
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| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: CHEF E1 | SHEET: E1 | OF 11 |
| DESIGNED BY: CWV/BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | | |

** GENERAL CONDITIONS **

PERFORM ALL WORK IN ACCORDANCE WITH THE LATEST ADOPTED EDITION OF THE NATIONAL ELECTRICAL CODE INCLUDING STATE OF ALASKA AMENDMENTS.

THE DRAWINGS ARE DIAGRAMMATIC AND DO NOT NECESSARILY SHOW ALL FEATURES OF THE REQUIRED WORK. PROVIDE ALL EQUIPMENT AND MATERIALS REQUIRED FOR A COMPLETE SYSTEM. VERIFY EXISTING FIELD CONDITIONS PRIOR TO STARTING CONSTRUCTION. IMMEDIATELY CONTACT THE ENGINEER FOR CLARIFICATION OF QUESTIONABLE ITEMS OR APPARENT CONFLICTS.

ALL EQUIPMENT AND MATERIALS SHOWN ARE NEW UNLESS SPECIFICALLY INDICATED AS EXISTING. WHERE ADDITIONAL OR REPLACEMENT ITEMS ARE REQUIRED, PROVIDE LIKE ITEMS BY THE SAME MANUFACTURER TO THE MAXIMUM EXTENT PRACTICAL. INSTALL ALL MATERIALS IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS AND INSTRUCTIONS, UNLESS INDICATED OTHERWISE.

PROTECT ALL MATERIALS AND EQUIPMENT DURING THE ENTIRE DURATION OF CONSTRUCTION WORK AGAINST CONTAMINATION OR DAMAGE. REPLACE OR REPAIR TO ORIGINAL MANUFACTURED CONDITION ANY ITEMS DAMAGED DURING CONSTRUCTION. IMMEDIATELY REPORT TO THE ENGINEER ANY ITEMS FOUND DAMAGED PRIOR TO COMMENCING CONSTRUCTION.

PERFORM WORK WITH SKILLED CRAFTSMEN SPECIALIZING IN SAID WORK. INSTALL ALL MATERIALS IN A NEAT, ORDERLY, AND SECURE FASHION, AS REQUIRED BY THESE SPECIFICATIONS AND COMMONLY RECOGNIZED STANDARDS OF GOOD WORKMANSHIP.

DO NOT CUT, DRILL, OR NOTCH STRUCTURAL MEMBERS UNLESS SPECIFICALLY APPROVED BY THE ENGINEER. MINIMIZE PENETRATIONS AND DISRUPTION OF BUILDING FEATURES. WHERE PREVIOUSLY COMPLETED BUILDING SURFACES OR OTHER FEATURES MUST BE CUT, PENETRATED, OR OTHERWISE ALTERED, SUCH WORK SHALL BE CAREFULLY LAID OUT AND PERFORMED, AND PATCHED TO ORIGINAL CONDITION. SEAL ALL EXTERIOR FLOOR AND WALL PENETRATIONS AS INDICATED.

CONTACT THE ENGINEER ONE-WEEK PRIOR TO COMPLETION OF ALL WORK TO SCHEDULE A SUBSTANTIAL COMPLETION INSPECTION. THE ENGINEER WILL GENERATE A PUNCH LIST OF CORRECTIVE ACTION ITEMS DURING THE INSPECTION. WORK WILL NOT BE CONSIDERED COMPLETE UNTIL ALL CORRECTIVE ACTION ITEMS IN THE ENGINEERS PUNCH LIST HAVE BEEN SATISFACTORILY COMPLETED AND PHOTOGRAPHIC OR OTHER POSITIVE DOCUMENTATION HAS BEEN PROVIDED TO THE ENGINEER.

PROVIDE ONE SET OF DRAWINGS CLEARLY MARKED UP WITH ALL AS-BUILT INFORMATION TO THE ENGINEER WITHIN TWO WEEKS OF COMPLETION.

** SPECIAL CONDITIONS **

ENSURE THAT APPROPRIATE SAFETY MEASURES ARE IMPLEMENTED AND THAT ALL WORKERS ARE AWARE OF THE POTENTIAL HAZARDS FROM ELECTRICAL SHOCK, BURN, ROTATING FANS, PULLEYS, BELTS, HOT MANIFOLDS, NOISE, ETC. ASSOCIATED WITH WORKING NEAR POWER GENERATION AND CONTROL EQUIPMENT.

CHANGE OVER FROM OLD SYSTEMS TO NEW SYSTEMS WILL REQUIRE SHUT DOWN OF THE POWER GENERATION SYSTEM. PLAN OUT AND COORDINATE WORK TO MINIMIZE DISRUPTION OF LOCAL POWER SERVICE. SCHEDULE OUTAGES IN ADVANCE WITH THE VILLAGE OFFICE.

** DEVICES AND EQUIPMENT **

DEVICES – LISTED FOR INTENDED SERVICE. MANUFACTURER/MODEL IN THE EQUIPMENT SCHEDULE IS PROVIDED TO INDICATE REQUIRED FEATURES. SUBSTITUTIONS OF EQUIVALENT ITEMS WILL BE ACCEPTED UNLESS ITEM SPECIFICALLY INDICATED NO SUBSTITUTES. INSTALL ALL DEVICES SUCH THAT MINIMUM REQUIRED ACCESS CLEARANCE IS MAINTAINED.

CONTROL PANELS – PROVIDE SHOP FABRICATED CONTROL PANELS AS REQUIRED. WHERE SPECIFICALLY INDICATED ON PANEL DRAWINGS PROVIDE LOGIC, LAYOUT, AND DEVICES AS INDICATED. ALL PANELS SHALL BE LISTED AND LABELED IN ACCORDANCE WITH AN APPROPRIATE THIRD PARTY INDEPENDENT STANDARD. BENCH TEST TO BE PERFORMED AT THE MANUFACTURING FACILITY PRIOR TO SHIPMENT.

NAMEPLATES – LAMACOID TYPE BLACK WITH WHITE CORE, BEVELED EDGES. PROVIDE NAMEPLATES FOR EACH DEVICE, DISCONNECT SWITCH, AND CONTROL PANELS/DEVICES. SPECIFICALLY, LABEL ALL BATTERY CHARGERS FOR THE ASSOCIATED GENERATING UNIT. ATTACH NAMEPLATES WITH EPOXY ADHESIVE OR SELF-TAPPING SCREWS.

SUPPORT – INDEPENDENTLY SUPPORT EACH DEVICE FROM BUILDING STRUCTURAL MEMBERS WITH CHANNEL STRUT OR FABRICATED BRACKETS UTILIZING APPROPRIATE FASTENERS. ALL FASTENERS SHALL BE GALVANIZED OR ZINC PLATED EXCEPT ON EXTERIOR INSTALLATIONS ALL TYPE 316 STAINLESS STEEL.

** RACEWAYS **

INTERIOR – ALL INTERIOR LOCATIONS SHALL BE ELECTRICAL METALLIC TUBING (EMT) EXCEPT WHERE SPECIFICALLY INDICATED AS WIREWAY. WIREWAY SHALL BE NEMA 1 WITH HINGED COVER AND MANUFACTURER PROVIDED CONNECTORS AND FITTINGS.

EXTERIOR – ALL EXTERIOR ABOVE GRADE LOCATIONS SHALL BE GALVANIZED RIGID CONDUIT (GRC). PROVIDE LIQUID TIGHT OIL RESISTANT FLEXIBLE CONDUIT WHERE INDICATED AND AS REQUIRED TO ACCOMMODATE MOVEMENT.

UNDERGROUND – ALL UNDERGROUND LOCATIONS SHALL BE SCH 40 PVC EXCEPT FOR GRC RISERS WHERE SPECIFICALLY INDICATED.

TERMINATION – FINAL CONNECTIONS TO DEVICES MAY BE WITH LIQUID TIGHT OIL RESISTANT FLEXIBLE CONDUIT. CONDUITS TERMINATING IN EXTERIOR ENCLOSURES SHALL UTILIZE A WEATHERPROOF CONDUIT HUB. CONDUITS TERMINATING IN INDOOR ENCLOSURES SHALL UTILIZE LOCKNUTS INSIDE AND OUT WITH A METALLIC CONDUIT BUSHING, HUB, OR BOX CONNECTOR INSIDE THE ENCLOSURE.

SUPPORT – SUPPORT CONDUIT FROM BUILDING STRUCTURAL MEMBERS WITH CHANNEL STRUT AND PIPE CLAMPS OR PIPE HANGERS. DO NOT SUPPORT FROM CONNECTIONS TO EQUIPMENT. DO NOT USE PERFORATED STRAPS FOR SUPPORT. ALL STRUT, BRACKETS, HANGERS, AND FASTENERS SHALL BE GALVANIZED OR ZINC PLATED EXCEPT ON EXTERIOR INSTALLATIONS TYPE 304 STAINLESS STEEL.

** CONDUCTORS **

GENERATOR LEADS, FEEDERS (480V), BATTERY CABLES, AND CONDUCTORS INSTALLED IN EXTERIOR LOCATIONS – TYPE VW-1, UL LISTED HIGH TEMPERATURE, EXTRA FLEXIBLE CABLE. 600V, 150°C THERMOSET EPDM INSULATION WITH TIN COATED COPPER CONDUCTOR. COBRA WIRE AND CABLE, BELDEN, OR EQUAL. ON GENERATOR LEADS AND COMMUNITY DISTRIBUTION FEEDER TERMINATE WITH COPPER COMPRESSION LUGS RATED FOR THE FULL AMPACITY OF THE CABLE AT 150°C.

GENERAL USE CONDUCTORS – CLASS B CONCENTRIC STRANDED, SOFT DRAWN COPPER. TYPE THHN INSULATION, 600V AND 75C RATED.

COLOR CODING – UNLESS SPECIFICALLY INDICATED OTHERWISE CONDUCTORS SHALL BE COLOR CODED AS FOLLOWS:

480-VOLT POWER CONDUCTORS
- PHASE A – BROWN
- PHASE B – ORANGE
- PHASE C – YELLOW
- NEUTRAL – WHITE WITH YELLOW STRIPE

120/208-VOLT POWER CONDUCTORS
- PHASE A – BLACK
- PHASE B – RED
- PHASE C – BLUE
- NEUTRAL – WHITE

FOR NO. 6 AWG AND SMALLER CONDUCTORS COLOR CODING SHALL BE PROVIDED BY USING CONDUCTORS WITH CONTINUOUS COLOR EMBEDDED IN THE INSULATION. FOR ALL CONDUCTORS LARGER THAN NO. 6 SCOTCH 35 MARKING TAPE OR EQUIVALENT MAY BE USED TO COLOR CODE THE CABLE. WHERE MARKING TAPE IS USED THE CABLE SHALL BE IDENTIFIED AT EVERY ACCESSIBLE LOCATION. PROVIDE A MINIMUM OF 2 INCHES OF TAPE AT EACH LOCATION.

GROUNDING – PROVIDE A SEPARATE EQUIPMENT GROUNDING CONDUCTOR IN EACH RACEWAY. DO NOT USE THE CONDUIT AS AN EQUIPMENT GROUNDING CONDUCTOR. EQUIPMENT GROUNDING CONDUCTORS SHALL BE CLASS B CONCENTRIC STRANDED, SOFT-DRAWN COPPER OF THE SIZES INDICATED ON THE DRAWINGS. EQUIPMENT GROUNDING CONDUCTORS FOR THE GENERATOR LEADS SHALL BE TYPE VW-1 AS SPECIFIED FOR GENERATOR LEADS. CONDUCTORS NOT INDICATED SHALL BE SIZED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.

GENERATOR CONTROL CONDUCTORS – TYPE VW-1, UL LISTED HIGH TEMPERATURE, EXTRA FLEXIBLE CABLE, 600V, 150°C THERMOSET EPDM INSULATION WITH TIN COATED COPPER CONDUCTOR EXCEPT FOR SPECIALTY CABLE WHERE INDICATED. COBRA WIRE AND CABLE, BELDEN, OR EQUAL. CONTROL CONDUCTORS ROUTED BETWEEN THE TERMINAL BLOCK LOCATED IN THE GENERATOR TERMINAL HOUSING AND THE TERMINAL BLOCKS LOCATED IN THE GENERATOR CONTROL SECTION OF THE SWITCHGEAR SHALL BE COLOR CODED EXACTLY AS INDICATED ON THE DRAWINGS AND PACKAGED INTO A SINGLE CONTROL CABLE BUNDLE INCLUDING SHIELDED AND SPECIALTY CONDUCTORS AS SPECIFIED BELOW.

SHIELDED CONDUCTORS – STRANDED TINNED COPPER CONDUCTORS, 600V POLYETHYLENE INSULATION, 100% COVERAGE ALUMINUM FOIL-POLYESTER TAPE SHIELD WITH A STRANDED TINNED COPPER DRAIN WIRE, AND PVC OUTER JACKET. SINGLE PAIR TWISTED #18 AWG, BELDEN #1120A OR EQUAL. SINGLE TRIAD TWISTED #18 AWG, BELDEN #3089A OR EQUAL. FOUR PAIR TWISTED #18 AWG, BELDEN #1049A OR EQUAL. TWO PAIR CANBUS CABLE #22 AWG AND #24 AWG TWISTED PAIRS, BELDEN 3084A OR EQUAL.

THERMOCOUPLE EXTENSION CABLE – SINGLE PAIR TWISTED #16 AWG SOLID ALLOY PER ANSI MC96.1 FOR TYPE K THERMOCOUPLES, 600V FLAME RETARDANT EPR INSULATION, 100 % COVERAGE ALUMINUM FOIL-POLYESTER TAPE SHIELD WITH A STRANDED TINNED COPPER DRAIN WIRE, AND FLAME RETARDANT CPE OUTER JACKET. HOUSTON WIRE AND HW113-1601K, OR EQUAL. TERMINATE ON TYPE K THERMOCOUPLE TERMINAL BLOCKS.

ETHERNET CABLE – CATEGORY 5E UNBONDED-PAIR CABLE, FOUR PAIR TWISTED, 24 GAUGE COPPER CONDUCTORS, 300V FEP INSULATION, BELDEN 1585LC OR EQUAL.

** ENGINE GENERATORS **

PROVIDE CATERPILLAR ENGINE/GENERATOR SETS OF PRIME CAPACITY INDICATED, NO SUBSTITUTES. THE ENGINE-GENERATOR SETS SHALL BE MOUNTED ON WELDED STRUCTURAL STEEL BASE COMPLETE WITH VIBRATION ISOLATORS. MATERIALS AND EQUIPMENT SHALL BE NEW AND OF CURRENT DESIGN, DELIVERED TO THE SITE COMPLETELY WIRED, TESTED AND READY FOR INSTALLATION. PROVIDE COMPLETE WITH GOVERNOR, 24VDC STARTING SYSTEM, INSTRUMENT PANEL, CONTROLS, SAFETY SHUT DOWNS, EXHAUST SYSTEM, DRIP PAN, AND ALL OTHER ACCESSORIES AS INDICATED AND REQUIRED. SEE THE ENGINE GENERATOR PURCHASE SPECIFICATIONS FOR ADDITIONAL DETAIL.

** PARALLELING SWITCHGEAR **

PROVIDE A FREESTANDING NEMA 1 ENCLOSURE WITH HINGED FRONT-OPENING DOORS. THE PANEL SHALL BE CONFIGURED AS INDICATED IN THE DRAWINGS. PANEL SHALL BE RATED 2,400-AMPERE COPPER, 3-PHASE, 4-WIRE WITH NEUTRAL AND GROUND BUSES. COMPLETE WITH PROVISIONS FOR FOUR GENERATORS, MASTER CONTROL/STATION SERVICE, TWO FEEDERS, FOUR CHARGE AIR COOLER VFDS, AND 2 RADIATOR VFDS AS INDICATED. EQUIPMENT ARRANGEMENT AND SIZES SHALL CONFORM TO THE ONE-LINE DIAGRAM. PANEL SHALL BE PAINTED ANSI 61 GRAY.

PROVIDE THE FOLLOWING FEATURES FOR EACH GENERATING UNIT – (A) GENSET CONTROL PACKAGE (GCP) THAT PROVIDES AUTOMATIC PARALLELING AND SYNCHRONIZATION PLUS COMMUNICATION WITH THE PLC, (B) ENGINE SPEED CONTROL, (C) LOAD SENSOR; (D) AUTOMATIC SYNCHRONIZER, (E) FREQUENCY METER, (F) POWER MONITOR WITH VOLTS, AMPS FREQUENCY, KW, PF, AND TOTAL KWH; (G) IDLE SPEED POTENTIOMETER AND RATED/IDLE SELECTOR SWITCH; (H) DRAW-OUT INSULATED CASE CIRCUIT BREAKER.

PROVIDE THE FOLLOWING PROTECTION FOR EACH GENERATING UNIT – (A) OVERCRANK, (B) OVER/UNDERVOLTAGE, (C) OVER/UNDER FREQUENCY, (D) REVERSE POWER, (E) OVERCURRENT, (F) DEAD BUS RELAY, (G) SYNC CHECK RELAY, (H) HIGH JACKET WATER TEMPERATURE, (I) HIGH LUBE OIL TEMPERATURE, (J) LOW LUBE OIL PRESSURE, (K) LOW LUBE OIL LEVEL, (L) OVERSPEED, (M) ANNUNCIATION PANEL WITH COMPLETE ANNUNCIATION OF FAILURE AND STATUS OF THE GENERATOR DEVICES.

PROVIDE THE FOLLOWING FEATURES IN THE MASTER CONTROL SECTION TO SERVE ALL GENERATING UNITS – (A) PRIMARY PROGRAMMABLE LOGIC CONTROLLER (PLC) FOR AUTOMATIC LOAD CONTROL AND SENSING, (B) BACKUP PROGRAMMABLE LOGIC CONTROLLER, (C) OPERATOR INTERFACE UNIT FOR OPERATOR CHANGES TO THE LOAD CONTROL SET POINTS IN THE PLC, (D) ANNUNCIATION PANEL WITH COMPLETE ANNUNCIATION OF FAILURE AND STATUS OF THE SWITCHGEAR DEVICES.

PROVIDE A MASTER CONTROL AND STATION SERVICE SECTION COMPLETE WITH – (A) MICROPROCESSOR BASED KILOWATT-HOUR METERS FOR THE BUS AND FOR THE STATION SERVICE; (B) MOLDED CASE CIRCUIT BREAKER FOR THE STATION SERVICE. PROVIDE A DISTRIBUTION SECTION COMPLETE WITH – (A) DRAW-OUT INSULATED CASE CIRCUIT BREAKERS FOR THE COMMUNITY FEEDERS; (B) CHARGE AIR COOLER VARIABLE FREQUENCY DRIVES. CIRCUIT BREAKER SIZES SHALL BE AS INDICATED ON THE ONE-LINE DIAGRAM.

OPERATION – THE PARALLELING SWITCHGEAR SHALL ALLOW THE OPERATOR TO SELECT EITHER MANUAL OPERATION OF ANY OR ALL OF THE GENERATING UNITS OR COMPLETE UNATTENDED AUTOMATIC OPERATION. THE CONTROL SYSTEM SHALL ALLOW THE SELECTION OF ALL OF THE GENERATING UNITS TO OPERATE IN MANUAL OR AUTOMATIC MODE OR A PORTION OF THE GENERATING UNITS TO OPERATE IN MANUAL MODE AND THE REMAINDER IN AUTOMATIC MODE. THE OPERATOR SHALL PLACE THE UNIT IN MANUAL OR AUTOMATIC MODE USING THE GCP.

AUTOMATIC – WHEN THE UNIT IS IN THE AUTOMATIC MODE, THE PROGRAMMABLE LOGIC CONTROLLER (PLC) SHALL SENSE THE DEMAND ON THE SYSTEM AND SHALL AUTOMATICALLY SELECT THE MOST APPROPRIATE ENGINE/GENERATOR UNIT OR COMBINATION OF UNITS TO MEET THE DEMAND. THE PLC SHALL AUTOMATICALLY START THE ENGINE/GENERATOR UNITS, BRING THEM TO THE PROPER SPEED, SYNCHRONIZE THE UNITS, AND CLOSE THE GENERATOR CIRCUIT BREAKER. WHEN THE PLC REMOVES AN ENGINE/GENERATOR FROM THE BUS, THE PLC SHALL REMOVE THE UNIT FROM THE BUS AND ALLOW THE ENGINE TO OPERATE FOR A COOLDOWN PERIOD BEFORE STOPPING THE ENGINE.

MANUAL – IN THE MANUAL MODE, THE OPERATOR SHALL BE ABLE TO START THE ENGINE/GENERATOR THROUGH THE GCP. THE GCP WILL START THE ENGINE/GENERATOR, BRING THE ENGINE UP TO SPEED, AND SYNCHRONIZE THE GENERATOR TO THE BUS. THIS SHALL BE ACCOMPLISHED INDEPENDENTLY FROM THE PLC.

EMERGENCY SHUTDOWN – UPON RECEIPT OF A CONTACT CLOSURE FROM THE FIRE SUPPRESSION SYSTEM, THE LOW COOLANT LEVEL SWITCH, OR THE EMERGENCY STOP PUSHBUTTON ALL OPERATING ENGINES SHALL BE IMMEDIATELY SHUT DOWN WITHOUT GOING THROUGH A SHUTDOWN PROCEDURE. THE SYSTEM SHALL REMAIN IN A LOCKOUT CONDITION UNTIL ALL ALARMS ARE CLEARED.

LOW FUEL LEVEL ALARM – A NORMALLY CLOSED CONTACT ON THE DAY TANK CONTROL PANEL SHALL OPEN ON A LOW FUEL LEVEL. THE LOW FUEL LEVEL INDICATION SHALL START A TIME DELAY RELAY, 2 HOURS, ADJUSTABLE, AND ILLUMINATE A RED LAMP "LOW FUEL LEVEL". IF THE FUEL LEVEL HAS NOT BEEN CORRECTED BY THE END OF THE TIMED INTERVAL THE ENGINES SHALL BE SHUT DOWN AND THE ALARM LAMP SHALL REMAIN ILLUMINATED. A MANUAL RESET BUTTON ON THE FRONT OF THE SWITCHGEAR SHALL BE PROVIDED TO RESET THE TIMER RELAY FOR ANOTHER INTERVAL AND PLACE THE ENGINES BACK IN SERVICE (IF TIMED OUT). THE RESET FUNCTION SHALL WORK ANY TIME DURING OR AFTER EXPIRATION OF THE TIMED INTERVAL.

SEE THE AUTOMATIC PARALLELING SWITCHGEAR PURCHASE SPECIFICATIONS FOR ADDITIONAL DETAIL.

** TESTING AND STARTUP**

EACH ENGINE/GENERATOR UNIT SHALL BE LOAD TESTED AT THE FACTORY FOR A MINIMUM OF 8 HOURS.

THE PARALLELING SWITCHGEAR SHALL BE FACTORY TESTED TO VERIFY ALL CONTROL AND ALARM FEATURES.

THE ENTIRE GENERATION PACKAGE SHALL BE FIELD TESTED WITH A LOAD BANK PRIOR TO PLACING IN SERVICE. FIELD TESTING SHALL INCLUDE ALL FEATURES OF BOTH AUTOMATIC AND MANUAL MODES PLUS ALL ALARM AND SHUTDOWN FUNCTIONS. LOCAL PLANT OPERATORS SHALL PARTICIPATE IN ALL TESTING.

ALL STATION SERVICE EQUIPMENT SHALL BE TESTED TO VERIFY PROPER OPERATION. ALL CONTROL AND ALARM FUNCTIONS SHALL BE VERIFIED.

UPON SUCCESSFUL COMPLETION OF TESTING, THE PLANT SHALL BE PLACED IN SERVICE. A MINIMUM OF ONE WEEK OF SYSTEM PERFORMANCE MONITORING AND LOCAL OPERATOR TRAINING SHALL BE PROVIDED UPON SYSTEM STARTUP PRIOR TO LEAVING THE PROJECT SITE.

## ELECTRICAL EQUIPMENT SCHEDULE

| ITEM NO. | DESCRIPTION | MANUFACTURER |
|---|---|---|
| 1 | MULTI-TONE ALARM WITH STROBE, 115V, NEMA 3R, WEATHER RESISTANT SURFACE MOUNT BELL BOX | WHEELOCK MT4-115-WH-VNS |
| 2 | DAY TANK VERTICAL ACTION FLOAT SWITCH, REVERSIBLE 70VASPST NC/NO SWITCH, 1/8" NPT, 1"MAX ø BUNA-N FLOAT FOR S.G=.47, MINIMUM 60" LONG PVC COATED #20 AWG LEAD WIRES | INNOVATIVE COMPONENTS LS-12-111/2 |
| 3 | MODERATE TEMP RANGE, 3 WIRE, PLATINUM RTD, 100 OHMS +/- 0.12%, 0.00385 TEMP COEFFICIENT, 1/2" NPT REDUCED TIP TYPE 316 SS THERMOWELL, 2-1/2" IMMERSION. | MURPHY RTD-225-400-100 |
| 4 | LINE VOLTAGE HEATING/COOLING THERMOSTAT, 120V, 9.8 FLA, SPDT, 44F TO 86F RANGE. | HONEYWELL T651A3018 |
| 5 | EMERGENCY FIXTURE, WALL MOUNT, 20 GA STEEL ENCLOSURE, LEAD-CALCIUM BATTERY, 120V INPUT, 12VDC, 150W, DUAL 12W HALOGEN LAMPS | PATHWAY 12D150-2L-H12 NO SUBSTITUTES |
| 6 | EMERGENCY FIXTURE WITH EXIT SIGN, WALL MOUNT, 20 GA STEEL ENCLOSURE, LEAD-CALCIUM BATTERY, 120V INPUT, DUAL 6V LAMPS, OPTION M1 STYLE MOUNT WITH LIGHT BEHIND SIGN | PATHWAY LEP12X1CR-M1 NO SUBSTITUTES |
| 7 | SURFACE MOUNTED/SUSPENDED FLOURESCENT FIXTURE, SOLID TOP, WIDE DISTRIBUTION, 48" LONG, 3 TUBE F32WT8 LAMP, INSTANT START MULTI VOLTAGE ENERGY SAVING BALLAST | LITHONIA MS8-ST-3-32-WD MVOLT |
| 8 | 150W HIGH PRESSURE SODIUM WALL MOUNT FIXTURE, MULTI-TAP BALLAST. PROVIDE WITH 120V PHOTO CELL CONTROL AND TWO LAMPS (ONE SPARE). | LITHONIA TWH150STB |
| 9 | 0-5 MINUTE TIMER SWITCH, 120V, 20A, 1HP RATED, INSTALL IN 4"x4" PRESSED STEEL BOX WITH METAL COVER. | INTERMATIC FF5M |
| 10 | SINGLE POLE SNAP SWITCH, 120V, 20A, METAL, 1-1/2HP RATED, INSTALL IN 4"x4" PRESSED STEEL BOX WITH METAL COVER, IVORY. | HUBBELL 1221-I |
| 11 | SINGLE POLE SNAP SWITCH WITH RED PILOT LIGHT, 120V, 20A, 1-1/2HP RATED, INSTALL IN 4"x4" PRESSED STEEL BOX WITH METAL COVER | HUBBELL 1221-PL |
| 12 | DOUBLE POLE SNAP SWITCH WITH RED PILOT LIGHT, 240V, 30A, 2HP RATED, INSTALL IN 4"x4" PRESSED STEEL BOX WITH METAL COVER | HUBBELL 3032-PL |
| 13 | STATION SERVICE TRANSFORMER – ENERGY STAR COMPLIANT, ENCLOSURE TYPE 1, 15kVA, HV 480 DELTA, LV 208Y/120 | EGS ELECTRICAL GROUP CAT. NO. ET2H15S |
| 14 | STATION SERVICE PANELBOARD, 3-PHASE MAIN BREAKER WITH COPPER BUS, 4 WIRE, 120/208V, 150A, 42 CIRCUITS, BOLT-IN BREAKERS, SURFACE MOUNT, NEMA 1 | SIEMENS |
| 15 | SURFACE MOUNT 125V NEMA 5-20R RECEPTACLE. INSTALL IN 4"x4" PRESSED STEEL BOX WITH METAL COVER. | HUBBELL 5362I |
| 16 | 125V NEMA 5-20R RECEPTACLE. MOUNT IN CAST FDA BOX WITH WEATHERPROOF COVER. | HUBBELL 5362I WITH CROUSE HINDS WLRD-1 COVER |
| 17 | 24-VOLT 20-AMP AUTO-EQUALIZING BATTERY CHARGER FOR 120 VOLT AC INPUT POWER, WITH OPTIONAL HIGH/LOW VOLTAGE, AC POWER FAILURE, & REMOTE SUMMARY ALARM RELAYS | CHARLES INDUSTRIES MODEL AA2420-HLPR |
| 18 | TEMPERATURE TRANSMITTER, RTD, 20-240°F RANGE, 4-20mA OUTPUT, 1/2" NPT PIPING CONNECTION, 6mm DIAMETER BY 2.5" LONG STEM, HIRSCHMANN ELECTRICAL CONNECTION | NOSHOK 800-20/240-1-1-8-8-025-6 |
| 19 | PRESSURE TRANSMITTER, 0-60 PSIG RANGE, 4-20mA OUTPUT, 1/4" NPT PIPING CONNECTION, HIRSCHMANN ELECTRICAL CONNECTION | NOSHOK 100-60-1-1-2-7 |
| 20 | NON-FUSED LOCKABLE SAFETY SWITCH, NEMA 3R ENCLOSURE, 3PST, 600V, 30A, MIN 5HP RATED | SQUARE D HU361RB |
| 21 | EXTERIOR SLAB HEAT TEMPERATURE CONTROLLER, NEMA 1, SPDT, -30°F TO 212°F, 16A/120V | JOHNSON A419ABC-1C |
| 22 | 56" DIAMETER PADDLE FAN, CEILING MOUNTED WITH DOWN ROD, WHITE, 120V PROVIDE WITH VARIABLE SPEED CONTROL | GRAINGER 4C771 WITH LUTRON FS5EWH CONTROL |
| 23 | THREE POINT MAGNETIC FLOAT SWITCH. 2-1/2" ANSI 150# RF FLANGE MOUNT, 1/2" NPT CONDUIT ENTRY, EXPLOSION PROOF CONSTRUCTION, LISTED FOR CLASS I, DIV 1 & 2 LOCATIONS, 1/2" DIAMETER FIXED LENGTH STAINLESS STEEL STEM, 2" MAX. DIAMETER STAINLESS STEEL FLOATS FOR S.G.=0.68, 200VDC 500mA FORM A CONTACTS. 90-1/2" STEM LENGTH. ACTUATION LENGTHS – 11"(N.O.), 23"(N.O.), & 88"(N.C.). | ISE-MAGTECH MLS-4EX-C-6-2.5"150#-0.68-T-P 90.5"-11"-23"-88" |
| 24 | EXHAUST FAN CONTACTOR, IEC STYLE, 12A, 120V COIL, NEMA 1 ENCLOSURE | ALLEN BRADLEY 100C12D10 & 198EBA966 |

RECORD DRAWING

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DATE: 9/28/09

State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503

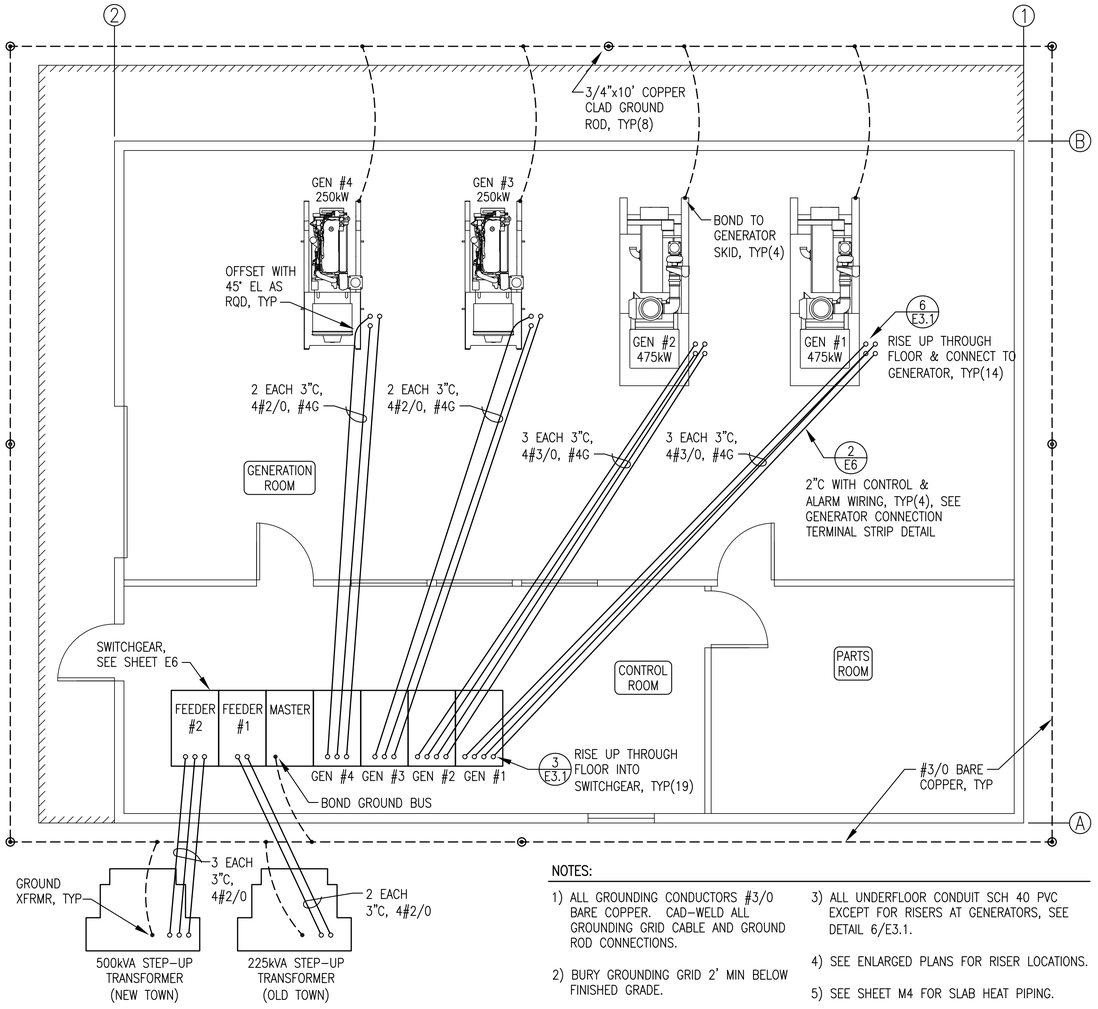
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: SPECIFICATIONS & EQUIPMENT SCHEDULE

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

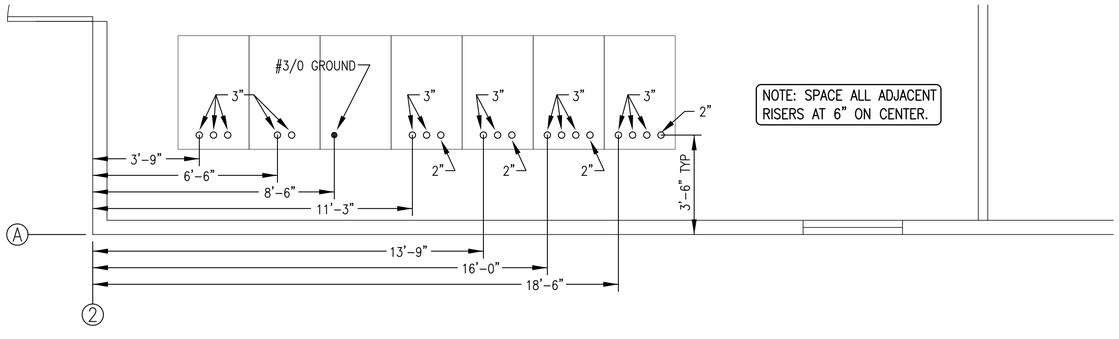
| | | | |
|---|---|---|---|
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH E2-E6 | SHEET: E2 OF 11 |
| DESIGNED BY: CWW/BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |



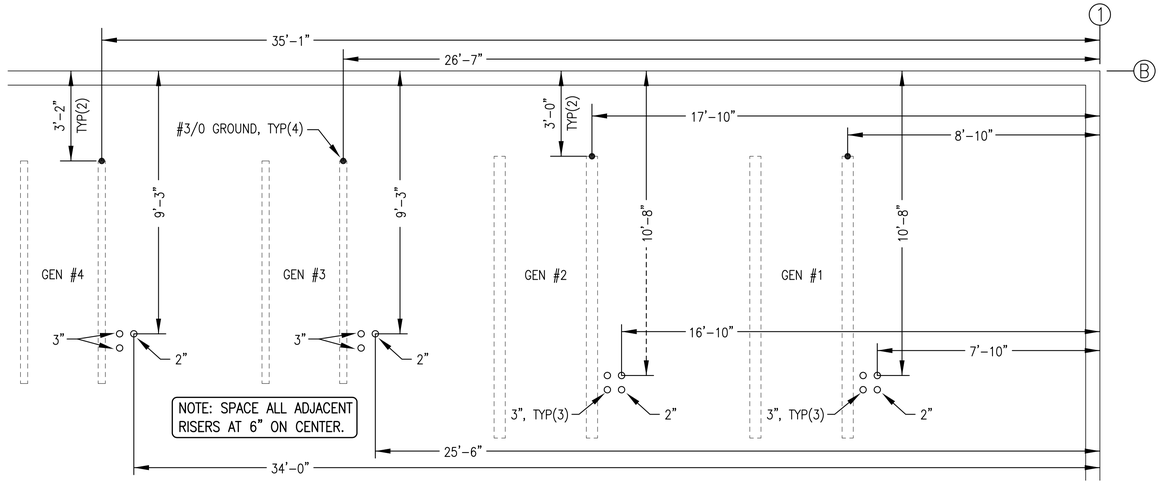

NOTES:

1) ALL GROUNDING CONDUCTORS #3/0 BARE COPPER. CAD-WELD ALL GROUNDING GRID CABLE AND GROUND ROD CONNECTIONS.
2) BURY GROUNDING GRID 2' MIN BELOW FINISHED GRADE.
3) ALL UNDERFLOOR CONDUIT SCH 40 PVC EXCEPT FOR RISERS AT GENERATORS, SEE DETAIL 6/E3.1.
4) SEE ENLARGED PLANS FOR RISER LOCATIONS.
5) SEE SHEET M4 FOR SLAB HEAT PIPING.

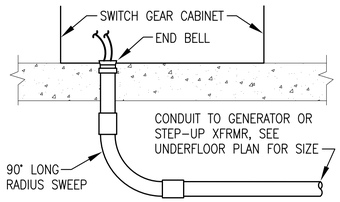
## 1 E3.1 UNDERFLOOR GENERATOR POWER & CONTROL PLAN
1/4"=1'




## 5 E3.1 ENLARGED SWITCHGEAR RISER LOCATION PLAN
3/8"=1'



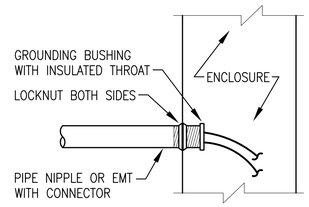

## 2 E3.1 ENLARGED GENERATOR RISER LOCATION PLAN
3/8"=1'




NOTE:

ALL CONDUIT & FITTINGS THIS DETAIL SCH 40 PVC.

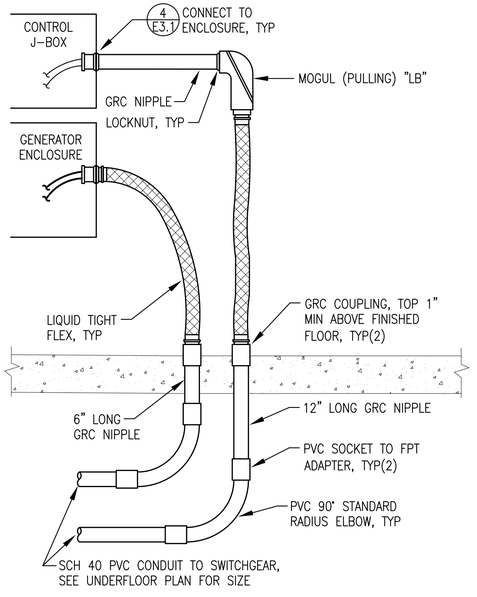
## 3 E3.1 SWITCHGEAR BOTTOM ENTRANCE
NO SCALE



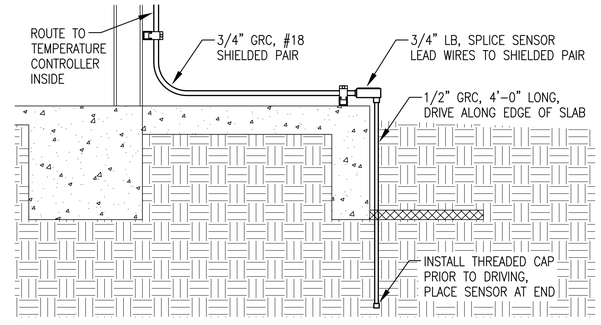

NOTES:

1) THIS DETAIL APPLIES TO ALL CONNECTIONS TO GENERATOR ENCLOSURES, SWITCHGEAR, AND PANELS.
2) ON GENERATOR ENCLOSURES MAKE ALL CONNECTIONS AS TIGHT AS POSSIBLE & INSTALL ADDITIONAL LOCKNUT AGAINST LB.

## 4 E3.1 CONNECTION TO ENCLOSURE
NO SCALE




## 6 E3.1 TYPICAL GENERATOR CONNECTION
NO SCALE




## 7 E3.1 SLAB HEAT TEMPERATURE SENSOR INSTALLATION
NO SCALE

**RECORD DRAWING**

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DATE: 9/28/09

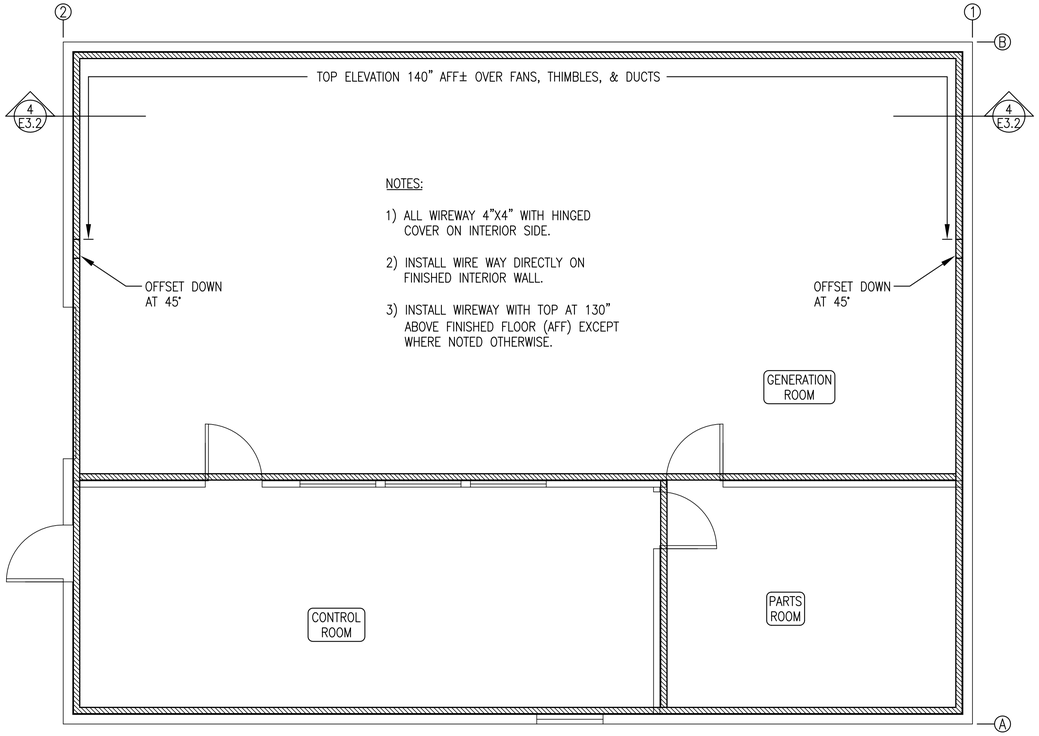
State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

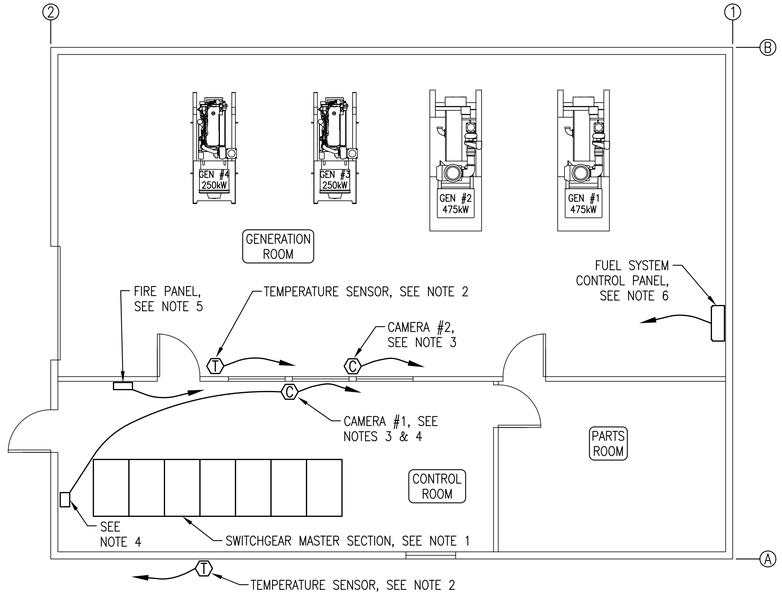
TITLE: UNDERFLOOR POWER & CONTROL PLANS & DETAILS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH E2-E6 | SHEET: E3.1 OF 11 |
|---|---|---|---|
| DESIGNED BY: CWV/BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |



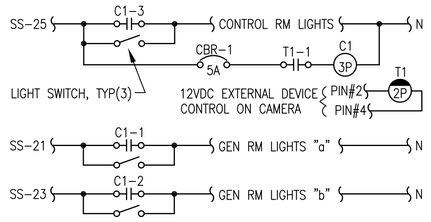

## 1 E3.2 WIREWAY PLAN
1/4"=1'




NOTES:

1) PROVIDE TELEPHONE AND HIGH SPEED INTERNET SERVICE CONNECTIONS THIS AREA.
2) RTD TEMPERATUIRE SENSOR, ROUTE #18 SHIELDED TRIAD TO SWITCHGEAR MASTER SECTION.
3) ROUTE 2#14 (12VDC) POWER TO CAMERA FROM POWER SUPPLY AT SWITCHGEAR UPS. ROUTE ETHERNET CABLE FROM CAMERA TO SERVER IN SWITCHGEAR.
4) INSTALL CONTACTOR WITH TIMER RELAY FOR REMOTE LIGHTING CONTROL. OPERATE FROM DRY CONTACT ON CAMERA #1. SET TIMER TO TURN LIGHTS ON FOR 5 MINUTES EACH TIME CAMERA IS OPERATED. SEE SCHEMATIC 3/E3.2.
5) ROUTE 4-WIRE TELEPHONE CABLE FROM FIRE SUPPRESSION CONTROL PANEL TO DESKTOP COMPUTER.
6) ROUTE CATEGORY 5E ETHERNET CABLE FROM FUEL SYSTEM CONTROL PANEL TO SWITCHGEAR MASTER SECTION.

## 2 E3.2 DATA/COMMUNICATION PLAN
3/16"=1'




NOTES:

1) INSTALL CONTACTOR, TIMER RELAY, AND CIRCUIT BREAKER IN 8"x8"x8" NEMA 1 JUNCTION BOX ON WALL ABOVE LIGHT SWITCHES.
2) ALL LIGHTING CIRCUIT WIRING MIN #12 AWG. ALL 5A CONTROL CIRCUIT WIRING MIN #16AWG.
3) SET TIMER FOR 5 MINUTES, SINGLE SHOT MODE.

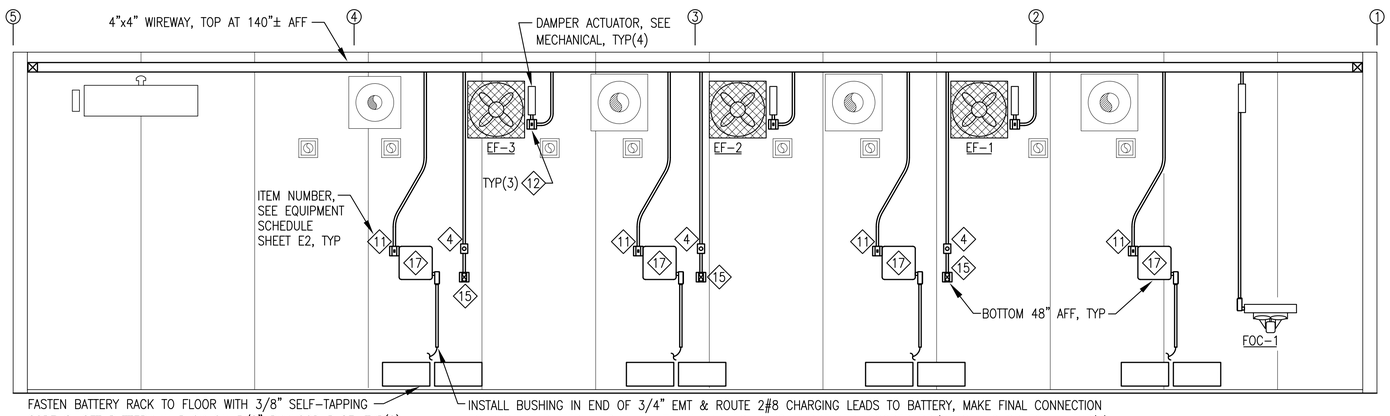
BILL OF MATERIALS:

CB1: 5A, 1P, RAIL MOUNT CIRCUIT BREAKER. ALLEN BRADLEY 1489-A1-050.

C1: 23A, 3P CONTACTOR, 120V COIL. ALLEN BRADLEY 100-C23D10.

T1: 10A, DPDT RELAY, 12VDC COIL, WITH SOCKET BASE AND TIMING MODULE. ALLEN BRADLEY 700-HA32Z12 RELAY WITH 700HN204 BASE AND 700HT3 SERIES B TIMING MODULE.

## 3 E3.2 LIGHTING REMOTE CONTROL SCHEMATIC
NO SCALE




## 4 E3.2 BACK WALL ELEVATION
3/8"=1'

RECORD DRAWING

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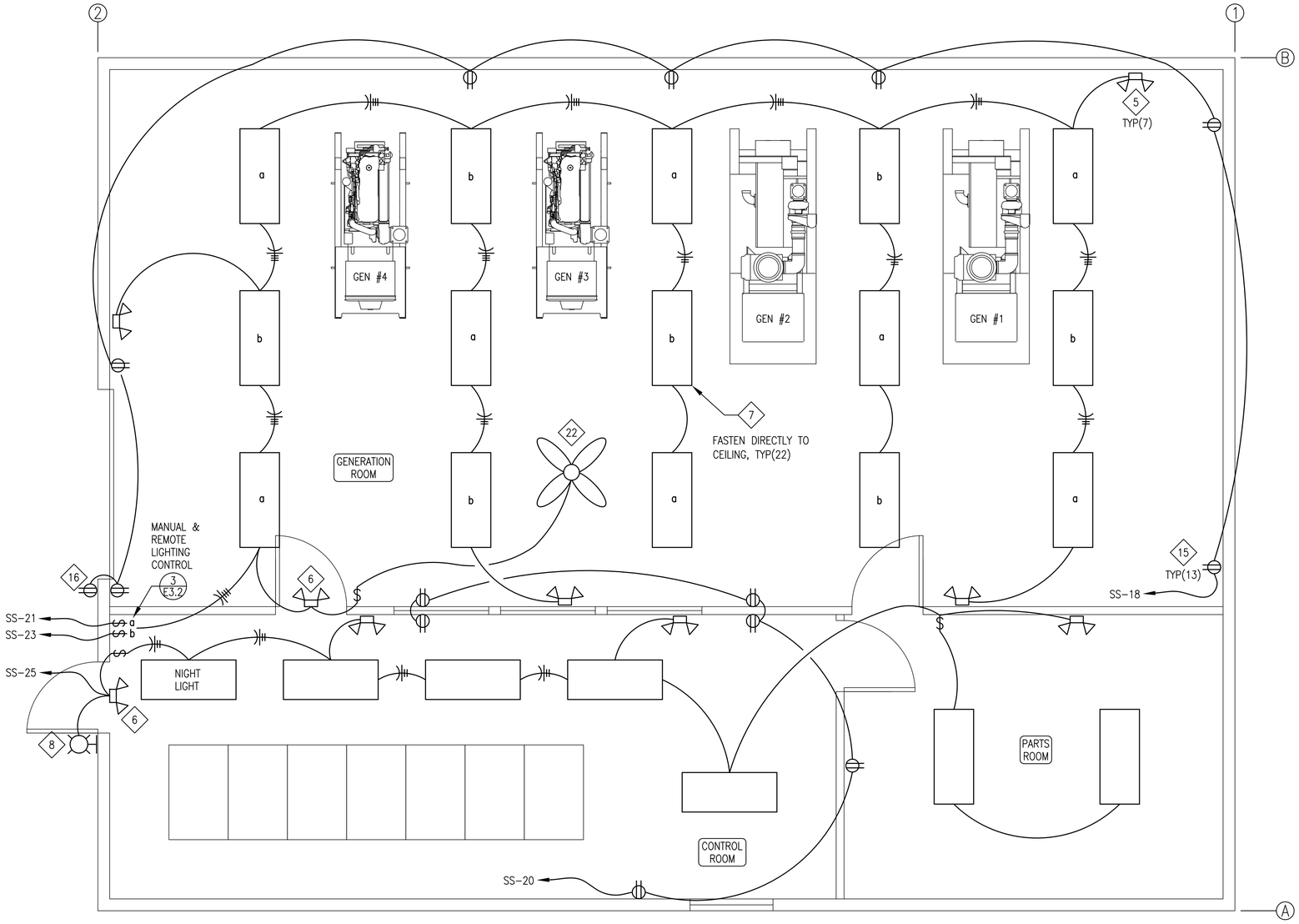
State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: WIREWAY PLAN, DATA/COMMUNICATION PLAN, & DETAILS

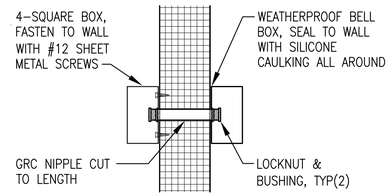
ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

| | | | |
|---|---|---|---|
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH E2-E6 | SHEET: E3.2 OF 11 |
| DESIGNED BY: CWV/BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |




1 E4 LIGHTING/RECEPTACLE PLAN
3/8"=1'

| BUILDING PLANS SYMBOL LEGEND | |
|---|---|
| SYMBOL | DESCRIPTION |
| SS-## | HOME RUN TO PANEL & BREAKER(S) INDICATED. SHORT DASH INDICATES HOT CONDUCTOR, LONG DASH INDICATES NEUTRAL CONDUCTOR, CURVED DASH INDICATES GROUND CONDUCTOR. IF NOT SPECIFICALLY INDICATED, PROVIDE 2#12 AWG & 1#12 AWG GROUND. |
| # | ELECTRICAL ITEM SEE EQUIPMENT SCHEDULE |
| 1/4 | MOTOR (HORESPOWER INDICATED) |
| MD | MOTORIZED DAMPER SEE MECHANICAL |
| | 125V, 20A DUPLEX RECEPTACLE |
| T | LINE VOLTAGE THERMOSTAT |
| $ | SNAP SWITCH/ SMALL MOTOR DISCONNECT |
| T$ | TIMER SWITCH |
| | GROUND |




2 E4 EXTERIOR WALL PENETRATION
NO SCALE

RECORD DRAWING

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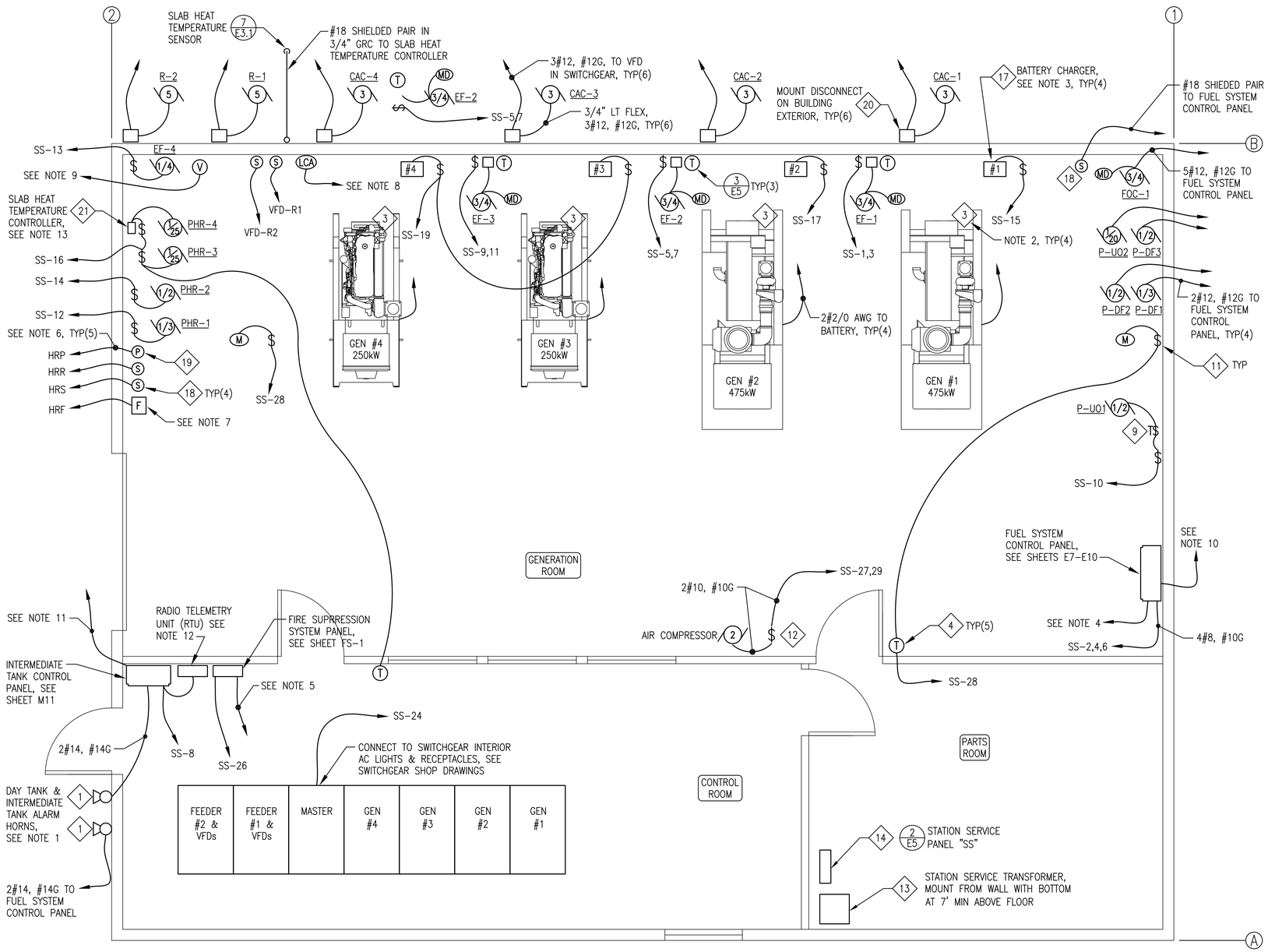
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

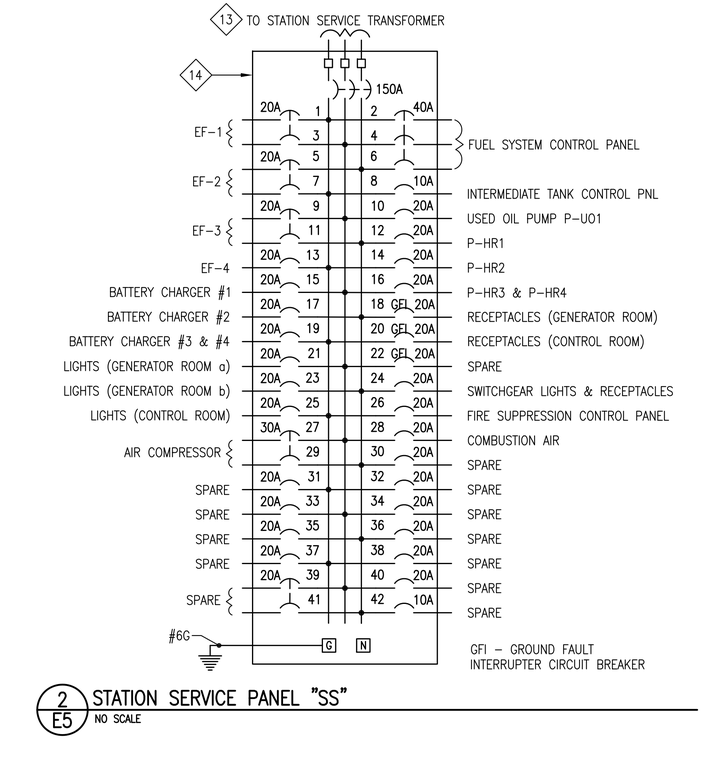
TITLE: LIGHTING/RECEPTACLE PLAN & DETAILS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH E2-E6 | SHEET: E4 OF 11 |
|---|---|---|---|
| DESIGNED BY: CWV/BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |

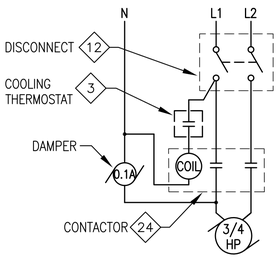



1/E5 STATION SERVICE PLAN
3/8"=1'

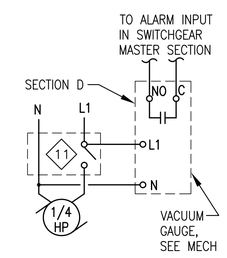



2/E5 STATION SERVICE PANEL "SS"
NO SCALE

NOTE: FAN MOTORS FURNISHED WITH INTEGRAL THERMAL PROTECTION.




3/E5 EF-1, 2, & 3 WIRING DIAGRAM
NO SCALE




4/E5 EF-4 WIRING DIAGRAM
NO SCALE

NOTES:

1) INSTALL PLACARD, SEE SHEET M1.1.
2) INSTALL RTD TEMPERATURE SENSOR IN COOLANT RETURN PIPE AND ROUTE SHIELDED TRIAD TO GENERATOR TERMINAL STRIP, SEE 2/E6.
3) MOUNT BATTERY CHARGER TO WALL AND INSTALL BATTERY ON FLOOR BELOW, SEE ELEVATION 2/E4. ROUTE 2#14 FROM CHARGER ALARM CONTACTS TO ASSOCIATED SWITCHGEAR GENERATOR SECTION, SEE TERMINAL STRIP DRAWING 2/E6.
4) ROUTE 2#14 FROM FUEL PANEL ENGINE RUN-DRY PREVENTION CONTACTS AND ROUTE #18 SHIELDED PAIR FROM DAY TANK METER PULSER TO SWITCHGEAR MASTER SECTION.
5) ROUTE 2#14 TO SWITCHGEAR MASTER SECTION FOR FIRE ALARM SHUT DOWN.
6) INSTALL TEMP AND PRESS TRANSDUCERS WHERE SHOWN ON COOLING PIPING ISOMETRIC. ROUTE #18 SHIELDED PAIR FROM EACH SENSOR TO SWITCHGEAR. TERMINATE RADIATOR COOLANT SENSORS AT ASSOCIATED VFD PANEL. TERMINATE HEAT RECOVERY SENSORS AT MASTER SECTION.
7) INSTALL FLOW METER FOR HEAT RECOVERY MONITORING WHERE SHOWN ON HEAT RECOVERY PIPING ISOMETRIC. PROVIDE POWER FROM P-HR2 DISCONNECT. ROUTE #18 SHIELDED PAIR TO SWITCHGEAR MASTER SECTION.
8) LOW COOLANT LEVEL ALARM SWITCH FURNISHED WITH GENERATORS AND INSTALLED AT EXPANSION TANK, SEE MECHANICAL. ROUTE 2#14 TO SWITCHGEAR MASTER SECTION.
9) ROUTE 2#14 FROM ALARM CONTACT ON CRANK VENT SYSTEM VACUUM GAUGE TO SWITCHGEAR MASTER SECTION, SEE DETAIL 4/E5.
10) 5#14, #14G TO BOTTOM OUTLET ACTUATOR VALVE ON INTERMEDIATE TANK, SEE SITE PLAN FOR LOCATION, SEE DAY TANK LOGIC DIAGRAM SHEET E9 FOR CONNECTION.
11) 9#14, #14G TO TOP FILL ACTUATOR VALVE AND 3-POINT FLOAT SWITCH ON INTERMEDIATE TANK, SEE SITE PLAN FOR LOCATION, SEE INTERMEDIATE TANK CONTROL PANEL LOGIC DIAGRAM SHEET E11 FOR CONNECTIONS.
12) INSTALL RADIO TELEMETRY UNIT (RTU) SALVAGED FROM EXISTING POWER PLANT. PROVIDE POWER AND PUMP RUN SIGNAL FROM INTERMEDIATE TANK CONTROL PANEL, SEE SHEET E11.
13) MOUNT SLAB HEAT CONTROLLER ON WALL NEAR P-HR4 & PROVIDE POWER FROM P-HR4 DISCONNECT.

RECORD DRAWING
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Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: STATION SERVICE PLAN, PANEL, & DETAILS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

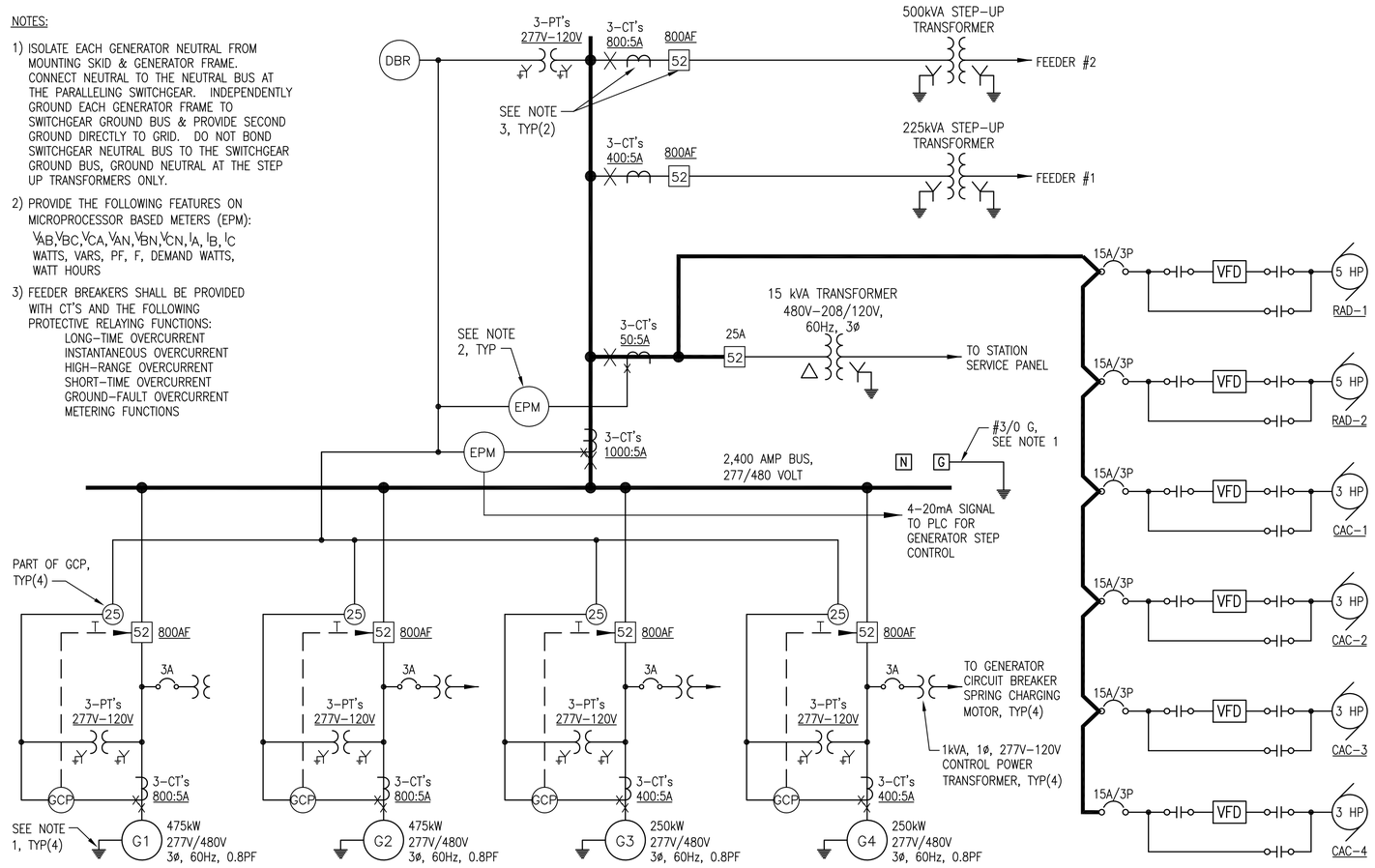
| | | | | |
|---|---|---|---|---|
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKICH E2-E6 | SHEET: E5 | OF 11 |
| DESIGNED BY: CWV/BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | | |

NOTES:

1) ISOLATE EACH GENERATOR NEUTRAL FROM MOUNTING SKID & GENERATOR FRAME. CONNECT NEUTRAL TO THE NEUTRAL BUS AT THE PARALLELING SWITCHGEAR. INDEPENDENTLY GROUND EACH GENERATOR FRAME TO SWITCHGEAR GROUND BUS & PROVIDE SECOND GROUND DIRECTLY TO GRID. DO NOT BOND SWITCHGEAR NEUTRAL BUS TO THE SWITCHGEAR GROUND BUS, GROUND NEUTRAL AT THE STEP UP TRANSFORMERS ONLY.

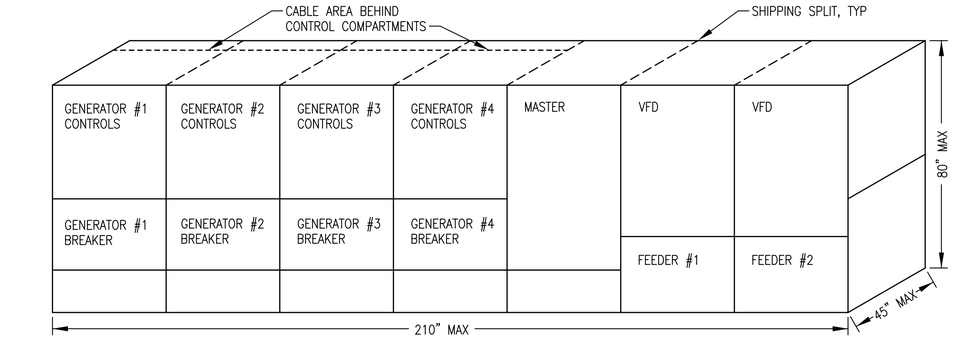
2) PROVIDE THE FOLLOWING FEATURES ON MICROPROCESSOR BASED METERS (EPM):
$V_{AB}, V_{BC}, V_{CA}, V_{AN}, V_{BN}, V_{CN}, I_A, I_B, I_C$
WATTS, VARS, PF, F, DEMAND WATTS, WATT HOURS

3) FEEDER BREAKERS SHALL BE PROVIDED WITH CT'S AND THE FOLLOWING PROTECTIVE RELAYING FUNCTIONS:
LONG–TIME OVERCURRENT
INSTANTANEOUS OVERCURRENT
HIGH–RANGE OVERCURRENT
SHORT–TIME OVERCURRENT
GROUND–FAULT OVERCURRENT
METERING FUNCTIONS




## 1 E6 SWITCHGEAR ONE–LINE DIAGRAM

NO SCALE




## 3 E6 SWITCHGEAR ENCLOSURE LAYOUT

NO SCALE

| | | |
|---|---|---|
| 1 | R | (+) ENGINE BATTERIES (#10 AWG) |
| 2 | BK | (–) |
| 3 | | RATED SPEED (PWM) — ECU SPEED CONTROL (#18 AWG PAIR) |
| 4 | | RATED SPEED (–) |
| 5 | | |
| 6 | Y–BK | ECU RUN (012), 24 VDC (#14 AWG) |
| 7 | O | STARTER RELAY, 24 VDC (#14 AWG) |
| 8 | | SPARE |
| 9 | | |
| 10 | | OIL LEVEL SWITCH |
| 11 | | (#18 AWG SHIELDED/TWISTED PAIR) |
| 12 | | MAGNETIC PICKUP |
| 13 | | (#18 AWG SHIELDED/TWISTED PAIR) |
| 14 | | |
| 15 | | OIL PRESSURE SENSOR |
| 16 | | (#18 AWG SHIELDED/TWISTED PAIR) |
| 17 | | JACKET WATER TEMPERATURE SENSOR |
| 18 | | (#18 AWG SHIELDED/TWISTED PAIR) |
| 19 | | SEE NOTE #3, TYP |
| 20 | | COOLANT RETURN TEMPERATURE RTD |
| 21 | | (#18 AWG SHIELDED/TWISTED TRIAD) |
| 22 | | |
| 23 | | SPARE |
| 24 | | |
| 25 | A | VOLTAGE REGULATOR AUXILIARY BIAS INPUT |
| 26 | B | (#18 AWG SHIELDED/TWISTED PAIR) |
| 27 | | INTAKE AIR TEMPERATURE SENSOR, 4–20mA |
| 28 | | (#18 AWG SHIELDED/TWISTED PAIR) |
| 29 | | AIR FILTER VACUUM SENSOR, 4–20mA |
| 30 | | (#18 AWG SHIELDED/TWISTED PAIR) |
| 31 | | |
| 32 | | CAT DATA LINK |
| 33 | | (#18 AWG SHIELDED/TWISTED PAIR) |
| 34 | | |
| 35 | | SPARE TERMINALS FOR FUTURE ADDITIONAL ECU |
| 36 | | COMMUNICATION WIRING (CANBUS, ETHERNET, ETC) |
| TC–1 | | EXHAUST TEMPERATURE TYPE "K" |
| TC–2 | | THERMOCOUPLE, SEE NOTE #2 |
| BC–1 | | #14 AWG TO BATTERY CHARGER ALARM, INSTALL |
| BC–2 | | AT SWITCHGEAR ONLY (NOT ON GENERATOR) |

NOTES:
1) PROVIDE IDENTICAL TERMINAL STRIPS IN EACH GENERATOR & EACH CORRESPONDING SECTION OF SWITCHGEAR (EXCEPT BATTERY CHARGER AS NOTED). LAY OUT & NUMBER TERMINALS EXACTLY AS SHOWN. USE WIRE GAUGES & COLOR CODE INDICATED FOR FIELD INTERCONNECTION.

2) PROVIDE TYPE "K" THERMOCOUPLE TERMINAL BLOCKS & EXTENSION WIRE.

3) IN ADDITION TO TERMINAL BLOCKS SHOWN PROVIDE 2 EACH 30A GROUNDING LUGS IN GENERATOR ENCLOSURE BONDED TO GENERATOR FRAME. TERMINATE DRAIN WIRES FOR ALL SHIELDS AT GENERATOR END ONLY.

## 2 E6 TYPICAL GENERATOR CONNECTION DETAILS

NO SCALE

### SWITCHGEAR SYMBOL LEGEND

- (G) DIESEL GENERATOR
- 52 — 80AT 250AF — CIRCUIT BREAKER, AT=AMP TRIP RATING, AF=AMP FRAME RATING
- 250A — CONTACTOR WITH AMPERE RATING
- CURRENT TRANSFORMER, M.R. – INDICATES MULTIRATIO, CT'S RATING FACTOR RF=2.0
- POTENTIAL TRANSFORMER
- WYE CONNECTION
- DELTA CONNECTION
- (EPM) MICROPROCESSOR–BASED METERING UNIT
- (DBR) DEAD BUS RELAY
- (GCP) GENSET CONTROL PACKAGE WOODWARD GCP–31
- (25) SYNCHRONIZING EQUIPMENT

RECORD DRAWING

THESE DRAWINGS HAVE BEEN PREPARED FROM INFORMATION PROVIDED BY OTHERS. THERE IS NO GUARANTEE AS TO THE ACCURACY OR COMPLETENESS OF THE INFORMATION CONTAINED HEREIN.

DATE: 9/28/09


State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY


PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: SWITCHGEAR DETAILS


ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511–1405 PHONE (907) 349–0100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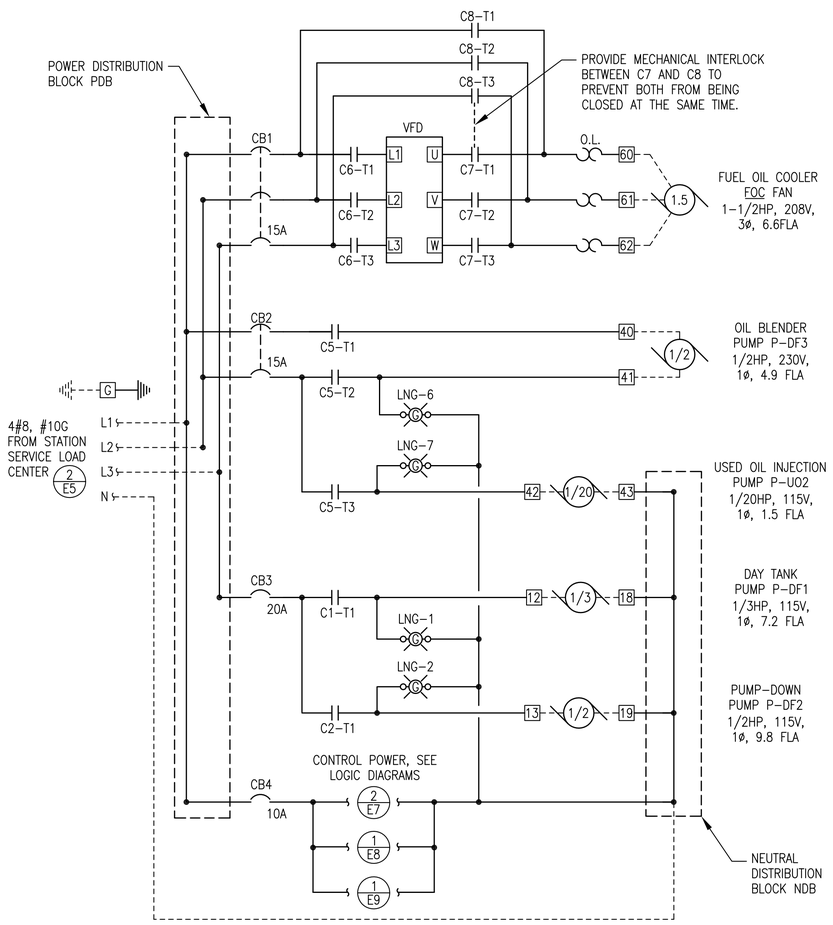
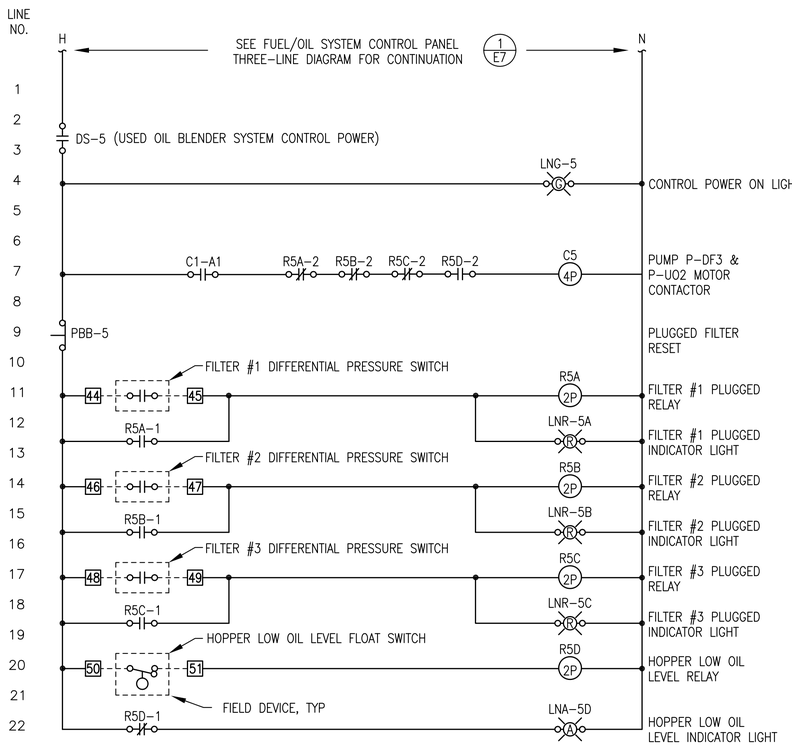
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH E2–E6 | SHEET: E6 | OF 11 |
| DESIGNED BY: CWV/BCG | DATE: 6/22/07 | PROJECT NUMBER: 06–02–9551 | | |




NOTE: ALL 1/2HP AND UNDER MOTORS EQUIPPED WITH INTEGRAL THERMAL PROTECTION.

## 1 E7 FUEL SYSTEM CONTROL PANEL THREE-LINE DIAGRAM

NO SCALE




## 2 E7 USED OIL BLENDER SYSTEM LOGIC DIAGRAM

NO SCALE

## USED OIL BLENDER SYSTEM SEQUENCE OF OPERATIONS:

1. WHEN THE BLENDER CIRCUIT BREAKER AND CONTROL POWER SWITCH ARE CLOSED; THE GREEN POWER LIGHT IS ON AND POWER IS PROVIDED TO ALL CONTROL DEVICES.
2. NORMAL OPERATION – WHENEVER THE DAY TANK FILLS BOTH THE DIESEL CIRCULATING PUMP, P-DF3, AND THE USED OIL INJECTION PUMP, P-UO2, RUN AND THE ASSOCIATED GREEN PUMP RUNNING LIGHTS ARE ON.
3. PLUGGED FILTER – IF THE DIFFERENTIAL PRESSURE ACROSS A FILTER REACHES THE ALARM SETPOINT, BOTH PUMPS STOP RUNNING AND THE RED FILTER PLUGGED LIGHT FOR THE ASSOCIATED FILTER TURNS ON. THE ALARM LATCHES AND THE SYSTEM WILL NOT OPERATE UNTIL THE PROBLEM IS CORRECTED. AFTER THE FILTER ELEMENT HAS BEEN CHANGED THE BLACK RESET BUTTON MUST BE PRESSED OR THE CONTROL POWER MUST BE TURNED OFF AND BACK ON TO RESUME NORMAL OPERATION.
4. HOPPER LOW OIL LEVEL – WHEN THE OIL LEVEL FALLS BELOW THE LOW LEVEL FLOAT SWITCH, BOTH PUMPS STOP RUNNING AND THE AMBER HOPPER LOW OIL LEVEL LIGHT TURNS ON. THE SYSTEM WILL NOT OPERATE UNTIL THE USED OIL LEVEL IN THE HOPPER RISES ABOVE THE LOW LEVEL. RESET IS NOT REQUIRED.

| PANEL | | FIELD |
|---|---|---|
| C5-T1 | 40 | L1 TO PUMP PDF-3 |
| C5-T2 | 41 | L2 TO PUMP PDF-3 |
| C5-T3 | 42 | PUMP P-UO2 POWER |
| N | 43 | PUMP P-UO2 NEUTRAL |
| | 44 | FILTER #1 SWITCH L1 |
| | 45 | FILTER #1 SWITCH L2 |
| | 46 | FILTER #2 SWITCH L1 |
| | 47 | FILTER #2 SWITCH L2 |
| | 48 | FILTER #3 SWITCH L1 |
| | 49 | FILTER #3 SWITCH L2 |
| | 50 | OIL LEVEL SWITCH L1 |
| | 51 | OIL LEVEL SWITCH L2 |
| | 52 | SPARE |
| | 53 | SPARE |

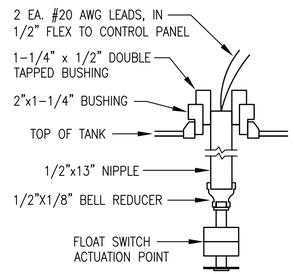
NOTE: INSTALL TERMINAL STRIP VERTICALLY AS SHOWN. LOCATE TERMINAL STRIP TO THE RIGHT OF PANEL DEVICES TO ACCOMMODATE CONDUCTOR ROUTING FROM CONDUITS CONNECTING TO THE TOP, BOTTOM OR RIGHT SIDE (FACING) OF PANEL. SEE SUBPANEL LAYOUT 2/E10.

## 3 E7 USED OIL BLENDER TERMINAL STRIP TB-2

NO SCALE

## LEGEND

| | | | |
|---|---|---|---|
| R# CONTROL RELAY | R#-# NORMALLY OPEN CONTACT | SW-# NORMALLY OPEN FLOAT SWITCH | |
| T# TIME DELAY RELAY | SS-# 2-POSITION SELECTOR SWITCH | SW-# NORMALLY CLOSED FLOAT SWITCH | |
| C# CONTACTOR | R#-# NORMALLY CLOSED CONTACT | SV# SOLENOID VALVE | |
| # TERMINAL BLOCK | O.L. OVERLOADS | ASL-# ALARM & STROBE LIGHT | |
| CB-# CIRCUIT BREAKER | PB-# NORMALLY OPEN MOMENTARY PUSH BUTTON | | |
| PANEL WIRING | PB-# NORMALLY CLOSED MOMENTARY PUSH BUTTON | FIELD WIRING | |




NOTES:

1) THIS DETAIL IS FOR FIELD INSTALLATION ONLY AND IS NOT PART OF THE PANEL BID.
2) SEE SHEET M5 FOR ADDITIONAL PIPING DETAIL.
3) PRIOR TO INSTALLATION CHASE THREADS ON FLOAT SWITCH WITH 1/8" PIPE DIE TO CLEAN OFF ANY EXCESS EPOXY, USE CARE TO AVOID DAMAGING WIRES.

## 4 E7 USED OIL HOPPER FLOAT SWITCH INSTALLATION

NO SCALE

RECORD DRAWING

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State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: FUEL SYSTEM CONTROL PANEL 3-LINE DIAGRAM & OIL BLENDER LOGIC

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

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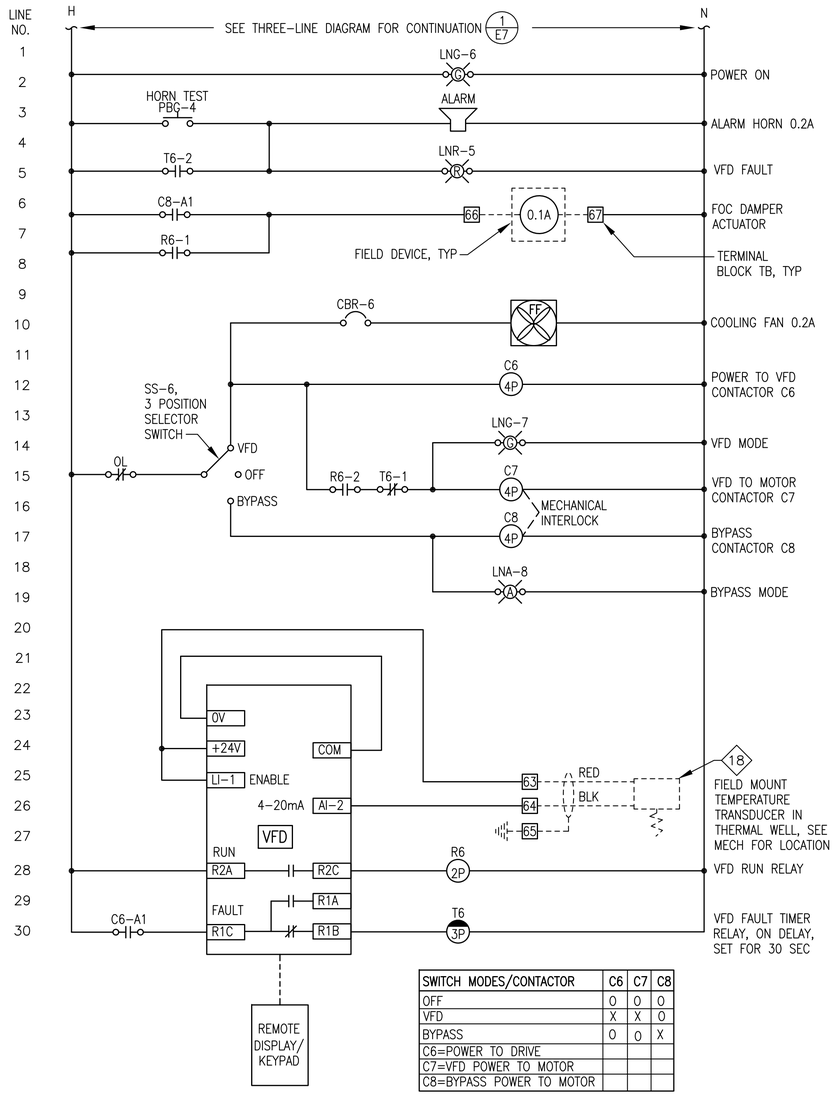
|---|---|---|---|---|---|
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH E7-E11 | SHEET: E7 | OF 11 |
| DESIGNED BY: CWV/BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | | |




| SWITCH MODES/CONTACTOR | C6 | C7 | C8 |
|---|---|---|---|
| OFF | 0 | 0 | 0 |
| VFD | X | X | 0 |
| BYPASS | 0 | 0 | X |
| C6=POWER TO DRIVE | | | |
| C7=VFD POWER TO MOTOR | | | |
| C8=BYPASS POWER TO MOTOR | | | |

X – INDICATES CONTACT OR CONTACTOR CLOSED

1/E8 FUEL OIL COOLER VFD LOGIC DIAGRAM
NO SCALE

## FUEL OIL COOLER VFD SEQUENCE OF OPERATION:

1) WHEN THE CIRCUIT BREAKER IN STATION SERVICE PANEL "SS" AND THE INTERNAL BREAKER CB1 ARE CLOSED POWER IS PROVIDED TO ALL CONTROL DEVICES AND THE "POWER ON" LIGHT IS ON.

2) WHEN THE 3-POSITION SELECTOR SWITCH IS IN THE "OFF" POSITION, THE FAN WILL NOT OPERATE.

3) WHEN THE 3-POSITION SELECTOR SWITCH IS IN THE "BYPASS" MODE, THE FAN WILL OPERATE AT FULL SPEED AND THE "BYPASS MODE" LIGHT WILL BE ON. THE VFD WILL NOT BE IN SERVICE.

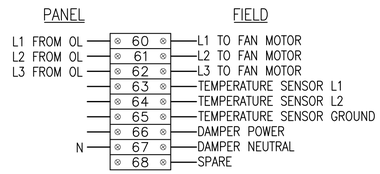
4) WHEN THE 3-POSITION SELECTOR SWITCH IS IN THE "VFD" POSITION, THE FAN WILL OPERATE UNDER CONTROL OF THE VFD AND THE "VFD MODE" LIGHT WILL BE ON. THE REMOTE TEMPERATURE SENSOR WILL SENSE FUEL RETURN TEMPERATURE AND SEND A 4-20MA SIGNAL TO THE VFD WHERE 20°F EQUALS 4 MA AND 240°F EQUALS 20 MA. USING ITS INTERNAL PROPORTIONAL CONTROL, THE VFD WILL MODULATE THE FAN SPEED AS REQUIRED TO MAINTAIN FUEL TEMPERATURE AT THE OPERATING SETPOINT. ONCE THE FAN SPEED REACHES A MINIMUM SPEED OF 10% (FIELD ADJUSTABLE), THE VFD WILL MAINTAIN THAT SPEED AS LONG AS THE FUEL TEMPERATURE IS ABOVE THE MINIMUM SETPOINT. AS THE COOLANT TEMPERATURE RISES, THE VFD WILL INCREASE THE SPEED OF THE FAN MOTOR UP TO 100%.

5) WHEN THE FUEL TEMPERATURE IS BELOW THE MINIMUM SETPOINT, THE MOTOR WILL STOP. THE MOTOR WILL REMAIN OFF UNTIL THE TEMPERATURE REACHES THE OPERATING SETPOINT. THE MOTOR WILL START AT MINIMUM SPEED AND RAMP UP TO THE REQUIRED SPEED.

6) THE FOC DAMPER WILL BE OPEN ANY TIME THE FOC FAN RUNS (BOTH VFD AND BYPASS MODES).

7) THE SPEED OF THE FAN MOTOR WILL BE DISPLAYED ON THE REMOTE DISPLAY/KEYPAD MOUNTED ON THE FRONT DOOR OF THE PANEL.

8) IN THE EVENT OF A FAILURE OF THE VFD, AFTER 30 SECONDS THE ALARM HORN WILL SOUND, THE RED "VFD FAULT" LAMP WILL ILLUMINATE, AND THE VFD WILL BE LOCKED OUT. THE FOC FAN CAN BE MANUALLY OPERATED IN BYPASS MODE.




NOTE: INSTALL TERMINAL STRIP VERTICALLY AS SHOWN. LOCATE TERMINAL STRIP TO THE RIGHT OF PANEL DEVICES TO ACCOMMODATE CONDUCTOR ROUTING FROM CONDUITS CONNECTING TO THE TOP, BOTTOM OR RIGHT SIDE (FACING) OF PANEL. SEE SUBPANEL LAYOUT 2/E10.

2/E8 VFD TERMINAL STRIP TB-1
NO SCALE

### LEGEND

- R# — CONTROL RELAY
- T# — TIME DELAY RELAY
- C# — CONTACTOR
- # — TERMINAL BLOCK
- CB-# — CIRCUIT BREAKER
- PANEL WIRING
- R#-# — NORMALLY OPEN CONTACT
- SS-# — 2-POSITION SELECTOR SWITCH
- R#-# — NORMALLY CLOSED CONTACT
- O.L. — OVERLOADS
- PB-# — NORMALLY OPEN MOMENTARY PUSH BUTTON
- PB-# — NORMALLY CLOSED MOMENTARY PUSH BUTTON
- FIELD WIRING
- SW-# — NORMALLY OPEN FLOAT SWITCH
- SW-# — NORMALLY CLOSED FLOAT SWITCH
- SV# — SOLENOID VALVE
- ASL-# — ALARM & STROBE LIGHT

RECORD DRAWING

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DATE: 9/28/09

| REV. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| 1 | ADD R6-2 CONTACT ON C7 COIL CIRCUIT, DELETE C7 AUX CONTACT ON ENABLE CIRCUIT | 12/03/07 | BCG |

State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: FUEL SYSTEM CONTROL PANEL VFD LOGIC

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

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| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH E7-E11 | SHEET: E8 OF 11 |
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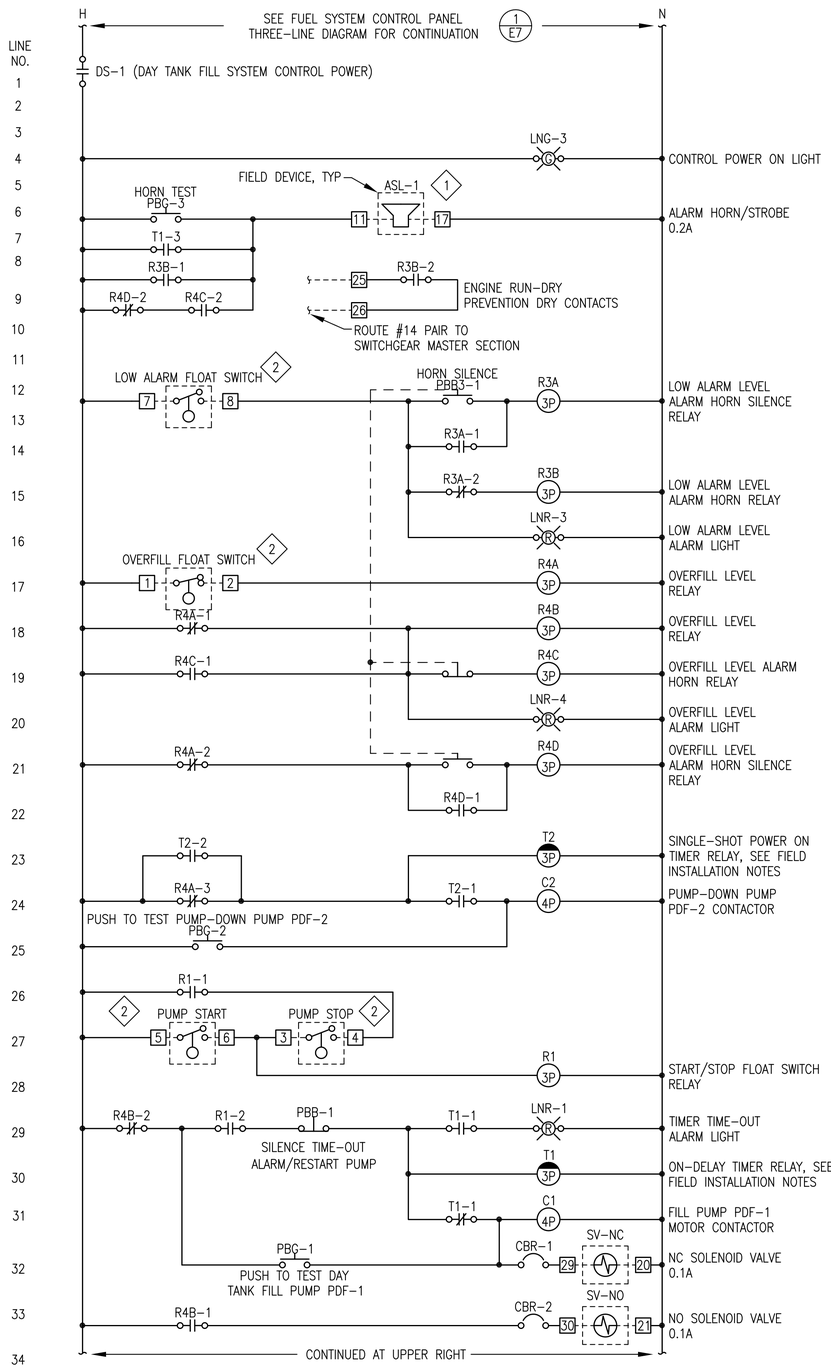
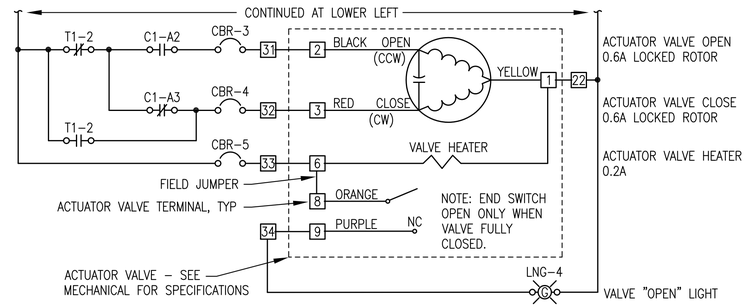



1 E9 DAY TANK AUTOMATIC FILL SYSTEM LOGIC DIAGRAM

NO SCALE




1 E9 DAY TANK AUTOMATIC FILL SYSTEM LOGIC DIAGRAM (CONTINUED)

NO SCALE

PANEL FIELD

| | | |
|---|---|---|
| FLOAT SWITCH POWER | 1 | OVERFILL FLOAT SWITCH L1 |
| | 2 | OVERFILL FLOAT SWITCH L2 |
| | 3 | PUMP STOP FLOAT SWITCH L1 |
| | 4 | PUMP STOP FLOAT SWITCH L2 |
| | 5 | PUMP START FLOAT SWITCH L1 |
| | 6 | PUMP START FLOAT SWITCH L2 |
| | 7 | LOW ALARM FLOAT SWITCH L1 |
| | 8 | LOW ALARM FLOAT SWITCH L2 |
| | 9 | SPARE |
| | 10 | CONTROL PANEL POWER FROM CB-4 (NO FIELD WIRING) |
| | 11 | ALARM/STROBE POWER |
| | 12 | FILL PUMP PDF-1 MOTOR POWER |
| | 13 | PUMP-DOWN PUMP PDF-2 MOTOR POWER |
| | 14 | SPARE |
| | 15 | SPARE |
| N | 16 | CONTROL PANEL NEUTRAL FROM NDB (NO FIELD WIRING) |
| | 17 | ALARM/STROBE NEUTRAL |
| | 18 | FILL PUMP PDF-1 MOTOR NEUTRAL |
| | 19 | PUMP-DOWN PUMP PDF-2 MOTOR NEUTRAL |
| | 20 | DAY TANK NC SOLENOID VALVE NEUTRAL |
| | 21 | DAY TANK NO SOLENOID VALVE NEUTRAL |
| | 22 | INTERMEDIATE TANK ACTUATOR VALVE NEUTRAL |
| | 23 | SPARE NEUTRAL |
| | 24 | SPARE NEUTRAL |
| | 25 | ENGINE RUN-DRY PREVENTION L1 TO SWITCHGEAR |
| | 26 | ENGINE RUN-DRY PREVENTION L2 TO SWITCHGEAR |
| | 27 | SPARE |
| | 28 | SPARE |
| CBR-1 | 29 | NC SOLENOID VALVE POWER |
| CBR-2 | 30 | NO SOLENOID VALVE POWER |
| CBR-3 | 31 | INTERMEDIATE TANK REMOTE ACTUATOR VALVE OPEN SIGNAL |
| CBR-4 | 32 | INTERMEDIATE TANK REMOTE ACTUATOR VALVE CLOSE SIGNAL |
| CBR-5 | 33 | INTERMEDIATE TANK REMOTE ACTUATOR VALVE HEATER/END SWITCH POWER |
| | 34 | INTERMEDIATE TANK REMOTE ACTUATOR VALVE OPEN INDICATOR LIGHT SIGNAL |
| | 35 | SPARE |

NOTE: INSTALL TERMINAL STRIP VERTICALLY AS SHOWN. LOCATE TERMINAL STRIP TO THE RIGHT OF PANEL DEVICES TO ACCOMMODATE CONDUCTOR ROUTING FROM CONDUITS CONNECTING TO THE TOP, BOTTOM OR RIGHT SIDE (FACING) OF PANEL. SEE SUBPANEL LAYOUT 2/E10.

2 E9 DAY TANK TERMINAL STRIP TB-3

NO SCALE

## SEQUENCE OF OPERATIONS:

1. WHEN THE FUEL SYSTEM PANEL CIRCUIT BREAKER IN STATION SERVICE PANEL "SS", INTERNAL PANEL BREAKER CB2 AND THE DAY TANK CONTROL POWER SELECTOR SWITCH ARE CLOSED; THE POWER LIGHT IS ON AND POWER IS PROVIDED TO THE REMOTE ACTUATOR VALVE HEATER/"OPEN" LIGHT CIRCUIT.

2. WHEN THE DAY TANK IS NOT CALLING FOR FUEL, POWER IS PROVIDED TO THE REMOTE ACTUATOR VALVE CLOSE CIRCUIT. WHEN THE ACTUATOR IS IN THE FULLY CLOSED POSITION, THE CLOSING CIRCUIT IS BROKEN BY INTERNAL ACTUATOR LIMIT SWITCH #2 AND THE REMOTE ACTUATOR VALVE "OPEN" LIGHT IS OFF.

3. NORMAL FILL OPERATION – WHEN THE FUEL LEVEL DROPS TO THE "PUMP START" SWITCH, TIMER T1 IS STARTED, THE N.C. DAY TANK SOLENOID VALVE OPENS, THE REMOTE ACTUATOR VALVE OPENS & THE VALVE "OPEN" LIGHT TURNS ON, DAY TANK FILL PUMP P-DF1 IS ENERGIZED, THE PUMP P-DF1 "ON" LIGHT TURNS ON, AND THE USED OIL BLENDER RUN CIRCUIT DRY CONTACTS ARE CLOSED. WHEN THE ACTUATOR IS IN THE FULLY OPEN POSITION, THE OPENING CIRCUIT IS BROKEN BY INTERNAL ACTUATOR LIMIT SWITCH #7 AND THE REMOTE ACTUATOR VALVE "OPEN" LIGHT REMAINS ON. WHEN FUEL REACHES THE "PUMP STOP" FLOAT SWITCH BEFORE TIMER T1 TIMES-OUT, TIMER T1 IS RESET, THE N.C. DAY TANK SOLENOID VALVE AND REMOTE ACTUATOR VALVE CLOSE, THE REMOTE ACTUATOR VALVE "OPEN" LIGHT TURNS OFF, DAY TANK FILL PUMP P-DF1 IS DE-ENERGIZED, THE PUMP P-DF1 "ON" LIGHT TURNS OFF, AND THE USED OIL BLENDER RUN CIRCUIT DRY CONTACTS ARE OPENED.

4. TIMER OPERATION – IF TIMER T1 TIMES OUT; THE N.C. DAY TANK SOLENOID VALVE AND REMOTE ACTUATOR VALVE CLOSE, THE REMOTE ACTUATOR VALVE "OPEN" LIGHT TURNS OFF, DAY TANK FILL PUMP P-DF1 DE-ENERGIZES, THE PUMP P-DF1 "ON" LIGHT TURNS OFF, THE USED OIL BLENDER RUN CIRCUIT DRY CONTACTS ARE OPENED, THE "TIME-OUT" ALARM LIGHT TURNS ON, AND THE ALARM HORN SOUNDS. PRESSING THE "TIME-OUT ALARM SILENCE / PUMP RESTART" BUTTON RESETS THE TIMER, SILENCES THE ALARM HORN, AND STARTS THE NORMAL FILL OPERATION. (SEE FIELD INSTALLATION NOTES FOR TIMER T1 SETTING).

5. OVERFILL FUEL LEVEL – IF THE TANK OVERFILLS AND THE FUEL LEVEL REACHES THE "OVERFILL" FLOAT SWITCH, THE N.O. DAY TANK SOLENOID VALVE CLOSES, THE N.C. DAY TANK SOLENOID VALVE AND REMOTE ACTUATOR VALVE CLOSE, THE VALVE "OPEN" LIGHT TURNS OFF, DAY TANK FILL PUMP P-DF1 DE-ENERGIZES, THE PUMP P-DF1 "ON" LIGHT TURNS OFF, THE USED OIL BLENDER RUN CIRCUIT DRY CONTACTS ARE OPENED, TIMER T2 IS STARTED, PUMP-DOWN PUMP P-DF2 ENERGIZES FOR A TIMED INTERVAL, THE PUMP P-DF2 "ON" LIGHT TURNS ON, THE "OVERFILL LEVEL" ALARM LIGHT TURNS ON, AND THE ALARM HORN SOUNDS. WHILE THE FUEL LEVEL REMAINS ABOVE THE "OVERFILL" FLOAT LEVEL, PRESSING THE LEVEL ALARM HORN "SILENCE/RESET" BUTTON SILENCES THE ALARM HORN WHILE LEAVING THE "OVERFILL LEVEL" ALARM LIGHT ON. AFTER THE OVERFILL FAULT HAS BEEN CORRECTED (THE FUEL LEVEL FALLS BELOW THE "OVERFILL" FLOAT SWITCH), PRESSING THE LEVEL ALARM HORN "SILENCE/RESET" BUTTON TURNS OFF THE "OVERFILL LEVEL" ALARM LIGHT, OPENS THE N.O. DAY TANK SOLENOID VALVE, AND TURNS OFF THE ALARM HORN (IF NOT PREVIOUSLY SILENCED). THE LEVEL ALARM HORN "SILENCE/RESET" BUTTON MUST BE PRESSED AFTER THE OVERFILL FAULT HAS BEEN CORRECTED FOR THE NORMAL FILL OPERATION TO REPEAT WHEN THE FUEL LEVEL REACHES THE "PUMP START" FLOAT SWITCH. (SEE FIELD INSTALLATION NOTES FOR TIMER T2 SETTING).

6. LOW FUEL LEVEL – IF THE FUEL LEVEL FALLS BELOW THE "LOW ALARM" FLOAT SWITCH, THE "LOW FUEL LEVEL" ALARM LIGHT TURNS ON AND THE ALARM HORN SOUNDS. THE LEVEL ALARM HORN "SILENCE/RESET" BUTTON SILENCES THE ALARM HORN WHILE LEAVING THE "LOW FUEL LEVEL" ALARM LIGHT ON. PRESSING THE "TIME-OUT ALARM SILENCE / PUMP RESTART" BUTTON RESETS THE TIMER AND STARTS THE NORMAL FILL OPERATION. WHEN THE FUEL LEVEL RISES ABOVE THE "LOW ALARM" FLOAT SWITCH THE "LOW FUEL LEVEL" ALARM LIGHT TURNS OFF AND THE ALARM HORN TURNS OFF (IF NOT PREVIOUSLY SILENCED).

7. PUMP TEST – MOMENTARY CONTACT BUTTONS ARE PROVIDED TO TEST THE PUMPS. PRESSING THE DAY TANK FILL PUMP P-DF1 "PUSH TO TEST" BUTTON STARTS TIMER T1, MOMENTARILY OPENS THE N.C. DAY TANK SOLENOID VALVE AND ACTUATED BALL VALVE, ENERGIZES DAY TANK FILL PUMP P-DF1, TURNS ON THE PUMP P-DF1 "ON" LIGHT, AND CLOSES THE USED OIL BLENDER RUN CIRCUIT CONTACTS. PUMP P-DF1 IS LOCKED OUT IF THE TANK IS AT THE OVERFILL LEVEL. PRESSING THE PUMP DOWN PUMP P-DF2 "PUSH TO TEST" BUTTON ENERGIZES PUMP DOWN PUMP P-DF2 AND TURNS ON THE PUMP P-DF2 "ON" LIGHT.

RECORD DRAWING

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813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: FUEL SYSTEM CONTROL PANEL
DAY TANK FILL LOGIC

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

| | | | | |
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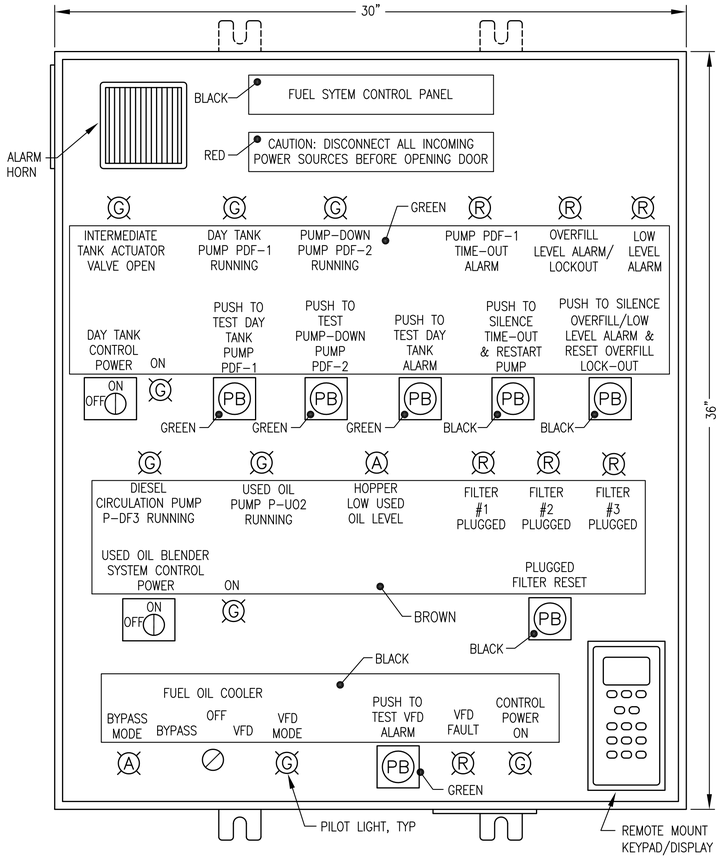
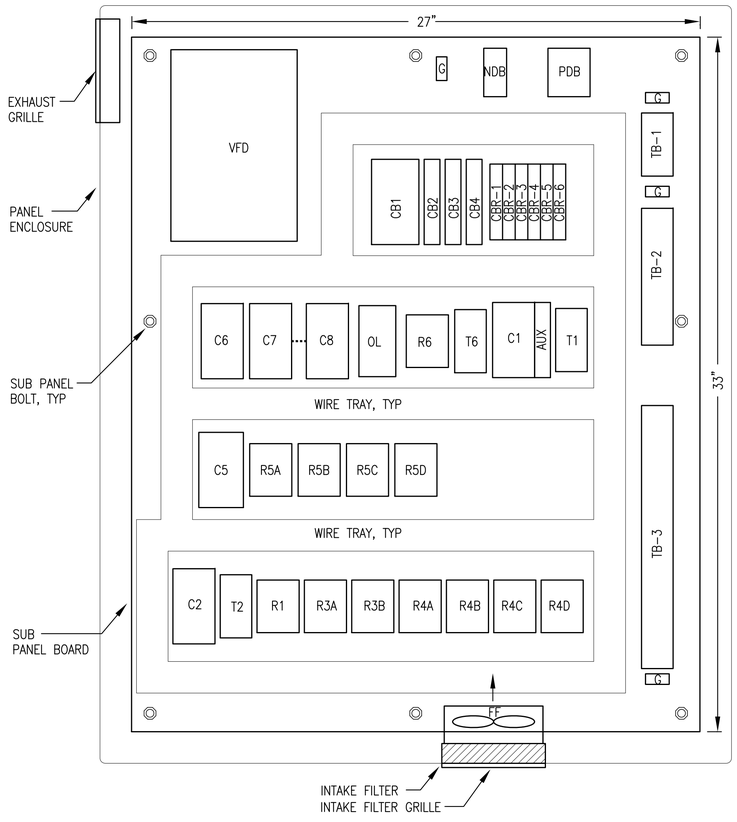


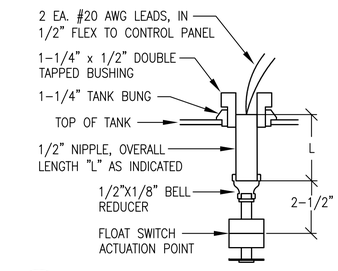

1 E10 FRONT PANEL LAYOUT
NO SCALE




2 E10 SUB PANEL LAYOUT
NO SCALE

## BILL OF MATERIALS (NOTE: PROVIDE MATERIALS AS SPECIFIED – NO SUBSTITUTIONS ALLOWED)

| TAG | QTY | MANUFACTURER | MODEL | DESCRIPTION |
|---|---|---|---|---|
| AL | 1 | INGRAM | AH115A8G | PANEL FACE MOUNTED ALARM HORN, GRAY |
| AUX | 1 | ALLEN-BRADLEY | 100-SA11 | AUXILIARY CONTACT FOR CONTACTOR, 2 POLE, NO, NC |
| C | 6 | ALLEN-BRADLEY | 100-C23D10 | 5HP, 208V, 23A, 3ø, MOTOR CONTACTOR W/ 1 N.O. AUX CONTACT |
| | 1 | ALLEN-BRADLEY | 100-MCA00 | CONTACTOR MECHANICAL INTERLOCK |
| CB1 | 1 | ALLEN-BRADLEY | 1489-A3-150 | 15A, 3P, RAIL MOUNT CIRCUIT BREAKER |
| CB2 | 1 | ALLEN-BRADLEY | 1489-A2-150 | 15A, 2P, RAIL MOUNT CIRCUIT BREAKER |
| CB3 | 1 | ALLEN-BRADLEY | 1489-A1-200 | 20A, 1P, RAIL MOUNT CIRCUIT BREAKER |
| CB4 | 1 | ALLEN-BRADLEY | 1489-A1-100 | 10A, 1P, RAIL MOUNT CIRCUIT BREAKER |
| CBR | 6 | ALLEN-BRADLEY | 1492-CH010 | RAIL-MOUNT CIRCUIT BREAKER, 1A |
| DS | 2 | ALLEN-BRADLEY | 194L-E201753 | DISCONNECT, 2 POSITION, 2 N.O., 20A, FACE MOUNT |
| | 2 | ALLEN-BRADLEY | 194L-HC4E1751 | KNOB ACTUATOR FOR LOAD SWITCH, ON/OFF, LOCKABLE |
| FF | 1 | HAMMOND | PF2000 | FILTER FAN (INTAKE AIR) WITH FILTER AND GRILLE |
| | 1 | HAMMOND | PFA2000 | EXHAUST AIR FILTER GRILLE |
| G | 8 | BLACKBURN | ADR2 | SCREW TERMINAL GROUND LUG FOR UP TO #2AWG |
| LNA | 2 | ALLEN-BRADLEY | 800T-QH10A | AMBER LED PILOT LIGHT, 120V, NEMA 4, 13 |
| LNG | 9 | ALLEN-BRADLEY | 800T-QH10G | GREEN LED PILOT LIGHT, 120V, NEMA 4, 13 |
| LNR | 7 | ALLEN-BRADLEY | 800T-QH10R | RED LED PILOT LIGHT, 120V, NEMA 4, 13 |
| NDB | 1 | MARATHON | 1411400 | DISTRIBUTION BLOCK |
| OL | 1 | ALLEN BRADLEY | 193-TAC10 | 208V, 3ø OVERLOAD, ADJUSTABLE 6A-10A RANGE |
| | 1 | ALLEN BRADLEY | 193-TAPM | OVERLOAD BASE |
| PBB | 2 | ALLEN-BRADLEY | 800-HAR2D2 | MOMENTARY PUSH BUTTON, 1 NC, NEMA 4X, BLACK |
| PBB3 | 1 | ALLEN-BRADLEY | 800-HAR2 | MOMENTARY PUSH BUTTON, NEMA 4X, BLACK |
| | 2 | ALLEN-BRADLEY | 800-TXD1 | NO CONTACT BLOCK |
| | 1 | ALLEN-BRADLEY | 800-TXD2 | NC CONTACT BLOCK |
| PBG | 4 | ALLEN-BRADLEY | 800-HAR1D1 | MOMENTARY PUSH BUTTON, 1 NO, NEMA 4X, GREEN |
| PDB | 1 | ALLEN-BRADLEY | 1492-PDM3141 | DISTRIBUTION BLOCK, 3P, 1LINE-4LOAD |
| R | 5 | ALLEN-BRADLEY | 700-HA32A1 | DPDT RELAY |
| | 5 | ALLEN-BRADLEY | 700-HN100 | 8 PIN SOCKET BASE |
| R | 7 | ALLEN-BRADLEY | 700-HA33A1 | 3PDT RELAY |
| | 7 | ALLEN-BRADLEY | 700-HN101 | 11 PIN SOCKET BASE |
| SS | 1 | ALLEN-BRADLEY | 800T-J2A | 3 POSITION MAINTAINED CONTACT SELECTOR SWITCH |
| T | 3 | ALLEN-BRADLEY | 700-HA33A1 | 3PDT RELAY |
| | 3 | ALLEN-BRADLEY | 700-HN205 | 11 PIN RELAY SOCKET BASE FOR TIMER |
| | 3 | ALLEN-BRADLEY | 700-HT3 | SERIES B TIMING MODULE |
| TB | 58 | ALLEN-BRADLEY | 1492-CAM1L | 35A, 600V, LARGE-HEAD SCREW TERMINALS |
| VFD | 1 | SQUARE D | ATV61HU15M3 | 2 HP, 208V, 3ø VARIABLE FREQUENCY DRIVE |
| | 1 | SQUARE D | VW3A1102 | MOUNTING KIT FOR REMOTE KEYPAD |
| | 1 | SQUARE D | | 2 METER LONG CABLE FOR REMOTE KEYPAD |
| | 1 | SQUARE D | VW3A3310 | ETHERNET COMMUNICATIONS CARD |




3 E10 DAY TANK FLOAT SWITCH INSTALLATION
NO SCALE

NOTES:

1) THIS DETAIL IS FOR FIELD INSTALLATION ONLY AND IS NOT PART OF THE PANEL BID.
2) SEE SHEET M5 FOR ADDITIONAL PIPING DETAIL.
3) PRIOR TO INSTALLATION CHASE THREADS ON FLOAT SWITCH WITH 1/8" PIPE DIE TO CLEAN OFF ANY EXCESS EPOXY, USE CARE TO AVOID DAMAGING WIRES.

## SHOP FABRICATION NOTES:

1. PROVIDE COMPLETE UL LISTED PANEL ASSEMBLY WITH ALL DEVICES INDICATED IN LOGIC DIAGRAMS SHEETS E7, E8 AND E9 EXCEPT FOR FIELD DEVICES. FIELD DEVICES ARE INDICATED BY LIGHT DASHED LINES. FIELD WIRING AND FIELD INSTALLED DEVICES PROVIDED BY OTHERS ARE SHOWN FOR INFORMATIONAL PURPOSES ONLY AND ARE NOT PART OF THE PANEL BID.
2. INSTALL IN A 30"x36"x12" NEMA 12 ENCLOSURE, MIN 14 GAUGE STEEL CONSTRUCTION WITH WITH 4 EACH INTEGRAL MOUNTING LUGS AT BACK, A MIN 14 GAUGE INTERIOR BACK PANEL, AND HINGED LOCKABLE DOOR. PAINT ENCLOSURE ANSI 61 GRAY AND PAINT BACK PANEL WHITE.
3. TAG EACH END OF ALL JUMPERS WITH DEVICE OR TERMINATION DESIGNATOR OF LANDING OF OPPOSITE END OF JUMPER (REVERSE ADDRESS).
4. LABEL ALL PANEL DEVICES ON BASE OR BACK PANEL ADJACENT TO ITEM. LABEL REMOTE EQUIPMENT CONNECTIONS AT EACH TERMINAL BLOCK BY THE ITEM TITLE AS SHOWN ON THE FIELD SIDE OF THE TERMINAL STRIP DRAWING.
5. PROVIDE BEVELED EDGE WHITE CORE NAMEPLATES, FACE COLOR AS INDICATED. SECURE TO PANEL FACE WITH A MINIMUM OF TWO MOUNTING SCREWS.
6. BENCH TEST COMPLETED UNIT. PROVIDE A SIGNED AND DATED BENCH TEST REPORT VERIFYING ALL FUNCTIONS. RED-LINE DESIGN DRAWINGS AS REQUIRED TO INDICATE AS-BUILT CONSTRUCTION AND RETURN TO ENGINEER.

## FIELD INSTALLATION NOTES:

1. PERFORM ALL FIELD WIRING IN ACCORDANCE WITH ELECTRICAL SPECIFICATIONS ON SHEET E2. FIELD WIRING TO MOTORS MIN #12 AWG. FIELD WIRING TO DAMPER ACTUATORS AND ALL CONTROL DEVICES (FLOAT SWITCHES, SOLENOID VALVES, ETC.) MIN #14 AWG. FIELD WIRING TO TEMPERATURE SENSOR MIN #18AWG SHIELDED/TWISTED PAIR. LABEL BOTH ENDS OF ALL CONDUCTORS WITH VFD PANEL TERMINAL BLOCK TERMINATION NUMBERS.
2. VERIFY THAT ALL DAY TANK FLOAT SWITCHES ARE ORIENTED FOR N.C. (OPEN ON RISE) OPERATION PRIOR TO INSTALLATION. ALL DAY TANK FLOATS SHOWN ON LOGIC DIAGRAM WITH TANK AT FULL (PUMP STOP) LEVEL.
3. FILL ALL PUMP CAVITIES WITH LUBE OIL PRIOR TO INITIAL OPERATION. VERIFY PROPER ROTATION OF ALL PUMPS. PRIME ALL PIPING WITH HAND PUMP AND FILL ALL FILTER BODIES PRIOR TO OPERATING SYSTEM.
4. FIELD TEST DAY TANK FILL OPERATION TO VERIFY ALL CONTROL AND ALARM FUNCTIONS. MANIPULATE FLOAT SWITCHES BY REACHING IN THROUGH ADJACENT 4" BUNG. TEMPORARILY SET TIMING RELAYS TO 10 SECONDS TO VERIFY TIME-OUT AND RESET FUNCTIONS.
5. SET DAY TANK FILL PUMP PDF-1 TIMING RELAY T1 TIME DELAY TO 30 MINUTES (APPROX. 55 GALS. REQUIRED FROM PUMP START TO PUMP STOP LEVEL @ APPROX. 4 GPM). ON THE INITIAL TANK FILL, THE PUMP TEST/RESET BUTTON MAY HAVE TO BE MANUALLY RESET IN ORDER TO GET THE FUEL LEVEL TO WITHIN THE NORMAL OPERATING RANGE. SEE "SEQUENCE OF OPERATIONS".
6. SET PUMP-DOWN PUMP P-DF2 TIMING RELAY T2 TIME DELAY TO 6 MINUTES (36 GALS. REQUIRED TO DROP LEVEL INTO NORMAL OPERATING RANGE @ APPROX. 6 GPM).
7. SET VFD FAULT TIMER RELAY T5 TO 30 SECONDS.
8. ADJUST VFD OVERLOAD TO 115% OF ACTUAL FAN MOTOR NAMEPLATE FLA RATING. WITH FAN RUNNING IN BYPASS MODE CHECK CURRENT IN ALL THREE PHASES AND VERIFY THAT MOTOR IS OPERATING WITHIN NAMEPLATE RATING.
9. VERIFY THAT VFD IS IN STANDARD (MATERIAL HANDLING) MODE. SET MINIMUM SPEED TO 6HZ (10%). SET TEMPERATURE TO SETPOINTS INDICATED IN MECHANICAL SPECIFICATIONS SEQUENCE OF OPERATION. FIELD TEST SYSTEM TO VERIFY ALL CONTROL AND ALARM FUNCTIONS. VERIFY TEMPERATURE SETPOINTS WITH PIPING THERMOMETERS.

RECORD DRAWING

THESE DRAWINGS HAVE BEEN PREPARED FROM INFORMATION PROVIDED BY OTHERS. THERE IS NO GUARANTEE AS TO THE ACCURACY OR COMPLETENESS OF THE INFORMATION CONTAINED HEREIN.

DATE: 9/28/09

| REV. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| 1 | ADD CB4 TO LAYOUT, REVISE BILL OF MATERIALS VFD COMPONENTS | 12/03/07 | BCG |

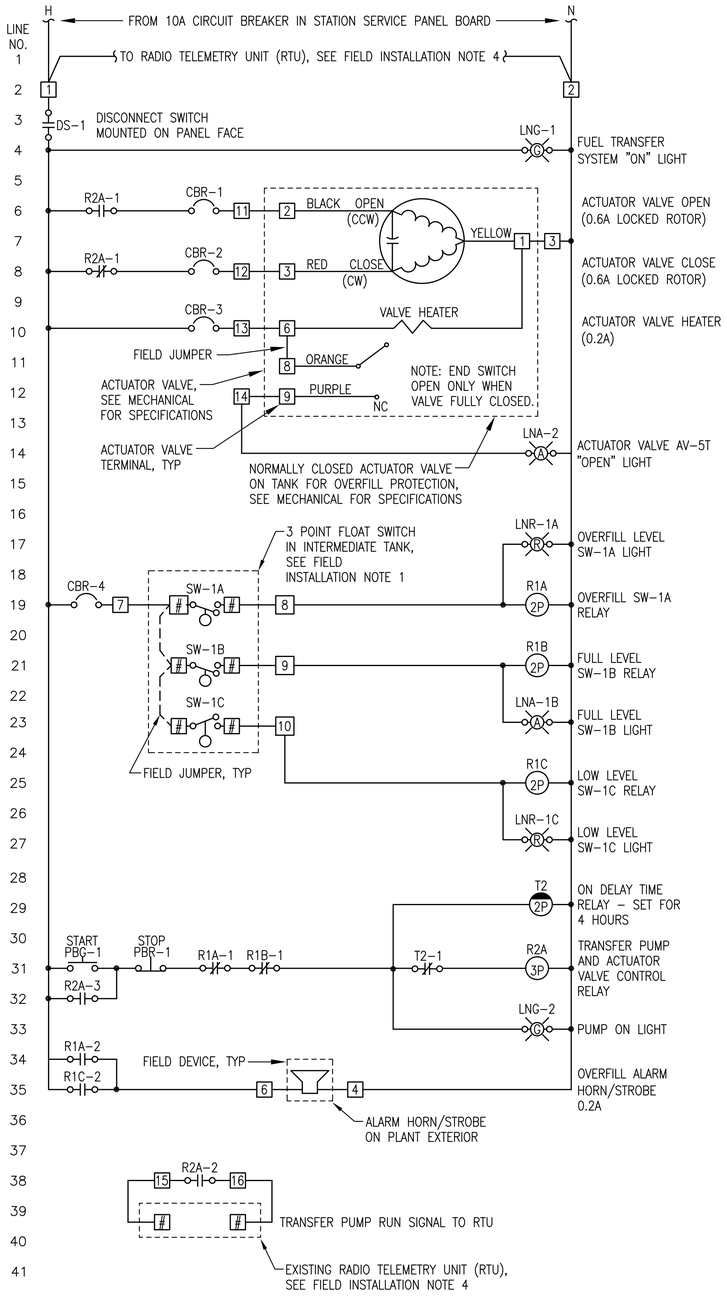
State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

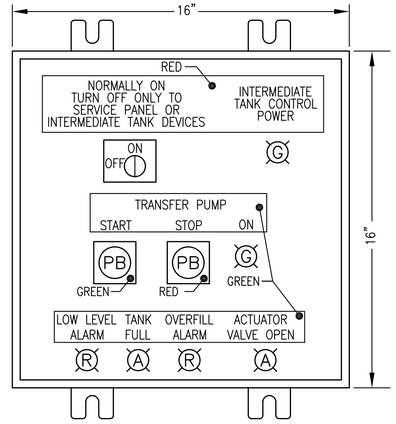
TITLE: FUEL SYSTEM CONTROL PANEL LAYOUT & BILL OF MATERIALS

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

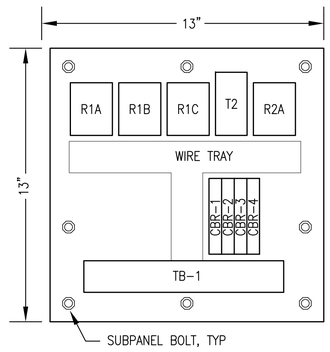
| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH E7-E11 | SHEET: E10 OF 11 |
|---|---|---|---|
| DESIGNED BY: CWV/BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |



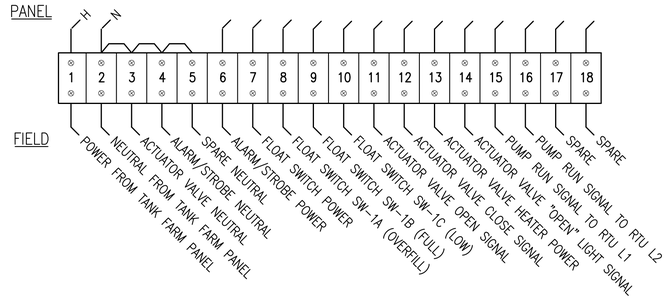

1 E11 LOGIC DIAGRAM
NO SCALE




2 E11 FRONT PANEL LAYOUT
NO SCALE




3 E11 SUBPANEL LAYOUT
NO SCALE




NOTE: IN ADDITION TO THE TERMINAL STRIP SHOWN, PROVIDE 3 EACH 30A SCREW TERMINAL GROUNDING BUS.

4 E11 TERMINAL STRIP TB-1
NO SCALE

## SEQUENCE OF OPERATIONS:

1) WHEN THE CIRCUIT BREAKER IN THE STATION SERVICE PANELBOARD AND THE DISCONNECT SWITCH ON THE PANEL FACE ARE CLOSED: POWER IS PROVIDED TO THE CONTROL PANEL, THE ACTUATOR VALVE HEATER, AND TO THE FIRST AUXILIARY END SWITCH ON THE ACTUATOR VALVE. IN NORMAL INACTIVE STATUS (TANK NOT BEING FILLED) POWER IS PROVIDED TO THE ACTUATOR VALVE CLOSE CIRCUIT. WHEN THE ACTUATOR IS IN THE FULLY CLOSED POSITION: THE ACTUATOR CLOSE CIRCUIT IS BROKEN BY AN INTERNAL LIMIT SWITCH IN THE ACTUATOR AND THE ACTUATOR VALVE "OPEN" LIGHT IS OFF.

2) NORMAL FILL OPERATION – WHEN THE "START" BUTTON IS PRESSED: THE TIMING RELAY IS STARTED, THE ACTUATOR VALVE BEGINS TO OPEN, A PUMP RUN SIGNAL IS SENT TO THE RTU, AND THE PUMP "ON" LIGHT TURNS ON. WHEN THE ACTUATOR VALVE REACHES THE FULLY OPEN POSITION: THE ACTUATOR OPEN CIRCUIT IS BROKEN BY AN INTERNAL LIMIT SWITCH IN THE ACTUATOR AND THE "ACTUATOR VALVE OPEN" LIGHT REMAINS ON. WHEN THE FUEL LEVEL REACHES THE FULL FLOAT SWITCH: THE "TANK FULL" LIGHT TURNS ON, THE TIMING RELAY IS RESET, THE ACTUATOR VALVE BEGINS TO CLOSE, THE PUMP RUN SIGNAL IS TERMINATED, AND THE PUMP "ON" LIGHT TURNS OFF. WHEN THE ACTUATOR VALVE REACHES THE FULLY CLOSED POSITION: THE "ACTUATOR VALVE OPEN" LIGHT TURNS OFF AND THE ACTUATOR CLOSE CIRCUIT IS BROKEN BY AN INTERNAL LIMIT SWITCH IN THE ACTUATOR. PRESSING THE "STOP" BUTTON AT ANY TIME DURING A NORMAL FILL CYCLE WILL PERFORM THE SAME FUNCTION AS THE FUEL LEVEL REACHING THE FULL FLOAT SWITCH EXCEPT THE "TANK FULL" LIGHT WILL NOT BE TURNED ON.

3) TIMER OPERATION – IF THE TIMING RELAY TIMES OUT BEFORE THE TANK IS FULL OR THE FILL CYCLE IS STOPPED: THE TIMING RELAY IS RESET, THE PUMP IS DE-ENERGIZED, THE PUMP "ON" LIGHT TURNS OFF, THE ACTUATOR VALVE CLOSES, AND THE "ACTUATOR VALVE OPEN" LIGHT TURNS OFF. THE PUMP CAN BE RE-STARTED BY PRESSING THE START BUTTON.

4) OVERFILL ALARM – IF THE TANK OVERFILLS AND THE FUEL LEVEL REACHES THE OVERFILL FLOAT SWITCH: THE PUMP RUN SIGNAL IS TERMINATED, THE TIMING RELAY IS RESET, THE "OVERFILL ALARM" LIGHT TURNS ON, AND THE ALARM HORN SOUNDS. THE "OVERFILL ALARM" LIGHT AND HORN WILL STAY ON UNTIL THE FUEL LEVEL FALLS BELOW THE OVERFILL FLOAT SWITCH OR THE CONTROL POWER IS TURNED OFF. THE PANEL WILL REMAIN IN ALARM STATUS AND A NEW FILL CYCLE CANNOT BE STARTED UNTIL THE FUEL LEVEL DROPS BELOW THE FULL LEVEL.

5) LOW LEVEL ALARM – IF THE FUEL LEVEL REACHES THE LOW LEVEL FLOAT SWITCH: THE "LOW LEVEL ALARM" LIGHT TURNS ON, AND THE ALARM HORN SOUNDS. THE "LOW LEVEL ALARM" LIGHT AND HORN WILL STAY ON UNTIL THE FUEL LEVEL RISES ABOVE THE LOW LEVEL FLOAT SWITCH OR THE CONTROL POWER IS TURNED OFF. THE PANEL WILL REMAIN IN ALARM STATUS UNTIL THE FUEL LEVEL RISES ABOVE THE LOW LEVEL.

## BILL OF MATERIALS (NOTE: PROVIDE MATERIALS AS SPECIFIED – NO SUBSTITUTIONS ALLOWED)

| TAG | QTY | MANUFACTURER | MODEL | DESCRIPTION |
|---|---|---|---|---|
| CBR | 4 | ALLEN-BRADLEY | 1492GH010 | CIRCUIT BREAKER, RAIL STYLE, 1 POLE, 1A |
| DS | 1 | ALLEN-BRADLEY | 194L-E201753 | DISCONNECT, 2 POSITION, 2 N.O., 20A, FACE MOUNT |
| | 1 | ALLEN-BRADLEY | 194L-HC4E1751 | KNOB ACTUATOR FOR LOAD SWITCH, ON/OFF, LOCKABLE |
| LNA | 2 | ALLEN-BRADLEY | 800HQRH10A | AMBER LED PILOT LIGHT, 120V, NEMA 4X |
| LNG | 2 | ALLEN-BRADLEY | 800HQRH10G | GREEN LED PILOT LIGHT, 120V, NEMA 4X |
| LNR | 2 | ALLEN-BRADLEY | 800HQRH10R | RED LED PILOT LIGHT, 120V, NEMA 4X |
| PBG | 1 | ALLEN-BRADLEY | 800HAR1D1 | MOMENTARY PUSH BUTTON, 1 NO, NEMA 4X, GREEN |
| | 1 | ALLEN-BRADLEY | 800HN101G | SILICONE BOOT FOR PUSH BUTTON, GREEN |
| PBR | 1 | ALLEN-BRADLEY | 800HAR6D2 | MOMENTARY PUSH BUTTON, 1 NC, NEMA 4X, RED |
| | 1 | ALLEN-BRADLEY | 800HN101R | SILICONE BOOT FOR PUSH BUTTON, RED |
| R (2P) | 3 | ALLEN-BRADLEY | 700HA32A1 | DPDT RELAY |
| | 3 | ALLEN-BRADLEY | 700HN100 | 8 PIN SOCKET BASE |
| R (3P) | 1 | ALLEN-BRADLEY | 700HA33A1 | 3PDT RELAY |
| | 1 | ALLEN-BRADLEY | 700HN101 | 11 PIN SOCKET BASE |
| T | 1 | ALLEN-BRADLEY | 700HA32A1 | DPDT RELAY |
| | 1 | ALLEN-BRADLEY | 700HN204 | 8 PIN SOCKET BASE |
| | 1 | ALLEN-BRADLEY | 700HT3 | SERIES B TIMING MODULE |
| TB | 18 | ALLEN-BRADLEY | 1492CAM1L | LARGE-HEAD SCREW TERMINALS, 35A, 600V |

## PANEL FABRICATION NOTES:

1) PROVIDE COMPLETE UL LISTED PANEL ASSEMBLY WITH ALL DEVICES INDICATED IN LOGIC DIAGRAM EXCEPT FOR FIELD DEVICES. FIELD DEVICES ARE INDICATED BY DASHED OUTLINES. FIELD WIRING AND FIELD INSTALLED DEVICES PROVIDED BY OTHERS ARE SHOWN FOR INFORMATIONAL PURPOSES ONLY AND ARE NOT PART OF THE PANEL BID.

2) INSTALL IN A 16"x16"x8" NEMA 12 STEEL ENCLOSURE WITH 4 EACH INTEGRAL MOUNTING LUGS AT BACK, A MIN 14 GAUGE INTERIOR BACK PANEL, AND HINGED LOCKABLE DOOR.

3) USE MINIMUM #14AWG FOR ALL WIRING UNLESS SPECIFICALLY NOTED OTHERWISE. TAG EACH END OF ALL JUMPERS WITH DEVICE OR TERMINATION DESIGNATOR OF LANDING OF OPPOSITE END OF JUMPER (REVERSE ADDRESS).

4) LABEL ALL PANEL DEVICES ON BASE OR BACK PANEL ADJACENT TO ITEM. LABEL REMOTE EQUIPMENT CONNECTIONS AT EACH TERMINAL BLOCK BY THE ITEM TITLE AS SHOWN ON THE FIELD SIDE OF THE TERMINAL STRIP DRAWING.

5) PROVIDE BEVELED EDGE WHITE CORE NAMEPLATES, FACE COLOR AS INDICATED, AND SECURE TO PANEL FACE WITH A MINIMUM OF TWO STAINLESS STEEL MOUNTING SCREWS.

6) BENCH TEST THE COMPLETED ASSEMBLY PRIOR TO SHIPPING. PROVIDE MIN 48 HOURS NOTICE TO ENGINEER TO SCHEDULE OBSERVATION OF BENCH TEST. PROVIDE SWITCHES AND LAMPS TO SIMULATE OPERATION OF ALL FIELD DEVICES.

## FIELD INSTALLATION NOTES:

1) PRIOR TO PLACING IN THE TANK, VERIFY PROPER OPERATION OF FLOAT SWITCH (ACTUATION LENGTH AND NO/NC FUNCTION). LABEL FLOAT SWITCH TERMINALS WITH THE NUMBER OF THE ASSOCIATED HOME RUN LANDING ON TB-1 IN THE CONTROL PANEL.

2) PERFORM ALL FIELD WIRING IN ACCORDANCE WITH SPECIFICATIONS ON SHEET E2. LABEL BOTH ENDS OF ALL FIELD WIRING WITH THE NUMBER OF THE ASSOCIATED HOME RUN LANDING ON TB-1 IN THE CONTROL PANEL. INSTALL JUMPERS ON FIELD DEVICES AS SHOWN. USE MIN #14AWG FOR CONNECTION TO ALL FIELD DEVICES UNLESS INDICATED OTHERWISE.

3) TEST ALL CONTROL AND ALARM FUNCTIONS UPON COMPLETION AND PRIOR TO PLACING INTO SERVICE. SET TIMERS TO 10 SECONDS TO VERIFY TIME OUT FUNCTION, THEN RE-SET TO VALUES SHOWN.

4) REMOVE EXISTING RTU FROM OLD POWER PLANT AND INSTALL IN NEW PLANT. IDENTIFY TERMINALS USED FOR EXISTING PUMP RUN SIGNAL PRIOR TO DISCONNECTING FROM EXISTING CONTROL PANEL AND CONNECT PUMP RUN SIGNAL FROM NEW CONTROL PANEL TO SAME TERMINALS ON RTU. PROVIDE POWER TO RTU FROM INTERMEDIATE TANK CIRCUIT.

RECORD DRAWING
THESE DRAWINGS HAVE BEEN PREPARED FROM INFORMATION PROVIDED BY OTHERS. THERE IS NO GUARANTEE AS TO THE ACCURACY OR COMPLETENESS OF THE INFORMATION CONTAINED HEREIN.
DATE: 9/28/09

State of Alaska
Department of Community and Economic Development
AIDEA/AEA
Rural Energy Group
813 West Northern Lights Blvd.
Anchorage, Alaska 99503
ALASKA ENERGY AUTHORITY

PROJECT: AKIACHAK POWER SYSTEM UPGRADE

TITLE: INTERMEDIATE TANK CONTROL PANEL

ALASKA ENERGY AND ENGINEERING, INC
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405 PHONE (907) 349-0100

| DRAWN BY: BCG | SCALE: AS NOTED | FILE NAME: AKCH E7-E11 | SHEET: E11 OF 11 |
|---|---|---|---|
| DESIGNED BY: CWV/BCG | DATE: 6/22/07 | PROJECT NUMBER: 06-02-9551 | |

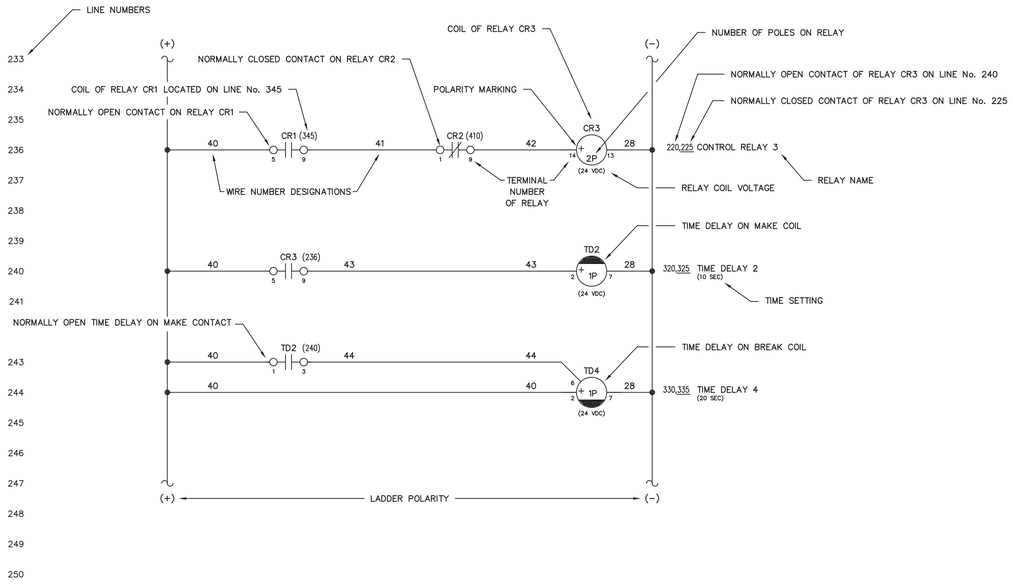
ALASKA ENERGY AUTHORITY
RURAL ENERGY GROUP
813 W. NORTHERN LIGHTS BLVD.
ANCHORAGE, ALASKA 99503
HTTP://WWW.AIDEA.ORG

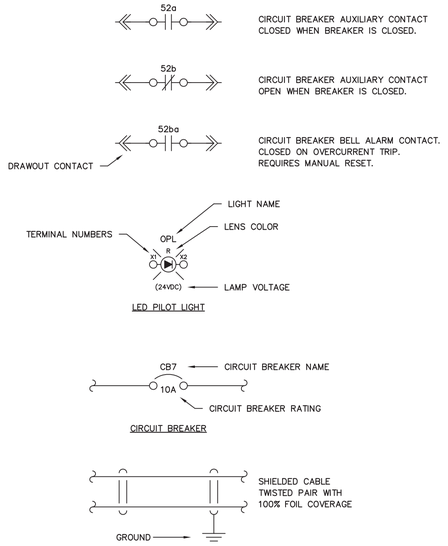
# AKIACHAK GENERATOR SWITCHGEAR
# ALASKA ENERGY AUTHORITY PURCHASE ORDER No. REG-07020
# CONTROLLED POWER, INC. JOB No. 6190

| DRAWING No. | DRAWING TITLE |
|---|---|
| 6190-2101-D | COVER SHEET |
| 6190-3101-D | SCHEMATIC LEGEND AND NOTES |
| 6190-4101-D | GENERATOR SWITCHGEAR ELEVATION VIEW, OUTLINE DIAGRAM |
| 6190-4201-D | GENERATOR SWITCHGEAR PLAN VIEW, OUTLINE DIAGRAM |
| 6190-5101-D | GENERATOR SINGLE LINE, SCHEMATIC DIAGRAM |
| 6190-5201-D | GENERATOR 1 AC THREE LINE, SCHEMATIC DIAGRAM |
| 6190-5202-D | GENERATOR 2 AC THREE LINE, SCHEMATIC DIAGRAM |
| 6190-5203-D | GENERATOR 3 AC THREE LINE, SCHEMATIC DIAGRAM |
| 6190-5204-D | GENERATOR 4 AC THREE LINE, SCHEMATIC DIAGRAM |
| 6190-5205-D | MASTER AC THREE LINE, SCHEMATIC DIAGRAM |
| 6190-5206-D | MASTER AC THREE LINE, SCHEMATIC DIAGRAM |
| 6190-5207-D | VFD AC THREE LINE, SCHEMATIC DIAGRAM |
| 6190-5208-D | VFD AC THREE LINE, SCHEMATIC DIAGRAM |
| 6190-5301-D | GENERATOR 1 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5302-D | GENERATOR 1 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5303-D | GENERATOR 1 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5304-D | GENERATOR 2 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5305-D | GENERATOR 2 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5306-D | GENERATOR 2 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5307-D | GENERATOR 3 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5308-D | GENERATOR 3 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5309-D | GENERATOR 3 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5310-D | GENERATOR 4 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5311-D | GENERATOR 4 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5312-D | GENERATOR 4 DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5313-D | MASTER DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5314-D | MASTER DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5315-D | MASTER DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5316-D | VFD DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5317-D | VFD DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5318-D | VFD DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5319-D | VFD DC CONTROL, SCHEMATIC DIAGRAM |
| 6190-5401-D | BREAKER CONTROL, SCHEMATIC DIAGRAM |
| 6190-5402-D | BREAKER CONTROL, SCHEMATIC DIAGRAM |
| 6190-5403-D | FEEDER 1 & 2 BREAKER CONTROL, SCHEMATIC DIAGRAM |
| 6190-5501-D | PLC COMMUNICATION, SCHEMATIC DIAGRAM |
| 6190-5502-D | PLC COMMUNICATION, SCHEMATIC DIAGRAM |
| 6190-5503-D | PLC COMMUNICATION, SCHEMATIC DIAGRAM |
| 6190-5601-D | COMMUNICATION NETWORK SINGLE LINE DIAGRAM |
| 6190-5602-D | COMMUNICATION NETWORK SCHEMATIC DIAGRAM |
| 6190-5701-D | HEATER, LIGHTING & FAN CONTROL, SCHEMATIC DIAGRAM |
| 6190-6101-D | CONTROL SWITCH TARGET DIAGRAM |
| 6190-6201-D | NAMEPLATE ENGRAVING SCHEDULE |
| 6190-7101-D | INTERCONNECTION DIAGRAM |
| 6190-7102-D | INTERCONNECTION DIAGRAM |
| 21116-AKK-BOM | SWITCHGEAR UPGRADE BILL OF MATERIALS |

6190-2101-D
07-18-07

Plot date: 2007/10/1 - 11:54




NOTES:

1. SCHEMATIC IS SHOWN AS FOLLOWS:
   - ALL AC AND DC POWER REMOVED
   - ALL RELAY CONTACTS DE-ENERGIZED
   - ALL CIRCUIT BREAKERS IN THE OPEN/RESET POSITION
   - ALL MODE SWITCHES IN THE "OFF" POSITION
   - ALL EMERGENCY STOP SWITCHES IN THE "NORMAL" POSITION
   - ALL PRESSURE SWITCHES SHOWN WITHOUT PRESSURE PRESENT
   - ALL LEVEL SWITCHES SHOWN WITHOUT FLUID PRESENT
   - ALL TEMPERATURE SWITCHES SHOWN AT AMBIENT
2. ⊛ INDICATES FIELD TERMINALS IN GENERATOR CONTROL SECTION.
3. ⊡ INDICATES TERMINALS AT ENGINE/GENERATOR.
4. ◈ INDICATES INTERCONNECT TERMINALS IN MASTER SECTION.
5. ◉ INDICATES FIELD TERMINALS IN MASTER SECTION.
6. ◎ INDICATES INTERCONNECT TERMINALS IN GENERATOR CONTROL SECTION.
7. ◎ INDICATES INTERCONNECT TERMINALS IN VFD/DIST SECTION.
8. ◉ INDICATES FIELD TERMINALS IN VFD/DIST SECTION.
9. — — INDICATES FIELD WIRING BY OTHERS
   ALL CONTROL WIRING TO BE No. 14 AWG, 600 VOLT, TYPE SIS EXCEPT AS NOTED
10. SHIELDED WIRING TO BE No. 18 AWG, 300 VOLT, TWISTED LINE WITH 100% FOIL COVERAGE
11. ALL DIODES ARE 1N4007 EXCEPT AS NOTED

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

AEA PURCHASE ORDER No. CONTROLLED POWER JOB No. 6190

TITLE: SCHEMATIC LEGEND & NOTES

| SCALE: NONE | DATE: 07-18-07 | DWN. BY: GPN |
|---|---|---|
| DWG. No: 6190-3101-D | SHEET: 1 OF 1 | CKD. BY: JMD |

JOB: AKIACHAK

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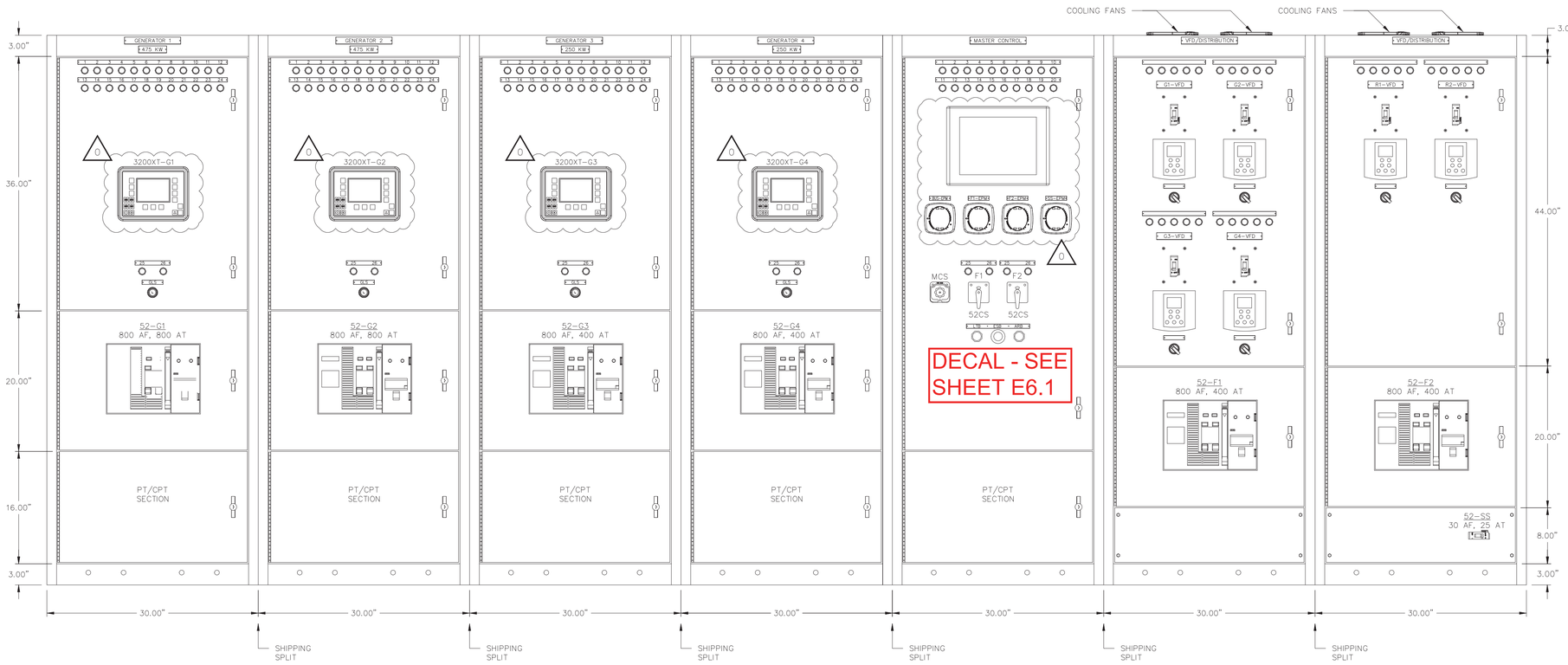
Plot date: 2007/10/1 - 11:53




GENERATOR SWITCHGEAR – FRONT VIEW

277/480V, 2400A, COPPER BUS, 3Ø, 4W 65 KAIC

SIDE VIEW

NOTES:

1. EACH SECTION SHIPPED INDIVIDUALLY.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR SWITCHGEAR ELEVATION VIEW

| | | |
|---|---|---|
| SCALE: 1/10 | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-4101-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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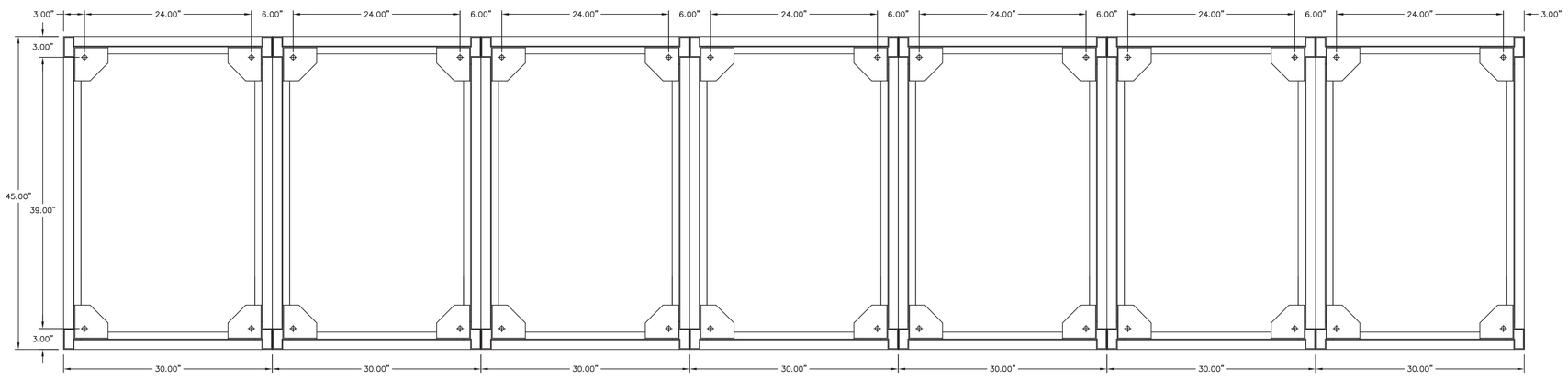
REAR




FRONT

GENERATOR SWITCHGEAR – PLAN VIEW

NOTES:
1. EACH SECTION SHIPPED INDIVIDUALLY.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

AEA PURCHASE ORDER No. REG-07020 CONTROLLED POWER JOB No. 6190

TITLE: GENERATOR SWITCHGEAR PLAN VIEW, OUTLINE DIAGRAM

| | | |
|---|---|---|
| SCALE: 1/10 | DATE: 07-18-07 | DWN. BY: GPN |
| DWG. No: 6190-4201-D | SHEET: 1 OF 1 | CKD. BY: JMD |
| JOB: AKIACHAK | | |

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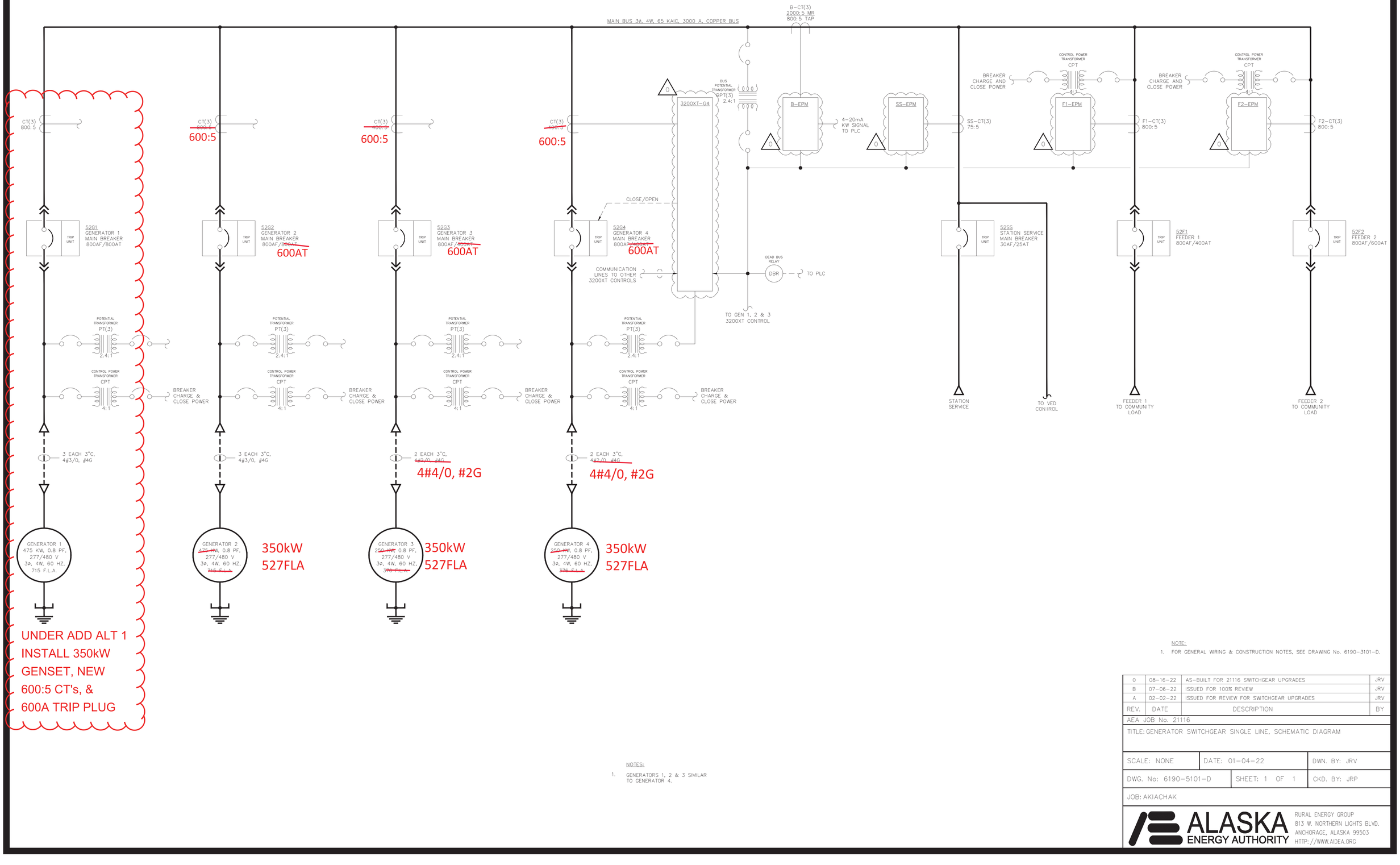
Plot date: 2007/10/1 – 11:52




NOTES:

1. GENERATORS 1, 2 & 3 SIMILAR TO GENERATOR 4.

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR SWITCHGEAR SINGLE LINE, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5101-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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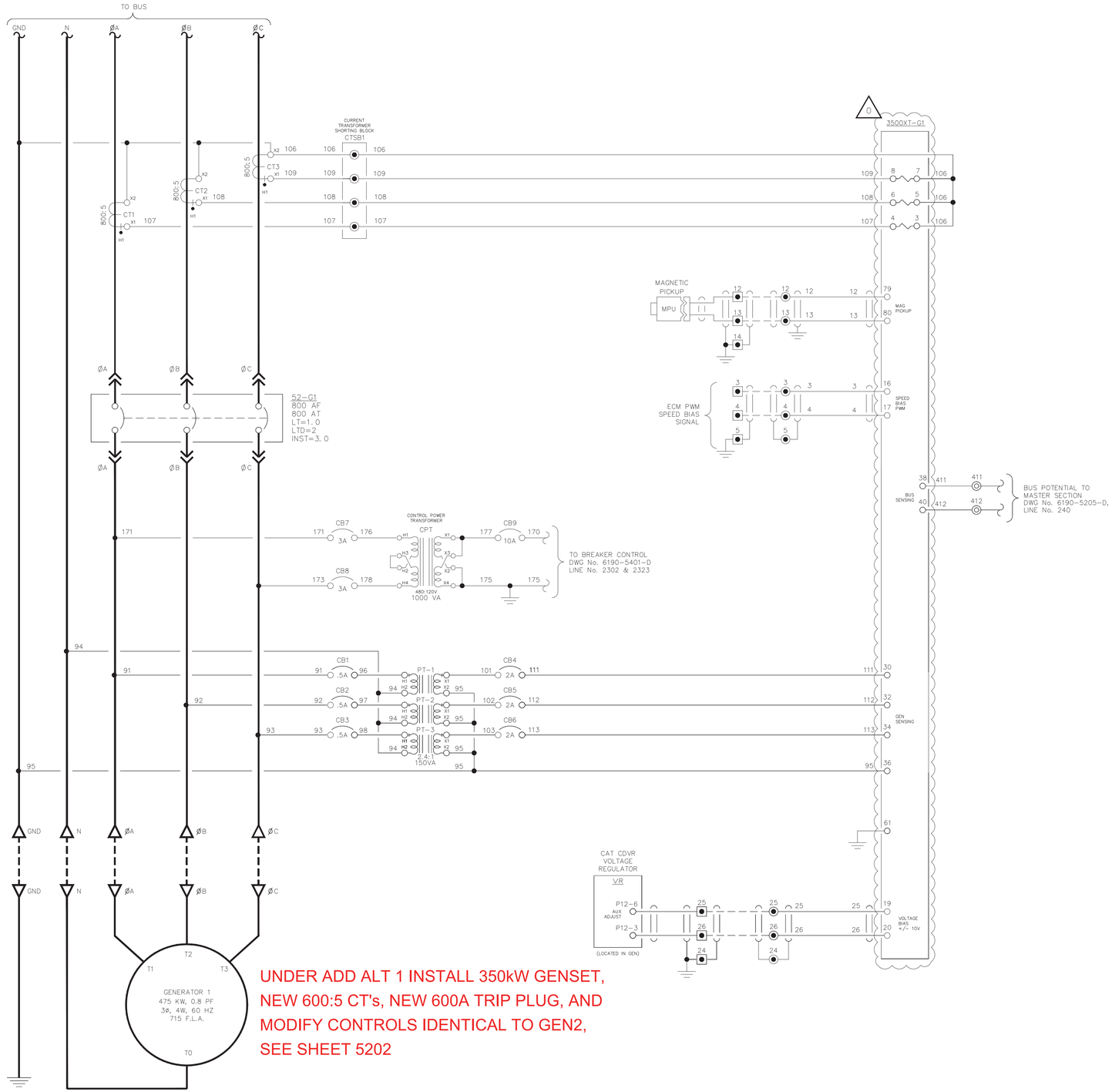


UNDER ADD ALT 1 INSTALL 350kW GENSET, NEW 600:5 CT's, NEW 600A TRIP PLUG, AND MODIFY CONTROLS IDENTICAL TO GEN2, SEE SHEET 5202

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 1 AC THREE LINE, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5201-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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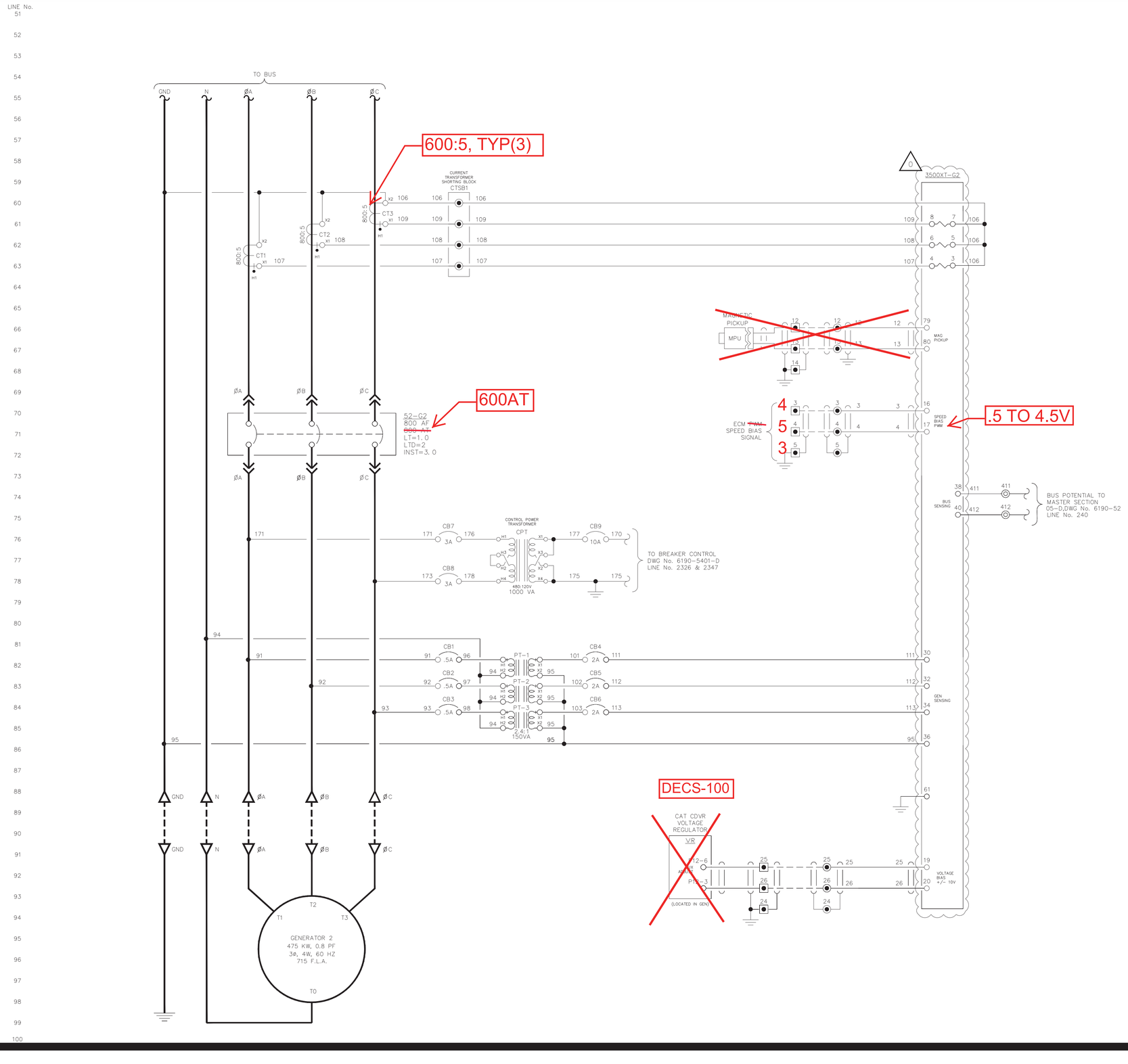


NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 2 AC THREE LINE, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5202-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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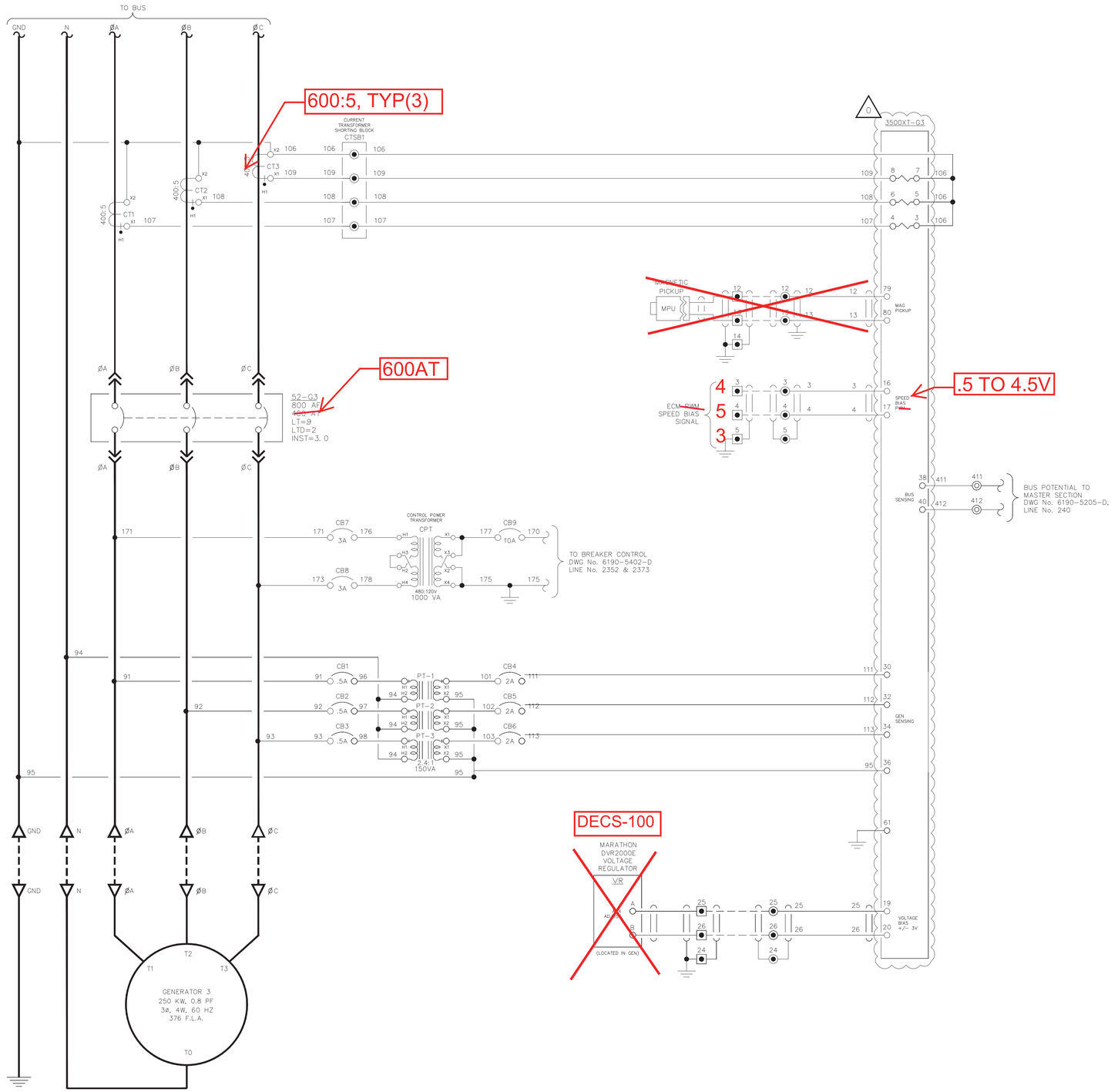


NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 3 AC THREE LINE, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5203-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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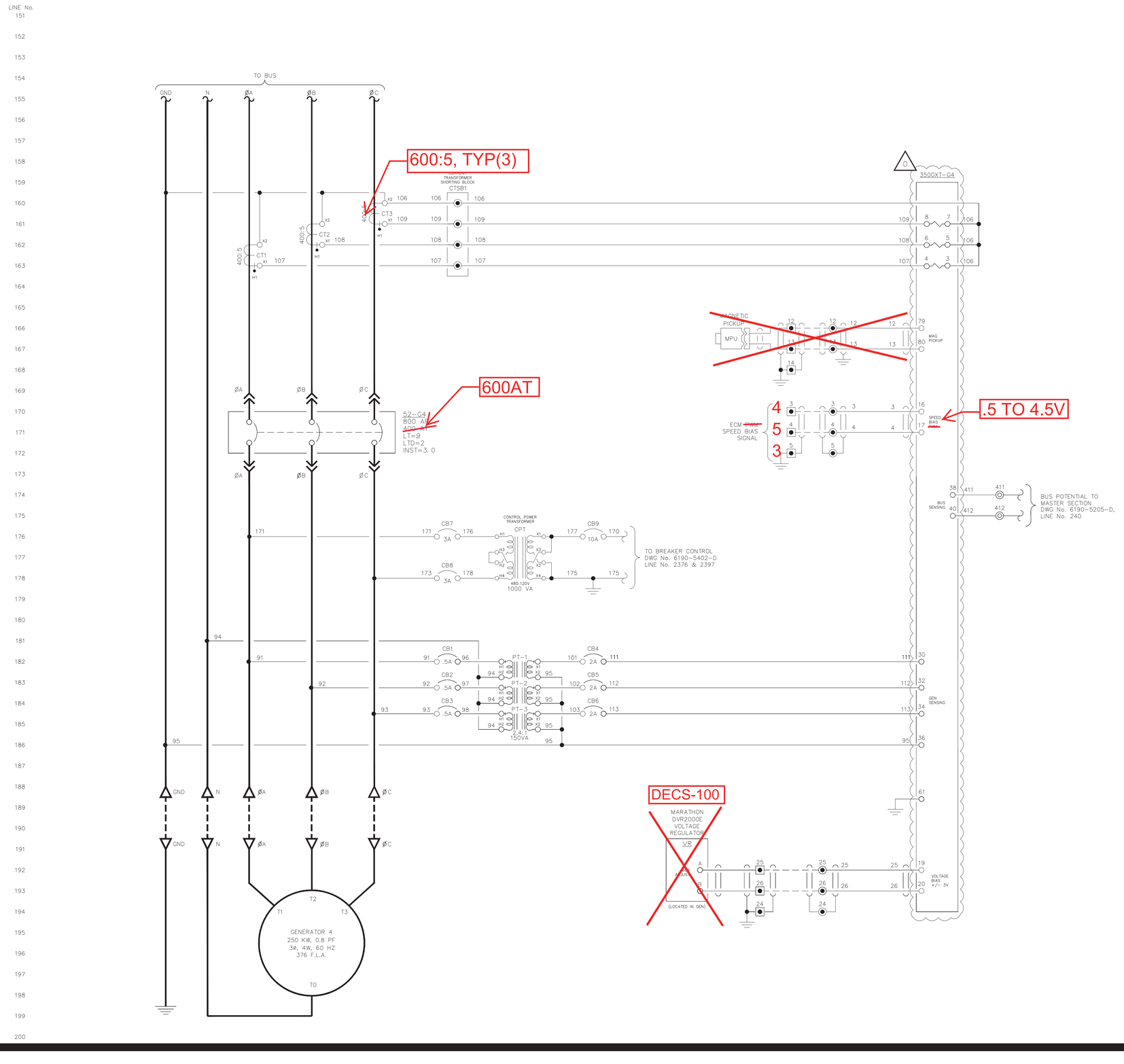


NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 4 AC THREE LINE, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5204-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

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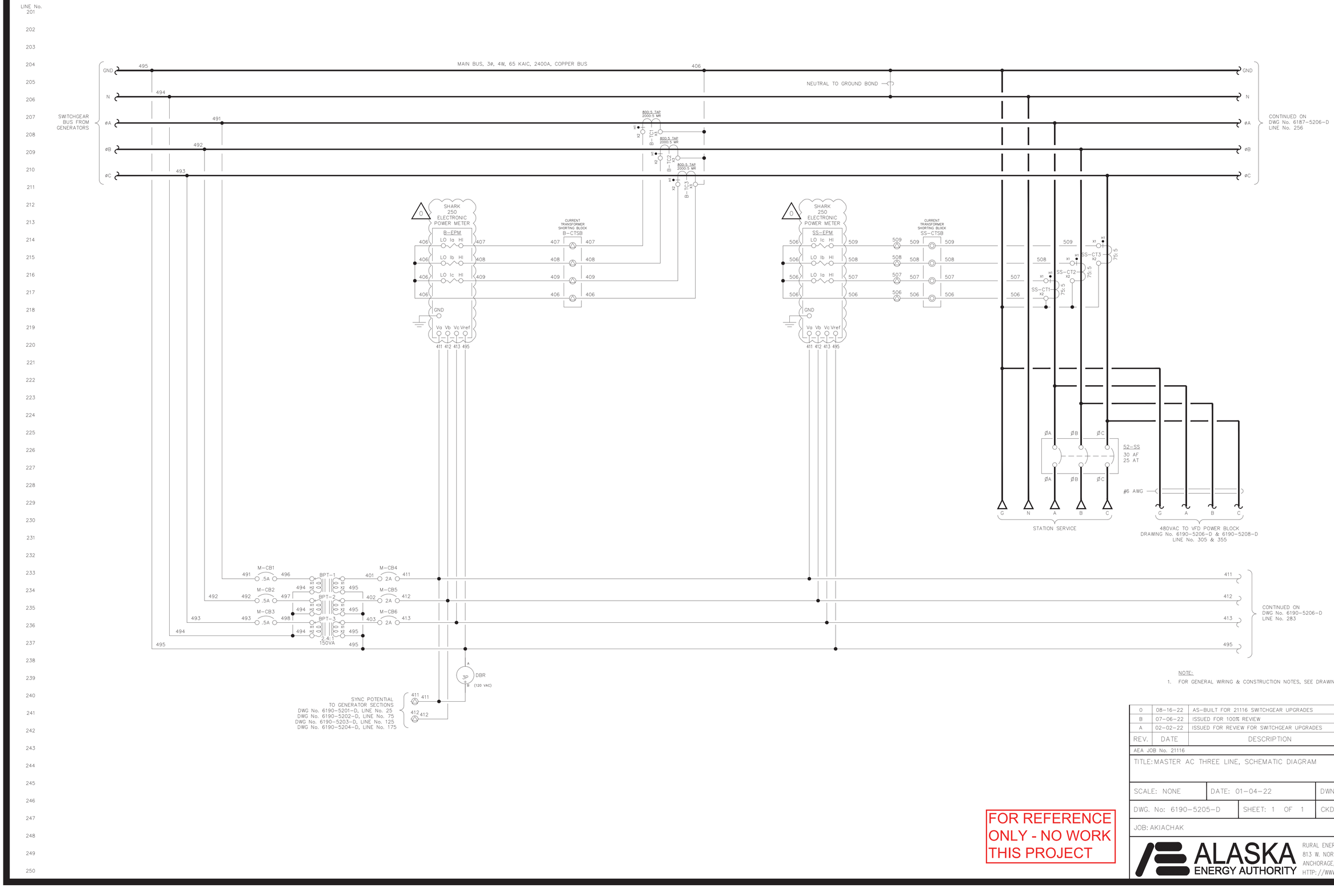


NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: MASTER AC THREE LINE, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5205-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

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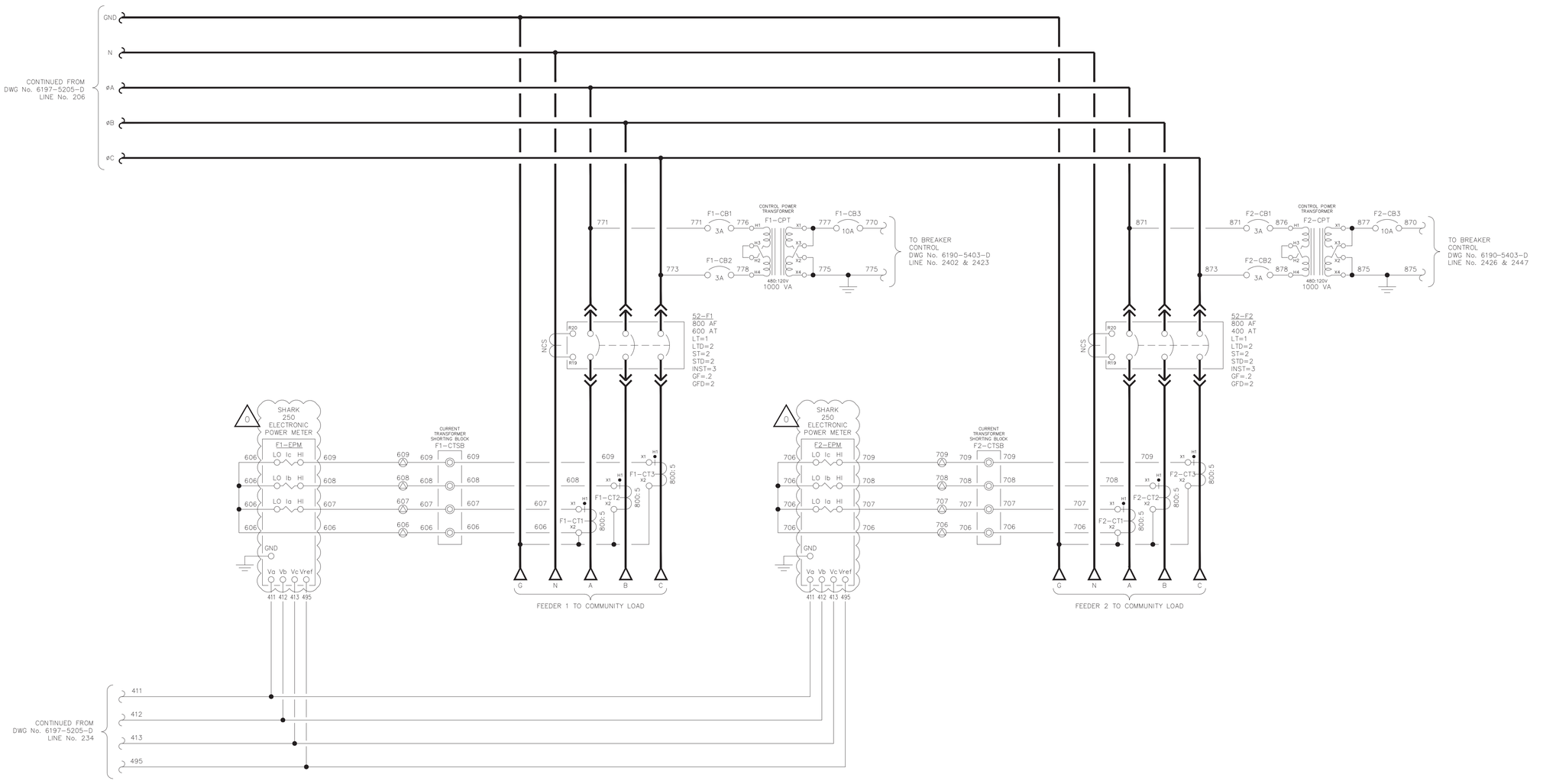


NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: MASTER AC THREE LINE, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-21 | DWN. BY: JRV |
| DWG. No: 6190-5206-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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LINE No.

CONTINUED FROM
DWG No. 6190-5205-D
LINE No. 229

G øA øB øC

#6 AWG

G A B C — PDTB POWER DISTRIBUTION TERMINAL BLOCK

#10 AWG

#10 AWG

#10 AWG

M1-A M1-B M1-C — M1-52 30 AF 15 AT

M1-A1 M1-B1 M1-C1

M1-C1

M1-G M1-A2 M1-B2 M1-C2

M1-VFD

M1-GND M1-A3 M1-B3 M1-C3

M1-C2

M1-C3

MECH. INTERLOCK

M1-A4 M1-B4 M1-C4

M1-O.L.

M1-T1 M1-T2 M1-T3

480V
3 HP

FAN
MOTOR 1

M2-A M2-B M2-C — M2-52 30 AF 15 AT

M2-A1 M2-B1 M2-C1

M2-C1

M2-G M2-A2 M2-B2 M2-C2

M2-VFD

M2-GND M2-A3 M2-B3 M2-C3

M2-C2

M2-C3

MECH. INTERLOCK

M2-A4 M2-B4 M2-C4

M2-O.L.

M2-T1 M2-T2 M2-T3

480V
3 HP

FAN
MOTOR 2

M3-A M3-B M3-C — M3-52 30 AF 15 AT

M3-A1 M3-B1 M3-C1

M3-C1

M3-G M3-A2 M3-B2 M3-C2

M3-VFD

M3-GND M3-A3 M3-B3 M3-C3

M3-C2

M3-C3

MECH. INTERLOCK

M3-A4 M3-B4 M3-C4

M3-O.L.

M3-T1 M3-T2 M3-T3

480V
~~3 HP~~ 5 HP

FAN
MOTOR 3

NEW 5 HP CAC,
SEE SHEET E3.3

M4-A M4-B M4-C — M4-52 30 AF 15 AT

M4-A1 M4-B1 M4-C1

M4-C1

M4-G M4-A2 M4-B2 M4-C2

M4-VFD

M4-GND M4-A3 M4-B3 M4-C3

M4-C2

M4-C3

MECH. INTERLOCK

M4-A4 M4-B4 M4-C4

M4-O.L.

M4-T1 M4-T2 M4-T3

480V
~~3 HP~~ 5 HP

FAN
MOTOR 4

NEW 5 HP CAC,
SEE SHEET E3.3

UNDER ADD ALT 3
REPLACE ALL VFD'S,
SEE SHEET E6.2

NOTE:
1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

AEA PURCHASE ORDER No. REG-07020 — CONTROLLED POWER JOB No. 6190

TITLE: VFD THREE LINE, SCHEMATIC DIAGRAM

| SCALE: NONE | DATE: 07-18-07 | DWN. BY: GPN |
|---|---|---|
| DWG. No: 6190-5207-D | SHEET: 1 OF 1 | CKD. BY: JMD |

JOB: AKIACHAK



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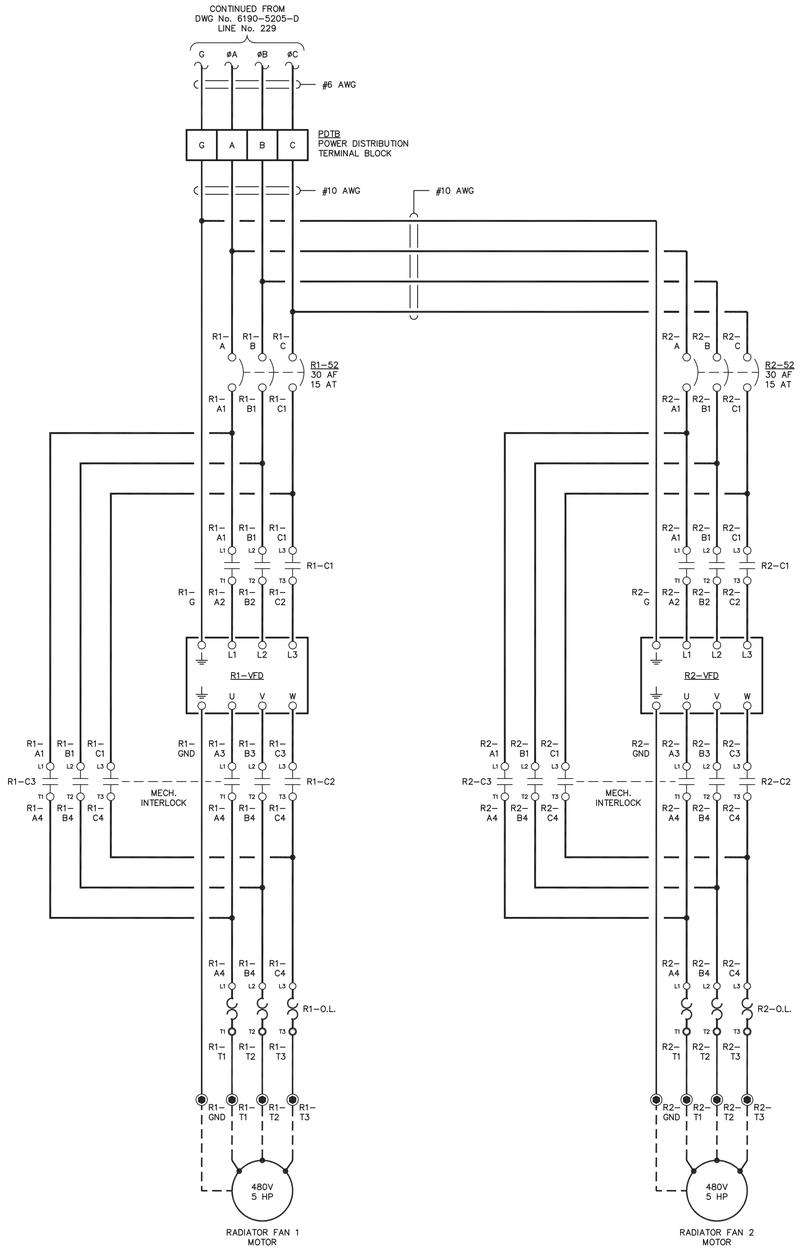
Plot date: 2007/10/1 - 11:49







UNDER ADD ALT 3
REPLACE ALL VFD'S,
SEE SHEET E6.2

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

AEA PURCHASE ORDER No. REG-07020 CONTROLLED POWER JOB No. 6190

TITLE: VFD THREE LINE, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 07-18-07 | DWN. BY: GPN |
| DWG. No: 6190-5208-D | SHEET: 1 OF 1 | CKD. BY: JMD |
| JOB: AKIACHAK | | |



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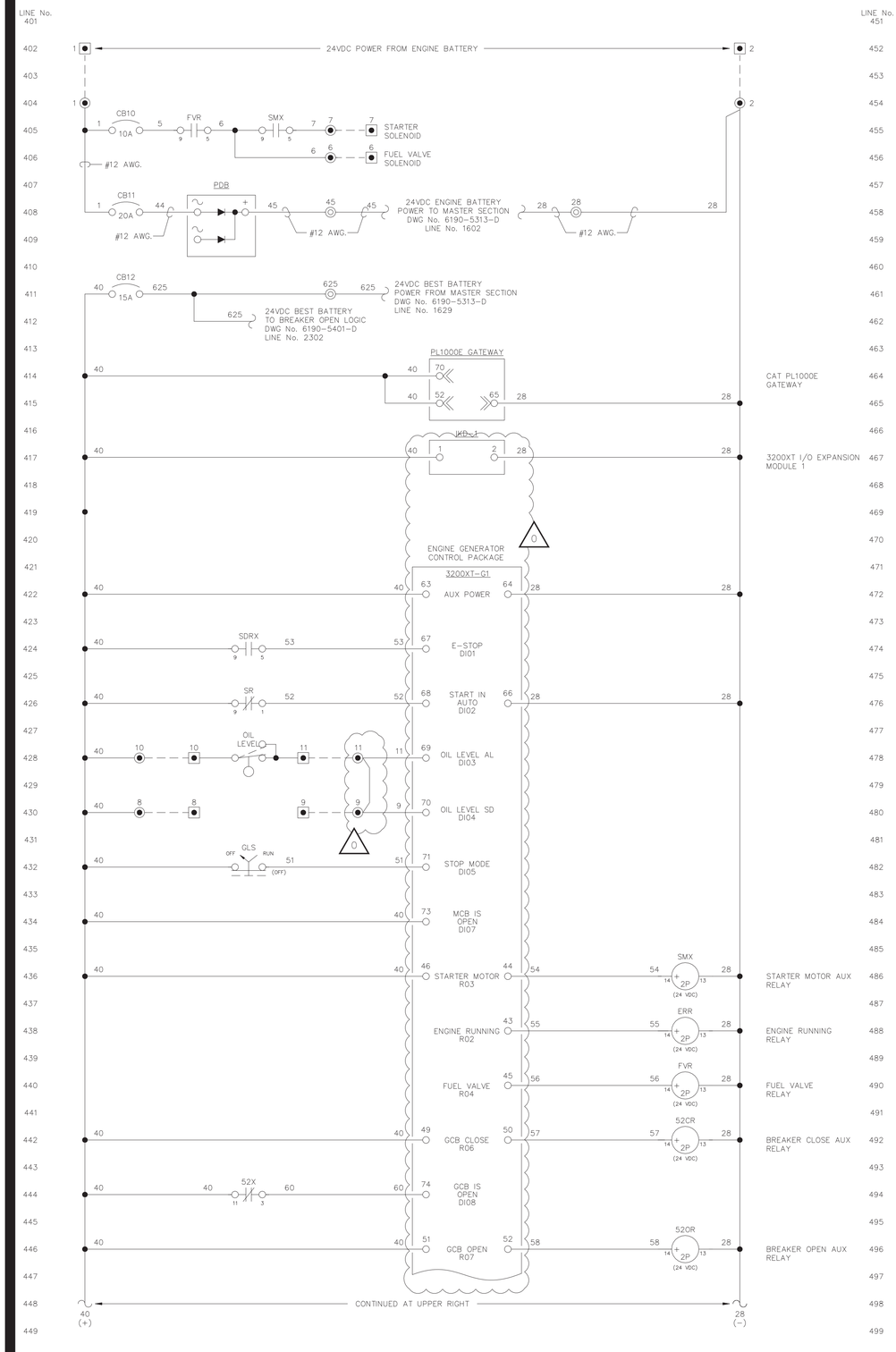
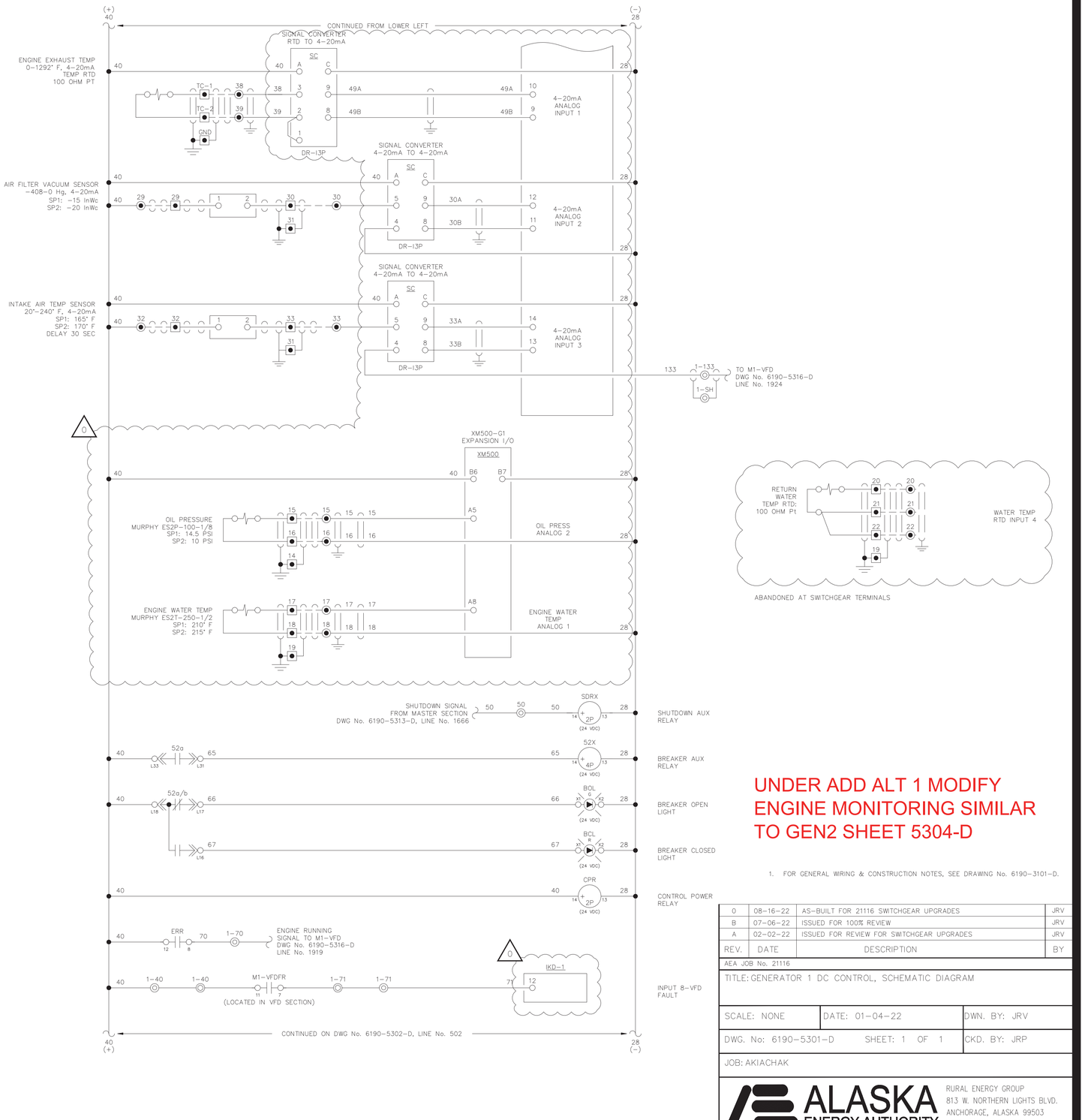
Plot date: 2007/10/1 - 11:48




UNDER ADD ALT 1 MODIFY ENGINE MONITORING SIMILAR TO GEN2 SHEET 5304-D

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 1 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5301-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

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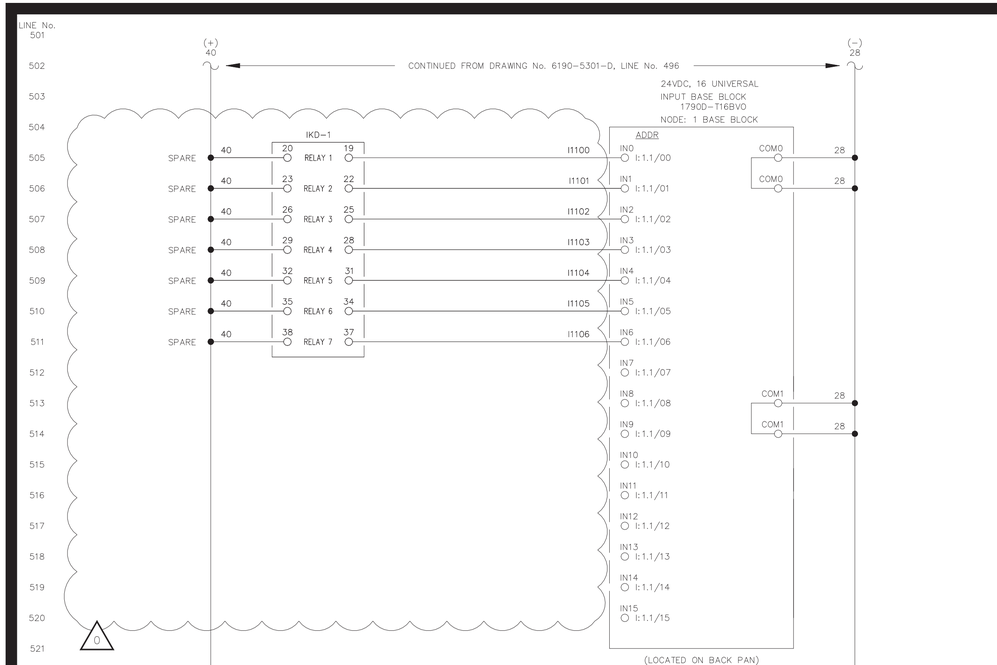


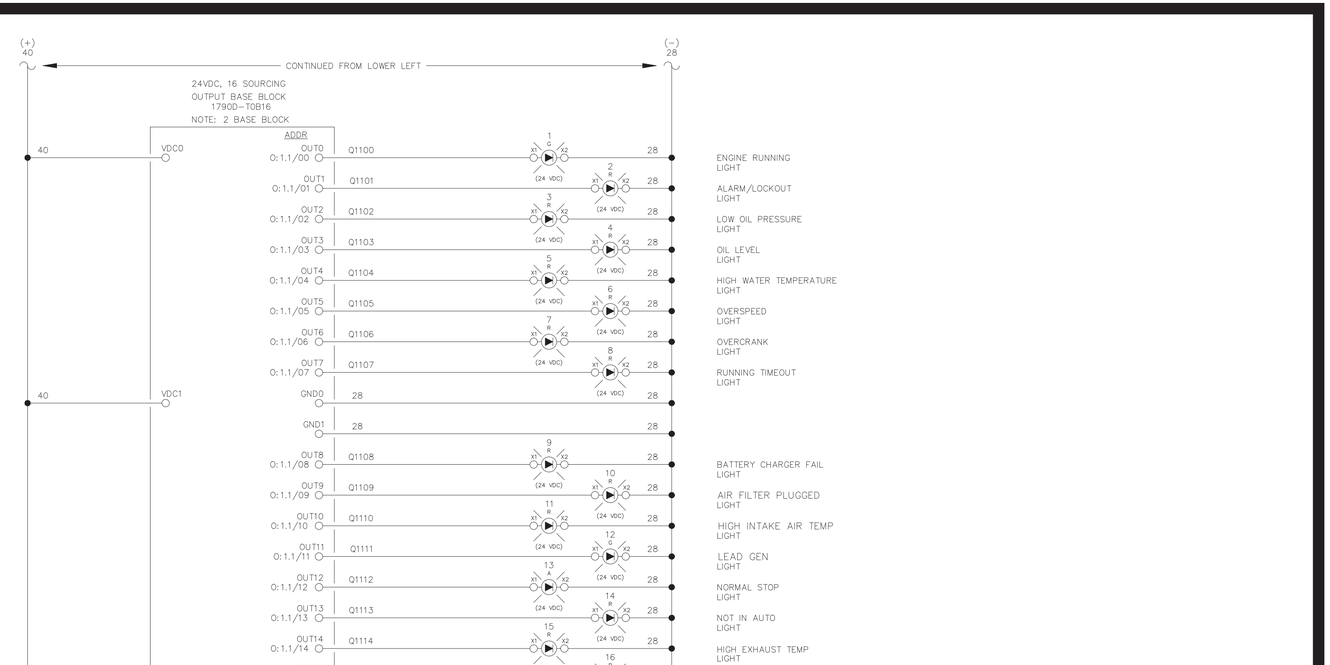


FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:
1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 1 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5302-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

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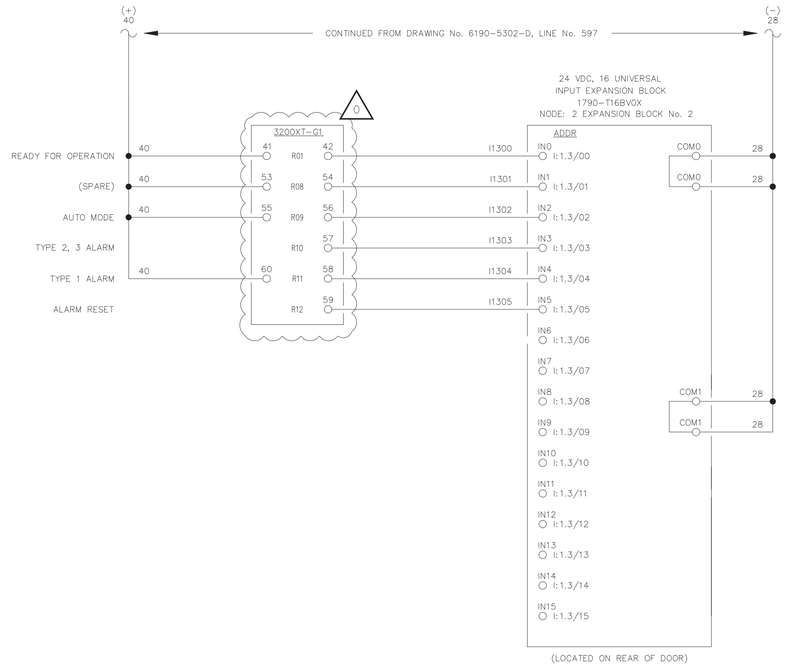


NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 1 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5303-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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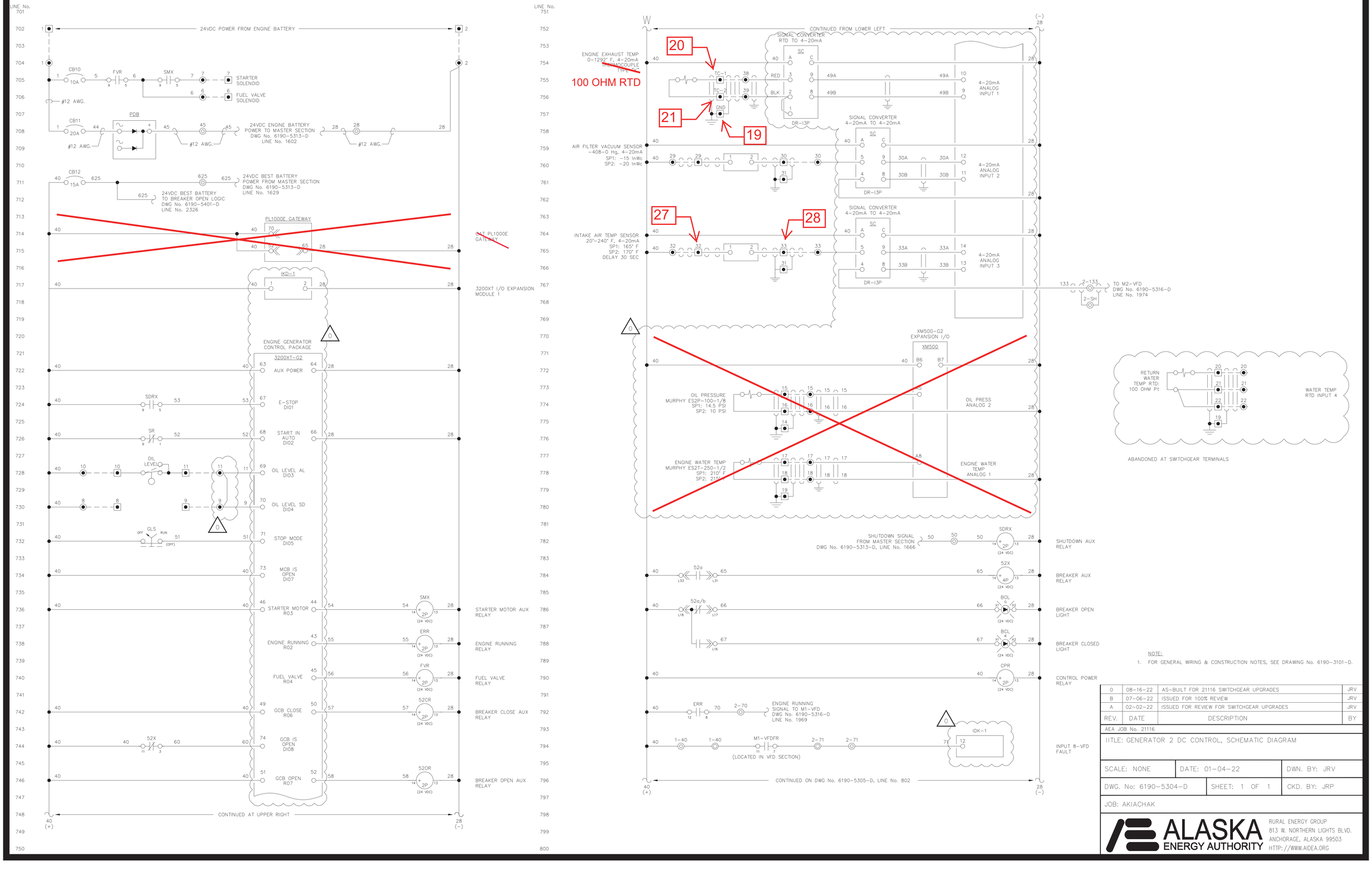


NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 2 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5304-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

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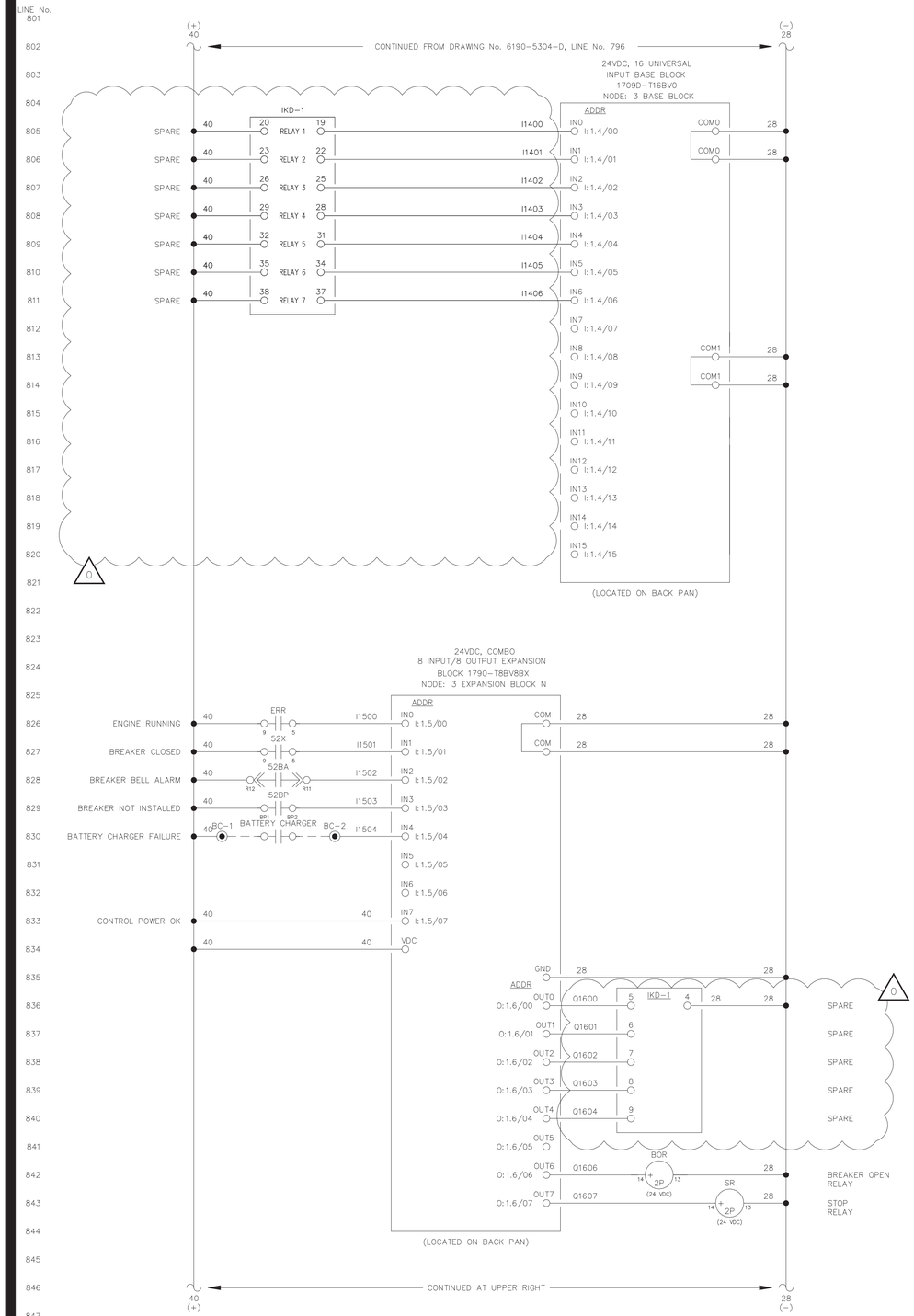


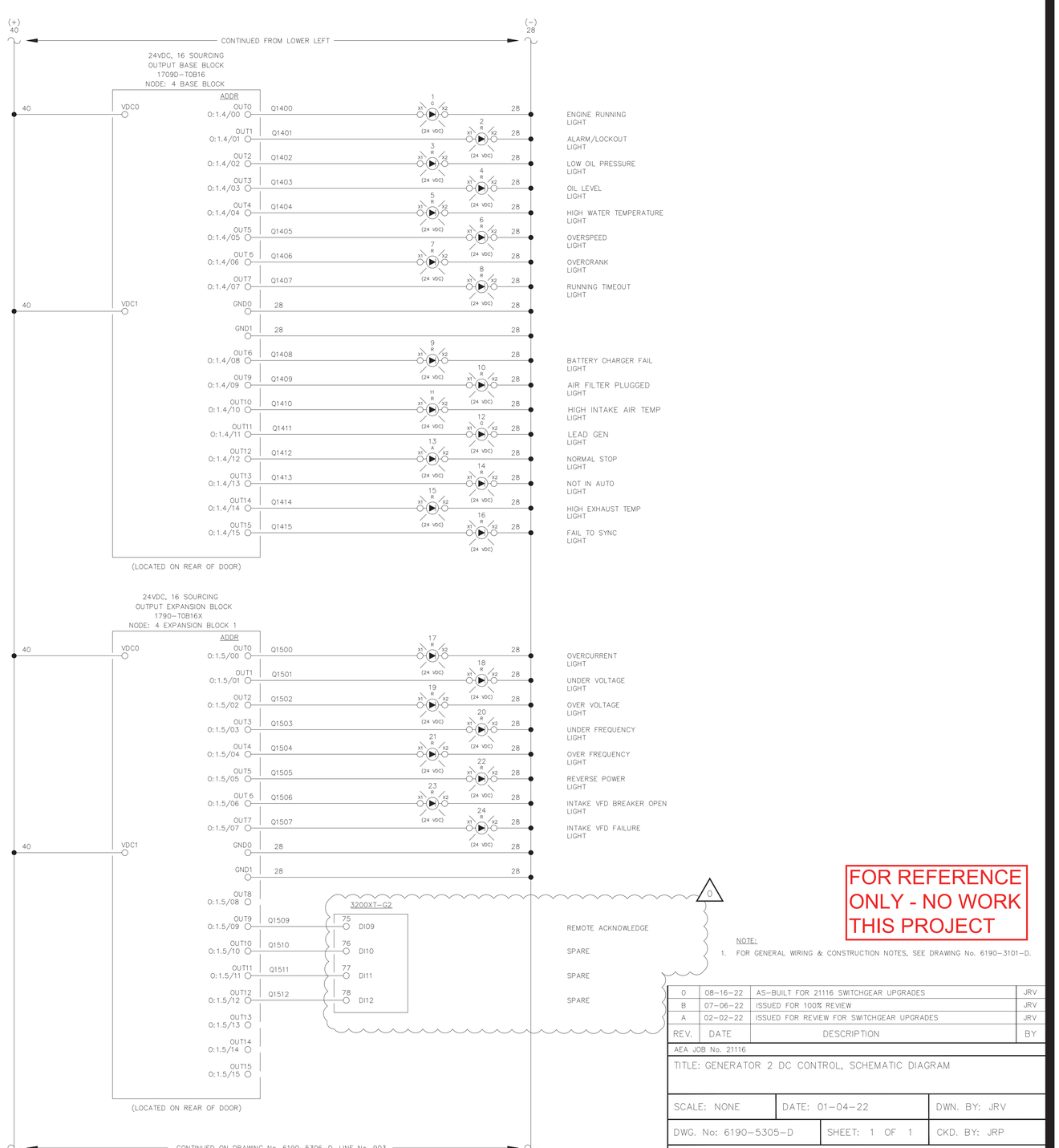


FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:
1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 2 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5305-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

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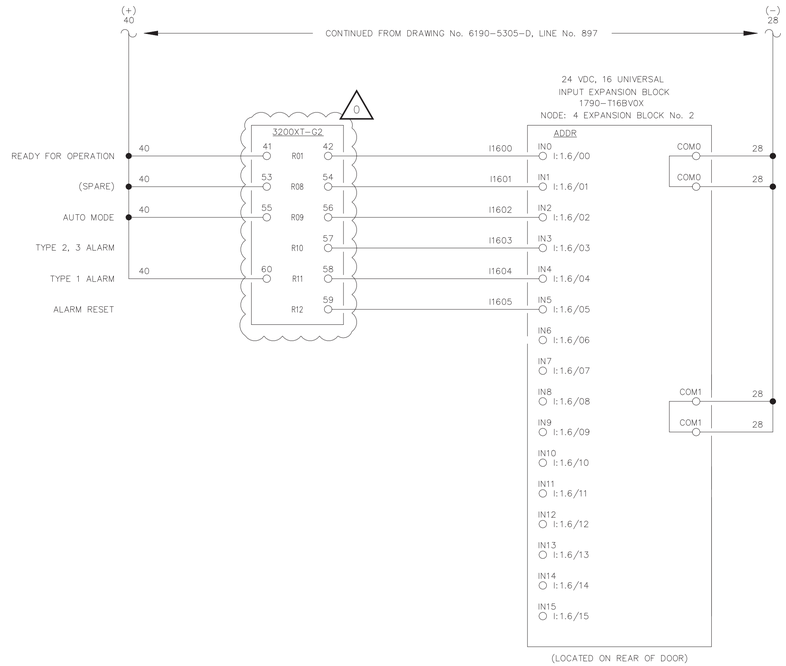


FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:

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| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
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| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 2 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5306-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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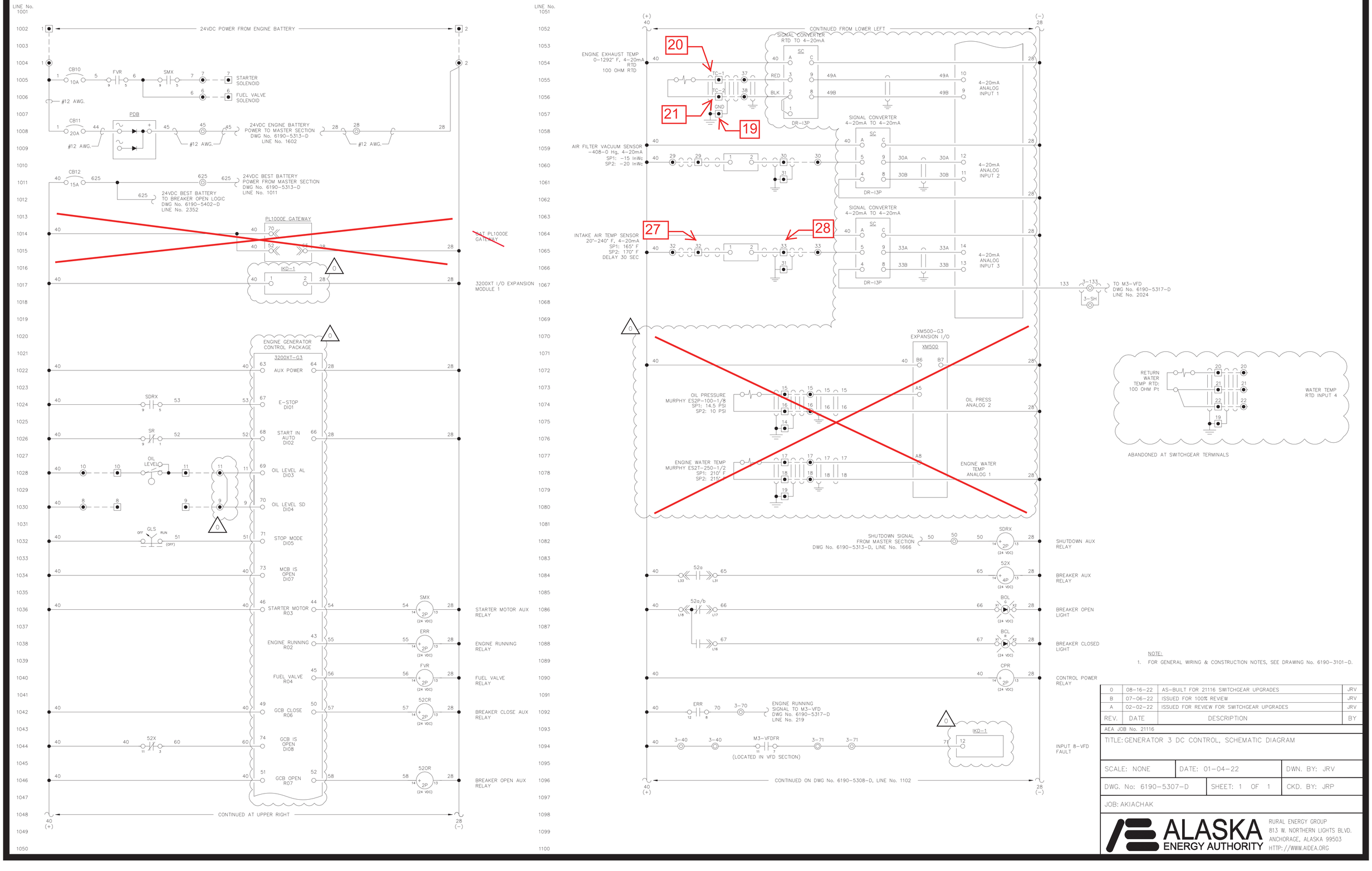


NOTE:

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AEA JOB No. 21116

TITLE: GENERATOR 3 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5307-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

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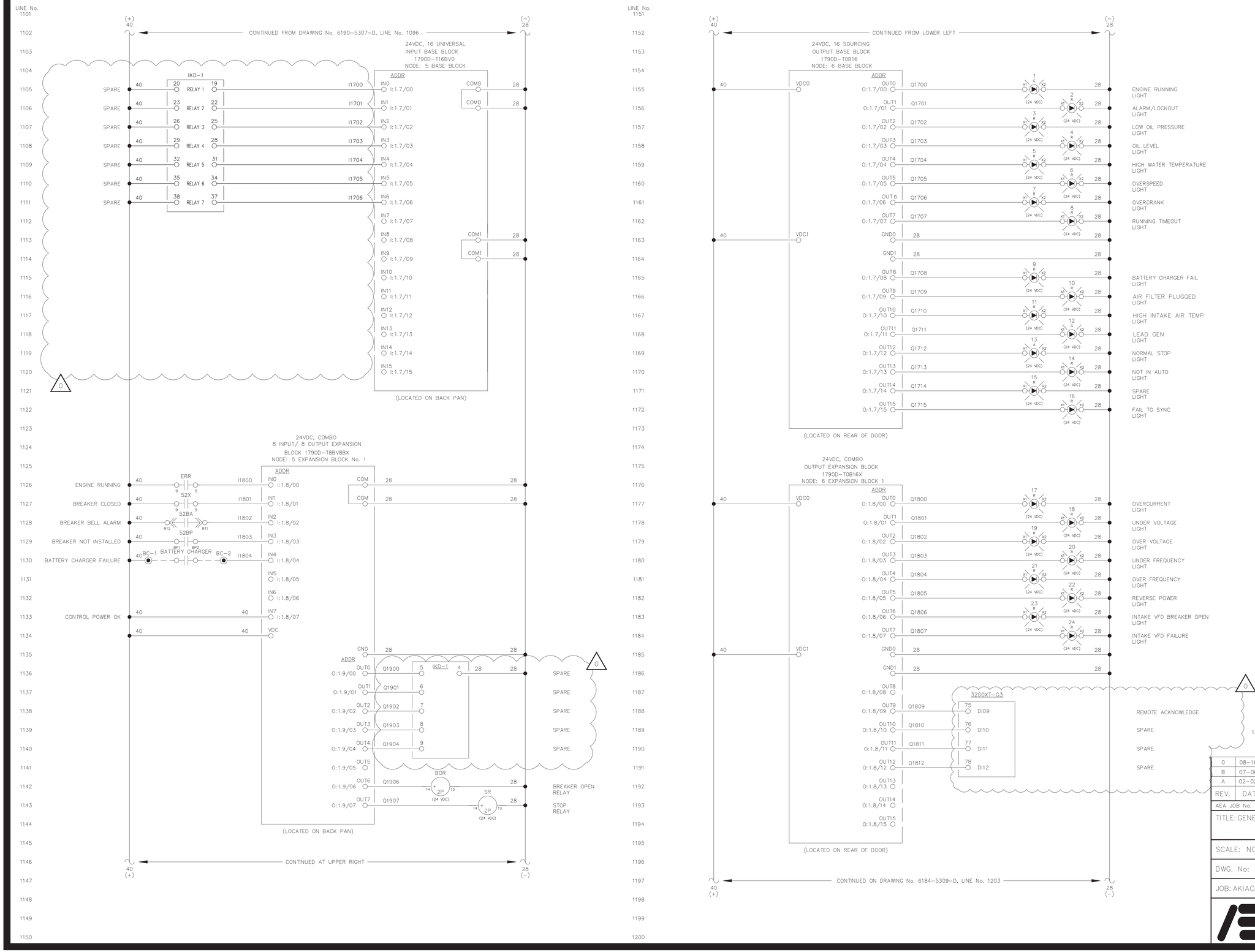


FOR REFERENCE ONLY - NO WORK THIS PROJECT

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AEA JOB No. 21116

TITLE: GENERATOR 3 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5308-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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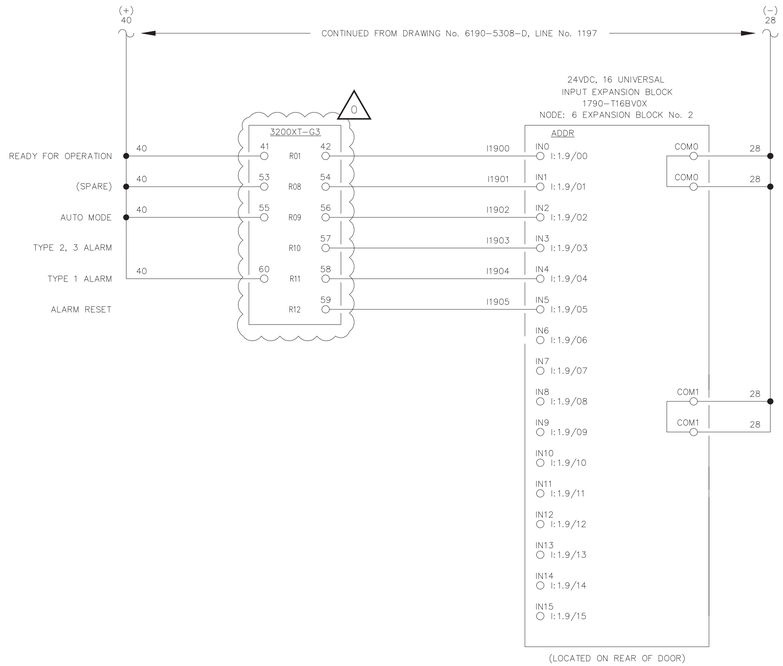


FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:

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| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 3 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5309-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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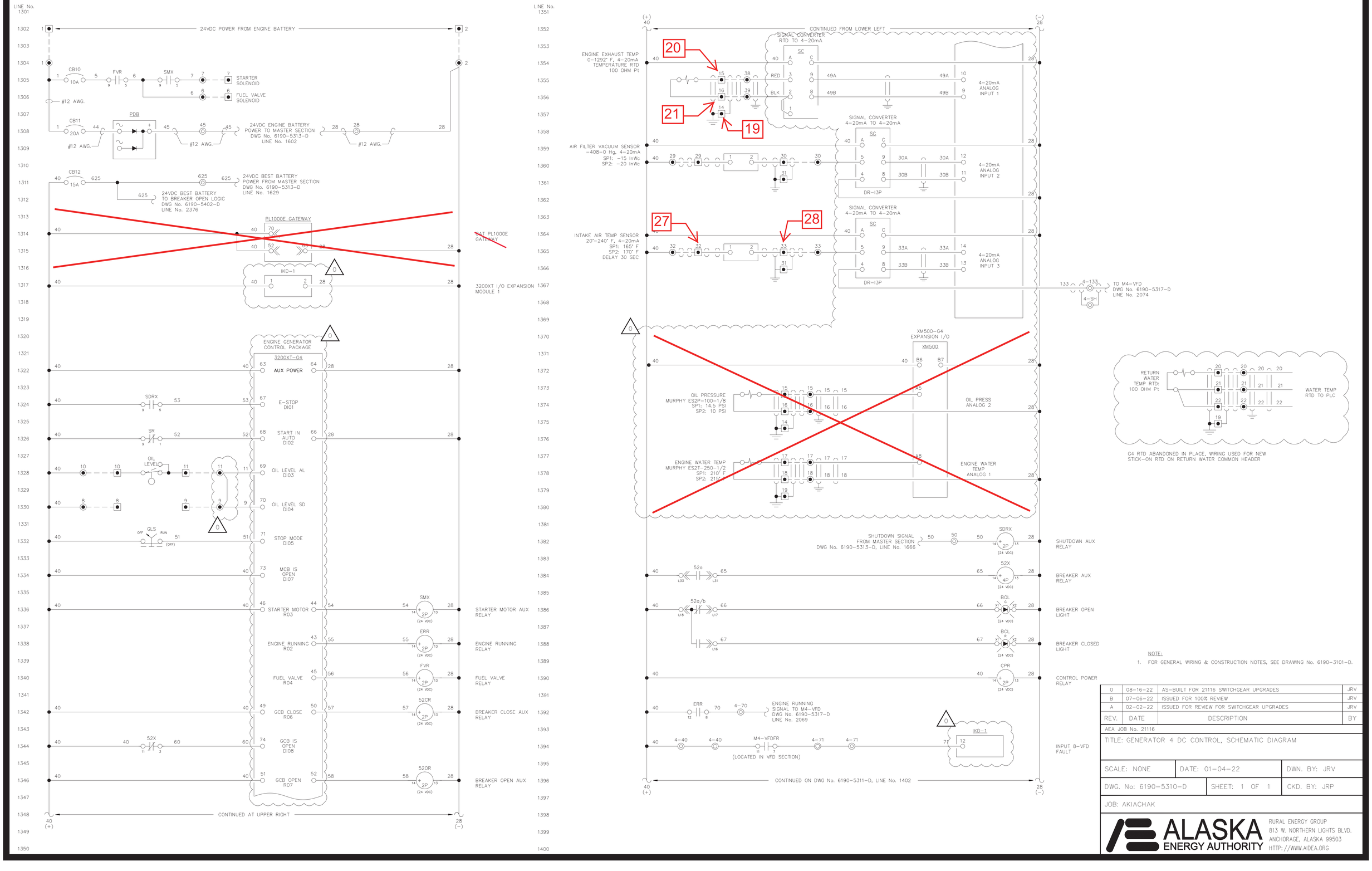


NOTE:

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AEA JOB No. 21116

TITLE: GENERATOR 4 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5310-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

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CONTINUED FROM DRAWING No. 6190-5310-D, LINE No. 1396

24VDC, 16 UNIVERSAL
INPUT BASE BLOCK
1790D-T16BV0
NODE: 5 BASE BLOCK

IKD-1

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SPARE | 40 | 20 RELAY 1 19 | I11000 | IN0 | I:1.10/00 | COM0 | 28 |
| SPARE | 40 | 23 RELAY 2 22 | I11001 | IN1 | I:1.10/01 | COM0 | 28 |
| SPARE | 40 | 26 RELAY 3 25 | I11002 | IN2 | I:1.10/02 | | |
| SPARE | 40 | 29 RELAY 4 28 | I11003 | IN3 | I:1.10/03 | | |
| SPARE | 40 | 32 RELAY 5 31 | I11004 | IN4 | I:1.10/04 | | |
| SPARE | 40 | 35 RELAY 6 34 | I11005 | IN5 | I:1.10/05 | | |
| SPARE | 40 | 38 RELAY 7 37 | I11006 | IN6 | I:1.10/06 | | |
| | | | | IN7 | I:1.10/07 | | |
| | | | | IN8 | I:1.10/08 | COM1 | 28 |
| | | | | IN9 | I:1.10/09 | COM1 | 28 |
| | | | | IN10 | I:1.10/10 | | |
| | | | | IN11 | I:1.10/11 | | |
| | | | | IN12 | I:1.10/12 | | |
| | | | | IN13 | I:1.10/13 | | |
| | | | | IN14 | I:1.10/14 | | |
| | | | | IN15 | I:1.10/15 | | |

(LOCATED ON BACK PAN)

24VDC, COMBO
8 OUTPUT/ 8 INPUT EXPANSION
BLOCK 1790-T8BV8BX
NODE: 5 EXPANSION BLOCK No.1

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENGINE RUNNING | 40 ERR 9 5 | I11100 | IN0 | I:1.11/00 | COM | 28 | 28 |
| BREAKER CLOSED | 40 52X 9 5 | I11101 | IN1 | I:1.11/01 | COM | 28 | 28 |
| BREAKER BELL ALARM | 40 52BA R12 R11 | I11102 | IN2 | I:1.11/02 | | | |
| BREAKER NOT INSTALLED | 40 52BP BP1 BP2 | I11103 | IN3 | I:1.11/03 | | | |
| BATTERY CHARGER FAILURE | 40 BC-1 BATTERY CHARGER BC-2 | I11104 | IN4 | I:1.11/04 | | | |
| | | | IN5 | I:1.11/05 | | | |
| | | | IN6 | I:1.11/06 | | | |
| CONTROL POWER OK | 40 | 40 | IN7 | I:1.11/07 | | | |
| | 40 | 40 | VDC | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | GND | 28 | 28 | | | | |
| SPARE | OUT0 O:1.12/00 | O11200 | IKD-1 5 4 | 28 | 28 | | |
| SPARE | OUT1 O:1.12/01 | O11201 | 6 | | | | |
| SPARE | OUT2 O:1.12/02 | O11202 | 7 | | | | |
| SPARE | OUT3 O:1.12/03 | O11203 | 8 | | | | |
| SPARE | OUT4 O:1.12/04 | O11204 | 9 | | | | |
| | OUT5 O:1.12/05 | | | | | | |
| BREAKER OPEN RELAY | OUT6 O:1.12/06 | O11206 | BOR 14 2P 13 (24 VDC) | | 28 | | |
| STOP RELAY | OUT7 O:1.12/07 | O11207 | SR 14 2P 13 (24 VDC) | | 28 | | |

(LOCATED ON BACK PAN)

CONTINUED AT UPPER RIGHT

CONTINUED FROM LOWER LEFT

24VDC, 16 SOURCING
OUTPUT BASE BLOCK
1790D-T0B16
NODE: 6 BASE BLOCK

| | | | | | | |
|---|---|---|---|---|---|---|
| 40 | VDC0 | OUT0 O:1.10/00 | O11000 | 1 G | 28 | ENGINE RUNNING LIGHT |
| | | OUT1 O:1.10/01 | O11001 | 2 R | 28 | ALARM/LOCKOUT LIGHT |
| | | OUT2 O:1.10/02 | O11002 | 3 R | 28 | LOW OIL PRESSURE LIGHT |
| | | OUT3 O:1.10/03 | O11003 | 4 R | 28 | OIL LEVEL LIGHT |
| | | OUT4 O:1.10/04 | O11004 | 5 R | 28 | HIGH WATER TEMPERATURE LIGHT |
| | | OUT5 O:1.10/05 | O11005 | 6 R | 28 | OVERSPEED LIGHT |
| | | OUT6 O:1.10/06 | O11006 | 7 R | 28 | OVERCRANK LIGHT |
| | | OUT7 O:1.10/07 | O11007 | 8 R | 28 | RUNNING TIMEOUT LIGHT |
| 40 | VDC1 | GND0 | | | 28 | |
| | | GND1 | | | 28 | |
| | | OUT8 O:1.10/08 | O11008 | 9 R | 28 | BATTERY CHARGER FAIL LIGHT |
| | | OUT9 O:1.10/09 | O11009 | 10 R | 28 | AIR FILTER PLUGGED LIGHT |
| | | OUT10 O:1.10/10 | O11010 | 11 R | 28 | HIGH INTAKE AIR TEMP LIGHT |
| | | OUT11 O:1.10/11 | O11011 | 12 G | 28 | LEAD GEN LIGHT |
| | | OUT12 O:1.10/12 | O11012 | 13 A | 28 | NORMAL STOP LIGHT |
| | | OUT13 O:1.10/13 | O11013 | 14 R | 28 | NOT IN AUTO LIGHT |
| | | OUT14 O:1.10/14 | O11014 | 15 R | 28 | SPARE LIGHT |
| | | OUT15 O:1.10/15 | O11015 | 16 R | 28 | FAIL TO SYNC LIGHT |

(LOCATED ON REAR OF DOOR)

24VDC, 16 SOURCING
OUTPUT EXPANSION BLOCK
1790D-T0B16X
NODE: 6 EXPANSION BLOCK

| | | | | | | |
|---|---|---|---|---|---|---|
| 40 | VDC0 | OUT0 O:1.11/00 | O11100 | 17 R | 28 | OVERCURRENT LIGHT |
| | | OUT1 O:1.11/01 | O11101 | 18 R | 28 | UNDER VOLTAGE LIGHT |
| | | OUT2 O:1.11/02 | O11102 | 19 R | 28 | OVER VOLTAGE LIGHT |
| | | OUT3 O:1.11/03 | O11103 | 20 R | 28 | UNDER FREQUENCY LIGHT |
| | | OUT4 O:1.11/04 | O11104 | 21 R | 28 | OVER FREQUENCY LIGHT |
| | | OUT5 O:1.11/05 | O11105 | 22 R | 28 | REVERSE POWER LIGHT |
| | | OUT6 O:1.11/06 | O11106 | 23 R | 28 | INTAKE VFD BREAKER OPEN LIGHT |
| | | OUT7 O:1.11/07 | O11107 | 24 R | 28 | INTAKE VFD FAILURE LIGHT |
| 40 | VDC1 | GND0 | | | 28 | |
| | | GND1 | | | 28 | |
| | | OUT8 O:1.11/08 | | | | |
| REMOTE ACKNOWLEDGE | | OUT9 O:1.11/09 | O11109 | 3200XT-G4 75 DI09 | | |
| SPARE | | OUT10 O:1.11/10 | O11110 | 76 DI10 | | |
| SPARE | | OUT11 O:1.11/11 | O11111 | 77 DI11 | | |
| SPARE | | OUT12 O:1.11/12 | O11112 | 78 DI12 | | |
| | | OUT13 O:1.11/13 | | | | |
| | | OUT14 O:1.11/14 | | | | |
| | | OUT15 O:1.11/15 | | | | |

(LOCATED ON REAR OF DOOR)

CONTINUED ON DRAWING No. 6184-5312-D, LINE No. 1503

FOR REFERENCE ONLY - NO WORK THIS PROJECT`

NOTE:
1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
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| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
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AEA JOB No. 21116

TITLE: GENERATOR 4 DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5311-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

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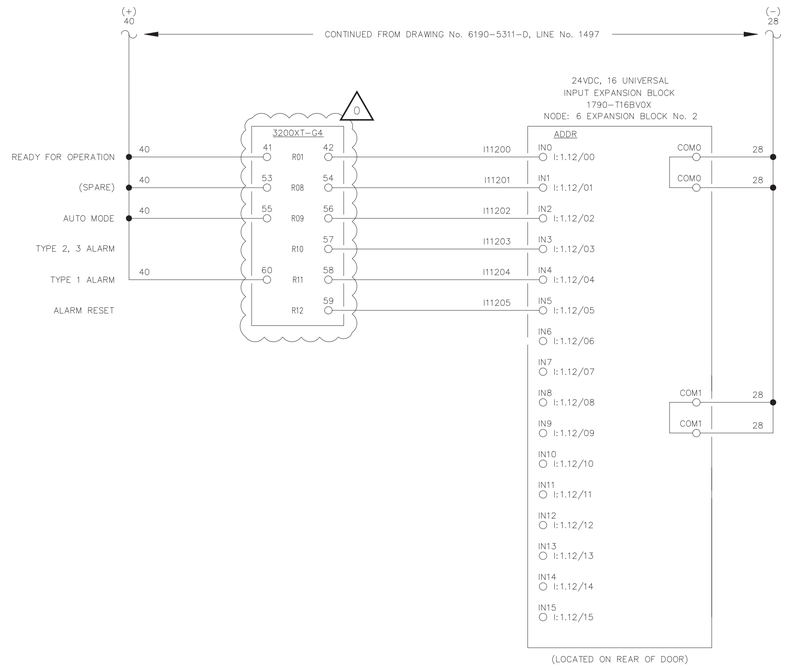


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TITLE: GENERATOR 4 DC CONTROL, SCHEMATIC DIAGRAM

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JOB: AKIACHAK

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INSTALL NEW 24VDC 15A CIRCUIT BREAKER AND DIODE BLOCK

24 VDC FROM GENERATORS 1 – 4
DWG No. 6190–5301–D, LINE No. 408
DWG No. 6190–5304–D, LINE No. 708
DWG No. 6190–5307–D, LINE No. 1008
DWG No. 6190–5310–D, LINE No. 1308

#12 AWG.

M–CB 15A

RVC

24VDC INPUT

24VDC OUTPUT

M–CB12 15A

PDB1 POWER DIODE BLOCK

TO DWG No. 6190–5701–D LINE No. 2703

M–CB10 15A

M–CB11 15A

PS 120VAC INPUT

POWER SUPPLY

GND

24VDC OUTPUT

TO DWG No. 6190–5701–D LINE No. 2703

TO AUXILIARY EQUIPMENT DWG No. 6190–5315–D LINE No. 1803

TO SECTION LIGHTS DWG No. 6190–5701–D LINE No. 2751

PLC 1769–L33ER 24VDC POWER SUPPLY

M–CB8 5A

M–CB9 5A

QIU 24 VDC POWER

BEST BATTERY SECTIONS, G1, G2, G3, G4
DWG No. 6190–5301–D, LINE No. 411
DWG No. 6190–5304–D, LINE No. 711
DWG No. 6190–5307–D, LINE No. 1011
DWG No. 6190–5310–D, LINE No. 1311

BEST BATTERY TO FEEDER 1 & 2 BREAKER OPEN LOGIC
DWG No. 6190–5403–D
LINE No. 2402 & 2426

BEST BATTERY TO VFD/DISTRIBUTION SECTION, DWG No. 6190–5316–D
LINE No. 1904 &
DWG No. 6190–5318–D
LINE No. 2104

M–CB7 15A

F1–52CS (CLOSE)

F1–BCRX

F1–52R

F1–52CR (24 VDC)

FEEDER 1 BREAKER CLOSE RELAY

F1–52CS (TRIP)

F1–BORX

F1–52OR

F1–52CR (24 VDC)

FEEDER 1 BREAKER OPEN RELAY

F2–52CS (CLOSE)

F2–BCRX

F2–52OR

F2–52CR (24 VDC)

FEEDER 2 BREAKER CLOSE RELAY

F2–52CS (TRIP)

F2–BORX

F2–52OR

F2–52CR (24 VDC)

FEEDER 2 BREAKER OPEN RELAY

CONTINUED AT UPPER RIGHT

CONTINUED FROM LOWER LEFT

F1–52 L18 L16

F1–BCL (24 VDC) FEEDER 1 BREAKER CLOSED LIGHT

F1–BOL (24 VDC) FEEDER 1 BREAKER OPEN LIGHT

F2–52 L18 L16

F2–BCL (24 VDC) FEEDER 2 BREAKER CLOSED LIGHT

F2–BOL (24 VDC) FEEDER 2 BREAKER OPEN LIGHT

SLWLR 2P (24 VDC)

SYSTEM LOW WATER LEVEL

SYSTEM LOW WATER LEVEL RELAY

FIRE ALARM

FAR 2P (24 VDC)

FIRE ALARM RELAY

SLWLR

FAR

EMERGENCY STOP BUTTON ESB

TO G1, G2, G3 & G4 SHUTDOWN RELAY
DWG No. 6190–5301–D, LINE No. 482
DWG No. 6190–5304–D, LINE No. 782
DWG No. 6190–5307–D, LINE No. 1082
DWG No. 6190–5310–D, LINE No. 1382

TO DWG No. 6190–5314–D LINE No. 1776

**4 CHANNEL ANALOG INPUT BASE BLOCK 1790D–TN4C0 NODE: 9 BASE BLOCK**

ADDR VDC GND

B–EPM AOUT GND

BUS TOTAL LOAD SIGNAL 0–600 KW, 4–20mA CH0 M1:1.0 COM0

HEAT RECOVERY PRESSURE SENSOR 0–60 PSI, 4–20mA 6B1 SH CH1 M1:1.1 COM1

HEAT RECOVERY SUPPLY TEMPERATURE SENSOR 20°–240° F, 4–20mA CH2 M1:1.2 COM2

HEAT RECOVERY RETURN TEMPERATURE SENSOR 20°–240° F, 4–20mA CH3 M1:1.3 COM3

(LOCATED ON BACK PAN)

CONTINUED ON DWG No. 6190–5314–D, LINE No. 1703

NOTE:
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TITLE: MASTER DC CONTROL, SCHEMATIC DIAGRAM

SCALE: NONE | DATE: 01–04–22 | DWN. BY: JRV

DWG. No: 6190–5313–D | SHEET: 1 OF 1 | CKD. BY: JRP

JOB: AKIACHAK

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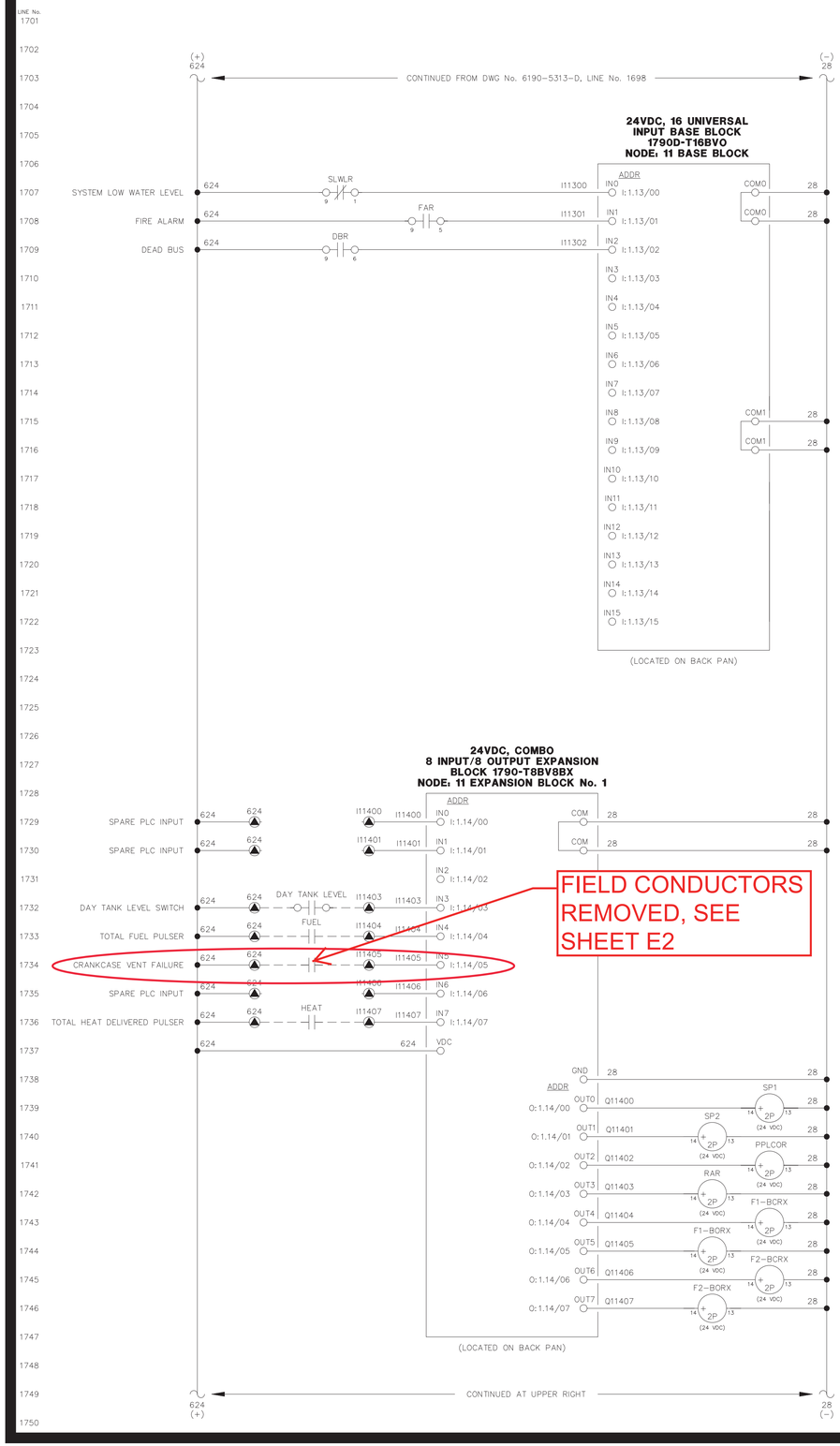


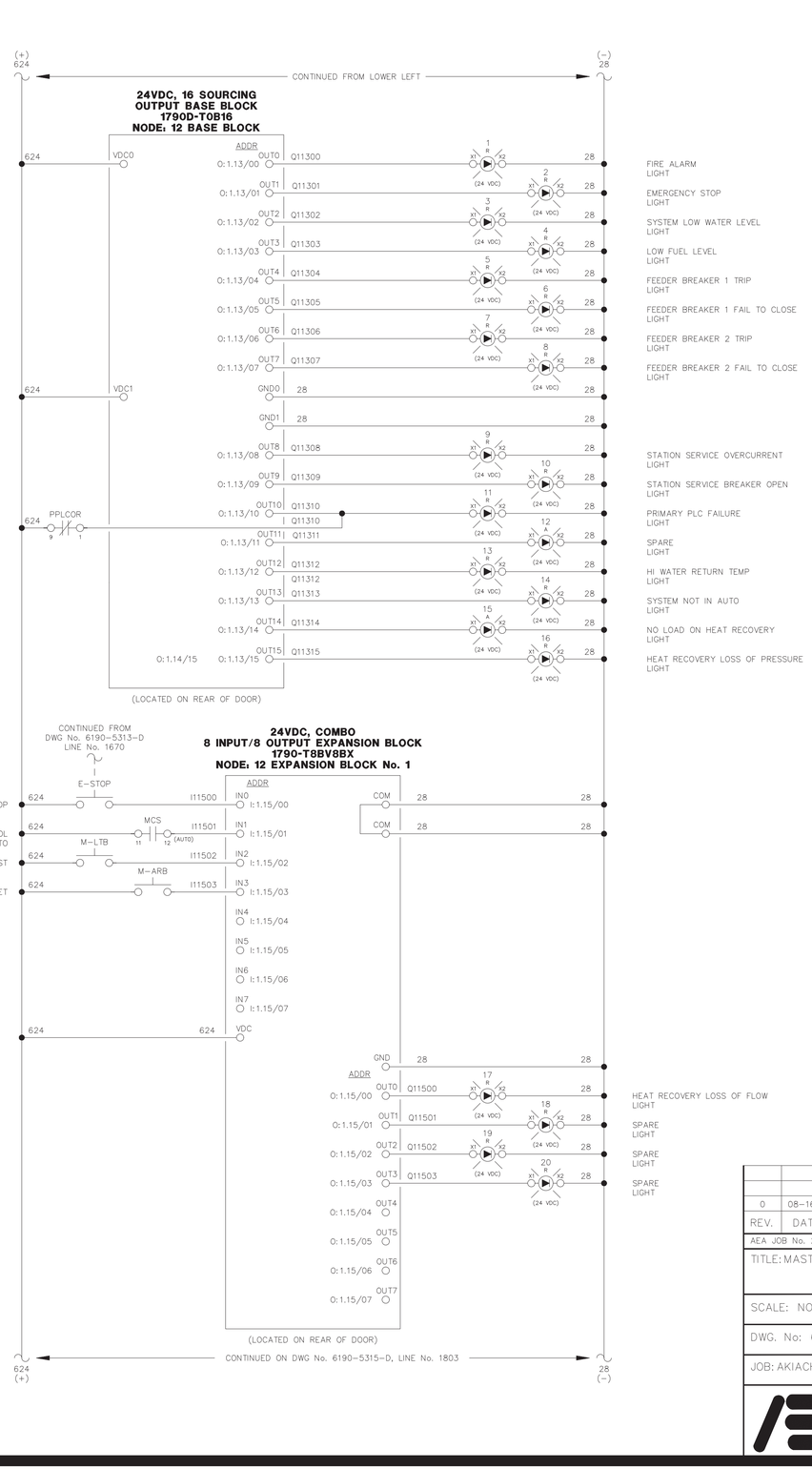


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AEA JOB No. 21116

TITLE: MASTER DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
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| DWG. No: 6190-5314-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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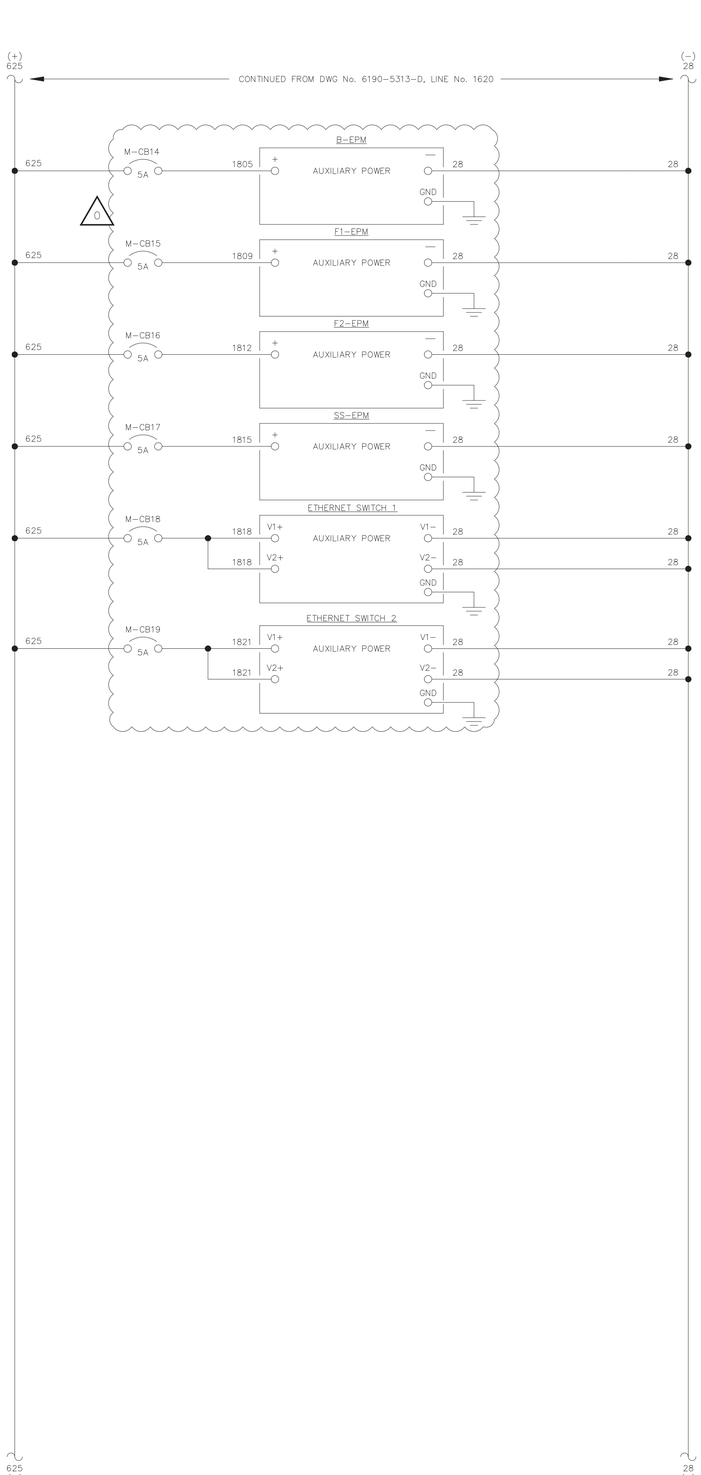


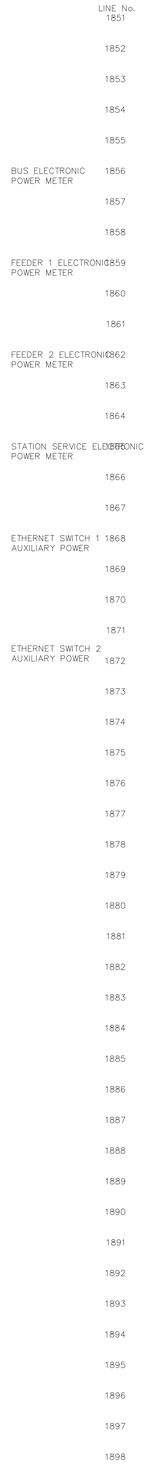


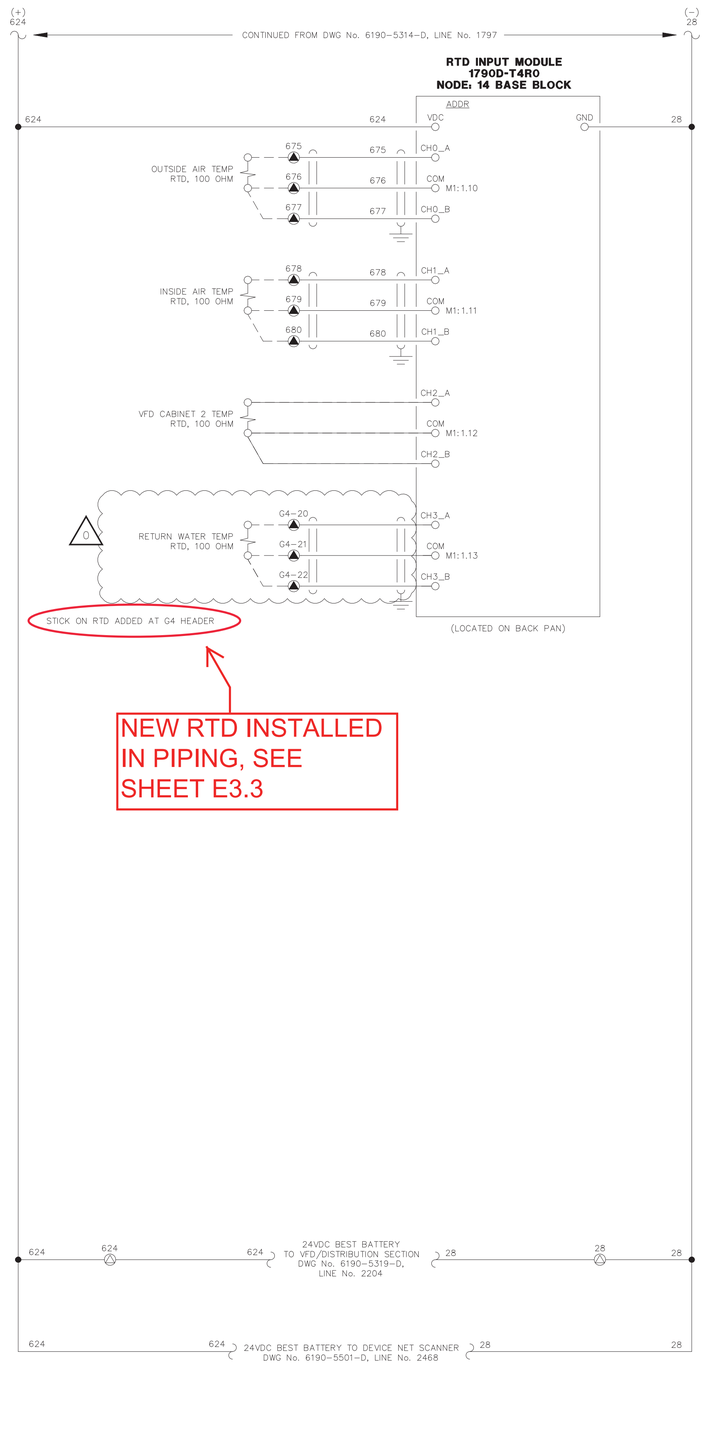


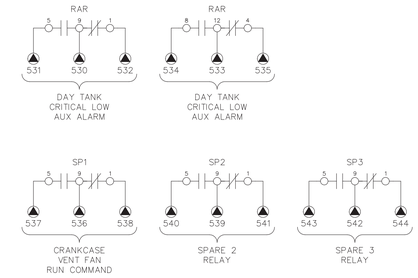


1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: MASTER DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5315-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

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RURAL ENERGY GROUP
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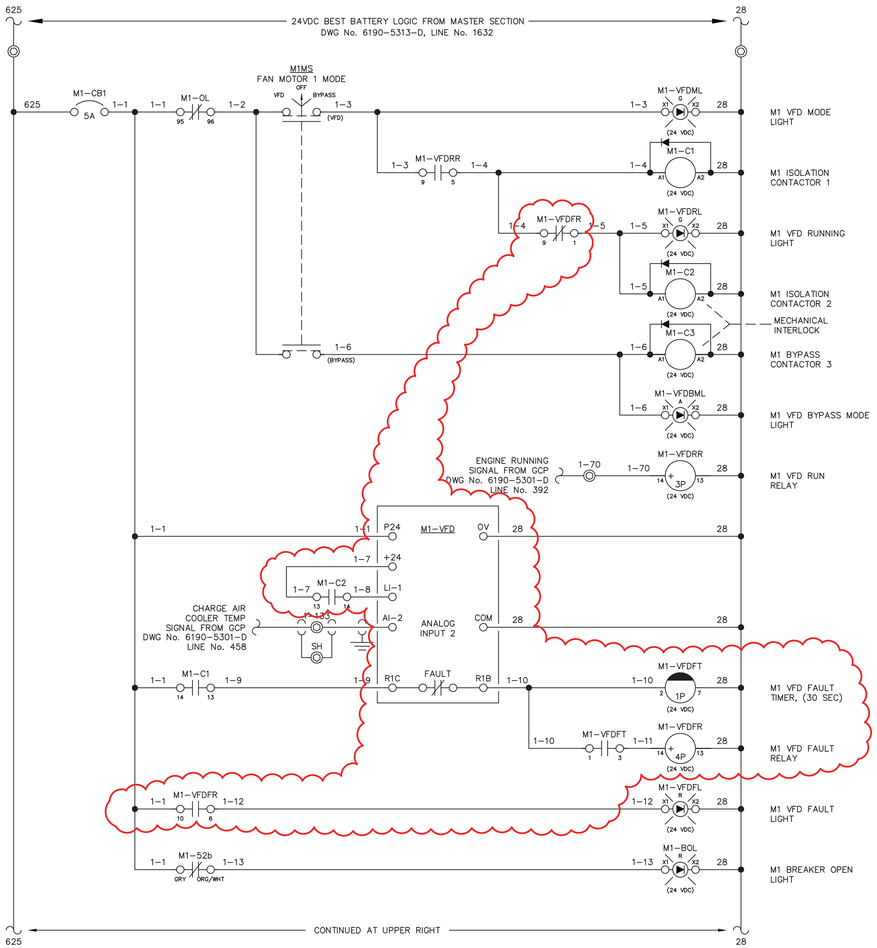
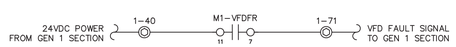
ANCHORAGE, ALASKA 99503
HTTP://WWW.AIDEA.ORG

## ENGINE 1 CHARGE AIR COOLER VFD

M1

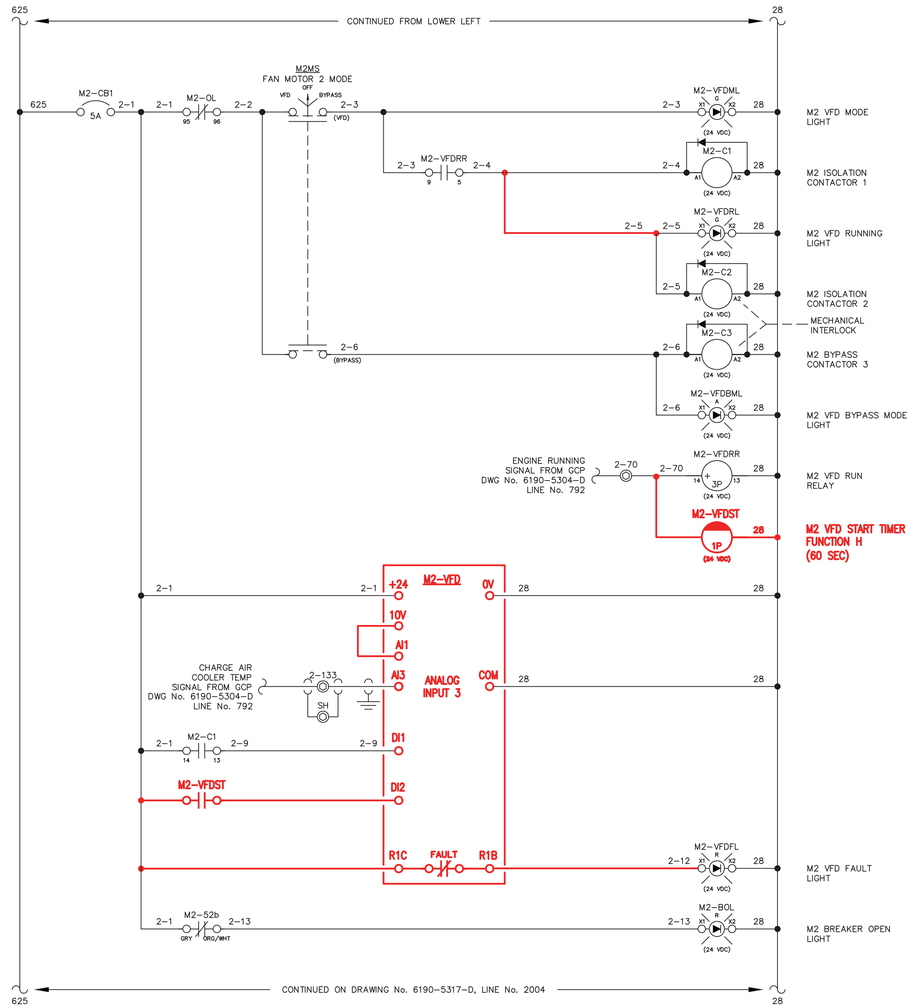


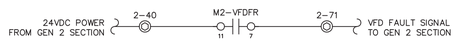




ON ALL CHARGE AIR COOLER VFD's DEMOLISH
ALL DEVICES AND JUMPERS WITHIN RED CLOUD

## ENGINE 2 CHARGE AIR COOLER VFD

M2




ON ALL CHARGE AIR COOLER VFD's INSTALL
NEW DEVICES AND JUMPERS SHOWN IN RED

UNDER ADD ALT 3
REPLACE ALL VFD'S,
SEE SHEET E6.2

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

AEA PURCHASE ORDER No. REG-07020 — CONTROLLED POWER JOB No. 6190

TITLE: VFD DC CONTROL, SCHEMATIC DIAGRAM

| SCALE: NONE | DATE: 07-18-07 | DWN. BY: GPN |
|---|---|---|
| DWG. No: 6190-5316-D | SHEET: 1 OF 1 | CKD. BY: JMD |

JOB: AKIACHAK

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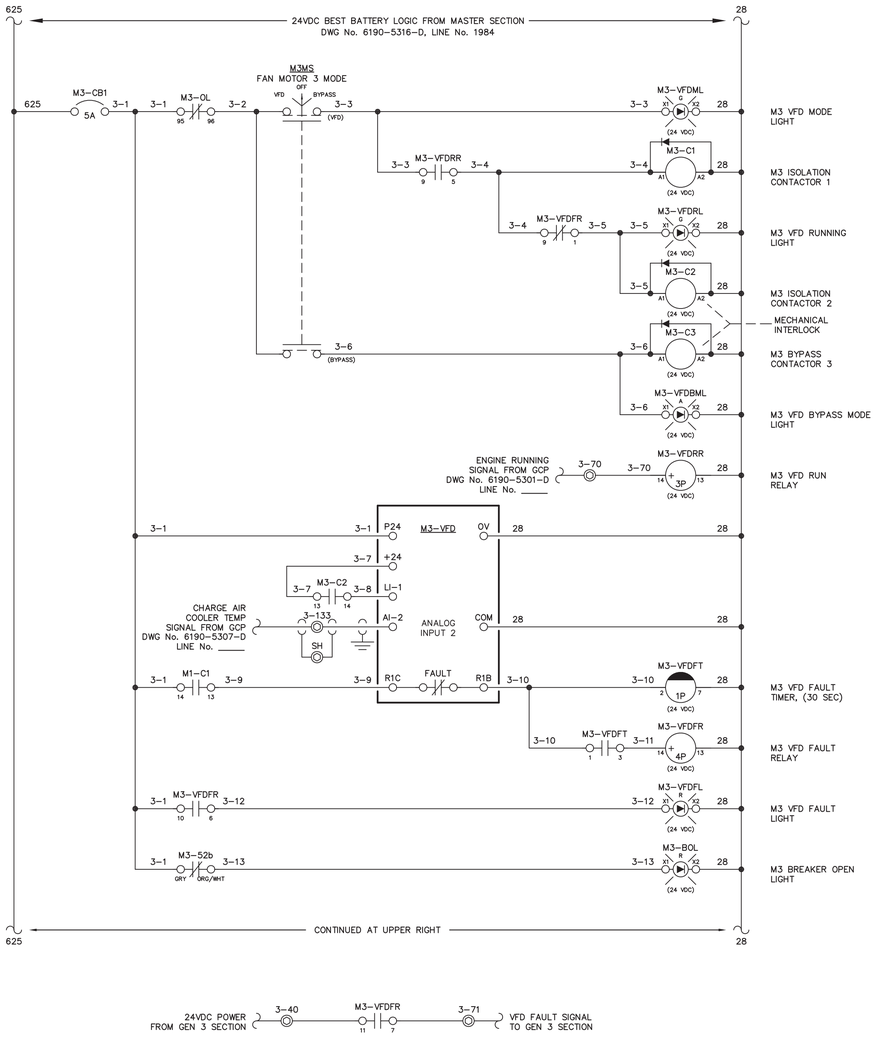
HTTP: //WWW.AIDEA.ORG

## ENGINE 3 CHARGE AIR COOLER VFD

M3



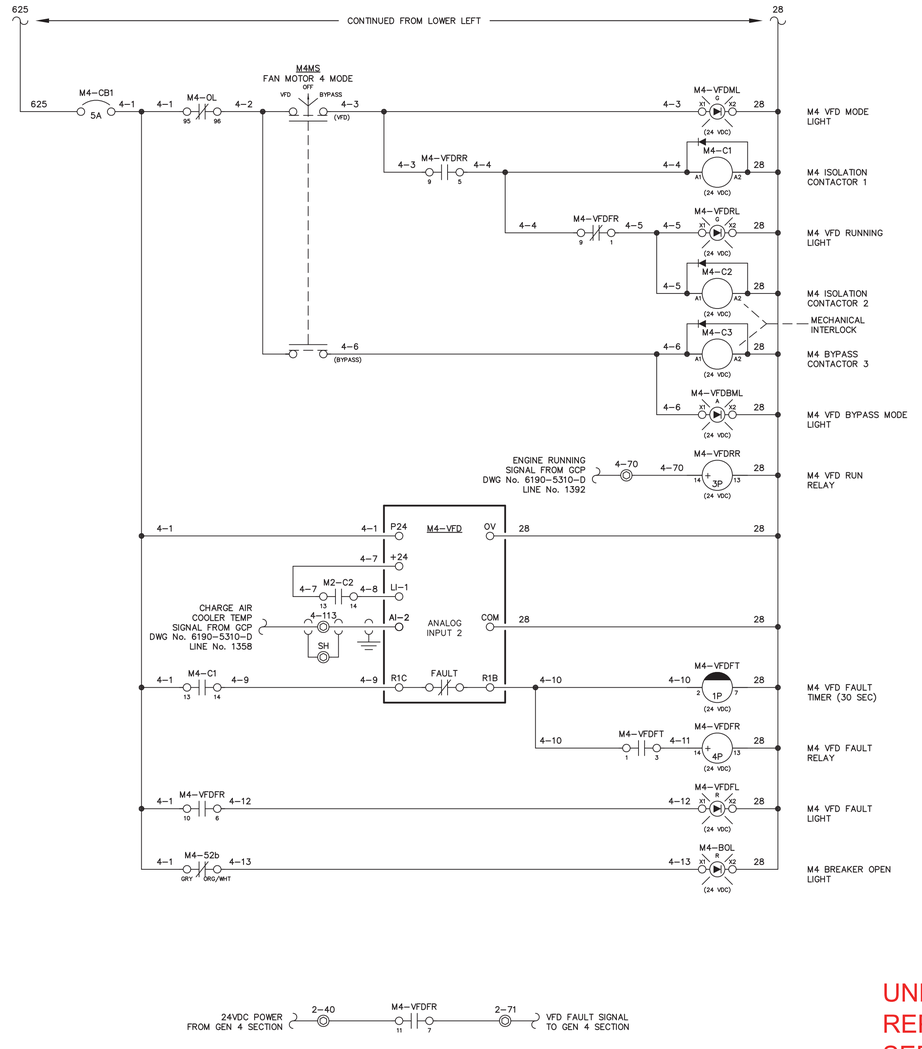




DEMOLISH ALL DEVICES AND JUMPERS AND INSTALL NEW DEVICES AND JUMPERS AS SHOWN ON SHEET 5317-D

## ENGINE 4 CHARGE AIR COOLER VFD

M4







DEMOLISH ALL DEVICES AND JUMPERS AND INSTALL NEW DEVICES AND JUMPERS AS SHOWN ON SHEET 5317-D

UNDER ADD ALT 3
REPLACE ALL VFD'S,
SEE SHEET E6.2

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

AEA PURCHASE ORDER No. REG-07020 — CONTROLLED POWER JOB No. 6190

TITLE: VFD DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 07-18-07 | DWN. BY: GPN |
| DWG. No: 6190-5317-D | SHEET: 1 OF 1 | CKD. BY: JMD |
| JOB: AKIACHAK | | |



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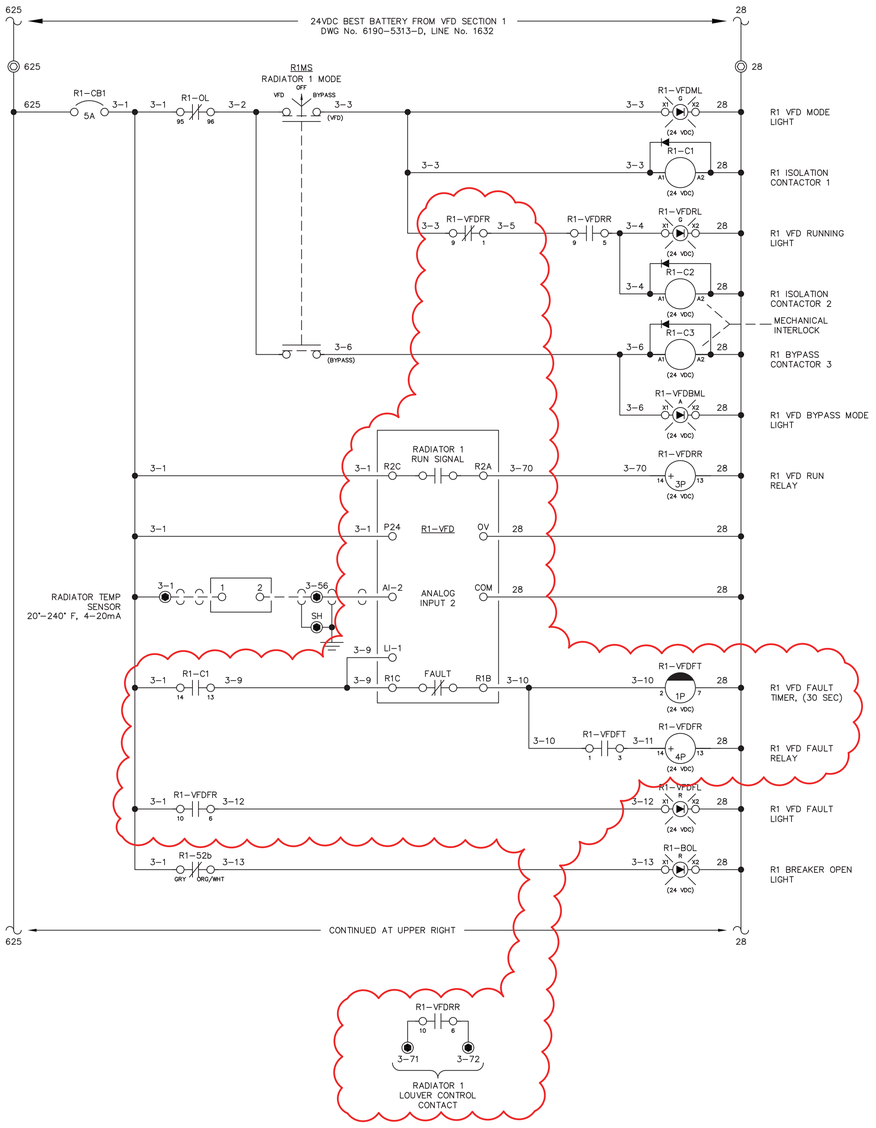
Plot date: 2007/10/1 - 11:38

## RADIATOR 1 VFD

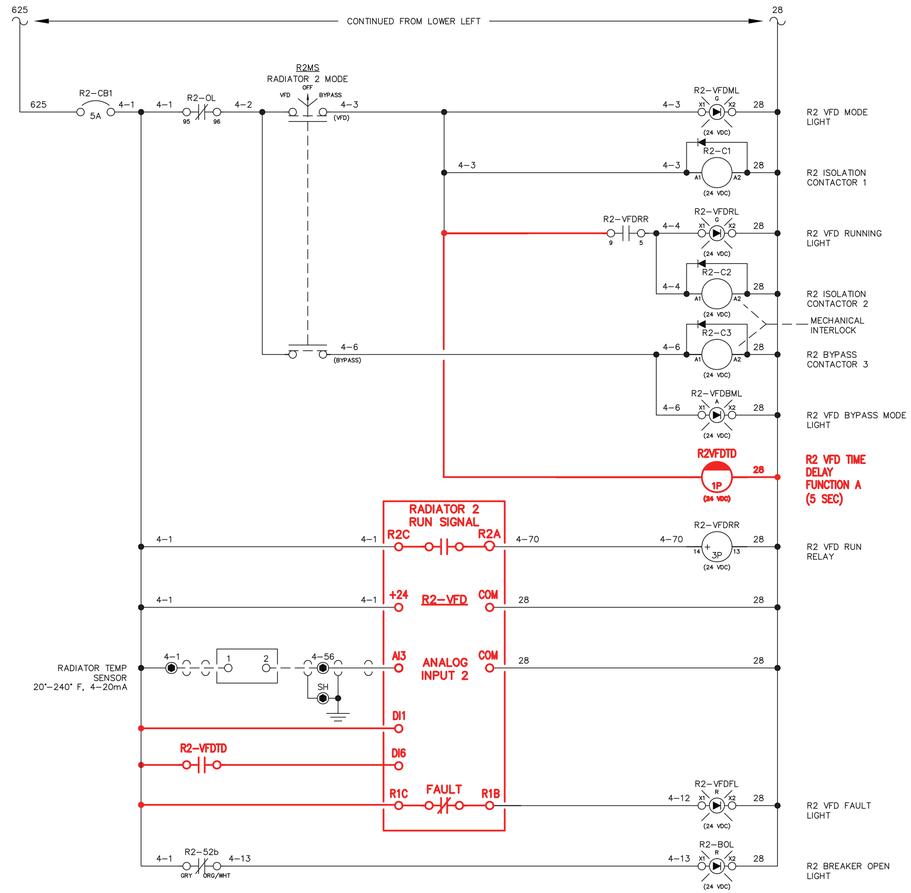
R1




ON ALL RADIATOR VFD's DEMOLISH ALL DEVICES AND JUMPERS WITHIN CLOUD

## RADIATOR 2 VFD

R2




ON ALL RADIATOR VFD's INSTALL NEW DEVICES AND JUMPERS SHOWN IN RED

UNDER ADD ALT 3
REPLACE ALL
VFD'S. SEE SHEET

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

AEA PURCHASE ORDER No. REG-07020 — CONTROLLED POWER JOB No. 6190

TITLE: VFD DC CONTROL, SCHEMATIC DIAGRAM

| SCALE: NONE | DATE: 07-18-07 | DWN. BY: GPN |
|---|---|---|
| DWG. No: 6190-5318-D | SHEET: 1 OF 1 | CKD. BY: JMD |

JOB: AKIACHAK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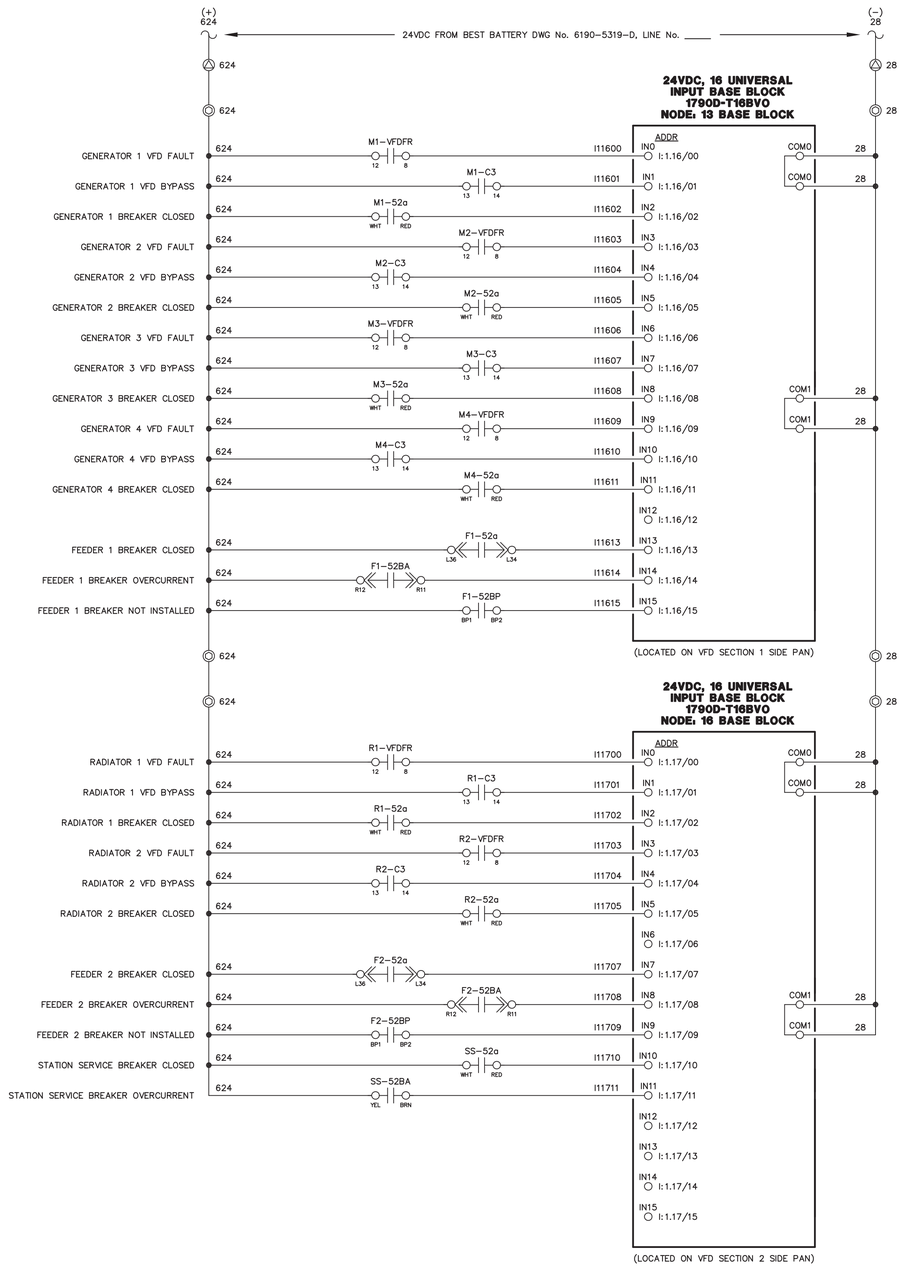


FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

AEA PURCHASE ORDER No. REG-07020 CONTROLLED POWER JOB No. 6190

TITLE: VFD DC CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 07-18-07 | DWN. BY: GPN |
| DWG. No: 6190-5319-D | SHEET: 1 OF 1 | CKD. BY: JMD |
| JOB: AKIACHAK | | |



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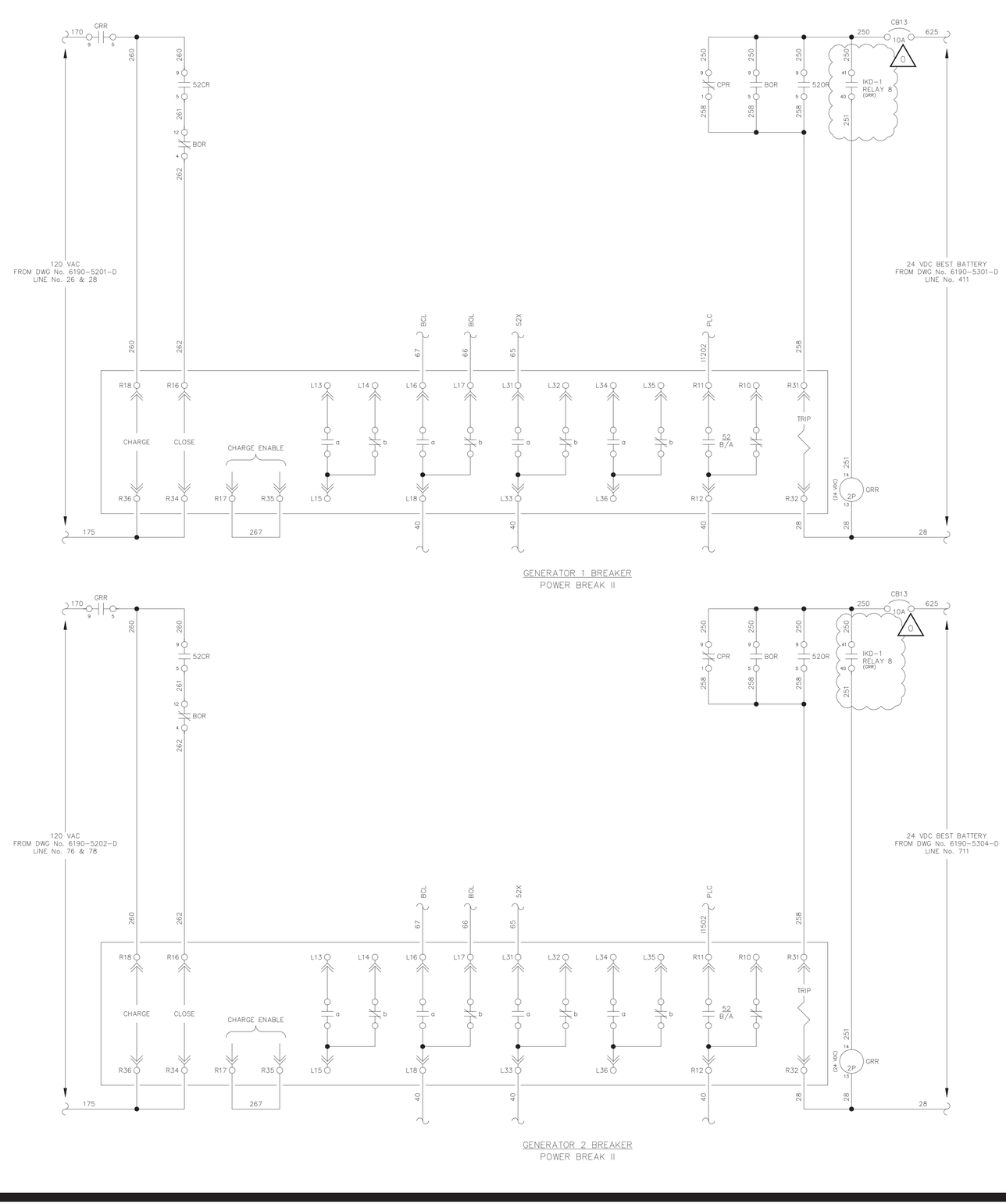
HTTP://WWW.AIDEA.ORG

Plot date: 2007/10/1 - 11:33




FOR REFERENCE ONLY - NO WORK THIS PROJECT

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 1 & 2 BREAKER CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5401-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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RURAL ENERGY GROUP
813 W. NORTHERN LIGHTS BLVD.
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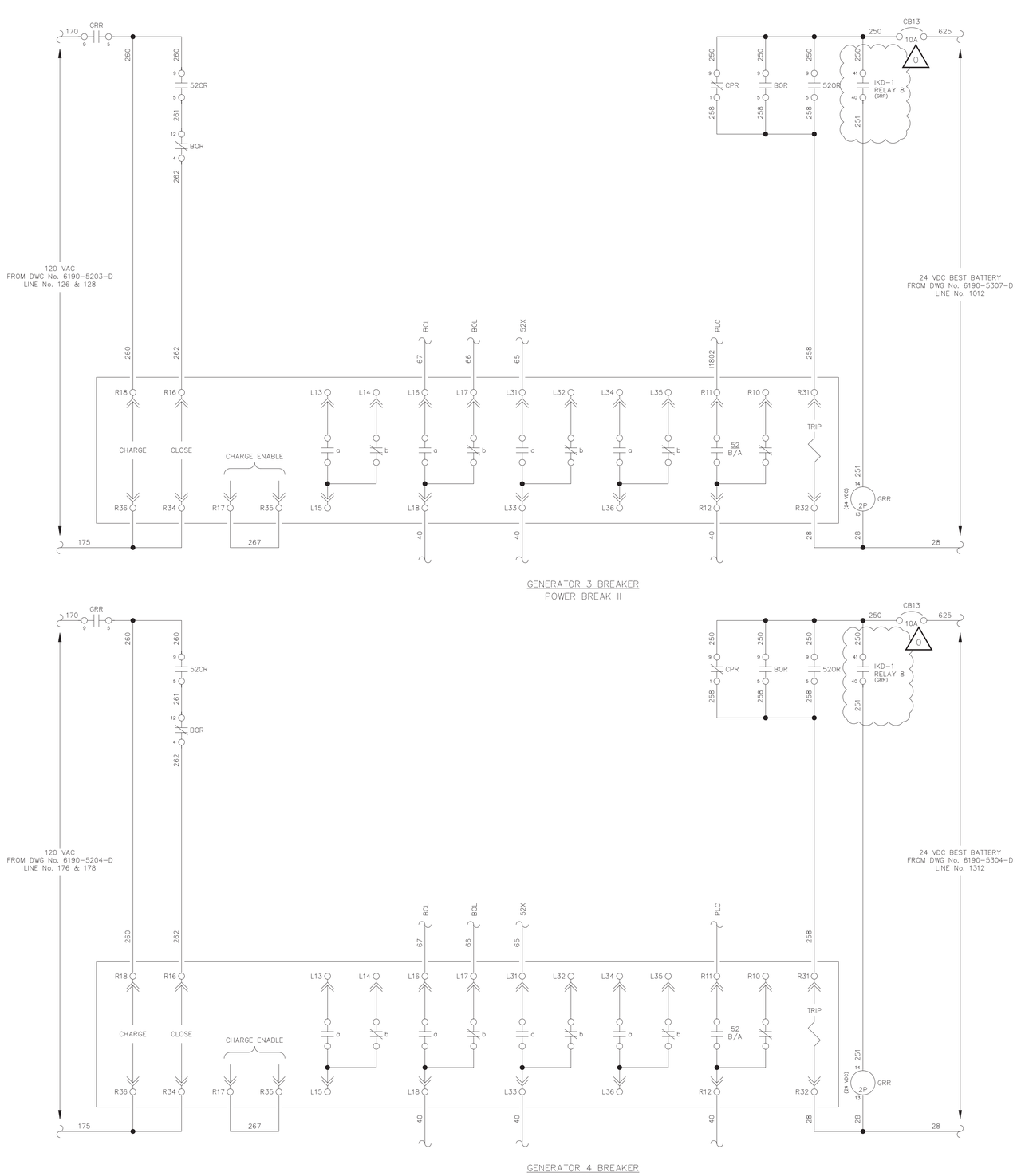


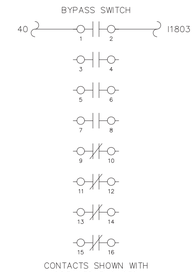


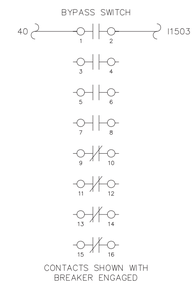


FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: GENERATOR 3 BREAKER CONTROL, SCHEMATIC DIAGRAM

| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
|---|---|---|
| DWG. No: 6190-5402-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

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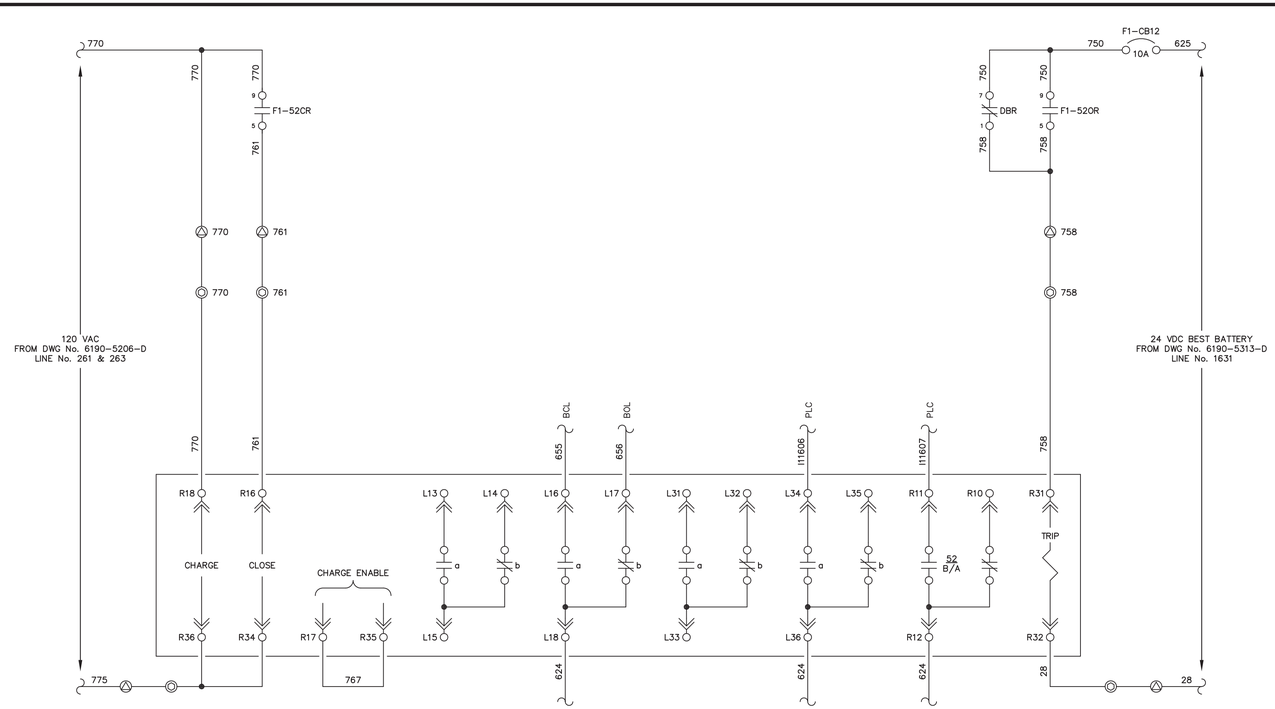
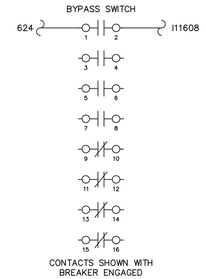
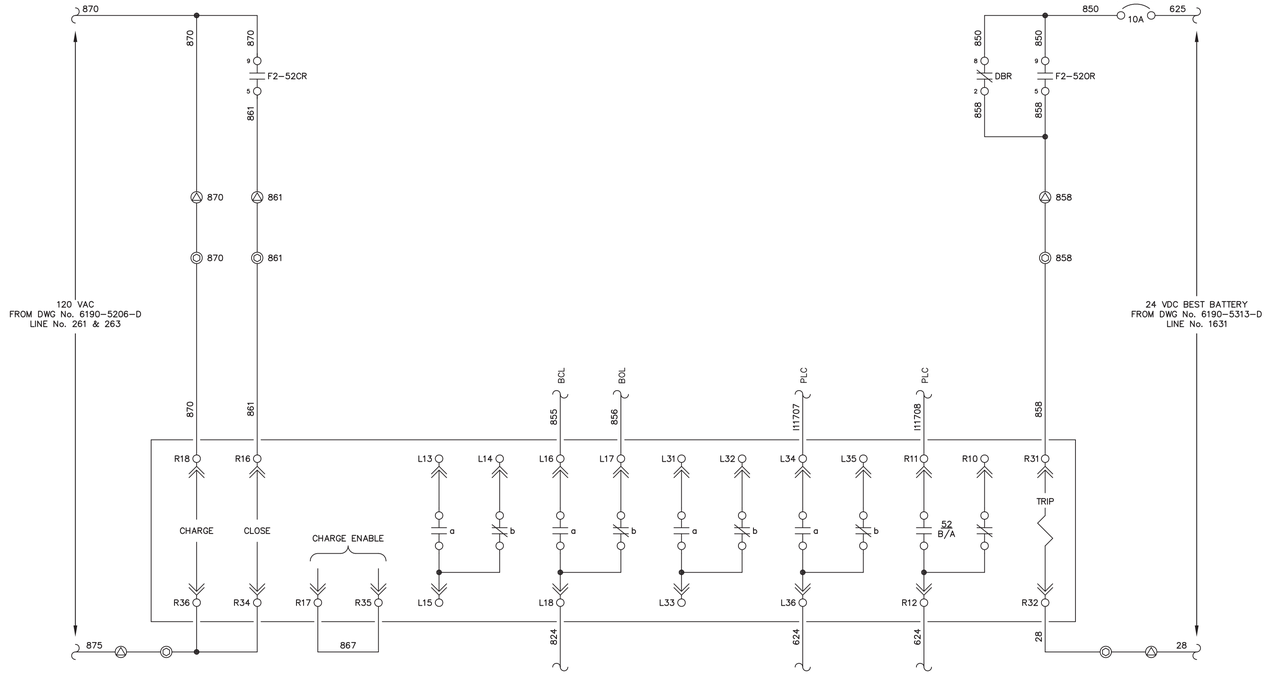
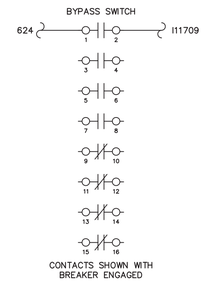



FEEDER 1 BREAKER
POWER BREAK II




FEEDER 2 BREAKER
POWER BREAK II




FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:
1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

AEA PURCHASE ORDER No. REG-07020 CONTROLLED POWER JOB No. 6190

TITLE: FEEDER 1 & 2 BREAKER CONTROL, SCHEMATIC DIAGRAM

| SCALE: NONE | DATE: 07-18-07 | DWN. BY: GPN |
|---|---|---|
| DWG. No: 6190-5403-D | SHEET: 1 OF 1 | CKD. BY: JMD |
| JOB: AKIACHAK | | |



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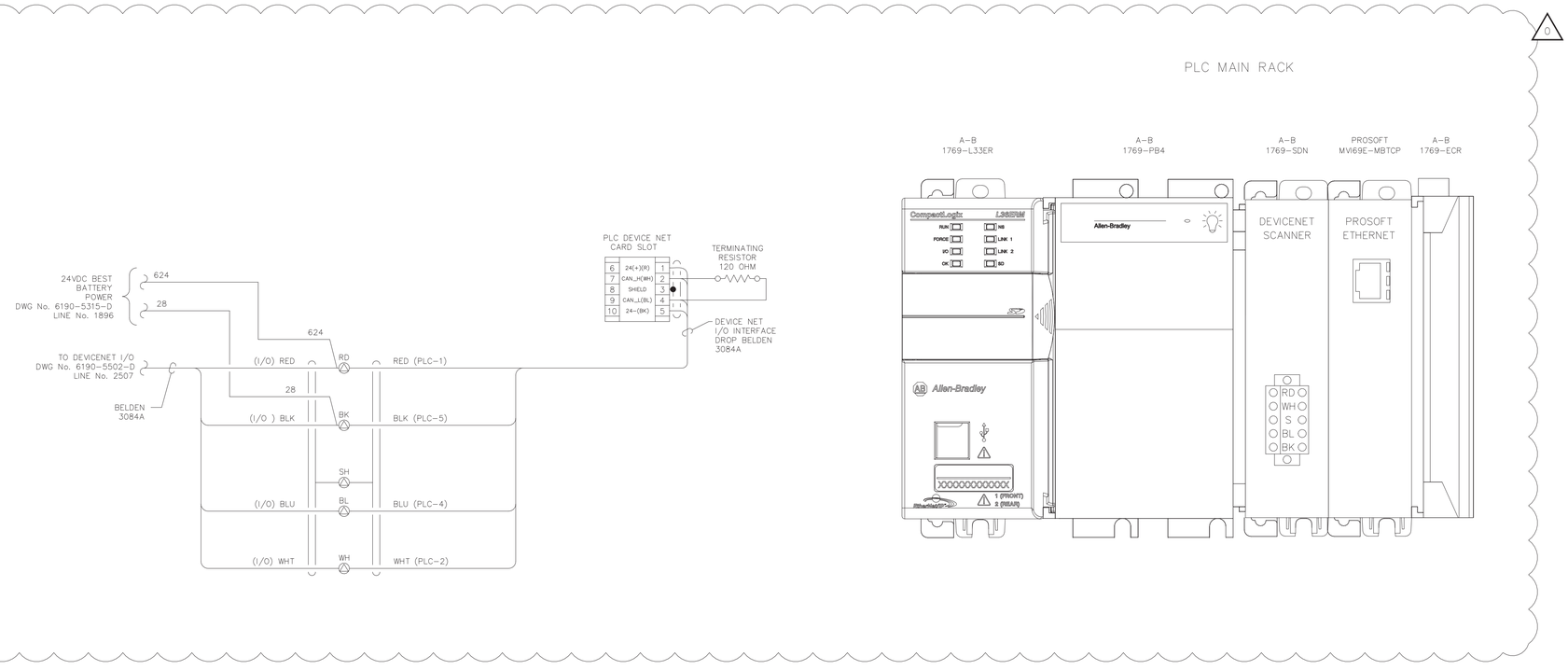
ANCHORAGE, ALASKA 99503
HTTP://WWW.AIDEA.ORG

Plot date: 2007/10/1 - 11:30




FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190–3101–D.

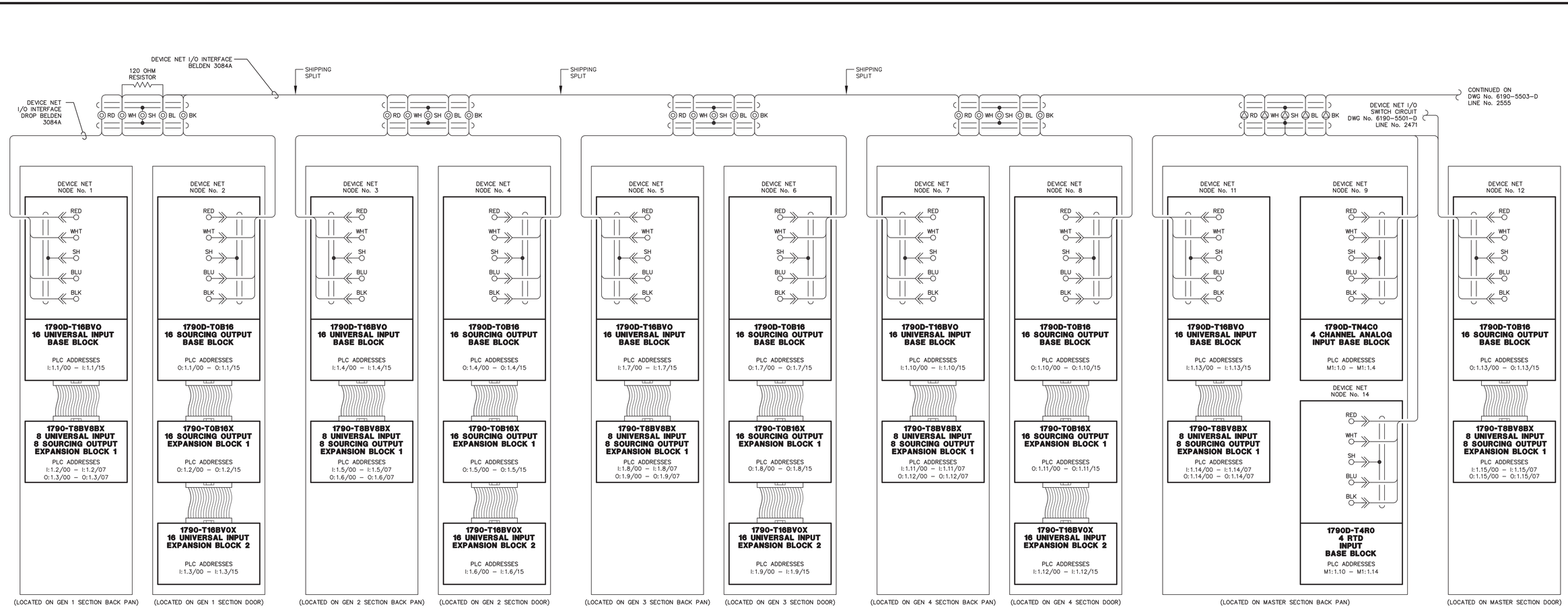
| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08–16–22 | AS–BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07–06–22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02–02–22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: PLC COMMUNICATION, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01–04–22 | DWN. BY: JRV |
| DWG. No: 6190–5501–D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

ALASKA ENERGY AUTHORITY
RURAL ENERGY GROUP
813 W. NORTHERN LIGHTS BLVD.
ANCHORAGE, ALASKA 99503
HTTP://WWW.AIDEA.ORG




FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

AEA PURCHASE ORDER No. REG-07020 CONTROLLED POWER JOB No. 6190

TITLE: PLC COMMUNICATION, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 07-18-07 | DWN. BY: GPN |
| DWG. No: 6190-5502-D | SHEET: 1 OF 1 | CKD. BY: JMD |
| JOB: AKIACHAK | | |



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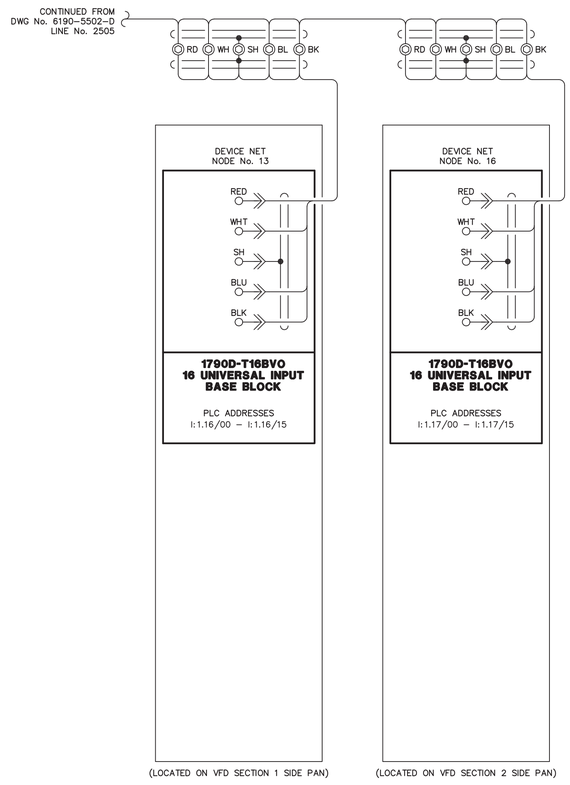
HTTP://WWW.AIDEA.ORG

Plot date: 2007/10/1 – 11:26




NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

AEA PURCHASE ORDER No. REG-07020 CONTROLLED POWER JOB No. 6190

TITLE: PLC COMMUNICATION, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 07-18-07 | DWN. BY: GPN |
| DWG. No: 6190-5503-D | SHEET: 1 OF 1 | CKD. BY: JMD |
| JOB: AKIACHAK | | |



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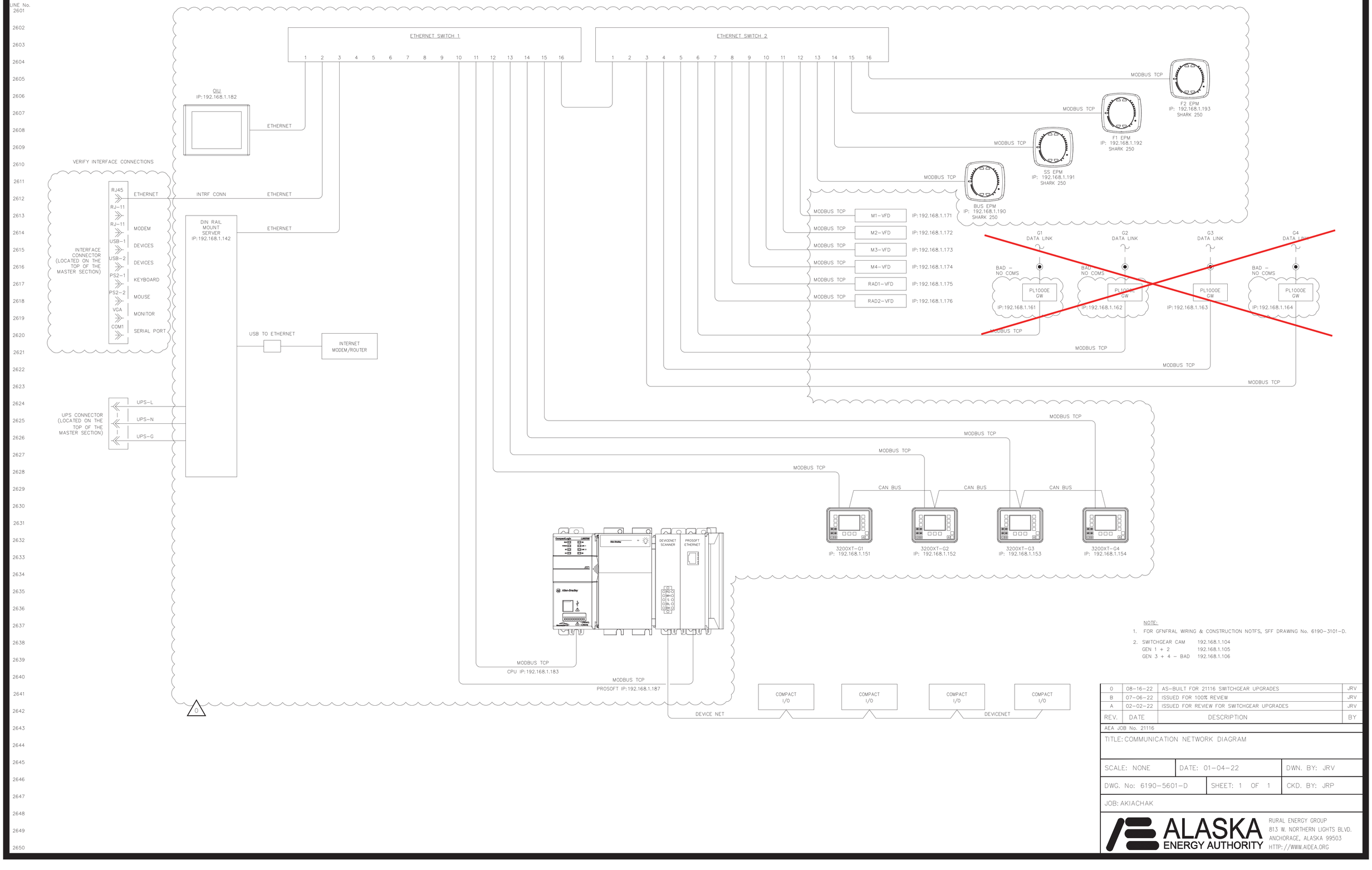
Plot date: 2007/10/1 – 11:25




NOTE:

1. FOR GFNFRAL WIRING & CONSTRUCTION NOTFS, SFF DRAWING No. 6190-3101-D.
2. SWITCHGEAR CAM 192.168.1.104
   GEN 1 + 2 192.168.1.105
   GEN 3 + 4 – BAD 192.168.1.106

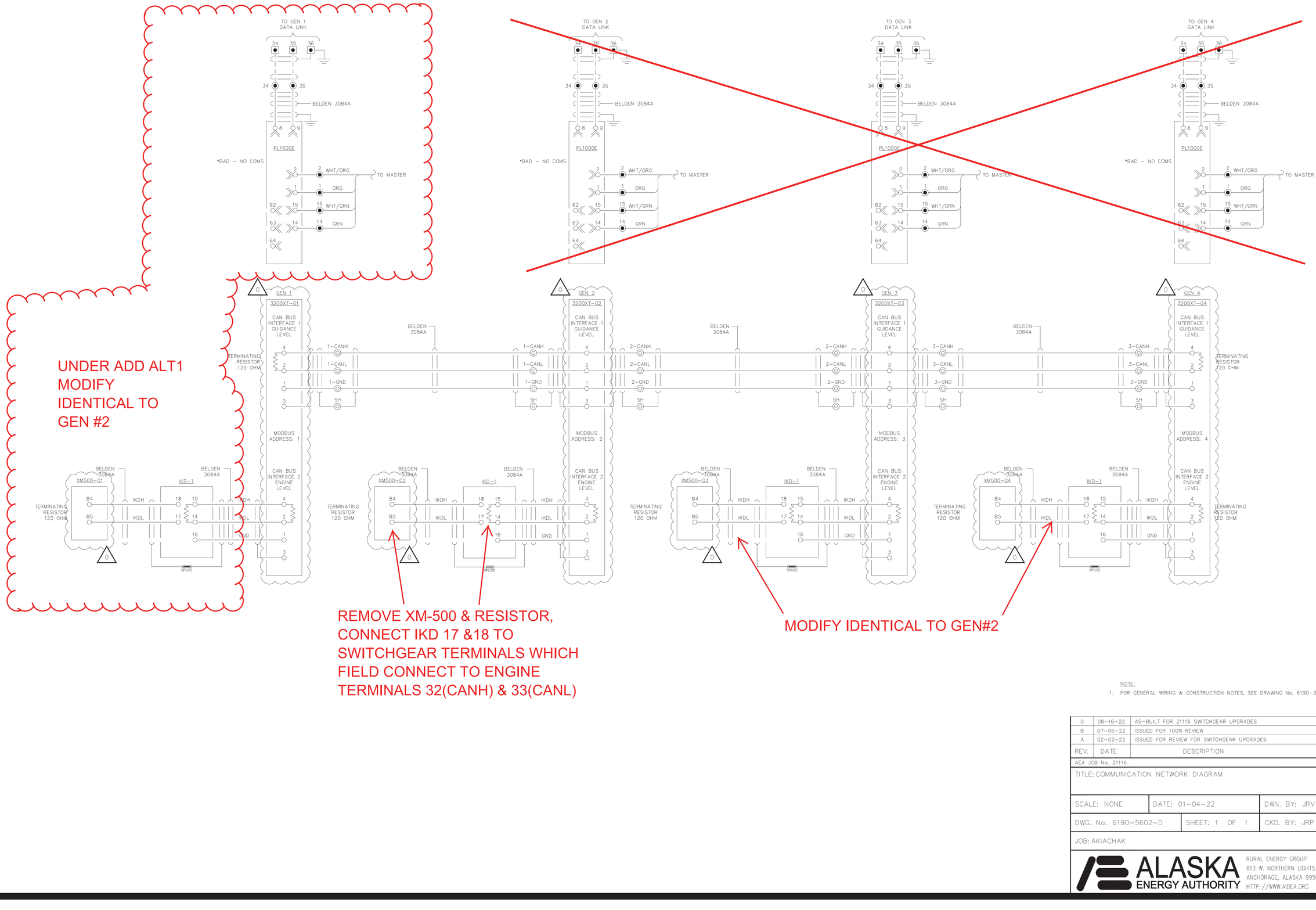
| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: COMMUNICATION NETWORK DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5601-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

ALASKA ENERGY AUTHORITY
RURAL ENERGY GROUP
813 W. NORTHERN LIGHTS BLVD.
ANCHORAGE, ALASKA 99503
HTTP://WWW.AIDEA.ORG




NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

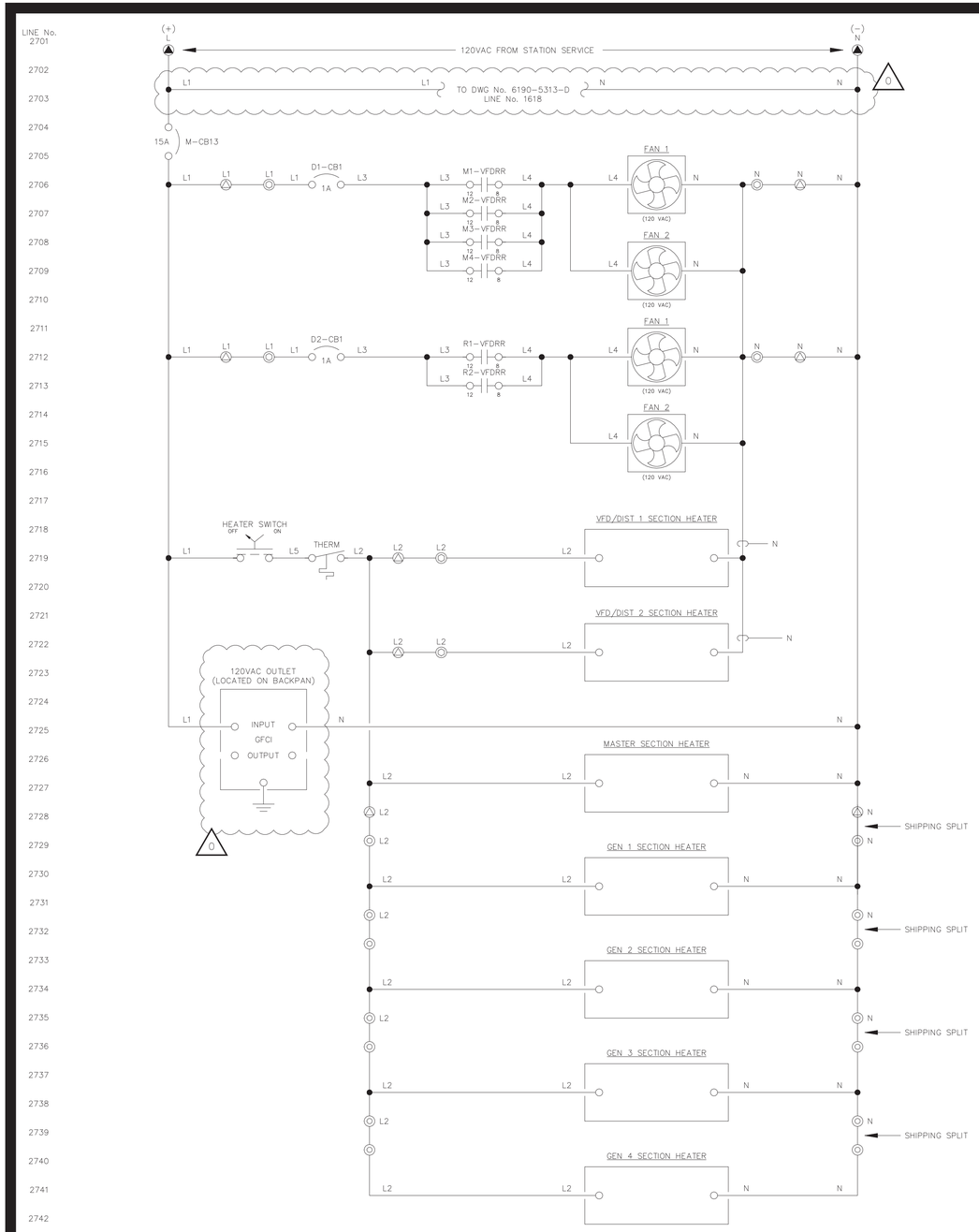
AEA JOB No. 21116

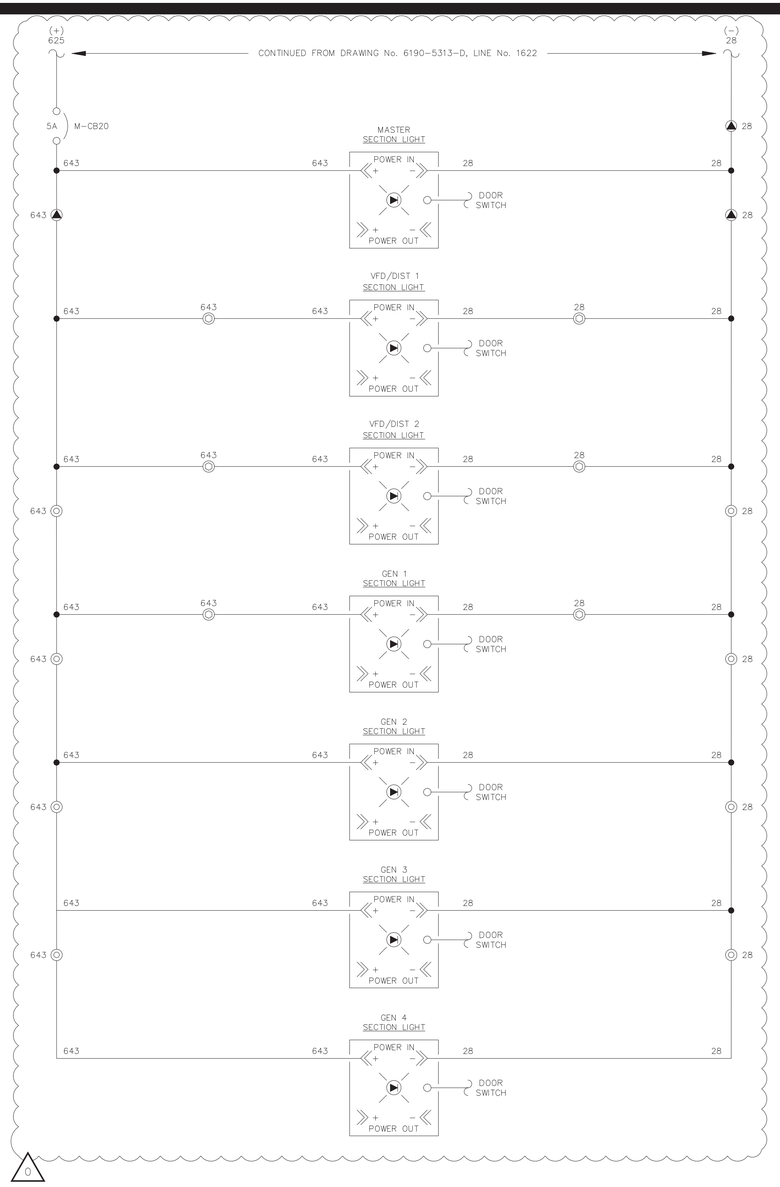
TITLE: COMMUNICATION NETWORK DIAGRAM

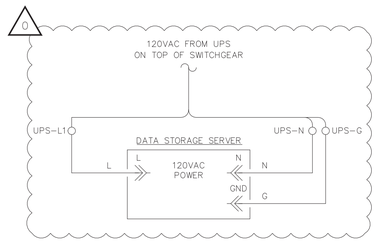
| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5602-D | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK

ALASKA ENERGY AUTHORITY
RURAL ENERGY GROUP
813 W. NORTHERN LIGHTS BLVD.
ANCHORAGE, ALASKA 99503
HTTP://WWW.AIDEA.ORG




FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190-3101-D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

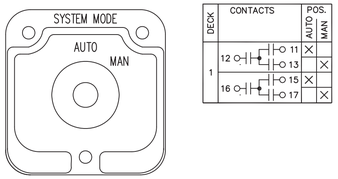
AEA JOB No. 21116

TITLE: HEATER, LIGHTING & FAN CONTROL, SCHEMATIC DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 6190-5701-D | SHEET: 1 OF 1 | CKD. BY: JRP |
| JOB: AKIACHAK | | |

ALASKA ENERGY AUTHORITY
RURAL ENERGY GROUP
813 W. NORTHERN LIGHTS BLVD.
ANCHORAGE, ALASKA 99503
HTTP://WWW.AIDEA.ORG

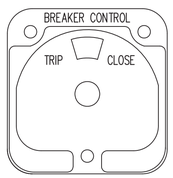
SYSTEM MODE SWITCH – SMS




| DECK | CONTACTS | POS. AUTO | POS. MAN |
|---|---|---|---|
| 1 | 12 – 11 | X | |
| | 13 | | X |
| | 16 – 15 | X | |
| | 17 | | X |

(ELECTROSWITCH 24201C)
KNURLED HANDLE
QTY 1

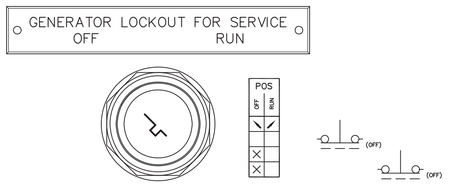
BREAKER CONTROL SWITCH – 52CS




| DECK | CONTACTS | POS. TRIP | POS. NORM. CLOSE |
|---|---|---|---|
| 1 | 11 – 18 | X | |
| | 16 – 17 | | X |

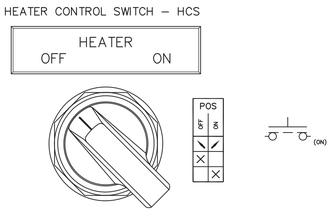
(ELECTROSWITCH 2438D)
PISTOL GRIP HANDLE
SPRING RETURN TO CENTER
QTY 2

ENGINE CONTROL SWITCH – ECS



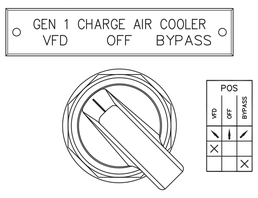

KEY OPERATED
2 POS MAINTAINED
QTY 4

HEATER CONTROL SWITCH – HCS



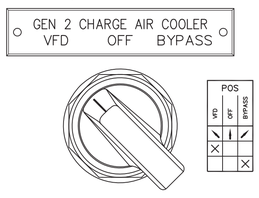

MAINTAINED
LOCATED ON MASTER
BACK PAN

VARIABLE FREQUENCY DRIVE SWITCH – VFDS



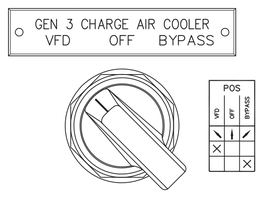

3 POS MAINTAINED

VARIABLE FREQUENCY DRIVE SWITCH – VFDS



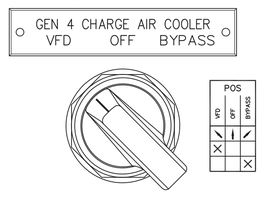

3 POS MAINTAINED

VARIABLE FREQUENCY DRIVE SWITCH – VFDS



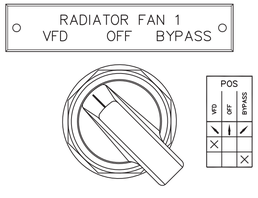

3 POS MAINTAINED

VARIABLE FREQUENCY DRIVE SWITCH – VFDS



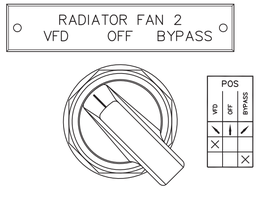

3 POS MAINTAINED

VARIABLE FREQUENCY DRIVE SWITCH – VFDS




3 POS MAINTAINED

VARIABLE FREQUENCY DRIVE SWITCH – VFDS




3 POS MAINTAINED

FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:
1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190–3101–D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

AEA PURCHASE ORDER No. REG–07020 CONTROLLED POWER JOB No. 6190

TITLE: CONTROL SWITCH TARGET DIAGRAM

| SCALE: NONE | DATE: 07–18–07 | DWN. BY: GPN |
|---|---|---|
| DWG. No: 6190–6101–D | SHEET: 1 OF 1 | CKD. BY: JMD |
| JOB: AKIACHAK | | |



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NP. TEXT 1/8" QUANTITY 4 SCALE 1/1

| ENGINE RUNNING | ALARM/ LOCKOUT | LOW OIL PRESSURE | OIL LEVEL | HIGH WATER TEMPERATURE | OVERSPEED | OVERCRANK | RUNNING TIMEOUT | BATTERY CHARGER FAIL | AIR FILTER PLUGGED | HIGH INTAKE AIR TEMP | LEAD GEN |
|---|---|---|---|---|---|---|---|---|---|---|---|

NP. TEXT 1/8" QUANTITY 4 SCALE 1/1

| NORMAL STOP | NOT IN AUTO | FAIL TO SYNC | OVERCURRENT | UNDER VOLTAGE | OVER VOLTAGE | UNDER FREQUENCY | OVER FREQUENCY | REVERSE POWER | INTAKE VFD BREAKER OPEN | INTAKE VFD FAILURE |
|---|---|---|---|---|---|---|---|---|---|---|

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

| FIRE ALARM | EMERGENCY STOP | SYSTEM LOW WATER LEVEL | LOW FUEL LEVEL | F1 BREAKER TRIP | F1 FAIL TO CLOSE | F2 BREAKER TRIP | F2 FAIL TO CLOSE | STATION SERVICE OVERCURRENT | CRANKCASE VENT FAILURE |
|---|---|---|---|---|---|---|---|---|---|

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

| PRIMARY PLC FAILURE | OPERATING ON BACKUP PLC | BACKUP PLC FAILURE | SYSTEM NOT IN AUTO | NO LOAD ON HEAT RECOVERY | HEAT RECOVERY LOSS OF PRESS | HEAT RECOVERY LOSS OF FLOW |
|---|---|---|---|---|---|---|

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

| LAMP TEST | EMERGENCY STOP | ALARM RESET |
|---|---|---|

NP. TEXT 1/8" QUANTITY 6 SCALE 1/1

| BYPASS | VFD | RUNNING | FAULT | VFD BREAKER OPEN |
|---|---|---|---|---|

NP. TEXT 1/2" QUANTITY 1 SCALE 1/1

MASTER CONTROL

NP. TEXT 1/2" QUANTITY 1 SCALE 1/1

GENERATOR 1

NP. TEXT 1/2" QUANTITY 1 SCALE 1/1

GENERATOR 2

NP. TEXT 1/2" QUANTITY 1 SCALE 1/1

GENERATOR 3

NP. TEXT 1/2" QUANTITY 1 SCALE 1/1

GENERATOR 4

NP. TEXT 1/2" QUANTITY 2 SCALE 1/1

VFD/DISTRIBUTION

NP. TEXT 1/4" QUANTITY 1 SCALE 1/1 ⚠ SEE NOTE 4

MANUFACTURED BY:
CONTROLLED POWER, INC.
17909 BOTHELL EVERETT HWY., S.E. #102
BOTHELL, WA. 98012
(425)-485-1778
SERIAL NUMBER: 6190

NP. 13 TEXT 1/4" QUANTITY 1 SCALE 1/1

RADIATOR No. 1

NP. TEXT 1/4" QUANTITY 1 SCALE 1/1

RADIATOR No. 2

NP. TEXT 1/4" QUANTITY 1 SCALE 1/1

GENERATOR No. 1 CHARGE AIR COOLER

NP. TEXT 1/4" QUANTITY 1 SCALE 1/1

GENERATOR No. 2 CHARGE AIR COOLER

NP. TEXT 1/4" QUANTITY 1 SCALE 1/1

GENERATOR No. 3 CHARGE AIR COOLER

NP. TEXT 1/4" QUANTITY 1 SCALE 1/1

GENERATOR No. 4 CHARGE AIR COOLER

NP. TEXT 1/2" QUANTITY 2 SCALE 1/1

250 KW

NP. TEXT 1/2" QUANTITY 2 SCALE 1/1

475 KW

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

GEN 1 CHARGE AIR COOLER VFD OFF BYPASS

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

GEN 2 CHARGE AIR COOLER VFD OFF BYPASS

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

GEN 3 CHARGE AIR COOLER VFD OFF BYPASS

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

GEN 4 CHARGE AIR COOLER VFD OFF BYPASS

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

HEATER OFF ON

NP. TEXT 1/8" QUANTITY 4 SCALE 1/1

BREAKER POSITION OPEN CLOSED

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

F1 BREAKER POSITION OPEN CLOSED

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

F2 BREAKER POSITION OPEN CLOSED

NP. TEXT 1/8" QUANTITY 4 SCALE 1/1

GENERATOR LOCKOUT FOR SERVICE OFF RUN

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

GENERATOR 1

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

GENERATOR 2

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

GENERATOR 3

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

GENERATOR 4

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

BUS TOTALIZING

NP. TEXT 1/8" QUANTITY 2 SCALE 1/1

FEEDER 1

NP. TEXT 1/8" QUANTITY 2 SCALE 1/1

FEEDER 2

NP. TEXT 1/8" QUANTITY 2 SCALE 1/1

STATION SERVICE

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

RADIATOR FAN 1 VFD OFF BYPASS

NP. TEXT 1/8" QUANTITY 1 SCALE 1/1

RADIATOR FAN 2 VFD OFF BYPASS

REMOVE 2 EXISTING 250KW & 2 EXISTING 45OKW NAMEPLATES & REPLACE WITH 4 NEW 350KW NAMEPLATES

NOTES:
1. ALL NAMEPLATES SHALL BE BLACK FACE WITH WHITE LETTERS EXCEPT AS NOTED.
2. ALL NAMEPLATES SHALL HAVE PRESSURE SENSITIVE ADHESIVE ON BACK, 100 % COVERAGE.
3. ALL NAMEPLATES SHALL HAVE MOUNTING HOLES DRILLED AS INDICATED.
4. ⚠ INDICATES THAT NAMEPLATE SHALL BE BRUSHED ALUMINUM WITH BLACK ENGRAVED LETTERS.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|

AEA PURCHASE ORDER No. REG-07020 — CONTROLLED POWER JOB No. 6190

TITLE: NAMEPLATE ENGRAVING SCHEDULE, FABRICATION DIAGRAM

| SCALE: NONE | DATE: 06-04-07 | DWN. BY: GPN |
|---|---|---|
| DWG. No: 6190-6201-D | SHEET: 1 OF 1 | CKD. BY: JMD |

JOB: AKIACHAK

1" 0" 1" 2"
SCALE: 1"= 1"



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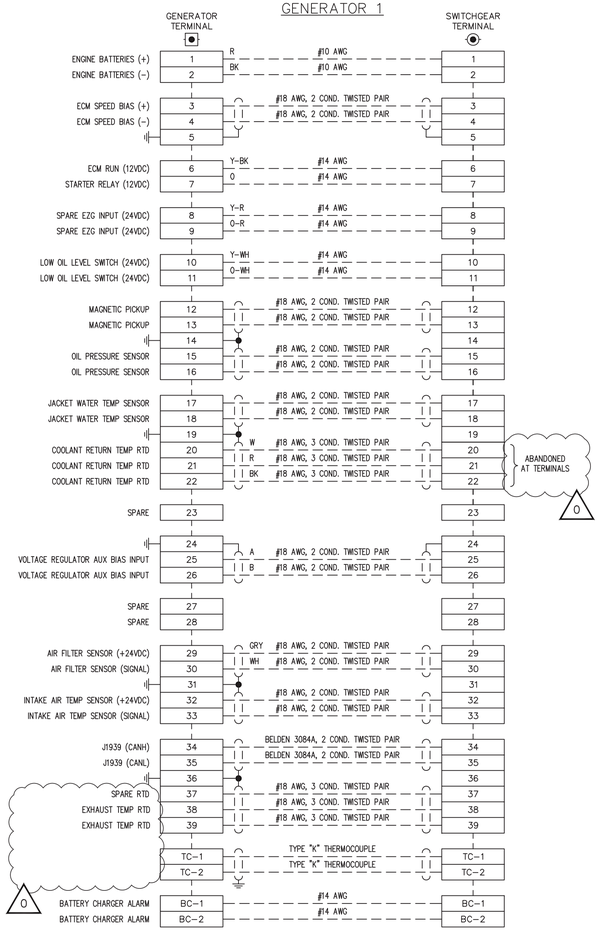
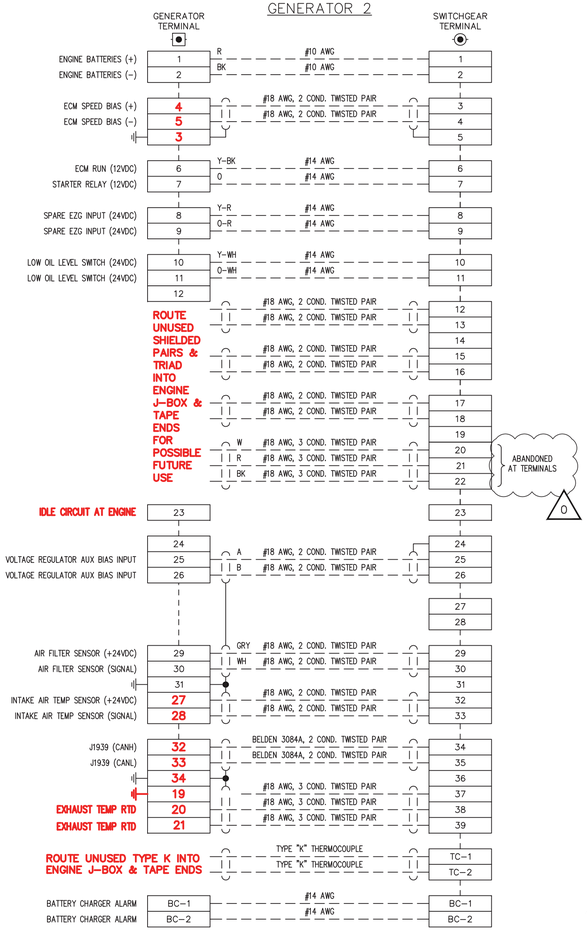
Plot date: 2007/10/1 - 11:17

## GENERATOR 1



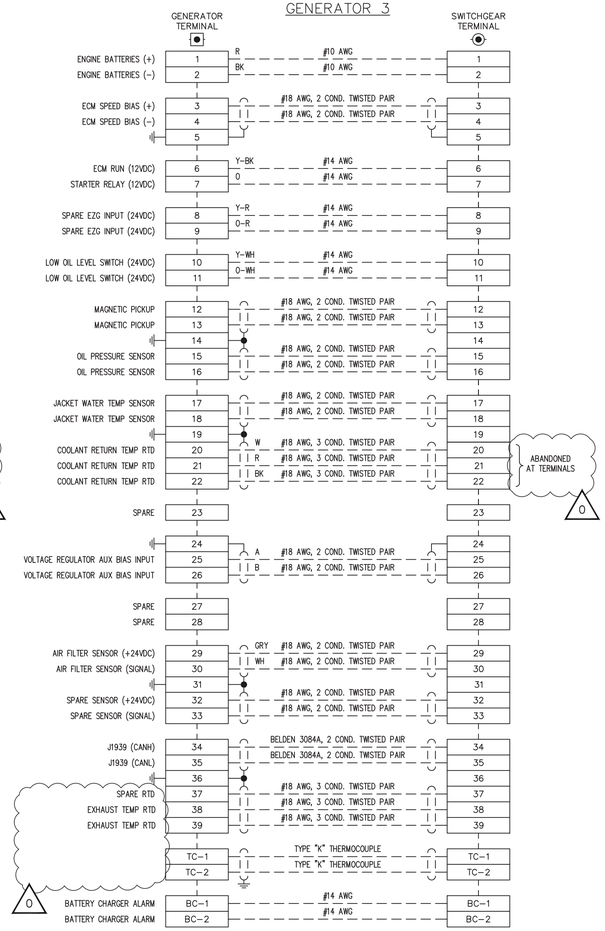

UNDER ADD ALT1 INSTALL NEW OWNER FURNISHED ENGINE J-BOX WITH TERMINATIONS IDENTICAL TO GEN #2

## GENERATOR 2

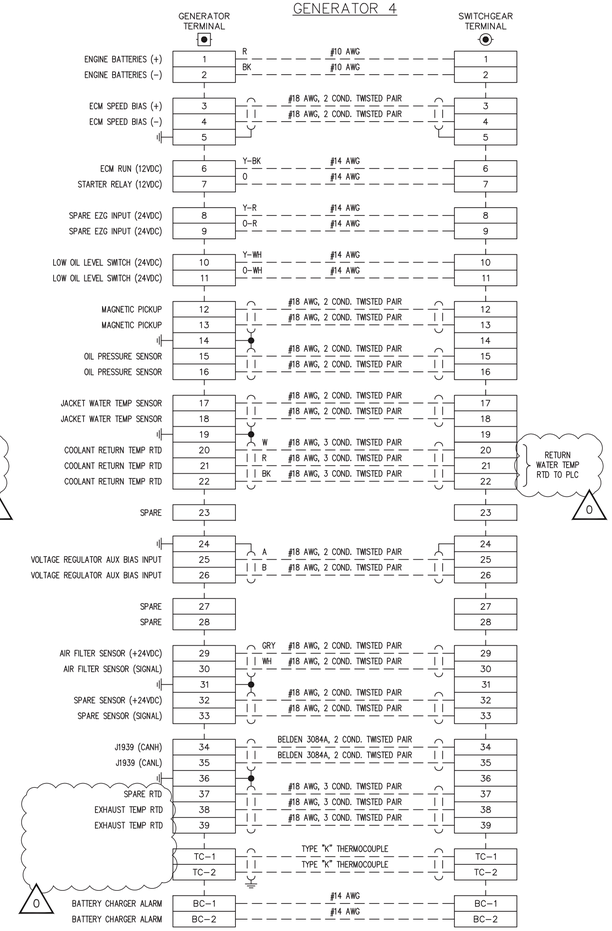



INSTALL NEW OWNER FURNISHED ENGINE J-BOX AND CONNECT TO EXISTING FIELD WIRING AS SHOWN. TERMINAL NUMBERS THAT ARE DIFFERENT ON THE NEW J-BOX FROM THE EXISTING ARE SHOWN IN RED.

## GENERATOR 3




## GENERATOR 4




ON GEN #3 AND GEN #4 INSTALL AND CONNECT NEW OWNER FURNISHED ENGINE J-BOX WITH TERMINATIONS IDENTICAL TO GEN #2

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190–3101–D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08–16–22 | AS–BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: INTERCONNECTION DIAGRAM

SCALE: NONE | DATE: 01–04–22 | DWN. BY: JRV

DWG. No: 6190–7101–D | SHEET: 1 OF 1 | CKD. BY: JRP

JOB: AKIACHAK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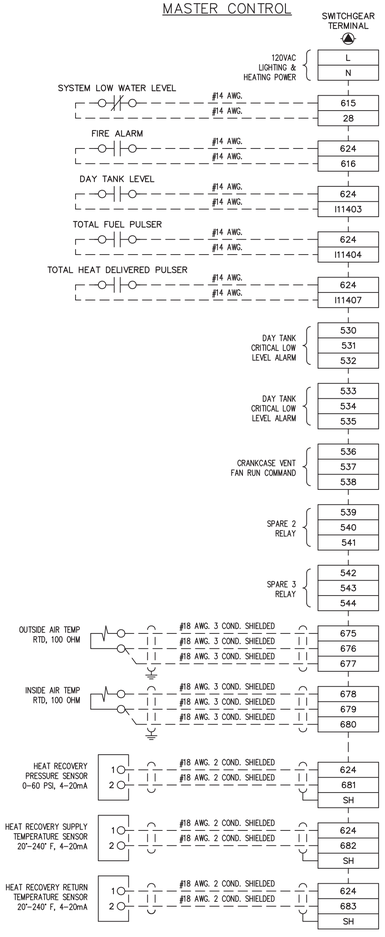
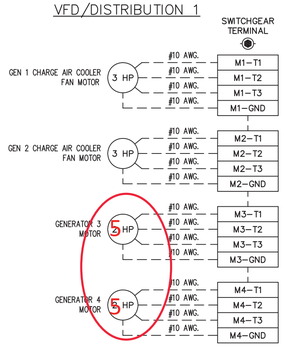
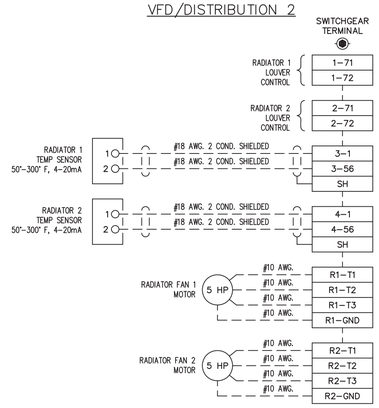
## MASTER CONTROL




## VFD/DISTRIBUTION 1




## VFD/DISTRIBUTION 2




FOR REFERENCE ONLY - NO WORK THIS PROJECT

NOTE:

1. FOR GENERAL WIRING & CONSTRUCTION NOTES, SEE DRAWING No. 6190–3101–D.

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

AEA PURCHASE ORDER No. REG–07020 — CONTROLLED POWER JOB No. 6190

TITLE: INTERCONNECTION DIAGRAM

| | | |
|---|---|---|
| SCALE: NONE | DATE: 07–18–07 | DWN. BY: GPN |
| DWG. No: 6190–7102–D | SHEET: 1 OF 1 | CKD. BY: JMD |
| JOB: AKIACHAK | | |



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Plot date: 2007/10/1 – 11:54

# BILL OF MATERIAL

| ESTIMATED QUANTITY | DESCRIPTION | MANUFACTURER/CATALOG NUMBER |
|---|---|---|
| 4 | GENSET CONTROLLER 3200XT-P1 | WOODWARD / 8440-2082 |
| 4 | MURPHY XM500 EXPANSION I/O | MURCAL / 78700420 |
| 12 | ANALOG SIGNAL CONVERTER | OMEGA / DR-I3P |
| 4 | MURPHY PRESSURE SENSOR | MURCAL / ES2P-100 |
| 4 | MURPHY TEMPERATURE SENSOR | MURCAL / ES2T-250/300-1/2 |
| 4 | MURPHY TEMPERATURE SENSOR TERMINAL BOOT | MURCAL / 00-00-3624 |
| 1 | SHARK 250 DIGITAL METER - BUS | ELECTRO IND. / SHARK250-60-10-V2-D-INP100S-20mAOS-X |
| 3 | SHARK 250 DIGITAL METER - STATION SERVICE | ELECTRO IND. / SHARK250-60-10-V2-D-INP100S-X-X |
| 1 | ALLEN-BRADLEY PLC CONTROLLER | ALLEN-BRADLEY / 1769-L33ER |
| 1 | ALLEN-BRADLEY PLC POWER SUPPLY | ALLEN-BRADLEY / 1769-PB4 |
| 1 | ALLEN-BRADLEY DEVICENET SCANNER | ALLEN-BRADLEY / 1769-SDN |
| 1 | ALLEN-BRADLEY PLC END CAP | ALLEN-BRADLEY / 1769-ECR |
| 1 | PROSOFT MODBUS/TCP COMM MODULE | PROSOFT / MVI69E-MBTCP |
| 1 | 15" TOUCHSCREEN HMI | CINCOZE / CV-115C/P1001 |
| 1 | DATA STORAGE SERVER | ONLOGIC / ML100G-52 |
| 2 | REDLION N-TRON 116TX NETWORK SWITCH | REDLION / 116TX |
| 1 | BATTERY BUFFER MODULE | SIEMENS / 6EP1933-2EC51 |
| 1 | 120 VAC - 24 VDC POWER SUPPLY 480WATT | PULS / CP20.241-S1 |
| 1 | 15 AMP GFCI CONVENIENCE OUTLET | PHOENIX CONTACT / 5600639 |
| 1 | 1500VA RACK MOUNT UPS | TRIPP-LITE / SMART1500LCD |
| 7 | LED ENCLOSURE LIGHT 1200 LUMEN | HOFFMAN / EL1200D24V |
| 7 | LED DOOR SWITCH KIT | HOFFMAN / ELD0801U |
| 7 | 5 AMP CIRCUIT BREAKER | ABB / SU201M-C5 |
| 1 | PT100 STICK-ON RTD | AUTOMATION DIRECT / RTD1-S02L06-01 |
| 1 | 3 PIN RTD CONNECTOR | AUTOMATION DIRECT / RTD-SP |
| 1 | 3 PIN RTD CONNECTOR | AUTOMATION DIRECT / RTD-SJ |
| 7 | BRACKET MOUNT KIT | HOFFMAN / ELAO2SF |
| 7 | TERMINAL CONNECTION KIT | HOFFMAN / ELCN124V |

FOR REFERENCE ONLY - NO WORK THIS PROJECT

| REV. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 0 | 08-16-22 | AS-BUILT FOR 21116 SWITCHGEAR UPGRADES | JRV |
| B | 07-06-22 | ISSUED FOR 100% REVIEW | JRV |
| A | 02-02-22 | ISSUED FOR REVIEW FOR SWITCHGEAR UPGRADES | JRV |

AEA JOB No. 21116

TITLE: AKIACHAK SWITCHGEAR UPGRADE BILL OF MATERIALS

| | | |
|---|---|---|
| SCALE: NONE | DATE: 01-04-22 | DWN. BY: JRV |
| DWG. No: 21116-AKK-BOM | SHEET: 1 OF 1 | CKD. BY: JRP |

JOB: AKIACHAK GENERATOR SWITCHGEAR UPGRADE

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ANCHORAGE, ALASKA 99503
HTTP://WWW.AIDEA.ORG