



BID REQUEST
FOR
Denai'na Wellness Center Standby Generator Installation

Issued By:
Kenaitze Indian Tribe
150 N. Willow St.
Kenai, AK 99611

Prepared by:
Don Ohler
February 20, 2021

1 INTRODUCTION

1.1 ORGANIZATION

The Kenaitze Indian Tribe (Tribe) is a federally recognized tribal government, re-organized in 1971 under the statutes of the Indian Reorganization Act of 1934, as amended for Alaska in 1936. The Tribe serves over 5,000 community members, Alaska Natives, and American Indians in the central and upper Kenai Peninsula. The Tribe's Headquarters is located at 150 N Willow Kenai, Alaska 99611.

1.2 MISSION STATEMENT

To assure the Kahtnuht'ana Dena'ina thrive forever.

1.3 SOLICITATION

The Tribe is soliciting Electrical Contractor lump sum proposals for the installation of an Owner/Furnished Cummins 200 KW Enclosed Standby Generator with an Automatic Transfer Switch for the Denai'na Wellness Center located 508 Upland Street, Kenai, Alaska 99611 A mandatory site inspection is required.

PERFORMANCE PERIOD

The following is the performance period for the electrical contracting services.

Issue Notice of Intent to Award	April 2021
Commissioning and Closeout	August2021

The agreement resulting from this bid request shall be effective from the date of execution of the agreement through the completion of services. In the event the work is not completed within this timeframe, the Tribe, in its sole opinion, may determine the contractor to be in breach of the terms of the agreement.

1.4 BUDGET AND FUNDING

The project is jointly funded with Federal and Kenaitze Indian Tribe funds. Federal Davis-Bacon labor wages are required.

1.5 THE TRIBE'S PROJECT REPRESENTATIVES

Don Ohler, Construction Director, dohler@kenaitze.org (907) 529-7692
James Rendle, Project Manager, jrendle@kenaitze.org (701) 214-8591
Jeremy Harlow, Quality Control, jharlow@Kenaitze.org (907) 252-1981
Procurement Supervisor: Lisa List lalist@kenaitze.org (907) 335-7214
Contracting Officer: Dawn Nelson dnelson@kenaitze.org (907) 335-7200
EDC Engineers, Cory Wardrope cory@edc-alaska.com (907) 257-0613
Cummins Project Manager, Darrel Wayman darrel.wayman@cummins.com (907) 748-3602

2 BACKGROUND

2.1 PROPOSED FACILITY

The DWC Facility is owned and operated solely by the Tribe and falls within the government jurisdiction of the City of Kenai. The building must meet applicable local, state, and federal codes and standards.

The Tribe has received stamped civil, electrical and mechanical drawings for this project which are herein attached.

3 INSTRUCTION TO PROPOSERS

3.1 PROPOSAL SUBMISSION DEADLINE

To be considered, a complete bid package with Payment and Performance Bonds must be received by the Tribe at the address outlined within this solicitation no later than 4:00 pm Alaska Time on April 2, 2021. Any Proposals received after this deadline will not be accepted.

3.2 REQUIRED NUMBER OF COPIES

One (1) electronic copy of the bid proposal may be emailed to dohler@kenaitze.org. Bid proposals sent via email should be sent in a single PDF document format, with the Bid Title noted in the subject line.

3.3 CONFLICT OF INTEREST AND RESTRICTIONS

If any bid proposer, proposer's employee, subcontractor, or any individual working on the bid proposal may have a possible real or perceived conflict of interest that may affect the objectivity, analysis, and/or performance of the contract, it shall be declared in writing and submitted to The Tribe at or before the submission deadline. The Tribe shall determine in writing if the conflict is significant and material and if so, may disqualify the bidder from submitting a proposal.

3.4 PROPOSER'S REVIEW AND SUBSTANTIVE QUESTIONS

Bidders should carefully review this request for errors, questionable or objectionable materials, and items requiring clarification.

Questions regarding the request for bids must be directed in writing to Don Ohler, Construction Director at dohler@kenaitze.org. All emails must identify the bid title in the subject line, include the contact information for the person submitting the question. All questions must be submitted using this format and must be received no later than March 19, 2021.

The Tribe will review the submitted questions and respond to all inquiries in writing by replying via email to all inquirers and interested bidders at one time. The email will provide every question received and each accompanying response. This will ensure all potential bidders receive the same information.

3.5 ADDENDUM TO THE Bid Proposal

The Tribe reserves the right to issue written addenda to revise or clarify the bid specifications, respond to questions, and/or extend the due date of bids.

3.6 Mandatory Site Visit

A Mandatory Site Visit will be held on March 12, 2021.

4 BID REQUEST GENERAL CONDITIONS

4.1 CANCELLATION OR DELAY OF THE BID

The Tribe reserves the right to terminate this request for bids at any time, without reason.

The Tribe reserves the right to modify or otherwise alter any or all of the requirements herein. In the event of a modification, bidders will be given an equal opportunity to modify their bids as identified in writing by the Tribe.

4.2 COST OF PROPOSAL PREPERATION

The issuance of this Bid Request, the submission of a response by any bidder, and the acceptance of such response do not obligate the Tribe in any manner. The Tribe is not liable for any costs incurred by bidders prior to the issuance and execution of a contract to the low bidder selected as a result of the bid request. The Tribe shall not be responsible for any costs associated with preparing and/or submitting a proposal in response to this bid request, in any manner or for any reason.

Kenaitze is a federally-recognized Indian tribe and, as such, possesses sovereign immunity from suit as stated in section 4.10 of this document.

4.3 ACCEPTANCE of Bid Request

A 5% Bid Security Bond must accompany all bids and will be held for 60 days.

The Tribe reserves the right to reject any or all proposals received.

The Tribe reserves the right to accept other than the lowest cost proposal, and to negotiate the specified dollar amount, or any portion of that amount.

4.4 Proposal Validity

The contractors bid proposal will remain valid for 60 days from the bid submission deadline. No price proposal will be accepted if marked "price prevailing at the time of delivery", "estimated price", or something similar. All prices shall be marked "Lump Sum" and must be in U. S. Dollars

4.5 Subcontractors

The successful contractor must disclose to the Tribe the use and identity of all subcontractors it intends to use to perform the project requirements. The Tribe reserves the right to approve all subcontractors if it so chooses. The contractor is solely responsible for the satisfactory performance of and compensation to any and all subcontractors.

4.6 Insurance Requirements

Contractor shall supply a certificate of insurance for \$1,000,000.00 for General Liability Insurance, \$2,000,000.00 Umbrella Insurance, \$1,000,000.00 Product Operations Insurance, Regulatory Workman's Compensation Insurance, and Vehicle Insurance. **Contractor shall submit Proof of Insurance with the Bid proposal.** The contractor shall be financially responsible for all deductibles, costs, and self-insured retention's and/or self-insurance required herein.

4.7 Contract Issuance

This Bid Request does not obligate the Tribe or the selection of the apparent low bidder until a lump sum contract is signed and approved by both parties. If approved, it is effective from the date of final approval by the Contracting Officer. The Tribe shall not be responsible for work done, even in good faith, prior to final contract approval. If there is any conflict between these documents and the approved contract, these documents shall govern.

Additional conditions may be required, depending upon the nature and extent of the services to be provided. The Tribe reserves the right to negotiate a change or modification to any of the proposed conditions.

The Tribe reserves the right to negotiate changes following the award

Upon notice of Intent to Award by the Tribe, it is expected that the selected contractor will review and sign the Tribe's Contract Documents, which is included with the Bid Request information as a draft. Interested Bidders are expected to carefully review the Tribe's Contract Documents for electrical services provided and advise the Tribe in the proposal if any of the terms or conditions of the agreement are objectionable. If any provisions are objectionable, the Bidder must provide alternate terms and conditions which are acceptable to it. The Tribe reserves the right to reject any terms and conditions that fails to indicate that the Bidder is willing to execute the Tribe's standard Contract form of agreement or fails to propose terms and conditions for the agreement that are acceptable to the Tribe.

The Owner and Bidder may rely on the Initial Information. Both parties, however, recognize that such information may materially change and, in that event, if mutually agreed upon, the Owner and the apparent low bidder may appropriately adjust the Schedule of Work, the Bidder's services and compensation.

4.8 DELIVERY OF PROPOSALS

The Tribe assumes no responsibility or liability for the transmission, delay, or delivery of Bidders submission by either public or private carriers.

4.9 PROPOSALS WITHDRAWAL AND CORRECTION

Bids may be corrected or withdrawn by a written request received prior to the Submission Deadline. Any corrected proposal must be received by The Tribe prior to the Bid Closing Deadline in order to be considered timely.

4.10 MULTIPLE PROPOSALS

The Tribe will not accept multiple bids from the same bidder.

4.11 RESTRICTION ON COMMUNICATION

From the date issued until the Submission Deadline, Proposers are directed not to communicate with any Tribe employee, Council Member, Committee/Board Member, officers, or agents regarding any matter relating to this Bid Request, other than through dohler@kenaitze.org. The Tribe reserves the right to reject any proposal due to violation of this provision.

4.12 PROPOSER'S REVIEW AND DIRECTIONAL QUESTIONS

The Tribe will review the submitted questions and respond to all inquiries in writing by replying via email to all inquirers and interested bidders at one time. The email will provide every question received and each accompanying response. This will ensure all potential Proposer's receive the same information.

4.13 SOVERIGN IMMUNITY

The Tribe is reluctant to sign any contract or agreement that specifically asks or implies a waiver of sovereign immunity. If presented with a contract or agreement that contains or implies a waiver, the Tribe will likely ask that the following be included prior to consideration:

“SOVEREIGN IMMUNITY: Kenaitze is a federally-recognized Indian tribe and, as such, possesses sovereign immunity from suit. By entering into this Agreement, the Tribe does not intend to waive its sovereign immunity and does not do so. Nothing in this Agreement shall be construed as a waiver of the sovereign immunity of the Tribe.”

5 BIDDING ELECTRICAL CONTRACTORS SCOPE OF SERVICES

5.1 ELECTRICAL SERVICES

Provide all permitting, labor, tools, equipment, room and board, and necessary transportation for the successful installation and commissioning of the Owner Furnished Cummins Enclosed Standby Generator and Automatic Transfer Switch for the Denai'na Wellness Center located in Kenai, Alaska. The electrical contractor will acquire and coordinate all activities aside from owner furnished equipment as outlined in the attached set of stamped drawings, which will include coordinating with Homer Electric Association and Enstar Gas Company for required upgrades (owner is to pay for HEA and Enstar upgrades to services). Upon final installation, the electrical contractor shall coordinate with Siemens, Cummins, and EDC for all standby generator project commissioning activities and if necessary, make any and all adjustments and corrections. Upon final commissioning acceptance and approval by the electrical engineer, contractor shall coordinate any training requirements and submit any as-builds to the electrical engineer of record and O & M manuals to the owner.

5.2 KICKOFF or PRECONSTRUCTION MEETING

The Kickoff or Preconstruction Meeting will take place 10 days after Notice of Award and after all contract documents have been approved and signed in Kenai, Alaska. The successful electrical contractor will present a detailed Project Schedule detailing any required power shut off notifications to the Kenaitze Indian Tribes Project Manager 48 hours in advance so as not to disrupt the Denai'na Wellness Staff. This meeting will include the Electrical Contractor, Facilities Director and Facilities Manager, and Construction Director, Kenaitze's Project Manager.

5.3 PROCESS SUBMITTALS

The Submittal Process will be forward to Kenaitze Indian Tribe's Project Manager (TBD), and forwarded to EDC the Electrical Engineer of Record. The Electrical Contractor will develop the Submittal Schedule and forward to Kenaitze's Project Manager for review.

5.4 CHANGE ORDERS AND WORK CHANGE DIRECTIVES

The Kenaitze Project Manager will receive any and all Change Order requests from the electrical contractor for review. The Kenaitze Project Manager will respond to any notice from the electrical contractor of differing site conditions, including conditions relating to underground facilities such as utilities and hazardous environmental conditions. The Project Manager will promptly conduct reviews and prepare findings, conclusions, and recommendations for the Tribe's use.

5.5 CHANGE PROPOSALS AND CLAIMS

With the Tribe's concurrence, the Kenaitze Project Manager will process each duly submitted Change Order request from the electrical contractor and, within 10 days after receipt, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing with a copy provided to the Tribe and electrical contractor. Electrical contractor's markup on change orders for Overhead and Profit shall not exceed 15% (fifteen percent), and general conditions will only be permitted if a contract time extension is warranted.

5.6 SUBSTANTIAL COMPLETION

Substantial Completion will be considered when project is ready for commissioning.

5.7 OPERATION & MAINTENANCE MANUALS

The Electrical Contractor will prepare a comprehensive Operations & Maintenance Manual to be submitted to the Tribe for review.

5.8 REDLINES AND ASBUILT DRAWINGS

The electrical contractor will furnish redlined as-built drawings to the Kenaitze's Project Manager and to the engineer of record, EDC Engineers.

5.9 COMMISSIONING AND PROJECT CLOSE OUT

The Electrical Contractor will coordinate all commissioning efforts, operation and maintenance training, all inspection reports, or any other pertinent documents to the installation of the DWC Standby Generator.

6 SCHEDULE

6.1 SUBMITTAL FORMAT AND QUALITY

The electrical contractor shall provide a detailed Project Schedule starting with the Award date, identifying construction activities with milestones, and detailing the commissioning and closeout dates.

6.2 NOTICE OF AWARD

Notice of Award will be given after all bids have been presented to the Kenaitze Indian Tribal Council for review. The apparent low bidder will be pointed out and recommended. However, Council will make the final decision for award.

7 ANTICIPATED CONTRACTUAL ARRANGEMENTS

7.1 EXECUTION OF AGREEMENT

Within five days after Notice of Intent to Award, contractor will provide all required both 100% Payment and 100% Performance Bonds as required for said project.

The Tribe reserves the right to require documentation that each bidder is an established business and abiding by the ordinances, regulation, and laws of the State of its Incorporation, and the State of Alaska.

If a Proposer is required by any regulatory agency to maintain a professional license or certification to provide any service or product solicited under this Bid Request, the Tribe reserves the right to require the bidder to provide documentation of bidder's current license and/or certification before considering the bid and/or before awarding the contract.

THE END

ELECTRICAL LEGEND	
SYMBOL	DESCRIPTION
	EXPOSED CONDUIT
	UNDERGROUND/CONCEALED CONDUIT
	UNDERGROUND ELECTRIC UTILITY LINE
	OVERHEAD ELECTRIC UTILITY LINE
	3/4" X 10' COPPER CLAD STEEL GROUND ROD
	CONDUIT RUN - CHANGE IN ELEVATION
	LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT
	JUNCTION BOX OR FITTING
	MOLDED CASE CIRCUIT BREAKER, X = AMPERE RATING, Y = NO. OF POLES
	KILOWATT-HOUR METER
	PANELBOARD
	DISCONNECT SWITCH - FUSED
	DISCONNECT SWITCH - NON-FUSIBLE
	ENGINE-FIRED GENERATOR SET
	20A, 120V, GFI RECEPTACLE, DUPLEX NEMA 5-20R
OTHER SYMBOLS ARE AS DEFINED BY NOTE.	

CIRCUIT AND DEVICE LEGEND

A-1,α GROUP OR EQUIPMENT IDENTIFICATION.
 "A" DENOTES PANEL NAME
 "1" DENOTES CIRCUIT NUMBER
 "α" DENOTES SWITCH LEG AS INDICATED.

ABBREVIATIONS

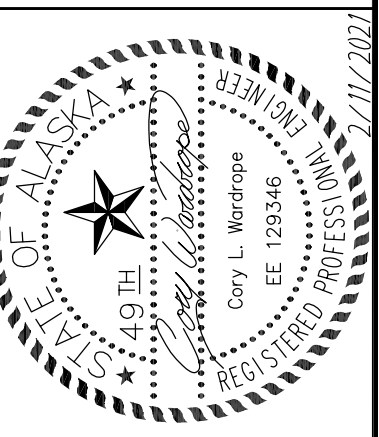
A	ANALOG SIGNAL, AMPERE
AFF	ABOVE FINISH FLOOR
AFG	ABOVE FINISH GRADE
BAS	BUILDING AUTOMATION SYSTEM
BCU	BARE COPPER
C	CONDUIT
CID1	CLASS I, DIVISION 1
CID2	CLASS I, DIVISION 2
CP	CONTROL PANEL
CT	CURRENT TRANSFORMER
CU	COPPER
E	EMERGENCY
FLA	FULL LOAD AMPERES
G	GROUND CONDUCTOR
GES	GROUNDING ELECTRODE SYSTEM
GFI	GROUND FAULT INTERRUPTING
GRC	GALVANIZED RIGID (STEEL) CONDUIT
GND	GROUND
HDPE	HIGH DENSITY POLYETHYLENE CONDUIT
HEA	HOMER ELECTRIC ASSOCIATION
HP	HORSEPOWER
KVA	KILO-VOLT-AMPERES
LTF	LIQUID TIGHT FLEXIBLE CONDUIT (METALLIC)
MBJ	MAIN BONDING JUMPER
MLO	MAIN LUG ONLY
MTR	MOTOR
N.I.C.	NOT IN CONTRACT
NC	NORMALLY CLOSED
NO	NORMALLY OPEN, NUMBER
NTS	NOT TO SCALE
PH	PHASE
SS	STAINLESS STEEL
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
V	VOLTS
W	WATTS
WP	WEATHERPROOF
XFMR	TRANSFORMER

INSTRUMENT IDENTIFIER	
XX = FUNCTION / YY = LOOP	
ECA	EMERGENCY/STANDBY POWER AVAILABLE
EDCA	BATTERY CHARGER ALARM
HS	HAND SWITCH / GENSET NOT-IN-AUTO
LAH	LEVEL ALARM HIGH
LAL	LEVEL ALARM LOW
NCA	NORMAL POWER AVAILABLE
YA	FAULT INDICATION
YC	RUN REQUEST
YL	RUN STATUS
ZSE	IN STANDBY POSITION
ZSN	IN NORMAL POSITION

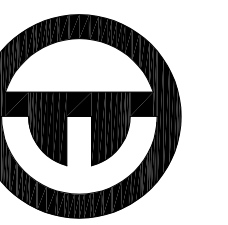
INSTRUMENTATION LEGEND	
	FIELD MOUNTED INSTRUMENT XX = FUNCTION; YY = TAG NO.
	FIELD MOUNTED INSTRUMENT LIGHT XX = FUNCTION; YY = TAG NO.
	PANEL MOUNTED INSTRUMENT LIGHT XX = FUNCTION; YY = TAG NO.

GENERAL NOTES

- ALL ELECTRICAL WORK SHALL BE INSTALLED IN ACCORDANCE WITH ALL REQUIREMENTS OF THE LATEST ADOPTED EDITION OF THE NATIONAL ELECTRICAL CODE (NEC), AND STATE AND LOCAL CODES GOVERNING THE PROJECT. IF DIRECT CONFLICT ARISES BETWEEN DESIGN DOCUMENTS AND GOVERNING CODES, THE CODES SHALL TAKE PRECEDENCE. ALL WORK SHALL BE PERFORMED UNDER THE SUPERVISION OF A JOURNEYMAN ELECTRICIAN EXHIBITING A CERTIFICATE OF FITNESS IN THE STATE OF ALASKA.
- THE CONTRACTOR SHALL OBTAIN ALL REQUIRED CONSTRUCTION PERMITS AND PAY ALL ASSOCIATED FEES.
- THE CONTRACTOR SHALL FIELD VERIFY ALL ASPECTS OF THE WORK. ANY DISCREPANCY BETWEEN DESIGN DOCUMENTS AND FIELD CONDITIONS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
- MATERIALS AND EQUIPMENT SHALL BE AS SPECIFIED AND ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION AS SUITABLE FOR THE USE INTENDED. ALL ELECTRICAL EQUIPMENT SHALL BE LISTED AND LABELED BY A NATIONALLY RECOGNIZED TESTING LABORATORY FOR THE PURPOSE FOR WHICH IT IS INSTALLED. WHENEVER POSSIBLE, SIMILAR ITEMS SHALL BE SUPPLIED BY THE SAME MANUFACTURER THROUGHOUT THE PROJECT.
- DIMENSIONS AND LOCATIONS OF EQUIPMENT ARE APPROXIMATE. INSTALLATION SHALL BE VERIFIED BASED ON ACTUAL MANUFACTURER'S DATA, SHOP DRAWINGS, AND FIELD INVESTIGATION.
- SITE WORK AND UTILITIES ARE SHOWN IN APPROXIMATE LOCATIONS; ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR SHALL FIELD VERIFY ALL INSTALLATIONS PRIOR TO COMMENCEMENT OF WORK. COORDINATE ALL WORK WITH UTILITIES AS REQUIRED.
- CONDUIT ROUTINGS ARE DIAGRAMMATIC AND SHALL BE FOLLOWED TO THE EXTENT PRACTICABLE. NOT ALL CONDUIT ROUTINGS ARE SHOWN; CONTRACTOR IS RESPONSIBLE FOR DETERMINING ROUTING/PENETRATIONS AND RECEIVING APPROVAL OF ROUTING/PENETRATIONS FROM OWNER'S REPRESENTATIVE.
- CONDUCTORS SCHEDULED FOR DEMOLITION SHALL BE REMOVED IN THEIR ENTIRETY.
- CONDUIT SCHEDULED FOR DEMOLITION SHALL BE REMOVED IN ENTIRETY WHERE EXPOSED. BELOW GRADE CONDUITS MAY BE ABANDONED IN PLACE PROVIDED STUB-UPS ARE CUT TO 12" BELOW GRADE; DISTURBED SURFACES SHALL BE FINISHED TO MATCH EXISTING.
- SEAL UNUSED EQUIPMENT PENETRATIONS WITH PLUGS OR CAPS MEETING THE EQUIPMENT NEMA RATING.
- ALL EQUIPMENT AND MATERIALS DEMOLISHED UNDER THIS CONTRACT SHALL BE DISPOSED OF OFFSITE BY CONTRACTOR.
- PROVIDE ARC HAZARD WARNING LABELS IN ACCORDANCE WITH NEC 110.16. AVAILABLE FAULT CURRENT AND OVERCURRENT PROTECTIVE DEVICE CLEARING TIMES ARE AVAILABLE UPON REQUEST.
- PROVIDE FIELD MARKINGS TO SERVICE EQUIPMENT IN ACCORDANCE WITH NEC 110.24. A SHORT-CIRCUIT CALCULATION HAS BEEN PERFORMED. THE CALCULATION RESULTS ARE AVAILABLE UPON REQUEST.



EDC, INC.
 213 W. FIREWEED LANE
 ANCHORAGE, AK 99503
 (907) 276-7933
 LICENSE NO. AECCT005



REV	DATE	REVISION DESCRIPTION

KENAITZE INDIAN TRIBE
DENAINA WELLNESS CENTER
STANDBY GENERATOR
 KENAI, ALASKA
ELECTRICAL LEGENDS
AND ABBREVIATIONS

BAR IS 1 INCH ON ORIGINAL DRAWING
 0 1"
 DESIGNED BY: CLW
 DRAWN BY: OM, CLW
 CHECKED BY: JAP
 DATE: 02-11-2021

ELECTRICAL SPECIFICATIONS

26 01 26 – TESTING OF ELECTRICAL SYSTEMS

- A. TEST ALL FEEDERS AND POWER CONDUCTORS PRIOR TO TERMINATION WITH A MEGAOHM METER PER THE MANUFACTURER’S RECOMMENDATIONS. TEST VOLTAGE SHALL BE 1,000Vdc. REPLACE ALL CONDUCTORS EXHIBITING LESS THAN 10 MEGAOHM IMPEDANCE. REPEAT TESTING AS REQUIRED TO VERIFY COMPLIANCE.
- B. COORDINATE WITH GENERATOR AND ATS SUPPLIER FOR ON-SITE TESTING, STARTUP, AND TRAINING SPECIFIED HEREIN.
- C. COORDINATE WITH SIEMENS FOR TESTING OF MODIFICATIONS TO THE EXISTING BUILDING AUTOMATION SYSTEM (BAS).
- D. ADDITIONAL TESTING REQUIREMENTS ARE INCLUDED IN SECTION 26 32 00.

26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

- A. SYSTEM DESCRIPTION:
 - 1. SCOPE OF WORK: FURNISH, INSTALL, TEST, AND PLACE INTO SATISFACTORY AND SUCCESSFUL OPERATION ALL MATERIALS, EQUIPMENT, DEVICES, AND NECESSARY APPURTENANCES TO PROVIDE A COMPLETE SERVICE ENTRANCE SWITCHBOARD, STANDBY GENERATOR, AND AUTOMATIC TRANSFER SWITCH INSTALLATION, AS INDICATED ON THE PLANS AND SPECIFIED HEREIN.
 - 2. ALL COMPONENTS FOR THE PROJECT SHALL BE LISTED OR LABELED BY UL (UNDERWRITERS LABORATORIES), FM (FACTORY MUTUAL) OR OTHER AGENCIES RECOGNIZED BY THE STATE OF ALASKA MECHANICAL INSPECTIONS DIVISION. WORK SHALL COMPLY WITH ALL LISTED AND APPLICABLE INDUSTRY STANDARDS, CODES, LOCAL ORDINANCES AND MANUFACTURER’S INSTRUCTIONS.
 - 3. SYSTEM SHALL BE COMPLETE AND SHALL INCLUDE ALL TERMINATIONS TO PROVIDE A FUNCTIONAL SYSTEM AS DESCRIBED HEREIN.
 - 4. PROJECT CONDITIONS: CONTRACTOR SHALL VERIFY IN THE FIELD EXISTING CONDITIONS.
 - 5. ALL ELECTRICAL WORK SHALL BE PERFORMED BY OR UNDER THE DIRECT SUPERVISION OF A LICENSED JOURNEYMAN ELECTRICIAN CERTIFIED BY THE STATE OF ALASKA.
 - 6. COORDINATE OUTAGES WITH THE OWNER. OUTAGES SHALL BE COORDINATED A MINIMUM TWO (2) WEEKS PRIOR TO THE PLANNED OUTAGE.

- B. STANDARDS, CODES AND REGULATIONS:
 - 1. NFPA 70 – NATIONAL ELECTRICAL CODE (NEC), LATEST ADOPTED EDITION.
 - 2. NFPA 30 – FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE, LATEST ADOPTED EDITION.
 - 3. NFPA 110 – STANDARD FOR EMERGENCY AND STANDBY POWER SYSTEMS.
 - 4. IBC – INTERNATIONAL BUILDING CODE, LATEST ADOPTED EDITION.
 - 5. IFC – INTERNATIONAL FIRE CODE, LATEST ADOPTED EDITION.
 - 6. IHS – INDIAN HEALTH SERVICES TECHNICAL HANDBOOK, HEALTH CARE FACILITIES DESIGN AND CONSTRUCTION, AVAILABLE AT WWW.IHS.GOV.
 - 7. LOCAL CODES AND AMENDMENTS.

- C. SUBMITTALS:
 - 1. GENERAL: PROVIDE SUBMITTALS OF ALL MATERIAL AND EQUIPMENT PROPOSED FOR USE ON THE PROJECT. INCLUDE CATALOG NUMBERS, PERFORMANCE DATA, WIRING DIAGRAMS, AND ROUGH-IN DIMENSIONS.
 - 2. MANUFACTURER’S INSTALLATION INSTRUCTIONS: INCLUDE INSTRUCTIONS FOR STORAGE, HANDLING, PROTECTION, EXAMINATION, PREPARATION AND INSTALLATION OF PRODUCTS.
 - 3. INSTALLER QUALIFICATIONS: PROVIDE EVIDENCE OF ELECTRICAL INSTALLERS CURRENT JOURNEYMAN ELECTRICIAN CERTIFICATE OF FITNESS.
 - 4. TEMPORARY POWER PLAN:
 - a. THE CONTRACTOR SHALL SUBMIT A TEMPORARY POWER PLAN FOR REVIEW AND ACCEPTANCE PRIOR TO PERFORMING WORK. THE CONTRACTOR SHALL PROVIDE ALL ASPECTS OF TEMPORARY POWER THAT MAY BE REQUIRED INCLUDING BUT NOT LIMITED TO: DESIGN, CONSTRUCTION, LABOR, MATERIAL, FUEL, MAINTENANCE, AND ALL OTHER INCIDENTAL ITEMS REQUIRED FOR A FUNCTIONAL TEMPORARY POWER SYSTEM.
 - b. THIS IS A SENSITIVE FACILITY WITH A VARIETY OF EQUIPMENT AND

VARYING OPERATIONS. THE CONTRACTOR SHALL COORDINATE WITH FACILITY OPERATIONS PERSONNEL THROUGHOUT THE WORK.

- c. ELECTRICAL OUTAGES SHALL NOT OCCUR DURING 7:00AM – 6:00PM, MONDAY; 7:00AM – 7:00PM, TUESDAY – FRIDAY; 8:00AM – 5:00PM, SATURDAY WITHOUT PRIOR APPROVAL; ELECTRICAL OUTAGES OUTSIDE OF THESE TIMES SHALL BE PERMITTED PROVIDED THE OUTAGE TIME AND DURATION IS COORDINATED IN ADVANCE WITH THE OWNER.
- d. THE TEMPORARY POWER SYSTEM SHALL BE CAPABLE OF PROVIDING CONTINUOUS POWER TO THE ENTIRE FACILITY WITHOUT INTERRUPTION. THE 12-MONTH AVERAGE FACILITY DEMAND LOAD IS 105KW, PEAK OF 120KW; THE TEMPORARY POWER SYSTEM SHALL HAVE MINIMUM 125KW CAPACITY.
- e. THE TEMPORARY POWER SYSTEM MAY BE A PORTABLE GENERATOR OR UTILITY PROVIDED TEMPORARY SERVICE.
- f. THE TEMPORARY POWER SYSTEM SUBMITTAL SHALL IDENTIFY TEMPORARY MODIFICATIONS TO THE FACILITY GROUNDING SYSTEM.
- g. ONE MEANS OF TEMPORARY POWER WOULD BE TO CONNECT A TEMPORARY POWER SYSTEM TO THE EXISTING STANDBY DISCONNECT SWITCH AND MODIFYING THE EXISTING MANUAL TRANSFER SWITCH (MTS) INSIDE OF THE ELECTRICAL ROOM. THE MTS INTERIOR WOULD BE REMOVED, THE MAIN CB WOULD BE OPENED, AND THE TEMPORARY POWER SYSTEM WOULD DIRECTLY POWER PANEL ‘SDP’ AND BACKFEED POWER TO PANEL ‘MDP’ VIA THE EXISTING 400A CB ‘MTS-S’. COORDINATION WITH FACILITY OPERATIONS PERSONNEL MAY BE REQUIRED IN STAGED STARTING OF EQUIPMENT TO AVOID NUISANCE TRIPPING OF THE 400A CB.

- D. OPERATION AND MAINTENANCE DATA:
 - 1. PROVIDE ALL MANUFACTURER’S RELEVANT MAINTENANCE AND OPERATING INSTRUCTIONS INCLUDING PROCEDURES NECESSARY FOR SYSTEM START-UP, OPERATION, EMERGENCY OPERATION AND SHUTDOWN.
 - 2. OPERATION AND MAINTENANCE MANUAL SHALL BE INDEXED, LABELED AND SHALL INCLUDE MAINTENANCE INSTRUCTIONS, PRODUCT DATA, SHOP DRAWINGS AND STEP BY STEP PROCEDURES FOR INSPECTION, REPAIR, CLEANING AND CALIBRATION.

- E. EQUIPMENT CONNECTIONS:
 - 1. PROVIDE ALL WIRING AND CONNECTIONS REQUIRED FOR A FUNCTIONAL SYSTEM.

- F. PENETRATIONS:
 - 1. ALL ELECTRICAL PENETRATIONS THROUGH FIRE RATED BARRIERS SHALL BE SEALED IN ACCORDANCE WITH NEC AND THE MANUFACTURERS INSTRUCTIONS. MATERIALS SHALL BE SUITABLE FOR THE FIRE STOPPING OF PENETRATIONS AND CAPABLE OF MAINTAINING AN EFFECTIVE BARRIER AGAINST FLAME, SMOKE AND GASES IN COMPLIANCE WITH THE REQUIREMENTS OF ASTM, UL AND OTHER INDUSTRY STANDARDS.
 - 2. THE RATING OF THE FIRE STOPS SHALL BE THE SAME AS THE RATED FLOOR, WALL OR CEILING ASSEMBLY.

- G. EXECUTION
 - 1. INSTALLATION OF ALL WORK SHALL BE MADE SO THAT ALL COMPONENT PARTS ARE INSTALLED AND FUNCTION AS A COMPLETE, WORKABLE SYSTEM.
 - 2. ALL WORK SHALL COMPLY WITH THE REQUIREMENTS OF THE NEC, NECA 1 – STANDARD FOR GOOD WORKMANSHIP IN ELECTRICAL CONSTRUCTION, AND THE STANDARDS AND CODES LISTED HEREIN. WHERE QUESTIONS ARISE REGARDING WHICH REQUIREMENTS AND STANDARDS APPLY, THE MORE STRINGENT SHALL PREVAIL.
 - 3. ALL WORK SHALL COMPLY WITH THE REQUIREMENTS AND RECOMMENDATIONS OF THE PRODUCT MANUFACTURER.
 - 4. REPLACE AND/OR REPAIR TO ORIGINAL (OR BETTER) CONDITION ANY EXISTING STRUCTURES, MATERIALS, EQUIPMENT, ETC. INADVERTENTLY DAMAGED OR DEMOLISHED DURING THE COURSE OF CONSTRUCTION AT NO ADDITIONAL COST TO THE OWNER.
 - 5. ALL EARTHWORK SHALL BE PERFORMED IN ACCORDANCE WITH THE KENAI MUNICIPAL CODE, CODES, AND STANDARDS LISTED HEREIN. SEE CIVIL FOR ADDITIONAL REQUIREMENTS.

26 05 19 – WIRE AND CABLE

- A. ALL WIRING SHALL BE COPPER WITH TYPE XHHW-2 INSULATION UNLESS OTHERWISE NOTED.
- B. ALL WIRING SHALL BE ACCORDING TO AMERICAN WIRE GAUGE (AWG).

C. MINIMUM BRANCH CIRCUIT CONDUCTOR SIZE SHALL BE #12 AWG. MINIMUM CONTROL CIRCUIT SIZE SHALL BE #18 AWG. MULTI-PAIR CONTROL CABLES SHALL BE RATED FOR DIRECT BURIAL.

D. MODBUS CABLE SHALL BE MINIMUM #22 AWG WITH ONE TWISTED PAIR, ONE SINGLE REFERENCE CONDUCTOR, AND AN OVERALL SHIELD. MODBUS CABLE INSTALLATION SHALL BE COORDINATED WITH SIEMENS.

E. COLOR CODING SHALL BE AS FOLLOWS AND CONSISTENT THROUGHOUT THE ENTIRE INSTALLATION.

1. 120/208 V, 3PH, 4W:
 PHASE A – BLACK, PHASE B – RED,
 PHASE C – BLUE, NEUTRAL – WHITE.

E. USE PROPERLY SIZED INSULATED WIRE CONNECTORS WITH PLASTIC CAPS FOR ALL CONDUCTORS #8 AWG AND SMALLER. TERMINATE #6 AND LARGER WITH CRIMP OR COMPRESSION TYPE CONNECTORS INSTALLED PER THE MANUFACTURERS RECOMMENDATIONS AND INSULATE WITH PROPERLY SIZED 600 VOLT RATED HEAT SHRINK TUBING AND ELECTRICAL TAPE. BELOW GRADE SPLICES SHALL BE WATERPROOF AND LISTED FOR DIRECT BURIAL.

26 05 26 – GROUNDING AND BONDING:

- A. ALL GROUNDING AND BONDING SHALL COMPLY WITH THE NEC, STANDARDS AND CODES LISTED HEREIN, MANUFACTURER’S RECOMMENDATIONS AND LOCAL CODES.
- B. PROVIDE AN EQUIPMENT GROUNDING CONDUCTOR WITH ALL CIRCUITS.
- C. PROVIDE AND BOND TO CONCRETE ENCASED ELECTRODES WHERE CALLED FOR ON THE PLANS.

25 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

A. ALL WIRING SHALL BE INSTALLED IN GALVANIZED RIGID METALLIC CONDUIT OR GALVANIZED INTERMEDIATE METALLIC CONDUIT (IMC) UNLESS OTHERWISE NOTED. ALL FITTINGS, CONNECTORS, BOXES, ETC. SHALL BE APPROVED FOR USE AS GROUNDING MEANS.

B. UTILIZE SHORT EXTENSIONS (36 INCH MAXIMUM) OF FLEXIBLE, LOW TEMPERATURE LIQUIDTIGHT CONDUIT (LFMC) FOR CONNECTIONS OF ALL MOTORS AND OTHER EQUIPMENT SUBJECT TO VIBRATION.

C. COMPLETELY AND THOROUGHLY CLEAN AND SWAB RACEWAY SYSTEM BEFORE INSTALLING CONDUCTORS.

D. ALL UNDERGROUND CONDUIT SHALL BE BURIED A MINIMUM OF 24 INCHES BELOW GRADE AND IN ACCORDANCE WITH THE NEC.

E. WIREWAYS:

1. WIREWAYS SHALL BE CONSTRUCTED OF GALVANIZED STEEL, UL LISTED, HINGED, AND RATED NEMA 3R.

2. INSTALL WIREWAYS PARALLEL WITH BUILDING LINES AND THE HINGED SIDE DOWN.

F. JUNCTION BOXES:

1. PROVIDE GALVANIZED CAST STEEL BOXES WITH THREADED HUBS AND GASKETED COVERS.

26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

A. PROVIDE ENGRAVED LAMINATED PLASTIC NAMEPLATES WITH BLACK LETTERS ON A WHITE BACKGROUND TO IDENTIFY ALL ELECTRICAL DISTRIBUTION AND CONTROL EQUIPMENT, AND LOADS SERVED AS NOTED ON THE DRAWINGS.

B. LETTER HEIGHTS SHALL BE 1/8 INCH FOR INDIVIDUAL SWITCHES, MOTOR STARTERS AND 1/2 INCH ON PANELBOARDS AND CONTROL PANELS. SECURE NAMEPLATES TO EQUIPMENT FRONTS USING SS SCREWS OR RIVETS.

C. PROVIDE WIRE MARKERS FOR ALL POWER AND CONTROL CIRCUITS IDENTIFYING BRANCH OR FEEDER CIRCUIT AND/OR WIRE NUMBER INDICATED ON CONTROL SYSTEM SHOP DRAWINGS.

D. PROVIDE ARC FLASH HAZARD WARNING LABELS AND EQUIPMENT SHORT CIRCUIT CURRENT MARKINGS IN ACCORDANCE WITH ARTICLE 110 OF THE NEC.



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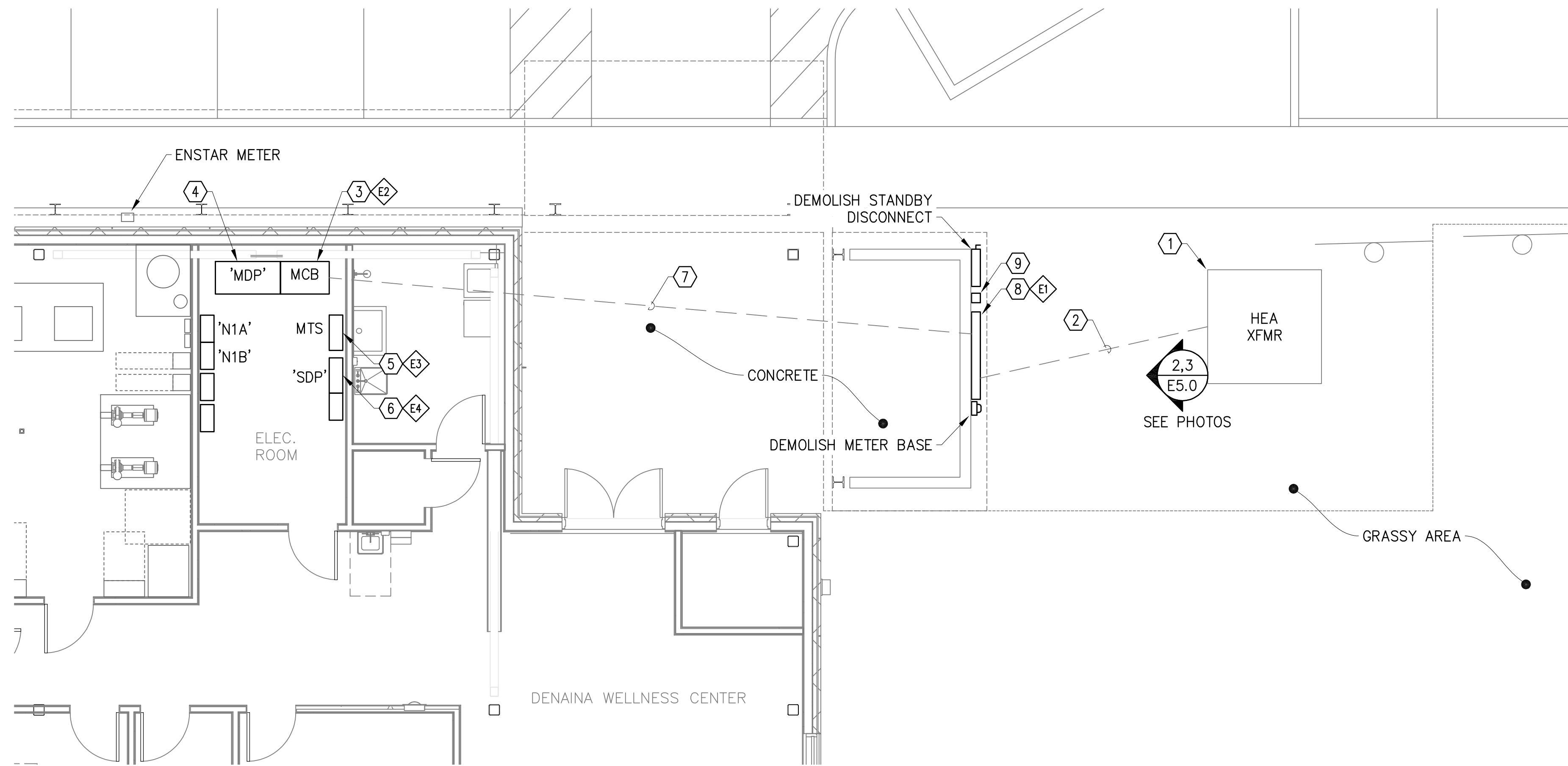
KENAITZE INDIAN TRIBE
DENAINA WELLNESS CENTER
STANDBY GENERATOR
 KENAI, ALASKA

ELECTRICAL SPECIFICATIONS

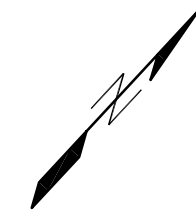
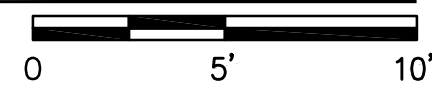
BAR IS 1 INCH ON ORIGINAL DRAWING
 0 1"

 DESIGNED BY: CLW
 DRAWN BY: OM, CLW
 CHECKED BY: JAP
 DATE: 02-11-2021

p:\Projects\kenaitze_it\kenai_wellness_center_generator\Dwg\E3.0 ELECTRICAL SITE PLAN - DEMOLITION.dwg PLOT DATE: 2021-11-09 09:54



1 ELECTRICAL SITE PLAN - DEMOLITION
E3.0 SCALE: 1"=5'-0"

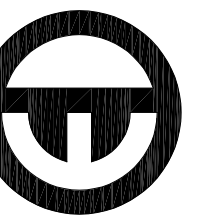


SHEET NOTES

- ① EXISTING HOMER ELECTRIC ASSOCIATION (HEA) SERVICE TRANSFORMER. COORDINATE ALL WORK WITH HEA.
- ② APPROXIMATE LOCATION OF EXISTING HEA SERVICE LATERALS. PROTECT IN PLACE PRIOR TO NEW SERVICE INSTALLATION.
- ③ EXISTING MAIN CIRCUIT BREAKER (MCB) DISCONNECT SWITCH IN 'MDP'.
- ④ EXISTING MAIN DISTRIBUTION PANEL 'MDP'.
- ⑤ EXISTING 400A, 4-WIRE, 3PDT MANUAL TRANSFER SWITCH (MTS). DEMOLISH SWITCH INTERIOR; ENCLOSURE TO REMAIN AND BE CONVERTED TO JUNCTION BOX.
- ⑥ EXISTING DISTRIBUTION PANEL 'SDP'.
- ⑦ EXISTING BELOW GRADE/UNDER SLAB SERVICE ENTRANCE CONDUITS AND CONDUCTORS FROM CT CABINET TO MCB TO REMAIN FOR RE-USE ON THIS PROJECT. SEE POWER ONE-LINE SHEET E4.0 FOR DETAILS.
- ⑧ EXISTING 2,000A, 3Ø, 4-WIRE CT CABINET TO BE DEMOLISHED. COORDINATE WORK WITH HEA. SEE DETAIL 3, SHEET E5.0.
- ⑨ EXISTING SHUNT-TRIP PUSHBUTTON. FIELD VERIFY SHUNT-TRIP SOURCE. PUSHBUTTON TO BE RELOCATED AND REWIRED TO NEW SERVICE DISCONNECT CIRCUIT BREAKER. SEE SHEETS E3.1 AND E4.0 FOR ADDITIONAL INFORMATION.
- Ⓜ SEE SHEET E4.0 FOR ELECTRICAL EQUIPMENT SCHEDULE.



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(907) 276-7933
LICENSE NO. AEC0705



REV	DATE	REVISION DESCRIPTION

KENAITZE INDIAN TRIBE
DENAINA WELLNESS CENTER
STANDBY GENERATOR
KENAI, ALASKA

ELECTRICAL SITE PLAN - DEMOLITION

BAR IS 1 INCH ON ORIGINAL DRAWING
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DRAWN BY: OM, CLW
CHECKED BY: JAP
DATE: 02-11-2021

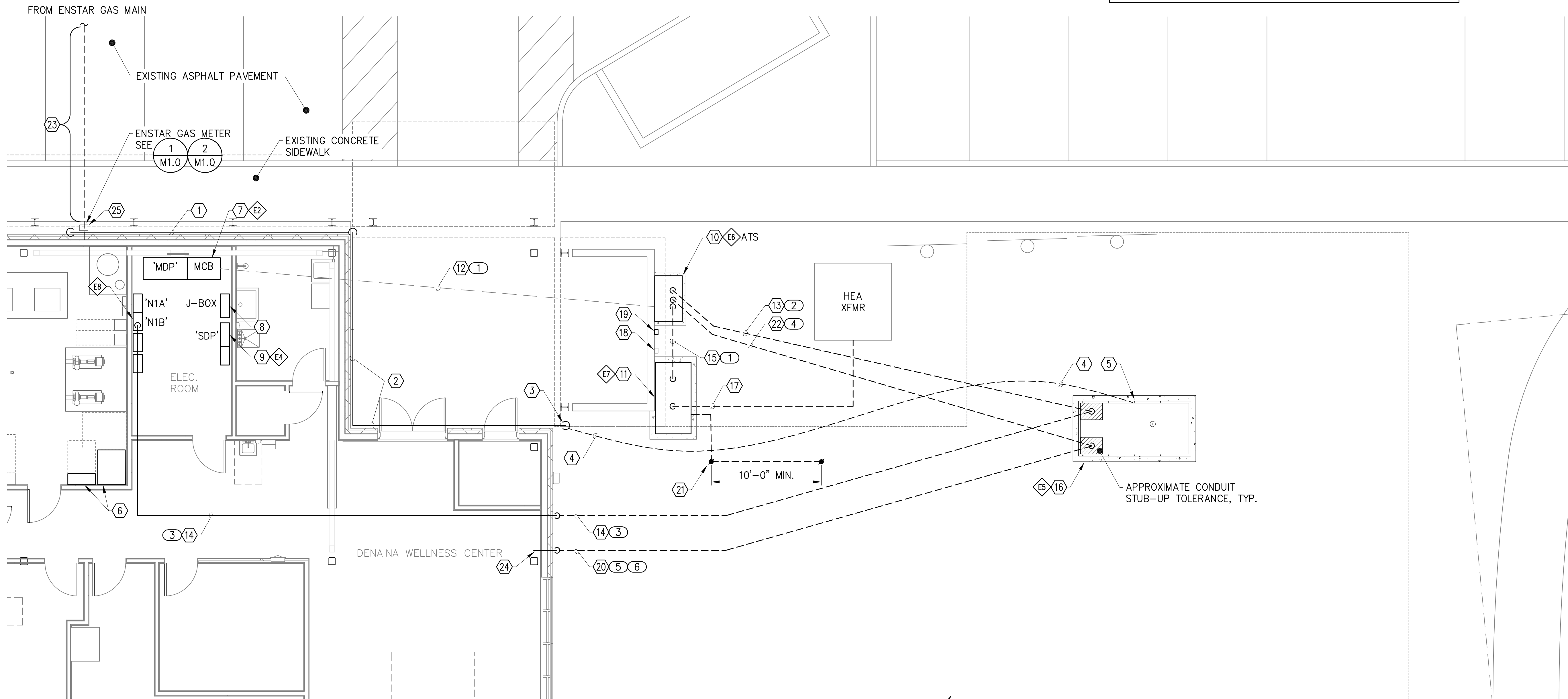
SHEET NOTES

- ① 1-1/4" NATURAL GAS - SCH 40 BLACK PIPE RUN LOW (APPROXIMATELY 1' ABOVE GRADE) ALONG OUTSIDE OF BUILDING.
- ② NATURAL GAS LINE ROUTED AT 8' ABOVE GRADE ALONG OUTSIDE OF BUILDING.
- ③ TRANSITION FROM 1-1/4" SCH 40 BLACK PIPE TO 1-1/4" SDR 11 HDPE 1' ABOVE GRADE.
- ④ 1-1/4" SDR 11 ROUTED BELOW GRADE TO GENERATOR. 18" MINIMUM BURY DEPTH. PROVIDE METALLIC TRACER TAPE 6" ABOVE PIPE.
- ⑤ PROVIDE TRANSITION TO SCH 40 BLACK STEEL PIPE RISER. CONNECT NATURAL GAS TO GENERATOR PER MANUFACTURER'S INSTRUCTIONS. PROVIDE REGULATOR AS SHOWN ON DETAIL 3, SHEET M1.0.
- ⑥ EXISTING BUILDING AUTOMATION SYSTEM (BAS) EQUIPMENT. COORDINATE WORK WITH SIEMENS IMPLEMENTATION AND COMMISSIONING TEAM IN COMMUNICATION CONNECTIONS.
- ⑦ EXISTING MAIN CIRCUIT BREAKER (MCB) DISCONNECT SWITCH. PROVIDE NEW PLACARD READING, "MDP MAIN."
- ⑧ EXISTING CONVERTED JUNCTION BOX.
- ⑨ EXISTING DISTRIBUTION PANEL 'SDP'. PROVIDE NEW FEEDER CONDUCTORS BETWEEN 'MDP' AND 'SDP' ROUTED THROUGH CONVERTED JUNCTION BOX AND EXISTING CONDUITS. SEE POWER ONE-LINE SHEET E4.0 FOR DETAILS.
- ⑩ OWNER PROVIDED, CONTRACTOR INSTALLED PAD-MOUNTED AUTOMATIC TRANSFER SWITCH (ATS). INSTALL OVERTOP EXISTING SERVICE ENTRANCE CONDUITS. FIELD VERIFY AND MODIFY CONDUITS TO COORDINATE WITH ATS CONDUIT TOLERANCES.
- ⑪ PROVIDE AND INSTALL PAD-MOUNTED SERVICE SWITCHBOARD WITH UTILITY METERING SECTION AND SERVICE DISCONNECT CIRCUIT BREAKER. CONTRACTOR SHALL COORDINATE THE INSTALLATION OF NEW SERVICE EQUIPMENT AND SHALL MEET THE REQUIREMENTS OF HOMER ELECTRIC ASSOCIATION (HEA).

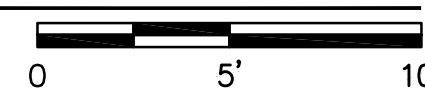
- ⑫ EXISTING BELOW GRADE SERVICE ENTRANCE CONDUCTORS IN CONDUIT BETWEEN NEW ATS AND EXISTING MCB. SEE POWER ONE-LINE SHEET E4.0 FOR DETAILS.
- ⑬ FEEDER CIRCUIT BETWEEN GENERATOR AND ATS; SINGLE LINE SHOWN FOR CLARITY.
- ⑭ BRANCH CIRCUITS FOR GENERATOR HEATERS AND BATTERY CHARGER; SEE PANEL SCHEDULE ON SHEET E4.0 FOR DETAILS.
- ⑮ NORMAL POWER FEEDER BETWEEN SWITCHBOARD AND ATS.
- ⑯ OWNER PROVIDED, CONTRACTOR INSTALLED GENERATOR SET WITH SOUND-ATTENUATED, WEATHERPROOF ENCLOSURE ON CONCRETE PAD. PROVIDE CONCRETE ENCASED ELECTRODE PER NEC 250.52 AND BOND TO NEW GROUNDING ELECTRODE SYSTEM USING #2/0 BCU; SEE SHEET NOTE 21.
- ⑰ SERVICE LATERALS BY HEA.
- ⑱ REINSTALL SHUNT-TRIP PUSHBUTTON AND WIRE TO NEW SERVICE DISCONNECT CIRCUIT BREAKER PER MANUFACTURER'S INSTRUCTIONS.
- ⑲ GENERATOR EMERGENCY STOP SWITCH (E-STOP). WIRE PER MANUFACTURER'S INSTRUCTIONS FOR GENERATOR SHUTDOWN. PROVIDE PLACARD READING, "GENERATOR E-STOP".
- ⑳ GENSET CONTROL/COMMUNICATIONS CIRCUITS TO BAS; SINGLE LINE SHOWN FOR CLARITY. COORDINATE INSTALLATION WITH THE OWNER AND SIEMENS. SEE SHEET NOTES 6 AND 24. SEE NARRATIVE ON SHEET E5.0, DETAIL 4.
- ㉑ GROUNDING ELECTRODE SYSTEM. PROVIDE TWO (2) 3/4"x10' CU-CLAD STEEL GROUND RODS DRIVEN 12" BELOW GRADE, MIN. BOND USING THE EXOTHERMIC WELD METHOD AND #3/0 AWG BCU CONDUCTORS; BOND GENSET TO GES (NOT SHOWN FOR CLARITY).
- ㉒ GENERATOR CONTROLS CIRCUITS (GENERATOR RUN REQUEST AND E-STOP) TO ATS. MAINTAIN 12" SEPARATION FROM POWER CIRCUITS TO THE EXTENT PRACTICAL.

- ㉓ GAS SERVICE LINE TO BE REPLACED BY ENSTAR. CONTRACTOR SHALL COORDINATE ALL WORK AS REQUIRED WITH ENSTAR, AND PAY ALL ASSOCIATED PERMITS, FEES, AND COSTS ASSOCIATED WITH THE WORK. ENSTAR WILL BORE THE NEW SERVICE LINE FROM THEIR GAS MAIN TO THE EXISTING GAS METER. ENSTAR'S REPORTED FEE FOR SERVICE UPGRADE IS \$4,200, WHICH DOES NOT INCLUDE EXCAVATION AND SURFACE REHABILITATION. CONTRACTOR SHALL COORDINATE TO PROVIDE ALL EXCAVATION NECESSARY FOR ENSTAR TO PERFORM THEIR WORK, AND TO REPAIR ALL DAMAGED SURFACES TO MATCH EXISTING.
- ㉔ FINAL ROUTING TO BAS EQUIPMENT SHALL BE DETERMINED IN THE FIELD IN COORDINATION WITH SIEMENS. CONTRACTOR SHALL PERFORM ALL WORK AS REQUIRED.
- ㉕ COORDINATE WITH ENSTAR IN DISCONNECTION AND RECONNECTION OF EXISTING PULSER WIRING.
- Ⓔ SEE SHEET E4.0 FOR ELECTRICAL EQUIPMENT SCHEDULE

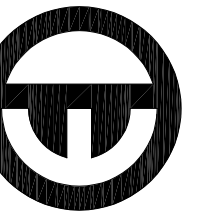
CIRCUIT / FEEDER SCHEDULE	
TAG	DESCRIPTION
①	FIVE EACH: 4"C, 4#600 (3H, N), 1#250 (G)
②	THREE EACH: 4"C, 4#250 (3H, N), 1#1/0 (G)
③	1"C, 2#10 (2H), 2#10 (H, N), 1#10 (G)
④	3/4"C, 2#14 (+,-), 4#14 (4SIG), 1#14 (G)
⑤	3/4"C, 2#14 (2SIG), 1#14 (G)
⑥	3/4"C, MODBUS CABLE (1PR TW, REF GND, OVERALL SHIELD)*
*COORDINATE CABLE WITH SIEMENS	



1 MECHANICAL AND ELECTRICAL SITE PLAN - NEW WORK
E3.1 SCALE: 1"=5'-0"



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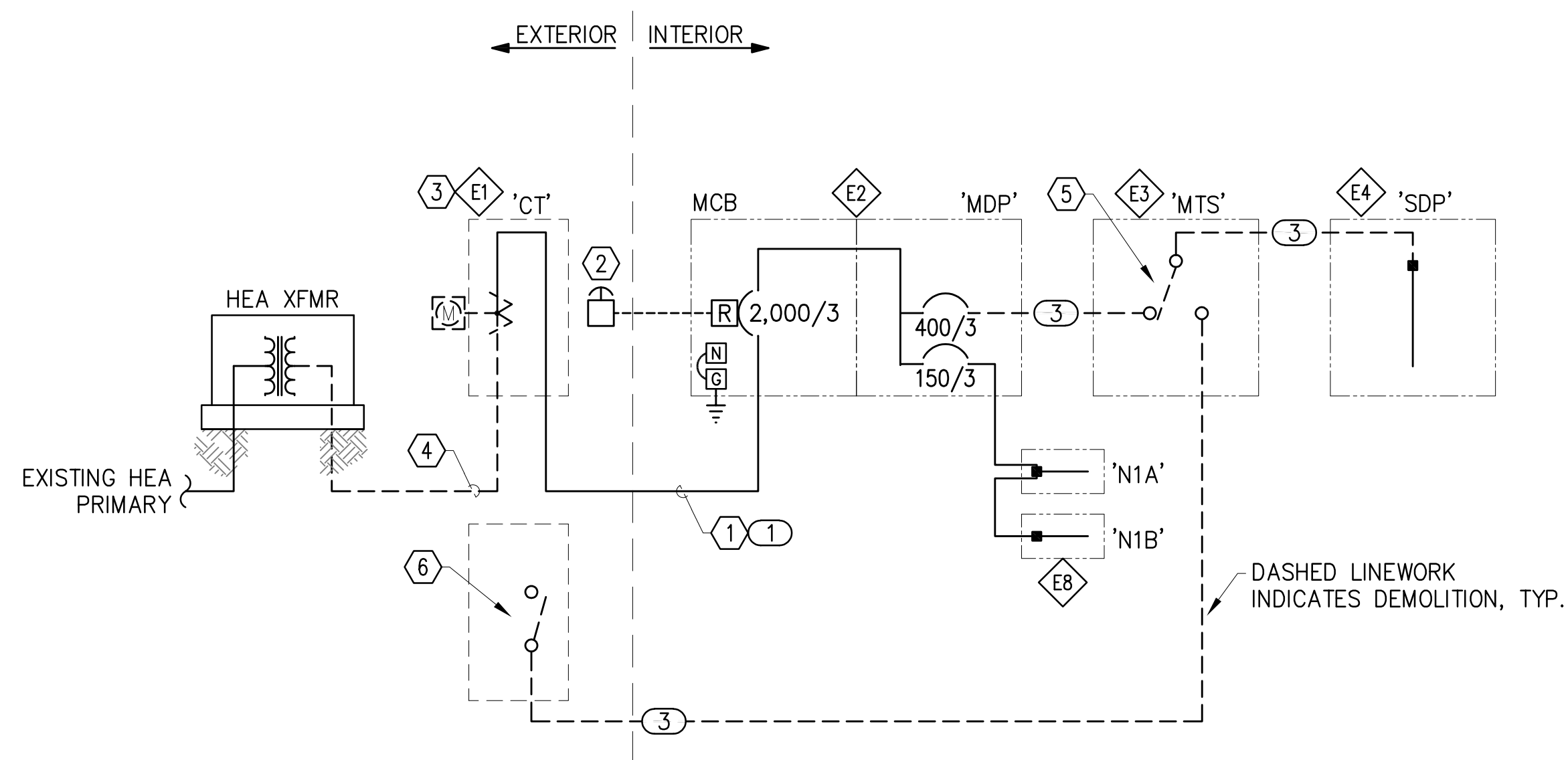


REV	DATE	REVISION DESCRIPTION

KENAITZE INDIAN TRIBE
DENAINA WELLNESS CENTER
STANDBY GENERATOR
 KENAI, ALASKA
MECHANICAL AND ELECTRICAL
SITE PLAN - NEW WORK

BAR IS 1" INCH ON ORIGINAL DRAWING
 DESIGNED BY: CLW
 DRAWN BY: OM, CLW
 CHECKED BY: JAP
 DATE: 02-11-2021

E3.1



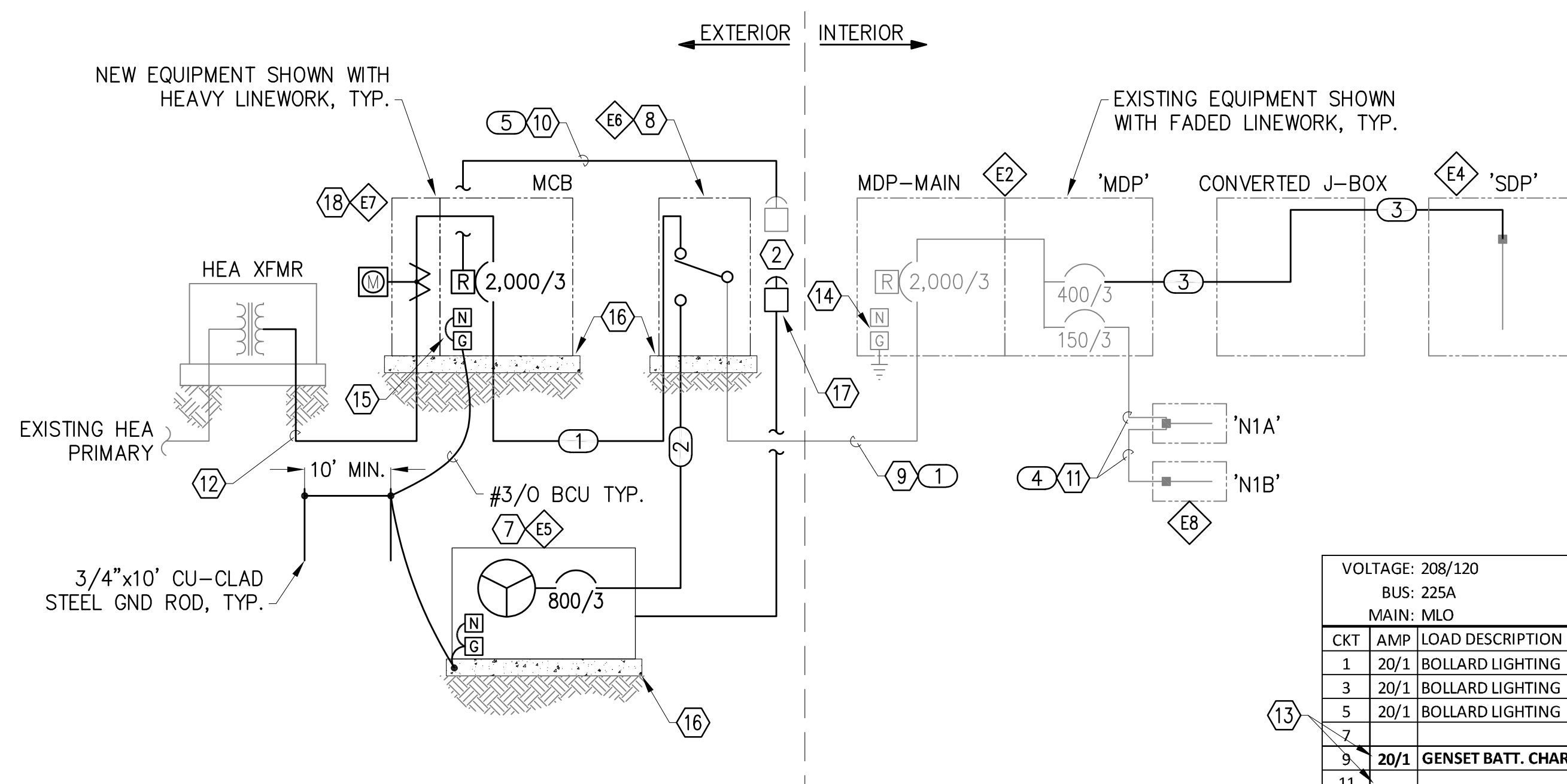
1 PARTIAL POWER ONE-LINE - DEMOLITION
E4.0 SCALE: NTS

ITEM NO.	DESCRIPTION	MANUFACTURER
E1	EXISTING CT CABINET. SEE DETAIL 3, SHEET E5.0.	ERICKSON
E2	EXISTING 2,000A, 208/120V, 3Ø, 4-WIRE, NEMA 1 MAIN DISTRIBUTION PANEL 'MDP' WITH 2,000A MAIN CIRCUIT BREAKER DISCONNECT.	SQUARE D QED
E3	EXISTING 400A, 240V, 3Ø, 4-WIRE, 3PDT, NEMA 1, MANUAL TRANSFER SWITCH (MTS).	SQUARE D
E4	EXISTING 400A, 208V, 3Ø, 4-WIRE, NEMA 1 DISTRIBUTION PANEL 'SDP'.	SQUARE D MODEL I-LINE
E5	*200kW, 208/120V, 3Ø, 4-WIRE, STANDBY GENERATOR SET	CUMMINS MODEL C200N6*
E6	*2,000A, 208V, 3Ø, 4-WIRE, 4PDT, 65kAIC, NEMA 3R, AUTOMATIC TRANSFER SWITCH	CUMMINS OTPC
E7	2,000A, 208V, 3Ø, 4-WIRE, 65kAIC, NEMA 3R SWITCHBOARD WITH UTILITY METERING COMPARTMENT AND 2,000A CIRCUIT BREAKER DISCONNECT WITH ENERGY REDUCTION MAINTENANCE SWITCH, ADJUSTABLE LONG-TIME, SHORT-TIME, INSTANTANEOUS, AND ZONE SELECTIVE INTERLOCKING FUNCTIONALITY	SQUARE D BOARD: QED; BREAKER: RG2000
E8	EXISTING 225A, 208V, 3Ø, 4-WIRE, NEMA 1 PANEL BOARD 'N1B'	SQUARE D

* INDICATES OWNER PROVIDED, CONTRACTOR INSTALLED EQUIPMENT

SHEET NOTES

- EXISTING SERVICE ENTRANCE CONDUCTORS. REMOVE AND REINSTALL AS REQUIRED.
- EXISTING SHUNT-TRIP DISCONNECT PUSHBUTTON. FIELD VERIFY SHUNT-TRIP SOURCE. REMOVE AND REINSTALL EXISTING SHUNT-TRIP PUSHBUTTON TO TRIP NEW SERVICE DISCONNECT CIRCUIT BREAKER.
- DEMOLISH CT CABINET AND METER BASE.
- EXISTING SERVICE LATERALS TO BE DEMOLISHED. COORDINATE ALL WORK WITH SERVING UTILITY, HOMER ELECTRIC ASSOCIATION (HEA).
- DEMOLISH MTS AND FEEDER CONDUCTORS FROM 'MDP' TO 'SDP'. CONDUITS TO REMAIN FOR RE-USE ON THIS PROJECT.
- DEMOLISH DISCONNECT SWITCH AND ASSOCIATED FEEDER TO MTS. CUT CONDUITS 12" BELOW GRADE AND ABANDON IN PLACE.
- NEW STANDBY GENERATOR SET. INSTALL AS A SEPARATELY DERIVED SYSTEM.
- NEW ATS.
- CONNECT EXISTING SERVICE ENTRANCE CONDUCTORS TO NEW ATS. SPLICE ADDITIONAL LENGTHS OF CONDUCTORS AS REQUIRED FOR TERMINATION TO EQUIPMENT.
- PROVIDE NEW SHUNT-TRIP CIRCUIT FROM EXISTING SHUNT-TRIP PUSHBUTTON TO NEW CIRCUIT BREAKER.
- 'N1A', 'N1B' FEEDER FROM 'MDP' TOTAL CONNECTED LOAD PER ASBUILT: 48A @ 208V, 3Ø; NEW FEEDER LOAD: 59A @ 208V, 3Ø. SEE 'SERVICE LOAD SUMMARY' THIS SHEET. CIRCUIT SIZE SHOWN FOR REFERENCE ONLY.
- NEW SERVICE LATERALS BY HEA. COORDINATE ALL WORK WITH HEA.
- PROVIDE NEW GFPE TYPE CIRCUIT BREAKERS, RATINGS AS SHOWN.
- REMOVE NEUTRAL TO GROUND BONDING JUMPER IN MDP-MAIN.
- PROVIDE NEUTRAL TO GROUND BOND IN NEW MCB WITH #400 KCMIL OR EQUIVALENT PER NEC SECTION 250.102.
- PROVIDE NEW EQUIPMENT PADS; SEE CIVIL FOR DETAILS.
- GENERATOR E-STOP. WIRE TO GENERATOR CONTROLLER FOR REMOTE EMERGENCY SHUTDOWN. SEE SHEET E3.1, SHEET NOTE 22, AND CIRCUIT SCHEDULE FOR DETAILS.
- NEW SERVICE ENTRANCE SWITCHBOARD. INSTALL PER MANUFACTURER'S WRITTEN INSTRUCTION AND SPECIFICATIONS.



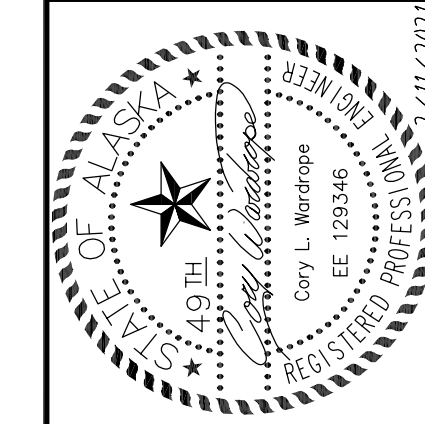
2 PARTIAL POWER ONE-LINE - NEW WORK
E4.0 SCALE: NTS

TAG	DESCRIPTION
1	FIVE EACH: 4"C, 4#600 (3H, N), 1#250 (G)
2	THREE EACH: 4"C, 4#250 (3H, N), 1#1/0 (G)
3	TWO EACH: 3"C, 4#4/0 (3H, N), 1#2 (G)
4	2"C, 4#4/0 (3H, N), 1#6 (G)
5	3/4"C, 2#12 (H, N), 1#12 (G)

VOLTAGE: 208/120 BUS: 225A MAIN: MLO		PANEL 'N1B' SCHEDULE				MIN. A.I.C. RATING: 10,000 ENCLOSURE: NEMA 1 MOUNTING: SURFACE						
CKT	AMP	LOAD DESCRIPTION	KVA	LOAD	A	B	C	LOAD	KVA	LOAD DESCRIPTION	AMP	CKT
1	20/1	BOLLARD LIGHTING								LTG: RECEIVING, GAS, HWAY 139	20/1	2
3	20/1	BOLLARD LIGHTING								LTG: X-RAY, DRESS, ORTHO, RM 098		4
5	20/1	BOLLARD LIGHTING								LTG: BOILER, ELECTRICAL, SOILS		6
7										LTG: RM 110, 111, 112, 114, 115		8
9	20/1	GENSET BATT. CHARGER, OIL PAN HEAT								LTG: SITE - EMPLOYEE PARKING	20/2	10
11	20/2	GENSET COOLANT HEATER								LTG: SITE - MAIN PARKING	20/2	12
13										LTG: SITE - SOUTH EAST DRIVE	20/2	14
15										LTG: SITE: CANOPY/BUILDING NORTH		16
17										LTG: SITE: BUILDING SOUTH		18
19										LTG: SITE: WALKWAY SOUTH	20/2	20
21												22
23												24
25												26
27												28
29												30
31												32
33												34
35												36
37												38
39												40
41												42

SERVICE LOAD CALCULATION	
(1) EXISTING DEMAND LOAD	
EXISTING 12 MONTH PEAK DEMAND LOAD	= 133.3 KVA *
NEC 220.87 FACTOR 25%	= 33.3 KVA
SUBTOTAL	= 166.6 KVA
(2) DELETED LOADS	
ITEM	DESCRIPTION
1	NONE
	= 0.0 KVA
SUBTOTAL	= 0.0 KVA
(3) LOADS NOT ACCOUNTED FOR IN 12-MONTH PEAK DEMAND	
ITEM	DESCRIPTION
1	FUTURE BUILDING ADDITION
	= 43.0 KVA
SUBTOTAL	= 43.0 KVA
(4) NEW LOADS	
ITEM	DESCRIPTION
1	GENERATOR BATTERY CHARGER
	= 0.7 KVA
	CONTINUOUS LOAD FACTOR 25%
	= .2 KVA
2	GENERATOR HEATERS
	= 2.5 KVA
	CONTINUOUS LOAD FACTOR 25%
	= 0.6 KVA
SUBTOTAL	= 4.0 KVA
TOTAL NEW SERVICE DEMAND LOAD	
LOAD 1 - LOAD 2 + LOAD 3 + LOAD 4	= 213.6 KVA
	593 AMPS @208V, 3Ø

* RECEIVED FROM HEA ON 12 DEC. 2020. POWER FACTOR=0.9 ASSUMED.

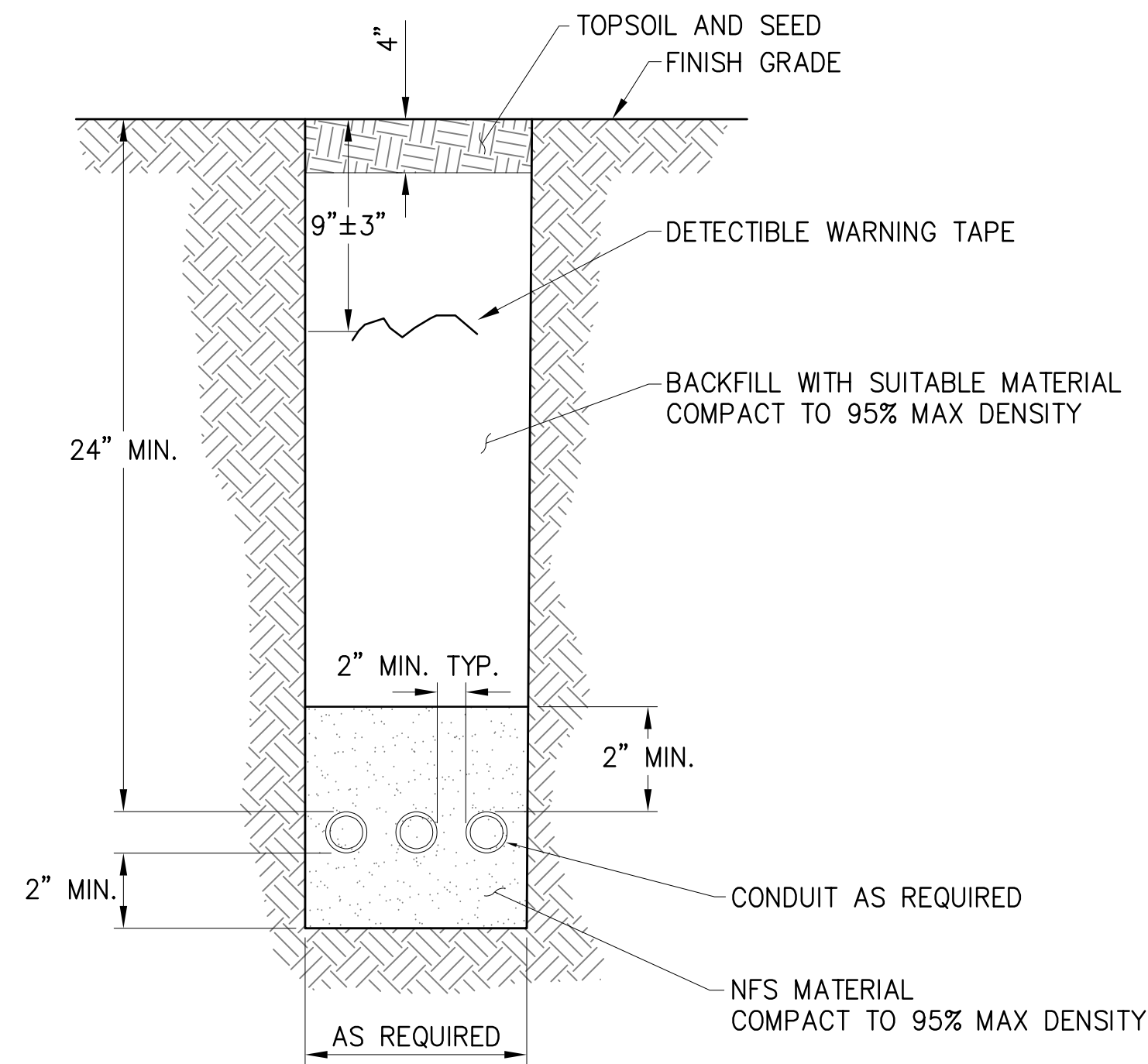


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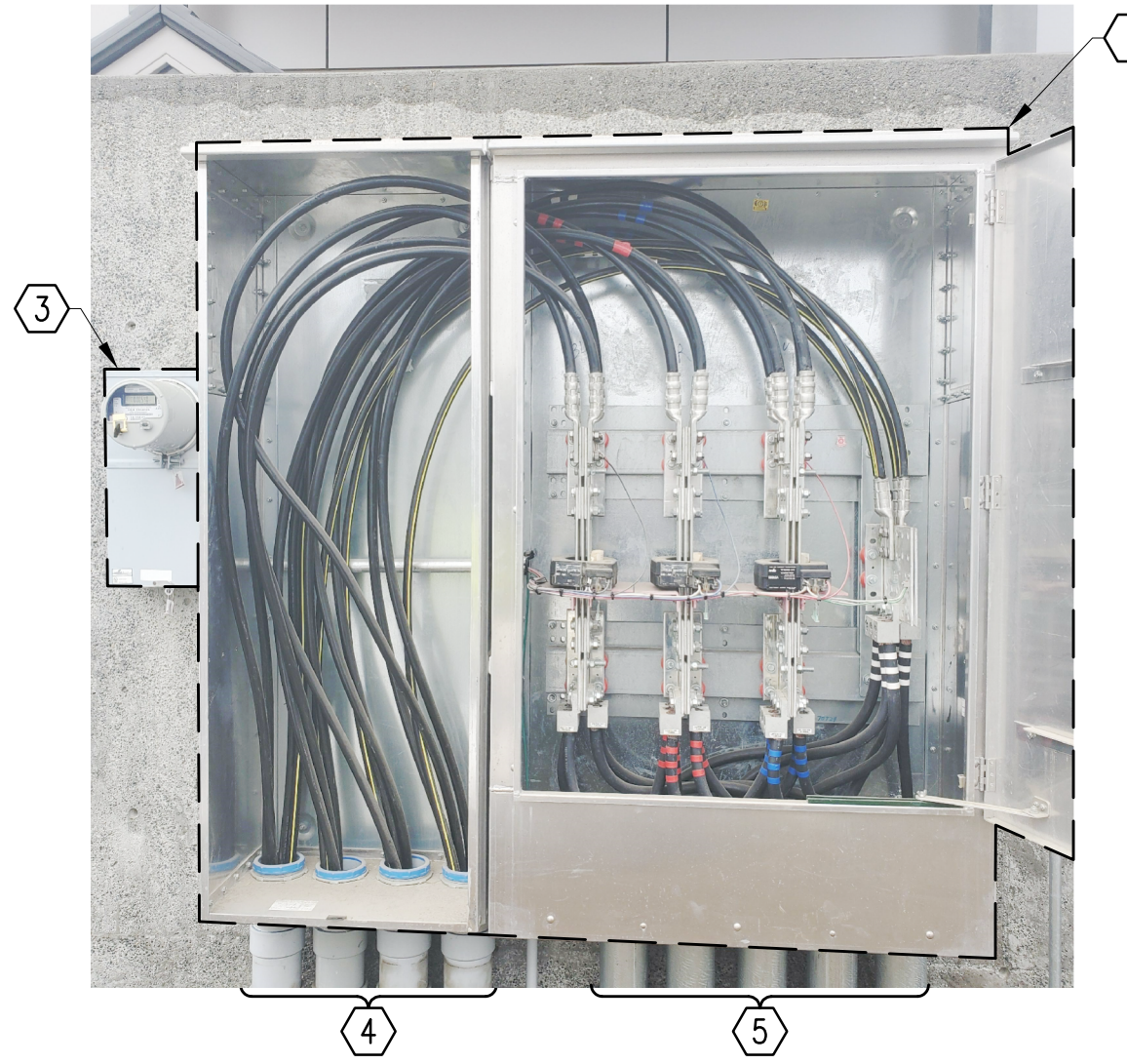
KENAITZE INDIAN TRIBE
DENAINA WELNESS CENTER
STANDBY GENERATOR
KENAI, ALASKA
POWER ONE-LINE AND PANEL SCHEDULE

BAR IS 1 INCH ON ORIGINAL DRAWING
DESIGNED BY: CLW
DRAWN BY: OM, CLW
CHECKED BY: JAP
DATE: 02-11-2021



DETAIL NOTE: MAINTAIN SEPARATION BETWEEN POWER AND CONTROL CIRCUITS, 12" HORIZONTAL MINIMUM.

1 GRAVEL/GRASS TRENCH DETAIL
E5.0 SCALE: NTS



3 PHOTO - EXISTING CT CABINET INTERIOR
E5.0 SCALE: NTS

GENERATOR TO BUILDING AUTOMATION SYSTEM (BAS) CONTROL

SCOPE OF WORK

THE CONTRACTOR SHALL BE RESPONSIBLE TO IMPLEMENT ALL OF THE FOLLOWING:

THE GENERATOR SET SHALL BE PROVIDED WITH CONTROL EQUIPMENT TO INTERFACE WITH THE EXISTING BUILDING AUTOMATION SYSTEM (BAS). THE BAS SHALL BE PROGRAMMED BASED ON THE FUNCTIONAL NARRATIVE.

THE BAS WAS INSTALLED BY SIEMENS, SIEMENS JOB NUMBER: 440P-120094, SHOP DRAWINGS ARE AVAILABLE UPON REQUEST. ALL WORK SHALL BE COORDINATED THROUGH SIEMENS AND THE OWNER.

THE GENERATOR SET SHALL COMMUNICATE WITH THE BAS THROUGH A MODBUS SERIAL CONNECTION. POINT OF INTERCONNECT WITH THE BAS SHALL BE FIELD DETERMINED BY SIEMENS TO (ONE OF) THE EXISTING MODBUS NETWORK(S). ALL GENERATOR MODBUS REGISTER MONITORING AND CONTROL POINTS SHALL BE MADE ACCESSIBLE THROUGH THE BAS. THE INTENT IS TO ENABLE THE GENERATOR TO BE FULLY MONITORED AND TRENDED BY THE BAS. THE PROGRAMMING SHOULD ALSO BE COORDINATED WITH ROUTINE MAINTENANCE EXERCISING OF THE GENERATOR SET AND TRANSFER SWITCH, ENABLING THE ABILITY TO ADD LOAD TO THE GENERATOR DURING TESTING TO MEET THE REQUIREMENTS OF NFPA 110. THE MAINTENANCE EXERCISING ROUTINE SHALL BE ENABLED TO OVERRIDE THE LOAD REDUCTION MODE REFERENCED BELOW.

THE GENERATOR SET SHALL ALSO COMMUNICATE WITH THE BAS THROUGH A DISCRETE INPUT CONNECTION. THE INPUT TO THE BAS SHALL BE PROGRAMMED FOR A GENERATOR OVERLOAD (kW) WARNING. THE WARNING SIGNAL SHALL BE ADJUSTABLE, WITH INITIAL SETTING AT 90% OF GENERATOR NAMEPLATE RATING FOR A 60 SECOND DURATION. THE INTENT IS TO ENABLE THE BAS TO TURNDOWN AVAILABLE LOAD SHOULD THE GENERATOR APPROACH NAMEPLATE RATING. THE BAS MAY REQUIRE AN APOGEE DISCRETE INPUT CARD TO BE INSTALLED; COORDINATE WITH SIEMENS. CONTRACTOR IS RESPONSIBLE FOR COORDINATING AND DETERMINING IF THE BAS WILL SINK OR SOURCE THE SIGNAL FROM THE GENERATOR

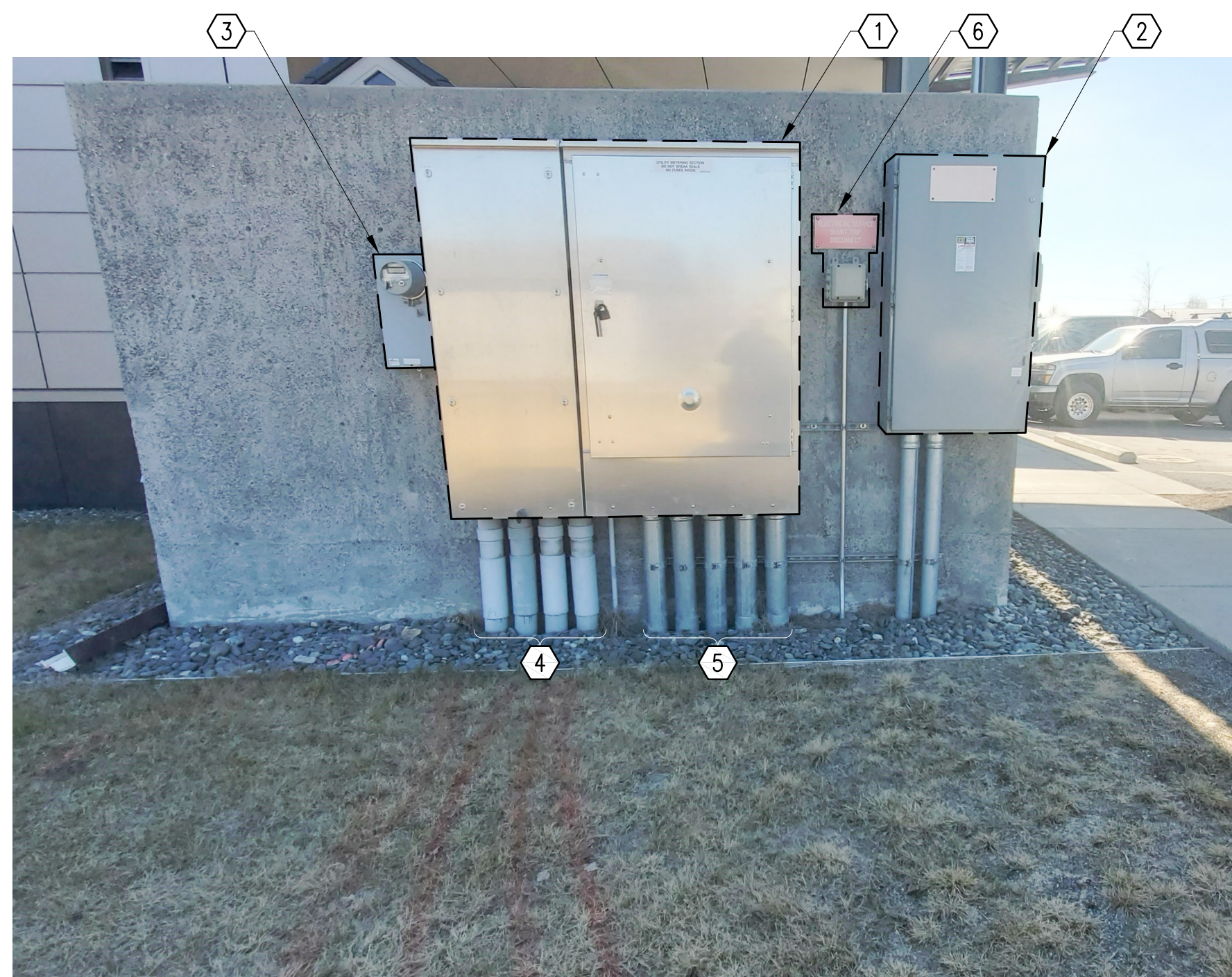
FUNCTIONAL NARRATIVE

1. WHEN THE BAS RECEIVES A GENERATOR OVERLOAD WARNING SIGNAL, THE BAS SHALL ENTER A LOAD REDUCTION MODE.
2. THE LOAD REDUCTION MODE, VIA THE BAS, SHALL DISABLE AIR-COOLED CONDENSING (ACC) UNITS ACC-2 AND ACC-3 UNTIL NORMAL (UTILITY) POWER IS RESTORED.
3. IF A SPACE SERVED BY ACC-2 OR ACC-3 REACHES A TEMPERATURE OF 85 DEGREES FAHRENHEIT, THE RESPECTIVE ACC UNIT SERVING THE SPACE SHALL BE COMMANDED ON BY THE BAS.
4. WHEN THE OVERHEATED SPACE RETURNS TO ITS DESIGNATED TEMPERATURE, THE BAS SHALL RETURN TO LOAD REDUCTION MODE.
5. WHEN NORMAL (UTILITY) POWER IS RESTORED, THE BAS SHALL RETURN ACC-2 AND ACC-3 TO NORMAL OPERATION.

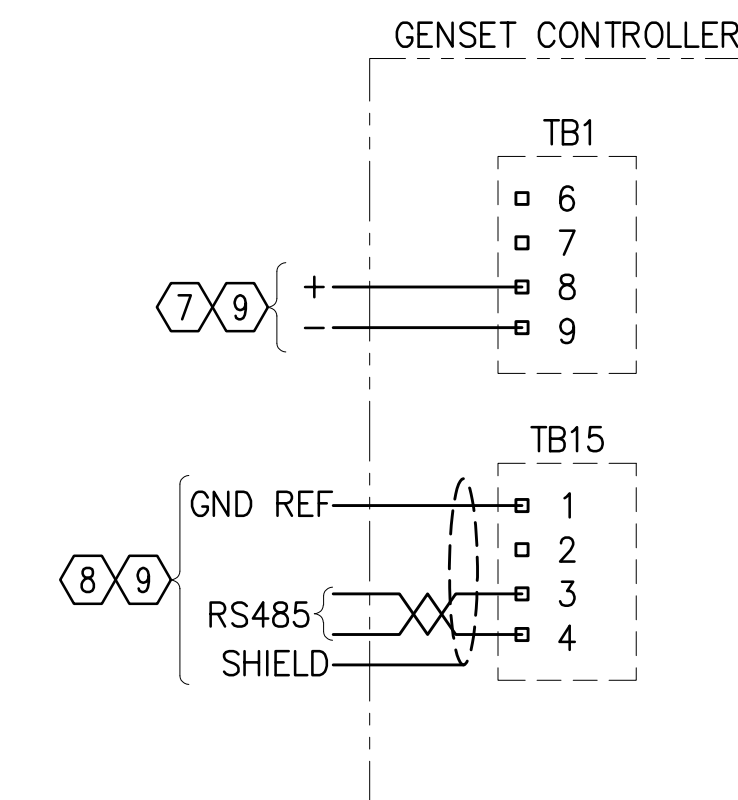
4 GENSET CONTROL TO BUILDING AUTOMATION SYSTEM NARRATIVE
E5.0 SCALE: NTS

SHEET NOTES

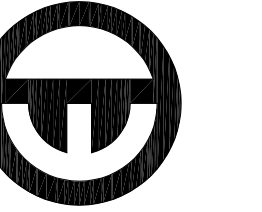
- 1 DEMOLISH CT CABINET.
- 2 DEMOLISH DISCONNECT SWITCH.
- 3 DEMOLISH METER BASE.
- 4 UTILITY SERVICE LATERALS TO BE DEMOLISHED. COORDINATE WORK WITH HEA.
- 5 SERVICE ENTRANCE CONDUITS AND CONDUCTORS TO REMAIN FOR REUSE ON THIS PROJECT. SEE ELECTRICAL PLAN SHEETS FOR ADDITIONAL INFORMATION.
- 6 REMOVE AND REINSTALL SHUNT-TRIP PUSHBUTTON. SEE SHEETS E3.1 AND E4.0 FOR ADDITIONAL INFORMATION. RELOCATE SIGNAGE.
- 7 GENERATOR OVERLOAD (kW) WARNING TO BUILDING AUTOMATION SYSTEM.
- 8 GENERATOR MODBUS COMMUNICATIONS TO BAS.
- 9 SEE SITE PLAN SHEET E3.1 FOR EXTERIOR ROUTING TO BUILDING. CIRCUIT ROUTING WITHIN THE BUILDING TO BE FIELD DETERMINED IN COORDINATION WITH SIEMENS.



2 PHOTO - EXISTING CT CABINET AND MTS
E5.0 SCALE: NTS



EDC, INC.
213 W. FIREWEED LANE
ANCHORAGE, AK 99503
(907) 276-7933
LICENSE NO. AECCT05

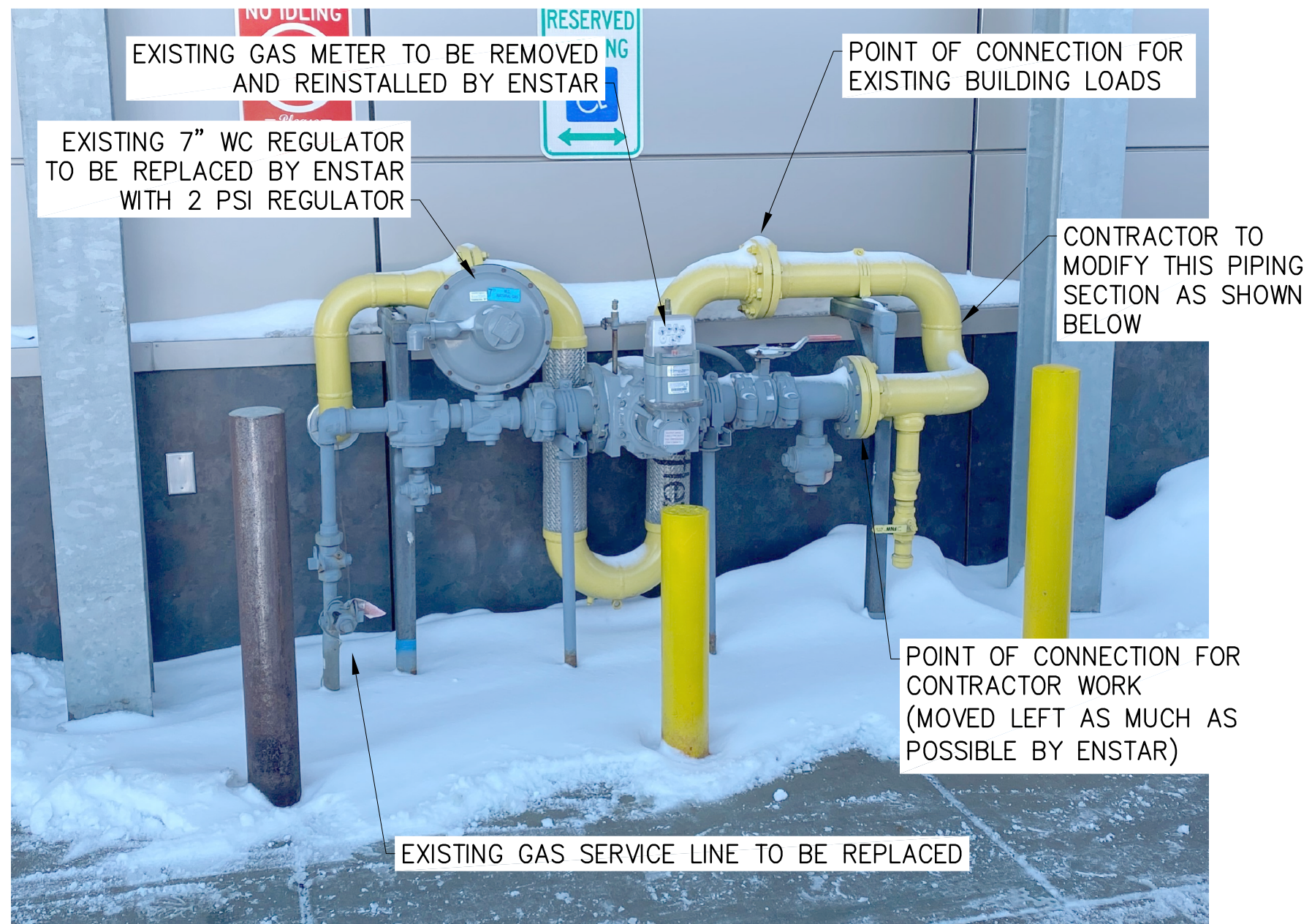


REV	DATE	REVISION DESCRIPTION

KENAITZE INDIAN TRIBE
DENAINA WELNESS CENTER
STANDBY GENERATOR
KENAI, ALASKA
ELECTRICAL DETAILS

BAR IS 1 INCH ON ORIGINAL DRAWING
DESIGNED BY: CLW
DRAWN BY: OM, CLW
CHECKED BY: JAP
DATE: 02-11-2021

E5.0



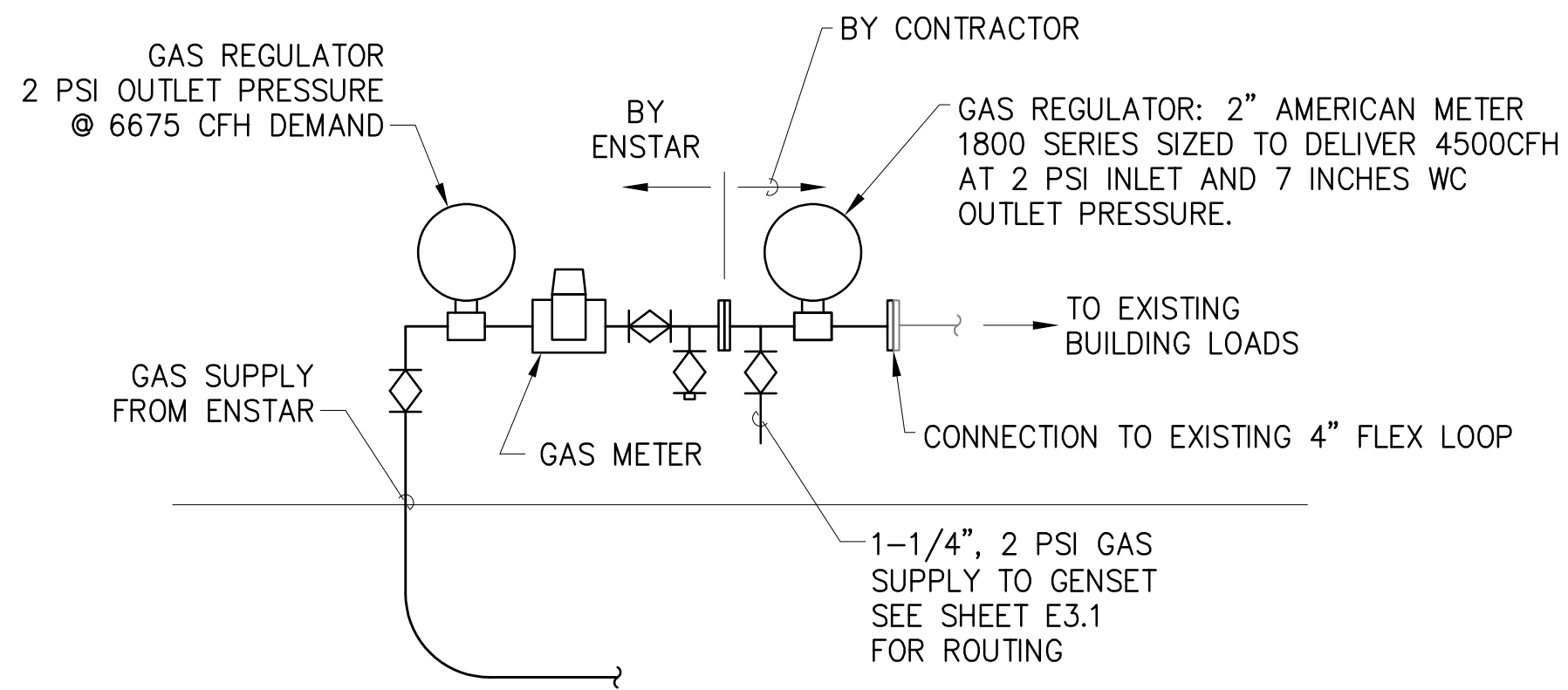
NOTES:

1. GREY PIPING AND EQUIPMENT TO BE REPLACED BY ENSTAR, MOVING IT TO THE LEFT AS MUCH AS POSSIBLE OR PRACTICAL.
2. NEW TOTAL GAS LOAD IS 6575 CFH
3. CONTRACTOR SHALL MODIFY PIPING FROM THE 4" FLANGED JUNCTION OF GREY AND YELLOW PIPING AT OUTLET OF THE METER TO THE INLET SIDE OF THE FLEX LOOP TO ACCOMMODATE A 2" MEDIUM PRESSURE GAS BRANCH TAP WITH 1-1/4" LOCKING VALVE TO THE GENERATOR LOCATION, REGULATOR TO REDUCE PRESSURE TO 7 INCHES WC, AND RECONNECT TO THE 4" FLANGED INLET OF THE FLEX LOOP. SEE DETAIL 2/M1.0
4. COORDINATE DISCONNECTION AND RECONNECTION OF EXISTING PULSER WIRING WITH ENSTAR. DO NOT REMOVE PULSER FROM METER; ALL METER WORK TO BE PERFORMED BY ENSTAR

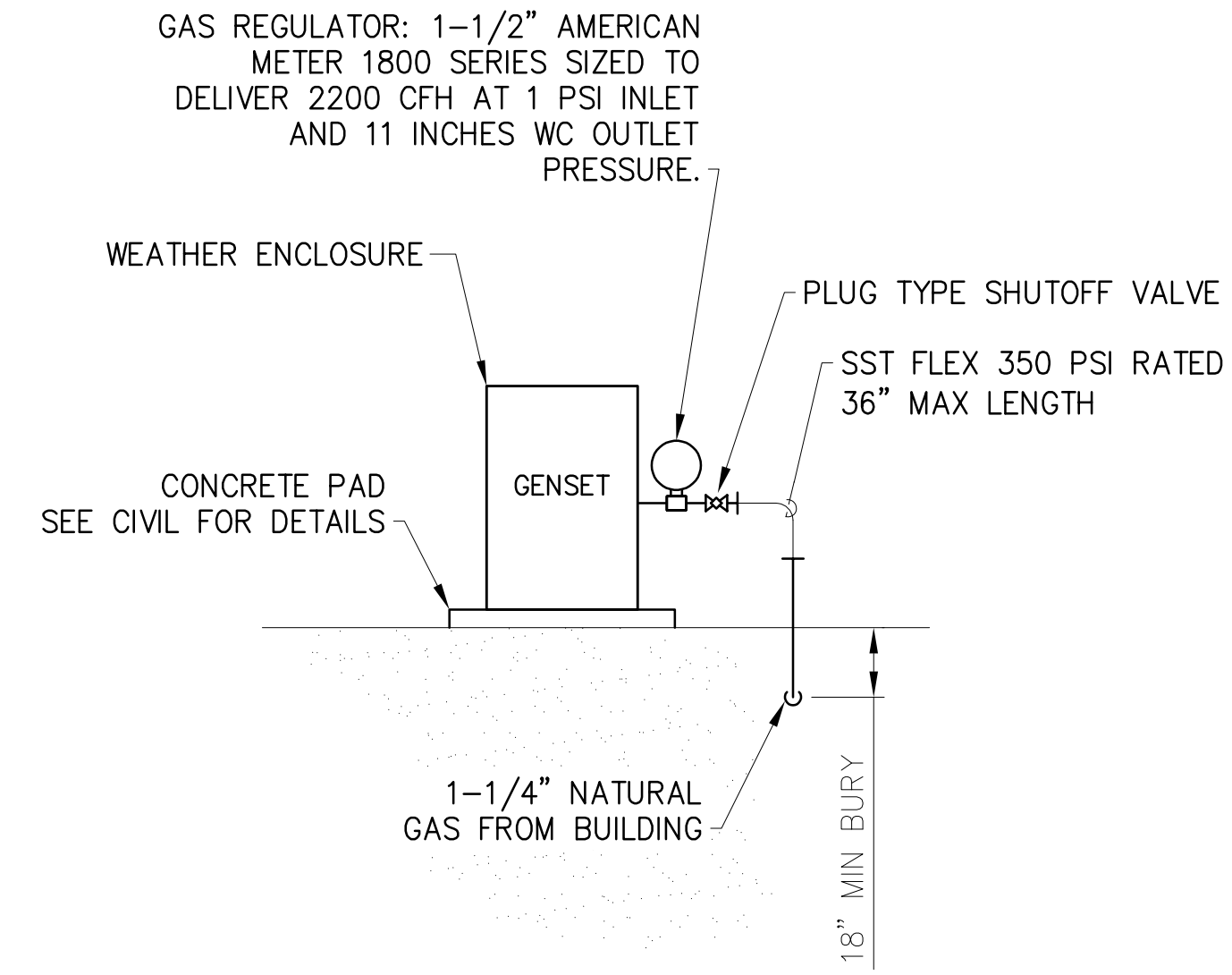
1 EXISTING GAS METER INSTALLATION
M1.0 SCALE: NTS

NOTES:

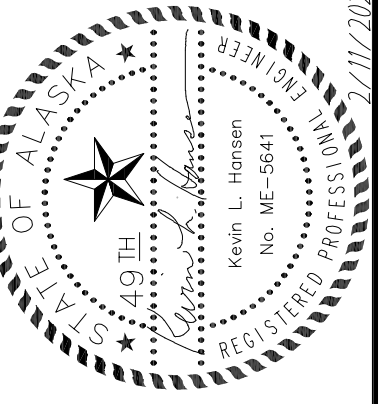
1. THE CONTRACTOR SHALL COORDINATE INSTALLATION OF ALL NATURAL GAS RELATED EQUIPEMENT AND SHALL MEET THE REQUIREMENTS OF THE UTILITY.
2. THE CONTRACTOR SHALL COORDINATE WITH THE NATURAL GAS UTILITY TO ENSURE TIMELY APPLICATION FOR INSTALLATION OF SERVICE. ALL COSTS RELATED TO THE SERVICE APPLICATION AND INSTALLATION BY THE UTILITY, INCLUDING SERVICE LINE AND CONNECTION COSTS SHALL BE PAID FOR BY THE OWNER.



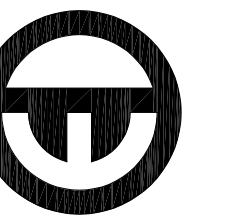
2 NATURAL GAS PIPING SCHEMATIC
M1.0 SCALE: NTS



3 GENERATOR PIPING DETAIL
E3.1 SCALE: NTS



EDC, INC.
213 W. FIREWEED LANE
ANCHORAGE, AK 99503
(907) 276-7933
LICENSE NO. AEC0705



REV	DATE	REVISION DESCRIPTION

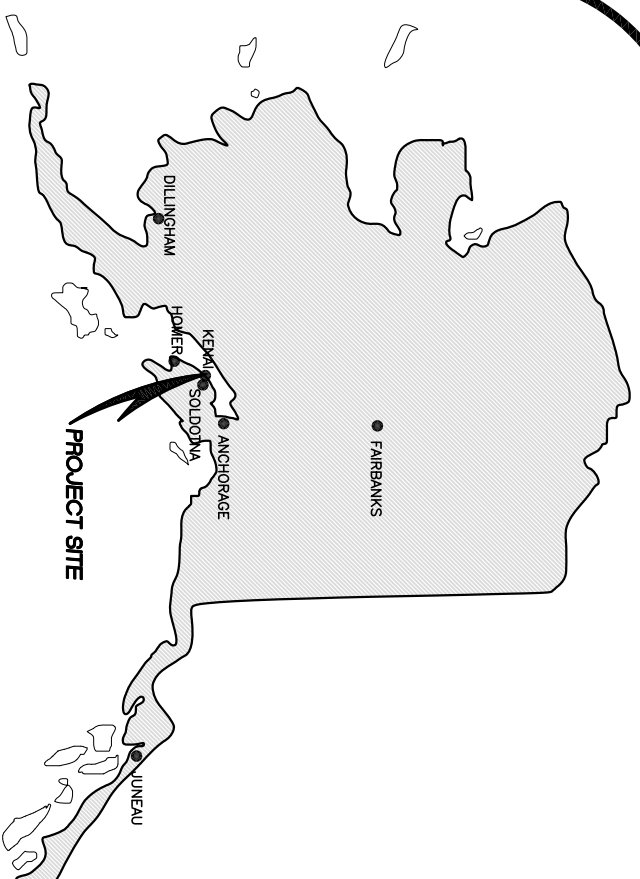
KENAITZE INDIAN TRIBE
DENAINA WELLNESS CENTER
STANDBY GENERATOR
KENAI, ALASKA
MECHANICAL DETAILS

BAR IS 1 INCH ON ORIGINAL DRAWING
DESIGNED BY: KLH
DRAWN BY: OM, CLW
CHECKED BY: JAP
DATE: 02-11-2021

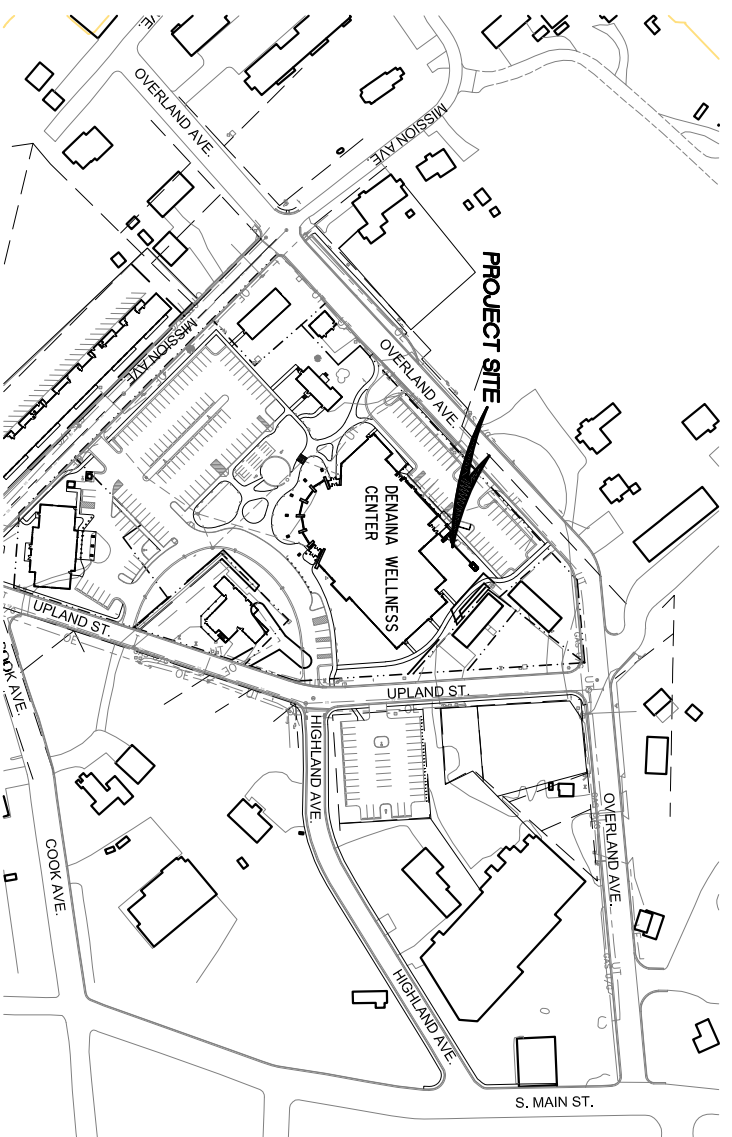
M1.0

DENNAINA WELLNESS CENTER GENERATOR PAD

KENAITZE INDIAN TRIBE



LOCATION MAP



VICINITY MAP
SCALE: NOT TO SCALE



DRAWING INDEX

DRAWING
TITLE SHEET, AND LOCATION MAP
SITE PLAN, GENERAL NOTES
DETAILS
DETAILS

SHEET
T1
C20
C30
C40

	<p>CONSULTING ENGINEERS STRUCTURAL/CIVIL</p>
	<p>155 BIDARKA ST. KENAI, AK 99611 TEL. (907) 283 - 3583 NELSONENGINEER@ALASKA.NET</p>

TECHNICAL SPECIFICATIONS

GENERAL
 ALL MATERIALS AND CONSTRUCTION SHALL CONFORM TO REQUIREMENTS OF THE INTERNATIONAL CODE COUNCIL INTERNATIONAL BUILDING CODE (IBC) 2012 EDITION, WHERE EXPLICIT DETAILS ARE NOT SHOWN OR DESCRIBED, THE MINIMUM REQUIREMENTS OF THE ABOVE CODE SHALL APPLY. UNLESS OTHERWISE NOTED, ALL CODES, STANDARDS AND OTHER PUBLICATIONS CITED SHALL REFER TO THE LATEST EDITION.

LOCATION
 THIS PROJECT IS DESIGNED FOR THE ADDITION OF A GENERATOR FOR THE DENAINA WELLNESS CENTER IN KENAI, AK.

CONCRETE
 MIXING, SELECTION OF MATERIALS, AND PLACING OF ALL CONCRETE SHALL CONFORM TO THE REQUIREMENTS OF THE IBC, CHAPTER 19. AN AIR ENTRAINING AGENT SHALL BE USED IN ALL CONCRETE MIXES FOR CONCRETE WORK WHICH IS TO BE EXPOSED TO EARTH OR WEATHER. AIR ENTRAINMENT SHALL BE 5% +/- 1% BY VOLUME. ALL CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH (F'c) = 3000 P.S.I. CONCRETE FOR INTERIOR AND EXTERIOR SLABS SHALL CONTAIN 0.1% BY VOLUME 'GENESIS FIBER' COLLATED FIBRILLATED POLYPROPYLENE FIBER PER CUBIC YARD OF CONCRETE. THE FIBER SHALL BE THOROUGHLY MIXED INTO THE CONCRETE IN TRANSIT TO THE SITE, IN ACCORDANCE WITH THE FIBER MANUFACTURER'S RECOMMENDATIONS.

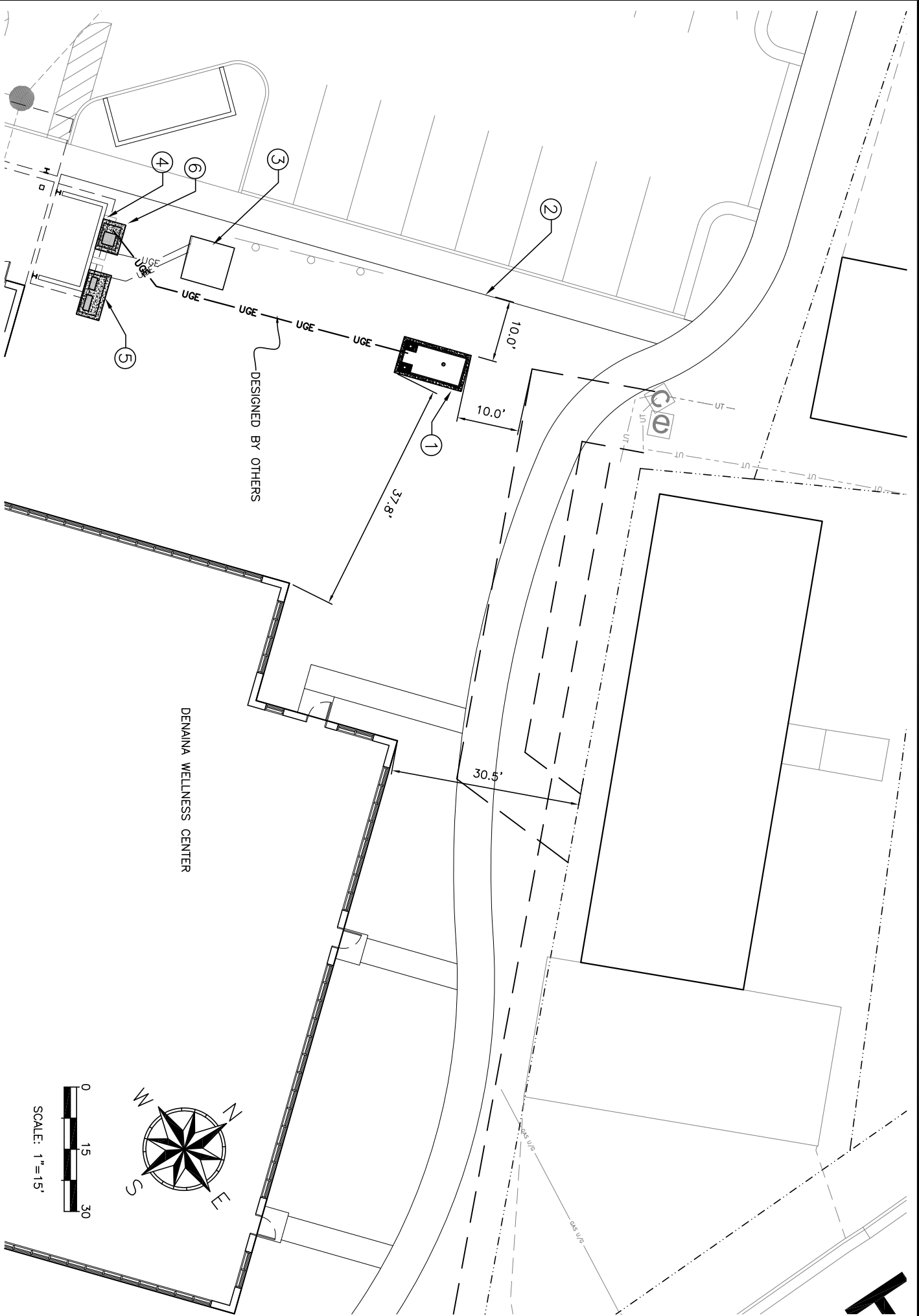
REINFORCING STEEL
 UNLESS NOTED OTHERWISE, ALL REINFORCING STEEL SHALL BE DEFORMED BARS CONFORMING TO IBC CHAPTER 19. REINFORCING BARS SHALL BE GRADE 60. REINFORCING STEEL SHALL BE SECURELY TIED IN PLACE WITH #16 DOUBLE ANNEALED IRON WIRE. REINFORCING IN FOOTINGS SHALL BE SUPPORTED ON WELL CURED CONCRETE BLOCKING OR APPROVED METAL CHAIRS. REINFORCING BARS SHALL BE SPLICED BY A LAP OF AT LEAST 30 BAR DIAMETERS. A MINIMUM LAP FOR ALL BARS SHALL BE 24". CONCRETE COVER OVER REINFORCING SHALL BE 3" FOR CONCRETE CAST AGAINST EARTH. CONCRETE COVER FOR FORMED CONCRETE THAT WILL BE EXPOSED TO WEATHER OR EARTH SHALL BE 2" MINIMUM FOR #6 THROUGH #18 BARS AND 1 1/2" MINIMUM FOR #5 BARS AND SMALLER, INCLUDING WELDED WIRE FABRIC (WWF). OTHER REINFORCEMENT SHALL HAVE A MINIMUM COVERAGE OF NOT LESS THAN 3/4".

SPECIAL INSPECTION NOTES
 OWNER SHALL PROVIDE A SPECIAL INSPECTION PROGRAM IN ACCORDANCE WITH IBC CHAPTER 17. PROVIDE DOCUMENTATION OF SPECIAL INSPECTION TO ENGINEER OF RECORD AND BUILDING OFFICAL.

CONCRETE
 1.) INSPECTION OF REINFORCING STEEL SIZE AND PLACEMENT PRIOR TO PLACING OF CONCRETE.
 2.) INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING PLACED
 3.) PERIODIC INSPECTION OF ANCHORS INSTALLED IN HARDENED CONCRETE.
 4.) PERIODIC INSPECTION OF MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES.

LEGEND

EXISTING (E)		PROPOSED (P)	
— OHE —	UTILITY — OVERHEAD ELECTRIC	— UGE —	UTILITY — UNDERGROUND ELECTRIC
— UGT —	UTILITY — UNDERGROUND TELEPHONE	— RL —	UTILITY — RAIN LEADER
— SS —	UTILITY — SEWER LINE	— SD —	UTILITY — STORM DRAIN
— W —	UTILITY — WATER LINE	—	BUILDING/STRUCTURE LINE
—	CONCRETE LINE	—	DITCH CENTERLINE
—	DRAINAGE SWALE	—	EASEMENT
—	EDGE OF PAVEMENT	—	PROPERTY LINE



A SITE PLAN

GRAPHIC SCALE: 1" = 15' (22X34), 1" = 30' (11X17)

UTILITIES PLAN KEY NOTES

- ① 11'-2"x6'-0"x16"D GENERATOR CONCRETE PAD. SEE SHEET C3.0
- ② EXISTING EDGE OF SIDEWALK
- ③ HEA TRANSFORMER
- ④ EXISTING JUNCTION BOX. CONNECT GENERATOR POWER. DETAILS BY OTHERS
- ⑤ 7'-6"x3'-9"x12"D SWITCH GEAR CONCRETE PAD. SEE SHEET C4.0
- ⑥ 5'-0"x3'-9"x12"D TRANSFER SWITCH CONCRETE PAD. SEE SHEET C4.0

GENERAL NOTES

1. DRAWING IS BASED ON ORIGINAL DENAINA WELLNESS CENTER BUILDING DESIGN. CONTRACTOR TO VERIFY ALL EXACT LOCATIONS OF ALL THE SITE FEATURES.
2. PROVIDE MINIMUM 24" COVER OVER CONDUIT AND BACKFILL WITH NATIVE NON-FROST-SUSCEPTIBLE MATERIAL.
3. COMPACT BACKFILL TO 95% MAX DRY DENSITY IN 12" LIFTS.
4. EXISTING UTILITY INFORMATION IS APPROXIMATE. CONTRACTOR TO CALL ALASKA DIG LINE 811 TO DETERMINE ACTUAL UTILITY LINE LOCATIONS.
5. ELECTRICAL INSTALLATION: CONDUIT, BOXES, ENCLOSURES, WIRING, ETC. TO BE PERFORMED IN ACCORDANCE WITH ELECTRICAL SPECIFICATIONS.
6. CONTRACTOR TO PROVIDE 4" TOPSOIL/SEEDING IN ALL DISTURBED AREAS.

**CONSULTING ENGINEERS
 STRUCTURAL/CIVIL**
 155 BIDARKA ST
 KENAI, AK 99611
 TEL. (907) 283 - 3583
 NELSONENGINEER@ALASKA.NET
 AK CORP. AUTHORIZATION AECC 1291

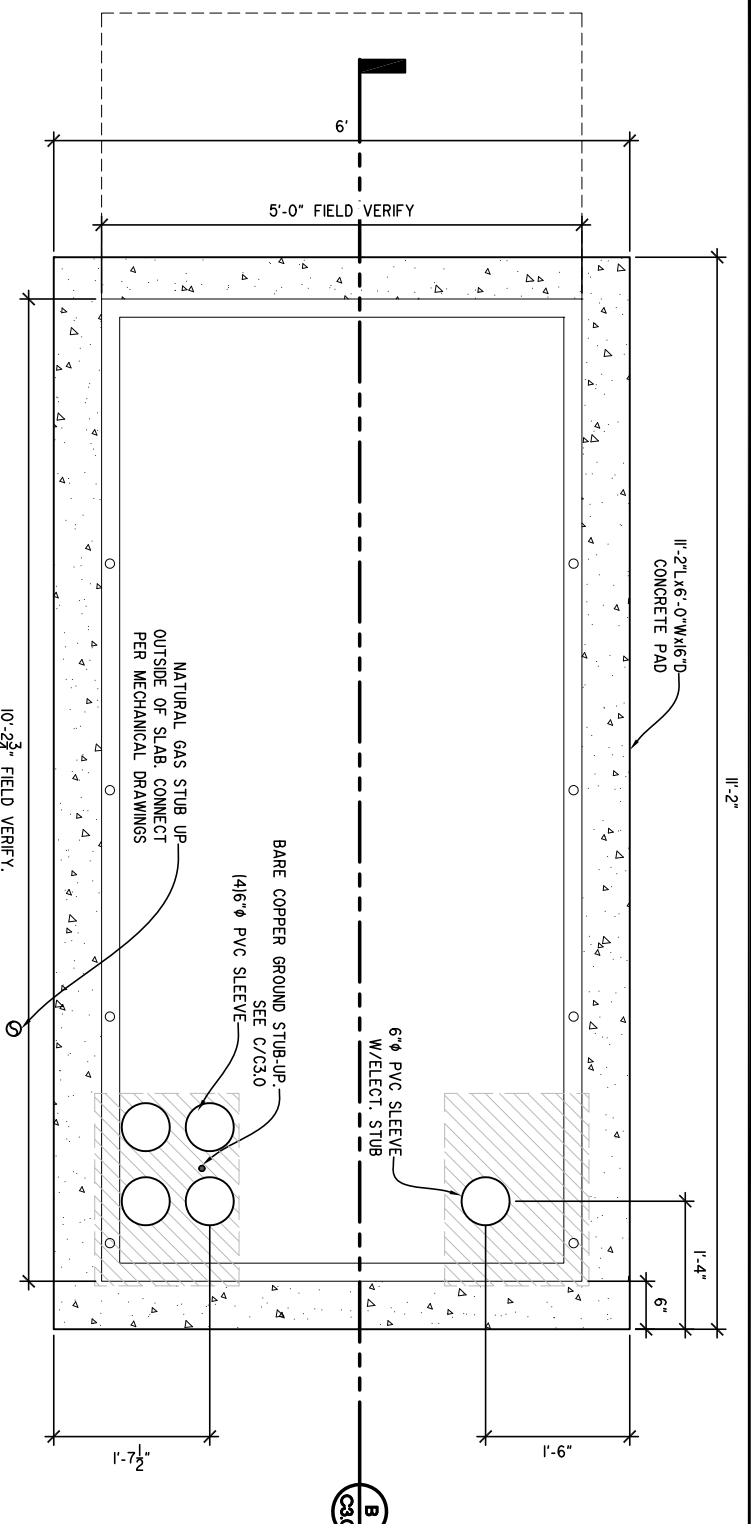


DWC GENERATOR AND ELECTRICAL FOUNDATIONS
 KENAITZE INDIAN TRIBE
 KENAI, ALASKA
 SITE PLAN

NO.	REVISION	DATE

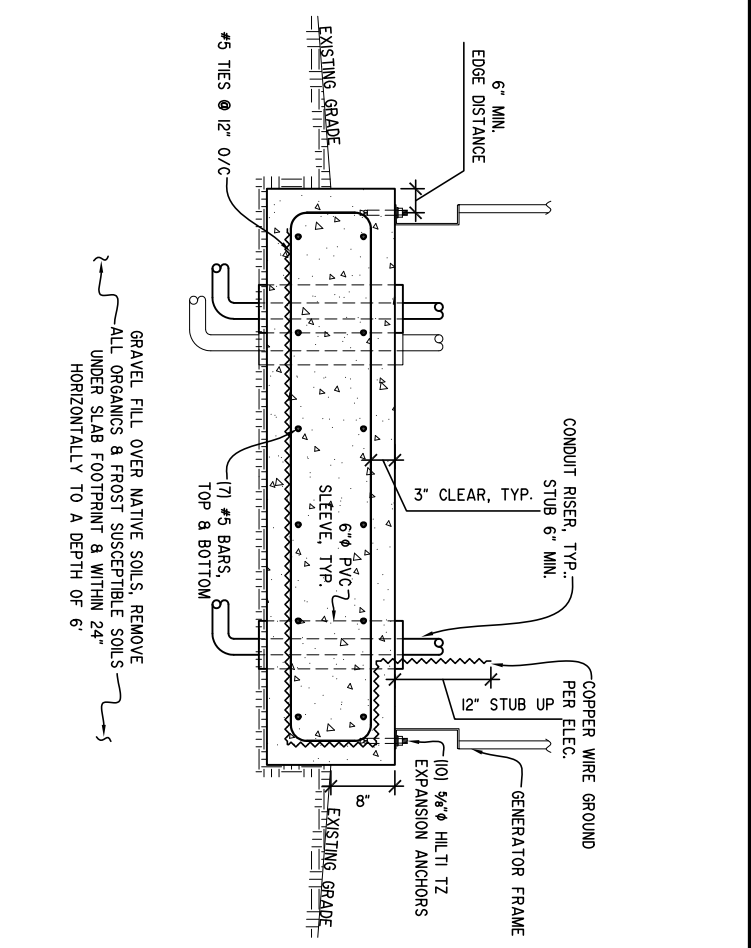


PROJECT NO.
1955
 DRAWN BY:
CAM
 CHECKED BY:
MZD
 DATE: 02/10/21
 SCALES: NOTED
 HORZ. NOTED
 VERT. NOTED
 SHEET
C2.0
 OF 4

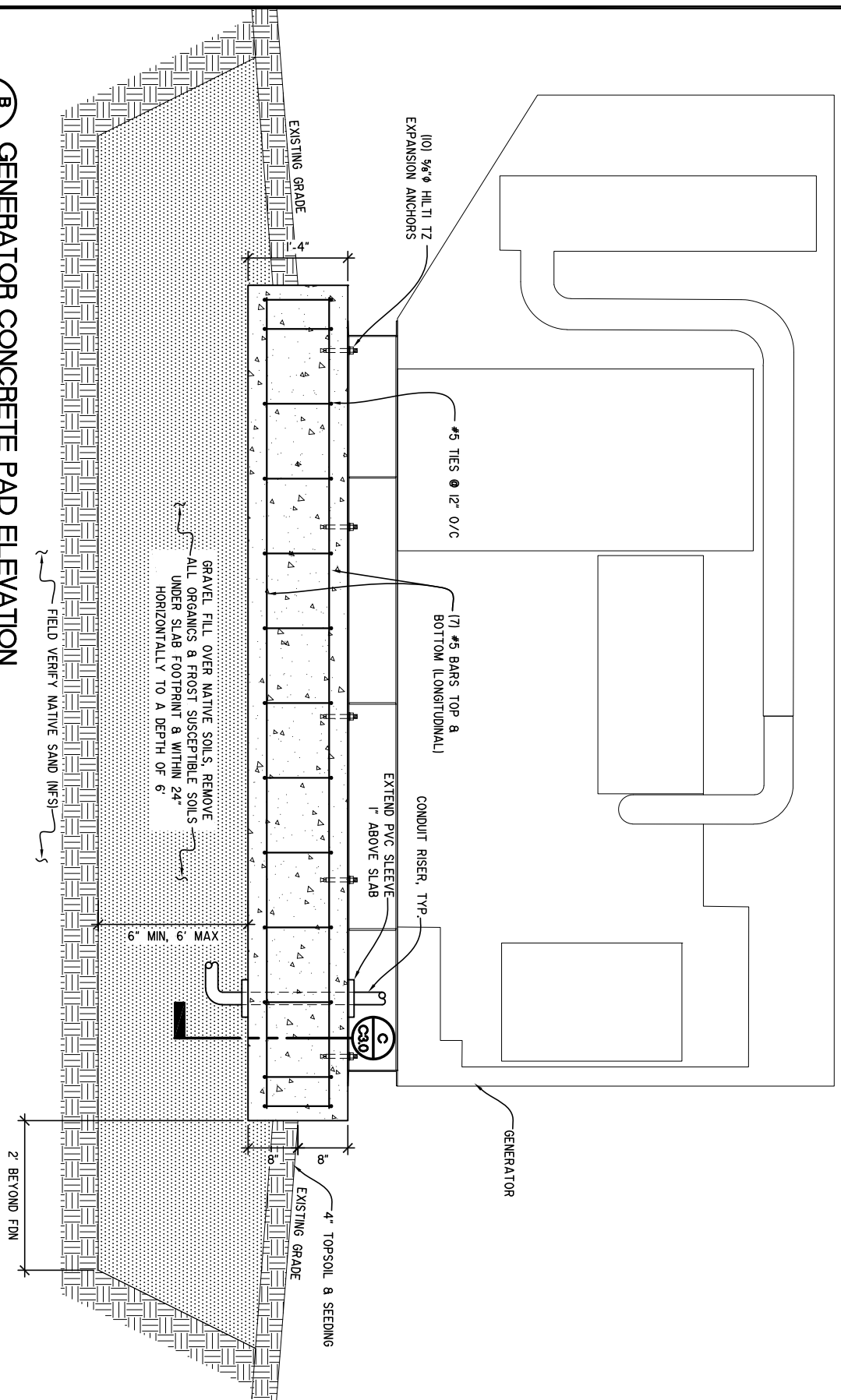


NOTE:
VERIFY DIMENSIONS WITH
GENSET SUPPLIER PRIOR
TO CONSTRUCTION

A GENERATOR CONCRETE PAD PLAN
SCALE: 1"=1'-0" (22x34) / 1/2"=1'-0" (11x17)

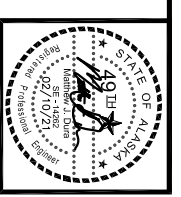


C GENERATOR CONCRETE PAD CROSS SECTION
SCALE: 1"=1'-0" (22x34) / 1/2"=1'-0" (11x17)



B GENERATOR CONCRETE PAD ELEVATION
SCALE: 1"=1'-0" (22x34) / 1/2"=1'-0" (11x17)

NO.	REVISION	DATE



**CONSULTING ENGINEERS
STRUCTURAL/CIVIL**

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AK CORP. AUTHORIZATION AECC 1291

DWC GENERATOR AND ELECTRICAL FOUNDATIONS

KENAITZE INDIAN TRIBE
KENAI, ALASKA
DETAILS

PROJECT NO. 1955

DRAWN BY: CAM

CHECKED BY: MZD

DATE: 02/10/21

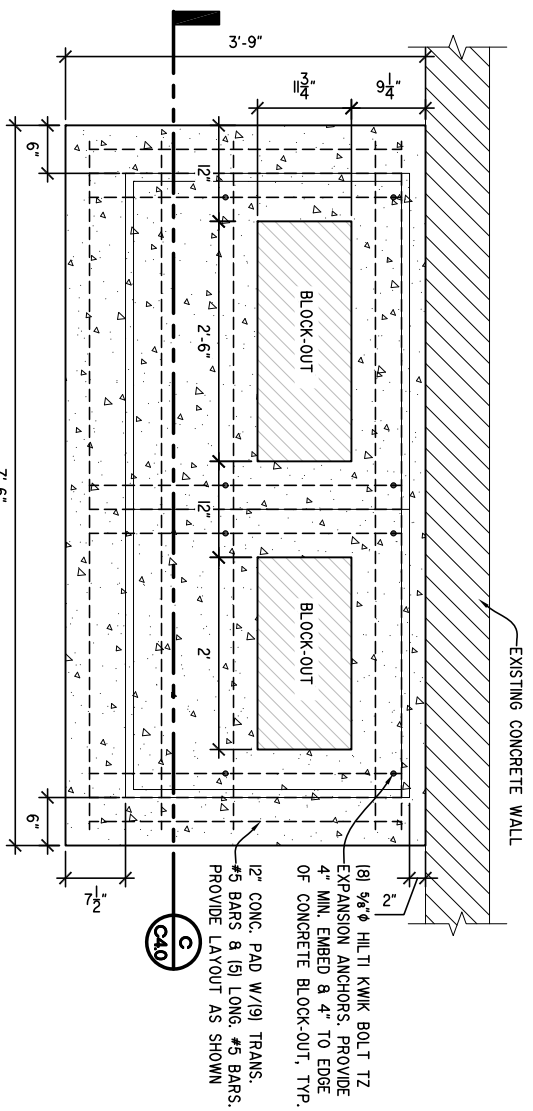
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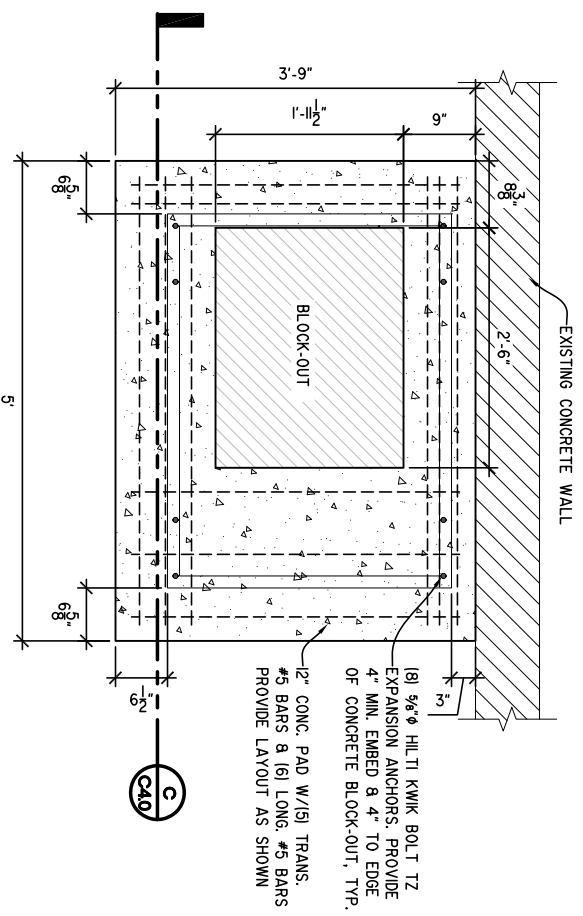
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C3.0

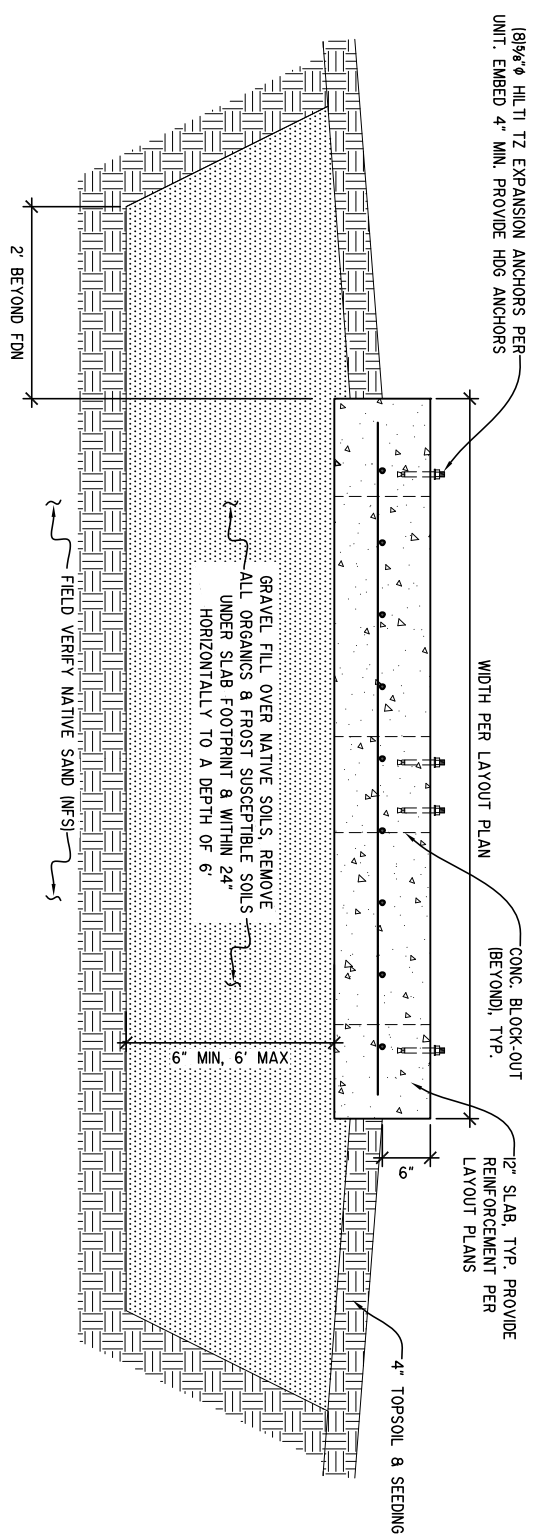
SHEET 3 OF 4



A SWITCH GEAR SLAB PLAN LAYOUT
 SCALE: 1"=1'-0" (22x34) / 1/2"=1'-0" (11x17)



B TRANSFER SWITCH SLAB PLAN LAYOUT
 SCALE: 1"=1'-0" (22x34) / 1/2"=1'-0" (11x17)

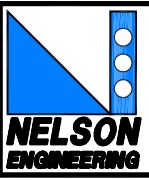


C TYP. ELEC. UNIT CROSS SECTION
 SCALE: 1"=1'-0" (22x34) / 1/2"=1'-0" (11x17)



NO.	REVISION	DATE

**CONSULTING ENGINEERS
 STRUCTURAL/CIVIL**
 155 BIDARCA ST
 KENAI, AK 99611
 TEL. (907) 283 - 3583
 NELSONENGINEER@ALASKA.NET
 AK CORP. AUTHORIZATION AECC1291



DWC GENERATOR AND ELECTRICAL FOUNDATIONS
 KENAITZE INDIAN TRIBE
 KENAI, ALASKA
 DETAILS

PROJECT NO.
 1955
 DRAWN BY:
 CAM
 CHECKED BY:
 MZD
 DATE: 02/10/21
 SCALES: NOTED
 HORIZ. NOTED
 VERT. NOTED
 SHEET
C4.0
 4 OF 4



CUMMINS INC

2618 Commercial Dr.

Anchorage, AK 99501

907-279-7594

January 22, 2021 (*Updated on 2/10/21*)

Record Submittal for:
Dena'ina Wellness Center Standby Generator

Cummins Inc. Project No. 100537

PO No.: PO002663

Prepared for:

Don Ohler

Kenaitze Indian Tribe

P.O. Box 988

Kenai AK, 99611

Phone No.: 907-335-7208

Fax No. :

Email : DOhler@kenaitze.org

Prepared by: Darrell Wayman

Office Number: 907-275-3212

Mobile Number: 907-748-3602

Fax Number: 907-276-6340

Email address: darrell.wayman@cummins.com



Project Name: **Dena'ina Wellness Center Standby Generator**
Project Number: **100537**

Dear: Don Ohler

Attached please find the updated record submittal,

Current lead time is approximately

12 & 16 weeks

A Cummins project team has now been assigned to your project. Their names and contacts are listed below. For technical issues, your Project Manager, Darrell Wayman, will best be able to assist you at this stage of the project. Feel free to contact anyone on your Project Team directly."

Name	Title	Function	Phone	email
Brant Smith	Territory Manager Anchorage	Sales Scope & Design	907-275-3211	brant.c.smith@cummins.com
Darrell Wayman	Project Manager Anchorage	Submittals Technical Issues Logistics Coordinate Start & Test Documentation	907-275-3212	darrell.wayman@cummins.com
Sharon Biddle	Project Coordinator Portland	Credit	503-972-6667	sharon.biddle@cummins.com
Jenness Mann	Project Coordinator Portland	Invoicing	503-972-6646	jenness.mann@cummins.com
Dan Lanske	GM - Power Gen Sales North	Sales Management	425-277-5334	dan.lanske@cummins.com

Best regards,

Brant Smith
Cummins Inc.



January 22, 2021

Notice to End User or Contractor

Approval Drawings

This Approval Drawing Package is submitted as our interpretation of the contract drawings and/or the specifications for this job.

It is the obligation of the electrical contractor and reviewing engineer to determine that the item quantities and accuracy of this submittal is correct as required for the job. Any inaccuracies or deviations must be addressed with Cummins Inc. before release to manufacturing. Any releases of material to manufacturing by the above parties constitute an acceptance of the accuracy of the submittal. Any changes after release will be viewed as a change order, subject to pricing changes.

Please take the time to review this package for accuracy to prevent any after-shipment problems. This will allow the job to be shipped correctly and prevent any delay in energization.

Cummins Power Generation provides a large amount of technical information on its products, as well as specific technical topics aimed at clarifying our position on topical issues. Below you'll find links to valuable information that would help you with our recommendations for installation on different topics.

Technical Manuals

[T-011 Application Manual - Transfer Switches](#)

[T-016 Application Manual - Paralleling](#)

[T-030 Application Manual - Liquid Cooled Generator Sets](#)

[T-034 Application Manual - Networking](#)



Project Name: **Dena'ina Wellness Center Standby Generator**
 Project Number: **100537**
 PO Number: **PO002663**

Summary Sheet

(Not for Construction, please refer to specific materials within submittal or call Cummins Inc. to double check values.)

Project Manager Darrell Wayman 907-275-3212

Major Equipment Shipping Weights and Dimensions

Equipment	Length (in)	Width (in)	Height (in)	Weight (lbs)	Color	Sources Drawing Number
Generator Enclosure	159" Shipping	60 Shipping	79" Shipping	8,600 lbs.	Onan Green	Generator Outline Drawing C200N6-02
N/A						
	Deep (in)	Width (in)	Height (in)	Weight (lbs)	Color	Sources Drawing Number
ATS	51"	38"	90"	960 lbs.	Green	0310-0744

Generator Set - Lug Information

Max. Breaker Amps	Wire (Copper)			
	Lug Qty	Size		
800 (ATS)	3	2/0 - 600kcmil CU		

Automatic Transfer Switch - Lug Information

Amperage	Cable/Phase & Cable Size
2000	(8 Wires) #2-600MCM CU-AL Per Phase - Ground Lugs (1 Wire) #6-250MCM Qty. 6

AC Power Supplies needed for Genset Accessories

Note: Generator accessory loads need 120/240 1 Phase power supply provide by the contractor. Power is fed by others through stub-up in floor of enclosure.

Accessories	No. phases	Voltage	Amps
Reference Submittal for heater Spec/Data Sheets			

Table of Contents

Materials Summary Start-Up Check List

Generator – C200 N6

- Specifications/Model Data Sheets
- Warranty Statement
- Power Command 3.3 Control System
- Exhaust Emission Data Sheet
- EPA Exhaust Compliance Statement
- Prototype Test Summary
- Alternator Data Sheet
- Sound Data Sheet
- Enclosure Spec Sheets
- Generator (Open Configuration) Outline Drawing
- Generator (Housing) Outline Drawing
- Generator Fuel Train Vaporizer Components (Factory Installed on Skid)
- Cummins Installation/O&M Manual, A042J614 (provided via separate file)

Generator Accessories

- Remote Annunciator Panel Specification Sheet
- Battery Charger Specification Sheet
- Starting Batteries
- Battery Blanket Heater
- Engine Oil Pan Heater

Generator Control Interconnection Wiring

- Interconnection Control Wiring, Simplified
- Interconnection Control Wiring, Factory-Full Version
- PCCNet Communications Wiring Specs
- Drawing - Relays, User Configured K631-2
- Data Sheet, Control Digital Input Output Modules

Automatic Transfer Switch – 2000Amp OTPCG

- Specification Sheet
- Warranty Statement
- Seismic Certificate of Compliance
- Outline Drawing
- Withstand Closing Ratings per Circuit Breaker

Material Summary

ITEM NUMBER	DESCRIPTION	Quantity
1	<p>Cummins C200N6 Natural Gas Outdoor Generator Set C200N6 Genset - Spark Ignited, Natural Gas, 60Hz, 200kW 1 ENG PSI11 SB, 302 HP, 10.5:1, Factory Certified for Emissions 1 CAT Catalyst NSPS 2/4/1 1 A331-2 Duty Rating - Standby Power 1 L090-2 Listing - UL 2200 1 C002-2 Natural Gas 1 F202-2 Enclosure - Sound Attenuated, LEVEL2, with Exhaust System 1 P187-2 Onan Green Enclosure Color 1 B268-2 Generator - UCIDI274J (ADS #212), 60Hz, Winding 311 1 R098-2 Voltage - 120/208, 3phase 1 B240-2 Exciter / Regulator - Shunt 1 A292-2 Heater - Alternator, 120VAC 1 KX21-2 Set Control - Power Command 5.3 MLD w/ overload warning 1 H609-2 Controls Facing Left 1 E082-2 Radiator Cooled 1 H389-2 Shutdown - Low Coolant Level 1 H557-2 Coolant Heater - 208/240V / 2500W 1 E098-2 Sightglass on Radiator 1 A366-2 Engine Governor - Electronic, Isochronous Only 1 A334-2 Engine Starter - 24 VDC Motor 1 A333-2 Battery Charging Alternator - Normal Output 1 D041-2 Engine Air Cleaner - Normal Duty 1 H706-2 Lube Oil, Engine Filled Prior to Shipment 1 H669-2 Anti-Freeze - 50/50 Mix, System Filled Prior to Shipment 1 A466-2 Critical Grade Silencer, Carbon Steel 1 H487-2 Oil Heater - 120 VAC 1ph 1 H268-2 Extension - Oil Drain 1 E089-2 Extension - Engine Coolant Drain 1 H606-2 Bargraph - AC Analog Meters 1 H738-2 Heater - Main Display 1 L050-2 Manuals in English 2 F149-2 Vibration Isolators 6 C4D Batteries - C4D Wet (QTY</p> <p>2) 2 F065-2 Battery Rack 1 A465-2 Battery Charger, 120/240 VAC Input, 10A / 24Vdc Output 1 149-0751 Fuel Strainer - Gaseous, 2in NPT 1 MM-2-15 Flexible Fuel Connection - Gaseous, 2in NPT 1 KS53-2 Signals-Aux, Input / Output 1 H739-2 Control Kit, System Input / Output 1 K631-2 Relays - Genset Status (User Configured) 1 KP74-2 Switch - Emergency Stop, External 1 M149-2 Circuit Breaker - LSiG_800A_80%, 600/525V 1 L280-2 Genset Warranty - Standby Power 2 year / 200 hours 1 KM72-2 Shunt Trip - 24VDC, Circuit Breaker 1 F997-02 Std CB Mounting Option 1 F998-02 Left side mounting 1</p>	1



ITEM NUMBER	DESCRIPTION	Quantity
2	Engine Starting Battery	1
3	Extra Engine Heaters	1
4	Cummins OTPCG, Automatic Transfer Switch: 2000A OTPC2000, Transfer Switch-Onan, PowerCommand, 2000 Amp Transfer Mode - Delayed Transition Application - Utility to Genset IBC Seismic Certification Listing - UL 1008 / CSA Certification Cabinet - Type 3R Frequency - 60 Hz System - 3 Phase, 3 or 4 Wire Voltage - 208 Volts AC Level 2 Transfer Switch Control Display - Digital Monitor - Relay Signal Terminal Lugs - (Feature Option N008) Transfer Switch Warranty - Year 0 - 2: Parts, Labor and Travel Year 3 - 5: Parts Only Year 6 - 10: Main Contacts Only Packing - Wooden Crate Poles - 4 (Switched Neutral)	1
5	O&M's	1
6	On-site Start-up / System Testing / Owner Training	1
7	Freight allowed to Kenai, Alaska (Off loading by others)	1

GENERATOR



Specification sheet

Gaseous fuel generator set

11.1L engine series
130 kW - 200 kW 60 Hz



Description

The Cummins 11.1L engine series commercial generator set (GenSet) boasts a fully-integrated power generation system providing optimum performance, reliability and versatility for stationary non-emergency standby and non-emergency prime power applications.

Features

- Power Solutions International (PSI) industrial engine - rugged 4-cycle industrial spark-ignited engine delivers reliable power, low emissions, and quick response to load changes
- Designed, tested, and certified to UL 2200 standards (See Fuel installation requirements on page 5)
- Stamford rugged and reliable alternator with state-of-the-art technology
- One-year warranty supported by a worldwide Cummins twenty-four hour, seven days-a-week distributor network
- Accepts 100% rated load in a single step
- Surge rating - 110% of nameplate
- The GenSet accepts full rated load in a single step in accordance with NFPA 110 Type 10 (ten seconds) for Level 1 and Level 2 Emergency or Standby Power Supply Systems (EPSSs)
- Efficient and localized operation monitoring and control options:
 - Modbus over the Internet (monitor and control)
 - Remote HMI (monitor and control)
 - Field server reliable interface to a building management system Supervisory Control and Data Acquisition (SCADA) (monitor, only)
- Optional Power Command Control (PCC) 3300 technology provides digital (precise) frequency and voltage regulation

Model	→ Standby power rating*		Prime power rating*	Emissions compliance	Engine data sheet
	Propane 60 Hz kW (kVa)	NG 60 Hz kW (kVa)	NG 60 Hz kW (kVa)		
→ C200N6	130 (163)	200 (250)		EPA SI stationary non-emergency certified	PSI 36300018
			180 (225)	EPA stationary non-emergency and MOH certified	

* Tested at 0.8 power factor (PF) per NFPA 110.

GenSet specifications

Voltage regulation, no load to full load	±1%
Random voltage variation	±1% (three-phase only)
Frequency regulation	Isochronous
Random frequency variation	±0.5%

Engine Specifications

Base Engine	Power Solutions International (PSI)
Displacement	11.1 L (677 in ³)
Regenerative Power	11 kW
Cylinder Block Configuration	Cast iron
Cranking Current	900 amps at ambient temperature of 0 °C (32 °F)
Battery Charging Alternator	45 amps
Battery Type	4D (x2)
Starting Voltage	24-volt, negative ground
Standard Cooling System	See derates on Engine Data Sheet
Lube Oil Filter Types	One spin-on canister-combination full flow with bypass

Alternator specifications

Design	Brushless, 4-pole, drip-proof revolving field
Stator	2/3 pitch
Rotor	Direct-coupled by flexible disc
Insulation System	Class H per NEMA MG1-1.65 or better
Standard Temperature Rise*	125 °C
Exciter Type	Shunt or Permanent Magnet Generator (PMG)
Phase Rotation	A (U), B (V), C (W)
Alternator Cooling	Direct-drive centrifugal blower

* For UL 1004 ratings, refer to temperature rise at 120 °C or below, and ambient temperature up to 40 °C

Full-load amperage (FLA) at rated voltage

Model	Rating	Voltage*								
		120/240 (1 Ph)	120/208	127/220	139/240	220/380	240/416	254/440	277/480	347/600
C200N6	Propane Stdby	N/A	451	426	391	247	226	213	195	156
C200N6	NG Prime	N/A	625	590	541	342	312	295	271	217
C200N6	NG Standby	N/A	694	656	601	380	347	328	301	241

*Three-phase FLA based on 0.8 power factor (PF).

Rated load fuel consumption in standard cubic feet per hour (CFH)*

Model	Rating	Fuel type	100% Load	75% Load	50% Load	25% Load
C200N6	Standby	Propane	814	651	488	244
C200N6	Prime	NG	2043	1630	1341	518
C200N6	Standby	NG	2115	1692	1269	635

*See Fuel installation requirements on page 5.

NOTE: Fuel inlet pressure, measured at the fuel shut off valve while under full load, must be 180 to 280 mm WC (7 to 11 in. WC). Fuel supply pressure must not exceed 635 mm WC (25 in. WC) under any conditions.

PowerCommand control system

The PowerCommand Control is an integrated GenSet control system providing voltage regulation, engine protection, operator interface and isochronous governing (optional). The integration of all functions into a single control system provides enhanced reliability and performance compared to conventional GenSet control systems. Prototype tested; UL, CSA, and CE compliant.

The PowerCommand control system includes:

Features

- InPower PC-based service tool available for detailed diagnostics.
- Battery monitoring and testing features and smart starting control system.
- Standard PowerCommand Control Network (PCCNet) interface to devices such as remote annunciator for NFPA 110 applications.

Environmental conditions

- Control boards potted for environmental protection.
- Ambient operating temperature from: -40 to +70 °C (-40 to 158 °F). HMI from -20 to +70 °C (-4 to 158 °F).
- Operating altitude up to 4000 m (13,000 ft.).

AC protection

- Field overload.
- Over current warning and shutdown.
- Over and under voltage shutdown.
- Over and under frequency shutdown.
- Over excitation (loss of sensing) fault.
- Integrated digital electronic voltage regulator.

Digital voltage regulation

- Three-phase line-to-line sensing.
- Configurable torque matching.
- Integrated digital electronic voltage regulator.

Engine data

- DC voltage battery charge.
- Adjustable lube oil pressure.
- Adjustable engine idle speed.
- 12/24 VDC battery configuration.

Alternator data

- 50/60 Hz frequency.
- Three-phase AC current.
- AC: Single or three-phase line-to-line or line-to-neutral.
- Digital output voltage regulation within +/-1.0% any loads between no load to full. Drift equals no more than +/-1.5% for 40 °C (104 °F) temperature change in eight hours.

Control functions

- Cycle cranking.
- PCCNet interface.
- Configurable inputs (2).
- Configurable outputs (2).
- Remote emergency stop.
- Time delay start and cooldown.

Engine protection

- Cranking lockout.
- Overspeed shutdown.
- Fail to start (overcrank) shutdown.
- Fail to crank shutdown.
- Sensor failure indication.
- Redundant start disconnect.
- Low fuel level warning or shutdown.
- Low oil pressure warning and shutdown.
- High coolant temperature warning and shutdown.
- Low coolant level warning or shutdown.
- Low coolant temperature warning.
- High, low, and weak battery voltage warning.

Operator/display panel

- Manual off switch.
- Bargraph display (optional).
- LED lamps indicating GenSet running, not in auto, common warning, common shutdown, manual run mode, and remote start.
- Alphanumeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols).

Other display data

- Fault history.
- GenSet model data.
- RS485 Modbus interface.
- Start attempts, starts, running hours.
- Data logging and fault simulation (requires InPower service tool).

Control options

- Remote operator panel.
- PMG alternator excitation.
- AC output analog meters (bargraph).
- Auxiliary output relays (2).
- Modbus to BACnet Module.
- 120/240 V, 100 W anti-condensation heater.
- Remote annunciator with configurable inputs (3) and configurable outputs (4).
- Auxiliary, configurable signal inputs (8) and configurable relay outputs (8).
- PowerCommand 3.3 control with AmpSentry protection.

→ PowerCommand 3.3 control system



An integrated microprocessor based generator set control system providing voltage regulation, engine protection, alternator protection, operator interface and isochronous governing. Refer to document S-1570 for more detailed information on the control.

AmpSentry - Includes integral AmpSentry protection, which provides a full range of alternator protection functions that are matched to the alternator provided.

Power management - Control function provides battery monitoring and testing features and smart starting control system.

Advanced control methodology - Three-phase sensing, full wave rectified voltage regulation, with a PWM output for stable operation with all load types.

Communications interface - Control comes standard with PCCNet and Modbus interface.

Regulation compliant - Prototype tested: UL, CSA and CE compliant.

Service - InPower PC-based service tool available for detailed diagnostics, setup, data logging and fault simulation.

Easily upgradeable - PowerCommand controls are designed with common control interfaces.

Reliable design - The control system is designed for reliable operation in harsh environment.

Multi-language support - English, Spanish, French (standard); other languages (optional).

Operator panel features

Operator/display panel

- Displays paralleling breaker status.
- 320 x 240 pixels graphic LED backlight LCD.
- Provides direct control of the paralleling breaker.
- Alphanumeric display with pushbuttons.
- Auto, manual, start, stop, fault reset, and lamp test/panel lamp switches.
- LED lamps indicating GenSet running, remote start, not in auto, common shutdown, common warning, manual run mode, auto mode and stop.

Paralleling control functions

- First Start Sensor System selects first genset to close to bus.
- Phase Lock Loop Synchronizer with voltage matching.
- Sync check relay.
- Isochronous kW and kVar load sharing.
- Load govern control for utility paralleling.
- Extended Paralleling (baseload/peak shave) Mode.
- Digital power transfer control, for use with a breaker pair to provide open transition, closed transition, ramping closed transition, peaking and base load functions.

Other control features

- 150 watt anti-condensation heater.
- DC distribution panel.
- AC auxiliary distribution panel.

Alternator data

- Line-to-neutral and line-to-line AC volts.
- Three-phase AC current.
- Frequency.
- kW, kVar, and power factor kVa (three-phase and total).
- Winding temperature (optional).
- Bearing temperature (optional).

Engine data

- DC voltage and engine speed.
- Lube oil pressure and temperature.
- Coolant temperature.
- Comprehensive FAE data.

Other display data

- GenSet model data.
- Start attempts, starts, running hours, kW hours.
- Load profile (operating hours at % load in 5% increments).
- Fault history – up to 32 events.
- Data logging and fault simulation (requires InPower™).
- Air cleaner restriction indication.
- Exhaust temperature in each cylinder.

Standard control functions

Digital governing

- Temperature dynamic governing.
- Integrated digital electronic isochronous governing.

Digital voltage regulation

- Configurable torque matching.
- 3-phase, 4 wire line-to-line sensing.
- Integrated digital electronic voltage regulator.

AmpSentry AC protection

- AmpSentry protective relay.
- Over current and short circuit shutdown.
- Over current warning.
- Single and three-phase fault regulation.
- Low oil pressure warning and shutdown.
- High coolant temperature warning and shutdown.
- Low coolant level warning and shutdown.
- Low coolant temperature warning.
- Over and under voltage shutdown.
- Over and under frequency shutdown.
- Overload warning with alarm contact.
- Reverse power and reverse var shutdown.
- Field overload shutdown.
- Fuel-in-rupture-basin warning or shutdown.
- Full authority electronic engine protection.
- AMM arc flash provision

Engine protection

- Cranking lockout; overspeed shutdown; and battleshort.
- Sensor failure indication.
- Low fuel level warning or shutdown.
- Fail to start (overcrank) and fail to crank shutdown.
- Full authority electronic engine protection.
- Battery voltage monitoring, protection, and testing.

Control functions

- Data logging and cycle cranking.
- Load shed.
- Remote emergency stop.
- Time delay start and cooldown.
- Configurable inputs and outputs (20).
- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop.

GenSet options and accessories

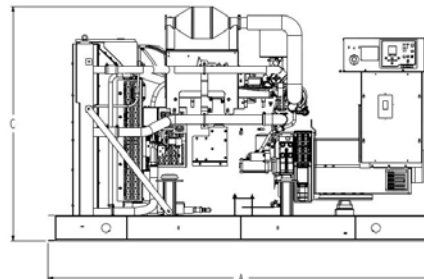
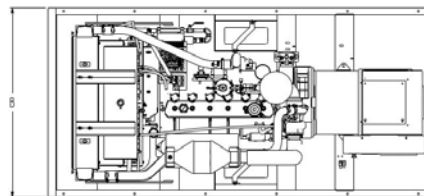
Engine

- 120/208-240 V, 2500 W coolant heaters
 - 120 V, 400 W oil pan heater
- Fuel system** - flexible fuel connector and fuel strainer

Exhaust system - GenSet mounted muffler (enclosure models, only)

Generator set

- PCC 3.3 MLD controls
- Batteries and battery charger
- ABB EMAX E.O. generator breaker
- Main line circuit breaker
- PowerCommand Network Input/Output (I/O) Module
- Modbus to BACnet Module
- Weather protective enclosure (F001) with silencer
- Level II enclosure w/silencer
- Audible alarm; remote drains; oil maintainer
- Remote annunciator panel and spring isolators
- Two-year standby warranty
- Five-year basic power warranty



This outline drawing is for reference only.
Do not use for installation design.

	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)
C200N6 Standby	3124 (123)	1524 (60)	1886 (74)
C200N6 Prime	4039 (159)	1524 (60)	1892 (75)

NOTE: Consult drawings for applicable weights. See enclosure Specification Sheet for enclosure dimensions.

Codes and standards

Codes and standards compliance may not be available with all model configurations - consult factory for availability.



Underwriters Laboratory (UL) is a world leader in product safety testing and certification. This GenSet is certified to UL2200 as open set, weather enclosure, and sound-attenuated enclosure configurations. The generator is certified to UL1004. The PowerCommand® Control System is certified to UL508. (See Fuel Installation Requirements on this page.)



CSA Group tests products under a formal process to ensure that they meet the safety and/or performance requirements of applicable standards. This GenSet is certified to: CSA 22.2 No. 100 Motors and Generators; CSA 22.2 No. 0.4-044 Bonding of Electrical Equipment; CSA 22.2 No. 14 Industrial Control Equipment; and CSA 22.2 No. 0 General Requirements - Canadian Electrical Code, Part II. (See Fuel Installation Requirements on this page.)



Engine is certified to Stationary Non-Emergency U.S. EPA New Source Performance Standards (NSPS), 40 CFR 60 subpart JJJJ.
Engine is certified to Mobile Non-Emergency U.S. EPA New Source Performance Standards (NSPS), 40 CFR 60 subpart JJJJ.
U.S. applications must be applied per EPA regulations.



This product has been manufactured under the controls established by a Bureau Veritas Certification approved management system that conforms to ISO 9001:2015.

Fuel installation requirements

Gas supply pressure is specified at the inlet to the fuel shut-off solenoid (FSO). If this engine is equipped with two FSOs in series, this value should be measured at the inlet to the downstream FSO. Each FSO can reduce the supply pressure up to 5" W.C. at full load. Additional options added to the fuel train such as those for CSA or UL compliance, strainers and/or flex connections can add restriction that must be considered in the site installation.

Ratings definitions

Emergency Standby Power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power is in accordance with ISO 3046, AS 2789, DIN 6271, and BS 5514.

Prime Power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271, and BS 5514.

Base Load (Continuous) Power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271, and BS 5514.

Demand Response Power Rating - Spark Ignited Gas (DRP):

Applicable for supplying electrical power in parallel with commercially available power in variable and non-variable load applications. This fuel rating is intended for use in situations where power outages are contracted, such as in utility power curtailment. Engine operation is limited to a total of 500 hours per year. Engines may be operated in parallel to the public utility for up to 500 hours per year, with an average load factor no greater than 80% of rated Demand Response Power. Engines with Standby Power ratings available can be run in Emergency Standby applications up to the Standby Power rating for up to 50 hours per year. The customer should be aware, however, that the life of any engine will be reduced by constant high load operation.

Warning: Backfeed to a utility system can cause electrocution and/or property damage. Do not connect GenSets to any building electrical system except through an approved device or after the building main disconnect is open. Neutral connection must be bonded in accordance with National Electrical Code.

Specifications are subject to change without notice.

Power You Can Rely On

To order, contact centralregionorders@cummins.com.



Cummins Sales and Service
875 Lawrence Drive
DePere, Wisconsin 54115

cummins.com



Cummins NPower LLC Generator Sets Limited Warranty

4/24/2015

Commercial Generating Set

This limited warranty applies to all Cummins NPower LLC (hereinafter referred to as "Cummins NPower" branded commercial generating sets and associated accessories (hereinafter referred to as "Product"). This warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

Warranty Period:

The warranty start date for stationary Product is the date of initial startup, demonstration or 18 months after factory ship date, whichever is sooner. The warranty start date for rental or oil and gas products is the date of receipt of Product by the end customer. See table for details.

→ **Emergency Standby Power (ESP)** is defined as the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a reliable utility power outage. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP. For applications supporting an unreliable utility service, the Prime Power (PRP) rating should be used.

Unlimited Time Prime Power (UPRP) is defined as being the maximum power which a generator set is capable of delivering while supplying a variable electrical load not to exceed to exceed 70% average of Unlimited Prime power rating during any operating period of 250 hours. Total operating time at 100%UPRP rating shall not exceed 500 hours/year.

Limited Time Prime Power (LPRP) is defined as being a limited number of hours in a non-variable load application. It is intended for use in situations where power outages are contracted, such as in utility power curtailment. Engines may be operated in parallel to the public utility up to 500 hours/year at power levels never to exceed the LPRP rating.

Continuous Power (CRP) is defined as being able to supply utility power at a constant 100 percent load for an unlimited number of hours per year. No overload capability is available for this rating. Reference Cummins Bulletin # 3381307

Base Warranty Duration (Whichever occurs first)

Rating	Months	Maximum Hours
Emergency Standby Power (ESP)	12	200
Unlimited Time Prime Power (UPRP)	12	Unlimited
Limited Time Prime Power (LPRP)	12	750
Continuous Power (CRP)	12	Unlimited

Cummins NPower Responsibilities:

In the event of a failure of the Product during the warranty period due to defects in material or workmanship, Cummins NPower will only be responsible for the following costs:

- All parts and labor required to repair the Product.
- Reasonable travel expenses to and from the Product site location.
- Maintenance items that are contaminated or damaged by a warrantable failure.



Owner Responsibilities:

The owner will be responsible for the following:

- Notifying the Cummins NPower distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins NPower's published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.

In addition, the owner will be responsible for:

- Incremental costs and expenses associated with Product removal and reinstallation resulting from difficult or non-standard installations.
- Costs associated with rental of generating sets used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

Limitations:

This limited warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating or application guidelines.
- Normal wear and tear, negligence, accidents or misuse.
- Improper and/or unauthorized installation.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins NPower published guideline or policy.
- Use of improper or contaminated fuels, coolants or lubricants.
- Improper storage before and after commissioning.
- Owner's delay in making Product available after notification of potential Product problem.
- Replacement parts and accessories not authorized by Cummins NPower.
- Use of Battle Short Mode.
- Owner or operator abuse or neglect such as: operation without adequate coolant or lubricants; over-fueling; over-speeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device.
- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the generating set.

This Limited Warranty **does not** apply to:

- Costs of maintenance, adjustments, installation, commissioning or start-up.
- Starting batteries, battery chargers, heating elements, trailers and enclosures. (These components shall be covered by the respective manufacturer's warranty.)
- Components added to the Product after shipment from Cummins NPower.

Please contact your local Cummins NPower Distributor for clarification concerning these limitations.



Extended Warranty

Extended Coverage may be purchased to include parts and labor for the engine and generator for a 5 year, 1500 hour period. The extended engine warranty is outlined as described in Bulletin #3624423 for Cummins ENCOMPASS Extended Coverage program.

Warranty Options (Whichever occurs first)

Rating	Months	Maximum Hours
Emergency Standby Power (ESP) – 2 yr Basic Extension	24	400
Emergency Standby Power (ESP) – 5 yr ENCOMPASS Extension	60	1500

NOTES:

- For Base Engine Warranty Only, reference Cummins Bulletin # 3381307.
- The A/C Generator (Alternator) carries a 2 Year / 1000 hours warranty, limited to 500 hours per year for 2 years, whichever is shorter for Emergency or Standby use.

Cummins NPower Right to Failed Components:

Failed components claimed under warranty remain the property of Cummins NPower. Cummins NPower has the right to reclaim any failed component that has been replaced under warranty.

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS NPOWER IN REGARD TO THE PRODUCT. CUMMINS NPOWER MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT IS CUMMINS NPOWER LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This limited warranty shall be enforced to the maximum extent permitted by applicable law. This limited warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.



PowerCommand® 3.3 Generator Set Digital Integrated Control System



Bargraph Optional

Introduction

The PowerCommand® 3.3 control system is a microprocessor-based generator set monitoring, metering, and control system, which is comprised of PowerCommand® Control 3300 and the Human Machine Interface 320. PCC3300 supports multiple operation modes including:

- Standalone,
- Synchronization only,
- Isolated bus paralleling,
- Utility single generator set paralleling,
- Utility multiple generator set paralleling,
- Utility single generator set paralleling with power transfer control (automatic mains failure),
- Isolated bus paralleling with Masterless Load Demand

PowerCommand® Control 3300 is designed to meet the exacting demands of the harsh and diverse environments of today's typical power generation applications for Full Authority Electronic or Hydromechanical engine power generator sets.

Offering enhanced reliability and performance over more conventional generator set controls via the integration of all generator control functions into a single system, PCC3300 is your Power of One generator set control solution.

Benefits and Features

- 320 x 240 pixels graphical LED backlit LCD
- Multiple languages supported
- AmpSentry™ protection provides industry-leading generator overcurrent protection
- Digital Power Transfer Control (Automatic Mains Failure) provides load transfer operation in open transition, closed transition, or soft (ramping) transfer modes

- Extended Paralleling (Peak Shave/Base Load) regulates the genset real and reactive power output while paralleled to the utility. Power can be regulated at either the genset or utility bus monitoring point
- Digital frequency synchronization and voltage matching
- Isochronous Load Sharing
- Droop kW and kVAr control
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop initiate a test with or without load, or a Base Load or Peak Shave session
- Digital automatic voltage regulation is provided using three phase sensing and full wave FET type regulator, which is compatible with either shunt or PMG excited systems with a standard AUX103 AVR or an option for a more powerful high-current field drive capability AUX106 AVR
- Digital engine speed governing is provided on applicable platforms
- Generator set monitoring (including metering) and protection with PCC3300 measuring voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Utility / AC Bus metering and protection with PCC3300 voltage, current, kW and kVAr offering a measurement accuracy of 1%
- 12 V (DC) and 24 V (DC) battery operation
- RS-485 Modbus® interface for interconnecting to customer equipment
- Warranty and service – Cummins Power Generation offers a comprehensive warranty and worldwide distributor service network
- Global regulatory certification and compliance: PCC3300 is suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std. and CE standards

PowerCommand® Generator Set Digital Control System PCC 3300



Introduction

PCC3300 is an industry-leading digital generator set control suitable for usage on a wide range of diesel and lean burn natural gas generator sets in both standalone as well as paralleling applications.

PowerCommand® is compatible with either shunt or PMG excitation, and is suitable for usage with reconnectable or non-reconnectable generators. Configuration for any frequency, voltage and power connection from 120 V (AC) to 600 V (AC) line-to-line or 601 V (AC) to 45k V (AC) with an external PT is supported. The PCC3300 derives its own power from the generator set starting batteries and functions over a voltage range of 8 V (DC) to 30 V (DC).

Features

- PCC3300 supports configurable control features via software download using InPower PC-compatible software
- 12 V (DC) and 24 V (DC) battery operation
- Digital automatic voltage regulation is provided using three phase sensing and full wave FET type regulator, which is compatible with either shunt or PMG excited systems with a standard AUX103 AVR or an option for a more powerful high-current field drive capability AUX106 AVR
- Digital engine speed governing on applicable platform is provided, which is capable of providing isochronous frequency regulation
- Full authority J1939 CANBus® prime mover communications and control is provided for platforms with an Engine Control Module (ECM)
- AmpSentry™ protection provides industry-leading alternator overcurrent protection:
 - Time-based generator protection applicable to both line-to-line and line-to-neutral, that can detect an unbalanced fault condition and swiftly react appropriately. Balanced faults can also be detected by AmpSentry and appropriate acted upon.
 - Reduces the risk of Arc Flash due to thermal overload or electrical faults by inverse time protection

- Generator set monitoring offers status information for all critical prime mover and generator functions
- AC and DC digital generator set metering is provided. AC measurements are configurable for single or three phase sensing with PCC3300 measuring voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Battery monitoring system continually monitors the battery output and warns of the potential occurrence of a weak battery condition
- Relay drivers for prime mover starter, fuel shutoff (FSO), glow plug/spark ignition power and switched B+ applications are provided
- Integrated generator set protection is offered to protect the prime mover and generator
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop initiate a test with or without load, or a Base Load or Peak Shave session
- Digital Power Transfer Control (Automatic Mains Failure) provides load transfer operation in open transition, closed transition, or soft (ramping) transfer modes
- Extended Paralleling (Peak Shave/Base Load) regulates the genset real and reactive power output while paralleled to the utility. Power can be regulated at either the genset or utility bus monitoring point
- Digital frequency synchronization and voltage matching
- Isochronous Load Sharing
- Droop kW and kVAr Control
- The synchronization check function provides adjustments for phase angle window, voltage window, frequency window and time delay
- Utility / AC Bus metering and protection with PCC3300 voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Advanced serviceability is offered via InPower™, a PC-based software service tool
- PCC3300 is designed for reliable operation in harsh environments with the unit itself being a fully encapsulated module
- RS-485 ModBus interface for interconnecting to customer equipment
- Native on PCC3300: Four discrete inputs, two dry contact relay outputs and two low-side driver outputs are provided and are all configurable.
 - Optional extra PCC3300 input and output capability available via AUX101
- Warranty and service – Cummins Power Generation offers a comprehensive warranty and worldwide distributor service network
- Global regulatory certification and compliance: PCC3300 is suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std. and CE standards

Base Control Functions

HMI capability

Options: Local and remote HMI320 options are available

Operator adjustments: The HMI320 includes provisions for many set up and adjustment functions.

Genset hardware data: Access to the control and software part number, genset rating in kVA and genset model number is provided from the HMI320 or InPower.

Data logs: Information concerning all of the following parameters is periodically logged and available for viewing; engine run time, controller on time, number of start attempts, total kilowatt hours, and load profile. (Control logs data indicating the operating hours at percent of rated kW load, in 5% increments. The data is presented on the operation panel based on total operating hours on the generator.)

Fault history: Provides a record of the most recent fault conditions with control date and time stamp. Up to 32 events are stored in the control non-volatile memory.

Alternator data

- Voltage (single or three phase line-to-line and line-to-neutral)
- Current (single or three phase)
- kW, kVAR, Power Factor, kVA (three phase and total)
- Frequency

For Lean Burn Natural Gas Engine applications:

- Alternator heater status
- Alternator winding temperature (per phase) as well as alternator drive end and non-drive end bearing

Utility/AC bus data

- Voltage (three phase line-to-line and line-to-neutral)
- Current (three phase and total)
- kW, kVAR, Power Factor, kVA (three phase and total)
- Frequency

AmpSentry: 3x current regulation for downstream tripping/motor inrush management. Thermal damage curve (3-phase short) or fixed timer (2 sec for 1-Phase Short or 5 sec for 2-Phase short).

Engine data

- Starting battery voltage
- Engine speed
- Engine temperature
- Engine oil pressure
- Engine oil temperature
- Intake manifold temperature
- Coolant temperature
- Comprehensive Full Authority Engine (FAE) data (where applicable)

Lean Burn Natural Gas (LBNG) application parameters include:

- Safety shutoff valve status
- Valve proving status
- Downstream gas pressure
- Gas inlet pressure
- Gas mass flow rate
- Control valve position
- Gas outlet pressure
- Manifold pressure and temperature
- Throttle position
- Compressor outlet pressure
- Turbo speed
- Compressor bypass position
- Cylinder configuration (e.g., drive end and non-drive end configurations)
- Coolant pressure 1 and 2 as well as coolant temperature 1 and 2 for both HT/LT respectively
- Exhaust port temperature (up to 18 cylinders)
- Pre-filter oil pressure
- Exhaust back pressure
- Parent ECM internal temperature and isolated battery voltage
- Speed bias
- Child ECM internal temperature and isolated battery voltage
- Knock level, spark advance, and knock count (for up to 18 cylinders)
- Auxiliary supply disconnect status
- Engine heater status
- Coolant circulating pump status
- Lube oil priming pump status
- Lube oil status
- Oil heater status
- Derate authorization status
- Start system status
- Ventilator fan status
- Ventilation louvre status
- Radiator fan status
- DC PSU status
- Start inhibit/enable status and setup

Service adjustments – The HMI320 includes provisions for adjustment and calibration of genset control functions. Adjustments are protected by a password. Functions include:

- Engine speed governor adjustments
- Voltage regulation adjustments
- Cycle cranking
- Configurable fault set up
- Configurable input and output set up
- Meter calibration
- Paralleling setup
- Display language and units of measurement

Prime Mover Control

SAE-J1939 CAN interface to full authority ECMs (where applicable). Provides data transfer between genset and engine controller for control, metering and diagnostics.

12 V (DC) or 24 V (DC) nominal battery voltage is supported by PCC3300 for normal operation.

Temperature dependant prime mover governing dynamics: This function is supported enabling the engine to be responsive when warm and more stable when operating at lower temperature via providing control and modification over electronic governing parameters as a function of engine temperature.

Isochronous governing is provided in order to control prime mover speed within $\pm 0.25\%$ of nominal rated speed for any steady state load from no load to full load. During operation frequency drift should not exceed $\pm 0.5\%$ of nominal frequency given a 33°C (or 60°F) change in ambient temperature within an eight-hour period.

Droop electronic speed is governing capability is natively offered by PCC3300 to permit droop from 0% to 10% between no load to full load.

Remote start capability is built into the PCC3300 as the unit accepts a ground signal from remote devices to automatically command the starting of the generator set as well as the reaching of rated speed, voltage and frequency or otherwise run at idle speed until prime mover temperature is adequate. The presence of a remote start signal shall cause the PCC3300 to leave sleep mode and return to normal power mode. PCC3300 supports an option for delayed start or stop.

Remote Start Integrity: In compliance with NEC2017 Start Signal Integrity standard – NFPA70 Article 700.10(D)(3), the remote start circuit from ATS to PCC3300 is continuously monitored for signal disturbance due to broken, disconnected or shorted wires via a configurable input. Loss of signal integrity results in activation of a remote start signal.

Remote and local emergency stopping capability: PCC3300 accepts ground signal from a locally or remotely mounted emergency stop switch to cause the generator set to immediately shutdown. The generator set is prevented from either running or cranking with the emergency stop switch engaged. If PCC3300 is in sleep mode, then the activation of any emergency stop switch shall return PCC3300 to normal powered state along with the activation of the corresponding shutdown and run-prevention states.

Sleep mode: PowerCommand 3.3 supports a configurable low current draw state, which is designed with consideration to the needs of prime applications or other applications without a battery charger (in order to minimize battery current drain).

Automatic prime mover starting: Any generator set controlled by PCC3300 is capable of automatic starting achieved via either magnetic pickup or main alternator output frequency. PCC3300 additionally supports

configurable glow plug control where applicable.

Prime mover cycle cranking: PCC3300 supports configurable starting cycles and rest periods. Built-in starter protection is incorporated to prevent the operator from specifying a starting sequence that may be damaging.

Configurable time delay functionality: PCC3300 supports time delayed generator set starting and stopping (for cooldown). Permissible time delays are as follows (noting a default setting is 0 seconds):

1. Start delay: 0 seconds to 300 seconds prior to starting after receiving a remote start signal.
2. Stop delay: 0 seconds to 600 seconds prior to shut down after receiving a signal to stop in normal operation modes.

Lean Burn Natural Gas application specific parameters

PCC3300 supports prime mover inhibiting in order to permit application-specific processes (i.e. Auxiliaries) to be started first.

Generator Control

PCC3300 performs both Genset voltage sensing and Genset voltage regulation as follows:

- Voltage sensing is integrated into PCC3300 via three phase line-to-line sensing that is compatible with shunt or PMG excitation systems
- Automatic voltage regulation is accomplished by using a three phase fully rectified input and has a FET output for good motor starting capability.

Major features of generator control include:

Digital output voltage regulation - Capable of regulating output voltage to within $\pm 1.0\%$ for any loads between no load and full load. Voltage drift will not exceed $\pm 1.5\%$ for a 40 °C (104 °F) change in temperature in an eight-hour period. On engine starting or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level.

The automatic voltage regulator feature can be disabled to allow the use of an external voltage regulator.

Droop voltage regulation - Control can be adjusted to droop from 0-10% from no load to full load.

Torque-matched V/Hz overload control - The voltage roll-off set point and rate of decay (i.e. the slope of the V/Hz curve) is adjustable in the control.

Fault current regulation - PowerCommand® will regulate the output current on any phase to a maximum of three times rated current under fault conditions for both single phase and three phase faults. In conjunction with a permanent magnet generator, it will provide three times rated current on all phases for motor starting and short circuit coordination purpose.

Cylinder Cut-off System (CCS): PCC 3300 supports Cylinder Cut-off System which is used to operate the engines on half bank at no load and light load conditions. CCS has the following benefits on engine

performance- improved emission standards, improved fuel efficiency, reduced hydrocarbons, reduced white smoke, reduced wet stacking and higher exhaust temperature at light loads to improve turbocharger operations and catalyst performance.

Step Timing Control (STC): PCC 3300 supports STC functionality which is used to advance the engine timing of a hydro-mechanical engine during start up and light load conditions. During ADVANCED injection timing, it:

- Improves cold weather idling characteristics
- Reduces cold weather white smoke
- Improves light load fuel economy
- Reduces injector carboning

Paralleling Functions

First Start Sensor™ system – PowerCommand® provides a unique control function that positively prevents multiple gensets from simultaneously closing to an isolated bus under black start conditions. The First Start Sensor system is a communication system between the gensets that allows the gensets to work together to determine which genset is a system should be the first to close to the bus. The system includes an independent backup function, so that if the primary system is disabled the required functions are still performed.

Synchronizing – Control incorporates a digital synchronizing function to force the genset to match the frequency, phase and voltage of another source such as a utility grid. The synchronizer includes provisions to provide proper operation even with highly distorted bus voltage waveforms. The synchronizer can match other sources over a range of 60-110% of nominal voltage and -24 to +6 hertz. The synchronizer function is configurable for slip frequency synchronizing for applications requiring a known direction of power flow at instant of breaker closure or for applications where phase synchronization performance is otherwise inadequate.

Load sharing control – The genset control includes an integrated load sharing control system for both real (kW) and reactive (kVar) loads when the genset(s) are operating on an isolated bus. The control system determines kW load on the engine and kVar load on the alternator as a percent of genset capacity, and then regulates fuel and excitation systems to maintain system and genset at the same percent of load without impacting voltage or frequency regulation. The control can also be configured for operation in droop mode for kW or Kvar load sharing.

Load govern control– When PowerCommand® receives a signal indicating that the genset is paralleled with an infinite source such as a utility (mains) service, the genset will operate in load govern mode. In this mode the genset will synchronize and close to the bus, ramp to a pre-programmed kW and kVar load level, and then operate at that point. Control is adjustable for kW

values from 0-100% of standby rating, and 0.7-1.0 power factor (lagging). Default setting is 80% of standby and 1.0 power factor. The control includes inputs to allow independent control of kW and kVar load level by a remote device while in the load govern mode. The rate of load increase and decrease is also adjustable in the control. In addition, the control can be configured for operation in kW or kVAR load govern droop.

Load demand control – The control system includes the ability to respond to an external signal to initiate load demand operation. On command, the genset will ramp to no load, open its paralleling breaker, cool down, and shut down. On removal of the command, the genset will immediately start, synchronize, connect, and ramp to its share of the total load on the system.

Sync check – The sync check function decides when permissive conditions have been met to allow breaker closure. Adjustable criteria are: phase difference from 0.1-20 deg, frequency difference from 0.001-1.0 Hz, voltage difference from 0.5-10%, and a dwell time from 0.5-5.0 sec. Internally the sync check is used to perform closed transition operations. An external sync check output is also available.

Genset and utility/AC bus source AC metering – The control provides comprehensive three phase AC metering functions for both monitored sources, including: 3-phase voltage (L-L and L-N) and current, frequency, phase rotation, individual phase and totalized values of kW, kVAR, kVA and Power Factor; totalized positive and negative kW-hours, kVAR-hours, and kVA-hours. Three wire or four wire voltage connection with direct sensing of voltages to 600V, and up to 45kV with external transformers. Current sensing is accomplished with either 5 amp or 1 CT secondaries and with up to 10,000 amp primary. Maximum power readings are 32,000kW/kVAR/kVA.

Power transfer control – provides integrated automatic power transfer functions including source availability sensing, genset start/stop and transfer pair monitoring and control. The transfer/retransfer is configurable for open transition, fast closed transition (less than 100msec interconnect time), or soft closed transition (load ramping) sequences of operation. Utility source failure will automatically start genset and transfer load, retransferring when utility source returns. Test will start gensets and transfer load if test with load is enabled. Sensors and timers include:

Under voltage sensor: 3-phase L-N or L-L under voltage sensing adjustable for pickup from 85-100% of nominal. Dropout adjustable from 75-98% of pickup. Dropout delay adjustable from 0.1-30 sec.

Over voltage sensor: 3-phase L-N or L-L over voltage sensing adjustable for pickup from 95-99% of dropout. Dropout adjustable from 105-135% of nominal. Dropout delay adjustable from 0.5-120 sec. Standard configuration is disabled and is configurable to enabled in the field using the HMI or InPower service tools.

Over/Under frequency sensor: Center frequency adjustable from 45-65 Hz. Dropout bandwidth adjustable from 0.3-5% of center frequency beyond pickup bandwidth. Pickup bandwidth adjustable from 0.3-20% of center frequency. Field configurable to enable.

Loss of phase sensor: Detects out of range voltage phase angle relationship. Field configurable to enable.

Phase rotation sensor: Checks for valid phase rotation of source. Field configurable to enable.

Breaker tripped: If the breaker tripped input is active, the associated source will be considered as unavailable.

Timers: Control provides adjustable start delay from 0 - 300sec, stop delay from 0 - 800sec, transfer delay from 0-120sec, retransfer delay from 0-1800sec, programmed transition delay from 0-60sec, and maximum parallel time from 0-1800sec.

Negative Sequence Current Protection: PCC3300 supports this protection natively in order to determine if the generator is at any point was running subject to negative phase sequencing.

Breaker control – Utility and Genset breaker interfaces include separate relays for opening and closing breaker, as well as inputs for both 'a' and 'b' breaker position contacts and tripped status. Breaker diagnostics include Contact Failure, Fail to Close, Fail to Open, Fail to Disconnect, and Tripped. Upon breaker failure, appropriate control action is taken to maintain system integrity.

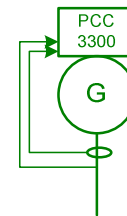
Exerciser clock –The exerciser clock (when enabled) allows the system to be operated at preset times in either test without load, test with load, or extended parallel mode. A Real Time Clock is built in. Up to 12 different programs can be set for day of week, time of day, duration, repeat interval, and mode. For example, a test with load for 1 hour every Tuesday at 2AM can be programmed. Up to 6 different exceptions can also be set up to block a program from running during a specific date and time period.

Extended paralleling – In extended paralleling mode (when enabled) the controller will start the genset and parallel to a utility source and then govern the real and reactive power output of the genset based on the desired control point. The control point for the real power (kW) can be configured for either the genset metering point ("Base Load") or the utility metering point ("Peak Shave"). The control point for the reactive power (kVAR or Power Factor) can also be independently configured for either the genset metering point or the utility metering point. This flexibility would allow base kW load from the genset while maintaining the utility power factor at a reasonable value to avoid

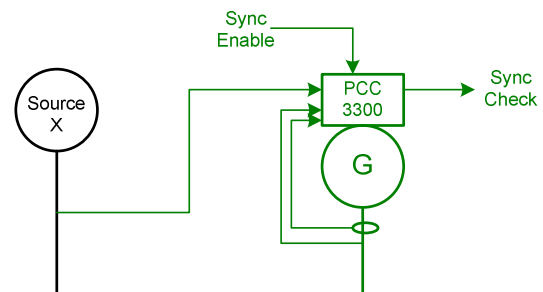
penalties due to low power factor. The System always operates within genset ratings. The control point can be changed while the system is in operation. Set points can be adjusted via hardwired analog input or adjusted through an operator panel display or service tool.

Application types – Controller is configured to operating in one of six possible application types. These topologies are often used in combinations in larger systems, with coordination of the controllers in the system either by external device or by interlocks provided in the control. Topologies that may be selected in the control include:

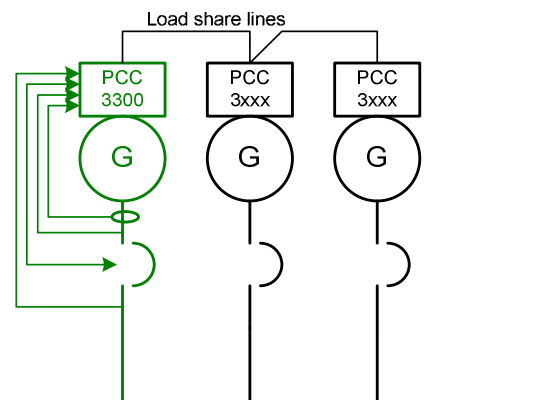
Standalone: Control provides monitoring, protection and control in a non-paralleling application.



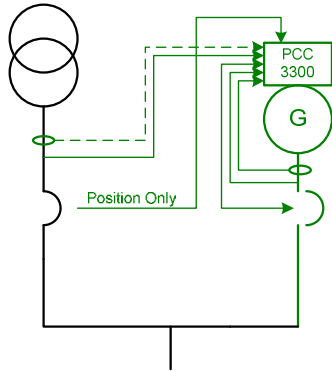
Synchronizer only: control will synchronize the genset to other source when commanded to either via a hardwired or Modbus driven input.



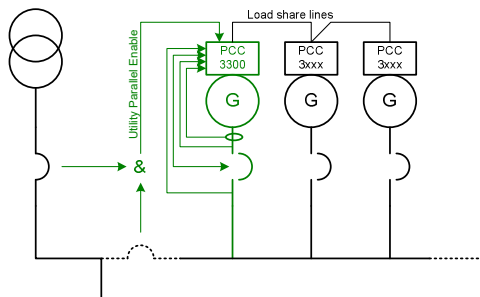
Isolated Bus: allows the genset to perform a dead bus closure or synchronize to the bus and isochronously share kW and kVAR loads with other gensets.



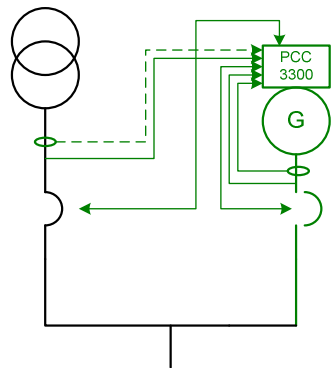
Utility Single: Control monitors one genset and utility. The control will automatically start and provide power to a load if the utility fails. The control will also resynchronize the genset back to the utility and provides extended paralleling capabilities.



Utility Multiple: Supports all functionality of Isolated Bus and provides extended paralleling to the utility. Extended paralleling load set points follow a constant setting; dynamically follow an analog input, Modbus register or HMI.

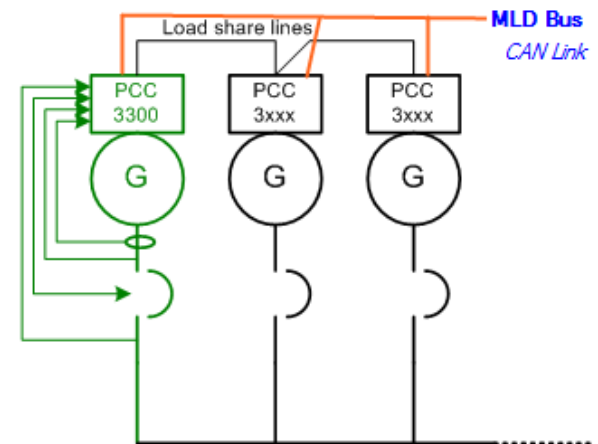
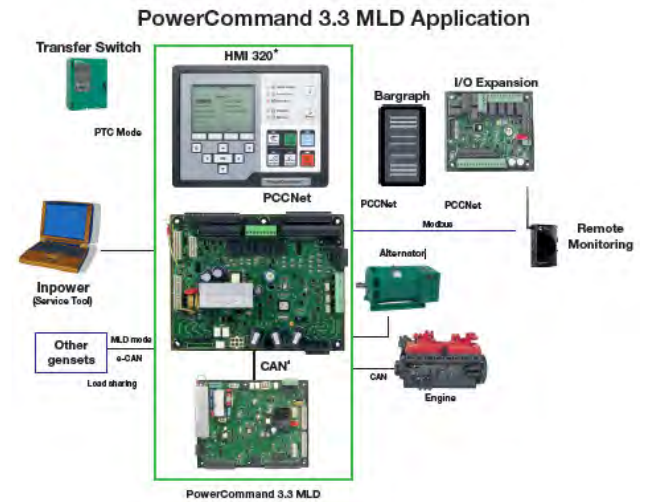


Power Transfer Control: Control operates a single genset/single utility transfer pair in open transition, fast closed transition, or soft closed transition. Extended paralleling functionality also provides base load and peak shave options.



Masterless Load Demand (Optional Feature):

PowerCommand® 3.3 with Masterless Load Demand (MLD) technology enables generator sets to start/stop automatically based on load demand. Masterless Load Demand-capable generators are equipped with an additional s-CAN network connection that allows sharing of information amongst paralleled generator sets. MLD has been designed for hassle-free installation, commissioning and operation. MLD functionality. Integrated on-board system logic provides the MLD topology control without the need for any additional system.



PCC3300 External Voltage and Frequency Biasing Inputs

PCC3300 supports externally driven voltage and frequency biasing capability in order to permit external paralleling (if intending to use this feature please contact your local distributor for further information).

Protective Functions

On operation of a protective function the control will indicate a fault by illuminating the appropriate status LED on the HMI, as well as display the fault code and fault description on the LCD. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower service tool provide service keys and procedures based on the service codes provided. Protective functions include:

Battle short mode

When enabled and the *battle short* switch is active, the control will allow some shutdown faults to be bypassed. If a bypassed shutdown fault occurs, the fault code and description will still be annunciated, but the genset will not shutdown. This will be followed by a *fail to shutdown* fault. Emergency stop shutdowns and others that are critical for proper operation (or are handled by the engine ECM) are not bypassed. Please refer to the Control Application Guide or Manual for list of these faults.

Derate

The Derate function reduces output power of the genset in response to a fault condition. If a Derate command occurs while operating on an isolated bus, the control will issue commands to reduce the load on the genset via contact closures or Modbus. If a Derate command occurs while in utility parallel mode, the control will actively reduce power by lowering the base load kW to the derated target kW.

Configurable alarm and status inputs

The control accepts up to four alarm or status inputs (configurable contact closed to ground or open) to indicate a configurable (customer-specified) condition.

The control is programmable for warning, derate, shutdown, shutdown with cooldown or status indication and for labeling the input.

Emergency stop

Annunciated whenever either emergency stop signal is received from external switch.

General prime mover protection

Low and high battery voltage warning - Indicates status of battery charging system (failure) by continuously monitoring battery voltage.

Weak battery warning - The control system will test the battery each time the genset is signaled to start and indicate a warning if the battery indicates impending failure.

Low coolant level warning - Can be set up to be a warning or shutdown.

Low coolant temperature warning - Indicates that engine temperature may not be high enough for a 10 second start or proper load acceptance.

Fail to start (overcrank) shutdown - The control system will indicate a fault if the genset fails to start by the completion of the engine crank sequence.

Fail to crank shutdown - Control has signaled starter to crank engine but engine does not rotate.

Cranking lockout - The control will not allow the starter to attempt to engage or to crank the engine when the engine is rotating.

Fault simulation -The control in conjunction with InPower software, will accept commands to allow a technician to verify the proper operation of the control and its interface by simulating failure modes or by forcing the control to operate outside of its normal operating ranges. InPower also provides a complete list of faults and settings for the protective functions provided by the controller.

For Lean Burn Natural Gas Engine applications:

Off load running (protection) - This feature protects the engine in the event the genset is being called to go off load for too long.

Hydro Mechanical fuel system engine protection:

Overspeed shutdown - Default setting is 115% of nominal

Low lube oil pressure warning/shutdown - Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

High lube oil temperature warning/shutdown - Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

High engine temperature warning/shutdown - Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

Low coolant temperature warning - Indicates that engine temperature may not be high enough for a 10 second start or proper load acceptance.

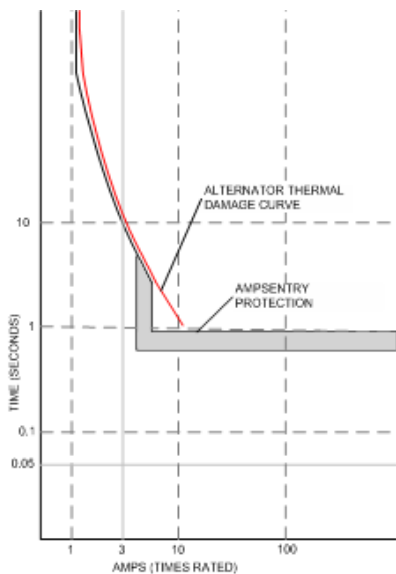
High intake manifold temperature shutdown - Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

Full authority electronic engine protection:

Engine fault detection is handled inside the engine ECM. Fault information is communicated via the SAE-J1939 data link for annunciation in the HMI.

Alternator Protection

AmpSentry protective relay - A comprehensive monitoring and control system integral to the PowerCommand® Control System that guards the electrical integrity of the alternator and power system by providing protection against a wide array of fault conditions in the genset or in the load. It also provides single and three phase fault current regulation (3x Current) so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. Thermal damage curve (3 phase short) or fixed timer (2sec for 1P short, 5sec for 2P short). See document R1053 for a full-size time over current curve. The control does not include protection required for interconnection to a utility (mains) service.



AmpSentry Maintenance Mode (AMM) - Instantaneous tripping, if AmpSentry Maintenance mode is active (50mS response to turn off AVR excitation/shutdown genset) for arc flash reduction when personnel are near genset.

High AC voltage shutdown (59) - Output voltage on any phase exceeds preset values. Time to trip is inversely proportional to amount above threshold. Values adjustable from 105-125% of nominal voltage, with time delay adjustable from 0.1-10 seconds. Default value is 110% for 10 seconds.

Low AC voltage shutdown (27) - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-20 seconds. Default value is 85% for 10 seconds. Function tracks reference voltage. Control does not nuisance trip when voltage varies due to the control directing voltage to drop, such as during a V/Hz roll-off or synchronizing.

Under frequency shutdown (81 u) - Genset output frequency cannot be maintained. Settings are adjustable from 2-10 Hz below reference governor set point, for a 5-20 second time delay. Default: 6 Hz, 10 seconds. Under frequency protection is disabled when excitation is switched off, such as when engine is operating in idle speed mode.

Over frequency shutdown/warning (81o) - Genset is operating at a potentially damaging frequency level. Settings are adjustable from 2-10 Hz above nominal governor set point for a 1-20 second time delay. Default: 6 Hz, 20 seconds, disabled.

Overcurrent warning/shutdown (51) - Implementation of the thermal damage curve with instantaneous trip level calculated based on current transformer ratio and application power rating.

Loss of sensing voltage shutdown - Shutdown of genset will occur on loss of voltage sensing inputs to the control.

Field overload shutdown - Monitors field voltage to shutdown genset when a field overload condition occurs.

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point. Adjustment range: 80-140% of application rated kW, 0-120 second delay. Defaults: 105%, 60 seconds.

Reverse power shutdown (32) - Adjustment range: 5-20% of standby kW rating, delay 1-15 seconds. Default: 10%, 3 seconds.

Reverse Var shutdown (40) - Shutdown level is adjustable: 15-50% of rated Var output, delay 10-60 seconds. Default: 20%, 10 seconds.

Short circuit protection - Output current on any phase is more than 175% of rating and approaching the thermal damage point of the alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time.

Negative sequence overcurrent warning (46) - Control protects the generator from damage due to excessive imbalances in the three phase load currents and/or power factors.

Custom overcurrent warning/shutdown (51) - Control provides the ability to have a custom time overcurrent protection curve in addition to the AmpSentry protective relay function.

Ground fault overcurrent (51G) - Control detects a ground fault either by an external ground fault relay via a contact input or the control can measure the ground current from an external current transformer. Associated time delays and thresholds are adjustable via InPower or HMI.

Paralleling Protection

Breaker fail to close Warning: When the control signals a circuit breaker to close, it will monitor the breaker auxiliary contacts and verify that the breaker has closed. If the control does not sense a breaker closure within an adjustable time period after the close signal, the fail to close warning will be initiated.

Breaker fail to open warning: The control system monitors the operation of breakers that have been signaled to open. If the breaker does not open within an adjustable time delay, a Breaker Fail to Open warning is initiated.

Breaker position contact warning: The controller will monitor both 'a' and 'b' position contacts from the breaker. If the contacts disagree as to the breaker position, the breaker position contact warning will be initiated.

Breaker tripped warning: The control accepts inputs to monitor breaker trip / bell alarm contact and will initiate a breaker tripped warning if it should activate.

Fail to disconnect warning: In the controller is unable to open either breaker, a fail to disconnect warning is initiated. Typically, this would be mapped to a configurable output, allowing an external device to trip a breaker.

Fail to synchronize warning: Indicates that the genset could not be brought to synchronization with the bus. Configurable for adjustable time delay of 10 -900 seconds, 120 default.

Phase sequence sensing warning: Verifies that the genset phase sequence matches the bus prior to allowing the paralleling breaker to close.

Maximum parallel time warning (power transfer control mode only): During closed transition load transfers, control independently monitors paralleled time. If time is exceeded, warning is initiated and genset is disconnected.

Bus or genset PT input calibration warning: The control system monitors the sensed voltage from the bus and genset output voltage potential transformers. When the paralleling breaker is closed, it will indicate a warning condition if the read values are different.

Field Control Interface

Input signals to the PowerCommand® control include:

- Coolant level (where applicable)
- Fuel level (where applicable)
- Remote emergency stop
- Remote fault reset
- Remote start
- Rupture basin
- Start type signal
- Battle short
- Load demand stop
- Synchronize enable
- Genset circuit breaker inhibit
- Utility circuit breaker inhibit
- Single mode verify
- Transfer inhibit – prevent transfer to utility (in power transfer control mode)
- Retransfer inhibit – prevent retransfer to genset (in power transfer control mode)
- kW and kVAR load setpoints

Configurable inputs - Control includes (4) input signals from customer discrete devices that are configurable for warning, shutdown or status indication, as well as message displayed

Input signals for Lean Burn Natural Gas Engine applications:

- Gearbox oil pressure/temperature protection
- Fire fault
- Earth fault support as a discrete input via an appropriate secondary detection device
- Differential fault
- DC power supply fault
- Genset Interface Box (GIB) isolator open fault
- Start inhibit/enable (x3)
- Radiator fan trip
- Ventilator fan trip
- Ventilation louvers closed
- Start system trip
- Alternator heater trip
- Alternator heater status
- Alternator winding temperature (PT100 RTDx3)
- Alternator drive end bearing temperature (PT100 RTD)
- Alternator non-drive end bearing temperature (PT100 RTD)

Output signals from the PowerCommand® control include:

- Load dump signal: Operates when the genset is in an overload condition.
- Delayed off signal: Time delay-based output which will continue to remain active after the control has removed the run command. Adjustment range: 0 - 120 seconds. Default: 0 seconds.

- Configurable relay outputs: Control includes (4) relay output contacts (3 A, 30VDC). These outputs can be configured to activate on any control warning or shutdown fault as well as ready to load, not in auto, common alarm, common warning and common shutdown.
- Ready to load (genset running) signal: Operates when the genset has reached 90% of rated speed and voltage and latches until genset is switched to off or idle mode.
- Paralleling circuit breaker relays outputs: Control includes (4) relay output contacts (3.5A, 30 VDC) for opening and closing of the genset and utility breakers.

Output Signals for Lean Burn Natural Gas Engine applications:

- Start inhibit/enable event
- Emergency stop event
- Ventilator fan run control
- Louvre control
- Radiator fan control
- Alternator heater control
- Engine at idle speed event

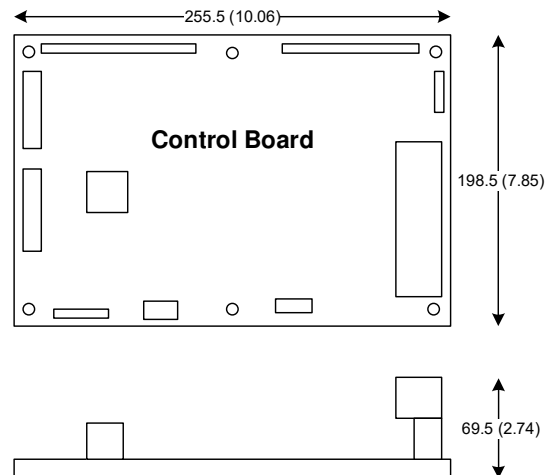
Communications connections include:

- PC tool interface: This RS-485 communication port allows the control to communicate with a personal computer running InPower software.
- Modbus RS-485 port: Allows the control to communicate with external devices such as PLCs using Modbus protocol.

Note - An RS-232 or USB to RS-485 converter is required for communication between PC and control.

- Networking: This RS-485 communication port allows connection from the control to the other Cummins Power Generation products.

Mechanical Drawing



PowerCommand® Human Machine Interface HMI320



Description

This control system includes an intuitive operator interface panel that allows for complete genset control as well as system metering, fault annunciation, configuration and diagnostics. The interface includes five genset status LED lamps with both internationally accepted symbols and English text to comply with customer's needs. The interface also includes an LED backlit LCD display with tactile feel soft-switches for easy operation and screen navigation. It is configurable for units of measurement and has adjustable screen contrast and brightness.

The run/off/auto switch function is integrated into the interface panel.

All data on the control can be viewed by scrolling through screens with the navigation keys. The control displays the current active fault and a time-ordered history of the five previous faults.

Features:

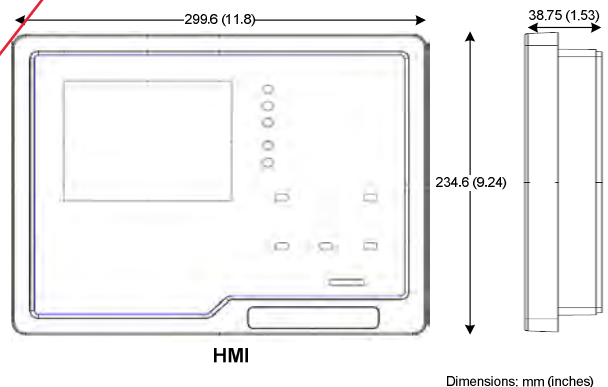
- LED indicating lamps
 - genset running
 - remote start
 - not in auto
 - shutdown
 - warning
 - auto
 - manual and stop
 - Circuit breaker open (if equipped)
 - Circuit breaker closed (if equipped)
- 320 x 240 pixels graphic LED backlight LCD.
- Four tactile feel membrane switches for LCD defined operation. The functions of these switches are defined dynamically on the LCD.
- Seven tactile feel membrane switches dedicated screen navigation buttons for up, down, left, right, ok, home and cancel.

- Six tactile feel membrane switches dedicated to control for auto, stop, manual, manual start, fault reset and lamp test/panel lamps.
- Two tactile feel membrane switches dedicated to control of circuit breaker (where applicable).
- Allows for complete genset control setup.
- Certifications: Suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std. and CE standards.
- Languages supported: English, Spanish, French, German, Italian, Greek, Portuguese, Finnish, Norwegian, Danish, Russian (Cyrillic), Chinese, Hungarian, Japanese, Polish, Korean, Romanian, Brazilian Portuguese, Turkish, Dutch, and Czech

Communications connections include:

- PC tool interface - This RS-485 communication port allows the HMI to communicate with a personal computer running InPower.
- This RS-485 communication port allows the HMI to communicate with the main control board.

Mechanical Drawing



Software

InPower (beyond 6.5 version) is a PC-based software service tool that is designed to directly communicate to PowerCommand® gensets and transfer switches, to facilitate service and monitoring of these products.

Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 °C (-40 °F) to +70 °C (158 °F), and for storage from -55 °C (-67 °F) to +80 °C (176 °F). Control will operate with humidity up to 95%, non-condensing.

The HMI is designed for proper operation in ambient temperatures from -20 °C (-4 °F) to +70 °C (158 °F), and for storage from -30 °C (-22 °F) to +80 °C (176 °F).

The control board is fully encapsulated to provide superior resistance to dust and moisture. Display panel has a single membrane surface, which is impervious to effects of dust, moisture, oil and exhaust fumes. This panel uses a sealed membrane to provide long reliable service life in harsh environments.

The control system is specifically designed and tested for resistance to RFI/EMI and to resist effects of vibration to provide a long reliable life when mounted on a genset. The control includes transient voltage surge suppression to provide compliance to referenced standards.

Certifications

PowerCommand® meets or exceeds the requirements of the following codes and standards:

- NFPA 110 for level 1 and 2 systems.
- ISO 8528-4: 1993 compliance, controls and switchgear.
- CE marking: The control system is suitable for use on generator sets to be CE-marked.
- EN 50081-1,2 residential/light industrial emissions or industrial emissions.
- EN 50082-1,2 residential/light industrial or industrial susceptibility.
- ISO 7637-2, level 2; DC supply surge voltage test.
- Mil Std 202C, Method 101 and ASTM B117: Salt fog test.
- UL 6200 recognized, suitable for use on UL 2200 Listed generator sets.
- CSA C282-M1999 compliance
- CSA 22.2 No. 14 M91 industrial controls.
- PowerCommand® control systems and generator sets are designed and manufactured in ISO 9001 certified facilities.
- ROHS (Restriction of Hazardous substance) complaint both for HMI 320 & PCC3300v2.

Reference Documents

Please refer to the following reference documents available in the PowerSuite library:

- PowerCommand™ 3.3. Application Guide
- T-037: PowerCommand Control Application Manual (ANSI Protective Functions)
- T-040: PowerCommand 3.3 Paralleling Application Guide

Please refer to the following reference documents available on Cummins Quickserve:

- Service Manuals for PC3.3 (non-MLD) and PC3.3 (MLD)
- Modbus Register Mapping

Warranty

All components and subsystems are covered by an express limited one-year warranty. Other optional and extended factory warranties and local distributor maintenance agreements are available.



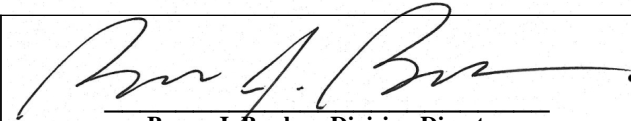


**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2020 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT**

**OFFICE OF TRANSPORTATION
AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105**

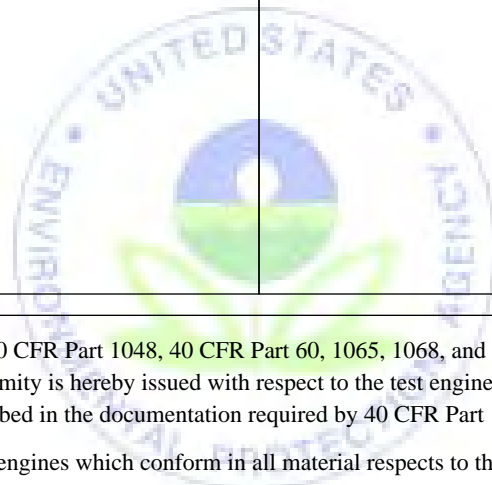
Certificate Issued To: Power Solutions International, Inc.
(U.S. Manufacturer or Importer)
Certificate Number: LPSIB11.1NGP-019

Effective Date:
10/02/2019
Expiration Date:
12/31/2020


Byron J. Bunker, Division Director
Compliance Division

Issue Date:
10/02/2019
Revision Date:
N/A

Manufacturer: Power Solutions International, Inc.
Engine Family: LPSIB11.1NGP
Mobile/Stationary Certification Type: Mobile and Stationary
Fuel : LPG/Propane
Natural Gas (CNG/LNG)
Emission Standards :
Part 60 Subpart JJJJ Table 1
NOx (g/Hp-hr) : 1.0
CO (g/Hp-hr) : 2.0
VOC (g/Hp-hr) : 0.7
Mobile Part 1048
CO (g/kW-hr) : 4.4
NMHC + NOx (g/kW-hr) : 2.7
HC + NOx (g/kW-hr) : 2.7
Stationary Part 1048
CO (g/kW-hr) : 4.4
HC + NOx (g/kW-hr) : 2.7
NMHC + NOx (g/kW-hr) : 2.7
Emergency Use Only : N



Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR Part 1048, 40 CFR Part 60, 1065, 1068, and 60 (stationary only and combined stationary and mobile) and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following nonroad engines, by engine family, more fully described in the documentation required by 40 CFR Part 1048, 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new nonroad spark-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 1048, 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 1048, 40 CFR Part 60. This certificate of conformity does not cover nonroad engines imported prior to the effective date of the certificate.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068.20 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 1048, 40 CFR Part 60. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 1048, 40 CFR Part 60.

This certificate does not cover large nonroad engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.



PROTOTYPE TEST REPORT

60HZ TEST SUMMARY



**PCC
1.1X/2.2X
CONTROLS**

GENERATOR SET MODELS

PSI 11.1L
C200N6 (130 kW) (PROPANE)
→ C200N6 (200 kW)

REPRESENTATIVE PROTOTYPE

MODEL: C200N6
ENGINE: PSI 11.1L
ALTERNATOR: 3K (ADS213)

The following summarizes prototype testing conducted on the designated representative prototype of the specified models. This testing is conducted to verify the complete generator set electrical and mechanical design integrity. Prototype testing is conducted only on generator sets not sold as new equipment.

MAXIMUM POWER: 200KW

All listed generator sets are guaranteed to meet or exceed the specified rating. The stated output power was achieved while running at normal operating temperature, with all power consuming auxiliaries in place.

MAXIMUM MOTOR STARTING: 791 KVA (PMG)

The generator was tested to simulate motor starting by applying the specified kVA load at low lagging power factor. With this load applied, the generator recovered to a minimum of 90% rated voltage.

ALTERNATOR TEMPERATURE RISE:

The highest rated temperature rise (125 °C) test results are reported as follows to verify that worst case temperature rises do not exceed allowable NEMA MG1 limits for Class H insulation. Tests were conducted per IEE 115, rise by resistance and embedded detector, with the alternator connected for the highest and lowest rated voltages. Only the highest temperatures are reported.

<u>LOCATION</u>	<u>Maximum Rise (°C)</u>
Alternator Stator	125
Alternator Rotor	125
Exciter Stator	125
Exciter Rotor	125

TORSIONAL ANALYSIS AND TESTING:

The generator set was calculated to verify that the design is not subjected to harmful torsional stresses in excess of 5000 psi.

DURABILITY:

The generator set was subject to an endurance test operating at variable load up to the standby rating to verify structural soundness and durability of the design.

STEADY STATE PERFORMANCE:

The generator set was tested to verify steady state operating performance within the specified maximum limits.

Voltage Regulation:	± 1.0%
Random Voltage Variation:	± 1.0%
Frequency Regulation:	Isosynchronous
Random Frequency Variation:	±0.50%

TRANSIENT PERFORMANCE (200KW):

The generator set was tested with the standard alternator to verify single step loading capability as required by NFPA 110. Verify acceptable voltage and frequency response on load addition or rejection were evaluated. The following were recorded:

Full Load Acceptance @ 0.8PF:

Voltage Dip	28 %
Recovery Time	2.4 Seconds
Frequency Dip	22.6 %
Recovery Time	4.2 Seconds

Full Load Rejection @ 0.8PF:

Voltage Rise	9 %
Recovery Time	3.0 Seconds
Frequency Rise	6.3 %
Recovery Time	2.4 Seconds

ELECTRICAL & MECHANICAL STRENGTH:

The generator set was subjected to several single phase and three phase faults to verify that the generator set can safely withstand the forces associated with short circuit conditions. The generator set was capable of producing full rated output at the conclusion of the testing.

3 PHASE REACTANCES (per unit, ± 10%)

Based on full load at 125 °C rise rating

	110/190	120/208	139/240	
	220/380	240/416	277/480	347/600
Synchronous		2.90	2.34	
Transient		0.14	0.11	
Subtransient		0.09	0.07	
Negative Sequence		0.12	0.10	
Zero Sequence		0.02	0.02	

COOLING SYSTEM: 40 °C AMBIENT

0.50 H2O RESTRICTION

The cooling system was tested to determine ambient temperature and static restriction capabilities. The test was performed at full rated load in elevated ambient temperatures under actual static restriction conditions.



ALTERNATOR DATA SHEET

Frame Size

UCD3J

CHARACTERISTICS

WEIGHTS

Wound Stator Assembly	670.205 lb	304 kg
Rotor Assembly	597.45 lb	271.9 kg
Complete Alternator	1602.76 lb	727 kg

MAXIMUM SPEED

2250 rpm

EXCITATION CURRENT

Full Load	2.20 Amps
No Load	0.50 Amps

INSULATION SYSTEM

Class H Throughout

1 Ø RATINGS

(1.0 Power Factor)

(Based on specified temperature rise at 40°C ambient temperature)

125°C Rise Ratings kW/kVA
105°C Rise Ratings kW/kVA

60 Hz (Winding no)

Double Delta

4 Lead

120/240

120/240

161/201

175/219

150/188

157/196

50 Hz (Winding no)

Double Delta

110-120

220-240

140/175

126/158

3 Ø RATINGS

(0.8 Power Factor)

(Based on specified temperature rise at 40°C ambient temperature)

150°C Rise Ratings kW
kVA

125°C Rise Ratings kW
kVA

105°C Rise Ratings kW
kVA

80°C Rise Ratings kW
kVA

Upper Broad Range

LBR*

347/600

120/208

127/220

139/240

190-208

347/600

240/416

255/440

277/480

380-416

Broad Range

110/190

115/200

120/208

127/220

220/380

230/400

240/415

254/440

230 kW
288 kVA

240 kW
300 kVA

255 kW
319 kVA

255 kW
319 kVA

230 kW
288 kVA

200 kW
250 kVA

200 kW
250 kVA

200 kW
250 kVA

172 kW
215 kVA

215 kW
269 kVA

225 kW
281 kVA

240 kW
300 kVA

240 kW
300 kVA

215 kW
269 kVA

184 kW
230 kVA

184 kW
230 kVA

184 kW
230 kVA

164 kW
205 kVA

200 kW
250 kVA

211 kW
264 kVA

220 kW
275 kVA

220 kW
275 kVA

200 kW
250 kVA

168 kW
210 kVA

168 kW
210 kVA

168 kW
210 kVA

148 kW
185 kVA

170 kW
213 kVA

180 kW
225 kVA

190 kW
238 kVA

190 kW
238 kVA

170 kW
213 kVA

154 kW
193 kVA

154 kW
193 kVA

154 kW
193 kVA

128 kW
160 kVA

3 Ø REACTANCES

(per unit ± 10%)

(Based on full load at 105°C Rise Rating)

Synchronous

Transient

Subtransient

Negative Sequence

Zero Sequence

416

440

480

380

600

380

400

415

440

2.651 2.457 2.221 2.00 2.00 1.939 1.75 1.626 N/A

0.164 0.153 0.137 0.13 0.13 0.103 0.093 0.086 N/A

0.096 0.09 0.08 0.07 0.07 0.07 0.064 0.059 N/A

0.117 0.109 0.098 0.14 0.14 0.117 0.105 0.098 N/A

0.048 0.045 0.04 0.04 0.04 0.044 0.04 0.037 N/A

3 Ø MOTOR

STARTING

Maximum kVA (Shunt)
(90% Sustained Voltage) (PMG)

→ 770
920

770
920

770
920

535
678

TIME CONSTANTS (Sec)

Transient

Subtransient

Open Circuit

DC

0.045

0.045

0.045

0.045

0.015

0.015

0.015

0.015

1.270

1.270

1.270

1.270

0.030

0.030

0.030

0.030

WINDINGS (@20°C)

Stator Resistance
(Ohms per phase)

Rotor Resistance

(Ohms)

Number of Leads

0.0128

0.0128

0.0128

0.0128

2.0000

2.0000

2.0000

2.0000

12

12

6

12

* Lower broad range 110/190 thru 120/208, 220/380 thru 240/416.



PSI 11.1L Sound Data 60 Hz C200N6

Sound Pressure Levels @ 7 meters dB(A)

Configuration		Position (Note 1)								8 Position Average
		1	2	3	4	5	6	7	8	
Standard Unhoused	Infinite Exhaust	80.7	84.6	85.3	84.4	82.5	86.9	85.9	84.9	84.4
F001 Weather	Mounted Muffler	83.4	83.0	81.3	83.1	85.5	84.5	81.5	83.1	83.2
F001 Level 2.0	Mounted Muffler	73.0	70.5	70.8	72.2	71.1	73.6	71.9	72.9	72.0

Note 1. Position 1 faces the Generator Set (GenSet) front per ISO 8528-10. The positions proceed around the GenSet in a counter-clockwise direction in 45° increments. All positions are at 7 m (23 ft) from the surface of the GenSet and 1.2 m (48 in) from floor level.

Sound Power Levels

Configuration		Octave Band Center Frequency (Hz)								Sound Power Level
		63	125	250	500	1000	2000	4000	8000	
Standard Unhoused	Infinite Exhaust	75.7	93.3	99.7	105.3	106.8	106.8	103.1	99.6	112.3
F001 Weather	Mounted Muffler	92.9	97.3	100.1	105.3	105.7	104.1	99.7	97.7	111.1
F001 Level 2.0	Mounted Muffler	84.9	93.3	95.4	96.9	95.8	94.7	90.1	86.6	102.8

All values are estimated based on similar Cummins GTA855E data that was measured and recorded at the Cummins Acoustic Technology Center in a controlled environment.
 Data is based on a 100% rated load with a standard radiator-fan package.
 Sound levels are subject to instrumentation, measurement, installation, and manufacturing variability.
 The sound data for a GenSet with infinite exhaust does not include exhaust noise.

Sound pressure levels are measured per ANSI S1.13 and ANSI S12.18, as applicable.
 The reference sound pressure is 20 µPa.

Sound power levels are measured per ISO 3744 and ISO 8528-10, as applicable.
 The reference sound power is 1 pw (10⁻¹² W).



Specification sheet

Weather-protective and sound-attenuated

Steel enclosures

130-750 kW regulated standby generator sets



Description

Cummins provides the option of protecting your Cummins Generator Set (GenSet) with weather protective and sound attenuated steel enclosures that not only limit the GenSet from producing high decibels of sound, but also protect the GenSet from harsh weather conditions. These field-installable enclosure kits are designed to enclose the entire GenSet while allowing ample air flow for cooling. Multiple kit configurations are available for each GenSet model to suit most weather protection and sound control requirements:

Weather-protective enclosures (F001-WPE) provide protection from climate conditions and include an internally-mounted exhaust silencer. The enclosure and exhaust silencer are appropriate for applications where sound reducing enclosures are not required.

Level I sound-attenuated enclosures (F001-L1) provide weather protection and include an internally-mounted exhaust silencer and sound insulating panels. The silencer and the panels reduce the noise level of the GenSet to a level below that achieved with a weather protective enclosure. Level I sound-attenuated enclosures are appropriate for applications where sound reducing enclosures are required.

Level II sound-attenuated enclosures (F001-L2) provide weather protection and include an internally-mounted exhaust silencer and sound insulating panels which reduce the noise level of the GenSet to a level below that achieved with a Level I sound-attenuated enclosure. Level II sound-attenuated enclosures are appropriate for applications where sound reducing enclosures are required.

130 to 200 kW standard construction

- 14-gauge, low carbon, hot-rolled ASTM A1011 steel construction (panels)
- 12-gauge, low carbon, hot-rolled ASTM A1011 steel construction (posts)

250 to 750 kW standard construction

- Galvannealed steel construction for corrosive environments
- Aluminum construction offered as an option for corrosive environments

Features and benefits

- Stainless steel hardware
- Compact footprint
- Zinc phosphate pretreatment, e-coat primer and super durable powder topcoat print minimizes corrosion and color fade
- Two or three recessed doors per side (depending on GenSet dimensions) for service access
- Doors keyed alike for added security and convenience
- Weather protective seals around all doors on WPE & sound attenuated enclosures
- Enclosed exhaust silencer improves safety and protects against rust
- Critical sound level exhaust silencers in sound attenuated enclosures
- Rain collar and rain cap
- Non-hygroscopic sound-attenuating material
- Easy access lifting points for spreader bars and forklift, depending on model
- Enclosure attaches directly to GenSet skid base
- Designed for ambient temperatures up to 40 °C (104 °F)*
- Enclosures are designed for outdoor use only
- Standard wind rating of 100 mph
- Removable enclosure panels or hinged doors provide easy GenSet access
- Fixed louvers
- Cambered roof prevents water accumulation
- Fuel and electrical stub-up area within enclosure perimeter

Refer to the GenSet Specification Sheet and the Sound Data Sheet for specific capabilities.

*GenSets with weather-protective or sound-attenuated enclosures may reduce the ambient capability by 2 to 4.5 °C (4 to 8 °F), depending on the type of enclosure and site conditions.

Housing options

- 5 kW heater
- 100A, 120/240V distro panel
- AC lights (2 X AC vaporproof)
- 120V GFI convenience receptacles (2)
- Motorized intake and discharge louvers

UL 2200 available

- External E-Stop
- High wind bracing
- DC lights w/ timer (2)
- Floor (required for non-pad or spring isolator mounting)

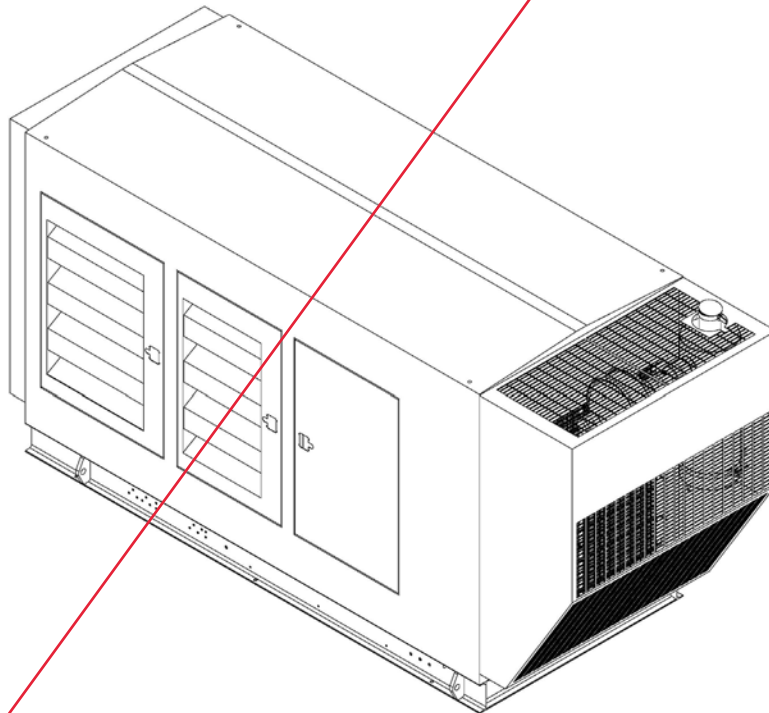


Rating (kW)	Model	Engine	Description	Outline drawing
130	C200N6	PSI 11.1L	Weather protective enclosure (upgrade from open set)	GFPC-02
130	C200N6	PSI 11.1L	Level 2 enclosure (upgrade from weather enclosure)	GFPC-02
200	C200N6	PSI 11.1L	Weather protective enclosure (upgrade from open set)	GFPC-02
200	C200N6	PSI 11.1L	Level 2 enclosure (upgrade from weather enclosure)	GFPC-02
250	C250N6	GTA855e	Weather protective enclosure (upgrade from open set)	C250N6-02
250	C250N6	GTA855e	Level 1 enclosure (upgrade from weather enclosure)	C250N6-03
250	C250N6	GTA855e	Level 2 enclosure (upgrade from Level 1 enclosure)	C250N6-03
300	C300N6	GTA855e	Weather protective enclosure (upgrade from open set)	C300N6-02
300	C300N6	GTA855e	Level 1 enclosure (upgrade from weather enclosure)	C300N6-03
300	C300N6	GTA855e	Level 2 enclosure (upgrade from Level 1 enclosure)	C300N6-03
335	C550N6	GTA38E	Weather protective enclosure (upgrade from open set)	C500N6-02
335	C550N6	GTA38E	Level 1 enclosure (upgrade from weather enclosure)	C500N6-03
335	C550N6	GTA38E	Level 2 enclosure (upgrade from Level 1 enclosure)	C500N6-03
350	C350N6	KTA19SLB	Weather protective enclosure (upgrade from open set)	GFEB-02
350	C350N6	KTA19SLB	Level 1 enclosure (upgrade from weather enclosure)	GFEB-03
350	C350N6	KTA19SLB	Level 2 enclosure (upgrade from Level 1 enclosure)	GFEB-03
400	C400N6	GTA28E	Weather protective enclosure (upgrade from open set)	C400N6-02
400	C400N6	GTA28E	Level 1 enclosure (upgrade from weather enclosure)	C400N6-03
400	C400N6	GTA28E	Level 2 enclosure (upgrade from Level 1 enclosure)	C400N6-03
400	C400D6B	QSZ13	Weather protective enclosure (upgrade from open set)	C400D6B-02
400	C400D6B	QSZ13	Level 1 enclosure (upgrade from weather enclosure)	C400D6B-03
400	C400D6B	QSZ13	Level 2 enclosure (upgrade from Level 1 enclosure)	C400D6B-03
450	C450N6	GTA28E	Weather protective enclosure (upgrade from open set)	C450N6-02
450	C450N6	GTA28E	Level 1 enclosure (upgrade from weather enclosure)	C450N6-03
450	C450N6	GTA28E	Level 2 enclosure (upgrade from Level 1 enclosure)	C450N6-03
500	C500N6B	GTA28E	Weather protective enclosure (upgrade from open set)	C500N6B-02
500	C500N6B	GTA28E	Level 1 enclosure (upgrade from weather enclosure)	C500N6B-03
500	C500N6B	GTA28E	Level 2 enclosure (upgrade from Level 1 enclosure)	C500N6B-03
550	C550N6	GTA38E	Weather protective enclosure (upgrade from open set)	C550N6-02
550	C550N6	GTA38E	Level 1 enclosure (upgrade from weather enclosure)	C550N6-03
550	C550N6	GTA38E	Level 2 enclosure (upgrade from Level 1 enclosure)	C550N6-03
600	C600N6	GTA50E	Weather protective enclosure (upgrade from open set)	C750N6-02
600	C600N6	GTA50E	Level 1 enclosure (upgrade from weather enclosure)	C750N6-03
600	C600N6	GTA50E	Level 2 enclosure (upgrade from Level 1 enclosure)	C750N6-03
650	C650N6	GTA50E	Weather protective enclosure (upgrade from open set)	C750N6-02
650	C650N6	GTA50E	Level 1 enclosure (upgrade from weather enclosure)	C750N6-03
650	C650N6	GTA50E	Level 2 enclosure (upgrade from Level 1 enclosure)	C750N6-03
750	C750N6	GTA50E	Weather protective enclosure (upgrade from open set)	C750N6-02
750	C750N6	GTA50E	Level 1 enclosure (upgrade from weather enclosure)	C750N6-03
750	C750N6	GTA50E	Level 2 enclosure (upgrade from Level 1 enclosure)	C750N6-03

Installed weather enclosure dimensions*			
Model	Length (in.)	Width (in.)	Height (in.)
▶ C200N6	159	60	85
C250N6	183	70	99
C300N6	183	70	99
C350N6	183	70	101
C400N6	219	90	124
C400D6B	183	70	95
C450N6	219	90	124
C500N6B	219	90	124
C550N6	248	102	136
C600N6	269	102	136
C650N6	269	102	136
C750N6	269	102	136

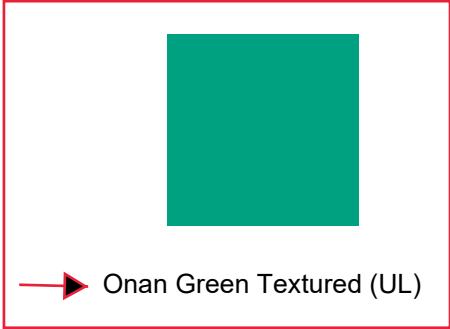
For detailed sound data, refer to the Sound Data Sheet for a specific model.

* All dimensions are estimated based on enclosure drawings.



Enclosure paint options

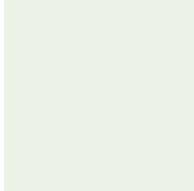
These standard enclosure colors are available as selected in Cummins pricing. All GenSet enclosures will be painted Onan Green Textured, unless otherwise ordered. Underwriters Laboratories (UL) colors noted are included in standard pricing; other colors selected for UL units would have additional charges. Contact your local sales representative for more information.



Moss Green



Cream



Sugar White



Cummins Red



Cummins Beige (UL)



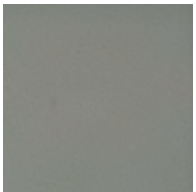
Chocolate Brown



Compartment Tan Textured (UL)



Spectrum Gray



ANSI 61 Gray (UL)



Jet Black

Cummins Sales and Service
 875 Lawrence Drive
 DePere, Wisconsin 54115

cummins.com

ENGINE SERVICE CONNECTIONS

GAS INLET -----2.00" NPT
 LP CONNECTION -----1/4" FNPT
 ENGINE WATER IN -----2.75" O.D.
 ENGINE WATER OUT -----3.00" O.D.
 DE-AERATION -----N/A
 OIL DRAIN PLUG -----1/2" NPT
 EXHAUST STACK -----5.00" O.D.
 CHARGE AIR IN -----2.50" O.D.
 CHARGE AIR OUT -----2.50" O.D.
 EXH TEMP COUPLING -----N/A

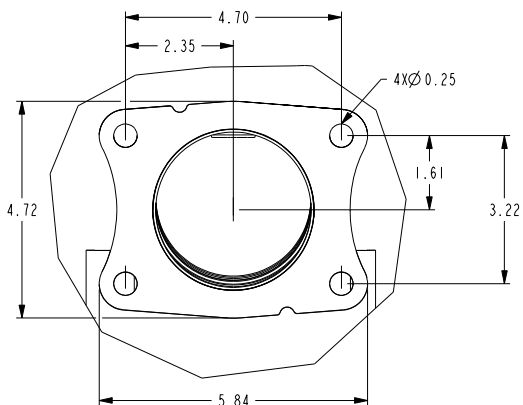
FLUID CAPACITIES

ENGINE OIL -----5 - 6.6 GAL
 ENGINE COOLANT -----5.5 GAL
 RADIATOR COOLANT -----17.5 GAL

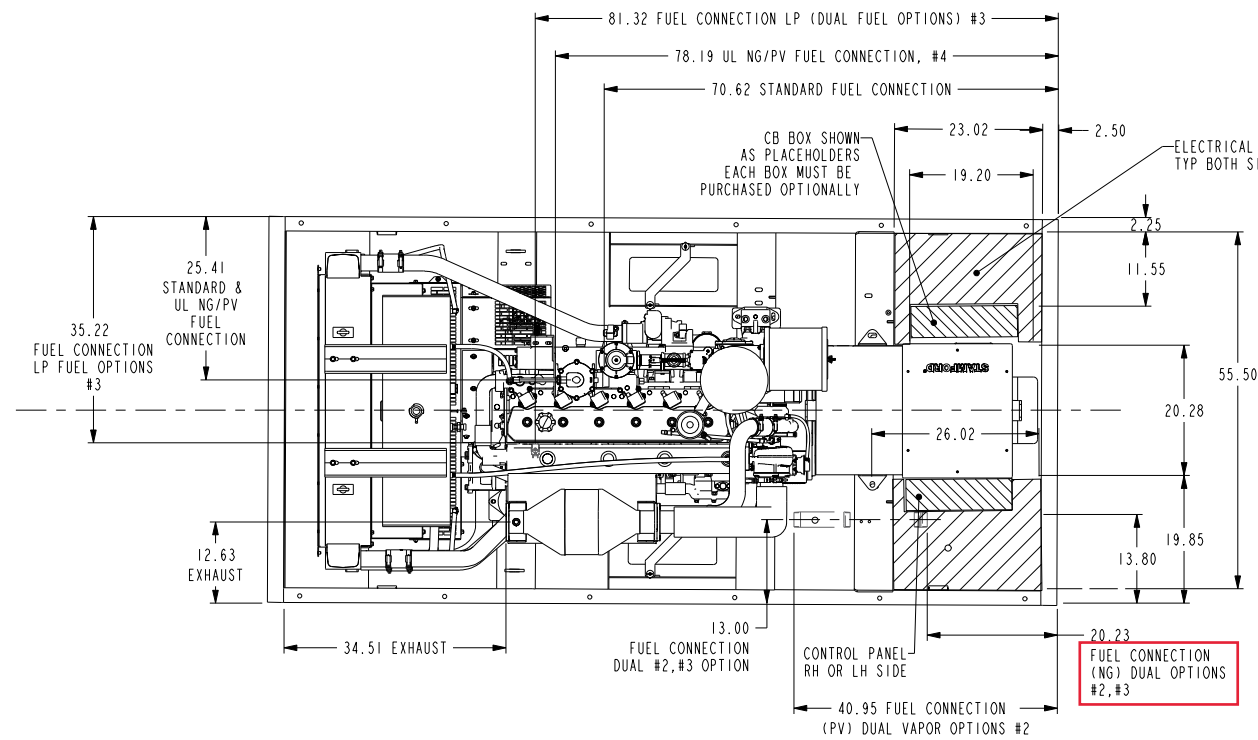
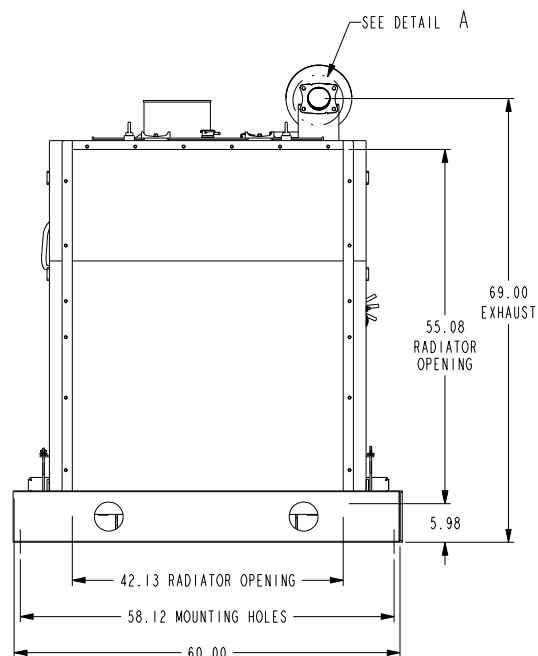
NEWAGE GENERATOR FRAME SIZE	DIMENSION "A"	DIMENSION "B" CENTER OF GRAVITY	DIMENSION "C" CENTER OF GRAVITY	TOTAL WEIGHT OF UNIT
UC1274H	117.91	57.49	28.22	5778LBS/2620KG
UCD274J	119.67	59.09	27.11	6014LBS/2728KG
UCD274K	119.67	59.67	27.55	6091LBS/2763KG

REV	REL NO	REVISION	DWN	CKD	APVD	DATE
-	2019-195	INITIAL RELEASE	LO629	NA372	NA372	03MAY19
1	2019-555	UPDATED NUMBER	LO629	NA372	NA372	12NOV19

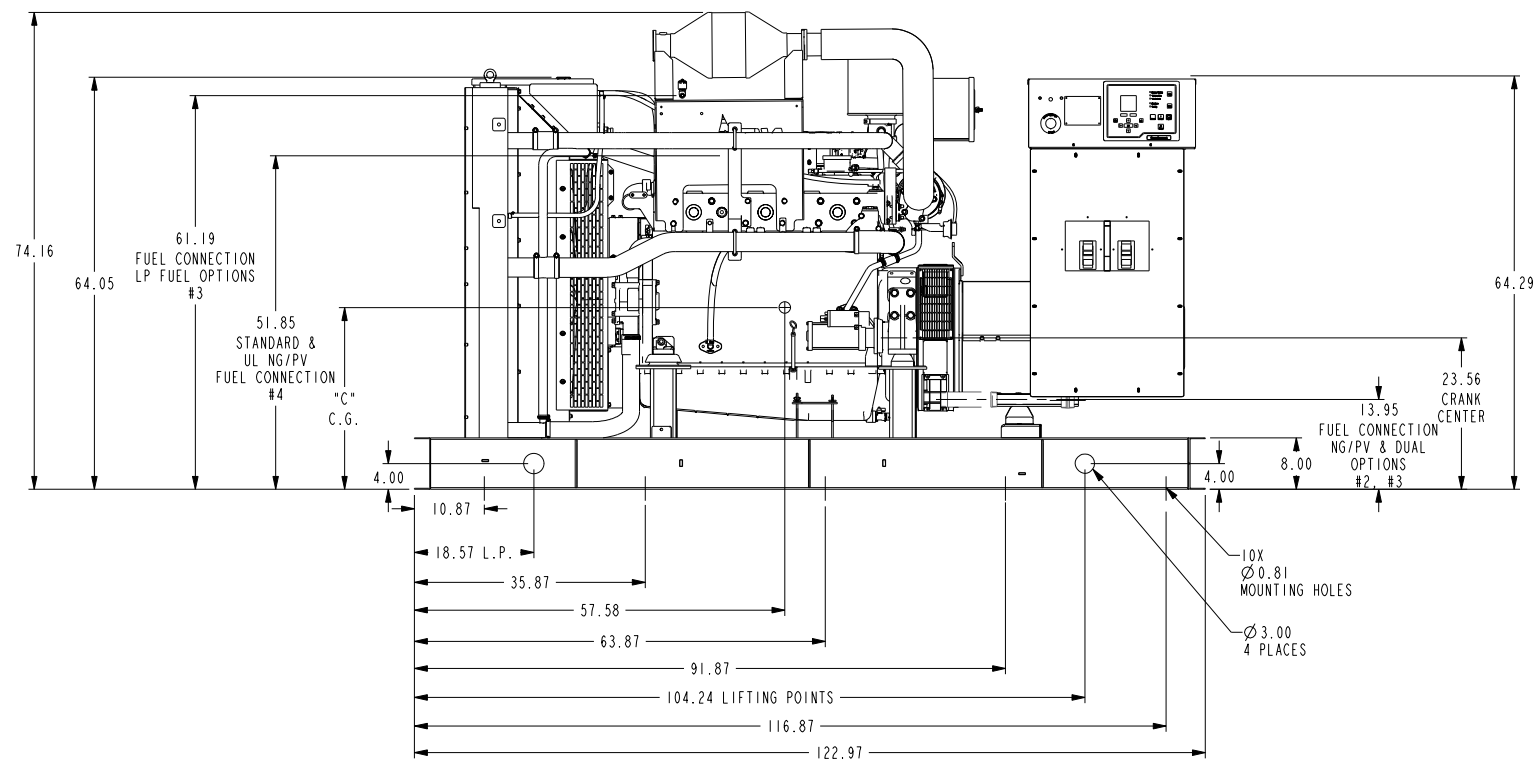
FUEL OPTION	REF CNP PRINT#
#2 DUAL VAPOR	A042A184
#3 DUAL LP/NG	A042A185
#4 UL PV/NG	TBD



DETAIL A
SCALE 0.500



CUSTOMER IS RESPONSIBLE FOR LOCATION AND INSTALLATION OF EXHAUST SYSTEM



- NOTES:
 1) ALL WEIGHTS AND DIMENSIONS ARE APPROXIMATE
 - WEIGHTS DO NOT INCLUDE BATTERIES OR OPTIONAL EQUIPMENT
 2) CNP RECOMMENDS 4 POINT LIFT WHEN LIFTING TO PREVENT DAMAGE TO UNIT
 3) GENSETS HAVE INTEGRAL ISOLATION
 4) ISOLATORS: DIMENSIONS DENOTED BY ASTERISKS " * X.XX * " INDICATE MOUNTING LOCATION(S) FOR (6X) ISOLATORS (MODEL CK-2-4) IF SO EQUIPPED
 ISOLATOR CK-2-4 HEIGHT: 6.50"

DIMENSIONS ARE IN: INCHES [] ARE IN: INCHES	DO NOT SCALE PRINT	CMI DATA CLASSIFICATION Cummins Confidential		Cummins Inc.	
DRAWING TOLERANCES UNLESS OTHERWISE SPECIFIED: X: ± 1/16 IN OR 4 mm Y: ± 1/32 IN OR 0.7 mm Z: ± 0.01 IN OR 0.25 mm ANGULAR TOLERANCES: ± °	SCALE 0.070	DWN LO629 CKD - APVD NA372 DATE 03MAY2019		ITEM NAME GENSET, 11L OPEN	CAD SHEET 1 OF 1
<small>THIS DOCUMENT (AND THE INFORMATION SHOWN THEREON) IS CONFIDENTIAL AND PROPRIETARY AND SHALL NOT BE DISCLOSED TO OTHERS IN HARD COPY OR ELECTRONIC FORM, REPRODUCED BY ANY MEANS, OR USED FOR ANY PURPOSE WITHOUT WRITTEN CONSENT OF CUMMINS INC.</small>			<small>FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5-2009</small>		<small>MUST CONFORM TO CES 10903</small>

ENGINE SERVICE CONNECTIONS

GAS INLET -----2.00" NPT
 LP CONNECTION -----1/4" FNPT
 ENGINE WATER IN -----2.75" O.D.
 ENGINE WATER OUT -----3.00" O.D.
 DE-AERATION -----N/A
 OIL DRAIN PLUG -----1/2" NPT
 EXHAUST STACK -----5.00" O.D.
 CHARGE AIR IN -----2.50" O.D.
 CHARGE AIR OUT -----2.50" O.D.
 EXH TEMP COUPLING -----N/A

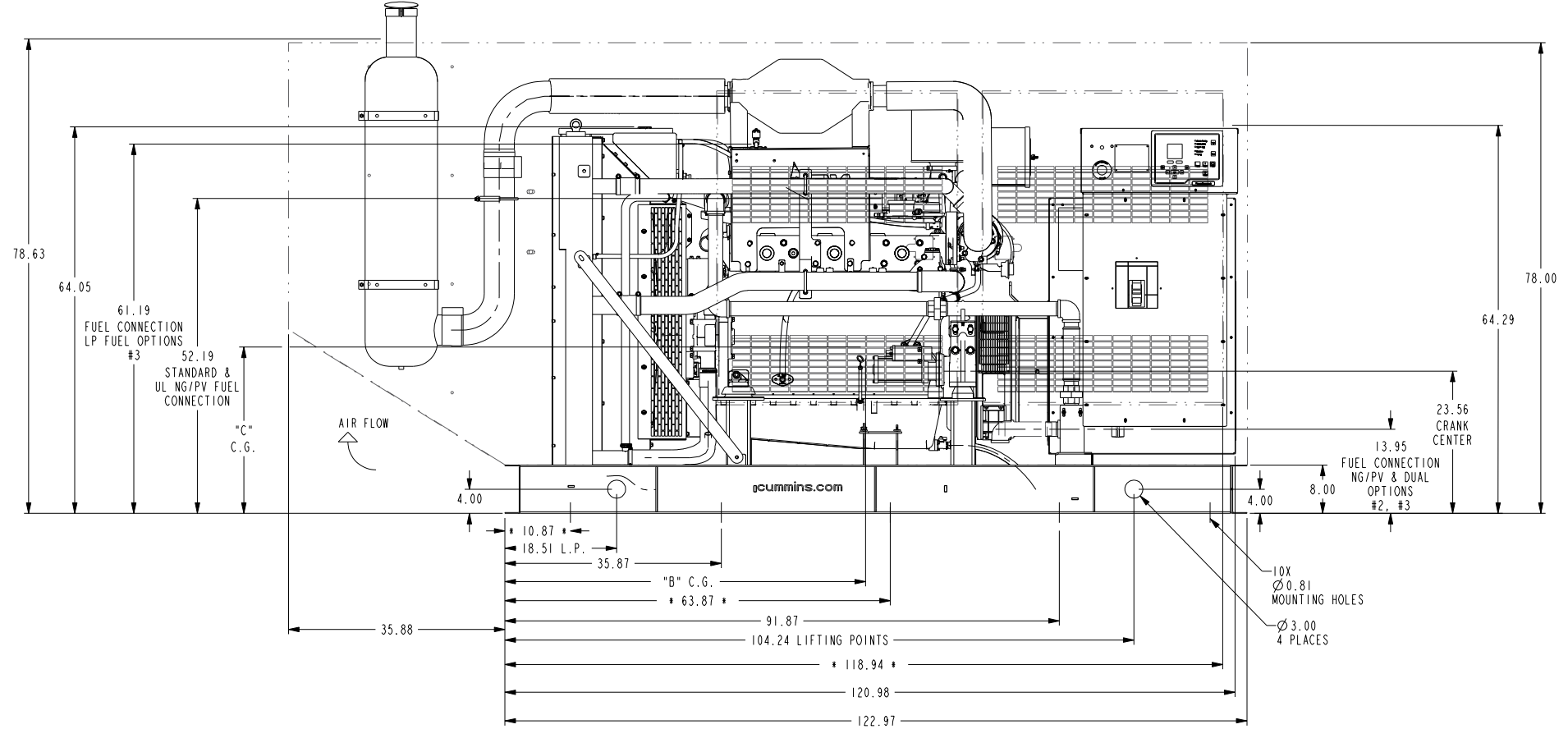
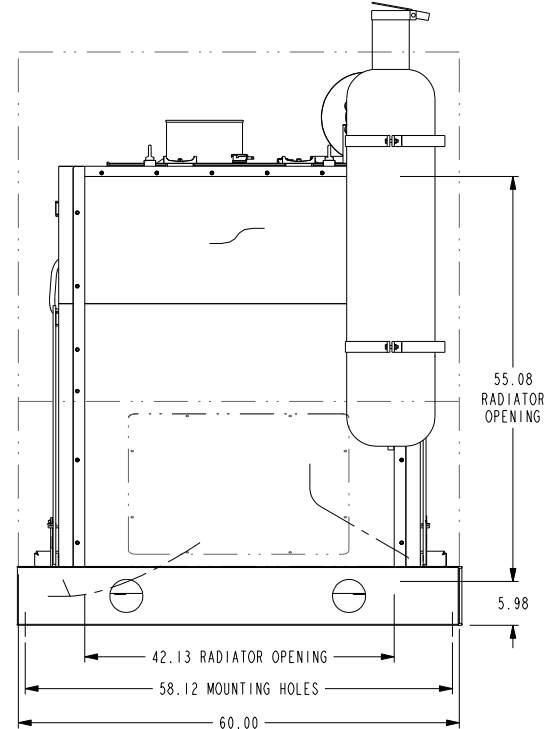
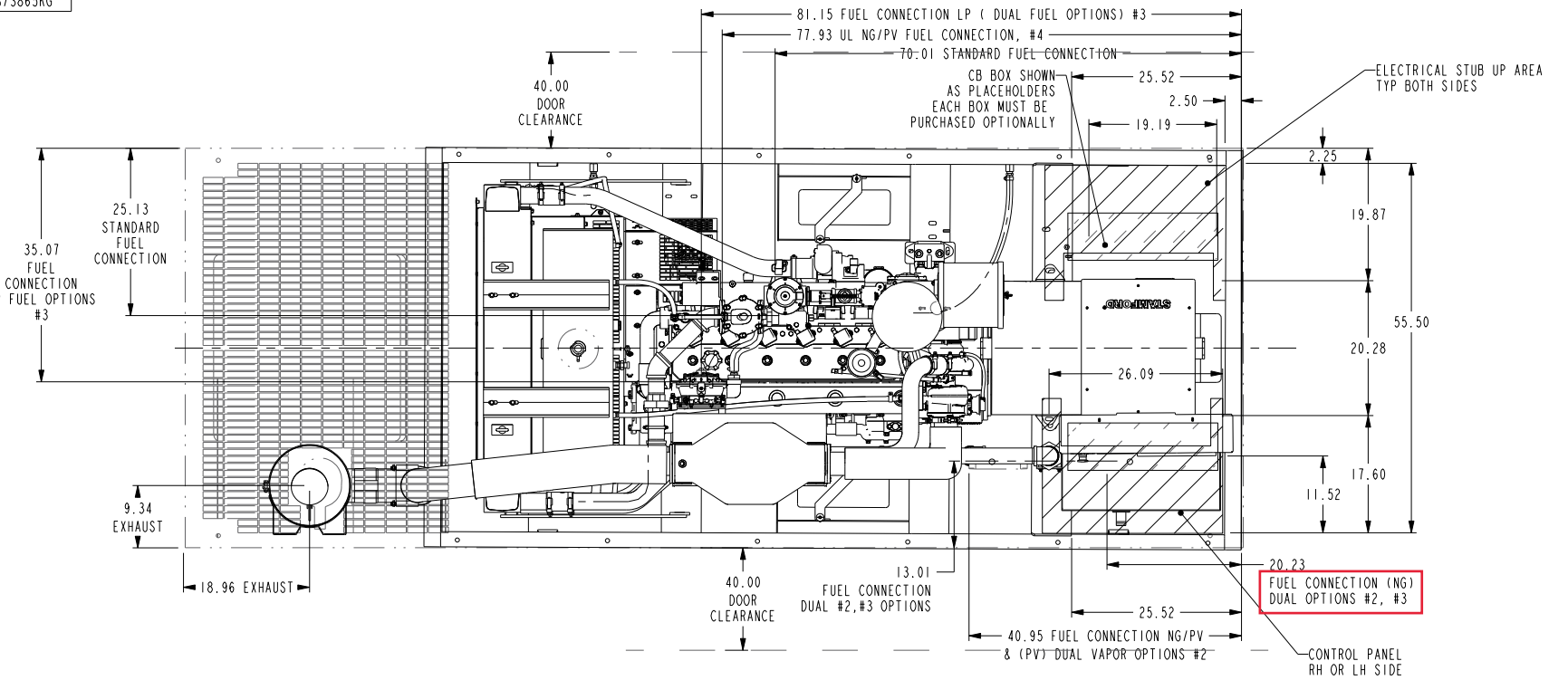
FLUID CAPACITIES

ENGINE OIL -----5 - 6.6 GAL
 ENGINE COOLANT -----5.5 GAL
 RADIATOR COOLANT -----17.5 GAL

NEWAGE GENERATOR FRAME SIZE	DIMENSION "A"	DIMENSION "B" CENTER OF GRAVITY	DIMENSION "C" CENTER OF GRAVITY	TOTAL WEIGHT OF UNIT
UC1274H	117.91	57.49	28.22	8209LBS/3723KG
UCD274J	119.67	59.09	27.11	8445LBS/3830KG
UCD274K	119.67	59.67	27.55	8522LBS/3865KG

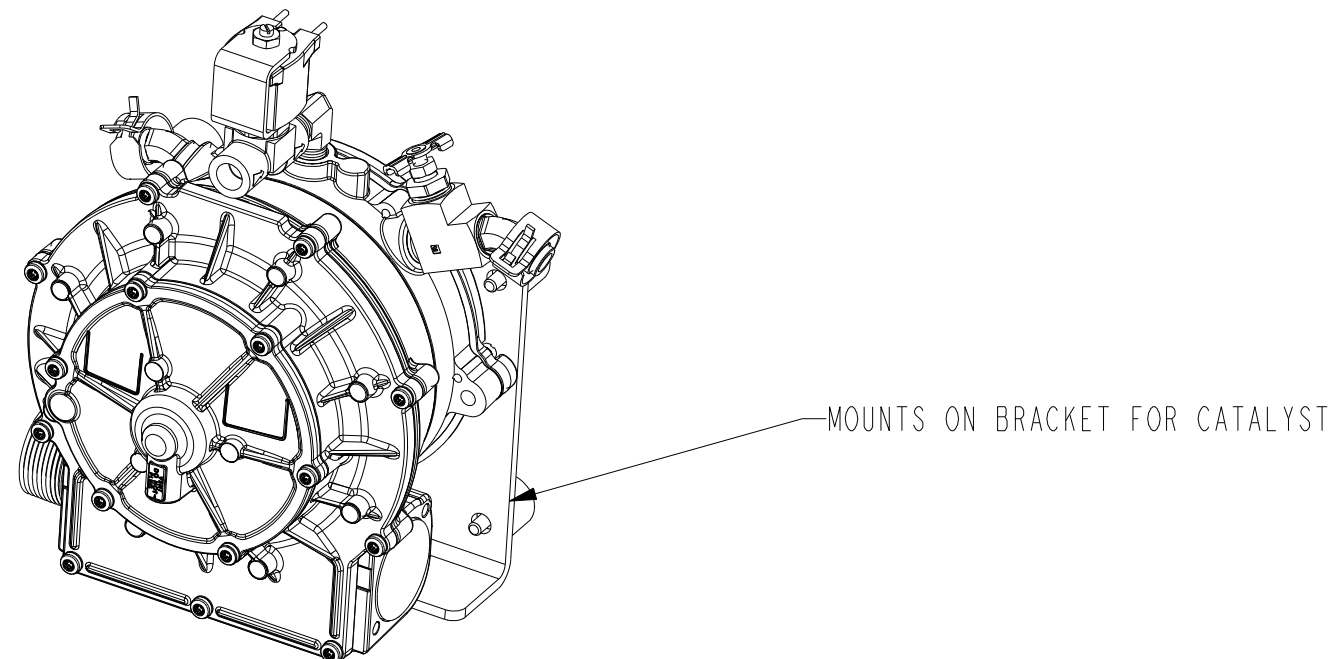
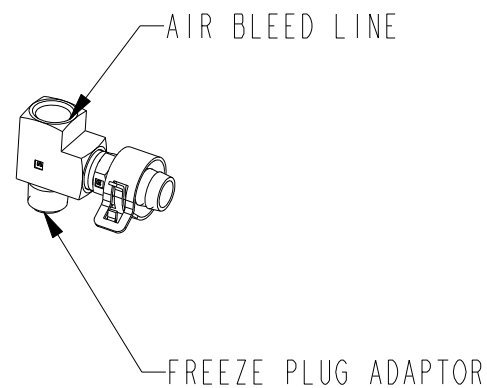
REV	REL NO	REVISION	DWN	CKD	APVD	DATE
-	2019-195	INITIAL RELEASE	LOG629	NA372	NA372	06MAY19
1	2019-555	UPDATED NUMBER	LOG629	NA372	NA372	12NOV19

FUEL OPTION	REF CNP PRINT#
#2 DUAL VAPOR	A042A182
#3 LP/NG	A042A184
#4 UL PV/NG	TBD



- NOTES:
- ENCLOSURE
 - A. TO BE PAINTED ONAN GREEN UNLESS OTHERWISE NOTED ON ORDER
 - B. ALL HARDWARE TO BE STAINLESS STEEL
 - C. ALL DOORS KEYED ALIKE
 - D. STAINLESS STEEL LIFT-OFF HINGES
 - E. FOLDING T-HANDLE COMPOSITE DOOR LATCH
 - ALL WEIGHTS AND DIMENSIONS ARE APPROXIMATE
 - A. WEIGHTS DO NOT INCLUDE BATTERIES OR OPTIONAL EQUIPMENT
 - B. WEIGHTS INCLUDE STANDARD CRITICAL GRADE EXHAUST
 - CNP RECOMMENDS 4 POINT LIFT WHEN LIFTING TO PREVENT DAMAGE TO UNIT
 - GENSETS HAVE INTEGRAL ISOLATION
 - ISOLATORS: DIMENSIONS DENOTED BY ASTERISKS " * X.XX * " INDICATE MOUNTING LOCATION(S) FOR (6X) ISOLATORS (MODEL CK-2-5) IF SO EQUIPPED
 ISOLATOR CK-2-5 HEIGHT: 6.50"

DIMENSIONS ARE IN: INCHES [] ARE IN: INCHES DRAWING TOLERANCES UNLESS OTHERWISE SPECIFIED X: ± 1/16 IN OR 1.6 mm Y: ± 1/32 IN OR 0.8 mm Z: ± 0.01 IN OR 0.25 mm ANGULAR TOLERANCE: ± 0.1°	DO NOT SCALE PRINT SCALE 0.080	CMI DATA CLASSIFICATION Cummins Confidential	Cummins Inc. ITEM NAME GENSET, ILL ENCLOSED CAD SHEET 1 OF 1 ITEM NUMBER C200N6-02 REV 1
	MUST CONFORM TO CES 10903	FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5-2009	



(Cummins factory installed NG fuel vaporizer - Contractor to provide all other non-skid mounted fuel related components for a complete operating system)



- NOTES:
- SUPPLIER: POWER SOLUTION INTERNATIONAL INC. OR EQUAL
 - SUPPLIER P/N: 59300031

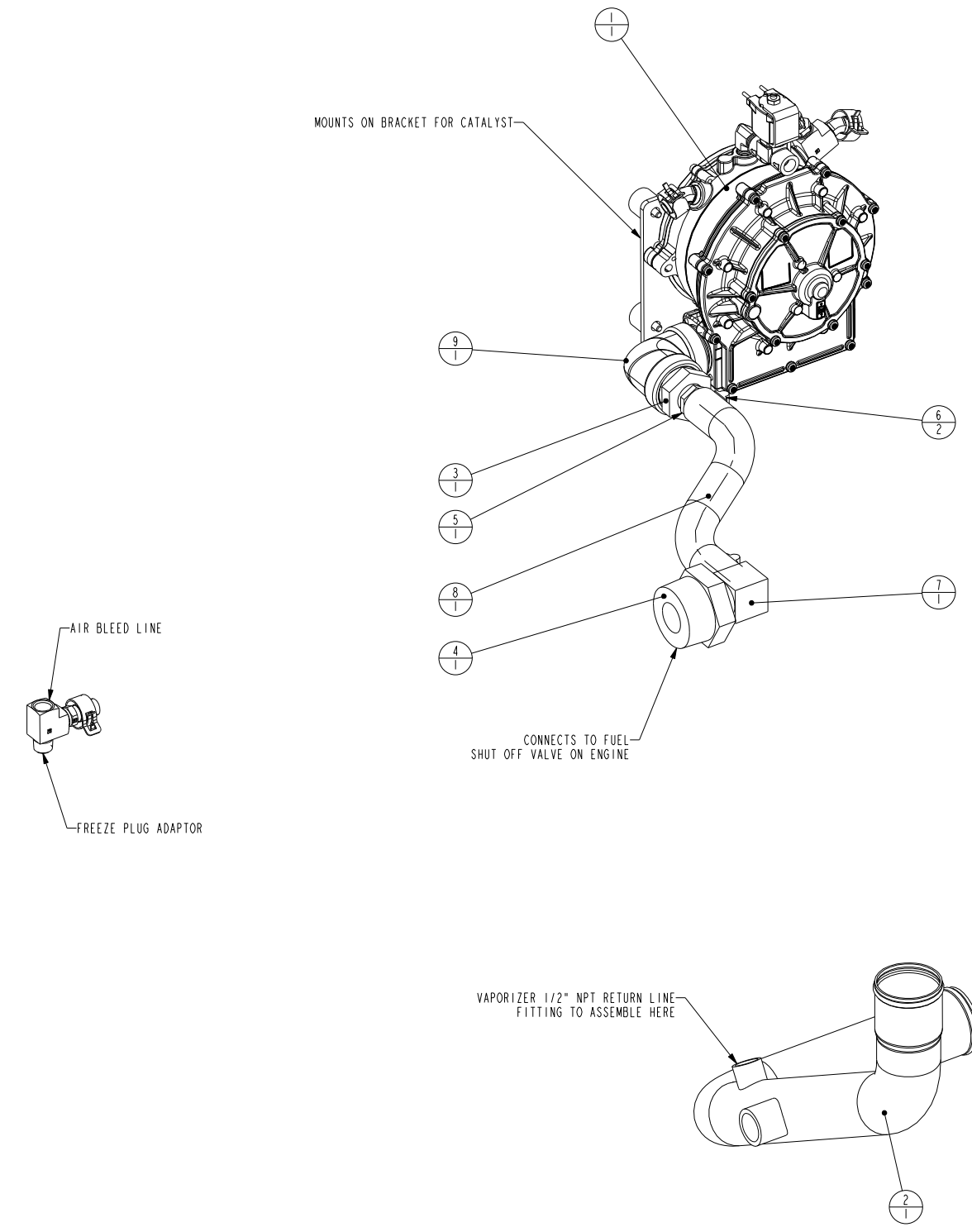
REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE

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	CUMMINS NPOWER LLC CORPORATE OFFICE 1600 BUERKLE ROAD WHITE BEAR LAKE, MN WWW.CUMMINSNPOWER.COM	CUSTOM DESIGN AND UPFIT CENTER 875 LAWRENCE DRIVE DEPERE, WISCONSIN
	VAPORIZER, IIL PSI	

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE			
ANGULAR DIMENSIONS ± 1°	MACHINED SURFACES	IMPERIAL UNITS MACHINE TOLERANCES .XX ± 0.010 .XXX ± 0.005	METRIC UNITS MACHINE TOLERANCES .X ± 0.4 .XX ± 0.2
THIRD ANGLE PROJECTION	125	FORM TOLERANCES .XX ± 0.030 .XXX ± 0.015	FORM TOLERANCES .X ± 0.8 .XX ± 0.4
		FAB TOLERANCES .XX ± 0.060 .XXX ± 0.030	FAB TOLERANCES .X ± 1.5 .XX ± 0.8
DWG UNITS: IN/LB/S	DRAWN BY: RMJ PRO-ENGINEER	SCALE: 0.313	DATE: 18FEB2014 INIT ECO: 2014-004
EST WEIGHT: 42238.628	SHEET 1 OF 1	DRAWING NO: A042A441	

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	VAPORIZER, 11L, PSI	A042A441
2	1	OSP, A042G048, TUBE, JW, 11, 1L	A042J376
3	1	BUSH, RED, -20 NPT X -12 FNPT	12176-20-12
4	1	BUSH, RED, -32 NPT X -16 FNPT	12176-32-16
5	1	FTG, STR, -12 BARB X -12 NPT	12548-12-12
6	2	CLAMP, WORM, .69-1.25	14990-12
7	1	ELB, 90 DEG, -12 BEAD X -16 NPT	16899-12-16
8	1	HOSE, FUEL 3/4"ID, 18"LONG	26601
9	1	ELBOW, 90°, 1 1/4" NPT FEMALE, BLK STEEL	B90H



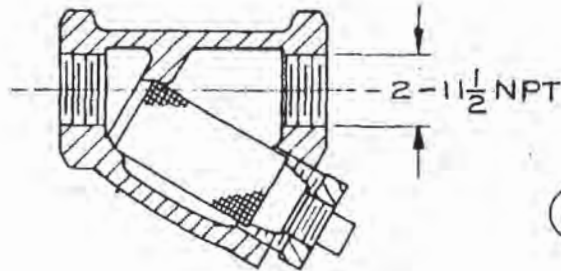
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FUEL TRAIN, LIQUID PROPANE 11L				DWG UNITS: IN/LB/S PRO-ENGINEER		DRAWN BY: RMJ DATE: 12FEB2014	
UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE:				DWG UNITS: IN/LB/S SCALE: 0.375		SHEET 1 OF 1 DRAWING NO: A042A183	
ANGULAR DIMENSIONS ± °		MACHINED SURFACES:		METRIC UNITS:		EST WEIGHT: 5.899	
FINED ANGLE PROJECTION		125°		125°		125°	
A 2016-829 REMOVED FTG & TAPPED NOTE; ADDED A042J376		TJK 14DEC2016		ECO		DESCRIPTION OF REVISION	
REV		REV BY		DATE		DESCRIPTION OF REVISION	

Cummins ship loose dry-type filter strainer to be installed by the Contractor.

149-0751
MICROFILMED

ER NO	REV	NO	REVISION	ENG	CKR	DATE
			SUP SO'S 149P751 W/CHGS-OLD DWG	TD		2-10-58
	A		NOTE 3 WAS 30 OR 40 MESH	TAA	CP	10-24-73
	A		"W/LINER" REMOVED	TAA	WB	1-9-74
	A		WAS 40 MESH, 1/64 OPEN, 210 WIRE	TAA	WB	3-25-74
	A		ADDED NOTE 3-B	TAA	HP	10-31-77
73329	B	1	REVISED NOTES 3 & 3A	WBS	BG	9-4-96

V.O. DRAWING



NOTES:

1. 2" PIPE SIZE
2. MATL-CAST SEMI-STEEL BODY
3. 20 MONEL WIRE MESH
 - A. 20 MESH: .033 OPENING
 - B. ALTN MATL: STAINLESS STEEL WIRE MESH
4. SELF CLEANING
5. FOR USE WITH NATURAL GAS

(B) (A)

NEAT ASSY	SIMILAR TO	SEPIA FROM	ITEM	PART NO.	DWG SIZE	QTY	BULK	DESCRIPTION OR MATERIAL
		149A558						
		DR	JER					
		CKR	CP					
		ENGR	WW					
		SAMP REL		DATE	2-12-71	SC	~	
		PROD REL	WW	2-18-71				
		PROD REL						
<p>TOLERANCES UNLESS OTHERWISE SPECIFIED</p> <p>FRACTIONS ±</p> <p>ANGLES . . . ±</p> <p>HOLES . . . ±</p> <p>DECIMALS</p> <p>2 PLACE ±</p> <p>3 PLACE ±</p>								<p>Ongn DIVISION OF STUDEBAKER CORPORATION Minneapolis, Minnesota</p> <p>STRAINER</p> <p>149-0751</p>
<p>The proprietary design information on this print is the property of the Division of Studebaker Corporation and its use without the written consent of the Corporation is prohibited.</p>								<p>DWG SIZE</p> <p>A</p>

FORM 80274

GENERATOR ACCESSIORES

Battery Charger

A048G602 10A 50/60 Hz

A051H785 20A 50/60 Hz



Description

Cummins Power Generation fully automatic battery chargers are constant voltage/constant current chargers incorporating a 4-stage charging algorithm. Designed for use in applications where battery life and reliability are important; these chargers, complete with built-in equalize charge capability, are ideal for stationary or portable starting battery charging service.

To achieve optimum battery life, a 4-stage charging cycle is implemented. The four charging stages are constant current, high-rate taper charge, finishing charge, and maintaining charge. During the constant current cycle the charger operates at maximum possible output in the fast charge mode. During the high-rate taper charge cycle the charger stays at fast charge voltage level until battery current acceptance falls to a portion of the charger rated output. During the finishing charge cycle the charger operates at the float voltage and completes the battery charge. During the maintaining charge cycle the charger supplies only a few milliamps required by the battery to stay at peak capability.

An optional temperature sensor (A043D534) may be used to adjust charging voltage based on temperature of the battery. Use of a battery temperature sensor helps to increase battery life by preventing over or under charging. The battery temperature sensor also protects the battery from overheating. Temperature compensation sensor is required for all applications when battery charger and battery are located in different temperature or battery heater is being used.

Battery chargers are field-configurable for charging either 12 or 24 VDC battery systems at 50/60 Hz operation. Simple jumper selectors enable selection of output voltage and battery type.

Features

Protection – Surge protected to IEEE and EN standards. All models include single pole cartridge type fuses mounted on the printed circuit board to protect against input or output overcurrent.

Easy installation – Clearly marked terminal blocks and panel knockouts provide convenient connections of input and output leads.

User display – Output voltage and current, fault information and status are indicated on the front panel. Includes precision ammeter and voltmeter.

Monitoring – Status LED indicators are provided to show the condition of the charger. LED's on the right side of the monitor indicate operational functions for Temperature Compensation active (Green), AC on (Green), Float (Green) or Boost (Amber) mode, as well as Battery Fault (Red). LED's on the left side of the monitor illuminate (in Red) when Charger fail, High or Low VDC or AC fail occur.

Adjustable float voltage – Float voltage can be set, using easy to understand jumpers, for optimum battery performance and life.

Construction – NEMA-1 (IP20) corrosion resistant aluminum enclosure designed for wall mounting.

Faults – The charger senses and annunciates the following fault conditions: AC power loss, battery overvoltage, battery under voltage, battery fault conditions and charger failure. Includes an individual 30 volt/2 amp isolated contact for each alarm.

Vibration resistant design – complies with UL991 class B vibration resistance requirements.

Listed – C-UL listed to UL 1236 CSA standard 22.2 No 107.2-M89. Suited for flooded and AGM lead acid and NiCd batteries in generator set installations.

Warranty – 5 year CPG warranty.



Status and Fault LED



Field selectable jumper

Specifications

Performance and physical characteristics

Output:	Nominal voltage	12VDC* or 24VDC
	Float voltage– 12VDC batteries	12.87, 13.08, 13.31, 13.50*, 13.62, 14.30
	Float voltage– 24VDC batteries	25.74, 26.16, 26.62, 27.00*, 27.24, 28.60
	Equalize-voltage	6.5% above float voltage sensing
	Output voltage regulation	±0.5% (1/2%) line and load regulation
	Maximum output current	10 or 20 amps nominal
	Equalize charging	Battery interactive auto-boost
Input:	Voltage AC	120, 208, 240 ±10%
	Frequency	60/50 Hz ±5%
Approximate net weight:		10A: 25 lbs. (11.36 Kg) 20A: 50 lbs. (22.68 Kg)
Approximate dimensions: height x width x depth-in		10A: 12.50" x 7.66" x 6.50"(318x195x165 mm) 20A: 13.06" x 13.95" x 6.83"(332x354x173 mm)
Ambient temperature operation: At full rated output		- 4°F to 104 °F (-20 °C to 45 °C)

Note:

- Battery charger comes with default settings of 12VDC and 13.50/27.00VDC float voltage and can be changed to the battery manufacture recommendations. Replacement printed circuit board and fuses are identified in the Owner's Manual (10A: A050S537 and 20A: A051X126) which resides in Quick Serve On-Line. Service parts can be purchased through the Memphis Distribution Center. The PC board replacement instruction sheet (10A: A052N073, 20A: A053W929) and service manual (A050D829) is also available.
- Installation and application must comply with "section 4.5.3 batteries and battery charger" of application guide T-030 (Liquid Cooled Generator Set Application Manual A040S369).

Caution:

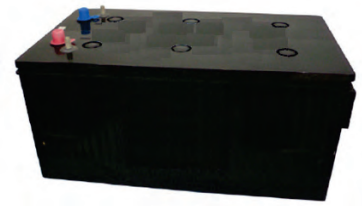
- Higher input voltages (i.e. 480VAC or 600VAC) can be applied if a transformer with a 120VAC-240VAC output is installed. Higher input voltages (i.e. 480VAC or 600VAC) can be applied if a transformer with a 120VAC-240VAC output is installed. For voltages higher than 240 VAC, step-down transformer must be used. Review the respective Owner/Installation manual A050S537 for 10Amp and A051X126 20A chargers for supplier recommended step-down transformer requirements.
- 10Amp battery charger is recommended for genset applications with 1 or 2 factory provided batteries. 20Amp battery charger is recommended for Cummins Genset applications with 3 or 4 factory provided batteries. Please consider the auxiliary DC loads connected to the genset batteries and size this charger as per the T-030 application guide to prevent misapplication issues.
- Back feed to a utility system can cause electrocution and/or property damage. Do not connect generator sets to any building electrical system except through an approved device or after building main switch is open.
- For professional use only. Must be installed by a qualified service technician. Improper installation presents hazards of electrical shock and improper operation, resulting in severe personal injury and/or property damage.
- Use this charger for charging LEAD-ACID or LIQUID ELECTROLYTE NICKEL-CADMIUM batteries only. Do not use this battery charger for charging dry cells, alkaline, lithium, nickel-metal hydride, or sealed nickel-cadmium batteries that are commonly used with home appliances. These batteries may burst and cause injuries to persons and damage to property.
- Do not parallel these battery chargers with any other charging system.

Americas
1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Phone: 763 574 5000
Fax: 763 574 5298

Europe, CIS, Middle East and Africa
Manston Park Columbus Ave.
Manston Ramsgate
Kent CT 12 5BF United Kingdom
Phone 44 1843 255000
Fax 44 1843 255902

Asia Pacific
10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

Generator Starting Batteries



> **Specification sheet**

Our energy working for you.™



**Power
Generation**

Battery Specifications

Part number	Battery	Cold cranking amps	Voltage	Reserve capacity	Length	Width	Height	Group size	Ship weight lbs	Qts electrolyte
0416-0439	Dry	1400	12	430	20.75	11.00	9.63	8D	110	16.0
0416-0579	Dry	525	12	90	10.25	6.63	8.75	24C-675	20	6.0
0416-0579-01	Wet	525	12	90	10.25	6.63	8.75	24C-675	36	6.0
0416-0796	Wet	725	12	150	13.00	6.88	9.63	31-4	62	4.2
0416-0823	Dry	725	12	150	13.00	6.88	9.63	31-4	42	4.2
0416-0848	Dry	1080	12	270	20.75	8.63	9.63	4D	85	13.0
0416-0980	Wet	1000	12	200	13.00	6.88	9.63	31-5	65	4.2
0416-1040	Dry	800	12	160	13.00	6.88	9.44	31	65	4.2
0416-1051	Wet	530	12	80	8.13	6.63	7.50	26-775	31	3.7
0416-1105	Wet	1400	12	430	20.75	11.00	9.63	8D	125	16.0
0416-1138	Sealed	NA	12	NA	5.88	3.88	3.75	NP12-12	9	4.0
0416-1264	Dry	730	12	420	20.67	10.83	9.45	8D	110	16.0
0416-1291	Sealed	800	12	110	10.00	6.88	7.81	34	38	4.0
0416-1330	Wet	810	12	146	10.25	6.63	8.88	24XL	43	5.9
0416-1332	Dry	420	12	60	9.13	5.25	8.88	22NF	19	4.0

BATTERY THERMAL WRAP — NO THERMOSTAT

Model Number	Volts	Watts	Length
KBW5015-000	120	50	28" (71cm)
KBW8015-000	120	80	36" (91cm)
KBW16015-000	120	160	72" (183cm)

Prolong the life of your battery with HOTSTART thermal battery wraps with or without thermostat.

- Durable, fire-retardant vinyl cover that resists oils and acids.
- All standard battery pads and battery wraps come with 6' (183cm) grounded cord and plug.
- Fast, easy installation.
- Boosts battery cranking power as much as 75%.

BATTERY THERMAL WRAP — WITH THERMOSTAT

Thermostat range: 65°F - 80°F (18°C - 27°C)

Model Number	Volts	Watts	Length
KBW5015T-000	120	50	26" (66cm)
KBW5024T-000	240	50	26" (66cm)
KBW8015T-000	120	80	44" (112cm)
KBW8024T-000	240	80	44" (112cm)
KBW10015T-000	120	100	56" (142cm)
KBW10024T-000	240	100	56" (142cm)

Thermostatically controlled battery thermal wraps provide optimum heating regardless of ambient temperature.

- At 80°F (27°C), the battery will achieve maximum cold cranking amps.
- Battery is constantly maintained at 80°F (27°C).
- Provides greater heat rise than plates or pads.
- Thermostat will eliminate battery damage caused by overheating and acid spill.

Battery Thermal Wrap



Silicone Pad Heaters



Not for use on batteries

Model Number	Dimensions	Volts	Watts
AF10015 AF10024	4" x 5" (101.6 x 127.0 mm)	120 240	100 100
AF15015 AF15024	4" x 5" (101.6 x 127.0 mm)	120 240	150 150
AF25015* AF25024	5" x 6" (127.0 x 152.4 mm)	120 240	250 250
AF40015 AF40024	6" x 8" (152.4 x 203.2 mm)	120 240	400 400

Flexible, Versatile and Easy to Install.

HOTSTART adhesive pad heaters can be used on oil pans, hydraulic reservoirs, engine blocks, hydraulic cylinders and diesel fuel tanks.

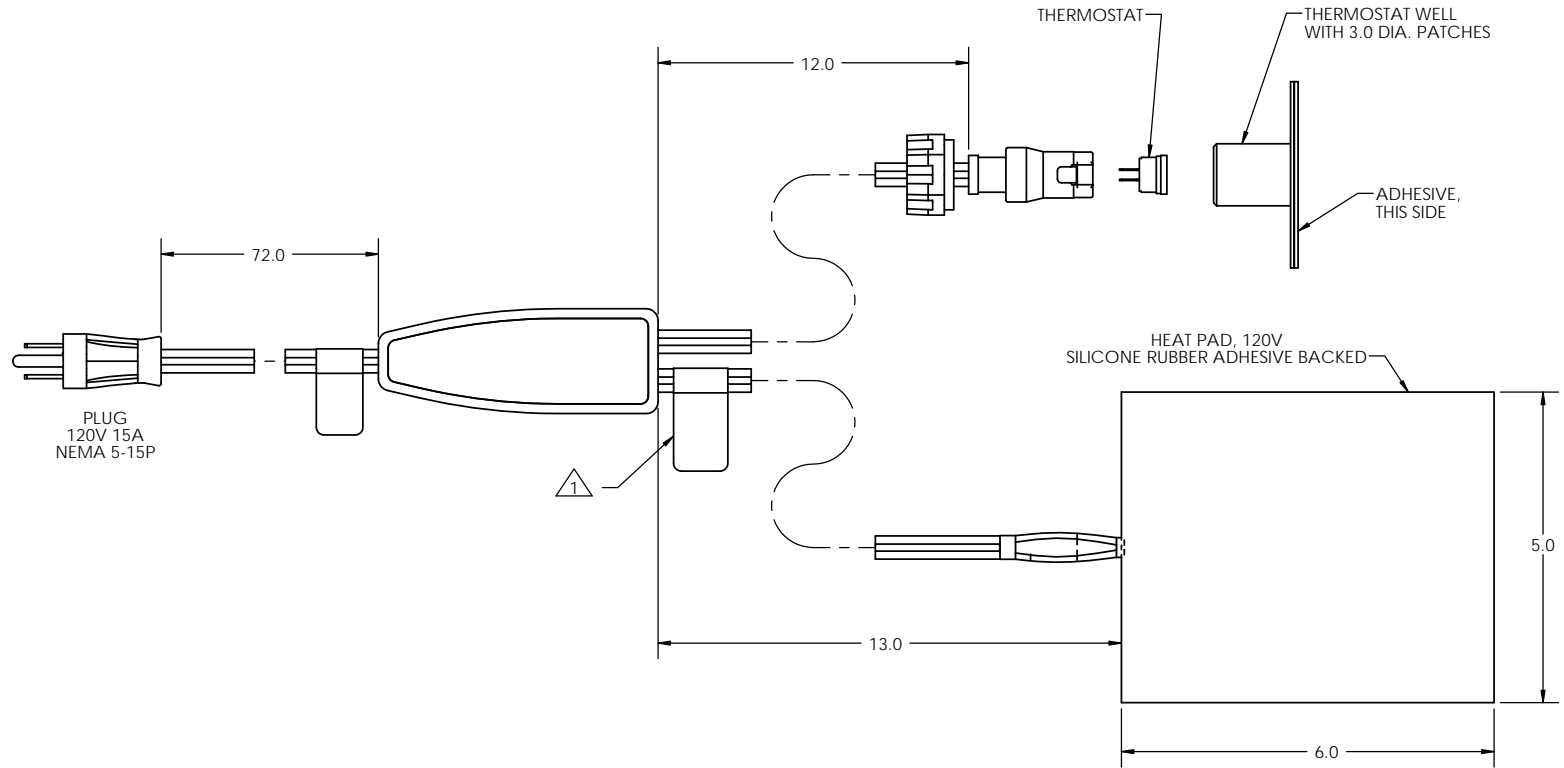
- Easy peel and stick application
- Etched foil heating element for optimal heat transfer and long life
- Durable silicone/fiberglass cover resists abrasion
- Assembled with a standard 6' (183cm) HPN cord and plug (240V without plug)

* Includes integrated thermostat (see drawing, next page)

Application Guideline	100 Watt	150 Watt	250 Watt	400 Watt
Engine oil pan	2 - 5 quarts 1.9 - 4.7L	5 - 8 quarts 4.7 - 7.5L	2 - 5 gallons 7.5 - 19L	5 - 8 gallons 19 - 30.3L
Diesel Tank	5 - 7 gallons 19 - 26.5L	7 - 10 gallons 26.5 - 38.0L	10 - 20 gallons 38.0 - 75.7L	20 - 30 gallons 75.7 - 113.5L
Hydraulic Tank	1 - 5 gallons 4.0 - 19L	5 - 10 gallons 19 - 38.0L	10 - 20 gallons 38.0 - 75.7L	20 - 30 gallons 75.7 - 113.5L
Water Tank	up - 2 gallons up - 7.5L	2 - 4 gallons 7.5 - 15L	4 - 7 gallons 15 - 26.5L	7 - 10 gallons 26.5 - 38.0L

CAUTION: Do not use pads with higher than recommended wattage for specific oil capacities.
For use on metal surfaces only.

REVISIONS					
REV.	ECO	DATE	DESCRIPTION	AUTH.	DR.



NOTES:

- 1. LABEL WITH PART NUMBER, WATTS, VOLTS AND DATE CODE.
- 2. ALL DIMENSIONS ARE FOR REFERENCE ONLY.

AF4001510-000	AF 400W 120V 6X5 72IN 1012	100°F ON - 120°F OFF
AF2501508-000	AF 250W 120V 6X5 72IN 810	80°F ON - 100°F OFF
PART NUMBER	DESCRIPTION	T-STAT RANGE

KIM HOTSTART MFG. SPOKANE, WA.
 PROPRIETARY INFORMATION
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HEAT PAD SILICONE RUBBER ADHESIVE BACKED 120V W/T-STAT

APPROVALS	DATE	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)	DWG. NO.
DRAWN BY ALS	06-18-09	TOLERANCES	AF2501508-000S
APPROVED BY RDH	06-18-09	ANGULAR xxx ± N/A	SIZE B
THIRD ANGLE PROJECTION		± N/A°	ORIGIN CP 0288
		DO NOT SCALE DRAWING	SCALE 1:2
			SHEET 1 OF 1
			REV 00



GENERATOR

Control Interconnection Wiring





**CUMMINS 3300 CONTROLLER
INTERCONNECTION DIAGRAM**

Cummins Sales and Service
14775 Wicks Blvd.
San Leandro, Ca 94577

REV	DATE	DESCRIPTION

John McWilliams
Direct: 510-347-6673
Cell: 510-693-0910
john.lmcwilliams@cummins.com

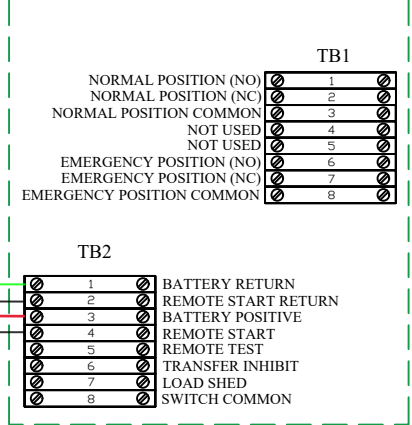
PROJECT	JMAC	DESIGNED BY	JMAC
DATE		DATE	
SCALE		SCALE	
NO. SCALE	6.27.16	NO. SCALE	

GENERATOR SET

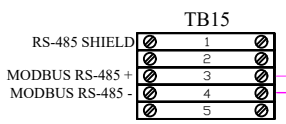
UPPER TIER

- PCCNET A
- PCCNET B
- PCCNET SHIELD / GND
- READY TO LOAD DRIVER
- CUSTOMER FUSED B+ 3A
- CONFIGURABLE OUTPUT 1 COM
- CONFIGURABLE OUTPUT 1 N.O.
- CONFIGURABLE OUTPUT 2 COM
- CONFIGURABLE OUTPUT 2 N.O.
- REMOTE START RETURN
- REMOTE START
- CONFIGURABLE INPUT 1
- CONFIGURABLE INPUT COM
- CONFIGURABLE INPUT 2
- REMOTE ESTOP RETURN
- REMOTE EMERGENCY STOP

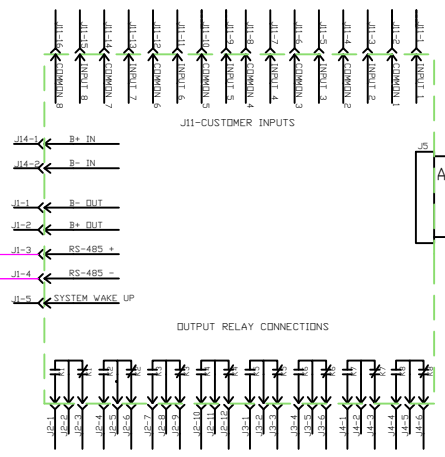
AUTOMATIC TRANSFER SWITCH



TO B+ TERMINAL
ON GENERATOR
STARTER MOTOR



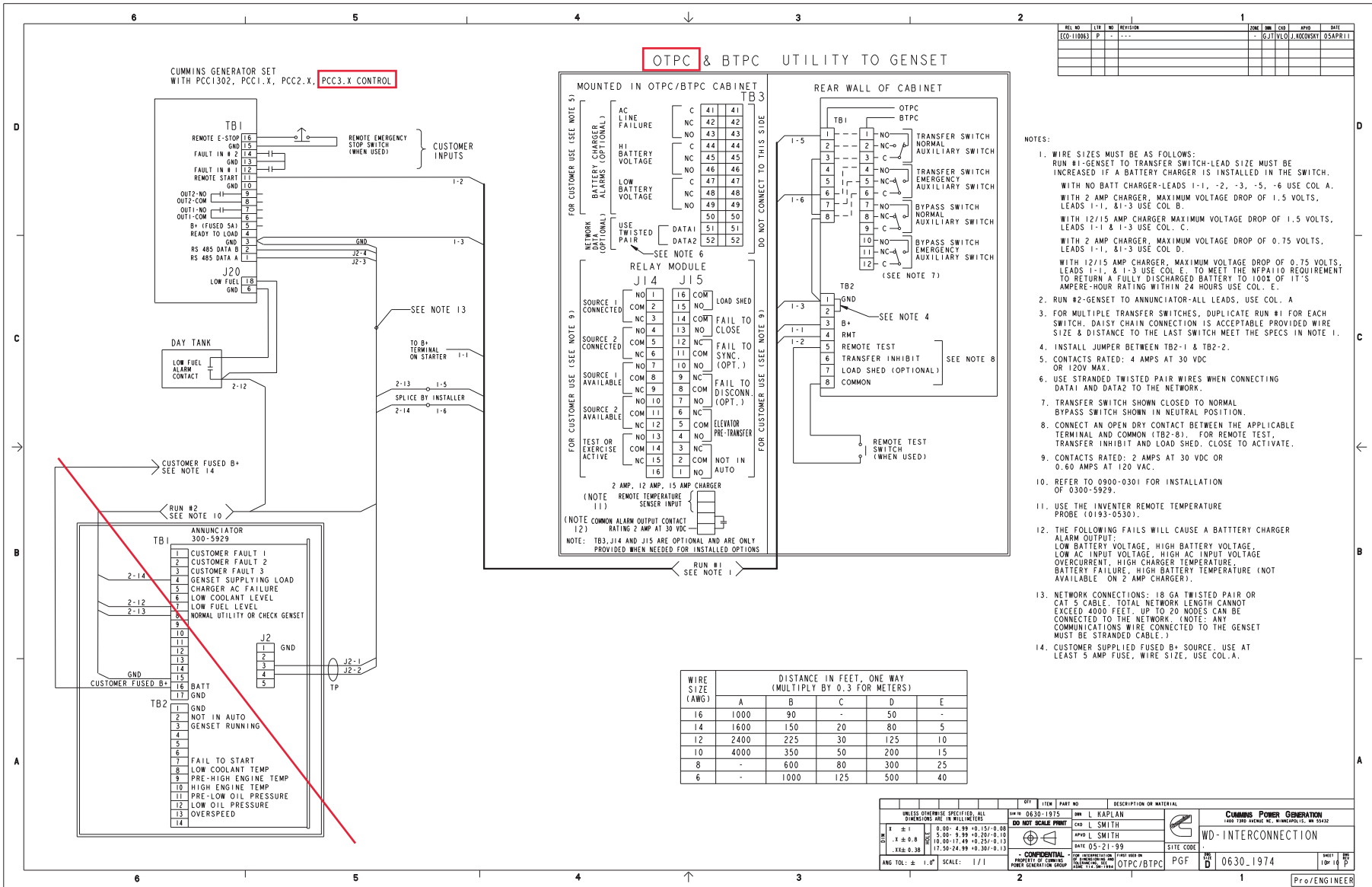
AUX 101
SYSTEM I/O DEVICE
(Factory Installed at Generator Control)



AUX 102
IF
USED

14 AWG STRANDED WIRE





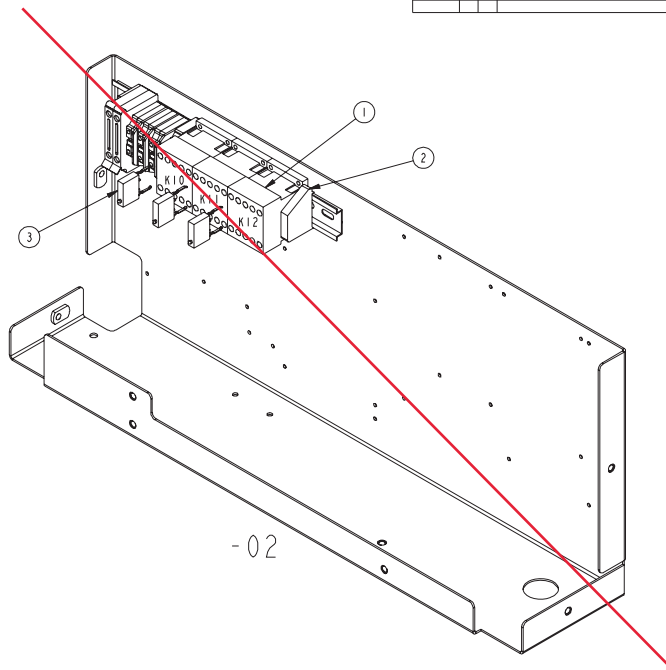
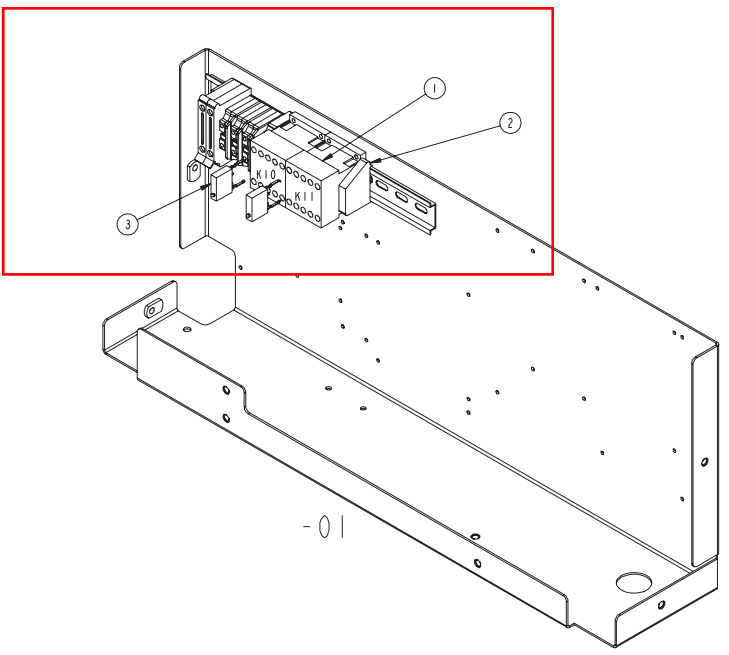
REV NO	DATE	BY	REVISION	ZONE	APPD	DATE
ECO-110063	P	-	...	-	GJT/VLO/J.MOON/SAT	05APR11

- NOTES:
- WIRE SIZES MUST BE AS FOLLOWS:
 RUN #1-GENSET TO TRANSFER SWITCH-LEAD SIZE MUST BE INCREASED IF A BATTERY CHARGER IS INSTALLED IN THE SWITCH.
 WITH NO BATTY CHARGER-LEADS 1-1, -2, -3, -5, -6 USE COL A.
 WITH 2 AMP CHARGER, MAXIMUM VOLTAGE DROP OF 1.5 VOLTS, LEADS 1-1, & 1-3 USE COL B.
 WITH 12/15 AMP CHARGER MAXIMUM VOLTAGE DROP OF 1.5 VOLTS, LEADS 1-1 & 1-3 USE COL C.
 WITH 2 AMP CHARGER, MAXIMUM VOLTAGE DROP OF 0.75 VOLTS, LEADS 1-1, & 1-3 USE COL D.
 WITH 12/15 AMP CHARGER, MAXIMUM VOLTAGE DROP OF 0.75 VOLTS, LEADS 1-1, & 1-3 USE COL E. TO MEET THE NFPA110 REQUIREMENT TO RETURN A FULLY DISCHARGED BATTERY TO 100% OF IT'S AMPERE-HOUR RATING WITHIN 24 HOURS USE COL E.
 - RUN #2-GENSET TO ANNUNCIATOR-ALL LEADS. USE COL. A
 - FOR MULTIPLE TRANSFER SWITCHES, DUPLICATE RUN #1 FOR EACH SWITCH. DAISY CHAIN CONNECTION IS ACCEPTABLE PROVIDED WIRE SIZE & DISTANCE TO THE LAST SWITCH MEET THE SPECS IN NOTE 1.
 - INSTALL JUMPER BETWEEN TB2-1 & TB2-2.
 - CONTACTS RATED: 4 AMPS AT 30 VDC OR 120V MAX.
 - USE STRANDED TWISTED PAIR WIRES WHEN CONNECTING DATA1 AND DATA2 TO THE NETWORK.
 - TRANSFER SWITCH SHOWN CLOSED TO NORMAL BYPASS SWITCH SHOWN IN NEUTRAL POSITION.
 - CONNECT AN OPEN DRY CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-B). FOR REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED, CLOSE TO ACTIVATE.
 - CONTACTS RATED: 2 AMPS AT 30 VDC OR 0.60 AMPS AT 120 VAC.
 - REFER TO 0900-0301 FOR INSTALLATION OF 0300-5929.
 - USE THE INVENTER REMOTE TEMPERATURE PROBE (0193-0530).
 - THE FOLLOWING FAILS WILL CAUSE A BATTERY CHARGER ALARM OUTPUT:
 LOW BATTERY VOLTAGE, HIGH BATTERY VOLTAGE, LOW AC INPUT VOLTAGE, HIGH AC INPUT VOLTAGE, OVERCURRENT, HIGH CHARGER TEMPERATURE, BATTERY FAILURE, HIGH BATTERY TEMPERATURE (NOT AVAILABLE ON 2 AMP CHARGER).
 - NETWORK CONNECTIONS: 18 GA TWISTED PAIR OR CAT 5 CABLE. TOTAL NETWORK LENGTH CANNOT EXCEED 4000 FEET. UP TO 20 NODES CAN BE CONNECTED TO THE NETWORK. (NOTE: ANY COMMUNICATIONS WIRE CONNECTED TO THE GENSET MUST BE STRANDED CABLE.)
 - CUSTOMER SUPPLIED FUSED B+ SOURCE. USE AT LEAST 5 AMP FUSE, WIRE SIZE, USE COL.A.

WIRE SIZE (AWG)	DISTANCE IN FEET, ONE WAY (MULTIPLY BY 0.3 FOR METERS)				
	A	B	C	D	E
16	1000	90	-	50	-
14	1600	150	20	80	5
12	2400	225	30	125	10
10	4000	350	50	200	15
8	-	600	80	300	25
6	-	1000	125	500	40

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		REV: 0630-1974	PART NO:	DESCRIPTION OR MATERIAL:
DRAWN BY: L. SMITH		APPD: L. KAPLAN	DATE: 05-21-99	SITE CODE:
CHECKED BY: L. SMITH		DATE: 05-21-99	SCALE: 1/1	PROJECT: 0630-1974
ANG TOL: ± .01		CONFIDENTIAL	PROPERTY OF CUMMINS POWER GENERATION GROUP	WD-INTERCONNECTION
SHEET 10P 14		PGF	0630-1974	Pro/ENGINEER

REL NO	REV	NO	REVISION	ENG	CHK	APP	DATE
FRD33633	A	1	PRODUCTION RELEASE	TA	TA	LD	06-22-07
FRD33624	B	1	ADD CONTROLLED PRODUCT LABEL	3A	TA	TA	09-11-07
FRD35942	C	1	ADD 000C.0125 TO -03, -04	2A	TA	TA	03-05-08



TABULATION		
PART NO.	CURRENT ER	DESCRIPTION
0179_5612_01	FRD33624	PRODUCTION
0179_5612_02	FRD33624	PRODUCTION
0179_5612_03	FRD35942	KIT
0179_5612_04	FRD35942	KIT

-THIS IS A CONTROLLED PRODUCT-
 PER DATA PROCEDURE PMS-1052
 TO MAINTAIN CONTROL AND BE RESPONSIBLE OF THE CORRECT
 STABILITY OF THE SYSTEMS LISTED BELOW

DESIGN: EIA CSMA MFC
 OTHER
 OTHER
 OTHER

MANUFACTURING, MATERIAL, AND DESIGN CONTROL: SERIAL/1154
 CHANGE, REVISIONS, OR SUBSTITUTIONS OF MATERIAL,
 PROCESS, OR PERFORMANCE FOR THIS PRODUCT MUST BE
 APPROVED BY THE FOLLOWING DESIGN CONTROL REPRESENTATIVES:
 DESIGN CONTROL FACILITY/RESULTS
 DESIGN CONTROL FACILITY/

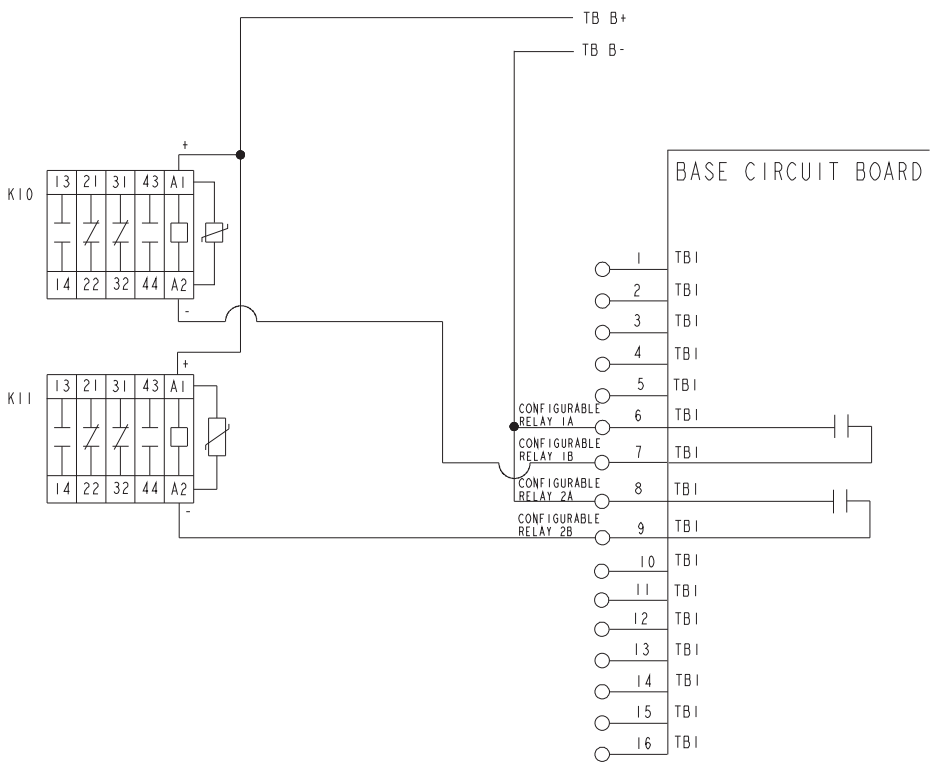
REF	REF	REF	REF	ITEM	PART NO	DESCRIPTION OF MATERIAL
1	1	-	7	000C-0125	INSTRUCTION SHEET	
REF	-	-	6	0179_5612	RELAY - INSTL (DRAWING ONLY)	
1	-	1	-	5	0338_5103_02	HARNESS-RELAY
-	-	1	4	0338_5103_01	HARNESS-RELAY	
3	2	3	2	0305_1009	SUPPRESSOR-VOLTAGE	
1	1	1	2	0332_2878	TERMINAL BLOCK	
3	2	3	2	0307_2873	RELAY-CONTROL (12_VDC)	

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		T. LABEL	
± 1	0.00 - 4.99 +0.15/-0.08	± 0.1	0.00 - 4.99 +0.15/-0.08
± 0.8	5.00 - 9.99 +0.25/-0.10	± 0.1	10.00 - 17.49 +0.25/-0.13
± 0.38	17.50 - 24.99 +0.30/-0.13	± 0.1	25.00 - 99.99 +0.30/-0.13
ANG TOL: ± 1.0°	SCALE: 1/2		

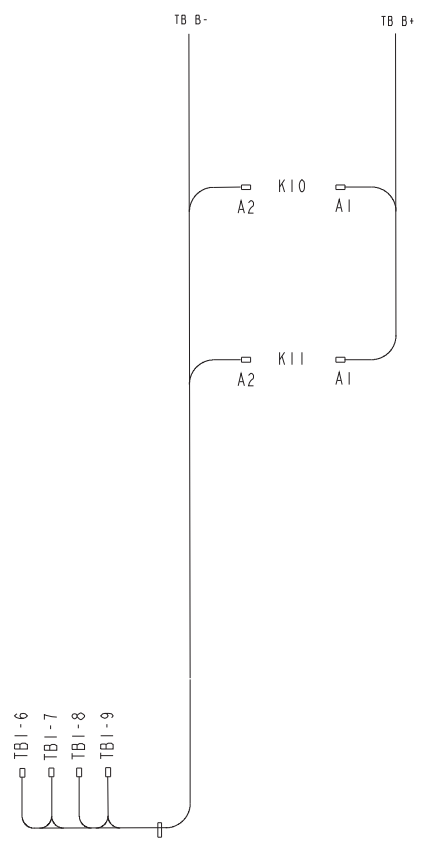
		CUMMINS POWER GENERATION 1400 FORD AVENUE, MC KENZIEVILLE, MO 64649	
RELAY_INSTL		DATE 06-22-07	
SITE CODE		PGF	
0179_5612		SHEET 1 OF 3	

Pro/ENGINEER

REL NO	REV	NO	REVISION	ENG	CHK	APP	DATE
FRD33833	A	1	PRODUCTION RELEASE	-	TA	TA	LD 06-22-07
FRD33824	B	1	-	TA	TA	LD 09-11-07
FRD35942	C	1	-	TA	TA	LD 03-05-08



WIRING DIAGRAM



WIRING SCHEMATIC FOR CONFIGURATION WITH CUSTOMER OUTPUT RELAY OPTION

- 01

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		REV	ITEM	PART NO	DESCRIPTION OF MATERIAL
TOLERANCES		TOLERANCES		TOLERANCES	
FRACTION	DECIMAL	FRACTION	DECIMAL	FRACTION	DECIMAL
± 1	0.00 - 4.99	± 0.15	0 - 0.08	± 0.15	0 - 0.08
± 0.8	5.00 - 9.99	± 0.25	0 - 0.10	± 0.25	0 - 0.10
± 0.5	10.00 - 17.49	± 0.25	0 - 0.13	± 0.25	0 - 0.13
± 0.38	17.50 - 24.99	± 0.38	0 - 0.13	± 0.38	0 - 0.13
ANG TOL: ± 1.0°		SCALE: 1/2		SCALE: 1/2	
PROPERTY OF CUMMINS POWER GENERATION GROUP		CONFIDENTIAL		CONFIDENTIAL	
FOR INFORMATION ONLY		FOR INFORMATION ONLY		FOR INFORMATION ONLY	
DATE 11-26-14		DATE 11-26-14		DATE 11-26-14	
DSSGA, AB, AC		DSSGA, AB, AC		DSSGA, AB, AC	
PGF		PGF		PGF	
REV D		REV D		REV D	
0179_5612		0179_5612		0179_5612	
SHEET 2		SHEET 2		SHEET 2	
OF 3		OF 3		OF 3	
C		C		C	

Pro/ENGINEER

PowerCommand[®] Input/output Expansion Module

AUX 101 and AUX 102

Factory Installed Inside the Generator Control Panel



> Specification sheet



Power Generation

Our energy working for you.™

Description

The PowerCommand AUX 101 Input/output Module and the AUX 102 Input/output Expansion Module provide up to sixteen (16) relay output and up to twelve (12) discrete/analog inputs for auxiliary control and monitoring of the power system.

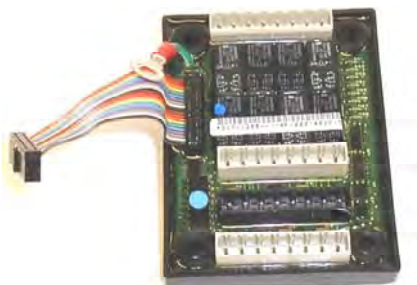
Analog/discrete inputs can be used for system fault expansion and/or generator set metering.

Relay outputs can be used for controlling equipment such as motors, louvers, lamps, fans and pumps. The relays may be configured individually from the genset control operator interface or using InPower™ software.

The AUX 101 and AUX 102 modules are compatible with genset controls supporting a PCCNet network and require a twisted pair connection. This includes the PCC 1301 control.

AUX 101 - Contains eight (8) Form-C relay output sets and eight (8) discrete/analog inputs.

AUX 102 - Easily connects to the AUX 101 to provide an additional eight (8) Form-C relay outputs and (4) additional discrete inputs.



AUX 102 - Expansion

Features

- Up to sixteen (16) configurable Form-C relays provide easy control of system equipment such as lamps, louvers, motors and pumps. LED status of each relay.
- Up to twelve (12) configurable discrete inputs for monitoring equipment status and faults. Equipment status and faults will be annunciated.
- Up to eight (8) analog inputs. Analog inputs can be assigned one of seven preprogrammed functions:
 - Oil temperature
 - Exhaust temperature
 - Fuel level
 - Ambient temperature
 - Alternator RTD
 - Speed bias (for manual paralleling only)
 - Voltage bias (for manual paralleling only)
- Two 5 VDC voltage sources for use with active senders.
- Four programmable current sources for use with resistive senders.
- Two status LEDs:
 - DS1 (green) indicates the AUX 101 is connected to the network and operating normally
 - DS2 (red) indicates the AUX 101 has lost its connection or is not connected to the network
- Device number indicator. Seven segment LED used to uniquely define more than one AUX 101 on the same network.
- May be connected at any point in the PCCNet network.
- Plug-and-play networking - No binding required.
- Pluggable terminal blocks allow easy one-time wiring.
- Less wiring makes installation and system upgrades quick and easy.
- PowerCommand controls are supported by a worldwide network of independent distributors who provide parts, service and warranty support.
- UL Listed and labeled; CSA certified; CE compliant.

Specifications

Signal requirements

Network connections - RS485, twisted-pair 78 kbps

Control power - 5-40 VDC

Current

- 200 mA typical at 12 V, no active relay
- 100 mA typical at 24 V, no active relay
- 800 mA at 12 V, all relays active

Terminations for control power accept wire up to 16 ga.

Environment

The AUX 101 and AUX 102 are designed for proper operation in ambient temperatures from -40 °C to +60 °C (-40 °F to +140 °F) and for storage from -40 °C to +80 °C (-40 °F to +176 °F). Modules will operate with humidity up to 95%, non-condensing

Relay ratings (AUX 101)

- Normally closed: 3 A at 250 VAC or 30 VDC
- Normally open: 5 A at 250 VAC or 30 VDC

Relay ratings (AUX 102)

- 2 A at 125 VAC, 2 A at 30 VDC

Input ratings (AUX 101)

- Active low inputs
- Maximum voltage 24 VDC (inputs 1 - 6)
- Maximum voltage 40 VDC (inputs 7 - 8)

Network length - Maximum 1219 m (4000 ft)

Approved wiring - Cat 4 or Cat 5 (stranded)

Configurations

All configurations are stored in the main genset control and are modified from the generator set control HMI or using InPower PC software.

Discrete/analog inputs:

Each AUX 101 input can be configured as discrete or analog. AUX 102 inputs are discrete only. Discrete inputs have the following configuration options:

- Active high or active low
- Event, warning or shutdown
- Programmable text (displayed on genset HMI and InPower software)

Analog inputs have a set of predefined functions and can only be configured on certain module inputs. Below is a list of functions and possible module inputs:

- Input 1 - Voltage bias (-3 to +3 VDC)*
- Input 2 - Speed bias (0 to +5 VDC)*
- Inputs 3 - 6
 - Oil temperature
 - Exhaust temperature
 - Ambient air temperature
 - Fuel level
 - Alternator temperature

Inputs are defaulted to disabled

* Please note that speed and voltage bias interfaces are for manual paralleling only and must not be used with automatic paralleling controls.

Relay outputs

Outputs can be configured to energize on occurrence of any event or fault code supported by the genset control.

The relay outputs default to the following:

AUX 101

- 1 - Low oil pressure
- 2 - High engine temperature
- 3 - Charger AC failure
- 4 - Battery (low, weak, high)
- 5 - Engine overspeed
- 6 - Fail-to-start
- 7 - Not-in-auto
- 8 - Generator set running

AUX 102

- 9 - Pre-low oil pressure
- 10 - Pre-high engine temperature
- 11 - Low coolant level*
- 12 - Low fuel level*
- 13 - Low coolant temperature
- 14 - Common alarm
- 15 - Not defined
- 16 - Not defined

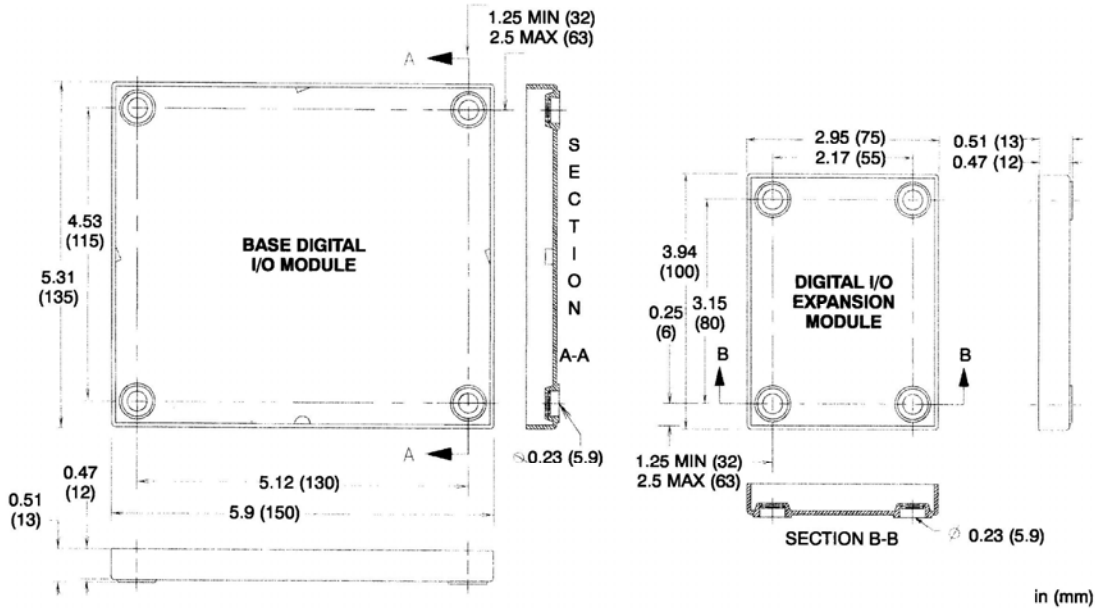
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Dimensions



Ordering information

Part number	Description
0541-1291	AUX 101 Digital Input/output Module - Base – PCC 1301
0184-0263	AUX 101 Digital Input/output Module - Base – PCC 1301 on DN and GN model generator sets
0630-3142	AUX 102 Digital Input/output Module wiring diagram - Instruction sheet C693
0541-0772	AUX 102 Digital Input/output Module - Expansion

PCCNet Logo

Look for this logo on spec sheets of PCCNet compatible devices.



See your distributor for more information.

Cummins Power Generation

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Manston Ramsgate
Kent CT 12 5BF United Kingdom
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Fax 44 1843 255902

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10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

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www.cumminspower.com

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TRANSFER SWITCH



OTPC Transfer Switch Open and Closed Transition

40 - 4000 Amp

Description

OTPC transfer switches are designed for operation and switching of electrical loads between primary power and Standby generator sets. They are suitable for use in emergency, legally required and optional Standby applications. The switch monitors both power sources, signals generator set startup, automatically transfers power, and returns the load to the primary power source when the utility returns and stabilizes. OTPC transfer switches are available with closed transition transfer. By briefly connecting the two sources (for 100 msec or less), the transfer from the alternate source back to the normal source occurs without interruption in the power supply to loads.



Features

PowerCommand® control – A fully featured microprocessor-based control with digital display. Controls allow operator to enter settings and make adjustments to software-enabled features easily and accurately. Accommodates up to eight event schedules.

Programmed transition – Open transition timing can be adjusted to completely disconnect the load from both sources for a programmed time period, as recommended by NEMA MG-1 for transfer of inductive loads.

Advanced transfer switch mechanism – Unique bi-directional linear actuator provides smooth, Continuous transfer switch action during automatic operation.

Robust control system design – Optically isolated logic inputs and isolation transformers for AC power inputs provide high-voltage surge protection.

Main contacts – Heavy-duty silver alloy contacts with multi-leaf arc chutes are rated for motor loads or total system load transfer. They require no routine contact maintenance.

Continuous load current not to exceed 100% of switch rating and Tungsten loads not to exceed 30% of switch rating.

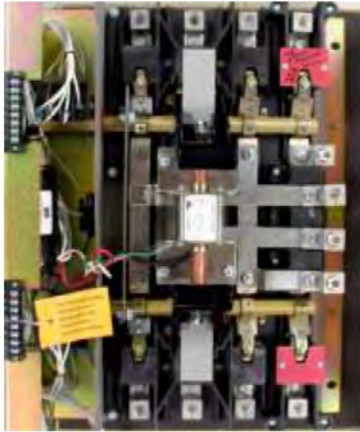
Communications capability – The transfer switch is capable of communicating with other transfer switches, SCADA and remote monitoring systems, or Cummins generators utilizing LonWorks® protocol.

Easy service/access – Single-plug harness connection and compatible terminal markings simplify servicing. Access space is ample. Door-mounted controls are field-programmable; not tool is required.

Complete product line – Cummins offers a wide range of equipment, accessories and services to suit virtually any backup power application.

Warranty and service - Products are backed by a comprehensive warranty and a worldwide network of distributors with factory-trained service technicians.

Transfer Switch Mechanism



- Transfer switch mechanism is electrically operated and mechanically held in the source 1 and source 2 positions. The transfer switch incorporates electrical and mechanical interlocks to prevent inadvertent interconnection of the sources.
- Independent break-before-make action is used for both 3-pole and 4-pole/switched neutral switches. This design allows use of sync check operation when required, or control of the operating speed of the transfer switch for proper transfer of motor and rectifier-based loads (programmed transition feature).
- True 4-pole switching allows for proper ground (earth) fault sensing and consistent, reliable operation for the life of the transfer switch. The neutral poles of the transfer switch have the same ratings as the phase poles and are operated by a common crossbar mechanism, eliminating the possibility of incorrect neutral operation at any point in the operating cycle, or due to failure of a neutral operator.
- High pressure silver alloy contacts resist burning and pitting. Separate arcing surfaces further protect the main contacts. Contact wear is reduced by multiple leaf arc chutes that cool and quench the arcs. Barriers separate the phases to prevent interphase flashover. A transparent protective cover allows visual inspection while inhibiting inadvertent contact with energized components
- Switch mechanism, including contact assemblies, is third party certified to verify suitability for applications requiring high endurance switching capability for the life of the transfer switch. Withstand and closing ratings are validated using the same set of contacts, further demonstrating the robust nature of the design

Specifications

Voltage rating	600 VAC, 50 or 60 Hz.
Arc interruption	Multiple leaf arc chutes provide dependable arc interruption.
Neutral bar	A full current-rated neutral bar with lugs is standard on enclosed 3-pole transfer switches.
Auxiliary contacts	Two isolated contacts (one for each source) indicating switch position are provided for customer use. Contacts are normally open, and close to indicate connection to the source. Wired to terminal block for easy access. Rated at 10 amps Continuous and 250 VAC maximum. UL recognized, and CSA-certified.
Operating temperature	-40 °F (-40 °C) to 140 °F (60 °C)
Storage temperature	-40 °F (-40 °C) to 140 °F (60 °C)
Humidity	Up to 95% relative, non-condensing
Altitude	Up to 10,000 ft (3,000 m) without derating
Surge withstand ratings	Voltage surge performance and testing in compliance with the requirements of IEEE C62.41 (Category B3) and IEEE C62.45.
Total transfer time (source-to-source)	Will not exceed 6 cycles at 60 Hz with normal voltage applied to the actuator and without programmed transition enabled.
Manual operation handles	Transfer switches rated through 1000 amps are equipped with permanently attached operating handles and quick-break, quick-make contact mechanisms suitable for manual operation. Transfer switches over 1000 amps are equipped with manual operators. All switches must be de-energized before manual operation is attempted.

Transition Modes

→ **Open transition/programmed:** Controls the time required for the device to switch from source to source, so that the load generated voltages decay to a safe level before connecting to an energized source. Recommended by NEMA MG-1 to prevent nuisance-tripping breakers and load damage. Adjustable 0-60 seconds, default 0 seconds. Programmed transition is standard on 150-1200 amp switches, and optional on 1600-4000 amps.

Open transition/in-phase: Initiates open transition transfer when in-phase monitor senses both sources are in phase. Operates in a break-before-make sequence. Includes ability to enable programmed transition as a back-up. If sources are not in phase within 120 seconds, switches from 40-1200 amps will transfer using programmed transition (not available on open transition switches over 1200 amps).

Closed transition: Used in applications where loads are sensitive to the momentary power interruption that occurs when performing open transition between sources. Closed transition is accomplished by briefly (<100 msec) paralleling two good sources to eliminate the momentary break in the power supply. Closed transition is only available as an option on OTPC models from 1000-4000 amps.

Genset-to-genset: Either genset can be designated as the lead genset. If the lead genset goes down or is taken offline, the transfer switch starts the second genset and transfer the load. The control can be programmed to alternate between the two gensets at a set interval up to 336 hours (2 weeks).

PowerCommand Control

PowerCommand controls are microprocessor based and developed specifically for automatic transfer switch operation. The control includes all of the features and options required for most applications.

- LED lamps indicate source availability, source connected, exercise mode and test mode.
- Flash memory stores the control settings.
- Contents of the memory are not lost even if power to the controller is lost.
- On-board battery maintains the real-time clock setting and the engine start time delay.
- Choice of two control packages allows selection of the most suitable control for the application.

Control Functions

Level 1 control (C023)

Open transition (in-phase)

Open transition (programmed)

Utility-to-genset applications

Software adjustable time delays:

- Engine start: 0 to 120 sec
- Transfer normal to emergency: 0 to 120 sec Re-transfer emergency to normal: 0 to 30 min
- Engine stop: 0 to 30 min
- Programmed transition: 0 to 60 sec

Undervoltage sensing: 3-phase normal, 1-phase emergency

- Accuracy: \pm 2%
- Pickup: 85% to 100% of nominal voltage
- Dropout: 75% to 98% of pickup setting
- Dropout time delay: 0-4 sec

Overvoltage sensing: 3-phase normal, 1-phase emergency

- Accuracy: \pm 2%
- Pickup: 95% to 99% of dropout setting
- Dropout: 105% to 135% of nominal voltage
- Dropout time delay: 0 to 120 sec

Over/under frequency sensing:

- Accuracy: \pm 0.05 Hz
- Pickup: \pm 5% to \pm 20% of nominal frequency
- Dropout: 1-5% beyond pickup
- Dropout time delay: 0.1 to 15.0 sec

Programmable genset exerciser: One event/schedule with or w/o load

Basic indicator panel:

- Source available/connected LED indicators
- Test/exercise/override buttons
- Digital display – optional (M018)
- Analog bar graph meter display – optional (D009)

Date/time-stamped event recording: 50 events

Load sequencing: Optional with network communications module M031. Provides control for eight steps of load with an adjustable time delay for each step on transfer, re-transfer or both.

→ Level 2 control (C024)

Open transition (in-phase)

Open transition (programmed)

Closed transition: Includes fail-to-disconnect timer to prevent extended paralleling with the utility

Utility-to-genset applications

Utility-to-utility applications

Genset-to-genset applications

Software adjustable time delays:

- Engine start: 0 to 120 sec
- Transfer normal to emergency: 0 to 120 sec
- Re-transfer emergency to normal: 0 to 30 min
- min Engine stop: 0 to 30 min
- Programmed transition: 0 to 60 sec

Undervoltage sensing: 3-phase normal, 3-phase emergency

- Accuracy: \pm 2%
- Pickup: 85% to 100% of nominal voltage
- Dropout: 75% to 98% of pickup setting
- Dropout time delay: 0-4 sec

Overvoltage sensing: 3-phase normal, 3-phase emergency

- Accuracy: \pm 2%
- Pickup: 95% to 99% of dropout setting
- Dropout: 105% to 135% of nominal voltage
- Dropout time delay: 0 to 120 sec

Over/under frequency sensing:

- Accuracy: \pm 0.05 Hz
- Pickup: \pm 5% to \pm 20% of nominal frequency
- Dropout: 1-5% beyond pickup
- Dropout time delay: 0.1 to 15.0 sec

Voltage imbalance sensing:

- Dropout: 2% to 10%
- Pickup: 90% of dropout
- Time delay: 2.0 to 20.0 sec

Phase rotation sensing:

- Time delay: 100 msec

Loss of single phase detection:

- Time delay: 100 msec

Programmable genset exerciser: Eight events/schedules with or w/o load

Basic indicator panel:

- Source available/connected LED indicators
- Test/exercise/override buttons
- Digital display – standard
- Analog bar graph meter display – optional (D009)

Date/time-stamped event recording: 50 events

Load sequencing: Optional with network communications module M031. Provides control for eight steps of load with an adjustable time delay for each step on transfer, re-transfer, or both.

Genset-to-genset: Same functions as above for lead and secondary generators.

Utility-to-utility: Same functions as above, for preferred and alternate source

Time-Delay Functions

Engine start: Prevents nuisance genset starts due to momentary power system variation or loss. Not included in utility-to-utility systems.

Transfer normal to emergency: Allows genset to stabilize before application of load. Prevents power interruption if normal source variation or loss is momentary. Allows staggered transfer of loads in multiple transfer switch systems. For genset-to-genset applications, delays transfer of load from lead to secondary generator.

Re-transfer emergency to normal: Allows the utility to stabilize before re-transfer of load. Prevents needless power interruption if return of normal source is momentary. Allows staggered transfer of loads in multiple transfer switch systems. For genset-to-genset applications, delays re-transfer of load from secondary back to lead generator.

Engine stop: Maintains availability of the genset for immediate reconnection if the normal source fails shortly after retransfer. Allows gradual genset cool down by running unloaded. Not included in utility-to-utility systems.

Elevator pre-transfer signal: Requires optional relay signal module (M023). Signals elevator system that transfer is pending and delays transfer for pre-set interval of 0-60 seconds to prevent a power interruption during elevator operation

User Interfaces

Basic interface panel

LED indicators provide at-a-glance source and transfer switch status for quick summary of system conditions. Test and override buttons allow delays to be bypassed for rapid system checkout.

→ Digital display (M018)

The digital display provides a convenient method for monitoring load power conditions, adjusting transfer switch parameters, monitoring PowerCommand network status or reviewing transfer switch events. Password protection limits access to adjustments to authorized personnel. The digital display is optional with the PowerCommand Level 1 control and comes standard with the Level 2 control.

User Interface Options

Front panel security key (M017)

Locks front panel to prohibit access to digital control settings. Prevents unauthorized activation of transfer or test functions.

Bar graph meter display (D009)

An LED bar graph display provides an easy-to-read indicator of the level of power being supplied to the load. Information displayed includes: 3-phase voltage and current, frequency, power factor, and kilowatts. Green, amber, and red LEDs provide at-a-glance indication of system acceptability. Available as an option with the Level 2 PowerCommand microprocessor control.

Control Options

→ Relay signal module (M023)

Provides relay output contacts for sending information to the building monitoring and control system. Relay outputs include: source 1 connected/available, source 2 connected/available, not in auto, test/exercise active, failed to disconnect, failed to synchronize, failed to transfer/re-transfer, and elevator control pre-transfer signal.

Loadshed (M007)

Removes the load from the emergency power source by driving the transfer switch to the neutral position when signalled remotely. Transfers load back to the emergency source when the signal contacts open. Immediately re-transfers back to the primary source when available. Available for utility-to-genset applications only.

PowerCommand network interface (M031)

Provides connection to the PowerCommand network. LonWorks compatible for integration with building monitoring and control system.

Load power and load current monitoring (M022)

Measures load phase and neutral current, power factor, real power (kW) and apparent power (kVA). Warns of excessive neutral current resulting from unbalanced or nonlinear loads. Minimum current level detection is 3%.

UL Withstand and Closing Ratings

OTPC transfer switches must be protected by circuit breakers or fuses. Referenced drawings include detailed listings of specific breakers or fuse types that must be used with the respective transfer switches. Consult with your distributor/dealer to obtain the necessary drawings. Withstand and closing ratings (WCR) are stated in symmetrical RMS amperes.

Transfer switch ampere	MCCB protection			Special circuit breaker protection		
	WCR @ volts max with specific manufacturers MCCBs	Max MCCB ratings	Drawing reference	With specific current limiting breakers (CLB)	Max CLB rating	Drawing reference
40, 70, 125 3-pole	14,000 at 480	225 A	A050J441	200,000 at 480	225 A	A048J566
	14,000 at 600			100,000 at 600		
40, 70, 125 4-pole	30,000 at 480	400 A	A048E949	200,000 at 480	400 A	A051D533
	30,000 at 600			100,000 at 600		
150, 225, 260	30,000 at 480	400 A	A048E949	200,000 at 480	400 A	A051D533
	30,000 at 600			100,000 at 600		
300, 400, 600	65,000 at 480	1200 A	A056M829	200,000 at 480	1200 A	A048J564
	65,000 at 600			100,000 at 600		
800, 1000 open	65,000 at 480	1400 A	A056M821	150,000 at 480	1400 A	A048J562
	50,000 at 600			100,000 at 600		
1000, 1200 closed	85,000 at 480	1600 A	A052L319	200,000 at 480	1600 A	A048P186
	65,000 at 600*			200,000 at 600		
1200 open, delayed	85,000 at 480	1600 A	A056M825			
	65,000 at 600*					
1600, 2000, 3000, 4000	These amperages don't have specific circuit breaker ratings. See 3 cycle ratings table.					

*CSA only

Fuse Protection

Transfer switch ampere	WCR @ volts max. with current limiting fuses	Max fuse, size and type	Drawing reference
40, 70, 125 3- and 4-pole	200,000 at 480	200 A Class, J, RK1, RK5, T	A050J441
	200,000 at 600		
150, 225, 260	200,000 at 480	600 A Class, J, RK1, RK5 1200 A Class L or T	A048E949
	200,000 at 600		
300, 400, 600	200,000 at 480	600 A Class, RK1 or RK5 1200 A Class L or T	A056M829
	200,000 at 600		
800, 1000 open	200,000 at 480	600 A Class, J, RK1 or RK5 1200 A Class T 2000 A Class L	A056M821
	200,000 at 600		
1000, 1200 closed	200,000 at 480**	3000 A Class L	A052L319
1200 open	200,000 at 480	600 A Class, J, RK1 or RK5 1200 A Class T 2000 A Class L	A056M825
	200,000 at 600		
1600, 2000	200,000 at 480**	2500 A Class L	A052L322
3000	200,000 at 480**	4000 A Class L	A052L322
4000	200,000 at 480**	6000 A Class L	A052L324
	200,000 at 600*		

*CSA only

**UL only

3-Cycle Ratings

Transfer switch ampere	WCR @ volts max 3 cycle rating	Max MCCB rating	Drawing reference
300, 400, 600	25,000 at 600	1200 A	A056M829
800, 1000	35,000 at 600	1400 A	A056M821
1000, 1200 closed	50,000 at 480	1600 A	A052L319
	42,000 at 600*		
1200 open	50,000 at 480	1600 A	A056M825
	42,000 at 600		
1600, 2000	100,000 at 480	4000 A	A052L322
	65,000 at 600*		
3000	100,000 at 480	4000 A	A052L322
	65,000 at 600*		
4000	100,000 at 480	5000 A	A052L324
	85,000 at 600*		

*CSA only

Transfer Switch Lug Capacities

All lugs are 90°C rated and accept copper or aluminium wire unless indicated otherwise.

Amp rating	Cables per phase	Size
40, 70, 125 3-pole	1	#12 AWG-2/0
40 4-pole	1	#14 AWG-2/0
70, 125 4-pole	1	#6 AWG - 300 MCM
150, 225	1	#6 AWG - 300 MCM
260	1	#6 AWG - 400 MCM
300, 400	2	Two hole lug, one accepts 3/0 AWG – 600 MCM and the other accepts #4 AWG – 250 MCM
600	2	250 - 500 MCM
800, 1000 open, delayed	4	250 - 500 MCM
1000, 1200 closed	4	#2 AWG to 600 MCM
1200 open, delayed	4	# 2 AWG to 600 MCM, standard (Feature N045) 1/0 AWG to 750 MCM, optional (Feature N066) Compression Lug Adapter, optional (feature N032)**
1600 2000	8	#2 AWG to 600 MCM (lugs optional)
3000	8	#2 AWG to 600 MCM (lugs optional)
4000	12	1/0 AWG to 750 MCM (lugs optional)

**Recommended Compression lugs (½” stud , 1-3/4” centers) Lug mounting hardware included

750 MCM	600 MCM	500 MCM	Manufacturer
CRA- 750L2	CRA-600L2	CRA-500L2	ILSCO
2ACL-750	2ACL-600	2ACL-500	
2IACL-750	2IACL-600	2IACL-500	
54223	54289	54286	THOMAS & BETTS
60278	60275	60273	
60278N	60278N	60278N	
LCN75	LCN600	LCN500	
ATL502	ATL602	ATL5002	
YA39-2LN	YA36-2LN	YA34-2LN	BURNDY
YA39-2N	YA36-2N	YA34-2N	
YA44L-2NTC-LD	-	YA38L-2NTC-FX	
YAG44L-2NTC-LD	-	YAG38L-2NTC-LD	
YA44-2N-FXB	-	YA38-2N-FXB	
YA39A5 And YA39AM2	YA36A3	YA34A3	

Enclosures

Dimensions - transfer switch in UL type 1 enclosure

Amp rating	Height		Width		Depth				Weight 3-pole type		Outline drawing
					Door closed		Door open				
	in	mm	in	mm	in	mm	in	mm	lb	kg	
40, 70, 125 3-pole	27.0	686	20.5	521	12.0	305	31.5	800	82	37	0310-0544
40, 70, 125 4-pole	35.5	902	26.0	660	16.0	406	41.0	1042	165	75	0500-4896
150, 225	35.5	902	26.0	660	16.0	406	41.0	1042	165	75	0310-0414
260	43.5	1105	28.5	724	16.0	406	43.0	1093	170	77	0310-0540
300, 400, 600	54.0	1372	25.5	648	18.0	457	42.0	1067	225	102	0310-1307
800, 1000 open	68.0	1727	30.0	762	20.6	524	48.5	1232	360	163	0310-0417
1000, 1200 closed	76.3	1937	36.0	915	22.7	577	54.0	1372	450	204	0310-0482
1200 open, delayed	90.0	2290	39.0	991	27.5	699	64.7	1644	730	331	A030L605
1600, 2000*	90.0	2290	39.0	915	48.0	1219	84.0	2134	1100	499	0310-0483
3000*	90.0	2290	36.0	915	48.0	1219	84.0	2134	1250	567	0310-0484
4000*	90.0	2290	46.5	1180	60.0	1520	106	2700	1850	839	0500-4485

Dimensions - transfer switch in UL type 3R, 4, or 12 enclosure

Amp rating	Height		Width		Depth				Weight		Cabinet type	Outline drawing
					Door closed		Door open					
	in	mm	in	mm	in	mm	in	mm	lb	kg		
40, 70, 125 3-pole	34.0	864	26.5	673	12.5	318	36.5	927	125	57	3R, 12	0310-0453
											4	0310-0445
40, 70, 125 4-pole	42.5	1080	30.5	775	16.0	406	44.0	1118	190	86	3R, 12	0500-4896
											4	0500-4896
150, 225	42.5	1080	30.5	775	16.0	406	44.0	1118	215	97	3R, 12	0310-0454
											4	0310-0446
260	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	3R, 12	0310-0455
											4	0310-0447
300, 400, 600	59.0	1499	27.5	699	18.5	419	41.5	1054	290	132	3R, 12	0310-1315
											4	0310-1316
800, 1000 open	73.5	1867	32.5	826	20.8	529	49.5	1257	410	186	3R, 12	0310-0457
											4	0310-0449
1000, 1200 closed	76.3	1937	36.0	915	22.7	577	54.0	1372	450	204	3R, 12, 4	0310-0482
1200 open	90.0	2290	39.0	991	27.5	699	64.7	1644	730	331	3R, 12	A030L605
											4	A041N372
1600, 2000*	90.0	2290	38.0	826	50.9	1293	80.0	2032	1100	499	3R, 12, 4	0310-0744
3000*	90.0	2290	38.0	965	51.0	1295	84.5	2146	1250	567	3R	0310-0745
4000*	90.0	2290	49.0	1244	60.0	1524	105	2654	1850	839	3R	0500-4486

Dimensions - transfer switch in UL type 4X stainless steel enclosure

Amp rating	Height		Width		Depth				Weight		Cabinet type	Outline drawing
					Door closed		Door open					
	in	mm	in	mm	in	mm	in	mm	lb	kg		
40, 70, 125 3-pole	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
40, 70, 125 4-pole	46.0	1168	32.0	813	16.0	406	46.0	1168	1168	255	4X	0500-4896
150, 225	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
260	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
300, 400, 600	73.5	1867	32.5	826	19.5	495	49.5	1257	410	186	4X	0500-4185
800, 1000 open	73.5	1867	32.5	826	19.5	495	49.5	1257	410	186	4X	0500-4185
1000, 1200 closed	7.0	1778	40.0	1016	19.8	502	59.0	1499	450	204	4X	0310-0482
1200 open	90.0	2290	39.0	991	27.5	699	64.7	1644	730	331	4X	A041N372
1600, 2000*	90.0	2290	35.5	826	50.9	1293	80.0	2032	1100	499	4X	0310-0744

* Rear and side access is required for installation. Dimensions shown are for 4-pole. For information on 3-pole switches, call factory.

Submittal Detail

Amperage ratings

- 40
- 70
- 125
- 150
- 225
- 260
- 300
- 400
- 600
- 800
- 1000
- 1200
- 1600
- 2000
- 3000
- 4000

Voltage ratings

- R020 120*
- R038 190
- R021 208
- R022 220
- R023 240
- R024 380
- R025 416
- R035 440
- R026 480
- R027 600

* Single phase connection (not available on 1200-4000 amps)

Pole configuration

- A028 Poles - 3 (solid neutral)
- A029 Poles - 4 (switched neutral)

Frequency

- A044 60 Hertz
- A045 50 Hertz

Transfer mode

- A077 Open transition/in-phase
- A078 Open transition/programmed
- A079 Closed transition (available 1000-4000 amps, for closed transition below 1000 amps, see CHPC spec sheet S-1437)

Application

- A035 Utility to genset
- A036 Utility to utility
- A037 Genset to genset

System options

- A041 Single Phase, 2-wire or 3-wire (not available 1200- 4000 amps)
- A042 Three Phase, 3-wire or 4-wire

Enclosure

- B001 Type 1: Indoor use, provides some protection against dirt (similar to IEC type IP30)
- B002 Type 3R: Intended for outdoor use, provides some protection from dirt, rain and snow (similar to IEC type IP34)
- B003 Type 4: Indoor or outdoor use, provides some protection from wind-blown dust and water spray (similar to IEC type IP65)
- B004 Open Construction: No enclosure – includes automatic transfer switch and controls (call factory for dimensions)
- B010 Type 12: Indoor use, some protection from dust (similar to IEC type IP61)
- B025 Type 4X: Stainless steel, indoor or outdoor use, provides some protection from corrosion (similar to IEC Type IP65)

Standards

- A046 UL 1008/CSA certification
- A064 NFPA 20 compliant (not available on 1200-4000 amp switches)
- A080 Seismic certification

Controls

- C023 PowerCommand control - Level 1
- C024 PowerCommand control - Level 2

Control options

- M017 Security key - front panel
- M018 Digital display
- M022 Load monitoring (min current level 3%)
- M023 Relay signal module. Includes pre-transfer module for elevator control
- M031 LonWorks network communications module (FTT-10)

Meter

- D009 Analog bar graph meter

Battery chargers

- K001 2 amps, 12/24 volts
- KB59 15 amps, 12 volts
- KB60 12 amps, 24 volts Protective relays (closed transition)
- M045 Paralleling timer and lock-out relays, ANSI/IEEE 62PL and 86
- M046 Paralleling timer, lock-out and reverse power relays, single phase, ANSI/IEEE 62PL, 86 and 32R
- M047 Paralleling timer, lock-out and reverse power relays, three phase, ANSI/IEEE 62PL, 86 and 32R
- Auxiliary relays - Relays are UL listed and factory installed. All relays provide two normally closed isolated and two normally open contacts rated 10 amps at 600 VAC. Relay terminals accept from one 18 gauge to two 12 gauge wires per terminal.
- L101 24 VDC coil - installed, not wired (for customer use).
- L102 24 VDC coil - emergency position - relay energized when switch is in Source 2 (emergency) position.
- L103 24 VDC coil - normal position - relay energized when switch is in Source 1 (normal) position
- L201 12 VDC coil - installed, not wired
- L202 12 VDC coil - emergency position - relay energized when switch is in Source 2 (emergency) position
- L203 12 VDC coil - normal position - relay energized when switch is in Source 1 (normal) position

Miscellaneous options

- M003 Terminal block - 30 points (not wired)
- N020 Terminal block – re-transfer inhibit
- M007 Load shed - from emergency - drives switch to neutral position when remote signal contact closes
- N009 Power connect - bus Stabs (1200 amp open construction only)
- N013 Extension harness (open construction only) Lug Kits (select one)
- N008 Cable lugs, mechanical, 600 MCM, 8 per pole (1600A, 2000A, 3000A only)
- N032 Lug adapters, compression, ½ Stud (1200A only)
- N045 Cable lugs, mechanical, 600 MCM, 4 per pole (1200A only)
- N066 Cable lugs, mechanical, 750 MCM, 4 per pole (1200A only)
- N056 Cable Lugs, mechanical, 750 MCM, 12 per pole (4000A only)

Warranty

- G010 Years 0-2: Parts, labor and travel Years 3-5: Parts only Years 6-10: Main contacts only
- G013 Years 0-5: Comprehensive Years 6-10: Main contacts only







Shipping

- A051 Packing - export box

Accessories

- AC-167 Accessories specifications sheet

Certification

 <p>All switches are UL 1008 Listed with UL Type Rated cabinets and UL Listed CU-AL terminals.</p>	 <p>All switches comply with NEMA ICS 10.</p>
 <p>All switches are certified to CSA 282 Emergency Electrical Power Supply for Buildings, up to 600 VAC.</p>	 <p>All switches comply with IEEE 446 Recommended Practice for Emergency and Standby Power Systems.</p>
<p>NEC</p> <p>Suitable for use in emergency, legally required and Standby applications per NEC 700, 701 and 702.</p>	 <p>This transfer switch is designed and manufactured in facilities certified to ISO9001.</p>
 <p>All switches comply with NFPA 70, 99 and 110 (Level 1).</p>	

For more information contact your local Cummins distributor or visit power.cummins.com

Our energy working for you.™





Warranty Statement

Global Power Electronics

Transfer Switch

Limited Warranty

Transfer Switch

This limited warranty applies to all Cummins Power Generation® branded Transfer Switches and associated accessories (hereinafter referred to as "Product").

This warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

Warranty Period:

The warranty start date is the date of commissioning†, demonstration or 18 months after factory ship date, whichever is sooner.

† Date of commissioning not to exceed date of Generator Set initial start-up.

Transfer Switch Coverage Duration:

The warranty coverage duration for Transfer Switches is defined in the table below for the different product families:

Product Family	Duration
GTEC, LT, LC, RST, OTEC	▪ 1 Year: Parts, Labor & Travel
RSS, RA, and other Power Transfer Devices††	▪ 2 Years: Parts, Labor & Travel
▶ OTPC, BTPC, OHPC, CHPC, PLT	▪ Years 0-2: Parts, Labor & Travel ▪ Years 3-5: Parts Only ▪ Years 6-10: Main Contacts Only

†† Devices manufactured by Cummins Power Generation that allow power transfer between two power sources.

Cummins Power Generation®

Responsibilities:

In the event of a failure of the Product during the warranty period due to defects in material or workmanship, Cummins Power Generation® will only be responsible for the following costs:

- Parts and labor required to repair the Product as defined by coverage duration.
- Reasonable travel expenses to and from the Product site location as defined by coverage duration.

Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.

In addition, the owner will be responsible for:

- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of power generating equipment used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

Limitations:

This limited warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Non-conformance to applicable industry standards for installation
- Normal wear and tear.
- Improper and/or unauthorized installation.
- Negligence, accidents or misuse.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Improper storage before and after commissioning.
- Owner’s delay in making Product available after notification of potential Product problem.
- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Owner or operator abuse or neglect such as: late servicing and maintenance and improper storage.
- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the transfer switch or paralleling system.

This limited warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Damage to customer property.

Please contact your local Cummins Power Generation® Distributor for clarification concerning these limitations.

CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:

Failed components claimed under warranty remain the property of Cummins Power Generation®. Cummins Power Generation® has the right to reclaim any failed component that has been replaced under warranty.

Extended Warranty:

Cummins Power Generation® offers several levels of Extended Warranty Coverage. Please contact your local Cummins Power Generation ® Distributor for details.

www.power.cummins.com

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS POWER GENERATION ® IN REGARD TO THE PRODUCT. CUMMINS POWER GENERATION® MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

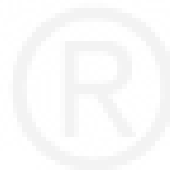
IN NO EVENT IS CUMMINS POWER GENERATION® LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This limited warranty shall be enforced to the maximum extent permitted by applicable law. This limited warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.

Product Model Number: _____

Product Serial Number: _____

Date in Service: _____





MASON WEST, INC.

1601 E. Miraloma Ave. Placentia, CA 92870
TEL (714) 630 - 0701, FAX (714) 632 - 0302

SEISMIC CERTIFICATE OF COMPLIANCE

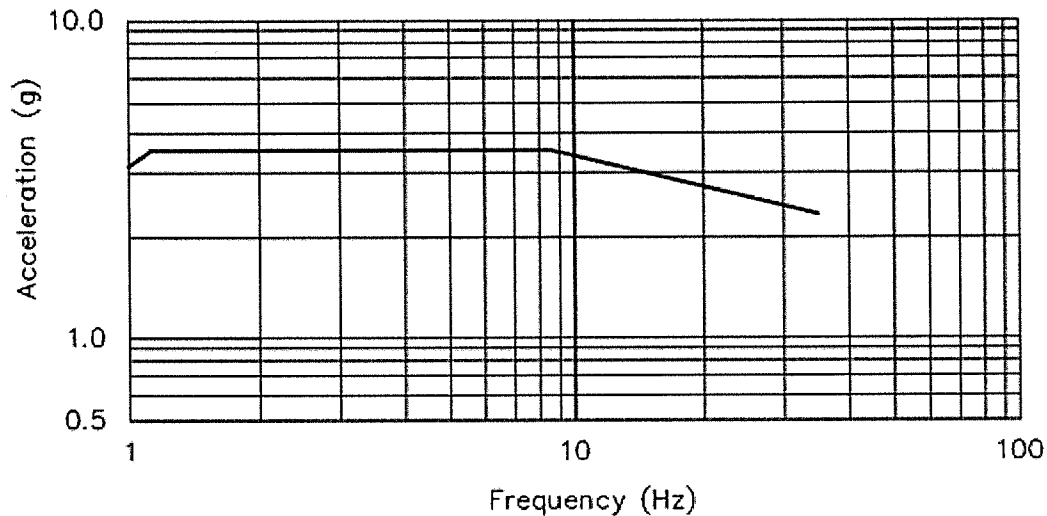
CUMMINS POWER GENERATION

OTPC, OTEC, OTPCSE, OTECSE, CHPC, OHPC & BTPC
AUTOMATIC & BY-PASS TRANSFER SWITCHES

QUALIFIED TO IBC 2009/2012, ASCE 7-10 & ICC AC-156

S_{ds} = 2.17g, I_p = 1.5, Site Class D, z/h = 1.0

Representative Spectrum

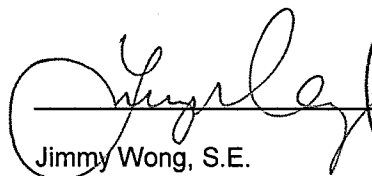


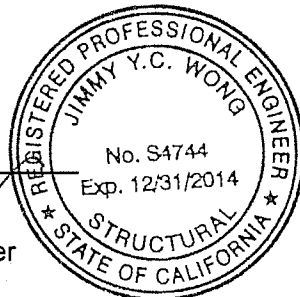
Reference Seismic Qualification Testing Reports:

1. Clark Dynamic Testing Laboratory Report No. T4374, T4418, T4683 & T4497
2. Environmental Testing Laboratory, Inc. Report No. ETL 11383 & 11383A

This is to certify that Mason West has reviewed the above referenced reports of the Seismic Qualification Test. The reports cover the testing data and results of the Automatic & By-Pass Transfer Switches provided by Cummins Power Generation. Each of the equipment represents the most seismically vulnerable construction in its product line platform. See Table 1A, 1B, 1C & 1D for certified models under this certification.

Mason West confirms that the equipment and the testing have complied with all of the requirements according to IBC 2009 / 2012 referencing ASCE 7-10 and ICC AC-156.


Jimmy Wong, S.E.
Principal Structural Engineer
Mason West, Inc.

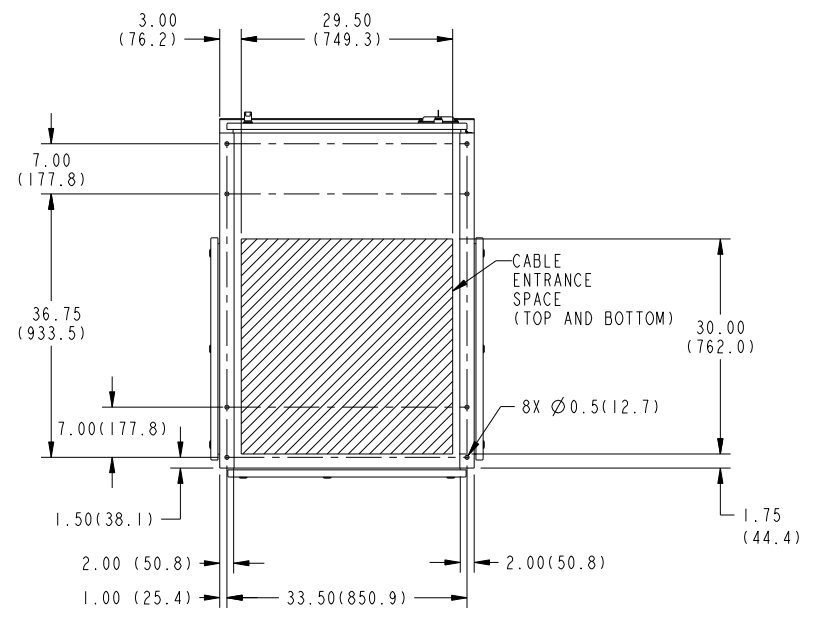
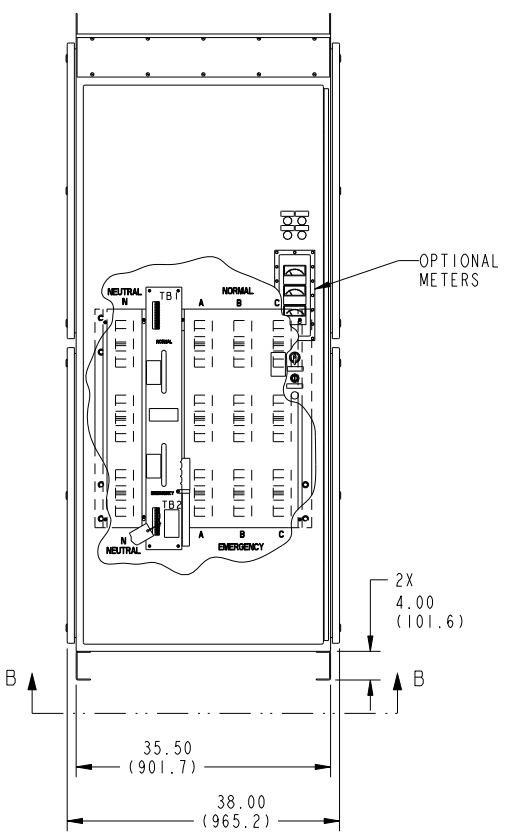
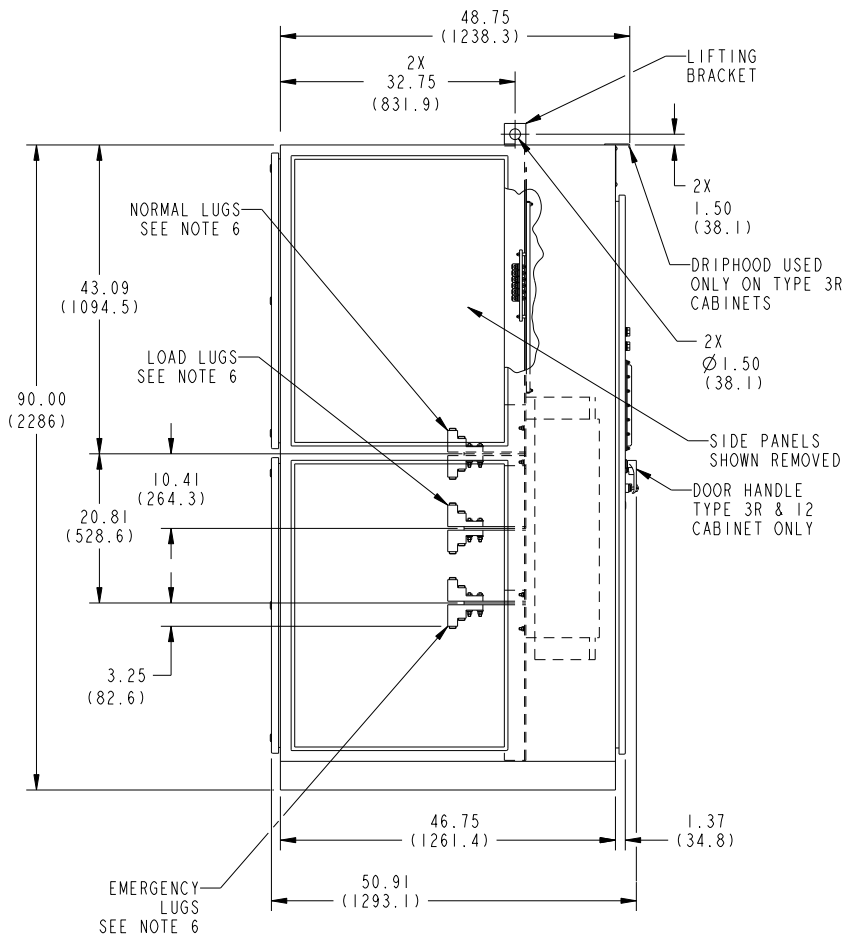
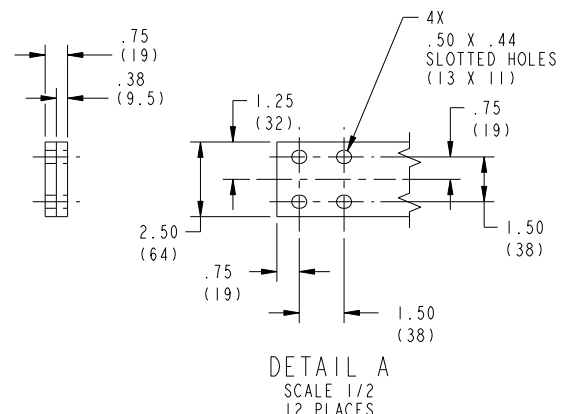
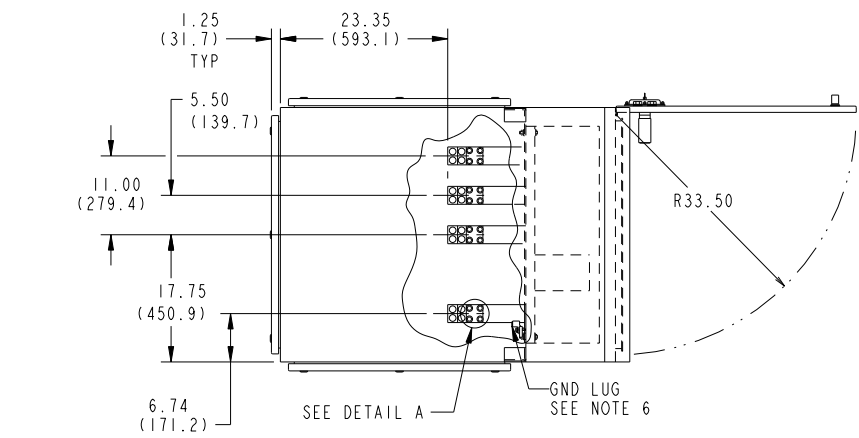


Issued Date: March 19, 2013

Cummins Part Number: A045V378

Enclosures: Table 1A, 1B, 1C & 1D for all certified models under this certification.

REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-104167	G	6	ZONE B2, REVISED NOTE 4, SEE ECO	PKN	LJY	L.SMITH	12DEC11
		7	ZONE A2, REVISED NOTE 7	PKN	LJY	L.SMITH	12DEC11
		8	ZONE D2, RMV DIM 1.75	PKN	LJY	L.SMITH	12DEC11
		9	ZONE C1, ADD DIM 1.75	PKN	LJY	L.SMITH	12DEC11



VIEW B-B
MOUNTING HOLES IN BASE

- NOTES:
- APPROX. WEIGHT: 960 LBS
MASS: 436 kg
 - DIMENSIONS IN () ARE MILLIMETERS.
 - USE SEPARATE CONDUITS FOR CONTROL WIRING AND POWER WIRING. DO NOT COMBINE.
 - REAR OR SIDE ACCESS IS REQUIRED FOR INSTALLATION. REAR ACCESS IS PREFERRED. SIDE ACCESS IS RECOMMENDED FOR MAINTENANCE PURPOSES. REFER TO THE NATIONAL ELECTRICAL CODE FOR THE REQUIREMENTS FOR ELECTRICAL INSTALLATIONS
 - OUTLINE DWG FOR CABINET STYLE NEMA 3R, 4 & 12.
 - SHOWN WITH OPTIONAL LUGS.
OPTIONAL LUG CAPACITY
(8 WIRES) #2-600 MCM (35-3000) CU-AL PER PHASE
GROUND LUGS (1 WIRE) #6-250 MCM (16-120) QTY 6
 - WIRE BENDING SPACE CONFORMS TO NATIONAL ELECTRIC CODE (NFPA70).

1600-2000 AMP 4 POLE

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM 10	OWN G. THOMAS		CUMMINS POWER GENERATION															
DO NOT SCALE PRINT		CND B. GROSS	APVD G. BELCZAK		OUTLINE-CONTROL BOX															
<table border="1"> <tr> <td>CH</td> <td>TOL</td> <td>FEEL</td> </tr> <tr> <td>X ± 1</td> <td>0.00- 4.99 +0.15/-0.08</td> <td></td> </tr> <tr> <td>.X ± 0.8</td> <td>5.00- 9.99 +0.20/-0.10</td> <td></td> </tr> <tr> <td>.XX ± 0.38</td> <td>10.00-17.49 +0.25/-0.13</td> <td></td> </tr> <tr> <td></td> <td>17.50-24.99 +0.30/-0.13</td> <td></td> </tr> </table>	CH	TOL	FEEL	X ± 1	0.00- 4.99 +0.15/-0.08		.X ± 0.8	5.00- 9.99 +0.20/-0.10		.XX ± 0.38	10.00-17.49 +0.25/-0.13			17.50-24.99 +0.30/-0.13		DATE 06SEP07	DATE 06SEP07	SITE CODE	PGF	SHEET 2 OF 2
CH	TOL	FEEL																		
X ± 1	0.00- 4.99 +0.15/-0.08																			
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	17.50-24.99 +0.30/-0.13																			
ANG TOL: ± 1.0°	SCALE: 1/8	CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	FIRST USED ON 01 1600-2000 AMP	0310_0744	REV G															

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-151289	A	I	PRODUCTION RELEASE	JFM	GAC	LHS	14APR15

1600, 2000, 2600, 3000 AMPS
TRANSFER SWITCH EQUIPMENT TYPE A(PC)
FOR USE ON EMERGENCY OR STAND-BY SYSTEMS RATED FOR TOTAL
SYSTEM OR MOTOR LOADS

Suitable for control of motors, electric discharge lamps, tungsten filament lamps and electric heating equipment where the sum of motor full-load ampere ratings and the ampere rating of other loads do not exceed the ampere rating of the switch and the tungsten load does not exceed 30 percent of switch rating.
Rated Frequency : 50/60Hz
IEC Utilization Category : 32A, 32B

SHORT-CIRCUIT RATING

When protected by a circuit breaker, this Transfer Switch is suitable for use in a circuit capable of delivering the Short-Circuit current for the maximum time duration and voltage marked below. The circuit breaker must include an instantaneous trip response and shall not include a short-time response.
The maximum clearing time of the instantaneous trip response must be equal to or less than the time duration shown for the marked short circuit current.

Switch Amperes	Short-Circuit Current (RMS Symmetrical Amperes x 1000)	Voltage (VOLTS AC, Maximum)	Time Duration (sec. Maximum)	Agency
1600-2000A	100	480	0.050	UL/IEC/CSA
2600-3000A	100	480	0.050	UL/IEC/CSA
1600-2000A	65	600	0.050	CSA
2600-3000A	65	600	0.050	CSA

SHORT-TIME CURRENT RATING

This Transfer Switch does not include Short-Time Current Ratings.

SHORT-CIRCUIT RATING WHEN PROTECTED BY FUSE

When protected by a fuse of the specific fuse class and maximum amperage rating as marked below, this transfer switch is suitable for use in circuits capable of delivering the Short-circuit current at the maximum voltage marked

Switch Amperes	Short-Circuit Current (RMS Symmetrical Amperes x 1000)	Voltage (VOLTS AC, Maximum)	Fuse Class	Rating Amperes	Agency
1600-2000A	200	480	L	2500A Max.	UL/IEC
2600-3000A	200	480	L	4000A Max.	UL/IEC

USE COPPER OR ALUMINUM WIRE EXCEPT COPPER ONLY FOR FUSE APPLICATION

V-2353-B

NOTES:
1. THIS LABEL IS FOR INFORMATION PURPOSE ONLY. THE LABEL IS SUPPLIED BY THE MANUFACTURER WITH THE TRANSFER SWITCH.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIN TO		DWN J. MCCARTHY		CUMMINS POWER GENERATION																	
DO NOT SCALE PRINT				CKD G. COLLEEN																			
<table border="1"> <tr> <td>DIM</td> <td>X ± 1</td> <td>HOLE</td> <td>0.00- 4.99 +0.15/-0.08</td> </tr> <tr> <td></td> <td>.X ± 0.8</td> <td></td> <td>5.00- 9.99 +0.20/-0.10</td> </tr> <tr> <td></td> <td>.XX ± 0.38</td> <td></td> <td>10.00-17.49 +0.25/-0.13</td> </tr> <tr> <td></td> <td></td> <td></td> <td>17.50-24.99 +0.30/-0.13</td> </tr> </table>		DIM	X ± 1	HOLE	0.00- 4.99 +0.15/-0.08		.X ± 0.8		5.00- 9.99 +0.20/-0.10		.XX ± 0.38		10.00-17.49 +0.25/-0.13				17.50-24.99 +0.30/-0.13	CONFIDENTIAL PROPERTY OF CUMMINS POWER GENERATION GROUP		APVD L. SMITH		LABEL, INFORMATION SITE CODE	
DIM	X ± 1	HOLE	0.00- 4.99 +0.15/-0.08																				
	.X ± 0.8		5.00- 9.99 +0.20/-0.10																				
	.XX ± 0.38		10.00-17.49 +0.25/-0.13																				
			17.50-24.99 +0.30/-0.13																				
ANG TOL: ± 1.0°		SCALE: 1:1		DATE 14APR15		FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994 FIRST USED ON PGF																	
				DWN SIZE C A052L322		SHEET 1 of 1 DWG REV A																	



ALWAYS ON

Cummins Sales and Service

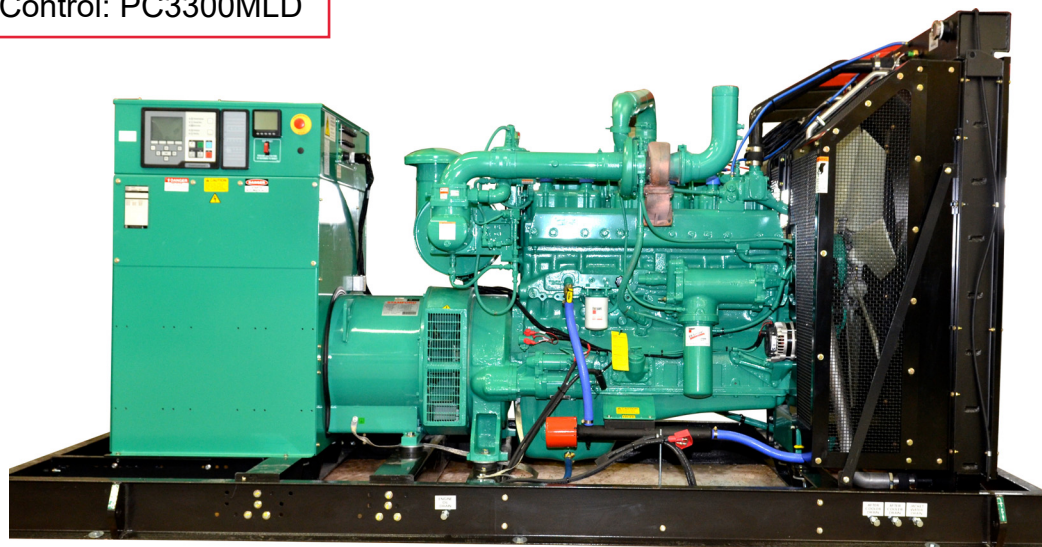
Pacific Region: Alaska - Washington - Oregon - California - Hawaii



Natural gas generator sets manufactured in De Pere, Wisconsin

Installation, operation, and maintenance manual

Model: C200N6
Engine: PSI 11L
Control: PC3300MLD





This manual contains proprietary information to equipment produced by Cummins Inc. and is being supplied solely for the purpose of installing, operating, maintaining, and servicing the natural gas generator set (GenSet) purchased from Cummins Sales and Service in De Pere, Wisconsin. For warranty information, please visit our website at cummins.com.



This product has been manufactured under the controls established by a Bureau Veritas Certification approved management system that conforms with ISO 9001:2015.

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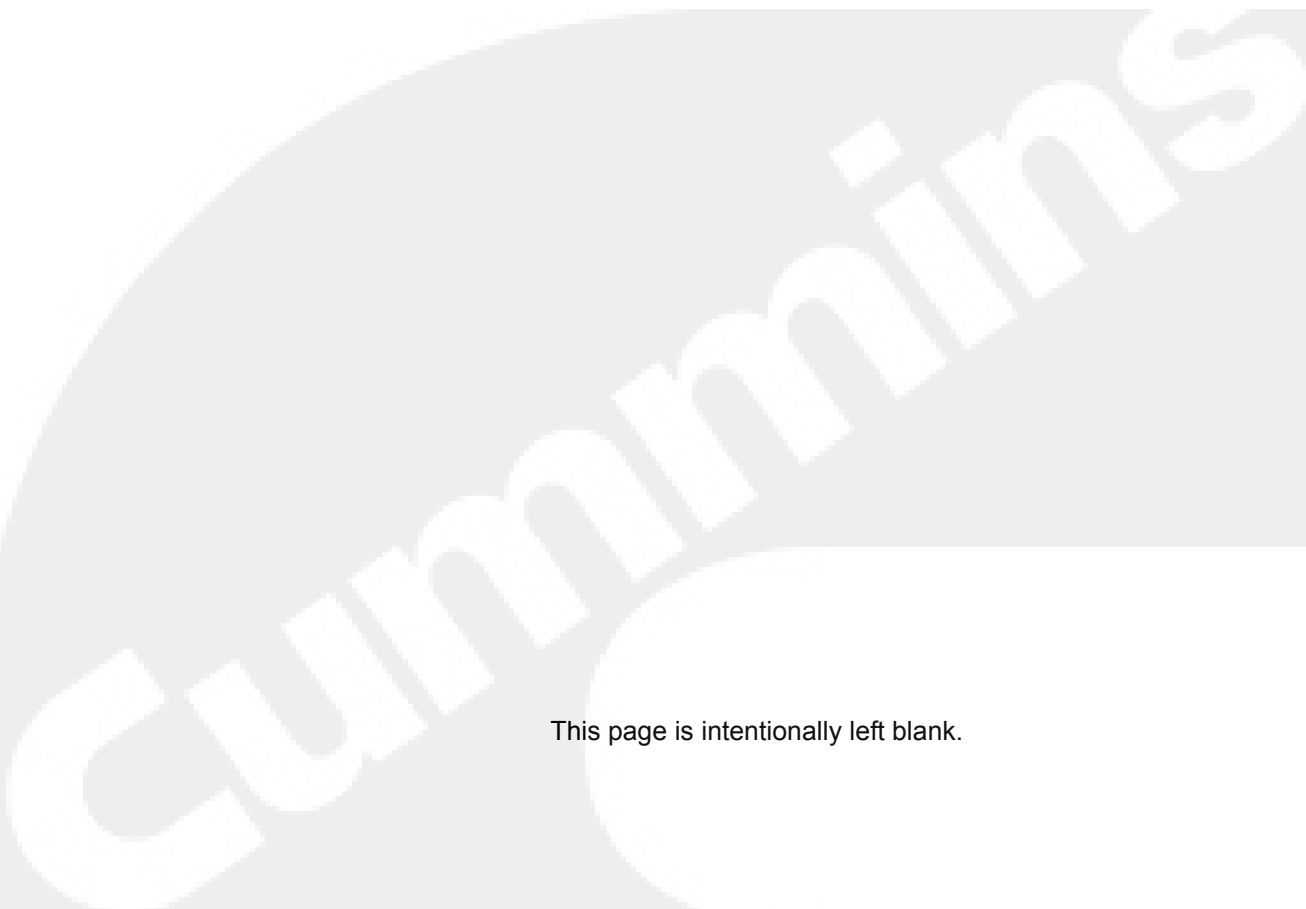
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Section 1 - Safety

1.1 Introduction

Cummins Sales and Service Generator Set (GenSet) manuals should be considered part of the equipment. Keep the manuals with the equipment. If the equipment is traded or sold, give the manuals to the new owner.

The GenSet has been carefully designed to provide safe and efficient service when properly installed, maintained, and operated. However, the overall safety and reliability of the complete system is dependent on many factors outside the control of the GenSet manufacturer. To avoid possible safety hazards, make all mechanical and electrical connections to the GenSet exactly as specified in this manual.

All systems external to the generator (fuel, electrical, etc.) must comply with all applicable codes. Make certain all required inspections and tests have been completed and all code requirements have been satisfied before certifying the installation is complete and ready for service. All personnel responsible for operation and maintenance of the equipment should read and thoroughly understand this manual.

SAVE THESE INSTRUCTIONS.

Safe and efficient operation can be achieved only if the equipment is properly operated and maintained. Many accidents are caused by failure to follow fundamental rules and precautions.

1.2 Use of advisory and cautionary statements

1.2.1 Advisory statements

Advisory statements are used throughout this manual to call attention to special information and correct operating procedures. Throughout this manual, these Advisory Statements are delineated by the terms “NOTE” and “IMPORTANT” in uppercase letters:

NOTE: *A general advisory statement relating to equipment operation and maintenance procedures.*

IMPORTANT: *A specific advisory statement intended to prevent damage to the equipment or its associated components.*

1.2.2 Cautionary statements

Cautionary statements highlight particular safety precautions pertaining to personal injury and/or damage to the equipment. Cautionary Statements are always preceded by the following symbols:



This symbol warns of immediate hazards which will result in severe personal injury or death.



This symbol refers to a hazard or unsafe practice which CAN result in severe personal injury or death.



Indicates the presence of a hazard or unsafe practice which can result in personal injury, or General Safety Precautions.

1.3 General safety precautions

Read and understand all of the safety precautions and warnings before performing any repair. Special safety precautions are included in the procedures when they apply. This list contains the general safety precautions that **must** be followed to provide personal safety:

Perform a walk around inspection and alert all area personnel that the equipment will be starting before manual operation.



Contact with hot liquid can cause severe burns.

Safety

WARNING

Do not open the pressure cap while the engine is running. Let the engine cool down before removing the cap. Turn the cap slowly and do not open it fully until the pressure has been relieved.

DANGER

Moving parts can cause severe personal injury. Use extreme caution around moving parts. All guards must be properly fastened to prevent unintended contact.

CAUTION

Used engine oils have been identified by some state and federal agencies to cause cancer or reproductive toxicity.

CAUTION

Do not ingest, breathe the fumes, or contact used oil when checking or changing engine oil. Wear protective gloves and face guard.

WARNING

Incorrect operation can cause severe personal injury or death. Do not operate equipment when fatigued, or after consuming any alcohol or drug. Ensure that only suitably-trained and experienced service personnel perform electrical and/or mechanical services.

CAUTION

Substances in exhaust gases have been identified by some state and federal agencies to cause cancer or reproductive toxicity. Do not breathe in or come into contact with exhaust gases.

WARNING

Ignition of combustible liquids is a fire or explosion hazard which can cause severe burns or death. Do not store fuel, cleaners, oil, etc., near the GenSet.

CAUTION

GenSets in operation emit noise, which can cause hearing damage. Wear appropriate ear protection at all times.

WARNING

Contact with hot surfaces can cause severe burns. Wear appropriate personal protective equipment (PPE) when working on hot equipment and avoid contact with hot surfaces.

IMPORTANT: Make sure that only suitably trained and experienced service personnel perform electrical and/or mechanical service.

WARNING

Ethylene glycol, used as an engine coolant, is toxic to humans and animals. Wear appropriate PPE. Clean up coolant spills and dispose of used coolant in accordance with local environmental regulations.

DANGER

Ignition of combustible liquids is a fire or explosion hazard which can cause severe burns or death. Do not use combustible liquids like ether.

DANGER

Accidental or remote starting of the GenSet can cause severe personal injury or death.

IMPORTANT: Isolate all auxiliary supplies and use an insulated wrench to disconnect the starting battery cables (negative [-] first).

WARNING

Materials drawn into the GenSet are a fire hazard. Fire can cause severe burns or death. Keep the GenSet and the surrounding area clean and free from obstructions. Make sure the GenSet is mounted in a manner to prevent combustible materials from accumulating under the unit.

⚠ WARNING

Accumulated grease and oil are a fire hazard. Fire can cause severe burns or death. Keep the GenSet and the surrounding area clean and free from obstructions. Repair oil leaks promptly.

IMPORTANT: Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth. Class B fires involve combustible and flammable liquid fuels and gaseous fuels. Class C fires involve live electrical equipment. (Refer to NFPA No. 10 in applicable region.)

IMPORTANT: Before performing maintenance and service procedures on enclosed GenSets, make sure the service access doors are secured open.

⚠ CAUTION

Stepping on the GenSet can cause parts to bend or break, leading to electrical shorts, or to fuel, coolant, or exhaust leaks. Do not step on the GenSet when performing maintenance or inspections.

IMPORTANT: Read and follow all Safety Precautions, Warnings, and Cautions throughout this manual and the documentation supplied with the GenSet.

1.3.1 Moving parts

Moving parts can cause severe personal injury or death. When operating the GenSet, follow these guidelines:

- Keep hands, clothing, and jewelry away from moving parts.
- Before starting work on the GenSet, disconnect the battery charger from its AC source, then disconnect the starting batteries using an insulated wrench, negative (-) cable first. This will prevent accidental starting.
- Make sure that fasteners on the GenSet are secure. Tighten supports and clamps; keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry in the vicinity of moving parts or while working on the GenSet. Loose clothing and jewelry can become caught in moving parts.

- If any adjustments must be made while the unit is running, use extreme caution around hot exhaust system components, moving parts, etc.

⚠ DANGER

Debris ejected during catastrophic failure can cause serious injury or death by impact, severing or stabbing.

To prevent injury while operating the alternator:

- Keep away from the air inlet and air outlet when the alternator is running.
- Do not cause overheating by running the alternator outside of the rating plate parameters.
- Do not overload the alternator.
- Do not run an alternator with excessive vibration.
- Do not synchronize parallel alternators outside the specified parameters.

As shown in [Figure 1-1](#), always wear suitable PPE when working in the hatched areas shown in the diagram or directly in-line with any air inlet/outlet.

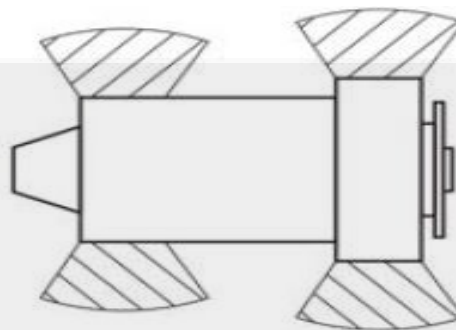


Figure 1-1 GenSet hatched areas

Safety

1.3.2 Electrical shock hazards

It is the policy of Cummins to perform all electrical work in a de-energized state. However, employees or suppliers may be permitted to occasionally perform work on energized electrical equipment only when qualified and authorized to do so and when troubleshooting, or if de-energizing the equipment would create a greater risk or make the task impossible and all other alternatives have been exhausted.

Guidelines to follow when working on de-energized electrical systems:

- Use proper PPE. Do not wear jewelry. Ensure that any conductive items are removed from pockets, as these items can fall into equipment and the resulting short circuit can cause shock or burning. Refer to standard NFPA 70E for PPE standards.
- Lockout/tag-out electrical systems prior to working on them. Lockout/tag-out is intended to prevent injury due to unexpected start-up of equipment or the release of stored energy.
- Lockout/tag-out all circuits and devices before removing any protective shields or making any measurements on electrical equipment.
- Follow all applicable regional electrical and safety codes.

 **DANGER**

Voltages and currents present an electrical shock hazard that can cause severe burns or death. Contact with exposed energized circuits with potentials of 50 Volts AC or 75 Volts DC or higher can cause electrical shock and electrical arc flash. Refer to standard NFPA 70E or equivalent safety standards in corresponding regions for details of the dangers involved and for the safety requirements.

Guidelines to follow when working on energized electrical systems:

- Do not tamper with or bypass interlocks unless you are authorized to do so.
- Understand and assess the risks - use proper PPE. Do not wear jewelry. Ensure that any conductive items are removed from pockets, as

these items can fall into equipment and the resulting short circuit can cause shock or burning. Refer to standard NFPA 70E for PPE standards.

- Ensure that an accompanying person who can undertake a rescue is nearby.

1.3.3 Alternating current (AC) supply and isolation

It is the sole responsibility of the customer to provide AC power conductors for connection to load devices and the means to isolate the AC input to the terminal box; these must comply with local electrical codes and regulations (for example, BS EN 12601:2010 Reciprocating internal combustion engine driven generating sets). Safety may require the installation of a disconnect means for the GenSet, either on the GenSet or where the GenSet conductors enter a facility.

The disconnecting device is not provided as part of the GenSet, and Cummins accepts no responsibility for providing the means of isolation.

IMPORTANT: *The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations. This equipment must be earthed (grounded).*

1.3.4 Fuel and fumes

Fire, explosion, and personal injury or death can result from improper practices. Do not fill fuel tanks while the engine is running unless the tanks are outside the engine compartment. Fuel contact with a hot engine or exhaust is a potential fire hazard. Do not permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the GenSet or fuel tank.

Fuel lines must be adequately secured and free of leaks. Fuel connections should be made with an appropriate flexible line. Do not use copper piping on flexible lines, as copper will become brittle if continuously vibrated or repeatedly bent.

Ensure all fuel supplies have a positive shutoff valve.

Ensure the battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc.

Any spillage that occurs during coolant fill, oil top-off, or oil change must be cleaned up before starting the GenSet.

Fluid containment is incorporated into the bed frame and must be inspected at regular intervals. Any liquid present should be drained and disposed of in line with local health and safety regulations. Failure to perform this action may result in liquid spillage, which could contaminate the surrounding area.

▲ DANGER

Fire, explosion, and personal injury or death can result from improper practices. Do not permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the GenSet.

Flammable vapor can cause an engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury, and death. Do not operate a GenSet where a flammable vapor environment can be created, unless the GenSet is equipped with an automatic safety device to block the air intake and stop the engine. The owners and operators of the GenSet are solely responsible for operating the GenSet safely. Contact your authorized Cummins distributor for more information.

1.3.5 Exhaust gases

Position the GenSet so that exhaust gases are discharged away from enclosed or sheltered areas, and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust system daily for leaks per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.

▲ DANGER

Contact with hot exhaust gases can cause severe burns. Wear PPE when working on equipment and avoid contact with hot surfaces.

▲ WARNING

Inhalation of exhaust gases can cause asphyxiation and death. Pipe exhaust gas outside and away from windows, doors, or other inlets to

buildings. Do not allow exhaust gas to accumulate in habitable areas.

▲ DANGER

Contaminated insulation is a fire hazard. Fire can cause severe burns or death. Remove any contaminated insulation and dispose of it in accordance with local regulations.

Position the exhaust away from flammable materials. Make sure that the exhaust outlet is not obstructed. Personnel using this equipment must be made aware of the exhaust position.

IMPORTANT: *To minimize the risk of fire, make sure make sure that the engine is allowed to cool thoroughly before performing maintenance or operation tasks.*

1.4 Earth ground connection

The neutral of the GenSet may be required to be bonded to earth ground at the GenSet location, or at a remote location, depending on the system design requirements. Consult the engineering drawings for the facility or a qualified electrical design engineer for proper installation.

NOTE: *The end user is responsible to make sure that the ground connection point surface area is clean and free of rust before making a connection.*

NOTE: *The end user is responsible for making sure that an earthing arrangement that is compliant with local conditions is established and tested before the equipment is used.*

1.5 AC Distribution Panel Door

Opening the AC distribution panel door while the GenSet is running will trip the GenSet circuit breaker and abruptly shut off power to all loads. Make sure that the GenSet is not running and is in **OFF** mode before you open the AC distribution panel door.

When multiple GenSets are paralleled together and running, the busbars at each connected GenSet will have voltage present even if that specific GenSet is not running. Always power down and lock out/ tag-out every GenSet that is paralleled together before conducting maintenance, troubleshooting, or opening the AC distribution panel door on any connected GenSet.

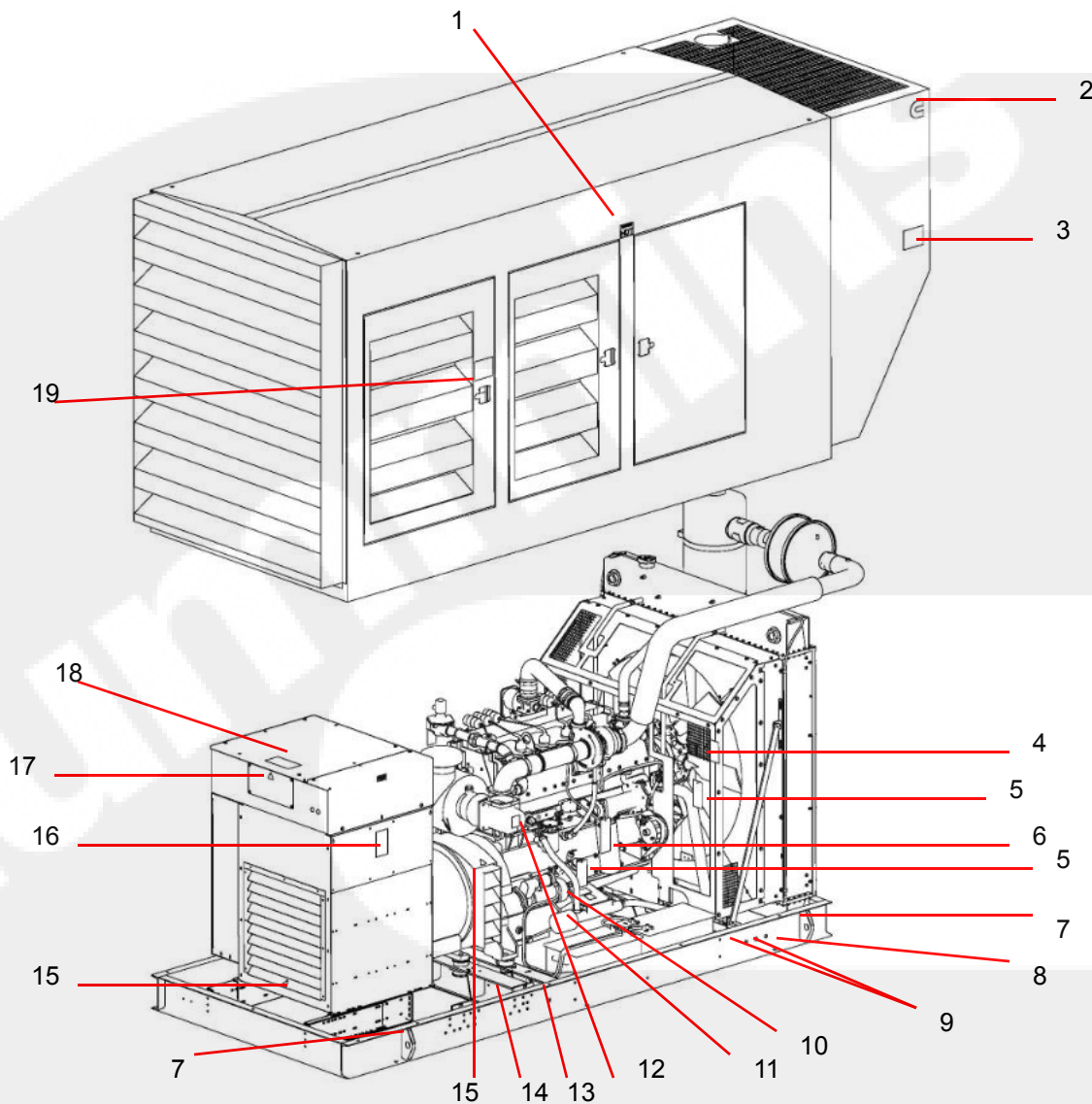
Safety

1.6 Decommissioning and disassembly

Decommissioning and disassembly of the GenSet at the end of its working life must comply with local guidelines and legislation for disposal/recycling of components and contaminated fluids. This procedure must only be carried out by suitably trained and experienced service personnel. For more information contact your authorized distributor.

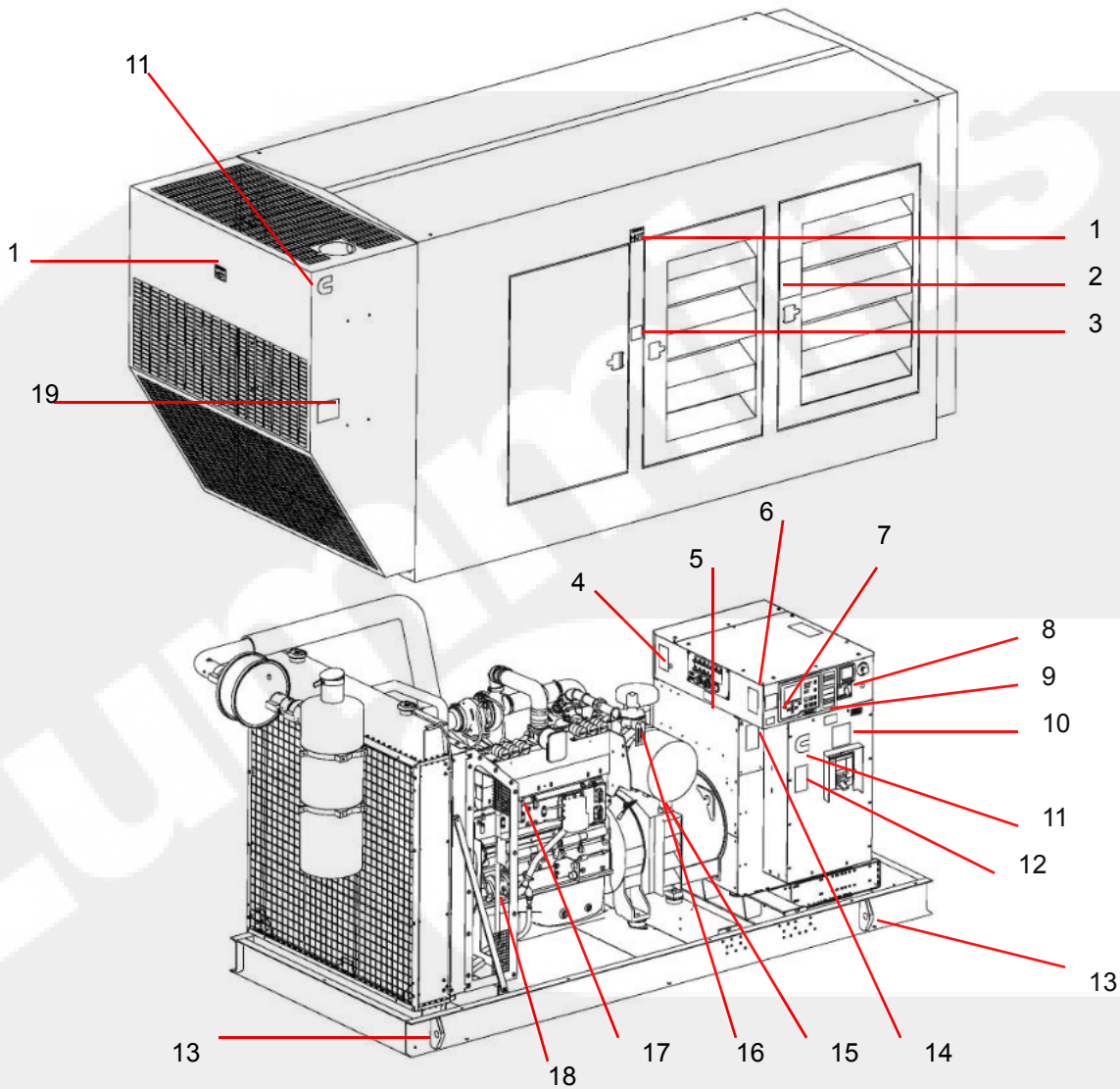


1.7 Safety decals



- | | |
|--------------------------------------------------------|-----------------------------------------------------------|
| 1. Caution, Hot (P/N 6940-13) | 12. Operation Maintenance and Service (P/N 0098- 6074-02) |
| 2. Cummins 4" Black Logo | 13. Engine Oil Drain (P/N 16565) |
| 3. Danger Burn (P/N A030Z096) | 14. Ground (P/N 9526-07) |
| 4. Warning, Rotating Fan (P/N 6940-06) | 15. Warning (Triangle Exclamation Point) (Label_C) |
| 5. Fluids Tag (P/N 6940-17) | 16. Warning, Equipment Voltage (P/N A042E925) |
| 6. Emissions Tag | 17. Danger, High Voltage (Lightning Bolt) (Label_B) |
| 7. Lifting Point (P/N 9526-13) | 18. Danger, Refer to Manual (Label_A) |
| 8. Jacket Water Drain (P/N 16564) (model-specific) | 19. Danger, Electricity (P/N A042Z074) |
| 9. Low Temperature Aftercooler (LTA) Drain (P/N 16563) | |
| 10. Caution, Hot (P/N 6940-02) | |
| 11. Warning, Disconnect Battery (P/N A042E928) | |

Figure 1-2 GenSet decal locations (typical) right side



- | | |
|---------------------------------------------------------------|----------------------------------------------------|
| 1. Caution, Hot (P/N 6940-13) | 10. Danger, Multi-warning (P/N A042E924) |
| 2. Warning, Danger Lockout/Tagout (P/N A042E929) | 11. Cummins 4" Black Logo |
| 3. Danger (P/N A034C535) | 12. Feature Code Tag (099-2433) |
| 4. Cummins Emissions Solution (CES) Catalyst Tag | 13. Lifting Point (P/N 9526-13) |
| 5. Service and Installation Decal (P/N 6940-50) | 14. Warning, Equipment Voltage (P/N A042E925) |
| 6. GenSet Data Tag | 15. Warning (Triangle Exclamation Point) (Label_C) |
| 7. Decal, Maximum Imbalance (P/N 98-8875) | 16. Warning, NG Contaminants (P/N 11071) |
| 8. Electronic Control Module (ECM) Reset Switch Decal (17282) | 17. Warning, Rotating Fan (P/N 6940-06) |
| 9. Warning, Disconnect Battery (P/N A042E928) | 18. Fluids Tag (P/N 6940-17) |
| | 19. Danger, Burn (P/N A030Z096) |

Figure 1-3 GenSet decal locations (typical) left side



KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE



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Section 2 - Introduction

2.1 Introduction

To ensure safe and reliable operation, each operator should read this manual before operating the generator set (GenSet) for the first time. This manual includes:

- Procedures for locating and transporting
- Procedures for operation
- Recommendations for optimal operation
- Maintenance schedules
- Troubleshooting charts
- Service information for component parts and specifications.

The purpose of this manual is to provide the users with sound, general information for correct and safe operation and maintenance procedures. Cummins cannot accept any liability whatsoever for problems arising as a result of following recommendations in this manual.

The information contained within this manual is based on information available at the time of going to print. In line with Cummins policy of continuous development and improvement, information may change at any time without notice. The users should therefore ensure that - before commencing any work - they have the latest information available.

Access to, and the installation and operation of, the GenSet must be restricted to qualified service personnel who have been instructed of the reasons for the restrictions applied to the location of the GenSet and any precautions that must be taken. Access to and operation of the GenSet must be governed by the use of a special tool, or lock and key, or other means of security that is monitored by the authority responsible for that location.

IMPORTANT: *This GenSet is not a life support system. It can stop without warning. Children, persons with physical or mental limitations, and pets*

could suffer personal injury or death. A personal attendant, redundant power, or an alarm system must be used if GenSet operation is critical.

These installation recommendations apply to typical installations with standard model GenSets. However, because of the many variables in any installation, it is not possible to provide specific recommendations for every situation. If there are any questions not answered by this manual, contact your nearest Cummins distributor for assistance.

Users are respectfully advised that, in the interests of good practice and safety, it is their responsibility to employ competent persons to carry out any installation work. It is essential that the utmost care is taken with the application, installation, and operation of any engine due to their potentially hazardous nature. Careful reference should also be made to other Cummins literature. A GenSet must be operated and maintained properly for safe and reliable operation. For further assistance, contact your authorized distributor.



Improper operation and maintenance can lead to severe personal injury or loss of life and property by fire, electrocution, mechanical breakdown, or exhaust gas asphyxiation. Read and follow the safety precautions in Section 1 - Safety and carefully observe all instructions and precautions in this manual.

IMPORTANT: *The installer bears sole responsibility for the selection of the appropriate GenSet, for its proper installation, and for obtaining approvals from the authorities (if any) having jurisdiction over its installation and application.*



Unauthorized modifications or replacement of fuel, exhaust, air intake, or speed control system components that affect engine emissions are prohibited by law in the State of California.

Introduction

A power generation system must be carefully planned and correctly installed for proper operation. This involves two essential elements:

- **Application** (as it applies to GenSet installations) refers to the design of the complete power generation system that usually includes power distribution equipment, transfer switches, ventilation equipment, and mounting pads, as well as cooling, exhaust, and fuel systems. Each component must be correctly designed so the complete system will function as intended. Application and design is an engineering function generally done by specifying engineers or other trained specialists. Specifying engineers or other trained specialists are responsible for the design of the complete system and for selecting the materials and products required.
- **Installation** refers to the actual set-up and assembly of the power generation system. The installers set up and connect the various components of the system as specified in the system design plan. The complexity of the system normally requires the special skills of qualified electricians, plumbers, sheet metal workers, etc. to complete the various segments of the installation. This is necessary so all components are assembled using standard methods and practices.

This manual DOES NOT provide application information for selecting a GenSet or designing the complete installation. If it is necessary to design the various integrated systems (fuel, exhaust, cooling, etc.), additional information is required. Review standard installation practices. For engineering data specific to the GenSet, refer to the Specification and Data Sheets.

DANGER

Contact with high voltages can cause severe electrical shock, burns, or death. Make sure that only a trained and experienced electrician makes generator electrical output connections, in accordance with the installation instructions and all applicable codes.

DANGER

Faulty electrical generating equipment can cause severe personal injury or death. GenSets must be

installed, certified, and operated by trained and experienced person in accordance with the installation instructions and all applicable codes.

2.2 How to obtain service

When the GenSet requires servicing, contact your nearest Authorized Cummins Distributor. Factory-trained Parts and Service representatives are ready to handle all your service needs. When contacting your distributor, always supply the complete model, specification, and serial number as shown on the GenSet nameplate.

To contact your local Authorized Cummins Distributor in the United States or Canada, call 1-800-CUMMINS (this automated service utilizes touch-tone phones only). By selecting Option 1 (press 1), you will be automatically connected to the nearest distributor. For outside North America, call your nearest Authorized Cummins Distributor, or visit our website at www.cummins.com for distributor information.

WARNING

Incorrect service or parts replacement can result in severe personal injury, death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and /or mechanical service.

NOTE: For Cummins engine-related inquiries, please contact a Cummins technical service support representative at 1-800-CUMMINS (1-800-286-6467) for more information. For questions about the generator controls on this model please contact Cummins Sales and Service at 1-866-831-7620.

2.3 Product modification disclaimer

Agency-certified products purchased from Cummins comply only with those specific requirements and as noted on company product specification sheets. Subsequent modifications must meet commonly accepted engineering practices and/or local, state and national codes and standards. Product modifications must be submitted to the local authority having jurisdiction (AHJ) for approval. The information, specifications, and recommended guidelines in this manual are based on information in effect at the time of printing. Cummins Sales and Service and Cummins, Inc. reserves the right to make changes at any time without obligation. If you find differences between your engine and the information in this manual, contact your local Cummins Authorized



Repair Location or call 1-800-CUMMINS (1-800-286-6467) toll free in the U.S. and Canada.

2.4 Use of standby heating devices

In accordance with NFPA 110 Standard for Emergency and Standby Power Systems, Cummins Sales and Service recommends installing GenSets (life safety systems) equipped with engine jacket water coolant heaters in locations where the minimum ambient temperature is below 4 °C (40 °F). NFPA also requires that the engine jacket water coolant be maintained at a minimum of 32 °C (90 °F) and, for most applications, accept the emergency load in ten seconds or less.

2.5 GenSet nameplate

Each GenSet is labeled with a nameplate that provides its unique information. A typical GenSet nameplate is shown in [Figure 2-1](#).

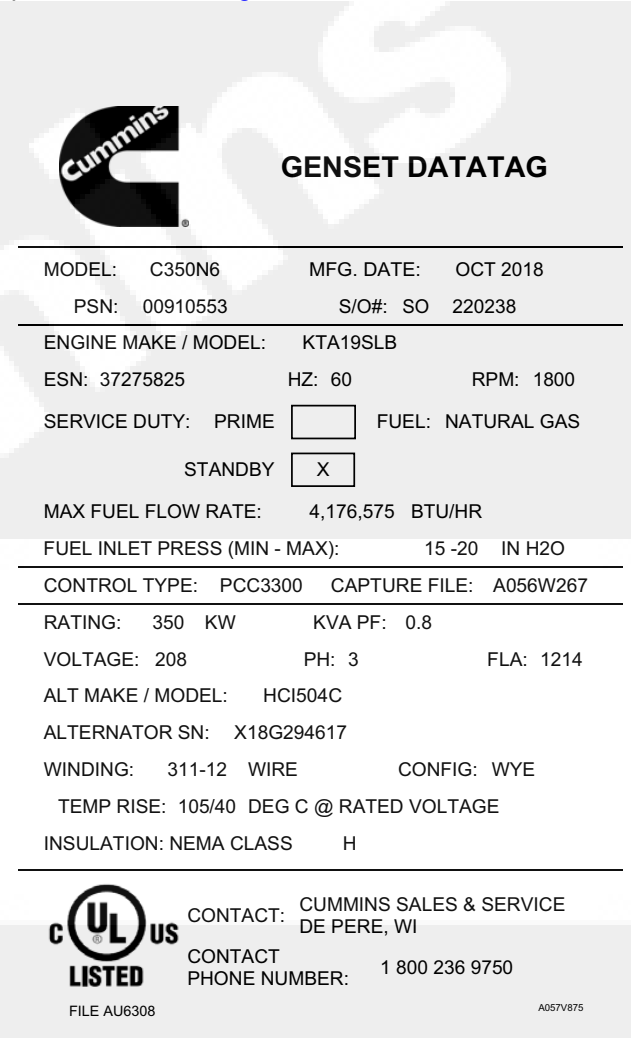


Figure 2-1 GenSet Nameplate (Typical)

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Section 3 - Installing the generator set

3.1 Introduction

This section provides detailed instructions for locating, providing access to, mounting and ventilating the generator set (GenSet). Users are respectfully advised that, in the interests of good practice and safety, it is their responsibility to employ competent persons to carry out any installation work.

GenSet installations must be engineered so the GenSet will function properly under the expected load conditions. Use these instructions as a general guide only. Follow the instructions of the consulting engineer when locating or installing any components. The complete installation must comply with all local and state building codes, fire ordinances, and other applicable regulations. Consider these requirements before installation:

- Level mounting surface
- Adequate cooling air
- Adequate fresh induction air
- Discharge of GenSet air

- Non-combustible mounting surface
- Discharge of exhaust gases
- Electrical connections
- Accessibility for operation and servicing
- Noise levels
- Vibration isolation

As shown in [Figure 3-1](#), a standalone application is when the GenSet is not paralleled to any other GenSets. When operation is standalone, the Operator Panel **Home** screen displays **GenSet Config** as **Single**.

The GenSet can be operated in **Manual** and **Auto** mode in a standalone application. When in **Manual** mode, the operator manually controls the main breaker operation. When in **Auto** mode, the GenSet control automatically controls the breaker operation.

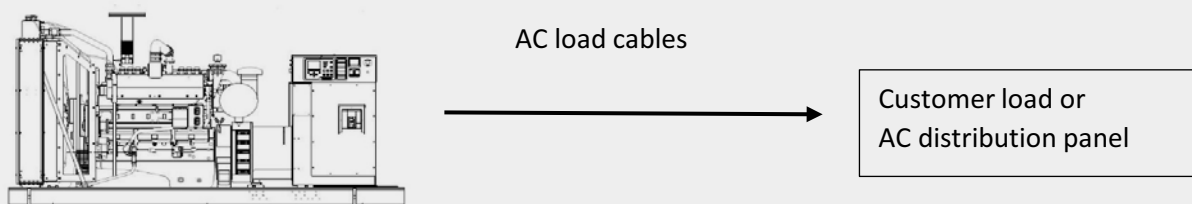


Figure 3-1 GenSet standalone application

3.2 Choosing the Location

The GenSet location is decided mainly by related systems such as ventilation, wiring, fuel, and exhaust. The GenSet should be located as near as possible to the main power service entrance. Exhaust must not be able to enter or accumulate around inhabited areas.

Position an open GenSet with adequate surrounding space and on a level surface. The area immediately around the GenSet must be free of any flammable material. Provide a location away from extreme ambient temperatures and protect the GenSet from adverse weather conditions. An optional housing is available for outside operation.

Installing the generator set

Use the following information to locate the GenSet for optimal operating conditions:

Surface: Concrete or compacted gravel with the container resting on solid, poured concrete blocks, or timber blocks spaced at reasonable intervals around the perimeter of the container.

Leveling: Level the container from side-to-side within +35 mm (1.38 in.), and end-to-end within +25 mm (.98 in.).

Placement:

- Allow for adequate access to entry doors.
- Make sure that the air inlets are not obstructed by surrounding trees, buildings, or other obstructions.
- Make sure that noise distribution (to prevent echoing) is kept to a minimum.
- Consider exhaust output location that may affect immediate neighbors.
- Take into consideration the prevailing wind direction so that the engine combustion air inlet is upwind and the exhaust discharge is downwind.
- Evaluate the immediate area around the location of the mounting surface for proper drainage so that moisture runoff is sufficient to prevent ponding around the GenSet.

WARNING

Incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical component installation.

3.3 Providing access to the GenSet

Generally, at least 1 meter (3.3 ft) of clearance should be provided on all sides of the GenSet for maintenance and service access. (Increase the clearance by the width of the door, if optional housing is used.)

A raised foundation or slab of 150 mm (6 in.) or more above the floor level will make servicing easier.

Lighting should be adequate for operation, maintenance, and service operations and should be connected on the load side of the transfer switch so that it is available at all times.

3.4 Mounting the GenSet

GenSets (and their enclosures) are mounted on a steel skid that provides proper support. The engine-generator assembly is isolated from the skid frame by rubber mounts that provide adequate vibration isolation for normal installations. Where required by building codes or special isolation needs, GenSets may be mounted on rubber pads or mechanical spring isolators. The use of unapproved isolators may result in harmful resonances and may void the GenSet warranty.

Mount the GenSet on a substantial and level base such as a concrete pad. A non-combustible material must be used for the pad. www.cumminsnpower.com

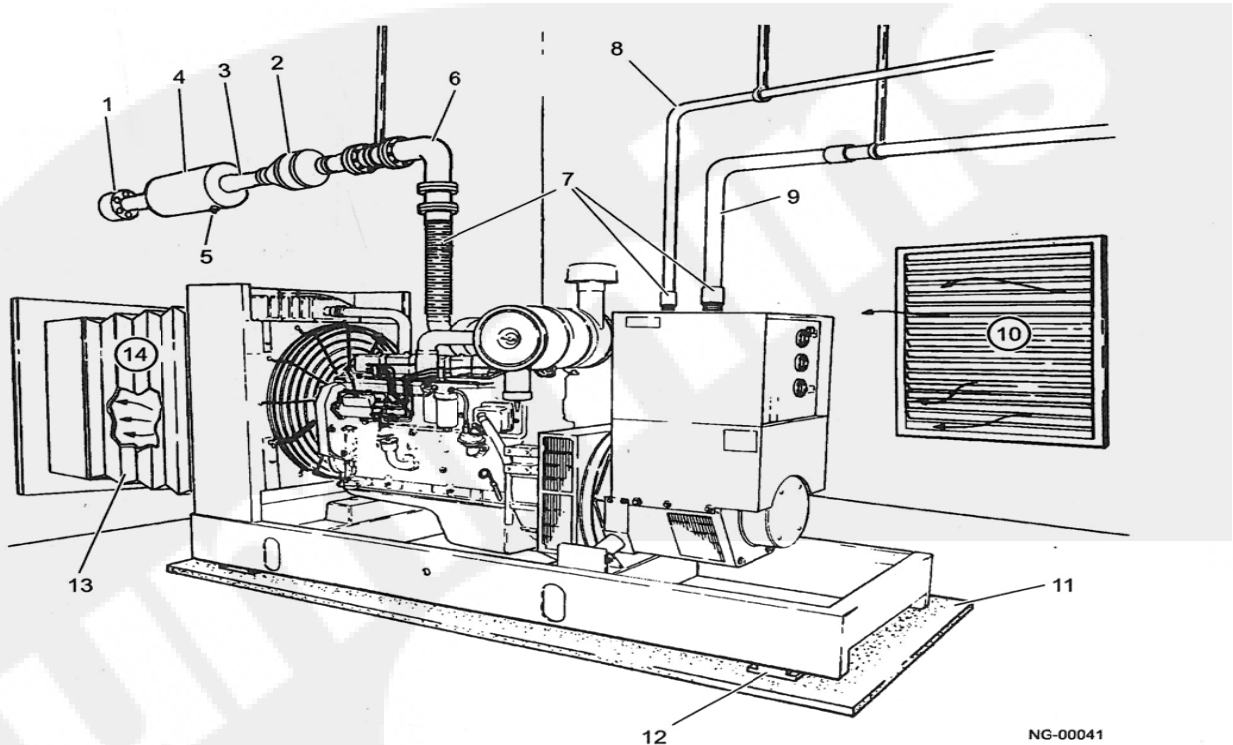
Use 16 mm (5/8 in.) or 19 mm (3/4 in.) anchored mounting bolts to secure the GenSet skid to the floor to prevent movement.

Support the GenSet on a structure able to resist the dynamic weight of the GenSet: ± 3 g-force vertical and ± 3 g-force horizontal. Use four Grade 5, 1/2"-13 threaded fasteners to secure the GenSet frame to the mounting structure. The mounting holes have 1/2"-13 weld nuts. Torque the screws to 35 lb-ft (41 N-m) (0.41" through mounting holes are also available).

IMPORTANT: *To avoid equipment damage, do not attempt to support the GenSet from the ends. All of the service points can be accessed from the service side.*

NOTE: *Depending on the location and the intended use, federal, state, or local laws and regulation may require the customer to obtain an air quality emissions permit before beginning installation of the GenSet. Be sure to consult local pollution control or air quality authorities before completing construction plans.*





- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> 1. Thimble 2. Three-Way Catalyst 3. Exhaust Line 4. Silencer 5. Condensation Drain Plug 6. Sweeping Elbow 7. Flexible Sections | <ol style="list-style-type: none"> 8. Control Wiring 9. Power Wiring 10. Air Inlet 11. Level Concrete Base 12. Seismic Isolators (Optional) 13. Flexible Bellows 14. Air Outlet |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 3-2 GenSet installation configuration (typical)

NOTE: It is the owner/operator's responsibility to complete site-specific emission requirements to ensure compliance with the United States (US) Environmental Protection Agency (EPA) Stationary Spark-Ignited (SI) New Source Performance Standards (NSPS).

Prior to operation, the emissions on the GenSet must be dialed-in at the job-site per the following Customer Engineering Bulletin (CEB) or Cummins Application Engineering Bulletin (AEB) requirements:

- AEB 24.51 Industrial Natural Gas Startup Procedure for Commissioning of Electronic Air Fuel Ratio (AFR) Controlled Engines with Catalyst - Emission-related Installation Instructions.

- AEB 24.52 Three-Way Catalyst (TWC), Three-Way Catalyst XL and Three-Way Catalyst XLS Installation Requirements.
- [For GTA855E] Manual 4325956 GTA855E CM558/2358 G101 Operation and Maintenance Manual and CEB 0015 GTA 855 and GTA 855e Gas Compression and G-Drive Technical Package.
- [For KTA19SLB and QSK19] CEB 00321 KTA19G Power Generation Natural Gas Startup Procedure.

To obtain a copy of these engineering bulletins, contact your local service representative.

Installing the generator set

3.5 Ventilating the GenSet

Unrestricted air flow for cooling, ventilation and combustion is essential for proper GenSet performance and service life. The air cooling flow openings are at the sides and rear back of the GenSet. The discharge opening is at the front of the GenSet.

Make sure frame cross members, exhaust tail pipes and other equipment do not cross underneath the air intake and discharge openings. Do not block the air inlet and outlet openings with screens, expanded metal or the like; they restrict air flow and could cause the GenSet to overheat.

Section 4 - Mechanical connections

4.1 Introduction

This section provides detailed instructions for connecting the fuel, exhaust, ventilation, and cooling systems to the generator set (GenSet). Users are respectfully advised that, in the interests of good practice and safety, it is their responsibility to employ competent persons to carry out any installation work. To avoid possible safety hazards, make all mechanical connections to the GenSet exactly as specified in this manual. All mechanical systems must comply with all applicable codes. Make certain that all required inspections and tests have been completed and all code requirements have been satisfied before

certifying the installation is complete and ready for service.

4.2 Connecting the fuel system

Based on model, the Cummins GenSets can be equipped to operate on natural gas alone, propane alone (propane derate applies), or on dual fuel.

Figure 4-1 shows a typical natural gas fuel system. Before starting any type of fuel installation, all pertinent state and local codes must be complied with and the installation must be inspected before the unit is put in service.

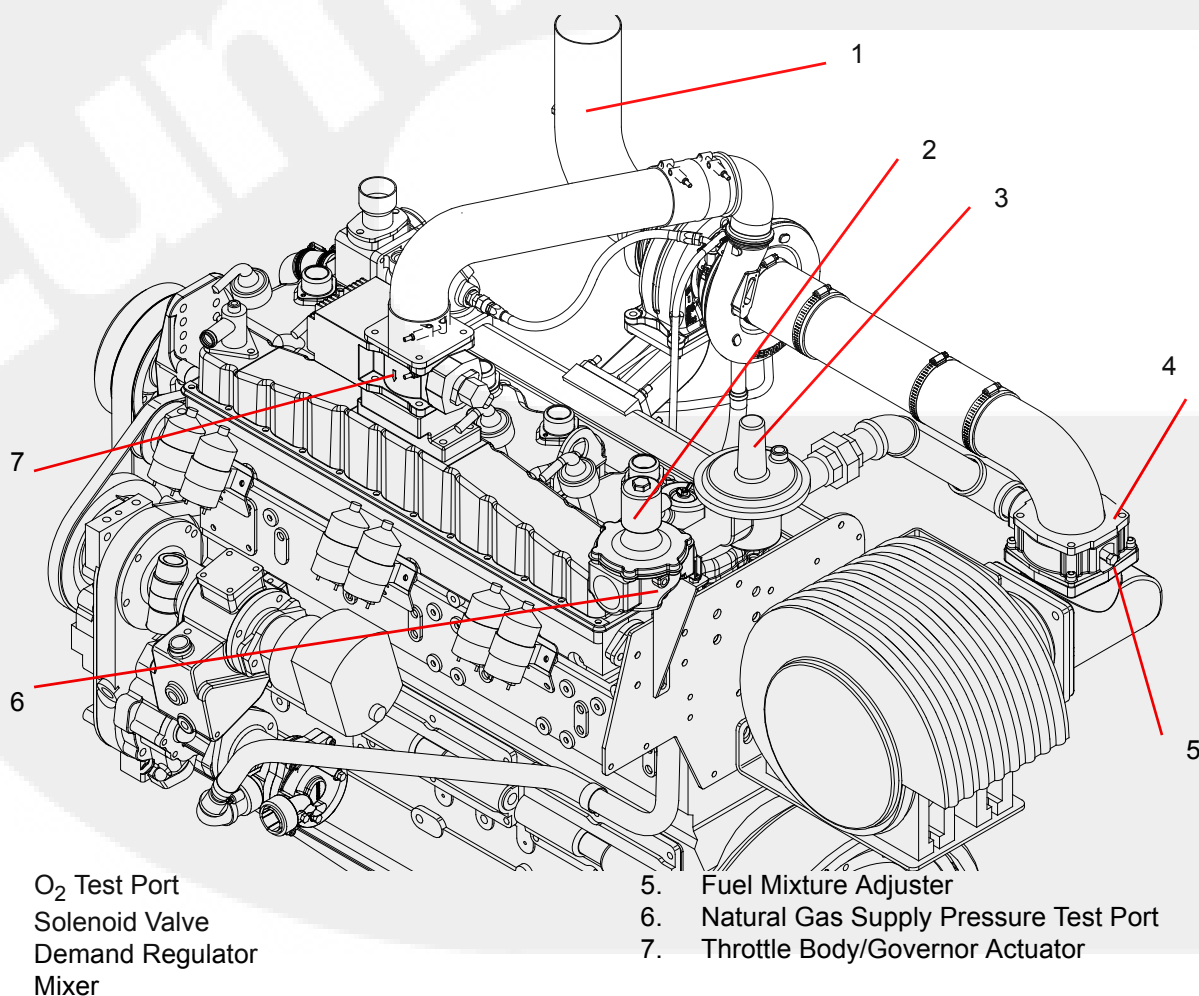


Figure 4-1 Natural gas fuel system (typical)

Mechanical connections

In all fuel system installations, cleanliness is of the utmost importance. Make every effort to prevent the entrance of moisture, dirt, or contaminants of any kind. Clean all fuel system components before installing.

IMPORTANT: *All pipe-threaded fuel system fittings, including container fittings, must be assembled using a pipe joint sealing compound designed for use with natural gas or propane, as applicable per industry standards.*

4.2.1 Attaching the fuel lines

A flexible fuel hose(s) or a section of flexible fuel hose(s) must be used between the engine's fuel system and the fuel supply line to protect the fuel system from damage caused by vibration, and expansion and contraction. The GenSet fuel supply line must be a dedicated supply line from the utility.

WARNING

Fuel leaks create fire and explosion hazards which can result in severe personal injury or death. Always use flexible tubing between the engine and the fuel supply to avoid line failure and leaks due to vibration. The fuel system must meet applicable codes.

Installation of the fuel hose must be done according to all applicable codes and standards, as well as installation recommendations provided by the manufacturer. The flexible hose used must be approved by the hose manufacture for use with the GenSet fuel type and product application.

Support the fuel lines to restrain movement and prevent chaffing or contact with sharp edges, electrical wiring, and hot exhaust parts.

WARNING

Sparks and hot surfaces can ignite fuel, leading to severe personal injury or death. Do not route fuel lines near electrical wiring or hot exhaust parts.

Fuel lines must be routed and secured per local, state, and national codes.

Install a dry-type fuel filter ahead of the service pressure regulator to protect the sensitive pressure regulating components and orifices downstream from rust,

scale, and other solid substances carried along in the gas stream.

WARNING

Gaseous fuels are flammable and explosive and can cause severe personal injury or death. Do not smoke if you smell gas or are near fuel tanks or fuel-burning equipment or are in an area sharing ventilation with such equipment. Keep flames, sparks, pilot lights, electrical arcs and arc-producing equipment and all other sources of ignition well away from the GenSet and areas sharing ventilation.

WARNING

NFPA No. 58 Liquefied Petroleum Gas Code requires all persons handling and operating propane to be trained in proper handling and operating procedures.

The gaseous-fuel supply system design, materials, components, fabrication, assembly, installation, testing, inspection, operation, and maintenance must comply with applicable codes. (Refer to authorities having jurisdiction (AHJs) and reference NFPA No. 37 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, NFPA No. 54 National Fuel Gas Code, and NFPA No. 58 Liquefied Petroleum Gas Code.)

Most codes require both manual and electric (battery-powered) shutoff valves ahead of the flexible fuel hose(s). The manual valve should be of the indicating type.

If an automatic safety shut-off valve with visual indicators or leak test valves are required, then it shall be the responsibility of the customer or contractor to provide them. The electric valve should be wired so that the valve is closed when the GenSet is off.

The recommendations in Cummins Application Manual T-030 Liquid-cooled Generator Sets should be followed in regard to fuel supply system pipe sizes, manual shut-off valves, fuel filters, and gas pressure regulators. *To obtain a copy of this manual, contact your local service representative.*

4.2.2 Adjusting the fuel pressure and mixture

IMPORTANT: *Gas supply pressure is specified at the inlet to the on-engine Maxitrol regulator or the electronic pressure regulator (EPR). As standard equip-*



ment, one fuel shut-off (FSO) valve is located upstream from the regulator on this unit. Additional options added to the fuel train, such as those for CSA or UL compliance, and/or flexible fuel connections or strainers, add restriction that must be considered when determining gas supply pressure.

⚠ WARNING

High gas supply pressure can cause gas leaks which can lead to fire and severe personal injury or death. Gas supply pressure must be adjusted to proper specifications by qualified personnel.

For propane (vapor withdrawal) and natural gas, the fuel supply pressure must be between 3.75 and 5 kPa (15-20 in. WC) under full-load operation and is not to exceed 5.0 kPa (20 in. WC) under any condition. The recommended minimum fuel pressure is 3.7 kPa (15 in. WC). See [Figure 4-2](#) for the location of the pressure test ports.

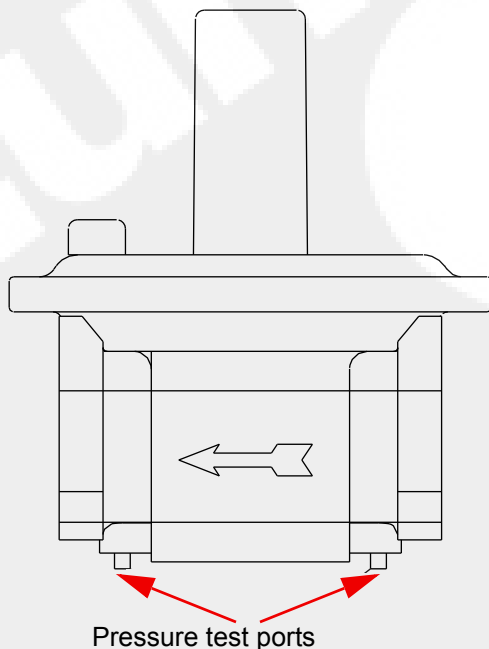


Figure 4-2 Demand regulator

For models C180N6, C55L6 and C55N6, C140L6 and C150N6, and C130L6 and C200N6 without a secondary regulator, the recommended gas pressure is 1.7 - 2.7 kPa (7-11 in. WC). For propane (liquid withdrawal), the maximum permissible fuel supply

pressure is 862 kPa (125 psi) under any operating condition.

⚠ DANGER

Gaseous fuel leaks into an inadequately ventilated space can lead to explosive accumulations of gas. Natural gas rises when it is released into the air and can accumulate under overhanging hoods and inside housings and buildings. Propane sinks when released into the air and can accumulate inside housings, basements and other below-grade spaces. Precautions must be taken to prevent gas leaks and the accumulation of gaseous fuel in the event of a leak.

⚠ WARNING

Natural gas is lighter than air, and will tend to gather under hoods. Liquefied petroleum gas (LPG) is heavier than air, and will tend to gather in sumps or low areas. NFPA Standard No. 58 Liquefied Petroleum Gas Code requires all persons handling and operating LPG to be trained in proper handling and operating procedures.

IMPORTANT: Read the warranty statement provided with the GenSet for US Environmental Protection Agency (EPA) restrictions on servicing specific components.

A Cummins GenSet engine is equipped with one shut-off solenoid valve and one demand pressure regulator. UL GenSets have two solenoid valves. It is important that the fuel shut-off solenoids are operating properly.

GenSets for optional liquid withdrawal of propane are equipped with a converter that vaporizes the fuel with hot engine coolant. A GenSet equipped for dual fuel (natural gas and propane) has a gas mixer that serves both fuels. A fuel pressure switch to detect loss of natural gas pressure is provided for automatic changeover to propane while the engine is running. Manual shut-off valves are provided in each supply line for manual changeover systems.

During normal operation, the engine fuel/air ratio is determined by the fuel trim valve operating in conjunction with the oxygen sensor and the air/fuel control module. Your authorized Cummins distributor can monitor fuel system/oxygen sensor operation using the Cummins Insite service tool.

Mechanical connections

IMPORTANT: Always use NO_x and CO test equipment to set emission levels.

WARNING

Do not attempt to correct the fuel pressure by adjusting the fuel system before determining that the engine and the ignition system are functioning properly. Especially be sure to check for air cleaner restriction due to dirt accumulation.

4.2.3 Checking for gas leaks

While the system is under pressure, check all fuel-system connections - including the container with associated valves and fittings - for leaks using a soap and water solution or equivalent.

4.3 Connecting the exhaust system

The exhaust outlet may be sited at the top or the bottom of the GenSet. Make sure that the exhaust outlet is not obstructed. Personnel using this GenSet must be made aware of the exhaust position. Position the exhaust away from flammable materials. In the case of the exhaust outlets at the bottom, make sure that vegetation is removed from the vicinity of the exhaust.

The exhaust system design should meet federal, state, and local code requirements. Be sure to pipe all exhaust gases to the outside of any enclosure. Locate the exhaust outlets away from any air inlets to avoid gases re-entering the enclosure.

Exhaust installations are subject to various detrimental conditions such as extreme heat, infrequent operation, and light loads. Regularly inspect the exhaust system both visually and audibly to see that the entire system remains fume tight and safe for operation.

DANGER

Inhalation of exhaust gases can result in severe personal injury or death. Do not use exhaust heat to warm a room, compartment or storage area.

WARNING

Inhalation of exhaust gases can result in severe personal injury or death. Use extreme care during installation to provide a tight exhaust system. Terminate the exhaust pipe away from enclosed or sheltered areas, windows, doors and vents.

For indoor installation, use sealed joint type fittings (for example, National Pipe Thread (NPT) fittings) to provide a tighter exhaust system. Use of slip type fittings (secured with a muffler clamp) may allow leakage of exhaust gases into the building.

As shown in [Figure 4-3](#), use an approved thimble where exhaust pipes pass through walls or partitions. Insulated wall/roof thimbles are used where exhaust pipes pass through a combustible roof or wall (e.g., wood framing or insulated steel decking, etc.). Uninsulated wall/roof thimbles are used where exhaust pipes pass through a non-combustible wall or roof, such as concrete. Build the exhaust system according to the code requirements in effect at the installation site. Refer to NFPA 37 [Stationary Combustion Engines and Gas Turbines](#) and follow recommendations given in Cummins Application Manual T-030 [Liquid-cooled Generator Sets](#) for accepted design practices. *To obtain a copy of this manual, contact your local service representative.*

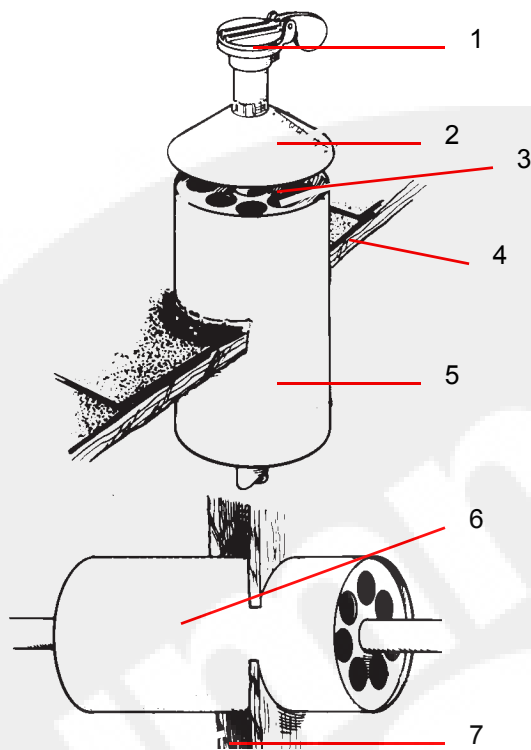
WARNING

Hot exhaust pipes can start a fire and cause severe injury or death if improperly routed through walls. Use an approved thimble where exhaust pipes pass through walls or partitions.

Rain caps are attached to the discharge end of vertical exhaust pipes. The rain cap clamps onto the end of the pipe and opens due to exhaust discharge force from the GenSet. When the GenSet is stopped, the rain cap automatically closes, protecting the exhaust system from rain, snow, etc.

CAUTION

Weight applied to the engine exhaust components can result in damage. Support the muffler and exhaust piping so that no weight or stress is applied to engine exhaust.

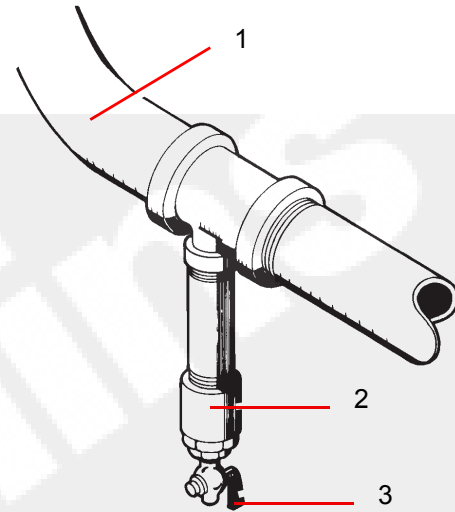


1. Rain Cap (included in the shipment)
2. Drip Cap (owner-supplied)
3. Holes in end of inner sleeve (owner-supplied)
4. Roof (owner-supplied)
5. Thimble in vertical orientation (owner-supplied)
6. Thimble in horizontal orientation (owner-supplied)
7. Wall of partition (owner-supplied)

Figure 4-3 Mounting exhaust thimble

IMPORTANT: Liability for injury, death, damage, and warranty expense due to the use of unapproved mufflers or modifications to the exhaust system becomes the responsibility of the person installing the unapproved muffler or performing the modification. Contact a Cummins Sales and Service distributor for approved exhaust system parts.

Pitch a horizontal run of exhaust pipe **DOWNWARD** (away from the engine) to allow any moisture condensation to drain away from the engine. If an exhaust pipe must be turned upward, install a condensation trap at the point where the rise begins (shown in Figure 4-4.).



1. Exhaust Line (owner-supplied)
2. Condensation Trap (owner-supplied)
3. Valve Handle - shown in open position (owner-supplied)

Figure 4-4 Condensation trap

If there is danger of personal contact, shield or insulate the exhaust lines. If the exhaust system is insulated, provide at least two inches of air space around all sensors. If the pipes pass close to a combustible wall or partition, allow at least 305 mm (12 in.) of clearance. Before installing insulation on the exhaust system components, check the exhaust system for leaks while operating the GenSet under full load. Correct all leaks, as necessary.

⚠ WARNING

Exhaust pipes are very hot and they can cause severe personal injury or death from direct contact or from fire hazard. Shield or insulate exhaust pipes if there is danger of personal contact or when routed through walls or near other combustible materials.

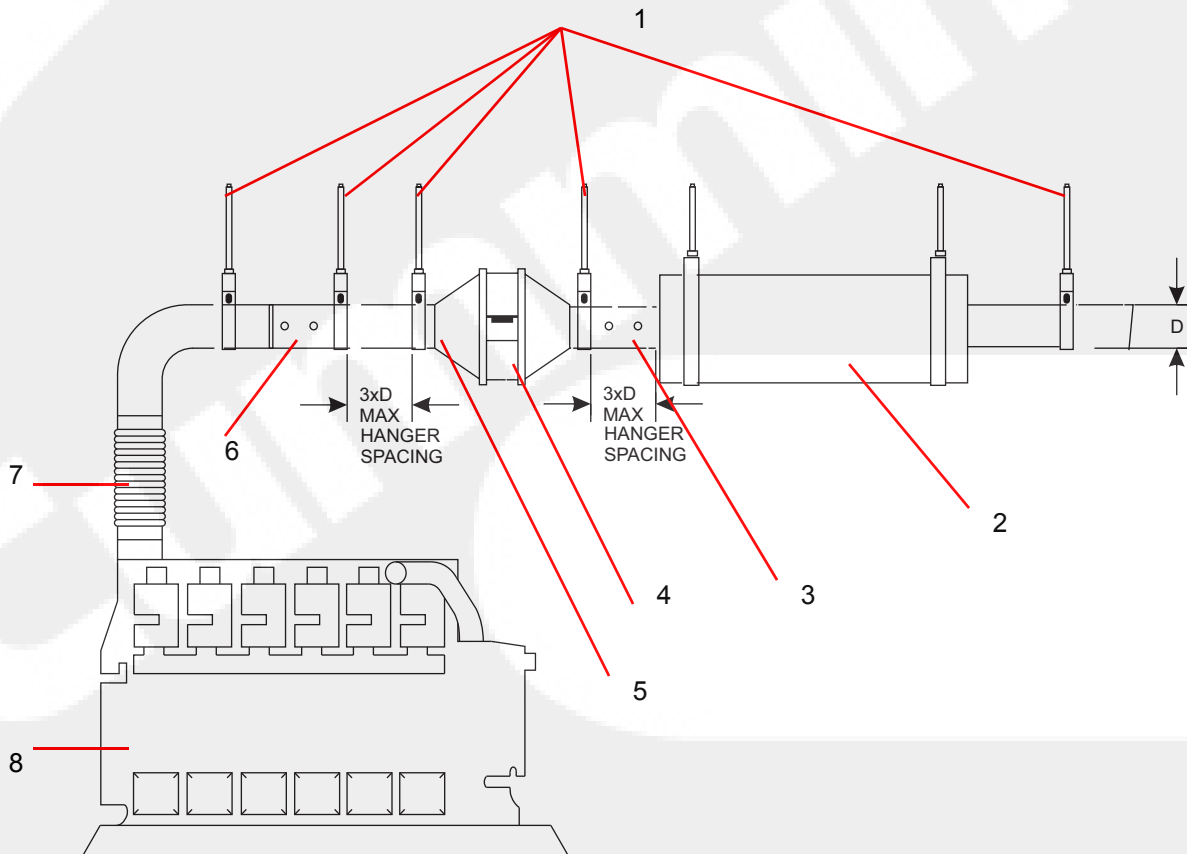
Mechanical connections

4.4 Installing sensors

Engine-mounted sensors monitor the various GenSet systems (e.g., lube oil pressure, cooling system temperature, etc.). On select model-specific engines, the natural gas, oxygen, and temperature sensors have to be mounted in the exhaust ports in both pre- and post-catalyst locations. (See [Figure 4-5](#) and [Figure 4-6](#).) The customer is responsible for the installation

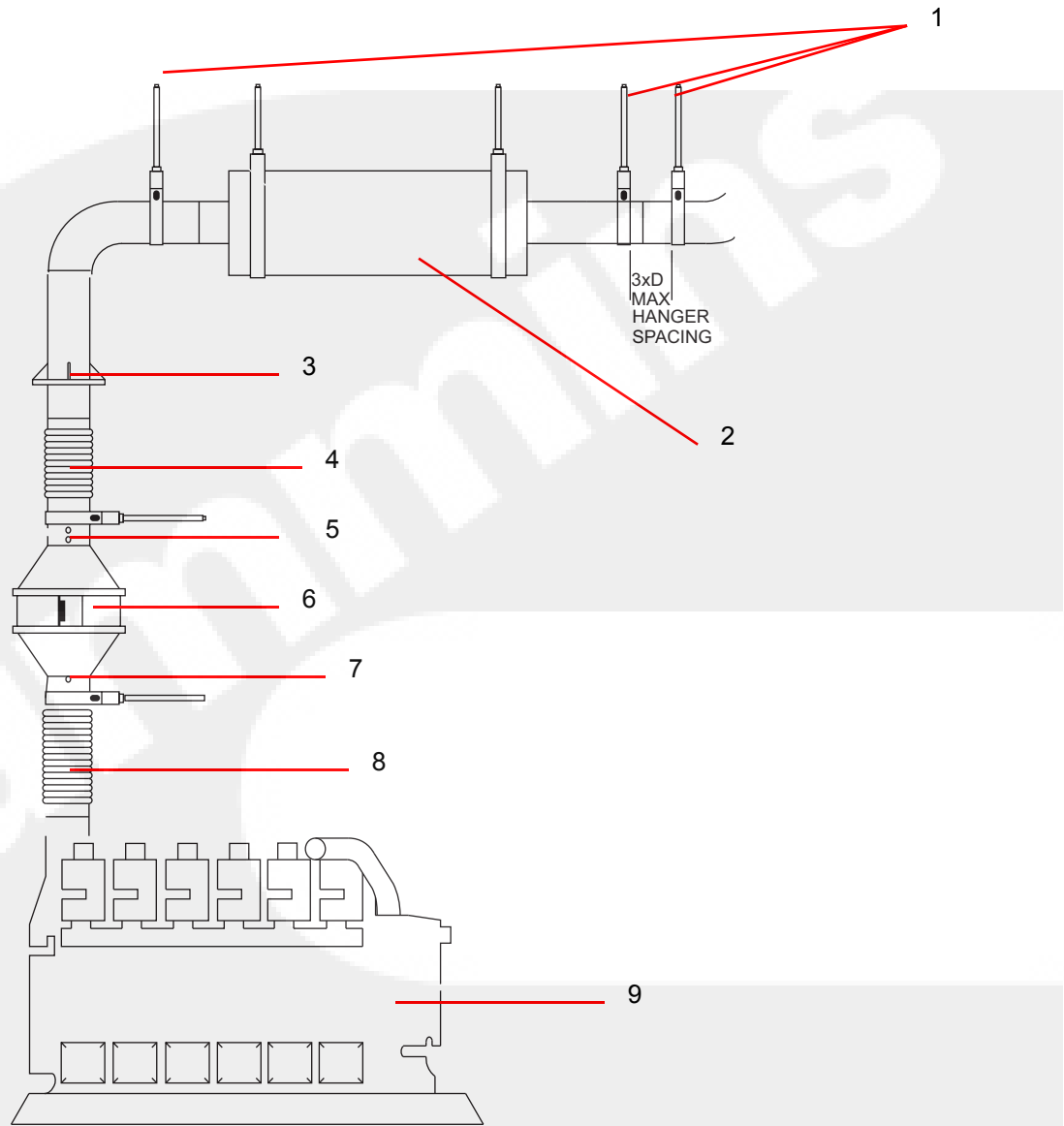
of these sensors. For more information, refer to Customer Engineering Bulletin (CEB) 00115 [GTA 855](#) and [GTA 855e Gas Compression and G-Drive Technical Package](#). To obtain a copy of these engineering bulletins, contact your local service representative.

NOTE: Four inches of clearance for insulation (and other items) around the sensors is required.



- | | |
|----------------------------------------------------|-----------------------------------------------------|
| 1. Hangers | 5. Air Exhaust Temperature 482-732 °C (900-1350 °F) |
| 2. Silencer | 6. Pre O ₂ and Temperature Sensor Port |
| 3. Post O ₂ and Temperature Sensor Port | 7. Expansion Joint |
| 4. Three-way Catalyst (model-specific) | 8. Engine |

Figure 4-5 Recommended horizontal exhaust mounting configuration (typical)



- | | |
|----------------------------------------------------|---------------------------------------------------|
| 1. Hangers | 6. Three-way Catalyst |
| 2. Silencer | 7. Pre-O ₂ and Temperature Sensor Port |
| 3. Fixed support | 8. Expansion Joint |
| 4. Expansion Joint (optional) | 9. Engine |
| 5. Post-O ₂ and Temperature Sensor Port | |

Figure 4-6 Recommended vertical exhaust mounting configuration (typical)

4.5 Installing the air fuel ratio (AFR) controller (model-specific)

Select model-specific natural gas engines are equipped with an air fuel ratio (AFR) controller and are designed to meet emission requirements for EPA SI NSPS codes. The engines are also capable of

meeting EPA SI NSPS emissions standards with an AFR controller and a factory-supplied catalyst.

The AFR control system uses an oxygen sensor architecture with a catalyst, if applicable, to control exhaust emissions. The AFR control system controls

Mechanical connections

the fuel flow based on exhaust oxygen. The controller opens or closes the fuel control valve (FCV) in the fuel line based on feedback from the oxygen sensor(s).

Follow the AFR controller's instructions and engine manufacturer's instructions to set the air fuel ratio. Refer to the AFR controller manual for more information. Analyze the engine exhaust gases with a NO_x, CO, or HC analyzer downstream of the three-way catalyst. If the emissions do not meet specifications, contact your Cummins distributor and replace the catalyst module(s), as needed. This procedure shall be performed at the time of installation of the natural gas three-way catalyst, after any re-assembly, and periodically, according to the schedule provided by the manufacturer throughout the life of the three-way catalyst.

4.6 Installing catalyst-removable elements (model-specific)

Refer to Application Engineering Bulletin (AEB) 24.52 [Three-Way Catalyst \(TWC\), Three-Way Catalyst XL and Three-Way Catalyst XLS Installation Requirements](#) for accepted design practices for catalyst-removable elements. (To obtain a copy of this engineering bulletin, contact your local service representative.) Some GenSets require a three-way or oxidation catalyst to meet emission requirements. There is a precious metals element inside the housing of the catalyst that converts exhaust to EPA requirements. Some catalysts have a removable body that can be replaced with a new element when required. Most catalysts come installed on the GenSet from the factory. Some catalysts require customer mounting. Check with your distributor or service technician for details on your product.

4.7 Installing the engine three-way catalyst (model-specific)

Refer to AEB 24.52 [Three-Way Catalyst \(TWC\), Three-Way Catalyst XL and Three-Way Catalyst XLS Installation Requirements](#) for accepted design practices for three-way catalysts. (To obtain a copy of this engineering bulletin, contact your local service representative.) The natural gas three-way catalyst reduces the oxides of nitrogen (NO, NO₂) and hydrocarbons (HC) from the natural gas exhaust. **Read this manual before installing, operating, or servicing the engine equipped with a natural gas catalytic converter.**

The natural gas three-way catalyst, when installed properly, meets US EPA SI NSPS emission reduction

requirements on NO, NO₂, CO, and HC for Original Engine Manufacturer (OEM) technology on stoichiometric natural gas engines. Removal of these devices without prior approval from the state and regulatory agencies can be constituted as tampering.

NOTE: Handle the natural gas three-way catalyst with care. Do not hammer or drop the unit. Do not weld or drill holes in the body of the natural gas three-way catalyst without prior approval of Cummins Inc. or its distributors.

The following are recommendations for installation and application of a natural gas three-way catalyst for select models of natural gas engines. It is recommended that systems incorporating a natural gas three-way catalyst be designed by - or in conjunction with - Cummins engineers. In order to receive Cummins approval of the three-way catalyst installation, the installation must meet the following requirements (exceptions to these requirements can only be approved by Cummins engineers):

- The three-way catalyst and housing shall be the correct part number for the application.
- The three-way catalyst shall be mounted with a mounting system strong enough to support both the additional weight and dynamic loads.
- The three-way catalyst must be supported by the piping to which it is attached. (See [Figure 4-5](#) and [Figure 4-6](#)).
- The exhaust piping material must be compatible with the three-way catalyst housing material, either cold-rolled steel or an appropriate grade of stainless steel.
- The exhaust piping shall be supported separately from the three-way catalyst. No external force(s) can be imposed upon the catalyst housing greater than 22.7 kg (50 lb) in any direction.
- A flexible tubing (i.e., bellows or flex pipe) must be placed between the engine and the beginning of the exhaust piping. This will isolate the three-way catalyst and other downstream components from engine vibration.
- For vertical flow mounting, ensure that the stack above the catalyst is independently supported. (See [Figure 4-6](#).)



- Cantilevering loads off the end of the three-way catalyst must be avoided.
- With the exception of models C55L6 and C55N6 (GCMC) and C140L6 and C150N6 (GFPA), Cummins GenSet engine oil shall meet 15W40 Low Ash (or better) specifications, as required by the engine manufacturer. C55L6, C55N6, C140L6, and C150N6 require the use of Society of Automotive Engineers (SAE) 5W30 engine oil with an American Petroleum Institute (API) rating of SM or newer.
- The catalyst must be installed to guarantee an air exhaust temperature into the catalyst of 455-677 °C (850-1250 °F). Any temperature outside this range may affect the catalyst performance or life.
- The owner is responsible for keeping the natural gas three-way catalyst system on the equipment because the removal of the system may cause a violation of local emission regulations.
- The owner is responsible for periodic inspection of the system in accordance with these and other operational instructions.
- The owner is responsible for maintaining the operation of the engine in a way that would NOT adversely affect the natural gas three-way catalyst system. Any misfire, stack detonations, or oil or debris in the exhaust system must be recorded in the equipment's service record.
- The owner is responsible for maintaining complete oil consumption and service records, as well as software files, where applicable, and to make them available to a requesting Cummins authorized repair location for troubleshooting purposes.

WARNING

To reduce the possibility of personal injury, use a hoist or get assistance to lift the assembly.

CAUTION

The existing exhaust pipe silencer hangers cannot hold the weight of a natural gas catalyst. Install appropriate customer-supplied natural gas three-way catalyst mounting brackets.

WARNING

Do not touch the surface of the existing silencer during or up to thirty minutes after operation. All surfaces are hot and can cause personal injury.

To properly install a three-way catalyst, follow these steps:

1. Ensure the engine ignition system and AFR controller system are functioning properly according to the manufacturer's specifications prior to starting installation of the three-way catalyst.
2. Press the **Emergency Stop** button.
3. Turn off - or remove - AC power from the battery charger and then remove the negative (-) battery cable from the GenSet starting battery using an insulated wrench.
4. Turn off the fuel supply.
5. Ensure the engine and auxiliary equipment are safely locked out and cannot be engaged.
6. Bolt the natural gas three-way catalyst mounting bracket (supplied by the customer, according to the application) to a solid structure.
7. Install the customer-supplied mounting clamps to the natural gas three-way catalyst housing. Tighten the mounting clamps enough to hold them in place (see [Figure 4-5](#) and [Figure 4-6](#)) and to allow movement to connect the inlet and outlet exhaust pipes.
8. Connect the inlet and outlet exhaust pipes to the catalyst inlet and outlet.
9. Connect the customer-supplied mounting clamps to the catalyst mounting bracket.
10. Tighten the natural gas catalyst mounting clamps.

4.8 Installing the ventilation and cooling systems

GenSets dissipate heat and fumes that must be removed by proper cooling and ventilation. GenSets in factory-mounted housings for outdoor installation are designed for proper cooling and ventilation.

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Indoor installations require careful design with respect to cooling and ventilation. Indoor installations need properly sized and positioned vents for required airflow. All radiator cooling air must be discharged to the outdoors. Duct adapter kits are available, if necessary.

DANGER

Engine or radiator cooling air may carry deadly carbon monoxide gas which can cause asphyxiation and death. All engine or radiator cooling air must be discharged outdoors. Do not use radiator cooling air for heating a room or compartment.

For indoor installations, locate vents so incoming air passes through the immediate area of the installation before exhausting. Install the air outlet higher than the air inlet to allow for convection air movement.

Size the vents and ducts so they are large enough to allow the required flow rate of air. Wind will restrict free airflow if it blows directly into the air outlet vent. Locate the outlet vent so the effects of wind are eliminated (or install a wind barrier). The "free area" of ducts must be as large as the exposed area of the radiator. Refer to the GenSet data sheet for the airflow requirements and allowed airflow restrictions.

Dampers or louvers protect the GenSet and equipment room from the outside environment. Their operation of opening and closing should be controlled by operation of the GenSet.

In cooler climates, movable or discharge dampers are used. These dampers allow the air to be recirculated back to the equipment room. This enables the equipment room to be heated while the GenSet engine is still cold, increasing the engine efficiency.

4.9 Installing the remote radiator cooling system

The remote radiator cooling system (including an electrically-driven fan) can be substituted in place of mounted components. Removal of the radiator and the fan from the GenSet reduces noise levels without forcing dependence on a continuous cooling water

supply (necessary with heat exchanger cooling). The remote radiator installation must be completely protected against freezing.

Remote radiator plumbing will vary with installation. Follow recommendations given in Cummins Application Manual T-030 Liquid-cooled Generator Sets. (To obtain a copy of this engineering bulletin, contact your local service representative.) Refer also to the GenSet data sheet www.cumminspower.com for friction head and static head limits.

IMPORTANT: Before filling the cooling system, check and fasten all hardware. This includes hose clamps, capscrews, fittings, and connections. Use flexible coolant lines with a heat exchanger or remote mounted radiator options.

4.10 Installing the radiator set cooling duct

Radiator set cooling air is drawn past the control end of the GenSet by a pusher fan that blows air through the radiator. Locate the air inlet to the rear of the GenSet. Make the inlet vent opening 1½ times larger than the radiator area.

NOTE: Louvers and screens over air inlet and outlet openings restrict air flow and vary widely in performance. A louver assembly with narrow vanes, for example, tends to be more restrictive than one with wide vanes. The effective open area specified by the louver or screen manufacturer should be used. Confer with a consulting engineer to verify allowable airflow and restriction.

Locate the cooling air outlet directly in front of the radiator and as close as possible. The outlet opening must be at least as large as the radiator area. The length and shape of the air outlet duct should offer minimum restriction to airflow.

Attach a canvas or sheet metal duct to the air outlet opening using screws and nuts so the duct can be removed for maintenance purposes. The duct prevents recirculation of heated air. Before installing the duct, remove the radiator core guard.

Section 5 - Electrical connections

5.1 Introduction

This section provides the procedures that are used to connect the electrical system of the generator set (GenSet).

Before making any electrical connections, make certain the GenSet cannot be accidentally started:

1. Make sure that the Operator Panel is in **OFF** mode.
2. Press the **Emergency Stop** button.
3. Turn off - or remove - AC power from the battery charger and then remove the negative (-) battery cable from the GenSet starting battery using an insulated wrench.
4. If the GenSet is being installed in an application where it may parallel with other generators or utility sources, the GenSet control system may be energized from an external source. Lock out (tag out) any external source that can provide AC power to the GenSet.

The GenSet electrical system involves:

- Connecting the controls.
- Connecting the load cable.
- Connecting standard and optional AC equipment (e.g., a control box heater, a coolant heater, etc.).
- Connecting the batteries.

When field connection is made at the generator terminations, installation should be completed with UL-listed (or local code) conductors and connectors of appropriate size and rating. Strain relief, bending space, raceway, and other installation features should be completed in compliance with local code.

Local regulations often require that wiring connections be made by a licensed electrician and that the installation be inspected and approved before opera-

tion. All connections, wire sizes, materials used, etc., must conform to the requirements of electrical codes in effect at the installation site.

Before starting the GenSet, check to make sure that all electrical connections are secure, and that all wiring is complete. Replace and secure any access panels that have been removed during installation. Check that the load cables from the GenSet are properly connected.

WARNING

Backfeed to a utility system can cause electrocution or property damage. Do not connect to any building electrical system except through an approved device and after the building main switch is opened.

5.2 DC control wiring connections

The PowerCommand Control (PCC) controls the starting and stopping sequence of the engine through the Electronic Control Module (ECM) mounted on the engine. There are several PCC options available. For specific operating procedures, refer to the PCC manual shipped with the unit. [Figure 5-1](#) and [Figure 5-2](#) depict each of the PCC optional displays.

DANGER

Contact with high voltage components can cause severe personal injury or death by electrocution. Do not open the main control housing while the GenSet is running. Read and observe all warnings and cautions in your GenSet manuals.

Only technically-qualified personnel should open the control housing. Voltages are present which can cause electrical shock, resulting in personal injury. Even with the power removed, improper handling of components can cause electrostatic discharge and damage circuit board components.

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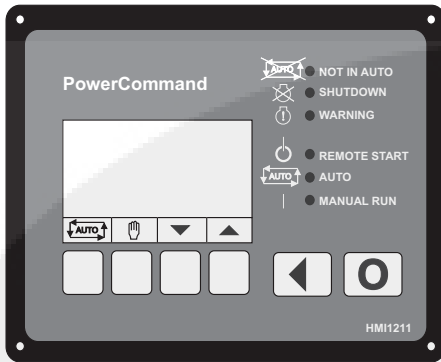


Figure 5-1 PCC 1.1 (1302)



Figure 5-2 PCC3.3 (3300)

All GenSet control functions are contained on one circuit board (base board). The base board provides engine speed governing (optional), main generator voltage output regulation, and complete GenSet monitoring. The operating firmware provides control of the GenSet and its performance characteristics and displays performance information on a digital display panel. It accepts menu-driven control and set-up input from the push button switches on the Operator Panel (HMI).

5.2.1 Installing the control wiring

The GenSet PCC Control Panel box contains connection points for remote control and monitor options.

CAUTION

Stranded copper wire must be used for all customer connections to the PCC Control Panel.

Solid copper wire may break due to GenSet vibration.

Use flexible conduit for all wiring connections to the GenSet. All conduit used for control wiring is attached to the PCC control housing.

Route the control wiring through the PCC control housing and access holes. Use the access holes that correspond to where the wires are terminated inside the control box.

A compression type strain-relief connector should be used to prevent dust, insects, etc. from entering the control box.

Use cable ties to keep the control wiring away from sharp edges and AC power cables within the control housing.

5.2.2 Connecting the remote monitor/control

Customer monitor/control connections are attached to terminal block TB-1. Optional equipment such as a remote annunciator panel, sensing devices used to monitor GenSet operation, remote start/stop switches, battery charger, etc. are attached to TB-1. Refer to the customer connections diagram in [Wiring Diagrams](#).

IMPORTANT: *The battery charger must be connected to a power source that is protected by a ground fault circuit interrupter (GFCI).*

CAUTION

Always run control circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.

Digital connections: Connection points (other than relayed outputs, network, switched B+, and B+) are considered digital connections to terminal strip TB-1. The recommendations for these connections specifies:

- Less than 305 m (1000 ft), use 20 gauge stranded copper wire.
- 305 to 610 m (1000 to 2000 ft), use 18 gauge stranded copper wire.

Relay connections: Due to the wide variety of devices that can be attached to the relay outputs of TB-1, the electrical contractor must determine the gauge of the stranded copper wire that is used at this installation site. Refer to the PCC customer connections diagram in the GenSet drawings. (See [Wiring Diagrams](#).)

Network connections:

- 18 ga twisted pair wire or Cat 5 cable
- RS485 connection
- Total network length cannot exceed 4000 feet
- Up to 20 nodes can be connected to the network

NOTE: *Any communications wire connected to the GenSet should be stranded cable.*

For more information, refer also to the specific PCC Installation Manual.

Switched B+: (Fused at 5 amps.) Due to the wide variety of devices that can be attached to the relay outputs of TB-1, the electrical contractor must determine the gauge of the stranded copper wire that is used at this installation site. Refer to the PCC customer connections diagram in the GenSet drawings. (See [Wiring Diagrams](#).)

B+: (Fused at 10 amps.) Due to the wide variety of devices that can be attached to the relay outputs of TB-1, the electrical contractor must determine the gauge of the stranded copper wire that is used at this installation site. Refer to the PCC customer connections diagram in the GenSet drawings. (See [Wiring Diagrams](#).)

5.2.3 Connecting control relays (optional)

Damage to the base board can occur if the voltage suppressors are not installed across relay coils (A1/A2) of control relays K11, K12, and K13 before connecting the GenSet battery cables.

The three optional control relays are rail mounted inside the PCC Control Panel housing. Each relay is a four-pole relay with two poles normally open and two poles normally closed. These relays are used to control auxiliary equipment, such as fans, pumps, and motorized dampers. Energizing of the relays is defined by the user.

The contacts are rated at 10 amps at 600 VAC. For more information, refer to [Wiring Diagrams](#).

5.2.4 Configuring the PCC

It may be necessary to configure the PCC for site-specific commands (e.g., language, start/stop time delays, cycle crank, customer fault 1 and 2, etc.). Refer to the model-specific PCC manual for programming instructions.

5.3 AC electrical connections

This section provides the procedures used to connect the AC electrical system of the GenSet. The customer must provide the AC power conductors for connection to load devices and the means to isolate the AC input to the terminal box and these must comply with local electrical codes and regulations.

All connections, wire sizes, materials used, etc. must conform to the requirements of electrical codes in effect at the installation site. Contractor guidelines for appropriate conduit and wire sizing for this GenSet can be found by referring to [Table 5-1](#).

WARNING

Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

WARNING

Ventilate battery area before working on or near battery. Wear goggles.

WARNING

Accidental starting of the GenSet can cause severe personal injury or death. Press the Emergency Stop button and disconnect the charger before disconnecting battery cables. Disconnect negative (-) cable first and reconnect last.

CAUTION

Disconnect the battery charger from AC source before disconnecting battery cables. Otherwise,

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disconnecting cables can result in voltage spikes damaging to DC control circuits of the GenSet.

CAUTION

Each of the operations described in this section should be done only by persons trained and experienced in electrical maintenance. Improper procedures may result in property damage, bodily injury or death.

Conduit and wire size
Table 5-1. Suggestions for electrical contractor's consideration

MAX BREAKER AMPS	Wire (Copper)		Conduit	
	QTY	SIZE	QTY	SIZE
2500A	6	600 MCM	6	4"
2000A	5	500 MCM	5	3½"
1600A	5	350 MCM	5	3½"
1200A	3	500 MCM	3	3½"
1000A	3	400 MCM	3	3½"
800A	2	500 MCM	2	3½"
600A	2	300 MCM	2	3"
400A	1	500 MCM	1	3½"
225A	1	4/0	1	2½"
150A	1	1/0	1	2"

WARNING

Improper wiring can cause a fire or electrocution, resulting in severe personal injury or death and/or property and equipment damage.

Before starting the GenSet, check to make sure that all electrical connections are secure and that all wiring is complete. [Table 5-2.](#) and [Table 5-3.](#) specify the nominal value of tightening torque to be applied to the clamping screws of the terminal connectors. Replace and secure any access panels that have been removed during installation. Check that the load cables from the GenSet are properly connected.

NOTE: *Class 1 wiring methods are to be used for field wiring connections to terminals of a class 2 circuit.*

WARNING

Backfeed to the utility system can cause electrocution or property damage. Do not connect to any building electrical system except through an approved device and after the building main switch is opened



Table 5-2. Tightening torque for pressure wire connectors having internal socket head screws

Socket Size Across Flats		Tightening Torque	
mm	inch	N-m	lb inches
3.2	1/8	5.1	45
4.0	5/32	11.4	100
4.8	3/16	13.8	120
5.6	7/32	17.0	150
6.4	1/4	22.6	200
7.9	5/16	31.1	275
9.5	3/8	42.4	375
12.7	1/2	56.5	500
14.3	9/16	67.8	600



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Table 5-3. Tightening torque for pressure wire connectors having screws

Size of wire that is to be used for connection of the unit		Tightening torque, lb-in (N-m)			
		Slotted head no. 10 (4.7 mm) and larger ¹		Hexagonal head - external drive socket wrench	
AWG/kcmil	mm ²	Slot width - 0.047 inch (1.2 mm) or less; and slot length - 1/4 inch (6.4 mm) or less	Slot width - over 0.047 inch (1.2 mm); and slot length - over 1/4 inch (6.4 mm)	Split-bolt Connectors	Other Connections
18 - 10	.82 - 5.3	20 (2.3)	35 (4.0)	80 (9.0)	75 (8.5)
8	8.4	25 (2.8)	40 (4.5)	80 (9.0)	75 (8.5)
6 - 4	13.3 - 21.2	35 (4.0)	45 (5.1)	165 (18.6)	110 (12.4)
3	26.7	35 (4.0)	50 (5.6)	275 (31.1)	150 (16.9)
2	33.6	40 (4.5)	50 (5.6)	275 (31.1)	150 (16.9)
1	42.4	-	50 (5.6)	275 (31.1)	150 (16.9)
1/0 - 2/0	53.5 - 67.4	-	50 (5.6)	385 (43.5)	180 (20.3)
3/0 - 4/0	85 - 107.2	-	50 (5.6)	500 (56.5)	250 (28.2)
250 - 350	127 - 177	-	50 (5.6)	650 (73.4)	325 (36.7)
400	203	-	50 (5.6)	825 (93.2)	325 (36.7)
500	253	-	50 (5.6)	825 (93.2)	375 (42.4)
600 - 750	304 - 380	-	50 (5.6)	1000 (113.0)	375 (42.4)
800 - 1000	406 - 508	-	50 (5.6)	1100 (124.3)	500 (56.5)
1250 - 2000	635 - 1016	-	50 (5.6)	1100 (124.3)	600 (67.8)

NOTE - Connectors having a clamping screw with multiple tightening means (for example, a slotted, hexagonal head screw) are to be tested using both values of torque.

¹For values of slot width or length not corresponding to those specified, select the largest torque value associated with the conductor size. Slot width is the nominal design value. Slot length is to be measured at the bottom of the slot.

5.3.1 Installing the transfer switch

A transfer switch must be used for switching the load from the normal power source to the GenSet. Follow the instructions provided with the transfer switch when connecting the load and control wiring.

5.3.2 Configuring the generator voltage

The available generator output voltages and maximum current ratings are specified on the GenSet nameplate (See [Figure 2-1](#)). The line-to-neutral voltage is always the lower voltage shown and the line-to-line voltage is the higher rating.

These generators can be configured to the nameplate voltages as shown on the Reconnection Diagram located in the generator manual supplied with this equipment. Many of the voltages listed will require reconfiguration of the generator output leads on the connection terminal block. This reconfiguration must only be done by qualified personnel that are trained and experienced to perform electrical installation. The GenSet was adjusted to produce a specified voltage during production verification testing prior to shipment. Refer to the applicable Generator Installation, Service and Maintenance Manual.

CAUTION

Reconfiguring GenSets to higher voltages can exceed the voltage capability of the specific generator windings. This will damage the generator, decrease line current, and render line circuit breakers too large. Consult with your distributor before performing a reconnection for a different voltage.

CAUTION

Reconfiguring GenSets to lower voltages can reduce GenSet ratings, and also increase line current, rendering the line circuit breakers too small. Consult with your distributor before performing a reconnection for a different voltage.

5.3.3 Connecting the load

Flexible conduit and stranded conductors must be used for connections to take up movement of the GenSet.

All loads are connected to the generator by bolting stranded load wires to the appropriate terminals on the generator reconnection terminal block or circuit breaker lugs. The terminals are stamped **U** (corresponds to **L1**), **V** (corresponds to **L2**), **W** (corresponds to **L3**) and **N** (corresponds to **L0**) to indicate the line and neutral connections.

5.3.4 Balancing the load

When connecting loads to the GenSet, balance the loads so the current flow from each line terminal (**L1**, **L2** and **L3**) is about the same. This is especially important if both single-phase and three-phase loads are connected. Any combination of single-phase and three-phase loading can be used as long as each line current is about the same, within ten percent of median value, and no line current exceeds the nameplate rating of the GenSet (see [Figure 2-1](#)). Check the current flow from each line after connections by observing the Control Panel display.

5.3.5 Installing current transformers

Refer to the reconnection diagram to identify the output leads/phase that must be routed through each Current Transformer (CT), as well as the appropriate transformer post selection for meter sensing leads.

The transformers are labeled **CT1**, **CT2** and **CT3** on the reconnection wiring diagram.

The CTs must be installed according to the following CT Installation Requirements:

NOTE: *The CT has a dot on one side. This dot must be facing toward the generator (conventional current flowing into the dot). A dot is also used to indicate post 1 of the CT.*

- a. **CT1** - **U** load leads (A phase)
- b. **CT2** - **V** load leads (B phase)
- c. **CT3** - **W** load leads (C phase)

Route the appropriate load wires through each CT. The CTs have dual secondaries (3 posts). The CT secondary wire, marked "1", is connected to post 1 of the CT. The CT secondary wire, marked "2/3", is connected to post 2 for high voltage GenSets, or to post 3 for low voltage GenSets. (Refer to [Wiring Diagrams](#).)

5.3.6 Connecting the coolant heater (optional)

CAUTION

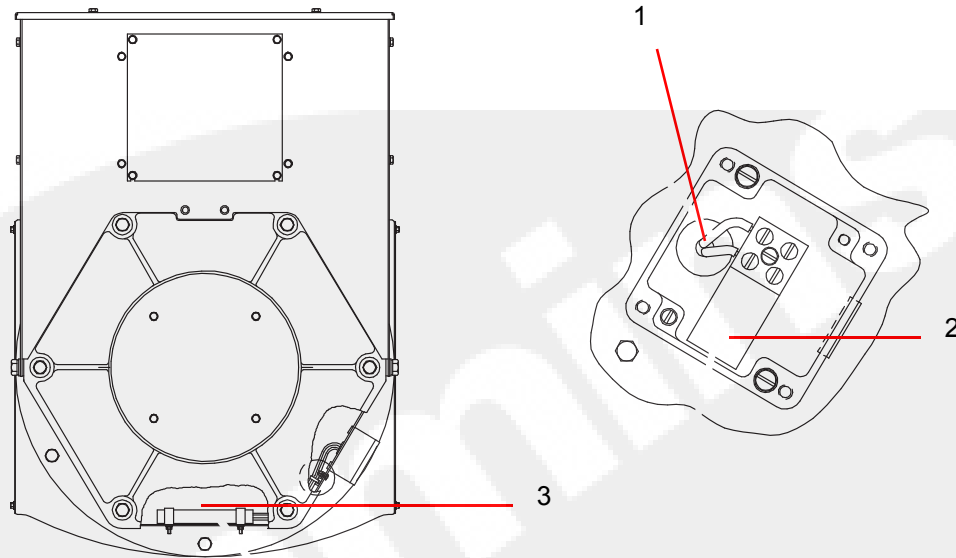
The coolant heater must not be operated while the cooling system is empty or damage to the heater will occur.

Coolant heaters keep the engine coolant warm when the engine is shut down. This reduces startup time and lessens engine wear caused by cold starts. The coolant heater is electrically operated and thermostatically controlled.

Connect the coolant heater to a source of power that will be on during the time the engine is not running. Be sure the voltage rating is correct for the heater element rating and that the thermostat is set to the correct temperature prior to starting.

[Figure 5-3](#) illustrates a typical generator heater. Connect the heater(s) to a source of power that will be on during the time the engine is not running. Power connections are made to the terminal block in the heater terminal box. Be sure the voltage rating is correct for the heater element rating.

Electrical connections



1. Heater terminal leads
2. Heater terminal box
3. Heater

Figure 5-3 Generator heater installation (typical)

▲ DANGER

Water or moisture inside a generator increases the possibility of flashing and electrical shock which can cause equipment damage and severe personal injury or death. Ensure that the generator is dry both inside and out.

NOTE: The “**Engine Cold**” (Code 1435) message, in conjunction with illumination of the warning light, is provided to meet the requirements of NFPA 110. The engine cold sensing logic initiates a warning when the engine jacket water coolant temperature falls below 21 °C (70 °F). In applications where the ambient temperature falls below 4 °C (40 °F), a cold engine may be indicated even though the coolant heaters are connected. Under these conditions, although the GenSet may start, it may not be able to accept load within ten seconds. When this condition occurs, check the coolant heaters for proper operation. If the coolant heaters are operating properly, other precautions may be necessary to warm the engine before applying a load.

5.3.7 Installing/replacing batteries

▲ WARNING

Accidental starting of the GenSet can cause severe personal injury or death. Press the Emer-

gency Stop button and disconnect the charger before disconnecting battery cables. Disconnect negative (-) cable first and reconnect last. To prevent arcing, use an insulated wrench to connect the positive battery cable before connecting the negative battery cable.

Starting the unit requires batteries as specified on the GenSet data sheet. Service the batteries, as necessary.

NOTE: Servicing of the batteries is to be performed or supervised by trained personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from battery components.

NOTE: If an automatic transfer switch is installed without a built-in charge circuit, connect a separate battery charger. A battery charger is required when the PCC is active.

IMPORTANT: The battery charger must be connected to a power source that is protected by a ground fault circuit interrupter (GFCI).

▲ WARNING

Ignition of explosive battery gases can cause severe personal injury or death. Always connect negative (-) battery cable last to prevent arcing.

To install or replace a battery (or batteries), follow these steps:

1. Provide adequate room for servicing or replacing the batteries. Provide protection from extremes of temperature and weather.
2. Secure the battery with hold-down bolts that are tight, but not over-tight.
3. Smear the terminals with petroleum jelly, if necessary.
4. Fit the vents firmly in position and ensure that the battery is clean and dry.
5. Verify correct polarity when connecting the battery to the GenSet. Even momentary incorrect connection can cause damage to the electrical system.
6. Ensure that the batteries are configured properly for 12 VDC or 24 VDC standard operations.
7. Check the battery cables and connections to ensure they are installed correctly and in good condition. Terminal connections must be tight, but not over-tight.

NOTE: Coat the battery terminals with NOCO/Anti-OX to prevent corrosion.

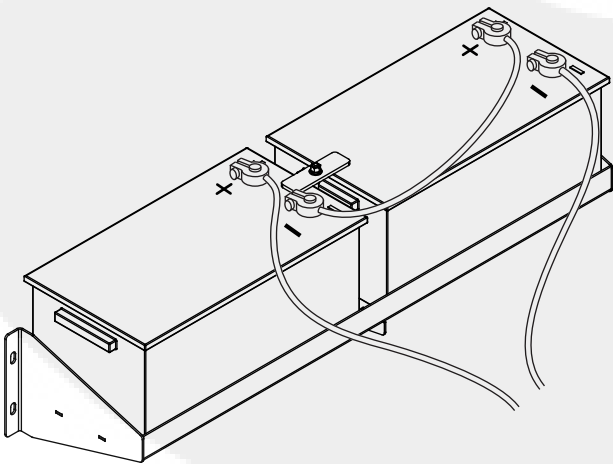


Figure 5-4 Series battery connection - 24 VDC

⚠ WARNING

A battery presents a risk of electrical shock and high short circuit current. The following precautions are to be observed when working on batteries:

- **Remove watches, rings, or other metal objects.**
- **Use tools with insulated handles.**
- **Wear rubber gloves and boots.**
- **Do not lay tools or metal parts on top of batteries.**
- **Disconnect the charging source prior to connecting or disconnecting battery terminals.**
- **Determine if the battery is inadvertently grounded. When inadvertently grounded, remove the source of the ground. Contact with any part of a grounded battery is capable of resulting in electrical shock. The risk of such shock is reduced when such grounds are removed during installation and maintenance (applicable to a generator not having a grounded supply circuit).**
- **Only personnel knowledgeable of batteries and the required precautions may service batteries. Keep unauthorized personnel away from batteries.**
- **LEAD-ACID batteries present a risk of fire because they generate hydrogen gas. Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switches or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near the battery. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface.**
- **Disconnect the battery charger from the AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes that could damage the DC control circuits of the set.**

Electrical connections

- ***In case of accidental physical contact, immediately wash skin with soap and water. In case of contact, immediately flood the eyes with large amounts of water for a minimum of fifteen minutes. IMMEDIATELY CALL A PHYSICIAN.***
- ***Electrolyte or explosion of a battery can cause severe personal injury or death. Do not burn the battery in a fire for disposal. Do not open or mutilate batteries. Damage to the battery case will release electrolyte which is harmful to the skin and eyes and is also toxic. Burning of a battery may cause an explosion.***

NOTE: Ni-Cad battery systems are often required in extreme high or low ambient temperatures because their performance is less affected by temperature extremes than that of lead-acid batteries. Ni-Cad batteries require special battery chargers in order to bring them to the full-charge level. These chargers must be provided with a filter to reduce “charge ripple” which can disrupt the engine and GenSet control systems.

IMPORTANT: The battery charger must be connected to a power source that is protected by a ground fault circuit interrupter (GFCI).

⚠ CAUTION

DO NOT connect battery charging cables to any electronic control system component. This can damage the electronic control system.

⚠ WARNING

Batteries can emit explosive gases during charging. Always ventilate the compartment before servicing the batteries. Remove sources of spark or open flame. To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) cable last. DO NOT connect battery charging cables to any electronic control system component. This can damage the electronic control system.

The minimum recommended reserve capacity (RC) and cold cranking amperes (CCA) values for a particular engine can be found on the model-specific GenSet data sheet. RC and CCA definitions can be found in Society of Automotive Engineers (SAE) Standard J537 Storage Batteries. All battery information is for lead/acid batteries.

Always replace the starting battery with the same number and type (vented, lead acid) of battery. Properly dispose of the expired battery in accordance with local environmental agency requirements. Batteries may be supplied by a Cummins Distributor as an option, or may be supplied by the customer.

⚠ WARNING

The electrolyte is a dilute sulfuric acid that is harmful to the skin and eyes. It is electrically conductive and corrosive. The following safety precautions are to be observed when replacing or replenishing electrolyte solution in the batteries:

- ***Wear full eye protection and protective clothing.***
- ***Where electrolyte contacts the skin, wash it off immediately with water.***
- ***Where electrolyte contacts the eyes, flush thoroughly and immediately with water and seek medical attention.***
- ***Spilled electrolyte is to be washed down with an acid neutralizing agent. A common practice is to use a solution of 500 grams (1 lb) bicarbonate of soda to 4 liters (1 gallon) of water. The bicarbonate of soda solution is to be added until the evidence of reaction.***





Section 6 - Pre-start installation checklist

6.1 Introduction

The generator set (GenSet) has been carefully designed to provide safe and efficient service when properly installed, maintained, and operated. However, the overall safety and reliability of the complete system is dependent on many factors outside the control of the GenSet manufacturer.

Access to, and installation and operation of, the GenSet must be restricted to qualified service personnel who have been instructed of the reasons for the restrictions applied to the location of the GenSet and any precautions that must be taken. Access to and operation of the GenSet must be governed by the use of a special tool, or lock and key, or other means of security that is monitored by the authority responsible for that location.

Before starting the GenSet, check to make sure that all electrical connections are secure, and that all wiring is complete. Replace and secure any access panels that have been removed during installation. Check that the load cables from the GenSet are properly connected.

6.2 Ensuring emissions compliance

IMPORTANT: *It is the owner/operator's responsibility to complete site-specific emission requirements to ensure compliance with the US EPA SI NSPS and all state and local codes and ordinances.*

Some GenSets are site-compliant capable. However, most GenSet emissions certifications are regulated by local, regional, and national codes and may require frequent site testing. Emissions on this GenSet must be dialed-in at the job-site according to the following Customer Engineering Bulletin (CEB) or Cummins Application Engineering Bulletin (AEB) requirements:

- AEB 24.51 Industrial Natural Gas Startup Procedure for Commissioning of Electronic AFR Controlled Engines with Catalyst - Emission-related Installation Instructions,
- AEB 24.52 Three-Way Catalyst (TWC), Three-Way Catalyst XL and Three-Way Catalyst XLS Installation Requirements.
- [For GTA855E] Manual 4325956 GTA855E CM558/2358 G101 Operation and Maintenance Manual and CEB 00115 GTA 855 and GTA 855e Gas Compression and G-Drive Technical Package.
- [For KTA19SLB and QSK19] CEB 00321 KTA19G Power Generation Natural Gas Startup Procedure.

NOTE: *To obtain a copy of these engineering bulletins, please contact your local service representative.*



Pre-start installation checklist

6.3 Completing the pre-start checklist

The following checklist outlines the necessary safety and operation inspections that need to be made before starting the GenSet for operation.

General	
	The GenSet wattage capacity is sufficient to handle the maximum anticipated load.
	At least 0.9 m (3 ft) of clearance (or greater, for the housing door) is provided around the entire GenSet for service and ventilation.
	The GenSet is located in an area not subject to flooding.
	All operating personnel have read and are familiar with the GenSet Operator Manual, all health and safety procedures, warnings, cautions, precautions, and the other documentation supplied with the GenSet.
	All operators have been thoroughly briefed on preventative maintenance procedures.
	All operators have read and understand all important safety instructions
GenSet support	
	The floor, roof, or earth on which the GenSet rests is strong enough and will not all shifting or movement. Observe local codes on the soil-bearing capacity due to freezing and thawing.
	The GenSet is properly supported and retained to an approved base.
	The supporting base is large enough and is of non-combustible material.
Cooling air flow	
	The GenSet air inlet is faced into the direction of the strongest prevailing winds.
	Air inlet openings are unrestricted and are at least 1½ times larger than the air outlet area.
	The cooling air outlet is on the downwind side of the building (if not, a wind barrier was constructed)
	Proper ducting material (sheet metal, canvas) is used between the radiator and the air outlet.
Fuel system	
	Propane fuel tanks meet or exceed all local, state, or national codes.
	Fuel lines are properly installed, supported, and protected against damage.
	An approved flexible fuel line is installed between the main fuel supply and the GenSet's fuel system near the GenSet to protect it against damage caused by vibration, expansion, and contraction.
	Lockable fuel supply shutoff valves are installed to prevent fuel flow in case of leaks and for ease of maintenance.
	The fuel system is properly primed.
	No fuel leaks are found in the supply line or the engine fuel system.
Exhaust system	
	Operators are thoroughly briefed on the dangers of carbon monoxide gas.
	Areas around the GenSet are well ventilated with no possibility of exhaust fumes entering building doors, windows, or intake fans.
	Exhaust gases are piped safely outside and away from the building.



Pre-start installation checklist

	The correct length of approved rigid pipe is connected to the GenSet flexible pipe using approved securing methods with no weight resting on the engine exhaust components. There are no bends in the flex section.
	A condensation drain is provided in the lowest section of the exhaust piping.
	Exhaust piping is insulated to guard against burns to personnel.
	Exhaust piping passing through walls or ceilings have approved fire-proof materials and are in compliance with all codes.
	Exhaust piping is large enough in diameter to prevent excessive back pressure on the engine.
	Verify that the oxygen and temperature sensors are installed pre- and post-catalyst, if applicable.
	AC and DC wiring
	Wire sizes, insulation, conduits, and connection methods all meet applicable codes.
	AC and DC wires are separated in their own conduit to prevent electrical induction.
	All load, line, and generator connections are proper and correct.
	Flexible conduit is used between the GenSet and the building or surrounding structure.
	GenSet pre-start
	The GenSet engine is properly serviced with oil and coolant.
	The Emergency Stop button is depressed.
	Batteries are properly installed, serviced and charged.
	The battery charger and engine coolant heater are connected and operational.
	All GenSet covers and safety shields are installed correctly.



Pre-start installation checklist

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Section 7 - System controls

7.1 Introduction

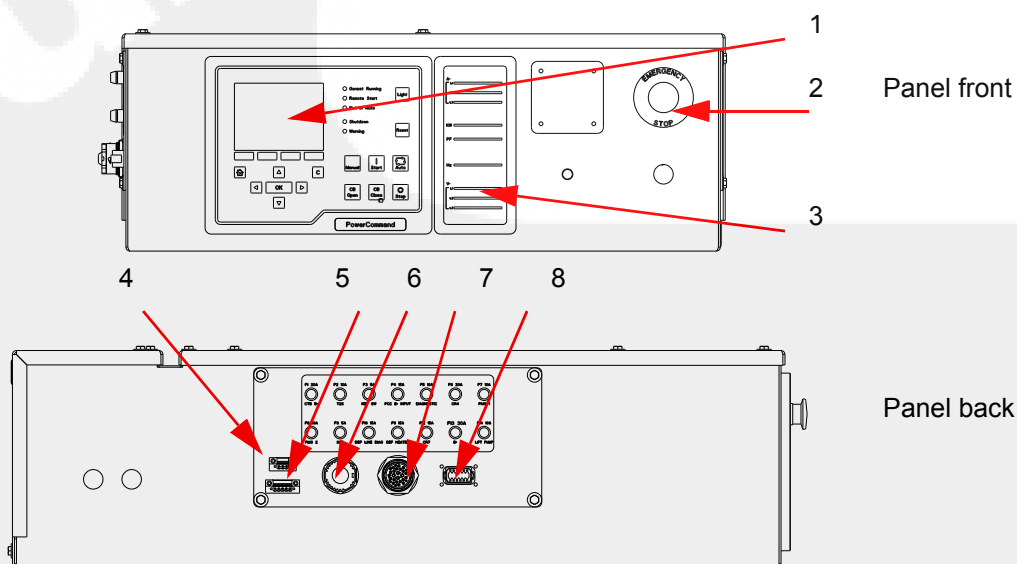
The control system is used to start and stop the GenSet from the operator panel in either **Manual** or **Auto** mode. It is suitable for stand alone or paralleling GenSets in both standby and prime-power applications providing full GenSet monitoring capability and protection. It monitors the engine for temperature, oil pressure, and speed, and provides voltage and current metering. In the event of a fault, the control indicates the fault type on the display screen and automatically shuts down the GenSet on critical faults.

The standard control system operates on 24 VDC battery power. The history data is stored in non-volatile memory and is not deleted if battery power is lost.

7.2 Control panel

All gauges, indicators, control buttons, and the display screen are on the face of the control system panel. In **Power On** mode, power is continuously supplied to the control panel. The control operating firmware and control panel lamps/graphical display remain active until the Sleep mode is activated.

Sleep mode is used to reduce battery power consumption when the control is not being used. In this mode, the control operating software is inactive and the lamps and graphical display on the control panel are off. When proper conditions are met (i.e. no unacknowledged faults), the sleep mode activates after five minutes of keypad inactivity. To activate the control and view the menu display without starting the GenSet, press any control button.



- | | |
|-----------------------------------------------|---------------------------------|
| 1. HMI operator panel | 6. Engine diagnostic connection |
| 2. Emergency Stop button | 7. Engine harness |
| 3. Bar graph | 8. Remote harness connection |
| 4. HMI operator panel service tool connection | |
| 5. PCC service tool connection | |

Figure 7-1 GenSet control panel (typical)

System controls

7.2.1 HMI operator panel

The PowerCommand 3.3 MLD control is operated by the Start/Stop/Manual/Auto buttons on the Operator Panel. It enables the operator to look at the status, adjust settings, and start and stop the GenSet. The HMI operator panel includes lamp indicators, operating-mode change buttons, a graphical display, and navigation/menu selection buttons. [See 7.3 HMI operator panel.](#)

7.2.2 Bar graph

This is an analog graph for electrical inputs.

7.2.3 Emergency Stop button

Become familiar with the **Emergency Stop** button for emergency shutdown of the GenSet. The **Emergency Stop** button stops the GenSet immediately and prevents starting of the GenSet from any location (local or remote).

To activate the **Emergency Stop** button, press the large red knob located at the rear of the GenSet near the Operator Panel.

To reset the **Emergency Stop** button:

1. Pull - or twist and pull - the red **Emergency Stop** button and allow it to pop out.
2. Press the **Stop** button on the Operator Panel to acknowledge this action.
3. Press the **Reset** button on the Operator Panel.
4. Press the **Stop, Manual, or Auto** button on the Operator Panel for the desired mode of operation.

NOTE: *Do not use the **Emergency Stop** button to shut down an engine unless a serious fault develops as this will prevent a cooling down run in which the lubricating oil and engine coolant carry the heat away from the engine combustion chamber and bearings in a safe manner.*

IMPORTANT: *Emergency Stop shutdown can only be reset at the Operator Panel.*

7.2.4 HMI operator panel service tool connection

The HMI operator panel service tool connection is used for connecting the InPower service tool to the operator panel to perform troubleshooting, adjustments, or other diagnostic procedures.

7.2.5 PCC service tool connection

The PCC service tool connection is used for connecting the InPower service tool to the PCC to perform troubleshooting, adjustments, or other diagnostic procedures.

7.2.6 Diagnostic connection

This is an engine diagnostic port for use with the Cummins Insite tool.

7.2.7 Engine harness

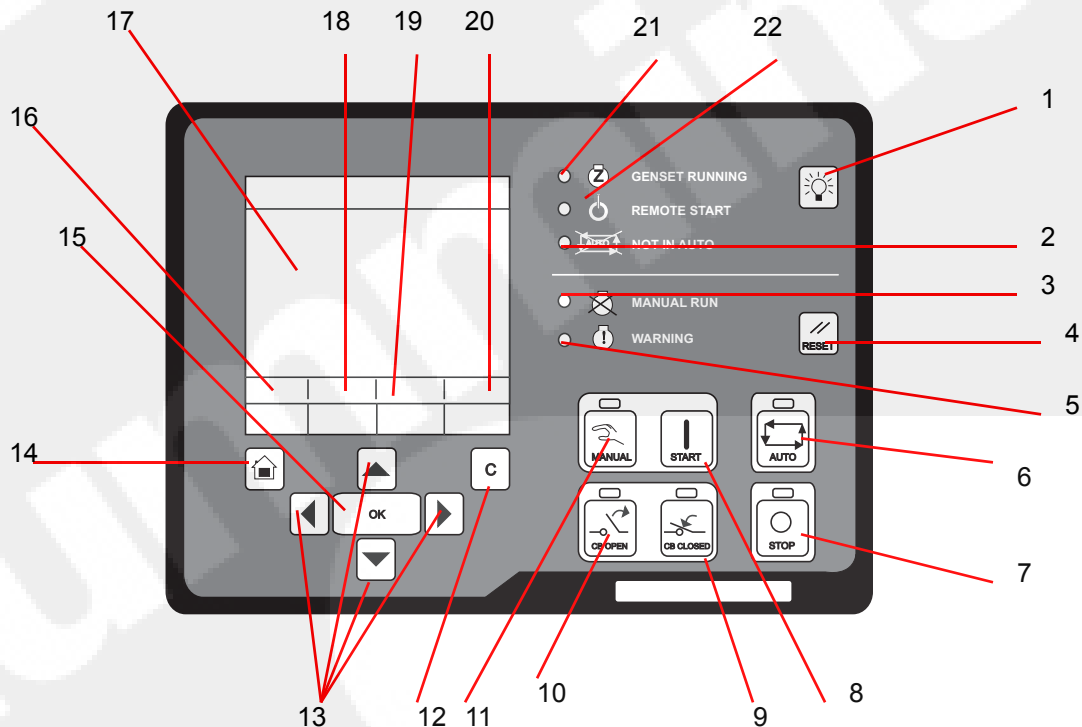
The electrical port for the engine harness.

7.2.8 Remote harness connection

The electrical port for the remote harness.

7.3 HMI operator panel

The operator panel can display SAE or Metric units of measurement and should be set during the initial setup of the GenSet. Only trained and experienced personnel are allowed to change the default setting. Contact your authorized distributor.



- | | |
|----------------------------------|---------------------------------------------------------|
| 1. Lamp (LED) test button | 13. Menu navigation (up, down, left, and right) buttons |
| 2. Indicator lamp - not in auto | 14. Home button |
| 3. Indicator lamp - manual run | 15. Item select button |
| 4. Reset button | 16. Voltage Adjustment sub-menu button |
| 5. Indicator lamp - warning | 17. Graphical display |
| 6. Auto button | 18. Paralleling sub-menu button |
| 7. Stop button | 19. Aftertreatment sub-menu button |
| 8. Start button | 20. Faults sub-menu button |
| 9. Circuit breaker closed button | 21. Indicator lamp - GenSet running |
| 10. Circuit breaker open button | 22. Indicator lamp - remote start |
| 11. Manual button | |
| 12. Cancel button | |

Figure 7-2 HMI operator panel

7.3.1 Lamp (LED) test button

Press this button to test the lamps (LEDs). All of the lamps should turn on for five seconds. Press and hold this for three seconds to turn on or off (to toggle) an external panel lamp.

7.3.2 Indicator lamp - not in auto

This red lamp is lit when the control is not in **Auto**. The GenSet is running in **Manual** mode.

7.3.3 Indicator lamp - manual run

This red lamp is lit when the control detects a Shut-down condition. The GenSet cannot be started when

System controls

this lamp is on. After the condition has been corrected, the lamp can be reset by first pressing the **Stop** button and then the **Reset** button.

7.3.4 Reset button

Press this to reset any active faults.

If the condition(s) that caused an existing shutdown fault still exists, the GenSet generates the fault again.

If the condition(s) that caused an existing warning fault still exists, the GenSet generates the fault again, but the operator panel stops displaying it in the graphical display.

7.3.5 Indicator lamp - warning

This amber lamp is lit whenever the control detects a Warning condition. This lamp is automatically shut off when the Warning condition no longer exists.

7.3.6 Auto button

Press this button to put the GenSet into the **Auto** mode. In this mode, the GenSet is controlled by a remote switch or device (e.g. transfer switch).

The green lamp above this button lights when the GenSet is in **Auto** mode.

7.3.7 Stop button

Press this button to put the GenSet into the **Off** mode. This disables **Auto** and **Manual** modes. The green lamp above this button lights when the GenSet is in the **Off** mode.

If the GenSet is running - in either **Manual** or **Auto** mode - and the **Stop** button is pressed, the engine shuts down.

7.3.8 Start button

When the **Manual** button is pressed, the **Start** button must be pressed within ten seconds to start the GenSet. The GenSet starts up normally.

In other modes, this button has no effect.

7.3.9 Circuit breaker closed button

The circuit breaker closed button is used in **Manual** mode only. When pressed, it enables the GenSet circuit breaker to close when the GenSet is up to speed and voltage (i.e., ready to accept the load).

7.3.10 Circuit breaker open button

The circuit breaker open button is used for electrically-operated circuit breakers in **Manual** mode only. When pressed, it enables the GenSet circuit breaker to open and disconnect from the load.

7.3.11 Manual button

Press this button to put the GenSet into the **Manual** mode. The **Start** button must then be pressed within ten seconds. Failure to do this results in the control mode defaulting, putting the GenSet into the **Off** mode.

The green lamp above this button is lit when the GenSet is in **Manual** mode.

7.3.12 Cancel button

Press the **C** (cancel) button at any time to go to the previous screen. Any changes being made must be saved (press **OK**) before pressing cancel or they will be lost.

7.3.13 Menu navigation buttons

Four navigation buttons (up, down, left, and right) are used to navigate and change selections in the graphical display.

7.3.14 Home button

Press the **Home** button at any time to return to the **Home** screen. If changing parameters or values on a screen, changes must be saved (press **OK**) before pressing the **Home** button or changes will not be saved.

7.3.15 Item select button

Press the **OK** button to select the item currently highlighted in the graphical display:

- If the selected item is a sub menu item, this opens the sub menu or screen.
- If the selected item is a parameter, this adjusts the parameter or prompts you for a password.
- If the selected item is an adjusted value, this saves the change.
- If the selected item is an action, the graphical display runs the action or prompts for a password.

7.3.16 Voltage adjustment sub-menu button

See 7.5 Voltage Adjustment sub-menu.

7.3.17 Paralleling sub-menu button

The Paralleling menu allows for detailed paralleling adjustments. The adjustments contained in this menu are intended only for advanced level users and technicians. For the majority of paralleling applications, there is no need to adjust any parameters in the **Paralleling** menu.

7.3.18 Graphical display

See 7.4 Graphical display.

7.3.19 Aftertreatment sub-menu button

See 7.6 Aftertreatment sub-menu.

7.3.20 Faults sub-menu button

See 7.7 Faults sub-menu.

7.3.21 Indicator lamp - GenSet running lamp

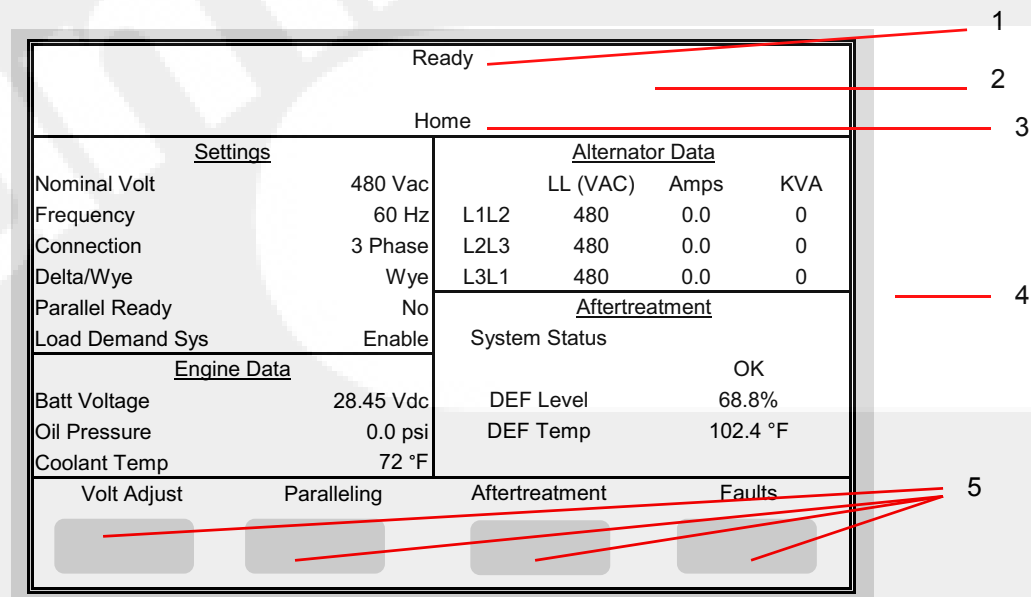
This is an illuminated green lamp when the GenSet is running at, or near, the rated speed and voltage. This Indicator Lamp is not illuminated when the GenSet is warming up or cooling down.

7.3.22 Indicator lamp - remote start lamp

This green lamp indicates the control is receiving a **Remote Run** signal. The **Remote Run** signal has no effect unless the GenSet is in **Auto**.

7.4 Graphical display

As shown in Figure 7-3, the graphical display is used to view the operating system menus. System messages (communication, event, and fault) are also shown on the display, as well as event and fault information, system status, parameters, and sub-menu screens.



- | | |
|--------------------------------|---------------------------|
| 1. Control status | 4. GenSet data parameters |
| 2. Active fault or screen name | 5. Sub menu buttons |
| 3. Screen name | |

Figure 7-3 Graphical display Home screen

7.4.1 Control status

As shown in Figure 7-3, the top of the graphical display will show the control status of the GenSet:

- **Ready** - This is the default state. The controller is ready to start the GenSet.
- **Starting** - The controller is starting the engine and the engine speed is greater than zero rpm but has not reached idle speed yet.
- **Running** - The GenSet engine is running at rated speed (1800 rpm 60 Hz or 1500 RPM 50 Hz).

System controls

- **Idle** - The engine is running at idle speed.
- **Cool down** - The controller is reducing the engine speed to idle speed to allow the engine to cool down after the stop command has been initiated.
- **Stopping** - The controller is stopping the engine, and the engine speed is still greater than zero.
- **Emergency Stop** - There is an active shutdown fault.
- **Setup mode** - The controller is in Setup mode.
- **Wait to power-down** - The controller is ready to enter **Power-down** mode, but another device is sending a **System Wakeup** signal.

7.4.2 Active fault

There are three fault level signals generated by the control system:

- **Warning** - Signals an imminent or non-critical fault for the engine or GenSet. The control provides an indication only for this condition. This is a warning fault. [See 7.7.2 Active warning.](#)
- **Shutdown** - Signals a potentially critical fault for the engine or GenSet. The control immediately takes the engine off-load and automatically shuts it down. This is a shutdown fault that initiates a shutdown without a cool down sequence. [See 7.7.1 Active shutdown.](#)
- **Shutdown with cool down** - This is a shutdown fault that initiates a shutdown with a cool down sequence.

If there is an active fault, the graphical display shows the fault code and the fault name at the top of the screen between the **Control Status** and the **Screen name**. Press the **Reset** button for the graphical display to stop showing active warning faults, even if the condition, or conditions, that caused the fault, or faults, has not been corrected. The warning LED remains on.

The graphical display always shows any active shutdown faults, even if the **Reset** button is pressed.

7.4.3 Screen name

As shown in [Figure 7-4](#), the graphical display will show the menu or sub-menu screen name near the top of the screen.

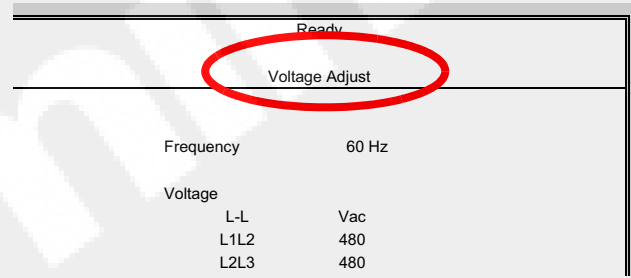


Figure 7-4 Screen name display

7.4.4 GenSet data parameters

As shown in [Figure 7-3](#), the graphical display shows data values for:

- GenSet settings
- engine data
- alternator data
- aftertreatment

Under normal conditions, the data parameter will display a numerical or text value appropriate to the unit being measured. In the instance of a GenSet fault, an affected data parameter will display an appropriate fault value, as applicable.

7.4.4.1 GenSet data normal values

Table 7-1. shows the units of measure or the meaning of the value of the GenSet data parameters under no-fault conditions.

Table 7-1. GenSet data parameters

Data parameter title	Data values	Data parameter definition
Settings		
Nominal Volt	[numeral] Vac	Output voltage configuration
Frequency	60 Hz or 50 Hz	Frequency configuration
Connection	Single or 3 Phase	Alternator voltage configuration
Delta/Wye	Delta or Wye	Alternator wiring configuration
Parallel Ready	Yes or No	Indicates if the paralleling communication cable is connected
Load Demand system	Enable or Disable	Load demand status while in paralleling mode
Engine ata		
Battery Voltage	[numeral] Vdc	Battery voltage value
Oil Pressure	[numeral] psi	Engine oil pressure
Coolant Temp	[numeral] °F	Engine coolant temperature in degrees Fahrenheit
Alternator Data		
L1L2	[V]-[A]-[KVA]-[KW]-[PF]	Real-time voltage, amperage, power, power factor
L2L3	[V]-[A]-[KVA]-[KW]-[PF]	Real-time voltage, amperage, power, power factor
L3L1	[V]-[A]-[KVA]-[KW]-[PF]	Real-time voltage, amperage, power, power factor
Aftertreatment		
System Status	Current status of the aftertreatment system:	
	OK	No inducements are active
	Check Status	An inducement is active See Figure 7-11 Home screen.
DEF Level	[numeral]%	DEF level in the on-board DEF tank
DEF Temp	[numeral] °F	Temperature in degrees Fahrenheit of the DEF in the on-board DEF tank

System controls

7.4.4.2 GenSet data fault values

When an active fault code is shown on the graphical display (See 7.4.2 Active fault.), a fault indicator appears next to the applicable data parameter. These appear on the Home screen when the value of a specific parameter is missing, unexpected, or outside the range allowed for the parameter. These fault indicators may appear:

- When the GenSet is first started
- As the GenSet shuts down
- When the emergency stop is pushed
- When a sensor is not connected

Table 7-2. GenSet data parameters fault values

GenSet data parameter fault indicator	Description
NWF	Network Failure - There is a PCCNet network failure or a CAN (ECM) failure
OORL	Out Of Range Low - The value is less than the lowest allowed value for this parameter
OORH	Out Of Range High - This value is greater than the highest allowed value for this parameter
-- -- --	This value is not applicable

7.4.5 Sub menu options

Press the appropriate button to navigate to the desired menu-selection screen. If nothing is showing above the menu button, the button is not active. If the graphical display is not big enough to show all related information, an up and/or down arrow will be visible. Press the menu-select button beneath the arrow to see additional related screens. If all information fits on one screen, no arrow will be visible. The sub-menu functions are outlined in the following sections.

7.5 Voltage Adjustment sub-menu

The voltage screen allows for changing the voltage, changing the frequency, or checking the load data. As shown on the Home screen in Figure 7-5, press the menu-select button below **Volt Adjust** to access the **Voltage Adjust** screen.

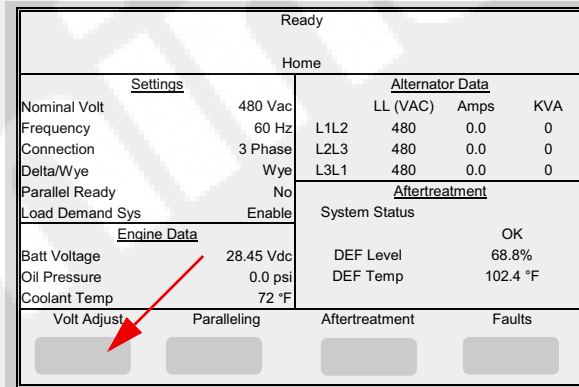


Figure 7-5 Home screen

As shown in Figure 7-6, the **Voltage Adjust** screen allows the user to adjust the GenSet frequency and voltage, as well as access the load data.

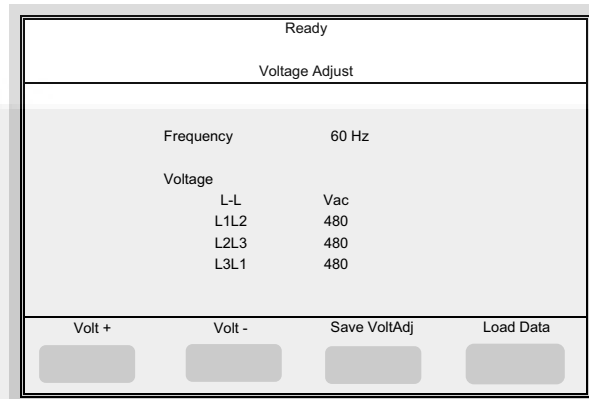


Figure 7-6 Voltage Adjust screen



7.5.1 Adjust frequency

As shown in [Figure 7-7](#), to change the frequency from the **Voltage Adjust** screen - when the GenSet is not running - use the Operator Panel **UP** and **DOWN** arrows to highlight **Frequency** and then press **OK**. This opens a selection box to change the frequency to either **60 Hz** or **50 Hz**. Use the menu-selection buttons below the arrows to change the frequency and press **OK**.

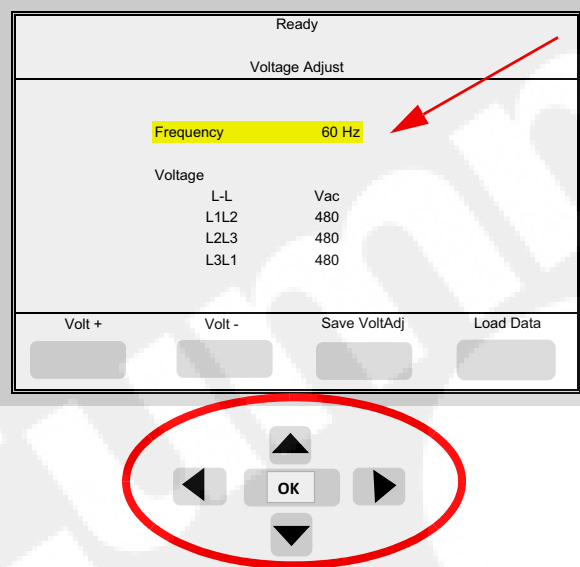


Figure 7-7 Adjust Frequency screen

NOTE: Press the **C** (cancel) button at any time to go to the previous screen. Any changes being made must be saved (press **OK**) before pressing cancel or they will be lost.

NOTE: Press the **Home** button at any time to return to the home screen.

7.5.2 Adjust voltage

The voltage can be adjusted +/- 5% of the nominal voltage. As shown in [Figure 7-8](#), to change the voltage, use the menu navigation up and down arrow buttons to highlight the load demand to change and then press **OK**. Press the button below **Volt +** (increase) or **Volt -** (decrease). When done, press the button below **Save VoltAdj** to save the new voltage value.

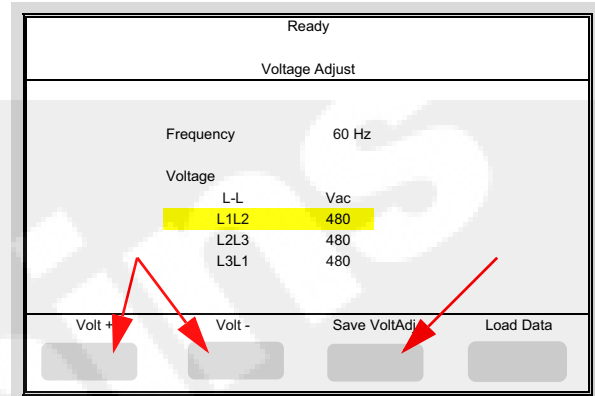


Figure 7-8 Voltage Adjust screen

7.5.3 Display load data

As shown in [Figure 7-9](#), the **Voltage Adjust** screen, allows the user to access the load data by pressing the **Load Data** button.

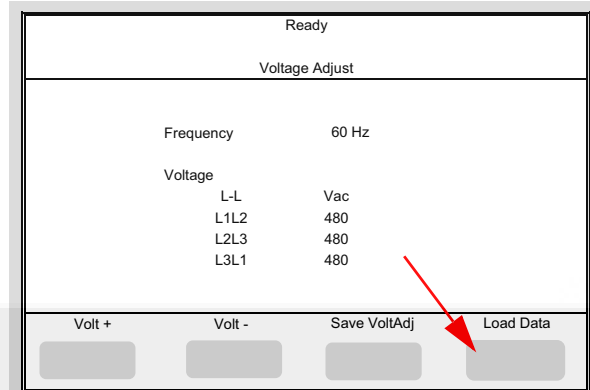


Figure 7-9 Voltage Adjust screen

System controls

As shown in [Figure 7-10](#), the **Load Data** menu displays the GenSet load data for L1-L2, L2-L3, and L3-L1. It displays nominal voltage, line voltage, amperage, KW and kVA in real time.

	LL (VAC)	LN (VAC)	Amps	Kw	kVa
L1L2	480	277	75	100.0	75
L2L3	480	277	75	100.0	75
L3L1	480	277	75	100.0	75

Frequency 60 Hz

Volt + Volt - Save VoltAdj Load Data

Figure 7-10 Load Data screen

7.6 Aftertreatment sub-menu

The **Aftertreatment** screen displays real-time information about the GenSet aftertreatment. As shown on the **Home** screen in [Figure 7-11](#), press the menu-select button below **Aftertreatment** to access the **Aftertreatment** screen.

Settings		Alternator Data		
Nominal Volt	480 Vac	LL (VAC)	Amps	KVA
Frequency	60 Hz	L1L2	480	0.0
Connection	3 Phase	L2L3	480	0.0
Delta/Wye	Wye	L3L1	480	0.0
Parallel Ready	No	Aftertreatment		
Load Demand Sys	Enable	System Status	OK	
Engine Data		DEF Level	68.8%	
Batt Voltage	28.45 Vdc	DEF Temp	102.4 °F	
Oil Pressure	0.0 psi			
Coolant Temp	72 °F			

Volt Adjust Paralleling Aftertreatment Faults

Figure 7-11 Home screen

As shown in [Figure 7-12](#), the **Aftertreatment** screen displays information about the aftertreatment system:

- **DEF Level** - Percent of the DEF tank that is full of DEF

- **DEF Temp** - Temperature of the DEF in the tank
- **DEF Concentration** - Concentration of the DEF in the tank
- **DEF Heater** - Whether the DEF heater is **On** or **Off**
- **SCR Inducement Severity - Inducement Non-active or Inducement Active** - the severity of the SCR inducement.

Aftertreatment Information	
DEF Level	75.20%
DEF Temp	86.2 °F
DEF Concentration	32.75%
DEF Heater	Off
SCR Inducement Severity	Inducement Nonactive

AT Condition

Figure 7-12 Aftertreatment Information screen

NOTE: The **AT Condition** button leads to the **Condition** and **Inhibit** features of GenSet aftertreatment which are password protected to prevent unintentional activation/deactivation of the aftertreatment cleaning process.

Manual conditioning can only be initiated when the ECM determines a manual conditioning is necessary. Under normal operation and use manual conditioning of the aftertreatment system is not necessary.

It is not necessary to inhibit the aftertreatment system conditioning (cleaning) under normal operation and use, however, for certain troubleshooting procedures it may be necessary. Inhibiting the automatic after-treatment cleaning process for non-troubleshooting procedures causes decreased GenSet and aftertreatment performance and reliability, as well as undesirable systems operation.

Contact your local Cummins distributor for assistance with the GenSet aftertreatment.

7.7 Faults sub-menu

A fault message is an indicator of a Warning or Shutdown condition. The **Faults** screen allows the user to display active shutdown, active warning, or fault history data. Fault message data includes:

- the fault number
- a short description
- where the fault occurred (if the GenSet control did not detect the fault and is simply reporting the fault)
- date and time the fault occurred

As shown on the **Home** screen in [Figure 7-13](#), press the menu-select button below **Faults** to access the **Faults** screen.

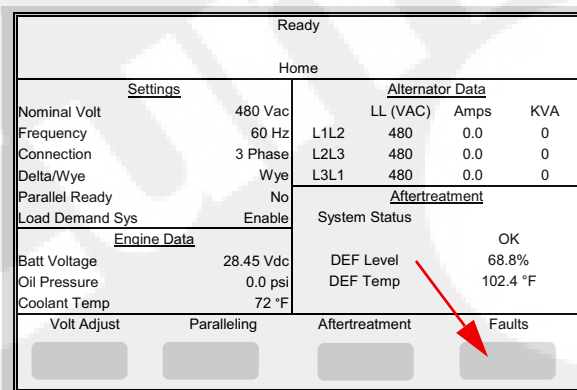


Figure 7-13 Home screen

As shown in [Figure 7-14](#), the **Faults** screen allows the user to select a detailed view of active shutdowns, active warnings, or fault historical data. Use the Operator Panel **UP** and **DOWN** arrows to choose a menu to view (and press **OK**) or press the menu-select button below the desired screen option.

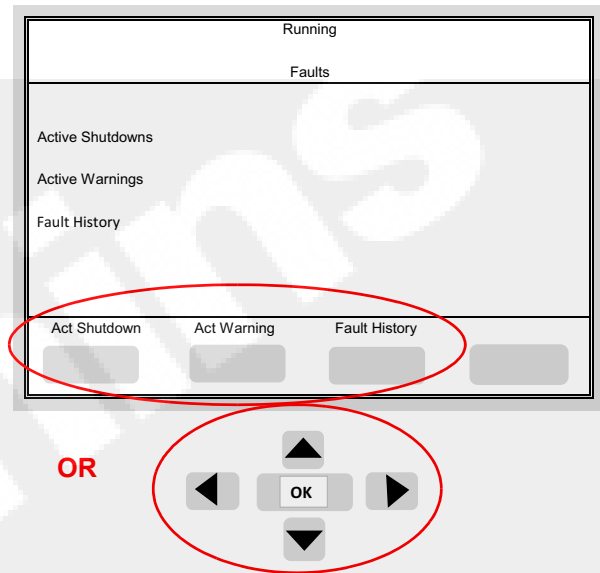


Figure 7-14 Faults screen

NOTE: If there are no active faults or warnings, the screen will flash, but remain at the same screen after selecting **Active Faults** or **Active Warnings**.

NOTE: The time and date stamp for fault codes may not be accurate, as the time and date need to be reset each time the DC disconnect switch is turned off (i.e., the GenSet control loses DC power).

Active Shutdown, Active Warning, and Fault History screens all display the fault descriptors outlined in [Table 7-3](#).

System controls

Table 7-3. Fault descriptors

Name	Description
Index	Index number of the fault
Fault	Fault code number
SA: Eng Hrs	
SA	Source Address - the controller that identified the fault, it is blank if the GenSet control identified the fault.
:Eng Hrs	Number of hours the engine had run (not necessarily continuously) when the fault was generated
YY/MM/DD	[year]/[month]/[date] the fault was generated.
HH:MM:SS	[hour]/[minute]/[second] the fault was generated.

7.7.1 Active shutdown

As shown in [Figure 7-15](#), the **Active Shutdown** screen displays information regarding any active shutdown faults. Up to thirty-two shutdown faults may be stored for viewing. The same fault code may appear multiple times. Use the two menu-select **UP** and **DOWN** buttons to toggle to the next page.

Shutdown faults must be acknowledged after the fault has been corrected. If in **Auto** or **Manual** mode, the control must be set to **Stop** mode (off). Faults are cleared from the control panel display by pressing **Stop** and then the **Reset** button.

Faults are re-announced if they are detected again after being acknowledged.

Running				
Active Shutdowns				
Index	Fault	SA: Eng Hrs	YY/MM/DD	HH:MM:SS
1/32	2815	1816.1	14/02/01	3:27:42
Genset CT Ratio High				
2/32	1433	1816.1	14/02/01	0:38:00
Local Emergency Stop				
3/32	1449	1816.0	14/02/01	3:27:42
Under Frequency				

Figure 7-15 Active Shutdown screen

7.7.2 Active warning

As shown in [Figure 7-16](#), the **Active Warning** screen displays information regarding any active warning faults. Up to thirty-two warning faults may be stored for viewing. The same fault code may appear multiple times. Use the two menu-select **UP** and **DOWN** buttons to toggle to the next page.

Running				
Active Warning				
Index	Fault	SA: Eng Hrs	YY/MM/DD	HH:MM:SS
3/32	1449	1816.0	14/02/01	3:27:42
Under Frequency				

Figure 7-16 Active Warning screen



7.7.3 Faults history

As shown in [Figure 7-17](#), the **Faults History** screen displays information regarding any historical fault codes that are no longer active. Up to thirty-two faults may be stored for viewing. The same fault code may appear multiple times. Use the two menu-select **UP** and **DOWN** buttons to toggle to the next page.

Running				
Fault History				
Index	Fault	SA: Eng Hrs	YY/MM/DD	HH:MM:SS
1/32	2815	1816.1	14/02/01	3:27:42
Genset CT Ratio High				
2/32	1433	1816.1	14/02/01	0:38:00
Local Emergency Stop				
3/32	1449	1816.0	14/02/01	3:27:42
Under Frequency				
<div style="display: flex; justify-content: space-between; align-items: center;"> ◀ ▶ ⏪ ⏩ ⏴ ⏵ </div>				

Figure 7-17 Fault History screen



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Section 8 - Operation

8.1 Introduction

The generator set (GenSet) can be started or stopped using **Manual** or **Auto** mode. In **Auto** mode the GenSet is remotely started and stopped using the remote start input on the control panel. In **Manual** mode the operator uses buttons on the HMI to start and stop the GenSet. All indicators, control switches/buttons, and graphical display are located on the face of the operator panel and LEDs are provided on the operator panel to indicate the operating mode of the GenSet.

IMPORTANT: *This text should be read in conjunction with the **System Overview** and the **Control System** sections of this manual.*

Once the GenSet has achieved nominal voltage and frequency, the set is ready to be paralleled with the busbar supply. Each GenSet is paralleled completely independently of any others by a separate PCC. The PowerCommand 3.3 control unit monitors both the incoming supply and the busbar voltage and frequency. It adjusts the incoming supply to match the busbar supply over a wide span of busbar parameters. Synchronization is achieved under full control and at the correct phase coincidence.

In **Auto** mode, the PowerCommand 3.3 control receives a breaker close signal when synchronization has been achieved, and signals the main breaker to close. In **Manual** mode, the main breaker is closed to connect the GenSet to the busbars by using the breaker **Close** button. The PowerCommand 3.3 control performs a synchronization check in both **Manual** and **Auto** modes before allowing the GenSet circuit breaker to close.

When in parallel with the busbar supply, the GenSet voltage and frequency are dependent upon the busbar parameters and the control is changed to kW and kVAR load management. Apart from the protection systems, there is no common coupling between GenSets. This allows for any set (or its relevant controls) to be under maintenance without affecting the others.

When the control system detects that the GenSet is up to speed and voltage, the load ramps from the mains to the GenSet. The engine governor control system keeps the electrical output within the correct parameters.

8.2 Safety

To ensure maximum performance and reliability from your GenSet, it is essential that certain components are inspected periodically and, where necessary, maintenance procedures are carried out.

Numerous safety devices may be available - such as air intake shutoff devices - to minimize the risk of overspeeding in which an engine, because of the application, might operate in a combustible environment (from a fuel spill or gas leak, for example). Cummins does not know how the engine will be used. The equipment owner and operator, therefore, is responsible for safe operation in a hostile environment. Consult your authorized distributor for further information.

 **DANGER**

Engine over speeding can cause component failure, fire, or an explosion which can cause severe personal injury or death. Do not operate an engine where there are or can be combustible vapors.

NOTE: *Cummins recommends the installation of an air intake shutoff device or a similar safety device to minimize the risk of over-speeding where an engine will be operated in a combustible environment.*

IMPORTANT: *Long periods of idling (more than ten minutes) can damage an engine. Do not idle the engine for excessively long periods.*

Operation

 **DANGER**

Inhalation of exhaust gases can cause asphyxiation and death. Exhaust pipes should be faced away from enclosed or sheltered areas, windows, doors, and vents. Do not use exhaust heat to warm a room, compartment, or storage area.

 **DANGER**

Contact with high voltages can cause severe electrical shock, burns, or death. Do not open the GenSet output box while the GenSet is running. Read and observe all warnings and cautions in the GenSet manuals. Make sure that only suitably trained and experienced service personnel perform electrical and/or mechanical service. Even with the power removed, improper handling of components can cause electrostatic discharge.

Only trained and experienced personnel should carry out GenSet operations. Before operating the system, the operator should become familiar with all health and safety procedures, warnings, cautions, precautions, and documentation supplied with the GenSet. (see [Section 1 - Safety](#)). Observe all of the warnings and cautions at all times.

Before operating the GenSet become familiar with the equipment and how it is operated (including all controls, manually operated valves, and alarm devices). Safe and efficient operation can only be achieved if the GenSet is operated correctly.

Become familiar with the **Emergency Stop** button for emergency shutdown of the GenSet. The **Emergency Stop** button stops the GenSet immediately and prevents starting of the GenSet from any location (local or remote).

To activate the **Emergency Stop** button, press the large red knob located at the rear of the GenSet near the Operator Panel.

To reset the **Emergency Stop** button:

1. Pull - or twist and pull - the red **Emergency Stop** button and allow it to pop out.
2. Press the **Stop** button on the Operator Panel to acknowledge this action.
3. Press the **Reset** button on the Operator Panel.

4. Press the **Stop, Manual, or Auto** button on the Operator Panel for the desired mode of operation.

NOTE: Do not use the **Emergency Stop** button to shut down an engine unless a serious fault develops as this will prevent a cooling down run in which the lubricating oil and engine coolant carry the heat away from the engine combustion chamber and bearings in a safe manner.

IMPORTANT: Emergency Stop shutdown can only be reset at the Operator Panel.

8.3 Operating recommendations

8.3.1 Breaking in a new engine

Special 'running-in' oils are not recommended for new or rebuilt Cummins engines. Use the same type of oil during 'running-in' as is used in normal operation.

The engine should be run at varying loads during the first few hours of operation to allow the components to 'bed in.' Avoid long periods of light load or full load running particularly during the early life of the engine.

8.3.2 Exercising the GenSet

Regular exercising keeps engine parts lubricated, prevents oxidation of electrical contacts, and in general helps provide reliable engine starting. Exercise the GenSet for a minimum of two hours once a month, if GenSet use is infrequent. Exercise the GenSet with a minimum load of half-rated power to ensure the engine reaches normal operating temperatures.

8.3.3 Loading the GenSet

When operating the GenSet under unique operating conditions, precautions may need to be taken to help ensure GenSet performance and reliability.

- When operating the GenSet in ambient temperatures below -20° F (-29° C), it should be operated with greater than 10% of rated load to ensure proper GenSet and aftertreatment performance.
- When operating the GenSet for extended periods of time at loads less than 5% of rated load, it should periodically be loaded for 1-2 hours at greater than 35% of rated load to help ensure GenSet and aftertreatment performance.



Do not to operate the GenSet at idle or at rated speed with no load for excessively long periods of time. This can result in the following:

- Fuel dilution of the lubricating oil
- Carbon buildup in the cylinder
- Cylinder head valve sticking
- Reduced engine and aftertreatment performance

NOTE: *The engine should not be operated at an idle no load condition for prolonged periods (more than 15 minutes) of time. Operating engines at idle (650 to 1000 rpm) in cold ambient temperatures wastes fuel, accelerates wear, and can result in serious engine damage. Under low temperature conditions, incomplete combustion will occur, allowing deposits of unburned tars and carbon to buildup on the valve guide and valves and eventually cause valve sticking.*

NOTE: *If it is necessary to keep the engine running for extended periods of time at rated speed with no load, the GenSet should be connected to a load of at least 35% of rated load to ensure optimal engine and aftertreatment performance. Such a load could consist of a heater element or load bank.*

IMPORTANT: *Failure to follow published guidelines may result in undesired engine and aftertreatment performance.*

8.3.4 Low temperature operation

Engines can be difficult to start and operate in ambient temperatures below 32 °F. Cold weather aids may be needed to ensure proper GenSet starting, operation, and reliability. Cummins recommends equipping natural gas standby GenSets (life safety systems) with engine water jacket coolant heaters to maintain the coolant at a minimum of 32 °C (90 °F) and, for most applications, accept the emergency load in ten seconds or less. Although most Cummins GenSets will start in temperatures down to -32 °C (-25 °F) when equipped with engine water jacket coolant heaters, it might take more than ten seconds to warm the engine up before a load can be applied when ambient block temperatures are below 0 °C (32 °F). A **Low Coolant Temp (code 1435)** message, in conjunction with illumination of the **Warning** LED, will advise the operator of a possible delay in accepting the load. The engine cold sensing logic initiates a warning when the engine water jacket coolant tem-

perature falls below 21 °C (70 °F). In applications where the ambient temperature falls below 0 °C (32 °F), a cold engine may be indicated even though the coolant heaters are connected and functioning correctly. Under these conditions, although the GenSet may start, it may not be able to accept the load within ten seconds. When this condition occurs, check the coolant heaters for correct operation. If the coolant heaters are operating correctly, other precautions may be necessary to warm the engine before applying a load.

In cold climates, it is critical that the following items be appropriately maintained and selected based on ambient operating temperatures:

- The battery is properly sized.
- An appropriate mixture of antifreeze is used in the cooling system.
- The proper grade of fuel is being used.
- The correct weight of engine oil is being used.
- The GenSet engine comes equipped with an engine coolant heater and/or an engine breather heater to help ensure proper operation in cooler climates.

As the operating climate becomes colder, an increasing amount of cold weather aids are required for satisfactory performance. Depending on the specific operating conditions some or all of the below items may be required to help ensure proper GenSet starting, operation, and reliability:

- Engine coolant immersion heaters (block heaters)
- Optional engine oil heaters
- Optional battery heaters
- Diesel fueled engine coolant heaters
- Fuel heater
- GenSet cooling air inlet and outlet louvers

Contact your local distributor for additional information and guidance on selecting the proper cold weather starting and operating aids for your specific operating conditions.

Operation

NOTE: When operating the GenSet in ambient temperatures below -20°F (-29°C) it is recommended that the GenSet be operated with greater than 10% of rated load to ensure proper engine and aftertreatment performance.

CAUTION

Do not use ether as a cold-start aid. GenSet is equipped with AFR heater. Using ether could to damage and low pressure.

8.3.5 High temperature operation

In high ambient temperatures, when operating at full load, it is normal for the high coolant temperature warning to be given. This indicates that the engine is operating near to its maximum capacity. If operation in high temperature environments is anticipated, increase the frequency of checks for cooling air inlet and outlet obstructions, correct coolant level, and that the radiator is free of debris. Also make sure the appropriate engine oil viscosity is used for the ambient temperatures.

To avoid condensation problems, keep fuel supply tanks as full as possible by filling up each time the engine is used. Condensation (water) can cause clogging of the fuel filters as well as possible freezing problems. In addition, water mixing with the sulfur in the fuel forms acid which can corrode and damage engine parts.

8.3.6 Operation and GenSet ratings

All GenSet ratings are based on:

- Variable load is calculated in accordance with methods and formulas given in ISO 8528-1-2005.
- All three-phase generators are rated for 0.8 power factor lag. Single-phase generators are rated for 1.1 power factor.
- Ambient temperature of -27°C (81°F)
- Altitude above sea level 150 meters (490 feet)
- Relative humidity of 60%

Output power may be subject to derate if the above conditions are exceeded. Engine power and resulting electrical output decrease as ambient temperature or

altitude increases. For derating factors applicable at specific sites, contact your authorized distributor.

If any of the above conditions are not satisfied, the operational life of the generating set may be reduced.

8.3.6.1 Emergency standby power rating

The Emergency Standby Power Rating (ESP) is applicable for supplying emergency power for the duration of a utility power interruption, between the stated maintenance intervals and under the stated ambient conditions. All maintenance must be carried out as prescribed in Cummins manuals. No overload capability is available for this rating and utility parallel operation is not permitted at the standby power rating.

8.3.6.2 Prime power rating

The Prime Power Rating (PRP) is the maximum power available during a variable load sequence which may be run for an unlimited number of hours per year, between the stated maintenance intervals and under the stated ambient conditions. All maintenance must be carried out as prescribed in Cummins manuals.

8.4 Operator pre-start checks

IMPORTANT: *Electric arc flash can cause electrical shock, severe burns, or death. Make sure the alternator is dry before the GenSet is operated.*

The GenSet may be operated manually using the GenSet Operator Panel (HMI) buttons or automatically using a remote start signal. Access and operation of the GenSet must be restricted to qualified service personnel who have been instructed of the reasons for the restrictions applied to the location of the GenSet and any precautions that must be taken. Access and operation of the GenSet must be governed by the use of a special tool, or lock and key, or other means of security that is monitored by the authority responsible for that location.

Before attempting to start the GenSet, the operator should read through this entire manual and the specific engine manual provided as part of the documentation pack supplied with the GenSet. It is essential that the operator be completely familiar with the GenSet and the PowerCommand[®] Control.

LEDs are provided on the Operator Panel to indicate the operating (**Manual** or **Auto**) mode of the GenSet. Authorized personnel must decide whether to choose

Manual or Auto mode during the GenSet initial setup. If the GenSet requires an access password for operation, the **Mode Change Access Code** display screen will appear. This access password permission can only be granted or denied by the authorized personnel during operation of the GenSet.

NOTE: For cold starting with loads, use an oil pan heater and a coolant heater, if a separate source of power is available. The optional heater will help provide reliable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating.



Contacting high voltage components can cause severe personal injury or death by electrocution. Do not open the control output box while the GenSet is running. Read and observe all warning and cautions in your manuals.



Only technically-qualified personnel should open the control housing. Voltages are present which can cause electrical shock, resulting in personal injury. Even with the power removed, improper handling of components can cause electrostatic discharge and damage circuit board components.

Before starting the GenSet, make sure that proper maintenance and pre-start checks have been performed.

The pre-start checks for all GenSet operation include:

1. Fuel Supply:

- Ensure that the fuel system is primed.
- Ensure there are no leaks and all fittings are tight.
- Verify that the auxiliary fuel system is properly connected (if equipped).

NOTE: If the engine detects no or low natural gas pressure, it will default to propane and the control will display that the engine is in propane mode.

2. **Lubrication** - With the engine stationary and level, check the engine lubrication oil level and

ensure that the correct level is always maintained.

3. **Coolant** - Check the engine coolant level and make sure that the level is always maintained at the coolant expansion tank. Fill the cooling system to the bottom of the fill neck in the radiator fill or expansion tank. Do not check the coolant level while the engine is hot.

4. **Cooling air inlet/outlets** - Make sure that the cooling air inlets/outlets are unobstructed.

5. Exhaust system:

- Ensure that the exhaust components are secure and not warped
- Ensure that the exhaust outlet is unobstructed
- Ensure that no combustible materials are near the system

- Ensure that gases are discharged away from building openings

- Ensure that there are no leaks and all fittings are tight

6. **Batteries** - Make sure that the batteries are charged and that all connections are correct, tight, and free of corrosion.

7. **Auxiliary powered AC supplies** - make sure that all auxiliary equipment is receiving power from the customer's supply.

8. **Emergency Stop** - Make sure that the Emergency Stop button is fully operational.

8.5 Starting the GenSet

The following sub-sections cover the procedures used to start and stop the GenSet. Before starting the GenSet, make sure that the proper maintenance and pre-start checks have been performed.



Inhalation of exhaust gases can cause asphyxiation and death. Use extreme care during installation to provide a tight exhaust system. Terminate exhaust pipes away from enclosed or sheltered areas, windows, doors, and vents. Do not use

Operation

exhaust heat to warm a room, compartment, or storage area.

DANGER

Contact with hot liquid can cause severe burns. Do not open the pressure cap while the engine is running. Let the engine cool down before removing the cap. Turn the cap slowly and do not open it fully until the pressure has been relieved.

CAUTION

One operator should be in complete charge, or working under the direction of someone who is in complete charge. Remember that, upon starting the GenSet, cables and switchgear will become energized, possibly for the first time. Furthermore, equipment that does not form part of the GenSet installation may become electronically charged. Only authorized and competent personnel should carry out this work.

IMPORTANT: Avoid off-load running for other than short periods. A minimum loading of 30% is recommended. This loading will help to prevent the build up of carbon deposits. The engine must be shut down as soon as possible after the appropriate functions have been checked.

The PCC controls the starting and stopping sequence of the engine. During starting, automatic checks are carried out for the integrity of various protection systems. The PCC will not allow the GenSet to continue the starting sequence if the integrity of a sensor is considered to be in doubt. When a start command is given, the control commands the engine to start. If the engine does not start on the first attempt, the control goes through three start cycles composed of 15 seconds of cranking and 30 seconds of rest.

IMPORTANT: For dual-fuel applications, the GenSet will start in propane mode, unless the **RESET** button is pressed. After the GenSet has been operated using Natural Gas, the **RESET** button will not have to be pressed at each start.

The PCC initiates a starter cranking signal and will perform an automatically sequenced manual start under a complete engine protection system, combined with full monitoring capability. If a fault is sensed at start-up, the engine will be locked out and will not start.

NOTE: The PCC displays engine oil pressure, coolant temperature, coolant level, and speed. The Electronic Control Module (ECM) also monitors the engine coolant temperature using a different sensor.

If the ECM shuts down the engine, it will send a signal to the PCC which will display **ENGINE WARNING** (fault code **1311**). Each digit of the three digit numerical fault code will be displayed as flashes. There will be a brief pause between digits and a longer pause before the repetition. Refer to the PCC 3300 manual for information on troubleshooting fault codes.

NOTE: Fault code **123** may be indicating higher-than-expected engine coolant temperature. If overheating is suspected, measure the coolant temperature with a gauge while the engine is warming up. If the temperature exceeds 107 °C (225 °F), service the cooling system as necessary. If the temperature is not higher than expected but shutdown recurs, the coolant sensor may be faulty.

See your authorized Cummins distributor regarding the wiring harness and software required for performing engine diagnostics using a personal computer (laptop).

The GenSet can be configured for one to seven starting cycles with set times for crank and rest periods for all starting modes (manual/remote). The default setting is for three start cycles composed of fifteen seconds of cranking and thirty seconds of rest.

NOTE: The number of starting cycles, and the crank and rest times are programmed from within the **Setup** menu. Trained and experienced service personnel are required to change the default setting. Contact your authorized Cummins distributor for more information.

CAUTION

Make sure that all pre-start checks are carried out before starting the GenSet. Do not attempt to start the GenSet until it is safe to do so. Cummins recommends regular inspections and cleaning of discharge hoods. Snow buildup on or around the GenSet and other obstructions can cause GenSet failure and possible damage to the equipment. Warn all others in the vicinity that the GenSet is about to start.



8.5.1 Starting from the operator panel (manual mode)

CAUTION

When changing modes, the GenSet may start or stop without warning. Make sure there is no danger to personnel or equipment should the GenSet unexpectedly start or stop when changing modes.

To start the GenSet in **Manual Run** mode:

1. Press the **Manual** button on the Operator Panel.
2. Then press the **Start** button within ten seconds. (Failure to press the **Start** button within this time will result in the GenSet changing to the **Off** mode.)

The PCC will initiate a starter cranking signal and will perform an automatically sequenced manual start under a complete engine protection system combined with full monitoring capability. This will activate the engine control system and the starting procedure. The starter will begin cranking, and after a few seconds the engine will start and the starter will disconnect.

IMPORTANT: *If the engine does not start, the starter disengages after a specified period of time and the controller indicates a **Fail to Start** shutdown fault. See [8.5.3 Failure to Start shutdown](#).*

Once the engine has started and reached rated speed, the circuit breaker can be manually opened or closed using the buttons on the Operator Panel.

To disable **Manual Run** mode:

- Press the **Auto** button. If the GenSet is running when it leaves **Manual** mode, it will continue to run if the remote start signal is active.

OR

- Press the **Stop** button. If there is no active remote start signal, the GenSet will stop.

8.5.2 Starting from remote location (auto mode)

The GenSet is capable of being remotely started while in Auto mode. This can be done through the use of a remote start switch, transfer switch, or other device. While in **Auto** mode, the GenSet control mon-

itors the status of the remote start contacts on the GenSet control panel.

Once the control senses continuity (closed contacts) on the remote start contacts, the control automatically starts the GenSet and closes the breaker at the appropriate time.

Once the remote start signal is removed (open contacts), the control automatically opens the main circuit breaker and shuts down the GenSet.

IMPORTANT: *Do not apply voltage to the remote start contacts. GenSet control system damage will occur.*

IMPORTANT: *The GenSet does not shutdown immediately when the remote start signal is removed. It enters a delay-to-stop countdown timer along with entering a cool down cycle, when applicable.*

To initiate **Auto** mode:

1. Turn the GenSet DC disconnect switch to the on position.
2. Press the **Auto** button on the HMI to enable Auto mode.

This allows the GenSet to be started from a remote switch or device (e.g. transfer switch).

In response to the remote start, the control lights the **Remote Start** indicator and initiates the starting sequence. This start incorporates a **Time Delay to Start** function.

DANGER

Should a remote start signal be received, the GenSet starts automatically. Make sure there is no danger to personnel or equipment should the GenSet start without warning.

The starting/stopping sequence for a remote start is as follows:

1. After receiving a remote start signal, the PCC initiates the start sequence. This input signal is received from a transfer switch, a remote start switch, etc. The **Remote Start** LED is lit.

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2. The **Time Delay to Start** (0-300 seconds) begins.
3. When the **Time Delay to Start** has expired, the engine starts. After the engine has started and reached rated speed, the GenSet circuit breaker automatically closes, allowing the GenSet to power any connected loads.

IMPORTANT: *The **Run/Idle** switch must be in the **Run** position in order for the main circuit breaker to close.*

4. When the remote start signal is removed, a **Time Delay to Stop** (0-600 seconds) begins. This time delay is used to transfer the load (if connected to another power source) and let the engine cool down.
5. When the **Time Delay to Stop** has expired, the engine stops.

NOTE: *The **Time Delay to Start** and **Time Delay to Stop** is configurable in the **Advanced Genset Setup** menu. The **Advanced Set Up** menu is intended for qualified and trained service technicians only. Adjustments made within this menu will affect GenSet performance and operation, in some cases negatively. Under most operational conditions there is no need to make any adjustments within this menu. Contact your authorized distributor for assistance.*

To disable **Auto** mode:

- Remove the remote start signal.

OR

- Press the **Manual** button.

OR

- Press the **Stop** button. If there is no active remote start signal, the GenSet will stop. This may include a cool down run.

IMPORTANT: *Do not perform a hot shutdown under load; a hot shutdown may result in engine damage.*

8.5.3 Failure to Start shutdown

Should the engine fail to start, the starter will disengage after a specified period of time and the PCC will indicate a **Fail to Start** shutdown.

To clear a **Fail to Start** shutdown:

1. Press the **Stop** button.
2. Then press the **Reset** button.
3. Before attempting to re-start, wait a minimum of two minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt, refer to the [Troubleshooting](#) section of this manual.

8.6 Loading the GenSet

When operating the GenSet under unique operating conditions, precautions may need to be taken to help ensure GenSet performance and reliability:

- When operating the GenSet in ambient temperatures below -20° F (-29° C), it should be operated with greater than 50% of rated load to ensure proper GenSet performance.
- When operating the GenSet for extended periods of time at loads less than 5% of rated load, it should periodically be loaded for 1-2 hours at greater than 50% of rated load to help ensure GenSet performance.

NOTE: *The engine should not be operated at an idle no load condition for prolonged periods (more than 15 minutes) of time. Operating engines in cold ambient temperatures wastes fuel, accelerates wear, and can result in serious engine damage. Under low temperature conditions, incomplete combustion will occur, allowing deposits of unburned tars and carbon to buildup on the valve guide and valves and eventually cause valve sticking.*

If it is necessary to keep the engine running for extended periods of time at rated speed with no load, the GenSet should be connected to a load of at least 35% of rated load to ensure optimal engine and after-treatment performance. Such a load could consist of a heater element or load bank. Failure to follow published guidelines may result in undesired engine and after-treatment performance.

8.7 Stopping the GenSet

Halting the GenSet operation can be done manually from the Operator Panel, automatically from a remote location, or immediately from the Operator Panel using the **Emergency Stop** button.



NOTE: Do not use the Emergency Stop switch to shut down the GenSet unless a serious fault develops. The Emergency Stop push-switch must not be used for a normal shut-down. An emergency stop does not allow for proper cooldown (where the lubricating oil and engine coolant carry the heat away from the engine combustion chamber and bearings) of the GenSet in a safe manner.

IMPORTANT: Be sure to run the GenSet at no load for three to five minutes before stopping. This allows the lubricating oil and engine coolant to carry heat away from the combustion chamber and bearings.

8.7.1 Switching to off from manual mode of operation

To stop operation of the GenSet when it has been running in **Manual** mode:

1. Remove the load.
2. On the Operator Panel, press the **Stop** button once to put the GenSet into a cool down run. The Operator Panel will display the cool down timer.
3. When the cool down timer expires, the GenSet will then shut off and enter the **Off** mode.

NOTE: Pressing the **Stop** button twice will stop the GenSet immediately - without a cool down run - and the GenSet will immediately enter the **Off** mode. If possible, hot shutdown under load should be avoided to help prolong the reliability of the GenSet. A hot shutdown may result in a **Hot Shutdown Warning**.

8.7.2 Switching to off from auto mode of operation

To **manually** stop operation of the GenSet when it has been running in **Auto** mode:

1. Remove the load.
2. On the Operator Panel, press the **Stop** button once to stop the GenSet immediately (without a cool down run).
3. The GenSet will then enter the **Off** mode.
4. If possible, re-start the GenSet in **Manual** mode with the circuit breaker open, and then follow the **Manual** mode procedures to stop the GenSet to allow for the cool down run.

To **remotely** stop operation of the GenSet when it has been running in **Auto** mode:

1. Remove the load.
1. Open the main circuit breaker.
2. Turn off the remote start signal. Once the remote start signal has been turned off, the GenSet starts its shutdown sequence: **Time Delay to Stop** function (zero to 600 seconds) and **Cool down at Idle** (zero to ten minutes, or longer, if necessary to obtain normal operating temperatures prior to shutdown).

NOTE: The GenSet remains in **Auto** mode and can be restarted by a remote start signal unless the **Stop** button on the Operator Panel is pressed. The GenSet will then enter the **Off** mode.



When Masterless Load Demand (MLD) is enabled, stopping a GenSet may cause one or more stopped GenSets to start.

8.7.3 Emergency stopping

The **local Emergency Stop** button is located near the rear of the GenSet, in close proximity to the Operator Panel. This is a mechanically latched switch that will unconditionally stop the engine when pressed, bypassing any time delay to stop. Push this button **IN** for emergency shutdown of the engine.

NOTE: If the engine is not running, pushing the button in will prevent the starting of the engine, regardless of the start signal source (manually or remotely).

When the **Emergency Stop** button is pressed at the Operator Panel, the Operator Panel display will illuminate red at the **Shutdown Indicator Lamp** and fault code **1433 LOCAL EMERGENCY STOP** will appear on the graphical LCD display.

IMPORTANT: Do not use the Emergency Stop button to shut down an engine unless a serious fault develops. The Emergency Stop button must not be used for a normal shutdown as this will prevent a cool down run in which the lubricating oil and engine coolant carry away heat from the engine combustion chamber and bearings in a safe manner. Make sure the cause of the emergency stop is fully investigated

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and remedied before resetting the fault(s) and restarting the GenSet. Make sure the remote start control is not active or, when the Emergency Stop is reset, the GenSet could start running.

To reset the **Emergency Stop** button:

1. Pull - or twist and pull - the red **Emergency Stop** button and allow it to pop out.
2. Press the **Stop** button on the Operator Panel to acknowledge this action.
3. Press the **Reset** button on the Operator Panel.
4. Press the **Stop, Manual, or Auto** button on the Operator Panel for the desired mode of operation.



Section 9 - Maintenance

9.1 Introduction

The engine and generator set (GenSet) are to be operated in accordance with all manufacturer's guidelines and recommendations. The following sections outline the steps and guidelines for general inspections and maintenance repairs.

All maintenance tasks must be assessed for health and safety risks and the preventative measures identified must be actioned. Accompaniment is required for tasks where the presence of someone else will add significantly to the safety of the task. Read, understand, and comply with all Caution and Warning notes in this manual. Ensure adequate lighting and staging (where required) are installed.

All warranty work must be completed by an authorized Cummins distributor. For additional engine maintenance information that is not contained in this manual, see the engine Operation and Maintenance Manual or the Owners Manual.

9.2 Maintenance compliance requirements

Owner/Operator unit engine certification must be monitored and documented to remain in compliance with NFPA and the Environmental Protection Agency (EPA). Refer to NFPA 110 Standard for Emergency and Standby Power Systems. Reference to the EPA Spark-Ignited (SI) New Source Performance Standards (NSPS) final ruling can be found under Title 40 Code of Federal Regulation (CFR) 60.4243.

NOTE: *Some GenSets require a three-way or oxidation catalyst to meet emission requirements. There is a precious metals element inside the housing of the catalyst that converts exhaust to EPA requirements. Some catalysts have a removable element in the center (only available on some models) that can be replaced with a new element when required. Most catalysts come installed on the GenSet from the factory. Some catalysts require customer mounting. Check with your distributor or service technician for details on your product. Check the manufacturer's recommended maintenance or replacement schedule.*

For complete information, the owner/operator should review the entire NFPA 110 and CFR 60.4243.

The following paragraphs highlight general maintenance record-keeping requirements:

- A permanent record of the Emergency Power Supply System (EPSS) inspections, tests, exercising, operation, and repairs shall be maintained and readily available.
- EPSSs, including all appurtenant components, shall be inspected weekly and exercised under load at least monthly.
- If the GenSet is used for standby power or for peak load shaving, such use shall be recorded and shall be permitted to be substituted for scheduled operations and testing of the GenSet.
- Equivalent loads used for testing shall be automatically replaced with the emergency loads in case of failure of the primary source.
- SI GenSets shall be exercised at least once a month with the available EPSS load for thirty minutes or until the water temperature and the oil pressure have stabilized.
- Load tests of GenSets shall include complete cold starts.
- Transfer switches shall be operated monthly.
- If you operate and maintain the certified stationary SI internal combustion engine and control device according to the manufacturer's emission-related written instructions, you must keep records of conducted maintenance to demonstrate emissions compliance. No performance testing is required if you are an owner or operator.
- If you do not operate and maintain the certified stationary SI internal combustion engine and control device according to the manufacturer's emission-related written instructions, your engine will be considered a non-certified engine,



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and you must demonstrate emissions compliance according to the EPA or the Authorities Having Jurisdiction (AHJs), as appropriate.

- If you are an owner or operator of a stationary SI internal combustion engine less than 100 horsepower (HP), you must keep a maintenance plan and records of conducted maintenance to demonstrate emissions compliance. To the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. No performance testing of a stationary SI internal combustion engine less than 100 HP is required if you are an owner or operator.
- If you are an owner or operator of a stationary SI internal combustion engine greater than or equal to 100 HP and less than or equal to 500 HP, you must keep a maintenance plan and records of conducted maintenance. To the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, you must conduct an initial performance test within one year of engine startup to demonstrate compliance.
- If you are an owner or operator of a stationary SI internal combustion engine greater than 500 HP, you must keep a maintenance plan and records of conducted maintenance. To the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, you must conduct an initial performance test within one year of engine startup and conduct subsequent performance testing every 8,760 hours or 3 years, whichever comes first, thereafter to demonstrate compliance.

9.3 Recommended maintenance schedules

The GenSet should be maintained according to the maintenance schedules outlined in the engine Operation and Maintenance manual. Perform maintenance tasks as specified using hourly or daily periods - whichever occurs first. Use the running time meter to keep an accurate log of all service performed.

Some maintenance procedures require special tools or must be completed by qualified personnel. Contact your local Cummins Authorized Repair Location for

detailed information. For additional information on engine-specific maintenance procedures, reference the engine Operation and Maintenance Manual and/or the Owners Manual.

If the GenSet will be subjected to any extreme operating conditions, consult with your local Authorized Cummins Distributor and determine a suitable schedule of maintenance. The time between service intervals should be reduced accordingly. Some of the factors that can affect the maintenance schedule include:

- Ambient temperatures below 18 °C (0 °F) or above 38 °C (100 °F)
- Exposure to weather
- Exposure to salt water
- Exposure to dust, sand, or other airborne contaminants

9.4 General maintenance inspections while in operation

During operation, be alert for mechanical problems that could create unsafe or hazardous conditions. Preventative maintenance begins with day-to-day awareness of the condition of the GenSet. Look and listen for changes in engine performance, sound, or appearance that can indicate service or repair is needed. Check the GenSet mounting bolts for any signs of wear. The following sections cover several areas that should be frequently inspected for continued safe operation.

STAY ALERT!



Look!
Listen!
Assess!



Monitor fluid levels (engine oil, engine coolant, and fuel), oil pressure, and coolant temperature frequently. During operation, be alert for mechanical problems that could create unsafe or hazardous conditions:

- Leaks
- Loose or damaged parts
- Worn or damaged belts
- Any change in engine or GenSet appearance.

IMPORTANT: *Components that have guards against inadvertent touching must be visually inspected only. Do not remove the guards to do the inspection.*

9.4.1 Engine

The engine must be maintained in good mechanical condition if the operator is to obtain optimum satisfaction from its use. Monitor fluid levels and oil pressure and coolant temperatures frequently. Most engine problems give an early warning. Look and listen for changes in engine performance, sound, or appearance that can indicate service or repair is needed:

- Misfire
- Significant vibration
- Unusual noises
- Sudden changes in engine operating temperatures or pressures
- Excessive exhaust smoke
- Low lubricating oil pressure
- Loss of (or low) power
- Abnormal engine coolant temperature
- Excessive use of coolant, fuel, or lubricating oil
- Any coolant, fuel, or lubricating oil leaks
- Unexplained frequency fluctuation

9.4.2 Lubrication

Check the engine oil level and look for any oil leaks.

9.4.3 Fuel system

Inspect the fuel supply lines, filters, and fittings for leaks. Check any flexible sections for cuts, cracks, and abrasions and make sure they are not rubbing against anything that could cause breakage. If any fuel leaks are detected, shut down the GenSet, turn off the supply valves, and have any fuel leaks corrected immediately.

WARNING

Ignition of fuel can cause severe personal injury or death by fire or explosion. Do not permit any flame, cigarette, arcing switch or equipment, pilot light, or other igniter near the fuel system or in any areas sharing ventilation.

9.4.3.1 Fuel filters (optional - mobile off-highway (MOH) models, only)

Our in-line fuel filters are designed for optimal performance of the GenSet. They provide the best choice for customers who want to extend service intervals and increase GenSet uptime. Optional pressure indicators and automatic drains are available on some models. Check the installation and service manuals for your specific filter (models vary by unit) for details. Check the pressure differential across the filter to ensure restriction is within operating range. If the pressure loss is out of range, see the Owner Manual to change the filter.

9.4.3.2 Fuel heater (optional - MOH models only)

Fuel heaters are available on some MOH models. They are designed to provide heating of engine fuel for optimal performance of the GenSet. The fuel heater is designed to provide uninterrupted fuel flow in cold temperature environments when it is needed most. Check the heater for fuel flow to ensure minimal pressure loss during operation. See the Owner Manual for regular maintenance schedules.

9.4.3.3 Regulator (optional)

Prime regulators are available on some models for fuel pressure reduction from the source. Regulators vary by manufacturer and model. Check with your distributor or service technician for details on the use and settings of your regulator. Be sure to follow the manufacturer's recommended maintenance schedule.

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9.4.4 Coolant system

CAUTION

Operating the GenSet when coolant level is low can cause serious engine damage.

Check the engine coolant level and look for coolant leaks around the bottom of the GenSet and on the ground below. Minor leaks that can be replenished by daily additions of coolant to the recovery tank should be repaired by a qualified service technician as soon as possible. Larger leaks are cause for shutting down the GenSet until it can be repaired. Refer to the engine Operation and Maintenance manual.

9.4.5 AC electrical system

It is important to regularly check to see that all aspects of the GenSet are receiving adequate electricity. Be sure to check the following:

- **Frequency/RPM:** The generator frequency should be stable under load and the reading should be the same as the GenSet nameplate rating (see [Figure 2-1 GenSet Nameplate \(typical\)](#)).
- **AC voltmeter (Alternator menu):** At no load, the line-to-line or line-to-neutral voltage(s) should be the same as the GenSet nameplate rating (see [Figure 2-1 GenSet Nameplate \(typical\)](#)).
- **AC ammeter (Alternator menu):** At no load, the current readings should be zero. With a load applied, each line current should be similar.
- **Lamp Test Button:** Press the **Lamp Test** button (the light bulb icon). All of the LED lamps should illuminate for five seconds to ensure that all warning indicators are working properly.

NOTE: *Class 1 wiring methods are to be used for field wiring connections to terminals of a Class 2 circuit.*

9.4.6 DC electrical system

Check the terminals on the batteries for clean and tight connections. Loose or corroded connections create resistance which can hinder starting.

9.4.7 Exhaust system

Inspect the entire exhaust system visually and audibly, including the exhaust manifold, muffler and

exhaust pipe . Check for leaks at all connections, welds, gaskets, and joints and also make sure that exhaust components are not heating surrounding areas excessively. If any leaks are detected, shut down the GenSet and have the leaks corrected immediately.

DANGER

Inhalation of exhaust gases can result in severe personal injury or death. Be sure deadly exhaust gas is piped outside and away from any windows, doors, vents or other inlets to building. Do not allow exhaust gases to accumulate in habitable areas.

9.4.8 Heaters (optional)

Check to ensure that all wiring is intact (no shorts or frayed wires) and there are no obstructions around all heaters:

- Battery heater
- Breather heater
- Control heater
- Coolant heater
- Oil heater

9.4.9 Base drains (optional)

Some units are equipped with drain extensions that allow for oil or coolant (or both) drains to be brought out to the base edge for convenient maintenance. These drains have valves installed for control. Remove the cap and open the valve to drain. Close the valve and restore the cap before refilling. Check the end of the drain line/valve for obstructions. Check all drain connections for leaks or worn parts.

9.5 General maintenance inspections while not in operation

9.5.1 Accidental restart prevention

Before any work is carried out for significant maintenance, the GenSet must be immobilized. If a GenSet is paralleled with others, all GenSets being paralleled must be immobilized before any work is performed on any one of them. Even if the GenSet(s) is put out of service by pressing the **Stop** button on the Operator

Panel, the GenSet(s) cannot be considered safe to work on until the engine(s) are properly immobilized.

To immobilize the engine:

1. Press the **Stop** button on the Operator Panel to shut down the GenSet.
2. Press the **Emergency Stop** button. This will prevent the GenSet from starting, regardless of the start signal source, and will provide an additional safety step for immobilizing the GenSet.

NOTE: When the **Emergency Stop** button is pressed, the Operator Panel will indicate the shutdown condition by illuminating the red Shutdown status lamp and displaying a message on the graphical display.

3. Disconnect all component heaters, as applicable, and the battery charger from the external power supply.

CAUTION

Disconnect battery charger from AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes which are damaging to DC control circuits of the GenSet.

4. Disconnect the starting batteries. Disconnect the negative (-) cable first, using an insulated wrench.

WARNING

Accidental starting of the GenSet can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.

5. Lock the cables (with a padlock) to prevent reconnection during maintenance.
6. Place warning notice - "GenSet immobilized for safe working conditions" - at the Operator Panel to indicate that maintenance is in progress.

WARNING

Failure to properly immobilize all connected GenSets in a paralleling application before

working on any one of them could cause severe personal injury. Never work on one paralleled GenSet without first immobilizing all connected GenSets.

DANGER

Contacting high voltage components can cause electrocution, resulting in severe personal injury or death. Keep the output box covers in place during troubleshooting.

WARNING

Lead-acid batteries present a risk of fire because they generate hydrogen gas. Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switches, or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

Ventilate battery area before working on or near battery. Wear goggles. Stop the GenSet and disconnect the battery charger before disconnecting the battery cables. Disconnect the negative (-) cable first and reconnect last.

9.5.2 Lubrication system

The use of quality engine oils, combined with appropriate oil and filter change intervals, are critical factors in maintaining engine performance and durability. Extending the oil and filter change interval beyond the recommendations will decrease engine life due to factors such as corrosion, deposits, and wear. It is the responsibility of the operator or changes at the recommended intervals. Consult the engine Operation and Maintenance Manual and/or Owners Manual for detailed engine oil specifications.

To properly maintain the GenSet lubrication system, you must routinely check the engine oil level, change the engine oil at the recommended service interval, change the engine oil filter, and inspect the (optional) oil reservoir.

DANGER

Engine components (drains, filters, hoses, etc.) can be hot and cause severe burns, lacerations of

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the skin, and liquid splash. Use personal protective equipment when working with or around hazardous materials. Examples of personal protective equipment include (but are not limited to) safety glasses, protective gloves, hard hats, steel-toed boots, and protective clothing.

⚠ DANGER

Crankcase pressure can blow hot engine oil out the fill opening causing, severe burns. Always stop the GenSet before removing the oil fill cap.

⚠ WARNING

State and federal agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin.

⚠ DANGER

Hot crankcase oil can cause burns if it is spilled or splashed on skin. Keep fingers and hands clear when removing the oil drain plug and wear protective clothing.

9.5.2.1 Checking the engine oil level

For accurate readings, shut off the engine and wait approximately ten minutes before checking the engine oil level. This allows oil in the upper portion of the engine to drain back into the crankcase (oil pan).

The dipstick is stamped with **FULL** and **ADD** to indicate the level of oil in the crankcase. As shown in [Figure 9-1](#), check the oil level while the engine is cold and keep the oil level **halfway** between the **FULL** and **ADD** marks on the dipstick. Remove the oil fill cap and add oil, when necessary.

⚠ CAUTION

Do not operate the engine with the oil level below the **ADD** mark or above the **FULL** mark. Overfilling can lead to oil foaming and expulsion from the breather cap. Operation below the **ADD** mark can cause loss of oil pressure.

⚠ CAUTION

Avoid prolonged or repeated skin contact. Comply with all local health and safety regulations/codes during handling or disposal.

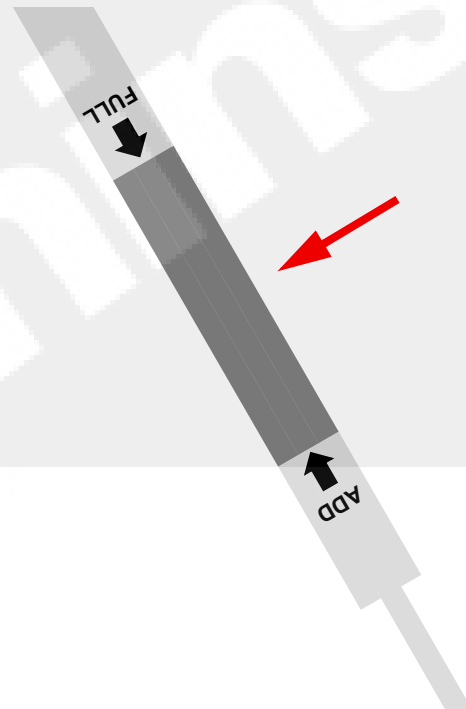


Figure 9-1 Normal oil level (cold engine) on the dipstick

If the oil level is found to be insufficient, oil must be added:

1. Make sure GenSet is off.
2. Ensure that the oil fill cap area is clean to prevent debris from entering the engine.
3. Add the appropriate amount of oil based on the engine oil level check performed beforehand.
4. Recheck the engine oil level. Based on the results, add or drain additional oil.
5. Clean up and dispose of any waste oil in accordance with local environmental regulations.

If the oil level is found to be excessive, oil must be drained from the engine:

1. Make sure GenSet is off.
2. Press the **Emergency Stop** button on the GenSet.
3. Turn off the DC disconnect switch, if applicable.
4. Disconnect the starting batteries. Disconnect the negative (-) cable first, using an insulated wrench.
5. Access (or connect) the oil drain hose. Move the free end of the oil drain hose to the exterior of the GenSet or the GenSet enclosure and place it into an appropriately sized container.
6. Remove the oil drain hose plug.
7. Slowly open the oil drain valve to allow oil to drain into the container.
8. When oil has stopped flowing from the oil drain hose, close the oil drain valve and install the oil drain hose plug.
9. Recheck the engine oil level.
10. Add or drain additional oil until the correct oil level is achieved.
11. Clean the oil drain hose and dispose of used oil in accordance with local environmental guidelines.
12. Place the oil drain hose away from moving parts.

NOTE: *High oil level may be caused by fuel in the oil. If fuel is suspected to be present in the oil, contact your local distributor for troubleshooting and or repair information.*

9.5.2.2 Changing the engine oil and oil filter

Change the lubricating oil and filter at the specified oil change interval. Change the oil more often in hot or dusty environments.

IMPORTANT: *If equipped, disconnect the oil pan heater and/or the coolant heater prior to changing the oil. Reconnect the heater(s) once the oil change is complete.*

To change the oil:

1. Run the GenSet under load until it is up to operating temperature, 60° C (140° F).
1. Make sure the engine is off.
2. Press the **Emergency Stop** button on the GenSet.
3. Turn off the DC disconnect switch, if applicable.
4. Disconnect the starting batteries. Disconnect the negative (-) cable first, using an insulated wrench.
5. Access (or connect) the oil drain hose. Move the free end of the oil drain hose to the exterior of the GenSet or the GenSet enclosure and place it into an appropriately sized container.
6. Remove the oil drain hose plug.
7. Slowly open the oil drain valve to allow oil to drain into the container.
8. When oil has stopped flowing from the oil drain hose, close the oil drain valve and install the oil drain hose plug.
9. Place a container under the oil filter to catch residual oil when the cap is removed.
10. Clean the area around the oil filter head, remove the oil filter and discard it in accordance with local environmental regulations.
11. Thoroughly wipe off the filter mounting surface. Remove the O-ring, if it does not come off with the filter.
12. Fill the new filter with clean oil of the appropriate viscosity. To fill, pour the oil into the center hole of the filter.

NOTE: *Be careful that no debris is poured into the filter. If using an oil supply with a metallic or plastic seal under the cap, be careful to peel the seal back. Puncturing the seal with a knife or sharp object can create debris in the oil container.*

Maintenance

NOTE: *Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the FULL and ADD marks on the dipstick.*

NOTE: *The lack of lubrication while the filter is pumped full of oil at start-up can damage the engine. Be sure to fill the oil filter before installing.*

13. Apply a thin film of oil to the filter gasket and install a new element.
14. Use clean oil to coat the O-ring surface of the oil filter.
15. Apply a light film of lubricating oil to the gasket sealing surface of the engine before installing the filter.
16. Spin the element on by hand until the gasket just touches the mounting pad and then turn an additional 1/2 to 3/4 turn. Do not over tighten.

NOTE: *Mechanical over-tightening of the filter can distort the threads or damage the filter element seal. Do not over tighten.*

17. Fill the engine with clean lubricating oil to the proper level.
18. Install the oil fill cap securely.
19. Connect the starting batteries.
20. Turn DC disconnect switch (if applicable) to the **ON** position.
21. Pull out the **Emergency Stop** button.

NOTE: *Engine oil pressure must be indicated on the graphical display within 15 seconds after starting. If oil pressure is not registered within 15 seconds, shut off the engine immediately to avoid engine damage. Recheck the oil level.*

22. Run the GenSet at idle to inspect for leaks at the oil drain valve and oil filter seal. Tighten connections only as much as is necessary to eliminate leaks. Do not over tighten.
23. Shut off the engine.

24. Wait approximately 5 minutes to let the oil drain from the upper parts of the engine and recheck the oil level.

25. Add or drain oil, as necessary, to bring the oil level to **halfway** between the **FULL** and **ADD** marks on the dipstick.

26. Dispose of the used oil and oil filter in accordance with local environmental regulations.

WARNING

Used oil and filters must be disposed of properly to avoid environmental damage and clean-up liability. Check all federal, state and local regulations for disposal requirements.

9.5.2.3 Inspecting the oil reservoir (optional)

Five- or ten-gallon oil tanks are optional on some units to allow for extended service intervals between maintenance. These tanks are typically plumbed to an **Oil Maintainer Switch** that controls the flow into the engine oil pan. It is imperative that this switch is functioning properly without obstruction and (if the switch is vented) the vent is not obstructed. The tank should be filled with oil per the engine manufacturer guidelines. Check all of the connections to the oil reservoir for leaks or worn parts.

9.5.3 Cooling system

The coolant level should be checked daily. With the engine cool, inspect the coolant level by view in the sight glasses. The coolant level should be maintained at the top of the sight glass. If the coolant level is found to be low, add the appropriate amount of coolant to bring the coolant level to the top of the sight level glass.

DANGER

Standing on the engine, bed frame, alternator or other generator set parts may cause severe personal injury, death, and/or equipment. Always work from a secure platform.

Ensure the appropriate type of engine coolant is added, in the appropriate concentration of antifreeze. Cummins recommends the use of fully formulated antifreeze/coolant meeting Cummins Engineering Standards (CES) 14603. For further details and discussion of coolant for Cummins engines, refer to Service Bulletin 3666132, [Cummins Coolant Require-](#)

ments and Maintenance. Typically, antifreeze/coolants meeting ASTM4985 (GM6038M specification) or ASTM D6210 criteria are acceptable antifreeze/coolants for engines covered by this manual. Low-silicate antifreeze/coolants meeting ASTM D4985 (GM6038M specification) are not adequate for extended service intervals.

Satisfactory engine coolant inhibits corrosion and protects against freezing, if necessary. Cummins recommends using either a 50/50 mixture of good-quality water and fully-formulated antifreeze, or fully-formulated coolant, when filling the cooling system. Good-quality water is important for cooling system performance. Excessive levels of calcium and magnesium contribute to scaling problems, and excessive levels of chlorides and sulfates cause cooling system corrosion. Cummins recommends using Fleetguard Compleat. It is available in both glycol forms (ethylene and propylene).

Fully-formulated antifreeze must be mixed with good-quality water at a 50/50 ratio (40- to 60- percent working range). A 50/50 mixture of antifreeze and water gives a -36°C (-33°F) freezing point and a 108°C (226°F) boiling point, which is adequate for locations in North America. The actual lowest freezing point of ethylene glycol antifreeze is at 68 percent. Using higher concentrations of antifreeze will raise the freezing point of the solution and increase the possibility of a silica gel problem.

In ambient temperatures of 0°C to -32°C (32°F to -25°F), use 50% ethylene glycol antifreeze and 50% water for the engine coolant mixture.

In ambient temperatures of -32°C to -54°C (-25°F to -65°F), use 60% ethylene glycol antifreeze and 40% water for the engine coolant mixture.

Do not use soluble oils in the cooling system. The use of soluble oils will:

- corrode brass and copper
- damage heat transfer surfaces
- damage seals and hoses

Do not use sealing additives in the cooling system. The use of sealing additives will:

- buildup in coolant low-flow areas

- plug the radiator and oil cooler
- possibly damage the water pump seal

WARNING

Removing a hot engine radiator fill cap can cause severe burns from heated coolant spray or steam. Do not remove the radiator fill cap from a hot engine. Wait until the engine temperature is below 50°C (122°F) before removing the radiator fill cap. Remove the radiator fill cap slowly to release coolant system pressure.

WARNING

Avoid prolonged or repeated skin contact with antifreeze.

NOTE: Engine castings can be damaged if cold coolant is added to a hot engine. Do not add cold coolant to a hot engine. Allow the engine to cool to below 50°C (122°F) before adding coolant.

9.5.3.1 Checking the coolant level

Check the coolant level during shutdown periods and ensure the fluid level is visible in the sight glass.

WARNING

Loss of coolant can allow the engine to overheat without protection of a shutdown device and cause severe damage to the engine. Maintain the coolant level for proper operation of the high engine temperature shutdown system.

CAUTION

The engine can overheat and be damaged if coolant is filled improperly.

9.5.3.2 Adding coolant

Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50°C (120°F) before adding coolant. When the engine is first started, monitor the coolant level. As trapped air is expelled from the system, the coolant level may drop and additional coolant must be added.

Maintenance

WARNING

To prevent severe scalding, let the engine cool before removing the radiator fill cap. Turn the cap slowly, and do not open it fully until the pressure has been relieved.

To add coolant using the radiator fill cap:

1. Make sure the engine is off.
2. Press the **Emergency Stop** button on the GenSet.
3. Turn off the DC disconnect switch, if applicable.
4. Disconnect the starting batteries. Disconnect the negative (-) cable first, using an insulated wrench.
5. Check to make sure that all drain cocks are closed and all hose clamps secure.
6. Slowly remove the radiator fill cap to release any residual pressure in the cooling system.
7. Slowly add engine coolant until the coolant level reaches the full level on the coolant sight glass.
8. Install the radiator fill cap. Push down and twist clockwise until the cap lip hits the tank stop flange.
9. Connect the starting batteries.
10. Turn DC disconnect switch (if applicable) to the **ON** position.
11. Pull out the **Emergency Stop** button.
12. Operate the GenSet for fifteen minutes or until the engine reaches normal operating temperature. Turn off the GenSet and allow the engine to cool.
13. Recheck the coolant level. To add additional coolant repeat the steps above, as necessary.

9.5.3.3 Changing the coolant filter

Refer to the

9.5.3.4 Draining and flushing the cooling system

WARNING

Some coolant is toxic. Keep coolant away from children and animals. Follow local environmental regulations for disposal.

To maintain adequate corrosion protection and remove rust and scale deposits, drain and flush the radiator at the recommended interval.

CAUTION

The heater element will burn out if the engine coolant is removed with the heater connected to a power source.

To drain and flush the cooling system:

1. Disconnect the engine coolant heater (if equipped) from the power source.
2. Allow the engine to cool and then remove the radiator fill cap.
3. Open the radiator drain cock and remove the water drain plugs (one on each side of engine).

NOTE: *If the engine is equipped with an engine coolant heater, drain the coolant from the heater by removing the hose and clamp from the bottom of the heater.*

4. After the coolant has completely drained, place the end of a water hose into the radiator fill port and turn on the water supply.
5. Regulate the flow of water into the radiator until it is equal to the outflow from the drain openings.
6. Continue flushing until the outflow from the drains is clear of rust sediment.
7. Replace the water drain plugs and close the radiator drain cock when flushing is complete.
8. Refill the cooling system with the recommended coolant (refer to [9.5.3.1 Checking the coolant level](#)).

DANGER

Some coolant is toxic. Keep coolant away from children and animals. Follow local environmental regulations for disposal. Ethylene glycol anti-freeze is considered toxic. Dispose of it according to local regulations for hazardous substances.

9. If applicable - after the cooling system has been properly filled - connect the engine coolant heater plug to a power source.

CAUTION

The heater element will burn out if the power is connected before it is filled with coolant or if straight antifreeze solution is used for coolant. Before connecting the power, fill the engine with coolant and run it for a while to circulate the coolant through the heater.

9.5.3.5 Inspecting the radiator

Proper air flow through the radiator is required for proper engine operation. A blocked or restricted radiator leads to the engine overheating as well as decreased engine performance.

The engine cooling fan pushes large amounts of air through the radiator whenever the GenSet is running. In addition to pushing air through the radiator, the fan also pushes environmental debris, such as dust, dirt, straw, and lint through the radiator which may build up on the radiator core. Buildup of debris on the core will restrict air flow, reducing the ability to cool.

Inspect the radiator core for debris. Remove all dirt or foreign material with a soft brush or cloth. Use care to avoid damaging the fins. If available, use a low pressure compressed air or stream of water (maximum of 242 kPa [35 psi]) in the opposite direction of normal air flow to clean the radiator. If using water, protect the engine and the generator from over spray.

WARNING

Improper use of compressed air can cause minor bodily injury from flying debris and dirt. Wear appropriate eye and face protection when using compressed air.

Also inspect the radiator core for the following items:

- damaged or bent fins
- radiator core leaks
- damaged or cracked hoses
- loose or damaged hose clamps
- damaged electric coils

9.5.3.6 Replacing the radiator fill cap

Proper cooling system pressure (13 psi) is essential for optimal engine cooling and minimal coolant loss. Replace the radiator fill cap every two years to guard against deteriorated seals and leaks.

9.5.3.7 Inspecting the coolant heater, if applicable

Check the operation of the coolant heater by verifying that hot coolant is being discharged from the outlet hose. **Do not touch the outlet hose.** If the heater is operational, radiant heat should be felt with a hand held close to outlet hose.

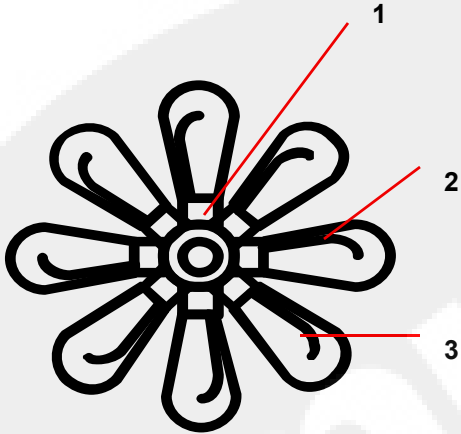
DANGER

Contact with the cooling system or the engine can result in serious burns. Do not touch the cooling system or the engine during GenSet maintenance until they have cooled.

Maintenance

9.5.3.8 Inspecting the cooling fan

As shown in Figure 9-2, a visual inspection of the cooling fan is required daily.



1. Check for loose rivets or retaining bolts.
2. Check for cracks.
3. Check for bent or loose blades.

Figure 9-2 Cooling fan inspection

Do not operate the GenSet with a damaged fan. Contact your authorized distributor for repair or replacement of a damaged fan.

▲ DANGER

Moving parts can cause severe personal injury. Use extreme caution around moving parts. All guards must be properly fastened to prevent unintended contact.

▲ WARNING

Never pull or pry on the fan, this can damage the fan blade(s) and cause fan failure

9.5.4 Fluid containment (optional)

The fluid containment area must be inspected at regular intervals and any liquid should be drained off and disposed of in line with local health and safety regulations. Failure to perform this action may result in spillage of liquids likely to contaminate the surrounding area.

9.5.5 Air intake system

Clean the air filter every 100 hours of operational time and more often in extremely dusty conditions. If the yellow gauge has crossed the red mark on the service indicator, replace the primary and secondary (if applicable) air filters.

The primary filter and the secondary filter are located inside of the air cleaner housing. To change the filter element:

1. Make sure the engine is off.
2. Press the **Emergency Stop** button on the GenSet.
3. Turn off the DC disconnect switch, if applicable.
4. Disconnect the starting batteries. Disconnect the negative (-) cable first, using an insulated wrench.
5. Unscrew the center bolt securing the air filter access cover and remove the filter element. Make sure the gasket around the service door remains seated. Tap the filter on a flat surface to remove dirt.
6. Place a light source inside the filter and inspect it for air passage. If necessary, apply a low pressure air source (207 kPa [30 psi]) to the inside of filter to remove as much of the dirt as possible.
7. If reusable, install the air filter, reposition the cover and secure. If in need of replacement, continue these steps.
8. Wipe out the inside of the air filter housing. Make sure the element seal areas are clean and free of defects.
9. Inspect the new filter element seals, make sure seals are clean and free of defects.
10. Insert the new secondary element so the plastic ring tab is facing the inside of the housing and is accessible for the next service interval.
11. Push the secondary element into the back of the housing so all surfaces are seated inside the housing. Apply pressure to all four corners to make sure the element is secure within the housing. The secondary element includes an O-ring to provide an airtight seal.

12. Before installing a new primary filter element, use a marker to note on the element handle whether a new secondary element should be installed at the next primary service event.
13. Before inserting the new primary filter element, check that the O-ring is toward the secondary element.
14. Push the primary element into the housing so all surfaces are seated inside the housing.
15. Apply pressure to the two tabs on the side of the primary element.
16. Install the air filter access cover and screw in the center bolt.
17. If the service door does not close easily, reconfigure the primary element for correct installation.
18. Reset the air filter service indicator.
19. Connect the starting batteries.
20. Turn DC disconnect switch (if applicable) to the **ON** position.

21. Pull out the **Emergency Stop** button.

9.5.6 Engine crankcase ventilation filter, if applicable

The crankcase ventilation system is a closed crankcase breather system, meaning the crankcase gases are not vented to the atmosphere. The crankcase ventilation filter requires periodic maintenance.

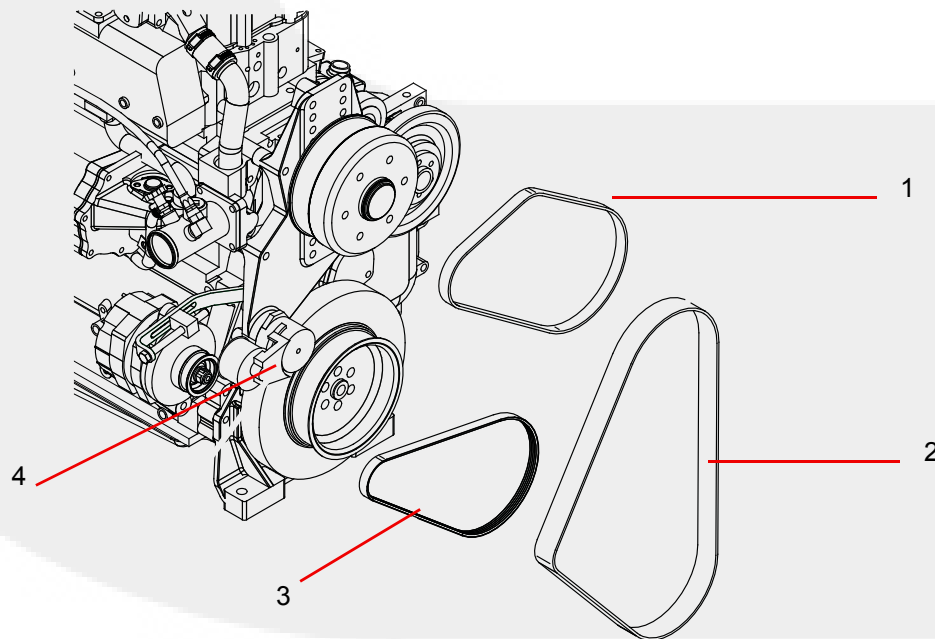
To drain the catch bottle:

1. Remove the cover from the catch bottle.
2. Remove the catch bottle from the bracket.
3. Empty the catch bottle in a safe manner.
4. Reinstall the catch bottle into the bracket and replace the cover.

9.5.7 Belt replacement

Visually inspect the belt through the guarding and check for:

- Intersecting cracks. Small transverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are NOT acceptable.



- | | |
|---------------------------------------|-----------------------------|
| 1. Auxiliary Drive Belt (if equipped) | 3. Alternator Drive Belt(s) |
| 2. Fan Drive Belt(s) | 4. Tensioner Arm |

Figure 9-3 Belt replacement (typical)

Maintenance

- Frays or pieces of material missing.
- Glazed or cracked side walls.
- Uneven wear on sidewalls of belt.

Visually inspect sheaves through the guarding and check for:

- Damaged or worn grooves.
- Breaks on flanges of grooves.
- Frays or pieces of material missing.

9.5.7.1 Replacing a spring tensioner belt

To **remove** a spring tensioner belt for replacement:

1. Make sure the engine is off.
2. Press the **Emergency Stop** button on the GenSet.
3. Turn off the DC disconnect switch, if applicable.
4. Disconnect the starting batteries. Disconnect the negative (-) cable first, using an insulated wrench.
5. Remove the belt guard or side fan guard (between the engine and the radiator) to gain access to the belt.
6. Using a socket wrench, rotate the tensioner pulley arm away from the belt and remove the belt(s).

WARNING

The belt idler is under tension. Do not allow your hands to get between the belt and pulley. Personal injury will result.

NOTE: Always wear proper protective eye wear when starting and checking GenSet.

To **install** a new spring tensioner belt:

1. Slip the belt onto all but one pulley.
2. Rotate the tensioner pulley arm away from the belt and position the belt over the alternator pulley. Slowly release the belt tensioner pulley

arm onto the belt. **NOTE:** The spring-loaded idler used on this design maintains the correct belt tension.

3. Install the belt guard or the fan guard.
4. Check the fan belt tension. Factory specification for fan belt tension is: 7.0 to 9.0 mm (0.28 to 0.35 in.) / 98 N [10 kgf, 22 lbf].
5. Connect the starting batteries.
6. Turn DC disconnect switch (if applicable) to the **ON** position.
7. Pull out the **Emergency Stop** button.
8. Start the GenSet and visually check the belt for proper alignment with the engine running.

9.5.7.2 Replacing a manual tensioner belt

To **remove** a manual tensioner belt for replacement:

1. Make sure the engine is off.
2. Press the **Emergency Stop** button on the GenSet.
3. Turn off the DC disconnect switch, if applicable.
4. Disconnect the starting batteries. Disconnect the negative (-) cable first, using an insulated wrench.
5. Remove the belt guard or side fan guard (between the engine and the radiator) to gain access to the belt.
6. Loosen the jam nut on the sliding pulley assembly.
7. Loosen the tightener bolt to allow the sliding pulley to move (releasing the belt tension) and remove the belt(s).

NOTE: Always wear proper protective eye wear when starting and checking GenSet.

To **install** a new manual tensioner belt:

1. Slip belt(s) onto all pulleys.
2. Tighten the tensioner bolt to the correct amount of belt tension. Measure the tension on the

- belt(s) using a Cummins ST1138 belt tension gauge. Check the fan belt tension. Factory specification for fan belt tension is: 7.0 to 9.0 mm (0.28 to 0.35 in.) / 98 N [10 kgf, 22 lbf].
3. Tighten the jam nut on the sliding pulley assembly. Torque to the appropriate value based on the torque values specified in [Component parts and specifications](#).
 4. Re-check the belt tension using the Cummins ST1138 belt tension gauge.
 5. Install the belt guard or the fan guard.
 6. Connect the starting batteries.
 7. Turn DC disconnect switch (if applicable) to the **ON** position.
 8. Pull out the **Emergency Stop** button.
 9. Start the GenSet and visually check the belt for proper alignment with the engine running.

3. Lightly lubricate spark plug threads with high temperature anti-seize compound.
4. Insert the replacement spark plug.

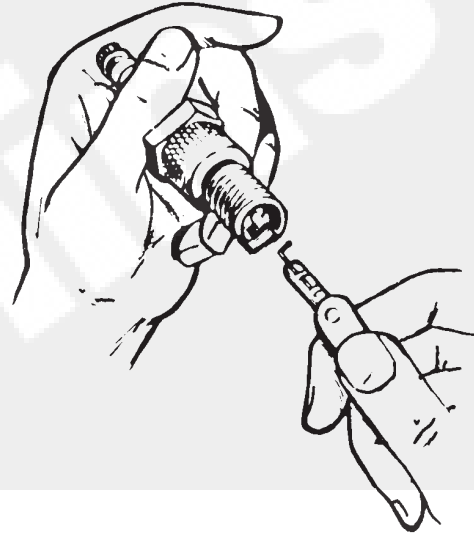


Figure 9-4 Gapping spark plugs

9.5.8 Ignition system

The ignition system consists of the ignition module, ignition coil packs, high tension wires, and spark plugs. Maintenance consists of periodic inspections to detect possible problems and replacement of worn or deteriorated parts. The ignition system must be completely functional or the GenSet may run poorly or be unable to carry a full load.

9.5.8.1 Replacing spark plugs

The engine may require additional service if the spark plugs show any of the following conditions:

- Carbon fouled - overly-rich mixture
- Oil fouled - high oil consumption
- Burned - excessive engine temperature

Contact your authorized service distributor for help.

Before installing new spark plugs:

1. Clean all dirt and grit away from the spark plug seats.
2. Check each spark plug gap and reset as necessary.

9.5.8.2 Replacing spark plug connections

Check the spark plug wires for good contact at the ignition coil pack and spark plugs. Terminal connections should be tight and fully seated. All spark plug covers and cable end boots should be in good condition and fit tightly. There should be no breaks or cracks in the insulation. Replace the wire if any of these conditions are found.

9.5.8.3 Replacing the ignition coil pack

Check for cracks, carbon tracks or corrosion on the ignition coil packs. Replace a coil pack if any of these conditions are found.

9.5.9 Batteries

Batteries require attention at all times, even when not working. A battery will not last if it is neglected. When the GenSet use is infrequent, the utility-powered or solar-powered battery charger must be connected to ensure the batteries remain charged. Never allow a battery to become completely flat (fully discharged), or to stand in a discharged condition, or damage will result.

IMPORTANT: *The battery charger must be connected to a power source that is protected by a ground fault circuit interrupter (GFCI).*

Maintenance

Handling and proper use of batteries is not hazardous if the correct precautions are observed and personnel are trained in their use:

- Use proper PPE. Do not wear jewelry. Remove any conductive items from pockets. These items can fall into equipment and result in a short circuit, which can cause shock or burning. Refer to local standards for PPE details (in the U.S, see NFPA 70).
- Keep batteries upright to prevent spillage. Electrolyte is a dilute sulphuric acid that is harmful to the skin and eyes.
- Use tools with insulated handles to prevent the risk of electric shock.
- Keep the battery, and the battery area, clean and dry. If fitted, ensure that the vent caps are securely screwed down, or pushed home.
- To avoid contamination of the battery, only clean it when the vent plugs (if fitted) are in place.
- Keep the battery terminals and connections free from corrosion by lightly coating them with petroleum jelly.
- Make sure each battery is secured to prevent movement.
- Before disconnecting a battery, isolate the utility-powered or solar-powered battery charger.
- To disconnect the battery, use an insulated wrench to disconnect the negative cable first.
- To connect the battery, use an insulated wrench to connect the negative cable last

WARNING

A battery presents a risk of electrical shock and high short circuit current. The following precautions are to be observed when working on batteries:

- **Remove watches, rings, or other metal objects.**
- **Use tools with insulated handles.**
- **Wear rubber gloves and boots.**

- **Do not lay tools or metal parts on top of batteries.**
- **Disconnect the charging source prior to connecting or disconnecting battery terminals.**
- **Determine if the battery is inadvertently grounded. When inadvertently grounded, remove the source of the ground. Contact with any part of a grounded battery is capable of resulting in electrical shock. The risk of such shock is reduced when such grounds are removed during installation and maintenance (applicable to a generator not having a grounded supply circuit).**

WARNING

Only personnel knowledgeable of batteries and the required precautions may service batteries. Keep unauthorized personnel away from batteries.

DANGER

Lead-acid batteries present a risk of fire because they generate hydrogen gas. Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

CAUTION

Ventilate battery area before working on or near battery. Wear goggles. Press the Emergency Stop button and disconnect the charger before disconnecting battery cables. Disconnect the negative (-) cable first and reconnect last.

CAUTION

Disconnect the battery charger from the AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes that could damage the DC control circuits of the set.

To prevent dangerous arcing, always depress the **Emergency Stop** button and then disconnect the

negative ground cable from the battery before working on any part of the electrical system or the engine.

9.5.9.1 Cleaning the batteries

▲ WARNING

Do not open or mutilate the battery or batteries. Released electrolyte is a dilute sulfuric acid that is harmful to the skin and eyes. Do not get the substance in your eyes or contact with skin. Wear goggles and protective clothing, rubber gloves, and apron when servicing batteries.

To properly clean the batteries:

1. Keep the batteries clean by wiping them with a damp cloth whenever dirt appears excessive.
2. If corrosion is present around the terminal connections, remove battery cables and wash the terminals with a solution consisting of 4 oz. (113 g) of baking soda added to 1 quart (.94 Liter) of water. (This solution is also used for removing spilled electrolyte.)
3. Be sure the vent plugs are tight to prevent the cleaning solution from entering the cells.
4. After cleaning, flush the outside of the battery and surrounding areas with clean water.
5. Keep the battery terminals clean and tight. After making the connections, coat the terminals with a light application of petroleum jelly or non-conductive grease to retard corrosion.
6. After cleaning, make sure the battery and surrounding areas are dry.

9.5.9.2 Performing a specific gravity inspection (not applicable for maintenance-free batteries)

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell:

1. Hold the hydrometer vertically and take the reading.
2. Correct the reading by adding four gravity points (0.004) for every ten degrees the electrolyte temperature is above 27 °C (80 °F). A fully charged battery will have a corrected specific gravity of 1.245.

3. Charge the battery, if the reading is below 1.200.

9.5.9.3 Inspecting the electrolyte level

▲ CAUTION

Do not add water in freezing weather unless the engine will run long enough (two to three hours) to assure a thorough mixing of water and electrolyte.

Check the level of the electrolyte (acid and water solution) in the batteries at least every 200 hours of operation.

If necessary, fill the battery cells to the bottom of the filler neck with distilled water and recharge. If one cell is low, check the case for leaks. Keep the battery case clean and dry. An accumulation of moisture will lead to a more rapid discharge and battery failure.

▲ WARNING

The electrolyte is a dilute sulfuric acid that is harmful to the skin and eyes. It is electrically conductive and corrosive.

The following safety precautions are to be observed when replacing or replenishing electrolyte solution in the batteries:

- **Wear full eye protection and protective clothing.**
- **Where electrolyte contacts the skin, wash it off immediately with water.**
- **Where electrolyte contacts the eyes, flush thoroughly and immediately with water and seek medical attention.**
- **Spilled electrolyte is to be washed down with an acid neutralizing agent. A common practice is to use a solution of 500 grams (1 lb) bicarbonate of soda to 4 liters (1 gallon) of water. The bicarbonate of soda solution is to be added until the evidence of reaction (foaming) has ceased. The resulting liquid is to be flushed with water and the area dried.**

9.5.9.4 Replacing a battery

Always replace the starting battery with the same number and type (vented, lead acid, maintenance-free, Ni-Cad) of battery. Properly dispose of the

Maintenance

expired battery in accordance with local environmental agency requirements.

WARNING

Electrolyte or explosion of battery can cause severe personal injury or death. Do not burn the battery in a fire for disposal. Do not open or mutilate batteries. Damage to the battery case will release electrolyte which is harmful to the skin and eyes and is also toxic. Burning of a battery may cause an explosion.

NOTE: *Nickel-cadmium (Ni-Cad) battery systems are often required in extreme high or low ambient temperatures because their performance is less affected by temperature extremes than that of lead-acid batteries. Ni-Cad batteries require special battery chargers in order to bring them to the full-charge level. These chargers must be provided with a filter to reduce "charge ripple" which can disrupt the engine and GenSet control systems.*

IMPORTANT: *The battery charger must be connected to a power source that is protected by a ground fault circuit interrupter (GFCI).*

9.5.10 Fuel system

9.5.10.1 Purging the coalescing filter

The GenSet may be equipped with a coalescing filter for the natural gas fuel supply to protect the engine from wet-fuel sources.

The coalescing filter is self-purging and will drain to a remote waste water tank in the same forward compartment as the filter. This drain tank should be checked daily until a suitable drain schedule can be determined. Both the tank and coalescing filters are equipped with water level switches that will shut the unit down should the liquid level get too high. The waste water tank is capable of holding approximately 10 gallons.

Drain water and sediment more often than scheduled if fuel quality is poor or condensation cannot be avoided. Dispose of the water, sediment and fuel drained off in accordance with local environmental regulations. Refer to the engine Operation and Maintenance manual for detailed instructions.

CAUTION

The waste water tank is not under pressure, but the coalescing filter can drain automatically at any time while fuel supply pressure is present, even if the unit is off.

CAUTION

Purging the coalescing filter completely of water will allow the supply fuel to pass into the waste water tank. If purging the coalescing filter manually, observe the site glass to retain some water in the filter housing.

To purge the coalescing filter:

1. Ensure the GenSet is off.
2. Press the **Emergency Stop** button.
3. Turn off the DC disconnect switch, if applicable.
4. Shut the fuel valves for both natural gas and propane vapor.
5. Locate the waste water drain on the right side of the frame.
6. Attach a drain line to the frame bulkhead fitting and run to a suitable container.
7. Open the drain valve on the inboard side of the frame rail.
8. Drain the waste water tank fully.
9. Shut the drain valve.
10. Remove the drain line and container. Waste water must be disposed of in accordance with local environmental guidelines.
11. Connect the starting batteries.
12. Turn DC disconnect switch (if applicable) to the **ON** position.
13. Pull out the **Emergency Stop** button.
14. Open fuel supply valves.
15. Resume operation.



NOTE: Depending on the amount of fluid drained, priming of the fuel system may be required to prevent hard starting.

9.5.10.2 Changing the coalescing filter

1. Ensure the engine is off.
2. Press the **Emergency Stop** on the GenSet.
3. Turn off the DC disconnect switch, if applicable.
4. Shut the fuel valves for both natural gas and propane vapor.
5. Clean the area around the fuel filters to prevent debris from entering the fuel system
6. Dispose of used fuel filters in accordance with local environmental guidelines.
7. Connect the starting batteries.
8. Turn DC disconnect switch (if applicable) to the **ON** position.
9. Pull out the **Emergency Stop** button.

9.5.10.3 Inspecting the hoses and fuel lines

With the GenSet operating, visually inspect the fuel lines, filters, and fittings for leaks. Check any flexible sections for cuts, cracks and abrasions and ensure they are not rubbing against anything that could cause breakage. If any leaks are detected, shut down the GenSet. Contact your authorized distributor and have the leaks corrected immediately

9.6 Out-of-service maintenance

When the GenSet will be stored or removed from operation for an extended period of time, preventative maintenance must be performed to avoid rust accumulation, corrosion of bearing surfaces within the engine, and gum formation in the fuel system. To prepare the GenSet for storage, be sure to do the following:

1. Start the GenSet and run the engine until it reaches the correct operating temperature.
2. Shut down the engine.
3. Depress the **Emergency Stop** button.
4. Turn off and disconnect the battery charger (if equipped).

5. Disconnect the battery (negative [-] first) and store the battery in a cool, dry place. Connect the battery to the charger every 30 days to maintain it at full charge.
6. Drain the engine oil while still warm and refill with new oil recommended for the GenSet. Attach a tag indicating the type of oil used.
7. Remove the spark plugs and pour two ounces of rust preventative oil into each spark plug opening. Barr engine over to complete three to four rotations of the crank shaft to distribute the oil on the cylinder walls and then reinstall the spark plugs.
8. Disconnect the engine coolant heater from the power source (if equipped).
9. Drain the cooling system, including the engine block.
10. Remove the air cleaner and seal off the carburetor air inlet opening and PVC hose.
11. Plug the exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
12. Disconnect the oil pan heater from the power source (if equipped).
13. Clean and wipe the entire unit. Coat parts susceptible to rust with a light coat of oil.
14. Cover the entire GenSet loosely after the engine has cooled down.

9.7 Returning the GenSet to service preparation

NOTE: Always wear protective clothing and goggles before starting GenSet.

1. Remove the protective cover.
2. Remove the exhaust plugs, as well as the seal from the carburetor and the PVC hose.
3. Replace the air cleaner.
4. Check the oil dipstick to make sure the crankcase is full.
5. Refill the cooling system per model specifications provided with the unit. (See model-specific engine manual or specification sheet for model specification information.)

Maintenance

6. Reconnect the battery (positive [+] cable first) and check the specific gravity.
7. Connect the battery charger (if applicable).
- IMPORTANT:** *The battery charger must be connected to a power source that is protected by a ground fault circuit interrupter (GFCI).*
8. Connect the oil pan heater and engine coolant heater to the power supply (if equipped).
9. Turn DC disconnect switch (if applicable) to the **ON** position.
10. Pull out the **Emergency Stop** button.
11. Remove all loads before starting the GenSet.
12. Start the GenSet and apply a load of at least 50% of the nameplate rating (see [Figure 2-1 GenSet nameplate \(typical\)](#)).
13. Check the display for normal readings. The GenSet is now ready for service.



Section 10 - Troubleshooting

10.1 Introduction

This section outlines basic troubleshooting measures for remedying generator set (GenSet) operational issues. For detailed instructions to assist in locating and identifying the possible causes of faults in the GenSet, refer to the specific PCC manual. Refer also to the engine-specific operator manual for engine specifications.

10.2 Basic troubleshooting and safety considerations

10.2.1 Accidental restart prevention

Before any work is carried out for significant maintenance, the GenSet must be immobilized. If a GenSet is paralleled with others, all GenSets being paralleled must be immobilized before any work is performed on any one of them. Even if the GenSet(s) is put out of service by pressing the **Stop** button on the Operator Panel, the GenSet(s) cannot be considered safe to work on until the engine(s) are properly immobilized.

To immobilize the engine:

1. Press the **Stop** button on the Operator Panel to shut down the GenSet.
2. Press the **Emergency Stop** button. This will prevent the GenSet from starting, regardless of the start signal source, and will provide an additional safety step for immobilizing the GenSet.

NOTE: When the **Emergency Stop** button is pressed, the Operator Panel will indicate the shutdown condition by illuminating the red Shutdown status lamp and displaying a message on the graphical display.

3. Disconnect all component heaters, as applicable, and the battery charger from the external power supply.

CAUTION

Disconnect battery charger from AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes

which are damaging to DC control circuits of the GenSet.

4. Disconnect the starting batteries. Disconnect the negative (-) cable first, using an insulated wrench.

WARNING

Accidental starting of the GenSet can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.

5. Lock the cables (with a padlock) to prevent reconnection during maintenance.
6. Place warning notice - "GenSet immobilized for safe working conditions" - at the Operator Panel to indicate that maintenance is in progress.

WARNING

Failure to properly immobilize all connected GenSets in a paralleling application before working on any one of them could cause severe personal injury. Never work on one paralleled GenSet without first immobilizing all connected GenSets.

DANGER

Contacting high voltage components can cause electrocution, resulting in severe personal injury or death. Keep the output box covers in place during troubleshooting.

WARNING

Lead-acid batteries present a risk of fire because they generate hydrogen gas. Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switches, or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching bat-

Troubleshooting

teries by first touching a grounded metal surface.

Ventilate battery area before working on or near battery. Wear goggles. Stop the GenSet and disconnect the battery charger before disconnecting the battery cables. Disconnect the negative (-) cable first and reconnect last.

10.2.2 General troubleshooting

Before starting any fault finding actions, perform the following general inspections:

- Ensure that all switches and controls are in their correct positions.
- Check for adequate fuel.
- Check for adequate lubricating oil.
- Correct the coolant level.
- Ensure that the area around the radiator and the radiator core are free from obstruction.
- Check for adequate battery charge.
- Secure the battery connections.
- Secure the electronics and alternator connections.
- Secure the panel connections.
- Ensure that the protection circuits have been replaced.
- Ensure that blown fuses have been replaced.
- Reset any tripped contactors or circuit breakers.

10.3 Line circuit breaker issues

The optional line circuit breaker mounts in the generator output box. If the load exceeds the circuit breaker rating, the line circuit breaker will open, preventing the generator from being overloaded. If the circuit breakers trip, locate the source of the overload and correct as necessary. Manually reset the breaker to reconnect the load to the GenSet.

Validate that the bus rotation is clock-wise “A, B, C”.

10.4 Controls and diagnostics issues

See your authorized Cummins dealer regarding software, hardware and/or network requirements for control and diagnostics via computer or network.

10.5 Operator panel indicator lamps

The Operator Panel digital display on the front of the GenSet includes Indicator Lamps that illuminate when necessary. These Indicator Lamps do not illuminate if they are not called by the GenSet PCC.

When the **Lamp Test** button (the light-bulb icon) is depressed, all of the LED lamps should illuminate for five seconds indicating that all warning indicators are working properly. The **Warning** LED illuminates a yellow lamp whenever the PCC detects a condition in the operation of the GenSet that warrants attention. This lamp is automatically shut off when the problematic condition no longer exists.

10.6 Fault codes

The PCC continuously monitors engine sensors for abnormal conditions, such as low oil pressure and high coolant temperature. If any of these conditions occur, the Operator Panel will illuminate the **Warning Indicator Lamp** (yellow) and display a **Fault Code** on the digital display.

Should a fault condition occur during operation, consult the PCC Manual to locate and correct the problem. Fault codes generally require an authorized service representative to correct the fault.

WARNING

Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures.

Faults must be acknowledged after the fault has been corrected. If the GenSet is in **Auto** or **Manual** mode, the control must first be set to **Stop** mode (off). Faults are cleared from the Operator Panel display by pressing the **Reset** button.

Faults are also acknowledged when in **Auto** mode and the remote start command is removed (remote stop signal is sent).

Faults are re-announced if they are detected again after being acknowledged.

NOTE: *Some warnings remain active after the condition is corrected and the control **Reset** button is pressed. This will require the GenSet to be shutdown to reset the warning indicator.*

10.7 Troubleshooting tips

The following information is intended as a guide to troubleshooting some common non-technical equipment problems. Many problems can be resolved using corrective maintenance, adjustment, or minor repair. Refer to the vendor-supplied literature, electrical schematics, and mechanical prints for additional information. For engine-related issues, refer to the engine Operation and Maintenance Manual or contact the Cummins Customer Assistance Center at 1-866-831-7620.

WARNING

*The status checks should be performed **ONLY** by a qualified technician. Contact with exposed electrical components could cause extreme personal injury or death.*

WARNING

*Before equipment operation, **ALL** guards, covers, and protective devices **MUST BE** in place and securely fastened. Serious personal injury could result from contact with exposed or moving components.*

CAUTION

***AVOID** servicing complex components such as: printed circuit boards, programmable controllers and Electronic Control Modules (ECMs) not specifically authorized by Cummins. Contact your local Cummins distributor before performing any extensive maintenance. In the United States or Canada, call 1-800-888-6626 (this automated service utilizes touch-tone phones only). By selecting Option 1 (press 1), you will be automatically connected to the nearest distributor.*

WARNING

Never climb or stand on the equipment frame, guards, or enclosures. Contact with exposed or moving components can cause personal injury or equipment damage.

Troubleshooting

10.7.1 Engine will not start

POSSIBLE CAUSE	SOLUTION
<p>Low battery voltage.</p> <p>Low gas pressure.</p>	<p>Crank voltage must be above 19 volts.</p> <p>Reset the low fuel switch to propane lockout. This must be done each time the gas utility is restored.</p> <p>Check the gas pressure on the utility side of the gas regulator.</p> <p>Have the gas regulator tested by the gas company.</p> <p>Have the gas company turn on the gas.</p> <p>For Cummins engines, verify that there is 16-20 inches of water pressure at the engine solenoid. For PSI engines, verify that there is 7-11 inches of water pressure at the engine solenoid. If not, check for gas pressure on the utility side of the gas regulator.</p> <p>Check if the gas is turned off.</p>
No voltage at the gas solenoid.	<p>Check for 12 or 24 volts to the gas solenoid. If no voltage is present, troubleshoot the gas solenoid.</p> <p>Test the gauge panel for no voltage to the gas solenoid.</p>
Low WC after the gas demand regulator.	<p>For Cummins engines, verify that there is 5 inches of WC downstream from the engine mounted gas regulator while the engine is cranking. For PSI engines, verify that there is 7 inches of WC downstream from the engine mounted gas regulator while the engine is cranking.</p> <p>Check if the vent is blocked and clear the blockage.</p> <p>Check the regulator diaphragm for leaks.</p>
Air cleaner is plugged or restricted.	<p>Check the piping and inlet for restriction.</p> <p>Change the air filter.</p>
Governor actuator not opening.	<p>Check if there is switched battery voltage at the governor controller. If no voltage, test the gauge panel for switched battery voltage.</p> <p>If switched battery voltage is present at the governor controller, check for magnetic pickup voltage of at least 2.5 A/C volts.</p> <p>If no magnetic pickup voltage, check the magnetic pickup adjustment to the flywheel is 1/2 to 3/4 turn out from the flywheel.</p> <p>Check for a pulse-width modulation (PWM) signal to the actuator while the engine is cranking.</p> <p>Readjust or replace the magnetic pickup, as necessary.</p> <p>Troubleshoot the actuator using the control panel drawing for that engine model.</p> <p>Check the harness from the actuator to the controller.</p> <p>Replace the actuator harness, if necessary.</p> <p>Replace the governor actuator, if necessary.</p>
No spark.	<p>Check if the timing mark is in the window on the Altronic® magneto.</p> <p>Remove the Altronic® magneto and check the coupler. Replace the coupler, as necessary.</p> <p>Check the CD2000 ignition module. If the red Indicator LED is illuminated (but not flashing), then it is powered. A flashing red Indicator will indicate a fault condition. Refer to the CD2000 manual to troubleshoot this issue.</p> <p>Check the engine for mechanical problems.</p> <p>Check for voltage to the ignition coils.</p> <p>Test the ignition harness. Replace, as necessary.</p> <p>Test the ignition coils. Replace, as necessary.</p> <p>Test the spark plug wires. Remove the spark plugs and check for fouling. Replace bad spark plugs, as necessary.</p>



Altronic® magneto timed to engine incorrectly.	Time the Altronic® magneto to the engine per the service manual.
	Check the engine for mechanical problems.

10.7.2 Engine will not pull load

POSSIBLE CAUSE	SOLUTION
Engine is running rough.	<p>Check the engine for misfiring.</p> <p>Check the engine timing and adjust it to specification.</p> <p>Check the spark plugs. Replace bad spark plugs.</p> <p>Test the spark plug wires. Replace bad spark plug wires.</p> <p>Test the ignition coils. Replace bad ignition coils.</p> <p>Test the ignition wiring from the ignition module to the coils. Replace a bad ignition harness.</p> <p>Check the gas mixture.</p> <p>Check the magnetic pickup.</p> <p>Test the ignition module. Replace a bad ignition module.</p> <p>Check the air filter for restriction. Replace the air filter, as necessary.</p>
Gas pressure dropping off at the inlet side of the utility gas regulator.	<p>Have utility check the gas pressure volume.</p> <p>Check that the gas pressure to the engine gas regulator is at specification. Adjust, as necessary.</p>
No gas pressure at the outlet side of the engine gas regulator.	Test the engine-mounted gas regulator.
Turbo boost is not within specifications.	<p>Check the intake system for air leaks or restrictions. Repair any leak or restriction.</p> <p>Replace the turbo, as necessary.</p>
Governor is not operating properly.	<p>Check the engine for mechanical problems.</p> <p>Check the PWM converter, if used.</p> <p>Validate the PWM from the PCC output.</p>

10.7.3 Failure of emissions certification

(model-specific)

POSSIBLE CAUSE	SOLUTION
Gill AFR Controller Center Lamp Not Illuminated	The valve control may be in Open Loop mode.
	The Lambda Sensor Temperature may be out of range.
	The valve position may be out of range.
	The O ₂ sensor has failed.

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Section 11 - Parts and specifications

11.1 Introduction

This section provides information for ordering parts, routine and emergency service contacts, recommended spare parts inventory, and general GenSet specifications for drive belt tension, cap screw markings and torque values, and battery replacement.

11.2 Ordering replacement parts

Replacement parts for the Cummins equipment are manufactured to the same quality standards and specifications as the original equipment. Unapproved substitution may result in poor performance, reduced service life, lost production, or unsafe operation.

Cummins relies on the best and most cost-effective shipping methods, unless specific instructions or requirements are requested by the customer. When ordering parts, please refer to the GenSet nameplate (see [Figure 2-1](#)) and be prepared to provide the following information:

- Model and serial number.
- Part description by name or number.
- Quantity required.
- Purchase order number.

NOTE: *A purchase order number is desirable, even if the part(s) are supplied on a Returned Goods Authorization (RGA) issue number. A purchase order number helps Cummins Sales and Service and its customers track the parts and necessary credits.*

11.3 Routine service

Personnel at Cummins Authorized Repair Locations can assist you with the correct operation and service of your engine. Cummins has a worldwide service network of more than 5,000 distributors and dealers who have been trained to provide sound advice, expert service, and complete parts support.

Check the telephone directory yellow pages or refer to [Section 2.2 How To Obtain Service](#) for the nearest Cummins Authorized Repair Location.

11.4 Emergency repairs and technical service

The Cummins, Inc. Customer Assistance Center provides a 24-hour, toll-free telephone number to aid in technical and emergency service when a Cummins Authorized Repair Location cannot be reached or is unable to resolve an issue with a Cummins product.

If assistance is required, call toll-free: 1-800-CUMMINS (1-800-286-6467) for all 50 states, Bermuda, Puerto Rico, the Virgin Islands, and the Bahamas.

Outside of North America, contact your Regional Office. Telephone numbers and addresses are listed in the International Directory on the Cummins website at: cummins.com.

11.5 Recommended spare parts inventory

To minimize downtime and increase productivity, Cummins, Inc. recommends maintaining a stock of spare parts critical to uninterrupted engine operation. Shipping costs can be lower using ground transportation rather than overnight or next day air freight. For this reason, Cummins can provide a list of recommended spare parts. Contact the Cummins Authorized Repair Location for additional information.

11.6 Specifications

For model specific information, see the specification data sheet provided with the GenSet. You can also view the specification data sheet by visiting our website at: cummins.com.

The following tables provide recommendations for drive belt tension; cap screw markings and torque values; and general model specifications.



Parts and specifications

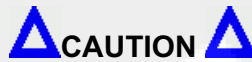
Table 11-1. Drive belt tension

SAE belt size	Belt tension new		Belt tension range used	
	N	lbf	N	lbf
0.380 in	620	140	270 to 490	60 to 110
0.440 in	620	140	270 to 490	60 to 110
1/2 in	620	140	270 to 490	60 to 110
11/16 in	620	140	270 to 490	60 to 110
3/4 in	620	140	270 to 490	60 to 110
7/8 in	620	140	270 to 490	60 to 110
4 rib	620	140	270 to 490	60 to 110
5 rib	670	150	270 to 530	60 to 120
6 rib	710	160	290 to 580	65 to 130
8 rib	890	200	360 to 710	80 to 160
10 rib	1110	250	440 to 890	100 to 200
12 rib	1330	300	530 to 1070	120 to 240
12 rib K section	1330	300	890 to 1070	200 to 240
31 rib	1668	375	1330 to 1560	300 to 350



Figure 11-1 Cap screw markings and torque values

Cap Screw Markings and Torque Values



Always use a cap screw of the same measurement and strength as the cap screw being replaced. Using the wrong cap screws can result in engine damage.

Always use the torque values listed in the following tables when specific torque values are not available.

When the ft-lb value is less than 10, convert the ft-lb value to in-lb to obtain a better torque with an in-lb torque wrench. Example: 6 ft-lb equals 72 in-lb.

Metric Cap Screw Identification

Sample:	M8-1.25 x 25		
Value:	M8	1.25	X 25
Meaning:	Major thread diameter in millimeters	Distance between threads in millimeters	Length in millimeters

Metric Cap Screw Head Markings

Metric cap screws and nuts are identified by the grade number stamped on the head of the cap screw or on the surface of the nuts.

Commercial Steel Class	8.8	10.9	12.9
Caps Screw Head Markings			

US Customary Cap Screw Identification

Sample:	5/16 x 18 x 1-1/2		
Value:	5/16	18	1-1/2
Meaning:	Major thread diameter in inches	Number of threads per inch	Length in inches

U.S. Customary Cap Screw Head Markings

U.S. Customary cap screws are identified by radial lines stamped on the head of the cap screw.

SAE Grade 5 w/ three lines	SAE Grade 8



Parts and specifications

Figure 11-2 Cap screw torque values

Metric Cap Screw Torque Values (lubricated threads)

Class:	8.8				10.9				12.9			
Diameter	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
mm	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	13	10	7	4	14	9	7	4
7	14	9	11	7	18	14	11	7	23	18	11	7
8	23	17	18	14	33	25	18	14	40	29	18	14
10	45	33	30	25	65	50	30	25	70	50	30	25
12	80	60	55	40	115	85	55	40	125	95	55	40
14	125	90	90	65	180	133	90	65	195	145	90	65
16	195	140	140	100	280	200	140	100	290	210	140	100
18	280	200	180	135	390	285	180	135	400	290	180	135
20	400	290	—	—	550	400	—	—	—	—	—	—

U.S. Customary Cap Screw Torque Values (lubricated threads)

Grade:	SAE Grade 5				SAE Grade 8			
Cap Screw Body Size	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4-20	9	7	8	6	15	11	8	6
1/4-28	12	9	9	7	18	13	9	7
5/16-18	20	15	16	12	30	22	16	12
5/16-24	23	17	19	14	33	24	19	14
3/8-16	40	30	25	20	55	40	25	20
3/8-24	40	30	35	25	60	45	35	25
7/16-14	60	45	45	35	90	65	45	35
7/16-20	65	50	55	40	95	70	55	40
1/2-13	95	70	75	55	130	95	75	55
1/2-20	100	75	80	60	150	110	80	60
9/16-12	135	100	110	80	190	140	110	80
9/16-18	150	110	115	85	210	155	115	85
5/8-11	180	135	150	110	255	190	150	110
5/8-18	210	155	160	120	290	215	160	120
3/4-10	325	240	255	190	460	340	255	190
3/4-16	365	270	285	210	515	380	285	210
7/8-9	490	360	380	280	745	550	380	280
7/8-14	530	390	420	310	825	610	420	310
1-8	720	530	570	420	1100	820	570	420
1-14	800	590	650	480	1200	890	650	480





Section 12 - Wiring diagrams

12.1 Wiring diagrams - electronic engines

Drawing Title	Drawing No.
Schematic, controls interface GTA855E engine	A042H078
Schematic, controls interface KTA19SLB engine	A042H074
Schematic, controls interface GTA855E and KTA19 EICS engines	A059H093
Schematic, controls interface QSK19G MOH engine	A042D408
Schematic, controls interface GTA38E and GTA50E engines	A042F753
Schematic, overall PSI engine models - PCC1302	22726
Schematic, overall PSI engine models - PCC3300	A060R187

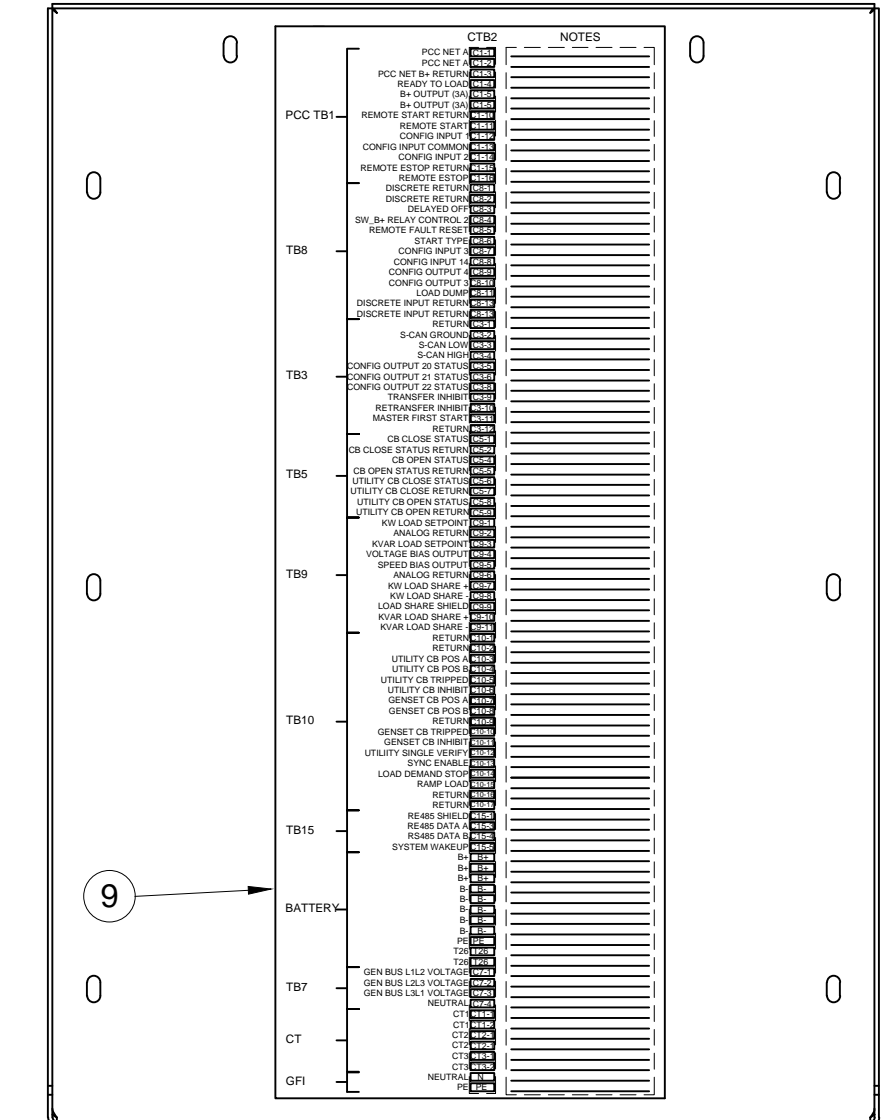
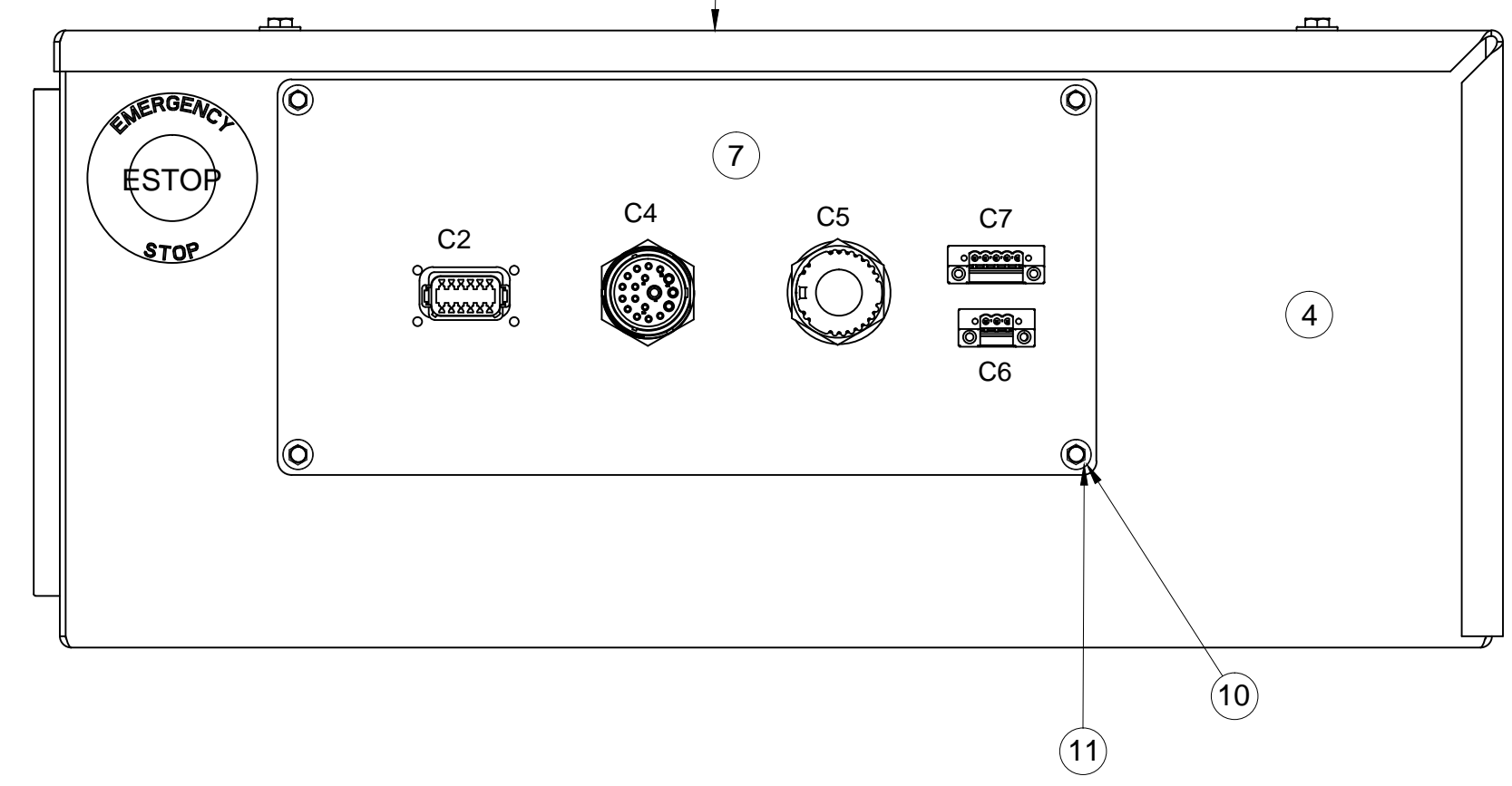
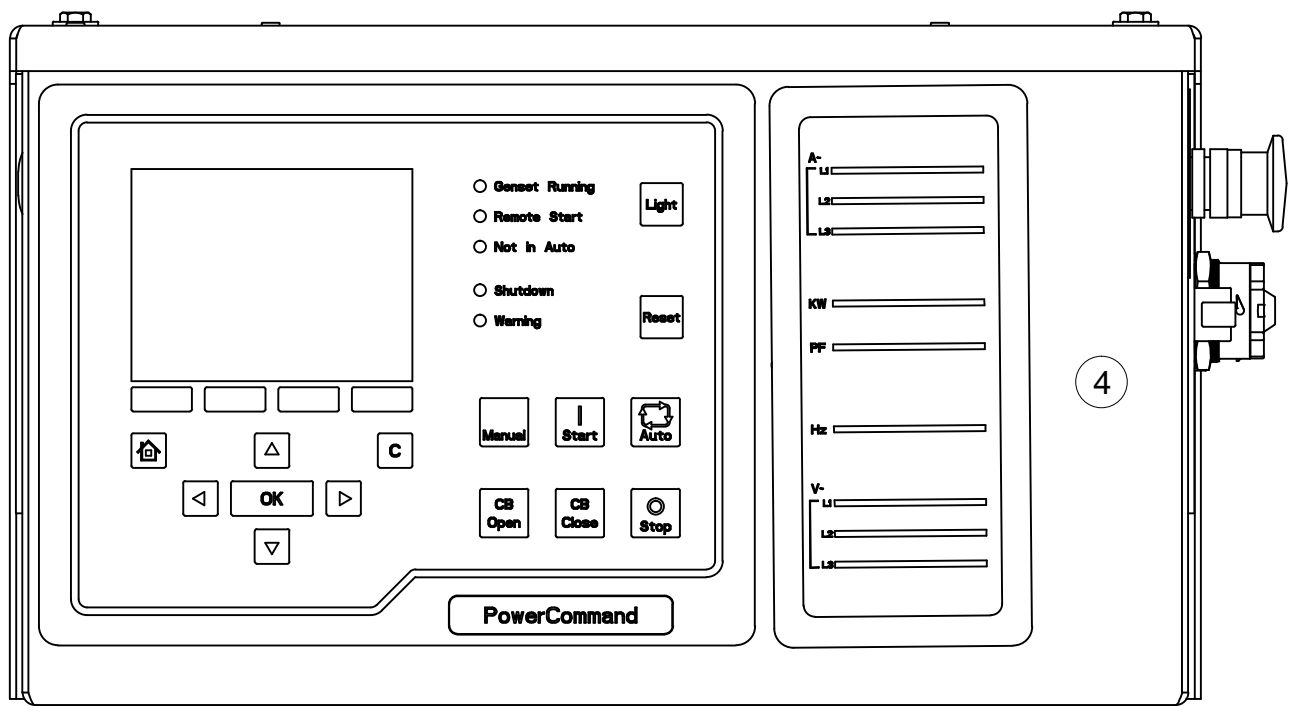
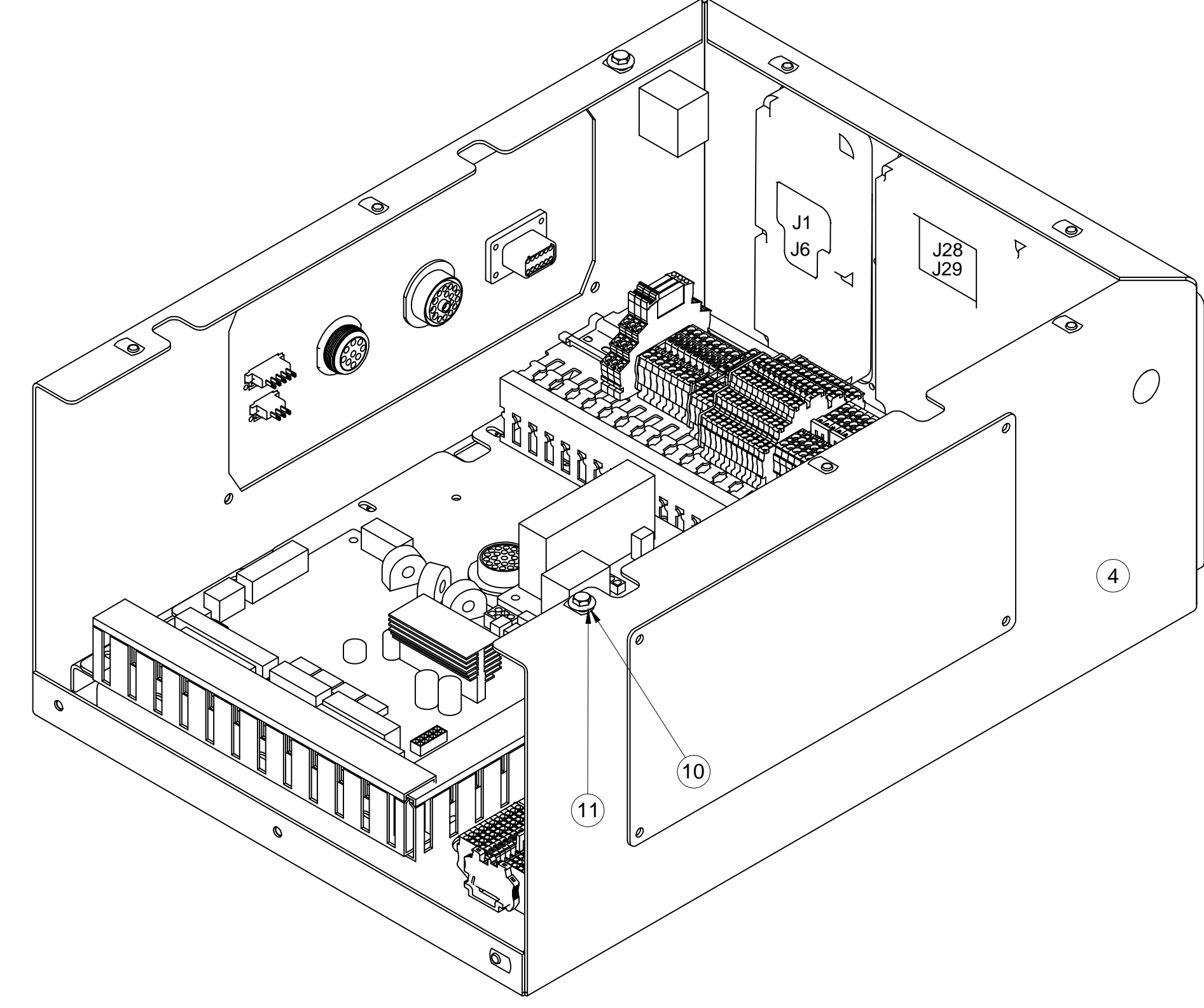
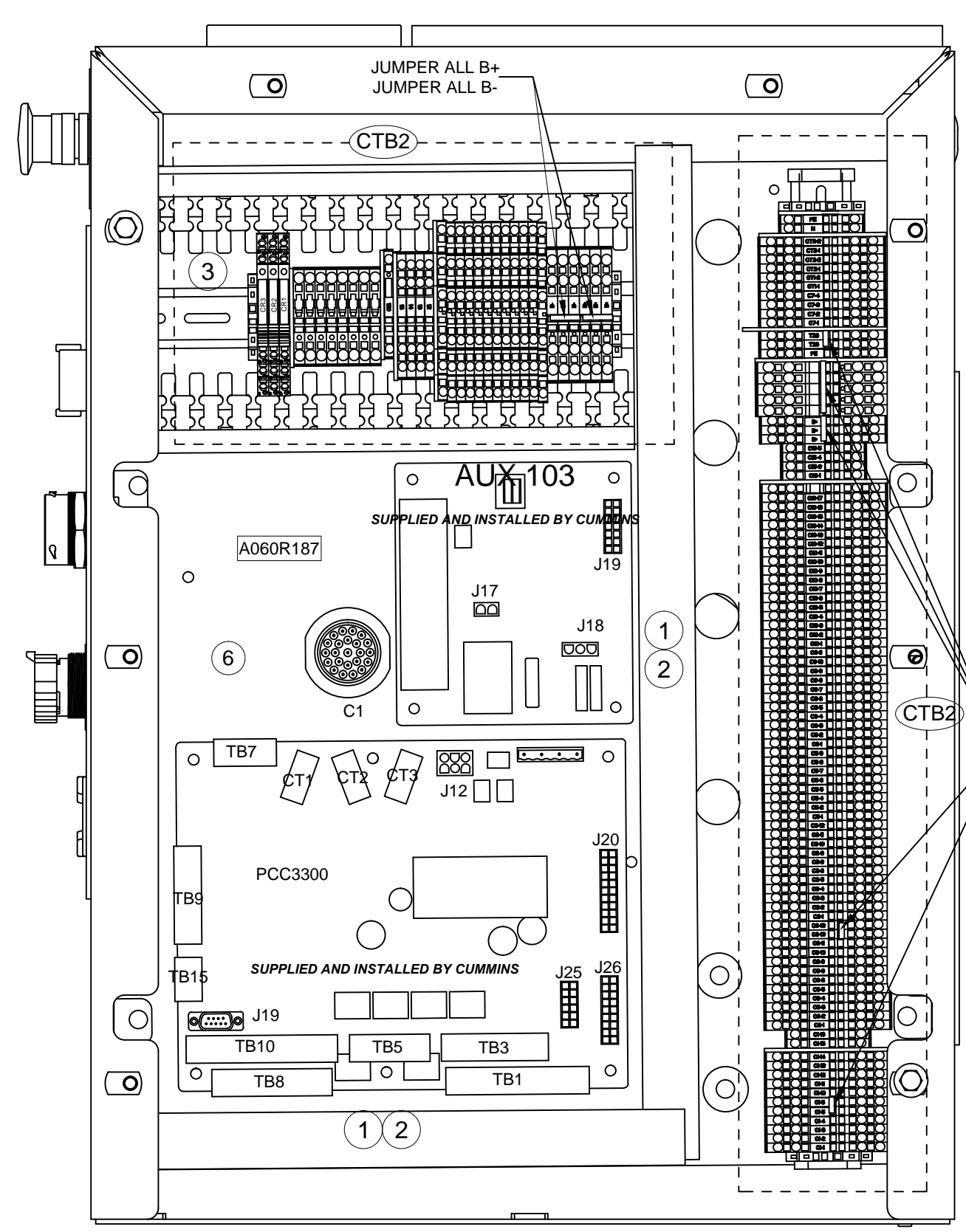
12.2 Wiring diagrams - hydro-mechanical engines

Drawing Title	Drawing No.
Schematic, controls interface G855GC and GTA 855GC engines	A042D412
Schematic, controls interface GTA855 and KTA19GC engines	A042H089
Schematic, controls interface GTA28 engine	A042H084
Schematic, controls interface GTA38 and GTA50 engines	A042H086

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REV	REL NO	REVISION	DWN	CKD	APVD	DATE
-	2018-372	RELEASED TO PRODUCTION	OP610	HV937	HV937	09JUL2018



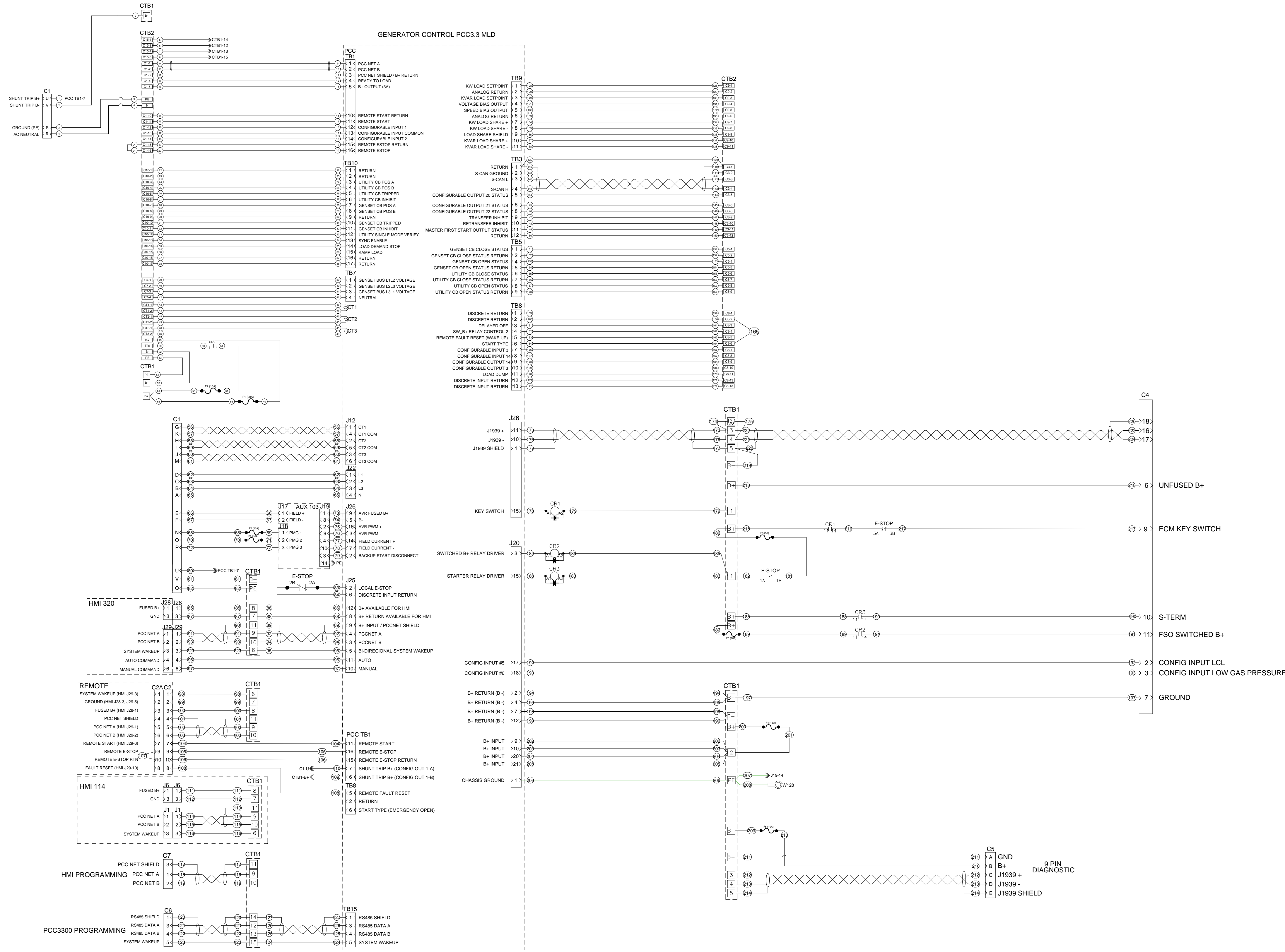
- NOTES:
- CONNECTORS PCC3300 AND THE AUX103 SHALL LAND IN THEIR RESPECTIVE ENCLOSURE OPENING AND CONNECTED TO DEVICES AT CUMMINS.
 - ALL LEADS/WIRES SHALL BE MARKED A MAXIMUM OF 2" FROM EACH END SO THAT THE STAMP IN THE FROM-TO LIST IS LEGIBLE FOR CIRCUITS LABELED "W".
 - ALL WIRE MUST BE UL LISTED AND RATED FOR 600V.
 - CONNECTORS C6 & C7 NEED TO HAVE SLOT SEALED WITH RTV SILICONE.
 - ANY OPENINGS IN BOX NOT WELDED NEED TO BE SEALED WITH RTV SILICONE.
 - ITEM 14 USED TO HOLD PANEL IN BOX.
 - USE 4 WASHER AND BOLTS PER COVER FOR SHIPPING.
 - ALL HARDWARE TO BE GRADE 5 ZINC PLATED.

- MANUFACTURING NOTES:
- PCC, HMI AND AUX103 ARE SHIPPED LOOSE FOR INSTALLATION
 - CT WIRES TO RUN THRU CT ON BOARD FOLLOWING ARROW ON CT

TAGS	QTY	CATALOG	MFG	DESCRIPTION
DN	2	0801733	PHOENIX CONTACT	DIN RAIL, PERFORATED, NS 35/7.5 PERF 2000mm
B+ B-	3	1051003	PHOENIX CONTACT	MARKER, TERMINAL, 6.2mm, ZB 6
PE	1	3210525	PHOENIX CONTACT	TERMINAL FEED THROUGH, 4 POSITION, PT2.5
1-11	11	3210512	PHOENIX CONTACT	TERMINAL FEED THROUGH, 6 POSITION, PT2.5
12-15	4	3209778	PHOENIX CONTACT	TERMINAL FEED THROUGH, 4 POSITION, 30A, PT2.5 QUATTRO
120	1	3030184	PHOENIX CONTACT	COVER, END, D-ST 2.5 QUATTRO
CR1-CR3	3	1051003	PHOENIX CONTACT	MARKER, TERMINAL, 6.2mm, ZB 6
F1-F8	8	46253	WAYTEK	FUSE, MINI AUTOMOTIVE 5A
29-50'	1	0801733	PHOENIX CONTACT	DIN RAIL, PERFORATED, NS 35/7.5 PERF 2000mm
CTB1	1	3030184	PHOENIX CONTACT	COVER, END, D-ST 2.5 QUATTRO
E-STOP	1	HW1B-V4F13-R	IDEC	PUSH BUTTON, EMERGENCY STOP
J6	1	1480704-0	TYCO	CONNECTOR, PLUG, 6 POSITION
J12	6	350551-1	TYCO	TERMINAL SOCKET, 20-14 AWG
J17	2	350551-1	TYCO	TERMINAL SOCKET, 20-14 AWG
J18	1	1480700-0	TYCO	CONNECTOR, PLUG, 3 POSITION
J19	1	170582-1	TYCO	PLUG, CONNECTOR, 14 POSITION
J20	16	171639-1	TYCO	TERMINAL SOCKET
J22	1	282809-4	TYCO	PLUG, TERMINAL BLOCK, 4 POSITION
J25	1	171639-1	TYCO	PLUG, CONNECTOR, 12 POSITION
J26	1	171639-1	TYCO	PLUG, CONNECTOR, 18 POSITION
J28	1	172167-1	TYCO	PLUG, CONNECTOR, 4 POSITION
J29	2	171639-1	TYCO	TERMINAL SOCKET
J28	1	171639-1	TYCO	PLUG, CONNECTOR, 15 POSITION
J29	5	171639-1	TYCO	TERMINAL SOCKET
C2	1	0460-202-1614	DEUTSCH	CONNECTOR, RECEPTACLE, KEY A, 12 POSITION
C2-A	2	0460-202-1614	DEUTSCH	TERMINAL PIN, SOLID, NICKEL, SIZE 16, 18-20 AWG
C6	1	071083	PHOENIX CONTACT	CONNECTOR, 5 POSITION, DFK-MS TB 2.5-GF
C7	1	071083	PHOENIX CONTACT	CONNECTOR, 3 POSITION, DFK-MS TB 2.5-GF
C5	3	0460-202-1614	DEUTSCH	TERMINAL PIN, GOLD, SIZE 16, 18-20 AWG
C4	1	114017	DEUTSCH	PLUG, SEALING, SIZE 12-16
C1	1	112283-90	DEUTSCH	NUT, PANEL
PCC TB1	1	378635-8	TYCO	PLUG, CONNECTOR, 16 POSITION
TB3	1	478635-6	TYCO	PLUG, CONNECTOR, 9 POSITION
TB7	1	128289-5	TYCO	PLUG, CONNECTOR, 4 POSITION
TB8	1	478635-1	TYCO	PLUG, CONNECTOR, 13 POSITION
TB9	1	478635-1	TYCO	PLUG, CONNECTOR, 11 POSITION
TB10	1	878634-4	TYCO	PLUG, CONNECTOR, 17 POSITION
J1, TB15	2	796841-6	TYCO	PLUG, CONNECTOR, 6 POSITION
W128	1	30004	WAYTEK	TERMINAL 1/4" STUD RING, 20-18
40'	1	F1X0VH6	PANDUIT	WIRE WAY 1.75 W X 2.25 T
40'	1	G1VH6	PANDUIT	COVER, DUST
12'	1	DR02L06	PANDUIT	WIRE WAY, DIN RAIL, 6.25 W X 2.15 H
4	1	A059H404	CUMMINS NPOWER	PANEL CONTROL CABINET BOTTOM PCC3300/PCC300
5	1	A042K698	CUMMINS NPOWER	PANEL CONTROL CABINET COVER PCC3300/PCC300
6	1	A059H076	CUMMINS NPOWER	PLATE, COMPONENT
7	1	A059H405	CUMMINS NPOWER	PLATE, CONNECTOR PANEL
8	1	A042B917	CUMMINS NPOWER	PLATE, OPENING
9	1	A059H463	CUMMINS NPOWER	DECAL, TERMINAL STRIP
10	16	20000-025	CUMMINS NPOWER	WASHER, FLAT, 0.25
11	16	20228-050	CUMMINS NPOWER	SCREW PHH 0.25-20X0.50
12	6	20228-050	CUMMINS NPOWER	SCREW PAN HEAD 0.25-20X0.50 ZINC PHILLIPS
13	5	2703	HEYCO	PLUG, HOLE, 0.875
AR	1	FSD77-5-D	PANDUIT	FERRULE, 18AWG
AR	1	FSD78-0-D	PANDUIT	FERRULE, 16AWG
AR	1	FSD80-0-D	PANDUIT	FERRULE, 14AWG

DIMENSIONS ARE IN INCHES
 DO NOT SCALE PRINT
 CMI DATA CLASSIFICATION
 Cummins Confidential
 SCALE 1:00
 DWN OP610
 CKD HV937
 APVD HV937
 DATE 09JUL2017
 FOR INTERPRETATION OF DIMENSIONS AND TOLERANCES, SEE ASME Y14.5-2009
 MUST CONTAIN THIS INFORMATION
 ITEM NAME
 PANEL, CONTROL
 PSI UPFIT, RIGHT PCC3300
 ITEM NUMBER
 A060R187
 ACAD SHEET
 1 OF 3

REV	REL NO	REVISION	DWN	CKD	APVD	DATE
-	2018-372	RELEASED TO PRODUCTION	OP610	HV937	HV937	09JUL2018



DIMENSIONS ARE IN INCHES [] ARE IN:	DO NOT SCALE PRINT SCALE 1.00	CMI DATA CLASSIFICATION Cummins Confidential	Cummins Inc. ITEM NAME PANEL, CONTROL PSI UPFIT, RIGHT PCC3300
DIMENSION TOLERANCES X: .0050 IN OR 2.5mm Y: .0030 IN OR 0.76mm Z: .0050 IN OR 0.127mm ANGULAR TOLERANCE: .5°		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE DRAWING PRACTICES	MUST CONFORM TO ALL TOLERANCES
DWN OP610 CKD HV937 APVD HV937 DATE 09JUL2018	ITEM NUMBER A060R187	ACAD SHEET 2 OF 3	

Table with columns: REV, REL NO, REVISION, DWN, CKD, APVD, DATE. Includes text: 2018-372 RELEASED TO PRODUCTION, OP610 HV937 HV937 09JUL2018

Main wiring diagram table with columns: CIRCUIT #, FROM CONNECTOR, POSITION, TO CONNECTOR, POSITION, WIRE DATA, WIRE TYPE, STAMP, FUNCTION, NOTES. Includes circuit details for CT1, CT2, CT3, CT4, CT5, CT6, CT7, CT8, CT9, CT10, CT11, CT12, CT13, CT14, CT15, CT16, CT17, CT18, CT19, CT20, CT21, CT22, CT23, CT24, CT25, CT26, CT27, CT28, CT29, CT30, CT31, CT32, CT33, CT34, CT35, CT36, CT37, CT38, CT39, CT40, CT41, CT42, CT43, CT44, CT45, CT46, CT47, CT48, CT49, CT50, CT51, CT52, CT53, CT54, CT55, CT56, CT57, CT58, CT59, CT60, CT61, CT62, CT63, CT64, CT65, CT66, CT67, CT68, CT69, CT70, CT71, CT72, CT73, CT74, CT75, CT76, CT77, CT78, CT79, CT80, CT81, CT82, CT83, CT84, CT85, CT86, CT87, CT88, CT89, CT90, CT91, CT92, CT93, CT94, CT95, CT96, CT97, CT98, CT99, CT100, CT101, CT102, CT103, CT104, CT105, CT106, CT107, CT108.

Continuation of the wiring diagram table, including circuit details for CT109 through CT223, covering various components like CT109 through CT223.

Technical specifications and company information including: DIMENSIONS ARE IN INCHES, DO NOT SCALE PRINT, CMI DATA CLASSIFICATION, Cummins Confidential, ITEM NAME: PANEL, CONTROL, PSI UPFIT, RIGHT PCC3300, ITEM NUMBER: A060R187, ACAD SHEET: 3 OF 3.