

SPECIFICATION

Emergency Generator System for
Search and Rescue Station Located
In Burgeo, NL

Project Number F6879-181032

PREPARED FOR

Fisheries and Oceans Canada

DATE

May 14, 2018

Revision 1




PROVINCE OF NEWFOUNDLAND AND LABRADOR

pegnl **PERMIT HOLDER**
This Permit Allows

MADERRA ENGINEERING

To practice Professional Engineering
in Newfoundland and Labrador.
Permit No. as issued by PEG Y0253
which is valid for the year 2018
by Permit Holder (MIRC No.) 02824

PROVINCE OF NEWFOUNDLAND

 **PERMIT HOLDER**
This Permit Allows

AFN ENGINEERING INC.

To practice Professional Engineering
in Newfoundland and Labrador.
Permit No. as issued by APECN E0292
which is valid for the year 2018

List of Drawings

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<u>DRAWING NO</u>	<u>TITLE</u>
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C2	Containment Curb
E1	Electrical Site Plan & Details
E2	Electrical Single Line Diagram
S1	Generator System Concrete Pad & Access Platform Pads
S2	Generator System Concrete Pad & Access Platform Sections
S3	Generator System Access Platform Sections and Details

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Appendix A: Shop Drawings of Owner Supplied Equipment

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1.1 SCOPE

- .1 The work consists of the furnishing of all plant, labour, equipment and material for emergency generator installation at the Search and Rescue facility in Burgeo, NL, in strict accordance with specifications and accompanying drawings and subject to all terms and conditions of the Contract. The generator and associated fuel tank and transfer switch will be supplied by the Owner and is to be picked-up at DFO's warehouse in Donovan's Industrial Park, Mount Pearl, by the successful Contractor and delivered to the site. The successful contractor assumes all responsibility for the loading, delivery and installation of Owner supplied equipment. Any damages to Owner supplied equipment will be replaced at the Contractor's cost. The approved shop drawings for Owner supplied equipment is attached as Appendix A.
- .2 Contractor to submit detailed work plan prior to initiating any work activities. Detailed plan to include a Sequence of Work (S.W.) outlining the procedure proposed for the reconfiguration of the existing electrical service. Where applicable, the S.W. to cover the installation of the new standby generator set, automatic transfer switch and panels along with the installation and terminations of the standby service feeder, new utility service feeder, supply feeder for new panel "DPB", transfer of branch circuits from existing panel "DPA" to new panel "DPB", and a schedule of the downtime required. In all instances, shut down of the existing systems is to be minimal and to the approval of the Departmental Representative.

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1.2 DESCRIPTION OF
WORK

- .1 In general, work under this contract consists of The work consists of:
- installing a new 150kW emergency generator and associated 72 hour capacity fuel tank (approx. 3,200 litre tank).
 - Construction of a new emergency power electrical service trench. Service trench to be completed to match surrounding terrain including provisions for new asphalt where applicable.
 - Construction of a new fenced compound for the emergency generator system, including concrete pads, chain link fencing and access steps/grating.
 - Modifications to the existing electrical room to accommodate the new work.
 - New exterior automatic transfer switch on a dedicated concrete pad.

Do not proceed with any portion of the work until the Departmental Representative has approved the Contractor's written work plan. Note that the Contractor will be responsible for engaging a Cummins manufacturer's representative to assist with commissioning and training of the system, at the installation site (all costs associated with engaging the Cummins representative will be the responsibility of the successful contractor).

1.3 SITE OF WORK

- .1 Work will be carried out at Burgeo, NL.

1.4 DATUM

- .1 If requested by the Contractor, the Departmental Representative will establish a benchmark prior to the start of work activities.

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1.5 FAMILIARIZATION
WITH SITE

- .1 Before submitting a bid, it is recommended that bidders visit the site and its surroundings to review and verify the form, nature and extent of the work, materials needed for the completion of the work, the means of access to the site, any accommodations they may require, and in general shall obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid or costs to do the work. No allowance shall be made subsequently in this connection on account of error or negligence to properly observe and determine the conditions that will apply.
- .2 Contractors, bidders or those they invite to site are to review specification Section 01 35 29.06 - Health and Safety Requirements before visiting site. Take all appropriate safety measures for any visit to site, either before or after acceptance of bid.
- .3 Obtain prior permission from the Departmental Representative before carrying out such site inspection.

1.6 CODES AND
STANDARDS

- .1 Perform work in accordance with the latest edition of the National Building Code of Canada, and any other code of provincial or local application including all amendments up to project bid closing date provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
- .2 Materials and workmanship must meet or exceed requirements of specified standards, codes and referenced documents.

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1.7 TERM ENGINEER

- .1 Unless specifically stated otherwise, the term Engineer where used in the Specifications and on the Drawings shall mean the Departmental Representative.

1.8 SETTING OUT
WORK

- .1 Set grades and layout work in detail from control points and grades established by Departmental Representative.
- .2 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated or as directed by Departmental Representative.
- .3 Provide devices needed to layout and construct work.
- .4 Supply such devices required to facilitate Departmental Representative's inspection of work.

1.9 COST BREAKDOWN

- .1 Before submitting first progress claim submit breakdown of Contract price in detail as directed by Departmental Representative and aggregating contract price.
- .2 Provide cost breakdown in same format as the numerical and subject title system used in this specification project manual and thereafter sub-divided into major work components as directed by Departmental Representative.
- .3 Upon approval by Departmental Representative, cost breakdown will be used as basis for progress payment.
- .4 This will be a lump sum project. Individual work items will not be measured separately for payment.

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1.10 WORK SCHEDULE

- .1 Submit within 7 work days of notification of acceptance of bid, a construction schedule showing commencement and completion of all work within the time stated on the Bid and Acceptance Form and the date stated in the bid acceptance letter.
- .2 Provide sufficient details in schedule to clearly illustrate entire implementation plan, depicting efficient coordination of tasks and resources, to achieve completion of work on time and permit effective monitoring of work progress in relation to established milestones.
- .3 As a minimum, work schedule to be prepared and submitted in the form of Bar (GANTT) Charts, indicating work activities, tasks and other project elements, their anticipated durations and planned dates for achieving key activities and major project milestones provided in sufficient details and supported by narratives to demonstrate a reasonable plan for completion of project within designated time. Generally Bar Charts derived from commercially available computerized project management system are preferred but not mandatory.
- .4 Submit schedule updates on a minimum bi-weekly basis and more often, when requested by Departmental Representative, due to frequent changing project conditions. Provide a narrative explanation of necessary changes and schedule revisions at each update.
- .5 The schedule, including all updates, shall be to Departmental Representative's

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approval. Take necessary measures to complete work within approved time. Do not change schedule without Departmental Representative's approval.

- .6 All work on the project will be completed within the time indicated on the Bid and Acceptance Form.

1.11 ABBREVIATIONS

- .1 Following abbreviations of standard specifications have been used in this specification and on the drawings:

CGSB - Canadian Government
Specifications Board
CSA - Canadian Standards Association
NLGA - National Lumber Grades
Authority
ASTM - American Society for Testing
and Materials

- .2 Where these abbreviations and standards are used in this project, latest edition in effect on date of bid call will be considered applicable.

1.12 SITE OPERATIONS

- .1 Arrange for sufficient space adjacent to project site for conduct of operations, storage of materials and so on. Exercise care so as not to obstruct or damage public or private property in area. All arrangements for space and access will be made by Contractor.

1.13 PROJECT MEETINGS

- .1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording minutes.
- .2 Project meetings will take place on site of work unless so directed by the Departmental Representative.

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| | .3 | Departmental Representative will assume responsibility for recording minutes of meetings and forwarding copies to all parties present at the meetings. |
| | .4 | Have a responsible member of firm present at all project meetings. |
| <u>1.14 PROTECTION</u> | .1 | Store all materials and equipment to be incorporated into work to prevent damage by any means. Note that there will be no temporary storage space available in the existing building for the Contractor. |
| | .2 | Repair or replace all materials damaged in transit or storage to the satisfaction of Departmental Representative and at no cost to Canada. |
| <u>1.15 EXISTING SERVICES</u> | .1 | Where work involves breaking into or connecting to existing services, carry out work at times directed by governing authorities, with minimum of disturbance to site operations, and tenant operations. |
| | .2 | Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings. |
| | .3 | Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of services. Provide temporary services when directed by Departmental Representative to maintain critical facility systems. |
| <u>1.16 DOCUMENTS REQUIRED</u> | .1 | Maintain at job site, one copy each of the following:
.1 Contract Drawings |

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- .2 Specifications
- .3 Addenda
- .4 Contract and any resulting amendments signed by contracting authority.
- .5 Test Reports
- .6 Copy of Approved Work Schedule
- .7 Site specific Health and Safety Plan and other safety related documents.

1.17 PERMITS

- .1 Obtain and pay for all permits, certificates and licenses as required by Municipal, Provincial, Federal and other Authorities.
- .2 Provide appropriate notifications of project to municipal and provincial inspection authorities.
- .3 Obtain compliance certificates as prescribed by legislative and regulatory provisions of municipal, provincial and federal authorities as applicable to the performance of work.
- .4 Submit to Departmental Representative, copy of application submissions and approval documents received for above referenced authorities.
- .5 Comply with all requirements, recommendations and advice by all regulatory authorities unless otherwise agreed in writing by Departmental Representative. Make requests for such deviations to these requirements sufficiently in advance of related work.

1.18 CUTTING,
FITTING AND
PATCHING

- .1 Execute cutting, including excavation, fitting and patching required to make work fit properly.

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1.19 ACCEPTANCE

- .1 Prior to the issuance of the Certificate of Substantial Performance, in company with Departmental Representative, make a check of all work. Correct all discrepancies before final inspection and acceptance.

1.20 WORKS
COORDINATION

- .1 Responsible for coordinating the work of the various trades, where the work of such trades interfaces with each other.
- .2 Convene meetings between trades whose work interfaces and ensure that they are fully aware of the areas and the extent of where interfacing is required. Provide each trade with the plans and specifications of the interfacing trade, as required, to assist them in planning and carrying out their respective work.
- .3 Canada will not be responsible for or held accountable for any extra costs incurred as a result of the failure to carry out coordination work. Disputes between the various trades as a result of their not being informed of the areas and extent of interface work shall be the sole responsibility of the General Contractor and shall be resolved at no extra cost to Canada.

1.21 CONTRACTOR'S
USE OF SITE

- .1 Responsible for arranging the storage of materials on or off site, and any materials stored at the site which interfere with any of the day to day activities at or near the site will be moved promptly at the Contractor's expense, upon request by Departmental Representative.

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1.22 WORK
COMMENCEMENT

- .2 Exercise care so as not to obstruct or damage public or private property in the area.
- .3 At completion of work, restore area to its original condition. Damage to ground and property will be repaired by Contractor. Remove all construction materials, residue, excess, etc., and leave site in a condition acceptable to Departmental Representative.
- .1 Mobilization to project site is to commence immediately after acceptance of bid and submission of Site Specific Safety Plan and insurance and bonding documentation, unless otherwise agreed by Departmental Representative.
- .2 Project work on site is to commence as soon as possible, with a continuous reasonable work force, unless otherwise agreed by Departmental Representative.
- .3 Delivery challenges, coordination with site users, and the location of the work site may require the use of longer working days and additional work force to complete the project within the specified completion time.
- .4 Make every effort to ensure that sufficient material and equipment is delivered to site at the earliest possible date after acceptance of bid and replenished as required.

PART 1 - GENERAL

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| <u>1.1 SECTION
INCLUDES</u> | .1 | Inspecting and testing by inspecting firms or testing laboratories designated by Departmental Representative. |
| | | |
| <u>1.2 RELATED
REQUIREMENTS
SPECIFIED ELSEWHERE</u> | .1 | Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under various sections. |
| | | |
| <u>1.3 APPOINTMENT
AND PAYMENT</u> | .1 | Departmental Representative will appoint and pay for services of testing laboratory except for the following:
.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
.2 Inspection and testing performed exclusively for Contractor's convenience.
.3 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.
.4 Tests requested by Departmental Representative to confirm material specifications when the applicable manufacturer's documentation or test results are unavailable.
.5 Additional tests specified in the following paragraph. |
| | .2 | Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work. |

1.4 CONTRACTOR'S
RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - .1 Provide access to Work to be inspected and tested.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment, where required.
- .2 Notify Departmental Representative sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

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PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 Product data.
- .2 Samples.
- .3 Certificates.

1.2 SUBMITTAL
GENERAL REQUIREMENTS

- .1 Submit to Departmental Representative for review submittals listed, including samples, certificates and other data, as specified in other sections of the Specifications. Note that any and all changes to the contract will have to be approved in writing by the Contracting Authority. Departmental Representative will provide a list of required samples/product data sheets to be provided, after contract award.
- .2 Submit with reasonable promptness and in orderly sequence so as to allow for Departmental Representative's review and not cause delay in Work. Failure to submit in ample time will not be considered sufficient reason for an extension of Contract time and no claim for extension by reason of such default will be allowed.
- .3 Do not proceed with work until relevant submissions are reviewed by Departmental Representative.
- .4 Present product data, samples and mock-ups in SI Metric units.
- .5 Where items or information is not produced in SI Metric units, provide soft converted values.
- .6 Review submittals prior to submission to

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Departmental Representative. Ensure during review that necessary requirements have been determined and verified, required field measurements or data have been taken, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.

- .1 Submittals not stamped, signed, dated and identified as to specific project will be returned unexamined by Departmental Representative and considered rejected.
- .7 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent work and coordinate.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative's review.
- .11 Submittal format: paper originals, or alternatively clear and fully legible photocopies of originals. Facsimiles are not acceptable, except in special circumstances pre-approved by Departmental Representative. Poorly printed non-legible photocopies or facsimiles will not be accepted and be returned for resubmission.
- .12 Make changes or revision to submissions which Departmental Representative may require,

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consistent with Contract Documents and resubmit as directed by Departmental Representative. When resubmitting, notify Departmental Representative in writing of any revisions other than those requested.

- .13 Keep one reviewed copy of each submittal document on site for duration of Work.

1.3 PRODUCT DATA

- .1 Product data includes drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit sufficient copies of product data which are required by the General Contractor and sub-contractors plus 2 copies which will be retained by Departmental Representative. Ensure sufficient numbers are submitted to enable one complete set to be included in each of the maintenance manuals specified, if applicable.
- .3 Allow 10 calendar days for Departmental Representative's review of each submission.
- .4 Adjustments or corrections made on product data by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, advise Departmental Representative in writing prior to proceeding with Work.
- .5 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections and comments are made, fabrication and installation may proceed upon receipt of shop drawings. If product data are rejected and noted to be Resubmitted, do not proceed with

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that portion of work until resubmission and review of corrected product data, through same submission procedures indicated above.

- .6 Accompany each submission with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and project number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each product data and sample.
 - .5 Other pertinent data.
- .7 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and project number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Cross references to particular details of contract drawings and specifications section number for which product data submission addresses.
 - .6 Details of appropriate portions of Work.
- .8 After Departmental Representative's review, distribute copies.
- .9 The review of samples and product data by the Departmental Representative or their delegated representative is for sole purpose of ascertaining conformance with general concept. This review shall not mean that the Departmental Representative approves the detail design inherent in the product data, responsibility for which shall remain with

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Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in product data or of responsibility for meeting all requirements of the construction and Contract Documents. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.

1.4 SCHEDULES,
PERMITS AND
CERTIFICATES

- .1 Upon acceptance of bid, submit to Departmental Representative copy of Work Schedule and various other schedules, permits, certification documents and project management plans as specified in other sections of the Specifications.
- .2 Submit copy of permits, notices, compliance Certificates received by Regulatory Agencies having jurisdiction and as applicable to the Work.
- .3 Submission of above documents to be in accordance with Submittal General Requirements procedures specified in this section.

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| <u>1.1 SECTION INCLUDES</u> | .1 Fire Safety Requirements. |
| | .2 Hot Work Permit. |
| <u>1.2 RELATED WORK</u> | .1 Section 01 35 29.06 - Health and Safety Requirements. |
| <u>1.3 REFERENCES</u> | .1 Fire Protection Standards issued by Fire Protection Services of Human Resources Development Canada as follows:
.1 National Fire Code - Standard for Construction Operations - latest edition (http://www.hrsdc.gc.ca/eng/labour/fire_protection/policies_standards/commissioner/301/page00.shtml).
.2 National Fire Code - Standard for Welding and Cutting - latest edition (http://www.hrsdc.gc.ca/eng/labour/fire_protection/policies_standards/commissioner/302/page00.shtml).
.3 FCC standards, may also be viewed at the Regional Labour Canada Office located at Baine Johnson Centre, 10 Fort William Place, St. John's, NL, A1C 1K4; Telephone 1-800-641-4049; fax 1-709-772-5985. |
| <u>1.4 DEFINITIONS</u> | .1 Hot Work defined as:
.1 Welding work.
.2 Cutting of materials by use of torch or other open flame devices.
.3 Grinding with equipment which produces sparks. |
| <u>1.5 SUBMITTALS</u> | .1 Submit copy of Hot Work Procedures and sample of Hot Work permit to Departmental Representative for review, within five (5) calendar days after notification of acceptance of bid. |

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| | .2 | Submit in accordance with the Submittal General Requirements specified in Section 01 33 00. |
| 1.6 FIRE SAFETY REQUIREMENTS | .1 | Implement and follow fire safety measures during Work. Comply with following: <ul style="list-style-type: none">.1 National Fire Code, latest edition..2 Fire Protection Standards FCC 301 and FCC 302 - latest edition..3 Federal and Provincial Occupational Health and Safety Acts and Regulations as specified in Section 01 35 29.06. |
| | .2 | In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed. |
| 1.7 HOT WORK AUTHORIZATION | .1 | Obtain Departmental Representative's written "Authorization to Proceed" before conducting any form of Hot work on site. |
| | .2 | To obtain authorization submit to Departmental Representative: <ul style="list-style-type: none">.1 Contractor's typewritten Hot Work Procedures to be followed on site as specified below..2 Description of the type and frequency of Hot Work required..3 Sample Hot Work Permit to be used. |
| | .3 | Upon review and confirmation that effective fire safety measures will be implemented during performance of hot work, Departmental Representative will provide authorization to proceed as follows: <ul style="list-style-type: none">.1 Issue one written "Authorization to Proceed" covering the entire project for |

duration of work or;

.2 Separate work, or segregate certain parts of work, into individual entities. Each entity requiring a separately written "Authorization to Proceed" from Departmental Representative. Follow Departmental Representative's directives in this regard.

.4 Requirement for individual authorization based on:

.1 Nature or phasing of work;

.2 Risk to Facility operations;

.3 Quantity of various trades needing to perform hot work on project or;

.4 Other situation deemed necessary by Departmental Representative to ensure fire safety on premises.

.5 Do not perform any Hot Work until receipt of Departmental Representative's written "Authorization to Proceed" for that portion of work.

1.8 HOT WORK PROCEDURES

.1 Develop and implement safety procedures and work practices to be followed during the performance of Hot Work.

.2 Procedures to include:

.1 Requirement to perform hazard assessment of site and immediate hot work area for each hot work event in accordance with Hazard Assessment and Safety Plan requirements of Section 01 35 29.06.

.2 Use of a Hot Work Permit system for each hot work event.

.3 The step by step process of how to prepare and issue permit.

.4 Permit shall be issued by Contractor's site Superintendent, or other authorized person designated by Contractor, granting permission to worker or subcontractor to

proceed with hot work.

.5 Provision of a designated person to carryout a Fire Safety Watch for a minimum of 60 minutes immediately upon completion of the hot work.

.6 Compliance with fire safety codes and standards specified herein and occupational health and safety regulations specified in Section 01 35 29.

.3 Generic procedures, if used, must be edited and supplemented with pertinent information tailored to reflect specific project conditions. Clearly label as being the Hot Work Procedures applicable to this contract.

.4 Hot Work Procedures shall clearly establish worker instructions and allocate responsibilities of:

.1 Worker(s),

.2 Authorized person issuing the Hot Work Permit,

.3 Fire Safety Watcher,

.4 Subcontractors and Contractor.

.5 Brief all workers and subcontractors on Hot Work Procedures and Permit system established for project. Stringently enforce compliance.

.1 Failure to comply with the established procedures may result in the issuance of a Non-Compliance Notification at Departmental Representative's discretion with possible disciplinary measures imposed as specified in Section 01 35 29.06

1.9 HOT WORK PERMIT

.1 Hot Work Permit to include, as a minimum, the following data:

.1 Project name and project number.

.2 Building name, address and specific room or area where hot work will be performed.

.3 Date when permit issued.

- .4 Description of hot work type to be performed.
 - .5 Special precautions required, including type of fire extinguisher needed.
 - .6 Name and signature of person authorized to issue the permit.
 - .7 Name of worker (clearly printed) to which the permit is being issued.
 - .8 Time Duration that permit is valid (not to exceed 8 hours). Indicate start time and date, and completion time and date.
 - .9 Worker signature with date and time upon hot work termination.
 - .10 Specified time period requiring safety watch.
 - .11 Name and signature of designated Fire Safety Watcher, complete with time and date when safety watch terminated, certifying that surrounding area was under continual surveillance and inspection during the full watch time period specified in Permit and commenced immediately upon completion of Hot Work.
 - .2 Permit to be typewritten form. Industry Standard forms shall only be used if all data specified above is included on form.
 - .3 Each Hot Work Permit to be completed in full and signed as follows:
 - .1 Authorized person issuing Permit before hot work commences.
 - .2 Worker upon completion of Hot Work.
 - .3 Fire Safety Watcher upon termination of safety watch.
 - .4 Returned to Contractor's Site Superintendent for safe keeping.
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| 1.10 DOCUMENTS
<u>ON SITE</u> | .1 Keep Hot Work Permits and Hazard assessment documentation on site for duration of Work. |
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- .2 Upon request, make available to Departmental Representative or to authorized safety representative for inspection.

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| <u>1.1 SECTION INCLUDES</u> | .1 Procedures to isolate and lockout electrical facility or other equipment from energy source. |
| <u>1.2 RELATED WORK</u> | .1 Section 01 35 24 - Fire Safety Requirements.
.2 Section 01 35 29.06 - Health and Safety Requirements. |
| <u>1.3 REFERENCES</u> | .1 C22.1-06 - Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
.2 CAN/CSA C22.3 No. 1-10 - Overhead Systems.
.3 COSH, Canada Occupational Health and Safety Regulations made under Part II of the Canada Labour Code. |
| <u>1.4 DEFINITIONS</u> | .1 Electrical Facility: means any system, equipment, device, apparatus, wiring, conductor, assembly or part thereof that is used for the generation, transformation, transmission, distribution, storage, control, measurement or utilization of electrical energy, and that has an amperage and voltage that is dangerous to persons.
.2 Guarantee of Isolation: means a guarantee by a competent person in control or in charge that a particular facility or equipment is isolated.
.3 De-energize: in the electrical sense, that a piece of equipment is isolated and grounded, e.g. if the equipment is not grounded, it cannot be considered de-energized (DEAD).
.4 Guarded: means that an equipment or facility |

is covered, shielded, fenced, enclosed, inaccessible by location, or otherwise protected in a manner that, to the extent that is reasonably practicable, will prevent or reduce danger to any person who might touch or go near such item.

- .5 Isolate: means that an electrical facility, mechanical equipment or machinery is separated or disconnected from every source of electrical, mechanical, hydraulic, pneumatic or other kind of energy that is capable of making it dangerous.
- .6 Live/alive: means that an electrical facility produces, contains, stores or is electrically connected to a source of alternating or direct current of an amperage and voltage that is dangerous or contains any hydraulic, pneumatic or other kind of energy that is capable of making the facility dangerous to persons.

1.5 COMPLIANCE
REQUIREMENTS

- .1 Perform lockouts in compliance with:
 - .1 Canadian Electrical Code.
 - .2 Federal and Provincial Occupational Health and Safety Acts and Regulations as specified in Section 01 35 29.06.
 - .3 Regulations and code of practice as applicable to mechanical equipment or other machinery being de-energized.
 - .4 Procedures specified herein.
- .2 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.

1.6 SUBMITTALS

- .1 Submit copy of proposed Lockout Procedures and sample form of lockout permit or lockout tags for review.
- .2 Submit documentation within 7 calendar days of acceptance of bid. Do not proceed with work until submittal has been reviewed by Departmental Representative.
- .3 Submit above documents in accordance with the submittal requirements specified in Section 01 33 00.
- .4 Resubmit Lockout Procedures with noted revisions as may result from Departmental Representative's review.

1.7 ISOLATION OF
EXISTING SERVICES

- .1 Obtain Departmental Representative's written authorization prior to conducting work on an existing active, energized service or facility required as part of the work and before proceeding with lockout of such services or facility.
- .2 To obtain authorization, submit to Departmental Representative the following documentation:
 - .1 Written Request for Isolation of the service or facility and;
 - .2 Copy of Contractor's Lockout Procedures.
- .3 Make a Request for Isolation for each event, unless directed otherwise by Departmental Representative, and as follows:
 - .1 Fill-out standard forms in current use at the Facility when so directed by Departmental Representative or;
 - .2 Where no form exist at Facility, make request in writing identifying:

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- .1 Identification of system or equipment to be isolated, including it's location;
- .2 Time duration, indicating Start time and date, and Completion time and date when isolation will be in effect;
- .3 Voltage of service feed to system or equipment being isolated;
- .4 Name of person making the request.
- .3 Document to be in typewritten format.
- .4 Do not proceed until receipt of written notification from Departmental Representative granting the Isolation Request and authorization to proceed with the isolation of designated equipment or facility. Departmental Representative may designate other individual at the Facility as the person authorized to grant the Isolation Request.
- .5 Conduct safe, orderly shut down of equipment or facilities, de-energize and isolate power and other sources of energy and lockout items in accordance with requirement of clause 1.8 below.
- .6 Plan and schedule shut down of existing services in consultation with the Departmental Representative and the Facility Manager. Minimize impact and downtime of facility operations.
- .7 Determine in advance, as much as possible, in cooperation with the Departmental Representative, the type and frequency of situations which will require a Request for Isolation. Follow Departmental Representative's directives in this regard.
- .8 Conduct hazard assessment as part of the

planning process of isolating existing equipment and facilities. Hazard Assessments to conform with requirements of Health and Safety Section 01 35 29.06.

1.8 LOCKOUTS

- .1 Isolate and lockout electrical facilities, mechanical equipment and machinery from all potential energy sources prior to starting work on such items.
- .2 Develop and implement lockout procedures to be followed on site as an integral part of the Work.
- .3 Use energy isolation lockout devices specifically designed and appropriate for type of facility or equipment being locked out.
- .4 Use industry standard lockout tags.
- .5 Provide appropriate safety grounding and guards as required.
- .6 Prepare Lockout Procedures in writing. Describe safe work practices, work functions and sequence of activities to be followed on site to safely isolate all potential energy sources and lockout/tagout facilities and equipment.
- .7 Include within procedures a system of worker request and issuance of individual lockout permit by a person, employed by Contractor, designated to be "in-charge" and being responsible for:
 - .1 Controlling issuance of permits or tags to workers.
 - .2 Determining permit duration.
 - .3 Maintaining record of permits and tags issued.

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- .4 Submitting a Request for Isolation to Departmental Representative when required in accordance with Clause 1.7 above.
- .5 Designating a Safety Watcher, when one is required based on type of work.
- .6 Ensuring equipment or facility has been properly isolated, providing a Guarantee of Isolation to worker(s) prior to proceeding with work.
- .7 Collecting and safekeeping lockout tags, returned by workers, as a record of the event.
- .8 Clearly establish, describe and allocate, within procedures, the responsibilities of:
 - .1 Workers.
 - .2 Designated person controlling issuance of lockout tags/permits.
 - .3 Safety Watcher.
 - .4 Subcontractors and General Contractor.
- .9 Procedures shall meet the requirements of Codes and Regulations specified in clause 1.5 above.
- .10 Generic procedures, if used, must be edited, supplemented with pertinent information and tailored to reflect specific project conditions. Clearly label as being the procedures applicable to this contract.
 - .1 Incorporate site specific rules and procedures established by Facility Manager and in force at site. Obtain such procedures through Departmental Representative.
- .11 Procedures to be in typewritten format.
- .12 Submit copy of Lockout Procedures to Departmental Representative, in accordance with submittal requirements of clause 1.6 herein, prior to commencement of work.

1.9 CONFORMANCE

- .1 Ensure that lockout procedures, as established for project on site, are stringently followed. Enforce use and compliance by all workers.
- .2 Brief all persons working on electrical facilities, mechanical and other equipment fed by an energy source on requirements of this section.
- .3 Failure to perform lockouts in accordance with regulatory requirements or follow procedures specified herein may result in the issuance of a Non-Compliance Notification at Departmental Representative's discretion with possible disciplinary measures imposed as specified in Section 01 35 29.06.

1.10 DOCUMENTS
ON SITE

- .1 Post Lockout Procedures on site in common location for viewing by workers.
- .2 Keep copies of Request for Isolation submitted to Departmental Representative and lockout permits or tags issued to workers during the course of work for full project duration.
- .3 Upon request, make such data available to Departmental Representative or to authorized safety representative for inspection.

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| <u>1.1 RELATED WORK</u> | .1 | Section 01 35 24 - Special Procedures on Fire Safety Requirements. |
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| <u>1.2 DEFINITIONS</u> | .1 | COSH: Canada Occupational Health and Safety Regulations made under Part II of the Canada Labour Code. |
| | .2 | Competent Person: means a person who is: |
| | .1 | Qualified by virtue of personal knowledge, training and experience to perform assigned work in a manner that will ensure the health and safety of persons in the workplace, and; |
| | .2 | Knowledgeable about the provisions of occupational health and safety statutes and regulations that apply to the Work and; |
| | .3 | Knowledgeable about potential or actual danger to health or safety associated with the Work. |
| | .3 | Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred. |
| | .4 | PPE: personal protective equipment. |
| | .5 | Work Site: where used in this section shall mean areas, located at the premises where Work is undertaken, used by Contractor to perform all of the activities associated with the performance of the Work. |
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| <u>1.3 SUBMITTALS</u> | .1 | Make submittals in accordance with Section 01 33 00. |
| | .2 | Submit to Departmental Representative, copies of the following documents |

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including updates.

- .1 Site specific Health and Safety Plan.
 - .2 Building permit, compliance certification and other permits obtained.
 - .3 Reports or directives issued by Federal and Provincial Inspectors and other Authorities having jurisdiction.
 - .4 Accident or incident reports.
 - .5 WHMIS - MSDS data sheets.
 - .6 Name of Contractor's Representative designated to perform health and safety supervision in site.
 - .7 Certificate of clearance from Workplace Health Safety and Compensation Commission (Assessment Services Department) of Newfoundland and Labrador.
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- .3 Submit within five (5) work days of notification of Bid Acceptance. Provide one (1) copy.
 - .4 Departmental Representative will review Health and Safety Plan and provide comments.
 - .5 The Contractor will revise the Plan as appropriate and resubmit within five (5) work days after receipt of comments.
 - .6 Departmental Representative's review and comments made of the Plan shall not be construed as an endorsement, approval or implied warranty of any kind by Canada and does not reduce Contractor's overall responsibility for Occupational Health and Safety of the Work.
 - .7 Submit revisions and updates made to the Plan during the course of Work.

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1.4 COMPLIANCE
REQUIREMENTS

- .1 Comply with the Occupational Health and Safety Act for the Province of Newfoundland and Labrador, and the Occupational Health and Safety Regulations made pursuant to the Act.
- .2 Comply with Canada Labour Code Part II, (entitled Occupational Health and Safety) and the Canada Occupational Health and Safety Regulations (COSH) as well as any other regulations made pursuant to the Act.
 - .1 The Canada Labour Code can be viewed at:
[www.http://laws.justice.gc.ca/en/L-2/](http://laws.justice.gc.ca/en/L-2/)
 - .2 COSH can be viewed at:
[www.http://laws.justice.gc.ca/eng/SOR-86-304/ne.html](http://laws.justice.gc.ca/eng/SOR-86-304/ne.html).
 - .3 A copy may be obtained at: Canadian Government Publishing Public Works & Government Services Canada Ottawa, Ontario, K1A 0S9 Tel: (819) 956-4800 (1-800-635-7943) Publication No. L31-85/2000 E or F).
- .3 Observe construction safety measures of:
 - .1 Part 8 of National Building Code.
 - .2 Municipal by-laws and ordinances.
- .4 In case of conflict or discrepancy between any specified requirements, the more stringent shall apply.
- .6 Maintain Workers Compensation Coverage in good standing for duration of Contract. Provide proof through submission of Certificate of Clearance from Workplace Health, Safety and Compensation Commission (Assessment Services Department) of Newfoundland and Labrador.
- .7 Obtain and maintain worker medical

surveillance documentation where prescribed by legislation or regulation.

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| <u>1.5 RESPONSIBILITY</u> | .1 | Be responsible for health and safety of persons on site, safety of property and for protection of persons and environment adjacent to the site to extent that they may be affected by conduct of Work. |
| | .2 | Comply with and enforce compliance by all workers, sub-contractors and other persons granted access to work site with safety requirements of Contract Documents, applicable Federal, Provincial, and local by-laws, regulations, and ordinances, and with site specific Health and Safety Plan. |
| <u>1.6 SITE CONTROL AND ACCESS</u> | .1 | Control the Work and entry points to Work Site. Approve and grant access only to workers and authorized persons. Immediately stop and remove non-authorized persons.
.1 Departmental Representative will provide names of those persons authorized by Departmental Representative to enter onto Work Site and will ensure that such authorized persons have the required knowledge and training on Health and Safety pertinent to their reason for being at the site, however, Contractor remains responsible for the health and safety of authorized persons while at the Work Site. |
| | .2 | Isolate Work Site from other areas of the premises by use of appropriate means.
.1 Erect fences, hoarding, barricades and temporary lighting as required to effectively delineate the Work Site, stop non-authorized entry, and to protect pedestrians and vehicular |

traffic around and adjacent to the
Work and create a safe environment.

.2 Post signage at entry points and other
strategic locations indicating
restricted access and conditions for
access.

.3 Provide safety orientation session to
persons granted access to Work Site.
Advise of hazards and safety rules to be
observed while on site.

.4 Ensure persons granted site access wear
appropriate PPE. Supply PPE to inspection
authorities who require access to conduct
tests or perform inspections.

.5 Secure Work Site against entry when
inactive or unoccupied and to protect
persons against harm. Provide security
guard where adequate protection cannot be
achieved by other means.

1.7 PROTECTION

.1 Give precedence to safety and health of
persons and protection of environment over
cost and schedule considerations for Work.

.2 Should unforeseen or peculiar safety
related hazard or condition become evident
during performance of Work, immediately
take measures to rectify situation and
prevent damage or harm. Advise
Departmental Representative verbally and
in writing.

1.8 FILING OF NOTICE

.1 File Notice of Project with pertinent
provincial health and safety authorities
prior to beginning of Work.

1.9 PERMITS

.1 Post permits, licenses and compliance
Certificates at Work Site.

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| | .2 | Where a particular permit or compliance certificate cannot be obtained, notify Departmental Representative in writing and obtain approval to proceed before carrying out applicable portion of work. |
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| 1.10 HAZARD
ASSESSMENTS | .1 | Perform site specific health and safety hazard assessment of the Work and its site. |
| | .2 | Carryout initial assessment prior to commencement of Work with further assessments as needed during progress of work, including when new trades and subcontractors arrive on site. |
| | .3 | Record results and address in Health and Safety Plan. |
| | .4 | Keep documentation on site for entire duration of the Work. |
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| 1.11 PROJECT/SITE
CONDITIONS | .1 | The following are known or potential project related safety hazards at site: <ul style="list-style-type: none">.1 Heavy lifting..2 Working at heights..3 Cutting tools and other construction power tools..4 Sharp objects (construction debris)..5 Electric shock. |
| | .2 | Above items shall not be construed as being complete and inclusive of potential health, and safety hazards encountered during work. |
| | .3 | Include above items into hazard assessment process. |

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1.12 MEETINGS

- .1 Contractor to hold pre-construction health and safety meeting prior to commencement of Work. Ensure attendance of:
 - .1 Superintendent of Work.
 - .2 Contractor's designated Health & Safety Site Representative.
 - .3 Subcontractor's Health and Safety Site Representative.
 - .4 Health and Safety Site Coordinator.
- .2 Conduct regularly scheduled tool box and safety meetings during the Work in conformance with Occupational Health and Safety regulations.
- .3 Keep documents on site.

1.13 HEALTH AND SAFETY PLAN

- .1 Prior to commencement of Work, develop written Health and Safety Plan specific to the work. Implement, maintain, and enforce Plan for entire duration of Work and until final demobilization from site.
- .2 Health and Safety Plan shall include the following components:
 - .1 List of health risks and safety hazards identified by hazard assessment.
 - .2 Control measures used to mitigate risks and hazards identified.
 - .3 On-site Contingency and Emergency Response Plan as specified below.
 - .4 On-site Communication Plan as specified below.
 - .5 Name of Contractor's designated Health & Safety Site Representative and information showing proof of his/her competence and reporting relationship in Contractor's company.
 - .6 Names, competence and reporting relationship of other supervisory

personnel used in the Work for
occupational health and safety
purposes.

- .3 On-site Contingency and Emergency Response Plan shall include:
 - .1 Operational procedures, evacuation measures and communication process to be implemented in the event of an emergency.
 - .2 Evacuation Plan: site and floor plan layouts showing escape routes, marshaling areas. Details on alarm notification methods, fire drills, location of fire fighting equipment and other related data.
 - .3 Name, duties and responsibilities of persons designated as Emergency Warden(s) and deputies.
 - .4 Emergency Contacts: name and telephone number of officials from:
 - .1 General Contractor and subcontractors.
 - .2 Pertinent Federal and Provincial Departments and Authorities having jurisdiction.
 - .3 Local emergency resource organizations.
- .4 On-site Communication Plan:
 - .1 Procedures for sharing of work related safety information to workers and subcontractors, including emergency and evacuation measures.
- .5 Address all activities of the Work including those of subcontractors.
- .6 Review Health and Safety Plan regularly during the Work. Update as conditions warrant to address emerging risks and

hazards, such as whenever new trade or subcontractor arrive at Work Site.

- .7 Departmental Representative will respond in writing, where deficiencies or concerns are noted and may request re-submission of the Plan with correction of deficiencies or concerns.
- .8 Post copy of the Plan, and updates, prominently on Work Site.

1.14 SAFETY SUPERVISION

- .1 Employ Health & Safety Site Representative responsible for daily supervision of health and safety of the Work.
- .2 Health & Safety Site Representative may be the Superintendent of the Work or other person designated by Contractor and shall be assigned the responsibility and authority to:
 - .1 Implement, monitor and enforce daily compliance with health and safety requirements of the Work
 - .2 Monitor and enforce Contractor's site-specific Health and Safety Plan.
 - .3 Conduct site safety orientation session to persons granted access to Work Site.
 - .4 Ensure that persons allowed site access are knowledgeable and trained in health and safety pertinent to their activities at the site or are escorted by a competent person while on the Work Site.
 - .5 Stop the Work as deemed necessary for reasons of health and safety.
- .3 Health & Safety Site Representative must:
 - .1 Be qualified and competent person in occupational health and safety.
 - .2 Have site-related working experience specific to activities of the Work.
 - .3 Be on Work Site at all times during

execution of the Work.

.4 All supervisory personnel assigned to the Work shall also be competent persons.

.5 Inspections:

.1 Conduct regularly scheduled safety inspections of the Work on a minimum daily basis. Record deficiencies and remedial action taken.

.2 Conduct Formal Inspections on a minimum monthly basis. Use standardized safety inspection forms. Distribute to subcontractors.

.3 Follow-up and ensure corrective measures are taken.

.6 Keep inspection reports and supervision related documentation on site.

1.15 TRAINING

.1 Use only skilled workers on Work Site who are effectively trained in occupational health and safety procedures and practices pertinent to their assigned task.

.2 Maintain employee records and evidence of training received. Make data available to Departmental Representative upon request.

.3 When unforeseen or peculiar safety-related hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

.4 All workers dealing with hazardous materials are required to provide evidence

of training, in accordance with Provincial regulations.

1.16 MINIMUM
SITE SAFETY RULES

- .1 Notwithstanding requirement to abide by federal and provincial health and safety regulations; ensure the following minimum safety rules are obeyed by persons granted access to Work Site:
 - .1 Wear appropriate PPE pertinent to the Work or assigned task; minimum being hard hat, safety footwear, safety glasses and safety vest.
 - .2 Immediately report unsafe condition at site, near-miss accident, injury and damage.
 - .3 Maintain site and storage areas in a tidy condition free of hazards causing injury.
 - .4 Obey warning signs and safety tags.
- .2 Brief persons of disciplinary protocols to be taken for non compliance. Post rules on site.

1.17 CORRECTION OF
NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative will stop Work if non-compliance of health and safety regulations is not corrected in a timely manner.

1.18 INCIDENT
REPORTING

- .1 Investigate and report the following incidents to Departmental Representative:
 - .1 Incidents requiring notification to

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Provincial Department of Occupational
Safety and Health, Workers Compensation
Board or to other regulatory Agency.

- .2 Medical aid injuries.
- .3 Property damage in excess of
\$10,000.00.

- .2 Submit report in writing.

1.19 HAZARDOUS
PRODUCTS

- .1 Comply with requirements of Workplace
Hazardous Materials Information System
WHMIS).
- .2 Keep MSDS data sheets for all products
delivered to site.
 - .1 Post on site and submit copy to
Departmental Representative.

1.20 SITE RECORDS

- .1 Maintain on Work Site copy of safety
related documentation and reports
stipulated to be produced in compliance
with Acts and Regulations of authorities
having jurisdiction and of those documents
specified herein.
- .2 Upon request, make available to
Departmental Representative or authorized
Safety Officer for inspection.

1.21 POSTING OF
DOCUMENTS

- .1 Ensure applicable items, articles, notices
and orders are posted in conspicuous
location on Work Site in accordance with
Acts and Regulations of Province having
jurisdiction.
- .2 Post other documents as specified herein,
including:
 - .1 Site specific Health and Safety Plan.
 - .2 WHMIS data sheets.

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1.1 DEFINITIONS

- .1 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.

1.2 DISPOSAL OF
WASTES AND
HAZARDOUS
MATERIALS

- .1 Do not bury rubbish and waste materials on site.
- .2 Do not dispose of hazardous waste or volatile materials, such as mineral spirits, paints, thinners, oil or fuel into waterways, storm or sanitary sewers or waste landfill sites.
- .3 Store, handle and dispose of hazardous materials and hazardous waste in accordance with applicable federal and provincial laws, regulations, codes and guidelines.
- .4 Dispose of construction waste materials and demolition debris, resulting from work, at approved landfill sites only. Carryout such disposal in strict accordance with provincial and municipal rules and regulations. Separate out and prevent improper disposal of items banned from landfills.
- .5 Establish methods and undertake construction practices which will minimize waste and optimize use of construction materials. Separate at source all construction waste materials, demolition debris and product packaging and delivery containers into various waste categories in order to maximize recycling abilities of various materials and avoid disposal of debris at landfill site(s) in a "mixed state". Where recycling firms, specializing in recycling of specific materials exist, transport such materials to

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the recycling facility and avoid disposal at landfill sites.

- .6 Communicate with landfill operator prior to commencement of work, to determine what specific construction, demolition and renovation waste materials have been banned from disposal at the landfill and at transfer stations.

1.3 POLLUTION CONTROL

- .1 Control emissions from equipment and plant to local authorities emission requirements.
- .3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- .4 Have emergency spill response equipment and rapid clean-up kit, appropriate to work, at site. Locate adjacent to work and where hazardous materials are stored. Provide personal protective equipment as required for clean-up.
- .5 Report, to Federal and Provincial Department of the Environment, spills of petroleum and other hazardous materials as well as accidents having potential of polluting the environment. Also notify Departmental Representative and submit a written spill report to Departmental Representative within 24 hours of occurrence.

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1.1 SECTION
INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.

1.2 INSPECTION

- .1 Facilitate Departmental Representative's access to Work. If part of Work is being fabricated at locations other than construction site, make preparations to allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection of Work designated for special tests, inspections or approvals by Departmental Representative or by inspection authorities having jurisdiction.
- .3 If Contractor covers or permits to be covered Work designated for special tests, inspections or approvals before such is made, uncover Work until particular inspections or tests have been fully and satisfactorily completed and until such time as Departmental Representative gives permission to proceed. Pay costs to uncover and make good such Work.
- .4 In accordance with the General Conditions, Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents.

1.3 INDEPENDENT
INSPECTION AGENCIES

- .1 Departmental Representative may engage and pay for service of Independent Inspection and Testing Agencies for purpose of inspecting and testing portions of Work except for the following which remain part of Contractor's responsibilities:
- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

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.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Tests as specified within various sections designated to be carried out by Contractor under the supervision of Departmental Representative.

.4 Additional tests specified in Clause 1.3.2.

.2 Where tests or inspections by designated Testing Agency reveal work not in accordance with contract requirements, Contractor shall pay costs for additional tests or inspections as Departmental Representative may require to verify acceptability of corrected work.

.3 Employment of inspection and testing agencies by Departmental Representative does not relax responsibility to perform Work in accordance with Contract Documents.

1.4 ACCESS TO WORK

.1 Furnish labour and facility to provide access to the work being inspected and tested.

.2 Co-operate to facilitate such inspections and tests.

.3 Make good work disturbed by inspections and tests.

1.5 PROCEDURES

.1 Notify Departmental Representative sufficiently in advance of when work is ready for tests, in order for Departmental Representative to make attendance arrangements with Testing Agency. When directed by Departmental Representative, notify such Agency directly.

.2 Submit representative samples of materials specified to be tested. Deliver in required

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quantities to Testing Agency. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

- .3 Provide labour and facilities to obtain and handle samples on site. Provide sufficient space on site for Testing Agency's exclusive use to store equipment.

1.6 REJECTED WORK

- .1 Remove and replace defective Work, whether result of poor workmanship, use of defective or damaged products and whether incorporated in Work or not, which has been identified by Departmental Representative as failing to conform to Contract Documents.
- .2 Make good damages to existing or new work, including work of other Contracts, resulting from removal or replacement of defective work.

1.7 TESTING BY CONTRACTOR

- .1 Provide all necessary instruments, equipment and qualified personnel to perform tests designated as Contractor's responsibilities herein or elsewhere in the Contract Documents.

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1.1 SANITARY
FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.2 WATER SUPPLY

- .1 Arrange, pay for and maintain temporary water supply in accordance with governing regulations and ordinances.

1.3 CONSTRUCTION
SIGN AND NOTICES

- .1 Contractor or subcontractor advertisement signboards are not permitted on site.
- .2 Only notices of safety or instructions are permitted on site.
- .3 Maintenance and Disposal of Site Signs:
 - .1 Maintain approved signs and notices in good condition for duration of project and dispose of off site on completion of project or earlier if directed by Departmental Representative.

1.4 REMOVAL OF
TEMPORARY
FACILITIES

- .1 Remove temporary facilities from site when directed by Departmental Representative.

PART 1 - GENERAL

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| <u>1.1 SECTION INCLUDES</u> | .1 | Barriers. |
| | .2 | Traffic Controls. |
| <u>1.2 INSTALLATION AND REMOVAL</u> | .1 | Provide temporary controls in order to execute work expeditiously. |
| | .2 | Remove from site all such work after use. |
| <u>1.3 HOARDING</u> | .1 | Erect temporary site enclosure using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m centres. Provide one lockable truck gate. Maintain fence in good repair. |
| <u>1.4 GUARD RAILS AND BARRICADES</u> | .1 | Provide as required by governing authorities and to approval of Departmental Representative. |
| <u>1.5 ACCESS TO SITE</u> | .1 | Provide and maintain access to adjacent facilities. |
| <u>1.6 PUBLIC TRAFFIC FLOW</u> | .1 | Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform work and protect the public. |
| <u>1.7 FIRE ROUTES</u> | .1 | Maintain access to property including overhead clearances for use by emergency response vehicles. |
| <u>1.8 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY</u> | .1 | Protect surrounding private and public property from damage during performance of work. |
| | .2 | Be responsible for damage incurred. |

1.1 GENERAL

- .1 Use new material and equipment unless otherwise specified.
- .2 Within 7 days of written request by Departmental Representative, submit following information for any materials and products proposed for supply:
 - .1 name and address of manufacturer;
 - .2 trade name, model and catalogue number;
 - .3 performance, descriptive and test data;
 - .4 manufacturer's installation or application instructions;
 - .5 evidence of arrangements to procure.
 - .6 evidence of manufacturer delivery problems or unforeseen delays.
- .3 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.
- .4 Use products of one manufacturer for equipment or material of same type or classification unless otherwise specified.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.2 PRODUCT QUALITY AND REFERENCED STANDARDS

- .1 Contractor shall be solely responsible for submitting relevant technical data and independent test reports to confirm whether a product or system proposed for use meets contract requirements and specified standards.
- .2 Final decision as to whether a product or system meets contract requirements rest solely with the Departmental Representative

in accordance with the General Conditions.

1.3 ACCEPTABLE
MATERIALS AND
ALTERNATIVES

- .1 Acceptable Materials: When materials specified include trade names or trade marks or manufacturer's or supplier's name as part of the material description, select and only use one of the names listed for incorporation into the Work.
- .2 Alternative Materials: Submission of alternative materials to trade names or manufacturer's names specified must be done during the bidding period following procedures indicated in the Instructions to Bidders.
- .3 Substitutions: After acceptance of bid, substitution of a specified material will be dealt with as a change to the Work in accordance with the General Conditions of the Contract.

1.4 MANUFACTURERS
INSTRUCTIONS

- .1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods to be used. Do not rely on labels or enclosure provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental representative in writing of any conflict between these specifications and manufacturers instructions, so that Departmental Representative will designate which document is to be followed.

1.5 AVAILABILITY

- .1 Immediately notify Departmental Representative in writing of unforeseen or unanticipated material delivery problems by manufacturer. Provide support documentation as per Clause 1.1.2 above.

1.6 WORKMANSHIP

- .1 Ensure quality of work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed.
- .2 Remove unsuitable or incompetent workers from site as stipulated in General Conditions.
- .3 Ensure cooperation of workers in laying out work. Maintain efficient and continuous supervision on site at all times.
- .4 Coordinate work between trades and subcontractors.
- .5 Coordinate placement of openings, sleeves and accessories.

1.7 FASTENINGS -
GENERAL

- .1 Provide metal fastenings and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use non-corrosive fasteners, anchors and spacers for securing exterior work and in humid areas.
- .2 Space anchors within limits of load bearing or shear capacity and ensure that they provide positive permanent anchorage. Wood or organic material plugs not acceptable.
- .3 Keep exposed fastenings to minimum, space evenly and lay out neatly.
- .4 Fastenings which cause spalling or cracking of material to which anchorage is made, are not acceptable.
- .5 Do not use explosive actuated fastening

devices unless approved by Departmental Representative. See Section 01 35 29 on Health and Safety in this regard.

1.8 FASTENINGS -
EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur and, use resilient washers with stainless steel.

1.9 STORAGE,
HANDLING AND
PROTECTION

- .1 Deliver, handle and store materials in manner to prevent deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled materials in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work. Provide additional cover where manufacturer's packaging is insufficient to provide adequate protection.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden

platforms and cover with waterproof tarpaulins during inclement weather.

- .6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Immediately remove damaged or rejected materials from site.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.10 CONSTRUCTION
EQUIPMENT AND PLANT

- .1 On request, prove to the satisfaction of Departmental Representative that the construction equipment and plant are adequate to manufacture, transport, place and finish work to quality and production rates specified. If inadequate, replace or provide additional equipment or plant as directed.
- .2 Maintain construction equipment and plant in good operating order. Prevent oil and other contaminant leaks. Should any contaminant leak onto ground or into the water, take immediate and appropriate measures to contain, cleanup and dispose in an environmentally responsible manner.

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PART 1 - GENERAL

1.1 GENERAL

- .1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
- .2 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .3 Prevent accumulation of wastes which create hazardous conditions.
- .4 Provide adequate ventilation during use of volatile or noxious substances.

1.2 CLEANING DURING
CONSTRUCTION

- .1 Maintain project grounds and public properties in a tidy condition, free from accumulations of waste material and debris. Clean areas on a daily basis.
- .2 Provide on-site garbage containers for collection of waste materials and debris.
- .3 Remove waste materials and debris from site on a daily basis.

1.3 FINAL CLEANING

- .1 In preparation for acceptance of the Work perform final cleaning.

1.1 RELATED <u>SECTIONS</u>	.1	01 74 11 - Cleaning.
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- | | | |
|-----------------|----|---|
| 1.2 WASTE AUDIT | .1 | At project start-up, conduct waste audit of:
.1 Site conditions identifying salvageable and non-salvageable items and waste resulting from demolition and removal work.
.2 Projected waste resulting from product packaging and from material leftover after installation work. |
| | .2 | Develop written list. Record type, composition and quantity of various salvageable items and waste anticipated, reasons for waste generation and operational factors which contribute to waste. |

- | | | |
|---------------------|----|---|
| 1.3 WASTE REDUCTION | .1 | Based on waste audit, develop waste reduction program. |
| | .2 | Structure program to prioritize actions, with waste reduction as first priority, followed by salvage and recycling effort, then disposal as solid waste. |
| | .3 | Identify materials and equipment to be:
.1 Protected and turned over to Departmental Representative when indicated.
.2 Salvaged for resale by Contractor.
.3 Sent to recycling facility.
.4 Sent to waste processing/landfill site for their recycling effort.
.5 Disposed of in approved landfill site. |
| | .4 | Reduce construction waste during installation work. Undertake practices which will minimize waste and optimize full use of new materials on site, such as:
.1 Use of a central cutting area to allow |

for easy access to off-cuts;

.2 Use of off-cuts for blocking and bridging elsewhere.

.3 Use of effective and strategically placed facilities on site for storage and staging of left-over or partially cut materials to allow for easy incorporation into work whenever possible avoiding unnecessary waste.

.5 Develop other strategies and innovative procedures to reduce waste such as minimizing the extent of packaging used for delivery of materials to site, etc.

1.4 MATERIAL SOURCE
SEPARATION PROCESS

.1 Develop and implement material source separation process at commencement of work as part of mobilization and waste management at site.

.2 Provide on-site facilities to collect, handle and store anticipated quantities of reusable, salvageable and recyclable materials.

.1 Use suitable containers for individual collection of items based on intended purpose.

.2 Locate to facilitate deposit but without hindering daily operations of existing building tenants.

.3 Clearly mark containers and stockpiles as to purpose and use.

.3 Perform demolition and removal of existing structure components and equipment following a systematic deconstruction process.

.1 Separate materials and equipment at source, carefully dismantling, labelling and stockpiling alike items for the following purposes:

- .1 Reinstallation into the work where indicated.
 - .2 Salvaging reusable items not needed in project which Contractor may sell to other parties. Sale of such items not permitted on site.
 - .3 Sending as many items as possible to locally available recycling facility.
 - .4 Segregating remaining waste and debris into various individual waste categories for disposal in a "non-mixed state" as recommended by waste processing/landfill sites.
 - .4 Isolate product packaging and delivery containers from general waste stream. Send to recycling facility or return to supplier/manufacturer.
 - .5 Send leftover material resulting from installation work for recycling whenever possible.
 - .6 Establish methods whereby hazardous and toxic waste materials, and their containers, encountered or used in the course work are properly isolated, stored on site and disposed in accordance with applicable laws and regulations from authorities having jurisdiction.
 - .7 Isolate and store existing materials and equipment identified for re-incorporation into the Work. Protect against damage.
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- | | |
|--|---|
| 1.5 WORKER TRAINING
AND SUPERVISION | .1 Provide adequate training to workforce, through meetings and demonstrations, to emphasize purpose and worker |
|--|---|

responsibilities in carrying out the Waste Management Plan.

- .2 Waste Management Coordinator: designate full-time person on site, experienced in waste management and having knowledge of the purpose and content of Waste Management Plan to:
 - .1 Oversee and supervise waste management during work.
 - .2 Provide instructions and directions to all workers and subcontractors on waste reduction, source separation and disposal practices.
- .3 Post a copy of Plan in a prominent location on site for review by workers.

1.6 CERTIFICATION
OF MATERIAL
DIVERSION

- .1 Submit to Departmental Representative, copies of certified weigh bills from authorized waste processing sites and sale receipts from recycling/reuse facilities confirming receipt of building materials and quantity of waste diverted from landfill.
- .2 Submit data at pre-determined project milestones as determined by Departmental Representative.
- .3 Compare actual quantities diverted from landfill with projections made during waste audit.

1.7 DISPOSAL
REQUIREMENTS

- .1 Burying or burning of rubbish and waste materials is prohibited.
- .2 Disposal of waste, volatile materials, mineral spirits, oil, paint, paint thinner

or unused preservative material into waterways, storm, or sanitary sewers is prohibited.

- .3 Do not dispose of preservative treated wood through incineration.
- .4 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.
- .5 Dispose of treated wood, end pieces, wood scraps and sawdust at a sanitary landfill.
- .6 Dispose of waste only at approved waste processing facility or landfill sites approved by authority having jurisdiction.
- .7 Contact the authority having jurisdiction prior to commencement of work, to determine what, if any, demolition and construction waste materials have been banned from disposal in landfills and at transfer stations. Take appropriate action to isolate such banned materials at site of work and dispose in strict accordance with provincial and municipal regulations.
- .8 Transport waste intended for landfill in separated condition, following rules and recommendations of Landfill Operator in support of their effort to divert, recycle and reduce amount of solid waste placed in landfill.
- .9 Collect, bundle and transport salvaged materials to be recycled in separated categories and condition as directed by recycling facility. Ship materials only to approved recycling facilities.

- .10 Sale of salvaged items by Contractor to other parties not permitted on site.

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1.1 PROJECT RECORD
DOCUMENTS

- .1 Departmental Representative will provide two white print sets of contract drawings and two copies of Specifications.
- .2 Maintain at site one set of the contract drawings and specifications to record actual "As-Built" site conditions.
- .3 At project completion, submit full manual of products used in new work (complete with manufacturer's data sheets, warranty data, user manuals, etc.). Maintenance manuals to be submitted in hard copy (2 copies) and in electronic format (pdf file format).

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1.1 INTENT

- .1 Undertake commissioning to bring the facility to a fully operational state and free of deficiencies in the most effective and timely manner available.
- .2 Commissioning incorporates inspection and quality assurance activities as construction progresses, including start up and demonstration, performance verification, fine tuning, and operator training.
- .3 Bear all costs associated with the required personnel and test equipment as outlined in specification sections and all costs with organizing and managing the activities of the applicable subtrades as identified in this section.
- .4 Fully document all tests and inspections performed during the construction, at start up, and during performance verification and fine tuning. Incorporate into final commissioning documentation.
- .5 Provide direct training to designated staff responsible for the operation and maintenance of the equipment and systems.

1.2 COMMISSIONING

- .1 Conduct commissioning once identified prerequisite activities are completed for a system and approved by the Departmental Representative.
- .2 Engineer to issue a commissioning plan based on the complexity of systems. Develop and implement a detailed schedule of commissioning related activities.
- .3 Test all electrical components and operating procedures by challenging these systems to realistic operating conditions and train operational staff.

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PART 1 GENERAL

1.1 SECTIONS INCLUDES

- .1 Methods and procedures for demolishing, salvaging, recycling and removing sitework items designated to be removed in whole or in part, and for backfilling resulting trenches and excavations. All areas disturbed during trenching to be reinstated to pre-construction conditions (this includes any grassed or paved areas).

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 35 29.06 - Health and Safety Requirements
- .3 Section 01 35 43 - Environmental Procedures
- .4 Section 01 45 00 - Quality Control
- .5 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.3 SUBMITTALS

- .1 Shop drawings:
 - .1 Submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning, where required by authorities having jurisdiction.
 - .2 Submit drawings stamped and signed by qualified professional engineer licensed in Province of Newfoundland and Labrador, Canada.
- .2 Submit plan indicating:
 - .1 Descriptions of and anticipated quantities of materials to be salvaged, reused, recycled and landfilled.
 - .2 Schedule of selective demolition.

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- .3 Submit copies of certified weigh bills, bills of lading from authorized disposal sites and reuse and recycling facilities for material removed from site upon request from Owner's Representative.

1.4 QUALITY ASSURANCE

- .1 Convene pre-installation meeting one week prior to beginning work of this section to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with building subtrades.
- .2 Arrange for site visit with Owner's Representative to examine existing site conditions adjacent to demolition work, prior to start of Work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, replace or make repairs to approval of Owner's Representative and at no cost to Owner.
- .2 Remove and store materials to be salvaged in a manner to prevent damage.
- .3 Store and protect in accordance with requirements for maximum preservation of material.

1.6 SITE CONDITIONS

- .1 In all circumstances ensure that demolition work does not adversely affect adjacent water courses groundwater and wildlife, or contribute to excess air and noise pollution.
- .2 Do not dispose of waste or volatile materials such as mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.

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- .3 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.
- .5 Protect trees, plants and foliage on site and adjacent properties where indicated.

1.7 EXISTING CONDITIONS

- .1 Prior to start of any demolition work, remove contaminated or hazardous materials as defined by authorities having jurisdiction from site and dispose of at designated disposal facilities.

1.8 SCHEDULING

- .1 Notify Owner's Representative in writing when unforeseen delays occur.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PREPARATION

- .1 Inspect site with Owner's Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.

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3.2 REMOVAL OPERATIONS

- .1 Remove items as indicated. Do not disturb items designated to remain in place.
- .2 Interim removal of stockpiled material may be required by Owner's Representative if it is deemed to interfere with operations of Owner's Representative, Owner or other contractors.

3.3 RESTORATION

- .1 Restore areas and existing works outside areas of demolition to match conditions of adjacent, undisturbed areas.
- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.4 CLEAN UP

- .1 Upon completion of work, remove debris, trim surfaces and leave work site clean.
- .2 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

END OF SECTION

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PART 1 GENERAL

1.1 GENERAL

- .1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
 - .2 CAN/CSA-22.3 No. 1, Overhead Systems.
 - .3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

1.3 CARE, OPERATION AND START-UP

- .1 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .4 Provide these services for such period, and for as many visits as necessary to put equipment in operation and

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ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
- .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, and other items that must be shown to ensure coordinated installation.
- .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Quality Control:
 - .1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Submit, upon completion of Work, load balance report as described in sentence 3.4.6.

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- .4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
 - .6 Manufacturer's Field Reports: submit to Departmental Representative within seven (7) working days of review, verifying compliance of Work and electrical system and instrumentation testing.
 - .7 Single Line Electrical Diagrams
 - .1 Provide single line electrical diagrams in glazed frames as follows:
 - .1 Electrical distribution system: locate in main electrical room.
 - .2 Drawings: 600 x 600 mm minimum size.
- 1.6 PERMITS, FEES AND INSPECTION
- .1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
 - .2 Pay associated fees.
 - .3 Departmental Representative will provide drawings and specifications required by Electrical Inspection Division and Supply Authority at no cost.
 - .4 Notify Departmental Representative of changes required by Electrical Inspection Division prior to making changes.
 - .5 Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Departmental Representative.
- 1.7 CO-ORDINATION
- .1 Co-ordinate work with work of other divisions to avoid conflict.
 - .2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.

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- .3 Locate all existing underground services and make all parties aware of their existence and location.
- .4 Where interference occurs, Departmental Representative must approve relocation of equipment and materials regardless of installation order.
- .5 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Departmental Representative shall decide the extent of relocation required.

1.8 CUTTING AND PATCHING

- .1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings shall be the responsibility of Division 26. Obtain written approval of Structural engineer before drilling any beams or floors.

1.9 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.10 RECORD DRAWINGS

- .1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.

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- .2 Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.
 - .3 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.
 - .4 Submit record drawings within 30 days prior to start of commissioning.
- 1.11 INSPECTION OF WORK
- .1 The Departmental Representative will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.
- 1.12 SCHEDULING OF WORK
- .1 Work shall be scheduled in phases as per other divisions of the specifications.
 - .2 Become familiar with the phasing requirements for the work and comply with these conditions.
 - .3 No additional monies will be paid for contractor's requirement to comply with work phasing conditions.
- 1.13 FIRE RATING OF PENETRATIONS
- .1 Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls.
 - .2 Use 3M brand or equal fire barrier products at each penetration.
 - .3 Acceptable products for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.

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- .4 Acceptable manufacturers: Nelson, Fire Stop Systems, 3M or approved equal. Material of same manufacturer to be used throughout project.

PART 2 PRODUCTS

2.1 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings.
- .2 Control wiring and conduit is specified in Division 26 for standard of quality.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment, which is not CSA certified, obtain special approval from Electrical Inspection Division.
- .3 Factory assemble control panels and component assemblies.

2.3 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

2.4 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.
- .2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

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2.5 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels:
 - .1 Embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate and label.
- .5 Identification to be English (and French where applicable).
- .6 Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.

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- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system name and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages and transformer number.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1, Canadian Electrical Code.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

<u>Conduit System</u>	<u>Prime Color</u>	<u>Auxiliary Color</u>
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

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PART 3 EXECUTION

3.1 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.2 LOCATION OF OUTLETS

- .1 Locate outlets as per drawings.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.4 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.6 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees

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-
- registered in a provincial apprentice's program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.
 - .3 Perform tests in Accordance with this section as noted and Section 01 91 13 - General Commissioning (Cx) Requirements.
 - .4 Load Balance:
 - .1 Measure phase current to panelboard with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.
 - .5 Conduct and pay for following tests:
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Motors, heaters and associated control equipment including sequenced operations of systems where applicable.
 - .4 Systems: communications.
 - .6 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

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- .7 Insulation resistance testing.
 - .1 Megger and record circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger and record 350 - 600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing and record value.
- .8 Carry out tests in presence of Departmental Representative.
- .9 Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.
- .10 Submit test results for Departmental Representative's review and include in Commissioning Manuals specified in Section 01 91 13 - Commissioning (Cx) Requirements.

3.7 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

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PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for copper bar.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper bar.
 - .5 Sized for conductors and bars as indicated.

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- .4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.
- .5 Terminal blocks for all pull boxes and junction boxes located on pedestals and under wharf panels.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

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PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors (0-1000 V).
- .2 Refer to drawings for wiring type required under different applications.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
 - .2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

PART 2 PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper and ACM alloy conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE. Related to new emergency generator feeders. RWU90 XLPE not required under interior floor slabs.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V, typically used for insulated ground wires.
- .4 Type ACM conductors permitted for feeders above 60 amps.

2.2 TECK Cable

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.

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- .2 Circuit conductors: copper and ACM alloy, size as indicated.
 - .3 Insulation:
 - .1 Cross-linked polyethylene XLPE, rating - 600 V.
 - .4 Inner jacket: polyvinyl chloride material.
 - .5 Armour: interlocking aluminum, compliant to applicable Building Code classification for this project.
 - .6 Overall covering: thermoplastic polyvinyl chloride material.
 - .7 Fastenings:
 - .1 One-hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 1500 mm centers.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
 - .8 Connectors:
 - .1 Watertight and/or type approved for TECK cable, as indicated.
- 2.3 CONTROL CABLES
- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket. Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW -40° C polyethylene insulation with shielding of tape coated with paramagnetic material wire braid over each conductor and overall covering of PVC jacket.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

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- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 No splices permitted in panelboard feeders in new construction. Splices in re-work or renovation projects only with pre-approval by Departmental Representative.

3.2 GENERAL CABLE INSTALLATION

- .1 Install cable in trenches in accordance with Section 33 71 73.02 - Underground Electrical Service.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors (0-1000 V).
- .3 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.
- .4 Conductor length for parallel feeders to be identical.
- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:

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- .1 In conduit systems in accordance with Section 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings.
 - .2 In underground ducts in accordance with Section 26 05 43.01- Installation of Cables in Trenches and in Ducts.
 - .3 In trenches in accordance with Section 26 05 43.01- Installation of Cables in Trenches and in Ducts.
 - .4 Overhead service conductors in accordance with Section 26 24 01 - Service Equipment.
- 3.4 INSTALLATION OF TECK CABLE 0 -1000 V
- .1 Install cables.
 - .1 Group cables wherever possible on channels.
 - .2 Install cable concealed, securely supported by straps and hangers.

END OF SECTION

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PART 1 GENERAL

1.1 INSTALLATION TOOLS

- .1 Include with the material one complete set of installation tools. Tools to include all hydraulic pumps, fittings, compression dyes, cutting tools, measuring devices necessary to install all components.

PART 2 EXECUTION

2.1 INSTALLATION

- .1 Install terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No. 41.

END OF SECTION

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PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .2 Section 26 05 00 - Common Work Results for Electrical.
- .3 Grounding conductors for all distribution grounding to be insulated copper, uninsulated where in contact with earth. Copper conductors shall, at a minimum, be used in the following areas: grounding of transformer neutrals, service entrance switch ground of neutral, padmount transformer grounding, ground rider conductors from main ground station to sub-closets, telephone and data system grounds and circuits rated less than 60 amps. Where type ACM conductors are used for circuits rated 60 amps or greater, type ACM bonding conductor is permitted.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA)
 - .1 CAN/CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities, where applicable.

PART 2 PRODUCTS

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as indicated to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.
- .3 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

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- .4 Plate electrodes: copper, surface area 0.2 m², 1.6 mm thick.
- .5 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .6 Insulated grounding conductors: green, type TW.
- .7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors, as required by local authority having jurisdiction.
 - .4 Thermit welded type conductor connectors, as indicated.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run insulated copper ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.

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- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground by welding copper to steel.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.
- .13 Ground secondary service pedestals.

3.2 MANHOLES

- .1 Install conveniently located grounding electrode and size 3/0 stranded copper conductor in each manhole.
- .2 Install ground rod in each manhole so that top projects through bottom of manhole. Provide with lug to which grounding connection can be made.

3.3 ELECTRODES

- .1 Install rod, plate electrodes and make grounding connections.
- .2 Bond separate, multiple electrodes together.
- .3 Use size 2/0, 3/0 or 4/0 AWG copper conductors for connections to electrodes as required by code.
- .4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

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3.4 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 208 V system.

3.5 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.6 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size as required by code.

3.7 PERMAFROST

- .1 Drive three -19 mm diam x 3 m copper clad ground rods at least 1.8 m apart in original undisturbed ground. If rods will not penetrate permafrost, drive at angle not more than 60° from vertical, and in same direction. Rods must be driven, not trenched.
- .2 Install ground wire from service neutral bar to rods and where buried use bare copper not smaller than size 1AWG7- strand or size 4AWG solid, and at least 460 mm below ground. Bond ground conductor, or short tap from it, to outside metal sheathing of building close to power service conduit. Use lug or cast clamp, with bronze or plated bolt, nut and washers (not sheet metal screw or wood screw). Remove paint from sheathing for good contact. Conduit is required only on outside wall of building. Indoors, run bare and fasten as specified for equipotential bonding wire.
- .3 Install electrode interconnections where metal parts, circuits or grounding conductors and/or electrodes are in proximity to lightning rod conductors.

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3.8 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and Section 01 19 13 - Commissioning (Cx) Requirements.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

END OF SECTION

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1.1 General

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results for Electrical.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data for cabinets.
- .2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Newfoundland and Labrador, Canada.

PART 2 PRODUCTS

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

- .1 PVC Junction boxes complete with bolt on gasket covers. Junction boxes to contain terminal blocks as indicated on drawings.

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- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm fir plywood backboard for surface flush mounting.

PART 3 EXECUTION

3.1 SPLITTER INSTALLATION

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal block as indicated.
- .4 Only main junction and pull boxes are indicated.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Install size 2 identification labels indicating system name voltage and phase.

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END OF SECTION

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PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Fittings.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1.

PART 2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

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- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.
- 2.3 CONDUIT BOXES
 - .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.
- 2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE
 - .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables. For use in wood stud construction only.
- 2.5 FITTINGS - GENERAL
 - .1 Bushing and connectors with nylon insulated throats.
 - .2 Knock-out fillers to prevent entry of debris.
 - .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
 - .4 Double locknuts and insulated bushings on sheet metal boxes.
 - .5 Double split rings for AC-90 terminations.
- 2.6 SERVICE FITTINGS
 - .1 'High tension' receptacle fitting made of 2-piece die-cast aluminum with brushed aluminum housing finish for 1 duplex receptacles. Bottom plate with two knockouts for centered or offset installation.
 - .2 Pedestal type 'low tension' fitting made of 2-piece die cast aluminum with brushed aluminum housing finish to accommodate two amphenol jack connectors.

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PART 3 EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit. Reducing washers are not allowed.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

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PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware, a National Standard of Canada.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Non-metallic Mechanical Protection Tubing (NMPT), a National Standard of Canada.

1.2 SUBMITTALS

- .1 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .2 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

PART 2 PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.

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- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.
- .6 FRE conduit: to CSA C22.2.
- .7 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3,

2.2 CONDUIT FASTENINGS

- .1 One-hole steel straps to secure surface conduits 50 mm and smaller. Two-hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory Fiberglass "ells" where 90°, 45 ° or 22.5 ° bends are required for 25 mm and larger conduits.
- .3 Ensure conduit bends other than factory "ells" are made with an approved bender. Making offsets and other bends by cutting and rejoining 90-degree bends are not permitted.
- .4 Connectors and couplings for EMT. Steel set-screw type, size as required.

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2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change or violate any part of the installed system components or the CSA/UL certification of these components.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .3 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .4 Surface mount conduits except in finished areas or as indicated.
- .5 Use rigid hot dipped galvanized steel threaded conduit for exposed work below 2.4 m above finished floor.

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- .6 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury, as well as concealed work in masonry construction.
- .7 Use rigid PVC conduit underground and buried in or under concrete slab on grade.
- .8 Use flexible metal conduit for connection to motors in dry areas connection to recessed incandescent fixtures without a prewired outlet box connection to surface or recessed fluorescent fixtures work in movable metal partitions.
- .9 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .10 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .11 Minimum conduit size for lighting and power circuits: 19 mm. 12 mm conduit is acceptable for switch leg drops only where one two-wire circuit and ground is required.
- .12 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .13 Mechanically bend steel conduit over 19 mm dia.
- .14 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .15 Install fish cord in empty conduits.
- .16 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .17 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Group conduits wherever possible on suspended channels.

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- .3 Do not pass conduits through structural members except as indicated.
- .4 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- 3.4 CONCEALED CONDUITS
 - .1 Run parallel or perpendicular to building lines.
 - .2 Do not install horizontal runs in masonry walls.
 - .3 Do not install conduits in terrazzo or concrete toppings.
- 3.5 CONDUITS IN CAST-IN-PLACE CONCRETE
 - .1 Locate to suit reinforcing steel. Install in centre one third of slab. Use rigid PVC conduit.
 - .2 Install sleeves where conduits pass through slab or wall.
 - .3 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
 - .4 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
 - .5 Encase conduits completely in concrete with minimum 25 mm concrete cover.
 - .6 Organize conduits in slab to minimize cross-overs.
- 3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE
 - .1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.
- 3.7 CONDUITS UNDERGROUND
 - .1 Slope conduits to provide drainage.

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- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On Completion and verification of performance of installation, remove surplus materials, excess materials rubbish, tools and equipment.

END OF SECTION

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Part 1 **General**

1.1 RELATED SECTIONS

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results for Electrical.
- .4 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 Canadian Standards Association, (CSA)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

PART 2 **PRODUCTS**

2.1 CABLE PROTECTION

- .1 38 x 140 mm planks pressure treated with copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.
- .2 Wooden post type markers: 89 x 89 mm, 1.5 m long, pressure treated with copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.

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-
- .1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

PART 3 EXECUTION

3.1 DIRECT BURIAL OF CABLES

- .1 After sand bed specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
- .2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Make termination and splice only as indicated leaving 0.6 m of surplus cable in each direction.
- .1 Make splices and terminations in accordance with manufacturer's instructions using approved splicing kits.
- .4 Underground cable splices not acceptable.
- .5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .6 Cable separation:
- .1 Maintain 75 mm minimum separation between cables of different circuits.
- .2 Maintain 300 mm horizontal separation between low and high voltage cables.
- .3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
- .4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

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-
- .5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
 - .6 Install treated planks on lower cables 0.6 m in each direction at crossings.
 - .7 After sand protective cover specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks as indicated to cover length of run.
- 3.2 CABLE INSTALLATION IN DUCTS
- .1 Install cables as indicated in ducts.
 - .1 Do not pull spliced cables inside ducts.
 - .2 Install multiple cables in duct simultaneously.
 - .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
 - .4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
 - .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
 - .6 After installation of cables, seal duct ends with duct sealing compound.
- 3.3 MARKERS
- .1 Mark cable every 150 m along cable runs and changes in direction.
 - .2 Mark underground splices.
 - .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.
 - .4 Install wooden post type markers.

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-
- .5 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and Section 01 91 13 - Commissioning (Cx) Requirements.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing at 100 % of original factory test voltage in accordance with manufacturer's recommendations.
 - .4 Leakage Current Testing.
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage for time period, specified by manufacturer.

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- .3 Record leakage current at each step.
- .7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test. Include results in Commissioning Manual.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

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1.1 General

1.2 SECTION INCLUDES

- .1 Service equipment and installation.

1.3 RELATED SECTIONS

- .1 Section 26 05 28 - Grounding - Secondary.
- .2 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .3 Section 26 24 16.01 - Panelboards Breaker Type.
- .4 Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .5 Section 26 28 23 - Disconnect Switches - Fused and Non-Fused.
- .6 Section 26 28 20 - Ground Fault Circuit Interrupters - Class "A".

PART 2 PRODUCTS

2.1 EQUIPMENT

- .1 Fused disconnect switch: in accordance with Section 26 28 23 - Disconnect Switches - Fused and Non-Fused, rating as indicated.
- .2 Enclosed circuit breaker: in accordance with Section 26 28 16.02 - Moulded Case Circuit Breakers, rating as indicated.
- .3 Panelboard breaker type: in accordance with Section 26 24 16.01 - Panelboards Breaker Type.
- .4 Cabinet type 'A' for utility revenue metering Junction box Pull box Splitter box: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets, size as indicated.
- .5 Ground fault equipment: in accordance with Section 26 28 20 - Ground Fault Circuit Interrupters - Class "A".

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PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install service equipment.
- .2 Connect to incoming service.
- .3 Connect to outgoing load circuits.
- .4 Install ground fault equipment.
- .5 Make grounding connections in accordance with Section 26
 05 28 - Grounding - Secondary.
- .6 Make provision for power supply authority's metering.

END OF SECTION

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PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results for Electrical.
- .4 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 SUBMITTALS

- .1 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 2 PRODUCTS

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

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-
- .2 250 and 600 V panelboards: bus and breakers rated for 10,000 and 18,000 A (symmetrical) minimum interrupting capacity respectively or as indicated on electrical drawings.
 - .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
 - .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
 - .5 Two keys for each panelboard and key panelboards alike.
 - .6 Tin plated aluminum bus with neutral of same ampere rating as mains.
 - .7 Mains: suitable for bolt-on breakers.
 - .8 Trim with concealed front bolts and hinges.
 - .9 Trim and door finish: baked grey enamel.
- 2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES
- .1 125 mm relay section on one or both sides of panels as indicated for installation of low voltage remote control switching components.
 - .2 Double stack panels as indicated.
 - .3 Contactors in mains as indicated.
 - .4 Feed through lugs as indicated.
- 2.3 BREAKERS
- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
 - .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
 - .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

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- .4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.
- .5 Lock-on devices for receptacles, fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits as indicated.

2.4 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

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PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

PART 2 PRODUCTS

2.1 RECEPTACLES

- .1 As noted on drawings for wharf pedestals and Jib Cranes.

2.2 COVER PLATES

- .1 As noted on drawings.

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PART 3 EXECUTION

3.1 INSTALLATION

 .1 Receptacles:

 .1 Install receptacles as per details.

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PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 78 00 - Closeout Submittals.
- .2 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2No.248.12, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition)).

1.3 SUBMITTALS

- .1 Submit fuse performance data characteristics for each fuse type and size above 600 A. Performance data to include: average melting time-current characteristics.

1.4 DELIVERY AND STORAGE

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in storage cabinet moisture free location.

1.5 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Three spare fuses of each type and size installed above 600 A.
- .3 Six spare fuses of each type and size installed up to and including 600 A.

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PART 2 PRODUCTS

2.1 FUSES GENERAL

- .1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer for entire project.

2.2 FUSE TYPES

- .1 Class L fuses (formerly HRC-L).
 - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type L2, fast acting.
- .2 Class J fuses (formerly HRCI- J).
 - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type J2, fast acting.
- .3 Class R -R fuses (formerly HRCI- R). For UL Class RK1 fuses, peak let-through current and its' peak let-through values not to exceed limits of UL 198E-1982, table 10.2.
 - .1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.
 - .2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.
- .4 Class -C fuses (formerly HRCII- C).

2.3 FUSE STORAGE CABINET

- .1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00 - Common Work Results - Electrical.

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PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit. Ensure correct fuses fitted to physically matched mounting devices.

- .1 Install Class R rejection clips for HRCI-R fuses.

- .2 Ensure correct fuses fitted to assigned electrical circuit.

- .3 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

- .4 Install spare fuses in fuse storage cabinet.

END OF SECTION

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PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results for Electrical.

1.2 SUBMITTALS

- .1 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

PART 2 PRODUCTS

2.1 BREAKERS GENERAL

- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating.

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2.2 THERMAL MAGNETIC BREAKERS DESIGN A

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 OPTIONAL FEATURES

- .1 Include:
 - .1 shunt trip.
 - .2 on-off locking device.
 - .3 handle mechanism.

2.4 ENCLOSURE

- .1 Mounted in NEMA 1 type enclosure, sprinkler proof as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

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PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results for Electrical.

PART 2 PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Fusible and non-fusible, disconnect switch in CSA Enclosure type 1, size as indicated.
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated, to Section 26 28 13.01 - Fuses - Low Voltage.
- .5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

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PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses as indicated.

END OF SECTION

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1.1 GENERAL

1.2 SCOPE OF WORK

- .1 Testing and commissioning are called for throughout the individual specifications. This does not relieve this trade from providing all testing and commissioning necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

1.3 SECTION INCLUDES

- .1 Commissioning of all building electrical systems and component including:
 - .1 Testing and adjustment.
 - .2 Demonstrations and Training.
 - .3 Instructions of all procedures for Harbour Authorities' personnel.
 - .4 Updating as-built data.
 - .5 Co-ordination of Operation and Maintenance material.

1.4 RELATED SECTION

- .1 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .2 Section 26 05 00 - Common Work Results for Electrical.

1.5 REFERENCES

- .1 CSA (Canadian Standards Association).
- .2 Underwriters Laboratories of Canada.

1.6 QUALITY ASSURANCE

- .1 Provide qualified trades persons, certified testing agencies, factory trained and approved by the Commissioning Team Leader.
- .2 Submit the names of all personnel to be used during the Commissioning activities for Departmental Representative's Approval.

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1.7 COMMISSIONING

- .1 The purpose of the commissioning process is to fully test all new building systems including architectural, mechanical and electrical components and operating procedures by challenging these systems to realistic operation conditions.
- .2 The Commissioning activities shall be coordinated by the General Contractor.
- .3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.
- .4 Contractor shall be responsible to update all documentation with information and any changes duly noted during the Commissioning exercise.
- .5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

1.8 SUBMITTALS

- .1 A commissioning document shall be prepared by the Departmental Representative prior to conducting these activities for use by the Commissioning Team.
- .2 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and coordinated through the General Contractor.
- .3 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

1.9 PREPARATION

- .1 Provide test instruments required for all activities as defined in the commissioning documents.

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- .2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the pre-commissioning check out operation.
- .3 Confirm all scheduled activities have identified personnel available.
- .4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

1.10 SYSTEM DESCRIPTION

- .1 Perform all start up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.
- .2 Harbour Authority will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.
- .3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.
- .4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

1.11 FINAL REPORT

- .1 This trade shall assemble all testing data and commissioning reports and submit them to the Departmental Representative.
- .2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

1.12 SCHEDULE OF ACTIVITIES

- .1 Commissioning activities shall be conducted based on pre-established schedule with the Departmental Representative.

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- .2 In addition, there will be two meetings held through the contract duration to introduce the parties of the commissioning team, establish the schedules and deadlines for the various activities and review the Commissioning Manual.
- .3 Adhering to the established schedule is very important as the co-ordination and scheduling of the participants will be difficult to alter once this is established. Close co-ordination of this schedule is important.
- .4 In the event project cannot be commissioned in the allotted time slot, the contractor shall pay for all costs associated with assembling the Commissioning Team at a later date. If the contractor has not performed his duties to reach commissioning stage as outlined earlier, he will incur all expenses of other trades and the Commissioning Team due to his non-compliance.

END OF SECTION

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1.1 GENERAL

- .1 This section describes the extent of services to be provided for wiring of equipment supplied by others.
- .2 Within the context of this section, Others means:
 - .1 The Owner, as defined in the Contract.
 - .2 Other contractors supplying and installing equipment to the contract.

1.2 EXTENT OF SERVICES PROVIDED

- .1 The work of this contract is to include all power and control wiring of equipment which is provided by Division 26.
- .2 All power and control wiring will be the responsibility of this contractor. Coordinate with owners and other trades for exact requirements.

1.3 RESPONSIBILITY OF DIVISION 26

- .1 It is the responsibility of the Division 26 subcontractor to verify final requirements for wiring of all equipment noted. Verification of wiring requirements to include:
 - .1 Confirmation of electrical characteristics.
 - .2 Location of connection point.
 - .3 Method of connection (i.e. direct or plug-in etc.)
- .2 Obtain and become familiar with shop drawings for all relevant equipment.
- .3 No claim for extra will be entertained for wiring equipment which has been indicated, or changes to installed wiring where installation proceeded prior to verification of electrical requirements.

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PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CA/CGSB-8.2, Sieves, Testing, Woven Wire, Metric
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.

1.2 DEFINITIONS

- .1 Excavation types (no distinction as this is a lump sum project):

- .1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 m³. Frozen material not classified as rock.
- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in work.
- .3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .4 Waste material: excavated material unsuitable for use in work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.
- .6 Unsuitable materials:
 - .1 Weak and compressible materials under excavated areas.
 - .2 Frost susceptible materials under excavated areas.
 - .3 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1.

<u>Sieve Designation</u>	<u>%Passing</u>
2.00 mm	100
0.10 mm	45-100
0.02 mm	10-80
<u>0.005 mm</u>	<u>0-45</u>

- .2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

1.3 EXISTING CONDITIONS

.1 Buried services:

- .1 Before commencing work verify location of buried services on and adjacent to site.
- .2 Prior to commencing excavation work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.
- .3 Confirm locations of buried utilities by careful test excavations.
- .4 Maintain and protect from damage, water, sewer, electric, telephone and other utilities and structures encountered as indicated.
- .5 Where utility lines or structures exist in area of excavation, obtain direction of Owner's Representative before removing or re-routing.
- .6 Record location of maintained, re-routed and abandoned underground lines.
- .7 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

- .1 Conduct, with Owner's Representative condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by work.
- .2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Owner's Representative.
- .3 Where required for excavation, cut roots or branches as approved by Owner's Representative.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Backfill Type 1 (Class A) and Type 2 fill:

- .1 Crushed, pit run or screened stone, gravel or sand.
- .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	%Passing	
	<u>Type1</u>	<u>Type2</u>
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
<u>0.075 mm</u>	<u>3-8</u>	<u>0-10</u>

- .2 Type 3 fill: selected material from excavation or other sources, approved by Owner's Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

PART 3 EXECUTION

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.2 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Owner's Representative's approval.

- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage. Protect buried services that are required to remain undisturbed.

3.3 SHORING, BRACING AND UNDERPINNING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Occupational Health and Safety Act for the Province of Newfoundland and Labrador.
- .2 Obtain permit from authority having jurisdiction.
- .3 Construct temporary works to depths, heights and locations as required.
- .4 During backfill operation:
 - .1 Remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
- .5 Upon completion of substructure construction remove excess materials from site and restore as indicated.

3.4 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while work is in progress.
- .2 Submit for Owner's Representative's review details of proposed dewatering or heave prevention methods.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in manner not detrimental to public and private property, or any portion of work completed or under construction.

3.5 EXCAVATION

- .1 Excavation must not interfere with bearing capacity of adjacent foundations.
- .2 Keep excavated and stockpiled materials a safe distance away from edge of trench as directed by Owner's Representative.
- .3 Restrict vehicle operations directly adjacent to open trenches.
- .4 Dispose of surplus and unsuitable excavated material off site.
- .5 Do not obstruct flow of surface drainage or natural watercourses.
- .6 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .7 Notify Owner's Representative when bottom of excavation is reached.
- .8 Obtain Owner's Representative approval of completed excavation.
- .9 Remove unsuitable material from trench bottom to extent and depth as directed by Owner's Representative.
- .10 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 95% of corrected maximum dry density.
- .11 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

3.6 FILL TYPES AND COMPACTION

- .1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum

densities obtained from ASTM D698 corrected maximum dry density.

- .1 Use Type 3 fill to subgrade level. Compact to 95%.
- .2 Type 2 to underside of Class A topping. Class A topping to surface (topped with asphalt where applicable).
- .3 To correct over excavation in trenches: use Type 2 fill to underside of sand bedding compacted to 95%.

3.7 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

3.8 BACKFILLING

- .1 Vibratory compaction equipment: approved by Owner's Representative.
- .2 Do not proceed with backfilling operations until Owner's Representative has inspected and approved installations.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .6 Backfill around installations.
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

- .3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 600 mm.

3.9 RESTORATION

- .1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by Owner's Representative.
- .2 Clean and reinstate areas affected by work as directed by Owner's Representative.

END OF SECTION

Appendix A:

Shop Drawings of Owner Supplied Equipment

Burgeo

Specification sheet



Diesel generator set QSB7 series engine

100 – 200 kW 60Hz



Description

Cummins® commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby and Prime Power applications.

Features

Cummins heavy-duty engine - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Control system - The PowerCommand® 1.1 electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance. The optional PowerCommand 2.2 control is UL 508 Listed and provides AmpSentry™ protection.

Cooling system - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

Enclosures - Optional weather protective and sound attenuated enclosures are available.

NFPA - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

Model	Standby rating		Prime rating		Continuous rating		Data sheets	
	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz	50 Hz
DSGAA	100 (125)		90 (113)				D-3349	
DSGAB	125 (156)		113 (141)				D-3350	
DSGAC	150 (188)		135 (169)				D-3351	
DSGAD	175 (219)		160 (200)				D-3516	
DSGAE	200 (250)		180 (225)				D-3517	

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Rev. 00

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Generator set specifications

Governor regulation class	ISO8528 Part 1 Class G3
Voltage regulation, no load to full load	± 1.0%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Radio frequency emissions compliance	Meets requirements of most industrial and commercial applications.

Engine specifications

Bore	107 mm (4.21 in)
Stroke	124.0 mm (4.88 in)
Displacement	6.69 L (408 in ³)
Configuration	Cast iron, in-line, 6 cylinder
Battery capacity	1100 amps minimum at ambient temperature of -18 °C to 0 °C (0 °F to 32 °F)
Battery charging alternator	100 amps
Starting voltage	12 volt, negative ground
Fuel system	Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff
Fuel filter	Single element, 10 micron filtration, spin-on fuel filter with water separator
Air cleaner type	Dry replaceable element
Lube oil filter type(s)	Spin-on, full flow
Standard cooling system	High ambient radiator Alternator specifications

Alternator specifications

Design	Brushless, 4 pole, drip proof, revolving field
Stator	2/3 pitch
Rotor	Single bearing, flexible discs
Insulation system	Class H
Standard temperature rise	150 °C Standby at 40 °C ambient
Exciter type	Torque match (short) standard, PMG optional
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform Total Harmonic Distortion (THDV)	< 5% no load to full linear load, < 3% for any single harmonic
Telephone Influence Factor (TIF)	< 50 per NEMA MG1-22.43
Telephone Harmonic Factor (THF)	< 3%

Available voltages

60 Hz Three phase Line-Neutral/Line-Line	60 Hz Single phase Line-Neutral/Line-Line
<ul style="list-style-type: none"> • 110/190 • 110/220 • 115/200 • 115/230 Delta • 120/208 • 120/240 Delta • 127/220 • 139/240 • 220/380 • 230/400 • 240/416 • 255/440 • 277/480 • 347/600 	<ul style="list-style-type: none"> • 110/220 • 115/230 • 120/240

Note: Consult factory for other voltages.

Generator set options and accessories

Engine <ul style="list-style-type: none"> • 120 V 150 W lube oil heater • 120/240 V 1500 W coolant heater 	Alternator <ul style="list-style-type: none"> • 105 °C rise • 125 °C rise • 120 V 100 W anti-condensation heater • PMG excitation • Single phase 	Exhaust system <ul style="list-style-type: none"> • Heavy duty exhaust elbow • Slip on exhaust connection
Fuel System <ul style="list-style-type: none"> 72 hours sub-base fuel tank 		

Generator set options and accessories (continued)

Generator set

- Battery ✓
- Battery charger ✓
- Enclosure: aluminium, steel, weather protective or sound attenuated
- Main line circuit breaker ✓
- Remote annunciator panel ✓
- Spring isolators
- 2 year Prime power warranty
- 2 year Standby power warranty ✓
- 5 year Basic power warranty

Note: Some options may not be available on all models - consult factory for availability.

Maderra Engineering

- ☐ REVIEWED
- ☒ REVIEWED AS NOTED
- ☐ RESUBMIT

BY: Canis Noseworthy

DATE: April 20, 2018

Review is for conformance with the general design concept and does not relieve the Contractor from his responsibility for detail design inherent in shop drawings; for errors or omissions in the shop drawings or for meeting all requirements of Contract Documents.

- 1) Power Command 2.2 Control System Required for Genset
- 2) Fuel Tank Vents To Extend To 142" (3.6m) Above Grnd.
- 3) 5 gallon fuel spill Containment c/w Lockable Cover Required on fuel Tank.
- 4) Genset Enclosure To be Rated To Withstand 150 mph (240km/h) Winds
- 5) Genset To be c/w oil pressure gauge + high oil pressure Alarm.
- 6) Fuel Tank To be c/w high fuel Alarm + CORROSION RESISTANT FINISH SUITABLE FOR INSTALLATION IN A MARINE ENVIRONMENT.
- 7) Genset Support Structure To be c/w corrosion Resistant Finish SUITABLE FOR INSTALLATION IN A MARINE ENVIRONMENT.
- 8) ALL Labels To Be English
- 9) Genset fuel Tank To be ULC S601-07 Listed
- 10) Heavy Duty Air Cleaner Required.

Power Command 2.2 Control System Required.

Control system PowerCommand 1.1



PowerCommand is an integrated generator set control system providing voltage regulation, engine protection, operator interface and isochronous governing (optional). Major features include:

- Battery monitoring and testing features and smart starting control system.
- Standard PCCNet interface to devices such as remote annunciator for NFPA 110 applications.
- Control boards potted for environmental protection.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower PC-based service tool available for detailed diagnostics.

Operator/display panel

- Manual off switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols).
- LED lamps indicating genset running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -20 °C to +70 °C
- Bargraph display (optional)

AC protection

- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload

Engine protection

- Overspeed shut down
- Low oil pressure warning and shut down ✓
- High coolant temperature warning and shut down ✓
- Low coolant level warning or shut down ✓
- Low coolant temperature warning ✓
- High low and weak battery voltage warning ✓
- Fail to start (overcrank) shut down ✓
- Fail to crank shut down ✓
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown ✓
- Fuel-in-rupture-basin warning or shutdown ✓
- Alternator data
- Line-to-Line and Line-to-Neutral AC volts ✓
- 3-phase AC current ✓
- Frequency ✓
- Total kVA ✓

Engine data

- DC voltage
- Lube oil pressure ✓
- Coolant temperature
- Engine speed

Other data

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

Digital governing (optional)

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

Digital voltage regulation

- Integrated digital electronic voltage regulator
- 2-phase Line-to-Line sensing
- Configurable torque matching

Control functions

- Time delay start and cooldown
- Cycle cranking
- PCCNet interface
- (2) Configurable inputs
- (2) Configurable outputs
- Remote emergency stop ✓
- Glow plug control (some models)

Options

- Auxiliary output relays (2)
- 120/240 V, 100 W anti-condensation heater
- Remote annunciator with (3) configurable inputs and (4) configurable outputs
- PMG alternator excitation ✓
- PowerCommand iWatch web server for remote monitoring and alarm notification (loose)
- Auxiliary, configurable signal inputs (8) and configurable relay outputs (8) ✓
- Digital governing
- AC output analog meters (bargraph) ✓
- Color-coded graphical display of: ✓
 - 3-phase AC voltage ✓
 - 3-phase current ✓
 - Frequency ✓
 - kVA ✓
- Remote operator panel
- PowerCommand 2.2 control with AmpSentry protection ✓

For further detail see document S-1531.



PowerCommand® 2.2 control system



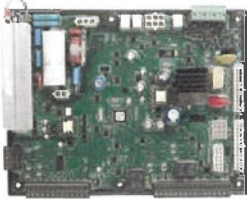
Control system description

The PowerCommand control system is a microprocessor-based generator set monitoring, metering and control system designed to meet the demands of today's engine driven generator sets. The integration of all control functions into a single control system provides enhanced reliability and performance, compared to conventional generator set control systems. These control systems have been designed and tested to meet the harsh environment in which gensets are typically applied.

Features

- 128 x 128 pixels graphic LED backlight LCD.
- Multiple language support.
- AmpSentry™ Protective Relay - True alternator overcurrent protection.
- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop.
- Digital voltage regulation. Three phase full wave FET type regulator compatible with either shunt or PMG systems.
- Generator set monitoring and protection.
- 12 and 24 VDC battery operation.
- Modbus® interface for interconnecting to customer equipment.
- Warranty and service. Backed by a comprehensive warranty and worldwide distributor service network.
- Certifications - Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.

PowerCommand digital genset control PCC 2300



Description

The PowerCommand generator set control is suitable for use on a wide range of generator sets in non-parallel applications. The PowerCommand control is compatible with shunt or PMG excitation style. It is suitable for use with reconnectable or non-reconnectable generators, and it can be configured for any frequency, voltage and power connection from 120-600 VAC Line-to-Line.

Power for this control system is derived from the generator set starting batteries. The control functions over a voltage range from 8 VDC to 30 VDC.

Features

- 12 and 24 VDC battery operation.
- Digital voltage regulation - Three phase full wave FET type regulator compatible with either shunt or PMG systems. Sensing is three phase.
- Full authority engine communications (where applicable) - Provides communication and control with the Engine Control Module (ECM).
- AmpSentry protection - for true alternator overcurrent protection.
- Common harnessing - with higher feature Cummins controls. Allows for easy field upgrades.
- Generator set monitoring - Monitors status of all critical engine and alternator functions.
- Digital genset metering (AC and DC). ✓
- Genset battery monitoring system to sense and warn against a weak battery condition.
- Configurable for single or three phase AC metering. ✓
- Engine starting - Includes relay drivers for starter, Fuel Shut Off (FSO), glow plug/spark ignition power and switch B+ applications.
- Generator set protection - Protects engine and alternator.

- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop.
- Advanced serviceability - using InPower™, a PCbased software service tool.
- Environmental protection - The control system is designed for reliable operation in harsh environments. The main control board is a fully encapsulated module that is protected from the elements.
- Modbus interface for interconnecting to customer equipment.
- Configurable inputs and outputs - Four discrete inputs and four dry contact relay outputs.
- Warranty and service - Backed by a comprehensive warranty and worldwide distributor service network.
- Certifications - Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.

Base control functions

HMI capability

Operator adjustments - The HMI includes provisions for many set up and adjustment functions.

Generator set hardware data - Access to the control and software part number, generator set rating in kVA and generator set model number is provided from the HMI or InPower.

Data logs - Includes 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. ✓

Engine data

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

Service adjustments - The HMI includes provisions for adjustment and calibration of generator set control functions. Adjustments are protected by a password. Functions include:

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

Engine control

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

12 VDC/24 VDC battery operations - PowerCommand will operate either on 12 VDC or 24 VDC batteries.

Temperature dependent governing dynamics (with electronic governing) - modifies the engine governing control parameters as a function of engine temperature. This allows the engine to be more responsive when warm and more stable when operating at lower temperature levels.

Isochronous governing - (where applicable) Capable of controlling engine speed within $\pm 0.25\%$ for any steady state load from no load to full load. Frequency drift will not exceed $\pm 0.5\%$ for a 33°C (60°F) change in ambient temperature over an 8 hour period.

Drop electronic speed governing - Control can be adjusted to droop from 0 to 10% from no load to full load.

Remote start mode - It accepts a ground signal from remote devices to automatically start the generator set and immediately accelerate to rated speed and voltage. The remote start signal will also wake up the control from sleep mode. The control can incorporate a time delay start and stop.

Remote and local emergency stop - The control accepts a ground signal from a local (genset mounted) or remote (facility mounted) emergency stop switch to cause the generator set to immediately shut down. The generator set is prevented from running or cranking with the switch engaged. If in sleep mode, activation of either emergency stop switch will wake up the control.

Sleep mode - The control includes a configurable low current draw state to minimize starting battery current draw when the genset is not operating. The control can also be configured to go into a low current state while in auto for prime applications or applications without a battery charger.

Engine starting - The control system supports automatic engine starting. Primary and backup start disconnects are achieved by one of two methods: magnetic pickup or main alternator output frequency. The control also supports configurable glow plug control when applicable.

Cycle cranking - Is configurable for the number of starting cycles (1 to 7) and duration of crank and rest periods. Control includes starter protection algorithms to prevent the operator from specifying a starting sequence that might be damaging.

Time delay start and stop (cooldown) - Configurable for time delay of 0-300 seconds prior to starting after receiving a remote start signal and for time delay of 0-600 seconds prior to shut down after signal to stop in normal operation modes. Default for both time delay periods is 0 seconds.

Alternator control

The control includes an integrated three phase line-to-line sensing voltage regulation system that is compatible with shunt or PMG excitation systems. The voltage regulation system is a three phase full wave rectified and has an FET output for good motor starting capability. Major system features 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.

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 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.

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, shutdown or status indication and for labelling the input.

Emergency stop

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

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.

General engine 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 generator set is signalled to start and indicate a warning if the battery indicates impending failure.

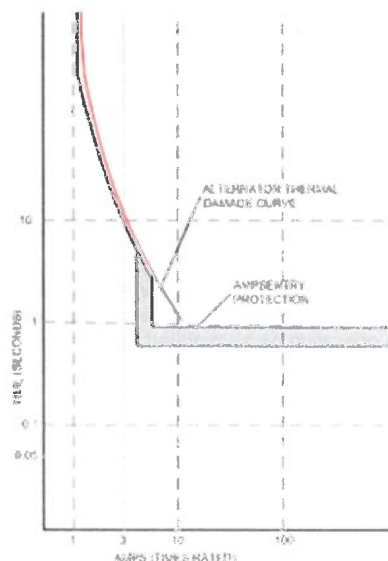
Fail to start (overcrank) shutdown - The control system will indicate a fault if the generator set fails to start by the completion of the engine crank sequence.

Fail to crank shutdown - Control has signalled 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.

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 generator set or in the load. It also provides single and three phase fault current regulation so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. See document R1053 for a full size time over current curve.



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 during synchronizing.

Under frequency shutdown (81 u) - Generator set 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 (81 o) - Generator set 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 - Thresholds and time delays are configurable. 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 generator set will occur on loss of voltage sensing inputs to the control.

Field overload shutdown - Monitors field voltage to shutdown generator set 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 - 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.

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 ✓
- Battleshort
- Rupture basin ✓
- Start type signal
- 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

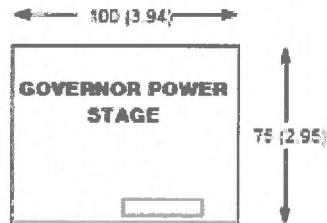
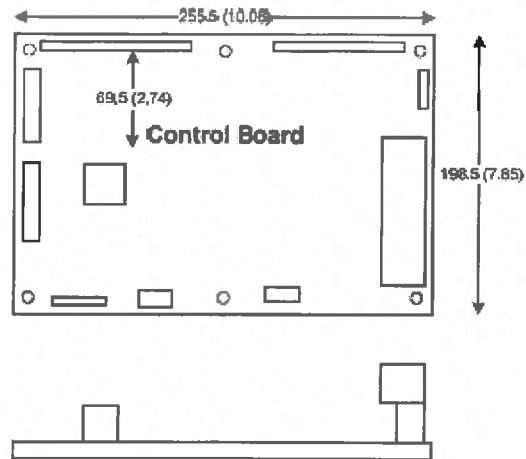
Output signals from the PowerCommand control include:

- Load dump signal: Operates when the generator set 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, 30 VDC). 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 (generator set running) signal: Operates when the generator set has reached 90% of rated speed and voltage and latches until generator set is switched to off or idle mode.

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 products.

Mechanical drawings



PowerCommand human machine interface HMI220



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 generator set status LED lamps with both internationally accepted symbols and English text to comply with customers' 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.

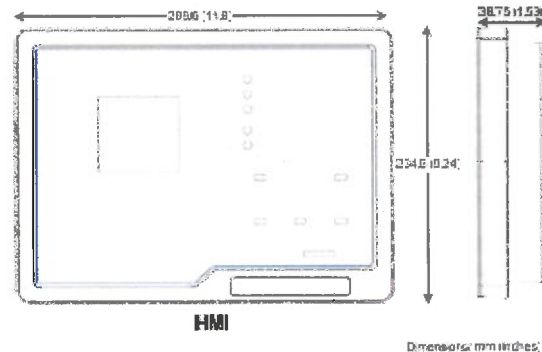
Features:

- LED indicating lamps
 - genset running
 - remote start
 - not in auto
 - shutdown
 - warning
 - auto manual and stop
 - 128 x 128 pixels graphic LED backlight LCD.
 - Two 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 generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.
- LCD languages supported: English, Spanish, French, German, Italian, Greek, Dutch, Portuguese, Finnish, Norwegian, Danish, Russian and Chinese Characters.

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 6.0 version) is a PC-based software service tool that is designed to directly communicate to PowerCommand generator sets 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 to +70 °C (-40 °F to 158 °F) and for storage from -55 °C to +80 °C (-67 °F to 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 to +70 °C (-4 °F to 158 °F) and for storage from -30 °C to +80 °C (-22 °F to 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 generator set. 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 508 recognized or Listed and 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.

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.



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Generator set data sheet



Model: DSGAC
Frequency: 60 Hz
Fuel type: Diesel
kW rating: 150 Standby
 135 Prime

Emissions level: EPA NSPS Stationary Emergency Tier 3 ✓

Exhaust emission data sheet:	EDS-1085
Exhaust emission compliance sheet:	EPA-1119
Sound performance data sheet:	MSP-1057
Cooling performance data sheet:	MCP-172
Prototype test summary data sheet:	PTS-285
Standard set-mounted radiator cooling outline:	A035C611
Optional set-mounted radiator cooling outline:	
Optional heat exchanger cooling outline:	
Optional remote radiator cooling outline:	

Fuel consumption	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	150 (188)				135 (169)				
Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full	Full
US gph	4.08	6.94	9.49	11.73	3.88	6.32	8.77	10.81	
L/hr	15.4	26.3	35.9	44.4	17.7	23.9	33.2	40.9	

Engine	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins Inc.		
Engine model	QSB7-G5 NR3		
Configuration	Cast iron, in-line, 6 cylinder		
Aspiration	Turbocharged and air-to-air after-cooled		
Gross engine power output, kW _m (bhp)	242 (324)	208 (279)	
BMEP at set rated load, kPa (psi)	1727 (251)	1558 (226)	
Bore, mm (in.)	107 (4.21)		
Stroke, mm (in.)	124 (4.88)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	7.4 (1464)		
Compression ratio	17.2:1		
Lube oil capacity, L (qt)	17.5 (18.5)		
Overspeed limit, rpm	2100		
Regenerative power, kW	19		

Ratings definitions

Emergency Standby Power (ESP):

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

Limited-Time Running Power (LTP):

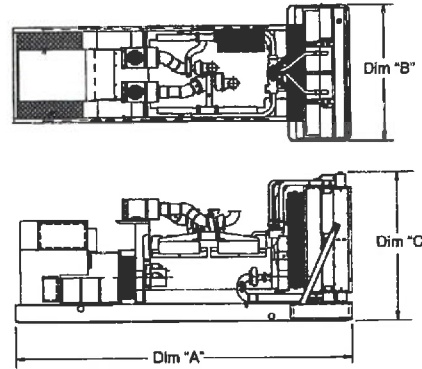
Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.

Prime Power (PRP):

Applicable for supplying power to varying electrical loads 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) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.



Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set weight* dry kg (lbs)	Set weight* wet kg (lbs)
DGDB	2656 (104.6)	1100 (43.3)	1549 (61)		1180 (2602)
DSGAB	2656 (104.6)	1100 (43.3)	1549 (61)		1225 (2700)
→ DSGAC ✓	2656 (104.6)	1100 (43.3)	1549 (61)		1263 (2784)
DSGAD	2656 (104.6)	1100 (43.3)	1549 (61)		1361 (3000)
DSGAE	2656 (104.6)	1100 (43.3)	1549 (61)		1361 (3000)

*Note: Weights represent a set with standard features. See outline drawings for weights of other configurations.

Codes and standards

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

	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.	UL2200	The generator set is available listed to UL 2200. ✓
	The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.	U.S. EPA	Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 3 exhaust emission levels. U.S. applications must be applied per this EPA regulation ✓
CSA	All low voltage models are certified to CSA C22.2 No.100 and CSA C22.2 No.14. ✓	International Building Code	The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003 IBC2006, IBC2009 and IBC2012. ✓

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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Fuel flow

Maximum fuel flow, L/hr (US gph)	106 (28)	
Maximum fuel flow with C174, L/hr (US gph)		
Maximum fuel inlet restriction with clean filter, mm Hg (in Hg)	127 (5)	
Maximum return restriction, mm Hg (in Hg)	152 (6)	

Air

	Standby rating	Prime rating	Continuous rating
Combustion air, m ³ /min (scfm)	14.6 (517)	14.2 (501)	
Maximum air cleaner restriction, kPa (in H ₂ O)	3.7 (15)		
Alternator cooling air, m ³ /min (cfm)	41.3 (1460)		

Exhaust

Exhaust flow at set rated load, m ³ /min (cfm)	35.2 (1241)	33.4 (1179)	
Exhaust temperature, °C (°F)	464 (867)	451 (845)	
Maximum back pressure, kPa (in H ₂ O)	10 (40)	10 (40)	

Standard set-mounted radiator cooling

Ambient design, °C (°F)	50 (122)	
Fan load, kW _m (HP)	9.7 (13.0)	
Coolant capacity (with radiator), L (US gal)	23 (6.1)	23 (6.1)
Cooling system air flow, m ³ /min (scfm)	351 (12400)	
Total heat rejection, MJ/min (Btu/min)	8.11 (7681)	7.57 (7167)
Maximum cooling air flow static restriction, kPa (in H ₂ O)	0.12 (0.5)	

Optional set-mounted radiator cooling

Ambient design, °C (°F)	
Fan load, kW _m (HP)	
Coolant capacity (with radiator), L (US gal)	
Cooling system air flow, m ³ /min (scfm)	
Total heat rejection, MJ/min (Btu/min)	
Maximum cooling air flow static restriction, kPa (in H ₂ O)	

Optional heat exchanger cooling	Standby rating	Prime rating	Continuous rating
Set coolant capacity, L (US gal)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum raw water pressure, jacket water circuit, kPa (psi)			
Maximum raw water pressure, after-cooler circuit, kPa (psi)			
Maximum raw water pressure, fuel circuit, kPa (psi)			
Maximum raw water flow, jacket water circuit, L/min (US gal/min)			
Maximum raw water flow, aftercooler circuit, L/min (US gal/min)			
Maximum raw water flow, fuel circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, after-cooler circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min)			
Raw water delta P at min flow, jacket water circuit, kPa (psi)			
Raw water delta P at min flow, aftercooler circuit, kPa (psi)			
Raw water delta P at min flow, fuel circuit, kPa (psi)			
Maximum jacket water outlet temp, °C (°F)			
Maximum after-cooler inlet temp, °C (°F)			
Maximum after-cooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum fuel return line restriction, kPa (in Hg)			

Optional remote radiator cooling¹

Set coolant capacity, L (US gal)	
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)	
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)	
Heat rejected, jacket water circuit, MJ/min (Btu/min)	
Heat rejected, aftercooler circuit, MJ/min (Btu/min)	
Heat rejected, fuel circuit, MJ/min (Btu/min)	
Total heat radiated to room, MJ/min (Btu/min)	
Maximum friction head, jacket water circuit, kPa (psi)	
Maximum friction head, aftercooler circuit, kPa (psi)	
Maximum static head, jacket water circuit, m (ft)	
Maximum static head, aftercooler circuit, m (ft)	
Maximum jacket water outlet temp, °C (°F)	
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)	
Maximum aftercooler inlet temp, °C (°F)	
Maximum fuel flow, L/hr (US gph)	
Maximum fuel return line restriction, kPa (in Hg)	

Weights²

Unit dry weight kgs (lbs)	
Unit wet weight kgs (lbs)	1263 (2784)

Notes:

¹ For non-standard remote installations contact your local Cummins representative.

² Weights represent a set with standard features. See outline drawing for weights of other configurations.

Derating factors

Standby	Engine power available up to 3048 m (10000 ft) at ambient temperature up to 40° C (104° F) and 2164 m (7100 ft) at 50° C (122° F). Consult your Cummins distributor for temperature and ambient requirements outside these parameters.
Prime	Engine power available up to 2743 m (9000 ft) at ambient temperature up to 40° C (104° F) and 1463 m (4800 ft) at 50° C (122° F). Consult your Cummins distributor for temperature and ambient requirements outside these parameters.
Continuous	

Ratings definitions

Emergency Standby Power (ESP):	Limited-Time Running Power (LTP):	Prime Power (PRP):	Base Load (Continuous) Power (COP):
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 in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.	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.	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. No sustained overload capability is available at this rating.

Alternator data

Three phase table ¹		105 °C	105 °C	105 °C	105 °C	125 °C	125 °C	125 °C	125 °C	125 °C	150 °C	150 °C	150 °C
Feature code		B418	B415	B268	B304	B417	B414	B267	B246	B303	B416	B413	B419
Alternator data sheet number		210	210	212	209	210	210	212	209	209	210	209	208
Voltage ranges		110/190 thru 120/208 220/380 thru 240/416	120/208 thru 139/240 240/416 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	347/600	110/190 thru 120/208 220/380 thru 240/416	120/208 thru 139/240 240/416 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	139/240 thru 277/480	347/600	110/190 thru 120/208 220/380 thru 240/416	120/208 thru 139/240 240/416 thru 277/480	347/600
Surge kW		165	165	167	166 ✓	165	165	167	166	166	165	164	164
Motor Starting kVA (at 90% sustained voltage)	Shunt	563	563	770	516	563	563	770	516	516	563	516	422
	PMG	663	663	920	607	663	663	920	607	607	663	607	497
Full load current - amps at Standby rating		120/208 521	127/220 493	139/240 452	220/380 285	240/416 261	254/440 246	277/480 226	347/600 181 ✓				

Alternator data (continued)

Single phase table		105 °C	105 °C	105 °C	125 °C	125 °C	125 °C	150 °C	
Feature code		B418	B415	B268	B417	B414	B267	B413	
Alternator data sheet number		210	210	121	210	210	212	209	
Voltage ranges		120/240 ²	120/240 ²	120/240 ³	120/240 ²	120/240 ²	120/240 ³	120/240 ²	
Surge kW		152	152	164	152	152	164	152	
Motor Starting kVA (at 90% sustained voltage)	Shunt	330	330	420	330	330	420	305	
	PMG	385	385	500	385	385	500	360	
Full load current - amps at Standby rating		$\frac{120/240^2}{417}$		$\frac{120/240^2}{625}$					

Notes:

¹ Single phase power can be taken from a three phase generator set at up to 2/3 set rated 3-phase kW at 1.0 power factor. Also see Note 3 below.

² The broad range alternators can supply single phase output up to 2/3 set rated 3-phase kW at 1.0 power factor.

³ The extended stack (full single phase output) and 4 lead alternators can supply single phase output up to full set rated 3-phase kW at 1.0 power factor.

Formulas for calculating full load currents:

Three phase output	Single phase output
$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$	$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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Alternator data sheet

Frame size: UC3F

Characteristics

Weights:	Wound stator assembly:	337 lb	153 kg
	Rotor assembly:	419 lb	190 kg
	Complete alternator:	1175 lb	533 kg
Maximum speed:		2250 rpm	
Excitation current:	Full load:	2 Amps	
	No load:	0.5 Amps	
Insulation system:	Class H throughout		

1 Ø Ratings (1.0 power factor)		60 Hz			50 Hz		
(Based on specific temperature rise at 40 °C ambient temperature)		Double delta	4 lead		Double delta		
		<u>120/240</u>	<u>120/240</u>		<u>110-120</u> <u>220-240</u>		
125 °C rise ratings	kW/kVA	109/109	125/125		96/96		
105 °C rise ratings	kW/kVA	98/98	113/113		87/87		
3 Ø Ratings (0.8 power factor)		Upper broad range		LBR*	347/600	Broad range	
(Based on specified temperature rise at 40 °C ambient temperature)		<u>120/208</u> <u>240/416</u>	<u>139/240</u> <u>277/480</u>	<u>190-208</u> <u>380-416</u>	<u>347/600</u>	<u>110/190</u> <u>220/380</u>	<u>120/208</u> <u>240/415</u> <u>127/220</u> <u>254/440</u>
150 °C Rise ratings	kW	150	170	148	170	136	136
	kVA	188	213	185	213	170	170
125 °C Rise ratings	kW	145	165	144	165	128	128
	kVA	181	206	180	206	160	160
105 °C Rise ratings	kW	130	150	128	150	116	116
	kVA	163	188	160	188	145	145
80 °C Rise ratings	kW	112	128	110	128	101	101
	kVA	140	160	138	160	126	126
3 Ø Reactances (per unit, ±10%)							
(Based on full load at 105 °C rise rating)							
Synchronous		2.21	1.92	1.68	1.97	2.04	1.71
Transient		0.18	0.15	0.14	0.16	0.17	0.15
Subtransient		0.13	0.11	0.09	0.10	0.12	0.10
Negative sequence		0.14	0.12	0.10	0.11	0.13	0.11
Zero sequence		0.08	0.07	0.07	0.07	0.08	0.07
3 Ø Motor starting							
Maximum kVA	(Shunt)	516	516	516		367	
(90% sustained voltage)	(PMG)	607	607	607		458	
Time constants (Sec)							
Transient		0.035	0.035	0.035		0.035	
Subtransient		0.011	0.011	0.011		0.011	
Open circuit		0.900	0.900	0.900		0.900	
DC		0.009	0.009	0.009		0.009	



Alternator data sheet

Frame size: UC3F

Windings		(@ 20° C)				
Stator resistance	(Line to Line, Ohms)		0.0480	0.0400	0.0700	0.0480
Rotor resistance	(Ohms)		0.0480	0.0400	0.0700	0.0480
Number of leads			12	12	6	12

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



Exhaust emission data sheet

150DSGAC

60 Hz Diesel generator set
EPA emission: Tier 3 ✓

Engine information:

Model:	Cummins Inc. QSB7-G5 NR3	Bore:	4.21 in. (107 mm)
Type:	4 cycle, in-line, 6 cylinder diesel	Stroke:	4.88 in. (124 mm)
Aspiration:	Turbocharged and CAC	Displacement:	408 cu. in. (6.7 liters)
Compression ratio:	17.2:1		
Emission control device:	Turbocharged and CAC		

	<u>1/4</u>	<u>1/2</u>	<u>3/4</u>	<u>Full</u>	<u>Full</u>
<u>Performance data</u>	<u>Standby</u>	<u>Standby</u>	<u>Standby</u>	<u>Standby</u>	<u>Prime</u>
BHP @ 1800 RPM (60 Hz)	69	122	176	232	209
Fuel consumption (gal/Hr)	4.0	6.8	9.3	11.5	10.6
Exhaust gas flow (CFM)	558	874	1129	1240	1179
Exhaust gas temperature (°F)	637	748	818	867	845

Exhaust emission data

HC (Total unburned hydrocarbons)	0.46	0.21	0.10	0.04	0.05
NOx (Oxides of nitrogen as NO2)	2.02	1.89	2.11	2.83	2.54
CO (Carbon monoxide)	2.30	1.35	0.73	0.38	0.51
PM (Particular Matter)	0.17	0.13	0.09	0.05	0.07
SO2 (g/Hp-hr)	0.17	0.17	0.16	0.15	0.15
Smoke (Bosch)	0.61	0.70	0.65	0.52	0.64

All values are Grams per HP-Hour

Test conditions

Data is representative of steady-state engine speed (± 25 RPM) at designated genset loads. Pressures, temperatures, and emission rates were stabilized.

Fuel specification:	ASTM D975 No. 2-D diesel fuel with 0.03-0.05% sulfur content (by weight), and 40-48 cetane number.
Fuel temperature	99 \pm 9 °F (at fuel pump inlet)
Intake air temperature:	77 \pm 9 °F
Barometric pressure:	29.6 \pm 1 in. Hg
Humidity:	NOx measurement corrected to 75 grains H2O/lb dry air
Reference standard:	ISO 8178

The NOx, HC, CO and PM emission data tabulated here are representative of test data taken from a single engine under the test conditions shown above. Data for the other components are estimated. These data are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits or with improper maintenance, may result in elevated emission levels.



Cooling system data

DSGAC

High ambient air temperature radiator cooling system ✓

	Duty	Rating (kW)	Max cooling @ air flow static restriction, unhooded (inches water/mm water)				Housed in free air, no air discharge restriction		
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	F182/F216	F173/F217	F232/F233
			Maximum allowable ambient temperature, degree C						
60 Hz	Standby	125	55	55	55	55	55	55	55
	Prime	135	55	55	55	55	55	55	55
	Continuous		N/A	N/A	N/A	N/A	N/A	N/A	N/A
50 Hz	Standby		N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Prime		N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Continuous		N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1. Data shown are anticipated cooling performance for typical generator set.
2. Cooling data is based on 1000 ft (305 m) site test location.
3. Generator set power output may need to be reduced at high ambient conditions. Consult generator set data sheet for derate schedules.
4. Cooling performance may be reduced due to several factors including but not limited to: Incorrect installation, improper operation, fouling of the cooling system, and other site installation variables.



Sound data 150DSGAC 60 Hz

Sound pressure level @ 7 meters, dB(A)

See notes 1-8 listed below

Configuration		Measurement location number								Average
		1	2	3	4	5	6	7	8	
Standard – unboxed (note 3)	Infinite exhaust	81.2	85.2	85.3	89.2	87.9	89.4	85.8	85.6	86.8
F182 – enclosure-steel, weather protective, w/ exhaust system	Mounted muffler	83.5	89.0	89.0	90.2	85.9	89.5	87.5	87.2	88.2
F216 – enclosure-aluminum, weather protective, w/ exhaust system	Mounted muffler	83.5	89.0	89.0	90.2	85.9	89.5	87.5	87.2	88.2
F173 – enclosure-steel, sound att, level 2, w/ exhaust system	Mounted muffler	72.3	74.5	72.7	73.0	72.4	74.1	71.9	73.4	73.1
F217 – enclosure-aluminum, sound att, level 2, w/ exhaust system	Mounted muffler	75.4	76.1	74.2	74.0	71.0	76.8	72.9	74.7	74.4
F232 – enclosure-steel, sound att, level 3, w/ exhaust system	Mounted muffler	68.6	69.4	69.0	71.4	69.3	71.3	68.7	70.2	69.9
F233 – enclosure-aluminum, sound att, level 3, w/ exhaust system	Mounted muffler	71.8	71.0	70.5	72.4	67.8	74.0	69.7	71.5	71.2

Sound power level, dB(A)

See notes 2-6, 9, 10 listed below

Configuration		Octave band center frequency (Hz)								Overall sound power level
		63	125	250	500	1000	2000	4000	8000	
Standard – unboxed (note 3)	Infinite exhaust	78.4	96.8	107.7	105.9	110.0	108.4	103.7	103.5	115.1
F182 – enclosure-steel, weather protective, w/ exhaust system	Mounted muffler	93.6	103.9	107.4	108.1	113.1	110.9	108.1	103.4	117.5
F216 – enclosure-aluminum, weather protective, w/ exhaust system	Mounted muffler	93.6	103.9	107.4	108.1	113.1	110.9	108.1	103.4	117.5
F173 – enclosure-steel, sound att, level 2, w/ exhaust system	Mounted muffler	83.3	92.9	95.6	93.2	95.3	95.0	94.0	90.6	102.5
F217 – enclosure-aluminum, sound att, level 2, w/ exhaust system	Mounted muffler	79.9	94.7	98.3	93.7	97.0	96.7	95.6	94.6	104.3
F232 – enclosure-steel, sound att, level 3, w/ exhaust system	Mounted muffler	79.7	90.3	92.1	90.7	93.3	92.9	92.5	87.3	100.4
F233 – enclosure-aluminum, sound att, level 3, w/ exhaust system	Mounted muffler	76.3	92.1	94.8	91.2	95.0	94.6	94.1	91.3	102.2

Exhaust sound pressure level @ 1 meter, dB(A)

Open exhaust (no muffler) @ rated load	Octave band center frequency (Hz)								Sound pressure level
	63	125	250	500	1000	2000	4000	8000	
	91.0	100.7	108.7	110.5	114.8	119.2	119.2	117.7	

Note:

1. Position 1 faces the engine front. The positions proceed around the generator set in a counter-clockwise direction in 45° increments. All position are at 7 m (23 ft) from surface of the generator set and 1.2 m (48 in.) from floor level.
2. Sound levels are subject to instrumentation, measurement, installation and manufacturing variability.
3. Sound data with remote-cooled generator sets are based on rated loads without cooling fan noise.
4. Sound levels for aluminum enclosures are approximately 2 dB(A)s higher than listed sound levels for steel enclosures.
5. Sound data for generator set with infinite exhaust do not include exhaust noise.
6. Data is based on full rated load with standard radiator-cooling fan package.
7. Sound pressure levels are measured per ANSI S1.13 and ANSI S12.18, as applicable.
8. Reference sound pressure is 20 µPa.
9. Sound power levels per ISO 3744 and ISO 8528-10, as applicable.
10. Reference power = 1 pw (10⁻¹² W).
11. Exhaust sound pressure levels are per ISO 6798, as applicable.

Cummins Inc.

Data and specification subject to change without notice

MSP-1057
(10/17)

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Data sheet

Circuit breakers

Description

This data sheet provides circuit breaker manufacturer part numbers and specifications. The circuit breaker box description is the rating of that breaker box installation on a Cummins generator. Please refer to the website of the circuit breaker manufacturer for breaker specific ratings and technical information.

Applicable models

Engine	Models					
Kubota	C10D6	C15D6	C20D6			
QSJ2.4	C20N6	C25N6	C30N6	C30N6H	C36N6	C36N6H
	C40N6	C40N6H	C50N6H	C60N6H		
B3.3	C25D6	C30D6	C35D6	C40D6	C50D6	C60D6
QSJ5.9G	C45N6	C50N6	C60N6	C70N6	C80N6	C100N6
QSJ8.9G	C125N6	C150N6				
QSB5	DSFAC	DSFAD	DSFAE	C50D6C	C60D6C	C80D6C
	C100D6C	C125D6C				
QSB7	DSGAA	DSGAB	DSGAC ✓	DSGAD	DSGAE	
QSL9	DSHAD	DQDAA	DQDAB	DQDAC		
QSM11	DQHAB					
QSX15	DFEJ	DFEK				

Instructions

1. Locate the circuit breaker feature code or part number and use the charts below to find the corresponding manufacturer circuit breaker catalog number.
2. Use the first letter of the circuit breaker catalog number to determine the "frame" of the breaker. If the first letter is an "N", use the second letter. Then follow the corresponding website link from the table below to find the breaker catalog number description.

Please refer to the catalog numbering systems page, which is given in the chart, to understand the nomenclature of the catalog number.

Frame	Catalog name*	Catalog number description page(s)
P	0612CT0101 http://www.schneider-electric.us/en/download/document/0612CT0101/	16-17
H, J, and L	0611CT1001 http://www.schneider-electric.us/en/download/document/0611CT1001/	8-9
Q	0734CT0201 http://www.schneider-electric.us/en/download/document/0734CT0201/	4

*The following link may also be used to search specifically by the breaker part number or for the catalog name listed above. <http://products.schneider-electric.us/technical-library/>

3. Search the catalog by using the first 3 letters of the breaker catalog number and the first 5 numbers to find information such as trip curves, accessories, and dimensional details regarding the circuit breaker.

*If the catalog number starts with "N", skip the N and begin your search with the second letter.

*If the first 3 letters are "PJP," the search will not work. You will need to start with just "PJ" and use the description pages to obtain the information you are looking for on the "PJP."

Example



After finding your circuit breaker catalog number to be "PJL36120U33EACUKMOYB," navigate to the P-frame catalog by using the link provided.

Look at pages 16-17 of the pdf catalog to find the nomenclature of the breaker.

Search the P-frame spec sheet using the search "PJL36120."

P	J	L	3	6	120	U33	E	AC	UK	MO	YB
P-Frame	Interrupting Rating	Lug Connection	Poles	Voltage Rating	Ampere Rating	Trip System	Rating Plug	3 Auxiliary Switch	24 Vac/dc UVR	24 Vdc Spring charging motor	Pad lockable Push-button cover

Feature Code	Breaker Box Description	Cummins Part #	Manufacturer	Breaker Catalog Number	Trip Unit	Plug Type
KT70-2	CircuitBrkr-150A, Right, 3P, 600/525V, TM, 80%, UL/IEC	0320-2346-55	Schneider Electric	HGL36150	Thermal Magnetic	N/A
KT71-2	CircuitBreaker-150A, Left, 3P, 600/525V, TM, 80%, UL/IEC	0320-2346-55A	Schneider Electric	HGL36150	Thermal Magnetic	N/A
KT72-2	CircuitBrkr-175A, Right, 3P, 600/525V, TM, 80%, UL/IEC	0320-2347-54	Schneider Electric	JGL36175	Thermal Magnetic	N/A
KT73-2	CircuitBreaker-175A, Left, 3P, 600/525V, TM, 80%, UL/IEC	0320-2347-54A	Schneider Electric	JGL36175	Thermal Magnetic	N/A
KT74-2	CircuitBrkr-200A, Right, 3P, 600/525V, TM, 80%, UL/IEC	0320-2347-53	Schneider Electric	JGL36200 ✓	Thermal Magnetic	N/A
KT75-2	CircuitBreaker-200A, Left, 3P, 600/525V, TM, 80%, UL/IEC	0320-2347-53A	Schneider Electric	JGL36200 ✓	Thermal Magnetic	N/A
KT76-2	CircuitBreaker-200A, Right, 3P, 240V, TM, 80%UL	0320-2238-60	Schneider Electric	QDL32200	Thermal Magnetic	N/A
KT77-2	CircuitBreaker-200A, Left, 3P, 240V, TM, 80%UL	0320-2238-60A	Schneider Electric	QDL32200	Thermal Magnetic	N/A
KT78-2	CircuitBrkr-225A, Right, 3P, 600/525V, TM, 80% UL/IEC	0320-2347-52	Schneider Electric	JGL36225	Thermal Magnetic	N/A
KT79-2	CircuitBreaker-225A, Left, 3P, 600/525V, TM, 80% UL/IEC	0320-2347-52A	Schneider Electric	JGL36225	Thermal Magnetic	N/A
KT80-2	CircuitBreaker-225A, Right, 3P, 240V, TM, 80%UL	0320-2238-59	Schneider Electric	QDL32225	Thermal Magnetic	N/A
KT81-2	CircuitBreaker-225A, Left, 3P, 240V, TM, 80%UL	0320-2238-59A	Schneider Electric	QDL32225	Thermal Magnetic	N/A
KT82-2	CircuitBrkr-250A, Right, 3P, 600/525V, TM, 80%, UL/IEC	0320-2347-51	Schneider Electric	JGL36250	Thermal Magnetic	N/A
KT83-2	CircuitBreaker-250A, Left, 3P, 600/525V, TM, 80%, UL/IEC	0320-2347-51A	Schneider Electric	JGL36250	Thermal Magnetic	N/A
KT84-2	CircuitBreaker-250A, Right, 2P, 240V, TM, 80%UL	0320-2238-51	Schneider Electric	QDL22250	Thermal Magnetic	N/A
KT85-2	CircuitBreaker-250A, Left, 2P, 240V, TM, 80%UL	0320-2238-51A	Schneider Electric	QDL22250	Thermal Magnetic	N/A
KT86-2	CircuitBreaker-250A, Right, 3P, 240V, TM, 80%UL	0320-2238-58	Schneider Electric	QDL32250	Thermal Magnetic	N/A



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 Rev. DO



THE VMC GROUP

The Power of Together™



CERTIFICATE OF COMPLIANCE

SEISMIC DESIGN OF NONSTRUCTURAL COMPONENTS AND SYSTEMS



Certification No.

VMA-49457-01C (Revision 02)

Expiration Date: 09/30/2017

Certification Parameters:

The nonstructural products (mechanical and/or electrical components) listed on this certificate are **CERTIFIED¹** FOR SEISMIC APPLICATIONS in accordance with the following building code² releases.

IBC 2006, IBC 2009, IBC 2012

The following model designations, options, and accessories are included in this certification. Reference report number **VMA-49457-01** as issued by The VMC Group for a complete list of certified models, included accessories/options, and certified installation methods.

Cummins QSB7-G5 DSGAx 100 kW – 200 kW

The above referenced equipment is **APPROVED** for seismic application when properly installed,³ used as intended, and contains a Seismic Certification Label referencing this Certificate of Compliance⁴. As limited by the tabulated values, below grade, grade, and roof-level installations, installations in essential facilities, for life safety applications, and/or of equipment containing hazardous contents are permitted and included in this certification with an Equipment Importance Factor assigned as $I_p=1.5$.

Certified Seismic Design Levels	
$S_{DS} \leq 2.48 \text{ g}$	$S_{DS} \leq 2.00 \text{ g}$
$z/h \leq 0.0$	$z/h \leq 1.0$
(Equipment at Grade)	(Equipment on Roof)
Soil Classes A, B, C, D, Seismic Risk Category I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{DS} value stated above.	
Certified Seismic Installation Methods	
Rigid mounting from unit base to rigid structure	

Shake Test of Active and Energized Components, Non-Active Components, and Equipment Structure:

Qualified by successful seismic shake table testing at the nationally recognized University of California Berkeley Pacific Earthquake Engineering Research Center under the witness of Panache Engineering Inc. Testing was conducted in accordance with ICC-ES AC-156 to envelope the Required Response Spectrum (RRS) of maximum horizontal flexible acceleration (A_{FLEX}) of 2.48 g and a rigid acceleration (A_{RIG}) of 0.99 g. This test level corresponds to an $S_{DS} = 2.48 \text{ g}$ with a z/h of 0.0. Testing was conducted in accordance with ICC-ES AC-156 to envelope the Required Response Spectrum (RRS) of maximum horizontal flexible acceleration (A_{FLEX}) of 2.00 g and a rigid acceleration (A_{RIG}) of 0.80 g. This test level corresponds to an $S_{DS} = 2.00 \text{ g}$ with a z/h of 1.0. Functionality was verified before and after the shake test.

Basis of Design for Supports and Attachments to the Building:

For calculations and analysis of the equipment attachment to the building structure, the equivalent static force method was employed using the Seismic Design Acceleration, F_p/W_p ,⁵ for Load Resistance Factored Design (LRFD) methods. This includes but is not limited to the unit anchoring requirements and external isolation calculations.

Seismic Design Acceleration Equation Genset at Grade $F_p/W_p = 0.4 \times (S_{DS}=2.48 \text{ g}) \times (I_p=1.5) \times (a_p/R_p=1.25) \times (1+2(z/h=0.0)) = 1.86 \text{ g}$

Seismic Design Acceleration Equation Genset at Roof $F_p/W_p = 0.4 \times (S_{DS}=2.00 \text{ g}) \times (I_p=1.5) \times (a_p/R_p=1.25) \times (1+2(z/h=1.0)) = 4.50 \text{ g}$

a_p/R_p is representative of the worst-case shake tested condition, as determined from Table 13.6-1 in ASCE/SEI7-05/10.



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CERTIFICATE OF COMPLIANCE

SEISMIC DESIGN OF NONSTRUCTURAL COMPONENTS AND SYSTEMS

Certified Product Table:

Cummins Engine	Product	Standby Rating (kW)	Tank	Enclosure	S _{DS} g	
					z/h = 0	z/h = 1
QSB7-G5	DSGAA	100	344 – 956 Gallon	QSB & Enclosure Note 1	2.48	2.00
	DSGAB	125			2.48	2.00
	DSGAC ✓	150			2.48	2.00
	DSGAD	175			2.48	2.00
	DSGAE	200			2.48	2.00

Notes:

1. F173-2, F182-2, F216-2, F217-2, F232-2, F233-2 enclosures are approved
2. Tank type can be UL142 or UL2085

This certification **includes** the generator sets configured with and without enclosures installed, with or without the sub-base tank. The generator set and included options shall be a catalogue design and factory supplied. The generator set and applicable options shall be installed and attached to the building structure per the manufacturer supplied seismic installation instructions. This certification **excludes** After Treatment Units (ATUs), all non-factory supplied accessories, including but not limited to mufflers, isolation/restraint devices, remote control panels, remote radiators, pumps and other electrical/mechanical components.



VMA-49457-01C (Revision 02)
Issue Date: August 01, 2014
Revision Date: June 30, 2017
Expiration Date: September 30, 2017



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CERTIFICATE OF COMPLIANCE

SEISMIC DESIGN OF NONSTRUCTURAL COMPONENTS AND SYSTEMS

Notes and Comments:

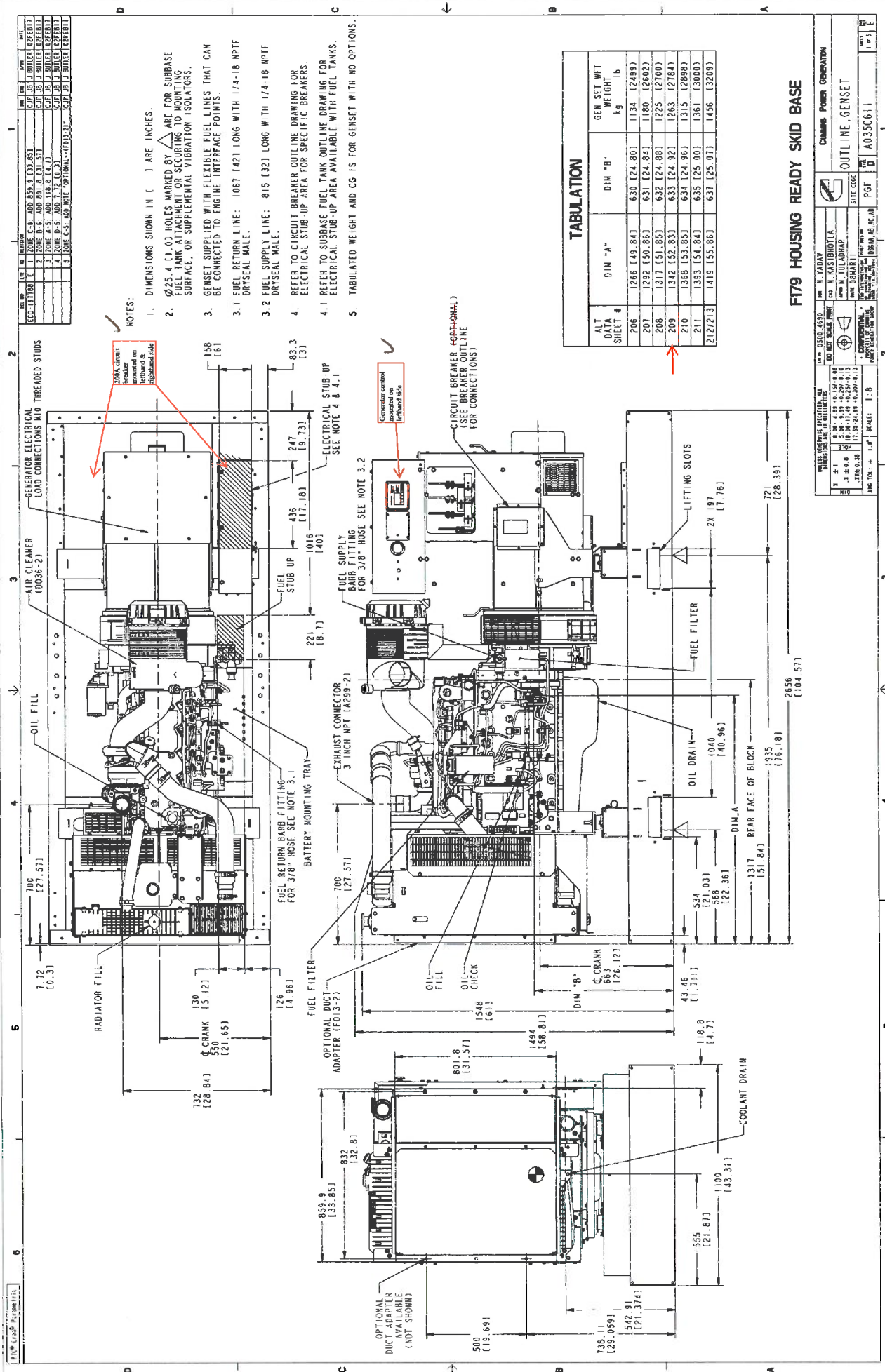
1. All equipment listed herein successfully passed the seismic acceptance criteria for shake testing non-structural components and systems as set forth in the ICC AC-156. The Test Response Spectrum (TRS) enveloped the Required Response Spectrum (RRS) for all units tested. The units cited in this certification were representative sample(s) of a contingent of models and all remained captive and structurally sound after the seismic shake simulation. The units also remained functionally operational after the simulation testing as functional testing was completed by the equipment manufacturer before and after the seismic simulations. Although a seismic qualified unit inherently contains some wind resisting capacity, that capacity is undetermined and is excluded from this certification. Snow/Ice loads have been neglected and thus limit the unit to be installed both indoors (covered by an independent protective structure) and out of doors (exposed to accumulating snow/ice) for ground snow loads no greater than 30 psf for all applications.
2. The following building codes are addressed under this certification:

IBC 2012 – referencing ASCE7-10 and ICC AC-156
IBC 2009 – referencing ASCE7-05 and ICC AC-156
IBC 2006 – referencing ASCE7-05 and ICC AC-156
3. Refer to the manufacturer supplied installation drawings for anchor requirements and mounting considerations for seismic applications. Required anchor locations, size, style, and load capacities (tension and shear) are specified on the installation drawings. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection, wall design, and attachment to non-building structures must be outlined and approved by the Engineer of Record for the project or building. Structural walls, structural floors, and housekeeping pads must also be seismically designed and approved by the project or building Structural Engineer of Record to withstand the seismic anchor loads as defined on the installation drawings. The installing contractor is responsible for observing the installation detailed in the seismic installation drawings and the proper installation of all anchors and mounting hardware.
4. For this certificate and certification to remain valid, this certificate must correspond to the "Seismic Certification Label" found affixed to the unit by the factory. The label ensures the manufacturer built the unit in conformance to the IBC seismic design criteria set forth by the Certified Seismic Qualification Agency, The VMC Group, and meets the seismic design levels claimed by this certificate.
5. When the site soil properties or final equipment installation location are not known, the soil site coefficient, F A, defaults to the Soil Site Class D coefficient. Soil Classes A, B, C, D, Seismic Risk Category I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the SDS values on page 1, respective to the applicable building code, Importance factor, and z/h ratio.
6. Mechanical, Electrical, and Plumbing connections to the equipment must be flexibly attached as to not transfer load through the connection. The structural integrity of any conduit, cable trays, piping, ductwork and/or flexible connections is the responsibility of others. This certification does not guarantee the equipment will remain compliant to UL or NEMA standards after a seismic event.

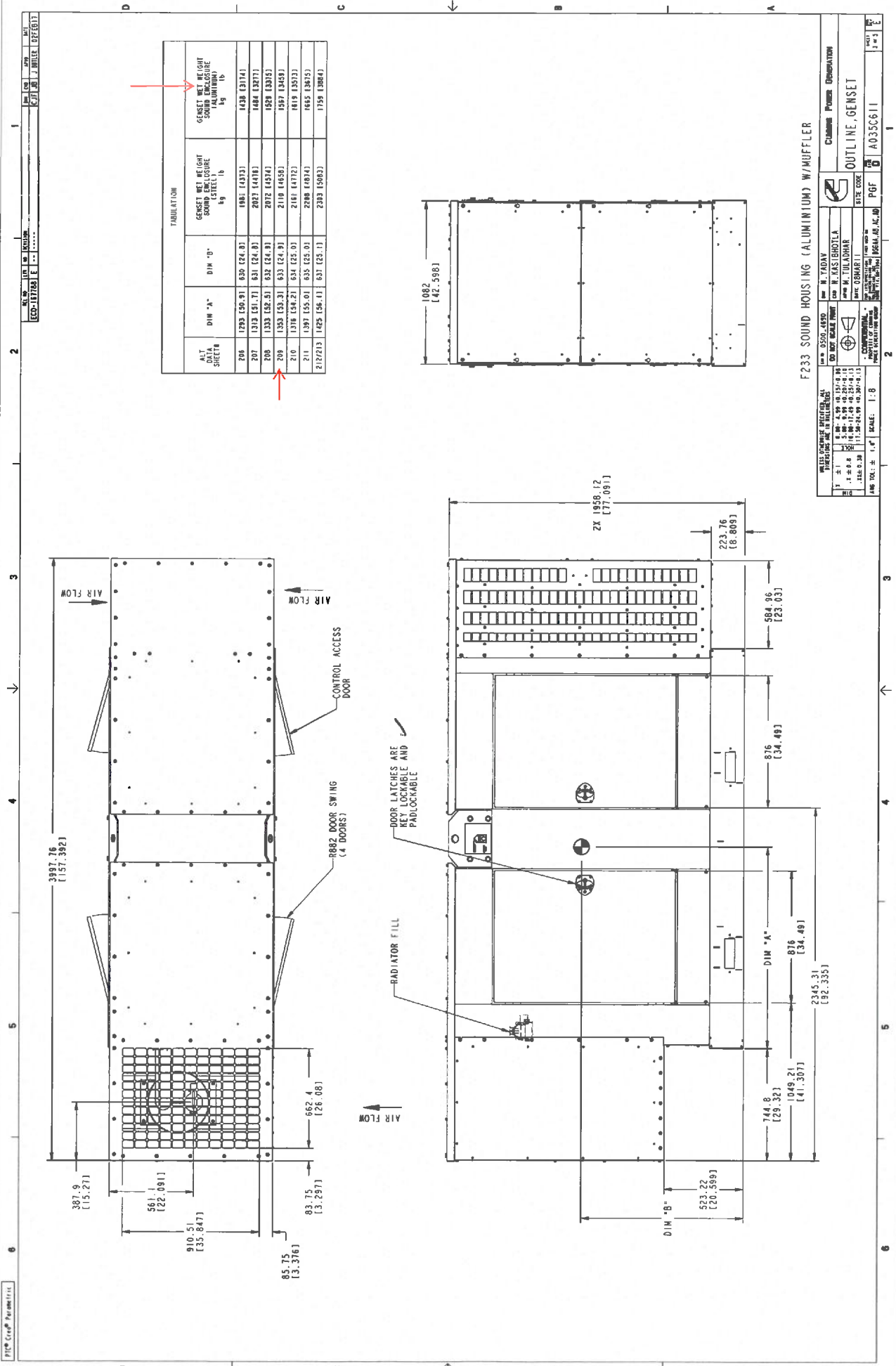
John P. Giuliano, PE
President, The VMC Group

VMA-49457-01C (Revision 02)
Issue Date: August 01, 2014
Revision Date: June 30, 2017
Expiration Date: September 30, 2017



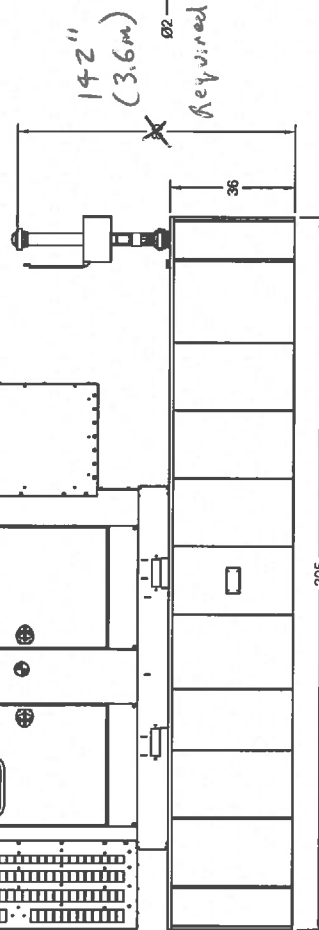
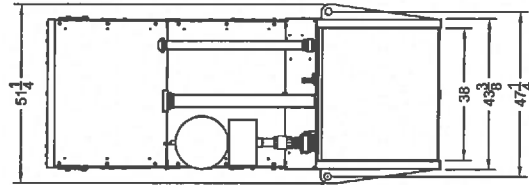
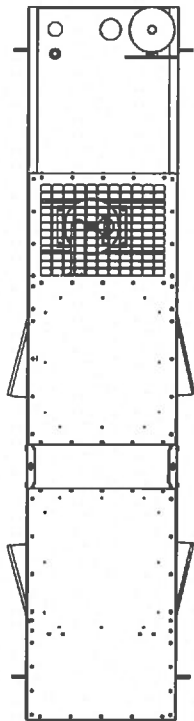


PICOP Corp Parametric



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Rev. DO

Total weight generator + enclosure + 72 hours fuel tank (dry)= 7716 Lbs



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UNIQUE
 12-04-2018
 0
 0.00
 0.00
 0.00

Date: 12-04-2018
 Version: 0
 Scale: N/A
 Designer: JASS

No. Drawing
 3256-01
 No. Drawing/No. Date
 3256

Sheet
 1
 Format
 B

POIDS :	4257 LBS
WEIGHT :	4257 LBS

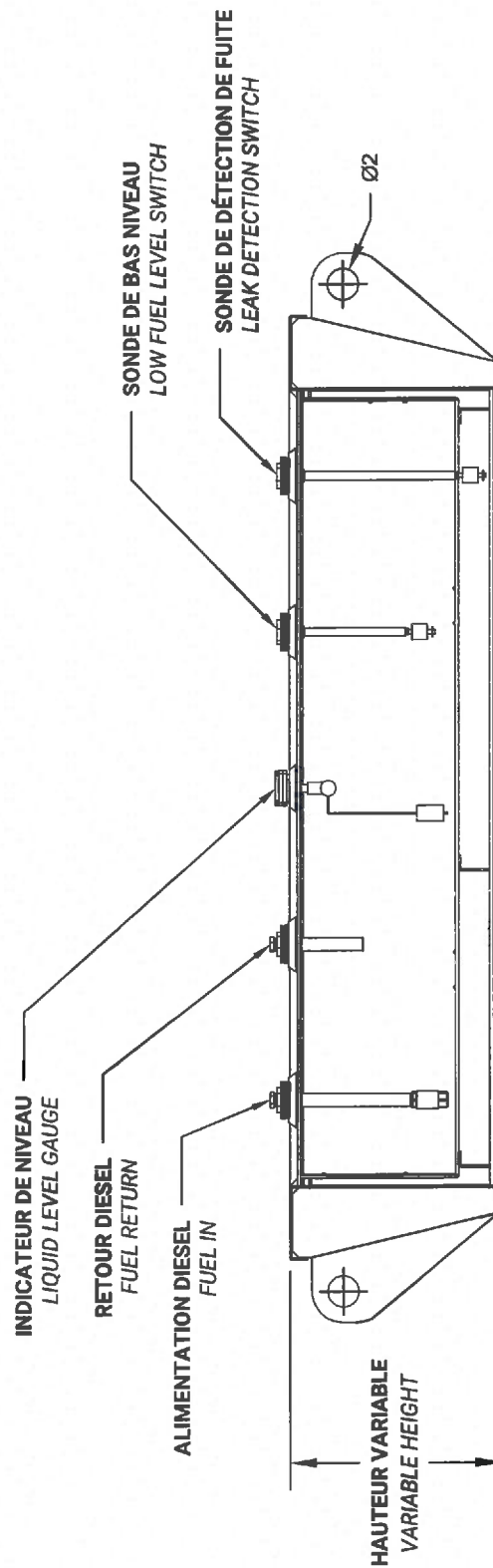


Not Disclosed/No. Disclosing	Quantity	Parent
3256 02	1	B
Not Disclosed/No. Disclosing		
3256		

Upper/Lower:	
Pl./In.	
TOL RANGES	
Dist. ±	0.05"
Frnc. ±	1/16"
Ang. ±	0.5°

Date	12-04-2018	Revision	0
Estimator/Scale	N/A	Designer/Draftsman	J.ASS

COMPOSANT COMPONENT	OPTIONS
ALIMENTATION DIESEL FUEL IN	●
RETOUR DIESEL FUEL RETURN	●
INDICATEUR DE NIVEAU LIQUID LEVEL GAUGE	●
SONDE DE BAS NIVEAU LOW FUEL LEVEL SWITCH	●
SONDE DE DÉTECTION DE FUITE LEAK DETECTION SWITCH	●
SONDE MULTI-NIVEAU MULTI-LEVEL GAUGE	



CONCEPTIONS DESSINS DANIEL

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Montréal, Québec H2Y 1K1
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Unité/Unit:
Po./In.
TOLERANCES
Dec. ± 0.05"
Frac. ± 1/16
Ang. ± 0.5°

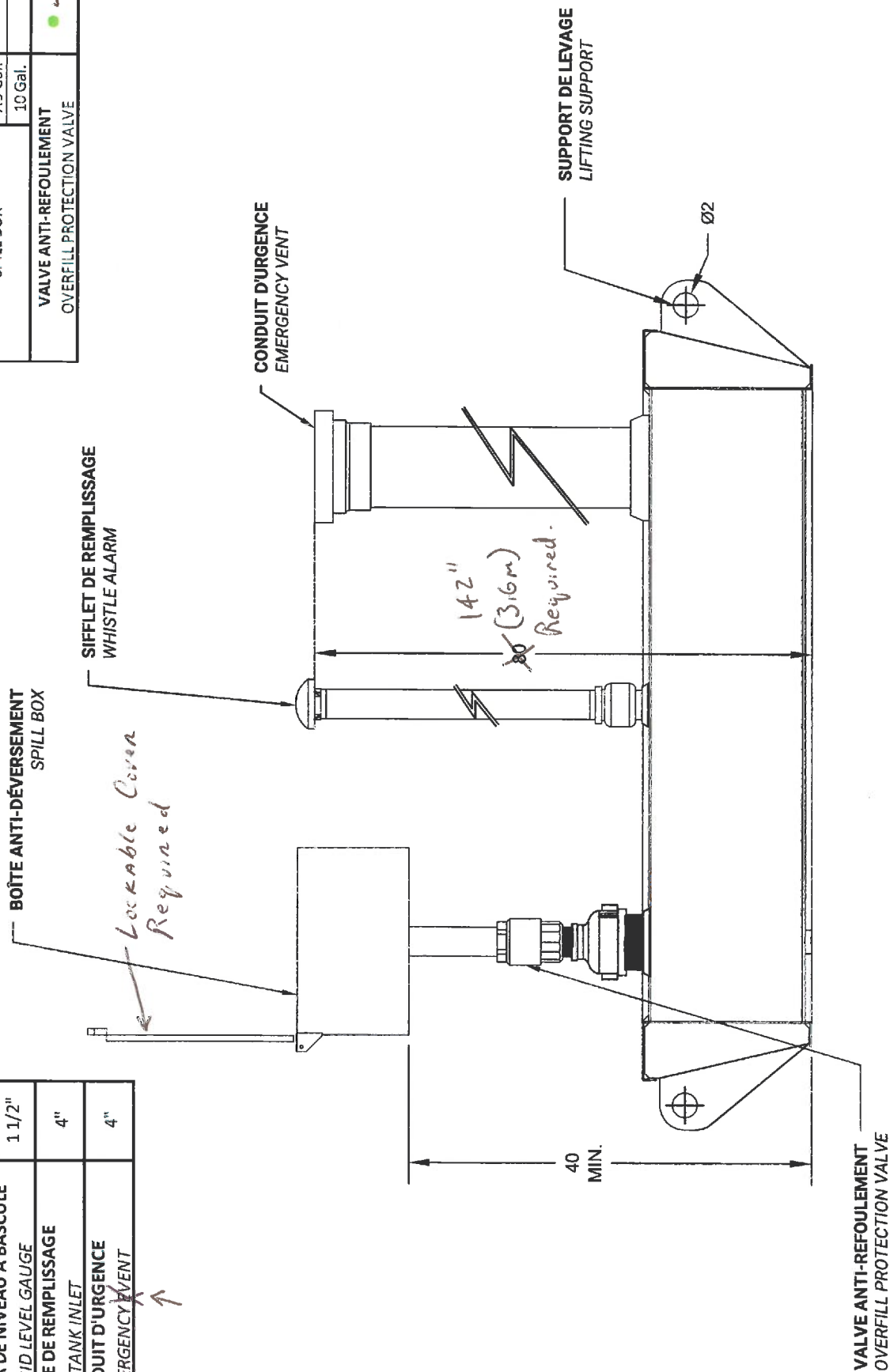
Date	Révision
12-04-2018	0
Échelle/Scale	Dessinateur/Draftsman
N/A	J.ASS.

No. Dessin/No. Drawing
3256-4
No. Soumission/No. Quote
3256

Qty/Qty	Format
1	A

STANDARD	
SIFFLET DE REMPLISSAGE WHISTLE ALARM	2"
INDICATEUR DE NIVEAU À BASCULE LIQUID LEVEL GAUGE	1 1/2"
TRAPPE DE REMPLISSAGE TANK INLET	4"
CONDUIT D'URGENCE EMERGENCY VENT	4"

OPTIONS	
BOÎTE ANTI-DÉVERSEMENT SPILL BOX	3.5 Gal.
	5 Gal.
	7.5 Gal.
	10 Gal.
VALVE ANTI-REFOULEMENT OVERFILL PROTECTION VALVE	



CONCEPTIONS DESSEINS DANIEL

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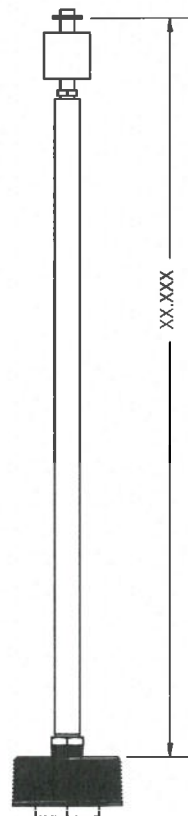
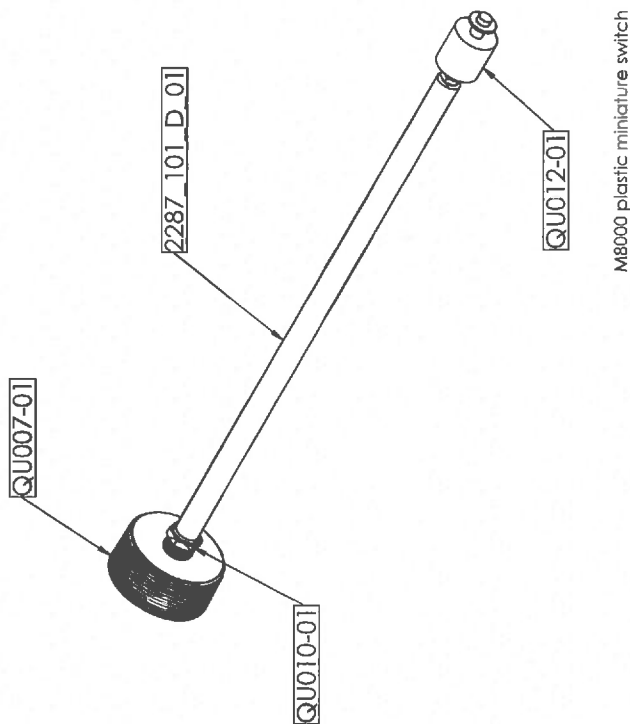


No. Dessin/No. Drawing	3256-3	Qté/Qty	1	Format	A
No. Soumission/No. Quote	3256				

Date	12-04-2018	Révision	0
Échelle/Scale	N/A	Dessinateur/Draftman	JASS.

Unité/Unit	Po./In.
TOLERANCES	
Dec. ±	0.05"
Frac. ±	1/16"
Ang. ±	0.5°

No	Description	Type	Matériel	Quantité	Opération	Inventaire
QU007-01	Reducing Tank Fitting - 2" NPT to			1	Q	1.00
QU010-01	Steel Hex Bushing 3/8" NPT to 1/4" NPT	QU010-01	44605K242	1	Q	1.00
QU012-01	Vertical-Mount Liquid-Level Float Switch	QU012-01	48095K61	1	Q	1.00
2287_101_D_01	Tuyau de la sonde de bas niveau	Tuyau .250 SCH 80	ACIER A53b	1	C	0.00



CONCEPTIONS DESINS DANIEL

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Unité: Po./In.
TOLERANCES
0.0" ± 0.05"
0.00" ± 0.015"
0.000" ± 0.005"
X/X" ± 1/16
Deg. ± 0.5°

Projet
Soumission
1154
Révision

Date
2016-09-19
Destinataire
Mathieu

Description
Leak detection switch
Qte
1
No. Pièce
2287_101_D



M7000 PBT 1/8" NPT Miniature Float Switch

Miniature Plastic Liquid Level Float Switch

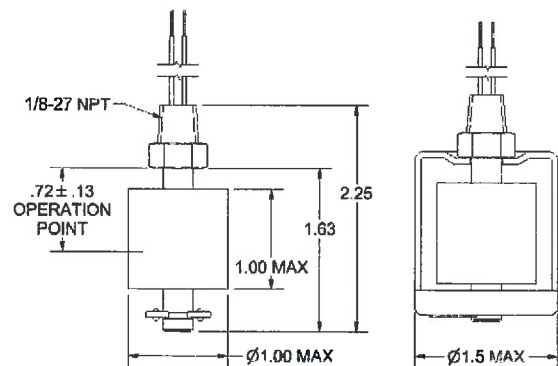
The M7000 miniature liquid level float switch has a PBT stem and a Buna-N float and is a superior choice to basic nylon float switches. The Buna-N float provides better buoyancy and is typically suitable for use in oils, water, aromatic hydrocarbons, diluted acids, and bases. This float switch is ideal for single point float switch level detection when needing to sense a high or low fluid level.

The M7000 is not recommended for use in hot water or soap water applications above 65°C.



Specifications

M7000 – Miniature Plastic Level Float Switch	
Stem Material	PBT
Float Material	Buna-N
Fitting Type	1/8" NPT Pipe Thread
Max. Temperature	105°C
Max. Pressure	150 PSIG
Float SG	0.45 SG
Switch Rating	30 Watt, 240V max. (AC/DC), SPST
Lead Wires	24", 22 AWG, Teflon Insulated (Standard)
Approvals	CE, UL, CSA
Availability	Stock



Custom configurations available. Contact Madison Company or your sales representative to discuss your application.

Note: SPST = Single Pole, Single Throw Reed Switch

Applications

- ♦ Oil tanks
- ♦ Hydraulic oil level detection
- ♦ Low or high alarms or shut-off switches

Electrical Ratings

Switches are rated for resistive loads. The table below represents the UL guidelines for current (Amperes resistive) at different voltages.

AC Voltage

30 VA Nominal	at 120 VAC	0.28 amps max
30 VA Nominal	at 240 VAC	0.14 amps max

DC Voltage

30 Watt Nominal	at 24 VDC	0.28 amps max
30 Watt Nominal	at 120 VDC	0.07 amps max



Model 517 Series 3½ Gallon AST Spill Container

SPECIFICATION SHEET

Application

Tank top spill containers are designed to contain small spills that occur at the fill point on aboveground storage tanks.

Features and Details

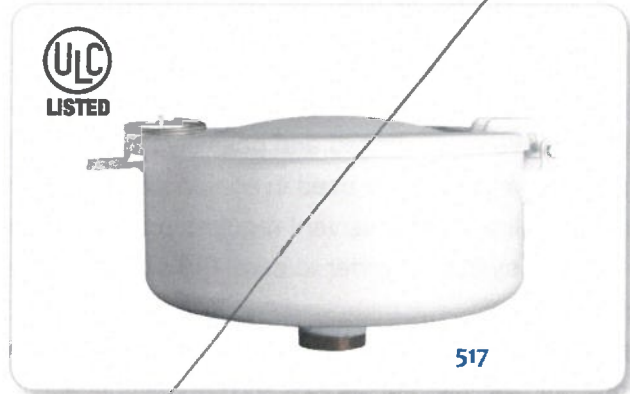
- 3½ gallon (13.25 liters) capacity
- Hinged cover is lockable with a padlock
- Centered connection
- **517** has male threaded inlet and outlet
- **517F** has female threaded inlet and outlet
- **517WO** includes removable screen for use as used oil collection point, male threads

Materials of Construction

- 16 gauge spun steel, powder coated white body and cover

Code Compliance

- Florida DEP EQ 345, meets the new and revised requirements for CAN-ULC-S663-11 (effective September 25, 2015)



5 gallon Spill Container
clw Lockable Cover is
Required.

Item Number	A	B	C	D	E	F	G	H	I	J
517--0100 AC	3½	M	C	2"	N	N	8½"	17½"	9.0	13 ⁹ / ₁₆ "
517--0200 AC	3½	M	C	4"	N	N	8½"	17½"	9.0	13 ⁹ / ₁₆ "
517--2500 ACPW	3½	M	C	2½"	N	N	8 ¹³ / ₃₂ "	17½"	9.0	13 ⁹ / ₁₆ "
517F--0100 AC	3½	F	C	2"	N	N	8"	17½"	10.50	13 ⁹ / ₁₆ "
517F--0200 AC	3½	F	C	4"	N	N	10½"	17½"	10.50	13 ⁹ / ₁₆ "
517F--2500 ACPW	3½	F	C	2½"	N	N	8 ¹³ / ₃₂ "	17½"	10.50	13 ⁹ / ₁₆ "
517WO-0100 AC	3½	M	C	2"	N	Y	8½"	17½"	11.0	13 ⁹ / ₁₆ "
517WO-0200 AC	3½	M	C	4"	N	Y	8 ¹¹ / ₁₆ "	17½"	11.0	13 ⁹ / ₁₆ "

SPECIFICATION OPTIONS:

- A—Capacity: Gallons
- B—Mounting connection: Male (M), Female (F)
- C—Mounting location: Center (C)
- D—Size: NPT threads
- E—Drain: Yes/No
- F—Screen: Yes/No
- G—Height: (inches)
- H—Width: (inches)
- I—Shipping weight: (lbs)
- J—Body diameter (inches)



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Rev. D0

Model 244 Emergency Vents | 3-inch

SPECIFICATION SHEET

Application

UL Listed emergency vent (pressure relief only) used on aboveground storage tanks, as a code requirement, to help prevent the tank from becoming over-pressurized and possibly rupturing if ever exposed to fire. The vent must be used in conjunction with a "normal vent". Correct application of this vent requires proper vent size and selection for the tank system in order to meet the specific venting capacity requirements.

The new design increases protection against weather, improves manufacturability and helps limit and control dust accumulation.

Code Compliance

When properly sized for the tank, this vent will conform to the requirements of the International Fire Code; National Fire Code of Canada; National Fire Protection Agency - NFPA 1, 30, 30A, 31, 37, 110; Petroleum Equipment Institute - PEI RP200, PEI RP800; Underwriters Laboratories Inc. UL-142, UL-2085, UL- 2244; Underwriters Laboratories of Canada CAN/ULC S601, CAN/ULC S602, CAN/ULC S652

Approvals

California Air Resource Board (CARB) Phase 1 Enhanced Vapor Recovery (EVR) AST Certified Products (VR-402-B) 

Underwriters Laboratories Inc. UL-2583

Item Number	A	B	C	D	E	F	G	Diameter	Height	Weight	Screen
244O--0050 AV	3"	60,994	F	8	I	A	AL	5 ⁵¹ / ₆₄ "	3"	7.0	
244O--0060 AV	3"	60,994	F	16	I	A	AL	5 ⁵¹ / ₆₄ "	3 ¹ / ₂ "	11.0	
244OS-0050 AV	3"	51,076	F	8	I	A	AL	5 ⁵¹ / ₆₄ "	3"	7.0	S
244OS-0060 AV	3"	51,076	F	16	I	A	AL	5 ⁵¹ / ₆₄ "	3 ¹ / ₂ "	11.0	S
244OM-0050 AV	3"	60,994	M	8	I	A	AL	5 ⁵¹ / ₆₄ "	3 ⁵¹ / ₆₄ "	7.0	
244OM-0060 AV	3"	60,994	M	16	I	A	AL	5 ⁵¹ / ₆₄ "	4 ¹ / ₂ "	11.0	
244OM-0060AVEVR	3"	60,994	M	16	I	B	AL	5 ⁵¹ / ₆₄ "	4 ¹ / ₂ "	11.0	
244OMS0050 AV	3"	51,076	B	8	I	A	AL	5 ⁵¹ / ₆₄ "	3 ⁵¹ / ₆₄ "	7.0	S
244OMS0050 AV	3"	51,076	M	8	I	A	AL	5 ⁵¹ / ₆₄ "	3 ⁵¹ / ₆₄ "	7.0	S
244OMS0060 AV	3"	51,076	M	16	I	A	AL	5 ⁵¹ / ₆₄ "	4 ¹ / ₂ "	11.0	S
244OMS0060AVEVR	3"	51,076	M	16	I	B	AL	5 ⁵¹ / ₆₄ "	4 ¹ / ₂ "	11.0	S

SPECIFICATION OPTIONS:

A—Size (inches)
B—Venting capacity / SCFH at 2.5 P.S.I.
C—Mounting connection: Female N.P.T. (F), Male N.P.T. (M), BSP (B)
D—Pressure settings: 8 or 16 oz/in2. Pressure required to open vent.
E—Cover: Cast iron powder coated (I)
F—Seat material: Viton A (A) or Viton B (B)
G—Body material: Aluminum (AL) or iron (I)
Diameter—Dimension across vent (inches)
Height—Dimension from base to top when closed (inches)
Weight—Shipping weight (lbs)
Screen (3 mesh stainless steel)—Yes (S), No (blank)
Bolt—Zinc plated steel



Fig. 244OM



Fig. 244O



UL
2583

WARNING: DO NOT FILL OR UNLOAD FUEL FROM A STORAGE TANK UNLESS IT IS CERTAIN THAT THE TANK VENTS WILL OPERATE PROPERLY. Morrison tank vents are designed only for use on shop fabricated atmospheric tanks which have been built and tested in accordance with UL 142, NFPA 30 & 30A, and API 650 and in accordance with all applicable local, state, and federal laws. In normal operation, dust and debris can accumulate in vent openings and block air passages. Certain atmospheric conditions such as a sudden drop in temperature, below freezing temperatures, and freezing rain can cause moisture to enter the vent and freeze which can restrict internal movement of vent mechanisms and block air passages. All storage tank vent air passages must be completely free of restriction and all vent mechanisms must have free movement in order to insure proper operation. Any restriction of airflow can cause excessive pressure or vacuum to build up in the storage tank, which can result in structural damage to the tank, fuel spillage, property damage, fire, injury, and death. Monthly inspection, and immediate inspection during freezing conditions, by someone familiar with the proper operation of storage tank vents, is required to insure venting devices are functioning properly before filling or unloading a tank.

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 MORRISON BROS. CO.

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Rev. 10

Model 446 Emergency Shut-Off Valve

SPECIFICATION SHEET

Application

The 446 normally open valve is designed to shut off liquid flow in the event of a fire or excessive temperatures. This emergency shut-off valve is installed in the fuel line from a storage tank to fuel burning equipment; such as back-up generators, boilers, and other flammable liquid burning appliances.

Features and Details

- cUL_{us} listed to ULC/ORD-C842 – Valves for Flammable and Combustible Liquids (See details below in Code Compliance)
- 165°F (73°C) fusible link activates spring closure
- ½" (12.7 mm), ¾" (19.05 mm) or 1" (25.4 mm) female NPT threaded connections
- Compact size reduces operational footprint requirement
- Easy to install and maintain

Operational Criteria

- Operating pressure rated at 50 psi (433.7 kPa)
- Operating temperature range rated at -20°F (-28°C) to 125°F (51°C)

Materials of Construction

- Body... 316 stainless steel
- Cap, shaft, tail fitting, poppet, and nut... 303 stainless steel
- Lever arm... 304 stainless steel
- Handle... 356-T6 aluminum
- Spring... 17-7 stainless
- O-ring and disc... Viton®

Code Compliance

- cUL_{us} listed to ULC/ORD-C842—Valves for Flammable and Combustible Liquids

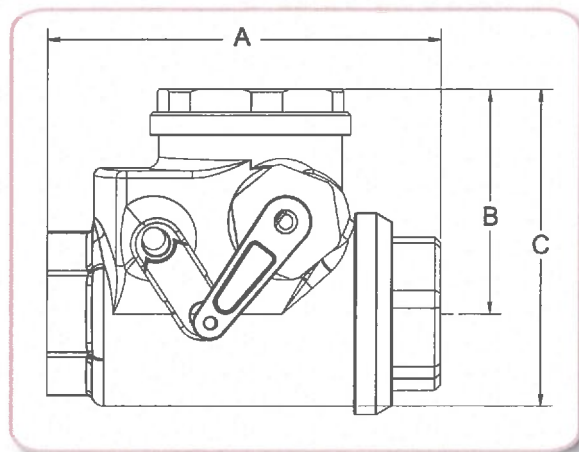
YRBX7.MH10308

Product Category Code
"Flammable Liquid Shutoff Valves
Certified for Canada"

Morrison cUL_{us}
File Number

- Click [here](#) for link to UL Online Certifications Directory

Item Number	Size	A	B	C	Weight (lbs)
446---0050 AV	½" (12.7 mm)	4 ⁹ / ₃₂ "	2 ⁷ / ₁₆ "	3 ⁷ / ₁₆ "	3.52
446---0075 AV	¾" (19.05 mm)	4 ⁹ / ₃₂ "	2 ⁷ / ₁₆ "	3 ⁷ / ₁₆ "	3.20
446---0100 AV	1" (25.4 mm)	4 ⁹ / ₃₂ "	2 ⁷ / ₁₆ "	3 ⁷ / ₁₆ "	3.40



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MORRISON BROS. CO.

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Rev. D0

Extended-Life Backflow-Prevention Valve
1/2 Female x 1/2 Female NPT

In stock

47715K23

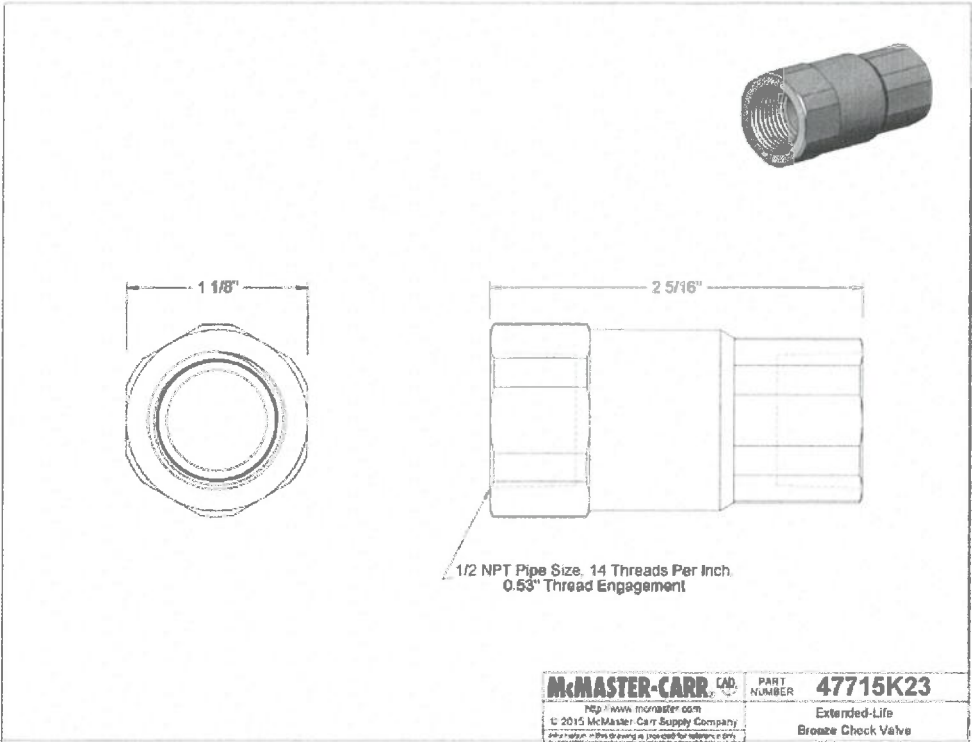


Valve Function	Backflow Prevention
For Use With	Air, Diesel Fuel, Gasoline, Inert Gas, Oil, Steam, Water
Activation	Pressure Driven
Connection Type	Pipe x Pipe
Connection	Threaded NPT Female Inlet x Threaded NPT Female Outlet
Pipe Size	1/2 x 1/2
Maximum Pressure	400 psi @ 70° F
Maximum Steam Pressure	125 psi @ 350° F
Minimum Opening Pressure	0.5 psi
Temperature Range	-20° to 350° F
Shape	Straight
End-to-End Length	2 5/16"
Mounting Orientation	Horizontal, Vertical
Material	
Body	Bronze
Seal	PTFE
Valve Type	Check
Check Valve Type	Spring Loaded
Flow Coefficient (Cv)	1.4

For a longer service life than valves with a brass body, these are made of bronze for additional strength and durability. They open to allow flow in one direction and close when flow stops or reverses.

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Rev. Do

2017-04-20



The information in this 3-D model is provided for reference only.

AFN027-EL-SG-004-45 of 61
Rev. 00



**ROCHESTER
GAUGES, INC.**

ISO 9001:2008 CERTIFIED

Magnetic Liquid-Level Gauges

**8600
Series**

Magnetic Liquid-Level Gauges

Application

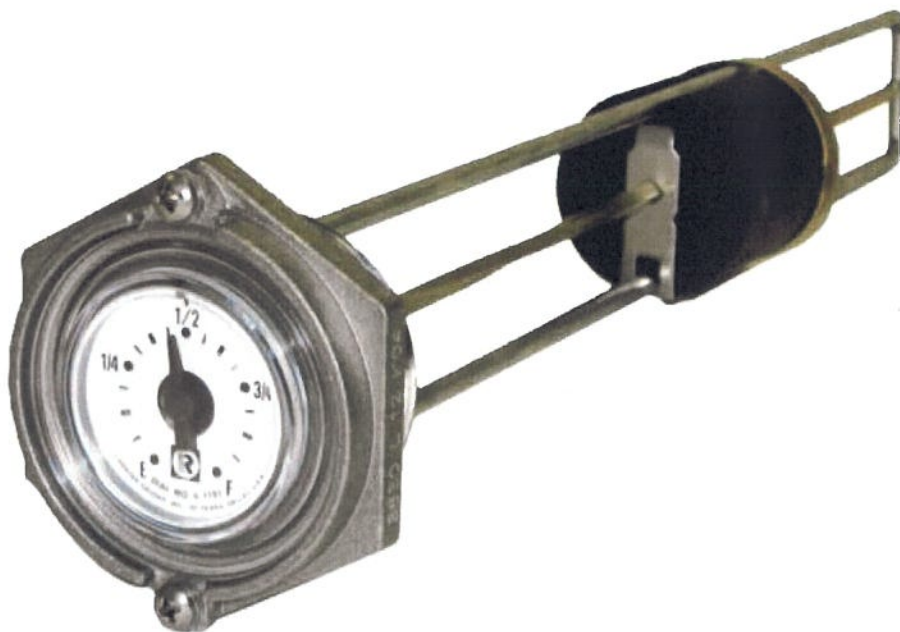
The 8600 Series Senior™ spiral gauges are designed for use in measuring liquid levels in hydraulic, lubricating or fuel-oil storage tanks, and gasoline and diesel fuel levels in stationary, standby and mobile generators. The 8600 Series is not recommended for off-road equipment.

General Information & Features

The 8640 spiral gauge incorporates a strong Alnico magnet capable of driving a TwinSite™ sender which provides a direct, fractional reading and also sends an electrical signal to a remote receiver.

The 8660 spiral gauge is supplied with an easy to read, side-view fractional dial. The model 8680 spiral gauge is equipped with a standard top reading fractional dial.

All 8600 Series spiral gauges have a 1 1/2" MNPT tank connection and are suitable for tank pressures up to 25 psig maximum. They are designed for top mounting in tanks up to 36" deep and some models are UL listed for flammable liquids.



Model #	Sender or Dial Type
8640	Senior TwinSite™ Sender in choice of 0-30, 0-90, or 240-30 Ohm ranges. Specify your preference when ordering.
8660	#5025S00570 Senior™ side-reading fractional dial.
8680	#5844S01793 Senior™ direct-reading fractional dial.

See reverse side for dimensional data, materials of construction, performance, and advice on how to order.

08/26/10

The Measure of Excellence

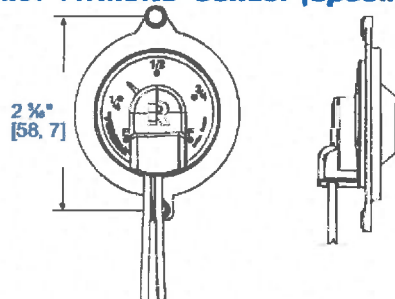
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8600 Series

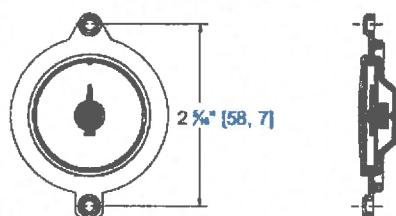
Magnetic Liquid-Level Gauges

[METRIC]

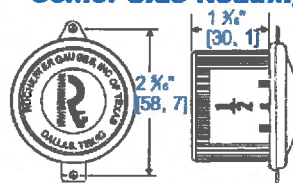
Senior TwinSite™ Sender (Specify ohm range)



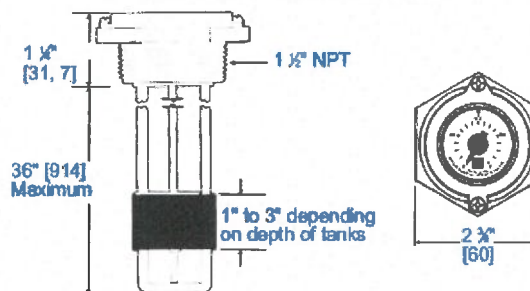
Senior Dial



Senior Side-Reading Dial



Standard Construction



General Specifications*

Mounting

Designed for top-mounting only.

Repeatability

Repeatability depends on proper gauge sizing & tank configuration. Normally, standard dials are $\pm 7\%$; side-reading dials are $\pm 8\%$; & TwinSite™ senders are $\pm 12\%$. Vibration improves repeatability.

Temperature

Standard operating range is -40°F to 158°F , -40°C to 70°C .

Humidity

Exposed portion should be painted for marine applications, less dial.

Shock

Shorter sizes are suitable for some mobile, off-road application.

Vibration

Shorter sizes are suitable for some mobile, off-road application.

Power

0.5 watts maximum for TwinSite™ versions.

Tank Pressure

0 to 25 psig [0 - 1, 7 Bar] maximum.

Approval

Direct indicating gauge. Available UL listed for flammable liquids. Some models UL recognized for marine service.

Materials of Construction*

Head

Die-cast zinc.

Guide Rod

Zinc-plated steel.

Centershaft

Brass.

Tie Plate, Guide & Bearing Pin

Stainless steel.

Float

Nitrile rubber.

Drive Magnet

Alnico.

Standard Dial

Polycarbonate, hermetically sealed.

Side-View Dial

Aluminum with polycarbonate crystal, hermetically sealed.

TwinSite™ Sender

Polyamide.

* Materials and specifications are subject to change without notice.

Pressure ratings subject to change due to temperature and other environmental considerations.

When ordering, specify:

1. Gauge model number.
2. Tank height.
3. Ohm range on TwinSite™ versions.
4. Riser height, if any.
5. Any special requirements.

08/26/10



The Measure of Excellence

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Rev. D1

VENT CAPS

- Available in threaded and slip-on designs
- Slip-On design solves clearance problems
- Rust-resistant zinc plated steel and cast iron, as-well-as rust-proof aluminum and zinc castings
- Available in sizes from 1" to 4"
- Each cap includes a screen, to prevent debris from entering the vent pipe
- 1-1/4" Minimum vent to meet NFPA 31 Requirements

Mushroom Vent Caps

- This popular style is used in the majority of installations in the United States, Alaska, and Canada
- Available in female NPT sizes from 1" to 4"
- Each cap is designed with a 30 mesh screen, to prevent debris from entering the vent pipe

Mushroom Vent Caps	
Part No.	Female NPT
14022	1"
14023	1-1/4"
14024	1-1/2"
14025	2"
14027	3"
14028	4"



Part No.
14025



Slip-On Vent Caps

- Zinc plated steel with screen
- Lightweight and economical

Slip-On Vent Caps	
Part No.	Pipe Size
14036	1"
14037	1-1/4"
14038	1-1/2"
14039	2"



Part No.
14039

Zinc Slip-On Cap

- Beckett's most economical design
- Zinc alloy won't rust
- Slip-on design
- Only requires ~1/16" pipe-to-wall clearance
- Supplied with set screw and wire screen
- Available in sizes from 3/4" to 1-1/2"

Zinc Slip-On Vent Caps	
Part No.	Pipe Size
14006	3/4" - 1"
14008	1-1/2"



Part No.
14006

Aluminum Slip-On Cap

- Ideal for "close-to-wall" installations.
- Requires only ~1/8" pipe-to wall clearance
- Rust proof cast aluminum design includes an integral screen
- Cap is secured to pipe using a single set screw

Aluminum Slip-On Vent Caps	
Part No.	Pipe Size
14009	2"



Part No.
14009

R.W. Beckett Corporation

Mail: PO Box 1289 - Elyria, OH 44036 - Ship: 38251 Center Ridge Rd. - N. Ridgeville, OH 44039

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Model 9095SA 2" Overfill Prevention Valve

SPECIFICATION SHEET

Application

The 9095SA series overfill prevention valve is designed to prevent the overfilling of liquid storage tanks by providing a positive shut-off during a pressurized fill.

Features and Details

Direct Fill Installations

- Installs on tank top by threading onto a 2 inch male NPT riser
- Installs inside 2" Morrison Model 516 or 518 tank top spill container

Remote Fill Installations

- Valve has 2" female NPT inlet threads for installation piping to remote fill point
- Field adjustable shutoff range between 2" to 12"
- Full flow until shutoff point
- Designed for fuel not requiring a drop tube

Materials of Construction

- Direct fill adaptor... aluminum (Part A or Part F)
- Body and piston... passivated aluminum
- Upper float rod... stainless steel
- Lower float rod... passivated aluminum
- Float... polypropylene
- Float guard... polypropylene

Operational Criteria

- Minimum 5 PSI flow requirements
- Maximum operating pressure is 100 PSI
- Maximum viscosity of 300 centistokes
- A tight fill connection is required for the valve to operate
- The estimated flow rate is 110 GPM at 10PSI pressure drop. (See flow curve.)

Code Compliance

ULC-S661-10 listed, NFPA 30, 30A, UFC, IFC, PEI/RP 200, PEI/RP 600, and Florida DEP EQ-858

Item Number	Size	Adaptor Number*	Description	Weight (lbs)
9095SA0200 AV	2"	800FSA1000 AA	Overfill prevention valve with part F male threaded, aluminum	6.10
9095SA0500 AV	2"	9095A-0224 MA	Overfill prevention valve with part A female threaded, aluminum	6.10

*Included with purchase of a 9095SA.

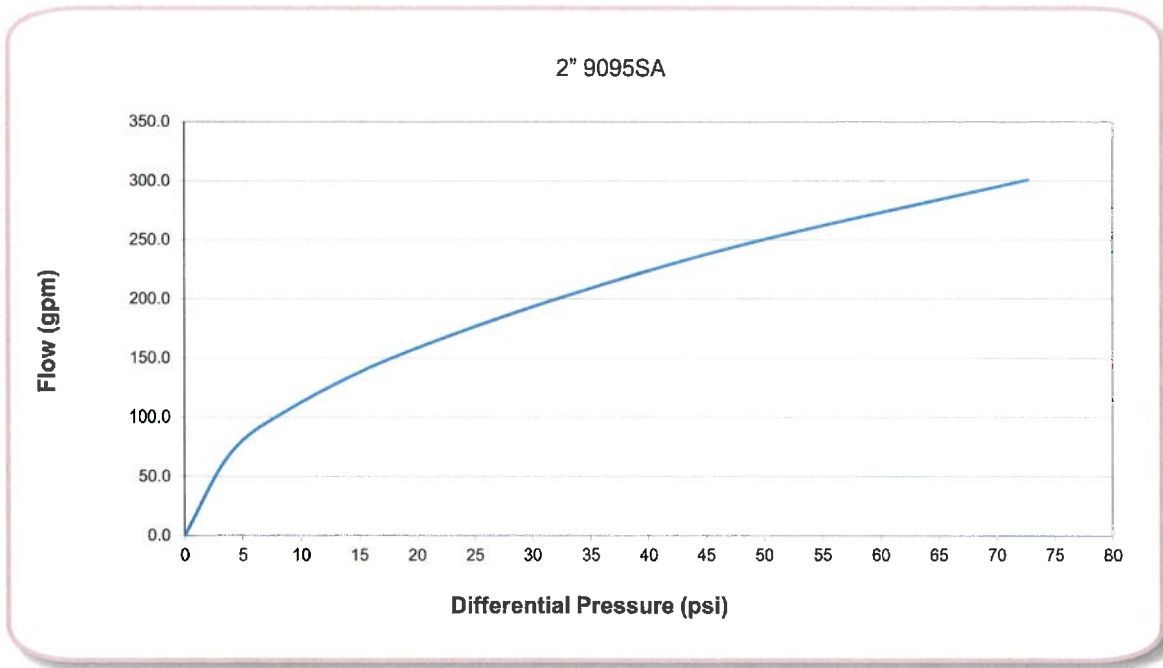


Flow chart on next page...



MORRISON BROS. CO.

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Rev. D0



Specification sheet

supplied loose
with the generator



Battery charger

A048G602 10 A 50/60 Hz

A051H785 20 A 50/60 Hz



Description

Cummins® 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 chargers 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 aluminium 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.

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Rev. 00



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"(318 x 195 x 165 mm) 20A: 13.06" x 13.95" x 6.83"(332 x 354 x 173 mm)
Ambient temperature operation: At full rated output -		- 4 °F to 104 °F (-20 °C to 45 °C)

Note:

1. 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.
2. 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:

1. 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, stepdown transformer must be used. Review the respective Owner/Installation manual A050S537 for 10Amp and A051X126 20A chargers for supplier recommended stepdown transformer requirements.
2. 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.
3. 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.
4. 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.
5. 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.
6. Do not parallel these battery chargers with any other charging system.

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

Our energy working for you.™



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NAAC-5802-EN (11/17)

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PowerCommand® Annunciator

Discrete Input or PCCNet



> Specification sheet

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**Power
Generation**

Description

The Universal Annunciator Module provides visual and audible indication of up to 20 separate alarm or status conditions, based on discrete (relay) inputs or network inputs. Each LED can be controlled by either a discrete wire input or by a signal on the PCCNet network sent from an external device, such as a PCC1301 or PCC2100 (version 2.4 or later) control.

In addition to the LEDs, the annunciator can control four custom relays based on signals received over the PCCNet. When one of the annunciator's discrete inputs is activated, the annunciator will broadcast that information over the network. By taking advantage of the network, discrete inputs and custom relays, the annunciator can be used as expanded I/O for a genset controller.

Easily installed in a location to give immediate notification of an alarm or warning status. Designed to give operating/monitoring personnel quick-glance status information. The module directly senses battery voltage to provide green/yellow/red alarm and status information for that parameter.

Genset controller complies with NFPA level two requirements when used with the display but without the annunciator panel. When used with the annunciator it meets NFPA level one requirements (emergency and standby power systems). The annunciator module can also be used for monitoring of transfer switch or other equipment status. ✓

Features

- Visual and audible warnings of up to 20 separate alarm or status conditions.
- LEDs can be controlled either via PCCNet or discrete input.
- Status of discrete inputs is broadcast on network.
- Four custom relays can be controlled over the PCCNet network.
- Configurable LED color (red, yellow or green) and selectable horn operation allows maximum flexibility.
- Standard NFPA 110 label, field configurable for other alarm status and conditions.
- Each audible alarm is annunciated, regardless of the number of existing alarm conditions displayed.
- Sealed membrane panel design provides environmental protection for internal components and is easy to clean.
- Configurable for negative (ground) input or positive input.
- Integral DC voltage sensing.
- Flush or surface mount provisions.
- UL Listed and labeled; CSA certified; CE marked.

Specifications

Signal requirements

Positive - Input impedance is 1.82 kOhms to ground; maximum input voltage = 31 VDC.

Negative - Input impedance is 1.82 kOhms to Bat+; inputs are at Bat+ level when open.

Sink/source current threshold for detection - 150 uA minimum, 3 mA maximum.

Typical conductor size: 16 ga for 304.8 m (1000 ft)

Max conductor size for terminal: 12 ga

Relay outputs

0.2 A at 125 VAC and 1 A at 30 VDC

Network connections

Use Belden 9729 two pair, stranded, shielded 24 AWG twisted pair cable for all PCCNet connections. Total network length can not exceed 1219 m (4000 ft). Up to 20 nodes can be connected to the network.

Note: Any communications wire connected to the generator set should be stranded cable.

Power

Maximum consumption: 15 watts

Battery voltage

Functional range - Audible and visual conditions operational from 6.5 to 31 VDC.

Low voltage setting - 12.0 VDC for 12 Volt nominal systems; 24.0 for 24 Volt nominal systems.

High voltage setting - 16.0 Volt for 12 Volt nominal systems; 32.0 Volt for 24 Volt nominal systems.

Alarm horn

Sound level: 90 dB at 30 cm

Physical

Weight (with enclosure): 1.4 kg (3.0 lbs)

Temperature

-20 °C to +70 °C (-4 °F to +158 °F)

Humidity

10% to 95% RH (non-condensing)

Default lamp configurations

Can be configured for current NFPA 110 standard or as a replacement for Legacy (pre-2001) NFPA 110 annunciator (300-4510 or 300 4511)

Lamp	Description	NFPA 110		
		Color	Horn	Flash
DS1	Customer fault 1	Green	No	No
DS2	Customer fault 2	Amber	No	No
DS3	Customer fault 3	Red	No	No
DS4	Genset supplying load	Amber	No	No
DS5	Charger AC failure	Amber	Yes	No
DS6	Low coolant level	Amber	Yes	No
DS7	Low fuel level	Red	Yes	No
DS8	Check generator set	Amber	No	No
DS9	Not in auto	Red	Yes	Yes
DS10	Generator set running	Amber	No	No
DS11	High battery voltage	Amber	Yes	No
DS12	Low battery voltage	Red	Yes	No
DS13	Weak battery	Red	Yes	No
DS14	Fail to start	Red	Yes	No
DS15	Low coolant temp	Red	Yes	No
DS16	Pre-high engine temp	Amber	Yes	No
DS17	High engine temp	Red	Yes	No
DS18	Pre-low oil pressure	Red	Yes	No
DS19	Low oil pressure	Red	Yes	No
DS20	Overspeed	Red	Yes	No

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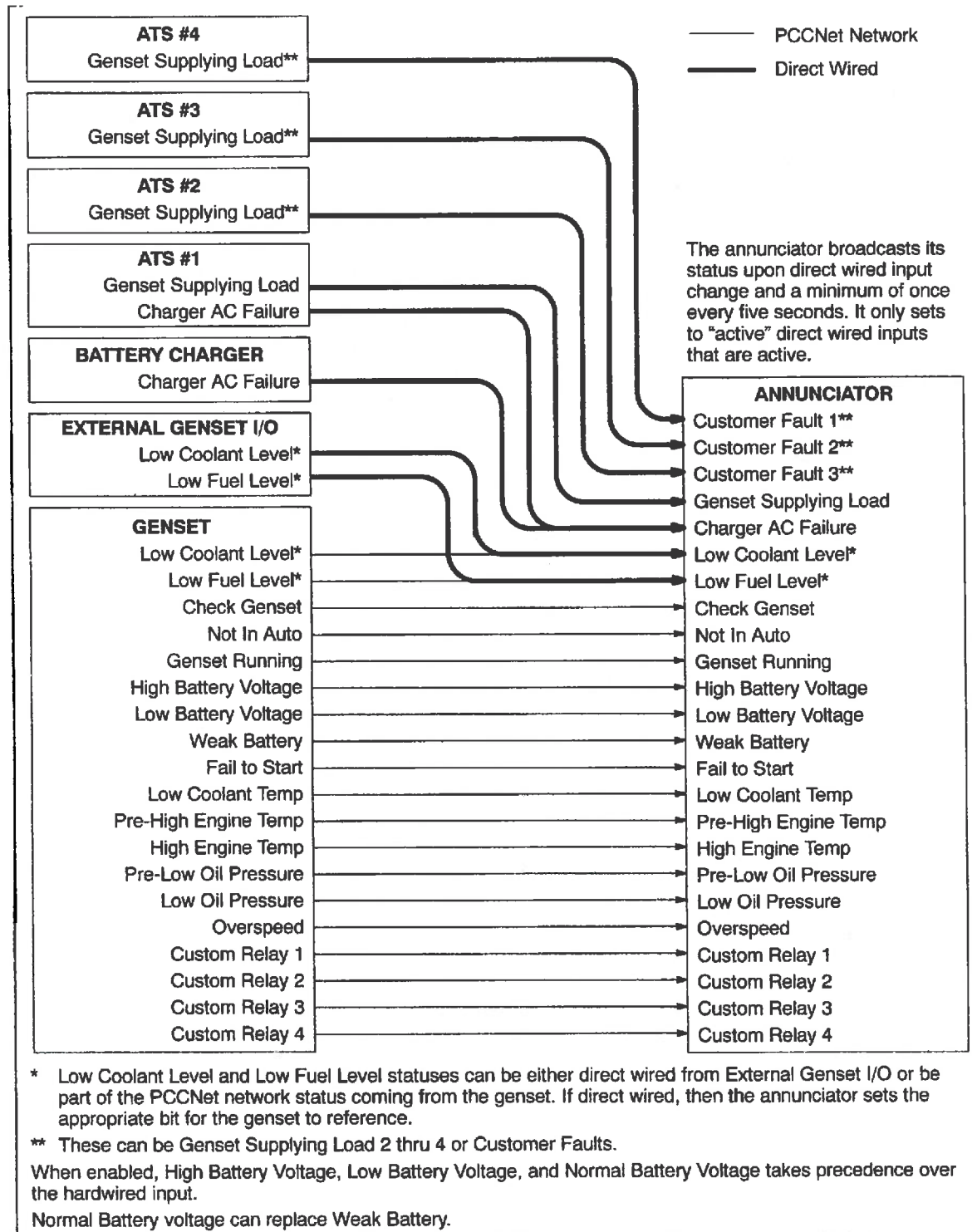
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Typical installation



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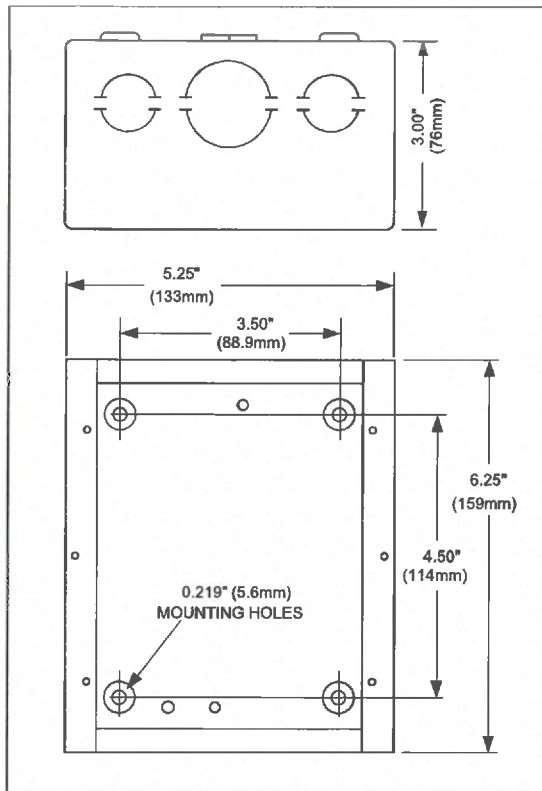
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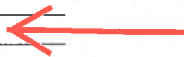
Dimensions



Dimensions: in (mm)

Ordering information

Part number	Description
0300-5929-01	Panel mount
0300-5929-02	Panel with enclosure



PCCNet
COMPATIBLE

See your distributor for more information.

Cummins Power Generation

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

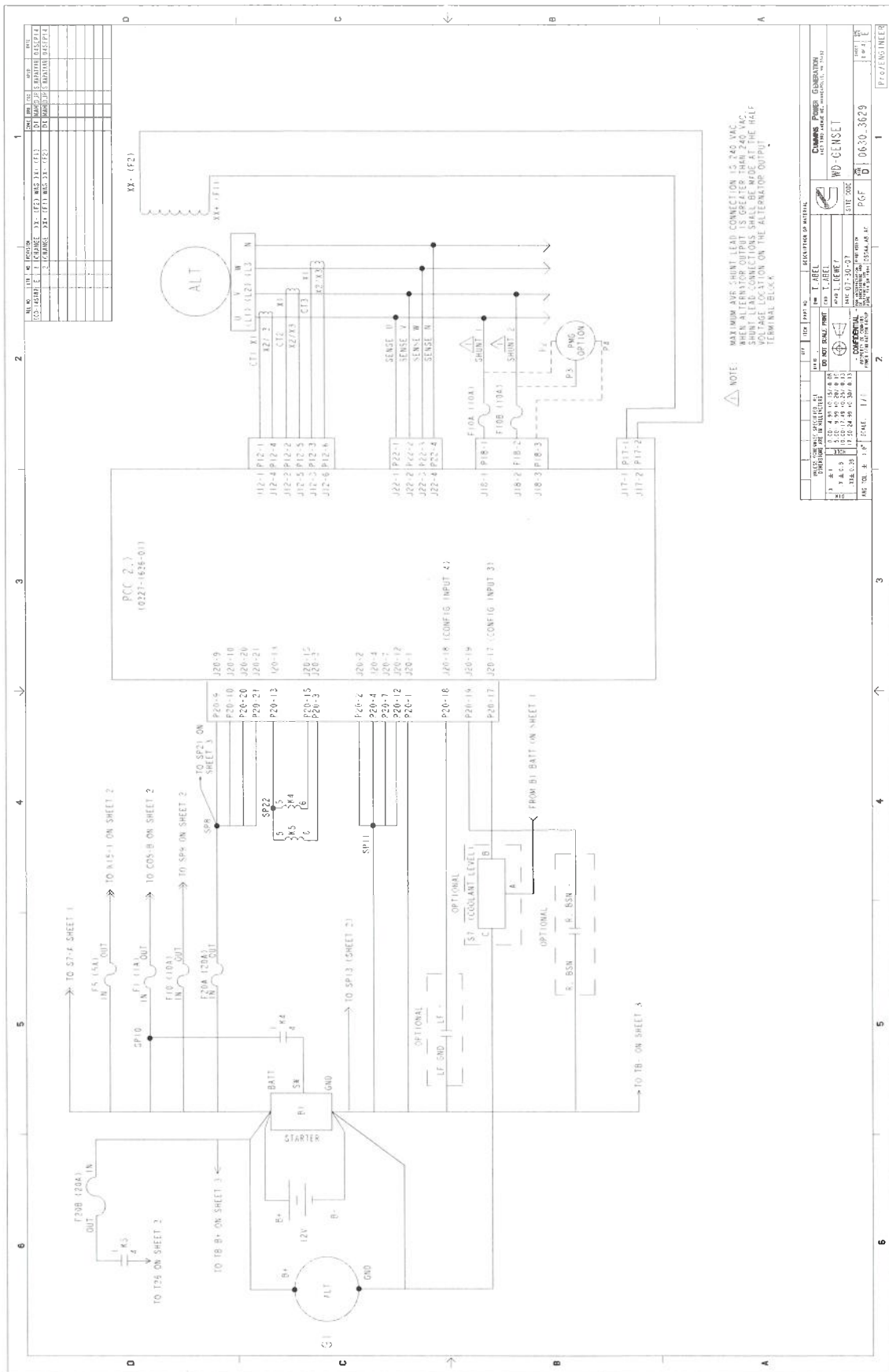
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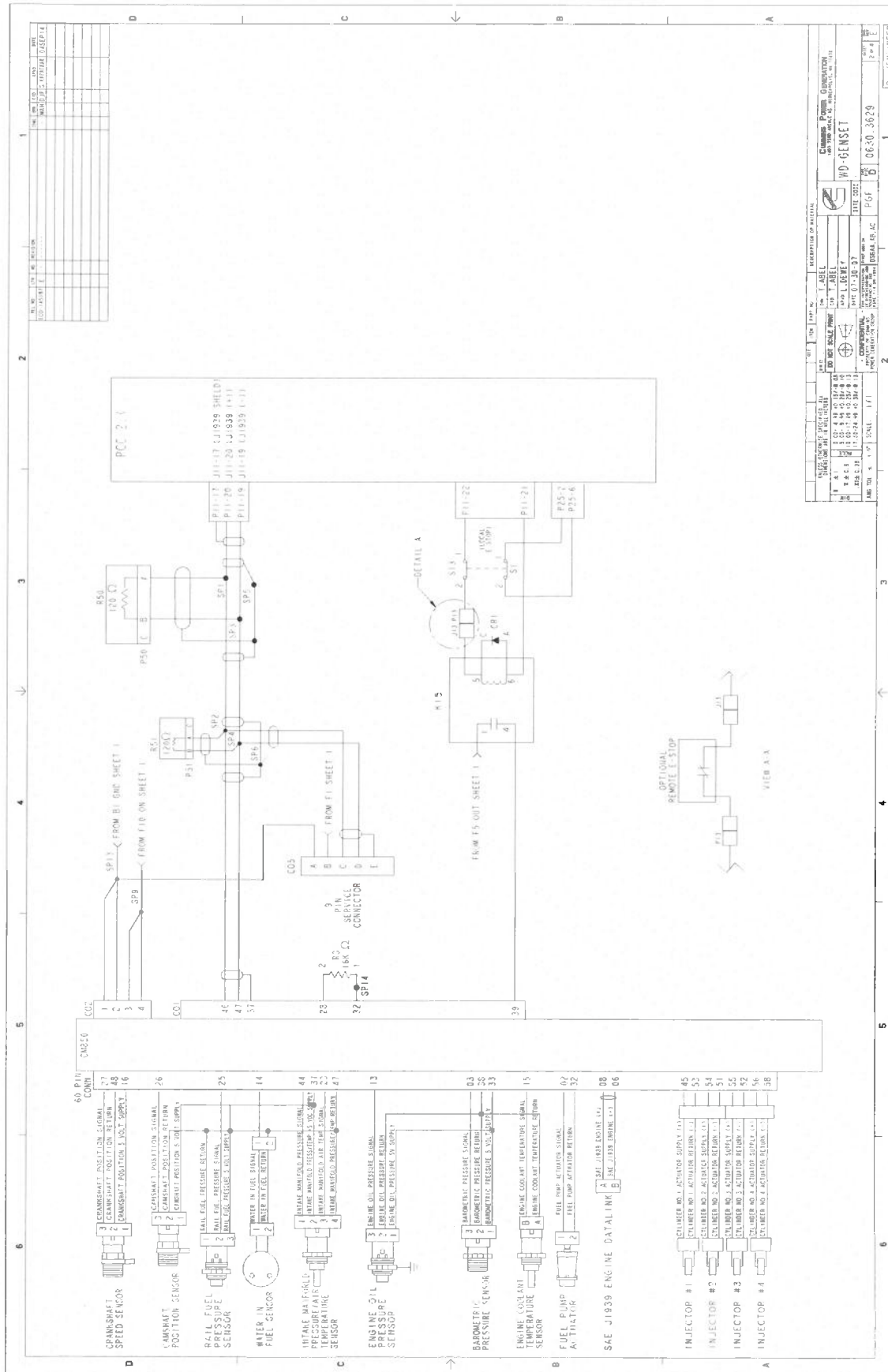
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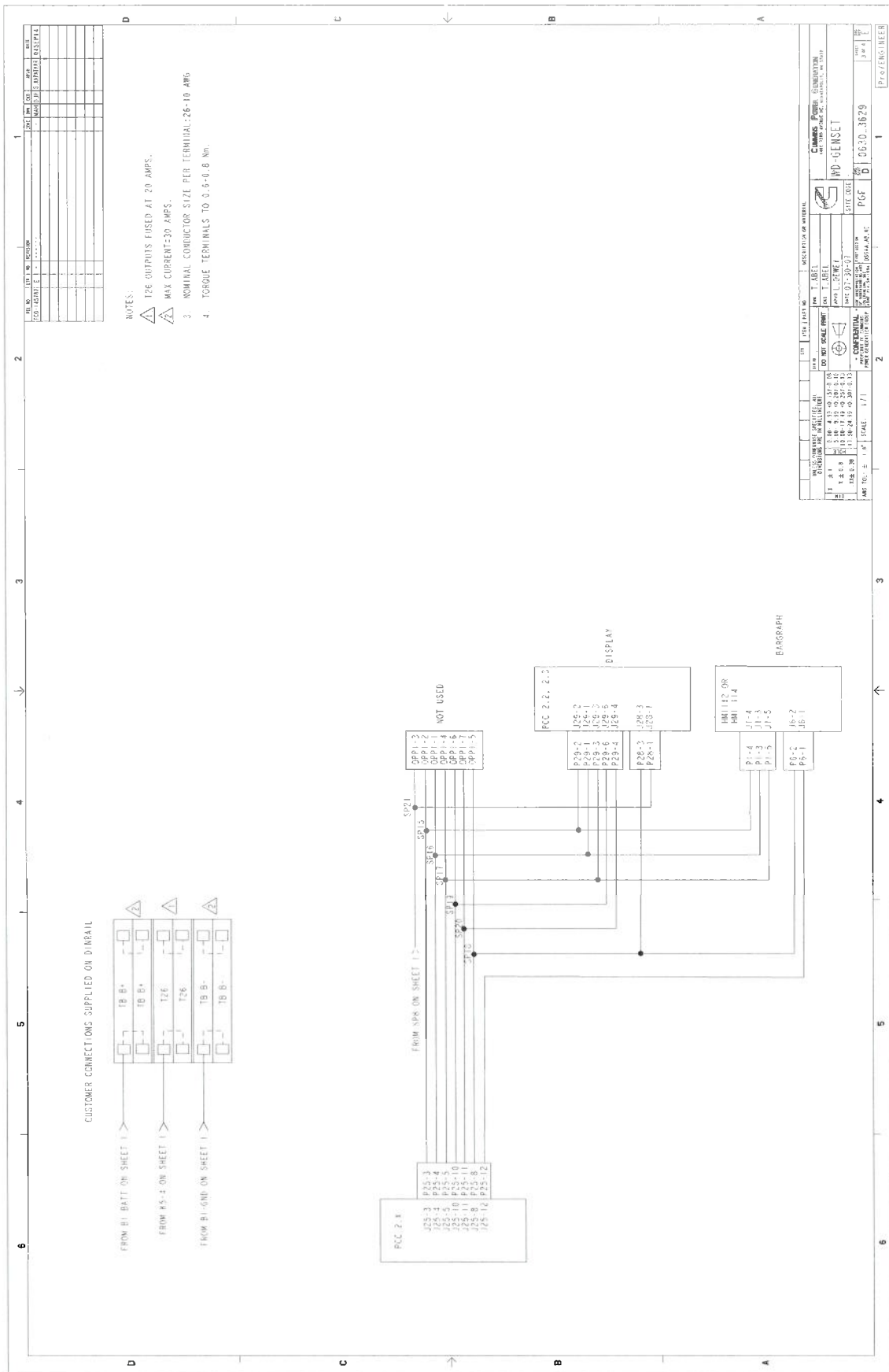
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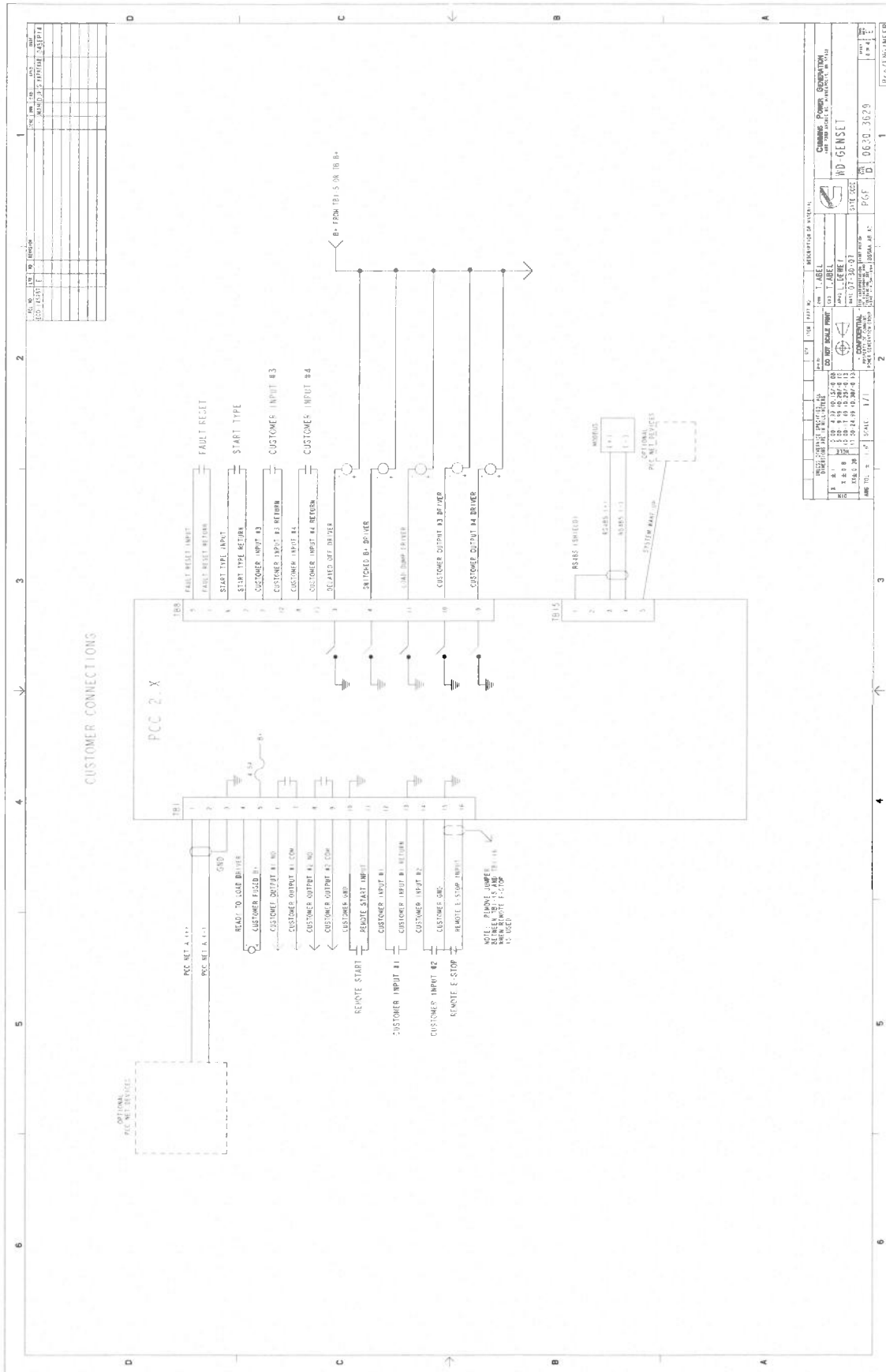


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3	3	06-20-2009	WD	WD	WD	WD-GENSET
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Drawing Name: 0630-3629 Revision: E
Part Name: 0630-3629 Revision: E
Sheet 2 of 5

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BTPC Bypass isolation transfer switch open or closed transition

150 – 4000 amps

Description

BTPC bypass isolation transfer switches combine a drawout automatic transfer switch with isolation mechanism and a manual bypass switch, to provide redundant power transfer and re-transfer capability for critical need applications requiring a reliable power supply to the load. BTPC switches are available with closed transition for transferring critical loads without interruption.

Like conventional transfer switches, BTPC transfer switches are designed for operation and switching of electrical loads between primary power and Standby generator sets. 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.

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 8 event schedules.

Closed transition available: 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.

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.

Closed door drawout operation: Bypass and total isolation of the automatic transfer switch occurs behind closed doors, to provide arc flash protection for operator.

For critical loads: Suitable for use in emergency, legally required and optional Standby applications.



BTPC bypass-isolation transfer switch

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 and 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. The automatic switch and bypass switch have the same ratings.

Communications capability: The transfer switch is capable of communicating with other transfer switches, SCADA networked accessories, or Cummins generators utilizing LonWorks® protocol.

Easy service/access: Single-plug harness connection and compatible terminal markings simplify servicing. Access space is ample. Doormounted controls are field-programmable; no 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.

Bypass mechanism

- Manual bypass switch mechanism allows the operator to select either the normal or emergency source by closing the bypass contacts. Visual indicators show bypass "source selected", bypass "closed" or "open" to either source, and automatic transfer switch isolation or "disable." Bypass of the automatic switch is accomplished with permanently mounted, mechanically operated devices without disturbing the power supply to system loads, and without opening enclosure door.
- Isolation contacts allow the automatic transfer switch and the bypass switch to be separated electrically and mechanically. The automatic transfer switch is isolated by a drawout mechanism similar to that used on power circuit breakers on transfer switches rated 1200 amps and less. On 1600-4000 amp models the drawout carriage is wheel-mounted.
- Protective safety shutters, provided on switches up to and including 1200 amps, cover the stationary power terminals on the bypass switch when the automatic transfer switch is isolated and removed.
- The drawout mechanism can be latched in one of three positions: "connected", "test", and "isolated". In the connected position the mechanism is locked. In the test position, the automatic switch is isolated but the controls receive power. In the isolated position, the automatic switch is completely isolated.
- The bypass switch mechanism is identical to the automatic switch except it is mechanically operated rather than electrically operated. Mechanical interlocks prevent operation of the bypass or automatic switches in any mode that would result in the interconnection of the sources.

PowerCommand control

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

- 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.

Panels

Basic indicator panel:

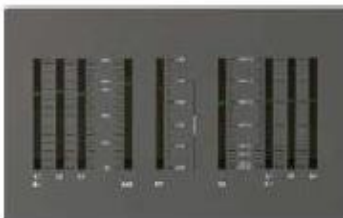
Source available/connected LED indicators
Test/exercise/bypass buttons



Digital display: Standard



Analog bar graph meter display: optional (D009)



Control functions: Level 2 control

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
- 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 98% of nominal voltage
- Dropout: 75% to 98% of pickup setting
- Dropout time delay: 0.1 to 1.0 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: 0.5 to 120 sec

Over/under frequency sensing: Normal and emergency

- Accuracy: $\pm 0.05\text{Hz}$
- Pickup: $\pm 5\%$ to $\pm 20\%$ of nominal frequency
- Dropout: $\pm 1\%$ 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

Loss of single phase detection

- Time delay: 100 msec

Programmable genset exerciser: Eight events/schedules with or without load

PowerCommand control (continued)

Time-delay functions

Engine start: Prevents nuisance genset starts due to momentary power 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 transfer. Allows gradual genset cool-down by running unloaded. Not included in utility-to-utility applications.

Elevator pre-transfer signal: Requires optional relay signal module (M023). 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: 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 (M018) is standard on the BTPC.

User interface options

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, power factor, and kilowatts. Green, amber and red LEDs provide at-a-glance indication of system acceptability.

Front panel security key (M017): Locks front panel to prevent access to digital control settings. Prevents unauthorized activation of transfer or test functions.

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 signaled remotely. Transfers load back to the emergency source when the signal contacts open. Immediately re-transfers back to the primary source when available. For utility-to-generator 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%.


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 at 250VAC 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 de-rating
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	External manual operator is provided via the bypass and isolation mechanism, providing quickmake/quick-break operation under load.

Certifications

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

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 MG1 to prevent nuisance tripping breakers and load damage. Adjustable 0-10 seconds, default 0 seconds. Programmed transition is standard on 150-1000 amp switches, and optional on 1200-4000 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 on 150 – 1000 amp switches and 1200 – 4000 amp switches that support programmed or closed transition. If sources are not in phase within 120 seconds, the system will transfer using programmed transition.

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.

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 transfers the load. The control can be programmed to alternate between the two gensets at a set interval up to 336 hours (2 weeks).

* Not available on 1200 amp and 4000 amp

UL withstand and closing ratings

The transfer switches listed below 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
150, 225, 260	30,000 at 480 25,000 at 600	400 A	A048E955	200,000 at 480	400 A	A051D533
				100,000 at 600	100,000 at 600	
300, 400, 600	65,000 at 480 65,000 at 600	1200 A	A056M836	200,000 at 480	1200 A	A048J544
				100,000 at 600	100,000 at 600	
800, 1000	65,000 at 480 65,000 at 600	1400 A	A056M548	200,000 at 480	1400 A	A048J546
				100,000 at 600	100,000 at 600	
1200A, 1000A closed	85,000 at 480 65,000 at 600*	1600 A	A052L319	N/A	N/A	N/A

Fuse protection

Transfer switch ampere	WCR @ volts max. with current limiting fuses	Max fuse, size and type	Drawing reference
150, 225, 260	200,000 at 600	600 A Class J, RK1, RK5 or 1200 A Class L, T	A048E955
300, 400, 600	200,000 at 600	600 A Class J, RK1, RK5 or 1200 A Class L, T	A056M836
800, 1000	200,000 at 600	600 A Class J, RK1, RK5, 1200 A Class T, or 2000 A Class L	A056M548
1200	200,000 at 480**	3000 A Class L	A052L319
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	A056M8336
800, 1000	42,000 at 600	1400A	A056M548
1200	50,000 at 480	1600 A	A052L319
	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 aluminum wire unless indicated otherwise.

Amp rating	Cables per phase	Size
150, 225	1	#6 AWG to 300 MCM
260	1	#6 AWG to 400 MCM
150, 225, 260 ¹	1	#4 AWG to 500 MCM
300, 400	1	#3/0 AWG to 600 MCM
300, 400	2	#3/0 AWG to 250 MCM
300, 400 ¹	2	#2 AWG to 600 MCM
600	2	250 MCM to 500 MCM
600 ¹	2	#2 AWG to 600 MCM
800, 1000	4 ²	250 MCM to 500 MCM
800, 1000 ¹	3	300 MCM to 750 MCM
1200	4	#2 AWG to 600 MCM
1600 ³ , 2000 ³	8	#2 AWG to 600 MCM Mechanical Lug 1/0 AWG to 750 MCM Mechanical Lug 500 MCM Compression Lugs, Includes 96 Blackburn CTL 5002 Lugs 600 MCM Compression Lugs, Includes 96 Blackburn CTL 6002 Lugs 750 MCM Compression Lugs, Includes 96 Blackburn CTL 7502 Lugs
3000 ³	8	#2 AWG to 600 MCM Mechanical Lug 1/0 AWG to 750 MCM Mechanical Lug 500 MCM Compression Lugs, Includes 96 Blackburn CTL 5002 Lugs 600 MCM Compression Lugs, Includes 96 Blackburn CTL 6002 Lugs 750 MCM Compression Lugs, Includes 96 Blackburn CTL 7502 Lugs
4000 ³	12	1/0 AWG to 750 MCM

Note 1: Optional lug capacities on accessories spec sheet AC-166.

Note 2: Four-wire for neutral bar is 3-pole only.

Note 3: Can be ordered without lugs

Enclosures

The transfer switch and control are floor-mounted in a key-locking enclosure. Wire bend space complies with 2011 NEC.

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	
150, 225, 260	71.5	1822	36.00	915	22.75	578	55.2	1402	564	256	310-0538
300, 400, 600	83.25	2115	36.00	914	22.75	578	55.2	1403	639	291	500-4726
800, 1000	90.00	2290	48.00	1219	27.75	705	62.5	1588	1097	499	310-0570
1200 3-pole ¹	90.0	2290	40.00	1016	27.00	686	67.0	1702	1980	898	310-0566
1200 4-pole ¹	90.00	2290	46.00	1168	27.00	686	73.0	1854	2185	991	310-0566
1600, 2000 3-pole ²	79.64	2023	40.76	1035	63.00	1600	102.1	2593	3139	1424	A030s193
1600, 2000 4-pole ²	79.64	2023	46.26	1175	63.00	1600	107.6	2733	3538	1605	A030x111
3000 3-pole ²	79.64	2023	40.76	1035	63.00	1600	102.1	2593	3513	1594	A030s195
3000 4-pole ²	79.64	2023	46.26	1175	63.00	1600	107.6	2733	4081	1851	A030x113
4000 3-pole ²	90.00	2290	47.50	1210	81.00	2060	128.5	3270	4730	2145	500-4488
4000 4-pole ²	90.00	2290	54.00	1370	81.00	2060	135.0	3430	5930	2689	500-4488

Note 1: Dimensions shown for Type 1 are for top entry only. If bottom or side entry is required, an adapter bay is required and the depth increases by 14 in (356 mm). See outline drawing. Adapter needs to be part of the original order.

Note 2: 1600-4000 amp switches are rear-connected. Rear or side access is required for cabling.

Dimensions - transfer switch in UL type ~~3R, 4, 4x, 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		
150, 225, 260	71.75	1822	36.00	915	22.75	578	55.20	1402	564	256	3R, 12	310-0651
	71.75	1822	36.00	915	22.75	578	55.20	1402	564	256	4, 4x	310-0652
300, 400, 600	83.25	2115	36.00	915	22.75	578	55.20	1402	639	290	3R, 12	500-4726
	83.25	2115	36.00	915	22.75	578	55.20	1402	639	290	4, 4x	500-4727
800,1000	90.0	2290	48.00	1214	27.75	705	62.50	1534	1097	498	3R	310-0711
	90.0	2290	48.00	1214	27.75	705	62.50	1534	1097	498	4, 4x, 12	310-0712
1200 3-pole ¹ 1200 4-pole ¹	90.00	2290	40.00	1016	28.25	718	65.50	1654	1980	748	3R, 12, 4, 4x	310-0734
	90.00	2290	46.00	1168	28.25	718	71.69	1821	2185	991	3R, 12, 4, 4x	310-0734
1600, 2000 3-pole ²	79.64	2023	40.76	1035	63.00	1600	102.1	2593	3139	1424	3R	A030s193
1600, 2000 4-pole ²	79.64	2023	46.26	1175	63.00	1600	107.6	2733	3538	1605	3R	A030x111
3000 3-pole ²	79.64	2023	40.76	1035	63.00	1600	102.1	2593	3513	1594	3R	A030s195
3000 4-pole ²	79.64	2023	46.26	1175	63.00	1600	107.6	2733	4081	1851	3R	A030x113
4000 3-pole ²	90.00	2290	48.50	1232	81.75	2076	131.00	3308	4730	2145	3R	500-4489
4000 4-pole ²	90.00	2290	55.00	1397	81.75	2076	137.00	3473	5930	2689	3R	500-4489

Note 1: 1200 amp switches are top entry only.

Note 2: 1600-4000 amp switches are rear-connected. Rear or side access is required for cabling.

Submittal detail

Amperage ratings

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

Voltage ratings

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

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

Application

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

System options

- A041 Single phase, 2-wire or 3-wire
- A042 Three phase, 3-wire or 4-wire

Auxiliary relays

Relays are UL listed and factory installed. All relays provide two normally closed isolated 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 in source 2 (emergency) position
- L103 24 VDC coil - normal position – relay energized when switch in source 1 (normal) position
- L201 12 VDC coil - installed, not wired (for customer use)
- L202 12 VDC coil - emergency position – relay energized when switch in source 2 (emergency) position
- L203 12 VDC coil - normal position – relay energized when switch in source 1 (normal) position

Miscellaneous options

- M003 Terminal block - 30 points (not wired)
- M007 Loadshed - from emergency - drives switch to neutral position when remote signal contact closes (utility-to-genset only)
- N009 Power connect - bus stabs (150-1000 amp open construction only)

Optional lug kits

- N046 Mechanical lugs – accept up to 8 #2 – 600 MCM cables per phase (1600-3000 amps only)
- N047 Mechanical lugs – accept up to 8 750 MCM cables per phase (1600-3000 amps only)
- N050 Compression lugs – accept up to 8 500 MCM cables per phase (1600-3000 amps only)
- N051 Compression lugs – accept up to 8 600 MCM cables per phase (1600-3000 amps only)
- N052 Compression lugs – accept up to 8 750 MCM cables per phase (1600-3000 amps only)

N056 Mechanical lugs – accept up to 12 750 MCM cables per phase (4000 amps only)

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 1200- 4000 amp switches)
- A080 Seismic certification Control options
- M017 Security key - front panel
- 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 A, 12/24 V
- KB59 15 A, 12 V
- KB60 12 A, 24 V

Protective relays

- M045 Paralleling timer and lockout relays, ANSI/IEEE 62PL and 86
- M046 Paralleling timer and lockout and reverse power relays, single phase, ANSI/IEEE 62PL, 86 and 32R
- M047 Paralleling timer and lockout and reverse power relays, three phase, ANSI/IEEE 62PL, 86 and 32R

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-166 Accessories specification sheet

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

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