

HARRIMAN

221 State Street Generator  
West Campus  
Augusta, ME

Project No. 15632

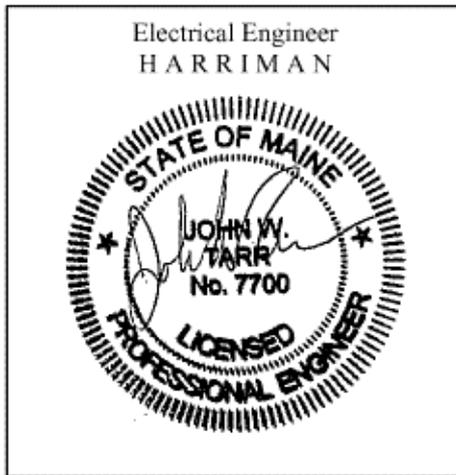
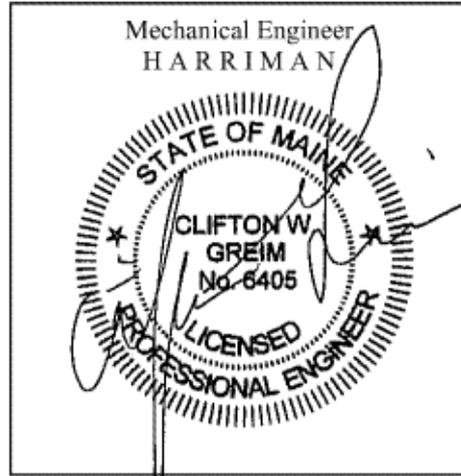
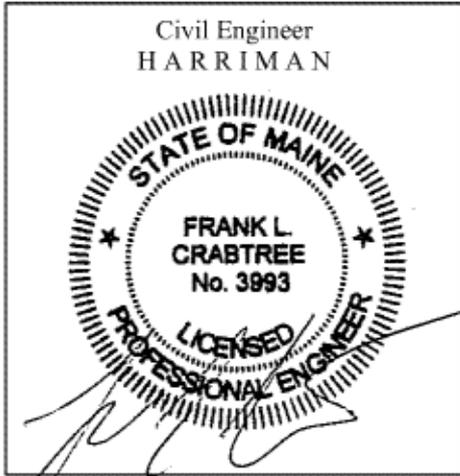
March 9, 2016

Construction Documents

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PROFESSIONAL SEAL PAGE



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221 STATE STREET  
EMERGENCY GENERATOR

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NOTICE TO CONTRACTORS  
REQUEST FOR BIDS

The State of Maine Bureau of General Services and Department of Health and Human Services are conducting a competitive bid process for the 221 State Street Emergency Generator Project at 221 State Street in Augusta, Maine. Bids will be opened and read aloud at the Bureau of General Services, 4<sup>th</sup> Floor Burton Cross State Office Building, 111 Sewall St, Augusta, ME 04330 at 2:00 p.m. on March 31, 2016.

The project involves the installation of a 500kW generator.

The detailed Notice to Contractors is on the BGS website:  
[http://www.maine.gov/bgs/constrpublic/contractors/gc\\_rfp.htm](http://www.maine.gov/bgs/constrpublic/contractors/gc_rfp.htm)

Bureau of General Services, 77 State House Station, Augusta, Maine 04333, 207-624-7360.

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**00 11 13**  
**Notice to Contractors**

**221 State Street Generator Project**

*Installation of 500kw generator.*

The cost of the work is approximately \$ 250,000. The work to be performed under this contract shall be completed on or before *July 15, 2016*.

1. Sealed Contractor bids for the project noted above, in envelopes plainly marked "Bid for *221 State Street Generator Project*" and addressed to:  
*Peter Glasow*  
*Bureau of General Services*  
*4th Floor, Cross State Office Building*  
*111 Sewall Street*  
*Augusta, Maine 04333-0077*  
will be opened and read aloud at *the address shown above* at **2:00 p.m.** on **March 30, 2016**. Bids submitted after the noted time will not be considered and will be returned unopened.
2. The bid shall be submitted on the Contractor Bid Form (section 00 41 13) provided in the Bid Documents. The Owner reserves the right to accept or reject any or all bids as may best serve the interest of the Owner.
3. Bid security *is required* on this project.  
The Bidder shall include a satisfactory Bid Bond (section 00 43 13) or a certified or cashier's check for 5% of the bid amount with the completed bid form submitted to the Owner.
4. Performance and Payment Bonds *are required* on this project.  
The selected Contractor shall furnish a 100% contract Performance Bond (section 00 61 13.13) and a 100% contract Payment Bond (section 00 61 13.16) in the contract amount to cover the execution of the Work.
5. Filed Sub-bids *are not required* on this project.
6. There *are no* Pre-qualified General Contractors on this project.
7. An on-site pre-bid conference *will not* be conducted for this project.
8. Bid Documents will be available on or about *March 9, 2016* and will be available electronically at no cost on the Bureau of General Services website.

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**00 21 13**  
**Instructions to Bidders**

1. Bidder Requirements

- 1.1 A bidder is a Contractor who is qualified, or has been specifically pre-qualified by the Bureau of General Services, to bid on the proposed project described in the Bid Documents.
- 1.2 Contractors and Subcontractors bidding on projects that utilize Filed Sub-bids shall follow the requirements outlined in these Bid Documents for such projects. See Section 00 22 13 for additional information.
- 1.3 Contractors are not eligible to bid on the project when their access to project design documents prior to the bid period distribution of documents creates an unfair bidding advantage. Prohibited access includes consultation with the Owner or with design professionals engaged by the Owner regarding cost estimating, constructability review, or project scheduling. This prohibition to bid applies to open, competitive bidding or pre-qualified contractor bidding or Filed Sub-bidding. The Bureau may require additional information to determine if the activities of a Contractor constitute an unfair bidding advantage.
- 1.4 Each bidder is responsible for becoming thoroughly familiar with the Bid Documents prior to submitting a bid. The failure of a bidder to review evident site conditions, to attend available pre-bid conferences, or to receive, examine, or act on addenda to the Bid Documents shall not relieve that bidder from any obligation with respect to their bid or the execution of the work as a Contractor.
- 1.5 Prior to the award of the contract, General Contractor bidders or Filed Sub-bidders may be required to provide documented evidence to the Owner or the Bureau showing compliance with the provisions of this section, their business experience, financial capability, or performance on previous projects.
- 1.6 The selected General Contractor bidder will be required to provide proof of insurance before a contract can be executed.
- 1.7 Contracts developed from this bid shall not be assigned, sublet or transferred without the written consent of the Owner.

2. Authority of Owner

- 2.1 The Owner reserves the right to accept or reject any or all bids as may best serve the interest of the Owner.
- 2.2 Subject to the Owner's stated right to accept or reject any or all bids, the Contractor shall be selected on the basis of the sum of the lowest acceptable bid plus any Alternate Bids the Owner elects to include.
- 2.3 The Owner is exempt from the payment of Federal Excise Taxes and Federal Transportation Tax on all shipments, as well as Maine State Sales and Use Taxes on items "...physically incorporated in real property ...". The bidder shall not include these taxes in their bid. See Section 00 72 13 for additional information.

**00 21 13**  
**Instructions to Bidders**

**3. Submitting Bids and Bid Requirements**

- 3.1 Each bid shall be submitted on the forms provided in the Bid Documents.
- 3.2 Each bid shall be valid for a period of thirty calendar days following the Project bid opening date and time.
- 3.3 A bid that contains an escalation clause is considered invalid.
- 3.4 Bidders shall include a Bid Bond or other approved bid security with the bid form submitted to the Owner when the bid form indicates such bid security is required. The bond value shall be 5% of the bid amount. The form of bond is shown in section 00 43 13.
- 3.5 Bidders shall include the cost of Performance and Payment Bonds in the bid amount if the bid amount will result in a construction contract value over \$125,000, inclusive of alternate bids that may be awarded in the contract. Pursuant to 14 M.R.S.A., Section 871, Public Works Contractors' Surety Bond Law of 1971, subsection 3, the selected Contractor is required to provide these bonds before a contract can be executed. The form of bonds are shown in section 00 61 13.13 and 00 61 13.16.
- 3.6 Bidders may modify bids in writing prior to the bid closing time. Such written amendments shall not disclose the amount of the initial bid. If so disclosed, the entire bid is considered invalid.
- 3.7 Bidders shall acknowledge on the bid form all Addenda issued in a timely manner. The Architect shall not issue Addenda affecting bidders less than 72 hours prior to the bid closing time. Addenda shall be issued to all companies who are registered holders of Bid Documents.
- 3.8 A bid may be withdrawn without penalty if a written request by the bidder is presented to the Owner prior to the bid closing time. Such written withdrawal requests are subject to verification as required by the Bureau. After the bid closing time, such written withdrawal requests may be allowed in consideration of the bid bond or, without utilizing a bid bond, if the Contractor provides documented evidence to the satisfaction of the Bureau that factual errors had been made on the bid form.
- 3.9 Projects which require a State of Maine wage determination will include that schedule as part of the Bid Documents. See section 00 73 46, if such rates are required.
- 3.10 Projects which require compliance with the Davis-Bacon Act are subject to the regulations contained the Code for Federal Regulations and the federal wage determination which is made a part of the Bid Documents. See section 00 73 46, if such rates are required.

**00 41 13  
Contractor Bid Form**

**221 State Street  
Emergency Generator Project**

To: *Peter Glasow*  
Bureau of General Services  
4<sup>th</sup> Floor Cross State Office Building  
111 Sewall Street  
Augusta, Maine 04330

The undersigned, or "Bidder", having carefully examined the form of contract, general conditions, specifications and drawings dated March 10, 2016, prepared by Harriman for 221 State Street Emergency Generator Project, as well as the premises and conditions relating to the work, proposes to furnish all labor, equipment and materials necessary for and reasonably incidental to the construction and completion of this project for the Base Bid amount of:

\_\_\_\_\_ Dollars  
\$ \_\_\_\_\_

Allowances *are included* on this project.

1. Alternate bids *are not included* on this project.
  
2. The Bidder acknowledges receipt of the following addenda to the specifications and drawings:

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_

3. Bid security *is required* on this project.  
The Bidder shall include a satisfactory Bid Bond (section 00 43 13) or a certified or cashier's check for 5% of the bid amount with this completed bid form submitted to the Owner.
  
4. Filed Sub-bids *are not required* on this project.  
The bid amount includes the following Filed Sub-bids which were submitted to the Bidder and to the Maine Construction Bid Depository.

**00 41 13  
Contractor Bid Form**

**221 State Street  
Emergency Generator Project**

5. The Bidder agrees, if this bid is accepted by the Owner, to sign the designated Owner-Contractor contract and deliver it, with any and all bonds and affidavits of insurance specified in the Bid Documents, within twelve calendar days after the date of notification of such acceptance, except if the twelfth day falls on a State of Maine government holiday or other closure day, a Saturday, or a Sunday, in which case the aforementioned documents must be received before 12:00 noon on the day following the holiday or other closure day, Saturday or Sunday.

As a guarantee thereof, the Bidder submits, together with this bid, a bid bond or other acceptable instrument as and if required by the Bid Documents.

6. This bid is hereby submitted by:

Signature: \_\_\_\_\_

Printed name and title: \_\_\_\_\_

Company name: \_\_\_\_\_

Mailing address: \_\_\_\_\_

City, state, zip code: \_\_\_\_\_

Phone number: \_\_\_\_\_

Email address: \_\_\_\_\_

State of incorporation,  
if a corporation: \_\_\_\_\_

List of all partners,  
if a partnership: \_\_\_\_\_

**00 43 13**  
**Contractor Bid Bond**

We, the undersigned, *insert company name of Contractor, select type of entity* of *insert name of municipality* in the State of *insert name of state* as principal, and *insert name of surety* as Surety, are hereby held and firmly bound unto *select title of obligee* in the penal sum of *five percent of the bid amount*, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns, signed this *insert day, i.e.: 8th* day of *select month, select year*, which is the same date as that of the bid due date.

The condition of the above obligation is such that whereas the principal has submitted to the Owner, or State of Maine, to a certain bid, attached hereto and hereby made a part hereof, to enter into a contract in writing, for the construction of *insert name of project as designated in the contract documents*

Now therefore:

If said bid shall be rejected, or, in the alternate,

If said bid shall be accepted and the principal shall execute and deliver a contract in the form of contract attached hereto, properly completed in accordance with said bid, and shall furnish a bond for the faithful performance of said contract, and for the payment of all persons performing labor or furnishing material in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time within which the Obligee may accept such bid and said Surety does hereby waive notice of any such extension.

**00 43 13  
Contractor Bid Bond**

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this *insert day, i.e.: 8th* day of *select month, select year*, which is the same date as that of the bid due date.

**Contractor**

\_\_\_\_\_  
*(Signature)*

*insert name and title*

*insert company name*

*insert address  
insert city state zip code*

**Surety**

\_\_\_\_\_  
*(Signature)*

*insert name and title*

*insert company name*

*insert address  
insert city state zip code*

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

00 52 13  
Contract Agreement

AdvantageME No.:

Funding: \_\_\_\_\_

State of Maine  
CONSTRUCTION CONTRACT

Agreement entered into the date of month in the year 2016 by and between the State of Maine through the insert agency name hereinafter called the *Owner* and insert Contractor company name, hereinafter called the *Contractor*, for service from not sooner than 1/1/2015 to 1/1/2015.

BGS Project No.: insert number assigned by BGS (not the PIP number)

Other Project No.: \_\_\_\_\_

The *Owner* and the *Contractor* agree as follows:

ARTICLE 1 SCOPE OF WORK

1.1 The *Contractor* shall furnish all of the materials and perform all the work described in the Specifications and shown on the Drawings for the project entitled: insert title of project shown on documents.

1.2 The Specifications and the Drawings have been prepared by firm name, acting as Designer and named in the documents as the Architect or Engineer. This firm has responsibilities for defining the scope of work governed by their agreement with the *Owner*, the Specifications and the Drawings, and the General Conditions and Special Provisions of the contract.

ARTICLE 2 COMPLETION DATE

2.1 The work to be performed under this contract shall be completed on or before date. For each calendar day the project remains uncompleted \$ \_\_\_\_\_ shall be charged as liquidated damages, as defined in 00 72 13 General Conditions.

ARTICLE 3 CONTRACT SUM

3.1 The *Owner* shall pay the *Contractor* for the performance of the contract, subject to additions and deductions provided by approved Change Orders in current funds as follows: amount in words dollars and 00cents, \$0.00

ARTICLE 4 CONTRACT BONDS

4.1 Contract bonds are not required if the contract amount is less than \$125,000 unless bonds are specifically mandated by the contract documents.

4.2 On this project, the *Contractor* shall furnish the *Owner* the appropriate contract bonds in the amount of 100% of the contract amount.

**00 52 13**  
**Contract Agreement**

**ARTICLE 5 PROGRESS PAYMENTS**

5.1 The *Owner* shall make payments on account of the contract as provided therein as follows: Each month 95% of the value, based on contract prices of labor and materials incorporated in the work and of materials suitably stored at the site thereof up to the first day of that month, as certified by the Architect or Engineer.

5.2 The *Owner* may cause the *Contractor* to be paid such portion of the amount retained hereunder as he deems advisable.

**ARTICLE 6 FINAL PAYMENT**

6.1 Final payment shall be due 30 days after completion and acceptance of the work, provided the *Contractor* has submitted evidence satisfactory to the *Owner* that all payrolls, material bills and other indebtedness connected with the work has been paid.

**ARTICLE 7 CONTRACT DOCUMENTS**

7.1 The General Conditions of the contract, instructions to bidders, bid form, Special Provisions, the written specifications and the drawings, and any Addenda, together with this agreement, form the contract; they are as fully a part of the contract as if hereto attached or herein repeated.

7.2 Specifications: *date of issuance*

7.3 Drawings: *each sheet number and title*

7.4 Addenda: *each addenda number and date, or "none"*

**ARTICLE 8 OTHER PROVISIONS**

8.1 *No other provisions.*

**00 52 13**  
**Contract Agreement**

The *Owner* and the *Contractor* hereby agree to the full performance of the covenants herein.

IN WITNESS WHEREOF the parties hereby execute this agreement the day and year first above written.

OWNER

CONTRACTOR

|                                       |  |
|---------------------------------------|--|
| <hr/> <i>(Signature)</i>              | <hr/> <i>(Signature)</i>               |
| <hr/> <i>(Date)</i>                   | <hr/> <i>(Date)</i>                    |
| <hr/> <i>(Printed name and title)</i> | <hr/> <i>(Printed name and title)</i>  |
| <hr/> <i>(Department name)</i>        | <hr/> <i>(Contractor company name)</i> |

|  |  |
|--|--|
| <b>BUREAU OF GENERAL SERVICES</b>                    |  |
| Contract Reviewed by:                                | Contract Approved by:                                      |
| <hr/> <i>(Signature)</i>                             | <hr/> <i>(Signature)</i>                                   |
| <hr/> <i>(Date)</i>                                  | <hr/> <i>(Date)</i>  |
| <hr/> <i>Project Manager/ Contract Administrator</i> | <hr/> <i>Joseph H. Ostwald</i>                             |
|  | <hr/> <i>Director, Planning, Design &amp; Construction</i> |

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**00 61 13.13**  
**Contractor Performance Bond**

Bond No.: insert bond number

We, the undersigned, insert company name of Contractor, select type of entity of insert name of municipality in the State of insert name of state as principal, and insert name of surety as Surety, are hereby held and firmly bound unto select title of obligee in the penal sum of the Contract Price \$ insert the Contract Price in numbers for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that if the principal shall promptly and faithfully perform the contract entered into this insert day, i.e.: 8th day of select month, select year, which is the same date as that of the construction contract, for the construction of insert name of project as designated in the contract documents, then this obligation shall be null and void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time which the Obligee may accept during the performance of the contract and said Surety does hereby waive notice of any such extension.

**00 61 13.13**  
**Contractor Performance Bond**

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this *insert day, i.e.: 8th* day of *select month, select year*, which is the same date as that of the construction contract.

**Contractor**

\_\_\_\_\_  
*(Signature)*

*insert name and title*

*insert company name*

*insert address*  
*insert city state zip code*

**Surety**

\_\_\_\_\_  
*(Signature)*

*insert name and title*

*insert company name*

*insert address*  
*insert city state zip code*

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

**00 61 13.16**  
**Contractor Payment Bond**

Bond No.: insert bond number

We, the undersigned, insert company name of Contractor, select type of entity of insert name of municipality in the State of insert name of state as principal, and insert name of surety as Surety, are hereby held and firmly bound unto select title of obligee in the penal sum of the Contract Price \$ insert the Contract Price in numbers for the use and benefit of claimants, defined as an entity having a contract with the principal or with a subcontractor of the principal for labor, materials, or both labor and materials, used or reasonably required for use in the performance of the contract, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that if the principal shall promptly satisfy all claims and demands incurred for all labor and materials, used or required by the principal in connection with the work described in the contract entered into this insert day, i.e.: 8th day of select month, select year, which is the same date as that of the construction contract, for the construction of insert name of project as designated in the contract documents, and shall fully reimburse the obligee for all outlay and expense with said obligee may incur in making good any default of said principal, then this obligation shall be null and void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time which the Obligee may accept during the performance of the contract and said Surety does hereby waive notice of any such extension.

**00 61 13.16  
Contractor Payment Bond**

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this *insert day, i.e.: 8th* day of *select month, select year*, which is the same date as that of the construction contract.

**Contractor**

\_\_\_\_\_  
*(Signature)*

*insert name and title*

*insert company name*

*insert address  
insert city state zip code*

**Surety**

\_\_\_\_\_  
*(Signature)*

*insert name and title*

*insert company name*

*insert address  
insert city state zip code*

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

**00 71 00**  
**Definitions**

1. Definitions

- 1.1 *Addendum*: A document issued by the Architect that amends the Bid Documents. Addenda shall not be issued less than seventy-two hours prior to the specified bid opening time.
- 1.2 *Allowance*: A specified dollar amount for a particular scope of work or service included in the Work that is identified in the Bid Documents and included in each Bidder's Bid. The Contractor shall document expenditures for an Allowance during the Project. Any unused balance shall be credited to the Owner. The Contractor is responsible for notifying the Owner of anticipated expenses greater than the specified amount and the Owner is responsible for those additional expenses.
- 1.3 *Alternate Bid*: The Contractor's written offer of a specified dollar amount, submitted on the Bid Form, for the performance of a particular scope of work described in the Bid Documents. The Owner determines the low bidder based on the sum of the base Bid and any combination of Alternate Bids that the Owner selects.
- 1.4 *Architect*: The Architect or Engineer acting as Professional-of-Record for the project. The Architect is responsible for the design of the Project.
- 1.5 *Architectural Supplemental Instruction (ASI)*: A written instruction from the Architect for the purpose of clarification of the Contract Documents. An ASI does not alter the Contract Price or Contract Time. ASIs may be responses to RFIs and shall be issued by the Architect in a timely manner to avoid any negative impact on the Schedule of Work.
- 1.6 *Bid*: The Contractor's written offer of a specified dollar amount or amounts, submitted on a form included in the Bid Documents, for the performance of the Work. A Bid may include bonds or other requirements. A base Bid is separate and distinct from Alternate Bids, being the only cost component necessary for the award of the contract, and representing the minimum amount of Work that is essential for the functioning of the project.
- 1.7 *Bid Bond*: The security designated in the Bid Documents, furnished by Bidders as a guaranty of good faith to enter into a contract with the Owner, should a contract be awarded to that Bidder.
- 1.8 *Bidder*: Any business entity, individual or corporation that submits a bid for the performance of the work described in the Bid Documents, acting directly or through a duly authorized representative.
- 1.9 *Bid Documents*: The drawings, procurement and contracting requirements, general requirements, and the written specifications -including all addenda, that a bidder is required to reference in the submission of a bid.
- 1.10 *Bureau*: The State of Maine Bureau of General Services in the Department of Administrative and Financial Services.
- 1.11 *Calendar days*: Consecutive days, as occurring on a calendar, taking into account each day of the week, month, year, and any religious, national or local holidays.
- 1.12 *Certificate of Substantial Completion*: A document developed by the Architect that describes the final status of the Work and establishes the date that the Owner may use the facility for its intended

**00 71 00**  
**Definitions**

purpose. The Certificate of Substantial Completion also include a provisional list of items (a "punch list") remaining to be corrected by the Contractor, if any, and identifies a date from which the project warranty period commences.

- 1.13 *Certificate of Occupancy*: A document developed by a local jurisdiction such as the Code Enforcement Officer that grants permission to the Owner to occupy a building.
- 1.14 *Change Order (CO)*: A document that modifies the contract and establishes the basis of a specific adjustment to the Contract Price or the Contract Time, or both. Change Orders may address correction of omissions, errors, and document discrepancies, or additional requirements. Change Orders should include all labor, materials and incidentals required to complete the work described. A Change Order is not valid until signed by the Contractor, Owner and Architect and approved by the Bureau.
- 1.15 *Change Order Proposal (COP)*: Change proposed by the Contractor in the contract amount, requirements, or time, which becomes a Change Order when approved by the Owner.
- 1.16 *Clerk of the Works*: The authorized representative of the Architect on the job site. Clerk of the Works is also called Architect's representative.
- 1.17 *Construction Change Directive (CCD)*: A written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to final agreement with the Contractor on adjustment, if any, in the Contract Price or Contract Time, or both.
- 1.18 *Contract*: A written agreement between the Owner and the successful bidder which obligates the Contractor to perform the work specified in the Contract Documents and obligates the Owner to compensate the Contractor at the mutually accepted sum, rates or prices.
- 1.19 *Contract Bonds (also known as Payment and Performance Bonds)*: The approved forms of security, furnished by the Contractor and their surety, which guarantee the faithful performance of all the terms of the contract and the payment of all bills for labor, materials and equipment by the Contractor.
- 1.20 *Contract Documents*: The drawings and written specifications (including all addenda), Standard General Conditions, and the contract (including all Change Orders subsequently incorporated in the documents).
- 1.21 *Contract Price*: The dollar amount of the construction contract, also called *Contract Sum*.
- 1.22 *Contract Time*: The designated duration of time to execute the Work of the contract, with a specific date for completion.
- 1.23 *Contractor*: Also called the "General Contractor" or "GC" the individual or entity undertaking the execution of the general contract work under the terms of the contract with the Owner, acting directly or through a duly authorized representative. The Contractor is responsible for the means, methods and materials utilized in the execution and completion of the Work.

**00 71 00**  
**Definitions**

- 1.24 *Drawings*: The graphic and pictorial portion of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.
- 1.25 *Filed Sub-bid*: The designated major Subcontractor's (or, in some cases, Contractor's) written offer of a specified dollar amount or amounts, submitted on a form included in the Bid Documents, for the performance of a particular portion of the Work. A Filed Sub-bid may include bonds or other requirements.
- 1.26 *Final Completion*: Project status indicating when the Work is fully completed in compliance with the Contract Documents. Final Completion is documented by a date on which the Contractor's obligations under the contract are complete and accepted by the Owner and final payment becomes due and payable.
- 1.27 *General Requirements*: The on-site overhead expense items the Contractor provides for the Project, typically including, but not limited to, building permits, construction supervision, Contract Bonds, insurance, field office, temporary utilities, rubbish removal, and site fencing. Overhead expenses of the Contractor's general operation are not included. Sometimes referred to as the Contractor's General Conditions.
- 1.28 *Owner*: The State agency which is represented by duly authorized individuals. The Owner is responsible for defining the scope of the Project and compensation to the Architect and Contractor.
- 1.29 *Owner's Representative*: The individual or entity contracted by the Owner to be an advisor and information conduit regarding the Project.
- 1.30 *Overhead*: General and administrative expenses of the Contractor's principal and branch offices, including payroll costs and other compensation of Contractor employees, deductibles paid on any insurance policy, charges against the Contractor for delinquent payments, and costs related to the correction of defective work, and the Contractor's capital expenses, including interest on capital used for the work.
- 1.31 *Performance and Payment Bonds (also known as Contract Bonds)*: The approved forms of security, furnished by the Contractor and their surety, which guarantee the faithful performance of all the terms of the contract and the payment of all bills for labor, materials and equipment by the Contractor.
- 1.32 *Post-Bid Addendum*: Document issued by the Architect that defines a potential Change Order prior to signing of the construction contract. The Post-Bid Addendum allows the Owner to negotiate contract changes with the Bidder submitting the lowest valid bid, only if the negotiated changes to the Bid Documents result in no change or no increase in the bid price.
- A Post-Bid Addendum may also be issued after a competitive construction Bid opening to those Bidders who submitted a Bid initially, for the purpose of rebidding the Project work without re-advertising.
- 1.33 *Project*: The construction project proposed by the Owner to be constructed according to the Contract Documents. The entire public improvement project may also include separate construction and other

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activities conducted by the Owner or other contractors. The Owner shall inform all contractors of the scope of the entire public improvement project relative to each individual contract.

- 1.34 *Proposal*: The Contractor's written offer submitted to the Owner for consideration containing a specified dollar amount or rate, for a specific scope of work, and including a schedule impact, if any. A proposal shall include all costs for overhead and profit. After acceptance by all parties a proposal amends the contract and is implemented by the Contractor.
- 1.35 *Proposal Request (PR)*: An Owner's written request to the Contractor for a Change Order Proposal.
- 1.36 *Punch List*: A document that identifies the items of work remaining to be done by the Contractor at the Close Out of a Project. The Punch List is created as a result of a final inspection of the work only after the Contractor attests that all of the Work is in its complete and permanent status.
- 1.37 *Request For Information (RFI)*: A Contractor's written request to the Architect for clarification, definition or description of the Work. RFIs shall be presented by the Contractor in a timely manner to avoid any negative impact on the Schedule of Work.
- 1.38 *Request For Proposal (RFP)*: An Owner's written request to the Contractor for a Change Order Proposal.
- 1.39 *Requisition for Payment*: The document in which the Contractor certifies that the Work described is, to the best of the Contractor's knowledge, information and belief, complete and that all previous payments have been paid by the Contractor to Subcontractors and suppliers, and that the current requested payment is now due. See *Schedule of Values*.
- 1.40 *Retainage*: The amount, calculated at five percent (5%) of the contract value or a scheduled value, that the Owner shall withhold from the Contractor until the work or portion of work is declared substantially complete or otherwise accepted by the Owner. The Owner may, if requested, reduce the amount withheld if the Owner deems it desirable and prudent to do so. (See Title 5 M.R.S.A., Section 1746.)
- 1.41 *Sample*: A physical example provided by the Contractor which illustrates materials, equipment or workmanship and establishes standards by which the Work will be judged.
- 1.42 *Schedule of the Work*: The document prepared by the Contractor and approved by the Owner that specifies the dates on which the Contractor plans to begin and complete various parts of the Work, including dates on which information and approvals are required from the Owner.
- 1.43 *Schedule of Values*: The document prepared by the Contractor and approved by the Owner before the commencement of the Work that specifies the dollar values of discrete portions of the Work equal in sum to the contract amount. The Schedule of Values is used to document progress payments of the Work in regular (usually monthly) requisitions for payment. See *Requisition for Payment*.
- 1.44 *Shop Drawings*: The drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

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- 1.45 *Specifications*: The portion of the Contract Documents consisting of the written requirements of the Work for materials, equipment, systems, standards, workmanship, and performance of related services.
- 1.46 *Subcontractor*: An individual or entity undertaking the execution of any part of the Work by virtue of a written agreement with the Contractor or any other Subcontractor. Also, an individual or entity retained by the Contractor or any other Subcontractor as an independent contractor to provide the labor, materials, equipment or services necessary to complete a specific portion of the Work.
- 1.47 *Substantial Completion*: Project status indicating when the Work or a designated portion of the Work is sufficiently complete in compliance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended purpose without unscheduled disruption. Substantial Completion is documented by the date of the Certificate of Substantial Completion signed by the Owner and the Contractor.
- 1.48 *Superintendent*: The representative of the Contractor on the job site, authorized by the Contractor to receive and fulfill instructions from the Architect.
- 1.49 *Surety*: The individual or entity that is legally bound with the Contractor and Subcontractor to insure the faithful performance of the contract and for the payment of the bills for labor, materials and equipment by the Contractor and Subcontractors.
- 1.50 *Work*: The construction and services, whether completed or partially completed, including all labor, materials, equipment and services provided or to be provided by the Contractor and Subcontractors to fulfill the requirements of the Project as described in the Contract Documents.

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1. Preconstruction Conference

- 1.1 The Contractor shall, upon acceptance of a contract and prior to commencing work, schedule a preconstruction conference with the Owner and Architect. The purpose of this conference is to:
- a) introduce all parties who have a significant role in the Project, including:
    - Owner (State Agency)
    - Bureau of General Services (BGS)
    - Architect
    - Consultants
    - Clerk-of-the-works
    - Contractor (GC)
    - Superintendent
    - Subcontractors
    - Other State agencies
    - Owner's Representative
    - Construction testing company
    - Commissioning agent
    - Special Inspections agent;
  - b) review the responsibilities of each party;
  - c) review any previously-identified special provisions of the Project;
  - d) review the Schedule of the Work calendar submitted by the Contractor to be approved by the Owner and Architect;
  - e) review the Schedule of Values form submitted by the Contractor to be approved by the Owner and Architect;
  - f) establish routines for Shop Drawing approval, contract changes, requisitions, et cetera;
  - g) discuss jobsite issues;
  - h) discuss Project close-out procedures;
  - i) provide an opportunity for clarification of Contract Documents before work begins;
  - j) schedule regular meetings at appropriate intervals for the review of the progress of the Work.

2. Intent and Correlation of Contract Documents

- 2.1 The intent of the Contract Documents is to describe the complete Project. The Contract Documents consist of various components; each component complements the others. What is shown as a requirement by any one component shall be inferred as a requirement on all corresponding components.
- 2.2 The Contractor shall furnish all labor, equipment and materials, tools, transportation, insurance, services, supplies, operations and methods necessary for, and reasonably incidental to, the construction and completion of the Project. Any work that deviates from the Contract Documents which appears to be required by the exigencies of construction or by inconsistencies in the Contract Documents, will be determined by the Architect and authorized in writing by the Architect, Owner and the Bureau prior to execution. The Contractor shall be responsible for requesting clarifying information where the intent of the Contract Documents is uncertain.
- 2.3 The Contractor shall not utilize any apparent error or omission in the Contract Documents to the disadvantage of the Owner. The Contractor shall promptly notify the Architect in writing of such errors or omissions. The Architect shall make any corrections or clarifications necessary in such a situation to document the true intent of the Contract Documents.

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3. Additional Drawings and Specifications

- 3.1 The Owner shall provide to the Contractor, at no additional expense to the Contractor, a reasonable quantity of additional Drawings and Specifications for the execution of the Work.
- 3.2 The Architect shall promptly furnish additional revised Drawings and Specifications that are created due to corrections or clarifications made by the Architect. All such information shall be consistent with, and reasonably inferred from, the Contract Documents. The Contractor shall do no work without the proper Drawings and Specifications.

4. Record of Documents

- 4.1 The Contractor shall maintain one complete set of Contract Documents on the jobsite, in good order and current status, for access by the Owner and Architect.
- 4.2 The Contractor shall maintain, continuously updated, complete records of Requests for Information, Architectural Supplemental Instructions, Information Bulletins, supplemental sketches, Change Order Proposals, Change Orders, Shop Drawings, testing reports, et cetera, for access by the Owner and Architect.

5. Ownership of Contract Documents

- 5.1 The designs represented on the Contract Documents are the property of the Architect. The Drawings and Specifications shall not be used on other work without consent of the Architect.

6. Shop Drawings

- 6.1 The Contractor shall administer Shop Drawings prepared by the Contractor, Subcontractors, suppliers or others to conform to the approved Schedule of the Work. The Contractor shall verify all field measurements, check and authorize all Shop Drawings and schedules required by the Work. The Contractor is the responsible party and contact for the Contractor's work as well as that of Subcontractors, suppliers or others who provide Shop Drawings.
- 6.2 The Architect shall review and acknowledge Shop Drawings, with reasonable promptness, for general conformity with the design concept of the project and compliance with the information provided in the Contract Documents.
- 6.3 The Contractor shall provide monthly updated logs containing: requests for information, information bulletins, supplemental instructions, supplemental sketches, change order proposals, change orders, submittals, testing and deficiencies.
- 6.4 The Contractor shall make any corrections required by the Architect, and shall submit a quantity of corrected copies as may be needed. The acceptance of Shop Drawings or schedules by the Architect shall not relieve the Contractor from responsibility for deviations from Drawings and Specifications, unless the Contractor has called such deviations to the attention of the Architect at the time of submission and secured the Architect's written approval. The acceptance of Shop Drawings or schedules by the Architect does not relieve the Contractor from responsibility for errors in Shop Drawings or schedules.

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**7. Samples**

- 7.1 The Contractor shall furnish for approval, with reasonable promptness, all samples as directed by the Architect. The Architect shall review and approve such samples, with reasonable promptness, for general conformity with the design concept of the project and compliance with the information provided in the Contract Documents. The subsequent work shall be in accord with the approved samples.

**8. Substitutions**

- 8.1 The Contractor shall furnish items and materials described in the Contract Documents. If the item or material specified describes a proprietary product, or uses the name of a manufacturer, the term "or approved equal" shall be implied, if it is not included in the text. The specific item or material specified establishes a minimum standard for the general design, level of quality, type, function, durability, efficiency, reliability, compatibility, warranty coverage, installation factors and required maintenance. The Drawing or written Specification shall not be construed to exclude other manufacturers products of comparable design, quality, and efficiency.
- 8.2 The Contractor may submit detailed information about a proposed substitution to the Architect for consideration. Particular models of items and particular materials which the Contractor asserts to be equal to the items and materials identified in the Contract Documents shall be allowed only with written approval by the Architect. The request for substitution shall include a cost comparison and a reason or reasons for the substitution.
- 8.3 The Architect may request additional information about the proposed substitution. The approval or rejection of a proposed substitution may be based on timeliness of the request, source of the information, the considerations of minimum standards described above, or other considerations. The Architect should briefly state the rationale for the decision. The decision shall be considered final.
- 8.4 The duration of a substitution review process can not be the basis for a claim for delay in the Schedule of the Work.

**9. Patents and Royalties**

- 9.1 The Contractor shall, for all time, secure for the Owner the free and undisputed right to the use of any patented articles or methods used in the Work. The expense of defending any suits for infringement or alleged infringement of such patents shall be borne by the Contractor. Awards made regarding patent suits shall be paid by the Contractor. The Contractor shall hold the Owner harmless regarding patent suits that may arise due to installations made by the Contractor, and to any awards made as a result of such suits.
- 9.2 Any royalty payments related to the work done by the Contractor for the Project shall be borne by the Contractor. The Contractor shall hold the Owner harmless regarding any royalty payments that may arise due to installations made by the Contractor.

**10. Surveys, Layout of Work**

- 10.1 The Owner shall furnish all property surveys unless otherwise specified.
- 10.2 The Contractor is responsible for correctly staking out the Work on the site. The Contractor shall employ a competent surveyor to position all construction on the site. The surveyor shall run the

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- axis lines, establish correct datum points and check each line and point on the site to insure their accuracy. All such lines and points shall be carefully preserved throughout the construction.
- 10.3 The Contractor shall lay out all work from dimensions given on the Drawings. The Contractor shall take measurements and verify dimensions of any existing work that affects the Work or to which the Work is to be fitted. The Contractor is solely responsible for the accuracy of all measurements. The Contractor shall verify all grades, lines, levels, elevations and dimensions shown on the Drawings and report any errors or inconsistencies to the Architect prior to commencing work.
11. Permits, Laws, and Regulations
- 11.1 The Owner is responsible for obtaining any zoning approvals or other similar local project approvals necessary to complete the Work, unless otherwise specified in the Contract Documents.
- 11.2 The Owner is responsible for obtaining Maine Department of Environmental Protection, Maine Department of Transportation, or other similar state government project approvals necessary to complete the Work, unless otherwise indicated in the Contract Documents.
- 11.3 The Owner is responsible for obtaining any federal agency project approvals necessary to complete the Work, unless otherwise indicated in the Contract Documents.
- 11.4 The Owner is responsible for obtaining all easements for permanent structures or permanent changes in existing facilities.
- 11.5 The Contractor is responsible for obtaining and paying for all permits and licenses necessary for the implementation of the Work. The Contractor shall notify the Owner of any delays, variance or restrictions that may result from the issuing of permits and licenses.
- 11.6 The Contractor shall comply with all ordinances, laws, rules and regulations and make all required notices bearing on the implementation of the Work. In the event the Contractor observes disagreement between the Drawings and Specifications and any ordinances, laws, rules and regulations, the Contractor shall promptly notify the Architect in writing. Any necessary changes shall be made as provided in the contract for changes in the work. The Contractor shall not perform any work knowing it to be contrary to such ordinances, laws, rules and regulations.
- 11.7 The Contractor shall comply with local, state and federal regulations regarding construction safety and all other aspects of the Work.
12. Taxes
- 12.1 The Owner is exempt from the payment of Federal Excise Taxes on articles not for resale and from the Federal Transportation Tax on all shipments, as well as Maine State Sales and Use Taxes. Pricing in all Change Order Proposals from the Contractor and Subcontractors shall not include these taxes.
- 12.2 Maine statute (36 M.R.S.A. §1760) allows "...an exemption from sales and use tax on items which will be physically incorporated in real property of an exempt organization. This exemption only applies to lumber, hardware, doors and windows, nails, insulation and other building materials actually affixed to realty. Tools, wearing apparel, consumable supplies, machinery and equipment used by the Contractor are taxable even if purchased specifically for the exempt job."
- 12.3 The Contractor may contact Maine Revenue Services, 24 State House Station, Augusta, Maine 04333 for guidance on tax exempt regulations authorized by 36 M.R.S.A. §1760 and detailed in Rule 302 (18-125 CMR 302).

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13. Labor and Wages

- 13.1 The Contractor shall conform to the labor laws of the State of Maine, and all other laws, ordinances, and legal requirements affecting the work in Maine.
- 13.2 The Architect shall include a wage determination document prepared by the Maine Department of Labor in the Contract Documents for state-funded contracts in excess of \$50,000. The document shows the minimum wages required to be paid to each category of labor employed on the project.
- 13.3 On projects requiring a Maine wage determination, the Contractor shall submit monthly payroll records to the Owner ("the contracting agency") showing the name and occupation of all workers and all independent contractors employed on the project. The monthly submission must also include the Contractor's company name, the title of the project, hours worked, hourly rate or other method of remuneration, and the actual wages or other compensation paid to each person.
- 13.4 The Contractor shall not reveal, in the payroll records submitted to the Owner, personal information regarding workers and independent contractors, other than the information described above. Such information shall not include Social Security number, employee identification number, or employee address or phone number, for example.
- 13.5 The Contractor shall conform to Maine statute by providing to the Owner a list of all subcontractors and independent contractors on the job site and a record of the entity to whom that subcontractor or independent contractor is directly contracted and by whom that subcontractor or independent contractor is insured for workers' compensation purposes.
- 13.6 The Contractor shall enforce strict discipline and good order among their employees at all times, and shall not employ any person unfit or unskilled to do the work assigned to them.
- 13.7 The Contractor shall promptly pay all employees when their compensation is due, shall promptly pay all others who have billed and are due for materials, supplies and services used in the Work, and shall promptly pay all others who have billed and are due for insurance, workers compensation coverage, federal and state unemployment compensation, and Social Security charges pertaining to this Project. Before final payments are made, the Contractor shall furnish to the Owner affidavits that all such payments described above have been made.
- 13.8 The Contractor may contact the Maine Department of Labor, 54 State House Station, Augusta, Maine 04333 for guidance on labor issues.

14. Insurance Requirements

- 14.1 The Contractor shall not commence work under this contract until the Contractor has obtained all insurance required under this article and such insurance has been approved by the Owner. The Contractor shall not allow any Subcontractor to commence work on a subcontract until all similar insurance required of the Subcontractor has been so obtained and approved.
- 14.2 The Owner does not warrant or represent that the insurance required under this article constitutes an insurance portfolio which adequately addresses all risks faced by the Contractor or its Subcontractors. The Contractor and Subcontractors of every tier shall satisfy themselves as to the existence, extent and adequacy of insurance prior to commencement of work.
- 14.3 The Contractor and any Subcontractor shall procure and maintain for the duration of the Project insurance of the types and limits set forth under this article and such insurance as will protect themselves from claims which may arise out of or result from the Contractor's or Subcontractor's execution of the work, whether such execution be by themselves or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable. The insurance coverage provided by the Contractor and any Subcontractor will be primary coverage.

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14.4 Workers' Compensation Insurance

Worker's Compensation insurance for all employees on site in accordance with the requirements of the Workers' Compensation law of the State of Maine.

Minimum acceptable limits for Employer's Liability are:

|                                |                         |
|--------------------------------|-------------------------|
| Bodily Injury by Accident..... | \$500,000               |
| Bodily Injury by Disease.....  | \$500,000 Each Employee |
| Bodily Injury by Disease.....  | \$500,000 Policy Limit  |

14.5 Liability Insurance

a) General Liability Insurance

General liability insurance for bodily injury and property damage liability for all hazards of the Project including premise and operations, products and completed operations, contractual, and personal injury liabilities. It shall include collapse and underground coverage - as well as explosion coverage if explosion hazards exist. Aggregate limits shall apply on a per location or project basis.

Minimum acceptable limits are:

|  |             |
|--|-------------|
| General aggregate limit .....                    | \$2,000,000 |
| Products and completed operations aggregate..... | \$1,000,000 |
| Each occurrence limit.....                       | \$1,000,000 |
| Personal injury aggregate .....                  | \$1,000,000 |

b) Automobile Liability Insurance

Automobile liability insurance against claims for bodily injury, death or property damage resulting from the maintenance, ownership or use of all owned, non-owned and hired automobiles, trucks and trailers.

Minimum acceptable limit is:

|                                |             |
|--------------------------------|-------------|
| Any one accident or loss ..... | \$1,000,000 |
|--------------------------------|-------------|

c) Owners Protective Liability Insurance

For Contracts exceeding \$50,000 in total Contract amount, Contractor shall secure an Owners Protective Liability policy naming the Owner as the Named Insured.

Minimum acceptable limits are:

|                               |             |
|-------------------------------|-------------|
| General aggregate limit ..... | \$2,000,000 |
| Each occurrence limit.....    | \$1,000,000 |

d) Pollution Liability Insurance

In the event that any disruption, handling, abatement, remediation, encapsulation, removal, transport, or disposal of contaminated or hazardous material is required, the Contractor or its Subcontractor shall secure a pollution liability policy in addition to any other coverages contained in this section. The insurance shall be provided on an occurrence based policy and shall remain in effect for the duration of the Project.

Minimum acceptable limit is:

|                            |             |
|----------------------------|-------------|
| Each occurrence limit..... | \$1,000,000 |
|----------------------------|-------------|

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14.6 Property Insurance

a) New Construction Only

The Contractor shall procure and maintain Builder's Risk insurance naming the Owner, Contractor and all Subcontractors as insureds as their interest may appear. The covered cause of loss form shall be Risks of Direct Physical Loss, endorsed to include flood, earthquake, testing and ensuing loss and shall include coverage for materials in transit and materials stored off site. Coverage shall be on a replacement cost and a completed value basis. Unless specifically authorized by the Owner, the limit of insurance shall not be less than the contract amount and coverage shall apply during the entire contract period until the Certificate of Substantial Completion is accepted by the Owner.

b) Renovations within and Additions to Existing Buildings Insured by State of Maine Risk Management Division

Insurance shall be provided by the Owner. The Owner shall provide the following Project information to the State of Maine Risk Management Division prior to commencement of the Work in order to initiate the insurance coverage: building name, street address and municipality, brief project description, project start date and completion date, contract dollar value, and Contractor name and address. Said insurance shall name the Contractor and all Subcontractors as insureds as their interest may appear. The covered causes of loss form shall be Risks of Direct Physical Loss, endorsed to include flood, earthquake, testing and ensuing loss and shall include coverage for materials in transit and materials stored off site. Theft coverage is not included and exclusions common to commercial property policies are applicable. The Contractor shall be responsible for a \$500 deductible per occurrence. Unless specifically authorized by the Owner, the limit of insurance shall not be less than the contract amount and coverage shall apply during the entire contract period until the Certificate of Substantial Completion is accepted by the Owner. Verification of insurance will be furnished to the Contractor upon request. The Contractor may independently acquire, at the Contractor's expense, coverage in excess of that maintained by the State of Maine.

- 14.7 The Contractor shall provide four original copies of all certificates of insurance in a form, and issued by, companies acceptable to the Owner prior to commencement of work. The certificates shall name the Owner as certificate holder and, shall identify the project name and BGS project number. The certificates shall contain a provision that coverage afforded under the insurance policies will not be canceled or materially changed unless at least thirty (30) calendar days prior written notice by registered letter has been given to the Owner.

15. Contract Bonds

- 15.1 When noted as required in the Bid Documents, the Contractor shall provide to the Owner a Performance Bond and a Payment Bond, or "contract bonds", upon execution of the contract. Each bond value shall be for the full amount of the contract and issued by a surety company authorized to do business in the State of Maine as approved by the Owner. The bonds shall be executed on the forms furnished in the Bid Documents. The bonds shall allow for any addition or deductions of the contract.
- 15.2 The contract bonds shall continue in effect for one year after final acceptance of the contract to protect the Owner's interest in connection with the one year guarantee of workmanship and materials and to assure settlement of claims for the payment of all bills for labor, materials and equipment by the Contractor.

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16. Allowances

- 16.1 The Contract Price shall include all allowances described in the Contract Documents. The Contractor shall include all overhead and profit necessary to implement each allowance in their Contract Price.
- 16.2 The Contractor shall not be required to employ parties for allowance work against whom the Contractor has a reasonable objection. In such a case, the Contractor shall notify the Owner in writing of their position and shall propose an alternative party to complete the work of the allowance.

17. Assignment of Contract

- 17.1 The Contractor shall not assign or sublet the contract as a whole without the written consent of the Owner. The Contractor shall not assign any money due to the Contractor without the written consent of the Owner.

18. Separate Contracts

- 18.1 The Owner reserves the right to create other contracts in connection with this Project using similar General Conditions. The Contractor shall allow the Owner's other contractors reasonable opportunity for the delivery and storage of materials and the execution of their work. The Contractor shall coordinate and properly connect the Work of all contractors.
- 18.2 The Contractor shall promptly report to the Architect and Owner any apparent deficiencies in work of the Owner's other contractors that impacts the proper execution or results of the Contractor. The Contractor's failure to observe or report any deficiencies constitutes an acceptance of the Owner's other contractors work as suitable for the interface of the Contractor's work, except for latent deficiencies in the Owner's other contractors work.
- 18.3 Similarly, the Contractor shall promptly report to the Architect and Owner any apparent deficiencies in their own work that would impact the proper execution or results of the Owner's other contractors.
- 18.4 The Contractor shall report to the Architect and Owner any conflicts or claims for damages with the Owner's other contractors and settle such conflicts or claims for damages by mutual agreement or arbitration, if necessary, at no expense to the Owner.
- 18.5 In the event the Owner's other contractors sue the Owner regarding any damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor, who shall defend such proceedings at the Contractor's expense. The Contractor shall pay or satisfy any judgment that may arise against the Owner, and pay all other costs incurred.

19. Subcontracts

- 19.1 The Contractor shall not subcontract any part of this contract without the written permission of the Owner.
- 19.2 The Contractor shall submit a complete list of named Subcontractors and material suppliers to the Architect and Owner for approval by the Owner prior to commencing work. The Subcontractors named shall be reputable companies of recognized standing with a record of satisfactory work.

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- 19.3 The Contractor shall not employ any Subcontractor or use any material until they have been approved, or where there is reason to believe the resulting work will not comply with the Contract Documents.
- 19.4 The Contractor, not the Owner, is as fully responsible for the acts and omissions of Subcontractors and of persons employed by them, as the Contractor is for the acts and omissions of persons directly or indirectly employed by the Contractor.
- 19.5 Neither the Contract Documents nor any Contractor-Subcontractor contract shall indicate, infer or create any direct contractual relationship between any Subcontractor and the Owner.

**20. Contractor-Subcontractor Relationship**

- 20.1 The Contractor shall be bound to the Subcontractor by all the obligations in the Contract Documents that bind the Contractor to the Owner.
- 20.2 The Contractor shall pay the Subcontractor, in proportion to the dollar value of the work completed by the Subcontractor, the dollar amount allowed to the Contractor at the time each Contractor's Requisition for Payment is approved by the Owner.
- 20.3 The Contractor shall pay the Subcontractor accordingly if the Contract Documents or the subcontract provide for earlier or larger payments than described in the provision above.
- 20.4 The Contractor shall pay the Subcontractor on demand for subcontract work or materials as far as executed and fixed in place, less retainage, at the time the Contractor's Requisition for Payment is approved by the Owner, even if the Architect fails to certify a portion of the Requisition for Payment for a cause not the fault of the Subcontractor.
- 20.5 The Contractor shall not make a claim for liquidated damages or penalty for delay in any amount in excess of amounts that are specified by the subcontract.
- 20.6 The Contractor shall not make a claim for services rendered or materials furnished by the Subcontractor unless written notice is given by the Contractor to the Subcontractor within ten calendar days of the day in which the claim originated.
- 20.7 The Contractor shall give the Subcontractor an opportunity to present and to submit evidence in any progress conference or disputes involving subcontract work.
- 20.8 The Contractor shall pay the Subcontractor a just share of any fire insurance payment received by the Contractor.
- 20.9 The Subcontractor shall be bound to the Contractor by the terms of the Contract Documents and assumes toward the Contractor all the obligations and responsibilities that the Contractor, by those documents, assumes toward the Owner.
- 20.10 The Subcontractor shall submit applications for payment to the Contractor in such reasonable time as to enable the Contractor to apply for payment as specified.
- 20.11 The Subcontractor shall make any claims for extra cost, extensions of time or damages, to the Contractor in the manner provided in these General Conditions for like claims by the Contractor to the Owner, except that the time for the Subcontractor to make claims for extra cost is seven calendar days after the receipt of Architect's instructions.

**21. Supervision of the Work**

- 21.1 During all stages of the Work the Contractor shall have a competent superintendent, with any necessary assistant superintendents, overseeing the project. The superintendent shall not be reassigned without the consent of the Owner unless a superintendent ceases to be employed by the Contractor due to unsatisfactory performance.

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- 21.2 The superintendent represents the Contractor on the jobsite. Directives given by the Architect or Owner to the superintendent shall be as binding as if given directly to the Contractor's main office. All important directives shall be confirmed in writing to the Contractor. The Architect and Owner are not responsible for the acts or omissions of the superintendent or assistant superintendents.
- 21.3 The Contractor shall provide supervision of the Work equal to the industry's highest standard of care. The superintendent shall carefully study and compare all Contract Documents and promptly report any error, inconsistency or omission discovered to the Architect. The Contractor may not necessarily be held liable for damages resulting directly from any error, inconsistency or omission in the Contract Documents or other instructions by the Architect that was not revealed by the superintendent in a timely way.

**22. Observation of the Work**

- 22.1 The Contractor shall allow the Owner, the Architect and the Bureau continuous access to the site for the purpose of observation of the progress of the work. All necessary safeguards and accommodations for such observations shall be provided by the Contractor.
- 22.2 The Contractor shall coordinate all required testing, approval or demonstration of the Work. The Contractor shall give sufficient notice to the appropriate parties of readiness for testing, inspection or examination.
- 22.3 The Contractor shall schedule inspections and obtain all required certificates of inspection for inspections by a party other than the Architect.
- 22.4 The Architect shall make all scheduled observations promptly, prior to the work being concealed or buried by the Contractor. If approval of the Work is required of the Architect, the Contractor shall notify the Architect of the construction schedule in this regard. Work concealed or buried prior to the Architect's approval may need to be uncovered at the Contractor's expense.
- 22.5 The Architect may order reexamination of questioned work, and, if so ordered, the work must be uncovered by the Contractor. If the work is found to conform to the Contract Documents, the Owner shall pay the expense of the reexamination and remedial work. If the work is found to not conform to the Contract Documents, the Contractor shall pay the expense, unless the defect in the work was caused by the Owner's Contractor, whose responsibility the reexamination expense becomes.
- 22.6 The Bureau shall periodically observe the Work during the course of construction and make recommendations to the Contractor or Architect as necessary. Such recommendations shall be considered and implemented through the usual means for changes to the Work.

**23. Architect's Status**

- 23.1 The Architect represents the Owner during the construction period, and observes the work in progress on behalf of the Owner. The Architect has authority to act on behalf of the Owner only to the extent expressly provided by the Contract Documents or otherwise demonstrated to the Contractor. The Architect has authority to stop the work whenever such an action is necessary, in the Architect's reasonable opinion, to ensure the proper execution of the contract.
- 23.2 The Architect is the interpreter of the conditions of the contract and the judge of its performance. The Architect shall favor neither the Owner nor the Contractor, but shall use the Architect's powers under the contract to enforce faithful performance by both parties.

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**General Conditions**

23.3 In the event of the termination of the Architect's employment on the project prior to completion of the work, the Owner shall appoint a capable and reputable replacement. The status of the new Architect relative to this contract shall be that of the former Architect.

**24. Management of the Premises**

- 24.1 The Contractor shall place equipment and materials, and conduct activities on the premises in a manner that does not unreasonably hinder site circulation, environmental stability, or any long term effect. Likewise, the Architect's directions shall not cause the use of premises to be impeded for the Contractor or Owner.
- 24.2 The Contractor shall not use the premises for any purpose other than that which is directly related to the scope of work. The Owner shall not use the premises for any purpose incompatible with the proposed work simultaneous to the work of the Contractor.
- 24.3 The Contractor shall enforce the Architect's instructions regarding information posted on the premises such as signage and advertisements, as well as activities conducted on the premises such as fires, and smoking.
- 24.4 The Owner may occupy any part of the Project that is completed with the written consent of the Contractor, and without prejudice to any of the rights of the Owner or Contractor. Such use or occupancy shall not, in and of itself, be construed as a final acceptance of any work or materials.

**25. Safety and Security of the Premises**

- 25.1 The Contractor shall continuously maintain security on the premises and protect from unreasonable occasion of injury all people authorized to be on the job site. The Contractor shall also effectively protect the property and adjacent properties from damage or loss.
- 25.2 The Contractor shall take all necessary precautions to ensure the safety of workers and others on and adjacent to the site, abiding by applicable local, state and federal safety regulations. The Contractor shall erect and continuously maintain safeguards for the protection of workers and others, and shall post signs and other warnings regarding hazards associated with the construction process, such as protruding fasteners, moving equipment, trenches and holes, scaffolding, window, door or stair openings, and falling materials.
- 25.3 The Contractor shall designate, and make known to the Architect and the Owner, a safety officer whose duty is the prevention of accidents on the site.
- 25.4 The Contractor shall restore the premises to conditions that existed prior to the start of the project at areas not intended to be altered according to the Contract Documents.
- 25.5 The Contractor shall protect existing utilities and exercise care working in the vicinity of utilities shown in the Drawings and Specifications or otherwise located by the Contractor.
- 25.6 The Contractor shall protect from damage existing trees and other significant plantings and landscape features of the site which will remain a permanent part of the site. If necessary or indicated in the Contract Documents, tree trunks shall be boxed and barriers erected to prevent damage to tree branches or roots.
- 25.7 Damage to the Work, including that which is reasonably protected, shall be repaired or replaced at the expense of the party who caused the damage.
- 25.8 The Contractor shall not load, or allow to be loaded, any part of the Project with a force which imperils personal or structural safety. The Architect may consult with the Contractor on such means and methods of construction, however, the ultimate responsibility lies with the Contractor.

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**General Conditions**

- 25.9 The Contractor shall not jeopardize any work in place with subsequent construction activities such as blasting, drilling, excavating, cutting, patching or altering work. The Architect must approve altering any structural components of the project. The Contractor shall supervise all construction activities carried out by others on site to ensure that the work is neatly done and in a manner that will not endanger the structure or the component parts.
- 25.10 The Contractor may act with their sole discretion in emergency situations that potentially effect health, life or serious damage to the premises or adjacent properties, to prevent such potential loss or injury. The Contractor may negotiate with the Owner for compensation for expenses due to such emergency work.
- 25.11 The Contractor shall keep the premises free of any unsafe accumulation of waste materials caused by the work. The Contractor shall regularly keep the spaces “broom clean”. See the Close-out of the Work provisions of this section regarding cleaning at the completion of the project.

**26. Changes in the Work**

- 26.1 The Contractor shall not proceed with extra work without an approved Change Order or Construction Change Directive. A Change Order which has been properly signed by all parties shall become a part of the contract.
- 26.2 A Change Order is the usual document for directing changes in the Work. In certain circumstances, however, the Owner may utilize a Construction Change Directive to direct the Contractor to perform changes in the Work that are generally consistent with the scope of the project. The Owner shall use a Construction Change Directive only when the normal process for approving changes to the Work has failed to the detriment of the Project, or when agreement on the terms of a Change Order cannot be met, or when an urgent situation requires, in the Owner's judgment, prompt action by the Contractor.
- 26.3 The Architect shall prepare the Construction Change Directive representing a complete scope of work, with proposed Contract Price and Contract Time revisions, if any, clearly stated.
- 26.4 The Contractor shall promptly carry out a Construction Change Directive which has been signed by the Owner and the Architect. Work thus completed by the Contractor constitutes the basis for a Change Order. Changes in the Contract Price and Contract Time shall be as defined in the Construction Change Directive unless subsequently negotiated with some other terms.
- 26.5 The method of determining the dollar value of extra work shall be by:
- a) an estimate of the Contractor accepted by Owner as a lump sum, or
  - b) unit prices named in the contract or subsequently agreed upon, or
  - c) cost plus a designated percentage, or
  - d) cost plus a fixed fee.
- 26.6 The Contractor shall determine the dollar value of the extra work for both the lump sum and cost plus designated percentage methods using the following rates. The rates include all overhead and profit expenses.
- a) Contractor - for any work performed by the Contractor's own forces, 20% of the cost;
  - b) Subcontractor - for work performed by Subcontractor's own forces, 20% of the cost;
  - c) Contractor - for work performed by Contractor's Subcontractor, 10% of the amount due the Subcontractor.
- 26.7 The Contractor shall keep and provide records as needed or directed for the cost plus designated percentage method. The Architect shall review and certify the appropriate amount which includes the Contractor's overhead and profit. The Owner shall make payments based on the Architect's certificate.

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**General Conditions**

- 26.8 Cost reflected in Change Orders shall be limited to the following: cost of materials, cost of delivery, cost of labor (including Social Security, pension, Workers' Compensation insurance, and unemployment insurance), and cost of rental of power tools and equipment. Labor cost may include a pro-ratio share of a foreman's time only in the case of an extension of contract time granted due to the Change Order.
- 26.9 Overhead reflected in Change Orders shall be limited to the following: bond premium, supervision, wages of clerks, time keepers, and watchmen, small tools, incidental expenses, general office expenses, and all other overhead expenses directly related to the Change Order.
- 26.10 The Contractor shall provide credit to the Owner for labor, materials, equipment and other costs but not overhead and profit expenses for those Change Order items that result in a net value of credit to the contract.
- 26.11 The Owner may change the scope of work of the Project without invalidating the contract. The Owner shall notify the Contractor of a change of the scope of work for the Owner's Contractors, which may affect the work of this Contractor, without invalidating the contract. Change Orders for extension of the time caused by such changes shall be developed at the time of directing the change in scope of work.
- 26.12 The Architect may order minor changes in the Work, not involving extra cost, which is consistent with the intent of the design or project.
- 26.13 The Contractor shall immediately give written notification to the Architect of latent conditions discovered at the site which materially differ from those represented in the Drawings or Specifications, and which may eventually result in a change in the scope of work. The Contractor shall suspend work until receiving direction from the Architect. The Architect shall promptly investigate the conditions and respond to the Contractor's notice with direction that avoids any unnecessary delay of the Work. The Architect shall determine if the discovered conditions warrant a Change Order.
- 26.14 The Contractor shall, within ten calendar days of receipt of the information, give written notification to the Architect if the Contractor claims that instructions by the Architect will constitute extra cost not accounted for by Change Order or otherwise under the contract. The Architect shall promptly respond to the Contractor's notice with direction that avoids any unnecessary delay of the Work. The Architect shall determine if the Contractor's claim warrants a Change Order.
27. Correction of the Work
- 27.1 The Contractor shall promptly remove from the premises all work the Architect declares is non-conforming to the contract. The Contractor shall replace the work properly at no expense to the Owner. The Contractor is also responsible for the expenses of others whose work was damaged or destroyed by such remedial work.
- 27.2 The Owner may elect to remove non-conforming work if it is not removed by the Contractor within a reasonable time, that time defined in a written notice from the Architect. The Owner may elect to store removed non-conforming work not removed by the Contractor at the Contractor's expense. The Owner may, with ten days written notice, dispose of materials which the Contractor does not remove. The Owner may sell the materials and apply the net proceeds, after deducting all expenses, to the costs that should have been borne by the Contractor.
- 27.3 The Contractor shall remedy any defects due to faulty materials or workmanship and pay for any related damage to other work which appears within a period of one year from the date of substantial completion, and in accord with the terms of any guarantees provided in the contract.

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**General Conditions**

The Owner shall promptly give notice of observed defects to the Contractor and Architect. The Architect shall determine the status of all claimed defects.

- 27.4 The Architect may authorize, after a reasonable notification to the Contractor, an equitable deduction from the contract amount in lieu of the Contractor correcting non-conforming or defective work.

**28. Owner's Right to do Work**

- 28.1 The Owner may, using other contractors, correct deficiencies attributable to the Contractor, or complete unfinished work. Such action shall take place only after giving the Contractor three days written notice, and provided the Architect approves of the proposed course of action as an appropriate remedy. The Owner may then deduct the cost of the remedial work from the amount due the Contractor.
- 28.2 The Owner may act with their sole discretion when the Contractor is unable to take action in emergency situations that potentially effect health, life or serious damage to the premises or adjacent properties, to prevent such potential loss or injury. The Owner shall inform the Contractor of the emergency work performed, particularly where it may affect the work of the Contractor.

**29. Termination of Contract and Stop Work Action**

- 29.1 The Owner may, owing to a certificate of the Architect indicating that sufficient cause exists to justify such action, without prejudice to any other right or remedy and after giving the Contractor and the Contractor's surety seven days written notice, terminate the employment of the Contractor. At that time the Owner may take possession of the premises and of all materials, tools and appliances on the premises and finish the work by whatever method the Owner may deem expedient. Cause for such action by the Owner includes: if the contractor is adjudged bankrupt, or makes a general assignment for the benefit of its creditors, or if a receiver is appointed due to the Contractor's insolvency, or if the Contractor persistently or repeatedly refuses or fails to provide enough properly skilled workers or proper materials, or if the Contractor fails to make prompt payment to Subcontractors or material or labor suppliers, or if the Contractor persistently disregards laws, ordinances or the instructions of the Architect, or is otherwise found guilty of a substantial violation of a provision of the Contract Documents.
- 29.2 The Contractor is not entitled, as a consequence of the termination of the employment of the Contractor as described above, to receive any further payment until the Work is finished. If the unpaid balance of the contract amount exceeds the expense of finishing the Work, including compensation for additional architectural, managerial and administrative services, such balance shall be paid to the Contractor. If the expense of finishing the Work exceeds the unpaid balance, the Contractor shall pay the difference to the Owner. The Architect shall certify the expense incurred by the Contractor's default. This obligation for payment shall continue to exist after termination of the contract.
- 29.3 The Contractor may, if the Work is stopped by order of any court or other public authority for a period of thirty consecutive days, and through no act or fault of the Contractor or of anyone employed by the Contractor, with seven days written notice to the Owner and the Architect, terminate this contract. The Contractor may then recover from the Owner payment for all work executed, any proven loss and reasonable profit and damage.

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**General Conditions**

29.4 The Contractor may, if the Architect fails to issue a certificate for payment within seven days after the Contractor's formal request for payment, through no fault of the Contractor, or if the Owner fails to pay to the Contractor within 30 days after submission of any sum certified by the Architect, with seven days written notice to the Owner and the Architect, stop the Work or terminate this Contract.

**30. Delays and Extension of Time**

30.1 The completion date of the contract shall be extended if the work is delayed by changes ordered in the work which have approved time extensions, or by an act or neglect of the Owner, the Architect, or the Owner's Contractor, or by strikes, lockouts, fire, flooding, unusual delay in transportation, unavoidable casualties, or by other causes beyond the Contractor's control. The Architect shall determine the status of all claimed causes.

30.2 The contract shall not be extended for delay occurring more than seven calendar days before the Contractor's claim made in writing to the Architect. In case of a continuing cause of delay, only one claim is necessary.

30.3 The contract shall not be extended due to failure of the Architect to furnish drawings if no schedule or agreement is made between the Contractor and the Architect indicating the dates which drawings shall be furnished and fourteen calendar days has passed after said date for such drawings.

30.4 This article does not exclude the recovery of damages for delay by either party under other provisions in the Contract Document.

**31. Payments to the Contractor**

31.1 As noted under *Preconstruction Conference* in this section, the Contractor shall submit a Schedule of Values form, before the first application for payment, for approval by the Owner and Architect. The Architect may direct the Contractor to provide evidence that supports the correctness of the form. The approved Schedule of Values shall be used as a basis for payments.

31.2 The Contractor shall submit an application for each payment ("Requisition for Payment") on a form approved by the Owner and Architect. The Architect may require receipts or other documents showing the Contractor's payments for materials and labor, including payments to Subcontractors.

31.3 The Contractor shall submit Requisitions for Payment as the work progresses not more frequently than once each month, unless the Owner approves a more frequent interval due to unusual circumstances. The Requisition for Payment is based on the proportionate quantities of the various classes of work completed or incorporated in the Work, in agreement with the actual progress of the Work and the dollar value indicated in the Schedule of Values.

31.4 The Architect shall verify and certify each Requisition for Payment which appears to be complete and correct prior to payment being made by the Owner. The Architect may certify an appropriate amount for materials not incorporated in the Work which have been delivered and suitably stored at the site. The Contractor shall submit bills of sale, insurance certificates, or other such documents that will adequately protect the Owner's interests prior to payments being certified.

31.5 In the event any materials delivered but not yet incorporated in the Work have been included in a certified Requisition for Payment with payment made, and said materials thereafter are damaged, deteriorated or destroyed, or for any reason whatsoever become unsuitable or unavailable for use

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**General Conditions**

- in the Work, the full amount previously allowed shall be deducted from subsequent payments unless the Contractor satisfactorily replaces said material.
- 31.6 The Contractor may request certification of an appropriate dollar amount for materials not incorporated in the Work which have been delivered and suitably stored away from the site. The Contractor shall submit bills of sale, insurance certificates, right-of-entry documents or other such documents that will adequately protect the Owner's interests. The Architect shall determine if the Contractor's documentation for the materials is complete and specifically designated for the Project. The Owner may allow certification of such payments.
- 31.7 Subcontractors may request, and shall receive from the Architect, copies of approved Requisitions for Payment showing the amounts certified in the Schedule of Values.
- 31.8 Certified Requisitions for Payment, payments made to the Contractor, or partial or entire occupancy of the project by the Owner shall not constitute an acceptance of any work that does not conform to the Contract Documents. The making and acceptance of the final payment constitutes a waiver of all claims by the Owner, other than those arising from unsettled liens, from faulty work or materials appearing within one year from final payment or from requirements of the Drawings and Specifications, and of all claims by the Contractor, except those previously made and still unsettled.
- 31.9 The Owner shall retain five percent of each payment due the Contractor as part security for the fulfillment of the contract by the Contractor. The Owner may make payment of a portion of this "retainage" to the Contractor temporarily or permanently during the progress of the Work. The Owner may thereafter withhold further payments until the full amount of the five percent is reestablished. The Contractor may deposit with the Maine State Treasurer certain securities in place of retainage amounts due according to Maine Statute (M.R.S.A. 5, Section 1746).

**32. Payments Withheld**

- 32.1 The Architect may withhold or nullify the whole or a portion of any Requisitions for Payment submitted by the Contractor in the amount that may be necessary, in his reasonable opinion, to protect the Owner from loss due to any of the following:
- a) defective work not remedied;
  - b) claims filed or reasonable evidence indicating probable filing of claims;
  - c) failure to make payments properly to Subcontractors or suppliers;
  - d) a reasonable doubt that the contract can be completed for the balance then unpaid;
  - e) liability for damage to another contractor.

The Owner shall make payment to the Contractor, in the amount withheld, when the above circumstances are removed.

**33. Liens**

- 33.1 The Contractor shall deliver to the Owner a complete release of all liens arising out of this contract before the final payment or any part of the retainage payment is released. The Contractor shall provide with the release of liens an affidavit asserting each release includes all labor and materials for which a lien could be filed. Alternately, the Contractor, in the event any Subcontractor or supplier refuses to furnish a release of lien in full, may furnish a bond satisfactory to the Owner, to indemnify the Owner against any lien.

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**General Conditions**

- 33.2 In the event any lien remains unsatisfied after all payments to the Contractor are made by the Owner, the Contractor shall refund to the Owner all money that the latter may be compelled to pay in discharging such lien, including all cost and reasonable attorney's fees.

**34. Indemnification**

- 34.1 The Contractor shall indemnify and hold harmless the Owner, its officers, agents, and employees from and against any and all claims, liabilities and costs, including reasonable attorney's fees, for any or all injuries to persons, property or claims for money damages arising from the negligent acts or omissions of the Contractor, its employees or agents, officers or subcontractors in the performance of work under this Agreement.

**35. Workmanship**

- 35.1 The Contractor shall provide materials, equipment, and installed work equal to or better than the quality specified in the Contract Documents and approved in submittal and sample. The installation methods shall be of the highest standards, and the best obtainable from the respective trades. The Architect's decision on the quality of work shall be final.
- 35.2 The Contractor shall know local labor conditions for skilled and unskilled labor in order to apply the labor appropriately to the Work. All labor shall be performed by individuals well skilled in their respective trades.
- 35.3 The Contractor shall perform all cutting, fitting, patching and placing of work in such a manner to allow subsequent work to fit properly, whether that be by the Contractor, the Owner's Contractors or others. The Owner and Architect may advise the Contractor regarding such subsequent work. Notwithstanding the notification or knowledge of such subsequent work, the Contractor may be directed to comply with this standard of compatible construction by the Architect at the Contractor's expense.
- 35.4 The Contractor shall request clarification or revision of any design work by the Architect, prior to commencing that work, in a circumstance where the Contractor believes the work cannot feasibly be completed at the highest quality, or as indicated in the Contract Documents. The Architect shall respond to such requests in a timely way, providing clarifying information, a feasible revision, or instruction allowing a reduced quality of work. The Contractor shall follow the direction of the Architect regarding the required request for information.
- 35.5 The Contractor shall guarantee the Work against any defects in workmanship and materials for a period of one year commencing with the date of the Certificate of Substantial Completion, unless specified otherwise for specific elements of the project. The Work may also be subdivided in mutually agreed upon components, each defined by a Certificate of Substantial Completion.

**36. Close-out of the Work**

- 36.1 The Contractor shall remove from the premises all waste materials caused by the work. The Contractor shall make the spaces "broom clean" unless a more exactly cleaning is specified. The Contractor shall wash all windows and glass immediately prior to the final inspection, unless otherwise directed.

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**General Conditions**

- 36.2 The Owner may conduct the cleaning of the premises where the Contractor, duly notified by the Architect, fails to adequately complete the task. The expense of this cleaning may be deducted from the sum due to the Contractor.
- 36.3 The Contractor shall participate in all final inspections and acknowledge the documentation of unsatisfactory work, generally called the "punch list", to be corrected by the Contractor. The Architect shall document the successful completion of the Work in a dated Certificate of Substantial Completion, to be signed by Owner, Architect, and Contractor.
- 36.4 The Contractor shall not call for final inspection of any portion of the Work that is not complete and permanent installed. The Contractor may be found liable for the expenses of individuals called to final inspection meetings prematurely.
- 36.5 The Contractor and all major Subcontractors shall participate in the end-of-warranty-period conference, typically scheduled close to one year after the Substantial Completion date.

**37. Date of Completion and Liquidated Damages**

- 37.1 The Contractor may make a written request to the Owner for an extension or reduction of time, if necessary. The request shall include the reasons the Contractor believes justifies the proposed completion date. The Owner may grant the revision of the contract completion date if the Work was delayed due to conditions beyond the control and the responsibility of the Contractor. The Contractor shall not conduct unauthorized accelerated work or file delay claims to recover alleged damages for unauthorized early completion.
- 37.2 The Contractor shall vigorously pursue the completion of the Work and notify the Owner of any factors that have, may, or will affect the approved Schedule of the Work. The Contractor may be found responsible for expenses of the Owner or Architect if the Contractor fails to make notification of project delays.
- 37.3 The Project is planned to be done in an orderly fashion which allows for an iterative submittal review process, construction administration including minor changes in the Work and some bad weather. The Contractor shall not file delay claims to recover alleged damages on work the Architect determines has followed the expected rate of progress.
- 37.4 The Architect shall prepare the Certificate of Substantial Completion which, when signed by the Owner and the Contractor, documents the date of Substantial Completion of the Work or a designated portion of the Work. The Owner shall not consider the issuance of a Certificate of Occupancy by an outside authority a prerequisite for Substantial Completion if the Certificate of Occupancy cannot be obtained due to factors beyond the Contractor's control.
- 37.5 Liquidated Damages may be deducted from the sum due to the Contractor for each calendar day that the Work remains uncompleted after the completion date specified in the Contract or an approved amended completion date. The dollar amount per day shall be calculated using the Schedule of Liquidated Damages table shown below.

| <u>If the original contract amount is:</u>             | <u>The per day Liquidated Damages shall be:</u>              |
|--|--|
| More than \$100,000 and less than \$2,000,000 .....    | \$750  |
| More than \$2,000,000 and less than \$10,000,000 ..... | \$1,500  |
| More than \$10,000,000 .....                           | \$1,500 plus \$250 for<br>each \$2,000,000 over \$10,000,000 |

**00 72 13**  
**General Conditions**

38. Dispute Resolution

38.1 Mediation

- a) In the event of a dispute between the parties which arises under this Agreement in which the dispute cannot be resolved through informal negotiation, the dispute shall be submitted to a neutral mediator jointly selected by the parties.
- b) Either party may file suit before or during mediation if the party, in good faith, deems it to be necessary to avoid losing the right to sue due to a statute of limitations. If suit is filed before good faith mediation efforts are completed, the party filing suit shall agree to stay all proceedings in the lawsuit pending completion of the mediation process, provided such stay is without prejudice.
- c) In any mediation between the Owner and the Architect, the Owner has the right to consolidate related claims between Owner and Contractor.

38.2 Arbitration

- a) If the dispute is not resolved through mediation, the dispute shall be settled by arbitration. The arbitration shall be conducted before a panel of three arbitrators. Each party shall select one arbitrator; the third arbitrator shall be appointed by the arbitrators selected by the parties. The arbitration shall be conducted in accordance with the Maine Uniform Arbitration Act (“MUAA”), except as otherwise provided in this section.
- b) The decision of the arbitrators shall be final and binding upon all parties. The decision may be entered in court as provided in the MUAA.
- c) The costs of the arbitration, including the arbitrators’ fees shall be borne equally by the parties to the arbitration, unless the arbitrator orders otherwise.
- d) In any arbitration between the Owner and the Architect, the Owner has the right to consolidate related claims between Owner and Contractor.

**00 73 46**  
**Wage Determination Schedule**

**PART 1- GENERAL**

**1.1 Related Documents**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications Sections, apply to this Section.

**1.2 Summary**

- A. This Section includes the wage determination requirements for Contractors as issued by the State of Maine Department of Labor Bureau of Labor Standards or the United States Department of Labor.

**1.3 Requirements**

- A. Conform to the wage determination schedule for this project which is shown on the following page.

**PART 2 - PRODUCTS (not used)**

**PART 3 - EXECUTION (not used)**

**00 73 46**  
**Wage Determination Schedule**

End of Section 00 73 46

**00 73 46**  
**Wage Determination Schedule**

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**THIS DOCUMENT MUST BE CLEARLY POSTED AT THE PERTAINING STATE FUNDED PREVAILING WAGE CONSTRUCTION SITE**

State of Maine  
 Department of Labor  
 Bureau of Labor Standards  
 Wage and Hour Division  
 Augusta, Maine 04333-0045  
 Telephone (207) 623-7906

Wage Determination - In accordance with 26 MRSA §1301 et. seq., this is a determination by the Bureau of Labor Standards, of the fair minimum wage rate to be paid laborers and workers employed on the below titled project.

Title of Project -----221 State Street Emergency Generator

Location of Project – Augusta, Kennebec County

**2016 Fair Minimum Wage Rates  
 Building 2 Kennebec County  
 (other than 1 or 2 family homes)**

| <u>Occupation Title</u>                  | <u>Minimum Wage</u> | <u>Minimum Benefit</u> | <u>Total</u> | <u>Occupation Title</u>                          | <u>Minimum Wage</u> | <u>Minimum Benefit</u> | <u>Total</u> |
|--|---------------------|------------------------|--------------|--|---------------------|------------------------|--------------|
| Asbestos/Lead Removal Worker             | \$13.00             | \$0.51                 | \$13.51      | Insulation Installer                             | \$19.25             | \$2.33                 | \$21.58      |
| Assembler – Metal Building               | \$13.63             | \$3.38                 | \$17.01      | Ironworker - Reinforcing                         | \$21.00             | \$6.80                 | \$27.80      |
| Boom Truck (Truck Crane) Operator        | \$21.00             | \$2.85                 | \$23.85      | Ironworker - Structural                          | \$23.20             | \$20.52                | \$43.72      |
| Bricklayer                               | \$22.00             | \$2.68                 | \$24.68      | Laborers (incl. Helpers & Tenders)               | \$14.00             | \$0.35                 | \$14.35      |
| Bulldozer Operator                       | \$17.63             | \$3.24                 | \$20.87      | Laborers - Skilled                               | \$16.00             | \$1.20                 | \$17.20      |
| Carpenter                                | \$21.00             | \$3.47                 | \$24.47      | Loader Operator – Front End                      | \$17.21             | \$2.66                 | \$19.87      |
| Carpenter - Acoustical                   | \$15.00             | \$2.68                 | \$17.68      | Mechanic - Maintenance                           | \$20.00             | \$2.79                 | \$22.79      |
| Carpenter - Rough                        | \$18.65             | \$0.16                 | \$18.81      | Mechanic - Refrigeration                         | \$20.00             | \$3.63                 | \$23.63      |
| Cement Mason/Finisher                    | \$17.75             | \$2.15                 | \$19.90      | Millwright                                       | \$23.95             | \$19.19                | \$43.14      |
| Communication Equipment Installer        | \$24.04             | \$8.00                 | \$32.04      | Oil/Fuel Burner Servicer & Installer             | \$24.43             | \$6.13                 | \$30.56      |
| Concrete Pump Operator                   | \$24.25             | \$5.40                 | \$29.65      | Painter  | \$18.75             | \$0.00                 | \$18.75      |
| Crane Operator <15 Tons                  | \$21.25             | \$2.58                 | \$23.83      | Paperhanger                                      | \$17.00             | \$3.16                 | \$20.16      |
| Crane Operator =>15 Tons                 | \$24.50             | \$6.61                 | \$31.11      | Pipe/Steam/Sprinkler Fitter                      | \$26.25             | \$13.84                | \$40.09      |
| Crusher Plant Operator                   | \$15.80             | \$3.76                 | \$19.56      | Pipe Layer                                       | \$19.33             | \$2.37                 | \$21.70      |
| Dry-Wall Applicator                      | \$21.50             | \$2.63                 | \$24.13      | Plasterer  | \$43.93             | \$27.43                | \$71.36      |
| Dry-Wall Taper & Finisher                | \$25.00             | \$3.00                 | \$28.00      | Plumber (Licensed)                               | \$25.00             | \$3.16                 | \$28.16      |
| Electrician - Licensed                   | \$25.00             | \$5.47                 | \$30.47      | Plumber Helper/Trainee (Licensed)                | \$17.59             | \$2.61                 | \$20.20      |
| Electrician Helper/Cable Puller Licensed | \$16.00             | \$2.31                 | \$18.31      | Propane & Natural Gas Service & inst. (Licensed) | \$21.00             | \$3.87                 | \$24.87      |
| Elevator Construction/Installer          | \$53.30             | \$33.36                | \$86.66      | Roofer   | \$15.00             | \$1.15                 | \$16.15      |
| Excavator Operator                       | \$19.06             | \$2.44                 | \$21.50      | Sheet Metal Worker                               | \$20.59             | \$4.76                 | \$26.01      |
| Fence Setter                             | \$15.25             | \$1.32                 | \$16.57      | Sider  | \$22.75             | \$4.33                 | \$27.08      |
| Flagger                                  | \$16.70             | \$7.95                 | \$24.65      | Stone Mason                                      | \$17.80             | \$0.00                 | \$17.80      |
| Floor Layer                              | \$19.50             | \$4.51                 | \$24.01      | Tile Setter                                      | \$21.25             | \$4.76                 | \$26.01      |
| Furniture Installer/Assembler            | \$13.75             | \$0.85                 | \$14.60      | Truck Driver – Light                             | \$15.00             | \$0.99                 | \$15.99      |
| Glazier                                  | \$20.82             | \$2.71                 | \$23.53      | Truck Driver – Medium                            | \$15.00             | \$0.10                 | \$15.10      |
| Grader/Scraper Operator                  | \$17.50             | \$1.04                 | \$18.54      | Truck Driver – Heavy                             | \$14.25             | \$0.83                 | \$15.08      |
| Heating Ventilation Air Conditioning     | \$24.31             | \$4.63                 | \$28.94      | Truck Driver – Tractor Trailer                   | \$16.24             | \$3.28                 | \$19.52      |

The Laborer classifications include a wide range of work duties. Therefore, if any specific occupation to be employed on this project is not listed in this determination, call the Bureau of Labor Standards at the above number for further clarification.

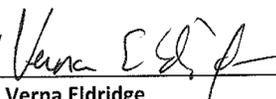
Welders are classified in the trade to which the welding is incidental.

Apprentices - The minimum wage rate for registered apprentices are those set forth in the standards and policies of the Maine State Apprenticeship and Training Council for approved apprenticeship programs.

Posting of Schedule - Posting of this schedule is required in accordance with 26 MRSA §1301 et. seq., by any contractor holding a State contract for construction valued at \$50,000 or more and any subcontractors to such a contractor.

Appeal - Any person affected by the determination of these rates may appeal to the Commissioner of Labor by filing a written notice with the Commissioner stating the specific grounds of the objection within ten (10) days from the filing of these rates with the Secretary of State.

Determination No: B2-022-2016  
 Filing Date: February 3, 2016  
 Expiration Date: 12-31-2016

A true copy  
 Attest:   
 Verna Eldridge  
 Wage & Hour Director  
 Bureau of Labor Standards

## DIVISION 01 SUPPLEMENTARY GENERAL REQUIREMENTS

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#### 1.1 RELATED DOCUMENTS

- A. General provisions of Contract, including General Conditions apply to this Division and to electrical contractors (also known as Contractor and/or General Contractor), Subcontractors and other persons supplying materials and/or labor, entering into the Project site and/or premises, directly or indirectly.
- B. This Division is intended to provide additional details and procedures for the implementation of requirements prescribed by the General Conditions document.

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#### 1.2 SUMMARY OF WORK

- A. Complete installation of a stand-by generator system that will provide emergency power in the event of a Utility outage.

- a. The Work shall include all labor, materials, supplies, equipment, components and systems required to complete the Project as specified and reasonably inferred by the Contract Documents, without exception, and all Work or portions of the Work normally required by accepted trade practices in projects of similar type, scope and locale, without which the Work could not be completed and without which the Work would not function properly.
- B. The Owner is the Maine Department of Health and Human Services;
  - a. Ms. Martha Kluzak, Director - Facility Management
  - b. Tel: 207-287-5837
- C. The Engineer for the Project is Harriman, 46 Harriman Drive, Auburn, ME 04210.
  - a. Tel. # (207)784-5100.
- D. The Work will be constructed under a single Contract for a stipulated Contract Sum including Addendum to Document.
- E. General Contractor Use of Premises: Limit use of the premises to construction activities in areas indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed. Keep all driveways and entrances serving the premises clear at all times.
  - 1. The staff will occupy the existing building during construction. Perform the Work so as not to interfere with the Owner's operations and use by the staff.
    - a. Notify Owner at least 72 hours before any temporary interruption of utilities, safety or support systems.
  - 2. Provisions are to be made for the convenience, safety and comfort of students, staff and the public within all usable areas.
  - 3. Normal working hours for on-site activities shall be 7:30 AM to 5:00 PM, Monday through Friday. Contractor may, at his discretion and at no extra cost to Owner, work on site after hours or weekends with Owner's approval.
  - 4. Keep all driveways and entrances serving the premises clear and available to the Owner, staff and the public at all times. Do not use these areas for parking or material storage. Schedule deliveries to minimize on-site storage of materials and equipment.
    - a. Construction parking and material storage will be in designated areas only. Location to be determined by Director of Facilities.
  - 5. Smoking is prohibited anywhere on property.
- F. Use of Existing Building:
  - 1. All contractor personnel who are performing work within the building during the day will be required to sign in at the Reception Office upon entry.
  - 2. All contractor personnel who are performing work will be issued an identity badge which must be visible at all times.
  - 3. Use of any room in the building for material storage required to perform work will not be allowed unless otherwise authorized by the Director of Facility Management.
  - 4. This building is a secure building and under no circumstances will an exterior door be allowed to be propped open during normal operating hours.
- G. Owner Occupancy Requirements: The Owner will be responsible for operation, maintenance and custodial service for occupied portions of the building.

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### 1.3 APPLICATIONS FOR PAYMENT

- A. Schedule of Values: Submit the fully completed Schedule of Values in a format approved by the Engineer to the Engineer no later than seven (7) days before the date scheduled for submittal of the initial Application for Payment.
1. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment.
- B. Applications for Payment: Progress payment dates and the period of construction Work covered by each Application for Payment.
1. Submit Application for Payment to the Owner and Engineer so that the Application will be received by the Engineer no later than five (5) days prior to the indicated date for each progress payment.
  2. Payment Application Forms: Use AIA Documents G702 "Application and Certification for Payment" and G703 "Continuation Sheet" or another form acceptable to the Engineer. Provide documentation and verification as required by Owner.
  3. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to the Engineer by means ensuring receipt within 48 hours. Each copy shall be complete.
  4. Waivers of Mechanics Lien: With final Application for Payment, submit waivers of mechanics lien from every entity who is lawfully entitled to file a lien related to the Work covered by the Payment.
    - a. Immediately upon receipt of final payment, Contractor shall execute waiver of mechanics lien for the period of construction covered by the application. Deliver so that Engineer receives original executed waiver no later than three (3) days after receipt of payment by Contractor.
    - b. Submit final Application for Payment with or preceded by final waivers from every entity involved with the performance of the Work covered by the application who could lawfully be entitled to a lien.
      - 1) The total amount of each entity's final waiver of lien shall equal the contract sum for that entity including all additions and reductions thereto.
  5. Final Payment Application: This application shall reflect Certificates of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
    - a. Administrative actions and submittals which must precede or coincide with submittal of the final Application for Payment include the following:
      - 1) Completion of Project closeout requirements.
      - 2) Completion of items specified for completion after Substantial Completion.
      - 3) Assurance that unsettled claims will be settled.
      - 4) Assurance that Work not complete and accepted will be completed without undue delay.
      - 5) Proof that taxes, fees and similar obligations have been paid.
      - 6) Removal of temporary facilities and services.
      - 7) Removal of surplus materials, rubbish and similar elements.

#### 1.4 ALLOWANCES

- A. Carry the sum of Eighty Five Thousand Dollars (\$85,000) to cover the costs of the Engine Generator Set that has been pre-selected by the Owner. A complete submittal package for the selected generator is included with the specification. Any changes in the costs for the generator package will be corrected by an add or deduct change order, based on the net difference without markup.
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#### 1.5 ALTERNATES

- A. None.
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#### 1.6 SCHEDULE OF WORK

- A. The Contractor shall develop a Schedule of Work that is respectful of the Owner's needs for use of the building, but with mutual understanding that temporary inconveniences within the building will be required.
- B. Within seven (7) working days following receipt of the fully executed formal Contract Agreement by the Contractor, the Contractor shall prepare a proposed Phasing and Progress Schedule. The final Schedule shall be mutually agreed to by the Owner and Contractor, and within the following guidelines.
  - 1. The Owner's business operations must continue throughout the entire construction period.
  - 2. Work within the building interior must comply with the Owner's requirements for continued use and occupancy.
  - 3. Applicable egress codes must be complied with during the construction period. In particular, building entrances and exit ways must be kept open at all times.
- C. The proposed Phasing and Progress Schedule shall include milestones for each week throughout the construction period. Include individual trades tasks for each week, schedule for all submittals, major equipment installation and startups, final completion date.

#### 1.7 MODIFICATION PROCEDURES

- A. Minor Changes in the Work
  - 1. Supplemental instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, may be issued by the Engineer on AIA Document G710 "Architect's Supplemental Instructions" or other approved form.
- B. Change Order Proposal Requests
  - 1. Owner-Initiated Proposals: The Engineer will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. Proposal requests issued by the Engineer are for information only.
    - a. Unless otherwise indicated in the proposal request, within 5 days of receipt of the proposal request, submit to the Engineer for the Owner's review an itemized estimate of cost including related costs necessary to execute the proposed change.

- 1) Include a statement indicating the effect the proposed change will have on the Contract Time.
  2. Contractor-Initiated Proposal: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Engineer.
    - a. Provide a complete description of proposed change. Indicate the reasons for the change and the effect of the change on the Work. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
    - b. Include an itemized list of products required and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Comply with requirements for product substitutions if the proposed change in the Work requires the substitution of one product or system for a product or system specified.
  - C. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Engineer may issue a Construction Change Directive on AIA G714 "Construction Change Directive", instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
    1. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
  - D. Change Order Procedures: Upon the Owner's approval of a Change Order Proposal Request, the Engineer or the General Contractor if so required by the Engineer, will issue a Change Order on AIA G701 "Change Order" for signatures of the Owner and Contractor, as provided in the Conditions of the Contract.
    1. Provide minimum of three (3) original copies with documentation, as required by Engineer.
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## 1.8 PROJECT COORDINATION

- A. Layout: The Contractor is responsible for all layout of all Work, even if such layout is done by others. The Contractor's responsibility includes but is not necessarily limited to levels, reference points, etc.
- B. Coordination: The Contractor shall coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly demolition and installation of each part of the Work. The Contractor shall also coordinate construction operations included under different Specifications that are dependent upon each other for proper installation, connection, inspections and approvals, accessibility and operation.
- C. Superintendent: The Contractor's superintendent shall be on site at any time Work is being done.
- D. On-Site Documents: The Contractor shall provide in a visible and accessible location on the site:

1. Complete, currently updated set of Specifications and Drawings, Change Orders and other Modifications, approved Shop Drawings, Product Data, Samples and similar submittals.
  2. Permits and notifications required by law, regulation, etc.
  3. List of Owner, Engineer, Contractor, superintendent, subcontractors, etc. Include name of contact person, telephone and fax numbers. Include telephone numbers for police, ambulance and fire departments.
- E. Administrative Procedures: The Contractor shall coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work.
- F. General Installation Provisions
1. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected to meet acceptable industry standards.
    - a. Should Contractor direct and require Installer to perform Work without correction of such unsatisfactory condition, Contractor shall be responsible for correction of any unacceptable Work resulting from conducting Work in such unsatisfactory condition.
  2. Recheck field measurements and dimensions, before starting each installation.
  3. Provide blocking, reinforcement, attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement including any required expansion joints or device even if not detailed or shown.
  4. Alteration Projects: Remove, cut, and patch Work in a manner to minimize damage, to provide smooth transitions, and to provide means of restoring Products and finishes to specified condition.
    - a. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.
  5. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
    - a. Control accumulation of waste materials and rubbish. Remove from work areas at least daily.
    - b. Control dust and debris from construction work at all times so it will not adversely affect the condition of adjacent areas. Abutting areas and streets will be swept and kept clean of debris.
    - c. All temporary enclosures shall protect occupants, existing building and adjoining buildings, to minimize noise, dust, odors, rain, heat and cold from entering the existing buildings.
    - d. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period.
    - e. Care shall be taken to avoid fumes entering into roof top unit intakes. Pay special attention to lower level roof adjoining this project.
  6. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

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## 1.9 CUTTING AND PATCHING

- A. General: Employ skilled workmen to perform ripping, cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- B. Operational and Safety Limitations: Do not cut, patch or secure materials and elements in a manner that would reduce their capacity to perform as intended, or would increase maintenance, or decrease operational life or safety. Obtain approval before cutting and patching operating elements or safety related systems.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior , in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.
- D. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- E. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review procedures with the original installer; comply with the original installer's recommendations.
- F. Cleaning: Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and similar items. Thoroughly clean piping, conduit and similar features before painting or finishing is applied. Restore damaged pipe covering to its original condition.

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## 1.10 REFERENCE STANDARDS & DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract. Definitions specific to individual Specifications are included in the appropriate Specification.
  - 1. "Inspect", "inspection" when used in conjunction with the Engineer's activities is the visual observation of construction to permit the Engineer to render his/her professional opinion as to whether the Contractor is performing the Work in a manner indicating that, when completed, the Work will be in accordance with the Contract Documents. Such observations shall not be relied upon by any party as acceptance of the Work, nor shall they relieve any party from fulfillment of customary and contractual responsibilities and obligations.
  - 2. "Certify", "certification" when used in conjunction with the Engineer's observation of the Site and the work means the Engineer's opinion based on his/her observation of conditions, knowledge, information and beliefs. It is expressly understood that the Engineer's certification of a condition's existence relieves no other party of any responsibility or obligation he/she has accepted by contract or custom.
  - 3. "Furnish" means supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
  - 4. "Install" describes operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

5. "Provide" means to furnish and install, complete and ready for the intended use.
- B. Specifications
1. References: "Refer to" references to specific Articles or Paragraphs of the Agreement or to related Specifications are provided as a convenience to the Contractor to facilitate locating of relevant requirements, procedures, or Work. The references given may not be complete or may not be the only ones affecting the particular Specification or Paragraph wherein the reference is located.
    - a. The Contractor remains responsible for locating and complying with all relevant requirements and procedures specified in the Contract Documents.
- C. Industry Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
1. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Where copies of standards are needed to perform a required construction activity, each entity is responsible for obtaining copies of each standard from the publication source.
- D. Governing Regulations and Regulations: The Contractor shall contact the authorities having jurisdiction prior to commencement of work and where necessary to obtain approvals if required.
- E. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.
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## 1.11 SUBMITTALS

- A. Administrative Submittals: Specific requirements for administrative submittals are located elsewhere in this Division 1.
- B. Submittal Procedures: The Contractor will be responsible for the completeness of all submittals. Specified items shall be clearly marked and indicated of each submittal. Unnecessary, extraneous, superficial and otherwise unusable information shall be removed or clearly marked to indicate what is and is not intended as part of the submittal.
1. Do not proceed with Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals prior to receiving approval from the Engineer.
  2. Forms: Use AIA forms as specified, or where specifically noted provide forms conveying the same information as the specified AIA form for approval of the Engineer prior to any use.
  3. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
  4. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittal.

- a. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.
  - 5. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
    - a. Use arrows or similar means to designate items. Do not use highlighter as it does not copy or reproduce.
  - 6. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from General Contractor to Engineer using a transmittal form. Submittals received from sources other than the General Contractor will be returned without action.
    - a. Transmittal Form: Use AIA G810, or another form acceptable to the Engineer.
  - 7. Resubmittals: Identify all changes made since previous submission.
- C. Shop Drawings: Shop Drawings include fabrication and installation drawings, seam locations, and similar drawings.
  - 1. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
  - 2. Sheet Size: Except for templates, patterns and similar full- size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 24" x 36".
  - 3. Submittal: Submit five (5) black-line prints for the Engineer's review; three (3) prints will be marked up and returned.
    - a. One returned marked-up print shall be maintained as a "Record Document".
- D. Required Stamps: Do not use or take on Site Shop Drawings without a TDI action stamp is present in connection with construction.
- E. Product Data
  - 1. Products Specified by Manufacturer and Model Number: For products specifically indicated by manufacturer and model number which will be provided as specified with no deviations, submit for approval a letter for each product certifying that it will be provided as specified with no deviations from Contract Documents. Also submit product data at time of Project completion as required for project closeout. For all other products, submit product data as required below.
  - 2. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, material test reports, and performance.
    - a. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information.
    - b. Submittals: Submit five (5) copies of each required submittal. The Engineer will retain two (2), and will return the others marked with action taken and corrections or modifications required.
    - c. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
      - 1) Do not proceed with installation until an applicable copy of Product Data is in the installer's possession.

- 2) Do not permit use of unmarked copies of Product Data without Engineer indicating action taken is attached in connection with construction.
- F. Manufacturer's Instructions: When specified in individual Specifications or specifically requested by Engineer, submit printed instructions for delivery, storage, assembly, and installation to Engineer in quantities specified for Product Data.
- G. Engineer's Action: Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer will review each submittal, mark to indicate action taken, and return promptly.
1. Engineer's Approval Stamp: The Engineer, where required, will complete the Engineer's Action portion of the stamp which will be appropriately marked, as follows, to indicate the action taken and comments may be provided:
    - a. Final Unrestricted Release: Where submittals are marked "Approved", that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
    - b. Final-But-Restricted Release: When submittals are marked "Approved as Noted", that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
    - c. Returned for Resubmittal: When submittal is marked "Not Approved, Revise and Resubmit", do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
      - 1) Do not permit submittals marked "Not Approved, Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress.
    - d. Rejected: When submittal is marked "Rejected", do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Do not resubmit that product.
    - e. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, stamped "Received for information only".
  2. Any sample, shop drawing, or other item requiring Engineer's approval, or copy thereof, that does not have a copy of Engineer's approval attached, shall be considered as not having been approved.
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## 1.12 TEMPORARY FACILITIES

- A. Submittals: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.
- B. Quality Assurance
1. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction.
  2. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition".

- C. Temporary Utility Usage: Engage the appropriate local utility company to install temporary service or connect to existing service.
  - 1. Use Charges: Contractor may use existing electrical service and use charges will be paid by Owner. Coordinate with Owner prior to connection.
  - 2. Parking: Arrange with Owner for temporary parking areas to accommodate construction personnel and visitors.
  - 3. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.
  
- D. Security and Protection Facilities Installation
  - 1. Temporary Fire Protection: Comply with NFPA 10 “Standard for Portable Fire Extinguishers” and NFPA 241 “Standard for Safeguarding Construction, Alterations and Demolition Operations”.
    - a. Locate fire extinguishers where convenient and effective for their intended purpose.
    - b. Maintain unobstructed access to fire extinguishers and access routes for fighting fires.
  - 2. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
  - 3. Environmental Protection: Provide protection, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.
  
- E. Materials and Equipment
  - 1. Submittals
    - a. Schedule of Long Lead Time Items: The Contractor shall provide the Engineer with a schedule of all long lead items for review and approval prior to ordering. Once approved, the Contractor shall pre-order items in a timely manner as not to delay the progress of the Work.
  - 2. Quality Assurance
    - a. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
    - b. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
      - 1) Provide interchangeable components of the same manufacture for components being replaced.
  - 3. Product Delivery, Storage, and Handling: Deliver, store and handle products in accordance with the manufacturer's written recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

- a. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
  - b. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
  - c. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that quantities are correct and that products are undamaged and properly protected.
  - d. Inspect products for damage when removed from storage area. Repair or replace damaged products before installation. Manufacturer's representative shall certify all repairs as meeting manufacturer's original standards.
4. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
- a. Provide products complete with all accessories, trim, finish, and details needed for a complete installation and for the intended use and effect.
  - b. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects, except where otherwise specified.
5. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous experience. Procedures governing product selection include the following:
- a. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
  - b. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
  - c. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
    - 1) Manufacturer's written recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
6. Installation of Products: Comply with manufacturer's written instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
- a. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

### 1.13 PRODUCT SUBSTITUTIONS

- A. "Substitutions" are requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the General Contractor after the Notice to Proceed. The following are not considered substitutions:

1. Substitutions requested by Bidders during the bidding period, and accepted prior to the Notice to Proceed, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
  2. Revisions to Contract Documents requested by the Owner or Engineer.
  3. Specified options of products and construction methods included in Contract Documents.
  4. The General Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.
- B. Substitution Request Submittal: Requests for substitution will be considered if, in the opinion of the Engineer, such substitution will be of benefit to the Owner.
1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
    - a. Attach completed "Contractor's Substitutions Checklist" to each request for substitution. Forms to be obtained from Engineer.
  2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
    - a. Product Data, including drawings, specification sheets, and descriptions of products, fabrication and installation procedures.
    - b. Samples, where applicable.
    - c. Product specifications and samples of the specified products for comparison.
    - d. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
    - e. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.
    - f. A statement indicating the substitution's effect on the General Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
    - g. Cost information, including additional cost or savings in other parts of the Work resulting from the proposed substitution and a proposal of the net change, if any in the Contract Sum.
    - h. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the General Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
  3. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer may request additional information or documentation necessary for evaluation of the request. Within 1 weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Engineer will notify the General Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name.
- C. Conditions: The General Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the

Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of Contract Documents.
3. The request is timely, fully documented and properly submitted.
4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
7. A substantial advantage is offered the Owner, in terms of cost savings, time savings, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear.
8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the General Contractor certifies that the substitution will overcome the incompatibility.
9. The specified product or method of construction cannot be coordinated with other materials, and where the General Contractor certifies that the proposed substitution can be coordinated.
10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the General Contractor certifies that the proposed substitution provide the required warranty.

- D. The General Contractor's submittal and Engineer's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

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#### 1.14 PROJECT CLOSEOUT

##### A. Completion

1. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.
2. Inspection Procedures: On receipt of a request for inspection, the Engineer and Owner will either proceed with inspection or advise the General Contractor of unfilled requirements. The Engineer will prepare following inspection, or advise the General Contractor of construction that must be completed or corrected before the certificate will be issued.

##### B. Close out Procedure

1. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
  - a. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include final waivers of lien, and certificates of insurance for products and completed operations where required.
  - b. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

- c. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Engineer.
  - d. Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, and similar final record information.
  - e. Submit consent of surety to final payment on AIA G707 "Consent of Surety to Final Payment".
- C. Record Document Submittals
- 1. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Show the actual installation where the installation varies substantially from the Work as originally shown. Mark drawings to show conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
    - a. Mark record sets with red non-erasable pencil and notes, details or sketches which are affected.
    - b. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
    - c. Note related Change Order numbers where applicable.
  - 2. Miscellaneous Record Submittals: Refer to other Specifications for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Engineer for the Owner's records.
  - 3. Maintenance Manuals: Organize maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder.
- D. Final Cleaning: Employ experienced workers for final cleaning. Clean all disturbed surfaces to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
- 1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
    - a. Remove labels that are not permanent labels.
    - b. Wipe surfaces of electrical and mechanical equipment.
    - c. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

## 1.15 WARRANTIES AND BONDS

- A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the General Contractor of the warranty on the Work that incorporates the

products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the General Contractor.

- B. **Related Damages and Losses:** When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- C. **Reinstatement of Warranty:** When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- D. **Replacement Cost:** Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The General Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.
- E. **Owner's Recourse:** Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 1. **Rejection of Warranties:** The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- F. **Owner's Right of Refusal:** The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- G. **Commencement Date of Warranties:** Date of Certificate of Substantial Completion designates a commencement date for warranties.
- H. **Form of Submittal:** At Final Completion compile two copies of each required warranty and bond properly executed by the General Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Refer to individual Specifications for specific content requirements, and particular requirements for submittal of special warranties.
  - 2. Verify that documents are in proper form, contain full information, and are notarized. Co-execute submittals when required.
  - 3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END OF DIVISION 01

## SECTION 01 02 00 - INFORMATION AVAILABLE TO BIDDERS

### PART 1 GENERAL

#### 1.1 INFORMATION FOR BIDDERS

- A. Appendix A, "Generator Documents" is available (included with these specifications) and is considered to be part of the Construction Documents for this project. These documents represent the engine generator set that has been preselected by the Owner and will be purchased as part of this Contract. Carefully review these documents as it will be the Contractor's sole responsibility for a complete and fully functional generator system, provide all necessary coordination, materials, equipment, programming, etc... to install the generator as indicated and intended.

END OF SECTION 01 20 00

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## SECTION 260010 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to all Division 26 Sections.
- B. Intent is to provide and install a complete stand-by generator system.
- C. Seismic Requirements

#### 1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including all Division 01 Supplementary General Requirements, apply to this section. Examine all contract documents for requirements affecting the work.

#### 1.3 DEFINITIONS

- A. As used in this section, "provide" shall mean, "furnish and install". "furnish" shall mean "to purchase and deliver to the project site complete with every necessary appurtenance and support", and "install" shall mean "to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project".

#### 1.4 WORK BY OWNER

- A. The Owner has preselected a generator for purchase as part of this contract. As part of this contract, an allowance will be carried to cover the costs of the preselected generator.
- B. Work Associated with Work by Owner and Provided under Division 26:
  - 1. Coordinate with the generator vendor and make all arrangements for delivery, receiving, storage, rigging, setting, installing, etc... as required for a complete and functional system.
  - 2. Work shall include inspection of generator equipment upon receipt and assuming all responsibility for function, performance and warranty of the complete generator system.
  - 3. All interconnecting wiring and all final connections as required for complete operating systems.
  - 4. Coordinate with the Owner for specific requirements.
  - 5. Generator shall be delivered to site and installed at location indicated on the drawings.

#### 1.5 SUBSTITUTIONS

- A. Refer to Division 01 for Product Substitutions.

#### 1.6 ALLOWANCES

- A. Refer to Division 01 for "Allowances", and Division 26 Section "Engine Generator Set".

## 1.7 REFERENCES

- A. NEMA Standards.
- B. NECA "Standard of Installation."
- C. NFPA 70 (N.E.C.) latest edition.
- D. NFPA 101 Life Safety Code.
- E. U.L. Standards.
- F. ANSI Standards.
- G. Maine Uniform Building and Energy Codes (MUBEC) which include provisions of:
  - 1. (IBC) International Building Code.
  - 2. (IEBC) International Existing Building Code.
  - 3. (IRC) International Residential Code.
  - 4. (IECC) International Energy Conservation Code.
  - 5. ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality.
  - 6. ASHRAE 62.2 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings.
  - 7. ASHRAE 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings.
  - 8. ASTM E1465-06 Radon Standard for new residential construction - (Maine Model Standard).

## 1.8 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 "Submittals".
- B. Include products specified in Division 26 individual sections.
- C. Submit Shop Drawings and product data grouped by individual Sections to include complete submittals of related systems, products, and accessories. Label each with Section number and title. Partial Section submittals will not be reviewed.

## 1.9 RECORD DRAWINGS

- A. Submit under provisions of Division 01 Sections "Project Closeout".
- B. Keep a marked set of Drawings at the site as a record set indicating all revisions in the work as the work progresses. At the completion of the work, mark the Drawings "As-Built Drawings" with the Contractor's name and date, and deliver to the Engineer.

## 1.10 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of the latest edition of ANSI/NFPA 70 National Electrical Code (N.E.C.).
- B. Conform to requirements of all local, State and Federal laws and regulations, plus local electric utility company's rules, and the Fire Underwriters' requirements.

- C. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.
- D. Secure and pay for all permits and certificates as required by local, State and Federal laws.
- E. Request inspections from authority having jurisdiction.
- F. Run separate circuits for lighting and receptacle outlets as indicated.
  - 1. Circuits shall be balanced and loads and capacities shall be in accordance with requirements of local electric light company and National Board of Fire Underwriters.
  - 2. Do not share neutral on branch circuits.
- G. The entire electrical system shall be permanently and effectively grounded in accordance with Code requirements.
- H. The Drawings indicate only diagrammatically the extent, layout and the general location and arrangement of equipment, conduit and wiring. Become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment will be properly located and readily accessible.
  - 1. Note that drawings do not show all junction boxes and fixture whips for lighting fixtures recessed in accessible ceilings. Although not specifically shown on the drawings, these fixtures shall be wired from junction boxes and maximum 6'-0" unsupported whips. Provide number of junction boxes as required allowing for the maximum 6'-0" whips. Wiring from fixture to fixture is not allowed. See Division 26 Section "Luminaires".
  - 2. Lighting and Devices shown with same panel and circuit designation with no home run symbol may share same home runs to panelboards provided that the furthest device on the circuit does not exceed 2-1/2% voltage drop.
  - 3. Where home run symbols are shown, use separate run to panelboard for each symbol, and do not share home run with other devices having same panel and circuit designation.

#### 1.11 PROJECT/SITE CONDITIONS

- A. Coordinate with all other trades to ensure proper access and space requirements.
- B. Where project conditions occur necessitating departures from the drawings, submit for approval the details of and reasons for departures prior to implementing any change.
- C. Alterations
  - 1. Visit the site and become familiar with the existing conditions, and the requirements of the Plans and Specifications. No claim will be recognized for extra compensation due to failure of becoming familiar with the conditions and extent of the proposed work.
  - 2. Execute all alterations, additions, removals, relocations, or new work, etc., as indicated or required to provide a complete installation in accordance with the intent of the Drawings and Specifications.
  - 3. Repair or replace to the Owner's satisfaction, all existing work disturbed or damaged by the alterations.
  - 4. Retain ownership and remove from site all existing materials, equipment, fixtures, wiring and devices disconnected and not reused and pay all charges for proper disposal of materials, except materials specifically indicated to be returned to Owner.
    - a. Obtain receipt of delivery from Owner's Representative.
  - 5. Do not reuse existing wiring except as specifically indicated. Existing conduit raceways may be reused, provided that the existing wires are removed and new wires are installed.

6. Provide finished blank plates on all existing ceiling and wall boxes which can not be removed.
7. Ensure all circuits in existing buildings are re-energized where existing panelboards are replaced, or existing wiring is rerouted, disconnected, or disturbed. Provide and install new wiring as required to meet this condition. Verify breaker/fuse sizes on existing circuits and do not load wiring to beyond 75% of their ampacities.

#### 1.12 SEQUENCING AND SCHEDULING

- A. Construct Work in sequence under provisions of Division 01 "Summary of Work".
- B. Arrange to execute the work at such times and in such locations as may be required to provide uninterrupted services for the building or any of its sections. If necessary, install temporary work to provide for this condition. Authorization for interrupting services shall be obtained, in writing, from the Owner. Costs for overtime work and temporary work shall be included in the bid.

#### 1.13 SEISMIC DESIGN

- A. This project requires special provisions for the support and restraint of equipment components of the standby generator system. The building has a Seismic Design Category = C and an Occupancy Category = III (3). Components of this system shall continue to function after an earthquake. These provisions shall be incorporated in accordance with the following:
  1. The requirements of this Section are complementary and additional to requirements listed elsewhere for the fastening and support equipment and components.
  2. Systems shall be adequately supported and restrained to resist seismic forces in accordance with the 2009 International Building Code and associated supplements.
  3. Provide pad-mounted equipment with approved seismic control devices as required to prevent overturning or movement. Seismic devices shall be capable of keeping equipment captive under seismic loads.

### PART 2 - PRODUCTS

#### 2.1 PAINTING

- A. In all areas where damage to existing surfaces has been done while completing electrical work, surface shall be repaired and painted to match surrounding areas. Coordinate with Owner for specific colors or products to be used or match existing as directed.

### PART 3 - EXECUTION

#### 3.1 WORKMANSHIP AND INSTALLATION

- A. Execute all work in a neat manner acceptable to the Local and State Electrical Inspector and Engineer. Follow manufacturer's installation recommendations.
- B. All electrical components and their attachments shall be properly supported and where required shall be designed for seismic forces.
- C. Perform all electrical work by licensed electricians well skilled in the trade and supervised by a

Master Electrician.

- D. Replace or repair to new condition, defective equipment and equipment damaged during installation or testing.

### 3.2 TESTING AND ADJUSTING

- A. The entire installation shall be free from short circuits and improper grounds. Test in the presence of the Engineer or their representatives.
- B. Test feeders with the feeders disconnected from the branch circuit panels.
- C. Test each individual branch circuit at the panel. In testing for insulation resistance to ground, the power equipment shall be connected for proper operation. In no case shall the insulation resistance be less than that required by the National Electrical Code and the manufacturer's recommendations. Correct failure in a manner satisfactory to the Engineer.
- D. Completely test and adjust each system specified under Division 26 for proper operation.

### 3.3 SLEEVES, INSERTS AND OPENINGS

- A. Sleeves:
  - 1. Furnish and install all sleeves required for the work.
  - 2. Sleeves through exterior building walls or through concrete construction shall be rigid galvanized steel.
  - 3. Sleeves shall be sized to provide a total of not less than 1/2-inch clearance around conduit.
  - 4. Sleeves for setting into walls shall be flush with finished construction. Sleeves for setting into floor shall be embedded in concrete slab and extend approximately 2 inches above finished floors.
  - 5. All sleeved openings within building shall be sealed airtight using fire barrier caulking with a UL classification for use as a fire penetration seal for walls and floors with up to a 3-hour fire rating expanded.
  - 6. Sleeves shall be provided in all locations where cables and conduits penetrate walls and floors.

END OF SECTION 260010

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## SECTION 260111 – CONDUIT

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Metal Conduit.
- B. PVC-Coated Rigid Steel Conduit
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- C. Flexible Metal Conduit.
- D. Liquidtight Flexible Metal Conduit.
- E. Electrical Metallic Tubing (EMT).
- F. Non-Metallic Conduit.
- G. Flexible Nonmetallic Conduit.
- H. Fittings and Conduit Bodies.

#### 1.2 RELATED SECTIONS

- A. Division 01 “Submittals”.
- B. Section 260010 “Basic Electrical Requirements”.

#### 1.3 REFERENCES

- A. NECA "Standard of Installation."
- B. NEMA Standards.
- C. NFPA 70 N.E.C. latest edition.
- D. U.L. Standards.

#### 1.4 DESIGN REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70 (N.E.C.)
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
- C. Conduit Size: ANSI/NFPA 70 (N.E.C.) for conductors indicated. Increase size as required to include bonding conductors specified.

## 1.5 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures".
- B. Include PVC-coated rigid steel conduit
- C. Include nonmetallic conduit (PVC) with associated fittings and describe intended use.
- D. Include expansion fittings for all conduit types used on the project.
- E. Include fire-stop seals and fillers.

## 1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section "Operation and Maintenance Data" and "Project Record Documents".
- B. Accurately record actual routing of all underground and other conduits 2" and larger.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 01.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

## 1.8 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to meet project conditions.
- D. Where conduit routing is not shown, and destination only is indicated, determine exact routing and lengths required.

## PART 2 - PRODUCTS

### 2.1 CONDUIT REQUIREMENTS

- A. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in minimum size 3/4 inch conduit.
- B. Underground Installations:
  - 1. More than Five Feet from Foundation Wall: Use rigid galvanized steel conduit,

- intermediate metal conduit, plastic coated steel conduit, thickwall nonmetallic conduit PVC-80, thinwall nonmetallic conduit PVC-40 encased in concrete where indicated.
2. Within two feet of pole base: Use rigid galvanized steel conduit.
  3. Within five feet from foundation wall: Use rigid galvanized steel conduit, intermediate metal conduit, plastic coated steel conduit, thickwall nonmetallic conduit PVC-80, thinwall nonmetallic conduit PVC-40.
  4. In or Under Slab on Grade:
    - a. Use rigid galvanized steel conduit, intermediate metal conduit, plastic coated steel conduit, thickwall nonmetallic conduit PVC-80 and thinwall nonmetallic conduit PVC-40.
    - b. Rise through slab in rigid galvanized steel conduit.
    - c. Conduit larger than 3/4" shall run below slab.
  5. Minimum Size: 3/4 inch.
  6. Under paved areas: rigid galvanized steel conduit or concrete encased PVC-40.
  7. Metallic conduits buried in soil: Coated with Bitumastic #50.
  8. Primary electrical service conduits from riser pole to pad mounted transformer: concrete encased PVC-40.
- C. Outdoor Locations, Above Grade: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit.
- D. In Slab Above Grade:
  1. Use rigid galvanized steel conduit, intermediate metal conduit, electrical metallic tubing with water tight connectors.
  2. Maximum Size Conduit in Slab: 3/4 inch.
  3. Rise through slab in rigid galvanized steel conduit.
- E. Interior Wet and Damp Locations: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit.
- F. Dry Locations:
  1. Concealed: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing.
  2. Concealed/ Accessible: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing.
  3. Exposed: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing.
    - a. Exposed conduit: Not allowed in finished areas except as specifically noted.
    - b. Finished areas: Exposed raceways specified under Division 26 Section "Surface Raceways".
- G. Panel Feeders: Use rigid galvanized steel, intermediate metal conduit, electrical metallic tubing, and PVC-40 in accordance with locations herein specified.
- H. Couplings and connectors for electrical metallic tubing up to 2" shall be steel set screw or compression type. Set-screw connection shall be used for all tubing sizes with a minimum of four set-screws for coupling and two set-screws for connectors and fittings for sizes 1-1/4" and larger.
- I. Couplings and connectors for rigid and intermediate metal conduit shall be threaded.
- J. Termination for all conduit and tubing shall have insulated bushings or insulated throat

connectors in accordance with code requirements.

- K. Permanent Connection to Motors: Dry locations, use flexible metal conduit. Damp or wet locations, use flexible liquidtight Type UA conduit with approved liquidtight fittings. Maximum length two feet (2').

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. In general, all raceways shall be concealed above ceilings and within finished walls - securely supported in accordance with code requirements. Wiring in areas with no finished ceilings (exposed construction) shall be exposed overhead such that all raceways are parallel or perpendicular to joists, columns or beams and all drops to wall devices shall be concealed in walls.
- B. Install exposed only where specifically indicated.
- C. Aluminum conduits shall not be installed below grade or in poured concrete or masonry.
- D. Install conduit in accordance with NECA "Standard of Installation."
- E. Install nonmetallic conduit in accordance with manufacturer's instructions.
- F. Arrange supports to prevent misalignment during wiring installation.
- G. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- H. Group Related Conduits:
  - 1. Support using conduit rack of Power-Strut, or approved equal.
  - 2. Parallel runs shall be neatly clustered with all bends and offsets of uniform pattern
  - 3. Provide space on each for 25 percent additional conduit.
- I. Substantially support with approved clips or hangers spaced not to exceed ten feet (10') on centers except 1/2" rigid conduit and 1/2" and 3/4" electrical metallic tubing shall have supports spaced not to exceed six feet (6').
- J. Fasten conduit supports to building structure.
  - 1. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
  - 2. Do not attach conduit to ceiling support wires.
  - 3. Conduits larger than 2" shall be supported from top cord of joists.
- K. Arrange conduit to maintain headroom and present neat appearance.
- L. Route conduit parallel and perpendicular to walls.
- M. Route conduit in and under slab from point-to-point.
  - 1. Install only where specifically indicated or required.
  - 2. Obtain approval from the Architect before installation.

- N. Do not cross conduits in slab.
- O. Maintain adequate clearance between conduit and piping.
- P. Maintain 6 inch clearance between conduit and surfaces with temperatures exceeding 104°F.
- Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes, before burying in trench.
- R. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- S. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction. Use factory elbows or hydraulic one-shot bender to fabricate bends in metal conduit 1 ½" or larger in size.
- T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- U. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.
- V. Provide suitable labeled nylon pull string in each empty conduit.
- W. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- X. Use sleeves when passing through floors and walls.
- Y. When serving roof top equipment, conduit shall enter within the weather-proof curbing. Maintain water tight roofing system.
- Z. Ground and bond conduit under provisions of Division 26 Section "Grounding and Bonding."
- AA. Identify conduit under provisions of Division 26 Section "Electrical Identification."
- BB. All elbows in nonmetallic conduit runs shall be rigid galvanized steel to eliminate "burn through" when pulling in conductors.

### 3.2 FIELD QUALITY CONTROL

- A. No wire shall be installed until work which might cause damage to wires or conduits has been completed.
- B. Conduits shall be thoroughly cleaned of water or other foreign matter before wire is installed.

### 3.3 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire-resistance rating of partitions and other elements, using approved seals, fillers and materials.

END OF SECTION 260111

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## SECTION 260123 - WIRE AND CABLE

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Building wire and cable.
- B. Wiring connectors and connections.

#### 1.2 RELATED SECTIONS

- A. Section 260010 "Basic Electrical Requirements."
- B. Section 260111 "Conduit."
- C. Section 260130 "Boxes."
- D. Section 260195 "Electrical Identification."

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 N.E.C. Latest Edition.
- C. U.L. Standards.

#### 1.4 DESIGN REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.
- C. All conductors shall be copper.
- D. Manufacturer's name, wire size and insulation type shall be clearly marked on the insulation or jacket.

#### 1.5 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."

#### 1.6 PROJECT CONDITIONS

- A. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
- B. Where wire and cable routing is not shown, and destination or circuit number only is indicated,

determine exact routing and lengths required.

## 1.7 COORDINATION

- A. Locate such that outlets are readily accessible.
- B. Determine required separation between cable and other work.
- C. Determine cable routing to avoid interference with other work.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. General Cable.
- B. Triangle PWC, Inc.
- C. Superior Essex Inc.
- D. Southwire Company.
- E. Allied Wire & Cable.
- F. Cerro Wire.
- G. Encore Wire Corporation.
- H. United Copper Industries.

### 2.2 WIRE AND CABLE

- A. Description: Single conductor insulated wire.
- B. Conductors: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: ANSI/NFPA 70 (N.E.C.), Type THHN/THWN, XHHW rated 90° C.

### 2.3 WIRING CONNECTORS

- A. Use the Following Types As Herein Specified:
  - 1. Split bolt connectors.
  - 2. Solderless pressure connectors.
  - 3. Spring wire connectors.
  - 4. Compression connectors.
  - 5. Insulation piercing connectors.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire has been completed.

### 3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

### 3.3 WIRING METHODS

- A. Concealed Dry Interior Locations: Use only wire Type THHN/THWN, and XHHW insulation, in raceway or metal clad cable.
- B. Exposed Dry Interior Locations:
  - 1. Use exposed wiring only where specifically indicated.
  - 2. Use only building wire Type THHN/THWN, and XHHW insulation, in raceway.
- C. Wet or Damp Interior Locations: Use only building wire Type THHN/THWN, XHHW, and XHHW-2 insulation, in raceway.
- D. Exterior Locations: Use only building wire Type THHN/THWN, XHHW, and XHHW-2 insulation, in raceway.
- E. Underground Installations: Use only building wire Type XHHW or XHHW-2 insulation installed in raceway.
- F. Panel and Transformer Feeders: Use only building wire Type XHHW or XHHW-2 insulation, in raceway.
- G. Use other wiring methods only as specifically indicated on Drawings.

### 3.4 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in raceways.
- C. In general, all wire in raceways shall be concealed above ceilings and within finished walls, securely supported in accordance with code requirements. Wiring in areas with no finished ceilings (exposed construction) shall be raceways exposed overhead, but run along structures such that raceways have minimum visibility and such that all raceways are parallel or perpendicular to joists, columns or beams and concealed in walls.
- D. Use solid conductor for feeders and branch circuits #10 AWG and smaller. At contractors option stranded conductors for #10 AWG and smaller shall be permitted as long as vinyl insulated support crimp-on fork terminals are use for all screw head terminations. Barrel lugs and screw activated compression clamps on back wired devices shall not require crimp-on terminals.

- E. Use stranded conductor for feeders and branch circuits #8 AWG and larger.
- F. Use stranded conductors for control circuits.
- G. Minimum Size Conductors for Power and Lighting Circuits #12 AWG Except as Follows:
  1. Minimum #10 AWG for 120 volt circuits more than 100 feet long.
  2. Minimum #10 AWG for 277 volt circuits more than 230 feet long.
  3. Sizes shall be not less than indicated.
  4. Note: Wire sizes indicated on drawings and schedules are minimum requirements and shall be adjusted to meet the above criteria.
- H. Use conductor not smaller than #14 AWG for control circuits with fusing sized accordingly.
- I. Pull all conductors into raceway at same time.
- J. Use suitable wire pulling lubricant for building wire #4 AWG and larger.
- K. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- L. Clean conductor surfaces before installing lugs and connectors.
- M. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- N. Use split bolt connectors, insulation piercing connectors or U.L. approved insulated connectors for copper conductor splices and taps, #6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- O. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, #8 AWG and smaller.
- P. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- Q. Wiring in sleeves passing through fire-rated barriers shall be sealed/filled with approved material to maintain the fire rating.

### 3.5 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Division 26 Section 260195 “Electrical Identification”.
- B. Identify each conductor with its circuit number or other designation indicated on Drawings.

### 3.6 FIELD QUALITY CONTROL

- A. Inspect wire and cable for physical damage and proper connection.
- B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- C. Verify continuity of each branch circuit conductor.

- D. Verify proper operation of each circuit.

### 3.7 TESTING

- A. For conductors larger than #8AWG, perform Insulation-Resistance Test on each field-installed conductor with respect to ground and adjacent conductors.
  1. Applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable.
  2. Take readings after 1 minute and until the reading is constant for 15 seconds.
  3. Minimum insulation-resistance values shall not be less than 25 Megohms for 300 volt rated cable and 100 Megohms for 600 volt rated cable.

END OF SECTION 260123

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## SECTION 260130 - BOXES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Wall and Ceiling Outlet Boxes.
- B. Pull and Junction Boxes.
- C. Hinged Cover Cabinet Enclosures.
- D. Terminal Blocks and Accessories.

#### 1.2 RELATED SECTIONS

- A. Section 260010 "Basic Electrical Requirements."
- B. Section 260111 "Conduit."
- C. Section 260170 "Grounding and Bonding."
- D. Section 260180 "Equipment Wiring."

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 N.E.C. Latest Edition.
- C. U.L. Standards.

#### 1.4 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures".
- B. Include product data for boxes larger than 12x12x6 inches and boxes with hinged covers.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 "Project Closeout"
- B. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes larger than 12" x 12" x 6" and boxes used for panel feeders.

#### 1.6 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose

specified and shown.

- C. Size per N.E.C. Art. 314.

## 1.7 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.
- C. Generally pull boxes are not shown on Drawings. Provide as required.

## 1.8 COORDINATION

- A. Locate such that outlets are readily accessible and do not interfere with other work.

## PART 2 - PRODUCTS

### 2.1 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: Standard type galvanized steel, minimum four inch square or octagon by 2-1/8 inch deep.
  - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
  - 2. Concrete Ceiling Boxes: Concrete type, three and four inch deep or depth as to coordinate with concrete slab.
  - 3. Single Wall Type: Minimum size, four inch square by 1-1/2 inch deep, except as noted. Provide dry wall plaster rings raised as required to insure flush finish mounting.
  - 4. Ganged Wall Type: Minimum depth 3 inches except as noted, ganged as required under common plate to contain device shown.
- B. Cast Boxes: Type FS and FD, aluminum or cast ferrous alloy.
  - 1. Provide number of threaded hubs as required.
  - 2. Use in all exterior, damp or exposed in mechanical space.
  - 3. Provide gasketed cover and accessories by box manufacturer for complete weatherproofing.

### 2.2 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: Standard type galvanized steel, minimum four inch square or octagon by 2-1/8 inch deep.
  - 1. Sizes up to 12x12x6 inch: Provide screw-type or hinged covers.
  - 2. Sizes greater than 12x12x6 inch: Provide hinged covers.
- B. Exterior Surface-Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.
  - 1. Material: Galvanized cast iron or Cast aluminum.
  - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush

mounting.

1. Material: Galvanized cast iron or Cast aluminum.
2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
3. Cover Legend: ELECTRIC.

- D. Fiberglass Handholes: Die-molded fiberglass handholes.
1. Cable Entrance: Pre-cut 6 x 6 inch cable entrance at center bottom of each side.
  2. Cover: Fiberglass weatherproof cover with nonskid finish.

## 2.3 CABINET ENCLOSURES

- A. Covers: Continuous hinge, held closed by [flush latch operable by [screwdriver.] [key.] [keyed to match branch circuit panelboard]]; finish in gray baked enamel.] [hasp and staple for padlock.]
- B. Boxes: Galvanized steel minimum 12"x12"x6" deep or as noted. Provide 3/4 inch (19 mm) thick plywood backboard painted matte white, for mounting terminal blocks.
- C. Power Terminals: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.
- D. Signal and Control Terminals: Modular construction type, channel mounted; tubular pressure screw connectors, rated 300 volts.
- 1.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
1. Except where specifically noted, boxes on finished surfaces shall be flush mounted with finished cover plate.
  2. Consult Engineer prior to installing in finished areas.
- B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- D. Install boxes to preserve fire-resistance rating of partitions and other elements, using appropriate materials and methods.
- E. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- F. Use gang box where more than one device is mounted together. Do not use sectional box.
- G. Use 4" square box with plaster ring for single device outlets.
- H. Use cast outlet box in exterior locations exposed to the weather and wet locations.

- I. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
  
- J. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
  - 1. Interior Dry Locations: Use hinged covers.
  - 2. Other Locations: Use surface-mounted cast metal box.

END OF SECTION 260130

## SECTION 260170 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

#### 1.2 RELATED SECTIONS

- A. Division 26 Section 260010 "Basic Electrical Requirements."

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 (N.E.C.) Latest Edition.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: Conform to requirements of ANSI/NFPA 70. (N.E.C.), except that the maximum system resistance shall be 5 ohms.

#### 1.5 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures".
- B. Product Data: Provide data for grounding electrodes and connections.
- C. Test Reports: Indicate overall resistance to ground.
- D. Manufacturer's Instructions: Include instructions for protection, examination, preparation and installation of exothermic connectors.

#### 1.6 GROUNDING ELECTRODE SYSTEM

- A. All connections shall be made by exothermic weld. Connections to thin water pipe shall be made by accessible clamp.
- B. Metal structure of the building.
- C. Rod electrode.

#### 1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section "Project Management and Coordination".

- B. Accurately record actual locations of grounding electrodes.

## PART 2 - PRODUCTS

### 2.1 ROD ELECTRODE

- A. Manufacturers:
  - 1. Erico, Eritech copper bonded ground rod.
  - 2. Substitutions: Under provisions of Division 01 Section "Substitutions and Product Options".
- B. Material: Copper-clad carbon steel.
- C. Diameter: 3/4 inch.
- D. Length: Sectional 10 feet.

### 2.2 MECHANICAL CONNECTORS

- A. Manufacturers:
  - 1. Thomas & Betts/Blackburn, Model J2D.
  - 2. Substitutions: Under provisions of Division 01 Section "Substitutions and Product Options".
- B. Material: Bronze.

### 2.3 EXOTHERMIC CONNECTIONS

- A. Manufacturers:
  - 1. Erico, Cadweld.
  - 2. Continental Industries, thermOweld.
  - 3. Burndy, BURNDYWeld.
  - 4. Substitutions: Under provisions of Division 01 Section "Substitutions and Product Options".

### 2.4 WIRE

- A. Material: Copper.
- B. Foundation Electrodes: #4/0 AWG.
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements, but not smaller than indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving rod electrodes.

### 3.2 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install rod electrodes at locations indicated and as required.
- C. Equipment Grounding Conductor: Provide separate, 600 volt insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- D. Provide and install equipment grounding conductor to each item of electrical equipment.
- E. Equipment grounding conductors shall be continuous where possible. Where splices are required, provide T & B, or approved equal, compression connectors of approved pattern. Insulate connectors to equivalent thickness of conductors.
- F. Provide grounding system for neutrals of dry type transformer secondaries as indicated and required.

END OF SECTION 260170

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## SECTION 260180 - EQUIPMENT WIRING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Electrical connections to equipment specified under other Sections.
- B. All line voltage wiring including final branch circuit connections to disconnects.
- C. Fused and non-fused disconnect switches for the equipment, except disconnect switches specifically provided with the equipment.

#### 1.2 RELATED SECTIONS

- A. Division 01 "Summary of Work".
- B. Division 26 Section "Basic Electrical Requirements".

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 (N.E.C.) Latest Edition.
- C. U.L. Standards.
- D. ANSI Standards.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.
- C. Drawings do not show all required disconnect servicing switches. Furnish and locate as required by N.E.C.
- D. Size fuses and thermal elements per N.E.C. and manufacturer's recommendations.
- E. Connect motors for correct voltage, phase and rotation.

#### 1.5 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 "Submittal".
- B. Include disconnect devices, wiring connections, special outlets.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Eaton/Cutler-Hammer.
- B. I-T-E Siemens.
- C. General Electric.
- D. Square D.

### 2.2 DISCONNECT SWITCHES

- A. Enclosed, heavy-duty type, except as noted with visible blades, Horsepower rated 600-volt and 250-volt ratings as required by the particular circuit.
- B. NEMA-1 enclosure, for dry locations; NEMA-3R rain-tight for exterior locations.
- C. Fuses and ampere rating and number of poles as indicated on Drawings, or as required by the specific equipment.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

### 3.2 PREPARATION

- A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

### 3.3 INSTALLATION

- A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment, but in no case less than the wire specified under Division 26 Section 260123 "Wire and Cable."
- B. Conduit Connections to Equipment: Dry locations, use flexible conduit. Damp or wet locations, use flexible liquidtight Type UA conduit with approved liquidtight fittings. Maximum length two feet (2').
- C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
- D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- E. Semiportable Machines: Use heavy-duty oil-resistant type SO cord with stranded copper

conductors No. 12 AWG, minimum size and number of wires as required to include each phase conductor, white neutral conductor, and green grounding conductor. Furnish and install Kellems Series H cord grips and spring hangers for each cord connected machine with overhead supply.

- F. Make wiring connections in wiring compartment of prewired equipment in accordance with manufacturer's instructions.
- G. Install disconnect switches, controllers, control stations, temperature switches as indicated or required.

END OF SECTION 260180

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## SECTION 260195 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Nameplates and Tape Labels.
- B. Wire and Cable Markers.
- C. Conductor Color Coding.

#### 1.2 RELATED SECTIONS

- A. Division 26 Section 260010 "Basic Electrical Requirements."

#### 1.3 REFERENCES

- A. NFPA 70 (N.E.C.) Latest Edition.

#### 1.4 REQUIREMENTS

- A. Label all new and existing panelboards plus circuits on all spaces of switchboards and distribution panels, all safety switches, controls, relays, junction boxes, pull boxes, pilot lights, special switches and outlets. Label on panelboards shall include name and circuit number of source.
- B. Nameplates shall identify function of device, space controlled, voltage conditions, fuse size, panel serving switch, as indicated or required without abbreviations. Details shall be as approved.
- C. Conform to requirements of ANSI/NFPA 70. (N.E.C.) Art. 200 for grounded neutral conductor, Art. 210 for branch circuits and art. 250 for grounding (bonding) conductor.

#### 1.5 SUBMITTALS

- A. Submit Shop Drawings, in accordance with Division 01 "Submittals".
- B. Only include if details of nameplates, wiring markers and conductor color code are not as specified below.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.
- B. Tape Labels: Vinyl adhesive tape with 1/4 inch black letters on white background.

- C. Junction Box Labels: Vinyl adhesive tape with 1/4 inch black letters on white background, indicate voltage and circuit.
- D. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.
- E. Fire Alarm Junction Boxes: Paint red (in areas of exposed construction paint only the cover).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install nameplates parallel to equipment lines.
- B. Secure nameplates to equipment fronts using screws, or rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations. Secure nameplate to outside face of surface panelboards in unfinished locations.
- C. Use tape labels only for identification of individual wall switches, receptacles, and control device stations.

### 3.2 WIRE IDENTIFICATION

- A. Conductors throughout the building shall be color coded to identify voltage and phases.
  - 1. All metallic bonding conductors - Green.
  - 2. Insulated Isolated Grounding Conductor: Green with yellow stripe.
  - 3. Phase Conductors of 120/208 Volt System: Black, red, blue. Neutral: white.
- B. All circuit conductors of the same color shall be connected to the same ungrounded feeder conductor throughout the installation.
- C. Where conductors are not available in the colors indicated, due to size, prewired cable, or other reason: Install identifying adhesive bands 3/4" wide of colors indicated above around each conductor within six inches (6") and twelve inches (12") of each end and at a maximum of five foot (5') intervals along wireways, at back of panelboards, and wherever conductors are accessible.
- D. Power and lighting circuits in panelboard gutters, pull boxes, [outlet and junction boxes,] and at load connection: Provide wire markers on each conductor and Identify with branch circuit or feeder number.
- E. System control wires at control panel and load connection:
  - 1. Provide wire markers on each conductor and identify with number as indicated on manufacturer's schematic and interconnection diagrams, and equipment manufacturer's Shop Drawings.
  - 2. Fire Alarm System: Follow local Fire Department color code and labeling standards.

END OF SECTION 260195

## SECTION 260622 – ENGINE GENERATOR SET

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Complete packaged exterior engine generator set. Pre-selected by the Owner.
- B. Automatic Transfer Switches. Existing
- C. Programming of existing automatic transfer switch.
- D. Fuel to completely fill the generator fuel tank.
- E. All work as required for a complete and fully functional System.

#### 1.2 RELATED SECTIONS

- A. Division 26 Section 260010 “Basic Electrical Requirements.”

#### 1.3 REFERENCES

- A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. ANSI/NEMA MG 1 - Motors and Generators.
- C. NFPA 110 - Standard for Emergency and Standby Power Systems.
- D. NEMA standards.
- E. NFPA 70 ( N.E.C.) latest edition.
- F. U.L. standards.
- G. ANSI standards.

#### 1.4 SUBMITTALS

- A. Submittal package for the pre-selected engine generator set is available from the Owner.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record location of engine generator and mechanical and electrical connections.
- B. Include Field Test results.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Included in submittal package.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Pre-selected.
- B. Supplier: Pre-selected.
  - 1. Authorized distributor of engine generator manufacturer with service facilities within 75 miles of project site and minimum three years documented experience.
  - 2. Company offering service contracts for continuing factory authorized service after the initial warranty period.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Accept packaged engine generator set and accessories on site in crates and verify damage.
- B. Transport, receive, store, protect, rig, handle and place at location indicated on the drawing.
- C. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

## 1.9 SYSTEM DESCRIPTION

- A. See submittal package available from Owner.

## PART 2 - PRODUCTS

2.1 See submittal package available from Owner

2.2 Provide lugs as required to terminate all conductors on generator output circuit breaker.

### 2.3 AUTOMATIC TRANSFER SWITCHES

- A. Existing: make all connections and program as required. Initially program generator to exercise weekly at 8AM on Friday's. Adjust prior to substantial completion as directed by the Owner.
- B. Three phase automatic transfer switch shall remotely start generator set automatically upon interruption of normal power and transfer the load circuits when the set reaches proper speed and voltage. When normal power is restored and stable, the automatic switch shall transfer to normal and time out for an engine cool down period before it automatically stops generator set. The transfer switch shall include the following features:
  - 1. Cranking Limiter: De-energize start circuit if engine fails to start as herein specified.
  - 2. Test Transfer Switch: Simulates power outage. When switched to "Test" position the engine generator set starts and assumes load, when returned to normal "On" position, the load transfers back to the line and the set stops via the delays specified herein. Include terminal block for remote test switch.
  - 3. Meters: Normal and emergency lights, exerciser set clock, running time meter AC voltmeter, AC ammeter.
  - 4. Normal power sensing shall be done by monitoring the voltage lines independently, not by monitoring the line-to-line voltage.
  - 5. Automatic Exercising Timer: Starts generator on a regular predetermined basis without transferring load. Timer for operating generator: Adjustable, 1 to 30 minutes. Timer for exerciser: Adjustable, 1 to 30 days.

6. Manual transfer handle to allow for manual transfer in case of control circuit failure.
  7. Auxiliary contacts to notify the fire alarm system of AC power failure.
- C. Automatic Sequence of Operation
1. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
  2. Time Delay to Start Alternate Source Engine Generator: 0.1 to 10 seconds, adjustable. Set to allow start and transfer of emergency loads within 10 seconds per NFPA.
  3. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
  4. Time Delay Before Transfer to Alternate Power Source: 0.30 to 30 seconds, adjustable.
  5. Once transferred to alternate source, initiate timer to transfer electrically operated switch.
  6. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
  7. Time Delay Before Transfer to Normal Power: 0.30 to 30 minutes adjustable; bypass time delay in event of alternate source failure. Set initially to 15 minutes.
  8. Time Delay Before Engine Shut Down: 1.0 to 30 minutes, adjustable, of unloaded operation. Set initially to 15 minutes.
  9. Alternate System Exerciser: Transfer load to alternate source during engine exercise period.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work and field dimensions are as shown on Drawings.
- B. Verify that required utilities are available in proper location and ready for use.
- C. Beginning of installation means installer accepts existing conditions.

#### 3.2 FIELD TEST and ADJUSTING

- A. Performed by the Contractor.
- B. Fill (completely) generator fuel tank prior to start-up and load bank testing, provide receipt from fuel delivery for Owner.
- C. Provide full load test at the site, after installation. Utilize portable resistance load bank, to augment transferred loads to meet full load requirements. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown, and return to normal.
  1. Run set at 50% load for 2 hours.
  2. Run set at 75% load for 2 hours.
  3. Run set at 100% load for 1 hour.
  4. Run test continuously from no load to full load. If test is interrupted for more than one hour then restart from step 1.
- D. DO NOT allow engine set to overheat.

- E. During test, record the following at 30 minute intervals:
  - 1. Time of day.
  - 2. Engine Coolant temperature.
  - 3. Outside air temperature.
  - 4. Temperature within enclosure.
  - 5. Kilowatts.
  - 6. Amperes.
  - 7. Voltage.
  - 8. Frequency.
  - 9. Oil pressure.
- F. Test alarm and shutdown circuits by simulating conditions.
- G. Confirm operation of the remote annunciator.
- H. Adjust generator output voltage and engine speed.

### 3.3 DEMONSTRATION

- A. Provide systems demonstration.
- B. Describe loads connected to emergency system and restrictions for future load additions.
- C. Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency power.
- D. Provide placard, framed under glass, at the ATS and at the remote annunciator locations describing the sequence of operation, including manual override to force the system to transfer to standby generator source and assume standby loads.

END OF SECTION 260622

## SECTION 312000 - EARTH MOVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  1. Preparing subgrades and finish grades. Cutting, filling, and providing additional materials required.
  2. Excavating, filling, and backfilling to grade.
  3. Excavating and backfilling for buried structures, tanks, pipes, wires, and conduits.
  4. Subbase and base course for roadways, drives, and walks.
  5. Restoring loam and seeding lawns.

#### 1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
  1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and finish pavement.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Crushed Stone (Drainage Fill): Crushed stone backfill to facilitate stormwater flow; that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
  2. Open(bulk) Excavation: Excavation more than 6 feet (3 m) in width.
  3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.

- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 2 cu. yd. (1.5 cu. m) for bulk excavation, footing, trench, and pit excavation, that cannot be removed by rock excavating equipment, without systematic drilling, ram hammering, or blasting, when permitted. Fragmented "weathered" rock which can be removed by excavation equipment with "ripper" teeth will be considered earth.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Aggregate layer placed between the subgrade and base course beneath pavement.
- K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### 1.4 SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D 2487; with particle gradation test results.
  - 2. Laboratory compaction curve according to ASTM D 1557.
- C. Pre-excavation Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

#### 1.5 QUALITY ASSURANCE

- A. Blasting: Not Anticipated. If ledge is encountered and blasting is approved by Owner, comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
  - 1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
  - 2. Seismographic monitoring during blasting operations.
- B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
  - 1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
  - 2. Seismographic monitoring during blasting operations.

- C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

## 1.6 PROJECT CONDITIONS

- A. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
  - 1. Pre-mark the boundaries of your planned excavation with white paint, flags or stakes, so utility crews know where to mark their lines.
  - 2. Call Dig Safe, at either 811 or 1-888-DIGSAFE, at least 72 business hours - but no more than 30 calendar days - before starting work. Don't assume someone else will make the call.
  - 3. If blasting, notify Dig Safe at least 24 business hours in advance.
  - 4. Wait 72 business hours for lines to be located and marked with color-coded paint, flags or stakes. Note the color of the marks and the type of utilities they indicate. Transfer these marks to the As-Built drawings.
  - 5. Contact the landowner and other non-member utilities (water, sewer, gas, etc.), for them to mark the locations of their underground facilities. Transfer these marks to the As-Built drawings.
  - 6. Re-notify Dig Safe and the non-member utilities if the digging, drilling or blasting does not occur within 30 calendar days, or if the marks are lost due to weather conditions, site work activity or any other reason.
  - 7. Hand dig within 18 inches in any direction of any underground line until the line is exposed. Mechanical methods may be used for initial site penetration, such as removal of pavement or rock.
  - 8. Dig Safe requirements are in addition to town, city and/or state DOT street opening permit requirements.
  - 9. For complete Dig Safe requirements, visit their website.
  - 10. If you damage, dislocate or disturb any underground utility line, immediately notify the affected utility. If damage creates safety concerns, call the fire department and take immediate steps to safeguard health and property.
  - 11. Any time an underground line is damaged or disturbed, or if lines are improperly marked, you must call Dig Safe.
- B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect or Owner, and then only after arranging to provide temporary utility services according to requirements outlined in Section 311000.
- D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures are in place.

## 1.7 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction. The Contractor shall conduct his operations in conformity with all Federal and State permit requirements concerning water, air, or noise pollution, or the disposal of contaminated or hazardous materials. Erosion control measures shown on the Plans are minimum only and are not intended to be complete. Satisfy the current requirements of the regulatory agencies.
- B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

## 1.8 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed, or abandoned in place.
  - 1. Arrange with utility companies to shut off indicated utilities.
  - 2. Owner will arrange to shut off indicated utilities within his control, when requested by Contractor.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect and Owner not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's or Owner's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups, free of rock or gravel larger than 6 inches (150 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups. Unsatisfactory soils also include

satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 6-inch (150-mm) sieve, 25-70 percent passing a 1/4-inch (6-mm) sieve, 0-30 percent passing a No. 40 (0.425-mm) sieve, and not more than 7 percent passing a No. 200 (0.075-mm) sieve. Maximum size stone passes 6-inch sieve. MDOT spec. 703.06 Type D.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 2-inch (50-mm) sieve, 45-70 percent passing a 1/2-inch (13-mm) sieve, 30-55 percent passing a 1/4-inch (6-mm) sieve, 0-20 percent passing a No. 40 (0.425-mm) sieve, and not more than 5 percent passing a No. 200 (0.075-mm) sieve. MDOT spec. 703.06 Type A.
- F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 2-inch (50-mm) sieve, 25-100 percent passing 1/4-inch (6-mm) sieve, 0-30 percent passing the No. 40 (0.425-mm) sieve, and not more than 7 percent passing a No. 200 (0.075-mm) sieve.
- G. Crushed Stone (Drainage Fill): Narrowly graded mixture of washed crushed stone; ASTM C 33; grading Size 56; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.
- H. Granular Borrow: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with maximum stone size of 6" (150-mm); the portion passing a 3-inch (75-mm) sieve shall meet the following: 100 percent passing the 3-inch (75-mm) sieve, 60-100 percent passing the 1/4-inch (6-mm) sieve, 0-50 percent passing the No. 40 sieve, and not more than 7 percent passing a No. 200 (0.075-mm) sieve. MDOT spec. 703.06 Type F.
- I. Sand: ASTM C 33; fine aggregate.

## 2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 2; AASHTO M 288.
  - 2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
  - 3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
  - 4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
  - 5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
  - 6. Apparent Opening Size: No. 70 (0.212-mm) sieve, maximum; ASTM D 4751.
  - 7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
  - 8. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.
- A. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 20 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 40 (0.430-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.05 per second, minimum; ASTM D 4491.
8. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.

### 2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
1. Portland Cement: ASTM C 150, Type I.
  2. Fly Ash: ASTM C 618, Class C or F.
  3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch (10-mm) nominal maximum aggregate size.
  4. Water: ASTM C 94/C 94M.
  5. Air-Entraining Admixture: ASTM C 260.
- B. Produce conventional-weight, controlled low-strength material with 140-psi (965-kPa) compressive strength when tested according to ASTM C 495.

### 2.4 INSULATION BOARD

- A. Extruded polystyrene with a "K" factor of 0.18, with 2.2 lb./cu. ft. density, and 30 psi compressive strength, manufactured by Dow Chemical, or approved equal. ASTM C 578, Type VI.

### 2.5 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
1. Red: Electric.
  2. Yellow: Gas, oil, steam, and dangerous materials.
  3. Orange: Telephone and other communications.
  4. Blue: Water systems.
  5. Green: Sewer systems.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
1. Red: Electric.
  2. Yellow: Gas, oil, steam, and dangerous materials.
  3. Orange: Telephone and other communications.
  4. Blue: Water systems.
  5. Green: Sewer systems.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  - 2. Water from construction dewatering operations shall be cleaned of sediment before reaching wetlands, water bodies, streams, or site boundaries. Conform to the requirements of the Department of Environmental Protection.

### 3.3 EXPLOSIVES

- A. Explosives: Not Anticipated. If explosives are needed and are approved by Owner, obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
  - 1. Perform blasting without damaging adjacent structures, property, or site improvements.
  - 2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.
- B. Rock excavation is not anticipated, however if encountered, ledge rock excavation cost shall be approved prior to excavation. Prior to blasting and rock excavation, provide survey grades of the top of the ledge surface, and calculations of the expected rock quantities to be excavated. Submit this data and obtain Architect's approval prior to proceeding with rock excavation. The Architect will determine the extent of rock excavation and classification.

### 3.4 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock.
  - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

- a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
  2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction.
- B. If hazardous waste or special waste as defined by the U. S. Environmental Protection Agency or State Department of Environmental Protection is encountered during excavation, the Contractor shall avoid disturbance of that material, and shall notify the Owner immediately. The State Bureau of Oil and Hazardous Waste Control must be notified and consulted prior to disturbance of the waste or contaminated soil. Removal and disposal of contaminated materials is not included in the Contract Bid, since it must be handled as directed by the regulatory agencies on a case-by-case basis.

### 3.5 EXCAVATION FOR STRUCTURES

- A. Excavate for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections. Do not disturb bottom of excavations intended as bearing surfaces.

### 3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### 3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line, unless pipe inverts are shown otherwise.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
1. Clearance: As indicated.
- C. Trench Bottoms: For ductile iron pipe, excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
  2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
  3. Excavate trenches 8 inches (200 mm) deeper than bottom of pipe elevation in rock or other unyielding bearing material to allow for bedding course.

- D. Trench Bottoms: For pipe materials other than ductile iron, excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
  - 1. Excavate trenches 8 inches (200 mm) deeper than bottom of pipe elevation in rock or other unyielding bearing material to allow for bedding course.

### 3.8 SUBGRADE INSPECTION

- A. Notify Owner, Architect, and Geotechnical Engineer when excavations have reached required subgrade.
- B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

### 3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.
  - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

### 3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of trees.

### 3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Place and compact initial backfill of bedding course material, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- D. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- E. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

### 3.13 INSULATION BOARD

- A. Place a leveling course of sand, 2 inches (50 mm) thick, over subgrade. Finish leveling course to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.
  - 1. Place leveling course on subgrades free of mud, frost, snow, or ice.
- B. Install insulation board in layers with abutting edges and ends along pipelines or other objects to be insulated.

### 3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 12 inches (300 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches (150 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, slabs, pads, steps, walkways, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under lawns, turf, or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
3. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.
4. Compact crush stone to 100% of its dry rodded weight.

### 3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  1. Provide a smooth transition between adjacent existing grades and new grades.
  2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  1. Lawn, turf, or unpaved Areas: Plus or minus 1 inch (25 mm).
  2. Pavements and walks: Plus or minus 1/2 inch (13 mm).

### 3.17 SUBBASE AND BASE COURSES

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade or granular fill layer, place subbase course and base course under pavements and walks as follows:
  1. Where fill is required, place satisfactory soil or granular borrow fill on prepared subgrade.
  2. Place base course material over subbase course under hot-mix asphalt pavement, concrete pavement, and unit pavers.
  3. Shape subbase course and base course to required crown elevations and cross-slope grades.
  4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
  5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
  6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### 3.18 FIELD QUALITY CONTROL

- A. Testing Agency: If deemed necessary, the Owner will engage a qualified Geotechnical Engineering testing agency to perform field quality control testing and inspections.

- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 1000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
  - 2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 100 feet (30 m) or less of trench length, but no fewer than two tests.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### 3.19 LOAMING AND SEEDING

- A. Topsoil: Topsoil for general site loam, except that existing on the site, will not be made available by the Owner. The Contractor shall be responsible for supplying any additional topsoil needed and hauling it to the site. It shall be obtained from naturally well drained areas. Whether from on-site or off-site source, the topsoil shall be a fertile, friable natural loam. ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 5 percent organic material content nor more than 15%; soluble salts less than 500 parts per million; free of stones 3/4 inch or larger in any dimension and other extraneous materials harmful to plant growth. Soil shall not be used for planting while in frozen or muddy condition. Unsuitable materials removed shall be disposed of by the Contractor.
- B. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- C. Seed Species: State-certified seed of grass species, 85 percent pure seed, and not more than 0.25 percent weed seed:
  - 1. General Lawn Areas: Proportioned by weight as follows:
    - a. 35 percent creeping red fescue.
    - b. 30 percent chewings fescue.
    - c. 35 percent perennial ryegrass
- D. Sow seed at a total rate of 5 lb/1000 sq. ft. (2.3 kg/92.9 sq. m).
- E. Sow 50% in one direction and 50% at right angles to the first seeding. Spread seed when soil is moist; lightly raked into top 1/8 inch of soil and rolled lightly in two directions.
- F. Hydroseeding may be used in-lieu of hand seeding.
- G. Take whatever measures are necessary to protect the seeded area while it is germinating. These measures shall include furnishing warnings signs, barriers, and other needed measures of protection.

- H. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
  - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
  - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

### 3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect or Geotechnical Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

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## SECTION 321216 - ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Saw-cutting or cold milling of existing asphalt pavement.
  - 2. Hot-mix asphalt.
  - 3. Pavement marking paint
- B. Related Requirements:
  - 1. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include technical data and tested physical and performance properties.
  - 2. Job-Mix Designs: For each job mix proposed for the Work.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and installer.
- B. Material Certificates: For each paving material.
- C. Material Test Reports: For each paving material, by a qualified testing agency.
- D. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the latest revision of "Standard Specifications for Highways and Bridges" of the State of Maine Department of Transportation (MDOT), for asphalt paving work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
  - 1. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
  - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
  - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

### 2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320, conform to MDOT specification Sec. 702.
- B. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application. Emulsified asphalt conforming to MDOT 702.04.
- C. Water: Potable.

### 2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled asphalt shingles from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
- B. Joint Sealant: ASTM D 6690 hot-applied, single-component, polymer-modified bituminous sealant.
- C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
  - 1. Color: White.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Sherwin-Williams Waterborne Traffic Paint, or equal.

## 2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
  1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  2. Roads and parking:
    - a. Surface Course: Conforming to HMA 9.5mm. MDOT, Section 703.09.
    - b. Binder Course: Conforming to HMA 19mm. MDOT, Section 703.09.
  3. Walks:
    - a. Surface Course: Conforming to HMA 9.5mm. MDOT, Section 703.09.

| Sieve Size      | Percent by Weight Passing – Combined Aggregate |  |                 |
|-----------------|--|--|-----------------|
|                 | Type 19 mm (B)                                 |  | Type 9.5 mm (D) |
| 25 mm (1")      | 100  |  |                 |
| 19 mm (3/4")    | 90-100   |  |                 |
| 12.5 mm (1/2")  | -90  |  | 100             |
| 9.5 mm (3/8")   | -  |  | 90-100          |
| 4.75 mm (No. 4) | -  |  | -90             |
| 2.36 mm (No. 8) | 23-49  |  | 32-67           |
| 75 µm (No. 200) | 2-8  |  | 2-10            |

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with appropriate compaction equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph (5 km/h).
  2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
  3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected, and underground conduits and utilities have been completed.

### 3.2 PATCHING

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter

of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

- B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

### 3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
  - 3. Treat exposed existing horizontal and vertical pavement surfaces with sprayed bituminous tack coat prior to placing new adjacent or overlaying bituminous pavement. Pavement which has been in place longer than 30 days shall be considered existing.

### 3.4 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
  - 2. Spread mix at a minimum temperature of 250 deg F (121 deg C).
  - 3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
  - 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
  - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
  - 2. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.5 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
  - 3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
  - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
  - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
  - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  - 1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  - 1. Average Density: 95 percent of reference laboratory density according to MDOT, but not less than 92.5 percent or greater than 97.5 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.7 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for at least 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm). Apply sufficient thickness to completely cover the underlying pavement with solid white (or yellow) lines, such that no pavement color shows through.

### 3.8 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus 1/2 inch (13 mm).
  - 2. Surface Course: Plus 1/4 inch (6 mm), no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course: 3/8 inch (9 mm).
  - 2. Surface Course: 1/4 inch (6 mm).
  - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. This will not relieve the Contractor of his quality control responsibilities
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Alignment: Pavement edges shall be in conformance to alignment with straight edges or smooth curved edges, without irregularities or ragged edges.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to MDOT specifications.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
  - a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than three cores taken.
  - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Replace and compact hot-mix asphalt where core tests were taken.
- G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### 3.10 WASTE HANDLING

- A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216

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## SECTION 323000 - SITE IMPROVEMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  1. Concrete Equipment Pads
  2. Pipe Bollards
  3. Steel Guardrail

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site in an undamaged condition.
- B. Carefully store materials off the ground to provide proper protection against oxidation, and other damage caused by ground contact.

### PART 2 - PRODUCTS

#### 2.1 CAST IN PLACE CONCRETE

- A. Concrete shall be 4000 psi, air-entrained, 0.40 w/c ratio, with smooth formed or troweled finish. Portland cement shall conform to the requirements of ASTM C-150, type III. Aggregates shall conform to the requirements of ASTM C-33, and shall be free of injurious amounts of deleterious substances. Reinforcing steel conforming to ASTM A615.
- B. Concrete for below-grade posts and encasement, that do not require visual finishes, shall be 3000 psi.

#### 2.2 PIPE BOLLARDS

- A. Steel pipe schedule 40 of size shown on the drawings, filled with concrete and painted with industrial-grade alkyd exterior paint, as specified on the drawings. Set in 12" diameter concrete base, as detailed.

## 2.3 ROADWAY GUARDRAIL

- A. Galvanized steel post and beam guardrail, conforming to MDOT 710.04, 710.07, and 710.08. Installation conforming to the pertinent portions of MDOT Section 606.

## PART 3 - EXECUTION

### 3.1 STRUCTURES, BASES, AND OTHER EQUIPMENT

- A. Install according to details shown on drawings and manufacturer's recommendations.

### 3.2 POST INSTALLATION

- A. Install posts for equipment on previously prepared surfaces to line and grade as indicated. Install in accordance with the manufacturer's written installation instructions except as modified herein.
- B. Excavation: Excavate for concrete embedded items to dimensions indicated. Clear post holes of loose material. Dispose of waste material as directed.
- C. Post Setting: Set posts plumb. Provide concrete bases for posts to depths shown on drawings. Thoroughly compact concrete to be free of voids and finish in a dome. Cure concrete a minimum of 72 hours before any further work is done on posts.

END OF SECTION 323000



**PRELIMINARY SUBMITTAL DATA**

EMERGENCY GENERATOR AND RELATED EQUIPMENT

**FOR INSTALLATION AT**

**221 State Street  
Augusta, ME**

**MILTON CAT PROJECT NO: ENPRO003475**

**REQUESTED BY**

ME Bureau of General Services

**PROPOSED BY**

MILTON CAT  
79 Robertson Blvd  
Brewer, ME 04412

PROJECT MANAGER: HANS CHRISTENSEN (207) 991-3127  
hans\_christensen@miltoncat.com

February 29, 2016

VERSION – S0

SUBMITTAL FOR: APPROVAL

# **SUBMITTAL BILL OF MATERIALS** **CATERPILLAR GENERATOR SET** **AND ACCESSORIES**

**221 State Street**  
**Augusta, ME**

**Project Manager: Hans Christensen 207-991-3127**

**Project Manager: Dave Nunnally 603-345-5038**

## **1.0 Caterpillar C15 Packaged Engine/Generator Assembly**

One (1) outdoor Caterpillar diesel generator set, model C15, rated 500kW, 625kVA, 1735 full load amps standby power duty, 120/208 volt, 3 phase, 4 wire, 60 hertz, 0.8 power factor, supplied with all standard accessories, plus the following:

- Caterpillar model C15 diesel engine, EPA Emergency Standby Emissions Certified, 6 cylinder configuration, 15.20 liter displacement
- UL2200 Packaged Generator Set
- ACERT Technology
- Base mounted radiator rated for 50 degree C ambient with air discharge adapter, coolant level sensor with alarm
- Dry type air cleaner with service indicator
- Cat ADEM electronic speed control governor, mounted
- Lube oil cooler
- Lube oil filter
- Jacket water heater
- SAE flywheel and housing
- Fuel oil cooler
- Flexible fuel lines
- Initial fill of engine lube-oil and 50/50 mix ethylene glycol/water solution
- Primary Fuel Filter with water separator
- Vibration damper and pulley guards
- Exhaust manifold and turbocharger guards

## **2.0 Generator Data**

- Over sized Caterpillar, 4 pole, synchronous, rated 500kW, 625kVA, LC7024F frame standby power duty, 105 degree C temperature rise over 40 degree C ambient, Class H insulation
- 1735 full load amps at 120/208 volt, 3 phase, 0.8 pf
- Caterpillar integrated voltage regulator, three phase voltage sensing, +- 1% regulation, volts per hertz response
- Factory tested in accordance with MIL-705B and NEMA MG1-22 standards
- AREP Generator

### 3.0 Main Line Circuit Breaker

One (1) Generator Mounted Mainline Circuit Breaker, 2000A LSI Trip, 100% Rated,(Right Hand Facing)

NEMA 1 enclosure, vibration isolated, mounted separately on base rails

Bottom Conduit entry with stub up

Integral trip unit for thermal and magnetic overload protection.

UL listed mainline circuit breakers.

Auxiliary Contact

\*\*Breaker provided with buss bar load side connections with NEMA hole pattern. ***Lugs to be provided by others.***

### 4.0 Generator Mounted Control Panel

Generator mounted (Left Hand Facing) electronic modular control panel (**EMCP 4.2**) with the following instrumentation and controls:

- Environmentally sealed, salt spray resistant front face rated for IP22
- Digital 32- Bit Microprocessor Based System
- Graphical 33 x132 pixel display
- Generator Monitoring:
  - Voltage (L-L, L-N)
  - Current (Phase)
  - Average Volt, Amp, Frequency
  - kW, kVAr, kVA (Average, Phase, %)
  - Power Factor (Average, Phase)
  - kW-hr, kVAr-hr (total)
  - Excitation voltage and current (with optional CDVR)
- Generator Protection:
  - Generator phase sequence
  - Over/Under voltage (27/59)
  - Over/Under Frequency (81/U)
  - Reverse Power (kW) (32)
  - Overcurrent (50/51)
  - Ground Fault Relay
- Engine Monitoring:
  - Coolant Temperature
  - Oil Pressure
  - Engine Speed
  - Battery Voltage
  - Run hours
  - Crank attempt and successful start counter
- Engine Protection:
  - Control switch not in auto (alarm)
  - High coolant temp (alarm and shutdown)
  - Low coolant temp (alarm)
  - Low coolant level (alarm)
  - High engine oil temp (alarm and shutdown)
  - Low, high, and weak battery voltage
  - Overspeed
  - Overcrank
- Controls:
  - Run/Auto/Stop Selector Switches
  - Speed and Voltage adjust

- Emergency Stop Push Button
  - Engine cycle crank
- Inputs and Outputs:
  - Two dedicated digital inputs
  - Six programmable digital inputs
  - Six programmable form A dry contacts
  - Two programmable form C dry contacts
  - Two digital outputs
- Communications:
  - Primary and Accessory CAN data links
  - RS485 annunciator data link
  - Modbus RTU (RS-485 Half duplex)

### **Remote Annunciator**

- NFPA 99/110 Compatible Alarm panel with selectable red, yellow, or green colored LED's
- Alarm Silence and Lamp Test Buttons
- RS485 communication link – ***cable to be supplied by others***
- 24VDC – from generator control cabinet
- Back box or surface or flush mount
- ***Shipped Loose for Installation by others***

### **5.0 Starting System**

- Quantity two (2) each Caterpillar oversize lead-acid battery, rated 1300 cold cranking amps, 190 ampere hours with rack and cables, installed on generator base rails. Batteries shipped wet.
- Battery charger dual rate automatic battery charger rated 10-ampere/24vdc output with charger high/low/malfunction alarm, mounted/wired inside weather enclosure.
- Engine coolant heater (1), 3000 watts, 240 volt, single phase, with thermostat controls, mounted/wired
- 45 amp battery charging alternator with Pulley/belt guards, mounted
- 24 VDC electric starting motor

### **6.0 Enclosure / Fuel System / Mounting**

#### **Enclosure**

- Level II Sound Attenuated Skin Tight Enclosure
- 14 Ga. Powder Coated Steel Construction
- Enclosure Color: RAL 7045 Grey
- Stainless steel flexible exhaust with nuts/bolts/gaskets, installed within housing
- Critical grade silencer, installed within housing
- Exhaust outlet, rain shield, rain cap, installed within housing

#### **Fuel Base Tank**

- UL 142 Sub Base Tank Assembly
- 1036 Gallon (1002 usable gallons)
- 110% Rupture basin
- Conduit access stub up area
- Mechanical Level Gauge
- Low Fuel Level Alarm Switch
- Fuel In Rupture Basin Switch

- Mechanical Fill Port with overflow prevention valve and 5 gallon spill containment
- High Fuel Level Alarm with audible/visual indication
- Supply and pick up tubes for engine connections
- Standard Vent Fittings

#### **Mounting**

- Linear vibration isolators, installed between engine-generator assembly and mounting base, seismic zone 4 rated.

### **7.0 Start-up & Testing**

- Standard Caterpillar 0.8 PF package generator factory certified test report
- Standard Caterpillar factory test report
- A factory trained service technician will perform start-up and tests to meet intent of project specifications
- On site load bank test
- Site Load Transfer Test
- Owner Training

### **8.0 Documentation**

#### **Warranty**

- Caterpillar standard two year limited warranty coverage

#### **Manuals**

- Two (2) sets of operation/maintenance/parts manuals will be forwarded after shipment of generator set from Caterpillar

### **9.0 Project Notes**

- All site rigging of equipment by others
- All off-loading of equipment at site by others
- Ship loose exhaust component installation by others
- All fuel by others
- Provide separate conduit for annunciator wiring and cables
- Must run AC and DC wiring separately
- ***Estimated Package Weight, including fuel tank and enclosure: 16,000 lbs***

### **10.0 System Drawings**

#### **Mechanical**

- Generator Set Package Drawings
- Fuel Tank Drawing

#### **Electrical**

- Generator Set Electrical Schematics



## **Submittal Table of Contents**

### **221 State Street**

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**Section 1**  
**Packaged Engine / Generator Set**

Caterpillar is leading the power generation marketplace with Power Solutions engineered to deliver unmatched flexibility, expandability, reliability, and cost-effectiveness.



## Specifications

| Generator Set Specifications |                   |
|------------------------------|-------------------|
| Minimum Rating               | 320 ekW (365 kVA) |
| Maximum Rating               | 500 ekW (550 kVA) |
| Voltage                      | 208 to 600 Volts  |
| Frequency                    | 50 or 60 Hz       |
| Speed                        | 1500 or 1800 RPM  |

| Generator Set Configurations |   |
|------------------------------|---|
| Emissions/Fuel Strategy      | Low Fuel Consumption, U.S. EPA Certified for Stationary Emergency Use Only (Tier 2 or Tier 3 Nonroad Equivalent Emission Standards), EU Stage IIIA Nonroad Emission Standards, China Nonroad III Emission Standards |

| Engine Specifications |  |                        |
|-----------------------|--|------------------------|
| Engine Model          | C15 ATAAC, I-6, 4-Stroke Water-Cooled Diesel |                        |
| Compression Ratio     | 16.1:1                                       |                        |
| Aspiration            | Air to Air Aftercooled                       |                        |
| Governor Type         | Adem™ A4                                     |                        |
| Fuel System           | MEUI   |                        |
| Bore                  | 137.2 mm                                     | 5.4 in                 |
| Displacement          | 15.2 L                                       | 927.56 in <sup>3</sup> |
| Stroke                | 171.4 mm                                     | 6.75 in                |

## Benefits And Features

### Cat Diesel Engine

- Reliable, rugged, durable design
- Field-proven in thousands of applications worldwide
- Four-stroke-cycle diesel engine combines consistent performance and excellent fuel economy with minimum weight

### Generator

- Matched to the performance and output characteristics of Cat engines
- Industry leading mechanical and electrical design
- Industry leading motor starting capabilities
- High Efficiency

### Cat EMCP Control Panel

The EMCP controller features the reliability and durability you have come to expect from your Cat equipment. EMCP4 is a scalable control platform designed to ensure reliable generator set operation, providing extensive information about power output and engine operation. EMCP4 systems can be further customized to meet your needs through programming and expansion modules.

### Seismic Certification

- Seismic Certification available.
- Anchoring details are site specific, and are dependent on many factors such as generator set size, weight, and concrete strength.
- IBC Certification requires that the anchoring system used is reviewed and approved by a Professional Engineer
- Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, CBC 2007, CBC 2010
- Pre-approved by OSHPD and carries an OSP-0321-10 for use in healthcare projects in California

### World Wide Product Support

Cat dealers provide extensive post-sale support including maintenance and repair agreements. Cat dealers have over 1,800 dealer branch stores operating in 200 countries. The Caterpillar S•O•S<sup>SM</sup> program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products

### Design Criteria

The generator set accepts 100% rated load in one step per NFPA 110 and meets ISO 8528-5 transient response.

## Standard Equipment

### Air Inlet

- Air Cleaner

### Cooling

- Package mounted radiator

### Exhaust

- Exhaust flange outlet

### Fuel

- Primary fuel filter with integral water separator
- Secondary fuel filter
- Fuel priming pump

### Generator

- Matched to the performance and output characteristics of Cat engines
- Load adjustment module provides engine relief upon load impact and improves load acceptance and recovery time
- IP23 Protection

### Power Termination

- Bus Bar

### Control Panel

- EMCP 4 Genset Controller

### Mounting

- Rubber vibration isolators

### Starting/Charging

- 24 volt starting motor
- Batteries

### General

- Paint - Caterpillar Yellow except rails and radiators gloss black

**C15 ACERT**  
**500 ekW/ 625 kVA/ 60 Hz/ 1800 rpm/ 208 V/ 0.8 Power Factor**

Rating Type: **STANDBY**

Emissions: **U.S. EPA Certified for Stationary Emergency Use Only (Tier 2 Nonroad Equivalent Emission Standards)**



**C15 ACERT**  
**500 ekW/ 625 kVA**  
**60 Hz/ 1800 rpm/ 208 V**

Image shown may not reflect actual configuration

**Metric English**

| Package Performance                             |         |     |
|---|---------|-----|
| Genset Power Rating with Fan @ 0.8 Power Factor | 500 ekW |     |
| Genset Power Rating                             | 625 kVA |     |
| Aftercooler (Separate Circuit)                  | N/A     | N/A |

| Fuel Consumption   |            |             |
|--------------------|------------|-------------|
| 100% Load with Fan | 137.6 L/hr | 36.3 gal/hr |
| 75% Load with Fan  | 105.8 L/hr | 28.0 gal/hr |
| 50% Load with Fan  | 87.9 L/hr  | 23.2 gal/hr |
| 25% Load with Fan  | 52.0 L/hr  | 13.7 gal/hr |

| Cooling System <sup>1</sup> |        |         |
|-----------------------------|--------|---------|
| Engine Coolant Capacity     | 20.8 L | 5.5 gal |

| Inlet Air                                |                          |            |
|--|--------------------------|------------|
| Combustion Air Inlet Flow Rate           | 39.5 m <sup>3</sup> /min | 1393.5 cfm |
| Max. Allowable Combustion Air Inlet Temp | 48 ° C                   | 119 ° F    |

| Exhaust System                                  |                           |                |
|---|---------------------------|----------------|
| Exhaust Stack Gas Temperature                   | 504.7 ° C                 | 940.5 ° F      |
| Exhaust Gas Flow Rate                           | 107.6 m <sup>3</sup> /min | 3800.7 cfm     |
| Exhaust System Backpressure (Maximum Allowable) | 10.0 kPa                  | 40.0 in. water |



**C15 ACERT**  
**500 kW/ 625 kVA/ 60 Hz/ 1800 rpm/ 208 V/ 0.8 Power Factor**

**Rating Type: STANDBY**

**Emissions: U.S. EPA Certified for Stationary Emergency Use Only (Tier 2 Nonroad Equivalent Emission Standards)**

| <b>Heat Rejection</b>                       |        |               |
|---|--------|---------------|
| Heat Rejection to Jacket Water              | 187 kW | 10619 Btu/min |
| Heat Rejection to Exhaust (Total)           | 501 kW | 28467 Btu/min |
| Heat Rejection to Aftercooler               | 120 kW | 6801 Btu/min  |
| Heat Rejection to Atmosphere from Engine    | 86 kW  | 4890 Btu/min  |
| Heat Rejection to Atmosphere from Generator | 37 kW  | 2076 Btu/min  |

| <b>Alternator<sup>2</sup></b>               |           |
|---|-----------|
| Motor Starting Capability @ 30% Voltage Dip | 1248 skVA |
| Current                                     | 1735 amps |
| Frame Size                                  | LC7024F   |
| Excitation                                  | AR        |
| Temperature Rise                            | 130 ° C   |

| <b>Emissions (Nominal)<sup>3</sup></b> |                           |             |
|--|---------------------------|-------------|
| NOx                                    | 2789.3 mg/Nm <sup>3</sup> | 5.7 g/hp-hr |
| CO                                     | 195.7 mg/Nm <sup>3</sup>  | 0.4 g/hp-hr |
| HC                                     | 3.6 mg/Nm <sup>3</sup>    | 0.0 g/hp-hr |
| PM                                     | 7.5 mg/Nm <sup>3</sup>    | 0.0 g/hp-hr |

**DEFINITIONS AND CONDITIONS**

1. For ambient and altitude capabilities consult your Cat dealer. Air flow restriction (system) is added to existing restriction from factory.
2. UL 2200 Listed packages may have oversized generators with a different temperature rise and motor starting characteristics. Generator temperature rise is based on a 40° C ambient per NEMA MG1-32.
3. Emissions data measurement procedures are consistent with those described in EPA CFR 40 Part 89, Subpart D & E and ISO8178-1 for measuring HC, CO, PM, NOx. Data shown is based on steady state operating conditions of 77° F, 28.42 in HG and number 2 diesel fuel with 35° API and LHV of 18,390 btu/lb. The nominal emissions data shown is subject to instrumentation, measurement, facility and engine to engine variations. Emissions data is based on 100% load and thus cannot be used to compare to EPA regulations which use values based on a weighted cycle.

Performance Number: DM8155

Change Level: 03

|                              |          |                                      |                    |
|------------------------------|----------|--------------------------------------|--------------------|
| SALES MODEL:                 | C15      | COMBUSTION:                          | DI                 |
| ENGINE POWER (BHP):          | 762      | ENGINE SPEED (RPM):                  | 1,800              |
| GEN POWER W/O FAN (EKW):     | 516.0    | HERTZ:                               | 60                 |
| GEN POWER WITH FAN (EKW):    | 500.0    | FAN POWER (HP):                      | 33.7               |
| COMPRESSION RATIO:           | 16.1     | ASPIRATION:                          | TA                 |
| RATING LEVEL:                | STANDBY  | AFTERCOOLER TYPE:                    | ATAAC              |
| PUMP QUANTITY:               | 1        | AFTERCOOLER CIRCUIT TYPE:            | JW+OC, ATAAC       |
| FUEL TYPE:                   | DIESEL   | INLET MANIFOLD AIR TEMP (F):         | 120                |
| MANIFOLD TYPE:               | DRY      | JACKET WATER TEMP (F):               | 192.2              |
| GOVERNOR TYPE:               | ELEC     | TURBO CONFIGURATION:                 | SINGLE             |
| CAMSHAFT TYPE:               | STANDARD | TURBO QUANTITY:                      | 1                  |
| IGNITION TYPE:               | CI       | TURBOCHARGER MODEL:                  | GTA5518BS-56T-1.58 |
| INJECTOR TYPE:               | EUI      | CERTIFICATION YEAR:                  | 2006               |
| REF EXH STACK DIAMETER (IN): | 6        | PISTON SPD @ RATED ENG SPD (FT/MIN): | 2,025.0            |
| MAX OPERATING ALTITUDE (FT): | 3,281    |                                      |                    |

| INDUSTRY       | SUBINDUSTRY     | APPLICATION     |
|----------------|-----------------|-----------------|
| ELECTRIC POWER | STANDARD        | PACKAGED GENSET |
| OIL AND GAS    | LAND PRODUCTION | PACKAGED GENSET |

General Performance Data

| GENSET POWER WITH FAN | PERCENT LOAD | ENGINE POWER | BRAKE MEAN EFF PRES (BMEP) | BRAKE SPEC FUEL CONSUMPTN (BSFC) | VOL FUEL CONSUMPTN (VFC) | INLET MFLD PRES | INLET MFLD TEMP | EXH MFLD TEMP | EXH MFLD PRES | ENGINE OUTLET TEMP |
|-----------------------|--------------|--------------|----------------------------|----------------------------------|--------------------------|-----------------|-----------------|---------------|---------------|--------------------|
| EKW                   | %            | BHP          | PSI                        | LB/BHP-HR                        | GAL/HR                   | IN-HG           | DEG F           | DEG F         | IN-HG         | DEG F              |
| 500.0                 | 100          | 762          | 361                        | 0.334                            | 36.3                     | 68.4            | 118.7           | 1,245.9       | 48.8          | 940.5              |
| 450.0                 | 90           | 683          | 324                        | 0.336                            | 32.7                     | 60.3            | 115.0           | 1,203.9       | 42.0          | 917.3              |
| 400.0                 | 80           | 607          | 288                        | 0.337                            | 29.3                     | 52.8            | 114.6           | 1,172.0       | 35.6          | 909.2              |
| 375.0                 | 75           | 570          | 271                        | 0.343                            | 28.0                     | 51.0            | 113.8           | 1,160.3       | 34.1          | 902.2              |
| 350.0                 | 70           | 534          | 253                        | 0.354                            | 27.0                     | 50.6            | 112.5           | 1,150.8       | 34.1          | 892.9              |
| 300.0                 | 60           | 462          | 219                        | 0.382                            | 25.2                     | 50.6            | 109.0           | 1,131.8       | 34.7          | 873.5              |
| 250.0                 | 50           | 392          | 186                        | 0.414                            | 23.2                     | 48.9            | 104.6           | 1,106.7       | 34.4          | 853.0              |
| 200.0                 | 40           | 323          | 153                        | 0.426                            | 19.6                     | 37.7            | 98.4            | 1,067.3       | 27.0          | 832.3              |
| 150.0                 | 30           | 253          | 120                        | 0.435                            | 15.7                     | 25.3            | 92.2            | 1,008.3       | 18.8          | 810.6              |
| 125.0                 | 25           | 218          | 103                        | 0.442                            | 13.7                     | 19.3            | 89.5            | 971.2         | 14.9          | 799.4              |
| 100.0                 | 20           | 182          | 86                         | 0.455                            | 11.8                     | 14.2            | 87.2            | 921.1         | 11.7          | 774.3              |
| 50.0                  | 10           | 109          | 52                         | 0.530                            | 8.3                      | 6.8             | 84.2            | 766.7         | 7.7           | 657.7              |

| GENSET POWER WITH FAN | PERCENT LOAD | ENGINE POWER | COMPRESSOR OUTLET PRES | COMPRESSOR OUTLET TEMP | WET INLET AIR VOL FLOW RATE | ENGINE OUTLET WET EXH GAS VOL FLOW RATE | WET INLET AIR MASS FLOW RATE | WET EXH GAS MASS FLOW RATE | WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG) | DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG) |
|-----------------------|--------------|--------------|------------------------|------------------------|-----------------------------|---|------------------------------|----------------------------|--|--|
| EKW                   | %            | BHP          | IN-HG                  | DEG F                  | CFM                         | CFM                                     | LB/HR                        | LB/HR                      | FT3/MIN  | FT3/MIN  |
| 500.0                 | 100          | 762          | 72                     | 398.1                  | 1,393.5                     | 3,800.7                                 | 6,079.3                      | 6,333.3                    | 1,334.6  | 1,209.8  |
| 450.0                 | 90           | 683          | 64                     | 367.8                  | 1,289.3                     | 3,450.2                                 | 5,606.3                      | 5,835.1                    | 1,231.9  | 1,118.9  |
| 400.0                 | 80           | 607          | 55                     | 337.6                  | 1,182.1                     | 3,126.2                                 | 5,117.7                      | 5,322.3                    | 1,122.9  | 1,021.3  |
| 375.0                 | 75           | 570          | 53                     | 330.7                  | 1,163.4                     | 3,046.9                                 | 5,031.6                      | 5,227.4                    | 1,100.0  | 1,002.5  |
| 350.0                 | 70           | 534          | 53                     | 330.6                  | 1,168.1                     | 3,031.7                                 | 5,051.6                      | 5,240.4                    | 1,102.1  | 1,007.1  |
| 300.0                 | 60           | 462          | 54                     | 332.7                  | 1,188.3                     | 3,031.5                                 | 5,143.1                      | 5,319.5                    | 1,118.0  | 1,027.9  |
| 250.0                 | 50           | 392          | 52                     | 326.5                  | 1,178.6                     | 2,961.3                                 | 5,104.5                      | 5,267.0                    | 1,109.2  | 1,025.1  |
| 200.0                 | 40           | 323          | 40                     | 278.3                  | 1,008.6                     | 2,509.3                                 | 4,352.9                      | 4,490.4                    | 955.0  | 882.1  |
| 150.0                 | 30           | 253          | 27                     | 222.8                  | 815.2                       | 1,989.2                                 | 3,499.6                      | 3,609.9                    | 769.9  | 711.3  |
| 125.0                 | 25           | 218          | 20                     | 195.4                  | 721.8                       | 1,729.3                                 | 3,088.6                      | 3,185.0                    | 675.3  | 624.6  |
| 100.0                 | 20           | 182          | 15                     | 171.3                  | 643.7                       | 1,498.0                                 | 2,746.9                      | 2,829.9                    | 596.9  | 553.5  |
| 50.0                  | 10           | 109          | 8                      | 133.2                  | 532.6                       | 1,117.2                                 | 2,266.7                      | 2,324.6                    | 491.6  | 460.2  |

Heat Rejection Data

| GENSET POWER WITH FAN | PERCENT LOAD | ENGINE POWER | REJECTION TO JACKET WATER | REJECTION TO ATMOSPHERE | REJECTION TO EXH | EXHUAUST RECOVERY TO 350F | FROM OIL COOLER | FROM AFTERCOOLER | WORK ENERGY | LOW HEAT VALUE ENERGY | HIGH HEAT VALUE ENERGY |
|-----------------------|--------------|--------------|---------------------------|-------------------------|------------------|---------------------------|-----------------|------------------|-------------|-----------------------|------------------------|
| EKW                   | %            | BHP          | BTU/MIN                   | BTU/MIN                 | BTU/MIN          | BTU/MIN                   | BTU/MIN         | BTU/MIN          | BTU/MIN     | BTU/MIN               | BTU/MIN                |
| 500.0                 | 100          | 762          | 10,619                    | 4,890                   | 28,467           | 15,987                    | 4,154           | 6,801            | 32,301      | 77,990                | 83,078                 |
| 450.0                 | 90           | 683          | 9,863                     | 4,850                   | 25,472           | 14,112                    | 3,741           | 5,675            | 28,958      | 70,234                | 74,817                 |
| 400.0                 | 80           | 607          | 9,041                     | 4,609                   | 22,939           | 12,671                    | 3,345           | 4,569            | 25,750      | 62,810                | 66,909                 |
| 375.0                 | 75           | 570          | 8,692                     | 4,420                   | 22,234           | 12,270                    | 3,195           | 4,370            | 24,187      | 59,989                | 63,903                 |
| 350.0                 | 70           | 534          | 8,428                     | 4,273                   | 21,896           | 12,066                    | 3,083           | 4,412            | 22,642      | 57,875                | 61,651                 |
| 300.0                 | 60           | 462          | 7,957                     | 4,041                   | 21,408           | 11,759                    | 2,881           | 4,607            | 19,611      | 54,095                | 57,625                 |
| 250.0                 | 50           | 392          | 7,483                     | 3,990                   | 20,431           | 11,144                    | 2,654           | 4,537            | 16,633      | 49,823                | 53,074                 |
| 200.0                 | 40           | 323          | 6,780                     | 4,301                   | 16,988           | 9,104                     | 2,245           | 3,137            | 13,687      | 42,142                | 44,892                 |
| 150.0                 | 30           | 253          | 6,009                     | 4,101                   | 13,295           | 6,979                     | 1,798           | 1,830            | 10,732      | 33,764                | 35,968                 |
| 125.0                 | 25           | 218          | 5,578                     | 3,764                   | 11,543           | 5,997                     | 1,572           | 1,310            | 9,239       | 29,508                | 31,433                 |
| 100.0                 | 20           | 182          | 5,092                     | 3,466                   | 9,876            | 5,013                     | 1,354           | 925              | 7,727       | 25,428                | 27,088                 |
| 50.0                  | 10           | 109          | 4,033                     | 3,079                   | 6,702            | 2,947                     | 944             | 445              | 4,629       | 17,732                | 18,889                 |

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

| GENSET POWER WITH FAN | EKW                 | 500.0   | 375.0   | 250.0   | 125.0   | 50.0    |
|-----------------------|---------------------|---------|---------|---------|---------|---------|
| PERCENT LOAD          | %                   | 100     | 75      | 50      | 25      | 10      |
| ENGINE POWER          | BHP                 | 762     | 570     | 392     | 218     | 109     |
| TOTAL NOX (AS NO2)    | G/HR                | 4,654   | 3,245   | 880     | 673     | 479     |
| TOTAL CO              | G/HR                | 567     | 622     | 1,886   | 968     | 615     |
| TOTAL HC              | G/HR                | 12      | 22      | 94      | 47      | 69      |
| PART MATTER           | G/HR                | 26.1    | 36.0    | 45.6    | 102.5   | 69.9    |
| TOTAL NOX (AS NO2)    | (CORR 5% O2) MG/NM3 | 3,012.5 | 2,702.6 | 905.9   | 1,214.3 | 1,346.5 |
| TOTAL CO              | (CORR 5% O2) MG/NM3 | 366.0   | 536.6   | 1,895.6 | 1,600.3 | 1,799.7 |
| TOTAL HC              | (CORR 5% O2) MG/NM3 | 6.8     | 16.9    | 80.6    | 61.7    | 187.7   |
| PART MATTER           | (CORR 5% O2) MG/NM3 | 14.7    | 25.2    | 40.0    | 155.2   | 161.9   |
| TOTAL NOX (AS NO2)    | (CORR 5% O2) PPM    | 1,467   | 1,316   | 441     | 591     | 656     |
| TOTAL CO              | (CORR 5% O2) PPM    | 293     | 429     | 1,516   | 1,280   | 1,440   |
| TOTAL HC              | (CORR 5% O2) PPM    | 13      | 32      | 151     | 115     | 350     |
| TOTAL NOX (AS NO2)    | G/HP-HR             | 6.19    | 5.74    | 2.26    | 3.10    | 4.41    |
| TOTAL CO              | G/HP-HR             | 0.75    | 1.10    | 4.84    | 4.46    | 5.66    |
| TOTAL HC              | G/HP-HR             | 0.02    | 0.04    | 0.24    | 0.22    | 0.63    |
| PART MATTER           | G/HP-HR             | 0.03    | 0.06    | 0.12    | 0.47    | 0.64    |
| TOTAL NOX (AS NO2)    | LB/HR               | 10.26   | 7.15    | 1.94    | 1.48    | 1.06    |
| TOTAL CO              | LB/HR               | 1.25    | 1.37    | 4.16    | 2.13    | 1.36    |
| TOTAL HC              | LB/HR               | 0.03    | 0.05    | 0.21    | 0.10    | 0.15    |
| PART MATTER           | LB/HR               | 0.06    | 0.08    | 0.10    | 0.23    | 0.15    |

RATED SPEED NOMINAL DATA: 1800 RPM

| GENSET POWER WITH FAN | EKW                 | 500.0   | 375.0   | 250.0   | 125.0   | 50.0    |
|-----------------------|---------------------|---------|---------|---------|---------|---------|
| PERCENT LOAD          | %                   | 100     | 75      | 50      | 25      | 10      |
| ENGINE POWER          | BHP                 | 762     | 570     | 392     | 218     | 109     |
| TOTAL NOX (AS NO2)    | G/HR                | 4,309   | 3,005   | 815     | 623     | 444     |
| TOTAL CO              | G/HR                | 303     | 332     | 1,009   | 518     | 329     |
| TOTAL HC              | G/HR                | 6       | 12      | 49      | 25      | 36      |
| TOTAL CO2             | KG/HR               | 358     | 276     | 228     | 134     | 79      |
| PART MATTER           | G/HR                | 13.4    | 18.5    | 23.4    | 52.5    | 35.8    |
| TOTAL NOX (AS NO2)    | (CORR 5% O2) MG/NM3 | 2,789.3 | 2,502.4 | 838.8   | 1,124.4 | 1,246.7 |
| TOTAL CO              | (CORR 5% O2) MG/NM3 | 195.7   | 287.0   | 1,013.7 | 855.8   | 962.4   |
| TOTAL HC              | (CORR 5% O2) MG/NM3 | 3.6     | 9.0     | 42.7    | 32.6    | 99.3    |
| PART MATTER           | (CORR 5% O2) MG/NM3 | 7.5     | 12.9    | 20.5    | 79.6    | 83.0    |
| TOTAL NOX (AS NO2)    | (CORR 5% O2) PPM    | 1,359   | 1,219   | 409     | 548     | 607     |
| TOTAL CO              | (CORR 5% O2) PPM    | 157     | 230     | 811     | 685     | 770     |
| TOTAL HC              | (CORR 5% O2) PPM    | 7       | 17      | 80      | 61      | 185     |
| TOTAL NOX (AS NO2)    | G/HP-HR             | 5.73    | 5.31    | 2.09    | 2.87    | 4.08    |
| TOTAL CO              | G/HP-HR             | 0.40    | 0.59    | 2.59    | 2.39    | 3.03    |
| TOTAL HC              | G/HP-HR             | 0.01    | 0.02    | 0.13    | 0.11    | 0.33    |

**PERFORMANCE DATA[DM8155]**

February 29, 2016

|                    |         |      |      |      |      |      |
|--------------------|---------|------|------|------|------|------|
| PART MATTER        | G/HP-HR | 0.02 | 0.03 | 0.06 | 0.24 | 0.33 |
| TOTAL NOX (AS NO2) | LB/HR   | 9.50 | 6.62 | 1.80 | 1.37 | 0.98 |
| TOTAL CO           | LB/HR   | 0.67 | 0.73 | 2.22 | 1.14 | 0.73 |
| TOTAL HC           | LB/HR   | 0.01 | 0.03 | 0.11 | 0.05 | 0.08 |
| TOTAL CO2          | LB/HR   | 790  | 610  | 503  | 295  | 175  |
| PART MATTER        | LB/HR   | 0.03 | 0.04 | 0.05 | 0.12 | 0.08 |
| OXYGEN IN EXH      | %       | 8.7  | 9.6  | 11.7 | 11.9 | 13.7 |
| DRY SMOKE OPACITY  | %       | 0.5  | 0.7  | 0.8  | 3.0  | 2.4  |
| BOSCH SMOKE NUMBER |         | 0.19 | 0.40 | 0.53 | 1.74 | 1.50 |

## ADEM™ A4 Engine Controller

The ADEM™ A4 is the main Electronic Control Module (ECM) used on select diesel engines. The ADEM A4 is an integral part of the innovative ACERT® Technology that provides higher degree of control over a large number of combustion variables than ever before. The ADEM A4 is designed to control/interface Electronic Unit Injector (EUI) equipped engines. The ADEM A4 engine system is composed of the ADEM A4 ECM, control software, sensors, actuators, fuel injectors, and interface to the generator system. The prime benefit of an ADEM A4 engine system is to better control and maintain the particulate emissions, both steady state and transient, while improving engine performance.



### FEATURES

#### RELIABLE, DURABLE

*All ADEM A4 controllers are designed to survive the harshest environments.*

- Environmentally sealed, die-cast aluminum housing isolates and protects electronic components from moisture and dirt contamination.
- Rigorous vibration testing ensures product reliability and durability.
- Accuracy maintained from -40° C to 85° C
- Electrical noise immunity to 100 volts/meter
- Internal circuits are designed to withstand shorts to +battery and -battery.
- Atmosphere cooled

#### SIMPLE SERVICING

*Each ADEM A4 system works in combination with the Caterpillar® ET service tool software to keep the engine operating at peak performance.*

- Displays measured parameters
- Retrieves active and logged event code documenting abnormal system operation
- Performs calibrations and diagnostic tests
- Supports flash programming of new software into the ADEM A4 ECM

#### SELF DIAGNOSTICS

*Each ADEM A4 ECM has a full compliment of diagnostics. The ECM can detect faults in the electrical system and report those faults to the service technician for quick repair.*

- Self-diagnostic capability pinpoints operational problems in need of attention.

#### ADVANCED FEATURES

- Isochronous or droop speed control
- Enhanced performance from fuel injection timing and limiting
- Adjustable monitoring of vital engine parameters
- Idle/rated speed setting
- Programmable speed acceleration ramp rate
- Adjustable cooldown duration
- Data link interfaces
- Cat Data link
- CAN J1939

#### OPTIONAL FEATURES

- Ether control system support
- Remote monitoring and control support

## DESCRIPTION

The ECM is housed in an environmentally sealed casting. All wiring connections to the ECM are made using two sealed connectors: a single seventy-pin connector and a single one hundred twenty-pin connector.

## ENGINE SPEED GOVERNING

Desired engine speed is calculated by the ECM and held within  $\pm 0.2$  Hz for isochronous and droop mode. The ECM accounts for droop that is requested. The proper amount of fuel is sent to the injectors due to these calculations. The ECM also employs cooldown/shutdown strategies, acceleration delays on startup, acceleration ramp times, speed reference and a low/high idle switch is also available via communications to the EMCP 3.

## FUEL LIMITING

Warm and cold fuel-air ratio control limits are controlled by the ECM. Electronic monitoring system derates, torque limit, and cranking limit, programmable torque scaling, and cold cylinder cutout mode are standard features.

## FUEL INJECTION TIMING

Master timing for injection is controlled by the ECM control. Temperature dependencies are accounted for in the fuel injection calculations.

## ELECTRONIC MONITORING

Electronic monitoring of vital engine parameters can be programmed. Warning, derate, and shutdown event conditions may be customized by the user.

## INFORMATION MANAGEMENT

The ECM stores information to assist with electronic troubleshooting. Active and logged diagnostic codes, active events, logged events, fuel consumption, engine hours, and instantaneous totals aid service technicians when diagnosing electronic faults and scheduling preventive maintenance.

## CALIBRATIONS

Engine performance is optimized through injection timing. Auto/manual sensor calibrations are standard features.

## ON-BOARD SYSTEM TESTS

System tests are available to assist in electronic troubleshooting. These tests include: injector activation, injector cutout, and override of control outputs.

## DATA LINK INTERFACES

The ADEM A4 communicates with the EMCP 3 via the J1939 Communication network. Additionally, the ADEM A4 can communicate with the Cat ET electronic service tool and the PL1000E, PL1000T.

## ELECTRONIC SENSING

The following sensing is available on the ADEM A4: oil pressure, fuel pressure, fuel temperature, atmospheric pressure, air inlet temperature, turbo outlet pressure, engine coolant temperature, engine speed, throttle, position, exhaust temperature, engine control switch position, oil filter pressure differential, fuel filter pressure differential, air filter pressure differential, crankcase pressure, and remote e-stop switch position.

---

## SPECIFICATIONS

### Humidity tolerance

0 to 90% relative humidity over operating temperature range

### Impervious to:

salt spray, fuel, oil and oil additives, coolant, spray cleaners, chlorinated solvents, hydrogen sulfide and methane gas, and dust

### Input and output protection

all inputs and outputs are protected against short circuits to +battery and -battery

### Input voltage range (24 VDC nominal)

18 to 32 VDC

### Mounting

engine mounted

### Reverse polarity protected

### Shock, withstands 20 g

### Temperature range

Operating: -40° C to 85° C (-40° F to 185° F)

Storage: -50° C to 120° C (-58° F to 248° F)

### Vibration

withstands 8.0 g @ 24 to 2 kHz

# Cat<sup>®</sup> ELC

Extended Life Coolant for Caterpillar and original equipment manufacturer (OEM)  
diesel and gasoline engines

50/50 Premix



## Recommended Use

Cat ELC meets or exceeds the requirements of the following specifications and guidelines:

- Cat EC-1
- TMC RP-329
- TMC RP-338
- ASTM D-3306
- ASTM D-6210
- SAE J1034

Cat ELC also meets the performance requirements of Cummins, Detroit Diesel, International, Mack and Volvo.

## Discover the Difference

Cat ELC is developed, tested and approved by Caterpillar to meet the same high standards as all Genuine Cat Parts.

- **Factory-Fill**—Used as standard factory-fill for all Cat machine cooling systems.
- **Lower Maintenance Costs**—Reduces engine coolant and additive costs by as much as 500% compared to conventional coolants. It eliminates the need for supplemental coolant additives, extends coolant change-out intervals and reduces disposal requirements.
- **Advanced Metal Protection**—Incorporates an advanced formula technology with organic acid additive corrosion inhibitors, such as a combination of mono and dicarboxylates for maximum protection of copper, solder, brass, steel, cast iron and aluminum.

**CATERPILLAR<sup>®</sup>**

## Cat ELC for Maximum Coolant Life

### Cat DEAC™

 **3000 Hour Life or 333,000 km (200,000 miles)**  
Cat Supplemental Coolant Additives Every 250 Hours or 25,000 km (15,000 miles)

### Cat ELC (Machines and Commercial Engines)

 **12,000 Hour Life or 6 Years\*\***  
(whichever comes first)  
Cat Extender Every 6000 Hours\*

### Cat ELC (Truck Engines)

 **1,000,000 km (600,000 miles) or 6 Years\*\***  
(whichever comes first)  
Cat Extender Every 500,000 km (300,000 miles)\*

\* Or one-half of the coolant service life.

\*\* These coolant change intervals are only possible with annual S-O-S Level 2 coolant sampling and analysis.

### Typical Characteristics\*

|   |                |
|---|----------------|
| Color   | Strawberry Red |
| Boiling protection with 15 psi (1 bar) radiator cap |                |
| 50% Cat ELC/50% water                               | 129°C (265°F)  |
| 60% Cat ELC/40% water (ELC concentrate added)       | 132°C (270°F)  |
| Freezing protection                                 |                |
| 50% Cat ELC/50% water                               | -37°C (-34°F)  |
| 60% Cat ELC/40% water (ELC concentrate added)       | -52°C (-62°F)  |
| Nitrite (50% solution)                              | 500 ppm        |
| Molybdate (50% solution)                            | 530 ppm        |

\*The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.

## S-O-S<sup>SM</sup> services for early problem detection

Protect your investment with Cat S-O-S Coolant Analysis, the ultimate detection and diagnostic tool for your equipment. We recommend S-O-S Level 1 Coolant Analysis according to the engine's Operation and Maintenance Manual, and Level 2 Coolant Analysis annually for all your Cat equipment.

## Cat ELC Extender for Longer Life

- Exceeds Cat EC-1 performance requirements
- Protects against cylinder liner/block pitting and cavitation erosion
- Should be added at 500,000 km (300,000 miles) for Cat powered on-highway trucks and 6,000 hours for commercial engines
- Extender is only necessary once during the life of the coolant
- Ensures Cat ELC performance to 1,000,000 km (600,000 miles) or 12,000 hours

## Cat ELC Extender and Flush Intervals

Cat ELC Extender should be added after 6,000 hours or 300,000 miles (500,000 km) of operation, and the system should be drained and flushed with clean water after 12,000 hours or 600,000 miles (1,000,000 km). No cleaning agents are needed. If S-O-S<sup>SM</sup> Services are used regularly, safe operation with Cat ELC may extend beyond 12,000 hours.

## Health and Safety

Under normal conditions of intended use, this product does not pose a risk to health. Excessive exposure may result in eye, skin or respiratory irritation. Always observe good hygiene measures. Read and understand the Material Safety Data Sheet (MSDS) before using this product. For a copy of the MSDS, visit us on the web at [www.catmsds.com](http://www.catmsds.com).

## CAT® DEALERS DEFINE WORLD-CLASS PRODUCT SUPPORT.

We offer you the right parts and service solutions, when and where you need them.

The Cat Dealer network of highly trained experts can help you maximize your equipment investment.



**Section 2**  
**Generator Data**

**GENERATOR DETAIL****FEBRUARY 29, 2016**For Help Desk Phone Numbers [Click here](#)**Selected Model**

**Engine:** C15      **Generator Frame:** LC7024F      **Genset Rating (kW):** 500.0      **Line Voltage:** 208  
**Fuel:** Diesel      **Generator Arrangement:** 4183897      **Genset Rating (kVA):** 625.0      **Phase Voltage:** 120  
**Frequency:** 60      **Excitation Type:** AREP      **Pwr. Factor:** 0.8      **Rated Current:** 1734.8  
**Duty:** STANDBY      **Connection:** PARALLEL STAR      **Application:** EPG      **Status:** Current

Version: 41764 /42186 /41431 /16667

**Spec Information**

| Generator Specification           |                 |                                | Generator Efficiency |           |                     |
|-----------------------------------|-----------------|--------------------------------|----------------------|-----------|---------------------|
| <b>Frame:</b> LC7024F             | <b>Type:</b> LC | <b>No. of Bearings:</b> 1      | <b>Per Unit Load</b> | <b>kW</b> | <b>Efficiency %</b> |
| <b>Winding Type:</b> RANDOM WOUND |                 | <b>Flywheel:</b> 14.0          | 0.25                 | 125.0     | 91.3                |
| <b>Connection:</b> PARALLEL STAR  |                 | <b>Housing:</b> 1              | 0.5                  | 250.0     | 93.6                |
| <b>Phases:</b> 3                  |                 | <b>No. of Leads:</b> 12        | 0.75                 | 375.0     | 93.8                |
| <b>Poles:</b> 4                   |                 | <b>Wires per Lead:</b> 2       | 1.0                  | 500.0     | 93.2                |
| <b>Sync Speed:</b> 1800           |                 | <b>Generator Pitch:</b> 0.6667 |                      |           |                     |

| Reactances                             | Per Unit | Ohms   |
|--|----------|--------|
| SUBTRANSIENT - DIRECT AXIS $X''_d$     | 0.1589   | 0.0110 |
| SUBTRANSIENT - QUADRATURE AXIS $X''_q$ | 0.1878   | 0.0130 |
| TRANSIENT - SATURATED $X'_d$           | 0.1994   | 0.0138 |
| SYNCHRONOUS - DIRECT AXIS $X_d$        | 3.8355   | 0.2655 |
| SYNCHRONOUS - QUADRATURE AXIS $X_q$    | 2.3013   | 0.1593 |
| NEGATIVE SEQUENCE $X_2$                | 0.1734   | 0.0120 |
| ZERO SEQUENCE $X_0$                    | 0.0116   | 0.0008 |

| Time Constants   | Seconds |
|--|---------|
| OPEN CIRCUIT TRANSIENT - DIRECT AXIS $T'_{d0}$         | 1.9290  |
| SHORT CIRCUIT TRANSIENT - DIRECT AXIS $T'_d$           | 0.1000  |
| OPEN CIRCUIT SUBTRANSIENT - DIRECT AXIS $T''_{d0}$     | 0.0130  |
| SHORT CIRCUIT SUBTRANSIENT - DIRECT AXIS $T''_d$       | 0.0100  |
| OPEN CIRCUIT SUBTRANSIENT - QUADRATURE AXIS $T''_{q0}$ | 0.1220  |
| SHORT CIRCUIT SUBTRANSIENT - QUADRATURE AXIS $T''_q$   | 0.0100  |
| EXCITER TIME CONSTANT $T_e$                            | 0.0300  |
| ARMATURE SHORT CIRCUIT $T_a$                           | 0.0150  |

Short Circuit Ratio: 0.27

Stator Resistance = 0.0026 Ohms

Field Resistance = 0.325 Ohms

| Voltage Regulation  |      | Generator Excitation       |                              |                        |
|---|------|----------------------------|------------------------------|------------------------|
| <b>Voltage level adjustment:</b> +/-                      | 5.0% | <b>No Load</b>             | <b>Full Load, (rated) pf</b> |                        |
| <b>Voltage regulation, steady state:</b> +/-              | 0.5% |                            | <b>Series</b>                | <b>Parallel</b>        |
| <b>Voltage regulation with 3% speed change:</b> +/-       | 0.5% | <b>Excitation voltage:</b> | 8.04 Volts                   | 45.13 Volts      Volts |
| <b>Waveform deviation line - line, no load:</b> less than | 2.0% | <b>Excitation current</b>  | 0.67 Amps                    | 3.09 Amps      Amps    |
| <b>Telephone influence factor:</b> less than              | 50   |                            |                              |                        |

### Selected Model

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**Duty:** STANDBY      **Connection:** PARALLEL STAR      **Application:** EPG      **Status:** Current

Version: 41764 /42186 /41431 /16667

### Generator Mechanical Information

| Center of Gravity |           |           |
|-------------------|-----------|-----------|
| Dimension X       | -630.0 mm | -24.8 IN. |
| Dimension Y       | 0.0 mm    | 0.0 IN.   |
| Dimension Z       | 0.0 mm    | 0.0 IN.   |

- "X" is measured from driven end of generator and parallel to rotor. Towards engine fan is positive. See General Information for details
- "Y" is measured vertically from rotor center line. Up is positive.
- "Z" is measured to left and right of rotor center line. To the right is positive.

|                        |                     |                      |
|------------------------|---------------------|----------------------|
| Generator WT = 1405 kg | * Rotor WT = 520 kg | * Stator WT = 885 kg |
| 3,097 LB               | 1,146 LB            | 1,951 LB             |

Rotor Balance = 0.0508 mm deflection PTP  
 Overspeed Capacity = 125% of synchronous speed

| Generator Torsional Data                                 |                  |                        |  |                         |                        |                           |
|--|------------------|------------------------|--|-------------------------|------------------------|---------------------------|
|  |                  |                        |  |                         |                        |                           |
| <b>J1 = Coupling and Fan</b>                             |                  | <b>J2 = Rotor</b>      |  | <b>J3 = Exciter End</b> |                        |                           |
| <b>TOTAL J = J1 + J2 + J3</b>                            |                  |                        |  |                         |                        |                           |
| <b>K1 = Shaft Stiffness between J1 + J2 (Diameter 1)</b> |                  |                        | <b>K2 = Shaft Stiffness between J2 + J3 (Diameter 2)</b> |                         |                        |                           |
| <b>J1</b>  | <b>K1</b>        | <b>Min Shaft Dia 1</b> | <b>J2</b>  | <b>K2</b>               | <b>Min Shaft Dia 2</b> | <b>J3</b>                 |
| 7.6 LB IN. s <sup>2</sup>                                | 77.8 MLB IN./rad | 5.7 IN.                | 60.9 LB IN. s <sup>2</sup>                               | 75.6 MLB IN./rad        | 5.5 IN.                | 3.3 LB IN. s <sup>2</sup> |
| 0.86 N m s <sup>2</sup>                                  | 8.79 MN m/rad    | 145.0 mm               | 6.88 N m s <sup>2</sup>                                  | 8.54 MN m/rad           | 140.0 mm               | 0.37 N m s <sup>2</sup>   |
| <b>Total J</b>   |                  |                        |  |                         |                        |                           |
|  |                  |                        | 71.8 LB IN. s <sup>2</sup>                               |                         |                        |                           |
|  |                  |                        | 8.11 N m s <sup>2</sup>                                  |                         |                        |                           |

---

**Selected Model**

**Engine:** C15      **Generator Frame:** LC7024F      **Genset Rating (kW):** 500.0      **Line Voltage:** 208  
**Fuel:** Diesel      **Generator Arrangement:** 4183897      **Genset Rating (kVA):** 625.0      **Phase Voltage:** 120  
**Frequency:** 60      **Excitation Type:** AREP      **Pwr. Factor:** 0.8      **Rated Current:** 1734.8  
**Duty:** STANDBY      **Connection:** PARALLEL STAR      **Application:** EPG      **Status:** Current

Version: 41764 /42186 /41431 /16667

**Generator Cooling Requirements -  
Temperature - Insulation Data**

|  |  |
|--|--|
| <b>Cooling Requirements:</b>                                 | <b>Temperature Data: (Ambient 40 °C)</b> |
| <b>Heat Dissipated:</b> 36.5 kW                              | <b>Stator Rise:</b> 130.0 °C             |
| <b>Air Flow:</b> 72.0 m <sup>3</sup> /min                    | <b>Rotor Rise:</b> 130.0 °C              |
| <b>Insulation Class:</b> H                                   |  |
| <b>Insulation Reg. as shipped:</b> 100.0 MΩ minimum at 40 °C |  |

**Thermal Limits of Generator**

|                              |           |
|------------------------------|-----------|
| <b>Frequency:</b>            | 60 Hz     |
| <b>Line to Line Voltage:</b> | 208 Volts |
| <b>B BR 80/40</b>            | 528.0 kVA |
| <b>F BR -105/40</b>          | 600.6 kVA |
| <b>H BR - 125/40</b>         | 660.0 kVA |
| <b>F PR - 130/40</b>         | 660.0 kVA |
| <b>H PR - 150/40</b>         | 699.6 kVA |
| <b>H PR27 - 163/27</b>       | 726.0 kVA |

**Selected Model**

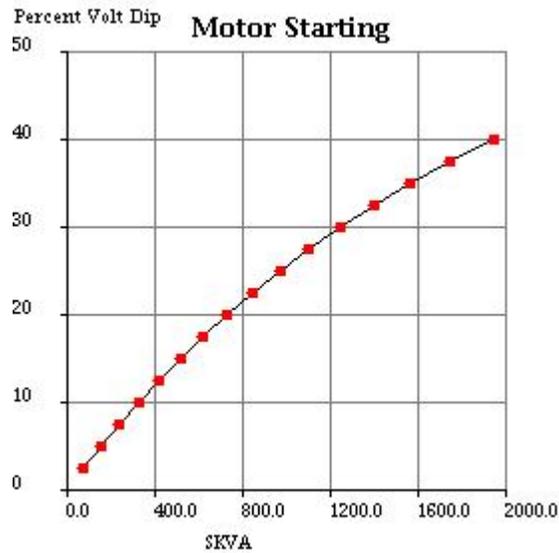
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Version: 41764 /42186 /41431 /16667

**Starting Capability & Current Decrement**

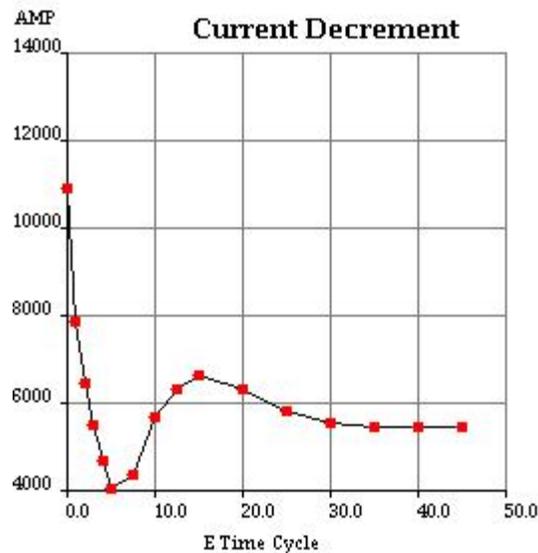
**Motor Starting Capability (0.6 pf)**

| SKVA  | Percent Volt Dip |
|-------|------------------|
| 75    | 2.5              |
| 153   | 5.0              |
| 236   | 7.5              |
| 323   | 10.0             |
| 416   | 12.5             |
| 514   | 15.0             |
| 617   | 17.5             |
| 728   | 20.0             |
| 845   | 22.5             |
| 970   | 25.0             |
| 1,104 | 27.5             |
| 1,248 | 30.0             |
| 1,402 | 32.5             |
| 1,567 | 35.0             |
| 1,747 | 37.5             |
| 1,941 | 40.0             |



**Current Decrement Data**

| E Time Cycle | AMP    |
|--------------|--------|
| 0.0          | 10,916 |
| 1.0          | 7,867  |
| 2.0          | 6,451  |
| 3.0          | 5,481  |
| 4.0          | 4,702  |
| 5.0          | 4,052  |
| 7.5          | 4,380  |
| 10.0         | 5,660  |
| 12.5         | 6,328  |
| 15.0         | 6,643  |
| 20.0         | 6,334  |
| 25.0         | 5,821  |
| 30.0         | 5,556  |
| 35.0         | 5,461  |
| 40.0         | 5,442  |
| 45.0         | 5,449  |



**Instantaneous 3 Phase Fault Current:** 10916 Amps      **Instantaneous Line - Line Fault Current:** 9021 Amps  
**Instantaneous Line - Neutral Fault Current:** 15092 Amps

**Selected Model**

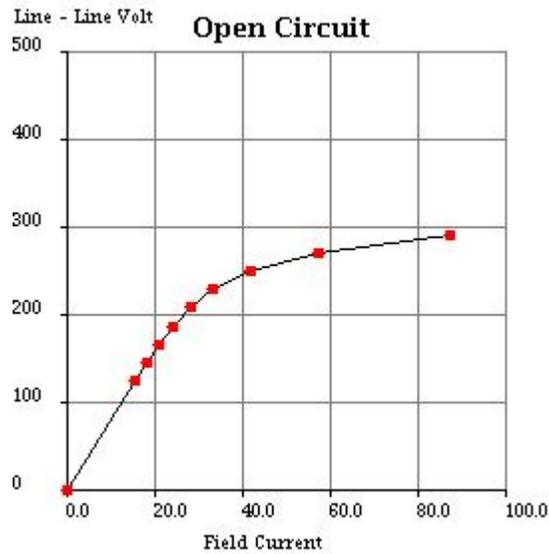
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**Generator Output Characteristic Curves**

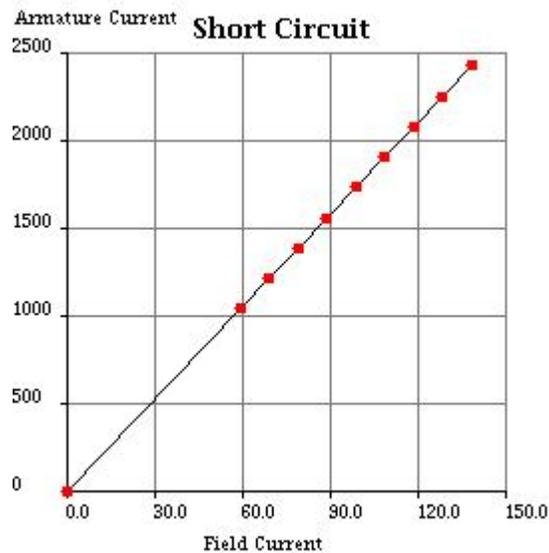
**Open Circuit Curve**

| Field Current | Line - Line Volt |
|---------------|------------------|
| 0.0           | 0                |
| 15.5          | 125              |
| 18.2          | 146              |
| 21.0          | 166              |
| 24.2          | 187              |
| 28.0          | 208              |
| 33.4          | 229              |
| 41.9          | 250              |
| 57.3          | 270              |
| 87.4          | 291              |



**Short Circuit Curve**

| Field Current | Armature Current |
|---------------|------------------|
| 0.0           | 0                |
| 59.2          | 1,041            |
| 69.1          | 1,214            |
| 78.9          | 1,388            |
| 88.8          | 1,561            |
| 98.7          | 1,735            |
| 108.6         | 1,908            |
| 118.4         | 2,082            |
| 128.3         | 2,255            |
| 138.2         | 2,429            |



**Selected Model**

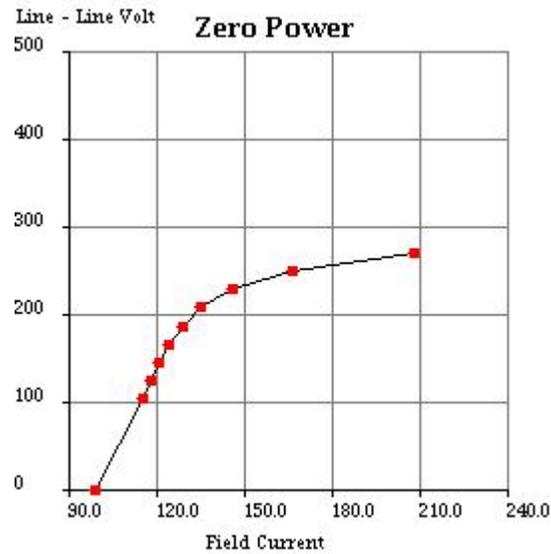
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Version: 41764 /42186 /41431 /16667

**Generator Output Characteristic Curves**

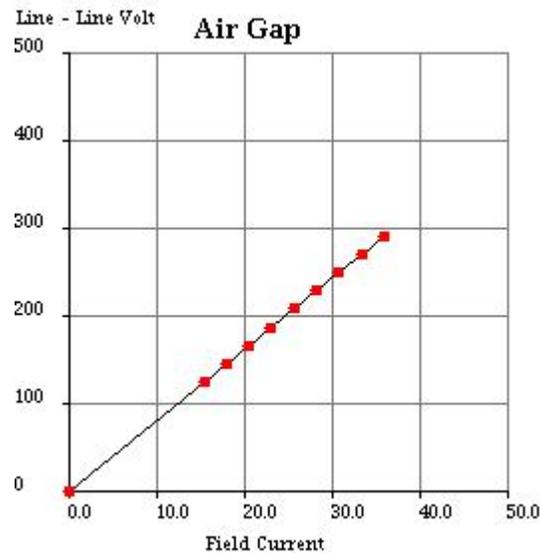
**Zero Power Factor Curve**

| Field Current | Line - Line Volt |
|---------------|------------------|
| 98.7          | 0                |
| 115.0         | 104              |
| 117.8         | 125              |
| 120.8         | 146              |
| 124.2         | 166              |
| 128.6         | 187              |
| 135.1         | 208              |
| 146.1         | 229              |
| 166.7         | 250              |
| 208.1         | 270              |

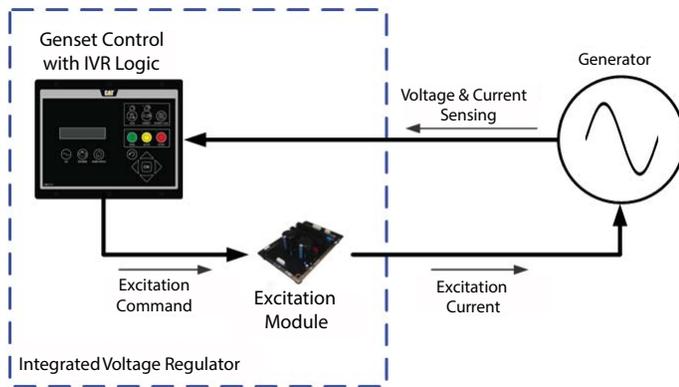


**Air Gap Curve**

| Field Current | Line - Line Volt |
|---------------|------------------|
| 0.0           | 0                |
| 15.4          | 125              |
| 17.9          | 146              |
| 20.5          | 166              |
| 23.0          | 187              |
| 25.6          | 208              |
| 28.2          | 229              |
| 30.7          | 250              |
| 33.3          | 270              |
| 35.8          | 291              |



# INTEGRATED VOLTAGE REGULATOR



## INTEGRATED VOLTAGE REGULATOR

The Integrated Voltage Regulator (IVR) is designed to provide robust, precise closed-loop control of the generator voltage, optimized transient performance and industry leading feature specification.

Caterpillar is leading the power generation marketplace with power solutions engineered to deliver unmatched flexibility, expandability, reliability and cost-effectiveness.

## FEATURES

When used with an Excitation Module, EMCP 4.3/4.4 and IVR-compatible EMCP 4.1/4.2 controllers offer:

- Automatic Voltage Regulation (AVR)
- Programmable stability settings
- Soft start control with an adjustable time setting in AVR control mode
- Dual Slope, Configurable Under Frequency (Volts/Hz) regulation
- Three-phase or single-phase generator voltage (RMS) sensing/regulation in AVR mode
- Setpoint adjustment from the EMCP display or Cat® ET ServiceTool
- IVR Operating Status and Voltage Bias Overview screens to provide an enhanced level of user interface
- Integrated Voltage Regulator event monitoring

EMCP 4.3/4.4 and IVR-compatible EMCP 4.2 controllers also offer:

- Power Factor Regulation (PF)
- Reactive Droop compensation
- Line drop compensation

## WORLDWIDE PRODUCT SUPPORT

- Worldwide parts availability through the Cat dealer network
- Over 1,800 dealer branch stores operating in 200 countries
- The best product support record in the industry
- Cat dealers provide extensive post sale support including maintenance and repair agreements

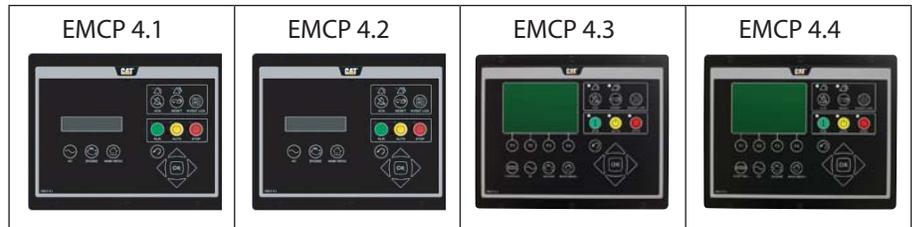
## COMPLETE SYSTEM INTEGRATION

Fully designed and factory tested to work seamlessly with Cat generators using Self Excitation (SE), Internal Excitation (IE) or Permanent Magnet (PMG) excitation systems and EMCP controls.

# INTEGRATED VOLTAGE REGULATOR



## INTEGRATED VOLTAGE REGULATOR FEATURE SPECIFICATION

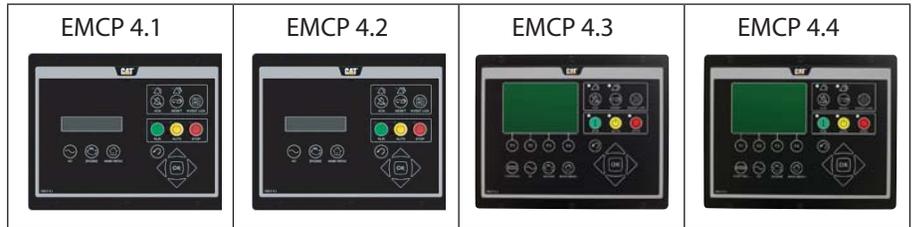


| <b>SPECIFICATIONS</b>                             |       |        |        |        |
|---|-------|--------|--------|--------|
| No Load to Full Load Regulation                   | ±0.5% | ±0.25% | ±0.25% | ±0.25% |
| Configurable Volts / Hz Characteristic            | •     | •      | •      | •      |
| Configurable Knee Frequency                       | •     | •      | •      | •      |
| Regulator Response Time                           | 10 ms | 10 ms  | 5 ms   | 5 ms   |
| Single and Three Phase Sensing                    | •     | •      | •      | •      |
| Voltage Adjustment Range (Configurable up to)     | ± 30% | ± 30%  | ± 30%  | ± 30%  |
| <b>CONTROL</b>                                    |       |        |        |        |
| Dual Slope Configurable Volts / Hz Characteristic | •     | •      | •      | •      |
| Excitation Enable / Disable Selection             | •     | •      | •      | •      |
| Line Loss (I <sup>2</sup> R) Compensation         | –     | •      | •      | •      |
| Reactive Droop Compensation                       | –     | •      | •      | •      |
| Power Factor Control Mode                         | –     | •      | •      | •      |
| <b>PROTECTION / ALARMS</b>                        |       |        |        |        |
| Generator Overvoltage                             | •     | •      | •      | •      |
| Generator Undervoltage                            | •     | •      | •      | •      |
| Over Excitation                                   | •     | •      | •      | •      |
| Loss of Sensing                                   | •     | •      | •      | •      |
| Generator Reverse VARs                            | –     | •      | •      | •      |
| Event Log   | •     | •      | •      | •      |
| <b>METERING</b>                                   |       |        |        |        |
| EMCP AC Metering                                  | •     | •      | •      | •      |
| EMCP Power Metering                               | –     | •      | •      | •      |
| Excitation Command Percentage                     | •     | •      | •      | •      |
| Operating Mode Status Indication                  | •     | •      | •      | •      |

# INTEGRATED VOLTAGE REGULATOR



## INTEGRATED VOLTAGE REGULATOR FEATURE SPECIFICATION (continued)



| VOLTAGE ADJUSTMENT                                      |          |          |              |              |
|---|----------|----------|--------------|--------------|
| EMCP 4 Display Voltage Bias                             | •        | •        | •            | •            |
| Digital Input (Raise / Lower) Voltage Bias <sup>1</sup> | •        | •        | •            | •            |
| Potentiometer Voltage Bias <sup>1</sup>                 | •        | •        | •            | •            |
| Analog Voltage Bias – Voltage Range <sup>1</sup>        | 0V to 5V | 0V to 5V | -10V to +10V | -10V to +10V |
| Analog Voltage Bias – Current Range <sup>1</sup>        | –        | –        | 0mA to 20mA  | 0mA to 20mA  |
| Analog Voltage Bias – PWM Range <sup>1</sup>            | –        | –        | 0% to 100%   | 0% to 100%   |
| SCADA (Modbus) Voltage Bias                             | –        | •        | •            | •            |

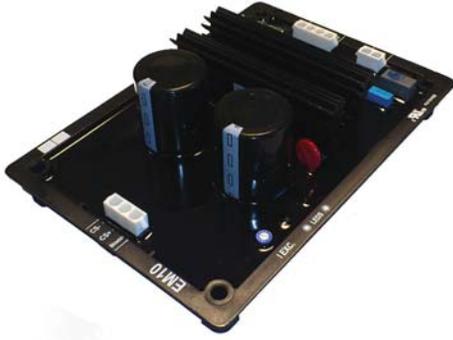
<sup>1</sup>Requires an available input on the EMCP 4.

# INTEGRATED VOLTAGE REGULATOR

## EXCITATION MODULE SPECIFICATION



The Integrated Voltage Regulator consists of an EMCP 4 interfacing with an Excitation Module. There are a range of Excitation Modules available to match Cat generator sets.



**Figure 1:**  
EM10 Excitation Module



**Figure 2:**  
EM15 Excitation Module

### EXCITATION MODULE TECHNICAL SPECIFICATION

|  | EM10   | EM15     |
|--|--|----------|
| Compatible Generator Excitation Types  | Self Excitation (SE)<br>Internal Excitation (IE)<br>Permanent Magnet (PMG) |          |
| Nominal Field Current Output           | 6 Amps   | 7 Amps   |
| Maximum (forcing) Field Current Output | 10 Amps  | 15 Amps  |
| Maximum AC Voltage Input               | 180 Vrms   | 240 Vrms |

For more information on the Excitation Module refer to the component spec sheet.

# INTEGRATED VOLTAGE REGULATOR



## EMCP 4 DISPLAY

### EXAMPLE SCREENS – EMCP 4.1/4.2

| VOLTS / Hz     |       |
|----------------|-------|
| TARGET VOLT    | 480 V |
| EXCITATION CMD | 4.5 % |

Figure 3: IVR Overview Screen

| VOLTAGE BIAS OVERVIEW |       |
|-----------------------|-------|
| MANUAL                | 10.0% |
| ANALOG                | 2.0%  |

|       |       |
|-------|-------|
| DROOP | -2.0% |
| TOTAL | 10.0% |

Figure 4: Voltage Bias Overview Screens

### EXAMPLE SCREENS – EMCP 4.3/4.4

| IVR OVERVIEW       |           |
|--------------------|-----------|
| OPERATING MODE:    |           |
| VOLTS / Hz         |           |
| TARGET VOLTAGE     | 480 V     |
| EXCITATION COMMAND | 4.5 %     |
| COMPENSATION       | DROOP     |
| GENSET             | PAGE DOWN |

Figure 5: IVR Overview Screen

| VOLTAGE BIAS OVERVIEW   |         |
|-------------------------|---------|
| ACTIVE VOLTAGE BIASING: |         |
| MANUAL                  | 10.0%   |
| ANALOG INPUT            | 2.0%    |
| DROOP                   | -2.0%   |
| TOTAL BIAS              | 10.0%   |
| GENSET                  | PAGE UP |

Figure 6: Voltage Bias Overview Screen

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Materials and specifications are subject to change without notice.  
 The International System of Units (SI) is used in this publication.

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**Section 3**  
**Main Line Circuit Breaker**

# C15 / C18 Circuit Breakers



## Manually Operated Circuit Breakers

| Current (A) | Frame | Number of Poles | Interrupting Ratings (kA rms) |      |      | Trip Units               | Lugs  | Auxiliary Options   |
|-------------|-------|-----------------|-------------------------------|------|------|--------------------------|---|---|
|             |       |                 | 240V                          | 480V | 600V |                          |   |   |
| 250         | T4N   | 3               | 65                            | 25   | 18   | Electronic LS/I (S or I) | 6 AWG - 350 kcmil                               | 1 Form C + 1 Bell Alarm 250VAC/VDC<br>Shunt Trip 24VDC      |
| 400         | T5N   | 3               | 65                            | 25   | 18   |                          | 3/0 - 250 kcmil (LOAD) (1) 250-500 kcmil (LINE) |   |
| 600         | T6N   | 3               | 65                            | 35   | 20   |                          | 2/0 - 400 kcmil                                 | 1 Form C + 1 Bell Alarm 400VAC / 250VDC<br>Shunt Trip 24VDC |
| 800         | T6N   | 3               | 65                            | 35   | 20   |                          | 2/0 - 400 kcmil                                 |   |
| 1200        | T7S   | 3               | 65                            | 50   | 25   |                          | 4/0 - 500 kcmil                                 |   |
| 1600        | R     | 3               | 65                            | 35   | 18   |                          | BUS BAR   |   |
| 2000        | R     | 3               | 65                            | 35   | 18   | Electronic LSI           | BUS BAR   | Form C (1NO + 1NC)<br>Shunt Trip 24VDC                      |
| 2500        | R     | 3               | 65                            | 35   | 18   |                          |   | BUS BAR   |

## Electrically Operated C15 & C18 Circuit Breakers

| Current (A) | Frame | Number of Poles | Interrupting Ratings (kA rms) |      |      | Trip Units     | Lugs            | Auxiliary Options             |
|-------------|-------|-----------------|-------------------------------|------|------|----------------|-----------------|-------------------------------|
|             |       |                 | 240V                          | 480V | 600V |                |                 |                               |
| 800         | T6N   | 3               | 65                            | 35   | 20   | Electronic LSI | 2/0 - 400 kcmil | 3 Form C + 1 Bell Alarm 24Vdc |
| 1200        | T7M-S | 3               | 65                            | 50   | 25   |                | 4/0 - 500 kcmil | 2 Form C + 1 Bell Alarm 24Vdc |

**PowerPact® M-, P- and R-Frame, and Compact® NS630b–NS3200 Circuit Breakers**  
**PowerPact® R-Frame Circuit Breakers**

**Table 47: UL/IEC Rated, Unit-Mount, Manually-Operated, 100%-Rated Electronic Trip Circuit Breakers with Micrologic® Electronic Trip Units**

| Trip Unit, Interchangeable, 3P, 4P <sup>1</sup>          |             | Circuit Breaker Catalog Number (Prefix Required) |                                |              |              |              |              |              |              |              |
|--|-------------|--|--------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|  |             | Prefix   | Current Rating (Sensor Rating) |              |              |              |              |              |              |              |
| Type   |             |  | 600 A                          | 800 A        | 1000 A       | 1200 A       | 1600 A       | 2000 A       | 2500 A       | 3000 A       |
| Micrologic Standard Trip Unit                            | 3.0 (LI)    | RGF  | 36060CU31A                     | 36080CU31A   | 36100CU31A   | 36120CU31A   | 36160CU31A   | 36200CU31A   | 36250CU31A   | 36300CU31A   |
|  |             | RJF  | 36060CU31A                     | 36080CU31A   | 36100CU31A   | 36120CU31A   | 36160CU31A   | 36200CU31A   | 36250CU31A   | 36300CU31A   |
|  |             | RKF  | 36060CU31A                     | 36080CU31A   | 36100CU31A   | 36120CU31A   | 36160CU31A   | 36200CU31A   | 36250CU31A   | 36300CU31A   |
|  |             | RLF  | 36060CU31A                     | 36080CU31A   | 36100CU31A   | 36120CU31A   | 36160CU31A   | 36200CU31A   | 36250CU31A   | 36300CU31A   |
|  | 5.0 (LSI)   | RGF  | 36060CU33A                     | 36080CU33A   | 36100CU33A   | 36120CU33A   | 36160CU33A   | 36200CU33A   | 36250CU33A   | 36300CU33A   |
|  |             | RJF  | 36060CU33A                     | 36080CU33A   | 36100CU33A   | 36120CU33A   | 36160CU33A   | 36200CU33A   | 36250CU33A   | 36300CU33A   |
|  |             | RKF  | 36060CU33A                     | 36080CU33A   | 36100CU33A   | 36120CU33A   | 36160CU33A   | 36200CU33A   | 36250CU33A   | 36300CU33A   |
|  |             | RLF  | 36060CU33A                     | 36080CU33A   | 36100CU33A   | 36120CU33A   | 36160CU33A   | 36200CU33A   | 36250CU33A   | 36300CU33A   |
| Micrologic Ammeter Trip Unit <sup>2</sup>                | 3.0A (LI)   | RGF  | 36060CU41A                     | 36080CU41A   | 36100CU41A   | 36120CU41A   | 36160CU41A   | 36200CU41A   | 36250CU41A   | 36300CU41A   |
|  |             | RJF  | 36060CU41A                     | 36080CU41A   | 36100CU41A   | 36120CU41A   | 36160CU41A   | 36200CU41A   | 36250CU41A   | 36300CU41A   |
|  |             | RKF  | 36060CU41A                     | 36080CU41A   | 36100CU41A   | 36120CU41A   | 36160CU41A   | 36200CU41A   | 36250CU41A   | 36300CU41A   |
|  |             | RLF  | 36060CU41A                     | 36080CU41A   | 36100CU41A   | 36120CU41A   | 36160CU41A   | 36200CU41A   | 36250CU41A   | 36300CU41A   |
|  | 5.0A (LSI)  | RGF  | 36060CU43A                     | 36080CU43A   | 36100CU43A   | 36120CU43A   | 36160CU43A   | 36200CU43A   | 36250CU43A   | 36300CU43A   |
|  |             | RJF  | 36060CU43A                     | 36080CU43A   | 36100CU43A   | 36120CU43A   | 36160CU43A   | 36200CU43A   | 36250CU43A   | 36300CU43A   |
|  |             | RKF  | 36060CU43A                     | 36080CU43A   | 36100CU43A   | 36120CU43A   | 36160CU43A   | 36200CU43A   | 36250CU43A   | 36300CU43A   |
|  |             | RLF  | 36060CU43A                     | 36080CU43A   | 36100CU43A   | 36120CU43A   | 36160CU43A   | 36200CU43A   | 36250CU43A   | 36300CU43A   |
|  | 6.0A (LSIG) | RGF  | 36060CU44A                     | 36080CU44A   | 36100CU44A   | 36120CU44A   | 36160CU44A   | 36200CU44A   | 36250CU44A   | 36300CU44A   |
|  |             | RJF  | 36060CU44A                     | 36080CU44A   | 36100CU44A   | 36120CU44A   | 36160CU44A   | 36200CU44A   | 36250CU44A   | 36300CU44A   |
|  |             | RKF  | 36060CU44A                     | 36080CU44A   | 36100CU44A   | 36120CU44A   | 36160CU44A   | 36200CU44A   | 36250CU44A   | 36300CU44A   |
|  |             | RLF  | 36060CU44A                     | 36080CU44A   | 36100CU44A   | 36120CU44A   | 36160CU44A   | 36200CU44A   | 36250CU44A   | 36300CU44A   |
| Micrologic Power Trip Unit with Modbus® Communications   | 5.0P (LSI)  | RGF  | 36060CU63AE1                   | 36080CU63AE1 | 36100CU63AE1 | 36120CU63AE1 | 36160CU63AE1 | 36200CU63AE1 | 36250CU63AE1 | 36300CU63AE1 |
|  |             | RJF  | 36060CU63AE1                   | 36080CU63AE1 | 36100CU63AE1 | 36120CU63AE1 | 36160CU63AE1 | 36200CU63AE1 | 36250CU63AE1 | 36300CU63AE1 |
|  |             | RKF  | 36060CU63AE1                   | 36080CU63AE1 | 36100CU63AE1 | 36120CU63AE1 | 36160CU63AE1 | 36200CU63AE1 | 36250CU63AE1 | 36300CU63AE1 |
|  |             | RLF  | 36060CU63AE1                   | 36080CU63AE1 | 36100CU63AE1 | 36120CU63AE1 | 36160CU63AE1 | 36200CU63AE1 | 36250CU63AE1 | 36300CU63AE1 |
|  | 6.0P (LSIG) | RGF  | 36060CU64AE1                   | 36080CU64AE1 | 36100CU64AE1 | 36120CU64AE1 | 36160CU64AE1 | 36200CU64AE1 | 36250CU64AE1 | 36300CU64AE1 |
|  |             | RJF  | 36060CU64AE1                   | 36080CU64AE1 | 36100CU64AE1 | 36120CU64AE1 | 36160CU64AE1 | 36200CU64AE1 | 36250CU64AE1 | 36300CU64AE1 |
|  |             | RKF  | 36060CU64AE1                   | 36080CU64AE1 | 36100CU64AE1 | 36120CU64AE1 | 36160CU64AE1 | 36200CU64AE1 | 36250CU64AE1 | 36300CU64AE1 |
|  |             | RLF  | 36060CU64AE1                   | 36080CU64AE1 | 36100CU64AE1 | 36120CU64AE1 | 36160CU64AE1 | 36200CU64AE1 | 36250CU64AE1 | 36300CU64AE1 |
| Micrologic Harmonic Trip Unit with Modbus Communications | 5.0H (LSI)  | RGF  | 36060CU73AE1                   | 36080CU73AE1 | 36100CU73AE1 | 36120CU73AE1 | 36160CU73AE1 | 36200CU73AE1 | 36250CU73AE1 | 36300CU73AE1 |
|  |             | RJF  | 36060CU73AE1                   | 36080CU73AE1 | 36100CU73AE1 | 36120CU73AE1 | 36160CU73AE1 | 36200CU73AE1 | 36250CU73AE1 | 36300CU73AE1 |
|  |             | RKF  | 36060CU73AE1                   | 36080CU73AE1 | 36100CU73AE1 | 36120CU73AE1 | 36160CU73AE1 | 36200CU73AE1 | 36250CU73AE1 | 36300CU73AE1 |
|  |             | RLF  | 36060CU73AE1                   | 36080CU73AE1 | 36100CU73AE1 | 36120CU73AE1 | 36160CU73AE1 | 36200CU73AE1 | 36250CU73AE1 | 36300CU73AE1 |
|  | 6.0H (LSIG) | RGF  | 36060CU74AE1                   | 36080CU74AE1 | 36100CU74AE1 | 36120CU74AE1 | 36160CU74AE1 | 36200CU74AE1 | 36250CU74AE1 | 36300CU74AE1 |
|  |             | RJF  | 36060CU74AE1                   | 36080CU74AE1 | 36100CU74AE1 | 36120CU74AE1 | 36160CU74AE1 | 36200CU74AE1 | 36250CU74AE1 | 36300CU74AE1 |
|  |             | RKF  | 36060CU74AE1                   | 36080CU74AE1 | 36100CU74AE1 | 36120CU74AE1 | 36160CU74AE1 | 36200CU74AE1 | 36250CU74AE1 | 36300CU74AE1 |
|  |             | RLF  | 36060CU74AE1                   | 36080CU74AE1 | 36100CU74AE1 | 36120CU74AE1 | 36160CU74AE1 | 36200CU74AE1 | 36250CU74AE1 | 36300CU74AE1 |

<sup>1</sup> For 4P, replace the leading 3 in the catalog number following the prefix with a 4 (RPF36060CU31A becomes RGF46060CU31A).

<sup>2</sup> Add E1 suffix for Modbus communications.

# PowerPact® M-, P- and R-Frame, and Compact® NS630b–NS3200 Circuit Breakers Electronic Trip Systems

**Table 16: Micrologic® Trip Unit Features (continued)**

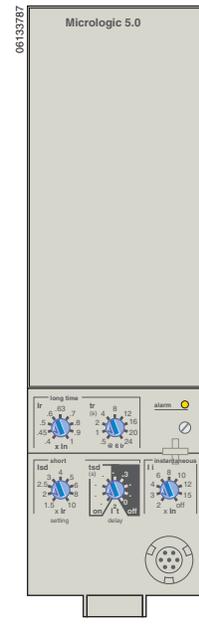
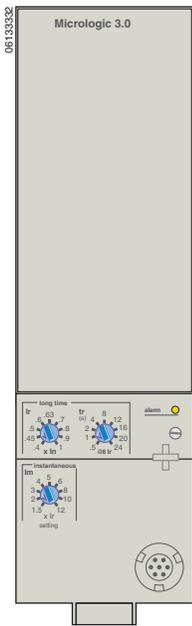
| Feature                                  | Micrologic Trip Unit (X = Standard Feature O = Available Option) |     |     |         |      |      |      |       |      |           |      |
|--|--|-----|-----|---------|------|------|------|-------|------|-----------|------|
|  | Standard   |     |     | Ammeter |      |      |      | Power |      | Harmonics |      |
|  | 2.0  | 3.0 | 5.0 | 2.0A    | 3.0A | 5.0A | 6.0A | 5.0P  | 6.0P | 5.0H      | 6.0H |
| Zone-Selective Interlocking <sup>3</sup> |  |     |     | X       |      | X    | X    | X     | X    | X         | X    |
| Communications                           |  |     |     | O       | O    | O    | O    | X     | X    | X         | X    |
| LCD Dot Matrix Display                   |  |     |     |         |      |      |      | X     | X    | X         | X    |
| Advanced User Interface                  |  |     |     |         |      |      |      | X     | X    | X         | X    |
| Protective Relay Functions               |  |     |     |         |      |      |      | X     | X    | X         | X    |
| Neutral Protection <sup>1</sup>          |  |     |     |         |      |      |      | X     | X    | X         | X    |
| Contact Wear Indication                  |  |     |     |         |      |      |      | X     | X    | X         | X    |
| Incremental Fine Tuning of Settings      |  |     |     |         |      |      |      | X     | X    | X         | X    |
| Selectable Long-Time Delay Bands         |  |     |     |         |      |      |      | X     | X    | X         | X    |
| Power Measurement                        |  |     |     |         |      |      |      | X     | X    | X         | X    |
| Power Quality Measurements               |  |     |     |         |      |      |      |       |      | X         | X    |
| Waveform Capture                         |  |     |     |         |      |      |      |       |      | X         | X    |

<sup>1</sup> 3Ø, 4W circuits require either a neutral current transformer or a 4-pole breaker..

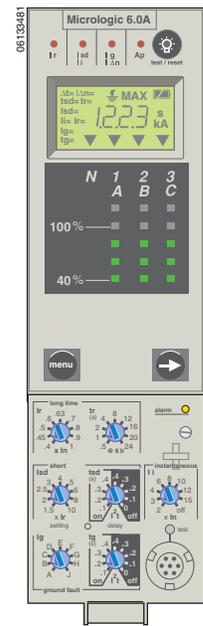
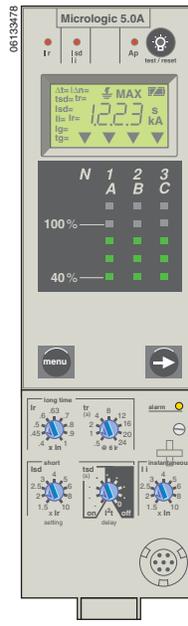
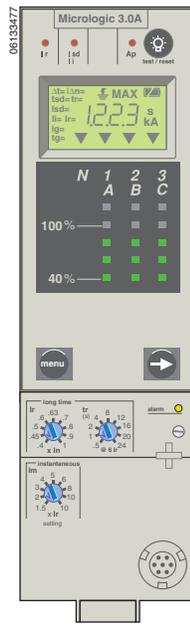
<sup>2</sup> Requires M6C Programmable Contact Module.

<sup>3</sup> Not available for 2.0A trip unit as upstream devices.

## Micrologic® 2.0, 3.0 and 5.0 Basic Trip Units

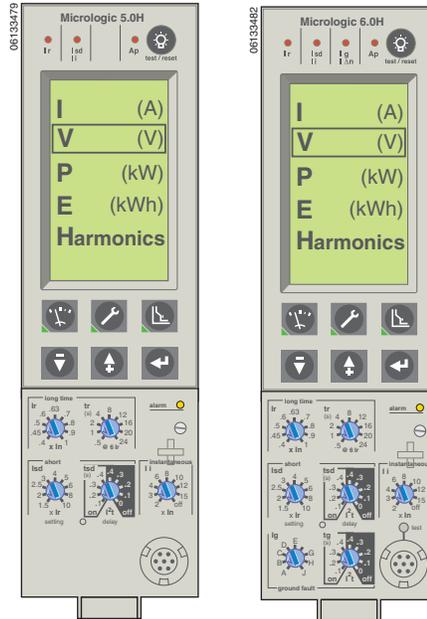
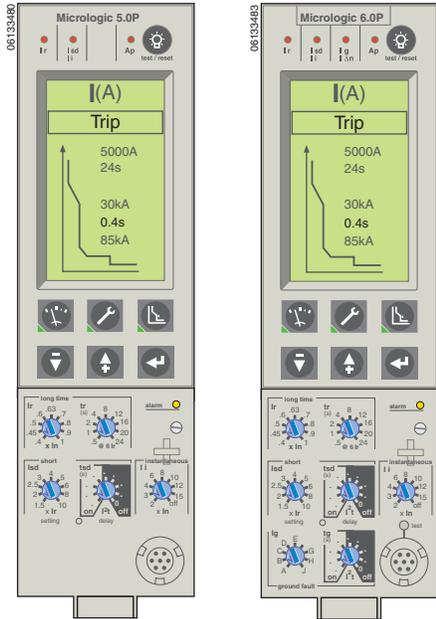


Micrologic 3.0 and 5.0 Basic Trip Units



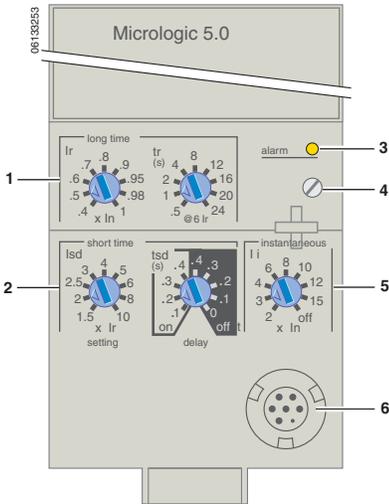
Micrologic 3.0A, 5.0A and 6.0A Trip Units

# PowerPact® M-, P- and R-Frame, and Compact® NS630b–NS3200 Circuit Breakers Electronic Trip Systems



Micrologic 5.0P and 6.0P Trip Units

Micrologic 5.0H and 6.0H Trip Units



- 1—Long-time current setting and tripping delay
- 2—Short-time pickup and tripping delay
- 3—Overload signal (LED)
- 4—Long-time rating plug screw
- 5—Instantaneous pickup
- 6—Test connector

The Micrologic 2.0, 3.0, and 5.0 basic trip units protect power circuits.

## Protection Settings

Protection thresholds and delays are set using the rotary switches. A full-range of long-time settings are available via field-installable adjustable rating plugs.

- Overload protection
  - True RMS long-time protection
  - Thermal imaging: Active thermal imaging before and after tripping
- Short-circuit protection
  - Short-time RMS
  - Selection of  $I^2t$  type (ON or OFF) for short-time delay
- Instantaneous protection
- Neutral protection on four-pole circuit breakers

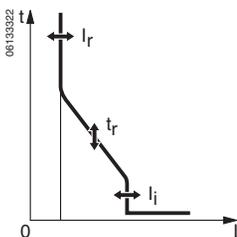
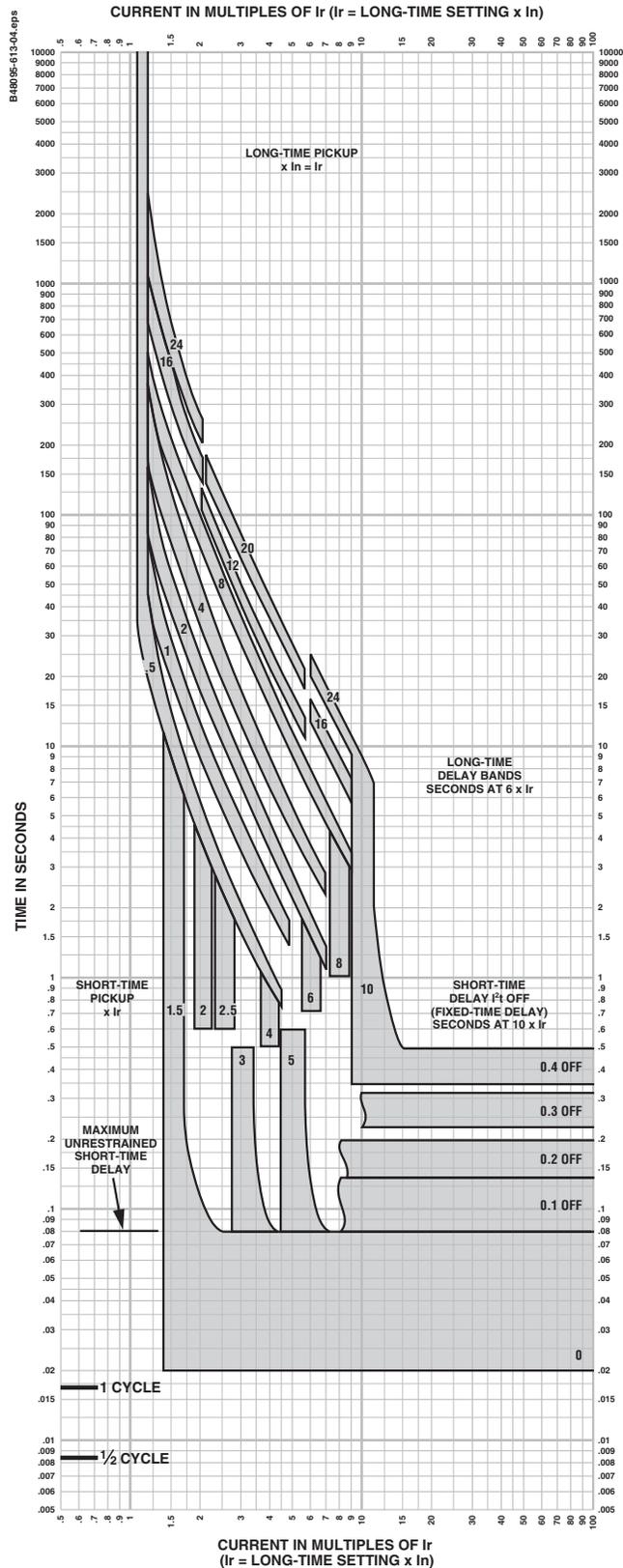


Table 17: Micrologic 2.0 and 3.0 Basic Trip Unit Settings

|                       |  | 2.0:                        | 0.40   | 0.50 | 0.60 | 0.70 | 0.80 | 0.90 | 0.95 | 0.98 | 1.00 |      |
|-----------------------|--|-----------------------------|--|------|------|------|------|------|------|------|------|------|
| Long-time Protection  | Current setting (A)                    |                             |  |      |      |      |      |      |      |      |      |      |
|                       | Tripping between 1.05 and 1.20 x $I_r$ | $I_r = I_n \times \dots$    | 3.0:   | 0.40 | 0.45 | 0.50 | 0.60 | 0.63 | 0.70 | 0.80 | 0.90 | 1.00 |
|                       |  |                             | Other ranges are available by changing rating plug |      |      |      |      |      |      |      |      |      |
| Long-time Protection  | Maximum Time Delay (s)                 | $t_r$ at 1.5 x $I_r$        | 12.5   | 25   | 50   | 100  | 200  | 300  | 400  | 500  | 600  |      |
|                       | Accuracy: 0 to -20%                    | $t_r$ at 6 x $I_r$          | 0.5  | 1    | 2    | 4    | 8    | 12   | 16   | 20   | 24   |      |
|                       |  | $t_r$ at 7.2 x $I_r$        | 0.34   | 0.69 | 1.38 | 2.7  | 5.5  | 8.3  | 11   | 13.8 | 16.6 |      |
|                       | Thermal Imaging                        |                             | 20 minutes before or after tripping                |      |      |      |      |      |      |      |      |      |
| Short-time Protection | Current Setting (A)                    |                             |  |      |      |      |      |      |      |      |      |      |
|                       | Accuracy: ±10%<br>No delay             | $I_{sd} = I_r \times \dots$ | 2.0:   | 1.5  | 2    | 2.5  | 3    | 4    | 5    | 6    | 8    | 10   |

# PowerPact® M-, P- and R-Frame, and Compact® NS630b–NS3200 Circuit Breakers Trip Curves

## Micrologic 5.0/6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Unit Characteristic Trip Curve



### Micrologic 5.0/6.0 A/P/H Trip Units

#### Long-Time Pickup and Delay Short-Time Pickup and I<sup>2</sup>t OFF Delay

The time-current curve information is to be used for application and coordination purposes only.

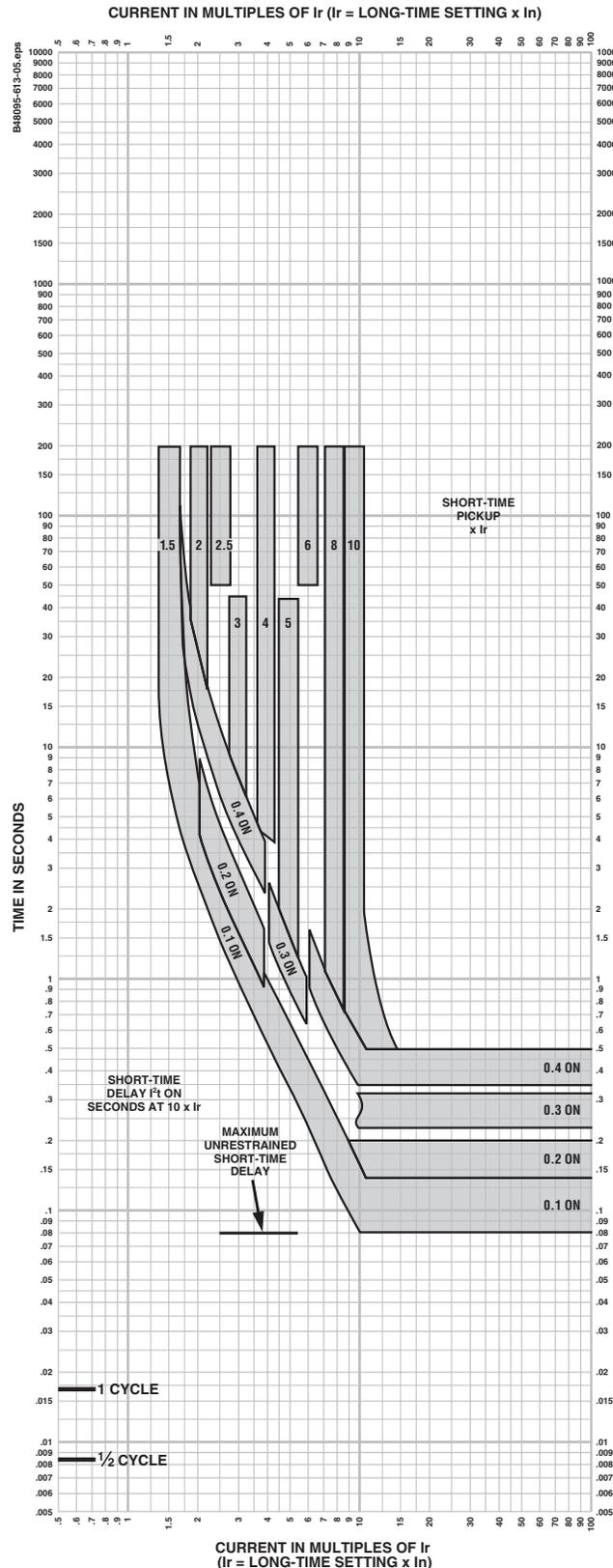
#### Notes:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. With zone-selective interlocking ON, short-time delay utilized, and no restraining signal, the maximum unrestrained short-time delay time band applies regardless of the setting.
4. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of the current.
5. For a withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 on page 134 for instantaneous trip curve. See table on page 138 for instantaneous override values.
6. Overload indicator illuminates at 100%.

Curve No. 0613TC0004  
Drawing No. B48095-613-04

# PowerPact® M-, P- and R-Frame, and Compact® NS630b–NS3200 Circuit Breakers Trip Curves

## Micrologic 5.0/6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Units Characteristic Trip Curve



### Micrologic 5.0/6.0 A/P/H Trip Units

#### Short-Time Pickup and $I^2t$ ON Delay

The time-current curve information is to be used for application and coordination purposes only.

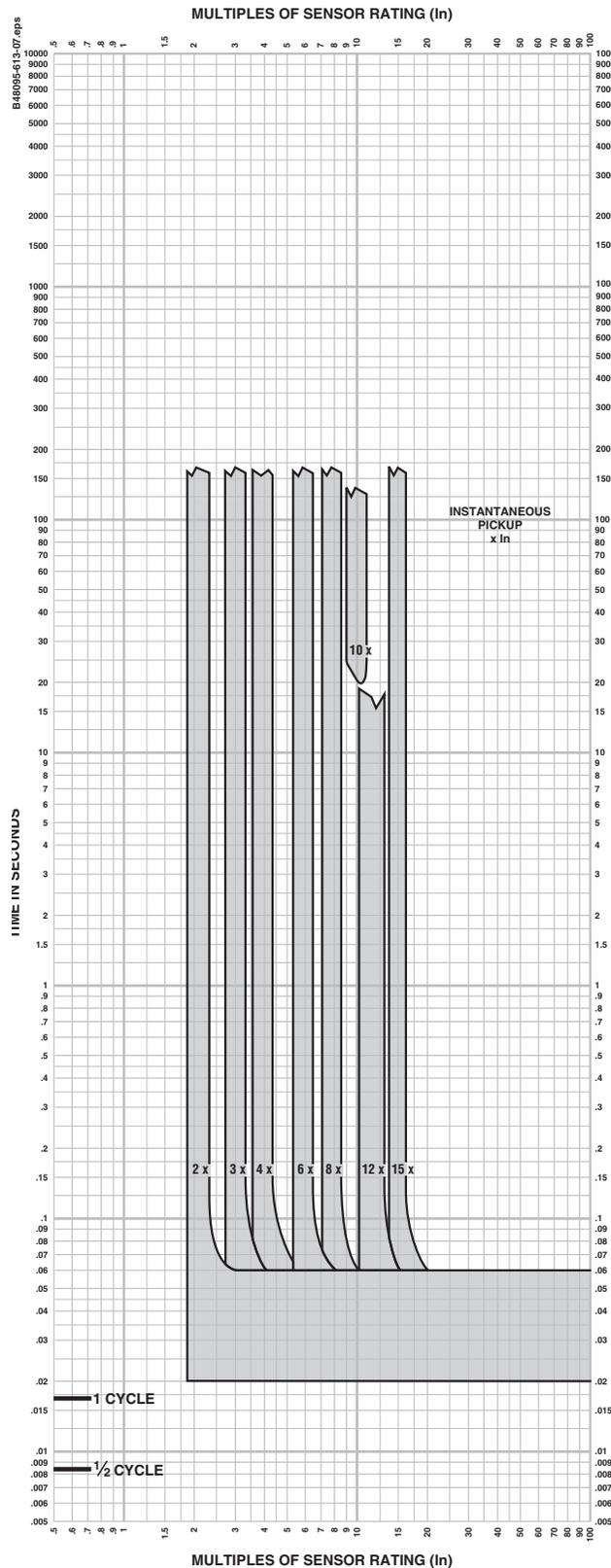
#### Notes:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. With zone-selective interlocking ON, short-time delay utilized, and no restraining signal, the maximum unrestrained short-time delay time band applies regardless of the setting.
4. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
5. For withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 on page 134 for instantaneous trip curve. See table on page 138 for instantaneous override values.
6. See Trip Curve 613-4 on page 132 for long-time pickup and delay trip curve.

Curve No. 0613TC0005  
Drawing No. B48095-613-05

# PowerPact® M-, P- and R-Frame, and Compact® NS630b–NS3200 Circuit Breakers Trip Curves

## Micrologic 5.0/6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Units Characteristic Trip Curve



### Micrologic 5.0/6.0 Trip Units

#### Instantaneous Pickup, 2X to 15X and OFF

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (- Notes:

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.
4. For a withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 on page 134 for the instantaneous trip curve. See table on page 138 for the instantaneous override values.
5. See trip curve 613-4 on page 132 and trip curve 613-5 on page 133 for long-time pickup, long-time delay, short-time pickup and short-time delay trip curves.

Curve No. 0613TC0007  
Drawing No. B48095-613-07

**Section 4**  
**Control Panel**

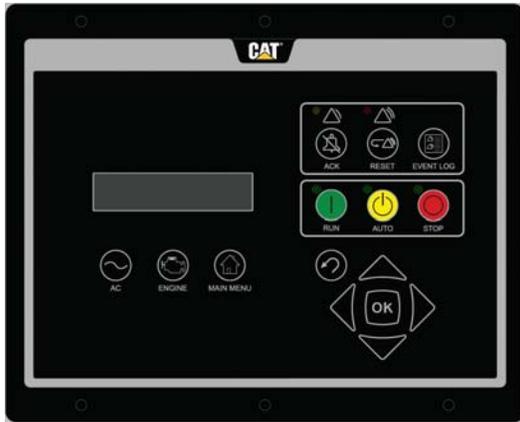


Image shown may not reflect actual package

## EMCP 4.2 GENERATOR SET CONTROLLER

Caterpillar is leading the power generation market place with power solutions engineered to deliver unmatched performance, reliability, durability and cost-effectiveness.

### FEATURES

#### GENERAL DESCRIPTION

The Cat<sup>®</sup> EMCP 4.2 offers fully featured power metering, protective relaying and engine and generator control and monitoring. Engine and generator controls, diagnostics, and operating information are accessible via the control panel keypads; diagnostics from the EMCP 4 optional modules can be viewed and reset through the EMCP 4.2.

#### FULL RANGE OF ATTACHMENTS

- Wide range of system expansion attachments, designed specifically to work with the EMCP 4.
- Flexible packaging options for easy and cost effective installation.

#### WORLD WIDE PRODUCT SUPPORT

- Cat dealers provide extensive pre and post sale support.
- Cat dealers have over 1,600 dealer branch stores operating in 200 countries.

#### FEATURES

- A 33 x 132 pixel, 3.8 inch, graphical display denotes text alarm/event descriptions, set points, engine and generator monitoring, and is visible in all lighting conditions.
- Textual display with support for 28 languages, including character languages such as Arabic, Chinese, and Japanese.
- Advanced engine monitoring is available on systems with an electronic engine control module.
- Integration with the Cat Digital Voltage Regulator (CDVR) provides enhanced system performance.
- Fully featured power metering, protective relaying, engine and generator parameter viewing, and expanded AC metering are all integrated into this controller.

- Real-time clock allows for date and time stamping of diagnostics and events in the control's logs as well as service maintenance reminders based on engine operating hours or calendar days.
- Up to 40 diagnostic events are stored in the non-volatile memory.
- Ability to view and reset diagnostics on EMCP 4 optional modules via the control panel removes the need for a separate service tool for troubleshooting.
- Set points and software stored in non-volatile memory, preventing loss during a power outage.
- Reduced power mode offers a low power state to minimize battery power requirements.
- Three levels of security allow for configurable operator privileges.
- Selectable units
  - Temperature: °C or °F
  - Pressure: psi, kPa, bar
  - Fuel Consumption: Gal/hr or Liter/hr

#### STANDARDS

- UL Recognized
- CSA C22.2 No.100,14, 94
- Complies with all necessary standards for CE Certification
  - 98/37/EC Machinery Directive
    - BS EN 60204-1 Safety of Machinery
  - 89/336/EEC EMC Directive
    - BS EN 50081-1 Emissions Standard
    - BS EN 50082-2 Immunity Standard
  - 73/23/EEC Low Voltage Directive
    - EN 50178 LVD Standard
- IEC529, IEC60034-5, IEC61131-3
- MIL STND 461

# EMCP 4.2 GENERATOR SET CONTROLLER

## STANDARD FEATURES

|                      |   |
|----------------------|---|
| Generator Monitoring | <ul style="list-style-type: none"> <li>• Voltage (L-L, L-N)</li> <li>• Current (Phase)</li> <li>• Average Volt, Amp, Frequency</li> <li>• kW, kVA, kVA (Average, Phase, %)</li> <li>• Power Factor (Average, Phase)</li> <li>• kW-hr, kVA-hr (total)</li> <li>• Excitation voltage and current (with CDVR)</li> <li>• Generator stator and bearing temp (with optional module)</li> </ul> |
| Generator Protection | <ul style="list-style-type: none"> <li>• Generator phase sequence</li> <li>• Over/Under voltage (27/59)</li> <li>• Over/Under frequency (81 O/U)</li> <li>• Reverse Power (kW) (32)</li> <li>• Reverse Reactive Power (kVA) (32RV)</li> <li>• Overcurrent (50/51)</li> </ul>  |
| Engine Monitoring    | <ul style="list-style-type: none"> <li>• Coolant temperature</li> <li>• Oil pressure</li> <li>• Engine speed (RPM)</li> <li>• Battery voltage</li> <li>• Run hours</li> <li>• Crank attempt and successful start counter</li> <li>• Enhanced engine monitoring (with electronic engines)</li> </ul>   |
| Engine Protection    | <ul style="list-style-type: none"> <li>• Control switch not in auto (alarm)</li> <li>• High coolant temp (alarm and shutdown)</li> <li>• Low coolant temp (alarm)</li> <li>• Low coolant level (alarm)</li> <li>• High engine oil temp (alarm and shutdown)</li> <li>• Low, high, and weak battery voltage</li> <li>• Overspeed</li> <li>• Overcrank</li> </ul>                           |
| Control              | <ul style="list-style-type: none"> <li>• Run / Auto / Stop control</li> <li>• Speed and voltage adjust</li> <li>• Local and remote emergency stop</li> <li>• Remote start/stop</li> <li>• Cycle crank</li> </ul>  |
| Inputs & Outputs     | <ul style="list-style-type: none"> <li>• Two dedicated digital inputs</li> <li>• Six programmable digital inputs</li> <li>• Six programmable form A dry contacts</li> <li>• Two programmable form C dry contacts</li> <li>• Two digital outputs</li> </ul>  |
| Communications       | <ul style="list-style-type: none"> <li>• Primary and accessory CAN data links</li> <li>• RS-485 annunciator data link</li> <li>• Modbus RTU (RS-485 Half duplex)</li> </ul>   |
| Language Support     | <p>Arabic, Bulgarian, Chinese, Czech, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Hungarian, Icelandic, Italian, Latvian, Lithuanian, Japanese, Norwegian, Polish, Portuguese, Romanian, Russian, Slovak, Slovene, Spanish, Swedish, Turkish</p>  |
| Environmental        | <ul style="list-style-type: none"> <li>• Control module operating temperature: -40°C to 70°C</li> <li>• Display operating temperature: -20°C to 70°C</li> <li>• Humidity: 100% condensing 30°C to 60°C</li> <li>• Storage temperature: -40°C to 85°C</li> <li>• Vibration: Random profile, 24-1000 Hz, 4.3G rms</li> </ul>  |

## EMCP 4 RS-485 ANNUNCIATOR

The EMCP 4 RS-485 annunciator serves to display generator set system alarm conditions and status indications. The annunciator has been designed for use on the EMCP 4 RS-485 annunciator data link for remote applications, providing customers with enhanced site flexibility.

The EMCP 4 annunciator is configurable to the standards of NFPA 99/110 for emergency standby generator systems.



### FEATURES

- The EMCP 4 annunciator provides sixteen (16) individual points of annunciation, with two (2) LED's included for each point.
- An additional pair of LED's provides status indication of the RS-485 communication network.
- Includes alarm horn with lamp test and alarm acknowledge pushbuttons.
- Configurable to NFPA 99/110 requirements for local and remote annunciation on emergency standby generator systems.
- Provides custom label kit including software for customer's specific alarms and arrangement
- Designed and tested to meet stringent impulse shock and operating vibration requirements
- Uses high quality shielded twisted-triad cable for robust remote communications
- Graphic symbols are provided next to each pair to indicate various alarms and events
- The annunciator can be mounted remotely up to 1200 m (4,000 ft).
- Provides superior visibility of the LED's in direct sunlight

### SPECIFICATIONS

#### Technical Data

##### Electrical

Battery Voltage Functional Range: 9 to 32 VDC

##### Power Consumption

Maximum:  $\approx$  12 watt at 24 VDC

Standby:  $\approx$  5 watt at 24 VDC

Control Power: 12-24 VDC

Communication: RS-485

Single, 8-pin Connector

##### Alarm

Sound Level 80 db

#### PHYSICAL

##### Weight

2.5 lb or  $\approx$  1.13 kg

#### ENVIRONMENTAL

##### Operating Temperature

-40° C to 70° C

-40° F to 158° F

##### Storage Temperature

-50° C to 70° C

-58° F to 158° F

##### Relative Humidity

90%

#### CERTIFICATIONS



UL Recognized

## LED COLOR SCHEME

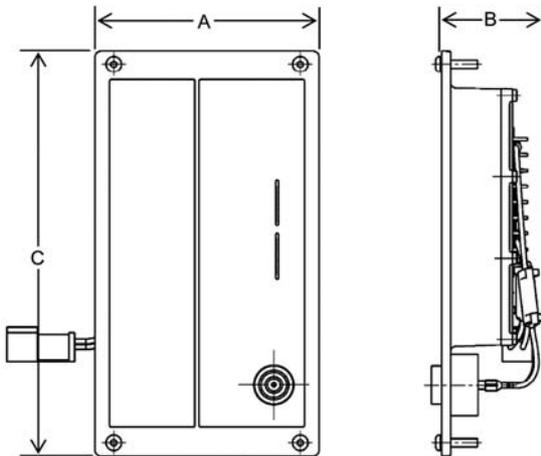
Each pair of LED's on the annunciator consists of two of three colors: green, yellow and red, which allows for custom configuration of status, warning and shutdown conditions.

The available colors and combinations are:

| Row | LED 1 | LED 2  |
|-----|-------|--------|
| 1   | Red   | Yellow |
| 2   | Red   | Yellow |
| 3   | Red   | Yellow |
| 4   | Red   | Yellow |
| 5   | Red   | Yellow |
| 6   | Red   | Green  |
| 7   | Red   | Yellow |
| 8   | Red   | Yellow |
| 9   | Red   | Yellow |
| 10  | Red   | Yellow |
| 11  | Red   | Yellow |
| 12  | Red   | Yellow |
| 13  | Green | Yellow |
| 14  | Green | Yellow |
| 15  | Red   | Green  |
| 16  | Red   | Yellow |

## STANDARD LED CONFIGURATION

- Emergency stop shutdown
- Overcrank shutdown
- Low coolant temperature warning
- High coolant temperature warning/shutdown
- Low oil pressure warning/shutdown
- Overspeed warning/shutdown
- Low coolant level warning/shutdown
- Low fuel level warning/shutdown
- EPS supplying load status
- Control switch not in auto warning
- High battery voltage warning/shutdown
- Low battery voltage warning/shutdown
- BATT charger AC failure warning/shutdown
- Low cranking voltage
- Engine running
- Tier 4 SCR



| Annunciator Dimensions |        |          |
|------------------------|--------|----------|
| <b>A</b>               | 158 mm | 6.22 in  |
| <b>B</b>               | 60 mm  | 2.37 in  |
| <b>C</b>               | 288 mm | 11.34 in |

Information contained in this publication may be considered confidential.

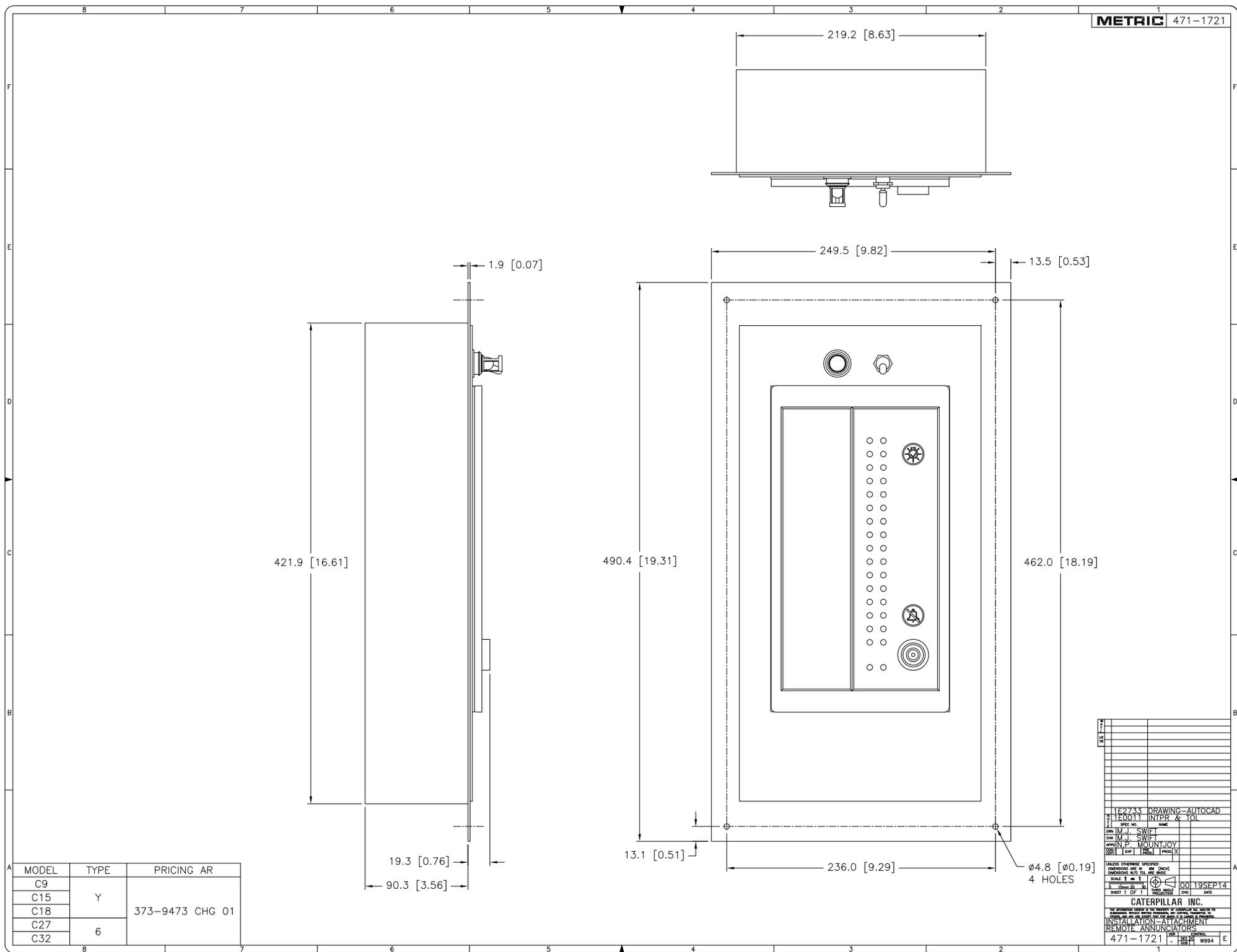
Discretion is recommended when distributing.

Materials and specifications are subject to change without notice.

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[www.Cat-ElectricPower.com](http://www.Cat-ElectricPower.com)

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| MODEL | TYPE | PRICING AR      |
|-------|------|-----------------|
| C9    | Y    | 373-9473 CHG 01 |
| C15   |      |                 |
| C18   |      |                 |
| C27   | 6    |                 |
| C32   |      |                 |

1E2733 DRAWING-AUTOCAD  
 1E0011 INTER & TOI

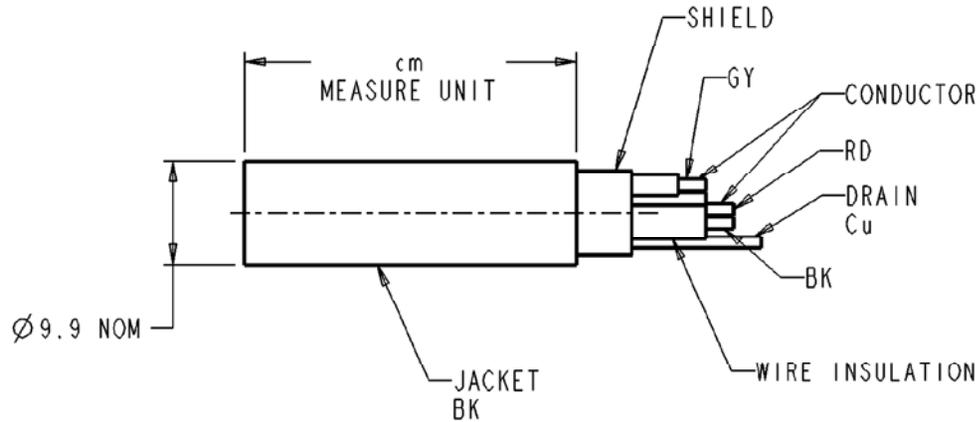
DESIGNER: M. J. SWIFT  
 CHECKED: M. J. SWIFT  
 APPROVED: N. P. MOUNTJOY  
 DATE: 1994 SEP 14

SCALE: 1:1  
 DIMENSIONS ARE IN MM (INCH)  
 UNLESS OTHERWISE SPECIFIED  
 DIMENSIONS ARE TO FACE UNLESS NOTED OTHERWISE

0019SEP14  
 CATERPILLAR INC.  
 INSTALLATION ATTACHMENT  
 REMOTE ANNUNCIATORS  
 471-1721-1-1994

**METRIC**

379-1796



- CABLE----- 3 CONDUCTOR W/ DRAIN AND SHIELD
- CONDUCTOR----- BK AND RD CONDUCTORS ARE TWISTED
- WIRE INSULATION----- 18 GA (COPPER 16 X 30 STRAND)
- JACKET----- POLYETHYLENE
- DRAIN----- THERMOPLASTIC ELASTOMERS
- SHIELD----- 18 GA COPPER 16 X 30
- MINIMUM BEND RADIUS--- ALUMINUM FOIL
- OPERATING TEMP RANGE-- 35
- IMPEDANCE----- -40°C TO +80°C
- CAPACITANCE----- 120±10 Ω
- VOLTAGE----- 11±10% pf/FT
- CERTIFICATION----- 600 V
- UL/CANADIAN STANDARD ASSOCIATION

NOTE A: NORTHWIRE INC  
FAWMI83-155

NOTE B: ASTM B3, ASTM B33, ASTM B172

INTENDED USE FOR THIS CABLE IS  
RS485 COMMUNICATION

DIM. W/O TOL ARE REF

|   |   |   |   |
|---|---|---|---|
| M<br>A<br>T<br>L  | A   | APPD PART   |   |
|   | B   | IE1541F WROUGHT MATL                                |   |
| H<br>T<br>R   |   |   |   |
|   |   | IE4246B ELEK SUBSTANCES                             |   |
|   |   | IE2722F DRAWING                                     |   |
|   |   | IE2442J APPROVAL                                    |   |
|   |   | IE2442A APPROVAL                                    |   |
|   |   | IE0507C IDENT                                       |   |
|   |   | IE0198R LETTERS                                     |   |
|   |   | IE0013Y CONFIDENTIALITY                             |   |
|   | N<br>O<br>T<br>E                                |   | IE0011 INTPR & TOL                      |
|   |   |   | <b>Caterpillar: Confidential Yellow</b> |
|   | PROD. <input checked="" type="checkbox"/> OTHER |   |   |
| UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN mm   |   | VERSION PRIMARY <input checked="" type="checkbox"/> |   |
| DIMENSIONS W/O TOL ARE BASIC  |   | TYPE SECONDARY                                      |   |
| THIRD ANGLE PROJECTION  |   | SHEET 1 OF 1  |   |
|   |   | DWG CONTROL A544                                    |   |
| <b>CATERPILLAR</b>  |   |   |   |
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| CABLE-BULK (ELECTRICAL)   |   |   |   |
| (RS485)   |   |   |   |
| 379-1796  |   | VER CHG   |   |
|   |   | - 00 B  |   |

**Section 5**  
**Starting System**

# Cat<sup>®</sup> Batteries



## Cat<sup>®</sup> Batteries—Greater Starting Power— Lower Maintenance—Longer Life

Cat Premium High Output (PHO) batteries are used in all Cat Machines and Engine Gen-Sets. They are designed to meet stringent Caterpillar design specifications, which provide industry leading cold cranking amps (CCA) capability and maximum vibration resistance.

Maintenance Free Accessible or low maintenance designs are available in wet and dry configurations.

General Service Line batteries are available in Maintenance Free Accessible or low maintenance designs. Wide selections of BCI group sizes are available for automotive, light truck, bus, industrial, agricultural, marine, recreational and valve regulated (VRLA-AGM & Gel) applications.



## World's Toughest Batteries



### Premium High Output—Maximum Vibration Resistance

- Vibration Resistance...five times the Industry Standard
- Exclusive "flat top" BCI group 4D & 8D batteries are Maintenance Free Accessible and have the industries highest cold cranking amps (CCA)
- Popular BCI group 31 Maintenance Free Accessible batteries with industry leading cold cranking amps...up to 1000 (CCA), for electric power, machine or on-highway truck and bus applications. Deep cycle models are available for truck, marine or recreational usage

## Specifications for Cat Premium High Output Batteries-Available Worldwide

| BCI Group Size | Part No.   | CCA ≈ | RC Mins † | Volts | Amp Hr. Capacity @ 20 Hrs. | Construction Notes | Accessibility - Fluid Level Check Hours | Length In (mm) | BCI Overall Dimensions |                | Nominal Weight |             |                                 |
|----------------|------------|-------|-----------|-------|----------------------------|--------------------|---|----------------|------------------------|----------------|----------------|-------------|---------------------------------|
|                |            |       |           |       |                            |                    |   |                | Width In (mm)          | Height In (mm) | Wet Lb (kg)    | Dry Lb (kg) | Nominal Acid to Fill Qt (liter) |
| 8D             | 153-5720   | 1500  | 465       | 12    | 210                        | C/MFA              | A - 1000                                | 20.5 (520)     | 10.8 (275)             | 9.8 (248)      | 132 (59.9)     | -           | -                               |
| 8D             | 101-4000   | 1400  | 400       | 12    | 190                        | LAC+               | A - 1000                                | 20.8 (527)     | 11.0 (278)             | 9.8 (248)      | 132 (59.9)     | 86 (39.0)   | 18.0 (17.0)                     |
| 4D             | 153-5710   | 1400  | 425       | 12    | 200                        | C/MFA              | A - 1000                                | 20.5 (520)     | 8.6 (218)              | 9.8 (248)      | 119 (54.0)     | -           | -                               |
| 4D             | 9X-9730    | 1300  | 400       | 12    | 190                        | LAC+               | A - 1000                                | 20.8 (527)     | 8.6 (218)              | 9.8 (248)      | 120 (54.0)     | 81 (36.8)   | 14.8 (14.0)                     |
| 4D             | 153-5700   | 1125  | 305       | 12    | 145                        | C/MFA              | A - 1000                                | 20.5 (520)     | 8.6 (218)              | 9.8 (248)      | 101 (45.8)     | -           | -                               |
| 4D             | 9X-9720    | 1000  | 275       | 12    | 140                        | LAC+               | A - 1000                                | 20.8 (527)     | 8.6 (218)              | 9.8 (248)      | 102 (45.8)     | 59 (26.8)   | 15.9 (15.0)                     |
| 31             | 175-4390   | 1000  | 180       | 12    | 90                         | C/MFA/S            | A - 1000                                | 12.9 (329)     | 6.8 (172)              | 9.3 (236)      | 60 (27.2)      | -           | -                               |
| 31             | 175-4370   | 825   | 190       | 12    | 100                        | C/MFA/S**          | A - 1000                                | 12.9 (329)     | 6.8 (172)              | 9.3 (236)      | 61 (27.2)      | -           | -                               |
| 31             | 175-4360   | 710   | 185       | 12    | 100                        | C/MFA/S***         | A - 1000                                | 12.9 (329)     | 6.8 (172)              | 9.3 (236)      | 62 (28.1)      | -           | -                               |
| 31/30H         | 115-2422   | 1000  | 170       | 12    | 90                         | C/MFA              | A - 1000                                | 12.9 (329)     | 6.8 (172)              | 9.5 (241)      | 63 (28.6)      | -           | -                               |
| 31/30H         | 115-2421   | 950   | 170       | 12    | 90                         | C/MFA+             | A - 1000                                | 12.9 (329)     | 6.8 (172)              | 9.5 (241)      | 64 (29.1)      | 44 (20.0)   | 6.6 (6.2)                       |
| 31/30H         | 9X-3404(1) | 950   | 165       | 12    | 95/100                     | C/MF               | NA                                      | 13.0 (331)     | 6.8 (172)              | 9.5 (241)      | 58 (26.3)      | -           | -                               |
| 31/30H         | 31-5760    | 750   | 165       | 12    | 95/100                     | C/MF               | AV - 1000                               | 13.0 (331)     | 6.8 (172)              | 9.5 (241)      | 56 (25.4)      | -           | -                               |
| 65             | 230-6368   | 880   | 140       | 12    | 70                         | C/MF               | NA                                      | 11.9 (304)     | 7.5 (191)              | 7.5 (191)      | 46 (20.9)      | -           | -                               |
| 24             | 153-5656   | 650   | 110       | 12    | 52                         | C/MF               | NA                                      | 11.0 (279)     | 6.9 (174)              | 9.0 (229)      | 39 (17.7)      | -           | -                               |

C9  
C15  
C18

#### Construction Notes:

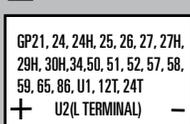
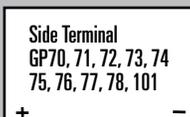
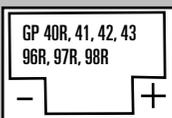
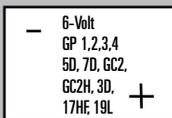
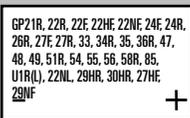
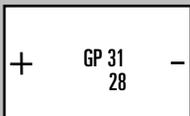
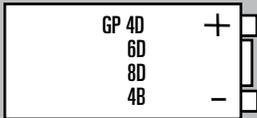
Batteries use SAE taper post design and are shipped wet except as:

- LAC = Low Maintenance - Hybrid Construction
- C = Calcium Lead Alloy Grid Design
- MF = Maintenance Free Non-Accessible
- MFA = Maintenance Free Accessible
  - A = Accessible
  - NA = Non-Accessible
- AV = Accessibly Varies - Accessibility varies depending on supplier used. If it has caps, it is accessible and fluid levels should be checked.
- S = Stud Terminals
  - + = Shipped Dry Only
  - \* = Side Terminals Only
- \*\* = Starting and Deep Cycle Battery
- \*\*\* = Deep Cycle and Starting Battery
- ≈ = Cold Cranking Amps for 30 seconds at 0° F (-18° C)
- † = Reserve Capacity Minutes minimum of 25 amp output at 80° F (27° C)
- SDT = Dual, Top mounted Terminals - Stud and SAE Post. Marine Deep Cycle/Starting Battery
  - 1 = Available in EAME and China only

#### Rugged Design—Built Tough—Reliable Starting

- Positive and negative plates are anchored to container bottom and locked at the top of cell element for maximum vibration resistance.
- Heavy-duty forged terminal post bushings provide maximum strength and resistance to acid seepage.
- Hefty full-frame grids, no sharp edges, optimum acid/paste combination provides better charge acceptance after deep discharge.
- Manifold vented cover with built-in Flame Arrestor... a safety feature that directs corrosive gases away from the battery and hold-downs.
- Thick, robust container resists rugged treatment typical of heavy-duty commercial use. Embossed part number & descriptors for easy serviceability.

## BCI Terminal Locations



Transit Bus Terminal for 8D Part # 250-0473  
 One piece end terminal.  
 Right end of Battery.  
 1/2" - 13 Steel Positive Stud  
 3/8" - 16 Steel Negative Stud  
 Terminal not serviceable

Type B

## Cat Premium High Output Batteries — Built Tough to Exceed Demanding Performance Test Requirements:

- 100 hour Vibration Testing – Five Times the Industry Standard**  
 Battery must be able to withstand vibration forces without suffering mechanical damage, loss of capacity, loss of electrolyte or without developing internal/external leaks  
 Battery must pass a high rate discharge test after the vibration testing
- Five 72-hour Deep Discharge/Recharge Test Cycles**  
 Battery must recover to 25 charging amps within 20 minutes and meet Industry Electrical Performance Standards
- 30 Day Complete Discharge Test**  
 Battery must recover to 25 charging amps within 60 minutes and meet Industry Electrical Performance Standards after recharging
- SAE J2185 Life Cycle Test**  
 Battery subject to deeper discharge and charge cycles at extreme temperatures not normally encountered in starting a machine or vehicle
- Cold Soak Test**  
 Battery cold soaked at sub-freezing temperatures and then tested by starting an equally cold engine



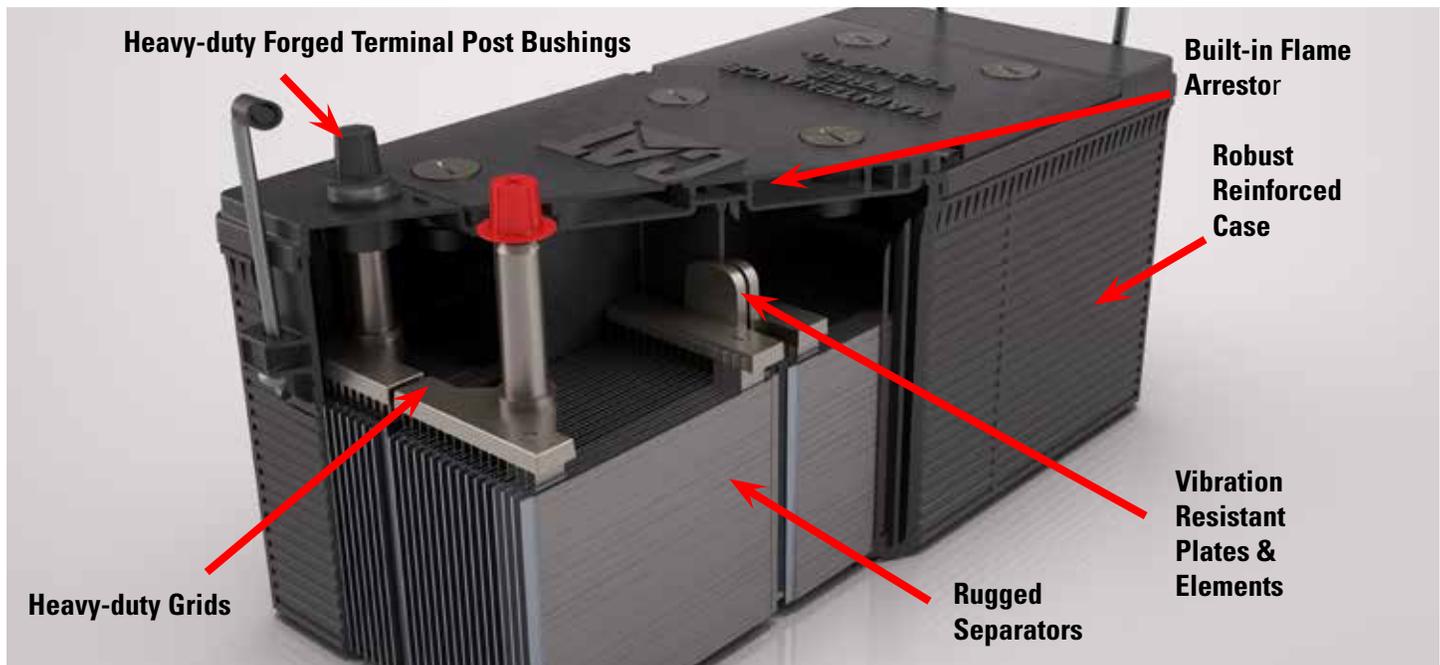
## Battery Accessories

- Group 31 - Charging Posts for Stud Terminals - Part # 4C-5637
- Screw-in Charging Posts for Side Terminals - Part # 4C-5638
- Wing Nut - Part # 2B-9498 for Part #'s 175-4390/175-4370/175-4360/8C-3628
- Wing Nut - Part # 3B-0723 for Part #'s 8C-3638 and 8C-3639
- Booster Cable 12' (3.66 m) - Part # 4C-4911
- Booster Cable 20' (6.00 m) - Part # 4C-4933
- Heavy Duty Commercial Fast Charger (110V) - Part # 4C-4921
- Heavy Duty Commercial Fast Charger (220V) - Part # 4C-4910

**Note: Ratings and Part Numbers are subject to change without notice.**



Recycle all scrap batteries.  
 We accept lead-acid batteries for recycling.



## Robust Components = Long Life + Reliable Starts

- Heavy-duty forged terminal post bushings provide maximum strength and resistance to acid seepage that causes corrosion and black posts. Thicker internal terminal posts provide lower electrical resistance and higher cold cranking amp output.
- Rugged micro porous polyethylene envelope separators protect against “shorts” and vibration damage. Deep Cycle batteries utilize double insulated Glass mat separators for longer cycling life.
- Maintenance Free Accessible batteries utilize calcium lead alloy on both positive and negative plates that reduces gassing and water consumption. Automotive batteries have Silver (Ag) Calcium Alloy Grids for resistance to high underhood temperatures.
- Heavy-duty, full frame battery grids with no sharp edges. An optimum acid/paste combination provides better charge acceptance after a deep discharge.
- Positive and Negative plates are anchored to the container bottom and the cell element is locked at the top for maximum vibration resistance. Straps are thicker, heavier and cast (not welded) into the plates.
- Manifold vented cover with built-in Flame Arrestor... a safety feature that directs corrosive gases away from the battery and hold-downs.
- Robust reinforced case provides extra strength in all temperature extremes. Brickwork design on sides reduces chance of punctures and case flexing. Embossed part number and descriptors for easy serviceability.

## CAT DEALERS DEFINE WORLD-CLASS PRODUCT SUPPORT.

We offer you the right parts and service solutions, when and where you need them.

The Cat Dealer network of highly trained experts keeps your entire fleet up and running to maximize your equipment investment.



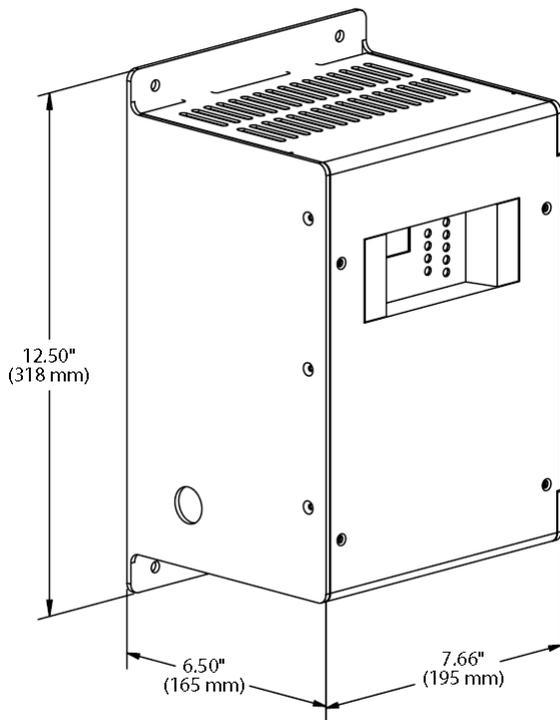


Image Shown may not Reflect Actual Package

## UL 10 AMP BATTERY CHARGER

This battery charger offers accurate, automatic charging of lead-acid and nickel cadmium batteries. The output voltage automatically adjusts to changing input, load, battery and ambient conditions. This prevents battery over-charging and consequent loss of battery electrolyte.

Standard features include AC line compensation, precision voltage regulation, current limiting, automatic 2-rate charging, voltmeter and ammeter, temperature compensation and UL Listing.

The user interface is easy to understand with digital metering, NFPA 110 alarms and a battery fault alarm.

### SPECIFICATION

|                       |                                   |
|-----------------------|-----------------------------------|
| Input Supply          | 110-120 V<br>208-240 V            |
| AC and DC Fuses       | (2 input and 2 output)            |
| Output voltage        | 24V                               |
| Frequency             | 50/60 Hz                          |
| Operating temperature | -20°C ( -4°F)<br>to +60°C (140°F) |

Housing constructed of rustproof anodized aluminum.

### STANDARDS

- C-UL listed to UL 1236
- NFPA 70, NFPA 110
- CSA 22.2 No 107 certified
- UL 1564
- CE DOC to EN 60335
- IBC Seismic Certification

### FEATURES

- Electronically current limited at 105% of rated output
- Alarm system
- Digital Display
- Lightning and voltage transient protection
- Protection of connected equipment against load dump protection
- Constant voltage, current limited, 4-rate automatic equalization
- IP 20 housing
- AC isolated from DC
- Temperature Compensation
  - On board temperature sensor with remote port
- Auto AC line compensation
- Output regulated by sensed battery voltage





Reference illustration

## C15 and C18 Jacket Water Heater

Factory installed jacket water heater for increased cold-starting capability. The system includes a tank-style metal heater with an integral high limit thermostat and a remote engine mounted control thermostat, durable silicone hoses and heater control relay wired to a common connection point in the control panel. The heater and thermostat location is optimized for maximum coolant flow and heating power efficiency.

### FEATURES

#### FACTORY INSTALLED

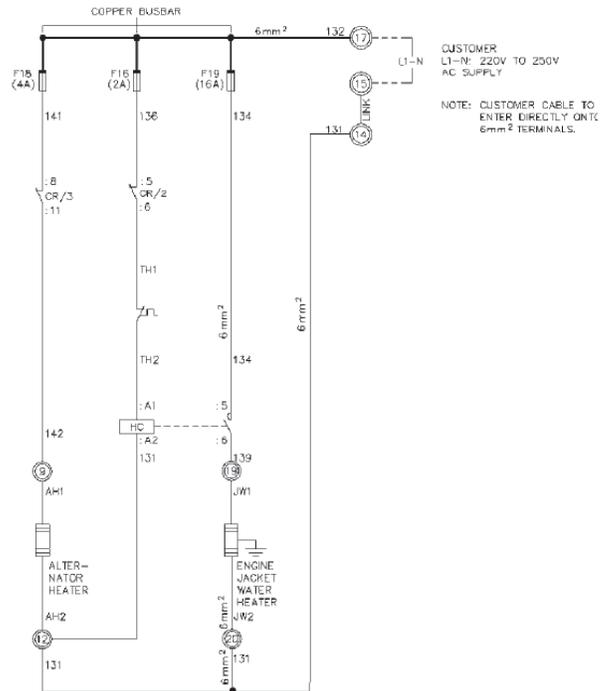
- Complete with silicone hoses
- Isolated tank heater vibration and shock tested to extreme limits to guarantee durability
- Optimized location of the heater on the genset base for maximum coolant flow
- Remote pilot thermostat located on the engine for optimized power cycle efficiency is factory set to 100° F (37.8°C)
- Automatically disconnected when engine is running via a dedicated heater relay located in the control panel.
- Supplied with UL recognized components
- Compatible with Cat® ELC and all chemicals
- All parts are serviceable and field replaceable
- Incoloy heater element for longer service life

#### SPECIFICATIONS

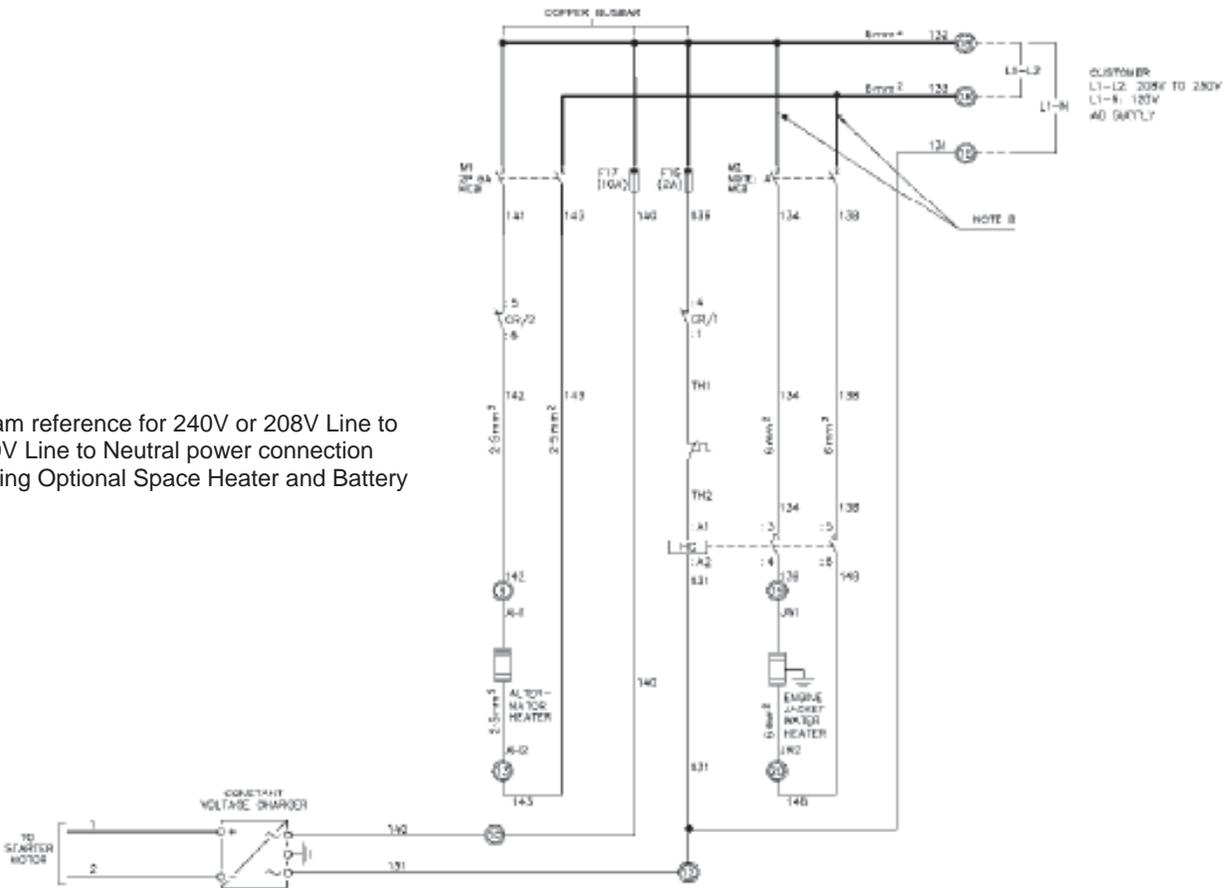
| Unit Specifications |                               |          |          |
|---------------------|-------------------------------|----------|----------|
|                     | Design Voltage                |          |          |
|                     | 208                           | 220      | 240      |
| Rating              | 2250                          | 2520     | 3000     |
| Frequency           | 50/60 Hz                      | 50/60 Hz | 50/60 Hz |
| Phase               | 1                             | 1        | 1        |
| Amps                | 10.82                         | 11.45    | 12.5     |
| Feature Code        | JWH0058<br>JWH0059<br>JWHD032 |          |          |

## WIRING DIAGRAMS

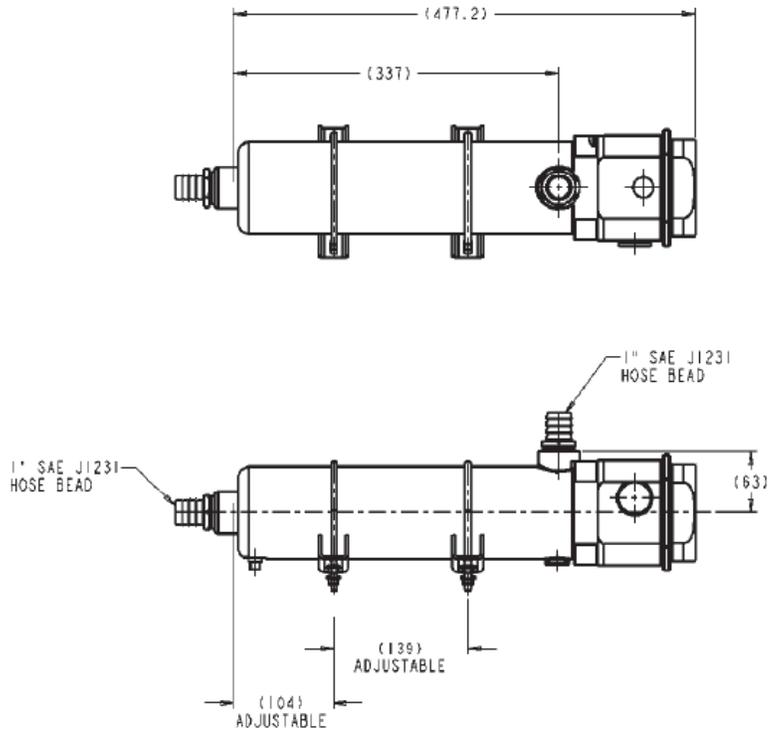
Wiring diagram reference for 240V Line to Neutral power connection



Wiring diagram reference for 240V or 208V Line to Line and 120V Line to Neutral power connection (Note: Including Optional Space Heater and Battery Charger)



## HEATER DETAIL



## HEATER OPERATION

The heater uses compliant components to UL and CSA, and is both CSA and UL approved.

When the generator set is not running, the heater is automatically connected to the AC supply through a power relay mounted in the control panel. Upon receiving a start signal, the AC supply is automatically disconnected by the power relay and automatically reconnected when the start signal is removed and the engine has stopped.

Pilot thermostat located on the engine precisely monitors and controls the engine coolant temperature and is wired to energize and de-energize heater power cycles.

A high-limit thermostat is built into the heater to regulate the output temperature to within safe limits.

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**Section 6**  
**Enclosure / Fuel Tank / Mounting**



Picture shown may not reflect actual package.

## C15 / C18 SOUND ATTENUATED ENCLOSURES

### US Sourced 60 Hz

### FEATURES

#### ROBUST / HIGHLY CORROSION RESISTANT

#### CONSTRUCTION

- Factory installed on skid base
- Environmentally friendly, polyester powder baked paint
- Zinc plated or stainless steel fasteners
- Internally mounted super critical exhaust silencing system
- Designed and tested to comply with UL 2200 Listed generator set package
- Compression door latches providing solid door seal

#### EXCELLENT ACCESS

- Large cable entry area for installation ease
- Accommodates side mounted single or multiple breakers
- Three doors on both sides
- Vertically hinged allow 180° opening rotation and retention with door stays
- Lube oil and coolant drains piped to the exterior of the enclosure base
- Radiator fill cover

#### SECURITY AND SAFETY

- Lockable access doors which give full access to control panel and breaker
- Cooling fan and battery charging alternator fully guarded
- Fuel fill, oil fill, and battery can only be reached via lockable access
- Externally mounted emergency stop button
- Designed for spreader bar lifting to ensure safety
- Stub-up area is rodent proof

#### TRANSPORTABILITY

These enclosures are of extremely rugged construction to withstand outdoor exposure and rough handling common on many construction sites.

#### OPTIONS

- Enclosure constructed with 14 gauge steel
- Enclosure constructed with 12 gauge aluminum (5052 grade)
- Caterpillar yellow\* or white paint
- Control panel viewing window\*
- UL Listed 8 hour integral fuel tank
- UL Listed 24 or 48 hour sub base fuel tanks
- Seismic certification per applicable building codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, IBC 2012, CBC 2007, CBC 2010
- IBC Certification for 150 mph wind loading
- Anchoring details are site specific and are dependent on many factors such as generator set size, weight, and concrete strength. IBC Certification requires that the anchoring system used is reviewed and approved by a professional engineer.

\*Not available with aluminum enclosures.

## Sound Attenuated Enclosure (steel) Sound Levels

| Sound Attenuated Enclosure |             | Cooling Air Flow Rate |       | Ambient Capability* |     | Sound Pressure Levels (dBA) at |          |            |          |             |          |
|----------------------------|-------------|-----------------------|-------|---------------------|-----|--------------------------------|----------|------------|----------|-------------|----------|
|                            |             |                       |       |                     |     | 1m (3.3 ft)                    |          | 7m (23 ft) |          | 15m (49 ft) |          |
| Model                      | Standby ekW | m <sup>3</sup> /s     | cfm   | °C                  | °F  | 100% Load                      | 75% Load | 100% Load  | 75% Load | 100% Load   | 75% Load |
| C15                        | 350         | 10.4                  | 22072 | 59                  | 138 | 84                             | 83       | 73         | 72       | 70          | 69       |
|                            | 400         | 10.4                  | 22072 | 51                  | 124 | 84                             | 84       | 73         | 73       | 70          | 70       |
|                            | 450         | 10.4                  | 22072 | 46                  | 115 | 85                             | 84       | 74         | 73       | 71          | 70       |
|                            | 500         | 12.5                  | 26415 | 48                  | 118 | 87                             | 86       | 75         | 74       | 72          | 71       |
| C18                        | 550         | 8.1                   | 17234 | 45                  | 113 | 87                             | 87       | 75         | 74       | 73          | 72       |
|                            | 600         | 8.1                   | 17234 | 43                  | 109 | 88                             | 87       | 75         | 75       | 73          | 72       |

\* Cooling system performance with sound attenuated enclosure restriction

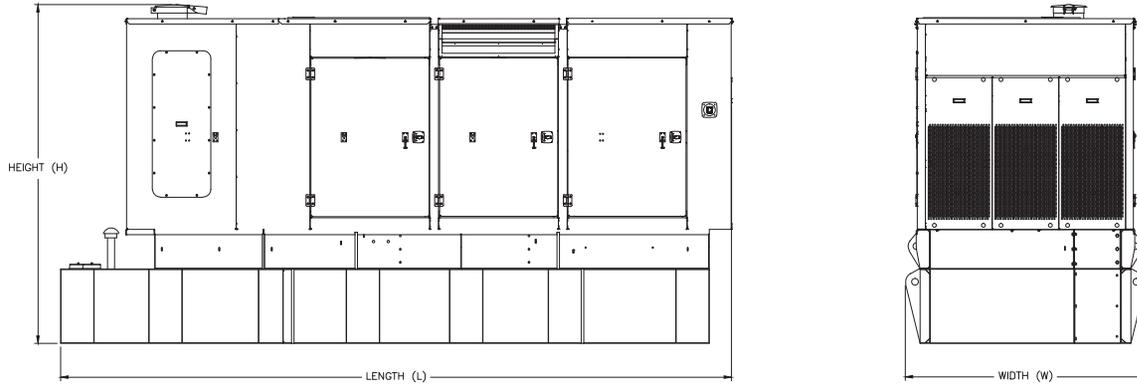
## Sound Attenuated Enclosure (Aluminum) Sound Levels

| Sound Attenuated Enclosure |             | Cooling Air Flow Rate |       | Ambient Capability* |     | Sound Pressure Levels (dBA) at 7m (23 ft) |          |
|----------------------------|-------------|-----------------------|-------|---------------------|-----|---|----------|
| Model                      | Standby ekW | m <sup>3</sup> /s     | cfm   | °C                  | °F  | 100% Load                                 | 75% Load |
| C15                        | 350         | 10.4                  | 22072 | 59                  | 138 | 72  | 72       |
|                            | 400         | 10.4                  | 22072 | 51                  | 124 | 73  | 73       |
|                            | 450         | 10.4                  | 22072 | 46                  | 115 | 74  | 72       |
|                            | 500         | 12.5                  | 26415 | 48                  | 118 | 75  | 73       |
| C18                        | 550         | 8.1                   | 17234 | 45                  | 113 | 76  | 75       |
|                            | 600         | 8.1                   | 17234 | 43                  | 109 | 76  | 76       |

\* Cooling system performance with sound attenuated enclosure restriction

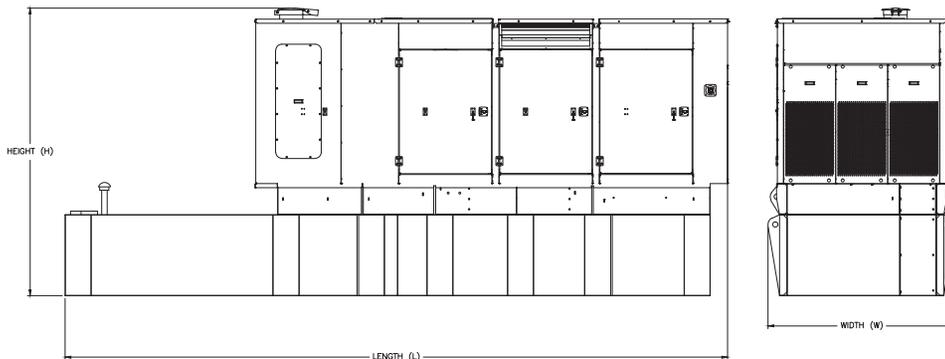
Note: Sound level measurements are subject to instrumentation, installation and manufacturing variability, as well as ambient site conditions.

## Sound Attenuated Enclosure Weights and Dimensions



### Sound Attenuated on a UL Listed 24 Hour Sub Base Fuel Tank Base

| Model | Rating<br>ekW | Length "L" |       | Width "W" |      | Height "H" |       | Weight (Steel) |       | Weight (Aluminum) |       |
|-------|---------------|------------|-------|-----------|------|------------|-------|----------------|-------|-------------------|-------|
|       |               | mm         | in    | mm        | in   | mm         | in    | kg             | lb    | kg                | lb    |
| C15   | 350           | 5741       | 226.0 | 2056      | 80.9 | 2955       | 116.3 | 6501           | 14332 | 6051              | 13340 |
|       | 400           |            |       |           |      |            |       |                |       |                   |       |
|       | 450           |            |       |           |      |            |       |                |       |                   |       |
|       | 500           |            |       |           |      |            |       |                |       |                   |       |
| C18   | 550           | 5741       | 226.0 | 2056      | 80.9 | 2897       | 114.1 | 7026           | 15490 | 6576              | 14498 |
|       | 600           |            |       |           |      |            |       |                |       |                   |       |



### Sound Attenuated on a UL Listed 48 Hour Sub Base Fuel Tank Base

| Model | Rating<br>ekW | Length "L" |       | Width "W" |      | Height "H" |       | Weight (Steel) |       | Weight (Aluminum) |       |
|-------|---------------|------------|-------|-----------|------|------------|-------|----------------|-------|-------------------|-------|
|       |               | mm         | in    | mm        | in   | mm         | in    | kg             | lb    | kg                | lb    |
| C15   | 350           | 6382       | 243.5 | 2056      | 80.9 | 3209       | 126.3 | 6717           | 14808 | 6267              | 13816 |
|       | 400           |            |       |           |      |            |       |                |       |                   |       |
|       | 450           |            |       |           |      |            |       |                |       |                   |       |
|       | 500           |            |       |           |      |            |       |                |       |                   |       |
| C18   | 550           | 7265       | 286.0 | 2056      | 80.9 | 3151       | 124.1 | 7517           | 16572 | 7067              | 15580 |
|       | 600           |            |       |           |      |            |       |                |       |                   |       |

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ENCLOSURE COLOR SELECTION

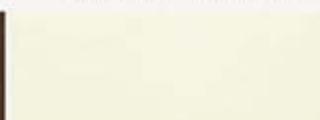
|  |   |   |
|--|---|---|
| <br>RAL 7032 Pebble Grey       | <br>RAL 7045 Telegrey 1      | <br>RAL 8014 Sepia Brown      |
| <br>RAL 7033 Cement Grey      | <br>RAL 7046 Telegrey 2     | <br>RAL 8015 Chestnut Brown  |
| <br>RAL 7034 Yellow Grey      | <br>RAL 7047 Telegrey 4     | <br>RAL 8016 Mahogany Brown  |
| <br>RAL 7035 Light Grey       | <br>RAL 8000 Green Brown    | <br>RAL 8017 Chocolate Brown |
| <br>RAL 7036 Platinum Grey    | <br>RAL 8001 Ocher Brown    | <br>RAL 8019 Grey Brown      |
| <br>RAL 7037 Dusty Grey       | <br>RAL 8002 Signal Brown   | <br>RAL 8022 Black Brown     |
| <br>RAL 7038 Agate Grey     | <br>RAL 8003 Clay Brown   | <br>RAL 8023 Orange Brown  |
| <br>RAL 7039 Quartz Grey    | <br>RAL 8004 Copper Brown | <br>RAL 8024 Beige Brown   |
| <br>RAL 7040 Window Grey    | <br>RAL 8007 Fawn Brown   | <br>RAL 8025 Pale Brown    |
| <br>RAL 7042 Traffic Grey A | <br>RAL 8008 Olive Brown  | <br>RAL 8028 Terra Brown   |
| <br>RAL 7043 Traffic Grey B | <br>RAL 8011 Nut Brown    | <br>RAL 9001 Cream         |
| <br>RAL 7044 Silk Grey      | <br>RAL 8012 Red Brown    | <br>RAL 9002 Grey White    |



Image shown may not reflect actual package.

## C15 / C18 Integral and Sub-Base Fuel Tanks

US Sourced  
Diesel Generator Set  
320 – 600 kW 60 Hz

### FEATURES

- UL listed for United States (UL 142) and Canada (ULC S601)
- Compliant with NFPA 30, 37 & 110 and CSA C282-09 & B139-09 standards.
- Dual wall
- Lockable fuel fill cap, 4" (101.6mm) NPT
- Fuel fill drop tube with in 6" (152mm) from bottom of tank
- Low fuel level warning standard, customer configurable warning or shutdown
- Primary tank leak detection switch in containment basin
- Tank design provides capacity for thermal expansion of fuel
- Fuel supply dip tube is positioned so as not to pick up fuel sediment
- Fuel return and supply dip tube is separated by an internal baffle to prevent immediate re-supply of heated return fuel
- Pressure washed with an iron phosphate solution
- Interior tank surfaces coated with a solvent-based thin-film rust preventative
- Heavy gauge steel gussets with internal lifting rings
- Primary and secondary tanks are leak tested at 20.7 kPa (3 psi) minimum
- Compatible with open packages and enclosures
- Gloss black polyester alkyd enamel exterior paint
- Welded steel containment basin (minimum of 110% of primary tank capacity)
- Direct reading fuel gauge with variable electrical output
- Emergency vents on primary and secondary tanks are sized in accordance with NFPA 30

### DESCRIPTION – Sub Base

- The sub-base fuel tank mounts below the generator set wide base

### DESCRIPTION – Integral

- Integral diesel fuel tank is incorporated into the generator set base frame
- Robust base design includes linear vibration isolators between tank base and engine generator

### OPTIONS

- Audio/visual fuel level alarm panel
- 5 gal (18.9 L ) spill containment
- Overfill prevention valve

# ATTACHMENTS



## INTEGRAL & SUB-BASE FUEL TANK BASE USEABLE CAPACITIES with Fuel Tank Dimensions & Weights

Integral – Width (W) 2014 mm (79.3 in)

Sub-base – Width (W) 2056 mm (81 in)

### OPEN SET & WEATHER PROTECTIVE ENCLOSURE

| C15 Tank Design | Feature Code | Total Capacity |        | Useable Capacity |        | TANK ONLY  |       |            |    |            |       | TANK AND PACKAGE |       |                 |       |
|-----------------|--------------|----------------|--------|------------------|--------|------------|-------|------------|----|------------|-------|------------------|-------|-----------------|-------|
|                 |              |                |        |                  |        | Dry Weight |       | Height 'H' |    | Length 'L' |       | Open Pgs Height  |       | Enc. Pgs Height |       |
|                 |              | Liter          | Gallon | Liter            | Gallon | kg         | lb    | mm         | in | mm         | in    | mm               | in    | mm              | in    |
| Integral        | FTDW002      | 1261           | 333    | 1215             | 321    | 1015       | 2,237 | 635        | 25 | 3814       | 150.1 | 2426             | 95.5  | 3200            | 126.0 |
| Sub-Base        | FTDW0010     | 2763           | 730    | 2498             | 660    | 1468       | 3,236 | 635        | 25 | 3810       | 150.0 | 2766             | 108.9 | 3537            | 139.3 |
| Sub-Base        | FTDW005      | 3921           | 1036   | 3793             | 1002   | 1659       | 3,657 | 635        | 25 | 5550       | 218.5 | 2766             | 108.9 | 3537            | 139.3 |
| Sub-Base        | FTDW006      | 7192           | 1900   | 7022             | 1855   | 2228       | 4,912 | 889        | 35 | 6184       | 243.5 | 3020             | 118.9 | 3793            | 149.3 |

| C18 Tank Design | Feature Code | Total Capacity |        | Useable Capacity |        | TANK ONLY  |       |            |    |            |       | TANK AND PACKAGE |       |                 |       |
|-----------------|--------------|----------------|--------|------------------|--------|------------|-------|------------|----|------------|-------|------------------|-------|-----------------|-------|
|                 |              |                |        |                  |        | Dry Weight |       | Height 'H' |    | Length 'L' |       | Open Pgs Height  |       | Enc. Pgs Height |       |
|                 |              | Liter          | Gallon | Liter            | Gallon | kg         | lb    | mm         | in | mm         | in    | mm               | in    | mm              | in    |
| Integral        | FTDW004      | 1457           | 385    | 1400             | 370    | 1060       | 2,337 | 635        | 25 | 3814       | 150.1 | 2400             | 94.5  | 3200            | 126.0 |
| Sub-Base        | FTDW0010     | 2763           | 730    | 2498             | 660    | 1468       | 3,236 | 635        | 25 | 3810       | 150.0 | 2740             | 107.9 | 3537            | 139.3 |
| Sub-Base        | FTDW005      | 3922           | 1036   | 3793             | 1002   | 1659       | 3,657 | 635        | 25 | 5550       | 218.5 | 2740             | 107.9 | 3537            | 139.3 |
| Sub-Base        | FTDW007      | 8384           | 2215   | 8176             | 2160   | 2150       | 4,134 | 889        | 35 | 7073       | 278.5 | 2994             | 117.9 | 3793            | 149.3 |

## INTEGRAL & SUB-BASE FUEL TANK BASE USEABLE CAPACITIES with Fuel Tank Dimensions & Weights

Integral – Width (W) 2014 mm (79.3 in)

Sub-base – Width (W) 2056 mm (81 in)

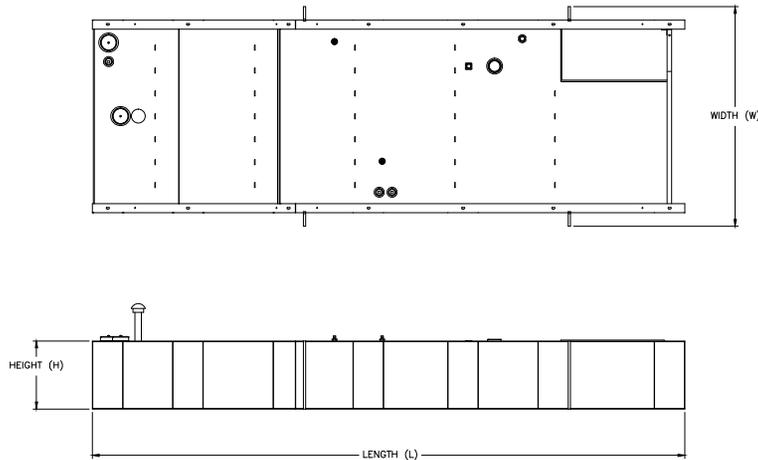
### SOUND ATTENUATED ENCLOSURE

| C15 Tank Design | Feature Code | Total Capacity |        | Useable Capacity |        | TANK ONLY  |       |            |    |            |       | TANK AND PACKAGE |    |                 |       |
|-----------------|--------------|----------------|--------|------------------|--------|------------|-------|------------|----|------------|-------|------------------|----|-----------------|-------|
|                 |              |                |        |                  |        | Dry Weight |       | Height 'H' |    | Length 'L' |       | Open Pgs Height  |    | Enc. Pgs Height |       |
|                 |              | Liter          | Gallon | Liter            | Gallon | kg         | lb    | mm         | in | mm         | in    | mm               | in | mm              | in    |
| Integral        | FTDW001      | 1261           | 333    | 1215             | 321    | 1015       | 2,237 | 635        | 25 | 4753       | 187.1 | NA               | NA | 2619            | 103.1 |
| Sub-Base        | FTDW0011     | 2763           | 730    | 2498             | 660    | 1468       | 3,236 | 635        | 25 | 4743       | 186.7 | NA               | NA | 2955            | 116.3 |
| Sub-Base        | FTDW005      | 3922           | 1036   | 3793             | 1002   | 1659       | 3,657 | 635        | 25 | 5550       | 218.5 | NA               | NA | 2955            | 116.3 |
| Sub-Base        | FTDW006      | 7192           | 1900   | 7022             | 1855   | 2228       | 4,912 | 889        | 35 | 6184       | 243.5 | NA               | NA | 3209            | 126.3 |

| C18 Tank Design | Feature Code | Total Capacity |        | Useable Capacity |        | TANK ONLY  |       |            |    |            |       | TANK AND PACKAGE |    |                 |       |
|-----------------|--------------|----------------|--------|------------------|--------|------------|-------|------------|----|------------|-------|------------------|----|-----------------|-------|
|                 |              |                |        |                  |        | Dry Weight |       | Height 'H' |    | Length 'L' |       | Open Pgs Height  |    | Enc. Pgs Height |       |
|                 |              | Liter          | Gallon | Liter            | Gallon | kg         | lb    | mm         | in | mm         | in    | mm               | in | mm              | in    |
| Integral        | FTDW003      | 1457           | 385    | 1400             | 370    | 1060       | 2,337 | 635        | 25 | 4753       | 187.1 | NA               | NA | 2557            | 100.7 |
| Sub-Base        | FTDW0011     | 2763           | 730    | 2498             | 660    | 1468       | 3,236 | 635        | 25 | 4743       | 186.7 | NA               | NA | 2897            | 114.1 |
| Sub-Base        | FTDW005      | 3921           | 1036   | 3793             | 1002   | 1659       | 3,657 | 635        | 25 | 5550       | 218.5 | NA               | NA | 2897            | 114.1 |
| Sub-Base        | FTDW007      | 8384           | 2215   | 8176             | 2160   | 2150       | 4,740 | 889        | 35 | 7073       | 278.5 | NA               | NA | 3155            | 124.2 |

# ATTACHMENTS



The heights listed above do not include lumber used during manufacturing and shipping.

## ESTIMATED RUN TIMES (HOURS) AT 100% LOAD

| C15 Tank Design | Feature Code | Standby Ratings (ekW) |     |     |     | Prime Ratings (ekW) |     |     |     |
|-----------------|--------------|-----------------------|-----|-----|-----|---------------------|-----|-----|-----|
|                 |              | 500                   | 450 | 400 | 350 | 455                 | 410 | 365 | 320 |
| Integral        | FTDW001/2    | 9                     | 9   | 10  | 11  | 10                  | 10  | 11  | 12  |
| Sub-Base        | FTDW0010/11  | 18                    | 19  | 21  | 23  | 20                  | 20  | 23  | 25  |
| Sub-Base        | FTDW005      | 27                    | 29  | 31  | 35  | 30                  | 31  | 34  | 37  |
| Sub-Base        | FTDW006      | 51                    | 53  | 58  | 65  | 56                  | 57  | 63  | 69  |

| C18 Tank Design | Feature Code | Standby Ratings (ekW) |     |  |  | Prime Ratings (ekW) |     |  |  |
|-----------------|--------------|-----------------------|-----|--|--|---------------------|-----|--|--|
|                 |              | 600                   | 550 |  |  | 545                 | 500 |  |  |
| Integral        | FTDW003/4    | 9                     | 9   |  |  | 9                   | 10  |  |  |
| Sub-Base        | FTDW0010/11  | 15                    | 17  |  |  | 17                  | 18  |  |  |
| Sub-Base        | FTDW005      | 23.5                  | 25  |  |  | 25                  | 27  |  |  |
| Sub-Base        | FTDW007      | 51                    | 54  |  |  | 54                  | 59  |  |  |

Tanks with full electrical stub-up area include removable end channel. Tanks with RH/LH stub-up include stub-up area directly below the circuit breaker or power terminal strips. Dimensions include weather-protective enclosure exhaust system.

Dual wall sub-base tanks are UL listed and constructed in accordance with Underwriters Laboratories Standard UL142 "Steel Aboveground Tanks for Flammable and Combustible Liquids" and Canada ULC S601 "Shop Fabricated Steel Aboveground Tanks for Flammable and Combustible Liquids."

Fuel tanks comply with the following United States NFPA Codes:  
 NFPA 30 – Flammable and Combustible Liquids Code  
 NFPA 37 – Standard for Installation and Use of Stationary Combustible Engine  
 NFPA 110 – Standard for Emergency and Standby Power Systems

Fuel tanks comply with the following Canadian Codes:  
 CSA C282-09 – Emergency Electrical Power Supply for Buildings  
 CSA B139-09 – Installation Code for Oil-Burning Equipment

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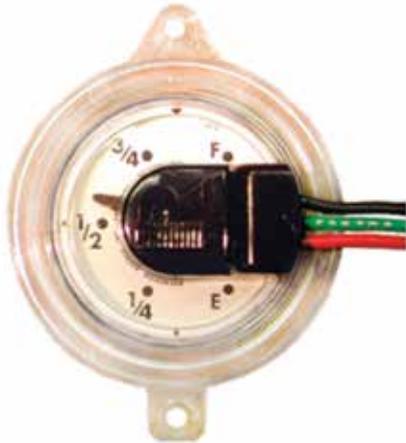


Image shown may not reflect actual configuration

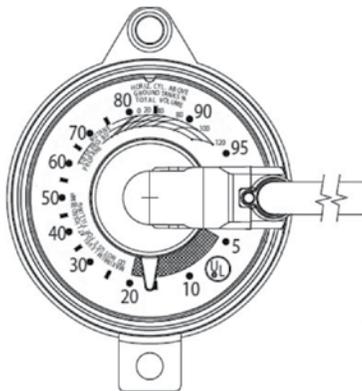
## Fuel Level Gauge and Sender

The unit consists of a magnetically driven dial for direct reading with a snap fit Hall Effect Module attached to the lens. This module sends an electrical signal to a remote fuel level monitor.

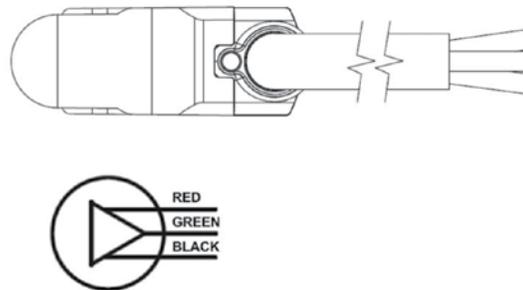
The module can provide ratiometric voltage output proportional to the liquid volume inside the tank.

### Features

- A magnetic drive allows a signal from the float mechanism inside the tank to be transmitted through a solid bulkhead.
- The dial is designed to allow a second magnetic coupling. This is a coupling from the pointer magnet, through the sealed lens and into the Hall Effect Module.
- The magnetic connection of the Hall Effect sensor is more reliable than systems that depend on the sliding contact of variable resistor devices.
- Hall Effect is a solid state technology with no moving contacts. It counts on the fact that a magnet bends the path of electrons moving through a semiconductor. The bending of the electrons can be detected and converted into an electrical signal.
- The dial is able to provide an electrical output which can be utilized for remote monitoring of tank levels.
- The dial case is hermetically sealed by ultrasonic welding to melt and fuse the case into one solid piece. This keeps weather out, ensuring “no-fog” read ability while greatly extending mechanical life.
- The seal is a high reliability, no-gasket design.
- The plastic case is far more resistant to corrosion than any metal-cased version and is capable of withstanding broad variations in temperature. The lens and case are a special, UV stabilized plastic material.



Remote-ready Dial, with Hall Effect Module



Hall Effect Module

## General and Functional Specifications\*

- Conformity:  $\pm 3\%$  at 5 VDC
- Operating temperature:  $-40^{\circ}$  to  $80^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$  to  $176^{\circ}\text{F}$ )
- Accuracy:  $\pm 4\%$  of full scale. (float gauge errors not included.)
- Repeatability:  $\pm 1\%$ .
- Operational voltage range: 3.5 to 6.0 VDC
- Output voltage: ratiometric 10–90% of input voltage @ 10–90% volume
- Resolution – infinite
- Operating current: 4.5 mA
- Output current:  $\pm 1$  mA
- Hall Effect modules are UL classified as intrinsically safe for Class 1, Division 1, Groups C and D (hazardous locations)

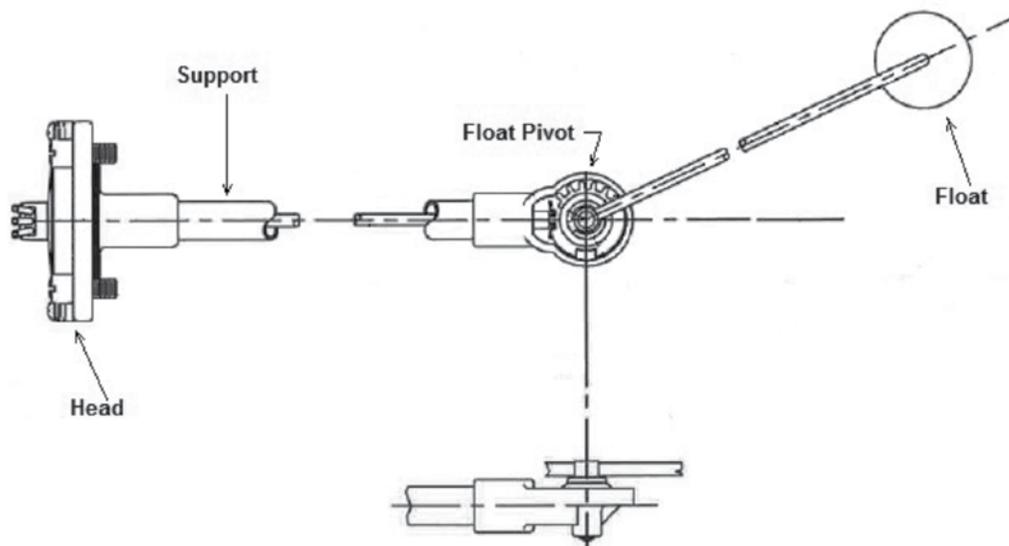
## Gauge Materials of Construction\*

- Head – die cast aluminum.
- Center shaft, support tube, and float rod – tempered aluminum
- Gears, cross stud, and bearing – stainless steel
- Drive magnet – alnico
- Gear housing – acetal
- Float – nitrile rubber

## Dial Materials of Construction\*

- Crystal and case: polycarbonate.
- Dial – painted aluminum

\*Materials and specifications are subject to change without notice. Ratings subject to change due to temperature and other environmental considerations.



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Image shown may not reflect actual configuration

## Overfill Prevention Valve for Use with 5 Gallon Spill Containment

The overfill prevention valve is installed at the fill port of a fuel tank.

Used in a pressurized tight fill application, the valve helps prevent tank overfills by closing when the liquid level reaches a pre-set warning level 95% full.

The valve is installed through a 4" threaded opening and has a built-in bleed hole that allows the fill hose pressure to be relieved after the valve closes. This bleed hole also provides anti-siphon protection for the valve.

### Features

- Designed for full flow until reaching the shutoff level
- Accepts 2" NPT drop tube, as required, to meet local jurisdiction codes
- Immediate and cushioned shutoff eliminates line shock
- Full flow up to within seconds of valve closure
- Integrated bleed hole prevents siphoning through the valve and allows less than 2% of the maximum flow to relieve fill line pressure so the fill nozzle can be disconnected without spilling product.
- Valve operates on simple mechanics with minimal moving parts. Shutoff is activated by basic hydraulic principles.
- Adjustable float
- 2" female threads x 4" female threads

### Construction Details

- Adaptor: aluminum (hard-coat anodized)
- Body: anodized aluminum
- Valve: weight 12.5 lbs.
- Float: Nitrophyl-N
- Plunger and dashpot: aluminum (hard-coated)
- Upper tube and float guard: E-coated steel
- Shutoff mechanism: stainless steel

### Product Warnings and Cautions

- 5 psi and 5 gpm is the minimum flow requirement for valve operation. Valve will NOT function in gravity fill applications.
- Maximum viscosity of 300 centistokes.
- Estimated flow rate of 175 gpm at 10 psi pressure drop
- The maximum operating pressure is 100 psi.
- Once closed the valve will allow flow of less than 2% of max flow to relieve fill line pressure.
- A tight fill is required for the valve to operate. Do not substitute any other fill adaptors for the special adaptor supplied.
- The valve must be used with clean product. Debris from products such as contaminated used oil may cause the valve to function improperly.

### Code Compliance

- NFPA 30, 30A, UFC, IFC, and PEI/RP200

Dimensions

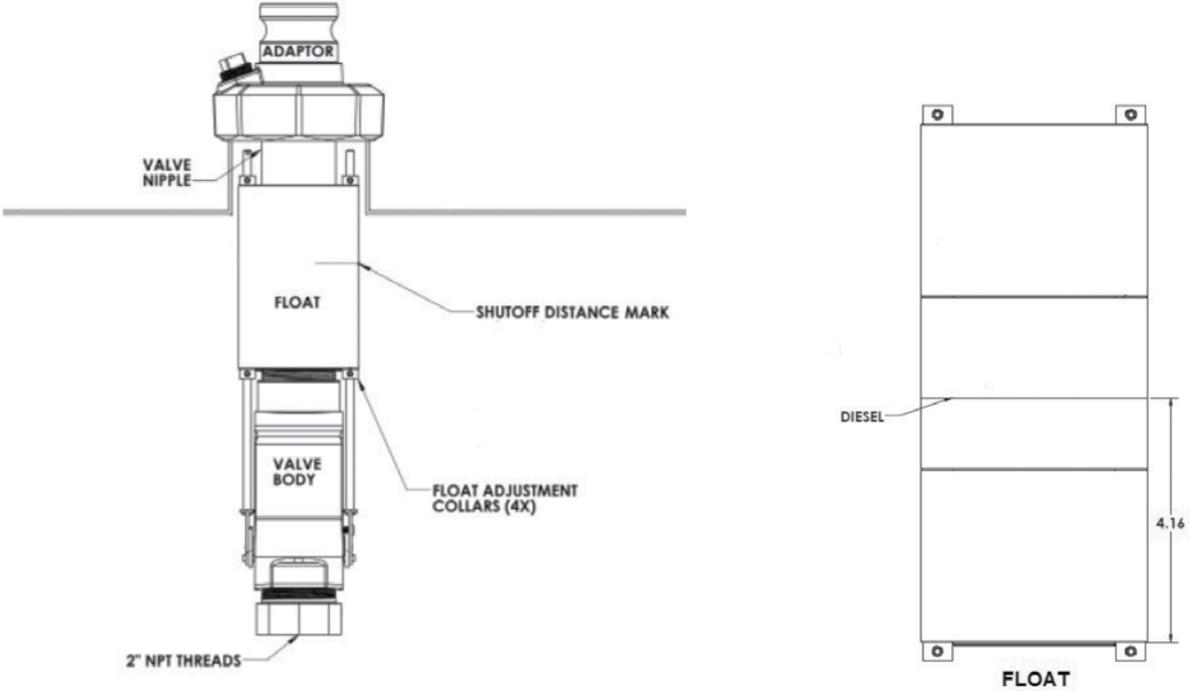


Image shown may not reflect actual configuration

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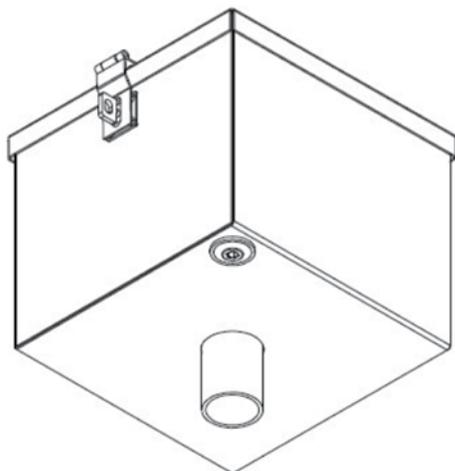


Image shown may not reflect actual configuration

### 5 Gallon Steel Spill Containment Box

Durable spill containment box designed for containment of small spills during filling of an above ground storage tank.

#### Features

- Optional overfill prevention valve
- Lockable hinged cover.

#### Dimensions

- Height: 13.08"
- Height with pipe: 13.40"
- Body Width: 12.38"
- Width: 13.68"
- Weight: 22 lbs.

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# PRODUCT NEWS

Engine Division

## Cat® Generator Set Vibration Isolators

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**Market:** Electric Power

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**Application:** Cat® C9, C15, C18 and C27 package generator sets, both U.S. and European sourced and all 3600 series package generator sets.

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**Description:** All Cat® C9, C15, C18 and C27 package generator sets utilize linear vibration isolators between the engine generator and the base. These isolators comply with the requirements of up to and including Seismic Zone 4 as stated below:

All Caterpillar® C9, C15, C18 and C27 package generator sets incorporate rubber-type isolators between the engine generator and the base. These isolators are over 95% efficient (85% for C27) in reducing vibration transmission. External isolation is not required. The design is deflection restraint limiting and will withstand high loads in any plane. The design of these isolators satisfies shear and axial load criteria to comply with the 1994 Uniform Building Code (UBC) Seismic Zone 4 requirements.

The isolators use a proprietary rubber compound, which is highly resilient and exhibits high fatigue life. The compound is resistant to water, heat and aging and is impervious to oil, water, antifreeze and diesel fuel.

All 3600 series generator sets use vertically restrained spring isolators between the generator set base and the foundation. These spring isolators also comply with the Uniform Building Code (UBC) Seismic Zone 4 requirements.

---

**Features/Benefits:** The above statement can be used to demonstrate compliance with Seismic requirements.

---

**Availability:** C9, C15, C18 and C27 : Effective immediately  
3600 series product: Effective immediately  
3500 series product: Available as a Special Engineering Request (SER). Please contact the Application Support Center at (765) 448-2400 or email them at [applicationsupport@cat.com](mailto:applicationsupport@cat.com) for more information.



WHERE THE WORLD TURNS FOR POWER

CAT Elastomer Vibration Isolator as found on C9, C15, C18 and C27 Gensets



**Section 7**  
**Startup and Testing**



**PRE START-UP CHECK LIST FOR CATERPILLAR DIESEL GENERATOR SET PACKAGES**

Please fill out the following documentation and send back to the following Project Manager prior to setting up the start-up of the generator set and its accessories.

**Project Manager: Hans Christensen**  
**Ph: 207-991-3127**  
**Fax #: 207-433-1171**  
**Email: hans\_christensen@miltoncat.com**

**Date: October 17, 2014**

1) Project Name : \_\_\_\_\_

2) Site Address: \_\_\_\_\_

3) Site Contact: \_\_\_\_\_

4) Contact Cell #: \_\_\_\_\_

5) Start-Up Request Date: \_\_\_\_\_

6) Load Bank Test Request Date: \_\_\_\_\_

Distance from generator to vehicle parking: \_\_\_\_\_

7) Training Request Date: \_\_\_\_\_

**“All Date requests will be confirmed by Milton CAT Field Service Dispatcher”**

8) Model: C15 Serial #: \_\_\_\_\_

**Mechanical:**

- I) Self-Contained (Factory Installed Sub-Base or Integral) Fuel Tanks: Tank has been filled at least 50% of usable capacity.
- II) Day Tanks or Separate Fuel Tanks: Supply and return lines are installed between tank and engine. Lines must be installed below engine injectors and supply line restriction cannot exceed 12' of vertical lift. Alarm / float control wiring has been completed.

**Electrical:**

- I) All conduits must be isolated with flexes.
- II) All wiring must be stranded (Please check off):

a. \_\_\_\_\_ 240 VAC, 40 Amp (Max Wire Size 8 Awg) rated disconnect Circuit shall be run and connected to Terminal Strip in the High Voltage Connection Box (Circuit Breaker Can)

**(Should be run in its own Conduit)**

**\*\*DO NOT ENERGIZE AC CIRCUIT BEFORE STARTUP VISIT\*\***

b. \_\_\_\_\_ ATS Auto start control wires Qty (2) 14AWG) need to be connected from ATS to Terminal Strip in low voltage connection box of the generator set controller.

c. \_\_\_\_\_ ATS Position Wires Qty (2) 14AWG) need to be connected from ATS to Terminal Strip in low voltage connection box of the generator set controller

**(Should be run in its own Conduits)**

d. Optional (If Supplied):

1) \_\_\_\_\_ Remote Annunciator Wiring to Generator EMCP 4 Control Panel

Required Wiring:

RS485 Cable, twisted shielded triad (Northwire FAWM183-155)

(2) 14AWG Wires for 12/24VDC.

**(Should be run in its own conduit)**

**Automatic Transfer Switch Exercise Schedule**

Day of Week: \_\_\_\_\_

Time: \_\_\_\_\_

Duration: \_\_\_\_\_

Frequency: \_\_\_\_\_ Weekly \_\_\_\_\_ Bi-Weekly \_\_\_\_\_ Monthly

Building Load: \_\_\_\_\_ With \_\_\_\_\_ Without

**The site electrician should be on site, on the date of start-up, in case any issues arise.**

**On-Site Personnel Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Milton**

Power Systems Division

**EPG Start Up Checklist**

| Customer Data/Contractor Data |       |                      |        |
|-------------------------------|-------|----------------------|--------|
| Name                          |       | Date First Visit     |        |
| Street                        |       |                      |        |
| City                          |       | Hours                |        |
| Electrical Contrator          |       |                      |        |
| Type of Installation          |       |                      |        |
| Standby                       | Prime | Peakshave            | CO-Gen |
| Engine Data                   |       | Generator Data       |        |
| EngineModel                   |       | Serial Number        |        |
| Serial Number                 |       | Arrangement          |        |
| Arrangement                   |       | Rating               |        |
| Engine HP rating              |       | Voltage              |        |
| Fuel Type                     |       | Amperage             |        |
| ATS 1                         |       | ATS 2                |        |
| Make                          |       | Make                 |        |
| Model                         |       | Model                |        |
| Ser#                          |       | Ser#                 |        |
| Voltage                       |       | Voltage              |        |
| Amp rating                    |       | Amp rating           |        |
| Environment                   |       |                      |        |
| Housed Outside                |       | Inside Building      |        |
| Housing Manufacturer          |       | Location in Building |        |
| Housing Serial Number         |       |                      |        |

| <b>Pre Start Checks</b>                                  |   |
|--|---|
| <b>Mounting</b>  | Adjust isolators                                    |
| Secured to level surface                                 | Proper Clearances                                   |
| <b>Lube System</b>                                       | <b>Fuel System Diesel</b>                           |
| Oil level  | Flexible lines                                      |
| Oil leaks  | Fuel solenoid wired                                 |
| <b>Cooling System</b>                                    | <b>Day Tank</b>                                     |
| Coolant level(JW)  | Wired to emergency source                           |
| Coolant level(SCAC)                                      | Proper elevation                                    |
| Proper Ventilation                                       | Floats operational                                  |
| <b>Remote Radiator(if equip)</b>                         | Alarms wired and operate                            |
| Isolation Valves at engine                               | Return line one size larger than supply             |
| Fans and pumps wired to emergency source and operational | Day tank solenoid wired to open only when pump runs |
| Elevation above engine within acceptable limits          |   |
| Check for leaks  | <b>Fuel System Gas</b>                              |
| Proper pipe sizing                                       | Manual Shutoff                                      |
|  | Solenoid installed/wired                            |
| <b>Exhaust System</b>                                    | Flex Connector (Approved)                           |
| Flexes   | Measure/Record Gas Pressure after solenoid valve    |
| Condensate trap  |   |
| Muffler  | Proper initial fuel mixture adjustments             |
| Correct Sizing   |   |
| Thimble through walls                                    |   |

| <b>Pre Start Checks</b>               |                        |
|---------------------------------------|------------------------|
| <b>Batteries</b>                      | <b>Generator</b>       |
| Proper size                           | Voltage                |
| Voltage                               | Wiring complete        |
| Proper battery rack                   | GROUNDING Y/N          |
| Charger wired                         | Where is it grounded   |
| Charger proper voltage                | <b>ATS</b>             |
| Float voltage setting                 | Correct Voltage        |
| Equalize setting                      | AC connections         |
| <b>Jacket Water Heater</b>            | Open/Closed Transition |
| Voltage                               | <b>Utility</b>         |
|                                       | Pick up                |
| KW                                    | Drop out               |
| Wired to Normal Source                | <b>Emergency</b>       |
| <b>CIM/CCM</b>                        | Pick up                |
| Customer connection                   | Drop out               |
| Proper wire size and type             | <b>Time Delays</b>     |
| Operational                           | Start                  |
| <b>Remote Annunciators</b>            | Transfer               |
| Customer connection                   | Neutral                |
| Proper wire size and type             | Retransfer             |
| Operational <i>See Attached Sheet</i> | Cooldown               |
| <b>Remote Start Wiring</b>            | Exerciser Set Day/Time |
| Wired to ATSS                         |                        |
| Proper wire size and type             |                        |
|                                       |                        |

| <b>Operational Checks (engine running)</b> |                        |                            |
|--|------------------------|----------------------------|
| <b>Record Actual</b>                       |                        | <b>Load Bank Test Y/N</b>  |
| Oil pressure                               |                        | <b>Operation with Load</b> |
| Coolant Temp                               |                        | <b>Frequency</b>           |
| Coolant Level                              |                        | <b>AC Voltage</b>          |
| Noise and Vibration/OK                     |                        | <b>A</b>                   |
| Battery Charge Rate                        |                        | <b>B</b>                   |
| AC Voltage                                 |                        | <b>C</b>                   |
| Frequency                                  |                        | <b>N</b>                   |
| Phase Rotation                             |                        |                            |
| <b>Shutdowns (verify)</b>                  | <b>Record settings</b> | <b>AC Amperage</b>         |
| Oil pressure                               |                        | <b>A</b>                   |
| Coolant Temp                               |                        | <b>B</b>                   |
| Overspeed Safety                           |                        | <b>C</b>                   |
| Overcrank                                  |                        | <b>N</b>                   |
| <b>Alarms (verify)</b>                     |                        |                            |
| Oil pressure                               |                        | <b>ATS (record actual)</b> |
| Coolant Temp                               |                        | Time Delay Start           |
| Coolant Level                              |                        | Time Delay Transfer        |
| Not in Auto                                |                        | Time Delay Neutral         |
| Low Battery Voltage                        |                        | Time Delay Retransfer      |
| High Battery Voltage                       |                        | Cooldown                   |
| Charger Failure                            |                        |                            |
| Low fuel                                   |                        |                            |
| High Fuel                                  |                        |                            |
| Critical High Fuel                         |                        |                            |
| Rupture Basin                              |                        |                            |
|  |                        |                            |
|  |                        |                            |

| Final Installation Recommendations |  |
|------------------------------------|--|
| A                                  |  |
|                                    |  |
| B                                  |  |
|                                    |  |
| C                                  |  |
|                                    |  |
| D                                  |  |
|                                    |  |
| E                                  |  |
|                                    |  |
|                                    |  |

| Final Review With Customer or Contractor |  |
|--|--|
| Checking Coolant                         |  |
| Checking Oil                             |  |
| Walk around inspection                   |  |
| Safe starting and stopping               |  |
| Maintenance Intervals                    |  |
| Weekly                                   |  |
| Monthly                                  |  |
| Annual                                   |  |
| Three year                               |  |
|  |  |

| Signatures   |                     |
|--------------|---------------------|
|              |                     |
|              |                     |
| Performed By | Customer/Contractor |
|              |                     |
|              |                     |
| Engineer     | Date                |

|          |
|----------|
| Date:    |
| Customer |
| Location |
| Serial # |



Power Systems Division  
Emergency Generator package  
Startup test Reporting

| SITE EVALUATION    |  | TECHNICIANS COMMENTS |  |
|--------------------|--|----------------------|--|
| # OF CABLE USED:   |  |                      |  |
| # FEET CABLE RUN   |  |                      |  |
| LOCATION OF GENSET |  |                      |  |

| TIME | KW | VOLTAGE |      |      | AMPS |      |      | HZ. | POWER FACTOR | D.C. VOLTAGE | OIL PRESS. | FUEL PRESS. | FUEL CONS. | J.W. TEMP. | A.C. TEMP. | EXH. TEMP. | SAFETY CHECKLIST                   |      | TRIP |  |
|------|----|---------|------|------|------|------|------|-----|--------------|--------------|------------|-------------|------------|------------|------------|------------|------------------------------------|------|------|--|
|      |    | PH 1    | PH 2 | PH 3 | PH 1 | PH 2 | PH 3 |     |              |              |            |             |            |            |            |            | POINT                              | OK   |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | SHUTDOWNS:                         |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | LOW OIL PRESSURE                   |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | HIGH COOLANT TEMP.                 |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | OVERSPEED                          |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | OVERCRANK                          |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | ALARMS:                            |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | LOW OIL PRESSURE                   |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | HIGH COOLANT TEMP.                 |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | LOW COOLANT TEMP.                  |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | NOT IN AUTO                        |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | LOW BATTERY VOLTAGE                |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | BATT CHARGER FAILURE               |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | LOW FUEL LEVEL                     |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | OFF PANEL ALARMS:                  |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | CRITICAL LOW FUEL LEVEL            |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | HIGH FUEL LEVEL                    |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | CRIT. HIGH FUEL LEVEL              |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | OVERFL. RETURN PUMP 1              |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | OVERFL. RETURN PUMP 2              |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | ENGINE CYCLE CRANK:                |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | SECONDS CRANKING                   |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | SECONDS REST                       |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | TOTAL CRANK CYCLES                 |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | TOTAL CRANK SECONDS                |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | VOLTAGE REGULATOR ADJUSTMENT RANGE |      |      |  |
|      |    |         |      |      |      |      |      |     |              |              |            |             |            |            |            |            | LOW                                | HIGH |      |  |

Technician \_\_\_\_\_ Logger s/n \_\_\_\_\_ Cal Due Date \_\_\_\_\_ Customer Witness to test \_\_\_\_\_

LIST DEFICIENCIES \_\_\_\_\_

Overall System Integrity  
Acceptable \_\_\_\_\_  
Deficiencies \_\_\_\_\_

Exhaust System Backpressure  
100% Load \_\_\_\_\_

**Section 8**  
**Documentation**

Effective with sales to the first user on or after December 1, 2010

# CATERPILLAR LIMITED WARRANTY

## Industrial, Petroleum, Locomotive, and Agriculture Engine Products and Electric Power Generation Products Worldwide

Caterpillar Inc. or any of its subsidiaries ("Caterpillar") warrants new and remanufactured engines and electric power generation products sold by it (including any products of other manufacturers packaged and sold by Caterpillar), to be free from defects in material and workmanship.

This warranty does not apply to Caterpillar Motoren (CM) product; engines sold for use in on-highway vehicle or marine applications; engines in machines manufactured by or for Caterpillar; 3500 and 3600 Family engines used in locomotive applications; 3000 Family engines, C0.5 through C4.4 and ACERT (C6.6, C7, C7.1, C9, C9.3, C11, C13, C15, C18, C27, and C32) engines used in industrial applications; or Cat batteries. These products are covered by other Caterpillar warranties.

This warranty is subject to the following:

### Warranty Period

- For new industrial engines, engines in a petroleum applications or Petroleum Power Systems, or engines in a Locomotive application, or Uninterruptible Power Supply (UPS) systems, the warranty period is 12 months after date of delivery to the first user.
- For Mobile Agricultural applications the warranty period is 24 months after date of delivery to the first user.
- For controls only (EPIC), configurable, and custom switchgear products, as well as automatic transfer switch products, the warranty period is 24 months after date of delivery to the first user.
- For electric power generation products in prime or continuous applications the warranty period is 12 months. For standby applications the warranty period is 24 months/1000 hours. For emergency standby applications the warranty period is 24 months/400 hours. All terms begin after date of delivery to the first user.

- For all Remanufactured Generator (GenEnds) products in prime or continuous applications the warranty period is 12 months. For standby applications the warranty period is 24 months/1000 hours. For emergency standby applications the warranty period is 24 months/400 hours. All terms begin after date of delivery to the first user.
- For all Remanufactured engines, the warranty period is 6 months (12 months for mobile agricultural and standby electric power generation applications) after date of delivery to the first user.

### Caterpillar Responsibilities

If a defect in material or workmanship is found during the warranty period, Caterpillar will, during normal working hours and at a place of business of a Cat dealer or other source approved by Caterpillar:

- Provide (at Caterpillar's choice) new, Remanufactured, or Caterpillar approved repaired parts or assembled components needed to correct the defect.
- Note: New, remanufactured, or Caterpillar approved repaired parts or assembled components provided under the terms of this warranty are warranted for the remainder of the warranty period applicable to the product in which installed as if such parts were original components of that product. Items replaced under this warranty become the property of Caterpillar.
- Replace lubricating oil, filters, coolant, and other service items made unusable by the defect.
  - Provide reasonable and customary labor needed to correct the defect, including labor to disconnect the product from and reconnect the product to its attached equipment, mounting, and support systems, if required.

For new 3114, 3116, and 3126 engines and electric power generation products (including any new products of other

manufacturers packaged and sold by Caterpillar):

- Provide travel labor, up to four hours round trip, if in the opinion of Caterpillar, the product cannot reasonably be transported to a place of business of a Cat dealer or other source approved by Caterpillar (travel labor in excess of four hours round trip, and any meals, mileage, lodging, etc. is the user's responsibility).

For all other products:

- Provide reasonable travel expenses for authorized mechanics, including meals, mileage, and lodging, when Caterpillar chooses to make the repair on-site.

### User Responsibilities

The user is responsible for:

- Providing proof of the delivery date to the first user.
- Labor costs, except as stated under "Caterpillar Responsibilities," including costs beyond those required to disconnect the product from and reconnect the product to its attached equipment, mounting, and support systems.
- Travel or transporting costs, except as stated under "Caterpillar Responsibilities."
- Premium or overtime labor costs.
- Parts shipping charges in excess of those that are usual and customary.
- Local taxes, if applicable.
- Costs to investigate complaints, unless the problem is caused by a defect in Caterpillar material or workmanship.
- Giving timely notice of a warrantable failure and promptly making the product available for repair.

(continue on the reverse side.....)

- Performance of the required maintenance (including use of proper fuel, oil, lubricants, and coolant) and items replaced due to normal wear and tear.
- Allowing Caterpillar access to all electronically stored data.

### Limitations

Caterpillar is not responsible for:

- Failures resulting from any use or installation that Caterpillar judges improper.

- Failures resulting from attachments, accessory items, and parts not sold or approved by Caterpillar.
- Failures resulting from abuse, neglect, and/or improper repair.
- Failures resulting from user's delay in making the product available after being notified of a potential product problem.
- Failures resulting from unauthorized repairs or adjustments, and unauthorized fuel setting changes.

- Damage to parts, fixtures, housings, attachments, and accessory items that are not part of the engine or electric power generation product (including any products of other manufacturers packaged and sold by Caterpillar).
- Repair of components sold by Caterpillar that is warranted directly to the user by their respective manufacturer. Depending on type of application, certain exclusions may apply. Consult your Cat dealer for more information.

*For products operating outside of Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:*

**NEITHER THE FOREGOING EXPRESS WARRANTY NOR ANY OTHER WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED, IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS THAT IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.**

**THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EXCEPT CATERPILLAR EMISSION-RELATED COMPONENTS WARRANTIES FOR NEW ENGINES, WHERE APPLICABLE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISION OF MATERIAL AND SERVICES, AS SPECIFIED HEREIN.**

**CATERPILLAR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

**CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.**

**IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS IS EXCLUDED IN ITS ENTIRETY.**

For personal or family use engines or electric power generation products, operating in the USA, its territories and possessions, some states do not allow limitations on how long an implied warranty may last nor allow the exclusion or limitation of incidental or consequential damages. Therefore, the previously expressed exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights, which vary by jurisdiction. To find the location of the nearest Cat dealer or other authorized repair facility, call (800) 447-4986. If you have questions concerning this warranty or its applications, call or write:

In USA and Canada: Caterpillar Inc., Engine Division, P. O. Box 610, Mossville, IL 61552-0610, Attention: Customer Service Manager, Telephone (800) 447-4986. Outside the USA and Canada: Contact your Cat dealer.

*For products operating in Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:*

**THIS WARRANTY IS IN ADDITION TO WARRANTIES AND CONDITIONS IMPLIED BY STATUTE AND OTHER STATUTORY RIGHTS AND OBLIGATIONS THAT BY ANY APPLICABLE LAW CANNOT BE EXCLUDED, RESTRICTED OR MODIFIED ("MANDATORY RIGHTS"). ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED (BY STATUTE OR OTHERWISE), ARE EXCLUDED.**

**NEITHER THIS WARRANTY NOR ANY OTHER CONDITION OR WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED (SUBJECT ONLY TO THE MANDATORY RIGHTS), IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS THAT IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.**

**TO THE EXTENT PERMITTED UNDER THE MANDATORY RIGHTS, IF CATERPILLAR IS THE SUPPLIER TO THE USER, CATERPILLAR'S LIABILITY SHALL BE LIMITED AT ITS OPTION TO (a) IN THE CASE OF SERVICES, THE SUPPLY OF THE SERVICES AGAIN OR THE PAYMENT OF THE COST OF HAVING THE SERVICES SUPPLIED AGAIN, AND (b) IN THE CASE OF GOODS, THE REPAIR OR REPLACEMENT OF THE GOODS, THE SUPPLY OF EQUIVALENT GOODS, THE PAYMENT OF THE COST OF SUCH REPAIR OR REPLACEMENT OR THE ACQUISITION OF EQUIVALENT GOODS.**

**CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.**

**CATERPILLAR IS NOT LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES UNLESS IMPOSED UNDER MANDATORY RIGHTS.**

**IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS IS EXCLUDED IN ITS ENTIRETY.**

This warranty covers every major component of the products. Claims under this warranty should be submitted to a place of business of a Cat dealer or other source approved by Caterpillar. For further information concerning either the location to submit claims or Caterpillar as the issuer of this warranty, write Caterpillar Inc., 100 N. E. Adams St., Peoria, IL USA 61629.

**Section 9**  
**Project Notes**

## Project Notes

### **Shipped Loose Items:**

- Generator Remote Annunciator

### **Electrical Wiring Requirements:**

- 40A, 120/240 circuit to feed:
  - 240VAC Battery Charger
  - 240VAC/ 3kW Jacket Water Heater
- Remote Annunciator
  - RS485 Cable, 18AWG Twisted Shielded Cable
  - 24VDC – (2) 14AWG
- Auto-Start Circuit
  - (2) 14AWG

### **Estimated Shipping Weights:**

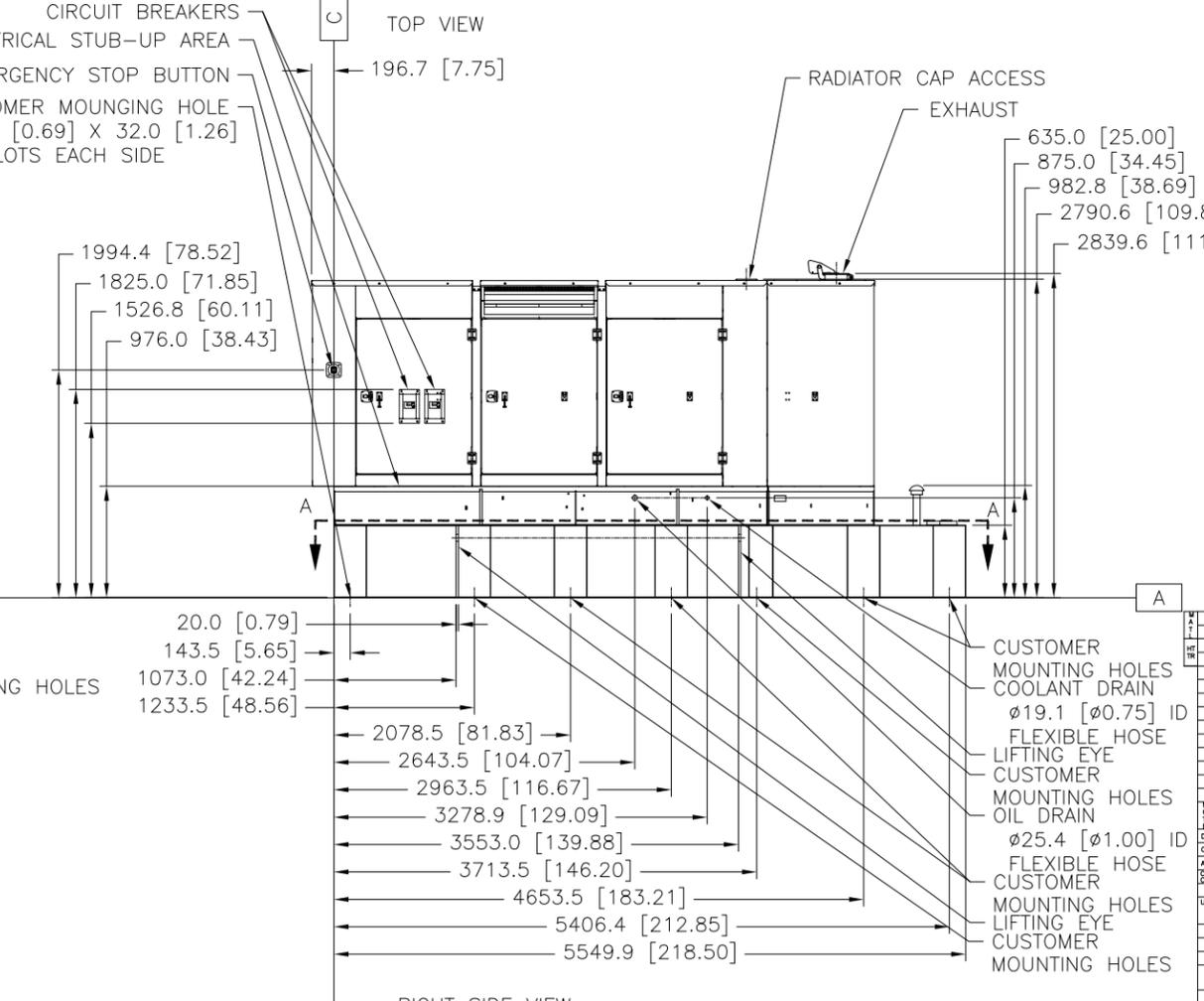
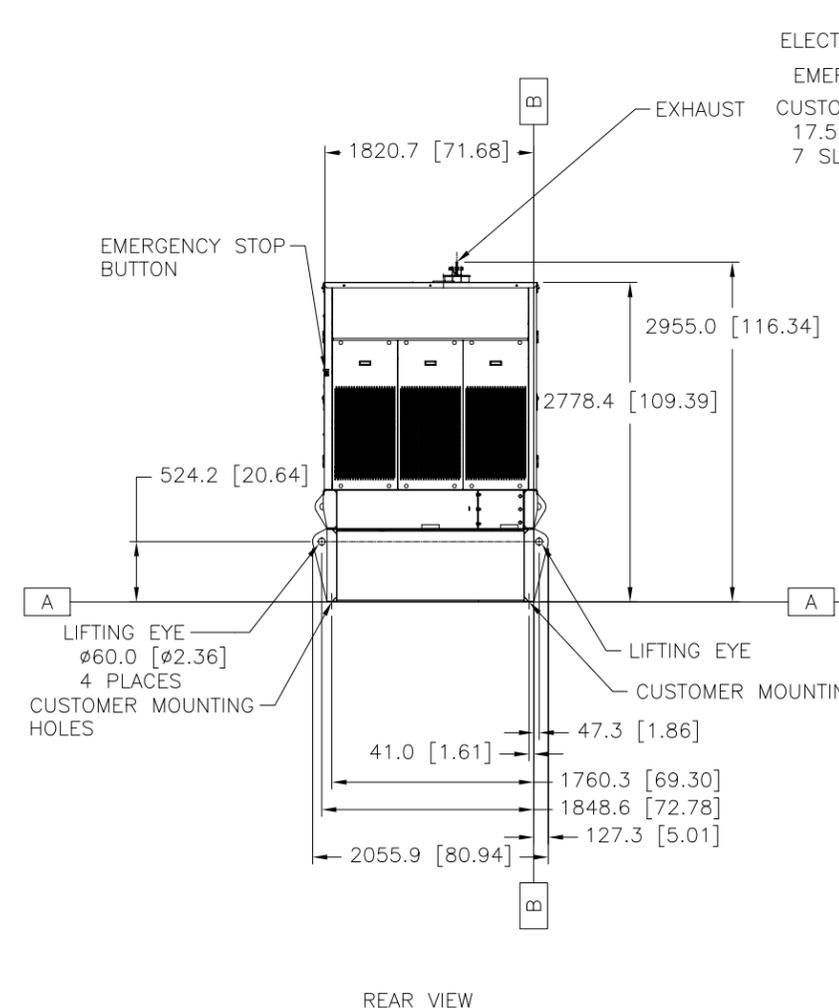
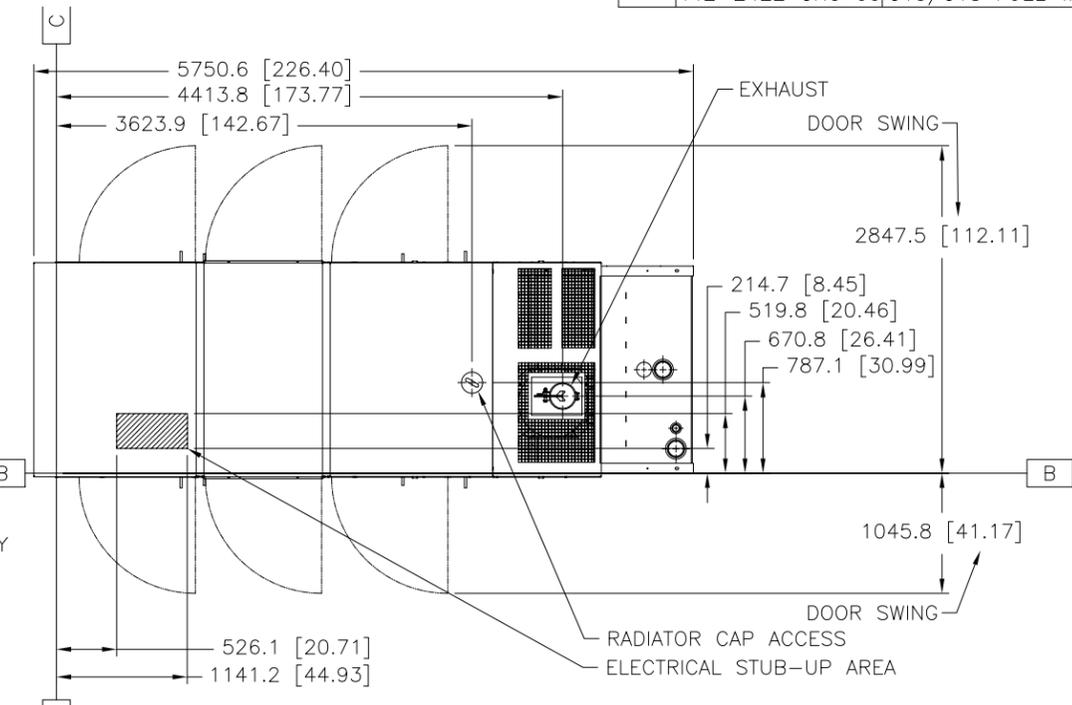
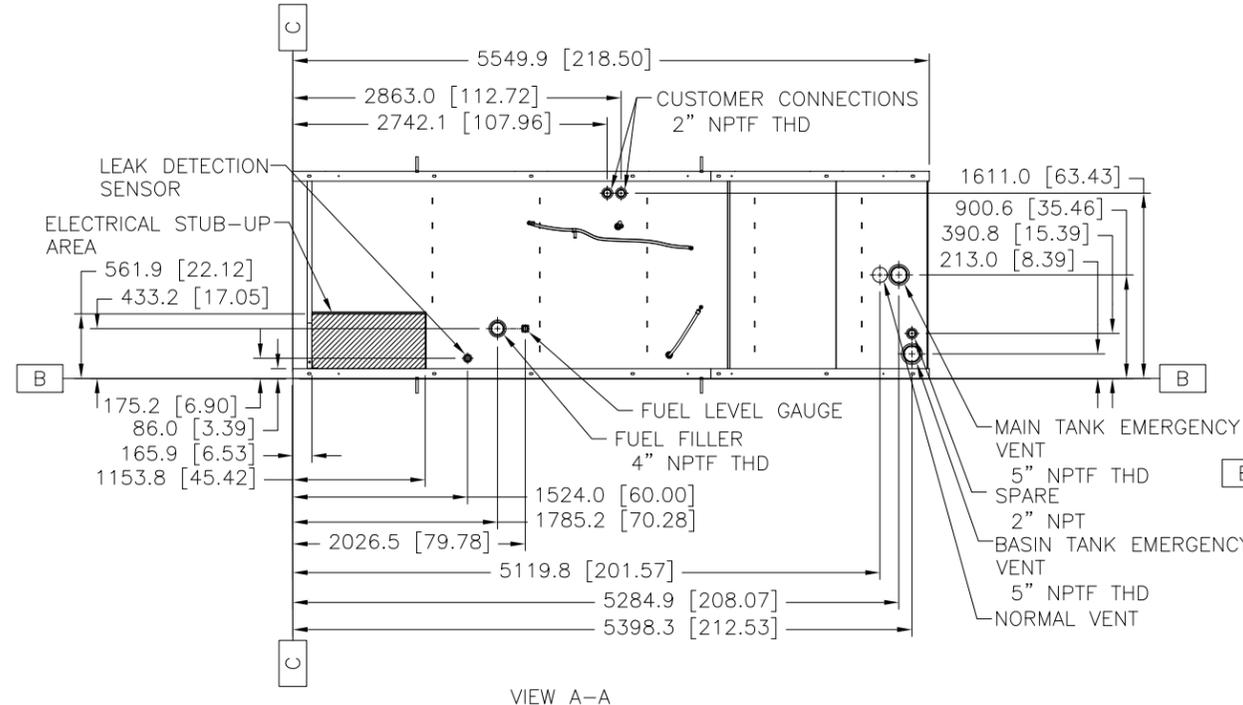
Generator Set with Enclosure & Fuel Tank: 16,000lbs

**Section 10**  
**Drawings**

# C15 Sound Attenuated Enclosure with 1036 Gallon Sub Base Fuel Tank

METRIC 449-9474

| NOTE | INSTALLATION DWG | DESCRIPTION            |
|------|------------------|------------------------|
| A    | 443-3071 CHG 00  | C15 GENSET SA ENC      |
|      | 442-2422 CHG 00  | C15/C18 FUEL TANK BASE |



- EXHAUST
- EMERGENCY STOP BUTTON
- LIFTING EYE  
ø60.0 [ø2.36]  
4 PLACES
- CUSTOMER MOUNTING HOLES
- 1820.7 [71.68]
- 2955.0 [116.34]
- 2778.4 [109.39]
- 524.2 [20.64]
- 41.0 [1.61]
- 47.3 [1.86]
- 1760.3 [69.30]
- 1848.6 [72.78]
- 127.3 [5.01]
- 2055.9 [80.94]

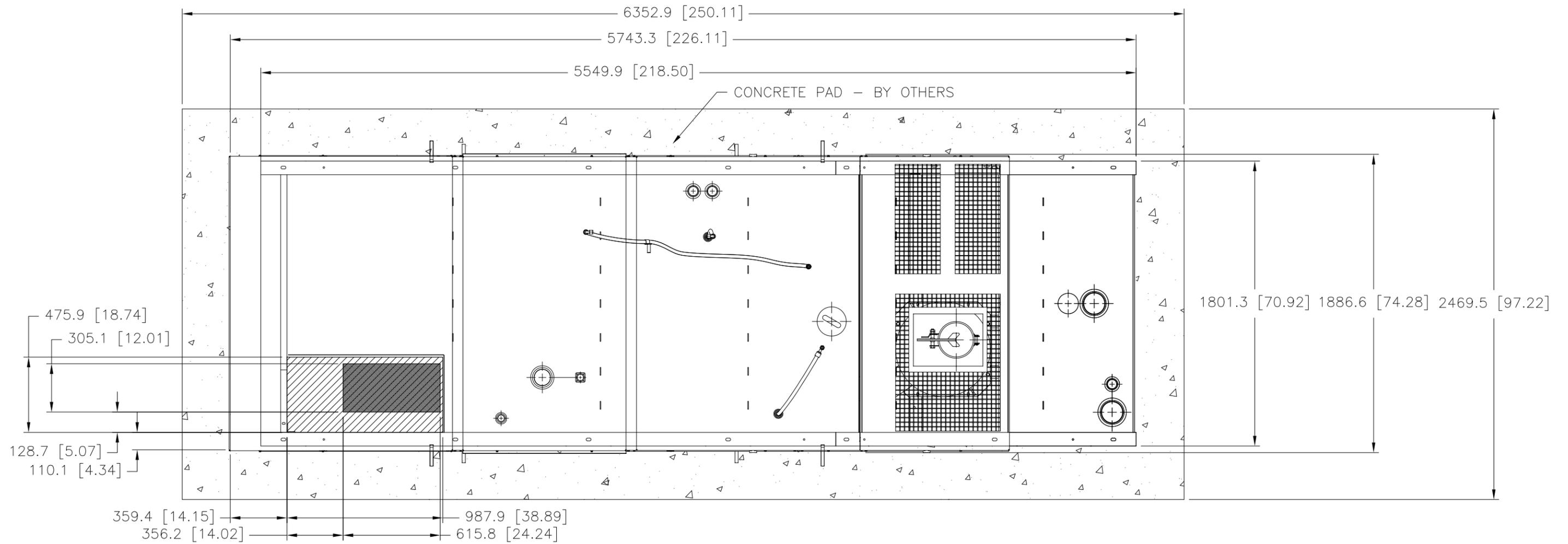
- CIRCUIT BREAKERS
- ELECTRICAL STUB-UP AREA
- EMERGENCY STOP BUTTON
- CUSTOMER MOUNTING HOLE  
17.5 [0.69] X 32.0 [1.26]  
7 SLOTS EACH SIDE
- 196.7 [7.75]
- 1994.4 [78.52]
- 1825.0 [71.85]
- 1526.8 [60.11]
- 976.0 [38.43]
- 2078.5 [81.83]
- 2643.5 [104.07]
- 2963.5 [116.67]
- 3278.9 [129.09]
- 3553.0 [139.88]
- 3713.5 [146.20]
- 4653.5 [183.21]
- 5406.4 [212.85]
- 5549.9 [218.50]
- RADIATOR CAP ACCESS
- EXHAUST
- 635.0 [25.00]
- 875.0 [34.45]
- 982.8 [38.69]
- 2790.6 [109.87]
- 2839.6 [111.79]
- CUSTOMER MOUNTING HOLES
- COOLANT DRAIN  
ø19.1 [ø0.75] ID
- FLEXIBLE HOSE
- LIFTING EYE
- CUSTOMER MOUNTING HOLES
- OIL DRAIN  
ø25.4 [ø1.00] ID
- FLEXIBLE HOSE
- CUSTOMER MOUNTING HOLES
- LIFTING EYE
- CUSTOMER MOUNTING HOLES

NOTE A: FOR INFORMATION REFERENCE  
THESE INSTALLATION DRAWINGS

| REV | DESCRIPTION            | DATE |
|-----|------------------------|------|
| 1   | 1E2733 DRAWING-AUTOCAD |      |
| 2   | 1E0011 INTERP & TOL    |      |
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UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN MM (INCH)  
DIMENSIONS W/O TOL ARE BASIC  
SCALE 1 = 20  
SHEET 1 OF 1  
CATERPILLAR INC.  
00 09SEP13  
449-9474





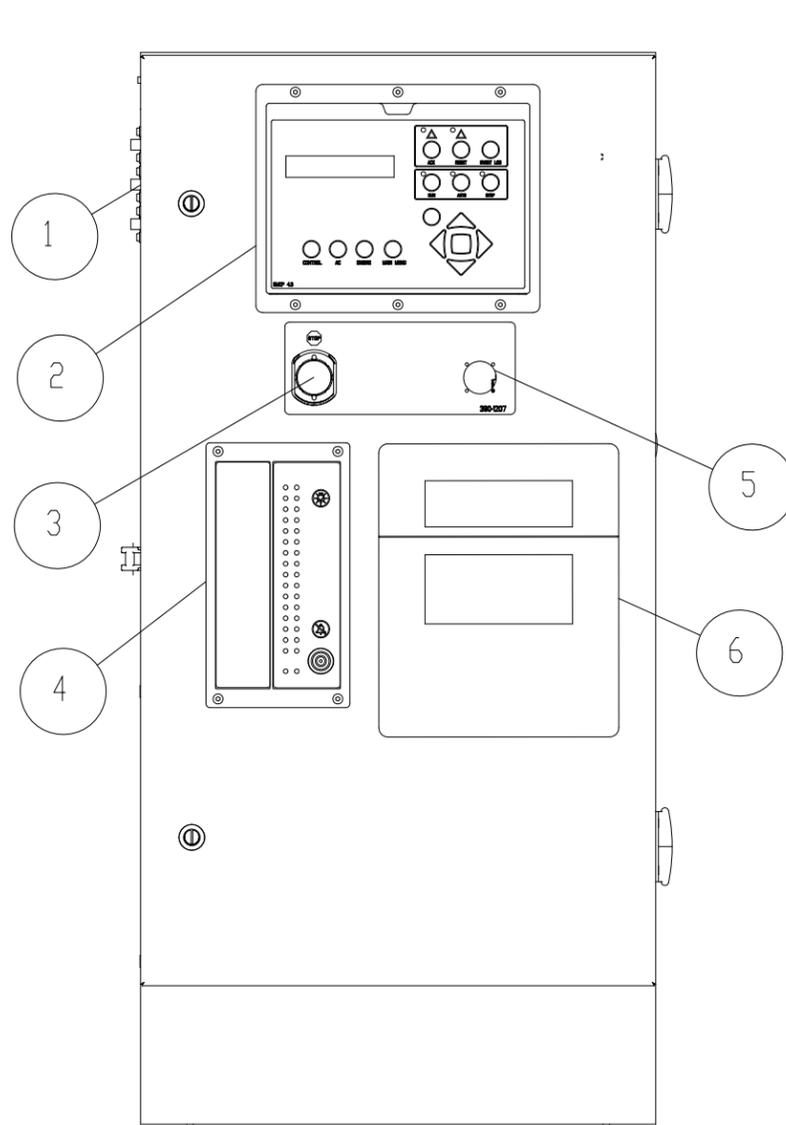
Notes:  
 Approx Generator Footprint: 70.92" x 226.11"  
 Approx Fuel Tank Footprint: 71.00" x 218.50"  
 Approx Electrical Stub Area: Main CB & Control Wires: 24.24" x 12.01"  
 Additional Clearances of 40" sides for Door Access Required

| REV | BY    | DATE  |
|-----|-------|-------|
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| 03  | _____ | _____ |
| 02  | _____ | _____ |
| 01  | _____ | _____ |
| 00  | _____ | _____ |

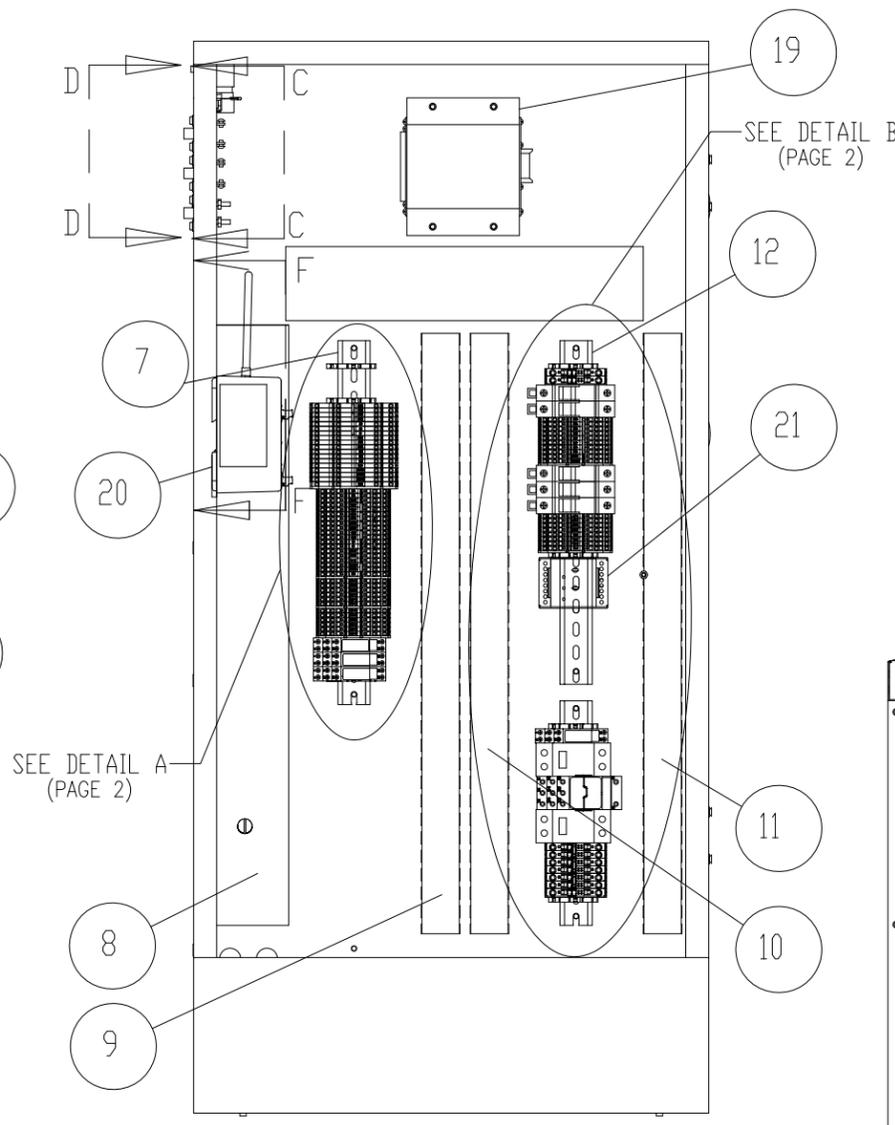
DIMENSIONS WITHOUT ARROWHEADS ARE LOCATED FROM PARALLEL ZERO PLANE.

|   |  |                          |
|---|--|--------------------------|
| <b>MILTON CAT</b><br><br>POWER SYSTEMS DIVISION | C15/C18 PGAN SA Enclosure<br>Sub Base Fuel Tank - Pad Detail |                          |
|   | ALL DIMENSIONS IN INCHES                                     | DRAWN BY: H. CHRISTENSEN |
|   | NOT TO SCALE   | CHECKED: H. CHRISTENSEN  |
|   | DATE: November 2013  | APPROVED: H. CHRISTENSEN |
|   | DWG No. 4499474APAD  | SHEET 1 OF 1             |

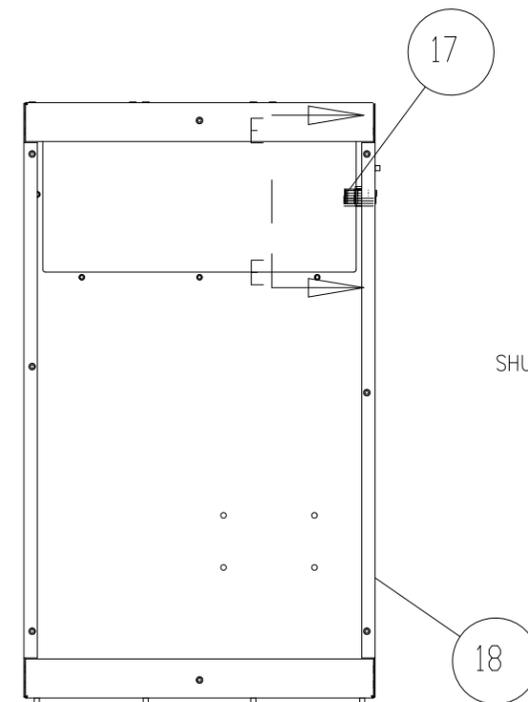
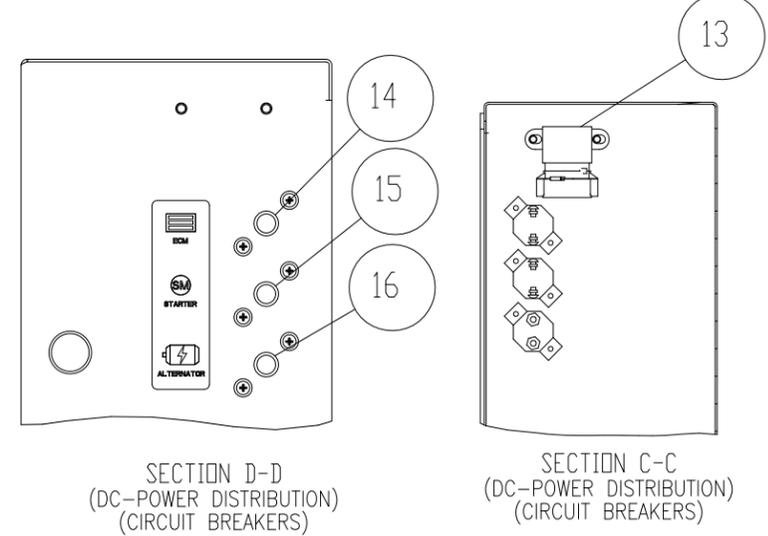
# COMPONENT LAYOUT



CONTROL PANEL  
FRONT VIEW



CONTROL PANEL  
INSIDE VIEW



SECTION E-E  
SHUNT TRIP CB & AUX CONTACTS  
374-5756 & 374-5746

- 1 EMCP 4.2 CONTROL PANEL
- 2 EMCP 4.2 CONTROLLER
- 3 ESTOP PUSH BUTTON
- 4 RS485 LOCAL ANNUNCIATOR
- 5 SERVICE TOOL CONNECTOR
- 6 DOCUMENT HOLDER
- 7 LOW VOLTAGE TERMINAL STRIP (DI,DO,RO,AI)

- 8 LOW VOLTAGE-DC CONTROL PANEL WIRING DUCT
- 9 LOW VOLTAGE-DC CUSTOMER WIRING DUCT
- 10 HIGH VOLTAGE AC/DC CONTROL PANEL WIRING DUCT
- 11 HIGH VOLTAGE AC/DC CUSTOMER CONNECTION DUCT

- 12 HIGH ENERGY TERMINAL AC/DC STRIP
- 13 SMMS RELAY
- 14 CIRCUIT BREAKER-ECM
- 15 CIRCUIT BREAKER-STARTER
- 16 CIRCUIT BREAKER-ALTERNATOR
- 17 BREAKER TERMINAL STRIP (OPTIONAL BREAKER)
- 18 BREAKER BOX
- 19 OPTIONAL DIO MODULE
- 20 OPTIONAL DEVICE SERVER
- 21 OPTIONAL GROUND FAULT RELAY

| REV | BY    | DATE  |
|-----|-------|-------|
| 04  | _____ | _____ |
| 03  | _____ | _____ |
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DIMENSIONS WITHOUT ARROWHEADS ARE LOCATED FROM PARALLEL ZERO PLANE.

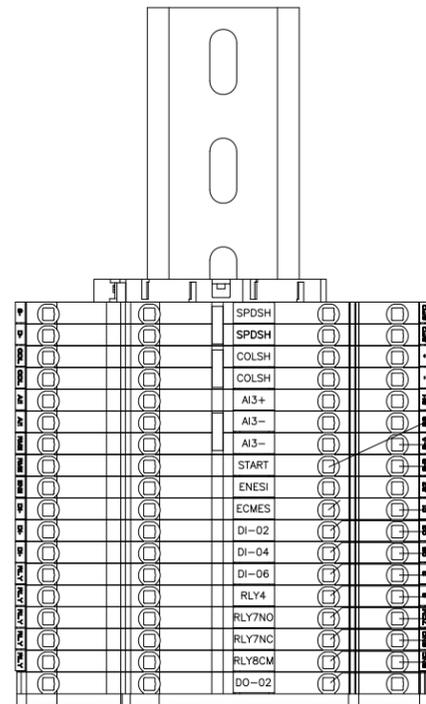


C9, C15 and C18 – Newberry Built  
EMCP 4.2 Customer Interconnect Wiring

ALL DIMENSIONS IN INCHES  
NOT TO SCALE  
DATE: March 2014  
DWG No. 3901189-1

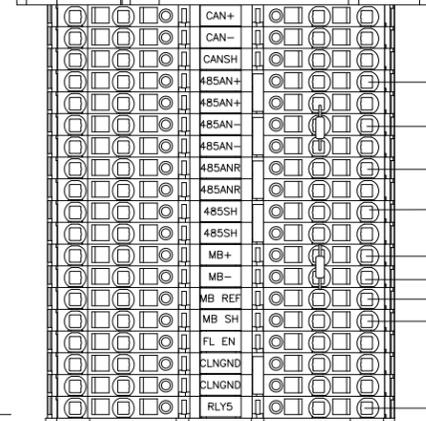
DRAWN BY: H. CHRISTENSEN  
CHECKED: H. CHRISTENSEN  
APPROVED: H. CHRISTENSEN  
SHEET 1 OF 2

# CUSTOMER CONNECTIONS



REMOTE START/STOP FROM ATS (WIRE TO BATT -)  
 REMOTE ESTOP (REMOVE JUMPER WHEN INSTALLED)

- DI-01
- DI-02
- DI-03
- DI-04
- DI-05
- DI-06
- OUTPUT RELAY 3 (NO)
- OUTPUT RELAY 4 (NO)
- OUTPUT RELAY 6 - SIGNAL TO GEN RUN RELAY
- OUTPUT RELAY 7 NO
- OUTPUT RELAY 7 COMMON
- OUTPUT RELAY 7 NC
- OUTPUT RELAY 8 NO
- OUTPUT RELAY 8 COMMON
- OUTPUT RELAY 8 NC
- DO-02



RS485AN +  
 RS485AN - RS485 REMOTE ANNUNCIATOR  
 RS485 REF  
 RS485 SH

MB+  
 MB- RS485 MODBUS (PLC/RTU)  
 MB REF  
 MB SH

OUTPUT RELAY 5 - SIGNAL TO COMMON SHUTDOWN RELAY

(AUX CONTACTS CB1)  
 OPEN/CLOSE

(AUX CONTACTS CB2)  
 OPEN/CLOSE

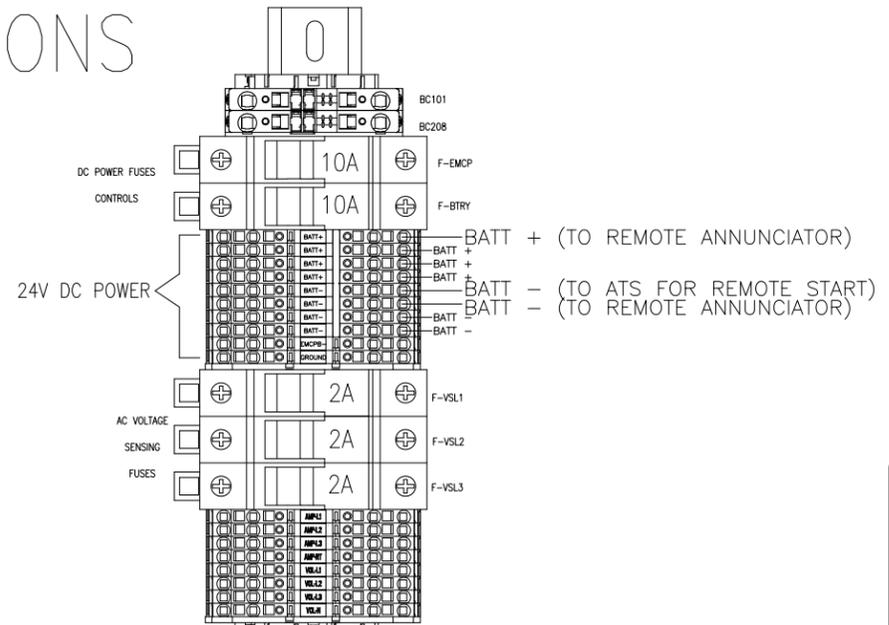
(SHUNT TRIP RELAY)

(GENERATOR FAULT RELAY)

(GENERATOR RUN RELAY)

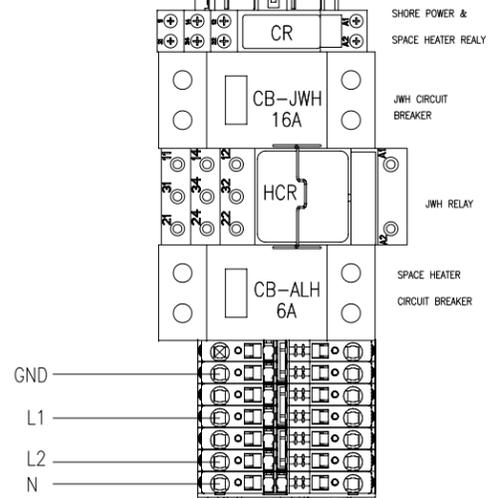
| RELAY TERMINALS |                 |
|-----------------|-----------------|
| TERM #          | DESCRIPTION     |
| 11              | COMMON          |
| 12              | NORMALLY CLOSED |
| 14              | NORMALLY OPEN   |
| 21              | COMMON          |
| 22              | NORMALLY CLOSED |
| 24              | NORMALLY OPEN   |

DETAIL A  
 EMCP 4.2 BLOCK  
 374-5736



(OPTIONAL GROUND FAULT RELAY)

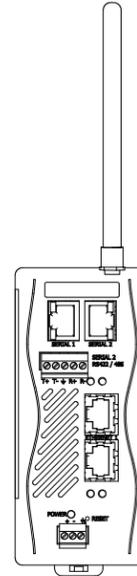
AC SHORE POWER



CUSTOMER SUPPLIED AC(SHORE POWER)

120/240V AC

DETAIL B  
 AC STD BLOCK  
 374-5735



SECTION F-F  
 (OPTIONAL DEVICE SERVER)

OPTIONAL

| REVISION HISTORY |    |      |
|------------------|----|------|
| REV              | BY | DATE |
| 04               |    |      |
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C9, C15 and C18 - Newberry Built  
 EMCP 4.2 Customer Interconnect Wiring

|                          |                          |
|--------------------------|--------------------------|
| ALL DIMENSIONS IN INCHES | DRAWN BY: H. CHRISTENSEN |
| NOT TO SCALE             | CHECKED: H. CHRISTENSEN  |
| DATE: March 2014         | APPROVED: H. CHRISTENSEN |
| DWG No. 3901189-2        | SHEET 2 OF 2             |

POWER SYSTEMS DIVISION

DIMENSIONS WITHOUT ARROWHEADS ARE LOCATED FROM PARALLEL ZERO PLANE.

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AUBURN BUSINESS PARK  
46 HARRIMAN DRIVE  
AUBURN, ME 04210  
207.784.5100 tel  
207.782.3017 fax

123 MIDDLE STREET  
PORTLAND, ME 04101  
207.775.0053 tel  
207.775.0460 fax

ONE PERIMETER ROAD  
MANCHESTER, NH 03103  
603.626.1242 tel  
603.626.1259 fax

170 MILK STREET, SUITE 5  
BOSTON, MA 02109-3438  
617.426.5050 tel  
617.426.5051 fax

[www.harriman.com](http://www.harriman.com)