STATE OF NEW YORK
OFFICE OF GENERAL SERVICES
DESIGN AND CONSTRUCTION GROUP
THE GOVERNOR NELSON A. ROCKEFELLER
EMPIRE STATE PLAZA
ALBANY, NY 12242

ADDENDUM NO. 1 TO PROJECT NO. 44306

HVAC WORK, ELECTRICAL WORK

REPLACE EMERGENCY GENERATOR AND SWITCHGEAR
BUILDING NO. 17
MID STATE CORRECTIONAL FACILITY
RIVER ROAD
MARCY, NEW YORK

August 13, 2013

NOTE: This Addendum forms a part of the Contract Documents. Insert it in the Project Manual. Acknowledge receipt of this Addendum in the space provided on the Bid Form.

ELECTRICAL SPECIFICATIONS

1. Specification 019113, Replace "General Commissioning Requirements" specification with attached Specification 019113 "General Commissioning Requirements".
2. Specification 261313-1-PC-E-2, Add Metal Clad Switchgear pre-functional checklist to applicable specification for commissioning.
3. Specification 263215-2-FTP-E-1. Add Diesel Alternator(Generators) – Power System – Metal Clad Switchgear Functional Checklist to applicable specification for commissioning.
4. Specification 263215-1-PC-E-1. Add Diesel Alternator(Generators) – Power System – Pre-Functional Checklist to applicable specification for commissioning.
5. Specification 263215-3-PC-E-3. Add Diesel Alternator(Generators) – Remote Radiator – Pre-Functional Checklist to applicable specification for commissioning.
6. Specification 263215-1-FTP-E4. Add Diesel Alternator(Generators) – Remote Radiator – Functional Checklist to applicable specification for commissioning.
7. Page 231010-2, Paragraph 1.03.D.3: Delete "For each tank".
8. Page 231010-5, Paragraph 2.01.L.: Replace the words "each 10000" with "15000".
9. Page 231010-5, Paragraph 2.15: Delete Paragraph "Fuel For Testing" entirely.
10. Page 260513-9, Paragraph 3.01.A.5: Replace "Do not exceed 2,130 pounds total strain on 2/0 AWG size cable for a 3 conductor pull (3 single conductor cables)" with "Do not exceed 5,600 pounds total strain on 350 MCM size cable for a 3 conductor pull (3 single conductor cables)".
11. Page 261313-6, Paragraph 1.03.D.3.c: Delete c. for Neutral Grounding Resistor entirely.
12. Page 261313-23, Paragraph 2.13.A.5: Delete "3.5"floppy disc drive, CDRW/DVD drive"

13. Page 263215-8, Paragraph 1.04.F.7: Change "The factory test must also include simulation of sync condition of each generator to each other as the two generators to the local utility. This simulation process will be one for each of the two generators and both units beginning with a simulated loss of utility power and then a return to utility power." to "The factory test must also include simulation of sync condition of generator to the local utility. This simulation process will be for the generator and beginning with a simulated loss of utility power and then a return to utility power".
14. Page 263215-14, Paragraph 2.01.I.2: Delete Sentence "The excitation system for each generator shall be separate."
15. Page 263215-14, Paragraph 2.01.I.10 & 12: Delete sentence no. 10 and 12.
16. Page 263215-16, Paragraph 2.01.I.14: Delete "#12" in sentence number 14.
17. Page 263215-19, Paragraph 2.04.A: Change "up to 600 feet" to "up to 400 feet".
18. Page 263215-23, Paragraph 3.01.B.1: Delete sentence "Provide diesel fuel as required to initially fill the fuel storage tank and day tank before commencing the preliminary system test."
19. Page 263215-23 Paragraph 3.01.B.2: Change sentence to read "Determine level of existing fuel, with facility and Director's Representative, in existing 15000 gallon tank before all generator testing and return to same level once all generator testing is completed including 1200 kw permanent load bank and fuel filtration system".
20. Page 263215-24 Paragraph 3.02.C.2.c: Change Sentence to read "Load Test: Using the facility system as load to the extent possible, plus supplemental load banks, supplied under Electrical Contract, run the following test at rated voltage:"

ELECTRICAL WORK DRAWINGS

21. Drawing No. E-001:
    a Add the Following Note B under the General Removal Notes:
    "PROVIDE RIGGING PLAN FOR REMOVAL OF STEAM GENERATOR AND ASSOCIATED EQUIPMENT, 750 KW GENERATOR AND ASSOCIATED EQUIPMENT, ALSO INSTALLATION OF PROPOSED 1750 KW GENERATOR AND PROPOSED SWITCHGEAR."
22. Drawing No. E-002:
    a Change the General Note A to read:
    "WHENEVER DRILLING OR CUTTING ANY EXISTING ELEMENTS OR ATTACHING TO ANY BEAMS, JOISTS, OR OTHER SURFACES COORDINATE WITH DIRECTOR'S REPRESENTATIVE TO PRECAUTIONS OR ABATEMENT REQUIREMENTS ANY SUSPECTED ASBESTOS, LEAD OR MOLD DISCOVERED SHALL BE REPORTED TO PROJECT MANAGER".
23. Drawing No. E-004:
    a. Change note "750 KW DIESEL GENERATOR SWITCHGEAR TO BE REMOVED BY E.C." TO "750 KW DIESEL GENERATOR SWITCHGEAR TO REMAIN" located on Detail 1, Lower Level Mechanical Demolition Plan.
    b. Change General Drawing Notes for "M-005" to "E-005" for two locations.
24. Drawing No. E-005:
    a. Change note "1" FPS FPR 1500GAL STORAGE TANK, REFER TO DRAWING
    E-004" to "1" FPS FPR 15000GAL STORAGE TANK, REFER TO DRAWING

E-004."

25. Drawing No. E-006:
    a. Add to removal note on Detail 2 – Partial Basement Plan – Building Number 27: "Existing Concrete Pad to Remain".
26. Drawing No. E-007:
    a. Add to removal note on Detail 2 – Partial Basement Plan – Building Number 31: "Existing Concrete Pad to Remain".

END OF ADDENDUM

James Dirolf, P.E.
Director of Design

SECTION 019113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the Contractor's responsibilities in the commissioning process. Commissioning requires the participation of the Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents.

B. The commissioning process integrates the traditionally separate functions of system documentation, equipment startup, performance testing and training. Commissioning during the construction phase is intended to achieve the following specific objectives in accordance with the Contract Documents:
   1. Verify and document that applicable equipment and systems are installed according to the manufacturer's recommendations, contract requirements, and industry standards and that they receive adequate operational checkout by installing contractors.
   2. Verify and document proper performance of equipment and systems.
   3. Verify and document that O&M documentation is complete.
   4. Verify and document that the Facility operating personnel are properly trained.

C. The systems and equipment to be commissioned are listed in this Section. The Contractor's general commissioning requirements and coordination are detailed in this Section. Specific requirements for commissioning of each system or piece of equipment are detailed in the specification Section for the individual systems or pieces of equipment. A detailed description of the overall commissioning process is included in the appendix.

D. The commissioning process does not reduce the responsibility of the Contractor to provide finished and fully functional systems and equipment.

1.02 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned in this project. Specific requirements for the commissioning of each system are included in the related specification Section.
   1. Electrical Work Contract:
      a. Metal Clad Switchgear
      b. 1200 kW Diesel Alternator Power System and Loadbank
      c. 1200 kW Remote Radiator

B. Example Commissioning Documents: Example Pre-Functional Checklists and Functional Test Procedures are provided following the specification Sections of equipment and systems that are scheduled to be commissioned. These documents are included to provide the Contractor examples of the type of documentation that will be required as part of the commissioning process. Equipment and system specific Pre-Functional Checklists and Functional Test procedures will be developed by the Commissioning Authority based on approved submittals, and then will be provided to the Contractors.

1.03 DEFINITIONS

A. Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.

B. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes in accordance with the Contract Documents.

C. Commissioning authority (CA): An independent agent responsible for the direction and coordination of the commissioning activities. The CA responsible to the Director's Representative.

D. Commissioning Plan: An overall plan that provides the structure, schedule and coordination planning for the commissioning process.

E. Commissioning Team: The members of the commissioning team consist of the Commissioning Authority, the Director's Representative, the Contractor, the architect and design engineers. The owner and the building or plant operator/engineer also may be members of the commissioning team.

F. Deferred Functional Tests: Functional tests that are performed after substantial completion, due to partial occupancy, seasonal requirements, design or other site conditions that prevent the test from being performed prior to substantial completion.

G. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents.

H. Factory Testing: Testing of equipment on-site or at the factory by factory personnel.

I. Functional Test Procedure (FTP): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes, such as during simulated power failure, weekly load test, component failures, etc. The CA develops the functional test procedures in sequential written form. The CA coordinates, oversees and documents the actual testing. The Contractor performs the functional tests. FTPs are performed after prefunctional checklists and startup are complete.

J. Phased Commissioning: Commissioning that is completed in phases due to the size of the structure or other scheduling issues, in order to minimize the total construction time. Commissioning shall be provided for each phase according to the schedule for that phase. Some repetition and/or remobilization may be required.

K. Prefunctional Checklist (PFC): A list of items to inspect and component tests to conduct to verify proper installation of equipment prior to initiating functional testing.

L. Startup: The initial starting or activating of dynamic equipment, including executing prefunctional checklists.

1.04 COORDINATION

A. The CA is hired by, and works for, the Director. The CA directs and coordinates the commissioning activities. All members of the commissioning team shall work together to fulfill their contractual responsibilities and meet the objectives of the Contract Documents.

B. The CA will work with the Contractor according to established protocols to schedule the commissioning activities. The Contractor shall integrate all commissioning activities into the approved progress schedule. All parties will address scheduling problems and make necessary notifications and changes in a timely manner in order to expedite the commissioning process and maintain the approved progress schedule.

1.05 COMMISSIONING PROCESS

A. Commissioning Plan. The commissioning plan provides guidance in the execution of the commissioning process. Following the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, although it may be revised as the project progresses.

B. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur. A more detailed description of the commissioning process can be found in the Appendix.

1. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the Commissioning Team.
2. Additional meetings will be required throughout construction, scheduled by the Director's Representative, to plan, scope, coordinate, and schedule future activities and to resolve problems. When possible, commissioning meetings will be scheduled immediately following construction meetings.
3. Equipment documentation is submitted to the CA during the submittal process, including detailed start-up procedures.
4. The CA works with the Contractor to develop startup activity lists and startup documentation. The CA provides prefunctional checklists to be completed by the Contractor during the startup process.
5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels. In each case prefunctional checklists (PFC) are completed, submitted, and approved before functional testing (FTP) begins.
6. The Contractor executes and documents the prefunctional checklists, and provides notification to the Director's Representative and the CA. The Contractor performs startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans.
7. The CA develops specific equipment and system functional performance test (FTP) procedures. The Contractor reviews the procedures and submits suggestions or comments. Procedures are finalized by the CA.
8. The procedures are executed by the Contractor, under the direction of the CA.
9. Items of non-compliance in material, workmanship, or setup are corrected and retested at the Contractor's expense. The Contractor is responsible for providing all resources, manpower, and materials necessary to rectify deficiencies as per requirements of the approved schedule.

10. The O&M documentation prepared by the Contractor is reviewed for completeness by the CA.
11. Commissioning is completed before Substantial Completion.
12. The CA reviews, pre-approves and attends the training provided by the Contractor and verifies that is was completed.
13. Deferred testing is conducted, as specified or required.

1.06 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor's commissioning responsibilities are as follows (all references apply to commissioned systems and equipment only):

1. Construction and Acceptance Phase:
   a. Attend the commissioning scoping meeting and other necessary meetings scheduled by the Director's Representative to facilitate the commissioning process.
   b. Facilitate the coordination of the commissioning work by the CA, and with the CA ensure that commissioning activities are being scheduled into the approved progress schedule.
   c. Provide detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, factory test reports, and full warranty information, including all responsibilities of the Director to keep the warranty in force. The installation, start-up and checkout materials that are actually shipped with the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CA. The CA may request further documentation necessary for the commissioning process.
   d. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
   e. Ensure that all subcontractors execute their commissioning responsibilities according to the Contract Documents and approved progress schedule.
   f. Assist in the process of writing detailed test procedures by clarifying the operation and control of commissioned equipment.
   g. Review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
   h. Develop a full start-up and testing plan using manufacturer's start-up procedures and the prefunctional checklists from the CA for all commissioned equipment. Submit to the CA for review and approval prior to startup.
   i. During the startup and initial checkout process, execute all portions of the prefunctional checklists for all commissioned systems and equipment. Verify that system installations include all ports, gages, thermometers, access doors, valves, etc., required for specified functional performance testing.
   j. Provide all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment.
   k. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.
   l. Address incomplete Work before functional performance testing.

m. Provide skilled technicians to execute startup of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

n. Provide skilled technicians to perform functional performance testing under the direction of the CA for specified equipment. Provide Manufacturer's Representative as required and as specified in the Specification. Assist the CA in interpreting the monitoring data, as necessary.

o. Correct deficiencies (differences between specified and observed performance) as directed by the Director's Representative.

p. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions. Provide a copy of the O&M manuals and submittals of commissioned equipment to the CA for review and approval.

q. Provide training as specified.

r. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

2. Warranty Period:

a. Execute seasonal or deferred functional performance testing in accordance with the specifications

b. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Contractor.

B. Specified special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment shall be provided by the Contractor, and turned over to the facility at the completion of the Work.

C. Datalogging equipment and software required to test equipment will be provided by the Contractor, but shall not become the property of the Director's Representative.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.01 MEETINGS

A. Scoping Meeting. Prior to the commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the Commissioning Team.

B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with the Contractor, appropriate sub-contractors and suppliers, the Owner's Representative, and the Director's Representative.

3.02 START-UP, PREFUNCTIONAL CHECKLISTS, AND INITIAL CHECKOUT

A. Prefunctional checklists and initial checkout shall ensure that the equipment and systems are hooked up and operational. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of systems or equipment.

B. Start-up and Initial Checkout Plan. The CA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer's recommended procedures have been completed.

C. Execution of Prefunctional Checklists and Startup.
   1. Four weeks prior to startup, the Contractor shall schedule startup and checkout with the Director's Representative.
   2. The Contractor shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.

3.03 FUNCTIONAL PERFORMANCE TESTING

A. Development of Test Procedures. Using the requirements in the specifications, the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. The Contractor shall provide assistance to the CA in developing the procedures. Prior to testing, the CA shall provide a copy of the test procedures to the Contractor who shall review the tests for feasibility, safety, equipment and warranty protection.

B. Functional performance testing shall document that each system is operating in accordance with the Contract Documents. During the testing process, areas of deficient performance shall be identified. Deficiencies shall be corrected by the Contractor and functional testing shall be re-scheduled. The Contractor shall be responsible for all costs associated with re-testing for functional performance.

C. Each system shall be operated through all modes of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

D. Test Methods. Each function and test shall be performed under conditions that simulate actual conditions as closely as possible. The Contractor shall execute the test and shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At the completion of the test, the Contractor shall return all building equipment and systems affected by these temporary modifications to their pre-test condition.

3.04 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals. The specific content and format requirements for the standard O&M manuals are detailed in Section 017716.

B. The Contractor shall compile and prepare commissioning documentation for all equipment and systems and include this information in the O&M manuals.

3.05 TRAINING

A. The Contractor shall be responsible for coordinating, scheduling, and documenting that all required training has been completed successfully.

B. The Contractor shall have the following training responsibilities:
1. Provide a training plan two weeks before the planned training.
2. Provide comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment.
3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment.
4. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
5. Training shall include:
   a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
   b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, and any emergency procedures.
   c. Discussion of relevant health and safety issues and concerns.
   d. Discussion of warranties and guarantees.
   e. Common troubleshooting problems and solutions.
   f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
   g. Discussion of any peculiarities of equipment installation or operation.

3.06 DEFERRED TESTING

A. Unforeseen Deferred Tests. If any check or test cannot be completed due to project conditions, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the Director's Representative. These tests will be conducted in the same manner as the seasonal tests as soon as possible.

B. Seasonal Testing. Seasonal testing (tests delayed until weather conditions are closer to the system's design conditions) shall be completed as part of this contract. Make any final adjustments to the O&M manuals and as-builts resulting from information gained during testing.

END OF SECTION

M/E ENGINEERING, P.C.
Mechanical/Electrical
Engineering Consultants

PREFUNCTIONAL CHECKLIST

MIDSTATE CORRECTIONAL FACILITY
REPLACE EMERGENCY GENERATOR AND SWITCHGEAR

PC-E-2 - METAL CLAD SWITCHGEAR

Components Included:
_____ Transformers
_____ Circuit Breakers
_____ Coordinated Relay Settings
_____ Switchgear
_____ Grounding System

Associated Work:
_____ Conduit and Wiring
_____ Motor Starters
_____ Tests and Inspections
_____ Diesel Alternator (Generator)

1. Submittal/Approvals:

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This prefunctional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Electrical	Date	Mechanical Contractor	Date
Manufacturer/Vendor	Date		

Prefunctional checklist items are to be completed as part of startup and initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Sub-Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor, subcontractor, trade or vendor responsible to verify completion of this item. A/E = Architect/Engineer, All = All Contractors, CA = Commissioning Agent, CC = Controls Contractor, EC = Electrical Sub-Contractor, GC = General Contractor, MC = Mechanical Sub-Contractor, MV = Manufacturer/Vendor.

Approvals: This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted.

Commissioning Agent	Date	Owner's Representative	Date

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2. Requested Documentation Submitted:

_____ Manufacturer's cut sheets.
_____ Installation and checkout manual and plan.
_____ Written copy of all parameters and settings.
_____ Performance data.
_____ Operating manual.
_____ Design criteria and setpoints.
_____ Factory test reports.

Documentation complete as per contract documents for given trade. _____ *Yes* _____ *No*

3. System Component Model Verification:

Component	Manufacturer	Model	Serial Number	Contr.
Existing Outdoor Utility Current Transformers Main Potential Transformers and Lighting Arrestor				
Section 1 - LS-C				
Section 2 - Incoming MS-1				
Section 3 - Incoming MS-2				
Section 4- Generator 1 52G1 Generator				
Section 5 - 52 Breaker LS-B				
Section 6 - Master Control (List major components):				
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
Generator Load Bank Switchgear				

4. Initial Setup and Checkout:

Check	Y/N	Contr.
Installation in compliance with NEMA and ANSI Standards.		
System installed in accordance with NFPA 70 National Electric Code.		
Grounding completed and tested.		
Primary and secondary transformers installed, no excessive heat or noises apparent.		
High voltage splice completed.		
Underwriters inspection completed and certificate issued.		
Feeders, conduits and circuits are tagged.		
Motor control centers installed.		
All conductor connections, splices and terminations checked.		
All conduits properly supported.		
All firestopping completed.		

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(New 09/01/10)

Check	Y/N	Contr.
All penetrations thru vapor barriers are sealed and inspected to maintain the integrity of the vapor barrier.		
Spare fuses have been provided.		
All connections and terminations to equipment in accordance with manufacturer's recommendations.		
Connections to equipment in moist and/or high temperature environments completed with appropriate materials.		
Building electrical system is operational.		
All connections to other building systems complete and operational.		
Interface with emergency power system, generator and transfer switch completed.		
All equipment, components, materials and fabrication methods have been reviewed and approved by the local power utility company.		
Installation methods and final connections are in accordance with the local power utility company standards.		
Factory tests of control wiring, protective relaying, metering, short circuits and dielectric impulse requirements have been completed and documented.		
A certified Engineering and Instrumentation Service Company has performed the documentation and testing of protective relay settings, calibrations and testing requirements.		
A coordination study has been performed and report issued.		
Arc flash evaluations have been performed and labels installed.		
Spare parts required by the contract documents have been provided.		
The equipment and installation methods meet BOCA seismic rating Zone 2 requirements.		
All equipment and sections are permanently labeled and identified.		
All terminations are complete with proper torque lugs.		
Grounding bus and equipment grounding is completed.		
Internal lightning arrestors installed.		
Removable element vacuum circuit breakers provided.		
All batteries, battery chargers and accessories installed.		
All AC and DC alarms installed, wired and operational.		
All required protection, control, monitoring, metering and interfacing solid state relays for the circuit breakers are installed and operational.		
Programmable controller installed, wired and functional.		
All interface control wiring completed between master controller and generator/radiator completed. Terminals labeled and wiring numbering matches as-builts and O&M manuals		

The checklist items of Part 4 are all successfully completed for given trade. _____ *Yes* _____ *No*

Notes:

END OF CHECKLIST

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PREFUNCTIONAL CHECKLIST

MIDSTATE CORRECTIONAL FACILITY
REPLACE EMERGENCY GENERATOR AND SWITCHGEAR

PC-E-1 - DIESEL ALTERNATOR (GENERATOR) POWER SYSTEM

Components Included:

_____	Diesel Alternator (Generator)	_____	Fuel Source
_____	Remote Radiator	_____	Combustion Air Source
_____	Switchgear	_____	Ventilation System
_____	BMS/DDC System	_____	Diesel Fuel Oil Pumps

1. Submittal/Approvals:

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This prefunctional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Mechanical	Date	Controls	Date
Electrical	Date	Diesel Alternator (Generator) Vendor	Date
Metal Clad Switchgear Vendor	Date	General Contractor	Date
Plumbing	Date	Manufacturer/Vendor	Date

Prefunctional checklist items are to be completed as part of startup and initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor, subcontractor, trade and/or manufacturer representative responsible to verify completion of this item. A/E = Architect/Engineer, All = All Contractors, CA = Commissioning Agent, CC = Controls Contractor, EC = Electrical Contractor, GC = General Contractor, MC = Mechanical Contractor, PC = Plumbing Contractor, M/V = Manufacturer/Vendor.

Approval: This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted.

Commissioning Agent	Date	Owner's Representative	Date

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2. Generator No. 1 Information:

Equipment Tag		Location	
System		Service Area	
Manufacturer		Model Number	
Serial Number		Capacity	
Volts/Phase Rating		Fuel Type	

3. Requested Documentation Submitted:

	Yes/No	Comments
Manufacturer's cut sheets.		
Installation and startup manual and plan.		
O&M manuals.		
Factory test results.		
Sequences and control strategies.		
Warranty certificate.		

Documentation complete as per contract documents for given trade. _____ *Yes* _____ *No*

4. Installation Checks:

Check if applicable, provide comment if unacceptable.

	Yes/No	Comments
Equipment installed per manufacturer's instructions and specifications.		
Equipment installed agrees with shop drawings and specifications.		
Verify mounting, location and clearances are per plans and specifications.		
Inspect for physical, electrical and mechanical condition of equipment and cabinet - no damage evident.		
Inspect panels and doors for proper fit and alignments.		
Verify the application of manufacturer recommended torque values applied to all electrical power terminations.		
Equipment is clean and clear of dust or dirt.		
Equipment labels permanently affixed.		
Seismic anchoring installed and functional where applicable (non-short circuiting).		
Verify remote monitoring/control panel installed per specification.		
Verify interconnection to other systems complete.		
Verify neutral low resistance grounding resistor installed and connector per plans, specifications and manufacturer's recommendations (for 5 kV and above rated generators).		
Verify fuel spill containment systems installed per plans and specifications.		
Verify motor/generator alignment.		
Verify generator set is anchored and grouted.		
Verify all fuel line connections.		

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(New 09/01/10)

	Yes/No	Comments
Verify generator starting system installed per plans, specifications and manufacturer's instructions.		
Verify muffler/exhaust system is installed per plans, specifications and manufacturer's instructions.		
Check diesel engine crankcase oil level.		
Check diesel engine coolant level.		
Check diesel engine drive belts.		
Check air filter.		
Check oil filter.		
Check battery.		
Check block heater (where applicable).		
Verify intake and relief louvers provided per documents.		
Remote radiators are installed and fully operational.		
Coolant system pumps are functional.		
Day tanks, fuel oil pumps and controls are installed and filled.		
Mufflers are installed and insulated.		
Starting system is installed and operational.		
Battery system is installed and charged.		
Grounding system is completed and tested.		
Switchgear and starters are installed and operational.		
All high and low voltage wiring is completed.		
Combustion air intakes are installed, wired and fully operational.		
Space ventilation system is installed, wired and fully operational.		
All fuel oil air piping, valves and operating devices are installed and fully functional.		
All exhaust stacks and miscellaneous vents are installed.		
All temperature and pressure gauges are installed.		
All temperature control functions are completed.		

The checklist items of Part 4 are all successfully completed for given trade. _____ *Yes* _____ *No*

5. Operational Checks:

Check if applicable, provide comment if unacceptable.

Operational Checks	Yes/No	Comments
Specified Sequences of operation and operating schedules have been provided with all variations documented.		
Specified point-to-point checks have been completed and documentation record submitted for this system.		
Generator control panel powered, interconnection diagnostics performed.		

The checklist items of Part 5 are all successfully completed for given trade. _____ *Yes* _____ *No*

6. Sensor Calibration:

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All field-installed temperature and pressure sensors and gages shall be calibrated. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed at the factory with calibration certification provided need not be field calibrated. All actuators should also be calibrated.

All sensors are calibrated within required tolerances. _____ *Yes* _____ *No*

Notes:

END OF CHECKLIST

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FUNCTIONAL TEST PROCEDURE

MIDSTATE CORRECTIONAL FACILITY
REPLACE EMERGENCY GENERATOR AND SWITCHGEAR

FTP-E-1 - DIESEL ALTERNATOR (GENERATOR) POWER SYSTEM INCLUDING GENERATOR METAL CLAD SWITCHGEAR (GMS)

1. Participants:

Party	Participation

Party filling out this for and witnessing testing: _____

Date of Test: _____

2. Prerequisite Checklist:

a. The following have been started up and startup reports and pre-functional checklists submitted and approved ready for functional testing:

_____ Metal Clad Switchgear Line-Up (GMS)
_____ Generator Load Bank Switchgear
_____ Generator Remote Radiators
_____ Fuel System
_____ Motor Starter
_____ Radiator

b. All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with debugging, loop tuning and sensor calibrations completed.

_____ _____
Controls Contractor Signature Date

c. _____ All A/E punch list items for this equipment corrected.
d. _____ These functional test procedures reviewed and approved by installing contractor.
e. _____ Safeties and operating ranges reviewed.
f. _____ Test requirements and sequences of operation attached.

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g. _____ Verify that generator gauges and meters for voltage, amperage and frequency are calibrated to hand-held or load profiler instrument readings.

h. _____ Other misc. checks of the prefunctional checklist and startup reports completed successfully.

i. _____ Monitor the safety and security personnel at test.

j. _____ All metal clad switchgear. High potential test reports submitted, phasing confirmed. High voltage termination installed as per manufacturer recommendations.

k. _____ Verify battery power function and operation for each breaker open and closed.

l. _____ Coordination with National Grid.

m. _____ Sequence of operation reviewed and approved by Director's Representative.

3. Generator No. 1 Testing Procedures and Record:

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including Special Conditions)	Expected and Actual Response[4] (Write Actual Response in brackets or circle)	Pass Y/N	Note #
Initial Procedures					
A		The Contractor shall follow the following acceptance procedure with the engine cold and no connected load. With (GMS) switch in the manual position, open the Utility breaker. Restore (GMS) to automatic position and close utility breaker.	Verify that power has been lost from each load served by emergency power.		
B		Connect Power Line Disturbance Monitor (PDM), Load Profiler and recording Multimeter to Generator/GPS			
Metal Clad Switchgear - Protection and Control Operation for Generator Power (Refer to Item 5 for Sequence of Operation)					
1		Interruption of utility source protective relays trip, utility breaker, multifunction relay, confirm relays, trip breakers.	Verify circuit breaker automatically closes when each required relay condition clears.		
2		Battery current draw for switchgear control. Record and measure current draw for control of circuit breakers.	Verifies battery capacity for switchgear operation and two (2) future generator breakers.		
3		Negative sequence voltage relay	Confirm relay operators breaker on loss of phase and over and under voltage		
4		Reverse Power Condition Power flow into utility source.	Protective relay detects condition and trips utility breaker. Verify circuit breaker opens and breaker closes automatically when fault clears.		
5		Automatic transfer from utility power to generator power.	Confirm sequence of Operation.		

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Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including Special Conditions)	Expected and Actual Response[4] (Write Actual Response in brackets or circle)	Pass Y/N	Note #
6		Auto transfer from generator to utility.	Confirm sequence of Operation.		
7		Manual transfer from utility to generator power.	Confirm sequence of Operation.		
8		Manual transfer for generator to utility	Confirm sequence of Operation.		
9		Generator starting problem	Confirm sequence of Operation.		
10		Generator fault	Confirm sequence of Operation.		
11		Diesel engine problems	Confirm all of conditions monitored at engine are displayed at the automatic closed transition system and each sends a trip command to relay and confirm generator shuts down. Perform test for each of the eight items listed.	9a _____ 9b _____ 9c _____ 9d _____ 9e _____ 9f _____ 9g _____ 9h _____	
Generator, GPS and Loads					
1		**Cold Start:** Open normal power breakers and immediately connect full loadbank load capacity to GPS unit. This connection must be made before engine generator is up to speed and transfer to generator power has been completed.	Observe the system's performance and record the following data using Power Line Disturbance Monitors (PDM) to monitor the transient responses. Compare to specifications.		
2		Verify battery current draw for control power. Record and measure current draw for 60 seconds during start and during first minute of runtime	Verifies starting and current draw on the batteries for generator control.		
3		Measure time using PDM.	Time delay from power failure to engine start signal should be within three (3) seconds (adjustable), [ ] seconds.		
4		Measure time using PDM.	Cranking time until prime-mover starts and runs should be within five (5) seconds, [ ] seconds.		
5		Measure time using PDM.	Time until engine-generator is at proper voltage and frequency should be within ____ (adjustable) seconds, [ ] seconds.		
6		Measure time using PDM.	Total time from power failure until generator circuit breaker 52-GM closes to generator power should be within ten (10) seconds, [ ] seconds.		

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Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including Special Conditions)	Expected and Actual Response[4] (Write Actual Response in brackets or circle)	Pass Y/N	Note #
7		Measure time using PDM.	Total time from breaker 52-GM closing to Feeder LS-C breaker to provide site power within four (4) seconds (adjustable), [ ] seconds. Total time from breaker 52-GM closing to Feeder LS-B breaker to provide site power within four (4) seconds (adjustable), [ ] seconds.		
8		Repeat procedures 1-5.	Document variances from specified performance.		
9		**Full Load Test:** Continue generator operation. Record voltage and amperage of each phase and frequency using a load profile monitor, note generator gauges, engine coolant temperature, oil pressure, and battery charge rate at 5 minute intervals for a period of one hour. Measure the temperature of all generator and GPS connections using a laser guided infrared temperature meter, Raytech or approved.	Refer to attached schedule.		

4. Performance Criteria for Data in Table Below (by Column number):

1. 5 minute intervals.
2. Amps: (per phase)
   A. _____
   B. _____
   C. _____
3. Volts: (per phase)
   A. (A-B) _____
   B. (B-C) _____
   C. (C-A) _____
4. Hertz: _____
5. Coolant T: _____
6. Oil Pressure: _____
7. Batt. Charge: _____
8. Ambient Temperature: _____

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9. Kilowatts (kW): _____
10. Percent of Max kW: _____
11. Winding Temperature: _____
12. Manifold Temperature: _____
13. Exhaust Temperature: _____
14. ATS Contacts Input Temp.: Note any significant variances between phases.
15. ATS Contacts Output Temp.: Note any significant variances between phases.

Time	A Amps	B Amps	C Amps	L1-L2 Volts	L1-L3 Volts	L2-L3 Volts	Oil Press.	Water	Amb.	Hz	kW	%	Batt Volts	Winding Temp	Manifold Temp	Exhaust Temp

Proced. No. & Spec. Seq. ID[1]	**Req ID No.[2]**	**Test Procedure[3] (including Special Conditions)**	**Expected and Actual Response[4] (Write Actual Response in brackets or circle)**	**Pass Y/N**	**Note #**
16		Disconnect load bank load from GMS, before transfer back to normal power. Restore normal power and record delay to normal power transfer. Range 0 - 150.	Delay to normal power should be five (5) minutes (adjustable), [ ] minutes.		
17		Record engine cool-down time. (Engine continues to run after transfer from generator to utility).	Cool down time should be five (5) minutes, [ ] minutes.		
18		**<u>Step Load Tests:</u>** After the cool-down timer has expired, start the engine-generator by opening the GMS normal input power circuit breaker. With the emergency bus energized, perform the adjacent step load tests, verifying that voltage and frequency remain within specified ranges during transition and that the frequency stability (rate of change) is acceptable. Observe and record frequency and voltage response using the Powerline Disturbance Monitor. Tune generator governor output to meet adjacent specifications. Document.	Specified frequency regulation range = ± ____ Hz Specified frequency regulation range = ± ____ V Specified frequency stability criteria: _____ Max. variance of: <u>Step</u> <u>Volt</u> <u>Freq.</u> <u>Stabil. OK</u> 0-25% ____ ____ _____ 0-50% ____ ____ _____ 0-100% ____ ____ _____ 100-50% ____ ____ _____ 100-25% ____ ____ _____ Governor tuned to meet specs.		

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Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including Special Conditions)	Expected and Actual Response[4] (Write Actual Response in brackets or circle)	Pass Y/N	Note #
19		Connect full load bank load to GMS. Maintain power flow for 15 minutes, then take temperature readings with infrared meter looking for hot spots.	There should be no significant variations in temperature between phases. Point T1 T2 T3 _____ _____ _____		
20		Open 52-GM breaker toTransfer load back to utility source. Maintain power flow for 15 minutes and take temperature readings with infrared meter looking for hot spots.	There should be no significant variations in temperature between phases. Point T1 T2 T3 _____ _____ _____		
21		GMS Test Switch: Operate the GMS test switch and verify that the generator starts and the E-power sequence is initiated. (Bypass the return to normal timer to accelerate the test sequence.)	Generator should start and E-power sequence initiated. Verify that total time to E-power meets that specified.		
22		Safety interlocking will be demonstrated by trying to operate the GPS and controls in a deranged manner, if possible.	Alarms should be generated and E-power system go or remain off-line.		
23		a) Simulate all alarms, alarm contact operation and remote annunciator operation by jumping across alarm contacts at GPS and generator. b) Verify any alarms to the BMS (DDC) or other remote monitoring sites.	a) All alarms are properly annunciated in the remote panel. b) Alarms received by BAS and remote sites.		
24		Check calibration of digital readouts of frequency, current and volts against a calibrated instrument for main circuit breaker. Generator circuit breaker.	Main circuit breaker values should be within the following tolerances: Hz: ± 0.1 Hz. Amps: ± .3% Volts: ± .3% Generator circuit breaker values should be within the following tolerances: Hz: ± 0.1 Hz. Amps: ± .3% Volts: ± .3%		
25		Run through complete sequences of operation from approved submittal dated May 11, 2011 or later	Confirm all required functions and sequences.		

[1] Sequences of operation attached to this test from specification. Follow approved sequences in submittals and latest approved by OGS dated 3-1-2012.

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[2] Mode or function ID being tested from testing requirements section of the project Specifications.
[3] Step-by-step procedures for manual testing, trend logging or data-logger monitoring.
[4] Include tolerances for a passing condition. Fill-in spaces or lines not in brackets denote sequence parameters still to be specified by the A/E, Controls Contractor or vendor. Write "Via BMS" for verifications of device position from BMS readout or "Via obs" for actual observation or from test instrument reading.
[5] Record any permanently changed parameter values and submit changes to Owner.

5. Miscellaneous Test Procedures:

a. Load Bank Switchgear:

1) Demonstrate function and interlock of kirk keys between existing generator switchgear and new generator load bank switchgear.

2) Confirm relay setting match final coordination study.

3) Load Bank Control Panel Demonstrate:

(a) Turn control power switch on _____ operation and power indicator on.

(b) Blower Control Switch: Verify operation and indication.

(c) Test air failure sensor indication light and over temperature.

(d) Verify master load switch on/off.

(e) Start generator and step loads on and off and record kW, amps and voltage on generator control panel.

(f) Verify remote load dump switch in generator switchgear.

6. Preliminary Switchgear Functional Sequence of Operation:

1) The EPS automation shall be provided with the following modes of operation:

(a) Automatic/Standby Mode

(1) The utility main breaker MS-1 is closed serving utility power to the generator/load bus.

(2) The utility main breaker MS-2 is open.

(3) The generator main breakers is open.

(4) The automation is standing by to act in response to a utility failure.

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(b) Single Utility Failure

(1) Utility protective relaying senses utility voltage or frequency out of tolerance on the MS-1 utility feed.

(2) The utility main breaker MS-1 is opened.

(3) The utility main breaker MS-2 is closed when utility power is stable.

(4) Signal is sent (via dry contacts) notifying Facility's Management System alerting to power failure on MS-1 Source.

(c) Emergency Mode (Utility Failure at MS-1 and MS-2 Utility main breakers)

(1) Utility Failure

i. Utility protective relaying senses utility voltage or frequency out of tolerance at both MS-1 and MS-2 utility main breakers.

ii. The utility main breakers are opened.

iii. Load shed sequence is executed.

iv. A run request is sent to the generator.

v. When up to voltage and frequency, the generator main breaker is closed.

vi. The system is now in emergency mode.

vii. Signal is sent (via dry contacts) notifying Facility's Management System alerting to power failure on MS-1 Source and MS-2 Source.

(2) Utility Restoration and Exit from Emergency Mode

i. Utility protective relaying senses utility voltage and frequency within tolerance.

ii. Following an adjustable time delay to assure that the utility power source is stable, the generator is synchronized and paralleled to the utility source by closing the utility main breaker MS-1.

iii. The generator main breaker is opened with no intentional delay.

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iv. The generator is allowed to run for its programmed cool down period and shut down.

v. The system is returned to automatic/standby mode.

(d) Transfer to Emergency Mode

(1) Entry

i. The operator places the system into the closed transfer to emergency mode.

ii. A run request is sent to the generator.

iii. The generator is allowed to warm up for an adjustable time delay.

iv. The generator is synchronized and paralleled to the utility source.

v. The generator main breaker is closed.

vi. The utility main breaker MS-1 is opened with no intentional delay.

vii. The system is now running in emergency mode.

(2) Exit from Emergency Mode

i. The operator returns the system to the automatic mode.

ii. Following an adjustable time delay, the generator is synchronized and paralleled to the utility source by closing the utility main breaker MS-1.

iii. The generator main breaker is opened with no intentional time delay.

iv. The system is returned to the automatic/standby mode.

(e) No Load Test Mode

(1) Entrance into No Load Test Mode

i. No load test is initiated by the operator.

ii. All available generator sets are started.

iii. All generator sets come up to voltage and frequency and remain running disconnected from the bus.

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iv. The system is now in no load test mode.

(2) Exit from No Load Test Mode

i. No load test is terminated by the operator.

ii. The generator sets are allowed to run for their programmed cool down period and shut down.

iii. The system is returned to the Automatic/Standby mode.

(f) Utility Fail Test Mode

(1) Entrance into Utility Fail Test Mode

i. Utility fail test is initiated by the operator.

ii. Voltage sensing at the utility protective relay is opened, which simulates a loss of utility.

iii. The system enters into emergency mode as described in the emergency mode sequence above.

(2) Exit from Utility Fail Test Mode

i. Utility fail test is terminated by the operator.

ii. Voltage sensing at the utility protective relay is restored, which simulates the return of utility power.

iii. The system exits from emergency mode as described in the emergency mode sequence above.

7. The EPS automation shall support two (2) sub-modes; load shed add and generator demand priority.

a. Load Shed:

1) Upon entrance into emergency of operation, the load shed control shall open all sheddable circuit breakers. As generator set comes on to the bus, essential priority level loads shall be added conditionally based on the number of generator sets on lie.

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2) Load Sensitive Load Shed: The system shall compare generator on-line capacity (in kW) to system load. If surplus generator capacity exists, load shed priority level(s) are shed. The load shed control, in its automatic shedding and adding of loads, shall not override any manual load shed/add operation.

3) Bus Underfrequency: Should the load bus frequency fall below the bus underfrequency setpoint, all priority level loads shall be shed. Load addition shall not resume until manually reset. The bus underfrequency protection shall override any manual load add operation.

8. Full Load Generator Test in addition to specified in Contract Documents, shall include the following:

a. The complete installation shall be tested for compliance with the specification following completion of all work. Testing shall be conducted by a representative of the manufacturer, with required fuel supplied the Contractor. Acceptance tests shall include "cold-start" full load test, a four hour full load test and a one step rated load pick up test in accordance with NFPA-110. Provide resistive load banks and provide temporary connections for the full-load test. See project manual for further details.

Sequences and Operational protocols verified with approved equipment. _____ *Yes* _____ *No*

Manufacturer/Vendor Signature	Date
Electrical Contractor Signature	Date
Commissioning Authority Signature	Date

Notes:

END OF TEST PROCEDURE

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M/E ENGINEERING, P.C.
Mechanical/Electrical
Engineering Consultants

PREFUNCTIONAL CHECKLIST

MIDSTATE CORRECTIONAL FACILITY
REPLACE EMERGENCY GENERATOR AND SWITCHGEAR

PC-E-3 - DIESEL ALTERNATOR (GENERATOR) POWER SYSTEM REMOTE RADIATOR

Radiator No. 1

Associated Checklists: _____ Diesel Alternator (Generator) _____ BMS/DDC System
_____ Motor Starters

1. Submittal/Approvals:

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This prefunctional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Mechanical	Date	General Contractor	Date
Electrical	Date	Manufacturer/Vendor	Date

Prefunctional checklist items are to be completed as part of startup and initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor, subcontractor, trade or vendor responsible to verify completion of this item. A/E = Architect/Engineer, All = All Contractors, CA = Commissioning Agent, CC = Controls Contractor, EC = Electrical Contractor, GC = General Contractor, MC = Mechanical Contractor, SC = Sheet Metal Contractor, TAB = Test and Balance Contractor, M/V = Manufacturer/Vendor.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted.

Commissioning Agent	Date	Owner's Representative	Date

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2. Requested Documentation Submitted:

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->	Radiator No. 1	Contr.
Manufacturer's cut sheets.		
Performance data (fan curves, coil data, etc.).		
Installation and startup manual and plan.		
Sequences and control strategies.		
O&M manuals.		

Documentation complete as per contract documents. _____ *Yes* _____ *No*

3. Model Verification:

1 = As Specified, 2 = As Submitted, 3 = As Installed. Check if Okay. Enter note number if deficient.

Equip Tag--->		Radiator No. 1	Contr.
Manuf.	1		
	2		
	3		
Model	1		
	2		
	3		
Serial #	3		
Capacity	1		
	2		
	3		
Volts/Ph/A	1		
	2		
	3		
Coolant	1		
	2		
	3		

The equipment installed matches the specifications for given trade. _____ *Yes* _____ *No*

4. Installation Checks:

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->	Radiator No. 1	Contr.
General Installation		
General appearance good, no apparent damage.		
Proper vibration isolators installed and adjusted.		
Seismic restraints in place (if required).		
Isolation valves and balancing valves installed.		
Pipe fittings and accessories complete. No visible leaks.		
Pipes not supported on equipment.		
Coolant system flushing complete and strainers cleaned.		
System fill/make-up line from engine to radiator installed.		
Vent provided.		
Manual bypass piping and valves installed.		
Core fins are straight and clean.		

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Check Equip Tag->	Radiator No. 1	Contr.
Thermometers installed.		
Pressure gauges installed.		
Test plugs installed near all control sensors and as per spec.		
Flow switch installed as required.		
Proper coolant level.		
No coolant leakage.		
Proper coolant additives.		
Drain valves installed.		
Purge unit installed, if specified.		
Piping type and flow direction labeled on piping.		
Equipment labels affixed		
Coolant heater installed properly.		
Size of over-current heaters in motor starters correct.		
Header tank is of adequate size.		
Overflow is clear and routed to avoid spillage.		
Piping pressure drops within manufacturer's recommendations.		
Engine vent pipes inclined towards radiator.		
Bleed valves provided on piping.		
Cooling coil guards installed.		
OSHA approved fan guards installed.		
Surge tank installed.		
Sight glass installed.		
Thermostatically controlled electric water jacket heaters installed.		
Diesel alternator (generator) engine temperatures maintained at 70°F.		
Lube oil cooler piped.		
Electrical and Controls		
Power wiring installed properly.		
All electrical components grounded properly.		
Control wiring and control system hooked up.		
Sensors calibrated.		
Control system interlocks hooked up and functional.		
Fan rotation confirmed.		
All control devices and wiring complete.		
Safeties installed and safe operating ranges for this equipment provided to the commissioning agent.		
Diesel alternator (generator) prefunctional checklists completed.		

The checklist items of Part 4 are all successfully completed for given trade. _____ *Yes* _____ *No*

5. Operational Checks: (These augment manufacturer's list. This is not the functional performance testing.)

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->	Radiator No. 1	Contr.
Measure line to line voltage phase imbalance for each fan: (%Imbalance = 100 x (avg. - lowest) / avg.) Record imbalance of compressor. Imbalance less than 2%?		

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Check **Equip Tag->**	**Radiator No. 1**	**Contr.**
Record full load running amps for each fan. _____ rated FL amps x _____srvc factor = _____ (Max amps). Running less than max?		
No unusual noise and vibration when running.		
Specified sequences of operation and operating schedules have been implemented with all variations documented.		
Specified point-to-point checks have been completed and documentation record submitted for this system.		
Startup report completed with this checklist attached.		
Startup report includes written certification from manufacturer that all specified features, controls and safeties have been installed and are functioning properly and that the installation and application comply with the manufacturer's recommendations.		

6. Sensor Calibration:

All field-installed temperature and pressure sensors and gages on equipment shall be calibrated. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated. All actuators should also be calibrated.

All sensors are calibrated within required tolerances. _____ *Yes* _____ *No*

Notes:

END OF CHECKLIST

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M/E ENGINEERING, P.C.
Mechanical/Electrical
Engineering Consultants

FUNCTIONAL TEST PROCEDURE

MIDSTATE CORRECTIONAL FACILITY
REPLACE EMERGENCY GENERATOR AND SWITCHGEAR

FTP-E-3 - DIESEL ALTERNATOR (GENERATOR) POWER SYSTEM REMOTE RADIATOR

Associated Equipment: _____ Radiators _____ Fans

Associated Checklists: _____ Diesel Alternator (Generator)

1. Participants:

Party	Participation

Party filling out this form and witnessing testing: _____

Date of Test: _____

2. Prerequisite Checklist:

a. The following have been started up and startup reports and pre-functional checklists submitted and approved ready for functional testing:

_____ Diesel Alternator (Generator)
_____ Metal Clad Switchgear

b. All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with debugging, loop tuning and sensor calibrations completed.

_____ _____
Manufacturer's Representative Signature Date

_____ _____
Electrical Contractor Signature Date

c. _____ Piping system flushing complete, coolant fill and required reports approved.
d. _____ Water treatment system is complete and operational.
e. _____ System is charged.
f. _____ Flow rate confirmed.
g. _____ All A/E punch list items for this equipment corrected.

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h. _____ The functional test procedures reviewed and approved by installing contractor.
i. _____ Safeties and operating ranges reviewed.
j. _____ Test requirements and sequences of operation attached.

3. Sensor Calibration Checks: Check the sensors listed below for calibration and adequate location. This is a sampling. Check if Okay. Enter comment if not.

Device	Device Calibrated	Device Location Appropriate	Comment	Verified Y/N
Coolant water supply temperature sensor.				
Coolant water return temperature sensor.				
Outdoor air temperature sensor.				
Room temperature sensor.				

4. Start-Up Installation Test: Check if Okay. Enter comment if not.

Item	Procedure	Observation	Comment	Verified Y/N
Piping Connections	Flexible piping connections eliminate vibrations into piping and building.			
Electrical Connections	Flexible conduit provided to limit vibration.			
Pipe Supports	Piping supported to eliminate stresses on piping connections to chiller.			
Pressure Gauges and Thermometers	Devices installed on coolant supply and return piping.			
Coolant Treatment	Solution with inhibitors introduced. Water analysis on record.			
Electrical Power	Voltage within 5% of nameplate.			
Fan Motor Phasing Sequence	Proper motor rotation verified.			
Starter Overload Setting	Overload properly selected/set.			
Circuit Breaker	Circuit breaker rating sized properly for equipment.			
Emergency Power	Circuit confirmed.			

5. Radiator No. 1 Functional Test Verification Record:

Item	Procedure	Observation Result	Comment	Verified (Y/N)
1	Command Generator No. 1 to run.	Generator safety and operational starting sequence starts. Generator starts, integral coolant pump operates. Thermostatically controlled		

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Item	Procedure	Observation Result	Comment	Verified (Y/N)
		valves allows engine coolant temperature rise to predetermined temperature (190 F. to 210 F.) per manufacturer's instructions. Once the coolant temperature reaches the predetermined set point, the first radiator fan starts. If the temperature continues to rise, the second and third fans will operate.		
2	Simulate full load operation and record coolant supply and return temperatures	_____ F. design supply _____ F. actual supply _____ F. design return _____ F. actual return		
3	Simulate full load conditions and record operating electrical characteristics of each fan motor. Record nameplate data for: Fan #1: _____ volts, _____ amps Fan #2: _____ volts, _____ amps Fan #3 _____ volts, _____ amps	Fan #1: Phase 1: ____V _____A Phase 2: ____V _____A Phase 3: ____V _____A Fan #2: Phase 1: ____V _____A Phase 2: ____V _____A Phase 3: ____V _____A Fan #3: Phase 1: ____V _____A Phase 2: ____V _____A Phase 3: ____V _____A		
4	Stimulate full load operation and record delta temperature across radiator core	Inlet side: _____ F. Discharge side: _____ F. Delta temp. _____ F.		
5	Record sound levels at 25 feet away from radiators with all fans operating.	Discharge: _____ dBA Left: _____ dBA Right: _____ dBA		
6	Repeat sound test with both radiators operating.	Discharge: _____ dBA Left: _____ dBA Right: _____ dBA		

Notes:

END OF TEST PROCEDURE

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