

**BY ORDER OF THE
SECRETARY OF THE AIR FORCE**

AIR FORCE INSTRUCTION 32-1062

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Civil Engineering

**ELECTRICAL SYSTEMS, POWER PLANTS
AND GENERATORS**



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This instruction implements Air Force Policy Directive (AFPD) 32-10, *Installations and Facilities*. It provides acquisition and operation and maintenance (O&M) requirements for power systems, individual real property installed equipment (RPIE), and Equipment Authorized Inventory Data (EAID) generators. This instruction applies to all personnel who operate and maintain RPIE and EAID electrical generators, to include Air Force Reserve Command (AFRC) units and the Air National Guard (ANG). It emphasizes safe, cost-effective, reliable, and environmentally-compliant methods and practices. This publication may be supplemented at any level, but all direct supplements must be routed to the Office of Primary Responsibility (OPR) of this publication for coordination prior to certification approval. The authorities to waive wing/unit level requirements in this publication are identified with a Tier ("T-0, T-1, T-2, T-3") number. See Air Force Instruction (AFI) 33-360, *Publications and Forms Management*, for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the Publication OPR for non-tiered compliance items. Refer recommended changes and questions about this publication to the OPR using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional chain of command. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of in accordance with the Air Force Records Information Management System (AFRIMS) Records Disposition Schedule (RDS). Use of the name or mark of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

SUMMARY OF CHANGES

This document is substantially revised and must be completely reviewed. This revision of AFI 32-1062 also replaces AFI 32-1063, *Electrical Power Systems*. AF Form 487, *Generator Operating Log (Inspection and Testing)*, has been updated and must be used for all generators installed after the publication date of this AFI. Generator authorization, classification, and validation have been consolidated in this revision. In accordance with the Director of Civil Engineers’ memorandum for “Authorization and Size Validation of Emergency and Standby Generators,” dated 1 April 2013, existing facilities with standby generators (RPIE or EAID) must be vetted through the generator authorization and classification process. New and replacement generators require Air Force Civil Engineer Center (AFCEC) authorization, classification, and design approval (paragraph 1.1). Authorization and classification must be obtained in advance of design approval (paragraph 6.1). Revalidation of facilities authorized standby generators must be conducted every five years (paragraphs 1.4.6, 9.1). A new authorization request is required for facilities with relevant changes to mission requirements or modifications to the electrical system (paragraph 9.1). Generator authorizations will be assigned by individual facility. Facilities with multiple generators must have a single authorization for all standby generators attached to the facility (paragraph 2.2).

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1. RESPONSIBILITIES.

1.1. **Air Force Director of Civil Engineers (AF/A4C).** Establishes policies for electrical systems, power plants and generators.

1.2. **Air Force Civil Engineer Center (AFCEC). (T-1)**

1.2.1. Director, AFCEC Operations (AFCEC/CO), or designee, is the approval authority for generator authorization, design, and classification to include Critical Operations Power Systems (COPS).

1.2.2. AFCEC/CO is the approval authority for five-year revalidation of generator authorizations (see paragraph 9.1) and the use of generators for prime power or cogeneration.

1.2.3. Chief, AFCEC Mechanical/Electrical Branch (AFCEC/COM), maintains master list of RPIE generators available for relocation, as compiled from the Major Commands (MAJCOMs) (see paragraph 1.2.1.2).

1.2.4. Director, AFCEC Environmental (AFCEC/CZ), provides guidance regarding local emission restrictions, spill containment, and fuel tank inspection requirements.

1.2.5. Director, AFCEC Energy (AFCEC/CN), reviews and coordinates on use of generators for co-generation and Prime Power.

1.2.6. Director, AFCEC Facility Engineering (AFCEC/CF), submits authorization and design approval requests to AFCEC/CO when projects are programmed without generator authorization.

1.3. MAJCOM.

1.3.1. **MAJCOM Senior Engineer.**

1.3.1.1. MAJCOM Senior Engineer may delegate the following tasks (may not be delegated below the MAJCOM).

1.3.1.2. Reviews and coordinates on generator authorization and design requests or recommend alternative for approval and submit requests to AFCEC/CO, or disapprove with no further action.

1.3.1.3. Reviews annual RPIE generator inventory reports and provide AFCEC/COM Civil Engineer Maintenance, Inspection, and Repair Team (CEMIRT) a list of generators that are oversized, available for relocation, and cannot be redistributed within their command (see paragraph 8.4).

1.3.1.4. Coordinates the five-year revalidation of generator authorizations with AFCEC/CO and forward validation reports to AFCEC/COSM by 1 October of the reporting year (see paragraph 9).

1.3.1.5. Coordinates prime and cogeneration requests for utility tariff control through AFCEC/CN (information copy to AFCEC/COSM).

1.3.1.6. Ensure Base Civil Engineers (BCEs) develops written prioritized refueling plans and requirements to support EAID and RPIE generator operation during extended power outages of not less than seven days.

1.3.2. **Vice Commanders (MAJCOM/CVs).** Approves deviations for Semiannual Full-System Testing, per paragraph 7.2.

1.4. **Installation Commander (or Equivalent).** Approves deviations from manufacturer service intervals. **(T-1)**

1.5. BCE.

1.5.1. **Real Property Electrical Power Systems.** The BCE provides, operates, and maintains all real property electrical power systems and equipment, including EAID equipment assigned to the BCE and RPIE items, with the exception of units supporting missile systems or special-use tenant generators lacking a signed memorandum of agreement (MOA). The BCE is responsible for operating and maintaining other real property and RPIE electrical systems (as applicable to each installation), including: **(T-1)**

1.5.1.1. Controls, sensors, and alarm circuits needed for operation of real property facilities, such as tank liquid level sensors and alarms.

1.5.1.2. Fire alarm systems.

1.5.1.3. Mass notification systems.

1.5.1.4. Facility-integrated photovoltaic panels, arrays, and components.

1.5.1.5. Electric and hybrid vehicle charging stations.

1.5.1.6. Joint-Services Interior Intrusion Detection Systems (J-SIIDS).

1.5.1.7. Electrical heating and air-conditioning systems using equipment similar to RPIE.

1.5.1.8. Electrical systems temporarily deployed during exercises or contingency or wartime operations, or systems permanently assigned to an installation.

1.5.1.9. Systems for utility plant management and distribution, such as energy management and control systems, which include supervisory control and data acquisition systems and utility monitoring and control systems. The BCE obtains advance written approval from AFCEC/COSM to install any generator security device, such as those used to mitigate electrical system vulnerability.

1.5.2. **Special-Use/Tenant Facility Systems. (T-1)** The BCE maintains and tests electrical power systems at special-use or tenant facilities in accordance with Air Force standards for RPIE and equipment typically assigned to the CE squadron. Using organizations are responsible for operator-level maintenance of equipment supplying power exclusively to these facilities. Real property accountability for equipment supplying power to a special-use facility or tenant organization resides with the BCE. The BCE ensures required MOAs are established; that they address reimbursable/non-reimbursable expenses and requests for additional levels of maintenance; and they receive Judge Advocate review. The BCE has no maintenance responsibility for electrical equipment that is not on the real property record or CE allowance standard and has no MOA in place.

1.5.2.1. The BCE will review and approve non-RPIE generator connections requested by tenant organizations through the work order process per paragraph 1.8. (T-1)

1.5.2.2. Defense Logistics Agency (DLA) capitalized real property and generator operation and maintenance that is funded through the DLA Sustainment, Restoration and Modernization (SRM) process is not a BCE responsibility without a MOA in place. If a MOA is in place, the terms of the MOA will determine BCE responsibility. (T-1)

1.5.3. **Technical Documentation. (T-1)** The BCE develops and maintains as-built electrical system drawings, operating procedures, schematics, and manufacturer O&M manuals.

1.5.4. **Generator Authorization, Design, and Classification.** The BCE: (T-1)

1.5.4.1. Develops and coordinates authorization, and design requests through the MAJCOM Senior Engineer to AFCEC for authorization and approval for RPIE and BCE-owned EAID generators, including generators procured with military construction (MILCON), O&M, SRM, DLA, or other funding. **Exception:** Develops and coordinates requests for generators serving dental and medical facilities through the medical field operating agency. (See memorandum templates in Attachments 2 and 3, or fillable forms located on the Air Force Portal, AFCEC Electrical Engineering site.) <https://www.my.af.mil/gcss-af/USAF/ep/contentView.do?contentType=EDITORIAL&contentId=c2D8EB9D63C49E8B4013C86DBD2091008&channelPageId=s2D8EB9D637283B5601377B2CE4030666&programId=t2D8EB9D6386BFB8B01394F5729351F52>

1.5.4.2. Maintains authorizations in the generator record.

1.5.5. **Generator Inventory.** The BCE: (T-1)

1.5.5.1. Conducts an annual inventory of all CE-operated and maintained RPIE and EAID generators by 1 August each year, including generators that are replacement-eligible, and forwards a copy to the MAJCOM Senior Engineer.

1.5.5.2. For RPIE generator accountability, reconciles the inventory with real property records; for EAID generators, with Custodian Authorization and Custody Receipt Listing records.

1.5.5.3. Includes generator classification and all generator data in each generator record, in accordance with AF Form 487.

1.5.6. **Five-Year Validation of Authorizations.** The BCE will conduct a validation of generator authorizations every five years to identify changes to mission or electrical system configurations and will forward validation reports to the MAJCOM Senior Engineer for revalidation (see paragraph 9). (T-1)

1.5.7. **Compliance with Federal Regulations.** The BCE ensures compliance with applicable provisions of 40 Code of Federal Regulations (CFR), Part 63 Subpart ZZZZ (all stationary prime power generators), 40 CFR Part 60 Subpart JJJJ (all stationary Spark Ignition (SI) generators), 40 CFR Part 60 Subpart IIII (all stationary Compression Ignition (CI) generators), and 40 CFR Part 89 (portable diesel generators). Depending on

generator location and age, operation and maintenance of generators in accordance with the manufacturer's written instructions or procedures may be required. **(T-0) Note:** CFR terminology is unique and conflicts with National Fire Protection Association (NFPA) terminology and this AFI. CFR definitions are used for the sole purpose of applying CFR requirements and are not used for classification purposes of the NFPA or this AFI.

1.5.8. Refueling Plans. The BCE develops written prioritized refueling plans and requirements to support EAID and RPIE generator operation and other generator operation identified within an approved MOA during extended power outages of not less than seven days. The BCE forwards a copy of the plans, together with the annual generator inventory, to the MAJCOM Senior Engineer. **(T-1)**

1.5.9. Parallel System Operation. The BCE ensures: **(T-1)**

1.5.9.1. EAID or RPIE generators or any generator owned by another agency will not operate in parallel with any real property electrical system (i.e., transformer, switchgear, or utility) unless authorized by AFCEC/CO. **(Exception:** Automatic Transfer Switches [ATSs] with momentary closed-transition transfer are permitted).

1.5.9.2. Variable renewable energy sources do not operate in parallel with mission-critical generation.

1.5.9.3. An interconnection agreement is in place when integrating utility-supplied energy into the installation electrical distribution system.

1.5.9.4. Any distributed resource operating in parallel with installation electrical systems complies with Institute of Electrical and Electronics Engineers (IEEE) 1547, *Standard for Interconnecting Distributed Resources with Electrical Power Systems*, and National Electrical Code (NEC) Articles 690 and 705, to ensure adequate protection and separation from facility power systems during outages.

1.5.10. Safety. The BCE:

1.5.10.1. Establishes a requirement for an onsite fire extinguisher near the generator in accordance with AFI 91-203, *Air Force Consolidated Occupational Safety Instruction*. **(T-1)**

1.5.10.2. Complies with safety codes and standards to ensure compliance with current electrical safe work practices in accordance with 29 CFR 1910. **(T-0)**

1.6. Installation Management Flights (Facility Manager for ANG). Installation Management Flights must coordinate with the BCE on generator installations and relocations to ensure compliance with regulations.

1.7. Facility Managers. (T-1)

1.7.1. Verify proper function of all building equipment and systems during generator functional testing using facility load; sign the AF Form 487 following the semi-annual generator test.

1.7.2. Maintain and post next to the generator a list of personnel trained to operate facility generators.

1.7.3. Initiate and obtain MAJCOM/CV approval for extending the semiannual generator testing, per paragraph 7.2.

1.7.4. Provide an organizational memorandum for record for facility electrical system testing and maintenance that is deferred for more than 6 months. Consult the installation Staff Judge Advocate on associated potential safety, environmental, and operational risks.

1.8. **Tenant Organizations.** Tenant organizations will submit a work request for any generator system that will be connected to real property, and establish an MOA with the BCE for the operation and maintenance of the generator on a reimbursable basis. **(T-1)**

2. AUTHORIZATION AND CLASSIFICATION OF GENERATORS.

2.1. AFCEC/CO may authorize the use of generators for prime power or cogeneration on a case-by-case basis. When submitting a request for cogeneration within the area electrical power system (EPS), the BCE must demonstrate that the system complies with IEEE 1547, and must negotiate an interconnection agreement with the area EPS (utility) supplier. **(T-1)**

2.2. Only dedicated standby generators may be authorized to support mission-essential functions. **(T-1)** Generators authorized to support mission-essential functions will be installed and connected to provide power only to mission-essential functions within a single facility in the event there is a loss of commercial power. **(T-1)** Using one standby system to support multiple facilities is not authorized due to simultaneous risk to multiple missions. **(T-1)** If unique circumstances exist where one standby system is required to support multiple facilities, an authorization request must be submitted to AFCEC/CO for approval. **(T-1)**

2.3. Three types of generators may be authorized: RPIE; EAID; and other (described in paragraphs 2.3.1 through 2.3.3). **(T-1)**

2.3.1. RPIE Generators. RPIE generators support mission-critical functions where controlled shut-down or delayed power restoration is unacceptable. They may be authorized for missions requiring immediate power restoration, uninterrupted power, or support for emergency systems as defined in NEC Article 700. **(T-1)** RPIE generators are classified as “Emergency,” “COPS,” Other Permanently Installed,” or “Petroleum, Oils, and Lubricants (POL)/Fuels” (see paragraphs 2.3.1.1 through 2.3.1.4).

2.3.1.1. Emergency. This classification applies to life safety systems required to comply with NEC Article 700. Emergency systems must also comply with NFPA 110, *Standard for Emergency and Standby Power Systems*, Level 1 criteria. **(T-0)**

2.3.1.2. COPS. The “COPS” classification applies to NEC Article 708 systems, which must comply with NFPA 110 Level 2 criteria. **(T-0)**

2.3.1.3. Other Permanently Installed. The “Other Permanently Installed” classification applies to other mission-critical functions not designated as “Emergency” or “COPS.” These systems must comply with NEC, Article 701, “Legally Required Standby Systems,” and NPFA 110 Level 2 criteria. **(T-0)**

2.3.1.4. POL/Fuels. This classification applies to Fuels Information Service Centers (Fuels Operation) and Type III, IV, and V hydrant fueling systems designed in accordance with Department of Defense Standard Designs AW 78-24-28, *Pressurized Hydrant Fueling System*, and AW 78-24-29, *Pressurized Hot Fueling System*, with a manual interlocked transfer switch. These systems must be sized to 50 percent of

pumping capacity in the Continental United States and 100 percent of pumping capacity Outside Continental United States. **(T-1)**

2.3.2. EAID Portable Units. EAID portable generators (trailer-mount or skid-mount) are classified as either “POL/Fuels” or “Portable” (see paragraphs 2.3.2.1 through 2.3.2.2). **(T-1)**

2.3.2.1. POL/Fuels. The EAID “POL/Fuels” classification applies to Types I and II hydrant fueling systems, bulk fuel storage areas, non-hydrant operating storage areas, and vehicle fueling stations that must be prepositioned. **(T-1)** Detached fuels testing labs not located in a fuels operations facility must have a generator connection plug and a manual transfer switch (MTS). **(T-1)**

2.3.2.2. Portable. “Portable” generators may be authorized for mission-essential functions where delayed power restoration is acceptable and portable generation decreases simultaneous risk to the facility and generator.

2.3.3. Other. Other generators (5 kW or less) not classified as RPIE or EAID are not addressed in this AFI. These generators are unit owned and are not the responsibility of the BCE to maintain, test or operate.

3. AUTHORIZATION AND CLASSIFICATION OF FACILITIES.

3.1. Facilities listed in paragraphs 3.1.1 through 3.1.28 will be authorized and must be classified as listed below, per the specified Unified Facility Criteria (UFC) or the general criteria in UFC 352001, *Interior Electrical Systems*. **(T-0)** Other facilities not addressed by the UFC may be approved by AFCEC/CO. **(T-1)**

3.1.1. Medical Healthcare and Ambulatory Care facilities (excludes medical business occupancies as defined by NFPA) in accordance with UFC 4-510-01, *Design: Medical Military Facilities* (Emergency or Portable).

3.1.2. Air navigation aids and facilities, and airfield lighting (COPS or Other Permanently Installed).

3.1.3. Mission/emergency-essential refrigerated storage rooms (Portable).

3.1.4. POL storage and dispensing facilities (POL/Fuels RPIE or EAID).

3.1.5. Mission-essential/critical utility plants (Other Permanently Installed).

3.1.6. Critical sewage lift stations with low-level to high-level alarm duration less than EAID deployment time (Other Permanently Installed).

3.1.7. Typical sewage lift stations with adequate alarm notification to start pre-positioned generator (Portable or Other Permanently Installed when required by local laws).

3.1.8. CE control centers (Portable or Other Permanently Installed).

3.1.9. Mission-essential/critical communication facilities and telephone exchanges (Other Permanently Installed).

3.1.10. Fire stations, including fire alarm, fire control, and radio equipment (Emergency).

- 3.1.11. Mission-essential computer automated data processing facilities (Other Permanently Installed).
- 3.1.12. Air traffic control towers (COPS or Other Permanently Installed).
- 3.1.13. Base weather stations (Other Permanently Installed or Portable).
- 3.1.14. Surveillance and warning facilities (Other Permanently Installed).
- 3.1.15. Primary command and control facilities (does not include headquarters facilities without direct and essential command and control functions) (Other Permanently Installed).
- 3.1.16. Remotely piloted aircraft control pods that are hardwired into a RPIE facility (Other Permanently Installed or Portable).
- 3.1.17. Munitions storage facilities (Other Permanently Installed, or Portable).
- 3.1.18. Entry control points, security gates, and related security lighting systems (Portable).
- 3.1.19. Aircraft and aircrew alert facilities (Other Permanently Installed).
- 3.1.20. Law enforcement and security facilities (COPS, Other Permanently Installed, or Portable).
- 3.1.21. Emergency operations centers in accordance with UFC 4-141-04, *Emergency Operations Center Planning and Design* (Other Permanently Installed).
- 3.1.22. Mission, property, and life support facilities at remote and not readily accessible sites, such as split-site aircraft warning and surveillance installations (Other Permanently Installed).
- 3.1.23. One dining facility per installation or geographic location (Other Permanently Installed or Portable).
- 3.1.24. Industrial facilities that have noxious fumes requiring removal (provide power for the exhaust system only; in the case of an aircraft corrosion control facility, also provide power to the hangar doors in accordance with UFC 4-211-02, *Aircraft Corrosion Control and Paint Facilities*) (Emergency) (Aircraft fuel cell repair facilities are not authorized emergency or standby power).
- 3.1.25. Readiness facilities relying on electrical power to support tactical or mission-essential operations (Other Permanently Installed).
- 3.1.26. Intelligence processing facilities providing mission-essential support to combat and contingency tactical missions (Other Permanently Installed).
- 3.1.27. Simulation or materials laboratories where continuous power is needed for human safety or to maintain low-tolerance temperature (<5 degrees Fahrenheit) and humidity (<5 percent) control to avoid catastrophic consequences. (Other Permanently Installed).
- 3.1.28. Emergency lighting, elevators, fire alarms, security systems, or other life safety equipment within high-occupancy buildings or places of assembly of 1,000 or more people, for safely moving people out (Emergency).

4. ACCOUNTING FOR GENERATORS.

4.1. **RPIE Generators. (T-1)** Notify the real property office if these generators are temporarily or permanently relocated from one facility to another. Document and account for all RPIE generators awaiting installation in the appropriate work order documents. For excess generators and associated equipment (i.e., automatic transfer switches), request MAJCOM review and disposition instructions before removing the generator and associated equipment from a RPIE facility. After removing a generator, account for it on Department of Defense (DD) Form 1149, *Requisition and Invoice/Shipping Document*, if the generator is shipped to another base or to the CEMIRT. If the generator is turned in to the Defense Reutilization and Marketing Office, account for it on DD Form 1348-1A, *Issue Release/Receipt Document*.

4.2. **EAID Generators. (T-1)** EAID generators are listed in Allowance Standard (AS), requisitioned from Warner Robins Air Force Life Cycle Management Center (AFLCMC/WNZEC), 235 Byron Street (Bldg 300-West Wing, Bay D), Robins AFB, GA 31098-1647, DSN 472-1640, Comm (478) 222-1640, and accounted for by Base Supply and AFLCMC/WNZEC. EAID units must be reclassified as RPIE, and coordinated with the Item Manager, AFLCMC/WNZEC when they no longer meet the definition for an EAID or turned in to Base Supply.

4.3. **AFLCMC/WNZEC. (T-1)** Report excess EAID generators to AFLCMC/WNZEC. Any RPIE or commercial EAID generators that are no longer required or are inoperable must be identified to the MAJCOM for review and disposition coordination. Disposal of mobile electric power (MEP) EAID generators must be first coordinated with the EAID Item Manager at AFLCMC/WNZEC. If generators are not required or needed by AFLCMC/WNZEC, they must be disposed of in the same manner as RPIE and commercial EAID generators.

5. DOCUMENTATION AND RECORDS.

5.1. Operations, maintenance, repair, and replacement of RPIE and EAID generators must be documented on the following forms and will become part of the shop record only: **(T-1)**

5.1.1. AF Form 719, *Historical Record - Diesel-Electric Generator and System*, for the life of the generator.

5.1.2. AF Form 487, *Generator Operating Log (Inspection and Testing)*, for three years within the shop record.

5.1.3. Generator authorization letter from AFCEC/COSM.

5.1.4. Approved generator design from AFCEC/COSM (installed after 1 Nov 2011).

5.1.5. Waivers or environmental permits with restrictions, if any.

6. GENERATOR DESIGN AND INSTALLATION, AND EPA REQUIREMENTS.

6.1. **RPIE Generator Authorizations and Designs. (T-1)** RPIE generator authorizations and design approvals must be obtained from AFCEC/CO or its designee. Submit the generator authorization request during project initiation (programming) and submit the design approval request at the 65 percent design milestone. If electrical design changes are made after the 65 percent design submittal, another design approval request is required.

Requests must be in accordance with the templates provided in Attachments 2 and 3, or downloaded from the Air Force Portal, AFCEC Electrical Engineering site. Authorization and approval memos become part of the generator permanent record.

6.2. EAID Generator Authorizations. (T-1) EAID generator authorizations must be approved in writing by AFCEC/CO or its designee. Submit generator authorization requests during project initiation (programming); design approvals are not required. Requests must be submitted in accordance with the template provided in Attachment 2, or downloaded from the Air Force Portal AFCEC Electrical Engineering site. The approval memo becomes part of the generator permanent record.

6.3. Partial Facility Generator Power. (T-1) When only a portion of a facility is authorized generator power, that portion of the facility must be serviced by a separate subpanel fed from the generator and switched by either an MTS or ATS, depending on the mission of the facility. A whole-building generator may be requested only when the authorized mission-essential load is greater than 70 percent of the total facility load. For existing facilities without segregated mission-essential subpanels, size replacement generators and transfer switches only for the authorized mission-essential load, and develop a plan for load-shedding all non-essential loads.

6.4. Generator Sizing. (T-1) Existing, new, or replacement EAID or RPIE generator systems must be sized to achieve greater than 50 percent rated load, and capable of supporting measured or calculated, starting, and step load as defined by a qualified, licensed electrical design engineer or the senior electrical engineer in the unit for in-house designed projects. For existing generator replacements, load data supporting generator selection must be provided; acceptable forms of support data would include the monthly load data recorded on AF Form 487, for the past 12 months; meter data showing average load and peak over a three-day period during a period of full operation; or accurate facility one-lines with all associated panel schedules, equipment schedules, and load calculations.

6.5. Load Banks. (T1) For generator installations sized 250 kW and higher, the design must include provision for portable load bank/generator connection at the ATS or distribution equipment (not at the generator). The connection must be sized for the generator kW rating. Reference UFC 3-540-01, *Engine-Driven Generator Systems for Backup Power Applications*, for additional guidance.

6.6. Mission Uninterruptable Power Supplies (UPS). (T-1) Mission UPSs installed to provide power conditioning and transitional backup power until RPIE generators assume the load must be configured to minimize UPS battery charging during generator operation and disabled when possible. Size the generator for actual UPS configuration and not based on maximum UPS capacity.

6.7. ATS or MTS.

6.7.1. Replace all solid neutral (3-phase, 3-pole) ATSs with switched neutral (3-phase, 4-pole) ATSs whenever the existing generator or ATS is replaced. **(T-1)**

6.7.2. Solid neutral MTSs are allowed for connecting EAID generators only when the EAID generator neutral-ground connection (main bonding jumper) is properly bonded or removed per NEC Article 250. **(T-1)**

6.8. **Medical Facility Generators.** Design of medical military facility generator systems must comply with UFC 4-510-01. **(T-0)**

6.9. **Standby Generators for Hangar Door Secondary Operation. (T-1)** This is not usually authorized and must be strongly justified when a secondary method cannot be installed. Existing and new backup generator installations for hangar door systems require AFCEC/CO approval, including instances where the generator is supplied as part of the hangar door installation. If approved, connections must be located within four (4) feet of the hangar floor below the hangar door motor.

6.10. **Generator Connections.** When a permanently installed generator is not authorized, manual connection points may be locally authorized by the BCE. For additional connection guidance, reference ETL 10-7.

6.11. **Automatic Transfer Switches.** Transfer switches must have either an internal or external bypass capability. **(T-1)**

6.12. **Critical Operations Power Systems (COPS). (T-1)** Power systems for missions critical to national security are required to comply with NEC Article 708, and must be pre-approved by AFCEC/CO. Submit COPS generator classification approval requests to AFCEC/CO through the appropriate MAJCOM Senior Engineer.

6.13. **Environmental Protection Agency (EPA) Requirements.** Federal regulatory air quality requirements for generator engines must be complied with; however, they vary greatly from engine to engine, and are frequently amended. **(T-1)** Requirements address emissions limits, operating limits, management practices, maintenance requirements, performance testing, record keeping, and reporting. Specific requirements differ according to whether the engine is new or existing; whether the engine is located at an area source or major source of hazardous air pollutants (HAP) emissions; and whether the engine is a compression ignition or a spark ignition engine. Several regulations (see paragraphs 6.13.1 through 6.13.2) have expanded the number and type of stationary RICE that must comply with federal requirements. **(T-0)**

6.13.1. **Stationary Generators.** The BCE shall ensure generators meet the following regulations: **(T-0)**

6.13.1.1. 40 CFR Part 63, Subpart ZZZZ, *National Emission Standard for Hazardous Air Pollutants (NESHAP) for RICE - "the RICE rule"*.

6.13.1.2. 40 CFR Part 60 Subpart JJJJ, *New Source Performance Standards (NSPS) - Standards of Performance for Stationary SI Internal Combustion Engines - "the Spark Ignition NSPS rule"*.

6.13.1.3. 40 CFR Part 60 Subpart IIII, *Standards of Performance for Stationary CI Internal Combustion Engines - "the Compression Ignition NSPS rule"*.

6.13.2. **Portable Generators.** The BCE shall ensure generators meet 40 CFR PART 89, *Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines. (T-0)*

7. RPIE GENERATOR AND ATS TESTING AND INSPECTIONS. (T-1 except as otherwise noted)

7.1. Accomplish inspections and full-system tests (generator, ATS with typical mission-essential facility load) on RPIE generators semiannually. Test generators under facility load.

7.2. The using organization may not deny the BCE permission to accomplish a full-system test. The BCE will make every effort to accommodate the user's mission operations within the testing month, but in no case will the time since the last full-system test exceed six months. (**Exception:** A *semiannual* full-system functional test with facility loads may be denied one time, if approved in writing by the MAJCOM/CV, resulting in an automatic three-month extension that will extend the maximum time between full-system tests to nine months.) If the MAJCOM/CV directs that a full-system test not be performed, the BCE must advise the Installation Commander that a second postponement will result in decertification and removal of the RPIE generator from the facility. The BCE will copy the MAJCOM Senior Engineer and AFCEC/CO on this action. Correspondence will be filed in the generator folder. The MAJCOM/CV may not delegate this authority.

8. REPORTING RPIE GENERATORS. (T-1 except as otherwise noted)

8.1. If functional load testing indicates the generator is loaded less than 30 percent of rated capacity over a 12-month period, BCEs will take actions described in paragraphs 8.1.1 through 8.1.1.2.

8.1.1. Compile a list of generators that do not meet the required 30 percent loading for facility loads over a 12-month period. Categorize and certify the generators as "Replacement Eligible," "Replace by Attrition" or "Replacement Not Feasible" (See Attachment 1, *Terms*) and document the category in a memo and file it with the generator records.

8.1.1.1. RPIE generators used to support large in-rush currents may be sized for starting current. These generators may be excluded from paragraph 8.1.1.

8.1.1.2. RPIE generators for fire pumps and RPIE generators rated 25 kW and lower are not required to comply with paragraph 8.1.1.

8.2. Any generator installation (new or replacement) and generator removal or relocation requires AFCEC/CZ coordination to ensure EPA clean air compliance regulations are met.

8.3. Consult with AFCEC/CZ when an EPA-permitted generator is removed from the base; that generator must be removed from the Clean Air Act Title V air permit. Additionally, because the permit requires an accurate list of active permitted generators on base, the BCE must check with AFCEC/CZ to determine if the generator size is small enough to be excluded from the permit.

8.4. By 1 October each year, MAJCOM Senior Engineers will review base generator inventory reports and provide AFCEC/COM CEMIRT a list of "Replacement Eligible" generators that cannot be redistributed within their command.

9. FIVE-YEAR REVALIDATION OF GENERATOR AUTHORIZATIONS. (T-1)

9.1. Every five years by 1 August of the reporting year, BCEs must revalidate through the MAJCOM Senior Engineer the generator authorization memorandum for changes to mission

or modifications to the authorized electrical system. MAJCOM Senior Engineers will coordinate with AFCEC/CO for reauthorization or extension of the existing generator authorization.

9.2. AFCEC/COSM must be notified through the MAJCOM Senior Engineer when a generator authorization is no longer required.

9.3. The BCE will prepare a plan for all generators that do not have an AFCEC authorization and are available for relocation or disposition. The plan will be included as a part of the revalidation process.

10. PRIME GENERATOR REQUIREMENTS. (T-1)

10.1. Generators used for prime power must be authorized by AFCEC/CO. Fuel and configuration requirements for standby generators do not apply to prime power generator installations.

11. POWER CONDITIONING AND CONTINUATION INTERFACING EQUIPMENT (PCCIE). (T-1)

11.1. PCCIE, which typically includes UPSs, is classified as equipment and must be owned by the mission and not the BCE. For guidance on acquisition and maintenance of UPS equipment, contact the PCCIE Product Group Manager, 500 CBSS/GBLD, Building 1207-N, 6029 Wardleigh Road, Hill AFB, UT 84056-5838.

JUDITH A. FEDDER, Lieutenant General, USAF
DCS/Installations, Logistics & Mission Support

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

AFPD 32-10, *Installations and Facilities*

AFI 32-1063, *Electric Power Systems*, 10 June 2005 (rescinded)

AFI 33-360, *Publications and Forms Management*

AFMAN 33-363, *Management of Records*

AFI 91-203, *Air Force Consolidated Occupational Safety Instruction*

ETL 13-4, *Standby Generator Maintenance and Testing Criteria*, 18 November 2013

ETL 10-7, *Connection Methods for Standby Generators – 600 Volts or Less* (rescinded)

NFPA 70, *National Electrical Code (NEC)*

40 CFR Part 63, Subpart ZZZZ, *National Emission Standard for Hazardous Air Pollutants (NESHAP) for RICE - "the RICE rule"*.

40 CFR Part 60 Subpart JJJJ, *New Source Performance Standards (NSPS) - Standards of Performance for Stationary SI Internal Combustion Engines – "the Spark Ignition NSPS rule"*

40 CFR Part 60 Subpart IIII, *Standards of Performance for Stationary CI Internal Combustion Engines – "the Compression Ignition NSPS rule"*

40 CFR Part 89, *Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines*

40 CFR 1068.30, *(General Compliance Provisions For Highway, Stationary, And Nonroad Programs) What Definitions Apply to This Part?*

IEEE 1547, *Standard for Interconnecting Distributed Resources with Electric Power Systems*

NFPA 110, *Standard for Emergency and Standby Power Systems*

UFC 4-510-01, *Design: Medical Military Facilities*, with Change 1

UFC 3-520-01, *Interior Electrical Systems*, with Change 2

UFC 3-540-01, *Engine-Driven Generator Systems for Backup Power Applications*

Prescribed Forms

AF Form 487, *Generator Operating Log (Inspection Checklist)*

AF Form 719, *Historical Record – Diesel-Electric Generator and System*

AF Form 731, *Crankshaft Deflection Record*

AF Form 734, *Cylinder Liner and Ring Wear Record*

AF Form 1167, *Daily Power Plant Operating Log (Diesel - Electric)*

AF Form 3507, *Diesel Engine Inspection Data*

AF Form 3508, *Diesel Cylinder Compression and Firing Tests*

AF Form 3509, *Daily Power Plant Operating Log (Gas Turbine - Electric)*

Adopted Forms

AF Form 979, *Danger*

AF Form 982, *Do Not Start*

Abbreviations and Acronyms

AFCEC—Air Force Civil Engineer Center

AFCEC/CF—Air Force Civil Engineer Center, Facility Engineering Directorate

AFCEC/CN—Air Force Civil Engineer Center, Energy Directorate

AFCEC/CO—Air Force Civil Engineer Center, Operations Directorate

AFCEC/COM—Air Force Civil Engineer Center, CEMIRT Division

AFCEC/COSM—Air Force Civil Engineer Center, Mechanical/Electrical Branch

AFCEC/CZ—Air Force Civil Engineer Center, Environmental Directorate

AFLCMC/WNZEC—Air Force Life Cycle Management Center

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFPD—Air Force Policy Directive

AFRIMS—Air Force Records Information Management System

AS—Allowance standard

ATS—Automatic Transfer Switch

BCE—Base Civil Engineer

CA/CRL—custodian receipt/custody receipt listing

CE—civil engineering

CFR—Code of Federal Regulations

CI—Compression Ignition Engine (Diesel Engine)

CONUS—continental United States

COPS—Critical Operations Power System

DD—Department (of) Defense (forms and directives)

DEPPM—Defense Energy Program Policy Memorandum

DLA—Defense Logistics Agency

DoD—Department of Defense

DRMO—Defense Reutilization and Marketing Office

EAID—Equipment Authorized Inventory Data

EMCS—emergency management and control system
CEMIRT—Civil Engineer Maintenance, Inspection, and Repair Team
EOC—emergency operations center
EPS—electrical power system
ETL—Engineering Technical Letter
FISC—Fuels Information Service Centers
FOA—Field Operating Agency
HAP—hazardous air pollutants
IEEE—Institute of Electrical and Electronics Engineers
ISO—International Organization for Standardization
J-SIIDS—Joint Services Interior Intrusion Detection System
kVA—kilovolt-ampere
kW—kilowatt
MAJCOM/CV—MAJCOM Environmental
MAJCOM—major command
MEP—mobile electric power
MILCON—military construction
MOA—memorandum of agreement
MTS—manual transfer switch
NEC—National Electrical Code
NESHAP—National Emission Standard for Hazardous Air Pollutants
NFPA—National Fire Protection Association
NSPS—New Source Performance Standards
O&M—operations and maintenance
OCONUS—outside the continental United States
OPR—office of primary responsibility
PCCIE—Power Conditioning and Continuation Interfacing Equipment
PF—power factor
POL—petroleum, oils, and lubricants
RDS—Records Disposition Schedule
RICE—reciprocating internal combustion engine
RPIE—real property installed equipment

S/R&M—Sustainment, Restoration, and Modernization

SCADA—Supervisory Control and Data Acquisition System

SI—spark ignition engine (gasoline or natural gas engine)

UFC—Unified Facilities Criteria

UMACS—utility monitoring and control system

UPS—uninterruptable power supply

Terms

Classification—Backup generators may be Real Property Installed Equipment (RPIE) or Equipment Authorized Inventory Data (EAID) portable units. RPIE generators support mission-critical functions where delayed power restoration is unacceptable. RPIE generators may be approved for missions that require immediate power restoration, uninterrupted power, or support to emergency systems defined in NFPA 70, *National Electrical Code* (NEC) Article 700. EAID generators support mission-critical or infrastructure-critical functions where delayed power restoration is acceptable.

Compression Ignition Engine (Diesel Engine)—A RICE that is not a spark ignition engine. Compression ignition engine (diesel engine) is an internal combustion engine that uses the heat of compression to initiate ignition and burn the fuel that has been injected into the combustion chamber.

Continuous Power (International Organization for Standardization (ISO) Engine Classification)—Power that a generator can continuously deliver for an unlimited number of hours per year while following the manufacturer's stated maintenance intervals. Load rating is continuous or nonvarying. Normally, a generator can operate at 110 percent of this rating for a limited period, usually 1 hour, with or without interruption, within a 12-hour period of operation. However, some generators do not offer overload capability and designers have to specify it if required.

Emergency Systems—NEC 700 life safety (e.g., hospitals), not mission-critical functions.

Portable Generator—Any generator that is used in a portable (or transportable) application in which the engine will not stay at a single location for a full year or more. Legally considered “NonRoad” RICE engines under 40 CFR 89. By definition no RPIE generator is a “portable generator” and nearly all EAID generators are “portable generators”. However, any EIAD generator remaining in a single location for at least a full year is legally reclassified and a “stationary generator.”

Prime Power—Generators rated for continuous operation. Generator may considered prime when utility source is not available or unreliable. Generators designed to operate in parallel with the utility are also considered to be prime power.

Qualified Person—One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved. Supervisors will set additional criteria as well as determine and document where each person within his control is qualified.

Reciprocating Internal Combustion Engine (RICE)—Means any reciprocating internal combustion engine which uses reciprocating motion to convert heat energy into mechanical work and which is not mobile. Stationary RICE differs from mobile RICE in that stationary RICE is not a non-road engine as defined at 40 CFR 1068.30, and is not used to propel a motor vehicle or a vehicle used solely for competition.

Semiannually:—Every six months.

Spark Ignition Engine (Gasoline or Natural Gas Engine)—A RICE with a spark plug (or other sparking device) and with operating characteristics significantly similar to the theoretical Otto combustion cycle. Spark ignition engines usually use a throttle to regulate intake air flow to control power during normal operation. Dual-fuel engines in which a liquid fuel (typically diesel fuel) is used for CI and gaseous fuel (typically natural gas) is used as the primary fuel at an annual average ratio of less than 2 parts diesel fuel to 100 parts total fuel on an energy equivalent basis are spark ignition engines.

Standby Power—Alternate power source that is available for through either automatic or manual operation. Standby power may be real property or equipment based on HQ AFCEC authorization.

Stationary Generator—Any generator that is used either in a fixed application or in a portable (or transportable) application in which the engine will stay at a single location for at least a full year. Legally considered “stationary RICE” engines under 40 CFR Part 63, Subpart ZZZZ, 40 CFR Part 60 Subpart JJJJ, and 40 CFR Part 60 Subpart IIII. By definition, all RPIE generators are “stationary generators”; however, if an EAID generator remains in one location for one year of more it is also legally considered a “stationary generator.”

Switchgear—An indoor or outdoor metal structure containing electrical switching and interrupting equipment with buses and connections and associated control, instrumentation, metering, protective, and regulating devices. The associated devices are in separate grounded metal compartments from the switching and interrupting equipment.

UPS—Uninterruptable power supply purchased with funds other than 3400 (Operations and Maintenance Appropriations). Owned by a mission, not the BCE. Classified as equipment, not RPIE. Meets NEC (NFPA 70-2011) definition as “...used to provide alternating current power to a load for some specified period of time in the event of power failure.”

Attachment 2**NEW AND REPLACEMENT GENERATOR AUTHORIZATION AND DESIGN
TEMPLATES**

(Date)

MEMORANDUM FOR HQ AETC CIVIL ENGINEER
AFCEC/COSM
IN TURN

FROM: XXX CES/CC
123 Bedford Way
All AFB, FL 11111

SUBJECT: Generator Authorization Request for Building <number>, All AFB, FL

1. Project Requested:

MAJCOM:
Base:
Project:
Status:
POC: (Name and Contact Information)
RPIE or EAID:
Classification: (Emergency, COPS, Other Permanently Installed, POL/Fuels, Portable)

2. Project Description: (What mission will the generator support? Mission description? New or replacement generator? Please be specific.)

3. Description of Emergency/Mission-Critical Loads: (Summary of loads that will be on generator power. What and why does it need power? Please be specific.)

4. Impact of Power Loss on Mission: (What is the impact to the mission if power is lost and not restored immediately or within a few hours?)

BCE Signature Block or designee

Attachment:
DD Form 1391 or AF Form 332

(Date)

1st Ind, HQ AETC CIVIL ENGINEER

MEMORANDUM FOR AFCEC/COSM

1. Recommend [approval/alternative] of generator authorization as a [RPIE/EAID].
(If recommending alternative state why it does or doesn't meet AFI requirements)
2. [Meets/Does not meet] AFI 32-1062 criteria.

Civil Engineer Signature Block or Designee

Generator Rating:
kW: kVA: PF:

Generator Duty:
Type of Fuel:
Fuel Supply:
 Day Tank Capacity:
 Sub-base Capacity:
 External Tank Capacity:
Enclosure Type:
Cooling Type:

BCE Signature Block or designee

Attachments:

1. One-line diagram
2. Emergency panel schedule
(Optional attachment is software sizing recommendation)

1st Ind, HQ AETC CIVIL ENGINEER

(Date)

MEMORANDUM FOR AFCEC/COSM

1. Recommend [approval/alternative] for generator design evidence and [____kW] generator size. (If recommending alternative state why)
2. [Meets/does not meet] the requirements of AFI 32-1062. (If it doesn't meet AFI requirements, state why.)

Civil Engineer Signature Block or Designee

Attachment 3

EXISTING GENERATOR AUTHORIZATION AND DESIGN SIZING TEMPLATE

(Date)

MEMORANDUM FOR HQ MAJCOM CIVIL ENGINEER
AFCEC/COSM
IN TURN

FROM: XXX CES/CC or AFCEE
123 Bedford Way
All Base, FL 11111

SUBJECT: Existing Generator Authorization & Design Sizing

1. Building Description:

MAJCOM:
Base:
Building Number:
Mission-Authorized Emergency Power:

2. Generator Description:

Generator Type: <RPIE or EAID>
Emergency Classification: <Emergency, COPS, Other>
AFI 32-1062 Sub Paragraph: <7.6.1 – 5.1.27>
Whole Building Generator: <Yes or No>

3. Description of Emergency/Mission-Critical Loads: <Narrative. Include special considerations that may drive a larger generator sizing>

4. Impact of power lost on mission: <Narrative>

5. Generator Design Information:

Service Transformer kVA:
Emergency Connected Load:
Emergency Demand Load:
Average kW: <From last 12 months>
Max kW: <From last 12 months>
Generator Rating (from nameplate): kW: kVA: PF:

Signature Block of XXX CES/CC
(or designated representative)

1st Ind, HQ MAJCOM CIVIL ENGINEER

(Date)

MEMORANDUM FOR AFCEC/COSM

1. MAJCOM Recommendation: <Approve RPIE, EAID, Connection Only, Disapprove>

MAJCOM EE (or Designee)
Signature Block