TEST METHOD 121

VIBRATION TEST

121.1 General. The generator set must be capable of withstanding externally imparted vibrations.

121.2 Apparatus. Instrumentation for measuring load conditions and ambient temperature shall be as described in EGSA 107T.

121.3 Procedure.

a. Inspect the trailer and generator set (s) to establish pretest criteria and physical condition.

b. Perform Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term) (rated load only).

c. Install instrumentation on the generator set to measure the vertical axis acceleration history.

d. The power unit or plant shall be driven five times over the following sections of the course at specified speed:

NOTE: The speeds will be utilized as specified unless the speed poses an unsafe driving condition, in which case the maximum safe operating speed will be utilized.

1. Course washboard (6-inch waves spaced 72 inches apart) - 5 mph.

2. Belgian block - 20 mph

3. Radial washboard (2-inch to 4-inch waves) - 15 mph.

4. 2-inch washboard - 10 mph

5. 3-inch spaced bump - 20 mph

e. After vibration, inspect the generator set for visual damage and record any damage on the data sheet. Perform Method 77, Frequency and Voltage Regulation, Stability andTransient Response Test (Short Term) (rated load only).

740.1.4 Results. Compare the condition of the generator set after vibration with the requirements of the requirement document.

740.1.5 Requirement document requirements. The following items must be specified in the individual requirement document:

a. Duration of the vibration portion of this method.

b. Voltage connection and frequency at which the pre- and post-vibration operation methods are to be performed.

c. The frequency requirements specified in paragraph 77.5a of Test Method 77.

d. The voltage requirements specified in paragraph 77.5b of Test Method 77.

e. Definition of vibration damage.

TEST METHOD 122

DROP TEST (FREE FALL)

122.1 General. The generator set must be capable of withstanding drops from reasonable heights to assure damage free transportability.

122.2 Apparatus. Instrumentation for measuring load conditions and ambient temperature shall be as described in EGSA 107T. In addition, a divided table top drop tester or a hoist with a suitable sling trapping device and a flat, firm base on which to drop the set shall be required. The base shall be reinforced concrete not less than 6 inches thick and extending not less than 4 feet beyond all sides of the set.

122.3 Procedure.

a. Perform Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term).

b. The equipment fuel tank shall be half full of fuel. Used batteries filled with water may be installed to prevent acid damage should the battery hold-down bracket fail. All liquids (except fuel) shall be at normal operating levels. Drop the set by a free fall, in that no ropes or other suspending media are supporting the set during the fall, the distance specified in the contract. For a corner drop the angle between the set base and the impact surface shall be 30 degrees.

c. Visually inspect the set for damage.

d. Perform Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term).

122.4 Results. Compare the results with the requirements of the contract.

122.5 Contract requirements. The following items must be specified in the individual contract:

a. The height of the drops the set must undergo.

b. The number of drops.

c. Whether the drops are to be flat, corner or both.

d. Angle of corner drop, if other than as specified herein.

e. The voltage requirements specified in para 77.5a of Test Method 77.

f. The frequency requirements specified in para 77.5b of Test Method 77.

g. The voltage connection and frequency at which this method shall be performed.

TEST METHOD 123

DROP TEST (ENDS)

123.1 General. The generator set must be capable of withstanding end drops which may be encountered in normal transportation.

123.2 Apparatus. Instrumentation for measuring load conditions and ambient temperatures shall be as described in EGSA 107T . In addition, a piece of 2 X 4 inch (± 1/2 inch) timber and a reinforced slab of concrete not less than 6 inches thick and extending not less than 4 feet beyond all sides of the set shall be required.

123.3 Procedure.

a. Perform Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term).

b. The equipment fuel tank shall be half full of fuel. Used batteries filled with water may be installed to prevent acid damage should the battery hold-down bracket fail. All liquids (except fuel) shall be at normal operating level. Support the set at one end by the 2 inch timber placed at right angles to the skids and within 6 inches of the end of the skid frame.

c. Raise the opposite end of the set to the height specified in the contract and release to fall freely onto the concrete slab.

d. Repeat step c above 5 additional times.

e. Repeat steps c and d above with the opposite end of the set on the timber.

f. Visually inspect the set for damage.

g. Perform Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term).

123.4 Results. Compare the results with the requirements of the contract.

123.5 Contract requirements. The following items must be specified in the individual contract:

a. The height of the drop.
b. The voltage requirements specified in para 77.5a of Test Method 77.
c. The frequency requirements specified in para 77.5b of Test Method 77.
d. The voltage connection and frequency at which this method is to be performed.

TEST METHOD 124

ROAD TRANSPORTABILITY TEST

124.1 General. The generator set attachments must be capable of withstanding the vibration and shock encountered during road transport. Skid mounted sets are transported either in the bed of wheeled vehicle cargo trucks or mounted on a cargo trailer singly (power unit configuration) or two sets are configured as a power plant (with a load transfer switch).

124.2 Apparatus. Instrumentation for measuring load conditions and ambient temperature shall be as described in, Test Methods 17,18. In addition, the test recording equipment shall be described in Test Methods 1, 4 and 6 (unless otherwise specified) A cargo truck of size applicable to the generator set under test will be required for skid set testing. A cargo trailer and compatible truck will be required for power unit and power plant testing. Instrumentation for measuring and recording the truck speed and road mileage shall be required.

124.3 Procedure.

124.3.1 Generator set (s) mounted on a trailer.

124.3.1.1 Preparation for test.

a. The generator set (s) shall be serviced to verify that all fluids are at normal operating levels with the exception of the fuel. Unless otherwise stated, the fuel tank will be one-half full.

b. The positive securement of the generator (s) and associated equipment to the trailer shall be verified.

c. The trailer shall be inspected and serviced in accordance with its technical manual including the brake system, suspension, lighting, tire pressure and lubrication.

d. Ancillary equipment weight, as specified herein, shall be positively secured to the trailer. Care should be taken in the placement of the weight so that access to the generator sets is not restricted for inspections and operational tests.

124.3.1.2 Slope operation.

a. The theoretical tipping angles (critical angles) should be calculated for both ends and side of the power unit or power plant before traversing the slopes to establish a rough approximation of the maximum slopes on which the trailer can safely negotiate. In theory, the critical angle is when the center of gravity (CG) of the item is located vertically above its center of rotation (the mid-point of the tire in a single-axle trailer).
b. Side slope. The power unit or power plant shall be towed in a sine wave pattern along

the horizontal length of the required side slope (s). The trailer will be towed in both directions on the slope. During the traversal of a slope, the trailer shall be stopped for inspection purposes. The power unit or plant shall be inspected for any shifting of on-board equipment, and the overflow of any fluid reservoirs. The results of the inspection shall be recorded. Power units or plants having a high vertical CG shall have their maximum side-slope ability tested with the aid of special safety precautions (i.e. a safety cable attached to the item to prevent accidental tip-over).

c. Longitudinal slope. The power unit or plant shall be towed up and down the required longitudinal slope (s). Particular attention will be given to the approach and departure of the trailer onto/from the slope. During traversal of the slope, the trailer shall be stopped for inspection purposes. The power unit or plant shall be inspected for any shifting of on-board equipment, and the overflow of any fluid reservoirs. The results of the inspection shall be recorded.

124.3.1.3 Road test.

a. Prior to start of road testing, Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term) shall be conducted. To detect electrical performance degradation Test Method 77 shall be conducted before the start and at the end of each roadability cycle of Table I. These tests will be performed at rated load only with stabilization requirements documented.

b. The power unit or plant shall be exposed to four cycles of the road schedule present in Table 1. At the beginning and end of each driving period (shift or day) the generator (s) shall be started and operated at no-load and examined for proper performance to ensure that rated voltage, rated frequency, and adequate oil pressure can be obtained. The generator set (s) and trailer will be visually inspected frequently for any evidence of structural damage, deformation, loosening, or breakage that may occur during travel. The results of the inspections shall be recorded.

c. During traversal of the road courses, the trailer shall be observed for evidence of weaving, inability to successfully track behind the prime mover, interference with the prime mover, fluid reservoir overflow, or any other hazardous characteristic.

124.3.2 Skid-mounted sets as loose cargo.

124.3.2.1 Preparation for test. Service the skid-mounted set (s) as indicated in 124.3.1.1a above. Unless specified herein, the skid-mounted set shall be tied down on a military cargo truck using the set lifting eyes and cargo straps.

124.3.2.2 Road test.

a. Prior to start of road testing, Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term) shall be conducted. To detect electrical performance degradation Test Method 77 shall be conducted before the

start and at the end of each roadability cycle of Table I. These tests will be performed at rated load only with stabilizationrequirements documented.

b. The skid-mounted set (s) shall be exposed to four cycles of the road schedule present in Table 1. At the beginning and end of each driving period (shift or day) the generator (s) shall be started and operated at no-load and examined for proper performance to ensure that rated voltage, rated frequency, and adequate oil pressure can be obtained. The generator set (s) and trailer will be usually inspected frequently for any evidence of structural damage, deformation, loosening, or breakage that may occur during travel. The results of the inspections shall be recorded.

TABLE I. Road Transportability Test Schedule.

Road Course (Aberdeen Proving Ground, Maryland)	Distance		Maximum Speed	
	mi	km	mph	km/hr
Paved highway	250	402	50	80
Level cross-country (Perryman 1)	250	402	20	32
Hilly cross-country (Churchville B)	125	201	20	32
Belgian Block	15	24	20	32
Totals	640	1029		

124.4 Results. Examine the set and record any deformation or damage. Compare the condition of the generator set following this method with the requirements of the contract.

124.5 Contract requirements. The following items must be specified in the individual contract.

a. Road courses other than as specified.

b. The voltage requirements specified in para 77.5a of Test Method 77.

c. The frequency requirements specified in para 77.5b of Test Method 77.

d. The voltage connection and frequency at which this method is to be performed.

TEST METHOD 125

RAILROAD IMPACT TEST

125.1 General. The generator set must be capable of withstanding the vibration and shock encountered in all forms of transportation and movement. The mechanical integrity of the set is tested by means of the shock loading encountered during the railroad impact test. The test also evaluates the method of tie-down on the rail car.

125.2 Apparatus. Instrumentation for measuring load conditions and ambient temperature shall be as described in EGSA 107T . Test recording equipment(s) for recording voltage and frequency shall be required. The test recording equipment shall be as described in EGSA 107T , Test Method 1 and 4, unless otherwise specified in the contract. In addition, two railroad cars with a total standing weight of not less than 250,000 pounds, divided approximately equally between the two cars, and one standard flat railroad car (test car) all with standard draft gear couplings or cushioned draft gear and conventional underframes, a means of moving the test car, an electrical or electronic device to determine the test car speed at impact, and shock measuring equipment as applicable, shall be required.

125.3 Procedure.

125.3.1 Preparation for test.

a. The equipment shall be mounted on the impact end of the test car in accordance with the standard loading and bracing method as shown in section 6 of the Association of American Railroads (AAR) "Rules Governing the Loading of Department of Defense Material on Open Top Cars" unless otherwise specified. No exotic or unusual tiedown methods shall be used. The longitudinal axis of the equipment shall be mounted parallel to the length of the test car.

b. Unless otherwise specified, the equipment fuel tank shall be half full of fuel. Used batteries filled with water may be installed to prevent acid damage should the battery hold-down bracket fail. All liquids (except fuel) shall be at normal operating level.

c. Any load in the stationary (buffer) cars shall be secured to prevent sliding or shifting; any movement greater than two inches resulting from the test shall be justification for retest.

125.3.2 Test.

a. Within four hours of the test and at the test site, perform Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term) (rated load only).

b. The couplers between the stationary cars shall be compressed to remove the slack and all of the air and hand brakes shall be set.

c. Locate the test car between the stationary cars and the locomotive. A minimum of 200 feet of reasonably level track between the test car and stationary cars is required to achieve the required locomotive speeds unless an inclined ramp and tug is used. A practice test run without impacting this test car may have to be conducted to assure the required speed of impact can be achieved.

d. Position the draft gear knuckles of the stationary and test cars for coupling.

e. Install the timing device to measure the test car speed (±0.05 MPH) within six feet of impact with the stationary cars.

f. Push the test car towards the stationary cars and release the test car when the desired test speed of 4 MPH (plus 0.5, minus 0.0 MPH) is reached (observed by using the locomotive's speedometer or by other means), thus allowing the test car to freely impact the stationary cars. If an inclined ramp and tug is used, move the test car to the incline position for the desired speed and release the test car allowing it to freely impact the stationary cars.

g. Record the speed of impact.

h. Visually inspect the equipment for liquid leaks, deformation, loosening, breakage or change of fit of any component or part including the method of tiedown, tiedown anchors and fittings, and observations of blocking and lading. Record results of inspection and observations.

NOTE: If adjustment of the lading, reconditioning of the bracing or items of securement is required during the impact tests, testing will stop. A complete, new impact test shall then be required.

i. Repeat 125.3.2b thru h at a speed of 6 MPH (plus 0.5, minus 0.0 MPH).

j. Repeat 125.3.2b thru h at a speed of 8 MPH (plus 0.5, minus 0.0 MPH).

k. Repeat 125.3.2b thru h at any other speeds specified in the contract.

l. Reverse the test car and repeat 125.3.2b thru h at 8 MPH (plus 0.5, minus 0.0 MPH) unless a higher speed is specified in the contract (see para 125.3.2k). No adjustment of the lading, reconditioning of the bracing or items of securement shall be made.

m. Within four hours after completion of the four impacts and final inspection, perform Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term) at the test site.

125.4 Results.

a. Compare the results of the test with the requirements of the contract.

b. Compare the results the tests specified in 125.3.2a and 125.3.2m with the requirements of the contract.

125.5 Contract requirements. The following items must be specified in the individual contract:

a. The quantity of equipment to be tested.

b. The equipment orientation and method of tiedown if other than that specified by the Association of American Railroads.

c. The location and orientation of shock recording or strain sensing devices if required.

d. Speeds other than as specified herein.

e. The failure definition for damage.

f. The frequency requirements specified in para 77.5a of Test Method 77

g. The voltage requirements specified in para 77.5b of Test Method 77.

h. Volume of fuel in fuel tank if other than as specified herein.

TEST METHOD 126

FORKLIFT HANDLING TEST

126.1 General. Generator sets must have the ability to withstand handling by mechanical equipment such as forklifts.

126.2 Apparatus. Instrumentation for measuring load conditions and ambient temperature shall be as described in EGSA 107T . In addition, a hard rubber tired forklift truck of sufficient capacity for the weight of the set and six nominal 1 by 4-inch boards longer than the width of the forklift truck shall be required.

126.3 Procedure.

a. Perform Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term).

b. Adjust the forks to the spacing appropriate for the generator set under test.

c. The generator set shall be lifted clear of the ground by the forklift truck at one side of the set and transported on the forks in the level or backtilt position across a hard pavement for a distance not less than 100 feet. Parallel pairs of 1-inch boards spaced 54 inches apart shall be flatwise on the pavement across the path of the forklift truck. The first pair shall be placed squarely across the truck's path and centered 30 feet form the starting point; the second pair shall be laid 60 feet from the starting point at an angle of 60 degrees to the truck's path so the left wheel strikes first; and the third pair shall be laid so feet from the starting point at about 75 degrees to the truck's path so the right wheel strikes first. If the generator set is more than 36 inches wide and is stable on 36-inch long forks, the forks shall extend only 36 inches under the set. The forklift truck carrying the set shall travel the 100 feet in about 23 seconds at a uniform speed (normal walking speed, approximately 3 mph), and then shall be brought to a stop.

d. The generator set shall be observed during the traverse and while the forklift truck is at a stop for any damage, evidence of inadequacy, or deflection of the set that might cause damage. Record results of observations on the data sheet.

e. The forklift truck shall be moved from the side to the end of the generator set. The forks shall be run under the set as far as possible and then operated to lift the end 6 inches. Observe the set, particularly in the vicinity of the end of the forks, and record observations. If the set can thus be lifted clear of the floor, transport it on the forks over the same 100 foot course, and record observations. If it cannot be thus lifted, report the length of the forks used.

f. Repeat step e above from the opposite end of the set.

g. Perform Test Method 77, Frequency and Voltage Regulation, Stability and Transient Response Test (Short Term).

126.4 Results. Compare the results with the requirements of the contract.

126.5 Contract requirements. The following items must be specified in the individual contract:

a. The direction(s) from which a forklift shall be capable of being used to transport the set.

b. The voltage requirements specified in para 77.5a of Test Method 77.

c. The frequency requirements specified in para 77.5b of Test Method 77

d. The voltage connection and frequency at which this method is to be performed.

TEST METHOD 127

FUEL LIFT TEST

127.1 General. The fuel pump must be capable of lifting fuel to the generator set.

127.2 Apparatus. Instrumentation for measuring load conditions and ambient temperature shall be as described in EGSA 107T . In addition an auxiliary fuel tank and a fuel line as specified in the contract shall be required.

127.3 Procedure.

127.3.1 Preparation for test.

a. Connect the load instrumentation for one voltage connection and frequency specified in the contract.

b. Connect the fuel line between the set and an auxiliary fuel supply located the lift distance below the fuel pump as specified in the contract.

127.3.2 Test.

a. Start and operate the set at rated voltage, rated frequency and rated load for 30 minutes from the set fuel tank. During all portions of this method read and record all instrumentation at maximum intervals of 15 minutes. For sets without integral fuel tanks start and operate from auxiliary tank and omit paragraph b (below).

b. At the end of 30 minutes of operation on the set fuel tank, with the set operating, transfer the fuel supply to the auxiliary fuel tank.

c. Continue to operate the set at rated voltage, rated frequency and rated load for one hour from the auxiliary fuel tank. During this portion of the method drop and apply rated load six times.

127.4 Results. Compare the operation of the set with the requirements of the requirement document.

127.5 Contract requirements. The following items must be specified in the individual contract:

a. Lift distance of the auxiliary fuel tank in relation to the set fuel pump.
b. The voltage connection(s) and frequency(ies) at which this method is to be performed.
c. Type of fuel to be used.
d. Length and size of fuel line.

TEST METHOD 128

WINTERIZATION TEST

128.1 General. The heater and its controls must function properly.

128.2 Apparatus. None other than the normal heater controls unless the overheat devices have to be bypassed.

128.3 Procedure.

a. Place the heater in operation by following the instructions on the set or in the technical manual. If the ambient temperature is such that the heater will not start, bypass the thermostats. Operate the heater for one cycle of operation.

b. If any of the thermostats were bypassed, they shall be returned to the control circuit.

c. Record whether the heater operated properly.

128.4 Results. Compare the results obtained with the requirements of the contract.

128.5 Contract requirements. The following item must be specified in the individual contract:

a. Proper operation criteria for the heater and its controls during the performance of this method.

TEST METHOD 129

RECTIFIER TEST

129.1 General. The rectifiers must be capable of withstanding the peak voltage and currents encountered during any operating condition.

129.2 Apparatus. Instrumentation for measuring load conditions and ambient temperature shall be as described in EGSA 107T . In addition, a shorting switch and a memory type oscilloscope shall be required.

129.3 Procedure.

1293.1 Preparation for test.

a. Connect the load and field instrumentation for one voltage connection and frequency specified in the contract.

b. Connect the shorting switch directly to the set output terminals.

c. Connect the memory oscilloscope to measure the voltage across one of the rectifiers specified in the contract (if necessary, slip rings shall be provided to evaluate rotating rectifiers).

129.3.2 Test.

a. Start and operate the generator set and allow the set to stabilize at rated load, rated voltage and rated frequency. During this period record all instrument readings including ambient temperature at minimum intervals of 10 minutes. If necessary, adjustments to the load, voltage and frequency may be made to maintain rated load at rated voltage and frequency. Adjustments to the voltage and frequency shall be limited to those adjustments available to the operator, specifically adjustments to the voltage or frequency adjust devices. On sets utilizing a droop-type speed control system as the prime speed control, the speed and droop portions of the control may be adjusted. No other adjustments to the voltage and frequency control systems shall be made unless permitted by the contract. Adjustments to the load, voltage or frequency controls shall be recorded on the data sheet at the time of adjustments. Unless otherwise specified in the contract, stabilization shall be considered to have occurred when four consecutive voltage and frequency recorded readings of the generator line output either remain unchanged or have only minor variations within plus or minus one-half the long-term stability bandwidth with no evident continued increase or decrease in value after the last adjustment to the load, voltage or frequency has been made (see figure 129-I).

b. After stabilization has occurred turn on the memory oscilloscope and record the peak voltage across the rectifier as the load is reduced to zero in one step (see figure 129-I).

c. Again use the memory oscilloscope and record the peak voltage across the rectifier as rated load is applied in one step.

d. While at rated load use the memory oscilloscope and record the peak voltage across the rectifier as the shorting switch is closed momentarily.

NOTE: In the case of 3-phase generator sets, a symmetrical 3-phase line-to-line short circuit shall be applied.

e. Repeat steps a thru d above two additional times.

f. Connect the memory oscilloscope and shunt to indicate the current through the rectifier.

g. Repeat steps a thru d above three additional times recording the peak current through the rectifier in each test.

h. Repeat steps a thru g above for each rectifier specified in the contract.

i. Repeat steps a thru h above for each voltage connection and frequency specified in the contract requirements.

j. Perform any additional procedures necessary for comparison of the rectifier ratings with the contract requirements.

129.4 Results. Compare the results with the rectifier ratings and compare both the results and the rectifier ratings with the requirements of the contract.

129.5 Contract requirements. The following items must be specified in the individual contract:

a. Voltage connection(s) and frequency(ies) at which this method is to be performed.

b. Peak inverse voltage rating of each rectifier to be tested.

c. Peak current rating of each rectifier to be tested.

d. Each rectifier on which this method is to be performed.

TEST METHOD 130

LOAD BANK TEST

130.1 General. Load banks are added to some diesel generator sets to increase the time between major maintenance due to light load conditions. This is done by keeping the engine loaded to more than 50 percent of its horsepower rating. The proper function of the load bank is of importance in keeping maintenance costs to a minimum.

130.2 Apparatus. Instrumentation for measuring load conditions and ambient temperature shall be as described in EGSA 107T .

130.3 Procedure.

130.3.1 Preparation for test.

a. Connect the load instrumentation to measure the load applied by the set load bank with the voltage sensing lines connected to the generator set output terminals for a voltage connection and frequency specified in the contract.

b. Connect the generator set integral load bank for the voltage connection used in step a above, and connect the load bank to the set electrically, if necessary.

130.3.2 Test.

a. Start and operate the generator set at rated voltage, rated frequency and no load. Record all instrument readings.

b. Using the load bank switch, energize the load bank at its minimum percent step. Record all instrument readings and note operation of load bank indicator light.

c. Repeat step b above for all other steps of the load bank switch.

d. Repeat step b above for any other load steps available.

e. Repeat 130.3 for any other voltage connection specified in the contract.

130.4 Results. Compare the power absorbed by the generator set integral load bank with the requirements specified in the contract.

130.5 Contract requirements. The following items must be specified in the individual contract.

a. The tolerance band in percent of rated load within which the load bank must operate at each step, if applicable.
b. The voltage connections at which this test shall be performed.