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Matériel Test Procedure 9-2-236
General Equipment Test Activity

U. S. ARMY TEST AND EVALUATION COMMAND
COMMOITY ENGINEERING TEST PROCEDURE

TANKS, LIQUID STORAGE, METAL

1. OBJECTIVE

The objective of this procedure is to determine the technical performance and safety characteristics of metal liquid storage tanks, and their associated tools and equipment, as described in QMR's, SDR's, Technical Characteristics, and as indicated by the particular design, and to determine the technical and maintenance suitability of metal liquid storage tanks for service tests.

2. BACKGROUND

A continuing need exists for improved metal, liquid storage tanks which offer a more permanent type storage facility than the collapsible version.

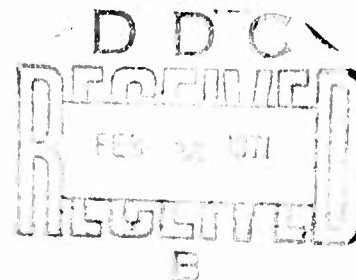
3. REQUIRED EQUIPMENT

One or more of the following items and facilities may be required to obtain data during the various evaluations of the metal tank:

- a. Flowmeter, 350-g.p.m., 4-inch
- b. Flowmeter, 500- to 2000-g.p.m., 6-inch
- c. Fuel sampling device
- d. Test fuel supply tank
- e. Test fuels
- f. Petroleum analysis facility
- g. Photographic facility
- h. Physical analysis facility
- i. Platform scales
- j. Pressure gages
- k. Pumping assembly, 350-g.p.m.
- l. Pumping assembly, single-stage, 6-inch
- m. Pumping assembly, two-stage, 6-inch
- n. Sampling containers
- o. Steel measuring tape
- p. Suction hose, 4-inch
- q. Pipe, 6-inch, coupled
- r. Thermocouples
- s. Thermometer, mercury-in glass
- t. Ohmmeter
- u. Electrostatic voltmeter

4. REFERENCES

- A. American Society for Testing and Materials -- Standards,
(ASTM Standards), Part 17



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AD 718592

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- B. Federal Specification VV-F-800 Diesel Fuel
- C. Military Specification MIL-G-3056 Gasoline, Automotive Combat
- D. Military Specification MIL-G-5572 Aviation Gasoline, Grades 80/87, 100/130, 115/145
- E. Military Specification MIL-T-6396 Tank, Fuel, Oil, Water-Alcohol, Coolant Fluid, Aircraft, Non-Self-Sealing, Removable, Internal
- F. Military Standard MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes
- G. National Fire Codes
- H. Technical Manual TM 10-1101 Petroleum-Handling Equipment and Operations
- I. Technical Manual TM 10-1105 Inspecting and Testing Petroleum Products
- J. USAMC Regulation 310-6 U. S. Army Materiel Command Quality Assurance Publications
- K. USAMC Regulation 385-12 Verification of Safety of Materiel from Development through Testing and Supply Disposition
- L. USAMC Regulation 385-224 AMC Safety Manual
- M. USATECOM Regulation 385-6 Safety Regulations for USATECOM
- N. TM 10-114 Cleaning Bulk Petroleum Storage Tanks, Railway Tank Cars, and Tank Trucks
- O. API Bulletin 2016 Cleaning Tanks Used for Gasoline or Similar Low Flash Point Products
- P. TM 5-9788-2 and 3
- Q. MTP 9-3-235, Tanks, Petroleum Liquid Storage, Fabric, Collapsible
- R. MTP 9-4-001, Desert Environmental Test of Construction, Support and Service Equipment
- S. MTP 9-4-002, Arctic Environmental Test of Construction, Support and Service Equipment
- T. MTP 9-4-003, Turf Environmental Test of Construction, Support and Service Equipment
- U. MTP 10-2-500, Physical Characteristics

5. SCOPE

5.1 SUMMARY

This material test procedure describes the following procedures:

- a. Preliminary Operation: A study to determine time required to erect and, when appropriate, disassemble the test item, time, personnel and equipment involved, and the integrity of welds, bolted seams, sealants and gasket material.
- b. Technical Performance: A study to determine that the test item is capable of storing fuel under various environmental conditions without contaminating the fuel and allowing for water drain-off and ventilation.
- c. Maintenance: A study to evaluate the adequacy of maintenance literature, tools, and repair kits when furnished.
- d. Safety: A study to determine the safety of the test item.

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e. Human Factors: A study to evaluate the ease, simplicity, and effort required to install, operate, maintain, and, when applicable, disassemble and transport the test item so as to cause the least amount of fatigue, irritation, etc. within due military consideration.

5.2 LIMITATIONS

This materiel test procedure applies to rigid bulk storage tanks for liquid - petroleum fuel and non-potable water. Test procedures for collapsible, fabric, petroleum liquid storage tanks are found in MTP 9-2-235.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Personnel

- a. Ensure the presence of test personnel capable of assembling, installing, operating and maintaining the test item.
- b. Personnel shall be trained in the use of the approved type of breathing apparatus before entering the tank after it has been used for fuel storage. A local standing operating procedure will be prepared outlining procedures to be followed by operating personnel when entering the tank for inspection or other purposes.

6.1.2 Initial Inspection

Upon receipt of the test item at the test site, perform the following:

- a. Visually inspect the test item packages and record the following:
 - 1) Evidence of packaging damage or deterioration
 - 2) Identification markings, including:
 - a) Name of contractor
 - b) Number and date of contract
 - c) Date of manufacturer
 - d) Other markings pertaining to the test item
- b. Weigh and measure the individual packages of the test item and its accessories and record the following:
 - 1) For each shipping package:
 - a) Contents
 - b) Weight
 - c) Length, width, and height
 - d) Cubage
 - 2) For the entire test item:

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- a) Weight
- b) Cubage

c. Unpack the test item, visually inspect it and record the following, when applicable:

1) Evidence of defects:

- a) Manufacturing
- b) Material
- c) Workmanship

- 2) Evidence of damage
- 3) Evidence of wear

NOTE: Make use of photographs, diagrams and narration to indicate the condition of the test item.

d. Presence of instruction plates, if applicable, including:

- 1) Identification, name and serial number
- 2) Caution instructions
- 3) Service instructions

e. Existence of shortages

6.1.3 Physical Characteristics

Determine and record the following physical characteristics of the test item:

a. For individual test item components, if applicable:

- 1) Weight
- 2) Length
- 3) Height and width
- 4) Overall diameter
- 5) Diameters of all openings and connections

b. Overall weight of the test item

6.2 TEST CONDUCT

6.2.1 Preliminary Operation

6.2.1.1 Erection

a. Erect the test item, within a berm or firewall, on a test site that will allow the test item to be installed in a pumping system which utilizes equipment standard to the military supply system.

NOTE: The test-system piping will be arranged so that the fuel can be pumped to and from the test tank and so that two or more tanks, as appropriate, can be manifolded together.

b. Perform the following checks, as appropriate, during erection:

- 1) For welded sections: Evaluate the quality of each weld by testing a portion of each weld by a method such as radiography or vacuum testing.
- 2) For bolted sections:
 - a) Evaluate the gasket material, using the appropriate procedures of MTP 10-2-500 to determine the following:
 - (1) Susceptibility to rupture
 - (2) Maximum allowable compression
 - (3) Effects of the various types of fuels, to which it shall be exposed, on the gasket material
 - b) Evaluate the tightness of the bolt/applied sealant combination by testing each seam as indicated in TM 5-9788-2 and TM 5-9788-3.
 - c) Evaluate the effects of the various types of fuel, to which the sealing compound shall be exposed, on the sealant.

c. Determine and record the following:

- 1) Outside diameter of the test item
- 2) Overall height of the test item
- 3) Inside diameter of the test item
- 4) Usable storage height of the test item
- 5) Theoretical storage capacity of the test item (determined from total internal cubage less support structures and interior fittings)
- 6) Manufacturer's capacity data

d. Record the following erection data:

- 1) No. of personnel required
- 2) Equipment required
- 3) Time required
- 4) Date(s) of erection
- 5) Adequacy of instructions
- 6) Type of soil
- 7) Amount of cut and fill
- 8) Amount of clearing and grubbing
- 9) Approximate slope of terrain
- 10) Slope of test site
- 11) Difficulties encountered
- 12) Mean ambient temperature and relative humidity

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6.2.1.2 Initial Check-Out Operations

a. Determine that the test item is structurally capable of supporting a full capacity of fuel by filling the tank with water and observing the structural integrity of the test tank.

b. Remove the water from the test item and fill the test item to capacity with fuel and record the following:

- 1) Fuel used
- 2) Time required to fill the tank
- 3) Amount of fuel used to fill the tank as indicated by metering

NOTE: Compare this value with the theoretical amount evaluated in paragraph 6.2.1.1.c5 and the manufacturer's data listed in paragraph 6.2.1.1.c6.

c. Retain the fuel in the test item for a minimum of 24 hours and inspect the tank for leaks, defects, etc. Record all deficiencies.

d. Evaluate the test item and record the time required.

e. Fill the test tank to capacity using the fuel of step b.

f. Repeat steps c and d.

6.2.1.3 Relocation of Test Item (when applicable)

Test tanks capable of being relocated shall be subject to the following:

a. Ensure that the test item and manifold have been completely drained.

b. Dismantle the test item, load the test item components into a transport vehicle, move it to its new test site and reassemble.

c. Record the following:

- 1) Time required to:
 - a) Disassemble the test item
 - b) Load the test item components onto the transport vehicle(s)
 - c) Time required to reassemble the test item
- 2) Difficulties encountered, if any:
 - a) Disassembling the test item
 - b) Loading the test item components onto the transport vehicle(s)
 - c) Moving the test item to its new location
 - d) Re-assembling the test item

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- 3) Number of personnel and special equipment required:
 - a) To disassemble the test item
 - b) Transport the test item
 - c) Re-assemble the test item
- 4) Mean ambient temperature and relative humidity

6.2.2 Technical Performance

During the technical evaluation of the test item each test tank shall be subject to the following tests and conditions:

- a. The test fuel specified in the test directive, for each test tank, shall be used during all test operations.
- b. The test tank(s) shall be installed in a test system as described in paragraph 6.2.1.1.a.
- c. Each test tank will be filled and emptied for a minimum of 20 cycles (filling and decanting) during the test.

6.2.2.1 Filling and Emptying Operations

- a. Fill the tank with fuel from the test fuel supply tank(s) and record the date(s) of operation.

NOTE: For the first cycle, meter in the total tank volume. Fuel then will be decanted from the test tank until pump suction is lost, thereby determining the amount of fuel that cannot be removed through normal pumping or suction. During each of the remaining cycles, only that amount of fuel needed to bring the tank to its rated capacity will be used.

- b. Measure and record the following:
 - 1) Time required to fill the tank
 - 2) Pump suction pressure
 - 3) Pump discharge pressure
 - 4) Ambient temperature and relative humidity
 - 5) Fuel temperature
 - 6) Difference in elevation between pump suction and tank inlet/outlet
 - 7) Distance between transfer pump and tank inlet/outlet
 - 8) Size, diameter, and type of pipe and manifold system
- c. When the tank is 25-, 50-, 75-, and 100-percent full, as indicated by flowmeters, perform the following:
 - 1) Record the volume of fuel in the test item as indicated by the test item automatic gaging devices, if applicable.

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NOTE: Install test metering equipment to check the accuracy of automatic gaging systems.

- 2) Determine and record the volume of fuel in the test item by means of a gaging system provided by the manufacturer.

NOTE: If a method of gaging is not provided by the manufacturer, the test team shall devise one using the criteria reference 4H (TM 10-1101).

d. Empty the tank, record the date of operation, and measure and record the following:

- 1) Time required to empty the tank
- 2) Pump suction pressure
- 3) Pump discharge pressure
- 4) Ambient temperature and relative humidity
- 5) Fuel temperature

e. When the tank is 100-, 75-, 50-, and 25-percent full, as indicated by flowmeters, record the following:

- 1) Volume of fuel in the test tank as indicated by the item's automatic gaging devices, if applicable
- 2) Volume of fuel in the tank as determined by the appropriate gaging system

f. When pump suction is lost record:

- 1) Volume of fuel remaining in the test tank
- 2) Volume of fuel that cannot be removed from the test tank by reducing the pump RPM

g. Inspect the test tank for the following, and record any deficiencies:

- 1) Evidence of corrosive action due to the test fuel
- 2) Leak at seams and/or welds
- 3) Deterioration of gaskets or sealants

h. Repeat steps a through g until a total of four cycles have been completed.

6.2.2.2 Water-Drain Facility Test

Fill the test item for the fifth time and perform the following:

- a. Inject water into the influent fuel stream rate at 0.5 percent of the fuel flow rate.
- b. Measure and record the requirements of step 6.2.2.1,b and 6.2.2.1.c.

c. Allow the tank to remain static for a minimum of 12 hours to permit the water to settle and perform the following:

- 1) Determine and record the location within the tank at which the water tends to concentrate

NOTE: The location is determined by taking samples from the tank bottom.

- 2) Determine and record if the water concentration location can adversely effect the efficient operation of the tank.

d. Operate the water drain-off system and record the amount of water which is removed from the tank. Compare this value with the amount of water injected into the tank to determine whether the drain off system is adequate.

e. Empty the tank and measure and record the requirements of step 6.2.2.1.d through 6.2.2.1.g.

6.2.2.3 Total Filling and Emptying Operation

a. Repeat paragraphs 6.2.2.1 and 6.2.2.2 until a minimum of 20 cycles have been completed.

b. During the conduct of paragraphs 6.2.2.1 and 6.2.2.2, determine the amount of fuel innage for each increase or decrease in fuel height as indicated by a fuel meter.

6.2.2.4 Pressure Surge Tests

During a minimum of two filling and emptying cycles, determine the effects of pressure surge on the test tank as follows:

6.2.2.4.1 Pressure, Volume Surge Tests - Perform the following:

a. During the filling portion of the cycle, with a normal flow rate, perform the following when the tank is 25-percent full:

- 1) Stop the pump(s) to create a pressure surge and record maximum.
- 2) Observe and record any detrimental effects.
- 3) Start the pump(s) and record maximum surge pressure.
- 4) Observe and record any detrimental effects.

b. Repeat step a increasing the flow rate by 5-percent steps until the flow rate is 125-percent times the normal flow rate.

c. Repeat steps a and b with the tank 50-, 75-, and 100-percent full.

d. Repeat steps a through c while emptying the tank.

6.2.2.4.2 Pressure, Volume, Valve Closing Surge Tests - Perform the following:

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- a. During the filling portion of the cycle with a normal flow rate, perform the following when the tank is 25-percent filled:
 - 1) Create a pressure surge by quickly opening and closing the tank valve.
 - 2) Observe and record any detrimental effects.
- b. Repeat step a, increasing the flow rate by 5-percent steps until the flow rate is 125-percent times the normal flow rate.
- c. Repeat steps a and b with the tank 50-, 75-, and 100-percent full.
- d. Repeat steps a through c while emptying the tank.

6.2.2.5 Static Fuel Storage Test

Determine the long range effects of fuel storage as follows:

- a. Fill the test tank to capacity with test fuel.
 - b. Obtain a five-gallon sample of the test fuel and store it in a glass container protected from solar radiation, and adjacent to the test item.
 - c. Perform an initial analysis of the test fuel, using the applicable sections of MTP 10-2-500, and record the following:
 - 1) Water content
 - 2) Solids content
 - 3) A.P.I. gravity
 - 4) Aromatic content
 - 5) Gum content
 - 6) Reid vapor pressure
 - 7) Distillation percentage
 - d. At monthly intervals, for a minimum of six months, perform the following:
 - 1) Obtain fuel samples from the bottom, middle, and top portion of the test tank.
 - 2) Analyze the samples of step d.1 and a sample of the fuel stored in step b as described in step c.
- NOTE:
1. The Reid vapor pressure test is conducted to determine vapor pressure degradation of the stowed fuel.
 2. The analysis of steps c.1 through c.5 is to determine if the vapor pressure is due to water condensation of the fuel, contamination from the test tank, or a combination of both.
 - 3) Obtain a sample of the water at the bottom of the test

tank and perform the following:

- a) Analyze the water and determine if, and to what extent, microbiological organisms tend to grow.
 - b) Determine if this water results in a chemical reaction with the tank material causing deterioration.
- 4) Gage the test tank and record the monthly fuel volume lost by evaporation or diffusion.

6.2.2.6 Post Technical Performance Tests

At the completion of the static storage test, decant the test tank and perform the following:

- a. Visually examine the test tank and record the following:
 - 1) Presence of corrosion of the tank interior
 - 2) Condition of sealing compounds and gasket material
 - 3) Condition of the tank foundation
 - 4) Condition of the tank interior support
- b. Vacuum test all seams of bolted test tank sections as described in TM 5-9788-2 and TM 5-9788-3 and evaluate and record their tightness.
- c. Evaluate the quality of welds, for welded sections of test tanks, by means of a vacuum test or radiography.

6.2.2.7 Manifold Adaptability (if applicable)

If a manifold is furnished, evaluate it to determine the following:

- a. Its adaptability to various size welded or coupled pipelines or hoselines.
- b. What special fittings, if any, are needed for connection to the intended pipeline systems.
- c. Whether the manifold assembly (section hose and/or steel tubing) is of sufficient length to permit joining of additional tanks to the system, allowing adequate tank spacing for fire safety purposes based on total tank capacities.

6.2.2.8 Environmental Tests

Repeat the procedures of 6.2.2.1 through 6.2.2.6 while subjecting the test item to the following environmental conditions:

- a. Arctic (cold-dry)
- b. Temperate (cold-wet)
- c. Tropic (hot-wet)
- d. Arid (hot-dry)

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6.2.3 Maintenance Evaluation

Conduct the following procedures in order to evaluate the adequacy of maintenance literature, tools, and repair kit, if furnished:

- a. Record the action taken in all scheduled and nonscheduled maintenance.
- b. Whenever a failure occurs, record the following:
 - 1) Time required to diagnose the cause of failure and make repairs
 - 2) Deficiencies in the repair kit, if any
 - 3) Perform the filling and emptying operations of paragraph 6.2.2.1.
- c. In the event that a repairable failure does not occur during the normal operation:
 - 1) Deliberately damage the tank.
 - 2) Make the necessary repairs.
 - 3) Perform the filling and emptying operation of paragraph 6.2.2.1.

6.2.4 Safety

Evaluate the safety characteristics of the test item based on a safety statement issued by the developing agency, as follows:

- a. Exercise normal safety precautions for petroleum handling as specified in TM 10-1101, TM 10-114 and API Bulletin 2016, at all times.
- b. Using an ohmmeter, measure and record the resistance between various parts of the test item and the ground to determine the adequacy of electrical grounding and bonding devices furnished with the test item.
- c. Measure and record the electrostatic buildup in the test tank and manifold during the pumping operation with an electrostatic voltmeter preferably during cold weather operations.
- d. Throughout the test period, installation, operation, disassembly and transport, observe and record any condition that might present a safety hazard, the cause of the hazard, and steps taken to alleviate the hazard.

6.2.5 Human Factors

Throughout the test observation will be made and recorded to determine the following:

- a. Environmental conditions affecting human performance during installation, operation, disassembly and transportation of the test item
- b. Information needed for operation decisions
- c. Simplification of maintenance
- d. Fatiguing operations

- repair
- e. Accessibility to the interior of the tank for cleaning and
 - f. Accessibility of operators controls

6.3 TEST DATA

6.3.1 Preparation for Test

6.3.1.1 Initial Inspection

- a. Record the following, as applicable:
 - 1) Evidence of packaging damage or deterioration
 - 2) Identification markings:
 - a) Name of contractor
 - b) Number and date of contract
 - c) Date of manufacturer
 - d) Other markings pertaining to the test item
 - 3) For each shipping container:
 - a) Contents
 - b) Weight in pounds
 - c) Length, width and height in feet and inches
 - d) Cubage in feet³
 - 4) For the entire crated test item:
 - a) Weight in pounds
 - b) Cubage in feet³
 - 5) For the test item:
 - a) Evidence of defects, as applicable:
 - (1) Manufacturing
 - (2) Material
 - (3) Workmanship
 - b) Evidence of damage
 - c) Evidence of wear
 - d) Presence of instruction plates, as applicable:
 - (1) Identification
 - (2) Caution instructions
 - (3) Service instructions
 - 6) Existence of shortages
- b. Retain all photographs taken.

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6.3.1.2 Physical Characteristics

Record the following:

- a. For each test item component, as applicable:
 - 1) Component nomenclature
 - 2) Weight in pounds
 - 3) Length in feet and inches
 - 4) Height and width in feet and inches
 - 5) Overall diameter in feet and inches
 - 6) Diameter of all openings and connections in inches
- b. Overall weight of the test item in pounds

6.3.2 Test Conduct

6.3.2.1 Preliminary Operation

6.3.2.1.1 Erection -

Record the following:

- a. For welds, when applicable:
 - 1) Quality of weld
 - 2) Method of inspection (vacuum, radiography)
- b. For bolted sections, when applicable:
 - 1) For the gasket:
 - a) Susceptibility to rupture
 - b) Maximum allowable compression in psi
 - c) Effects of fuel on gasket material
 - 2) Tightness of bolt/sealant combination
 - 3) Effects of fuel on sealing compound
- c. Outside diameter of the test item in feet and inches
- d. Overall height of the test item in feet and inches
- e. Inside diameter of the test item in feet and inches
- f. Usable storage height of the test item in feet and inches
- g. Theoretical storage capacity in gallons
- h. Manufacturer's rated storage capacity in gallons
- i. For erection:
 - 1) Number of personnel required
 - 2) Equipment required
 - 3) Time required in hours
 - 4) Time of erection in month and days

- 5) Adequacy of instructions
- 6) Type of soil
- 7) Amount of cut and fill required in cubic feet
- 8) Amount of clearing and grubbing in square feet
- 9) Approximate slope of terrain in percent
- 10) Test site slope in percent
- 11) Difficulties encountered
- 12) Mean ambient temperature in °F.
- 13) Mean relative humidity in percent

6.3.2.1.2 Initial Check-Out Operation -

Record the following:

- a. Structural integrity of the test tank
- b. Fuel used (Combat gasoline, CITE, etc.)
- c. Time required to fill the test tank in hours and/or minutes
- d. Amount of fuel required for 100-percent capacity in gallons
- e. Evidence of, when applicable:
 - 1) Leaks
 - 2) Defects
- f. Time required to decant the test tank in hours and/or minutes
- g. Number of checks (1 or 2)

6.3.2.1.3 Relocation of Test Item (when applicable) -

Record the following:

- a. Time required to, in hours:
 - 1) Disassemble the test item
 - 2) Load the test item onto transport vehicles
 - 3) Reassemble the item
- b. Difficulties encountered, if any:
 - 1) Disassembling the test item
 - 2) Loading the test item components onto transport vehicles
 - 3) Moving the test item to a new location
 - 4) Reassembling the test item
- c. Number of personnel required to:
 - 1) Disassemble the test item
 - 2) Transport the test item
 - 3) Reassemble the test item
- d. Mean ambient temperature in °F

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- e. Mean relative humidity in percent

6.3.2.2 Technical Performance

NOTE: Appendices A and B are examples of Test Data Sheets.

6.3.2.2.1 Filling and Emptying Operations -

Record the following for all filling and emptying operations:

- a. Fuel used (Combat gasoline, CITE, etc.)
- b. Test cycle number (1, 2, --- 20)
- c. When filling tank:
 - 1) Time (pumping) required to fill tank, in hours and/or minutes
 - 2) Pump suction pressure in inches of mercury
 - 3) Pump discharge pressure in psi
 - 4) Ambient temperature in °F
 - 5) Relative humidity in percent
 - 6) Fuel temperature in °F
 - 7) Difference in elevation between pump suction and tank inlet/outlet in feet
 - 8) Distance between transfer pump and tank inlet/outlet in feet
 - 9) For the manifold system:
 - a) Type
 - b) Size
 - c) Type of pipe
 - d) Diameter of pipe
 - 10) For gaging information:
 - a) Metered volumes in gallons
 - b) Gaging system volume indication in gallons
 - 11) Date in month(s) and day(s)
- d. When emptying tank:
 - 1) Time required in hours
 - 2) Pump suction pressure in inches of mercury
 - 3) Pump discharge pressure in psi
 - 4) Ambient temperature in °F
 - 5) Relative humidity in percent
 - 6) Fuel temperature in °F
 - 7) For gaging information:
 - a) Metered volumes at 25-, 50-, 75-, and 100-percent of capacity in gallons

- b) Gaging system volume indication in gallons
 - 8) Amount of fuel remaining in tank when pump loses suction, in gallons
 - 9) Amount of fuel that cannot be removed from tank by reduction of pump R.P.M. in gallons
 - 10) Date in month and day(s)
- e. Evidence of:
- 1) Corrosive action
 - 2) Leaks
 - 3) Deterioration of gasket or sealant

6.3.2.2.2 Water-Drain Facility Test -

Record the following for water-drain facility tests only:

- a. Cycle number (5, 10 --- etc.)
- b. Fuel rate of flow in gallons per minute
- c. Water injection rate in gallons per minute
- d. Total volume of water injected, in gallons
- e. Settling time, in hours
- f. Location of water concentration in the tank
- g. Volume of water drawn off in gallons
- h. Volume of water remaining in tank
- i. Effect of the water concentration on tank efficiency

6.3.2.2.3 Total Filling and Draining Operation -

Record the test tank innage/outage data.

6.3.2.2.4 Pressure Surge Tests -

- a. Record the following:
 - 1) Fuel rate of flow in gallons per hour
 - 2) Amount of fuel in tank, in percent of capacity
 - 3) Peak surge pressure in psi
 - 4) Detrimental effects on the test tank and test system

6.3.2.2.5 Static Fuel Storage Test -

a. Record the following test fuel information at the start of the test:

- 1) Water content
- 2) Solids content
- 3) API gravity
- 4) Aromatic content
- 5) Gum content

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- 6) Reid vapor pressure
- b. Record the following each month during the test period:
 - 1) Month of test (1st, 2nd, etc.)
 - 2) Date in day and month
 - 3) Sample location (bottom, middle, top, glass stored)
 - 4) For fuel analysis:
 - a) Water content
 - b) Solids content
 - c) API gravity
 - d) Aromatic content
 - e) Gum content
 - f) Reid vapor pressure
 - 5) Analysis of the test tank bottom water
 - 6) Volume of test fuel lost by evaporation and/or diffusion in gallons

6.3.2.2.6 Post Technical Performance Tests -

- a. Record the following, as applicable:
 - 1) Presence of corrosion of the tank interior
 - 2) Condition of the sealing compound and gasket material
 - 3) Condition of the tank foundation (cracks, corrosion, etc.)
 - 4) Condition of the tank interior support (corrosion, shifted position, etc.)
 - 5) Quality of the welds of welded sections
 - 6) Tightness of seams of bolted sections

6.3.2.2.7 Manifold Adaptability -

Record the following:

- a. Adaptability to welded pipelines
- b. Special fittings required for connection to hoses and coupled pipelines

6.3.2.3 Maintenance Evaluation

Record the following:

- a. Scheduled and nonscheduled maintenance performed
- b. Time required to diagnose cause of failures and to make repairs
- c. Deficiencies in the repair equipment and suggested corrective action
- d. For deliberate damage:
 - 1) Type of damage

2) Location of damage

e. For filling and emptying operation:

1) Fuel used (Combat gasoline, CITE)

2) When filling tank:

- a) Time (pumping) required to fill tank, in hours
- b) Pump suction pressure in inches of mercury
- c) Pump discharge pressure in psi
- d) Ambient temperature in °F
- e) Relative humidity in percent
- f) Fuel temperature in °F
- g) Difference in elevation between pump suction and tank inlet/outlet in feet
- h) Distance between transfer pump and tank inlet/outlet in feet
- i) For manifold system:
 - 1) Type
 - 2) Size
 - 3) Type of pipe
 - 4) Diameter of pipe

3) For gaging information:

- a) Metered volume indication at 25-, 50-, 75-, and 100-percent of capacity in gallons
- b) Gaging system volume indication in gallons

4) When emptying tank:

- a) Time required in hours
- b) Pump suction pressure in psi
- c) Pump discharge pressure in psi
- d) Ambient temperature in °F
- e) Relative humidity in percent
- f) Fuel temperature in °F
- g) For gaging information:
 - (1) Metered volume indication at 25-, 50-, 75-, and 100-percent of capacity in gallons
 - (2) Gaging system volume indication in gallons
- h) Amount of fuel remaining in tank when pump loses suction, in gallons
- i) Amount of fuel that cannot be removed from tank by reduction of pump R.P.M. in gallons

5) Evidence of:

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- a) Corrosive action
- b) Leaks
- c) Deterioration of gasket or sealant

6.3.2.4 Safety

Record the following:

- a. For resistance to ground tests:
 - 1) Component being tested
 - 2) Resistance in ohms
- b. Electrostatic buildup in volts:
 - 1) In the tank
 - 2) In the manifold, if applicable
- c. Safety hazards observed and corrective action taken

6.3.2.5 Human Factors

Record the following:

- a. Environmental conditions affecting human performance
- b. Information required for operator decisions or safety
- c. Procedures for maintenance simplification
- d. Fatiguing operations
- e. Accessibility to the interior of the tank for cleaning and repair
- f. Accessibility of operators controls

6.4 DATA REDUCTION AND PRESENTATION

6.4.1 General

Data obtained during the conduct of the test will be summarized using charts and graphs as appropriate. The test data will be evaluated by determining the extent to which it meets the requirements of the technical characteristics and detail specifications for the tank.

6.4.2 Innage Data

Prepare a strapping table using the innage data obtained as directed in paragraph 6.2.2.1 and recorded in paragraph 6.3.2.2.1.

APPENDIX A

TEST RUN DATA

Test Fuel _____ Test Item _____ Personnel _____
 Date _____ Weather _____ Time _____

TEST CYCLE NO.	TIME HRS.		PRESSURE (PSI) PUMP DIS.	PUMP TEST SUC. ITEM	METER READING (GPM)		TEST ITEMS DIMENSIONS (FILLED)(FT)			APPROX. VOL. FUEL REMAINING IN TANK (GALLONS)	GAUGED TANK VOLUME (GALLONS)
	START	STOP			IN	OUT	L	W	H		
		TOTAL									

TEST CYCLE NO.	TEMPERATURE (°F)		REMARKS
	AMB.	FUEL	

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NOTES:

APPENDIX B
FUEL SAMPLE ANALYSIS

Test Item _____ Test Fuel _____ Time _____
Date _____ Weather _____ Personnel _____

TEST CYCLE NO.	SAMPLE NO.	TIME	TEMPERATURE (°F)		VOL. FUEL IN TANK	SAMPLE LOCATION	SAMPLE ANALYSIS TEST RESULTS		OTHER
			FUEL	AMBIENT			WATER (PPM)	GUM CONTENT SOLIDS (MG/L)	

NOTES: