

TECHNICAL MANUAL

OPERATOR'S MANUAL

**CAPTURED FUEL TEST KIT
NSN 6630 01-248-5389**

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content requirements normally associated with Army technical manuals. This technical manual does, however, contain all essential information required to operate and maintain the equipment.

Approved for public release; distribution is unlimited.

WARNING

Do not smoke or use an open flame in the vicinity where captured fuel is being tested. Failure to comply may result in physical injury.

WARNING

Wear eye protection to avoid splashing fuel in eyes. Failure to comply may result in eye injury.

TECHNICAL MANUAL

NO. TM 5-6630-217-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 29 December 1989

Operator's Manual
FOR
CAPTURED FUEL TEST KIT
NSN 6630-01-248-5389

Approved for public release; distribution is unlimited.

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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INTRODUCTION

Purpose and Functions

The test kit for captured fuel is a compact, man-portable kit intended for use by field soldiers in order to determine if a fuel of opportunity (captured or commandeered) is suitable for use in diesel or gas turbine engines. Determination is by approximate measurement of *Specific Gravity Viscosity, and Visual Contamination*. All tests are combined in a single tester. The test kit is constructed of an amber transparent plastic. The test kit is contained in a plastic case which will also serve as a sample container. Positive determination of requires that all methods read acceptable or "GO".

Capabilities

The test kit will reliably and safely accept or reject a fuel of opportunity, and is designed to operate under adverse weather conditions, including rain, dust, humidity, salt fog, solar radiation as well as temperature extremes.

The test kit is designed to be operated in any temperature from 49 degrees Celsius (120 degrees F.) to -31 degrees Celsius (-25 degrees F.) and should not be damaged (made inoperable) by any temperature from 63 degrees Celsius (145 degrees F.) to -33 degrees Celsius (-27 degrees F.)

The test kit is designed to withstand the vibrational stress and shock encountered when transported within its transit case, and is also designed to be operable during day and night in combat environments and further to be fully operable by personnel wearing Protective clothing and arctic mittens and under reduced illumination.

Performance Characteristics

Sample size to operate test kit is less than 300ml (10 fluids ounces).

Operational time to operate test kit through one complete cycle at ambient temperatures, including: filling, reading specific gravity, viscosity, and visual contamination; and then draining the kit does not exceed 10 minutes.

Testing

Visually inspect the test kit for damage or leaks. Determine that all components are present that fluids in chambers 1 & 3 are at the same level, that orifices are clear and that the density Indicator (float) is intact. If the test kit is damaged, discard the damaged kit as no provision for maintenance exists; If not, proceed with the test.

The first test accomplished by looking through the test sample in chamber #4 at the grid lines, if the lines are not visible, the fluid being tested is not acceptable and the testing of the sample is terminated.

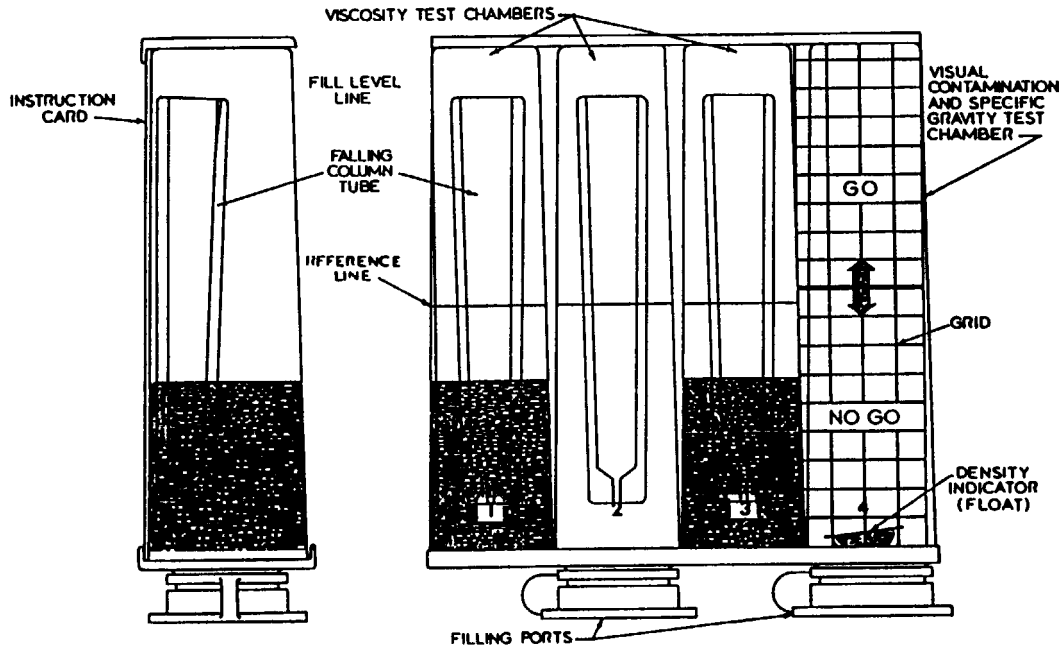
Filling and Draining

The test kit is equipped with two ports for filling. The ports are large enough to allow filling by pouring from a container. One port allows filling of the specific gravity/visual contamination module. This port is fitted with a barrier to prevent removal or loss of the density indicator from the test chamber. The second port allows filling the viscosity module test chamber and has a stainless steel screen installed within the port, which has a sieve size sufficient to retain particles equal to or greater than the smallest clearance in the viscosity tubes. Both ports are fitted with attached "snap caps" that allow the sample filled tester to be inverted without danger of spilling the samples. Both test chambers are filled to the appropriate levels and allowed to sit until test kit and test fuel are at approximately the same temperature. Fill time for both chambers including opening the ports, filling chambers and closing the ports can be accomplished in less than one minute. Draining both chambers is done simultaneously by pouring and shaking the tester. 95 to 98% of total sample fluids may be poured from tester within two minutes, including opening ports, draining and closing ports.

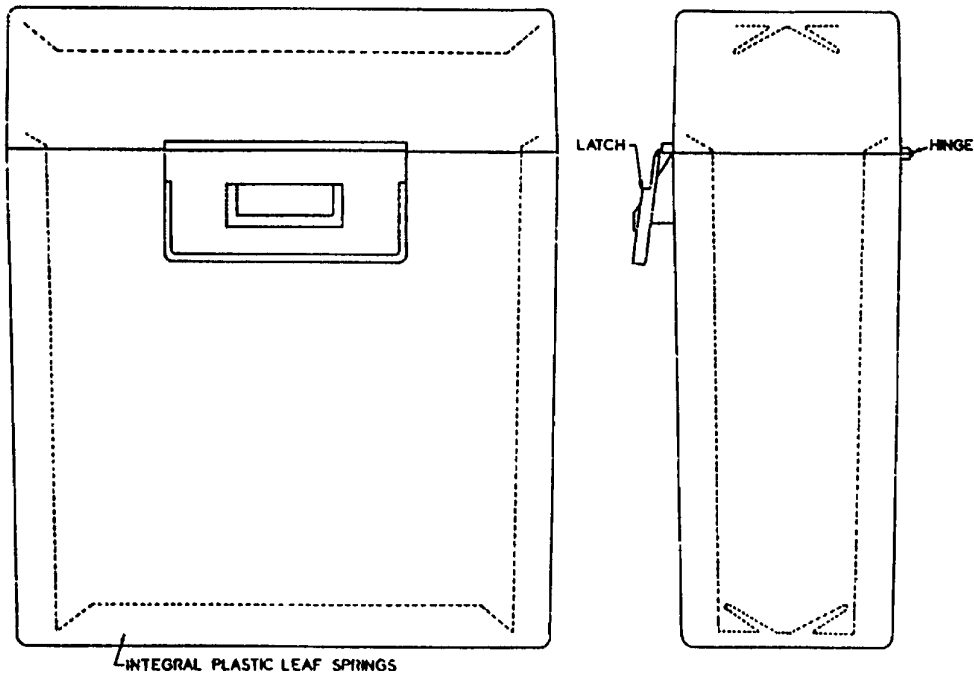
Specific Gravity Measurements

Specific gravity measurement is by means of an indicating densimeter. This densimeter is in the form of a "float". There are two possible readings. Acceptable or "GO" when the Indicator floats. Rejected or "NOGO" when the indicator sinks. The indicator is designed to float in test samples with a specific gravity of 0.78 (at 25 degrees Celsius) or higher; this is an acceptable or "GO" fuel. The indicator is designed to sink in a fuel with specific gravity of less than 0.78 (at 25 degrees Celsius).

CAPTURED FUEL TESTER



TRANSIT CASE FOR CAPTURED FUEL TESTER



Specific Gravity Measurements (cont.)

This is an unacceptable or "NOGO" fuel. The tester is appropriately labeled with "GO" and "NOGO" positions. The specific gravity system is temperature compensated because the specific gravity of the density indicator relative to that of the sample will remain constant. (Because the container allows for the density vs. temperature changes and the fluid is similar to the fluid under test.) Adequate time must be allowed for the indicator to become the same temperature as the fuel under test.

Viscosity Measurement

Viscosity measurement is by means of "submerged orifice falling column comparative viscometers." Three parallel viscometer tubes are utilized. The middle tube is open to receive the unknown fuel. The tubes on either side are sealed and contain hydrocarbon fluids that represent the lower and upper limits of acceptable viscosity (1.3 and 5.0 centistokes at 40 degrees Celsius).

The length of the tubes has been kept to a minimum, however they are long enough to allow sufficient time for the liquid columns to fall and give an adequate reading. The viscometer will be operated by first removing the instruction card and placing the test kit on it back (card holder down) on a level surface to allow the columns to fill with fluid and lose all bubbles. The kit is then raised to an upright position (caps down) so that all the columns start to fall at the same time. Acceptability is indicated by the lower limit column (mounted on the left facing the operator) reaching the bottom first; the test sample column (mounted in the middle) reaching the bottom second; and the upper limit column (mounted on the right) reaching the bottom last. The three tubes are marked as follows from left to right: "1", "2", and "3". Acceptability or "GO" requires that the columns fall in the order 1-2-3 any other order to fail is considered unacceptable or "NOGO".

Visual Contamination Level Measurement

Fuel contamination in the form of suspended solids and emulsified water will be measured by means of a visual indicator. The indicator is in the fourth module of the tester and shares this module with the specific gravity indicating densimeter. The back side of the module is marked with a rectangular grid of black lines on a white background.

Visual Contamination level (cont)

Lines are approximately 1 mm of (0.04 in.) wide with a spacing of 5 mm (0.20 in.). The grid will cover one entire side of the module. Acceptable or "GO" fuel is one in which the grid lines are fully visible when viewed through the fuel sample.

TRANSIT CASE - HOUSING

The transit case is made of a semi rigid plastic material and serves as both a protective case for the tester and as a potential sample collecting container. It is constructed with a "spring leaf" shock absorption system to protect the tester from damage due to rough handling.

Power and Utility Information

There is no power or utility requirement for operation of the tester, however a flashlight or other similar light source may be used for night operation.

Environmental Information

The test kit may be used or disposed without danger to the environment. None of the materials used are toxic, radioactive, explosive or poisonous. The small quantities of hydrocarbons in each tester should present no problem even under incineration.

List of items Furnished

The "Captured Fuel Test Kit" consists of three pieces:

1. Tester
2. Housing
3. Instruction Card

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Other Items

The test kit is furnished complete and ready for operation. The only additional item required is the fuel sample for testing. No requirement for maintainability exists as any test kit not functioning properly shall be replaced in the field. No tools or test equipment are required.

Warranty information

The test kit is warranted to meet the specifications set out in the purchase document.

Preparation For Use

When the kit is removed the box and unwrapped, it is ready for use and no assembly is required. The kit should be inspected for physical damage or leakage of the fluid standards at the time of receipt. Damaged test kits should be disposed of and replaced. No provision for maintenance exists.

General Theory Operation

The test kit consists of three pieces: The transit case, the tester and an operating instructions card.

Transit Case

The transit case has three functions:

1. As a transport and storage case for the tester.
2. As a shock absorption unit to protect the tester (The case holds the tester in place by means of integral "Leaf Springs").
3. As a transit container for receiving and transferring the fuel sample. (The housing may not be needed as a transit container, however it is designed to serve this purpose if required).

The Tester

This is the unit that performs all of the specified test functions of the "Captured Fuel Test Kit" It also serves as a holder for the operating instructions card, which slides into slot brackets on the back of the tester.

Three separate determinations are made using the tester. The order of testing is: A: Visual Contamination Level B: Specific Gravity C: Viscosity.

Order of the test is important to allow time for temperature equilibration of the fuels under test with the standard fluids in the tester.

If the test kit has been used previously, it must be rinsed with the test fuel before filling.

To begin the test, the tester is held inverted (caps up) with the filling ports of the two test chambers upright and open to receive the test fluid. Test fluid is poured first into chamber #4 to the top. The cap is snapped shut.

Next, the test fluid is poured into chamber #2 so that it is even with chambers 1 and 3, this cap is then closed, this fluid level requires more care and the operator should insure that the fluid levels in chambers 1, 2, & 3 are even. The time taken to introduce the two samples and begin the test is adequate to allow the density indicator in chamber #4 to equalize its temperature with the test sample; and for the sample in chamber #2 to equalize its temperature with the standard fluids on either side. After filling, the tester is inverted so that the filling ports are at the bottom of the tester and the module numbers can be read left to right 1,2,3,4.

Testing

WARNING

Do not smoke or use an open flame in the vicinity where captured fuel is being tested. Failure to comply may result in physical injury.

WARNING

Wear eye protection to avoid splashing fuel in eyes. Failure to comply may result in eye injury.

The first test is accomplished by looking through the test sample in chamber #4 at the grid lines, if the lines are *not* visible, the fluid being tested is *not* acceptable and the testing of the sample is terminated.

(By specification the fuel is deemed to have an excessive level of suspended solids and/or emulsified water if the grid lines cannot be seen). If the grid lines are fully visible through the sample, the test is rated "GO" or acceptable, and the operator proceeds with testing.

The second test is for specific gravity and also takes place in chamber #4 The density indicator (float) equalizes its temperature with the sample. It sits in the design of the density indicator so that it sinks in a fuel sample whose specific gravity is less than 0.78 (At 25 degrees Celsius) and to float in a fuel sample with a specific gravity of 0.78 (At 25 degrees Celsius) or higher. If the float sinks or remains suspended below the GO/NOGO line, the fuel being tested is not acceptable and the testing of the sample is terminated.

Test Kit for Captured Fuel TM 5 6630 217-10

If the density indicator remains suspended above the GO/NOGO line, the second test is rated "GO" or acceptable and the operator proceeds with the testing.

The third test is for viscosity and is a comparative measurement. Three parallel viscosity measuring tubes are utilized wherein a column of liquid falls slowly down the length of each tube. The rate of fall is proportional to the viscosity of the fluid in the tube. The three tubes in their containers are numbered 1, 2 & 3 from left to right facing the operator. Containers 1 & 3 have fuel samples of known viscosity sealed in with an inert atmosphere. To accomplish this test, remove instruction card, place test kit on back (card holder down) on level surface. Allow tubes in chambers 1, 2, & 3 to fill and lose bubbles. Raise test kit to upright position (caps down) and observe fall of fluid in tubes.

The three columns of fluid in the tubes will instantly begin to fall at rates proportionate to the viscosity of the fluids. If the columns fall in order 1, 2, 3 this indicates that the viscosity of the fuel being tested (column #2) falls between the viscosities of the sample fluids in columns 1 and 3, and is therefore acceptable or 'GO'. If fluids fall in any order except 1, 2, 3; reject fuel.

The "fuel of opportunity" is considered suitable for diesel or gas turbine engines only if all three tests have given "GO" readings.

Visual "GO". - Specific Gravity "GO". - Viscosity "GO".

Cleaning

After fuel testing procedures are completed, remove remaining fuel residue from transit case with a clean, dry, lint free cloth before storing test kit.

PREPARATION FOR RESHIPMENT

Test kits may be reshipped in the original containers supplied by the manufacturer, they are packed 20 to a style I overseas type wooden box conforming to PPP-B-636 minimum grade W5c, style FPF. No special preparation is required for reshipment as originally packaged.

If repackaging the kit, no special disassembly or component packaging is required. The kit is shipped as a unit with exterior packaging as in the original. The tester and instruction card are secured inside the transit case which should be latched shut. The kit shall then be completely wrapped in cushioning material conforming to PPP-C-1799, type I, 3/32 inches thick and held in place with pressure sensitive tape conforming to MIL-T-22085, type II or equivalent. The wrapped kit shall then be placed in a snug fitting fibreboard box conforming to PPP-B 636, minimum grade W5c, style FPF, before repacking in the wooden boxes. Shipping cases and boxes in good condition may be reused.

STORAGE

The captured fuel test kit is packaged for indoor storage and storage temperatures must not exceed 63 degrees C (145 degrees F) or fall below minus 33 degrees C (minus 27 degrees F). The facilities should be dry with no special ventilation required.

APPENDIX A
EXPENDABLE/DURABLE SUPPLIES AND MATERIAL LIST

Section I. INTRODUCTION

A-1. SCOPE

This appendix lists expendable/durable supplies and materials you will need to operate and maintain the Test Kit for Captured Fuel.

A-2. EXPLANATION OF COLUMNS

a. Column (1) - Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5. App. D").

b. Column (2) - Level. This column identifies the lowest level of maintenance that requires the listed item.

(enter as applicable)

- C - Operator/Crew
- O - Unit Maintenance
- F - Direct Support Maintenance
- H - General Support Maintenance

c. Column (3) - National Stock Number. This is the National stock number assigned to the item; use It to request or requisition the item.

d. Column (4) - Description. Indicates the Federal Hem name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

e. Column (5) - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea. in. pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

APPENDIX A

**EXPENDABLE/DURABLE SUPPLIES AND MATERIAL LIST
Captured Fuel Test Kit**

(1) Item No	(2) Maint Level	(3) National Stock Number	(4) Description	(5) U/M
1	0	7920-00-205-3570	Rag. Wiping	Bale
2	0	4240-00-816-3819	Goggles	Ea

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**Test Kit for Captured Fuel
TM 5 6630 217-10**

By Order of the Secretary of the Army:

CARL E. VUONO
General. United States Army
Chief of Staff

Official:
WILLIAM J. MEEHAN, II
Brigadier General. United States Army
The Adjutant General

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FORM 1075 (10-79) (10-79) (10-79)

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigram = .035 ounce
 1 dekagram = 10 grams = .35 ounce
 1 hectogram = 10 dekagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons
 1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F temperature	Fahrenheit subtracting 32)	5/9 (after temperature	Celsius	°C
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