Describes a method for evaluation of POL support equipment operational and functional performance characteristics. Identifies supporting test, facilities, and equipment required. Provides procedures for batch interface detection, fuel contamination level, switching manifold, strainer, and trap tests. Applicable to hoselines, pipelines, pressure regulators, switching manifolds, monitoring devices, batch detectors, fuel testers, filters, separators, strainers and traps.
<table>
<thead>
<tr>
<th>KEY WORDS</th>
<th>LINK A</th>
<th>LINK B</th>
<th>LINK C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch Interface Detection Equip</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel Tester</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hoselines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipeline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipeline Manifolds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POL Filter/Separator Equip</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POL Storage and Distribution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POL Supply System</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
U.S. ARMY TEST AND EVALUATION COMMAND
SYSTEM ENGINEERING TEST OPERATIONS PROCEDURES

AMTE-RP-702-108
*Test Operations Procedure 9-2-294

14 January 1972

POL SUPPORT EQUIPMENT

SECTION I  GENERAL

Paragraph Page
Purpose and Scope ........................................... 1 1
Background .................................................. 2 1
Equipment and Facilities .................................. 3 2

II. TEST PROCEDURES

Supporting Tests ........................................... 4 3

III. SUPPLEMENTARY INSTRUCTIONS

Batch Interface Detector ................................. 5 4
Fuel Tester .................................................. 6 5
Switching Manifold ........................................ 7 6
Strainer and Traps ......................................... 8 6

APPENDIX. REFERENCES ..................................... 8

SECTION I
GENERAL

1. Purpose and Scope. This TOP describes test procedures for evaluating the operational and performance characteristics of POL support equipment. Equipment covered includes: hoselines/pipelines, pressure regulators, switching manifolds, monitoring devices, batch detectors, fuel testers, filter-separators, strainers and traps. From the tests listed in Section II, the test director can select those that will satisfy the requirements for the particular test item and the particular test type (i.e., engineering test, initial production test, etc.). This document provides for simulated environmental testing but does not include service testing or environmental testing at climatic test sites.

2. Background. Modern Army tactical operations, involving the use of mechanized ground equipment, aircraft and miscellaneous mobile field equipment, require that adequate supplies of petroleum, oil and lubricants (POL) be readily available when and where needed. To provide these POL requirements necessitates an efficient and varied handling and distribution system, one that can operate under all possible

*This TOP supersedes TOPS 9-2-298 (25 Oct 67) and 9-2-299 (22 Jul 69), including all changes.

Approved for public release; distribution unlimited.

[Stamp: DDC]
environmental conditions with a minimum of maintenance and operations personnel. The type of support equipment conceived to be most appropriate for this purpose will generally consist of hoselines/pipelines, pressure regulators, switching manifolds, monitoring devices, batch detectors, fuel testers, filter-separators, traps, strainers, mobile delivery and associated system maintenance equipment. This combination of equipment should:

a. Be sufficiently durable to resist the effects and hazards of the weather, chaffing and wear from contact with every conceivable type of terrain, buffeting by waves and tides on water surfaces and collapse from external pressure when below water surface.

b. Prevent leakage of transported POL and the introduction of contaminants from surrounding environs.

c. Include means of regulating internal pressures created by increases and decreases in terrain elevations and thermal heating.

d. Monitor system operation.

e. Detect and indicate changes in POL composition.

f. Be capable of selected fuel flow switching.

g. Be able to test fuel for contamination and filter out any contaminants.

h. Provide a method of mobile delivery to user when required.

i. Provide a maintenance package for cleaning and general maintenance of the system components.

3. Equipment and Facilities. In addition to the equipment and facilities defined in the documents listed in Section II, the following are required to perform the procedures of Section III.

a. Test standard POL products (paras 5 and 6).

b. Contaminants (liquid and solid) (paras 6 and 8).

c. Signal generator (para 7).

d. Laboratory balances (para 8).

e. Pumps (paras 5, 6 and 8).
4. **Supporting Tests.** Common Engineering MTPs/TOPs, Military Standards, the tests defined in Section III, and other published documents to be considered in formulating a test plan are as follows:

<table>
<thead>
<tr>
<th>TEST SUBJECT TITLE</th>
<th>PUBLICATION NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Pre-operational Inspection</td>
<td></td>
</tr>
<tr>
<td>(1) Operator Training and Familiarization</td>
<td>10-2-500</td>
</tr>
<tr>
<td>(2) Photographic Coverage</td>
<td>7-3-519</td>
</tr>
<tr>
<td>b. Physical Characteristics</td>
<td>10-2-500</td>
</tr>
<tr>
<td>c. Safety</td>
<td>10-2-508</td>
</tr>
<tr>
<td>d. Hydrostatic Tests</td>
<td></td>
</tr>
<tr>
<td>(1) Pipelines and housing for filter-separators, manifolds, strainers and traps</td>
<td>ASME code for Unfired Pressure Vessels</td>
</tr>
<tr>
<td>(2) Pumps</td>
<td>9-2-183</td>
</tr>
<tr>
<td>(3) Containers</td>
<td>FED STD 101B Method 5009</td>
</tr>
<tr>
<td>(4) Hoselines</td>
<td>FED STD 601 Method 10211</td>
</tr>
<tr>
<td>(5) Pressure Regulator</td>
<td>MIL-R-23047A Para 4.6.3</td>
</tr>
<tr>
<td>e. Performance Tests</td>
<td></td>
</tr>
<tr>
<td>(1) Pumps</td>
<td>9-2-183</td>
</tr>
<tr>
<td>(2) Filter-Separators</td>
<td>MIL-F-8901B Paras 4.3, 4.4, 4.5, 4.6</td>
</tr>
<tr>
<td>(3) Batch Interface Detector (Refer to para 5)</td>
<td></td>
</tr>
<tr>
<td>(4) Pressure Regulator</td>
<td>MIL-R-23047A Paras 4.6.1, 4.6.2, 4.6.4</td>
</tr>
<tr>
<td>(5) Fuel Tester (Refer to para 6)</td>
<td></td>
</tr>
<tr>
<td>(6) Switching Manifold (Refer to para 7)</td>
<td></td>
</tr>
<tr>
<td>(7) Strainers and Traps (Refer to para 8)</td>
<td>MIL-S-17849C Para 4.4</td>
</tr>
<tr>
<td>f. Environmental Tests</td>
<td></td>
</tr>
<tr>
<td>(1) Temperature</td>
<td>MIL-STD-810B Method 501 and AR 70-38</td>
</tr>
<tr>
<td>(2) Sunshine</td>
<td>4-2-826</td>
</tr>
<tr>
<td>(3) Rain</td>
<td>2-2-815</td>
</tr>
<tr>
<td>(4) Humidity</td>
<td>4-2-820</td>
</tr>
</tbody>
</table>
5. Batch Interface Detector.

a. Objective. To determine that the test item will detect the differences in the specific gravity of POL products injected into it and initiate a change to the switching manifold to select the proper POL distribution outlet.

b. Method. The test item is installed in the input pipeline at a predetermined distance from the switching manifold. POL products of known and varying specific gravities are pumped into the pipeline and the test item is observed for proper indication of each change of POL product.

c. Data Required.

(1) Record for each POL product transferred to the input pipeline:

   (a) Type and specific gravity.
(b) Time, beginning and ending.

(c) Volume.

(2) Record for each change of batch interface indication:

(a) Specific gravity indicated.

(b) Time, beginning and change.

(c) Subsequent indications and time of change.

d. Analytical Plan. The detection and indication times determined for each change and type of POL product are summarized, analyzed and compared with the requirements of the MN to determine conformance to specifications.


a. Objective. To determine that the test item will indicate the contamination level of the POL products and provide a warning or automatic shut off when purity level is degraded.

b. Method. The test item is installed between the final filter-separator unit and the pipehead or hydrant. Pure fuels and fuels with known types and quantities per volume of contaminants (water, solids) are pumped into the pipeline input to the test item. The test item indicator is carefully observed for contamination measurements and for operation of warning system when contamination level exceeds limitations.

c. Data Required.

(1) Type (pure or % contaminated) and quantity of fuel injected with beginning and ending times.

(2) Contamination readings on fuel tester indicator with correlated time information.

(3) Operation of warning system with corresponding times.

d. Analytical Plan. The injected contaminated fuel types, volume and times are correlated with the indications registered by the test item and the degree of accuracy determined. This determination and accuracy of warning system operation is compared with the requirements of the MN to determine conformance to specifications.
7. **Switching Manifold.**

   a. **Objective.** To determine the capability of the test item to react to the indications of the batch interface detector or similar equipment with accurate and fast switching to selected distribution outputs.

   b. **Method.** The test item is instrumented to receive simulated batch interface detector signals from an appropriate signal generator. Signals are generated simulating POL products of varying specific densities and the test item is observed for selection of proper distribution outlets compatible with each signal received.

   c. **Data Required.**

      (1) Applied generator signal and time.

      (2) Selected distribution outlet operation and time.

   d. **Analytical Plan.** The applied signals and the selected distribution outlets are correlated by the common times and the accuracy of test item operation determined. This information is compared with the requirements of the MN to determine conformance to specifications.

8. **Strainers and Traps.**

   a. **Objective.** To determine the capability of the test item to remove solid contaminants from POL products.

   b. **Method.** The internal screen of the test item is removed, inspected to ensure cleanliness, weighed and then replaced. The test item is installed in a section of pipeline or hoseline and a specified volume of fuel containing a known quantity of contaminant is pumped through the test item. The internal screen and the sediment found in the test item after test is removed and weighed.

   c. **Data Required.**

      (1) Weight of solid contaminant in test fuel.

      (2) Weight of screen before and after test.

      (3) Weight of sediment in strainer or trap after test.

   d. **Analytical Plan.** The original weight of the screen is subtracted from the weight of screen and sediment after test. The result is divided by the known weight of contaminant in the test fuel and this result multiplied by 100 to obtain the percentage of contaminant removed by the test item. This percentage is compared with the requirements of the MN to determine conformance to specifications.
(b) Time, beginning and ending.
(c) Volume.

(2) Record for each change of batch interface indication:
   (a) Specific gravity indicated.
   (b) Time, beginning and change.
   (c) Subsequent indications and time of change.

d. Analytical Plan. The detection and indication times determined for each change and type of POL product are summarized, analyzed and compared with the requirements of the MN to determine conformance to specifications.


a. Objective. To determine that the test item will indicate the contamination level of the POL products and provide a warning or automatic shut off when purity level is degraded.

b. Method. The test item is installed between the final filter-separator unit and the pipehead or hydrant. Pure fuels and fuels with known types and quantities per volume of contaminants (water, solids) are pumped into the pipeline input to the test item. The test item indicator is carefully observed for contamination measurements and for operation of warning system when contamination level exceeds limitations.

c. Data Required.

(1) Type (pure or % contaminated) and quantity of fuel injected with beginning and ending times.

(2) Contamination readings on fuel tester indicator with correlated time information.

(3) Operation of warning system with corresponding times.

d. Analytical Plan. The injected contaminated fuel types, volume and times are correlated with the indications registered by the test item and the degree of accuracy determined. This determination and accuracy of warning system operation is compared with the requirements of the MN to determine conformance to specifications.
7. **Switching Manifold.**

   a. **Objective.** To determine the capability of the test item to react to the indications of the batch interface detector or similar equipment with accurate and fast switching to selected distribution outputs.

   b. **Method.** The test item is instrumented to receive simulated batch interface detector signals from an appropriate signal generator. Signals are generated simulating POL products of varying specific densities and the test item is observed for selection of proper distribution outlets compatible with each signal received.

   c. **Data Required.**

      (1) Applied generator signal and time.

      (2) Selected distribution outlet operation and time.

   d. **Analytical Plan.** The applied signals and the selected distribution outlets are correlated by the common times and the accuracy of test item operation determined. This information is compared with the requirements of the MN to determine conformance to specifications.

8. **Strainers and Traps.**

   a. **Objective.** To determine the capability of the test item to remove solid contaminants from POL products.

   b. **Method.** The internal screen of the test item is removed, inspected to ensure cleanliness, weighed and then replaced. The test item is installed in a section of pipeline or hose line and a specified volume of fuel containing a known quantity of contaminant is pumped through the test item. The internal screen and the sediment found in the test item after test is removed and weighed.

   c. **Data Required.**

      (1) Weight of solid contaminant in test fuel.

      (2) Weight of screen before and after test.

      (3) Weight of sediment in strainer or trap after test.

   d. **Analytical Plan.** The original weight of the screen is subtracted from the weight of screen and sediment after test. The result is divided by the known weight of contaminant in the test fuel and this result multiplied by 100 to obtain the percentage of contaminant removed by the test item. This percentage is compared with the requirements of the MN to determine conformance to specifications.
Recommended changes to this publication should be forwarded to Commanding General, U.S. Army Test and Evaluation Command, ATTN: AMSTE-PA-M, Aberdeen Proving Ground, Maryland 21005. Technical information related to this publication may be obtained from the preparing activity, Commanding Officer, Aberdeen Proving Ground, ATTN: STEAP-MT-DM, Aberdeen Proving Ground, Maryland 21005. Additional copies of this document are available from the Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. This document is identified by the accession number (AD No.) printed on the first page.
APPENDIX
REFERENCES

1. AR 70-38, "Research, Development, Test, and Evaluation of Materiel for Extreme Climatic Conditions."

2. USAMC Supplement 1 to AR 11-26, "Value Engineering."


5. FED. TEST METHOD STD. NO. 601, "Rubber: Sampling and Testing."


