PRODUCT IMPROVEMENT TEST OF NONMETALLIC FUEL TANKS

FOR

TRUCKS, M151 AND M715 SERIES

(PHASE I)

FIRST LETTER REPORT

BY

JUAN A. SUAREZ

JUNE 1974

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A Product Improvement Test of Nonmetallic Fuel Tanks for Trucks, M151 and M715 Series was conducted by US Army Yuma Proving Ground during the period 17 April 1973 through 10 May 1974. The purpose of the test was to determine the suitability of the nylon fuel tanks for M151 and M715 series trucks under desert environmental conditions. The test items were installed in M151 and M715 series trucks. These trucks were operated under routine, administrative operation on gravel, paved and cross-country terrain at US Army Yuma Proving Ground. It was concluded that under desert environmental conditions.
the nylon fuel tanks are suitable for use in the M715 and M151 series trucks.

It was recommended that:

(1) To preclude further fuel tank support bands slippage, one of the following actions must be implemented: (a) Change the nylon fuel tank design to provide molded depressions, or (b) join the support bands by installing two metal banding straps between them.

(2) Incorporate the operational procedure of grounding the fuel pump and the fuel sending unit in pertinent technical manuals.
STEYP-MTM

SUBJECT: First Letter Report on Product Improvement Test of Nonmetallic Fuel Tanks for Trucks, M151 and M715 Series, TECOM Project No. 1-VG-123-000-001 (Phase I)

Commander
US Army Tank-Automotive Command
ATTN: AMSTA-RHT
Warren, Michigan 48090

Dates of Test: 17 April 1973 through 10 May 1974

1. REFERENCES


STEYP-MTM
SUBJECT: First Letter Report on Product Improvement Test of Nonmetallic Fuel Tanks for Trucks, M151 and M715 Series, TECOM Project No. 1-VG-123-000-001 (Phase I)

2. BACKGROUND

Nonmetallic fuel tanks have certain advantages over metallic tanks in so far as they are not prone to corrosion, are light weight and are somewhat less expensive than metal fuel tanks. US Army Tank-Automotive Command has been in the process of securing from private industry, under contract, a quantity of nylon, high density polyethylene, and cross-linked polyethylene fuel tanks. Since this material is relatively new, the Army has established a program to field test them in all environments (hot, cold, dry, humid) for at least 1 year to determine their suitability to military application. A test program, Reference b, was initiated and its general plan was to test a quantity of nonmetallic fuel tanks at the arctic, desert, and tropic test sites. Due to unresponsive bidding from manufacturers, and, later, to delay in obtaining the necessary tooling required in manufacturing the test items, the original test program was revised and rescheduled by References c through g. In its revision, Reference e also includes testing the items at the temperate test site. Because the test items could not arrive at the different test sites at the same time, TACOM decided to divide the program into two phases. Phase I of the test (nylon fuel tanks) was to start between March and April 1973 at the arctic, desert and temperate test sites; Phase II of the test (high density polyethylene and cross-linked polyethylene fuel tanks) was to start between January and April 1974 at all four of the previously mentioned test sites.

This report is based on the results obtained during Phase I of the test (routine, administrative operation of the M151 and M715 series with the installed nylon fuel tanks on gravel, paved and cross-country terrain) at US Army Yuma Proving Ground.

3. OBJECTIVE

To determine the suitability of the nylon fuel tanks for the M151 and M715 series trucks under desert environmental conditions.

4. PROCEDURES AND RESULTS

Sixteen nylon fuel tanks (one each for eight M715 and one each for eight M151 series trucks) were received for test. Each test item was inspected;
no damage or irregularities were found. The conventional terne plate tank was removed from each of the facility trucks and stored for future reinstallation. The test items were installed in the above facility trucks in accordance with the installation and safety procedures outlined in TM 9-2320-218-20 (Organizational Maintenance Manual for M151 series trucks) and TM 9-2320-244-20 (Organizational Maintenance Manual for M715 series trucks). Since the M151A1 truck contains a self-grounded submerged fuel pump in the terne plate fuel tank, the fuel pump in the nylon fuel tank as well as the fuel sending unit had to be grounded. The mileage of each truck was then recorded. The 16 trucks were operated for 1 year under routine, administrative operation on gravel, paved and cross-country terrain. During the 1-year period, as circumstances permitted, the fuel tanks were checked for fuel leakage, cracking, bulging, etc. When a problem developed, it was investigated and then temporarily corrected by USAYPG to expedite testing. After the one-year test period was completed, the mileage of each truck was recorded again to establish total test miles on each nylon fuel tank. The nylon fuel tanks were inspected before and after removal from the trucks. No damage or irregularities were found in the test items except for some thermal expansion of the fuel tanks which was expected of this material. No color changes, cracking or crazing were found during this inspection.

Date of installation and removal of each test item, identification of each truck, total test miles accumulated on each test item, and pertinent remarks can be found in Inclosure 1. Photographs illustrating the nylon fuel tank as installed on the truck can be found in Inclosure 2. Meteorological data at USAYPG from April 1973 through April 1974 are included for information purposes in Inclosure 3.

The following incidents occurred with the M715's nylon fuel tanks during the 1 year of test:

a. After 116 days of operation and 2087 accumulated test miles on the nylon fuel tank which was installed in truck USA Reg No. 03B00469, the support bands were found to have slipped off (due to road vibrations) allowing the fuel tank to fall to the ground. The fuel lines and the gage wire were ripped loose. The fuel tank itself sustained minor scratches but did not rupture. The fuel tank was then reinstalled. At this time, two metal banding straps were installed joining the two support bands to keep them from separating.
b. Another incident similar to the one mentioned in the above paragraph occurred with truck USA Reg No. 03J43568 after 119 days of operation and 1652 accumulated test miles. Two metal banding straps were then installed joining the two support bands.

c. A last incident similar to the ones in the above paragraphs occurred with truck USA Reg No. 03E92768 after 125 days of operation and 761 accumulated test miles. However, the incident was noticed before the fuel tank could fall off, preventing possible damage to the fuel tank or any of its components. Metal banding straps were installed as explained above.

During the inspection of all the above incidents, it was found that the nuts on the end of the support bands could not be tightened further. However, there was an incident with M715 truck USA Reg No. 03M41668 where one of the nuts on the end of a support band loosened and fell off, allowing the support band to loosen and the tank to nearly fall off. The support bands were put back in place and the nut was tightened.

After the support band slippage incident occurred in three separate trucks, two metal banding straps were installed on each of the nylon fuel tanks on the rest of the M715 series trucks.

Illustrations of this modification can be found in Figures 3 and 4, Inclosure 2.

5. CONCLUSIONS

The nylon fuel tanks are suitable for use in the M715 and M151 series trucks under desert environmental conditions.

6. RECOMMENDATIONS

a. To preclude further fuel tank support bands slippage, one of the following actions must be implemented:

(1) Change the nylon fuel tank design to provide molded depressions, or

(2) Join the support bands by installing two metal banding straps between them (See Fig 3 and 4 of Incl 2).
SUBJECT: First Letter Report on Product Improvement Test of Nonmetallic Fuel Tanks for Trucks, M151 and M715 Series, TECOM Project No. 1-VG-123-000-001 (Phase I)

b. Incorporate the operational procedure of grounding the fuel pump and the fuel sending unit in pertinent technical manuals.

FOR THE COMMANDER:

RAMON J. HEICK
Acting Director of Materiel Test

Incl
1. Test Data
2. Photographs
3. Meteorological Data
4. Distribution List
<table>
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<tr>
<th>Dates</th>
<th>Installation</th>
<th>Truck USA Reg No.</th>
<th>Type of Truck</th>
<th>Total Test Miles</th>
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<td>17 Apr 73</td>
<td>2 May 74</td>
<td>2J8621</td>
<td>M151A1, 3% Ton</td>
<td>2,792</td>
<td>The submerged fuel pump and fuel sending unit must be grounded. Incorporation of this operational procedure in the pertinent technical manuals is required.</td>
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<td>18 Apr 73</td>
<td>29 Apr 74</td>
<td>2F0458</td>
<td>M151A1, 3% Ton</td>
<td>4,644</td>
<td>(1) After 127 days of operation and 1101 accumulated test miles, the nut on the end of a support band loosened and fell off. The support band loosened and the tank nearly fell off. (2) Two metal banding straps were added on 23 Aug 73 after 1169 accumulated test miles.</td>
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<td>20 Apr 73</td>
<td>10 May 74</td>
<td>2R0799</td>
<td>M151A1, 3% Ton</td>
<td>8,273</td>
<td>(1) After 125 days of operation and 761 accumulated test miles, the support bands began to slip off. The fuel tank did not fall off. (2) Two metal banding straps were added on 21 August 1973 after 761 accumulated test miles.</td>
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<td>2P8730</td>
<td>M151A1, 3% Ton</td>
<td>2,113</td>
<td>(1) Two metal banding straps were added (no record of date and mileage). (2) Vehicle remained parked since 29 Jan 74 waiting for power train repair parts.</td>
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<td>30 Apr 74</td>
<td>2N1756</td>
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<td>4,085</td>
<td>Two metal banding straps were added on 27 Aug 73 after 3343 accumulated test miles.</td>
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<td>23 Apr 73</td>
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<td>2K6397</td>
<td>M151A1, 3% Ton</td>
<td>5,098</td>
<td>Two metal banding straps were added on 27 Aug 73 after 432 accumulated test miles.</td>
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<td>2J8403</td>
<td>M151A1, 3% Ton</td>
<td>4,361</td>
<td>Two metal banding straps were added on 22 Aug 73 after 991 accumulated test miles.</td>
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<td>24 Apr 73</td>
<td>30 Apr 74</td>
<td>2J8565</td>
<td>M151A1, 3% Ton</td>
<td>4,763</td>
<td>Two metal banding straps were added on 23 Aug 73 after 1652 accumulated test miles.</td>
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<td>03M41668</td>
<td>M715, 1% Ton</td>
<td>6,941</td>
<td>(1) Two metal banding straps were added (no record of date and mileage).</td>
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<tr>
<td>18 Apr 73</td>
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<td>3,730</td>
<td>Two metal banding straps were added on 27 Aug 73 after 3343 accumulated test miles.</td>
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<td>6,691</td>
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<td>Two metal banding straps were added on 23 Aug 73 after 1652 accumulated test miles.</td>
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<td>30 Apr 74</td>
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<td>Two metal banding straps were added on 22 Aug 73 after 2087 accumulated test miles.</td>
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<td>26 Apr 73</td>
<td>7 May 74</td>
<td>03B00469</td>
<td>M715, 1% Ton</td>
<td>6,221</td>
<td>Two metal banding straps were added on 17 Aug 73 after 2087 accumulated test miles.</td>
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FIGURE 1. Nylon fuel tank as installed in an M151A1 1/4-ton truck (left 3/4 front view)
FIGURE 2. Nylon fuel tank as installed in an M151A1 1/4-ton truck (right 3/4 front view)
FIGURE 3. Nylon fuel tank as installed in an M715 1-1/4 ton truck (bottom front view). Note the crossed metal bands that had to be installed to keep the conventional support bands from separating.
FIGURE 4. Nylon fuel tank as installed in an M715 1-1/4 ton truck (bottom rear view). Note the crossed metal bands that had to be installed to keep the conventional support bands from separating.
METEOROLOGICAL SUMMARY FOR APRIL 1973

Maximum Daily Surface Temperature (°F)

Maximum and Minimum Daily Ambient Temperature (°F)

Maximum and Minimum Daily Relative Humidity (Percent)

Average Hourly Solar Radiation (Gm Cal/cm²)

Daily Prevailing Wind (Speed (mph) and Direction)

Average Daily Sky Condition

C - Clear
P - Partly Cloudy & Cloudy

Incl 3
Page 1 of 14
METEOROLOGICAL SUMMARY FOR MAY 1973

MAXIMUM DAILY SURFACE TEMPERATURE (°F)

MAXIMUM AND MINIMUM DAILY AMBIENT TEMPERATURE (°F)

MAXIMUM AND MINIMUM DAILY RELATIVE HUMIDITY (PERCENT)

AVERAGE HOURLY SOLAR RADIATION (GM CAL/CM²)

DAILY PREVAILING WIND (SPEED (MPH) AND DIRECTION)

AVERAGE DAILY SKY CONDITION C—CLEAR P—PARTLY CLOUDY & CLOUDY

Incl 3
Page 2 of 14
METEOROLOGICAL SUMMARY FOR JUNE 1973

MAXIMUM DAILY SURFACE TEMPERATURE (°F)

MAXIMUM AND MINIMUM DAILY AMBIENT TEMPERATURE (°F)

MAXIMUM AND MINIMUM DAILY RELATIVE HUMIDITY (PERCENT)

AVERAGE HOURLY SOLAR RADIATION (GM CAL/CM²)

DAILY PREVAILING WIND (SPEED (MPH) AND DIRECTION)

AVERAGE DAILY SKY CONDITION C-CLEAR P-PARTLY CLOUDY & CLOUDY

Page 3 of 14
METEOROLOGICAL SUMMARY FOR JULY 1973

MAXIMUM AND MINIMUM DAILY SURFACE TEMPERATURE (°F)

MAXIMUM AND MINIMUM DAILY AMBIENT TEMPERATURE (°F)

MAXIMUM AND MINIMUM DAILY RELATIVE HUMIDITY (PERCENT)

AVERAGE HOURLY SOLAR RADIATION (GM CAL/CM²)

DAILY PREVAILING WIND (SPEED (MPH) AND DIRECTION)

AVERAGE DAILY SKY CONDITION: C = CLEAR, P = PARTLY CLOUDY & CLOUDY

Incl 3
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METEOROLOGICAL SUMMARY FOR JANUARY 1974

AVERAGE DAILY SKY CONDITION

C - CLEAN
P - PARTLY CLOUDY AND CLOUDY

Incl 3
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METEOROLOGICAL SUMMARY FOR MARCH 1974

MAXIMUM DAILY SURFACE TEMPERATURE (°F)

MAXIMUM & MINIMUM DAILY AMBIENT TEMPERATURE (°F)

MAXIMUM AND MINIMUM DAILY RELATIVE HUMIDITY (PERCENT)

AVERAGE HOURLY SOLAR RADIATION (96 CAL/CM²)

DAILY PREVAILING WIND (SPEED (MPH) AND DIRECTION)

AVERAGE DAILY SKY CONDITION C-CLEAR P-PARTLY CLOUDY AND CLOUDY

Incl 3
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METEOROLOGICAL SUMMARY FOR APRIL 1974

Maximum Surface Temperature (°F)

Maximum & Minimum Daily Ambient Temperature (°F)

Maximum & Minimum Daily Relative Humidity (Percent)

Average Hourly Solar Radiation (Gm Cal/cm²)

Daily Prevailing Wind (Speed (MPH) and Direction)

Average Daily Sky Condition: C-Clear, P-Cloudy and Partly Cloudy
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