U. S. ARMY ARCTIC TEST BOARD
APO 733, Seattle, Washington

STEBE-AR 29 May 1963

SUBJECT: Report of USATECOM Test Project No 1-3-7760-60-D (23-OBT), Check Test of Winterization Kit (-65°F) for Truck, Utility, ¼-Ton, 4X4, M151

TO: See Distribution

1. This letter transmits final report on subject test (inclosure 1).

2. Test Results: The test Winterization Kit (-65°F), for Truck, Utility, ¼-Ton, 4X4, M151 was tested from 12 November 1962 through 31 March 1963. The test kit was exposed to and tested in blowing snow, freezing rain and sleet at ambient temperatures ranging from 44°F to -52°F. The test kit-vehicle combination was driven 6,350 miles and the personnel heater was operated for 481 hours with 498 start-run-stop cycles being completed. Test results, and results of a survey of 50 kits used during the arctic winter maneuver TIMBERLINE, at ambient temperatures as low as -70°F, revealed that the Winterization Kit (-65°F) for the Truck, Utility, ¼-Ton, 4X4, M151 was satisfactory with respect to durability and maintenance, and unsatisfactory with respect to functional suitability, ease of operation, compatibility of components, comfort, safety, and reliability.

3. Conclusions: It is concluded that:

a. The Winterization Kit (-65°F) for the Truck, Utility, ¼-Ton, 4X4, M151 is not suitable for Army use under arctic winter conditions until the deficiencies, and as many of the shortcomings as feasible, listed in Part B, Annex B of inclosure 1 have been corrected.

b. The engine primer pump and the starter drive detent are non-essential for satisfactory operation under arctic winter conditions of the Winterization Kit (-65°F) for the Truck, Utility, ¼-Ton, 4X4, M151.

4. Recommendations: It is recommended that:

a. The deficiencies, and as many of the shortcomings as feasible, listed in Part B, Annex B of inclosure 1 be corrected.

b. The engine primer pump and the starter drive detent assemblies not be included as components of the Winterization Kit (-65°F) for the Truck, Utility, ¼-Ton, 4X4, M151.

c. One modified Winterization Kit for Truck, Utility, ¼-Ton, 4X4, M151 be provided this Board for check test.

FOR THE PRESIDENT:

CHARLES A. BROWN
Lt Col, Infantry
Assistant Adjutant

2 Incl
1 - as
2 - Abstract Card

USATECOM

U S ARMY

ARCTIC TEST BOARD

Fort Greely, Alaska

REPORT OF USATECOM PROJECT 1-3-7760-60-D

CHECK TEST OF

WINTERIZATION KIT FOR TRUCK, UTILITY, $\frac{1}{4}$-TON, 4X4, M151

29 MAY 1963

For Information Only, Action by Higher Authroity Pending

REPORT OF USATECOM PROJECT 1-3-7760-60-D

CHECK TEST OF

WINTERIZATION KIT FOR TRUCK, UTILITY, $\frac{1}{4}$-TON, 4X4, M151

29 MAY 1963

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U. S. ARMY ARCTIC TEST BOARD
APO 733, Seattle, Washington

Report of USATECOM Project No 1-3-7760-60-D

Check Test of

Winterization Kit (-65°F) for Truck, Utility, ¼-Ton, 4X4, M151

12 November 1962 - 31 March 1963

Part I - General

A. References: See Annex A, Part III.

B. Authority:

1. Directive: Incl 6, ltr ATDEV-MGP 337, HQ, USCONARC, Ft Monroe, Virginia, 30 April 1962, subject: "Report of Arctic Test Planning Conference Held at HQ, USCONARC, 4-5 April 1962."

2. Purpose:

a. To determine if the modified Winterization Kit (-65°F) for Truck, Utility, ¼-Ton, 4X4, M151 is suitable for Army use under arctic winter conditions.

b. To determine whether the deficiencies reported in reference E, Annex A, have been corrected.

C. Description of Materiel:

1. The Winterization Kit (test kit) for the Truck, Utility, ¼-Ton, 4X4, M151 consists of an aluminum hardtop enclosure and a (-65°F) vehicle winterization kit. The test kit is designed to permit starting of the vehicle engine, satisfactory vehicle operation, and crew comfort at temperatures as low as -65°F.

2. The aluminum hardtop installation is a metal and glass enclosure designed to protect vehicle and crew from weather extremes and at the same time provide maximum crew comfort and vision. It is assembled and installed with common fasteners, bolts, nuts, and screws. Panels are of convient size so the whole enclosure may be shipped disassembled without excessive cubage requirements. The doors are equipped with sliding glass panels for ventilation and signaling. The enclosure is assembled with weather-resistant gaskets and sealed with caulking compound.

3. The (-65°F) vehicle winterization kit consists of a gasoline burning crew compartment heater of the fresh air type, equipped with a windshield defroster, and manual controls. Also furnished in the kit is a standard slave recepticle, a brush guard cover to control the cold air coming through the radiator, an engine priming pump, insulation material for the vehicle floor and wheel housing panels, and a starter-drive-detent control for freeing the starter drive if required when starting in extreme cold.

a. The heater is a model E-500 gasoline burning unit with a fresh air output of 30,000 BTU/hr and heated exhaust output of 20,000 BTU/hr. Fuel for the heater is drawn from the vehicle fuel tank by means of a separate electric fuel pump. Air for combustion is supplied by a blower contained in the heater. The same blower motor forces heated air into the vehicle crew compartment. The heater housing contains a damper and an electric damper-actuator which automatically diverts heated air to the battery compartment when activated by a thermostat switch located in the battery compartment. A "T" handle control on the heater housing is connected to the heater exhaust diverter valve. Pulling upward on the "T" handle shifts the flow of exhaust from the outboard exhaust pipe system to the engine heating shroud where the hot exhaust gasses escape between the edges of the shroud and the engine oil pan, heating the engine oil. Hot air defrosting is controlled by two damper valves, one located on the heater housing and one on the instrument panel.

b. The electric slave recepticle provides a means of starting the vehicle with a service cable connected to an external 24-volt power source when the engine cannot be started otherwise.

c. An engaging detent control for the starter drive is mounted on the instrument panel. In extreme cold, the starter drive gear may not slide to engage the engine flywheel. Under these conditions, the detent control allows the driver to free the gear for normal starter engagement.

d. The brush guard cover and flap, controls the flow of cold air through the radiator and protects the engine from wind-blown snow.

e. An engine priming pump is installed on the instrument panel and is connected to priming fittings in the intake manifold. Fuel for the priming system is taken through a shut-off valve in a feed line from the heater fuel pump. The priming pump is provided as a means of supplementing the carburator choke, if required, when starting the engine in extreme cold.

f. Insulation material is glued to the floor, the roof, the battery compartment cover and the wheel housings to assist in retaining heat in the crew and battery compartments.

4. One production model Winterization Kit (-65°F) mounted on Truck, Utility, ¼-Ton, 4X4, M151 (serial No 2D-1502) was received at the U. S. Army Arctic Test Board on 12 November 1962. A complete maintenance package was received during the test period.

5. Photograph of the M151 equipped with the test kit is included in Annex III.C.1.

D. Background:

1. A requirement for the test winterization kit is stated in reference C, Annex A.

2. Information concerning engineering tests is not currently available.

3. A pre-production model of the Winterization Kit (-65°F for the Truck, Utility, ¼-Ton, 4X4, M151 was service tested at the U. S. Army Arctic Test Board during the 1961-1962 arctic winter test season (para D, Annex A). Deficiencies and shortcomings regarding the test are discussed in Part A, Annex B. The 1961-1962 test revealed that the test kit was satisfactory with respect to maintenance and unsatisfactory with respect to the following:

a. Functional suitability.

b. Compatibility with related equipment.

c. Ease of operation, comfort, and safety.

d. Durability and reliability.

4. With reference to the 1961-1962 test, HQ, USCONARC recommended that:

a. The deficiencies and as many of the shortcomings as possible be corrected (para D, Annex A).

b. A modified Winterization Kit for the Truck, Utility, ¼-Ton, 4X4, M151, be provided the U. S. Army Arctic Test Board for check test (para D, Annex A).

c. The engine priming system be deleted as a component of the winterization kit (para D, Annex A).

5. Information concerning tripartite standardization is not available.

E. Test Objectives: Same as B2.

F. Findings: Tests were conducted by Major William T. Mahaffey, Armor, and other personnel of Test Division 2, U. S. Army Arctic Test Board.

1. The test kit was exposed to and tested in blowing snow, freezing rain and sleet at ambient temperatures ranging from 44°F to -52°F. The test kit-vehicle combination was driven 6,350 miles and the personnel heater was operated 481 hours with 498 start-run-stop cycles being completed.

2. The test kit was exposed to prevailing weather conditions throughout the test period except for those periods when maintenance indoors was required.

3. Results of a survey of fifty M151, ¼-ton truck winterization kits of the same model used during the arctic winter maneuver TIMBERLINE and which were exposed to ambient temperatures as low as -70°F were compared to test kit test results and reported in tests No 2, 3, and 4, as appropriate.

4. Failures reported in this Beards report of service test, (para E, Annex A) which were or were not satisfactorily corrected are discussed in Part A, Annex B.

5. The test kit was satisfactory with regard to maintenance and durability and unsatisfactory with respect to the following:

a. Functional suitability, ease of operation, and compatibility of components.

b. Comfort and Safety.

c. Reliability.

G. Discussion:

1. The failures previously reported as deficiencies, which if not corrected would cause damage to equipment, were not corrected (Defrosters cracked windshields, damper actuator diverted excessive amounts of heat to the battery compartment).

2. The failure previously reported as a deficiency which affected safe operation of the vehicle was not corrected (the defrosters were not capable of adequately defrosting the windshield).

3. The failures previously reported as deficiencies which caused discomfort to crew and passengers were not corrected (Heat diverter directed excessive amounts of heat against the right leg of the driver and left leg of the assistant driver, heat distribution within the hardtop enclosure was uneven).

4. Results of the test revealed that of 31 failures reported in this Board's 1961-62 report of service test, 11 were corrected; two were corrected, but introduced two new failures; 18 were not corrected, 10 of which recurred during this test (Part A, Annex B).

5. This Board's recommendation that the engine priming pump assembly be eliminated was not adopted. Neither the engine priming pump nor the starter drive detent were required during this test nor during operation TIMBERLINE.

H. Conclusions: It is concluded that:

a. The Winterization Kit (-65°F) for the Truck, Utility, ¼-Ton, 4X4, M151 is not suitable for Army use under arctic winter conditions until the deficiencies, and as many of the shortcomings as feasible, listed in Part B, Annex B, have been corrected.

b. The engine primer pump and the starter drive detent are non-essential for satisfactory operation under arctic winter conditions of the Winterization Kit (-65°F) for the Truck, Utility, ¼-Ton, 4X4, M151.

I. Recommendations: It is recommended that:

a. The deficiencies, and as many of the shortcomings as feasible, listed in Part B, Annex B be corrected.

b. The engine primer pump and the starter drive detent assemblies not be included as components of the Winterization Kit, (-65°F) for the Truck, Utility, ¼-Ton, 4X4, M151.

c. One modified Winterization Kit (-65°F) for the Truck, Utility, ¼-Ton, 4X4, M151 be provided this Board for check test.

CURTIS Y. KIMBALL
Colonel, Infantry
President

Part II - Test Data

A. Test No 1 - Preoperational Inspection and Physical Characteristics:

1. PURPOSE:

a. To determine whether the test kit-vehicle combination was in proper condition for test.

b. To determine the physical characteristics of the test kit.

2. METHOD:

a. Prior to testing, the test kit-vehicle combination was inspected in accordance with instructions contained in the maintenance package to insure that the test kit-vehicle combination was in proper condition for test.

b. The test kit was photographed and examined and the physcial characteristics were recorded.

3. RESULTS:

a. The test kit-vehicle combination was found to be in serviceable condition.

b. A photograph of the test kit-vehicle combination is included in Annex III.C.1.

c. The physical characteristics of the test kit were found to be as described in paragraph C, Part I.

B. Test No 2 - Functional Suitability, Ease of Operation, and Compatibility of Components:

1. PURPOSE:

a. To determine whether the test kit, as modified, was functionally suitable for Army use when mounted on the M151 $\frac{1}{4}$-ton truck.

b. To determine if there were any difficult functions associated with or resulting from operation of the test kit.

c. To determine whether components of the test kit were compatible with each other and with the M151 $\frac{1}{4}$-ton truck.

2. METHOD:

a. Components of the test kit were operated for the purpose of heating the battery and crew compartment, defrosting the windshield, and preheating the vehicle engine. The following data were recorded as appropriate.

(1) Ambient temperature prior to, during, and after each test.

(2) Length of cold-soak periods.

(3) Time required to pre-heat the engine.

(4) Cranking time required to start the engine.

(5) Time required for the engine coolant to reach operating temperature (140°F).

(6) Functional suitability, ease of operation, and compatibility of the following components with each other and with the M151 ¼-Ton truck:

(a) Electric switches controlling the operation of the personnel heater.

(b) Hot air diverter assembly for the personnel heater.

(c) Electrically operated damper actuator assembly which automatically diverted hot air to the battery compartment.

(d) Defroster diverter assembly to include ducting to the defroster outlets.

(e) Handles for the door glass of the hardtop assembly.

(f) Door-latch handles.

(g) Engine pre-heat controls.

(h) Engine pre-heat and personnel heater exhaust ducting.

(i) Seals for the panels and doors of the hardtop assembly

(j) Hood cover and fasteners.

(k) Flap for the radiator brush guard covers and flap fasteners.

(l) Electric slave outlet.

(m) Engine starter drive detent assembly.

(n) Engine primer pump assembly.

b. A survey was made of 50 production model M151 winterization kits used during the 1963 arctic winter maneuver 'TIMBERLINE. During the

maneuver, on-the-spot interviews and inspection of the winterization kits were conducted. Results of the survey were reported together with results obtained from tests of the test kit and the following data were recorded:

(1) Data listed in para 2a(6) above.

(2) Organizations and identification numbers of the vehicles involved in the survey.

3. RESULTS:

a. Data obtained from the survey made of 50 winterization kits during the TIMBERLINE maneuver reflected usage and exposure of the kit in ambient temperature as low as -70°F. A list containing the organization, bumper and/or USA registration number of the vehicles is included in Annex III. D.1.

b. Cold-start tests were conducted after the test kit-vehicle combination had been cold-soaked for periods of 13.5 to 24.0 hours during ambient temperatures ranging from 23°F to -52°F. Results revealed that the vehicle engine could be started at ambient temperatures as low as -52°F without pre-heat, however, cold starts under similar conditions with pre-heat reduced the crank-to-start time and time for the engine coolant to reach operating temperature (140°F) after the engine had started. Representative cold-start test data is shown below:

AMBIENT TEMPERATURES (°F)			Period of	Pre-Heat	TIME	
Cold-Soak		Temp	Cold Soak	Time	Crank to	To Reach 140°F
HI	LO	At Start	(Hours)	(Min)	Start (Sec)	(Min)
-38	-51	-50	16.0	30	26	5.83
-38	-52	-52	24.0	None	130	9.25
-38	-48	-38	13.5	15	60	7.35
-23	-27	-27	16.0	None	135	8.00

c. Test results and results of the TIMBERLINE survey revealed that the personnel heater was capable of pre-heating the engine of the M151 $\frac{1}{4}$-ton truck at ambient temperatures as low as -70°F.

d. Neither the engine starter drive detent nor the engine primer assemblies were used or required during test of the test kit. The TIMBERLINE survey revealed that the starter drive detent assembly was used by one driver and that the engine primer pump was used by two drivers. None of the drivers could state that either assembly was required.

e. The electric switches controlling the operation of the personnel heater were suitable in all respects.

f. The hot air diverter for the personnel heater of the test kit directed an uncomfortable amount of heat on the drivers right leg and the

assistant drivers left leg. All the hot air was diverted to the front of the vehicle resulting in heat distribution within the test hardtop enclosure being uneven. Temperatures between the front and rear of the vehicle varied as much as 50°F (para I.4, Annex B). Twenty of fifty operators interviewed during the TIMBERLINE survey reported that heat directed against the drivers and assistant driver's legs was excessive and that heat distribution within the hardtop enclosure was uneven.

g. The electrically operated damper actuator of the test kit controlling heat to the battery compartment of the test kit operated adequately; however, 31 of 50 operators interviewed during TIMBERLINE reported that the actuator was not reliable in operation. Inspection revealed that the hose to the battery compartment of 31 kits had been disconnected to prevent heat damage to the batteries (Test No 5).

h. The defroster controls and ducting operated satisfactorily; however, at ambient temperatures below -28°F, hot air deflected against the windshield defrosted only one-fifth of the windshield area. The defrosters could not remove ice from the outer surface of the windshield. Each of the 50 TIMBERLINE kit operators interviewed, reported this same deficiency (Test No 3). The defroster cracked both windshields on the test kit once at an ambient temperature of -4°F and again at -28°F ambient. Inspection of 50 kits during TIMBERLINE revealed that the defrosters had cracked 38 right and 30 left pieces of windshield glass (para I.1, Annex B).

i. The handles for the glass panels in the right and left door functioned adequately during test. No failures were reported during the TIMBERLINE survey.

j. The door latch handles were capable of latching and holding the doors closed; however, the process of latching the doors was confusing. If the handle was turned in the wrong direction, the handle stop was damaged (para A.12, Annex B). In addition, the steel latch on the door handles caused excessive wear against the door pillar posts. (Para I.6, Annex B). These failures were also reported by all fifty TIMBERLINE kit operators (Test No 5).

k. The engine preheat controls on the test kit and on the 50 kits inspected during TIMBERLINE were found to be suitable in all respects.

l. The seals (caulking material) for the side panels of the hardtop were satisfactory but unsightly (para A.2, Annex B). The seal used to seal the roof panels caused the paint to flake away from the top seams (Test No 5). The filler neck seal on the left door was too small and did not adequately seal the door around the filler neck. The seal came loose and fell from the door of the test kit on two occasions. Inspection of 50 TIMBERLINE kits revealed the seal to be too small on all vehicles and that 37 of the 50 seals had loosened from the door. Of these 37, 13 seals were missing (para I.5, Annex B).

m. The hood cover and fasteners on the test kit were found suitable; however, 32 of 50 operators interviewed during TIMBERLINE reported that the cover was difficult to fasten at the right and left front and that when the hood was lowered the cover caught on the blackout driving light.

n. The flap on the radiator brush guard cover could not be fastened at ambient temperatures below -10°F (para III.1, Annex B). At these low temperatures, the canvas flap appeared to harden and shrink.

o. The electric slave outlet was suitable in all respects.

p. The fresh air intake hose routed along the floor of the vehicle decreased cargo and passenger space. The hose was pulled loose from the heater by passengers entering and leaving the rear of the vehicle (para I.8, Annex B).

q. When chains were used on the rear wheels, the cross links struck and damaged the heater exhaust pipe (para I.3, Annex B). During the TIMBERLINE survey, this failure was found to exist on two of three vehicles on which chains had been installed.

r. The sound of air rushing through the fresh air intake made it difficult for the vehicle operator to converse through the opened left door glass (para I.9, Annex B).

C. Test No 3 - Comfort and Safety:

1. PURPOSE: To determine whether the test kit had any features which adversely affected the comfort and safety of the crew or passengers.

2. METHOD: Throughout the conduct of all operational tests, the test kit was operated in accordance with instructions contained in the maintenance package. Observations were made with respect to any safety hazards encountered and any discomfort suffered by the crew and passengers. The following data were recorded:

a. Discomfort suffered by the crew or passengers as the result of the test kit operation.

b. Safety hazards experienced by the crew or passengers as the result of test kit operations.

3. RESULTS:

a. An uncomfortable amount of hot air was diverted from the heater of the test kit against the drivers right leg and the assistant driver's left leg (Test No 2). This failure was also reported by 20 of 50, M151 operators interviewed during exercise TIMBERLINE.

b. Because the heat diverter assembly directed all hot air to the front of the vehicle, the front seat frames became so hot that they could not be safely touched with the bare hand (Para I.4, Annex B).

c. A safety hazard resulted from the inability of the defroster to adequately defrost and remove ice from the windshield and to defrost other glass panels of the hardtop enclosure. At ambient temperatures below -28°F, all glass panels in the hardtop enclosure became completely frosted and vision through the windshield was reduced by 80 percent within one and one-half hours of vehicle operation (Para I.2, Annex B).

d. Because the door handles on the inside of the vehicle were located to the rear of the driver and the assistant driver, it was difficult to reach to the rear and open or latch the doors (Para III.3, Annex B).

D. Test No 4 - Maintenance:

1. PURPOSE:

a. To determine whether maintenance of the test kit could be accomplished readily.

b. To accumulate data pertaining to man-hours expended in maintenance.

c. To review the maintenance package for the purpose of recommending necessary changes, deletions, additions, and corrections.

d. To accumulate parts usage data.

2. METHOD: Using appropriate tools and skills, all necessary maintenance was performed on the test kit in accordance with instructions contained in the maintenance package. First echelon maintenance was performed in an unsheltered area by operator personnel attired in appropriate arctic winter clothing. Scheduled second echelon maintenance, unscheduled second echelon, and field maintenance required as the result of test operations was performed as necessary. The following data were recorded:

a. Average man-hours required to perform daily first echelon maintenance.

b. Average man-hours required to perform scheduled second echelon maintenance.

c. Total miles of operation.

d. Total cycles of heater operation.

e. Total hours of heater operation.

f. Difficult maintenance operations.

g. Adequacy of on-vehicle (M151) and organizational tools to perform first and second echelon maintenance respectively.

h. Adequacy of the maintenance package with respect to the performance of first and second echelon maintenance.

3. RESULTS:

a. The test kit required a total of 18.25 man-hours to perform all first echelon maintenance for 6,350 miles and 481 hours of heater operation during which the heater completed 498 timed start-run-purge cycles (Test No 5). An average of 0.10 man-hours was required to perform daily first echelon maintenance.

b. Scheduled second echelon maintenance could be performed equally well both indoors and under field conditions. The average time required to perform scheduled second echelon maintenance was 0.62 man-hours.

c. There were no difficult or time consuming maintenance operations.

d. On vehicle and organizational tools were adequate for the performance of first and second echelon maintenance respectively.

e. The maintenance package was adequate for the performance of first and second echelon maintenance with the exceptions that instructions for replacing the handles on the door glass and the part number of the glue required were not provided (Para III.2, Annex B).

f. There were no test kit parts expended in maintaining the test kit; however, two windshield glass panels were replaced because of cracks caused by the defrosters (Test No 2).

E. Test No 5 - Durability and Reliability:

1. PURPOSE: To determine whether the test kit was durable and reliable when mounted on the Truck, Utility, $\frac{1}{4}$-ton 4x4, M151.

2. METHOD:

a. The test kit was operated during all types of weather available during the test period. The test kit was operated on highways, cross-country and on secondary roads.

b. The personnel heater was operated in cycles by starting, then running for fifteen minutes, purging, and then being turned off for five minutes.

c. The following data were recorded:

(1) Actual vehicle miles, hours, and cycles of heater operation.

(2) All defects, malfunctions, and failures which adversely affected operation of the test kit-M151 vehicle combination.

3. RESULTS:

a. Miles of vehicle operation: 6,350

b. Hours of heater operation: 481

c. Cycles of heater operation: 498

d. The following defects, malfunctions, and failures adversely affected the efficient operation of the test kit-M151 vehicle combination.

(1) The defrosters failed to adequately defrost the windshield and frost completely covered all glass panels in the hardtop enclosure (Tests No 2 and 3).

(2) The electrically controlled damper actuator failed on 31 of 50 kits used during TIMBERLINE (Test No 2).

(3) The steel door latches scraped against and caused excessive wear to the aluminum door pillar posts of the hardtop enclosure (para I.6, Annex B).

(4) Paint flaked away from the seams on the top of the hardtop enclosure because of the sealer used to seal the roof panels (Para I.7, Annex B).

(5) The defrosters cracked both windshield panels on the test kit-vehicle combination. A total of 38 right and 30 left windshield panels were cracked by defrosters on 50 kits used during TIMBERLINE (Test No 2).

(6) The filler neck seal failed to adequately seal the left door (Test No 2).

Part III - Annexes

ANNEX A

REFERENCES

A. DA Project No 546-09-020. RDB Priority No: Unknown.

B. Reports of Equipment Failure No 1 through 16, Project No 23-OBT, U. S. Army Arctic Test Board.

C. OTCM Item 34266, 6 May 1962.

D. Ltr, ATDEV-2 428, HQ, USCONARC, 2 July 1962, subject: "Report of Project No ATB 2-232, Service Test of Winterization Kit for Truck, Utility, $\frac{1}{4}$-Ton, 4X4, M151," with one inclosure.

ANNEX B

LIST OF EQUIPMENT FAILURES

PART A

DEFICIENCY/SHORTCOMING - PREVIOUS TEST	FINDINGS THIS TEST
A.1 The left front of the assistant driver's seat struck the defroster hose when the seat was tilted forward.	The hose had been relocated. Seat did not strike hose.
A.2 Weatherstrip material provided did not properly seal component panels to each other or the assembled kit to the body of the M151, $\frac{1}{4}$-ton.	Caulking compound was used to seal the body panels. Seal was adequate but unsightly.
A.3 The damper actuator assembly solenoid failed.	No visible modification was apparent. The solenoid did not fail during this test.
A.4 The electrical components of the damper actuator assembly were not protected by a circuit breaker.	A circuit breaker was not provided. No failure occurred during test.
A.5 The door lock plungers did not automatically engage the latch plate.	A new type steel latch was provided, however, the steel latch caused excessive wear to the aluminum striker post (para I.6, Part B).
A.6 The hot air inlet tube broke loose from the insulated battery box cover.	No visible modification was apparent. The inlet tube did not fail during this test.
A.7 The heater diverter assembly did not evenly distribute heat within the M151 personnel compartment.	This deficiency was not corrected (para I.4, Part B).
A.8 The battery compartment heat damper actuator failed to close off the hot air to the battery compartment.	This failure did not occur with the test kit; however, inspection of 50 kits during the winter maneuver Timberline revealed 31 failures of this nature.

DEFICIENCY/SHORTCOMING - PREVIOUS TEST	FINDINGS THIS TEST
A.9 The defroster failed to clear ice from the outer surface and failed to completely keep the inner surface of the windshield frost free.	No visible modification was apparent and the same failure recurred during test (para I.2, Part B).
A.10 Heat supplied from the personnel heater and ducted to the defroster diverter caused the right and left windshields to crack.	This failure was not corrected and was a recurring failure during this test (para I.7, Part B). Of 50 kits inspected during Timberline heat from the heater had broken 68 of 100 pieces of windshield glass.
A.11 The lower door hinges tore away from the door hinge support panel and the upper hinge on the left door loosened from the hinge support panel.	Defect was corrected by reinforcing the hinges and door panels. Failure did not recur during this test.
A.12 The door latch plunger and striker plate failed to lock the door in a closed position.	Defect was corrected, however, operation of the door latch was confusing. If turned in the wrong direction, the latch handle stop was damaged.
A.13 The eyelets on the hood cover caught and bent the fasteners along the top of the radiator brush guard.	There was no apparent correction of this defect. Failure did not recur during test because of special precautionary instructions given to operators.
A.14 Insulation material on the battery compartment cover and the gas tank came loose.	No visible modification was apparent. No failures were observed during test.
A.15 The hood, with hood cover installed, could not be fastened to the lock catch at the top center of the windshield.	Corrected. A hole in the cover was located over the catch on the hood.
A.16 The flame detector switch failed.	The failure did not recur during this test.

DEFICIENCY/SHORTCOMING - PREVIOUS TEST	FINDINGS THIS TEST
A.17 The felt used to line the left and right side tracks of the door window frames failed.	A new type runner was provided which remained serviceable during this test.
A.18 The front and rear sections of the door glass overlapped and made cleaning difficult.	The glass was cut so that there was a $1\frac{1}{4}$-inch overlap. Cleaning the glass was not difficult.
A.19 The door glass handles came loose from the glass.	No visible modification was apparent. The failure did not recur during this test.
A.20 Frost collected on the interior of the aluminum hardtop enclosure.	Vapor barrier insulation was installed on the inside of the roof. Frost did not collect on the interior of the enclosure during this test.
A.21 The fresh air intake hose decreased storage and passenger space. The hose was pulled loose from the heater by passengers entering or leaving the vehicle.	The defect was not corrected. The same failure occurred during this test (para I.8, Part B).
A.22 The flap on the brush guard cover could not be fastened in the closed position at ambient temperatures below -10°F.	The defect was not corrected. The same failure recurred during this test (para III.7, Part B).
A.23 The sliding glass panels slid open when the vehicle was in motion.	A felt seal was installed on one of the two glass panels on each door where they overlapped. The glass did not slide open during this test.
A.24 Noise created by air rushing into the air intake was excessive. The intake was located too close to the driver.	The defect was not corrected. The same failure occurred during test (para I.9, Part B).
A.25 The fuel filter failed to adequately filter fuel entering the fuel control valve.	No visible modification was apparent. This failure did not recur during this test.

DEFICIENCY SHORTCOMING - PREVIOUS TEST	REMARKS - THIS TEST
A.26 The hood cover had to be unsnapped to raise the hood.	No modification was made. No failure occurred during this test, however, inspection of 50 kits during Timberline revealed that 31 covers had not been snapped because it was difficult and time consuming.
A.27 The engine priming system was considered to be non-essential.	The engine priming system was not removed. It was neither used nor required during test.
A.28 The insulation material provided for the transmission cover had been incorrectly precut and could not be installed.	Corrected.
A.29 A maintenance package was not provided with the winterization kit.	A maintenance package was provided (Instruction and parts listing for the personnel heater were not initially available, but were later provided, para II.1, Part B).
A.30 The fuel pump and filter could not be mounted on the bracket provided.	Corrected.
A.31 The pin on the control arm of the exhaust diverter was broken, upon receipt of materiel.	No visible modification was apparent. The pin remained serviceable during this test.

III.B.4

PART B

SECTION I

This section contains deficiencies requiring elimination in order to make the item acceptable for use on a minimum basis.

DEFICIENCY	SUGGESTED CORRECTIVE ACTION	REMARKS
I.1 The defroster cracked the right and the left windshield glass.	Provide a means of defrosting the windshield that will not break the glass.	Test No 2, Part II. Report of Equipment Failures No 3, 6, and

DEFICIENCY	SUGGESTED CORRECTIVE ACTION	REMARKS
I.2 The defroster failed to adequately defrost the windshield and other glass in the hardtop enclosure.	Provide a defroster which will defrost the windshield and other glass.	Test No 2, Part II. Report of Equipment Failure No 4.
I.3 When chains were installed on the M151 vehicle, the cross chains hit and damaged the heater exhaust pipe.	Protect the exhaust pipe with a metal shield.	Test No 2, Part II. Report of Equipment Failure No 7.
I.4 The distribution of heat within the vehicle was uneven. Excessive heat was directed against the driver's right leg and the assistant driver's left leg. The seat frame became too hot to touch with the bare hand.	Provide even heat distribution without directing excessive heat on the legs of the driver and assistant driver, or against the seat frame.	Test No 2, Part II. Report of Equipment Failures No 8 and 11.
I.5 The filler neck seal on the left door did not adequately seal the door around the filler neck and it loosened and fell off.	Provide a larger seal and permanently fasten it to the door.	Test No 2, Part II. Report of Equipment Failure No 9.
I.6 During closing of the doors, the door latch scraped against and cut the aluminum striker plate post.	Provide a protective plate for the post.	Test No 5, Part II. Report of Equipment Failure No 10.
I.7 Paint flaked away from the seams on the roof of the hardtop because of the sealer which was used in the seam.	Eliminate a requirement for the seal.	Test No 5, Part II. Report of Equipment Failure No 15.
I.8 The fresh air intake hose decreased cargo and passenger space. The hose was pulled loose by passengers entering or leaving the vehicle.	Relocate the fresh air intake hose.	Test No 2, Part II. Report of Equipment Failure No 40 (para D, Annex A).

DEFICIENCY	SUGGESTED CORRECTIVE ACTION	REMARKS
I.9 It was difficult for the operator to converse with persons outside the vehicle because of the sound of air rushing through the the fresh air intake.	Relocate the fresh air intake hose.	Test No 2, Part II. Report of Equipment Failure No 39 (para D, Annex A).

SECTION II

This section list deficiencies and shortcomings in the item which were discovered during the test and satisfactorily corrected prior to completion of the test. They no longer represent a defect in the item tested. The correction must be applied to the production model of this item.

DEFICIENCY/SHORTCOMING	REMARKS
II.1 Operating instructions and a parts listing were not provided for the personnel heater.	Test No 4, Part II. Report of Equipment Failure No 1. Instructions and parts list were provided during the test.

SECTION III

This section contains shortcomings which should be corrected, if it can be done without unduly complicating the item or inducing another undesirable characteristic, either concurrent with elimination of the deficiencies in Section I, or in production engineering, or by product improvement.

SHORTCOMING	SUGGESTED CORRECTIVE ACTION	REMARKS
III.1 The flap on the radiator brush guard cover became hard and could not be fastened in the closed position during ambient temperatures below -10°F.	Provide a flap that can be fastened at temperatures below -10°F.	Test No 2, Part II. Report of Equipment Failure No 2.
III.2 Instructions for attaching the handle on the door glass and a part number for the glue required were not included in the maintenance package.	Include instructions and part number in maintenance package.	Test No 4, Part II. Report of Equipment Failure No 1.

SHORTCOMING	SUGGESTED CORRECTIVE ACTION	REMARKS
III.3 Because the inside door handles were located to the rear of the driver and the assistant driver, they were difficult to reach and turn.	Provide door handles which are easy to turn and latch.	Test No 3, Part II. Report of Equipment Failure No 16.

US ARMY ARCTIC TEST BOARD

FORT GREELY, ALASKA

PROJECT NO 1D-3776-60 27 NOV 63 NEGATIVE NO 125-1

CHECK TEST OF WINTERIZATION KIT FOR TRUCK,

UTILITY, $\frac{1}{4}$-TON, 4X4, M151

M151 TRUCK WITH TEST WINTERIZATION KIT INSTALLED

III.C.1

ANNEX D

Vehicles included in the arctic winter maneuver "TIMBERLINE" survey are listed below:

Organization	USA No	Bumper No
136th Ord, Yukon Command	2D1846	DS 7
136th Ord, Yukon Command	2D1775	DS 71
136th Ord, Yukon Command	2D1859	DS 11
136th Ord, Yukon Command	2D1948	DS 1
24th Ord (DS)	2D1780	DS 37
17th Signal Detachment	2D1714	SV 45
USARAL Signal Company	2D1975	Sig 1
Yukon Command MP	2D2017	MP 1
USARAL MP		MP 1
USARAL MP		MP 2
USARAL MP		MP 3
USARAL MP		MP 4
USARAL MP		MP 5
USARAL MP		MP 6
SCMTX1	2D1763	
4th BG, 23 Infantry, 37 Artillery	2D1853	HQ 4
4th BG, 23 Infantry	2D1721	
4th BG, 23 Infantry	2D1782	
4th BG, 23 Infantry	2D1887	E-6
4th BG, 23 Infantry	2D1924	HQ 9
4th BG, 9 Infantry	2D2005	HQ 66
4th BG, 9 Infantry	2D1861	A-2
4th BG, 9 Infantry	2D1749	A-1
1st Direct Support Group	2D1833	HQ 6
YC110T	2D1949	TRK 44
65 Transportation Co (Hel)	2D1804	Hel-1
65 Transportation Co (Hel)		Hel-3
65 Transportation Co (Hel)		Hel-9
MP Fort Greely	2D1886	TMP 33
MP Fort Greely	2D1897	TMP 34
MP Fort Greely	2D1928	TMP 35
MP Fort Greely	2D1918	TMP 36
18th Engineer	2D1867	YC 18
48th Engineer	2D1911	DS 20
48th Engineer	2D1832	DS 1
48th Engineer		DS 32
48th Engineer	2D1911	DS 20
Support Command	2D1781	DM-1
Support Command	2D1957	TMP-100
Support Command	2D1939	SV X-1
Support Command	2D2021	MP-4

Organization	USA No	Bumper No
56th Engineer	2D1835	CON-31
56th Engineer	2D1897	CON-6
548th Engineer	2D1931	HQ 8
548th Engineer	2C8770	HQ 2
521st Transportation Truck Co	2D1961	TK 6
521st Transportation Truck Co	2D1725	TK 100
521st Transportation Truck Co		TK 200
521st Transportation Truck Co		TK 300
521st Transportation Truck Co		TK 400

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AD_____ ACCESSION NO_____

United States Army Arctic Test Board, APO 733, Seattle, Washington WINTERIZATION KIT (-65°F) FOR THE TRUCK, UTILITY, ¼-TON, 4X4, M151. Final Report of Check Test of 29 May 1963. DA Project No 546-09-020. USATECOM Project No 1-3-7760-60-D. Unclassified Report. Tests were conducted to determine if the Winterization Kit had been sufficiently modified to make it suitable for Army use under arctic winter conditions. Test results and results of a survey made of 50 kits used during the 1963 arctic winter maneuver TIMBERLINE revealed that the defrosters were inadequate and cracked the windshield, the damper actuator failed, the canvas hood and brush guard cover were difficult to fasten at low ambient temperatures, and heat distribution in hardtop enclosure was uneven. The engine primer pump and the starter drive detent control assemblies were not required. The test kit was found to be satisfactory with respect to durability and maintenance, and unsatisfactory with respect to functional suitability, ease of operation, compatibility of components, comfort, safety, and reliability. It was concluded that the test kit required modification to make it suitable for Army use under arctic winter conditions. It was recommended that the winterization kit (-65°F be modified and returned for check test.

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