

THIS BOOK CON-
TAINS ADDED
SECTION ON
TROPICAL MAIN-
TENANCE

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**DRIVER'S
HANDBOOK**
FOR
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(CANADIAN)
AIRPORTABLE

• **KEEP IN TOOL KIT** •

HB-TPL/1

VEHICLE HANDBOOK SUPPLEMENT ON TROPICAL MAINTENANCE

**A PRELIMINARY SURVEY OF
POTENTIAL TROUBLES AND
THEIR PREVENTION IN THE FIELD**

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INTRODUCTION

The operation of vehicles in tropical territories entails certain potential troubles not normally encountered in more moderate or cold climates. These may be classified in general as:—

- (a) Fungus growth (mould)
- (b) Attack by insects (termites)
- (c) Rapid corrosion (rusting)

Much work is being done in the production of new vehicles to make them more nearly proof against such conditions. Some tropic-proofed components are already in production and others will soon follow; also additional tropic proofing will be introduced as development work is completed. In the meantime, reliable performance of existing vehicles is dependent upon intelligent and careful maintenance.

By no means all of the information gathered from operation of vehicles in the tropics has yet been put into a form suitable for practical application. Considerable information of a useful nature is available, however, and it is the purpose of this supplement to provide the best summary possible at this time for the information and guidance of field maintenance personnel.—The subject matter is presented in the following general manner:

PART I.—POTENTIAL TROUBLES—General Survey
of Nature, Extent and Prevention.

PART II.—PREVENTIVE MAINTENANCE—Classifications
and Recommended Practices.

PART III.—PROTECTIVE MATERIALS—General Types—
Specifications—Substitutes.

PART IV.—TABLE OF TROUBLES AND THEIR
REMEDIES.

As more information becomes available it will be incorporated in revised editions of this supplement, i.e., HB-TPL/2, etc. Eventually, the subject matter will be incorporated into the handbook proper.

PART I.—POTENTIAL TROUBLES

This Part (1.) deals with the "whys" and "wherefores" of possible tropical difficulties and is intended chiefly for supervisory personnel.—Practical applications are dealt with in Parts II., III. and IV.

In making this brief survey of potential troubles it is not intended to convey the impression that serious difficulties are bound to occur. On the contrary, it is important that it be recognized that there is little to be encountered which thoughtful and timely maintenance will not prevent. The only object of this review is to establish the factors involved, so that the reasons for special precautions will be better understood and maintenance thus more accurately directed.

Fungus Growth (Mould)

Nature :

Fungus growth, or mould, is a form of plant life which develops from tiny living organisms called "spores", so small that they are readily carried in the air. The main source of these airborne fungus spores is the soil, although they also enter the air direct from parent moulds growing above ground.

Unlike ordinary plants which thrive on inorganic (other than plant or animal) matter, moulds can live only on organic (plant or animal) matter. Mould on an orange or on cotton is an example of fungus growth on plant matter; mould on leather boots or on wool is an example of fungus growth on animal matter.

Note: Surface mould may be found even on metal, but this only occurs when some form of plant or animal (such as vegetable oil or grease, or just dirt) is present to provide a source of food.

Moulds feed on and thus destroy, or rot, the material upon which they are growing. The degree and rate of destruction of the "parent" material varies considerably, depending as it does upon the nature of the material itself, the type of fungus, and the atmospheric conditions. It may, however, be taken as certain that, except in the case of surface mould referred to in the note above, healthy mould will sooner or later destroy the structure of the material upon which it is feeding.

Fungus Growth (Mould)—Continued

Extent :

Fungus spores are present in the air in all territories. All that they need for development into mould are proper conditions of suitable food and moist, warm surroundings. Suitable food is available to them in all territories, but the tropics provide the most favourable climatic conditions and moulds flourish accordingly. They especially like closed-in, dank places.

Moulds can be rather a serious problem with certain types of stores and equipments, in fact wherever untreated plant or animal materials are used. In the case of vehicles, however, there is little in the way of basic food on which moulds may feed and the problem is not a serious one. The vulnerable spots will be (i) tarpaulins and curtains, (ii) fibre ropes, (iii) leather and cloth upholstery and webbing, (iv) fabric coverings on electrical wiring and, to a lesser degree, (v) wood.

Prevention :

In general, any protective coating which keeps moisture from direct contact with the material to be protected will prevent harmful fungus growths. The best of such protective coatings contain a fungicide (fungus poison) which prevents even surface mould.

Note: Some of these protective materials also contain an insecticide (insect poison) for protection against harmful insects which also attack some of the same materials. (See under "Attack by Insects".)

When suitable protective materials are not available, or where application in the field is for other reasons impractical, keeping the parts as clean and dry as possible will prove of great help. This is especially true in the case of fabrics, such as tarpaulins, curtains, etc.

Note: Fungicide treatment of electrical wiring, tarpaulins, upholstery, ropes, etc., is one of the tropic-proofing items being instituted in new vehicle production.

Attack by Insects (Termites)

Nature:

The nature of this tropical condition is self-explanatory from the title. It is a matter of direct attack by destructive insects on certain materials into which they burrow.

Extent:

Although the general subject of tropical insects is an extensive one, it is confined here to termites (commonly called "white ants" although not actually related to the ordinary ant) which attack chiefly wood and wood products. Given the opportunity, termites will in a remarkably short time eat out the interior of wood-work until it is a mere shell.

Prevention:

The best defence against termites is the use of an insecticide (insect poison). This is somewhat difficult even in vehicle production and for this and the further good reasons of rotting and warping, the use of wood is being held to a minimum in new vehicles headed for the tropics. Where still used, all wood will be treated with preservatives before prime and finish painting. Equivalent preventive measures should be exercised in the field to the degree that is practical.

Rapid Corrosion (Rusting)

Nature:

Corrosion is now considered to be completely explained only by what is known as the "Electrolytic Theory". In all its detail this theory is a rather complicated one combining unpleasantly large doses of both electricity and chemistry. For the purposes of this review, however, it may be simplified into the following:

Corrosion is possible only when oxygen (air) is present with water or moisture to act as an electrolyte (in the manner that a solution of sulphuric acid does in a wet battery).

Metallic materials in the presence of water create electrical forces which, in turn, cause chemical reactions between the metal and the water (also similar to the battery).

The first reaction is the combining of some of the metal with one part each of hydrogen and oxygen gases of which water

Rapid Corrosion (Rusting) Nature—Continued

is made (H_2O). But since there are two parts of hydrogen to each part of oxygen in water, one spare part of hydrogen is left over.

If no outside source of extra oxygen is available for the spare part of hydrogen to combine with, the action stops here because, strangely enough, the free hydrogen forms an insulating film over the metal and prevents further electro-chemical action. If, however, an outside supply of free oxygen (air) is available, this will combine with the free hydrogen and allow the process of corrosion to continue.

Note: The above explains the fact that rusting of metals immersed in water is much slower than that which takes place in the air. The reason is that only small amounts of free oxygen are present under water and very large amounts in the air.

Extent:

As is well known, rusting occurs to some degree in all climates. It is particularly rapid in the moisture-laden atmosphere of the tropics where condensation normally occurs at least once each day. The heat also tends to speed up the process, and should salt water also be present the rate of corrosion is greatly accelerated.

The rapid corrosion of metal parts is by far the most troublesome condition which must be dealt with in the tropics. It requires particular attention where vehicles are operating along beaches and are continuously in and out of salt water. Ordinarily, the electrical system is most subject to trouble, more particularly at connection points. However, under the worst conditions of beach operation all bare metal parts which may be reached by splash or spray will also require attention. In this latter category are such items as brakes, controls, lower sections of radiators, etc.

Prevention:

From the nature of corrosion it is obvious that the most effective preventive measure is to keep moisture off vulnerable parts. This is quite simple with most stationary parts not subject to rubbing; it is more difficult with working parts and stationery parts which are subject to rubbing. In all instances, prevention consists of applying a suitable protective material in accordance with the nature and function of the part.

PART II.—PREVENTIVE MAINTENANCE

As indicated in the foregoing introduction and general survey of conditions to be dealt with, preventive measures against possible tropical difficulties consist of a combination of well planned maintenance and the application of suitable protective materials. In this chapter are given recommended practices and procedures under their several sub-headings of normal Preventive Maintenance. Reference is made, as required, to Parts III and IV which deal with specialized Protective Materials and their applications to specific troubles.

NOTE: Tropic-proofed assemblies (generators, etc.) used in future vehicle production and supplied as spares will be identified by a Yellow or a Red paint marking (Yellow is actually the marking for wade-proofed assemblies but they are also tropic-proofed). Obviously these assemblies will not require the same degree of attention. They should, however, continue to be included in visual inspection and external cleaning procedures.

Lubrication

Vital under all conditions, efficient lubrication is a double "must" in the tropics and normal routine should be amplified in the following respects:

- (1) More frequent complete vehicle lubrication.
- (2) Extra care to see that ample fresh lubricant is added at all exposed points.
- (3) Daily oil can lubrication of all linkages and similar friction points.
- (4) Weekly draining of water and sediment from the oil cleaner, engine crankcase and gear cases.
- (5) Weekly application of a suitable lubricant to battery posts and terminals.

Notes on Lubricants:

- (a) Where available, special anti-corrosive oil (see under Part III) should be used for oil can lubrication.
- (b) Grease G.S. (or equivalent) is a good moisture-proofing material. It should be used freely in all suitable applications where such protection is required.

Inspections

In the performance of daily maintenance tasks in tropical territories, one of the most important functions is that of thorough inspection of components to detect signs of trouble so that timely preventive measures may be taken. Such inspection should include the following items, listed in table form for convenient reference.

PART(S)	INSPECT FOR—
(1) All painted body and sheet metal surfaces.	Signs of rusting at dented, chipped and scratched places; or at body welds and seams.
(2) Latches, hinges, stowage compartments.	The start of harmful rusting.
(3) All linkage controls, including carburetor.	Signs of rusting and sticking.
(4) Wheel and hub bolts, studs and nuts.	Signs of rusting.
(5) Fuel and brake lines.	Signs of rusting.
(6) Fuel tanks.	Rusting at seams or/and welds.
(7) Engine starter, generator and ignition systems; other electrical wiring.	Signs of harmful rusting at connection points or/and mould on covered wiring.
(8) Seat coverings, tarpaulins, curtains, webbing, fibre ropes, etc.	Signs of mould.
AND IN BEACH OPERATIONS AT LEAST:-	
(9) Chassis under-carriage.	Signs of harmful rusting.
(10) Radiator lower tank and core.	Signs of rusting.
<p>Note: See Part IV for recommended corrections for specific troubles which may be encountered.</p>	

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