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Improvised Repairs to Wheeled Vehicles in the Field

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**THESE HINTS ARE EMERGENCY MEASURES
AND WILL ONLY BE ADOPTED ON
OCCASIONS OF EMERGENCY IN THE FIELD**

THE WAR OFFICE,
July, 1943.

FOREWORD

The notes contained in this pamphlet describe emergency measures which may be taken by drivers in the event of breakdown of their vehicles in the field.

These are temporary expedients to keep vehicles on the road until such time as proper technical assistance can be obtained.

These measures will only be adopted in emergency and not during training in the United Kingdom.

They should be considered in the same light as the following simile :—

If a man breaks a blood-vessel, you apply a tourniquet as a temporary expedient. If you left it there for long, the limb would atrophy, so at the earliest possible moment you get the patient to a doctor, who gives the correct expert treatment.

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IMPROVISED REPAIRS TO WHEELED VEHICLES IN THE FIELD, 1943.

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1. THE ENGINE PROPER.

(a) Big-End Failure.

(i) *If knock is slight.*

REMEDY. Remove Sparking Plug in case of petrol engine and earth H.T. of plug. In case of Diesel Engines remove injector and bend injection pipe to discharge fuel oil into a container suitably placed. Ensure that oil in sump is at correct level. Drive on carefully, pressure on particular piston now reduced.

(ii) *Complete Failure of Bearing.*

REMEDY. Drain engine oil into clean receptacle, remove sump, taking care not to damage sump gasket. Remove connecting rod and piston and seal the oil drilling on crank pin journal by means of a Jubilee clip and small piece of jointing, as fitted to Radiator hose. Alternatively fit a wooden plug with outer end slotted to take wire binding. This step will ensure maintenance of oil pressure. Re-fit sump with gasket, refill with oil to correct level and proceed carefully to destination, keeping engine revs. to a minimum because of "out of balance forces".

NOTE. If clip has been removed from Radiator hose, bind hose tightly with cord or wire.

(b) Engine Sump.

(i) *Slight damage to sump through shot hole or striking by rocks.*

REMEDY. Plug hole with wood and/or cloth, turn engine over by hand to ensure that big-ends are clear of plug. Check oil level in sump.

(c) **Valves.**

(i) *Petrol engine — Sticking Valves.*

REMEDY. Disconnect air cleaner and inject some fuel oil or engine lubrication oil into the carburettor intake, or, remove valve covers, speed up engine in excess of idling speed, and spray valve stems and guides with a mixture of petrol and lubricating oil.

(ii) *Diesel Engine — Sticking Valves.*

REMEDY. Turn engine over slowly by hand and apply fuel oil to valve stem. The piston will close the valve and the rocker will open it. A few slow turns of engine will indicate if the valve can be made to work. Further, examine valve spring and if valve is sticking owing to broken or weak spring, a separate spring can often be tied on overhead to assist closing of valve and enable cylinder to function efficiently.

NOTE. A stuck open valve would probably result in serious damage to cylinder components.

REMEDY. Action as in 1 (a) (ii) and remove injector as 1 (a) (i).

(iii) *Valve springs broken.*

REMEDY. Remove broken spring and replace with flat ends together. Shortening of spring can be compensated by inserting suitable size plain washer between flat ends. The valve must then be held on to its seat in order to compress spring and insert washer. Method adopted will depend upon type of engine. Generally speaking, a screwdriver or flat bar inserted through plug hole will enable job to be done.

(d) Gaskets, Cutting of.

(i) *Inlet or exhaust manifolds.*

REMEDY. Smear manifold flange with oil or paint, place jointing over flange and press firmly. Remove jointing and cut away portions not required with scissors or sharp knife.

(ii) *Thin Gaskets for any flanges.*

METHOD. Press jointing firmly on to a surface to make good impression. Cut away material not required by light taps with hand hammer.

NOTE. Check to ensure that finished joint will not blank off essential openings.

2. LUBRICATION SYSTEM.

(a) Oil Filter.

(i) *Outer casing damaged.*

REMEDY. By-pass the oil filter from circuit by connecting the filter inlet pipe to the outlet pipe by means of rubber tubing. Bind well with cord or wire. Observe the oil pressure at frequent intervals.

(ii) *Pipe to pressure gauge.*

REMEDY. If slight fracture bind with cloth and wire. If fractured, close up pipe end on engine side of fracture by hammering or squeezing in order to seal lubrication system; pressure gauge will now be out of action. Check effectiveness of repair with engine running. Check sump oil level (wet sump system) and oil container level (dry sump system) at frequent intervals.

3. COOLING SYSTEM.

(a) Fan belt.

(i) *Clean break.*

REPAIR. Drill or pierce a series of staggered holes on either side of break. Lace together

neatly with ends butting by means of thick copper wire or leather bootlace. Refit belt and leave as slack as possible.

(ii) *Temporary fan belt.*

Use a leather strap. Overlap ends to correct circumference and lace up with copper wire or leather bootlace, or, use an oversize belt, cut out length to leave suitable overlap, which should consist of flat scarf. Drill or pierce holes in scarf and wire up, or, carefully splice a piece of suitable rope to correct length and refit.

(b) **Fan.**

(i) *Blade broken.*

REMEDY. Remove damaged and opposite blades to maintain balance.

(c) **Radiator.**

(i) *Shot through radiator header or bottom tank.*

REMEDY. Plug with wood and cloth.

(ii) *Small radiator leaks.*

REMEDY. A handful of fine sawdust put inside radiator will block openings due to expansion. If at hand, pea flour or pea soup boiled up in radiator will exude through small cracks and harden up for an effective repair. Chewing gum applied externally as necessary will make a good temporary repair. Soap should only be applied as a last resort as it makes the ultimate repair a difficult job.

(iii) *Shot through Honeycomb Radiator.*

REMEDY. Cut two pieces of inner tube and two pieces of board to suitable sizes. Place over damaged portion, boards inside and out, with rubber next to the radiator and secure with bolt and nut.

(iv) **Damaged Tubular Radiator.**

REMEDY. Cut out damaged portion and either close open ends of tubes with suitably shaped wooden plugs or close ends of tubes by means of pliers.

(v) **Radiator hose, damaged.**

REMEDY. Bind with canvas or cloth strips. Secure with tight wrapping of cord or wire. Again bind over if necessary to make effective repair.

(d) **Defective circulation of water—due to :-**

(i) Insufficient water (leakages in system).

(ii) No forced circulation of water due to pump not working (broken pump spindle or faulty fan belt drive.)

(iii) Ineffective cooling of water (defective fan).

REMEDY. Proceed slowly until temperature gauge reads high, stop vehicle, switch off engine and allow to cool — opening bonnet to expedite this. After cooling, top up with water as necessary and repeat procedure.

NOTE. If pump impeller is removed and spindle glands sealed to prevent water leakage, the thermosyphonic action is improved.

(e) **Thermostat.**

Faulty action resulting in restriction of water flow.

REMEDY. If possible remove complete thermostat, if not possible to remove, enlarge the circulation hole in its flange to increase quantity or flow.

4. PETROL SYSTEMS

Defective fuel supply to engine may be due to :-

(a) **Loss of petrol due to damage to component parts.**

(i) *Fuel Tank Leaking.*

REMEDY. Small leaks can often be sealed with chewing gum applied over damaged portion. Soap softened by kneading and then forced into cracks and small holes will effect a temporary repair. Larger holes require suitably shaped wooden plugs.

(ii) *Damaged Petrol Pipes.*

REMEDY. For cracks wrap pipe with rag and bind tightly with insulation tape, cord or wire. If pipe is fractured badly, kinked or flattened, cut out defective piece with hacksaw or file and slip short length of suitable rubber tubing from windscreen wiper unit or tyre pump hose over butted ends and bind them tightly with wire. Grease or soap applied to outside ends of rubber tube will assist in sealing.

(b) **Stoppage of petrol due to dirt in system.**

(i) *Choked petrol pipe.*

REMEDY. If petrol pipe is to the tank, break convenient union and blow back into the tank using tyre pump if possible. If pipe length can be disconnected and above method applied, the dirt can be removed from the system.

(ii) *Blocked petrol Tap.*

REMEDY. Remove tap and remove obstruction.

(iii) *Choked air vent on autovac.*

REMEDY. Remove and clear obstruction.

(iv) *Stoppage of petrol due to dirt in filter.*

REMEDY. Dismantle, flush out body and clean filter gauze.

(v) *Choked Carburettor.*

REMEDY. Remove jet and apply air pressure to clear. Do not use needles or wire to clear small orifices.

(c) **Stoppage of petrol due to defective components.**

(i) *Autovac—Damage to top portion.*

REMEDY. Remove and maintain requisite level by pouring in petrol as required.

(ii) *Sticking valve linkage.*

REMEDY. A light slap by hand on the outer casing often proves effective in freeing.

(iii) *Petrol pump.*

NOTE. Before disconnecting and dismantling, ensure that the trouble is not due to faults elsewhere in system.

Filter Choked.

REMEDY. Clean and replace carefully.

Starting up of engine after emptying of petrol system should be effected by means of starting handle if possible.

Complete failure.

REMEDY. If vehicle is fitted with a radiator condenser, remove and affix to convenient place above carb level. Connect condenser outlet to carb. fuel intake (or pipe from petrol pump outlet) by means of a rubber pipe. If no condenser is fitted any suitable can may serve the same purpose of gravity feed to carb.

(iv) *Carburettor Float Punctured.*

REMEDY. Slightly enlarge the hole and expel petrol. This is helped by immersing in hot water. Insert soft wood plug (match stick) into hole and ensure that projection of plug is a minimum. Alternatively, use small piece of chewing gum.

NOTE. Needle valve may need re-adjustment for correct petrol level.

(v) *Broken throttle cable on motor cycle.*

REMEDY. Remove air slide, disconnect air control and connect same to throttle slide. The

throttle control will now be operated by the air control lever.

(d) Stoppage of petrol due to air-locks.

(i) *Air-lock between tank and pump.*

REMEDY. Disconnect union at pump inlet and blow air through pipe back to tank. The momentary pressure built up in the tank will soon cause petrol to flow back to pump. Connect union and tighten.

(ii) *Air-lock between pump and carburettor.*

REMEDY. Disconnect union at fuel inlet to carburettor and operate pump by means of priming lever. When petrol flows freely replace union and tighten.

5. IGNITION SYSTEM.

(a) Contact breaker.

(i) *Contact breaker rocker arm spring broken.*

REMEDY. Cut a small block of rubber from a tyre and insert behind the rocker arm. Ensure that size of rubber will effect closing of contact points.

(ii) *Rocker arm seized in bush.*

REMEDY. Remove rocker arm by unscrewing spring and forcing same off its pivot. Use screwed end of centre fixing as a reamer. When satisfied that rocker arm is quite free on its fulcrum, reassemble, taking care with refitting of spring. The fibre should be perfectly dry and free from oil.

(iii) *Contact breaker points badly burnt or worn.*

REMEDY. Clean properly and change condenser. Application of lead pencil to surface of points will help to provide a metallic surface.

NOTE. Condensers fitted to prevent radio interference can be used to replace faulty condensers.

(b) Distributor.

- (i) *Distributor cap spring clips broken.*

REMEDY. Bind cap securely in position with insulation tape.

- (ii) *Carbon brush in distributor broken.*

REMEDY. Shape a brush from tinfoil and insert in position or shape temporary brush from lead pencil stub.

(c) Coil.

- (i) *Switch failure.*

REMEDY. Remove wires from switch, bare the ends and tie together, untie ends to stop engine. Leave untied until the engine is again started, or, if the switch is damaged, connect a wire direct from battery live terminal to coil terminal marked S.W. This wire must be disconnected to stop engine and to prevent the battery from discharging.

- (ii) *Ignition coil connection faulty.*

REMEDY. If earth connection and ignition coil body is disconnected or broken, tap a small piece of copper wire into the hole and complete the earth return.

(d) H.T. Leads.

- (i) *H.T. Leads outside of plugs and distributor cap wet.*

REMEDY. Wipe off moisture and then wipe with cloth moistened with petrol. Allow a period of time for the petrol to evaporate and subsequent starting will be facilitated.

(ii) *H.T. Wire broken.*

REMEDY. Remove defective wires and replace by copper or steel wire of sufficient diameter, making sure that the wire is kept away from other metal components. Tie in position with string or insulation tape.

(iii) *Fuses — failure of.*

REMEDY. Before replacing a fuse ascertain the reason for blowing of the fuse and rectify the fault before fitting a new fuse. If a fuse is not available insert a suitably wrapped piece of tinfoil or beat out a single strand of wire to reduce cross-section so that only normal current can pass.

(c) **Light springs.**

(i) *Tension return springs broken.*

REMEDY. Bands cut from old inner tubes will make temporary repair, or temporary repair may be effected by joining the broken ends with copper wire.

(ii) *Compression springs broken.*

REMEDY. When the spring is located by a through rod, insert a suitable washer to maintain compression required. Small springs may be replaced by cellular rubber.

(f) **Batteries.**

(i) *Insufficient electrolyte.*

REMEDY. Should the battery require distilled water and this is not available top up with radiator or any water with the exception of salty water.

(ii) *Cracked Tops.*

REMEDY. Seal the cracks by heating the blade of a knife or screwdriver and using a small portion of the battery as sealing compound.

(iii) *Discharged State.*

Tow the vehicle to start and providing the dynamo is charging the engine will continue to function. Alternatively replace by good battery until engine is started.

(g) **Starter Motor.**

(i) *Faulty operation.*

REMEDY. Before again depressing the button turn the engine by hand about 1/4 turn. The pinion may now be in contact with the better part of the flywheel ring and easier engagement ensured. The faulty flywheel should be renewed when possible.

NOTE. The starter pinion is inclined to jam on the flywheel ring when the starter button is depressed.

(ii) *Starter Motor Spins Freely and Engine does not Revolve.*

REMEDY. Wash the thread of the pinion with petrol to free pinion on shaft.

(iii) *Starter Motor Jammed.*

REMEDY. If there is a square end on the armature shaft apply spanner and turn armature in correct direction for disengagement of pinion. If there is no square on the armature shaft, loosen the bolts securing the starter motor, engage top gear and rock vehicle backwards and forwards.

NOTE. Rocking vehicle alone is often sufficient to free the starter motor.

(h) **Dynamo not Charging.**

REMEDY. Gently press together the cut-out points. Observe the reading on the ammeter. If ammeter shows charge and cut-out points will

not remain closed, the cut-out is faulty. Insert thin wooden wedge or rubber under bridge to keep points closed. Do not idle engine unnecessarily as the battery will be discharged through the closed points. Remove wedge before stopping the engine.

(i) Electrical Leads, Joining of.

When it becomes necessary to make a joint between the broken or frayed ends of an insulated lead, strip away the insulation, expose the core at the ends for a length of at least one inch. Scrape the bare ends clean and twist them together tightly, finally binding with several layers of insulation tape. In the case of twin or triple leads care must be taken to ensure that each joint is well insulated from the other. This is facilitated by staggering the position of joints of each lead. Finally bind around all the leads with sufficient insulation tape. If ends of leads are too short for overlapping insert in the gap a suitable length of copper wire and connect the ends. Cover with insulation tape.

6. WHEELS AND TYRES.

(a) Changing of—Jack missing or ineffective..

REMEDY. Pack up the axle with wood blocks or stones at a suitable position. Dig a hole under the wheel to effect change.

(b) Repairs to tyres difficult to remove.

(i) Repairs to Tube—No patching available.

REMEDY. Use rubber groundsheet.

No solution available.

REMEDY. Use ordinary cold patches, moisten patches with petrol, allow to become tacky and then apply to tube.

(ii) *Repairs to Cover—Gaiter Missing.*

REMEDY. Cut same from parts of web equipment, e.g. Pack or Haversack and inflate tyre before replacing wheel on vehicle.

(iii) *Outer Cover U.S.*

REMEDY. Remove inner tube and replace by rolled clothing packed into position as tightly as possible. Proceed at slow speed.

(c) Tyre Interchanging.

A 3 ton 10. 50 x 20 C.A.S. wheel and tyre will also fit a Morris 15 cwt. or 3 ton.

A Morris P.U. wheel and tyre will fit a 40m/m Bofors Carriage.

NOTE. Fit tyres in pairs rather than one only.

7. BRAKES

(a) Hydraulic Brakes—Fluid Pipe Broken.

(i) REMEDY. Blank off the connection to it from the master cylinder, or close the pipe at the break by pliers or hammer blow.

(ii) *Brakes hard on.*

REMEDY. Bleed oil from Screw or pipe for particular wheel.

(b) Vacuum assisted system—Failure of Booster.

REMEDY. Examine ends of the hose connection. If the hose has perished at end, cut off the defective piece and reconnect to manifold. Test repair by driving car and operating the brakes.

8. SUSPENSION

(a) Springs, Main.

Springs, Main Leaf—Broken.

REMEDY. If possible, improvise a splint from a pick head, tyre lever, crowbar, or spanner, place over broken ends and secure with wire or rope, after first jacking up vehicle at broken spring end to enable repair to be carried out with spring in unloaded position. Place a block of wood between chassis and axle and secure firmly. If the vehicle is fitted with cable brakes disconnect cable of wheel adjacent to broken spring.

9. TRANSMISSION

(a) Live Axles.

(i) *6 wheeled Vehicles—Damaged Axles.*

REMEDY. Should the rear axle become unserviceable disconnect the drive to it and withdraw the half shafts to allow the rear wheels to roll. Should the centre axle become unserviceable withdraw the corresponding half shafts.

Live axle—Damaged wheel or tyre which cannot be repaired.

REMEDY. Withdraw the half shafts and both wheels of the axle concerned and lash the axle to the chassis. The removed half shafts should always be wrapped up to prevent damage to the bearing portions.

(ii) *4 Wheeled Vehicles with 4 Wheeled Drive. Rear axle failure.*

REMEDY. Remove the rear propeller shaft and engage the front wheel drive. If the failure is attributed to a defective or seized bevel pinion of faulty differential gear, both rear axle half shafts should be removed.

Damaged Rear Axle Casing.

REMEDY. Carry on but periodically sluice the working parts with grease or oil.

(b) Gearbox.

(i) Gearbox Casing Damaged.

REMEDY. Carry on but sluice periodically with oil. Should the gear become jammed, declutch drive, start the engine, engage the clutch and drive away.

(ii) Gearbox Lever Broken Off.

REMEDY. Remove broken piece of lever and use suitable bar to lever third gear into mesh. Adopt same procedure as given for jammed gears in order to drive away.

(c) Clutch Slipping.

REMEDY. First ensure that there is free movement on the clutch pedal, adjusting same as necessary. If trouble persists, depress clutch pedal to free clutch plates and inject fluid from Pyrene Extinguisher into clutch casing between plates.

NOTE. Petrol can be used effectively for the same purpose, but care must be taken to remove drain plug in casing, to remove all traces of petrol before starting engine.

10. STEERING.

(a) Steering Arm Ball Joint Broken.

REMEDY. Insert a suitable bolt in place of ball ended screw and lock with a nut at the bottom.

Finally tighten up ball joint adjusting cap. If the taking up of the adjustment in the ball joint does not eliminate slackness, lash down with cord or wire.

(b) Track Rod Bent.

REMEDY. Remove rod and straighten by use of leverage. Replace and adjust for correct wheel "toe in".