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DIRECTORATE GENERAL BORDER ROADS

# GENERAL MAINTENANCE INSTRUCTIONS

No.8

**DRIVING & MAINTENANCE OF VEHICLES ON HILL ROADS**

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1

DIRECTORATE GENERAL BORDER ROADS  
**GENERAL MAINTENANCE INSTRUCTION**

**No '8**

**Driving and Maintenance of Vehicles on Hill Roads**

**General**

1. This instruction covers certain aspects of driving and maintenance that are of special significance when vehicles are continuously used on hill roads. Important aspects of maintenance by drivers are already dealt with in GMI No 6, and lubricants to be used in vehicles have been covered in GMT No 5. In addition where altitude results in extreme cold temperatures, frost precautions to be taken are covered in GMI No 2.

2. This instruction is, therefore, to be read in conjunction with the above-quoted GMIs and explains how to obtain the maximum longevity of vehicle components which undergo severe strain, in hill driving.

**Driving Aspects**

3. Even new and perfectly adjusted vehicles can be ruined in a short while due to poor driving on hill roads. Assemblies in particular that undergo severe strain on hill roads are engines clutch plates, brakes, steering mechanisms and tyres. To reduce this strain, drivers should know the art of driving on hill roads so as to get the optimum performance from their vehicles without straining these assemblies.

**Engines**

4. Engines are strained proportionately to the speed and torque to which they are subjected. Suddenly applied speeds and torques result in excessive strains that give rise to bore wear, big-end and small end wear and wear on the teeth of all inter-connected gears.

5. To avoid strain of engines the following driving habits should be inculcated in drivers:-

(a) Changing down to a gear that will comfortably enable the engine to pull up an incline well before the incline tends to stall the engine. A stalling engine that results in loss of speed (and therefore changing down) half way up an incline, is bad driving.

The degree to which the change down is to be made, is dependant on :

- (i) Gradient.
- (ii) Degree of bend in the road.
- (iii) Roughness of road surface.
- (iv) Altitude.

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(b) Ensuring that engines are never over-heated. For this the driver must ensure that his temperature gauge is periodically checked and halt if the temperature is above 200<sup>0</sup> F(93.3<sup>0</sup>c). Halts on hill convoys, must be arranged on nature of terrain, rather than on a time basis as on the plains.

(c) Vehicles should not be loaded to maximum capacity and the factors mentioned in para 5 (a) above taken into consideration in determining the degree of under-load.

(d) When coasting down-hill, the vehicle should be put in a gear that will enable the driver with moderate use of the brake to control the vehicle at a safe speed, without the engine being revved up unduly.

(e) Engines should be warmed up to approximately 150°F (65.5°C) if they are to immediately take a hill section of road.

(f) In towing another vehicle the principle to be followed, is that if vehicles (towed and towing) are of the same type the one towed should be unloaded, and the one towing only lightly loaded.

### **Clutch Plates**

6. Clutch plates are strained in hill driving invariably due to over-heating caused by slipping. This slipping takes place due to not following the principles of good driving outlined in sub-paras 5 (a), 5(c) and 5(d) above.

In addition the following produce clutch wear and breakage :

(a) Riding the clutch *i. e.* keeping the foot half pressed on the clutch pedal.

(b) Suddenly releasing the clutch pedal while starting on an uphill slope.

(c) Gathering too high a speed on a decline (in gear) and applying the brakes suddenly to re-gain control.

7. Avoidance of the above, will result in clutch plate giving almost the same life as in the plains.

### **Brakes**

8. Brakes are only strained in hill driving due to sudden applications to control downward over speeding. Normal applications of the brake pedal used in conjunction with the appropriate gear while coasting down-hill will not unduly tax the braking system.

### **Steering Mechanisms**

9. Steering mechanisms are strained due to constant turnings having to be made at sharp hill-road bends.

10. For individual safety and long life of steering mechanisms :-
- (a) Inspect steering mechanisms from tie rod end to steering box and tighten all loose bolts and nuts and ensure split-pins are in position.
  - (b) Lubricate all joints and check steering box lubricant, at three times the frequency laid down for normal running. See paras 14, 18 and 21 of GMI No 6.
  - (c) Refer for inspection of NISSAN 1 Ton steering to DGBR letter No. 67814/EME/T/ BRD/ 3 dated 15 May 61.

### *Tyres*

11. Tyres wear faster mainly due to rough hill roads and constant turns. As both these aspects cannot be avoided, tyre life can only be increased by moderate speeds and inflating tyres to pressures intermediate to those recommended for cross-country running and normal road running.

### **Repair and Inspection Aspects**

12. The efficient functioning of assemblies that are particularly strained in hill running, is very necessary. For this reason all repair of these assemblies must be of a high order and inspection standards severe enough to guarantee that vehicles will satisfactorily cope with the task they are to perform on hill roads.

13. Technicians must remember that the absence of an item as small as a split-pin may cause the death of the driver and occupants of a vehicle.

14. Vehicles which although Class 'A' under the rules, are not, in the opinion of the inspecting officer, fit to safely perform on hill roads, may be allowed to retain their classification, but the words "Not fit for hill roads" should be suffixed and the reasons for this given in the E0-3.

15. The question of replacement of such vehicles (where they cannot be otherwise used) may be taken up with Headquarters DGBR by CEs/DCEs.

### ***Engines***

16. Repairs to these should be of an order sufficient to produce adequate pulling power on heavy gradients and at altitudes, likely to be encountered. Consideration must be given to the fact that approximately 3% to 4% of power will be lost for every 1000 ft of altitude.

17. Engine tuning should include the following aspects :

- (a) A slightly lean mixture if high altitudes are to be encountered.
- (b) A slightly retarded timing if gradients encountered are steep.
- (c) Idling speeds should be above normal conditions.
- (d) Clean air cleaners at three times normal frequency.

***Clutch Plates and Brakes***

18. There should be no tendency for clutches to slip or for hand-brakes not to function. Foot-brakes must function at normal stopping distances.

19. NISSAN Clutches should be adjusted so that the difference in height between release levers should not be greater than .2mm. Clutch free pedal play should be about 1 to 1.25". In the case of the NISSAN PATROL the pedal to toe board distance is 8 .22". In the case of brakes (NISSAN) the stopping distance is approximately 14 meters at 50 km/hr and free pedal play should be 1/2" to 3/4".

***Steering Mechanisms***

20. Full details on checking and repairing the NISSAN 1 Ton steering is given in Repair Instruction No 1 and DGBR Headquarters letter No 67814/ENE/T/BRD/3 dated 15 May 61.

21. Steering data for other ' B' vehicles are given in the Repair Manuals on the subject. It is of particular importance that specifications laid down for steering wheel torque and back lash are not exceeded and any stiffness in steering is treated with suspicion.

**Conclusion**

22. The foregoing paragraphs deal only with the salient aspects of hill driving and maintenance. To be of value, this instruction should be read and explained to all drivers and technicians repairing vehicles. It is essential also that checks be carried out to ensure that equipment is not mis-used on hill roads, and that punitive measures are taken against drivers ignoring these instructions.

23. Where damage to equipment can be directly attributed to neglect and rash driving by drivers proportionate cost of damage should be paid for by the latter. Regarding this latter aspect however, it must be kept in mind that bad driving and mishandling of equipment may not cause equipment to break down, until very much later.

GMI No.8

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