

DIRECTORATE GENERAL BORDER ROADS
GENERAL MAINTANENCE INSTRUCTION NO. 165

ON

PNEMATIC TYRES AND TUBES LIFE

Aim

The aim of the instruction is to guide the user units to achieve maximum utilization of pneumatic tyres and tubes and Field Repair Workshops for proper conditioning.

General

Reference this Directorate letter No. 67721 / DGBR/ E4T dated 19 Nov 71. Appendix "A" Page 5.

2. Tyre life has been laid down as 24000 Kms for new tyres and 16000 Kms for retreated tyres as per the above cited reference only as a guide for Field Workshops for sentencing the tyres to BLR/BER.

3. The above stipulated life of tyres can be expected only when the vehicles with proper load and correct steering geometry are plying on good / tarmac road in the plains. Besides, good maintenance of tyre is correct air pressure, careful driving and timely action to rotate tyres will enhance tyre lives. In BRO, most of our vehicles run on hilly uneven roads and carry awkward loads like stones and barrels.

4. The purpose of this instruction is to acquaint the operator with the principles of tyre care and recommend to him what he may do by way of efficient tyre maintenance to reduce the operating costs.

5. Even operator should choose tyre with due care, fit the correct ones for the conditions of service, fir them in the right position, check service conditions, maintain chassis, and more than anything else organize a proper tyer maintenance service. If all things are done, a definite cost benefit will accrue in all the projects.

6. It is needles to assert that tyres are an expensive item in the cost budget of any transport undertaking, but all too frequently they are virtually ignored from the time of initial fitment until the time of ultimate failure and as result millions of potential tyre KMs are wasted each year. The road conditions and tyre of service play a big part in determining tyre life, but most of the factors under these headings are usually beyond the control of individual operator. There is, however very important factor influencing tyre which is under the direct control of the operator. These factor is efficient maintenance, and its implementation can bring about a substantial reduction in tyre cost per KM. A

modest increase of 5% in tyre mileage will represent a considerable saving in the yearly operating costs of even a small fleet actually achieved by the implementation of a simple, but efficient, tyre maintenance system.

7. Appendix "A" to this letter gives the essential information about tyres and tubes.

8. OC Workshop must be familiar with the road conditions, climatic and terrain effects, and the loads carried by the vehicle. OC Workshop is the right person to decide about the conditions and causes of failure of tyres for BLR/BRER. In all cases whether the tyre has achieved the stipulated life or not, OC Workshop should record to clearly whether the tyre has failed due to fair wear and tear or due to unfair wear and tear. Where a particular tyre yields lower life than other tyres used on similar tyre of vehicles deployed on similar duties under similar operating conditions, OC Workshop should use his technical judgment while declaring it BLR / BER due to fair / unfair wear and tear.

ESSENTIAL INFORMATION ABOUT TYRES AND TUBES

1. What if Pneumatic tyre ?

It is an air bag fitted to a road wheel. It consists of two main components the outer tyre or cover and the inner tube, both of which are mounted on a rim, the complete assembly forming an effective compressed air container, and the “AIR CARRIES THE LOAD”.

2. The tube

The tube is constructed so as to prevent the loss of compressed air and, at the same time be as flexible as possible. The cover is protection for the tube and has to be strong enough to restrain the compressed air in the tube and protect it from damages. At the same time, it has to be pliable enough to withstand continual flexing by the rotation of the tyre under load.

3. What does the tyre do

The tyre provide a cushion between the vehicle and the road thus eliminating road shock and damping down vibrations, it is transmits the power from the engine through the medium of the driving wheels to the road. When the brakes are applied, it is tyre again which transmits the whole of the retrading force. In order to give the maximum grip on the road surface a tyre is provided with a tread pattern and various designs of tread patterns are available to give the best performance for different conditions of operation.

Every tyre is for its particular job. “ It has a maximum load carrying capacity for a given recommended inflation pressure, and to obtain the performance with the minimum of cost it is desirable that theses and inflation pressures are not exceeded”.

Remember that the “ AIR CARRIES THE LOAD”.

4. Tyre Deflection

Each type and size of tyre is designed to deflect at a predetermined percentage when under a given a load and inflated with the specified air pressure. The correct deflection result in the proper contact of the tread area with the road surface. Proper defelection is vital for satisfactory tyre performance over load or incorrect air pressure increases or decreased the tyre deflection androad contact area of the tread.

The tyre designers have established for each tyre and size of tyre, the correct air pressure for various loads that all tyre should carry, upto maximum load for which each tyre is designed. By maintaining the correct air pressure applying to specified loads, the tyre deflection and tread contact area for which the tyre is designed remain constant.

5. Under Inflation

Under inflation is one of the destructive factor that enters into the performance of a tyre, and it is surprising how many operators give this important matter little consideration. A tyre is not properly inflated unless the air pressure is sufficient to support the load without excessive deflection and maintain the tyre beads in correct position on the rim under the conditions.

When a tyre is operated without sufficient air pressure, the side walls are subjected to excessive flexing and in each revolution the wheel side walls are forced to bend and recover to an excessive degree. The abnormal flexing action will result in breakdown of the structure, with the result that the tyre is weakened in this area and is unable to withstand ordinary road shocks. The individuals cards will became loose and break and in addition ply or tread separation may result under inflation is also the cause of rapid and uneven tread wear resulting in thousands of lost kilometers.

6. How to prevent costly under inflation failure

- (a) Make sure that tyres are inflated to the recommended pressure. Check regularly.
- (b) Ensure that valve caps are kept serewed on tightly.
- (c) Check for slow leaks whenever air pressure shows a decided drop.
- (d) Main blow leaks repaired immediately.

Always remember that tyres are costly whilst air is free.

7. Over inflation

There is a mistaken conception on the part of many operators that a tyre can be overloaded safely by over inflating. This is a very dangerous practice. Increasing air pressure to off set over loading simply distorts and strains the cord plies of the tyre beyond their capacity, eventually weakening the entire structure and terminating in premature failure. Over inflation promotes danger of bruising or concussion and cutting since it puts both carcass and tread under greater tension which increases the case with which either or bruises occurs. Over inflation causes fast tread wear in the center of tread due to decreases in road contact area and thus resulting in load per square inch.

It must be also remembered that over inflation reduces traction and skid resistance, because of the similar tread area in contact with the road surface. For this reason over inflated tyres are particularly dangerous on wet roads. Over inflation also gives harder riding, due to the fact that the tyre cushioning effect if greatly reduced, apart from discomfort this will result in higher vehicle maintenance costs.

8. Over loading

A large proportion of the premature tyre failures experienced are due to over loading. Every tyre, regard less of its type, is designed to carry a specific load at a specific inflation pressure and this load is the maximum the tyre can carry on the basis of 100 % performance and kilometers. If the load per tyre is in excess of the maximum specified limit then the kilometers given by the tyre will vary proportionately.

9. Bleeding

Tyre bleeding is the practice of letting air out of tyres when inflation pressure build up due to the heat of the operation. The procedure is wrong. It has been proved that such a practice causes even greater increase in tyre temperatures resulting in premature failures also operators may forget to re-inflate their tyres after vehicle has been standing overnight and consequently tyre failure occurs due to gross inflation. If these are not bled an equilibrium is reached between heat generated by the tyer flexing and heat dissipation, so that the temperature of the tyre remains constant. The bleeding of tyre reduces the tyre pressure, but not the temperature of a tyre. When tyres are bled. The flexing of the tyre side walls I increased, thus causing higher tyre temperatures than would have been reached if the inflation pressure had not been reduced. Excessive heated results infaster tread wear and increased danger o heat blot outs.

10. The effect of Heat

Excessive heat is generated by the abnormal flexing of a tyre due to overload or under inflation, and is aggravated by sustained high speed operation. High atmospheric temperatures will also further aggravated the position.

11. The effect of heat tyre fabric

The tenside strength of the fabric cords in the tyre casing is reduced when the casing is subjected to high temperature. At the same time the high temperatures cause the air in the tube to expand and this subjects the already weakened tyre cord to increased strain. Under these conditions the tyre is more more prove to injury as the result of impacts.

12. The effect of heat on tyre casing rubber compound

Extreme heat is highly destructive to the rubber compounds used in the casing of tyre and will almost certainly cause premature looseness failures.

13. The effect of heat on tread wear :-

Under the effects of extreme heat the abrasion resistance of the tread rubber compound is greatly reduced. When subjected to high temperature the tread rubber softens and therefore wears more rapidly resulting in decrease in tread life.

14. The effect of speed

High speed in increased tyre temperature and it is the experience of most operators that the faster one drives over any particular kind of surface the more rapid is the rate of wear of the tyre tread. However, the inter relation of increased wear of tyre treads with increase of speed from 56 to 72 Kms per hour reduces tread life by 22 % while a further increase to 80 Kms per hour reduces tread life to 33 %.

15. Road conditions

The life of a tyre is greatly affected by the type of road on which it runs, and it requires very little thought to appreciate that there is a vast difference between the abrasive action of a bone dry, flinty or “Kankar” surface, and that of a wet smooth bituminous road.

Tyres that run for their whole life on good earth or gravel roads can only be expected to render about 60% of Kms that they would have given on smooth, level, well paved roads.

If used on fresh cut roads, the life of the tyres will be only 50 % of the normal.

Again on very hilly roads, even where the road surface is good, the tread life will only be approximately 50 % of the normal so that on hilly twisting roads with poor surfaces, speeds and loads must receive special attention, if very short tyre life is to be avoided.

It must always be remembered that on any road the service rendered by a tyre is largely in the hands of the driver and indeed the driver is most important man in any consideration of tyre performances. Such things as the severity of acceleration or braking, speed and a watchful eye for potholes or other obstacles are wholly within the driver's controls. It also follows that inspection of tyres and for that matter, of the whole vehicle by the driver at regular intervals will catch small troubles before they become big.

(Note :- These percentage lives apply only to manufacturer's estimate of tyre life).

16. Vehicle mechanical irregularities

If tyres wear irregularly, or more rapidly than expected, it may be that vehicle mechanical irregularities are responsible. The following are some of the wheel or vehicle irregularities which may cause rapid or uneven tyre tread wear.

17. Wheel misalignment

It is very important that correct wheel alignment, according to the vehicle manufactures specification, should be maintained. Whilst this mainly applies to front wheel, it is also applicable to rear wheels in special circumstances.

A wheel 6.4 mm approximately out of alignment is dragged sideways appx 15 mtrs in every Km and the result is very rapid tread wear. Measurement of alignment is taken by means of an alignment gauge.

The distance is measured between the tyres at the opposite ends of the same axle. If the distance at the front of the tyre is less than that taken at the back, this is known as “TOC – IN”.

If the distance is greater at the front of the tyres than at the back, then it is known as “TOC – OUT”.

18. Excessive wheel camber

Camber is the angle by which the wheels are inclined from the vertical. When the top of the tyre is inclined away from the chassis member, that is further from the frame than the bottom of the tyre, then this is known as positive camber. If the top of the tyre is inclined towards the chassis member than it is known as negative camber.

In the case of twin tyres excessive camber may be due to a bent or sagging axle. This results in overloading of the inner tyres, which in addition to increasing the rate of tread wear on the shoulder of the tyre may also lead to premature failure of tyre. Exactly the same tread wear effect may be observed in tyres operated over heavily cambered roads and for this reason the use of differential inflation pressures might be advisable. Excessive camber may also due to excessive wear in th efront end bearing or incorrect king pin inclination.

19. Badly adjusted or grabbing brakes

Brakes out of adjustment and out of round brake drums cause rapid wear in a single spot.

Improperly adjusted brakes generally produce several spots on the tyre.

... 6/-

- (a) Loose steering linkage
- (b) Worn wheel bearings.
- (c) Spring or twisted frame.
- (d) Wobbly wheels.

All the above will result in uneven and irregular tyre tread wear.

20. TUBES

- (a) A tyre is not better than its tube

The pneumatic tyre and the vehicle it carries are supported by air confined with in the tube and not by the rubber and fabric by the tyre. This is clearly demonstrate when a tyre is run without air. Since the tube holds the air, the importance of the part the tube plays in the satisfactory performance of the tyre is readily apparent.

- (b) How to get good service from tubes

The long life and high kms given in present day tyres exhaust the useful service life of tubes. Therefore, when a tyre cover is worn to the point of being no longer serviceable the tube also is generally in an unserviceable condition and it should be replaced with a new one.

Always fit a new tube with a new cover.

- (c) Never use a tube in tyre cover of a size larger than that for which the tube was designed. The use of an under size tube results in :-
 - i) Excessive stretching of the tube, which thins the tube walls, causing abnormal loose of air.
 - ii) Decreased resitenence to chafing, tears and punctures.
 - iii) Abnormal strain on the valve base.
 - iv) Shorter life of tyre cover due to lower air retaining qualities of stretched tubes.
 - v) Excessive stretch and growth, which lasten deterioration of the tube rubber.
- (d) Never use a tube in a tyre cover of a size smaller than that for which the tube was designed. The tube will crease and fall prematurely.

...7/-

- (e) Always use a new valve core.
- (f) Make certain that the surface of the tube is clean and dusted with French chalk before mounting.
- (g) Ensure that the end of valve is clean before applying the air hose, this prevents dust and dirt being blown in to the tube.
- (h) Always check pressures with an accurate pressure gauge and ensure that correct pressures are maintained.
- (j) Always replace the valve cap after inflating the tyre.
- (k) When unmounted tubes are inflated for inspection they should not be inflated to the point of "Balooning".

21. Storage of Tyre covers & Tubes & General precautions.

Factors that contribute to the deterioration of stored covers and tubes are :-

- (a) Light (particularly sunlight, which is rich in ultra-violet rays).
- (b) O zone (from electrical generators etc.)
- (c) Heat.
- (d) Air currents.
- (e) Oil.
- (f) Water.
- (g) Dust and Dirt.

Any storage place should therefore be protected from these deteriorating agencies, which adversely affect the physical properties of the rubber, and hence the useful life of the articles.

- (i) The storage place should be kept as dark as possible, windows and skylight should be covered with a dark point and doors and openings kept closed as far as possible. Electric lights should not be left burning beyond the time necessary for work to be carried out in the stores.

- (ii) If the stores cannot be darkened for some reasons the rack should be covered with tarpauline or other closely knite fabric to exclude light .
- (iii) Covers and tubes should not be stored near electric motors, switch gear etc as these generate Ozone which is very destructive to rubber.
- (iv) the store room should be kept at a reasonably low and uniform temperature (70 to 80 F). In hot territories where this cannot be achieved the store building should be insulated from the direct run as far as possible. Such materials such as corrugated Iron should be avoided. In cool territories covers and tubes should be kept away from radiators and stream pipes.
- (v) Draught changes in the humidity of the air in the store should be avoided as far as possible as moisture will condense and collected inside the castings. This is not so serious with new covers, which usually have an adequate layers of rubber protecting the inner ply. Used covers often have cords exposed due to cuts etc. which allow ingress of water. Rotting of the casing can cover under these condition.
- (vi) It is not good practice to Place or stag or the tyre in piles, this tends to discomfort the bead wires and casing. If the black method is tied cover should be carefully aligned and the height restricted to the six feet.
- (vii) If the black method used the mixing of sizes should be avoided. Larger and heavier cover should never be stacked or smaller sizes, if mixed sizes must be stacked the sizes should be graded so that the smallest and lightest is at the top of the stacks.
- (viii) Before storing out covers they should be inspected and any necessary repairs made. (Oil and grease should be cleaned off, if perfect).
- (ix) When making insues from a tyre store the principle of “ First in, First out” should always be adhered to.

For Tubes

- (i) New tubes are usually received packed in cartoons or bays and they should not be taken out of these containers until recurired for use.
- (ii) Large stocks of tubes should not be carried as physical properties tend to deterioration on prolonged storage specially in hot climate.

(iii) In case where tubes are received fitted in the covers, with or without flaps, the pressure should be reduced to minimum to retain the tube in the cover. The assembly can be stored in the usual way of covers, but it is most important to keep light away from the portion of the tube exposed between the cover beads.

(iv) Used tubes should be deflected by removing the valve core, examined and any necessary repairs made. The valve core then be re-inserted and a small amount of air out into the tube, which is then folded carefully and stored in a carton or bag of suitable size if available. Used tyres can be stored slightly inflated in side cover is used care paragraph (iii) above. Whichever meth of storage is used care should be taken to exclude light from the tube.

22. The position of tyre to obtain maximum service

It is important to remember that irregular and for rapid wear can be caused for many reasons. Here we confine ourselves to a consideration of the means of obtaining even wear and maximum service from tyres, by utilizing of tyre positioning and rotation.

23. The proper matching of Dual Tyres

The proper matching of dual tyres is extremely important if maximum tyre service is to be obtained. The secret of dual tyre matching is to obtain as far as possible, an equal distribution of the load between the two tyres, forming a twin assembly. If for any reason there is an unequal distribution of the load between the twin tyres of a dual assembly, then affective rolling circumferences of the tyres will be different, and they will “fight” due to the fact the wheels are rigidly bolted together. As a result the tyre carrying the smaller load will “scuff” will be liable to fail prematurely.

Factors that will prevent an equirtable distribution of the load between the two tyres of a dual tyres of a dual tyre assembly are :-

- (i) The relative diameters of the twin tyres.
- (ii) The amount of air pressure in each tyre.
- (iii) The crown of center of the road.
- (iv) Loose wheel bearings.
- (v) Axle sag.

The manner of matching tyres may vary very considerably for different conditions of operations, but if there is no previous experience to use a guide for a particular vehicle in a particular type of service, then the best thing to do is to apply two tyres approximately of the same diameter to each dual assembled. In practice however the right prove difficult, and the some tolerance is allowed. The most desirable matching obtained by not exceeding 19.05 mm appx circumference, or 6.4mm appx in diameter for tyre sizes upto including 8.25 and 38.1 appx difference in circumference or 12.7 mm appx in diameter, size 9.00 & upwards.

Although not strictly correct in every case it may be taken as a general rule when fitting tyres of different diameters with in the tolerance mentioned above, that tyre having the smaller diameter should be fitted to the inside position.

24. The importance of fitting a tyre to correct size of rim and the importance of fitting twin tyres to rims having the correct off set

It is not important when tyres are fitted in twin formation that times having the correct off set are utilized. The followings notes will underline the importance of using a correct tyre/rim/off set combination.

- (i) Each and overy size of tyre is designed and manufactured to fit ideally on to one size of rim only. If the rim is vider or narrower than the ideal , than un-natural stresses will be set up in the body of the tyre, and the tyre will not be permitted to deflect according to the tyre designed is intentions. The result will be a reduction in tyre life and the possibility of complete premature failures.
- (ii) If there is insufficient space between twin tyres there is a risk that the side walls of the tyres will rub together generating excessive heat which cannot be dissipated. In addition the tyres will effectively be prevented from defecting properly and this will set up un-natural stress in the tyre ear case. The result will be premature failure . It must also be noticed that the tyre rubbing can occur even when tyres are mounted on the correct rims with the correct off set due to conditions of over loading and / or under inflation.
- (iii) If the dual inflation is too great there will be an unequal load distribution between two tyres on cambered roads. There will also be excessive dragging and scuffing of the out side tyre each time a corner is negotiated. The result will be rapid tread wear on the outer tyre and / or premature failure of the inner tyres.

25. Repaired tyres should be mounted in the outside dual position . When the repair is in the shoulder or side wall area the tyre should be so mounted on the rim that the required section is next to the locking ring or loose flange sides. The repair job will thus be in the center of the dual tyre assembly which is the easiest position. Should a tyre have more than one repair, give the major repair job first consideration when mounting.

26. Off Set

Off set is the measurement from the center line of the tyre to the outer have face of the wheel disc. Dimensionally, when tyres are being used in twin formation, the off set is half the distance between the center lines of twin tyres.