Best Practice Guide for Bus and Coach Tyre Maintenance

North Western Maintenance Liaison Committee

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CPT Best Practice Guide

Forward by the Senior Traffic Commissioner for Great Britain

I am delighted to endorse this important document as traffic commissioners want to ensure operators follow best practice, in addition to meeting minimum standards.

This Best Practice Guide for Bus and Tyre Maintenance builds on the Department for Transport's recommendation about the use of older tyres on buses and coaches.

It offers a wealth of advice to operators about tyre and safety and maintenance and I am sure that many operators will learn a lot from the document. I would like to record my personal thanks to the North West PCV Maintenance Liaison Committee who took the work on with enthusiasm and commitment. In doing so they worked with tyre manufacturers, the industry and operators.

The guide also makes clear that traffic commissioners need to be assured that operators follow best practice and only use tyres which are fit for purpose.

This guidance promotes best practice on the fitting of tyres, the use of tyres and the physical condition of tyres, which includes considerations about age.

As specialist regulators, traffic commissioners promote operator licence compliance, which is based on the twin principles of road safety and fair competition.

The majority of the industry operates well above the minimum standards and I know that this document will support operators and drivers in having access to information that will continue to promote best practice.

Beverley Bell

Beverley Bell
Senior Traffic Commissioner for Great Britain

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About this Guide this Guide

This Best Practice Guide has been written to explain the responsibilities and systems involved in maintaining tyres, regardless of operating conditions, fleet size or vehicle type. The procedures and systems explained in this Guide are useful for operators, drivers and all those responsible for operating, maintaining or providing passenger carrying vehicles. Traffic Commissioners, the Department for Transport and Driver Vehicle Services Agency have produced guidelines and this document is designed to be read inconjunction with those recommendations.

This is a guide to best practice and therefore not to be read as a definitive instruction as to how to comply with your legal obligations.

Introduction

Tyres are a crucial part of vehicle and driver safety and they need to be closely monitored. This guide will provide you with some best practice tips on how to maintain and check tyres to ensure you stay legal and safe while out on the road.

The development of a best practice guidance document is auseful resource for operators to minimise the impact of their activities on people and the environment. However, this Best Practice guidance does not replace any statutory requirements under relevant legislation.

The Driver Vehicle Standards Agency (DVSA) has produced figures that confirm tyre defects continue to be a major cause of vehicle test failures.

The courts can impose a substantial fine and three penalty points per tyre for tyre contraventions. Under the Motor Vehicles Construction and Use Regulations it is an offence punishable by law with severe penalties, for any person to **use** or **cause** or **permits** to be used on a public highway, any motor vehicle, if any of its tyres do not comply. In addition if you hold an operator's licence the Traffic Commissioner can take regulatory action if you do not adequately maintain your vehicles.

A study commissioned by the European Commission in 2014 highlighted the if tyre tread depth falls below 1.6mm the likelihood of a road traffic accident increases significantly. It further highlights the importance of correct tyre inflation pressures. Incorrect tyre pressures also contribute to a significant increase in road traffic accidents, both of these issues are covered within the body of this document,

Tyres and carbon footprint

Tyres are responsible for up to 30% of a vehicle's fuel usage – and it is fuel usage which contributes most significantly to carbon emissions. Some studies suggest that up to 90% of a tyre's 'wheel-to-wheel' carbon output is created during use.

The two main ways the right tyre can help to reduce a fleet's carbon footprint are through promoting fuel economy and through being suitable for re-grooving and retreading, both of which depend upon the tread depth and the quality of the compounds and materials used.

Don't let cost pressures compromise road safety. Look after your tyres and they won't leave you flat. You will also improve your Operator Compliance Risk Score (OCRS) through not having Driver Vehicle Services Agency (DVSA) attention at roadside encounters and improve your annual test first time pass rate.

Section 1 – Tyre Age and Ageing

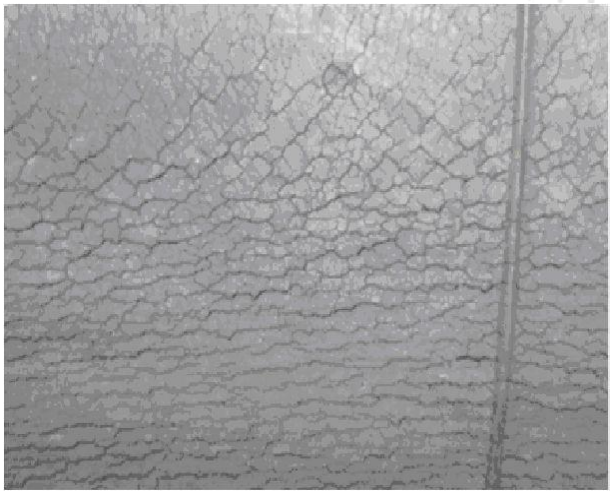
Tyre ageing is an issue of oxidation which can be accelerated by poor tyre maintenance. Certain rubbers 'work-harden' over time. This will lead to the rubber compound stiffening and surface crazing *(See Figure 1 below).* The stiffening and cracking of aged rubber can lead to the inner layers of the tyre delaminating from the steel belts rather than flexing with the steel as the tyre rolls under load.

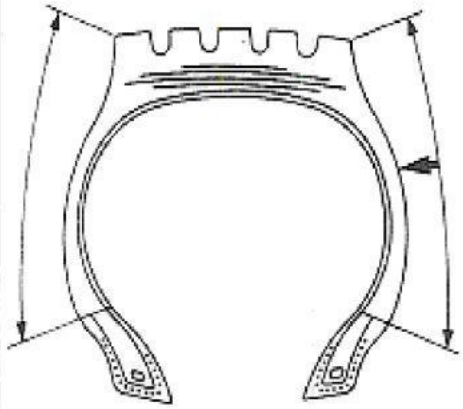
Cracked or crazed with age, caused by:

1. Excessive deformation in shoulders and sidewalls due to under inflation and/or overload.

2. Rubber deteriorations due to chemicals (such as cosmetic wax), oil and fats, sun (ultraviolet rays), ozone, and heat. Such deteriorations are often accelerated by under inflation and/or overload. Further information can be found in The European Tyre and Rim Technical Organisation's Recommendations 2014 (Edition 27 March 2014), www.etrto.org.

Figure 1 - Crazing





As a precaution, DfT strongly recommends that (ANY NEW OR RETREAD) tyres over 10 years old should not be fitted to the front axles of buses and coaches. Such tyres should be fitted only to the rear axles of vehicles as part of a twin tyre combination. *Although not enforceable it is considered best practice not to fit any tyre over 10 years old*. (Check date of manufacture) or Retread *Hot Cure* **date.**

Furthermore, the Senior Traffic Commissioner has stated that this is a minimum standard and that Traffic Commissioners will need to be assured that operators are fitting tyres that are fit for purpose – regardless of their age. Operators should therefore ensure that they only fit tyres that are fit and serviceable and that they follow best practice rather than minimum standards.

Drivers should seek expert advice if they are not sure. When you assess for damage, you should remember that old tyres – particularly if, like spare tyres, they are infrequently used – can crack or craze in the tyre wall and tread area.

The date of the original manufacture of a tyre is shown as a DOT reference, an example code is DOT A87C DEF 0102, the final set of four numbers is the date code. This four digit code shows the calendar week and the year of manufacture e.g. 0102 is week one of 2002. There are a small number of tyres that may not have a DOT code e.g. Retreads and in these cases the date of manufacture will still be shown elsewhere on the tyre, for instance if you see a separate group of letters and numbers such as 4202 this is the 42nd week of 2002.

In some cases there may be two date codes, one being the original manufacturer and the second from the retread manufacturer. It is recommended that the most recent date code is relevant to that tyre age. The oldest date code should be used to determine tyre casing age.

Fig; 2 – This tyre was produced in calendar week 47 of 2012

If your vehicle's tyres are showing signs of age, you must get them checked by an expert or replaced as a precaution.

Tyres in service, including spare tyres of 5 years or more, should continue to be inspected by a specialist on the planned maintenance schedule.

It is advisable to rotate spare wheel assemblies that are affixed to bus or coach bodies annually. If a wheel or tyre assembly is left in a spare (unused) state for any prolonged period of time, the properties of components will have a reduced lifespan and capability.

There are a number of avoidable and unavoidable conditions that affect tyre age.

Unavoidable

Climatic and seasonal conditions

Whilst the climatic and seasonal conditions have no affect whatsoever on the heat generated by a tyre, they will have an effect on the maximum temperature attained by the tyre and on the dissipation of the heat. The hotter a tyre runs, the lower the tread mileage will be.

It is important to remember that the rate of tread wear in summer will normally be more than the rate of tread wear in the winter. Not only is the temperature lower in the winter but conditions are usually wetter. Water is a lubricant to rubber and so tread wear will be reduced in wet conditions. However punctures may be more frequent because rubber is more easily cut and penetrated when wet.

It is often a necessity to fit snow chains when operating where climatic conditions require the fitment of snow chains. It is always advisable to ensure that any snow chain fitted is done so with the manufacturer's instructions and tyres are checked for any damage on removal, therefore training is paramount.

Roads

The life of any tyre will be affected by the road conditions on which it operates. The road contour, type of surface and degree of camber will all have some effect on the tyre's performance.

Road contour

The necessary amount of braking, accelerating and cornering is directly related to the road contour. Winding roads with high hedges or other obstructions to vision cause frequent braking, acceleration and side thrust on tyres at corners. These all tend to increase tread wear despite the fact that average speeds may not be very high. Alternatively, winding roads with good view on corners may incite faster cornering which can also increase tread wear.

Hilly roads, due to high traction efforts, braking and acceleration, will tend to increase tread wear. Narrow roads, particularly on housing estates, can cause kerbing which damage tyre walls and may cause an increase in wall ruptures.

Road camber

All roads have a camber for draining purposes, heavily cambered roads will cause the tyres on the nearside to undergo more distortion as they rotate because of the increased loading of the near side tyre and uneven loading across the tread. They are likely to wear out more rapidly than those on the offside.

Twins

The effect of road camber on twin tyres puts more weight on the inner, assuming that pressures are the same.

The inner is under heavier load and therefore it has more grip and dictates the revolutions per mile of the assembly. On regional work this commonly results in more rapid wear of the outer twin. In urban conditions it is the inner tyres which wear more rapidly.

Whilst the effect of road camber is strictly unavoidable, its affects can be minimised by attention to correct twinning. If the fitting of twinned tyres of unequal tread depths is unavoidable, use the tyre with greater depth as the outer twin, subject to a tread depth difference of no more than 4mm.

Type of work or journey

The type of work or journey undertaken by any vehicle will have an effect on the tyre life of that vehicle. The following conditions all have an effect on tyre life:-

Very frequent stops and starts

Constant braking and acceleration will accelerate tread wear.

Narrow roads

This will increase the incidence of kerbing and possible premature failure. Many of the effects noted

in the list above can be minimised or even overcome by taking advice on the correct tyre for the conditions of use of the vehicle.

Avoidable

Fitting

The correct fitting of tyres to their rims is of the utmost importance. Ensure that a recommended tyre lubricant is used; do not use anything that is oil-based as a lubricant.

Correct fitting of tyres will ensure that the tyre is fitted concentrically on the recommended rim, the bead area has not been distorted or stretched, and that there is no damage in the bead area that may lead to ingress of moisture or air into the casing of the tyres. Care must also be taken not to damage the casing plies in any way.

Maintenance (Tyres and Vehicles)

Tyres which are carefully maintained will last much longer than those which are neglected. Apart from lack of pressure maintenance the following factors will all reduce tyre performance.

Cuts

Cuts in any part of tyre which would permit water to reach the casing or bracing plies should always be properly repaired to a British standard. Moisture has a harmful effect on both textile and steel casings and if allowed to reach them will cause local weakness and the tyre could be unacceptable for retreading. Checks should be made for stone-trapping between twins.

Incorrect twins

Care should be taken to see that tyres of the type, size, service description and wear are twinned together. The only exception is the case of nearside twins dealt with in the section on road camber. A difference of up to 4mm in tread depth is acceptable.

Oil, Petrol, Diesel

Hydrocarbons (solvent) contamination will cause swelling of the rubber and it could even become tacky to touch. Severe contamination will render the tyre unusable. Many industrial chemicals and solvents can also cause damage to tyres; these should be removed using lots of water and a mild detergent.

Vehicle maintenance

- Component parts. Play in bearings, bushes; track rod ends etc. can affect tyre wear, as can badly adjusted brakes.

- Out of balance assemblies can cause localised wear on tyres, quite apart from putting extra strain on suspension components, bushes, bearings etc. The following illustrations indicate some typical abnormal tyre wear caused by mechanical anomalies.

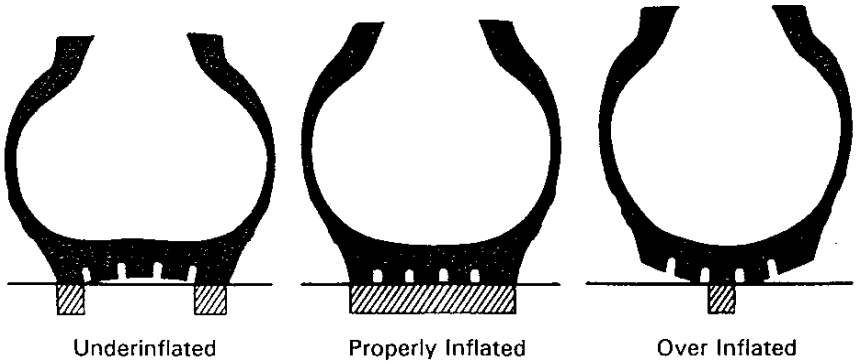
Load and inflation

Briefly, the requirements of a tyre are threefold:-

- To support the load imposed.
- To provide maximum grip on the road for control of the vehicle in all conditions.
- To give the best possible ride, subject to the other two criteria.

When the tyre is properly inflated it sits on the road in the attitude for which it was designed and, as the diagram below clearly shows, with the correct area of tread fully in contact with the road. It is in this condition, and only in this condition, that the tyre can provide its best performance in terms of grip and flexibility.

The effects of incorrect inflation can be summarised under three headings:-



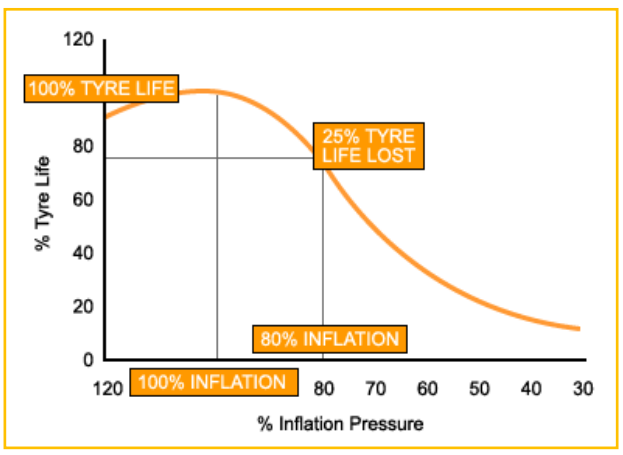
There is more to tyres than pressure and more to tyre safety than checking them once a year.

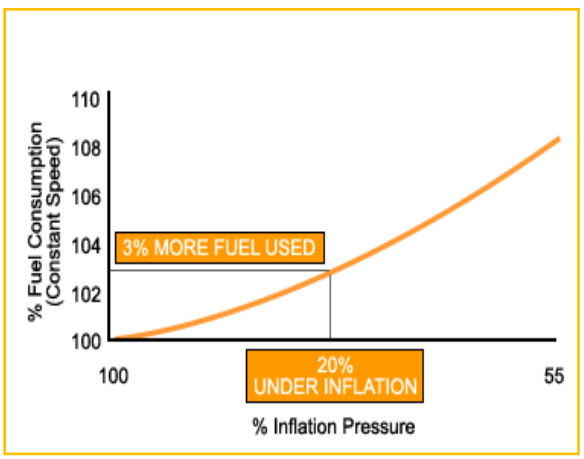
Tyre safety is an everyday issue - remember it is air pressure inside the tyre that carries the load, as low pressure will cost you fuel and affect vehicle handling. Operators should ensure that their drivers inspect their tyres on a regular basis and always include them in their daily walk around check.

NB: Tyre pressures need to be checked when the tyre is at ambient temperature.

Under-inflation

- Increased flexing, which makes the tyre overheat and may cause tyre failure.
- Increased wear means shorter service life and is illustrated:
- Higher rolling resistance and subsequently increased fuel consumption as illustrated below.





Safety

Correct pressures are undoubtedly a major consideration in obtaining the best performance and life from tyres. Deviation from the manufacturer's recommendations may lead to distinct deterioration in performance as well as tyre life.

Under-inflated tyres will cause over flex and overheat which will cause irreparable damage to the reinforcing structure. Continued use in this damaged condition may result in the rapid deflation of the tyre in service.

Over-inflated tyres can also lead to a drop in mileage potential. It reduces grip and increases irregular wear. Pressures can also affect the general handling of a vehicle e.g. the degree of under steer or over steer present.

Clearly, if only part of the tread is in full contact with the road it will take an unfair proportion of the stress and so the tyre will wear far more rapidly and unevenly. In addition severe under inflation encourages other peculiar types of wear - e.g. rubbing between twins on buses or coaches.

Various figures have been quoted for loss of tyre life due to incorrect pressures. In truth there are so many other variables to be considered apart from pressures that can have an effect; tyre type and size, vehicle type and loading and speeds. For example a pressure error of 20% will give up to 25% loss of tyre life.

Ride

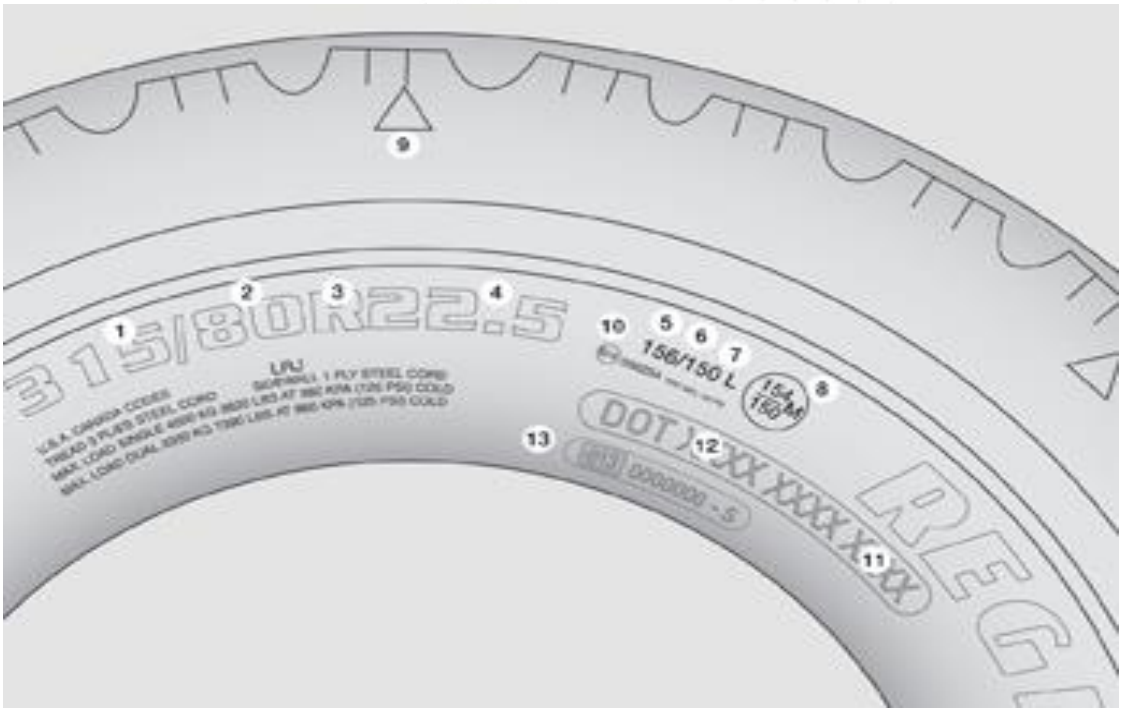
If the flexibility of the tyre is not adequate then the ride is compromised and over inflation is the more obviously undesirable. The ride on a bus or coach is significant to the driver and passengers. A bad ride may cause fatigue to the driver and passengers as well as fatigue in the body and chassis of the vehicle and increase maintenance costs.

Section 2 – Tyre Identification / Markings

The development of a best practice guidance document is a useful resource for operators to minimise the impact of their activities on people and the environment. However, this Best Practice guidance does not replace any statutory requirements under relevant legislation. All tyres across an axle should be of the same size, construction (Radial or Crossply) and the service description must match the vehicle plating for load and speed. See the diagram on page 14.

When purchasing new tyres, it is a requirement to use tyres with the EU Standard as this is a recognised quality standard. The illustration below provides an explanation of the markings currently found on a new tyre sidewall. When inspecting tyres, consideration must be taken of the operating terrain, the length of time the vehicle will be operating, and the mileage it will cover before the next tyre inspection takes place.

Tyre Markings



1. Tyre Section width (mm or inches).
2. Aspect ratio S.H. /S.W.
3. Radial construction (R=radial).
4. Rim diameter (inches).
5. Load index (max. load per tyre – single tyre
6. Load index (max. load per tyre – dual mounted).
7. Speed symbol
8. Alternative load indices when used with alternative speed
9. TWI = tread wear indicator).
10. ECE homologation number (The large ‘E’ indicates that the tyre is certified for use in Europe).
11. Date code (week, year).
12. DOT manufacturing code

13 Noise number, indicating that the tyre conforms to ECE noise regulations

Re-groovable

Tyres that have been constructed with the capability to be regrooved, will have the symble “Ʊ” at least 20mm in diameter, or the words “REGROOVABLE”, moulded into or on to each sidewall. Do not regroove a tyre that is missing this symbol or words.

Additional markings.

There are many additional markings thata cana be applied to vehicle tyres depending on their usage, these markings are required under various construction and use regulations and cover special applications such as, winter or snow use. For full explanation to each and every marking refer to British Tyre Manufacturers Association.

Load Index & Speed rating Chart

Load Index	Load in kg per tyre	Load Index	Load in kg per tyre	Load Index	Load in kg per tyre	Load Index	Load in kg per tyre	Load Index	Load in kg per tyre
62	265	75	387	88	560	101	825	114	1180
63	272	76	400	89	580	102	850	115	1215
64	280	77	412	90	600	103	875	116	1250
65	290	78	425	91	615	104	900	117	1285
66	300	79	437	92	630	105	925	118	1320
67	307	80	450	93	650	106	950	119	1360
68	315	81	462	94	670	107	975	120	1400
69	325	82	475	95	690	108	1000	121	1450
70	335	83	487	96	710	109	1030	122	1500
71	345	84	500	97	730	110	1060	123	1550
72	355	85	515	98	750	111	1090	124	1600
73	365	86	530	99	775	112	1120	125	1650
74	375	87	545	100	800	113	1150	126	1700

Speed Symbol	Speed in km/h
J	100
K	110
L	120
M	130
N	140
P	150
Q	160
R	170
S	180
T	190
H	210
V	240
W	270
Y	300
VR	>210
ZR	>240

Section 3 – Tyre Husbandry

Tyre Choice

Many PSV operators will have to register Local Service Buses with the Traffic Commissioner. In those cases the vehicles can be fitted with J - speed rated tyres. This enables the fitment of the special robust urban bus tyres.

Front Axles - Order of Selection

1. It is not recommended to fit drive axle tyres on the steer axle of a vehicle.

2. It is recommended that new tyres are fitted to steer axles, however, retreads may be used on the steer axle providing the size; construction and service description match the vehicles plating and it complies to Regilation ECE 109 (Type approval).

3. Tyre types must be fitted in pairs across the axle. Tyres shall be of the same casing construction (Radial or Crossply) having a similar tread design and made or retreaded by one manufacturer.

Rear Axles - Order of Selection

1. Tyres types must be fitted in pairs, preferably in axle sets. Tyres should be of the same casing construction (Radial or Crossply) having a similar tread design and made or retreaded by one manufacturer.

2. It is recommended that twinned tyres are:-

    - operated at the same pressure,

    - do not have a difference in tread of more than 4mm at the same stage of tyre life i.e. regrooved 4mm is not compatible with non regrooved 6mm.

3. Ensure tyres with previous kerbing damage are positioned so the worn sidewall is protected from further damage. Never refit a tyre with severe kerbing damage to any position e.g.

    - Where a tyre has suffered from sidewall cuts that expose the cords or bulges that are not repairable.

    - Where the casing plies are exposed or “ghosting” through the tyre.

    - Both sidewall indicators are worn to their maximum limit.

    - The lettering on both sidewalls of the tyre has disappeared.

Tyre Wear and damage

Wear patterns

There are many types of wear patterns the most common type of wear is below:

Tyre Wear Guide

The following guide will help you identify the causes and solutions of most common tyre wear patterns.

WEAR PATTERN		CAUSE	SOLUTION
	CENTRE WEAR	OVER INFLATION	Adjust pressure to particular load per tyre catalogue
	EDGE WEAR	UNDER INFLATION	Adjust pressure to particular load per tyre catalogue
	SIDE WEAR	LOSS OF CAMBER OR OVERLOADING	Make sure load doesn't exceed axle rating. Correction is 3/4- 1 degree positive camber (top of wheel rim 3/16" further out than bottom
	TOE WEAR	INCORRECT TOE-IN	Correct toe-in is 0-1/2 degree.
	CUPPING	OUT OF BALANCE	Check bearing adjustment and balance tyres.
	FLAT SPOTS	WHEEL LOCKUP & TYRE SKIDDING	Avoid sudden stops when possible and adjust brakes

Tyre wear should be checked frequently because once a wear pattern becomes firmly established; it becomes difficult to stop, even if the underlying cause is corrected.

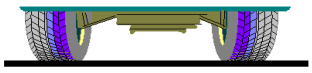
Wheel alignment

It is important that a vehicle's wheels are correctly aligned. Poor alignment will affect:

1) Tyre wear.
   - Excessive Toe in / Toe out

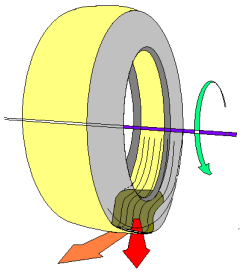
     and inter axle misalignment causing feathered wear.
2) Vehicle handling.
   - Wheel alignment.
   - Camber wear +/- handling.
   - Directional stability.
3) The vehicle fuel economy.

   (See examples on page 9)



TOE-OUT, inside shoulders

TOE-IN, outside shoulders



Damages

Flat spotting

As long as the damage is not to the cords, a flat spot does not contravene the Construction & Use

Regulations. However when the tyre wears, the flat spot will always stay ahead of the rest of the tyre and therefore would require monitoring. The easiest solution is to have the damage repaired. Any tyre that requires a repair due to flat spotting must be sent away to a designated third party repairer.

Object trapped between twins

When a twinned assembly has been identified as having an object trapped between the twins it is **vitally important** not to try and remove the object or the wheels without deflating the tyres first. If the object has been wedged between the tyres it may have caused damage to both tyres and be hazardous to remove wheels. Where damage has been identified on a tyre that has already been removed, it would be necessary to establish the whereabouts of its twin, and ascertain as to whether this tyre has been inspected. Under no circumstances should any tyre that has suffered from an object trapped between the twins be refitted to another vehicle without thorough inspection by a tyre damage trained operator.

Sidewall kerbing

The tyre is fit for service until the plies become exposed. When the sidewall lettering starts to disappear, it is time for the vehicle operator to turn the tyre on the wheel, please see later.

The size and service description must be visible on one side of the tyre for it not to contravene MOT requirements.

Turning Tyres on the Rim

It has always been said that careful tyre management can save the operator money. There are many simple checks and procedures which, if carried out at the correct time can extend tyre life and therefore, provide cost savings.

Turning the tyre on the rim is one of these procedures. Steer tyres, particularly on the nearside, often wear more on the one shoulder than the other. This can be due to the road camber, the continuous cornering and roundabouts on UK roads, misalignment or sometimes, under inflation.

The problem is that when one shoulder wears down to minimum tread there is still a significant amount of remaining tread left on the other shoulder when the tyre is removed. To avoid this waste the tyre should be turned on rim early enough to equalise the wear. A difference that is greater than 3mm from one shoulder to the other should instigate a turn on rim. This abnormal wear should be identified at inspection intervals (see Section 4).

Care must also be taken with the management of the drive axle tyre wear on the inner edge of the inner tyres.

Ancillary parts

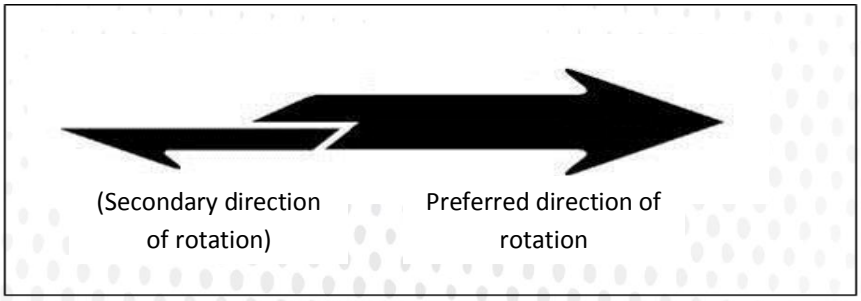
Replace any of the ancillary parts that may be missing, such as valve caps, valve extensions and their brackets.

Directional tyres

Certain passenger bus tyres have a directional tread pattern, designed to give optimum tread wear performance when fitted in the preferred direction. These are marked with a single arrow to indicate the preferred direction of rotation.

Bi-Directional tyres

In future, some tyres will be marked with a "Bi-Directional" arrow, which looks like this:-



The arrow with the larger head indicates the manufacturers' preferred rotation for the tyre, optimising tread wear performance.

Tyres marked with a bi-directional arrow should be run in the direction of rotation indicated by the larger arrow head.

However, if a tyre marked with the bi-directional arrow shows an irregular wear profile, (for example, a sloped wear pattern) then it may be turned on the rim and run in the direction of the smaller arrow head with no detriment to any other performance criteria.

In cases such as this, it is recommended that all tyres on the same axle should be turned on the rim such that all arrows face in the same direction.

When turning these tyres on the rim or moving from side to side on a vehicle, they should be treated in the same way as any other. *Please remember that tyres on the same axle must always be compatible with each other.*

Twinning

When two tyres are fitted side by side on one side of an axle (twinned) then the following guidelines must be observed:

Twinning of different brands of tyres is not recommended as dimensions of the casings can vary, causing possible accelerated wear to the smaller tyre.

The difference between the remaining tread pattern depths should not be greater than the manufacturers' recommendation at the same phase of life.

DO NOT TWIN REGROOVED TYRES WITH UNREGROOVED TYRES

Mis-aligned hand holds

When twinning tyres together it is "Best Practice" to put the inner and outer valves at 180 degree opposites to each other. If the valves are fitted together it may impair the taking of either tyre pressure.

It is advisable that on twin sets of wheels the inner tyre is fitted with a valve extension for ease of maintenance and pressure checking.

Tip: After checking tyre pressures, and to ensure the valve has seated a soapy liquid can be used to detect air leaks before fitting the dust cap.

Section 4 – Tyre Re-treading

It is important to note that you must not deviate from the manufacturer's specification when having to replace a tyre/wheel.

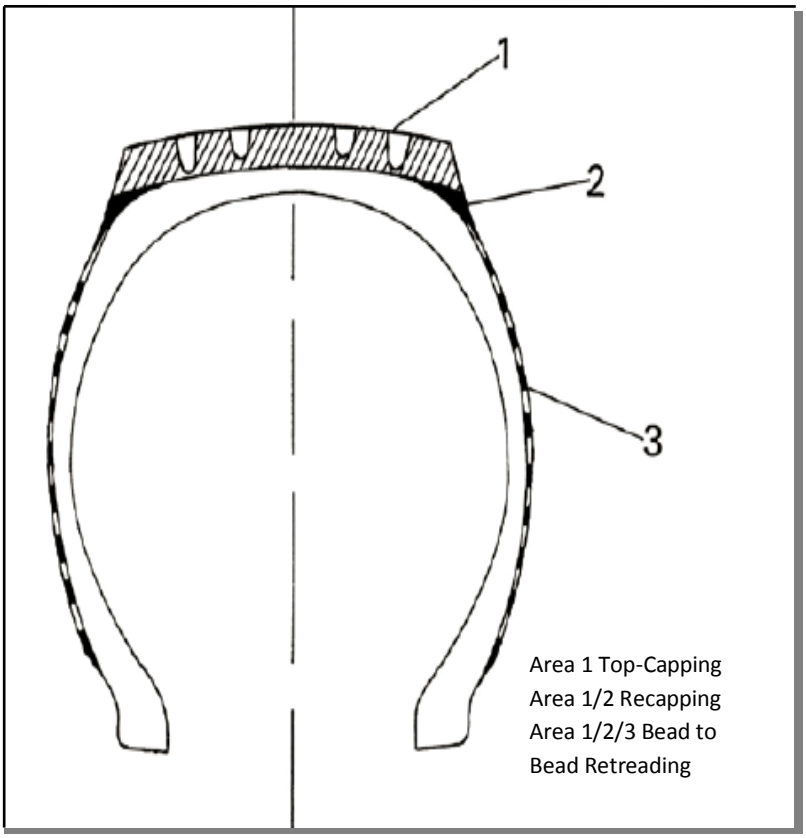
Retreaded tyres shall display on both sidewalls in the case of symmetrical tyres and at least on the outer sidewall in the case of asymmetrical tyres: The term "RETREAD".

What is a Retread?

Retread is a generic term for reconditioning or re-engineering of a worn tyre casing to extend its life. It covers the replacement of tread rubber and may include the renovation of the shoulder and sidewall. The safety, performance and structural integrity of a retreaded tyre depends entirely on the basic raw material 'the original tyre casing'.

Poor Tyre Management can result in casing rejection; professional retreaders scrutinize the casings' integrity throughout the entire retread process. Casings are subject to continuous process examinations and are retreaded in accordance with regulation ECE 109.

To maximize the life of a worn tyre casing "end users" should always observe in service recommendations specified by their tyre supplier and/or tyre manufacturer.



Area 1 Top-Capping
Area 1/2 Recapping
Area 1/2/3 Bead to Bead Retreading

There are three basic types of RETREADS

1) Top – Capping (Pre-cured retreading)
A process in which the worn tread rubber only is renewed, by application of a preformed and vulcanised tread. N.B ***NEW DATE IS STAMPED*** ON THE CASING BY THE RETREAD MANUFACTURER.

2) Recapping
A process in which worn rubber is removed from the tread and shoulder areas, followed by the application of new rubber. N.B ***NEW DATE IS STAMPED*** ON THE CASING BY THE RETREAD MANUFACTURER.

3) Bead to Bead, Retread (Hot Cure)
A process in which worn tread shoulder and sidewall rubber is removed and new rubber is applied, extending from bead to bead. N.B ***NEW DATE IS STAMPED*** ON THE CASING

When a full retread is carried out it is important to note that the date stamp of the original manufacture is replaced by the date the tyre is retread.

Retread ECE (Regulation 109) Uniform Provisions Concerning The Approval For The Production Of Retreaded Pneumatic Tyres For Commercial Vehicles And Their Trailers (Type Approval Mark).

Retreading a tyre makes economic and environmental sense, reducing life cycle costs and removing worn tyres from the waste stream.

The professional retreader checks the integrity of **every** casing prior to process. Significant developments in non-destructive testing equipment are used to ensure casing integrity. This is vital to ensure the high quality levels as demanded by ECE 109 regulations. *(Retread ECE (Regulation 109) Uniform Provisions Concerning the Approval for the Production of Retreaded Pneumatic Tyres for Commercial Vehicles and Their Trailers (Type Approval Mark)*

It is therefore recommended that you only use retreaded tyres that exhibit the ECE109 marking found on the sidewall of the tyre.

All retreads/casings (worn our tyres) selected for retreading out subjected to non-destructive testing to check the casing structural integrity and suitability for process and multiple lives. All retreads are covered by the regulation ECE 109, this regulation ensures that all retreads are examined and tested to same standard as that of new tyres.

Example methods adopted for non-destructive structural integrity testing are as follows:

- Shearography
- Ultrasonic testing
- Inflection Pressure Testing.
- Pin Hole detection
- All stages of inspection from initial to final inspection include a full external and internal physical examination by fully qualified operators.

Should you wish to identify your local Retread Company please contact the RETREAD MANUFACTURERS ASSOCIATION (Contact- Retread Manufacturers Association, Pershaws, Berewck Hall Court, White Colne, CO6 2QB. Tel: +44 (0) 1787 2221022 or email: rma@greentyres.com. www.greentyres.com) …A sign of quality.

Section 5 –Tyre Inspections

Pre inspection best practices

It is considered best practice to ensure that a vehicle inspector / tyre technician has:

- Correct personal protective equipment, (High visibility vest/coat, overalls, boots, gloves, head protection and knee pads).
- A calibrated pressure gauge.
- A digital tread depth gauge.
- A torch.
- A valve cap & valve core remover and a tyre pick can be useful.
- A clipboard, pen and necessary paperwork.
- Isolate the vehicle to be inspected by using a steering wheel cover to indicate the need for tyre maintenance. **Remember: safety is paramount.**

Conducting a fleet inspection

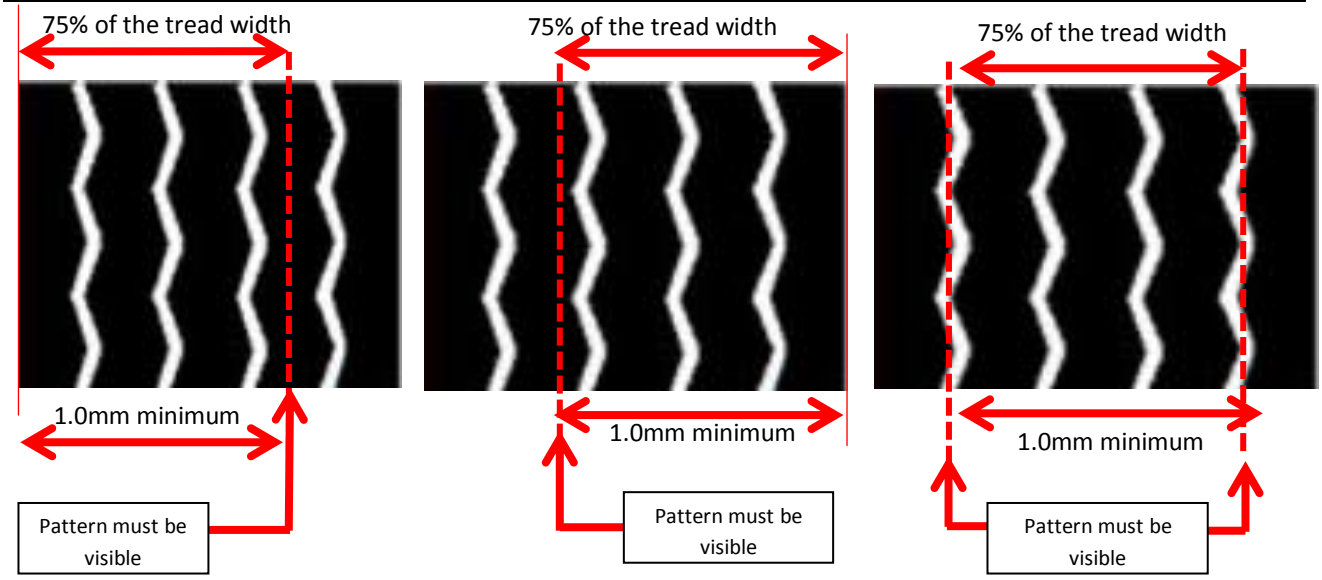
When carrying out a vehicle examination or fleet inspection a number of things can be done to maintain a high level of quality which is essential to protect the business and the operator's licence.

It is important to gather as much information as possible from the fleet inspection. The Examiner must examine the following: -

- The tyre's remaining tread depth (covering at least any 3 to 4 points of the breadth of the tread around the entire circumference).

- Minimum tread depths for vehicles of the 3.5 tons threshold are set out below:-

• Minimum tread depth	1mm, excluding any tie bar or tread wear indicator
Position of minimum tread depth band	Form a continuous band covering at least any 3/4 of the breadth of the tread around the entire circumference



- Inspect the tyre for tread / sidewall / bead damage.
- Inspect the tyre for abnormal wear patterns such as wheel alignment issues and mechanical faults.

- Check the condition of the wheel and wheel nuts for damage and the wheel nut indicators for movement.
- Inspect the valve, valve extension and the valve cap.
- Confirm that none of the tyres on the vehicle require a turn on rim.
- Check that no twinned assemblies are poorly twinned.

Section 6 - Storage and Stock of Tyres

The following recommendations should be followed regarding the storage of tyres:-

1. They should be kept away from any possible contact with oil or hydrocarbon solvents/lubricants.

2. They should be kept cool, dry, and moderately ventilated. Moist conditions should be avoided. Care must be taken to ensure no condensation occurs.

3. They should not be subject to heat and should be kept out of direct sunlight.

4. Ideally tyres should be stored vertically.

5. Ensure that as far as possible that tyre stock is used in order of delivery date and stock rotated on a regular basis.

6. Do not allow any tyres to become "aged" in stock. Aged means any tyre with superficial cracks or crazing around the sidewall lettering or features of the sidewall or tread as a consequence of prolonged exposure to ultraviolet light or chemical contamination (aggressive cleaning fluids). Or, if the tyre has been in stock for a long period of time without use. Tyres in service, including spare tyres, for 5 years or more should continue to be inspected by a specialist at least annually.

7. Do not keep unnecessary sizes in stock or over stock. Regular stock rotation will ensure that tyres do not become dormant.

8. A tyre that is full of water or debris must be cleaned before it is fitted to a wheel.

9. Solvents, fuels, lubricants, chemicals, acids, disinfectants and the like should not be kept in the store room. Rubber solutions should be stored in a separate room the administrative regulations on the storage and handling of inflammable liquids must be observed.

10. Products should be stored in a relaxed condition free from tension, compression or other deformation since these may cause cracking or permanent distortion.

Any tyre which has been stored must be visually inspected by competent staff before entering or re-entering service.

Section 7 – Tyre Pressure Maintenance

The importance of correctly inflated tyres.

The maintenance of correct tyre pressures is extremely important, not only from the performance and safety aspects but also from the tyre life point of view.

Correct tyre pressures produce the best ride and handling of the vehicle.

Maximum tyre life is obtained when the correct tyre pressures have been used throughout the tyre's life. An error in pressure of 20% will produce a reduction in tyre life of up to 25%.

Correct tyre pressures provide optimum tyre life, vehicle fuel efficiency, ride and handling.

You should record all tyre pressures as part of planned vehicle maintenance inspections. This will assist you in monitoring the tyre performance and highlighting pressure loss issues.

Calibration of tyre inflation equipment - It is vital that tyre inflation equipment is calibrated in line with the manufacturer's guidelines

Workplace Best Practice

1. The Vehicle operator must ensure that they have the correct pressure recommendations provided by the tyre manufacturer for the vehicle type.

2. It is good working practice that these pressure recommendations are displayed at the vehicle operator's premises and a copy given to their vehicle servicing agent (if applicable).

3. All pressure recommendations must be reviewed annually to ensure that they are current and comply with tyre manufacturer recommendations.

4. When any new vehicle types enter the fleet a recommendation must be asked of the tyre manufacturer and the pressure charts updated accordingly.

5. When a damaged tyre is removed from the vehicle, the tyre should be deflated.

6. When inflating a repaired tyre using a tyre cage, always follow the correct procedure using the manufactures' guidelines.

Section 8 – Wheel Assembly Fitment

Painting of wheels

There should be no paint on the mating faces of wheels (except the original manufacturers coating).

Wheel rims damaged by corrosion

Wheel rims can become corroded after a long period in service. Remove corrosion and assess the wheel suitability for service before refitting the tyre.

The importance of cleanliness cannot be over-emphasised when fitting tyres. Tyres should never be fitted with oily hands or on dirty oil patches off the garage floor and never 'trodden-on' with dirty boots.

You should also examine for cracks especially:

- Between the stud holes, handholds and brake inspection holes.
- Around the circumferential weld between the nave and rim.

Re-fitment of the wheel onto the vehicle.

Best practice dictates that a suitable re-fitment and re-torque policy should be in place as this is paramount to wheel security.

The following is a generic process; formal processes and setting should be sought from the Vehicle Manufacturer.

Final Tightening of Wheel Nuts	
NOTE: The final tightening of wheel nuts should be done using a calibrated torque wrench, set to the manufacturers or Operator's specified torque setting. This must be carried out wherever possible with the wheel in the "Raised Position" (i.e. before lowering the vehicle to the ground). Where this is not possible the vehicle should be "partially" lowered to the ground to enable the correct torque to be applied before "Fully" lowering the vehicle to the ground. a) Before securing the wheel to the vehicle it is important to check the condition of the wheel studs; locating holes in wheel for elongation; check nuts and collar. N.B. it is advisable to use a light lubricant on nuts/collars and studs on assembly, ensuring the nut collar freely spins before torqueing. b) When the wheel assembly has been secured to the vehicle, remove the axle stand and lower the vehicle.	**NOTE:** Before final tightening, ascertain that the wheel is correctly mounted as failure to locate the wheel correctly will result in its running eccentrically and **ALMOST CERTAINLY** coming loose. The final tightening of wheel nuts should be done following the garage wheel security procedure. An air impact tool should **NEVER** be used for the final tightening and neither should extensions on nut spanners and spiders as over-tightening may result in stretched threads, broken studs and cracked or distorted wheels.

Re-torque Procedure

There is a requirement (BS AU 50 Part 2 Section 7a) to have the wheel nuts re-checked (Re-torqued) to ensure they are still at the recommended torque setting. This should be done:-

After 30 minutes if the vehicle is stationary or within 40 kilometres (25 miles) to 80 kilometres (50 miles) if the vehicle is used

Section 9 - Repairing tyres

It is vital that any repair (Minor or Major) is undertaken by a trained operative. All major repairs should follow the standard of BS AU 159g.

Although not mandatory it is recommended that (major or minor) repaired tyres are fitted to a rear axle position only.

Minor repairs / Markings

There is no requirement in accordance with BS AU 159g to mark minor internal or external repairs.

Major repairs

Commercial vehicle tyres with major repairs conforming to the British Standard shall be marked by the repair agent, radially in line with each repair at a point just above the area covered by the rim flange, permanently and legibly, with the number of the British Standard, i.e. BS AU 159g, and with the repairer's name or identification mark. The minimum height of the characters shall be 4mm.

Prior to affecting a repair, the following important points should be borne in mind:

- Tyres shall be removed from their wheels and thoroughly inspected to ensure that they are suitable for repair.
- It is recommended that this inspection is carried out by a tyre repair trained operative.
- The insertion of a tube to affect a 'repair' to a minor penetration is not recommended.
- External plugging (string repair) or tyre sealants are not considered to be a permanent repair in accordance with BS AU 159g.

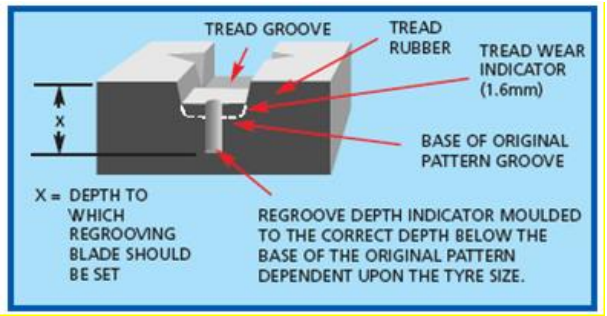
  N.B Tyre 'putty or dough' is usually a self vulcanising polymer compound that should only be used for localised cosmetic injuries i.e. Rubber only. Tyres with damages that extend to the reinforcing belt structure of the tyre should be assessed by a qualified repair technician and repaired in accordance with BS AU 159g.

Regrooving

Re-groove Depth Indicator (RDI) & Tread Wear Indicators

The re-groove depth indicators are at the base of the tread as described in the diagram on right.

It is advisable to refer to the manufacture guidance.



If you have a mix of sizes and types or you are not sure – seek guidance from your tyre supplier.

Tyre condition on buses and coaches is the 4th most common issue found during DVSA roadside inspections that attract prohibition, with tyre tread worn below the legal limit, being the most common fault closely followed by seriously under inflation and damage to sidewalls.

A number of incidents and queries have arisen recently regarding the issue of regrooving and partial regrooving.

Legal requirements

The Motor Vehicles (Construction and Use) Regulations define a re-cut (regrooved) pneumatic tyre in the following terms.

"A pneumatic tyre in which all or part of its original tread pattern has been cut deeper or burnt deeper or a different tread pattern has been cut deeper or burnt deeper than the original tread pattern."

Broadly speaking, most PSV's over 2.5 tons unladen weight can be fitted with regrooved tyres, provided that the tyres themselves are suitable for re-cutting.

However, the law forbids the use of regrooved tyres on the following:

- Passenger vehicles of less than 2540kg (approx. 2.5 ton) unladen weight, or less than 3050kg (approx. 3 ton) if designed to carry no more than 7 passengers, excluding the driver.
- Trailers classed as 'living vans' not more than 2040kg (approx. 2 ton) unladen weight.
- Trailers not equipped to carry any load except for plant, or fixed equipment (e.g., air compressor trailers) whose laden weight is less than 2290kg (approx. 2.25 ton).
- Any other trailers of less than 1020kg (approx. 1 ton) unladen weight.
- Tyres not carrying the word "REGROOVABLE".

IMPORTANT

The law specifically demands regrooving to be carried out properly without damaging or exposing any part of the ply or cord structure of the tyre. It must be carried out in accordance with tyre manufacturers' recommendations and to the tyre manufacturers' regrooved pattern.

The inspector must comply with the law and must only fit regrooved tyres on axles as defined in the operator's tyre policy.

The legislation covering the subject of regrooving and partial regrooving can be found in Regulation 27(5) and (6) of the Construction and Use Regulations. It is this information that the Police or any regulating body will use to determine the suitability of a regrooved tyre. Put simply, this regulation specifically demands that regrooving should be carried out properly without damaging or exposing any part of the ply or cord structure of the tyre. It must be carried out in accordance with tyre manufacturers' recommendations and to the tyre manufacturers' approved and registered regrooved pattern.

The manufacturer determines the recommended regrooving pattern for its tyres following thorough testing and confirmation that the pattern to be recommended meets all of its requirements regarding safety, security, water clearance, grip, cost effectiveness etc. Only then does that become the pattern that is registered with the Department of Transport. It is important, therefore, for reasons of both legality and overall performance that the following guidelines are adhered to.

Complete re-groove

The advice is straightforward with a complete regroove – it should be carried out entirely according to the recommended pattern, without adding or omitting anything, and there should be no problem from a safety or legal point of view.

Partial re-groove

The situation becomes a litter cloudier, and raises more questions and discussion, when dealing with partial re-groove.

It is strongly recommended that you regroove to the patterns, depths and widths, as instructed by the tyre manufacturers' publications, so ensuring good service of your tyre.

Where a tyre has worn abnormally, it may be possible to regroove just that part of the worn tyre, provided a sufficient portion of the original groove is visible before regrooving.

Section 10 - Commercial Vehicle Wheels

General Introduction

Basically, any vehicle wheel consists of two main components:

- RIM
- NAVE

The RIM is the part on which the tyre is mounted and thus its dimensions; shape and condition must be suitable to satisfactorily accommodate the particular tyre required for the vehicle.

The NAVE is basically a disc filling in the centre of the rim and its dimensions and shape must therefore be suited to the design of wheel hub on the vehicle to which it has to be mounted.

It is quite common, therefore, for two vehicles - each of the same tyre size - to have wheels with identical rims, but with different naves to suit their different designs of wheel hub. In this case, the wheels would not be interchangeable between the vehicles. This, in fact, is the usual situation for cars, which tend to have wheel naves unique to each model - or at least to a range of cars from one manufacturer.

Similarly, it is equally possible for two other vehicles to have similar (even identical) wheel hubs - and thus use identical naves in their wheels - but requires different rim sizes to suit different tyre sizes. This is unlikely to happen often with cars but is the usual situation on trucks where wheel hub dimensions are largely standardised.

The Important Dimensions

The purpose of the RIM is to provide a firm base on which to fit the tyre. To ensure this for any particular size of tyre, three vital dimensions are involved.

1. DIAMETER — To be wide enough to match the inner tyre diameter to ensure a firm seal between bead and wheel rim.
2. INSIDE RIM WIDTH — To space the tyre beads at optimum width, neither too narrow nor too wide, to ensure a firm “foundation”.
3. FLANGE HEIGHT — To be high enough to give adequate support to the tyre beads but not too high to interfere with the flexing of the sidewall.

The NAVE provides the link between the rim, carrying the tyre and the wheel hub on the vehicle. The hub carries a number of studs, arranged in a circle, onto which wheel nuts are threaded to clamp the wheel in place. Collectively these are known as the wheel fixings. There is usually a hole in the middle of the nave called the centre bore through which part of the hub may protrude.

To the vertical plane, the nave can also have an OFFSET or INSET which determines where the centre line of the rim, and hence the tyre, is placed relative to the face of the hub. This dimension determines the width of the wheel track.

OFFSET - The distance between the centre of the rim and the outside face of the nave. This information is useful when fitting twins to prevent kissing.

Section 11 – Training

Operators must ensure that they provide training to enable their staff to competently carry out duties they are assigned. This will mean that a variety of training is offered dependent on specific roles or duties. Consideration should be given as follows:

Driver training

It is a duty of the driver of a PSV to ensure that the tyres on the vehicle they will be driving are fit for purpose and safe to use. Each driver **must** carry out a 1st use vehicle walk around check before undertaking their journey / duty. The driver **must** be able enough to identify if a tyre fulfils legal requirements. It is prudent to include a training module as part of initial Driver induction detailing tyre inspection procedures. This training should be refreshed at least every 5 years.

Drivers and Operator licence holders are also reminded that the first use driver check forms part of a preventative maintenance programme and is an essential part of Operator licence obligations.

Regular checks and audits must be carried out by Transport Mangers to ensure that checks are thorough and effective, records of audits should be kept as evidence – failure to have a robust system in place will jeopardise your Operator's licence.

An example of first user check for tyres is included in DVSA publication DVD – "Check it Out PSV Driver's Walk-around Checks"

Vehicle Maintenance Staff

Any person who undertakes vehicle maintenance must be competently trained to identify tyre irregularities and staff must be able to prevent premature tyre failures by identifying wear patterns and changes in vehicle characteristics. They should have received formal training such as City & Guilds / NVQ / IMI (not exhaustive) in vehicle maintenance.

Staff must also be aware of manufacturers / operators tyre pressure maintenance guidelines and any other relevant policy relating to wheels and tyres. Maintenance facilities must have policies and guidelines on clear display and have sufficient, clean tools and work areas to enable effective inspection and repairs to be carried out.

Tyre Technicians

It is now common practice for many PSV/Coach Operators to use tyre manufacturers or appointed agents to maintain their fleet tyres – this is known as contract maintenance. Operators have realised the benefits of using an appointed tyre expert over recent years. There are obvious benefits to road worthiness compliance, safety and efficiency – not least, financial performance.

If operators choose to maintain their own tyres they must ensure that the tyre technician has adequate recognised training and experience relevant to their particular fleet. The operator must ensure that tyres are responsibly sourced and endorsed for UK and European use.

Many of the tyre manufacturers offer training packages from basic awareness to thorough accredited technician status award. (A sample list of training centres is included in appendices).

Appendices

References:

Department of Transport have produced a document "Careless Torque Costs Lives" which can be downloaded from https://www.gov.uk/government/publications/careless-torque-costs-lives
UK Construction & Use Regulations S24 & S27
ETRTO Recommendations
IRTE/FTA (wide wheel security)
British Standard BSAU 1599
British Tyre Manufacturers Association
Driver Vehicle Services Agency "Check it Out PSV Driver's Walk-around Checks"

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Steve Breckons – Bandvulc Group
Continental Tyres
Gary Powell – Bridgestone Tyres
Driver Vehicle Service Agency
Backhouse Jones Solicitors
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Department for Transport	www.gov.uk
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