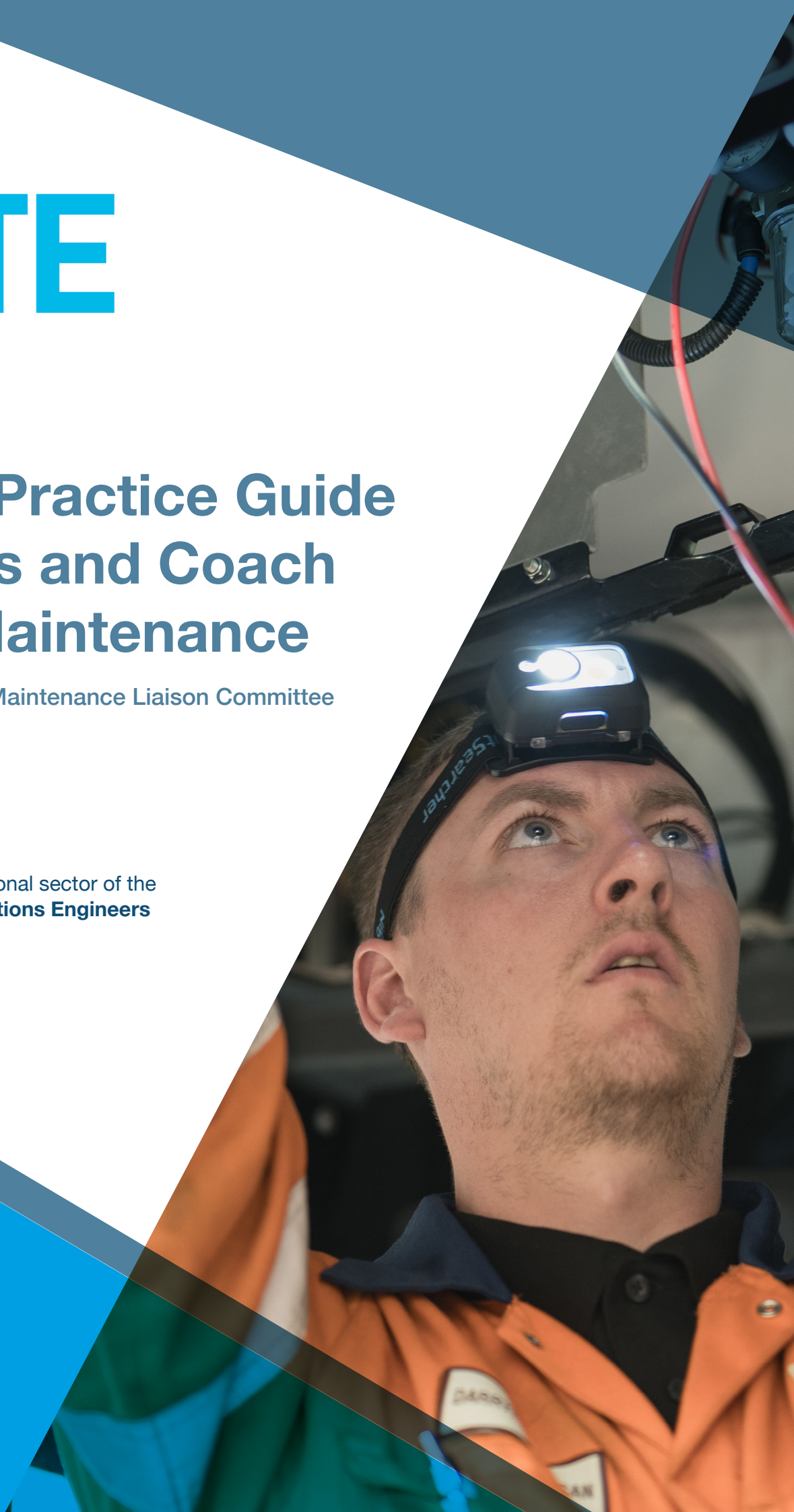
IRTE

Good Practice Guide for Bus and Coach Tyre Maintenance

North Western Maintenance Liaison Committee



IRTE is a professional sector of the
Society of Operations Engineers

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SOE (Society of Operations Engineers) is a professional membership organisation representing some 15,000 individuals and companies in engineering. It supports and encourages members throughout their careers and is committed to their ongoing growth and professional development.

Through a network of trustees, industry partners and members, SOE promotes good practice in operational and health and safety initiatives. SOE offers members continuing professional development and support throughout their careers, providing definitive recognition for both achievement and status. The organisation is a Licensed Council registration at EngTech, IEng and CEng levels.

SOE represents the Professional Sectors IRTE, IPlantE and BES and developed the technician-licensing scheme.

IRTE

IRTE (Institute of Road Transport Engineers), one of the most respected names in UK transport, has always been recognised as an impartial voice of industry.

IRTE publishes an industry leading technical journal, Transport Engineer, every month. Now online www.transportengineer.org.uk contains searchable editorial archive, daily online news updates, a supplier directory, e-zine newsletter, jobs, events, whitepapers and much more.

IRTE also hosts regular technical seminars and forums and works alongside DfT to promote efficiency and good practice. Recent events include biofuels, trips and falls from vehicles, truck operation, fuel efficiency and the Road Safety Act.

IRTE's technical committee also produces regular industry guidance on key topics. Follow the link here - SOE: Technical Guides to see other IRTE technical guides.

IRTE members come from a wide variety of transport-related roles. These include workshop managers, fleet engineers, transport managers, company directors, apprentices and technicians in the light and heavy goods vehicle and bus and coach sectors.

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About This Guide

This Good 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 The Driver & Vehicle Standards Agency have produced guidelines and this document is designed to be read in conjunction with those recommendations.

This is a guide to good 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 provides good practice tips on how to maintain and check tyres to ensure vehicles stay legal and safe while out on the road.

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

The Driver Vehicle Standards Agency (DVSA) regularly produces 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 play a significant role in a vehicle's fuel consumption. They are responsible for nearly **one-third of a vehicle's fuel usage**. This is primarily due to rolling resistance, which is the force that opposes the tyre's rolling motion. When tyres have high **rolling resistance**, the vehicle needs more energy (and thus more fuel) to keep them moving.

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.

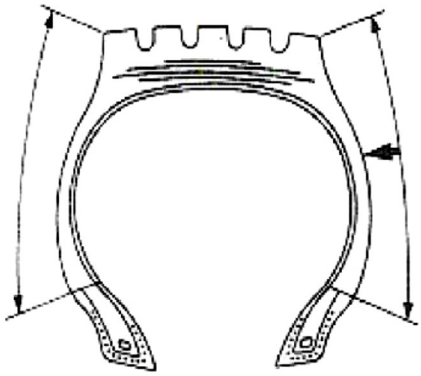
Don't let cost pressures compromise road safety. Looking after tyres is an important element in road safety. The safety and operational risk posed by poor tyre maintenance is significant. Operator Compliance Risk Score "OCRS" relies on a number of things including roadside checks by DVSA and MOT annual 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. 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 2, September 2024), www.etrto.org.



Since the 1st of February 2021 it has been illegal to use tyres more than 10 years old on the front steered axles of:

- buses
- coaches
- minibuses

and also to the rear axle, or axles, unless equipped with twin wheels.

To prove the age of a tyre it is further required that manufacture date, printed on the tyre, remain legible on all tyres.

Retreaded tyres are subject to the same requirement as first-life tyres. The date of retreading, instead of date of first manufacture, will be used to determine the tyre age.

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 good 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 manufacture of a new tyre can be determined from the code marked on the sidewall. The final four digits show the calendar week and the year of manufacture. The tyre in the photograph was manufactured in week 08 of 2020. Markings on retreaded tyres must show the most recent date of remanufacture. They may also show the date of original casing manufacture. Always refer to the latest date of manufacture, which will be the retread date.

This tyre was produced in calendar week 08 of 2020.

If your vehicle's tyres are showing signs of age, they must be 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.

If climatic conditions require the fitment of snow they must be fitted properly. 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 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 industry and manufacturer approved 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 plenty of water and a mild detergent.

> Vehicle Maintenance

- Component parts. Play in bearings, bushes; track rod ends etc. can affect tyre wear, as can incorrectly 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 maximum authorised load at the vehicle's legal maximum speed.
- 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:

Under-inflation Correct Over-inflation

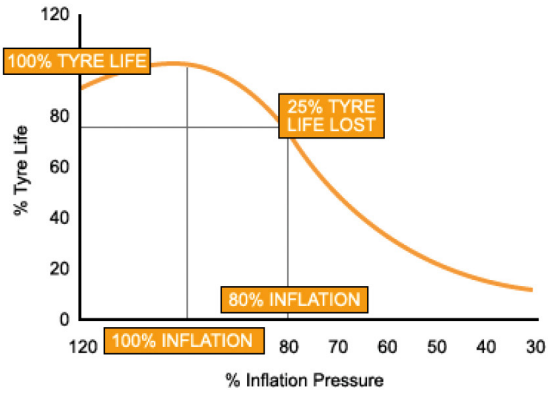
There is more to tyres than pressure and more to tyre safety than checking them once a year.

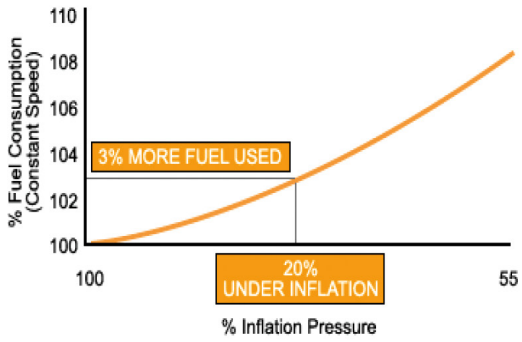
Tyre safety is an everyday issue – remember it is air pressure inside the tyre that carries the load, as low pressure will cost more in fuel and affect vehicle handling. Operators should ensure that their drivers inspect their tyres on a regular basis and always include them in their daily walk around 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 good practice guidance document is a useful resource for operators to minimise the impact of their activities on people and the environment. However, this good 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 below.

When purchasing new tyres, it is a requirement to use tyres with the UK 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 SH / SD Radial construction
3. (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
11. Date code (week, year)
12. DOT Manufacturing Code
13. Noise number – indicates 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 that can 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 kg	Load index	Load kg	Load index	Load kg	Load index	Load kg	Load index	Load kg
50	190	65	290	80	450	95	690	110	1060
51	195	66	300	81	462	96	710	111	1090
52	200	67	307	82	475	97	730	112	1120
53	206	68	315	83	487	98	750	113	1150
54	212	69	325	84	500	99	775	114	1180
55	218	70	335	85	515	100	800	115	1215
56	224	71	345	86	530	101	825	116	1250
57	230	72	355	87	545	102	850	117	1285
58	236	73	365	88	560	103	875	118	1320
59	243	74	375	89	580	104	900	119	1360
60	250	75	387	90	600	105	925	120	1400
61	257	76	400	91	615	106	950	121	1450
62	265	77	412	92	630	107	975	122	1500
63	272	78	425	93	650	108	1000	123	1550
64	280	79	437	94	670	109	1030	124	1600

Speed Rating Chart

Speed Rating	Speed (km/h)	Speed (mph)	Speed Rating	Speed (km/h)	Speed (mph)	Speed Rating	Speed (km/h)	Speed (mph)
A1	5	3	D	65	40	Q	160	99
A2	10	6	E	70	43	R	170	106
A3	15	9	F	80	50	S	180	112
A4	20	12	G	90	56	T	190	118
A5	25	16	J	100	62	U	200	124
A6	30	19	K	110	68	H	210	130
A7	35	22	L	120	75	V	240	149
A8	40	25	M	130	81	W	270	168
B	50	31	N	140	87	Y	300	186
C	60	37	P	150	93	ZR	Over 240	Over 150

Section 3 – Tyre Husbandry

> Tyre Choice

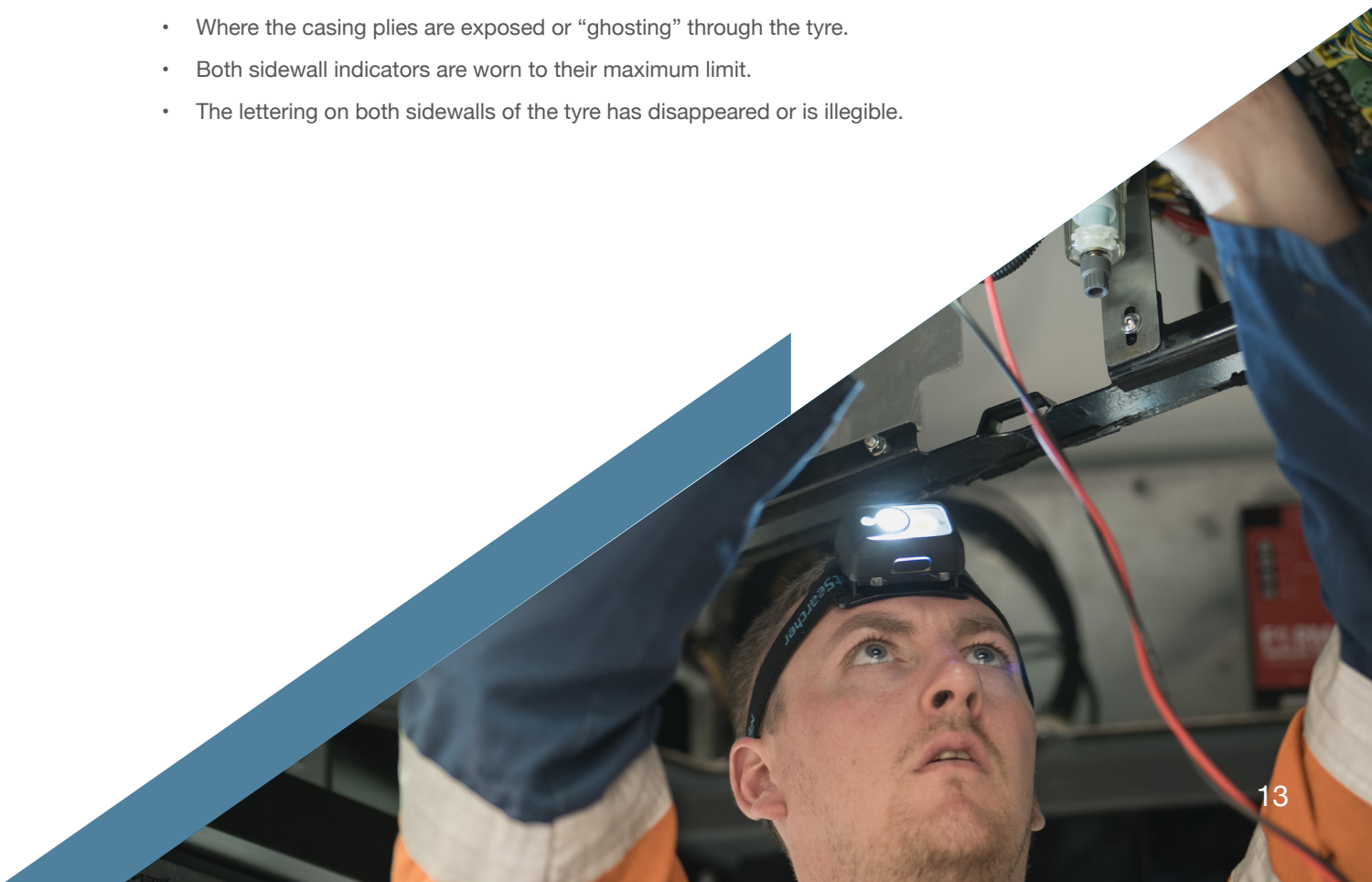
Many PSV operators will have to register Local Service Buses with the Traffic Commissioner. In those cases the vehicles can be fitted with J – speed rated tyres. This enables the fitment of the special robust urban bus tyres.

> Front Axles – Order of Selection

1. It is not permitted to fit drive axle tyres on the steer axle of a vehicle.
2. It is recommended that new tyres are fitted to steer axles, whilst it is strongly discouraged 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 or is illegible.



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:

Tyre wear

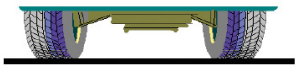
- Excessive Toe in/Toe out and inter axle misalignment causing feathered wear.

Vehicle handling

- Wheel alignment.
- Camber wear +/- handling.
- Directional stability.

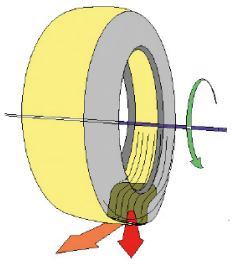
The vehicle fuel economy

(See examples on page 10)



TOE-OUT, inside shoulders

TOE-IN, outside shoulders



Damages

> Flat Spots

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 is 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 person.

> 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.

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 provided the tyre is not a uni-directional type, 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 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 maybe 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

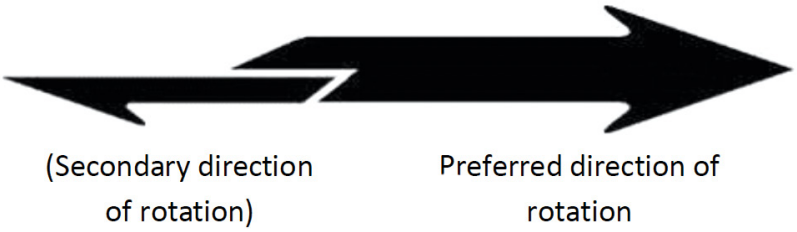
Replace any of the ancillary parts that may be missing, such as valve caps, valve extensions and their brackets.

> 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 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 “Good 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 Retreading

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?

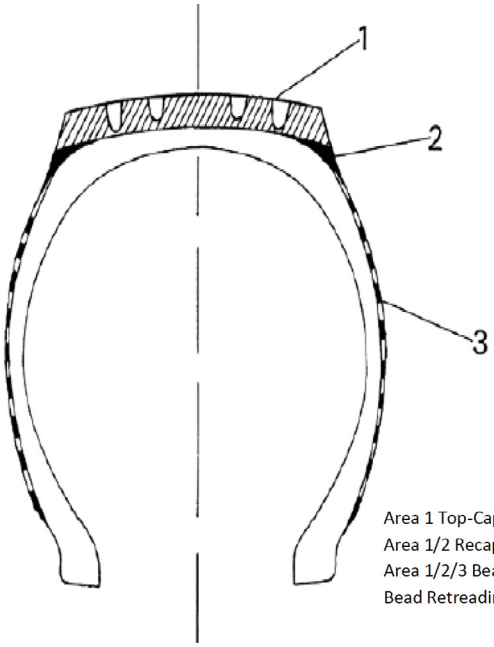
Retread is a generic term for reconditioning or re-engineering of a worn tyre casing to extend its life. It covers the replacement of tread rubber and may include the renovation of the shoulder and sidewall. The safety, performance and structural integrity of a retreaded tyre depends entirely on the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

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.



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

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 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.

Section 5 – Tyre Inspections

> Pre Inspection Good Practices

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

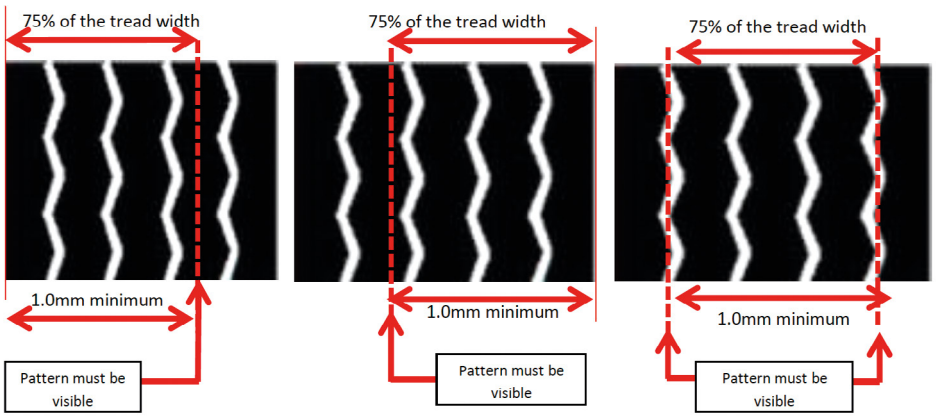
- Correct personal protective equipment, High visibility vest/coat, overalls, protective footwear (ankle support and toe protection), gloves, head protection eye and ear and knee pads.
- A calibrated pressure gauge.
- A digital tread depth gauge.
- A torch.
- A valve cap & valve core remover and a tyre pick.
- 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 and record 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 exceeding 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 any 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 contains anything including 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 Good 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 new or repaired tyre using a tyre cage every time is good safer practice, 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 oil or grease contaminated hands or laid on dirty oil patches off the workshop floor and never 'trodden-on' with oil or grease contaminated boots.

You must 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

Good 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. Further guidance is available from the IRTE – Wheel Security Best Practice Guide.

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.

British Tyre Manufacturers' Association

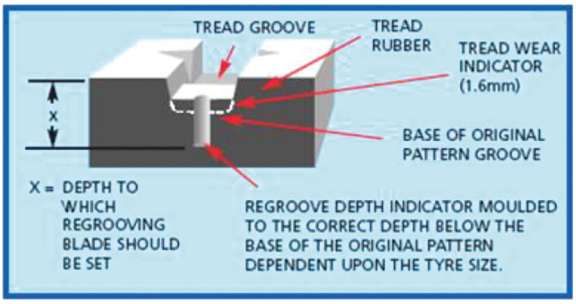
Regrooving

> 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 remains a significant concern during DVSA roadside inspections. The most common issues leading to prohibition include:

Tyre Tread Worn Below Legal Limit: This is the most frequent fault found.

Seriously Under-Inflated Tyres: Under-inflation can lead to safety hazards and reduced tyre life.

Damage to Sidewalls: Sidewall damage can compromise the structural integrity of the tyre.

These issues highlight the importance of regular tyre maintenance and inspections to ensure vehicle safety and compliance with regulations.

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

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 a common 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 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 walk around check before undertaking their journey/duty. The driver **must** be capable of identifying whether or not a tyre fulfils legal requirements. It is prudent to include a training module as part of initial and ongoing Driver training detailing tyre inspection procedures. This training should be refreshed at least every 5 years.

Drivers and Operator licence holders are also reminded that the walk around check forms part of a preventive maintenance programme and is an essential part of Operator licence obligations.

Regular checks and audits must be carried out by Transport Managers 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.

> 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/irtec Bus & Coach Accreditation (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 competent person has adequate recognised training and experience relevant to their particular fleet. The operator must ensure that tyres are responsibly sourced and endorsed for operation in the area or country of intended use (principally UK & EU).

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 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

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- Steve Breckons – Bandvulv Group
- Continental Tyres
- Gary Powell – Bridgestone Tyres
- Driver Vehicle Service Agency
- Backhouse Jones Solicitors
- British Tyre Manufacturers Association

Useful Contacts

(T) denotes training providers.

ATS Euromaster	T: 0370 066 3621 customer.relationship@euromaster.com
British Tyre Manufacturer Association (BTMA)	T: 01787 226995 | F: 0845 3016853 mail@btmauk.com
Bridgestone	T: 01926 488500
Bandvulc (T)	T: 01752 893559 | Sales: 01752 893257 sales@bandvulc.co.uk
City & Guilds	T: 0844 543 0000 | F: 0207 294 2413 centresupport@cityandguilds.com
Confederation of Passenger Transport	T: 020 7240 3131 | F: 020 7240 6565 admin@cpt-uk.org
Continental	T: 01895 425900
Driver & Vehicle Standards Agency (DVSA)	T: 0300 200 1122 customer.services@dsa.gsi.gov.uk
Department for Transport	www.gov.uk
Goodyear	T: 0121 306 6000 | F: 0121 306 6310 tyre.techuk@goodyear.com
Michelin (T)	T: 01782 401700 | F: 01782 401701 traininginfo@uk.michelin.com
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