



# GUIDE TO TYRE MANAGEMENT ON HEAVY VEHICLES



TYRE INDUSTRY FEDERATION



**NTDA**



**IRTE**



# FORWARD BY THE SENIOR TRAFFIC COMMISSIONER FOR GREAT BRITAIN

I am delighted to endorse this important document as traffic commissioners need to be assured that operators follow best practice, in addition to meeting minimum legal standards.

This guide sets out industry-recognised best practice regarding tyre maintenance on heavy vehicles. It offers a wealth of advice to operators about tyre choice, maintenance and safety, including consideration about the physical condition and age of tyres. 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 LGV and PCV Maintenance Liaison Committees who took the work on with enthusiasm and commitment. In doing so they worked with the representative bodies of the tyre and operating industries.

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**

Senior Traffic Commissioner for Great Britain

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# 1. INTRODUCTION

This guide contains essential information necessary to the safe and efficient management of tyres fitted to heavy vehicles: trucks, trailers, buses and coaches. It is addressed to vehicle operators in the UK and reflects UK regulations and operating conditions. The guidance may not be applicable in countries outside the UK. Equally, not all the advice may be applicable to specialist vehicles such as cranes or mobile plant.

Tyres are a safety critical element of every vehicle on the road. They are also one of the most highly regulated automotive components. Tyre manufacturers exercise great care in producing safe, reliable and compliant products. However, the manufacturer cannot accompany a tyre throughout its life; the vehicle operator is responsible for the tyre's in-service condition. This responsibility is backed by legal obligations concerning not only the condition of the tyre but also the processes and procedures in place to ensure that tyres in use are fit for purpose at all times.

## 2. TYRE MANAGEMENT SYSTEM

A robust tyre management system is essential for any professional vehicle operator and should ensure:

- That tyres in service are appropriate to the vehicle and operating conditions;
- That vehicle tyres are regularly and closely examined for damage and wear with mechanisms in place to address any identified issues;
- That processes exist to distribute best practice in tyre management throughout the fleet;
- That staff dealing with tyre management are properly trained and empowered to act with sufficient authority;
- That any technician dealing with tyre inspections or repairs is properly trained and qualified;
- That any on-site tyres are properly stored;
- That drivers are properly trained and equipped to recognise and report tyre issues.

Should you identify any discrepancies or shortcomings between the contents of this guide and your internal procedures you must address them immediately. Further information and assistance is available from the contacts listed in section 12.

# 3. TYRE CHOICE AND FITTING

## APPLICABLE REGULATIONS

Tyres are subject to extensive European and International regulations. Compliance is verified at type approval. It is illegal to sell tyres in the EU without the required type approval marking ("E-mark") on the sidewall.

UK Construction and Use Regulation 27 require that tyres fitted on the same axle are of the same size and construction (radial, cross-ply, etc) and that the load index and speed symbol must at least match the vehicle plated weight and the maximum legally permissible speed for the vehicle.

## RECOGNISED GUIDANCE

BS AU 50-2.7a: 1995 Code of practice for the selection and care of tyres and wheels for commercial vehicles.

Recommendations published by the European Tyre and Rim Technical Organisation (ETRTO) cover many aspects of tyre specification, use and management.

## BASIC PRINCIPLES

Briefly, the requirements of a tyre are:-

- To support the maximum authorised load at the vehicle's legal maximum speed;
- To grip the road for control of the vehicle in all conditions;
- To give the best possible ride and longevity subject to the two criteria above.

A tyre is defined by the following characteristics:

- Size designation comprising section width, aspect ratio and rim diameter;
- Construction — normally radial but less frequently cross ply or bias belted;
- Type of tread pattern according to individual manufacturer's designation;
- Load index and speed symbol (service description).

The operator must ensure that tyres are responsibly sourced and endorsed for UK and European use. Any tyre chosen as a replacement should normally be of the same size, construction, and service description as the original equipment. The vehicle and tyre manufacturers' data should be consulted before using a tyre with a different specification

from the vehicle's original equipment or if the application of the vehicle is likely to be changed. Always check with the vehicle manufacturer before fitting a physically larger tyre than the original equipment.

## PRINCIPAL TYRE MARKINGS

1. Tyre Section width
2. Aspect ratio
3. Construction (R=radial)
4. Rim diameter (inches)
5. Load Index (single tyre)
6. Load Index (dual mounted)
7. Speed symbol
8. Load indices when used at alternative maximum speed
9. Location of tread wear indicator
10. Type approval number
11. Manufacturing date code
12. DOT manufacturing site code
13. Supplementary type approval information



## TYRE CHOICE

**Steering axle:** It is generally not recommended to fit tyres designated for drive axle use on the steering axle of a vehicle as the handling may be adversely affected. It is strongly recommended that only new tyres or re-grooved new tyres should be fitted to steering axles and this is a requirement of Tempo 100 certification.

**On rear/ drive axles** care should be taken to ensure that only tyres of the same type, size, service description and wear are twinned together. The difference between the remaining tread pattern depths on twinned tyres should not generally be greater than 4mm at the same stage of tyre life (i.e. new, regrooved or retreaded). It is not recommended to twin regrooved tyres with un-regrooved tyres. Equally, twinning different brands of tyre is not recommended as casing characteristics may differ, possibly causing accelerated wear to one tyre.

Particular vigilance is required regarding the correct inflation of twinned tyres if accelerated wear is to be avoided. Ensuring that the inner and outer valves are fitted 180° opposite to each other and fitting a valve extension to the inner wheel will facilitate regular tyre pressure maintenance.

Many passenger carrying vehicle (PCV) 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, limited to a maximum speed of 100 km/h. This enables the fitment of especially robust urban bus tyres.

Tyres with previous sidewall abrasion damage should be positioned so that the worn sidewall is protected from further damage. Tyres with severe kerbing damage (e.g. exposed and damaged reinforcement cords) must be removed from service.

## **FITTING**

The correct fitting of tyres to their rims is of the utmost importance. Ensure that an appropriate quantity of a recommended tyre bead lubricant is applied. Do not use anything that is oil-based as a tyre lubricant. Cleanliness is of first importance when fitting tyres; tyres should never be fitted with oily hands and never 'trodden-on' with dirty boots.

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 to the bead area that may lead to ingress of moisture or air into the casing of the tyre. Care must also be taken when removing a tyre from the rim not to damage the bead area or casing plies in any way.

## **DIRECTIONAL TYRES**

A directional tyre is a tyre that the manufacturer recommends to be used in one direction of rotation to optimise tread wear performance. The use of a directional tyre in the opposite direction does not constitute an unsafe condition; although not optimal, overall performance and handling will not be compromised. Nonetheless, the use of a directional tyre in the opposite direction is not encouraged and should be considered to be a temporary measure only. Continued use of a directional tyre in the opposite direction may lead to uneven tyre wear and/or increased noise and vibration.

If a directional tyre shows an irregular wear profile, (for example, a sloped wear pattern) it may be turned on the rim and run in the opposite direction with no detriment to other performance criteria.

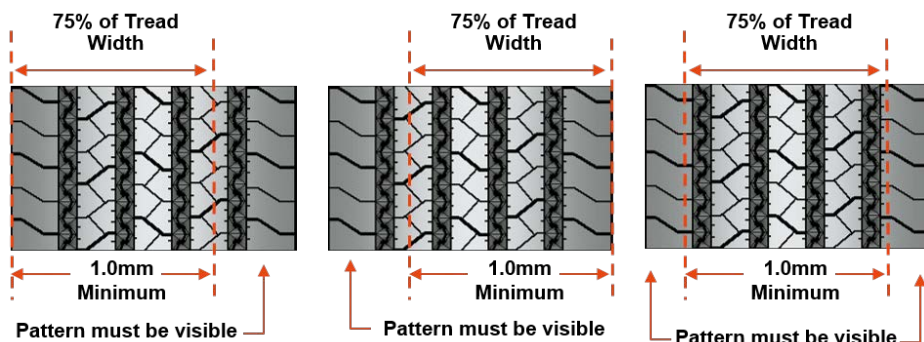
In cases such as this, it is recommended that all tyres on the same axle should be turned on the rim so that all rotational arrow markings face in the same direction. When turning these tyres on the rim or moving them from side to side on a vehicle, they should be treated in all other respects in the same way as any other tyre.

# 4. TYRES IN SERVICE

## APPLICABLE REGULATIONS

Construction and Use Regulation 27 requires that a tyre shall be suitable to its application and correctly inflated. The regulation also specifies limits to acceptable damage and the minimum requirements regarding tread depth.

Tread depth on heavy vehicles must not be less than 1mm at any point across a continuous band covering at least 75% of the width of the tread around the circumference of the tyre. (The minimum depth for lighter vehicles is 1.6mm). The tread pattern must also be visible across the remainder of the tread:



## RECOGNISED GUIDANCE

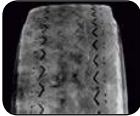



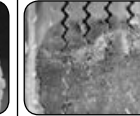
Detailed guidance regarding in-service issues is contained in the recommendations published by ETRTO.

## IRREGULAR TREAD WEAR

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.

Tyres on steering axles, particularly on the nearside, often wear more on 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. Equally, drive axle tyres frequently wear faster on the inner edge of the inner tyres. Turning the tyre on the rim, if carried out at the correct time, can extend tyre life and provide cost savings. A tyre should be turned on the rim early enough to equalise the wear. A difference greater than 3mm from one shoulder to the other should instigate a turn on rim.



					
<b>Type of wear</b>	<b>Centre wear</b>	<b>Shoulder Wear – both sides</b>	<b>One-sided Wear</b>	<b>Diagonal Wear</b>	<b>Flat Spots</b>
<b>Cause</b>	Over inflation or incorrect matching of tyres and rims. May also occur on high torque drive axle applications.	Under-inflation or incorrect matching of tyres and rims.	1) Excessive toe 2) Excessive camber 3) Non parallel axles 4) Bent axle 5) Non – uniform tyre and wheel assembly 6) Severe operating conditions.	1) Mismounting of tyre and wheel assembly to trailer 2) Mis-matched twins 3) High speed empty running 4) Improper bearing adjustment 5) Toe out.	Excessive sharp braking. Brakes locking, for example as a result of incorrect adjustment of trailer brake controls or defective brakes
<b>Correction</b>	Adjust pressure to the recommended level for the particular tyre location and load.	Adjust pressure to the recommended level for the particular tyre location and load.	Identify and correct mechanical defect. If wear is not too severe turn tyre on rim.	Identify and correct mechanical defect. If wear is not too severe turn tyre on rim.	Avoid harsh braking. Check brakes and braking system and correct any malfunction.

## WHEEL ALIGNMENT

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

- Tyre wear
- Vehicle handling
- Fuel economy



TOE-OUT, inside shoulders



TOE-IN, outside shoulders

## CORRECT INFLATION

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. Furthermore, 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.

## RESPONSES TO UNDER INFLATION

0-10% under inflation	Examine for external damage before re-inflation Re-inflate as soon as possible
10-20% under inflation	Examine for external damage before re-inflation Re-inflate immediately Monitor for continuing deflation
<b>20%+ under inflation</b>	<b>Remove tyre from rim and inspect for possible internal damage</b> <b>Monitor for continuing deflation</b>

An error in pressure of 20% will reduce tyre life by up to 25%. Equally, one tyre underinflated by 25% may contribute to an increase in fuel consumption of 3%.

The vehicle operator should procure and follow the specific pressure recommendations provided by the tyre manufacturer for the vehicle type and application. Tyre pressures should be checked when the tyre is at ambient temperature. Tyre inflation equipment should be regularly calibrated in line with the manufacturer's guidelines.

## OTHER TYRE CONDITIONS

### CUTS

Cuts could permit water to reach the casing or bracing plies, causing corrosion that may weaken the structure of the tyre if the exposure is prolonged. In addition to being potentially illegal, such damage could render the tyre unacceptable for retreading.

### OIL, PETROL, DIESEL

Many industrial chemicals and solvents, including oils, petrol and diesel, can damage tyres. These contaminants should be removed using plenty of water and a mild detergent. Severe contamination may render the tyre unusable.

### OBJECT TRAPPED BETWEEN TWINNED TYRES

If an object is trapped between twinned tyres the tyres should be deflated before attempting to remove it. Both tyres may have been damaged and should be thoroughly inspected by a competent tyre technician before re-entering service.

## SIDEWALL ABRASION

When the sidewall lettering starts to disappear, the vehicle operator should turn the tyre on the rim. The reinforcement plies must not be exposed and the size and service description markings must be visible on one side of the tyre for it to remain legal.

## AGEING

Tyre ageing is not a function of the passage of time alone but rather the cumulative exposure to adverse environmental and operational factors. Prolonged exposure to ozone or ultra-violet light can lead to degradation of the natural and synthetic rubbers used in tyres. Tyre manufacturers incorporate additives to reduce this phenomenon. The flexing of the tyre in normal use helps the diffusion of these additives to the surface of the tyre where they act against the adverse effects of exposure to ozone and ultra-violet light. This diffusion process is greatly reduced in tyres fitted to vehicles that are used infrequently. Consequently, such tyres are more susceptible to degradation caused by adverse environmental factors than tyres on vehicles that are frequently used. Spare wheels are a case in point.

Ageing-type damage causes localised hardening of the rubber leading to surface crazing. Similar damage can be caused by overheating resulting from under inflation or overloading. In severe cases, this stiffening can lead to de-lamination of the inner components of the tyre.

As a precaution, the Department for Transport strongly recommends that tyres over 10 years old should not be fitted to the front axles of buses and coaches and that such tyres should only be fitted to the rear axle as part of a twin tyre combination. DVSA will issue an advisory notice at annual test if this recommendation is not followed.

If a tyre is showing signs of ageing its condition should be assessed by a competent tyre technician. Some tyre manufacturers recommend that tyres over 10 years old should be withdrawn from service.

The date of manufacture of a tyre can be determined from the DOT 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 47 of 2012.



## 5. TYRE REPAIRS

It is vital that any repair is undertaken by a trained operative. All tyre repairs should follow the recommendations contained within BS AU 159g.

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

- Tyres must be removed from their wheels and thoroughly inspected by a competent tyre technician to ensure that they are suitable for repair;
- 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.

Tyre filler ('putty' or 'dough') is usually a self-vulcanising polymer compound that should only be used for localised cosmetic damage i.e. rubber only. Tyres with damage that extends to the reinforcement cords should be assessed by a qualified repair technician and, if appropriate, repaired in accordance with BS AU 159g.

### MAJOR REPAIRS

Heavy vehicle tyres with major repairs conforming to the British Standard must be marked by the repair agent, radially in line with each repair at a point just above the area covered by the rim flange. The marking must be permanently legible 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 must be 4mm.

It is recommended that tyres that have been subject to a major repair as defined in BS AU 159g should be fitted to a rear axle position only.

## 6. REGROOVING

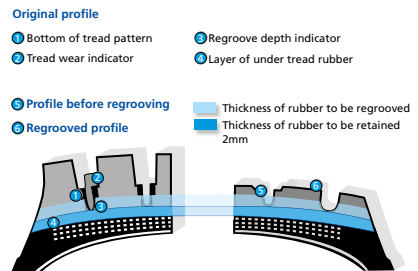
### APPLICABLE REGULATIONS

Construction and Use Regulations 24 and 27 apply. Only tyres identified on the sidewall as regroovable may legally be regrooved. This applies to both new and retreaded tyres. It is also a legal requirement that any regrooving must follow the pattern specified by the manufacturer. If the tyre cords are exposed as a result of regrooving the tyre is no longer legal and must be withdrawn from service.

## BASIC PRINCIPLES

The regrooving operation consists of cutting into the tread of a tyre a tread pattern deeper than the original, so as to prolong the tyre's useful life. When regrooving, it is of fundamental importance to avoid exposing the upper belts of the tyre, and to ensure that an adequate layer of rubber is left to protect them. Tyre manufacturers supply specific instructions regarding the patterns and procedures to follow in the regrooving of tyre treads. These include recommended groove widths and the depth of rubber to remove from the base of the original grooves.

Regrooving should normally be carried out on the entire tread according to the recommended pattern and procedure. However, 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. Clearly, this precludes further re-grooving later in the tyre's life.



## 7. RETREADING

### APPLICABLE REGULATIONS

Retreaded heavy vehicle tyres offered for sale in Europe must comply with UN ECE Regulation 109. This ensures that retreaded tyres meet the same standard for structural integrity under endurance testing as new tyres. In addition, the Regulation defines the sidewall markings required on a retreaded tyre including the UN ECE Type Approval mark. Retreaded tyres must bear the mark "RETREAD" on at least one sidewall.

### WHAT IS A RETREAD?

Retreading is a generic term for the remanufacturing of a worn tyre casing to extend its service life. In all cases it involves 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 depend largely on the condition of the original tyre casing. For this reason all tyre casings selected for retreading are subjected to close examination and extensive non-destructive testing to establish the casing's structural integrity and suitability for continued use.

Retreaded tyres are produced using one of two processes:

**Pre-moulded or “cold cure” retreading:** A pre-cured tread strip is applied to the prepared casing. The casing and tread are vulcanised together in an autoclave using a special rubber compound.

**Mould-cure or “hot cure” retreading:** In this process, uncured rubber compound is applied to the prepared casing. The new tread pattern and sidewall markings are formed during vulcanisation in a curing press.

Including retreaded tyres in an integrated tyre management programme offers improved lifecycle costs and reduced environmental impact.

## 8. TYRE STORAGE

Detailed guidance regarding the storage of tyres is contained in the ETRTO Recommendations.

Tyres should be kept in a cool, dry, and moderately ventilated environment away from any possible contact with oil or hydrocarbon solvents or lubricants. They should be kept away from sources of heat such as pipes or radiators and be protected from exposure to sunlight and strong artificial lighting. Avoid storage near any electrical equipment which may produce sparks, such as arc welding equipment.

Tyres should be stored in a relaxed condition free from tension, compression or other deformation, ideally arranged vertically.

## 9. WHEELS

All the issues relating to the care and maintenance of wheels and correct wheel nut re-torquing are covered comprehensively in the IRTE / FTA guide “Wheel security”.

## 10. TRAINING

Operators must ensure that they provide sufficient training to enable their staff to carry out competently the duties they are assigned. A range of appropriate training courses will be necessary according to the roles or duties concerned.

### DRIVER TRAINING

It is a duty of the driver of a PCV or LGV (Large Goods Vehicle) 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 thorough vehicle walk around check before undertaking their journey / duty. The driver must be competent enough to identify if a tyre fulfils legal requirements. Driver induction training should include a module detailing tyre inspection and defect recognition and reporting 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 preventive maintenance programme and is an essential part of Operator licence obligations.

Regular checks and audits must be carried out by Transport Managers and/or supervisory staff to ensure that checks are thorough and effective. Appropriate training will be needed to deliver this responsibility. 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 / Irtec 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 should 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 PCV or LGV Operators to use tyre manufacturers or appointed agents to maintain their fleet tyres under a maintenance contract. Operators have realised the benefits of using an appointed tyre expert over recent years. There are obvious benefits to road worthiness compliance, safety, efficiency and not least, financial performance.

If operators choose to maintain their own tyres they must ensure that the tyre technician has adequate recognised training, accreditation and experience relevant to their particular fleet. Many tyre manufacturers offer training packages from basic awareness to thorough accredited technician status award.

## 11. ACKNOWLEDGEMENTS

This guide has been compiled by the Tyre Industry Federation\* with the support of the Department for Transport, the Freight Transport Association, the Institute of Road Transport Engineers and the Road Haulage Association. Particular thanks are due to the North West LGV and PCV Maintenance Liaison Committees for their valuable input during the development of this document.

\*The Tyre Industry Federation comprises the British Tyre Manufacturers' Association, the Imported Tyre Manufacturers' Association, the National Tyre Distributors Association, the Retread Manufacturers' Association and the Tyre Recovery Association.

## 12. USEFUL CONTACTS

ORGANISATION	CONTACT	PHONE
<u><a href="#">Driver and Vehicle Services Agency</a></u>	<a href="mailto:enquiries@vosa.gov.uk">enquiries@vosa.gov.uk</a>	0300 123 9000
<u><a href="#">British Tyre Manufacturers' Association</a></u>	<a href="mailto:Info@btmauk.com">Info@btmauk.com</a>	01787 226995
<u><a href="#">Freight Transport Association</a></u>	<a href="mailto:enquiry@fta.co.uk">enquiry@fta.co.uk</a>	08717 112222
<u><a href="#">Imported Tyre Manufacturers Association</a></u>	<a href="http://www.itma-europe.com">www.itma-europe.com</a>	08453 700145
<u><a href="#">National Tyre Distributors Association</a></u>	<a href="mailto:info@ntda.co.uk">info@ntda.co.uk</a>	01296 482128
<u><a href="#">Retread Manufacturers Association</a></u>	<a href="mailto:rma@greentyres.com">rma@greentyres.com</a>	01787 221026
<u><a href="#">Road Haulage Association</a></u>	<a href="mailto:r.engley@rha.uk.net">r.engley@rha.uk.net</a>	01274 863100
<u><a href="#">Society of Operations Engineers/IRTE</a></u>	<a href="mailto:soe@soe.org.uk">soe@soe.org.uk</a>	020 7630 1111
<u><a href="#">Bandvulc Tyres Ltd</a></u>	<a href="mailto:technical@bandvulc.co.uk">technical@bandvulc.co.uk</a>	01752 893559
<u><a href="#">Bridgestone UK Ltd</a></u>	<a href="mailto:Bstuk.technical@bridgestone.eu">Bstuk.technical@bridgestone.eu</a>	01926 488580
<u><a href="#">Continental Tyre Group Ltd</a></u>	<a href="mailto:administrator.technical@conti.de">administrator.technical@conti.de</a>	01788 566240
<u><a href="#">Goodyear Dunlop Tyres (UK) Ltd</a></u>	<a href="mailto:tyre.techuk@goodyear.com">tyre.techuk@goodyear.com</a>	08453 453453
<u><a href="#">GiTi Tire (UK) Ltd</a></u>	<a href="mailto:technical@eu.giti.com">technical@eu.giti.com</a>	01565 831910
<u><a href="#">Hankook Tyre (UK) Ltd</a></u>	<a href="mailto:info@hankooktire.com">info@hankooktire.com</a>	01327 304100
<u><a href="#">Michelin Tyre plc</a></u>	<a href="http://www.trucks.michelin.co.uk">www.trucks.michelin.co.uk</a>	0845 366 1598
<u><a href="#">Pirelli UK Tyres Ltd</a></u>	<a href="mailto:contactcentertyres.uk@pirelli.com">contactcentertyres.uk@pirelli.com</a>	03459 616263

Several of the professional bodies listed above offer training courses relevant to tyre management. In addition, many tyre manufacturers offer specialist training courses covering numerous aspects of tyre use and management.