British Tyre Manufacturers' Association

Subject: Replacing Car Tyres – Important considerations

Issued: 9th June 2010 Reviewed: 1st June 2011

Tyre Technical Advisory Committee

The purpose of this document is to give general advice and guidance on a variety of important points to consider when replacing tyres on a car and applies to the UK only.
Some tyre manufacturer's advice on specific products may differ from these general guidelines. If advice is required on a specific product consult the relevant tyre manufacturer.
More detailed information on some of these subjects may be found in other BTMA statements listed at the end of this document.

UK Law (The Road Vehicles Construction and Use Regulations 24 through to 27 deals specifically with tyres), requires that tyres fitted to vehicles running on public roads conform to specific standards of condition and suitability for the type of application.

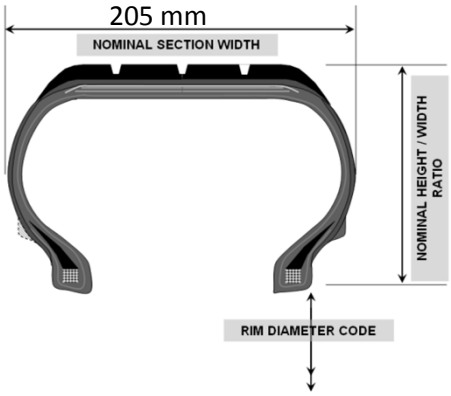
The condition of a tyre and how it relates to these regulations can be a key factor in determining when a tyre needs replacing.

Tyre Size markings and Service Description

The most common nomenclature used for Size markings is illustrated by the following example:

205/55 R16

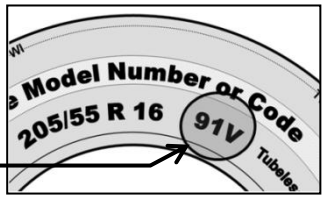
205 is the tyre section width in mm
55 is the Aspect Height/Width ratio in %
R denotes Radial Ply design
16 is the wheel rim diameter code (Inches)



55% Section height to width ratio

The ***Service Description*** of a tyre is its "Load Index" plus "Speed Symbol". For example

205/55 R16 91V



In this example the "91" is the Load Index and reference to standard industry tables stipulate that the maximum load for the tyre in this illustration is 615 kg.
The "V" in this example is the tyre's "Speed Symbol" indicating its maximum speed of 150 mph.
Although the law only demands tyres are capable of meeting the national speed limit, do not be tempted to fit a lower Speed Symbol tyre than originally fitted because it is important to note the "Speed Symbol" is not only an indicator to the tyre's maximum speed potential, but also an indicator of how well it copes under braking, cornering and acceleration. In some European countries the speed symbol of replacement tyres must by law be equal to or higher than the original fit tyres.
For obvious reasons the tyre's load capability must as a minimum match the loads imposed by the vehicle, statically and dynamically. UK law does stipulate replacement tyres must have a Load Index equal to or higher than the original fit tyre.

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The tyre specification originally fitted by the vehicle manufacturer is chosen to ensure the vehicle behaves in a safe manner. Deviation from the original specification will affect the vehicle's handling and in some cases may invalidate the manufacturer's warranty and the driver's insurance. Safety may also be compromised.
When replacing tyres it is very important that not only the tyre size is equivalent to the original fit tyres, but that the "Load Index" and "Speed Symbol" are equal to or higher than the original fit tyres.

The main reasons for this recommendation are-

- The original equipment tyre specification was selected to cater for the car's overall performance, not only in terms of its maximum speed but also, for example, its acceleration and handling. Furthermore, they form an integral part of the design of its suspension, braking and steering systems.
- Vehicle handling, safety and refinement may be adversely affected if unsuitable tyres are fitted.
- Tyres of an appropriate speed rating are essential if the car is driven to its full potential and, even for everyday UK motoring, they maintain the car's design characteristics in terms of safety and performance.
- In some countries it is illegal to drive on tyres which are of a lower speed rating than the maximum speed capability of the vehicle.

When to replace tyres (passenger vehicles) – Tread wear

A tyre's worn condition is generally the main reason for replacing a tyre.

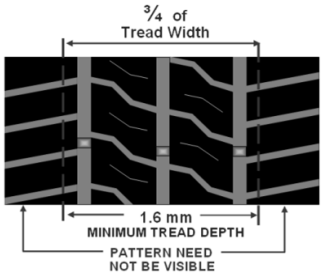
The legal requirements

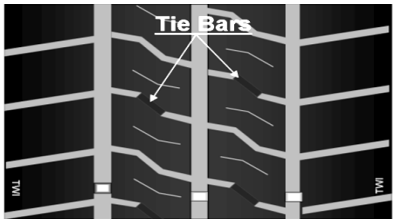
The law requires all tyres on passenger vehicles to be in a safe and well maintained condition.

Specifically on the subject of Tread Pattern depth, the law requires the tread depth to be a minimum of 1.6mm within a band comprising the central ¾ of the tread width and continuous around the entire tyre circumference.

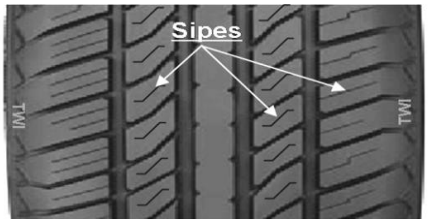
(Failure to replace a tyre, which has worn beyond this stage, can result in a fine of up to £2,500 + 3 points on the Driver's Licence – FOR EACH ILLEGAL TYRE)

However not all pattern features fall within the legal definition of "Tread Pattern". Any feature which is designed to wear out significantly before the main pattern are not subject to the minimum 1.6mm limit. Such features include "Tie Bars", "Sipes" and "tread wear indicators".

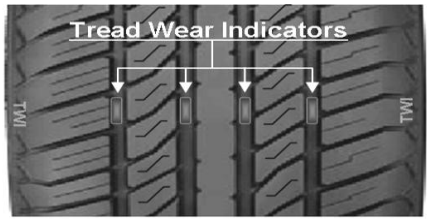




Tie bars are raised sections (bars) above the base of the tread groove that tie neighbouring elements (blocks) of the pattern together. They are not full pattern depth. They can resemble deep tread wear indicators



"Sipes" are small cut like pattern features which often are not full pattern depth and hence disappear before the tyre is worn out. "Sipe" depth is not subject to the 1.6mm legal minimum.



"Tread wear Indicators" (TWI's) are small raised sections in the patterns principle grooves. Their height above the base of the groove is between 1.6mm and 2.0mm. Their purpose is to provide a visible warning that a tyre is approaching the legal minimum tread depth. Tread pattern grooves at the point where TWI's are located not subject to the 1.6mm legal minimum depth.

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NOTE: Tyres that have been irreparably damaged or are not suitable for the purpose to which they are being used should be replaced immediately.

Tyres should be inflated to ensure their suitability for the purpose they are being used. (Usually this means in line with the vehicle manufacturer's recommendation)

Tread depth and wet braking efficiency

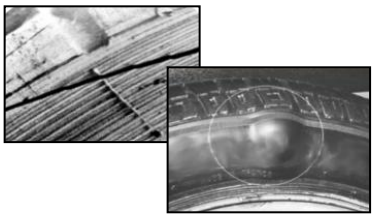
In wet conditions, road grip and braking efficiency progressively reduce with tyre wear. Stopping distances are longer, particularly as the tyre enters the second half of its service life. The Highway Code recommends that in wet conditions, drivers should double the distance between their car and the car in front, and reduce their speed.

Passenger car tyres have tread wear indicators at approximately1.6mm to warn the driver that a tyre is approaching its legal limit of tread depth.

Drivers of higher performance cars which typically have wider tyres should consider replacing their tyres before the legal limit is reached.

In the interests of safety and legality, drivers should not risk letting their tyres go below the legal tread depth limit of 1.6mm.

Damage



UK tyre regulations also cover tyre damage such as bulges, cuts and penetrations. A tyre showing such features should be inspected by a tyre professional in order to establish whether it requires replacing, as the tyre may be both illegal and dangerous.

Uneven Tread Wear

Uneven tread wear may also make it necessary to replace a tyre, as the condition of the tread may adversely affect the handling and wet grip properties of the tyre, even if the tyre may not be illegal from a tread wear point of view.

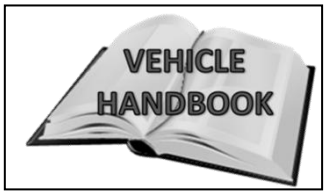
Age of Tyres

Consumers also need to be aware that the age of a tyre can influence service performance and should seek advice in order to establish if a tyre needs replacing. Conditions of storage and use will influence the rate at which a tyre ages. Typical symptoms of tyre ageing are cracked/crazed sidewalls and/or distorted tread. There is nothing in the current legislation that requires a tyre over a certain age to be replaced.

However some tyre and vehicle manufacturers do specify a recommended maximum age at which tyres should be replaced.

Please refer to the sections dealing with the Care and Maintenance of Tyres and Tyre Legislation for a more in depth briefing on the issues mentioned in relation to replacing tyres.

Tyre Selection



Having identified that a tyre requires replacing it is essential that the replacement tyre is compatible with the other tyres on the vehicle. Check that the tyre size and its full service description (load and speed indices) match the tyre being replaced. It is also important to check all the tyres on the vehicle are an appropriate fitment. This is particularly important when replacing tyres on a newly acquired used vehicle. If there is any doubt, refer to the vehicle handbook; contact the vehicle or tyre manufacturer or a tyre dealer.

Be alert to any special conditions that are contained in the vehicle handbook regarding the servicing and replacing of tyres. For example, some vehicle manufacturers recommend that tyres be replaced as a pair across an axle or that a repaired tyre should not be refitted.

Buying Part Worn Tyres – Cautionary Note

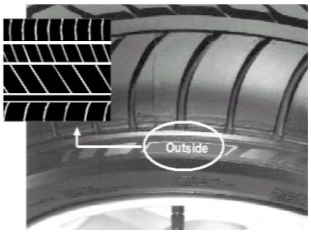
If considering purchasing "Part Worn / Used" tyres it is important to know their service history before buying. There will always be a reason why tyres are removed from a vehicle before they are worn out. This could be because they have been damaged in some way that is not easily visible to the untrained eye. If such a tyre is subsequently refitted to another vehicle the damage may manifest itself later possibly compromising vehicle and passenger safety.
It is usually better and safer to purchase a new tyre than a part worn tyre where its history is unknown.

Mixing of Tyres

The effects of mixing can be unpredictable and the following information is intended as a guide only. It is recommended that for optimum performance cars and light vans should be fitted with a matching set of tyres. For certain high performance cars, matching sets of vehicle manufacturer approved tyres are recommended to maintain the handling characteristics of the vehicle. We would always recommend consulting the vehicle handbook for this information. (See section "Vehicle Specific Tyres".)
It is illegal to mix tyre sizes and to mix tyre constructions e.g. radial, cross-ply etc, across an axle. (Note this does not apply in the case of a "Temporary Use" Spare tyre where they are restricted to a maximum speed of 50mph / 80 km/h). It is also illegal to fit radial tyres to the front axle and cross-plies to the rear.
It is inadvisable to mix tyres of different categories on a vehicle, e.g. Summer tyres, winter tyres, on/off road tyres etc and never across an axle. It is also not recommended that tyres with significantly different states of wear be mixed across an axle. Special care should also be taken with 4x4 vehicles where some vehicle manufacturers specify a maximum tread depth difference between axles. Consult the vehicle handbook.

Directional & Asymmetric tyre patterns

A "Directional" tyre is designed to provide enhanced performance (such as wet grip, noise reduction and directional stability). Hence the compromises in tread design necessary to enable a non-directional tyre to operate equally well in either direction of rotation have been eliminated. The improvement in performance is only achieved when the direction of rotation, clearly marked on the tyre sidewall, is observed.
A wheel to which a directional tyre is fitted cannot be re-positioned on the opposite side of a vehicle without reversing the tyre's direction of rotation. If a directional tyre is incorrectly fitted and the direction of rotation is opposed to the arrow then the advantages offered by the directional pattern will not be realised. Typically this may occur following a puncture and when the spare tyre is used. In such a case treat the tyre as a "Temporary Spare" and reduce the driving speed until the tyre can be refitted in the correct rotation, which should be at the earliest opportunity.



An "Asymmetric" tyre has a tread pattern, which differs on its inner side to that of the outer side and offers handling and cornering advantages over more standard non directional or non asymmetric tyres. Typically the pattern on the inner side has a higher groove content to cope with wet road conditions. The outer side has a higher plain surface area and comes into effect at higher cornering speeds particularly on dry roads.
Unlike directional tyres, an asymmetric tyre once fitted correctly to the wheel may be fitted to any wheel position on the vehicle. Tyre sidewalls are marked "outside" and "inside" or other similar wording indicating the correct fitment.
As in the case of directional tyres, if fitted incorrectly the advantages offered by the asymmetric pattern will not be realised and roadholding in both dry and wet conditions may be impaired particularly when driven at higher speed. In such cases treat the tyre as a "Temporary Spare" and reduce driving speed and refit the tyre correctly at the earliest opportunity.

Where to fit new tyres

Generally either replace two tyres (in pairs across the axle) or all four tyres. Also, remember to utilise the spare if appropriate.

If you choose to replace all four tyres, be careful to choose according to your own and your vehicle's requirements.

If fitting two tyres, it is recommended they be fitted to the rear of the car and 'match' with others as possible/feasible. The reason for this is to ensure as stable a handling position as possible particularly on wet roads. If one tyre is rendered unusable e.g. irreparable damage, and it is not possible/feasible to replace the pair, we recommend to fit a tyre as similar as possible to the original tyre, and as close as possible in tread depths.

As a secondary benefit for the owners of low annual mileage front wheel drive cars, the switching of the partly worn rear tyres to the front, enabling the new tyres to be fitted to the rear, creates a cycle which helps prevent their deterioration due to ageing/prolonged exposure. The rear tyres wear relatively slowly and leaving them in their original positions for a prolonged period can result in the need to replace them before they are significantly worn.

Please note the exceptions to this:

- Where the front and rear tyre sizes are different.
- Where the "system" concept of directional front and asymmetric rear tyres is applicable
- On certain four wheel drive vehicles where it would result in significant differences in tread depth.

Where a vehicle manufacturer gives different advice, follow the vehicle manufacturer's guidelines.

Tyre/Wheel Unit Balancing

Tyre manufacturers go to great lengths to produce uniform and round products. However with any multi component products often small mass differentials around the circumference are inevitable. To equalise these small deviations it is necessary to have the tyre and wheel unit balanced following tyre replacement. Unbalanced tyre/wheel units will cause vibrations to be felt through the car's steering wheel and / or through the vehicle's body leading to driver / passenger discomfort.

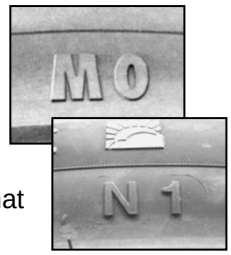
Deviation from Original Fit Tyre

If changing the tyre size from the original fit, ensure the Load Index and Speed Symbol of the replacement tyres are equal to or higher than the original fit tyres. Also ensure the replacement tyre's rolling circumference is comparable with the original fit tyre. It is advisable to check with the vehicle or tyre manufacturer that the intended replacement tyre is dimensionally possible and an appropriate fit on the vehicle. It is also equally important the tyre and wheel size are compatible.

Conversion guidelines require that, whether using existing or larger diameter wheels, replacement tyre rolling dimensions, load capacity and speed rating match those of the manufacturer approved tyres for the vehicle. A typical example of not applying these guidelines is the fitting of 195/50R15 82V to a vehicle requiring 195/60R15 88V. In this example there is a reduction in load capacity of 85kg per tyre, possibly rendering it overloaded/underinflated, and thus, potentially both dangerous and illegal. Furthermore, the 38mm reduction in overall diameter, and thus rolling dimensions, adversely affects gear ratios, ride height, speedometer reading and can affect ABS, traction control and pressure monitoring systems where applicable.

When changing tyre size from the original fit, it is recommended the vehicle's insurers are advised and their agreement obtained, otherwise insurance may be invalidated. Fitting of inappropriate tyres will affect the vehicle's handling, potentially compromise safety and hence render the vehicle illegal.

Vehicle Specific Tyres



Vehicles homologated on specific tyres should have the equivalent replacements fitted when they require changing.
Specific tyres for a specific vehicle (and marked accordingly) are possible. It is recommended to follow the vehicle handbook guidelines closely (or seek assistance from vehicle or tyre manufacturers) when changing these.
Examples are possible where one could deviate from those marked and others where that is not recommended –

e.g. 1) MO marking for Mercedes. It is possible to fit non-MO marked (and could use MO marked for another vehicle)

2) N-marked tyres for Porsche. Due to the particular characteristics of their vehicles, Porsches must take the correct N-marked fitments. It is also recommended that N-marked tyres are not used on any other vehicles.

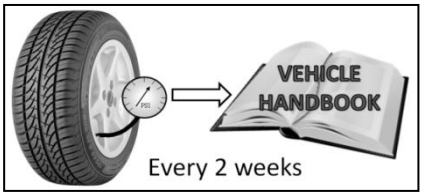
Others versions exist in the main for performance/prestigious vehicles such as Porsche, Chrysler, Ferrari, Mercedes AMG, Audi, Bentley, BMW and others.

NB: Other countries may have different laws regarding the replacement of Original Fitment tyres.

If in doubt, always contact your vehicle or tyre manufacturer for advice.

Tyre Care & maintenance

Tyre Inflation Pressure



Always maintain tyre pressures according to the vehicle or tyre manufacturer's recommendations. These can be found within the vehicle handbook or on a placard mounted on the vehicle on a door pillar or rear of fuel filler cap.
Check pressures every 2 weeks.

Removal of foreign objects

Check tyres regularly for visible signs of damage and foreign bodies such as stones, nails, screws etc embedded in the tyre. If left in the tyre, with continued use the object will cause further damage possibly rendering the tyre unfit for repair and in certain cases cause tyre failure. Carefully remove any objects embedded in the tyre. Irrespective of whether air loss occurs or not following removal of the foreign object, take the tyre to a dealer for inspection and, where applicable, repair. If any unusual symptom is discovered have the tyre checked by an expert without delay.

Irregular Tyre wear

Irregular wear on a tyre is usually caused by mechanical effect from the vehicle. Check the tyre for irregular wear. Any significant difference in wear rate across the width of the tread or around the tyre's circumference can mean worn or damaged suspension / steering components or misaligned wheels/axles. Have the vehicle checked by a dealer.

Tyre Age

Tyre manufacturers add ingredients to rubber compounds to slow down the rate at which tyres age. However conditions of storage and use (including tyre maintenance) have a larger influence over the tyre

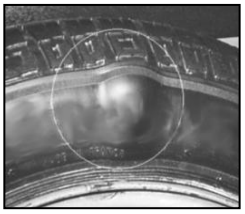
ageing process. Given these unknown variables the BTMA is unaware of any technical data that supports a specific tyre age for removal from service,
Tyres that are used infrequently (e.g. Caravans) and / or in coastal areas will age more quickly. Consumers should check tyres regularly for any sign of ageing, such as cracking / crazing of the tyre sidewall and or tread distortion.
A change in the dynamic properties of the tyre and/or vibrations could also be an indicator of the effects of tyre ageing.
If any such symptoms appear, replace the tyre immediately.
Vehicle manufacturers may recommend a specific age at which a tyre should be replaced based on their understanding of the specific vehicle application; BTMA recommends that any such instruction be followed.

Tyre Loading

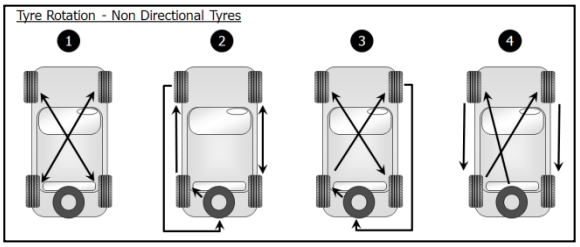
Do not overload tyres. Tyres are designed to accept a maximum load as indicated by their Load Index and then only when correctly inflated. If the maximum load is exceeded or the inflation pressure used is inadequate for the load being carried, it will result in reduced service life, increased fuel consumption and in severe cases premature failure of the tyre.
When replacing tyres ensure the Tyre Size is appropriate for the vehicle and that the Load Index and Speed Symbol are equal to or higher than those tyres originally fitted by the vehicle manufacturer.

Tyre Damages

Other than uneven wear, the next most frequent cause of premature tyre removal is damage caused by impacting a solid object e.g. kerbstone, or potholes. The most common first visible symptom of such damage is a bulge on the tyre sidewall. This is a clear indication the tyre's internal structure has been damaged. The tyre should be removed from service immediately.



Tyre/wheel Rotation



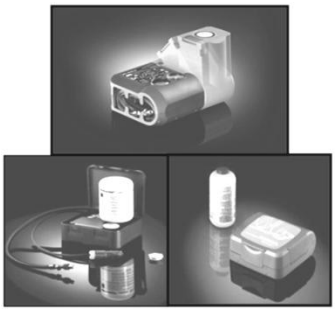
On most vehicles the tyres on each axle wear at different rates. Front wheel drive vehicles will wear the front tyres out before the ones on the rear axle. The converse is true for rear wheel drive vehicles. To extend the service life of the tyres it is a useful practice to rotate the wheels around the vehicle, thus evening out the wear amongst all four tyres. Illustrated here is one potential sequence. Note bringing the appropriate spare tyre into play at the first rotation. The frequency at which rotation is practical will depend on the actual service life of the tyres, but every 5,000 miles is suitable. The illustrated sequence only applies to tyres that do not have a directional tread pattern. Tyres with directional tread patterns may only be rotated from front to rear and vice versa, not diagonally. Rotating of tyres/wheels around the vehicle only applies if the tyres fitted to all road wheels are the same size and specification. (Note: Some 4 wheel drive vehicles are sensitive to large differences in tyre tread depths, additionally some vehicle manufacturers views on tyre/wheel rotation may differ from the above – consult the vehicle handbook)

Spare tyres

Often neglected is the "Spare" tyre/wheel. It is important to keep this correctly inflated as it cannot be forecast when it will be needed. As mentioned in Tyre/Wheel Rotation above, bring the spare tyre into service as often as practically possible. However an increasing number of vehicles are equipped with "Temporary" spare tyres which differ in size to the tyres on the main road wheels and are therefore not suitable for rotation. If forced to fit such a tyre, observe the Load Index / Speed Symbol and service

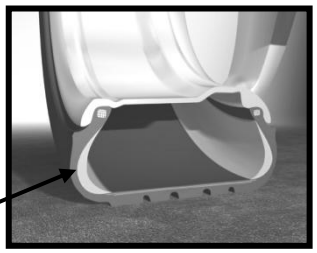
conditions marked on the tyre sidewall. Do not exceed 50 mph (80km/h). Also note that smaller temporary spare tyres usually require a higher inflation pressure than that of the normal road tyres.

Mobility Kits



A trend seen in recent years is for the spare tyre to be replaced with what is commonly referred to as a "mobility kit". These can range from a can of Tyre Puncture Sealant on its own or in combination with an electric compressor.
Such devices are intended as "Get you home" measures only, so the vehicle can be driven home or to a tyre dealer where the damaged tyre can be properly inspected to check its suitability for a permanent repair.
Do not be tempted to treat such devices as a permanent repair as they are not. They will not permanently repair a damaged tyre, they will only seal small holes caused by a puncturing agent.
In all cases carefully read and follow the manufacturer's directions for use.

Run Flat tyres



Unlike standard tyres "Run Flat" are designed to allow a limited amount of use in a partially or totally deflated condition. To qualify as a "Run Flat" tyre they must be capable of travelling a minimum distance of 50 miles (80km) at a speed of 50mph (80km/h).
There are a number of different designs on the market but the most popular is the "Self Supporting" run flat tyre (SST). These are tyres with specially reinforced sidewalls to cope with the weight of the vehicle even when deflated.

The guidelines and recommendations contained in this document equally apply to SST tyres. It is important to note that regular inflation pressure checking and correction is just as critical with an SST tyre as it is with a standard tyre. SST tyres should not be mixed with standard tyres on a vehicle.
Vehicles fitted with SST tyres must be equipped with a Tyre Pressure Monitoring System (TPMS). The actual conditions of use of SST tyres will vary according to the vehicle specification so it is very important the guidelines in the vehicle handbook are complied with.

Other related BTMA statements:

- Self Supporting Run Flat tyres (SST)
- Full Diameter Decorative Plastic Wheel Trims
- Liquid Sealants – Tyres in normal highway use
- Euro Look – Tyre and Wheel compatibility
- Tyre service life

Copies of these statements may be downloaded from the BTMA web-site:

www.btmauk.com