Greentyre Rear Wheels Introduction

Wheels for manual Wheelchairs:

Greentyre have been producing wheelchair wheels with puncture free polyurethane tyres in a range of different sizes and types for OEM supply for many years. In 2006 the Greencare DB1 modular wheelchair was introduced, and since then our range of wheels and castors has been expanded and tested to meet the wider performance specification criteria for a complete wheelchair, including customised applications and specialised performance criteria.

We can supply complete wheels and tyres, polyurethane or pneumatic. Specification, build quality, and suitability for intended environment, determines effectiveness and reliability. Greentyre wheel information is based upon standard ISO 7176-8 rolling road test, up to date development knowledge of the application and intended usage environment.

Rear wheels are the essential dynamic element of wheelchair construction. Diameter, position in relation to occupant mass, wheelbase and distance from the ground, together with the ride and grip characteristics, will determine how the wheelchair responds to propelling forces exerted by the occupant or attendant controlling the motion and direction of the wheelchair.

The Greencare DB1 wheelchair frame allows the rear wheel to be positioned according to the assessed user requirements. The accuracy of the assessment is significant, as we now need to deal with increased occupant demands for greater independence and a growing population of users increasing in weight.

Polyurethane puncture free tyres are our speciality, and we supply wheels with a range of tyre sizes and treads for different surface environments and occupants We also supply puncture free tyres in different colours for identification or occupant preference, as required.

On occupant propelled wheelchairs hand rim surface and shape can enhance function. Greentyre wheels are available with different handrim material and finish specifications. Polycoated steel handrims on basic wheels, lightweight aluminium and Greenrim shaped grip handrim as an option on 24inch wheels. High performance lightweight QD wheels with six point handrim fixings, large diameter aluminium flange hub were introduced as a Greencare DB1 occupant wheelchair build option in September 2011.

In 2013 we introduced the double grip rim specification on Greencare DB1 modular wheelchairs. This wheel combines with the Greentyre Classique tyre or a pnuematic tyre, to provide additional strength required for heavy occupant builds up to 200Kg and also for heavy occupant hub brakes.

Greentyre staff are available for further technical information and support .
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Attendant Wheels Performance and Service

Greentyre manufacture and supply complete wheels for attendant wheelchairs of 315mm diameter and 405mm diameter. The Greentyre attendant type wheels are injection moulded construction with an integrally moulded polyurethane puncture free tyre. Being integrally moulded, these tyres cannot roll off the wheel rim. The hub braked 400mm wheel has a rim fitted puncture free polyurethane tyre, and can also be supplied with a pneumatic tyre if requested.

The compact size of 315mm wheels on basic attendant propelled wheelchairs makes it possible to store a wheelchair in a small space without need for wheel removal. On DB1 the option of a 405mm diameter improves manoeuvrability, and the QD axle reduces the wheelchair weight for lifting.

The 315mm fixed hub wheel has been developed for the generic “ministry” 9L type wheelchair specification. The max occupant weight of this type of wheelchair frame was improved and increased to 125Kg by several UK manufacturers from year 2000 onwards. The Greentyre 315mm specification wheel and tyre was tested by several manufacturers, along with these original product developments. When replacing wheels on existing wheelchair frames that are being recycled, it is the original frame specification that is the occupant weight limiting factor.

The slightly larger 405mm diameter wheel is available for Greencare DB1 attendant propelled modular wheelchairs only, where it can be positioned according to configured build requirements. 400mm wheels with hub brakes are also available for attendant DB1 builds.

315mm diameter wheels for basic attendant propelled wheelchairs have a fixed M12 screwed stub axle construction, and are supplied with the axles permanently fixed in position, ready for assembly to the wheelchair, with lock nut and washer. On DB1 wheelchair additional QD (quick release) options of the 315mm and 405mm wheels, for modular wheelchair builds to meet different occupant and attendant assessed requirements are available.

The larger diameters of occupant controlled wheels make them easier to propel. When pushing force and control are critical a larger diameter is best for pushing.

The 315mm Greentyre wheel is rated to wheelchair occupant weight 125Kg
The 400mm Greentyre hub braked wheel is rated to occupant weight 150Kg
The 405mm Greentyre wheel is rated to wheelchair occupant weight 175Kg

Attendant Wheels Performance and Service (cont)

315mm (12.5 inch) and 405mm (16 inch)

The integrally moulded tyre construction of these wheels makes them maintenance free. It is not possible for the tyres to be removed from the wheel centre hub. The polyurethane tyre material and injection moulded hubs will withstand high levels of use over a wide range of environmental conditions, and should out last the life of the wheelchair.

The wheel hub bearings are double shielded, the inner bearing is 15mm diameter the outer bearing is 10mm diameter. The bearings run on a stepped steel spigot shaft, which is permanently assembled in its standard alignment position in the wheel hub, and locates into the wheelchair frame with a 12.7mm diameter shaft and M12 thread mounting. The reference dimension from tyre centre to the shaft and frame locating face is 42mm.

Attachment of the wheels to the wheelchair frame is effected by an M12 thread nut and lock washer. This should be torqued up to a minimum of 25 NM on basic steel framed wheelchairs such as 9L, or as indicated by the wheelchair manufacturer. On Greencare DB1 which has an injection moulded nylon frame mounting block assembly torque is 12NM. The addition of thread locking adhesive, such as loctite 243, to the screw threads will ensure that the wheel mounting assembly is totally secure.

On service checks, the wheel should be spun about its rotating axis. It should continue to rotate freely, without bearing noise. Lateral movement should be checked. The maximum acceptable deviation from concentricity during running is 2.0mm. The maximum acceptable free end float is 0.5mm. A wheel outside these tolerances should be replaced.

Tyres should be examined for wear and damage. Some discolouration, wear and surface damage is acceptable. A tyre with a superficial cut in it will continue to be suitable for use. Tyre examination is part of a routine service check. A tyre which has been damaged, with a deep cut or material torn out, such as is possible from running over a broken glass bottle, will continue to function without wheel failure, but it is recommended that if there is serious surface damage, or when a chair is recycled to another user, the wheels should be replaced.

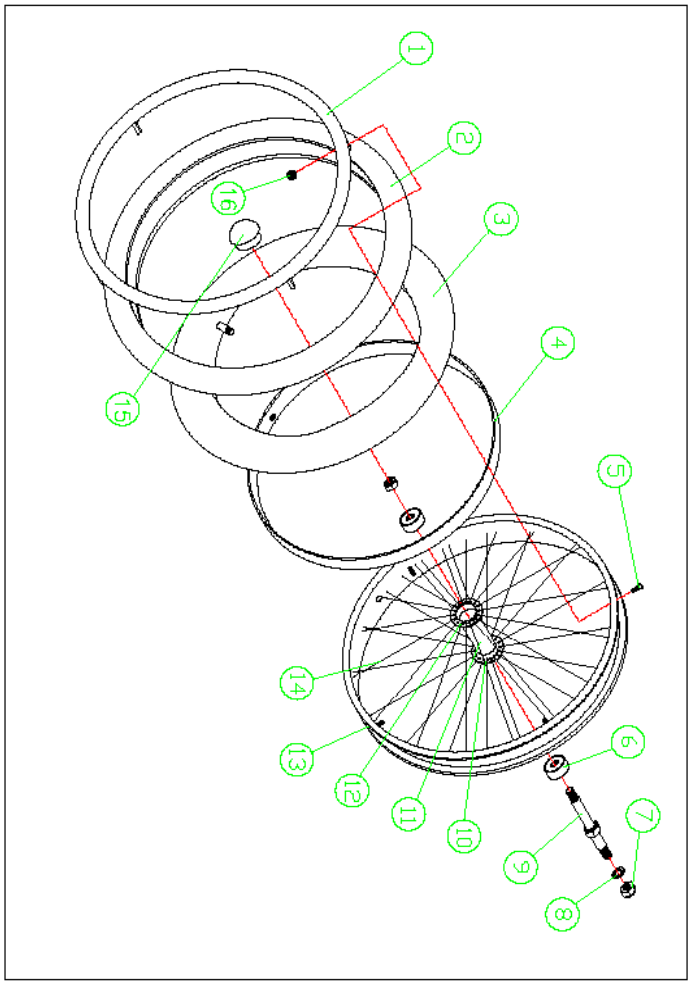
In a review of a user need, it may be found that pushing and controlling the wheelchair has become difficult for the carer due to environment, such as an outdoor slope, or there may be a history of accidental wheel damage.

On DB1 attendant modular chairs improved function can be achieved by changing from a 315mm diameter wheel to 405mm wheel, or fitting of attendant controlled hub brakes. Pushing and controlling effort would then be reduced. An alternative approach for recommended for heavier occupants is to fit a larger diameter propelling wheel to an attendant type build.

Occupant Wheels Performance and Service

Greentyre manufacture and supply, a wide range of high quality laced spoke construction wheels and tyres, and have an in depth knowledge of puncture free tyres for both the wheelchair and specialised bicycle industry. As a result of this background we are able to produce customised wheel build specifications to meet particular needs.

All occupant propelled wheel diameters are available with Greentyre, puncture free tyres in a range of tyre profiles, tread patterns and tyre colours. Pneumatic tyres are an option on basic popular size occupant propelled wheels, and on modular builds of DB1.



Basic Greentyre occupant propelled wheels of the fixed M12 screwed spigot fitting, are supplied ready for assembly, with spigot, locknut and washer. These have a frame fitting diameter of 12.7mm.

The basic Greentyre occupant propelled wheelchair fixed hub wheel was originally developed for the “ministry” 8L type wheelchair. Max occupant weight of this type of steel wheelchair frame specification was increased over years, up to 125Kg by several UK manufacturers. The Greentyre specification wheel and tyre was tested along with these original product developments. When replacing wheels on existing recycled frames, it is the original frame specification that is the occupant weight limiting factor.

QD (quick release) lightweight wheels with 12mm spindles and receivers with different head spacings, are available for the Greencare DB1 wheelchair in a range of different fitting sizes. QD axles require more maintenance in use and need to be frequently lubricated to allow ease of assembly and disassembly. He releasable function of QD axles means that there is increased clearance and detectable assembly movement, compared to fixed hub wheel.

Occupant propelled wheels Performance and Service (cont)

Both fixed and QD axles can be fitted to occupant propelled wheels rated up to 200Kg. Fixed hub wheels remain the strongest frame mounting, having reduced deflection, and a 16mm fitting diameter, increasing shear strength at the fixing.

From 2013, large flange wheels with a six point fixing handrim attachment are selected for intermediate loading of 175Kg.

Deflection of the wheel under heavy load is a natural consequence, and with large occupants this is coupled with outward deflection of the armrest panels. Deflection must be allowed for in the spacing distance of the wheel from the side frame to avoid rubbing contact, especially when subjected to high turning forces. Some active heavy occupants put additional roll off pressure on wheels when turning. This can mean that narrowest access specifications with close in wheels and low profile tyres are less achievable with very heavy occupants.

Very heavy occupants may spend longer static periods in the wheelchair indoors. Effort demanded should mean that such wheelchairs are moved around more slowly, with a less frequent shifting body weight on level surfaces. In outdoor use, wheels are subjected to higher loads. The effect on weight distribution is magnified with surface level change, or for example when a chair and heavy occupant are tied down in a transportation vehicle, where it is possible for a single wheel to be loaded excessively when the road surface cambers. This type of use should be noted in risk assessment and requires frequent service checks.

In 2013 we have introduced very strong double rim wheels in 24inch and 26inch diameters for hub brakes and for extra heavy demanding user applications up to 200Kg. including transportation use, or a history of wheel buckling. This deep section wheel has propelling rim and wheel rim combined. (see page 10)

Occupant weight distribution and the application environment is a major consideration in determining a suitable wheel and tyre specification. The modularity in the Greencare DB1 wheelchair frame allows wheels to be fitted according to user and environmental needs. As a general rule the rear wheels should carry 60% to 70% of the total static load. An active user introduces dynamic loading, by frequently shifting position in the wheelchair to achieve effective manoeuvrability. Active users will expect to use the wheelchair independently outdoors in a variety of different terrains, and so a puncture free tyre is a significant all round reliability benefit. However pneumatic tyres may still be a high performance consideration where optimised pressure maintenance is possible through the availability of a constant service function.

For the heavy user applications, including the demanding user category, who may not be heaviest in terms of size, but who frequently exert high loads, a fixed axle build with a 16mm frame mounting and puncture free Greentyre is the most reliable build recommendation. The QD axle is most suitable for reducing the wheelchair size for storage in a vehicle boot. We now recommend from January 2013 the increased strength double rim wheels fitted with the Classique standard Greentryre are used for such heavy use applications.

Occupant propelled wheels Performance and Service (cont)

wheel size	Build spec.	Spokes	Tyre availability	Handrim availability	Max. Occ. weight
510mm (20 inch)	Fixed axle Steel basic	36 2mm steel	Puncture free pu or pneumatic	Steel powder coated four point handrim fix	150Kg
560mm (22 inch)	Fixed axle Steel basic	36 2mm steel	Puncture free pu or pneumatic	Steel powder coated four point handrim fix	150Kg
560mm (22inch)	QD axle Steel basic	36 2mm steel	Puncture free pu or pneumatic	Steel powder coated four point handrim fix	150Kg
610mm (24 inch)	QD axle Steel basic	36 2mm steel	Puncture free pu or pneumatic	Steel powder coated four point handrim fix	150Kg
610mm (24 inch)	QD axle Al. large flange Hub brake	36 2mm steel	Puncture free pu or pneumatic	Aluminium lightweight Six point hand rim fix	150Kg
610mm (24 inch)	QD axle Al. large flange	36 2mm steel	Puncture free pu or pneumatic	Aluminium lightweight Six point hand rim fix	175Kg
610mm (24 inch)	Fixed axle Al. large flange	36 2mm steel	Puncture free pu or pneumatic	Aluminium lightweight Six point hand rim	175Kg
610mm (24 inch)	Fixed axle Al. large flange	36 2.6mm steel	Puncture free pu or pneumatic	Aluminium lightweight Six point hand rim fix	175Kg
610mm (24 inch)	QD axle Al. large flange	36 2.6mm steel	Puncture free pu or pneumatic	Aluminium lightweight Six point hand rim fix	175Kg
610mm (24 inch)	QD axle Hub brake	36 2.6mm steel	Puncture free pu or pneumatic	Aluminium lightweight Integrated double rim	200Kg
660mm (26 inch)	Fixed axle Al. large flange	36 2mm steel	Puncture free pu	Aluminium lightweight Six point hand rim fix	175 Kg
660mm (26 inch)	QD axle Al. large flange	36 2mm steel	Puncture free pu	Aluminium lightweight Six point hand rim fix	175 Kg
660mm (26 inch)	Fixed axle Al. large flange	36 2.6mm steel	Puncture free pu	Aluminium lightweight Integrated double rim	200 Kg
660mm (26 inch)	QD axle Al. large flange	36 2.6mm steel	Puncture free pu	Aluminium lightweight Integrated double rim	200 Kg
660mm (26 inch)	QD axle Al large flange Hub brake	36 2.6mm steel	Puncture free pu	Aluminium lightweight Integrated double rim	200 Kg

Spoked wheels are built to a high quality standard.
2mm zinc plated steel zinc spokes have a nominal linear tension of 40 Kg.
2.6mm stainless steel spokes have a nominal linear tension of 70 Kg.
Wheel hub bearings are 12mm diameter deep groove type with shielded covers.
Wheel rims are aluminium extruded profile with pegged joints.
Spokes lacing is a three-cross construction for reliability and all round strength.
Basic wheels have small flange 36 spoke steel hubs, four handrim fix points.
Lightweight wheels have, large flange 36 spoke al hubs, six handrim fix points.
Double rim wheels have large flange 36 thick spoke hubs, continuous handrim .

Occupant propelled wheels Performance and Service (cont)

To avoid transit damage during shipping, wheel axles may be supplied separately if requested, with M12 self locking fixing nut and hub cap, for final fitting. Nuts should be torqued up using a 19mm across flats spanner, against the hub bearing race to 5 NM.

Occupant wheels fitting.

When attaching a fixed hub wheel to the wheelchair frame the M12 nuts should be tightened to a nominal torque of 25 NM, on basic steel framed wheelchairs such as 8L, or as indicated by the wheelchair manufacturer. On Greencare DB1 which has an injection moulded nylon frame mounting module, assembly torque is 12NM. QD (quick release) wheels have separate receivers which are also torqued to 12NM. To carry out this operation two spanners are required, an open ended spanner to locate on the external hexagon feature, and prevent rotation, the other spanner tightening the internal fixing nut. We recommend the use of thread lock adhesive, such as loctite 243, for additional security of the wheel fixing nuts.

For active independent users the recommended hub construction is large flange light- weight, aluminium single piece machined hub, with a quick release action spindle, which locates in a receiver, attached to the frame. These wheels are suitable for use with either pneumatic tyres, or Greentyre mobility microcellular polyurethane tyres, which are a good puncture free and performance combination. To avoid transit damage during shipping, when supplied as spares, QD spindles and receivers are supplied separately, for final fitting

The quick release spindle shaft operates by pressing a button in the centre of the hub, which releases two locking balls at the end of the spindle allowing the spindle to be withdrawn from the receiver. For ease of assembly of the quick release shafts into the receiver, the use of none toxic light lubricant grease which leaves a film on the surface, for ease of assembly, is recommended.

The fit of the QD spindle shaft into receiver is controlled by the distance between the inner bearing face of the wheel hub and the two locking balls in the spindle. This distance can be adjusted to eliminate unnecessary transverse wheel movement. This adjustment of the effective wheel location requires the use of an 11mm across flats spanner on the spindle shaft to prevent rotation, and a 19mm across flats spanner on the setting nut under the spindle shaft hub cap.

When carrying out this adjustment it is absolutely essential to check that the locking balls on the end of the QD spindle are fully exposed at the internal locking face of the receiver, with a little clearance after assembly to ensure positive locking. Locking ball action should be positive and checked on both wheels on both sides of the wheelchair, to ensure that when a user replaces them after storage, they operate correctly either way around.

Occupant propelled wheels Performance and Service (cont)

Tyres:

The choice of tyres for manually propelled wheelchairs is between pneumatic and polyurethane puncture free material specifications.

Pneumatic Tyres:

These are normally inflated to a pressure of 3 bar (45 psi). The ground contact surface of a pneumatic tyre is rubber, this is a high friction material giving good grip characteristics and performance in most surface conditions. Pneumatic tyres are lighter than polyurethane puncture free tyres. When inflated to the correct pressure pneumatic tyres give good shock absorbing ride. Wheelchairs fitted with pneumatic tyres are easy to push, when the tyre condition is perfect, and at the correctly inflation pressure. They are a recommendation for wheelchairs used by very heavy occupants.

Major and frequent concerns with pneumatic tyres are possibility of punctures, surface wear, and pressure leakage, with subsequent inconvenience and cost of repair caused. When the inflation pressure is reduced, the rolling resistance increases and parking brake operation is adversely affected. When wheelchairs are used in outdoor environments punctures and tyre wear are inevitable. For the majority of wheelchair applications, the cost and inconvenience of puncture and tyre repair is significant compared to the reduced maintenance benefits of a puncture free tyre specification.

With pneumatic tyres we recommend that inflation pressure is routinely checked and maintained. Small bicycle hand pumps are difficult to use, requiring much time and effort to fully inflate a pneumatic wheelchair tyre. We recommend the use of a foot or powered pump for tyre inflation. Tyres should not be inflated using the air line equipment on garage forecourts, as these can input pressure instantly above tyre safety levels, resulting in a tyre fly off, and user injury.

Greentyre polyurethane puncture free tyres:

These are of a micro-cellular construction. Greentyres are a high quality material specification, intended to closely simulate the ride characteristics of a fully inflated pneumatic tyre. Polyurethane tyres have slightly less grip with the floor than a rubber pneumatic tyre, but are harder wearing, and retain consistent performance throughout the service life of the wheel, without tyre maintenance being required. When originally fitted new, the contact surface of polyurethane tyres may be smooth, however surface grip improves after a few weeks use.

Greentyre offer a range of tyre sections and tread patterns for wheelchair mobility tyres. The advantage of polyurethane puncture free tyres over pneumatic tyres is the total elimination of problems caused by punctures and air leakage. The Greentyre material specification is the result of many years experience with the wheelchair application and combines the functionality of a pneumatic tyre with the benefits of also being puncture free.

Occupant propelled wheels Performance and Service (cont)

Tyres: (cont)
A review of overall service cost will usually determine a change from pneumatic to a puncture free tyre. This is most cost effective when distance and frequency of service visit is significant. We recommend that when Greentyres are fitted, the tyre rim tape is retained, to reduce the effect of vibration in spoke nipples. When fitting puncture free tyres to wheels that have seen some service, it is important to also check the wheel as being suitable, with spokes tensioned to specification.

Assembly of puncture free polyurethane tyres can be carried out using the special Greentrye hand lever tools, designed to avoid rim damage. Do not use grease or heat to ease fitting. Fitting by hand is 90% technique and 10% force. Tyres must not be over stretched during assembly.This can damage the internal strengthening filaments, and loosen rim fit. Once located in the rim, tyres can be seated and aligned. For batches of tyres, we recommend a mechanical bench mounted fixture that stretches and positions the tyre over the wheel rim accurately, to improve assembly process control.

Basic Hand Rim

Handrims fitted to basic 20inch, 22inch and 24inch wheels are 16 mm grip section diameter polyester powder coated steel with fixing hole points for m5 screws. The welded handrim bracket fixing specification has a hole, compared to a slotted fork, as was standard up till 1995 on many wheelchair specifications. An optional fixing available on some wheels from 2013 uses a rim spacer bush. Both these fixing methods reduce possibility of accidental hand rim detachment. Security of handrim fixings should be regularly checked. DB1 anodised aluminum handrims used on 24inch and 26inch wheels are 19mm diameter and available in a choice of user grip spacings from wheel centre, narrow grip at 25mm and full grip at 37.5mm, dependant upon build specification. Handrim fitting and removal requires use of simple hand tools. The welded bracket construction makes it necessary to first remove the tyre.

Handrim Removal.
A frequently asked question is “can the handrim be taken off to make the chair more accessible through a tight door space.” The handrim does contribute to overall wheel strength against a buckling load. Also with the fixing bush narrow spaced option, a handrim can be fitted to be no wider than the central wheel hub. So we recommend the reduced space option over a total handrim removal.

Handrim damage
A problem of basic polycoated wheelchair hand rims is the frequency of surface damage to painted, aluminium or chrome plated surfaces. This can be caused in normal use, when a user is attempting to gain access through a narrow doorway, or during manoeuvres in a tight space. For many users this damage is a normal part of everyday use, and difficult, or impossible, to avoid. A damaged hand rim surface can be a concern. A surface chip or material peel back creates an uncomfortable edge. Damaged handrims should be replaced.

Occupant propelled wheels Performance and Service (cont)

Greenrim, polyurethane covered handrim.
Greencare can fit a Greenrim to 24inch wheels, and Flexel type polyurethane hand rim covers to other sizes, to reduce the effects of surface damage and improve handrim grip.

The Greenrim is a fuctional improvement with a unique composite material construction which is impact damage resistant, with an ability to absorb repeated surface knocks, and scuffing. Greenrim has a wipe clean surface, and any dirt can be removed with a damp cloth and mild washing detergent.

The Greenrim provides an efficiency improvement. It has a gripping profile and texture, providing the occupant with a comfortable ergonomic surface, which easily fits into the propelling hand, and increases the contact area.

Double Rim Wheels

In January 2013, Greencare Mobilty are introducing a new aluminium double rim wheel. This wheel has been specifically developed for use on wheelchairs.

The double rim combines tyre rim and hand rim into a single integrated section, providing an efficient gripping shape and also increased wheel strength against buckling under heavy occupant loading.

A typical section through this aluminium section wheel is shown opposite.

In demanding use applications, wheels are subjected to dynamic forces and increased leverage. The original build specification for 200Kg occupants and hub brakes now includes this. It is also included on high seat builds when propelling wheel diameter is increased to 26inches. A retrospective service change to this wheel in some cases may reduce damage caused by transportation tie downs.

The double rim has a comfortable propelling grip feature, which for many users is a great benefit in achieving a comfortable shape for the hand when pushing.

The QD and fixed axles for these double rim wheels are the same size as other wheels in our range. This allows direct substitution of this wheel as a replacement spare.