ROLLTEK INTERNATIONAL

CASTOR AND WHEEL GUIDE

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CASTOR TERMINOLOGY

Swivel Castor - an assembly in which a housing containing a wheel is free to swivel without restriction about the vertical axis of the swivel bearing with the castor wheel axle offset.

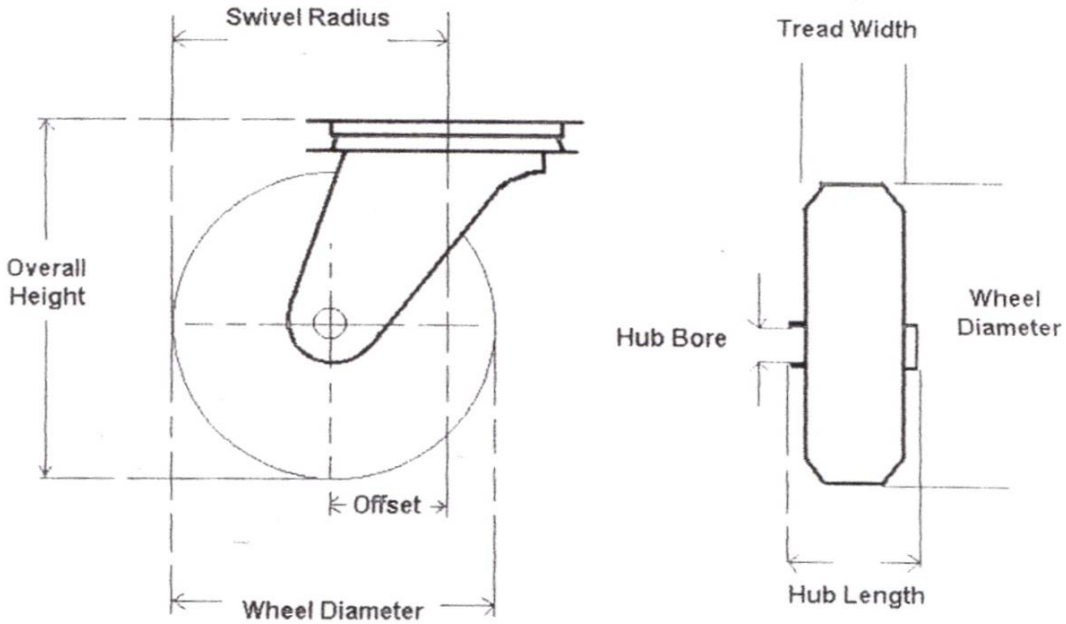
Fixed Castor – an assembly containing a wheel which cannot swivel about its vertical axis.

Offset – the horizontal distance between the centre of the wheel axle and the vertical axis of the swivel bearing: This may sometimes be known as the trail.

Swivel Radius – the radius of the circle produced by the outer edge of the wheel or wheels, when swiveling about the vertical axis measured through the horizontal plane of the axis.

Wheels – a revolving centre rotating freely on an axle of which the external part (in contact with the ground) can be constituted by the material of the wheel itself or by various other materials.

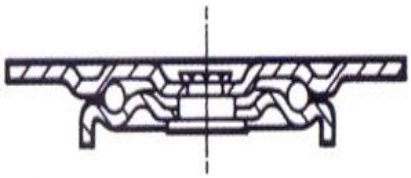
Tractive resistance – the effort required to move a piece of equipment fitted with castors; this is usually expressed as a percentage of the total load carried.

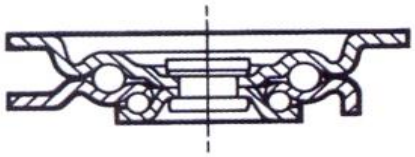


CASTOR TYPES

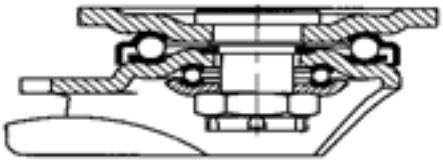
In general Castors can be sub-divided into three main types:

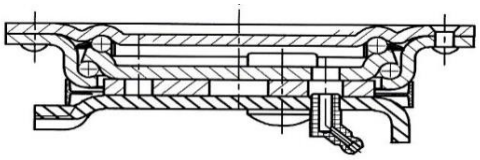
Pressed Steel (Refer to Rolltek Catalogue pages 8-48) www.rolltek.co.uk
Typical pressed steel type castors incorporate single and double ball race constructions. The balls run in tracks formed in the fork and top plate pressings which are secured together by a heavily riveted steel king pin.



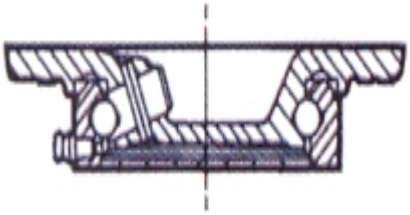


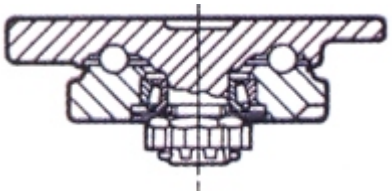
Pressed Steel Towable (Refer to Rolltek Catalogue pages 49-56) www.rolltek.co.uk
Heavy pressed steel castors incorporate double ball race construction. The balls run in tracks formed in the fork and top plate pressings which are secured together by a single high tensile nutted king pin or a triple high tensile bolted fork head





Fabricated Steel Towable (Refer to Rolltek Catalogue pages 58-70) www.rolltek.co.uk
These usually consist of heavy steel forgings which are precision machined and house combinations of tapered roller bearings or ball races. The fork legs are securely welded to the body forging giving an extremely strong construction suitable for extra heavy loads.





CASTOR SELECTION PROCESS

The following information with help your design team and sales department at Rolltek International evaluate which castor is required for each project. This information gathering process will enable us to minimize costs, by eliminating 'over specifying' and offering alternative castors to standard stocked items where necessary.

LOAD CAPACITY

This is calculated from the gross weight of the load and equipment. Special allowance should be made in the event of uneven distribution of weight, this can result in one wheel/castor carrying more load than the rest. Power towing can also contribute to severe shock loading.

Rough and uneven floors can also contribute to severe overloading. If one wheel/castor leaves the floor, the remaining castors must absorb the load.

Working conditions for castors can vary enormously both with regards to the type of floor and the severity of the actual application. In recognition of this variation all Rolltek castors and wheels are given load capacity ratings for average working conditions.

Average working conditions are typified by many factors where one or more of the following hazards may be present to a limited degree.

Overloading, shock loading, uneven floor surfaces – cracks, gullies, door guide rails etc. and the floor surface maybe of an abrasive nature.

It must be appreciated, however, that load capacity is not the only factor to be considered in choosing castors for a specific job. It may often be necessary to choose a castor with a load capacity several times greater than the conditions appear to warrant to ensure that the castors can give the desired performance.

CASTOR MOUNTINGS

Top Plate

The most common fixing with four boltholes to spread the load over the swivel head.

Single Bolthole

Limited to loads of up to 400kg. Designed to be mounted with a fastener through the centre of the swivel head. This style of castor can be fitted with expanders, solid steel stems, threaded stems, loose bolts etc.

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CASTOR CONFIGURATIONS

2 Swivel Castors and 2 Fixed Castors

Providing good load capacity and manoeuverability, this combination ensures accurate steering, even on long straight runs, making it the most practical combination for industrial use. Any trolley with this castor combination should be pushed with the fixed castors leading.

Maximum capacity for each wheel = load/3

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4 Swivel Castors

As this combination gives good load capacity with exceptional manoeuverability, it is suitable for winding runs and where sideways action is required. It is not recommended for straight runs or ramps, as it may be hard to guide, especially over bumpy terrain and when heavily loaded. However, equipping two castors with directional locks makes this arrangement very versatile and suitable for long straight runs.

Maximum capacity for each wheel = load/3

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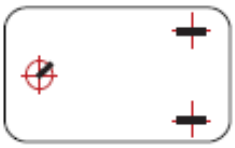
1 Swivel Castor and 2 Fixed Castors

This combination provides an economical solution for lightly loaded trolleys requiring good manoeuverability. The trolley must be reasonably small in size and load must be evenly distributed to ensure stability.

Maximum capacity for each wheel = load/2.5



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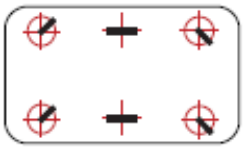
3 Swivel Castors

This provides good load capacity with excellent manoeuverability. However, equipment with this arrangement will be difficult to guide on straight runs particularly over uneven ground.

Maximum capacity for each wheel = load/2.5

CASTOR CONFIGURATIONS Continued..

4 Swivel Castors and 2 Fixed Castors (centrally pivoting)



This combination provides an extremely high load capacity, with great manoeuverability and stability. This is ideal for very long trolleys designed to carry heavy loads - the fixed castors can be replaced by wheels mounted onto a central axle.

The unit's base must be robust and the swivel castors are mounted to allow the trolley to pivot on the central wheels. Therefore, 25mm of packing is required above the two fixed castors (wheels) to give alternating load support, depending on which pair of wheels is in contact with the floor. The entire load rests on 2 central, fixed castors/wheels.

PLEASE NOTE: The swivel castors are subjected to shock loads if the trolley is tipped or the load is not evenly distributed.

Maximum capacity for each wheel = load/2

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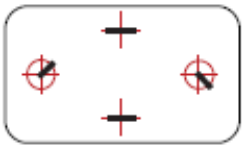
2 Swivel Castors and 2 Fixed Castors



Ideal for confined spaces, this configuration provides good load capacity with excellent manoeuverability. The fixed castor can be replaced by wheels which pivot the trolley centrally. In this case, 25mm of the packing is necessary above the two fixed castors (wheels) to give alternating load support. However, if the trolley is tipped or the load is not evenly distributed, the swivel castors are subjected to shock loads. The entire load rests on the 2 central, fixed castors/wheels.

Maximum capacity for each wheel = load/2

WORKING ENVIRONMENT

The environment in which castors and wheels are used in plays a huge part in deciding which product is suitable for the application.

WHEEL SELECTION

MANUAL APPLICATIONS - The choice of correct castor wheel is very closely related to the effort the operator can exert. 18kgf is the generally accepted figure for moving from a standing start, but his must be reduced to 12kgf once the truck is on the move. The operator can maintain this effort for reasonably short distances, but for longer distances of travel he cannot be expected to maintain a force of more than 6kgf. In choosing the type of wheel to specify, the above figures relate to the tractive resistance, which is usually expressed as a percentage of the total load carried, dependant on several factors and will vary for each application. Refer to tractive resistance section.

POWER TOWING - Not all castors are suitable for power towing. For castors that are suitable for this application (Maximum towing speed 4km/h) please refer to Rolltek catalogue pages 49-56 and 58-70.

Wheels can be divided into two main types:

- **RESILIENT (SOFT) TREAD WHEELS**
- **HARD TREAD WHEELS**

RESILIENT (SOFT) TREAD WHEELS

Resilient or Soft tread wheels, such as rubber or polyurethane, give the ultimate in quietness and floor protection but introduce a penalty from the point of view of ease of movement, as the tractive resistance or effort required to move them is generally up to 3 times greater than that of an equivalent size hard tread wheel. Polyurethane, however, has the remarkable property of being able to carry loads approaching that of cast iron. Polyurethane and Elastic Rubber has a great resistance to tearing and to abrasive wear.

For many high load manual applications soft tread wheels must be ruled out as although they are maybe capable of carrying the very high load the force required to move the equipment would require the effort of several operators.

However, the quiet running and floor protecting properties of the resilient tread wheels make them particularly suitable for power towing applications.

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Solid Rubber

Solid Rubber, medium load capacity, smooth cushioned ride, economical.

Temperature range: -20°C to +60°C

PVC

PVC tread for light duty applications.

Temperature range: -10°C to +60°C

Thermoplastic Rubber

Thermoplastic Rubber, medium load capacity, harder wearing than standard solid rubber.

Temperature range: -20°C to +60°C

Elastic Rubber

Elastic Rubber has a high load capacity and wear resistance with a smooth soft-cushioned ride.

Temperature range: -20°C to +60°C

Polyurethane

Polyurethane has a very high load capacity with abrasion, tear and chemical resistance and a soft ride.

Temperature range: -30°C to +90°C

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Anti-Static

Anti-static Non-marking material. Has a high load capacity with abrasion, tear and chemical resistance and a soft ride. The wheels we supply have an electrical resistance of less than 10^4 ohm. Each individual wheel is subjected to electrical testing.

Temperature range: -20°C to +70°C

Pneumatic

Pneumatic has excellent shock absorption working well on rough, uneven surface like gravel or grass.

Temperature range: -20°C to +60°C

Microcellular

Microcellular wheel behaves in a similar way to a pneumatic wheel, but has a microcellular infill which allows the wheel to keeps its bounce without the risk of puncturing.

Temperature range: -20°C to +60°C

HARD TREAD WHEELS

In the range of Hard tread wheels, it is usual to consider castors with cast iron wheels as a basic standard, as these are generally the strongest and have the longest life. They are also certainly the easiest to push and, in many cases, will, therefore, be the first choice for maximum mobility.

They have a disadvantage, however, of being rather noisy and can sometime cause excessive floor wear. As an alternative to cast iron, Injection Moulded Solid Nylon wheels have been developed. Nylon is unaffected by water and its use in the wet further enhances its self-lubricating properties. The load capacity of nylon approaches that of cast iron and these wheels also have the additional advantages of being quiet running, light in weight and limits damage to floors (Not advised for use on 'painted' concrete floors) They can also be used in the temperature range -40 C to 80 C, although at extremes of range it may be necessary to derate the load capacity of the wheels by up to 25% for very arduous conditions. For higher temperature applications reinforced phenolic or reinforced polyamide wheels should be used.

Cast Iron and Steel

Cast Iron and Steel wheels combine shock resistance with long life.

Temperature range: -40°C to +300°C

Nylon

Nylon has high load capacity, is light and clean and causes little floor damage.

Temperature range: -40°C to +80°C

Polypropylene

Polypropylene has good load capacity but not the abrasion or fracture resistance of nylon.

Operational temperature range: -20°C to +80°C

Phenolic

Phenolic is very hard, abrasion and fracture resistant but liable to wear and chipping.

High operational temperature range: up to +350°C

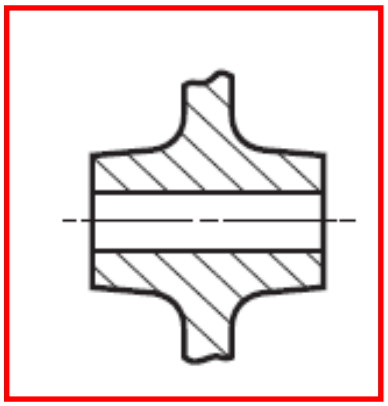
WHEEL MATERIAL STATISTICS

Wheel/Tyre *Centre*	*Polyurethane* *Cast Iron Alloy*	*Polyurethane* *Nylon*	*Elastic Rubber* *Cast Iron Alloy*	*Elastic Rubber* *Nylon*	*Nylon or Polypropylene*	*Cast Iron*	*Phenolic*	*Semi Elastic Rubber*
Floor Protection	Good	Good	Good	Good	Average	*NR	Average	Good
Shock Absorption	Good	Average	Good	Average	Average	Good	*NR	Average
Wear Resistance	Good	Good	Average	Average	Good	Good	Average	Average
Rough Handling	Good	Average	Good	Average	Average	Good	*NR	Average
Hygienic	*NR	Average	*NR	Average	Good	*NR	Good	Average
Wet Environment	*NR	Average	*NR	Average	Good	*NR	Average	Average
Sound Dampening	Good	Good	Good	Good	*NR	*NR	*NR	Good
Rolling Resistance	Medium	Medium	Med/High	Med/High	Low	Low	Low	High
Non-Marking	Yes	Yes	Yes	Yes	Yes	No	Yes	Grey – Yes Black - No

*NR = Not Recommended

BEARING OPTIONS

PLAIN BORE

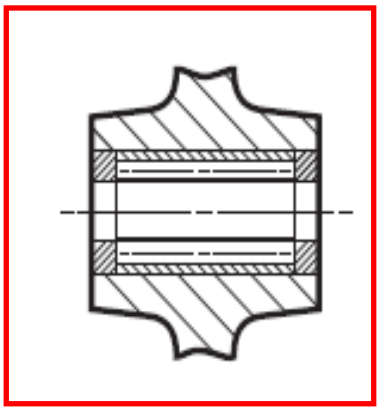


Consists of an axle hole machined or molded in the wheel centre. In the case of cast iron wheels and cast-iron centre wheels, frequent lubrication is essential. In the case of nylon centre wheels and those with nylon bushes, the axle tube is greased on assembly and in good conditions will run for a very long time without additional lubrication. There is, however, a risk of squeaking and excessive axle wear in dusty and gritty conditions.

Nylon plain bearing wheels are ideal for applications where steam cleaning and excessive water or liquids are present (to be used in conjunction with stainless steel tube)

Suitable for occasional use and light loads or where low rolling friction is not important.

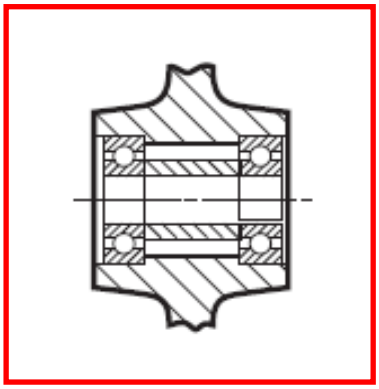
ROLLER BEARING



The most popular low-cost easy movement bearing. For light duty applications, roller bearings are greased on assembly and should under normal conditions not require replenishment.

Widely used to reduce manual effort needed to move heavy loads. This type of bearing needs no adjustment on the axle.

BALL BEARING



Precision ball journal bearings are ideal for applications where high radial loads and moderate axial loads are present. This configuration gives low rolling friction. Shielded to retain grease and exclude grit, dust, etc. Inner bearing races need to be clamped end wise on assembly. Suitable for manual propulsion and medium duty, moderate/high speed power towing.

WHEEL BEARING SELECTION

The main considerations in the selection of wheel bearings are:

- Radial Load
- Axial Load (side thrust)
- Speed of Rotation
- Occasional or Continual use
- Bearing Friction

Bearing Type	Radial Load	Axial Load	Speed of Rotation	Usage	Bearing Friction
Plain	Moderate	Very Light	Low	Occasional	Moderate (Nylon) High (Cast Iron)
Roller	Moderate	Very Light	Moderate	Continual	Low
Ball Bearing	High	Moderate	Moderate/High	Continual	Low

REGULAR v OCCASIONAL USE

OCCASIONAL USE

Castors fitted to a machine or other device to enable it to be delivered to the place where it is to be used or to enable it to be moved occasionally for very short distances.

For this type of application wheels of a smaller diameter may well be acceptable and are often used at their full rated capacity.

REGULAR USE

Castors for use on trucks, trolleys, trailers etc., which are used as a means of transportation (i.e., They are loaded with goods of some description and then regularly moved from one place to another)

For these applications it is obviously essential that castors should have the lowest tractive resistance and should also be able to swivel freely so that the trolley can be maneuvered without too much effort. To achieve this, wheels should be at least 100mm diameter and preferably 160mm or more, regardless of the rated load capacity and choose castors with swivel heads designed to give maximum mobility. This will normally eliminate single ball race swivel heads for this type of application.

CASTOR LUBRICATION

All moving parts of Rolltek castors are liberally treated with a grease containing a quantity of specially prepared additives. This forms a protective layer which minimizes wear by metal-to-metal contact.

Even the best lubricants must be replenished if the castor is to continue to give good service. In most swivel heads this can be done with a pressure oil gun, ensuring that the oil reaches the king pin head, on Fabricated Towable castors the swivel head is fitted with grease nipple.

Nylon wheel bushes are self-lubricating but will benefit from occasional lubrication particularly in very dusty conditions.

In low temperature applications consistency will increase up to the point when movement can become difficult, particularly with single ball race swivel castor. It is therefore essential to use special low temperature grease whenever it gets lower than minus 30 C.

At the top end of the temperature range the grease will last a long time except when it is subjected to forced draught ventilation such as in an oven. In this case the oil component will be volatilized and if replenishment is not carried out

frequently the components will be jammed by the formation of 'coke'. It is therefore essential to use high temperature grease whenever it gets higher than 130 C.

Although this grease is compatible with normal lithium-based greases, it is not good practice to try and convert standard castors and wheels for high temperature applications simply by pumping in the high temperature grease unless all the original grease has been purged. At the higher temperature, the original standard grease is liable to carbonize, resulting in damage to the bearing.

TRACTIVE RESISTANCE

The following Graphs have been produced to assist in the selection of wheels where Tractive Resistance (T.R.) or the effort required to move the load is of prime importance.

It should be noted that with hard tread wheels, the initial T.R. is very dependent on the floor surface. Small imperfections in the floor surface will increase the initial effort required to initiate movement. However, soft tread wheels are not affected to the same degree. The following graphs relate to good floor conditions.

To start a load moving the operator can exert a force of approximately 18kgf but this would be difficult to maintain for even a short period. Investigations have shown that a figure of 12kgf is the maximum that can be used for continuous effort. However, the operator can maintain this effort for only reasonable short distances, for longer distances of travel they cannot be expected to maintain a force of more than 6kgf.

The graphs relate only to roller bearing* wheels in line with the direction of travel. When two or more wheels in swivel castors are transverse, i.e., 90' to the line of travel, the T.R. will initially be up to about seven times higher than those in line.

Resilient tyred wheels supporting static loads for long periods develop a small flat on the tread. These normally roll out after the first revolution, but it is essential to allow for a higher starting load.

As a general guide for plain bearing wheels the effort figure required should be multiplied by 2. For ball bearing wheels the effort required will be reduced by approximately 20%.

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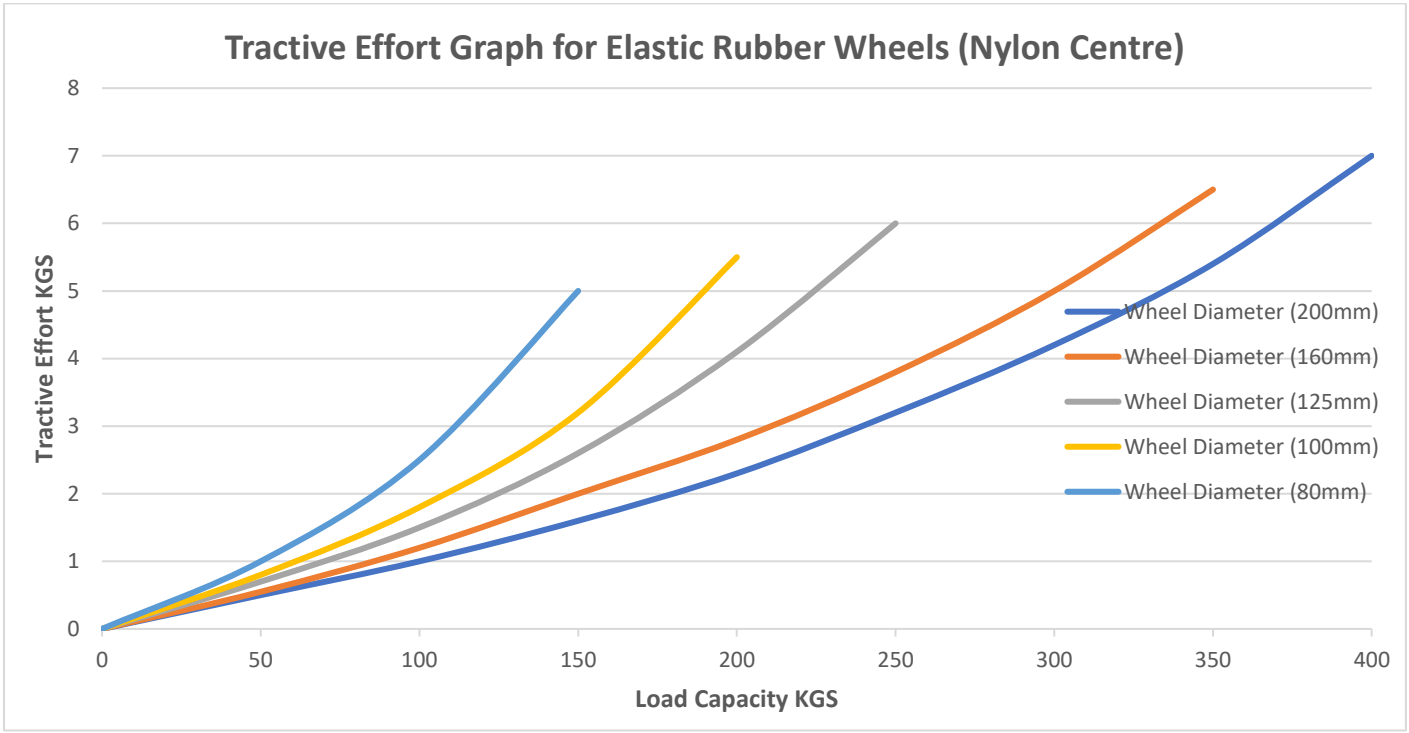

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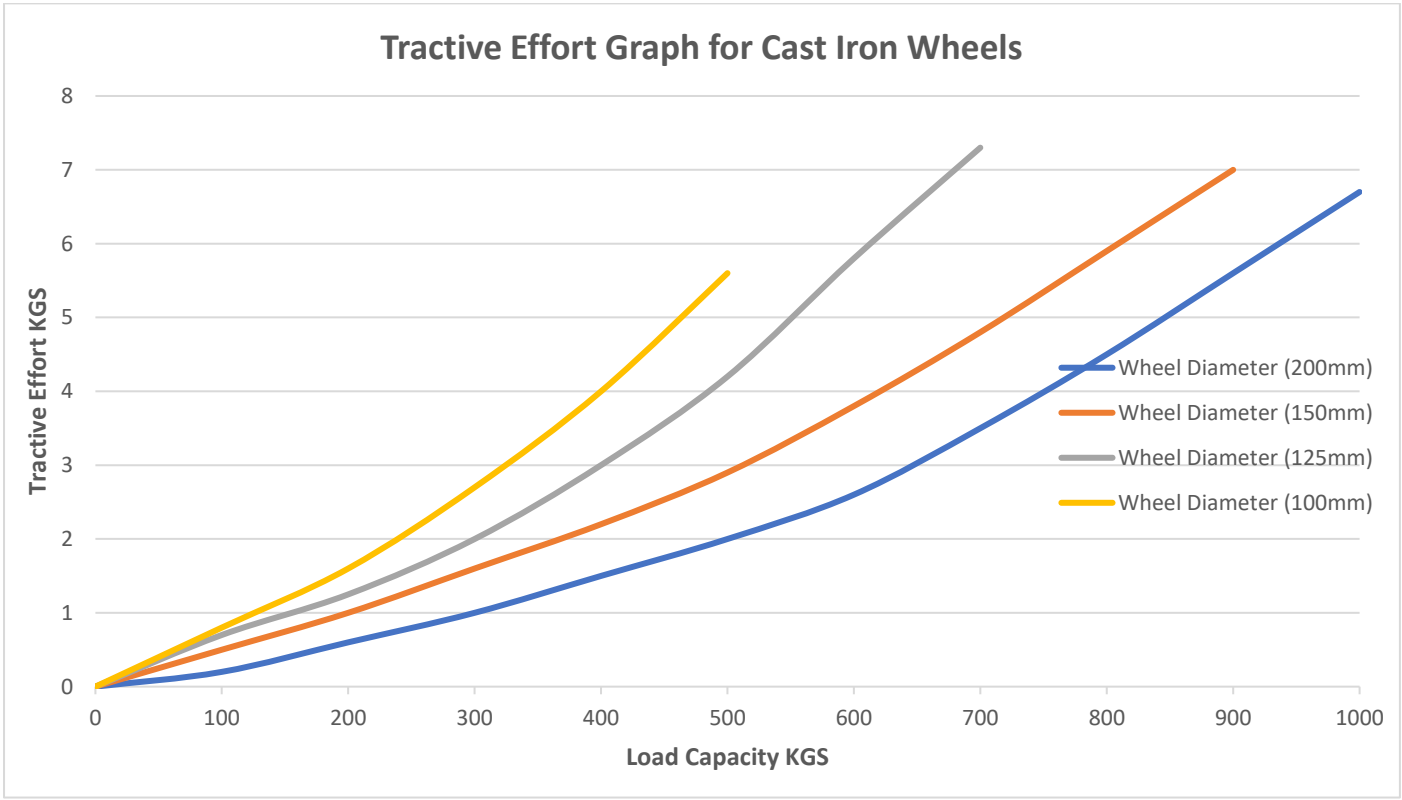

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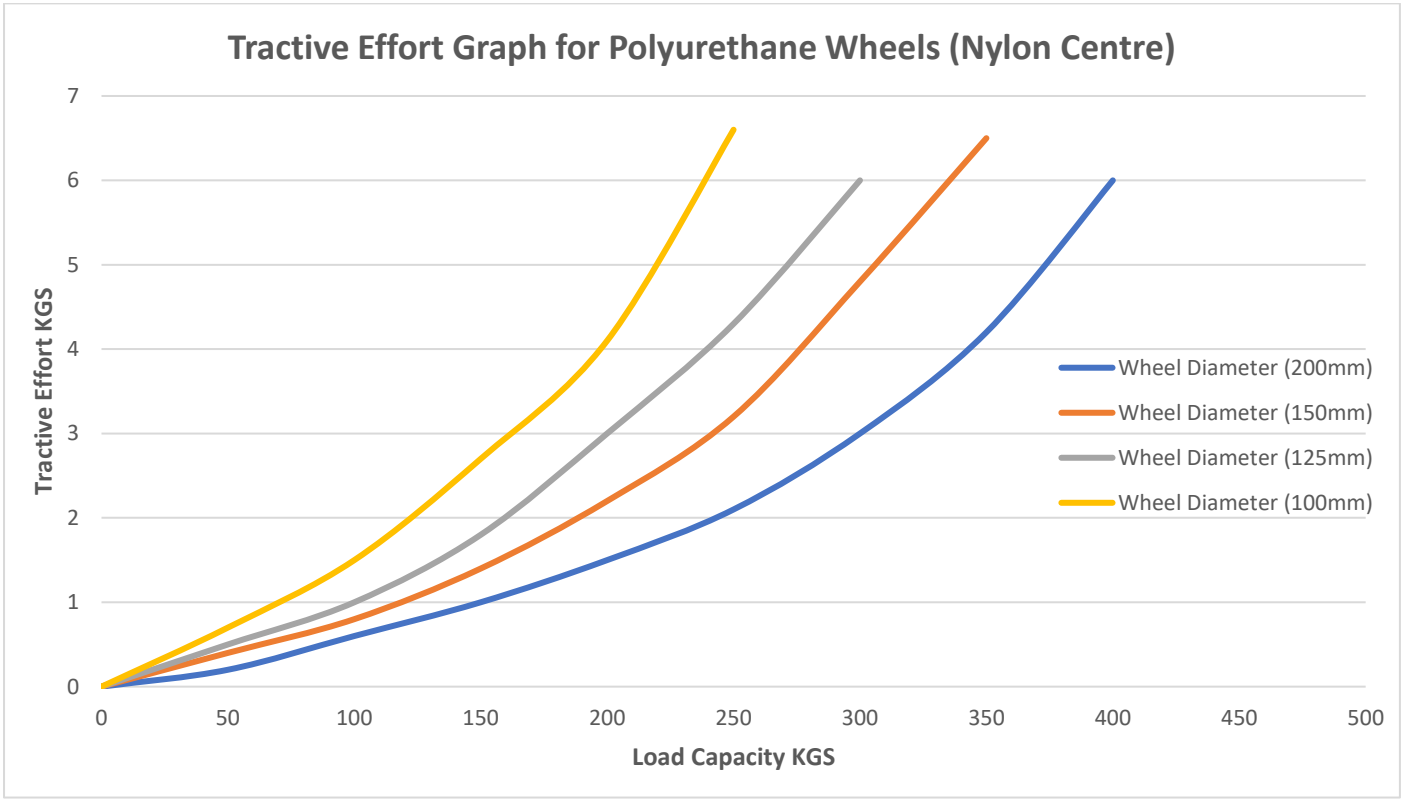

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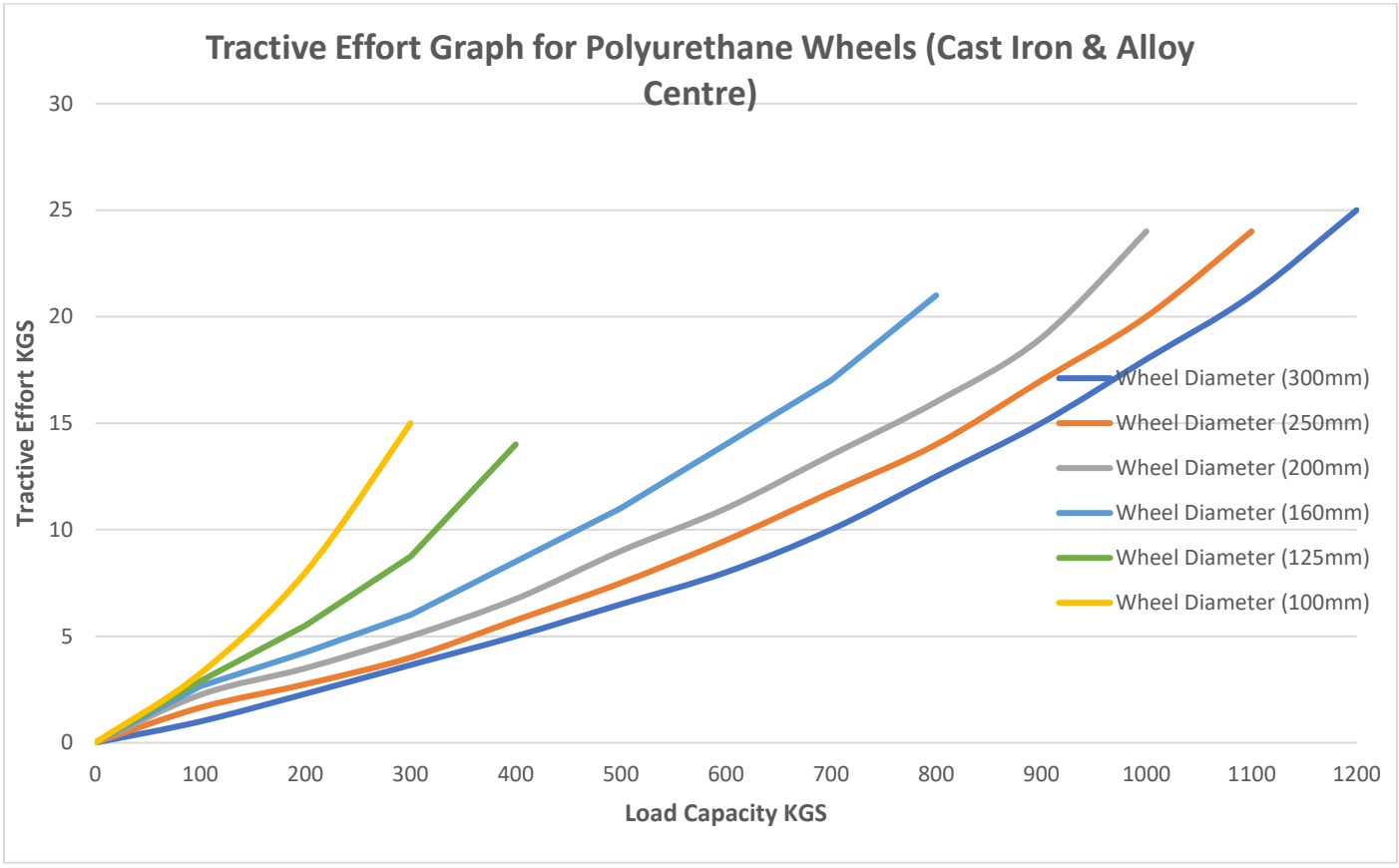

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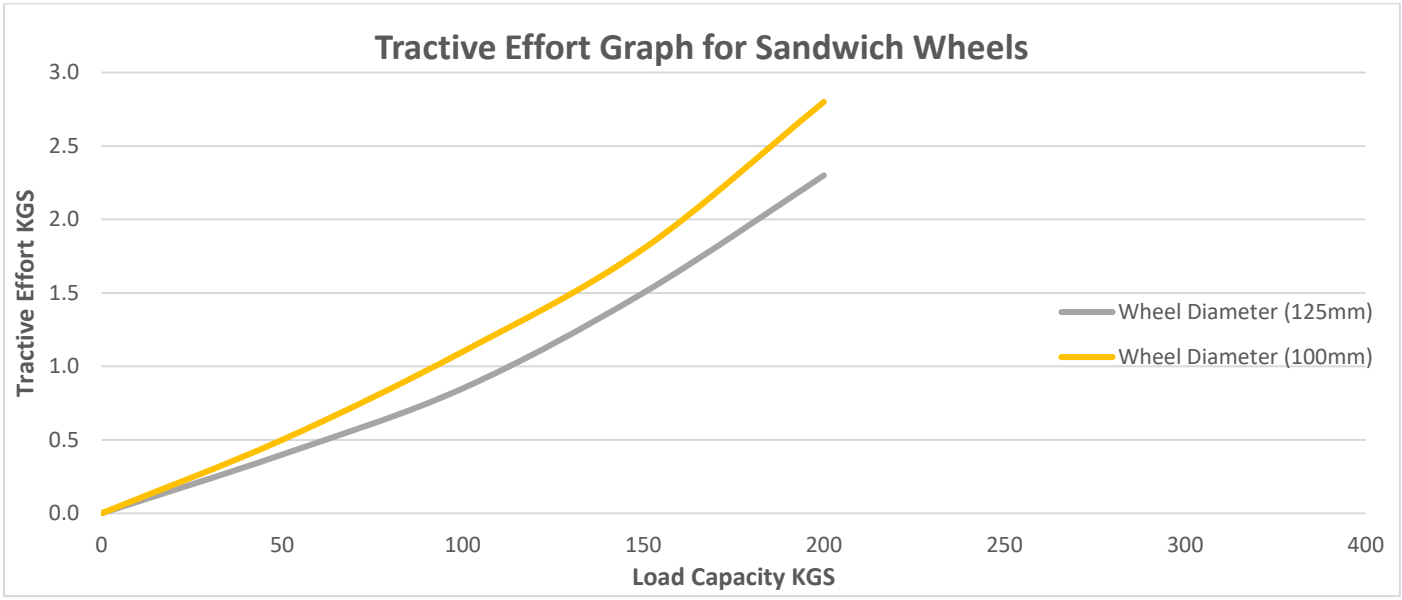

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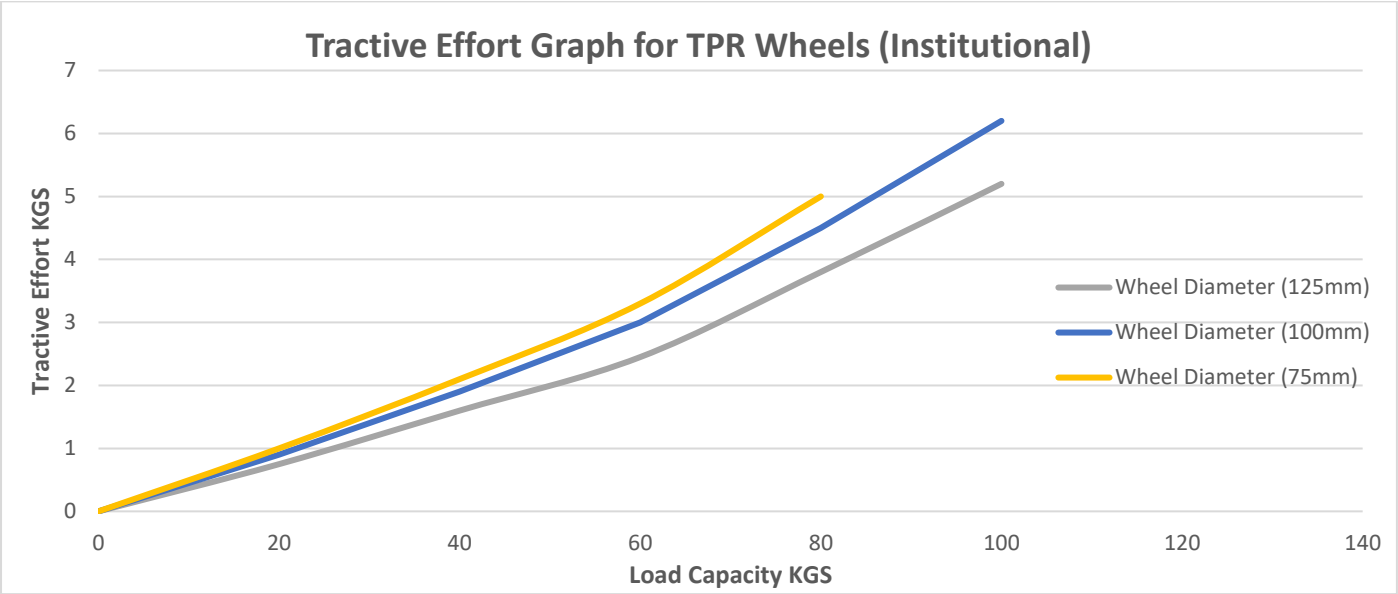

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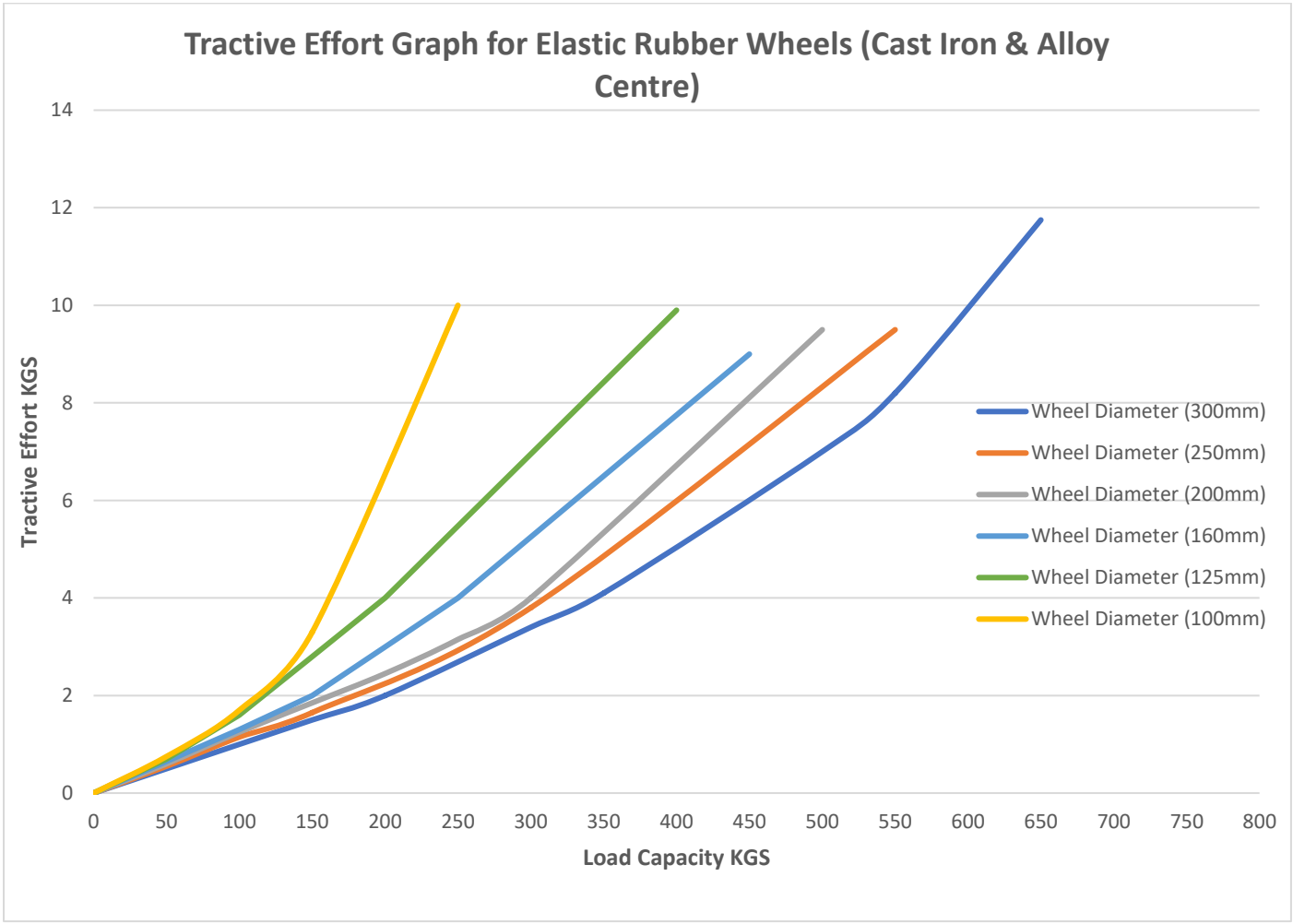

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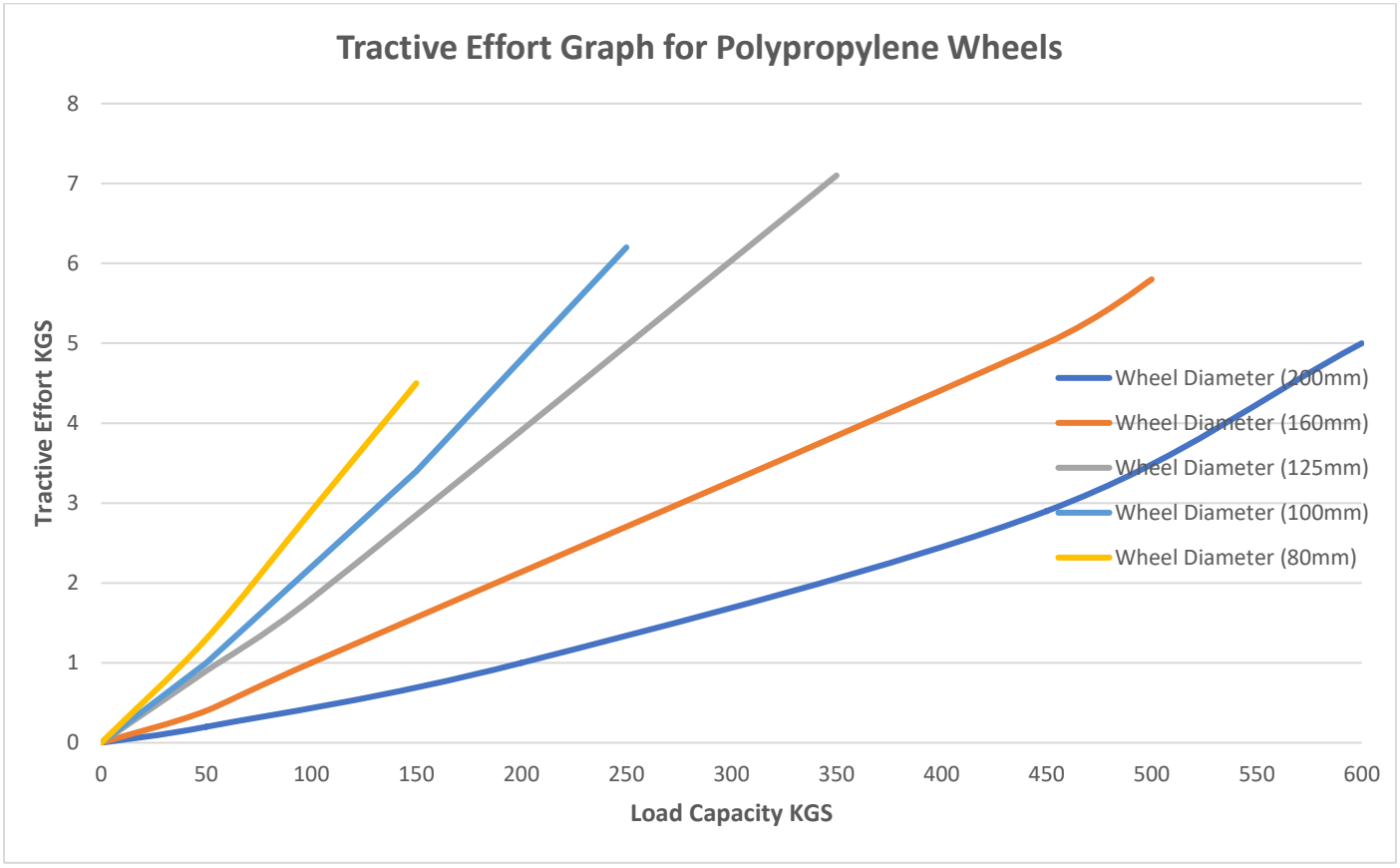

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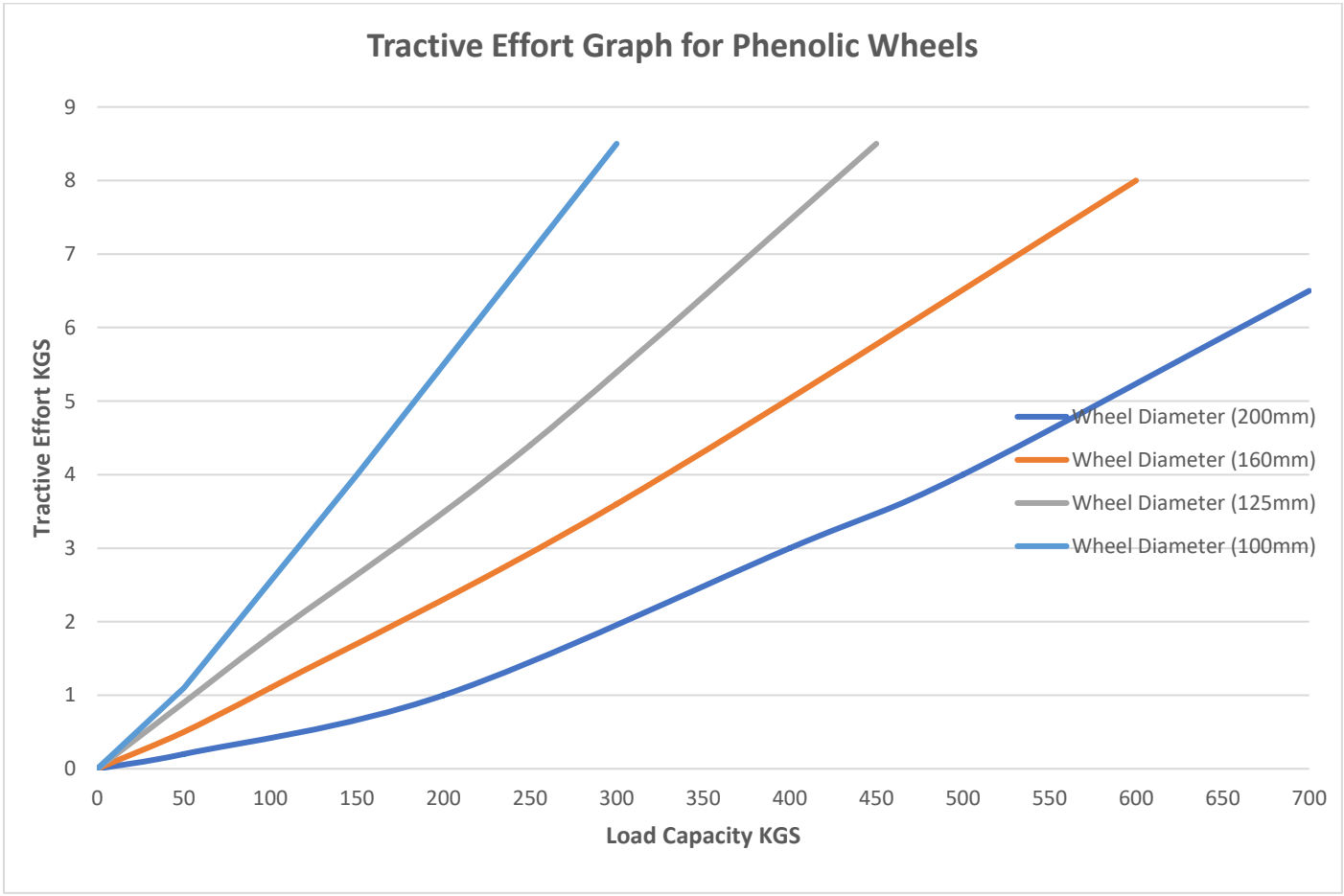

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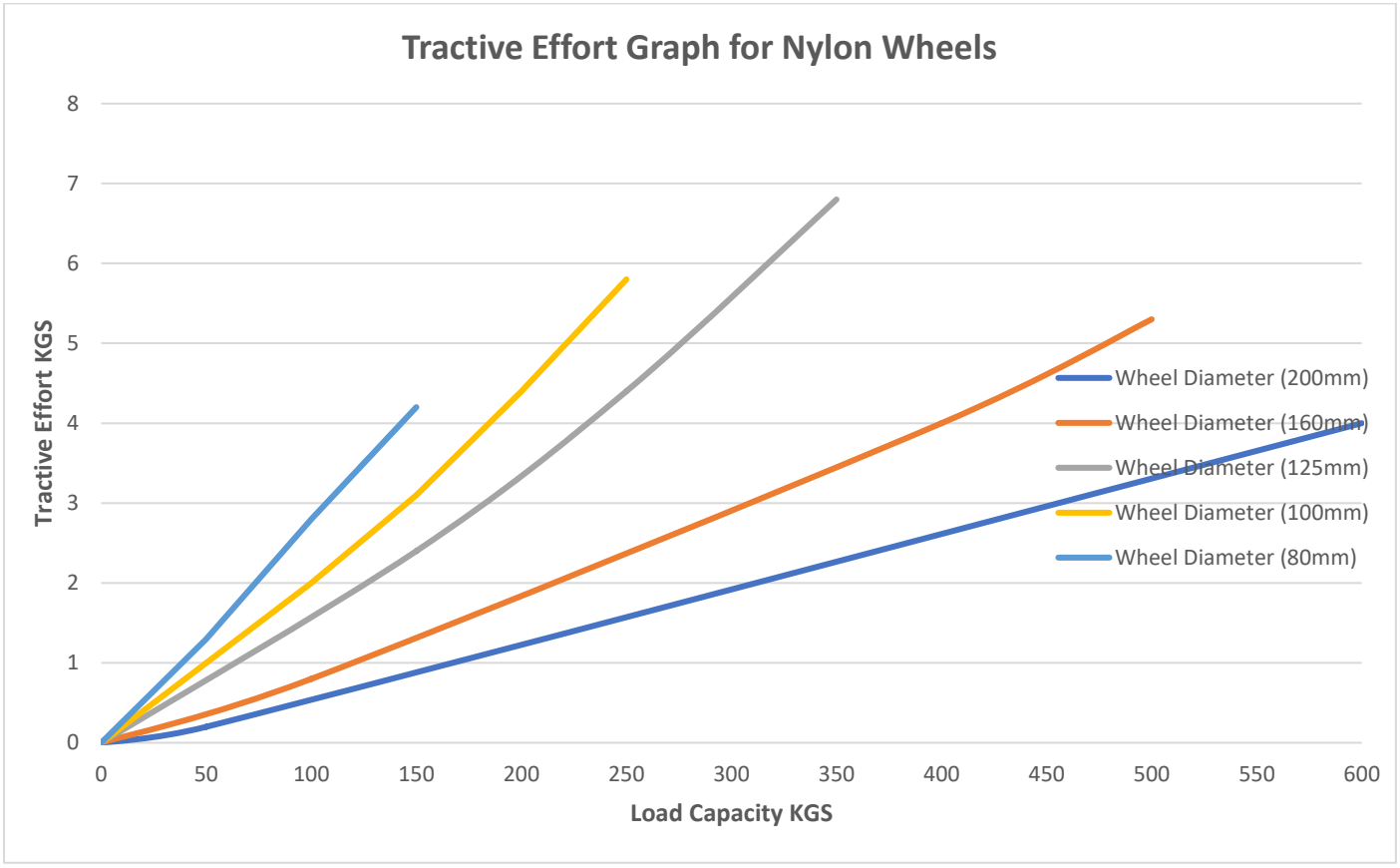

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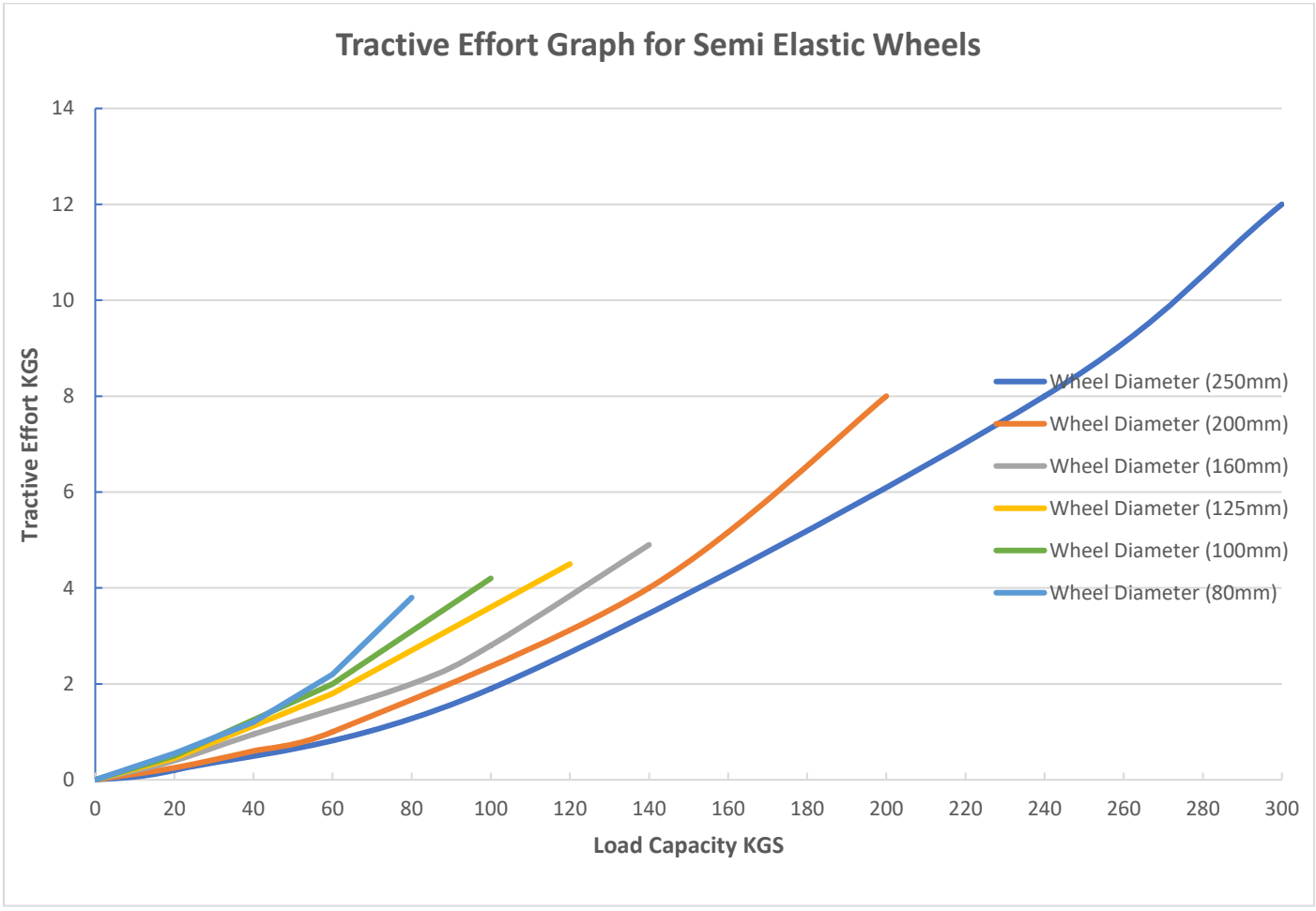

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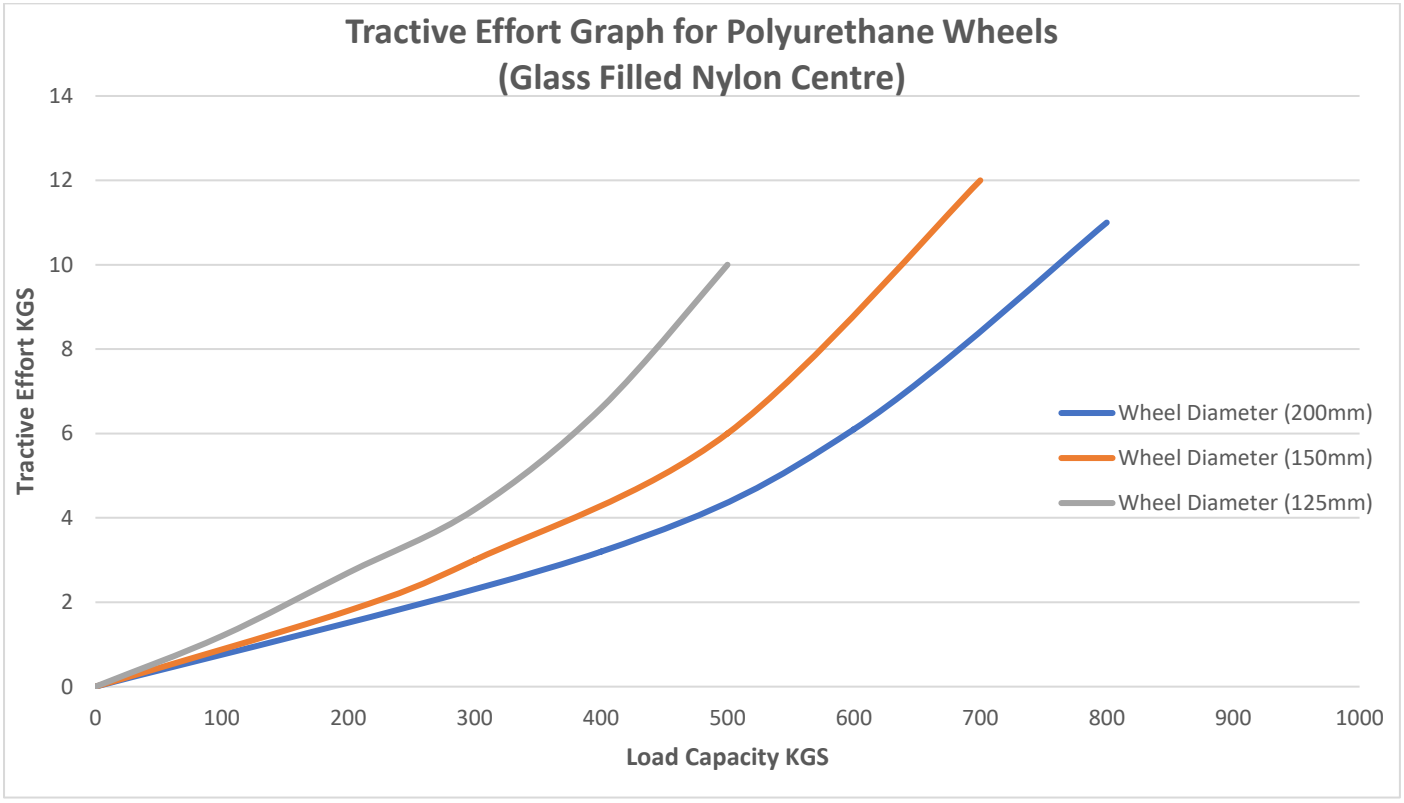

CHEMICAL RESISTANCE

The comprehensive guide that follows lists common chemicals and their reaction with tyre/wheel materials.

MATERIALS

- **CAST IRON**
- **RUBBER MATERIAL**
- **NYLON**
- **POLYPROPYLENE**
- **POLYURETHANE**

KEY

A. **LITTLE OR NO EFFECT**
B. **MODERATE EFFECT**
C. **SEVERE EFFECT**

CAST IRON MATERIAL

Acetic Acid (50%)	C
Acetone	A
Ammonia Solution	A
Bleach Solution	A
Butanol	A
Carbon Tetrachloride	A
Diesel Oils	A
Edible Oils	A
Ethanol	A
Hydrochloric Acid (up to 30%)	C
Hydrofluric Acid (up to 40%)	C
Hydrogen Peroxide (30%)	C
Hydrogen Sulphide	A
Machine Oil	A
Methanol	A
Mineral Oils	A
Motor Oils	A
Nitric Acids (10%)	C
Paraffin and Petrol	A
Phosphoric Acid (10%)	C
Seawater	A
Soap Solution	A
Sodium Bicarbonate	A
Sodium Hydroxide Sol. (10%)	A
Sulphuric Acid (up to 50%)	C
Trichloroethylene	A
Water	A
White Spirit	A

RUBBER MATERIAL

Acetic Acid (50%)	C
Acetone	C
Ammonium Hydroxide	C
Barium Hydroxide	B
Benzene	C
Bleach Solution	B
Borax	A
Boris Acid	A
Butane	C
Butanol	C
Butyric Acid (1%)	B
Butyric Acid (98%)	C
Calcium Bisulphate	C
Calcium Chloride	A
Calcium Hydroxide	B
Carbon Dioxide	A
Carbon Disulphate	C
Carbon Monoxide	C
Carbon Tetrachloride	C
Castor Oil	B
Chloride of Lime	C
Chlorine	C
Chromic Acid	C
Citric Acid 20c (10%)	A
Copper Sulphate (10%)	A
Cottonseed Oil	C

RUBBER MATERIAL continued..

Cyclohexane	C
Diesel Oil	B
Distilled Water (50c)	A
Edible Oils	A
Esters	C
Ethanol	C
Ether	C
Ethy Acetate	C
Ethyl Alcohol	A
Formaldehyde	C
Formic Acid	B
Fuel Oil	C
Gasoline	C
Glue	B
Glycerine	A
Glycol	A
Hydraulic Oils	C
Hydrochloric Acid (10%)	A
Hydrochloric Acid (30% +)	C
Hydrochloric Acid (cold)	C
Hydrochloric Acid (hot)	C
Hydrofluoric Acid (up to 40%)	C
H2O Water (20c)	A
Hydrogen	B
Hydrogen Peroxide (30%)	C
Hydrogen Sulphide	A

RUBBER MATERIAL continued..

Isopropyl Ether	C
JP-3 & JP-4	C
Kerosene	C
Lactic Acid	C
Linseed Oil	C
Lye	B
Machine Oil	C
Magnesium Chloride	A
Magnesium Hydroxide	A
Mercury	A
Methanol	C
Methyl Alcohol	A
Methyl Ethyl Ketone	C
Methylchloride	C
Milk	A
Mineral Oils	C
Monochlorobenzene	C
Motor Oil	C
Naphtha	C
Napthalene	C
Nitric Acid	C
Oil-Lubricating	C
Olive Oil	C
Palmic Acid	C
Paraffin	A
Perchlorethylene	C

RUBBER MATERIAL continued..

Petrol	C
Phenol	C
Phosphoric	A
Photographic Developer	A
Seawater / Brine	A
Silicone Oil	C
Soap Solution	A
Sodium Bicarbonate	A
Sodium Hydroxide	C
Soybean Oil	C
Sulphuric Acid (10%)	A
Sulphuric Acid (50%)	C
Tannic Acid	A
Toluene	C
Trichloroethylene	C
Turpentine	C
Steam (100c)	B
White Spirit	B
Xylene	C
Zinc Sulphate	A

NYLON MATERIAL

Acetaldehyde (aq sol.)	B
Acetamide (aq sol.)	A
Acetic Acid (50%)	B
Acetic Acid (80%)	C
Acetic Acid (aq sol.)	C
Acetone	A
Acrilonitrile	A
Alcohol Drinks	B
Allyl Alcohol	B
Aluminium Chloride (aq sol. 10%)	A
Aluminium Sulphate (aq sol.)	A
Ammonia Solution (weak)	B
Ammonium Chloride (aq sol. 10%)	A
Amyl Alcohol	A
Amyl Acetate	A
Anise Oil	B
Anyline	B
Barium Chloride (aq sol. 10%)	A
Benzaldehyde	B
Benzoic Acid (aq sol.)	B
Benzol / Benzene	A
Benzyl Alcohol	B
Bitumen	B
Bleach Solution	B
Boric Acid (aq sol.)	B
Butanol	A

NYLON MATERIAL continued..

Butter	A
Butyl Acetate	A
Butyl Alcohol	B
Butyl Phthalate	A
Butylene Glycol	B
Butyric Acid (1%)	B
Butyric Acid (98%)	C
Calcium Chloride (aq sol. 10%)	A
Calcium Chloride (aq sol. 20%)	C
Camphor	A
Carbon Disulphide	B
Carbon Disulphide (aq sol.)	A
Carbon Tetrachloride	A
Caustic Soda (aq sol. 10%)	A
Caustic Soda (aq sol. 50%)	B
Chloride of Lime	C
Chloridic Acid (aq sol.)	C
Chlorine Water	B
Chloroform	C
Chromic Acid (3%)	C
Chromic Acid (aq sol.)	B
Citric Acid (aq sol.)	B
Citric Acid 20c (10%)	C
Clove Oil	A
Concentrate Acetic Acid	C
Copper Sulphate (10%)	B

NYLON MATERIAL continued..

Copper Sulphate (aq sol.)	A
Copra Oil	A
Cyclohexane	A
Cyclohexanol	A
Decaline	A
Dichlorofluoro Ethylene	A
Diesel Oil	A
Dimethyl Formamide	A
Dioxane	A
Distilled Water (50c)	A
Edible Oils	A
Ethanol	A
Ether	B
Ethyl Acetate	A
Ethyl Alcohol	B
Ethyl Chloride	A
Ethyl Ether	A
Ethylene Glycol	B
Fats - Saturated	A
Ferric Chloride (aq sol.)	A
Flax Oil	A
Flouridic Acid (aq sol.)	C
Formaldehyde (aq sol.)	B
Formic Acid	C
Formic Acid (aq sol.)	C
Freon 12 - Liquid	A

NYLON MATERIAL continued..

Gaseous Chlorine	C
Glycerine	B
Glycol	B
Heptane	A
Hexane	A
Hydrochloric Acid (up to 30%)	B
Hydrofluoric Acid (up to 40%)	C
Hydrogen Peroxide (30%)	C
Hydrogen Sulphide	A
Hydrogen Sulphide (aq sol.)	A
Iodine Tincture (alcoholic)	C
Iso-Octane	A
Isopropyl Alcohol	B
Lactic Acid (aq sol. 10%)	B
Lactic Acid (aq sol. 90%)	C
Lavender Oil	A
Lead Acetate (aq sol.)	B
Lead Stearate	A
Linseed Oil	A
Lye	A
Magnesium Chloride (aq sol. 10%)	A
Mercuric Chloride	C
Mercury	A
Methanol	A
Methyl Acetate	A
Methyl Alcohol	B

NYLON MATERIAL continued..

Methyl Chloride	C
Methylene Chloride	B
Methyethyl Ketone	B
Milk	A
Mineral Oil	A
Mint Oil	A
Molton Phenol	B
Monochlorobenzene	C
Motor Oil	B
Napthalene	A
Nitric Acid (10%)	C
Nitrobenzol	B
Nitromethane	B
Octyl Phthalate	A
Oil	A
Oil for Transformer	A
Oelic Acid	A
Oleum	C
Olive Oil	A
Oxalic Acid (aq sol.)	B
Ozone	C
Paraffin	A
Perfumes	B
Peroxide Water (aq sol.)	C
Petrol	A
Petroleum Ether	A

NYLON MATERIAL continued..

Phenol	C
Phenol (aq sol.)	C
Phosphoric Acid (10%)	C
Phosphoric Acid (aq sol.)	C
Phosphoric Acid (conc)	C
Photographic Developer	B
Potash (aq sol. 10%)	A
Potash (aq sol. 50%)	B
Potassium Bichromate (aq sol.)	B
Potassium Bromite (aq sol.)	B
Potassium Carbonate	A
Potassium Iodine	C
Potassium Nitrate (aq sol.)	A
Potassium Permanganate (aq sol.)	C
Propyl Alcohol	B
Rose Oil	A
Salicylic Acid	A
Seawater	A
Silicone Oil	A
Silver Nitrate	A
Soap Solution	A
Sodium Bicarbonate	C
Sodium Bisulphite (aq sol.)	A
Sodium Carbonate (aq sol.)	A
Sodium Chloride (aq sol. 10%)	A
Sodium Hypochlorite (aq sol.)	A

NYLON MATERIAL continued..

Sodium Hydroxide (10%)	A
Sodium Nitrate	A
Sodium Silicate	A
Sodium Sulphate (aq sol.)	C
Sodium Thiosulphate (aq sol.)	C
Soya Bean Oil	B
Sulphur	A
Sulphuric Acid (up to 50%)	A
Sulphuric Acid (aq sol. up to 90%)	C
Tartaric Acid	A
Tetrahydrophurane	A
Tetralene	A
Thiony Chloride	A
Toluene	C
Toluol	A
Trichloroethylene	A
Trietanol Amine	A
Trifluoro Ethanol	A
Turpentine	A
Vaseline	A
Vinyl Chloride	B
Violet Oil	A
Water	B
Water (20c)	A
Water and Steam (100c)	B
White Spirit	A

NYLON MATERIAL continued..

Wine	B
Xylene	A
Zinc Chloride	B
Zinc Oxide	A

POLYPROPYLENE MATERIAL

Acetaldehyde	B
Acetate Solvents - Pure	B
Acetic Acid (up to 50%)	A
Acetic Acid (glacial 100%)	A
Acetone (DMK)	A
Acetophenone	A
Acetylene	A
Acriflavine (2% aq sol.)	A
Acrylic Emulsions	A
Allyl Chloride	B
Almond Oil	A
Aluminium Chloride	A
Aluminium Sulphate	A
Alums	A
Ammonia (up to 30%)	A
Ammonia Concentrate	A
Ammonia (gas liquid)	A
Ammonium Acetate	A
Ammonium Bicarbonate	A
Ammonium Carbonate	A
Ammonium Fluoride	A
Ammonium Hydroxide (10% aq sol.)	A
Ammonium Metaphosphate	A
Ammonium Nitrate	A
Ammonium Persuphate	A
Ammonium Phosphate	A

POLYPROPYLENE MATERIAL Continued..

Ammonium Sulphate	A
Ammonium Thiocyanate	A
Amyl Acetate	A
Amyl Alcohol	A
Amyl Chloride	B
Aniline	A
Anisole	A
Antifreeze	A
Antimony Chloride	A
Apple Juice	A
Aqua Regia	A
Aromatic Hydrocarbons	C
Asphalt	C
Barium Carbonate	A
Barium Chloride	A
Barium Hydroxide	A
Barium Salts	A
Barium Sulphate	A
Barium Sulphide	A
Beer	A
Beet Juice	A
Benzaldehyde	B
Benzene/Benzol	C
Benzene Sulponic Acid	B
Benzoic Acid	A
Benzoyl Chloride	A

POLYPROPYLENE MATERIAL Continued..

Benzyl Alcohol	A
Bismuth Carbonate	A
Bleach Solution	A
Bluing	A
Borax	A
Boric Acid	A
Brandy	A
Brine Solution	B
Bromine Gas (weak)	B
Bromine Liquid	B
Bromine Water	B
Butane	B
Butanol	A
Butter	A
Butyl Acetate	A
Butyl Phthalate	A
Calcium Bisulphate	A
Calcium Carbonate	A
Calcium Chlorate	A
Calcium Chloride (up to 50%)	A
Calcium Hydroxide	A
Calcium Hypochlorite	A
Calcium Nitrate (50% sol.)	A
Calcium Phosphate	A
Calcium Salts	A
Calcium Sulphate	A

POLYPROPYLENE MATERIAL Continued..

Camphor Oil	C
Can Sugar Liquors	A
Carbon Biosulphate	C
Carbon Dioxide (wet or dry)	A
Carbon Dioxide Solution	A
Carbon Diosulphate	A
Carbon Monoxide	A
Carbon Tetrachloride	C
Carbonis Acis	A
Carrot Oil	A
Castor Oil	A
Caustic Soda (conc. or diluted)	A
Cetyl Alcohol	A
Chlorobenzene	C
Chlorine Gas	C
Chlorine Liquid	C
Chlorine Water	A
Chlorine (wet)	A
Chlorine (dry)	C
Chlorinated Hydrocarbons	B
Chloroform	C
Chlorosulphonic Acid	C
Chrome Alum	A
Chocolate Syrup	A
Chromic Acid (up to 40%)	A
Chromic Acid 2N	A

POLYPROPYLENE MATERIAL Continued..

Cider	A
Citric Acid	A
Citric Acid 2N	A
Citrondropar (lemon)	A
Clove Oil	B
Coconut Oil	A
Cod Liver Oil	A
Coffee	A
Coke Oven Gas	A
Copper Salts	A
Copper Sulphate	A
Cottonseed Oil	A
Creosote	A
Cresal	C
Cresol	A
Cupric Chloride	A
Cupric Cyanide	A
Cupric Fluoride	A
Cupric Nitrate	A
Cupric Sulphate	A
Curous Chloride	A
Cyclohexane	B
Cyclohexanol	A
Cyclohexanone	B
DDT Spray	A
Decalin	C

POLYPROPYLENE MATERIAL Continued..

Dextrine	A
Dextrose	A
Diacetone Alcohol	A
Diazo Salts	A
Dibutyl Phthalate	B
Dichloroethylene	A
Diesel Oil	B
Diethanolamine	A
Diethyl Carbonate	A
Diethylene Glycol	A
Di-iso-octyl Phthalate	A
Dimethyl Ether	B
Dimethyl Formamide	A
Dimethylamine	A
Dioctyl Phthalate (DOP)	B
Dioxane	B
Disodium Phosphate	A
Distilled Water	A
Dobanic Acid	A
Dye (rit)	A
Edible Oils	A
Epichlorohydrin	A
Ethanol (up to 95%)	A
Ethanolamine	A
Ethers	A
Ethyl Acetate	B

POLYPROPYLENE MATERIAL Continued..

Ethyl Alcohol (up to 95%)	A
Ethyl Chloride	B
Ethylene Chloride	B
Ethyl Ether	B
Ethylene Di-Chloride	B
Ethylene Glycol	A
Ethylene Oxide	B
Ethyl Oleate	A
Fatty Acids C6	A
Ferric Chloride	A
Ferric Nitrate	A
Ferrous Chloride	A
Ferrous Sulphate	A
Formaldehyde (35% sol.)	A
Formaline (40% sol.)	A
Formic Acid (85%)	A
Formic Acid (anhydrous)	A
Freon	B
Fructose	A
Fruit Juice	A
Fruit Pulp	A
Fuming Nitric Acid	C
Furfural	B
Furfurol	A
Gas Oil	A
Gasoline	B

POLYPROPYLENE MATERIAL Continued..

Gasoline (aviation)	B
Gasoline (sour)	B
Gearbox Oil	A
Gelatine	A
Glucose	A
Glue	A
Glycerine	A
Glycolic Acid (30%)	A
Glycerol	A
Grape Sugar	A
Grease	A
Green Soap Solution	A
Heavy Duty Detergent	A
Heptane	B
Hexane	B
Household Ammonia solution	A
Household Detergent	A
Household Soap	A
Hydrobromic Acid	A
Hydrochloric Acid (con. 38%)	A
Hydrochloric Acid (aq sol. 10%)	A
Hydrochloric Acid (up to 50 %)	A
Hydrochloric Acid 2N	A
Hydrocynic Acid	A
Hydrofluoric Acid (up to 50%)	A
Hydrofluoric Acid (techn.)	A

POLYPROPYLENE MATERIAL Continued..

Hydrogen Bromide (10%)	A
Hydrogen Chloride Gas (dry)	A
Hydrogen Fluoride	A
Hydrogen	A
Hydrogen Peroxide (28% sol.)	A
Hydrogen Sulphide (dry)	A
Hydrogen Sulphide (wet, aq sol.)	A
Hydroquinone	A
Igepal	A
Ink (washable)	A
Iodine Solution	A
Iodine (in alcohol)	A
Iosan	A
Isopropyl Alcohol	A
Isopropyl Ether	B
Isooctane	B
Karo Syrup	A
Kerosene	A
Kerosene (no 2 fuel oil)	B
Lacquer and Lacquer Solvents	B
Lactic Acid	A
Lanolin	A
Lead Acetate	A
Lemon Oil	B
Lime Sulphur	A
Linseed Oil	A

POLYPROPYLENE MATERIAL Continued..

Linseed Oil (blue)	B
Lubricating Oil	B
Machine Oil	A
Magenta Dye (2% sol.)	A
Magnesium Chloride	A
Magnesium Carbonate	A
Magnesium Hydroxide	A
Magnesium Sulphate	A
Magnesium Sulphide	A
Malic Acid	A
Manganese Salts	A
Mayonnaise	A
Meat Sauce	A
Mercury	A
Mercuric Cyanide	A
Mercurochrome	A
Mercuric Chloride	A
Mercurous Nitrate	A
Methanol	A
Methyl Alcohol (100%)	A
Methyl Bromide	B
Methyl Ethyl Ketone	B
Methyl Isobutyl Carbinol	A
Methyl Isobutyl Ketone	A
Methylene Chloride	B
Milk	A

POLYPROPYLENE MATERIAL Continued..

Mineral Oil (white)	B
Molasses	A
Monochloracetic Acid	A
Motor Oil (Shell X-100)	A
Mustard Paste	A
n-Heptane	B
Naphtha	B
Naphthalene	B
Natural Gas	A
Neatsfoot Oil	A
Nickel Chloride	A
Nickel Nitrate	A
Nickel Salts	A
Nickel Sulphate	A
Nitric Acid (conc.)	A
Nitric Acid (dil, 10%)	A
Nitric Acid (30%)	B
Nitric Acid (40%)	B
Nitric Acid (conc. 50%)	B
Nitric Acid (75%)	B
Nitric Acid (fuming)	C
Nitrobenzene	A
Nitrogen Oxides	A
Nitrous Acids	A
Nutmeg Oils	C
Oils, Vegetables	A

POLYPROPYLENE MATERIAL Continued..

Oleic Acid	A
Oleum	C
Olive Oil	A
Oxalic Acid	A
Oxalic Acid (50%)	A
Oxygen Gas	A
Palmitic Gas	A
Paraffin wax	A
Paraldehyde	B
Peanut Oil	A
Peppermint Oil	A
Perchloric Acid	A
Petrol	B
Petroleum Oils (sour)	B
Petroleum Oils (refined)	A
Phenol	A
Phenol Solution (5%)	A
Phosphoric Acid (up to 85%)	A
Phosphorous Oxychloride	B
Photographic Developers	A
Picric Acid	B
Plating Solutions (all)	A
Potassium Bichromate / Sulphuric Acid / Water (5/100/5)	A
Potassium Bicarbonate	A
Potassium Borate	A
Potassium Bromate	A

POLYPROPYLENE MATERIAL Continued..

Potassium Bromide	A
Potassium Carbonate	A
Potassium Chlorate	A
Potassium Chloride	A
Potassium Chromate	A
Potassium Cyanide	A
Potassium Ferricyanide	A
Potassium Ferrocyanide	A
Potassium Fluoride	A
Potassium Hydroxide (up to 50%)	A
Potassium Iodide	A
Potassium Nitrate	A
Potassium Perborate	A
Potassium Perchlorate (10%)	A
Potassium Persulphate	A
Potassium Permangate Sol.	B
Potassium Sulphate	A
Potassium Sulphide	A
Potassium Sulphite	A
Propane	B
Propionic Acid	A
Propylene Dichloride	B
Pyridine	A
Rice Barn Oil	A
Rosin (light)	A
Safflower Oil	A

POLYPROPYLENE MATERIAL Continued..

Saurkraut	A
Shell X-100	A
Shellac	A
Shoe Polish (liquid)	A
Sea Water	A
Silica Gel	A
Silicone Oil	A
Silver Nitrate	A
Skydrol Oil	C
Soap Solution	A
Soapless Detergent	A
Sodium Bromide	A
Sodium Bromide Oil Sol.	A
Sodium Carbonate	A
Sodium Carbonate, satur, sol.	A
Sodium Carbonate (2% sol.)	A
Sodium Carbonate (2.5% aq. sol.)	A
Sodium Carbonate (20% sol.)	A
Sodium Chlorate	A
Sodium Chloride Sol.	A
Sodium Chloride (10% sol.)	A
Sodium Chlorite (up to 30%)	A
Sodium Chromate	A
Sodium Cyanide	A
Sodium Dichromate	A
Sodium Ferricyanide	A

POLYPROPYLENE MATERIAL Continued..

Sodium Ferrocyanide	A
Sodium Hydroxide (up to 60%)	A
Sodium Hypochlorite (5%)	A
Sodium Hypochlorite Solution	B
Sodium Metaphosphate	A
Sodium Nitrate	A
Sodium Palmitate (5% sol.)	A
Sodium Perborate	A
Sodium Phosphate (alkaline)	A
Sodium Phosphate (acid)	A
Sodium Phosphate (neutral)	A
Sodium Silicate	A
Sodium Sulphate	A
Sodium Sulphide	A
Sodium Sulphite	A
Sodium Thiosulphate	A
Soybean Oil	A
Spindle Oil	A
Stannic Chloride	A
Stannous Chloride	A
Starch	A
Stearic Acid	A
Succinic Acid	A
Sugars and Syrups	A
Sulphate Liquers	A
Sulphur	A

POLYPROPYLENE MATERIAL Continued..

Sulphuric Acid (up to 50%)	A
Sulphamic Acid	A
Sulphur Dichloride	A
Sodium Acetate	A
Sodium Benzoate (35%)	A
Sodium Bicarbonate	A
Sodium Bisulphate	A
Sodium Bisulphite	A
Sodium Borate	A
Sulphur Chloride	A
Sulphur Dioxide (dry)	A
Sulphur Dioxide (wet)	A
Sulphuric Acid (up to 98%)	A
Sulphurous Acid	A
Super Shell	B
Tallow	A
Tannic Acid	A
Tar	A
Tartaric Acid	A
Tea	A
Teepol 514 Solution (27%)	A
Tetrahydrofurane	A
Tetralin	B
Thiopen	A
Toluene	B
Tomato	A

POLYPROPYLENE MATERIAL Continued..

2T Oil	A
Transformer Oil	B
Transformer Oil, DTE/3D	B
Trichloracetic Acid 2N	A
Trichloroethylene	C
Triethanolamine	A
Tri-Sodium Phosphate	A
Turpentine	B
Two-Stroke Oil	A
Urea	A
Vanilladropar (vanilla)	A
Varnish	A
Vaseline	A
Vaseline Oil	A
Vinegar	A
Water	A
Wax Crayon	A
Wesson Oil	A
Wheat Germ Oil	A
Whiskey	A
White Paraffin	A
White Spirit (low aromatic cont.)	C
White Spirit (high aromatic cont.)	C
Wines	A
Xylene	B
Yeast	A

POLYPROPYLENE MATERIAL Continued..

Zinc Chloride	A
Zinc Oxide	A
Zinc Sulphate	A

POLYURETHANE MATERIAL

Acetaldehyde	C
Acetic Acid (up to 80%)	C
Acetic Acid (20% max)	B
Acetic Anhydride	C
Acetone	C
Acetyl Bromide	C
Acetyle Chloride	C
Acetylene	B
Adipic Acid	A
Aluminium Chloride	B
Aluminium Sulphide	B
Aluminium Sulphate	B
Ammonia	B
Ammonia Hydroxide	A
Ammonium Acetate	C
Ammonium Carbonate	B
Ammonium Hydroxide	A
Ammonium Nitrate	B
Ammonium Persulphate	B
Ammonium Sulphate	B
Ammonium Sulphide	B
Ammonium Thiocyanide	B
Amyl Acetate	C
Amyl Alcohol	C
Amyl Chloride	C
Aniline	C

POLYURETHANE MATERIAL Continued..

Aniline Hydrochloride	C
Animal Fats and Oils	B
Antimony Salts	B
Aqua Regia	C
Arsenic Salts	A
ASTM oil (1)	A
ASTM Oil (2 & 3)	B
ASTM Reference Fuel A	A
ASTM Reference Fuel B	B
Atlantic Oil	A
Barium Carbonate	B
Barium Hydroxide	A
Benzaldehyde	B
Benzene	C
Benzene (gasoline, aromatic)	B
Benzoic Acid	B
Bleach Solution	B
Borax	A
Boric Acid	A
Bromine	B
Bunker Oil	A
Butane	A
Butanol	B
Butyl Acetate	C
Butyl Alcohol	C
Butyric Acid (1%)	B

POLYURETHANE MATERIAL Continued..

Butyric Acid (98%)	C
Calcium Bisulphate	A
Calcium Carbonate	B
Calcium Chloride	A
Calcium Hydroxide	A
Calcium Nitrate	B
Calcium Sulphate	B
Carbon Dioxide	A
Carbon Disulphate	B
Carbon Monoxide	A
Carbon Tetrachloride	C
Castor Oil	A
Caustic Soda (burns)	C
Chlorine	C
Chloroatic Acid	C
Chloroform	C
Chromic Acid	C
Chromium Patassium Sulphate	B
Citric Acid (20c 10%)	B
Copper Chloride	A
Copper Sulphate	A
Cottonseed Oil	A
Cresol (meta)	C
Cupric Chloride	A
Cupric Nitrate	B
Cupric Sulphate	B

POLYURETHANE MATERIAL Continued..

Cyclohexane	B
Cyclohexanone	C
Dibutyl Ether	B
Dibutyl Phthalate	C
Dichlorobenzene (ortho)	C
Diesel Oil	B
Dimethyl Acetamide	C
Dimethyl Formamide	C
Distilled Water	B
Dodecyl Mercaptan	B
DTE Oil (heavy, medium)	B
ESS0 90 Lube Oil	A
Ethanol	B
Ether	A
Ethyl Acetate	C
Ethyl Alcohol	C
Ethyl Alcohol (Ethanol)	C
Ethyl Bromide	C
Ethylene Glycol	B
Ferric Chloride	B
Ferric Nitrate	B
Ferrous Chloride	B
Ferrous Sulphate	B
Formaldehyde	C
Formic Acid	C
Freon 12 or 113	A

POLYURETHANE MATERIAL Continued..

Fuel Oil	B
Gasoline	B
Glue	A
Glycerine (glycerol)	A
Glycol	B
Glycolic Acid	B
Greases	A
Heptane	A
Hexane	A
Hydraulic Oils	B
Hydrazine	C
Hydrobromic Acid	B
Hydrocarbon Oil	A
Hydrochloric Acid (20% max)	B
Hydrochloric Acid (30% +)	C
Hydrofluoric Acid (10% max)	B
Hydrofluoric Acid (over 10%)	C
Hydrogen	A
Hydrogen Peroxide (10% max)	B
Hydrogen Peroxide (over 10%)	C
Hydrogen Sulphide	B
Hydrochloric Acid	B
Iodine Solution	A
Isooctane	B
Isopropyl Alcohol (is propanol)	B

POLYURETHANE MATERIAL Continued..

Isopropyl Ether	B
JP-4 and JP-4 Oil	B
JP-5 and JP-6 Oil	C
Kerosene	B
Ketone	C
Lactic Acid (up to 40c, 10%)	B
Lactic Acid (up to 40c, 90%)	C
Lead Acetate	B
Linseed Oil	B
Lubricating Oil	B
Lye	C
Magnesium Chloride	A
Magnesium Hydroxide	A
Magnesium Salts	B
Malaic Acid	C
Mercury	A
Methanol	C
Methyl Alcohol (methanol)	C
Methylchloride	C
Methylene Chloride	C
Methylene Ketone	C
MIL-D-5606 Oil	C
MIL-L-7808 Oil	A
Milk	A
Mineral Oil	A
Mobil Artic Oil	A

POLYURETHANE MATERIAL Continued..

Monochlorobezene	B
Motor Oils	B
Naphtha	B
Naphthalene	B
Natural Gas	B
Nickel Salts	C
Nitric Acid	C
Nitrobenzene	C
Nitrogen	A
Oils - Lubricating	B
Oleic Acid	A
Olive Oil	B
Oxalic Acid (5%)	A
Oxygen	A
Ozone	A
Paints	A
Palmatic Acid	A
Perchloric Acid	C
Perchloroethylene	C
Petrol	A
Phenol (carbolic acid)	C
Phosphoric Acid (conc.)	C
Phosphoric Acid (dil.)	B
Photographic Developers	B
Potassium Cyanide	A
Potassium Hydroxide	B

POLYURETHANE MATERIAL Continued..

Potassium Salts	B
Propane	B
Propyl Alcohol	B
Propylene Glycol	B
Pydraul Oil	C
SAE 10 Oil	A
Sea Water	A
Silicic Acid	A
Silicone Oil	A
Silver Nitrate	B
Skydrol Oil	C
Soap Solution	A
Sodium Acetate	A
Sodium Bicarbonate	A
Sodium Bisulphate	B
Sodium Borate	B
Sodium Carbonate	B
Sodium Chlorate	B
Sodium Chloride	B
Sodium Cyanide	B
Sodium Dichromate	B
Sodium Ferrocyanide	B
Sodium Hydrosulphite	B
Sodium Hydroxide (45%)	B
Sodium Hypochlorite	C
Sodium Nitrate	B

POLYURETHANE MATERIAL Continued..

Sodium Silicate	A
Sodium Sulphate	B
Sodium Sulphide	B
Soybean Oil	B
Sperry Oil	B
Steam	C
Stearic Acid	C
Stoddard Solvent	A
Styrene	B
Sulphur Dioxide	B
Sulphuric Acid (10% max)	A
Sulphuric Acid (50%)	C
Tannic Acid (10%)	A
Tartaric Acid	A
Tin Salts	B
Toluene	C
Toluol	C
Transformer Oil	B
Trichloracetic Acid	C
Trichloroethylene	C
Tricresyl Phosphate	C
Triethanol Amine	B
Trisodium Phosphate	B
Turpentine	C
Urea	B
Varnish	B

POLYURETHANE MATERIAL Continued..

Vegetable Oil	A
Water	B
Water (100c)	C
Xylene	C
Xylol	C
Zinc Chloride	B
Zinc Sulphate	B