AUT GUIDE TO SELECTING CASTORS & WHEELS

A step by step guide to selecting the correct wheel & or castor.
In order to assist you in recommending the best product to your customer is an explanation as to how **environmental conditions are usually the major factor in selecting the correct castor or wheel. At the end is a list of questions to ask potential customers at the time of their enquiry**. Whilst not all questions need to be asked on all enquiries the answer(s) 'narrow' the available options.

This section is a general guide to the overall range of wheels & castors as shown in the Farnell catalogue. Following on from this are individual A4 sheets relating to each individual module.

A castor is usually a zinc plated pressed steel bracket which has a head or top plate that swivels (with the aid of one or two ball race) above the castor fork. The fork of the castor supports the wheel on a horizontal axle which in turn is supported by an axle bolt & nut.

The carrying capacity of a castor &/or wheel is often the most important aspect of the specification however this carrying capacity is generally arrived at following pre-defined laboratory testing. It is necessary to test in this way in order to give sufficient consideration to **all the environmental effects on a castor &/or wheel.**

ISO2175 defines in detail the methods of testing . The tests make pre-defined allowances for the following environmental conditions:

1. **TEST LOAD** — This is the load an individual castor is expected to sustain whilst moving.
2. **TEST SPEED** — Maximum speed of movement is 4km/Hour.
3. **ENVIRONMENTAL TEMPERATURE** — 20 Degrees Centigrade +/- 10 Degrees.
4. **SURFACE OR FLOOR CONDITION** — A hard horizontal rolling surface with the following surface 'obstacles':
   Height: 5% of wheel diameter for soft (less than 90 Shore 'A' hardness) & 2.5% of wheel diameter for harder tread wheels.
   Shape of 'obstacles': 100mm wide with leading edge that has 2.5 to 5mm radius. Arranged, alternatively left & right at 45 degrees to wheel or castor traverse axis.
   Position &quantity: At least 1 metre apart & the test requires 500 'obstacles' to ridden over by the castor or wheel.
5. **REGULARITY OF USE** — A cycle time with a maximum of 4 minutes which once achieved must then include a down time of 25% of the original cycle time taken into account.

CONCLUSION: At the end of the test period the wheel or castor should not show permanent deformation which would interfere with correct operation.
In reality if the actual environmental condition is less severe than the laboratory condition then the wheel &/or castor will last longer than usual & if worse than the laboratory condition shorter than usual. Usual could only ever be defined following careful measurement in a controlled environment however the **ISO2175 standard does not attempt to define life expectancy** as it would be impractical to attempt to measure actual environmental conditions during the whole of a wheel or castors expected life.

It is probably safe to conclude that when the above 5 environmental conditions are considered together then no two potential wheel &/or castor applications are exactly the same which is why it is necessary to default to an ISO laboratory test in order to define a wheel or castor's carrying capacity.

There is no built in safety factor in the carrying capacity of a wheel or castor due to the positive or negative effects of the alternate environmental conditions.

There is no particular life expectancy of a wheel or castor due to the positive or negative effects of the alternate environmental conditions.

In order to achieve a **particular performance criteria** it is sometimes necessary to select a wheel or castor with a **specification several times greater than the conditions appear to warrant**.

SITE CONDITIONS THAT NEED CAREFUL CONSIDERATION

Most environments in which castors are used are not complex. However if there are any site conditions that could be considered worse than the laboratory condition as defined in ISO 2175 then careful consideration must be given as to its effect on the satisfactory performance of the castor or wheel. The following are some particular site aspects that need careful considerations:

Carrying capacities.
The necessary carrying capacity of the anticipated castor is calculated by taking **the weight of the trolley plus the weight of the product(s) the trolley carries & dividing this total by 3.** The reason for dividing by 3 corners of the trolley instead of 4 is that if the ground surface is uneven or the trolley is not parallel with the ground then only three castors will be supporting the load. If the trolley has a liquid load or is particularly loaded at one end or one side then the carrying capacity should be calculated over 2 castors only.

Wheel types & rolling resistance.
The harder the wheel, the lower the rolling resistance (amount of force required to commence & maintain movement) & the higher the carrying capacity. However a hard wheel will damage any floor surface that is softer than the wheel. A hard tread has to try & climb over every obstacle on the floor surface & more often than not is halted by the smallest obstacles. A hard wheel needs to run on a hard floor surface, so it is noisy.
A wheel with a softer rolling surface has a higher rolling resistance & lower carrying capacity when compared to a harder tread wheel. However the softer wheel is unlikely to damage a floor surface & the softer wheel moves more easily over obstacles as the softer tread deforms when it comes into contact & therefore rolls more easily (than a hard tread) over the obstacle. A softer wheel also runs more quietly.
Softer wheels are generally those with a hardness less than 90 Shore 'A'.
As a general rule most applications will, look for a wheel that has a softer rolling surface so that the unit to which it is attached is relatively easy to push over most surfaces. The softer rolling surface also produces less noise than a harder wheel surface.

Sites where impact loads can occur.
An impact load can cause severe damage to a castor or wheel as often the total impact load is taken by the one leading castor or wheel e.g. where a trolley at maximum capacity is pushed over say a curbstone then the total load is taken by the one leading castor, rather than two or more castors. In particular if a trolley is power towed then curbstones, sills, drain covers etc should be approached squarely by the face of the wheel. If the contact with the obstacle happens at an angle of more than 20 degrees then it will cause the castor to turn at right angles to the obstacle, usually causing severe damage. At an angle of less than 20 degrees the castor is unlikely to turn at right angles but the side of the wheel is likely to be damaged.

Powered towing.
If a trolley is commonly pushed by hand & meets an obstruction it slows down or even comes to a halt & to overcome this an alternative route is found or the load reduced. In these circumstances neither the castors on the trolley or the individual responsible for pushing the trolley are likely to be strained.
This does not happen with power towing as there is usually more than sufficient power to keep the trolley moving causing impact loads to the castor or wheel if it comes into contact with an obstruction.

Most castors are not designed for power towing as the potential severity of the application requires a very substantial castor (substantial castors = high cost). Where it is necessary to power tow a trolley then heavy duty castors or wheels often with a specification several times greater than the conditions appear to warrant must be used. It is recommended that all power towing applications are refereed to the supplier/manufacturer in order to ensure correct specification is offered.
Power towing is often in excess of 4 km/hour, outside normal temperature ranges & has long cycle times- **all of these considerably reduce the normal carrying capacities**.

Sites where severe corrosion occurs due to water & various chemical substances.
Most standard castor brackets are zinc plated (some heavier duty castors are painted) which provides protection except in the more corrosive environments. In corrosive environments **stainless steel (grade AISI 304** is corrosion resistant) castors should be used in order to provide a longer life expectancy. In food preparation environments stainless steel castors are usually specified by those responsible for Health & Safety matters. If there is an environment where the castor or wheel comes into contact with particular chemicals then advise the supplier/manufacturer of the particular chemical as well as its concentration to allow the supplier/manufacturer to recommend the most suitable product for that particular environment.

Questions to ask prospects in order to define castor or wheel type.

Q1.
If an existing application. Is the part number known & is the current castor satisfactory/unsatisfactory?

If this information is available it is very valuable, for if the part number is known & the existing castor is satisfactory, then it is relatively simple to check specification against the manufacturers catalogue of the existing castor. This ensures that what we intend to offer is at least as good. If the existing castor is unsatisfactory & the part number is known then on checking the manufacturers catalogue of the existing castor, we can ensure we offer a better specification.
If in either instance the part number is not known but a sample castor is available then the existing castor has many clues which can contribute towards the specification of the replacement castor-see following questions.
It is important to note that some manufacturers mark either castors &/or wheels with some sort of part number(mark). This mark(s) can be a useful clue as to the item being used however be cautious as a mark on the tyre may relate only to the tyre & not the whole castor . Similarly a mark on other parts of the wheel or the bracket may not relate to the whole castor.
In conclusion to this question an existing product helps set a known benchmark thereby avoiding a purchasers tendency to pay insufficient attention (as the information may not be available) to the worst aspects of an environment.
All the remaining questions assume there is no reference to an existing application

Q2.
Is there a particular size (wheel diameter)of castor required?
Most customers have some idea as to the approximate size of castor they desire. Any indication of size immediately narrows the available specifications. It should be noted that all manufacturers refer to the actual diameter of wheel being the 'size' of the castor-sometimes customers refer to size as the overall height of the castor.
Usually the larger the wheel the easier it is to move (assuming similar floor types).

Q3.
What castor type is required?
The castor type again helps narrow the available specifications. The following are the most usual options:

- Rectangular swivel top plate with a 4 holes for attachment purposes.
- Round swivel top plate with single attachment hole (commonly known as bolt hole fitting).

- Has the swivel castor got a wheel &/or swivel stop. (commonly known as a brake but must not be used for slowing castor down-it is a stop only).
- Is the castor a none swiveling type which is commonly known as a fixed or rigid castor-helps to push trolley in a straight line but is not as maneuverable as a trolley with all swivel castors.
- Is the castor manufactured from pressed steel or is it fabricated (fabricated indicates a heavier duty castor).

Q4.
What is the required carrying capacity of the castor?
The carrying capacity is often part of the specification as defined by the customer & also helps to narrow the options on specification. However most customers calculate the required capacity over four & not three (see carrying capacities on page two) corners of the trolley. Often no consideration is given to the other environmental factors (speed, temperature, floor conditions & cycle times). As a consequence of this usual poor customer knowledge it is very important (where the opportunity exists) to listen carefully to the customer so as to hopefully pick up clues as to the actual requirement. Whilst it is not always practical to ask all the questions so as to precisely define specification, failure to gather sufficient information (which then results in premature failure of a castor or wheel) can only reflect on the supplier.

Q5.
How will the castor be attached to the trolley?
There are various ways of attaching a castor to a trolley & the particular method may have some effect on the eventual specification. The usual methods are as follows:

- **Bolting**- in particular 4 hole top plate castors & less occasionally single hole castors . This is the most effective way of attaching castors. However different products from different manufacturers often have different size top plates & top plate hole centres. So if it is necessary to replace an existing castor it is particularly important to ensure that the hole centres match up. It should be noted that in some castor ranges the swivel castor has different hole centres from the fixed or rigid equivalent castor.
- **Expanders**. These are attached to single hole fixing castors (commonly known as bolt hole) & like a 'rawlplug' expand inside a round or square steel tube so as to hold the castor in place. It should be noted that the size dimension of an expander refers to the inside dimension of a round or square steel tube & it is important to carefully tighten the expander set screw, as too much pressure will damage the expander & too little will cause the expander & castor to fall out. It should also be noted that an expander fitting is only suitable for light duty (maximum load per castor is 100kg) & a single point fixing has only 25% of the attachment strength of a four point fixing such as referred to in the 'bolting method of fixing'.
- **Welding of top plate or bolt hole castor**. Whilst welding is often used to attach castors it can damage the castor ballrace so **we do not recommend** welding as a solution.

Q6.
What other information is useful in order to decide on specification.
The following information can also be useful in arriving at a final specification.

- What is the overall height of the castor?
- Is the speed in excess of 4 km/hour?
- Is the temperature in excess of 20 Deg. C +/- 10 Deg. C.?
- Is the floor surface in a poor condition?
- Is there a particularly long cycle time?
- Is the environment particularly wet or influenced by chemical substances?
- Do the wheels need to be statically conductive?
- Do the wheels need to avoid marking floors

Q7.
What wheel type is required & are there any cost restrictions?
There are very many wheel types. If the customer knows what is required then this narrows the options. The alternate types of wheel achieve different results as outlined below & the more sophisticated the wheel type the greater the specification achievement & the higher the price.

Is there any other relevant information?

- Rubber tyre with plastic or pressed steel wheel centres.(relatively inexpensive)
- Rubber tyre vulcanised to nylon, cast iron or aluminium wheel centres.(moderately expensive)
- Nylon injection moulded wheels.(relatively inexpensive)
- Cast iron wheels.(relatively inexpensive)
- Polyurethane tyre bonded to nylon, cast iron or aluminium centre wheels.(moderate to high cost)
- Wheels for high temperature application.(low to moderate cost)

Generally the quietest running wheels have rubber tyres as well as offering the best 'cushion ride'. However wheels such as these with the 'softer' treads do not carry high loads due to their 'squashability'. The harder tread wheels (nylon, cast iron etc.) will carry more weight, size for size but are noisier & more likely to damage floors.

Q8.

What type of bearing is required in the wheel?

The bearing is fitted in the hub of the wheel & helps to reduce friction between the wheel & the axle on which it turns. Most wheels have a number of options as to bearing type which are generally as follows:

- **Plain bearing**. Usually incorporated as part of the moulded (nylon) or formed (cast iron wheel). In rubber tyred steel centre wheels the plain bore is formed with a nylon bush. Plain bearings have the advantage of being corrosion resistant (no parts to corrode) & the lowest cost.
- **Roller bearing.** These are small steel rollers usually held in a plastic cage. The cage & needles are located in the bore of a wheel in order to reduce friction between the wheel & axle on which it turns - thereby making the wheel easier to push then a plain bore wheel.
- **Ball bearing**. These are steel balls encapsulated in a steel cage. A ball bearing is usually fitted in each end of the wheel hub. This type of bearing has the least frictional resistance between wheel & axle so is commonly used on heavy duty wheels.

Q9.

What are the wheel dimensions?

There are four essential dimensions in order to specify a wheel.

1. The wheel **diameter**.
2. The wheel **tread width**.
3. The wheel **hub length**-particularly important if supplying a replacement wheel as it will need to fit between existing castor forks. Note that a ball bearing wheel usually has a shorter hub length as external spacers are usually required to fit between bearing & inside of castor fork.
4. The wheel **bore**-particularly important if supplying a replacement wheel as it will need to fit on to an existing axle size. Note that where a ball bearing wheel replaces a roller bearing wheel , the tolerance on the ball bearing wheel can be too tight to fit on a roller bearing axle.

Q10.

Is there any other relevant information?

As a final 'catch all' question. Is there any other relevant information?

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