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The use of castors on racks in the food processing industry

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The use of castors on racks in the food processing industry

Jonathan R Statham
Health and Safety Laboratory
Broad Lane
Sheffield
S3 7HQ

The Health and Safety Executive (HSE) has identified a problem in the food industry with racks which are moved into and out of both hot and cold areas during the course of a day. The racks may be operated in a hot area (temperatures of around 280^{O} C) and then moved into areas where temperatures are perhaps -30^{O} C. The problem appears to be that some of the wheels and castors currently in use are unsuitable for the application with the result that the wheels screech, producing noise levels in excess of 90 dB, and with time racks can become more difficult to manoeuvre with time.

This report provides recommendations for the food industry on the selection of wheels and castors.

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EXECUTIVE SUMMARY

OBJECTIVES

HSE had identified a problem in the food industry with racks which are moved into and out of both hot and cold areas during the course of a day. The racks may be operated in a hot area (temperatures of around 280^{O}C) and then moved into areas where temperatures are perhaps -30^{O}C. The problem appears to be that some of the wheels and castors currently in use are unsuitable for the application with the result that the wheels screech, producing noise levels in excess of 90 dB, and with time racks can become more difficult to manoeuvre.

MAIN FINDINGS

1. The main source of noise on castors used in high temperatures is that of corrosion on the bearing surfaces of the wheel axles. These are generally made from zinc-plated mild steel. The hard material of the wheels, often cast iron or phenolic, wears away the zinc coating in a relatively short period, resulting in noise when the bearing surfaces are no longer prevented from corroding. The solution to this problem, which has been widely implemented in Europe, is to use stainless steel axles with PTFE bushes which self lubricate the joint.

2. The continued use of cast iron wheels in the food industry is not recommended because of the damage which they do to floor surfaces. Where cast iron wheels are used with other types of wheel, the damaged floor will cause these types of wheel to deteriorate faster than they would on good floor surfaces.

3. Thermosetting plastics, usually phenolic, or high temperature rubber wheels are both suitable for use in the food industry. In combination with stainless steel axles and PTFE bushes, they will handle the temperatures in this industry without the noise problem which currently exists. The wheels and the PTFE bushes will, however, wear and require periodic replacement. The cost of this should be significantly less than that of repairing floor surfaces if cast iron wheels continue to be used. Rubber wheels are currently more expensive than phenolic wheels in the UK and have slightly lower load ratings because of their lower shear strength. They are, however the quietest type of wheel and could be a good option where noise is a major problem.

4. Most UK supplied castors come with a 105 x 80 mm fixing plate (ISO class 3) and a zinc-plated mild steel bearing. Once the zinc plating is worn away, these need to be lubricated if further wear is to be avoided. Once the bearing becomes significantly worn, corrosion and wear will occur leading to play in the bearing and increased wear of the wheel. Castors with 80 x 60 mm fixing plates (ISO class 2), widely supplied in Europe, generally have stainless steel bearings which do not corrode. This substantially increases the life of any type of castor, although worn wheels and PTFE bushes would will need to be replaced periodically.

5. Thermoplastics, recently developed for high temperature applications have only just reached the market. It is difficult to determine at this time how these materials will perform and they were not included in the trials conducted. However, it is intended that this type of wheel will have better impact resistance than phenolic wheels. It should be noted that these wheels do not have as high a temperature limit as the phenolic wheels.

1 INTRODUCTION

HSE has identified a problem in the food industry with racks which are moved into and out of both hot and cold areas during the course of a day. The racks may be operated in a hot area (temperatures of around 280^{O}C) and then be moved into areas where temperatures are perhaps as low as -30^{O}C. The problem appears to be that some of the wheels and castors currently in use are unsuitable for the application with the result that the wheels screech, producing noise levels in excess of 90 dB, and with time racks can become more difficult to manoeuvre. This may be due to deterioration of the bearing surfaces within the wheel and subsequent friction. Both wheels and castors are used depending on the type and size of rack design.

Mobile racks are used to store and transport food products during production. Racks are produced in many forms but typically appear as shown in Figure 1. The racks typically support removable shelving which is transferred from production lines to the racks manually. The racks are then pushed or pulled manually from one area of production to another. The racks and castors supporting them have to withstand the range of temperatures encountered during food production as well as the physical demands of day to day use. A drawing of a typical castor identifying the main components is shown in Figure 2.

This project was proposed by HSE's Food and Entertainment Sector with the following objectives:

(1) Approach and visit two trolley users selected by HSE and known to have the problems outlined above. The purpose of the visits was to confirm that the problems were fully understood by HSL and to check what users had already done in order that HSL could avoid going over ground already covered. HSL would also collect information on how users specify the wheels and what types of wheels are in fact used;

(2) Carry out an internet search for wheel manufacturers and seek information and specifications for their full range of products. Follow up information which is of interest and visit at least one manufacturer. The purpose of this part of the project was to check if potential solutions exist which had not been applied to the UK food industry. Wheel manufacturers were expected to include Revvo, Flexello, Blickle, British Castor and Fallshaw but others may need to be added;

(3) Report on the above work. Provide recommendations for the food industry to follow if solutions are already available. If new designs or approaches were needed to solve the problem then further work would be proposed.

Figure 1 - Food processing racking

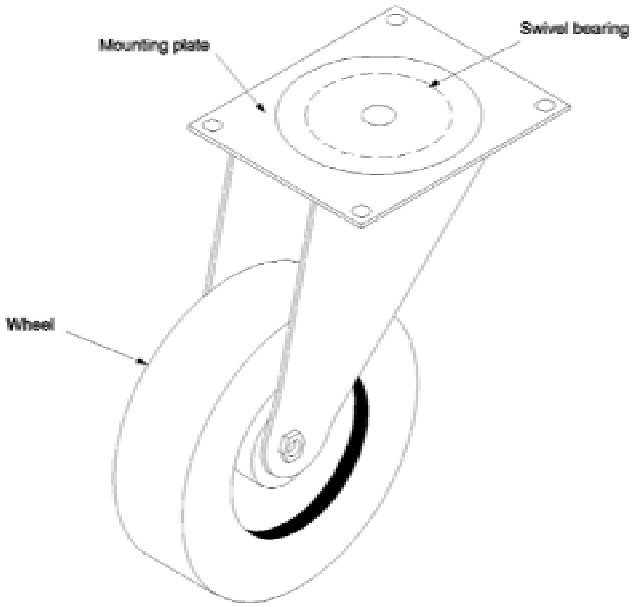

Figure 2 - Drawing of a typical castor

2 INFORMATION FROM USERS

To assist with the collection of information for the project, HSE provided contact information for a national food processing company. It was known that this company had experienced problems with wheel deterioration and with high noise levels resulting from this.

2.1 PRELIMINARY VISIT TO FOOD PROCESSING COMPANY

A meeting was held with the Health and Safety Executive of the food processing company on 22 November 2000. The purpose of the meeting was to discuss the project, how the company could assist the project and to identify potential sites where problems with castors on racks had been experienced.

The background to the noise problems was also discussed. The current situation was that the food processing company had purchased a number of smaller companies over time that had a range of different facilities and equipment. Some of the equipment, including racks with castor-type wheels, were relatively old and included a variety of types and condition. At present there was no company policy on the preferred type of castor to use on new trolleys or a specific maintenance regime to be applied to existing or new trolleys, although work was ongoing to identify a suitable product. The representative of the company was of the opinion that the noise problem was limited to sites where extremes of temperature were encountered, typically at what is known as a 'craft bakery' at an identified site. It was therefore proposed to visit this bakery to view the operation and hopefully locate examples of the problem castors.

It was suggested by the representative of the company that the noise problem was unlikely to be present at larger or more modern bakeries, where production is mechanised and therefore staff do not need to manually handle trolleys in or out of ovens or freezers.

Other factors which were believed to effect the choice of castors were the type of site or building in which the castors and racks were used. Many different types of floor are in use in the food processing industry, depending on the type of food being produced. These could include smooth concrete, non-slip surfaces and may include joints or level changes which could cause deterioration of the castors. The condition of the floor was also considered important, as the condition of the floor can deteriorate with time. In order to cover these factors, it was decided to visit a second site, a cake bakery, which had different production methods and facilities and would provide a broader range of information.

Another important area which was discussed was the economic implications of any changes that may be required to improve any potential problems. Many of the facilities which the food processing company operate have considerable numbers of racks which have been purchased over a long period and it would be financially difficult, for example, to replace all the castors on the racks currently in use. Therefore, to suggest a more expensive alternative would be difficult without substantial justification. Also, the flooring of these facilities is a major capital investment and can only be addressed long term. These factors would also have to be considered when suggesting a solution.

2.2 VISIT TO THE CRAFT BAKERY

The site visit to the craft bakery was made on 11 December 2000 and provided an opportunity to see at first hand the type of production and the methods of working. Detailed discussions were carried out with the site engineering manager, about the problems which had been experienced.

The site visit also provided opportunity to discuss the scale of the noise problem with the site general manager. She advised that the noise levels present in some areas of production were considered to be a potential problem, and that a noise survey would be done shortly to identify the noise levels and to determine the type of remedial action needed.

The engineering manager advised the author that the types of castor which were a particular problem on his site were an older type, with a wheel manufactured from cast iron. Some newer racks had phenolic wheels. It was his opinion that the noise problem was mainly due to the cast iron wheels, while the phenolic wheels were prone to damage and wear, needing replacement when damage became so severe that it prevented easy movement of the racks. Generally the cast iron wheels were considered to be indestructible, and were not being replaced due to being noisy alone.

The cast iron wheels were also considered to be harsh on the floor surface where these were used. The floor surface used at the bakery was mainly plain smooth concrete, and generally appeared to be in good condition. Where the floor surface changed level or was subject to frequent traffic with loaded racks, the surface could begin to wear, leading to the break-up of the surface if wear was allowed to progress. This type of damage to the flooring could be difficult and costly to repair. It was also noted that joints in the concrete and other obstructions, such as drainage gullies where racks were used outside there was the potential for damage to the castors.

The engineering manager had conducted a brief survey of the castors available and identified a phenolic wheeled castor with a grease port installed in the swivel bearing, which he believed was suitable for future use at the bakery. He had also initiated a maintenance routine of the racks which required the swivel bearing to be lubricated. The chosen castor would hopefully make this lubrication easier as well as requiring less frequent lubrication. It was hoped that lubrication of the castor swivel would increase castor life generally as well as reduce the noise produced by the castor.

While on site I was able to inspect a number of the different types of castor currently in use at the bakery. These were mainly the original cast iron wheeled type, but some had been replaced with phenolic wheels, including the type introduced by the engineering manager. It was noted that the phenolic wheels, said to have been in use for about 10 months, did not appear to have deteriorated significantly.

Several racks, when moved, were noted to produce a loud squealing sound from the castors. The engineering manager agreed to remove these castors and supply HSL with an example of each of the types for further examination. The castors supplied were a cast iron wheeled castor and the phenolic castor which are shown in Figures 3 and 4 respectively. It was noted while examining the castors that there were two different sizes of castor mounting on the racks. The size of mounting was to prove an important factor in the choice of castor and will be discussed later.

Figure 3 - Cast iron wheeled castor

Figure 4 - Phenolic wheeled castor

The type of produce on the racks could vary. Although the products were all bread, the loading could vary significantly. The engineering manager estimated that the maximum load that an individual rack would carry would be approximately 400 kg when the trolleys were loaded with sandwich bread. The temperature to which the racks were subjected was also examined for a range of products, the maximum being 260^{O}C, the lowest temperature being ambient. The duration of the baking cycle was variable, however, and was usually shorter when the higher temperatures are employed. A typical baking time was 20 minutes but could be longer at temperatures below the maximum.

It was also noted that while the racks that are in use at the bakery were all manufactured from stainless steel, all the castors examined had bodies manufactured from zinc plated mild steel. Many of the castors examined showed signs of corrosion, except those which had been recently replaced. The engineering manager advised that, while the trays upon which the food produce sits were cleaned frequently, the racks themselves were not routinely washed as part of the process. Other forms of food production do require frequent cleaning of the racks, however, and this is described later.

2.3 VISIT TO CAKE BAKERY

A site visit was made to the cake bakery on 22 March 2001. This visit was intended to provide experience of a wider range of types of food processing where racks are used. The visit was only partially successful in that the type of produce did not generally involve such high temperature as those at the craft bakery. However, some of the racks were subject to being chilled during production. While the final temperature of the product was not below 0^{O}C, the ambient temperature the castor may experience could be as low as -10^{O}C to allow accelerated chilling of the product.

A number of other considerations also arose. These included the routine washing down of both the racks and other production equipment each time a batch of produce was made. In addition to the racks, the cake bakery used castors on a range of other equipment including mixing bowls and conveyors. Some of the equipment was washed down using pressure cleaning equipment and sterilised each time it was used. This process could potentially remove the lubrication on the castors.

The floor surface at the cake bakery was also different to that at the craft bakery. Floor surfaces in both production areas and in areas used for washing down of the equipment had anti-slip coatings. These surfaces had a textured coating applied to provide increased friction to prevent slippage. This surface can be abrasive although at this site it was said not to present a problem.

It was noted that problems had been experienced with castors where it was believed that too small a diameter castor had been originally fitted by the equipment manufacturers. This had led to equipment being difficult to manoeuvre and adjust to the correct position. The castors had often been damaged in the area of the mounting, resulting in the castor needing to be replaced and the mounting modified.

Generally at the cake bakery, noise with castors was not considered to be a particular problem, the other problems described above having presented more difficulty. Some castors had recently had to be replaced where the nylon wheels that had been fitted had completely failed. The body of the wheel had broken up due to being overloaded. These castors were considered to be poor quality and to be completely under specified. As with the castors at the craft bakery,

the vast majority of castors were 100 mm diameter, irrespective of the size of the equipment to which they were fitted. Again, the size and type of the mounting plate of the castor was not consistent. This often required the modification of the racking or equipment when the castor was to be replaced or maintained. These modifications were considered to be more time consuming and costly than the replacement of the castor.

Most of the racks at both sites visited had been supplied by third parties without the user being involved in their specification. Racks which had been purchased more recently had been specified for their intended use, but the castors types were not part of this specification. For this reason it is likely that the cheapest alternative had been supplied.

2.4 SUMMARY OF MAIN USER PROBLEMS

The main problems identified from the visits to users were:

- The noise produced by castors, which could exceed 90 dB;
- Overloaded castors due to lack of a suitable castor specification;
- Damage to castors by uneven floor surfaces;
- Damage to floors by cast iron castors;
- Supply of small (100 mm diameter) castors when larger castors might be appropriate;
- Loss of lubrication;
- Corrosion of mild steel components of castors;
- Possible binding of rotating parts due to low temperatures and wear;
- Variations in types of castor fixing, limiting the choice of replacement castors or requiring expensive modification of the fixing.

3 CASTOR TYPES AND DESIGN

3.1 SURVEY OF SUPPLIERS

A literature and Internet search were conducted to enable a review of the available castor types, and to identify potential manufacturers or suppliers. The search identified a number of UK and European suppliers as well as a number further afield. A list of suppliers from whom information was gathered is included at Appendix 1 which includes contact phone numbers and/or website addresses.

A summary of what was found is set out in the following Sections of the report.

3.1.1 Wheel material

There are 4 main types of wheel material:

- Thermoplastics, including nylon, PVC and polypropelene
- Thermosetting plastics, mainly phenolic
- High temperature rubber
- Cast iron

Thermoplastics are widely used for castors on, for example, roll containers but traditionally have limited application at high temperatures. Existing castors of this type are generally not suitable for use in ovens and would not be expected to be an option in the food industry except where high temperatures are not part of the environment. However, manufacturers have been working to produce high temperature thermoplastic wheels but these have only just reached the market at the time of writing this report and have therefore not been tested alongside the other types.

Thermosetting plastics, particularly phenolics, have become more widely used in the food industry because they withstand the high temperatures, generally above 300^{O}C, which food trolleys need to withstand. Their main disadvantage is that they can by damaged by poor quality flooring and by defects in floors, such as concrete joints and ridges. They also wear and may need periodic replacement. For use on good floor surfaces, however, they are suitable. Some phenolics can also absorb water when subject to damp or wet conditions for long periods, this can be avoided by chosing the correct type of phenolic wheel. These should be considered if washing is carried out routinely.

High temperature rubber wheels are widely used in Europe for high temperature applications and are the quietest type of castor available. Where noise caused by contact between the floor and the wheels is a problem, they are a good choice. As with phenolic wheels, they will wear and may be damaged by poor or abrasive surfaces. They generally have slightly lower load ratings than an equivalent diameter phenolic wheel because of their lower shear strength. Their limited use in the UK at the present time makes them the most expensive option.

Castors with cast iron wheels can withstand high temperatures and are virtually indestructible. They will, however, cause damage to floors and are the noisiest type of castor to use. For these reasons, their use is declining and they are not recommended for this type of application.

3.1.2 Axle materials

Most castors supplied to the UK market have zinc plated mild steel axles. When the castors are new, the zinc will lubricate the wheel/axle surfaces but, in practice, this will wear away. The rate of wear will depend on the wheel type but hard materials such as cast iron or phenolic wheels will result in rapid wear. As a result the mild steel axles will corrode and the result will be squeaking castors. This is the loudest source of noise from the castors and the cause of castor noise exceeding 90 dB at some premises. Regular lubrication of the axle may help to control the noise but is unlikely to be cost effective in hot environments or where the lubricant is washed away by regular cleaning.

A solution to the problem is to use stainless steel axles in combination with PTFE bushes to provide self lubrication of the wheel/axle surfaces. The PTFE bushes will be subject to wear but are relatively cheap and easy to replace, and would be less time consuming in maintenance than manual lubrication.

3.1.3 Top plate fixings

One problem experienced at the craft bakery, that of different fixing dimensions on the castor base, was soon apparent. Dimensions for top plates are described in ISO 2184- Industrial castors- Dimensions of top plates- Part 1. Most European castor manufacturers supply a base with holes at 80 x 60 mm centres (ISO class 2), whereas castors traditionally manufactured in the UK have a base with holes at 105 x 80 mm centres (ISO class 3). This presented a potential problem of replacing castors with those of a different specification or material since the fixings may also be different. Not all material types are available with all mounting options. Although the base plates on the trolleys could be modified, this is a time consuming and therefore expensive option.

3.1.4 Castor body and swivel bearing

The body and top plate of the castor are typically manufactured from pressed steel. Castors are available in either zinc plated mild steel or stainless steel construction. The castors manufactured from stainless steel are supplied with stainless steel swivel bearings which do not require lubrication to prevent corrosion, whereas castors manufactured from zinc plated mild steel require the swivel bearing to remain lubricated to prevent corrosion of the swivel bearing. Corrosion of the swivel bearing will prevent the castor swivelling efficiently and may cause increased side loads to be applied to the castor components as well as the user of the racks. Ultimately the increased loads can result in premature failure of the castor. Zinc plate mild steel castors can be supplied with a number of different types of swivel bearing seal arrangement to prevent contamination of the bearing or loss of lubrication e.g during washing of racks, and also to allow lubrication to take place. Therefore, the environment in which the castor is to be used should be a factor when selecting the correct material for the body and swivel bearing.

3.1.5 Wheel diameter and floor surface

The larger the wheel diameter specified, the easier the trolleys will be to push or pull and the lower the manual handling forces needed to manoeuvre the trolleys. On poor surfaces, the force needed to start or stop a trolley with 125 mm diameter wheels from moving could be as high as 10% of the trolley load, compared with less than 5% on good surfaces such as smooth concrete (Roebuck and Norton, 2002). On trolleys with 100 mm diameter wheels and on poor surfaces,

the starting force could be up to 20% higher. On a poor surface, a loaded trolley weighing 400 kg could require a force of up to 50 kg to get it moving. This is well in excess of the guideline manual handling force of 25 kg for adult males (16 kg for females), above which a risk assessment would be expected to be done. A good floor surface and bigger wheels would substantially reduce these forces. A good floor surface will also reduce substantially the potential for damage to the castor wheels.

3.1.6 Castor classifications

Some suppliers classify their castors for use in different applications, for example, office use, general use, light industrial or heavy industrial. It is important that the correct classification is specified. This will depend on the floor quality, the expected loading compared to the safe load of the trolley and the frequency of movement. For example, when choosing a castor for a maximum working load of, say, 400 kg it might appear reasonable to choose castors rated at a load of 100 kg each. This is fine if the rating is a safe load rating which incorporates a safety factor for dynamic loading but not if the rating is a minimum failure load. On poor surfaces, the castors would experience dynamic loads well in excess of the static load of 100 kg and a safety factor is essential if rapid deterioration of the castors is to be avoided.

3.1.7 Summary

The information supplied by several of the manufacturers indicated that it was possible that a solution may already exist to the problem of noisy castors in this application, but the information on castor types and wheel material was not easy to interpret and was usually contained in an Annex to the main catalogue. For this reason it was decided to approach one of these suppliers for more detailed information.

3.2 VISIT TO CASTORS & WHEEL MANUFACTURER

The visit to the manufacturer was carried out on 15 March 2001 where castor specification were discussed with their technical director. The two examples of used, noisy castors supplied by the craft bakery were taken to the meeting for examination and comment.

When manufacturer's representative was shown the condition of the castors from the craft bakery he was not surprised by their condition he had clearly seen similar castors previously. While the general appearance of the castor was poor, he believed that the main problem was associated with the corrosion of the axle, and subsequent friction between axle and wheel and wheel and fork. Of the two examples examined, the cast iron castor, was considered to be almost indestructible, and the only obvious deterioration was the general corrosion of the castor components. Some corrosion and increased play was also observed in the swivel bearing, but the bearing still allowed the castor to function acceptably.

He considered that the phenolic wheel was also to be in fair condition for a wheel of this type. He had seen many phenolic wheels suffering from break-up due to impact damage. This could result from poor floor conditions, which could lead to the surface of the phenolic wheel spalling. This causes the wheel to stop rotating freely, which introduces higher impact loads to the wheel surface, causing further damage. Secondly, the bearings on swivel castors can suffer damage, wear or contamination, leading to the castor not swivelling and again leading to further impact damage of the phenolic wheel.

The main source of noise from the castor examples from LBD was a result of corrosion of the axle, the resultant friction between the axle and the wheel, and also friction between the wheel and castor forks. To prevent this type of corrosion, a system of stainless axle and bushes is supplied by this manufacturer. The system consists of a stainless steel axle with an outer sleeve of PTFE. Two PTFE washers are also fitted, one either side of the wheel, to prevent direct contact between the wheel and the castor body. The arrangement of these bushes is shown in Figure 5. The PTFE components particularly the washers are intended to be sacrificial and would therefore require replacing when worn. However, it was expected that the life of these components would be almost as long as that of a phenolic wheel. The typical life of a phenolic wheel is very much dependant on a number of factors and is therefore difficult to estimate accurately.

The stainless steel axle and PTFE bushes are normally supplied in a castor with all stainless components i.e. body, swivel bearing and mounting plate with European mounting hole positions. However, an alternative can be supplied with the ISO class 3 mounting traditionally supplied in the UK, but this is only manufactured in mild steel with zinc plating. Mild steel castor bodies were generally only supplied with cheaper forms of castor and were therefore of poorer construction and potentially shorter life. Despite this, the castor was supplied with the same load rating.

Another alternative to the phenolic wheel described above was a high temperature rubber wheeled castor. The wheel has a high temperature thermoplastic centre with a bonded high temperature rubber tyre. This type of castor is not commonly available in the UK, but is used widely in Europe. The castor had similar temperature rating to the basic phenolic wheel but did not have the same load rating. This type of castor was currently approximately twice the cost of comparative phenolic wheeled castors.

Figures 6 and 7 show the high temperature phenolic wheel and the high temperature rubber wheel respectively.

Cast iron wheeled castors are still supplied but these only find limited application due to the damage which they can cause to floor surfaces. Cast iron wheels are still used in other industries, typically where a phenolic wheeled castor cannot withstand the required load for a given size of castor. They are not recommended for the food industry.

Subsequent to the visit, information supplied by the manufacturer estimates that currently 50% of the high temperature wheels supplied by them in Europe are manufactured of high temperature rubber.

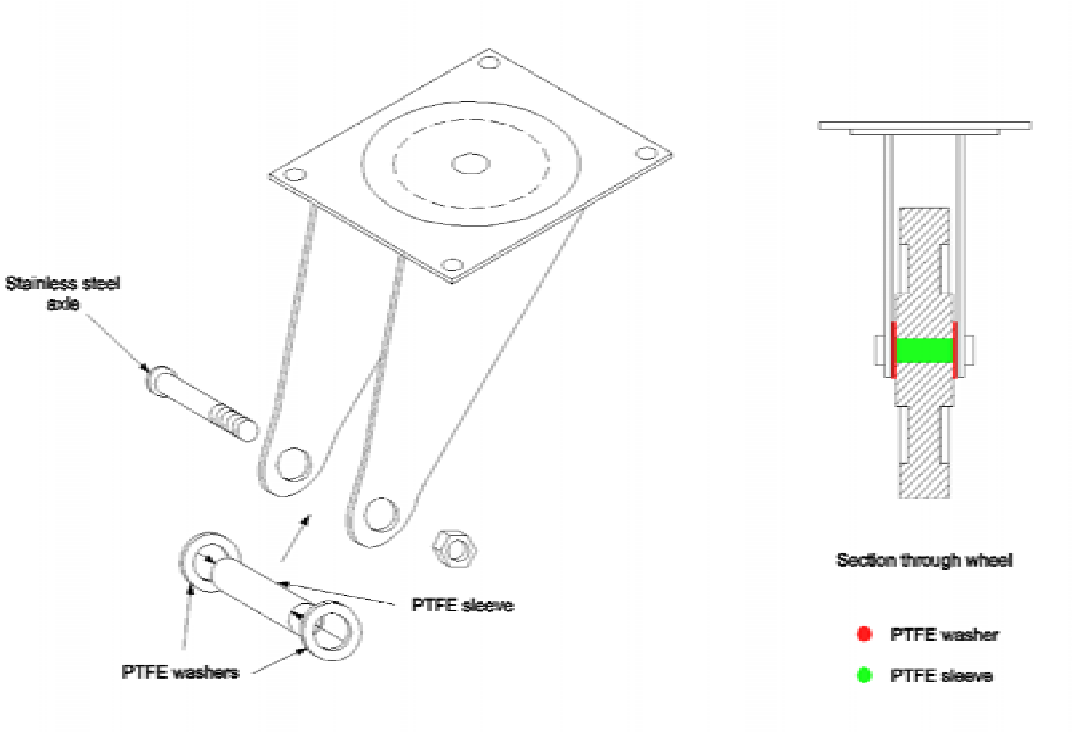

Figure 5 - Arrangement of PTFE bushes

Figure 6 - Phenolic wheeled castor

Figure 7 - High temperature rubber wheeled castor

4 TRIAL AT THE CRAFT BAKERY

In order to determine if castors identified as potentially suitable for the application as seen at the craft bakery could last a satisfactory length of time and perform acceptably, a limited trial of selected castors was arranged with the bakery. The trial was to last approximately 6 months and to be conducted over a busy Christmas period to allow the castors to experience as much duty as possible in that period.

Seven racks were involved in the trial:

- Three were equipped with phenolic-wheeled castors with 100 mm wheels and stainless steel axles with PTFE bushes. The mounting plate had 80 mm x 60 mm fixing holes (typical in Europe) and a castor bearing made from stainless steel;
- Three were equipped with phenolic-wheeled castors with 100 mm wheels and stainless steel axles with PTFE bushes. The mounting plate had 105 mm x 80 mm fixing holes (typical in the UK) and a castor bearing made from zinc-plated mild steel;
- One was equipped with high temperature rubber castors with 100 mm wheels and stainless steel axles with PTFE bushes. The mounting plate had 80 mm x 60 mm fixing holes and a castor bearing made from stainless steel.

Feedback after 6 months of service suggests that all 3 types of castor have performed satisfactorily, with no indication of the high noise levels found on other racks.

Both the phenolic wheeled castor types showed some wear, the wheel having visibly worn to a flatter profile. The castor bearing with the UK standard fixing pattern, manufactured from mild steel with zinc plating, had started to show increased play in the swivel bearings, and would imminently need lubrication of the swivel bearings to prevent corrosion. There was no apparent deterioration of the stainless steel bearings.

The high temperature rubber castors appeared to be functioning satisfactorily. There was no apparent deterioration of the castor body or bearings. Feedback from users of this rack suggests that the rack ‘feels less stable’ than others, but ‘is smoother and quieter than others’. The apparent reduction in stability may be due to flexing of the rubber tyres.

5 CONCLUSIONS

1. The main source of noise on castors used in high temperatures is that of corrosion on the bearing surfaces of the wheel axles. These are generally made from zinc-plated mild steel. The hard material of the wheels, often cast iron or phenolic, wears away the zinc coating in a relatively short period, resulting in noise when the bearing surfaces are no longer prevented from corroding. The solution to this problem, which has been widely implemented in Europe, is to use stainless steel axles with PTFE bushes which self lubricate the joint.

2. The continued use of cast iron wheels in the food industry is not recommended because of the damage which they do to floor surfaces. Where cast iron wheels are used with other types of wheel, the damaged floor will cause these types of wheel to deteriorate faster than they would on good floor surfaces.

3. Thermosetting plastics, usually phenolic, or high temperature rubber wheels are both suitable for use in the food industry. In combination with stainless steel axles and PTFE bushes, they will handle the temperatures in this industry without the noise problem which currently exists. The wheels and the PTFE bushes will, however, wear and require periodic replacement. The cost of this should be significantly less than that of repairing floor surfaces if cast iron wheels continue to be used. Rubber wheels are currently more expensive than phenolic wheels in the UK and have slightly lower load ratings because of their lower shear strength. They are, however the quietest type of wheel and could be a good option where noise is a major problem.

4. Most UK supplied castors come with a 105 x 80 mm fixing plate (ISO class 3) and a zinc-plated mild steel bearing. Once the zinc plating is worn away, these need to be lubricated if further wear is to be avoided. Once the bearing becomes significantly worn, corrosion and wear will occur leading to play in the bearing and increased wear of the wheel. Castors with 80 x 60 mm fixing plates (ISO class 2), widely supplied in Europe, generally have stainless steel bearings which do not corrode. This substantially increases the life of any type of castor, although worn wheels and PTFE bushes will still need to be replaced periodically.

5. Thermoplastics, recently developed for high temperature applications have only just reached the market. It is difficult to determine at this time how these materials will perform and were not included in the trials conducted. However, it is intended that this type of wheel will have better impact resistance than phenolic wheels. It should be noted that these wheels do not have as high a temperature limit as the phenolic wheels.

6 APPENDICES

6.1 APPENDIX 1 LIST OF CASTOR SUPPLIERS CONTACTED

Blickle	Milton Keynes	0190 8560904
		www.blickle.de
Castor Services	Halesowen	0121 5597797
Eurocastors	Glenrothes	0159 2774770
Fallshaw	Australia	www.fallshaw.com.au
Flexello	Slough	0175 3775200
International Castors	Colne	0124 9817917
Keystone	Birmingham	0121 7721010
Lag SpA	Crawley	01293 562386
		www.lagspa.it
Manner	Bristol	0145 4312780
		www.mannercastors.fi
Payson		www.paysoninc.com
Revvo	Christchurch	0120 2484211

British Castor Manufacturers Association 01628 475648

7 REFERENCES

Roebuck B and Norton G, 2002, Safety of Roll Containers, Health and Safety Laboratory, Report No ME/01/14, January 2002

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