ST

Maintenance Management Standard

Chapter 12: Spare parts and material management

Corporate Cement Industrial Performance
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LafargeHolcim

Content

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1. Introduction

In order to guarantee maximum plant availability at the lowest sustainable cost it has to be assured that the right spare parts are kept on stock. On one hand not having the right spare part at the right time, at the right place, in the right quantity can cause unnecessary equipment down time and expensive emergency orders. On the other hand holding too many spare parts leads to excessive costs, which reflects in unnecessary high inventory levels.

However, once the decision has been made to keep a certain spare on stock it has to be assured that it is kept in optimal condition. It is a goal of this chapter to give clear recommendations regarding storage practices of spare parts. Furthermore first of all a common understanding of what a critical spare part is shall be developed.

An harmonization will be done on the next version with the Inventory Management Business Process Recommendations issued by procurement in August 2016. Please to refer to this document if needed.

2. Critical spare part

In order to assure maximum plant availability at any time given it is indispensable to have a profound equipment knowledge. This also includes the knowledge of the different parts of an equipment. An equipment will most probably contain different types of parts such as consumables (e.g. nuts and bolts), wear parts (e.g. refractory bricks) and in some cases also parts that are not so easy to procure (high lead times) because they are not standard. The latter are often called critical spare parts, since if they are missing there is a considerable impact on production.

In the following section the different influencing factors such as lead time but also other already existing definitions of critical spare part will be discussed.

2.1 What is a critical spare part?

In order to classify a part as “critical spare part” from a maintenance point of view the following criteria have to be fulfilled:

1. The part is not part of a C-critical equipment, thus it is part of an A- or B-critical equipment
2. After developing an FMEA of the respective equipment the part is located outside the protection level (in the red zone of the risk matrix) in the according plant area risk matrix and the only way to reduce severity and / or probability of a potential incident is to hold the spare part on site

The flow diagram below (figure 1) illustrates the different steps as described above:

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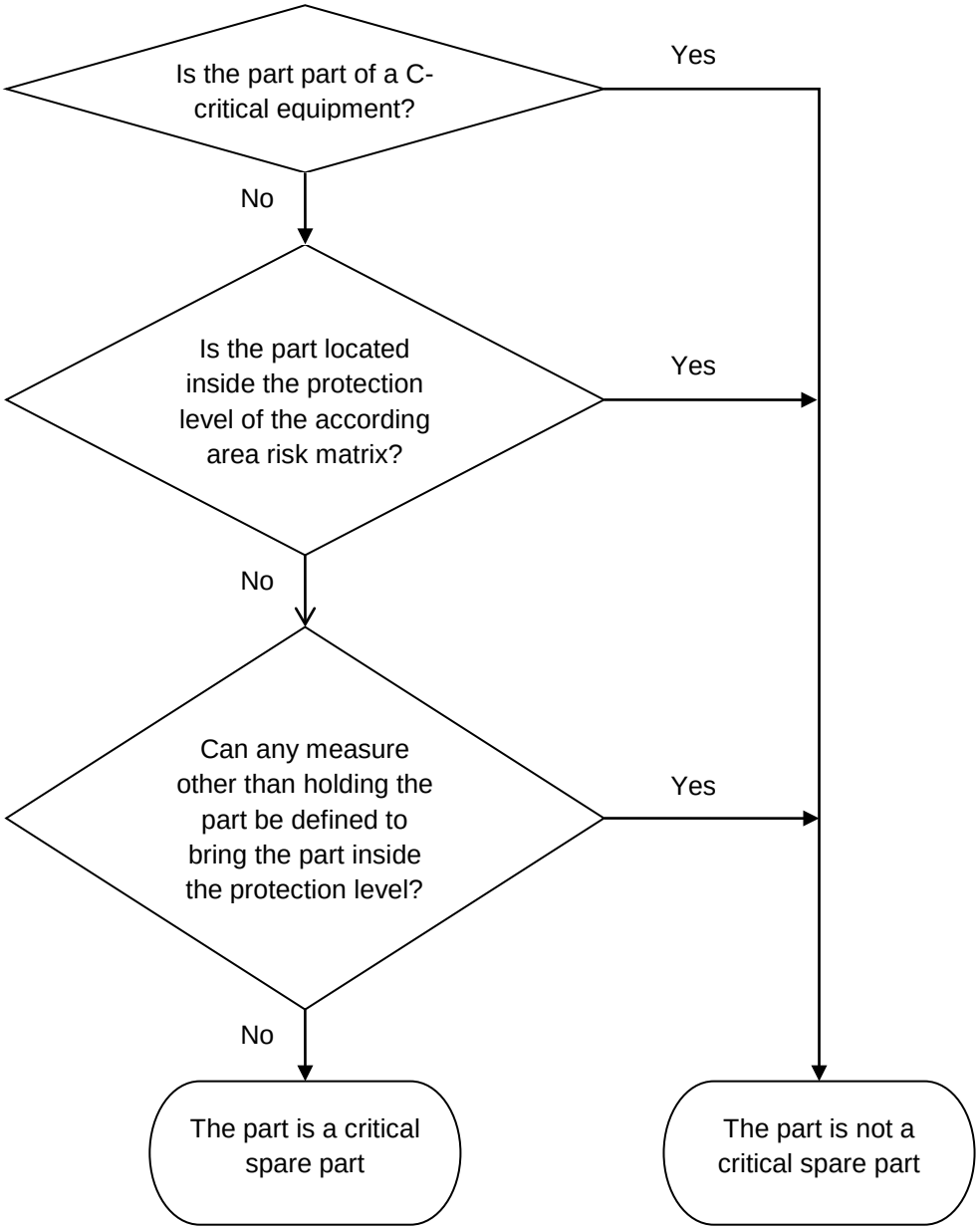

Figure 1: Flow diagram to judge whether a part should be a critical spare part or not

2.1.1 Equipment criticality rating and critical spares

As a first prerequisite to possibly be classified as critical spare part, a part has to be part of A-critical equipment. In some cases a part might also be classified as critical if it is part of B-critical equipment. In any case, it can not be part of C-critical equipment.

This prerequisite can be explained with the fact that any part that is not part of an A- or B-critical equipment - thus it will be part of a C-critical equipment - as per definition of the criticality rating will not affect production in case of an equipment stop. It therefore does not make sense to classify any part of a C-critical equipment as critical.

The reason for also considering parts which belong to B-critical equipment as possibly critical parts, is the fact that an equipment classified as B-critical will affect production within 24 hours. Considering the lead-times of many parts it is very possible that this additional time gain of 24 hours in comparison with the A-critical equipment will not be enough to prevent a serious production loss.

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2.1.2 Risk matrix and critical spares

Once the first prerequisite is fulfilled a part has to be put into relation with its specific area risk matrix.

Therefore the FMEA of the respective equipment has to be performed, which will lead to the definition of the risk of failure of this part (by defining the probability of occurrence and the severity in terms of production loss and maintenance cost). A crosscheck with the area risk matrix will then show weather a certain failure mode leads to an effect located outside or inside the protection level of the risk matrix.

If the failure mode as defined and with this the respective part is located outside the protection level, it has to be checked which measures can be taken to either reduce probability and or severity of this incident in order to move the part inside the protection level.

- Measures to be considered to reduce the probability of an incident:
    - Assurance of proper working conditions, such as clean working environment, proper lubrication and proper alignment
- Measures to be considered to reduce the severity of an incident:
    - Having a contingency plan

If none of the measures as mentioned above leads to a substantial reduction of either the probability or the severity in order to move the part inside the protection level, one last possibility might be holding the part on site. Keeping a part on stock will eliminate the lead time, which in many cases leads to a substantial reduction of the severity rating. But in fact, holding a spare part on site is only the last of many possibilities to reduce the severity of an incident.

2.2 Critical spares according LHARP

According LHARP a critical spare part has to fulfill the following criteria (see LHARP chapter 3.1.2.4, Lines 31-35):

- The part is not expected to be used within the next 12 months
- The value is above USD 20’000.- and the part can therefore be capitalized

Since the definition as found in LHARP does not take into consideration any impact that a missing part might have on production this definition is not suitable for maintenance in daily plant life. Further more it is very much possible that also parts with a value below USD 20’000.- have an important impact on production, as e.g. in the case of bearings.

It is highly recommended that all parts that are considered critical within a plant are properly listed. The list should at least show the technical specifications as well as the supplier information.

3. Storage and maintenance of/on spare parts

The purpose of this chapter is to give specific storage recommendations for parts that are often kept in a warehouse of a cement plant. By following these storage recommendations and any specific manufacturers’ recommendations it should be assured that the parts kept in the warehouse are in optimal condition at any time given.

Depending on special climatic conditions – high temperature and humidity - in some cases special measures might be required.

3.1 General storage Recommendations and Layout

The remarks made in this chapter apply for any parts stored in a closed warehouse. For parts stored on an outdoor storage yard refer to chapter “4.24 Outdoor Storage Yard”.

The storage location has to be clean and free of dust or other contaminants. The floor has to be clean. Equipment has to be stored in a dry location. Extreme heat or cold have to be avoided. Storage temperatures must range between 10°C to 38°C.

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If equipment is stored in shipping containers, “moisture absorbent” material should be placed in the container prior to storage and at least be checked once per year.. For warehouse storage the equipment has to be covered and well ventilated.

Parts to be stored out of direct sunlight.

In order to move and load the parts safely, overhead cranes or portable cranes of adequate capacity must be available. Heavy equipment / parts shall be stored close to the floor in order to facilitate handling.

Shelves have to be easily accessible from platforms and ladders. Aisles must be clearly marked and free of obstacles.

Refurbished and critical parts have to be marked with a tag, so they are clearly distinguishable form other ones.

Picture 1 and 2 give an idea of how a proper warehouse can look like.

Picture 1 and Picture 2: Warehouse overview – clean proper illumination

Scrap must be kept in a separate area. This area is only for temporary storage and scrap material has to be removed on a regular basis.

Hazardous goods (e.g. batteries or solvents) must be kept in a special area which is emptied on a regular base. Furthermore according safety measures such as proper ventilation and fire protection have to be taken.

Access to the warehouse must be restricted to defined responsible people. Key business partners / users must be provided with a security and access control system (e.g. swipe card system or magnetic). Beside the area with restricted access it is however highly recommended to have a self-service area, where consumables such as nuts and bolts are accessible at any time.

3.2 Lubricants

Lubricants are toxic substances that have to be handled with care in order to prevent any damage to health or the environment.

Lubricants have to be kept in a well-illuminated, separate room with proper ventilation in order to minimize the effect of temperature fluctuations. The room air volume has to be renewed 20 times per hour.

Fire extinguishers have to be available and emergency exits have to be marked. Warning signals are needed to communicate dangers. Smoking and eating should be prohibited in the area. The material data sheet for each lubricant must be available in the storeroom and in the safety department for quick reference in case of an accident. Any country-specific regulations for storage of lubricants have to be respected under all circumstances.

The table shows some suggested storage times for different lubricants (according to George Wills and A.R. Lansdown) based on 20°C ambient temperature. Note that a 10°C increase in storage temperature doubles the oxidation rate of the lubricant. It si therefore recommended to apply the principle “first in first out”.

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Product	Maximum Recommended Storage Time
Lithium Greases	12 months
Calcium Complex Greases	6 months
Lubricating Oils	12 months
Emulsion Type Fire resistant Fluids	6 months
Soluble Oils	6 months
Custom Blended Soluble Oils	3 months
Wax Emulsions	6 months

Table 1 Recommended storage times for different lubricants at 20°C

Each lubricant must have a defined place, be correctly identified (material data sheet!) and have small containers under the valves to catch all drippings. The water draining system of the storage room must be equipped with an oil recovering system in order to avoid polluting the environment. Drums must be kept horizontally and each drum must be properly labeled in order to prevent mixing up lubricants.

Once a drum has been opened a breather shall be installed so any air entering the drum is clean and without any humidity.

Picture 3: Lubricant Storage

Picture 4: Oil drum storage

For each type of oil, different containers with hermetic covers should be used. These must be properly labeled (picture 5). Each bin should only be used for one type of lubricant in order to avoid contamination (picture 6).

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Picture 5: Oil storage with filling station

Picture 6: Bins for each type of lubricant

Since drums are heavy proper handling equipment for moving them has to be available (pictures 7 and 8) as well as bins for small amounts.

Picture 7: **Drum carrier**

Picture 8: **Handling of drum with small crane**

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3.3 Bearings

Bearings need to be protected against dust, dirt, humidity and vibrations so should be kept in their original package (which will include the technical references) and stored horizontally (picture 9).

Bigger bearings are often delivered well packed and protected (e.g. in a wooden box with footings). It is recommended to keep these boxes in original condition and to only open them once the bearing is being used.

If the original package is not available, pack the bearing in some greased paper and keep in a closed box.

It is a good practice to keep all bearings in a common shelf (picture 10) or in special drawers.

New bearings may be coated in a rust preventative/preservative solution in order to protect them during shipment and storage. This coating must be removed from the bearing before mounting. An all-purpose industrial strength cleaner can be used for this purpose.

Standard bearings should not be kept on stock for more than five years.

Picture 9: **Storage shelf for bearings**

Picture 10: **Bearings storage room**

3.4 Electrical Motors

Motors shall be stored in their original crates. The storage area has to be free from any vibration. The recommended storage temperature is 5 to 35°C and humidity should be non-condensing.

All external parts of the motors subjected to corrosion have to be protected by corrosive-resistant coating.

The following points about bearings have to be taken into consideration:

1. Ball and roller (anti-friction re-greasable type) bearings: The bearings are to be fully greased at the time of going into extended storage. Motor shafts are to be rotated manually every 6 months and additional grease added in the bearings cavity. Rotate shaft by hand before putting into service.
2. Ball (anti-friction non-greasable): No additional bearing precautions are necessary.

All drains have to be fully operable while in storage, and/or drain plugs removed. The motors have to be stored so that the drain is at the lowest point. All breathers or automatic "T" drains must be operable to allow breathing at points other than through the bearing fits.

Where a large quantity of motors is stored an inspection or sampling should be made by removing the end brackets and visually inspecting for the presence of water in the grease or rust on the bearing. If present, replace the bearing and re-lubricate.

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All motors with a power greater than 500 kW have to be permanently equipped with a heater, which has to be switched on during the storage period. In order to monitor the condition of the insulation during storage it is recommended to apply the following procedure:

- Before storing a motor measure the insulation resistance (phase to ground) by a suitable insulation tester such as megohmmeter. Further more, the winding or copper resistance should also be measured by a low resistance ohmmeter. Measure the ambient temperature and humidity at the same time. These measurements will serve as a reference for later checks.
- In order to make sure that the readings are not misplaced, they should be recorded on a tag, which is physically attached to the motor.
- Repeat these measurements on a yearly base and before using the motor.

The resistance measurement should not change over time (remember that measurements have to be adjusted if temperature or humidity varies). However, if there is a change in the measurements the motor probably needs electrical or mechanical drying.

Instead of applying the measurement as described above, it is also possible to do a PI (Polarization Index) measurement. The application of a Hi-Pot or surge test is not recommended.

When handling a motor bigger than 250 kW, make sure the motor safety belts are properly tightened before moving.

Pictures 11 and 12 show how electrical motors can be stored on a shelf. Each motor is kept on a wooden pallet, which facilitates handling by forklift. The bigger a motor is, the closer it should be kept to the floor.

Picture 11 and Picture 12: **Storage of electrical motors**

3.5 Electronic Parts

Electronic parts (e.g. cards) should be kept in a separate room, which is either pressurized or air-conditioned. The temperature range should be between 5 to 35°C, and humidity should be non-condensing.

During storage, the cards shall always be kept in their antistatic bag (picture 13 and 14), which should be properly labeled. Only remove electronic equipment from the bag when it is about to be installed.

Grounding straps, as provided by PLC suppliers, must be used on shelves. If there are no straps installed the personnel body should be discharged by touching grounded metal.

Additionally it is vital that cards kept on stock are of the latest version actually used.

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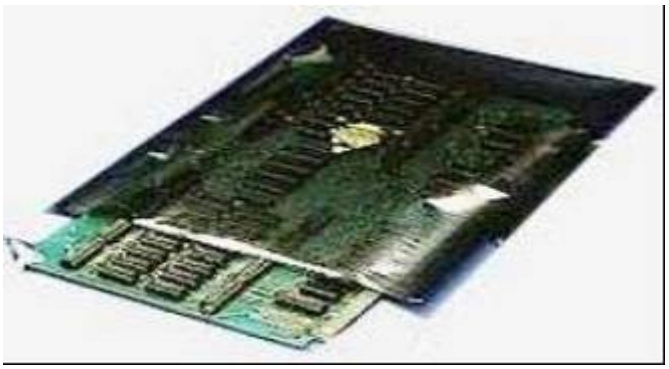
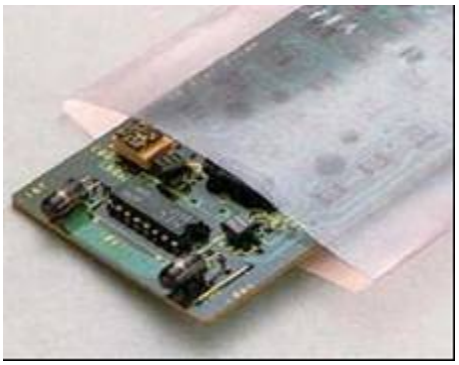
Capacitors in specific equipment such as VFD (Variable frequency Drive) and UPS (Uninterruptible Power Supply) have to be “formed” or rejuvenated at least every two years. This shall be done according to the supplier manual.

Any electronic equipment kept on stock that contains chemically active parts (e.g. batteries) has to be checked on a yearly basis. Acid leaks can ruin the entire unit, so it is recommended that batteries are isolated by sealing them in a separate bag.





Picture 13 and Picture 14: **Electronic card in antistatic bag**

3.6 Belts

Conveyor belts deteriorate over time, so stock quantities should be kept at the appropriate level to avoid long-term storage.

Belts should be protected against contamination, moisture, chemicals, extreme temperatures and UV light. The ideal storage temperature is between 10 and 20°C. Long exposure at temperatures even slightly below 4°C can harden or stiffen the compounds, and extreme temperature variations can have a negative effect on belts.

Sunlight and ozone deteriorate any exposed rubber over time. So belts should be stored out of direct sunlight. Electrical generators or arc welders can sometimes generate ozone. So belts should be stored some distance away from this type of equipment. It is wise to keep any unused belt stored in its protective factory packing until it is ready for installation.

Belts should be stored on a pallet or a cradle, not on the floor.

Heavy rolls should be suspended with the aid of a steel bar or laid on a thick, soft rubber foam bedding (picture 15). Rolls should not be stood on edge or leaned against a wall. Block the belt safely, so it can’t accidentally roll.

Picture 15: Storage of large and heavy belts

Joined belts should be rolled on a hard tube (no smaller than the recommended minimum pulley diameter for the belt) to prevent them from crimping (picture 16).

Rolls of narrow belts can be stored horizontally on boards or pallets. Several rolls of such products can be stacked as long as the resulting weight does not crush or deform the belts (picture 17). Note that this only applies for narrow belts.

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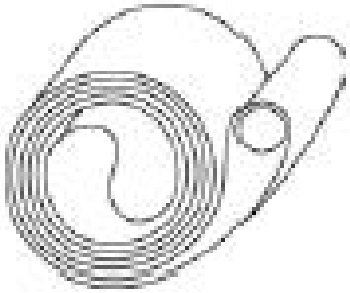
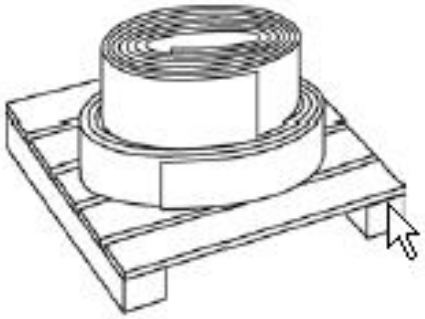


Picture 16: **Storage of joined belt**



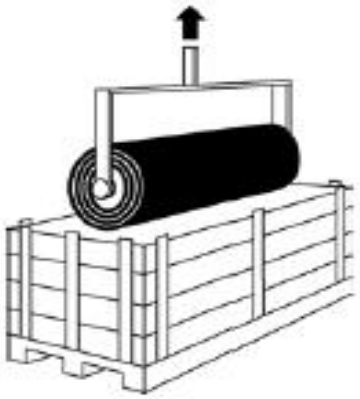
Picture 17: Horizontal storage of narrow belts

Before storing used belts, thoroughly clean and dry them, then dust them with tire talc or insert kraft paper between the layers.

To lift a large roll of belts, insert a steel bar through the hole at the core of the role and attach it to a hoist with two rope slings or chains attached to a crossbeam. To prevent damage to the belt edges by the ropes or chains the cross beam must be longer than the width of the roll (picture 18).

Belt rolls can also be transported using forklift trucks. If this is done ensure that the outer belt layers are not damaged by the fork edges.

Never apply a sling around the circumference of a roll of belting.



Picture 18: Belt handling

3.7 V-Belts

V-Belts can be stored on a wall as shown below in order to optimize space and sort by size.

Picture 19 and Picture 20: **Storage of V-belts**

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3.8 Chemicals

Chemicals must be kept in a separated ventilated room. All bins and containers need to be clearly labeled. Fire extinguishers must be available and emergency exits marked.

The chemicals must be segregated into hazardous classes first (starting with physical state) and then sorted alphabetically.

Picture 21: **Storage of chemicals**

Picture 22: **Chemicals on shelf**

Incompatible chemicals that must be stored in close proximity within each class to one another should be placed in trays (or other containment devices) to keep them segregated.

3.9 Gearboxes

Gearboxes should be filled with the lubricant as recommended by the supplier and periodically checked for leaks.

In order to prevent corrosion all surfaces of shafts need to be covered with an anticorrosive layer.

Shafts have to be turned several rotations twice a year.

Gearboxes should be stored on wooden pallets or supports. This will prevent humidity from accumulating underneath the gearbox (corrosion) and facilitate handling with a forklift.

The heavier a gearbox is, the closer to the floor it should be kept (picture 23).

Picture 23: Storage of gear boxes

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3.10 Impeller

When storing impellers still mounted on shaft, the shaft should be supported as close as possible to the impeller in order to prevent the shaft from bending (picture 24).

It is recommended to protect the shafts against corrosion and to store impellers indoors.

Picture 24: Impeller

3.11 Tools

Guarantee fast and easy access when storing tools. It is a good practice to store them on “tool-boards” (picture 25 and 26) to enable easy viewing of available equipment, quick identification off damaged equipment, and to optimize space utilization.

Picture 25 and Picture 26: **Tool boards**

3.12 Special Tools

“Special Tools” refers to tools that are used for special jobs, as e.g. hydraulic keys or cylinders.

These tools have to be checked and maintained on a regular basis. Since proper operation in many cases can only be verified when using the tools in the field, feed-back should be given from users when they return them to the warehouse.

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3.13 Consumables

Consumable as e.g. screws, nuts or bolts have to be easily accessible. A good practice is to keep consumables in small boxes as this is shown in picture 27 and 28. If they are kept this way, the boxes should be properly labeled.

Consumables may be handed out through the main counter or issued through a self service arrangement, depending on the individual plant situation.

Picture 27: **Consumables cabinet**

Picture 28: **Close up of boxes containing consumables**

3.14 Welding Material

Welding materials (e.g. welding rods) need to be kept in a dry and warm place to prevent absorption of humidity (picture 29).

The material should be kept in its original boxes.

It is a good practice to use infra-red light for heat, or keep the rods in an approved rod oven before usage in order to maintain the necessary temperatures.

Picture 29: Welding rods on a shelf

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3.15 Kiln Roller

In order to prevent surface corrosion, kiln rollers should be stored indoors (picture 30). If this is not possible they should be kept in a waterproof box. In this case it is important to ensure that there is no humidity in the box.

Even when kept indoors, surfaces should be protected with an anticorrosive agent and periodically checked.

Picture 30: Storage of kiln roller

3.16 Girth Gear

The girth gear has to be leveled in order to ensure that it is stored perfectly horizontally, thus preventing any deformation under its own weight. It should not be laid directly on the ground but on wooden supports (picture 31). Check the leveling once a year, since the wooden supports might warp over time.

Picture 31: Girth gear storage

In order to prevent corrosion it is advisable to store the girth gear indoors and to protect it with an anticorrosive agent.

3.17 Kiln Shell

If space permits, kiln shell pieces may be stored next to the kiln. This will facilitate handling and avoid complicated and time-consuming transports. If storage next to the kiln is not possible, the pieces can be stored in the outdoor storage yard.

They should be stored horizontally in order to prevent any deformation due to their own weight.

Additionally it is important that crossbars are mounted, so the shell is kept in shape.

If long-term storage is foreseen, it is vital to protect the shell with an anticorrosive layer/paint or a solid plastic cover.

If the kiln shell is stored some distance from the kiln and therefore needs to be transported by truck, it is a good practice to store the shell on poles, so it is at the same height as the truck.

3.18 Rubber Hoses

Rubber hoses can be divided into the following two groups:

1. Pneumatic and hydraulic pressure hoses
2. All other hoses like hydraulic return line and instrument hoses

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Concerning the shelf life of hoses, the following can be said:

Hoses made of polytetraflouruethylene (PTFE) material do not normally have a specified storage life but the storage life of rubber or synthetic rubber hoses is limited to 5 years (provided they are stored under standard conditions). The storage life of hose assemblies is calculated from the date of manufacture or assembly.

During storage, periodic inspections should be carried out once a year for signs of deterioration, weather cracks, signs of corrosion on the end fittings etc. Hoses should be pressure tested to 1.5 times the maximum working pressure every two years.

Before installation, pressure tests should be carried out at 1.5 times the maximum working pressure.

3.19 Refractory

Magnesia products, refractory lightweight bricks and all unburnt chemically bonded grades of bricks should, as a general rule, be stored in dry and well ventilated spaces.

Basic bricks deteriorate with hydration (contact with water). The original packaging provides optimum protection against any damage during transport and damage caused by splashing water. Despite this, hydration is sometimes unavoidable in extremely warm and humid weather conditions. Such conditions may lead to hydration after half a year. In tropical/subtropical climatic zones the (local) supplier should be asked for advice on the maximum storage life of refractory bricks in the local conditions. In any case, a "first in - first out" management of stock items is advisable. Hydrated bricks are characterized by cracks extending from the brick centre (like a web) over the surface. These cannot be used anymore but should be disposed of according to local regulations. Bricks that have become wet but do not show any cracks should be stored - in small stacks with 20 to 50 mm space between the bricks - in an enclosed space, where they should be allowed to dry at room temperature in an adequate air current. After having thoroughly dried them out, the bricks can be used. However, it is important to ensure that they are free from any cracks before installing them.

Burnt high alumina, alumina and fireclay bricks that have got wet can likewise be used after thorough drying. Unburnt chemically bonded brick grades may absorb moisture from the air even when being properly stored. As a result, the bricks may appear somewhat moist on the surface, and they give off a dull sound when struck with a hammer. However, their serviceability is in no way impaired. The bricks need not to be dried before use. In doubtful cases bricks have got wet and been dried can be sent to the supplier, who will test whether they are still suitable for use.

Mortars and monolithic refractories should be stored in dry, well-ventilated spaces. Such materials are rendered unfit for use, if they get wet or are stored for too a long time (refer to the instructions for using monolithic refractories).

Bricks and other products supplied as palletized unit loads should not be stacked too high (accident hazard). More particularly, the following heights for stacking the loaded pallets should not be exceeded:

Refractory products	Maximum Stacking height
Basic bricks such as PERILEX', ALMAG', MAGPURE', MAGNUM'	2 to 5 pallets
High alumina and fireclay bricks such as KRONEX'. REFRALUSIT'	2 to 5 pallets
Lighhrveight bricks /Insulating bricks such as REFRATHERM'150	2 pallets
Mortars, castables Stacking height	2 pallets

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The safe height of the stack will also depend on the bearing capacity of the surface on which it rests. On ground, which is not surfaced or paved the lowest of the above stacking heights should be used. In order to avoid any excessive edge pressure on the bricks, pallets stacked on top of one another should always bear over their entire area.

3.20 Steel Plates and Profiles, Pipes

These types of materials are used for several different purposes. Since they tend to be large and heavy handling is not easy. Therefore easy access – e.g. with the forklift - has to be guaranteed and special machines for cutting should be available in close proximity. Depending on the climatic conditions these materials might be stored in the outdoor storage yard (picture 32 and 33). However, in countries with heavy and frequent rainfall or high humidity it is advisable to store these materials indoors.

In the case of pipes it is necessary to ensure that no water builds up on the inside of the pipes since this would facilitate corrosion.

Picture 32: Outdoor storage of various steel profiles

Picture 33: Outdoor storage of steel plates

3.21 Cables, Chains and Hooks

Cables, chains and hooks that are being used for supporting and lifting heavy materials have to be kept in a dry place to prevent corrosion.

In order to guarantee maximum safety and optimal working conditions they have to be checked once-in-half-a-year by a qualified person (according Fatality Prevention Element Directive No 9, “Lifting and Supporting Loads”).

The maximum load each that these equipments can support needs to be clearly declared on the specific equipment.

Long cables should be stored on cable reels as shown in picture 37.

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Picture 34: Hoes

Picture 35: Various short lifting cables

Picture 36: Chain blocks

Picture 37: Cable reel as used for long cables

3.22 Gas Cylinders

Gas cylinders should not be stored for excessive periods of time. Only purchase sufficient quantities of gas to cover short-term needs. Stocks of gas cylinders should be rotated to ensure first in is first used.

Store gas cylinders in a dry place on a flat surface and open air. If this is not possible, store in an adequately ventilated building or part of a building specifically reserved for this purpose. Gas cylinders containing flammable gas should not be stored in a building used for other purposes. Keep gas cylinders in a place that can be locked, so access can be controlled. Store cylinders where they are not vulnerable to hazards caused by impact (e.g. from vehicles such as forklift trucks). Keep incompatible classes of gas separately. Keep flammables away from reactives.

Protect gas cylinders from external heat sources that may adversely affect their mechanical integrity and make sure that they are stored away from sources of ignition and other flammable materials. When transporting cylinders of compressed gases, the cylinder should always be strapped to a cylinder cart and the valves protected with a cover cap.

The cylinders must be clearly marked to show what they contain and the hazards associated with their contents.

Full and empty cylinders must be kept separately. A “full / empty” tag on each cylinder is recommended. The storage place has to be clearly marked – including appropriate warning signs (e.g. “no smoking”) and fire extinguishers have to be available. The valves of empty cylinders must be closed in order to prevent contamination.

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Picture 38 and Picture 39: Storage cages for gas cylinders. Full and empty cylinders are separated, warning signal available

3.23 Filters and Bag Filters

Filters should be stored in a very clean place and in their original packaging (picture 40). If the original packaging is not available, they should be stored in a closed box.

Any contamination of the filters by dust or other contaminants has to be strictly avoided since this will not only affect the filter performance and lifetime, but also the performance of the system where the filter will be used.

Cages for bag filters must be stored vertically and protected against crushing (picture 41).

Picture 40: Bag filter storage

Picture 41: Cages for bag filters

3.24 Outdoor Storage Yard

The outdoor storage yard should be kept as small as possible but as big as necessary. Since the material kept there, is getting exposed to the weather it has to be assured that only the heavy duty material is kept in there.

Although the material is kept outside it has to be assured that the quantity hold and the place where it is kept are known.

Material never should be placed directly on the ground but on supports as e.g. wooden pallets so water can drain. It is a good practice to even keep the material stored outdoors on shelves as shown in picture 42 and 43.

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Picture 42 and Picture 43: Outdoor storage yard with shelves

3.25 Summary

Table 2 includes a summary of the most important points to be considered, when doing a quick inspection of a warehouse (including the PMR's to be executed on different spares). It has however clearly to be pointed out, that this check-list does not replace a complete warehouse audit according the "warehouse check-sheet".

#	Part Type	Task description	Visual Check	PMR	Frequ. [weeks]
1	General	Ensure proper housekeeping is in place	X		24
		Ensure driving ways are free of obstacles	X		24
2	Lubricants	Ensure lubricant drums are stored horizontally	X		24
		Ensure drip trays are available	X		24
		Ensure that tools are kept very clean	X		24
		Ensure proper housekeeping is in place and the storage location is free of dust	X		24
3	Bearings	Ensure bearings are kept in a very clean environment	X		24
		Ensure bearings are kept in a closed bag and stored horizontally	X		24
4	Electrical motors	Ensure shafts of electrical motors are turned on a regular base		X	24
		Ensure heating system for motors bigger than 500 kW is connected		X	24
5	Electronic cards	Ensure all cards are kept in anti-static bags	X		24
6	Belts of conveyors	Ensure big belts are kept suspended on a steel bar	X		24
7	Welding Material	Ensure welding rods are kept in a dry place	X		24
8	Kiln rollers	Ensure kiln rollers are kept under a roof	X		24
		Ensure surfaces are covered with an anti-corrosive layer	X		24
9	Girth gear	Ensure girth gear is kept under a roof	X		24
		Ensure girth gear is kept horizontally (levelled!)	X		24
		Ensure surfaces are protected with an anti-corrosive layer	X		24
10	Kiln shell	Ensure cross-bars to support kiln shell are in place	X		24
11	Steel plates, profiles and pipes	Ensure steel plates, profiles and pipes are stored under a roof	X		24
12	Cables, chains and hooks	Ensure cables, chains and hooks are regularly inspected (visually and NDT)		X	52
		Ensure cables, chains and hooks are protected against corrosion	X		24
13	Gas cylinders	Ensure full and empty cyliders are clearly separated	X		24
		Enure gas cylinders are properly labelled	X		24
14	Filters and bag filters	Ensure filters are kept in a closed box	X		24
		Ensure filters are kept in a dust free environment	X		24

Table 2: "Quick-check" for warehouse including PMR's for spare parts

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For further information regarding warehousing also refer to the “Inventory Management Recommendations” document, which can be found under the Procurement/Standards section of the LafargeHolcim Portal.

4. Message

Having a common understanding of what a critical spare part is and using a standardized process to identify them, are important steps in the process of assuring maximum plant availability at the lowest sustainable inventory levels.

By properly identifying critical parts and implementing according measures to reduce their risk of failure expensive emergency orders und unplanned shutdowns due to missing parts can be avoided. Holding a critical part on stock thereby only is the last measure of a whole group of measures to be considered in order to minimize unexpected shutdowns.

Furthermore, once purchased, it is very important to properly store all parts. Proper storage will ensure that parts are in optimal condition once needed and avoid having unforeseen shutdowns due to damaged parts or poor condition of newly installed parts.

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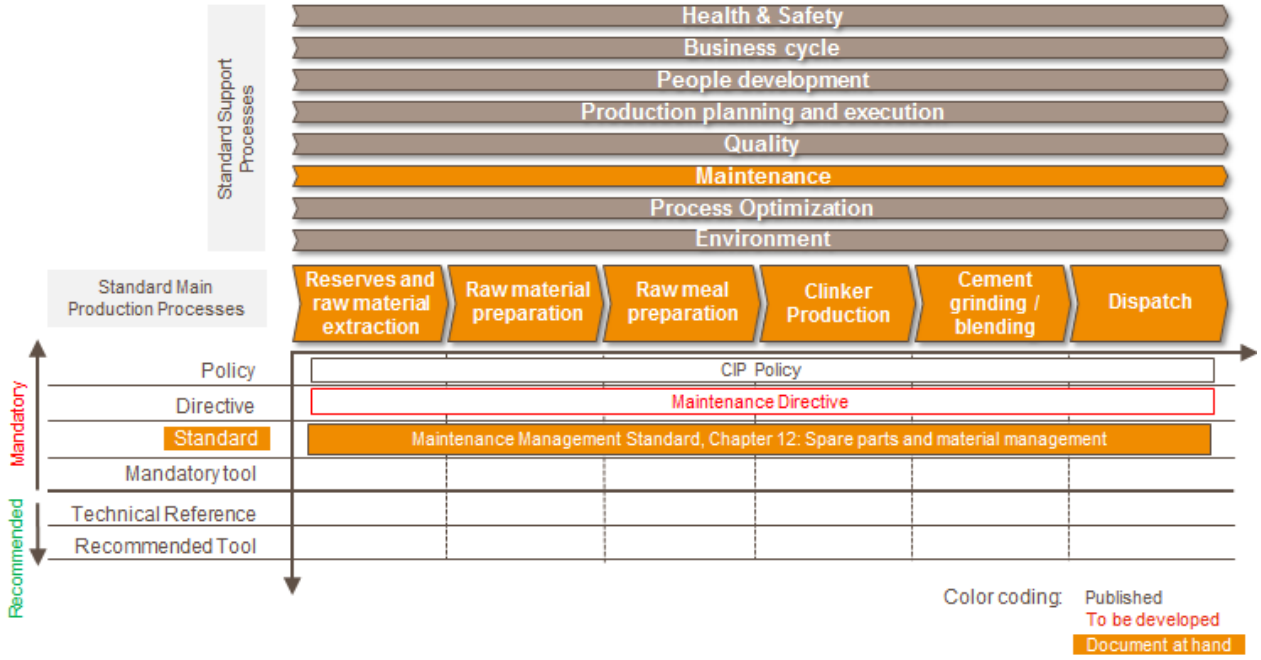
5. Document management

5.1 Cement Industrial Framework



5.2 Document information & revisions

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Validated by	CIP Standards and Tools		
Revisions	**Version**	**Date**	**Main changes**
	1.0	09 Jan 2017	First version

5.3 Related Document

	Type	Name
I	Policy	CIP policy
II	Directive	Maintenance Directive
III	Standard	Maintenance management standard, chapter 1 to 13
IV	Mandatory Tool	
VI	Technical Reference	
VI	Recommended Tool	

This document replaces:

Type	Name
Legacy Holcim	MER1MM_12V0_Spare parts and material management.doc
Legacy Lafarge	

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