Inventory and warehouse management

Cement Industrial Framework

CIF-PL-MN03

LafargeHolcim

Description

- Inventory and warehouse management process sets the necessary steps for needs identification, a systematic planning, managing, controlling and optimisation of inventories, combined with implementation of appropriate storage condition and preventive maintenance of spare parts in stock to preserve them in good condition.

  This process is based on the Maintenance management concept defined by Maintenance Management System.

Objectives

- Optimization of Net Working Capital through
  - Implementation of the Inventory Management process
  - Maximization of the availability of the correct spare parts and minimizing warehouse stock while achieving inventory targets
  - Reduction of inventory levels to the defined targets

Key Performance Indicators

- MRP usage [%]
- Value of obsolescence [RC]
- BOM material PR ratio [%]
- Inventory Index of annual standard clinker capacity [RC/t clinker]

1. Objectives

Inventory and warehouse management process sustain plant capabilities to fulfill its commitments to customers supported by systematic planning, managing and controlling of inventories, optimising the Net Working Capital required, ensuring appropriate storage and maintenance of spare parts in stock.
This process requires the active involvement of procurement and all plant departments.

2. Applicability

Inventory and warehouse management process is applicable to all integrated cement plant, clinker plants, grinding stations and blending stations.

3. Prerequisites for Implementation

The below processes and tools are required as prerequisite for full implementation of inventory and warehouse management

- **Tools**
  - LafargeHolcim Accounting and Reporting Principles (LHARP)
  - ACS equipment codification,
  - SAP system, including MM and PM modules with SAP Maintenance standard customization or equivalent integrated Enterprise resource planning solution (ERP) replicating the SAP Maintenance standard requirements
  - Material master data and naming convention,
  - Equipment master data,
  - Bill of materials
- **Processes**
  - CIF Work order system,
  - CIF Shutdown management,
  - CIF Production planning,
  - CIF Maintenance cost management,
  - P2P procurement process

4. Process Description

Plant Net Working Capital includes all plant inventories covering three distinct types:

- **production process inventories**: raw materials, correctives, raw meal, clinker, mineral components, cements and fuels,
- **maintenance related inventories**: wear parts, refractories, spare parts, materials and consumables,
- **dispatch packing materials inventories**.

Management of production process inventories it is covered by CIF Production planning process and dispatch packing materials inventories by the CIF Shipping station shift operation.
Inventory and warehouse management process covers the management process for maintenance related inventories.

This process is based on the Maintenance management concept defined by Maintenance Management System.

The basis for effective inventory and warehouse management is set by the Procure to pay process (P2P), shown in the figure 1.

There are three main stages of the P2P process which are in particular important to establish proper inventory and warehouse management:

- **Determine** the stock needs
- **Procure** the required stock
- **Manage** inventories

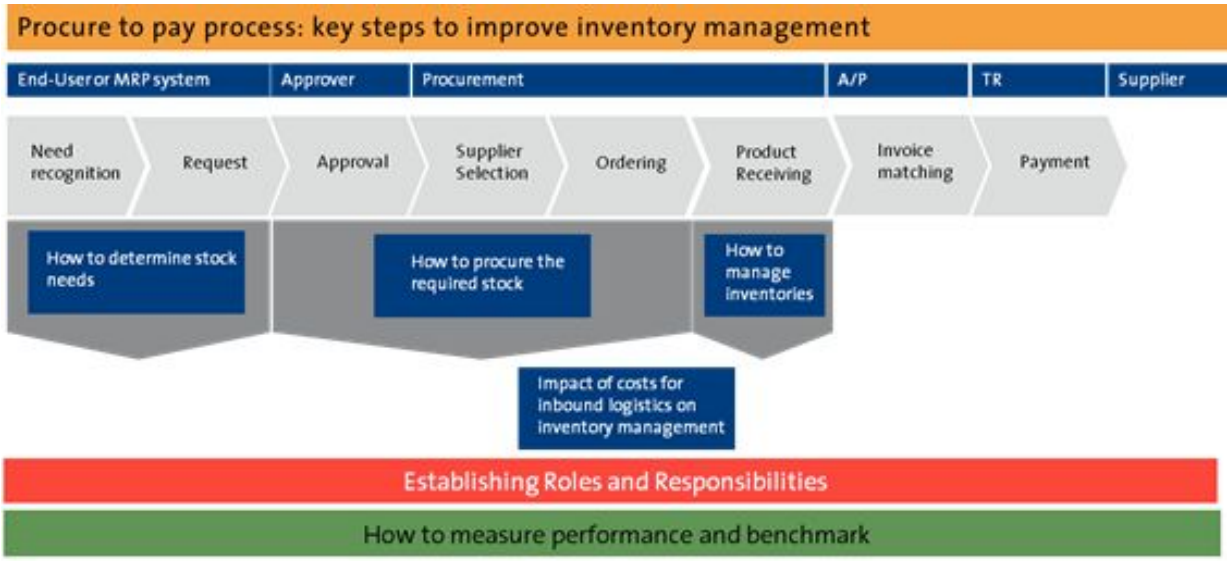

Fig. 1 Procure to pay process diagram

On the following pages this three main stages will be further developed and explained which are all essential part of the overall Material Requirement Planning (MRP) process.

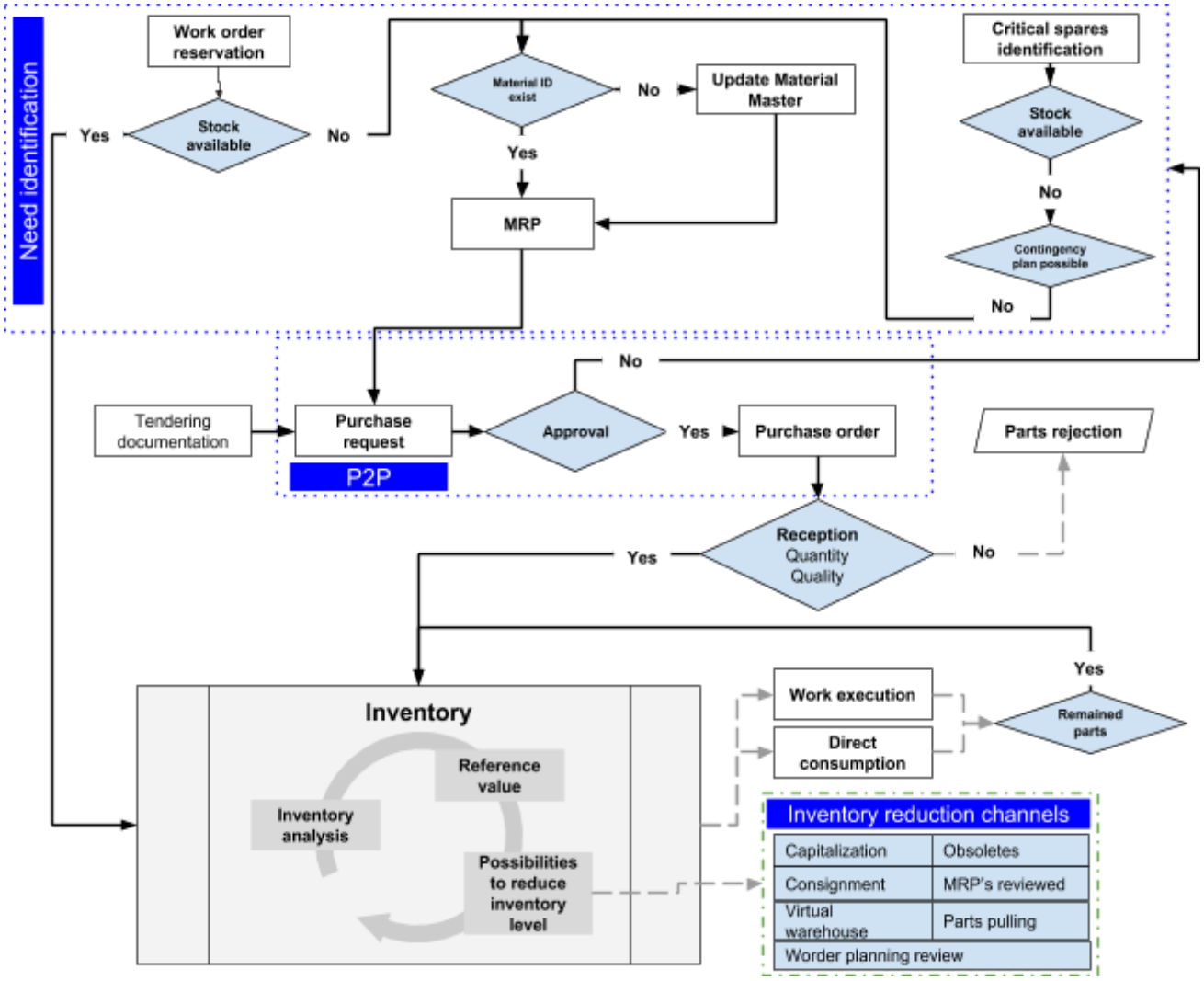

Fig 2. Inventory management process flow

4.1 Determine stock needs

The existence of stock is usually due to a difference in volume between goods receipt from logistic chains and goods issued generated by the demand. Thus, demand planning and forecasting are core aspects of inventory management to balance effectively the flow between receiving and issuing goods.

A key driver in the optimization process is the availability of required items. In order to optimize inventory levels, it is vital to have proper planning and scheduling. This ensures that the need for spare parts is communicated at an early stage and facilitates a systematic approach for needs detection considering the equipment criticality and the associated risk of failure.

To order a material for stock, the material must have a master record. The process to update the Material Master data is described in the figure 3. The replenishment of stock materials should be managed through MRP component. The strategy of the replenishment (e.g Reorder Point) is maintained in the material master record.

The need of stock material is determined by Reservation through the work orders and Critical Spares identification as results of the Failure Mode Effect Analysis (FMEA) performed.

Maintenance function plays the key role in MRP accuracy:

- **Planning** – Emergency orders should be true emergencies, not rush orders due to lack of planning or insufficient communication.
- **Lead times** – Consider that for critical equipment, manufacturers typically require 3-6 month lead times.
- **Reservations** – Reserve materials through work orders
- **Bill of material (BOM) accuracy** – Work jointly with Procurement to maintain BOM's

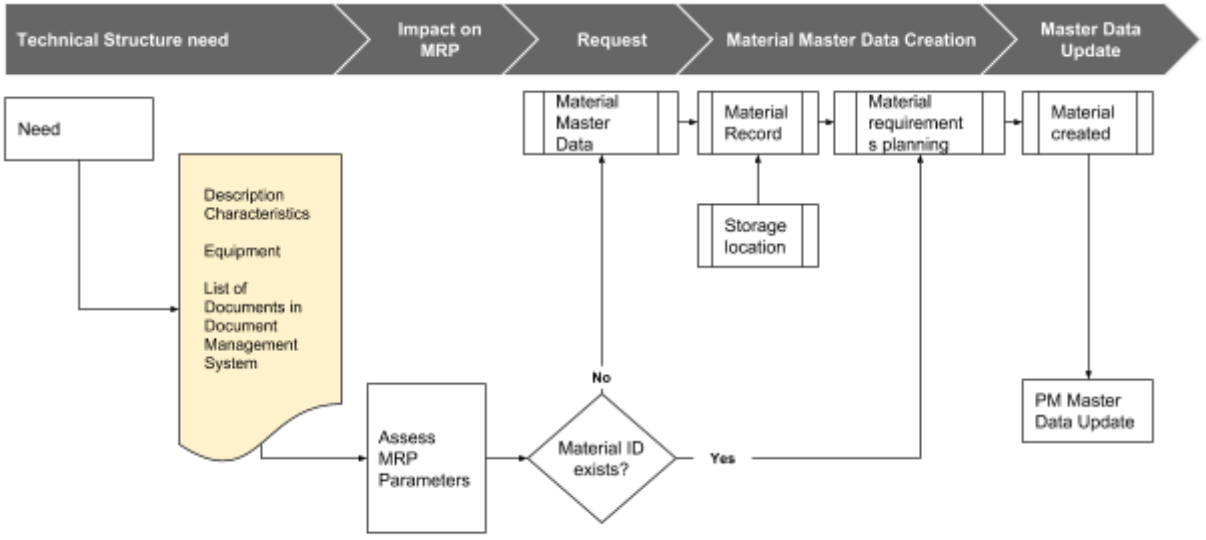

Fig. 3. Materials master management process

4.2 Procure the required stocks

The procurement process to be executed for goods acquisition depends on the Procurement Category. The operational procurement process for goods is based on the usage of standard ERP (Enterprise Resource Planning) functions, in order to ensure process efficiency, contract compliance and internal controls:

- For recurrent purchases MRP (Material Requirement Planning) triggers the stock replenishment,
- For non-recurrent purchases a bidding process is followed.

The Purchasing Process starts with proper Demand Planning and ends with proper Supplier Performance Evaluation.

The request for acquisition of a certain quantity of a material or service is made through a Purchase requisition and is initiated via a SAP and it is subject to a release and approval procedure. The Purchase requisition determines what and how much to order and the delivery date.

After Purchase Requisition approval, a Request for Quotation (RFQ) is required to identify the most optimum financial and technical Quotation.

- RFQ is an invitation extended to a vendor by purchasing organization to submit a quotation (bid) for the supply of materials or performance of services.
- Quotation is an offer by a vendor to a purchasing organization regarding the supply of materials or performance of services subject to specified conditions.

The RFQ and Quotation are managed in SAP. Maintenance function is responsible to supply the necessary technical specifications for materials or services requested.

If the RFQ is issued to several vendors, the system determine the most favourable quotation submitted and automatically generate letters of rejection to the unsuccessful bidders. The prices are then compared from all quotations received as a result of a competitive bidding process using the price comparison list. The comparison list ranks the quotations by item from lowest to highest price.

A reception process is defined and used to check the delivered goods against the quantity and quality requested through Purchase Order. Checking the delivered quantity is the responsibility of Warehouse management function. Quality checks of delivered goods are under the responsibility of Maintenance Management function and covers design specifications agreed with supplier.
If the quantity and quality does not confirm the agreed level the goods rejection process is initiated by procurement function.

4.3 Manage Inventory

Material is procured from external or internal sources on the basis of the requirements determined by MRP (Material Requirements Planning). The delivery is entered in Inventory Management based on receptions notes. The material is stored and managed under Inventory Management until it is used for internal purposes.

Material are released for consumption based on the generate materials slips triggered by reservations done through work order.

Following main elements of a proper inventory management have to be considered

- Immediate impact
  - Inventory analysis
    - to determine the gaps with inventory targets and provide actions for correction
  - Inventory index monitoring
    - comparison with inventory reference value and determination of potential reductions for further inventory value optimization
- Mid-term impact - Sustainable system
  - Establishing Stock Strategies
    - Effective stocking strategies are based on the knowledge of the requirements and a proper analysis of current inventories.
    - Inventory analysis serves to identify the items on which a business should focus its efforts (e.g. close control for high value items and simple control for low value items).
  - Implementation of Stock Strategy
    - The “Stock Strategy Matrix” has to be developed in order to facilitate decision-making on the stock strategies implementation
  - Maintaining Stock Strategies
    - “Planning of needs” and “negotiation with suppliers” are a vital part of maintaining optimal stock strategies.

4.4 Optimize Inventory

The inventory optimization must consider the plant specific conditions and can cover different approaches as:

- Consignment stocks
  - inventory that is held at the customer’s physical location, but is still legally owned by the supplier
  - consignment inventory optimizes NWC (Net Working Capital) levels by reducing inventory values
- Vendor Managed Inventory
  - is a means of optimizing supply chain performance in which the supplier is responsible for maintaining the customer’s inventory levels.

    - the supplier has access to the customer's inventory data and is responsible for generating purchase orders
    - through vendor managed inventory methods, a true partnership can be created between the supplier and the customer.
- Virtual warehouse
    - is a concept which makes it possible to share spare and wear parts between plants
    - when the end-user needs a spare part and this is not available in the local plant he looks into the virtual warehouse if a replacement is available. If the economic benefit is given, the item is transported from one plant to the other.
- Spare parts pooling on global, region, cluster and country level approach
- Central warehouse.
    - for materials that are common among several plants (ideally within short distance between them) an external storage location can be used. This is called central warehouse.

4.5 Roles and responsibilities

	Stock needs definition	**Procure the required stock**	**Manage the inventories**
Maintenance Management	Define and maintain BOM & spare part needs Manage reservations and order requirements Provide safety stocks requirements	Participate in the negotiations with vendors, when required by Procurement Determine criticality of parts Identify and establish links to bill of materials with optimal MRP settings for planned (PD) items	Conduct quality checks in the goods reception process where technical knowledge is required Support Material Master cleaning activities; Support the process for identifying obsolete items Maintenance of Spare parts and tools
Production Management	Adjustment of production plan monthly/weekly Provide safety stocks requirements Communicate annual requirements formally in advance (1 year +) to inventory officers and procurement	Participate in the negotiations with vendors, when required by Procurement	
Warehouse Management	Participate in demand planning / scheduling meetings of Operations Check accuracy of system data versus physical stock Administrate and control inventory requirements and reservations	Participate in the negotiations with vendors, when required by Procurement	Perform housekeeping in warehouse Ensure accuracy of system data versus physical stock Administrate and control inventory obsolescence and ageing Maintain defined stocking strategies Support the process for identifying obsolete items
Procurement Management	Participate in demand planning / scheduling meetings of Operations Analyze suppliers'/market's ability to cover the need for strategic and critical parts and provide delivery time information to Operations during planning	Lead negotiations with vendors, and involve Operations and Inventory as needed Implement lead times and delivery terms aligned to "field" expectations	Support Material Master cleaning activities; and Support the process for identifying obsolete items

		Implement and monitor a periodic supplier performance evaluation system	

4.6 Manage Warehouse

As described by the Inventory Management Business Process Recommendations, the warehouse layout defines the following areas:

- **Reception area**
  - allow quick visual control of the goods received each day. A quality inspection counter has to be available for holding goods pending quality control by technical personnel
- **Storage area**
  - area where parts with high rotation and heavy parts are stored. A labeling system differentiating critical items, dangerous items and refurbished items should be implemented and updated. Special building arrangements to guarantee the good condition of the stored items should be installed
- **Outdoor storage yard**
  - Since the material which is kept there is exposed to the weather, only heavy-duty material should be stored there. Material should never be placed directly on the ground but on supports such as pallets to allow water to drain away
- **Issuing area**
  - area in the warehouse where goods are issued, for which a clear issuing procedure must be implemented and communicated. Clerk's desk must have a computer for storage location searches in order to accelerate the issuing process
- **Staging and pick-up area**
  - area where warehouse personnel prepare in advance the materials required for certain maintenance activities based on information provided in advance, in order to support maintenance teams to optimize their resource utilization.
- **Self service area**
  - area to distribute high-rotation, low-cost items, thus simplifying the workload and allowing resources to be redirected to control and maintenance of more expensive parts. Security, control and monitoring equipment should be installed in the "self-service" areas

In order to guarantee the sustainability of optimal storage and safety conditions, warehouse housekeeping on a regular basis and Preventive Maintenance Routines (PMR) for spare parts held in the warehouse are defined and executed as part of the plant Preventive Maintenance Program.

5. Maturity Elements

Element	Emerging level	Requirements for Basic level	Requirements for Advanced level	Requirements for Excellent level	Measured by
Determine the stock needs	• Not all the requirements described for basic level are fully implemented or some of them are missing	• Material reservation process in place place and done through work order process only. • Maintenance materials are issued based on work orders only.	• Products & Services Classification System (PSCS) for all types of goods and services are in place and operational. • Materials must have master records in SAP • Critical spare parts are identified and with reservation determine the need of stock material.	• Systematic detection of spare parts needs by plant-specific risk matrix and FMEA processes performed and relies on changes in the market and in production process. • FMEAs focus on A-critical equipment (refer to the ABC SAP Maintenance	• All material reservations done through work orders • Good issues done only based on work orders • Materials assigned to BOM>65% • No materials without master records • A-critical equipment covered 100% by FMEA

				standard).	
Procure required stocks	• Not all the requirements described for basic level are fully implemented or some of them are missing	• Procurement, RQA (Request for Quotation) and Purchase Orders process are setted up and operational • Quality check of received parts are performed and have support of maintenance	• MRP (Material Requirement Planning) used to trigger stock replenishment for recurrent purchases • For non-recurring purchases a bidding process is in place. • The operational procurement process for goods is based on the usage of SAP	• The choice of the operational procurement process is based on the stock strategy matrix	• All work orders with parts planned have accurate basic start date in, to trigger the purchase request for required material
Manage inventory	• Not all the requirements described for basic level are fully implemented or some of them are missing	• Accurate inventory values/records through regular physical count	• MRP implemented based on stock strategy definition, master data settings, program planning, order conversion	• The Stock Strategy Matrix methodology used to define stock strategies • MRP optimization process in place • A standardised dashboard with current inventory, reference value, gaps, receipts, issues, defined and made available	
Optimize inventory	• Not all the requirements described for basic level are fully implemented or some of them are missing	• Obsolescence analysis and valorization process	• Consignment stocks applied • Spare parts capitalization • Spare parts pooling (global, region, cluster approach)	• Virtual warehouse implemented and operated • Regional warehouse for refractories, grinding media	

Manage warehouse	• Not all the requirements described for basic level are fully implemented or some of them are missing	• Warehouse layout and handling equipment available allows safe operations • Warehouse clean and housekeeping on a regular basis • The tools are properly located and controlled by responsible personnel • Ensure the minimum requirements for parts storage: not exposed / affected by weather factors, all parts with identification tags, issuing, receiving, scraps area properly defined, warehouses are closed and protected by fences and walls/roofs.	• Proper warehouse layout implemented (reception areas, storage area, identification system for stored goods, security and monitoring system, issuing area, outdoor storage yard, self service areas) • Warehouse layout posted visible • Specific and proper parts storage in place: lubricants, belts, electric motors, electronic parts, …) • Spare parts Preventive Maintenance Routines (PMR) formalized and implemented	• Barcode system implemented • Process and procedure for identification of usability of material defined and implemented • Spare parts condition evaluation	• Zero safety incidents or near misses in warehouse reported

6. Support for Implementation

The implementation of the key topics is done using a standard methodology described by the CIF roll-out methodology. The following information gives specific guidance for the implementation:

Implementation step	Duration, Timeline	Resources (people, training, equipment)	Reference documents and tools to be used
Set Procurement, RQA (Request for Quotation) and Purchase Orders process	2 months	Procurement	LH Inventory Management BPR
Implement quality check of received goods	1 month	Warehouse, Maint. to support on techn. check	
Accurate inventory values/records through regular physical count	continuous - starts 1 month after project kick off	Inventory	
Obsolesce analysis and valorization process	2 months	Inventory, Maint. to support	
Ensure Materials Handling with proper lifting devices certified by local authorities.	5 months	Inventory	

Training program implementation for warehouse employees.	3-6 months	Inventory	
Tools have a dedicated location and they are regularly checked by maintenance and required local authorities.	1 month	Inventory	
Apply minimum requirements for parts storage (see details in upper table)	3 months	Inventory	
Implement Products & Services Classification System (PSCS) for all types of goods and services	3 months	Maintenance, Inventory	PSCS Guideline
Build master records in SAP for all materials	3-5 months	Inventory, Planner to support	Master Data Management
Identify critical spare parts	2 months	Maintenance	
Set MRP (Material Requirement Planning) with proper parameters (MRP type, Reorder Point, MRP controller, Lot size, Lead time,...) to trigger stock replenishment for recurrent purchases	1 month	Inventory with support of Maintenance	LH Inventory Management BPR
Implement the bidding process for non-recurring purchases.	2 months	Procurement	Inventory optimization through Strategic MRP
Identify and apply spare parts consignment stocks	6-8 months	Inventory, Procurement	
Apply spare parts capitalization	3 months	Finance, Procurement	Parts Capitalization
Ensure spare parts pulling (global, region, cluster approach)	8 months	Procurement	
Apply and publish the proper warehouse layout including all areas required. Ensure specific and proper parts storage in place (lubricants, belts,..)	6-8 months	Inventory	LH Inventory Management BPR
Formalize and apply Preventive Maintenance Routines (PMR) for spare parts	1 month	Maintenance	
Identify or adjust spare part needs through risk matrix and FMEA processes to rely on changes in the market and in production process. Perform FMEAs on A-critical equipment (refer to ABC SAP Maintenance standard) first	3 months	Maintenance, Inventory	FMEA tool
Ensure MRP optimization process is in place through regular analysis on the MRP parameters.	6 months	Inventory with support of Maintenance	LH Inventory Management BPR
Build and implement a standardised dashboard with current inventory , reference value , gaps , receipts ,issues.	2 months	Inventory	

Implement virtual warehouse	6-12 months	Inventory	
Apply regional warehouse for refractories, grinding media	6-12 months	Inventory	
Implement barcode system	3 months	Inventory	LH Inventory Management BPR
Ensure process and procedure for identification of usability of material defined and implemented are available and applied	2 months	Inventory	
Perform spare parts condition evaluation on a regular basis	3 months	Inventory with support of Maintenance	

7. Document Management

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Validated by	CIP Standards & Tools		
Revisions	**Version**	**Date**	**Main changes**
	Beta	03.03.17	
	1.0	12.04.17	Content alignment and formatting
	1.1	30.03.18	Content review and update