

Description

- Lubrication Excellence defines the process of identification of equipment lubrication needs, lubrication application methods to be used, planning of lubrication execution, appropriate storage and handling of lubricants, lubrication tasks execution and monitoring performance to sustain process continuous improvement.

This process is based on the Maintenance management concept defined by MAC (Maintenance in Cement).

Objectives

- Zero equipment failures due to improper lubrication
- Optimisation of lubrication costs while assuring the conditions for a sustainable reliability for all equipment requiring lubrication

Key Performance Indicators

- Oil consumption ratio [#]
- Number of failures related to lubrication [#]

1. Objectives

Lubrication Excellence objective is zero equipment failures due to improper lubrication and optimisation of lubrication costs while assuring the conditions for a sustainable reliability for all equipment requiring lubrication.

2. Applicability

Maintenance cost management process is applicable to integrated cement plants, clinker plant, grinding and blending stations. Mobile equipment and railway engines and wagons are not subject of this process.

3. Prerequisites for Implementation

3.1. Processes

- [CIF Plant organization](#)
- [CIF Integrated people development](#)
- [CIF Production planning](#)
- [CIF Work order system](#)

3.2. Tools and systems

- [LafargeHolcim Asset Code System \(ACS\)](#)
- SAP Plant Maintenance (SAP PM) module with MAC-SAP standard customization or equivalent integrated Enterprise resource planning (ERP) solution

4. Process Description

Lubrication excellence process steps systematically follow a continuous improvement process as shown in the figure 1:

- identification of equipment lubrication needs,
- selection of appropriate lubrication application method,
- planning of lubrication execution,
- storage and handling of lubricants,
- lubrication tasks execution, and
- monitoring performance to sustain process continuous improvement

This process is based on the Maintenance management concept defined by [MAC \(Maintenance in Cement\)](#).

Preventive maintenance manager role is responsible to for implementation and continuous execution of Lubrication excellence process

4.1. Identification of equipment lubrication needs

Equipment lubrication needs are identified based on the information collected from equipment manuals and maintenance execution experience and collected information during previous maintenance activities.

All available information is consolidated in a so called **Lubrication chart** and will contain information about:

- equipment identification: ACS code and equipment type,
- equipment element to be lubricated,
- number of distinct lubrication points for this element,
- lubricant designation: lubricant name and type,
- installed quantity and for the cases where lubricant analysis is not economically feasible, the expected replacement frequency
- reapplication method, frequency and quantity to be applied, calculated based on elements technical characteristics,
- if applicable, lubricant sampling frequency for analysis,
- estimation of required personnel and duration for task execution.

[Lubrication Chart](#) will not cover mobile equipment, railway engines and hydraulic systems.

The list of required lubricants, necessary quantities and consumption pattern is extracted from the lubrication chart data consolidation. Based on these data and the estimation necessary quantity to overcome emergencies requiring oil top up or replacement, it is estimated the required stock level for each lubricant designation.

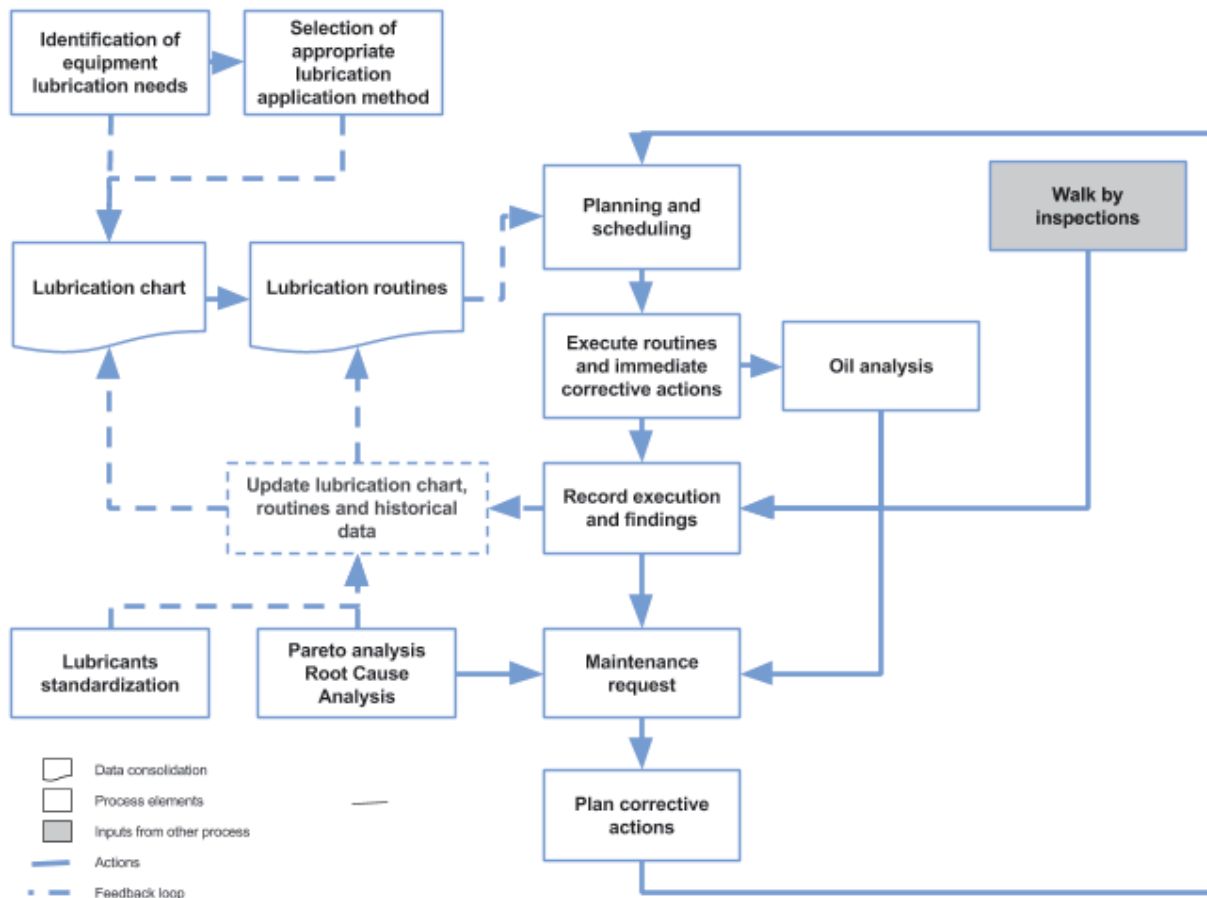


Fig 1. Lubrication Excellence process flow

4.2. Selection of appropriate lubrication application method

The identified lubrication needs are analyzed in order to determine the most appropriate method for lubricant application. Based on plant and individual equipment specificity preventive maintenance team must select the method to be used considering as targets:

- equipment criticality
- estimated equipment reliability increase
- restricted and high risk access for manual application
- personnel availability
- financial resources required

Methods to be considered as alternatives are:

- multipoints automatic central greasing installation,
- local automatic greasing with prefilled cartridges,
- lubricants spraying systems

Plant team analyzed and put in place all necessary actions to assure easy and safe access for lubrication activities to be performed on running conditions.

4.3. Planning and scheduling for lubrication execution

Information collected through the lubrication chart is grouped in logical sequences under lubrications routines.

Lubrications task will be grouped by execution frequencies, types of grease, equipment family and application method. Their development considers the logical path to go through the respective plant area, starting from the farthest point and the highest level, back to the maintenance workshop direction, considering the physical location of equipment to be lubricated.

Estimated duration to execute a routine considers:

- activity preparation,
- travel from workshop to the routine starting point,
- travels between each lubrication points during execution,
- execution time for each task, including cleaning,
- return time to workshop.

Estimated duration and requirements for personnel for each routines are used to leverage the load level for execution team. This is part of the general workload balancing of the preventive maintenance program.

Workload balance synchronize the planning of lubrication routines to be executed in stopped condition with the plant master schedule for equipment stops for preventive maintenance.

The final version of lubrication routines planning is defined as lubrication program and it is uploaded in the SAP PM as part of preventive maintenance program and set for automatic work order creation as PM02 work order types.

Lubrication work orders are part of the 13 weeks maintenance plan and of the weekly schedule as per Work order system.

4.4. Storage and handling of lubricants

In the lubrication excellence process there are two types of storages to be organized:

- **warehouse lubricants storage** - used to store all lubricant still part of the inventory under the lead of and responsibility of warehouse.
- **daily lubrication storage** - used to store lubricants for easy access and handling, necessary for daily lubrication tasks. Lubricants stocks on this storage are already booked as consumption and are not part of warehouse inventory, being under the lead and responsibility of lubrication team.

All lubricants storage facilities complies with the minimum requirements for appropriate storage condition as:

- used racks allow easy handling and appliance of the First-in First-out (FIFO) principle,
- handling of heavy lubricants containers is done by means of mechanized devices,
- oil spill containment systems are installed on all lubricants racks,
- storage spaces ensure minimum temperature variations and provide ventilation to limit condensation effect and high level of moistures,
- lubricants drums stored for longer periods are placed horizontally in a position to assure self seal,
- designated and labeled storage location per lubricant type,
- clear identification, date of production and entry in stock,
- safety data sheets are available in local language and easy accessible for all stored lubricants,
- warning signalization are posted in visible places according with the identified hazard,
- smoking and eating is prohibited in these spaces,
- fire detection and alarm systems are in place, linked with the plant general emergency alarm system,
- correct types of fire extinguishers and quantity are easy accessible in case of emergency
- used lubricants handling, storage, disposal and recording is done according with H&S and environmental regulation and plant specific waste disposal procedures.

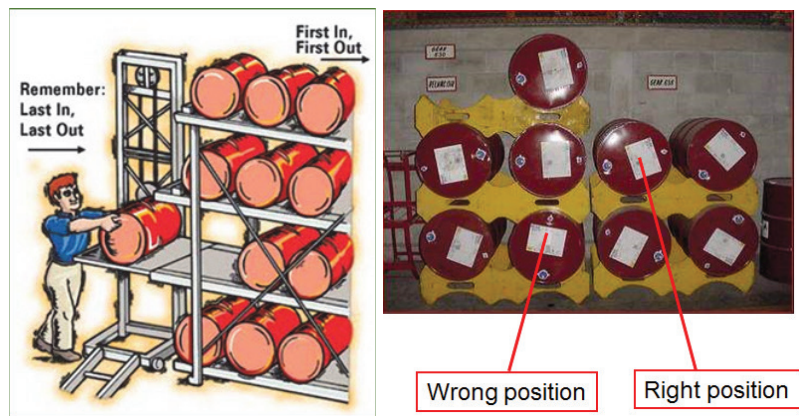


Fig 2. Examples of oil drum storage position and handling

Daily lubrication rooms are equipped with all necessary mobile and fixed tools for lubricants handling to avoid lubricant contamination during manipulation and temporary storing.

Handling process is set respecting minimum requirements as:

- new oils to be used for equipment requiring a high level of cleanliness are pre-filtered to reach the required level during transfer to dispenser system,
- a color code is defined and used for easy identification of lubricants and applied accordingly on containers, grease guns, oil and grease transfer pumps and oil filtration units.
The same code is used to identify lubricant used in equipment on the field.
An example is shown in the figure 3.
- lubrication tools and equipment are permanently kept clean and stored on contamination free rooms,
- lubricants are kept ready to be used only inside designated storage and access is facilitated around the clock for the cases when top up is necessary on emergency situations.
- oil storage containers are equipped with filter breathers.

4.5. Lubrication tasks execution

Lubrication tasks are executed according with established schedule by the specialized lubrication team.

For mobile equipment requiring daily/weekly re-greasing of joints, lubrication activities are performed by equipment operators before start of the shift on pre-defined frequency and with established quantities. These activities are part of operators routines tasks.

In case of activities requiring lubricant replacement, lubrication team will assure the correct handling and appliance by case through direct supervision or direct execution.



Fig .4 Example of lubricants color coding application

Oil sampling points enables collection of representative samples. Appropriate sampling devices and containers are used. Oil samples are labeled and required information is provided to be able to properly identify equipment and oil type for analysis traceability.

Simple analysis are performed in house and complex oil analysis are contracted with competent laboratories. For sensitive analysis, involving potential warranty claims, or potential supplier failures contra-probes are kept and contra-tests are done to independent laboratories, especially if the analysis are provided by the lubricants supplier.

4.6. Performance monitoring

Lubrication process performance is continuously monitored and analyzed through:

- walk by inspections performed by inspectors which targets lubricants levels in automatic lubrication equipment, gear boxes, transmission and hydraulic systems, lubricant spillages and sealing issues, bearings temperatures, visual check of lubricants quality, status of silica gel and normal breathers,
- oil and grease quality through analysis where relevant and feasible as cost level,
- active monitoring of grease and oil consumption,
- pareto charts analysis and Root cause analysis to determine solutions to be applied,
- lubricants standardization possibility studies to reduce the number of suppliers and types of lubricants used to enable inventory optimization and better condition for price negotiation,
- selection of most cost effective lubricants long term solution to ensure equipment reliability requirements by studying alternatives to lubricants in use (eg. mineral vs synthetic oil).

Conclusion from the analysis results are transposed in corrective actions and updates of lubrication chart and lubrication routines

5. Maturity elements

Element	Emerging level	Requirements for Basic level	Requirements for Advanced level	Requirements for Excellent level	Measured by
Identification of equipment lubrication needs	<ul style="list-style-type: none"> • Not all the requirements described for basic level are fully implemented or some of them are missing 	<ul style="list-style-type: none"> • Lubrication chart developed with all required information including oil sampling for analysis • Types of lubricants and quantities installed are identified 	<ul style="list-style-type: none"> • Lubrication chart data are used to define lubricants minimum required stocks for each lubricant designation • Lubricant chart contains reliable data about number of personnel and execution time required • Lubrication chart is reviewed at least once per year and as soon as deviations are identified 	<ul style="list-style-type: none"> • Lubrication chart is part of a dedicated software solution, easy accessible for all lubrication team members • Identified lubrication equipment needs are shared with other plants to be used on lubrication charts development 	<ul style="list-style-type: none"> • Schedule compliance [%] • Planning accuracy [%] • PM02 not performed, [#] • Oil consumption ratio (OCR) [#] • Number of failures related to lubrication [#]
Selection of appropriate lubrication application method		<ul style="list-style-type: none"> • Easy and safe access facilitated to all lubrication points • Breathers are installed and well maintain for all medium and big size gearboxes and lubrication tanks 	<ul style="list-style-type: none"> • Cartridge based automatic lubrication systems are installed as results of applications selection process targeting higher reliability at lowest cost • Silica gel breathers are installed and replaced on time for all medium and 	<ul style="list-style-type: none"> • Multipoint automatic lubrication systems in place replacing individual manual application installed as results of applications selection process targeting higher reliability at lowest cost 	

			big size gearboxes and lubrication tanks		
Planning of lubrication execution		<ul style="list-style-type: none"> • Lubrication routines are defined based on lubrication chart • Lubrication routines are planned and reviewed using the workload balancing 	<ul style="list-style-type: none"> • Lubrications routines execution time considers all phases required including preparation, travel time and execution • Lubrication program tasks are managed through the available ERP solution as part the general preventive maintenance program • Lubrication program is reviewed at least once per year and as soon as deviations are identified 	<ul style="list-style-type: none"> • Lubrication program is developed in a dedicated software solution, easy accessible for all lubrication team members • Lubrication program task work orders are automatically created as part of the preventive maintenance program in SAP • Lubrication program is reviewed and updated based on equipment utilization pattern • Lubrication program is part of the 13 weeks maintenance planning 	
Storage and handling of lubricants		<ul style="list-style-type: none"> • There is in place a lubricant storage as part of warehouse and one for daily lubrication activities under the lead of lubrication team. • Dedicated storage spaces are kept clean, dry and contamination free, • Storages are equipped with easy accessible rack, storage areas are labeled and segregated stored by type • Lubricants are appropriate labeled and segregated stored by type • Safety data sheets are available in local language in all storage locations for all lubricants in stock and easy accessible • Lubrication tools and handling devices available are kept clean and contamination free • Assuring proper disposal of 	<ul style="list-style-type: none"> • Oil storage racks allows appliance of FIFO principle • A color code is defined and used for lubricants identification and applied all lubrication tools and equipment on the field • 	<ul style="list-style-type: none"> • Lubricants storage spaces provide constant temperature, fire detection and 	

		lubricants and recording according to H&S and environmental requirements			
Lubrication tasks execution		<ul style="list-style-type: none"> Lubrications tasks are executed by the dedicated lubrication team 	<ul style="list-style-type: none"> Lubrication team is involved in all activities requiring lubricants replacement Oil sampling and analysis program covers all critical equipment, equipment with high oil quantities or special oil types with high cost Oil analysis results interpretations support decisions on corrective actions to eliminate the root cause Duration and planned operations are reviewed based on work order confirmations and lubrication routines are updated accordingly and workload balance updated 	<ul style="list-style-type: none"> Oil changes on all critical equipment, equipment with high oil quantities or special oil types with high cost is done only based on oil analysis results 	
Monitoring performance to sustain process continuous improvement		<ul style="list-style-type: none"> General tracking of oil consumption in place Lubrication chart is reviewed once per year and updated as soon as inaccurate information is identified or new information are acquired 	<ul style="list-style-type: none"> Oil consumption ratio reached and is maintained in the given target interval All failure due to lubrication failures and all incidents regarding lubrication are subject of RCA analysis and corrections action are put in place and results are actively monitored Regreasing frequencies and quantities applied are at reviewed least on yearly basis Lubricants stock requirements are regularly reviewed to minimize its level without compromising equipment reliability 	<ul style="list-style-type: none"> Plant actively act for lubrication standardization analysis solutions to reduce the number of different lubricants in use and the overall cost of lubrication 	

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
Lubrication chart and lubrication routines development Identification of lubrication requirements for all plant equipment and development of lubrication chart with all necessary details Prerequisite <ul style="list-style-type: none"> • <i>ACS implementation through entire plant</i> • <i>Preventive maintenance management role in place covering maintenance inspections, lubrication and condition monitoring</i> • <i>Preventive maintenance function as part of maintenance organization</i> 	6 month	Preventive maintenance manager, Lubrication team, Maintenance planning team. Lubrication management training Lubrication handling	CIF Preventive maintenance , Maintenance Management Standard Chapter 8 , Lubrication Management and organization Lubrication Chart Template Lubrication - Condition monitoring Lubrication - Oil analysis interpretation
Planning and scheduling for lubrication activities Workload balancing of all lubrication routines as part of preventive maintenance program. Transpose lubrication program in SAP task list and start the automatic PM01 work order generation for lubrication tasks Prerequisite <i>SAP and MAC-SAP are in place</i>	1 months	Preventive maintenance manager, Lubrication team, Maintenance planning team. MAC-SAP training: planning and scheduling	Maintenance Management Standard Chapter 7
Lubrication storage, daily lubrication room and lubricants handling Upgrade lubrication storage, daily lubrication room to match the defined requirements. Equip daily lubrication room with required tools and equipment	6 months	Preventive maintenance manager, Lubrication team,	Lubrication Storage and handling
Site preparation Prepare all equipment for safe and easy access for all running condition lubrication activities. Install appropriate lubrication devices and sampling points.	1 month	Preventive maintenance manager, Lubrication team, Maintenance execution team	

7. Document management

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