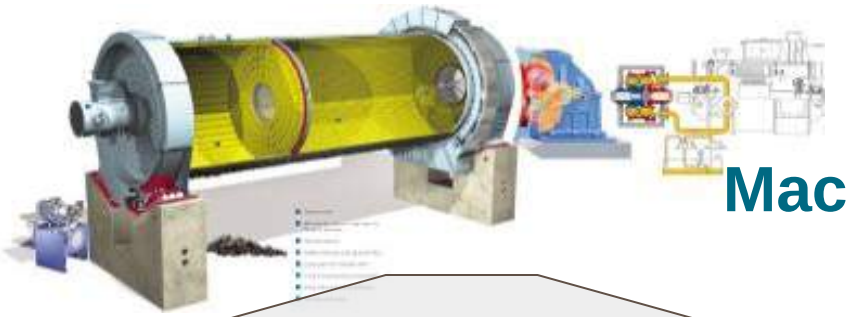
# Lubrication Management & Organization

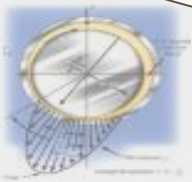
# Lubrication Management

## Objective:



**Machine availability**

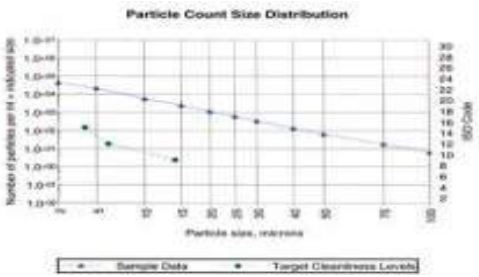
Lube Performance



Handle and storage

$$OCR = \frac{effective\ oil\ comsumption}{installed\ oil\ capacity}$$

KPI's




Troubleshooting

People

Application

Oil Analysis

# Agenda

Standard organization

Roles, responsibilities and required skills

Lubrication Chart

Oil Consumption Ratio (OCR)

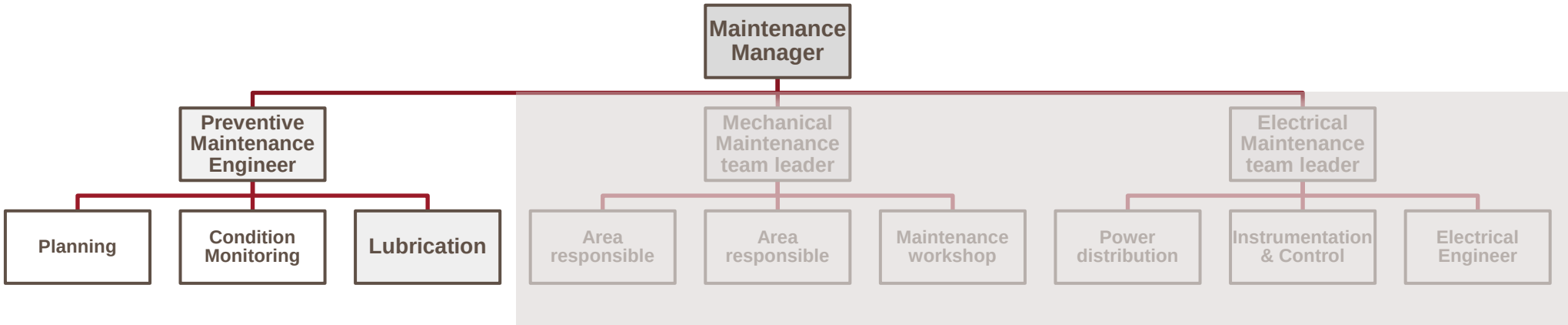
Re-lubrication

# Organization

- Lubrication function must cover activities such as:
  - lubricant selection,
  - lubricants storage,
  - handle,
  - preservation and
  - proper application.

- LafargeHolcim's lubrication strategy is to **centralize the lubrication** roles and responsibilities in the **Preventive Maintenance department**

# An efficient and effective Maintenance Organization




- **State of the art lubrication**
  - Wear & Tear control
  - Best knowledgeable people
  - Understanding effects of lubrication
- **Inspections**
  - Walk-by Inspections using the human senses
- **Condition monitoring**
  - Equipment monitoring with expertise and special tools
  - On-line surveillance

- **Root cause failure analysis**
  - Eliminate the need of intervention
  - Increase time between interventions
  - Reduce effort required on interventions
- **Failure history of parts and equipment**
  - Understanding of failure behavior
  - Understanding lifetime expectancy of parts and components

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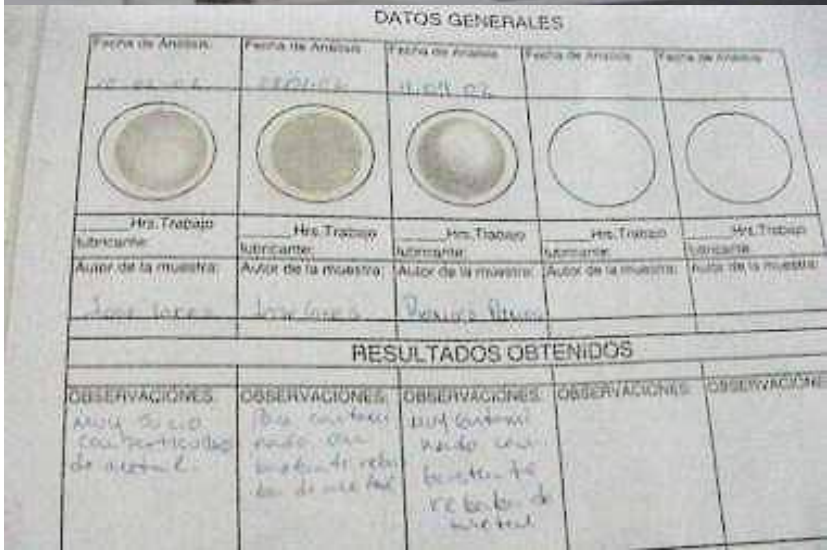
# Lubrication roles and responsibilities – Management

- Create **lubrication chart** and manage it
- Create an **oil sampling** program
- **Update routines** in management system (work load optimization)
- **Fill lubrication journal daily** (log book)
- Assure availability of Material **Safety Data Sheet** on workshop and medical service
- **Comunicate abnormal condition** and follow up (filter patch, pictures, temperature)



# Lubrication roles and responsibilities – Management

- Verify **oil inventory levels** on warehouse and workshop and storage condition
- Verify **filter elements inventory** and condition
- Maintain **lubric. identification labels** in the field
- Maintain in order the **cleanliness** of the lubrication workshop and tools
- Assure **proper disposal** and register according to environmental requirement

# Lubrication roles and responsibilities – Execution

- **Perform complete lubrication routines** according with PMR's
  - Equipment Inspection
    - oil leakages, temperature, lube pattern and consumption on pinion drive, lubrication cycles time per centralized systems, cleanness condition on support
  - Re lubrication and oil changes
    - Planning, schedule and execution
- Take the **oil samples** according to the program
- **Analyze sampling** results and share with vibration inspector

# Lubrication skills – Communication

- Suppliers
  - To optimize the performance of lubricant
  - Training and new developments
  - Discuss oil sampling results
- Maintenance and production department
  - Inform them about abnormal condition and discuss possibilities to repair
- Vibration inspector
  - Cross and correlate information with vibration measurements
- Planning
  - Create a notification and follow up

# Lubrication skills – Discipline

# Lubrication skills – Observation

- Visual inspection during the execution
  - Detailed inspection during grease or oil change

# Lubrication skills – Analysis

- Take out schedule samples and analysis for abnormal condition

# Lubrication Activities – Execution

- The execution must be done through WO generated by the system, for example:
  - Create the Work Order defining the job instructions, as well as technical information, safety instructions, materials, spare parts, tools, etc.
  - Be sure about the understanding of the instructions (Read the WO carefully)
  - Prepare the resources needed for the work (verify the condition of the tools, ensure the lubricant are the recommended to be used, cleaning media, etc,) and bring in the area in advance.
  - Prepare fire extinguisher and other safety equipment near to the area (if is needed)
  - Proceed to clean the equipment and surroundings (for clean up USE ONLY designated solvents).

# Lubrication Activities – Execution

- If some jobs has to be done while the equipment is not running, before executing the work be sure that the equipment is properly stopped by control room, the emergency buttons are pressed and the safety card is hanged on the equipment switch (the safety card must have the name of the technician working in place) and the technician is the only one allowed to remove the lock from it.
- It is important to cover or protect the work place from dust or any other contaminants.
- Drain the previous lubricant from the deposit (Check carefully the particles found in the oil / grease extracted form the equipment).
- Review the mechanical condition of the elements like bearings, gears, seals, etc,
- Clean /replace filters (breath filters / Oil filters)

# Lubrication Activities – Execution

- Refill the deposit with the new lubricant and with the right amount (Apply only what is specify on the lubrication table)
- Cover the equipment checking that all the screws are properly tighten (verify torque according to the specifications of the maintenance manual).
- Clean up the equipment and surroundings
- Remove the safety devices
- Test the equipment if needed (vibrations, temperature, leaks, etc)
- Inform the CCR operator the activities are finished
- Provide the feedback in the Work Order and in the Notification

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# Lubrication Chart

## Lubrication chart is the base of the lubrication program

- To develop the lubrication, it is required an adequate knowledge of
  - Lubricant properties
  - Selection and application
  - Lubrication and re-grease frequencies
  - Lubrication and re-lubrication methods

# Lubrication chart

- The lubrication chart consists of a template where all relevant information is gathered
  - Equipment identification including the specific lubrication points
  - Type, designation and amount of lubricant applied
  - Identification of activity type and the corresponding frequency,
  - together with all necessary information about:
  - Sampling, if required
  - Services
  - Inspections, frequency
  - Cleaning, frequency
  - Re-greasing or oil top-up, frequency and quantity
  - Grease or oil replacement, frequency

# Lubrication Chart

Holcim

## Lubrication Chart

Revision Date Nov 10

| Hac | Equipment Name | Element To Lubricate | Lubricant | | Quantity Installed | | Sample | ACTIVITY TYPE | | | | | | | | | | | | Lube Points | Application Method | Date Of Modification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Inspection | | Clean | | Condition Of Equipment | Reapplication | | | | Change | | | | | |
| | | | Type | Designation | Value | Unit | | Freq | Unit | Freq | Unit | | Freq | Unit | Quant. | Unit | Freq | Unit | | | | |
| 241-AD1 | Auxiliary Drive Gearbox | Auxiliary drive motor bearings | Grease | Lithol-24 | 0.2 | kg | | 1 | w | 1 | w | stopped | 6 | m | 0.20 | kg | 6 | m | | 2 | Manual | |
| 241-AD2 | Auxiliary Drive Gearbox | Auxiliary drive motor bearings | Grease | Lithol-24 | 0.2 | kg | | 1 | w | 1 | w | | 6 | m | 0.20 | kg | 6 | m | | 2 | Manual | |
| 241-SP1 | Pump YPY-800/400 | Motor bearings | Grease | Lithol-24 | 0.7 | kg | | 1 | w | 1 | w | | 6 | m | 0.70 | kg | 6 | m | | 2 | Manual | |
| 241-SP2 | Pump YPY-800/400 | Motor bearings | Grease | Lithol-24 | 0.7 | kg | | 1 | w | 1 | w | | 6 | m | 0.70 | kg | 6 | m | | 2 | Manual | |
| 241-SP3 | Pump YPY-800/400 | Motor bearings | Grease | Lithol-24 | 0.7 | kg | | 1 | w | 1 | w | | 6 | m | 0.70 | kg | 6 | m | | 2 | Manual | |
| 241-SP4 | Pump YPY-800/400 | Motor bearings | Grease | Lithol-24 | 0.7 | kg | | 1 | w | 1 | w | | 6 | m | 0.70 | kg | 6 | m | | 2 | Manual | |
| 241-VA1 | Slurry valve | Motor bearings | Grease | Lithol-24 | 0.15 | kg | | 1 | w | 1 | w | | 6 | m | 0.15 | kg | 6 | m | | 2 | Manual | |
| 241-VA3 | Slurry valve | Motor bearings | Grease | Lithol-24 | 0.15 | kg | | 1 | w | 1 | w | | 6 | m | 0.15 | kg | 6 | m | | 2 | Manual | |
| 241-VA7.M1 | Valve motor | Bearings of electric motor 5kW | Grease | Lithol-24 | 0.2 | kg | | 1 | w | 1 | w | | 6 | m | 0.20 | kg | 6 | m | | 4 | Manual packed lubr. | |
| 301-CA1 | Electric bridge crane l/c 12,5t | Bearings of electric motor 2,2kW | Grease | Lithol-24 | 0.1 | kg | | 1 | w | 1 | w | | 6 | m | 0.10 | kg | 6 | m | | 2 | Manual packed lubr. | |
| 302-CA1 | Electric bridge crane l/c 25t | Motor bearings | Grease | Lithol-24 | 0.2 | kg | | 1 | w | 1 | w | | 6 | m | 0.10 | kg | 6 | m | | 2 | Manual packed lubr. | |
| 361-AD1.M1 | Auxiliary Drive Electric motor | Auxiliary drive motor bearings | Grease | Lithol-24 | 0.3 | kg | | 1 | w | 1 | w | | 6 | m | 0.30 | kg | 6 | m | | 2 | Manual | |
| 361-MD2.M1 | Main Drive Electric motor | Auxiliary drive motor bearings | Grease | Lithol-24 | 0.3 | kg | | 1 | w | 1 | w | | 6 | m | 0.30 | kg | 6 | m | | 2 | Manual | |
| 361-MD4.M1 | Main Drive Electric motor | Auxiliary drive motor bearings | Grease | Lithol-24 | 0.3 | kg | | 1 | w | 1 | w | running | 6 | m | 0.30 | kg | 6 | m | | 2 | Manual | |

- The lubrication chart is an essential tool to structure and build lubrication PMR's

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Lubrication Chart

Oil Consumption Ratio (OCR)

Re-lubrication

# Oil Consumption Ratio (OCR)

- KPI measuring and evaluating the overall lubrication situation / performance of a plant, tracked on yearly base

$$\text{Oil consumption ratio} = \frac{\text{Total volume of oil replaced}}{\text{Total volume of oil installed}}$$

- Good practice value  0.45 to 0.85
- Only volume of oil installed over 5 liters shall be taken into consideration.
- Mobile equipment as e.g. trucks used in the quarry shall not be considered for the calculation

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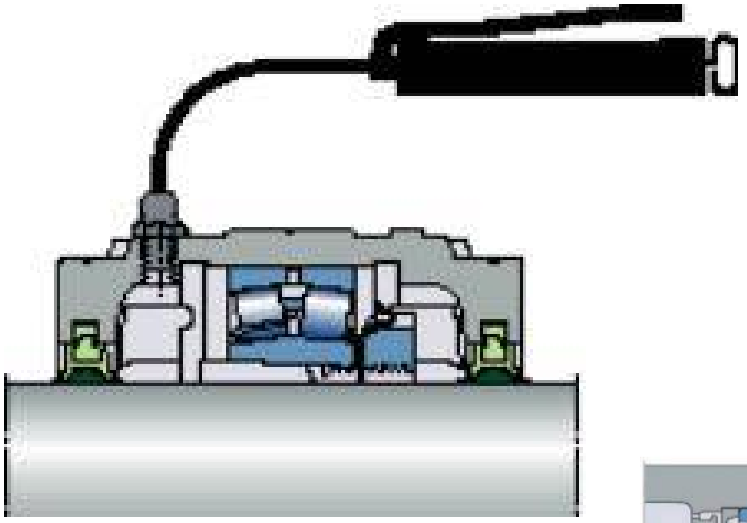
# Re-lubrication amounts

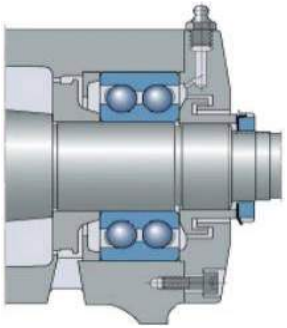
- Re-lubrication quantities suitable for each bearing are in a direct correlation with the bearing size and the location of the lubrication point related to the bearing

# Re-lubrication amounts

- Re-lubrication from the side

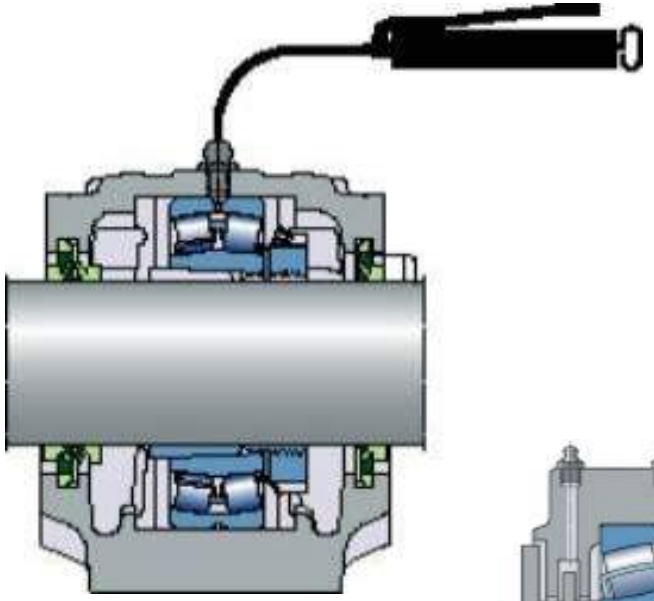
  $G_p = 0{,}005 * D * B$

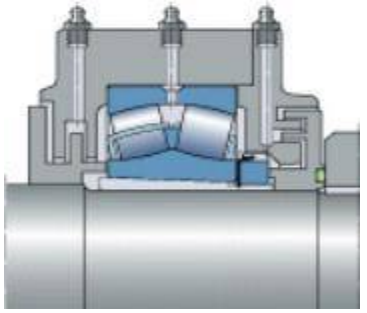




- Re-lubrication from the center

  $Gp = 0{,}002 * D * B$





where

$G_p$ = grease quantity to be added when replenishing, [g]

D = bearing outside diameter, [mm]

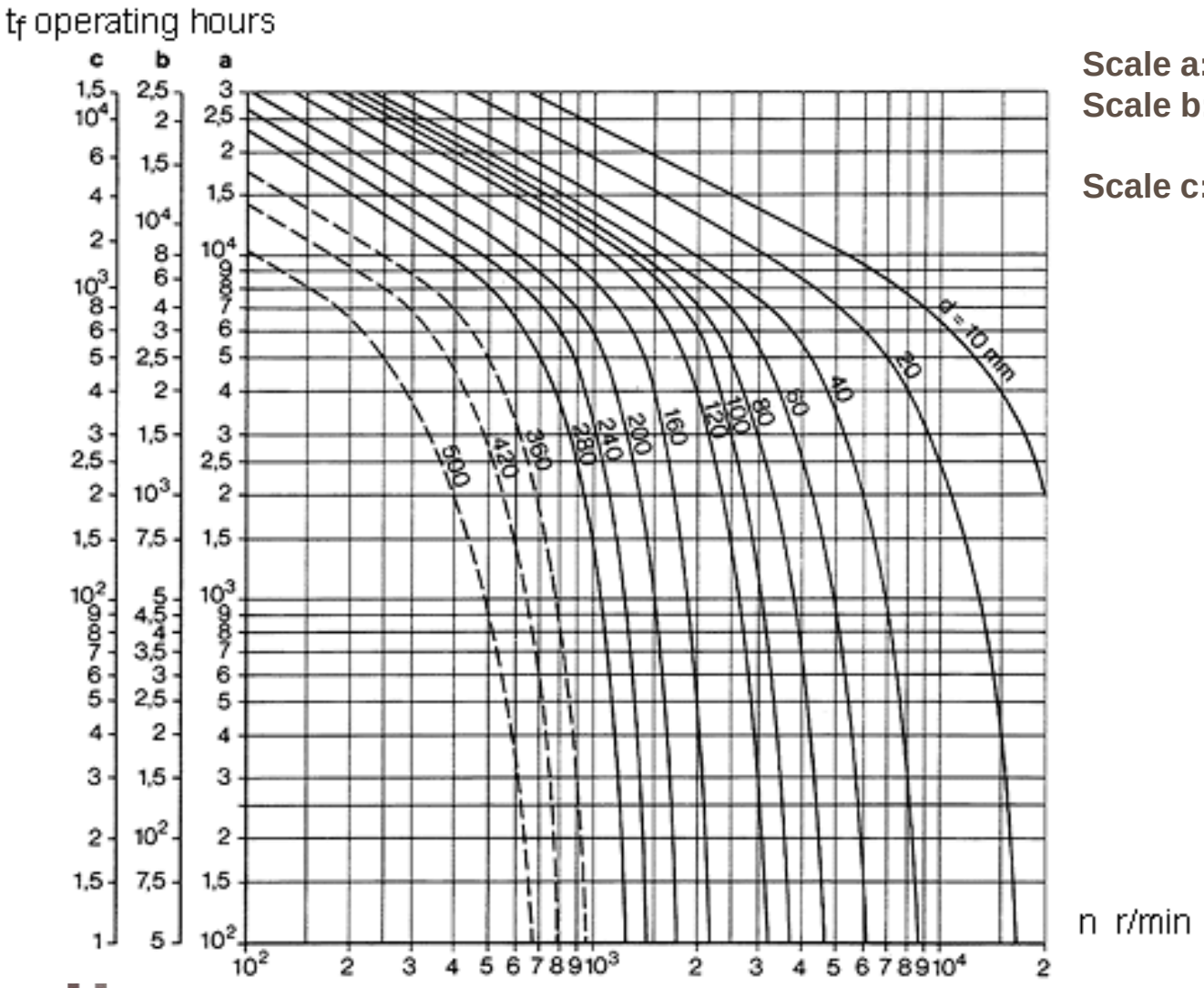
B = total bearing width (for thrust bearings use total height H), [mm]

# Re-lubrication intervals by SKF

- The time at which re-lubrication should be undertaken depends on many related factors.
  - bearing type and size,
  - speed,
  - operating temperature,
  - grease type,
  - space around the bearing and
  - the bearing environment.

- SKF recommends using experience based on data from actual applications and tests.

# Re-lubrication intervals by SKF old method



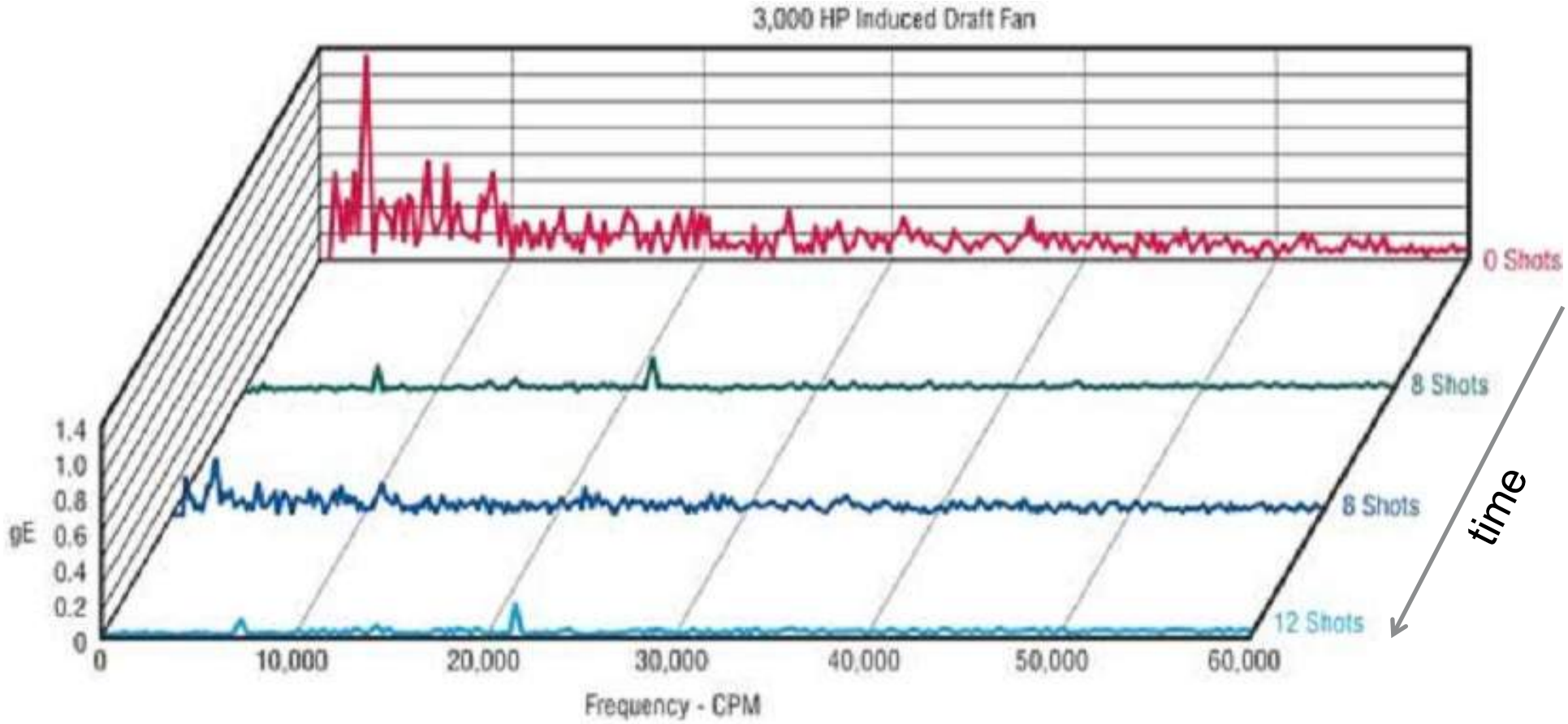

**Scale a:** Radial ball bearings

**Scale b:** Cylindrical roller bearings, needle roller bearings

**Scale c:** Sperical roller bearings, taper roller bearings, thrust ball bearings; full complement cylindrical roller bearings (0,2 tf);
Crossed cylindrical roller bearings with cage (0,3 tf); cylindrical roller thrust Bearings, needle roller thrust bearings, spherical roller thrust bearings (0,5 tf)

# Re-lubrication intervals by noise level method

- Establish re-greasing intervals according with the noise level. (SPM, Spike Energy, Enveloping)



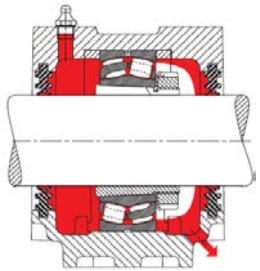
# Grease guns

- Lubrication technician need to know the output per stroke
- Factors to consider for standard grease guns:
  - How are you going to load the grease gun: suction, cartridge, bulk
  - What are the common lubrication quantity
  - What are the common type of grease fittings used in the facility
  - Where is the lubrication task being performed. Accessibility, customize grease gun per application

# Usage of grease gun – asic rules (1)

- Use caution and safety when prepare and using a grease gun and working around moving equipment.
- Regularly calibrate each grease gun based on used grease – establish the delivered quantity per stroke; mark each grease gun with this info.
- Vent plug or a relief port helps to flush old grease and reduce the risk of too much pressure on the bearing.
- Use extreme caution when loading grease into the grease gun to ensure that contaminants are not introduced.

  If using a cartridge, be careful when removing the metal lid that no metal slivers are introduced into the grease.
- Make sure the grease gun is clearly marked to identify the grease with which it should be charged.



# Usage of grease gun – basic rules (2)

- Always clean dispensing nozzle of the grease before using
- Always clean the grease fitting of all dirt before attaching the grease gun. Inspect and replace damaged fittings. Also clean the grease fitting after applying grease. Use grease-fitting caps..
- Ensure the proper grease is used at every grease point.
- Grease guns should be stored unpressurized in a clean, cool, dry area and in a horizontal position.

# Identification of grease points and grease guns

To prevent accidental incompatible greases:

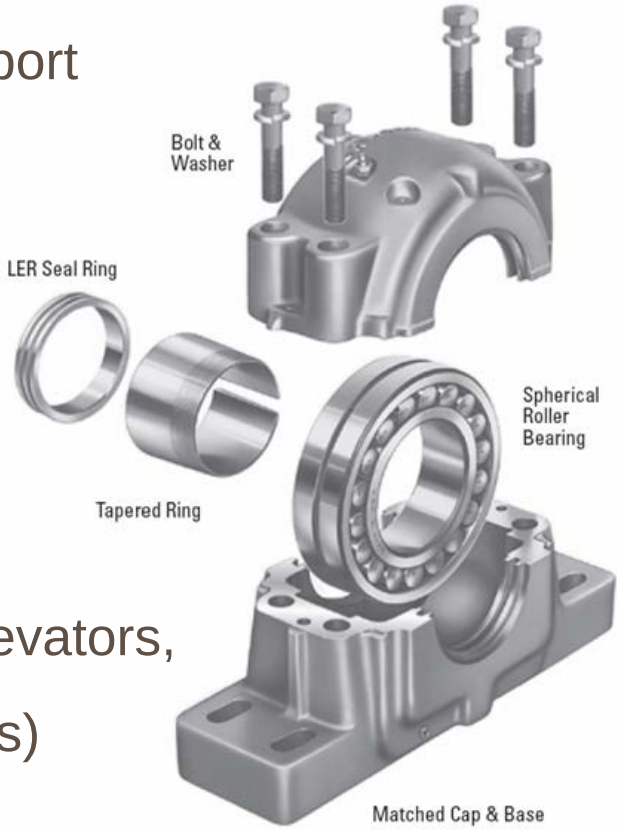
- Identify lubrication points and grease guns with proper labeling, color button head fittings, color dots or marks

# Change of grease

- To remove old grease, use an engine cleaning gun, always use dry air and a suitable degreaser.
- Before starting to clean the internal bearing, prepare first the working area, meaning clean around and from the out side of the bearing support before open, put in place all the tools which will be required, dust is the main factor which influences bearings performance.

# Change of grease

- After removing the used grease, fresh grease should first be packed between the rolling elements by hand, push the grease from one side of the bearing until the fresh grease goes out for the other side.
- The amount of grease in the free space of the support depends on the speed:
- If the bearing is running at high speed the free space should be filled 30% (e.g. fan and motor bearings)
- If the bearing is running at low speed the free space should be filled 50% (e.g. bucket elevators, screw conveyors, belt conveyors, hammer crushers)



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# Additional Slides

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