

**WELCOME**

**PRESENTATION ON**

**ENERGY CONSERVATION**

**THROUGH**

**HIGH PERFORMANCE LUBRICANTS**

**IN TEXTILE INDUSTRY**

**BEE – GTZ workshop for Textile Industry : TIRPUR 11-08-2010**

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**ENERGY CONSERVATION  
THROUGH HIGH PERFORMANCE  
LUBRICANTS: TEXTILE INDUSTRY**

**PRESENTED BY**

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## **MAJOR LUBRICANTS USED - TEXTILE INDUSTRY**

- **SPINDLE OIL**
- **DG SET OIL**
- **HYDRAULIC OIL**
- **GEAR OIL**
- **COMPRESSOR OIL**
- **HEAT TRANSFER OIL**
  
- **Presentation Coverage**
  - **Direct Electrical Energy Conservation through High Performance Lubricants**
  - **Lubricant Conservation for increased Profits & Save the Mother Earth**

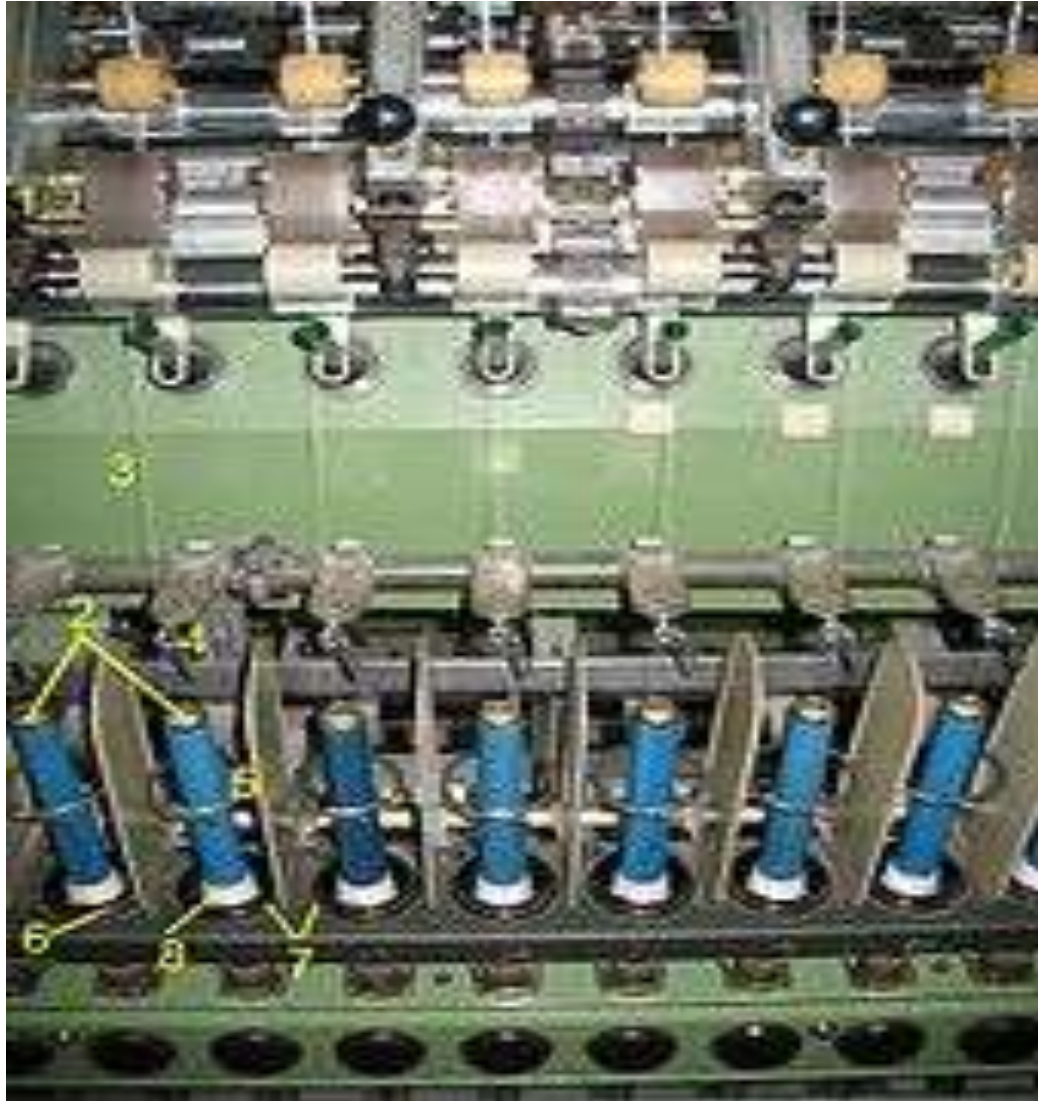
**DIRECT ELECTRICAL ENERGY CONSERVATION**  
**THROUGH**  
**HIGH PERFORMANCE LUBRICANTS**

## **ELECTRICAL ENERGY CONSERVATION - HIGH PERFORMANCE SPINDLE OIL**

- **CONVENTION SPINDLE OIL**
  - Base Oil + Additives ( Anti wear + Anti oxidant + Anti Corrosion + Anti Foaming )
- **Issues on Conventional Oil**
  - Unavoidable contamination of oil with lint's (Micro fibers from spinning yarn )
  - Mixing of lint's with oil leads to progressive thickening of Oil
  - Oil thickening leads to increased Viscosity of Oil
  - Thicker oil draws more power as it creates more resistance to the spindle movement
  - Progressively increase in power consumption
  - The additional Power consumption is estimated to the tune of 6% in Power Consumption

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## **Modern ring spinning frame**

- 1 Draughting rollers
- 2 Spindle
- 3 Attenuated roving
- 4 Thread guides
- 5 Anti-ballooning ring
- 6 Traveller
- 7 Rings
- 8 Thread on bobbin

## **ELECTRICAL ENERGY CONSERVATION - HIGH PERFORMANCE SPINDLE OIL**

- **PROBLEM WITH CONVENTION SPINDLE OIL**
  - Inability to prevents mixing of the lint's with the oil
- **Solution**
  - Improve the quality of the spindle oil so as to prevent 3mixing of the lint's with the oil and thus prevent progressive oil thickening
  - **HIGH performance SPINDLE oil**
    - Conventional Spindle Oil + Dispersant Additive
  - **Dispersant additive**
    - Does not allow lint's to mix with oil as it makes the lint's dispersed in the oil
    - Progressive oil thickening prevented
  - **No increased Power Consumption**

## **ELECTRICAL ENERGY CONSERVATION - HIGH PERFORMANCE SPINDLE OIL**

- **RESULT OF USING HIGH PERFORMANCE SPINDLE OIL**
  - **Estimated power Saving of 6% in Electrical Energy Consumption**
- **Validation**
  - **The Oil was initially developed in active co-operation between OIL Company (BPCL) and ATIRA**
  - **Power Saving was established through actual Field trail in ATIRA affiliated Textile Mills**
  - **Further validation time to time by SITRA and other Textile organization**

<b>Oil Co.</b>	<b>Conventional Oil</b>	<b>Energy Efficient Oil</b>
IOCL	Servo Spin	Servo Spin EE
BPCL	Hydrol / Spindle oil	Textrol

**The above are guidance purpose only. Please get the advise from lube marketing Companies for the right oils for your machinery**

**ELECTRICAL ENERGY CONSERVATION - HIGH PERFORMANCE OTHER CATEGORY OF OILS**

- **Similar Developments in other Category of oils**
  - **Energy Saving Gear Oils**
  - **Energy Saving Engine Oils**
    - **2 to 3 % savings in Energy Consumption**
    - **Improved formulation with High Performance Friction Modifier Additives**

**LUBRICANT CONSERVATION**

**FOR**

**INCREASED PROBIT & SAVE THE MOTHER EARTH**

## **LUBRICANT CONSERVATION : CRITICAL AREAS**

- **Lubricant storage, handling & Dispensing**
- **Oil de-toriation during storage**
- **Lubricants consumption in the equipment**
- **Re-refining & recycling of lubricant**

**. . . . Creating awareness & Training of staff is prime important to Lubricant Conservation**

## **STORAGE, HANDLING & DISPENSING**

- **Avoid Leakage & Spillage while storing & dispensing**
  - **Use proper decanting equipment (Mechanical pumps & Lube dispenser ) to avoid the spillage**
  - **Ensure Proper handling of Barrels to avoid damage and further leakage**
  - **Weathering of barrels leading to corrosion of barrels**
- **Care should be taken to take out all the oil from barrels ( No left over oil in the barrel.**

## **OIL DETORINATION : STORAGE**

- **Water contamination**
  - **Rain water / Breathing in & out action**
    - **Covered storage shed**
    - **9 O' Clock / 3 O'clock storage position of barrel bunks**
- **Dust & Particulate Contamination**
  - **Always keep the barrels tightly capped after each decantation**
  - **Cover the barrels with plastic sheets wherever the dusty atmosphere is encountered**
- **Long Storage time in the shed**
  - **Follow FIFO ( first in - first out)**

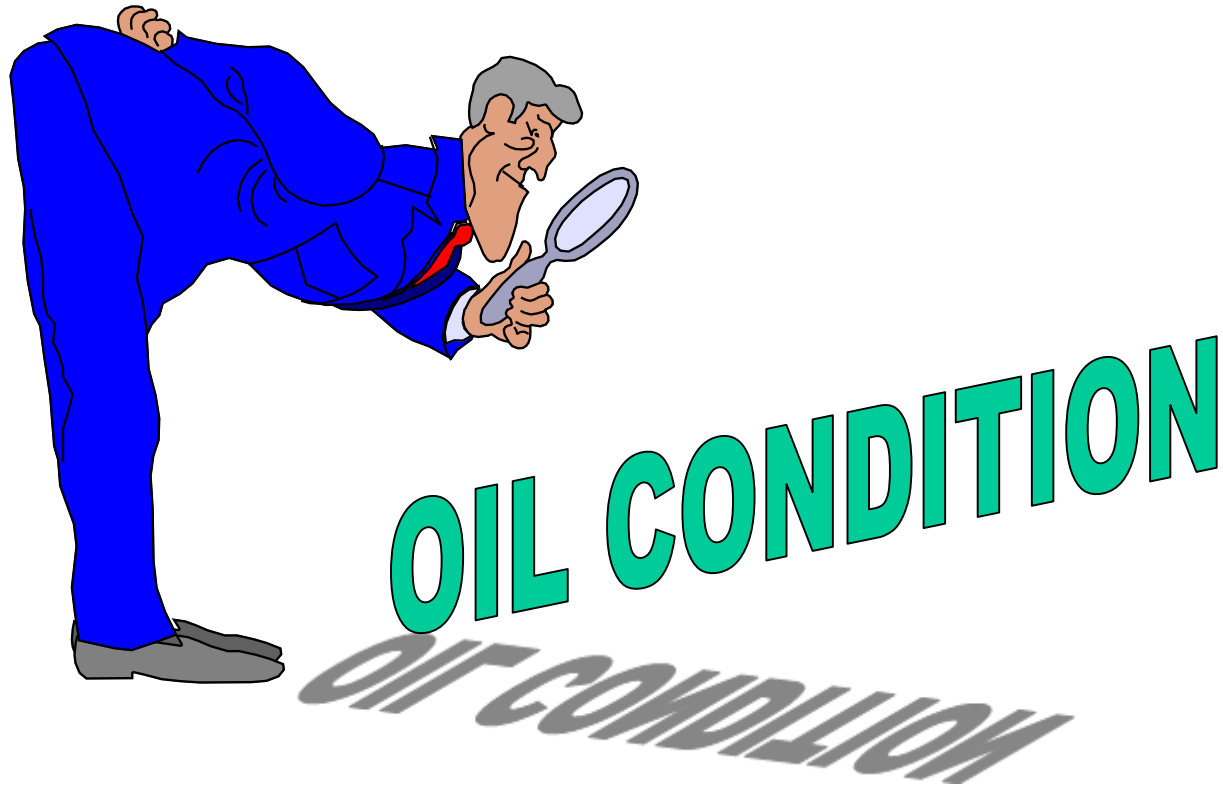
## **LUBRICANT CONSUMPTION CONTROL IN EQUIPMENT**

- **Switching over to high performance long drain oil**
  - **Engine Oil**
    - **Increased Drain period oils**
      - 10000 KMs to 22000 Kms
  - **Compressor Oils**
    - **Long drain Compressor Oils**
      - Double the Oil life
  - **Gear Oils**
  - **Hydraulic Oils**
- **Besides Oil saving the biggest benefit is the saving in downtime of machineries attributed to oil changing**

## **LUBRICANT CONSUMPTION CONTROL IN EQUIPMENT**

- **Regular monitoring practice to avoid leakage of lubricants**
  - Damaged seals / Leaky joints, drains
- **Use of the right quality of the oil**
  - Inadequate properties lead to faster deterioration & premature change of oil
- **Modification in the mode of Lubrication**
  - Total loss to bath lubrication
  - Control bulk oil temperature
- **Adopt Scientific lubricants replacement method**
  - Condition Monitoring Technique.

## **CONDITION MONITORING OF LUBE OIL**



## **OIL CHANGE SCHEDULE FOLLOWED IN INDUSTRY**

- **After Fixed Hour of use based on the equipment supplier recommendation**
  - **very conservative oil change period keeping in mind the severest working conditions encountered**
  - **In built safety to take care of extreme working condition**
  - **Oil is changed much before it loses its useful life**

**. . . . There exist the scope to increase the oil replacement intervals**

## **CONDITION MONITOREING TECHNIQUE**

- **Scientific way of assessing the useful life of Oil**
- **Set Rejection limit limits for oil change**
- **Help to take Proactive action on equipment working**
- **Help to establish the Application requirement on oil quality**
- **Help to establish the actual service life of the oil**
- **Help to reduce the scheduled downtime of the equipment for oil change**

## **CONDITION MONITORING OF LUBE OIL**

- **Oil analysis through condition monitoring is**
  - **To assure the user that the oil is in good condition**
  - **Advise remedial action in good times**
  - **Makes positive contribution to the efficient operation of the Equipment & its reliability.**
- **Allows customer to extend the periods from two oil change**
  - **Savings in oil cost**
  - **Equipment downtime cost**
- **The cost of oil change may be very high where the system capacities are large, But if the oil is contaminated or otherwise deteriorated to the extent failure occurs, the cost to rectify is multifold compared to oil change**

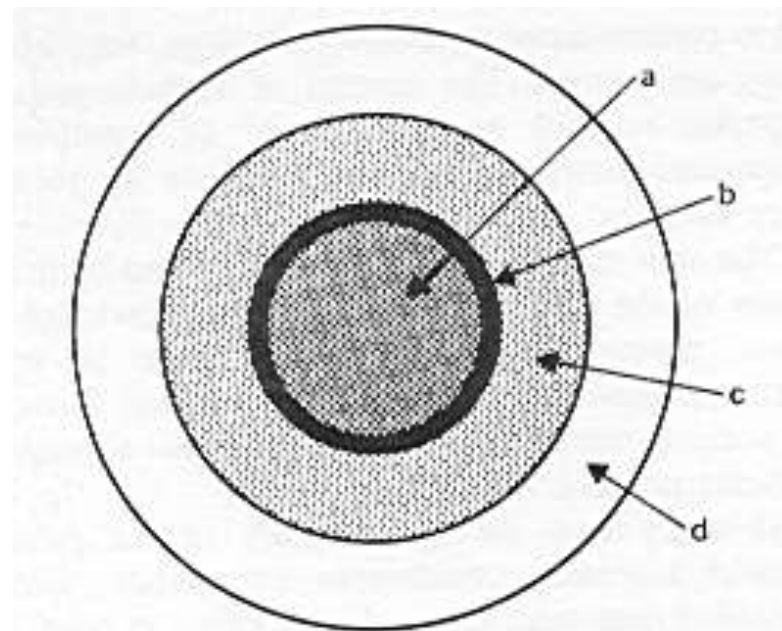
## **HOW TO PROCEED : CONDITION MONITORING**

- **Identifying the areas for Condition monitoring**
  - **Large lubrication system in the industry**
  - **Large number of similar equipment**
  - **Criticality of the equipment**
    - **Reduce costly Down time**
- **Identify the sampling points & intervals**
  - **Equipment / oil quality**
- **Testing of the used oil sample : Physio - Chemical characteristics**
- **Setting Rejection limits**

## **SAMPLING DURING CONDITION MONITORING**

- **Fresh oil / First sample at 5 minutes of operation**
- **Further sampling depends on the Oil change period recommended by the manufacturer.**
- **Minimum 4 samples during the recommended drain interval**
- **Then on more frequent sampling based on the previous test results of the used oil sample**

## **SPOT TEST ON USED OIL**



**Fig. 7.13 Idealized spot test.**

- |                          |                         |
|--------------------------|-------------------------|
| <b>a</b> Deposition zone | <b>c</b> Diffusion zone |
| <b>b</b> Edge            | <b>d</b> Oil zone       |

## **WATER DETECTION AT SITE**

**Procedure:** 2 drops of oil on a plate heated to 320°F

### **Observation**

No visible or audible change



Very small bubbles (≈0.5 mm) produced and quickly disappear



Bubbles approximately 2 mm are produced, gather to center, enlarge to ≈4 mm, disappear quickly



Bubbles ≈2-3 mm are produced growing to ≈4 mm, process repeats, possible violent bubbling and audible crackling



### **Approximate Water Present**

No free or emulsified water

0.05 - 0.1%  
500 - 1000 ppm

0.1 - 0.2%  
1000 - 2000 ppm

0.2 and more  
>2000 ppm

## **PARAMETERS MONITORED ON THE USED OIL SAMPLE**

- **Oil Characteristics**
  - Appearance / Colour
  - Water (Crackle test / Laboratory test)
  - Kinematic Viscosity / VI
  - TBN - Total Base Number
  - TAN - Total Acid Number
  - Pentane / Toluene Insoluble
  - Flash Point (For Engine Oil)
  - Trace Metal Analysis

## **INFERENCE FROM CHARACTERISTICS MONITORED**

- **Appearance**
  - **Black colourisation in used oils indicate oxidation of the oil / contamination with soot particles / additive change**
- **Viscosity**
  - **Viscosity increase / decreases with deterioration / contamination of the oil**
- **Water Content**
  - **Promotes corrosion / emulsification of the oil**
  - **Many EP additives hydrolyses with entrained water**

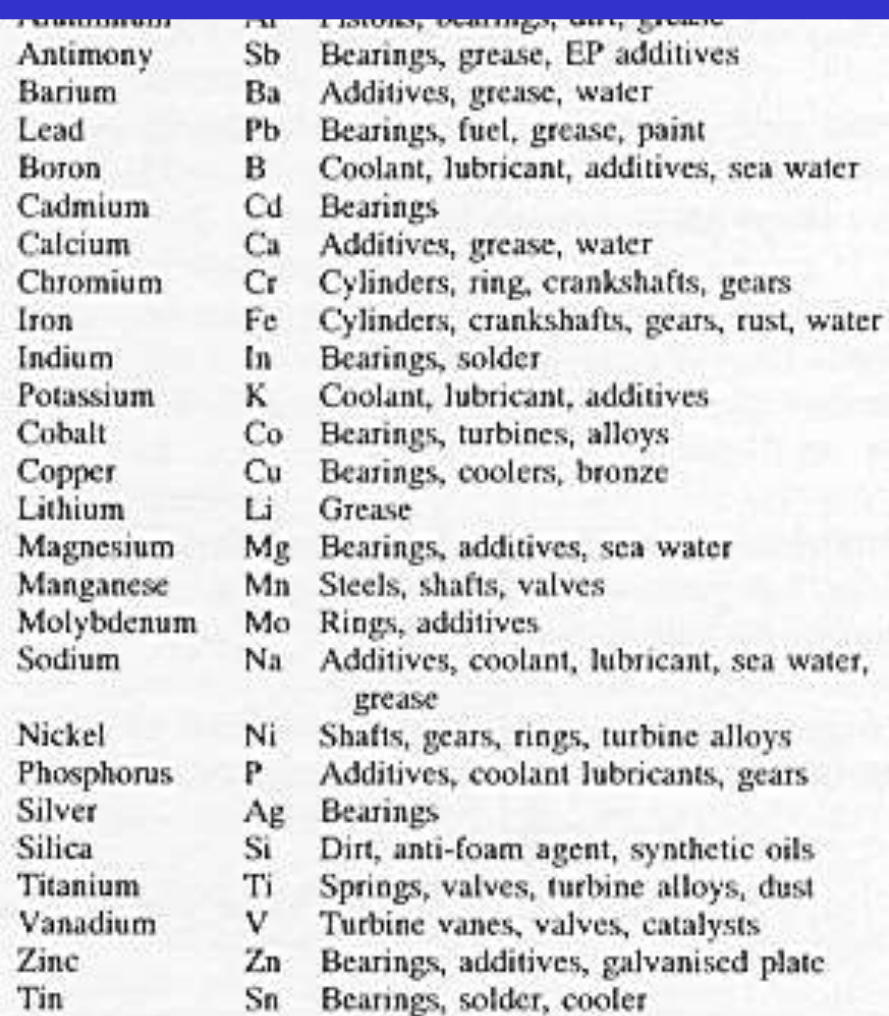

## **THE ORIGIN OF VISCOSITY CHANGES IN USED OIL**

	<b>Decreases Viscosity</b>	<b>Increases Viscosity</b>
<b>Changes to Base oil ( Molecular Changes)</b>	<ul style="list-style-type: none"><li>● Thermal Cracking of Oil molecules</li><li>● Shear thinning of VI Improvers</li></ul>	<ul style="list-style-type: none"><li>● Polymerisation</li><li>● Oxidation</li><li>● Evaporative Losses</li><li>● Formation of carbon &amp; oxide insoluble</li></ul>
<b>Additions to base oil (Contamination)</b>	<ul style="list-style-type: none"><li>● Fuel</li><li>● Refrigerant</li><li>● Solvents</li><li>● Wrong oil (Low viscosity)</li></ul>	<ul style="list-style-type: none"><li>● Water (Emulsion)</li><li>● Aeration</li><li>● Soot</li><li>● Antifreeze</li><li>● Wrong Oil (high viscosity)</li></ul>

## **INFERENCE FROM CHARACTERISTICS MONITORED**

- **Insoluble**
  - Metal debris, flakes from reaction products from EP additives and metal from running surfaces and organic compound from the oxidation of the oil are found as insoluble.
- **TAN**
  - Increase in TAN indicates initial or progressive acidification of the oil
- **Trace Metal Analysis**
  - Determination of all metal component present in the used oil
  - The source of wear particles can be pin pointed

**ORIGIN OF METAL  
IN  
LUBRICATING OIL**



Aluminum	Al	Pistons, bearings, dirt, grease
Antimony	Sb	Bearings, grease, EP additives
Barium	Ba	Additives, grease, water
Lead	Pb	Bearings, fuel, grease, paint
Boron	B	Coolant, lubricant, additives, sea water
Cadmium	Cd	Bearings
Calcium	Ca	Additives, grease, water
Chromium	Cr	Cylinders, ring, crankshafts, gears
Iron	Fe	Cylinders, crankshafts, gears, rust, water
Indium	In	Bearings, solder
Potassium	K	Coolant, lubricant, additives
Cobalt	Co	Bearings, turbines, alloys
Copper	Cu	Bearings, coolers, bronze
Lithium	Li	Grease
Magnesium	Mg	Bearings, additives, sea water
Manganese	Mn	Steels, shafts, valves
Molybdenum	Mo	Rings, additives
Sodium	Na	Additives, coolant, lubricant, sea water, grease
Nickel	Ni	Shafts, gears, rings, turbine alloys
Phosphorus	P	Additives, coolant lubricants, gears
Silver	Ag	Bearings
Silica	Si	Dirt, anti-foam agent, synthetic oils
Titanium	Ti	Springs, valves, turbine alloys, dust
Vanadium	V	Turbine vanes, valves, catalysts
Zinc	Zn	Bearings, additives, galvanised plate
Tin	Sn	Bearings, solder, cooler

## **WEAR PATTERN & WEAR METAL SHAPE**

- **Rubbing wear**
  - **< 15 microns, Smooth appearance, flat platelet with sharp edges**
- **Cutting Wear**
  - **Curled up shape like machining swarp**
  - **mainly by coal dust, environmental dust , abrasive quartz particle**
- **Severe Sliding Wear**
  - **> 15 microns, Irregular platelet**
  - **Excessive surface loading / Poor lubrication**

## **REJECTION LIMITS FOR ENGINE OIL**

<b>SL.NO</b>	<b>CHARACTERISTIC</b>	<b>LIMITS</b>
1.	KINEMATIC VISCOSITY, @ 100°C, cST	+ 25%
2.	PENTANE INSOLUBLES, %WT.	2.5% MAX
3.	TOTAL BASE NO., mg KOH/gm	50 % OF FRESH OIL
4.	WATER, VOL%	0.5% MAX
5.	FLASH POINT, COC, °C	200 MIN
6.	TRACE METALS, ppm Al, Cr, Cu, Fe, Pb & Si	MAX : 40, 40, 40, 100, 100 & 20

**Rejection limit given above are for guidance purpose only. These limits will vary depending on the OEMs requirements & lubrication systems**

## **REJECTION LIMITS FOR HYDRAULIC OIL**

<b>SL. NO.</b>	<b>CHARACTERISTIC</b>	<b>LIMITS</b>
1.	<b>KINEMATIC VISCOSITY @ 40°C, cST</b>	<b>+15 % MAX</b>
2.	<b>WATER CONTENT, VOL %</b>	<b>0.2% MAX</b>
3.	<b>PENTANE INSOLUBLES, % WT.</b>	<b>0.2% MAX</b>
4.	<b>INCREMENTAL ACIDITY, mg KOH/gm</b>	<b>1.0 MAX</b>

**Rejection limit given above are for guidance purpose only. These limits will vary depending on the OEMs requirements & lubrication systems**

## **REJECTION LIMITS FOR TURBINE OIL**

<b>SL. NO.</b>	<b>CHARACTERISTIC</b>	<b>LIMITS</b>
1.	<b>KINEMATIC VISCOSITY @ 40°C, cST</b>	<b>+/- 10 % MAX</b>
2.	<b>WATER CONTENT, VOL %</b>	<b>0.2% MAX</b>
3.	<b>TOTAL ACID NUMBER (Max. Increase) mg KOH/gm</b>	<b>0.3</b>
4.	<b>Calcium Content (Max. PPM)</b>	<b>10</b>

**Rejection limit given above are for guidance purpose only. These limits will vary depending on the OEMs requirements & lubrication systems**

## **REJECTION LIMITS FOR GEAR OIL**

<b>SL. NO.</b>	<b>CHARACTERISTIC</b>	<b>LIMITS</b>
<b>1.</b>	<b>KINEMATIC VISCOSITY @ 40°C, cST</b>	<b>+/- 25 % MAX</b>
<b>2.</b>	<b>WATER CONTENT, VOL %</b>	<b>0.2% MAX</b>
<b>3.</b>	<b>PENTANE INSOLUBLES % Max.</b>	<b>0.5</b>

**Rejection limit given above are for guidance purpose only. These limits will vary depending on the OEMs requirements & lubrication systems**

## **GREASE : CONDITION MONITORING**

- **Condition Monitoring is not done for reuse of the Greases**
- **But this technique is used for analysing the reason for bearing failure / malfunction of equipment**

## **USED GREASE ANALYSIS**

- **Dropping Point**
- **Penetration**
- **Appearance**
- **Colour**
- **Ash**
- **Trace Metal**
- **Water**
- **Insoluble Matters**

## **CASE STUDY ON CONDITION MONITORING**

<b>ENGINE</b>	<b>---</b>	<b>KIRLOSKAR CUMMINS DG</b>
		<b>SET 1000 KVA, 1500 RPM</b>
<b>CUMULATIVE</b>	<b>---</b>	<b>6000 HRS.</b>
<b>RUNNING HRS.</b>		
<b>SUMP CAPACITY---</b>		<b>190 LTR.</b>
<b>EARLIER OIL</b>	<b>---</b>	<b>SAE 40 HD TYPE-3</b>
<b>TRIAL OIL</b>	<b>---</b>	<b>MIL-C- MG OIL</b>
<b>CHANGE PERIOD</b>	<b>---</b>	<b>250 HRS.</b>
<b>( EARLIER )</b>		
<b>CHANGE PERIOD</b>	<b>---</b>	<b>400 HRS.</b>
<b>( AFTER TRIALS )</b>		

## **CASE STUDY ON CONDITION MONITORING**

<b>ENGINE</b>	<b>---</b>	<b>SKODA, CHD PRAHA</b>
		<b>GEN SET 860 KVA, 375 RPM</b>
<b>CUMULATIVE</b>	<b>---</b>	<b>4500 HRS.</b>
<b>RUNNING HRS.</b>		
<b>SUMP CAPACITY</b>	<b>---</b>	<b>630 LTR.</b>
<b>EARLIER OIL</b>	<b>---</b>	<b>SAE 40 HD TYPE-3</b>
<b>TRIAL OIL</b>	<b>---</b>	<b>SAE 40 - MIL-L-C OIL</b>
<b>CHANGE PERIOD</b>	<b>---</b>	<b>500 HRS.</b>
<b>( EARLIER )</b>		
<b>CHANGE PERIOD</b>	<b>---</b>	<b>1250 HRS.</b>
<b>( AFTER TRIALS )</b>		

## **USED OIL ANALYSIS : REMOVAL OF IMPURITIES**

<b>METHOD OF REMOVAL</b>	<b>DUST /DIRT</b>	<b>METAL PARTS</b>	<b>UNBURNT FUELS</b>	<b>WATER</b>	<b>OXIDATION PRODUCTS</b>
<b>FILTRATION</b>	<b>YES</b>	<b>YES</b>	<b>-</b>	<b>-</b>	<b>PARTIAL</b>
<b>GRAVITY PUR.</b>	<b>YES</b>	<b>YES</b>	<b>-</b>	<b>YES</b>	<b>PARTIAL</b>
<b>CENTRIFUGE</b>	<b>YES</b>	<b>YES</b>	<b>-</b>	<b>YES</b>	<b>PARTIAL</b>
<b>DEHYDRATION</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>YES</b>	<b>-</b>
<b>DISTILLATION</b>	<b>-</b>	<b>-</b>	<b>YES</b>	<b>YES</b>	<b>-</b>
<b>MAGNETIC SEP</b>	<b>-</b>	<b>YES</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>ACID TREATMENT</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>YES</b>

## **METHODS OF RE-REFINING**

- **MECHANICAL FILTRATION**
  - **AREA OR EDGE TYPE STRAINERS**
  - **DEPTH FILTERS :**
  - **ABSORBENT TYPE**
  - **ADSORBENT TYPE**
  - **GRAVITY SETTLING**
- **VACUUM DEHYDRATION**
- **CENTRIFUGAL SEPARATION**
- **MAGNETIC FILTRATION**
- **CHEMICAL TREATMENT PROCESSES**
  - **ACID / CLAY (I.I.R)**
  - **DISTILLATION / CLAY (R.R.L. JORHAT)**
  - **INSTITUTE OF PETROLEUM (IFP)**

## **RE-CYCLING & RECLAMATION OF LUBRICANTS**

- **Economical to put up plant for very high consumption units**
  - (e.g.) Steel Plant, Mines etc.
- **Collect & give to approved re-refiners**

**R ARUMUGAM**  
**BEE CERTIFIED ENERGY AUDITOR**

**THANK YOU**



**IT WAS MY PLEASURE TO INTERACT WITH ALL OF YOU**