

10 Steps of Lubrication Reliability



BRCE Workshop for Maintenance & Reliability Professionals

- Brief introduction
- Lubrication Technology
- Case studies
- The 10 Components of Lubrication Reliability
- Conclusion
- Management approach
- Checklist for basic auto assessment
- Questions .

Lubrication Reliability INTRODUCTION



- Company : Lubretect bvba
- Goal : Excellence & World Class Maintenance
- Strategy : **Lubrication Reliability**
- Implement : Lubrication Reliability program
- Tools : (10) Lubrication Best Practices & Equipment



WHY ?

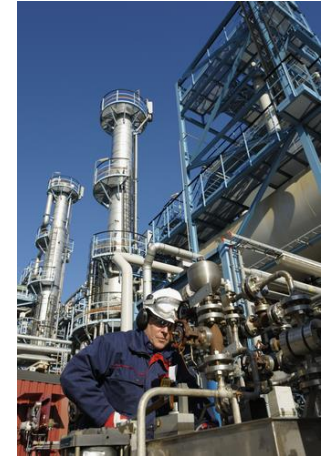


**BAD
Practice**



- Industrial production equipment Reliability:
 - Critical Mecanical components
 - Rotating equipment
 - Pumps, compressors, mixers, fans, ..
 - Bearings, gears
 - Lubrication techniques
 - Lubricants , oils & greases, hydraulics

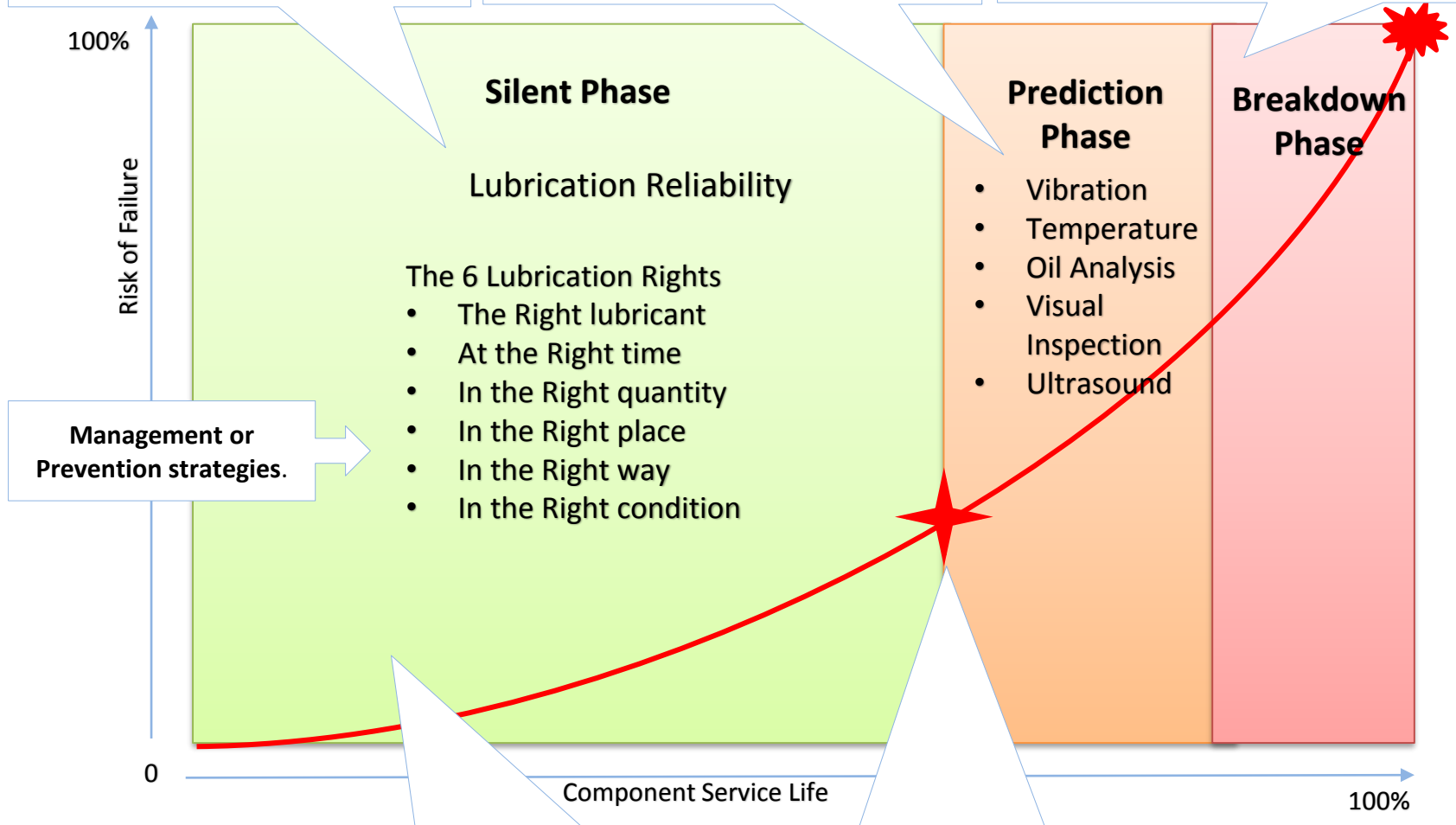
- Lubricants are the blood of your equipment
 - Right Type – Brand – Viscosity – etc.
 - Right Quantity
 - Right Temperature
 - Right Pressure / flow
 - Right Cleanliness level (ISO4406)



Silent Phase : where wear or damage is occurring due to inadequate lubrication conditions.

Prediction Phase : wear or damage is detectable by traditional Como like Vibration, Temperature, Visual Inspections,...

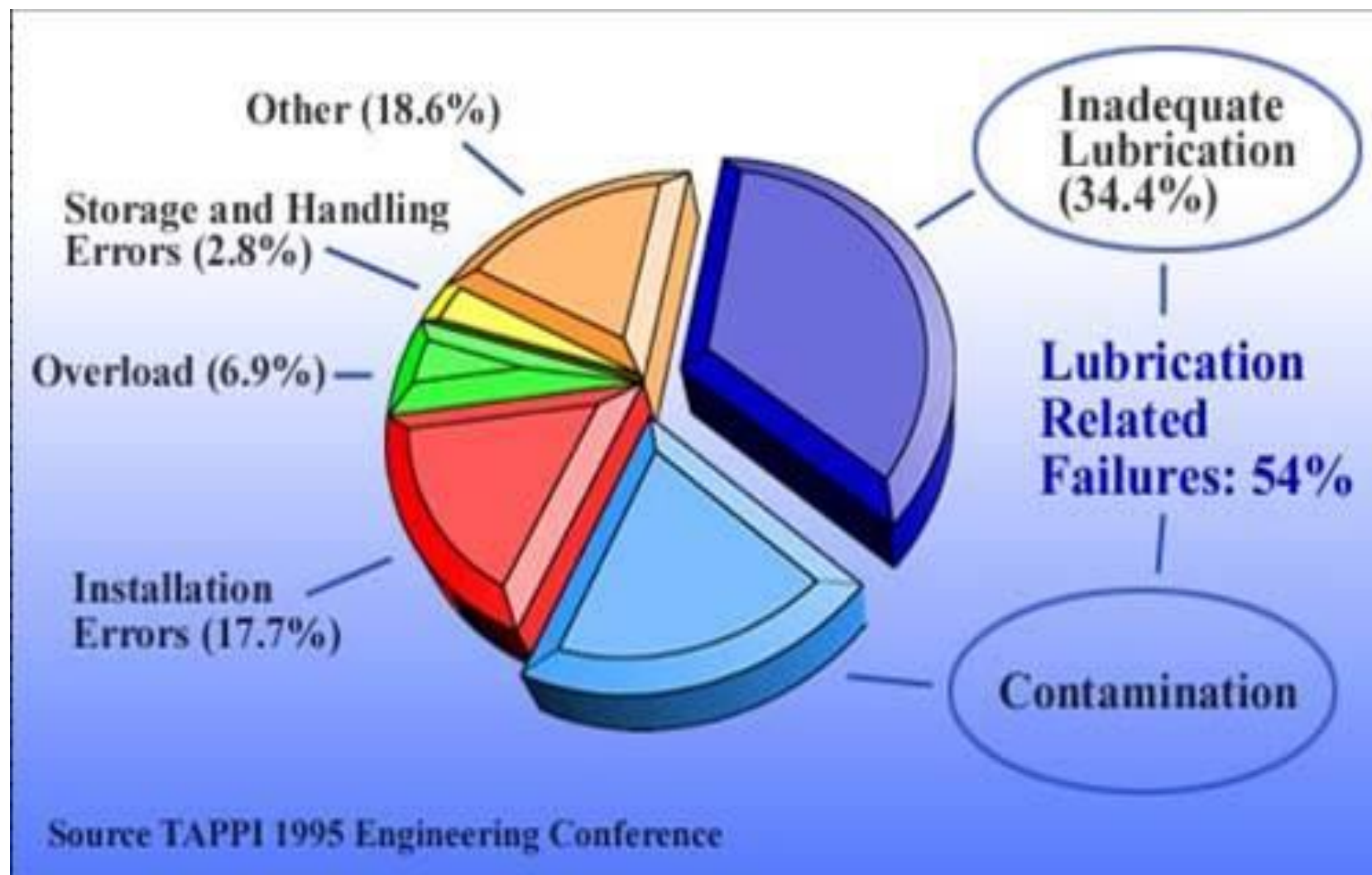
Breakdown Phase : when internal wear or damage has developed to the point failure is inevitable.



Life Extension : when the lubrication is managed effectually, then internal wear or damage is reduced and bearing life can be **maximized**.

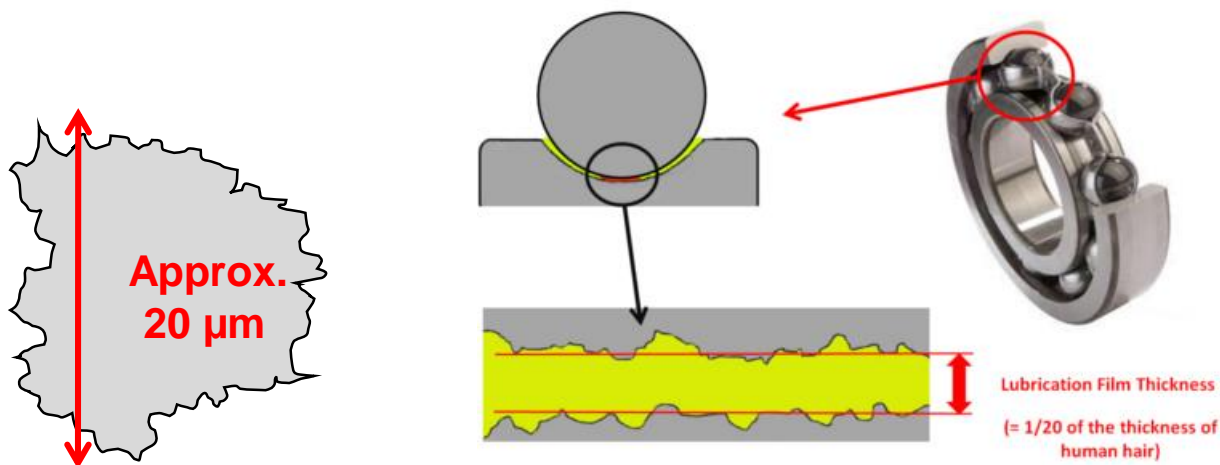
Point of no return : when internal wear or damage is detectable by PDM or inspections, it is then too late to maximize the bearing life – it is already defined.

Lubrication Reliability : LUBRICATION TECHNOLOGY



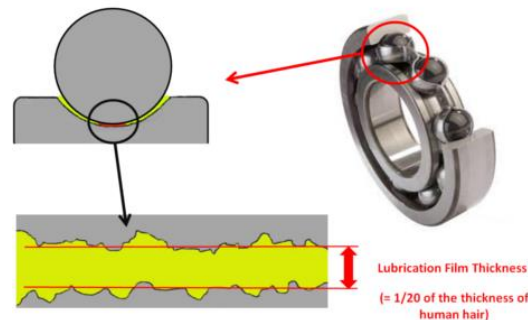
Lubricant

- Reduction metal-metal friction
 - Reduction surface wear
 - Increase component life
-
- Lube Film Thickness
 - Effective lubricant film thickness & viscosity
 - Clean & pure Lubricants uncontaminated
 - ***"bearings can have an infinite life when particles larger than the lubricant film are removed."*** SKF



➤ Typical Lube Film Thickness

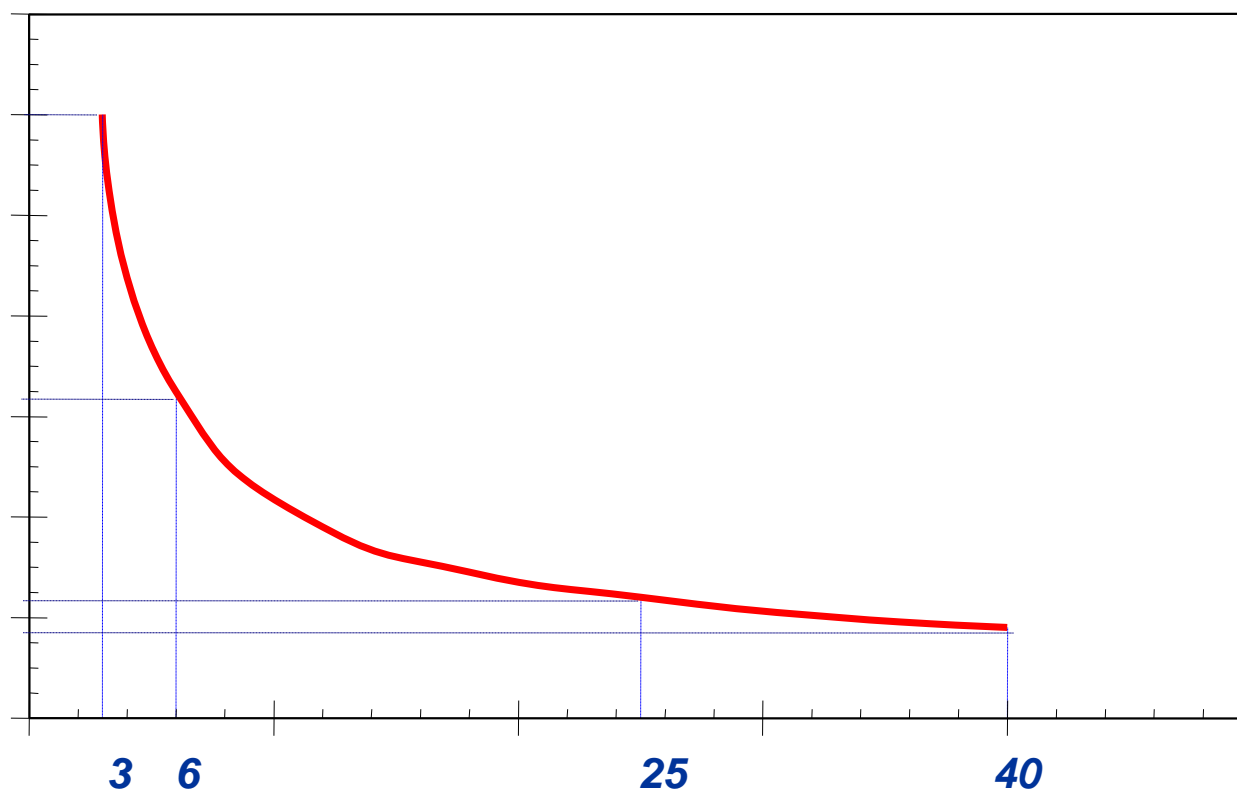
➤ Rolling elements :	0.1 - 3 μ
➤ Ball bearings :	0.1 - 3 μ
➤ Journal, sleeve bearing :	0.5 - 100 μ
➤ Engines, cylinder rings :	0.3 - 7 μ
➤ Gears :	0.1 - 1 μ
➤ Servo & prop. Valve :	1 - 3 μ
➤ Gear pumps :	0.5 - 5 μ
➤ Piston pumps :	0.5 - 5 μ
➤ Hydraulic cylinders :	5 - 50 μ
➤ Dynamic seals :	0.05 - 0.5 μ



Bearing life is function of lubricant Cleanliness

(Dr.D.P. MacPhearson , Westland Helicopters Ltd)

**Millions of Cycles
To Fatigue Failure**



Filter Rating (Particle size, μm , where Beta = 200)

Lubricant Cleanliness measured by ISO4406 (= Key Performance Index KPI)

Example = ISO Code 22/18/13

Larger than 4 μm = 22,340

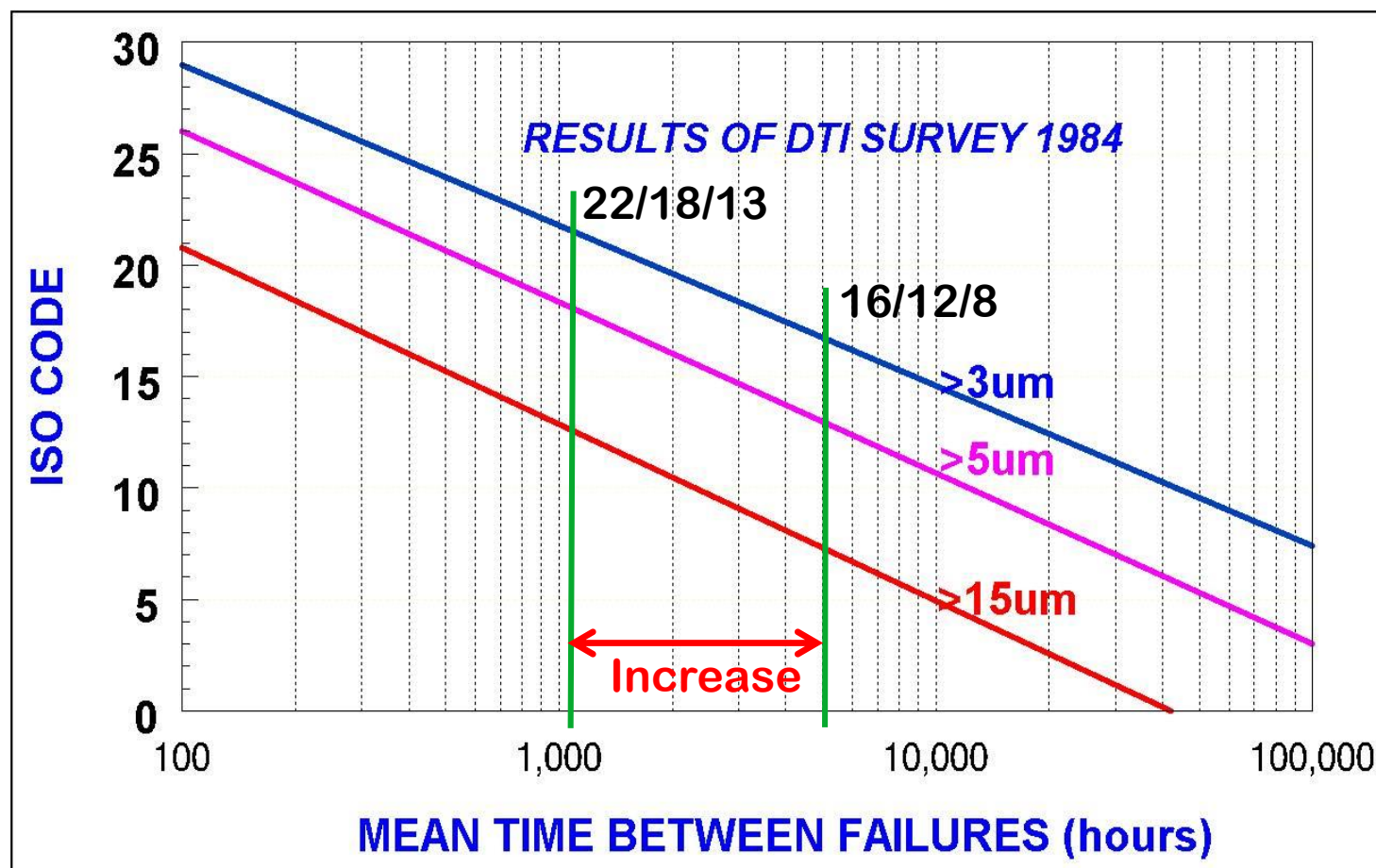
Larger than 6 μm = 1,950

Larger than 14 μm = 43

Allocation of Particle Count Scale Numbers		
	Particles per milliliter	
ISO Scale Number	More than	Less than
22	20,000	40,000
21	10,000	20,000
20	5,000	10,000
19	2,500	5,000
18	1,300	2,500
17	640	1,300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.25	2.5

Table 2: ISO 4406 Allocation of particle count scale number

Machine Failure is related to ISO4406 Code level
(finer filtration = less failures)



Filter rating is related to ISO4406 Code level
(finer filtration = better ISO code)

Filter μm Rating ($\beta - 1000$)	Typical ISO 4406 Cleanliness Code
1	12/10/07 - 14/12/10
3	14/12/10/ - 16/14/12
6	16/14/12 - 17/16/13
12	17/16/13 - 19/17/14
25	19/17/14 - 21/19/17

➤ **Typical recommended ISO 4406 Codes**

➤ **Bearings**

- Rolling elements : 16/14/11
- Ball bearings : 15/13/10
- Journal, sleeve bearing : 17/15/12
- Gearbox bearing: 16/14/11

➤ **Hydraulic valves**

- Directional valves: 20/18/15
- Servo valves: 15/13/10

➤ **Pumps**

- Gear Pumps: 20/18/15

➤ **New oils**

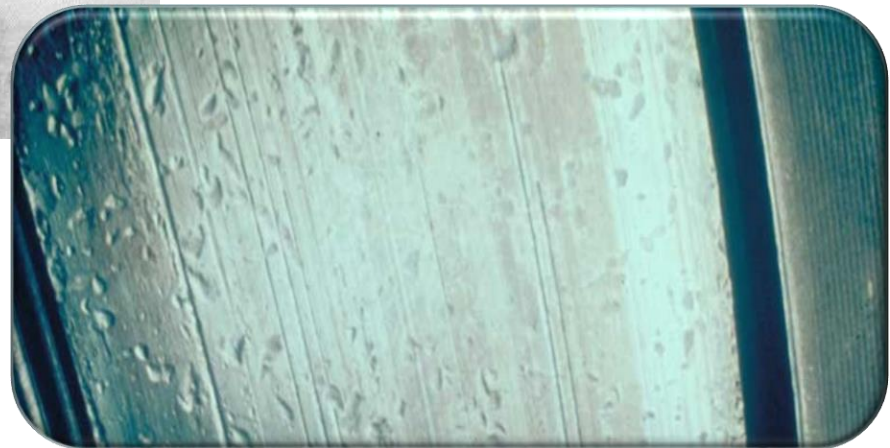
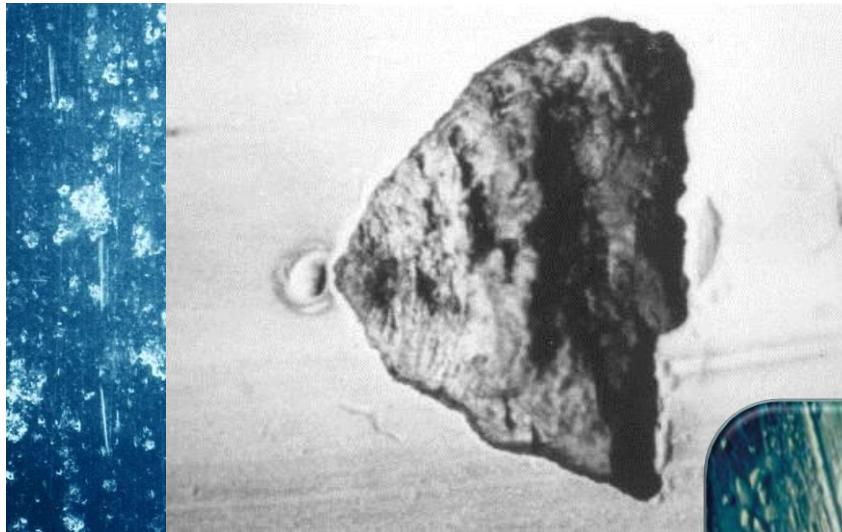
- Typical new oil : 25/22/19

Types of contamination

- Internal Surface wear (debris)
- Initial contamination (new lubricant)
- Ingressed contamination
 - Ambient dust & sand
 - Chemical production materials
 - Moisture
 - Water (internal)
 - Water (external)
 - Cleaning agents
- Cross-contamination



Internal contamination : mechanism of component wear



Is new oil clean enough ?

- 4 % of new oils have levels outside specification!
- New lubricants travel long way :

From manufacturing to :

- ➔ blending machine
- ➔ manufacturing storage tanks
- ➔ to truck-tanks (or drums)
- ➔ to customer storage
- ➔ to transfer equipment
- ➔ to machine



How to set Targets for ISO4406 Cleanliness Levels :

1. Measure > new fluids
2. All oils & hydraulic fluids
3. Machine designer spec = max level
4. Function of component life extension
5. Application & operation specifics



Recent Case Study

- Corrugator plant Netherlands
- 2006-2008, 24 months survey
- Investigation of all bearing failures
- Total of **2.300 €** bearing value
- Total of **150.000 €** maintenance cost



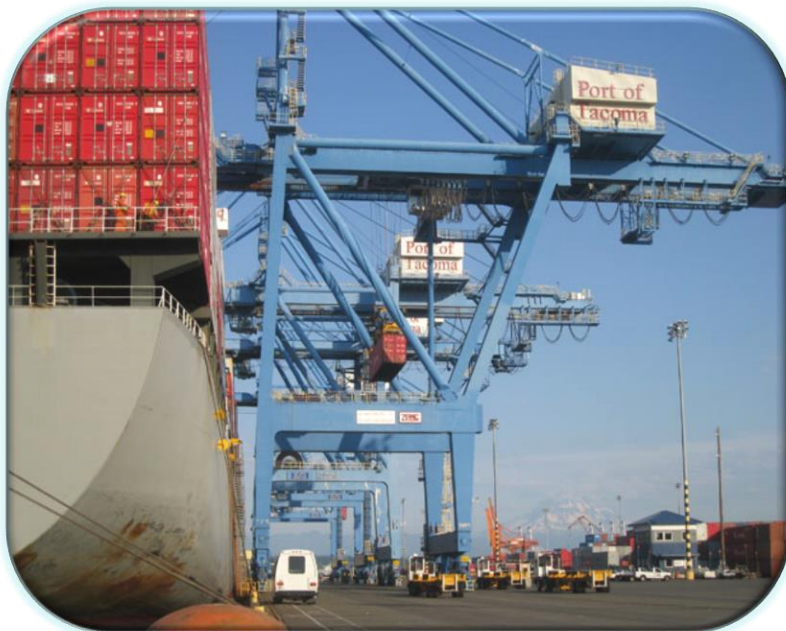
Lubrication Reliability : Case Study - Cardboard

Recent Case Study findings

- 60% bearing failures = lubrication related : wrong lubricant, over & under lubrication, contaminated lubricants
- 15% bearings failures = incorrect fitting & adjustment, bad mounting, damaged during fitting
- 5% bearings failures = ignorance & mistakes, wrong bearing type, wrong clearance or seals
- 20% bearings = no problem, no failures : no need for change as they were in good condition



Improvements in Cleanliness of Diesel Engine Oil @ Port of Tacoma



- From 19/16 ISO code to 15/12 gave a 3 X Life Extension.
- Mean Time Between Engine Rebuilds, from 7,200 hours to 21,000 Hours.
- Gain ?

**5 Year Net Gain =
\$ 702,391.00
Rate of Return = 662%
Payback Period = 2.04 m**

10 Components of Lubrication Reliability



Correct Lubrication is Essential . Please consult working instruction manual (1959)

➤ BASICS : 6 Rights in **LUBRICATION**

- Right LUBRICANT
- Right TIME
- Right QUANTITY
- Right PLACE
- Right WAY
- Right CONDITIONS



10 Components of Lubrication Reliability

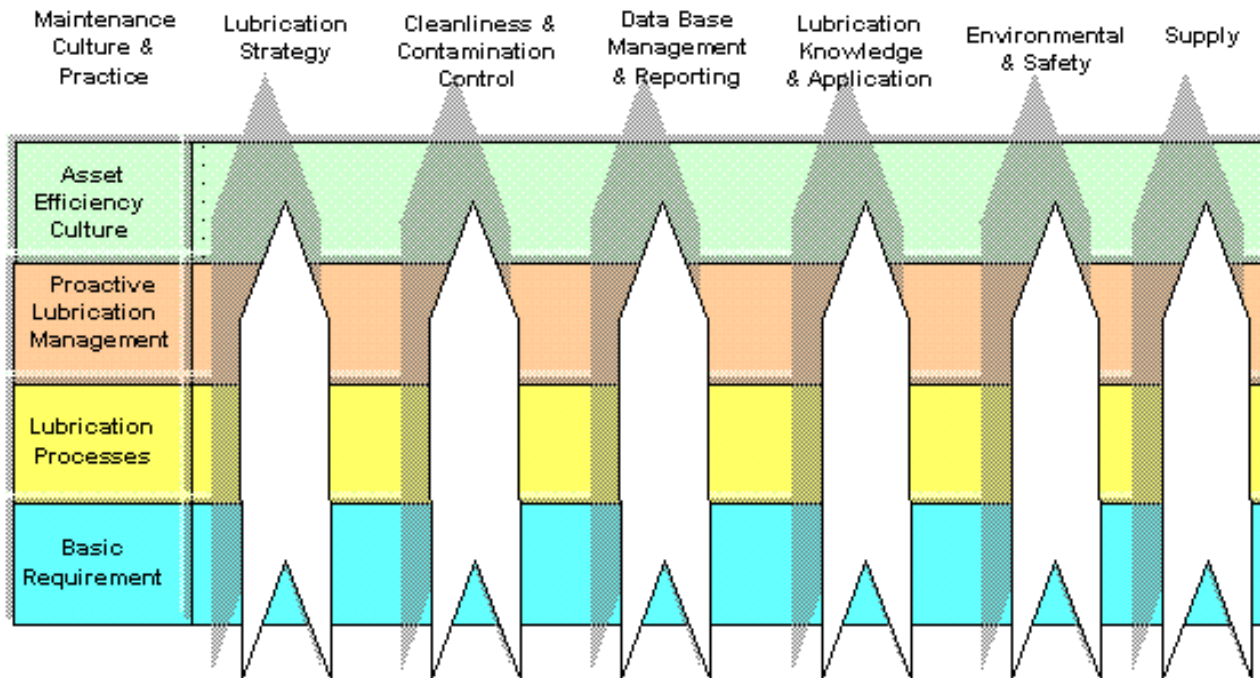
- 1 Lubrication Assessment
- 2 Organisation & Planning
- 3 Identification & Inspection
- 4 Cleanliness Control
- 5 Lubricant dispensing
- 6 Grease Lubrication
- 7 Contamination Control
- 8 Oil Monitoring
- 9 Environmental Control
- 10 Lubrication Training





1: Assessment & Benchmarking

- Where are we now ?
- What do we do wrong ?
- What do we need to improve ?



Best Practice Solution : LubeAssess Assessment program



1: Assessment & Benchmarking

➤ **Investigation of main 6 areas**

1. Lubrication strategy : is there one ? If yes, which one ?
2. Cleanliness & Contamination Control : lubricants, storage, dispensing equipment, machinery
3. Database management & reporting : how is the lubrication organisation managed and documented ?
4. Lubrication Knowledge & application : is personnel trained in lubrication practices and lubricant theory ?
5. Is the Lubrication environment secured , clean and safe to work in ?
6. How is the lubricant supply chain covered ?

Best Practice Solution : Lubrication Assessment



1: Assessment & Benchmarking

➤ **Benchmark and classify into 4 levels :**

- 1. Basic requirement level** : minimum reactive level
- 2. Lubrication process** : is the area part of a process basic strategy ?
- 3. Proactive lubrication management** : is the area based on proactive way of working ?
- 4. Asset Efficiency culture** : predictive, excellent ?

Best Practice Solution : Lubrication Assessment



1: Assessment & Benchmarking

	Lubrication Strategy	Cleanliness & Contamination Control	Data Base Management and Reporting	Lubrication Knowledge & Application
Basic Requirement	Dedicated Resources	Lube Room Standards in Place	Data Base Existence	Cost verses Investment in Uptime
Lubrication Processes	Instructions for the Work	Procedures for Reducing Contamination	Maintenance Planning Controls	Trained Staff on Lubrication
Proactive Lubrication Management	RCFA on all failed Parts	Oil Analysis and Evaluation	Dedicated Lube Software	Integrated in Reliability Program
Asset Efficiency Culture	KPI's on Lube Effect to Reliability	Overall Plant Cleanliness Measurements	Integrated and Seamless to CMMS	Measurement of Activity Effectiveness

Best Practice Solution : Lubrication Assessment



1: Assessment & Benchmarking

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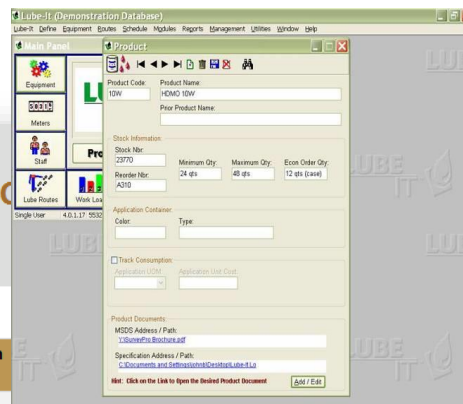
➤ **WAKE UP : Class Work !**

Best Practice Solution : Lubrication Self Assessment



2: Organisation & Planning

- Lubrication Planning
- Central Lubrication Management
- **Lubrication Management Software** (web, stand alone)



Workshop	Line	Equipment	CMMS Ref.	Lubrication point	Product	Current Qty	Recommended Qty	% increase	Number of unplanned tasks
Quarry	Line 1	Crusher	212-TX 453	Gear	TORQ GEAR 150	230	235	2%	2
Quarry	Line 1	Crusher	213-HG 763	Bearing	HUILE TORK X32	21	66	214%	2
Quarry	Line 1	Filter	432-JS 231	Bearing	GRAISSE MILLINIUM	12	20	67%	0
Burning	Line 1	Kiln	132-QZ 312	Gear	MOLYKOTE LGT 2 PLUS	1230	1750	42%	1
Burning	Line 1	ID fan	276-FR 612	Gear	GRAISSE XHP 222	57	60	5%	2

Best Practice Solution : Lubrication Management Software



2: Organisation & Planning

Stand Alone
Vender Specific

Stand Alone
Vender Neutral

Internet Based
Vender Specific

Internet Based
Vender Neutral

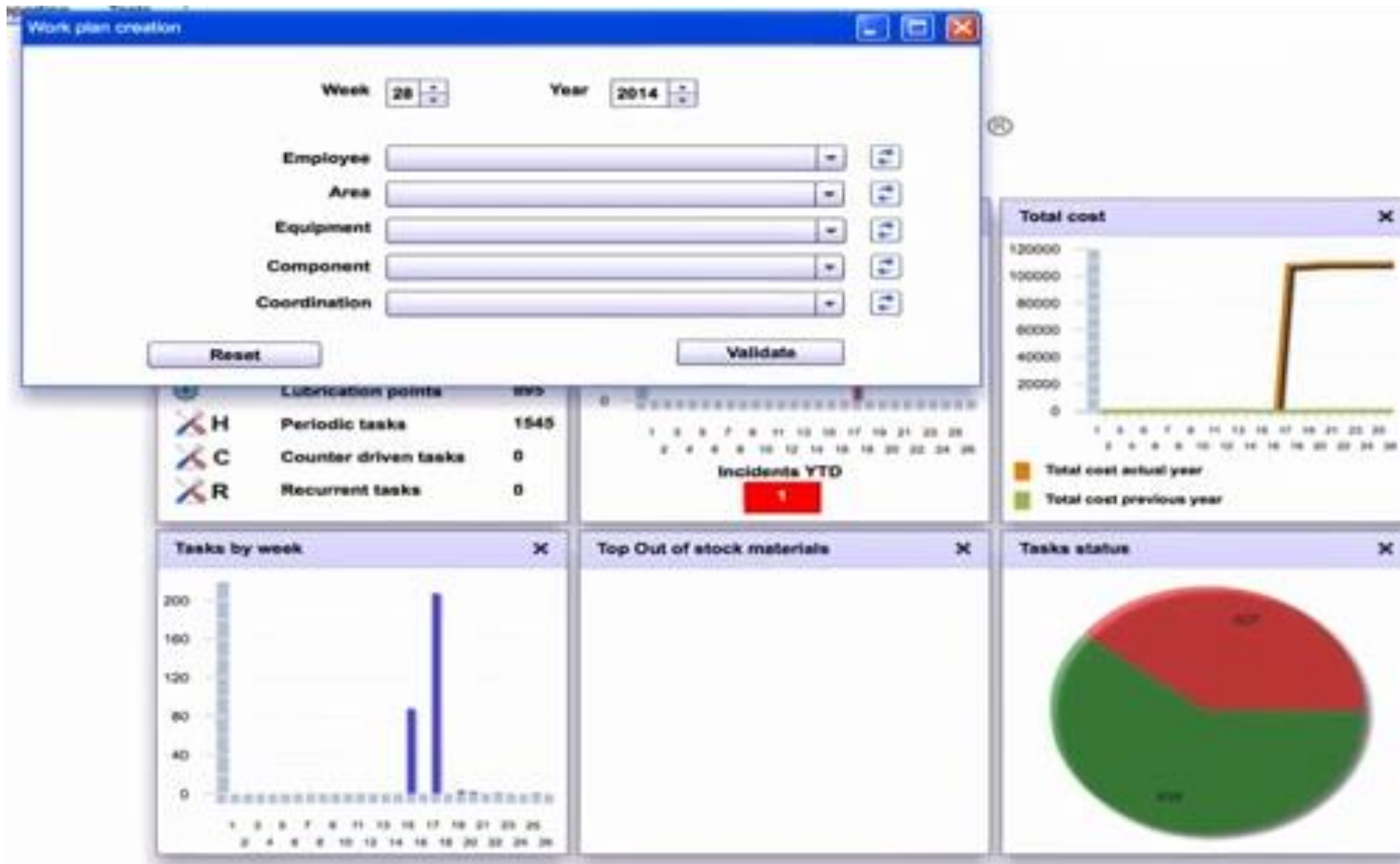
1. Plant structure
 - Plant down to specific point.
2. Activity / point
 - Lube, Qty, Process, Freq.
3. Time based Schedules
 - Paper copies or Handheld PC's
4. Closing out completed schedules
5. Enabling / Disabling points
6. Catering for shut down activities
7. Managing Routes
 - Changing points / responsibilities
8. Reporting activities and consumption

Ease of use



2: Organisation & Planning

Planned activities for a given period are organized in a Workplan schedule





2: Organisation & Planning

Plant general information





2: Organisation & Planning

Incidents are reflected on all future activities and Workplan

The screenshot displays the 'Incident reporting' dialog box within the Lubretec software. The dialog box contains the following fields and values:

- Area:** Production clinker
- Equipment:** Production clinker
- Component:** 461-FR1 Couronne FOUR
- Lubrication point:** CDE Four
- Task:** Reapplication
- CMMS Ref:** (empty)
- Employee:** (empty)
- Position:** (empty)
- Incident code:** Leak
- Incident handling:** Reapplicat
- Time:** 0.5
- Week:** 27, 2014
- Employee:** SUP
- Comment:** Water contamination

At the bottom of the dialog box are 'Save' and 'Cancel' buttons. Below the dialog box, a bar chart and a pie chart are visible, representing data from the system.



2: Organisation & Planning

Activity reports: Consumptions, costs, labor time...

Showing page 1 of 5

Area	Production clinker	Lubrication Cost per Equipment			LUBRILYS®	
Equipment		from 1 2014 to 27 2014				
Component					1/ 5	
Lubrication Point						
Area	Equipment	Component	Lubrication Point	Consumption Cost	Personnel Cost	Total Lubrication Cost
Production clinker	Production clinker			0	63	63
		441-VE1 Ventilateur DOPOL EXISTANTE		0	2	2
			palier cote accouplement	0	1	1
			palier cote libre	0	1	1
		442-VE1 Ventilateur		0	1	1
			Roulement moteur	0	1	1
		442-VE1 Ventilateur process		0	2	2
			Located bearing	0	1	1
			Non-located	0	1	1
		452-DQ1 Rotary air lock valve 630x800		0	1	1
			Reducer Gear box	0	1	1
		452-SF1 Surpresseur		0	3	3
			Gearbox	0	1	1
			paliers rotor	0	1	1
			Roulement moteur	0	1	1
		452-SF2 Surpresseur		0	3	3
			Gearbox	0	1	1
			paliers rotor	0	1	1
			Roulement moteur	0	1	1



3: Identification & Inspection

- Multiple types lubricants, avoiding errors
- Complex Chemistry & Compatibility
- TPM, ISO22000, OSHA-EU, IFS, 5S

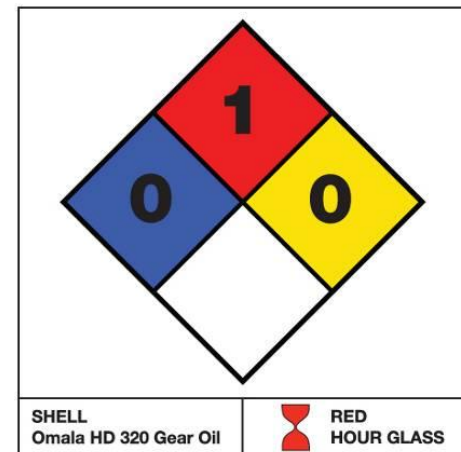


Best Practice Solution : Identification - labelling



3: Identification & Inspection











- How to implement Identification
 - Legislation (OSHA, ISO22000, Food, BRC,)
 - Internal organisation (SAP)
 - Application (Lubes, greases, other fluids)
 - Consolidation (simplify)
 - Codification (internal systems)



Best Practice Solution : Identification - labelling



3: Identification & Inspection

COLOUR	SHAPE	TYPE OF LUBRICANT	NAME OF PRODUCT	VISCOSITY
RED		Gear Box Oil	Shell Omala 220	ISO 220
BLUE		Gear Box Oil	Total GEAR 680	ISO 680
MID GREEN		Hydraulic Oil	Fuchs Hydro 46	ISO 46
BLACK		Hydraulic Oil	BP Hydrol 32	ISO 32
GREY		Transmission Oil	Caterpillar Transol	ISO 120
PURPLE		Transmission Oil	Shell Transol HT	SAE 10W
BEIGE		Compressor Oil	Klüber Compri XTC	ISO 46
DARK GREEN		General Lube Oil	Mobil Generol 220	ISO 220
YELLOW		Turbine Oil	Texaco Turbo T12	ISO 55
ORANGE		Motor Oil	Sunoco Synturo S	SAE 20W

Best Practice Solution : Lube Identification Chart



3: Identification & Inspection

Color	N°	Type of Lubricant	Name of product	NLGI Code
YELLOW	#1	Food Grade Grease	Cassida EP2 FG	# 2
RED	#2	Electric Motor Grease	Esso unirex N3	# 3
BLUE	#3	Bearing Grease	Renolin LX2	# 2
BLACK	#4	RTC Grease	Fuchs Ceptatlyn	# 1
PURPLE	#5	Coupling Grease	Faulk	# 5
GREY	#6	RTC Bearing Grease	Fuchs Stabyl LTS MO	# 2
ORANGE	#7	Extraction Grease	Tunap Tungrease 33-2	# 2

Best Practice Solution : Grease Identification Chart



3: Identification & Inspection

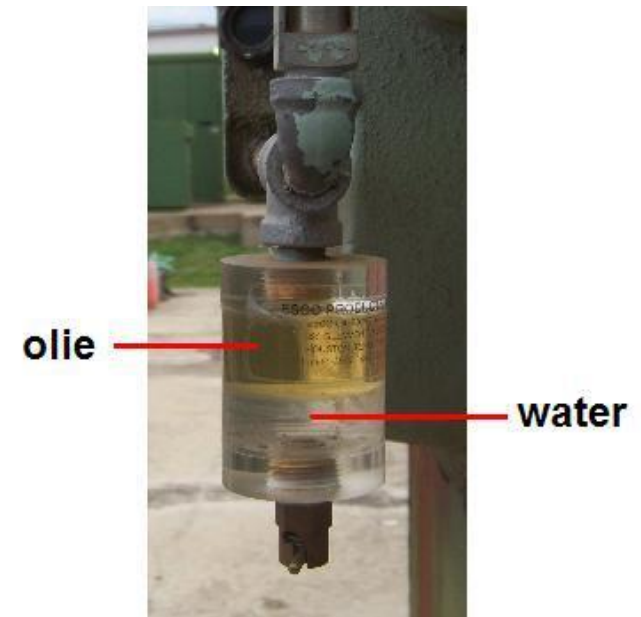
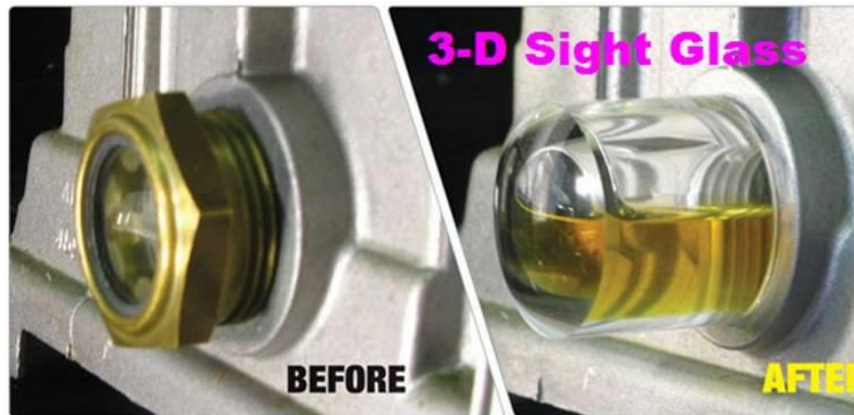
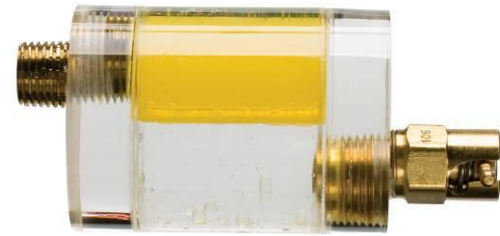


Best Practice Solution : Identification - labelling



3: Identification & Inspection

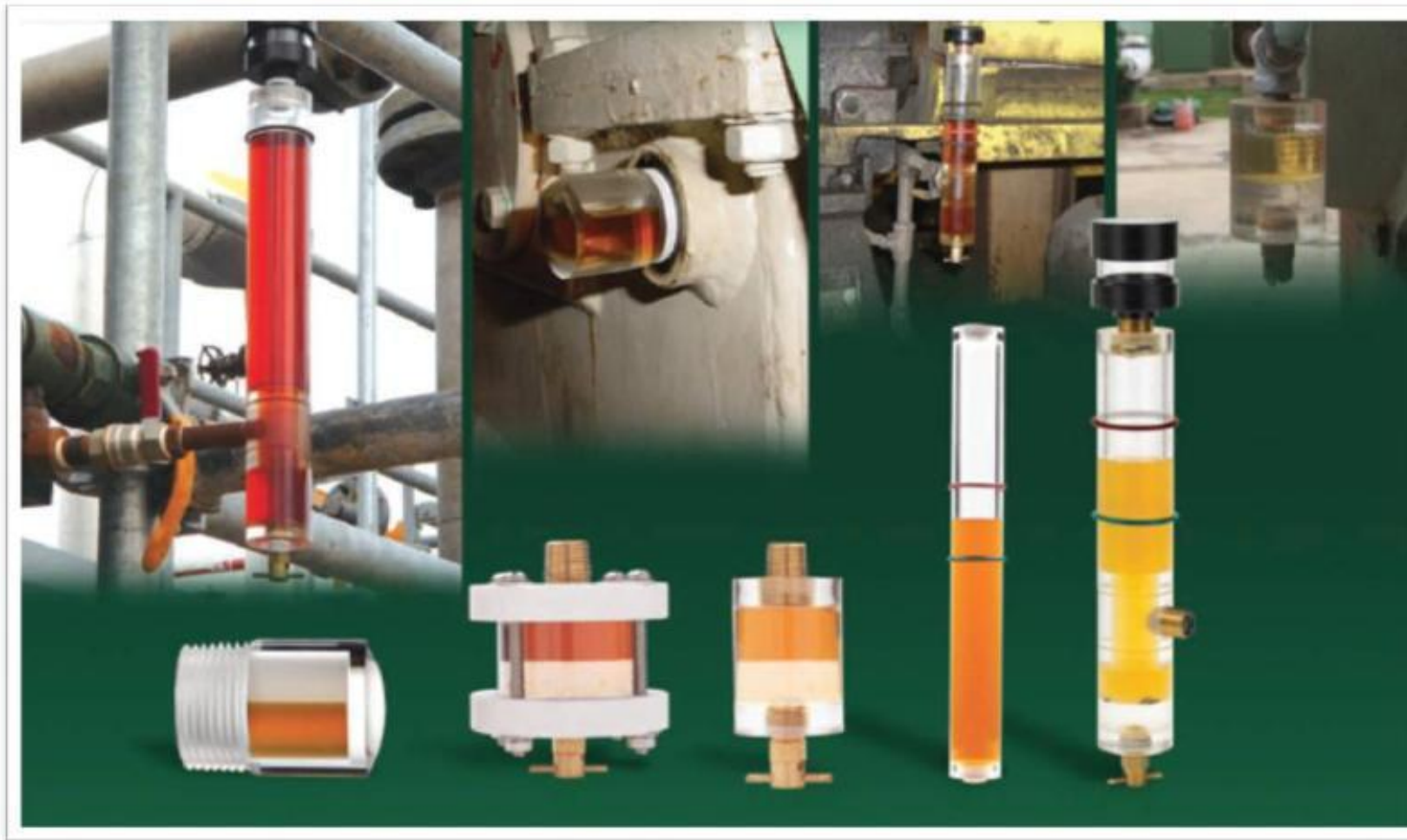
- Visual Oil Analysis
- Regular inspection (TPM)
- Quick oil level fault detection
- Efficient sampling, water tap



Best Practice Solution : 3D Oil Level , Oil Sight Glass



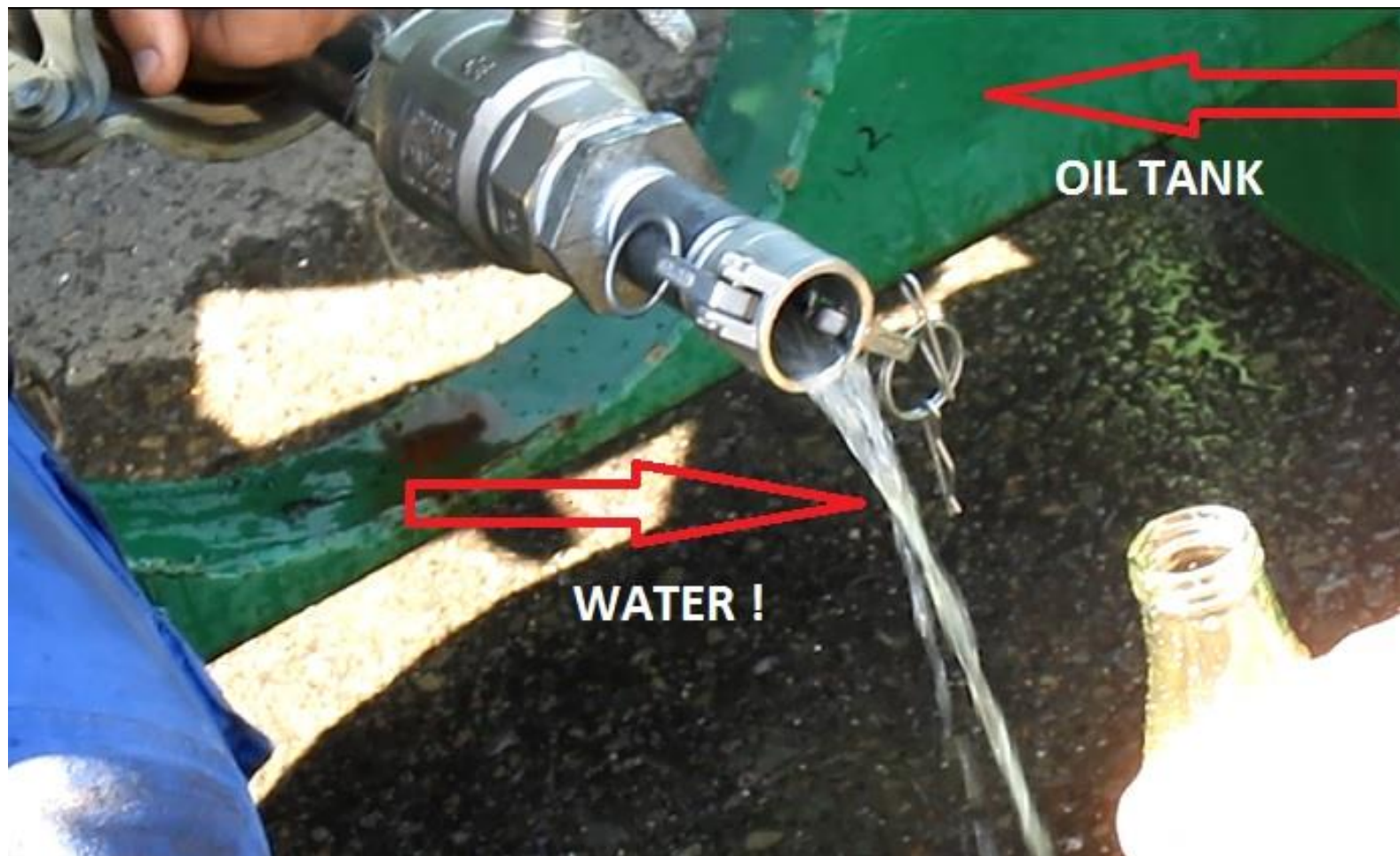
3: Identification & Inspection



Best Practice Solution: 3D Oil Level , Oil Sight Glass



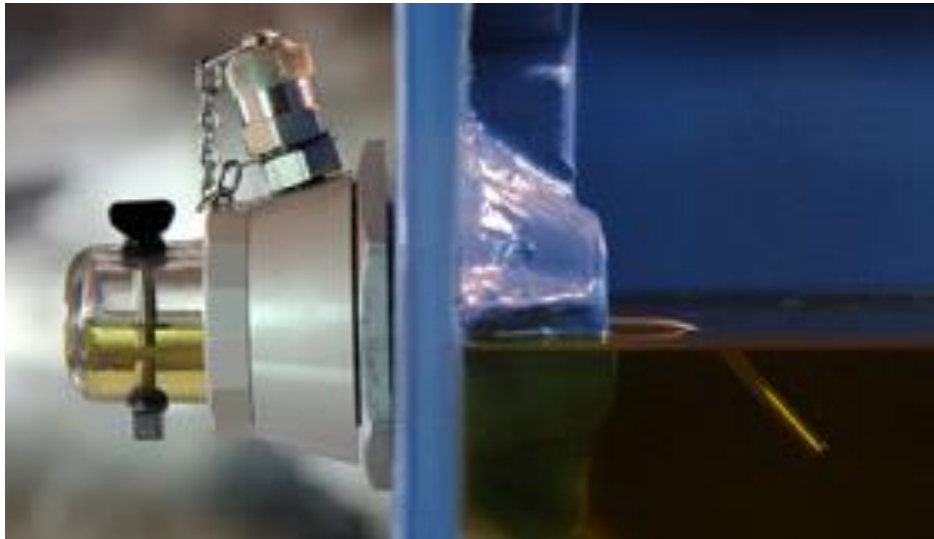
3: Identification & Inspection



Best Practice Solution : Oil Sight Glass & Water drain



3: Identification & Inspection



Best Practice Solution : Oil Sight Glass & Sampling



3: Identification & Inspection

Combination :

- Oil level inspection
- Oil quality (color inspection)
 - Water drain
 - Sampling port



Best Practice Solution : Oil Sight Glass & Water drain



4: Cleanliness Control

- Contamination is a major source of failure
- Clean lubricants in operation
- Clean lubricants in storage
- Lubricant Cleanliness Control Centres
- Safe & Clean storage-conditioning-transfer
- Protection from environment





4: Cleanliness Control

- Is this your storage area today ?





4: Cleanliness Control **Basic Protection**

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- Basic protective (clean) storage



Best Practice Solution : Lubricant storage



4: Cleanliness Control Basic Protection





4: Cleanliness Control **Basic Protection**

- Basic protective (clean) storage



- Horizontal storage
- Breather protection
 - Self closing tap
 - Identification
- Optional oil level

Best Practice Solution : Horizontal storage



4: Cleanliness Control Basic Protection

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4: Cleanliness Control **Basic Protection**

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4: Cleanliness Control **Basic Protection**

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- Basic protective (clean)



Best Practice Solution : Grease Station



4: Cleanliness Control **Basic Protection**

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4: Cleanliness Control **Basic Protection**

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4: Cleanliness Control **Basic Protection**

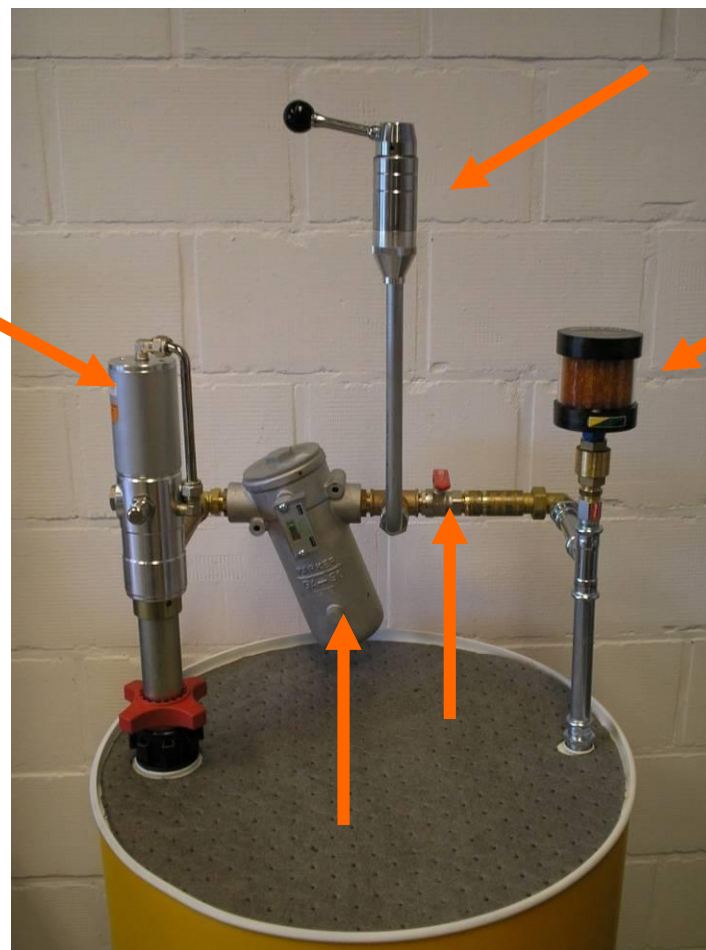
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4: Cleanliness Control Individual Storage

- Individual storage
+ lube upgrade (filter)



Best Practice Solution : Lubricant Storage System



4: Cleanliness Control Individual Storage

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- Individual storage
+ Lube Upgrade (filter)
Mobile



Best Practice Solution : Mobile Lubricant Storage System



4: Cleanliness Control **Basic Protection**

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4: Cleanliness Control Basic Protection

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4: Cleanliness Control Centralized Storage

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LUBRISTATION[®] S

- Horizontal Tanks
- Electrical pumps
- Breather Dryer Lubesec
- FILTRATION online (3)
- Retention tank

Advantage :

- Very compact
- 4 lubes / 1,7 m² surface
- Optimal protection
- Identification
- Options (meter, pumps)
- Per 2 lubes



Best Practice Solution : Tank Lubricant Storage System



4: Cleanliness Control Centralized

LUBRISTATION[®] LCU

- Vertical drums
- Pneumactical pumps
- Breather Dryer Lubesec
- FILTRATION online (3)
- Retention tank integrated

Advantage :

- Turn Key solution
- 20 – 40 ft containers
- Optimal protection
- Identification
- Options (meter, pumps)
- Atex, Condit., Off Shore



Best Practice Solution : Container Lubricant Storage System



4: Cleanliness Control Centralized LCU

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4: Cleanliness Control Centralized LCU

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Lubrication Reliability Technologies





4: Cleanliness Control Centralized

LUBRISTATION R(etrofitt)

- Vertical drums
- Pneumatically pumps
- Breather Dryer Lubesec
- FILTRATION online (3)
- Retention tanks

Features :

- **Existing luberoom**
- Tap bar - retention
- Closed loop piping
- Identification Label Safe
- Filtration 3, 10, 25 μ
- Options (meter, pumps)
- Complete lube storage



Best Practice Solution : Luberoom retrofit



4: Cleanliness Control Bulk Storage

Bulk Storage Systems by FluidDefense.

- Tank storage with optimal protection
- Best practice : filtration & contamination control
- Cleanliness, Efficiency, Safety, Reliability
- 30, 65, 120, 240 Gallon tanks



Best Practice Solution : Bulk Storage Systems



4: Cleanliness Control Bulk Storage

Lustor

- LDPE Tanks
- Pneumatic pumps
- Breather Dryer
- FILTRATION online (3 way)
- Retention pallet

Advantage :

- **Compact - INTEGRATED**
- 4 lubes / 1,2 m² surface
- Optimal protection
- Identification OILSAFE colors
- Options : hose reel, anti-static
- Per 1 lube

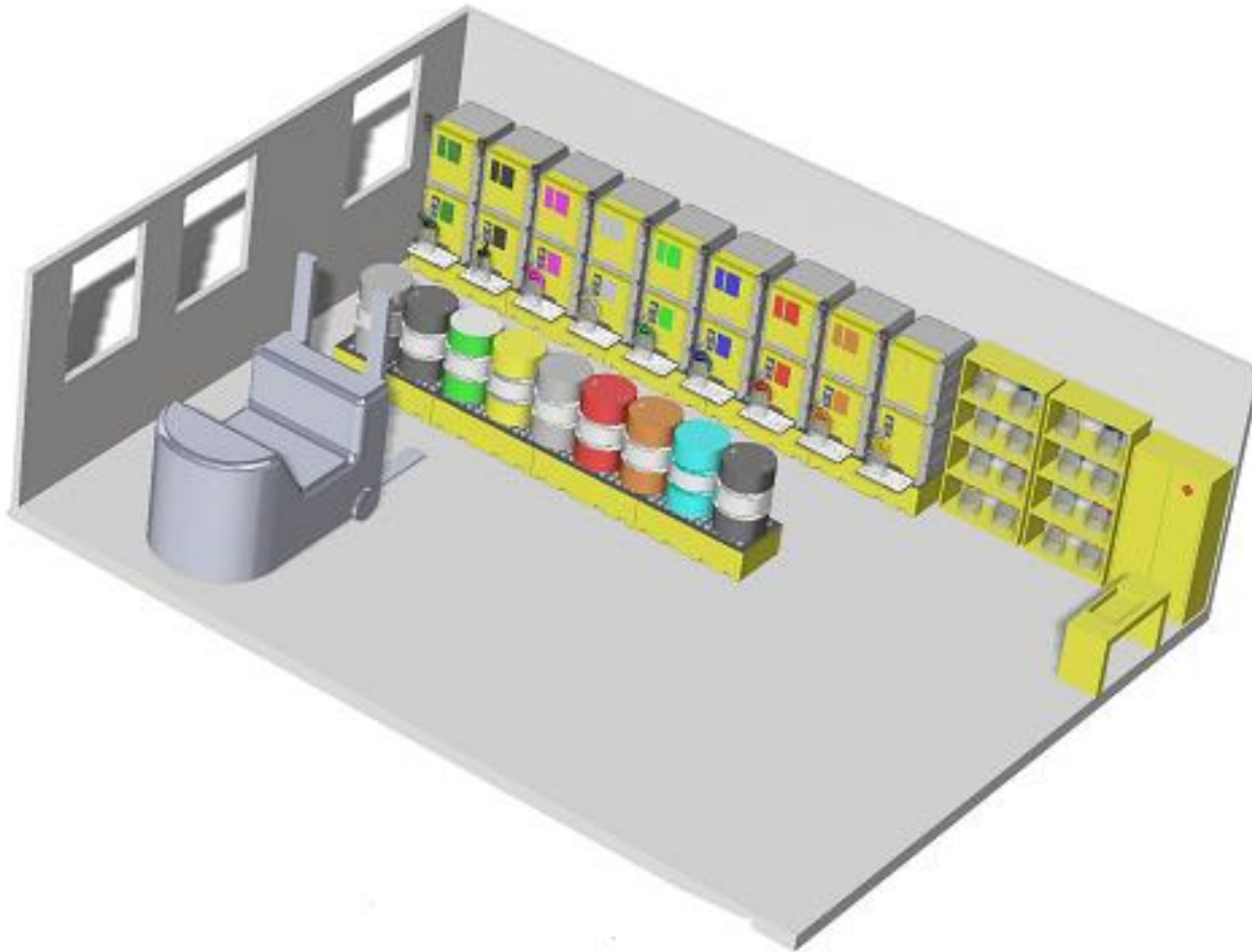


Best Practice Solution : Lubrication Storage System



4: Cleanliness Control Bulk Storage

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Best Practice Solution : Lubrication Storage Room



5: Lubricant Dispensing & Transfer

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- Still doing it the old fashion way ?



Best Practice Solution : Professional Oil Transfer System



5: Lubricant Dispensing & Transfer

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- Safe & Clean tools
- Efficient & user friendly
- Adapted to application
- Multi colored identification
- Contamination free
- Fully sealable



Best Practice Solution : OilSafe Oil Transfer System



6: Grease Lubrication

- Best practice tools
- Efficient & practical
- Color-coded, metered
- Automatic
- Ultrasound control



Best Practice Solution : Color coded, metering, auto



6: Grease Lubrication

- Mobile solutions
- Point of lubrication
 - Fixed in LCU



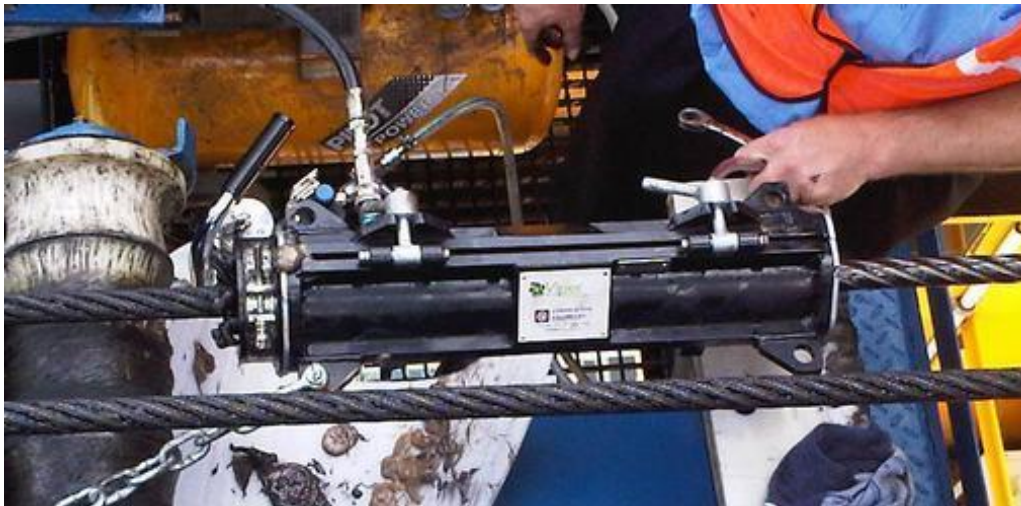
Best Practice Solution : Grease units



6: Grease Lubrication

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- Automatic - UltraSound
- Special tools
- Reliable Lubrication

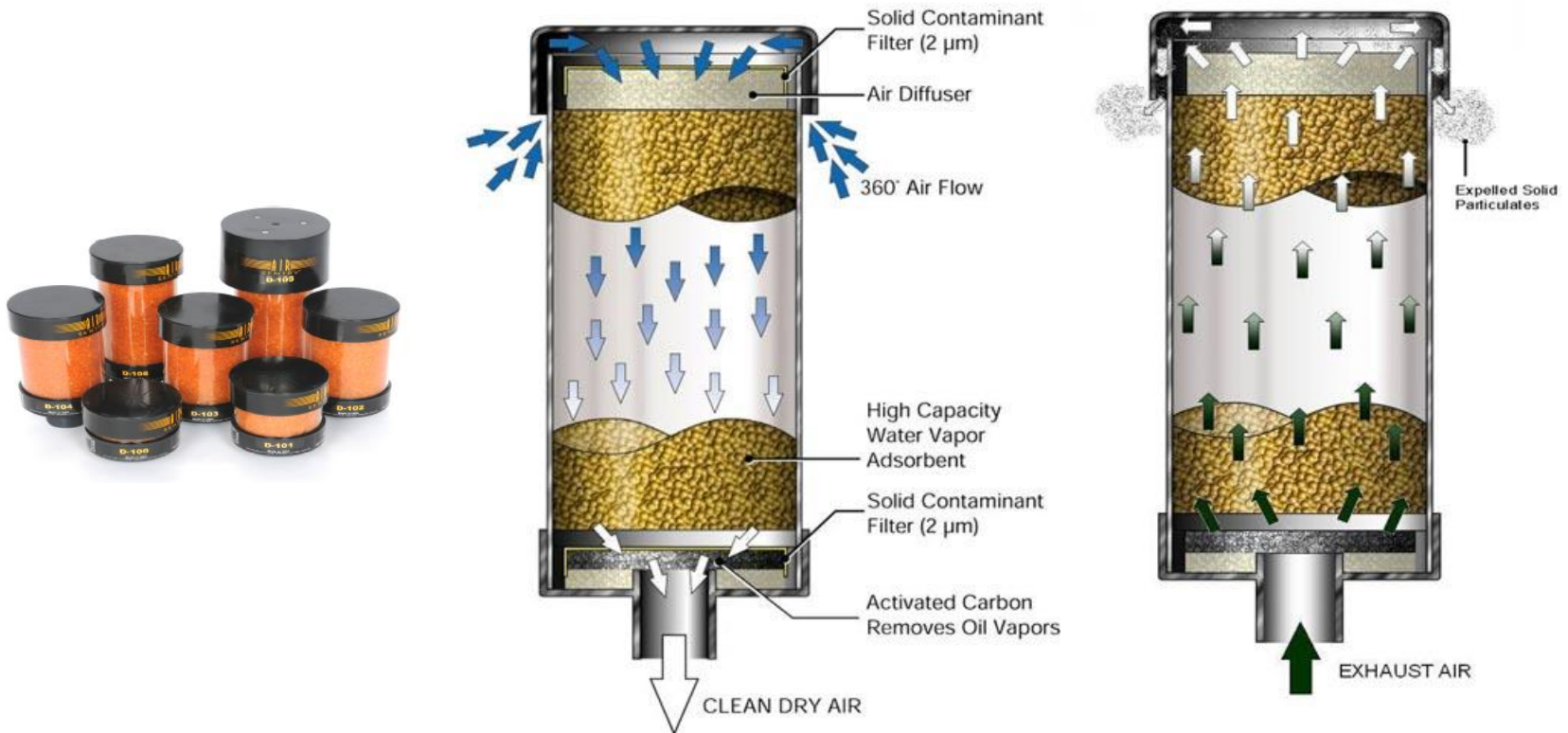


Best Practice Solution : Wire Rope Lubricator , Ultrasound Lube



7: Contamination Control **Protection**

- ISO4406 contamination check
- **Lubricant protection** : storage & production
 - dust, particles, production material, moisture, water



Best Practice Solution : Desiccant Breathers



7: Contamination Control **Protection**

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Lubrication Reliability Technologies



Best Practice Solution : Desiccant Breathers



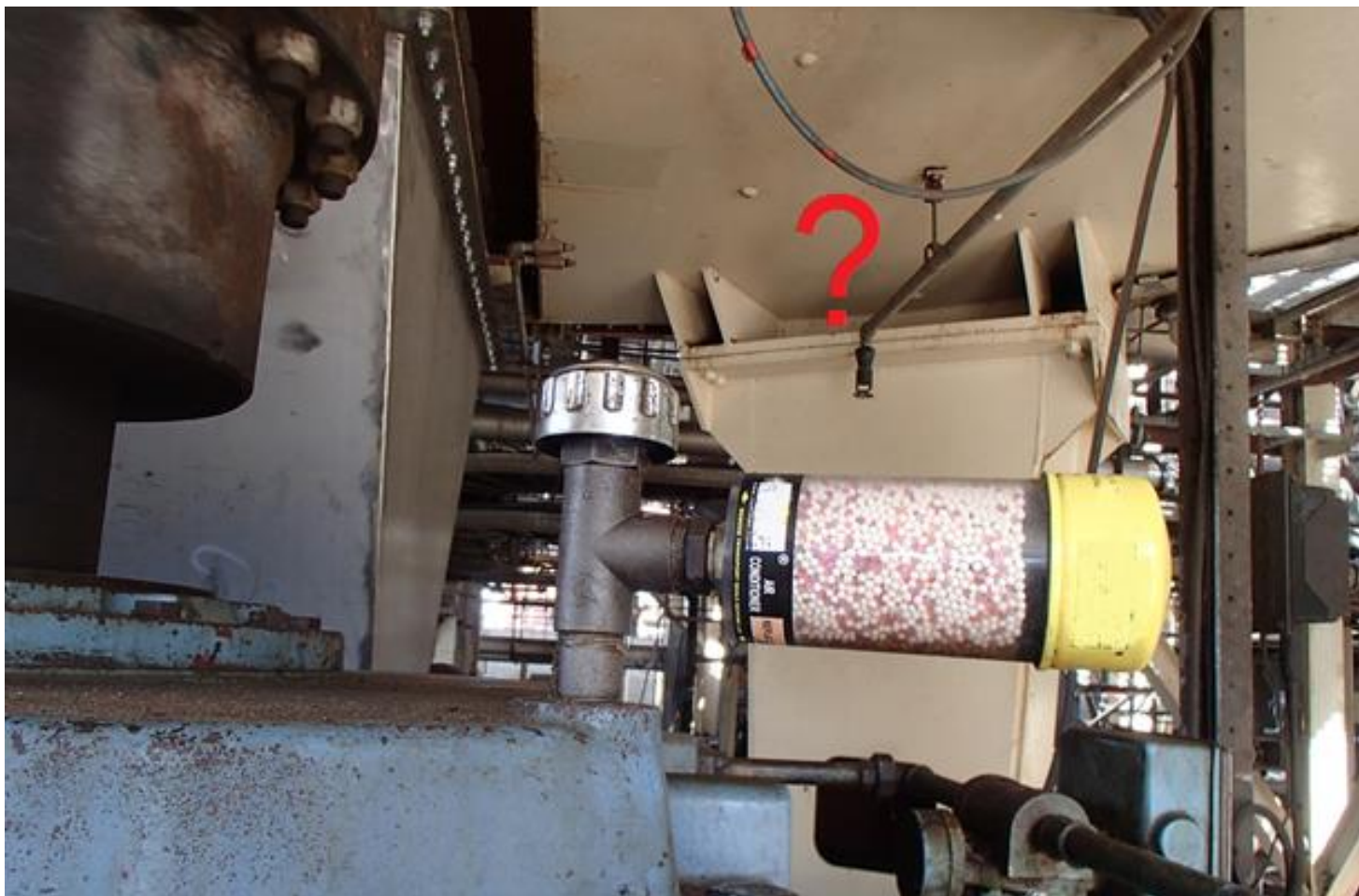
7: Contamination Control **Protection**



Best Practice Solution : Desiccant Breathers



7: Contamination Control **Protection**



QUIZ : Best Practice Error Desiccant beater



7: Contamination Control **Filtration**

- ISO4406 check imperative
- On line /Off line filtering
- **DE** - Contamination : particles, moisture
 - Gravity (tank deposit)
 - Centrifugal
 - Absorption (most common)
 - Vacuum
 - Airstripping
 - Heating (Lubes)
 - Electrostatic



Best Practice Solution : Filter units on line, off line



8: Oil Condition Monitoring

- ISO 4406 monitoring
- Lubricant life extension (chemistry)
- Cleanliness management



Best Practice Solution : Sampling Equip. , Analysers



Step 8: Oil Monitoring & Analysis

What to expect from an OA program :

To support a comprehensive diagnostic, preventive maintenance program for **monitoring** and **evaluating lubricant** and **equipment condition** .



Best Practice Solution : Oil Analysis Service



Step 8: Oil Monitoring & Analysis

Why start an Oil Analysis Program ?

- Real time Status of Equipment
- Equipment failure prediction
- Fewer parts to keep in inventory
- Less used lubricant consumption
- Higher reliability ,less downtime



Best Practice Solution : Oil Analysis Service



Step 8: Oil Monitoring & Analysis

4 Major Oil Analysis sets



➤ Hydraulic and Circulating Oils



➤ Gearbox Oils



➤ Compressor Oils



➤ Motor Oils

Best Practice Solution : Oil Analysis Service



Step 8: Oil Monitoring & Analysis

Hydraulic or Circulating Oils

Elemental Metals (wear)

ISO Particle Count (contamination)

Karl Fischer Water ppm (water cont)

Total Acid Number (use)

Viscosity @ 40°C or 100°C

Best Practice Solution : Oil Analysis Service



Step 8: Oil Monitoring & Analysis



Overall report severity based on comments:

Account Information		Component Information		Sample Information	
Account Number: Company Name: Contact: Address: Phone Number:		Component ID: 400-170 GB Secondary ID: HARP DRIVE LINE 4 WIRECUT Component Type: HELICAL GEAR Manufacturer: SUMITO Model: CHHJ-4175DCY-210 Application: FOOD/BEVERAGE PLANT Sump Capacity: 1 qt		Tracking Number: Lab Number: I-744603 Lab Location: Indianapolis Data Analyst: JUK Sampled: Received: Completed:	
Filter Information		Miscellaneous Information		Product Information	
Filter Type: NONE Micron Rating: 0		Wildcard 1: Wildcard 2: Wildcard 3: Miscellaneous:		Product Manufacturer: Product Name: 4090(H1) QUINPLEX WHITE GEAR O Viscosity Grade: ISO 220	
Comments	Flagged data does not indicate an immediate need for maintenance action. Continue to observe the trend and monitor equipment and fluid conditions. Gear and/or bearing metal is at a MODERATE LEVEL; Viscosity is SLIGHTLY LOW; ZINC slightly HIGH for this product; Lubricant change acknowledged; Sample information has been added or tests have been rerun or additional testing was added and the report has been regenerated; Sample RUSHED per customer request.				

	Wear Metals (ppm)										Contaminant Metals (ppm)		Multi-Source Metals (ppm)					Additive Metals (ppm)						
Sample #	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorous	Zinc
3	14	0	0	0	0	0	0	0	0	0	3	0	23	0	0	0	0	0	0	5	4	1	248	25
4	12	0	0	0	0	0	0	0	0	0	2	0	19	0	0	0	0	0	0	7	4	1	218	24
5	1	0	0	0	0	0	1	0	0	0	43	0	0	0	0	0	0	0	0	0	0	0	547	13
6	19	0	0	0	0	0	0	0	0	0	45	0	0	0	0	0	0	0	1	0	3	2	498	2
7	357	3	0	0	0	0	0	0	0	0	28	0	0	0	0	0	1	0	4	0	7	5	682	17
8	0	0	0	0	0	0	0	1	0	0	9	0	0	0	0	0	0	0	2	0	1	0	602	12

Sample #	Sample Information							Contaminants			Fluid Properties					
	Date Sampled	Date Received	Lube Time	Unit Time	Lube Change	Lube Added	Filter Change	Fuel Dilution	Soot	Water	Viscosity 40°C	Viscosity 100 °C	Acid Number	Base Number	Oxidation	Nitration
3	19-Oct-2008	28-Oct-2008	2		Yes		Unk			< .1 - Hotplate	395		1.01			
4	26-Apr-2009	05-May-2009	6		Yes		Unk			< .1 - Hotplate	411		1.59			
5	17-Oct-2009	28-Oct-2009	6		Yes		No			< .1 - Hotplate	440		1.55			
6	06-Aug-2010	09-Aug-2010	2	9	No		No			< .1 - Hotplate	190		1.30			
7	13-May-2012	21-May-2012	5	3	Yes		No			< .1 - Hotplate	190		0.28			
8	13-May-2012	18-May-2012	5	5	Unk		Unk			< .1 - Hotplate	193		1.02			

Best Practice Solution : FANPRO® Oil Analysis Service



Step 8: Oil Monitoring & Analysis

Check for possible source of ABRASIVES entry (such as faulty filter elements, Abrasives (Silicon) are at a SEVERE LEVEL; LUBRICANT CHANGE is suggested if metal is at a SIGNIFICANT LEVEL; We recommend an Analytical Ferrogram be wear and/or contamination present. Please contact Customer Service for add the form of alumina/silica (Dirt); In order to properly compare data to the con

Sample #	Fe	Cr	Ni	Al	Cu
7	1337	6	2	16	2
6	597	5	0	6	2
5	1276	14	6	7	7
4	5275	27	13	62	16
3	1748	5	0	12	8

Best Practice Solution : Oil Analysis Service



Step 8: Oil Monitoring & Analysis

Conclusion : You should be able to

- View reports within 24/48 hours
- Use web-based tools to manage data
- Rely on Skilled & Expert Analysis Team
- Excellent trending possibilities
- Support your Lubrication Reliability in daily maintenance practices



Best Practice Solution : Oil Analysis Program



Step 8: Oil Monitoring & Analysis

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Best Practice Solution : Sampling equipment and tools



9: Environmental Control

- Clean environment = clean lubrication = clean oil
- Maintenance strategies : 5S
- Environmental protection
- Efficiency tools

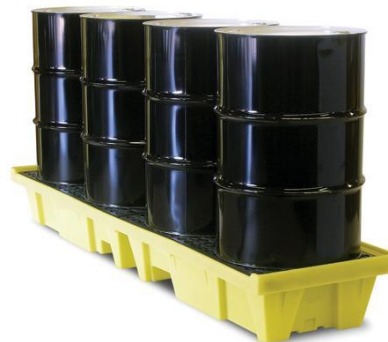


Best Practice Solution : Absorbents, Spill Control



9: Environmental Control

- Clean environment = clean lubrication = clean oil
- Practical Solutions



Best Practice Solution : Absorbents, Spill Control



10: Knowledge Management

- Reliability Lubrication Training
- Lubrication Technician -> Reliability Technician
- E-learning
- Certifications (International Council for Machinery Lubrication) , ea



Best Practice Solution : www.reliabilityinstitute.com

Lubrication Reliability **Conclusion**



**BAD
Practice**



Lubrication Reliability **Conclusion**



**BEST
Practice**



Custom System

- Company : Lubretec bvba
- Set Goal : Excellence & World Class Maintenance
- Use Strategy : **Lubrication Reliability**
- Start to Implement : Lubrication Reliability program
- Invest in Tools : Lubrication Best Practices & Equipment

Goal : World Class Maintenance

- What Maintenance Strategy
 - Reactive (fire fighting)
 - Planned (scheduled)
 - Proactive (planned & adapted)
 - Predictive (condition centered) = WCM



Strategy : Lubrication Reliability

- Lubrication >> strategy (Culture Change)
- Lubrication Excellence Mindset
- Use Best Practices
- Dedicate people
- Best in Class
- 4 steps :
 - Benchmark current performance (start & finish)
 - Define priorities (ROI)
 - Lubrication Reliability Plan
 - Implement the plan



Implement : Lubrication Reliability program

- Study 10 components
- Set up the LR program
- Budgetize & Invest
- Equipment modifications
- PROCESS versus PROJECT
- Continuous improvement

Tools : Lubrication Best Practices & Equipment

- Tools
- Products
- Knowledge by training
- Consultancy



Lubrication Reliability : Auto Assess Check List

- 💧 Consolidation of packaging (centralized storage)
 - ✓ Unique type of packaging (200 l)
 - ✓ Larger type
- 💧 Consolidation of lubricant types (less is more)
- 💧 Reception control
 - ✓ Type check & date
 - ✓ Damaged packaging
 - ✓ ISO4406 contamination level
- 💧 Proper identification
 - ✓ Color coding (refer to dispensing, avoiding mistakes)
 - ✓ Type – brand – internal order code
 - ✓ Viscosity
 - ✓ Application
 - ✓ Date of reception & of first use

- Pre-filtering of new oil to required ISO4406 level
 - ✓ While transfer to new storage tanks
 - ✓ Kidney loop on drum or tank
 - ✓ Correct filter rate in function of application
- Storage in proper environment
 - ✓ Clean dedicated lube room, not outside
 - ✓ Constant temperature & humidity
 - ✓ Organized, safe & efficient
 - ✓ Away from dirt causing production environment
 - ✓ Use of proper absorbents (no pellets, no sawdust)
 - ✓ Use of regulatory spill-retention equipment

Lubrication Reliability : Check List

- Storage in proper recipients
 - ✓ Lube supplier drums, containers (horizontal/vertical)
 - ✓ New plastic tanks - containers (rust free, translucent)
 - ✓ New steel coated tanks (with oil level)
 - ✓ New SS tanks (oil level)
- Protection
 - ✓ Protect lubes from humidity & dirt with breather-dryers
 - ✓ Fully closed containers/tanks, pump-tank connection.
 - ✓ Protect grease nipples, quick disconnects with caps & plugs.
- Transfer and dispensing
 - ✓ Closed loop tank-dispensing equipment preferred
 - ✓ Use of fully sealable dispensing equipment (chain of cleanliness)
 - ✓ Filtering during transfer and dispensing

- Continuous Lubrication Inspection
 - ✓ Oil Levels on machines (min-max level)
 - ✓ Water separation sight glass inspection and tap
 - ✓ Oil quality on machines (Oil analysis)
 - ✓ Lubricant and/or grease leakage
 - ✓ Storage inspection (open drums, dirty connectors, lost protect caps)
 - ✓ Grease level in automatic lubricators
 - ✓ Blocked grease lines
 - ✓ Filter Saturation indicators
 - ✓ Filter content inspection, pictures, samples (FMEA)
 - ✓ Breather-dryer inspection for saturation

Lubrication Reliability **Questions**

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10

Components of Lubrication Reliability

THANK YOU !

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