



Big Data analysis of laboratory values for lubricants in use

Stefan Mitterer, OELCHECK GmbH

Lubricant Expo 2022 - Essen

Content

1. Data transfer

- The information path
- Possible ways to exchange data

2. Evaluation of Big Data

- From one machine up to fleet management
- Clean data structure

3. Practical examples

- Individual data analysis
- From the machine to the entire fleet

4. Conclusion

Oil can talk – we understand the message



One drop of oil or grease contains data and information about itself and about the lubricated parts.

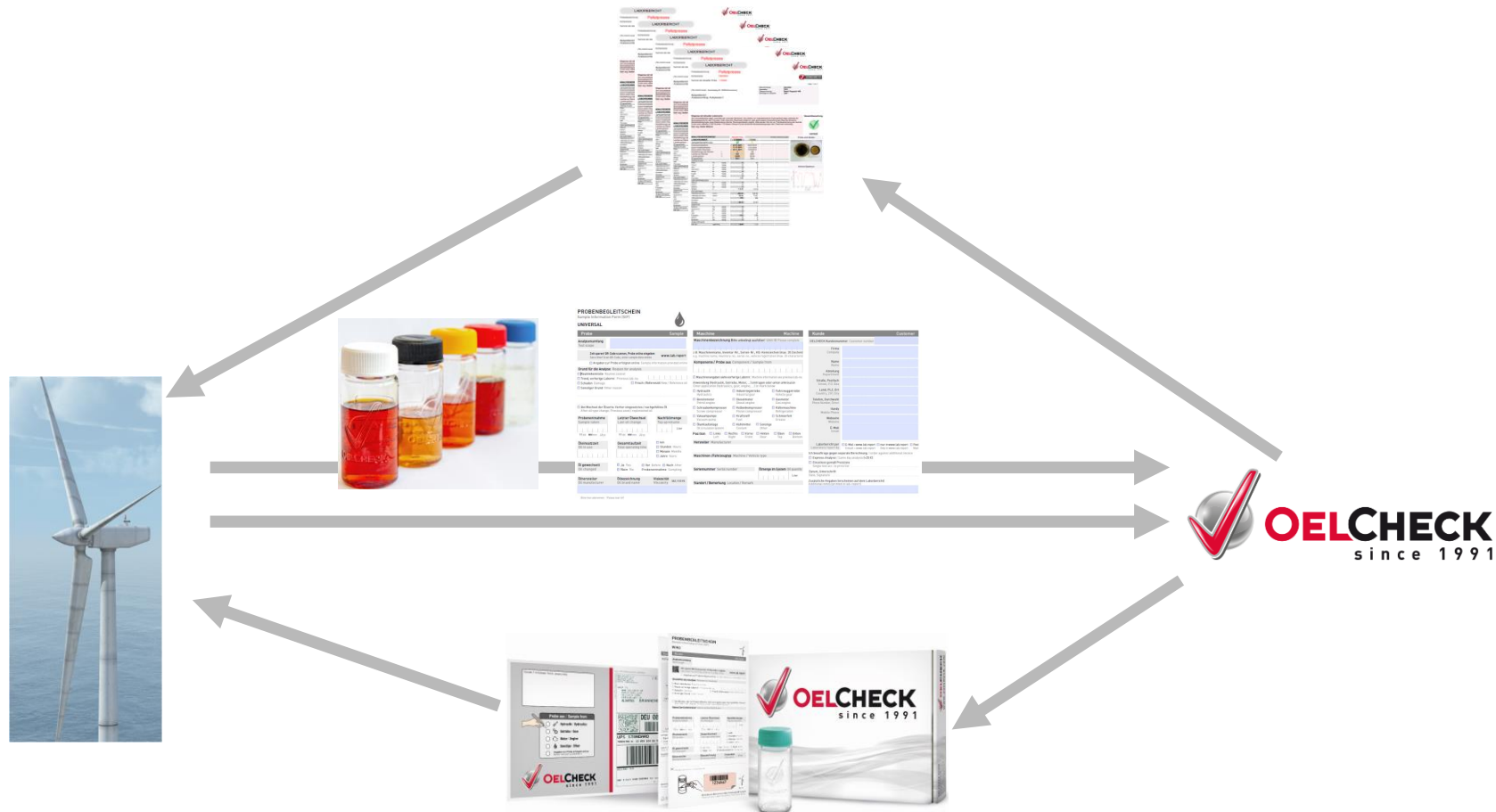


Precise lab equipment detects essential information even in a small sample volume.

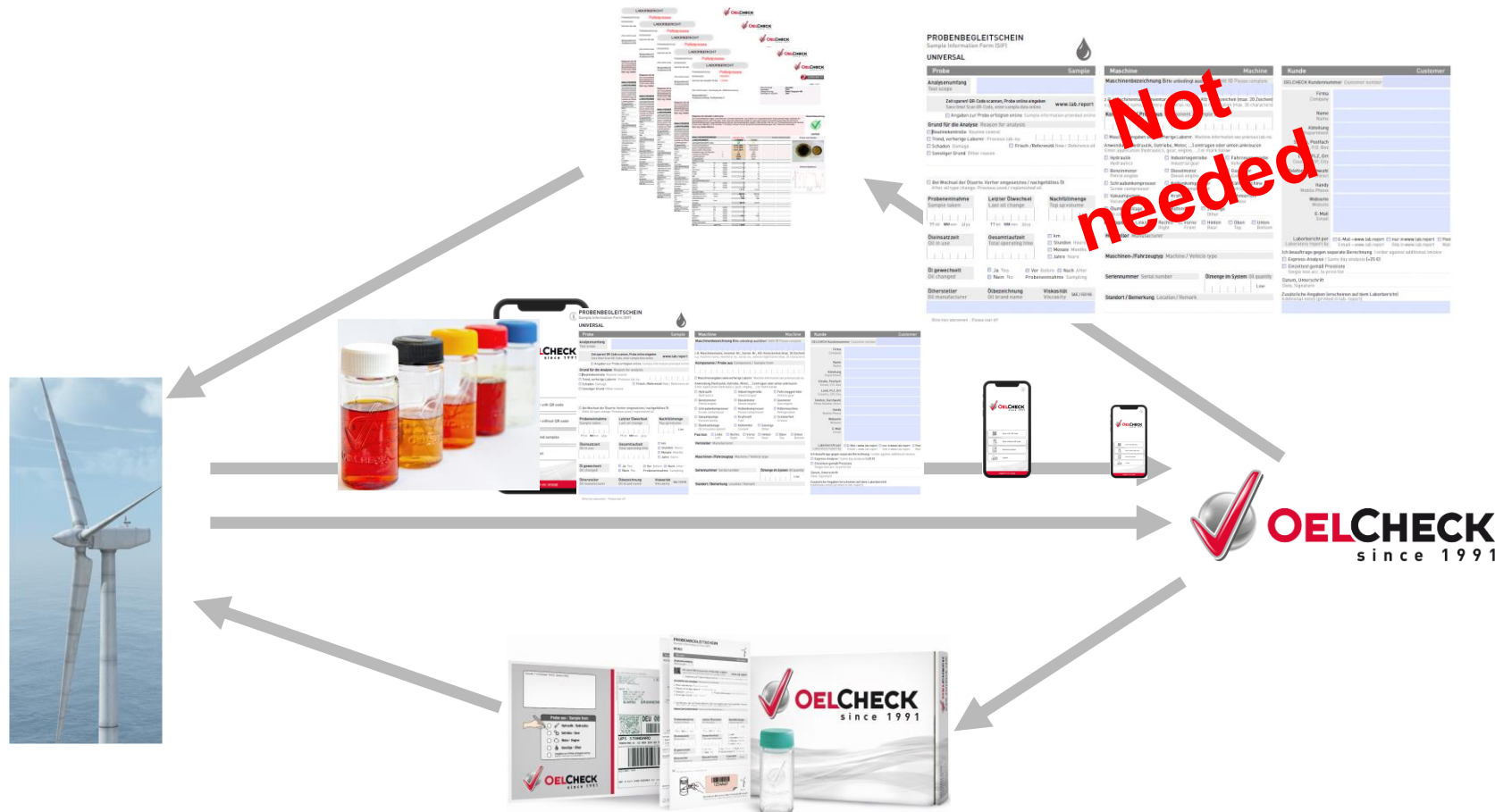


Experienced tribologists translate these values in comprehensible messages.

The information path

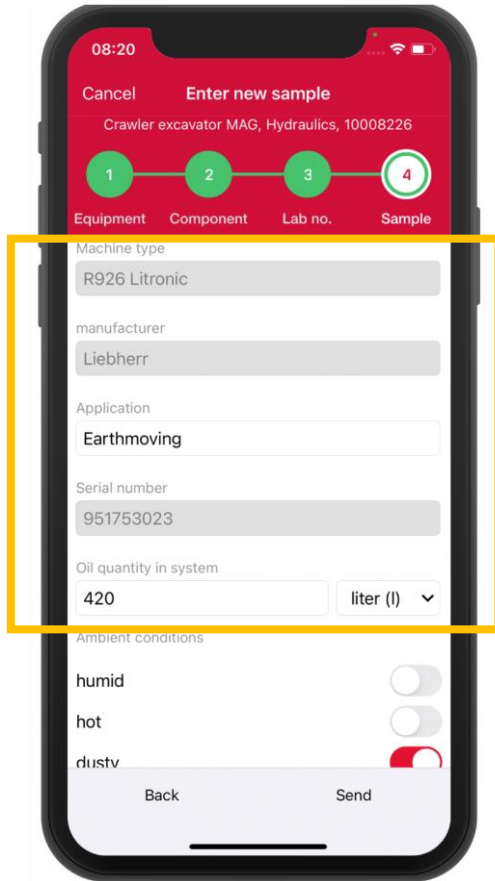


The information path



The information path

✓ pre-implementation of basic data



08:20

Cancel Enter new sample

Crawler excavator MAG, Hydraulics, 10008226

1 2 3 4

Equipment Component Lab no. Sample

Machine type

R926 Litronic

manufacturer

Liebherr

Application

Earthmoving

Serial number

951753023

Oil quantity in system

420 liter (l)

Ambient conditions

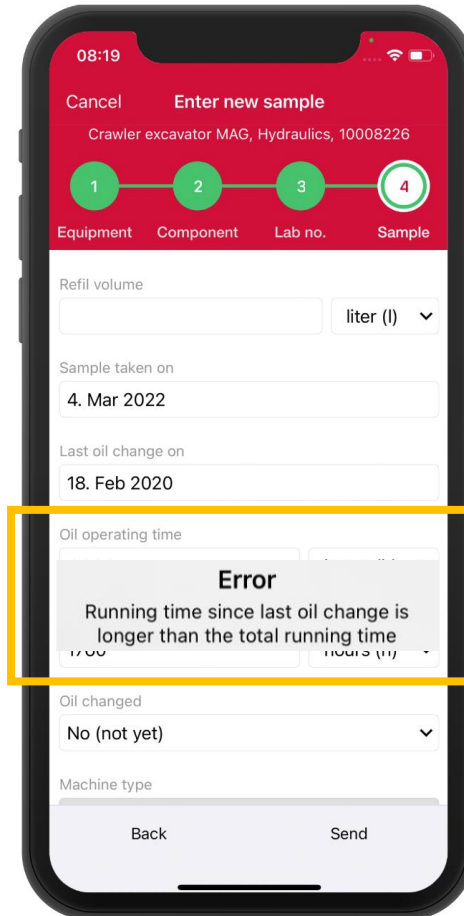
humid

hot

dusty

Back Send

✓ plausibility check



08:19

Cancel Enter new sample

Crawler excavator MAG, Hydraulics, 10008226

1 2 3 4

Equipment Component Lab no. Sample

Refil volume

liter (l)

Sample taken on

4. Mar 2022

Last oil change on

18. Feb 2020

Oil operating time

Error

Running time since last oil change is longer than the total running time

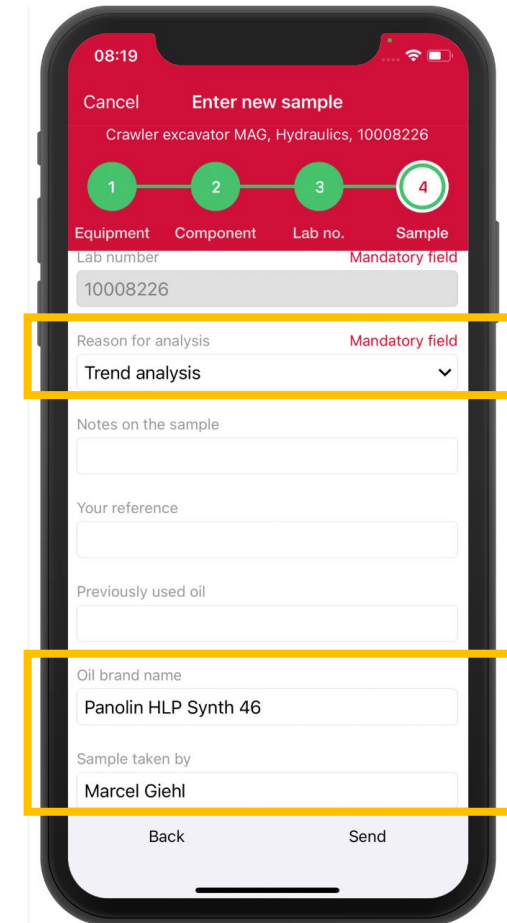
Oil changed

No (not yet)

Machine type

Back Send

✓ definition of mandatory fields



08:19

Cancel Enter new sample

Crawler excavator MAG, Hydraulics, 10008226

1 2 3 4

Equipment Component Lab no. Sample

Lab number

10008226

Reason for analysis

Trend analysis

Notes on the sample

Your reference

Previously used oil

Oil brand name

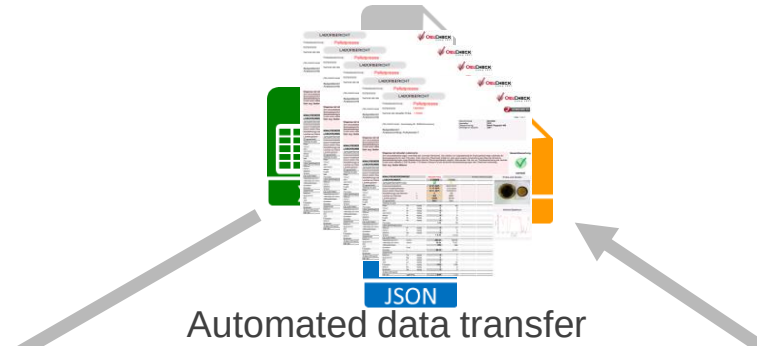
Panolin HLP Synth 46

Sample taken by

Marcel Giehl

Back Send

The information path



→ **F T P** **S**erver (**F**ile **T**ransfer **P**rotocol)

→ **A P I** (**A**pplication **P**rogramming **I**nterface)

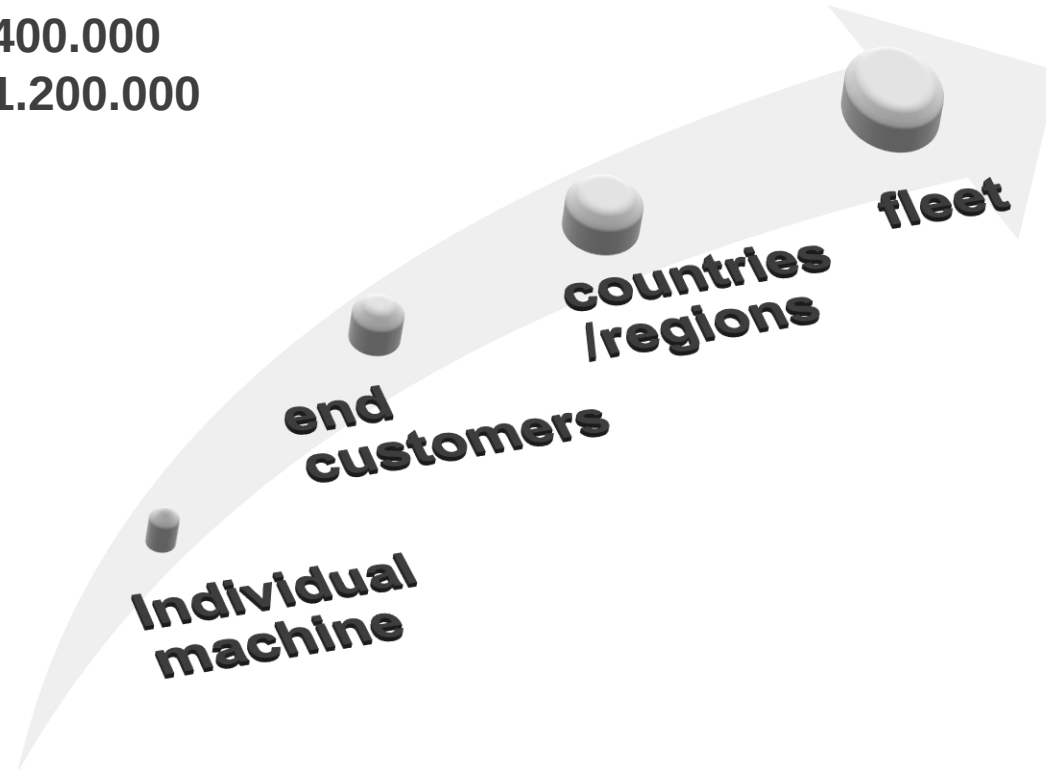
- ✓ constant access to current and previous data
- ✓ at any time
- ✓ direct connection to customer system
- ✓ data is integrated into customer system
- ✓ end customers also have access (telemetry software)

Analyzed data:

- Per lab report: ~40
- 3 samples/machine/a: ~120
- 300 samples: 12.000
- 10.000 samples: 400.000
- In 3 years: 1.200.000

→ Splitting of the data in:

- Complete fleet of machines
- Different countries/regions
- Individual end customers
- Individual machine



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- From the machine to the entire fleet

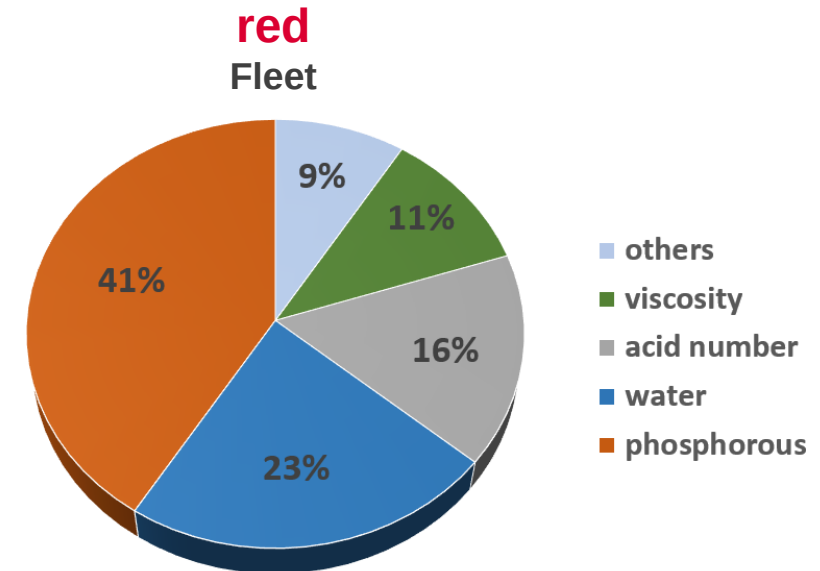
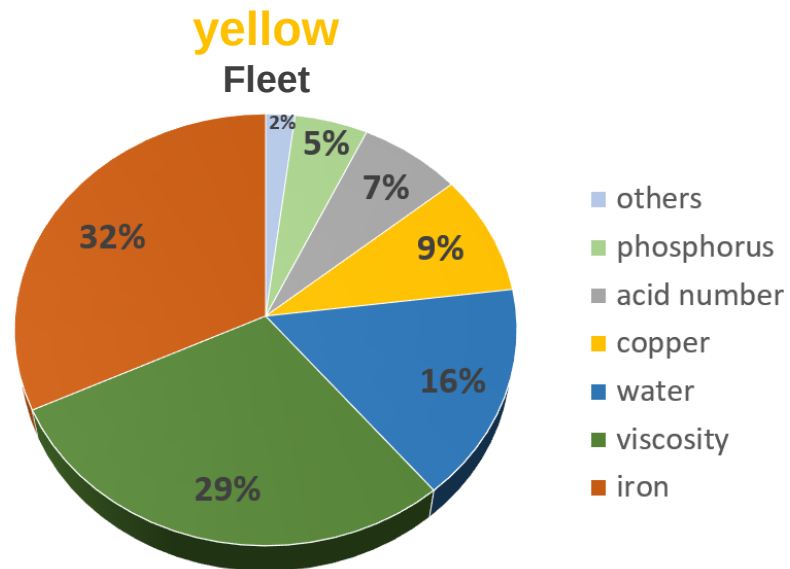
4. Conclusion

→ Fleetmanagement

Besides the color rating of the samples

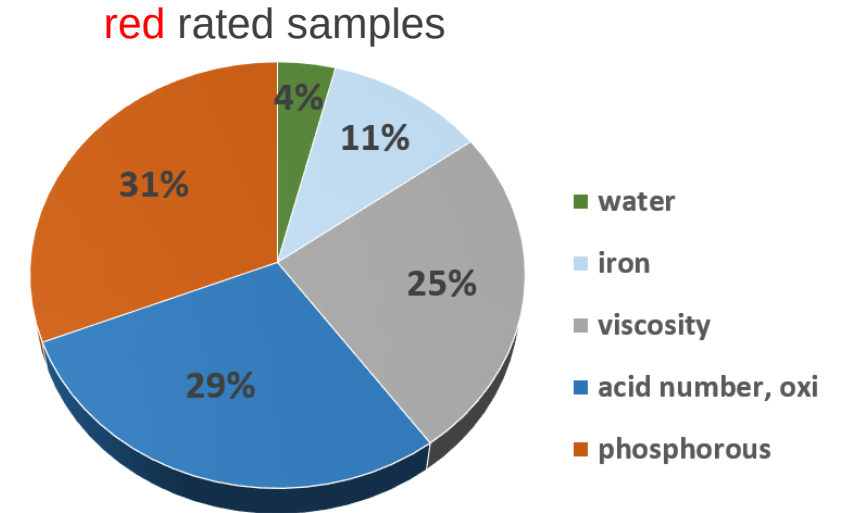
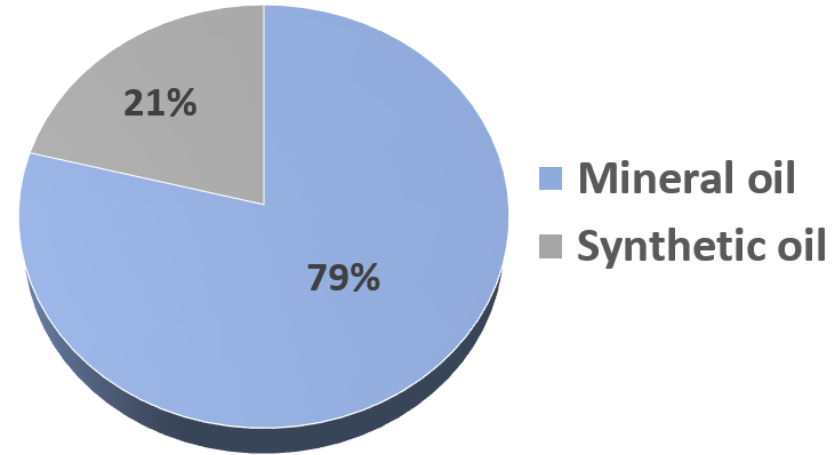
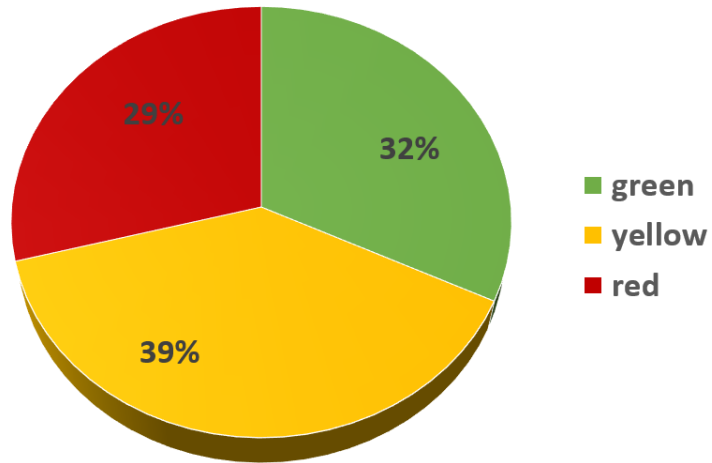
→ **reasons** for **yellow** rating (attention)?

→ **reasons** for **red** rating (action)?

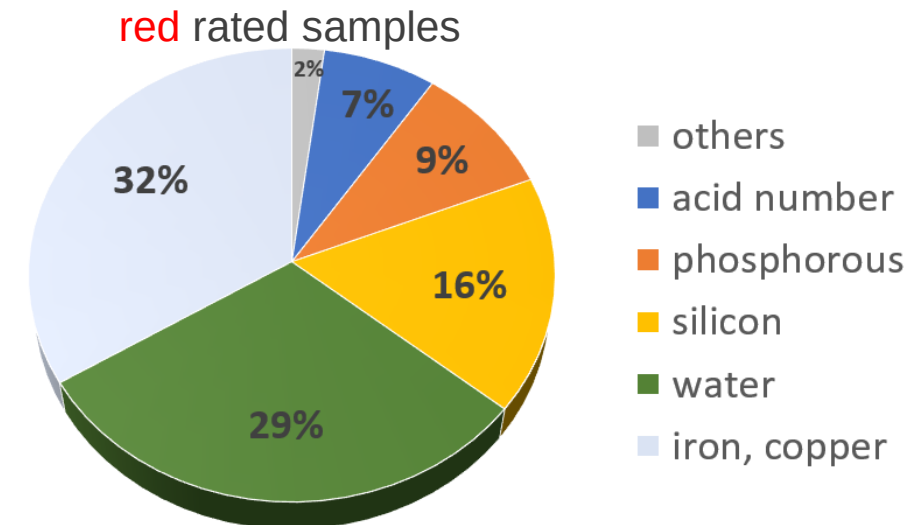
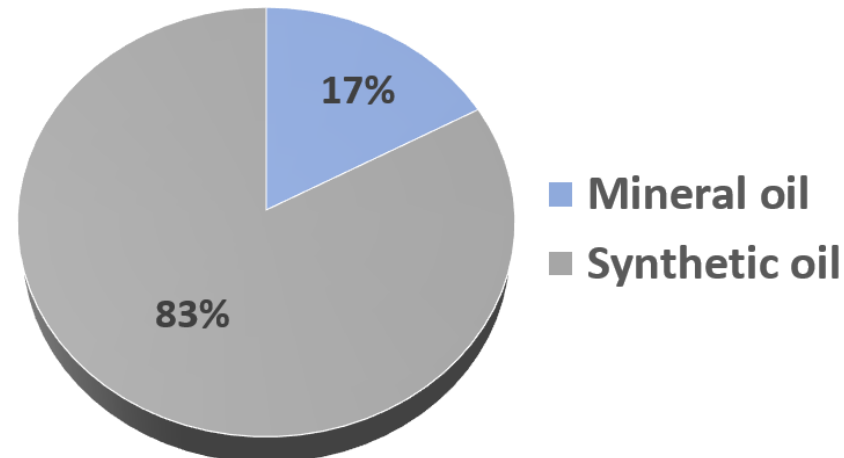
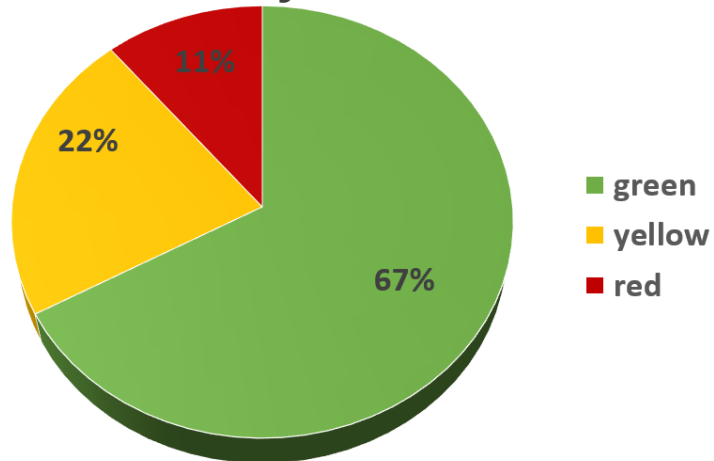


Evaluation of individual countries or regions

→ Country A



→ Country B



Evaluation of individual reports

→ Service concern

Definition of criteria:

- evaluation of the **rating**: green, yellow, red

							
WEAR							
Iron	Fe	mg/kg	125	24	23	107	
Chrome	Cr	mg/kg	1	0	0	1	
Tin	Sn	mg/kg	0	0	0	0	
Aluminum	Al	mg/kg	0	0	0	0	
Nickel	Ni	mg/kg	0	0	0	0	
Copper	Cu	mg/kg	11	0	0	0	
Lead	Pb	mg/kg	1	0	0	0	
Manganese	Mn	mg/kg	1	0	0	1	
PQ index	-		< 25	< 25	< 25	< 25	
CONTAMINATION							
Silicon	Si	mg/kg	0	1	6	7	
Potassium	K	mg/kg	0	0	0	0	
Sodium	Na	mg/kg	2	2	1	0	
Lithium	Li	mg/kg	-	2	3	3	
Water	%		< 0.10	< 0.10	< 0.10	< 0.10	
OIL CONDITION							
Viscosity at 40°C	mm²/s		181.25	222.18	214.87	210.03	
Viscosity at 100°C	mm²/s		16.74	19.10	19.49	18.43	
Viscosity index	-		97	97	103	97	
Oxidation	A/cm		1	1	1	1	
IR index	-		99.70	-	99.92	99.23	
ADDITIVES							
Calcium	Ca	mg/kg	34	3	2	2	
Magnesium	Mg	mg/kg	2	0	0	0	
Boron	B	mg/kg	5	6	7	0	
Zinc	Zn	mg/kg	20	16	30	61	
Phosphorus	P	mg/kg	277	341	250	162	
Barium	Ba	mg/kg	6	1	0	0	
Molybdenum	Mo	mg/kg	0	1	2	0	
Sulphur	S	mg/kg	9321	9912	11010	4854	
ADDITIONAL TESTS							
AN / NN	mgKOH/g		0.50	0.52	0.39	0.32	

Evaluation of individual reports

→ Service concern

Definition of criteria:

- evaluation of the rating: green, yellow, red

- **absolute values: H₂O, Fe, Cu...**

WEAR						
Iron	Fe	mg/kg	125	24	23	107
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Tin	Sn	mg/kg	0	0	0	0
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Evaluation of individual reports

→ Service concern

Definition of criteria:

- evaluation of the rating: green, yellow, red
- absolute values: H₂O, Fe, Cu...
- **percentage change: viscosity, additives...**

WEAR						
Iron	Fe	mg/kg	125	24	23	107
Chrome	Cr	mg/kg	1	0	0	1
Tin	Sn	mg/kg	0	0	0	0
Aluminum	Al	mg/kg	0	0	0	0
Nickel	Ni	mg/kg	0	0	0	0
Copper	Cu	mg/kg	11	0	0	0
Lead	Pb	mg/kg	1	0	0	0
Manganese	Mn	mg/kg	1	0	0	1
PQ index	-		< 25	< 25	< 25	< 25
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ADDITIONAL TESTS						
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Have required service action really been carried out?

→ maintenance (filtration, drying...)

- change in individual values
 - evaluation in trend with red rating
 - absolute (Fe, Cu, H₂O...)
 - in percent (V40, additives...)

WEAR		ANALYSENERGEBNISSE		2018		2020		2018	
SAMPLE RATING		LABORNUMMER		Aktuelle Probe		1705275		1705276	
Date testet		Gesamtbeurteilung		25.09.2019		19.09.2019		23.07.2018	
Da Gesamtbeurteilung		Untersuchungsdatum		19.09.2019		27.06.2019		18.07.2018	
Da Untersuchungsdatum		Datum Probenentnahme		-		-		25.06.2018	
Top Datum Probenentnahme		Datum letzter Ölwechsel		-		-		-	
V Ope Datum letzter Ölwechsel		Nachfüllmenge seit Wechsel		-		-		-	
In Tot Nachfüllmenge seit Wechsel		Laufzeit seit Wechsel		-		-		-	
C Oil c Laufzeit seit Wechsel		Laufzeit gesamt		1397		-		-	
T WEA Laufzeit gesamt		Öl gewechselt		42162		-		-	
A Iron Öl gewechselt		h		Nein		-		-	
IN Chron Verschleiß		h		-		-		-	
FC Tin Eisen		VERSCHLEIß		-		-		-	
Li Alumin Chrom		Eisen		-		-		-	
SM Nickel Zinn		Aluminium		-		-		-	
PM Copper Aluminium		Nickel		-		-		-	
S Pl Lead Nickel		Kupfer		-		-		-	
S Pl Molybde Kupfer		Blei		-		-		-	
WC Mangan Blei		Molybdän		-		-		-	
O Si PQ index Molybdän		Antimon		-		-		-	
O P PQ index Mangan		Mangan		-		-		-	
Vis Si CONTA PQ-Index		PQ-Index		-		-		-	
Vis Si Silicon		VERUNREINIGUNG		-		-		-	
Vis W Potassium SILIZIUM		Silizium		-		-		-	
Oxi Vi Water K. F Kalium		Kalium		-		-		-	
AD Vi OIL CON		Natrium		-		-		-	
Calc Vi Viscosity at Wasser		Sulfation		-		-		-	
Mag O Viscosity at ÖLZUS		IR-Index		-		-		-	
Bor C Viscosity in ADDITIVE		Kalzium		-		-		-	
Zinc C Oxidation		Magnesium		-		-		-	
Phos M ADDITIV		Bor		-		-		-	
Barium C Calcium		Zink		-		-		-	
Sulph Zi Magnesi		Phosphor		-		-		-	
Pi Boron		Schwefel		-		-		-	
Ba Zinc		Zink		-		-		-	
Si Phosph		Magnesium		-		-		-	
Barium Sulphur		Bor		-		-		-	
Sulphur		Zink		-		-		-	
		Phosphor		-		-		-	
		Barium		-		-		-	
		Schwefel		-		-		-	

Tremendous data volume

- countless lubricant analyses
- lab reports
- large amount of raw data



data pool of analyses and lubricants

Tribology know how

- oil analysis experts
- individual customer support



understanding oil



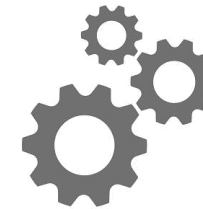
understanding machines

IT power

- inhouse IT department
- IT data experts
- machine Learning up to AI



Big data analysis



optimization of analysis data

- new limit values
- evaluation of fleets, regions...
- data analyses ...
- development of data usage



Oil can talk – we understand the message