

C Code : 10065
U Name : .
S Address : Lot P.T. 2317, No.21, Jalan PTB 1,
 Kawasan Perindustrian Tenggara Batu,
 Mukim Sungai Udang, 76400 Melaka.
T Site :
O Location :
M Test code : C823

E Unit ID : C20 C21 Comp
O Unit Type : Compressor Centrifugal
I Unit Make : COOPER
P Unit Model : GR3MSGEP-5RCD/30
M Oil type / : SHELL TURBO T ISO 46
E Viscosity
N Oil System Capacity : 2080 Liters



Notes (Finding, Evaluation, Interpretation, Suggestion and Recommendation)

Particle count indicates that oil cleanliness level is in unacceptable range.
 VsPI analysis indicates that the majority of the Varnish is in the insoluble state (MPC value is higher than VPI value).
 Note abnormal wear metals.
 Abnormal wear may be from poor lubrication due to the varnish build-up and other insoluble matter in the oil.
 Suggest using an off-line filtration system, that is capable of varnish and sludge removal, to clean up the oil system. A variety of different suppliers of such machines can be supplied upon request.

			Current Sample			Previous Sample			Baseline and Alarm Limit								
Condition History			Wear	Oil	Cont.	Wear	Oil	Cont.	Wear	Oil	Cont.	Alarm Limit					
												Alarm Limit Matrix -Set Name (Equipment type / oil type)					
Lab ID	Test Method	Result										Comp Centrifugal General SH Turbo T 46 (Air Liquid Malaysia)					
Bottle ID			246176	229766	218326												
Date Sampled			2000669	2002243	2000780												
Oil Hours (Kms)			09-Jan-14	18-Sep-13	08-May-13												
Unit Hours (Kms)			Not Given	Not Given	Not Given												
Oil Change			Not Given	Not Given	Not Given												
Oil Added (Liters)																	
Filters Hours (Kms)																	
Wear Condition												The New Oil (TNO)	Fine wear		Coarse wear		
Wear Element	Method	Unit	Fine(small) Wear	Coarse(large) Wear	Fine(small) Wear	Coarse(large) Wear	Fine(small) Wear	Coarse(large) Wear	Fine(small) Wear	Coarse(large) Wear	Fine(small) Wear	Coarse(large) Wear	U-Caution	U-Warning	U-Caution	U-Warning	
Iron	D-6595	PPM	2.7 W	12.7 W	2.3 W	3.7	0.7	9.6 W	0	>1	>2	>5	>8				
Chromium	D-6595	PPM	0.0	0.1	0.1	0.1	0.3	0.1	0	>1	>2	>1	>2				
Lead	D-6595	PPM	0.0	0.9	0.2	0.7	0.0	1.0	0	>1	>2	>5	>9				
Copper	D-6595	PPM	0.7	2.4 W	5.4 W	5.5 W	0.4	0.4	0	>1	>2	>1	>2				
Tin	D-6595	PPM	0.0	0.0	2.0 C	0.0	1.8	0.0	0	>2	>3	>2	>3				
Aluminum	D-6595	PPM	0.0	0.0	0.0	3.8 C	0.0	0.0	0	>1	>2	>3	>4				
Nickel	D-6595	PPM	0.0	1.0	0.1	0.9	0.7	1.2	0	>1	>2	>2	>4				
Silver	D-6595	PPM	0.0	0.0	0.0	0.0	0.0	0.0	0								
Molybdenum	D-6595	PPM	0.0	0.0	0.3	0.0	0.3	0.9	0								
Titanium	D-6595	PPM	0.0	0.0	0.0	0.0	0.1	2.0	0								
Oil Condition												TNO	L-Warning	L-Caution	U-Caution	U-Warning	
Viscosity @ 40 °C	D-445	cSt	47.9		46.9		47.5		47.9	<43.1	<45.5	>50.3	>52.7				
Viscosity @ 100 °C	D-445	cSt															
Oxidation	FTIR	Abs	7.5		7.1		7.3		7.1		>10.7	>12.4					
Nitration	FTIR	Abs	7.2		7.3		7.2		7.1		>10.7	>12.4					
TAN	D-974	mg KOH/g	0.07		0.06		0.06		0.07		>0.17	>0.37					
TBN	D-4739	mg KOH/g															
Contamination												TNO	Fine wear		Coarse wear		
Water	T-H2O CheckTM	% (Wt.)	0.011		0.029		0.012		0.020		>0.03	>0.05					
Sodium	D-6595	PPM	0		0		0		0								
Silicon	D-6595	PPM	1.2	2.0	0.5	1.6	0.0	5.0	0	>3	>5	>5	>8				
Additive Element												TNO					
Boron	D-6595	PPM	0		0		0		0								
Magnesium	D-6595	PPM	0		0		0		0								
Calcium	D-6595	PPM	0		0		0		0								
Barium	D-6595	PPM	0		0		0		0								
Phosphorus	D-6595	PPM	5		0		36		35								
Zinc	D-6595	PPM	3	2	2	2	1	2	0								
Additional Test												TNO	L-Caution	L-Warning	U-Caution	U-Warning	
Flash Point	D-3828	°C															
Viscosity Index	D-2270																

Note: Alarm Limits are variable and dependent upon dataset size and to be used as general guideline.
 No Sign or : NORMAL, : CAUTION (first level warning limit), : Warning (second level warning limit)
 U-Caution : Upper CAUTION Level, L-Caution : Lower CAUTION Level, First Level Alarm_Alert Limit in Upper Level and/or Lower Level
 U-Warning : Upper WARNING Level, L-Warning : Lower WARNING required Level, Second Level Alarm_Alert Limit in Upper Level and/or Lower Level
 Baseline will be data of either "The new oil" or "Reference oil" or "Oil specification". TNO = The new oil, RO = Reference oil, OS = Oil Specification
 Accuracy of interpretation and recommendation are based on representatives sample and information supplied. No warranty is expressed or implied for this report.

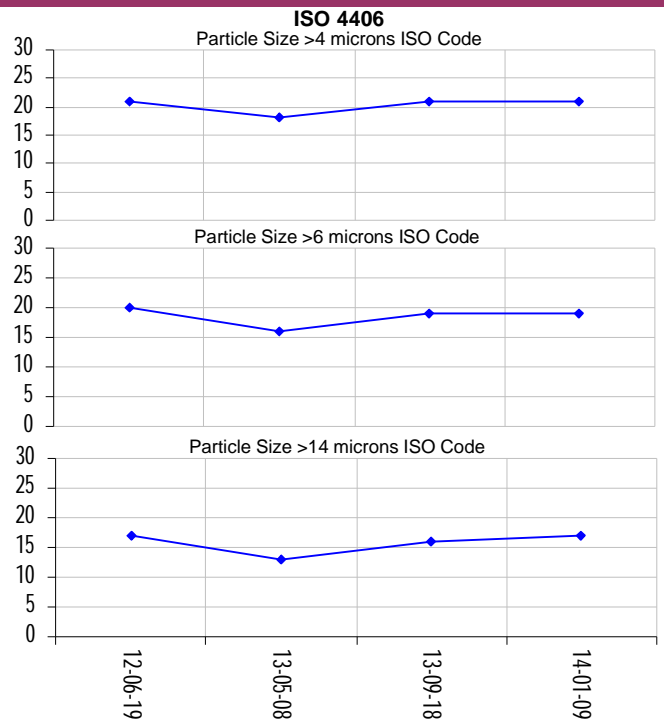
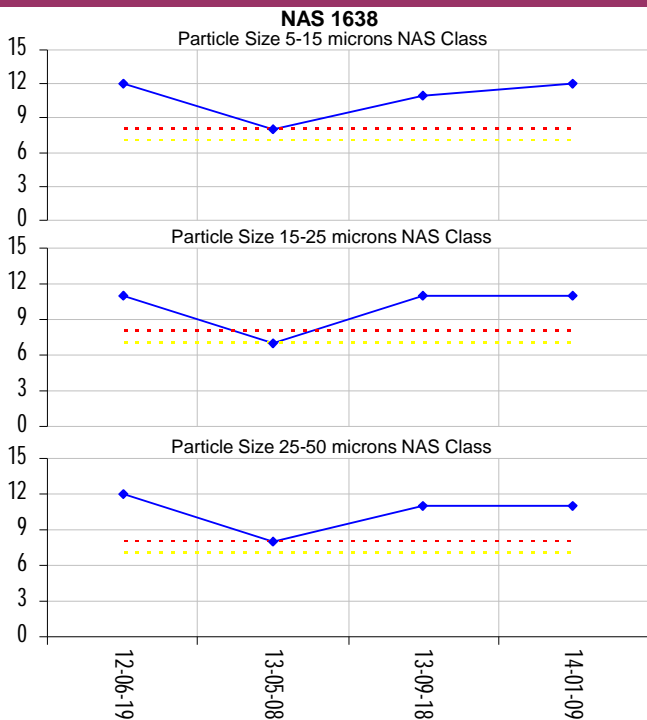
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 Unit ID : **C20 C21 Comp**
 Unit Type : Compressor Centrifugal
 Unit Make : COOPER
 Unit Model : GR3MSGEP-5RCD/30
 Oil type / Viscosity : SHELL TURBO T ISO 46
 Oil System Capacity : 2080 Liters

Notes (Finding, Evaluation, Interpretation, Suggestion and Recommendation)

Particle count indicates that oil cleanliness level is in unacceptable range.

Lab ID	Current Sample		Previous Sample				Particle Count				
	Bottle ID	246176	229766	218326			NAS 1638 ISO 4406				
Date Sampled	2000669	2002243	2000780			BASELINE					
Oil Hours (Kms)	09-Jan-14	18-Sep-13	08-May-13			Alarm Limit					
Unit Hours (Kms)	Not Given	Not Given	Not Given			Comp Centrifugal General SH					
Oil Change	Not Given	Not Given	Not Given			Turbo T 46 (Air Liquid Malaysia)					
Oil Added (Liters)											
Filters Hours (Kms)											
Contamination											
Particle Count NAS 1638 System Standard											
Particle Size Range	No. of Particles / 100ml.	Class	No. of Particles / 100ml.	Class	No. of Particles / 100ml.	Class	Class	No. of Particles / 100ml.	Class	No. of Particles / 100ml.	Class
Particle Size 5-15 microns	552,200	12 W	508,600	11 W	51,700	8 W		>16000	7	>32000	8
Particle Size 15-25 microns	50,200	11 W	46,200	11 W	4,700	7 C		>2850	7	>5700	8
Particle Size 25-50 microns	14,300	11 W	13,200	11 W	1,300	8 W		>506	7	>1012	8
Particle Size 50-100 microns	1,500	11	1,400	10	100	7					
Particle Size >100 microns	<100	9	<100	9	<100	5					
Particle Count ISO 4406:1999 System Standard											
Particle Size Range	No. of Particles / ml.	Class	No. of Particles / ml.	Class	No. of Particles / ml.	Class	Class	No. of Particles / ml.	Class	No. of Particles / ml.	Class
Particle Size > 4 microns	16,565	21	15,256	21	1,548	18					
Particle Size > 6 microns	4,637	19	4,271	19	434	16					
Particle Size > 14 microns	650	17	599	16	60	13					
ISO 4406 Class Rating	21 / 19 / 17		21 / 19 / 16		18 / 16 / 13						












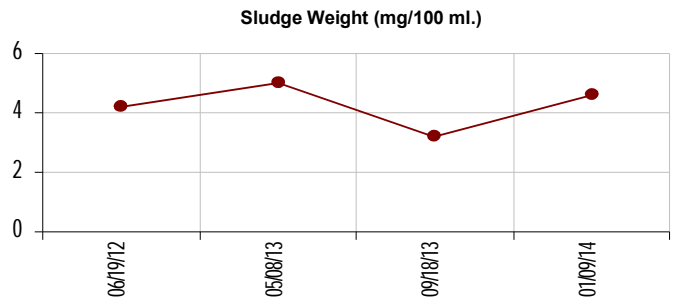
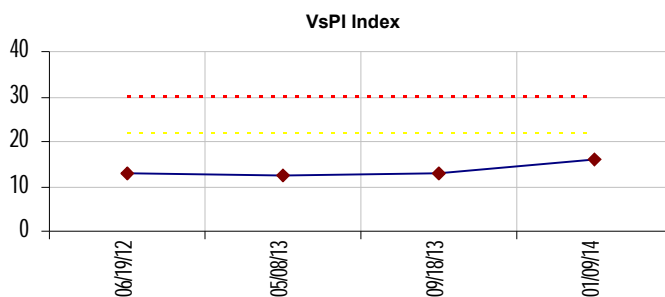
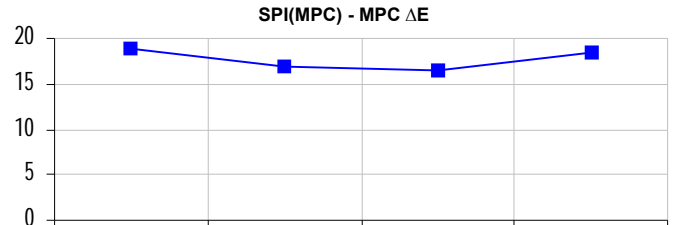
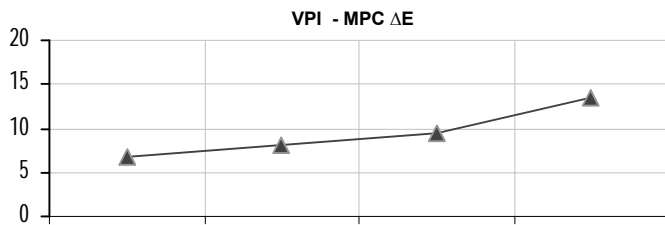
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 P Oil type / : SHELL TURBO T ISO 46
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Notes (Finding, Evaluation, Interpretation, Suggestion and Recommendation)

VsPI analysis indicates that the majority of the Varnish is in the insoluble state (MPC value is higher than VPI value).

	Current Sample		Previous Sample		ASTM D7843 M VsPI™ Varnish & Sludge Potential Index 								
Lab ID Bottle ID Date Sampled Oil Hours (Kms) Unit Hours (Kms) Oil Change Oil Added (Liters) Filters Hours (Kms)	246176	229766	218326	2000669		2002243	2000780	09-Jan-14	18-Sep-13	08-May-13	Not Given	Not Given	Not Given
Contamination						New Oil and Alarm Limit Name							
Varnish and Sludge Potential Index™ (VsPI™)						New Oil Limit Name							
VPI (Varnish Potential Index) : Soluble Varnish Type Contamination in Oil						Comp Centrifugal General SH Turbo T 46 (Air Liquid Malaysia)							
VPI™ Varnish Potential Index Soluble Varnish Contaminant													
VPI Rating	13.5	9.5	8.1			New Oil Caution Warning							
SPI (Sludge Potential Index) : Conform to ASTM D7843 - MPC (Membrane Patch Colorimetry) : Insoluble Varnish Type Contamination in Oil													
SPI™ Sludge Potential Index (MPC Membrane Patch Colorimetry) Insoluble Varnish Contaminant													
SPI(MPC) Rating	18.5	16.4	17.0			New Oil Caution Warning							
VsPI™	16.0	12.9	12.6			0 >22 >30							
Sludge Weight	4.6 mg/100 ml	3.2 mg/100 ml	5.0 mg/100 ml										


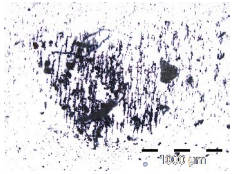
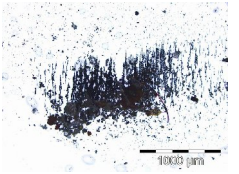
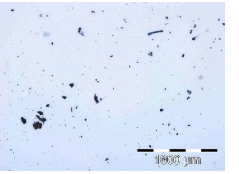
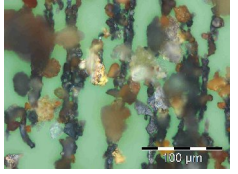
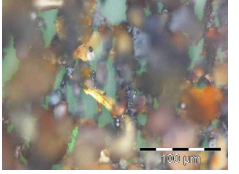
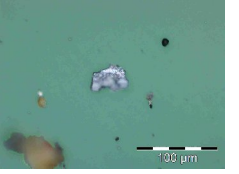

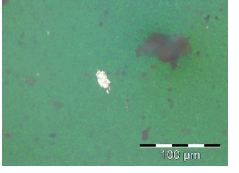
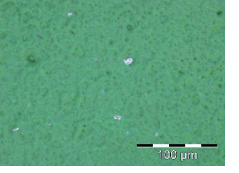


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E O U I P M E N T
Unit ID : **C20 C21 Comp**
Unit Type : Compressor Centrifugal
Unit Make : COOPER
Unit Model : GR3MSGEP-5RCD/30
Oil type / Viscosity : SHELL TURBO T ISO 46
Oil System Capacity : 2080 Liters

Notes (Finding, Evaluation, Interpretation, Suggestion and Recommendation)

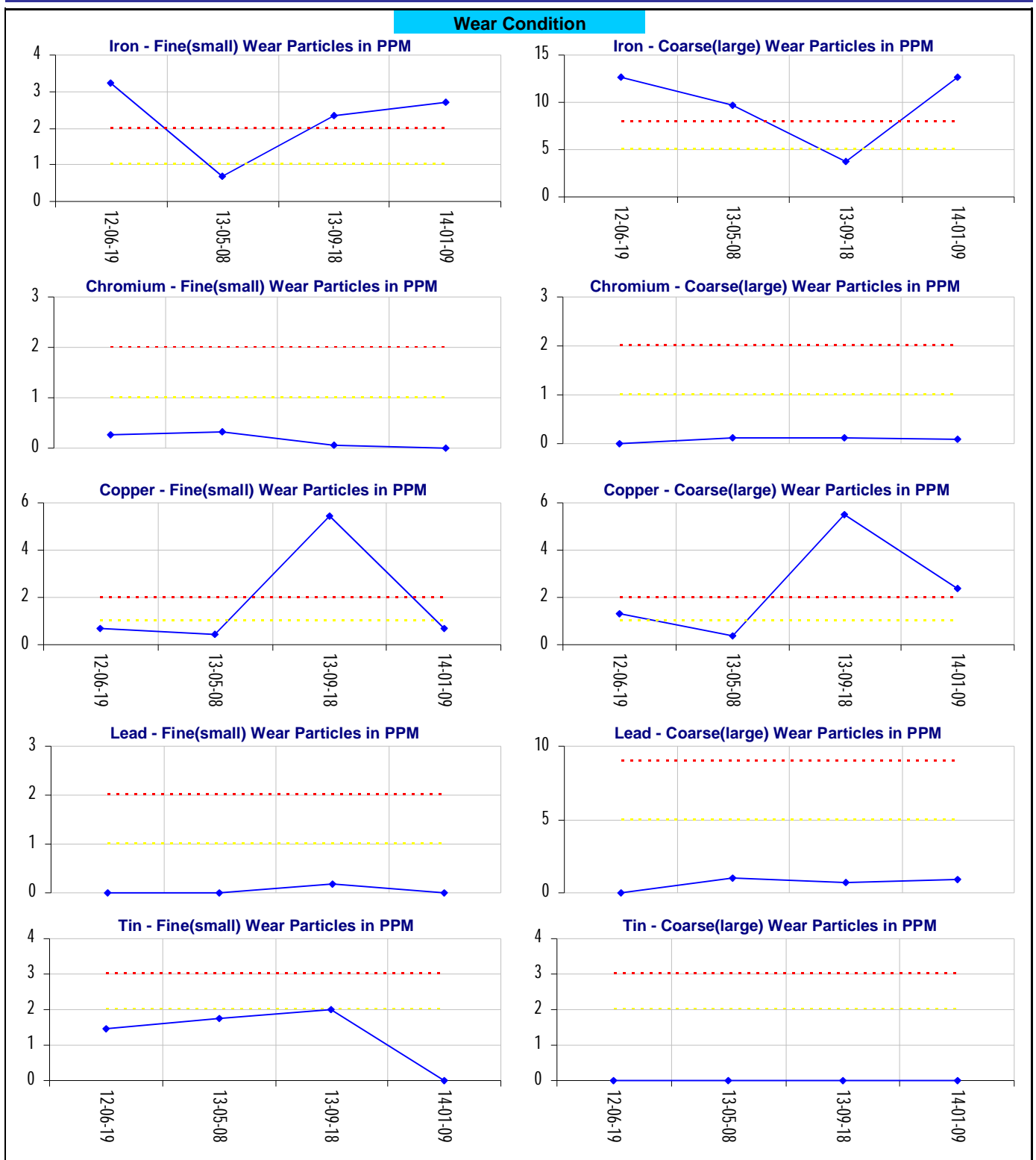
Copper (bronze or brass) fatigue particles are present.
Corrosion particles appear to make the majority of the ferrous particles present. Recommend check for root cause of the corrosion.

	Current Sample			Previous Sample								
Lab ID	246176	229766	218326	 ASTM D 7690 M								
Bottle ID	2000669	2002243	2000780									
Date Sampled	09-Jan-14	18-Sep-13	08-May-13									
Oil Hours (Kms)	Not Given	Not Given	Not Given									
Unit Hours (Kms)	Not Given	Not Given	Not Given									
Oil Change												
Oil Added (Liters)												
Filters Hours (Kms)												
Wear Condition	Typical Normal Condition											
Ferrographic Analysis	Typical Normal Condition											
Volume of Sample Used	3.00 ml	3.00 ml	3.00 ml									
Image of Wear & Contaminants (Ferrogram) Magnification 50X												
Image of Wear & Contaminants (Ferrogram) Magnification 500X												
Image of Wear & Contaminants (Filtergram) Magnification 500X												
Wear & Contaminants Particles	%Rating	Size (Micron)	Particle Type	%Rating	Size (Micron)	Particle Type	%Rating	Size (Micron)	Particle Type	%Rating	Size (Micron)	Particle Type
Normal Rubbing Wear	65	2-3	1	65	2-3	1	85	2-3	1			
Fatigue Gear Wear	5	5-10	1	5	5-20	1	5	5-40	1			
Fatigue Bearing Wear												
Fatigue Sphere												
Severe Sliding Wear												
Cutting Wear												
Black Oxides	10	5-40	1	5	5-40	1						
Red Oxides				5	5-60	1						
Corrosive Wear	10	20-40	1									
Dirt and Dust	5	10-60	3	10	10-80	3	5	5-60	3			
Copper	5	5-40	2	5	5-60	2						
White Metal				5	5-20	2						
							5	5-15	2			
Ferrographic Analysis Rating (FAR) rating in grade	A B C D F ☺			A B C D F ☹			A B C D F ☺					

%Rating : Percent area covered by wear debris particles or contaminant particles. Size : Size in micron unit (0.001 mm) Particle Type : 1: Ferrous Wear Particles 1.1: Low Alloy 1.2: Medium Alloy 1.3: High Alloy 1.4 Case Hardened 2: Non-ferrous Wear Particles 2.1: Copper 2.2: White Metal 2.3: Babbiting 3: Contamination Particles 3.1: Fibers	Ferrographic Analysis Rating (FAR) , rating in grade A : Excellent - normal rubbing wear condition B : Good - normal rubbing wear condition C : Fair or moderate - normal rubbing wear condition D : Severe and/or critical - wear condition F : Extreme severe and/or extreme critical - wear condition
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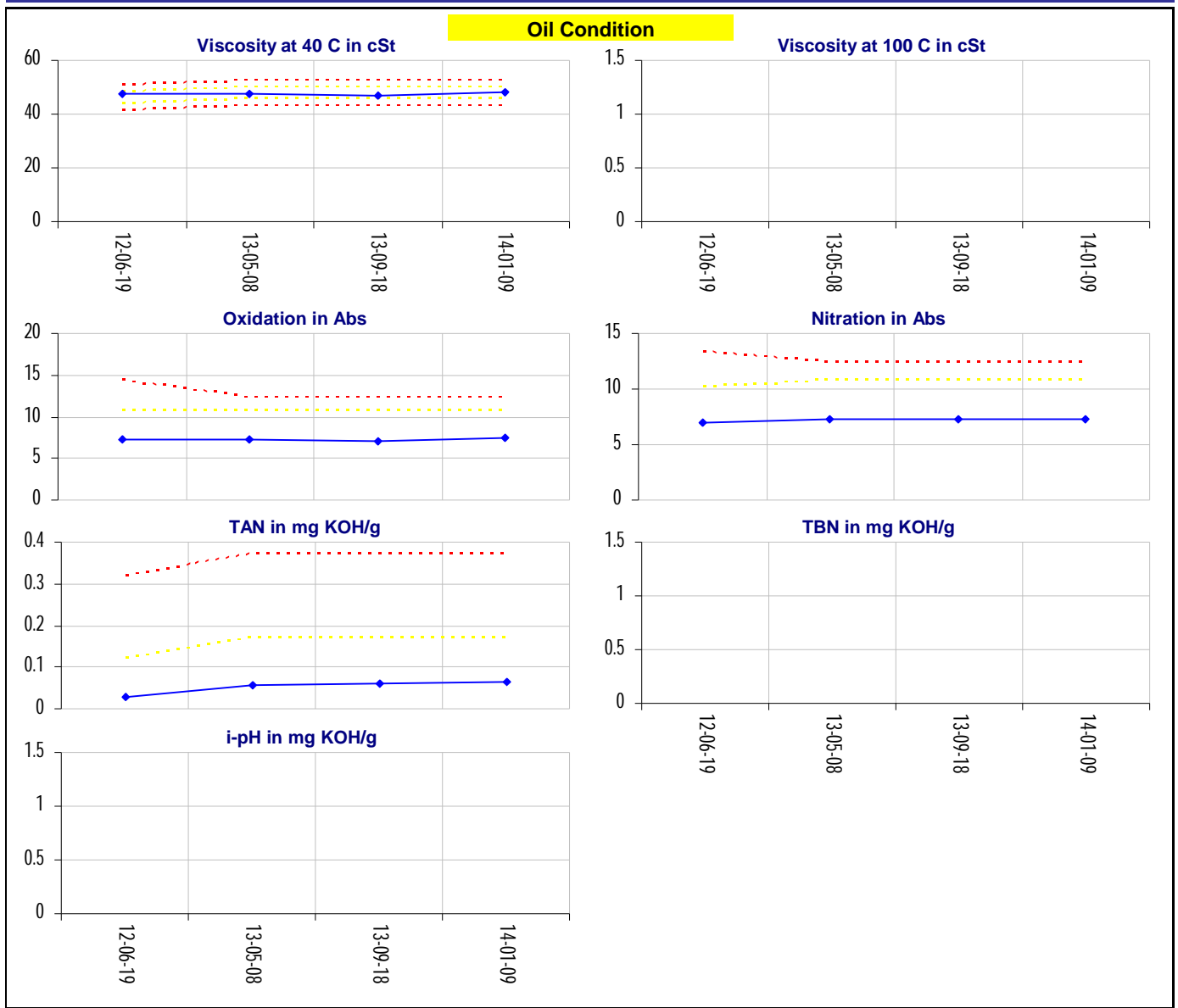
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