CUSTOMER

Code : **1006**

Name :

Address : Kawasan Perindustrian Tangga Batu, Mukim Sungai Udang, 76400 Melaka.

Site :

Location :

Test code : T815

EQUIPMENT

Unit ID : **ET20 ET21 Turbine**

Unit Type : Engine Turbine Gas

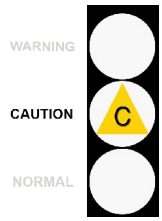
Unit Make :

Unit Model :

OIL

Oil type / Viscosity : SHELL TURBO T ISO 46

Oil System Capacity : 6000 Liters



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

All wear conditions and wear tests appear in normal working range.
All contaminant conditions and contaminant levels appear in normal ranges.
Oil condition tests indicate that the oil is slightly degraded.
All other wear tests and oil condition tests appear satisfactory, and the oil was still serviceable at the time of sampling.
Continue routine sampling interval.

Andy Sitton

Condition History	Test Method	Result	Current Sample Wear	Current Sample Oil	Current Sample Cont.	Previous Sample Wear	Previous Sample Oil	Previous Sample Cont.	Previous Sample Wear	Previous Sample Oil	Previous Sample Cont.
			N	C	N	N	N	W	C	N	W
Lab ID			246178			229768			218328		
Bottle ID			2002197			2002204			2000671		
Date Sampled			05-Feb-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											
Wear Element	**Method**	**Unit**	**Fine(small) Wear**	**Coarse(large) Wear**		**Fine(small) Wear**	**Coarse(large) Wear**		**Fine(small) Wear**	**Coarse(large) Wear**	
Iron	D-6595	PPM	0.7	2.0		0.4	1.1		1.6	12.4	W
Chromium	D-6595	PPM	0.0	0.1		0.1	0.4		0.0	0.1	
Lead	D-6595	PPM	0.0	1.0		0.0	0.0		0.0	0.7	
Copper	D-6595	PPM	0.1	0.2		0.0	0.1		0.5	0.2	
Tin	D-6595	PPM	0.0	1.3		0.0	0.3		2.2	0.0	
Aluminum	D-6595	PPM	0.0	0.0		0.1	0.2		0.7	0.0	
Nickel	D-6595	PPM	0.0	0.8		0.0	1.0		0.0	0.0	
Silver	D-6595	PPM	0.0	0.0		0.0	0.0		0.0	0.3	
Molybdenum	D-6595	PPM	0.0	0.0		0.0	0.8		0.0	1.2	
Titanium	D-6595	PPM	0.0	0.0		0.0	0.0		0.1	0.6	
Oil Condition											
Viscosity @ 40 °C	D-445	cSt	47.1			47.0			47.1		
Viscosity @ 100 °C	D-445	cSt									
Oxidation	FTIR	Abs	7.6			7.2			7.4		
Nitration	FTIR	Abs	7.2			7.2			7.2		
TAN	D-974	mg KOH/g.	0.06			0.06			0.05		
TBN	D-4739	mg KOH/g.									
Contamination											
Water	T-H2O Check™	% (Wt.)	0.010			0.016			0.017		
Sodium	D-6595	PPM	1			1			1		
Silicon	D-6595	PPM	0.0	0.4		0.0	2.9		1.1	0.7	
Additive Element											
Boron	D-6595	PPM	0			0			0		
Magnesium	D-6595	PPM	1			1			2		
Calcium	D-6595	PPM	1			1			1		
Barium	D-6595	PPM	0			0			0		
Phosphorus	D-6595	PPM	12			0			35		
Zinc	D-6595	PPM	13	1		9	2		7	4	
Additional Test											
Flash Point	D-3828	°C									
Viscosity Index	D-2270										

Baseline and Alarm Limit

Alarm Limit

Alarm Limit Matrix -Set Name (Equipment type / oil type)

Engine Turbine Gas General Shell Turbo T46 (Air Liq Malaysia)

BASELINE	The New Oil (TNO)	Fine wear U-Caution	Fine wear U-Warning	Coarse wear U-Caution	Coarse wear U-Warning
	0	>2	>3	>3	>5
	0	>1	>2	>1	>2
	0	>1	>2	>4	>7
	0	>6	>10	>4	>8
	0	>3	>6	>2	>4
	0	>1	>2	>2	>3
	0	>1	>2	>1	>2
	0				
	0				
	0				
	TNO	L-Warning	L-Caution	U-Caution	U-Warning
	47.9	<43.1	<45.5	>50.3	>52.7
	7.1			>10.7	>12.4
	7.1			>10.7	>12.4
	0.07			>0.27	>0.37
	TNO			U-Caution	U-Warning
				>0.03	>0.05
		Fine wear U-Caution	Fine wear U-Warning	Coarse wear U-Caution	Coarse wear U-Warning
	0				
	0	>3	>5	>8	>13
	TNO				
	0				
	0				
	0				
	0				
	35				
	1				
	TNO	L-Caution	L-Warning	U-Caution	U-Warning

Note: Alarm Limits are variable and dependent upon dataset size and to be used as general guideline.

No Sign or N : NORMAL , C or C : CAUTION (first level warning limit) , W or W : Warning (second level warning limit)

U-Caution : Upper CAUTION Level L-Caution : Lower CAUTION Level

U-Warning : Upper WARNING Level L-Warning : Lower WARNING required Level

First Level Alarm _Alert Limit in Upper Level and/or Lower 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.

CUSTOMER
Code : **1006**
Name :
Address : Kawasan Perindustrian Tangga Batu, Mukim Sungai Udang, 76400 Melaka.
Site :
Location :
Test code : T815

EQUIPMENT
Unit ID : **ET20 ET21 Turbine**
Unit Type : Engine Turbine Gas
Unit Make :
Unit Model :

OIL
Oil type / Viscosity : SHELL TURBO T ISO 46
Oil System Capacity : 6000 Liters

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

Particle count indicates oil cleanliness level is clean.

	Current Sample	Previous Sample		Particle Count NAS 1638 ISO 4406
Lab ID	246178	229768	218328	BASELINE / Alarm Limit
Bottle ID	2002197	2002204	2000671	
Date Sampled	05-Feb-14	18-Sep-13	08-May-13	Engine Turbine Gas General Shell Turbo T46 (Air Liq Malaysia)
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)				

Contamination

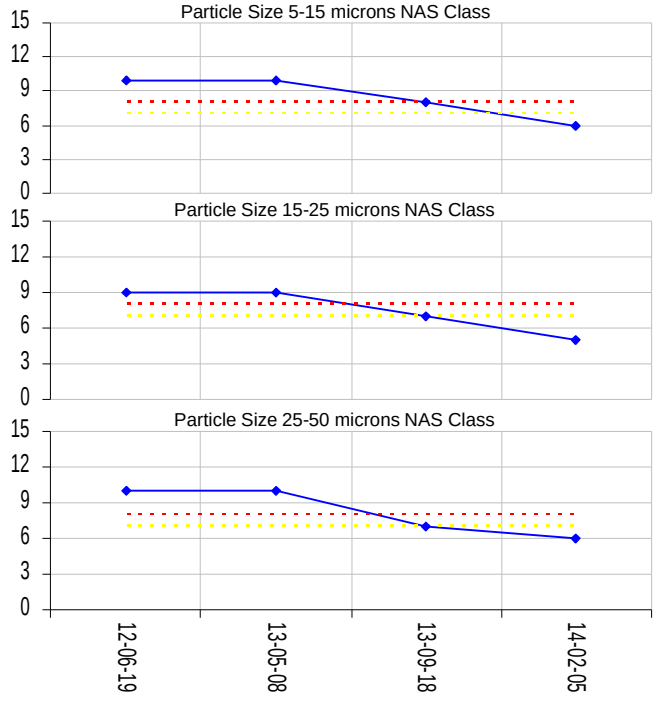
Particle Count NAS 1638 System Standard

Particle Size Range	No. of Particles / 100ml.	Class	No. of Particles / 100ml.	Class	No. of Particles / 100ml.	Class	Class	U-Caution No. of Particles / 100ml.	Class	U-Warning No. of Particles / 100ml.	Class
Particle Size 5-15 microns	12,200	6	33,600	8 W	166,700	10 W		>16000	7	>32000	8
Particle Size 15-25 microns	1,100	5	3,100	7 C	15,200	9 W		>2850	7	>5700	8
Particle Size 25-50 microns	300	6	900	7	4,300	10 W		>506	7	>1012	8
Particle Size 50-100 microns	<100	5	<100	6	400	9					
Particle Size >100 microns	<100	3	<100	5	<100	7					

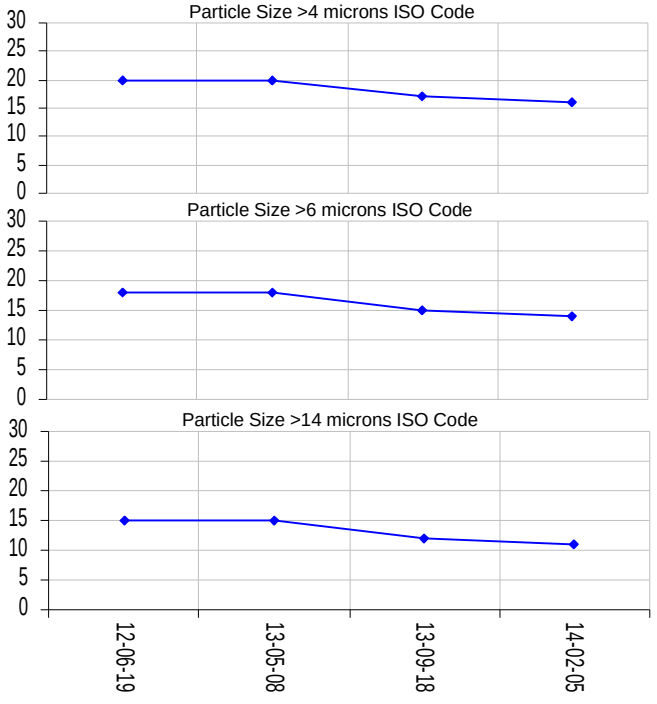
Particle Count ISO 4406:1999 System Standard

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	365	16	1,010	17	5,002	20					
Particle Size > 6 microns	102	14	282	15	1,400	18					
Particle Size > 14 microns	14	11	39	12	196	15					
ISO 4406 Class Rating	16 / 14 / 11		17 / 15 / 12		20 / 18 / 15						

NAS 1638



ISO 4406



CUSTOMER
Code : **1006**
Name :
Address : Kawasan Perindustrian Tangga Batu, Mukim Sungai Udang, 76400 Melaka.
Site :
Location :
Test code : T815

EQUIPMENT
Unit ID : **ET20 ET21 Turbine**
Unit Type : Engine Turbine Gas
Unit Make :
Unit Model :

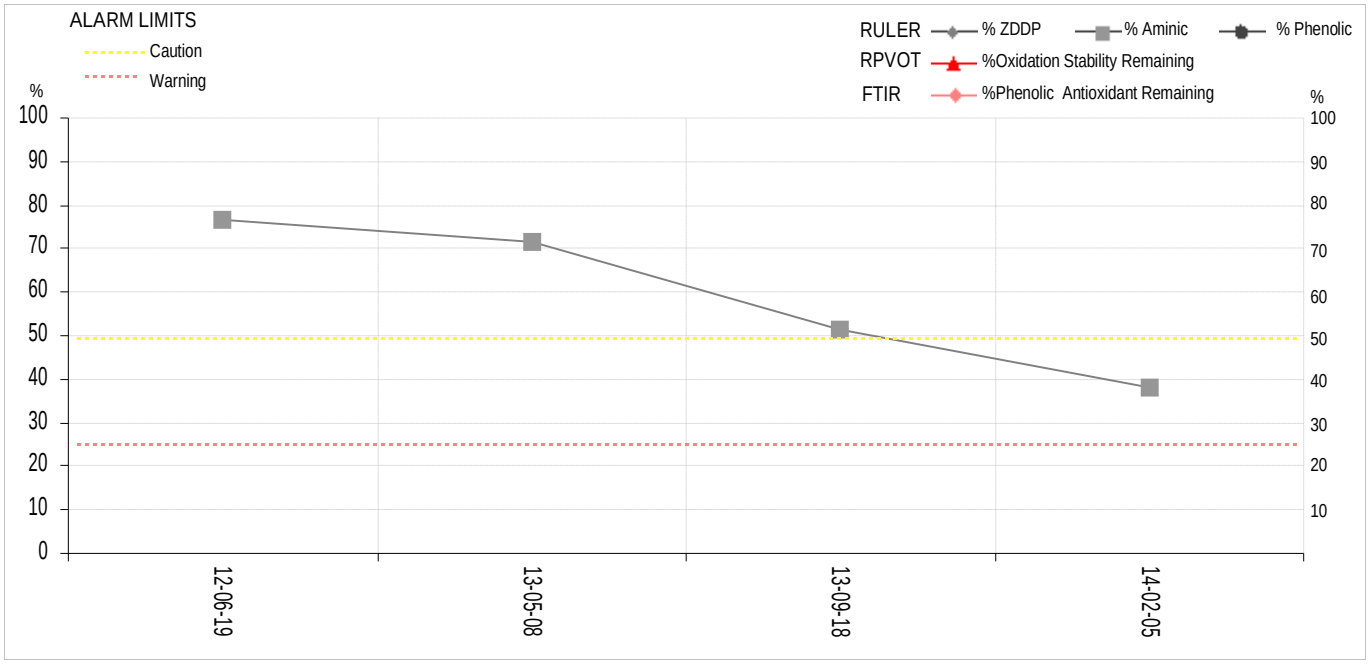
OIL
Oil type / Viscosity : SHELL TURBO T ISO 46
Oil System Capacity : 6000 Liters

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

Oil condition tests indicate that the oil is slightly degraded.

Andy Sitton

	Test Method	Result	Current Sample	Previous Sample		RULER TM RPVOT (RBOT) FTIR
Lab ID			246178	229768	218328	
Bottle ID			2002197	2002204	2000671	
Date Sampled			05-Feb-14	18-Sep-13	08-May-13	
Oil Hours (Kms)			Not Given	Not Given	Not Given	Based on and referred to ASTM D-4378-0
Unit Hours (Kms)			Not Given	Not Given	Not Given	Alarm Limit based on ASTM D-4378-08
Oil Added (Liters)						
Oilchange					No	
Filters Hours (Kms)						
Oil Condition						
RULER TM(Remaining Useful Life Evaluation Routine)						The New Oil / Caution / Warning
% ZDDP Antioxidant Remaining	D-6810-02 D-6971-04	%	n/p	n/p	n/p	100 / <50 / <25
%Aminic Antioxidant Remaining		%	38 C	51.3	71.6	
%Phenolic Antioxidant Remaining		%	n/p	n/p	n/p	
RULER Test Solution		Color	Green	Green	Green	
FTIR (Fourier Transform Infrared)						Caution / Warning
%Phenolic Antioxidant Remaining	D-2668	%	n/p	n/p	n/p	
RPVOT (Rotating Pressure Vessel Oxidation Test) or previously known as RBOT						Caution / Warning
Oxidation Stability	D-2272	Minutes				
%Oxidation Stability Remaining		%				



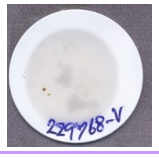
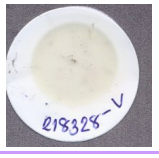
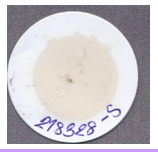
CUSTOMER
Code : **1006**
Name :
Address : Kawasan Perindustrian Tangga Batu, Mukim Sungai Udang, 76400 Melaka.
Site :
Location :
Test code : T815

EQUIPMENT
Unit ID : **ET20 ET21 Turbine**
Unit Type : Engine Turbine Gas
Unit Make :
Unit Model :

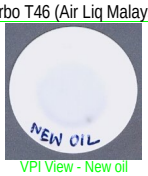
OIL
Oil type / Viscosity : SHELL TURBO T ISO 46
Oil System Capacity : 6000 Liters

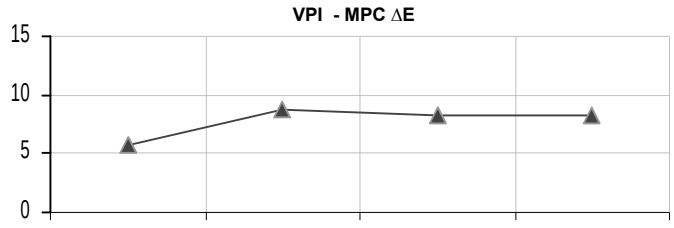
Notes (Finding, Evaluation, Interpretation, Suggestion and Recommendation)

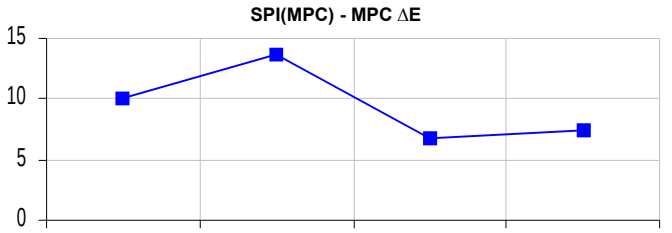
Varnish & Sludge Potential Index (VsPI) indicates only a minor amount of varnish & sludge products are present in the oil.

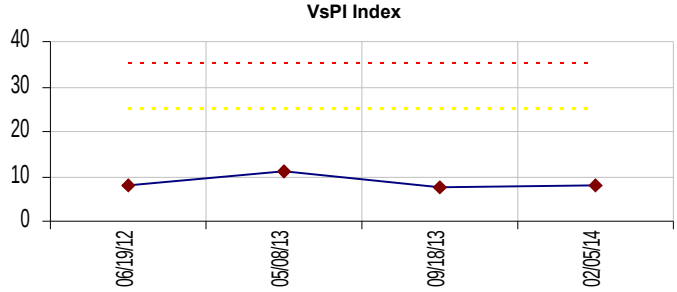
	Current Sample	Previous Sample	
Lab ID	246178	229768	218328
Bottle ID	2002197	2002204	2000671
Date Sampled	05-Feb-14	18-Sep-13	08-May-13
Oil Hours (Kms)	Not Given	Not Given	Not Given
Unit Hours (Kms)	Not Given	Not Given	Not Given
Oil Change			
Oil Added (Liters)			
Filters Hours (Kms)			
Contamination			
Varnish and Sludge Potential Index™(VsPI™)			
VPI (Varnish Potential Index)		: Soluble Varnish Type Contamination in Oil	
VPI™ Varnish Potential Index Soluble Varnish Contaminant	 VPI View	 VPI View	 VPI View
VPI Rating	8.3	8.3	8.7
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 Colormetry) Insoluble Varnish Contaminant	 SPI View	 SPI View	 SPI View
SPI(MPC) Rating	7.5	6.8	13.7
VsPI™	7.9	7.5	11.2
Sludge Weight	2.3 mg/100 ml	5.4 mg/100 ml	2.4 mg/100 ml

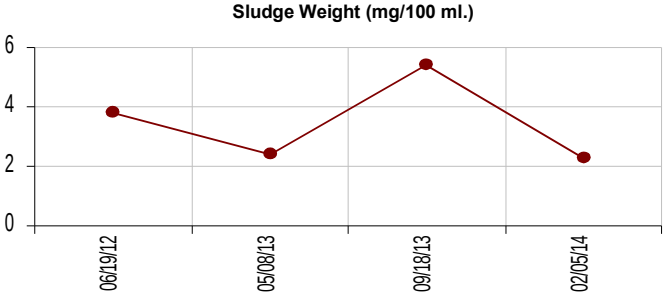
ASTM D7843 M

New Oil and Alarm Limit Name		
New Oil	Limit Name	
Engine Turbine Gas General Shell Turbo T46 (Air Liq Malaysia)		
 VPI View - New oil		
New Oil	Caution	Warning
 SPI (MPC) View - New oil		
New Oil	Caution	Warning
0	>25	>35









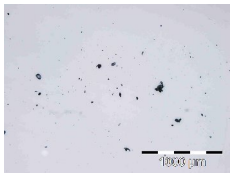
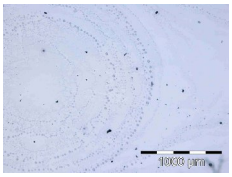
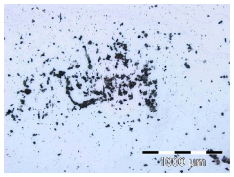
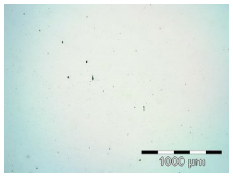
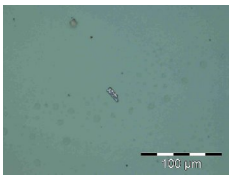
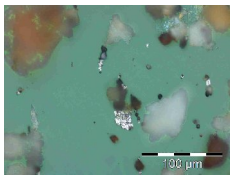
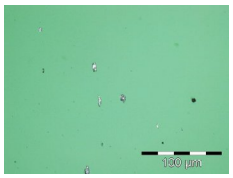
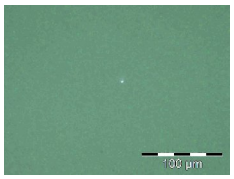
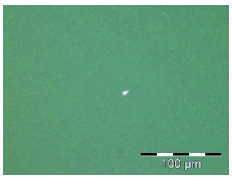
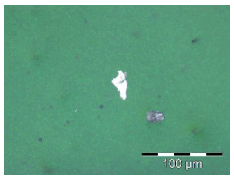
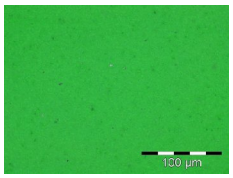
CUSTOMER
Code : **1006**
Name :
Address : Kawasan Perindustrian Tangga Batu, Mukim Sungai Udang, 76400 Melaka.
Site :
Location :
Test code : T815

EQUIPMENT
Unit ID : **ET20 ET21 Turbine**
Unit Type : Engine Turbine Gas
Unit Make :
Unit Model :

OIL
Oil type / Viscosity : SHELL TURBO T ISO 46
Oil System Capacity : 6000 Liters

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

Amount of visible ferrous particles, is normal, compared to the other similar samples.

	Current Sample	Previous Sample		
Lab ID	246178	229768	218328	
Bottle ID	2002197	2002204	2000671	
Date Sampled	05-Feb-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)				
				ASTM D 7690 M
Wear Condition				
Ferrographic Analysis				**Typical Normal Condition**
Volume of Sample Used	3.00 ml	3.00 ml	3.00 ml	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	90	2-3	1	95	2-3	1	75	2-3	1			
Fatigue Gear Wear	5	5-15	1				5	5-40	1			
Fatigue Bearing Wear												
Fatigue Sphere												
Severe Sliding Wear												
Cutting Wear												
Black Oxides							5	5-30	1			
Red Oxides												
Corrosive Wear												
Dirt and Dust	5	5-40	3	5	5-20	3	10	10-80	3			
Copper												
White Metal												
							5	5-50	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: Babbitting
3 : Contamination Particles
3.1:Fibers

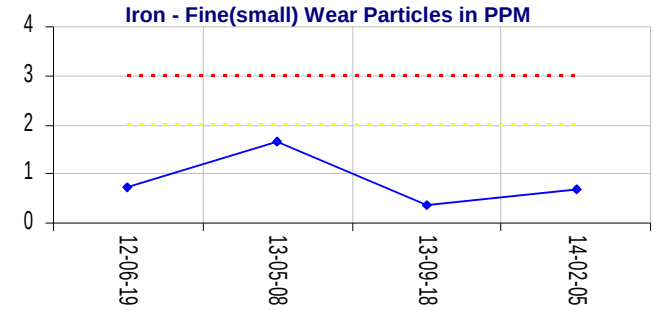
Ferrographic Analysis Rating (FAR) , rating in grade
A : Excellent - normal rubbing wear condition
B : Good - normal rubbing wear condition
C : Fair or moderate - normal rubbing wear condition
D : Severe and/or critical - wear condition
F : Extreme severe and/or extreme critical - wear condition

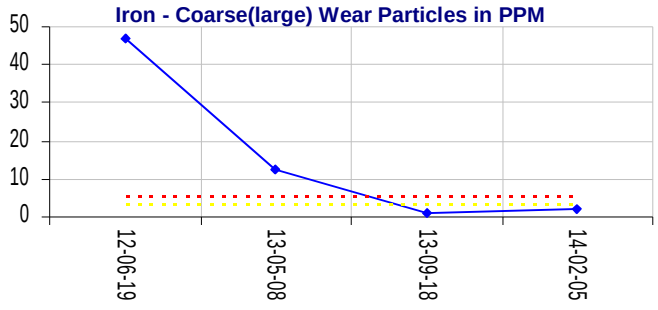
CUSTOMER
Code : **1006**
Name :
Address : Kawasan Perindustrian Tangga Batu, Mukim Sungai Udang, 76400 Melaka.
Site :
Location :
Test code : T815

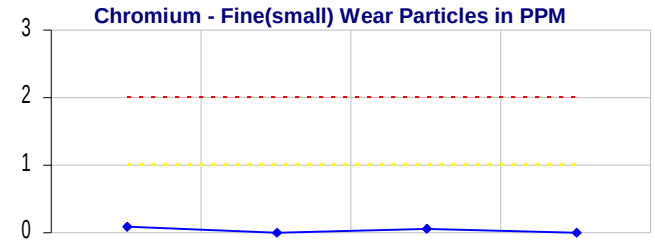
EQUIPMENT
Unit ID : **ET20 ET21 Turbine**
Unit Type : Engine Turbine Gas
Unit Make :
Unit Model :

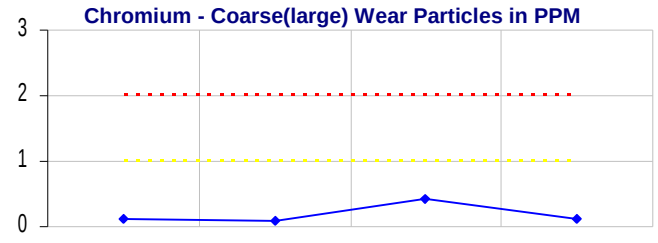
OIL
Oil type / Viscosity : SHELL TURBO T ISO 46
Oil System Capacity : 6000 Liters

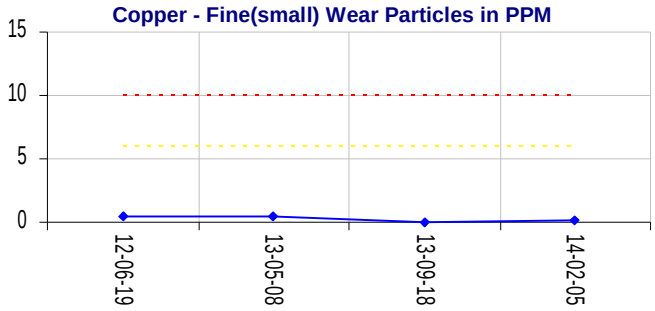
Wear Condition

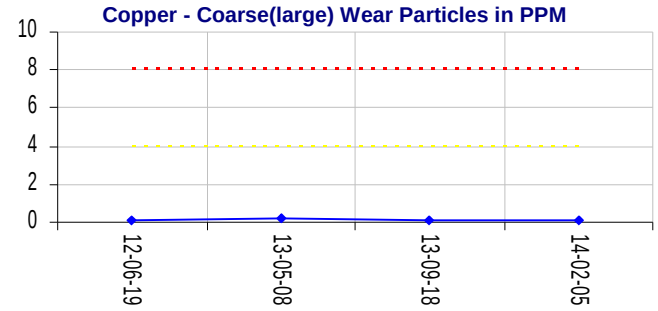


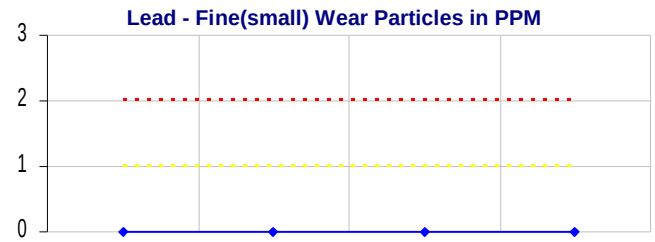


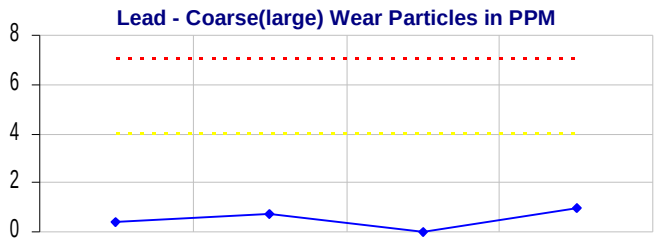


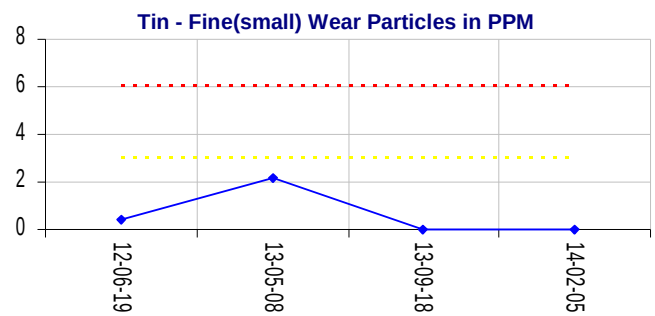


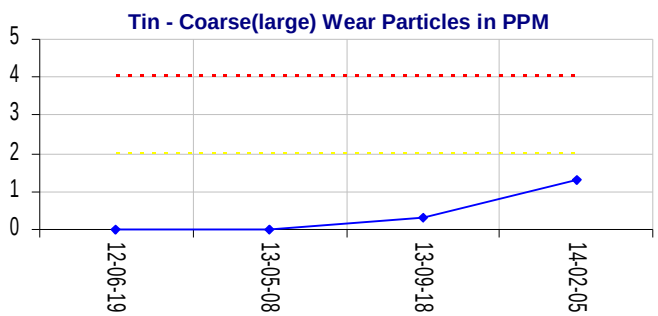










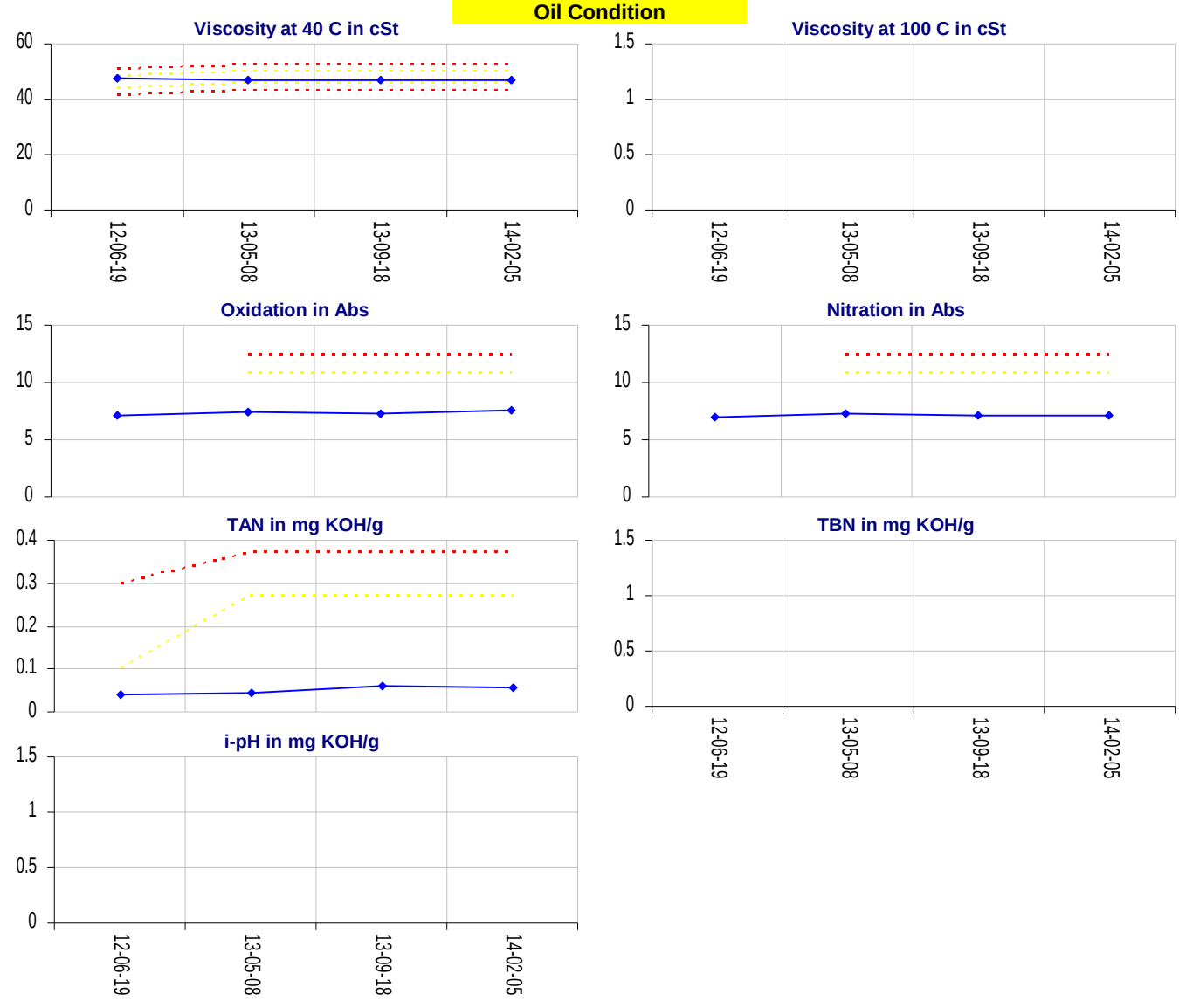


CUSTOMER
Code : **1006**
Name :
Address : Kawasan Perindustrian Tangga Batu, Mukim Sungai Udang, 76400 Melaka.
Site :
Location :
Test code : T815

EQUIPMENT
Unit ID : **ET20 ET21 Turbine**
Unit Type : Engine Turbine Gas
Unit Make :
Unit Model :

OIL
Oil type / Viscosity : SHELL TURBO T ISO 46
Oil System Capacity : 600 Liters

Oil Condition



CUSTOMER
Code : **1006**
Name :
Address : Kawasan Perindustrian Tangga Batu, Mukim Sungai Udang, 76400 Melaka.
Site :
Location :
Test code : T815

EQUIPMENT
Unit ID : **ET20 ET21 Turbine**
Unit Type : Engine Turbine Gas
Unit Make :
Unit Model :

OIL
Oil type / Viscosity : SHELL TURBO T ISO 46
Oil System Capacity : 6000 Liters

Contamination Condition