EDEN
TRANSFORMER OIL

1 Regent Business Centre, Revenge Road
Chatham, Kent, ME5 8UD
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Customer	Example	Sample Date	18/09/2017
	Factory	Test Date	03/10/2017
	Substation A	Laboratory Ref.	31707
Asset No.	ABC123	Eden Asset Tag	E0001
Serial No.	Example123	Insulating Medium	Mineral Oil
Unit	Transformer	Volume (Litres)	900
Make	Brentford	Sample Point	Bottom of main tank
DoM	2014	Rating	900 KVA

Compound	Satisfactory
Gasket	Satisfactory
Paint	Satisfactory
Oil Level	Satisfactory
Breather	Semi-sealed

Action Required

BS EN 60422:2013 (Good Condition)
Maintenance and supervision of oil filled equipment, category C

Acidity (mg KOH/g)	0.0455	0.15 Maximum
Withstood (kV average)	34	40 Minimum
Water Content (mg/Kg)	22	30 Maximum
Colour	Colourless (0)	Not dark
Appearance	Clear	Clear
Odour	Typical	Not acrid
Sediment	Clear	None
Fibres	Clear	None

Comments: The oil sample failed to meet the 'good condition' requirements for BS EN 60422:2013 due to low dielectric strength.

Hydrogen (ppm)	19	200	Max.
Methane (ppm)	70	150	Max.
Ethylene (ppm)	147	60	Max.
Ethane (ppm	28	150	Max.
Acetylene (ppm)	1	15	Max.
CarbonMonoxide (ppm)	52	500	Max.
CarbonDioxide (ppm)	907		
Nitrogen (ppm)	37,081		
Oxygen (ppm)	13,083		
Total Combustible Gas	317	50,000	Max.
Total Dissolved Gas	51,388		

DGA Comments:
DGA suggests there is a thermal fault in temperature range of 300-700 bad contacts/joints core and tank circulating currents.
Deteriorating seals and gaskets have also been known to cause similar gas formations.
Ethylene is at a serious level.

Furans-5-hydroxy-methyl-2-furfuraldehyde	
Furans-2-furfuraldehyde	
Furans-2-furyl-methyl-ketone	
Furans-5-methyl-2-furfuraldehyde	
Furans-2-furfuryl-alcohol	
Estimated Degree of Polymerisatio	

Furans Comments:
Furans not analysed.

Polychlorinated biphenyl	0

Polychlorinated biphenyl comments:
PCBs not detected.

Recommendations	Immediate resample to confirm data, otherwise, replace/degas the oil and examine/repair unit checking gasket condition, loose bolts,bad contacts and badly butted joints.
Date Of Next Sample	As soon as possible

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Customer	Example	Sample Date	13/02/2017
	Factory	Test Date	15/02/2017
	Substation A	Laboratory Ref.	30887
Asset No.	ABC123	Eden Asset Tag	E0001
Serial No.	Example123	Insulating Medium	Mineral Oil
Unit	Transformer	Volume (Litres)	900
Make	Brentford	Sample Point	Bottom of main tank
DoM	2014	Rating	900 KVA

Compound	Satisfactory
Gasket	Leak from LV bushing
Paint	Satisfactory
Oil Level	Satisfactory
Breather	Satisfactory

Action Required

BS EN 60422:2013 (Good Condition)
Maintenance and supervision of oil filled equipment, category C

Acidity (mg KOH/g)	0.0391	0.15 Maximum
Withstood (kV average)	47	40 Minimum
Water Content (mg/Kg)	19	30 Maximum
Colour	Light Yellow	Not dark
Appearance	Clear	Clear
Odour	Typical	Not acrid
Sediment	Clear	None
Fibres	Clear	None

Comments: The oil sample meets all 'good condition' requirements for BS EN 60422:2013.

Hydrogen (ppm)	1	200	Max.
Methane (ppm)	3	150	Max.
Ethylene (ppm)	2	60	Max.
Ethane (ppm	1	150	Max.
Acetylene (ppm)	0	15	Max.
CarbonMonoxide (ppm)	47	500	Max.
CarbonDioxide (ppm)	2,216		
Nitrogen (ppm)	58,614		
Oxygen (ppm)	25,643		
Total Combustible Gas	55	50,000	Max.
Total Dissolved Gas	86,527		

DGA Comments:
Sample represents unit is in satisfactory condition for continued service.

Furans-5-hydroxy-methyl-2-furfuraldehyde	
Furans-2-furfuraldehyde	
Furans-2-furyl-methyl-ketone	
Furans-5-methyl-2-furfuraldehyde	
Furans-2-furfuryl-alcohol	
Estimated Degree of Polymerisatio	

Furans Comments:
Furans not analysed.

Polychlorinated biphenyl	5

Polychlorinated biphenyl comments:
PCB level is below the label and register threshold specified by EU directive 96 59 and is lower than that typically managed by a regular waste carrier. Provided that the unit is not leaking we recommend that it is labelled accordingly and regularly inspected for leaks. No further action is required.

Recommendations	Sample represents insulating medium is in satisfactory condition for continued service.
Date Of Next Sample	In 12 months

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Customer	Example	Sample Date	21/11/2016
	Factory	Test Date	28/11/2016
	Substation A	Laboratory Ref.	30645
Asset No.	ABC123	Eden Asset Tag	E0001
Serial No.	Example123	Insulating Medium	Mineral Oil
Unit	Transformer	Volume (Litres)	900
Make	Brentford	Sample Point	Bottom of main tank
DoM	2014	Rating	900 KVA

Compound	Satisfactory
Gasket	Satisfactory
Paint	Satisfactory
Oil Level	Satisfactory
Breather	Satisfactory

BS EN 60422:2013 (Good Condition)
Maintenance and supervision of oil filled equipment, category C

Acidity (mg KOH/g)	0.01	0.15	Maximum
Withstood (kV average)	64.7	40	Minimum
Water Content (mg/Kg)	7	30	Maximum
Colour	Light Yellow (3)	Not dark	
Appearance	Clear	Clear	
Odour	Typical	Not acrid	
Sediment	Clear	None	
Fibres	Faint trace	None	

Comments: The oil sample meets all 'good condition' requirements for BS EN 60422:2013.

Hydrogen (ppm)	1	200	Max.
Methane (ppm)	1	150	Max.
Ethylene (ppm)	2	60	Max.
Ethane (ppm	1	150	Max.
Acetylene (ppm)	1	15	Max.
CarbonMonoxide (ppm)	1	500	Max.
CarbonDioxide (ppm)	12		
Nitrogen (ppm)	1		
Oxygen (ppm)	1		
Total Combustible Gas	5	50,000	Max.
Total Dissolved Gas	1		

DGA Comments:
Sample represents unit is in satisfactory condition for continued service.

Furans-5-hydroxy-methyl-2-furfuraldehyde	0.00
Furans-2-furfuraldehyde	0.00
Furans-2-furyl-methyl-ketone	0.00
Furans-5-methyl-2-furfuraldehyde	0.00
Furans-2-furfuryl-alcohol	0.00
Estimated Degree of Polymerisatio	1200

Furans Comments:
All furfurals are within acceptable limits

Polychlorinated biphenyl

Polychlorinated biphenyl comments:
PCBs not analysed.

Recommendations	Sample represents insulating medium is in satisfactory condition for continued service.
Date Of Next Sample	In 12 months

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Customer	Example	Sample Date	16/05/2016
	Factory	Test Date	17/05/2016
	Substation A	Laboratory Ref.	29895
Asset No.	ABC123	Eden Asset Tag	E0001
Serial No.	Example123	Insulating Medium	Mineral Oil
Unit	Transformer	Volume (Litres)	900
Make	Brentford	Sample Point	Bottom of main tank
DoM	2014	Rating	900 KVA

Compound	Satisfactory
Gasket	Satisfactory
Paint	Satisfactory
Oil Level	Requires topping up 25 litres approx
Breather	Needs replacing

Action Required

BS EN 60422:2013 (Good Condition)
Maintenance and supervision of oil filled equipment, category C

Acidity (mg KOH/g)	0.0235	0.15	Maximum
Withstood (kV average)	55	40	Minimum
Water Content (mg/Kg)	10	30	Maximum
Colour	Light yellow (2)	Not dark	
Appearance	Clear	Clear	
Odour	Typical	Not acrid	
Sediment	Clear	None	
Fibres	Faint trace	None	

Comments: The oil sample meets all 'good condition' requirements for BS EN 60422:2013.

Hydrogen (ppm)	22	200	Max.
Methane (ppm)	13	150	Max.
Ethylene (ppm)	47	60	Max.
Ethane (ppm	5	150	Max.
Acetylene (ppm)	3	15	Max.
CarbonMonoxide (ppm)	30	500	Max.
CarbonDioxide (ppm)	710		
Nitrogen (ppm)	60,748		
Oxygen (ppm)	22,271		
Total Combustible Gas	558	50,000	Max.
Total Dissolved Gas	84,287		

DGA Comments:
Sample represents unit is in satisfactory condition for continued service.

Furans-5-hydroxy-methyl-2-furfuraldehyde	0.00
Furans-2-furfuraldehyde	0.11
Furans-2-furyl-methyl-ketone	0.00
Furans-5-methyl-2-furfuraldehyde	0.00
Furans-2-furfuryl-alcohol	0.00
Estimated Degree of Polymerisatio	721

Furans Comments:
All furfurals are within acceptable limits

Polychlorinated biphenyl: 11

Polychlorinated biphenyl comments:
PCB level is below the label and register threshold specified by EU directive 96 59 but is higher than that typically managed by a regular waste carrier. Provided that the unit is not leaking we recommend that it is labelled accordingly and regularly inspected for leaks. No further action is required.

Recommendations	Sample represents insulating medium is in satisfactory condition for continued service.
Date Of Next Sample	In 12 months

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Customer	Example	Sample Date	16/05/2015
	Factory	Test Date	17/05/2015
	Substation A	Laboratory Ref.	31013
Asset No.	ABC123	Eden Asset Tag	E0001
Serial No.	Example123	Insulating Medium	Mineral Oil
Unit	Transformer	Volume (Litres)	900
Make	Brentford	Sample Point	Bottom of main tank
DoM	2014	Rating	900 KVA

Compound	Satisfactory
Gasket	Satisfactory
Paint	Satisfactory
Oil Level	Satisfactory
Breather	Satisfactory

Action Required

BS EN 60422:2013 (Good Condition)
Maintenance and supervision of oil filled equipment, category C

Acidity (mg KOH/g)	0.0230	0.15 Maximum
Withstood (kV average)	39	40 Minimum
Water Content (mg/Kg)	35	30 Maximum
Colour	Light yellow (2)	Not dark
Appearance	Clear	Clear
Odour	Typical	Not acrid
Sediment	Clear	None
Fibres	Trace	None

Comments: The oil sample failed to meet the 'good condition' requirements for BS EN 60422:2013 due to excessive moisture content and low dielectric strength.

Hydrogen (ppm)	21	200	Max.
Methane (ppm)	12	150	Max.
Ethylene (ppm)	4	60	Max.
Ethane (ppm	47	150	Max.
Acetylene (ppm)	2	15	Max.
CarbonMonoxide (ppm)	30	500	Max.
CarbonDioxide (ppm)	710		
Nitrogen (ppm)	60,748		
Oxygen (ppm)	22,270		
Total Combustible Gas	35	50,000	Max.
Total Dissolved Gas	84,287		

DGA Comments:
Sample represents unit is in satisfactory condition for continued service.

Furans-5-hydroxy-methyl-2-furfuraldehyde	0.00
Furans-2-furfuraldehyde	0.10
Furans-2-furyl-methyl-ketone	0.00
Furans-5-methyl-2-furfuraldehyde	0.00
Furans-2-furfuryl-alcohol	0.00
Estimated Degree of Polymerisatio	722

Furans Comments:
All furfurals are within acceptable limits

Polychlorinated biphenyl: 52

Polychlorinated biphenyl comments:
EU directive 96 59 requires that units contaminated above 50mg/Kg must be registered on an annual basis with the Environment Agency and both the unit and the main site entrance must be labelled.

Recommendations: Re-test to confirm sample is representative of the insulating liquid, or restore the insulating liquid to within the above mentioned British Standard through on-site purification treatment.

Date Of Next Sample: As soon as possible

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Guide to Routine Analysis Recommended Limits.

Mineral Oil : BS EN 60422				
Breakdown Voltage (kV)	Category	Good	Fair	Poor
	C : <72.5kV	>40	30-40	<30
	B : 72.5kV-170kV	>50	40-50	<40
	A : 170kV-400kV	>60	50-60	<50
	O : >400kV			
Water Content (mg/Kg)	Category	Good	Fair	Poor
	C : <72.5kV	<30	30-40	>40
	B : 72.5kV-170kV	<20	20-30	>30
	A : 170kV-400kV	<15	15-20	>20
	O : >400kV			
Acidity (mg KOH/g)	Category	Good	Fair	Poor
	C : <72.5kV	<0.15	-0.15-0.30	>0.30
	B : 72.5kV-170kV	<0.10	-0.10-0.20	>0.20
	A : 170kV-400kV	<0.10	-0.10-0.15	>0.15
	O : >400kV			

Notes:-
The working life of electrical equipment is stongly influenced by heat, from load and / or poor circulation of the insulating liquid, and the condition of the liquid.
It is therefore recommended that the insulating liquid is maintained within the parameters of 'good' condition for the appropriate category of equipment.
Maintaining low operating temperatures combined with low moisture and acidity levels will extend the servicable life of both the insulating liquid and equipment in to which it is installed.

MIDEL 7131 : BS EN 61203	
Breakdown Voltage (kV)	30
Water Content (mg/Kg)	400
Acidity (mg KOH/g)	2.0

Silicone : BS EN 7713	
Breakdown Voltage (kV)	30
Water Content (mg/Kg)	100
Acidity (mg KOH/g)	0.1

Notes:-
BS EN 7713 does not specify a maximum content.
100 mg/Kg is used as a guide.

Natural Esters, e.g. FR3 & MIDEL eN : BS EN 62975	
Breakdown Voltage (kV)	40
Water Content (mg/Kg)	200
Acidity (mg KOH/g)	0.30

Notes:-
BS EN 62975 Ed.1.0 (to be published 2019).
Use and maintenance guidelines of natural ester insulating liquids.