Debswana – Anglo American Fuel Additive Test Criteria

Centron Diesel Fuel Enhancer Lab & Performance Test Results

CENTRON ENERGY

TOMORROW'S FUEL TECHNOLOGY TODAY

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Executive Summary

In terms of its Energy Conservation Strategy, Debswana has identified strategic focus areas relating to energy conservation, reducing greenhouse gas emissions as well as harmful gases, to fight climate change and promote sustainable development. In addition Debswana also hopes to promote the emotional value of diamonds by demonstrating a firm commitment to environmental protection as well as human safety in its operations.

In 2009 Debswana initiated a project using Centron Fuel Additive with the potential of reducing its fuel consumption and hence its fuel carbon foot print by more than 5%.
The project would be executed in 3 phases where the results of each phase justifies the next.

Phase 1 entailed testing the performance of Centron Fuel Additive on 6 selected earth moving equipment at Jwaneng Diamond Mine. This phase was completed towards the end of 2010 and generated fuel consumption savings of around 10%, reduction of harmful gas emission by 41 – 53%, opacity 20- 24.5%, nitric oxides (NOx) and 6- 13.5% hydro carbons (HC) and visible indications of possible improved life of engine components.

The original Phase 2 scope entailed extending the test schedule to all of the earth moving equipment at Jwaneng Mine, including those of contractors, for a period of 6 months. The scope of Phase 2 was later revised at the request of Jwaneng Mine, and formulated to run the Centron proof of concept trial using 3 x 700kVA gen-sets continuously for a period of 2 months. 1 x unit, the control, was run on normal diesel for the full duration of the trial, whilst the other two, the trial units, were run on diesel dosed with Centron after the base-lines had been established. The objective of the requested amendment to the trial methodology was to eliminate as many variables as possible that may impact the actual performance of Centron Phase 2 produced average fuel consumption savings of 10.7% with top end savings of 13.5%.

On the basis of the results achieved during Phases 1 & 2, Phase 3 was approved. Whilst the Mine accepted the consumption savings of Phase 2 as conclusive, a decision was taken that Phase 3 will be restricted to a roll out of Centron Fuel Additive to 30 x 793 earth moving trucks at Jwaneng mine for a period of 6 months.

At a meeting held at Jwaneng on 20 September 2012, Debswana tabled a list of lab tests that Centron Fuel Additive would have to undergo as required by Anglo American within 90 days of starting Phase 3. This decision was revised in a meeting held at Gaborone on 30 November 2012 with the requirement to perform the tests prior to commencement of Phase 3. Furthermore, because of the risk posed to the greater economy in the event of a total failure due to the Centron Fuel Additive, Debswana legal performed a detailed review and approved Centron's Liability Cover prior to commencement of Phase 3. To further mitigate risk to production, the scope of Phase 3 was adjusted slightly to allow for a phased introduction of the 30 Caterpillar 793 earthmoving trucks to the trial over a period of 3 months.

This document contains a summary of the results of the tests performed as per the Anglo American requirement. Based on the positive results of the full battery of required testing Anglo American Senior Tribologist, Nick Perrin has confirmed that Centron has complied with Anglo American's engineering test requirement for fuel additives. To date Centron is the only fuel additive supplier to pursue and comply with this comprehensive test requirement.

Anglo / Debswana Test Criteria

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ANGLO PLATINUM

FROG No. **EFFECTIVE DATE: 2006**

SUBJECT: **PURCHASING OF MECHANICAL DEVICES AND LIQUID ADDITIVES FOR DIESEL FUEL SYSTEMS WHICH CLAIM TO IMPROVE CONSUMPTION AND PARTICULATE EMISSION OF DIESEL ENGINES**

SCOPE: This franchise rule is applicable to all Anglo Platinum employees responsible for the purchase of Mechanical Devices and Liquid Additives for diesel fuel systems which claim to improve consumption and particulate emission of diesel engines.

PURPOSE: To ensure that all operations derive the maximum benefit from using Anglo Platinum Supply Chain to evaluate and make recommendations on the credibility of using Mechanical Devices and Liquid Additives for diesel fuel systems.

REQUIREMENT:

1. The supplying company must comply with the following testing criteria before further consideration is sought from the Supply Chain/Consulting Engineers.

a. Mechanical Device or Additive effectiveness / benefits

Engine Test Bed test to evaluate the following criteria:

i. Fuel economy
ii. Exhaust emissions – increase/decrease in NO_2, CO etc.
iii. Power – increase/decrease
iv. Temperature deviation of coolant and lubricant
v. Cetane improver effective level

Test results must be evaluated after the engine test and if no advantages are gained no further testing will be initiated.

b. Additional tests to be conducted - Mechanical Devices

i. Haze – The device must not make the diesel cloudy or produce a colour change.

ii. Electrical Conductivity of distillate fuels to ASTM D2624

iii. Gums and Resins ASTM D381

iv. Filter blocking to ASTM D4539

v. Temperature deviation of coolant and lubricant.

c. Additional tests to be conducted – Liquid Additives

i. Anti-Corrosion to ASTM D665

ii. Anti-Foam to ASTM D892

iii. Deposit control – evaluation of test engine components according to fuel suppliers test methods.

iv. Haze – The additive must not make the diesel cloudy or produce a colour change.

v. Lubricity to ASTM D6079

vi. Electrical Conductivity of distillate fuels to ASTM D 2624

vii. Filter blocking to ASTM D4539

viii. Pour Point to ASTM D97

ix. Paint Staining

x. Injector spray pattern/pressure test to ISO8984 parts 1 & 2 :1993

2. The Device or Additive must not affect the cold filter plugging point and be tested accordingly. Samples of diesel for the test must be obtained from a typical local working area.

3. Compatibility
   - The Devise must be 100% compatible with the operation of the OEM's engine fuel system with no detrimental effects.
   - The Additive must be 100% compatible with the current fuel supplier's diesel additive pack system.

4. The Additive must not in any way indicate degradation of the engine oil used by any of the Group's engines.

5. All the above tests must be conducted with the co-operation and liaison with the group's diesel and lubricant supplier's to ensure no compatibility problems with the current products being supplied. Any cost relating to the above-mentioned tests will be for the device/additive supplier's account.

6. Any initiatives/trials need to be communicated to and coordinated with the respective Commodity Team in the Supply Chain. This includes tests and trials initiated by the respective Mine Standards Committees. The relevant Supply Chain Commodity Team will act as custodian of these initiatives.

7. It should be clearly noted that site tests of any devices or additives are not permitted unless prior agreement has been obtained from the responsible authority of the Supply Chain/Consulting Engineers.

8. Conducting of the above mentioned tests is not a guarantee that the device or additive will be used. The Supply Chain, Group Tribologist and Consulting Engineers will make the final decision based on the results and any comments from the group's diesel and lubricants supplier. Engine OEM's comments will also be taken into consideration.

9. Any orders treated as special (such as for R & D purposes) must not exceed 10% of the planned budget allocated to the said item purchased in one year.

10. It should be duly noted that test results obtained may vary depending upon the engine type and respective generation such as Euro 2. Older type engines may realise greater savings through the utilisation of devices or additives.

REFERENCES:

Anglo Platinum Group Purchasing Policy (SCN-POL-GEN-001)

APPROVED BY:

R.G. MILLS
DIRECTOR OF MINING

Distribution:
Director of Mining
Director of Engineering & Projects
Director of Process
General Manager Rustenburg Mines
Mine Managers
Head: Mine Technical Services
Head: Mine Geological Services
Head: Operating Joint Ventures
General Manager Eastern Limb Development
Business Leader Modikwa (for information)
Finance Managers
Head of Supply Chain
FFF Diesel Conservation Committee
Manager Strategic Commodity Management

Version: 1.0
Last Revision Date: 08 June 2006

Centron Diesel Fuel Enhancer Test Results: Anglo American Testing Criteria / Requirement

	Mechanical Device or Additive effectiveness / benefits	Test Status	Test Score	Test Spec	Test Result
Ĉ	**Requirements**				
i	Fuel economy	Complete	**Fuel Savings: 9.1% phase 1 13.5% phase 2 testing @ Jwaneng**	3rd party Verified 5%+ fuel savings	**Pass**
ii	Exhaust emissions -increase/decrease in N02, CO etc.	Complete	**Emission decrease: Opacity 41.3% - 51.3% Nox 20.1% - 24.5% HC 6% - 14.3% testing @ Jwaneng**	3rd party Verified % decrease in exhaust emissions	**Pass**
iii	Power -increase/decrease	Complete	**5% increase in HP**	HP increase	**Pass**
iv	Temperature deviation of coolant and lubricant	Phase 3	**TBD**	% change +/-	**TBD**
v	Cetane improver effective level	Complete	**3-5 points**	pt increase	**Pass**
v.i	Cetane improver effective level	Complete	**60.6**	45	**Pass**
Additional tests required - Liquid Additives					
i	Anti-Corrosion to ASTM 0665	Complete	**1**	1 max	**Pass**
ii	Anti-Foam to ASTM 0892	Complete	**Nil / No Foaming**	No foaming	**Pass**
iii	Deposit control -evaluation of test engine components to fuel suppliers test methods	Phase 3	**TBD**	No deposits	**TBD**
iv	Haze -The additive must not make the diesel cloudy or produce a colour change	Complete	**Clear**	Clear	**Pass**
v	Lubricity to ASTM 06079 / Need to get Debswana to accept ISO 12156-1 HFRR wear test	Complete	**237**	460	**Pass**
vi	Electrical Conductivity of distillate fuels to ASTM 02624	Complete	**377**	50 - 450	**Pass**
vii	Filter blocking to ASTM 04539	Complete	**0.0 C**	use temp	**Pass**
viii	Pour Point to ASTM 097	Complete	**(-15.0 C)**	use temp	**Pass**
ix	Paint Staining	Complete	**No Staining**	No staining	**Pass**
x	Injector spray pattern/pressure test to IS08984 parts 1 & 2: 1993	Complete	**See page 53**	No degradation	**Pass**
2	The Device or Additive must not affect the **cold filter plugging point** and be tested accordingly. Samples of diesel for the test must be obtained local working area	Complete	**(-5.0 C)**	3 max	**Pass**
3	Compatibility The Additive must be 100% compatible with the current fuel supplier's diesel additive pack system.	Complete	**Compliant in all diesel fuel National Standard catagories**	Full range SAN:342	**Pass**
3i	Flash Point ASTM D93	Complete	**79**	55 min	**Pass**
3ii	Sulphur content XRF	Complete	**413**	500 max	**Pass**
3iii	Carbon residue ASTM D524	Complete	**0.1**	0.2 max	**Pass**
3iv	Ash content ASTM D482	Complete	**0.005**	0.01 max	**Pass**
3v	Water content ASTM D4377	Complete	**<0.01**	0.05 max	**Pass**
3vi	Viscosity @ 40C	Complete	**3.331**	2.2 to 5.3	**Pass**
3vii	Density @ 20C	Complete	**0.8358**	0.8000 min	**Pass**
3viii	Distillation Temperature ASTM D86	Complete	**358**	362 max	**Pass**
3ix	Total contamination IP440	Complete	**0.1**	24 max	**Pass**
3i	Oxidation stability ASTM D2274	Complete	**0.001**	2.0 max	**Pass**

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4	The Additive must not in any way indicate degradation of the engine oil used by any of the Group's engines.	Phase 3	**TBD**	No degradation	**TBD**
5	All the above tests must be conducted with the co-operation and liaison with the group's diesel and lubricant supplier's to ensure no compatibility problems with the current products being supplied. Any costrelating to the above-mentioned tests will be for the additive supplier's account.	**Done**	**Done**	N/A	N/A
6	Any initiatives/trials need to be communicated to and coordinated with the respective Commodity Team in the Supply Chain. This includes tests and trials initiated by the respective Mine Standards Committees. The relevant Supply Chain Commodity Team will act as custodian of these initiatives	**Done**	**Done**	N/A	N/A
7	It should be clearly noted that site tests of any devices or additives are not permitted unless prior agreement has been obtained from the responsible authority of the Supply Chain/Consulting Engineers.	**Noted**	**Noted**	N/A	N/A
8	Conducting of the above mentioned tests is not a guarantee that the additive will be used. The Supply Chain, Group Tribologist and Consulting Engineers will make the final decision based on the results and any comments from the group's diese and lubricants supplier. Engine OEM's comments will also be taken into consideration	**Noted**	**Noted**	N/A	N/A
9	Any orders treated as special (such as for R&D purposes) must not exceed 10% of the planned budget allocated to the said item purchased in one year.	**N/A**	**N/A**	N/A	N/A
10	It should be duly noted that test results obtained may vary depending upon the engine type and respective generation such as Euro 2. Older type engines may realise greater savings through the utilisation of additives	**Noted**	**Noted**	N/A	N/A

"With regard to the attached engineering instruction which I compiled to address the testing of additives both mechanical and liquid it required that any company wishing to test their products had to complete the stated tests and requirements in the said document.

On doing so Anglo American and its associated divisions would then consider testing of such a product on completing the requirements and test stipulated in the document.

Centron to date have complied with the Engineering instruction by 95% with just some admin details. (6 to 10) to be concluded."

Regards,
Nick Perrin
Senior Tribologist
Anglo American

AngloAmerican

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Fuel Economy

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Fuel Economy - Debswana Jwaneng Phase 1 Test Result

Presentation outline: Phase 1

- Project Outline
- Methodology
- Results
- Summary

Test Company:
- Clean Air Testing Solutions

Project Outline:

- Started: October 2010
- Ended: December 2010
- Objective:
- CAT 793 – Onsite baseline and results phases
- Testing to confirm fuel consumption savings with Centron
- Mechanical savings

Fuel Consumption Test Methodology
- Baseline litre per hour was collected manually for 14 days
- 3 Cat 700 kva gen sets were leased to perform the test
- Re-fueling of the test units was performed every 12 hours
- At the conclusion of 8 weeks running with Centron compared baseline litres per hour to results phase litres per hour for
- Calculated fuel savings based on reduction in litres per hour
- Fuel consumed & hours operated was recorded at each re-fuel
- Ratio of 3.2 ml of Centron per litre of diesel both the test units and control unit

Fuel Economy - Debswana Jwaneng Phase 1 Test Result

Executive summary:

Fuel Economy Improvement (% LPH)	9.12%
Reduction in emissions (% opacity)	41% - 53%
Reduction in emissions (HC)	6% - 13.5%
Reduction in emissions (NO_x)	20% - 24.5%
Carbon Footprint Reduction (Metric Tonnes/annum)	145,555
Number of Litres of Fuel Saved Annually (L)	5,47.,000
Net Annual Savings (Fuel savings less Centron cost)()	14,984,400
Return on Investment (ROI%)	194%

- **Reduction in black smoke = Cleaner emissions**

Fuel Consumption Test Methodology

- Baseline information was collected manually and compared to electronic recordings for all 23 Cat 793 dump trucks
- 6 trucks selected by Jwaneng to participate in testing phase
- The 6 '793' test vehicles were dosed onsite, during morning refuelling
- Ratio of 3.2 ml of Centron per litre of diesel
- The test vehicles were dosed before refuelling
- At the conclusion of 6 weeks running with Centron compared test truck(s) baseline litres per hour to results litres per hour
- Calculated individual truck and total test fleet fuel savings

Results: Fuel consumption figures

	Baseline			Results Phase			% Change to baseline
Unit	LPH	Hours	Litres	Hours	Litres	LPH	
793/480	**160.51**	205.1	34856.5	313.7	48816.1	**147.87**	**-7.9%**
793/482	**166.83**	240.4	39347.9	329.6	52980.0	**148.77**	**-10.8%**
793/483	**155.66**	203.1	31601.0	255.8	39042.3	**141.67**	**-9.0%**
793/486	**160.81**	221.5	29385.9	297.1	47491.8	**149.41**	**-7.1%**
793/492	**169.7**	222.6	37924.5	208.7	33355.6	**151.66**	**-10.6%**
793/494	**181.64**	240.8	35804.5	329.9	57674.1	**164.72**	**-9.3%**
FLEET TOTAL	**165.86**	1333.5	208920.3	1734.8	279359.9	**150.68**	**-9.12%**

Results: Mechanical indicators

480 fuel filters: Comparison of fuel filter before Centron initiation and after Centron initiation, both at 500 hr services.

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Fuel Economy - Debswana Jwaneng Phase 1 Test Result

Test Result Summary:

• Fuel consumption savings:

– Fleet fuel consumption saving of 9.12%;
– The fuel savings for each truck were consistently favourable;
– What's noteworthy is the consistency in the improvement in the consumption on each individual vehicle.
– Fuel economy performance will continue to improve on a gradual basis until its maximum performance level of anything from 10 to 20% is achieved, which typically occurs within 8 weeks of continued use of Centron.

Fuel Economy - Debswana Jwaneng Phase 2 Test Result

Presentation outline: Phase 2

– Project Outline

– Executive Summary

– Methodology

– Results Summary

Test Company:
• Clean Air Testing Solutions

Project Outline:

• Started: August 2011
• Ended: October 2011

• **Objective:**
  • Perform fuel economy testing on CAT 700 kva gen sets
  • Testing to confirm fuel consumption savings with Centron
  • Compare test results to Phase 1 testing to verify fuel savings
  • Test & control unit gen sets used to remove operating variables

Fuel consumption test results

Debswana Jwaneng Phase 2 Fuel Economy Results with Centron (700 kva CAT Gen Sets)

		Baseline Phase			Results Phase			% Change to baseline
Unit	Load	LPH	Hours	Litres	LPH	Hours	Litres	LPH
GE09 Control	64%	80.4	324	26060	80.4	324	26060	0.00%
GE07 Test	71%	81.7	248	20219	70.6	362	25584	-13.5%

Test Result Summary:
• Fuel consumption savings:
– Gen set fuel consumption savings of 13.5%
– Test performed in steady state environment under constant load to remove operating variables of Cat 793 Haulers
– Verified fuel savings determined to be consistent with results of phase 1 testing in which 9.1% fuel savings was achieved

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Exhaust Emissions

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Exhaust Emissions - Jwaneng Diesel Project

Project Outline:

- Started: October 2010
- Ended: December 2010
- Objective:
- CAT 793 – Onsite baseline and results phases
- Testing to confirm harmful emission reduction with Centron

Test Company:

- Clean Air Testing Solutions

Introduction:

- Pollutant regulations:
– Policy, commitment & effort from industry
- Components of diesel exhaust emissions:
– hydrocarbons (HC), carbon monoxide (CO), carbon dioxide (CO2), oxygen (O2), nitric oxides (NOx) and sulphur oxides.
- Many variables affect emission results:
– environmental conditions, altitude, parasitic loads & engine temperatures.

Emissions Testing Methodology

- Environmental Protection Agency (EPA) approved methodology for cumulative effect diesel fuel additives.
- EPA approved opacity meter, SAE J1667
- EPA approved 5 gas analyser
– Pocket Gas™ portable 5 gas

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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Emission variables:

- Individually selected vehicles only;
- CO, CO2, NOx, HC, O2;
- Baseline and monthly monitoring;

Results: Optical results of smoke reduction

494 – (Before Centron)

494 – (After Centron)

Baseline Emission Results

Baseline Emissions - November 10, 2010						
EQUIP NUMBER	Average Emissions					Opacity
	HC	CO	CO2	O2	NOx	(%)
793/480	8.5	0.012	2.72	16.85	472	5.4
793/482	8.5	0.011	2.76	16.75	543	6.3
793/483	8.0	0.013	2.78	16.80	508	8.2
793/486	7.5	0.017	2.88	16.77	581	12.4
793/492	8.0	0.009	2.94	16.49	680	5.9
793/494	8.0	0.010	2.96	16.44	668	12.9
FLEET AVERAGE	**8.1**	**0.012**	**2.84**	**16.68**	**575**	**8.5**

Emission Results with Centron

% Reduction in Emissions Compared to Baseline						
EQUIP NUMBER	Average Emissions					Opacity (%)
	HC	CO	CO2	O2	NOx	
793/480	7.8	0.013	2.70	16.82	349	3.5
793/482	6.8	0.011	2.69	16.70	425	3.3
793/483	7.3	0.013	2.75	16.94	410	2.7
793/486	5.9	0.014	2.71	16.90	439	4.6
793/492	n/a	n/a	n/a	n/a	n/a	n/a
793/494	7.2	0.011	2.96	16.32	547	5.8
FLEET AVERAGE	6.99	0.01	2.76	16.74	434.07	3.98
FLEET AVERAGE %	-13.5%	3.24%	-2.77%	0.34%	-24.5%	-53.27%

Exhaust Emissions - Jwaneng Diesel Project

Emissions Test Result Summary

• Visual inspection and emissions results:

– Reduction and elimination of the black smoke clearly demonstrates that the use of Centron resulted in cleaner, more efficient fuel combustion resulting in less overall harmful emissions and improved fuel economy performance;

– Reduction in maintenance costs and increased asset life.

Evidence in the condition of the fuel filters;

– Best results achieved over the evaluation period and results of the last day of the evaluation displayed.

– Reductions in HC ranged from 5.98 to 13.51%.

– Reductions in NOx ranged from 20.14 to 24.50%.

– Reductions in Opacity - Black Smoke averaged 53.27%

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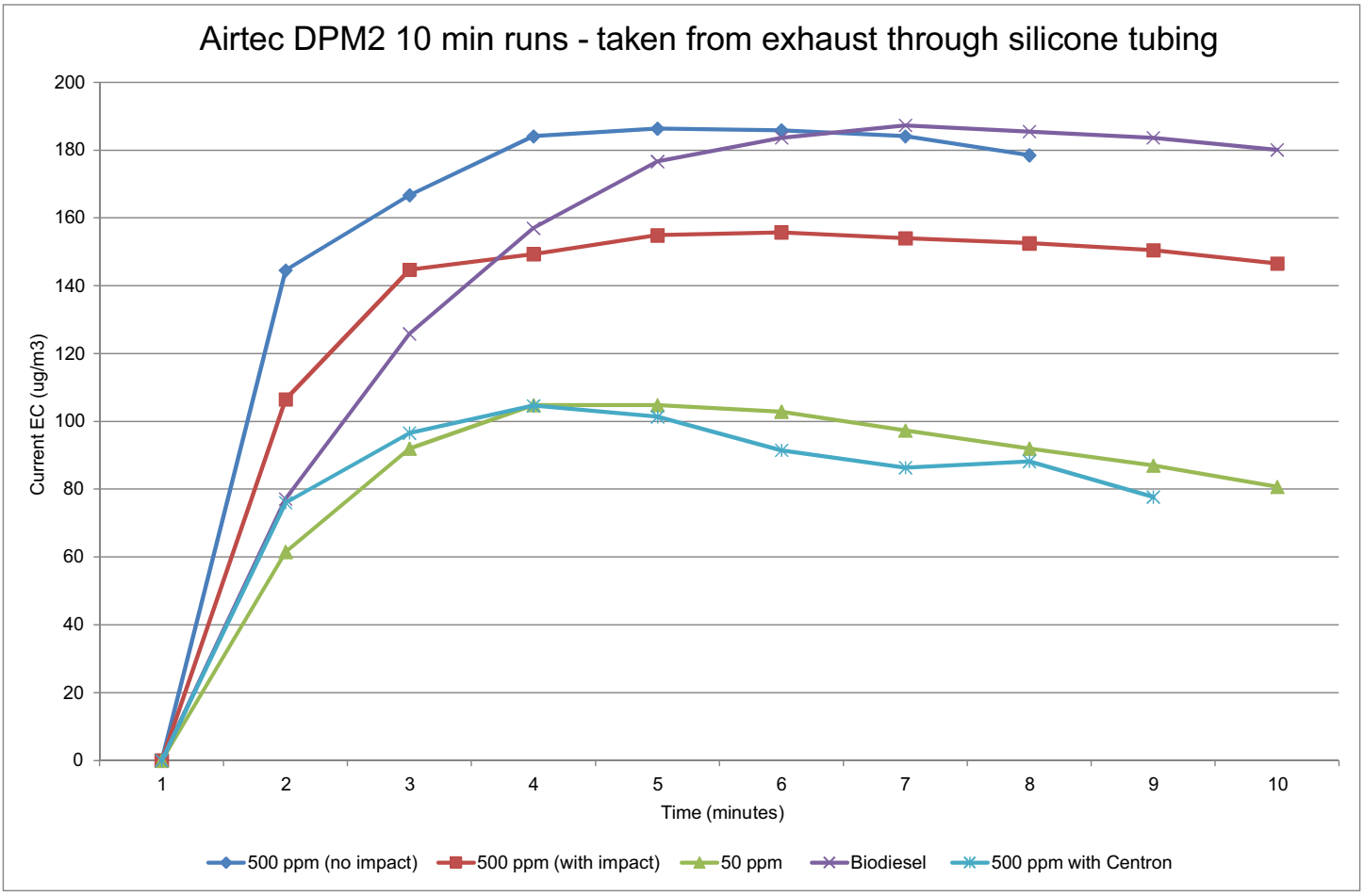

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Power Increase / Decrease

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Power Increase/decrease - Johnson & Tower Lab Dyno Horse Power & Fuel Economy Test Result

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25-Mar-05
Sysco - Jessup, MD Facility

Dyno Test Results - Centron Fuel Saver

Vehicle # 424

(1) Oroginal Baseline MPG taken from vehicle computer = 6.00 MPG

(2) Miles Driven	**3/30/2005**	**163.7**
	3/31/2005	**154.5**
(3) Total Miles Driven		**318.2**
(4) Fuel Consumed	**3/30/2005**	**22.10 gallons**
	3/31/2005	**23.75 gallons**
(5) Total Fuel Consumed	**3/30/2005**	**45.85 gallons**

(6) MPG Calculation 45.85 gallons / 318.2 miles = 6.94 MPG

(7) MPG Comparison
6.94 MPG with Centron
6.00 Baseline MPG without Centron
0.94 MPG Increase in Fuel Economy

(8) MPG % Increase 6.00 MPG / 0.94 increase in MPG = 15.70% increase in MPG

(9) Horse power percent increase approximately by 5%

Test Performed by:
JT JOHNSON & TOWERS

Power Increase/decrease - Johnson & Tower Lab Dyno Horse Power & Fuel Economy Test Result

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TOMORROW'S FUEL TECHNOLOGY TODAY

25-Mar-05
Sysco - Jessup, MD Facility

Dyno Test Results - Centron Fuel Saver

Vehicle # 429

(1) Oroginal Baseline MPG taken from vehicle computer = 6.02 MPG

(2) Miles Driven	**3/30/2005**	**192.8**
	3/31/2005	**143.3**
(3) Total Miles Driven		**336.1**
(4) Fuel Consumed	**3/30/2005**	**27.40 gallons**
	3/31/2005	**18.25 gallons**
(5) Total Fuel Consumed	**3/30/2005**	**45.65 gallons**

(6) MPG Calculation 45.85 gallons / 336.1 miles = 7.36 MPG

(7) MPG Comparison
7.36 MPG with Centron
6.02 Baseline MPG without Centron
1.34 MPG Increase in Fuel Economy

(8) MPG % Increase 6.02 MPG / 1.34 increase in MPG = 22.25% increase in MPG

(9) Horse power percent increase approximately by 5%

Test Performed by:
JT JOHNSON & TOWERS

Power Increase/decrease - Johnson & Tower Lab Dyno Horse Power & Fuel Economy Test Result

Mar 28 07 02:00p AEG 262-478-9343 p.2

JOHNSON & TOWERS, INC. www.johnsontowers.com

J & T LANDOVER (301) 832-9100
3501 IRONWOOD PLACE
LANDOVER, MD 20785

PLEASE REMIT TO P.O. BOX 630804, BALTIMORE, MD 21263-0804
PHONE (410) 687-0500 FAX (410) 687-5137

PAGE 1

CUST#:22121
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	NET 30 DAYS	PICKUP	R468915F	3/29/05

QTY	PC	ITEM#	DESCRIPTION	B/O	SHIP	PRICE	EXTEND-PRICE

CONTACT: (443)755-1082 STEVE
COMPLAINT:
DYNO TEST 3 TRUCKS. #424,429 AND 473,3 TIMES FOR FUEL ECONOMY. FIRST TIME REG FUEL. 2ND & 3RD TIME WITH FUEL ADDIATIVE, WHILE CUST AND DRIVERS WAIT.
.
CORRECTION: DYNO TESTED 3 TRUCKS. PRINTED NECESSARY INFORMATION FOR CUSTOMER. HOOKED UP PRO LINK TO TRUCK 424 AND CHECKED TRIP MILEAGE 163 MILES SINCE CLEARED ON 03/29/05. AVERAGE LOAD 46%. AVERAGE MPG 7.4. 22.1 GALLONS OF FUEL USED AND 2.2 HOURS OF IDLE TIME. HOOKED UP ON DYNO AND TESTED AT APPROX 70 MPH. 72 TO 100% ENGINE LOAD. NOTICED INCREASE IN HORSEPOWER OF APPROX 5%. PRINTED NECESSARY INFORMATION FOR CUSTOMER AND REMOVED FROM DYNO. HOOKED UP PROLINE TO TRUCK 429 AND CHECKED TRIP MILEAGE 192.8 MILES SINCE CLEARED ON 03/29, 6.9 ENGINE HOURS, 2.3 IDLE TIME, 7.0 AVG MPG AS OPPOSED TO 6.0 WHEN RESET ON 03/29. CLEARED TRIP DATA. HOOKED UP ON DYNO AND TESTED. AT APPROX 70 MPH 72 TO 100% ENGINE LOAD NOTICED APPROX 6% INCREASE IN HORSEPOWER SINCE TESTED ON 03/29. HOOKED UP TRUCK 473 ON DYNO AND TESTED AT APPROX 70 MPH AND NOTICED APPROX 4% INCREASE IN HORSEPOWER.
HOOKED UP TRUCK 424 TO SHOP CART AND CHECKED AND PRINTED TRIP DATA AND EXTRACTED DDEC REPORTS. HOOKED UP ON

CONTINUED

Temperature deviation of coolant and lubricant

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Temperature deviation of coolant and lubricant TBD Phase 3 Testing Jwaneng

TBD - Testing Will Be Performed during Phase 3 Jwaneng

Note: Centron is proven to decrease operating temperatures

Verification of coolant and lubricant temperature deviation will be performed and certified by Barloworld & Clean Air Testing Solutions: 3rd party test company overseeing phase 3

Cetane Improver Effective Level

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Cetane Improver Effective Level - Brenntag Test Result

Brenntag Great Lakes, LLC

BRENNTAG

3/13/06

Lew Herro
American Energy Group
2070 Wisconsin Ave
Grafton Wisconsin 53024

Lew,

This is to again confirm our discussions regarding your product.

1) Water Emulsification: Centron emulsifies water that may be found in the fuel. Your product contains both coupling agents and emulsifiers at significant quantities that will entrain water in the fuel system. These products also lower the surface tension of the fuel and enhance the distribution in the combustion chamber.

2) Cetane Rating increase: We have reviewed the analysis of the Fuel tested with your product added. After the addition of your product, analysis has shown an increase of between 3 and 5 points.

Please let me know if we can be of further service.

Sincerely

Brenntag Great Lakes
John Lipscomb
Corporate Account Executive

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

TEST REPORT

SABS

Enquires: M Gqadu
Tel: (012) 428 7094
Acceptance date: 2012-01-19
Date: 2012-02-13
Report: 2112/U4012T1/13/PT
Page: 1 of 2

Centron Energy SA
Attention: Mr Richard Miller
P.O Box 16329
LYTTLETON
0140

TESTING TO SAN 342:2006

1 SAMPLE DESCRIPTION

1 x 5L Diesel sample diluted with 16ml of diesel fuel enhancer.

The sample was received in a condition suitable for testing.

2 SAMPLE SUBMITTED

Sample received date: 2013/01/15
Testing starting date: 2013/01/31
Testing completion date: 2013/01/31

3 TESTING REQESTED

Automotive diesel fuel: SANS 342: 2006 Edition 4

4 CONCLUSION

The sample complies with the requirements of specification SANS 342:2006 in respect of the tests conducted.

TEST REPORT

TESTING TO SANS 342:2012
2112/U4012T1/13/PT

5 TEST RESULTS

Property	Results	Requirements of specification SANS 343
Flash Point (ASTM D93), C °	79,0	55 min
Cetane number (ASTM D613)	60,6	45 min
HFRR, Lubricity corrected wear scar diameter (wsd 1.4) at 60°C (ISO 12156)	237	460 max
Sulphur content (XRF), mg/kg	413	500 max
Copper strip corrosion, 3h at 100°C (IP 154), classification	1	1 max
Cold filter plugging point (IP 309), Classification	-5	3 max
Carbon residue on 10% (v/v) distillation residue (D524),% (m/m)	0.10	0.2 max
Ash content (D482),% (m/m)	0.005	0.01 max
Water content (ASTMD 4377),% (v/v)	<0.01	0.05 max
Viscosity at 40 °C (IP 71),mm /s	3.331	2,2 to 5,3
Density at 20°C (IP 365),kg/l	0.8358	0.8000 min
Distillation (ASTM D86) temperature, °C for 90% (v/v) recovery	358.0	362 max
Total contamination, mg/kg (IP 440)	0.1	24 max
Oxidation Stability, mg/100 ml (D2274)	0.001	2,0 max

6 CONCLUSION

The sample complies with the requirements of specification SANS 342:2006 in respect of the tests conducted.

S Mtshemla
Senior Test Officer: Industrial & Petrochemicals Laboratory
B. Tech Chemistry

J Motaung
Manager: Industrial & Petrochemicals Laboratory

1 Dr Lategan Road, Groenkloof, Private Bag X191, Pretoria, 0001. Tel +27 12 428 7911. Fax +27 12 3441568

Anti-Corrosion to ASTM 0665

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

TEST REPORT

2112/U4012T2/13/PT

4 TEST RESULTS

Property	Results	Requirements of specification SANS 342
Haze (Observation)	Clear	-
Electrical conductivity	377	-
Pour point (ASTM D97), ˚C	-15.0	3max
Anti-corrosion (ASTM D665),	Pass	-
Foaming characteristics, foam volume after 10mm setting period (ASTM D892), ml a) sequence I b) sequence II c) sequence III	 Nill Nill Nill	 - - -

S Mtshemla
Senior Test Officer: Industrial & Petrochemicals Laboratory
B. Tech Chemistry

J Motaung
Manager: Industrial & Petrochemicals Laboratory

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Anti-Foam to ASTM 0892

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

TEST REPORT

2112/U4012T2/13/PT

4 TEST RESULTS

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Deposit control

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

Deposit control - TBD Phase 3 Testing Jwaneng

TBD - Testing Will Be Performed during Phase 3 Jwaneng

Note: Powerful detergent in Centron is proven to remove carbon deposits plus continually keep the fuel system, fuel injectors & combustion chamber free of hard deposits. Deposit control testing will be performed and certified by Barloworld & Clean Air Testing Solutions during phase 3

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

Haze

The additive must not make the diesel cloudy or produce a colour change

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

TEST REPORT

2112/U4012T2/13/PT

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Lubricity to
ASTM 06079 / ISO 12156-1
HFRR wear test

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

TEST REPORT

SABS

Enquires: M Gqadu
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Automotive diesel fuel: SANS 342: 2006 Edition 4

4 CONCLUSION

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TESTING TO SANS 342:2012
2112/U4012T1/13/PT

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Electrical Conductivity of distillate fuels to ASTM 02624

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

TEST REPORT

2112/U4012T2/13/PT

4 TEST RESULTS

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Filter blocking to ASTM 04539

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

SOUTHWEST RESEARCH INSTITUTE®

6220 CULEBRA RD. 78238-5166 • P.O. DRAWER 28510 78228-0510 • SAN ANTONIO, TEXAS, USA • (210) 684-5111 • WWW.SWRI.ORG

February 8, 2013

Mr. Sam Hoot
Centron South Africa
19001 Edenderry
Northville, MI 48168
Office: 248-613-7076
Group901@wwnet.com

Re: Diesel Analysis
1.08.05 11831.01.001 [WO# 67443]

Dear Mr. Hoot:

The samples received on February 1, 2013 have been analyzed as requested. The samples were received in good condition in 5-gallon and one quart plastic containers. Sample identification, method used, and results are shown in the attached table. Analyses were completed by February 8, 2013.

Test aliquots were taken in accordance with the ASTM test procedure. Analyses were performed in accordance with the test procedure with no deviations or modifications. The analyses pertain only to the sample(s) received by Southwest Research Institute and represent only a sampling of this batch. This report shall not be reproduced except in full without the express written permission of Southwest Research Institute. If you have any questions please call me at (210)-522-6920.

Sincerely,

Mary R. Nelson

Mary R. Nelson
Senior Research Scientist
Petroleum Products Research Department
Office of Automotive Engineering – Div. 08

HOUSTON, TEXAS (713) 977-1377 • WASHINGTON, DC (301) 881-0226

February 8, 2013

TEST SUMMARY REPORT
CENTRON SOUTH AFRICA
SWRI Work Order # 67443

Test Method	1:320 Additive/Diesel blend*
ASTM D4539 LTFT, deg C	0.0

*Note: Blend made with Centron Diesel Enhancer at 1/320 treatment rate. Sample was allowed to sit more than 24 hours before testing began.

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Pour Point to ASTM 097

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

TEST REPORT

2112/U4012T2/13/PT

4 TEST RESULTS

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Paint Staining

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

Q·Chem Solutions

1 February 2013

LABORATORY REPORT

PAINT STAINING EFFECT OF DIESEL TREATED WITH 1:320 CENTRON DIESEL ADDITIVE

SCOPE

In order to comply with Anglo American's purchasing requirements for Liquid Additives for Diesel Fuel Systems, the requirement for paint staining was evaluated using **Centron Diesel Additive** dosed at 1:320 into diesel.

LABORATORY EVALUATION

2 Mild Steel test panels (degreased and de-rusted) were prepared and coated with white Plascon Road Marking Paint. The coating was allowed to cure for 24 hours.

1 ml of straight Diesel was placed on one panel and 1 ml of Diesel with an addition of 1:320 **Centron Diesel Additive** placed on the other panel. A contact time of 100 hours was allowed at an ambient temperature of between 18°C - 32°C.

After this period the panels were examined for staining. The Diesel was then washed off with a mild detergent and after drying, the panels were re-examined for staining.

RESULTS / OBSERVATIONS

Photos attached. Key ....II.... Unwashed. III... Washed with mild detergent

No staining was evident on either of the panels.

CONCLUSION

It is our considered opinion from the observations of the above test that Diesel treated with a dosage of 1:320 **Centron Diesel Additive** will not cause staining of painted surfaces.

D.A. MACKAY
B.Sc (Ind. Chem.), B.Comm. Pr.Sci.Nat, MSACI.

Q • Chem Solutions cc Reg no. 2007/117757/23
Tel: (011) 452 2814 • Fax: (011) 452 7687 • Cell: 083 648 4117 • damackay@global.co.za
4 Ockert Avenue Highway Gardens Edenvale 1609 • P O Box 8780 Edenglen 1613
Members: D A Mackay BSc (Ind.Chem.) BCom, I H Mackay Nat.Dip. (Analytical Chem)

Injector spray pattern/pressure test to IS08984 parts 1 & 2

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

PRIME FUEL INJECTION

The Diesel Component Repairer

BOSCH
Diesel Service

Prime Fuel Injection
15 van der Bijl Street
Alrode South, Alberton
Tel: 011 900 1435/2733
Fax: 011 900 2907
sandy@primefuel.co.za
www.primefuel.co.za

24th January 2013

To Whom It May Concern,

Injector with Bosch part number 0445 120 007 was used to perform ISO8984 (spray pattern & pressure test).

We first tested it with fuel (without additives) to get our basic result.

We then tested it with fuel (with additives) and found no negative impact on the injector whatsoever.

Regards,

Hennie Havenga

The Device or Additive must not affect the cold filter plugging point

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

TEST REPORT

TESTING TO SANS 342:2012
2112/U4012T1/13/PT

5 TEST RESULTS

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Viscosity at 40 °C (IP 71),mm /s	3.331	2,2 to 5,3
Density at 20°C (IP 365),kg/l	0.8358	0.8000 min
Distillation (ASTM D86) temperature, °C for 90% (v/v) recovery	358.0	362 max
Total contamination, mg/kg (IP 440)	0.1	24 max
Oxidation Stability, mg/100 ml (D2274)	0.001	2,0 max

6 CONCLUSION

The sample complies with the requirements of specification SANS 342:2006 in respect of the tests conducted.

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B. Tech Chemistry

J Motaung
Manager: Industrial & Petrochemicals Laboratory

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Compatibility

The Additive must be 100% compatible with the current fuel supplier's Pass diesel additive pack system.

- Flash Point ASTM D93 Complete 79 55 min Pass
- Sulphur content XRF Complete 413 500 max Pass
- Carbon residue ASTM D524 Complete 0.1 0.2 max Pass
- Ash content ASTM D482 Complete 0.005 0.01 max Pass
- Water content ASTM D4377 Complete <0.01 0.05 max Pass
- Viscosity @ 40C Complete 3.331 2.2 to 5.3 Pass
- Density @ 20C Complete 0.8358 0.8000 min Pass
- Distillation Temperature ASTM D86 Complete 358 362 max Pass
- Total contamination IP440 Complete 0.1 24 max Pass
- Oxidation stability ASTM D2274

CENTRON ENERGY
TOMORROW'S FUEL TECHNOLOGY TODAY

TEST REPORT

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2112/U4012T1/13/PT

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Centron Test Results: SAB SANS 342:2006 & ASTM D975 #2 Diesel 500ppm (Feb 2013)

Tested with 500ppm diesel fuel

Property	SANS 342:2006 Requirement	ASTM D975 Grade No. 2-D 500ppm	Centron 2013 SABS Test Results	Compliance with ASTM D975 & SANS 342:2006
Flash Point "ASTM D93" C	55 Min	52 Min	79	Pass
Cetane Number "ASTM D613"	45 Min	40 Min	60.6	Pass
Lubricity "ISO12156" HFRR	460 Max	520 Max	237	Pass
Sulfur Content "XRF"	500 Max	500 Max	413	Pass
Copper Strip Corrosion "IP154	1 Max	3 Max	1	Pass
Cold Filter Plugging Point "IP309"	3 Max	N/A	-5	Pass
Carbon Residue "D524" "ISO 4262"	0.2 Max	0.35 MAX	0.1	Pass
Ash "D482" "ISO 6245"	0.01% Max	0.01% Max	0.005%	Pass
Water Content "ASTMD 4377"	0.05% Max	0.05% Max	<0.01%	Pass
Viscosity "IP71"	2.2 to 5.3	1.9 to 4.1	3.331	Pass
Density at 20C "IP365"	0.8000 Min	N/A	0.8218	Pass
Distillation "ASTM D86 ISO 3405"	362 Max	300 - 358	358	Pass
Total Contamination mg/kg "IP440"	24 Max	N/A	0.1	Pass
Oxidation Stability mg/100ml "D2274"	2.0 Max	N/A	0.001	Pass