X-1R Global Ltd

To:	All X-1R distributors	**From:**	Nigel (Mac) McKenzie
Cc:		**Date:**	2015.02.27
Subject:	Reduction of Sludge build-up with the use of X-1R Engine Treatment		

Management Overview

Most manufacturers have now introduced high compression short stroke engines in their bid to reduce fuel consumption in their cars. These engines have the ability to give a much higher power output than was previously possible for smaller capacity engines with the recent 1100cc Ford engine used in the Mondeo capable of outperforming the previous 2000cc engine in the same car. Coupled with the use of these engines there has been a marked increase in the service interval with most manufacturers opting for a 10,000 to 12,000 kilometre average between oil changes.

Concurrently there has been a rapid increase in the number of complaints received by consumer groups particularly in the USA about the formation of engine killing sludge. This is not because of any particular design issue with the new engines or a sudden deterioration of the oils used but it can be firmly linked to a number of factors including the nature of driving. Sludge is caused by a number of factors (see engineering Bulletin: The Formation of Sludge) one of which is not driving "under normal conditions" as one prominent manufacturer describes it, this is best described as continued stop-start driving or normal town driving!

To prove that X1R Engine Treatment will actually inhibit the formation of sludge we undertook a two ASTM tests following the D4742 Oxidation Stability and D4683 HTHS Viscosity protocols. Oxidation of oil is seen as the precursor for the formation of sludge and thus by increasing the time taken for oxidation to occur demonstrates the increased resistance of an oil to form sludge. Our tests showed that with the addition of X1R Engine Treatment in three reference oils Oxidation Stability could be increased by as much as 61%. Making an oil more viscous may also contribute to sludge build up however the viscosity test conducted at high temperature and high stress proved that by adding X1R Engine Treatment there is no change in the viscosity of the fluid it is added to.

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The following report discusses effect on Oxidation Stability and HTHS Viscosity of Oils by addition of X-1R Engine Treatment. This report also compares oxidation stability of common US branded synthetic blend engine oils after addition of X-1R Engine Treatment.

Introduction:

Oxidation stability is a chemical reaction that occurs with a combination of the lubricating oil and oxygen. The rate of oxidation is accelerated by high temperatures, water, acids and catalysts such as copper. The rate of oxidation increases with time. The service life of a lubricant is also reduced with increases in temperature. Oxidation will lead to an increase in the oil's viscosity and deposits of varnish and sludge. The rate of oxidation is dependent on the quality and type of base oil as well as the additive package used. Some synthetics, such as polyalphaolefins (PAO), have inherently better oxidation stability than do mineral oils. This improved oxidation stability accounts for the slightly higher operating temperatures that these synthetic oils can accommodate. Generally, oxidation will reduce the service life of a lubricant by half, for every 10 °C increase in fluid temperature above 60°C.

Several methods may be used to determine or evaluate the oxidation stability of lubricating oil, which is usually regarded as the number of hours or minutes until a given increase in viscosity is noted or until there is a given increase in the acid number (AN). One of these methods is ASTM D4742 (TFOUT). This test method evaluates the oxidation stability of engine oils for gasoline automotive engines. This test, run at 160°C, utilizes a high pressure reactor pressurized with oxygen along with a metal catalyst package, a fuel catalyst, and water in a partial simulation of the conditions to which an engine oil may be subjected in a gasoline combustion engine.

When engine oil becomes contaminated, its viscosity will change. Viscosity will increase as the engine oil contaminated with soot, dirt and sludge or is oxidized and decreases if it is contaminated with fuel. One of the tests used to measure engine oil's ability to provide an effective adequate viscosity in high shear components, such as the journal bearings and between piston rings and cylinders under severe operating conditions, is the High Temperature High Shear (HTHS) Viscosity test. If the engine oil is not able to maintain an adequate viscosity when high engine operating conditions and high shear rates are encountered, wear to critical parts will occur and the minute particles of iron that are scraped from cylinder walls accelerate oil oxidation at high temperatures and also can contribute further to oil sludge.

High Temperature High Shear (HTHS) Viscosity is measured by ASTM D4683 and as the name suggests it determines oil's stability in a high temperature, high stress conditions. The oil's ability to withstand shearing and tearing is very important especially at high RPM. The oil's ability to protect bearings, cylinder walls and rings, connecting rod bearings, main bearings, cam lobes and lifters, etc. is vital to an engine. For an oil to pass the ASTM D4683, an oil must have a protective viscosity of 2.9 cP at 150 °C. HTHS Viscosity changes are usually attributed to oil instability (due to various reasons of degradation; oxidation, thinning/ thickening, breakdown at extreme conditions etc.).

To show if and how X-1R Engine Treatment affects Oxidation Stability and HTHS Viscosity of Mineral and Semi-synthetic oils used by Proton, engine oil samples were sent to couple of third-party labs. To compare results with other branded engine oils, samples of Castrol GTX Synthetic Blend 10W-30 Engine Oil and Valvoline Max Life 10W-40 Engine Oil were also sent to the lab.

Oxidation stability (ASTM D4742) was conducted at Petro-Lubricant Testing Laboratories, Inc located in State of New Jersey, USA. The lab has ISO 9001:2008 and ISO 17025-2005 certification and also has DOD CAGE CODE 5X955 approval for Military Qualification Testing. The lab is also a member of ASTM, STLE and ACS. HTHS Viscosity test (ASTM D4683) was conducted at Analytical Testing Services (a third-party lab based in the state of Pennsylvania, USA). Test Details and results are provided on the following pages of this report.

ASTM D4742 - Oxidation Stability

Scope:

- This test method evaluates the oxidation stability of engine oils for gasoline automotive engines.
- This test, run at 160°C, utilizes a high pressure reactor pressurized with oxygen along with a metal catalyst package, a fuel catalyst, and water in a partial simulation of the conditions to which an oil may be subjected in a gasoline combustion engine. This test method can be used for engine oils with viscosity in the range from 4 mm^2/s (cSt) to 21 mm^2/s (cSt) at 100°C, including re-refined oils.
- This test method is not a substitute for the engine testing of engine oil in established engine tests, such as Sequence IIID.
- The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

Significance and Use

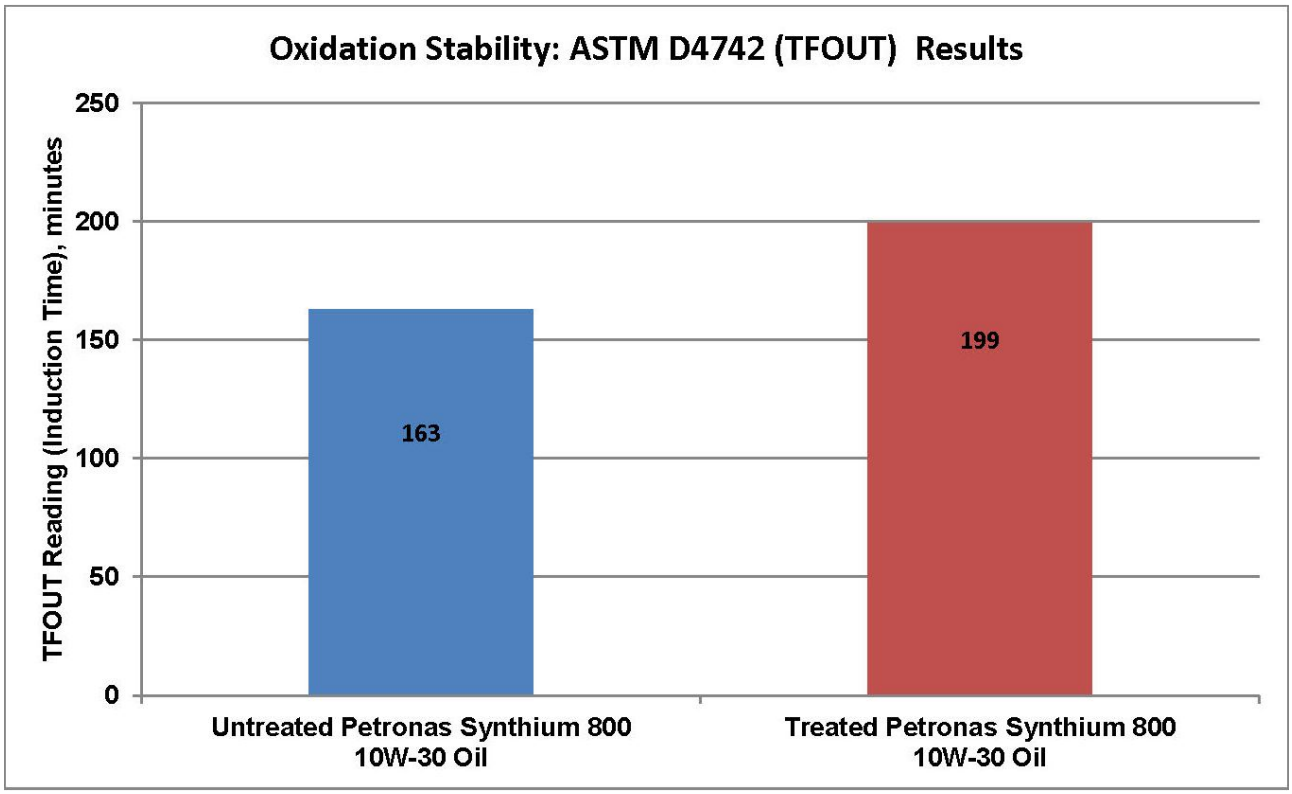
- This test method is used to evaluate oxidation stability of lubricating base oils with additives in the presence of chemistries similar to those found in gasoline engine service. Test results on some ASTM reference oils have been found to correlate with sequence IIID engine test results in hours for a 375% viscosity increase. The test does not constitute a substitute for engine testing, which measures wear, oxidation stability, volatility, and deposit control characteristics of lubricants. Properly interpreted, the test may provide input on the oxidation stability of lubricants under simulated engine chemistry.
- This test method is intended to be used as a bench screening test and quality control tool for lubricating base oil manufacturing, especially for re-refined lubricating base oils. This test method is useful for quality control of oxidation stability of re-refined oils from batch to batch.
- This test method is useful for screening formulated oils prior to engine tests. Within similar additive chemistry and base oil types, the ranking of oils in this test appears to be predictive of ranking in engine tests. When oils having completely different additive chemistry or base oil type are compared, oxidation stability results may not reflect the actual engine test result.
- Other oxidation stability test methods have demonstrated that soluble metal catalyst supplies are very inconsistent and they have significant effects on the test results. Thus, for test comparisons, the same source and same batch of metal naphthenates shall be used.

Samples Identification and Test Results:

Test-1: (Petronas Synthium 800 10W-30 Engine Oil - Untreated and Treated with X-1R Engine Treatment)

Petronas Synthium 800 10W-30 Engine Oil and X-1R Engine Treatment samples were sent to the lab. Lab Technician then prepared two samples on site, first sample was "Untreated Petronas Synthium 800 10W-30 Engine Oil" and second sample was "Petronas Synthium engine oil treated with X-1R Engine Treatment" at the treat rate of 2 fluid oz per quart of engine oil, which is approximately 5.88% by volume of X-1R Engine Treatment in engine oil. Both samples were tested for Oxidation Stability by ASTM D4742 and TFOUT readings (Induction Time) in "minutes" were reported.

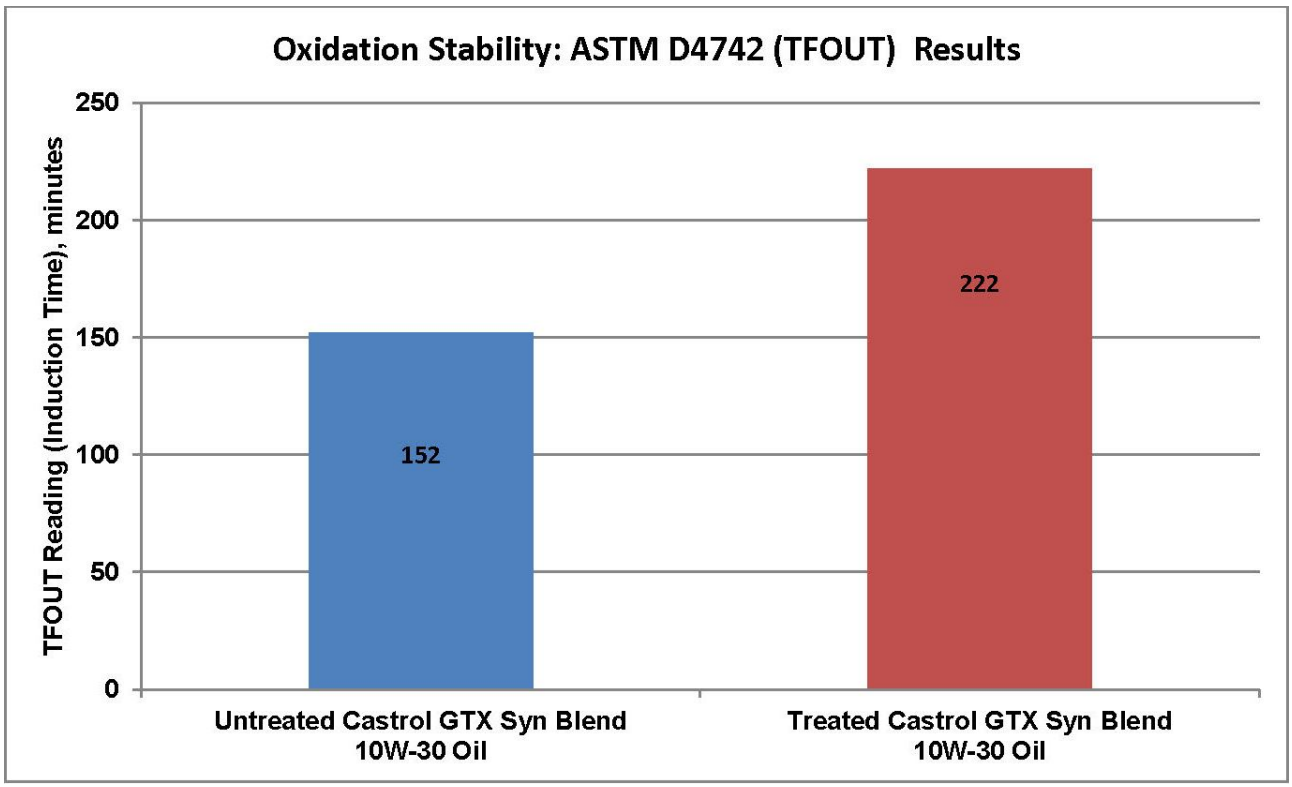
Test Results: Please refer to page 10 and page 11 of this report for summary of test results provided by Petrolube Labs. These results are presented in the chart/graph below.



Test-2: (Castrol GTX Synthetic Blend 10W-30 Engine Oil - Untreated and Treated with X-1R Engine Treatment)

Castrol GTX Synthetic Blend 10W-30 Engine Oil and X-1R Engine Treatment samples were sent to the lab. Lab Technician then prepared two samples on site, first sample was "Untreated Castrol GTX Synthetic Blend 10W-30 Engine Oil" and second sample was "Castrol GTX engine oil treated with X-1R Engine Treatment" at the treat rate of 2 fluid oz per quart of engine oil, which is approximately 5.88% by volume of X-1R Engine Treatment in engine oil. Both samples were tested for Oxidation Stability by ASTM D4742 and TFOUT readings (Induction Time) in "minutes" were reported.

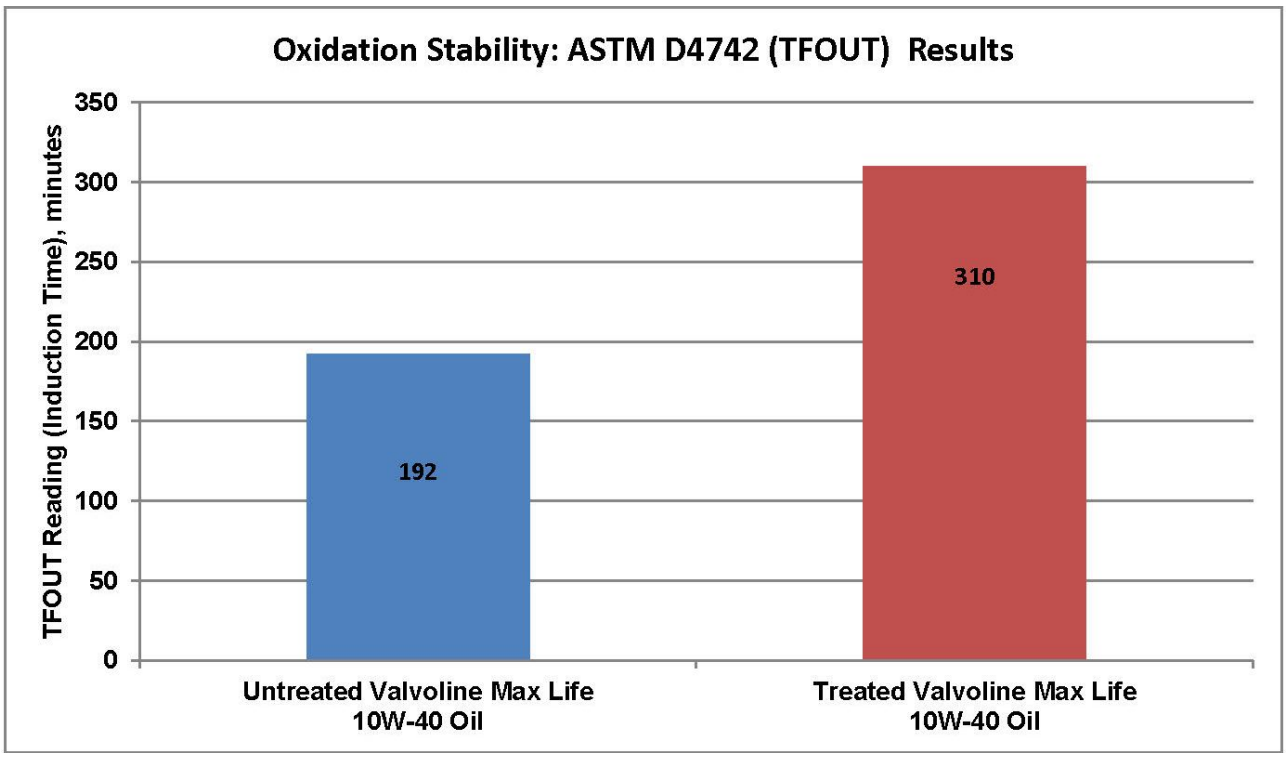
Test Results: Please refer to page 12 of this report for summary of test results provided by Petrolube Labs. These results are presented in the chart/graph below.



Test-3: (Valvoline Max Life 10W-40 Engine Oil - Untreated and Treated with X-1R Engine Treatment)

Valvoline Max Life 10W-40 Engine Oil and X-1R Engine Treatment samples were sent to the lab. Lab Technician then prepared two samples on site, first sample was "Untreated Valvoline Max Life 10W-40 Engine Oil" and second sample was "Valvoline Max Life engine oil treated with X-1R Engine Treatment" at the treat rate of 2 fluid oz per quart of engine oil, which is approximately 5.88% by volume of X-1R Engine Treatment in engine oil. Both samples were tested for Oxidation Stability by ASTM D4742 and TFOUT readings (Induction Time) in "minutes" were reported.

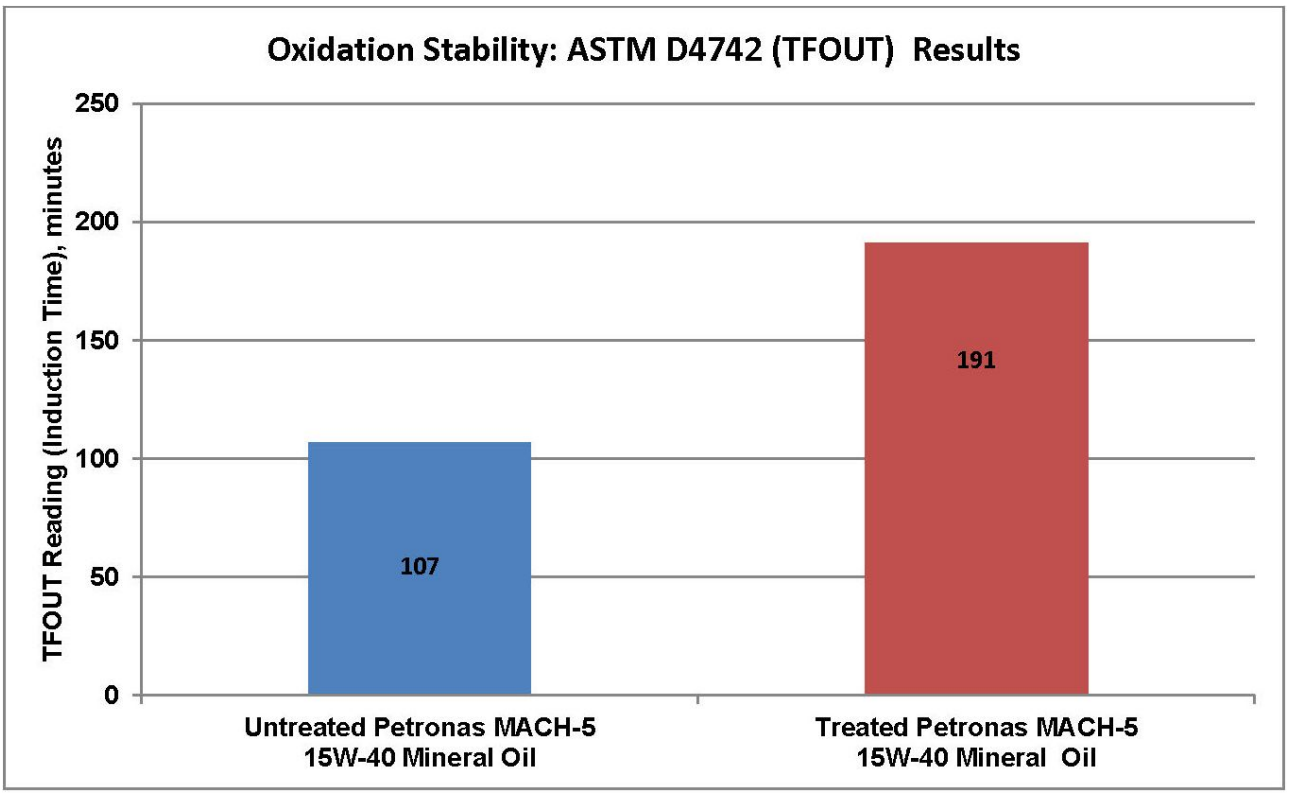
Test Results: Please refer to page 13 of this report for summary of test results provided by Petrolube Labs. These results are presented in the chart/graph below.



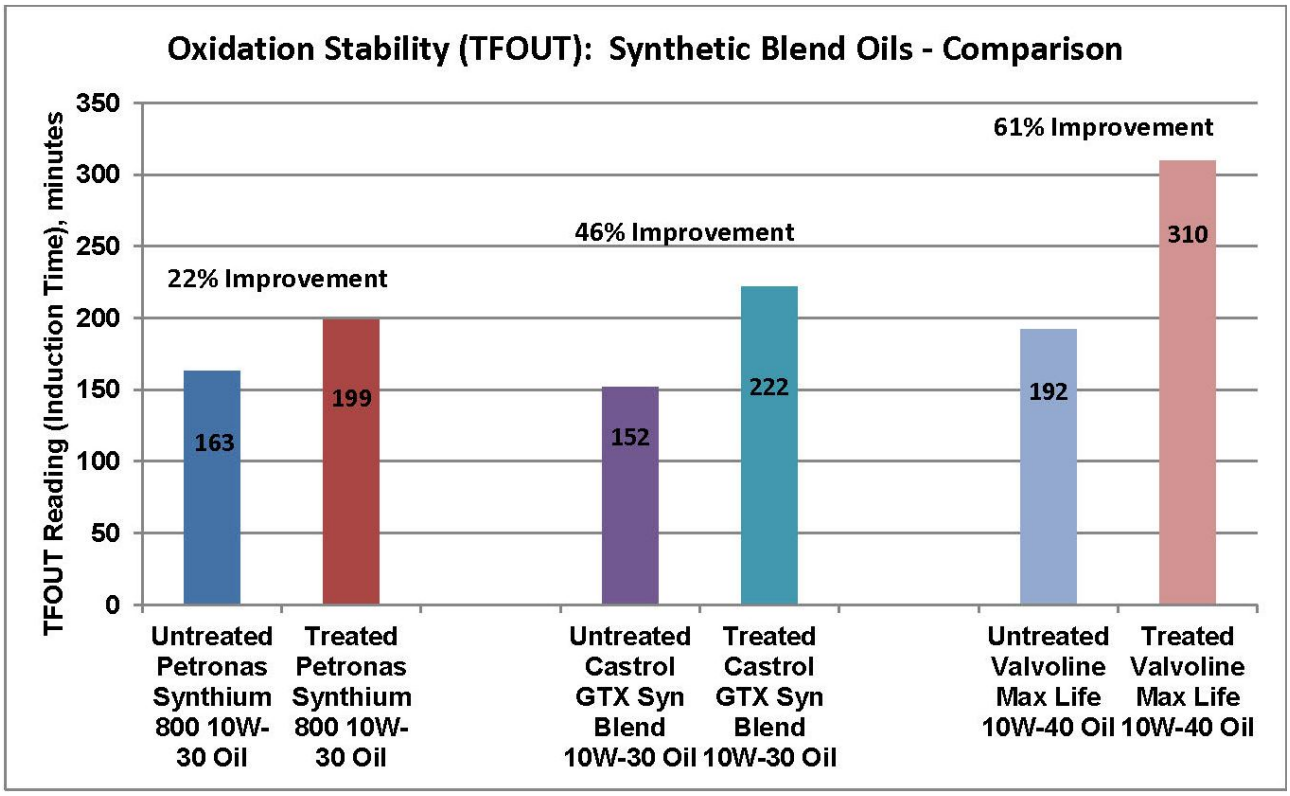
Test-4: (Petronas MACH-5 15W-40 Mineral Engine Oil - Untreated and Treated with X-1R Engine Treatment)

Petronas MACH-5 15W-40 Engine Oil and X-1R Engine Treatment samples were sent to the lab. Lab Technician then prepared two samples on site, first sample was "Untreated Petronas MACH-5 15W-40 Engine Oil" and second sample was "Petronas MACH-5 engine oil treated with X-1R Engine Treatment" at the treat rate of 2 fluid oz per quart of engine oil. Both samples were tested for Oxidation Stability by ASTM D4742 and TFOUT readings (Induction Time) in "minutes" were reported.

Test Results: These results are presented in the chart/graph which appears on next page.



Oxidation Stability: Synthetic Blend Engine Oils - Results Comparison



Test Results Analysis:

- TFOUT reading (Induction Time) for "Untreated" Petronas Synthium 800 10W-30 Engine Oil was 163 minutes and that for X-1R treated engine oil was 199 minutes. Based on TFOUT readings, there is 22% increase in Oxidation Stability of Petronas Engine Oil after addition of X-1R Engine Treatment.
- TFOUT reading (Induction Time) for "Untreated" Castrol GTX Synthetic Blend 10W-30 Engine Oil was 152 minutes and that for X-1R treated engine oil was 222 minutes. Based on TFOUT readings, there is 46% increase in Oxidation Stability of Castrol GTX Engine Oil after addition of X-1R Engine Treatment.
- TFOUT reading (Induction Time) for "Untreated" Valvoline Max Life 10W-40 Engine Oil was 192 minutes and that for X-1R treated engine oil was 310 minutes. Based on TFOUT readings, there is 61% increase in Oxidation Stability of Valvoline Max Life Engine Oil after addition of X-1R Engine Treatment.
- TFOUT reading (Induction Time) for "Untreated" Petronas MACH-5 15W-40 Engine Oil was 107 minutes and that for X-1R treated engine oil was 191 minutes. Based on TFOUT readings, there is 78% increase in Oxidation Stability of Petronas MACH-5 Engine Oil after addition of X-1R Engine Treatment.
- Above results clearly show that X-1R Engine treatment improves oxidation stability of Petronas Engine Oils as well as other engine oils which in turn helps in delaying/preventing sludge formation in that engine oil that is attributed to oxidation of base oil (present in engine oil) at moderate to high temperature and in presence of condensation water, dust/dirt contamination.

ASTM D4683 - HTHS Viscosity

Scope:

- This test method covers the laboratory determination of the viscosity of engine oils at 150 °C and $1.0 \cdot 10^6\ s^{-1}$ using a viscometer having a slightly tapered rotor and stator called the Tapered Bearing Simulator (TBS) Viscometer.
- The Newtonian calibration oils used to establish this test method range from approximately 1.2 mPa·s to 7.7 mPa·s at 150 °C. The precision has only been determined for the viscosity range 1.47 mPa·s to 5.09 mPa·s at 150 °C for the materials listed in the precision section.
- The non-Newtonian reference oil used to establish the shear rate of $1.0 \cdot 10^6\ s^{-1}$ for this test method has a viscosity closely held to 3.55 mPa·s at 150 °C by using the absolute viscometry of the TBS.
- Manual, semi-automated, and fully automated TBS viscometers were used in developing the precision statement for this test method.
- Application to petroleum products such as base oils and formulated engine oils was determined in preparing the viscometric information for this test method.
- The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.
- This test method uses the milliPascal·second (mPa·s) as the unit of viscosity. This unit is equivalent to the centipoise (cP).

Significance and Use:

- Viscosity values at the shear rate and temperature of this test method have been indicated to be related to the viscosity providing hydrodynamic lubrication in automotive and heavy duty engines in severe service.
- The viscosities of engine oils under such high temperatures and shear rates are also related to their effects on fuel efficiency and the importance of high shear rate, high temperature viscosity has been addressed in a number of publications and presentations.

Samples Identification:

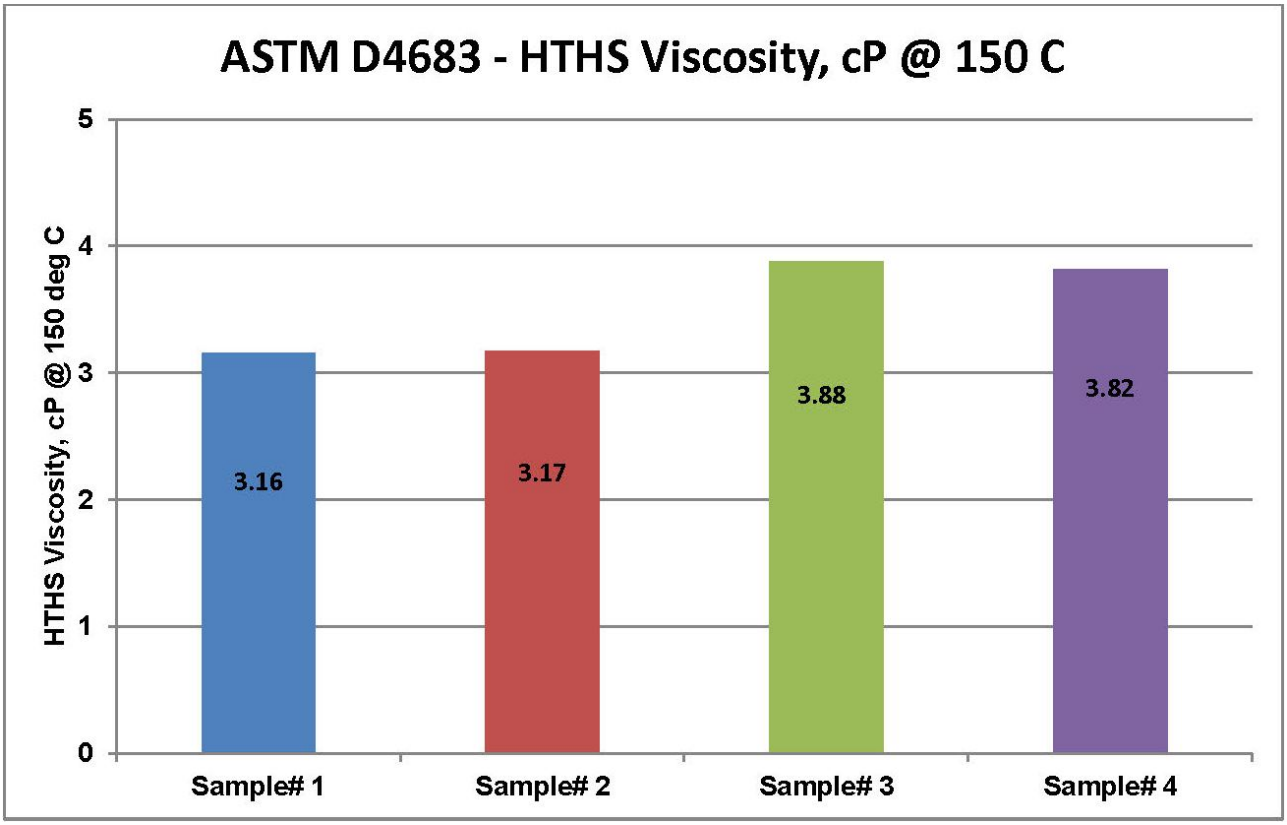
Sample# 1: Proton MACH-5 Mineral 15W-40 Engine Oil (Untreated)

Sample# 2: Proton MACH-5 Mineral 15W-40 Engine Oil treated with 6.25 volume% X-1R Engine Treatment

Sample# 3: Proton Semi-Synthetic 10W-30 Engine Oil (Untreated)

Sample# 4: Proton Semi-Synthetic 10W-30 Engine Oil treated with 6.25 volume% X-1R Engine Treatment

Test Results: Please refer to last page (page 14) of this report for summary of test results provided by ATS Lab.



Test Results Analysis:

Sample# 1 and Sample# 2 are Proton's MACH-5 Mineral 15W-40 Engine Oil without and with X-1R Engine Treatment respectively. HTHS Viscosity readings for Sample# 1 and Sample# 2 are almost same, 3.16 cp and 3.17 cp respectively. So there is no significant change in HTHS viscosity of Proton's Mineral Oil by addition of X-1R Engine Treatment.

Sample# 3 and Sample# 4 are Proton's Semi-Synthetic 10W-30 Engine Oil without and with X-1R Engine Treatment respectively. HTHS Viscosity readings for sample# 3 and sample# 4 are fairly close (within experimental error), 3.88 cp and 3.82 cp respectively. So again there is no significant change in HTHS viscosity of Proton's Semi-Synthetic Oil by addition of X-1R Engine Treatment.

Severe operation conditions such as high temperature, high shear could cause engine oils to degrade; oxidize and oxidation products are one of major contributor to sludge formation. Oxidation also causes engine oil to thicken, i.e. change its Viscosity.

As per ASTM D4683 test results, HTHS Viscosity of both engine oils used by Proton are unaffected by addition of X-1R Engine treatment, which shows Proton's Engine Oil's lubricating Viscosity (and hence its stability) is maintained in severe operational conditions even after adding X-1R Engine Treatment.

Conclusion:

- X-1R Engine treatment improves oxidation stability of Petronas and other engine oils. Since oxidation of engine oil at moderate to high temperature is one of key contributing factor towards sludge formation in engine oil, the results of ASTM D4742 (TFOUT) clearly shows that addition of X-1R Engine Treatment in engine oil used by Proton will actually delay sludge formation in that oil during recommended oil-change interval.
- X-1R Engine Treatment does not affect HTHS Viscosity of both, mineral and semi-synthetic engine oils used by Proton. Since HTHS Viscosity determines oil's stability in high temperature, high shear/stress conditions, the attached test results of ASTM D4683 prove that X-1R Engine treatments does not adversely affect engine oils used by Proton in severe conditions and therefore eliminating one major factor contributing to the oil degradation such as sludge formation at high temperature in those engine oils.

Attachment: Please refer to next 5 pages for ASTM D4742 Oxidation Stability and ASTM D4683HTHS Viscosity Test Results provided by Petro Lube Labs and ATS Lab respectively.

PETRO-LUBRICANT TESTING LABORATORIES, INC.

Member A.S.T.M.

116 Sunset Inn Road
PO Box 300 Lafayette, N.J. 07848
fax 973-579-9447
phone 973-579-3448

February 5, 2015

Test Report 15012907a

X-1R Corp
375 Fentress Blvd.
Daytona Beach, FL 32114

ATTN: Mr. Jeff Ketchledge

RE: Your sample of January 29, 2015 Final Report

Dear Sir,

Analysis of your sample has been completed. The results are as follows:

SAMPLE: Petrona Synthium 800 10W30
Lab # 15012907

TEST METHOD	DESCRIPTION	RESULTS
ASTM D4742	Thin Film Oxygen uptake Test – TFOUT	163 minutes

Please call if you have any questions regarding this report.

Respectfully submitted,

John Wintermute
Technical Director

JW:sh

PETRO-LUBRICANT TESTING LABORATORIES, INC.

Member A.S.T.M.

116 Sunset Inn Road
PO Box 300 Lafayette, N.J. 07848
fax 973-579-9447
phone 973-579-3448

February 3, 2015

Test Report 15012907

X-1R Corp
375 Fentress Blvd.
Daytona Beach, FL 32114

ATTN: Mr. Jeff Ketchledge

RE: Your samples of January 29, 2015 Final Report

Dear Sir,

Analysis of your samples has been completed. The results are as follows:

SAMPLE: 94.12% Petrona Synthium 800 10W30 (Lab # 15012907)
with 5.88% X-1R Concentrate (Lab# 15012908) by volume

TEST METHOD	DESCRIPTION	RESULTS
ASTM D4742	Thin Film Oxygen uptake Test – TFOUT	199 minutes

Please call if you have any questions regarding this report.

Respectfully submitted,

John Wintermute
Technical Director

JW:sh

PETRO-LUBRICANT TESTING LABORATORIES, INC.

Member A.S.T.M.

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PO Box 300 Lafayette, N.J. 07848
fax 973-579-9447
phone 973-579-3448

February 19, 2015

Test Report 15020501

X-1R Corp
375 Fentress Blvd.
Daytona Beach, FL 32114

ATTN: Mr. Jeff Ketchledge

RE: Your samples of February 5, 2015 Final Report

Dear Sir,

Analysis of your samples has been completed. The results are as follows:

SAMPLE: Castrol GTX Syn Blend SAE 10W30 (Neat)
Lab # 15020501

TEST METHOD	DESCRIPTION	RESULTS
ASTM D4742	Thin Film Oxygen uptake Test – TFOUT	152 minutes

SAMPLE: 94.12% Castrol GTX Syn Blend SAE 10W30 (Lab # 15020501)
with 5.88% X-1R Concentrate (Lab# 15012908) by volume

TEST METHOD	DESCRIPTION	RESULTS
ASTM D4742	Thin Film Oxygen uptake Test – TFOUT	222 minutes

Please call if you have any questions regarding this report.

Respectfully submitted,

John Wintermute
Technical Director

JW:sh

PETRO-LUBRICANT TESTING LABORATORIES, INC.

Member A.S.T.M.

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fax 973-579-9447
phone 973-579-3448

February 20, 2015

Test Report 15020502

X-1R Corp
375 Fentress Blvd.
Daytona Beach, FL 32114

ATTN: Mr. Jeff Ketchledge

RE: Your samples of February 5, 2015 Final Report

Dear Sir,

Analysis of your samples has been completed. The results are as follows:

SAMPLE: Valvoline Max Life SAE 10W-40 (Neat)
Lab # 15020502

TEST METHOD	DESCRIPTION	RESULTS
ASTM D4742	Thin Film Oxygen uptake Test – TFOUT	192 minutes

SAMPLE: 94.12% Valvoline Max Life SAE 10W-40 (Lab # 15020502)
with 5.88% X-1R Concentrate (Lab# 15012908) by volume

TEST METHOD	DESCRIPTION	RESULTS
ASTM D4742	Thin Film Oxygen uptake Test – TFOUT	310 minutes

Please call if you have any questions regarding this report.

Respectfully submitted,

Josiah Wintermute
Chief Chemist

JW:sh

Analytical Testing Services, Inc.
[ATS] An Independent Laboratory

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(814) 432-7214
FAX: 814-432-9424
www.WeTestIT.com

January 15, 2015

Jeff Ketchledge
The X-1R Corporation
375 Fentress Blvd
Daytona Beach, FL 32114

Dear Jeff:

The following are the results for the samples submitted for analysis.

ATS Lab ID		**98186**	**98187**	**98191**	**98192**
X-1R ID:		**Sample #1 Proton MACH 5 Mineral 15W40 Engine Oil Untreated**	**Sample #2 Proton MACH 5 Mineral 15W40 Engine Oil Treated withX-1R Engine Treatment**	**Sample #3 Proton Semi-Synthetic 10W30 Engine Oil Untreated**	**Sample #4 Proton Semi-Synthetic 10W30 Engine Oil Treated with 6.25 vol% X-1R Engine Oil Treatment**
Test	**Description**	**Results**			
D4683	HTHS Viscosity @150°C	3.16 cp	3.17 cp	3.88 cp	3.82 cp
D4742	Oxidation Stability (TFOUT)	Pending			

Thank you for your business, and we look forward to working with you in the future.

Very truly yours,

Richard M. Eakin,
President

Reference: Interim Report emailed to Jeff Ketchledge at jeff@x1r.com on Jan-15-2015.