TWO-STROKE-CYCLE GASOLINE ENGINE LUBRICANT EVALUATION

D4863 ASTM TC SEQUENCE II Test Procedure
Title / Validity Declaration Page

VERSION 20011213

CONDUCTED FOR

	V = VALID
	I = INVALID

Test Number:	
Reference	**Non-Reference**
Primary Oil	Primary Oil
EOT Date:	EOT Date:
EOT Time:	EOT Time:
Alternate Codes:	
Test Stand: Stand Run#:	Lab Run #:
Formulation/Stand Code:	

In my opinion this test _____ been conducted in a valid manner in accordance with the ASTM Test Method D4863 and the appropriate amendments through the information letter system. The remarks included in this report describe the anomalies associated with this test.

SUBMITTED BY: _____

Testing Laboratory

_____

Signature

_____

Typed Name

_____

Title

TABLE OF CONTENTS

TWO-STROKE-CYCLE GASOLINE ENGINE LUBRICANT EVALUATION

D4863 ASTM TC SEQUENCE II Test Procedure

Objective

This procedure is a non-destructive test designed to evaluate the lubricity of a two-cycle engine lubricant. This characteristic is evaluated by measuring the decrease in torque caused by the increase in spark plug temperature.

Summary of Procedure

The engine employed is an air-cooled, single cylinder Yamaha CE50S engine with the following general specifications:

Displacement	3.0 cu. in. (49 cm^3)
Cylinder Bore	1.57 in. (40 mm)
Stroke	1.54 in. (39.2 mm)
Compression Ratio	7.2:1

The engine is assembled before each test using new piston, rings, piston pin, gaskets, and spark plug. Since piston to cylinder wall clearance is critical to this procedure, it is measured and corrected when necessary.

A two-hour cyclic break-in is completed before each test begins. During conditioning runs which precede tightenings, the engine is stabilized at the following conditions:

Engine, r/min	4000 ± 30
Engine Load	W.O.T.
Spark Plug Gasket Temp., ˚C	170 ± 1.1
Reference Fuel/Oil Ratio	150:1
Candidate Fuel/Oil Ratio	150:1

At a specified time, the cooling air is stopped and torque decrease (drop) is monitored as spark plug temperature rises. When the spark plug temperature reaches 350˚C, cooling air is restored.

This procedure is repeated five times in each of two sets on both the reference and non-reference lubricants. Additional tightenings are made if an apparent out-of-line measurement is found (as a difference > 0.75 lbs. in. between maximum and minimum values in each set). The reference lubricant is run first and the non-reference immediately follows. The runs are then repeated in the same order. Thus, when the test is completed, there are at least ten values of torque drop for both the reference and the non-reference lubricants.

Upon completion of the test, the data is analyzed according to the Practice E178 for identifying outliers and the student's "T" test for differences between means.

TWO-STROKE-CYCLE GASOLINE ENGINE LUBRICANT EVALUATION
D4863 ASTM TC SEQUENCE II

SUMMARY OF ENGINE TEST RESULTS
YAMAHA CE50S TIGHTENING TEST

Test Number: _____ Fuel: _____ Start Date: _____
Stand Number: _____ Fuel/Oil Ratio: _____ E.O.T. Date: _____
Test Length: _____ Fuel Batch ID: _____

Delta Torque, lbs. in.

Lubricant Code:	Ind Bench:	Lab Code:	Tightening No.:
Temperature, ˚C			Mean
300			
325			
350			

Lubricant Code:	Ind:	Lab Code:	Tightening No.:
Temperature, ˚C			Mean
300			
325			
350			

Lubricant Code:	Ind Bench:	Lab Code:	Tightening No.:
Temperature, ˚C			Mean
300			
325			
350			

Lubricant Code:	Ind:	Lab Code:	Tightening No.:
Temperature, ˚C			Mean
300			
325			
350			

Temperature, ˚C	Mean	Mean
300		
325		
350		

Previous Reference Data Code	Date	Test Number	Mean

TWO-STROKE-CYCLE GASOLINE ENGINE LUBRICANT EVALUATION
D4863 ASTM TC SEQUENCE II

SUMMARY OF ENGINE TEST RESULTS
YAMAHA CE50S TIGHTENING TEST

Lubricant Code: _____ Test Number: _____ E.O.T. Date: _____

Student T Test For Significance of Difference Between

	Benchmark	Non-Reference
Code:		
Lab Code:		
Number of Data Points:		
Mean:		
Std. Dev. (n-1):		
Outlier Tightening Numbers:		
Variance:		
Combined Estimate of Std. Dev:		
Degrees of Freedom:		
Critical Value t*:		
t Critical 0.05 (95% confidence):		
Confidence Level:		

On the basis of the Student "T" test there is a significant difference between the reference and non reference lubricants at the 95% confidence level.

t* is compared to the critical value of t, t critical, from table A4.1.

TABLE A4.1 Critical Values of the t -

Degrees of Freedom	Degrees of Confidence				
	90%	95%	97.5%	99%	99.5%
10	1.372	1.812	2.228	2..764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.705	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750

TWO-STROKE-CYCLE GASOLINE ENGINE LUBRICANT EVALUATION

SUMMARY OF ENGINE TEST RESULTS
YAMAHA CE50S TIGHTENING TEST

Lubricant Code: _____ Lab Code: _____ Tightening No.: _____

Operating Parameters

Miscellaneous

	Average
Tightening No.	
Seconds	
Fuel Flow, lb/h	
Horsepower, ft-lbf.	
Barometer Press., in. Hg	

Temperature, ˚F

Ambient	
Wet	
Dry	
Dynamometer	
Intake Air	
Fuel	
Exhaust	

Torque, lbf-in.

@ 170˚C	
@ 200˚C	
@ 300˚C	
@ 325˚C	
@ 350˚C	

Delta Torque, lbf-in.

@ 300˚C	
@ 325˚C	
@ 350˚C	

TWO-STROKE-CYCLE GASOLINE ENGINE LUBRICANT EVALUATION
D4863 ASTM TC SEQUENCE II

SUMMARY OF ENGINE TEST RESULTS
YAMAHA CE50S TIGHTENING TEST

Lubricant Code: _____ Lab Code: _____ Tightening No.: _____

Operating Parameters

Miscellaneous

Tightening No.	Average
Seconds	
Fuel Flow, lb/h	
Horsepower, ft-lbf.	
Barometer Press., in. Hg	

Temperature, ˚F

Ambient	
Wet	
Dry	
Dynamometer	
Intake Air	
Fuel	
Exhaust	

Torque, lbf-in.

@ 170˚C	
@ 200˚C	
@ 300˚C	
@ 325˚C	
@ 350˚C	

Delta Torque, lbf-in.

@ 300˚C	
@ 325˚C	
@ 350˚C	

TWO-STROKE-CYCLE GASOLINE ENGINE LUBRICANT EVALUATION
D4863 ASTM TC SEQUENCE II

SUMMARY OF ENGINE TEST RESULTS
YAMAHA CE50S TIGHTENING TEST

Lubricant Code: _____ Lab Code: _____ Tightening No.: _____

Operating Parameters

Miscellaneous

	Average
Tightening No.	
Seconds	
Fuel Flow, lb/h	
Horsepower, ft-lbf.	
Barometer Press., in. Hg	

Temperature, ˚F

Ambient	
Wet	
Dry	
Dynamometer	
Intake Air	
Fuel	
Exhaust	

Torque, lbf-in.

@ 170˚C	
@ 200˚C	
@ 300˚C	
@ 325˚C	
@ 350˚C	

Delta Torque, lbf-in.

@ 300˚C	
@ 325˚C	
@ 350˚C	

TWO-STROKE-CYCLE GASOLINE ENGINE LUBRICANT EVALUATION
D4863 ASTM TC SEQUENCE II

SUMMARY OF ENGINE TEST RESULTS
YAMAHA CE50S TIGHTENING TEST

Lubricant Code: _____ Lab Code: _____ Tightening No.: _____

Operating Parameters

Miscellaneous

	Average
Tightening No.	
Seconds	
Fuel Flow, lb/hr	
Horsepower, ft-lbf.	
Barometer Press., in. Hg	

Temperature, ˚F

Ambient	
Wet	
Dry	
Dynamometer	
Intake Air	
Fuel	
Exhaust	

Torque, lbf-in.

@ 170˚C	
@ 200˚C	
@ 300˚C	
@ 325˚C	
@ 350˚C	

Delta Torque, lbf-in.

@ 300˚C	
@ 325˚C	
@ 350˚C	

TWO-STROKE-CYCLE GASOLINE ENGINE LUBRICANT EVALUATION

D4863 ASTM TC SEQUENCE II

Test Oil Code:	**Test Number:**	**EOT Date:**

Total Number of Remarks or Deviations ☐

Remark or Deviation

TWO-STROKE-CYCLE GASOLINE ENGINE LUBRICANT EVALUATION

D4863 ASTM TC SEQUENCE II

Test Fuel Analysis (Last Batch)

Lab:	**EOT Date:**	**End Time:**
Stand:	**Run Number:**	
Formulation / Stand Code:		
Supplier:	**Batch Identifier:**	

Measurement	Specs.	Analysis	Test Method
Gravity, ˚API			
Color			
Doctor Test			
Copper Corrosion, 3 h @ 212 ˚F	1 Maximum		D 130
Reid Vapor Pressure, psig			
Research Octane Number			
Motor Octane Number			
(Research + Motor) / 2			
Total Sulfur, % Weight	0.04 - 0.05		D 2622
Gum, mg/100 mL			
Oxidation Stability, min			
Lead, g/gal			
Distillation, ˚C			
IBP	Report		D 86
10%	Report		D 86
50%	Report		D 86
90%	282 - 338		D 86
EP	Report		D 86
Recovery, %			
Pona, % vol			
Paraffins + Napthenes			
Olefin	Report		D 1319
Aromatics % Vol.	28 - 33		D 1319