

# Multiple Test Acceptance Criteria for PC-10 Chemical Limits

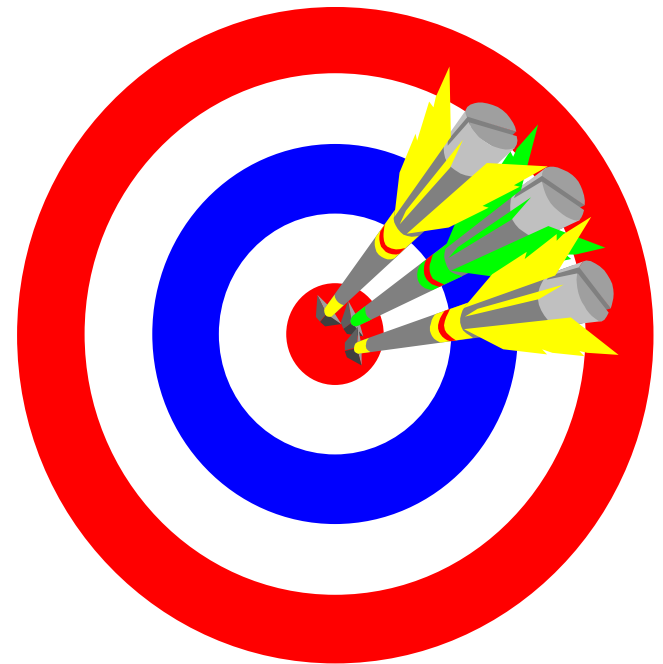
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Heavy Duty Engine Oil  
Classification Panel  
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# Multiple Test Acceptance Criteria - MTAC

**MTAC** is any data based approach for evaluation of the quality and performance of a formulation where more than one test may be run.

The method selected should recognize the precision of the test and the statistical reality that confidence in results increases as the number of tests increases.



**Designation: D 3244 – 97 (Reapproved 2002)**  
**Standard Practice for**  
**Utilization of Test Data to Determine Conformance with**  
**Specifications<sup>1</sup>**

- “7.2.1 Some specifications, because of the product characteristic or the end use of the product, or both, require that the receiver have a high degree of assurance that the product actually meets or exceeds the quality level indicated by the specification value. For the purpose of this practice, such specifications are called *critical* specifications.
- 7.2.2 Specifications that require assurance only that the product quality is not substantially poorer than is indicated by the specification level are called *noncritical* specifications for the purposes of this practice.”

# D3244 Type Limits

<u>One test limits</u>	<u>Non-critical acceptance limit</u>	<u>Critical acceptance limit</u>
Sulfated Ash (D874) – 1.0% Max.	1.08	0.92
Phosphorus (D4951) – 0.12% Max.	0.127	0.113
Sulfur (D4951) – 0.4% Max.	0.44	0.36
Sulfur (D2622) – 0.4% Max.	0.42	0.38

<u>Two test limits</u>	<u>Non-critical acceptance limit</u>	<u>Critical acceptance limit</u>
Sulfated Ash (D874) – 1.0% Max.	1.06	0.94
Phosphorus (D4951) – 0.12% Max.	0.125	0.115
Sulfur (D4951) – 0.4% Max.	0.43	0.37
Sulfur (D2622) – 0.4% Max.	0.42	0.38

<u>Three test limits</u>	<u>Non-critical acceptance limit</u>	<u>Critical acceptance limit</u>
Sulfated Ash (D874) – 1.0% Max.	1.05	0.95
Phosphorus (D4951) – 0.12% Max.	0.124	0.116
Sulfur (D4951) – 0.4% Max.	0.42	0.38
Sulfur (D2622) – 0.4% Max.	0.41	0.39

# Traditional HD Tiered Limits

Tiered pass/fail limits reflect increased confidence in multiple test results

Parameter	1 Test Limit	2 Test Limit	3 Test Limit
Wear	a	a + b	a + b + c
Rating	a	a - b	a - b - c

A one tailed confidence interval is used to give less than a 5% chance that an oil to be excluded will pass the test

# Traditional HD Tiered Limits

If the 2 test pass limit for sulfated ash is set at 1.0 and the standard deviation is 0.05 (0.142/2.8):

$$\begin{aligned} 1.0 &= \text{Excluded mean} - 0.05 * 1.645 / \sqrt{2} \\ & \quad [ \text{Excluded mean} \\ &= 1.0 + 0.05 * 1.645 / \sqrt{2} = 1.06 \end{aligned}$$

$$1 \text{ test limit} = 1.06 - 0.05 * 1.645 / \sqrt{1} = 0.98$$

$$3 \text{ test limit} = 1.06 - 0.05 * 1.645 / \sqrt{3} = 1.01$$