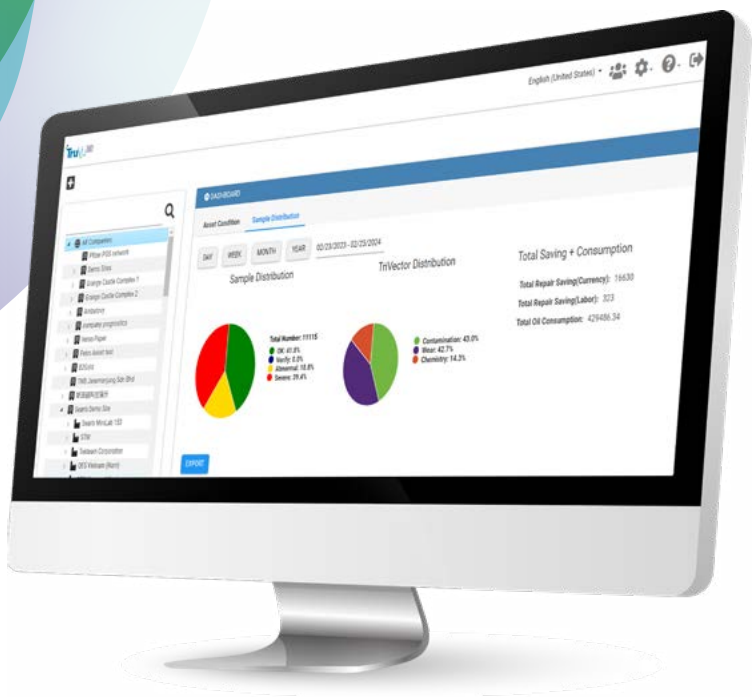
White paper

Avoiding Alarm Fatigue Using Condition Based Alarm Limits in TruVu360



TruVu360 Insight. On-site.

Creating an effective lubrication program consists of many parts from selecting the appropriate equipment to test to selecting the right parameters to test on the oil.

While these are both important steps not be overlooked, the most daunting part tends to be setting alarm limits on equipment. The challenges include setting limits too conservatively, increasing the chances too many components alarm. This can leave an overwhelming number of work orders and likely stretch the budget to maintain the strict levels. On the other hand, setting alarms too loosely leaves a greater risk of missing a critical alarm and can pose a safety risk.

To overcome these challenges associated with alarm limits, TruVu 360 now offers a Condition Based Alarm feature based on statistical evaluation of alarm limits using *ASTM D7720 Standard Guide for Statistically Evaluating Measurand Alarm Limits when Using Oil Analysis to Monitor Equipment and Oil for Fitness and Contamination.*

The statistical evaluation using D7720 can be applied to all existing component types within TruVu 360. A historical sample set of at least 80 samples within a component type is required to complete the calculation.

Using the guidelines outlined in the ASTM D7720, TruVu 360 produces an output that helps the user:

- Evaluate current alarm limits in each limit set to determine if current alarm limits are effective.
- Recommends adjustments of alarm limits per limit set based on historical data (>80 samples needed).
- Evaluate the effectiveness of current alarms vs recommended alarm limits.
- Carefully and systematically develop an alarm strategy that is achievable and sustainable.

Admin-level user permissions are required to generate the calculations and change alarm limits within a component type. On the next page is a typical output the user will see.

Statistical Evaluation of Alarm Limits to ASTM D7720

Limit Set	Category	Sub-Category	Limit Type	Parameter Code Name	Parameter Name	Unit	Sample Count	Abnormal Limit		Percent Abnormal		Severe Limit		Percent Severe		0%	25%	50%	75%
								Current	Recommended	Current	Recommended	Current	Recommended	Current	Recommended				
Engine, Heavy duty diesel	Engine	Heavy duty diesel	Absolute	ml-el.ti	Titanium	ppm	80	3	0	1.25	6	5	0	0	3	0	0	0	0.2
Engine, Heavy duty diesel	Engine	Heavy duty diesel	Absolute	ml-el.cu	Copper	ppm	80	12	0.14	7.5	6	26.4	0.04	2.5	3	0	0.35	0.62	1.87
Engine, Heavy duty diesel	Engine	Heavy duty diesel	Absolute	ml-el.cr	Chrome	ppm	80	1	0.07	50	6	1.5	0	28.75	3	0	0.25	0.96	1.58
Engine, Heavy duty diesel	Engine	Heavy duty diesel	Absolute	ml-el.v100	Visc 100	cSt	87	17	5.65	1.15	6	18	5.1	0	3	4.9	11.67	13.3	14.6
Engine, Heavy duty diesel	Engine	Heavy duty diesel	Absolute	ml-el.v100	Visc 100	cSt	87	14	5.65	60.92	6	12	5.1	29.89	3	4.9	11.67	13.3	14.6
Engine, Heavy duty diesel	Engine	Heavy duty diesel	Absolute	ml-el.v40	Visc 40	cSt	88	104	28.62	77.27	6	92	24.26	50	3	22.6	76	92	102.7
Engine, Heavy duty diesel	Engine	Heavy duty diesel	Absolute	ml-el.v40	Visc 40	cSt	88	127	28.62	1.14	6	138	24.26	0	3	22.6	76	92	102.7
Engine, Heavy duty diesel	Engine	Heavy duty diesel	Absolute	ml-el.na	Sodium	ppm	80	4	2.17	37.5	6	6	1.89	16.25	3	1.69	2.97	3.46	4.62
Engine, Heavy duty diesel	Engine	Heavy duty diesel	Absolute	ml-el.fe	Iron	ppm	80	28	6.91	40	6	35	6.6	26.25	3	4.96	10.66	21.08	37.66
Engine, Heavy duty diesel	Engine	Heavy duty diesel	Absolute	ml-el.nl	Nickel	ppm	80	0.5	0	18.75	6	1	0	8.75	3	0	0.01	0.19	0.41

Figure 1: TruVu 360 Condition Based Alarms Report Output (powered by ASTM D7720)

1. **Sample Count:** The number of samples in the limit set.
2. **Abnormal Limit – Current:** The current abnormal limit used in the limit set for the corresponding parameter.
3. **Abnormal Limit – Recommended:** The recommended abnormal limit that may replace the current abnormal limit. The abnormal limit is calculated according to ASTM D7720.
4. **Percent Abnormal – Current:** The percent of samples that triggered abnormal alarms for the corresponding parameter.
5. **Percent Abnormal – Recommended:** The recommended percent of samples that should trigger abnormal alarms. The value is based on statistics outlined in ASTM D7720 and is dependent on the sample count. *Note: A large difference between the current and recommended percent of alarms may indicate that the alarm limits should be updated.*
6. **Severe Limit – Current:** The current severe limit used by the limit set for the corresponding parameter.
7. **Severe Limit – Recommended:** The recommended severe limit that may replace the current Severe limit. The severe limit is calculated according to ASTM D7720.
8. **Percent Severe – Current:** The percent of samples that triggered severe alarms for the corresponding parameter.
9. **Percent Severe – Recommended:** The recommended percent of samples that should trigger severe alarms. The value is based on statistics outlined in ASTM D7720 and is dependent on the sample count. *Note: A large difference between the current and recommended percent of alarms may indicate that the alarm limits should be updated.*
10. **0%:** The 0th percentile of the corresponding parameter in the sample data. This is equivalent to the minimum value.
11. **25%:** The 25th percentile or 1st quartile of the corresponding parameter in the sample data. 25% of the data are less than this value.
12. **50%:** The 50th percentile or median of the corresponding parameter in the sample data. 50% of the data are less than this value.
13. **75%:** The 75th percentile or 3rd quartile of the corresponding parameter in the sample data. 75% of the data are less than this value.
    a. The percentile result for each property can help in determining if the recommended limit is reasonable. If the values for the percentiles steadily increase with increasing percentile, then the recommended limit should represent the statistics of the parameter.
    b. If all of the percentiles are 0 or near the LOD then the recommended limits should be carefully reviewed because they may be set too low, which could allow noise to trigger alarms.

Conclusion

Alarm fatigue can get in the way of lubrication programs making small improvements over time. However, utilizing the concept of condition-based alarms can help users avoid this. By carefully and systematically using data to drive alarm limits, the user can set more effective and practical alarms which can sustain maintenance efforts year after year. For assistance in utilizing this feature, please contact Spectro Scientific Support.

For more info visit: www.spectrosci.com

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