ASTM INTERNATIONAL

Designation: D7596 – 14

Standard Test Method for
Automatic Particle Counting and Particle Shape
Classification of Oils Using a Direct Imaging Integrated
Tester[1]

Raptor compliance to ASTM D7596-14

This document is intended to be a simple way for readers to understand how the Raptor Particle Contamination Monitor meets or exceeds the recommendations set forth by the ASTM D7596-14

ASTM D7596-14 Recommendation	Raptor Performance	Assessment
Measurement Range: 4 µm to ≥70 µm particle size	**Raptor:** Measures from 1 µm and above	**Exceeds** – Raptor captures particles smaller than ASTM lower limit of 4 µm, providing finer detection of contamination.
Shape Classification Threshold: ≥20 µm only	**Raptor:** Classifies particles by shape down to **1 µm**	**Exceeds** – Reporting codes require detection of small particles; Raptor also classifies particles by shape down to **1 µm.**
Particle Classification Types: Cutting, Sliding, Fatigue, Nonmetallic, Fibers, Water, Air	**Raptor:** Includes all ASTM-defined categories + Enhanced subtypes via image database matching	**Meets and Enhances** – User can use pre-set classification types or create custom classifications based on their specific needs.
Soot Content Detection: Up to ~1.5% by weight	**Raptor:** Measured by image obscuration	**Meets** – Seen and measured by pixel obscuration values.
Maximum Concentration Limit: 5 million particles/mL	**Raptor:** Effectively operates at high concentrations using dilution protocols	**Meets** – Handles particle-rich samples with software correction for dilution. Reports concentration for whole sample or specific classes.
Sample Viscosity Handling: Up to 150 mm²/s at 40°C (undiluted); higher with solvent	**Raptor:** Supports a wide viscosity range; compatible with dilution or heated sample handling	**Meets** – Comparable or better flexibility for high-viscosity fluids.
Image Capture and Analysis: CCD-based direct imaging	**Raptor:** High-resolution imaging with advanced algorithms	**Enhances** – Better image fidelity and depth of field, supporting accurate classification of particles down to **1 µm**.
Compliance Reporting: ISO 4406 format required	**Raptor:** Fully supports ISO 4406 & NAS 1638 and NAVAIR	**Meets** – Compatible with standard cleanliness codes.

Particle Count, Concentration, Size, Shape, Wear Classification
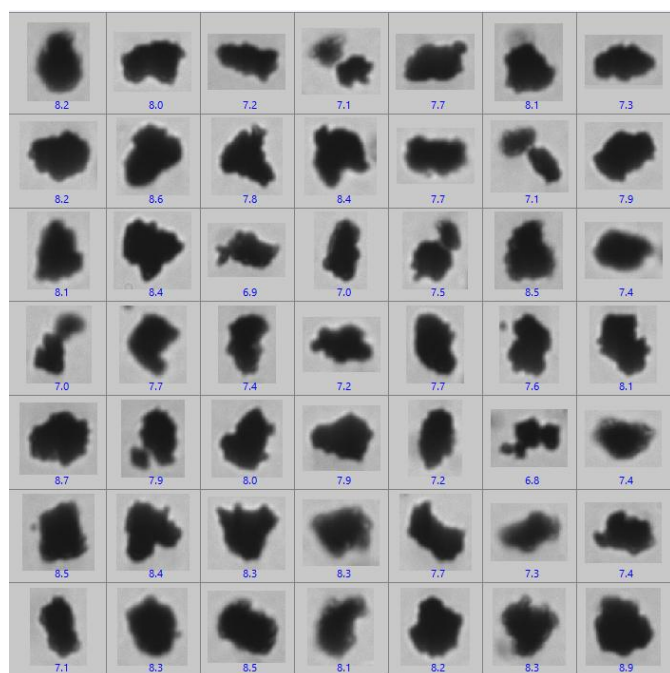## Comply to the new ISO 21018-1 for Fluid Contamination Monitoring

The *Particle Insight Oil Analysis System* provides particle counts and codes for the most popular industry requirements. Software upgrades available free of charge when new regulations are released. Available accessories include cleaning fluid, calibration check fluid, and virtual based training.

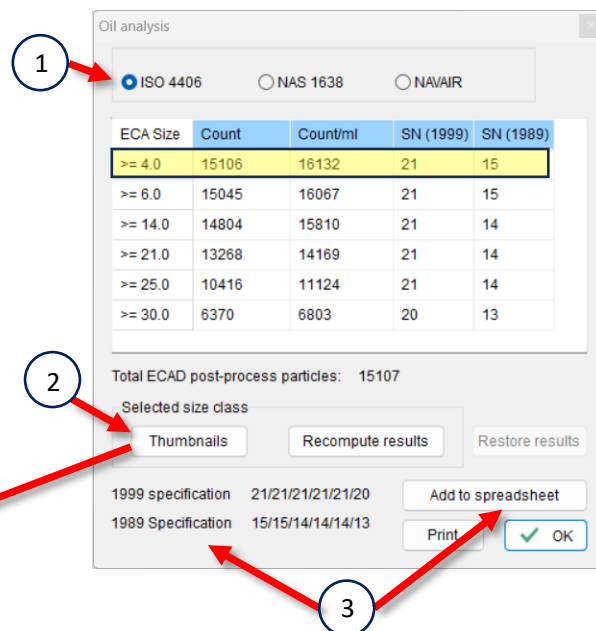## Simple user interface packed with information

1 – Select count code desired and results are updated with total count per size class and concentration.

2 – Select to view thumbnail images for particles in a specific size class offering objective evidence and identification to take accurate and immediate action to correct problems. Thumbnails available for particles >1μm.
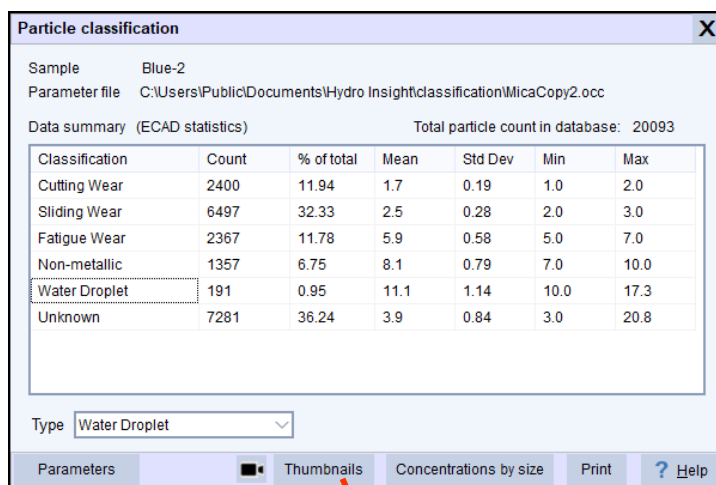
3 – Class codes reported on-screen, can be printed, or can be added to spreadsheet for tracking and trending.

Oil analysis

○ ISO 4406   ○ NAS 1638   ○ NAVAIR

ECA Size	Count	Count/ml	SN (1999)	SN (1989)
>= 4.0	15106	16132	21	15
>= 6.0	15045	16067	21	15
>= 14.0	14804	15810	21	14
>= 21.0	13268	14169	21	14
>= 25.0	10416	11124	21	14
>= 30.0	6370	6803	20	13

Total ECAD post-process particles: 15107

Selected size class

[Thumbnails] [Recompute results] [Restore results]

1999 specification 21/21/21/21/21/20
1989 Specification 15/15/14/14/14/13

[Add to spreadsheet] [Print] [✓ OK]

8.2 8.0 7.2 7.1 7.7 8.1 7.3
8.2 8.6 7.8 8.4 7.7 7.1 7.9
8.1 8.4 6.9 7.0 7.5 8.5 7.4
7.0 7.7 7.4 7.2 7.7 7.6 8.1
8.7 7.9 8.0 7.9 7.2 6.8 7.4
8.5 8.4 8.3 8.3 7.7 7.3 7.4
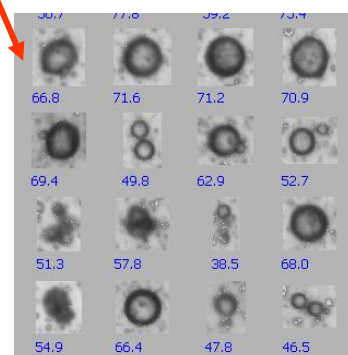7.1 8.3 8.5 8.1 8.2 8.3 8.9

High Resolution Thumbnails shown in greyscale view to enhance users understanding of all particles starting at 1μm. Can detect and eliminate bubbles if user wants to.

The Wear Classification window allows the user to view statistics, statistical listing, and particle thumbnails for each desired type of particle >1μm. Wear classifications can be adjusted to meet users needs. Additional classification types can also be created.

Particle classification

Sample   Blue-2
Parameter file   C:\Users\Public\Documents\Hydro Insight\classification\MicaCopy2.occ

Data summary (ECAD statistics)   Total particle count in database: 20093

Classification	Count	% of total	Mean	Std Dev	Min	Max
Cutting Wear	2400	11.94	1.7	0.19	1.0	2.0
Sliding Wear	6497	32.33	2.5	0.28	2.0	3.0
Fatigue Wear	2367	11.78	5.9	0.58	5.0	7.0
Non-metallic	1357	6.75	8.1	0.79	7.0	10.0
Water Droplet	191	0.95	11.1	1.14	10.0	17.3
Unknown	7281	36.24	3.9	0.84	3.0	20.8

Type Water Droplet

[Parameters] [Thumbnails] [Concentrations by size] [Print] [? Help]

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ISO 4406 data

ECA Size	Count	Count/ml	SN (1999)	SN (1989)
>= 4.0	6583	482857	26	19
>= 6.0	2606	191193	25	18
>= 14.0	4	322	16	9
>= 21.0	0	0	0	0
>= 25.0	0	0	0	0
>= 30.0	0	0	0	0

Total ECA post-process particles: 20092

1999 Spec. 26/25/16/0/0/0
1989 Spec. 19/18/9/0/0/0

Classification	Count	% of total	Mean	Std Dev	Min	Max
Cutting Wear	2400	11.94	1.7	0.19	1.0	2.0
Sliding Wear	6497	32.33	2.5	0.28	2.0	3.0
Fatigue Wear	1657	8.25	5.8	0.57	5.0	7.0
Non-metallic	918	4.56	8.0	0.78	7.0	10.0
Water Droplet	105	0.52	11.1	1.08	10.0	17.3
Unknown	8518	42.39	4.4	1.52	3.0	20.8

SYSTEM DATA SUMMARY

RAPTOR *particle shape analyzer* 6.02

1 sheet report showing Reporting Codes, Classification, System data with concentration, 1 page of thumbnail images

Greyscale view of all particles in selected classification. Can easily detect unimportant particles such as air bubbles.