Designation: D8072 – 17

Standard Classification for Reporting Solids and Insoluble Water Contamination of Hydrocarbon-Based Petroleum Products When Analyzed by Imaging Instrumentation[1]

This standard is issued under the fixed designation D8072; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This classification identifies a concise code which can be used by imaging instruments for reporting of solid particles and insoluble water content in hydrocarbon-based petroleum products. The coding system includes the reporting of water content and particle counts in the ≥1 µm range.

NOTE 1— Calibration is not in accordance with ISO 11171. Comparability to ISO 4406 and its requirements is not inferred.

1.2 It is valid for imaging instruments measuring particle size by projected equivalent particle diameter (see 3.1.1), and which are calibrated and verified using particle size and count standards traceable to NIST.[2]

1.3 Due to the variation of method and instrument types and resolutions, the reporting of results will include the ASTM standard used to conduct the analysis.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ISO Standards:*[3]

ISO 3 Preferred numbers—Series of preferred numbers

ISO 4406 Hydraulic Fluid Power—Fluids—Method for coding the level of contamination by solid particles

ISO 11171 Hydraulic fluid power—Calibration of automatic particle counters for liquids

3. Terminology

3.1 *Definitions:*

3.1.1 *projected equivalent particle diameter, n*—the diameter calculated from the projected area of a particle if that area formed a circle, and in equation form is:

Projected Equivalent Particle Diameter = $\sqrt{}$(projected area/0.785)

4. Significance and Use

4.1 The purpose of this code is to simplify the reporting of solid particle counts and water droplet concentrations present in petroleum products when measured by imaging instruments. Industry is accustomed to using a three number code to report contamination levels and so this reporting method for imaging instruments is presented to organize results in a similar format.

4.2 Particle count results as described by this classification are reported per the preferred number ranges in Table 1. Preferred numbers were originally developed by Charles Renard and codified in ISO 3. This format is the preferred reporting format since ISO 4406 has no ability to report water.

4.3 Imaging instruments are capable of identifying insoluble water droplets separate from solids, and therefore a suffix code is added after the three (or four) solid particle codes to report water content in parts per million (ppm (v)). To report water content, detected droplets will be converted to ppm (v). The distribution of water droplet size may be reported if it is useful, but it is not required.

[1] This classification is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.96.05 on In-Service Lubricants Particle Counting Practices and Techniques.

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[2] Referenced standards must be certified by the manufacturer as prepared to appropriate National Institute of Standards and Technology (NIST) standards of traceability. See http://www.nist.gov.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

TABLE 1 Particle Count Conversion Table

Greater than	Less than or equal to	Range Identifying Number
2 500 000		>28
1 300 000	2 500 000	28
640 000	1 300 000	27
320 000	640 000	26
160 000	320 000	25
80 000	160 000	24
40 000	80 000	23
20 000	40 000	22
10 000	20 000	21
5000	10 000	20
2500	5000	19
1300	2500	18
640	1300	17
320	640	16
160	320	15
80	160	14
40	80	13
20	40	12
10	20	11
5	10	10
2.5	5	9
1.3	2.5	8
0.64	1.3	7
0.32	0.64	6
0.16	0.32	5
0.08	0.16	4
0.04	0.08	3
0.02	0.04	2
0.01	0.02	1
0	0.01	0

5. Basis of Classification

5.1 The code converts particle counts into a single number identifier, representing particle count ranges as shown in Table 1, in each of three basic particle size ranges which are used to report the result in the following example format:

DXXXX 17 / 16 / 14 – 6
where:
DXXXX references the ASTM standard used to perform the analysis.
17 represents the particle count in the ≥4 µm range,
16 represents the particle count in the ≥6 µm range,
14 represents the particle count in the ≥14 µm range,
6 represents the water concentration in parts per million (ppm (v)).

5.2 An optional 5th digit may be added to report the ≥1 µm range and would be displayed as shown in the following example format:

DXXXX 20 / 17 /16 /14 – 6

where the first numerical entry (20) represents the ≥1 µm range with the other entries the same as in 5.1.

6. Reporting

6.1 For solids, the ranges of Table 1 represent particle counts reported on a per millilitre basis and made by imaging instruments measuring the projected equivalent particle diameter.

6.2 *Reporting Format:*

6.2.1 The basic code structure required for reporting is as follows:

DXXXX X / Y / Z

where the DXXXX details the ASTM standard used to perform the analysis, and X, Y and Z are identifying numbers from Table 1 for particle counts in the ≥4 µm, ≥6 µm, and ≥14 µm ranges respectively.

6.2.2 Optional expanded code formats for reporting include:

DXXXX X /Y / Z – W

where W is the identifying number for the water concentration in ppm (v), and

DXXXX V / X / Y / Z – W

where V is the identifying number for the ≥1 µm range. Reporting of water (W) remains optional.

7. Keywords

7.1 imaging; particle count; water