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THE THIRD EDITION:
ISO 8217 undergoes a major overhaul

A new set of specs

Wanda Fabriek of Intertek Caleb Brett, consultant to Lloyd's Register's FOBAS and ISO TC 28/ SC 4 Working Group 6 Convenor, announces the introduction of the third edition of international fuel quality standard ISO 8217

As Convenor of the 8/SC4/ Working Group 6 (WG6) committee, I am happy to inform the bunker industry that the final draft international standard (FDIS) ballot on the International Organization for Standardization's (ISO) specification for marine fuels, ISO 8217, terminated on 26 September 2005 with no negative votes submitted. The ISO/IEC Directives state that publication should occur within two months of the document obtaining approval at FDIS level. I am now able to inform the industry that the Third Edition of ISO 8217 was published on 1 November 2005.

The changes

The third edition of ISO 8217 contains important changes aimed at reducing the problems and uncertainties observed with marine fuel quality. There are a lesser number of fuel grades, new parameters have been incorporated into the list of fuel properties and some of the limits are much stricter.

The Introduction to the third edition of ISO 8217 explains the rational for the number of grades considered by the new specification. It says that:

'The specifications in this International Standard were prepared in co-operation with the marine and petroleum industries to meet the requirements for marine fuels supplied on a world-wide basis for consumption on board ships. Crude oil supplies, refining methods, ships' machinery and local conditions vary considerably. These factors have led historically to a large number of categories of residual fuels being available internationally, even though locally or nationally there may be relatively few categories. Several of the residual fuels are unique in origin to one country or area, but nevertheless are included in the specification because of their importance in the international marine fuel market.'

'The third edition of ISO 8217 contains important changes aimed at reducing the problems and uncertainties observed with marine fuel quality'

Distillates Grades

There are no changes to the number of grades for the distillate fuel oils.

Residual Grades

The number of residual fuel oil grades is reduced from 15 in the current ISO 8217:1996 to 10 grades of residual fuel in the third edition. The changes will be:

- Deletion of RMC 10 grade and re-naming of RMB 10 and RMC 10 to RMA 30 and RMB 30 respectively. Both grades will differ only by density and the pour point limits. All limits of other characteristics/parameters are identical
- RMH 45, RMK 45 and RML 45 will be removed from the specification on the basis that there was no difference, apart from the viscosity, between the specification parameters' limits for RM 45 grades and RM 55 grades
- RML 55 will also be removed from the specification. The purpose of introducing it in the first edition of the standard was to provide what was believed to be a need for under boiler fuel in steamships. In the event it appears that no suppliers have ever made the grade available
- RMH 55 and RMK 55 will be re-named RMH 700 and RMK 700 with a maximum viscosity of 700 centistoke (cst) at 50°C. The decision to set the viscosity at 700 cst closely reflects manufacturing capabilities, as well as the highest viscosity that the current equipment can reasonably cope with.

The third edition is a large document and contains nine annexes, each explaining different fuel characteristic in greater detail. The fuel quality parameters, which are not included in the main table of the specification, like for example fuel acidity, are discussed in the annex to the main document. All annexes are informative, which means that they are not mandatory.

Characteristic changes

This third edition of the standard reflects several important changes aimed at bridging

the gap between the best available analytical methodology and the ever-changing reality of the bunker market.

Viscosity: One of the most essential changes is to the viscosity classification of residual fuels, by changing the reference temperature from 100ºC to 50ºC. This change reflects the commercial market reality of purchasing bunkers on the basis of kinematic viscosity measured and expressed at 50ºC and not at 100ºC. This subject created a lot of discussions and the main issue that swayed the decision to change is the fact that, in the majority of cases, the viscosity is measured at 100ºC and calculated at 50ºC to confirm the viscosity purchased. Due to the unpredictable rheology of residual fuels this often creates a necessity to analyse the viscosity at 50ºC anyway, as the measurement of kinematic viscosity at 50ºC is, after all, the final arbitrator as to whether a fuel does or does not comply with the ordered viscosity.

The bunker market places great importance on the value of fuel viscosity, simply because the amount of diluent blended into the residue dictates the price of the final product.

Sulphur: The third edition aligns limits on sulphur to those ratified by the **International Maritime Organization (IMO)**. Thus the maximum limit of 5.0% m/m for current residual fuel oil grades is reduced to 4.5% m/m. The following grades have reduced limits: RME 180, RMF 180, RMG 380, RMH 380, RMK 380, RMH 700 and RMK 700.

Ash content: The maximum ash content limit of residual fuels for the current RMH 35, RMK 35, RMH 55 and RMK 55 grades has been lowered from 0.20% m/m to 0.15% m/m. This is a very significant change, which further limits those extraneous elements resulting from the crude and refinery processing that contribute to engine wear and to fouling and corrosion in the engine and exhaust systems.

Sediment: For distillate DMB grade of fuel oil, the sediment test by ISO 3735 has been substituted by the Total Sediment Existent by ISO 10307 Part 1, with the maximum limit of 0.10% m/m.

Water content: The maximum water content limit of residual fuels has been lowered from 0.8% v/v for the current RMD 15 grade and from 1.0% v/v to 0.5% v/v for all other RM grades. This is a considerable improvement in the quality of the bunker fuel oil as delivered that addresses significantly the often expressed and understandable concern that the purchaser should not be required to pay for water.

Density: The maximum density limits for the lower viscosity categories of residual fuels has also been lowered. For RMA 30 grade the density will be reduced from 975.0 to 960.0 kilogrammes per cubic metre (kg/m^3) maximum and, for RMB grade, from 981.0 to 975 kg/m^3 maximum.

Used Lubricating Oil (ULO): The inclusion of used lubricating oil is controlled in the third edition by limits on levels of zinc, phosphorous and calcium in all the residual fuel categories and in the DMC grade. The aim of this limit is that the fuel shall be free from ULO. The specification will declare that a fuel shall be considered to be free from ULO if one or more of the elements zinc, phosphorus and calcium are below or at the specified limits. All three elements shall exceed their limit before a fuel shall be deemed to contain ULO. The maximum limits are: zinc - 15 milligrammes per kilogramme (mg/kg), phosphorus - 15 mg/kg and calcium - 30 mg/kg.

'One of the most essential changes is to the viscosity classification of residual fuels, by changing the reference temperature from 100ºC to 50ºC'

The WG6 debated this issue for a long time, seeking to provide the technical evidence for a variety of arguments raised against and for the inclusion of the limits on ULO into the specification. A significant part of the arguments revolved around the variability of used lubricating oil composition and the fact that a limit on calcium or zinc does not translate into a fixed limit on used lubricating oil. However, the three elements together detected in the ratio dictated by the structure of ZDDP additive compound (commonly present in automotive lubricants), provides the best fingerprinting of the presence of ULO in bunkers.

The evaluation of the detection of ULO was only the first stage of the WG6 work. The second stage of the development of the specification limit was to prepare accurate and precise test methodology for the determination of the selected ULO fingerprinting elements, namely calcium, zinc and phosphorus. In 2003, under the auspices of the **Energy Institute** in the UK (formally the **Institute of Petroleum**), three large round robin exercises were run. The three separate test methods are:

- IP 470/03 Determination of aluminium, silicon, vanadium, nickel, iron, calcium, zinc and sodium in residual fuel oil by ashing, fusion and atomic absorption spectrometry
- IP 500/03 Determination of the phosphorus content of residual fuels by ultra-violet spectrometry
- IP 501/03 Determination of aluminium, silicon, vanadium, nickel, iron, sodium, calcium, zinc and phosphorus in residual fuel oil by ashing, fusion and inductively coupled plasma emission spectrometry

The methods have been published with the statistically acceptable precision data and are included in the third edition. The construction of the limit is based on the average background amount of the presence of these trace elements in bunker fuel oil from crude sources, the test method's reproducibility data and the requirements of ISO 4259:1992, which state that for a single specification limit the specified limit shall be not less than twice the test method's reproducibility value.

So the publication of the third edition of ISO 8217 brings new test methodologies and the updates of previously used methodologies. Clause 2 entitled 'Normative references' lists all the test methods. The clause states: '*The following referenced documents are indispensable for the application of the document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.*'

This is one of the most important statements of the specification often overlooked by the user. In all editions of ISO 8217 (as well as in all other petroleum products'

specifications) all referenced documents (i.e. test methods) are dated. This is essential because the specification limits are based on the reproducibility of individual test methods as stated above.

It is necessary to point out that the sulphur test method ISO 8754 in the current ISO 8217:1996 is dated 1992 and in the third edition is dated 2003. The test precision data of ISO 8754:2003 is different to that of ISO 8754:1992 due to the fact that it was re-checked using today's fuels.

In view of this I would like to refer to the article published in *Bunkerspot* entitled 'Quality in mind' (see *Bunkerspot* August/ September, page 34). I would like to expand that article indicating the grey areas for sulphur determination for compliance to IMO MARPOL 73/78 Annex VI Sulphur Regulation 14(1) implemented on 19 May 2005, using ISO 8754:2003.

Calculated single results

The Buyer: A bunker buyer who has no other source of information on the true sulphur value than a single test result, shall consider that the fuel fails the Annex VI stipulations, with 95% confidence, only if the test result is such that

Test result > Regulation limit + (0.59 x Reproducibility)

Example 1: Fuel supplied to the maximum sulphur limit of 4.5% m/m.
ISO 8754:2003 reproducibility R = 0.0812 (x + 0.15), where x = average result (a single result). R = 0.3776% m/m.
Test result > 4.5 + (0.59 x 0.3776) = 4.7228 = 4.72% m/m.

Consequently, if the single test result is greater than 4.72% m/m, then the buyer can consider the sample to *fail* the regulation with 95% confidence.

Example 2: Fuel supplied to the maximum sulphur limit of 1.5% m/m.
ISO 8754:2003 reproducibility R = 0.1340% m/m.
Test result > 1.5 + (0.59 x 0.1340) = 1.5791 = 1.58% m/m.

Consequently, if the single test result is greater than 1.58% m/m, then the recipient can consider the sample to *fail* the regulation with 95% confidence.

The Supplier: A bunker supplier who has no other sources of information than a single result shall consider that the fuel *meets* the regulation maximum limit with 95% confidence, only if the test result is such that
Test result < or = regulation limit – (0.59 x Reproducibility).

Example 3: A supplier has delivered fuel to Annex VI regulations with a maximum sulphur limit of 4.5% m/m. R = 0.3776% m/m (as calculated above).
Test result < or = 4.5 – (0.59 x 0.3776) = 4.2772 = 4.28% m/m.

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Consequently, if a single test result is less than or equal to 4.28% m/m, then the supplier can consider the result to *meet* the regulation with 95% confidence.

Example 4: A supplier has delivered fuel to Annex VI with maximum sulphur limit of 1.5% m/m. R = 0.1340% m/m (as calculated above).
Test result < or = 1.5 – (0.59 x 0.1340) = 1.4209 = 1.42% m/m.

Consequently, if a single test result is less than or equal to 1.42% m/m, then the supplier can consider the result to *meet* the regulation with 95% confidence.

Calculated two results

If the supplier and buyer cannot reach an agreement about the sulphur content of a fuel, Clause 10 of ISO 4259, entitled '*Acceptance and rejection rules in case of dispute*', gives the appropriate procedures to be followed. The procedures only cover the situation where each laboratory is analysing fuel samples that are subdivisions from one representative sample.

Summary

The table below contains the summary of Grey Areas (based on single result) outside which the sulphur content can be deemed as non-compliant.

MARPOL Annex VI	Sulphur Test Method ISO 8574:1992		Sulphur Test Method ISO 8574:2003	
Specified Sulphur Limit in (%m/m)	Lower Limit Suppliers Upper Target	Upper Limit Buyers Maximum Acceptance Limit	Lower Limit Suppliers Upper Target	Upper Limit Buyer Maximum Acceptance Limit
4.50	4.33	4.67	4.28	4.72
1.50	1.43	1.57	1.42	1.58
0.20	0.17	0.23	0.18	0.22
0.10	0.07	0.13	0.09	0.11
Test methods' Reproducibility values 'R'				
4.50	0.2915		0.3776	
1.50	0.1265		0.1340	
0.20	0.0550		0.0284	
0.10	0.0495		0.0203	

It is important for the industry to note that the third edition of ISO 8217 cancels and replaces the ISO 8217:1996 (second) edition. The third edition should be therefore quoted in the bunker purchasing quality clause in order to incorporate the new methodology.

This information will be disseminated through the industry in due time and does not affect current contractual agreements on bunker clauses. However, it is recommended that bunker clauses are updated as and when contracts are renewed of as soon as it is considered practical.

Further guidance on the Third Edition of ISO 8217 may be obtained by emailing the Lloyd's Register FOBAS team on fobas@lr.org.

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