Changes to ISO Fuel Standards

- **Fourth edition of ISO 8217 – Specifications of marine fuels- and ISO 8216-1 – Classification of marine fuels- were published on the 15th of June 2010 and are available on the ISO website www.iso.org**
- ISO standards are normally revised every 5 years. Each standard is looked after by a Working Group (WG) and in case of the ISO 8216-1 and ISO 8217 it is ISO TC28/SC4/WG6.
- Work on the fourth edition began in March 2008, about the same time that the International Maritime Organization (IMO) requested ISO to prepare a specification for marine fuels to coincide with the implementation of the Revised MARPOL Annex VI on 1st July 2010.

Changes in ISO 8216-1:2010 versus ISO 8216-1:2005

The ISO 8216-1 entitled "Classification of marine fuels" has been revised and now it comprises: 4 categories of distillates and 6 categories (11 grades) of Residual Fuels.

Changes for Distillates:

- a new distillate category designation DMZ has been added, due to the new technical evidence provided by engine manufacturers and users, based on the recent experiences with fuel pumps leakage and wear damage. It was accepted to insert an additional grade with an increased minimum viscosity of 3 cSt at 40℃, but otherwise identical in its characteristics to the DMA grade.

- the DMC grade, being a blend of residual and distillate components, has been re-classified as a residual fuel RMA10 and moved to Table 2.

Changes for Residuals:

- new grade was added designation RMA10

- the previous RMA30 and RMB30 grades have been consolidated to a new RMB30 grade

- the previous RMF180 grade has been deleted

- RMG grade has been expanded to cover 4 grades 180, 380, 500 and 700

- RMH 380 and RMH700 grades were deleted

- RMK was expanded to include 500 grade, apart from previous 380 and 700 grades

Scope of ISO 8217:2010 versus ISO 8217:2005

The ISO 8217 standard specifically refers to petroleum derived products only, however WG6 agreed that Gas to Liquids (GTL) products fall within the scope of the Standard being paraffinic hydrocarbons produced from petroleum natural gas via synthesis gas using gas to liquids technology.   Since the GTL products are paraffinic hydrocarbons and they are undistinguishable from the rest of the petroleum based marine fuel, no actual reference needs to be made for GTL synthesized hydrocarbons in the scope of the standard. The GTL products clearly fall within the scope of the standard, unlike bio-derived materials which are specifically excluded.

For other products, such as biomass to liquid (BMTL) and hydrotreated vegetable oil (HVO), the WG maintained that these shall be considered as a separate issue for discussion during the next revision of the standard.

Changes to both Distillate and Residual Fuels are:

- Acid number limits included

- Hydrogen sulphide (H2S) limits included

Acid Number – the limits for Distillate fuels were adopted from the accepted industry's guiding limit of 0.5 mg KOH/g. The limits for Residual Fuels are set at max limit of 2.5 mg KOH/g.

H2S - the new limit will only be applied from 1 July 2012, which will allow the industry to gain global experience of the prevailing levels and with the new test method. Since there is presently no limit, placing a global limit of 2 mg/kg will better protect the end user. The new limit will ensure that the whole industry follows a precautionary practice. For Distillate Fuels the test method's precision is under development through the Energy Institute in London.

Changes for Distillate Fuels only are:

1. DMA – minimum viscosity was increased to 2 cSt at 40 deg C
2. DMZ - minimum viscosity was introduced at 3 cSt at 40 deg C
3. DMB - minimum viscosity was introduced at 2 cSt at 40 deg C4.
4. APPEARANCE was modified due to the fact that in some countries the distillate fuels are dyed and are not transparent. For such fuels water content shall be determined by KF and be in compliance of 200 mg/kg limit.
5. OXIDATION STABILITY – was introduced because the refinery processes used to manufacture distillate fuels can lead to products which may be of limited oxidation stability. In addition, today's non-marine distillate fuels can contain a significant amount of bio-derived components, which might impact on the oxidation stability of the fuel. Also the transportation of pure Distillate Fuels and Distillate Fuels containing bio derived material like FAME, especially through multi product pipeline installations, have shown that some FAME is transferred into the pure Distillate Fuels
6. LUBRICITY - A lubricity requirement has been included and is applicable to clear and bright D/Fs with a low sulphur content below 500 mg/kg. The lubricity limit is based on the existing requirements for high speed automotive and heavy duty industrial diesel engines, of 520 wear scar diameter. The 460 wear scar limit was required only for a

particular form of passenger car fuel injection equipment and therefore not applicable to marine fuel pumps. Engine manufacturers are in the process of reviewing their limits to this value.

Changes for Residual Fuels only are:

1. STABILITY – to assess stability Potential Total Sediment (TSP) has been assigned as the reference test method. Accelerated Total Sediment (TSA) has been added as an alternative test method.
2. SULPHUR – due to wide range of various changing limits and requirements both internationally and locally the sulphur limits are not included in Table 2
3. ASH limits were reduced
    - for RMA10 – from 0.05 to 0.040 mass%
    - for RMB30, RMD80 and RME180 – from 0.100 to 0.070 mass%,
    - for all grades of RMG – from 0.150 to 0.100 mass %
    - no change for RMK grades – at 0.150 mass%
4. VANADIUM limits were reduced
    - for RMA10 – from 100 to 50 mg/kg,
    - for RMB30 grade – no change at 150 mg/kg
    - for RMD80 grade – from 350 to 150 mg/kg
    - for RME180 grade – from 200 to 150 mg/kg
    - all RMG grades – at 350 mg/kg
    - for all grades of RMK – from 600 to 450 mg/kg
5. 5. ALUMINIUM AND SILICON limits were significantly reduced
    - for RMA10 – same at 25 mg/kg,
    - for RMB30 and RMD80 – from 80 mg/kg to 40 mg/kg
    - for RME180 – from 80 to 50 mg/kg
    - for all grades of RMG and RMK – from 80 to 60 mg/kg
6. SODIUM CONTENT – was added to all residual fuel grades at 100 mg/kg with the exception of RMA10 and RME 180 where the limit is set at 50 mg/kg.
7. ULO – Due to changes to lubricating oils formulations improved criteria for assessing the presence of ULO in marine fuels were included. The new approach to the limit has been derived from extensive statistical survey reports. The new combination of elements will not trigger incorrect identification of ULO. In view of the difficulty of establishing a wording that fuel is free of ULO, the WG agreed that it should be expressed in terms of when a fuel does contain ULO and amend the wording in Table 2 as follows:
   A fuel shall be free from ULO. A fuel shall be considered to contain ULO when either one of the following conditions is met: Ca > 30 and Zn > 15 or Ca > 30 and P > 15
8. CCAI

   From the specification writers point of view it is hard to describe the enormity of the task at hand. The chemistry of residual fuels is probably the most complex of the oil barrel and some of the components of the final blend are rather resultants than controlled fractions. Furthermore, the various specification grades of residual fuels are not blended at the refineries and therefore different cutter stocks of unknown chemistry available to today's supply chain are added. With this in mind, the complexity of the ignition/combustion properties of marine fuels must be fully appreciated and carefully researched. Nonetheless, as an indication of ignition performance, CCAI has been added as in order to avoid fuels with uncharacteristic density-viscosity relationships. For engines and/or applications where ignition quality is known to be particularly critical, Annex F provides a basis for suppliers and purchasers of marine residual fuels to agree on tighter ignition quality characteristics.

The basis for including CCAI was as a substitute for a minimum viscosity limit. The CCAI limit included in the marine fuels standard is there to prevent abnormal or peculiar fuel blends from finding their way into the market. It is recognised that CCAI of 870 is not a guarantee to pose no risk for engines, but neither is a lower value such as 860.

9. Four new Annexes were included (A, B, D, C) and some were deleted or revised.

BIO COMPONENT

The bulk of bio-derived automotive fuels currently available are the product of a transesterification process which removes the glyceride fraction to produce a Fatty Acid Methyl Ester (FAME) – commonly referred to as bio-diesel. While bio-derived fuels can be produced by other process methods there is no general experience with regard to their application in marine systems and hence this Standard does not address those issues. FAME as defined by EN14214 and ASTM D6751.

As the scope of ISO 8217 refers to petroleum derived products, the inclusion of any bio-derived products is ruled out. However the practice of blending FAME into automotive diesel makes it almost inevitable, under current supply processes, that some marine distillates, and even perhaps marine residual fuels, may contain FAME as a result of cross contamination within the distribution system.

In spite of this, WG6 agreed to adoption of the precautionary principle, to address any safety concerns that may exists in this area of using either blends of FAME/petroleum products or 100% FAME. This is required as there is no known generalised experience in respect of storage, handling, treatment and service performance (including overboard discharges) of biodiesel within the broad spectrum of the marine environment. Furthermore, while biodiesel has proven to be acceptable for use in automotive and truck engines, there are unknowns as to the potential effects of FAME products on the range of marine engines and other equipment (i.e. oily water separators (OWS) or overboard discharge monitors (ODM) currently in service.

With FAME, the primary concern relates to storage and handling and these include:

- poor low temperature flow properties
- tendency to oxidation and long term storage issues.
- affinity to water

- risk of microbial growth
- FAME material deposition on exposed surfaces including filter elements.

Additionally there are a variety of different sourced FAME products each with its own particular characteristics having implications in respect of storage, handling, treatment, engine operations and emissions.

In those instances where the use of fuels containing FAME is being contemplated it should be ensured that the ship's storage, handling, treatment, service and machinery systems, together with any other machinery components (such as bilge and oil drain systems) are compatible with such a product.

In view of this for the purpose of this International Standard it was agreed that:

- in the case of distillate fuels (DMX, DMA, DMZ and DMB when clear and bright), it is recommended that "de minimis"be taken as not exceeding approximately 0,1 volume % when determined in accordance with EN 14078.
- in the case of DMB when it is not clear and bright and all categories of residual fuels, "de minimis"cannot be expressed in numerical terms since no test method with formal precision statement is currently available. Thus, it should be treated as contamination from the supply chain system.

H2S

Prior to this revision of ISO 8217, there was no limit on the amount of H2S permissible in marine fuels. However, because of its potentially fatal nature, operators of fuel storage terminals have prevented H2S from entering the supply chain system. Notwithstanding this, the Working Group acknowledges that whilst H2S should not be present in marine fuels, the current test methodology and the requirements for setting the specification limits cannot guarantee that H2S gas will not be released during the course of onboard storage and handling. It has therefore recommended 2 mg/kg in the liquid phase as the maximum limit for both residual and distillate fuel oils.

The most important reason and benefit of measuring H2S in liquid phase is that it deals with the key issue, which is to measure the potential latent H2S concentration of the fuel oil that could be released over a period of time from a bunker fuel at any suitable conditions, when the fuel is transferred, heated and agitated by the rolling action of the ship, rather than the measurement of variable equilibrium dynamics of the vapour phase.

Vapour phase measurements in ship's tank head space are strongly influenced not only by the amount of H2S in the liquid phase but also by factors such as: fuel oil chemistry, temperature of the product, volume of the headspace, degree of agitation of the product, configuration of tank venting arrangements and duration of storage.

Therefore the measurement of H2S in vapour phase of the test method's container as a fuel quality parameter could provide a false expectation for safe use, often providing lower than expected results, Such results must be interpreted with due diligence and care as they are not related to the total H2S entrained in the fuel or cargo.

Measurement of H2S, using Draeger tube in vapour phase, as per standard test method (ASTM D5705), while totally appropriate as an occupational health protection measure, has its limitations. The head space gas distribution in the test method's container is uniform in composition, however the gas distribution in the ship's tank head space is not uniform in composition.

Another most important consideration is when a supplier delivers fuel to a customer, the supplier should measure the presence of H2S in the liquid phase of the fuel in order to provide an indication of the maximum amount of H2S that may emerge from the liquid phase during subsequent handling of the fuel. How much H2S emerge from the liquid phase and what will be the resulting vapour concentration on board the vessel will depend on many factors like temperature, movement and the ullage space. These are factors that are beyond the control of the supplier of the fuel. It is therefore not appropriate to consider a vapour space measurement as part of a sales specification. However vapour space measurement are appropriate to verify operational conditions on board a ship for crew health protection.

Additionally it has to be appreciated that the WG6 proposed to use the limit 2 mg/kg only as a guide for 2 years from 1 July 2010.

The Future

The issues that could not be resolved during this revision will be debated for the next revision and these are:

- Studying ignition and combustion properties. WG6 will continue working to establish all necessary correlations between estimated cetane numbers (ECN) and engine performance

- Studying a possibility of including bio-diesel in marine fuels

- Studying contamination cases and developing standard test methodology to deal with a disturbing trend of an ever increasing number of possible low sulphur cutter stocks available on the market today.