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To the Members

Dear Sirs,

General Advice for ship's loading DRI A (HBI) at Venezuela

We have obtained information on General Advice for ship's loading DRI A (HBI) at Venezuela from our correspondents, VENEPANDI C.A. Please find attached their Circular.

We hope it will be of help to you with regard to the safe voyaging.

Yours faithfully,

The Japan Ship Owners' Mutual Protection & Indemnity Association
Loss Prevention and Ship Inspection Department
Tel: +81 3 3662 7229
Fax: +81 3 3662 7107
E-mail: lossprevention-dpt@piclub.or.jp
Website: https://www.piclub.or.jp

VENEPANDI

The P&I Correspondent in Venezuela

Caracas, 18th June 2015

Venepandi´s Circular - 017 – General advice for ship´s loading DRI A (HBI) at Orinoco River

Since the reactivation of Palua´s and San felix´s (Orinoco river) HBI plants that has increased significantly the shipments of the mentioned cargo, risks have increased for which we´ve prepared this circular including some precautionary measures and advice for all vessels calling locally to take into consideration.

Please note that we could sumarize the most frequent issues that have taken place at the Orinoco River in groundings (that will be treated in a further circular) and cargo misdeclarations that could lead to hazardous situations due high moisture on cargo (iron ore fines) with potential liquefaction or wet cargo (DRI, etc) or cargoes declared as Iron ore fines but resulting to be DRI or DRI A (HBI) resulting to be DRI B or C.

Indeed Ferrominera is currently the only one terminal where the Iron ore fines can be loaded at, but in others terminal´s like Orinoco Iron or SIDOR, vessels can load some iron cargoes like HBI or DRI by products that despite are not classified as iron ore fines, have low percentages of iron, less than 10% that does not require the same cares than a regular DRI shipment with an percentage higher than 60% than can be potentially a dangerous cargo.

For these cargoes that are not iron ore fines (reminding that a cargo is classified under this category when the iron percentage does not exceed 1%), we´ve found by our experience that any carrier vessel should take the proper measures like use all kind of ventilations available, i.e. maintain a proper level of ventilation (naturally and from the vessel), keeping the cargo away from any kind of liquid (rain, etc) and monitoring constantly all the temperatures in every hold, to check the situation.

Taking note of the above, it is highly recommended to owners to appoint surveyor a as a precautionary measure in order to carry out a preloading and loading survey in order to check the moisture content of the cargo stockpiles as well as to monitor the temperatures throught the loading in order to determine timely any strategy to take to avoid further issues due the moisture content of the cargo or any other hazardous situation and who could confirm that the cargo complies with the IMSBC code and is suitable for carriage.

The following represents an extract from the cargo handbook on the warnings on the IMSBC code:

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Quote:
Direct Reduced Iron (DRI)From Cargo Handbook - the world's largest cargo transport guidelines website Jump to: navigation, search Infobox on Direct Reduced Iron (DRI) Example of Direct Reduced Iron (DRI) Facts Origin World wide Stowage factor (in m3/t) Briquettes: 0,3-0,4 m3/t Lumps, pellets: 0,5-0,6 m3/t Fines, byproducts: 0,3-0,55 m3/t

Humidity / moisture Briquettes: <1% (IMO) Lumps, pellets: <0,3% (IMO) Fines, byproducts: <0,3% (IMO)

Ventilation Briquettes: surface ventilation Lumps, pellets: No (inert) Fines, byproducts: No (inert)

Risk factors Self-heating / auto ignition Oxygen depletion Highly reactive with air and (sea) water Formation of hydrogen (explosion hazard)

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Description / Application / Shipment - Storage / Risk factors

Direct-reduced iron (DRI), also called sponge iron, is produced from direct reduction of iron ore (in the form of lumps, pellets or fines) by a reducing gas produced from natural gas or coal. The reducing gas is a mixture majority of hydrogen (H2) and carbon monoxide (CO) which acts as reducing agent. This process of directly reducing the iron ore in solid form by reducing gases is called direct reduction.

The conventional route for making steel consists of sintering or pelletization plants, coke ovens, blast furnaces, and basic oxygen furnaces. Such plants require high capital expenses and raw materials of stringent specifications. Coking coal is needed to make a coke strong enough to support the burden in the blast furnace. Integrated steel plants of less than one million tons annual capacity are generally not economically viable. The coke ovens and sintering plants in an integrated steel plant are polluting and expensive units.

Direct reduction, an alternative route of iron making, has been developed to overcome some of these difficulties of conventional blast furnaces. DRI is successfully manufactured in various parts of the world through either natural gas or coal-based technology. Iron ore is reduced in solid state at 800 to 1,050 °C

either by reducing gas (H2+CO) or coal. The specific investment and operating costs of direct reduction plants are low compared to integrated steel plants and are more suitable for many developing countries where supplies of coking coal are limited.

The direct reduction process is intrinsically more energy efficient than the blast furnace because it operates at a lower temperature, and there are several other factors which make it economical:

Direct-reduced iron has about the same iron content as Pig Iron, typically 90–94% total iron (depending on the quality of the raw ore) as opposed to about 93% for molten pig iron, so it is an excellent feedstock for the electric furnaces used by mini mills, allowing them to use lower grades of scrap for the rest of the charge or to produce higher grades of steel.
Hot-briquetted iron (HBI) is a compacted form of DRI designed for ease of shipping, handling, and storage.
Hot Direct Reduced Iron (HDRI) is iron not cooled before discharge from the reduction furnace, immediately transported to a waiting electric arc furnace and charged thereby saving energy.
The direct reduction process uses pelletized iron ore or natural "lump" ore. One exception is the fluidized bed process which uses (requires) sized iron ore particles. Select few ores are suitable for direct reduction.
The direct reduction process can use natural gas contaminated with inert gases, avoiding the need to remove these gases for other use. However, any inert gas contamination of the reducing gas lowers the effect (quality) of that gas stream and the thermal efficiency of the process.
Supplies of powdered ore and raw natural gas are both available in areas such as Northern Australia, avoiding transport costs for the gas. In most cases the DRI plant is located near natural gas source as it is more cost effective to ship the ore rather than the gas.

India is the world’s largest producer of direct-reduced iron, a vital constituent of the steel industry. Many other countries use variants of the process, so providing iron for local engineering industries.

Problems
Directly reduced iron is highly susceptible to oxidation and rusting if left unprotected, and is normally quickly processed further to steel. The bulk iron can also catch fire since it is pyrophoric.

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Sponge iron is not useful by itself, but can be processed to create wrought iron. The sponge is removed from the furnace, called a bloomery, and repeatedly beaten with heavy hammers and folded over to remove the slag, oxidise any carbon or carbide and weld the iron together. This treatment usually creates wrought iron with about three percent slag and a fraction of a percent of other impurities. Further treatment may add controlled amounts of carbon, allowing various kinds of heat treatment (e.g. "steeling").

Today, sponge iron is created by reducing iron ore without melting it. This makes for an energy-efficient feedstock for specialty steel manufacturers which used to rely upon scrap metal.

More information on DRI
Direct Reduced Iron may be in the form of pellets, lumps or briquettes, and is used as a feed for blast furnaces. The material, if wetted, may oxidize rapidly and generate heat over a period of time. In addition, hydrogen may be generated, which could possibly form an explosive atmosphere.

Moulded briquettes minimise certain risks; other products, such as cold moulded briquettes and specially processed material, appear to act similarly. However, as a general precaution, every effort should be made to prevent the ingress of water into cargo compartments. Flammable gases should be prevented from entering adjacent enclosed spaces. Prior to shipment, Direct Reduced Iron should be aged for at least 72 hours or treated with some passivation technique to reduce its activity to at least the same level of the aged product. Holds should be maintained under inert atmosphere (less than 5% oxygen and less than 1% hydrogen) throughout the voyage. Direct Reduced Iron, which has been manufactured or treated in a manner approved by the competent authority to provide protection against corrosion and oxidation by water and air, may be shipped without inerting. If wetting to the top level of a bulk stow occurs then this will not necessarily create a problem. However, a problem may arise if the stow is then moved for loading on to carrying vehicles or into a vessel, at which time the wet material is relocated into the centre of the stow. This commodity has, in some cases, been incorrectly described as Sponge Iron, Iron Pellets or Iron Ore Pellets.

DRI is produced by passing hot reducing gases such as hydrogen, methane and carbon monoxide over iron ore (oxide), which is usually in the form of pellets or lumps. Although the process is conducted at high temperatures, these are still substantially below the melting point of iron. This means that the lumps and pellets retain their original shape, but are considerably lighter owing to the removal of oxygen from the ore. Therefore, the pellets and lumps have a hugely porous structure, which makes the material extremely reactive and prone to re-oxidation

on contact with air end/or moisture. These oxidation reactions cause self-heating in the stow, which can lead to auto-oxidation in which cargo temperatures in excess of 900°C can be generated. Moreover, contact with moisture evolves hydrogen, an extremely flammable and sensitive gas that has caused explosions in the holds of several ships following its ignition.

The Adamandas and the Ythan

In 2003 the Adamandas was deliberately sunk by the French Authorities following overheating of her cargo of 21.000 MT of DRI pellets. On 28 February 2004, hydrogen explosions in four of her cargo holds caused the total loss of the Ythan off Colombia, together with the deaths of six of her crew including the Master. The hydrogen had been produced from a cargo of damp DRI fines.

Mandatory 2011

In the wake of this incident, a paper was submitted to the IMO Maritime Safety Committee (MSC) by the Marshall Islands, and the topic has been discussed at subsequent meetings of the Sub-committee on Dangerous Goods, Solid Cargoes and Containers (DSC). Eventually, new schedules were agreed in September 2008 and were adopted by MSC Resolution in December 2008 as part of the new IMSBC Code, which was published in 2009. The Code has been recommendatory from l January 2009, but became mandatory on 1 January 2011.

Three types of DRI

The IMSBC Code now categorise three types of DRI.

1. The first, type DRI (A), is the less reactive, high-density variety of DRI that is known as Hot Briquetted Iron HBI, or Hot Moulded Briquettes HMB 2. The second type, DRI (B), is highly reactive, low density DRI in the form of lumps and pellets and cold moulded briquettes.
3. The schedule now included a new entry DRI ©, which is described as By-product fines and is intended to include all the materials generated as by-products in the manufacture and handling process of DRI (A) and/or DRI (B).
4. DRI (B) may now only be carried under an inert gas atmosphere, and DRI (C) is subjected to the same requirements as DRI (B). The main changes to the Code are summarized later on.

Caveat

The IMSBC Code provides for the requirements of carriage of any cargo covered by the Code to be varied by consent of three competent authorities: Where this Code requires that a particular provision for the transport of solid bulk cargoes shall be complied with, a competent authority or competent authorities (port State of departure, port State of arrival or flag State) may authorise any other provision by

exemption if satisfied that such provision is at least as effective and safe as that required by this Code. Acceptance of an exemption authorized under this section by a competent authority not party to it is subject to the discretion of that competent authority. Accordingly, prior to any shipment covered by the exemption, the recipient of the exemptions shall notify other competent authorities concerned.

The door is therefore open for parties to seek exemption from any or all of the requirements for the carriage of this or any other cargo. 'High Moisture' DRI Fines containing up to 12% moisture and 75% metallic iron are being offered for carriage without inert gas on the basis that the hydrogen will be removed using the ship's mechanical ventilation. However, sea trials showed that hydrogen accumulated in the holds in explosive concentrations when the ventilation was suspended for a short period of time, as would be expected during bad weather. Moreover, the recommended ventilation regime would not have prevented the explosions that caused the loss of Ythan. Therefore one should be very cautious when such a cargo is offered. Some manufacturers are blending quantities of DRI fines with fines recovered from the un-reduced iron ore, and offering them as (non hazardous) iron ore fines. Again, caution is to be exercised upon offering such a cargo for shipment. On the other hand, many grades of iron ore are prepared specifically for reduction in DRI furnaces, and are often referred to as 'direct reduction iron ore pellets', or similar. These do not require any special provisions for transport by sea, and can be differentiated from DRI (B) by their chemical composition.

The main changes to the Code

All types of DRI

Fines are now defined as particles up to 6,35 mm in size.
The carrier's representative is to have reasonable access to stockpiles and loading installations for inspection.
The cargo temperatures are to be monitored during loading and recorded in a log.
The ship shall be provided with a detector suitable for measuring hydrogen in an oxygen depleted atmosphere and for use in a flammable atmosphere.
Cargo temperatures and hydrogen concentrations in hold atmospheres are to be monitored on voyage.
The hydrogen concentration is to be measured in holds prior to opening hatch covers.
All records of measurements are to be retained on board for two years

DRI (A), Briquettes, hot-moulded

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The maximum limit on the moisture content is 1% The cargo is to comprise essentially whole briquettes.
Surface ventilation only shall be conducted as necessary. When mechanical ventilation is used, the fans shall be certified as explosion-proof and shall prevent spark generation. Wire mesh guards shall be fitted over inlet and outlet ventilation openings.

DRI (B), Lumps, pellets, cold-moulded briquettes

The average particle size is from 6,35 mm to 25 mm.
Loading conveyors are to be dry
Prior to loading, an ultrasonic test or another equivalent method with a suitable instrument shall be conducted to ensure weather tightness of the hatch covers and closing arrangements.
The moisture content must be less than 0,3% and must be monitored during loading.
Any cargo that has already been loaded into a cargo space and which subsequently becomes wetted, or in which reactions have started, shall be discharged without delay.
Carriage is only permitted under an insert gas blanket.
The ship shall be provided with the means of reliably measuring the temperature at several points within the stow, and determining the concentrations of hydrogen and oxygen in the cargo space atmosphere on voyage whilst minimising the loss of the inert atmosphere.
The ship shall be provided with the means to ensure that the requirements to maintain the oxygen concentration below 5% can be achieved throughout the voyage. The ship's fixed CO2 fire-fighting system shall not be used for this purpose.

The ship shall not sail until the master and a competent person are satisfied that:

1. All loaded cargo spaces are correctly sealed and inerted.
2. The cargo temperatures have stabilised at all measuring points and are less than 65°C.
3. The concentration of hydrogen in the free space has stabilised and is less than 0,2% by volume (i.e. 5% of the lower explosive limit, L.E.L.).

The ship shall be provided with a detector suitable for measuring oxygen in a flammable atmosphere.

The oxygen concentration shall be maintained at less than 5% throughout the duration of voyage.

DRI ©, By-products, Fines

The average particle size is less than 6,35 mm, and there are to be no particles greater than 12 mm in size.
'The reactivity of this cargo is extremely difficult to assess due to the nature of the material that can be included in the category. A worst-case scenario should therefore be assumed at all times.'
The carriage requirements are identical to those for DRI (B), including the 0,3% limit on moisture.

Information to be obtained
Before Loading:
Cargo blends containing DRI (C) can be identified by their chemical composition, details of which must be requested. The chemical composition must include the total iron content (Fe), the metallic (or free) iron content (Feo) and the moisture content. This information should preferably be supported by a certificate from an independent testing laboratory and must relate to the cargo that is being offered for shipment: in other words, a "generic" analysis is not acceptable. The certificate should state the method and standards that have been followed when obtaining the samples that have been tested (preferably ISO 10835: 2000) and the standards that have been followed to determine the metallic iron content (preferably BS ISO 5416: 2006). The date on which the sampling took place should also be checked to ensure relevance.

The iron in a cargo of iron ore is chemically bound with other elements and therefore it contains no metallic (or free)iron. If the cargo contains any metallic iron (Feo), then it must be a DRI derivative: DRI (A) and (B) cargoes typically contain about 85% metallic iron,whereas in blends containing DRI (C) it can be as low as1% or 2%. Such blended cargoes should be regarded as the hazardous commodity DRI (C) and be carried in accordance with the provisions of the Code. If in doubt, expert advice should be sought.

Having identified the cargo as DRI (C), the IMSBC Code sets out the information that must be provided to the Master. In addition to the general requirements, the entry for DRI (C) specifies the following:
"Prior to loading the cargo, the shipper shall provide the master with a certificate issued by a competent person recognised by the National Administration of the port of loading stating that the cargo, at the time of loading, is suitable for

shipment; that it conforms with the requirements of this Code; that the moisture content is less than 0.3%; and the temperature does not exceed 65°C. The certificate shall state that the cargo meets the loading criteria in regards to ageing and material temperature."

"Prior to shipment, the cargo shall be aged for at least 30 days and a certificate confirming this shall be issued by a competent person recognised by the National Administration of the port of loading."

"Shippers shall provide to the master, prior to loading, comprehensive information on the cargo and safety procedures to be followed in the event of emergency."

"The cargo temperature shall be monitored during loading and recorded in a log detailing the temperature for each lot of cargo loaded, a copy of which shall be provided to the master. After loading, a certificate shall be issued by a competent person recognised by the National Administration of the port of loading confirming that throughout the whole consignment of fines and small particles the moisture content has not exceeded 0.3% and the temperature does not exceed 65°C.

Exemptions from the requirements of the IMSBC Code For cargoes that are listed in Appendix 1 of the IMSBC Code, such as DRI (C), Section 1.5 allows a competent authority to authorize any other provision or exemption if satisfied that such alternative provision is at least as effective and safe as that required by the Code. Three competent authorities are recognised: the port State of departure, port State of arrival and the flag State. Prior to any shipment covered by such an exemption, the recipient of the exemption must notify the other competent authorities concerned, who may or may not accept that exemption.

Although the IMSBC Code permits an exemption, it is strongly advised to adhere to the carriage requirements as detailed in the IMSBC entry for DRI (C). If carriers choose not to follow this advice, they should satisfy themselves that all of the three competent authorities named above have been notified and have accepted the exemption, that the rules of the flag State Administration are not breached and that the exemption certificate is maintained on board each ship transporting the solid bulk cargoes in accordance with the exemption.

For cargoes that are offered for transport in accordance with an exemption as described above, the loading, carriage and safety procedures must be clearly stated. In particular, the master must be advised of the ventilation rates and durations for each cargo space; the required standard of explosion protection of the ventilation fans; details of the arrangement of ventilation ducts into the holds; the method and frequency of monitoring the hydrogen concentrations in each cargo space; the method and frequency of monitoring the cargo temperatures in each cargo space; the criteria defining an emergency; the procedures to follow in

the event of emergency; shipper's contact numbers in the event of emergency; and the procedures to follow before and during discharge.

The IMSBC Code schedule for DRI (C) sets maximum allowable moisture content as 0.3% for carriage. When cargoes are offered with moisture content in excess of this then they are not compliant, and at higher moisture contents they may additionally pose a realistic risk that they may liquefy in a similar manner to certain iron and nickel ore cargoes. Therefore, any Declaration relating to such cargoes must classify the material as Group A and B and the accompanying test certificate(s) must state the Transportable Moisture Limit and actual moisture content of the shipment. The certificate(s) should also refer only to the cargo that is being offered for shipment, i.e. not a generic measure obtained from previous shipments, and the standards that have been followed when obtaining the samples that have been tested.

The IMSBC Code also addresses cargoes that are not listed in Appendix 1 of the IMSBC Code and provides that such cargoes can be carried under conditions which are defined by and subject to a tripartite agreement between the competent authorities of the ports of loading and unloading and the flag State. However, if a cargo is described as iron ore fines, or one of the other descriptions contained in the background section of this circular, and is found to contain any metallic iron content (Feo), then it should be regarded as DRI (C) and be carried in accordance with the provisions of the Code as the tripartite agreement procedure is for cargoes not listed in Appendix 1 of the Code.

Risk factorsAlways consult the IMSBC Code for particulars on aspects like Hazard, Stowage & Segregation, Hold cleanliness, Weather precautions, Ventilation, Carriage, Discharge, etc.

Unquote.

Finally, we strongly recommend to avoid the appointment of any company related to the shippers given the evident conflict of interests for which in case the appointent of an expert/surveyor is under consideration, we would reccomed to approach us on a free of charge basis to receive more information.

Should you have any question about this or any other matter, please don't hesitate on contacting us.

Carlos Carrasco
Operations Manager

VENEPANDI C.A.
C.C.C.T, Torre B, Piso 10, Oficina 1001, Av. Ernesto Blohm, Chuao, Caracas, Venezuela P.C.1064
Phones: Master: +58 212 959.3338 / +58 212 959.3352 / +58 212 959.3347
Mobiles: +58 412 222 94 94/ +58 414 2239428

The P&I Correspondent in Venezuela

Caracas, 18th June 2015

Venepandi, C.A.

VENEPANDI C.A.
C.C.C.T, Torre B, Piso 10, Oficina 1001, Av. Ernesto Blohm, Chuao, Caracas, Venezuela P.C.1064
Phones: Master: +58 212 959.3338 / +58 212 959.3352 / +58 212 959.3347
Mobiles: +58 412 222 94 94/ +58 414 2239428