



上海期货交易所
SHANGHAI FUTURES EXCHANGE

上海国际能源交易中心
SHANGHAI INTERNATIONAL ENERGY EXCHANGE



Low Sulfur Fuel Oil Futures Handbook for Trading

低硫燃料油期货 合约交易操作手册

2020

Low Sulfur Fuel Oil Futures Handbook for Trading 2020

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Product Overview

Characteristics and Classification

Fuel oil, a type of refined oil, is one of the heavier residual products from the refining of crude oil, after lighter components such as gasoline, kerosene, and diesel are first separated. Primarily the residue from the cracking and straight-run distillation of crude oil, fuel oil is characterized by its high viscosity as well as the significant amount of non-hydrocarbon compounds, resins, and asphaltenes. Fuel oil is principally used in oil refining and chemical, transport, construction, and metallurgy industries. Marine fuel, especially bonded marine fuel, is seeing rising demand in recent years.

Generally, lighter components are always separated out earlier than heavier ones during the refining of crude oil. Fuel oil is the last product coming out of the refining process; its quality is affected by many factors including the crude stream, refining technology, and the extent of refining. Marine fuel powers much of the shipping and transport industries. As such, it must meet a wide range of quality requirements for use in marine diesel engines; otherwise, potential safety hazard may be caused. Furthermore, it must be free of any additives or chemical waste that may endanger the safety of the ship or affect the performance of the machinery, damage the health of the crew, or pollute the air.

Different classifications of marine fuel are listed as follows:

- According to China's national standard GB/T 17411, marine fuel is broadly categorized into distillate fuel and residual fuel. The former is mainly made of light distillates, and is further classified into four grades of DMX, DMA, DMZ, and DMB by density, cetane index, and

other quality metrics; the latter is mainly made of heavy fuel oil, and by quality and viscosity, can be further categorized into 6 fuel types and 7 viscosity designations, yielding 11 grades, namely RMA 10, RMB 30, RMD 80, RME 180, RMG 180, RMG 380, RMG 500, RMG 700, RMK 380, RMK 500, and RMK 700.

- By sulfur content, marine fuel can be classified into grades I, II, and III. For the residual variety, the three grades correspond to a maximum sulfur content of 3.50%, 0.50%, and 0.10% m/m, respectively. Starting from January 1, 2020, the International Maritime Organization (IMO) requires a sulfur cap of 0.50% m/m on fuel oil used by all ships worldwide, except for ships using “equivalent” compliance methods.

Low sulfur fuel oil (LSFO) has become a mainstream product on the market since 2020. Conventional residual fuel is produced through blending the vacuum residues with other components. But as the low sulfur era approaches, the existing production processes need to be changed. There are three principal ways to produce LSFO: (1) distillation of low sulfur crude oil; (2) mixing and blending low sulfur residual fuel with high sulfur heavy fuel; and (3) using processing facilities to lower the sulfur content of high sulfur residual fuel.

■ Key Quality Metrics

China’s current national standard GB/T 17411-2015 for marine fuel was made based on ISO 8217. It is a mandatory standard covering such major technical indicators as kinematic viscosity, sulfur content, hydrogen sulfide, flash point, moisture, acid value, and total sediment.

- **Kinematic viscosity.** This is the most important performance indicator for fuel oil and also the main criterion by which fuel oil is graded. Kinematic viscosity measures a fluid’s resistance to flow and its value indicates how easily fuel oil can flow, be pumped and atomized. The unit of kinematic viscosity is mm^2/s .



- **Sulfur content.** The sulfur content in residual fuel depends on that of the blending components and is classified by concentration into levels I, II, and III. Starting from January 1, 2020, IMO requires all ships traversing international waters to use fuel oils with a maximum sulfur content of 0.50% m/m. It is the responsibility of the buyer to determine the maximum permissible sulfur content in fuel oil based on the design of the marine engine, emission regulations, and the local regulations of the region where the fuel oil and related equipment will be used.
- **Density.** This refers to the mass of fuel per unit volume. The quantity of fuel can be accurately determined after measuring its density and volume, making density a key number in fuel trading. As the density of fuel is related to chemical composition, it can be used to determine the class and quality of the fuel.
- **Calculated carbon aromaticity index (CCAI).** This is an indicator of the ignition performance of residual fuel, computed from the fuel's density and viscosity. The inclusion of CCAI into the national standard is intended to prevent prolonged ignition delay potentially caused by fuel oil with an abnormal density-viscosity relation.
- **Flash point.** This is an effective indicator for the risk of fire from fuel oil.
- **Hydrogen sulfide.** H₂S is a highly toxic gas. Exposure to high concentrations of H₂S is hazardous or even fatal. H₂S can be formed during the refining process or build up from fuel oil in storage tanks, barges, and customer (consumption) tanks.
- **Acid value.** Highly acidic fuels arising from acidic compounds can often accelerate the damage to marine diesel engines, most often starting from the fuel injection parts.
- **Total sediments.** Sediments in fuel will exacerbate equipment wear-and-tear and clog fuel injectors. Sediments may accumulate in storage tanks, filter screens, or equipment, leading to blockage between the oil tank and burner.
- **Carbon residue.** This refers to the percentage by mass of the carbon

residues formed after evaporation and thermal cracking of fuel at a specific high temperature.

- **Pour point.** This refers to the lowest temperature at which a fuel specimen can flow under specified laboratory conditions. Buyers should ensure the pour point of fuel oil meets the requirements of on-board equipment, especially when the vessel is sailing in a cold environment.
- **Moisture.** Water content reduces the calorific value of fuel oil and the performance of combustion machinery. Because water may lead to furnace flameout, shutdown, or other incidents, its concentration in fuel must be strictly controlled.
- **Ash content.** All residual fuels contain some forms of metals. Some are from the fuel itself, such as vanadium, calcium, and nickel, while others – sodium, aluminum, silicon, and iron, for example – are from foreign sources. When fuel oil is burned, metals are turned into oxides, sulfides, or more complex compound particulates and then coalesce into ash content. The melting point of ash content varies widely based on its composition. The ash content from fuel oil may deposit on pipe walls, boiler heating surface, or other equipment, thus lowering the efficiency of heat transfer.
- **Vanadium.** It is commonly found in crude oil. Because its organic forms are soluble in crude oil, it is also present in residual fuel. Burning vanadium with sodium produces low-melting point compounds which cause serious furnace erosion and high-temperature corrosion.
- **Sodium.** As salt is corrosive, this metric is used to determine whether salt concentration is increased by seawater introduced during transport. When residual fuel is combusted to generate power, sodium compounds with low melting points are one of the reasons why scale would form on, and thereby corrode, the valves and nozzles of marine diesel engines and the blades of turbo blowers.
- **Aluminum + silicon.** Generally coming from the catalyst powder left over in residues, silicon and aluminum form hard oxides which can easily abrade combustion equipment.



- **Net calorific value.** The amount of heat released from complete combustion of a unit weight of fuel minus the heat of formation and dissolution of acid is called the total calorific value, which less the heat of vaporization of water yields the net heat value.
- **Used lubricating oil (calcium + zinc or calcium + phosphorus).** The acidic materials formed from oxidation of ULO are corrosive; the metal additives in lubricating oil increase ash content; and the abrasive particles present in ULO cause accelerated wear. For these reasons, fuel oil should not contain ULO.
- **Compatibility (level).** A standard-conforming fuel may work flawlessly when used alone but flocculate when mixed with a different type of naphtha or heavy fuel oil. This phenomenon is also very common during blending, reflecting the incompatible nature of the types of fuels used in the blending.
- **Cleanness.** Cleanness measures the number of suspended particles in fuel and indicates the product's stability.
- Styrene and phenol have significant adverse effects on the quality of low sulfur marine fuel, including coking, corrosion, and stratification, and thus affecting its normal use.

Overview of the Domestic and International Fuel Oil Markets

International Fuel Oil Market

1. Global Supply and Demand

The world's main production centers of fuel oil are concentrated in the Middle East, South America, Russia, and China. Global annual production is about 500 million metric tons, of which 300-400 million metric tons are traded on the open market. Data shows that the global consumption for marine fuel in recent years has reached 280 million metric tons; the Asia-Pacific region is seeing surging demand and is now the world's biggest consumer of marine fuel, accounting for 45% of the global total.

There are four major marine fuel markets in the world: Asia (Singapore, China, Japan, and South Korea), Europe's ARA (Amsterdam, Rotterdam, and Antwerp), the Mediterranean Sea region (Fujairah), and the Americas (U.S. East Coast). These regions are distinguished by their thriving maritime trade and freight shipping as well as the highly developed marine fuel market.

The global shipment of high sulfur fuel oil mainly follows three routes: from Europe to Singapore and the Gulf of Mexico, from the Middle East to Singapore and Northeast Asia, and from the Gulf of Mexico and Latin Americas (including Mexico, Venezuela, and Brazil) to Singapore and Northeast Asia.

Singapore is the world's largest marine fuel consumption hub at a sales volume of 47.46 million metric tons in 2019. Thanks to its advantageous geographical location, adaptive economic policies, and a long-term commitment to its oil exchange market, Singapore has attracted almost



all multinational oil companies and global trading companies to its local fuel oil market. Moreover, the blending components produced in other parts of the world also converge in Singapore, where they are blended and then sold as refined oil products.

2. 2020 IMO Sulfur Limit Brings Tremendous Changes to the Global Marine Fuel Market

■ IMO: *The International Convention for the Prevention of Pollution from Ships*

In September 1997, the International Maritime Organization (IMO) amended the *International Convention for the Prevention of Pollution from Ships* (MARPOL73/78), adding Annex VI (*Regulations for the Prevention of Air Pollution from Ships*) to prescribe strict limits on air pollutants like SO_x and NO_x emissions. This was followed up with numerous revisions.

At its 70th session, the Marine Environment Protection Committee (MEPC) ruled on the date that worldwide sulfur emission limit would take effect: Starting from January 1, 2020, the sulfur content of marine fuels used by ships operating outside Emission Control Areas (ECAs) is to be reduced from less than 3.5% m/m to less than 0.50% m/m.

At its 71st session, MEPC adopted amendments to the information to be included in the bunker delivery note relating to the supply of marine fuel oil to ships which have fitted alternative mechanisms to address sulfur emission requirements. This means that ships with exhaust gas cleaning systems or other purification devices would be allowed to use fuel oil with a sulfur content higher than the MEPC standard.

At its 73rd session, MEPC prohibited the carriage of non-compliant fuel oil for the purpose of ship propulsion, effective since March 1, 2020, except for ships using “equivalent” compliance methods .

At its 74th session, MEPC clarified the definitions of delivered sample, in-use fuel oil, and on-board fuel oil; specified the standards for the

selection of fuel oil sampling points; and approved the *2019 Guidelines for Consistent Implementation of the 0.50% Sulfur Limit Under MARPOL Annex VI*.

■ Changes in marine fuel consumption

Countries have taken active measures to comply with the 2020 IMO sulfur limit. Research shows that there will be three major changes to the consumption of marine fuel to meet the limit:

(1) Switch to LSFO (less than 0.50% m/m of the sulfur content) or marine gas oil (MGO). Low sulfur heavy marine fuel can be used in most ships today without modification, but comes at a higher production cost. All-in-all, it is the most economical solution at present. The other option is low sulfur light marine fuel, which is currently the most readily available compliant product that has a stable volume-production quality, but its long-term use requires ship modifications, and its compatibility (in terms of viscosity, etc.) with existing low-speed engines needs to be evaluated.

(2) Installation of an exhaust gas cleaning system (“scrubber”) in ships, so that they can still use marine fuels with sulfur content no higher than 3.50% m/m. Ship owners need to weigh the savings from the use of cheaper high sulfur fuels against the investment in additional equipment and the issue of disposing of the wastewater and other desulfurization-related liquid wastes. At present, countries and regions including China, the United States, Singapore, Germany, Belgium, Norway, and United Arab Emirates have expressly prohibited ships on international voyages from discharging, in their territorial waters, washwater from open-loop scrubbers, while countries including Japan and South Africa still allow it.

(3) Conversion to alternative energies such as liquefied natural gas (LNG). Although LNG is widely available, there are currently very few ocean-going ships capable of using it as fuel. Furthermore, the lack of resupply facilities – which limits the range of a ship – the high cost of fuel, and the amount of space required to store LNG onboard are all challenges that need to be addressed.



Overview of China's Fuel Oil Market

Fuel oil is one of the most market-driven petroleum and petroleum products in China. The updated petroleum pricing scheme released on October 15, 2001 by the former State Planning Commission (now the National Development and Reform Commission) abolished the pricing restrictions on fuel oil, allowing its circulation and price to be entirely driven by market forces. This change has helped align its domestic price with the international market and promoted its internationalization.

Most of the fuel oil consumed in China is marine fuel. China's marine fuel market can be divided into the domestic-voyage segment and the bonded fuel segment. Supply for the former segment mainly comes from domestic refineries and blending companies, while that for the latter comes almost exclusively from import. The tax rebate policy for fuel oil exports is expected to change the supply of bonded marine fuel in China.

1. Domestic Policies on Fuel Oil

■ Consumption tax

The *Circular on Adjusting and Improving Consumption Tax Policies* (Caishui [2006] No. 33) introduced the adjustment for the then consumption tax, including the tax categories, tax rates and relevant policies. These adjustments went into effect on April 1, 2006. The Circular named seven categories of refined oil products subject to consumption tax: gasoline, diesel, naphtha, oil solvent, lubricating oil, fuel oil, and aviation kerosene, and tentatively set a uniform tax rate of 30% on all these categories.

The *Circular on Adjusting the Consumption Tax Policies for Certain Refined Oil Products* (Caishui [2008] No. 19) has changed the consumption tax on fuel oil to ¥0.1 per liter starting from January 1, 2008. The *Circular on Raising the Consumption Tax Rate on Refined*

Oil Products (Caishui [2008] No. 167) has increased that tax rate to ¥0.8 per liter, effective January 1, 2009. Subsequent adjustments have increased the tax rate to the current level of ¥1.2 per liter (or ¥1,218 per metric ton).

■ Import administration

In China, the import quotas of fuel oil were granted only to state-trading enterprises in the past; however, per the provisions of *China's Protocol of Accession to the WTO*, a certain quantity of fuel oil may be imported by non-state trading enterprises. Specifically, qualified non-state-trading enterprises may import fuel oil within their permitted annual quota. On January 1, 2004, China lifted the fuel oil import quota system and replaced it with automatic import licensure. The *Application Requirements, Allocation Principles, and Relevant Procedures for Permitted Quantities of Non-State Trading Import of Fuel Oil in 2020* provides that a total of 16.20 million metric tons of fuel oil may be imported by non-state trading enterprises in 2020, and that the five major state-owned importers, namely CNPC, Sinopec, CNOOC, Zhuhai Zhenrong Corporation, and Sinochem, will not be subject to any quantity caps on import.

■ Export tax rebate

On January 22, 2020, the Ministry of Finance, State Administration of Taxation, and General Administration of Customs co-issued the *Circular on Implementing Import Tax Rebate for Fuel Oils Bunkered by Ships on International Routes*, refunding (or exempting) the 13% value-added tax of export on fuel oil bunkered at Chinese ports by international-route ships starting from February 1, 2020. The fuel oil mentioned in this circular specifically refers to the product with HS Code of "27101922". According to this policy, the customs will issue an export declaration form for fuel oil that enters an export supervision storage facility for fueling international-route ships. The taxpayer can then submit the form and other relevant materials to the tax authority to receive the tax rebate or exemption for export.



■ Environmental policies

The *PRC Law on the Prevention and Control of Atmospheric Pollution* was amended on August 29, 2015 with updates taking effect as of January 1, 2016. The amended law provides that China will adopt a comprehensive approach to combat air pollution from coal, industries, automobiles and ships, fugitive dust, and agriculture; a joint cross-regional approach against air pollution; and a coordinated approach to control air pollutants and greenhouse gases such as particulates, sulfur dioxide, nitrogen oxides, volatile organic compounds, and ammonia.

On December 2, 2015, the Ministry of Transport issued the *Implementation Plan for Emission Control Areas in the Pearl River Delta, Yangtze River Delta, and Bohai Sea Rim (Beijing, Tianjin and Hebei)*. Accordingly, China has set up its first Emission Control Area (ECA) to control air pollutants from ships including sulfur oxides, nitrogen oxides, and other particulates. The Plan stated that starting from January 1, 2016, if conditions permit, a port in an ECA may implement more stringent emission controls than existing requirements, including prohibiting a docked ship from using fuel oil with sulfur content higher than 0.5%*m/m*; and that starting from 2017, a ship docked in key port areas within an ECA must use such fuel oil except for the one-hour period after docking and the one-hour period before exiting the port. Starting from 2018, the scope of this requirement would be expanded to all ships docked at a port within ECA; and starting from 2019, to all ships entering an ECA.

On October 27, 2017, the Ministry of Transport and 12 other agencies co-issued the *Guidance on Securing the Supply and Strengthening the Joint Supervision of Low Sulfur Marine Fuels*. Among other things, this document calls for: (1) establishing a basic rule framework governing the supply of low sulfur marine fuels; (2) accelerating the revision of the marine fuel standard; (3) strengthening the supervision of marine fuel; and (4) strengthening the coordination among regulatory authorities.

On November 30, 2018, the Ministry of Transport issued the *Implementation Plan for Controlling Ship-Created Air Pollutants in Emission Control Areas*. The Plan requires that: (1) From January 1, 2019, sea-going ships should use marine fuel with sulfur content not exceeding 0.5% m/m when in ECAs; large inland river ships and ships traveling between domestic inland ports and sea ports should use fuel oil that meets the revised national marine fuel standards; and other ships traversing inland rivers should use diesel that meets relevant national standards. And from January 1, 2020, sea-going ships entering inland EMAs should use marine fuels with sulfur content not exceeding 0.1% m/m; (2) From March 1, 2020, ships that have not installed SO_x and particulate control equipment or adopted equivalent measures may only use or carry marine fuels specified in the Implementation Plan when entering ECAs; (3) From January 1, 2022, sea-going ships entering coastal ECAs in the Hainan area should use marine fuels with sulfur content not exceeding 0.1% m/m; (4) A study will be conducted on the feasibility of requiring all sea-going ships entering a coastal EMA to use marine fuels with a sulfur content not exceeding 0.1% m/m from January 1, 2025.

On October 23, 2019, the Maritime Safety Administration issued the *Implementation Plan of 2020 Global Sulfur Cap for Marine Fuels* which provides that: (1) From January 1, 2020, international ships entering waters of PRC must use fuel oil with a maximum sulfur content of 0.5% m/m, where “fuel oil” means any fuel oil, including both distillate fuels and residual fuels, delivered onboard for the propulsion or operation of a ship by combustion; (2) From January 1, 2020, international-route ships entering China’s inland ECAs must use fuel oil with a sulfur content not exceeding 0.1% m/m; from January 1, 2022, international-route ships entering ECAs in the Hainan area must use fuel oil with a sulfur content not exceeding 0.1% m/m; (3) From March 1, 2020, ships entering waters of PRC may not carry fuel oils with a sulfur content exceeding 0.50% m/m if they are for self-use. (4) For international-route ships using alternative measures that meet the equivalence criteria as set out in Regulation 4 of Annex VI of the *International*



Convention for the Prevention of Pollution from Ships, the requirements of the above (1), (2), and (3) can be exempted. The term “alternative measures” means the use of any apparatus, equipment, or alternative fuel capable of achieving the same or better emission reduction results than otherwise required. From January 1, 2020, ships are prohibited from discharging wash water from open-loop scrubbers in China’s ECAs.

■ Policies for pilot free-trade zone

From April 2017, Hangzhou Customs released several innovative regulatory measures. Highlights include: (1) Cross-region direct supply (cross-customs direct supply). Suppliers will directly supply bonded fuel oil from Zhoushan Customs to that of other customs including Ningbo, Nanjing, and Shanghai as well as Jiaxing, Wenzhou and Taizhou for international-route ships. (2) Bunkering at moorings outside ports. Fuel barges can supply bonded fuel oil to international-route ships that are moored outside a port. (3) One-to-many bunkering. One fuel barge can supply bonded fuel oil to multiple ships in one bunkering operation. (4) Many-to-one bunkering. Several fuel barges can supply bonded fuel oil to one ship in one bunkering operation. (5) Post-bunkering declaration. A supplier of bonded fuel oil for international-route ships may make customs declarations after bunkering. (6) Public depot. Several suppliers can share a public bonded depot for supplying bonded fuel oils to ships. (7) Quarantine declaration exemption. international-route ships that are moored outside a port waiting to be bunkered can be exempted from quarantine declaration if they are evaluated as low-risk ships.

On August 8, 2017, the General Administration of Customs released the *Operating Procedures of PRC Customs on Regulation of Cross-Customs Direct Supply of Bonded Fuel*, a breakthrough rule of the customs on how cross-customs direct supply of bonded fuel is to be regulated. The Operating Procedures provides specific, uniform rules for such bonded fuel operations in Shanghai, Nanjing, Hangzhou, and Ningbo, which facilitate the coordination among the customs authorities

in these four regions and help develop the Northeast Asia Bunkering Hub.

On July 4, 2018, the General Office of the Ministry of Commerce issued a reply on the bonded fuels blending business in the China (Zhejiang) Pilot Free-Trade Zone (FTZ), supporting companies in the FTZ to engage in the physical blending of bonded fuels as well as related processing and trading activities.

On August 2, 2019, the State Council released the *Notice on the Master Plan on Establishing Six New Pilot Free-Trade Zones*. In particular, the plans support the development of bonded marine fuel business in the Shandong and Hebei FTZs, and permit companies registered in the FTZs to carry out blending operations for bonded oils of different tax numbers, marking the further opening-up of the bonded marine fuel market.

■ Policies for bonded fuel operation

Starting from 2006, a special state license is needed to supply bonded fuel to ships on international voyages. The Ministry of Commerce has thus granted such license to China Marine Bunker (PetroChina), Sinopec Zhejiang Zhoushan Petroleum, China Changjiang Bunker (Sinopec), China Shipping & Sinopec Suppliers, and Brightoil Petroleum (Holdings).

To drive the growth of international bunkering business, the government of Zhoushan released the *Interim Measures of China (Zhejiang) Pilot Free-Trade Zone on the Operation and Administration of Bonded Fuel for Ships on International Voyages* (ZZF [2017] No. 32) in 2017, effective from June 1, 2017. The Measures is applicable to the sale, and the supervision and administration of sale of bonded fuel to ships on international voyages by companies registered in the Zhejiang FTZ. “Sales activities” here means the provision of bonded fuel to those ships within the jurisdictional boundaries of Hangzhou Customs.

Between June 2017 and September 2019, nine companies were approved to engage in these sales, namely Zhejiang Petroleum Fuel

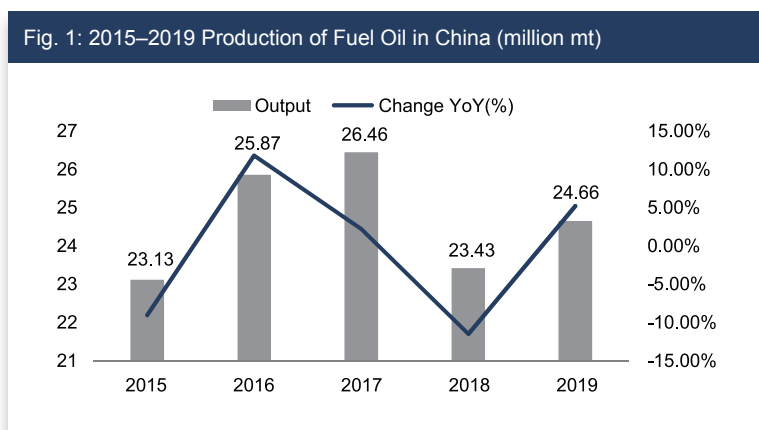


Oil Sales, Zhoushan Zheneng Petrochemical, CEFC International (Zhoushan) Petroleum, CNPC & TAFO Marine Fuel, Zhoushan Free Zone Energy and Chemical, Zhoushan Port International Trade, Zhoushan National Pelagic Fishery Base Group Marine Fuel Supply, Consort Bunkers (Zhoushan), Zhejiang Free Trade Zone PetroChina Fuel Oil, and National Petroleum Chemical (Zhoushan). To date, Zhoushan boasts 14 qualified bonded marine fuel suppliers.

2. Domestic Supply of Fuel Oil

■ Domestic production of fuel oil

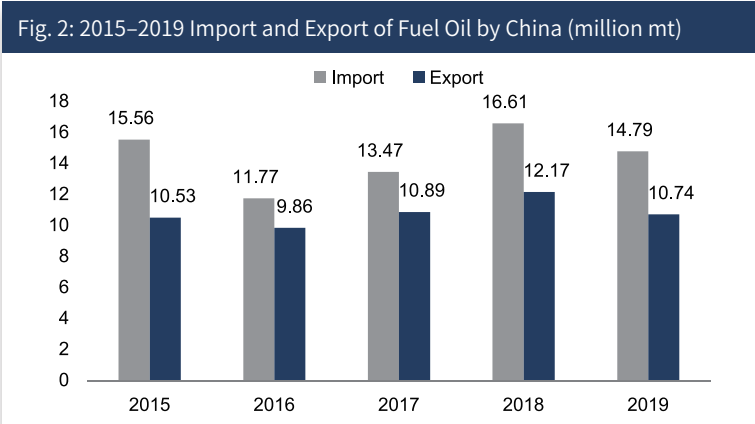
With growing crude oil processing volume in China, fuel oil production has also been on the rise. But the production fell in 2018 because of the consumption tax reform and the development of domestic deep-processing facilities. In 2019, China produced 24.66 million metric tons of fuel oil.



Source: National Bureau of Statistics of China

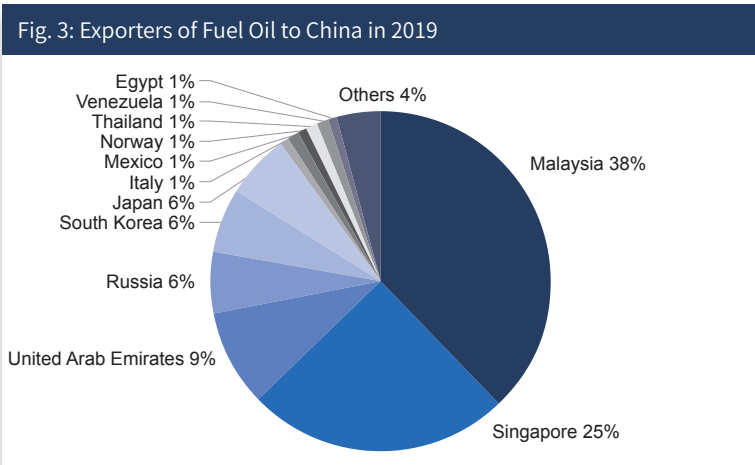
■ Domestic import and export of fuel oil

China imported 14.79 million metric tons of fuel oils in 2019, a year-on-year decrease of 11%, and exported 10.74 million metric tons, down by 12%.



Source: General Administration of Customs

China imports fuel oil mainly from countries in Southeast Asia and the Middle East, Malaysia, and Singapore in particular.



Source: General Administration of Customs



■ Import and export trades of fuel oil in China

In 2019, 87% of fuel oil imported by China, was shipped to supervised bonded zones to meet the domestic demands for bonded fuel oil, most of which was blended fuel oil. The remaining 13%, chiefly straight-run fuel oil, was general imports to be processed by local refineries as raw materials.

In 2019, over 99% of fuel oil exported by China was bonded marine fuel.

■ Trends in domestic supply of LSFO

After the 2020 sulfur limit released by the IMO, the major oil companies in China have all set LFSO production plans and other corresponding measures. Market predicts that China's production capacity for LSFO will reach 18.15 million metric tons in 2020, as a result of imminent trial production and facility modification by major refineries.

On June 5, 2019, Sinopec announced that its annual production capacity for low sulfur heavy marine fuels would reach 10 million metric tons in 2020 and over 15 million metric tons by 2023. Accordingly, Sinopec has made changes to ten subsidiary refineries in the Bohai Sea Rim, Yangtze River Delta, and South China. Likewise, in July 2019 CNPC announced that it was preparing its refineries to produce a targeted 4 million metric tons of LSFO each year.

3. China's Demand for Fuel Oil

■ Fuel oil consumption structure

Before 2005, the primary consumers of fuel oil in China were the transport, petroleum refining, chemicals, construction materials, and power and heating industries. But as environmental policies tightened, the demand declined.

From 2005 to 2012, consumption by power and heating industries plunged. In 2012, petroleum refining and transport industries accounted

for 51% and 40% of China's fuel oil demand, respectively.

Since 2012, due to the widespread switch to alternative and clean energy, demand for industrial fuel oil – mostly by metallurgy and light industries – and for fuel oil by the electricity sector has been falling. Moreover, as independent refineries applied for and received higher import quotas for crude oils, fuel oil consumption in the petroleum refining industry has also shrunk significantly. However, this general downward trend is offset somewhat in recent years by the increasing demand due to deep processing of aromatics.

In 2019, about 69% of fuel oil consumed in China was marine fuels used for transportation, 24% was used as raw materials for petrochemical refining and processing, and the remaining 7% was used for the extraction of various aromatic solvents, bitumen blending, or as an industrial fuel (for boilers).

■ China's marine fuel market

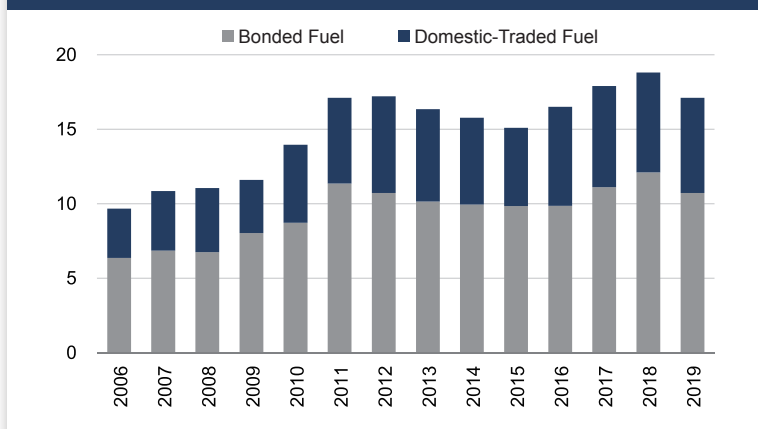
China's marine fuel market can be divided into domestic-traded, duty-paid marine fuel market and bonded marine fuel market.

Domestic-traded marine fuel is primarily supplied to ships on domestic routes. The demand for this type of fuel has been declining due to higher consumption tax starting from January 1, 2009 and tightening environmental policies. At present, the demand is about six million metric tons a year.

Bonded marine fuel is mainly supplied to ships on international voyages. Most of the fuel oil is 380 CST imported from Singapore and Malaysia. Recent market demand is over 10 million metric tons a year.



Fig. 4: Consumption Structure of Marine Fuel in China (million mt)



Source: JLC, General Administration of Customs

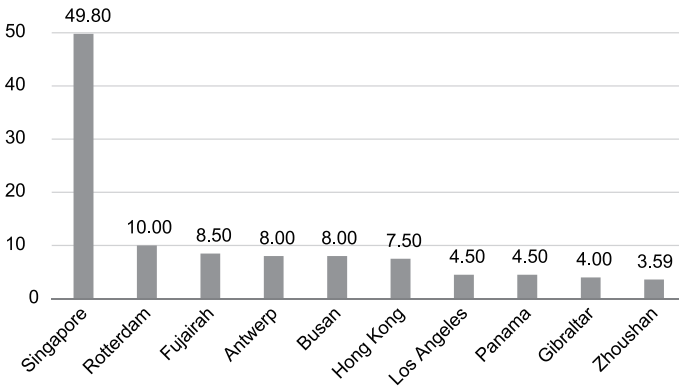
■ China's bonded marine fuel market

Bonded marine fuel refers to bonded marine fuel oil supplied to ships that carry import or export goods on international routes ending or originating in China. It is exempt from customs duty, import VAT, and consumption tax during import and sales, and is stored in specially designated depots, under the supervision of the customs.

Domestic consumption of bonded marine fuel is concentrated in coastal areas, especially at ports serving as major foreign-trade hubs in the Yangtze River Delta, Bohai Sea Rim, and South China. The most well-known of these ports include Ningbo-Zhoushan, Shanghai, Qingdao, Tianjin, Dalian, Rizhao, Zhangjiagang, Qinhuangdao, Nanjing, and Guangzhou.

Since 2017, Zhoushan has been leading other areas in terms of growth of bonded marine fuel market. In 2018, Zhoushan directly supplied 3.59 million metric tons of bonded marine fuel, becoming China's largest bunkering hub and a global top-ten bunkering hub for the first time. This figure increased a further 14% in 2019, to 4.10 million metric tons.

Fig. 5: World's Top Ten Bunkering Hubs in 2018 by Volume (million mt)



Source: Port of Zhoushan



Low Sulfur Fuel Oil Pricing Model and Influencing Factors on the Physical Market

Market Pricing Model

Internationally, fuel oil is predominantly priced based on a selection of marine fuel varieties. Major fuel oil production and consumption regions around the world widely adopt the pricing models that see the most active trading.

- (1) Rotterdam: Platts Rotterdam Barges
- (2) U.S. Gulf Coast: Platts USGC 3.0% No. 6
- (3) The Mediterranean Sea: MOP MED (Mean of Platts Mediterranean)
- (4) The Middle East: MOP AG (Mean of Platts Arab Gulf)
- (5) The Far East: MOPS (Mean of Platts Singapore)

In particular, MOPS is a pricing mechanism of Platts Singapore. Published on Platts Asia Pacific/Arab Gulf Marketscan for market reference, MOPS is a price independently produced and generally determined by Platts based on quotes in the paper market and physical market as well as trading results within the Platts assessment window. This fixing process, occurring between 4:00-4:30 p.m. each day for oil products, can be viewed on the open trading information platform run by Platts, and the results from which will be displayed on the Platts Global Alert (PGA) page 190. Fuel oil is one of many products tracked on this platform, where admitted participants, including major oil companies like Shell and BP and trading houses like Glencore and Vitol, submit information on bids and offers. The platform is not intended for physical delivery of fuel oil, but rather to create a transparent market price.

It is important to note that the price published by Platts is not the spot price for fuel oils being loaded on the current day, but the delivery price 15 days afterwards. This is because in light of the trading practices in Asia, most companies tend to buy and sell fuel oil in advance, therefore, most physical delivery takes place in 15–30 days following the day of trade.

Starting from January 2019, Platts began publishing price assessments for VLSFO with a sulfur content of 0.5% m/m.

The 2020 global sulfur limit imposed by IMO will have a significant effect on both the output and the demand for middle distillates. Before there is an active and effective benchmark price for low sulfur fuel oil, the price for 10 ppm diesel will be used as the benchmark.

Singapore has an active paper market. It is an OTC market taking shape around 1995, and adopts cash delivery rather than physical delivery. Products traded on the market mainly include crude oil, naphtha, gasoline, diesel, jet fuel, and fuel oil. Despite its OTC nature, the market is widely recognized due to its transparent price formation process (based on Platts benchmarks) and broad range of participants in the Asia-Pacific region.

Exchanges including ICE and CME all list Singapore fuel oil contracts which are OTC swaps cash-settled based on MOPS. Available products cover 380 CST, 180 CST, 0.5% marine fuel oil, calendar spread, viscosity spread, and crack spread, among others.



Factors Influencing Low Sulfur Fuel Oil Price

1. Fluctuation of International Crude Oil Price

Since fuel oil is derived from crude oil, its price movement is inextricably linked to international crude oil price. After 2010, however, the exceptionally sluggish shipping market has weakened the Singapore fuel oil price, especially in comparison with the price trend of international crude oil over the same period. The transition from high sulfur to low sulfur fuel oils has had a significant impact on market supply and demand, including a slight drop in correlation between the price of fuel oil and the price of international crude oil.

2. Demand by the Shipping Market

As one of the biggest consumers of fuel oil, the shipping industry directly affects the demand for fuel oil and, by extension, the price. In February 2016, BDI (Baltic Dry Index, for dry bulk commodities) reached its historic low of 290 while the Platts 380 CST fuel oil price also hit its lowest point in over ten years. In general, demand by the shipping market is greatly influenced by international politics, regional economic development, and global trade flows.

3. Supply and Demand of the Singapore Market

Singapore is the world's largest fuel oil bunkering and trading hub. As a result, the size of arbitrage supply, sales volume, and inventory will all influence the price of fuel oil.

4. Environmental Requirements

The 2020 sulfur cap is expected to significantly change the consumption structure of bonded marine fuel. The addition of desulfurization equipment and the use of LSFO, marine gas oil, liquefied natural gas, or other clean energy options would markedly increase the cost of fuel for ships, thus creating sharp price fluctuation. Future IMO and governmental policies on ship emissions are also likely to significantly affect the demand for fuel oil.

5. Exchange Rate

Internationally, fuel oil/diesel trades are denominated in U.S. dollars, therefore changes in exchange rates against USD inevitably influences the price of LSFO futures.

Cost of Imported Bonded Low Sulfur Fuel Oil

LSFO futures are traded on the basis of net price, bonded delivery, and RMB-denomination on the Shanghai International Energy Exchange (INE or the “Exchange”). Price is net of consumption tax, VAT, and custom duty.

The price of imported marine fuel in China is mainly based on the average of the price assessments of Singapore fuel oil/diesel (MOPS). The cost of imported bonded LSFO is generally calculated as follows:

Cost of imported bonded LSFO = (MOPS + discounts) × exchange rate + other expenses

- The exchange rate is based on the daily published rate;
- Other expenses include: port/dock charges, ISPS charge, freight forwarder charge, contribution to Oil Pollution Compensation Fund, terminal handling charge, storage fees, commodity inspection fees, etc.

If bonded LSFO is transported from a bonded zone into the territory of China, its cost will be as follows:

$[(\text{MOPS} + \text{discounts}) \times \text{exchange rate} \times (1 + \text{custom duty rate}) + \text{consumption tax}] \times (1 + \text{VAT rate}) + \text{other expenses}$

- VAT: 13%
- Custom duty: 1%
- Consumption tax: ¥1.2 per liter for fuel oil, or ¥1,218 per metric ton (current as of May 2020).



Guide to Trade Low Sulfur Fuel Oil Futures

LSFO futures are traded on the basis of international platform, net pricing, bonded physical delivery, and RMB denomination.

Participation Models

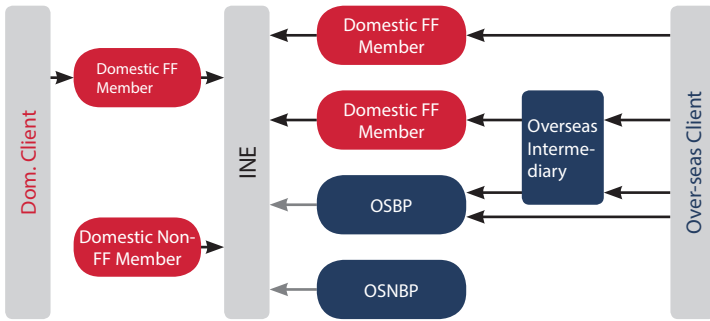
Domestic Clients

Domestic clients eligible to apply for INE membership can apply to become Non-Futures Firm Members (“Non-FF Members”) to directly trade LSFO futures; other domestic clients can trade LSFO futures through domestic Futures Firm Members (“FF Members”).

Overseas Clients

Overseas clients can trade LSFO futures in the following four ways:

- I: Directly through domestic futures firms;
- II: Through Overseas Intermediaries that have partnered with domestic futures firms or overseas special brokerage participants (OSBPs);
- III: Through OSBPs;
- IV: As overseas special non-brokerage participants (OSNBPs)

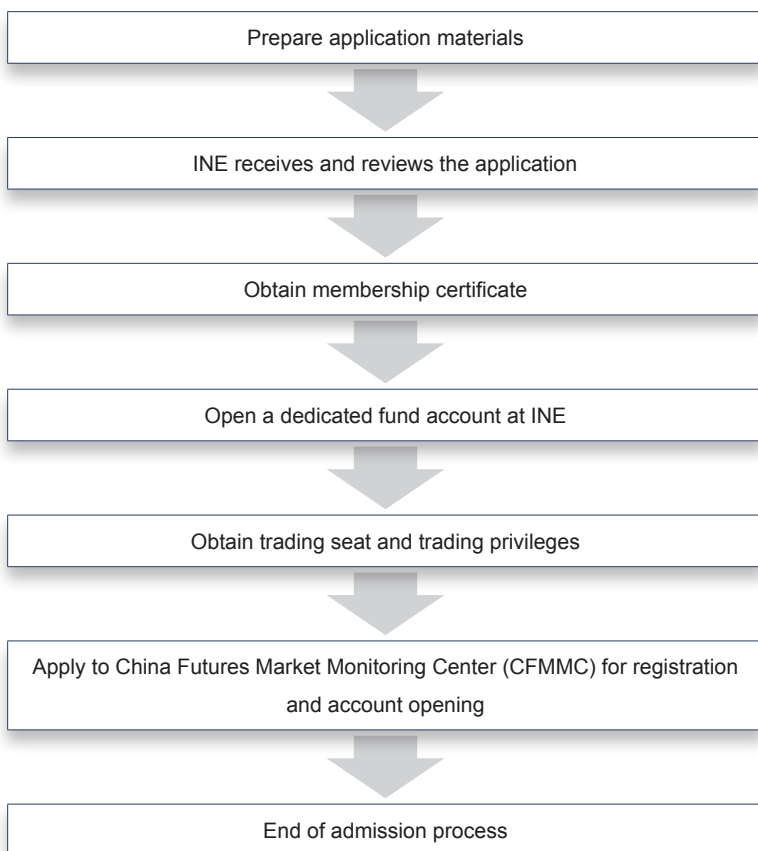


Note: Black arrows indicate trading, clearing, and delivery. Grey arrows indicate direct access to trading at INE, but overseas special participants (OSPs) must participate in clearing and delivery through domestic FF Members.

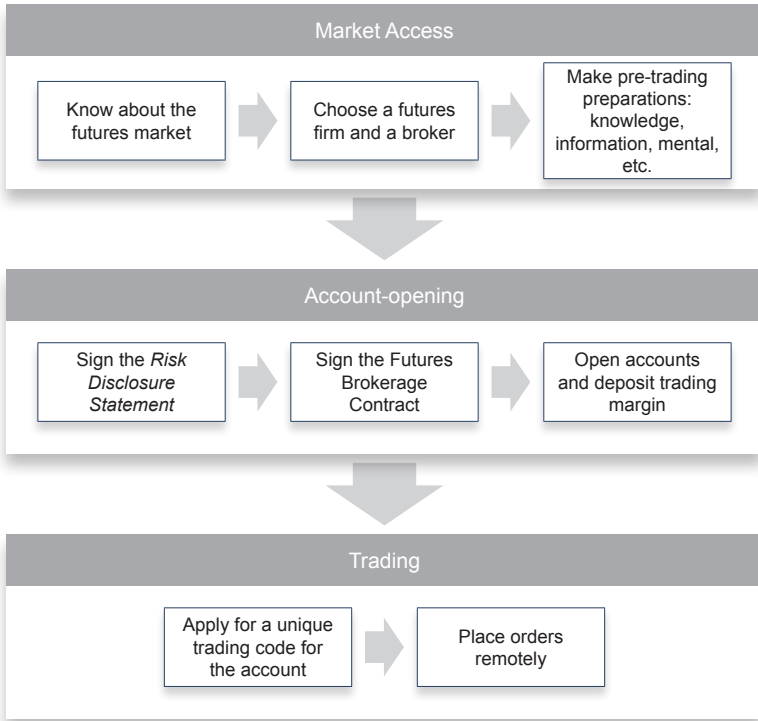


Guide to Market Access for Domestic Members and Clients

Membership Admission Process

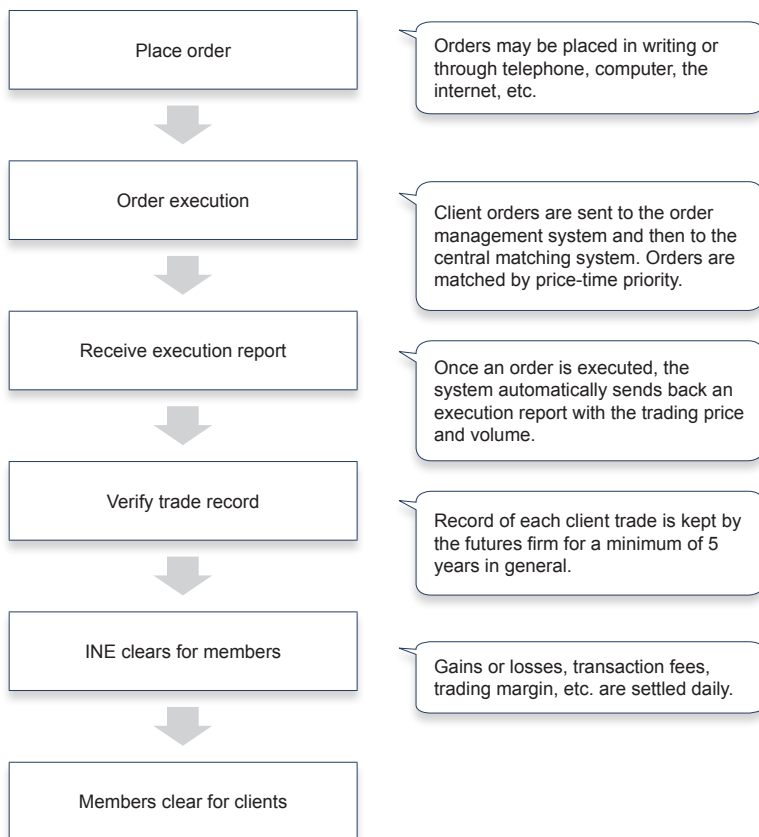


Domestic Clients Market Access Process

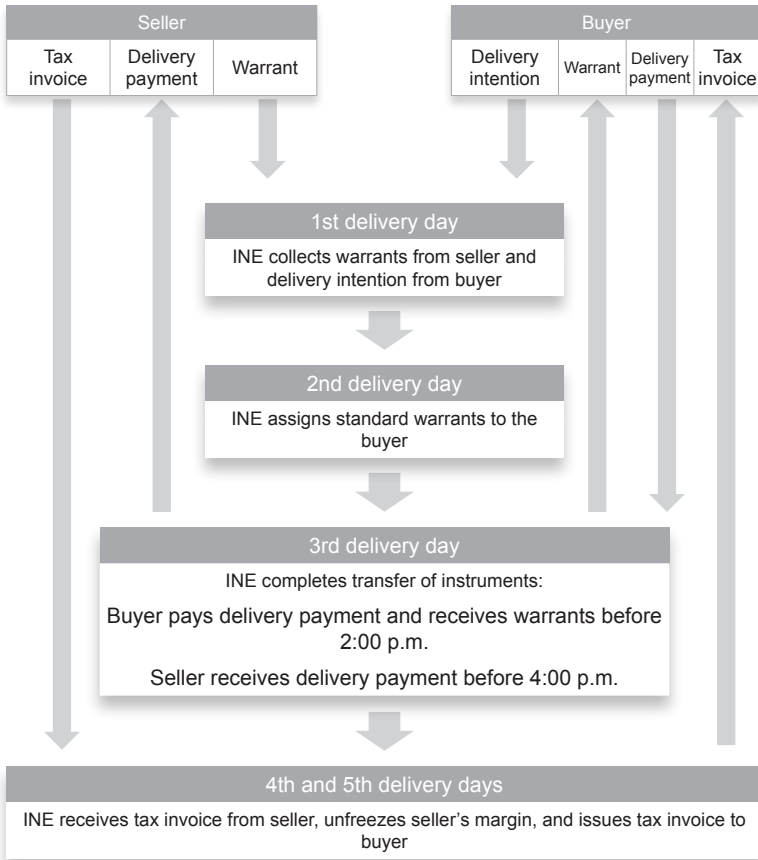




Trading and Clearing



Delivery

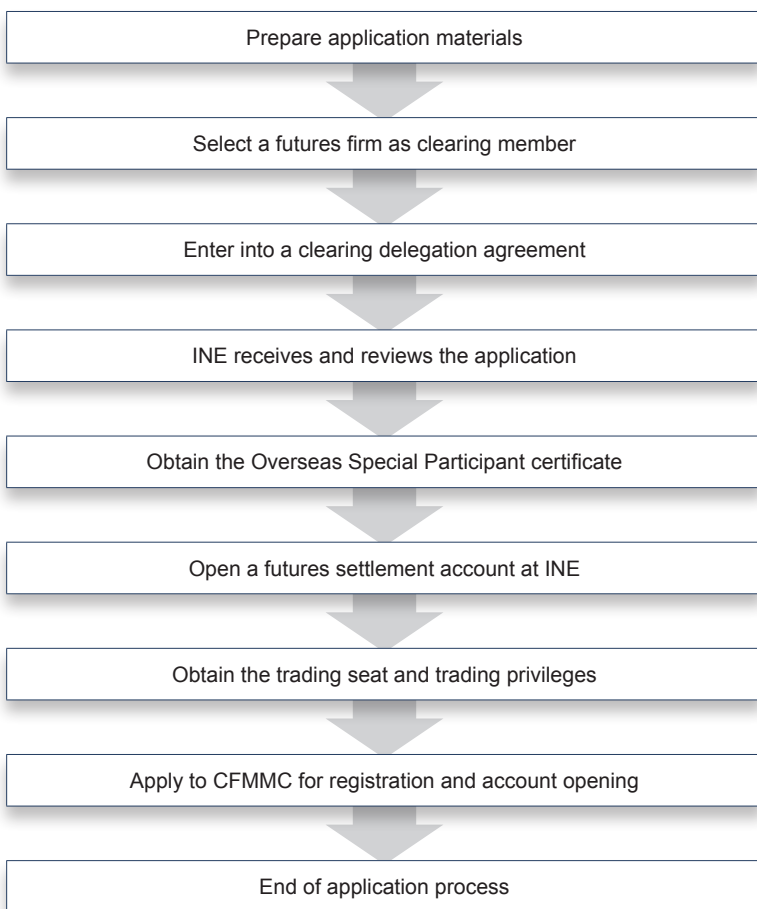




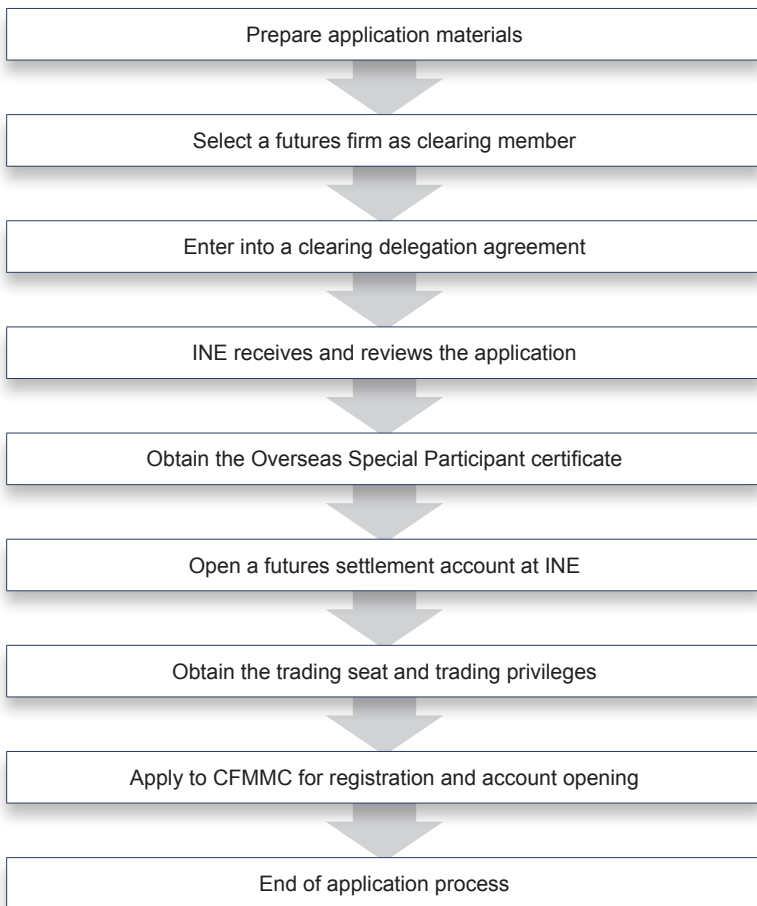
Guide to Market Access for Overseas Clients and Brokers

Qualification Application/Filing Process for OSPs and Overseas Intermediaries

1. Qualification Application Process for OSNBPs

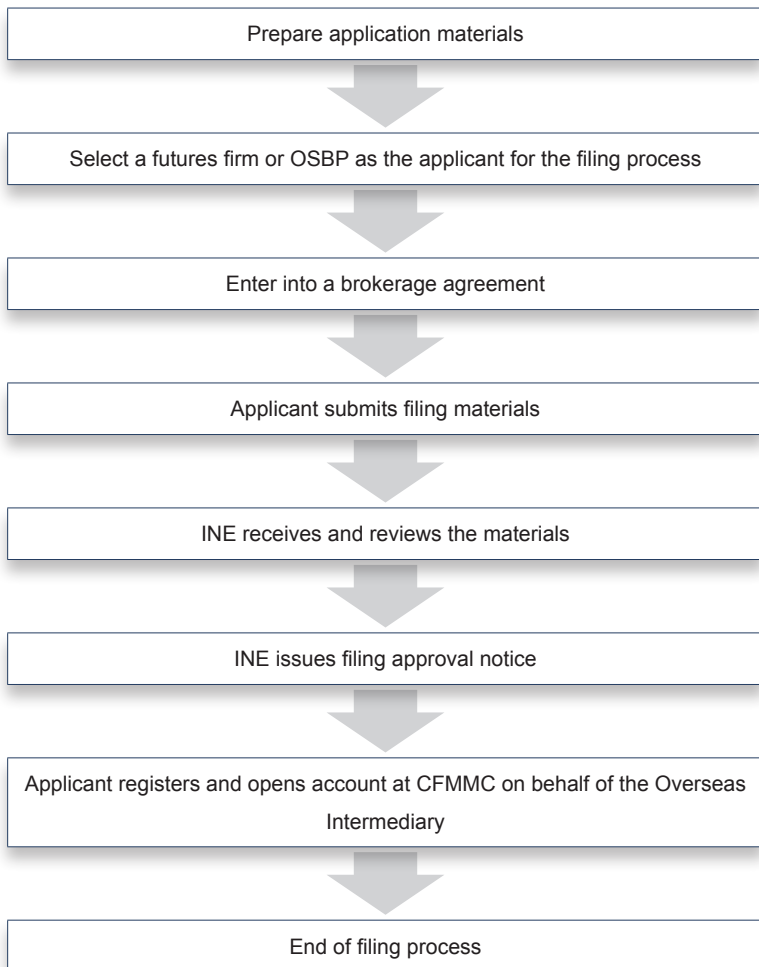


2. Qualification Application Process for OSBPs



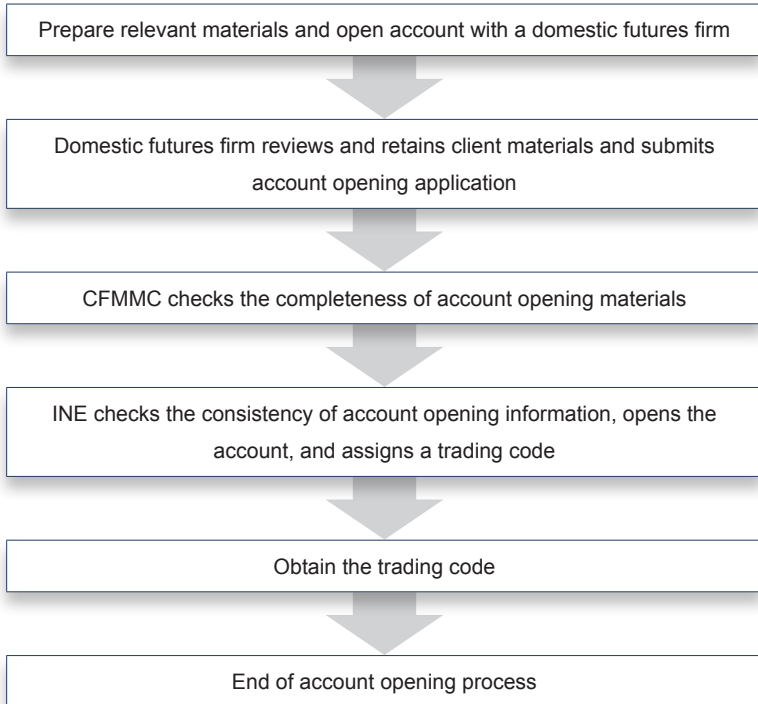


3. Filing Process for Overseas Intermediaries



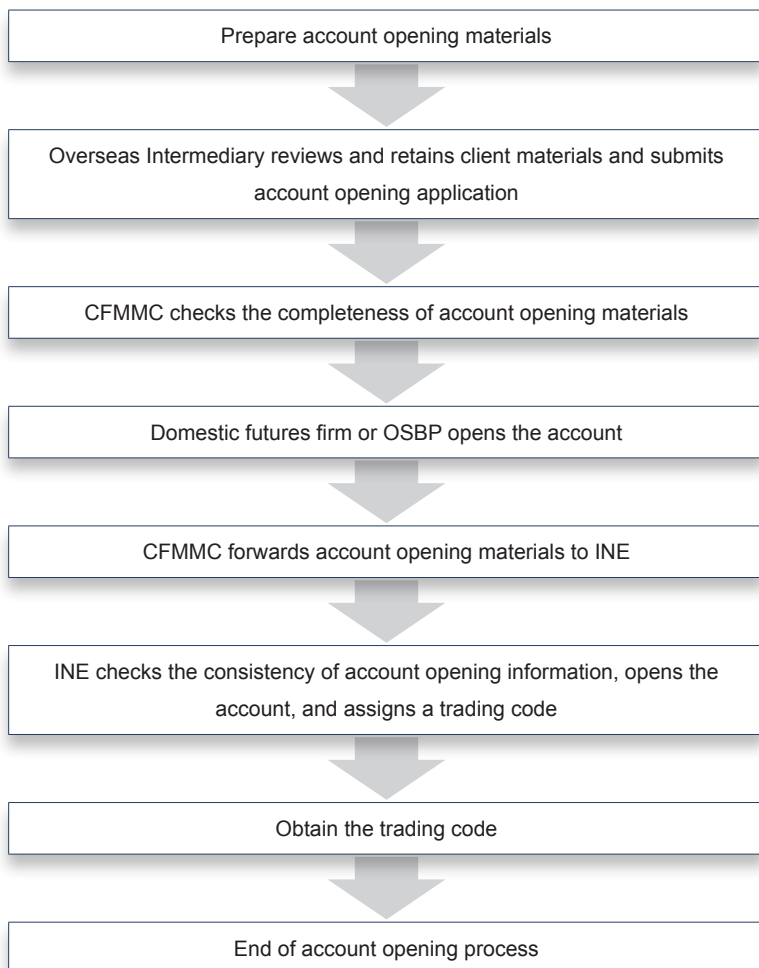
Account Opening for Overseas Clients

1. Directly through domestic futures firms

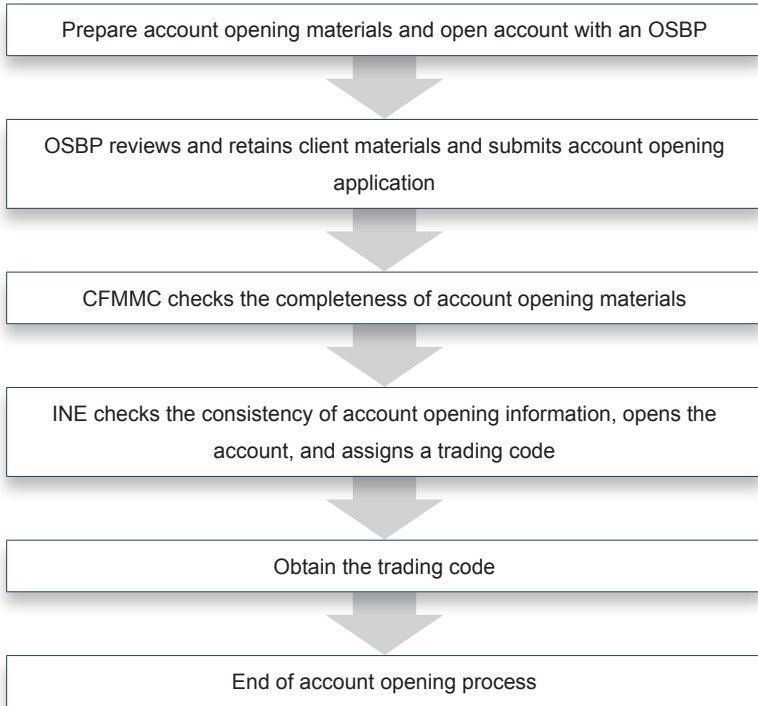




2. Through Overseas Intermediaries that have partnered with domestic futures firms or OSBPs

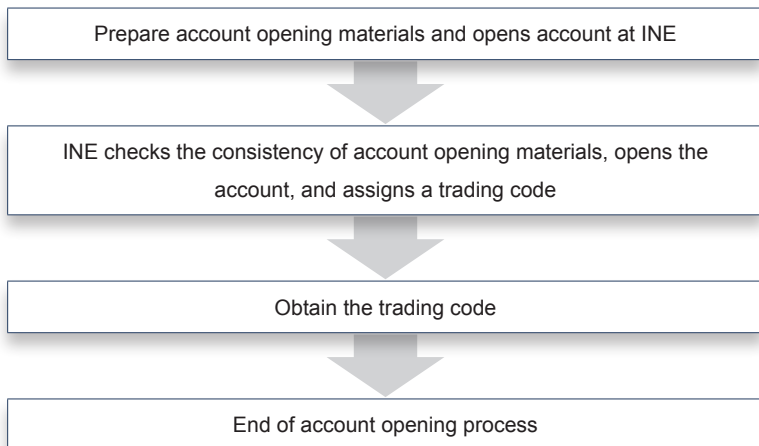


3. Through OSBPs





4. As OSNBPs



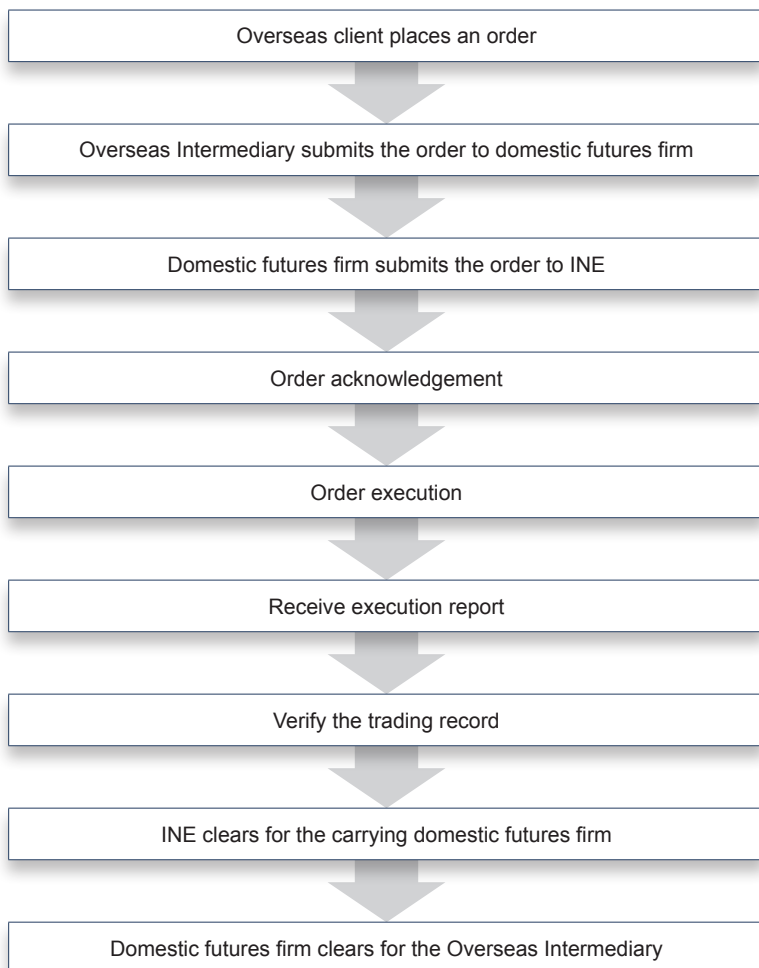
Trading and Clearing for Overseas Clients

1. Directly through domestic futures firms

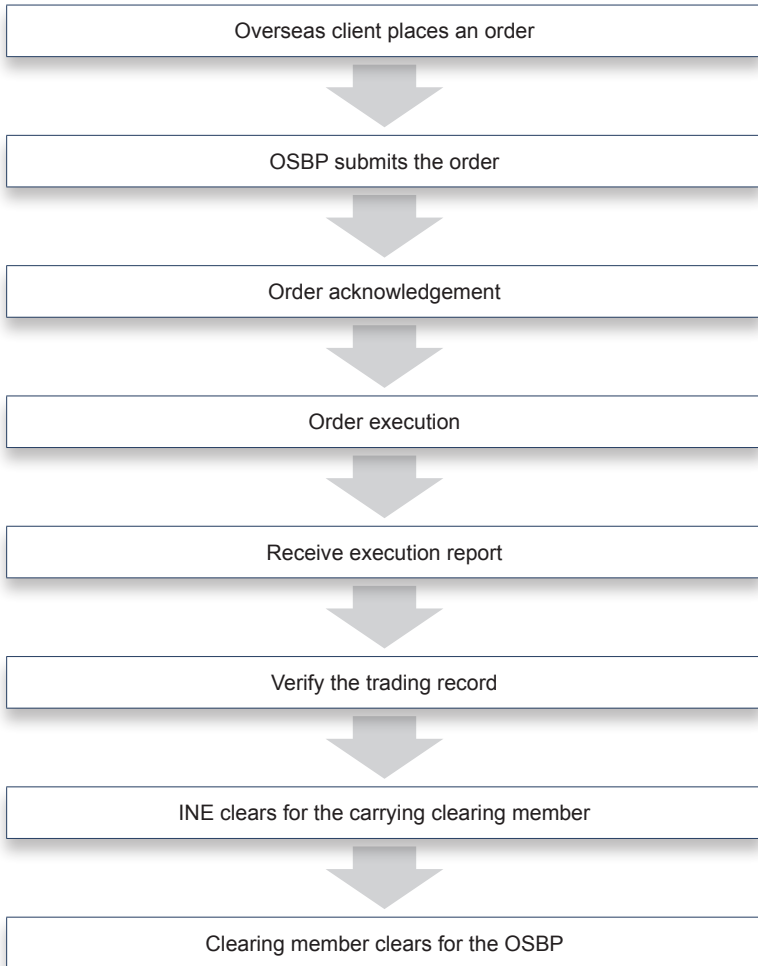




2. Through Overseas Intermediaries that have partnered with domestic futures firms or OSBPs

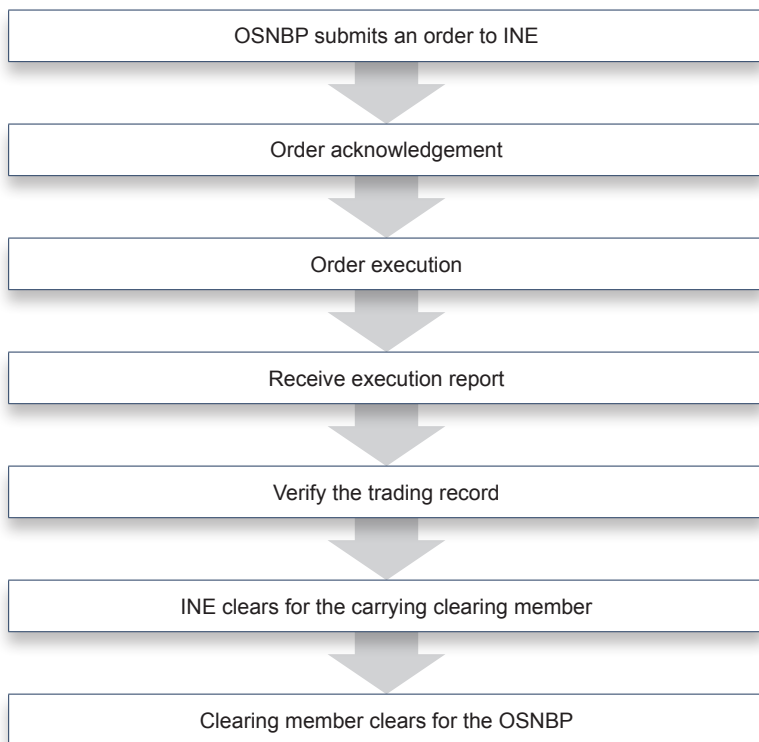


3. Through OSBPs



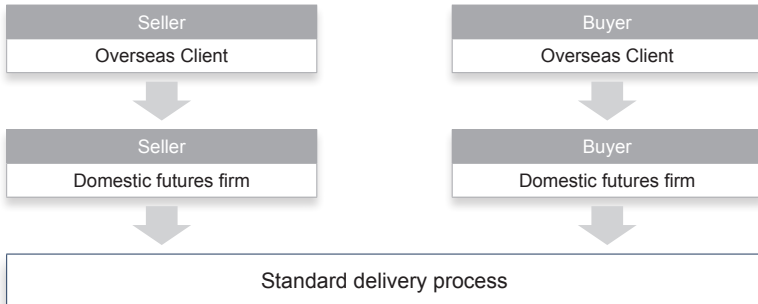


4. As OSNBPs



Delivery Process for Overseas Clients

1. Directly through domestic futures firms

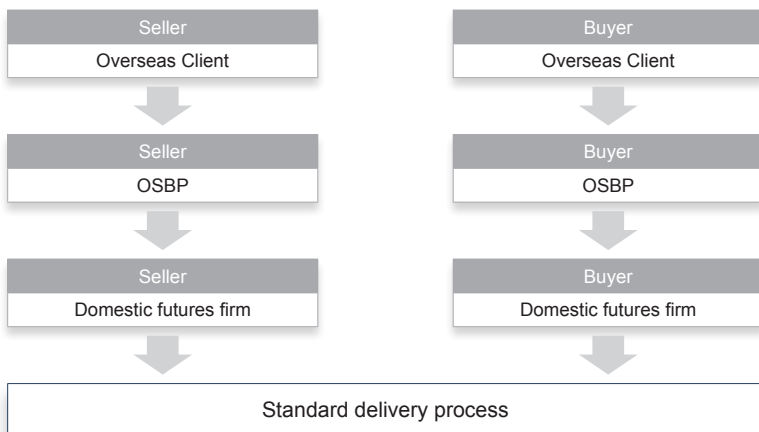


2. Through Overseas Intermediaries that have partnered with domestic futures firms or OSBPs

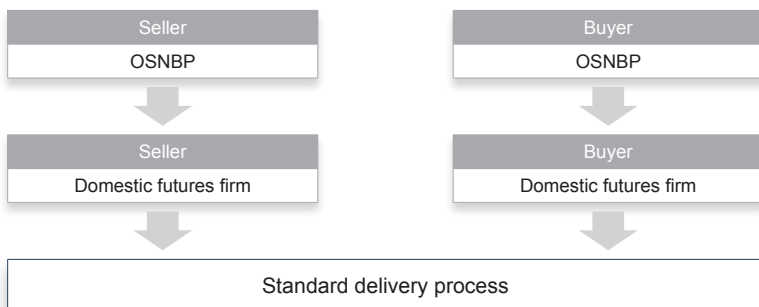




3. Through OSBPs



4. As OSNBPs



Major Futures Trading Rules

Risk Management Rules

1. Trading margin

- Trading margin refers to the funds deposited by a Member into the dedicated settlement accounts of the Exchange to ensure the fulfillment of a contract and to be used as margin for the positions held by the Member. The minimum trading margin for an LSFO futures contract is 8% of the contract value.
- The Exchange applies different rates of trading margin for a futures contract based on different periods of trading from its listing to its last trading day.

Trading margins for an LSFO futures contract at different trading periods	
Period of Trading	Minimum Trading Margin as Percentage of the Contract Value
As of listing	8%
As of the first trading day of the month prior to the delivery month	10%
As of the second trading day prior to the last trading day	20%

- If the trading margin of a futures contract shall be adjusted, the Exchange shall, at the daily clearing on the trading day prior to the next trading day when the adjustment to the margin requirement is applied, settle all positions the futures contract based on the new trading margin rate. If the margin is insufficient at that time, the position holder must deposit funds to meet the new margin requirement, and the relevant Member shall ensure the new margin requirement is met before the opening of the next trading day.



The holder of a short position may use standard warrants as the performance bond for the futures contracts with the same underlying and equivalent amount of positions he/she holds, in which case, the trading margin requirement for these positions shall be waived.

2. Price limit

- Price limit refers to the maximum range the price of a contract may move up or down from the settlement price of the previous day during a trading day. Orders with prices beyond such limit will be considered invalid and will not be executed.
- If an LSFO futures contract is in a limit-locked market on a trading day (denoted as D1, and D0 represents the previous trading day, and the following 5 successive trading days are D2, D3, D4, D5 and D6), the price limit and trading margin for the futures contract on D2 shall be adjusted as follows:

(1) the same direction limit price for D2 shall be fixed at 3 percentage points higher than that for D1;

(2) the trading margin on D2 shall be fixed at two percent (2%) greater than the percentage range or price limit for D2. If the adjusted trading margin is smaller than what is applied at the clearing of D0, the same trading margin applied on D0 shall be used as the trading margin for that contract.

If D1 is the first trading day for a newly listed futures contract, the contract's trading margin on that day shall be adopted as the trading margin at the daily clearing on D0.

- The price limit and trading margin for the futures contract mentioned above on D3 shall be adjusted as follows:
 - (1) If a same direction limit-locked market does not occur on D2, the price limit and trading margin for D3 will return to the normal level;
 - (2) If a reverse direction limit-locked market occurs on D2, a new

round of a limit-locked market is deemed to be triggered, i.e., D2 shall become D1 for the new round of limit-locked market, and the trading margin and the price limit for the following trading day shall be set pursuant to Article 16 of the *Risk Management Rules of the Shanghai International Energy Exchange (Risk Management Rules)*; or

(3) If a same direction limit-locked market occurs on D2, the price limit for D3 shall be fixed at 5 percentage points above the price limit for D1, and the trading margin shall be fixed at 2 percentage points above the regular price limit for D3. If the adjusted trading margin is lower than what was applied at the time of clearing on D0, the trading margin on D0 shall apply.

- In the event that a same direction limit-locked market of the futures contract mentioned above does not occur on D3, the price limit and trading margin for D4 shall return to the normal level.

The occurrence of a reverse direction limit-locked market on D3 will trigger a new round of a limit-locked market, i.e., D3 shall become D1 for the new round, and the trading margin and the price limit for the following trading day shall be set pursuant to Article 16 of the *Risk Management Rules*; or

If the same direction limit-locked market continues to exist on D3, which means the market has been locked at the limit price for three (3) consecutive trading days, the Exchange may, at the time of clearing on D3, suspend withdrawal of funds by some or all of its Members and take the following measures:

- (1) if D3 is the last trading day of the futures contract, the contract will move to the settlement and delivery phase on the next trading day;
- (2) if D4 is the last trading day, the futures contract will continue to be traded on D4; the price limit and trading margin for D3 shall be extended to D4, and the contract shall move to the settlement and delivery phase on the next trading day; or
- (3) if neither D3 nor D4 is the last trading day, the Exchange may, after



the market close on D3, execute either of the two measures prescribed in Article 19 or 20 of the Risk Management Rules subject to market conditions.

- Article 19 of the *Risk Management Rules* provides that after the market close on D3, the Exchange may, in its sole discretion, announce that the futures contract will continue to be traded on D4, and take one or more of the following measures:

- (1) adjusting the price limit, but not to be more than $\pm 20\%$;
- (2) requiring additional trading margins from some or all of the Members and/or OSPs on either or both of the long or short positions at the same or different rates of trading margin;
- (3) suspending the opening of new positions by some or all of the Members and/or OSPs;
- (4) limiting the withdrawal of funds;
- (5) requiring the close-out of positions by a prescribed deadline;
- (6) exercising forced position liquidation; and/or
- (7) taking other measures the Exchange deems necessary.

If the Exchange implements the measures in the preceding paragraph, the trading of the contract mentioned above on D5 shall be conducted as follows:

- (1) if a same direction limit-locked market does not occur on D4, the price limit and trading margin for D5 shall return to the normal level;
- (2) if a reverse direction limit-locked market occurs on D4, a new round of a limit-locked market is deemed to be triggered, i.e., D4 becomes D1 for the new round, and the trading margin and the price limit for the following trading day shall be set pursuant to Article 16 of the *Risk Management Rules*; or
- (3) if the same direction limit-locked market continues to exist on D4, which means the market has been locked at the limit price for four

(4) consecutive trading days, the Exchange may announce that an abnormal circumstance occurs, and take risk control measures as provided in the applicable rules of the Exchange.

- Article 20 of the *Risk Management Rules* provides that after the market close on D3, the Exchange may, in its sole discretion, announce its decision to suspend the futures contract mentioned above from trading on D4, and announce on D4 its decision to take either of the measures stipulated in Article 21 or 22 of the *Risk Management Rules* (referenced below):

Option 1: The Exchange may, according to Article 20 of the *Risk Management Rules*, announce that the trading of the contract will be extended to D5, and take one or more of the following measures:

- (1) adjusting the price limit, but not to be over $\pm 20\%$;
- (2) requiring additional trading margins from some or all of the Members and/or OSPs on either or both of the long or short positions at the same or different rates of trading margin;
- (3) suspending the opening of new positions by some or all of the Members and/or OSPs;
- (4) limiting the withdrawal of funds;
- (5) requiring the close-out of positions by a prescribed deadline;
- (6) exercising forced position liquidation; and/or
- (7) taking other measures the Exchange deems necessary.

If the Exchange implements the measures in the preceding paragraph, the trading of the contract mentioned above on D6 shall be conducted as follows:

- (1) If a same direction limit-locked market does not occur on D5, the price limit and trading margin for D6 shall return to the normal level;
- (2) If a reverse direction limit-locked market occurs on D5, a new round of a limit-locked market is deemed to be triggered, i.e., D5 becomes



D1 for the new round, and the trading margin and price limit for the following trading day shall be set pursuant to Article 16 of the Risk Management Rules; or

(3) If the same direction limit-locked market continues to exist on D5, which means the market has been locked at limit price for five (5) consecutive trading days, the Exchange may announce that an abnormal circumstance occurs and take risk control measures as provided in the applicable rules of the Exchange.

Option 2: During forced position reduction, the Exchange automatically matches all existing unfilled orders that are placed at the limit price by the close of Forced Position Reduction Base Date with the open positions held by traders who record profits on their net positions, in proportion to the positions held and at the limit price of Forced Position Reduction Base Date. If a trader holds both long and short positions, these positions shall be netted before being matched with the remaining orders in the manner above.

3. Risk management measures for major price fluctuations

When the cumulative price movement (denoted as N) of a futures contract reaches (1) 12% or more for 3 consecutive trading days (denoted as D1-D3); (2) 14% or more for 4 consecutive trading days (denoted as D1-D4); or (3) 16% or more for 5 consecutive trading days (denoted as D1-D5), the Exchange may, in its sole discretion, take one or more of the following measures and inform the CSRC before the implementation:

- (1) require additional trading margin from some or all of the Members and/or OSPs on either or both of the long or short positions at the same or different rates of trading margin;
- (2) limit the withdrawal of funds by some or all the Members;
- (3) suspend the opening of new positions by some or all of the Members and/or the OSPs;

- (4) adjust the price limit, but not to be more than $\pm 20\%$;
- (5) require the close-out of positions by a prescribed deadline;
- (6) exercise forced position liquidation; and/or
- (7) take other measures the Exchange deems necessary.

N is calculated according to the following formula:

$$N = \frac{P_t - P_0}{P_0} \times 100\%$$

where $t = 3, 4, 5$; P_0 is the settlement price of the trading day prior to D1; P_t is the settlement price of the trading day t , and $t = 3, 4, 5$; P_3 is the settlement price of D3; P_4 is the settlement price of D4; and P_5 is the settlement price of D5.

4. Position limit

- Position limit means the maximum position the Exchange allows a Member, an OSP, an Overseas Intermediary or a client to hold.
- A percentage-based position limit applies to FF Members, OSBPs and Overseas Intermediaries, and both a percentage-based and a fixed-amount position limit apply to Non-FF Members, OSNBPs and clients.

Position limit proportion (%) and position limit (lots) for an LSFO futures contract at different trading periods									
	From the Day of Listing to the First Trading Day of the Month Prior to the Delivery Month		From the Day of Listing to the Last Trading Day of the Third Month Prior to the Delivery Month			The Second Month Prior to the Delivery Month		The Month Prior to the Delivery Month	
	Open interest (lots)	Position limit proportion (%)	Open interest (lots)	Position limit proportion (%) and position limit (lots)		Position limit (lots)		Position limit (lots)	
		FF Member, OSBP, Overseas Intermediary		Non-FF Member, OSNBP	Client	Non-FF Member, OSNBP	Client	Non-FF Member, OSNBP	Client
LSFO Futures	$\geq 100,000$	25	$\geq 100,000$	10	10	1,500	1,500	500	500
			$< 100,000$	10,000	10,000				

Note: Open interest and position limits are counted by either long or short positions.



5. Large trader position reporting

A Member, an OSP or a client whose general positions in a futures contract reach the general position limit set by the Exchange, or an Overseas Intermediary whose general positions in a futures contract reaches or exceeds 60% of its general position limit, shall take the initiative to file a large trader position report with the Exchange by 3:00 p.m. of the following trading day.

The Exchange may, in its sole discretion, require specific Members, OSPs, Overseas Intermediaries or clients to submit large trader position reports or other supporting materials, and may examine the above-mentioned documents from time to time.

6. Forced position liquidation

The Exchange shall perform forced position liquidation, if:

- (1) the clearing deposit balance of a Member recorded on any of the internal ledgers at the Exchange, whether they are for its own clients or its authorized clearing entities, falls below 0, and the Member fails to meet the margin requirement within the specified time limit;
- (2) the open positions of a Non-FF Member, an OSNBP or a client exceed the applicable position limit;
- (3) a Non-FF Member, an OSNBP or a client fails to round the positions held in a futures contract to the required multiples within the specified time limit, or is not qualified to make or take delivery for expired contracts it holds;
- (4) a violation of the Exchange's rules occurs that warrants a forced position liquidation;
- (5) any emergency happens that warrants a forced position liquidation;
or
- (6) any other conditions exist that makes the forced position liquidation necessary.

7. Risk warning

The Exchange applies risk warning. The Exchange may take one or a combination of the following measures to warn against and resolve risks: (1) requesting an explanation from market participants with respect to a specific situation; (2) conducting an interview to give a verbal alert; (3) issuing a risk warning letter; (4) giving a reprimand; (5) issuing a risk warning notice to the public; and/or (6) taking other measures deemed necessary by the Exchange.

8. After the market close on the eighth trading day prior to the last trading day of an LSFO futures contract, positions held by individual clients who are not able to issue or accept tax invoices during delivery must be closed out completely. From the seventh trading day prior to the last trading day on, the positions held by such clients will be subject to forced position liquidation by the Exchange.

Hedging Rules

Hedging is a risk avoidance strategy where a trader buys (or sells) futures contracts whose underlying asset is of identical type and quantity to the commodities to be sold (or bought) on the physical market, so that losses suffered on one market will be mostly offset by the gains made on the other market regardless of how the price fluctuates on the physical market.

For hedging and arbitrage positions in an LSFO futures contract, the regular months are the period from the listing day of the contract to the last trading day of the third month prior to the delivery month; the nearby delivery months are the second month prior to the delivery month and the month prior to the delivery month.

The hedging quota of an LSFO futures contract shall be approved by



the Exchange. Clients shall apply to their account opening institutions, and the account opening institutions shall apply to the Exchange after reviewing the application materials. Non-FF Members and OSNBPs shall directly apply to the Exchange for the hedging quota.

1. Materials required from clients applying for the hedging quota for regular months

A Non-FF Member, an OSNBP or a client needs to submit the following materials in accordance with the contract to apply for the hedging quota for regular months:

- (i) an Application (Approval) Form of Hedging Quota for Regular Months, including the applicant's basic information, the contracts concerned, the requested hedging quota for regular months, and other information;
- (ii) a copy of the business license, a certificate of incorporation, or other documents that may prove the applicant's business scope;
- (iii) business performance in physical commodities in the previous year or the latest audited annual financial report;
- (iv) the business plan for physical commodities for the current year or the following year, and any purchase and sale contracts or other valid documentations relevant to the hedging application;
- (v) the hedging strategy, including analyses of the source of risks and hedging objectives;
- (vi) hedging management rules, if the applicant is a Non-FF Member or an OSNBP; and
- (vii) other materials requested by the Exchange.

A Non-FF Member, an OSNBP or a client may apply for hedging quota for regular months for more than one contract once at a time.

2. Materials required from clients applying for the hedging quota for nearby delivery months

A Non-FF Member, an OSNBP or a client needs to submit the following materials in accordance with the contract to apply for the hedging quota for nearby delivery months:

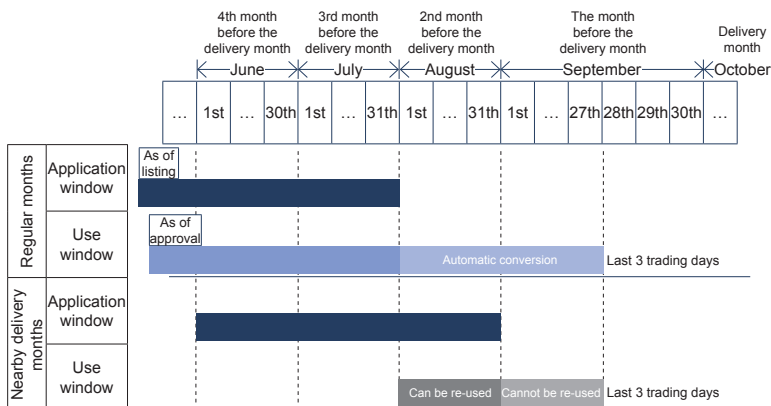
- (i) an Application (Approval) Form of Hedging Quota for Nearby Delivery Months, including the applicant's basic information, the contracts concerned, the requested hedging quota for nearby delivery months, and other information;
- (ii) a copy of business license, a certificate of incorporation, or other documents that may prove the applicant's business scope;
- (iii) relevant materials which can prove the authenticity of the hedging needs, including the production plan for the current year or the previous year, warrants for physical commodities, processing orders, purchase and sale contracts, purchase and sale tax invoices, or other valid certificates of the ownership of physical commodities corresponding to the application quota;
- (iv) hedging management rules, if the applicant is a Non-FF Member or an OSNBP; and
- (v) other materials requested by the Exchange.

If the above materials have been submitted to the Exchange previously and there has been no change thereafter, there is no need to re-submit such materials.



3. Application and use windows for hedging quota

Take LU2110 for example:



Note: For those who fail to apply for the hedging quota for nearby delivery months as those months approach, the Exchange will treat the lower of the granted hedging quota for regular months and the general position limit of the listed product in nearby delivery months as the hedging quota for nearby delivery months.

4. Examples of hedging in LSFO futures

Example of short hedge:

As suppliers of LSFO, both importers of marine fuels and refineries of refined oil can hedge against potential losses at the actual time of sale due to price change by taking a short position in the corresponding futures of the underlying commodity, in order to ensure the reasonable profit margin of the commodity ready to be sold to the market or the commodity still in the process of production or blending and will be introduced to the market. Short hedge means first selling the same quantity of futures, and then, at time of sale of the physical commodity, buying the same quantity of futures to close out their position.

Here is an example: a supplier learned in July that the price of LSFO is ¥3,500 per metric ton, which it believed to be quite favorable and thus increased its inventory. However, the supplier is worried that an oversupply on the physical market would lead to price fall and erode its profit margin. To avoid the risk of falling prices, the supplier decides to take a short hedge in LSFO futures on INE. This hedge and the resulting gains or losses are illustrated below:

	Physical Market	Futures Market	Basis
July 1	Price of LSFO: ¥3500/ metric ton	500 lots of Sep LSFO contract sold at ¥3,600 /metric ton	-¥100/ metric ton
August 1	5,000 metric tons sold at ¥3,450/metric ton	500 lots of Sep LSFO contract bought to close at ¥3,550/ metric ton	-¥100/ metric ton
Hedging Result	- ¥50/metric ton	+ ¥50/metric ton	
Net gain or loss: 0			

While the adverse price movement of ¥50 per metric ton on the physical market incurs a loss of ¥250,000 to the supplier, a gain by the same amount on the futures market offsets that loss, thereby eliminating the negative effect of the price change.

Example of long hedge:

Fuel oil consumers such as marine fuel suppliers are concerned about price increase in LSFO. To avoid potential losses from price increase at time of fuel purchase, they can take a long hedge position on the futures market, i.e., first buy the same quantity of futures product to create a “virtual” inventory, and then, at time of purchase of the physical commodity, sell the futures to close out their position.

Here is an example: through a forward contract concluded on June 1, a supplier of marine fuel has agreed to deliver a shipment of LSFO to a ship owner in September. The contract stipulates a fixed price for the shipment, based on the LSFO futures price of ¥3,500 per metric ton then prevailing on INE. At the time of contract execution, the supplier has no inventory in stock. To control its cost and lock in profit, the supplier decides to enter an LSFO futures trade on INE. The details of this trade are given below:



	Physical Market	Futures Market	Basis
June 1	Price of LSFO: ¥3,500/ metric ton	500 lots of Sep LSFO contract bought at ¥3,600/metric ton	-¥100/ metric ton
August 25	5,000 metric tons bought at ¥3,550/metric ton	500 lots of Sep LSFO contract sold to close at ¥3,650 /metric ton	-¥100/ metric ton
Hedging Result	- ¥50/metric ton	+ ¥50/metric ton	
Net gain or loss: 0			

While the adverse price movement on the physical market incurs a loss of ¥250,000 to the marine fuel supplier, a gain by the same amount on the futures market offsets that loss, thereby eliminating the negative effect of the price change.

Clearing Rules

1. Day-to-day clearing

- The Exchange implements daily mark-to-market.
- If, after the completion of daily clearing, the clearing deposit balance of any internal ledger of a Member with the Exchange is lower than the prescribed minimum requirement, such clearing result shall be deemed as the Exchange's margin call to the Member, and the gap between the two amounts shall be the amount of additional funds required by the margin call.
- Following the margin call, the Exchange may instruct the relevant Designated Depository Bank to transfer the required amount from the Member's dedicated fund account to the Exchange's dedicated settlement account. If a deficiency still exists, the Member must make up the shortfall prior to market open on the next trading day, or the following rules shall apply:
 - (1) If the clearing deposit balance of any internal ledger of the Member with the Exchange is at or above zero, the corresponding Member or OSP of such internal ledger shall not open any new position;

(2) If the clearing deposit balance of any internal ledger of the Member with the Exchange is less than zero, the Exchange shall implement forced position liquidation or takes other measures according to the *Risk Management Rules*.

- After the completion of daily clearing, the clearing deposit balance in RMB on any internal ledger of a Member may not be lower than the minimum clearing deposit, otherwise, the Exchange may debit a corresponding amount of RMB funds from the Member's dedicated fund account. If a deficiency still exists, the Member must make up the shortfall prior to market open on the next trading day. If the Member fails to do so, the Exchange may impose forced foreign exchange conversion by unilaterally converting the Member's foreign currency funds in its dedicated fund account or in the Exchange's dedicated settlement account into RMB.

2. Collaterals pledged as margin

- Non-FF Members, OSNBPs, and clients may, subject to the Exchange's approval, use standard warrants, foreign currency funds and other assets as margin.
- The Clearing House of the Exchange is responsible for managing margin collaterals. The cutoff time for submitting a deposit or withdrawal application is 3:00 p.m. of each trading day. Under special circumstances, the Exchange may postpone the processing time.
- Margin collaterals are limited to the following assets:
 - (1) standard warrants;
 - (2) foreign currencies (type of currencies, haircut, and scope of application are prescribed by the Exchange separately); and
 - (3) other assets approved by the Exchange.
- A Non-FF Member or an OSNBP shall submit an application to the Exchange to use collaterals as margin. A client shall delegate its



carrying FF Member, OSBP, or Overseas Intermediary to apply to the Exchange and complete relevant procedures. Upon receiving the application, the Exchange will verify the collaterals and credit the corresponding amount of margin.

- The value of the margin collateral is calculated as follows:

(1) For standard warrants used as margin collateral, the settlement price of the day for the front-month futures contract of the underlying product shall be used as the benchmark price for calculating the market value of the standard warrants. Prior to the market close of the day, the market value shall be calculated based on the benchmark price of the previous trading day. Standard warrants are subject to a minimum 20% haircut when posted as margin.

(2) The benchmark price for other margin collaterals shall be determined by the Exchange.

The term “discounted value” means the after-haircut value of the margin collaterals. During the daily clearing, the Exchange updates the benchmark prices of the day and adjusts the discounted values of margin collaterals according to the aforementioned methodology.

Delivery Rules

- The LSFO futures contract adopts physical delivery, bonded delivery, and warehouse delivery.
- Delivery notice

Before submitting a load-in application, an owner shall properly coordinate with relevant agencies and organizations such as terminals, ports, pipeline companies, customs, and commodity inspection agencies. Before loading LSFO into a Designated Delivery Storage Facility, the owner shall submit a load-in application to the Exchange no less than 15 days before the proposed load-in date. Where the load-in application is submitted less than 15 days before the proposed

load-in date but the owner is otherwise prepared for the load-in and the Designated Delivery Storage Facility raises no objection over the load-in, the Exchange may approve the application based on the available storage capacity and other factors. The validity period of an LSFO load-in application is 15 days from the date of approval by the Exchange.

The owner must ensure that information and documents for the load-in application are true, and need to pay a load-in deposit of RMB 30/ metric ton.

■ Quality pre-check

LSFO to be loaded in or out of a Designated Delivery Storage Facility shall be inspected in accordance with the Low Sulfur Fuel Oil (Futures) Inspection Rules; sampling is conducted in accordance with GB/T 4756. Designated Delivery Storage Facilities shall cooperate with Designated Inspection Agencies during the inspections.

Before the unloading and load-in of LSFO, the owner shall entrust a Designated Inspection Agency to perform quality pre-check, according to the standards and methods set out in the futures contract, with respect to density, kinematic viscosity, sulfur content, moisture, flash point, and, if mixed tank storage is needed, compatibility. The owner may not unload the LSFO until it passes the quality pre-check, so as to ensure that the LSFO to be delivered meets the quality standards prescribed by the Exchange.

■ Load-in quality inspection

Before the load-in, the Designated Inspection Agency shall take samples of the commodities from the ship tanks or other transport containers (Sample A) and from the Designated Delivery Storage Facility (Sample B), and have them sealed. Sample A is classified into Sample A1 and Sample A2, where Sample A1 contains multiple samples taken from each single ship tank or single container of the load-in commodities, and Sample A2 is the proportional mixture of all the samples of A1. After load-in, the Designated Inspection Agency shall take another sample from the depot of the Designated Delivery



Storage Facility (Sample C), test the sample, and issue an inspection report. If Sample C passes the inspection, it means the commodities delivered by the owner have met the quality standard. When submitting quality inspection report for the commodities to be delivered, the owner shall submit the inspection report based on Sample C.

If Sample C fails the testing, the Designated Inspection Agency shall test Sample A and Sample B, which may lead to one of the following four scenarios:

(1) If Sample A passes but Sample B fails the testing, it means the commodities delivered by the owner are qualified. The Designated Delivery Storage Facility is then liable for the disqualification of the commodities in the depot after the load-in. The testing fees for Sample A and Sample B shall be borne by the Designated Delivery Storage Facility.

(2) If Sample B passes but Sample A fails the testing, it means the commodities delivered by the owner are unqualified. The owner is then liable for the disqualification of the commodities in the depot after the load-in. The testing fees for Sample A and Sample B shall be borne by the owner.

(3) If both Sample A and Sample B pass the testing, it means the commodities delivered by the owner are qualified. The Designated Delivery Storage Facility is then liable for the disqualification of the commodities in the depot after the load-in. The testing fees for Sample A and Sample B shall be borne by the Designated Delivery Storage Facility.

(4) If both Sample A and Sample B fail the testing, it means the commodities delivered by the owner and those originally in the depot are both unqualified. Both the owner and the Designated Delivery Storage Facility are then liable for the disqualification of the commodities in the depot after the load-in. The testing fees for Sample A shall be borne by the owner and those for Sample B shall be borne by the Designated Delivery Storage Facility.

Under any of the above four scenarios, if either of Sample A1 or Sample A2 is unqualified, Sample A is considered unqualified. When submitting the quality inspection report, the owner shall submit the inspection report based on Sample A.

■ Delivery documents

At the time of creation of bonded standard warrants during the load-in of LSFO, both the originals and photocopies of the inspection certificate issued by the Designated Inspection Agency, certificate of origin, and other supporting documents including but not limited to bill of lading, inspection certificate from the loading port, customs approval of load-in, inspection certificate for bonded blended marine fuel oil, and producer's product quality inspection report shall be submitted to the Exchange for verification. The Exchange will keep the photocopies after verifying the originals.

■ Validity period of bonded standard warrants of LSFO

Bonded standard warrants of LSFO are valid for 6 months from the next month of their creation. Upon expiration of a bonded standard warrant, the underlying commodities shall be converted to physical commodities.

■ Delivery procedures

The physical delivery of a matured futures contract shall be completed within the delivery period provided by the futures contract. The delivery period refers to the five (5) consecutive trading days immediately after the last trading day of the futures contract. These five (5) consecutive trading days are called the First, Second, Third, Fourth and Fifth Delivery Day, respectively. The Fifth Delivery Day is the last delivery day.

1. The First Delivery Day (Application)

(1) Buyers submit notice of delivery intention. Buyers submit, via the Standard Warrant Management System, a notice of intention to the Exchange for accepting the commodities, including information such as the products, quantities, and the names of the Designated Delivery Storage Facilities.



(2) Sellers submit standard warrants. Sellers shall submit the valid standard warrants for which storage fees have been paid in full to the Exchange via the Standard Warrant Management System. Sellers are responsible for the storage fees before the Fifth Delivery Day (inclusive); buyers are responsible for the storage fees after the Fifth Delivery Day.

2. The Second Delivery Day (Matching)

The Exchange matches and allocates available standard warrants in accordance with the principles of “time priority, quantity rounding, nearest matching, and overall arrangement.”

The Exchange allocates the standard warrants that cannot be used for the physical delivery of the futures contract in the next month to the buyers according to the proportion of each buyer’s delivery volume to the total delivery volume of the month.

3. The Third Delivery Day (Payment and obtaining the warrant)

(1) Buyers pay and obtain the warrants. Buyers shall make the delivery payment to the Exchange before 2:00 p.m. on the Third Delivery Day and obtain the standard warrants.

(2) Sellers receive the payment. The Exchange shall transfer the delivery payment to the sellers before 4:00 p.m. on the Third Delivery Day. This time limit may be extended by the Exchange under special circumstances.

4. The Fourth and Fifth Delivery Day (Submitting tax invoices and returning margin)

Sellers should submit all the tax invoices corresponding to the delivery commodities to the Exchange. The tax invoices shall have the information and format required by the Exchange. Other matters, such as the unfreezing of margin and the submission of tax invoices, shall follow the provisions of the *Clearing Rules of the Shanghai International Energy Exchange*.

■ Final settlement price

The final settlement price of LSFO futures is the benchmark price for the delivery settlement of LSFO futures, and is calculated as the arithmetic mean value of the settlement prices of that contract during the last five (5) trading days on which at least one trade in the contract has been executed. At delivery settlement, the buyer and the seller shall settle based on such final settlement price as adjusted by the premiums or discounts of the delivery.

(1) The bonded final settlement price is the basis for calculating and assessing the dutiable value of LSFO at customs declaration by the holder of an LSFO bonded standard warrant. The formula for the bonded final settlement price of an expired contract is:

Bonded final settlement price = Final settlement price.

(2) When a bonded standard warrant is used in an exchange of futures for physicals (EFP), the formula for the EFP bonded final settlement price is:

EFP bonded final settlement price = Settlement price of the previous trading day prior to the EFP application day of the first-nearby contract.

(3) When non-standard warrants are used in an EFP, the final settlement price is as negotiated by the trading parties.

■ Measurement of load-in and load-out weight

The weight of LSFO at load-in or load-out is as indicated by the document issued by the Designated Inspection Agency, based on measurements taken at the shore tanks of the Designated Delivery Storage Facility. Weight shall be measured by the tank capacity gauge; where the load-out weight is below the minimum level prescribed by the Exchange, the Designated Inspection Agency may choose flow meter or other measurement tools instead.

■ Requirements for pipelines

Both before and after the load-in or load-out of LSFO, the Designated



Delivery Storage Facility shall ensure that the oil pipelines are either fully filled or emptied, and that the oil in the pipelines will not affect the quality of oil to be unloaded and can flow readily. LSFO may not be loaded in or out at below 35 °C.

■ Delivery unit

The delivery unit of an LSFO futures contract is 10 metric tons. Delivery must be made in integral multiple(s) of the delivery unit.

■ Minimum load-in quantity

The minimum load-in quantity for LSFO is 5,000 metric tons. The minimum load-out quantity for LSFO is 1,000 metric tons, unless the load-in and load-out quantity otherwise agreed between the owner and the Designated Delivery Storage Facility.

■ Loss compensation and overfill or underfill

The loss compensation at load-in or load-out of LSFO shall be paid by the owner to the Designated Delivery Storage Facility according to the following formula within three (3) business days after the inspection reports are issued by the Designated Inspection Agency:

Loss compensation at load-in = weight of LSFO indicated on bonded standard warrants issued × 0.6‰ × (settlement price of the trading day before the load-in completion day of the first-nearby LSFO futures contract + delivery premiums and discounts)

Loss compensation at load-out = weight of LSFO indicated on bonded standard warrants cancelled × 0.6‰ × (settlement price of the trading day before the load-out completion day of the first-nearby LSFO futures contract + delivery premiums and discounts)

The “overfill or underfill” during load-in and load-out of LSFO is the difference between the weight specified on the weight certificate issued by the Designated Inspection Agency at load-in or load-out and the weight indicated on the bonded standard warrants issued or cancelled. Overfill or underfill for LSFO during load-in or load-out may not exceed

±3% of the weight specified in the corresponding application. The owner shall directly settle the overfill or underfill with the Designated Delivery Storage Facility according to the following formula within three (3) business days after inspection reports are issued by the Designated Inspection Agency:

The payment for overfill or underfill during load-in or load-out = overfill or underfill weight of LSFO within the tolerance level × (settlement price of the first-nearby LSFO futures contract for the trading day before the load-in completion day + delivery premiums and discounts)

■ Delivery Fees

The buyer and seller involved in a physical delivery shall each pay a delivery fee at the rate of RMB 1 /metric ton to the Exchange.

■ Overseas clients' participation in physical delivery

Clients, OSPs who clear through Members, and Overseas Intermediaries who trade and clear through Members (the aforementioned clients, OSPs and Overseas Intermediaries are collectively referred to as "Clearing Delivery Principals") shall perform the physical delivery through their carrying Members at the Exchange.

The clients of OSBPs and Overseas Intermediaries shall perform the physical delivery through their carrying OSBPs and Overseas Intermediaries.

Unless otherwise prescribed by the Exchange, clients who cannot issue or accept the prescribed tax invoices of the Exchange shall not make or take delivery.

■ Exchange of futures for physicals

Exchange of futures for physicals, or EFP, is the process where the buyers and the sellers who hold opposite positions in a futures contract expiring in the same month agree to, subject to the approval of the Exchange, tender a notice to have their respective positions in such contract closed out by the Exchange at the price prescribed by the



Exchange, and transfer, at the price mutually agreed upon, warrants of the same quantity and the same or similar type of underlying commodity as the futures contract.

The EFP application period is from the listing day of a futures contract to the second trading day (inclusive) before the last trading day of the contract.

After the buyers and the sellers who hold opposite positions in a futures contract expiring in the same month reach an agreement, either party may submit the EFP application to the Exchange via the Standard Warrant Management System before 2:00 p.m. of any trading day (the application day) within the EFP application period, and perform the EFP upon the approval of the Exchange.

A Clearing Delivery Principal that conducts EFPs through the Exchange using standard warrants shall follow the following procedures:

- (1) The Clearing Delivery Principal for the seller's carrying Member authorizes the Member to use the standard warrants for the EFP.
- (2) The Member submits the standard warrants to the Exchange within the prescribed time.
- (3) The Exchange allocates the standard warrants to the buyer's carrying Member.
- (4) After the buyer's Member makes payment, the Exchange releases the standard warrants that have been allocated to that Member, and transfers the payment to the seller's carrying Member.
- (5) The buyer's Member allocates the standard warrants to the Clearing Delivery Principal.

A buyer's Member shall allocate the standard warrants to the Clearing Delivery Principal within three (3) business days after it receives them. An OSBP or Overseas Intermediary shall agree with the Member on the timeframe for this allocation, and then allocates the standard warrants to its client within three (3) business days after it receives them. If the

buyer's Member or OSBP is not able to make such allocation within the prescribed time, it shall promptly report the reasons for this delay to the Exchange.

For an EFP that is settled through the Exchange using standard warrants, the trading margin is calculated based on the settlement price of the corresponding delivery month contract for the trading day before the EFP application day. The exchange of payment and standard warrants shall be completed through the Exchange within the trading day following the application day, unless otherwise prescribed by the Exchange.

For an EFP that is settled through the Exchange using standard warrants, the seller shall submit the tax invoice to the Exchange within five (5) trading days after the exchange of payment and standard warrants. If the seller submits the tax invoice before 2:00 p.m., the Exchange will, after verifying the tax invoice, unfreeze the corresponding margin during the time of clearing on the same day. If the seller submits the tax invoice after 2:00 p.m., the Exchange will unfreeze the corresponding margin during the time of clearing on the next trading day. After receiving the tax invoice from the seller, the Exchange will issue a tax invoice to the buyer on the next trading day.

If non-standard warrants are used for an EFP, the buyer and the seller shall abide by relevant laws and regulations, and submit the relevant sale and purchase agreement, the non-standard warrants, and other materials as required. The payment for the underlying commodities, the non-standard warrants, and the tax invoice shall be transferred directly between the buyer and the seller.



Standard Contract

Low Sulfur Fuel Oil Contract Specifications

Product	Low Sulfur Fuel Oil
Contract Size	10 metric tons/lot
Price Quotation	(RMB) Yuan/metric ton (no tax or duty included in the quotation)
Minimum Price Fluctuation	1 Yuan/metric ton
Daily Price Limits	±5% from the settlement price of the previous trading day
Delivery Months	January, February, March, April, May, June, July, August, September, October, November, and December
Trading Hours	9:00-11:30 a.m., 1:30-3:00 p.m. (Beijing Time), and other trading hours as prescribed by the Exchange
Last Trading Day	The last trading day of the month prior to the delivery month (postponed accordingly if it is a national holiday or weekend; the Shanghai International Energy Exchange is entitled to adjust the last trading day in accordance with the national holidays or weekends.)
Delivery Period	Five (5) consecutive trading days after the last trading day
Grades and Quality Specifications	Low sulfur marine fuel oil, refer to Appendix for detailed quality standards
Delivery Venues	Delivery Storage Facilities designated by the Shanghai International Energy Exchange
Minimum Trading Margin	8% of contract value
Settlement Type	Physical delivery
Product Symbol	LU
Listing Exchange	Shanghai International Energy Exchange

Appendix to LU Contract

■ Delivery Unit

The delivery unit of low sulfur fuel oil futures contract is 10 metric tons. The delivery quantity shall be integral multiple(s) of the delivery unit.

■ Quality Standards

Low sulfur marine fuel oil to be delivered shall meet the quality standards for low sulfur marine fuel oil set by the Shanghai International Energy Exchange (the “Exchange”). “Low sulfur marine fuel oil” refers to homogeneous hydrocarbon mixtures extracted from petroleum, with certain amount of additives permitted for performance and characteristics gains. Low sulfur marine fuel oil shall not contain any inorganic acid and used lubricating oil, nor any substance that may cause abnormal operations of ships, nor any artificially added additive or chemical waste that may endanger ship safety, adversely affect machine’s performance, or be harmful or increase air pollutions.

Specific rates of premiums and discounts will be separately prescribed and announced by the Exchange.



Quality Standards of Low Sulfur Fuel Oil of the Shanghai International Energy Exchange		
Properties	Limit	Test Method
Kinematic viscosity (50 °C, mm ² /s)	380.0 max 100.00 min	ASTM D445
Density (15 °C, kg/m ³)	991.0 max 930.0 min	ASTM D1298
Calculated Carbon Aromaticity Index (CCAI)	870 max	ISO 8217:2017(E)
Sulfur content (m/m, %)	0.50 max	ASTM D4294
Flash point (closed cup) (°C)	60.0 min	ASTM D93
Hydrogen sulfide (mg/kg)	2.00 max	IP570
Acid value (mg KOH/g)	2.5 max	ASTM D664
Total sediment (thermal aging test) (m/m, %)	0.10 max	ASTM D4870
Carbon residue (m/m, %)	18.00 max	ASTM D4530
Pour point (°C)	30 max	ASTM D97
Moisture (V/V, %)	0.50 max	ASTM D95
Ash content (m/m, %)	0.100 max	ASTM D482
Vanadium (mg/kg)	350 max	IP 501
Sodium (mg/kg)	100 max	IP 501
Aluminum + Silicon (mg/kg)	60 max	IP 501
Net calorific value (cal/g)	9,500 min	ASTM D240
Used lubricating oil (ULO) (mg/kg) Calcium and Zinc Calcium and phosphorus	Fuel oil should be free of ULO, which is deemed to be present if any of the following conditions is met: Ca > 30 and Zn > 15 or Ca > 30 and P > 15	IP501
Compatibility (level)	No higher than spot No. 2	ASTM D4740
Cleanness (level)	No higher than spot No. 2	
Styrene (mg/kg)	20 max	GB/T 6041
Phenol (mg/kg)	10 max	

■ Designated Delivery Storage Facilities

Designated Delivery Storage Facilities will be separately announced by the Exchange.

Appendix

Designated Inspection Agencies for Low Sulfur Fuel Oil

Name	Address	Contacts	Phone	Fax
China Certification & Inspection Group Inspection Co., Ltd.	17/F, Sanyuan Building, 18 Xibahe Dongli, Chaoyang District, Beijing	Chen Hong Gu Chen	010-84603658 13801063685 010-84603548 13810060886	010-84603183
SGS-CSTC Standards Technical Services Co., Ltd.	16/F, Century Yuhui Mansion, 73 Fucheng Road, Haidian District, Beijing	Chen Zhou Zhao Qi	0574-89070154 13306678519 0755-26392411 13821643138	0574-87777875
Shanghai Orient Intertek Testing Services Co., Ltd.	Building T52-3-2 North, 1201 Guiqiao Road, Jinqiao Economic and Technological Development Zone, Pudong New Area, Shanghai	Guan Lianjun Zhang Jian	0574-87836578 13306668721 0532-58715778 13869863179	0574-87840759
Shanghai Customs Industrial Products and Raw Material Testing Technology Center	1208 Minsheng Road, Pudong New Area, Shanghai	Zhang Jidong Li Chen	021-67120903 13918256560 021-38620750 13331978879	021-67120902

Designated Delivery Storage Facilities for Low Sulfur Fuel Oil

Name	Office Address	Storage Address	Contacts	Phone	Fax
Sinochem Xingzhong Oil Staging (Zhoushan) Co., Ltd.	Sinochem Xingzhong Administrative Area, Aoshan Bridge East, Lincheng Sub-District, Dinghai District, Zhoushan, Zhejiang Province	Aoshan Island, Lincheng Sub-District, Dinghai District, Zhoushan, Zhejiang Province	Xiao Bin Sun Chengchao	0580-2061786 13906807550 0580-2061858 18158599850	0580-2036444
Yangshan Shengang International Oil Logistics Co., Ltd.	Building DEF, 14/F, Times Square, 500 Zhangyang Road, Pudong New Area, Shanghai	Shenjiawan Terminal, Yangshan Deepwater Port, Shanghai	Dong Wei Xu Tingting	021-68405123 13788931707 021-68405060 15921888108	021-68405190
Zhejiang Offshore Petroleum Reserve Co., Ltd.	No. 22, Yandun Industrial Area, Cengang Sub-District, Dinghai District, Zhoushan, Zhejiang Province	No. 22, Yandun Industrial Area, Cengang Sub-District, Dinghai District, Zhoushan, Zhejiang Province	Ding Rong Xu Rongfen	0580-8710877 13857205955 0580-8710858 13567676865	0580-8710858
Dading Petroleum Logistics Co., Ltd.	496 Aoshan East Road, Lincheng Sub-District, Dinghai District, Zhoushan, Zhejiang Province	496 Aoshan East Road, Lincheng Sub-District, Dinghai District, Zhoushan, Zhejiang Province	Cai Linbo Ye Tao	18626852579 13857217124	0580-8171161 0580-8171134



Low Sulfur Fuel Oil (Futures) Inspection Rules (Trial)

Chapter 1 General Provisions

Article 1 These *Rules* are jointly formulated by the low sulfur fuel oil futures inspection agencies designated by the Shanghai International Energy Exchange (“INE” or the “Exchange”).

Article 2 These *Rules* are formulated in accordance with national provisions on commodity inspection and applicable rules of the Exchange to ensure the smooth inspection for low sulfur fuel oil futures delivery and to standardize the inspection prior to physical delivery.

Article 3 These *Rules* are applicable to the inspection for low sulfur fuel oil futures delivery. The Exchange, Designated Inspection Agencies, Designated Delivery Storage Facilities, consigners of inspection (“Consigners”), and other relevant organizations shall abide by these Rules.

Chapter 2 Inspection Procedures

Section 1 Inspection Standards and Methods

Article 4 Inspections under these Rules shall be governed by the standards and methods set forth in the following documents. For undated references, the latest edition of the referenced document shall apply:

GB/T 1885 – *Petroleum Measurement Tables*

GB/T 4756 – *Method for Manual Sampling of Petroleum Liquids*

GB/T 6041 – *General Rules for Mass Spectrometric Analysis (for measuring the amount of styrene and phenol)*

GB/T 8927 – *Petroleum and Liquid Petroleum Products - Temperature Measurement - Manual Methods*

GB/T 13236 – *Petroleum and Liquid Petroleum Products - Equipment for Measurement of Liquid Level in Storage Tanks - Manual Methods*

GB/T 13894 – *Petroleum and Liquid Petroleum Products - Measurement of*

Liquid Level in Tanks - Manual Methods

GB/T 19779 – *Petroleum and Liquid Petroleum Products – Calculation of Oil Quantities - Static Measurement*

JJG 168 – *Verification Regulation of Vertical Metal Tank Capacity*

API MPMS 17.6 – *Guidelines for Determining the Fullness of Pipelines between Vessel and Shore Tanks*

ASTM D93 – *Standard Test Methods for Flash-Point by Pensky-Martens Closed Cup Tester*

ASTM D95 – *Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation*

ASTM D97 – *Standard Test Method for Pour Point of Petroleum Products*

ASTM D240 – *Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter*

ASTM D445 – *Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)*

ASTM D482 – *Standard Test Method for Ash from Petroleum Products*

ASTM D664 – *Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration*

ASTM D1298 – *Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method*

ASTM D4294 – *Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry*

ASTM D4530 – *Standard Test Method for Determination of Carbon Residue (Micro Method)*

ASTM D4740 – *Standard Test Method for Cleanliness and Compatibility of Residual Fuels by Spot Test*

ASTM D4870 – *Standard Test Method for Determination of Total Sediment in Residual Fuels*

IP 501 *Determination of Aluminium, Silicon, Vanadium, Nickel, Iron, Sodium,*



Calcium, Zinc and Phosphorous in Residual Fuel Oil by Ashing, Fusion and Inductively Coupled Plasma Emission Spectrometry

IP570 – Determination of Hydrogen Sulfide in Fuel Oil - Rapid Liquid Phase Extraction Method

Section 2 Load-In Inspection

Article 5 Acceptance of Inspection Assignment by Designated Inspection Agencies

Consigner shall entrust, in writing and 24 hours before load-in, a Designated Inspection Agency to perform the load-in inspection (comprising quality pre-check before load-in as well as weight and quality inspections for the shore tanks for load-in), and file with it the load-in plan mutually agreed upon by the Consigner and the Designated Delivery Storage Facility. If the residual oil within the vessel-to-shore tank pipeline needs to be displaced, the Consigner shall submit the displacement plan at the same time and specify the pipeline displacement volume. The Designated Delivery Storage Facility shall displace the residual oil if it is of a lower quality than that of the low sulfur fuel oil to be loaded in for futures delivery.

The Consigner shall provide the following documents for the purpose of entrustment :

- (1) For inbound bonded low sulfur fuel oil to be delivered directly from the ships to the Designated Delivery Storage Facility after berthing and unloading: Low sulfur Fuel Oil Inspection Certificate issued by the loading port, bill of lading, customs load-in approval document, low sulfur fuel oil load-in application / approval notice from the Exchange, and other documents as required;
- (2) For inbound bonded low sulfur fuel oil to be delivered to the Designated Delivery Storage Facility through ship-to-ship transfer in a domestic anchorage: low sulfur fuel oil inspection certificate issued by the loading port of the mother ship, bill of lading, customs load-in approval document, fuel oil load-in application / approval notice from the Exchange, and other relevant documents. The Designated Inspection Agency shall supervise the unloading and loading of fuel oil during the ship-to-ship transfer, securely seal the tanks on the receiving vessel for pre-unloading verification at the Designated Delivery Storage Facility, and provide relevant supporting documents as required;
- (3) For bonded low sulfur fuel oil under the processing trade route or the general

trade route to be delivered to the Designated Delivery Storage Facility: export customs declaration form, export verification checklist under the processing trade manual, export statutory inspection certificate, commodity inspection certificate of low sulfur fuel oil issued by the loading port, producer's product quality inspection report, certificate of origin, low sulfur fuel oil load-in application / approval notice from the Exchange, and other materials as required.

(4) For bonded low sulfur fuel oil delivered to the Designated Delivery Storage Facility from other bonded storage facilities through customs transit or blended in the Designated Delivery Storage Facility: the commodity inspection certificate for the bonded blended low sulfur fuel oil, certificate of origin, low sulfur fuel oil load-in application / approval notice from the Exchange, and other materials as required.

The Designated Inspection Agency shall maintain close contact with the Consigner and the Designated Delivery Storage Facility, stay current with the load-in status, and timely arrange for inspections.

Article 6 On-Site Load-In Inspection by Designated Inspection Agencies

(1) Quality pre-check before load-in

(A) The Consigner shall, before the unloading and load-in of low sulfur fuel oil for futures delivery, determine with the Designated Inspection Agency and Designated Delivery Storage Facility the time, location, and method of sampling for the quality pre-check before load-in. Where the Consigner chooses to conduct the pre-check at a domestic loading port, the Designated Inspection Agency shall take samples from the ship tanks immediately after loading; then seal all compartment hatch covers and valves, small hatch covers, choke outlet valves, seawater valves, as well as outboard discharge valves; and record the seal numbers. Upon arrival of the vessel at the unloading port, the Designated Inspection Agency shall verify the integrity of the seals and the seal numbers. Unloading shall only be carried out if the shipment passes the quality pre-check. Where the Consigner chooses to conduct the pre-check and sampling at the unloading port, unloading shall only be carried out if the samples from the ship tanks pass the pre-check.

(B) Sampling standard: GB/T 4756.

(C) The Designated Inspection Agency shall carry out laboratory testing according to the scope of quality pre-check specified by the Exchange, which



covers density, kinematic viscosity, sulfur content, moisture, flash point, and compatibility (where mixed tank storage is needed) using the standards and test methods set out in Appendix I.

(D) Upon completion of the quality pre-check, the Designated Inspection Agency shall issue a pre-check report and timely submit it to the Consigner, the Designated Delivery Storage Facility, and the Exchange. Unloading and load-in shall not begin until the positive pre-check report is received.

(2) Sealing and unsealing

(A) The Designated Inspection Agency shall ensure all valves to any shore tank not designated for futures delivery are tightly closed and properly sealed.

(B) The Designated Inspection Agency shall, together with the Designated Delivery Storage Facility, seal the outlet valves, water discharge valves, and drain valves of the shore tanks designated for futures delivery ("designated futures shore tanks") as well as all bypass valves connected to the unloading pipelines, and record and submit the seal numbers to the Designated Delivery Storage Facility for signature confirmation, so as to ensure the designated shipment is fully unloaded into designated shore tanks.

(C) Upon completion of load-in, the Designated Inspection Agency shall, together with the Designated Delivery Storage Facility, verify the integrity of seals and seal numbers before unloading, and shall ensure the inlet valves to the designated futures shore tanks are closed and sealed; record and submit the seal numbers to the Designated Delivery Storage Facility for signature confirmation; and remove the seals on the bypass valves connected to the unloading pipelines.

(3) Pre-load-in shore tank inspection

(A) Measurement

(a) Ascertain the qualifications of the shore tanks designated for low sulfur fuel oil delivery set in JJG 168. Shore tanks shall be calibrated by a qualified national metrological administrative authority; the tank capacity tables shall be within the calibration validity period.

(b) Check the fullness of shore tank pipelines. The pipelines shall be fully filled, either by circulation for Designated Delivery Storage Facilities equipped with circulation facilities or by displacement of the residual oil in the vessel-to-shore

tank pipelines, to ensure accuracy in the measurement of the quantity of low sulfur fuel oil transferred.

(c) Ascertain, in accordance with GB/T 13236, that all equipment used for shore tank measurement (including thermometers and gauging tapes, etc.) is calibrated by a qualified national metrological administrative authority, within the calibration validity period, and compliant with the explosion protection policies of the Designated Delivery Storage Facility.

(d) Measure the innage or ullage, free water, oil temperature, and tank ambient temperature together with the measuring personnel of the Designated Delivery Storage Facility and the Consigner in accordance with GB/T 13894 and GB/T 8927.

(e) If oil transfer is not started within eight (8) hours following the initial measurement, re-measurement according to the foregoing method shall be conducted and the results of which shall prevail.

(f) Measurements in shore tanks that have a low level of low sulfur fuel oil shall avoid the critical zone.

(B) Sampling

(a) Sample categories

(i) Sample A1: Sample from a single ship tank or single container (multiple samples)

(ii) Sample A2: Proportional mixture of A1 (two samples)

(iii) Sample B: Sample from shore tank before load-in (three samples)

(iv) Sample C: Sample from shore tank after load-in (three samples)

(b) Ship tank sampling (Sample A1)

(i) After boarding, request from vessel charterer the materials related to the loading of low sulfur fuel oil for futures delivery, including the certificate of weight, ullage report, bill of lading, certificate of quality, vessel documentation, piping layout, vessel experience factor, and stowage plan, among others.

(ii) Request from the charterer the accompanying low sulfur fuel oil sample taken at the loading port.

(iii) Together with the charterer, take two parallel samples (1.5 L × 2 canisters)



from each ship tank carrying the low sulfur fuel oil for futures delivery in accordance with GB/T 4756, and properly seal and label the samples.

(c) Proportionally mixed samples from ship tanks (A2)

The Designated Inspection Agency shall prepare two sets (1.5 L × 2 canisters) of proportionally mixed samples based on Sample A1, and properly seal and label them.

(d) Shore tank sampling (Sample B)

Before unloading, take three parallel samples (3 L × 3 canisters) from each shore tank in accordance with GB/T 4756 and properly seal and label them. Where the innage is too low for the taking of Sample B, the Designated Inspection Agency shall note it down in the sampling report. The before-transfer density of the tank shall be the one in the latest inspection report provided by the Designated Delivery Storage Facility.

(e) The foregoing samples shall be sealed and stored at the location specified by the Designated Inspection Agency and, where needed for testing purposes, any set may be opened.

(4) Post-load-in shore tank inspection

(A) Measurement

(a) Take measurements four (4) hours after the oil surface has stabilized following unloading.

(b) Check the valve seals and residual oil in pipelines and make best effort to ensure the latter is in the same condition before and after oil transfer. If the conditions differ before and after unloading, the difference shall be accounted for in computations.

(c) Measure the innage or ullage, free water, oil temperature, and tank ambient temperature together with the measuring personnel of the Designated Delivery Storage Facility and the Consigner in accordance with the methods under Clause (2)(A)(e) of this Article 6.

(B) Sampling

(a) Shore tank sampling (Sample C)

After unloading, take three parallel samples (3 L × 3 canisters) from each shore

tank in accordance with GB/T 4756 and properly seal and label them.

(b) The foregoing samples shall be sealed and stored at the location specified by the Designated Inspection Agency and, where needed for testing purposes, any set may be opened.

Article 7 As requested by GB/T 19779, weight of low sulfur fuel oil in shore tanks shall be calculated according to the density value from laboratory testing.

Article 8 Laboratory Testing at Load-In

(1) Designated Inspection Agencies shall conduct laboratory testing on the items prescribed by the Exchange (see Appendix I), which include kinematic viscosity, density, calculated carbon aromaticity index (CCAI), sulfur content, flash point (closed cup), hydrogen sulfide, acid value, total sediment (thermal aging test), carbon residue, pour point, moisture, ash content, vanadium, sodium, aluminum + silicon, net calorific value, used lubricating oil (ULO) (calcium and zinc, calcium and phosphorus), compatibility, cleanness, styrene, and phenol.

Styrene and phenol are tested through gas chromatography-mass spectrometry (GC-MS). See Appendix III for details.

(2) Any laboratory conducting these tests shall have the certifications recognized by the China National Accreditation Service for Conformity Assessment (CNAS).

(3) All samples shall be kept for three (3) months.

(4) Sample testing procedures.

(A) Sample C passes → testing ends.

(B) Sample C fails → Sample B fails → Sample A2 passes → testing ends.

(C) Sample C fails → Sample B passes → Sample A2 fails → testing ends.

(D) Samples C fails → Sample B fails → Sample A2 fails → testing ends.

(E) Sample C fails → Sample B passes → Sample A2 passes → testing on Sample A1 for each individual item that fails the test → testing ends.

The Designated Inspection Agency shall issue an inspection report upon the end of testing.

Section 3 Load-Out Inspection

Article 9 Acceptance of Inspection Assignment by Designated Inspection



Agencies

Consigner shall entrust, in writing and 24 hours before the load-out of low sulfur fuel oil for delivery, a Designated Inspection Agency to perform the load-out inspection. For the purpose of entrustment, the Consigner shall provide the weight value that is to be cancelled from the standard warrants for low sulfur fuel oil; the Designated Delivery Storage Facility shall provide the serial number of the relevant shore tanks and other relevant materials. The Designated Inspection Agency shall maintain close contact with the Consigner and the Designated Delivery Storage Facility, stay current with the load-out status, and timely arrange for inspections.

Article 10 On-Site Load-out Inspection by Designated Inspection Agencies

(1) Unsealing and resealing

(A) The Designated Inspection Agency shall ensure all valves to any shore tank that are not designated for futures delivery are tightly closed and properly sealed.

(B) Before the load-out, the Designated Inspection Agency shall, together with the Designated Delivery Storage Facility, jointly confirm the integrity of the seals on the designated futures shore tanks secured in place after the latest load-in or load-out, and verify the seal numbers. If there are no abnormalities, the Designated Inspection Agency shall unseal the outlet valves of the storage tanks and approve the shipment, and timely reseal them following the shipment. The Exchange shall be immediately notified of any issue uncovered during the verification process.

Where the owner does not entrust any Designated Inspection Agency, the person authorized by the Designated Delivery Storage Facility to handle futures delivery shall be responsible for arranging the unsealing and resealing. Such resealing shall be completed within 24 hours of the completion of load-out.

(2) Pre-load-out shore tank inspection

(A) Measurement

(a) Ascertain the qualifications of the shore tanks designated for low sulfur fuel oil delivery set in JJG 168. Shore tanks shall be calibrated by a qualified national metrological administrative authority; the tank capacity tables shall be within the calibration validity period.

(b) Check the fullness of shore tank pipelines. The pipelines shall be fully filled to ensure accuracy in the measurement of the quantity of low sulfur fuel oil transferred. Designated Delivery Storage Facilities equipped with a circulation system shall activate it to fully fill the pipelines.

(c) Ascertain, in accordance with GB/T 13236, that all equipment used for shore tank measurement (including thermometers and gauging tapes) is calibrated by a qualified national metrological administrative authority, within the calibration validity period, and compliant with the explosion protection policies of the Designated Delivery Storage Facility.

(d) Measure the innage or ullage, free water, oil temperature, and tank ambient temperature together with the measuring personnel of the Designated Delivery Storage Facility and the Consigner in accordance with GB/T 13894 and GB/T 8927. If oil transfer is not started within eight (8) hours following the initial measurement, re-measurement according to the foregoing method shall be conducted and the results of which shall be conclusive.

(e) Measurements in shore tanks that have a low level of low sulfur fuel oil shall avoid the critical zone.

(B) Sampling

(a) Shore tank sampling

Before low sulfur fuel oil transfer, take three parallel samples (3 L × 3 canisters) from each shore tank in accordance with GB/T 4756 and properly seal and label them.

(b) The foregoing samples shall be sealed and stored at the location specified by the Designated Inspection Agency and, where needed for testing purposes, any set may be opened.

(3) Post-load-out shore tank inspection

(A) Take measurements two (2) hours after the oil surface has stabilized following the oil transfer.

(B) Check the valve seals and residual oil in pipelines and make best effort to ensure the latter is in the same condition before and after oil transfer. If the conditions differ, the difference shall be accounted for in computations.

(C) Measure the innage or ullage, free water, oil temperature, and tank ambient



temperature together with the measuring personnel of the Designated Delivery Storage Facility and the Consigner in accordance with GB/T 13894 and GB/T 8927.

(D) Measurements in shore tanks that have a low level of low sulfur fuel oil shall avoid the critical zone.

Article 11 As requested in GB/T 19779, the weight of low sulfur fuel oil in shore tanks shall be calculated according to the density value from laboratory testing.

Article 12 Laboratory Testing at Load-Out

(1) Designated Inspection Agencies shall conduct laboratory testing on the items prescribed by the Exchange (see Appendix I), which include kinematic viscosity, density, CCAI, sulfur content, flash point (closed cup), hydrogen sulfide, acid value, total sediment (thermal aging test), carbon residue, pour point, moisture, ash content, vanadium, sodium, aluminum + silicon, net calorific value, used lubricating oil (ULO) (calcium and zinc, calcium and phosphorus), compatibility, cleanness, styrene, and phenol.

Styrene and phenol are tested through gas chromatography-mass spectrometry (GC-MS), see Appendix III for details.

(2) Any laboratory conducting these tests shall have the certifications recognized by CNAS.

(3) All samples shall be kept for three (3) months.

Section 4 Pipeline Displacement

Article 13 Standards of Pipeline Displacement

(1) The pipeline displacement volume shall be based on the design capacity of the unloading pipeline between the vessel and the shore tanks as declared by the Designated Delivery Storage Facility, the volume shall be confirmed by the Designated Delivery Storage Facility and the Consigner with their signatures.

(2) To ensure measurement accuracy, the Designated Inspection Agency shall select no more than two (2) ship tanks that contain little or no free water for pipeline displacement, the selection of which selection shall be confirmed by the Designated Delivery Storage Facility and the Consigner with their signatures.

(3) The liquid level of the spot shore tanks for pipeline displacement shall avoid the critical zone.

(4) Any low sulfur fuel oil for futures delivery within the ship-to-shore tank pipelines shall be fully displaced into the designated futures shore tanks upon completion of unloading. The volume of low sulfur fuel oil loaded into such tanks shall be identical to the volume displaced through the pipelines since the start of unloading. Where discrepancy exists between the volume delivered from the ship and the volume received by the shore tanks, the latter shall be conclusive.

Article 14 Procedures for Displacing Residual Oil in Ship-to-Shore Tank Pipelines

(1) At the start of unloading, the residual oil within the ship-to-shore tank pipelines shall be displaced into spot shore tanks with the low sulfur fuel oil in designated ship tanks intended for futures delivery. The Designated Inspection Agency shall measure the liquid volume in the designated ship tanks and in the spot shore tanks both before and after pipeline displacement. The volume delivered from the designated ship tanks shall be applied in settlement.

(2) Upon completion of unloading, the low sulfur fuel oil for futures delivery within the ship-to-shore tank pipelines shall be displaced into designated futures shore tanks with the low sulfur fuel oil in spot shore tanks or in the designated ship tanks for the next shipment. The Designated Inspection Agency shall measure the liquid volume in the spot shore tanks or designated ship tanks and in the designated futures shore tanks both before and after the said displacement. The volume received by the designated futures shore tanks shall be applied in settlement. The details of this process are as follows:

(A) If the Designated Delivery Storage Facility is equipped with a circulation system, the displacement shall be conducted using the spot low sulfur fuel oil in spot shore tanks.

(B) If not, the displacement shall be conducted using the low sulfur fuel oil in the designated ship tanks for the next shipment.

Article 15 Any Designated Inspection Agency entrusted to oversee pipeline displacement shall measure the shore tanks and designated ship tanks involved in the displacement and issue a pipeline displacement report.

Section 5 Inspection Report

Article 16 The results from any on-site load-in or load-out inspection shall be confirmed by the Consigner, the Designated Delivery Storage Facility, and the Designated Inspection Agency with signature. The Designated Inspection



Agency shall issue the inspection report within two (2) days following the joint confirmation.

Rounding in calculations shall be governed by applicable standards and methods.

Article 17 An inspection report shall comprise a quality pre-check certificate, certificate of weight, shore tank measurement report, certificate of quality, sampling report, and pipeline displacement report (if necessary), among others. The unit of weight is either metric tons or kilograms.

Article 18 Designated Inspection Agencies shall issue the inspection report in both Chinese and English in accordance with the requirements of Consigners (see Appendix II for template). The report number shall be unique.

Chapter 3 Miscellaneous

Article 19 For the purpose of these Rules, “low sulfur fuel oil” means low sulfur marine fuel oil that meets the corresponding quality standards set by the Exchange. “Low sulfur marine fuel oil” refers to homogeneous hydrocarbon mixtures extracted from petroleum, with certain amount of additives permitted for performance and characteristics gains. Low sulfur marine fuel oils shall not contain any inorganic acid and used lubricating oil, any substance that may cause abnormal operations of ships, nor any artificially added additive or chemical waste that may endanger ship safety, adversely affect machine’s performance, or be harmful to health or increase air pollutions.

Any matter not covered by these Rules shall be governed by the Articles of Association, the General Exchange Rules, and other implementing rules of the Exchange.

Article 20 The Designated Inspection Agencies of the Exchange (jointly) reserve the right to interpret these Rules.

Article 21 These Rules shall come into effect as of September 18, 2020 after being filed with the Exchange.

Appendix I

INE Low Sulfur Fuel Oil (Futures) Quality Standards

Properties	Specifications	Test Method
Kinematic viscosity (50 °C, mm ² /s)	380.0 max 100.0 min	ASTM D445
Density (15 °C, kg/m ³)	991.0 max 930.0 min	ASTM D1298
Calculated Carbon Aromaticity Index (CCAI)	870 max	ISO 8217:2017(E)
Sulfur content (m/m, %)	0.50 max	ASTM D4294
Flash point (closed cup) (°C)	60.0 min	ASTM D93
Hydrogen sulfide (mg/kg)	2.00 max	IP 570
Acid value (mg KOH/g)	2.5 max	ASTM D664
Total sediment (thermal aging test) (m/m, %)	0.10 max	ASTM D4870
Carbon residue (m/m, %)	18.00 max	ASTM D4530
Pour point (°C)	30 max	ASTM D97
Moisture (V/V, %)	0.50 max	ASTM D95
Ash content (m/m, %)	0.100 max	ASTM D482
Vanadium (mg/kg)	350 max	IP 501
Sodium (mg/kg)	100 max	IP 501
Aluminum + Silicon (mg/kg)	60 max	IP 501
Net calorific value (cal/g)	9,500 min	ASTM D240
Used lubricating oil (ULO) (mg/kg) Calcium and Zinc Calcium and phosphorus	Fuel oil should be free of ULO, which is deemed to be present if any of the following conditions is met: Ca > 30 and Zn > 15 or Ca > 30 and P > 15	IP501
Compatibility (level)	No higher than spot No. 2	ASTM D4740
Cleanness (level)	No higher than spot No. 2	
Styrene (mg/kg)	20 max	GB/T 6041
Phenol (mg/kg)	10 max	



Appendix II

Quality Pre-Check Report (Bilingual)

No.:

Date:

Low Sulfur Fuel Oil (Futures) Inspection Quality Pre-Check Certificate (Low Sulfur Fuel Oil Load-In)

Applicant: XXXX

Declared product: XXXX low sulfur fuel oil

Declared weight: XXXX metric tons

Approval notice No.: XXXX

Designated Delivery Storage Facility: XXXX

Sample source: Tank XX; ship xx, ship tank XX

Sample category: Sample C, tank XX; or Sample A2, ship xx, ship tank XX

Sampling date: YYYY/MM/DD - DD

Laboratory:

Testing results:

Our inspectors took representative samples in accordance with GB/T 4756, with the following testing results:

Properties	Unit	Standard	Result	Test Method
Density (15 °C)	kg/m ³	991.0 max 930.0 min	XXX.X	ASTM D1298
Kinematic viscosity (50 °C)	mm ² /s	380.0 max 100.0 min	XXX.X	ASTM D445
Sulfur content	% (m/m)	0.50 max	To 3 significant figures	ASTM D4294
Moisture	% (v/v)	0.50 max	X.X5	ASTM D95
Flash point (closed cup)	°C	60.0 min	XX.5	ASTM D93
Compatibility	Level	No higher than spot No. 2	X	ASTM D4740

Conclusion:

Our testing shows that the above low sulfur fuel oil product meets the quality requirements for the load-in pre-check as specified in the standard low sulfur fuel oil futures contract of Shanghai International Energy Exchange.

Note: This Certificate is issued in one original and three duplicates

*** End ***

Inspection Report

No.:

Date:

Low Sulfur Fuel Oil (Futures) Inspection

Certificate of Weight

(Low Sulfur Fuel Oil Load-In / Load-Out)

Applicant: XXXX

Declared product: XXXX low sulfur fuel oil

Declared weight: XXXX metric tons

Approval notice No.: XXXX

Designated Delivery Storage Facility: XXXX

Delivery tank No.: Tank XX; Tank XX

Load-in / Load-out method: Unload from XX to storage facility XX / From storage facility XX to XX

Inspection time: YYYY/MM/DD - DD

Inspection standard: Low Sulfur Fuel Oil (Futures) Inspection Rules (Trial)

Inspection results:

Based on measurements of ullage, free water, and oil temperature taken before and after load-out/load-in at the above shore tanks, the measurement tables provided by the shore tank operator, and appropriate corrections for density, our inspectors have calculated the load-in/load-out quantity for the abovementioned low sulfur fuel oil to be XXXX.XXX metric tons, or XXXX.0 kilograms. Details are as follows: Tank XX, load-in/load-out quantity of XXXX.XXX metric tons (XXXX.0 kg), (in)compliant with quality requirements; Tank XX, load-in/load-out quantity of XXXX.XXX metric tons (XXXX.0 kg), (in)compliant with quality requirements; Total compliant quality: XXXX.XXX metric tons (XXXX.0 kg).

Note: This Certificate is issued in one original and three duplicates

Signature and seal of the Designated Inspection Agency:

*** End ***



No.:

Date:

**Low Sulfur Fuel Oil (Futures) Inspection
Shore Tank Measurement Report**

Designated Delivery Storage Facility		Declared product	
Ship		Inspection date	YYYY/MM/DD - DD

Parameter	Tank No.:		Tank No.:	
	Before	After	Before	After
Date and time	XXXX-XX-XX XX:XX			
Liquid level (m)	.XXX			
Free water level (m)	.XXX			
Oil temperature (°C)	.X5			
Total measured height (m)	.XXX			
Total observed volume (m ³)	.XXX			
Pipeline volume (m ³)	.XXX			
Free water volume (m ³)	.XXX			
CTE	.XXXXX			
Floating roof adjustment (m ³)	.XXX			
Gross observed volume (m ³)	.XXX			
VCF (T 60B)	.XXXX			
GSV (m ³ @ 20 °C)	.XXX			
Density (kg/m ³ @ 20 °C)	.X			
Gross fuel quantity (kg)	.0			
Gross fuel quantity (metric ton)	.XXX			

Low Sulfur Fuel Oil Transfer Quantity

Tank No.		
Gross fuel quantity (kg)	.0	
Gross fuel quantity (m/t)	.XXX	

The above density value is based on testing by *** laboratory

*** End ***

No.:

Date:

**Low Sulfur Fuel Oil (Futures) Inspection
Certificate of Quality**

(Low Sulfur Fuel Oil Load-In / Load-Out)

Applicant: XXXX

Declared product: XXXX low sulfur fuel oil Declared weight: XXXX metric tons

Approval notice No.: XXXX

Designated Delivery Storage Facility: XXXX

Sample source: Tank XX; Tank XX Sampling date: YYYY/MM/DD - DD

Sample category: Sample C or Sample B, tank XX

Laboratory:

Testing results:

Our inspectors took representative samples in accordance with GB/T 4756, with the following testing results:

Properties	Unit	Specifications	Result	Test Method
Kinematic viscosity (50 °C)	mm ² /s	380.0 max 100.0 min	XXX.X	ASTM D445
Density (15 °C)	kg/m ³	991.0 max 930.0 min	XXX.X	ASTM D1298
CCAI		870 max	3 sig. figures	ISO 8217:2017(E)
Sulfur content	% (m/m)	0.50 max	3 sig. figures	ASTM D4294
Flash point (closed cup)	°C	60.0 min	XX.5	ASTM D93
Hydrogen sulfide	mg/kg	2.00 max	X.XX	IP 570
Acid value	mgKOH/g	2.5 max	X.XX	ASTM D664
Total sediment (thermal aging test)	% (m/m)	0.10 max	X.XX	ASTM D4870
Carbon residue	% (m/m)	18.00 max	3 sig. figures	ASTM D4530
Pour point	°C	30 max	Integer	ASTM D97
Moisture	% (v/v)	0.50 max	X.X5	ASTM D95
Ash content	% (m/m)	0.100 max	X.XXX	ASTM D482
Vanadium	mg/kg	350 max	Integer	IP 501
Sodium	mg/kg	100 max	Integer	IP 501
Aluminum + Silicon	mg/kg	60 max	Integer	IP 501
Net calorific value	cal/g	9,500 min	Integer	ASTM D240



ULO Calcium and Zinc Calcium and phosphorus	mg/kg	Fuel oil should be free of ULO, which is deemed to be present if any of the following conditions is met: Ca > 30 and Zn > 15 or Ca > 30 and P > 15	Integer	IP501
Compatibility	Level	No higher than spot No. 2	X	ASTM D4740
Cleanness	Level	No higher than spot No. 2	X	ASTM D4740
Styrene	mg/kg	20 max	Integer	GB/T 6041
Phenol	mg/kg	10 max	Integer	GB/T 6041

Conclusion:

Our testing shows that the above low sulfur fuel oil product meets the quality requirements as specified in the standard low sulfur fuel oil futures contract of Shanghai International Energy Exchange.

Note: This Certificate is issued in one original and three duplicates

*** End ***

No.:

Date:

**Low Sulfur Fuel Oil (Futures) Inspection
Sampling Report**

Designated Delivery Storage Facility		Declared product	
Ship		Inspection date	
Sampling agency		Sampling inspector	

Category	Source	Quantity	Use	Type	Sampling Time	Seal Number
C	Shore tank XX	1 × 3 L	Lab analysis	Mixture		X
C	Shore tank XX	2 × 3 L	Seal and store	Mixture		X/X
B	Shore tank XX	1 × 3 L	Lab analysis	Mixture		X
B	Shore tank XX	2 × 3 L	Seal and store	Mixture		X/X
A1	Ship tank #1	2 × 1.5 L	Seal and store	Mixture		X/X
A1	Ship tank #2	2 × 1.5 L	Seal and store	Mixture		X/X
A1	...	2 × 1.5 L	Seal and store	Mixture		X/X

Note: Samples should be kept for three months. In the event of a dispute extending beyond the three-month period, the samples should be kept until the dispute is resolved.

* * * End * * *



No.:

Date:

**Low Sulfur Fuel Oil (Futures) Inspection
Pipeline Displacement Report**

Designated Delivery Storage Facility		Declared product	
Ship		Inspection date	YYYY/MM/DD - DD

Parameter	Delivering Ship Tank No.				Receiving Shore Tank No.			
	XX		XX		XX		XX	
	Before	After	Before	After	Before	After	Before	After
Date and time								
Liquid level (m)	.XXX							
Free water level (m)	.XXX							
Oil temperature (°C)	.X5							
Total measured height (m)	.XXX							
Total observed volume (m ³)	.XXX							
Pipeline volume (m ³)	.XXX							
Free water volume (m ³)	.XXX							
Floating roof adjustment (m ³)	.XXX							
Gross observed volume (m ³)	.XXX							
VCF (T 60B)	.XXXX							
GSV (m ³ @ 20 °C)	.XXX							
Density (kg/m ³ @ 20 °C)	.X							

Delivered / Received Low Sulfur Fuel Oil Volume

Ship tank No. / Shore tank No.	XX	XX
TOV (m ³ @ observed temp.)	.XXX	.XXX
GSV (m ³ @ 20 °C)	.XXX	.XXX

Notes:

1. "Liquid level" for "Delivering Ship Tank No." column refers to the ullage of the tank.
2. The design capacity of pipelines as declared by the Designated Delivery Storage Facility is _____ m³.

*** End ***

Appendix III

Gas Chromatography and Mass Spectrometry Testing of Styrene and Phenol in Low Sulfur Fuel Oil

1. Scope

The gas chromatography and mass spectrometry (GC-MS) method is applicable to the testing of the amount of styrene and phenol in low sulfur fuel oil.

Low sulfur fuel oil to be tested shall be homogenous and without stratification and sediment.

2. Normative Reference Document

GB/T 6041 – General Rules for Mass Spectrometric Analysis

3. Terms and Definition

No.	CAS Registry Number	English Name	Chinese Name	Limit (mg/kg)
1	100-42-5	Styrene	benyixi	≤ 20
2	108-95-2	Phenol	benfen	≤ 10

4. Summary

Dissolve the sample in a toluene-ethanol mixture (4:1 by volume), filter it through an organic membrane, and perform a GC-MS analysis. Conduct a qualitative identification of styrene and phenol based on a total ion chromatogram (TIC) and gas spectrum (GS), and quantitative calculation through selected ion monitoring (SIM).

5. Application

Styrene and phenol have significant adverse effects on the quality of marine low sulfur fuel oil, including coking, erosion, stratification, and thus affect its normal use. GC-MS analysis is an accurate and efficient method to determine the amount of styrene and phenol in marine low sulfur fuel oil.

6. Interference

The characteristic ions of styrene are detected at m/z 104, which is shared by some hydrocarbons in low sulfur fuel oil. Therefore, quantitative calculation should be made in view of the chromatographic retention time and reference mass spectrum of standard styrene, so as to ensure that ions at m/z 104 are produced by styrene, not hydrocarbons.

7. Reagents and materials

Unless otherwise specified, all reagents used in this method should be chromatographically pure.



- 7.1 Toluene
- 7.2 Ethanol
- 7.3 Styrene
- 7.4 Phenol
- 7.5 Carrier gas: helium, 99.999% pure or higher.
- 7.6 Volumetric flasks: 20 mL, 50 mL.
- 7.7 Standard stock solution: Weigh and mix an appropriate amount of standard styrene and phenol in a 50 mL volumetric flask, add the toluene-ethanol mixture (4:1 by volume) into the flask to prepare standard stock solution with a concentration of 50 mg/mL.

Note: The standard stock solution is preferably kept in a refrigerator (0-4 °C) for use within six months.

- 7.8 Standard testing solution: prepare standard testing solution with a concentration of 10 mg/L to 100 mg/L as needed through stepwise dilution with the 4:1 toluene-ethanol mixture.

Note: standard testing solution is preferably kept in a refrigerator (0-4 °C) for use within three months.

- 7.9 Organic filter membrane: PTFE, with a pore size of 0.45 μm.

8. Instruments and Equipment

- 8.1 GC-MS instrument with EI ion source.
- 8.2 Balance with a resolution of 0.1 mg.

9. Analytical Procedures

- 9.1 Sample preparation

Weigh a 2 g sample of low sulfur fuel oil to the nearest 0.1 mg, fully mix and dissolve the sample in the 4:1 toluene-ethanol mixture to a volume of 20 mL, filter the solution through a 0.45 μm organic membrane to produce a sample solution, then perform a GC-MS analysis.

- 9.2 Blank test

Process reagents to be used in the test according to 9.1, then perform a GC-MS analysis.

- 9.3 Determination

- 9.3.1 Specifications for GC-MS instrument

Because GC-MS instruments vary in their specifications, no universal values can be given. Nonetheless, the specifications of an instrument should ensure that during the GC-MS testing, the components under testing can be readily distinguished from the other components (mainly hydrocarbons). The specifications listed below are for reference.

Volume injection	1.0 μ L
Chromatography column	Restek DHA-50, 50 m \times 200 μ m \times 0.5 μ m or high-temperature-resistant, non-polar chromatography columns with comparable specifications
Column heating process	Hold at an initial temperature of 50 $^{\circ}$ C for 1 minute, heat the column to 100 $^{\circ}$ C at 20 $^{\circ}$ C/min and hold for 5 minutes, then heat to 300 $^{\circ}$ C at 20 $^{\circ}$ C/min and hold for 10 minutes
Column flow (constant flow)	2 mL/min
Injection port	Split-flow mode, 10:1 split ratio, 300 $^{\circ}$ C
Transmission line temperature	300 $^{\circ}$ C
Type of ion source	Electron ionization (EI)
MS tune method	Automatic tune
MS scan mode	Scan, selected ion monitoring (SIM)
MS scan range	50-700
Characteristic ion	Styrene: m/z 104 phenol: m/z 94
Time of operation	28.5 min

9.3.2 Qualitative analysis

First, determine the retention time for styrene and phenol in the standard stock solution with GC-MS, then test the sample solution with the GC-MS instrument under the same settings and conditions. If a chromatographic peak is detected within the retention time and the corresponding fragmentation spectrum is identical to the standard fragmentation spectra of styrene and phenol, then the sample is deemed to contain styrene and phenol.

9.3.3 Quantitative analysis

Test the standard testing solutions (as described in 7.8) of at least five different concentrations, then make a standard plot of peak area versus concentration. A sample solution with a concentration beyond the linear range should be diluted before testing.

This method uses external standard quantification for styrene and phenol through integration of the peak area of characteristics ions according to 9.3.1.

10. Formula

Read the peak area of the characteristic ions of styrene and phenol in the sample solution, identify the concentrations of styrene and phenol C_i based on the standard plot, and calculate the amount of styrene and phenol according to equation (1).

$$X_0 = \frac{V \times C_i}{m}$$



where:

X_0 is the amount (mg/kg) of styrene or phenol in the sample;

C_1 is the concentration (mg/L) of styrene or phenol in the sample solution;

V is the standard volume (mL) of the sample;

m is the mass (g) of the sample.

The result should be rounded to three significant figures.

11. Quantitative Limit, Recovery Rate, and Precision

11.1 Quantitative limit

The quantitative limits for styrene and phenol are both 10 mg/kg.

11.2 Recovery rate

Add a certain amount of standard solution of known concentration to the sample, and analyze the recovery rate according to the steps under section 9. The recovery rate should be between 90% and 110%.

11.3 Precision

The absolute difference between two independent measurements conducted under repeatability conditions should not exceed 10% of the average value.

12. Testing report

The testing report should at least include:

- a. Source and description of the sample;
- b. Testing result: average value of the parallel samples;
- c. Abnormalities observed during the testing; and
- d. Testing date.

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