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Base Oils Methodology

The main use for base oils is in the manufacture of lubricants, of which there are many thousands of types. The best-known are automotive lubricants, but there are many more applications in which lubricants are used, some of which are highly specialised. One litre of lubricants is composed of anywhere between 50% and 90% base oil, the rest being made up of additives.

The traditional method of producing base oils is to feed straight-run fuel oil into a Vacuum Distillation column, the output of which can either go into fuels processing or be fed into a solvent extraction plant. The fluid is further treated to remove unwanted properties such as wax, sulphur, and aromatics.

Unlike most other oil and chemical products, there is no industry standard for base oils. Most refineries manufacture different quality base oils. In automotive usage, viscosity index, pourpoint, oxidation stability and volatility are important, but there are other important criteria for measuring base oils in industrial applications for example.

ICIS pricing quotes Base Oil prices in **Europe, Asia-Pacific**, the **Middle East** and the **USA**.
Prices relate to paraffinic base oils in all areas, except in the US where both paraffinic and naphthenic base oils prices are quoted.

Frequency:
The European and US reports are published weekly on Tuesdays, the Middle East report on Thursdays and the Asia Pacific report on Fridays. A daily is also published in Asia.

Base Oils (EUROPE)

Weekly Price Assessments:

SN 150 Spot Prices

- FOB NWE DOMESTIC (USD/MT)
- FCA NWE DOMESTIC TRUCKS (EUR/MT)
- FOB EUROPE EXPORT (USD/MT)
- FOB BALTIC SEA EXPORT (USD/MT)
- FOB BLACK SEA EXPORT (USD/MT)

SN 500 Spot Prices

- FOB NWE DOMESTIC (USD/MT)
- FCA NWE DOMESTIC TRUCKS (EUR/MT)
- FOB EUROPE EXPORT (USD/MT)
- FOB BALTIC SEA EXPORT (USD/MT)
- FOB BLACK SEA EXPORT (USD/MT)

SN 900 Spot Prices

- FOB BALTIC SEA (USD/MT)

Brightstock Spot Prices

- FOB NWE DOMESTIC (USD/MT)
- FCA NWE DOMESTIC TRUCKS (EUR/MT)
- FOB EUROPE EXPORT (USD/MT)

Group III Spot Prices

- 4cSt FCA ARA TRUCKS (EUR/MT)
- 6cSt FCA ARA TRUCKS (EUR/MT)

Low Sulphur Vacuum Gasoil (VGO)

- FOB ROTTERDAM (USD/MT)

High Sulphur Vacuum Gasoil (VGO)

- FOB ROTTERDAM (USD/MT)

3.5% Fuel Oil

- FOB ROTTERDAM (USD/MT)

<u>Base Oils (ASIA-PACIFIC)</u>
Weekly Price Assessments:

GROUP I BASE OILS

SN 150 Spot Prices

- EX-TANK SINGAPORE (USD/MT)
- FOB ASIA EXPORT (USD/MT)
- CFR INDIA (USD/MT)
- CFR NORTH EAST ASIA (USD/MT)

SN 500 Spot Prices

- EX-TANK SINGAPORE (USD/MT)
- FOB ASIA EXPORT (USD/MT)
- CFR INDIA (USD/MT)
- CFR NORTH EAST ASIA (USD/MT)

Brightstock Spot Prices

- EX-TANK SINGAPORE (USD/MT)
- FOB ASIA EXPORT (USD/MT)
- CFR INDIA (USD/MT)
- CFR NORTH EAST ASIA (USD/MT)

GROUP II BASE OILS

150 Neutral Spot Prices

- FOB NORTH EAST ASIA (USD/MT)
- CFR NORTH EAST ASIA (USD/MT)
- CFR INDIA (USD/MT)

500 Neutral Spot Prices

- FOB NORTH EAST ASIA (USD/MT)
- CFR NORTH EAST ASIA (USD/MT)
- CFR INDIA (USD/MT)

GROUP III BASE OILS

4cSt Spot Prices

- FOB Asia (USD/MT)
- CFR NORTH EAST ASIA (USD/MT)

6cSt Spot Prices

- FOB Asia (USD/MT)
- CFR NORTH EAST ASIA (USD/MT)

8cSt Spot Prices

- FOB Asia (USD/MT)
- CFR NORTH EAST ASIA (USD/MT)

RELATED OIL PRODUCT PRICES

3.5% Fuel Oil

- FOB Singapore (USD/MT)

0.05% Gas Oil

- FOB Singapore (USD/MT)

Base Oils (USA)

Weekly Price Assessments

Paraffinic Posted Prices: ICIS pricing reports all major refiners (ExxonMobil; Holly; Paulsboro Refining Company (PRC); Calumet; Chevron; SK Lubricants; PHILLIPS 66; Motiva) posted base oils prices issued for the US as well as prices for the major Venezuelan producer - PDVSA. FOB locations vary from producer to producer, but this is noted on each report. Prices are recorded in USD/gal. Effective dates of posted prices are also reported. Price categories are broken down into Group I, Group II, Group II+, Group III and Group III+. Posted Prices are provided to ICIS pricing by each producer, with the exception of ExxonMobil. This information is obtained through industry sources.

Spot Market Prices (Paraffinic): Prices are reported on in USD/gal and on an FOB/USGC basis for Neutrals 100; 150; 200-250; 300-350; 500-550; 600-650 and Bright Stock. Prices are reported on in USD/gal and on a FOB Brownsville, Texas, basis for Neutral Bright Stock.

Spot Market Prices (Naphthenic): Prices are reported in USD/gal and on an FOB/Plant basis for Pale Oils 60, 100, 150, 200, 300, 500, 750, 1200, 2000, 2400. PDVSA publishes posted prices.

Feedstock Prices: Vacuum Gasoil (VGO) is used as a key feedstock indicator for the Base Oils market. VGO assessments are spot prices for cargoes of Low Sulphur (max 0.5% sulphur) and High Sulphur (max 1.6% Sulphur material).

Base Oils (Middle East)
Weekly Price Assessments
SN 150 Spot Prices

- CFR UAE (USD/MT)

SN 500 Spot Prices

- CFR UAE (USD/MT)

Iran List Prices
Sepahan Oil
SN 500

- FOB Iran (USD/MT)
- CFR UAE (USD/MT)

Base Oils (Africa)
Weekly Price Assessments
SN 150 Spot Prices

- EX-TANK DURBAN (ZAR/KG)
- FD MOROCCO (USD/MT)
- FD EGYPT (USD/MT)

SN 500 Spot Prices

- EX-TANK DURBAN (ZAR/KG)
- FD MOROCCO (USD/MT)
- FD EGYPT (USD/MT)

Brightstock Spot Prices

- EX-TANK DURBAN (ZAR/KG)
- FD MOROCCO (USD/MT)
- FD EGYPT (USD/MT)

General Information:

Assessment window: Price assessments are based on information supplied by market participants in the week up to close of business on Tuesdays at 1700 hours in London and Houston. For the Asia-Pacific report, price assessments are based on information gathered in the week up to Fridays at 1700 hours in Singapore. For the Middle East report, price assessments are based on information gathered in the week up to Thursdays at 1400 hours in Dubai, or 1800 hours in Singapore. For the Africa Report, price assessments are based on information gathered in the week up to close of business on Wednesdays at 1800 hours in London. All prices are determined following verification from major buyers and sellers, incorporating discussions and confirmation of actual done deals.

In the absence of confirmed deals, ICIS may move spot prices based on "best" bids, offers and market fundamentals especially when supply-demand dynamics are

moving quickly. ICIS will adopt a conservative view when adjusting assessments in the absence of confirmed deals.

Significant developments in feedstock markets or in the downstream finished lubricant sector will also be taken into account during price assessment, used to determine price direction if not necessarily a particular price point.

For example, if upstream vacuum gasoil (VGO) and crude oil prices are falling at a time when finished lubricant demand is low as illustrated by industry data, ICIS editors may move base oils prices down to reflect lower buying interest and these upstream/downstream market dynamics, in the absence of confirmed trades. This reduction may occur despite producers' offers remaining steady. The opposite will also apply in a rising market, despite bids remaining steady. These moves are to be made at the editor's discretion and will only be used in a conservative manner.

Timing (Asia): Cargoes loading two-four weeks forward or delivered two-six weeks forward from the date of publication will be considered for assessment. US cargoes to India and China take about 35-45 days and this window will be considered for assessment purposes. In Europe, all assessments are for cargoes loading within four weeks. Spot truck volumes within the Amsterdam-Rotterdam-Antwerp (ARA) region are typically delivered within four weeks.

Assessment basis: European domestic Group I (500 tonnes +) quotations refer to a 95 viscosity index (VI) minimum specification base oil manufactured by a northwest European refiner. FOB prices refer to no particular installation, jetty or load port. Prices quoted are for minimum cargoes of 500 tonnes, most commonly moved by barge. Monthly and official list prices announced by major suppliers will be included, provided they are not considered exceptional to the rest of the market any given week. Typically, these listed prices populate the upper ends of the ranges published, when included. Smaller volumes will attract a premium to the range.

European domestic Group I truck price quotations are wider in terms of specifications than the above as they include some of the higher quality base oils imported into northwest Europe from other parts of Europe, Russia and the NIS. The minimum VI considered for each are as follows: SN150 (95 VI); SN500 (90 VI); brightstock (90 VI). Base oils with a VI below these levels, which may attract a significant price discount, will be excluded in order not to skew the published price ranges. These assessments cover volumes of up to 499 tonnes, commonly moved by truck by suppliers, traders and distributors. Trucks are normally around 23 tonnes each.

European Group III base oil prices are assessed for individual truck loads of 4cSt and 6cSt material, typically around 23 tonnes. The product is commonly made available from storage within the ARA region and sold on an FCA basis.

European Export quotations encompass all west European and European Mediterranean Sea refiners. Prices are quoted on an FOB Europe basis, and do not refer to any particular load port. Prices quoted are for cargo quantities of a minimum 1,000 tonnes and the typical minimum VI is 95.

Russia & New NIS (New Independent States) export quotations refer to typical specifications as manufactured by refiners in this region, including those base oils with VIs below 90. Prices are quoted FOB Baltic Sea and FOB Black Sea, and do not refer to any particular load port. Prices quoted are for cargo quantities of a minimum 1,000 tonnes. In normal market conditions, base oils with higher VIs populate the upper ends of the ranges published.

In Asia, Group I quotations on a FOB Asia, CFR NE Asia and ex-tank Singapore basis are based on a minimum VI of 95 while CFR India Group I quotations refer to a minimum VI of 85.

Ex-tank Singapore prices represent sales on an ex-tank basis from secondary storage in Singapore to local blenders. Exxon Mobil's prices to its term customers are often taken into account in the assessment process as its prices function as a benchmark for both ex-tank Singapore and FOB Asia export sales. The ex-tank Singapore numbers also function as a benchmark for export sales in other Southeast Asian countries, because Singapore is a major base oil production base and exporter in the region.

In the ex-tank Singapore spot market, the traded cargo sizes are typically 500 tonnes to 1,000 tonnes, but when demand is seasonally weak, the typical traded cargo size is 300 tonnes.

In the absence of transactions e.g. in an inactive week, the highest bid and lowest offer will be used to derive the price range in accordance with market fundamentals. Transactions that are non-repeatable will not be included.

Small cargoes of 299 tonnes and below also take place in the Singapore ex-tank market. Such trades are reported only in the text of the report and not included as part of the assessment.

FOB Asia (export) prices represent sales of material from Asia. Singapore, Indonesia, Thailand, Taiwan, Japan, China, India and Pakistan supply Group I base oils. The Group III base oil production centres are in South Korea, Indonesia and Malaysia. Prices quoted are for cargo quantities of a minimum 1,000 tonnes.

CFR India numbers are assessed prices of imports of base oils into India from producers in Europe, the US, the Middle East and Asia. Prices quoted are for cargo quantities of a minimum 1,000 tonnes.

Group II CFR India quotes cover the cargoes coming in mostly from South Korea to India. Sometimes Group II cargoes are also sold from the US into India. Group I prices reflect mainly supplies from Iran. Prices quoted are for cargo quantities of a minimum 1,000 tonnes.

CFR North East Asia prices capture spot deals into China, Taiwan, South Korea and Japan. China and Taiwan import Group I and II base oils regularly. South Korea buys Group I base oils from time to time, while Japan imports small quantities of Group II base oils. Prices quoted are for cargo quantities of a minimum 1,000 tonnes.

Group I spot supply to the northeast Asian markets comes mainly from Singapore, Thailand, Indonesia, Taiwan and Japan. Europe exports Group I base oils to northeast Asia when the west-east arbitrage economics are favourable. Spot cargoes for Group II base oils to northeast Asia are mainly from South Korea and Taiwan.

Much of the day-to-day activity taking place in the US market is done on a contract basis, using posted prices as a key factor in a number of formulas (privy to supplier/consumer only).

Europe feedstock prices are given as a reference point only. Both high and low sulphur VGO prices are quoted on a USD/tonne FOB Rotterdam basis. Low sulphur VGO has a maximum sulphur content of 0.5%, while high sulphur material has a maximum of 1.6%. 3.5% fuel oil prices are quoted in USD/tonne basis FOB Rotterdam.

The latest FOB Singapore spot assessments for 3.5% fuel oil and 0.05% sulphur gas oil from ICIS-C1 are included in the Asia base oil report.

CFR UAE quotations for SN 150 and SN 500 reflect mainly prices of base oil spot supply from Iran. The UAE also imports similar grades from Europe, and Russia & New NIS on a spot basis when arbitrage economics are favourable, and such deals will be reflected in the weekly price assessment. Saudi Arabia is also a regular supplier to the UAE, although most deals are done on a term basis. India and Pakistan also supply Group I base oils from time to time.

ICIS CFR UAE pricing considers SN 150 and SN 500 bulk cargoes that are at least 2,000 tonnes in size. ICIS takes into account Iranian SN 150 and SN 500 imports that typically have a minimum VI of around 90. ICIS also takes into consideration Russian supplies that commonly have a VI of less than 95, and product from Europe and Saudi Arabia that have a VI of at least 95. The SN 500 list prices of Iranian producer Sepahan Oil are posted in the weekly report for pricing reference.

Russian and European imports into the UAE are usually sold on LC 30-60 days basis or open credit terms of 30-60 days. The payment for Iranian cargoes typically involves full or partial cash in advance.

FD Morocco and FD Egypt prices are based on trades within the relevant local market and include cost of delivery. Specification guidelines are equivalent to those of **European Export** quotations and also include locally produced material. Numbers are based on absolute prices or are calculated as ICIS Europe Export low, average or high plus a premium.

Ex Tank Durban prices are based on sales from storage facilities in Durban and include locally produced material as well as imported material. Buyers may be either in South Africa or neighbouring states and the price does not include delivery costs. Product specifications are equivalent to those in the domestic European market.

Shipping: A section on the transportation of Base Oils in bulk is included. The information contained has been obtained from the ICIS pricing Chemical Tanker Shipping reports and also directly from shipping sources. In the shipping market, the general term for base oils is "lubes", which is not a reference to finished lubricants.

Shipping fixtures refer to cargoes that have been chartered on a vessel. The fixtures are anonymous, i.e. the charterer's name is withheld. A fixture details the vessel name, cargo size, number of grades (if known), load port and discharge port, loading dates and freight rate, if available.

Shipping enquiries refer to cargo enquiries that have been circulated in the shipping market. They are in the same format as the fixtures.

17 February 2014