WORK INSTRUCTION WI 18 – TANK PREPARATIONS & QUALITY GUIDELINES

1. SCOPE & CONTROLS

1.1 Scope of Work Instruction

This WI is a guide to the preparation of cargo tanks for the carriage of petroleum products on ***Company Vessels only***. BP Masters should take into consideration their own vessel's tank configurations and any local requirement, which may require a departure from this guide necessary to ensure that cargo tanks are properly prepared for the carriage of the nominated cargo. If a departure is required, the Master must request permission from the Company.

1.2 Responsibility

The responsibility for the suitability of cargo tanks to carry the nominated grades lies with the Master. The Chief Officer (C/O) is responsible to the Master for the efficient tank-cleaning, gas-freeing and tank preparation operations.

A written plan for every ballast and tank cleaning operation (including stress and trim calculations) shall be drawn up by the C/O in advance and approved by the Master. The C/O shall provide unambiguous written instructions prior to any cargo, ballast, tank cleaning or gas freeing operation. Every Officer-of-the-Watch (OOW) shall read and then sign these instructions as understood prior to conducting a cargo watch, and shall be responsible for ensuring that the instructions are complied with.

Logs of all tank preparation operations shall be maintained and retained in accordance with the matrix in Appendix A in *WI 03*.

1.3 Safety Precautions

This Work Instruction should be read in conjunction with the guidance given in ISGOTT. The Master and deck officers shall ensure that all procedures and precautions contained within the following publications are adhered to:

a) WI 24 – Occupational Health and Safety
b) WI 14 – Inert Gas System
c) ISGOTT
d) MARPOL
e) Cargo Operations Manual
f) I.G. Manual
g) Relevant Check Lists

1.4 Use of Inert Gas

The inert gas system must be properly operated during tank washing, gas-freeing and tank preparation operations (WI 14 & ISGOTT).

Prior to the commencement of tank washing, and every 60 minutes thereafter, the oxygen level within an inerted tank atmosphere shall be verified to be less than 8% by volume both at 1 metre below deck and at 50% of the tank depth.

Should the oxygen content in the tank exceed 8% by volume, tank washing must cease immediately and the tank must be purged to less than 8% oxygen by volume before washing may continue.

2. TANK CLEANING

2.1 Standard of Tank Cleaning Required

2.1.1 Reasons for Tank Cleaning

Tank cleaning is carried out to:

a) Prevent the build-up of oily residues
b) Prepare tanks for the carriage of the next cargo or clean ballast
c) Facilitate gas freeing and tank entry for repairs/tank mopping
d) Comply with Charter Party requirements
e) Comply with MARPOL

2.1.2 Instructions Received with Loading Orders

To minimise bunker consumption, environmental impact and associated costs, vessels should only tank clean when necessary. When the Ship Operator makes cargo inquiries, the Master shall revert with the anticipated tank preparations required. These must be confirmed once the cargo is fixed.

Should the vessel receive tank cleaning instructions which conflict with those set out in these Work Instructions, the Master must contact the Ship Operator to resolve the conflict prior to commencement of tank preparation. If a cargo specification is not provided, the Master should assume a higher specified grade will be lifted and undertake the tank preparation required for such higher grade. It should be noted that it is the ship owner's responsibility to ensure that the vessel arrives at the load port with tanks prepared to lift the nominated cargo; Charterers are under no obligation to provide tank preparation guidance or tank inspection/approval prior to loading.

2.1.3 Standard Required

The Tank Cleaning Guidelines within this Work Instruction are to be used as a guide to the degree of cleaning necessary between cargoes, except when the Charterer, or Company issues special instructions.

The standard of cleanliness required by some Charterers or receivers may be lower than that set out in the Tank Cleaning Guide. This may be due to the intended use of the cargo being different from that which one might expect. It is imperative therefore to ensure that, where Charterers' cleaning instructions conflict with this Work Instruction, such instructions are always received in writing, challenged and confirmed with the Ship Operator before implementation.

Unless specifically agreed in the Charter Party, neither a Time Charterer nor a Voyage Charterer has the right to insist on the observance of their own tank cleaning requirements in place of these Work Instructions. However, the Charter Party may often provide for the vessel to present for loading with its

tanks, pumps and pipelines properly cleaned to the satisfaction of the Charterer's appointed inspector.

Where a Charterer has tank-cleaning requirements in excess of those required under these Work Instructions (incl. use of excessive pressures or temperatures) these should form part of the agreed Charter Party. If they do not, then the Charterer must be made aware that any additional time/costs will be for their account.

Deleted:

2.2 Bottom and Line Flushing

2.2.1 Flushing Tank Bottoms

With written instructions, it may be acceptable to flush tank bottoms (usually ashore after agreement) in lieu of tank washing.

2.2.2 Water Flushing Pumps and Lines

Normally completed after tank washing, it is recommended to wash up cargo lines and drops, not down. On completion, all lines and pumps must be well stripped into a slop tank or directly ashore.

2.2.3 Fresh Water Rinsing

When loading certain cargoes such as Vacuum Gas Oil, Wax Distillate and some Solvents, it may be necessary to 'fresh water rinse' any tank that has been salt water washed or previously contained salt water ballast.

2.3 Elimination Of Water In Special Cargoes

Where total elimination of water is required after washing tanks for special cargoes (lubes and Jet), the following procedures must be followed after comprehensive tank, line & pump stripping:

1. Cargo lines valves must be opened and lines drained dry. This includes manifolds, drop lines, discharge lines and tank suctions.
2. Cargo pumps and their associated air vessels, vacuum breakers, strainers and by-passes must be opened and drained dry.
3. Individual tank suction valves must be opened and remain open during the tank mopping process.
4. Where fitted, fixed eductor systems must be blown through with air, valves opened, and lines left to drain into the tank prior to mopping.
5. Fixed tank washing valves must be opened and any water between the main line and the machine, drained into the tank prior to mopping.

Any list placed on the vessel to assist in draining and mopping must be removed before the tank is finally inspected to allow any puddles on the upper stringers and stiffeners to drain down. The Inert Gas Deck Seal overboard line must be checked to ensure that it is free from blockage and all valves are fully open. Any substantial increase in the deck seal water level will cause "carry over" and introduce water back into the tank during re-inerting.

It is Company policy not to inert cargo tanks prior to or during, the carriage of lube oils due to the possibility of introducing water or impurities from the I.G. system.

2.4 Retained Residues

2.4.1 Cargo Residues

The quantity of cargo residues on board should be reduced in accordance with MARPOL 73/78 Regulations. Generally loading on top of crude or dirty product slops is unacceptable to most Charterers. **Clarification should be sought from the Company on an individual voyage basis**. Subject to receipt of written instructions, cargo residues may be discharged to slop reception facilities, otherwise they must be retained on board, segregated from the cargo.

A Charterer may issue instructions differing from those above. Charterer's instructions should be followed unless they contravene the MARPOL 73/78 Regulations in which case Company guidance must be sought.

2.4.2 Tank Washing Residues

Scale and solid residues within a tank can contain volatile liquids and generate gas when disturbed. Crude carriers can control the build up of residue with effective crude oil washing. When oil impregnated sludge has to be physically removed from tanks, it must not be dumped at sea but bagged and landed to shore reception facilities.

2.4.3 Engine Room Residues

Residues from engine room separators and purifiers should normally be stored in E/R holding tanks but may sometimes need to be transferred to cargo tanks.

Provided this is an approved procedure as stated in the IOPP Certificate Supplement, a crude or black oil vessel may transfer E/R residues to their slop tanks where they may be discharged ashore or have cargo "loaded on top". On clean product tankers, unless the slop tanks can be adequately cleaned to shore, E/R sludge must not be transferred into cargo or slop tanks to avoid cargo contamination.

Residue transfers from the E/R to the cargo system must be recorded in **both** the Machinery and Cargo Oil Record Books (MARPOL). The temporary connection between the E/R and cargo tank must only be in place during transfer operations.

2.4.4 Residues – Singapore area

Strict tank cleaning regulations are in force in the areas around Singapore. All tank cleaning contractors must be registered with the Ministry of Environment, and tank cleaning waste must be disposed of at a facility operated by the Port of Singapore Authority (PSA).

PSA tank cleaning permits will only be granted if the tank owner (or representative) can prove that the waste will be disposed of at an approved facility. The Company will administer such compliance, and any vessel planning to tank wash should notify its Ship Superintendent well in advance.

2.5 Tank Washing

2.5.1 Methods of Tank Cleaning

The Company's policy is that tanks must be washed in the inerted condition. If the Master considers it necessary to undertake tank washing under any other condition, guidance must be sought from the Company beforehand. ISGOTT describes tank atmospheres for washing. See also the vessel's Cargo Operations Manual.

2.5.2 Temperature Restrictions in Coated Tanks

The temperature and pressure of washing water in coated tanks must not exceed those recommended by both the tank coating manufacturer and the tank cleaning equipment manufacturer.

It is recommended to keep the washing water temperature at least 15°C above the Pour Point of the previous cargo.

2.5.3 After Black Oil Cargoes

Double hull tankers with deep-well pumps and no internal tank framing are generally capable of cleaning from heavy fuel to gas oil with fixed tank washing machines only. On vessels with internal piping and/or framing, the use of additional portable tank washing machines may be required to remove residues from shadow areas.

If portable tank washing machines are used to supplement fixed machines, washing must be conducted in an inert condition. Portable heads are to be introduced only after the fixed tank wash machines have completed a full wash. The inert gas pressure must be reduced to a minimum positive pressure while washing is underway. Sand bags or equivalent should be placed on and around the saddles to reduce the flow of inert gas through the tank wash openings.

The amount of washing required to change from a black oil to white will depend on the tank configuration and the standard of washing. As a general rule 3 to 4 hours per tank is required with fixed machines followed by any additional portable tank machine washing if required. Portable tank machine 'drop-levels' should be pre-calculated to maximise the effect on shadow areas unreachable with fixed machines. Unless the vessel has obtained a degree of confidence from previous washing, the tank should be gas-freed and inspected to confirm the effectiveness of the washing.

It may be necessary to 'wing-out' portable machines by tying them off on the tank structure to enhance washing effectiveness. If so the tank should be gas-

freed for entry, the portable machine 'winged-out' and the tank then re-inerted prior to further washing.

While washing, machines should be checked constantly to ensure they are turning properly. Machines are prone to seizing due to piping scale or rust if they are not used regularly. Spare machines should be readily available if required for replacement.

Damage to machines may occur if they are suspended near the tank sides or bottom when the vessel is rolling. It may be acceptable for the Master to alter course to reduce rolling in such circumstances. Washing in heavy rolling conditions is not recommended because the ineffectiveness of stripping inhibits the washing.

2.5.4 After Clean Oil Cargoes

1. Cold Water / Hot Water Washing in Coated Tanks
   The temperature of water for washing coated tanks is outlined in the Tank Cleaning Guide and should be followed. Hot water washing may be required in lieu of cold for tank entry or removing greasy films after some cargoes.

2. Washing in Un-coated Tanks
   General instructions for washing in uncoated tanks are covered later in this Work Instruction. Prior to washing uncoated tanks for cargo preparation purposes, the vessel's intended washing plan must be forwarded to the Fleet Operation's Superintendent for approval.

3. Over-Washing
   Important as it is to ensure that all cargo tanks can accept the nominated cargo, it is equally important to avoid excessive tank washing. Excessive washing is an unnecessary expense due to the extra bunkers consumed, added wear on washing equipment and tank coating deterioration over time.

2.5.5 Preparing For Dry Dock/Repair

When preparing for a dry-dock or lay-up which requires gas free certification, all tanks, lines, pumps, 'vac-strip', priming systems, and separator tanks must be thoroughly washed with hot water until all traces of oil have been removed, and thereafter gas-freed. Pump room bilges and cofferdams must also be thoroughly washed and gas-freed. A very high standard of cleanliness must be achieved, and portable machines may well be required to reach such a standard.

Due to inadequate washing, waxy deposits or sediment may remain on the tank bottom. These residues might require hand cleaning (picking) for removal. Due to the high expense and time lost in hand cleaning, all efforts should be made to wash tanks as effectively as possible.

2.5.6 Using Chemicals

Due to legal restrictions and the Company's environmental considerations, tank cleaning chemicals are no longer used as a matter of course. If chemicals are required for stringent cleaning, specific instructions will be given by the Company.

2.5.7 Crude Oil Washing (COW)

Statutory requirements for Crude Oil Washing are contained within MARPOL. The vessel's Cargo Operations and COW Manuals, as well as ISGOTT provide invaluable information.

The entire COW system is to be tested to 1.5 times the working pressure at a suitable time prior to usage (before arrival). Testing must be recorded in the appropriate Deck Log book and Cargo Record book. When undertaking COW operations the appropriate checklists contained within the cargo booklet must be completed.

3. TANK INSPECTIONS

3.1 Responsibility

Although responsibility for the suitability of cargo tanks to carry the nominated grades lies with the Master, installation supervisors or independent cargo surveyors acting on behalf of the cargo owner may conduct tank inspections. Such tank inspections do not relieve the Master of his/her responsibilities.

3.2 Inspection of Tanks Under Inerted Conditions

Vessels fitted with Inert Gas systems must arrive at the loading port with the oxygen content in all cargo tanks below eight percent (8%) unless instructed to the contrary in the voyage orders.

Requests by installation supervisors or cargo surveyors to gas free any cargo tanks for inspection should only be complied with if the Charter Party provides for this. Any delays and costs involved would need to have been agreed at the negotiation of the Charter Party. If on BP Group business, or where the Charter Party does not confer the right to de-inert/re-inert, gas freeing of tanks should only proceed if the Charterer accepts the subsequent costs and delays. This acceptance must be sought through the Company office and instructions received in writing.

After gas freeing for inspection, loading may only commence into re-inerted tanks with an oxygen content of below 8%. Such loading may be concurrent with the continued inerting of other tanks. Loading must not commence into tanks which do not contain Inert Gas (except for loading Lube Oils).

4. CARGO AND ASSOCIATED LINES

4.1 Heating Coils

Heating coils are to be pressure tested, and if necessary blown through and repaired, on each occasion prior to:

a) Loading a cargo which requires heating.
b) Tank repairs (to avoid leakage of hydrocarbon product or fumes into tank under repair)
c) Gas freeing for voyage repairs or dry-docking.

4.2 Non-Carriage of Jet Products in Tanks with Copper Alloy Heating Coils

Jet must not be carried within cargo tanks with heating coils made from copper alloys, as the copper may have a deleterious effect on the Jet's thermal stability. Copper-Nickel alloys, Brass and Bronze coils all contain copper. Ship's officers must inform themselves whether the vessel's heating coils contain copper.

The rate at which contamination takes place depends upon the quantity of copper in the alloy, the trace components in the product, time of exposure and temperature. Concentrations of copper above 10 parts per billion (ppb) start to affect the thermal stability and 50 ppb invariably produces a complete failure.

If approval has been given for the carriage of Jet-A1 in cargo tanks fitted with copper alloy heating coils, additional sampling can be expected at the loading and discharge ports. Ship's staff must also ensure that ship samples are taken and that sample bottles are flushed with product at least three times before the final sample is taken, labelled and sealed.

4.3 Line Washing

Line washing procedures are contained within the vessel's Cargo Operations Manual. Careful visual inspection of the actual pumproom line configuration should be undertaken to identify any problem areas or "dead ends" which will require special attention.

4.4 Cargo Pumps & Lines Compatibility

Work Instruction WI 13 *Cargo Handling and Stowage – Compatibility and Segregation* should be read in conjunction with these notes. The Tank Cleaning Guide will assist the Chief Officer in choosing tanks, lines and pumps to expedite cargo handling.

Charterer's voyage instructions may state a degree of compatibility or separation required. Should these instructions differ greatly from the guidelines given in this Work Instruction, the Master must contact the Ship Operator as soon as possible, who will revert confirming instructions.

4.5 Cargo Lines And Valves Testing

During cargo tank entries, every effort should be made to head test pipelines and valves with water to ensure integrity. An inspection of coatings and fittings should be undertaken at the same time. On no account should cargo be used to head test pipelines and valves, nor should compressed air be used to test cargo valves in

cargo tanks. Cargo valve testing routines are part of the vessel's planned maintenance systems.

During normal cargo operations, a record should be kept of suspected or confirmed valves which pass, and every effort made to repair valves on ballast periods.

5. PRODUCT QUALITY

5.1 Products Characteristics

The quality characteristics of petroleum products are measured by a number of standard laboratory tests which either measure an absolute quality of the product in question (density, sulphur content) or show behaviour of the product under particular conditions (see also *Work Instruction WI 13 – Cargo Handling and Stowage*).

Information regarding the following characteristics can be found within either ISGOTT or the Petroleum Measurement Paper No. 8.

- Cloud Point
- Density
- Flash Point
- Pour Point
- Viscosity
- Reid Vapour Pressure
- True Vapour Pressure

5.2 Vapour Segregation

When carrying multi-grade cargoes there is a possibility of contamination due to the mixing of vapours through the inert gas line(s). Vapours from lower flash point cargoes can reduce the flash point of higher flash point cargoes to a point where the entire cargo becomes off specification. This can occur with both white and black oil cargoes (when both crude and fuel oils are carried).

Volatile cargoes must be vapour segregated from non-volatile cargoes. Cargoes with incompatible vapours should be physically isolated from each other during the voyage, so long as proper monitoring is in place to ensure that tank pressures remain within working limits.

Lube oils should be loaded into tanks which are gas free and not inerted, and vented to atmosphere. Only after the product has been discharged should inert gas be introduced into the tank.

6. TANK CLEANING GUIDELINES

6.1 Basis Of Tables

The Tank Cleaning Guide Table is intended to give guidance for the tank preparation necessary to achieve a standard of cleanliness suitable for white oil cargoes loaded into coated tanks and dirty products/crude loaded into coated or uncoated tanks. Depending upon a specific vessel's tank configuration and cargo

specifications, preparations may be reduced from those in the guide, provided written approval has been received from the Company.

For vessels with uncoated tanks hot water washing will generally be required in lieu of cold, however specific instructions must be obtained from the Company.

These tables are intended for guidance when no other instructions for tank preparation have been received from or been approved by the Company.

6.2 Naphtha / Clean Condensate / LDF

Naphtha (Full Range/Light/Heavy)	Virgin Naphtha (VN)
Light Distillate Feedstock (LDF)	Chemical Feedstock
Platformer Feed	Cat. Reformer Feedstock
Clean Condensate	Natural Gasoline
Pentane Plus	Straight Run Gasoline
Straight Run Benzene (SRB)	

Comments

Heavier grades of LDF can tolerate a small contamination by Jet A1, DPK, Solvents, or lighter grades of LDF. As Feedstocks tend to be unrefined they may put other products off-spec on odour, corrosion test, etc.

Naphtha & LDF cannot tolerate any lead whatsoever and therefore should be buffered from leaded cargoes by the prior carriage of another product. Washing after Unleaded Motor Spirit is required due to oxygenates which may adversely affect the processing of Naphtha.

LDF nominated for certain ports (for example BP Saltend) may require loading into "well drained" tanks rather than washed in order to avoid chlorine ingress.

If in any doubt as to whether condensate is “clean” of “dirty”, contact the Ship Operator.

6.3 Aviation Gasoline (Av-Gas)

Avgas	Aviation Gasoline
Aviation Spirit	

Comments

Av-Gas has a high lead content, a flashpoint within the ambient temperature range, and is usually dyed. It has a strict specification for aviation purposes.

For Uncoated Tanks – wash with hot water and remove loose scale from tank bottoms if required.

6.4 Leaded Motor Spirit

Premium Motor Spirit (PMS)	Regular Motor Spirit (RMS)
Motor Gasoline	Mogas

Comments
Leaded Motor Spirits are frequently dyed and may contain surface-active additives. Any measurable contamination with unleaded products (over 1%) will cause the Research Octane Number (RON) to drop. Where contamination between grades is unavoidable the lower RON grade should be contaminated with the higher and not vice-versa.

After the carriage of Marked/Dyed Gas Oil or Kerosene, tanks will require washing.

For Uncoated Tanks – wash with hot water rather than cold and remove loose scale from tank bottoms if required.

6.5 Unleaded Motor Spirits and Motor Spirit Blending Components

Regular Unleaded	Premium Unleaded (ULMS)
Superplus (SUMS)	Methyl Tertiary Butyl Ether (MTBE)
Toluene	Reformate
Cat Cracked Spirit (light/heavy)	Alkylate
Steam Cracked Spirit (light/heavy)	

Comments
Thorough water washing of tanks after leaded products and draining of pumps/lines is essential to remove any lead contamination. After the carriage of Marked/Dyed Gas Oil or Kerosene, the tanks will require washing.

For Uncoated Tanks – wash with hot water rather than cold and remove loose scale from tank bottoms if required.

6.6 Solvents

Special Boiling Point Solvents (SBPS)	BP Solvent
Rubber Solvent	Unleaded Cleaning Spirit

Comments
These are unleaded and have flashpoints within the ambient temperature range. Due to a considerable variation within grades guidance on cross-contamination will be specific. As purity is essential, no contamination by other types of product can be tolerated.

For Uncoated Tanks – wash with hot water rather than cold and remove loose scale from tank bottoms if required.

6.7 Jets / Aviation Kerosenes

Jet A-1	Aviation Turbine Kerosene (ATK)
Avtur	Kerosene Water White
Dual Purpose Kerosene (DPK)	Avcat High Flash/Low Freeze
JP5 High Flash/Low Freeze	JP8

TS1 (Russian) RT (Russian)

Comments
Unleaded and volatile (flashpoints from 28°C upwards). They have a strict specification for aviation purposes and contamination from all other grades except for un-dyed Gas Oil / Kerosene's as well as some Solvents cannot be tolerated.

If loading on top of un-dyed Gas Oil or Kerosene's, the tank must be educted so that ROB is less than 0.1% of the Jet / Kerosene to be loaded.

Water haze in Aviation Turbine Kerosene can lead to filter blockage by ice particles. Water will eventually settle out if left standing but this is not possible at most installations. Utmost care must be taken to ensure that all tanks, lines and pumps are free from water before loading or discharging.

Hand mopping is especially essential for Aviation Turbine Kerosene (JP5) for the U.S. Forces. Any water will leach out an anti-icing additive mixed with JP5. Special UK Ministry of Defence requirements may be advised at the time of loading. Every precaution must be taken to drain pumps and lines thoroughly.

6.8 Un-dyed Premium & Regular Kerosenes

Regular Kerosene	Blending Kerosene
Premium Kerosene	Odourless Kerosene
Kerosene Feedstock	Superior Kerosene
Burning Oil (US / Canada)	Lighting Kerosene
Stove Oil (US / Canada)	

These products are similar to Jet and Aviation Kerosene's apart from the fact that they will not require mopping after water washing unless after Lube Oils and LFO.

6.9 Dyed Kerosenes

The very small quantity of dye used in dyed kerosene has the ability to put Jet-A1, DPK or un-dyed Kerosene off-spec for colour. Tanks which previously contained dyed kerosene must be washed and mopped or educted dry prior to loading the un-dyed products.

6.10 Gas Oil

Automotive Gas Oil (AGO)	Odourless Gas Oil
Automotive Diesel Oil (ADO)	Odourless Gas Oil Feedstock
No. 2 Furnace Oil (US / Canada)	Mud Drilling Oil
Extra Light Fuel Oil (ELFO)	47/20 Dieso
Navy Distillate	Inferior Kerosene
Distillate Marine Diesel (Pale) DERV	High Speed Diesel Oil Navy Distillate

Comments
Unleaded with minimum flashpoint requirements, varying between 55.5°C and 65.6°C. The level of acceptable contamination by lighter distillates depends on the flashpoint. Although lead free, very small quantities of lead can be tolerated.

Water haze, produced by pumping fuel containing free water, can re deposit a water layer in installation or domestic customers tanks. When such water contains salt it presents a potential corrosion hazard if allowed to accumulate. This problem has been particularly associated with hazy ELFO used for domestic heating, and is unacceptable.

Although water haze in gas oil supplied as fuel for gas turbines is not in itself harmful to the operation of the engine, its presence does indicate that sodium (which can cause severe pitting on the turbine blades) may be present in an unacceptably high concentration. Care should be taken to ensure that all water is drained from the system and, in particular, from cargo pumps and lines.

If Gas Oil is hazy on loading, water will generally tend to settle out during the voyage. If water dips are found prior to discharge, receivers should be advised and where possible agreement reached for the settled water to be stripped ashore before the bulk discharge of the cargo. This will minimise the risk of re-hazing the oil from the mixing action of the ship's pumps. If stripping ashore is not possible then it is advisable to transfer the stripped water to a cargo tank on board.

For Uncoated Tanks – wash with hot water rather than cold and remove loose scale from tank bottoms if required.

6.11 Marked or Dyed Gas Oil

The very small quantity of dye used in dyed Gas Oil has the ability to put un-dyed Gas Oil (and Jet-A1, DPK, un-dyed Kerosene) off-spec for colour. Tanks which previously contained dyed Gas Oil must be washed prior to loading these un-dyed products.

6.12 Ultra Low Sulphur Gas Oil

Ultra Low Sulphur Turbine Gas Oil Low Sulphur Marine Gas Oil

Comments
These products have a sulphur level below 0.5% and are salt water critical. This is due to the extremely high specification of the product, which precludes sodium (found in sea water). In some cases, vessels may be requested to fresh water wash, as well as mopping.

6.13 Crude Oils / Dirty Condensates

Masters should refer to the Company's "Crude Oil – Carriage Temperature and COW Requirements" document prior to loading Crude Oil or Condensate. Although specific tank preparation instructions will be advised by the Charterer in the voyage

instructions, this document provides Company recommended washing instructions for Single and Double Hull vessels. In the event of conflict between the Charterer's specific instructions and this document (Crude Oil – Carriage Temp & COW), written confirmation of tank washing instructions must be obtained via the Ship Operator.

The document is regularly updated with H2S information gained directly from BP vessels and terminals. Masters should send in H2S reports directly to the Broadgate Cargo Assurance Team (outside of QA) by e-mail (gbcargoassurance@bp.com), on every occasion that crude oil cargoes are carried.

6.14 Lubricating Oils

The presence of any water in lubricating oils is not acceptable, and tank preparation after most cargoes will involve tank entry and mopping as well as the opening-up of valves and strainer boxes. For quality reasons and to avoid the introduction of any water, Lube Oils are to be loaded, carried, and discharged within Air not Inert Gas.

6.15 Wax Distillate/Vacuum Gas Oil / Cracker Feed

Wax Distillate Vacuum Gas Oil

Comments

These products are sodium critical. Tanks that have been washed with seawater, must be finally fresh-water washed to remove the sodium left behind by the seawater. On occasions Vacuum Gas Oil may be loaded on top of very light crudes and condensates without washing. On these occasions, specific instructions will be given from the Company.

6.16 Medium & Heavy Fuel Oils

Medium Fuel Oil: 100-225 cSt@50°c
Heavy Fuel Oil: 380 + cSt@50°c (incl. High Sulphur Atmospheric Residue)

Comments

Due to MFO / HFO having a significantly lower pour point than Low Sulphur Fuel Oils (LSFO), only minimum contaminations of LSFO can be tolerated. Tanks containing LSFO should be drained (educted / stripped) as much as possible prior to loading MFO / HFO.

Washing is generally required for loading MFO / HFO after crude, however washing may be avoided, provided that the following conditions are observed:

a) Crude oil remaining on board is less than 0.1% of the volume in each tank.
b) The fuel oil is maintained at the maximum permissible temperature during the voyage in order to correct the Flashpoint.
c) The cargo tanks nominated to load Fuel Oil after Crude Oil are purged to reduce the hydrocarbon level to below the lower flammable limit.

6.17 Low Sulphur Fuel Oil (LSFO)

Low Sulphur Fuel Oil (LSFO) Low Sulphur Waxy Residue (LSWR)
Low Sulphur Atmospheric Residue

LSFO has a sulphur content of 1.0% or less. Because LSFO is frequently manufactured with sulphur content very close to the specification limit, only minimum contaminations with other fuel oils can be tolerated. Stringent hot washing must normally be carried out before loading Low Sulphur Fuel Oil after crude oil.

6.18 Light Fuel Oil (LFO)

Light Fuel Oil (LFO) Fuel Oil 30/35
Furnace Fuel Oil 50/50 No. 4 Fuel Oil
U.S. Navy Special Burner Fuel

Comments

LFO has a low viscosity. Because wax has been known to cause serious problems with some LFO grades, it is recommended to wash tanks that previously contained other Fuel Oils or Crude Oil with the hottest water permissible by the tank coatings and tank washing machine manufacturers respectively in order to remove wax.

Dispensation from the Company may be received from washing after MFO / HFO / LSWR however, if the quantity of ROB is less than 0.1%, and previous cargo has a low wax content.

6.19 Carriage of Other Products

If products outside the range of the guide are to be loaded, special requirements for tank cleaning will be passed to the Master via the Ship Operator either with the loading orders, or through other written instructions.

7. LNG VESSELS – WARM UP, INERTING, AERATION, GASSING UP AND COOLDOWN OPERATIONS.

7.1 Supervision and Control of Operations

All warm-up, Inerting, Aerating, Gassing Up and Cool-down operations must be approved by BP Shipping, NWSSSC or NGSCO, as appropriate.

Either the Master or Chief Engineer must be onboard to supervise all Warm Up, Inerting, Aerating, Gassing Up and Cool-down operations. The Chief Officer is responsible to the Master for the efficient performance of operations covered in this section.

The Cargo Engineer is responsible to the Chief Engineer and Chief Officer for the correct operation of all cargo handling equipment including Vaporisers, Compressors and Inert Gas Generating Equipment.

A cargo plan for every operation covered by this section must be drawn up in advance and approved by the Master.

Deck officers and the cargo engineer must be fully conversant with the cargo plan, signing it to acknowledge that it has been fully understood. Any additional information/instructions must be entered in the Chief Officer's Cargo Order Book. The OOW is responsible for ensuring that the Chief Officer's instructions are complied with and he/she must sign the relevant entries in the Cargo Order Book. Where the OOW or the cargo engineer is uncertain as to the requirements of the cargo plan or the Chief Officer's instructions he/she should seek clarification from the Chief Officer before signing.

A comprehensive written log of all operations covered under this section must be maintained and be retained onboard for a period of six years from the end of the relevant cargo operation.

Adequate notice concerning the requirement for pumps and services must be given to the Chief Engineer. The deck and engine departments shall liase closely during all operations regarding the use of Boil Off Gas for fuel.

All operations shall take place in accordance with the relevant Company or Project Cargo Manual. All involved personnel must be familiar with the approved operational detail contained in this Manual. Whilst alongside due regard shall be had to any terminal regulations and requirements.

7.2 Stripping of Cargo Tanks

All tanks to be warmed up, whether for single tank entry or for pre-docking, shall be stripped to the minimum level as advised in the Company or Project Cargo Manual. If the spray pump is used it must be started in ample time, with reference to the minimum head requirements, to ensure that the pump immediately picks up suction, the bearings are lubricated and pump is adequately cooled.

Under normal conditions the Spray pump must be started prior to stopping the final Cargo Pump. Pump motor loading and discharge valve position will have to be monitored closely and in the latter stage of stripping, the pump should be operated in the manual mode.

To minimise the LNG retained on board, and reduce the time required for the warm-up operation, the liquid risers and crossovers and spray lines may be purged ashore on completion of the discharge using the vessel's nitrogen supply. Instructions for this operation are contained in the Company or Project Cargo Manual. This operation must be discussed and agreed with the discharge terminal as it will extend the normal discharge timetable.

7.3 Warm Up

LNG from the liquid and spray lines must be properly drained prior to the warm up operation and the lines proved liquid free. The warm up of the cargo tanks is achieved by drawing cold cargo vapour from the tanks using the HD compressors, circulating the vapour through the cargo heaters, and returning it back to the tanks.

Large quantities of gas will be generated during the initial stages of the warm up as the residual LNG in the tanks is vaporised. The gas may be burnt in the boilers, utilising the steam-dump, if necessary, with any excess being vented to atmosphere via No.1 vent mast. During venting, where operations permit, cargo vapour should be heated to a temperature above -80C so that the vapour is lighter than air and will disperse more readily.

When proceeding from a Japanese discharge port to a dry-dock in Japan, the operations must be carried out in an official "Gas Freeing Zone" and the shore authorities must be consulted and informed accordingly.

7.4 Inerting Cargo Tanks and Liquid Lines

The correct procedure for Inerting will be found in the Project Cargo Manual. It is essential that procedures are followed step by step to ensure all tanks lines and equipment are properly inerted.

The entire cargo system is purged with inert gas from the Inert Gas Generator until the hydrocarbon content is less than 1% by volume throughout.

The dangers of Carbon Monoxide presence in inert gas with <1% O_2 content should be understood by all staff. See the Inert Gas Generator manufacturer's handbook.

Liquid Lines and manifolds will be inerted during the purging of the cargo tanks. The inerting of the spray-line, forcing vaporiser, safety relief valves, vapour lines and cargo machinery will take place on completion of cargo tank purging. It is essential that all sample points are checked for hydrocarbon content prior to completion of the inerting operation. Safety valves should be purged by using the hand easing gear.

7.5 Aeration

Some repair ports may accept the vessel for certain repair work with inerted tanks.

Aeration is carried out to ensure the tanks are fit for entry and the remainder of the system ready for any repair work. Procedures laid down in the appropriate Company or Project Cargo Manual must be followed to ensure the whole system is correctly aerated.

Aeration is completed when all parts of the cargo system fulfil the following conditions

a)	Oxygen content	21%.
b)	Carbon dioxide content	0.5% or less.
c)	Carbon Monoxide content	50 ppm or less
d)	Hydrocarbon content	< 1% LEL

7.6 Inerting After Docking

Prior to the closing of any cargo tank a full inspection must be conducted to check for cleanliness along with the security of all equipment and fittings. All loose materials, and tools must be removed. The person responsible for the inspection must ensure that they are the last person out of the tank and supervise the closing of the dome manhole cover.

Inerting must be carried out in accordance with the procedures laid down in the appropriate Company or Project Cargo Manual.

During inerting the tank manhole cover must be pressurised and tested with a suitable soap solution to check for leaks. Any other pipe-work or cargo machinery disturbed during the docking must be treated in a like manner. Inerting is complete when the oxygen content at all sampling points is less than 1% by volume.

7.7 Nitrogen Purging

Nitrogen purging is carried out to prevent the freezing of carbon dioxide found in inert gas. The following parts of the cargo system will be purged prior to initial cooldown:

a) Liquid manifold crossover line.
b) LNG vaporiser supply line.
c) Manifold cooldown line.

The carbon dioxide content on completion should be less than 1% by volume.

7.8 Gassing Up

The Gassing up procedures are covered in the relevant Cargo Manual.

LNG from the terminal is supplied to the LNG vaporiser via a selected liquid manifold and the vaporiser supply line. The outlet temperature of the LNG vaporiser must be set at a minimum of +20ºC. The warm cargo vapour is supplied to the cargo tanks via the LNG vapour line. The displaced inert gas is returned ashore via the LNG liquid lines, HD compressors and vapour manifold.

After cargo tank gassing up is complete, the liquid lines, spray lines, vapour line and machinery will be gassed up. Cooldown of the shore arm will be in accordance with terminal procedures.

The system is gassed up when the carbon dioxide content is less than 1% and the hydrocarbon content is more than 95% at the lower sampling point in each tank.

7.9 Initial Cooldown

The Cooldown procedures are covered in the Project Cargo Manual. The cooldown rates in the manuals must not be exceeded, as they are ship specific.

Large amounts of vapour will be generated at the start of cooldown and the HD compressors must be ready to run as soon as cooldown is commenced. The

cooldown rate should be increased as the different spray patterns are employed. Gas burning may be commenced during the cooldown operation.

Cooldown will be completed when the tank temperatures reach the minimum specified for loading in the Cargo Operations Manual and the Terminal Regulations, as appropriate.

Cooldown prior to loading may be required where the ship has been instructed to maximise discharge and retain minimum heel. In such cases the relevant procedures in the Company or Project Cargo manuals must be followed and communicated to the terminal. Where provided, cooldown tables must be consulted for calculating the quantity of LNG used during cooldown.

7.10 Safety Precautions

The Master must ensure that the precautions contained in the following publications are complied with:

a) *WI 24 – Occupational Health and Safety*.
b) Relevant Check Lists.
c) Relevant Operations and Instruction Manuals.
d) Company or Project Instructions.
e) *Liquid Gas Handling Principles* (SIGTTO) and vessel's IG Manual.

The Inert Gas System shall be run in accordance with *WI 14 – Inert Gas System.*

The venting of gas to atmosphere must only take place during daylight hours when the wind's relative velocity is more than 10m/sec, visibility good and when there is no traffic in the vicinity.

The following safety precautions must be complied with at all times:

a) During operations a good watch must be kept on all pipelines and equipment so that any leak can be dealt with before a build up of gas occurs, or steel structure damage occurs due to LNG impingement.

b) All ventilation fans within gas dangerous zones must be running continuously to disperse any gas present.

c) On any occasion where there may be cargo vapours on deck, the air conditioning must be run in the re-circulation mode.

d) During any cargo operation, all ports and doors must be kept closed.

e) Gas venting must be suspended during all electrical storms.

f) No work shall be done on deck that involves scaling, hammering, chipping or the use of power tools.

g) Particular care should be taken during the operations contained in this section due to periods of high activity and the operations being non-routine in nature.

h) All portable Bends and Spool pieces must only be connected when required for a particular operation. They must be removed and blanks fitted when the operation has been completed.

i) In port smoking regulations shall be enforced.

7.11 LNG Cargo Tank Entry

Procedures and requirements that need to be in place prior to entry into LNG cargo tanks follow the same format as those for entry into other enclosed spaces. One area where differences exist is in the range of toxic gases checked. Due to the nature of the cargo there is no need to test the tank atmosphere for hydrogen sulphide, benzene or total mercaptans, but checks must be made for the concentration of carbon dioxide and carbon monoxide. The tank is considered to be gas free when the following criteria have been met:

- the indicated oxygen level on a calibrated oxygen analyser is 21%
- carbon dioxide level is less than 0.5% by volume
- carbon monoxide content is less than 50 ppm
- hydrocarbon gas concentration throughout the tank is not more than 1% of the lower flammable limit (LFL).

During tank entry at sea, aeration shall continue throughout the period that the tank is opened for inspection and maintenance to prevent the ingress of moist air.

Where a single tank is required to be warmed up, inerted and aerated for entry, the instructions given in the vessel's Cargo Operation Manual shall be followed. In cases where these instructions are not provided in the Cargo Operations Manual, a procedure should be drawn up and agreed with the relevant ship's superintendent. Prior to a single tank entry, where other tanks and lines contain hydrocarbons, a Stage 2 Risk Assessment shall be completed and the relevant safeguards agreed with the vessel's superintendent.

BP Tank Cleaning Guide

Previous Cargo / Cargo to be Loaded	Naphtha / Clean Condensates / LDF	Avgas	Leaded Motor Spirit	Unleaded Motor Spirit	Solvents	Jet / Aviation Kerosenes	Kerosenes (Un-dyed)	Kerosenes (Dyed)	Gas Oil (Un0dyed)	Gas Oil (Dyed)	Ultra Low Sulphur Gas Oil	Crude Oils / Dirty Condensates	Lube Oils	Wax Distillate / Vacuum Gas Oil	Heavy / Medium Fuel Oil	Low Sulphur Fuel Oil (LSFO / LSWR)	Light Fuel Oil (LFO)
Naphtha / Clean Condensates / LDF																	
Avgas																	
Leaded Motor Spirit																	
Unleaded Motor Spirit																	
Solvents ★	PM	PM	PM	PM				PM		M				M			M
Jet / Aviation Kerosenes	PM	PM	PM	PM				PM		M							M
Kerosenes (Un-dyed)	P	P	P	P													
Kerosenes (Dyed)	P	P	P	P													
Gas Oil (Un-dyed)	P	P	P	P	P							P					
Gas Oil (Dyed)	P	P	P	P	P							P					
Ultra Low Sulphur Gas Oil ★	PM	PM	PM	PM	PM			PM		M							M
Crude Oils / Dirty Condensates																	
Lube Oils ★	PM	PM	PM	PM	PM								LUB				
Wax Distillate / Vacuum Gas Oil ★	P	P	P	P	P							P					
Heavy / Medium Fuel Oil	PX	PX	PX	PX	P							PX					
Low Sulphur Fuel Oil (LSFO / LSWR)	PX	PX	PX	PX	P							P					
Light Fuel Oil (LFO)	PX	PX	PX	PX	P							P			X	X	

THIS GUIDE COVERS WHITE OIL CARGOES IN COATED TANKS.
AND BLACK OIL / CRUDE CARGOES IN EITHER COATED OR UNCOATED TANKS.

No washing required - strip and drain well
Refer Notes: 1 & 2

Wash tanks with **COLD** sea water until tank is clean
Refer Notes 1, 2 & 3

Wash tanks with **HOT** sea water until tank is clean.
Refer Notes 1, 2 & 3

Product NOT to be loaded unless specific instructions have been issued by BP Head Office

P Tanks to be purged to below 2% Hydrocarbon by volume

M Tanks to be **MOPPED DRY**

X If ROB is less than 0.1%, and purging (if required) is effective, cargo may be loaded directly on top without washing

★ Tanks that have been washed for the carriage of these products must have a final wash with fresh water followed by Notes 1, 2 &3.

LUB To ensure minimum grade to grade admixture, tanks to be stripped dry, pump column and deck lines to be blown and drained. Tanks to be visually inspected to ensure min ROB

Notes:
1. Tanks to be stripped dry such that any liquid ROB is confined to the pump well - or better.
2. Pump columns, deck lines, drops are to be educted (or blown for framo pumps) clear, and drained free of all product and water.
3. Deck lines, loading drops and cross over lines must be thoroughly washed and drained.