

Instruction for Flushing

Lubricating Oil System

20.10.2020


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1 Introduction

Before running the engine for the first time, it is essential to remove any foreign particles (i.e. any dirt) from the piping system. This especially applies to slag and spelter which may be caused by welding and hard soldering, respectively. Foreign particles that are left over due to incorrect or insufficient cleaning can cause serious damages to the engine and system components. For example, this can have significant influence on the engine performance and result in costly repairs. The manufacturing quality of the pipe connections will determine the level of effort required for the cleaning. More advanced welding methods such as inert gas welding will result in less scales, slag and spelter having to be removed in the cleaning. Common cleaning methods include manual cleaning by hand, use of pressurised air, or flushing the system with oil.

In any case, the cleaning must always finish with the flushing of the system oil through the piping system.

2 Required flushing

Generally, flushing is required after the following stages (see Figure 1):

- Engine assembly in the assembly shop (by the engine manufacturer)
- Engine installation in the ship (by the shipyard)
- Ship delivery and maintenance work

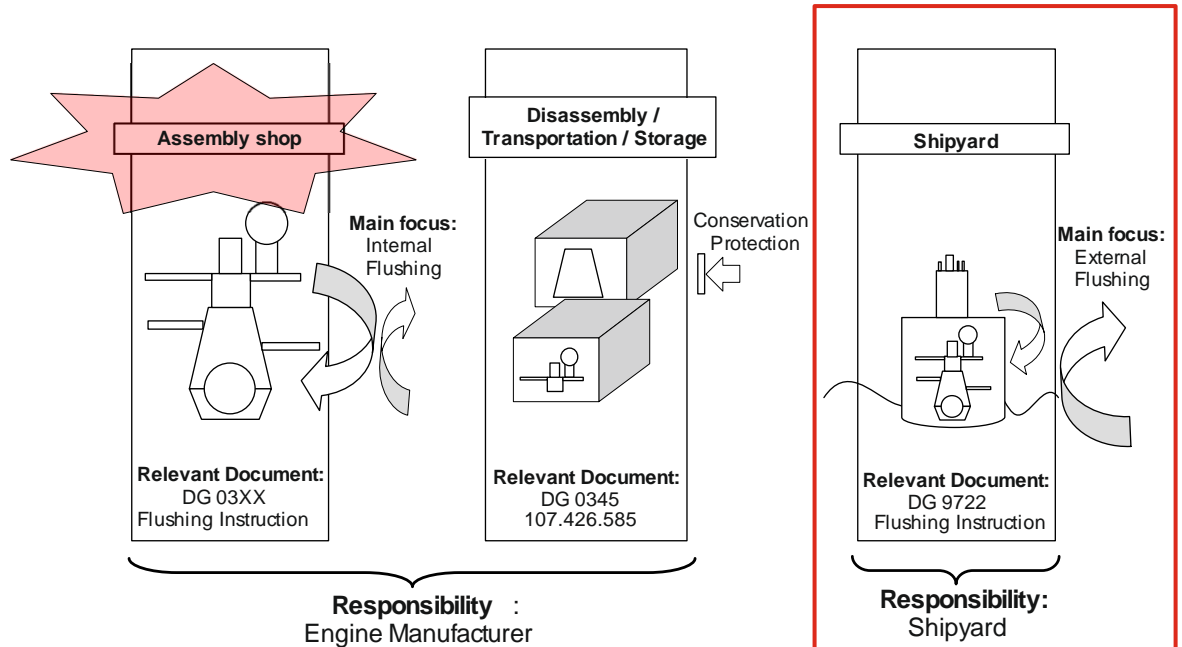


Figure 1: Engine flushing during stages of delivery

This document focuses on the flushing procedure for all external systems which is the responsibility of the shipyard (i.e. all components that are not part of the engine). The engine components are normally cleaned by the engine manufacturer, especially since the engine itself must be cleaned before the first run at the shop test by the manufacturer. However, depending on the engine delivery (i.e. including engine assembly by the shipyard where several parts have been opened, removal of protection such as the cover, disassembled A-frame, bedplate, etc.) and/or the packing (i.e. damages to the packing), there is the potential that foreign particles may have entered the engine components. If this is the case, the engine components must be cleaned again by the shipyard. The flushing procedures for internal flushing of the engine must be applied (this document is included in the engine builder drawing set).

To minimise the risk of contaminating the engine assembly parts it is recommended to follow the guidelines specified in the document **Guideline for Engine Protection after Shop Test** which is provided on the WinGD webpage using the following link: <https://www.wingd.com/en/documents/w-2s/engine-installation/guideline-for-engine-protection/>

Note: In any case, before running the engine for the first time, it is essential to flush the piping systems.

3 Flushing medium

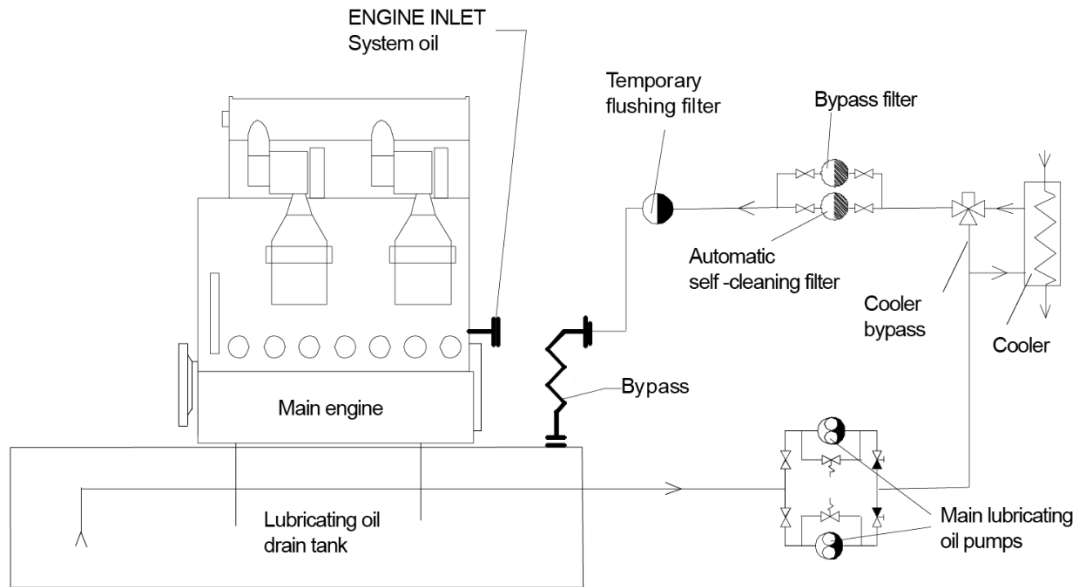
The flushing medium includes lubricating oil from the lubricating oil drain tank. This lubricating oil is continuously cleaned by the lubricating oil separators. The oil temperature must always be maintained at approximately 40-60 °C. This temperature can be sustained by tank heaters and especially the separator pre-heaters.

4 Flushing procedure

On the ship side, before performing the external flushing of the components, an appropriate preparation for the external flushing procedure must be carried out as outlined in section 4.1.

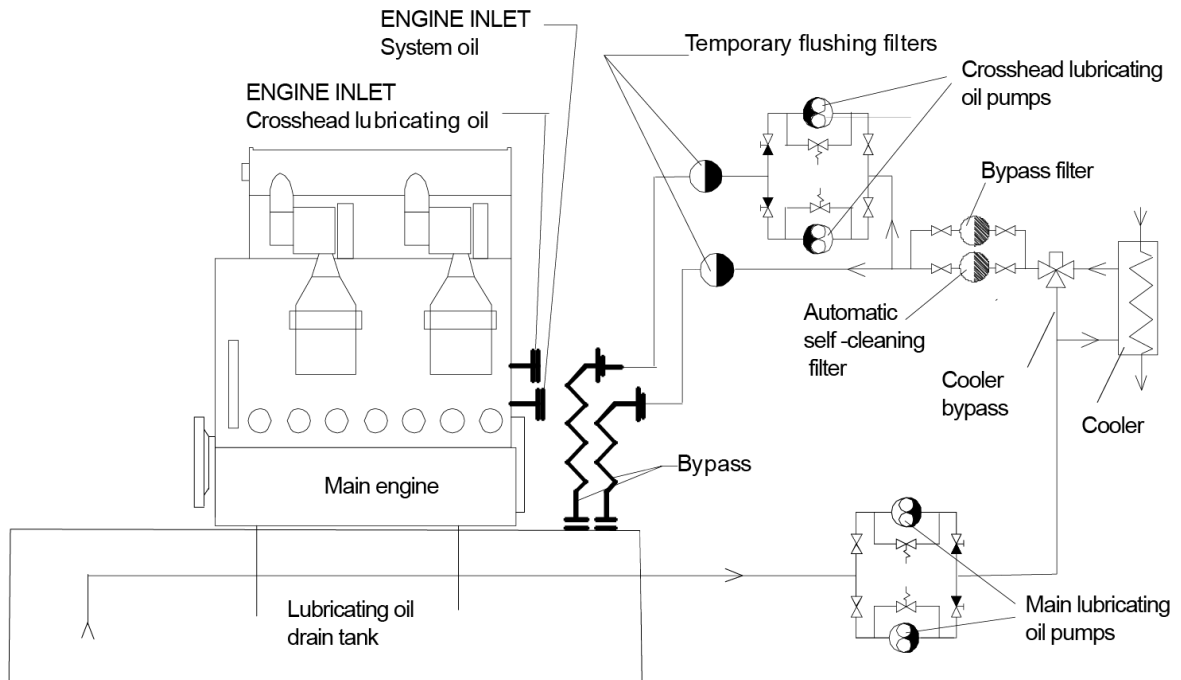
4.1 Preparation for the external flushing procedure

1. Disconnect the lubricating oil system on the ship side from the lubricating oil system on the engine side. This is carried out by using any hose(s) or pipe(s) to bypass the lubricating oil system on the engine side straight back into the lubricating oil drain tank. See Figure 2 and Figure 3 for how to connect the hose(s) or pipe(s) for engines without crosshead pumps and for engines with crosshead pumps, respectively.
2. Blank the engine connections to prevent foreign particles from entering the engine components during the flushing procedure. This is carried out by applying blanking pieces which include, for example, blind flanges or covers.
3. On the ship side, install a temporary flushing filter (located just upstream from the bypass). See Figure 2 and Figure 3 for the arrangement. The filter must have a maximum mesh size (absolute sphere passing mesh) of 30 µm and be equipped with magnetic elements. Also, the bypass filter of the automatic self-cleaning filter on the ship side can be used in combination with or instead of a temporary flushing filter. However, if the bypass filter of the automatic self-cleaning filter is used, then the original filter cartridges within the filter housing must be replaced by temporary filter cartridges which also include magnetic filter inserts. This is to ensure proper cleaning.
4. Switch to the bypass of the automatic self-cleaning filter.
5. Disconnect the cooler(s) from the lubricating oil circulation line. The oil must bypass the cooler(s) and go directly to the filters and the lubricating oil drain tank.
6. Open the crankcase doors and the crankcase round covers to ensure adequate ventilation within the engine's crankcase. This is to prevent condensation.
7. Fill the lubricating oil drain tank with enough lubricating oil to ensure that the level remains above the minimum required suction level for the pump inlet.



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Figure 2: Preparation for the flushing procedure of engines without crosshead pumps



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Figure 3: Preparation for the flushing procedure of engines with crosshead pumps

4.2 External flushing of the components on the ship side

1. Flush the complete lubricating oil system by operating the system pumps. The system pumps include the main lubricating oil pumps and the crosshead pumps (where crosshead pumps are applicable) simultaneously.
2. Tap the lubricating oil circulation pipes periodically (or preferably, attach vibrators to the pipes).
3. Inspect the suction and discharge pump pressures and make sure that the pumps are not running hot.
4. Inspect the pressure drop of all filters (the temporary flushing filter and/or the bypass filter of the automatic self-cleaning filter on the ship side) and clean them periodically.
5. Flush the entire system until the flushing filter remains clean which is an indication of clean lubricating oil. On a clean flushing filter, no deposits can be found on the filter or on the magnetic filter inserts.
6. Take oil samples and assess whether the limits for the applicable particle count and size classes have been met (see section 7.1).

4.3 Internal flushing of the engine components

The engine components are normally cleaned by the engine manufacturer, especially since the engine itself must be cleaned before the first run at the shop test by the manufacturer. However, depending on the engine delivery (i.e. including engine assembly by the shipyard where several parts have been opened, removal of protection such as the cover, disassembled A-frame, bedplate, etc.) and/or the packing (i.e. damages to the packing), there is the potential that foreign particles may have entered the engine components. If this is the case, the engine components must be cleaned again by the shipyard. The flushing procedures for internal flushing of the engine must be applied (this document is included in the engine builder drawing set).

1. On the ship side, check whether the flushing of the components has been successfully completed (see section 4.2).
2. Remove all blanking pieces and any engine bypass hose(s) or pipe(s).
3. Reconnect the engine to the lubricating oil system.
4. On the engine side, prepare all pipe connections for internal flushing of the engine. The detailed instructions are provided in the internal flushing instructions for the engine as included in the engine builder drawing set.
5. On the ship side, operate the system pumps to flush the components on the ship side together with the components on the engine side. The system pumps include the main lubricating oil pumps and the crosshead pumps (where crosshead pumps are applicable) simultaneously.
6. Check and clean the filter(s) in the lubricating oil system periodically.
7. Flush the entire system until the flushing filters remain clean which is an indication of clean lubricating oil. On clean flushing filters, no deposits can be found on the filters or on the magnetic filter inserts.
8. Take oil samples and assess whether the limits for the applicable particle count and size classes have been met (see section 7.1).

Note: Normally, the internal flushing takes at least eight hours.

5 Commissioning of the lubricating oil system

After the successful completion of the flushing procedure (see sections 4.2 and 4.3), the following steps for commissioning of the lubricating oil system must be carried out:

1. On the ship side, check that no deposits (such as metallic particles) can be found on the magnetic filter inserts or at the bottom of the filter housings.
2. Once the system is confirmed to be clean, remove all temporary flushing equipment such as blanking pieces, any engine bypass hose(s) or pipe(s), and temporary flushing filters.
3. Clean all pipe-connecting pieces which were not previously flushed.
4. On the engine side, drain the lubricating oil from the distribution pipe to the main bearings.
5. Inspect the inside of the pipes of the entire system for deposits. If all the pipes are clean, proceed to re-fit all of them.
6. Inspect the bottom of the crankcase and lubricating oil drain tank. If necessary, clean both.
7. If the bypass filter of the automatic self-cleaning filter was used, clean the filter housings and insert the original filter cartridges. If temporary flushing filter(s) was/were used, then uninstall the temporary flushing filter(s).
8. Check to make sure that all connections and components are properly connected by checking that all screw-fastened connections are tight and mechanically secured for normal operation.
9. Remove the inspection cover of the thrust bearing which is located at the main bearing girder #2. The detailed instructions are provided in the internal flushing instructions for the engine as included in the engine builder drawing set.
10. Start the system pumps. The system pumps include the main lubricating oil pumps and the crosshead pumps (where crosshead pumps are applicable) simultaneously. Circulate the lubricating oil for approximately two hours under normal operating pressure and temperature.
11. Inspect the oil flow on all bearings, spray nozzles and any other engine components (such as dampers) for proper oil flow.
12. Check and clean the filter(s) in the lubricating oil system periodically.
13. Turn the crankshaft with the engaged turning gear periodically.
14. Carry out an inspection of the crankcase before refitting all the crankcase doors.

6 Cleaning of the cylinder oil supply system

In addition to the main lubricating oil system, the cylinder oil supply system must also be free of foreign particles before being re-connected to the engine. Therefore, a visual inspection of the storage and service tanks must be carried out. If foreign particles are found by visual inspection, then proper cleaning must be carried out to remove them. The same applies for the complete piping from the storage tank to the engine.

7 Definition and verification of fluid cleanliness

Verifying the fluid cleanliness is an important step in the lubrication oil flushing procedure. This verification provides an indication of the fluid's abrasive potential. Abrasive particles in the oil can cause wear on different parts of the engine. The limits for the applicable particle count and size classes are provided in section 7.1.

As a first step, a visual inspection is highly recommended to assess the fluid cleanliness. This is completed prior to any particle counting being performed. This provides an initial assessment of the fluid cleanliness and can save time and resources.

The visual inspection includes the following:

- A filter inspection which includes assessment of the deposits found on the magnetic filter inserts, filter towel, etc.
- A crankcase inspection which involves examination of any deposits and contaminations on the walls and floor of the crankcase. Also, this includes evaluation of the oil colour.
- A sludge inspection which includes assessment of the sludge from the separators, the automatic self-cleaning filter, etc.
- Counting the number of back-flushing cycles of the automatic self-cleaning filter. A high number of cycles indicates a high level of fouling.

Note: To confirm the fluid cleanliness, it is highly recommended that an approved examination by particle counting be performed to confirm that the limits have been achieved. This particle counting must be in accordance to SAE or ISO standard.

7.1 Particle count and size classes

Particle count and size classes are specified in the document **Lubricants for WinGD engines** provided on the WinGD webpage using the following link: <https://www.wingd.com/en/documents/w-2s/tribology/fuel-lubricants-water/lubricants-for-wingd-engines.pdf/>

Note: The WinGD limits, which must be met for the applicable particle count and size classes are provided in the document **Lubricants for WinGD engines**.

FLUSHING-INSTRUCTION_WinGD-2S_LUBRICATING-OIL-SYSTEM

TRACK CHANGES

DATE	SUBJECT	DESCRIPTION
2016-06-26	Flushing Instruction	First web upload
2020-11-16	107.341.455	Flushing Instruction – new revision

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