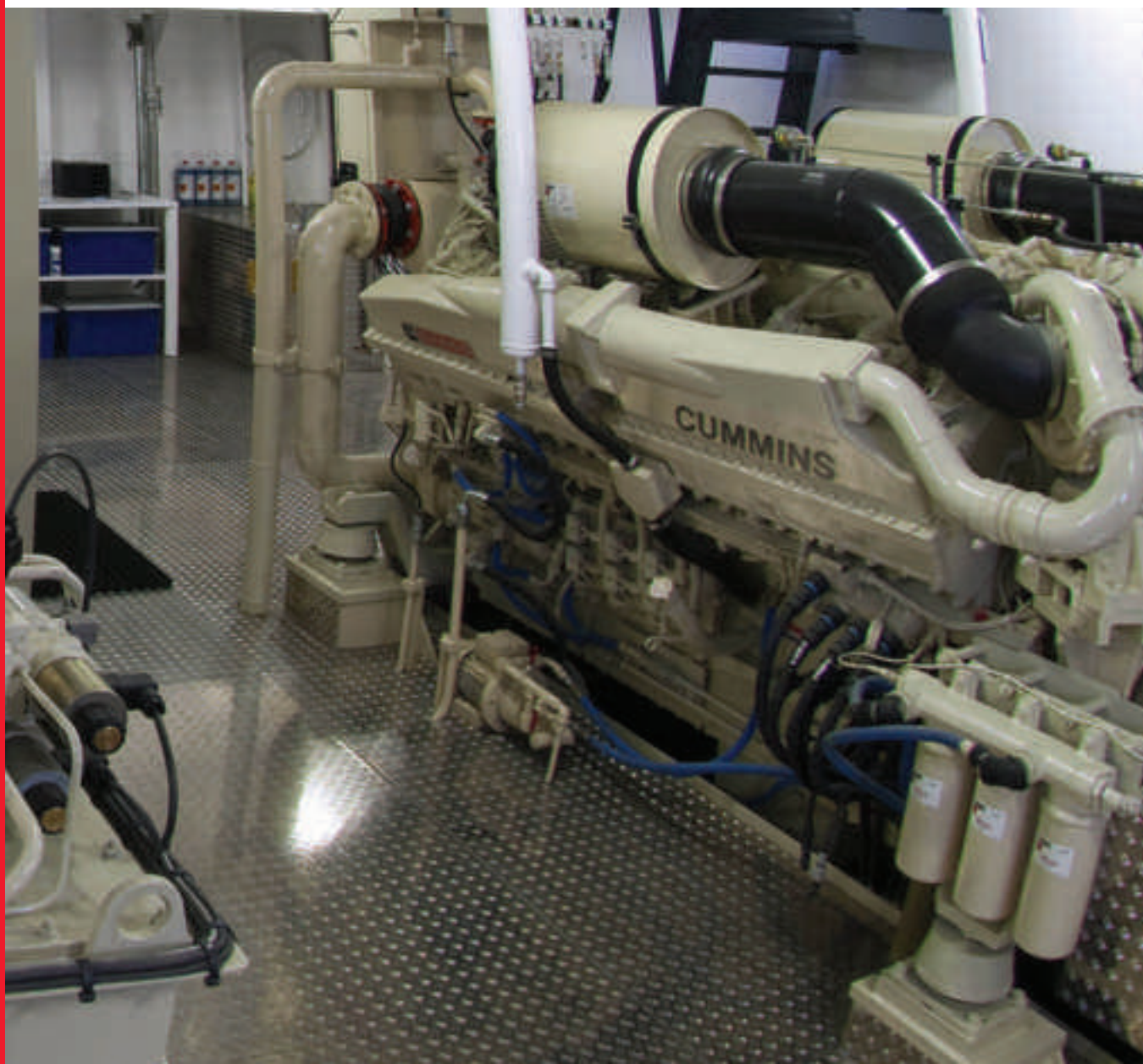
QSK MCRS Marine Engine Maintenance

Quick Reference Guide



Fuel Quality

Importance

Modern fuel systems have been developed to reduce emissions and to improve engine performance. These fuel systems operate at extreme pressures generated by components with tight tolerances. Very small, hard particles are harmful to fuel system components. For these reasons, clean fuel is essential to fuel system component life.

Fuel Source

Many sources of fuel contamination can occur as fuel travels from the refinery to the vessel. This is the reason Cummins recommends implementing a fuel sampling program to ensure the vendor is providing fuel that meets or exceeds the ISO 4406 recommended diesel fuel cleanliness level of 18/16/13.

Fuel sampling analysis is particularly helpful when fuel is frequently purchased from the same vendor. Contact your local Cummins service representative for assistance in implementing a fuel sampling program.

Fueling

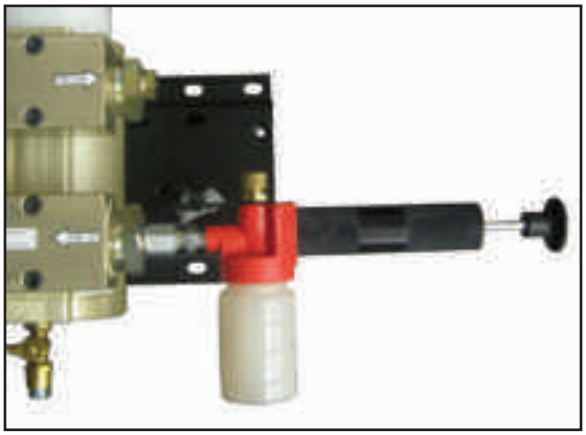
Cleanliness during fueling plays a vital role in overall engine health. During vessel fueling extra precaution should be practiced to prevent introducing contaminants into the vessel's fuel system.

To prevent common causes of contamination:

- Ensure fuel dispensing equipment is free of dirt or corrosion debris
- Regularly clean fuel storage tanks
- Inspect fuel tank caps and their associated seals. Replace any damaged parts
- Protect fuel tank openings from environmental contamination such as rain, wind or snow

Fuel Storage

- Ensure adequate fuel is in the storage and/or day tanks. Running the engine dry of fuel may cause fuel pump and/or fuel injector failure
- Avoid long term fuel storage (beyond 90 days) without treatment for stability
- Maintain vessel fuel system components such as centrifuges, filters, supply lines and tanks to ensure that fuel delivered to the Stage 1 filtration inlet meets or exceeds 18/16/13 fuel cleanliness. A fuel sampling port is provided at this location to help monitor fuel quality



These are just some of the key areas you should be aware of to gain the greatest service life from a Cummins engine. For more details, consult your engine's Operation and Maintenance Manual or contact your local Cummins distributor.

Fluid Quality

Fuel Filtration

In order to ensure the required fuel cleanliness level, Cummins has implemented a 3 stage filtration strategy for QSK MCRS engines.

- Stage 0 - OEM- or customer-supplied
- Stage 1 - Remote-mounted Sea Pro 5© filter assembly supplied by Cummins. **Please note: the Stage 1 pressure indicator should not be used to determine filter service intervals. It is intended to indicate poor fuel quality conditions that cause premature filter plugging**

- Stage 2 - On-engine mounted canister type filters supplied by Cummins

Oil Quality

- Use a high-quality 15W-40, API CH-4 or better, heavy duty engine oil that is designed for the climate in which the vessel will operate. Lower viscosity multigrades can be used in colder climates
- Always pre-fill primary filters with clean engine oil prior to installing

Coolant Quality

- Test coolant for appropriate Supplemental Coolant Additives (SCA) and anti-freeze (glycol) concentration levels
- Coolant should be comprised of 40-60% anti-freeze with an SCA concentration of 3-5 units per gallon of total coolant system capacity. If you elect to operate at anti-freeze levels below 40%, SCA levels should be as close to five units as possible. Under no condition does Cummins recommend operating below 25% anti-freeze levels; 25% anti-freeze provides approximately -10°C (15°F) freeze protection
- When topping off the cooling system, use a premix of high-quality water, anti-freeze and SCA. Cummins Filtration offers Compleat EG or PG Concentrate and Premix to eliminate most of the guesswork involved in maintaining the cooling system's proper chemical make-up

Maintenance Tips

Daily: Pre-Start

1. Inspect
   - Engine for damage, leaks and loose or frayed belts
   - Sea water strainer for debris and clean if needed
   - Air cleaner restriction indicator
   - Differential pressure indicator on Stage 1 fuel filter(s). If the indicator post has "popped-up," all Stage 1 and Stage 2 filters must be replaced immediately. Service the Stage 0 filter system per manufacturer recommendations
2. Check fluid levels
   - Fuel
   - Engine lubricating oil
   - Engine lubricating oil in Centinel makeup tank if applicable
   - Engine coolant
3. Drain
   - Water/sediment from fuel filters/water separators
   - Condensation from compressed air tanks if applicable
4. Check the engine monitoring system to ensure all gauges, warning lights and alarm indicators are operational
5. Document, report and correct any issues that were identified
6. After all of the above have been completed, the engine can be started

Daily: Post-Start

1. Listen for unusual noises from the engine
2. Monitor engine pressure and temperature gauges and shut down the engine if pressure or temperature readings do not match specifications
3. Idle the engine 3 to 5 minutes to attain a minimum coolant temperature of 60°C [140°F] before operating with a load
4. Once the vessel is underway, monitor engine RPM. The engine should never be operating in an "overload condition." An overload condition is defined as an engine not attaining rated RPM as indicated on the engine dataplate during normal operating conditions. Operating in an overload condition will reduce engine life. In the event of an overloaded condition, reduce throttle and correct the cause of overload
5. Record engine pressure and temperature readings daily in the vessel's log. Any change in engine or marine gear normal operating range could be cause for alarm and should be noted
6. During engine operation, continue to monitor alarms and abnormal gauge readings. If a "Water in Fuel" alarm sounds, it is important to immediately drain water from the fuel separators. Failure to do so may result in rapid failure of the fuel system

Maintenance Tips

Every 250 Hours or 6 Months

1. Inspect
   - Engine wiring for external damage
   - Sacrificial zinc plugs in cooling system if applicable
   - Belt tension if applicable
   - Air cleaner piping, hoses and clamps
   - Air cleaner element(s)
   - Crankcase breather tube
   - Batteries
   - Coolant quality
   - Stage 0 fuel filtration - service this filter system per manufacturer recommendations. Manually fill filters with clean diesel fuel in order to prime if applicable
2. Replace
   - Stage 1 fuel filters - manually fill filters with clean diesel fuel in order to prime. Do not use the Stage 1 pressure indicator to determine filter service intervals
   - Stage 2 fuel filters - do not pre-fill Stage 2 filters. Pre-filling can introduce contaminants directly into the fuel injectors
   - Engine oil and oil filters. If extended oil change intervals are desired, reference the O&M manual for the chart method. If your engine is equipped with the Centinel™ system, perform an oil sample analysis to determine if replacement is necessary
   - Coolant filters
3. Drain
   - Water and sediment from fuel tanks
   - Oil from crankcase demister canister

1,500 Hours or 1 Year Interval

1. Steam clean engine
2. Check/replace hoses as required
3. Check cold start aids (seasonal)
4. Torque engine mounting bolts to appropriate value
5. Inspect sea water pump if applicable
6. Clean the sea water heat exchanger if applicable
7. Check engine protection system
8. Check crankshaft end clearance
9. Professional tank cleaning service of all fuel supply tanks

4,000 Hours or 1 Year Interval

Test coolant replacement limits

6,000 Hours or 2 Years Interval

1. Inspect/check the vibration damper
2. Inspect/check the coolant pump
3. Inspect/check the turbo charger
4. Inspect coolant pressure cap for any visual damage

9,000 Hours or 2 Years Interval

Drain and flush coolant system. The coolant may be reused if replacement limits have not been exceeded

10,000 Hours Interval

1. Replace fuel injectors
2. Adjust valves

Resources

Resources

- Fuels for Cummins Engines (Bulletin 3379001)
- Fuel Sampling for Particle Counting Test (Bulletin 4022123)
- Cummins Coolant Requirements and Maintenance (Bulletin 3666132)
- Cummins Engine Oil and Oil Analysis Recommendations (Bulletin 3810340)

Web Resources

- Marine Website - marine.cummins.com
- QuickServe Online - qsol.cummins.com
- Worldwide Service Locator - wsl.cummins.com
- Operation and Maintenance Manual - available on QuickServe Online

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Bulletin 4082007 Printed in U.S.A. REV 10/11