TECHNICAL CIRCULAR WK 43

SMALL PARTICLES, BIG DAMAGE: CAT FINES IN MARINE FUEL



MARINER'S UPDATE
COMPLIANCE WITH SIMPLICITY

CAT FINES IN MARINE FUEL

Hard, tiny and abrasive. A practical guide to keeping them out of the engine.

Key point: fuel can meet the sulphur limit and still carry high CAT fines. Meeting the delivery specification does not guarantee a safe fuel at the engine inlet. The ship's treatment plant is the main defence.

1. What are CAT fines?

Catalytic fines are microscopic, very hard particles of aluminium oxide and silicon dioxide. They are left over from the catalytic cracking (FCC) process in refineries and can be present in HSFO, VLSFO and other blended residual fuels. They are harder than many engine surfaces, and their small size lets them slip through a poorly performing treatment plant. The level is judged by measuring **aluminium + silicon (Al + Si)** in the fuel.

2. How do they reach the engine?

Refinery FCC unit catalyst carryover	**Blending** into residual fuel	**Bunker delivery** to the ship	**Ship's treatment** last line of defence

How much arrives depends on the refinery, the blend components and how well the fuel is cleaned on board.

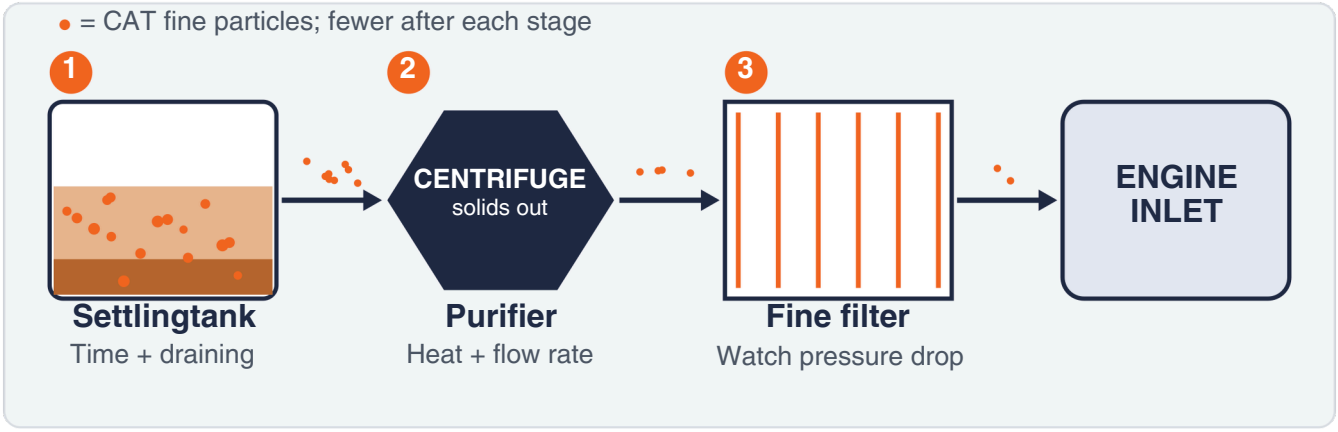
3. What damage do they cause?

Where	What happens
Fuel injection equipment	Abrasive wear of pumps, plungers, barrels, valves and injectors. Spray quality drops and combustion suffers.
Liners and piston rings	Particles get trapped between rings, liner and grooves: faster wear, sticking rings, blow-by, scuffing and, in severe cases, seizure.
Whole plant	Frequent filter backflushing, more maintenance, higher cylinder oil use, unplanned stoppages and possible off-hire.

Damage can develop **before the crew notices any change in performance**, which is why prevention and monitoring matter.

4. The treatment plant: three stages, one barrier

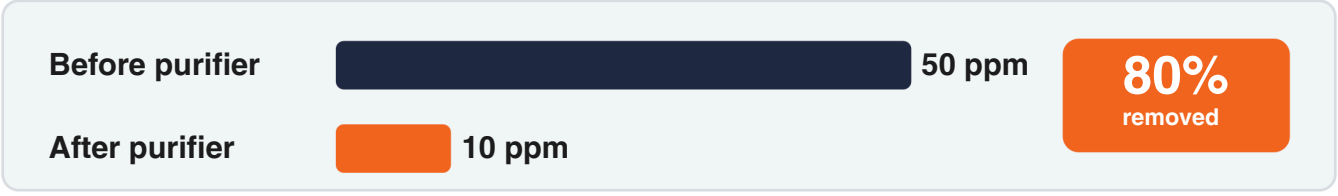
Settling, purification and filtration work together. None replaces the others.



Stage	Good practice
1 Settling tanks	Allow enough settling time. Keep the right temperature. Drain water and sediment regularly and avoid disturbing the bottom. Do not mix batches of unknown compatibility. ***Settling alone cannot remove the smallest particles.***
2 Purifier	Run temperature, throughput and arrangement as the maker specifies. Keep the bowl and disc stack clean and check for wear. Verify the sludge discharge works.
3 Fine filter	Watch differential pressure and investigate frequent backflushing. **Never bypass a filter** without an approved risk assessment and SOP. Frequent alarms mean poor purification: fix the cause, not the symptom.

5. Sampling: prove the plant is working

- **At bunkering:** sample, seal and document per company procedure; review the quality certificate too.
- **Before and after the purifier:** compare Al + Si to confirm CAT fines are being removed.
- **At the engine inlet:** check the fuel that actually reaches the engines.



Purifier efficiency = (before - after) ÷ before × 100 = (50 - 10) ÷ 50 × 100 = 80%. Example values only.

6. Watch the engine

Keep monitoring even when treatment looks good:

- Liner temperature trends
- Scavenge drain iron trends
- Scavenge space and wear signs
- Cylinder pressure data
- Piston ring condition
- Fuel pump and injector condition
- Cylinder oil feed rate
- Filter pressure, backflush, sludge

No single indicator is conclusive. Compare with baselines and the maker's limits; a sudden change in several cylinders needs **prompt investigation**.

7. If high CAT fines are found

1	**Verify**	Review bunker analysis; sample before and after treatment.
2	**Check plant**	Temperature, throughput, bowl, sludge discharge, filters.
3	**Protect engine**	Risk assessment first; follow the maker's instructions.
4	**Monitor**	Filters, engine parameters, liners and wear indicators.
5	**Report**	Tell the Company; keep samples, records and corrective action.

Never assume purification will fix contaminated fuel. If treatment cannot reach the required quality, consult the engine maker and Technical Manager before use.

8. Who does what

- **Chief Engineer:** Builds CAT fines handling into fuel procedures and planned maintenance, reviews bunker and lab reports, and keeps purifiers, heaters and filters well run.
- **Engine room team:** Record temperatures, throughput and filter pressures; report suspected fuel damage with evidence.

Compliant fuel must still be well treated before it reaches the engine.

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