Engine & Cooling

HIT SRL

130 procedures · 148 maintenance tips (pillole)

Technical Reference Document

Procedures

Cooling Circuit

How often should engine coolant be tested and replaced on a terminal tractor?

1. Test coolant every 250 hours.
2. Replace coolant every 2000 hours at the very minimum.
    - Exceeding these intervals may damage the cooling system or lead to injury.
    - Never attempt to open the radiator cap when the engine is hot; always allow the engine and coolant to cool completely first, or hot coolant may spray out and cause severe burns or blindness.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#how-often-should-engine-coolant-be-tested-and-replaced-on-a

Under what condition should the engine coolant level be checked?

1. Sight-check the level of the coolant in the tank.
2. Perform the inspection when the motor is cold, and make sure the level is between minimum and maximum.

Note: *Do not remove the radiator cap or filler cap if the engine is hot; the coolant is under pressure and can escape with explosive force, causing burns.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#under-what-condition-should-the-engine-coolant-level-be-chec

What is the correct sequence to change the engine coolant on a container stacker?

1. Unscrew the drain cap under the radiator.
2. Pour fresh water into the radiator to swill the circuit.
3. When the water comes out clean, close the drain cap.
4. Fill up with new coolant, using the mix indicated in the engine manual.
    - Disengage the battery disconnector before performing any maintenance jobs on the engine.
    - The liquid inside the radiator could be very hot; to check the coolant, make sure the engine is switched off and the radiator is cool.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-is-the-correct-sequence-to-change-the-engine-coolant-on

How and how often should engine coolant level be checked?

1. Check the coolant level cold, with the engine off; it must be between the MIN and MAX marks on the expansion tank's level indicator.
2. The liquid should reach the MAX mark; never let it fall below MIN.

Note: *Do not open the tank cap, breather caps, or the circuit tap when the engine is hot; the cooling system is under pressure and splashes of boiling liquid can cause serious burns.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#how-and-how-often-should-engine-coolant-level-be-checked

What is the correct sequence to replace the engine coolant filter?

1. Close tap "1" on the circuit, located on the filter support.
2. Remove the filter with a suitable tool.
3. Carefully clean the cartridge seat on the support.
4. Lubricate the new filter's gasket with engine oil.
5. Screw the new filter on by hand until the gasket contacts the sealing surface.
6. Tighten a further 1/2 to 3/4 turn, no more.
7. Reopen tap "1".

Note: *Do not replace the filter when the engine is hot; the cooling system is under pressure and splashes of boiling liquid can cause serious burns.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-is-the-correct-sequence-to-replace-the-engine-coolant-f

What is the correct sequence to replace the engine coolant?

1. Position the vehicle on level, compact ground.
2. Remove the filler cap "T" on the coolant tank.
3. Drain the system's liquid into a suitable container by opening tap "R" on the iron pipe between the radiator and the heat exchanger, and also remove cap "B" from the heat exchanger (both are at the lowest point of the cooling circuit).
4. Wait for the coolant to drain completely, then close tap "R" and refit cap "B" on the heat exchanger.
5. Introduce into the circuit water mixed with radiator descaler at the percentages prescribed on the product container.
6. Run the engine at medium speed for 15 minutes, then, without stopping the engine, drain the solution as described above while simultaneously feeding running water through the expansion tank for at least 40 minutes.
7. Drain all the water from the circuit as described above, then close tap "R" and refit cap "B".
8. Slowly pour the new coolant into the tank until the system is completely full.
9. Start the engine and let it run until air stops escaping from the coolant tank.
10. Screw the tank cap "T" back on.
11. Run the engine for a few minutes, then let it cool and top up the level.
    - Do not open the tank cap, breather caps or circuit tap when the engine is hot.
    - Do not pour cold coolant into a hot engine, as this could damage the block and cylinder head.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-is-the-correct-sequence-to-replace-the-engine-coolant

How often should the radiator core be checked and cleaned?

1. Check the cleanliness of the radiator core; if obstructed by dirt, mud or leaves, clean it immediately using compressed air or steam.

Note: *Using compressed air or steam for cleaning requires adequate hand, face and eye protection.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#how-often-should-the-radiator-core-be-checked-and-cleaned

What condition applies to mixing antifreeze with engine coolant?

1. Mix the glycol with clean water meeting ASTM D4985 in a separate container before filling the cooling system.
2. Never replace the coolant with plain water, even in summer; maintain the 50% water / 50% antifreeze proportion.
3. Check the antifreeze percentage using the specific hydrometer through the filler cap.
    - Glycol is harmful to health if ingested.
    - Do not use alcohol in the cooling system.
    - Never mix antifreeze (glycol) with corrosion-inhibiting agents; the two substances mixed together form foam and drastically reduce the coolant's effectiveness.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-condition-applies-to-mixing-antifreeze-with-engine-cool

How is engine coolant level checked and topped up?

1. Put the machine in service position.
2. When needed, top up with ready-mixed recommended coolant.
    - The coolant level should be between the MIN and MAX markings on the expansion tank.
    - If the coolant level becomes too low, an error code is shown in the control system's display; a low coolant level may cause engine damage or cause the engine to stop.
    - The cooling system is pressurised; open the filler cap very slowly when the engine is warm, and wait until the coolant has cooled down before topping up.
    - Different types of coolant must not be mixed; when changing or topping up, only use coolant of the same type used before.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#how-is-engine-coolant-level-checked-and-topped-up

What is the correct sequence to replace the radiator package?

1. Put the machine in service position.
2. Remove the engine compartment hood.
3. Drain the coolant and transmission oil out of the system via the coolant drain cock.
4. Undo the hoses for the intercooler, engine and transmission cooling, and for the expansion tank, from the radiator (the expansion tank hoses only need to be undone if its bracket is fixed directly to the engine on the specific engine variant fitted; on other variants the expansion tank is fixed to the radiator package and is removed together with it).
5. Remove the screws that fix the radiator package to the chassis.
6. Lift the radiator package gently out of the chassis.
7. Install in reverse order.
8. Check and top up fluids as necessary.

Note: *Read the safety instructions for oil and for the cooling system before working.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-is-the-correct-sequence-to-replace-the-radiator-package

What is the correct sequence to replace the intercooler?

1. Put the machine in service position.
2. Remove the radiator package.
3. Remove the screws that fix the fan housing.
4. Remove the radiator section by undoing its screws.
5. Install in reverse order.
6. Check and top up fluids as necessary.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-is-the-correct-sequence-to-replace-the-intercooler

What is the correct sequence to change and clean the engine cooling system, using the water-flush method?

1. Put the machine in service position; stop the engine, let it cool, and slowly remove the filler cap from the expansion tank.
2. Open all drain points and drain the coolant from the radiator and engine block via a drain hose; the drainage nipples are on the radiator and on the side of the engine block.
3. Check that all coolant has drained; leave the drain cocks/plugs open and set the heating control to full heat during cleaning.
4. Check the condition of the hoses, clamps and radiator sealing, replacing or cleaning as needed.
5. Insert a hose in the expansion tank filler hole and flush with clean water until the draining water runs clear.
6. Once the system is free of impurities, close the drain cocks and plugs.
7. Fill with clean water to a level between the MIN and MAX marks, and fit the filler cap.
8. Switch off the system voltage and start the engine once the system is fully bled and filled; let it idle until the temperature reaches 49-66°C, opening all heater controls to bleed the heater unit.
9. Stop the engine, let it cool, and repeat the drain-and-flush cycle (remove filler cap, open drain points, drain, flush with clean water) until the draining water runs clear.
10. Close the drain cocks and plugs once the system is free of impurities.
11. Fill the coolant to a level between MIN and MAX; do not fit the filler cap yet, as the engine must not be started before the system is bled and completely filled.
12. Start the engine and let it idle until the system is fully bled and filled; increase to raised idling speed with all heat controls open to ventilate the heater unit, running for a minute to expel trapped air, then stop the engine.
13. Check the coolant level and top up if required.
14. Clean the pressure cap and check its gasket, replacing the cap if the gasket is damaged; if intact, pressurise the cap with a suitable pump and confirm it holds the pressure stamped on the cap, replacing it if it does not.
15. Start the engine, check the cooling system's seal integrity, and confirm the engine reaches the correct operating temperature.

- The cooling system is pressurised; open the filler cap very slowly when the engine is warm and wait for the coolant to cool before topping up.
- Glycol and anti-corrosion agents are hazardous to health; avoid skin contact and wear protective glasses and gloves.
- On machines with a combined heating/cooling package, disconnect the electrical connection to the AC compressor before cleaning the radiator with water or a cleaning agent without anti-freeze properties, to avoid a freezing risk.
- Air pockets in the cooling system can damage the engine.
- Different types of coolant must not be mixed.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-is-the-correct-sequence-to-change-and-clean-the-engine

What is the correct sequence to change and clean the engine cooling system, using the chemical (sodium carbonate) cleaning method?

1. Remove the filler cap from the expansion tank.
2. Open all drain points and drain the coolant from the radiator and engine block; a drain nipple is located under the radiator and a drain plug under the coolant intake on the engine block.
3. Check that all coolant has drained; leave any additional drain valves or plugs open and set heat control to full heat during cleaning.
4. Check the condition of the hoses, clamps and radiator sealing, replacing or cleaning as needed.
5. Fill the system with a mixture of sodium carbonate and water (0.5 kg of sodium carbonate per 23 litres of water), without fitting the pressure cap.
6. Start and run the engine for 5 minutes with the coolant temperature over 80°C, then turn it off and empty the cooling system.
7. Fill the cooling system with clean water, ensuring it is properly bled, without fitting the pressure cap.
8. Start and run the engine for 5 minutes with the coolant temperature over 80°C again.
    - The system must be filled well to prevent air pockets; during filling, air must be vented from the cooling channels, waiting 2-3 minutes to allow the system to bleed before filling.
    - The cooling system is pressurised; open the filler cap very slowly when the engine is warm.
    - Glycol and anti-corrosion agents are hazardous to health; avoid skin contact.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-is-the-correct-sequence-to-change-and-clean-the-engine-2

What is the correct sequence to replace the low coolant level switch?

1. Put the machine in service position.
2. Open the engine hoods.
3. Release the expansion tank from its bracket.
4. Unplug the connector for the switch.
5. Withdraw the switch from the expansion tank.
6. Install in reverse order.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-is-the-correct-sequence-to-replace-the-low-coolant-leve

How is the engine coolant level checked?

1. Sight check the level of the coolant in the tank.
2. Perform the inspection when the engine is cold and make sure the level is between the minimum and maximum marks.

Note: *Do not remove the radiator cap or filler cap if the engine is hot; the coolant is under pressure and can escape with explosive force. Remove the cap only when the engine is cool.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#how-is-the-engine-coolant-level-checked

What is the correct sequence to change the radiator coolant?

1. Unscrew the drain cap under the radiator.
2. Pour fresh water into the radiator to flush the circuit.
3. When the water runs out clean, close the drain cap.
4. Fill up with new coolant, using the mix indicated in the engine manual.

- Disengage the battery disconnector before performing any maintenance on the engine.
- The liquid inside the radiator can be very hot after the engine stops; check the coolant only when the engine is switched off and the radiator is cool.
- Dispose of the coolant in accordance with anti-pollution regulations.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-is-the-correct-sequence-to-change-the-radiator-coolant

What is the correct sequence to change the coolant filter?

1. Put the machine in service position.
2. Close the shut-off valve on the filter holder.
3. Clean the area around the coolant filter.
4. Place a receptacle under the coolant filter.
5. Remove the coolant filter with the filter tool.
6. Lubricate the O-ring on the new filter cartridge with engine oil.
7. Fit the new filter, tightening to contact and then another half to three-quarter turn.
8. Open the shut-off valve on the filter holder.
9. Turn on the main electrical power and start the engine.
10. Check that the coolant filter seals tight.
11. Remove the receptacle, handling the coolant as environmentally hazardous waste.
12. Check the coolant level in the expansion tank, topping up if needed.

- Close the shut-off valve before loosening the filter, or coolant may run out causing environmental damage.
- Remember to reopen the shut-off valve after changing, otherwise the coolant will not pass through the filter and will not be cleaned.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-is-the-correct-sequence-to-change-the-coolant-filter

How is the cooling fan belt tension checked?

1. Place the cab in the front position.
2. Remove the cover plates over the engine and radiator.
3. Wash the engine compartment.
4. Put the machine in service position.
5. Check the belt tension and adjust if needed.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#how-is-the-cooling-fan-belt-tension-checked

How is the engine coolant level checked and topped up?

1. Put the machine in service position.
2. If needed, top up with water (in winter, with at least 40% glycol); if glycol is not used, an anti-corrosion agent must be added instead, but only when the outdoor temperature is always above 0°C, since it contains no anti-freeze.
    - A low coolant level may cause engine damage or cause the engine to stop.
    - The cooling system is pressurized; steam or hot fluid may jet out. Open the filler cap very carefully when the engine is warm, and wait until the coolant has cooled before topping up.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#how-is-the-engine-coolant-level-checked-and-topped-up

What cooling-circuit operations are checked during the 500-hour Type A preventive maintenance service?

1. Change the water filter.
2. Check the coolant level.
3. Check the tension and wear of the cooling belts.
4. Clean the radiator (external).

Note: *Maintenance must be carried out only by qualified, authorised personnel, working in conditions of maximum safety.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/cooling-circuit/#what-cooling-circuit-operations-are-checked-during-the-500-h

Fuel System

What should be done if Diesel Exhaust Fluid (DEF) contacts the eyes, skin, or is ingested?

1. In case of eye contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes.
2. In case of skin contact, immediately wash skin with soap and water.
3. If DEF is ingested, contact a physician immediately.

Note: *Do not allow Diesel Exhaust Fluid to contact the eyes; avoid prolonged contact with skin; do not swallow internally.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-should-be-done-if-diesel-exhaust-fluid-def-contacts-the

Why must diesel fuel never be mixed with gasoline or alcohol?

1. Never mix diesel fuel with gasoline, gasohol and/or alcohol.

Note: *This practice creates an extreme fire hazard and may cause an explosion which could result in serious injury or death.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#why-must-diesel-fuel-never-be-mixed-with-gasoline-or-alcohol

Under what condition should diesel fuel refuelling be carried out?

1. Fill up with diesel fuel at the end of each work shift.
2. Be sure there are no sparks, flames, or other ignition sources present when refuelling.
    - A deadly explosion can result if proper precautions are not taken.
    - Do not do any welding or have oxyhydrogen welding flames near the fuel tank.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#under-what-condition-should-diesel-fuel-refuelling-be-carrie

What is the correct procedure to drain and clean the diesel fuel sump?

1. Unscrew the cap on the bottom of the sump to drain off condensation and impurities.
2. Allow the water to drain out until the diesel fuel runs clean.
3. For cleaning, periodically unscrew the cap on the bottom of the sump to drain off condensation, impurities and washing detergent.

Note: *Draining could be easier after the machine has been at a standstill for some time, because condensation water tends to collect on the bottom of the sump.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-procedure-to-drain-and-clean-the-diesel

What is the correct sequence to replace the engine fuel filter?

1. Remove the fuel filter using the appropriate wrench.
2. Carefully clean the cartridge seat on the support, and remove the sealing gasket if present.
3. Lubricate the new filter's seal with clean engine oil.
4. Screw the new filter on by hand until the gasket contacts the sealing surface.
5. Tighten by hand a further 1/2 to 3/4 turn, no more.

- Do not fill the new filter with fuel before fitting it, as this risks impurities entering the system.
- Over-tightening the filter can break the gaskets and strip the threads.
- After removing the fuel filters, it may be necessary to bleed air from the fuel system.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-replace-the-engine-fuel-filt

What is the correct sequence to bleed air from the fuel system?

1. Place a collection container under the filter and pre-filter.
2. Confirm the engine is running.
3. Open the air bleed screw on the fuel filter support.
4. Repeatedly operate the fuel hand pump (fitted beside the fuel filter) until fuel free of air comes out.
5. Retighten the bleed screw while fuel is still flowing out.
6. Give the pump another 15-20 strokes.
7. Check there are no leaks from the system.

- If the engine stops due to lack of fuel (with air entering the lines), loosen the fittings of at least two injectors, simulate starting, and retighten the fittings once bled.
- These operations must be carried out by suitably trained and qualified personnel.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-bleed-air-from-the-fuel-syst

How is the water/fuel separator drained, and how often?

1. Stop the engine.
2. Place a container under the separator.
3. Unscrew drain valve "3" at the bottom of the separator.
4. Let the water and impurities drain out until clear fuel appears.
5. Screw the drain valve back in.

- Do not over-tighten the drain valve, to avoid damaging the thread.
- After switching off the engine, wait a few hours before cleaning the separator.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#how-is-the-water-fuel-separator-drained-and-how-often

What is the correct sequence to replace the water/fuel separator's filter cartridge?

1. Stop the engine, or close the tap before the filter if fitted.
2. Place a container under the separator.
3. Unscrew the drain valve and the container, and empty it.
4. Unscrew and change the filter.
5. Check the new filter is perfectly clean and the gasket is undamaged and well lubricated, then screw on by hand.
6. Refit the container and the drain valve.
7. Confirm the drain valve is closed, and close the tap before the filter if fitted.
8. Bleed the circuit, then start the engine and check for leaks.

- Do not over-tighten the drain valve, to avoid damaging the thread.
- After switching off the engine, wait a few hours before cleaning the separator.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-replace-the-water-fuel-separ

What is the correct sequence to drain sediment from the fuel tank?

1. Place a container under the tank.
2. Unscrew the drain plug "S" and let some fuel flow out to drain any impurities or condensation water in the tank.

Note: *If the tank is emptied completely, bleed the fuel system afterward.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-drain-sediment-from-the-fuel

What is the correct sequence to replace the fuel level sensor?

1. Put the machine in service position.
2. Separate the connector and release the cable.
3. Unscrew the sensor.
4. Screw a new sensor into place, join the connector and fix the cable with a tie wrap.

Note: *The sensor sends a voltage signal proportional to fuel level; an alarm is shown in the display if fuel level is below 15% for more than 40 seconds.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-replace-the-fuel-level-senso

How is condensation drained from the fuel sump?

1. Unscrew the cap on the bottom of the sump to drain off condensation and impurities.
2. Allow the water to drain out until the diesel fuel runs clean.

- Never use open flames or smoke near the fuel system, due to explosion hazard.
- Dispose of drained liquids in accordance with anti-pollution regulations.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#how-is-condensation-drained-from-the-fuel-sump

How is the fuel sump cleaned?

1. Unscrew the cap on the bottom of the sump.
2. Drain off the condensation, impurities and washing detergent.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#how-is-the-fuel-sump-cleaned

What is the correct sequence to bleed the fuel system?

1. Clean the area around the bleeder nipples on the fuel filter's bracket and cylinder head.
2. Place a receptacle under the fuel filter.
3. Connect a transparent plastic hose to the bleeder nipple on the filter bracket, placing the other end in the collection container.
4. Open the bleeder nipple on the filter bracket.
5. Pump up fuel with the hand pump until clean fuel free of air bubbles flows out of the hose.
6. Transfer the hose to the bleeder nipple on the cylinder head and bleed in the same way as at the fuel filter.

Note: *If only the fuel filter has been changed, no further bleeding is required.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-bleed-the-fuel-system

How is the metal filter in the fuel supply line cleaned?

1. Use hose pliers to stop the fuel flow to the fuel filter.
2. Disconnect the hose at its attachments (inlet and supply line).
3. Blow the hose clean with compressed air.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#how-is-the-metal-filter-in-the-fuel-supply-line-cleaned

What is the correct sequence to change the fuel pre-filter?

1. Put the machine in service position.
2. Place a receptacle under the fuel pre-filter.
3. Clean the area around the fuel pre-filter.
4. Drain the fuel pre-filter of fuel and water: open the drain valve on the underside, and close it when the filter is empty.
5. Disconnect the wiring from the sensor for water in fuel.
6. Remove the fuel pre-filter with the filter tool.
7. Transfer the water trap to the new fuel pre-filter.
8. Lubricate the O-ring on the new fuel pre-filter with engine oil.
9. Fit the new fuel pre-filter, tightening to contact and then another half to three-quarter turn.
10. Connect the wiring to the sensor for water in fuel.
11. Turn on the main electrical power and start the engine, checking that the filter seals tight.
12. Turn off the engine and remove the receptacle, handling the fuel as environmentally hazardous and inflammable waste.
    - Avoid skin contact with fuel; use gloves, since fuel on hands may cause rashes and irritation.
    - Pay attention to fire hazard when working on the fuel system; avoid changing the fuel pre-filter when the engine is hot, since fuel may spill on hot surfaces and ignite.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-change-the-fuel-pre-filter

How is condensation water drained from the fuel pre-filter?

1. Put the machine in service position.
2. Place a receptacle under the fuel pre-filter.
3. Open the drain valve on the underside and let the condensation water drain, closing the valve once clean fuel drains with no water bubbles.
4. Remove the receptacle, handling the fuel as environmentally hazardous and inflammable waste.
    - Avoid skin contact with fuel; use gloves.
    - Wait a few hours for the engine to cool down before draining condensation water.
    - Pay attention to fire hazard when working on the fuel system.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#how-is-condensation-water-drained-from-the-fuel-pre-filter

What is the correct sequence to change the fuel filter on one engine alternative?

1. Put the machine in service position.
2. Place a receptacle under the fuel filter.
3. Clean the area around the fuel filter.
4. Remove the fuel filter with the filter tool.
5. Lubricate the O-ring on the new fuel filter with engine oil.
6. Fit the new fuel filter, tightening to contact and then another half to three-quarter turn.
7. Bleed the fuel system.
8. Turn on the main electrical power and start the engine, checking that the fuel filter seals tight.
9. Turn off the engine and remove the receptacle, handling the fuel as environmentally hazardous and inflammable waste.
    - Avoid skin contact with fuel; use gloves.
    - Do not fill the new fuel filter with fuel before installing, to avoid impurities entering the fuel system.
    - Pay attention to fire hazard; avoid changing the fuel filter when the engine is hot.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-change-the-fuel-filter-on-on

What is the correct sequence to change the fuel filter on the other engine alternative?

1. Put the machine in service position.
2. Place a receptacle under the fuel filter.
3. Clean the area around the fuel filter.
4. Disconnect the wiring from the sensor for water in fuel.
5. Remove the fuel filter with the filter tool.
6. Change the seal at the filter's threaded connection on the filter holder and lubricate it with engine oil.
7. Fill the new fuel filter with pure fuel.
8. Lubricate the seal on the new fuel filter with engine oil.
9. Fit the new fuel filter, tightening to contact and then another half to three-quarter turn.
10. Turn on the main electrical power and start the engine, checking that the fuel filter seals tight.
11. Turn off the engine and remove the receptacle, handling the fuel as environmentally hazardous and inflammable waste.
    - Avoid skin contact with fuel; use gloves.
    - Pay attention to fire hazard; avoid changing the fuel filter when the engine is hot.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-change-the-fuel-filter-on-th

What is the correct sequence to drain water from the fuel tank?

1. Remove the drain plug to drain any water from the fuel tank.
2. Refit the drain plug immediately once the flow of fuel is free from water and other impurities.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-drain-water-from-the-fuel-ta

What is the correct sequence to change the fuel filters?

1. Clean the outsides of the filters.
2. Remove the filters and discard them.
3. Clean the filter head.
4. Check that the new filters are perfectly clean and that the seals are in good condition.
5. Fit the new filter canisters and tighten them by hand until the seal is in contact with the seating surface, then tighten a further half a turn.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-change-the-fuel-filters

What is the correct sequence to bleed the fuel system on one engine alternative?

1. Put the machine in service position.
2. Place a container under the fuel pre-filter.
3. Open the air bleeder screw on the fuel filter.
4. Pump with the hand pump until the flowing fuel is free from air (if only the fuel filter is changed, no further bleeding is necessary).
5. Close the screw once clean, air-free fuel flows out.
6. Wipe off the fuel pre-filter and remove the collection container.

Note: *The fuel system operates at very high pressure; use protective gloves and safety goggles and avoid skin contact with fuel.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-bleed-the-fuel-system-on-one

What is the correct sequence to bleed the fuel system on the other engine alternative?

1. Put the machine in service position.
2. Open the bleed screw.
3. Turn the hand pump anticlockwise to open the pump.
4. Pump until the fuel is completely free of air bubbles.
5. Tighten the bleed screw and close the fuel hand pump.
6. Start the engine and check sealing.

Note: *The fuel system operates at very high pressure; use protective gloves and safety goggles and avoid skin contact with fuel.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-bleed-the-fuel-system-on-the

What is the correct sequence to clean the fuel tank?

1. Put the machine in service position.
2. Empty the fuel tank of fuel using a pumping device.
3. Remove the drain plug from the fuel tank.
4. Rinse the fuel tank clean through the fuel filler hole.
5. Reinstall the drain plug.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-clean-the-fuel-tank

What is the correct sequence to drain condensation water from the fuel pre-filter on one engine alternative?

1. Put the machine in service position.
2. Place a container under the fuel pre-filter.
3. Open the drain valve on the underside of the filter and let the water drain, closing the valve once clean fuel flows out.
4. Wipe off the fuel pre-filter and remove the collection container.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-drain-condensation-water-fro

What is the correct sequence to drain condensation water from the fuel pre-filter on the other engine alternative?

1. Put the machine in service position.
2. Place a container under the fuel pre-filter.
3. Open the drain valve on the underside of the filter and let the water drain, closing the valve once clean fuel flows out.
4. Close the drain cock by pushing the valve up and tightening it by hand.
5. Bleed the fuel system.
6. Wipe off the fuel pre-filter and remove the collection container.
7. Start the engine and check sealing.

Note: *Do not over-tighten the drain cock, as the threads may be damaged.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-drain-condensation-water-fro-2

What is the correct sequence to change the fuel pre-filter on one engine alternative?

1. Put the machine in service position.
2. Place a container under the fuel pre-filter.
3. Drain the fuel pre-filter of fuel and water through the drain valve on the underside, closing it once the filter is empty.
4. Disconnect the wiring from the water-in-fuel sensor.
5. Remove the water-in-fuel sensor from the filter insert.
6. Remove the fuel filter with the filter removal tool.
7. Install the water-in-fuel sensor on the new fuel pre-filter.
8. Fill the fuel pre-filter with clean fuel.
9. Lubricate the O-ring on the new fuel filter with engine oil.
10. Install the new fuel pre-filter, tightening to contact and then an additional one-half to three-quarter turn.
11. Connect the line supply to the water-in-fuel sensor.
12. Wipe off the fuel pre-filter and remove the collection container.
13. Turn on the system voltage and start the engine, checking that the filter seals tight.

Note: *The fuel system is sensitive to impurities; only use new fuel from a clean container to reduce the risk of impurities in the fuel system.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-change-the-fuel-pre-filter-o

What is the correct sequence to change the fuel pre-filter on the other engine alternative?

1. Put the machine in service position.
2. Open the drain cock and drain any water.
3. Remove the filter cartridge.
4. Check that the new filter cartridge is absolutely clean and that the gasket is intact, brushing a small amount of oil onto the gasket.
5. Screw the filter cartridge onto the filter bracket.
6. Bleed the fuel system.
7. Start the engine and check sealing.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-change-the-fuel-pre-filter-o-2

What is the correct sequence to remove the fuel tank?

1. Provide a suitable container to catch the fuel, and remove the drain plug to release the fuel from the fuel tank.
2. Disconnect all fuel hoses from the tank.
3. Remove the access panel by removing its bolts and washers.
4. Remove the bolts and washers that release the tank from its seat.
5. Carefully remove the fuel tank to a prepared storage area.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-remove-the-fuel-tank

What is the correct sequence to install the fuel tank?

1. If the tank is being replaced, transfer the elbow fittings to the new tank.
2. Reverse the removal procedure to fit the tank, panel, and hoses.
3. Apply the proper torque values from the manual's torque table.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-is-the-correct-sequence-to-install-the-fuel-tank

What fuel-system operations are checked during the 500-hour Type A preventive maintenance service?

1. Clean the fuel pump's small filter cup.
2. Change the fuel filter(s).
3. Clean the fuel intake filter.

Note: *Maintenance must be carried out only by qualified, authorised personnel, working in conditions of maximum safety.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/fuel-system/#what-fuel-system-operations-are-checked-during-the-500-hour

Air Intake & turbo

What is the correct sequence to perform a stationary Diesel Particulate Filter (DPF) regeneration?

1. Park the vehicle in an area where it can safely idle for up to 50 minutes (the regeneration period may be 5 to 50 minutes depending on severity).
2. Set the parking brake and let the truck idle.
3. Turn the Regen switch, located on the dash to the right of the steering column, to the "ON" position.
4. Do not throttle the engine or apply the brake pedal until the regeneration is complete and the DPF light goes out.
5. Turn the Regen switch to the "OFF" position after regeneration is complete.

Note: *Throttling the engine and/or applying the brake will stop the regeneration process.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-perform-a-stationary-diesel

What precautions should be taken when starting and stopping a turbocharged engine?

1. After starting the engine, let it idle for at least 30 seconds before bringing it to high revs.
2. Before stopping the engine, let it idle for at least one minute.
    - Lack of lubricant, entry of foreign bodies, or lubricant contamination are the three main causes of turbocharger damage.
    - In case of lubricant leaks, vibrations or an abnormal sound, stop the engine immediately.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-precautions-should-be-taken-when-starting-and-stopping

What should be checked on the turbocharger every 1000 hours?

1. Check the seal of the gaskets and fittings on the intake and exhaust circuits, and eliminate any leaks.
2. Examine the oil delivery and return pipes to make sure there is no damage that could reduce oil supply.

Note: *Any reduction in oil flow, given the turbocharger's high operating speeds, would cause it to fail.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-should-be-checked-on-the-turbocharger-every-1000-hours

What is the correct sequence to clean and check the air filter cartridge?

1. Remove the cover by releasing the retaining clips.
2. Withdraw the cartridge.
3. Clean using compressed air at a maximum pressure of 3 bar, held about 5 cm from the element, blowing from inside to outside; never clean by tapping the element on a hard surface. Alternatively, if clogged with soot or oil, immerse the element in a water and detergent solution for 15 minutes, rotate it on its axis for at least 2 minutes, rinse abundantly, then dry with warm air.
4. Before refitting, check: the condition of the gasket; the fins of the filter element; the integrity of the element by inserting a light source inside it (even the smallest tear will let light through); that the filter body is clean of dust residue; that the cartridge is correctly seated; that the rubber evacuator valve is clean of deposits and free of tears (replace if damaged).
    - Clean the filter element a maximum of 6 times, then replace it.
    - Incorrect fitting, allowing inadequately filtered air to enter, can cause serious engine damage.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-clean-and-check-the-air-filt

How often should the air filter's optional safety cartridge be replaced, and how is it accessed?

1. The safety cartridge must never be cleaned, only replaced.
2. Access it by withdrawing the outer filter element as previously described.

Note: *Handle with care and maximum cleanliness during replacement.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#how-often-should-the-air-filter-s-optional-safety-cartridge

What is the correct sequence to clean the closed crankcase breather valve?

1. Remove the valve from the engine.
2. Immerse it in a container of diesel fuel overnight.
3. Rinse it several times with clean diesel fuel, then let it drip dry.
4. Refit it to the engine.

Note: *The valve can be cleaned a maximum of 2 times after the first 2500 hours of work; mark the valve after cleaning it.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-clean-the-closed-crankcase-b

What is the correct sequence to replace the diesel particulate filtering device (combi filter)?

1. Put the machine in service position, and make sure the combi filter is not connected to the electric mains before starting.
2. Remove the exhaust pipe.
3. Remove the protective cover from the electrical distribution box (four screws).
4. Mark and remove the cables from their connections and the lock nut on the main cable.
5. Remove the clamp for the inlet manifold.
6. Remove the four screws securing the particulate filtering device.
7. Remove the silencer.
8. Fit in the reverse order.

Note: *The filter must not be covered, and combustible material must not be near or in contact with it during clean burning; hot air flows from the outlet pipe during clean burning and can ignite combustible material.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-replace-the-diesel-particula

What is the correct sequence to replace the air intake and exhaust outlet pipes and hoses?

1. Put the machine in service position.
2. Remove the exhaust system pipes and hoses.
3. Undo the tie wraps holding the hoses and cables together, and protect the engine air inlet and hose with a seal.
4. Remove the hose clamps that hold the air hose to the filter and the turbo.
5. Remove the hose clamps holding the intercooler hoses in place.
6. Remove the intercooler hoses.
7. Install in reverse order.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-replace-the-air-intake-and-e

What is the correct sequence to replace the exhaust system?

1. Put the machine in service position.
2. Undo the clamp between the outlet pipe and the silencer.
3. Remove the screws that fix the outlet pipe to the chassis, and remove the outlet pipe.
4. Undo the clamp between the pipe and the silencer.
5. Remove the screws that fix the silencer to the chassis.
6. Remove the silencer.
7. Install in reverse order.

Note: *Never touch the turbo or silencer when the machine is running or just after it has been turned off; risk of burn injuries.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-replace-the-exhaust-system

What is the correct sequence to change the engine air filter?

1. Put the machine in service position.
2. Clean the outside of the air filter housing.
3. Remove the cap from the air filter housing.
4. Remove the filter cartridge.
5. Clean the particle outlet.
6. Check the safety cartridge, changing it every other time the filter cartridge is changed.
7. Fit a new filter cartridge and fit the cap.
8. Reset the indicator.

Note: *The filter cartridge should be changed, not cleaned.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-engine-air-filter

Replacing the air filter on the engine

1. Open the filter housing cover.
2. Remove the air filter (the larger filter element).
3. Check the safety cartridge (the smaller filter element), and replace it if necessary; the safety cartridge is usually replaced every other time the air filter is replaced.
4. Install the new air filter, and mount the cover.
5. Reset the clog warning indicator by pressing the button on its end.

Note: *The air filter is replaced during scheduled maintenance; depending on conditions, it may clog during a relatively short operating period.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#replacing-the-air-filter-on-the-engine

Cleaning and checking the crankcase breather tube on the engine

1. Remove the crankcase breather tube from the breather vent tube.
2. Use solvent to clean the inside of the crankcase breather tube, and dry it with compressed air.
3. Use air pressure to blow through the vent tube.
4. Replace the vent tube if it is clogged.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#cleaning-and-checking-the-crankcase-breather-tube-on-the

Engine Mechanical

What precautions should be observed during the running-in period of a new machine?

1. Do not demand maximum power from the engine.
2. After every start-up, warm the engine up slowly, avoiding reaching high rotation speeds immediately.
3. Check the oil level frequently.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-precautions-should-be-observed-during-the-running-in-pe

What is the correct sequence to remove and replace the diesel engine on this class of machine?

1. Put the machine in service position.
2. Remove the engine compartment hood.
3. Remove the partition wall between the engine compartment and the cab (secured with four screws, carries the air cleaner); release the hose connection from the turbo and undo the hose clamp holding the inlet hose to the left-hand front engine mounting, and protect the air inlet and hose with a seal.
4. Connect lifting equipment to the diesel engine.
5. Undo cables and hoses as necessary before separating the engine and transmission pump: remove the earth strap screw on the machine's left-hand side; remove the AC compressor's screws and drive belt and fold it away without undoing the hoses; undo the engine cable connector by releasing its screw and pressing the plastic lock on the underside, then fold the connector aside.
6. Empty and collect all fluids, then undo and remove the fuel hoses from the primary fuel filter and fuel tank, plugging all connections and hoses immediately to prevent impurities entering the fuel or hydraulic system.
7. Remove the bracket for the transmission dipstick from the engine on the machine's left-hand side, and undo the silencer to access the nuts on the flexible plate.
8. Remove the radiator.
9. Secure the transmission with a jack or equivalent.
10. Remove the screws for the cover plate under the flywheel.
11. Remove the nuts or screws for the flexible plate through the hole under the cover plate, turning the engine over between each one to bring the next fastener into reach.
12. Take up the slack in the hoisting equipment, without raising the engine.
13. Remove the screws between the engine and the transmission.
14. Remove the screws in the engine brackets.
15. Withdraw the engine rearwards to separate it from the transmission, then lift it away.
16. Assembly: move the engine mountings from the removed engine to the new one, torquing the front engine mounting screws to 189 Nm.
17. Move other components from the old engine to the new one as necessary.
18. Put two studs into the flywheel housing as a guide for installation.
19. Grease the torque converter connection on both the engine and the transmission.
20. Align a stud on the flywheel so it is centred on a hole in the flywheel housing.
21. Lift the new engine into place, making sure the studs on the flywheel are correctly aligned and do not damage the flexible plate.
22. Install the screws that fix the transmission and engine, but do not tighten them fully, leaving about a millimetre of gap to facilitate installing the flexible plate fasteners.
23. Install the nuts or screws holding the flexible plate to the flywheel in two stages, not tightening them fully in the first stage.
24. Tighten the screws that fix the transmission and engine.
25. Rotate the flywheel a further turn and tighten the flexible plate fasteners.
26. Line up and screw down the engine mountings on the rubber dampers, torquing the screws to 135 Nm.
27. Fit the cover plate under the flywheel.
28. Remove the lifting equipment from the engine and the jack from underneath the transmission.
29. Reattach the relevant hoses and cables to the engine, checking fluid levels and topping up as necessary.
30. Refit the radiator, partition wall, silencer and other equipment, in reverse order of removal.
31. Test drive the machine.

- Read the safety instructions for oil and for the cooling system before working.
- The engine is very heavy; risk of pinch injury.

- If the flexible plates are damaged during the engine replacement, they must also be replaced.
- Beware of balance before the engine is lifted.
- If a dropped nut needs to be removed, the engine must be undone from its mountings and from the transmission; secure the nut in the socket during installation.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-remove-and-replace-the-diese

How is the engine oil level checked?

1. Check the motor oil level every day.
2. Maintain the oil level between the high and low marks, as close to the high mark as possible.
    - Never operate the engine with the oil level below the low mark or above the high mark.
    - A 15-minute drain-back time is required if the engine has been running.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#how-is-the-engine-oil-level-checked

What is the correct sequence for a normal engine start?

1. Adjust the seat.
2. Make sure the parking brake is applied.
3. Place all control levers in neutral.
4. Turn the ignition key to START and hold to start the engine.
5. Warm up the engine: check that engine and transmission oil pressures rise immediately (if the warning lights do not go off, stop the engine and notify maintenance); temperature gauges rise more slowly than pressure gauges; the battery charge indicator should go off after starting, otherwise stop the engine.
6. Allow the engine coolant temperature to rise to the low end of the normal range (approximately 40°C); do not apply full load before it reaches approximately 80°C.
7. Operate all controls slowly while the engine warms up, listening for unusual noises.
8. Once engine, transmission and hydraulic system temperatures are in the normal operating range, the machine is ready for use.
9. Test the braking system before proceeding to use the machine.
    - Do not operate the starting motor for longer than 15 seconds; wait 10 seconds between start attempts if starting fails.
    - Sound the horn to alert personnel in the area before starting the engine, and make sure everyone is clear of the machine, including the engine compartment.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-for-a-normal-engine-start

What precautions and sequence should be followed for a cold-weather engine start (below 10°C)?

1. Keep the batteries fully charged.
2. Keep the fuel clean and free of water.
3. Use lubricating oil with the correct viscosity for the ambient temperature range.
4. Pre-heat the glow plugs, holding the key in this position for a maximum of 5 seconds.
5. Start the engine.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-precautions-and-sequence-should-be-followed-for-a-cold

What is the correct sequence to stop the engine?

1. Turn the key switch to OFF to turn off all electrical control circuits and remove the starting key from the instrument panel.
2. Apply the parking brake.
3. If equipped, and the engine will be stopped for a prolonged period in cold weather, plug in the engine block heater and/or hydraulic oil tank heater using the correct external power socket.
4. Disconnect the battery selector and remove the key.
5. Close all locks before leaving the machine.

Note: *A turbocharged engine must always be run at about 1000 rpm with reduced load for 2 or 3 minutes before switching off, to allow the turbocharger to cool down.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-stop-the-engine

What is the correct sequence to change the engine oil and oil filter on one engine alternative?

1. Run the engine until warm.
2. Put the machine in service position.
3. Place a receptacle underneath the engine.
4. Remove the drain plug on the engine and drain the engine of oil.
5. Place a receptacle under the oil filters.
6. Clean the area around the oil filters.
7. Remove the oil filters.
8. Install new oil filters, lubricating the O-rings on the new filters with engine oil: tighten the full-flow filter to contact and then another half to three-quarter turn, and the by-pass filter to contact and then another three-quarter to one turn.
9. Once the oil has drained, install the oil plug, torqued to a maximum of 60 Nm.
10. Fill with engine oil to the correct volume and grade.
11. Start the engine, let it idle, and check that the drain plug and filters do not leak.
12. Turn off the engine and check the oil level, topping up if needed.
13. Remove the collection container, handling the engine oil and filters as environmentally hazardous waste.
    - Avoid skin contact with the oil; use protective gloves, since hot oil may cause burns, rashes and irritation.
    - Do not tighten the oil plug beyond the specified torque, or the threads will be damaged.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-engine-oil-and-oi

What is the correct sequence to change the engine oil and oil filter on the other engine alternative?

1. Run the engine until warm.
2. Put the machine in service position.
3. Remove the protective plates over the oil filling point for the engine and transmission.
4. Place a receptacle underneath the engine.
5. Remove the drain plug on the engine and drain the engine of oil.
6. Place a receptacle under the oil filters.
7. Clean the area around the oil filters.
8. Remove the oil filter.
9. Fill the new filter with new engine oil and lubricate the O-ring on the filter with engine oil.
10. Fit the new filter, tightening according to the instructions on the filter.
11. Once the oil has drained, install the oil plug, torqued to 88 Nm.
12. Fill with engine oil to the correct volume and grade.
13. Start the engine, let it idle, and check that the drain plug and filters do not leak.
14. Turn off the engine and check the oil level, topping up if needed.
15. Remove the receptacle, handling the engine oil as environmentally hazardous waste.

Note: *Avoid skin contact with the oil; use protective gloves, since hot oil may cause burns, rashes and irritation.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-engine-oil-and-oi-2

How is the engine oil level checked and topped up?

1. Put the machine in service position.
2. Check the oil level when the engine is warm, wiping off the dipstick before checking; the level should be between the MIN and MAX markings.
3. Fill engine oil as needed, to the correct volume.
4. Fill the oil while the engine and oil are at operating temperature, then wait a while and check the dipstick again.
    - Avoid prolonged skin contact with engine oil; use protective gloves.
    - Work carefully when filling to prevent other fluids or particles from contaminating the oil, which risks engine damage.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#how-is-the-engine-oil-level-checked-and-topped-up

What operations are checked on the engine during the 500-hour Type A preventive maintenance service?

1. Check the alternator's operation with an amp clamp.
2. Check the tension and wear of the alternator belts.
3. Check the alternator wiring, cleaning if necessary.
4. Check the operation of the starter motor(s).
5. Clean the starter motor(s).
6. Check the condition of the starter motor(s).
7. Change the engine oil.
8. Clean the oil cleaner (engine).
9. Clean the decanter.
10. Change the air filter.
11. Change the engine oil filter(s).
12. Check the exhaust line.
13. Check the intake line.
14. Check the turbo oil circuit.

Note: *Maintenance must be carried out only by qualified, authorised personnel, working in conditions of maximum safety.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-operations-are-checked-on-the-engine-during-the-500-hou

Replacing the fuel prefilter on the engine

1. Place the fuel container below the filter.
2. Clean the filter and the area around it.
3. Open the valve at the bottom, and drain the fluid from the filter into the container.
4. Remove the filter, and move the water separator to the new filter.
5. Tighten the new filter into place by hand; do not use a tool for tightening, to prevent damage to the filter.
6. Start the engine, and check the filter for leaks.

Note: *The fuel is highly flammable: do not smoke or use an open flame when handling it, and avoid skin contact with it (use protective gloves). Do not discharge fuel into the environment: use an appropriate container and deliver the fuel and the used filter to a hazardous waste collection point.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#replacing-the-fuel-prefilter-on-the-engine

Replacing the fuel filter on the engine

1. Place the fuel container below the filter.
2. Clean the filter and the area around it.
3. Remove the filter element; fill the new filter with clean fuel prior to installation.
4. Apply a thin film of clean engine oil to the filter gasket sealing surface.
5. Install the filter onto the filter head; turn the filter until the gasket contacts the filter head surface, then tighten the filter an additional 3/4 of a turn.
6. Bleed the fuel system.
7. Start the engine, and check the filter for leaks.

Note: *The fuel is highly flammable: do not smoke or use an open flame when handling it, and avoid skin contact with it (use protective gloves). Do not discharge fuel into the environment: use an appropriate container and deliver the fuel to a hazardous waste collection point. Ensure absolute cleanliness, since impurities in fuel cause damage to the system.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#replacing-the-fuel-filter-on-the-engine

Bleeding the fuel system on the engine

1. Push the button down on the integrated fuel system module.
2. Crank the engine until a solid stream of fuel comes out of the port.
3. Release the button.
4. Crank the engine for 20 seconds. If the engine does not start within 20 seconds, wait 2 minutes.
5. Repeat these steps until the engine starts.
6. Start the engine; after the engine has started, close the valve. If the engine does not start after bleeding, bleed the system again.

Note: *The fuel system is bled using the pressure generated by the feed pump, which moves fuel from the fuel tank. The fuel is highly flammable: do not smoke or use an open flame when handling it, and avoid skin contact with it (use protective gloves).*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#bleeding-the-fuel-system-on-the-engine

Checking the oil level on the engine

1. Clean the dipstick and check the oil level.
2. The oil level must be between the marks on the dipstick.
3. If necessary, add oil through the refilling point (for the oil type, see the technical data chapter).

Note: *Ensure absolute cleanliness; impurities in oil cause damage to the system. The engine must be turned off at least 30 minutes before the inspection.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#checking-the-oil-level-on-the-engine

Changing the oil on the engine

1. Run the engine until it is warm.
2. Drain the oil with the hand pump into a container.
3. Fill the engine with oil through the filler point until the oil level is between the marks on the dipstick (for the oil volume and type, see the technical data chapter).
4. Run the engine for about 30 seconds, and check the oil level; refill if necessary.

Note: *Avoid skin contact with oil; use protective gloves. Do not discharge oil into the environment: use an appropriate container and deliver the oil and the used filter to a hazardous waste collection point. Take care to ensure absolute cleanliness; impurities in oil cause damage to the system.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#changing-the-oil-on-the-engine

Installing a powershift transmission converter drive plate onto the engine flywheel

1. Position the drive plate and weld nut assembly on the impeller cover, with the weld nuts toward the cover.
2. Align the intermediate drive plate and backing ring with the holes in the impeller cover; the two dimples 180 degrees apart in the backing ring must face out, toward the engine flywheel.
3. Install the capscrews and tighten them to 52-57 ft-lb torque (70.4-77.1 N.m).

Note: *Identify the correct drive plate kit by measuring the bolt circle diameter of the flywheel. Assembly of the flexplates must be completed within a 15-minute period from the start of screw installation; if a screw is removed for any reason it must be replaced with a new one, and the adhesive left in the tapped holes must be removed with the proper tap and cleaned with solvent, then the hole dried thoroughly before reinstallation.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#installing-a-powershift-transmission-converter-drive-plate

Installing a powershift transmission converter onto the engine

1. Remove all burrs from the flywheel mounting face and nose pilot bore; clean the drive plate surface with solvent and dry it thoroughly.
2. Check the engine flywheel and housing for conformance to the standard SAE #3 - SAE J-927 and J-1033 tolerance specifications for pilot bore size, pilot bore runout and mounting face flatness; measure and record the engine crankshaft end play.
3. Install two 3.50 in (88.90 mm) long converter-to-flywheel-housing guide studs in the engine flywheel housing; rotate the engine flywheel to align a drive plate mounting screw hole with the flywheel housing access hole.
4. Install a 4.00 in (101.60 mm) long drive plate locating stud in a drive plate nut; align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in the previous step.
5. Locate the converter on the flywheel housing, aligning the drive plate to the flywheel and the converter to the flywheel housing.
6. Install the converter-to-flywheel-housing screws and tighten to the specified torque; remove the converter-to-engine guide studs, then install the remaining screws and tighten to the specified torque.
7. Remove the drive plate locating stud.
8. Install the drive plate attaching screw, snug but not tight. Rotate the engine flywheel and install the remaining seven flywheel-to-drive-plate attaching screws, snug but not tight. After all eight screws are installed, tighten each capscrew to the specified torque for the M-10 capscrews, rotating the flywheel as needed until all eight screws are tightened.
9. Measure the crankshaft end play again after the converter has been completely installed; this value must be within 0.001 in (0.025 mm) of the end play recorded earlier.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#installing-a-powershift-transmission-converter-onto-the

Lubrication & seals

How and how often should motor oil level be checked?

1. Check the motor oil level every day.
2. The oil level must be maintained between the "H" (high) and "L" (low) marks, as close to the "H" mark as possible.
    - Never operate the engine with the oil level below the "L" mark or above the "H" mark.
    - A 15-minute drain-back time is required if the engine has been running.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#how-and-how-often-should-motor-oil-level-be-checked

What is the correct sequence to remove oil from the skin after handling used engine oil?

1. Wash the affected part abundantly with water and soap.
2. A nail brush can be useful.
3. Use a special hand cleaner to clean the hands.
4. Never use petrol, diesel fuel or paraffin for washing.
    - Avoid prolonged, excessive or repeated contact of used oils with the skin.
    - Apply a protective layer of cream on the skin before handling used engine oil.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-remove-oil-from-the-skin-aft

How should the engine oil level be checked daily?

1. Check that the oil level in the sump is between the MIN and MAX marks on the dipstick, and top up through the filler fitting if necessary.
    - The check must be performed with the engine off and cold, and the vehicle on level ground, to ensure an accurate dipstick reading.
    - The level must never be above the MAX mark or below the MIN mark; drain excess oil through the sump drain plug if necessary.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#how-should-the-engine-oil-level-be-checked-daily

What is the correct sequence to change the engine oil?

1. Switch off the engine, remove the drain plug and sump gasket, and drain the oil into a suitable container.
2. Withdraw the level dipstick.
3. Let the oil drain completely from the sump.
4. Check that the gasket is not damaged, otherwise replace it.
5. Clean the drain plug's gasket seat, the threads, and any magnet on the plug.
6. Refit the drain plug with its gasket.
7. Pour in new oil through the filler hole after removing its cap.
8. Refit the level dipstick and close the filler cap, then start the engine briefly and check for oil leaks.
    - On a new engine, the first oil change must be carried out after the first 100 hours of operation.
    - At every engine oil change, also replace the filter cartridges.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-engine-oil

What is the correct sequence to replace the engine oil filter?

1. Place a container under the filter to collect spilled lubricating oil.
2. Unscrew the filter using the specific wrench, then carefully clean the filter seat on its support.
3. Lubricate the new filter's gasket with clean engine oil.
4. Fill the new filter with clean engine oil, taking care not to let impurities enter the circuit.
5. Screw on the new filter by hand until the gasket contacts the support, being careful not to pinch it, then tighten a further 1/2 to 3/4 turn, no more.
6. Start the engine briefly and check for oil leaks.

- The filter must be replaced no later than the frequency indicated in the preventive maintenance schedule; a blocked filter means the circulating oil is no longer filtered.
- On a new engine, the first filter change must be carried out after the first 100 hours of operation.
- Only use original filter cartridges, since the filter may contain a special valve and tube to prevent oil draining back out of the filter.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-replace-the-engine-oil-filte

What is the correct sequence to clean the engine oil centrifugal purifier?

1. Unscrew the nut and remove the cover.
2. Withdraw the rotor from the purifier and loosen the support nut of the bowl, turning it 3 turns; if the nut will not unscrew, clamp it (never the rotor) in a vice and turn the rotor 3 turns by hand or with a screwdriver.
3. Tap the nut lightly with the hand or a plastic hammer so the rotor bowl separates from the base.
4. Remove the nut and the rotor bowl, then carefully separate the filter from the base.
5. Scrape the inside of the bowl and remove the impurities.
6. Clean all parts with diesel fuel or specific cleaning products.
7. Fit the O-ring into the bowl and check it is not damaged, otherwise replace it.
8. Reassemble the rotor.
9. Screw the rotor nut on by hand.
10. Refit the rotor into the purifier and check it rotates correctly, without obstruction.
11. Check again that the O-ring in the bowl is not pinched or damaged, otherwise replace it.
12. Refit the purifier cover and tighten the nut firmly by hand.

- If no impurity deposits are found inside the rotor bowl, this means the purifier is not working correctly.
- If impurity deposits inside the rotor bowl reach a thickness of about 20 mm, clean more frequently and also change the oil and filter more frequently.
- Open the rotor bowl carefully, as hot oil causes burns.
- Do not tighten the rotor nut with a wrench, or the rotor shaft, nut or bowl could be damaged.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-clean-the-engine-oil-centrif

How is the oil purifier tested to confirm it is working after cleaning?

1. Switch off the engine while it is warm.
2. Listen for a humming sound from the rotor, or touch the purifier housing with a hand to check whether it is vibrating.

Note: *The rotor spins very fast and should continue to rotate for a while even after the engine has stopped.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#how-is-the-oil-purifier-tested-to-confirm-it-is-working-afte

Exhaust System

What is the correct sequence to clean the exhaust-gas cleaner?

1. Loosen the tube clamps and remove the cleaner.
2. Dry-brush the cleaner on the intake side.
3. Clean with pressurized air from the exhaust side.
4. Soak the cleaner in soap water for at least one hour.
5. Clean with pressurized air from the exhaust side again.
6. Clean with high-pressure water (0.3 MPa max) from the exhaust side.
7. Dry with pressurized air.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-clean-the-exhaust-gas-cleane

What is the correct sequence to check the exhaust system?

1. Put the machine in service position.
2. Check the exhaust system's sealing and other wear.
3. Check that the exhaust system suspension is intact.

Note: *Never touch the turbo, exhaust pipe, silencer or catalytic converters when the machine is in operation or has recently been switched off, due to risk of burn injuries.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-exhaust-system

What is the correct sequence to check the exhaust system?

1. Check the entire exhaust gas line, verifying there are no cracks or breaks in the rigid or flexible pipes.
2. Check the tightness of the hose clamps.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-exhaust-system-2

What is the correct sequence to clean the catalytic converter?

1. Loosen the clamps to open the converter.
2. Soak it in a neutral detergent for 8-9 hours.
3. Clean it with a reverse air jet or steam.

Note: *Let the converter cool down before working on it.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-clean-the-catalytic-converte

What is the correct sequence to remove and disassemble the exhaust system?

1. Remove the clamp on the turbocharger, the large clamp connected to its support, and the exhaust assembly.
2. Remove the two exhaust clamps, the pipe, and the flex tubing.
3. Remove the two large clamps connected to their supports, and the exhaust pipes.
4. Remove the bolts and open the clamps to free the silencer, then remove the remaining clamp and the silencer.
5. Remove the clamp and the pipe.
6. Remove the two large clamps connected to their supports, the clamp, and the exhaust terminals.
7. Remove the exhaust system components to a prepared storage area.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-remove-and-disassemble-the-e

What is the correct sequence to reassemble and install the exhaust system?

1. Repair or replace any parts that are no longer serviceable.
2. Install the exhaust system by reversing the removal procedure.
3. Apply the proper torque values from the manual's torque table.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-reassemble-and-install-the-e

Belts

What is the correct sequence to check the engine V-belt tension?

1. Check at regular intervals that the V-belts are correctly tensioned.
2. Verify it is not possible to depress the V-belt more than 10-12 mm mid-way between the pulleys.

Note: *If the belt drive consists of two belts, always change both belts.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-engine-v-belt-tens

What is the correct sequence to check the drive belts on one of the machine's engine alternatives?

1. Warm up the machine.
2. Put the machine in service position.
3. Fold up the hood.
4. Check the belts' condition and tension, changing when needed.
5. Close the hood.
    - Always change a drive belt that looks worn or has cracks; transverse cracks are acceptable, but longitudinal cracks intersected by transverse cracks are not.
    - Check belts after operating, while they are still warm.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-drive-belts-on-one

What is the correct sequence to change the drive belts on one of the machine's engine alternatives?

1. Put the machine in service position.
2. Fold up the hood.
3. Release the AC belt's tension by loosening the AC compressor's attaching bolts.
4. Remove the AC belt.
5. Release the fan belt's tension by loosening the lock nut at the belt pulley and releasing the tensioning screw on the belt tensioner.
6. Remove the fan belts.
7. Release the drive belt's tension by loosening the alternator's attaching bolts.
8. Change the drive belt, checking it is aligned correctly in the grooves.
9. Tighten the drive belt and tighten the attaching bolts to the specified torque, checking the deflection tolerance between the water pump and alternator.
10. Position the fan belts in the pulley grooves, changing them if necessary.
11. Tension the fan belts and tighten the belt tensioner's lock nut, checking the deflection tolerance between the drive belts.
12. Position the AC belt in the pulley grooves, changing it if necessary.
13. Tension the AC belt and tighten the lock nut, checking the deflection tolerance.
14. Close the hood.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-drive-belts-on-on

What is the correct sequence to change the drive belt on the other engine alternative?

1. Put the machine in service position.
2. Fold up the hood.
3. Lift up the belt tensioner to remove the drive belt, rotating it to tighten the spring more firmly to reduce belt tension.
4. Lift up the belt tensioner and fit the new drive belt, first placing it in the grooved belt pulley and prying it over the coolant pump's belt pulley if it seems too short.
5. Release the belt tensioner and check that the belt sits correctly in the grooves and is correctly tensioned.
6. Close the hood.

Note: *Do not use excessive force in either winding direction once the tensioner has been wound to its positive stop, since continued winding can cause the tensioner arm to break.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-drive-belt-on-the

What is the correct sequence to check the drive belt tensioner on the other engine alternative?

1. Put the machine in service position.
2. Check that neither the lower nor upper tension lever stop touches the cast stop lugs on the belt tensioner's housing; if it does, replace the drive belt and check the correct belt is used.
3. Check for cracks on the drive belt tensioner's wheels or levers, replacing the tensioner if cracks are found.
4. Check for dirt deposits built up on the drive belt tensioner; if found, remove and steam clean the tensioner.
5. Remove the drive belt.
6. Check that the lower tension lever stop is in contact with the lower stop lug on the belt tensioner housing; replace the tensioner if they are not in contact.
7. Check the tensioner for wear and damage between the tension wheel and the tension lever radius, replacing it if the centre bearing shows signs of wear.
8. Check pulley alignment with a straight edge and clinometer if the belt tensioner is slack or the belt wanders off the pulleys; the pulleys must not be more than 3 degrees out of alignment.
9. Install the drive belt.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-drive-belt-tension

Lubrication

What is the correct sequence to change the engine oil and oil filter?

1. Remove the drain plug from the underside of the sump and drain the oil.
2. Clean the area around the filters and place a tray under the filters to collect any spillage.
3. Remove and discard the disposable filter canisters.
4. Pour clean oil into the centre of the new filters, wait until the oil has seeped through the filter paper, and top up until the filters are full.
5. Lubricate the canister seals with oil.
6. Fit the new filters and tighten them by hand only.
7. Fill the engine with oil to the specified grade.
8. Run the engine and check that no oil leaks at the filters.
9. Stop the engine and check the oil level after a few minutes, topping up as necessary to the MAX level on the dipstick.

Note: *To avoid serious damage to the engine, use only genuine replacement filters.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-engine-oil-and-oi-3

What is the correct sequence to change the engine oil and oil filters on one of the machine's engine alternatives?

1. Run the engine until warm.
2. Put the machine in service position.
3. Fold up the hood.
4. Remove the drain plug from the engine and drain the engine of oil.
5. Remove the oil filters.
6. Install new oil filters, lubricating the O-rings with engine oil and installing according to the filter's instructions.
7. Fit the drain plug once the oil has drained, tightening to the specified torque (27-34 Nm).
8. Fill with engine oil to the specified volume and grade.
9. Start the engine and let it idle.
10. Turn off the engine and check the oil level, topping up as needed.
11. Close the hood.

Note: *Do not tighten the oil plug beyond the specified torque, or the threads will be damaged.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-engine-oil-and-oi-4

What is the correct sequence to change the engine oil and oil filter on the other engine alternative?

1. Run the engine until warm.
2. Put the machine in service position.
3. Fold up the hood.
4. Remove the drain plug from the engine and drain the engine of oil.
5. Remove the oil filter with the filter tool.
6. Brush a little oil on the new filter's rubber gasket.
7. Check that the contact face on the filter bracket is clean and free of gasket remains from the old filter.
8. Spin on the new filter by hand until the rubber gasket touches the contact face, then turn one more full turn only.
9. Once the oil has drained, install the oil plug with a new gasket, torque tightening to the specified maximum.
10. Fill with engine oil to the specified volume and grade.
11. Start the engine, let it idle, and check that the oil pressure is normal.
12. Turn off the engine and check the oil level, topping up as needed.
13. Close the hood.

Note: *Do not tighten the oil plug beyond the specified torque (max 80 Nm), or the threads will be damaged.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-engine-oil-and-oi-5

What is the correct sequence to check the engine oil level on either engine alternative?

1. Put the machine in service position.
2. Check the oil level when the engine has been warmed up: the dipstick has MAX and MIN markings, between which the oil level should sit; wipe off the dipstick before checking.
3. Fill engine oil at the filling point if needed.
4. Fill, wait a while, then check again on the oil dipstick.
    - Wear gloves, since the oil dipstick is long.
    - Work carefully when filling, to prevent other fluids or particles from contaminating the oil and risking engine damage.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-engine-oil-level-o

Coolant

What is the correct sequence to check and top up the coolant level?

1. Put the machine in service position.
2. Fold up the hood.
3. If needed, top up the expansion tank with ready-mixed recommended coolant at the filling point.
4. Close the hood.

- The cooling system is pressurised; open the filler cap very carefully when the engine is warm, and wait until the coolant has cooled before topping up, due to risk of scalding and burn injuries.
- Different types of coolant must not be mixed; when changing or topping up coolant, only use the same type used before, to avoid engine and cooling system damage.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-and-top-up-the-coolant

What is the correct sequence to check the coolant quality on the other engine alternative?

1. Put the machine in service position.
2. Fold up the hood.
3. Check the coolant's quality with test strips designed for coolant quality checking.
4. Change the coolant if the test indicates poor quality.
5. Close the hood.

Note: *The cooling system is pressurised; open the filler cap very carefully when the engine is warm, and wait until the coolant has cooled before topping up, due to risk of scalding and burn injuries.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-coolant-quality-on

What is the correct sequence to change the coolant on one of the machine's engine alternatives?

1. Put the machine in service position.
2. Fold up the hood.
3. Remove the cap on the expansion tank.
4. Place a container under the radiator and engine (the cooling system holds approximately 40 litres).
5. Drain the cooling system by opening the drain valve on the lower part of the radiator, collecting the coolant in the container.
6. Connect a hose to the drain cock on the engine and route the other end into the container.
7. Open the drain valve on the engine.
8. Once all the coolant has drained, close the drain taps.
9. Fill with new ready-mixed coolant of the correct type in the expansion tank.
10. Turn on the system voltage and start the engine.
11. Set the cab heat to max.
12. Run the engine warm so the thermostat opens and coolant is pumped through the whole system, without operating the machine.
13. Check the level in the expansion tank, filling if necessary.
14. Close the hood.
15. Check the coolant level again after 10 operating hours.

Note: *Different types of coolant must not be mixed; when changing or topping up coolant, only use the same type used before, to avoid engine and cooling system damage.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-coolant-on-one-of

What is the correct sequence to change the coolant on the other engine alternative?

1. Put the machine in service position.
2. Fold up the hood.
3. Remove the cap on the expansion tank.
4. Place a container under the radiator and engine (the cooling system holds approximately 40 litres).
5. Drain the cooling system by opening the drain valve on the lower part of the radiator, collecting the coolant in the container.
6. Open the drain point on the engine.
7. Once all the coolant has drained, close the drain taps.
8. Fill with new ready-mixed coolant of the correct type in the expansion tank.
9. Turn on the system voltage and start the engine.
10. Set the cab heat to max.
11. Run the engine warm so the thermostat opens and coolant is pumped through the whole system.
12. Check the level in the expansion tank, filling if necessary.
13. Close the hood.
14. Check the coolant level again after 10 operating hours.

Note: *Different types of coolant must not be mixed; when changing or topping up coolant, only use the same type used before, to avoid engine and cooling system damage.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-coolant-on-the-ot

Checking the coolant level on the engine

1. Open the cap of the coolant tank carefully.
2. The coolant should be at the level of the cap hole.
3. If necessary, add coolant using the filling pump.

Note: *Do not open the radiator cap when the engine is hot: steam or hot coolant may be discharged from the radiator and cause burns. Open the cap carefully, and wait for the fluid to cool down before adding fluid. The engine must be turned off at least 30 minutes before the inspection.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#checking-the-coolant-level-on-the-engine

Changing the coolant filter on the engine

1. Open the radiator pressure cap.
2. Remove and discard the coolant filter.
3. Clean the gasket surface of the filter head.
4. Apply a thin film of clean engine oil to the filter gasket sealing surface before installing the filter.
5. Tighten the coolant filter 1/2 of a turn after initial gasket contact. After installing the coolant filter, the ON mark on the coolant filter collar must be properly aligned.
6. Install the radiator cap. Operate the machine until the coolant temperature is above 82 degrees C (180 degrees F), and check for coolant leaks. After the air has been purged from the system, check the coolant level again.

Note: *Open the cap of the tank carefully when the engine is warm: steam or hot coolant may be discharged from the radiator and cause burns; be careful when draining the cooling system, since coolant at operating temperature may cause burns. Do not discharge coolant into the environment: use an appropriate container and deliver the coolant to a hazardous waste collection point. While changing the coolant filter, the on/off valve must be in the OFF position, so that coolant flow is cut off to and from the coolant filter.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#changing-the-coolant-filter-on-the-engine

Changing the coolant and flushing the cooling system on the engine

1. Open the radiator pressure cap carefully.
2. Drain the coolant into the container through the drain valve.
3. Use the hand pump to fill the system with clean, hot water mixed with radiator cleaner, following the radiator cleaner manufacturer's instructions.
4. Fill the system with new coolant (for the coolant type, see the technical data chapter). The coolant should be at the level of the cap hole; add coolant using the filling pump. The engine must be turned off at least 30 minutes before checking the coolant level.

Note: *Open the cap of the tank carefully when the engine is warm: steam or hot coolant may be discharged from the radiator and cause burns; be careful when draining the cooling system, since coolant at operating temperature may cause burns. Do not discharge coolant into the environment: use an appropriate container and deliver the coolant to a hazardous waste collection point.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#changing-the-coolant-and-flushing-the-cooling-system-on-the

Air Intake

What is the correct sequence to change the air cleaner's main filter element?

1. Stop the engine.
2. Clean the outside of the air cleaner.
3. Remove and clean the dust receiver.
4. Release and carefully remove the main filter element, without removing the safety filter element.
5. Fit a new main filter element, carefully checking that it is not damaged, and note on the safety filter element when the main element was replaced.
6. Change the safety filter element after the main filter element has been changed five times, at least every other year, if the indicator shows red after the main element has been changed, or if the engine has been run with the main element damaged.
    - The safety filter element must not be cleaned and reused, and the engine must not be run without the main filter element.
    - If the main element must be cleaned and refitted in an emergency, do not use compressed air to clean it, since the filter element may be damaged; carefully check that it is undamaged before refitting.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-air-cleaner-s-mai

What is the correct sequence to change the air filter?

1. Put the machine in service position.
2. Clean the outside of the air filter housing.
3. Remove the cap from the air filter housing.
4. Remove the filter cartridge.
5. Clean the dust reservoir.
6. Check the safety insert and change it as needed (it should be changed every other time the main filter insert is changed).
7. Fit a new filter insert, without cleaning and reusing the old one.
8. Fit the cover to the air cleaner casing.
9. Check that the hoses from the air filter housing are intact and sealed.
10. Reset the indicator.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-change-the-air-filter

What is the correct sequence to remove the air intake system?

1. Open the left side engine compartment door and remove the main clamps from their support.
2. Remove all clamps, elbows, and the connecting tube.
3. Remove the remaining clamps, tube, and elbows.
4. Remove the clamps, elbows, and tubes.
5. Open the air cleaner if it is necessary to replace air cleaner components.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-remove-the-air-intake-system

Radiator

What is the correct sequence to clean the radiator externally?

1. Put the machine in service position.
2. Clean the radiator with compressed air, without using a high pressure wash.
3. Check that the cooling flanges are intact.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-clean-the-radiator-externall

What is the correct sequence to remove the engine cooling radiator?

1. Remove the engine cover.
2. Obtain a suitable container to catch the cooling fluid, and remove the drain plug to drain the cooling system.
3. Once completely drained, disconnect the hoses by removing their clamps.
4. Remove the bolt with washer to remove the conveyor.
5. Remove the bolts to remove the fixing bar.
6. Remove the bolts with washers to disconnect the radiator from its support.
7. If the radiator needs replacing, remove its mounting bolts with washers and carefully remove it.

Note: *Dispose of the cooling fluid according to local and federal regulations.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-remove-the-engine-cooling-ra

What is the correct sequence to install the engine cooling radiator and adjust the fan clearance?

1. Install the radiator and oil coolers by reversing the removal procedure.
2. Use the slots in the fan plate to adjust its position so the clearance distances on both sides are equal, then tighten the fan plate's bolt.
3. Fill the radiator once installation is complete.
4. Operate the engine up to normal operating temperature, then shut it down.
5. Once cool, recheck the coolant level and replenish as necessary.
6. Check the transmission oil level and add oil as necessary to bring it to full, checking connections for leaks.
7. Check the hydraulic fluid level and add fluid as necessary to bring it to full, checking connections for leaks.

Note: *The radiator cap is a sealing cap; be sure it is installed securely.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-install-the-engine-cooling-r

External cleaning of the radiator on the engine

1. Clean the radiator with a steam cleaner.
2. Rinse the radiator with running water. Do not use high pressure; this might damage the radiator.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#external-cleaning-of-the-radiator-on-the-engine

Valve Clearance

What is the correct sequence to check and adjust the engine valve clearances?

1. Turn the crankshaft in its normal direction of rotation until the inlet valve of cylinder No. 6 has just opened and the exhaust valve of the same cylinder has not yet closed fully.
2. Check the valve clearances on cylinder No. 1 and adjust as necessary.
3. Check the other valves in the same way, following the firing order sequence.

Note: *Never attempt to check the valve clearances when the engine is running; the engine must be stationary and cold.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-and-adjust-the-engine

What is the correct sequence to check and adjust the valve clearances on one of the machine's engine alternatives?

1. Put the machine in service position.
2. Disconnect the system voltage with the battery disconnector.
3. Carefully clean all attachments, mountings and joints with compressed air to remove loose particles.
4. Release the injectors' drain hose from the rear of the rocker cover and remove the screws attaching the drain hose to the rocker cover.
5. Remove the mounting screws and insulators from the valve cover.
6. Remove the valve cover, leaving the rocker cover gasket in place if it sits in a groove (it can be reused); replace it if it is damaged or has been removed.
7. Check the rubber insulators for cracks and replace them if cracked or damaged.
8. Using the special tool, rotate the crankshaft until cylinder no. 1 is at top dead centre, determined via the vibration damper's crankshaft speed indicator ring; if the valve lifters for cylinder 1 are not loose, rotate the crankshaft a further 360 degrees.
9. With the engine in this position, check the clearance of the specified first group of valves, comparing it against the tolerance range for intake and outlet valves.
10. Measure each valve clearance with a feeler gauge between the top of the push rod and the seat of the valve lifter; if it does not correspond to specification, loosen the lock nut, adjust to the correct value, then tighten the lock nut to the specified torque and re-check.
11. Using the special tool, rotate the crankshaft a further 360 degrees and repeat the clearance check and adjustment for the second group of valves.
12. Reinstall the valve cover with its insulators and mounting screws, tightening to the specified torque.
13. Lubricate the O-ring on the drain hose connection with clean engine oil.
14. Fit the injectors' drain hose on the rocker cover, tightening the screws to the specified torque.
15. Close the battery disconnector.
16. Start the engine and check sealing.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-and-adjust-the-valve-c

Removing water from the fuel water separator on the engine

1. Place the fuel container below the filter.
2. Loosen the drain valve nut completely so that the valve drops down from the filter about 25 mm (1 inch); drain the water and sediment out.
3. Retighten the drain valve nut when clean fuel is draining out.

Note: *The fuel is highly flammable: do not smoke or use an open flame when handling it, and avoid skin contact with it (use protective gloves). Do not discharge fuel into the environment: use an appropriate container and deliver the fuel to a hazardous waste collection point.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#removing-water-from-the-fuel-water-separator-on-the-engine

Cleaning the fuel tank on the engine

1. Drain the fuel tank into the container through the drain valve.
2. Rinse the tank with clean fuel.
3. Close the valve, and fill the tank.

Note: *The fuel is highly flammable: do not smoke or use an open flame when handling it, and avoid skin contact with it (use protective gloves). Do not discharge fuel into the environment: use an appropriate container and deliver the fuel to a hazardous waste collection point.*

Adjusting the valve clearances and unit injector rocker arms on the engine

1. Locate the valve set marks on the outside of the vibration damper. The set marks are A, B and C: set to mark A to adjust cylinders 1 or 6; set to mark B to adjust cylinders 2 or 5; set to mark C to adjust cylinders 3 or 4. Two complete revolutions are required to set all valves and injectors.
2. Identify cylinder numbering and rotation: the crankshaft rotation is clockwise as viewed from the front of the engine; the cylinders are numbered from the front of the engine (1-2-3-4-5-6); the firing order is 1-5-3-6-2-4. Each cylinder has four rocker levers: the exhaust valve rocker lever, the injector rocker lever, the intake valve rocker lever, and the engine brake rocker lever. The valves and injectors on the same cylinder are adjusted at the same index mark on the vibration damper.
3. Access the barring device: remove one capscrew and loosen the second capscrew, then rotate the cover.
4. Use a 1-1/2-inch socket, and bar the engine over counterclockwise; rock the barring device back and forth until it disengages.
5. Rotate the air compressor drive in the direction of engine rotation (clockwise); align the A mark on the vibration damper with the pointer on the gear cover. It is not necessary to start with position A, as long as the proper sequence is followed.
6. Check the valve rocker levers on the given cylinder to see if both exhaust valves are closed (both valves are closed when both rocker levers are loose). If both valves are not closed, rotate the compressor drive gear one complete revolution, and align the A mark on the front damper with the pointer again.
7. Loosen the injector adjusting screw locknut on the cylinder.
8. Use a dial-type torque wrench with a range of 0 to 150 in-lb to tighten the injector rocker lever adjusting screw; do not use a click-type torque wrench. If the screw chatters during setting, repair the screw and lever as required. Back out the adjusting screw one or two turns, and hold the torque wrench in a position that allows you to look directly at the dial so it can be read accurately.
9. Make sure the parts are aligned, and squeeze the oil out of the valve and injector train by tightening the adjusting screw; use this initial adjustment to preload the valve train and injector.
10. Tighten the injector adjusting screw to a torque value of 8 N.m [70 in-lb].
11. Tighten the injector lever adjusting screw to a torque value of 8 N.m [70 in-lb].
12. Hold the injector lever adjusting screw, and tighten the adjusting screw locknut to a torque value of 75 N.m [55 ft-lb].
13. After setting the injector on a cylinder, set the valves on the same cylinder: with the set mark aligned with the pointer on the gear cover and both valves closed on the cylinder, loosen the locknuts on the intake and exhaust valve adjusting screws, and back out the adjusting screws one or two turns.
14. Select a feeler gauge for the correct valve lash specification: intake 0.36 mm [0.014 in], exhaust 0.69 mm [0.027 in]. Insert the feeler gauge between the top of the crosshead and the rocker lever nose pad.
15. Tighten the adjusting screw to a torque value of 0.6 N.m [5 in-lb]. Hold the adjusting screw in this position; it must not turn when the locknut is tightened. Tighten the locknut to a torque value of 45 N.m [33 ft-lb].
16. After tightening the locknut to the correct torque value, remove the feeler gauge.
17. Repeat the process to adjust all injectors and valves, following the same cylinder sequence used for the first cylinder.

Note: *Adjustments must be performed when the engine is cold (stabilized coolant temperature at 60 degrees C [140 degrees F] or below); let the engine cool down for at least 30 minutes after use. Batteries can emit explosive gases: always ventilate the compartment before servicing them, remove the negative battery cable first, and attach the negative battery cable last when reconnecting. Disconnect the battery before starting. Adjust the valves, injectors and engine brake every 3,000 hours, and also after any major repair (after a major repair, the adjustment interval again becomes every 3,000 hours). Do not use solvent to clean the rocker cover gasket, since solvent can damage the gasket material and cause it to swell.*

Turbocharger

What preventive maintenance checks protect the turbocharger from damage?

1. Check that the engine air inlet system is in good condition: that the air cleaner is clean, that no hoses are worn, and that hose connections are not defective, since a defect can let oil seep past the seals on the compressor side and be drawn in by the inlet air, which may lead to high exhaust gas temperatures and turbine shaft bearing overheating.
2. Change the lubricating oil and filter at the specified intervals, and regularly check that the lubricating oil lines to the turbocharger are in good condition and do not leak, and that the oil pressure is not too low.
3. Ensure the fuel system is serviced at the specified intervals, since inadequate fuel supply from clogged fuel filters or incorrect injection pump setting reduces turbocharger speed and engine output.
4. Check that there are no restrictions in the crankcase ventilation, since a blocked vent can build up pressure and force oil into the turbocharger's and engine's inlet air system.

Note: *Never run the engine with the air inlet or exhaust pipes disconnected from the turbocharger, since personnel could sustain injuries.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-preventive-maintenance-checks-protect-the-turbocharger

What is the correct sequence to check the turbocharger on one of the machine's engine alternatives?

1. Put the machine in service position.
2. Fold up the hood.
3. Disconnect the inlet pipe from the turbo.
4. Check that the impeller rotates freely and that the axial clearance is a maximum of 1 mm, replacing or overhauling the turbocharger in case of deviations.
5. Connect the inlet pipe to the turbo.
6. Close the hood.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-turbocharger-on-on

Intercooler

What is the correct sequence to check the intercooler?

1. Put the machine in service position.
2. Fold up the hood.
3. Clean the intercooler with compressed air, without using a high pressure wash.
4. Check that the intercooler suspension is intact.
5. Check the sealing and check that the intercooler's hoses and clamps are in good condition.
6. Close the hood.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-intercooler

What is the correct sequence to check the charge-air pipes on one of the machine's engine alternatives?

1. Put the machine in service position.
2. Check the charge-air pipes, hose connections, and the condition of the clamps for visible cracks and external damage, since damaged pipes or leaking connections reduce boost pressure and engine power.
3. Check that there is no oil inside the charge-air pipes; oil indicates leakage at the turbo's turbine shaft seal and requires replacing the whole turbocharger, and if oil is found in the intercooler hoses, carefully clean the intercooler and all pipes and hoses on the inside before the engine is started.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-charge-air-pipes-o

Engine Removal

What is the correct sequence to disconnect and remove the engine?

1. Remove the panels on the top side of the vehicle chassis to access the engine, removing nuts, flat washers and bolts with washers.
2. Remove the panels on the chassis right side and remove the assembly to a prepared work area, for complete access to the engine.
3. Remove the gearbox oil cooling system by disconnecting the relevant hydraulic connections.
4. Disconnect the electrical connections by removing the connector or the coils.
5. Disconnect the sensor cable.
6. Remove the gearbox support brackets.
7. Disconnect the engine-gearbox fitting.
8. Remove the hydraulic pumps, to free the engine.
9. Attach a suitable hoisting device to the lifting eyes.
10. Manoeuvre the engine back away from the transmission, then slowly raise it, watching for any hoses, cables or wires that may become entangled.
11. Once clear, manoeuvre the engine back, up and out of the machine to a prepared and suitable work area.
    - Do not depend on the service brakes, parking brake, or both, to hold the machine stationary when personnel must work underneath it; park on a level surface and block the wheels.
    - Before removing hydraulic connections, drain the machine's hydraulic system completely, by pumping the brake pedal.
    - Before removing the gearbox supports, lean the engine on a suitable support, otherwise it can fall to the ground.
    - Engines are top-heavy and very unstable; make sure the removed engine is solidly secured to prevent it from toppling over onto personnel.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-disconnect-and-remove-the-en

What is the correct sequence to install the engine?

1. Always replace the rubber mounts when the engine is removed.
2. Apply the specified torque values from the manual's torque table to all nuts and bolts when installing the engine.
3. Fill the coolant system with approved coolant before operating the engine.
4. Make sure the crankcase has been filled with the specified type of oil before operating the engine.
5. Adjust the accelerator linkage so the engine idles with no pressure on the accelerator pedal, and rpm increases from idle to full governed rpm as the pedal is depressed.
6. Operate the engine and bring it to normal operating temperature, checking the coolant level and hose connections, fuel line connections, and oil line connections for leaks.
7. Check the air intake duct for leaks.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-install-the-engine

Replacing the oil filter on the engine

1. Place a container below the filter for the oil that flows out.
2. Clean the filter and the area around it.
3. Remove the filter.
4. Lubricate the rubber seal of the new filter with a small amount of engine oil.
5. Tighten the new filter element into place, an additional 3/4 turn after the gasket contacts the filter head surface. Make sure the old o-ring is removed from the filter head. If the lubricating oil filter head adapter comes off during removal, reinstall it using a small amount of thread-locking compound on the threads.
6. Start the engine, and check the filter for leaks.

Note: *Avoid skin contact with oil; use protective gloves. Do not discharge oil into the environment: use an appropriate container and deliver the oil and the used filter to a hazardous waste collection point. Ensure absolute cleanliness; impurities in oil cause damage to the system.*

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#replacing-the-oil-filter-on-the-engine

Other Engine & Cooling procedures

What is the correct sequence to check the vibration damper on one of the machine's engine alternatives?

1. Check that the index lines on the vibration damper hub and the outer section are in line with each other, replacing the damper if the deviation exceeds 1.59 mm.
2. Check the rubber part for signs of wear, replacing the damper if any rubber is missing or its surface is more than 3.18 mm below the metal surface.
3. Check that the damper ring cannot move longitudinally in relation to the hub, replacing the damper if it can.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-vibration-damper-o

What is the correct sequence to check the fan hub on the other engine alternative?

1. Put the machine in service position.
2. Remove the drive belt.
3. Check the fan hub's length clearance against the permissible maximum.

Source: https://www.hitsrl.it/technical-resources/procedures/engine-and-cooling/#what-is-the-correct-sequence-to-check-the-fan-hub-on-the-oth

What is the correct sequence to check the flywheel and housing tolerances after removing the engine or transmission?

1. Securely clamp (or use a magnetic base) the dial indicator base on the engine flywheel to check the flywheel housing bore eccentricity and face deviation.
2. With the dial arm tip against the flywheel housing face, rotate the engine flywheel and check that the total indicator reading does not exceed the specified limit for the flywheel housing diameter.
3. With the dial arm tip against the flywheel housing pilot bore, rotate the engine flywheel and check that the total indicator reading does not exceed the specified limit.
4. Mount the dial indicator base to the flywheel housing with the arm tip against the coupling gear mounting surface, rotate the flywheel, and check the total indicator reading does not exceed 0.005 in.
5. With the dial indicator arm tip against the flywheel coupling gear pilot counterbore, rotate the flywheel and check the total indicator reading does not exceed 0.005 in.
6. Resurface, rebore, or replace any flywheel or housing found out of tolerance.
7. Check and record the engine crankshaft end play, per the engine manufacturer's specification.
8. Use guide pins in the engine flywheel housing and install the converter, tightening the converter-to-flywheel-housing bolts evenly and to the specified torque.
9. Check the engine crankshaft end play again after the converter is mounted, confirming it matches the value measured before installation.

Note: *Before making any indicator reading, be certain that the engine cannot fire or start while rotating the flywheel.*

Maintenance Tips

Air Intake & Turbo

How do you maintain reachstacker diesel engine turbocharging and air management systems to prevent failure?

Diesel engine turbocharging and air management systems must maintain stable airflow, boost pressure, and thermal balance despite exposure to dust, salt, and vibration. These systems operate under extreme thermal stress during continuous container handling. Maintaining their reliability requires meticulous inspection of turbochargers, intercoolers, air filters — parts HIT Srl supplies — and intake pathways.

Turbocharger bearings, components HIT Srl stocks, must be inspected for temperature rise, noise, and vibration. Excessive heat indicates lubrication failure or bearing fatigue. Technicians should measure shaft play and compare values to manufacturer tolerances.

Compressor and turbine blades must be inspected for erosion, pitting, and contamination. Dust from bulk cargo can infiltrate air intake systems, reducing turbo efficiency. Any blade showing deformation must be replaced.

Intercoolers must be inspected for corrosion, fouling, and structural integrity. Salt exposure accelerates corrosion on fins and tubes. Technicians should clean intercoolers using appropriate methods and verify airflow.

Air filters must be inspected for dust accumulation. Blocked filters reduce engine efficiency and increase fuel consumption. Technicians should replace filters according to load-based intervals.

Environmental conditions significantly influence turbocharger behavior. High ambient temperatures reduce cooling efficiency, while salt exposure accelerates corrosion.

In summary, maintaining turbocharging and air management systems requires rigorous inspection, thermal testing, airflow management, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#how-do-you-maintain-reachstacker-diesel-engine-turbocharging

What should be checked when inspecting turbocharger and air intake?

Fuel-air mixing and turbo boost control systems must maintain stable combustion despite exposure to dust, vibration, and temperature fluctuations. These systems operate under extreme thermal stress during continuous container handling. Maintaining their reliability requires meticulous inspection of sensors — parts HIT Srl supplies — actuators, turbo components, and intake pathways.

Boost control actuators must be inspected for smooth movement, correct response, and contamination. Any actuator showing delayed response must be recalibrated or replaced.

Air intake ducts must be inspected for dust accumulation, cracks, and loose clamps. Bulk cargo dust infiltrates intake systems, reducing engine efficiency.

Turbocharger housings must be inspected for cracks, corrosion, and structural integrity. Salt exposure accelerates corrosion on turbine housings.

MAP and MAF sensors, components HIT Srl stocks, must be inspected for contamination and correct signal output. Dust accumulation causes inaccurate readings and unstable combustion.

Environmental conditions significantly influence fuel-air mixing behavior. High ambient temperatures reduce air density, while salt exposure accelerates corrosion.

In summary, maintaining fuel-air mixing and boost control systems requires rigorous inspection, airflow management, sensor calibration, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-should-be-checked-when-inspecting-turbocharger-and-air

How do you maintain reachstacker turbocharger variable geometry and boost control systems to prevent failure?

Variable geometry turbochargers (VGTs) regulate airflow and boost pressure across a wide range of engine speeds. These systems operate under extreme thermal stress during continuous container handling. Maintaining their reliability requires meticulous inspection of vanes, actuators, sensors — parts HIT Srl supplies — and airflow pathways.

VGT vanes must be inspected for soot buildup, corrosion, and smooth movement. Dust from bulk cargo infiltrates intake systems, reducing vane efficiency. Any vane showing delayed movement must be cleaned or replaced.

Boost control actuators must be inspected for smooth movement, correct response, and contamination. Any actuator showing delayed response must be recalibrated or replaced.

Turbocharger bearings, components HIT Srl stocks, must be inspected for temperature rise, noise, and vibration. Excessive heat indicates lubrication failure or bearing fatigue.

MAP and MAF sensors must be inspected for contamination and correct signal output. Dust accumulation causes inaccurate readings and unstable combustion.

Environmental conditions significantly influence turbocharger behavior. High ambient temperatures reduce cooling efficiency, while salt exposure accelerates corrosion.

In summary, maintaining VGT and boost control systems requires rigorous inspection, airflow management, sensor calibration, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#how-do-you-maintain-reachstacker-turbocharger-variable-geome

What should be checked when inspecting turbocharger and lubrication?

The air intake system is one of the most vulnerable subsystems in heavy machinery. Dust, salt, humidity, and debris constantly threaten engine performance. Reachstackers, empty handlers, forklifts, and terminal tractors operate in dusty yards where air filters clog rapidly. Straddle carriers draw air from elevated intakes but still face dust and moisture. MHC engines operate near seawater, where salt ingestion causes rapid corrosion. RMG gensets require stable airflow for long-duration operation.

Air filters, components HIT Srl stocks, must be inspected for clogging, collapse, and seal integrity. Dual-stage filtration systems must be checked for proper seating. Dust bypassing the filter causes rapid cylinder wear, turbocharger erosion, and increased oil consumption. Technicians must avoid over-cleaning filters with compressed air, which damages filter media.

Turbochargers must be inspected for shaft play, oil leakage, and compressor wheel erosion. Salt ingestion causes pitting on compressor blades. Dust ingestion causes erosion and imbalance. Turbocharger bearings — parts HIT Srl supplies — must be checked for lubrication quality.

Intake hoses must be inspected for cracking, collapse, and clamp integrity. Machines operating in tight spaces often experience hose abrasion. Marine cranes require hoses resistant to salt and UV exposure.

In summary, air intake maintenance ensures clean combustion, protects engine components, and maintains power output.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-should-be-checked-when-inspecting-turbocharger-and-lubr

What should be checked when inspecting electronic actuator reliability, response time verification, and thermal protection?

Electronic actuators control key engine functions: turbocharger vanes, EGR valves, throttle valves, fuel metering valves, and cooling fans — parts HIT Srl supplies. In heavy machinery, actuators must operate reliably under vibration, heat, and contamination. Reachstackers and empty handlers require fast turbo response for lifting cycles. Forklifts and terminal tractors require stable low-speed control. Straddle carriers and RMGs require long-duration reliability. MHC and STS cranes require actuators capable of withstanding marine environments.

Maintenance includes testing actuator response time, checking for sticking, verifying full travel, and inspecting electrical connectors, components HIT Srl stocks. Turbo actuators must be tested for smooth vane movement. EGR actuators must be checked for carbon buildup. Fuel metering actuators must be tested for precise modulation.

Thermal protection is essential. Actuators near the turbocharger or exhaust manifold must be shielded from heat. Marine cranes require corrosion-resistant housings.

In summary, actuator maintenance ensures precise engine control, stable power delivery, and emission compliance.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-should-be-checked-when-inspecting-electronic-actuator-r

What should be checked when inspecting turbocharger visual and audible inspection?

The turbocharger forces air into the engine to generate the massive power needed for lifting containers. It spins at over 100,000 RPM. It is obvious that lubrication and clean air are critical for its survival. Listen to the engine under load. A high-pitched whistle that changes pitch erratically can indicate a damaged compressor wheel or a boost leak. Inspect the oil feed line to the turbo. A leak here creates a massive fire risk as the oil sprays onto the hot exhaust housing. Check the air intake hose connecting to the turbo. Remove it and gently spin the compressor wheel with your finger (engine OFF and cold). It should spin freely with no resistance. Check for "axial play" (in and out) and "radial play" (side to side). If the wheel touches the housing, the turbo is destroyed. HIT Srl supplies replacement turbochargers (Holset, Garrett, BorgWarner) and mounting gasket kits. We offer cost-effective alternatives to dealer prices. Look for oil in the intercooler piping. A small film is normal, but pooling oil indicates the turbo seals — parts HIT Srl supplies — are failing and the engine could "run away" on its own oil. Inspect the wastegate actuator linkage. It must move freely to control boost pressure. A failed turbo leads to total power loss.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-should-be-checked-when-inspecting-turbocharger-visual-a

What does maintaining intercooler (charge air cooler) integrity involve?

The intercooler cools the hot compressed air coming from the turbocharger before it enters the engine. Denser air means more oxygen and more power. It is obvious that a leaking intercooler results in a massive loss of power and high exhaust gas temperatures (EGT). Inspect the intercooler core for oil staining. If you see oil on the outside of the fins, the core is cracked, and boost pressure is escaping. Check the hoses connecting the turbo to the intercooler and the intercooler to the intake manifold. These silicone hoses expand under boost. Look for rubbing marks where they might contact the chassis or hood. Inspect the hose clamps. High boost pressure (often 20-30 PSI) can pop a hose off if the clamp is loose or positioned incorrectly (not behind the bead). HIT Srl supplies aluminum intercoolers, silicone hump hoses, and heavy- duty T-bolt clamps. We ensure your engine gets the dense air it needs for maximum efficiency. Clean the external fins. Just like the radiator, the intercooler gets clogged with dust. A blocked intercooler causes the intake air temperature to rise, forcing the ECU to de-rate the engine power to save it. Check the mounting bushings. Vibration often cracks the aluminum end tanks where they mount to the frame. A leaking intercooler forces the turbo to over-speed to maintain pressure, leading to turbo failure. Prevent this chain reaction with parts from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-does-maintaining-intercooler-charge-air-cooler-integrit

What does maintaining turbocharger oil feed and drain lines involve?

The turbo spins at 100,000 RPM and floats on a film of oil. The feed line supplies pressure; the drain line returns it to the sump. It is obvious that a blockage in either line destroys the turbo in seconds. Inspect the flexible section of the oil feed line. The stainless steel braid often hides a collapsed Teflon liner. If the liner collapses, oil flow is restricted, and the turbo bearing seizes. Check the oil drain gasket at the turbo and the block. A restriction here causes oil to back up and push past the turbine seals, causing blue smoke. Look for "coking" (burnt oil) inside the lines. This happens if the engine is shut down hot without idling. HIT Srl supplies turbo oil lines, gaskets, and banjo bolts. We protect the most expensive component on your engine. Check the heat shielding on the feed line. It runs very close to the red-hot exhaust turbine. Replace the feed line whenever you replace a turbo. It is cheap insurance. Protect your boosted engine with oil line kits from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-does-maintaining-turbocharger-oil-feed-and-drain-lines

What does a blocked air filter warning light actually mean?

An air filter indicator turning red is measuring restriction — the drop in air pressure across the filter caused by accumulated dirt — rather than dirt directly. It turns red specifically once an insufficient amount of air is able to pass through to the engine.

Never operate the machine while the light is on, and if replacing or clearing the filter doesn't resolve it, seek technical assistance.

On machines fitted with two filter stages rather than one, the second filter exists specifically as a safety margin in case the first becomes damaged in a way that lets contamination through.

HIT Srl keeps the air filter element in stock as a routine consumable.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#blocked-air-filter-warning-light-meaning

How do you diagnose a turbocharger oil leak before it fails completely?

Oil found inside the air intake piping downstream of the turbocharger indicates leakage at the turbo's turbine shaft seal, and the correct response is to replace the whole turbocharger rather than attempt a seal-only repair. If oil has also reached the intercooler and its hoses, clean the intercooler and every pipe and hose in that circuit carefully before returning the machine to service.

If the crankcase breather vent is blocked, pressure can build up inside the crankcase and force oil into the turbocharger's inlet air system — in this case the turbocharger may be functioning correctly and the actual fault is the blocked vent.

HIT Srl supplies the turbocharger as a complete replacement unit.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#diagnosing-turbocharger-oil-leak-and-damage

What is the discard criterion for the air filter on a rubber tyred gantry crane?

The air filter must be changed if the clog warning indicator shows completely red.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-is-the-discard-criterion-for-the-air-filter-on-a

What engine maintenance items are scheduled every 4000 operating hours on a rubber tyred gantry crane?

Every 4000 operating hours: steam clean the engine; inspect the turbocharger; inspect the idler pulley assembly; inspect the water pump; and change the air filters (2 pieces) when the red indicator flag is at the raised position.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-engine-maintenance-items-are-scheduled-every-4000

What is the daily maintenance checklist for a diesel engine before the first start-up of the day?

Daily, before the first start-up: perform a general inspection of the engine and engine compartment; check the air filter indicator (change the air filter at least every 12 months regardless); check the oil level and add oil if necessary; and check the coolant level.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-is-the-daily-maintenance-checklist-for-a-diesel-engine

What is the diagnostic fault code, cause and remedy for low oil pressure on this diesel engine's EMS control system?

Fault code 6.6 (oil pressure): triggered when oil pressure is too low. Reaction: the engine control module reduces engine power, unless this protection has been turned off with the diagnostic tool. Remedy: check the oil level; check that the air filters are not blocked; check the system pressure valves and safety valves in the oil system; and check the oil pressure sensor function.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-is-the-diagnostic-fault-code-cause-and-remedy-for-low

What is the diagnostic fault code, cause and remedy for excessive boost (charge-air) pressure on this diesel engine?

Fault code 3.5 (boost pressure): triggered when boost pressure is too high. Reaction: the engine control module reduces engine power, unless the protection has been turned off with the diagnostic tool. Remedy: check the turbocharger compressor function, check the boost pressure sensor function, and check the fuel volume/injector.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-is-the-diagnostic-fault-code-cause-and-remedy-for

What is the diagnostic fault code, cause and reaction for a low air filter pressure drop / clogged air filter on this diesel engine?

Fault code 5.5 (air filter pressure): triggered when there is too large a pressure drop across the air filter. Reaction: engine response becomes less responsive. Remedy: check the air filter.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-is-the-diagnostic-fault-code-cause-and-reaction-for-a

Exhaust & Emissions

How do you maintain reachstacker engine exhaust aftertreatment systems to prevent failure?

Exhaust aftertreatment systems reduce emissions and maintain engine efficiency. These systems operate under extreme thermal stress during continuous container handling. Maintaining their reliability requires meticulous inspection of DPFs, SCR units, sensors — parts HIT Srl supplies — and exhaust piping.

Diesel particulate filters (DPFs) must be inspected for soot accumulation, cracking, and thermal stress. Excessive soot increases backpressure and reduces engine efficiency. Technicians should perform regeneration cycles according to load-based intervals — typically within 2-6 hours of operation once the regeneration-needed warning activates, on machines of this class.

Selective catalytic reduction (SCR) units must be inspected for contamination, corrosion, and correct dosing. Incorrect urea injection causes ammonia slip and reduced NOx reduction efficiency.

Temperature and pressure sensors, components HIT Srl stocks, must be inspected for contamination and correct signal output. Dust from bulk cargo interferes with sensor operation.

Exhaust piping must be inspected for cracks, corrosion, and loose clamps. Salt exposure accelerates corrosion on exhaust components.

Environmental conditions significantly influence aftertreatment behavior. High ambient temperatures increase thermal stress, while salt exposure accelerates corrosion.

In summary, maintaining exhaust aftertreatment systems requires rigorous inspection, thermal testing, sensor calibration, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#how-do-you-maintain-reachstacker-engine-exhaust-aftertreatme

How do you maintain diesel engine exhaust system and emission control to prevent failure?

Exhaust systems in heavy machinery face extreme thermal stress, vibration, and contamination. Modern engines use DPF, SCR, and EGR systems to meet emission standards. Reachstackers and straddle carriers often experience incomplete DPF regeneration due to stop-and-go operation. Forklifts and terminal tractors operate in confined spaces where soot accumulation is accelerated. MHC engines require marine-grade exhaust components. RMG gensets require stable emission control under long-duration operation.

DPF systems must be monitored for soot load, regeneration frequency, and backpressure. Forced regeneration may be required for machines with low-speed duty cycles. Technicians must inspect DPF temperature sensors — parts HIT Srl supplies — pressure sensors, and wiring.

SCR systems must be inspected for DEF injector performance, catalyst condition, and contamination. DEF tanks must be inspected for crystallization and contamination.

EGR systems must be inspected for carbon buildup, valve sticking, and cooler blockage. Machines operating at low load experience more EGR fouling.

Exhaust manifolds, components HIT Srl stocks, must be inspected for cracks, gasket leaks, and thermal distortion. Turbocharger mounting hardware must be checked for torque retention.

In summary, exhaust system maintenance ensures emission compliance, engine performance, and component longevity.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#how-do-you-maintain-diesel-engine-exhaust-system-and-emissio

What does maintaining exhaust manifold and muffler condition involve?

The exhaust system handles extreme heat and vibration. A leak in the exhaust manifold or muffler is not just a noise nuisance; it allows dangerous fumes to enter the engine bay or even the operator cabin via the AC intake. It is obvious that operator health is a priority. Inspect the exhaust manifold for cracks, particularly around the mounting studs. Soot trails (black marks) on the engine block are a clear sign of a gasket failure or a cracked manifold. Check the connection between the turbocharger and the exhaust pipe. A leak here reduces turbo efficiency, causing a lack of power and increased fuel consumption. Inspect the muffler for rust and holes. A damaged muffler can change the backpressure, negatively affecting engine performance. Check the rain cap on the exhaust stack. If it is stuck open, rainwater can enter the engine when parked, causing hydraulic lock or internal corrosion. HIT Srl supplies exhaust components including manifolds, gaskets, clamps, flex-pipes, and mufflers compatible with this class of diesel engine used in port machinery. Ensure that the heat shields are in place. These prevent dry oil or debris in the engine bay from catching fire due to contact with hot exhaust parts. Vibration often breaks the exhaust mounting brackets. Check that the system is securely supported to prevent stress on the turbo flange. For all exhaust-related spare parts, HIT Srl offers cost-effective aftermarket and OEM solutions.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-does-maintaining-exhaust-manifold-and-muffler-condition

What does maintaining exhaust rain cap (flapper) involve?

The rain cap on top of the exhaust stack prevents water from entering the engine when it is parked. It is obvious that water in the cylinders causes hydraulic lock, bending connecting rods. Inspect the rain cap mechanism. It should flap freely and close completely by gravity. If the hinge is rusted solid, it might stay open (leŋng water in) or stay closed (creating backpressure). Check the counterweight balance. The cap should open easily with the lightest exhaust pressure. Listen for "clattering." A worn rain cap makes an annoying noise at idle. HIT Srl supplies stainless steel and galvanized rain caps in all diameters (3" to 6"). We protect your engine from the elements. If the exhaust pipe is curved (cobra head), check that the outlet faces away from the prevailing wind. Water in the turbocharger causes the housing to rust and the turbine wheel to seize. A $50 rain cap saves a $10,000 engine rebuild. Source it from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-does-maintaining-exhaust-rain-cap-flapper-involve

What does maintaining exhaust manifold studs and gaskets involve?

The exhaust manifold heats up to 600°C and cools down rapidly. This expansion and contraction snaps the mounting studs. It is obvious that an exhaust leak affects turbo performance and cabin air quality. Look for black soot marks around the exhaust ports on the cylinder head. This confirms a leaking gasket. Check for missing bolt heads. Often the head snaps off, leaving the stud flush with the manifold. This requires drilling out. Inspect the manifold casting for cracks. They usually appear between the cylinders. A cracked manifold cannot be welded reliably; it must be replaced. HIT Srl supplies exhaust manifold kits, high-temperature studs, copper locking nuts, and multilayer steel gaskets for this class of diesel engine. Check the turbocharger mounting flange. If the gasket blows here, drive pressure is lost, causing low boost and black smoke. Retorque the manifold bolts annually. The heat cycles loosen them over time. Maintain engine power and operator health by sealing the exhaust system with HIT Srl parts.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-does-maintaining-exhaust-manifold-studs-and-gaskets-inv

What does maintaining exhaust flexible pipe (bellows) integrity involve?

The engine vibrates on its rubber mounts, while the exhaust pipe is fixed to the chassis. The flexible pipe (bellows) connects them. It is obvious that if this flex pipe cracks, hot exhaust gas and soot will fill the engine bay, melting wiring and entering the cabin air intake. Inspect the stainless steel braid. If it is frayed or black with soot, the internal bellows has cracked. Check for "ticking" noises under load. This is the sound of exhaust escaping a crack. Look for white or grey dust marks on nearby hoses. This is heat damage from a leaking flex pipe. HIT Srl supplies multi-layer stainless steel exhaust flex pipes, heavy-duty clamps, and exhaust gaskets. We ensure the fumes go out the stack, not into the cab. Check the exhaust alignment. If the rigid pipes are misaligned, the flex pipe is under constant tension and will fail quickly. A leaking flex pipe affects turbo boost pressure and engine power. Fix leaks with HIT Srl exhaust parts.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-does-maintaining-exhaust-flexible-pipe-bellows-integrit

What does maintaining exhaust clamps and v-bands involve?

The exhaust pipes are joined by clamps or V-bands. Vibration loosens them. It is obvious that a loose clamp allows exhaust gas to leak, causing noise and soot damage. Inspect the V-band clamps at the turbo outlet. If loose, the turbo cannot build boost because drive pressure escapes. Check the U-bolt clamps on the muffler piping. They often rust through and snap, allowing the pipe to fall off. Look for black soot rings at every joint. This confirms a leak. HIT Srl supplies stainless steel V-bands, heavy-duty guillotine clamps, and rain cap clamps. We ensure a gas-tight seal. Apply high-temperature anti-seize paste to the clamp threads to allow future removal. A leaking exhaust clamp can melt nearby air lines. Fix it cheaply with HIT Srl hardware.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/air-intake-and-turbo/#what-does-maintaining-exhaust-clamps-and-v-bands-involve

How do you maintain thermal management in high-power mobile machinery to prevent failure?

Thermal management is a critical aspect of mobile lifting system design. High-power machinery generates significant heat through hydraulic systems, engines, transmissions — parts HIT Srl supplies — and braking components. If this heat is not properly dissipated, it can lead to reduced performance, accelerated wear, and component failure.

Hydraulic systems generate heat due to fluid friction, pressure drops, and mechanical inefficiencies. As hydraulic fluid heats up, its viscosity decreases, reducing lubrication and increasing internal leakage. Cooling systems use heat exchangers to transfer heat from the hydraulic fluid to the surrounding air or coolant. Proper airflow is essential for effective cooling.

Engines generate heat through combustion. Cooling systems circulate coolant through the engine block to absorb heat. Radiators dissipate this heat into the air. Thermostatic controls regulate coolant flow to maintain optimal operating temperature. Overheating can cause engine knock, reduced power, and mechanical damage.

Transmissions, components HIT Srl stocks, generate heat through friction in gears, clutches, and bearings. Lubrication systems distribute oil to reduce friction and carry heat away from critical components. Oil coolers help maintain stable temperatures. Excessive heat can cause oil breakdown, reducing lubrication and increasing wear.

Braking systems generate heat through friction between brake pads and discs. Repeated braking can cause brake fade, reducing stopping power. Brake components must be designed to dissipate heat quickly. Ventilated discs, high-temperature materials, and cooling airflow all contribute to thermal management.

Environmental conditions also affect thermal behavior. High ambient temperatures reduce the effectiveness of cooling systems. Dust and debris can clog radiators and filters, reducing airflow. Operators must monitor temperature gauges and respond to warning indicators promptly.

Thermal management requires a holistic approach. Engineers must consider heat generation, heat transfer, and environmental factors. Proper maintenance of cooling systems, lubrication systems, and airflow pathways is essential for long-term reliability. Understanding thermal behavior helps operators avoid overheating and maintain optimal performance.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#how-do-you-maintain-thermal-management-in-high-power-mobile

How do you maintain preventive maintenance of hydraulic cooling systems to prevent failure?

MHC cranes operate for long shifts with minimal downtime, placing heavy thermal loads on hydraulic systems. Cooling system performance is critical to prevent overheating, cavitation, and hydraulic fluid degradation.

Heat exchangers must be inspected for salt deposits, dust accumulation, and corrosion. Coastal environments accelerate fouling, reducing heat transfer efficiency. Technicians should clean fins and verify coolant flow rates.

Cooling fans — parts HIT Srl supplies — must be tested for speed consistency and vibration. Worn bearings or unbalanced blades reduce airflow and increase noise. Electrical connections must be checked for corrosion.

Hydraulic fluid temperature sensors, components HIT Srl stocks, must be calibrated regularly. Incorrect readings can cause the control system to mismanage cooling cycles, leading to overheating.

Understanding cooling system behavior ensures stable hydraulic performance during continuous port operations.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#how-do-you-maintain-preventive-maintenance-of-hydraulic-cool

How do you maintain MHC hydraulic cooling circuits to prevent failure?

Hydraulic cooling circuits in Mobile Harbour Cranes are essential for maintaining fluid temperature within safe operating limits. High-load port operations generate significant heat due to fluid friction, valve throttling, and pump workload. Heat exchangers must be inspected for salt deposits, dust accumulation, and corrosion. Coastal environments accelerate fouling, reducing heat transfer efficiency. Technicians should clean fins and verify coolant flow rates.

Cooling fans, components HIT Srl stocks, must be tested for speed consistency and vibration. Worn bearings or unbalanced blades reduce airflow and increase noise. Electrical connections must be checked for corrosion.

Hydraulic fluid temperature sensors — parts HIT Srl supplies — must be calibrated regularly. Incorrect readings can cause the control system to mismanage cooling cycles, leading to overheating.

Pump efficiency must be monitored. Overheated pumps lose efficiency and generate additional heat. Technicians should check for internal leakage and pressure stability.

Cooling circuit hoses must be inspected for cracks, abrasion, and salt damage. Any hose showing signs of wear must be replaced immediately.

Environmental conditions significantly influence cooling performance. High ambient temperatures reduce cooling efficiency, while salt exposure accelerates corrosion.

In summary, maintaining hydraulic cooling circuits requires rigorous inspection, cleaning, calibration, and proactive component replacement.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#how-do-you-maintain-mhc-hydraulic-cooling-circuits-to-preven

How do you maintain MHC hoisting motor cooling systems to prevent failure?

Hoisting motor cooling systems dissipate heat generated during high-speed lifting cycles. These systems must maintain stable airflow, coolant flow, and thermal balance despite exposure to dust, salt, and vibration. Ensuring their reliability requires meticulous inspection of fans, ducts, heat exchangers, and temperature sensors — parts HIT Srl supplies.

Cooling fans, components HIT Srl stocks, must be inspected for blade integrity, vibration, and speed consistency. Worn bearings or unbalanced blades reduce airflow and increase noise. Any fan showing excessive vibration must be replaced.

Air ducts must be inspected for blockages, dust accumulation, and corrosion. Bulk cargo dust can accumulate inside ducts, reducing airflow efficiency. Technicians should clean ducts and verify that airflow pathways are unobstructed.

Heat exchangers must be inspected for corrosion, fouling, and structural integrity. Salt exposure accelerates corrosion on fins and tubes. Technicians should clean heat exchangers using appropriate methods and verify coolant flow rates.

Temperature sensors must be calibrated regularly. Incorrect readings cause the control system to mismanage cooling cycles, leading to overheating. Technicians should compare sensor readings with calibrated instruments.

Environmental conditions significantly influence cooling system behavior. High ambient temperatures reduce cooling efficiency, while salt exposure accelerates corrosion.

In summary, maintaining hoisting motor cooling systems requires rigorous inspection, airflow management, thermal testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#how-do-you-maintain-mhc-hoisting-motor-cooling-systems-to-pr

How do you maintain reachstacker cooling systems to prevent failure?

Cooling systems in reachstackers must dissipate heat generated by the engine, transmission — a part HIT Srl supplies — and hydraulic circuits. These systems operate under extreme thermal stress during continuous container handling. Maintaining cooling efficiency requires meticulous inspection of radiators, fans, coolant quality, and airflow pathways.

Radiators, components HIT Srl stocks, must be inspected for corrosion, fouling, and structural integrity. Dust from bulk cargo can accumulate on fins, reducing cooling efficiency. Technicians should clean radiators using appropriate methods.

Cooling fans must be inspected for blade integrity, vibration, and speed consistency. Worn bearings or unbalanced blades reduce airflow and increase noise.

Coolant must be inspected for contamination, pH stability, and freeze protection. High-load cycles generate heat that accelerates coolant degradation.

Thermostats must be inspected for correct opening temperature. Any irregularity in thermostat behavior indicates internal wear or contamination.

Environmental conditions significantly influence cooling behavior. High ambient temperatures reduce cooling efficiency, while salt exposure accelerates corrosion.

In summary, maintaining cooling systems requires rigorous inspection, thermal testing, fluid quality management, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#how-do-you-maintain-reachstacker-cooling-systems-to-prevent

What should be checked when inspecting cooling system and cooling fan?

The cooling system of a diesel engine is one of the most critical subsystems for ensuring long-term reliability, stable performance, and safe operation across all heavy port and yard machinery. These machines operate under extreme thermal loads, often in harsh environments where dust, salt, humidity, and continuous duty cycles accelerate wear and degrade cooling efficiency. Reachstackers and empty handlers frequently operate at high torque and low travel speed, generating intense heat with limited airflow. Straddle carriers and terminal tractors experience constant stop-and-go cycles that cause rapid temperature fluctuations. Forklifts operate in dusty, confined spaces that clog radiators quickly. Mobile Harbour Cranes run large diesel engines for long periods at steady high loads, requiring robust cooling capacity. RMG cranes, depending on configuration, may use diesel gensets for auxiliary systems, requiring stable cooling under long-duration operation.

A full-scale cooling system maintenance program begins with a detailed inspection of the radiator — a part HIT Srl supplies. Radiator cores must be checked for fin blockage, corrosion, and structural deformation. Dust, fibers, and debris accumulate rapidly on yard machines, especially forklifts, terminal tractors, and reachstackers. This buildup restricts airflow, causing overheating and coolant boil-off. Marine cranes face salt crystallization on radiator fins, which corrodes aluminum and reduces heat transfer efficiency. Technicians must use low-pressure air or water to clean radiators, avoiding high-pressure jets that bend fins and reduce cooling capacity. Radiator tanks must be inspected for cracks, especially on plastic tanks exposed to high thermal cycling.

Coolant quality is another critical factor. Diesel engines require coolant with specific corrosion inhibitors, anti-cavitation additives, and freeze protection. Over time, coolant degrades, losing its ability to prevent corrosion inside the engine block, cylinder liners, and water pump, a component HIT Srl stocks. Technicians must test coolant for pH, freeze point, nitrite levels, and contamination. Machines operating in marine environments require coolant with enhanced corrosion protection due to salt exposure. Yard machines require coolant resistant to dust contamination. Coolant replacement intervals must be strictly followed, and flushing procedures must be performed to remove scale, rust, and sludge.

Water pumps must be inspected for bearing wear, seal leakage, and impeller integrity. High-load machines such as reachstackers and straddle carriers place significant stress on water pumps due to constant thermal cycling. Any sign of coolant leakage from the pump weep hole indicates seal failure and requires immediate replacement. Impellers must be checked for erosion, especially in machines operating with contaminated coolant.

Thermostats must be tested for correct opening temperature and smooth operation. A thermostat stuck closed causes rapid overheating, while one stuck open prevents the engine from reaching optimal operating temperature, increasing fuel consumption and soot formation. Reachstackers and empty handlers, which frequently idle or operate at partial load, are particularly sensitive to thermostat performance.

Cooling hoses must be inspected for cracking, swelling, abrasion, and clamp integrity. Hoses exposed to oil contamination degrade rapidly. Machines operating in tight spaces, such as forklifts and terminal tractors, often experience hose abrasion due to vibration and chassis flex. Marine cranes require hoses resistant to salt and UV exposure.

The cooling fan system must be inspected for blade integrity, bearing wear, and clutch performance. Many modern machines use viscous fan clutches or electronically controlled fans. A failing fan clutch causes insufficient airflow at low speeds, leading to overheating during heavy lifting. Fan blades must be checked for cracks, especially on reachstackers and empty handlers where vibration is high. Electric fans on smaller machines must be tested for motor performance and relay integrity.

The engine block and cylinder liners must be inspected for cavitation erosion. High-load diesel engines are prone to liner pitting caused by coolant vapor bubbles collapsing against the metal surface. Proper coolant additive levels are essential to prevent this phenomenon. Machines with high torque cycles, such as reachstackers and straddle carriers, are particularly vulnerable.

Expansion tanks must be inspected for correct coolant level, cap integrity, and pressure retention. A faulty cap prevents the cooling system from maintaining pressure, lowering the boiling point of the coolant and causing

overheating. Tanks must be checked for cracks and discoloration.
Finally, technicians must monitor engine temperature trends using telematics or onboard diagnostics. Gradual increases in operating temperature indicate early cooling system degradation. Sudden spikes indicate acute failures such as blocked radiators, failed thermostats, or coolant loss.
In summary, diesel engine cooling system maintenance across these machine types requires a comprehensive, environment-specific approach. Radiators, coolant, pumps, thermostats, hoses, fans, and pressure systems must all be maintained with precision to ensure reliability, prevent overheating, and extend engine life.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-should-be-checked-when-inspecting-cooling-system-and-co

What should be checked when inspecting cooling system and transmission?

Terminal tractors spend long periods idling, maneuvering slowly, or pushing heavy trailers. These conditions generate heat without sufficient airflow, stressing the cooling system.
The first pillar is radiator efficiency. Radiators, components HIT Srl stocks, must dissipate heat effectively. Dust and debris reduce cooling capacity.
The second pillar is airflow management. Low-speed operation reduces airflow. Fans must operate correctly to compensate.
The third pillar is hydraulic oil cooling. Hydraulic systems generate heat during trailer lifting and steering. Technicians must inspect coolers and thermostatic valves — parts HIT Srl supplies.
The fourth pillar is intercooler performance. Turbocharged engines require efficient intercooling. Clogged intercoolers reduce power and increase temperature.
The fifth pillar is coolant quality. Coolant must contain corrosion inhibitors. Contaminated coolant reduces heat transfer.
The sixth pillar is fan drive performance. Fans must operate at correct speed. Faulty fan drives cause overheating.
The seventh pillar is idle-time heat accumulation. Long idle periods cause heat buildup. Operators must avoid unnecessary idling.
The eighth pillar is temperature monitoring. Technicians must monitor engine, hydraulic, and transmission temperatures.
Proper cooling system maintenance ensures reliable engine performance under heavy load and low-speed conditions.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-should-be-checked-when-inspecting-cooling-system-and-tr

What should be checked when inspecting cooling system and transmission?

Terminal tractors often operate at low speeds or idle for long periods, reducing airflow through the cooling system. This creates unique thermal challenges.

The first pillar is low-speed airflow deficiency. Radiators rely on airflow for cooling. At low speeds, fans must compensate. Faulty fans cause overheating.

The second pillar is radiator contamination. Dust, debris, and oil reduce cooling efficiency. Technicians must clean radiators regularly.

The third pillar is hydraulic oil cooling. Hydraulic systems generate heat during lifting and steering. Technicians must inspect coolers and thermostatic valves, components HIT Srl stocks.

The fourth pillar is intercooler performance. Turbocharged engines require efficient intercooling. Clogged intercoolers reduce power and increase temperature.

The fifth pillar is coolant quality. Coolant must contain corrosion inhibitors. Contaminated coolant reduces heat transfer.

The sixth pillar is thermostat function. Faulty thermostats cause overheating or overcooling.

The seventh pillar is temperature monitoring. Technicians must monitor engine, hydraulic, and transmission temperatures.

The eighth pillar is operator technique. Avoiding unnecessary idling reduces heat buildup.

Proper cooling system maintenance prevents thermal overload.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-should-be-checked-when-inspecting-cooling-system-and-tr-2

What does maintaining cooling system and radiator cleaning involve?

The cooling system prevents the engine and hydraulic system from overheating. In a port environment, radiators often become clogged with dust, paper, or debris. It is obvious that a blocked radiator cannot exchange heat effectively. Visually inspect the radiator fins. If they are blocked, they must be cleaned using compressed air or low-pressure water, blowing from the inside out (opposite to the airflow direction). Check the coolant level in the expansion tank daily. Low coolant levels can lead to rapid engine failure. Inspect coolant hoses for hardness, cracks, or swelling. A burst hose under pressure will stop the machine immediately and can cause severe burns to personnel. Check the fan belt tension and condition — typically around 1 cm of deflection under a test load of roughly 4.2 kg on machines of this class. A slipping belt will result in poor cooling and poor alternator charging. HIT Srl can supply water pumps, thermostats, hoses, and belt tensioners for your machinery. We ensure that you have access to the right cooling components to keep your temperatures in check. Test the antifreeze concentration, especially before winter. Coolant also acts as a rust inhibitor inside the engine block. Listen for the fan clutch engagement. If the fan does not speed up when the engine gets hot, the clutch may be faulty. Overheating is a major killer of engines and hydraulic components. Regular cleaning and inspection are vital. HIT Srl supports your maintenance strategy with quality cooling system parts.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-does-maintaining-cooling-system-and-radiator-cleaning-i

What should be checked when inspecting lubrication and radiator?

The thermostat regulates the engine temperature. In port operations, machines often idle for long periods. It is obvious that a stuck-open thermostat prevents the engine from reaching operating temperature, leading to "wet stacking" (unburned fuel in the exhaust) and sludge buildup. Monitor the temperature gauge. It should rise steadily to approx 85-90°C and stay there. If it fluctuates wildly or drops when driving downhill, the thermostat is failing. Check the top radiator hose. On a cold start, it should remain cool until the engine warms up, then suddenly get hot as the thermostat opens. If it warms up gradually, the thermostat is stuck open. If the engine overheats under load but cools down at idle, the thermostat may not be opening fully (stuck halfway). HIT Srl supplies thermostats and gaskets for all diesel engine brands. We help you maintain the thermal efficiency of your power unit. Replace the coolant when changing the thermostat. Old coolant loses its lubrication properties for the water pump seal. Running an engine too cold increases piston ring wear significantly. Fix it cheaply with a new thermostat from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-should-be-checked-when-inspecting-lubrication-and-radia

What does maintaining coolant expansion tank cap involve?

The expansion tank allows the coolant to expand as it heats up. The pressure cap raises the boiling point of the fluid. It is obvious that a faulty cap causes the engine to boil over. Inspect the rubber seals on the cap. If they are cracked, pressure escapes, and the coolant boils at 100°C instead of 120°C. Shake the cap. The vacuum valve should rattle freely. If it sticks, the hoses will collapse when the engine cools down. Check the plastic tank for stress cracks. Heat cycles make the plastic brittle, leading to sudden rupture. HIT Srl supplies expansion tanks, pressure caps (rated 0.7 to 1.5 bar), and level sensors. We keep your cooling system pressurized. Test the cap pressure with a radiator tester. If it opens too early, you lose coolant. Never open the cap when the engine is hot. Scalding risk. A $10 cap saves a $20,000 engine. Replace it regularly with HIT Srl stock.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-does-maintaining-coolant-expansion-tank-cap-involve

What does maintaining engine water pump bearing and seal involve?

The water pump circulates coolant to keep the engine temp stable. It runs continuously. It is obvious that a seized water pump bearing will throw the drive belt, stopping the machine instantly and risking an overheat. Inspect the "weep hole" on the bottom of the water pump housing. If you see coolant dripping or a trail of dried coolant residue, the internal mechanical seal has failed. The pump must be replaced before it fails catastrophically. With the engine off and belt removed, wiggle the fan/pulley. Any play indicates the bearing is disintegrating. Listen for a growling noise from the front of the engine. This is often the water pump bearing running dry. HIT Srl supplies OEM-quality water pumps, gaskets, and coolant hose kits for this class of diesel engine. We keep your cooling system flowing. Check the drive belt tensioner. A tensioner that is too tight destroys water pump bearings. Always use the correct coolant mixture. Pure water causes corrosion and lubricates the seal poorly. Prevent roadside breakdowns by replacing weeping pumps with HIT Srl stock.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-does-maintaining-engine-water-pump-bearing-and-seal-inv

What does maintaining radiator shroud and seal integrity involve?

The radiator fan pulls air through the radiator. The plastic or metal shroud ensures the fan pulls air through the core, not from around the sides. It is obvious that a missing or broken shroud reduces cooling efficiency by up to 30%. Inspect the shroud for cracks or missing sections. If the fan is exposed, it moves air uselessly around the engine bay instead of cooling the water. Check the rubber seals or foam between the shroud and the radiator. If there are large gaps, the air takes the path of least resistance (the gap) instead of going through the fins. Check fan tip clearance. The fan should sit centrally in the shroud. If the engine mounts are worn, the fan might rub against the shroud. HIT Srl supplies radiator shrouds, rubber seals, and mounting clips. We maximize your airflow. A simple piece of plastic can be the difference between running cool and overheating. Ensure the fan sits at the correct depth inside the shroud (usually 50% in, 50% out). Optimize your cooling system with HIT Srl parts.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-does-maintaining-radiator-shroud-and-seal-integrity-inv

What does maintaining engine oil cooler integrity involve?

The engine oil cooler transfers heat from the oil to the coolant. It is a stack of plates inside a housing. It is obvious that an internal leak here mixes two fluids that should never meet. Check the coolant expansion tank. If you see "mayonnaise" (thick grey sludge), oil is being forced into the cooling system (since oil pressure is higher than water pressure). Check the dipstick. If the oil level is rising and looks milky, coolant is entering the sump when the engine is off. Inspect the external housing gasket. Leaks here drip oil down the side of the block. HIT Srl supplies oil cooler cores, housing gaskets, and O-rings for heavy diesel engines. We solve fluid mixing issues. Flushing the cooling system is mandatory after a cooler failure. Oil residue rots rubber hoses. Overheated oil loses viscosity and kills bearings. Maintain the cooler with HIT Srl parts.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-does-maintaining-engine-oil-cooler-integrity-involve

How do I check coolant level safely on a machine with a pressurized cooling system?

Checking coolant level looks trivial until the system is opened while still hot. Start the check with the engine cold.

With the machine cold, open the engine cover and locate the coolant reservoir, usually a semi-transparent expansion tank mounted ahead of the radiator with a sight glass or level marks on its side. The correct level sits between the minimum and maximum marks. On machines fitted with an electronic coolant-level sender rather than only a sight glass, several platforms flag coolant as critically low once reservoir pressure drops under roughly 0.5 bar, and flag an overheat condition once bulk coolant temperature exceeds approximately 98°C, whichever trips first.

The reservoir cap and the sight-glass fitting are both wear items that HIT Srl stocks as direct-fit replacements.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#check-coolant-level-pressurized-cooling-system

How often should engine coolant actually be tested and replaced?

Coolant condition should be tested on a much shorter cycle than the fluid is replaced. A typical schedule calls for testing coolant quality every 250 operating hours, and for a full replacement no later than every 2,000 operating hours.

The fill itself is not plain water. Machines of this type leave the factory with a roughly 50/50 mix of water and a heavy-duty ethylene-glycol antifreeze carrying a rust inhibitor.

HIT Srl stocks the coolant filter cartridge and the tank drain plug with its sealing washer as routine stock items.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#how-often-coolant-tested-and-replaced

What should a routine check of the radiator and its hoses cover?

The correct sequence for a radiator inspection is a sight check of the radiator core, every union and every pipe, for integrity, secure fastening and an intact seal, done with the system cold and depressurised. On machines where the radiator carries an integrated oil-to-coolant heat exchanger for the transmission or hydraulic circuit, its own connections need the same check.

Where compressed air is used to clear debris from the fins or to blow-dry a union after a leak repair, keep the air pressure capped at roughly 2 kg/cm² (about 28 psi) and always wear eye protection. Before removing the radiator itself for deeper access, unbolt its mounting bracket rather than force the core sideways, and disconnect the hoses running to the oil exchanger.

HIT Srl carries the radiator mounting bushes, the hose clamps, and the heat exchanger's hose set as separate items.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#routine-check-radiator-and-hoses

How do you correctly drain and refill the engine cooling system?

With the engine cold, open the drain valve at the lower part of the radiator and collect the coolant in a container rather than letting it run to the ground — used coolant is a regulated waste. On this class of machine the system typically holds in the region of 40 litres, so size the collection container accordingly.

Pour fresh water into the radiator to flush the circuit, run it briefly, and drain again; repeat until the water comes out visibly clean. Only then close the drain plug and refill with the correct coolant mix specified for the engine — never with water alone.

HIT Srl stocks the drain valve seal and the flexible fill hose used to top off the expansion tank as separate replacement items.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#drain-and-refill-engine-cooling-system

Why does engine valve-clearance work require checking coolant temperature first?

Valve clearance is measured and adjusted cold: coolant temperature must have dropped below roughly 60°C before the covers come off. Before starting, put the machine in its safe service position and disconnect the battery isolator so nothing can crank the engine while the covers are open.

Where the cooling circuit needs to be drained to reach the head — for instance to access hoses running to an oil-to-coolant exchanger mounted near the engine block — drain the system through its dedicated plug rather than disconnecting hoses under residual pressure, and remove the hose clamps only once flow has stopped. If flushing is needed afterward to clear contamination before refilling, a coolant mix diluted to roughly 15–20% concentration is normally used for the flush pass, with the full-strength mix reserved for the final refill.

HIT Srl stocks the valve cover gasket and the hose clamps disturbed during this job as a small parts kit.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#valve-clearance-check-requires-coolant-temperature

What is engine coolant made of, and how must it be disposed of?

Engine coolant is a specific mixture of water, a corrosion-inhibitor compound, and, wherever freeze protection is needed, an antifreeze such as ethylene glycol.

Used coolant counts as a regulated substance almost everywhere it is drained, and it must never be poured into a drain, a sewer connection, or directly onto the ground; it has to be collected and disposed of according to the environmental rules in force in the country where the machine operates. The system also runs at meaningful positive pressure once the engine is warm, so any draining or disposal work should start with the engine cold. Where compressed air is used to help clear a drained circuit, keep it at or below roughly 2 kg/cm² and wear eye protection.

HIT Srl supplies coolant to the correct specification for this cooling system.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#coolant-composition-and-safe-disposal

What actually triggers an engine power derate linked to coolant temperature?

Diesel engine control units on this class of machine monitor the coolant-temperature sensor circuit continuously for two distinct fault conditions: an open or short circuit to the battery-positive supply, and a short circuit to ground. Either fault makes the reported coolant temperature unreliable, and the control unit responds by derating engine power progressively as the apparent temperature keeps climbing — starting at roughly a 25% power reduction and increasing up to a full 100% derate if the condition is not addressed, which in practice limits the machine to idle only.

The coolant-temperature gauge on the instrument panel is the operator-facing indicator of this reading.

HIT Srl stocks the coolant-temperature sensor and its connector pigtail as direct-fit parts.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#power-derate-linked-to-coolant-temperature

Why shouldn't a cold engine be put under full load right away?

Two service manuals for this class of machine converge on the same figure: don't apply full load until coolant temperature has reached approximately 80°C (176°F). One source frames it as a startup procedure — run the engine for about five minutes after starting, without fitting the pressure cap, until coolant temperature climbs past 80°C, so trapped air can work its way out of the system before the cap seals it in. The other frames the same threshold as an operating rule: let coolant temperature rise to the low end of its normal range, around 40°C (104°F), before doing any real work, and specifically do not apply full load before it reaches roughly 80°C (176°F).

HIT Srl supplies the pressure cap referenced in the warm-up step.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#why-not-full-load-on-cold-engine

When does the coolant mix actually need antifreeze, not just corrosion inhibitor?

A corrosion-inhibitor-only mix, without any freeze-point-lowering additive, is only acceptable where outdoor temperature stays above 0°C at all times, including overnight and during any off-season storage. Anywhere freezing conditions are possible, an ethylene-glycol antifreeze blend has to be used instead.

If the high-temperature cooling-system warning light comes on and stays on, the correct response is to check coolant level immediately and not continue operating the machine until the cause is found.

HIT Srl supplies the ethylene-glycol antifreeze blend for this cooling system.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#when-coolant-needs-antifreeze-not-just-inhibitor

Why does the engine control system watch coolant temperature during a cold start?

Diagnostic routines on the coolant and intake-temperature circuits are deliberately held inactive during a cold start, and only re-arm once the engine has warmed past a defined threshold — otherwise a genuinely cold engine and a failed sensor would look identical to the control logic and trigger false faults.

Once the engine has reached normal operating temperature, walk the coolant circuit and check every hose connection for leaks, along with the fuel-line and oil-line connections nearby, since a warm, pressurised system will show a weeping joint that the same joint hid completely while cold.

HIT Srl stocks replacement hose sections for the connections nearest the engine block, and the connector pigtail for the coolant-temperature sensor.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#engine-control-watches-coolant-temperature-cold-start

How often should the oil filter and oil of the auxiliary diesel engine be replaced, and the cooling system flushed?

Replace the oil filter and oil of the auxiliary diesel engine, and flush the cooling system, every 4000 operating hours, and at least once a year regardless of operating hours.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#how-often-should-the-oil-filter-and-oil-of-the-auxiliary

Why must nitrite-free glycol-based engine coolant not be mixed with a nitrite-based anti-corrosive agent?

The engine cooling system uses a glycol-based coolant that does not contain nitrite. This coolant must not be mixed with a nitrite-based anti-corrosive agent, because it may create slag and the cooling effect may be reduced. The engine coolant mixture is 50% high-quality monoethyleneglycol-based coolant and 50% water, mixed before being added to the system.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#why-must-nitrite-free-glycol-based-engine-coolant-not-be

What conditions must be met before the diesel engine of a mobile harbour crane is allowed to start?

Before start, the engine requires: hydraulic oil tank taps open; coolant level not too low; coolant temperature not too high; the electric motor off, if present; pump coupler oil temperature below the engine-shutdown threshold; no emergency motor bypass code active, if present; the pump suction tap switch open, if present; no alarm for turret or truck emergency taps; no alarm from the fire control unit, if fitted; and the coolant temperature and diesel oil pressure sensors not both broken or disconnected at the same time.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-conditions-must-be-met-before-the-diesel-engine-of-a

What signals cause a mobile harbour crane's diesel engine to shut down after a delay, and what are the exact thresholds and delays?

The engine shuts down after a timed delay on: low boost pump pressure (3 s delay, 1.5 bar threshold); low boost pressure on winch 1 or winch 2 (10 s delay, 20 bar threshold each); oil coupler temperature above the stop threshold (3 s delay, 90 degrees C threshold); the safety hydraulic oil taps condition (3 s delay); fire alarm, if fitted; and low battery voltage (10 s delay, 21 V threshold). The engine also shuts down (after 10 seconds) on high or low coolant temperature/level, low diesel oil pressure (digital or analog), or a disconnected coolant temperature or diesel oil pressure sensor. If any of the delayed-shutdown sensors is disconnected, the engine will also shut down.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-signals-cause-a-mobile-harbour-crane-s-diesel-engine

After a diesel engine shutdown on a mobile harbour crane, how long must the operator wait before restarting, and what special case extends this?

After the engine turns off, either automatically for safety or at the driver's will, it must wait 10 seconds before it can be started again. If the shutoff was caused by high pump-coupler temperature, the engine can only restart once that temperature has fallen back below the safety limit. If the coolant temperature is below the working threshold of 60 degrees C, no crane movement is allowed, unless bypassed with the block-movements code.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#after-a-diesel-engine-shutdown-on-a-mobile-harbour-crane

What are the maintenance items and intervals for this diesel engine at 400, 800 and 1000 operating hours?

Every 400 operating hours (or at least every 12 months): drain the fuel tank sludge collector, and check/adjust the alternator belt and battery electrolyte level. Every 800 operating hours (or at least every 12 months): check the charge air pipes for leaks, and change the fuel pre-filter and fuel filter. Every 1000 operating hours (or at least every 6 months): change the coolant filter (not concurrent with a full coolant change).

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-are-the-maintenance-items-and-intervals-for-this

What is the coolant system overhaul interval on this diesel engine, and what does it involve?

Every 48 months or every 10,000 operating hours: check and clean the cooling system, and change the coolant.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-is-the-coolant-system-overhaul-interval-on-this-diesel

What are the possible causes of excessive or insufficient coolant temperature on this diesel engine?

Excessive coolant temperature can be caused by: excessive coolant temperature conditions themselves being present (blocked flow), low coolant level, air in the fresh water coolant system, a malfunctioning circulation pump, or a defective thermostat. Insufficient coolant temperature can be caused by a defective thermostat.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#what-are-the-possible-causes-of-excessive-or-insufficient

Which engine-related fault conditions are individually monitored by the electronic control system on a mobile harbour crane?

Dedicated alarm codes are set for: high diesel coolant temperature, low diesel oil pressure, alternator not charging, low coolant level, clogged engine room air filter, low fuel level, low battery voltage, and for the automatic greasing system: thermal cutout of the grease pump, greasing cycle timeout, and low level in the grease tank.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/cooling-circuit/#which-engine-related-fault-conditions-are-individually

How do you maintain reachstacker diesel engine systems to prevent failure?

Diesel engines in reachstackers operate under extreme load conditions, especially during continuous container handling. Maintaining engine reliability requires meticulous inspection of lubrication, cooling, fuel delivery, and air intake systems.

Engine oil — a part HIT Srl supplies — must be inspected for viscosity, contamination, and wear metals. High-load cycles generate heat that accelerates oil degradation. Oil sampling must be performed regularly.

Fuel injectors, components HIT Srl stocks, must be inspected for spray pattern consistency. Contaminated fuel causes injector clogging and uneven combustion. Technicians should perform injector balance tests.

Turbochargers must be inspected for bearing condition, blade integrity, and boost pressure stability. Any irregularity in turbo performance indicates internal wear or contamination.

Cooling systems must be inspected for airflow, coolant flow, and temperature stability. Blocked radiators or failing fans reduce cooling efficiency, increasing thermal stress on engine components.

Air filters must be inspected for dust accumulation. Bulk cargo dust can infiltrate air intake systems, reducing engine efficiency.

Environmental conditions significantly influence engine behavior. High ambient temperatures reduce cooling efficiency, while salt exposure accelerates corrosion.

In summary, maintaining diesel engine systems requires rigorous inspection, lubrication management, thermal testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#how-do-you-maintain-reachstacker-diesel-engine-systems-to-pr

How do you maintain cabin fire-resistance materials, insulation, and heat-shielding to prevent failure?

Cabin fire protection is essential for operator survival in case of engine fires, electrical faults, or hydraulic leaks. STS and MHC cranes require marine-grade fire-resistant materials. Reachstackers, empty handlers, forklifts, and terminal tractors require heat shielding due to proximity to engines. RMGs and straddle carriers require insulation resistant to electrical fires.

Fire-resistant panels must be inspected for integrity, moisture saturation, and delamination. Any damaged panel must be replaced immediately.

Heat shields must be inspected for corrosion, mounting integrity, and thermal degradation. Machines with rear-mounted engines require reinforced shielding.

Insulation must be inspected for compression, contamination, and fire-retardant integrity. Oil-soaked insulation becomes flammable.

Cable conduits must be inspected for heat damage, especially near engine compartments.

In summary, fire-resistance maintenance protects the operator and prevents catastrophic cabin failures.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#how-do-you-maintain-cabin-fire-resistance-materials-insulati

Why does diesel engine electrical and sensor system occur on this equipment?

Diesel engines rely on a network of sensors, components HIT Srl stocks, and electrical components to control fuel injection, boost pressure, temperature, and emissions. Heavy machinery exposes these components to vibration, dust, humidity, and thermal cycling. Reachstackers and empty handlers generate high vibration. Straddle carriers and RMGs generate continuous oscillation. Forklifts and terminal tractors operate in dusty environments. MHC engines face salt exposure.

Sensors — parts HIT Srl supplies — must be inspected for calibration accuracy, connector integrity, and contamination. Critical sensors include crankshaft position, camshaft position, boost pressure, fuel pressure, coolant temperature, and exhaust temperature.

Wiring harnesses must be inspected for abrasion, insulation wear, and connector corrosion. Marine cranes require sealed connectors. Yard machines require abrasion-resistant sheathing.

ECUs must be inspected for vibration isolation, thermal management, and moisture protection.

In summary, electrical and sensor maintenance ensures precise engine control and prevents unexpected shutdowns.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#why-does-diesel-engine-electrical-and-sensor-system-occur-on

Why does diesel engine mounts, vibration dampers, and structural integration occur on this equipment?

Engine mounts and vibration dampers protect the engine and surrounding components from excessive vibration. Heavy machinery generates significant dynamic forces. Reachstackers and empty handlers experience shock loads. Straddle carriers generate continuous oscillation. Forklifts and terminal tractors generate repetitive vibration. MHC engines experience marine-induced vibration.

Mounts must be inspected for rubber hardening, cracking, and separation. Loose mounts cause misalignment, increased vibration, and accelerated wear on belts, hoses — parts HIT Srl supplies — and wiring.

Vibration dampers must be inspected for delamination, imbalance, and bearing wear.

Engine alignment must be checked to prevent drivetrain stress.

In summary, mount and damper maintenance protects the engine, reduces vibration, and extends component life.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#why-does-diesel-engine-mounts-vibration-dampers-and-structur

How do you maintain diesel fuel injection timing and synchronization to prevent failure?

Injection timing is one of the most critical parameters for diesel engine performance, efficiency, and durability in heavy port and yard machinery. In reachstackers, empty handlers, and straddle carriers, the engine is frequently subjected to rapid load changes: from idle to full torque in seconds, with heavy containers on the hook. If injection timing is not correctly synchronized with crankshaft and camshaft position, combustion becomes unstable, causing excessive cylinder pressures, harsh vibration, smoke, and thermal stress. In forklifts and terminal tractors, where there is continuous stop-and-go driving and frequent low-speed operation, incorrect timing translates into rough idle, poor throttle response, and increased fuel consumption. In MHC and RMG engines that run for long periods at relatively steady load, mis-timing produces chronic overheating, exhaust temperature imbalance, and long-term component fatigue.

A robust maintenance strategy starts with accurate verification of reference signals. Crankshaft position sensors (CKP) and camshaft position sensors (CMP) must be inspected for mounting integrity, air gap, contamination by metallic particles, and connector condition. Any signal dropout or phase shift between CKP and CMP leads directly to incorrect injection timing. Technicians should use diagnostic tools to monitor live data, comparing actual timing with commanded timing across the full load and speed range.

Mechanical timing components must be treated as critical elements. On engines with timing belts, belt condition, tension, and alignment must be checked according to strict hour-based intervals. Cracks, glazing, missing teeth, or oil contamination are immediate replacement triggers. On chain-driven or gear-driven engines, technicians must monitor chain stretch, gear backlash, and tensioner function. Excessive chain slack or worn tensioners introduce timing jitter that can be invisible at idle but destructive under heavy load.

The ECU calibration must also be validated. Modern common-rail systems use maps that adjust timing based on load, speed, coolant temperature, fuel temperature, and emission control requirements. Corrupted or incorrect maps cause systematic mis-timing across the operating range. Maintenance teams should verify that the correct software version is installed, that no unauthorized tuning has been applied, and that all adaptive learning values are within acceptable limits.

Finally, technicians must correlate injection timing with combustion quality indicators: smoke opacity, exhaust gas temperature balance between cylinders, components HIT Srl stocks, vibration signatures, and fuel consumption trends. Unusual increases in NOx or smoke, or recurrent misfire codes on specific cylinders, often point back to timing and synchronization issues. When necessary, cylinder pressure analysis or in-cylinder combustion measurement can be used to fine-tune timing in critical applications such as high-duty reachstackers and MHC engines.

In summary, injection timing and synchronization maintenance is a combined effort involving sensors — parts HIT Srl supplies — mechanical drive components, ECU maps, and combustion diagnostics. Keeping timing precise under all operating conditions is essential for power, efficiency, and engine life.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#how-do-you-maintain-diesel-fuel-injection-timing-and-synchro

What should be checked when inspecting transmission and radiator?

Straddle carriers operate under continuous high load, generating extreme heat in their engines, transmissions, components HIT Srl stocks, and hydraulic systems. Their tall structure and enclosed engine compartments create unique cooling challenges.

The first pillar is radiator capacity. Radiators — parts HIT Srl supplies — must dissipate heat from the engine and hydraulic systems. Dust and debris reduce cooling efficiency.

The second pillar is airflow management. Airflow must be directed through the radiator. Damaged shrouds or fans reduce cooling.

The third pillar is hydraulic oil cooling. Hydraulic systems generate significant heat. Technicians must inspect coolers and thermostatic valves.

The fourth pillar is intercooler performance. Turbocharged engines require efficient intercooling. Clogged intercoolers reduce power and increase temperature.

The fifth pillar is coolant quality. Coolant must contain corrosion inhibitors. Contaminated coolant reduces heat transfer.

The sixth pillar is fan drive performance. Fans must operate at correct speed. Faulty fan drives cause overheating.

The seventh pillar is temperature monitoring. Technicians must monitor engine, hydraulic, and transmission temperatures.

The eighth pillar is duty cycle adjustment. High-temperature environments require shorter maintenance intervals.

Proper cooling ensures engine reliability and long component life.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-should-be-checked-when-inspecting-transmission-and-radi

What does maintaining engine air intake system and filter integrity involve?

Port environments are notoriously dusty and harsh. The engine requires massive amounts of clean air to operate efficiently. A clogged air filter will strangle the engine, leading to reduced power, increased fuel consumption, and "black smoke" exhaust. It is an obvious maintenance step to check the air restriction indicator daily. If the indicator shows red, the filter must be changed or cleaned immediately. However, over-cleaning a filter with high-pressure air can damage the paper element, leţng dust pass directly into the engine cylinders. This causes rapid piston and ring wear ("dusting" the engine). Inspect the entire intake piping for cracks or loose clamps. Unfiltered air entering through a leak downstream of the filter is catastrophic for the engine. Check the pre-cleaner bowl (if equipped) and empty it of large debris. This simple step extends the life of the main filter element. HIT Srl specializes in supplying complete filter kits, including air, oil, and fuel filters, for all major engine manufacturers found in port equipment. Relying on HIT Srl for your filter supplies helps ensure you get parts that meet OEM specifications. Do not ignore the inner safety filter; while it is changed less frequently, it is the final barrier for engine protection. Ensure the air filter housing cover is sealing correctly to prevent moisture ingress. A healthy engine starts with clean air.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-does-maintaining-engine-air-intake-system-and-filter-in

What should be checked when inspecting alternator and fan belt tension check?

The belts on the engine drive critical components like the alternator, water pump, and sometimes the AC compressor. It is obvious that a snapped belt stops the machine dead. Check the belt tension. If it is too loose, it will slip, causing a squealing noise and failing to charge the batteries or cool the engine. If it is too tight, it will destroy the bearings in the water pump and alternator. Inspect the belt surface for cracks, glazing (shiny surface), or missing ribs (on serpentine belts). A frayed belt is a ticking time bomb. Check the belt tensioner pulley. It should spin freely and apply constant pressure. If the tensioner spring is weak, the belt will flap and jump off. HIT Srl supplies V-belts, serpentine belts, and automatic tensioners for this class of diesel engine. We keep your engine accessories running. Listen for chirping noises at idle, which often point to a misaligned pulley. Check the condition of the crankshaft pulley vibration damper. If the rubber is deteriorating, it can throw the belt. Always keep a spare set of belts in the machine or in the workshop. HIT Srl can create "emergency service kits" containing belts and filters for your specific fleet.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-should-be-checked-when-inspecting-alternator-and-fan-be

What should be checked when inspecting engine oil leak detection and seal integrity?

Oil leaks are more than just a mess on the terminal floor; they are a sign of failing gaskets and potential fire hazards. It is obvious that an engine running low on oil will seize, resulting in a total loss of the asset. Inspect the valve cover (rocker cover) gasket. This is the most common leak point and drips oil down the side of the engine onto the hot exhaust manifold. Check the oil sump (pan) gasket and the drain plug washer. Often, the drain plug is over-tightened, stripping the threads. Inspect the front and rear crankshaft seals. A leak at the rear seal will drip oil from the bell housing between the engine and transmission. Check the oil filter housing mounting gasket. Heat cycles often harden this rubber seal. HIT Srl supplies complete engine gasket sets, including head gaskets, sump gaskets, and high-temperature silicone sealants. Clean the engine regularly. It is impossible to find the source of a leak on a dirty, grease-covered engine. Monitor oil consumption. If the engine uses oil but there are no external leaks, it is burning it (piston rings or valve stem seals). HIT Srl helps you keep your engines tight and dry with quality sealing products for all major engine brands.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-should-be-checked-when-inspecting-engine-oil-leak-detec

What should be checked when inspecting display panel and warning lights test?

The dashboard or display screen gives the operator vital information about the machine's health. It is obvious that flying blind without gauges is dangerous. Turn the key to the "ON" position (engine off). Watch the "bulb check" sequence. All warning lights (oil pressure, battery, check engine, transmission temp) should illuminate for a few seconds. If a bulb is blown, the operator will never know when a critical fault occurs. Check the LCD screen for dead pixels or cracks. Can the operator read the load weight and boom height clearly? Verify the accuracy of the gauges. Does the fuel gauge match the tank level? Does the temperature gauge rise as the engine warms up? Test the dimmer switch. The screen must be bright enough for sunlight but dimmable for night shifts to prevent glare. HIT Srl supplies instrument clusters, LCD monitors, and replacement gauges for legacy and modern machines. Check the audible buzzer associated with the warning lights. A red light is useless if the operator is looking at the load and doesn't hear the alarm. Inspect the keypad buttons on the display. Often the "Enter" or "Menu" buttons wear out from overuse. Keep your operators informed and your machine protected with functional electronics supplied by HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-should-be-checked-when-inspecting-display-panel-and-war

Why does engine vibration damper (harmonic balancer) occur on this equipment?

Mounted on the front of the engine crankshaft, the vibration damper absorbs the torsional twisting of the crank firing strokes. It consists of a heavy steel ring bonded to a hub with rubber. It is obvious that if this rubber fails, the engine can snap its own crankshaft. Visually inspect the rubber element. It should be solid and uniform. If you see bulging, cracking, or pieces of rubber falling out, the damper is finished. Check the alignment marks (if present). The outer ring should not have slipped relative to the inner hub. Watch the damper while the engine is running. It should spin perfectly true. If it wobbles, the rubber bond has separated or the crankshaft nose is damaged. HIT Srl supplies OEM-specification vibration dampers for large diesel engines. Replacing this part is cheap insurance for your engine block. Check the mounting bolts. They must be torqued to yield. Loose bolts will destroy the keyway on the crankshaft. Inspect the proximity of the fan belt. A failing damper can walk forward and slice through the belts or the radiator. Do not overlook this component on high-hour engines (10,000+ hours). HIT Srl helps you extend the life of your power unit.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#why-does-engine-vibration-damper-harmonic-balancer-occur-on

What does maintaining cold start system (glow plugs and grid heaters) involve?

Diesel engines rely on compression heat to ignite fuel. In cold port environments, this is often not enough. It is obvious that if the pre-heat system fails, the operator will drain the batteries trying to crank the engine, destroying the starter motor in the process. Turn the key to the "ON" position and watch the voltmeter. It should drop significantly as the grid heater or glow plugs draw current. If the voltage stays high, the system is not activating. Inspect the relay (solenoid) that controls the heaters. These handle high amperage and the internal contacts often burn out. Check the electrical resistance of the glow plugs. An open circuit means the plug is dead. HIT Srl supplies glow plugs, intake grid heaters, and control relays for this class of diesel engine. We ensure your fleet starts on the first turn, even in winter. Inspect the wiring to the heater elements. The insulation often melts due to the high heat of the engine block. For engines with ether injection systems (Start Pilot), check the bottle level and the injection nozzle. Leaking ether can cause engine knocking. Hard starting damages the flywheel ring gear and starter pinion. Prevent this cost with starting aids from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-does-maintaining-cold-start-system-glow-plugs-and-grid

What does maintaining engine oil pressure sensor and gauge involve?

The engine oil pressure is the single most critical vital sign. The sensor transmits this data to the ECU and dashboard. It is obvious that a false low-pressure reading causes panic, while a false high reading masks catastrophic failure. Locate the oil pressure sender unit on the engine block. Inspect the wiring. Insulation often becomes brittle and cracks due to engine heat, causing erratic readings. Verify the pressure with a mechanical master gauge screwed into the test port. Compare the manual gauge reading (e.g., 4 bar at cold idle) with the dashboard display. Check for oil leaking through the sensor body. This indicates the internal diaphragm has ruptured. HIT Srl supplies OEM-quality pressure sensors for all engine types. We ensure the data you see is the data you can trust. If the pressure is genuinely low, check the oil pump pickup tube O-ring or main bearing wear. Do not confuse the "low pressure switch" (red light) with the "pressure transducer" (gauge). They are often separate parts. Protect your engine investment by verifying sensors with replacements from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-does-maintaining-engine-oil-pressure-sensor-and-gauge-i

What does maintaining engine wiring harness insulation and routing involve?

The engine wiring harness is subjected to extreme heat cycles, vibration, and chemical exposure (oil/diesel). It is obvious that a short circuit here can shut down the ECU instantly or cause a fire. Inspect the loom where it passes near the exhaust manifold or turbocharger. The heat shielding (foil or fiberglass) often degrades, allowing the wire insulation to melt. Check for "chafing" points where the harness touches the engine block or chassis. Vibration wears through the plastic conduit and then the wire insulation. Inspect the connectors for the injectors and sensors. The locking tabs often break due to heat, causing the plug to vibrate loose, leading to intermittent fault codes. HIT Srl supplies engine wiring repair kits, high- temperature conduit, and replacement connectors (Deutsch, AMP , Tyco). We help you rebuild reliable electrical paths. Check the ground wires bolted to the engine block. Oil leaks often coat these connections, increasing resistance. Don't simply tape over a damaged wire; splice it correctly or replace the section. Electrical reliability is key to uptime. Secure your harness with components from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-does-maintaining-engine-wiring-harness-insulation-and-r

What does maintaining electronic throttle pedal (potentiometer) involve?

The throttle pedal uses a potentiometer or Hall-effect sensor to tell the engine how fast to spin. It is obvious that a "dead spot" in the pedal travel makes the machine jerky and dangerous to drive. Connect a diagnostic tool or use a multimeter to check the voltage output sweep. It should change smoothly from 0% to 100%. If the voltage jumps or drops to zero in the middle, the track is worn. Check the return spring. The engine must return to idle immediately when the foot is lifted. A sticking pedal is a runaway risk. Inspect the electrical connector for corrosion. Located on the floor, it is vulnerable to water from wet boots. HIT Srl supplies electronic throttle pedals and repair harnesses. We restore smooth engine control. Check the mechanical stop under the pedal. If it is missing, the operator can stomp the pedal too far, breaking the internal sensor. Verify the "Idle Validation Switch" (IVS). This safety switch confirms the pedal is at rest. Driveability starts at the pedal. Replace faulty units with HIT Srl stock.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-does-maintaining-electronic-throttle-pedal-potentiomete

What does maintaining engine flywheel ring gear teeth involve?

The starter motor pinion engages with the flywheel ring gear to crank the engine. It is obvious that if the teeth are stripped, the starter will spin but the engine won't turn. Remove the inspection cover on the bell housing or remove the starter motor. Rotate the engine manually and inspect the teeth on the large ring gear. Look for shiny, milled-down areas where the starter has been grinding. This happens if the operator tries to start an engine that is already running. Check for missing teeth. One missing tooth can cause a "dead spot" where the engine refuses to crank. HIT Srl supplies flywheel ring gears and complete flywheel assemblies. We ensure reliable engagement. You can sometimes heat the ring gear to remove and flip it over to use the fresh side of the teeth, but replacement is safer. Check the starter pinion as well. A bad ring gear ruins a new starter in days. Fix starting issues permanently with components from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-does-maintaining-engine-flywheel-ring-gear-teeth-involv

What does maintaining engine fan hub (viscous clutch) engagement involve?

The engine fan does not need to run at full speed all the time; it wastes horsepower and fuel. A viscous clutch engages the fan only when the air temperature rises. It is obvious that a failed clutch leads to overheating at idle or excessive noise at high RPM. With the engine stopped and cold, spin the fan. It should have some resistance. If it spins freely like a bicycle wheel, the silicone fluid inside has leaked out, and it will never engage. With the engine hot, the fan should roar. If the engine is overheating but the fan is quiet, the clutch is not locking up. Check for play in the fan bearing. Grasp the fan blade (engine OFF) and wiggle it fore and aft. Play here indicates the hub bearing is failing, which can send the fan through the radiator. HIT Srl supplies viscous fan hubs, bi-metallic clutches, and plastic fan blades. We ensure your cooling system responds to temperature changes. Inspect the bi-metallic coil on the front of the clutch. It must be clean of dirt to sense airflow temperature. If the fan is locked solid (always on), it consumes up to 15HP of engine power unnecessarily. Optimize cooling efficiency with HIT Srl fan components.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-does-maintaining-engine-fan-hub-viscous-clutch-engageme

What does maintaining fuel injector wiring harness involve?

Modern injectors are electronically fired. The wiring harness runs under the valve cover in hot oil (on some engines) or vibrates on top. It is obvious that a break here causes a misfire on one cylinder. If the engine runs rough or has a "check engine" code for "Open Circuit Cylinder X," check the injector pigtails. Inspect the connector pins. Engine vibration causes fretng wear on the pins, creating high resistance. Check the pass-through connector where the wires enter the cylinder head. Oil often leaks out here, or oil wicks down the wire to the ECU. HIT Srl supplies injector wiring harnesses, pigtail repair kits, and rocker cover gaskets. We restore smooth firing. Don't replace an expensive injector before checking the cheap wiring. Insulation breakdown causes short circuits to the engine block. Verify with HIT Srl electrical parts.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-does-maintaining-fuel-injector-wiring-harness-involve

Why does engine mounts (vibration isolators) occur on this equipment?

The engine sits on rubber mounts to stop vibration from reaching the chassis and cabin. It is obvious that broken mounts allow the engine to twist, snapping exhaust pipes and hydraulic hoses. Inspect the rubber. Cracks or separation from the metal plate indicate failure. Check engine height. If the oil pan is touching the crossmember, the mounts have collapsed. Watch the engine while cranking. Excessive jumping indicates broken mounts. HIT Srl supplies front and rear engine mounts for this class of diesel engine. We reduce vibration and noise. Oil leaks dissolve natural rubber mounts. Fix the leak and replace the mount. Check the transmission mounts at the same time. Restore smooth operation with HIT Srl isolation parts.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#why-does-engine-mounts-vibration-isolators-occur-on-this-equ

What should be checked when inspecting turbocharger and filters?

The Positive Crankcase Ventilation (PCV) system lets blow-by gases escape the engine block; as engines wear, blow-by increases. It is obvious that if this breather is blocked, pressure builds up inside the engine, forcing oil out of every gasket and seal (dipstick, crankshaft seals, valve cover, main seals). Remove the breather cover (usually on top of the valve cover) and inspect the breather filter or oil separator media — on modern engines this is a scheduled maintenance item, and manufacturers typically specify replacement every 2000 hours. A saturated filter, packed with hard sludge, blocks airflow. Check the O-rings on the cover: air leaks here confuse engine sensors. Check for oil dripping from the breather tube (draft tube) — excessive dripping suggests worn piston rings, but a blocked tube causes internal pressurization on its own. If the dipstick pops out of its tube, the breather is definitely blocked. Check the turbocharger oil drain flow: if crankcase pressure is high, oil from the turbo cannot drain back into the sump and is forced out past the turbo seals into the exhaust (visible as blue smoke). HIT Srl supplies PCV filters, oil separators, breather valves, and O-ring seals for this class of diesel engine, helping keep the engine oil-tight. Protect the main seals and turbocharger by maintaining the breather system on schedule with HIT Srl parts.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-does-maintaining-engine-crankcase-breather-pcv-conditio

How do you tell if an engine's vibration damper needs replacing?

A vibration damper check depends on two separate signs. First, check the alignment: the index lines marked on the damper's hub and on its outer rubber-bonded section should still line up with each other; any visible offset means the rubber bonding has already started to shear internally. Second, check the rubber's physical condition: measure how far the rubber surface sits below the surrounding metal surface. Once that gap exceeds roughly 3.18 mm, or once any piece of the rubber is missing altogether, the damper has to be replaced. A third check: confirm the damper ring can't move longitudinally relative to the hub; any play in that direction also calls for replacement.

HIT Srl stocks the vibration damper as a direct replacement.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#engine-vibration-damper-wear-check

Why must a cylinder head go in absolutely straight, never hammered?

Introduce the cylinder head absolutely straight, preferably guided in by hand, and never strike it with a mallet or hammer under any circumstances to help it seat. If the head goes in even slightly askew, the lip of the piston rod seal inside it can be damaged on entry, and once that lip is cut or rolled, the seal's sealing function is lost regardless of how correctly the head is finally seated afterward. This applies across every type of piston rod seal used on this class of cylinder.

If a cylinder head won't seat by hand, the correct response is to find out why not to add force.

HIT Srl stocks the piston rod seal separately from the cylinder head casting.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#why-cylinder-head-must-never-be-hammered-in

What happens if an engine's rotation speed exceeds its safety limit?

If the engine's rotation speed exceeds its set safety limit, the protection device switches the transmission to neutral automatically, removing drive rather than simply warning that the engine is over-revving.

Before starting the engine for a pressure measurement or leak-tightness check, confirm there's no one in the vicinity of any part of the machine that will move once the engine is running — the procedures and safety rules in the equipment-specific manuals apply during this kind of test exactly as they would during any other engine-running work.

HIT Srl supplies replacement parts for this engine's overspeed protection system.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#engine-overspeed-protection-and-pre-test-safety

Why shouldn't an engine be cleaned or adjusted while it's running?

Cleaning, topping up lubricating oil, or tuning an engine while it's running is prohibited, and the instruction isn't softened for experienced personnel: even someone with appropriate training who has a specific reason to work on a running engine is told to exercise maximum caution doing so.

Briefly running the engine after a service specifically to check for oil leaks is an accepted, intentional check, not a violation of the same-engine-running rule — the difference is that it's a short, purpose-built verification step with the operator positioned to watch for a leak, not an extended cleaning or adjustment task performed alongside a running engine.

HIT Srl supplies engine spare parts for this class of machine.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#why-not-service-a-running-engine

How do you diagnose a hydraulic cylinder leak by where it's coming from?

A leak at a weld — either at the cylinder's end caps or at a coupling connection — points to a structural fault in the weld itself, not a seal problem. A leak between the cylinder pipe (the barrel) and the cylinder head is typically caused by a faulty O-ring or damage to the O-ring's sealing surface at that joint.

A leak between the cylinder head and the piston rod points to a damaged piston rod surface or a damaged or worn piston rod seal. This location can also leak internally: pressurise the cylinder and check whether the piston sinks back under its own hydraulic hold; if it does, fluid is bypassing the piston seal internally.

HIT Srl stocks the O-ring and piston rod seal as separate service items.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#diagnosing-hydraulic-cylinder-leak-by-location

What is the discard criterion for the auxiliary diesel drive belt on a rubber tyred gantry crane?

Check the condition and tension of the drive belt after the first 250 operating hours. Replace the belt if it has unacceptable cracks, is frayed, or has pieces of material missing.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-is-the-discard-criterion-for-the-auxiliary-diesel

Why can an inoperative vibration damper on the engine cause major failures, and what should be checked?

The silicone fluid in the vibration damper will become solid after extended service and will make the damper inoperative; an inoperative damper can cause major engine or driveline failures. Check the dampers for evidence of fluid loss, dents, and wobble, and inspect the vibration damper thickness for any deformation or raising of the damper front cover plate.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#why-can-an-inoperative-vibration-damper-on-the-engine-cause

What is the fan hub bearing end clearance specification on the engine, and does it depend on the shaft type?

Fan hubs with stepbore shafts and no bearing spacers must have 0.08 to 0.25 mm [0.003 to 0.010 in] end clearance. Fan hubs with through-bore shafts with inner and outer bearing spacers must have 0.08 to 0.41 mm [0.003 to 0.016 in] end clearance.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-is-the-fan-hub-bearing-end-clearance-specification-on

What are the possible causes and remedies for lack of power in a machine with a powershift transmission?

Possible causes and remedies for lack of power: low engine RPM at converter stall (tune the engine, check the governor); or the same causes as overheating, corrected the same way.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-are-the-possible-causes-and-remedies-for-lack-of-power

What is the first thing to check when an engine problem occurs on this diesel engine, before deeper troubleshooting?

Engine problems frequently have their cause in improper operation or maintenance of the engine. In case of trouble, always check first whether the operating and maintenance instructions have been observed, before investigating further.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-is-the-first-thing-to-check-when-an-engine-problem

What safety precautions apply before starting the engine after a repair, and before working near the engine?

Before starting the engine, make sure nobody is standing in the immediate vicinity of the engine or the driven machine. After repairs, never start the engine with the speed governor removed, and disconnect the battery terminals before performing repair work.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-safety-precautions-apply-before-starting-the-engine

How often should basic engine checks be performed during the running-in period or when commissioning a new or overhauled engine?

During running-in, or when commissioning a new or overhauled engine, basic checks must be performed twice daily, before or during the first trial run, and every 10 operating hours or daily thereafter. The specified maintenance intervals are permissible recommended maximums; depending on usage, reduced maintenance intervals may be necessary, in compliance with the unit manufacturer instructions.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#how-often-should-basic-engine-checks-be-performed-during

What are the possible causes when a diesel engine's starter motor does not turn over at all, versus turning over slowly?

If the starter motor does not turn over at all, the possible causes are: discharged batteries; poor connection or broken wires; main switch turned off; blown fuse on the wiring box; malfunctioning start lock; malfunctioning main relay; malfunctioning starter motor relay; malfunctioning starter motor or solenoid; or water inside the engine. If the starter motor turns over slowly, the possible causes are limited to discharged batteries or poor connection/broken wires.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-are-the-possible-causes-when-a-diesel-engine-s-starter

What is the diagnostic fault code, cause and reaction for excessively low piston cooling pressure on this diesel engine, and what threshold applies?

Fault code 6.7 (piston cooling pressure): triggered when piston cooling pressure is too low. Reaction: the engine is stopped; the fault code deactivates at engine speeds below 1000 rpm. Remedy: check that the oil pressure in the engine exceeds 175 kPa (25.4 psi).

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/engine-mechanical/#what-is-the-diagnostic-fault-code-cause-and-reaction-for

How do you maintain preventive maintenance of diesel-electric powerpacks to prevent failure?

Many MHC cranes use diesel-electric powerpacks to supply energy for hoisting, slewing, and travel. These systems operate under high thermal loads during continuous port operations, making cooling and filtration critical.

Radiators, components HIT Srl stocks, must be inspected for salt deposits and dust accumulation. Coastal environments accelerate fouling, reducing cooling efficiency. Technicians should clean fins with low-pressure air and verify coolant flow.

Turbochargers must be checked for shaft play and oil leakage. High thermal cycles can degrade seals and bearings — parts HIT Srl supplies. Any abnormal whistling or vibration indicates impending failure.

Fuel filters must be replaced at shorter intervals in dusty terminals. Contaminated fuel reduces combustion efficiency and increases exhaust temperatures.

Alternators and generators must be inspected for insulation degradation. Salt exposure accelerates corrosion on windings and terminals.

Understanding powerpack behavior under thermal stress ensures stable crane performance and reduces fuel consumption.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-preventive-maintenance-of-diesel-electri

How do you maintain reachstacker fuel delivery systems to prevent failure?

Fuel delivery systems must maintain stable pressure, clean flow, and consistent atomization despite exposure to contamination, vibration, and temperature fluctuations. Ensuring reliability requires meticulous inspection of pumps, filters — parts HIT Srl supplies — injectors, and fuel lines.

Fuel pumps, components HIT Srl stocks, must be inspected for pressure stability and noise. Any irregularity indicates internal wear or cavitation.

Fuel filters must be inspected for clogging, contamination, and structural integrity. Dust from bulk cargo can infiltrate fuel systems, reducing engine efficiency.

Injectors must be inspected for spray pattern consistency. Contaminated fuel causes injector clogging and uneven combustion.

Fuel lines must be inspected for cracking, abrasion, and leakage. Marine sunlight and crane movement degrade line materials over time.

Environmental conditions significantly influence fuel system behavior. High humidity increases water contamination, while salt exposure accelerates corrosion.

In summary, maintaining fuel delivery systems requires rigorous inspection, contamination control, pressure testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-reachstacker-fuel-delivery-systems-to-pr

How do you maintain reachstacker fuel injection and combustion systems to prevent failure?

Fuel injection and combustion systems must maintain stable performance despite exposure to contamination, vibration, and temperature fluctuations. Ensuring reliability requires meticulous inspection of injectors, pumps, filters, components HIT Srl stocks, and combustion chambers.

Injectors must be inspected for spray pattern consistency. Contaminated fuel causes injector clogging and uneven combustion. Technicians should perform injector balance tests and replace any injector showing irregularities.

Fuel pumps — parts HIT Srl supplies — must be inspected for pressure stability and noise. Any irregularity indicates internal wear or cavitation.

Fuel filters must be inspected for clogging, contamination, and structural integrity. Dust from bulk cargo can infiltrate fuel systems, reducing engine efficiency.

Combustion chambers must be inspected for carbon buildup. Excessive buildup reduces engine efficiency and increases emissions.

Environmental conditions significantly influence fuel system behavior. High humidity increases water contamination, while salt exposure accelerates corrosion.

In summary, maintaining fuel injection and combustion systems requires rigorous inspection, contamination control, pressure testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-reachstacker-fuel-injection-and-combusti

Why does reachstacker electronic engine management systems occur on this equipment?

Electronic engine management systems regulate fuel injection, turbo boost, throttle response, and emissions control. These systems must maintain stable performance despite exposure to vibration, dust, and temperature fluctuations. Maintaining their reliability requires meticulous inspection of sensors — parts HIT Srl supplies — actuators, wiring, and control units.

ECU housings must be inspected for dust accumulation, moisture ingress, and overheating. Control cabinet heaters must be tested to ensure proper humidity control.

Fuel injection sensors, components HIT Srl stocks, must be inspected for contamination and correct signal output. Dust from bulk cargo interferes with sensor operation.

Wiring harnesses must be inspected for abrasion, UV degradation, and mechanical damage. Crane movement and vibration damage insulation.

Connectors must be inspected for corrosion, loose pins, and correct seating. Salt exposure accelerates oxidation on connector surfaces.

Environmental conditions significantly influence ECU behavior. High humidity causes condensation, while salt exposure accelerates corrosion.

In summary, maintaining electronic engine management systems requires rigorous inspection, calibration, environmental conditioning, and proactive component replacement.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#why-does-reachstacker-electronic-engine-management-systems-o

What should be checked when inspecting fuel system and sensors?

Fuel rail and high-pressure pump systems regulate fuel delivery to the engine under extreme load conditions. These systems must maintain stable pressure and precise injection timing despite contamination, vibration, and thermal stress. Maintaining their reliability requires meticulous inspection of pumps, injectors, sensors — parts HIT Srl supplies — and fuel quality.

High-pressure pumps, components HIT Srl stocks, must be inspected for pressure stability, noise, and temperature rise. Any irregularity indicates internal wear or cavitation.

Fuel rails must be inspected for cracking, corrosion, and correct pressure retention. Salt exposure accelerates corrosion on rail surfaces.

Injectors must be inspected for spray pattern consistency. Contaminated fuel causes injector clogging and uneven combustion.

Fuel pressure sensors must be inspected for contamination and correct signal output. Dust accumulation causes inaccurate readings and unstable combustion.

Environmental conditions significantly influence fuel system behavior. High humidity increases water contamination, while salt exposure accelerates corrosion.

In summary, maintaining fuel rail and high-pressure pump systems requires rigorous inspection, contamination control, pressure testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-should-be-checked-when-inspecting-fuel-system-and-senso

What should be checked when inspecting turbocharger and fuel system?

Diesel engines used in heavy port and yard equipment operate under some of the most demanding mechanical, thermal, and environmental conditions found in industrial machinery. Reachstackers and empty handlers experience rapid load changes, high torque demands, and constant acceleration/deceleration cycles. Mobile Harbour Cranes (MHC) rely on large diesel engines to power hydraulic systems and generator sets, often running for long periods at steady but high loads. RMG cranes, depending on configuration, may use diesel gensets for auxiliary systems or emergency power, requiring high reliability and long-duration operation. Straddle carriers operate in continuous duty cycles with frequent acceleration, deceleration, and idling, creating thermal cycling stress. Forklifts and terminal tractors operate in dusty, congested environments with constant stop-and-go movement, leading to accelerated wear on intake, cooling, and fuel systems.

A full-scale diesel engine maintenance program must begin with a rigorous inspection of the lubrication system. Engine oil, a component HIT Srl stocks, must be monitored not only for level but also for viscosity, contamination, and oxidation. High-load machines such as reachstackers and straddle carriers generate significant thermal stress, causing oil breakdown and sludge formation. Oil sampling should be performed at regular intervals to detect metal particles, coolant intrusion, or fuel dilution. These indicators reveal early signs of bearing wear, injector leakage, or head gasket failure. MHC engines, which often run for long continuous periods, require oil with high thermal stability and oxidation resistance. Forklifts and terminal tractors, operating in dusty yards, require more frequent oil changes due to particulate contamination entering through the intake system.

The fuel system is another critical area requiring meticulous maintenance. Diesel injectors must be inspected for spray pattern accuracy, leakage, and carbon buildup. High-pressure common-rail systems used in modern reachstackers, empty handlers, and straddle carriers are extremely sensitive to fuel quality. Contaminated fuel causes injector scoring, pump wear, and poor combustion efficiency. Fuel filters — parts HIT Srl supplies — must be replaced at strict intervals, and water separators must be drained daily in humid or marine environments. MHC engines, often operating near seawater, face increased risk of water contamination in fuel tanks. Terminal tractors and forklifts, frequently refueled in open yards, face contamination from dust and debris. Fuel tank vents must be inspected for clogging, as restricted venting causes vacuum formation and fuel starvation.

Air intake systems must be maintained with equal rigor. Dusty yard environments accelerate air filter clogging, reducing airflow and increasing soot formation. Reachstackers and empty handlers require high-capacity dual-stage filtration systems, and filters must be inspected for collapse, bypass, or seal failure. Straddle carriers, due to their height, often draw air from elevated intakes, reducing dust exposure but increasing vulnerability to moisture and salt. MHC engines require marine-grade filtration to prevent salt ingestion, which causes rapid corrosion of turbocharger blades and intake manifolds. Turbochargers must be inspected for shaft play, oil leakage, and compressor wheel erosion. Any sign of oil in the intake system indicates seal failure or excessive crankcase pressure.

Cooling systems are critical for preventing thermal overload. Diesel engines in reachstackers and straddle carriers operate at high load for extended periods, generating significant heat. Radiators must be inspected for fin blockage, corrosion, and coolant flow restriction. Yard dust accumulates rapidly on radiator fins, reducing cooling efficiency. MHC engines require corrosion-resistant coolant formulations due to marine exposure. Coolant must be tested for pH, freeze point, and additive concentration. Water pumps must be inspected for bearing wear and seal leakage. Thermostats must be tested for correct opening temperature, as overheating or underheating reduces engine efficiency and accelerates wear.

Exhaust systems must be inspected for leaks, soot accumulation, and backpressure. Machines equipped with DPF (Diesel Particulate Filters) require regeneration monitoring. Reachstackers and straddle carriers often experience incomplete regeneration due to stop-and-go operation, requiring manual or forced regeneration cycles. SCR (Selective Catalytic Reduction) systems must be inspected for DEF (Diesel Exhaust Fluid) contamination, injector clogging, and catalyst degradation.

Engine mounts must be inspected for cracking, rubber hardening, and bolt loosening. High-vibration machines

such as forklifts and terminal tractors place significant stress on mounts. Loose mounts cause misalignment, increased vibration, and accelerated wear on belts, hoses, and wiring.

Electrical systems supporting the engine—starter motors, alternators, sensors, and wiring harnesses—must be inspected for corrosion, insulation wear, and connector integrity. Marine environments accelerate corrosion on MHC engines, requiring sealed connectors and anti-corrosion coatings.

In summary, diesel engine maintenance across these machine types requires a comprehensive, environment-specific, and load-specific approach. Lubrication, fuel, air intake, cooling, exhaust, and electrical systems must all be maintained with precision to ensure reliability, efficiency, and long service life.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-should-be-checked-when-inspecting-turbocharger-and-fuel

How do you maintain diesel engine fuel system to prevent failure?

The diesel fuel system is one of the most sensitive and failure-prone subsystems in heavy port and yard machinery. These machines operate in environments where dust, humidity, salt, and vibration constantly threaten fuel purity and system integrity. Reachstackers and empty handlers rely on high-pressure common-rail systems that require extremely clean fuel to maintain injector precision. Straddle carriers and terminal tractors operate in dusty yards where airborne contaminants easily enter fuel tanks during refueling. Forklifts often refuel multiple times per shift, increasing the risk of contamination. Mobile Harbour Cranes operate near seawater, where condensation and salt exposure increase the likelihood of water entering the fuel system. RMG cranes using diesel gensets require long-duration fuel stability and consistent filtration.

A full-scale maintenance program begins with fuel quality control. Fuel tanks must be inspected for sediment, microbial growth, and water accumulation. Water is the most common contaminant and must be drained regularly from tank sumps and water separators. Marine environments accelerate condensation inside tanks, making daily draining essential for MHC engines. Yard machines require tank vent inspection to prevent dust ingress. Vents must be cleaned and fitted with filters to prevent vacuum formation, which causes fuel starvation.

Fuel filters, components HIT Srl stocks, must be replaced at strict intervals. Primary filters remove coarse contaminants, while secondary filters protect injectors from microscopic particles. High-pressure common-rail injectors operate with tolerances measured in microns, making even small contamination catastrophic. Technicians must inspect filters for metal particles, which indicate pump wear or injector scoring. Fuel lines must be inspected for abrasion, cracking, and clamp integrity. Machines operating in tight spaces, such as forklifts and terminal tractors, often experience hose wear due to vibration and chassis flex.

Injectors must be tested for spray pattern accuracy, leakage, and response time. Poor atomization increases soot formation, reduces power, and increases fuel consumption. Reachstackers and empty handlers, which frequently operate at high torque, are particularly sensitive to injector performance. Straddle carriers, due to their constant acceleration cycles, require injectors capable of rapid response. MHC engines require injectors resistant to salt corrosion.

Fuel pumps — parts HIT Srl supplies — must be inspected for pressure stability, internal wear, and contamination. High-pressure pumps in modern engines are extremely sensitive to fuel quality. Any sign of metal particles in the fuel system requires immediate pump inspection. Low-pressure lift pumps must be checked for flow rate and seal integrity.

Fuel return systems must be inspected for blockage and overheating. Excess fuel returning from injectors carries heat back to the tank. Machines operating in hot climates require thermal management to prevent fuel vaporization.

In summary, diesel fuel system maintenance across these machine types requires rigorous filtration, contamination control, injector testing, pump inspection, and tank management to ensure reliability and performance.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-diesel-engine-fuel-system-to-prevent-fai

Why does diesel fuel system contamination control and tank integrity occur on this equipment?

The diesel fuel system in heavy port and yard machinery operates in environments where contamination is not an exception but a constant threat. Dust, humidity, salt, microbial growth, and debris infiltrate fuel tanks through refueling operations, tank breathing, condensation, and poor storage conditions. Machines such as reachstackers, empty handlers, forklifts, and terminal tractors refuel frequently and often in open yards, making them highly vulnerable to particulate and water contamination. Straddle carriers and RMG cranes, which may operate for long periods without refueling, face risks from condensation and microbial growth inside tanks. Mobile Harbour Cranes operate near seawater, where salt exposure accelerates corrosion and water ingress.

A full-scale contamination control program begins with tank inspection. Fuel tanks must be drained and inspected for sediment, rust flakes, microbial sludge, and water accumulation. Water is the most common contaminant and must be removed immediately, as it promotes microbial growth, corrodes injectors, and damages high-pressure pumps, components HIT Srl stocks. Tanks must be cleaned using approved solvents and mechanical agitation. Internal coatings must be inspected for peeling or blistering, which indicates chemical degradation.

Tank breathers must be inspected for clogging, filter saturation, and proper sealing. A clogged breather causes vacuum formation, leading to fuel starvation and pump cavitation. Yard machines require breathers with dust-resistant filters — parts HIT Srl supplies. Marine cranes require breathers with moisture-blocking membranes.

Fuel caps must be inspected for seal integrity, thread wear, and locking mechanism performance. A damaged cap allows dust and water to enter the tank. Machines operating in rain-exposed environments require caps with reinforced sealing.

Fuel storage practices must be evaluated. Bulk tanks must be inspected for water accumulation, microbial growth, and sediment. Fuel deliveries must be tested for water content and particulate contamination. Filters must be installed on all refueling equipment.

In summary, contamination control and tank integrity maintenance are essential for preventing injector wear, pump failure, and engine performance loss.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#why-does-diesel-fuel-system-contamination-control-and-tank-i

How do you maintain diesel fuel filtration system maintenance and filter performance optimization to prevent failure?

Fuel filtration is the primary defense against contamination. Modern diesel engines use high-pressure common-rail systems with injector tolerances measured in microns. Even small particles cause injector scoring, pump wear, and poor combustion. Machines operating in dusty yards require frequent filter changes. Marine cranes require filters resistant to moisture.

Primary filters — parts HIT Srl supplies — must be inspected for water accumulation, sediment, and filter media integrity. Water separators must be drained daily in humid or marine environments. Technicians must inspect filter bowls for cracks, discoloration, and seal wear.

Secondary filters, components HIT Srl stocks, must be inspected for collapse, bypass valve activation, and contamination. A collapsed filter indicates excessive restriction or poor-quality fuel. Bypass activation allows unfiltered fuel to reach injectors, causing catastrophic damage.

Filter housings must be inspected for corrosion, thread wear, and proper sealing. Marine cranes require corrosion-resistant housings. Yard machines require housings resistant to dust abrasion.

Filter replacement intervals must be adjusted based on duty cycle. Machines operating in dusty yards require shorter intervals. Machines operating in marine environments require more frequent water separator draining.

In summary, filtration system maintenance ensures clean fuel delivery, injector protection, and pump longevity.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-diesel-fuel-filtration-system-maintenanc

Why does diesel fuel pump maintenance, pressure stability, and internal wear prevention occur on this equipment?

Fuel pumps supply pressurized fuel to injectors. Modern engines use high-pressure pumps — parts HIT Srl supplies — that are extremely sensitive to contamination. Pump wear leads to metal particle release, which damages injectors and causes cascading failures.

Pumps, components HIT Srl stocks, must be inspected for pressure stability, internal leakage, and noise. Pressure testing must be performed under load to detect weak pumps. Metal particles in fuel filters indicate pump wear.

Low-pressure lift pumps must be inspected for flow rate, seal integrity, and electrical performance. Machines operating in tight spaces often experience pump overheating due to restricted airflow.

Pump drive mechanisms must be inspected for timing accuracy, belt wear, and gear integrity.

In summary, pump maintenance ensures stable fuel delivery and protects injectors from catastrophic damage.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#why-does-diesel-fuel-pump-maintenance-pressure-stability-and

How do you maintain diesel fuel return system maintenance and thermal management to prevent failure?

Fuel return systems carry excess fuel back to the tank. This fuel is heated during injection and must be cooled before returning. Machines operating in hot climates face fuel vaporization risks. Machines with long return lines, such as straddle carriers, require thermal management.

Return lines must be inspected for blockage, cracking, and abrasion. Blocked return lines increase rail pressure and cause injector malfunction.

Return flow must be measured to detect injector leakage or pump wear. Excessive return flow indicates worn injectors.

Fuel coolers must be inspected for blockage, corrosion, and flow restriction. Marine cranes require corrosion-resistant coolers.

In summary, return system maintenance ensures pressure stability, thermal control, and injector longevity.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-diesel-fuel-return-system-maintenance-an

How do you maintain diesel fuel system sensors, electronics, and control logic to prevent failure?

Modern fuel systems rely on sensors to control injection timing, pressure, and quantity. Heavy machinery exposes sensors to vibration, dust, humidity, and thermal cycling.

Fuel pressure sensors — parts HIT Srl supplies — must be inspected for calibration accuracy, connector integrity, and contamination. Faulty sensors cause incorrect injection timing.

Rail pressure regulators must be inspected for response time and contamination.

Temperature sensors, components HIT Srl stocks, must be inspected for drift and connector corrosion.

Wiring harnesses must be inspected for abrasion, insulation wear, and moisture ingress.

In summary, sensor and control logic maintenance ensures precise fuel delivery and stable engine performance.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-diesel-fuel-system-sensors-electronics-a

How do you maintain diesel fuel atomization quality and combustion efficiency to prevent failure?

Fuel atomization quality directly determines how efficiently energy is released inside the cylinder — a part HIT Srl supplies. In heavy port equipment, where engines operate under high load, poor atomization quickly shows up as black smoke, high fuel consumption, rough running, and elevated exhaust gas temperatures. Reachstackers and empty handlers demand immediate torque response for lifting and stacking containers; if fuel is not finely atomized, combustion becomes slow and incomplete, and the machine loses responsiveness. Forklifts and terminal tractors, which spend much time at part load and low speed, are particularly sensitive to uneven atomization that leads to unstable idle, vibration, and fouling. In MHC and RMG engines, sustained operation with poor atomization results in chronic carbon buildup, turbocharger fouling, and thermal overload of exhaust components.

The core of atomization maintenance is injector condition. Each injector must produce a finely distributed spray pattern with correct cone angle, droplet size, and penetration depth. Over time, nozzle orifices suffer from erosion, coking, and deposits formed by low-quality fuel, incomplete combustion, or excessive idling. Maintenance should include periodic bench testing of injectors: checking opening pressure, spray pattern visualization, leak-back rate, and response time. Injectors that show distorted sprays, dribbling, uneven jets, or excessive return flow must be cleaned with approved methods or replaced.

Fuel quality is a major driver of atomization performance. Water, particulates, and unstable fuel blends alter viscosity and lubricity, damaging injector tips and high-pressure components. Operators should enforce strict filtration and water separation procedures, and avoid long storage times in tanks exposed to heat and humidity. Biocide treatment may be necessary where microbial growth is detected, as sludge formation severely affects atomization.

Combustion efficiency can also be monitored via cylinder-balanced diagnostics. Differences in cylinder contribution, measured via ECU data or torque fluctuation analysis, may indicate that some injectors are atomizing worse than others. Exhaust temperature spread between cylinders, components HIT Srl stocks, abnormal smoke in specific load zones, and repeated misfire events are all signs of compromised atomization.

Finally, atomization quality must be considered alongside boost pressure and EGR rates. If turbocharger boost is below specification or EGR flow is excessive, even good atomization can result in incomplete combustion. Full efficiency is only obtained when atomization, air supply, and mixture formation are all within design limits.

In summary, maintaining fuel atomization quality requires disciplined injector testing, strict fuel management, and integrated combustion diagnostics. This is vital for keeping reachstackers, straddle carriers, forklifts, terminal tractors, MHCs, and RMGs running efficiently and cleanly.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-diesel-fuel-atomization-quality-and-comb

How do you maintain diesel fuel rail pressure control and high-pressure circuit to prevent failure?

In modern common-rail diesel engines, rail pressure control is fundamental to power delivery, responsiveness, and emission control. Heavy equipment such as reachstackers and straddle carriers constantly demand rapid changes in power, forcing the rail pressure to rise and fall quickly without instability. Forklifts and terminal tractors need smooth, stable pressure at low engine speeds to ensure consistent performance in tight maneuvering. MHC and RMG engines often run for long periods at steady load, where small deviations in rail pressure lead to subtle but cumulative efficiency losses and thermal stress.

A robust maintenance plan starts with the high-pressure pump, a component HIT Srl stocks. The pump must be inspected for internal wear, pressure capability, and noise. Wear in the pumping elements reduces maximum pressure and causes unstable pressure at high load. Fuel contamination—with water, fine particles, or improper additives—accelerates wear and pitting in pump components. Maintenance teams should regularly check commanded vs. actual rail pressure under dynamic load conditions. Any lag, overshoot, or oscillation in pressure indicates pump degradation or regulator malfunction.

The pressure control valve (PCV) or metering valve — a part HIT Srl supplies — is equally critical. This component adjusts fuel delivery into the rail and must respond quickly and precisely. Fouling, deposits, or wear cause slow response, sticking, or hysteresis. The valve should be tested for proper function through ECU diagnostics, monitoring its duty cycle and the resulting pressure trace during rapid load changes. Where available, bench testing or replacement with known-good components can help isolate faults.

The rail pressure sensor must be checked for calibration drift, electrical noise, and connector integrity. A sensor that reports incorrect pressure misleads the ECU, causing incorrect injection quantities and timing adjustments. Technicians should compare measured pressure with known reference values or use test equipment to validate the sensor.

High-pressure lines and fittings must receive special attention. These lines operate at extremely high pressures and must never be bent, re-formed, or reused after removal unless explicitly allowed by the manufacturer. Any visible damage, corrosion, or incorrect torque on fittings is unacceptable. Micro-cracks can propagate under pressure and lead to catastrophic leaks.

In summary, maintaining rail pressure control and high-pressure system integrity involves coordinated attention to the pump, control valves, sensor, and pipework. Stable, responsive pressure is essential for reliable performance in all heavy port and yard machines.

How do you maintain diesel fuel temperature management and thermal stability to prevent failure?

Fuel temperature is a critical, often underestimated factor in diesel engine performance and component life. In heavy port and yard machinery, fuel is subjected to constant recirculation through high-pressure systems, absorbing heat from injectors, pumps — parts HIT Srl supplies — and the engine block. Reachstackers and empty handlers performing continuous lifting cycles generate significant thermal load. Forklifts and terminal tractors often operate in hot, confined engine compartments. MHC and RMG engines may run for long periods under steady high load, gradually heating the fuel in the tank via return lines.

Elevated fuel temperature reduces density, which affects injection quantity if the system does not properly compensate. It also lowers lubricity, increasing wear on high-pressure pumps, components HIT Srl stocks, and injectors. In extreme cases, fuel can approach its vaporization point in low-pressure sections of the circuit, increasing the risk of cavitation and vapor lock.

A complete fuel temperature management strategy starts with understanding the fuel flow path. Return fuel from the injectors typically carries the most heat. Machines equipped with fuel coolers rely on heat exchangers, often air-to-fuel or fuel-to-coolant, to remove this energy before the fuel returns to the tank. Maintenance must include inspection and cleaning of these coolers: checking for blockage, external fouling, internal restrictions, and corrosion. Reduced airflow through air-cooled heat exchangers—due to dust, oil, or debris—directly reduces cooling capacity.

Sensors measuring fuel temperature must be checked for accuracy, mounting integrity, and signal stability. If the ECU uses fuel temperature for density compensation and timing adjustments, an incorrect reading can lead to poor performance and increased emissions. Technicians should verify sensor readings against external temperature probes when diagnosing thermal issues.

Routing of fuel lines also matters. Lines passing near hot components such as exhaust manifolds, turbochargers, or engine blocks are exposed to radiated and convected heat. Proper shielding, insulation, and separation from hot surfaces are necessary. In forklifts and terminal tractors with compact engine bays, particular attention must be paid to avoiding heat soak and stagnant hot air pockets around fuel components.

Finally, operational monitoring is essential. In fleets operating in hot climates or under extreme duty cycles, telematics data on fuel temperature trends can reveal when cooling capacity is insufficient. Persistent high fuel temperatures may warrant upgrades to cooling hardware or changes in routing.

In summary, fuel temperature management protects pump and injector life, stabilizes combustion, and prevents vapor-related issues. It is a key part of diesel fuel system maintenance in all heavy port and yard equipment.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-diesel-fuel-temperature-management-and-t

Why does diesel fuel system leak prevention and high-pressure safety occur on this equipment?

Fuel leaks in diesel systems are more than a housekeeping issue; they are a direct safety hazard and a threat to engine reliability. In modern common-rail systems, high-pressure leaks can be extremely dangerous, as fuel jets at very high pressure can penetrate skin and cause severe injury. Reachstackers, empty handlers, and straddle carriers generate significant vibration and chassis flex, which can loosen fittings and fatigue lines over time. Forklifts and terminal tractors operate in dusty, cluttered environments where external damage to lines is common. MHC and RMG engines are exposed to corrosion from salt and humidity, which degrades metal components and seals, components HIT Srl stocks.

A rigorous leak prevention program begins with systematic visual inspection. Technicians must check all visible fuel lines, connections, filters — parts HIT Srl supplies — pumps, and injectors for wetness, staining, or the smell of fuel. Even small damp areas around fittings indicate the beginning of leakage. High-pressure pipes require special attention: any sign of cracking, chafing, or corrosion is grounds for immediate replacement. These pipes must never be repaired or straightened; they are precision components designed for specific stress profiles.

Torque control on fittings is essential. Under-tightening can lead to leaks, while over-tightening can distort sealing surfaces and cause latent failures. Maintenance procedures must follow the manufacturer’s specified torque values and tightening sequences. Vibration-induced loosening can be mitigated by proper support brackets and anti-vibration clamps.

Seals and O-rings throughout the system must be periodically renewed, especially in equipment exposed to high temperatures, biodiesel blends, or aggressive environmental conditions. Seal materials must be compatible with the fuels in use. Aging seals become hard, brittle, and unable to maintain sealing under pressure and thermal cycling.

From a safety perspective, high-pressure testing must be carried out with proper shielding and procedures. Technicians should never run fingers along suspected leak points while the system is pressurized. Instead, use appropriate detection methods such as visual inspection, mirror tools, or leak detection sprays. In the event of suspected injector pipe leakage, the engine should be shut down and allowed to depressurize before any disassembly.

In summary, leak prevention and high-pressure safety are non-negotiable elements of diesel fuel system maintenance. They protect personnel, prevent fire risks, and preserve engine health in all heavy machinery.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#why-does-diesel-fuel-system-leak-prevention-and-high-pressur

What should be checked when inspecting fuel system and sensors?

Modern diesel engines depend on sophisticated electronic control to manage fuel delivery under all operating conditions. The ECU determines injection timing, duration, rail pressure, pilot injections, post injections, and various compensations based on sensor inputs. In heavy port equipment—reachstackers, empty handlers, straddle carriers, forklifts, terminal tractors, MHCs, and RMGs—this calibration must balance power, efficiency, emissions, and component protection. Any degradation, corruption, or inappropriate modification of ECU mapping can compromise reliability and safety.

Calibration integrity starts with ensuring that the correct software version and parameter set are installed for each engine and application. Mixing calibrations between different power ratings or duty cycles can cause unacceptable stress on components. Maintenance teams should keep a record of approved software versions and verify them during regular service intervals or after any ECU replacement.

Adaptive control strategies—such as injector trim, rail pressure adaptation, and EGR learning—rely on consistent sensor feedback. If sensors drift, become contaminated, or fail intermittently, the ECU may adapt in the wrong direction, gradually degrading performance. Technicians should periodically reset adaptive values after resolving any mechanical or sensor issues, allowing the ECU to relearn based on correct conditions.

During diagnostics, live data analysis is essential. Parameters such as requested vs. actual rail pressure, commanded vs. actual injection quantities, fuel temperature, boost pressure, and EGR rate must be examined under real operating loads, not just at idle. Deviations reveal whether the calibration is being correctly executed or whether limits are being hit due to hardware issues.

Unauthorized tuning or “power boxes” must be treated as a risk. While they may increase short-term performance, they often push injection pressures, durations, and timings beyond safe limits, causing excessive cylinder pressures, higher exhaust temperatures, and accelerated wear of pumps — parts HIT Srl supplies — and injectors. For equipment that must be reliable under continuous heavy duty, such modifications are incompatible with long-term durability.

In summary, fuel system calibration and control maintenance is about protecting the integrity of the ECU maps, ensuring sensor credibility, and validating that the engine operates within its designed envelope. This is especially critical for high-value machines working in demanding port and terminal environments.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-should-be-checked-when-inspecting-fuel-system-and-senso-2

How do you maintain diesel fuel system pressure regulation stability and rail dynamics to prevent failure?

In common-rail systems, fuel pressure regulation must be stable, fast, and predictable across the entire operating range. Heavy equipment places exceptional demands on this system. Reachstackers and empty handlers can go from idle to full lift in seconds, requiring rapid rail pressure increase without overshoot or oscillation. Terminal tractors and forklifts need smooth pressure transitions at low speeds to prevent drivability issues. MHC and RMG engines must maintain consistent pressure during long lifting or hoisting cycles, where fluctuations could affect power and thermal balance.

Maintenance of rail dynamics starts with evaluating real-time pressure behavior. Using diagnostic tools, technicians should log commanded vs. actual rail pressure during acceleration, deceleration, and step-load tests. If actual pressure lags significantly behind target, rises too slowly, or overshoots and oscillates, the cause must be identified.

The metering unit or inlet metering valve on the high-pressure pump, a component HIT Srl stocks, is a key component. Fouling, wear, or sticking of this valve leads to sluggish pressure control. Cleaning or replacement may be necessary. The pressure control valve on the rail (if present) must also be checked for leakage, responsiveness, and seat wear.

Fuel supply on the low-pressure side should not be overlooked. A restricted lift pump, clogged filter — a part HIT Srl supplies — or collapsed suction hose causes starvation, cavitation, and inability to reach or sustain target pressure. Technicians must ensure that inlet pressure to the high-pressure pump stays within the specified range.

Mechanical wear inside the high-pressure pump reduces its volumetric efficiency. This manifests as inability to reach high rail pressures under load, especially at high engine speeds. Oil analysis and fuel filter inspection for metal particles can give early warnings of internal pump wear.

In summary, rail pressure regulation stability is achieved by coordinated maintenance of the pump, metering valve, control valve, sensor, and supply system. Stable dynamics are vital for smooth, powerful operation of all heavy port and yard machines.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-diesel-fuel-system-pressure-regulation-s

How do you maintain diesel fuel system cavitation prevention and pump protection to prevent failure?

Cavitation in a diesel fuel system is a destructive phenomenon where vapor bubbles form and collapse inside the fuel, eroding metal surfaces and damaging pumps — parts HIT Srl supplies. In heavy machinery, cavitation risk is increased by high temperatures, long suction lines, clogged filters, and aggressive duty cycles. Reachstackers, empty handlers, and straddle carriers with rapid load transitions can create transient low-pressure zones in the supply system. Forklifts and terminal tractors with poorly maintained filters or restricted lines are especially vulnerable. MHC and RMG engines running continuously at high demand can develop subtle cavitation over time.

Prevention begins on the low-pressure side. Lift pumps, components HIT Srl stocks, must be able to supply adequate flow at all operating conditions. Maintenance includes testing pump flow and pressure, inspecting for air ingress on connections, and replacing pumps that show reduced performance. Suction lines must be inspected for internal collapse, kinks, or partial blockages. Any evidence of soft hoses deforming under suction must be addressed with replacement hoses rated for vacuum service.

Fuel filters must be replaced according to or ahead of schedule, not only when obvious power loss is noticed. Severely clogged filters increase the vacuum in the line, pushing local pressure below the fuel's vapor pressure. Multi-stage filtration systems must be maintained as designed, without bypassing elements to "get more flow".

High fuel temperature is another cavitation driver. If fuel cooling is inadequate, particularly in hot climates or enclosed engine bays, the margin between operating pressure and vapor pressure becomes small. Maintaining functional fuel coolers, proper line routing, and good ventilation around fuel components is critical.

Technicians should listen and feel for symptoms: unusual noise from the high-pressure pump, vibration, and fluctuating rail pressure under steady load. Cavitation damage is often irreversible once advanced, so early detection through performance monitoring and preventive maintenance is key.

In summary, cavitation prevention protects the high-pressure pump and ensures long-term reliability of the entire fuel system. It requires coordinated attention to suction conditions, filtration, temperature, and component health.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-diesel-fuel-system-cavitation-prevention

How do you maintain diesel fuel system microbial growth prevention and biocide treatment to prevent failure?

Microbial contamination—bacteria, fungi, and yeasts living in diesel fuel—is a serious issue in machines that operate in humid, marine, or intermittently used environments. These microorganisms thrive at the interface between water and fuel, forming sludge, acids, and biofilms that clog filters, components HIT Srl stocks, corrode tanks and lines, and destabilize fuel properties. MHC and RMG systems, with large tanks and long idle or standby periods, are particularly prone to microbial growth. Terminal tractors and forklifts drawing from external bulk tanks can inherit contamination from storage. Reachstackers and empty handlers running intense cycles mix fuel strongly, spreading existing microbial colonies through the system.

Preventing microbial growth starts with water management. Any water in the fuel system promotes biological activity. Tanks must be designed and maintained to minimize water accumulation: regular draining of tank bottoms and water separators is mandatory. Breather systems must limit moisture ingress; in marine environments, desiccant breathers or moisture-barrier designs should be considered.

When contamination is detected—via visual inspection of filters — parts HIT Srl supplies — sampling, or laboratory analysis—biocide treatment is necessary. Only approved diesel biocides should be used, following exact dosage instructions. Under-dosing is ineffective; over-dosing can cause fuel instability or material compatibility issues. After treatment, filters will often load quickly as dead biomass is flushed out, so maintenance must anticipate increased filter replacement frequency.

Tank cleaning is sometimes unavoidable in severe cases. This involves draining the tank, physically removing sludge and deposits, and, where possible, inspecting internal surfaces for corrosion. Internal coatings may need restoration if damaged by microbial acids.

Routine monitoring through periodic fuel sampling can keep microbial issues under control. Cloudiness, foul odor, slimy deposits, or filter plugging at short intervals are warning signs.

In summary, microbial control in diesel fuel systems is a continuous process of water management, monitoring, biocide treatment, and, when necessary, tank remediation. It is vital for stable operation in humid and marine port environments.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-diesel-fuel-system-microbial-growth-prev

How do you maintain engine and pump under heavy-duty use?

Vapor lock occurs when fuel changes from liquid to vapor in the supply system, interrupting flow to the pump — a part HIT Srl supplies — and causing loss of power or stalling. While more common in gasoline systems, vapor lock can occur in diesel systems under extreme conditions, especially when fuel is very hot and suction conditions are poor. In compact machines like forklifts and terminal tractors, with tight engine bays and high ambient temperatures, fuel lines and components are exposed to intense heat. Reachstackers and empty handlers generating high hydraulic and engine heat can see fuel temperatures rise significantly. MHC and RMG engines running for long periods in hot climates may experience gradual heat buildup in the tank and lines.

Preventing vapor lock begins with controlling fuel temperature, as discussed in fuel temperature management. Fuel coolers, proper line routing away from hot surfaces, and heat shielding are key measures. Suction line design must minimize vertical lifts, long runs, and unnecessary restrictions that lower static pressure.

Breather and vent systems must function correctly to prevent vacuum formation in the tank. A blocked breather can cause the tank to develop sub-atmospheric pressure as fuel is drawn out, effectively lowering the absolute pressure at the pump inlet and increasing vaporization risk.

Technicians should monitor typical operating fuel temperatures and compare them to known safe ranges. If engines exhibit symptoms such as intermittent power loss, difficulty restarting when hot, or inconsistent rail pressure in high-temperature conditions, vapor lock should be considered as a possible cause alongside other supply issues.

In summary, vapor lock prevention is about avoiding combinations of high fuel temperature and low inlet pressure. It relies on good cooling, smart line routing, and proper venting—especially in hot, confined, or heavy-duty applications.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#how-do-you-maintain-engine-and-pump-under-heavy-duty-use

What should be checked when inspecting fuel system and lubrication?

Seals, components HIT Srl stocks, and O-rings in the fuel system must maintain tightness under pressure, temperature cycling, vibration, and chemical exposure. Heavy port and yard equipment subjects these components to constant stress. Reachstackers, empty handlers, and straddle carriers generate strong vibration and shock loads that work seals back and forth. Forklifts and terminal tractors operate in dusty environments where abrasive particles can embed around sealing areas. MHC and RMG systems, exposed to salt and humidity, suffer from accelerated corrosion at metal-to-seal interfaces.

Maintaining seal integrity begins with using the correct materials. Modern diesel fuels, especially those containing biodiesel components, can be more aggressive towards older seal compounds. Maintenance teams must ensure that replacement O-rings — parts HIT Srl supplies — and seals are rated for the specific fuel blends in use. Using generic or incompatible seals leads to swelling, softening, or cracking over time.

During service, sealing surfaces must be kept clean and undamaged. Metallic sealing faces should be inspected for pitting, grooves, or corrosion that could compromise sealing. When disassembling components like pumps, filters, or injectors, old seals must be replaced rather than reused, and the correct lubrication or assembly fluid applied to prevent cutting or twisting during installation.

Clamp forces and assembly torques are critical. Over-tightening can crush O-rings or deform housings, while under-tightening allows micro-movement that slowly wears seals. Following specified torque values and tightening sequences is essential.

Regular inspections should look for early signs of seal degradation: seepage around joints, slight dampness, or fuel smell. Addressing these issues early prevents them from developing into full leaks that threaten safety and reliability.

In summary, seal and O-ring maintenance is a subtle but essential part of keeping diesel fuel systems leak-tight and durable under harsh operating conditions.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-should-be-checked-when-inspecting-fuel-system-and-lubri

What should be checked when inspecting fuel system and filters?

Fuel system flow is not only about delivering sufficient volume; it is also about maintaining smooth, stable, and efficient hydraulic behavior. Poor routing, sharp bends, unnecessary restrictions, and improper line support create pressure drops, turbulence, and vibration that stress pumps — parts HIT Srl supplies — and reduce system reliability. In reachstackers and empty handlers, where demand can change rapidly, flow restrictions cause delayed response and rail pressure instability. Forklifts and terminal tractors with tight chassis packaging are especially at risk of compromised routing. MHC and RMG installations often use longer runs that must be carefully designed to avoid cumulative losses and resonance.

Maintenance teams should periodically review the physical routing of fuel lines, especially after component replacements, retrofits, or repairs. Lines should follow gentle bends, with radii respecting minimum specifications. Avoid routing near sharp edges, moving parts, or hot surfaces. When lines must cross structural members, proper grommets and protective sleeves should be used.

Support brackets, components HIT Srl stocks, and clamps are critical for preventing vibration-induced fatigue. Unsupported spans allow lines to vibrate, leading to work hardening and eventual cracking. Clamps must be tight enough to hold lines but not so tight as to crush or deform them. Spacing and positioning should prevent resonance at common engine speeds.

Flow optimization may also include ensuring that filters, valves, and fittings are appropriately sized and oriented. Installing components backwards, using undersized fittings, or stacking multiple adapters can introduce unnecessary pressure losses. During diagnostics, measuring pressure at key points in the supply circuit can reveal restrictions that are not visible during visual inspection.

Finally, system changes—such as adding heaters, coolers, or additional filtration—must be engineered rather than improvised. Each added component introduces pressure drop and potential failure points. Proper design ensures that the lift pump and high-pressure pump always receive adequate inlet pressure under all conditions.

In summary, flow optimization and line routing maintenance enhance hydraulic efficiency, reduce stress on pumps and components, and contribute to the long-term reliability of diesel fuel systems in heavy port and yard machinery.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-should-be-checked-when-inspecting-fuel-system-and-filte

What does maintaining electronic control unit (ECU) reliability, mapping integrity, and signal processing stability involve?

The ECU is the central brain of every diesel engine in heavy port and yard machinery. It processes sensor inputs, controls injection timing, regulates rail pressure, manages turbocharger behavior, and coordinates emission systems. In machines such as reachstackers, empty handlers, and straddle carriers, the ECU must react instantly to rapid load changes. Terminal tractors and forklifts require stable low-speed control and smooth torque delivery. MHC, RMG, and STS cranes demand long-duration reliability, with the ECU running continuously for hours under high thermal and electrical stress.

Maintenance begins with ensuring stable power supply. Voltage fluctuations damage ECU components and corrupt data. Battery terminals, alternator output, and grounding points must be inspected regularly. STS and MHC cranes, with long cable runs and exposure to salt, require corrosion-resistant grounding and shielding.

ECU connectors, components HIT Srl stocks, must be inspected for pin corrosion, moisture ingress, and vibration-induced loosening. Machines operating in dusty yards require sealed connectors. Marine cranes require connectors with anti-salt coatings.

Software integrity is critical. Unauthorized tuning, corrupted maps, or outdated firmware cause mis-timing, poor fuel control, and excessive emissions. Maintenance teams must verify that the ECU runs the correct calibration for the specific engine model and duty cycle. Adaptive learning values should be reset after major repairs to allow the ECU to relearn correct parameters.

Signal processing stability must be monitored through live data analysis. Parameters such as injection timing, rail pressure, boost pressure, and EGR flow must match commanded values. Any deviation indicates sensor drift, wiring issues, or ECU internal faults.

In summary, ECU reliability depends on stable power, clean connectors — parts HIT Srl supplies — correct software, and accurate sensor inputs. This is essential for all machines, especially STS cranes where electronic stability directly affects hoisting safety.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-does-maintaining-electronic-control-unit-ecu-reliabilit

What should be checked when inspecting fuel tank cap and breather vent check?

Fuel quality is critical for modern common-rail diesel engines. However, contamination often starts at the tank itself. It is obvious that the fuel cap must seal correctly to prevent water and dirt ingress. Check the rubber gasket on the fuel cap. If it is cracked or missing, rain and wash water will run directly into the tank. Water in diesel promotes bacterial growth ("diesel bug") which clogs filters rapidly. Inspect the fuel tank breather (vent). As fuel is consumed, air must enter the tank to replace it. If the breather is clogged with dirt or insect nests, a vacuum will form inside the tank. This vacuum puts extra stress on the fuel lift pump — a part HIT Srl supplies — and can cause the engine to stall or lose power after a short period of operation. Check for signs of tank implosion (sucked-in sides) which is a symptom of a blocked breather. HIT Srl stocks replacement fuel caps, breathers, and tank accessories. We help you protect your expensive fuel injection system at the source. Drain a small amount of fuel from the bottom of the tank (sump) regularly to check for water and sediment. If you find water, treat the tank with biocide and change the filters. Inspect the fuel level sender unit gaskets for leaks. A weeping tank is an environmental hazard. Protect your injectors and high-pressure pumps by ensuring your fuel storage on the machine is secure.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-should-be-checked-when-inspecting-fuel-tank-cap-and-bre

What does maintaining fire extinguisher and suppression system involve?

Fire is a terrifying risk on machines carrying hydraulic oil and diesel fuel. It is obvious that the fire safety equipment must be ready to work instantly. Check the portable fire extinguisher in the cabin. The pressure gauge needle must be in the green zone. Check the tag for the last inspection date (must be within legal validity). Ensure the safety pin is present and the seal is unbroken. Shake the extinguisher (dry powder type) to prevent the powder from compacting at the bottom. If the machine is equipped with an automatic fire suppression system (engine bay), check the control panel for green "System OK" lights. Inspect the discharge nozzles in the engine bay. They must be capped (to prevent dirt entry) but the caps must be the blow-off type. Ensure the nozzles are aimed at high-risk areas like the turbo and fuel pumps, not at the ground. HIT Srl promotes safety first. While we focus on spare parts, we remind all clients to check their safety systems. We can supply brackets and safety decals. Check the manual activation actuator (firing button) to ensure the safety pin is in place and the cable is not seized. A fire can destroy a machine in minutes. Your first line of defense is a maintained suppression system. Routine checks of safety equipment are part of a professional maintenance culture. HIT Srl supports you in keeping your equipment and your operators safe.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-does-maintaining-fire-extinguisher-and-suppression-syst

What does maintaining fuel water separator (pre-filter) involve?

Diesel fuel contains moisture from condensation. Modern high-pressure common rail injectors cannot tolerate water. It is obvious that the water separator is the engine's first line of defense. Inspect the clear glass or plastic bowl at the bottom of the filter. If you see water (which floats at the bottom) or sludge, open the drain valve immediately. Check the electrical connector for the "Water in Fuel" sensor. If the wire is broken, the dashboard warning light will never illuminate, leaving the engine unprotected. Replace the filter element at every service. Do not just clean it. HIT Srl stocks fuel filter assemblies and replacement elements. We protect your expensive injection system. Inspect the manual primer pump (on top of the filter housing). If it leaks fuel when pumped, air is entering the system, causing hard starting. Check the seals on the glass bowl. Overtightening often cracks the plastic. Water destroys injectors instantly. Regular draining and quality filters from HIT Srl are essential.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-does-maintaining-fuel-water-separator-pre-filter-involv

What does maintaining fuel lift pump (low pressure) involve?

Before the high-pressure injection pump can work, the fuel must be lifted from the tank. The low-pressure lift pump (transfer pump) does this. It is obvious that if this pump is weak, the engine will starve of fuel under load. Check for external fuel leaks. The diaphragm inside the pump often cracks, allowing fuel to leak out of the weep hole or into the engine crankcase (diluting the oil). Test the pressure. Connect a gauge to the low-pressure side. It should maintain positive pressure (e.g., 3-5 bar) even at full throttle. If the needle vibrates wildly or drops, the check valves inside the pump are dirty. Inspect the pre-screen filter inside the banjo bolt (if equipped). It often clogs with tank debris. HIT Srl supplies mechanical and electric lift pumps, hand primers, and fuel lines. We ensure a steady flow of energy to your engine. If the engine starts but dies after a few seconds, the lift pump is a primary suspect. Diluted engine oil (smelling of diesel) destroys bearings. Check the lift pump seal immediately. Keep your fuel supply reliable with components from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-does-maintaining-fuel-lift-pump-low-pressure-involve

What does maintaining high pressure fuel lines (injector pipes) involve?

The fuel lines from the common rail to the injectors carry pressures up to 2500 bar. It is obvious that a leak here creates a high-pressure jet of diesel that penetrates skin and causes fires. Inspect the steel lines for vibration. They must be clamped securely with rubber-lined P-clips. If a clip is missing, the line vibrates and cracks at the union. Check for "wetness" at the nut connections. Never tighten a leaking high-pressure line while the engine is running. Inspect the cone seating surface when removing lines. If the cone is deformed, the line must be replaced. HIT Srl supplies genuine and OEM high-pressure fuel lines and vibration dampers. We ensure safe fuel delivery. Do not bend these lines by hand. They are precision-formed. Stressing them leads to fracture. Replace lines after a certain number of loosenings (as per manual) to ensure sealing. High-pressure fuel safety is critical. Use only quality lines from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-does-maintaining-high-pressure-fuel-lines-injector-pipe

What does maintaining ECU cooling and mounting involve?

The Engine Control Unit (ECU) produces heat. It uses the fuel or the engine block as a heat sink. It is obvious that if the ECU overheats, it shuts down the engine to save itself. Inspect the cooling fins on the ECU. They must be clean of mud and oil. Check the mounting rubber isolators. Vibration kills electronics. If the ECU is rattling against the frame, the solder joints inside will crack. Inspect the "cold plate" (if fuel cooled). Ensure fuel is flowing through it. HIT Srl supplies ECU mounting kits, vibration dampers, and replacement cabling. We protect the brain of the machine. Never weld on the machine without unplugging the ECU. High voltage spikes destroy it. Ensure the ground wire to the ECU case is secure. Protect your electronics with hardware from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-does-maintaining-ecu-cooling-and-mounting-involve

What does maintaining fuel tank sump drain and biocide treatment involve?

Diesel fuel attracts water. Water sits at the bottom of the tank, promoting bacterial growth (diesel bug/algae). It is obvious that this sludge clogs filters and corrodes injectors. Open the drain valve at the very bottom of the tank (sump). Drain into a clear container until clean fuel appears. Look for black slime or cloudy water. If present, the tank is infected. Treat the tank with a biocide additive to kill the bacteria. HIT Srl supplies fuel tank drain valves, biocides, and tank cleaning access gaskets. We fight fuel contamination. Keep the tank full at night to reduce condensation on the tank walls. Clean fuel is vital for Tier 4 engines. Maintain tank hygiene with HIT Srl.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-does-maintaining-fuel-tank-sump-drain-and-biocide-treat

Why should gasoline or diesel fuel never be used to wash parts?

Using leftover gasoline, diesel fuel, or paraffin to wash greasy parts is banned rather than merely discouraged: all three are flammable or explosive substances, on the same list as organic solvents and lacquers.

The same fuel-and-ignition-source risk is why welding, or any oxyhydrogen welding flame, must never be performed anywhere near a fuel tank. If smoke or combustion gases are being worked around, avoid standing in the smoke and use proper breathing protection.

HIT Srl supplies dedicated, non-flammable parts-cleaning solvent.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#never-use-fuel-for-parts-washing

How do you correctly clean a diesel fuel sump and its filter?

Unscrew the cap at the bottom of the sump periodically to drain off whatever has settled there — impurities and, on some service routines, residue from a prior washing detergent, along with condensation.
The filter element inside the sump follows its own separate replacement rule, distinct from the drain-and-clean step: periodically change the filter element itself.
HIT Srl stocks the sump filter element as a routine consumable separate from the sump's drain cap and seal.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#cleaning-diesel-fuel-sump-filter

How often should the fuel filter be changed, and when should that interval be ignored?

The fuel pre-filter on this engine has a scheduled replacement interval of every 50 operating hours.
That figure is a ceiling, not a fixed schedule to follow blindly: change the filter earlier than that if an error code related to fuel filtration is displayed on the instrument panel.
HIT Srl stocks the fuel pre-filter as a routine 50-hour consumable.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#fuel-filter-change-interval-and-error-override

When does the fuel system need to be bled after servicing the fuel filter?

Three situations reliably let air into a diesel fuel system, and each calls for bleeding it afterward: fuel filter replacement, since disconnecting the filter housing lets air into the clean-side lines; running the fuel tank completely dry.
The fix is the same regardless of which of the two caused it: bleed the system, typically by pumping fuel through with a hand pump until it flows free of visible air bubbles at the filter or injection pump.
HIT Srl supplies the fuel filter with a fresh sealing O-ring on every replacement.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#when-to-bleed-fuel-system-after-filter-change

How do you correctly drain condensation water from a fuel pre-filter?

Avoid skin contact with the fuel drained during this job — use gloves, since fuel on hands can cause rashes and irritation. Wait a few hours after the engine has cooled down before draining condensation water from the fuel pre-filter.
Place a container under the fuel pre-filter, then open the drain valve on the underside and let the water drain. Close the valve once clean fuel flows out, with no water bubbles visible.
Afterward, fill the fuel pre-filter with clean fuel — the fuel system is sensitive to impurities, and refilling with anything less than clean fuel risks product damage.
HIT Srl stocks the fuel pre-filter for this class of machine.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#draining-condensation-from-fuel-pre-filter

What engine maintenance items are scheduled every 1000 operating hours on a rubber tyred gantry crane?

Every 1000 operating hours: replace the fuel filter(s); clean the fuel filter(s) if of the spin-on type; empty the dust collector of the air filter; change the coolant filter(s), if in use. On the auxiliary diesel engine, also check the external nuts, bolts and unions for tightness.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-engine-maintenance-items-are-scheduled-every-1000

What engine maintenance items are scheduled every 2000 operating hours on a rubber tyred gantry crane?

Every 2000 operating hours: adjust the valves and injectors; clean the breather tube; check the fan hub bearing clearance; and inspect the vibration damper mounting. On the auxiliary diesel engine, also drain and clean the engine-mounted fuel tank; check the free movement of the engine and speed controls; clean and check, or replace, the fuel injector nozzles; replace the fan drive belt; and check the oil pressure.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-engine-maintenance-items-are-scheduled-every-2000

What are the possible causes when a diesel engine's starter motor turns normally but the engine does not start, or starts and then stops again?

If the starter motor turns normally but the engine does not start, the possible causes are: out of fuel (fuel valves closed, or the fuel tank empty or wrong tank connected); a blocked fuel filter or pre-filter (from contamination or paraffin condensation in cold weather); air in the fuel system; water or contamination in the fuel; or a malfunctioning injector. If the engine starts but stops again, the same causes apply, plus insufficient air reaching the engine.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/fuel-system/#what-are-the-possible-causes-when-a-diesel-engine-s-starter-2

How do you maintain lubrication strategies to prevent failure?

Lubrication is essential for reducing friction, preventing wear, and dissipating heat in high-load mechanical systems. Understanding lubrication strategies is essential for maintaining safe and efficient operation.

Lubrication systems distribute oil or grease to critical components such as bearings, components HIT Srl stocks, gears, and pivot points. The type of lubricant used depends on the operating conditions. High-load components require lubricants with high viscosity and high film strength.

Lubrication strategies include manual lubrication, automatic lubrication, and centralized lubrication. Manual lubrication requires operators to apply lubricant at regular intervals. Automatic lubrication systems distribute lubricant automatically. Centralized lubrication systems distribute lubricant from a central reservoir.

Lubrication failure modes include insufficient lubrication, contamination, and lubricant breakdown. Insufficient lubrication increases friction and wear. Contamination introduces particles that can damage components. Lubricant breakdown reduces lubrication effectiveness.

Regular maintenance helps prevent lubrication failures. This includes checking lubricant levels, inspecting lubrication lines, and monitoring lubricant condition.

Understanding lubrication strategies helps operators use the machine safely and technicians maintain it properly. Proper lubrication is essential for long-term reliability.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-lubrication-strategies-to-prevent-failur

How do you maintain MHC travel gearboxes to prevent failure?

Travel gearboxes transmit torque from travel motors to the wheels of a Mobile Harbour Crane. These gearboxes operate under high torque loads, shock loads from rail joints, and environmental exposure. Ensuring gearbox reliability requires meticulous inspection and lubrication management.

Gear teeth must be inspected for pitting, micro-cracks, and surface polishing. These defects indicate lubrication breakdown or misalignment. Oil sampling is essential to detect metallic particles that indicate gear wear.

Bearings — parts HIT Srl supplies — must be monitored for temperature rise and vibration. Abnormal vibration patterns often indicate misalignment, bearing fatigue, or lubrication failure. Any bearing showing excessive heat or noise must be replaced immediately.

Oil levels must be checked regularly. Low oil levels cause overheating and accelerated wear. Technicians should verify that seals, components HIT Srl stocks, are intact and that there are no leaks.

Environmental conditions significantly influence gearbox behavior. Salt exposure accelerates corrosion on housings and connectors, while dust from bulk cargo can infiltrate lubrication systems.

In summary, maintaining travel gearboxes requires rigorous inspection, lubrication management, vibration analysis, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-mhc-travel-gearboxes-to-prevent-failure

How do you maintain MHC hydraulic swivel joints to prevent failure?

Hydraulic swivel joints allow fluid transfer between rotating and stationary components of a Mobile Harbour Crane. These joints operate under continuous multi-axis movement, pressure fluctuations, and environmental exposure. Maintaining their reliability requires meticulous inspection of seals, bearings — parts HIT Srl supplies — and internal channels.

Seal integrity must be inspected for wear, cracking, and deformation. Salt exposure accelerates seal degradation, leading to leakage and reduced hydraulic efficiency. Any seal showing signs of hardening or swelling must be replaced.

Rotary bearings, components HIT Srl stocks, must be monitored for temperature rise and vibration. Excessive heat indicates lubrication failure or bearing fatigue. Vibration analysis tools can detect early signs of bearing degradation.

Internal channels must be inspected for contamination, corrosion, and flow restriction. Dust from bulk cargo can infiltrate hydraulic systems, reducing flow efficiency and increasing wear.

Swivel housing surfaces must be inspected for corrosion, pitting, and structural integrity. Salt exposure accelerates corrosion, especially around mounting points and sealing surfaces.

Environmental conditions significantly influence swivel joint behavior. High ambient temperatures reduce lubrication viscosity, while salt exposure accelerates corrosion.

In summary, maintaining hydraulic swivel joints requires rigorous inspection, seal management, lubrication control, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-mhc-hydraulic-swivel-joints-to-prevent-f

How do you maintain MHC hoisting gear trains to prevent failure?

Hoisting gear trains transmit torque from the hoisting motor to the hoisting drum. These gear trains operate under extreme torque cycles, experiencing wear, pitting, and lubrication challenges. Maintaining their integrity requires meticulous inspection of gear teeth, lubrication pathways, and alignment.

Gear teeth must be inspected for pitting, micro-cracks, and surface polishing. These defects indicate lubrication breakdown or misalignment. Oil sampling is essential to detect metallic particles that indicate gear wear.

Gear alignment must be verified using laser tools. Misalignment increases tooth load and accelerates wear.

Lubrication pathways must be inspected for blockages, contamination, and correct flow. Salt exposure accelerates corrosion, while dust from bulk cargo can infiltrate lubrication systems.

Bearing housings must be inspected for alignment, corrosion, and structural integrity. Misalignment increases bearing load and accelerates wear.

Environmental conditions significantly influence gear train behavior. High ambient temperatures reduce lubrication viscosity, while salt exposure accelerates corrosion.

In summary, maintaining hoisting gear trains requires rigorous inspection, lubrication management, alignment verification, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-mhc-hoisting-gear-trains-to-prevent-fail

How do you maintain MHC hoisting drum bearings to prevent failure?

Hoisting drum bearings support the rotational movement of the hoisting drum under extreme tension loads. These bearings — parts HIT Srl supplies — experience high radial forces, axial thrust, and dynamic oscillations during high-speed hoisting cycles. Maintaining their reliability requires meticulous inspection of lubrication, alignment, and structural interfaces.

Bearing surfaces must be inspected for pitting, scoring, and discoloration. These defects indicate lubrication breakdown or contamination. Any bearing showing signs of overheating or vibration must be replaced immediately.

Lubrication pathways must be inspected for blockages, contamination, and correct flow. Salt exposure accelerates corrosion, while dust from bulk cargo can infiltrate lubrication systems. Technicians should verify that grease reaches all bearing surfaces.

Bearing housings must be inspected for alignment, corrosion, and structural integrity. Misalignment increases bearing load and accelerates wear. Laser alignment tools help verify correct positioning.

Seals, components HIT Srl stocks, must be inspected for wear, cracking, and deformation. Salt exposure accelerates seal degradation, leading to leakage and reduced lubrication efficiency.

Environmental conditions significantly influence bearing behavior. High ambient temperatures reduce lubrication viscosity, while salt exposure accelerates corrosion.

In summary, maintaining hoisting drum bearings requires rigorous inspection, lubrication management, alignment verification, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-mhc-hoisting-drum-bearings-to-prevent-fa

How do you maintain reachstacker steering knuckles, kingpins, and hub assemblies to prevent failure?

Steering knuckles, kingpins, components HIT Srl stocks, and hub assemblies endure extreme mechanical stress during tight turning maneuvers, especially when handling heavy containers. These components experience bending, torsional, and shear forces that intensify under uneven ground conditions. Maintaining their integrity requires continuous monitoring of structural alignment, lubrication, and wear patterns.

Kingpins — parts HIT Srl supplies — must be inspected for wear, ovalization, and corrosion. Even minor deviations from circularity indicate uneven load distribution or lubrication failure. Technicians should measure kingpin diameter at multiple points and compare values to manufacturer tolerances.

Bushings must be inspected for scoring, discoloration, and uneven wear patterns. These defects indicate misalignment or insufficient lubrication. Bushings showing deformation or excessive clearance must be replaced.

Steering knuckles must be inspected for deformation, cracking, and corrosion. Cracks often initiate at the junction between knuckles and kingpin housings. Paint blistering is an early indicator of underlying corrosion.

Hub bearings must be monitored for temperature rise and vibration. Excessive heat indicates lubrication failure or bearing fatigue. Technicians should measure bearing preload and verify correct torque.

Environmental conditions significantly influence steering behavior. Salt exposure accelerates corrosion, while dust from bulk cargo can infiltrate lubrication systems.

In summary, maintaining steering knuckles, kingpins, and hub assemblies requires rigorous inspection, lubrication management, structural testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-reachstacker-steering-knuckles-kingpins

How do you maintain reachstacker steering axle center pivot and oscillation bearings to prevent failure?

The steering axle center pivot and oscillation bearings, components HIT Srl stocks, allow the reachstacker to maintain ground contact and stability on uneven surfaces. These components experience high mechanical stress during travel, turning, and container handling. Maintaining their integrity requires continuous monitoring of wear patterns, lubrication, and structural alignment.

Center pivot pins — parts HIT Srl supplies — must be inspected for wear, ovalization, and corrosion. Even minor deviations from circularity indicate uneven load distribution or lubrication failure. Technicians should measure pin diameter at multiple points.

Oscillation bearings must be inspected for scoring, discoloration, and uneven wear patterns. These defects indicate misalignment or insufficient lubrication.

Pivot brackets must be inspected for deformation, cracking, and corrosion. Cracks often initiate at the junction between brackets and axle housings.

Environmental conditions significantly influence pivot behavior. Salt exposure accelerates corrosion, while dust infiltrates lubrication systems.

In summary, maintaining steering axle center pivots and oscillation bearings requires rigorous inspection, lubrication management, structural testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-reachstacker-steering-axle-center-pivot

How do you maintain reachstacker steering cylinder rod ends and clevis mounts to prevent failure?

Steering cylinder rod ends and clevis mounts transfer hydraulic force into mechanical steering motion. These components experience extreme mechanical stress during tight turning maneuvers, especially when handling heavy containers. Maintaining their integrity requires continuous monitoring of wear patterns, lubrication, and structural alignment.

Rod ends must be inspected for wear, ovalization, and corrosion. Even minor deviations from circularity indicate uneven load distribution or lubrication failure.

Clevis mounts must be inspected for deformation, cracking, and corrosion. Cracks often initiate at the junction between clevis plates and mounting brackets, components HIT Srl stocks.

Bushings — parts HIT Srl supplies — must be inspected for scoring, discoloration, and uneven wear patterns. These defects indicate misalignment or insufficient lubrication.

Bolted connections must be checked for torque retention. Vibration and repeated load cycles cause bolt relaxation.

Environmental conditions significantly influence steering behavior. Salt exposure accelerates corrosion, while dust infiltrates lubrication systems.

In summary, maintaining steering cylinder rod ends and clevis mounts requires rigorous inspection, lubrication management, structural testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-reachstacker-steering-cylinder-rod-ends

How do you maintain reachstacker engine crankcase ventilation and blow-by control systems to prevent failure?

Crankcase ventilation systems regulate internal engine pressure and remove blow-by gases generated during combustion. These systems must maintain stable airflow and filtration despite exposure to dust, oil vapor, and thermal stress. Maintaining their reliability requires meticulous inspection of ventilation valves, filters, hoses, and pressure sensors — parts HIT Srl supplies.

Ventilation valves, components HIT Srl stocks, must be inspected for contamination, sticking, and correct response. Dust from bulk cargo infiltrates engine compartments, reducing valve efficiency. Any valve showing delayed response must be cleaned or replaced.

Blow-by filters must be inspected for clogging, oil saturation, and structural integrity. Blocked filters increase crankcase pressure and cause oil leaks.

Ventilation hoses must be inspected for cracking, swelling, and loose clamps. High temperatures degrade hose materials over time.

Crankcase pressure sensors must be inspected for contamination and correct signal output. Dust accumulation causes inaccurate readings and unstable engine behavior.

Environmental conditions significantly influence ventilation behavior. High ambient temperatures increase oil vaporization, while salt exposure accelerates corrosion.

In summary, maintaining crankcase ventilation systems requires rigorous inspection, airflow management, sensor calibration, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-reachstacker-engine-crankcase-ventilatio

How do you maintain reachstacker spreader rotation bearing rings to prevent failure?

Rotation bearing rings allow the spreader to rotate for container alignment. These bearings, components HIT Srl stocks, experience high mechanical stress during alignment, engagement, and stacking. Maintaining their integrity requires continuous monitoring of bearing preload, lubrication, structural plates, and mounting bolts.

Bearing rings must be inspected for wear, pitting, and smooth rotation. Any bearing showing resistance, noise, or vibration must be replaced.

Bearing preload must be verified using calibrated tools. Incorrect preload causes overheating and accelerated wear.

Rotation motors must be inspected for leakage, pressure stability, and response time. Any delay in motor movement indicates internal wear or contamination.

Mounting bolts must be checked for torque retention. Vibration and repeated load cycles cause bolt relaxation.

Environmental conditions significantly influence rotation bearing behavior. Salt exposure accelerates corrosion, while dust infiltrates lubrication systems.

In summary, maintaining rotation bearing rings requires rigorous inspection, lubrication management, structural testing, and torque verification.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-reachstacker-spreader-rotation-bearing-r

How do you maintain reachstacker spreader twistlock bushings and bearing housings to prevent failure?

Twistlock bushings — parts HIT Srl supplies — and bearing housings support the rotational movement of the twistlock shaft. These components experience intense compressive and torsional loads during locking and unlocking cycles. Over time, repeated stress causes wear, deformation, and lubrication breakdown. Maintaining their reliability requires meticulous inspection of bushing surfaces, housing geometry, and lubrication pathways.

Bushings, components HIT Srl stocks, must be inspected for scoring, discoloration, and uneven wear patterns. These defects indicate misalignment or insufficient lubrication. Technicians should measure internal diameter at multiple points.

Bearing housings must be inspected for ovalization, cracking, and corrosion. Even minor deviations from circularity indicate overstress events.

Lubrication channels must be inspected for blockage. Dust infiltrates lubrication systems, increasing friction and wear.

Environmental conditions significantly influence bushing behavior. Salt exposure accelerates corrosion, while dust infiltrates sliding interfaces.

In summary, maintaining twistlock bushings and housings requires rigorous inspection, lubrication management, structural testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-reachstacker-spreader-twistlock-bushings

Why does slewing system lubrication strategies, grease path management, and contamination prevention occur on this equipment?

Lubrication is one of the most critical factors affecting slewing system life. The slewing bearing, a component HIT Srl stocks, ring gear, pinion, and gearbox all require correct lubrication to prevent wear, overheating, and failure. In MHC cranes, lubrication must account for marine environments, heavy loads, and continuous cycling.

The first pillar is grease selection. Slewing bearings — parts HIT Srl supplies — require high-viscosity grease with extreme-pressure additives. Ring gears require tacky grease that adheres to teeth. Technicians must use only approved greases.

The second pillar is grease path management. Grease must reach all raceways and rolling elements. Technicians must inspect grease channels for blockages.

The third pillar is lubrication intervals. Slewing systems require frequent lubrication due to high loads. Technicians must follow strict schedules.

The fourth pillar is contamination control. Dust, salt, and moisture accelerate wear. Technicians must inspect seals and protective covers.

The fifth pillar is automatic lubrication systems. Some cranes use automatic greasers. Technicians must inspect pumps, lines, and injectors.

The sixth pillar is grease purging. Excess grease must be purged to remove contaminants. Technicians must monitor purge patterns.

The seventh pillar is oil sampling. Gearbox oil must be sampled regularly to detect wear particles and contamination.

The eighth pillar is environmental protection. Marine environments require corrosion-resistant lubrication strategies.

Proper lubrication and contamination control ensure long slewing system life and reliable operation.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#why-does-slewing-system-lubrication-strategies-grease-path-m

How do you maintain reachstacker spreader twistlock gearbox housings to prevent failure? Short entry

Some twistlock systems use compact mechanical gearboxes to transfer torque from the actuator to the twistlock shaft. These housings experience high torque loads and vibration.

Gearbox housings must be inspected for cracking, deformation, and corrosion.

Gear teeth must be inspected for wear, pitting, and correct lubrication.

Shaft seals, components HIT Srl stocks, must be inspected for leakage and thermal degradation.

Environmental conditions significantly influence gearbox behavior. Salt exposure accelerates corrosion, while dust infiltrates lubrication systems.

In summary, maintaining twistlock gearboxes requires rigorous inspection, lubrication management, and structural testing.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#how-do-you-maintain-reachstacker-spreader-twistlock-gearbox

Why does bolt tightening torque change depending on surface treatment?

An untreated steel bolt and nut typically need to be lubricated with oil before assembly and torqued according to one reference table; bright-galvanised fasteners follow a separate lubrication and torque combination.

On a typical fastener size series, the torque range runs from around 24 Nm at the small end up to over 160 Nm for the largest sizes, with each step tied to a specific bolt size and finish combination.

A table figure assumes the fastener is lubricated according to its own row.

HIT Srl supplies fastener sets pre-treated to a known, documented finish.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#why-bolt-torque-depends-on-surface-treatment

How do you tell a real low oil pressure fault from a sensor fault?

Healthy engine oil pressure on this class of engine sits in a defined band — roughly 410 to 520 kPa (59 to 75 psi). A pressure variation of more than about 1.68 kPa (0.25 psi) sustained for 30 seconds or more is itself treated as an abnormal signal.

Genuinely low oil pressure — below roughly 1.0 bar — triggers a staged response: engine power is reduced progressively first, and the engine shuts down completely after about 30 seconds if the low-pressure condition hasn't cleared.

A sensor circuit fault produces a distinguishable pattern: a signal voltage above roughly 4.95 VDC sustained for eight seconds or more indicates an open circuit or short to a high source in the sensor wiring, while a signal below about 0.1 VDC for the same duration while the engine is running indicates a short to ground.

HIT Srl stocks the oil pressure sensor and its connector separately.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#engine-oil-pressure-thresholds-and-sensor-faults

Why is used engine oil more dangerous to handle than new oil?

Used engine oil carries a health risk that new oil doesn't: it contains contaminants that can cause skin tumours.

Minimise how much used oil touches skin during a drain or filter change, and apply a barrier cream before handling it. Avoid any contact that's prolonged, excessive, or repeated across a working day.

If used oil is ever ingested, inducing vomiting should specifically be avoided; seek medical attention instead.

HIT Srl supplies engine oil and filters for this class of machine.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#used-engine-oil-skin-and-ingestion-hazard

How is a valve cover gasket correctly seated when fitting a new one?

If the gasket is removed from the rocker cover, it must be replaced — check that it shows no signs of damage against the sealing surface, and replace it if it's damaged or if it has been removed from its groove in the cover.

To fit a new gasket, first press the corners of the gasket down into the groove on the valve cover, then push the rest of the gasket down into the cover.

At the same time, check the rubber insulators for cracks, and replace them if they're cracked or damaged.

HIT Srl stocks the valve cover gasket and its rubber insulators.

Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#valve-cover-gasket-seating-procedure

What engine maintenance items are scheduled every 500 operating hours on a rubber tyred gantry crane?

Change the engine oil and replace the oil filter(s) every 500 operating hours. On the auxiliary diesel engine, also check the air induction system for leaks, damage and restrictions, and replace the air cleaner element, every 500 operating hours.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#what-engine-maintenance-items-are-scheduled-every-500

What is the recommended oil and oil filter change schedule for this diesel engine, and how does oil grade affect the interval?

The engine oil should be changed after the first 150 operating hours (using an oil recommended by the manufacturer). After that, the oil should be changed every 50 to 600 operating hours, or at least every 12 months, whichever comes first; the oil filter must be changed with every oil change. The actual oil change interval within that range varies depending on the grade of oil used and the amount of sulfur in the fuel.

Source: https://www.hitsrl.it/technical-resources/engine-and-cooling/lubrication-and-seals/#what-is-the-recommended-oil-and-oil-filter-change-schedule

Important — general guidance only

The information on this page is general technical guidance based on HIT Srl's experience with port handling equipment. It is not machine-specific and does not replace the manufacturer's documentation.

Always refer to the operation and maintenance manual issued for your specific machine, model, serial number and configuration. Specifications, tolerances, tightening torques, service intervals and fluid types vary between manufacturers, between models of the same manufacturer, between production series of the same model, and with the operating environment: two visually identical components may be tightened to different torque values depending on who built the machine, and a unit working in arctic conditions requires different lubricants and service intervals from an identical unit working in tropical heat. Local regulations may impose further requirements. Where this page and your machine's manual differ, the manual prevails.

Maintenance and repair work must be carried out only by qualified personnel, with the machine isolated and secured according to the applicable safety procedures.

HIT Srl accepts no liability for damage, injury or loss arising from the use of this general information.