Driveline, Axles & Brakes

HIT SRL

135 procedures · 238 maintenance tips (pillole)

Technical Reference Document

Procedures

Drive Axle

What is the correct sequence to replace the drive axle?

1. Park the machine with blocks behind the steering wheels.
2. Stop the engine and turn the starter key to position I.
3. Depressurise the hydraulic system.
4. Turn the starter key to position 0 and cut the main current.
5. Insert suitable support between the steering axle and the frame on both sides.
6. Undo the hydraulic hoses from the distribution block, plugging all unions at once to protect the hydraulic system from contamination.
7. Remove the cover over the parking brake.
8. Undo the locknut and tighten the screw to compress the brake spring, until the brake pads come loose from the brake discs; put the cover back over the parking brake.
9. Undo the hydraulic hose and unplug the switch from the parking brake, plugging all unions at once to protect the hydraulic system from contamination.
10. Undo the propeller shaft from the drive axle and fix it in place, as there is a risk it would otherwise be pulled apart.
11. Connect lifting equipment to the lifting lugs on the mast in a secure manner and lift the machine so the drive wheels are lifted from the ground.
12. Remove the drive wheels from the drive axle.
13. Block up the drive axle under the hubs.
14. Undo the screws which fix the drive axle to the frame.
15. Lift the machine up so that the frame is lifted away from the axle.
16. Lift out the drive axle.
17. Transfer the equipment from the old axle to the new axle.
18. Clean the mating surfaces on the drive axle and frame, and the mating surfaces for the washers underneath the drive axle.
19. Lift the drive axle in under the frame.
20. Lower the frame down onto the drive axle, checking that the guides fit and that the drive axle is centred in the frame.
21. Fit the new screws which fix the drive axle to the frame, after checking that the threads are not damaged and that all dirt is removed.
22. Tighten all nuts in number order to give metal contact between the drive axle and the chassis; continue tightening all nuts in number order to half torque (325 Nm, oil); finish by tightening all nuts in number order to full torque (650 Nm, oil), and re-tighten the attaching bolts after 50 hours operating time.
23. Rust proof the new screws with suitable paint.
24. Connect the hydraulic hoses to the distribution block.
25. Connect the hydraulic hose and the cable for the switch to the parking brake, and adjust the parking brake.
26. Connect the propeller shaft to the drive axle, torquing the bolts to 98 Nm, and re-tighten the attaching bolts after 50 hours operating time.
27. Check the oil level in the drive axle.
28. Start the machine and bleed the brakes.
29. Check carefully that no leakage occurs.

- The drive axle and the machine are very heavy; risk of pinch injury. It is not permissible to go under a machine which has been lifted by a jack etc.
- The drive axle can start to roll away; pinch risk. Make sure that the drive axle does not roll away when not under control.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-the-drive-axle

How often should the drive axle hub and differential oil be checked or changed?

1. Make a daily sight check to see there are no oil leaks on the outer part of the axle.
2. Check the oil level in the hubs and differential housing every 100 hours.
3. Change the oil in the hubs and differential housing every 1500 hours.
    - Before starting inspection, make sure the diesel engine is off, the disconnecting switch is disengaged, and the machine is stable and braked.
    - If the machine is lifted with hydraulic jacks for maintenance, place wedges under the rear axle wheels and further supports under the machine's support points.
    - Before beginning work, including wheel removal, completely deflate the tyres; never stand directly in front of a tyre when deflating or inflating it.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#how-often-should-the-drive-axle-hub-and-differential-oil-be

What checks should be performed on the drive axle attachment?

1. Check the drive axle's attachment to the frame for corrosion on structural elements such as attaching bolts.
2. Check-tighten the drive axle's attaching bolts to 2350 Nm.
3. Check-tighten the wheel nuts to 400 Nm.
4. Check the bolted joint to the parking brake caliper's attaching plate and brake disc.
5. Check that the drive axle seals tight.
6. Check the oil level in the drive axle and hub reductions.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-checks-should-be-performed-on-the-drive-axle-attachment

What is the correct sequence to change the drive axle oil (hubs and differential)?

1. Position the machine so the drain plug on each drive wheel is lowest vertically; for one wheel, move the machine forward or backward, for the other, lift the wheel off the ground and rotate it into position.
2. Put the machine in service position.
3. Remove the drain plug on both wheel hubs, also removing the level and filler plug to facilitate draining; drain both sides separately.
4. Remove the drain plug in the drive axle (at the bottom), also removing the level and filler plug to facilitate draining.
5. Clean the drive axle's breather while the oil is draining.
6. Fit the drain plugs.
7. Fill oil in the hubs until the level is flush with the level and filler hole.
8. Fit the level and filler plug.
9. Fill oil in the differential until the level is flush with the level and filler hole.
10. Fit the level and filler plug.
11. Turn on the main electric power.
12. Check the oil in the drive axle after a short test drive.

Note: *The oil is very viscous; fill slowly and check the level in stages so the oil has time to settle.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-change-the-drive-axle-oil-hu

What is the correct sequence to change the drive axle oil?

1. Drive the machine forward until the oil drain plug on one of the wheel hub reductions is at its lowest point of travel.
2. Remove the oil plug and drain the oil, then refit the plug.
3. Repeat the procedure on the other wheel.
4. Remove the drain plug from the bottom of the differential and drain the oil, then refit and tighten the drain plug.
5. Fill each hub reduction with fresh oil through the filler plug until the level indicator is horizontal, then refit and tighten the filler plug to the specified volume.
6. Remove the level plug from the differential and fill the differential with oil to the specified volume, then refit and tighten the level plug.
7. Check that the oil level is up to the level holes, topping up as necessary.

Note: *To ensure the wheel ends of planetary axles with a common wheel end/housing bowl oil level are properly lubricated, fill each wheel end directly with oil before the machine is put back into operation; do not fill the axle through the drive unit or housing bowl only.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-change-the-drive-axle-oil

What is the correct sequence to check the drive axle?

1. Check the drive axle's attachment to the frame for corrosion on structural elements such as the attaching bolts.
2. Check and tighten the drive axle's attaching bolts to 1530 Nm.
3. Check and tighten the wheel nuts to 650 Nm.
4. Check the bolted joint to the parking brake caliper's attaching plate and brake disc.
5. Check that the drive axle seals tightly.
6. Check the oil level in the drive axle and the hub reductions.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-drive-axle

What is the correct sequence to change the drive axle oil (hubs and differential)?

1. Position the machine so the hub reductions' drain plugs at the wheels are in the lowest position on both drive wheels, moving the machine or lifting and rotating a wheel as needed.
2. Put the machine in service position.
3. Position a receptacle by each hub, with a piece of sheet metal in the wheel rim to lead oil into the receptacle.
4. Remove the drain plugs and the level/filling plugs for the hubs on both sides, draining each side separately.
5. Position a receptacle under the differential and remove its drain plug and level/filling plug.
6. Clean the drive axle's breather while the oil is draining.
7. Install the drain plugs on the hubs and the differential, checking that the seals are intact, clean and correctly positioned.
8. Fill oil in the hubs slowly until the level is flush with the filling and level holes, checking the level in stages so it has time to settle.
9. Install the hubs' level and filler plugs, checking that the seals are intact, clean and correctly positioned.
10. Fill oil in the differential until the level is flush with the filler and level hole.
11. Install the level and filler plug on the differential, checking that the seal is intact, clean and correctly positioned.
12. Remove the receptacle.
13. Turn on the system voltage and test-drive the machine.
14. Check the oil level in the drive axle after the short test-drive.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-change-the-drive-axle-oil-hu-2

What is the correct sequence to check the drive axle mounting bolts?

1. Check the tightness of the eight tie-rods that fasten the drive axle to the frame, to the specified torque (2000 Nm).

Note: *Park the machine on flat, compact ground and switch off the engine before carrying out any maintenance.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-drive-axle-mountin

What is the correct sequence to check the differential oil level?

1. Check the oil level with the machine on level ground, the engine off, and after the oil has cooled and settled.
2. The level is correct when oil flows out of the level-plug hole.
3. If needed, top up with new oil through the filler-plug hole.
4. Check that the breather is clean and functioning properly (also check and clean the parking brake cylinder's breather).

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-differential-oil-l

What is the correct sequence to change the differential oil?

1. Drain the oil into a suitable container by unscrewing the drain plug and the filler plug, letting the oil drain completely and checking for metal particle residue.
2. Thoroughly wash the inside of the casing with kerosene, then let it drain well before introducing new oil.
3. Check the drain plug for metal residue and refit it.
4. Fill with new oil through the filler-plug hole until it overflows.
5. Refit the filler plug.
6. Recheck the level (via the level-plug hole) after a test run, and verify there are no oil leaks.

Note: *The replacement must be carried out with the engine off.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-change-the-differential-oil

What is the correct sequence to check the hub reduction oil level?

1. Check the level with the machine on level ground, engine off, after the oil has cooled and settled.
2. Position the engraved 'OIL' level line horizontally.
3. The level is correct when oil flows out of the level-plug hole with the mark horizontal.
4. If needed, top up with new oil through the filler-plug hole.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-hub-reduction-oil

What is the correct sequence to change the hub reduction oil?

1. Position the engraved 'OIL' level line horizontally, so the drain plug is at the lowest point.
2. Drain the oil into a suitable container by unscrewing the drain plug and the filler plug, letting the oil drain completely and checking for metal particle residue.
3. Thoroughly wash the inside of the casing with kerosene, then let it drain well before introducing new oil.
4. Check the drain plug for metal residue and refit it.
5. Fill with new oil through the filler-plug hole until it overflows.
6. Refit the filler plug.

Note: *The replacement must be carried out with the engine off.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-change-the-hub-reduction-oil

Checking the tightening torques of the driveline/axle fasteners

1. Do a full cleaning of the inspected area.
2. Check every screw and nut of the relevant driveline/axle fastening points.
3. Check visually for defects: loose screws or nuts, damage, cracks, deformations, corrosion.
4. For screws without a nut, use tap testing: hit the screws lightly with a tap test hammer and listen to the sound (or use an analysis instrument). If a screw is damaged or the prestress is low, the sound is lower compared to an undamaged, sufficiently tight screw.
5. Replace a defective screw or nut with a new one with all the characteristics of the original. Check tightening torques from the technical data chapter. Never retighten a loose screw or nut.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-the-tightening-torques-of-the-driveline-axle

Adjusting the hub bearings on a rigid planetary drive axle

1. Measure the hub's rotational resistance to check the current preload.
2. If the bearings show backlash or the measured resistance is below the normal range, adjust the bearings using the shims: to eliminate backlash, reduce the quantity of shims or use shims of a different thickness.
3. Adjust the bearings until the measured rotational resistance falls within the specified normal range for the bearing condition (new or used).

Note: *The hubs turn on single-row tapered roller bearings, which must operate without backlash and with the correct preload.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#adjusting-the-hub-bearings-on-a-rigid-planetary-drive-axle

Brakes

What should be checked on the brake system during a scheduled safety inspection?

1. Check brake controls for proper operation; make sure the foot-operated treadle in the cab is operating smoothly and is not damaged.
2. Visually inspect the brake drums, brake chambers, and slack adjusters; check for loose, missing or broken components, and for cracks and other signs of severe wear.
3. Listen for air leaks in the cab and underneath the chassis; check air pressure regularly using the dash-mounted gauge; be alert for any sudden drops in pressure while operating and after the engine is shut off (a minimum air pressure of 70 P.S.I. / 4.83 bar is required to operate).
4. Visually check hoses and pneumatic lines for damage and chafing.
5. Check the operation of both the service and parking brake systems; be alert for any reduction in braking performance or unusual noises while braking.

Note: *Do not operate the vehicle until the brake system has been thoroughly inspected; failure to do so could lead to serious injury or death.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-should-be-checked-on-the-brake-system-during-a-schedule

What is the correct sequence to manually release (cage) the tractor's spring parking brakes with an external caging tool?

1. Shut the engine off and remove the key.
2. Block all wheels front and rear to prevent the vehicle from rolling forward and backward.
3. Determine whether the chamber has an internal or external caging tool; proceed with an external-mounted tool.
4. Remove the access plug from the brake canister.
5. Insert the caging tool into the access hole, "T" end first.
6. Turn the caging tool 1/4 turn to engage with the slot on the pressure plate.
7. Try to pull the caging tool out; it should not pull out — if it does, repeat the previous two steps.
8. Thread the nut and washer down onto the threaded end of the caging tool all the way to the canister.
9. Tighten the nut until the threaded portion of the release tool extends approximately 3 inches (76.2 mm) out of the nut (4 inches / 101.6 mm for Type 3036 and 3636 chambers).
    - Never manually release (cage) the spring brakes before the wheels are properly blocked.
    - Never use an impact wrench to tighten the nut onto the release bolt.
    - Never exceed the specified extension lengths and never exceed 50 ft. lbs. (67.79 N•m) of torque on the release nut, or the chamber may be damaged.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-manually-release-cage-the-tr

What should be done if the low air pressure warning light and buzzer do not shut off after start-up?

1. If the warning light and buzzer do not shut off at least 5 minutes after start-up, shut the engine down and determine why the air system is not charging.

Note: *If the Low Air indicator light or buzzer indicates a loss of air pressure while driving, the vehicle should be stopped immediately and not operated until the air system is repaired.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-should-be-done-if-the-low-air-pressure-warning-light-an

What rules must be followed when parking a terminal tractor with an automatic transmission?

1. Always apply the parking brake.
2. Never park the vehicle by leaving it in gear; always place the transmission shifter selector in the "Neutral" position.
3. Never park a tractor-trailer combination unless the trailer parking brakes are operational and applied.

Note: *Failure to observe these rules when parking the vehicle may lead to death or serious injury.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-rules-must-be-followed-when-parking-a-terminal-tractor

What is the correct sequence to test an air brake system for leak-down during preventative maintenance?

1. Disconnect the gladhands from the trailer.
2. Run the engine at fast idle and allow air pressure to stabilize at 120 P.S.I. for at least 1 minute.
3. Shut off the engine and observe the dash gauge(s) for 2 minutes.
4. Confirm the drop in pressure does not exceed 2 P.S.I. (0.137 bar) over the 2-minute period.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-test-an-air-brake-system-for

Which brake disc cracks are acceptable, and which mean immediate replacement?

1. Formation of cracks: acceptable.
2. Radial cracks: not acceptable.
3. Surface not uniform under 1 mm: acceptable.
4. Continuous cracks: not acceptable.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#which-brake-disc-cracks-are-acceptable-and-which-mean-immedi

What is the correct sequence to adjust the parking brake caliper on this class of front drive axle?

1. Loosen the lock nut of the adjustment screw and, with hydraulic pressure applied, turn the adjustment screw clockwise until the pads are in positive contact with the brake disc.
2. Turn the adjustment screw, tightening the lock nut.
3. Lock the adjustment screw by tightening the lock nut.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-adjust-the-parking-brake-cal

How can the parking brake be released manually in an emergency if hydraulic pressure is lost?

1. Loosen the lock nut of the adjustment screw.
2. Turn the adjustment screw anticlockwise until the brake is free.

Note: *After this operation, the vehicle must only be towed and must not be driven under its own power.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#how-can-the-parking-brake-be-released-manually-in-an-emergen

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

1. Change the brake oil filter (supply line).
2. Change the brake oil filter (return line).
3. Check the brake oil level.
4. Check for oil leaks from pipes, fittings and components of the brake system.
5. Check the accumulator pressure condition.
6. Check disc brake pad wear.
7. Clean the brake oil radiator.
8. Check for oil leaks from fittings and components.
9. Check the parking brake's operation.
10. Check the parking brake warning lamp and its safety function.

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/driveline-axles-and-brakes/#what-brake-system-operations-are-checked-during-the-500-hour

Wheels Tires & rims

What should be checked on the tyres during the pre-operational inspection?

1. Carry out a sight check of the pressure, the tread and the sides of the tyres.
2. In case of faults, the tyre must be carefully inspected by maintenance personnel before being used.
3. Make sure the rim and hub cap are not deformed.

Note: *A dislodged locking ring or exploding tyre can be deadly to anyone close to the tyre or in the path of the dislodged, flying ring; only properly trained persons are to service the tyres.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-should-be-checked-on-the-tyres-during-the-pre-operation

What is the correct sequence to safely inflate a tyre on this class of machine?

1. Ask all personnel to leave the area.
2. Fit the self-locking connector on the tyre valve.
3. Take up a position at the side of the wheel, at a distance of at least 2 metres from the wheel centre.
4. Cautiously start to inflate the tyre, frequently checking the pressure does not exceed the value indicated on the plate.
5. When the pressure is correct, disconnect the self-locking connector and screw the valve cap back on.

Note: *Absolutely avoid standing directly in front of the wheel; if the tyre bursts in that position, this would cause serious injury or death.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-safely-inflate-a-tyre-on-thi

What materials are needed to fit a new tyre, and what are the first stages of the fitting procedure?

1. Materials required: tyre; wheel complete with snap ring; two tyre levers; hammer; tyre fitting paste; tubeless valve for earth moving machinery; triangular gasket; three self-locking pliers with parallel jaws.
2. First stage: place the wheel on three blocks so it is approx. 10 cm off the floor and fit the valve; grease the parts of the wheel in contact with the tyre and the seat of the triangular gasket, both on the wheel and the tapered ring; grease the tyre beads.
3. Second stage: fit the tyre to the basic wheel and then to the tapered ring; with the tyre levers, fit the rubber triangular gasket in its seats.
4. Third stage: using the tyre levers, lower the tapered ring so the triangular gasket is completely exposed, and apply grease in the indicated area.
5. Fourth stage: firmly apply the three pliers at regular intervals to seat the snap ring against the wheel, then open the air supply to inflate the tyre until the pliers are ejected or the tapered ring closes the snap ring.
6. Fifth stage: using a hammer, tap the snap ring to seat it correctly, check it is tight against the wheel, then proceed with final inflation.

Note: *For safety reasons, the tyre must be contained within a safety cage during inflation.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-materials-are-needed-to-fit-a-new-tyre-and-what-are-the

What is the correct periodic maintenance procedure for wheels and tyres?

1. Deflate the tyre.
2. Remove the tyre from the wheel.
3. Brush the seats (tyre beads and ring seat).
4. Inspect the wheel for signs of wear.
5. Subject the wheel to magnetoscopic inspection at the snap ring seat, the tyre bead seat on the basic wheel, and the tyre bead seat on the tapered ring.
    - Wheels and tyres should be serviced at least once a year.
    - Service operations must be assigned to qualified personnel only.
    - Do not carry out any welding on the wheel without express authorisation.
    - Replace worn parts with original replacement parts only.
    - The wheel must be checked at each tyre change and at least once every 12 months.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-periodic-maintenance-procedure-for-wheel

What is the correct sequence to remove a tyre from its wheel?

1. Undo the bolts and separate the tyre from the machine.
2. Remove the snap ring using a lever, then remove the triangular rubber gasket.
3. Separate the rear part of the basic wheel using a spike or a semi-automatic machine.
4. Withdraw the wheel from the tyre.
5. Separate the tapered ring from the tyre using a spike or a semi-automatic machine.

Note: *Always check that the tyre is fully deflated before carrying out any operations on the tyre or wheel.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-remove-a-tyre-from-its-wheel

What maintenance should be performed on a rim when a tyre is removed?

1. Remove the wheel from the vehicle and remove the tyre; clean the wheel carefully, particularly the mating surfaces.
2. Examine the rim along its entire circumference; examine the wheel disc, paying particular attention to the area where it is secured to the hub.
3. Check for any signs of wear or buckling, rust, breakages or cracks.
4. Check that all surfaces, particularly those in contact with the tyre or the vehicle, are sufficiently protected against corrosion; repaint if necessary after removing any surface rust and applying a suitable primer, taking care not to apply too great a paint thickness on the mating surfaces.
    - Rims and centres must never be repaired by welding or by "patching" areas where material is lacking.
    - When replacing entire wheels or the removable rings of composite rims, make sure the new parts are perfectly interchangeable with the old ones in size, type and section.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-maintenance-should-be-performed-on-a-rim-when-a-tyre-is

How should a rim be inspected at each tyre change?

1. Remove the tyre and disassemble all the rim components.
2. Clean thoroughly all the areas to be examined.
3. Carry out a careful visual inspection; in cases of doubt, use a penetrating dye test to discover any cracks.
4. Inspect all component parts of the rim for signs of wear, dents or other damage.
    - Replace any parts found to be damaged.
    - Always use a new O-ring seal before reassembly.
    - Clean any areas of rust with a wire brush and treat with an anti-rust compound.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#how-should-a-rim-be-inspected-at-each-tyre-change

What is checked on the tyres and rims during the 500-hour Type A preventive maintenance service?

1. Visually check the condition of the rims and tyres.

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/driveline-axles-and-brakes/#what-is-checked-on-the-tyres-and-rims-during-the-500-hour-ty

Parking Brake

What is the correct sequence to replace the parking brake valve?

1. Put the machine in service position.
2. Depressurize the hydraulic system.
3. Unplug the connector from the valve.
4. Remove the nut securing the spool.
5. Remove the spool from the valve.
6. Remove the valve from the valve block.
7. Replace the valve.
8. Fit in reverse order.
9. Turn on the main electric power and start the engine; run the engine at idling speed.
10. Test the parking brake a couple of times.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-the-parking-brake-va

What is the correct sequence to check that the parking brake valve applies and releases the parking brake correctly?

1. Start the engine and run it at idle until the warning lamp for brake pressure goes out and the accumulator charging valve changes to cooling.
2. Switch off the engine and turn the starter key to position I.
3. Release the parking brake with the parking brake switch and check that the parking brake's brake caliper releases and is able to move.
4. Activate the parking brake with the parking brake switch and check that the parking brake's brake caliper is applied.
    - As long as there is oil pressure in the accumulator system, it is possible to disable the parking brake with the parking brake switch when the engine is off.
    - The machine may start to roll when the parking brake is released; block the wheels so the machine cannot roll.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-that-the-parking-brake

What is the correct sequence to replace and adjust the parking brake unit?

1. Put the machine in service position.
2. Depressurize the hydraulic system.
3. Unplug the connector from the switch.
4. Detach the hydraulic hose from the parking brake unit, plugging the connection immediately to protect the hydraulic system from impurities.
5. Remove the parking brake unit attaching bolts.
6. Remove the parking brake unit.
7. Transfer the connection adapter and the parking brake switch to the new parking brake unit.
8. Fit the new parking brake unit.
9. Connect the hydraulic hose to the parking brake unit, checking that the O-rings are intact and fitted correctly.
10. Connect the connector to the parking brake switch.
11. Turn on the main electric power and start the engine; run the engine at idling speed.
12. Release the parking brake.
13. Adjust the adjustment screw so that the brakes are applied.
14. Back off the adjustment screw 0.5±0.1 mm.
15. Tighten the lock nut, holding the adjustment screw still to avoid turning it as well.
16. Refit the cover to the calliper.
17. Test the parking brake a couple of times.
18. Check that the hydraulic connections are sealed tightly.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-and-adjust-the-parki

What is the correct sequence to replace the parking brake's normally-open switch?

1. Put the machine in service position.
2. Depressurize the hydraulic system.
3. Unplug the connector from the switch.
4. Remove the switch from the parking brake unit.
5. Replace the switch.
6. Fit in reverse order.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-the-parking-brake-s

What is the correct sequence for the parking brake's initial adjustment?

1. Ensure that the spring cap is fully engaged in the housing.
2. Loosen the parking brake.
3. Turn the nut against the washer.
4. Apply the parking brake.
5. Turn the spring cap until the total clearance between the disc and the lining is 0.5 mm.
6. Loosen the parking brake.
7. Back up the nut and lock it with the locking pin; the brake is now ready for operation.

Note: *The spring cap has a clockwise thread and the stud has an anti-clockwise thread; never try to screw the spring cap in with the springs in compression, as the threads may be damaged.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-for-the-parking-brake-s-initial

What is the correct sequence to compensate for parking brake lining wear?

1. Apply pressure.
2. Turn the nut against the washer.
3. Release the pressure.
4. Turn the spring cap until the total clearance between the disc and the linings is reduced to 0.5 mm.
5. Apply pressure.
6. Back up the nut and lock it with the locking pin; the brake is now operational again.

Note: *After emergency braking, the brake pads have to be checked and replaced if necessary.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-compensate-for-parking-brake

What is the correct sequence to check and adjust the parking brake unit?

1. Start the engine and run up hydraulic pressure until the accumulators are fully charged and the accumulator charging valve switches to cooling.
2. Turn off the engine and turn the start key to position I.
3. Release the parking brake.
4. Check that the parking brake caliper can move on the bracket.
5. Check that the brake disc is clean from oil and dirt.
6. Remove the cover from the brake caliper and check there is no oil inside it.
7. Loosen the lock nut.
8. Adjust the adjustment screw so the brakes are applied.
9. Turn back the adjusting screw so the clearance between pad and disc becomes 0.5±0.1 mm.
10. Tighten the lock nut, holding the adjustment screw still to avoid turning it as well.
11. Refit the cover on the caliper.
12. Check the function of the parking brake.

Note: *The machine may start to roll; block the wheels so it cannot roll when the parking brake is released.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-and-adjust-the-parking

What is the correct sequence to change the parking brake pads?

1. Put the machine in service position with the wheels blocked.
2. Remove the cover from the brake caliper.
3. Loosen the lock nut.
4. Loosen the adjusting screw so the brake pads become loose.
5. Remove the split pin and loosen the nut on the attaching bolt holding the parking brake caliper.
6. Pull out the attaching bolt so the brake pads can be twisted out and removed (the bolt does not have to be fully removed).
7. Remove the parking brake pads.
8. Clean the brake disc with methylated spirit.
9. Fit the new parking brake pads.
10. Press back the attaching bolt.
11. Fit the nut and a new split pin.
12. Adjust the parking brake.

Note: *The machine may start to roll; block the wheels so it cannot roll when the parking brake is released.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-change-the-parking-brake-pad

Checking and aligning the hoist brake on a rubber tyred gantry crane

1. Check that the linkage of the brake works properly (for example, that there is no bending in the brake arms or top levers when the brake is releasing). Misalignment can also be recognized from uneven wear of the disc and the brake pad linings; in case of unevenly worn brake pad linings, the brake pads must be replaced before alignment.
2. Remove the wedge.
3. Release the brake spring completely by turning the adjustment nut counterclockwise.
4. Remove the catch by unscrewing the fastening screw.
5. Turn the reserve stroke adjustment nut counterclockwise to move the brake pads away from the disc.
6. Loosen the brake mounting bolts.
7. Rotate the brake spring adjustment nut clockwise until the upper edge of the torque indicator shows about 1/3 of the nominal braking torque (see the brake's type plate for the braking torque).
8. Turn the reserve stroke adjustment nut clockwise to press the brake pads against the disc; the brake aligns itself to the brake disc.
9. Check that the brake disc's edge exceeds the brake pads by 5 mm, measured from the outer edge of the brake pad (not from the brake pad carrier). If necessary, adjust by moving the brake.
10. Check the brake alignment.
11. Insert the wedge loosely and without force into the guide way.
12. Reinstall the catch.
13. Tighten the brake mounting bolts to a tightening torque of 655 N.m.
14. Adjust the braking torque and the thruster's reserve stroke; these are covered by separate follow-up checks.

Note: *Immediate risk of crushing: always use the safety switch with a lock when servicing the hoist brake, since the safety switch prevents the hoist brake from releasing during service. Misalignment of the brake can cause weak contact pressure between brake pads and disc and lead to lowered braking torque, so it is important that the brake is correctly aligned. Turning the reserve stroke adjustment nut may damage the automatic wear compensator (AWC) if the catch is still in place.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-and-aligning-the-hoist-brake-on-a-rubber-tyred

Checking and adjusting the air gap between hoist brake pads and brake disc

1. Release the brake with the thruster.
2. Check the air gap between the brake pads and brake disc.
3. Remove the cover.
4. Remove the adjusting screws and clean the threads of any adhesive agent.
5. Tighten the adjusting screws evenly with a screwdriver until the air gap is zero, then loosen the screws one quarter rotation.
6. Insert the wedge loosely and without force into the guide way.
7. Actuate and release the brake several times until the wedge does not move further down.
8. Check that the air gap is equal on both sides of the brake disc. If the air gap is too large on the stop side, turn both adjusting screws clockwise; if too large on the opposite side, turn both adjusting screws counterclockwise.

Note: *If the gaps are considerably unequal, adjustment is needed. "Stop side" means the side of the brake equipped with the wedge.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-and-adjusting-the-air-gap-between-hoist-brake-pads

Checking the reserve stroke of the hoist brake thruster

1. Release the brake with the thruster.
2. Measure the distance between the thruster frame and piston rod.
3. Remove the catch by unscrewing the fastening screw.
4. Adjust the distance to 155 mm with the adjustment nut.
5. Apply the brake.
6. Reinstall the catch, ensuring that the catch pin is within the catch.

Note: *Adjusting the reserve stroke may damage the automatic wear compensator (AWC) if the catch is in place during the procedure. The correct distance between the thruster frame and piston rod is 155 mm (+3/-1 mm); the lower edge of the cap has to be at the centre of the notch marked "10".*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-the-reserve-stroke-of-the-hoist-brake-thruster

Adjusting the parking brake caliper on a rigid planetary drive axle

1. Loosen the caliper by unscrewing the mounting bolts.
2. Remove the cover.
3. Apply pressure to the caliper, between 95 and 200 bar.
4. Tighten the adjustment bolt until the brake is clamped on the disc.
5. Tighten the mounting bolts until they make contact with the rubber springs, then tighten a further 1 to 2 flats (0.4-0.8 mm).
6. Once the bolts are adjusted, tighten the jam nuts against the mounting surface to the specified torque.
7. Adjust the running clearance to 0.5-0.8 mm with the adjustment bolt.
8. Use the second adjustment bolt to even up the running clearance on each side of the disc.
9. Mount the cover.

Note: *Adjust the caliper whenever the parking brake becomes inefficient.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#adjusting-the-parking-brake-caliper-on-a-rigid-planetary

Replacing the thruster on a quayside container crane's motor brake

1. Take out the split pin from the upper and lower shaft on the thruster.
2. Pull out the pin roll on the thruster end, and lay the thruster aside firmly.
3. Pull out the pin roll on the support.
4. Suspend the thruster away.
5. Install a new thruster.

Note: *The thruster's internal structure is complex; do not attempt to repair it on site. If it is faulty, remove the whole thruster and send it to a professional for repair.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-the-thruster-on-a-quayside-container-crane-s

Replacing the spring on a quayside container crane's motor brake

1. Screw the torque adjustable screw bolt onto the nut.
2. Turn the torque adjustable screw bolt clockwise, making sure it does not hold back the dummy plate under the tube.
3. Pull out the dummy plate under the spring tube with an appropriate hammer.
4. Turn the torque adjustable screw bolt counterclockwise until the spring force disappears completely, then remove the nuts on the bolt's upper end.
5. Pull out the bolt, spring support and spring, and install a new spring.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-the-spring-on-a-quayside-container-crane-s-motor

Replacing the automatic compensating device on a quayside container crane's motor brake

1. Remove the compensating plate.
2. Remove the split pin on the shaft, and loosen the holding screw on the pin roll.
3. Pull out the compensating screw bolt from the cross square tube.
4. Loosen the nuts on the screw bolt.
5. Pull out the screw shaft.
6. Pull out the pin roll.
7. Pull out the automatic compensating device and set-square assembly from the brake arm.
8. Remove the set square, take out the automatic compensating device, and install a new one.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-the-automatic-compensating-device-on-a-quayside

Replacing the brake gasket on a quayside container crane's motor brake

1. Loosen the brake release device manually, revolving the adjustable nut sufficiently.
2. Loosen the gasket binding bolt.
3. Move the gasket level to break it away from the key, then pull it out.
4. Align and install a new gasket.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-the-brake-gasket-on-a-quayside-container-crane-s

Replacing the hydraulic cylinder on a quayside container crane's drum brake

1. Loosen the bolts on the shaft end plate, and remove the plate.
2. Pull out the four pin rolls between the hydraulic cylinder and brake arm, one by one.
3. Suspend the cylinder to a safe place.
4. Install a new cylinder.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-the-hydraulic-cylinder-on-a-quayside-container

Replacing the pedestal spring on a quayside container crane's drum brake

1. Loosen the two screws on the spring.
2. Pull out the old pedestal spring, install a new one, and realign it.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-the-pedestal-spring-on-a-quayside-container-crane

Replacing the brake gasket on a quayside container crane's drum brake without removing the whole brake

1. Loosen the holding screw on the pedestal pin.
2. Suspend the pedestal out.
3. Move the pedestal to a safer place.
4. Loosen the holding nuts on the gasket.
5. Pull out the old gasket, and install a new one.

Note: *It generally is not necessary to remove the whole drum brake for this, although removing it is a safer and more effective way to work.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-the-brake-gasket-on-a-quayside-container-crane-s-2

Propeller Shaft

What is the correct sequence to replace the propeller shaft?

1. Put the machine in service position.
2. Remove the propeller shaft's attaching bolts.
3. Remove the propeller shaft.
4. Clean the contact surfaces (cross-toothed) on the drive axle and gearbox.
5. Fit the propeller shaft attaching bolts, torqued to 98 Nm (oil).
6. Re-tighten the attaching bolts after 50 hours operating time.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-the-propeller-shaft

What checks and lubrication should be performed on the propeller shaft at scheduled intervals?

1. After 50 hours, check-tighten the attaching bolts at the mountings to the drive axle and transmission, torqued to 200 Nm.
2. After 500 hours, clean the propeller shaft and check the clearance in the universal joints.
3. After 1000 hours, grease the universal joints with an NLGI EP2 universal grease, and check-tighten the attaching bolts at the mountings to the drive axle and transmission, torqued to 200 Nm.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-checks-and-lubrication-should-be-performed-on-the-prope

What is the correct periodic check for the propeller shaft?

1. After 50 hours, check and tighten the retaining bolts at the mountings for the drive axle and transmission to 98 Nm.
2. After 500 hours, clean the propeller shaft and check the clearance in the universal joints.
3. After 1000 hours, grease the universal joints with universal grease and check and tighten the mounting retaining bolts to 98 Nm.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-periodic-check-for-the-propeller-shaft

What is the correct sequence to lubricate and check the propeller shaft?

1. Inject grease with a manual pump (never a high-pressure greasing pump) into the pressure fittings of the universal joints (and the sliding sleeve if fitted); full filling is indicated by grease coming out.
2. Check the tightness of the bolts fastening the propeller shaft to the drive axle and to the transmission, to the specified torque (100 Nm).
    - Always switch off the engine before working on the propeller shaft.
    - On machines with automatic greasing, the propeller shaft must still be greased manually.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-lubricate-and-check-the-prop

What propeller-shaft operations are checked during the 500-hour Type A preventive maintenance service?

1. Grease the propeller shaft.
2. Tighten the propeller shaft's bolted joints.

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/driveline-axles-and-brakes/#what-propeller-shaft-operations-are-checked-during-the-500-h

Drive Axle & differential

When must the driver-controlled differential lock never be engaged?

1. The differential must not be engaged when travelling at higher speeds.
2. The differential must not be engaged when travelling down steep grades with limited traction.

Note: *When the differential is fully locked, the vehicle will have reduced steering capability; not observing these conditions can result in loss of vehicle control, damage to components, serious injury or death.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#when-must-the-driver-controlled-differential-lock-never-be-e

What safety precautions must be observed before servicing a drive axle?

1. Before starting the inspection, make sure the diesel engine is off, the disconnecting switch is disengaged and the machine is stable and braked.
2. If the machine is lifted with hydraulic jacks for maintenance, place wedges under the wheels of the rear axle and further supports under the machine support points.
3. Before beginning work, including wheel removal, completely deflate the tyres; never stand directly in front of the tyre when deflating or inflating.
4. To drain oil from the hubs or differential housing, use a container large enough to hold the quantity of oil to be drained.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-safety-precautions-must-be-observed-before-servicing-a

What should be checked daily versus every 100 or 1000 hours on a drive axle?

1. Daily: sight check for oil leaks on the outer part of the axle.
2. Every 100 hours: check the level of oil in the hubs and differential housing.
3. Every 1000 hours: replace the oil in the hubs and differential housing.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-should-be-checked-daily-versus-every-100-or-1000-hours

What drive-axle and differential operations are checked during the 500-hour Type A preventive maintenance service?

1. Change the differential oil.
2. Change the hub oil.
3. Clean the drive axle's breather.
4. Tighten the drive axle's bolted joints.

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/driveline-axles-and-brakes/#what-drive-axle-and-differential-operations-are-checked-duri

Brake Pedal

What is the correct sequence to replace the brake pedal?

1. Put the machine in service position.
2. Depressurize the hydraulic system.
3. Secure the brake valve and the steering valve on the cab's underside.
4. Screw down the set screw for the brake pedal all the way to facilitate access.
5. Detach the steering valve from the pedal bracket by removing the steering valve's attaching bolts and pulling the valve down slightly so the steering shaft releases from the steering valve.
6. Detach the brake valve from the brake pedal by removing the brake valve attaching bolts securing the brake valve to the cab floor.
7. Remove the four screws securing the bracket to the cab floor.
8. Undo the splint pins and drive the shaft out.
9. Replace the brake pedal.
10. Fit in reverse order.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-the-brake-pedal

What checks and adjustments should be made on the brake pedal?

1. Clean the floor around the brake pedal and check that nothing is obstructing its movement.
2. Check that the brake pedal springs back properly and that the clearance between the brake pedal and the brake valve is 1-1.5 mm; if necessary, adjust the brake pedal stop screw to give the correct clearance.
3. Check that the pedal moves easily.
4. Lubricate the pedal hinge with an NLGI EP2 grade multi-purpose grease.
5. Check that the rubber pad on the brake pedal is intact and that the pattern is not worn away; replace as necessary.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-checks-and-adjustments-should-be-made-on-the-brake-peda

What checks and adjustments should be made on the brake pedal?

1. Clean the floor around the brake pedal and check that nothing blocks its movement.
2. Check that the brake pedal springs back sufficiently and that the clearance between the pedal and brake valve is 1-1.5 mm, adjusting the set screw if needed.
3. Check that the pedal's travel is smooth.
4. Grease the pedal hinges with an NLGI EP2 universal grease.
5. Check that the rubber on the pedal is intact and the tread pattern is not worn out, replacing it if necessary.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-checks-and-adjustments-should-be-made-on-the-brake-peda-2

What is the correct sequence to check and adjust the brake pedal?

1. Clean the floor around the brake pedal and check that nothing blocks its movement.
2. Check that the brake pedal returns all the way and that the clearance between the brake pedal and brake valve is 1-1.5 mm, adjusting the pedal's stop bolt if needed.
3. Check that the pedal's travel is smooth.
4. Grease the pedal hinges with EP2 universal grease.
5. Check that the rubber on the pedal is intact and the tread pattern is not worn out, changing it when needed.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-and-adjust-the-brake-p

Transmission & converter

How and how often should transmission oil level be checked?

1. Check the oil level every day, at a temperature between 82-93°C with the motor running at low revs.
2. The oil level should always be at the FULL reference mark.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#how-and-how-often-should-transmission-oil-level-be-checked

How often should transmission oil level be checked, and the filter and oil be changed?

1. Check the oil level daily to ensure it is on the FULL mark.
2. Change the oil filter every 500 hours.
3. Change the oil every 1500 hours.
    - Before starting inspection, make sure the diesel engine is off, the power switch is disengaged and the machine is stable and braked.
    - Allow the transmission to cool before performing any maintenance jobs.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#how-often-should-transmission-oil-level-be-checked-and-the-f

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

1. Change the gearbox oil filters.
2. General greasing.
3. Check the gearbox oil level.
4. Check for oil leaks from the gearbox's fittings and components.

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/driveline-axles-and-brakes/#what-gearbox-operations-are-checked-during-the-500-hour-type

Performing the converter stall test on a powershift transmission

1. Put the vehicle against a solid barrier, such as a wall, and/or apply the parking brake and block the wheels.
2. Put the directional control lever in forward (or reverse, as applicable).
3. Select the highest speed.
4. With the engine running, slowly increase engine speed to approximately half throttle and hold until the transmission (converter outlet) oil temperature reaches the operating range, respecting the 30-second stall / 15-second neutral cycle.

Note: *The transmission fluid must be at operating temperature (82-93 degrees C / 180-200 degrees F) to obtain correct fluid level and pressure readings; to raise the oil temperature, either operate the vehicle or run the engine with the converter at stall. Be careful that the vehicle does not move unexpectedly when operating the engine and converter at stall RPM. Do not operate the converter at stall condition for longer than 30 seconds at a time: shift to neutral for 15 seconds and repeat the procedure until the desired temperature is reached. Excessive temperature (120 degrees C / 250 degrees F maximum) will cause damage to the transmission clutches, fluid, converter and seals.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#performing-the-converter-stall-test-on-a-powershift

Brake Valve

What is the correct sequence to check the brake valve's pressure and sealing?

1. Operate and warm up the machine so the hydraulic oil reaches at least 50°C operating temperature.
2. Put the machine in service position.
3. Connect a pressure gauge (0-25 MPa) to the measuring outlet for brake pressure on the distribution block.
4. Start the machine and run it at idling speed until the accumulator is charged and the accumulator charging valve changes to cooling.
5. Press the pedal to the bottom and read off the pressure, comparing it with the pressure plate on the left-hand front mudguard.
6. Turn off the engine.
7. Depress the pedal fully and keep it pressed down, checking the pressure; it must correspond with the value specified on the pressure plate and must not decrease from this value for 15 seconds.
8. Release the pedal; the brake pressure must decrease to 0 MPa immediately. If it does not, adjust the pedal's zero position with the screw under the pedal; if the pedal is correctly adjusted and the pressure still does not fall to 0 MPa, replace the brake valve.
9. Remove the pressure gauge and fit the protective cap on the measuring outlet.
    - Read the safety instructions for oil before working.
    - If the brake pedal is correctly adjusted and the pressure does not fall to 0 MPa, the brake valve is not sealed and can cause the brakes to remain applied and then overheat during operation.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-brake-valve-s-pres

What is the correct sequence to replace the brake valve?

1. Put the machine in service position.
2. Depressurize the hydraulic system.
3. Remove the horn from the brake valve and fit it to the new brake valve.
4. Mark up and detach the hydraulic hoses from the brake valve, plugging the connections immediately to protect the hydraulic system from impurities.
5. Secure the brake valve under the cab.
6. Remove the brake valve attaching bolts.
7. Remove the brake valve by pulling it downward.
8. Transfer the connection adapters to the new brake valve.
9. Fit the new brake valve, remembering the spacer ring.
10. Connect the hydraulic hoses to the brake valve according to the marking, checking that the O-rings are intact and fitted correctly.
11. Grease and adjust the brake pedal.
12. Turn on the main electric power and start the engine; run the engine at idling speed.
13. Test the brakes a couple of times.
14. Check that the brake valve's connections are sealed tightly.
15. Bleed the wheel brakes' brake cylinders.

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

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-the-brake-valve

What is the correct sequence to replace the shuttle valve for dual brake pedals?

1. Put the machine in service position.
2. Depressurize the hydraulic system.
3. Mark up and detach the hydraulic hoses and fittings from the shuttle valve, plugging the connections immediately to protect the hydraulic system from impurities.
4. Remove the socket cap screws that hold the shuttle valve.
5. Transfer the connection adapters to the new shuttle valve.
6. Fit the new shuttle valve.
7. Connect the hydraulic hose and fittings to the shuttle valve according to the marking, checking that the O-rings are intact and fitted correctly.
8. Turn on the main electric power and start the engine; run the engine at idling speed.
9. Test the brakes a couple of times.
10. Check that the shuttle valve's connections are sealed tightly.
11. Bleed the wheel brakes' brake cylinders.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-the-shuttle-valve-fo

Accumulator

What is the correct sequence to check the brake accumulator's condition?

1. Start the engine and let it idle for approximately 1 minute, until the accumulator charging valve switches to cooling.
2. Turn off the engine and turn the start key to position I.
3. Apply and release the brake several times, counting how many applications are possible before the low brake pressure warning light activates; it should be possible to apply the brake 8 times before the light activates.
4. If the warning light activates sooner, one of the brake system's accumulators is probably defective and should be checked further.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-brake-accumulator-2

What is the correct sequence to check the accumulator charging pressure?

1. Operate and warm up the machine so the hydraulic oil reaches operating temperature (50°C).
2. Depressurise the hydraulic system.
3. Connect a pressure gauge to the measuring outlet for accumulator charging pressure on the accumulator charging valve.
4. Start the engine and let it idle.
5. Close the accumulator drain valve, checking it is completely closed and the lock ring tightened.
6. Check that the pressure slowly rises to the specified accumulator charging pressure on the pressure plate.
7. Brake repeatedly and check at which pressure the accumulator charging valve switches to charging; it should switch to cooling at 13±0.5 MPa.
8. Depressurise the hydraulic system.
9. Remove the pressure gauge and fit the protective cap on the pressure check connection.
10. Close the accumulator drain valve again, checking it is completely closed and the lock ring tightened.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-accumulator-chargi

What is the correct sequence to check the brake accumulators?

1. Start the engine and let it idle for approximately 1 minute, until the accumulator charging valve switches to cooling.
2. Turn off the engine and turn the start key to position I.
3. Apply and release the brake several times, counting how many applications are possible before the low brake pressure warning lamp activates; it should be possible to apply the brake at least 8 times before it activates.
4. If the warning light activates earlier, investigate the accumulators further, since one is probably defective.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-brake-accumulators

Transmission Removal

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

1. Park the machine on a level surface and block the wheels to prevent movement.
2. Open the battery compartment door and disconnect the battery cables (negative first), isolating them.
3. Disconnect the engine from the transmission, following the engine disconnection procedure.
4. Once the engine is disconnected from the transmission, remove the propeller shaft by removing its bolt.
5. Attach a suitable hoist and sling to the transmission.
6. Remove any other cables or wires that may interfere with removal.
7. Manoeuvre the transmission forward, away from the engine, then slowly hoist it while watching for any wires or cables that might become entangled.
8. Lower it to the floor and secure it to prevent it from toppling over onto personnel.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-disconnect-and-remove-the-tr

What is the correct sequence to install the flex plate?

1. Position the flex plate and weld nut assembly on the impeller cover, with the weld nuts toward the cover.
2. Align the intermediate flex plate and backing ring with the holes in the impeller cover, positioning the backing ring's two dimples (180° apart) toward the engine flywheel.
3. Install the bolts and lockwashers, tightening to a torque of 23-25 ft-lbs.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-install-the-flex-plate

What is the correct sequence to install the transmission?

1. Remove all burrs from the flywheel mounting face and nose pilot bore, and clean the drive plate surface with solvent.
2. Check the engine flywheel and housing for conformance to the standard tolerance specifications for pilot bore size, pilot bore runout, and mounting face flatness, and measure and record the engine crankshaft end play.
3. Align the bolt, drive ring, and flex plate holes.
4. Install the flex plate attaching bolt, snug but not tightened, then rotate the engine flywheel and install the remaining flywheel-to-drive attaching bolts snug but not tightened; once all 7 bolts are installed, torque each one to 25-30 ft-lbs, rotating the flywheel between each bolt until all are tightened.
5. Install the stud with bolt and washer, and align the transmission assembly to the engine.
6. Apply the torque values from the manual's torque table to all nuts and bolts.
7. If transmission failure had occurred, back-flush with clean transmission oil and compressed air until all foreign material is removed, then replace the transmission fluid, filter, connecting lines and cooler, and fill with clean, previously unused fluid.
8. Ensure the transmission cooling hoses are properly connected to the inlet and outlet ports.
9. After the transmission shift and disconnecting controls are connected, check the operation of the control valve.

Note: *Do not reverse the transmission cooler lines, since this would back-flush the transmission cooling system.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-install-the-transmission

Brake Control System

What is the correct sequence to check the parking brake's working pressure?

1. Measure the pressure at the designated test point; the working pressure must be 130 bar.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-parking-brake-s-wo

What is the correct sequence to check the pedal brake's working pressure?

1. Measure the pressure at the designated test point; the working pressure must be 145 bar.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-pedal-brake-s-work

What is the correct sequence to depressurise the brake system before changing the brake filter?

1. Open the tap.
2. Pump the brake pedal until it no longer comes back up.

Note: *Verify the system is not under pressure before performing the filter change.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-depressurise-the-brake-syste

Wheel Brake

What is the correct sequence to bleed the wheel brakes?

1. Put the machine in service position.
2. Place a ring spanner on the bleed nipple and connect a transparent hose to it, directing the other end of the hose into a collection container.
3. Start the machine and press down on the brake pedal, keeping the pedal pressed down.
4. Open the bleed nipple and allow oil to run out until it is free of air bubbles, letting through at least two litres of oil to ensure no air pockets remain in the system.
5. Close the bleed nipple.
6. Move the spanner and hose to the other side and repeat the same steps.
    - Avoid skin contact with brake oil, which may be warm; use protective gloves.
    - Both the brake cylinder and disc brake must be bled after any work where the brake system is opened or after work on the wheel brake.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-bleed-the-wheel-brakes

What is the correct sequence to bleed the wheel brakes?

1. Put the machine in service position.
2. Place a box wrench on the breather nipple and connect a transparent hose to it, routing the other end into a collection container.
3. Start the machine and push down the brake pedal, holding it down.
4. Open the breather nipple and let the oil run out until free from air bubbles.
5. Close the breather nipple.
6. Move the wrench, hose and collection container, and repeat on the other side.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-bleed-the-wheel-brakes-2

Checking the wheel hub and angle gear lubrication oil level on a driven wheel

1. Remove the cover.
2. Clean the wheel hub.
3. Turn the wheel into a position where the wheel hub drain hole is about 15 degrees below the centre line of the gear unit.
4. Remove the plug.
5. The oil level must be at the same level as the fill hole; add oil if necessary, and wait a few minutes for the oil to flow to the angle gear. The oil type is the same as for the wheel hub.
6. Reinstall the plug and the cover.

Note: *In one series of wheel gear units there are two oil plugs located at 75 degrees; in the other series the oil plugs are located at 180 degrees.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-the-wheel-hub-and-angle-gear-lubrication-oil-level

Changing a driven wheel on a rubber tyred gantry crane

1. Put the bottle jack under the running wheel fork.
2. Lift with the bottle jack 160 mm.
3. Fix the support with plates and bolts to the plate under the sill beam.
4. Add the turn stopper.
5. Add a support under the jack.
6. Lift with the jack 160 mm.
7. Add a further support under the first support.
8. Add a second support under the jack.
9. Lift with the jack 160 mm.
10. Add a second support under the first support.

Note: *Check that the ground is straight and flat under the jack. Pay attention to the cleanliness of the rim, wheel hub and wheel nuts: any paint, oil or grease on these surfaces prevents proper tightening of the wheel nuts, and loose nuts allow the rim to move, which causes severe damage to the hub. Required lifting equipment: 1 bottle jack; 1 turn stopper (length 80 mm); 1 support (length 2825 mm); 4 supports (length 140 mm).*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#changing-a-driven-wheel-on-a-rubber-tyred-gantry-crane

Checking the wheel hub lubrication oil level on a non-driven wheel

1. Remove the cover.
2. Clean the wheel hub.
3. Turn the wheel into a position where the wheel hub drain hole is about 15 degrees below the centre line of the gear unit.
4. Remove the plug.
5. The oil level must be at the same level as the fill hole; add oil if necessary, and wait a few minutes for the oil to flow to the wheel hub. The oil type is given in the technical data section.
6. Reinstall the plug and the cover.

Note: *In one series of wheel gear units there are two oil plugs located at 75 degrees; in the other series the oil plugs are located at 180 degrees.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-the-wheel-hub-lubrication-oil-level-on-a-non

Changing a non-driven wheel on a rubber tyred gantry crane

1. Put the bottle jack under the driving wheel fork.
2. Lift with the bottle jack 160 mm.
3. Fix the support with plates and bolts to the plate under the sill beam.
4. Add the turn stopper.
5. Add a support under the jack.
6. Lift with the jack 160 mm.
7. Add a further support under the first support.
8. Add a second support under the jack.
9. Lift with the jack 160 mm.
10. Add a second support under the first support.

Note: *Check that the ground is straight and flat under the jack. Pay attention to the cleanliness of the rim, wheel hub and wheel nuts: any paint, oil or grease on these surfaces prevents proper tightening of the wheel nuts, and loose nuts allow the rim to move, which causes severe damage to the hub. Required lifting equipment: 1 bottle jack; 1 turn stopper (length 80 mm); 1 support (length 2825 mm); 4 supports (length 140 mm).*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#changing-a-non-driven-wheel-on-a-rubber-tyred-gantry-crane

Checking the AWC (automatic wear compensator) of the hoist brake for wear

1. Rotate the compensating nut clockwise to compensate for lining wear and the reduced reserve stroke.
2. Replace worn parts, and the complete AWC unit, as soon as possible.
3. Release one brake at a time using the manual release; the second brake must hold the load safely. If necessary, check and repeat the brake adjustment.

Note: *The catch and the freewheel may be subject to wear. Wear can be recognized from a constant reduction of the reserve stroke in case of lining wear, even though the AWC is actuated.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-the-awc-automatic-wear-compensator-of-the-hoist

Removing and disassembling a planetary wheel end for service

1. Park the vehicle on a level surface, and block the wheels that will not be raised.
2. Raise the vehicle so the area to be serviced is off the ground, and support it with safety stands.
3. Remove the nuts, washers and wheel rim clamps, then remove the tyre, rim and spacer.
4. Rotate the hub assembly until the oil drain plug in the planetary spider is at the bottom.
5. Remove the oil drain plug, and drain and discard the lubricant.
6. Match-mark the spider and wheel hub for correct alignment when reassembling.
7. Remove the planetary spider cover capscrews, and remove the cover.
8. Remove the spider-to-hub capscrews and washers, or nuts and washers.
9. Insert a pry bar into the assembly notches and separate the planetary spider assembly from the wheel hub assembly, without fully removing the spider assembly yet. On axles without assembly notches, strike the spider with a plastic or rubber mallet to separate it instead.

Note: *Always wear safe eye protection when performing this maintenance. Block the wheels to prevent the vehicle from moving, and support the vehicle with safety stands; never work under a vehicle supported only by jacks, since jacks can slip or fall over and cause serious personal injury. Note: the planetary gearing on flange-mounted hubs can be serviced without removing the tyre from the wheel end.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#removing-and-disassembling-a-planetary-wheel-end-for-service

Installing the wheel hub and adjusting the wheel bearing preload on a planetary wheel end

1. Use a lifting device to carefully lift and slide the wheel hub assembly over the spindle, keeping it aligned with the spindle to avoid oil seal damage.
2. Install the ring gear hub assembly, including the outer bearing cone, on the spindle.
3. Install the wheel bearing adjusting nut on the spindle.
4. Tighten the wheel bearing adjusting nut to the initial seating torque for the relevant axle capacity class, while rotating the wheel hub.
5. Continue rotating the hub at least one full revolution in both directions.
6. Tighten the wheel bearing adjusting nut again to the initial seating torque, while rotating the wheel hub in both directions; repeat the seating and rotating steps until the adjusting nut will not advance further under the initial seating torque.
7. Loosen the adjusting nut 1/8 to 1/4 turn.
8. Tighten the adjusting nut to the final adjustment torque for the relevant axle capacity class, while rotating the wheel hub.
9. Install the adjusting nut lockplate, either with its flat side against a flat surface of the nut, or with its notch over a corner of the nut; if necessary, tighten the adjusting nut further (never loosen it) to align the lockplate holes with the threaded holes in the ring gear hub.
10. Install new lockplate capscrews with pre-applied locking agent on the threads; if reusing the original capscrews, apply 2-3 drops of a threadlocking compound to the internal threads of the ring gear hub. Tighten the capscrews to 60-75 lb-ft (81-102 N.m).

Note: *Take care when using lifting devices: inspect a lifting strap for damage before use, and never use it to shock-load or drop-load a component, to avoid serious personal injury and component damage. Do not loosen the adjusting nut once the final adjustment torque is set, since this can result in an incorrect bearing preload. When using a threadlocking compound, follow the manufacturer's instructions to avoid eye and skin irritation; if it gets into the eyes, flush them with water for 15 minutes and seek medical attention as soon as possible.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#installing-the-wheel-hub-and-adjusting-the-wheel-bearing

Replacing the hydraulic cylinder on a quayside container crane's wheel brake

1. Lock out the crane's motion affecting safe driving by performing the lock-out and tag-out procedure.
2. Release the spring force.
3. Bracket the wheel brake with a fork truck, and remove the bolts on its support.
4. Suspend the wheel brake with the fork truck.
5. Install a new wheel brake with the fork truck, connect the oil hose, and adjust it according to the alignment criteria.
6. Remove the lock-out and tag-out devices, and pre-operate the crane.
7. Start up and monitor the crane to verify its operation before returning it to service.

Note: *The hydraulic cylinder is the main actuating component of the wheel brake and needs special tools to assemble; it is difficult to repair on site. If it fails, replace the whole cylinder and have it repaired in a workshop by a professional.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-the-hydraulic-cylinder-on-a-quayside-container-2

Replacing the brake gasket on a quayside container crane's wheel brake

1. Lock out the crane's motion for the affected drives by performing the lock-out and tag-out procedure.
2. Open the brake to its widest span.
3. Loosen the bolts on the gasket.
4. Hold the gasket by hand, sever it toward the wheel side to break it away from the key, and pull it out along the wheel radial direction.
5. Inspect the gasket surface for cleanliness, deformation, and greasy dirt.
6. Install a new gasket of the same type along the wheel radial direction, aligning the gasket groove with the joint key groove.
7. Screw down all the bolts.
8. Adjust the wheel brake per the alignment criteria.
9. Remove the lock-out and tag-out devices, and pre-operate the crane.

Note: *Replace the gasket when its thickness is less than 2 mm.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-the-brake-gasket-on-a-quayside-container-crane-s-3

Brake Oil Tank

What is the correct sequence to change the brake system tank's breather filter?

1. Clean the area around the brake tank's breather filter.
2. Remove the cover from the filter holder by removing the screw in the middle and lifting away the cover.
3. Remove the old filter cartridge.
4. Clean the filter holder, working carefully so impurities do not enter the tank.
5. Fit a new filter cartridge.
6. Refit the cover to the filter holder.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-change-the-brake-system-tank

What is the correct sequence to change the brake system oil?

1. Put the machine in service position.
2. Depressurize the hydraulic and brake systems.
3. Place a receptacle under the brake oil tank (holds approximately 140 litres).
4. Clean the area around the drain plug.
5. Remove the drain plug and drain the tank.
6. Fit the drain plug, using a new gasket washer.
7. Clean the area around the filling point.
8. Remove the filler cap and fill the tank with oil, to the correct volume and grade.
9. Check that the drain plug seals tight.
10. Remove the receptacle, handling the oil as environmentally hazardous waste.

Note: *Always depressurize the hydraulic systems before working on them; avoid skin contact with the oil, use protective gloves.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-change-the-brake-system-oil

Changing the lubrication oil of a driven wheel hub

1. Remove the cover.
2. Clean the wheel hub.
3. Turn the wheel into a position where the wheel hub drain hole is at the lowest position.
4. Remove the plugs.
5. Drain the oil into a container through the drain hole.
6. Turn the wheel into a position where the wheel hub drain hole is about 15 degrees below the centre line of the gear unit.
7. Fill the hub with lubrication oil up to the level of the filling hole, until it reaches the level of the second plug. The oil type is the same as for the wheel hub.
8. Reinstall the plugs and the cover.

Note: *Avoid skin contact with oil; use protective gloves. Do not discharge oil into the environment: use an appropriate container and deliver the oil 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/driveline-axles-and-brakes/#changing-the-lubrication-oil-of-a-driven-wheel-hub

Changing the lubrication oil of a non-driven wheel hub

1. Remove the cover.
2. Clean the wheel hub.
3. Turn the wheel into a position where the wheel hub drain hole is at the lowest position.
4. Remove the plugs.
5. Drain the oil into a container through the drain hole.
6. Turn the wheel into a position where the wheel hub drain hole is about 15 degrees below the centre line of the gear unit.
7. Fill the hub with lubrication oil up to the level of the filling hole, until it reaches the level of the second plug. The oil type is the same as for the wheel hub.
8. Reinstall the plugs and the cover.

Note: *Avoid skin contact with oil; use protective gloves. Do not discharge oil into the environment: use an appropriate container and deliver the oil 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/driveline-axles-and-brakes/#changing-the-lubrication-oil-of-a-non-driven-wheel-hub

Checking and adjusting the air gap of the gantry brake

1. Remove the fan cover.
2. Loosen the fixing screws, screw the adjustment bushes into the magnetic section using a fixed spanner, and tighten the fixing screws again.
3. Check the air gap again.

Note: *In normal application, the brake is practically maintenance-free. Only in applications involving extremely high frictional work does the air gap S1 have to be checked at defined intervals and readjusted to the nominal value before the maximum air gap is exceeded. Before commissioning, it must be checked in the de-energized state that the air gap is uniform and equal to the nominal size, using a feeler gauge between the armature disk and magnetic section at 3 points on the circumference. When the motor is recommissioned, the brake must be checked for correct operation. The nominal air gap S1 is 0.5 mm (minimum 0.5 mm), and the maximum allowed air gap S1 is 1.5 mm. Frictional surfaces must not come into contact with oil or grease.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-and-adjusting-the-air-gap-of-the-gantry-brake

Checking and adjusting the trolley brake

1. Remove the fan cover.
2. Loosen the fixing screws, screw the adjustment bushes into the magnetic section using a fixed spanner, and tighten the fixing screws again.
3. Check the air gap again.

Note: *Do not leave the lever in the brake: tripping hazard. In normal application, the brake is practically maintenance-free. Only in applications involving extremely high frictional work does the air gap S1 have to be checked at defined intervals and readjusted to the nominal value before the maximum air gap is exceeded. Before commissioning, it must be checked in the de-energized state that the air gap is uniform and equal to the nominal size, using a feeler gauge between the armature disk and magnetic section at 3 points on the circumference. When the motor is recommissioned, the brake must be checked for correct operation. The nominal air gap S1 is 0.5 mm (minimum 0.5 mm), and the maximum allowed air gap S1 is 1.5 mm. Frictional surfaces must not come into contact with oil or grease.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-and-adjusting-the-trolley-brake

Draining and refilling the oil on a driven axle assembly

1. Open the drain holes on the carrier assembly, on the wheel assemblies, and if present, on the interaxle differential and drop gear housing; on the hub assemblies, the drain plug should be turned downward.
2. Replace the oil draining plugs after draining.
3. Remove the oil filler plug and the oil level control plug on the carrier assembly, on the wheel assembly, and if present, on the interaxle differential and drop gear housing.
4. Fill with oil and check the oil level at the oil level plug hole (overflow control); wait a few minutes, and if the level falls, add oil until the level remains constant.

Note: *Place the vehicle in a horizontal position. Draining the oil is to be done only when the oil is warm. Clean all lubrication points before opening them.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#draining-and-refilling-the-oil-on-a-driven-axle-assembly

Replacing a motor coupling on a quayside container crane

1. Lower the spreader to the ground and slacken the main hoist ropes (or position the boom level and slacken the boom hoist ropes).
2. Lock out the crane's motion for the affected drives by performing the lock-out and tag-out procedure.
3. Disconnect the coupling between the drum and the rotary limit switch, and use slings and softeners to connect the drum to the service crane.
4. Tie off each of the ropes in the machinery house to remove the rope load from the drum.
5. Remove the electrical connection from the motor brake, release the brake manually, then remove the brake.
6. Remove the chain pulley (generally in two halves) using the service crane.
7. Remove the driven side jaw.
8. Remove the brake disc.
9. Remove the driven side half coupling, protecting the reducer shaft during the process.
10. Unfold the cover of the new coupling, clean off the anti-rust oil, and heat-insert the two half couplings (or use oil bath heating).
11. When re-aligning, match the serial number between the half coupling and the brake disc.
12. Thread the heated half coupling onto the reducer shaft as quickly as possible, not exceeding ten minutes, to avoid it seizing before it is in position.
13. Realign the motor coupling per the alignment method; for allowable compensation rate, installation separation and nut torque, refer to the coupling manual.

Note: *A newly purchased coupling should be anti-corrosion treated and well sealed.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-a-motor-coupling-on-a-quayside-container-crane

Replacing a drum coupling (dental/gear type) on a quayside container crane

1. Disjoin the drum coupling step by step, protecting the outer dental boss and inner dental flange.
2. To demount the inner dental flange: place the drum in an area near the assembly, then unfasten its nuts, suspend the flange with the service crane, and drop it out from the drum step by step.
3. Before demounting the outer dental boss, assess whether it is still useful; if it is to be discarded, plane it off from the key slot with fire so the coupling drops out easily.
4. Add an appropriate height shim stack under a jack (all shims stuffed in place), position the jack steadily on top of the shims.
5. Position the raising flange at the peak, passing the double screw through the hole in the flange.
6. Tighten the nuts, ensuring the interface between the raising flange and jack is level and in full contact.
7. Start the jack; the whole procedure normally takes about one hour.
8. To clean the rust-inhibiting oil from the new coupling, first take apart the inner dental flange, outer dental boss and abrasion indicator, and clean them carefully.
9. Heat-insert the outer dental boss (or use oil bath heating).
10. Telescope the abrasion indicator into place once preparation is complete.
11. Telescope the outer dental boss onto the reducer shaft as quickly as possible, since it will shrink into place in a short time.
12. After the outer dental boss is fixed, telescope the abrasion indicator.
13. Realign the drum coupling per the alignment method; for allowable compensation rate, refer to the coupling manual.

Note: *Before replacement, carefully study the drawings and understand the drum coupling's construction. A newly purchased coupling should be anti-corrosion treated and well sealed.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-a-drum-coupling-dental-gear-type-on-a-quayside

Transmission Oil Cooler

What is the correct sequence to replace the transmission oil cooler?

1. Remove the engine access panels.
2. Break the suction in the hydraulic tank to reduce fluid loss (some fluid in the cooler and lines will still be lost).
3. Provide a suitable container to catch draining hydraulic oil.
4. Drain all coolant liquid via the drain plug, then disconnect the engine cooling hoses from the exchanger by removing their clamps.
5. Tag, disconnect and cap the transmission oil exchanger hoses.
6. Support the weight of the transmission oil exchanger, then remove its bolts to release it.

Note: *Dispose of drained oil in accordance with local and federal regulations.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-the-transmission-oil

What is the correct sequence to install the transmission oil cooler?

1. Install the transmission oil cooler by reversing the removal procedure.
2. Fill the transmission to the Low mark on the sight gauge, then operate the engine until the transmission oil reaches normal operating temperature.
3. Check the oil level and add oil to bring it to the Full mark on the sight gauge.
4. Check all hoses and connections for leaks.

Note: *Do not reverse the hydraulic cooling or transmission cooling hoses, since this would back-flush the oil cooling system and cause internal damage.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-install-the-transmission-oil

Checking and changing the oil in a powershift transmission with torque converter

1. Every 500 operating hours, change the oil filter element.
2. Every 1000 operating hours, drain and refill the system: drain with the oil at 150 to 200 degrees F (65.6-93.3 degrees C).
3. Drain the transmission and remove the sump screen; clean the screen thoroughly and replace it, using new gaskets.
4. Drain the oil filters, remove and discard the filter elements; clean the filter shells and install new elements.
5. Refill the transmission to the LOW mark.
6. Run the engine at 500-600 RPM to prime the converter and lines.
7. Recheck the level with the engine running at 500-600 RPM, and add oil to bring the level to the LOW mark. When the oil temperature is hot (180-200 degrees F / 82.2-93.3 degrees C), make the final oil level check and bring the oil level to the FULL mark.

Note: *Check oil level daily with the engine running at 500-600 RPM and the oil at 180 to 200 degrees F (82.2-93.3 degrees C), maintaining the level to the FULL mark. It is recommended that filter elements be changed after 50 and 100 hours of operation on new, rebuilt or repaired units. Normal drain periods and filter change intervals assume average environmental and duty-cycle conditions; severe or sustained high operating temperatures, or very dusty atmospheric conditions, will cause accelerated deterioration and contamination, requiring shorter change intervals.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-and-changing-the-oil-in-a-powershift-transmission

Servicing the machine after a transmission overhaul

1. Drain the entire system thoroughly.
2. Disconnect and clean all hydraulic lines; where feasible, remove the lines from the machine for cleaning.
3. Replace the oil filter elements, cleaning the filter cases thoroughly.
4. Thoroughly clean the oil cooler: back-flush it with oil and compressed air until all foreign material is removed (flushing in the direction of normal oil flow will not adequately clean it); if necessary, remove the cooler assembly for cleaning with oil, compressed air and a steam cleaner. Do not use flushing compounds.
5. Reassemble all components, using only the recommended oil type. Fill the transmission through the filter opening until fluid reaches the LOW mark; if the dipstick is not accessible, remove the lower check plug and fill until oil runs from the lower oil hole, then replace the filler and level plug.
6. Run the engine two minutes at idle to prime the torque converter and hydraulic lines, then recheck the fluid level with the engine running at idle. Add fluid as necessary to reach the LOW mark or until it runs freely from the lower check plug hole, then install the level plug or dipstick. Recheck with hot oil (180-200 degrees F / 82.2-93.3 degrees C).
7. Recheck all drain plugs, lines and connections for leaks, and tighten where necessary.

Note: *The transmission, torque converter and its hydraulic system are important links in the driveline between the engine and the wheels; the proper operation of one depends on the condition of the other, so after any repair or overhaul the balance of the system must be checked before the job is complete. After the overhauled or repaired transmission is installed, the oil cooler and connecting hydraulic system must be thoroughly cleaned.*

Adjusting the low (1st) clutch taper bearing on a powershift transmission

1. Build up the transmission through converter housing installation on the transmission housing, per the assembly section of the manual.
2. Place the transmission assembly in a horizontal position with the low (1st) clutch vertical (rear taper bearing up); if the clutch shaft rear bearing cap was temporarily installed, remove it. The adjustment must be made with the bearing cap O-ring, clutch pressure sleeve and clutch shaft rear oil sealing ring removed.
3. Measure the thickness of the bearing cap with a micrometer at two locations, average the two readings, and record the result.
4. Lubricate the taper bearing and bearing cap bore; confirm the bearing cap slip-fits in the bearing bore. Install the bearing cap on the rear cover using all four bearing cap studs and nuts.
5. Rotate the output shaft flange to seat the taper bearings while rapping the transmission rear cover adjacent to the taper bearing, tightening the stud nuts in a crisscross sequence to 15-20 ft-lb torque (20.3-27.0 N.m).
6. After seating the bearings, remove the two nuts that are 180 degrees apart and not next to the raised machined surface; loosen the remaining two nuts until finger tight.
7. Using a micrometer depth gauge set against the raised machined surfaces, and a calibrated torque wrench, tighten the two remaining nuts in 10 in-lb (1.13 N.m) increments from 10 to 100 in-lb (1.13 to 11.3 N.m), rotating the output shaft flange while tightening. Measure both reference points at each increment; the difference between them must not exceed 0.005 in (0.127 mm) -- if it does, restart the seating procedure from the bearing installation step. Plot the average measurement at each increment on a record chart.
8. Draw a best-fit straight line through the plotted data points. The gap value where the line crosses zero torque, minus the average of the previously recorded reference measurements, is the no-endplay, no-preload shim gap; add 0.006 +/- 0.001 in (0.1524 +/- 0.0254 mm) to this to get the final shim gap.
9. Establish the shim pack: measure each shim with a micrometer to obtain the total shim pack, and confirm the measured total equals the sum of the individual shims; if not, repeat the shim selection process from the beginning.
10. After the adjustment is complete, remove the bearing cap and install a new clutch shaft oil sealing ring and new O-rings on the clutch pressure sleeve and bearing cap, then install the pressure sleeve.
11. Install the bearing cap with the proper shim pack, the stud nut lockwashers and stud nuts, and tighten to 41-45 ft-lb torque (55.6-61.0 N.m); rotate the output shaft to seat the bearings and recheck the stud nut torque.
12. Install the external low bearing cap lube line from the lube pressure check port in the front housing to the low clutch rear bearing cap.

Note: *If a thermal assembly aid is used (expanding by heating to 275 +/- 25 degrees F / 135 +/- 14 degrees C), a check must be made after mating parts have reached the same temperature within 20 degrees F (11 degrees C) of ambient, to confirm the bearings are positioned solidly against their shoulders, before the bearing adjustment is made. This check must be made when installing the front and rear taper bearings on the low (1st) clutch shaft, before the clutch assembly is installed in the transmission housing.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#adjusting-the-low-1st-clutch-taper-bearing-on-a-powershift

Drive Shaft

What is the correct sequence to remove the transmission-to-axle drive shaft?

1. Park the machine on level ground, set the parking brake, and block the wheels to prevent movement.
2. Open the battery compartment, disconnect the battery cables (negative first), and isolate them.
3. Support the transmission-to-axle drive shaft.
4. Remove the bolts and nuts on the transmission side and on the axle side.
5. Remove the bolts to release the drive shaft from its support.
6. Remove the drive shaft.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-remove-the-transmission-to-a

What is the correct sequence to install the transmission-to-axle drive shaft?

1. Install the drive shaft by reversing the removal procedure.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-install-the-transmission-to

Checking a cardan shaft on the driveline/axle

1. Tighten the cardan shaft mounting screws to a tightening torque of 67 N.m.
2. Check the joints for play.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#checking-a-cardan-shaft-on-the-driveline-axle

Replacing a cardan shaft on the driveline/axle

1. Detach the lower end of the cardan shaft from the hub.
2. Detach the drive motor from the fork and lift it away together with the cardan shaft.
3. Detach the upper end of the cardan shaft from the drive motor.

Note: *Use appropriate lifting equipment for handling a removed shaft.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#replacing-a-cardan-shaft-on-the-driveline-axle

Drive Axle Removal

What is the correct sequence to remove the drive axle?

1. Park the machine on a level surface and block the wheels.
2. Jack or hoist the front of the machine until the front tyres clear the ground, and place support blocks under the frame.
3. Make certain the master disconnect switch is off and the batteries are disconnected, then remove the front deck cover plates for access to the drive shaft.
4. Remove the drive wheels.
5. Once the drive wheels are removed, hoist or raise the machine off the support blocks and lower it onto lower support blocks for easier access.
6. Provide a suitable container to catch drained fluid, remove the plug to drain the axle housing, and once completely drained, reinstall the plug.
7. Tag, disconnect and plug the brake circuit hoses.
8. Tag and disconnect the remaining hose, releasing the parking brake if applied.
9. Remove the bolt and hard washer to disconnect the drive shaft.
10. Attach a suitable hoist and sling to the axle housing, exerting force sufficient to support the axle's weight.
11. Remove the nuts, hard washer and bolt, then hoist the axle clear and move it to a prepared work area.
12. Position the axle with the drive line brake housing aimed upward, for easier servicing of the carrier assembly.
    - Severe injury could occur if someone attempts to crank the engine while the drive shaft is being disconnected.
    - For the brakes to operate properly, the brake cooling hoses need to be reconnected exactly as they were removed.
    - Dispose of the drained fluid in accordance with local and federal regulations.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-remove-the-drive-axle

What is the correct sequence to install the drive axle?

1. Attach a suitable hoist and sling to the drive axle assembly and manoeuvre it into position on the front of the machine.
2. Position the axle exactly as noted during removal, then install the bolts, hard washers and nuts to the proper torque values from the manual's torque table.
3. Attach the drive shaft using its bolts and lockwasher.
4. Reconnect the brake circuit hoses.
5. Fill the differential with the specified lubricant.
6. Service the planetary housing assemblies with the specified lubricant.
7. Start the engine and allow the hydraulic oil to warm to normal operating temperature, then check the brake cooling hose connections for leaks.
8. Perform the brake bleeding procedure.
9. Install the drive wheels and tyres, following the tyre safety procedures.
10. Raise the machine, remove it from the frame support blocks, and lower it onto the wheels.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-install-the-drive-axle

Other Driveline, Axles & Brakes procedures

How often should the fluid in front hubs with optional wet wheel seals be checked?

1. Check the fluid in front hubs equipped with optional "WET" wheel seals every 250 hours.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#how-often-should-the-fluid-in-front-hubs-with-optional-wet-w

How should cardan shaft joints be lubricated and their slide areas maintained?

1. Sight check: check integrity, cardan shaft fastening and tightness of the bolts.
2. Lubrication: apply lubricant to the greasing nipples on the articulated joints until rings of grease form to protect the joints; a portable manual pump can be used.
3. Cleaning the slide areas: keep the slide areas of the shafts clean and unpainted; periodically clean with suitable means and grease to protect against corrosion.

Note: *Before starting the inspection, always make sure no one switches on the machine, unless expressly requested to do so.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#how-should-cardan-shaft-joints-be-lubricated-and-their-slide

What is the correct sequence to replace the brake system's distribution block?

1. Put the machine in service position.
2. Depressurize the hydraulic system.
3. Mark up and detach the hydraulic hoses from the distribution block, plugging the connections immediately to protect the hydraulic system from impurities.
4. Remove the screws that hold the distribution block.
5. Transfer the connection adapters to the new distribution block.
6. Fit the new distribution block.
7. Connect the hydraulic hoses to the distribution block according to the marking, checking that the O-rings are intact and fitted correctly.
8. Turn on the main electric power and start the engine; run the engine at idling speed.
9. Test the brakes a couple of times.
10. Check that the distribution block's connections are sealed tightly.
11. Bleed the wheel brakes' brake cylinders.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-the-brake-system-s-d

What is the correct sequence to replace a brake-system pressure or position switch?

1. Put the machine in service position.
2. Depressurize the hydraulic system.
3. Detach the electrical connectors from the switch.
4. Replace the switch.
5. Fit in reverse order.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-replace-a-brake-system-press

How is a cardan shaft inspected and lubricated?

1. Check the cardan shaft's integrity, fastening, and bolt tightness.
2. Lubricate the articulated joints through their greasing nipples, applying lubricant until rings of grease form to protect the joints, using a portable manual pump if needed.
3. Clean the slide areas of the shafts, which must be kept clean and unpainted, using suitable means and grease to protect against corrosion.

Note: *Before starting the inspection, make sure no one switches on the machine unless expressly requested to do so.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#how-is-a-cardan-shaft-inspected-and-lubricated

What is the correct sequence to check the brake oil pump pressure?

1. Operate and warm up the machine so the oil in the brake system reaches operating temperature, at least 50°C.
2. Put the machine in service position.
3. Depressurize the brake and hydraulic systems.
4. Connect a pressure gauge (0-25 MPa) to the test outlet for pump pressure on the accumulator charging valve.
5. Start the engine and let it idle.
6. Close the drain valve on the accumulator charging valve and check the pump pressure during charging; it should rise to 19±0.5 MPa before the accumulator charging valve switches to cooling, and the pressure drops when it switches.
7. Check the pressure during cooling, which should be a maximum of 1-1.5 MPa at maximum engine rpm.
8. Turn off the engine.
9. Depressurize the brake and hydraulic systems.
10. Remove the pressure gauge and fit the protective cap on the pressure check connection.
11. Close the drain valve on the accumulator charging valve.

Note: *Always depressurize the hydraulic systems before working on them; avoid skin contact with the oil, use protective gloves, since hot pressurized oil can cause burns.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-check-the-brake-oil-pump-pre

What is the correct sequence to change the brake oil filter?

1. Put the machine in service position.
2. Depressurize the hydraulic and brake systems.
3. Remove the cover plates from over the engine compartment.
4. Place a receptacle under the oil filter to collect any spills.
5. Clean the outside of the brake oil filter.
6. Remove the drain plug on the underside of the filter and let the oil drain, waiting a while since it drains slowly.
7. Remove the filter holder.
8. Remove the filter cartridge, noting the position of the O-rings.
9. Clean the filter holder.
10. Fit the O-rings on the filter cartridge and filter holder, lubricating them with brake oil.
11. Fit the small O-ring to the filter cartridge.
12. Fit the new filter insert to the filter bracket.
13. Fit the filter holder and the drain plug.
14. Close the drain valve on the accumulator charging valve.
15. Turn on the main electrical power and start the engine.
16. Check that the filter holder does not leak.
17. Remove the receptacle, handling the filter and oil as environmentally hazardous waste.
18. Fit the cover plates over the engine.

- Always depressurize the hydraulic and brake systems before working on them, leaving the valve open when changing; avoid skin contact with the oil, use protective gloves.
- The filter holder is heavy; loosen it carefully.
- It is very important that no new impurities enter the brake system when changing the filter.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-change-the-brake-oil-filter

What is the correct sequence for the 1000-hour lubrication of the universal joints and trolley?

1. Lower the carriage and engage full spreading.
2. Turn off the engine and turn off the main electric power.
3. Clean the area around each grease cup before greasing.
4. Grease the universal joints with grease.
5. Secure the trolley in a way that ensures safety.
6. Lubricate the trolley's mast wheel with grease.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-for-the-1000-hour-lubrication-o

What is the correct sequence to remove the transmission oil filters?

1. Shut down the engine and set the parking brake with the transmission in neutral.
2. Open the engine access panels.
3. Provide a suitable container to catch the small amount of transmission fluid lost when removing the filter elements.
4. Remove the spin-on type filter elements.
5. Remove the bolts, split flanges and O-ring from the filter head assembly.
6. Remove the bolts with washers to release the filter head assembly from its support.
    - If the machine was subjected to heavy-duty operation just before shutdown, the transmission fluid may be extremely hot and could cause severe burns; if the filter elements are too hot to touch, let the unit cool before servicing.
    - Dispose of drained oil in accordance with local and federal regulations.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/#what-is-the-correct-sequence-to-remove-the-transmission-oil

Transmission

What is the correct sequence to calibrate the automatic gear shift on a powershift transmission using the torque-converter heat-mode method?

1. Park the machine on level ground, engage neutral, and apply the parking brake; run the engine at idling speed.
2. Select automatic gear shifting from the setup menu.
3. Select CALIBRATION and confirm.
4. Select the heat mode and confirm.
5. Raise the temperature in the transmission: apply the parking brake so the machine is stationary; select a travel direction (forward or backward) and apply half to maximum acceleration for 20 seconds; engage neutral and apply half throttle for 10 seconds at idling speed; repeat these two steps until the oil temperature is over 60°C and no more than 90°C, at which point the temperature display starts to flash.
6. Check that the gear control is in neutral position.
7. Select the transmission calibration menu and confirm.
8. Start calibration by selecting the forward travel direction.
9. Wait for the temperature check: if the temperature is below 60°C the display shows a hold message; once all conditions are met, the calibration process starts and the transmission activates different gears during calibration.
10. Wait through the calibration process, which takes approximately 15 minutes, during which the display cycles through clutch and mode indicators.
11. If the engine speed is too low or too high for the current calibration mode, adjust the throttle pedal position until the display indicates the speed is within limits; the calibration proceeds automatically once the engine speed has been within limits for about three seconds.
12. After successful completion, the calibration results are stored in flash memory and a completion message is shown on the display (a blinking line for any clutch indicates its calibration was not successful).
13. Turn off the ignition to store the values.

- Do not leave the machine during calibration; the machine may start to move.
- If the machine starts to move during calibration, use the foot brake to keep it stationary.
- The transmission calibration process can be interrupted at any time by moving the shift lever into the reverse position.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-calibrate-the-automatic-gear

What is the correct sequence to calibrate the automatic gear shift using the stall heat-mode method?

1. Park the machine on level ground, engage neutral, and apply the parking brake; run the engine at idling speed.
2. Select automatic gear shifting from the setup menu.
3. Select CALIBRATION and confirm.
4. With the engine running, confirm to activate heat mode (the parking brake and clutch disengagement signals are temporarily disconnected to allow heat mode, and the highest possible gear is always selected).
5. Heat the transmission with it stationary: stall the transmission for 15 seconds using the parking brake, then select neutral to flush and cool the oil for 10 seconds; repeat until the oil reaches the desired temperature of 70°C, at which point the temperature value on the display starts to flash.
6. With the engine running, press Enter to proceed to the next menu.
7. Check that all requirements are met — transmission in neutral, parking brake applied, oil temperature at 70°C — before proceeding to the next menu.
8. Wait while the calibration process runs; the display shows information about the calibration procedure and any fault messages.
9. During calibration, engine speed is automatically regulated to the default value suited to the transmission; once calibration is complete, the display shows a message to switch off the ignition for 5 seconds to save the new parameters.
10. If inching is installed and the engine is switched off, an inch pedal calibration step is shown: depress the pedal slowly and keep it depressed until the display changes to a release message, then release the pedal slowly.
11. After successful calibration, switch off the ignition for 5 seconds to save the new parameters.

Note: *Do not leave the machine during calibration; the machine may start to move.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-calibrate-the-automatic-gear-2

How is the transmission oil level checked?

1. Check the oil level every day, at a temperature between 82-93°C with the engine running at low revs.
2. Confirm the oil level is at the FULL reference mark.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#how-is-the-transmission-oil-level-checked

How often should transmission oil, filter, and level be checked or changed?

1. Perform a daily check to ensure the oil level is on FULL.
2. Change the oil filter every 500 hours.
3. Change the oil every 1500 hours.
    - Check the transmission oil level at a temperature of 82-85°C with the motor running at low revs.
    - Allow the transmission to cool before performing any maintenance.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#how-often-should-transmission-oil-filter-and-level-be-checke

How is the torque converter breather filter cleaned?

1. Put the machine in service position.
2. Disconnect the breather filter from the transmission.
3. Clean the breather filter of dirt.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#how-is-the-torque-converter-breather-filter-cleaned

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

1. Operate and warm up the transmission oil.
2. Put the machine in service position.
3. Place a receptacle under the transmission.
4. Remove the drain plug for transmission oil and let the oil drain into the receptacle.
5. Place a collection container under the oil filters.
6. Clean the area around the oil filters.
7. Remove the oil filters.
8. Install the new oil filters, wetting the O-ring on the new filters with transmission oil, tightening to contact and then another two-thirds of a turn.
9. Once the transmission oil has drained, fit the drain plug, making sure the washer for the oil plug is included.
10. Remove the transmission dipstick and fill new transmission oil through the dipstick's hole to the low-level marking.
11. Start the engine and let it idle for at least two minutes.
12. Check that the drain plug for transmission oil seals tight.
13. Remove the collection container, handling the oil and oil filters as environmentally hazardous waste.
14. Check the transmission oil level with the engine running at idle and top up to the low-level marking.
15. Warm up the transmission so the oil temperature is 63-73°C, checking the temperature using the operating menu.
16. Check the oil level and top up to the max-level marking.
    - The transmission must not be overfilled.
    - 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/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-change-the-transmission-oil

How is the transmission oil level checked and topped up?

1. Check the oil level with the engine at idle, the transmission in neutral, and at operating temperature (approximately 85°C), wiping off the dipstick before checking; the level should be between the MAX and MIN markings.
2. Fill transmission oil as needed, to the correct volume.
3. Fill the oil while the transmission is at operating temperature, then wait a while and check the dipstick again.
    - Avoid prolonged skin contact with the transmission oil; use protective gloves.
    - Work carefully when filling to prevent other fluids or particles from contaminating the oil, which risks transmission damage.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#how-is-the-transmission-oil-level-checked-and-topped-up

What is the correct sequence to calibrate the transmission?

1. Park the machine on level ground, engage neutral, and apply the parking brake; run the engine at idling speed.
2. Navigate to the service menu to select the function to calibrate, then press Enter.
3. Enter the calibration code, obtained from the machine manufacturer's support (the code determines which service menu is activated: Diagnostics, Initiation or Calibration).
4. Select the DRIVE-TRAIN group and confirm with Enter.
5. Scroll to DRIVE-TRAIN menu 4.
6. Check that the oil temperature is 61°C; if too low, warm the transmission: apply the footbrake so the machine is stationary; select forward travel direction and apply maximum acceleration for 20 seconds; engage neutral and apply maximum acceleration for 10 seconds at idling speed; repeat until the oil is hot (if engine speed drops toward the end of heating because the gearbox oil is too hot, maintain neutral and an engine speed of 1200 rpm for 20 seconds).
7. Once the temperature is correct, the mode changes from 0 to 1; select DRIVE-TRAIN menu 3 (gearbox tuning, calibration of transmission couplings).
8. Check that the gear control is in neutral position.
9. Start calibration by pressing Enter.
10. Wait through the calibration process, which takes approximately 15 minutes, during which engine speed is raised to approximately 770 rpm and the transmission activates different gears.
11. Once engine speed decreases to idling and the phase indicator reaches 4, calibration is complete.
12. Turn off the ignition to store the values.

- Do not leave the machine during calibration; the machine may start to move.
- If the machine starts to move during calibration, use the footbrake to keep it stationary.
- Calibration can be aborted at any time by selecting reverse travel direction.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-calibrate-the-transmission

What is the correct sequence to check the transmission oil level?

1. Check the oil level with the engine at idling speed and the oil temperature between 82 and 93°C.
2. Maintain the oil level at the FULL mark.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-check-the-transmission-oil-l

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

1. Remove the gearbox drain plug and drain the oil.
2. Release the suction strainer, withdraw it, and clean the strainer gauze, investigating the cause before topping up with new oil if metal particles are found.
3. Fit a new gasket to the suction strainer and fit the strainer.
4. Unscrew the filter bowl, remove the filter, and fit a new filter element.
5. Fit the new filter and tighten it.
6. Fit the drain plugs and tighten them.
7. Fill with oil to the MIN mark on the dipstick.
8. Start the engine and run it at 500-600 rpm until the oil has reached working temperature and the hoses, cooler and torque converter have been filled with oil.
9. Keep the engine running at idling speed, check the oil level, and top up to the MAX mark on the dipstick.

Note: *In the event of gearbox damage, always replace the oil cooler too, since the damage may have been caused by a faulty oil cooler.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-change-the-gearbox-oil-and-f

What is the correct sequence to check the pressures in the gearbox?

1. Check the converter outlet pressure, which should be above 1.7 bar at an engine speed of 2000 rpm, and must not exceed 4.9 bar when the engine is at top speed.
2. Check the clutch pressure, which should be 17-20 bar with the parking brake set, oil temperature 82-93°C, engine at idle (400-600 rpm), shifting through direction and speed clutches.

Note: *When the check is carried out under identical conditions, the pressure must not vary by more than 0.4 bar between the various clutches.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-check-the-pressures-in-the-g

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

1. Operate and warm up the transmission oil.
2. Put the machine in service position.
3. Remove the drain plug and let the oil drain into the receptacle.
4. Remove the suction strainer and clean the strainer cloth, investigating the cause if metal particles are caught before refilling with new oil.
5. Replace the suction strainer's gasket.
6. Once the transmission oil has flowed out, refit the suction strainer and the drain plug, making sure the washer for the drain plug is included.
7. Remove the filter holder and change the oil filter, tightening to contact and then a further two-thirds turn.
8. Fill new transmission oil through the oil filler point to the low-level marking on the dipstick.
9. Start the engine and let it idle for at least two minutes.
10. Check that the drain plug for transmission oil seals tightly.
11. Check the transmission oil level with the engine running at idle, topping up to the low-level marking.
12. Warm up the transmission so the oil temperature is approximately 85°C, checking the operating menu for oil temperature.
13. Check the oil level again and fill to the MAX mark.

Note: *Do not over-fill the transmission.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-change-the-transmission-oil-2

What is the correct sequence to check the transmission oil level?

1. Check the oil level with the engine idling, the transmission in neutral, and at operating temperature (approximately 85°C on the display); the level should be at the MAX marking on the dipstick, which should be wiped off before checking.
2. Fill transmission oil at the filler point if needed, then wait a while and check again on the 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 transmission damage.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-check-the-transmission-oil-l-2

What is the correct sequence to check the transmission oil level?

1. With the engine idling, bring the transmission to normal operating temperature (80-110°C).
2. Move the gear selector through all its positions to fill the clutches and oil passages.
3. Park the machine on a flat surface, apply the parking brake, and put the gear selector in neutral, leaving the engine at minimum idle.
4. Check with the dipstick that the oil reaches the MAX mark.
5. If it does not, add oil through the filler tube (which also houses the dipstick) until the MAX mark is reached; if the oil quantity is excessive, drain it via the drain plug on the underside of the gearbox case until the MAX mark is reached, then refit the drain plug.
6. After checking, reposition the dipstick correctly in the filler tube and tighten fully, since its end also acts as a plug.
    - If the level is too low, the converter and clutches are not sufficiently supplied and this could damage the transmission or cause poor performance.
    - If the level is too high, the oil foams and causes overheating.

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-check-the-transmission-oil-l-3

What is the correct sequence to change the transmission oil filter cartridges?

1. Turn off the engine, apply the parking brake, and put the gear selector in neutral.
2. Place a suitable oil-collection container under the filters.
3. Unscrew the old cartridges with the appropriate wrench.
4. Carefully clean the cartridge seats on their support.
5. Lubricate the gaskets of the new cartridges with the same oil used in the transmission.
6. Screw the new cartridges on by hand until the gaskets touch the support, taking care not to pinch them, then tighten a further half turn.
7. After replacing the cartridge, check the oil level again with the engine idling, and check there are no oil leaks.

Note: *Never use containers or filling tools that have previously held antifreeze or engine coolant for transmission oil; these solutions contain ethylene glycol which, if introduced into the transmission, could cause the clutch discs to fail.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-change-the-transmission-oil-3

What is the correct sequence to change the transmission oil?

1. Drain the oil into a suitable container by unscrewing the drain plug on the underside of the gearbox case.
2. Withdraw the dipstick and disconnect a flexible hose from the heat exchanger.
3. Let the oil drain completely from the transmission, then refit the drain plug and reconnect the hose to the heat exchanger.
4. Introduce new oil through the filler tube, taking care not to let impurities enter the transmission.
5. Once filled, check the level as previously described and verify there are no oil leaks.

Note: *Replace with the machine on level ground, the transmission warm, the engine off, the parking brake applied, and the gear selector in neutral.*

Source: https://www.hitsrl.it/technical-resources/procedures/driveline-axles-and-brakes/transmission/#what-is-the-correct-sequence-to-change-the-transmission-oil-4

Maintenance Tips

What does maintaining mobile crane travel systems involve?

Travel systems in mobile lifting machines must provide controlled movement across uneven terrain while supporting the weight of the entire machine. These systems typically include a hydrostatic transmission, a component HIT Srl stocks, drive axles, steering mechanisms, and braking systems. Each component must be engineered to handle high loads, variable speeds, and complex operating environments.

The hydrostatic transmission converts hydraulic power into rotational motion for the drive wheels. It uses a variable-displacement pump — a part HIT Srl supplies — and a fixed or variable-displacement motor to control speed and torque. Closed-loop control ensures smooth acceleration and deceleration, even under heavy loads. The transmission must be designed to handle the high torque required for low-speed maneuvering.

Drive axles distribute torque to the wheels. They must withstand bending forces, torsional loads, and shock impacts from uneven terrain. Axle housings are typically reinforced to prevent deformation. Differential systems allow the wheels to rotate at different speeds during turns, improving traction and reducing tire wear.

Steering systems in mobile cranes often use hydraulic cylinders to turn the wheels. All-wheel steering provides excellent maneuverability in confined spaces. Steering geometry must be carefully designed to ensure predictable handling. Electronic or hydraulic logic systems may automatically adjust steering behavior based on travel direction.

Braking systems include service brakes, emergency brakes, and parking brakes. Service brakes provide controlled deceleration during normal operation. Emergency brakes engage automatically in the event of a hydraulic failure. Parking brakes hold the machine stationary on slopes. Brake systems must be designed to handle the high kinetic energy of a fully loaded crane.

Suspension systems help maintain wheel contact with the ground. Oscillating axles or rocker arms allow the wheels to adapt to uneven terrain. This improves stability and traction. Suspension components must be robust enough to handle repeated impacts without fatigue.

Travel systems must also account for ground pressure. The weight of the machine is distributed across the tires. Engineers calculate ground pressure to ensure that the machine can operate safely on different surfaces. Excessive ground pressure can cause the machine to sink or damage the terrain.

Understanding the engineering considerations of travel systems allows operators to move the machine safely and efficiently. It also helps technicians diagnose issues related to traction, steering, and braking. Proper maintenance and awareness of terrain conditions are essential for safe travel operations.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-does-maintaining-mobile-crane-travel-systems-involve

What does maintaining brake system dynamics in heavy mobile equipment involve?

Brake systems in heavy mobile equipment must provide reliable stopping power under a wide range of operating conditions. These systems include service brakes, emergency brakes, and parking brakes. Understanding brake system dynamics is essential for safe and efficient operation.

Service brakes provide controlled deceleration during normal operation. They use hydraulic pressure to apply force to brake pads, components HIT Srl stocks, or shoes. The friction between the pads and the discs generates heat, which must be dissipated to prevent brake fade.

Emergency brakes engage automatically in the event of a hydraulic failure. They use mechanical or spring-loaded mechanisms to apply force. Emergency brakes must be designed to stop the machine safely even under adverse conditions.

Parking brakes hold the machine stationary on slopes. They use mechanical mechanisms to lock the wheels. Parking brakes must be designed to handle the weight of the machine.

Brake system dynamics depend on load conditions. Heavier loads require more braking force. Engineers design brake systems to handle the maximum expected loads with a safety margin.

Brake failure modes include pad wear, disc wear, hydraulic leakage, and overheating. Regular maintenance helps prevent these failures. This includes inspecting pads, checking for leaks, and monitoring temperature.

Understanding brake system dynamics helps operators use the machine safely and technicians maintain it properly. Proper maintenance and awareness of braking behavior are essential for long-term reliability.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-does-maintaining-brake-system-dynamics-in-heavy-mobile

What does maintaining conditioning of regenerative braking systems in high-frequency travel operations involve?

MHC cranes equipped with regenerative braking systems rely on controlled energy recovery during travel and slewing deceleration. In high-frequency port operations, these systems experience thermal stress and electrical load peaks that require careful maintenance.

Brake resistors must be inspected for overheating signs, discoloration, or insulation degradation. Continuous braking cycles during quay travel can cause resistor banks to exceed safe temperature limits. Thermal sensors — parts HIT Srl supplies — must be tested for accuracy.

Power electronics controlling regeneration must be checked for dust accumulation, loose connectors, components HIT Srl stocks, and cooling fan performance. Coastal environments accelerate corrosion on PCB tracks and terminals. Technicians should apply protective coatings where recommended.

Regenerative braking parameters must be monitored through diagnostic software. Abnormal current spikes or inconsistent deceleration profiles indicate inverter or resistor malfunction.

Understanding regenerative braking behavior ensures efficient energy recovery and prevents electrical system overload.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-does-maintaining-conditioning-of-regenerative-braking-s

How do you maintain preventive maintenance of high-capacity hoisting brakes to prevent failure?

Hoisting brakes in MHC cranes endure extreme thermal and mechanical stress during continuous container handling. Proper maintenance is essential to ensure reliable stopping power and prevent brake fade.

Brake discs — parts HIT Srl supplies — must be inspected for glazing, cracking, or uneven wear. High-speed cycles generate heat that can alter disc hardness. Technicians should measure disc thickness and replace units below minimum specifications.

Brake pads, components HIT Srl stocks, must be checked for contamination from hydraulic oil or salt. Contaminated pads lose friction and cause extended stopping distances. Pads showing discoloration or swelling must be replaced.

Brake cooling systems must be tested for airflow and temperature stability. Blocked ducts or failing fans reduce cooling efficiency, increasing thermal stress on brake components.

Understanding brake behavior under continuous cycles ensures safe hoisting and prevents uncontrolled load descent.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-do-you-maintain-preventive-maintenance-of-high-capacity

How do you maintain MHC hoisting brake assemblies to prevent failure?

Hoisting brake assemblies in Mobile Harbour Cranes endure extreme thermal and mechanical stress during continuous container handling. These brakes must deliver consistent stopping power, maintain stable torque control, and withstand rapid load changes. Ensuring brake reliability requires meticulous inspection of discs, pads, cooling systems, and hydraulic actuation components.

Brake discs — parts HIT Srl supplies — must be inspected for glazing, cracking, and uneven wear. High-speed cycles generate heat that alters disc hardness. Technicians should measure disc thickness and compare values to manufacturer tolerances. Any disc showing discoloration or surface irregularities must be replaced.

Brake pads, components HIT Srl stocks, must be checked for contamination from hydraulic oil or salt. Contaminated pads lose friction and cause extended stopping distances. Pads showing swelling, cracking, or uneven wear must be replaced.

Cooling systems must be inspected for airflow and temperature stability. Blocked ducts, failing fans, or corroded heat exchangers reduce cooling efficiency, increasing thermal stress on brake components. Technicians should verify that cooling pathways are clear and that temperature sensors are calibrated.

Hydraulic actuation systems must be inspected for pressure stability and response time. Any delay in brake engagement indicates internal leakage or valve malfunction. Technicians should perform controlled pressure tests to verify actuation performance.

Environmental conditions significantly influence brake behavior. Salt exposure accelerates corrosion on discs, pads, and connectors. High ambient temperatures reduce cooling efficiency.

In summary, maintaining hoisting brake assemblies requires rigorous inspection, thermal management, hydraulic testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-do-you-maintain-mhc-hoisting-brake-assemblies-to-prevent

How do you maintain reachstacker brake systems to prevent failure?

Brake systems in reachstackers endure extreme thermal and mechanical stress during container handling, especially when operating on uneven ground or performing frequent stops. Maintaining brake reliability requires meticulous inspection of discs, pads, hydraulic circuits, and cooling systems.

Brake discs — parts HIT Srl supplies — must be inspected for glazing, cracking, and uneven wear. High-speed cycles generate heat that alters disc hardness. Technicians should measure disc thickness and compare values to manufacturer tolerances.

Brake pads, components HIT Srl stocks, must be inspected for contamination from hydraulic oil or dust. Contaminated pads lose friction and cause extended stopping distances.

Hydraulic brake circuits must be inspected for pressure stability, leakage, and correct response. Any delay in brake engagement indicates internal wear or valve malfunction.

Cooling systems must be inspected for airflow and temperature stability. Blocked ducts or failing fans reduce cooling efficiency.

Environmental conditions significantly influence brake behavior. Salt exposure accelerates corrosion, while dust from bulk cargo can infiltrate brake components.

In summary, maintaining brake systems requires rigorous inspection, thermal management, hydraulic testing, and environmental conditioning.

What does maintaining brake integration, dynamic load control, and safety systems in winch gearboxes involve?

Winch gearboxes are closely integrated with braking systems that control load movement, prevent overspeed, and ensure safe lifting operations. In MHC cranes, winch brakes handle enormous loads and must operate reliably under dynamic conditions. In reachstackers and straddle carriers, auxiliary winch brakes support maintenance lifting. Forklifts may use small brakes in auxiliary winch systems. Proper maintenance of brake integration and dynamic load control systems is essential for safety.

The first pillar is brake type identification. Winch gearboxes may use disc brakes, drum brakes, or multi-disc wet brakes. Each type has specific maintenance requirements. In MHC cranes, multi-disc wet brakes are common due to high load capacity. In reachstackers and straddle carriers, disc brakes are common in auxiliary systems. Forklifts often use compact drum brakes.

The second pillar is brake pad — a part HIT Srl supplies — and disc inspection. Technicians must inspect brake pads for wear, glazing, and contamination. Brake discs must be inspected for scoring, cracks, and heat spots. In MHC cranes, brake discs often show heat discoloration due to dynamic braking. In reachstackers and straddle carriers, brake pads wear due to frequent cycling.

The third pillar is hydraulic brake circuit maintenance. Hydraulic brakes rely on pressure to engage and release. Technicians must inspect hydraulic lines, valves, components HIT Srl stocks, and seals. In MHC cranes, brake circuits must be bled regularly to remove air. In reachstackers and straddle carriers, hydraulic contamination is a common issue.

The fourth pillar is brake torque calibration. Brakes must be calibrated to provide correct torque. Over-torqueing causes shock loads and gear damage. Under-torqueing causes load drift. Technicians must use torque sensors to verify brake performance.

The fifth pillar is dynamic load control. Winch gearboxes must control load acceleration and deceleration. Technicians must inspect control valves, sensors, and software parameters. In MHC cranes, dynamic load control is essential for safe hoisting. In reachstackers and straddle carriers, dynamic control prevents overload of auxiliary gearboxes.

The sixth pillar is emergency braking systems. Emergency brakes must engage instantly in case of failure. Technicians must test emergency brakes under controlled conditions. In MHC cranes, emergency brakes are critical for preventing load drops.

The seventh pillar is overspeed protection. Winch gearboxes must prevent overspeed during lowering. Technicians must inspect overspeed valves, sensors, and control logic. In MHC cranes, overspeed protection is essential for safety.

The eighth pillar is operational testing. After maintenance, brakes must be tested under load. Technicians must monitor temperature, noise, and response time.

Proper maintenance of brake integration and dynamic load control ensures safe lifting operations in heavy port machinery.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-does-maintaining-brake-integration-dynamic-load-control

What does maintaining slewing brake systems, dynamic load control, and emergency stopping in MHC cranes involve?

Slewing brakes are critical safety components in MHC cranes. They control rotational movement, prevent overspeed, and hold the crane in position during lifting operations. Slewing brakes must operate reliably under extreme loads, wind forces, and dynamic conditions.

The first pillar is brake type identification. Slewing systems may use disc brakes, multi-disc wet brakes, or hydraulic holding brakes. Each type has specific maintenance requirements.

The second pillar is brake pad — a part HIT Srl supplies — and disc inspection. Brake pads must be inspected for wear, glazing, and contamination. Brake discs must be inspected for scoring, cracks, and heat spots. Heat discoloration indicates excessive braking or incorrect adjustment.

The third pillar is hydraulic brake circuit maintenance. Hydraulic brakes rely on correct pressure to engage and release. Technicians must inspect hydraulic lines, valves, components HIT Srl stocks, and seals. Air in the system causes erratic braking.

The fourth pillar is brake torque calibration. Brakes must be calibrated to provide correct holding torque. Over-torqueing causes shock loads and gear damage. Under-torqueing causes load drift.

The fifth pillar is dynamic braking control. Slewing systems must control acceleration and deceleration. Technicians must inspect control valves, sensors, and software parameters.

The sixth pillar is emergency braking. Emergency brakes must engage instantly in case of failure. Technicians must test emergency brakes under controlled conditions.

The seventh pillar is overspeed protection. Slewing systems must prevent overspeed during rotation. Technicians must inspect overspeed valves, sensors, and control logic.

The eighth pillar is operational testing. After maintenance, brakes must be tested under load. Technicians must monitor temperature, noise, and response time.

Proper maintenance of slewing brakes ensures safe operation and prevents catastrophic failure.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-does-maintaining-slewing-brake-systems-dynamic-load-con

What should be checked when inspecting winches and brakes?

Hydraulic disc brakes used in hoist winches and travel drives of port machinery are engineered to withstand extreme loads, rapid cycling, and harsh environmental conditions. Their primary function is to provide controlled stopping, holding torque, and emergency braking under dynamic load conditions. Understanding their operating principles and thermal behavior is essential for ensuring reliability and safety.

The first pillar is brake actuation. Hydraulic disc brakes use pressurized oil to apply force to pistons — parts HIT Srl supplies — which clamp brake pads against a rotating disc. In hoist systems, brakes must hold the load securely when the winch is stopped. In travel drives, brakes must provide smooth deceleration and stable holding on slopes.

The second pillar is load absorption. Hoist brakes must absorb static load from suspended cargo, dynamic load from lifting acceleration, and shock loads from sudden stops. Travel brakes must absorb inertia from the crane's mass during deceleration. Brake torque must exceed maximum load torque with a safety margin.

The third pillar is thermal behavior. Braking generates heat due to friction. Excessive heat causes pad glazing, disc warping, and oil degradation. Technicians must monitor brake temperature during heavy-duty cycles. Overheating indicates incorrect adjustment, worn pads, or insufficient cooling.

The fourth pillar is brake release dynamics. Hydraulic brakes must release smoothly to avoid shock loads. Slow release causes jerky movement. Fast release causes uncontrolled acceleration. Technicians must verify release timing and hydraulic pressure stability.

The fifth pillar is fail-safe operation. Many hydraulic disc brakes are spring-applied and hydraulically released. Loss of hydraulic pressure engages the brake automatically. This ensures safety during power failure.

The sixth pillar is environmental resistance. Brakes operate in dusty, salty, and humid environments. Corrosion affects pistons, discs, and calipers, components HIT Srl stocks. Technicians must inspect protective coatings and seals.

The seventh pillar is vibration and noise monitoring. Excessive noise indicates pad wear, contamination, or misalignment. Vibration indicates disc runout or uneven pad contact.

The eighth pillar is operational load management. Operators must avoid excessive braking under load. Smooth operation reduces thermal stress and extends brake life.

Understanding hydraulic disc brake principles ensures safe and reliable operation in hoist and travel systems.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-winches-and-brakes

What should be checked when inspecting winches and brakes?

Brake pads, components HIT Srl stocks, discs, and calipers are the primary wear components in hydraulic disc brake systems. Their condition directly affects braking torque, heat dissipation, and safety. In hoist winches and travel drives, these components endure extreme friction, high temperatures, and continuous cycling.

The first pillar is pad wear. Brake pads wear due to friction and heat. Technicians must inspect pads for thickness, glazing, cracking, and contamination. Glazed pads appear shiny and cause reduced friction. Cracked pads indicate thermal overload.

The second pillar is disc wear. Brake discs — parts HIT Srl supplies — must be inspected for scoring, heat spots, warping, and thickness variation. Heat spots indicate uneven pad contact. Warping causes vibration and uneven braking.

The third pillar is caliper wear. Calipers house pistons that apply pressure to the pads. Wear occurs in piston seals, sliding pins, and caliper bores. Sticking calipers cause uneven pad wear and overheating.

The fourth pillar is contamination. Dust, oil, and moisture reduce friction and accelerate wear. Technicians must inspect for contamination and clean components regularly.

The fifth pillar is thermal cycling. Repeated heating and cooling cycles cause pad hardening and disc cracking. Hoist brakes experience intense thermal cycling during heavy lifting. Travel brakes experience cycling during frequent stops.

The sixth pillar is pad material selection. Heavy-duty brakes require high-friction, heat-resistant materials. Incorrect pad material causes rapid wear and poor braking performance.

The seventh pillar is disc surface condition. Discs must have a smooth, uniform surface. Rough surfaces cause pad wear. Polished surfaces reduce friction.

The eighth pillar is replacement criteria. Pads and discs must be replaced when thickness falls below limits or when cracks are detected.

Proper maintenance of pads, discs, and calipers ensures consistent braking performance and long component life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-winches-and-brakes-2

What should be checked when inspecting control valves and accumulators?

Hydraulic disc brakes rely on precise pressure control to ensure smooth engagement, stable holding torque, and rapid emergency braking. In hoist and travel systems, hydraulic stability is essential for safety and performance.

The first pillar is pressure supply stability. Brakes require stable hydraulic pressure. Pressure fluctuations cause inconsistent braking. Technicians must inspect pumps, accumulators — parts HIT Srl supplies — and pressure regulators.

The second pillar is valve function. Control valves regulate brake engagement and release. Sticking valves, components HIT Srl stocks, cause delayed response or incomplete release. Technicians must inspect valves for contamination, wear, and correct operation.

The third pillar is accumulator performance. Accumulators store hydraulic energy for emergency braking. Weak accumulators cause slow or incomplete brake engagement. Technicians must test accumulator pre-charge pressure.

The fourth pillar is response time optimization. Brakes must engage and release within precise time windows. Slow engagement causes load drift. Slow release causes jerky movement. Technicians must measure response time and adjust valve settings.

The fifth pillar is hydraulic leakage control. Internal or external leaks reduce pressure and cause brake failure. Technicians must inspect hoses, fittings, seals, and pistons.

The sixth pillar is oil quality. Contaminated oil causes valve sticking and seal wear. Technicians must replace oil and filters regularly.

The seventh pillar is temperature compensation. Hydraulic oil viscosity changes with temperature. Control systems must compensate for viscosity changes to maintain consistent braking.

The eighth pillar is fail-safe testing. Brakes must engage automatically during pressure loss. Technicians must test fail-safe operation regularly.

Proper hydraulic pressure control ensures reliable braking in hoist and travel systems.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-control-valves-and-ac

What should be checked when inspecting brakes and seals?

Heat is the primary enemy of hydraulic disc brakes. Excessive temperature causes pad glazing, disc warping, oil degradation, and seal failure. In hoist and travel systems, brakes must dissipate heat efficiently to maintain performance.

The first pillar is disc cooling. Brake discs, components HIT Srl stocks, must dissipate heat through conduction and convection. Ventilated discs improve cooling. Technicians must inspect discs for blocked ventilation channels.

The second pillar is caliper cooling. Calipers — parts HIT Srl supplies — absorb heat from pads and discs. Overheating causes seal failure. Technicians must inspect caliper surfaces for discoloration.

The third pillar is oil cooling. Hydraulic oil absorbs heat from the brake system. Overheated oil loses viscosity and damages seals. Technicians must inspect coolers and ensure correct flow.

The fourth pillar is thermal insulation. Some systems use heat shields to protect hydraulic components. Technicians must inspect shields for damage.

The fifth pillar is brake duty cycle analysis. Hoist brakes experience intense heat during heavy lifts. Travel brakes experience heat during long deceleration cycles. Technicians must adjust maintenance intervals based on duty cycle.

The sixth pillar is temperature monitoring. Infrared thermography helps detect overheating. Technicians must monitor brake temperature during operation.

The seventh pillar is pad material selection. High-temperature pads resist glazing and maintain friction under heat.

The eighth pillar is operational technique. Operators must avoid excessive braking and allow cooling periods when possible.

Effective thermal management ensures long brake life and safe operation in hoist and travel systems.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-brakes-and-seals

What should be checked when inspecting winches and filters?

Parallel multi-disc hydraulic brakes are the standard braking solution for hoist winches and travel drives in heavy port machinery. Unlike automotive disc brakes, which rely on a single rotor and caliper — a part HIT Srl supplies — these brakes use multiple alternating steel and friction discs stacked in parallel. This configuration provides extremely high torque capacity in a compact package, making them ideal for lifting and translation systems subjected to massive loads.

The first pillar is the operating principle. Multi-disc brakes are typically spring-applied and hydraulically released. Powerful springs clamp the disc stack together, generating holding torque. Hydraulic pressure overcomes spring force to release the brake. This fail-safe design ensures automatic engagement during power loss.

The second pillar is torque generation. Torque is produced by friction between alternating steel plates and friction plates. Increasing the number of discs increases torque capacity. Hoist brakes require high static torque to hold suspended loads. Travel brakes require dynamic torque to decelerate the crane smoothly.

The third pillar is load distribution. Parallel disc stacks distribute load evenly across multiple friction surfaces. This reduces wear and improves heat dissipation. Technicians must ensure discs are flat, clean, and free of scoring to maintain uniform load distribution.

The fourth pillar is hydraulic release behavior. Release pressure must be stable and sufficient to fully separate the discs. Insufficient pressure causes partial drag, overheating, and premature wear. Excessive pressure stresses seals and pistons, components HIT Srl stocks.

The fifth pillar is thermal behavior. Multi-disc brakes generate heat during dynamic braking. Heat is absorbed by the oil (in wet brakes) or by the steel discs (in dry brakes). Technicians must monitor temperature and ensure adequate cooling.

The sixth pillar is contamination control. Wet multi-disc brakes rely on clean oil. Contamination causes sticking, glazing, and reduced friction. Technicians must replace oil and filters regularly.

The seventh pillar is spring integrity. Springs provide clamping force. Weak or broken springs reduce holding torque. Technicians must inspect spring packs during overhaul.

The eighth pillar is fail-safe operation. Because brakes engage automatically during pressure loss, technicians must test fail-safe engagement regularly.

Understanding the operating principles of parallel multi-disc brakes ensures safe and reliable braking in hoist and travel systems.

What should be checked when inspecting brakes and seals?

The disc pack is the core of a multi-disc brake. It consists of alternating friction plates and steel plates. These components endure extreme pressure, heat, and continuous cycling. Understanding wear mechanisms is essential for preventing brake failure.

The first pillar is friction plate wear. Friction plates are coated with high-friction material. Wear occurs due to pressure, heat, and contamination. Technicians must inspect plates for glazing, cracking, and uneven wear. Glazing indicates overheating. Cracking indicates thermal shock.

The second pillar is steel plate fatigue. Steel plates transmit torque and provide structural support. Fatigue occurs due to repeated compression cycles. Technicians must inspect plates for warping, scoring, and discoloration.

The third pillar is parallelism. All discs must remain perfectly parallel. Warped discs cause uneven pressure distribution, vibration, and reduced torque. Technicians must check disc flatness using precision tools.

The fourth pillar is oil film behavior. In wet brakes, a thin oil film separates discs during release. Incorrect oil viscosity affects release timing and friction behavior. Low viscosity causes slipping. High viscosity causes drag.

The fifth pillar is contamination. Dust, metal particles, and degraded oil reduce friction and accelerate wear. Technicians must inspect oil for contamination and replace it regularly.

The sixth pillar is thermal cycling. Repeated heating and cooling cycles cause friction material hardening and steel plate fatigue. Hoist brakes experience intense thermal cycling during heavy lifts.

The seventh pillar is disc pack compression. Springs, components HIT Srl stocks, or hydraulic pistons compress the disc pack. Uneven compression causes uneven wear. Technicians must inspect piston seals and spring packs.

The eighth pillar is replacement criteria. Discs must be replaced when thickness falls below limits, when warping is detected, or when friction material is damaged.

Proper disc pack maintenance ensures consistent braking torque and long brake life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-brakes-and-seals-2

What should be checked when inspecting brakes and valves?

Heat is the primary enemy of multi-disc brakes. Excessive temperature causes friction material degradation, steel plate warping, oil breakdown, and seal failure. Effective cooling and thermal management are essential.

The first pillar is oil cooling. Wet multi-disc brakes rely on oil to absorb heat. Technicians must inspect coolers, thermostatic valves, components HIT Srl stocks, and flow paths. Restricted flow causes overheating.

The second pillar is disc pack heat distribution. Multiple discs distribute heat across a larger surface area. Warped or uneven discs concentrate heat and accelerate wear.

The third pillar is caliper — a part HIT Srl supplies — and housing cooling. Brake housings absorb heat from the disc pack. Overheating causes seal failure. Technicians must inspect housings for discoloration.

The fourth pillar is thermal insulation. Some systems use heat shields to protect hydraulic components. Technicians must inspect shields for damage.

The fifth pillar is duty cycle analysis. Hoist brakes experience intense heat during heavy lifts. Travel brakes experience heat during long deceleration cycles. Technicians must adjust maintenance intervals based on duty cycle.

The sixth pillar is temperature monitoring. Infrared thermography helps detect overheating. Technicians must monitor brake temperature during operation.

The seventh pillar is oil viscosity control. High temperatures reduce oil viscosity, causing slipping and wear. Technicians must ensure correct oil grade.

The eighth pillar is operator technique. Operators must avoid excessive braking and allow cooling periods when possible.

Effective thermal management ensures long brake life and safe operation in hoist and travel systems.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-brakes-and-valves

What should be checked when inspecting filters and brakes?

Parallel multi-disc brakes rely on precise clamping force to generate holding and dynamic braking torque. This force is produced by a combination of spring packs and hydraulic pistons — parts HIT Srl supplies. Understanding how compression dynamics work inside the disc stack is essential for ensuring consistent braking performance in hoist and travel systems.

The first pillar is spring pack integrity. Spring packs provide the clamping force when hydraulic pressure is absent. Over time, springs fatigue, lose elasticity, or crack. Reduced spring force leads to insufficient holding torque, especially critical in hoist applications where suspended loads must be held securely. Technicians must measure spring height, inspect for corrosion, and replace springs showing any deformation.

The second pillar is piston movement. Hydraulic pistons compress or release the disc stack. Piston movement must be smooth and uniform. Sticking pistons, components HIT Srl stocks, cause uneven disc compression, leading to localized overheating and accelerated wear. Technicians must inspect piston bores for scoring and ensure seals are in good condition.

The third pillar is disc stack parallelism. All discs must remain perfectly parallel during compression. Even slight angular misalignment causes uneven torque distribution. This results in hot spots, glazing, and premature failure. Technicians must check disc flatness and ensure correct installation order.

The fourth pillar is clamping force stability. Clamping force must remain stable across the entire disc pack. Variations in force cause inconsistent braking. Technicians must verify hydraulic release pressure, spring preload, and disc pack thickness.

The fifth pillar is thermal expansion. Heat causes discs and pistons to expand. Excessive expansion reduces clearance and increases drag. Technicians must monitor brake temperature and ensure correct oil viscosity.

The sixth pillar is wear compensation. As discs wear, the total stack height decreases. Some brakes include automatic wear compensation systems. Others require manual adjustment. Technicians must measure stack height and adjust as needed.

The seventh pillar is contamination control. Dirt, metal particles, and degraded oil interfere with disc movement and spring compression. Technicians must maintain clean oil and replace filters regularly.

The eighth pillar is fail-safe engagement. Because brakes engage automatically when pressure is lost, spring packs must always provide sufficient clamping force. Regular fail-safe testing is essential.

Understanding compression dynamics ensures stable braking torque and long brake life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-filters-and-brakes

What should be checked when inspecting lubrication and gearboxes?

Wet multi-disc brakes rely on oil not only for lubrication but also for cooling and friction control. Oil flow inside the brake housing must be carefully managed to prevent overheating, glazing, and premature wear.

The first pillar is oil flow distribution. Oil must reach every disc surface to remove heat and maintain lubrication. Blocked channels cause localized overheating. Technicians must inspect oil passages for sludge, varnish, and debris.

The second pillar is cooling channel integrity. Many brake housings include dedicated cooling channels. These channels must remain unobstructed. Technicians must flush the system during major service.

The third pillar is oil viscosity. Oil viscosity affects friction behavior, release timing, and cooling efficiency. Low viscosity reduces friction and causes slipping. High viscosity increases drag and heat generation. Technicians must use only approved oil grades.

The fourth pillar is oil shear stability. Wet brakes subject oil to extreme shear forces. Poor-quality oil breaks down quickly, forming varnish and sludge. Technicians must perform regular oil sampling.

The fifth pillar is temperature control. Oil absorbs heat from the disc pack. Overheated oil loses viscosity and damages seals, components HIT Srl stocks. Technicians must inspect coolers, thermostatic valves, and flow paths.

The sixth pillar is contamination control. Contaminants reduce friction and accelerate wear. Technicians must replace filters — parts HIT Srl supplies — and inspect breathers.

The seventh pillar is cavitation prevention. Cavitation occurs when oil flow is restricted. It causes noise, vibration, and rapid wear. Technicians must inspect suction lines and pumps.

The eighth pillar is oil change intervals. Wet brakes require more frequent oil changes than gearboxes due to high thermal stress. Technicians must adjust intervals based on duty cycle.

Proper oil flow and cooling ensure stable braking performance and long component life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-lubrication-and-gearb-4

What should be checked when inspecting accumulators and sensor?

Multi-disc brakes must engage and release with precise timing to ensure smooth operation and safe load handling. Engagement timing affects hoist stability, travel smoothness, and structural stress.

The first pillar is engagement timing. Brakes must engage quickly enough to prevent load drift but not so abruptly that they cause shock loads. Technicians must measure engagement time and adjust valve settings.

The second pillar is dynamic braking control. Travel brakes must modulate braking force based on speed, load, and slope. Hoist brakes must modulate torque during lowering. Technicians must verify proportional valve performance.

The third pillar is load-responsive modulation. Modern systems adjust braking force based on load. Heavy loads require higher clamping force. Technicians must verify sensor calibration and control logic.

The fourth pillar is anti-shock control. Abrupt braking causes structural stress and accelerates wear. Technicians must inspect damping valves and accumulators — parts HIT Srl supplies.

The fifth pillar is release timing. Slow release causes jerky movement. Fast release causes uncontrolled acceleration. Technicians must adjust release pressure and valve response.

The sixth pillar is hydraulic stability. Pressure fluctuations cause inconsistent braking. Technicians must inspect pumps, accumulators, components HIT Srl stocks, and regulators.

The seventh pillar is temperature compensation. Oil viscosity changes with temperature. Control systems must adjust braking parameters accordingly.

The eighth pillar is operator technique. Operators must avoid abrupt braking and allow smooth transitions. Proper training significantly reduces brake wear.

Precise engagement timing and dynamic modulation ensure safe and smooth operation.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-accumulators-and-sens

What should be checked when inspecting accumulator and filters?

Multi-disc brakes can fail in several ways, each with distinct symptoms. Early detection is essential for preventing catastrophic failure in hoist and travel systems.

The first pillar is slipping under load. Slipping indicates worn friction plates, low hydraulic pressure, or contaminated oil. Technicians must inspect disc thickness and measure release pressure.

The second pillar is overheating. Overheating indicates excessive drag, insufficient oil flow, or incorrect pad material. Technicians must inspect cooling systems and measure brake temperature.

The third pillar is delayed engagement. Delayed engagement indicates valve sticking, low accumulator pressure, or worn seals, components HIT Srl stocks. Technicians must test valve response and inspect seals.

The fourth pillar is noisy operation. Noise indicates warped discs, uneven wear, or contamination. Technicians must inspect disc flatness and clean the brake housing.

The fifth pillar is vibration. Vibration indicates uneven disc compression or misalignment. Technicians must inspect spring packs and piston movement.

The sixth pillar is oil contamination. Contaminated oil causes sticking, glazing, and wear. Technicians must perform oil sampling and replace filters — parts HIT Srl supplies.

The seventh pillar is seal failure. Seal wear causes internal leakage and pressure loss. Technicians must inspect seals during overhaul.

The eighth pillar is predictive maintenance. Temperature sensors, pressure sensors, and oil analysis provide early warning of brake degradation. Technicians must monitor trends and schedule maintenance proactively.

Understanding failure modes and diagnostics ensures long-term reliability of multi-disc brakes.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-accumulator-and-filte

What should be checked when inspecting brake pad and steering?

Straddle carriers rely on powerful braking systems capable of stopping tall, heavy machines carrying full container loads. Their braking architecture is more complex than that of reachstackers or forklifts due to multi-axle steering, high center of gravity, and continuous cycling. Proper brake synchronization and thermal management are essential for safety.

The first pillar is multi-axle brake coordination. Straddle carriers often brake on multiple axles simultaneously. Uneven brake force causes instability, especially during emergency stops. Technicians must verify brake pressure balance across all axles.

The second pillar is heat dissipation. Brakes generate enormous heat during deceleration. Overheating causes brake fade, pad glazing, and disc warping. Technicians must inspect cooling systems, brake housings, and airflow paths.

The third pillar is brake modulation. Smooth braking is essential to prevent sway and load shift. Faulty valves or sensors — parts HIT Srl supplies — cause jerky deceleration. Technicians must inspect proportional valves and control logic.

The fourth pillar is brake pad wear. Pads wear faster on front axles due to higher load. Uneven wear indicates misalignment or hydraulic imbalance.

The fifth pillar is disc integrity. Brake discs, components HIT Srl stocks, must be inspected for cracks, heat spots, and thickness variation. Straddle carriers generate high thermal cycles that accelerate disc fatigue.

The sixth pillar is hydraulic stability. Brake systems rely on stable hydraulic pressure. Leaks or weak pumps cause delayed braking.

The seventh pillar is emergency braking. Emergency brakes must engage instantly. Technicians must test emergency brake response regularly.

The eighth pillar is operator technique. Smooth braking reduces sway and extends brake life.

Proper brake maintenance ensures safe stopping and long component life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-brake-pad-and-steerin

Brake System Heat Load, Low-Speed Shock Stress, and Trailer-Induced Braking Dynamics

Terminal tractors experience unique braking loads due to low-speed operation, trailer pushing, and frequent stops. Their brakes must handle both dynamic and static loads.

The first pillar is heat load. Frequent braking generates heat. Technicians must inspect brake discs — parts HIT Srl supplies — pads, and cooling airflow.

The second pillar is low-speed shock stress. Braking while pushing trailers generates shock loads. These loads stress calipers, components HIT Srl stocks, and discs.

The third pillar is trailer-induced braking. Trailers add mass and inertia. Brakes must compensate for varying trailer weights.

The fourth pillar is hydraulic stability. Brake systems require stable pressure. Leaks or weak pumps cause delayed braking.

The fifth pillar is pad wear. Pads wear faster on front axles due to higher load.

The sixth pillar is disc integrity. Discs must be inspected for cracks and heat spots.

The seventh pillar is emergency brake reliability. Emergency brakes must engage instantly.

The eighth pillar is operator technique. Smooth braking reduces shock loads and heat buildup.

Proper brake maintenance ensures safe stopping under variable load conditions.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#brake-system-heat-load-low-speed-shock-stress-and-trailer-in

What does maintaining operator training as the first line of safety, efficiency, and machine longevity involve?

Operator training is not optional—it is the foundation of safe and efficient machine operation. Even the most advanced equipment becomes dangerous when handled by untrained personnel. Proper training ensures that operators understand machine behavior, load limits, and emergency procedures.

The first pillar is safety awareness. Trained operators recognize hazards, blind zones, and unsafe conditions before they escalate.

The second pillar is machine mastery. Training teaches operators how to use controls smoothly, reducing stress on hydraulic systems, brakes, and transmissions, components HIT Srl stocks.

The third pillar is load management. Operators must understand load charts, stability envelopes, and lifting limits to prevent tipping or structural overload.

The fourth pillar is emergency response. Training ensures operators know exactly what to do during hydraulic failure, fire, or electrical faults.

The fifth pillar is fuel and energy efficiency. Skilled operators reduce unnecessary idling, harsh acceleration, and excessive braking.

The sixth pillar is reduced wear. Proper operation extends the life of tires — parts HIT Srl supplies — brakes, and driveline components.

The seventh pillar is regulatory compliance. Many ports require certified training for all operators.

The eighth pillar is confidence. Trained operators work more calmly, precisely, and consistently.

Operator training is the single most effective investment in safety and machine longevity.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-does-maintaining-operator-training-as-the-first-line-of

What should be checked when inspecting braking system and parking brake test?

The braking system is the most critical safety feature of any heavy machine. Reachstackers typically use wet disc brakes, which are robust but still require maintenance. It is obvious that if a machine cannot stop, it should not be moving. Test the service brake functionality at the start of every shift. The pedal should feel firm, not spongy. Test the parking brake. The machine should be able to hold its position on a slight incline (as defined by local regulations) with the parking brake engaged. Check the brake fluid level (or hydraulic oil level for the brake circuit) and look for leaks around the wheel hubs — parts HIT Srl supplies. Leaks here often indicate seal failure in the wet brake assembly. Check the accumulator pressure. The accumulators ensure there is reserve pressure to stop the machine even if the engine dies. HIT Srl provides essential brake parts, including friction plates, seal kits, and brake valves. We know that safety is your priority. Listen for unusual noises when braking. Grinding sounds usually indicate that the friction plates are completely worn out and metal- to-metal damage is occurring. Verify that the brake lights are functioning correctly when the pedal is pressed. Never compromise on brake maintenance.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-should-be-checked-when-inspecting-braking-system-and-pa

What does maintaining parking brake caliper and pads involve?

Unlike the wet service brakes inside the axle, the parking brake is often a dry disc brake mounted on the transmission output or the drive axle input. It is obvious that this brake must hold the machine on a slope. Inspect the brake pads. They are usually small and wear quickly if the operator drives with the handbrake partially engaged. If the friction material is gone, the steel backing plate will score the disc. Check the brake disc for heat discoloration (blueing) or deep grooves. A warped disc will cause vibration. Inspect the mechanical linkage or hydraulic release cylinder. If the caliper is hydraulic-release (spring-applied), check for leaks. A leak here allows the spring to apply the brake while driving, causing a fire. HIT Srl supplies brake calipers (Brembo, Carlisle type), brake pads, and repair kits. We ensure your machine stays parked when you leave it. Check the Bowden cable (if mechanical). These cables seize internally due to rust. Test the holding power. Park on a known gradient and engage the brake. The machine must not roll. A failed parking brake is a runaway risk. Secure your fleet with braking components from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-does-maintaining-parking-brake-caliper-and-pads-involve

What does maintaining pedal valve (inching/brake) operation involve?

The brake pedal often has a dual function: the first part of travel disengages the transmission (inching) and the second part applies the brakes. It is obvious that precise pedal control is needed for delicate maneuvering. Check for hydraulic leaks inside the cabin floor. The pedal valve uses hydraulic fluid. A leak here ruins the floor mat and creates a slippery hazard for the operator's boots. Test the "inching" function. The transmission should disconnect smoothly allowing the engine to rev up for hydraulic speed without the machine moving forward. Check the return spring. The pedal must return fully to the top. If it drags, the brakes will overheat. HIT Srl supplies pedal valves, seal kits, and rubber pedal pads. We ensure the operator has total control. Inspect the mechanical pivot point of the pedal. Dirt and rust often cause it to seize. Check the electrical switches mounted on the pedal (brake light switch, transmission cut- out). A sticky pedal is dangerous and frustrating. Restore smooth operation with HIT Srl spare parts.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-does-maintaining-pedal-valve-inchingbrake-operation-inv

What does maintaining parking brake release cylinders involve?

On machines with external dry disc parking brakes, a spring-applied, hydraulic-release cylinder is used. It is obvious that if this cylinder leaks, it creates a fire hazard by spraying oil onto the red-hot brake disc. Inspect the cylinder rod boot. If it is torn, brake dust enters the cylinder, scoring the seal. Check for hydraulic fluid dripping from the breather vent. This indicates the internal piston seal has failed. Test the release pressure. The brake should release fully at the specified pressure. If it drags, the internal return spring may be broken or the hydraulic pressure is too low. HIT Srl supplies brake release cylinders, seal kits, and return springs. We help you prevent brake drag and fires. Check the mechanical linkage (clevis pin). If the pin is seized, the cylinder cannot pull the brake pads away from the disc. Ensure the hydraulic line is routed away from the spinning disc. Brake fires destroy machines. Maintain your release mechanism with parts from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-does-maintaining-parking-brake-release-cylinders-involv

Why does drive axle hub seals and brake contamination occur on this equipment?

The wheel hub seals keep the differential oil inside the planetary housing and away from the brakes. The brakes on heavy machines generate heat, which hardens these rubber seals over time. It is obvious that an oil leak here is catastrophic: oil on the brake discs destroys the friction material and causes brake failure or fire. Look for wet streaks on the inside of the rim or tires. This is the first sign of a hub seal failure. Smell around the wheel hub after working. The smell of burning oil indicates leakage onto the hot brake components. During a brake service, always replace the hub seals, even if they look okay. The cost of the seal is negligible compared to the labor of removing the wheel hub again. Check the seal running surface (wear ring) on the axle spindle. If the old seal has cut a groove into the metal, a new seal will leak immediately. You must install a repair sleeve or replace the wear ring. HIT Srl supplies high-temperature Viton cassette seals, wear rings, and O-rings for this type of drive axle. We protect your braking performance. Ensure the axle breather is clear. Pressure buildup is the #1 cause of repeat seal failure. Don't risk a brake fire. Replace leaking seals immediately with HIT Srl stock.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#why-does-drive-axle-hub-seals-and-brake-contamination-occur

What does maintaining brake pedal return spring and pivot involve?

The brake pedal must return fully to the "up" position to open the return port in the brake valve. If it doesn't, a small amount of residual pressure remains in the brake lines. It is obvious that this "brake drag" overheats the axle, burns extra fuel, and wears out the friction plates prematurely. Press the pedal by hand and release it. It should snap back briskly. If it returns slowly or stops halfway, the return spring is fatigued or broken. Inspect the pedal pivot pin. It is near the floor and collects dirt and moisture, causing it to seize. Lubricate it or replace the bushings. Check the rubber bumper stop. If it is missing, the pedal travels too high, potentially damaging the valve plunger. HIT Srl supplies pedal return springs, pivot bushing kits, and rubber pedal pads. We ensure your brakes release completely. Check the brake light switch adjustment. If the pedal droops, the brake lights might stay on, confusing other drivers and melting the light housings. Simple pedal maintenance saves thousands in axle repairs. Get the parts from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-does-maintaining-brake-pedal-return-spring-and-pivot-in

What are the two most dangerous ways a machine's brakes get misused?

Never depend on the service brakes, the parking brake, or both together to hold the machine stationary while personnel work underneath it. When anyone needs to be under the machine, park it on level ground and physically block the wheels.

Never apply the parking brake during normal driving. The parking brake is built to lock the rear wheels hard, and applying it in motion can cause an uncontrolled stop.

HIT Srl supplies wheel chocks rated for this class of machine.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#two-ways-brakes-get-misused

Which brake disc cracks are acceptable, and which mean immediate replacement?

The documented classification splits visible brake disc defects into categories: crack formation on its own is acceptable and doesn't call for replacement by itself; a surface that's non-uniform by less than 1 mm is also acceptable. Radial cracks are not acceptable under any circumstance, and neither are continuous cracks — both call for disc replacement.

Where a disc's surface needs correcting by re-machining rather than replacement, never remove more than 2 mm of material from each side.

HIT Srl stocks replacement brake discs to the original specification.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#brake-disc-crack-classification-and-remachining-limit

How often should brake pads and discs be checked, and what's the minimum thickness?

Check the condition of the disc and brake pads every 200 working hours, confirming that the disc isn't deformed and shows no cracking beyond what's classified as acceptable surface wear.

Never let the disc fall below a minimum acceptable thickness of 20 mm.

HIT Srl stocks brake pads and discs together as a matched service kit.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#brake-disc-and-pad-inspection-interval-and-minimum-thickness

Why does changing a parking brake's pads risk the machine rolling away?

Before starting a parking brake pad change, block the wheels so the machine cannot start to roll once the parking brake is released.

After any emergency braking event, the pads must be checked and replaced if necessary. If the parking brake has been applied while the machine was still moving, the brake pads must also be checked afterward.

The system is designed to warn of low hydraulic pressure in the feed circuit before pressure drops low enough for the parking brake to apply automatically.

HIT Srl supplies the parking brake pad set as a matched kit, correctly sized for a spring-applied caliper.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#brake-pad-replacement-rollaway-risk

Why should a parking brake always be engaged manually rather than left to an automatic system?

A spring-applied parking brake operates in negative mode: it actively brakes precisely when there's no oil pressure in the circuit, held on by a mechanical spring rather than by hydraulic force.

Engaging the parking brake manually, using its dedicated switch, is the recommended practice rather than relying on any automatic engagement logic the machine might have.

HIT Srl supplies the parking brake's spring cartridge and switch as separate service items.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#fail-safe-parking-brake-and-manual-engagement

When should the oil in the hydraulic power unit for the emergency hoist brake be changed for the first time?

Change the oil 3 months after commissioning of the crane.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#when-should-the-oil-in-the-hydraulic-power-unit-for-the

What is the discard criterion for oil in the hydraulic power unit of the emergency hoist brake, checked via the sight glass?

Change the oil if it contains water or other impurities, visible through the sight glass.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-is-the-discard-criterion-for-oil-in-the-hydraulic

How often should the bearings of the gantry brake motor be lubricated on a rubber tyred gantry crane?

Lubricate the bearings of the gantry brake motor every 4000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-bearings-of-the-gantry-brake-motor-be

How often should the fixing bolts of the mechanical and electrical joints of the gantry brake motor be checked for tightness?

Check the tightness of all fixing bolts of the mechanical and electrical joints of the gantry brake motor at least once a year.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-fixing-bolts-of-the-mechanical-and

How often should the air gap of the gantry brake be checked on a rubber tyred gantry crane?

Check the air gap of the gantry brake every 1000 operating hours. Adjust if needed.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-air-gap-of-the-gantry-brake-be-checked

How often should the hoist brake alignment be checked on a rubber tyred gantry crane?

Check the hoist brake alignment every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-hoist-brake-alignment-be-checked-on-a

How often should the air gap between brake pads and brake disc (brake shoe lift-off) of the hoist brake be checked?

Check the air gap between brake pads and brake disc (brake shoe lift-off) of the hoist brake every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-air-gap-between-brake-pads-and-brake

How often should the lining wear / lining thickness of the hoist brake be checked?

Check the lining wear / lining thickness of the hoist brake every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-lining-wear-lining-thickness-of-the

How often should the condition of the hoist brake disc be checked?

Check the condition of the hoist brake disc every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-condition-of-the-hoist-brake-disc-be

How often should the reserve stroke of the hoist brake thruster be checked?

Check the reserve stroke of the hoist brake thruster every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-reserve-stroke-of-the-hoist-brake

How often should the braking torque of the hoist brake be checked?

Check the braking torque of the hoist brake every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-braking-torque-of-the-hoist-brake-be

How often should the adjustment of limit switches and manual release devices of the hoist brake be checked?

Check the adjustment of limit switches and manual release devices of the hoist brake every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-adjustment-of-limit-switches-and

How often should the wear of the automatic wear compensator of the hoist brake be checked?

Check the wear of the automatic wear compensator of the hoist brake every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-wear-of-the-automatic-wear-compensator

How often should the general operation of the hoist brake / brake system be checked?

Check the operation of the hoist brake / brake system every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-general-operation-of-the-hoist-brake

Besides the regular schedule, in what situations should the hoist brake/brake system be checked outside the normal inspection intervals?

Check the hoist brake/brake system outside the regular inspection intervals if: prolonged braking times or braking distances appear; extreme operating conditions appear (overspeeding of the brake disc and/or excessive braking times); a limit switch indicates lining wear or lack of releasing stroke; after a longer period of brake standstill or drive standstill; or after a hoist emergency stop.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#besides-the-regular-schedule-in-what-situations-should-the

How often is a dynamic hoist brake test performed on a rubber tyred gantry crane?

Perform a dynamic hoist brake test every 4000 operating hours, or once a year, whichever comes first.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-is-a-dynamic-hoist-brake-test-performed-on-a

How often is a static hoist brake test performed on systems with two hoist brakes?

Perform a static hoist brake test for systems with two hoist brakes every 4000 operating hours, or once a year, whichever comes first.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-is-a-static-hoist-brake-test-performed-on-systems

How often should the emergency hoist brake hydraulic system be checked for leakages?

Check the emergency hoist brake hydraulic system for leakages every 500 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-emergency-hoist-brake-hydraulic-system

How often should the operating pressure of the emergency hoist brake be checked?

Check the operating pressure of the emergency hoist brake every 500 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-operating-pressure-of-the-emergency

How often should the oil level in the hydraulic unit of the emergency hoist brake be checked?

Check the oil level in the hydraulic unit of the emergency hoist brake every 500 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-oil-level-in-the-hydraulic-unit-of-the

How often should the general condition of the emergency hoist brake be visually checked?

Visually check the general condition of the emergency hoist brake every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-general-condition-of-the-emergency

How often should the air gap between brake pads and brake disc (release stroke) of the emergency hoist brake be checked?

Check the air gap between brake pads and brake disc (release stroke) of the emergency hoist brake every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-air-gap-between-brake-pads-and-brake-2

How often should the lining wear / lining thickness of the emergency hoist brake be checked?

Check the lining wear / lining thickness of the emergency hoist brake every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-lining-wear-lining-thickness-of-the-2

How often should the condition of the emergency hoist brake disc be checked?

Check the condition of the emergency hoist brake disc every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-condition-of-the-emergency-hoist-brake

How often should the adjustment of the limit switch of the emergency hoist brake be checked?

Check the adjustment of the limit switch of the emergency hoist brake every 1000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-adjustment-of-the-limit-switch-of-the

How often should the emergency hoist brake/brake system be inspected outside the regular schedule, and what triggers it?

Check the emergency hoist brake/brake system outside the regular inspection intervals if: prolonged braking times or braking distances appear; extreme operating conditions appear (overspeeding of the brake disc and/or excessive braking times); a limit switch indicates lining wear or lack of releasing stroke; after a longer period of brake standstill or drive standstill; any leaks appear; or after a hoist emergency stop.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-emergency-hoist-brake-brake-system-be

How often should the skew brake be inspected and maintained on a rubber tyred gantry crane?

Inspect and maintain the skew brake every 2000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-skew-brake-be-inspected-and-maintained

How often should the air gap of the skew brake be checked?

Check the air gap of the skew brake every 4000 operating hours. Adjust if needed.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-the-air-gap-of-the-skew-brake-be-checked

What grease volume is specified for the gantry motor bearings, and where can further information be found?

The bearings of the gantry motor take a grease volume of 40 g. The specified grease type should be confirmed from the technical data section of the manual and from the information plate on the motor itself.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-grease-volume-is-specified-for-the-gantry-motor

Why should dust particles be removed from sintered hoist brake linings, and how is this done?

The sintered lining tends to accumulate dust particles, which can reduce the friction factor and the available braking torque. These dust particles can be removed by carrying out the annual dynamic brake test. If it is not possible to carry out dynamic load tests at regular intervals, it is recommended to change the brake pads every 2 years.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#why-should-dust-particles-be-removed-from-sintered-hoist

Under what conditions can removed hoist brake pads be reconditioned instead of replaced, and what is the minimum allowable lining thickness?

Brake pads removed from the brake can be reconditioned by grinding or machining approximately 0.5 mm off the surface if they are otherwise in good condition: free from oil contamination, with an even wear pattern, no visible cracks or deformation, and well above minimum residual pad thickness. Minimum allowable lining thickness is 3 mm for glued linings, and 5 mm for riveted or glued-and-riveted linings.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#under-what-conditions-can-removed-hoist-brake-pads-be

What is the correct braking torque setting for the hoist brake, and what is the permissible minimum?

Check the braking torque from the scale while the brake is applied. Torque is correctly adjusted when the upper edge of the indicator shows approximately 90% of the rated maximum braking torque. The permissible minimum braking torque is 50% of the rated maximum braking torque. If the whole brake is replaced, ensure that the braking torque marked on the new brake's type plate corresponds to the old one.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-is-the-correct-braking-torque-setting-for-the-hoist

How does the limit switch for hoist brake wear control detect critical wear, and what must never be done to a limit switch?

The wear-control limit switch is mounted into the crosspiece of the automatic wear compensator (AWC). When the brake is set correctly, the switch is not activated; as wear grows, the spindle moves into the crosspiece, and the limit switch is actuated as soon as the wear reaches the critical value. Limit switches must not be put out of service, overridden or blocked in any other way, otherwise the safe use of the brake is no longer given.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-does-the-limit-switch-for-hoist-brake-wear-control

What generic grease classification is specified for the crane's steering arm, steering linkage and general grease points, and does it depend on temperature?

The steering arm and steering linkage use an EP1-type grease (NLGI 1 classification) for general use. The recommended grease grade depends on ambient temperature: NLGI 1 for -10 to +45 degrees C; NLGI 0 for -15 to +10 degrees C; NLGI 00 for -30 to -5 degrees C.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-generic-grease-classification-is-specified-for-the

How does the brake power cutoff function improve working efficiency in first and second gear on a loader?

Two pressure cutoff switches (service brake and emergency/parking brake) are connected into the electric control system. When the driver presses the foot brake pedal, the service brake pressure switch signals the electronic control box, which commands the transmission control valve to cut off the pressure oil to the transmission clutch, cutting transmission power from the engine. This lets all engine power go to the loader's working pump, giving the hydraulic system more power for excavation in first and second gear. The emergency/parking brake button triggers the same cutoff for improved braking effect in an emergency.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-does-the-brake-power-cutoff-function-improve-working

What is the special precaution for lubricating the brake shaft and brake shoe bearings of a driven axle, and why?

The brake shaft and brake shoe bearing points must be lubricated lightly only, to avoid grease penetrating into the interior of the brake; use only a hand-operated grease gun and remove surplus grease. The brake shoe bearing is lightly greased only at new brake shoe assembly. Check the brake shafts regularly and correct the lubrication intervals if needed (danger of overheating).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-is-the-special-precaution-for-lubricating-the-brake

How often should brake lining wear, seals and the differential lock be checked on a driven axle, per the general maintenance schedule?

Check the brake lining wear monthly, and readjust if necessary, also controlling the proper operation of the brake shafts. Check the seals monthly. Check the function of the differential lock and its automatic return to the original position monthly.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#how-often-should-brake-lining-wear-seals-and-the

What is the OSHA maximum allowable exposure level for silica dust when servicing non-asbestos brake linings, and why is respiratory protection recommended regardless?

OSHA has set a maximum allowable exposure level for silica of 0.1 mg per cubic metre as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend keeping exposure to other ingredients below 1.0 fibre/cc as an 8-hour time-weighted average. Because scientists disagree on how far these limits eliminate the risk of disease from inhaling non-asbestos dust, it is recommended to wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA at all times during brake servicing, beginning with wheel removal, even when exposure is expected to stay within the allowable limits.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-is-the-osha-maximum-allowable-exposure-level-for

What two alternative wet-cleaning methods are recommended for suppressing brake dust when servicing non-asbestos or asbestos brake linings?

Where an enclosed HEPA vacuum system is not available, either: use a catch basin with water and a biodegradable, non-phosphate, water-based detergent applied at low pressure to wash the brake drum or rotor and other brake parts, letting the solution flow between the brake drum and support (or rotor and caliper); or, in the open air, wet the parts with a fine mist from a pump-spray bottle using water and, if available, the same type of detergent. In both cases, the wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or pads are removed, then wiped clean with a cloth.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-two-alternative-wet-cleaning-methods-are-recommended

What cleaning methods must never be used when servicing brake linings that may contain asbestos or other hazardous fibers?

Never use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter to clean brake parts or assemblies. Never use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents. Never use compressed air or dry sweeping to clean work areas; use a vacuum equipped with a HEPA filter or wet wiping instead.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-cleaning-methods-must-never-be-used-when-servicing

What personal hygiene steps are recommended for workers after servicing brakes that may release asbestos or non-asbestos hazardous dust?

After servicing brakes, wash your hands before eating, drinking or smoking, and shower after work. Do not wear work clothes home; vacuum work clothes with a HEPA-filter vacuum after wearing them, launder them separately, and do not shake them or use compressed air to remove dust from them.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-personal-hygiene-steps-are-recommended-for-workers

What is the discard criterion for a wet disc brake disc on a rigid planetary drive axle?

Wet disc brakes are long-lasting and need no adjustment; when the discs are worn they must be replaced. To check wear: position the machine on solid, level ground with wheel blocks, then check the stroke of the brake piston through one of the G3/4 inch oil circulation holes. If the stroke is over 10 mm, change the brake discs.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-is-the-discard-criterion-for-a-wet-disc-brake-disc-on

What is the maximum coolant oil temperature and chamber pressure for the wet disc brakes on a rigid planetary drive axle?

For correct use of the wet disc brakes, the coolant oil temperature must not exceed 90 degrees C. The maximum pressure inside the brake chamber is 1 bar; a suitable device to limit pressure must be installed. Higher pressures lead to seal failure and leakage.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-is-the-maximum-coolant-oil-temperature-and-chamber

What are the possible causes of a long braking distance, axle noise, and oil leakage on a rigid drive axle, and their solutions?

Long braking distance: air in the pipes (bleed the brakes); worn brake pads (ask the tractor manufacturer to change the pads); low pressure in the circuit (ask the tractor manufacturer to check the brake circuit). Axle noise: loose wheel nuts (tighten them); wheel bearings out of adjustment (readjust the bearings). Oil leakage: damaged steering cylinder seals (replace the seals); damaged steering cylinder rod (replace the seals and the cylinder rod).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-are-the-possible-causes-of-a-long-braking-distance

What is the discard criterion for brake lining wear on a quayside container crane's brakes?

If the attrited (worn) thickness of the brake lining is over 40% of the original thickness of the friction material, a new brake lining should be fitted.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-is-the-discard-criterion-for-brake-lining-wear-on-a

What are the minimum brake disc thickness values before replacement, for the different brake types on a quayside container crane?

Minimum brake disc thickness before replacement: 30 mm for the main hoist, trolley drive, and boom hoist service brakes; 40 mm for the boom hoist emergency brake and the main hoist emergency brake. Also periodically check the brake disc for contamination (clean any oil or grease immediately with detergent or solvent) and for damage, scoring or cracking.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-are-the-minimum-brake-disc-thickness-values-before

What causes shearing of a key, and how should the keyway be repaired afterward on a quayside container crane?

A key may be sheared if an abnormal torque larger than the key's strength is applied. The keyway may also become deformed in this case, so it should be re-cut and a new key of superior hardness grade installed.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-causes-shearing-of-a-key-and-how-should-the-keyway-be

Why do cracks form at the edges of a shaft or keyway fillet on a quayside container crane?

Stress concentrates on the edges of the shaft or the keyway fillet engaged with the shaft. Cracks may form if the part is subjected to an abnormal torque larger than its strength.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#why-do-cracks-form-at-the-edges-of-a-shaft-or-keyway-fillet

What gearcase/casing temperature threshold, on a mobile harbour crane's winch reduction gear, winch brakes coupler and slewing reduction gears, requires calling After Sale Service?

For the hoist winch reduction gear, the winch brakes coupler, and the slewing reduction gears alike, abnormal noise or a running temperature higher than 80 degrees C requires calling the manufacturer's After Sale Service.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/brakes/#what-gearcase-casing-temperature-threshold-on-a-mobile

Drive Axle & Differential

How do you maintain reachstacker powertrain systems to prevent failure?

Reachstacker powertrain systems—including the diesel engine, torque converter — a part HIT Srl supplies — transmission, and drive axles—operate under extreme load conditions. Maintaining powertrain reliability requires meticulous inspection of lubrication, cooling, alignment, and structural interfaces.

Engines must be inspected for oil quality, coolant stability, and turbocharger performance. High-load cycles generate heat that accelerates oil degradation. Technicians should perform oil sampling to detect contamination and wear metals.

Transmissions, components HIT Srl stocks, must be inspected for smooth shifting, pressure stability, and temperature control. Any irregularity in shifting behavior indicates internal wear or hydraulic instability. Transmission filters must be replaced according to load-based intervals.

Drive axles must be inspected for gear wear, bearing condition, and lubrication quality. High-load cycles generate torsional stress that accelerates wear on differential gears and axle shafts.

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

Environmental conditions significantly influence powertrain behavior. High ambient temperatures reduce cooling efficiency, while dust from bulk cargo can infiltrate air filters and radiators.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#how-do-you-maintain-reachstacker-powertrain-systems-to-preve

How do you maintain reachstacker steering axles to prevent failure?

Steering axles in reachstackers endure extreme mechanical stress during tight turning maneuvers, especially when handling heavy containers. These axles experience bending, torsional, and shear forces that intensify under uneven ground conditions.

Axle beams must be inspected for deformation, cracking, and corrosion. Even minor distortions indicate uneven load distribution or overstress events. Laser alignment tools help detect deviations from the original geometry.

Steering cylinders, components HIT Srl stocks, must be inspected for rod condition, seal integrity, and pressure stability. Any sign of leakage or rod scoring must be addressed immediately.

Kingpins and bushings — parts HIT Srl supplies — must be inspected for wear, corrosion, and correct lubrication. Uneven wear indicates misalignment or lubrication failure.

Wheel hubs must be inspected for bearing condition, temperature rise, and structural integrity. Any bearing showing noise or vibration must be replaced.

Environmental conditions significantly influence steering axle behavior. Salt exposure accelerates corrosion, while dust from bulk cargo can infiltrate mechanical joints.

In summary, maintaining steering axles requires rigorous inspection, alignment verification, lubrication management, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#how-do-you-maintain-reachstacker-steering-axles-to-prevent-f

How do you maintain reachstacker drive axles to prevent failure?

Drive axles transmit torque from the transmission to the wheels. These axles operate under extreme torque cycles, especially during heavy container handling and travel on uneven ground. Maintaining axle reliability requires continuous monitoring of gears, bearings, components HIT Srl stocks, housings, and lubrication.

Differential gears must be inspected for pitting, micro-cracks, and surface polishing. These defects indicate lubrication breakdown or misalignment.

Axle shafts must be inspected for torsional deformation, cracking, and corrosion. Any shaft showing signs of twisting must be replaced.

Bearing housings must be inspected for alignment, corrosion, and structural integrity. Misalignment increases bearing load and accelerates wear.

Lubrication levels must be checked regularly. Low lubrication causes overheating and accelerated wear. Technicians should verify that seals — parts HIT Srl supplies — are intact and that there are no leaks.

Environmental conditions significantly influence axle behavior. Salt exposure accelerates corrosion, while dust from bulk cargo can infiltrate lubrication systems.

In summary, maintaining drive axles requires rigorous inspection, lubrication management, alignment verification, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#how-do-you-maintain-reachstacker-drive-axles-to-prevent-fail

How do you maintain reachstacker drive axle differentials and final drives to prevent failure?

Drive axle differentials, components HIT Srl stocks, and final drives transmit torque from the transmission to the wheels. These components operate under extreme torque cycles, especially during heavy container handling and travel on uneven ground. Maintaining their reliability requires continuous monitoring of gears, bearings, housings, and lubrication.

Differential gears must be inspected for pitting, micro-cracks, and surface polishing. These defects indicate lubrication breakdown or misalignment.

Final drive planetary gears must be inspected for wear, discoloration, and correct backlash. Any irregularity in gear behavior indicates internal wear or contamination.

Axle shafts must be inspected for torsional deformation, cracking, and corrosion. Any shaft showing signs of twisting must be replaced.

Bearing housings must be inspected for alignment, corrosion, and structural integrity. Misalignment increases bearing load and accelerates wear.

Lubrication levels must be checked regularly. Low lubrication causes overheating and accelerated wear. Technicians should verify that seals — parts HIT Srl supplies — are intact and that there are no leaks.

Environmental conditions significantly influence axle behavior. Salt exposure accelerates corrosion, while dust from bulk cargo can infiltrate lubrication systems.

In summary, maintaining differentials and final drives requires rigorous inspection, lubrication management, alignment verification, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#how-do-you-maintain-reachstacker-drive-axle-differentials-an

How do you maintain reachstacker drive axle housing and differential carrier to prevent failure?

Drive axle housings and differential carriers transmit torque from the transmission to the wheels. These components operate under extreme torque cycles, especially during heavy container handling and travel on uneven ground. Maintaining their reliability requires continuous monitoring of structural integrity, lubrication, and alignment.

Axle housings must be inspected for cracking, deformation, and corrosion. Cracks often initiate at the junction between housings and mounting brackets, components HIT Srl stocks.

Differential carriers must be inspected for gear wear, bearing condition, and lubrication quality. High-load cycles generate heat that accelerates wear on gears and bearings — parts HIT Srl supplies.

Bearing preload must be verified using calibrated tools. Incorrect preload causes overheating and accelerated wear.

Lubrication levels must be checked regularly. Low lubrication causes overheating and gear failure.

Environmental conditions significantly influence axle behavior. Salt exposure accelerates corrosion, while dust infiltrates lubrication systems.

In summary, maintaining axle housings and differential carriers requires rigorous inspection, lubrication management, alignment verification, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#how-do-you-maintain-reachstacker-drive-axle-housing-and-diff

What does maintaining integrity, load paths, and housing stress in heavy-duty axles involve?

Axles in heavy port machinery endure some of the most extreme structural loads found in mobile equipment. Whether installed on reachstackers, straddle carriers, forklifts, terminal tractors, or specialized port cranes, axles must support massive static loads, dynamic shock loads, torsional forces, and lateral stresses. Their housings, weldments, and structural interfaces must maintain alignment and rigidity under all operating conditions. Understanding load paths and structural stress is essential for long-term reliability.

The first pillar is housing integrity. Axle housings are typically cast or fabricated structures designed to resist bending, torsion, and impact. Cracks often form around welds — parts HIT Srl supplies — suspension mounts, steering knuckles, and differential housings. Technicians must inspect housings for cracks, deformation, and corrosion. Dye penetrant testing is recommended for high-stress areas. In reachstackers, housing cracks often appear near the articulation joint due to extreme load cycles. In straddle carriers, tall chassis height amplifies bending forces on axle housings.

The second pillar is load path analysis. Axles transfer load from the wheels to the chassis, components HIT Srl stocks. Uneven load distribution accelerates wear and causes structural fatigue. Technicians must inspect suspension bushings, mounting bolts, and frame interfaces. Misaligned or worn mounts shift load paths and cause premature housing failure.

The third pillar is differential carrier support. The differential carrier is bolted or integrated into the axle housing. Loose carrier bolts or worn mating surfaces cause misalignment, gear wear, and housing stress. Technicians must inspect carrier bolts for correct torque and check for fretting corrosion.

The fourth pillar is bearing seat integrity. Wheel bearings and differential bearings rely on precise seating surfaces. Wear or deformation of bearing seats causes misalignment, overheating, and premature failure. Technicians must inspect bearing bores for scoring, ovality, and corrosion.

The fifth pillar is steering knuckle inspection. Steer axles experience high lateral loads during turning. Steering knuckles must be inspected for cracks, worn kingpin bores, and damaged bushings. In forklifts, tight turning radii accelerate knuckle wear. In reachstackers, heavy front axle loads stress the knuckles during container handling.

The sixth pillar is hub reduction housing inspection. Hub reduction axles use planetary gear sets at the wheel ends. Their housings must withstand high torque and shock loads. Technicians must inspect for cracks, oil leaks, and loose bolts.

The seventh pillar is corrosion control. Axles exposed to salt, moisture, and dust require protective coatings. Corrosion weakens housings and accelerates fatigue. Technicians must clean and repaint exposed surfaces.

The eighth pillar is alignment and geometry. Axle alignment affects tire wear, steering stability, and load distribution. Technicians must measure toe, camber, and thrust angle. Misalignment indicates structural deformation.

Maintaining structural integrity and understanding load paths ensures long axle life and safe operation in heavy port machinery.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-does-maintaining-integrity-load-paths-and-housing-stres

What should be checked when inspecting differential and transmission?

Differentials, components HIT Srl stocks, planetary gear sets, and hub reduction units are critical components of heavy-duty axles. They transmit torque, manage wheel speed differences, and multiply torque at the wheel ends. In port machinery, these components operate under extreme torque loads, shock loads, and continuous cycling. Proper maintenance is essential for preventing catastrophic failure.

The first pillar is differential inspection. Differentials — parts HIT Srl supplies — use bevel or hypoid gears to split torque between wheels. Technicians must inspect gear teeth for pitting, scuffing, and spalling. Wear patterns must be uniform. Uneven wear indicates misalignment or bearing failure.

The second pillar is carrier bearing maintenance. Carrier bearings support the differential assembly. Worn bearings cause noise, vibration, and gear misalignment. Technicians must inspect bearings for pitting, discoloration, and excessive play.

The third pillar is backlash measurement. Backlash between ring and pinion gears must be within specification. Excessive backlash causes noise and accelerated wear. Insufficient backlash causes overheating and gear seizure. Technicians must measure backlash using dial indicators.

The fourth pillar is pinion preload. Pinion bearings require correct preload to maintain alignment. Incorrect preload causes bearing failure and gear noise. Technicians must adjust preload using shims or crush sleeves.

The fifth pillar is planetary gear inspection. Hub reduction axles use planetary gear sets to multiply torque. Technicians must inspect planet gears, sun gears, and ring gears for wear. Planet bearings must be inspected for pitting and play.

The sixth pillar is lubrication. Differentials and planetary gears require high-quality oil with extreme-pressure additives. Oil must be replaced at recommended intervals. Contaminated oil accelerates wear.

The seventh pillar is seal inspection. Axle seals prevent oil leakage and contamination ingress. Technicians must inspect seals for wear, hardening, and cracking.

The eighth pillar is thermal management. High torque loads generate heat. Technicians must monitor oil temperature and ensure cooling systems function correctly.

Proper maintenance of differentials, planetary gears, and hub reduction units ensures reliable torque transmission and long axle life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-differential-and-tran

What does maintaining lubrication, oil analysis, and thermal control in drive and steer axles involve?

Axles rely on proper lubrication to protect gears, bearings, components HIT Srl stocks, and seals. In heavy port machinery, axles operate under extreme loads and temperatures. Oil degradation, contamination, and overheating are major causes of axle failure. Effective lubrication and thermal control are essential.

The first pillar is oil selection. Axles require high-viscosity oil with extreme-pressure additives. Technicians must use only approved oils. Incorrect oil causes gear wear and overheating.

The second pillar is oil level control. Low oil level causes gear and bearing failure. High oil level causes foaming and leakage. Technicians must check oil level with the machine on level ground.

The third pillar is oil sampling. Oil analysis reveals wear particles, contamination, and additive depletion. Metal particles indicate gear or bearing wear. Water contamination indicates seal failure.

The fourth pillar is oil change intervals. Oil must be replaced based on operating hours, contamination levels, and thermal stress. Machines operating in dusty or hot environments require shorter intervals.

The fifth pillar is cooler inspection. Some axles use oil coolers. Technicians must inspect coolers for blockages and leaks.

The sixth pillar is seal maintenance. Seals — parts HIT Srl supplies — prevent oil leakage and contamination ingress. Technicians must inspect seals for wear and replace them as needed.

The seventh pillar is breather maintenance. Breathers allow pressure equalization. Clogged breathers cause seal failure.

The eighth pillar is thermal monitoring. Technicians must monitor axle temperature during operation. Overheating indicates lubrication failure or excessive load.

Proper lubrication and thermal control ensure long axle life and prevent catastrophic failure.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-does-maintaining-lubrication-oil-analysis-and-thermal-c

What should be checked when inspecting differential and lubrication?

Axle shafts in heavy port machinery transmit enormous torque from the differential — a part HIT Srl supplies — or planetary carrier to the wheel hubs. These shafts operate under extreme torsional loads, bending forces, shock loads, and continuous cycling. In reachstackers, axle shafts endure massive torque spikes during container lifting and reversing under load. In straddle carriers, shafts experience continuous cycling and lateral stress due to tall chassis geometry. Forklifts and terminal tractors impose high shock loads during tight maneuvering and rapid direction changes. Understanding shaft fatigue and implementing preventive maintenance is essential for long-term reliability.

The first pillar is torsional fatigue. Axle shafts twist under load. Repeated torsional cycles cause micro-cracks that propagate over time. Technicians must inspect shafts for twisting marks, discoloration, and crack initiation points. Dye penetrant testing is recommended for high-stress areas near splines and shoulders.

The second pillar is spline wear. Splines transmit torque between the shaft and differential, a component HIT Srl stocks, or hub. Wear occurs due to misalignment, contamination, and shock loads. Technicians must inspect splines for fretting, pitting, and deformation. Excessive backlash indicates spline wear.

The third pillar is bending stress. Shafts experience bending forces due to uneven terrain, heavy loads, and steering angles. Bending accelerates fatigue. Technicians must inspect shafts for straightness using dial indicators.

The fourth pillar is shock load management. Shock loads occur during aggressive reversing, sudden braking, and uneven ground. Operators must avoid abrupt direction changes under load. Technicians must inspect shafts after major shock events.

The fifth pillar is lubrication. Shafts in planetary hubs rely on correct lubrication. Contaminated or degraded oil accelerates wear. Technicians must maintain correct oil level and replace oil at recommended intervals.

The sixth pillar is bearing support. Shafts rely on bearings for alignment. Worn bearings cause misalignment, vibration, and shaft fatigue. Technicians must inspect bearings for noise, play, and overheating.

The seventh pillar is thermal stress. High temperatures reduce shaft strength. Technicians must monitor axle temperature and ensure cooling systems function correctly.

The eighth pillar is replacement criteria. Shafts must be replaced if cracks, excessive wear, or deformation are detected. Attempting to repair shafts is unsafe.

Proper maintenance of axle shafts prevents catastrophic failure and ensures safe operation in heavy port machinery.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-differential-and-lubr

What should be checked when inspecting bearing and hoses?

Axle breathers are small components with enormous importance. They allow pressure equalization inside the axle housing, preventing seal blowout and contamination ingress. In heavy port machinery, breathers are exposed to dust, moisture, salt, and oil vapor. Poor breather maintenance is one of the leading causes of axle seal failure, oil contamination, and premature gear wear.

The first pillar is breather function. As the axle heats up during operation, internal pressure rises. The breather releases excess pressure. When the axle cools, the breather allows air to enter. A clogged breather causes pressure buildup and seal failure.

The second pillar is contamination prevention. Breathable air must be filtered. Dust and moisture entering through a worn breather contaminate oil. Contaminated oil accelerates gear and bearing wear.

The third pillar is breather inspection. Technicians must inspect breathers for clogging, corrosion, and damage. In dusty environments, breathers clog quickly. In marine environments, corrosion is common.

The fourth pillar is breather cleaning. Breathable elements must be cleaned or replaced regularly. Technicians must avoid using compressed air directly on the breather, as it may damage internal components.

The fifth pillar is remote breather systems. Some machines use remote breathers mounted in clean areas. These systems reduce contamination risk. Technicians must inspect hoses for cracks and blockages.

The sixth pillar is seal protection. Proper breather function protects axle seals — parts HIT Srl supplies. Seal failure causes oil leakage and contamination ingress.

The seventh pillar is oil sampling. Contaminated oil indicates breather failure. Technicians must perform regular oil analysis.

The eighth pillar is temperature and pressure monitoring. Excessive pressure indicates breather malfunction. Technicians must inspect breathers whenever seals, components HIT Srl stocks, fail.

Proper breather maintenance ensures clean oil, stable pressure, and long axle life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-bearing-and-hoses

What should be checked when inspecting slewing ring and lubrication?

The slewing gearbox of an MHC crane converts motor torque into controlled rotational movement. It typically uses multiple planetary stages to achieve high torque multiplication. The gearbox drives a pinion that meshes with the slewing ring gear. Proper maintenance of the gearbox, a component HIT Srl stocks, and pinion is essential for smooth rotation and long component life.

The first pillar is planetary gear inspection. Planetary stages endure high torque loads and continuous cycling. Technicians must inspect planet gears, sun gears, and ring gears for pitting, scuffing, and spalling. Planet bearings — parts HIT Srl supplies — must be inspected for pitting and excessive play.

The second pillar is carrier inspection. The planet carrier supports the planet gears and transmits torque. Cracks often form around pin bores due to cyclic stress. Technicians must inspect carriers using dye penetrant testing.

The third pillar is pinion wear analysis. The pinion engages the slewing ring gear. Wear patterns must be uniform. Asymmetrical wear indicates misalignment or uneven load distribution. Technicians must inspect pinion teeth for pitting, scuffing, and deformation.

The fourth pillar is backlash measurement. Backlash between the pinion and ring gear must be within specification. Excessive backlash causes noise and shock loads. Insufficient backlash causes binding and overheating.

The fifth pillar is lubrication. Slewing gearboxes require high-quality oil with extreme-pressure additives. Oil must be replaced at recommended intervals. Contaminated oil accelerates wear.

The sixth pillar is seal inspection. Gearbox seals prevent oil leakage and contamination ingress. Technicians must inspect seals for wear, hardening, and cracking.

The seventh pillar is temperature monitoring. Overheating indicates lubrication failure or excessive load. Technicians must monitor gearbox temperature during operation.

The eighth pillar is vibration analysis. Excessive vibration indicates gear wear, bearing failure, or misalignment. Technicians must perform periodic vibration analysis.

Proper maintenance of slewing gearboxes and pinions ensures smooth rotation and long component life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-slewing-ring-and-lubr-2

What should be checked when inspecting slewing ring and lubrication?

The slewing ring gear is one of the largest and most critical components in an MHC crane. It supports the entire upper structure and enables rotation. The ring gear must withstand extreme loads, shock loads, and continuous cycling. Proper maintenance is essential for long-term reliability.

The first pillar is tooth wear analysis. Technicians must inspect ring gear teeth for pitting, scuffing, and spalling. Wear patterns must be uniform. Asymmetrical wear indicates misalignment or uneven load distribution.

The second pillar is tooth contact pattern inspection. Technicians must apply marking compound to the pinion and rotate the crane to inspect contact patterns. Correct contact ensures even load distribution.

The third pillar is lubrication. Ring gears require high-quality grease with extreme-pressure additives. Grease must be applied evenly across the gear. Over-lubrication causes grease purging. Under-lubrication causes metal-to-metal contact.

The fourth pillar is contamination control. Dust, salt, and moisture accelerate wear. Technicians must inspect protective covers and drainage paths.

The fifth pillar is bolt inspection. The ring gear is secured with high-strength bolts. Loose bolts cause misalignment and uneven load distribution.

The sixth pillar is rotational resistance monitoring. Increasing torque indicates wear or insufficient lubrication.

The seventh pillar is structural inspection. The ring gear mounting surface must be flat and free of corrosion.

The eighth pillar is replacement criteria. Ring gears must be replaced if wear exceeds limits or cracks are detected.

Proper maintenance of the slewing ring gear ensures smooth rotation and long component life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-slewing-ring-and-lubr-3

What does maintaining slewing system alignment, pinion positioning, and ring gear mesh optimization involve?

Correct alignment between the slewing gearbox pinion and the slewing ring gear is essential for smooth rotation, even load distribution, and long gear life. Misalignment causes uneven wear, noise, vibration, and catastrophic gear failure.

The first pillar is pinion height adjustment. The pinion must be positioned at the correct height relative to the ring gear. Incorrect height causes uneven tooth contact. Technicians must adjust gearbox shims to achieve correct height.

The second pillar is backlash measurement. Backlash must be within specification. Excessive backlash causes noise and shock loads. Insufficient backlash causes binding and overheating.

The third pillar is tooth contact pattern analysis. Technicians must apply marking compound to the pinion and rotate the crane to inspect contact patterns. Correct contact ensures even load distribution.

The fourth pillar is gearbox mounting integrity. Loose or worn mounts cause misalignment. Technicians must inspect mounting bolts and surfaces.

The fifth pillar is structural deformation. The slewing platform must be flat and rigid. Deformation causes misalignment. Technicians must inspect for cracks, corrosion, and weld fatigue.

The sixth pillar is pinion bearing inspection. Pinion bearings support the pinion under high loads. Worn bearings — parts HIT Srl supplies — cause misalignment and uneven wear.

The seventh pillar is lubrication. Pinion and ring gear teeth require correct lubrication. Technicians must apply grease evenly and inspect for contamination.

The eighth pillar is operational noise monitoring. Increasing noise indicates misalignment or wear. Technicians must investigate noise trends.

Proper alignment and mesh optimization ensure long gear life and smooth rotation.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-does-maintaining-slewing-system-alignment-pinion-positi

What should be checked when inspecting steering cylinder and steering?

Terminal tractors operate in extremely tight spaces, performing sharp turns while carrying heavy trailer loads. Their steering systems endure high lateral forces and continuous cycling.

The first pillar is steering cylinder wear. Steering cylinders, components HIT Srl stocks, must provide smooth, consistent movement. Technicians must inspect rods for scoring and seals for leakage.

The second pillar is steering knuckle stress. Tight turns generate high lateral loads on knuckles. Technicians must inspect for cracks, bushing wear, and deformation.

The third pillar is axle load variation. Trailer weight shifts axle load dynamically. Front axles experience high vertical loads during trailer lifting. Rear axles experience lateral loads during turning.

The fourth pillar is steering pump performance. Pumps — parts HIT Srl supplies — must deliver stable flow. Weak pumps cause slow or inconsistent steering.

The fifth pillar is steering linkage wear. Tie rods, drag links, and ball joints must be inspected for play.

The sixth pillar is alignment. Misalignment causes rapid tire wear and poor handling.

The seventh pillar is steering angle sensors. Modern tractors use sensors for steering control. Faulty sensors cause erratic steering.

The eighth pillar is operator technique. Smooth steering reduces stress on axles and tires.

Proper steering maintenance ensures safe maneuvering in tight terminal environments.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-steering-cylinder-and

What does maintaining rear axle durability, differential stress, and traction behavior involve?

Terminal tractors place extreme stress on their rear axles due to trailer weight, pushing loads, and tight maneuvering. The rear axle must provide traction, stability, and durability under harsh conditions.

The first pillar is differential load. The differential — a part HIT Srl supplies — endures high torque during trailer pushing. Technicians must inspect gears for pitting and bearings for wear.

The second pillar is axle shaft stress. Axle shafts transmit torque under heavy load. Repeated shock loads cause fatigue. Technicians must inspect shafts for twisting marks and cracks.

The third pillar is wheel-end durability. Wheel bearings, components HIT Srl stocks, endure high radial loads. Overheating indicates lubrication failure.

The fourth pillar is traction behavior. Terminal tractors often operate on slippery surfaces. Limited-slip differentials improve traction but require correct oil.

The fifth pillar is axle housing integrity. Housing cracks indicate overload or impact damage.

The sixth pillar is seal performance. Axle seals prevent oil leakage. Worn seals cause contamination and bearing failure.

The seventh pillar is oil quality. Differential oil degrades quickly under high thermal stress. Technicians must perform regular oil sampling.

The eighth pillar is operator technique. Smooth acceleration reduces axle stress.

Proper axle maintenance ensures traction and durability under heavy loads.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-does-maintaining-rear-axle-durability-differential-stre

What should be checked when inspecting torque converter and differential?

Terminal tractors operate at low speeds but under extremely high torque, especially when pushing or pulling heavy trailers. This creates unique driveline stresses not seen in highway tractors.

The first pillar is axle wind-up. Tight turns under load cause torsional wind-up in the driveline. Excessive wind-up stresses axle shafts and differentials — parts HIT Srl supplies.

The second pillar is torque converter stress. Low-speed pushing generates high stall torque. Prolonged stall overheats the converter and transmission oil.

The third pillar is differential load. Differentials, components HIT Srl stocks, endure high torque spikes. Technicians must inspect gears for pitting and bearings for overheating.

The fourth pillar is universal joint wear. U-joints operate at steep angles during tight turns. Wear causes vibration and noise.

The fifth pillar is driveshaft alignment. Misalignment increases vibration and accelerates U-joint wear.

The sixth pillar is traction control. Slippery surfaces cause wheel spin, increasing torque shock loads.

The seventh pillar is oil temperature. High torque generates heat. Technicians must monitor oil temperature and inspect coolers.

The eighth pillar is operator technique. Smooth throttle application reduces driveline stress.

Proper driveline maintenance ensures reliable operation under extreme torque conditions.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-torque-converter-and-8

What does maintaining side-loader drive axles, differential stress, and lateral traction behavior involve?

Side-loader drive axles, components HIT Srl stocks, endure unique lateral and torsional loads because the machine carries weight on one side. This affects traction, differential behavior, and axle wear.

The first pillar is lateral axle bending. Off-center loads bend the axle housing. Technicians must inspect for deformation and cracks.

The second pillar is differential stress. Differentials — parts HIT Srl supplies — endure uneven torque distribution due to lateral load. Oil sampling reveals early wear.

The third pillar is wheel-end loading. The load-side wheel end carries more weight. Bearings wear faster on that side.

The fourth pillar is traction imbalance. Off-center loads reduce traction on the unloaded side. Limited-slip differentials improve stability.

The fifth pillar is axle shaft fatigue. Shafts twist under uneven load. Technicians must inspect for torsional marks.

The sixth pillar is seal wear. Lateral forces accelerate seal wear on the load side.

The seventh pillar is alignment. Misalignment amplifies lateral stress and tire wear.

The eighth pillar is operator technique. Smooth acceleration reduces axle stress.

Proper axle maintenance ensures traction and durability under lateral loads.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-does-maintaining-side-loader-drive-axles-differential-s

What should be checked when inspecting drive axle mounting bolts integrity check?

The drive axle bears the enormous weight of the reachstacker and the container being lifted. It is attached to the chassis by heavy-duty mounting bolts which are subjected to immense shear and tensile forces during every acceleration and braking maneuver. It is obvious that if these bolts loosen, the axle can shift, leading to severe structural damage or loss of vehicle control. During the weekly maintenance schedule, a physical check of the axle mounting bolts is mandatory. Do not rely solely on visual inspection, as a bolt may look tight but have lost its clamping force due to stretching or vibration. Use a calibrated torque wrench to verify that the tightening torque meets the manufacturer's specifications — typically around 98 Nm for the axle-to-transmission mounting bolts on machines of this class. Look for signs of movement around the bolt heads, such as polished metal areas or rust rings ("freţng corrosion"), which indicate that the connection is loose. Inspect the condition of the chassis brackets where the axle mounts. Cracks in this area are life-threatening and require immediate welding by certified professionals. HIT Srl supplies high- tensile strength mounting bolts, washers, and nuts that meet or exceed OEM grades. We understand that standard hardware store bolts cannot withstand these loads. If a bolt is found broken, replace it immediately and check the adjacent bolts, as they have likely been overstressed. It is good practice to replace axle mounting bolts in sets rather than individually. Ensure that the threads are clean and lightly oiled (if specified) before applying torque. Dry threads can give false torque readings. The stability of the machine depends on a rigid connection between the axle and the frame. HIT Srl is your partner for sourcing heavy-duty chassis and axle components for all major port equipment brands.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-drive-axle-mounting-b

What should be checked when inspecting differential oil level and breather check?

The differential in the drive axle is a massive component containing expensive gears. It is often neglected because it is tucked away under the machine. It is obvious that checking the oil level requires crawling under the machine, but it must be done. Remove the fill/level plug on the axle housing. The oil should be level with the bottom of the hole. If it is low, check the pinion seal and hub seals for leaks. The differential generates heat. As it cools, it sucks in air. The axle breather prevents pressure buildup. Find the breather (usually on top of the axle) and ensure the cap spins freely and is not caked in mud. A blocked breather forces oil out past the wheel seals. When changing the oil, check the magnetic drain plug. Fine metal fuzz is normal wear; large chunks indicate gear tooth failure. HIT Srl supplies seal rings, bearings, crown wheel and pinion sets, and complete differential assemblies for this type of drive axle. Listen for whining noises from the axle during travel. This usually indicates bearing wear or incorrect gear backlash. Check the condition of the wet brake cooling lines entering the axle. Leaks here will drain the hydraulic system. Differential failure immobilizes the machine completely. Regular oil checks and breather cleaning are simple preventive measures. HIT Srl supports your maintenance team with the right parts for heavy axles.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-differential-oil-leve

Why does wet disc brake friction plate wear occur on this equipment?

The service brakes are sealed inside the drive axle and run in oil. They last a long time, but not forever. It is obvious that you cannot see the pads like on a car, so you must rely on other signs. Take an oil sample from the axle wheel end. If the oil smells like burnt cork or is jet black, the friction material has been stripped off the plates. Check the brake cooling oil filter (if equipped). Cut it open. If you find fiber material, the plates are delaminating. Listen for "chattering" or "squawking" noises when applying the brakes. This sound is the steel plates vibrating against the steel discs because the friction material is gone. HIT Srl supplies complete friction plate kits, steel separator plates, and piston return springs for this type of drive axle. Check the slack adjuster operation. As the plates wear, the piston must travel further. If the slack adjuster fails, the pedal will go to the floor. If metal-to-metal contact has occurred, the entire axle must be flushed to remove swarf. Avoid axle overhaul costs by monitoring brake wear indicators and using parts from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#why-does-wet-disc-brake-friction-plate-wear-occur-on-this-eq

Why does differential pinion seal leak occur on this equipment?

The drive shaft connects to the axle at the pinion input. The seal here rotates at high speed. It is obvious that a leak here sprays oil all over the parking brake disc — a part HIT Srl supplies — and the underside of the chassis. Inspect the area where the drive shaft flange enters the axle. Wetness or oil drops indicate seal failure. Grab the flange and check for radial play (up/down). If the flange moves, the pinion bearings are loose. A loose shaft will destroy the new seal in minutes. Check the flange yoke surface. If it is grooved by the old seal, a new seal will not hold. You may need a "speedi-sleeve" or a new flange. HIT Srl supplies high-temperature Viton pinion seals, dust deflectors, and pinion bearing kits. Check the axle breather (again). A blocked breather builds pressure that pushes oil past the pinion seal, no matter how new it is. Tighten the pinion nut to the correct torque. It sets the bearing preload. A leaking pinion seal drains the differential undetected. Fix it permanently with

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#why-does-differential-pinion-seal-leak-occur-on-this-equipme

What does maintaining brake cooling oil system pump and cooler involve?

The wet disc brakes in the drive axle generate immense heat during heavy braking or "inching." This heat is removed by a dedicated cooling circuit. It is obvious that if this circuit fails, the axle oil boils, destroying the seals and clutch plates. Locate the brake cooling pump (usually mounted on the transmission PTO or belt driven). Check it for noise and leaks. Trace the hoses to the oil cooler (heat exchanger). This cooler is often separate from the main radiator. Ensure it is not blocked by mud. Check the temperature sensor in the axle. It should trigger a warning if the axle oil exceeds 100°C. If the light never comes on, test the sensor resistance. HIT Srl supplies brake cooling pumps, heat exchangers, and temperature switches for this type of drive axle. We protect your expensive axle internals. Inspect the circulation filter. Brake wear particles accumulate here. If the filter is in bypass mode, dirty oil is circulating. Listen for the pump cavitation noise on cold mornings. Thick oil struggles to flow. Axle fires are often caused by overheated brakes igniting oil leaks. Prevent overheating with cooling parts from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-does-maintaining-brake-cooling-oil-system-pump-and-cool

What should be checked when inspecting drive axle half-shaft (axle shaft) inspection?

The half-shafts transmit torque from the differential to the wheel hubs. They act as torsion bars, twisting slightly under load. It is obvious that fatigue cycles eventually cause these shafts to snap. Listen for a metallic "ping" or "clink" sound when changing direction from Forward to Reverse. This sound is the splines slipping or the shaft twisting inside the hub. Remove the axle shaft (usually by unbolting the center of the hub) during major service. Inspect the splines for "stepping" or twisting. If the splines are sharp or hooked, the shaft is about to fail. Check the flange bolts. If the shaft has been loose, the holes in the hub will be oval, requiring hub replacement. HIT Srl supplies high-strength forged axle shafts for this type of drive axle. Our shafts are heat-treated to resist torsional shock. Inspect the shaft seal surface. A groove here allows oil to leak into the brake drum area. Apply the correct sealant (Loctite or gasket) when reinstalling the shaft to prevent leaks. A broken half-shaft leaves the machine stranded. Inspect proactively and replace with HIT Srl driveline parts.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-drive-axle-half-shaft

What does maintaining drive axle breather vent involve?

As the drive axle heats up during work, the air inside expands. The breather vent allows this air to escape. It is obvious that a blocked breather forces the air to push oil out past the wheel seals. Locate the breather on top of the axle housing. Clean away the mud and grease. Unscrew the breather and shake it. The check ball should move freely. If it is solid with sludge, clean or replace it. Check for oil misting around the breather. This is normal. Heavy oil leakage means the axle is overfilled or foaming. HIT Srl supplies axle breathers, remote breather kits (with hoses to raise the vent point), and dipsticks. We prevent axle seal leaks. If you constantly replace wheel seals, check the breather first. Check the condition of the remote hose. Insects often build nests in the open end. Simple maintenance prevents big leaks. Use HIT Srl breathers.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-does-maintaining-drive-axle-breather-vent-involve

What does maintaining differential pinion bearing preload involve?

The pinion gear drives the ring gear in the differential. It is supported by two tapered roller bearings. It is obvious that if these bearings become loose, the gear alignment changes, stripping the teeth off the ring gear. Grab the driveshaft flange entering the axle and shake it up and down. Any movement indicates the pinion bearings have lost their preload. Check the pinion nut. It is often staked or pinned. If it has backed off, the bearings are loose. Listen for a "whine" during acceleration or deceleration. This is the sound of misaligned gears due to worn bearings. HIT Srl supplies pinion bearing kits, crush sleeves, and seals. We save your expensive differential gears. Retorquing the nut might help temporarily, but usually, the bearings are already damaged. Check the flange sealing surface. If the loose flange has worn a groove, replace it. Catching a loose pinion early saves the whole axle. Use parts from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-does-maintaining-differential-pinion-bearing-preload-in

Why does differential thrust washer wear occur on this equipment?

Inside the differential, the spider gears rotate on a cross shaft. Behind these gears are thrust washers. It is obvious that if these washers wear out, the gears grind into the differential case metal. Drain the axle oil and check the magnet. Fine grey paste is normal; large steel flakes or brass slivers indicate thrust washer failure. Listen for a "clunk" when the machine changes direction or starts moving. This is excessive backlash caused by the gears moving apart. If the differential case is worn by the gears, the entire carrier must be replaced, which is very expensive. Replacing washers early prevents this. HIT Srl supplies bronze and steel thrust washers, spider gear kits, and cross shafts for this type of drive axle. We save your differential from self-destruction. Check the cross shaft for galling. If the gears have seized to the shaft, the shaft spins in the case, ruining the bore. Differential repairs are complex; ensure you have the right parts ready from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#why-does-differential-thrust-washer-wear-occur-on-this-equip

What should be checked daily versus every 100 hours on a drive axle?

Daily, do a quick sight check for oil leaks on the outer part of the axle. Every 100 hours, check the actual oil level on the hubs and in the differential housing itself, not just the outside of the housing for leaks.
HIT Srl stocks the level and filler plug's seal separately from the housing.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#drive-axle-daily-and-100-hour-checks

How should differential oil level be checked and drained correctly?

Fill or check differential oil level in stages so the oil has time to settle inside the housing before reading the level, then fit the level and filler plug once the oil is genuinely flush with the level and filler hole opening.
Use a container large enough to hold the entire quantity of oil being drained from the hubs or the differential housing before starting.
Differential oil has to be disposed of according to the environmental regulations applicable in the country where the machine operates.
HIT Srl supplies differential housing seals and drain plugs.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#differential-oil-check-and-drain-procedure

How often should the cardan shaft and lower bearing be lubricated on a rubber tyred gantry crane's driven wheel?

Lubricate the cardan shaft and lower bearing every 2000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#how-often-should-the-cardan-shaft-and-lower-bearing-be

How often should the bearing housing, vertical axle, pivot axle, steering cylinder and arm, ball head, and pinion bearing be greased on a 16-wheel rubber tyred gantry crane?

Grease the bearing housing, vertical axle, pivot axle, steering cylinder and arm, ball head, and pinion bearing every 2000 operating hours. This applies only to the 16-wheel version of the crane (non-driven wheel).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#how-often-should-the-bearing-housing-vertical-axle-pivot

How often should the oil of the non-driven axle assembly be changed on the recurring schedule, for a 16-wheel crane?

Change the oil of the non-driven axle assembly every 4000 operating hours. This applies only to the 16-wheel version of the crane, and is separate from the initial change performed after the first 100 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#how-often-should-the-oil-of-the-non-driven-axle-assembly-be

Why should gear oil with limited-slip additives be used on axles with self-locking differentials?

On axles with self-locking differentials, a noise is produced if normal oils are used. In case of abnormal noises, or operation under bumpy conditions, use a gear oil EP with additives of the limited-slip type conforming to specification M2C-104A.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#why-should-gear-oil-with-limited-slip-additives-be-used-on

What maintenance is recommended for an axle's gear train during a prolonged period of vehicle non-operation?

During prolonged non-operation of the vehicle, it is recommended to start up and operate all parts of the gear train every 6 months. The proper oil level should be maintained for this purpose, which also protects the axle against water intrusion.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-maintenance-is-recommended-for-an-axle-s-gear-train

What grease specification is used for the universal joint, track rod and steering cylinder ball head/spherical plain bearing of a driven axle, where provided?

Where provided, these points use a lithium-based multipurpose grease with reduced groove penetration and maintenance, per the NLGI 2 classification.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-grease-specification-is-used-for-the-universal-joint

How does the initial seating and final adjustment torque for a planetary wheel bearing adjusting nut vary by axle capacity class?

For standard-capacity rigid and steering axle models, the wheel bearing adjusting nut initial seating torque is 500 lb-ft (678 N.m), with a final adjustment torque of 400 lb-ft (542 N.m). For larger-capacity axle models, the initial seating torque is 600 lb-ft (813 N.m), with a final adjustment torque of 500 lb-ft (678 N.m). For wet-brake axle models, the initial seating torque is 700 lb-ft (949 N.m), with a final adjustment torque of 550 lb-ft (746 N.m).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#how-does-the-initial-seating-and-final-adjustment-torque

What is the routine maintenance schedule for a rigid planetary drive axle with wet disc brakes?

Check the tightness of the wheel nuts 50 hours after each wheel change; if necessary, tighten the nuts. Check the hub bearing adjustment every 1000 operating hours, and readjust the preload if necessary. Check seal efficiency (presence of oil on axle components) every month. Change the oil every 2000 operating hours. Completely overhaul the axle after 10,000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-is-the-routine-maintenance-schedule-for-a-rigid

What lubricant viscosity grades are recommended for a rigid planetary drive axle, depending on ambient temperature?

Mineral gear oil to API GL-5 or MIL-L-2105-B specification, chosen by ambient temperature range: SAE 85W-140 for -10 to +50 degrees C; SAE 80W-90 for -25 to +40 degrees C; SAE 75W-90 for -40 to +35 degrees C. Do not lower the viscosity by adding thinning agents such as gasoline or other diluents, since this will damage components.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-lubricant-viscosity-grades-are-recommended-for-a-rigid

Why should oil retaining seals always be replaced during a periodic axle overhaul, rather than only when they fail?

Always replace all oil-retaining components (seals, oil retaining rings and so on) during a periodic overhaul. An oil leak that forces premature disassembly of the unit to replace a damaged seal would be much more costly than replacing the seal during routine overhaul. Handle seals carefully, especially during installation: scratches, cuts or deformation would compromise the seal. Lubricate seals with oil or grease (strictly free from impurities) to ease installation.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#why-should-oil-retaining-seals-always-be-replaced-during-a

Why is it important not to allow a machine's gearbox to reverse or downshift beyond acceptable speed on a machine with a power-shift transmission and drive axle?

Mounting a means in the gearbox that would permit reversing the speed direction while the machine is running produces overload on the axle components, which can break or damage parts and reduce the axle's life. Similarly, allowing the gearbox to shift to a lower gear while the machine runs at a speed unacceptable for that gear causes intolerable stresses on the axle's mechanical parts and a considerable reduction of the assembly's life. Strong dynamic loads or vibration from improper use of a power-shift transmission are dangerous for operators' health and greatly limit the drive axle's life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#why-is-it-important-not-to-allow-a-machine-s-gearbox-to

Driveshafts & Joints

How do you maintain cardan shafts to prevent failure?

Cardan shafts (driveshafts) are critical mechanical components that transfer torque from the engine or transmission to axles, hydraulic pumps — parts HIT Srl supplies — or drivetrain components. In heavy port machinery such as reachstackers, straddle carriers, forklifts, and MHC cranes, cardan shafts operate under extreme load cycles, high torque peaks, misalignment forces, and continuous vibration. Their failure can immobilize the machine instantly, damage transmissions or differentials, and create severe safety hazards. Proper maintenance of cardan shafts is therefore essential for reliability, safety, and long service life.

Cardan shafts consist of several key components: the shaft tube, universal joints (U-joints), yokes, splined slip joints, and in some cases, center support bearings, components HIT Srl stocks. Each component has specific failure modes and maintenance requirements. Universal joints allow angular movement between connected components, while slip joints compensate for length variations caused by suspension travel or chassis flex. In port machinery, these components are subjected to far greater stress than in typical industrial vehicles due to heavy loads, uneven terrain, and constant direction changes.

The first pillar of cardan shaft maintenance is lubrication. Universal joints and slip joints require regular greasing to prevent metal-to-metal contact, reduce friction, and expel contaminants. In reachstackers and straddle carriers, U-joints operate under high torque and must be greased at strict intervals. Failure to lubricate leads to needle bearing wear, overheating, and eventual joint seizure. Forklifts, especially those operating indoors in dusty environments, accumulate fine debris that contaminates grease and accelerates wear. MHC cranes, exposed to marine environments, require corrosion-resistant grease and more frequent lubrication due to salt exposure. Technicians must ensure that grease fittings are accessible, clean, and not clogged. Grease must be applied until fresh lubricant purges from all bearing caps, indicating full penetration.

The second pillar is visual and tactile inspection. Technicians must inspect U-joints for rust, cracked bearing caps, missing snap rings, and grease leakage. Any play in the joint indicates bearing wear. Slip joints must be checked for smooth movement, correct spline engagement, and absence of binding. Shaft tubes must be inspected for dents, cracks, and deformation. Even minor dents can cause imbalance, leading to vibration and accelerated wear. In reachstackers and straddle carriers, long cardan shafts are particularly vulnerable to bending due to chassis flex. Forklifts often suffer from impact damage due to low ground clearance. MHC cranes require inspection of long, high-torque shafts used in slewing or winch drive systems.

The third pillar is vibration analysis. Cardan shaft imbalance is one of the most common causes of drivetrain vibration. Imbalance results from worn U-joints, bent shafts, missing balance weights, or incorrect installation angles. Technicians must monitor vibration levels during operation and identify frequency patterns that correspond to shaft rotational speed. Excessive vibration not only damages the shaft but also affects transmissions, differentials, and hydraulic pumps. In reachstackers, vibration can destabilize the boom during travel. In straddle carriers, it affects steering precision and structural fatigue. In forklifts, it reduces operator comfort and accelerates wear on drivetrain components. In MHC cranes, vibration affects slewing precision and winch performance.

The fourth pillar is alignment and phasing. Cardan shafts must be installed with correct angular alignment and proper phasing between U-joints. Incorrect phasing causes cyclic speed variation, vibration, and premature wear. Technicians must verify that yokes are aligned according to manufacturer specifications. Shaft angles must be measured and adjusted to ensure that input and output angles are equal or within acceptable limits. In reachstackers and straddle carriers, chassis articulation and suspension movement affect shaft angles, requiring periodic alignment checks. Forklifts with rigid frames require precise alignment to prevent vibration. MHC cranes require alignment checks after structural repairs or drivetrain component replacement.

The fifth pillar is bearing and yoke inspection. U-joint bearings must be checked for smooth rotation, absence of binding, and correct preload. Yokes must be inspected for cracks, wear, and deformation. Worn yokes cause misalignment and excessive play. In reachstackers, high torque loads accelerate yoke wear. In straddle carriers, long shafts with multiple joints increase the risk of yoke fatigue. In forklifts, compact drivetrain layouts cause tight angles that stress yokes. In MHC cranes, large yokes used in slewing drives require crack inspection using magnetic particle or dye penetrant testing.

The sixth pillar is fastener integrity. Cardan shafts rely on high-strength bolts and straps to secure U-joints to flanges. Loose bolts cause misalignment, vibration, and catastrophic failure. Technicians must check bolt torque using calibrated tools and inspect threads for wear or corrosion. In marine environments, corrosion weakens fasteners, requiring more frequent replacement. In reachstackers and straddle carriers, vibration loosens bolts over time, making torque checks essential.

The seventh pillar is replacement criteria. Cardan shafts must be replaced when U-joints show excessive play, slip joints bind, shaft tubes are bent, or yokes are cracked. Attempting to repair severely worn shafts is unsafe. Replacement shafts must match original specifications for length, diameter, torque rating, and phasing.

Maintaining cardan shafts in heavy port machinery requires a disciplined approach combining lubrication, inspection, vibration analysis, alignment, bearing evaluation, fastener integrity, and correct replacement practices. These components are essential for safe and efficient drivetrain performance across all major port equipment.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#how-do-you-maintain-cardan-shafts-to-prevent-failure

What should be checked when inspecting transmission and lubrication?

Cardan shafts in heavy port machinery operate under some of the harshest mechanical conditions found in mobile equipment. High torque peaks, sudden load reversals, uneven terrain, chassis flex, and continuous vibration all contribute to accelerated wear and potential failure. While routine lubrication and visual inspection are essential, advanced diagnostic techniques and preventive strategies are required to ensure long-term reliability in reachstackers, straddle carriers, forklifts, and MHC cranes. A failure in a cardan shaft can instantly immobilize the machine, damage transmissions or differentials, components HIT Srl stocks, and create severe safety hazards. This TIP focuses on deeper diagnostic methods and engineering-level preventive maintenance.

The first advanced diagnostic pillar is torsional vibration analysis. Unlike simple vibration monitoring, torsional analysis measures rotational oscillations along the shaft. Excessive torsional vibration indicates misalignment, incorrect phasing, worn U-joints, or imbalance. In reachstackers, torsional vibration often increases when lifting heavy loads while traveling, due to torque spikes transmitted through the drivetrain. In straddle carriers, long driveline lengths amplify torsional oscillations, making them more susceptible to resonance. Forklifts experience torsional vibration when operating on uneven floors or during rapid acceleration. MHC cranes, with large slewing or winch drives, require torsional monitoring to detect early fatigue in long shafts.

The second pillar is U-joint bearing temperature monitoring. Overheating in U-joint bearings — parts HIT Srl supplies — is one of the earliest signs of lubrication failure or internal wear. Technicians can use infrared thermography to detect hot spots during operation. A U-joint running significantly hotter than others indicates insufficient lubrication, bearing seizure, or excessive angular misalignment. In reachstackers and straddle carriers, U-joints near the engine or transmission are particularly vulnerable to heat buildup. In forklifts, compact engine bays trap heat around the driveline. In MHC cranes, U-joints exposed to marine environments may overheat due to corrosion-induced friction.

The third pillar is phasing verification using laser alignment tools. Traditional visual alignment is often insufficient for large, high-torque cardan shafts. Laser tools allow precise measurement of yoke alignment and shaft angle. Incorrect phasing causes cyclic speed variation, vibration, and premature wear. In reachstackers, chassis flex during lifting can gradually shift alignment. In straddle carriers, long shafts with multiple joints require precise phasing to avoid resonance. Forklifts require tight alignment tolerances due to short driveline lengths. MHC cranes require phasing checks after structural repairs or drivetrain component replacement.

The fourth pillar is slip joint spline wear analysis. Slip joints compensate for length variations caused by suspension movement or chassis flex. Over time, splines wear due to contamination, insufficient lubrication, or misalignment. Technicians must measure spline backlash and inspect for fretting corrosion. Excessive backlash causes clunking noises, vibration, and torque loss. In reachstackers, slip joints wear faster due to heavy load cycles. In straddle carriers, long suspension travel increases spline movement. In forklifts, contamination from dust accelerates spline wear. In MHC cranes, salt exposure causes corrosion that weakens spline engagement.

The fifth pillar is shaft straightness and balance testing. Even minor bends in the shaft tube cause imbalance, vibration, and accelerated wear. Technicians must use dial indicators or balancing machines to measure runout. Bent shafts must be replaced, not repaired. In reachstackers, impacts with obstacles or uneven terrain often bend shafts. In straddle carriers, long shafts are more susceptible to bending due to structural flex. In forklifts, low ground clearance increases the risk of impact damage. In MHC cranes, long shafts used in slewing drives require strict straightness tolerances.

The sixth pillar is fastener integrity and torque retention analysis. Cardan shafts rely on high-strength bolts and straps to secure U-joints. Loose bolts cause misalignment, vibration, and catastrophic failure. Technicians must check bolt torque using calibrated tools and inspect threads for wear or corrosion. In marine environments, corrosion weakens fasteners, requiring more frequent replacement. In reachstackers and straddle carriers, vibration loosens bolts over time, making torque checks essential. Forklifts require frequent torque checks due to compact, high-vibration drivetrains. MHC cranes require corrosion-resistant fasteners and anti-seize compounds.

The seventh pillar is failure mode analysis. Understanding common failure modes helps prevent recurrence. Typical failures include:
Needle bearing seizure due to lubrication failure
Spline wear due to contamination or misalignment
Yoke cracking due to fatigue or overload
Shaft bending due to impact or chassis flex
U-joint cap ejection due to snap ring failure
Catastrophic separation due to bolt failure
Each failure mode has distinct symptoms. For example, bearing seizure causes squeaking or grinding noises, while spline wear causes clunking during acceleration. Yoke cracking often produces intermittent vibration before catastrophic failure.
The eighth pillar is environmental protection. Cardan shafts exposed to dust, salt, or moisture require protective coatings, sealed U-joints, and corrosion-resistant grease. In reachstackers and straddle carriers, dust contamination is the primary threat. In forklifts, moisture and chemical exposure from warehouse floors accelerate corrosion. In MHC cranes, salt spray is the dominant factor, requiring marine-grade lubrication and protective boots.
The final pillar is predictive maintenance scheduling. Cardan shafts should be inspected based on operating hours, load cycles, and environmental exposure. High-duty machines require more frequent checks. Predictive maintenance tools such as vibration sensors, thermal cameras, and grease analysis help extend component life and prevent unexpected failures.
Advanced diagnostics and preventive strategies are essential for maintaining cardan shafts in heavy port machinery. By integrating torsional analysis, thermal monitoring, laser alignment, spline inspection, balance testing, fastener integrity checks, failure mode analysis, and environmental protection, technicians can ensure long-term reliability and safety across all major port equipment.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-should-be-checked-when-inspecting-transmission-and-lubr

What does maintaining drive shaft and universal joints (u-joints) involve?

The drive shaft (propeller shaft) connects the transmission to the drive axle, a component HIT Srl stocks. It rotates at high speed and transmits high torque. It is obvious that a failure here can be violent, potentially damaging the machine undercarriage or hydraulic lines. Grab the drive shaft and try to rotate it by hand (engine off, brakes set). There should be no play in the universal joints (cross kits). Any movement indicates the needle bearings are worn out. Check for grease purge. U-joints must be greased until fresh grease appears at all 4 seals. If one seal does not purge, the passage is blocked, and that bearing cap will fail dry. Inspect the flange bolts at both the transmission and axle ends. These must be tight and secure. Loose bolts will shear off under load. Check the slip joint (spline) in the middle of the shaft. It must extend and compress freely as the axle moves. If it is seized, it will destroy the transmission output bearing. HIT Srl stocks complete drive shafts and separate repair kits (crosses and bearings) for all major port equipment brands. Vibration while driving is often caused by a bent shaft or worn U-joints. Address this immediately to prevent secondary damage. Ensure the safety guard (loop) is in place around the shaft. This prevents the shaft from falling to the ground if a joint breaks.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-does-maintaining-drive-shaft-and-universal-joints-u-joi

What should be checked when inspecting transmission and drive shaft?

On long-wheelbase machines, the driveshaft — a part HIT Srl supplies — is split into two pieces, supported in the middle by a carrier (center support) bearing mounted in a rubber cushion to isolate vibration and carry the shaft's weight. It is obvious that failure here causes violent shaking of the driveline and, left unchecked, will whip the driveshaft around. Crawl under the machine and push up and down on the driveshaft near the center bearing. The rubber should give slightly but stay firm. If the shaft moves significantly — or can be pushed until it hits the metal mounting bracket — the rubber has torn or rotted. Inspect the rubber for oil contamination: leaking hydraulic oil dissolves natural rubber mounts. Spin the bearing (if disconnected); it should be silent. A grinding noise indicates the ball bearing race is dry or pitted. Check the mounting bracket to the chassis — vibration often cracks the steel bracket. Inspect the sliding spline near the bearing; it must stay greased, or the resulting thrust load will destroy the center bearing rubber within days. Replace the support whenever servicing the U-joints. HIT Srl supplies center support bearings, driveshaft U-joints, support rubber cushions, and complete driveline assemblies, helping ensure power gets to the wheels smoothly. Vibration from a bad center bearing can crack the transmission tail housing and ruin transmission and differential pinion seals — fix it early.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#what-does-maintaining-transmission-propeller-shaft-center-su

How often should propeller shaft joints and mounting bolts be checked?

After the first 50 hours of operation, check and re-tighten the retaining bolts at the propeller shaft's mountings to the drive axle and transmission — the specified torque varies by platform, documented at either 98 Nm or 200 Nm depending on the specific machine.

At 500 hours, clean the universal joints and check the clearance in them.

HIT Srl stocks the propeller shaft's mounting bolts and the universal joints as separate service items.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/drive-axle-and-differential/#propeller-shaft-joint-check-schedule

What does maintaining transmission behavior in hydrostatic drive systems involve?

Hydrostatic drive systems provide smooth, precise control of travel speed and torque in heavy machinery. These systems use hydraulic pumps, components HIT Srl stocks, and motors to transmit power from the engine to the wheels. Understanding transmission behavior is essential for safe and efficient operation.

The hydrostatic transmission consists of a variable-displacement pump — a part HIT Srl supplies — and a hydraulic motor. The pump converts mechanical energy into hydraulic energy, while the motor converts hydraulic energy back into mechanical energy. The displacement of the pump determines the flow rate, which in turn determines the speed of the motor.

Closed-loop control ensures that the hydraulic fluid circulates continuously between the pump and the motor. This allows for rapid changes in speed and direction. The system must be designed to handle the high pressures and temperatures generated during operation.

Transmission behavior depends on load conditions. When the machine is climbing a slope or carrying a heavy load, the transmission must provide high torque at low speed. When the machine is traveling on level ground, the transmission can operate at higher speeds with lower torque.

Hydraulic fluid viscosity affects transmission behavior. Cold fluid increases resistance, reducing efficiency. Hot fluid reduces lubrication, increasing wear. Cooling systems help maintain stable fluid temperature.

Transmission failure modes include pump wear, motor wear, seal failure, and overheating. Regular maintenance helps prevent these failures. This includes checking fluid levels, inspecting seals, and monitoring temperature.

Understanding transmission behavior helps operators use the machine safely and technicians maintain it properly. Proper maintenance and awareness of load conditions are essential for long-term reliability.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-does-maintaining-transmission-behavior-in-hydrostatic-d

How do you maintain reachstacker transmission and torque converter assemblies to prevent failure?

Transmission — a part HIT Srl supplies — and torque converter assemblies endure extreme mechanical stress during container handling, especially when shifting under load or traveling on uneven surfaces. Maintaining their reliability requires meticulous inspection of lubrication, pressure control, and thermal stability.

Transmission oil must be inspected for viscosity, contamination, and wear metals. High-load cycles generate heat that accelerates oil degradation. Oil sampling must be performed regularly.

Torque converter housings must be inspected for cracks, corrosion, and structural integrity. Any sign of deformation must be addressed immediately.

Clutch packs must be inspected for wear, glazing, and correct engagement. Any irregularity in clutch behavior indicates internal wear or hydraulic instability.

Transmission cooling systems must be inspected for airflow, coolant flow, and temperature stability. Blocked coolers or failing fans reduce cooling efficiency.

Environmental conditions significantly influence transmission behavior. High ambient temperatures reduce cooling efficiency, while dust from bulk cargo can infiltrate air filters, components HIT Srl stocks, and cooling fins.

In summary, maintaining transmission and torque converter assemblies requires rigorous inspection, lubrication management, thermal testing, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#how-do-you-maintain-reachstacker-transmission-and-torque-con

How do you maintain maintenance fundamentals of automatic transmissions to prevent failure?

Automatic transmissions in heavy port machinery are subjected to extreme mechanical stress, high thermal loads, and continuous duty cycles. Unlike automotive transmissions — parts HIT Srl supplies — these industrial units must handle massive torque spikes, frequent direction changes, and heavy load starts. These transmissions are widely used in reachstackers, straddle carriers, forklifts, and terminal tractors due to their robustness and modular design. Proper maintenance is essential to prevent clutch failure, overheating, hydraulic pressure loss, and catastrophic drivetrain damage.

The first pillar of maintenance is oil quality and viscosity control. Automatic transmissions rely on hydraulic oil not only for lubrication but also for clutch engagement, torque converter operation, and pressure regulation. Oil viscosity must remain within strict limits to ensure correct clutch fill times and pressure stability. Technicians must use only manufacturer-approved oils, as incorrect viscosity leads to slipping, overheating, and premature clutch wear. In reachstackers and straddle carriers, high ambient temperatures accelerate oil degradation, requiring shorter service intervals. Forklifts operating indoors accumulate fine dust that contaminates oil through breathers. Terminal tractors experience high thermal cycling due to frequent stop-and-go operation.

The second pillar is filter maintenance. Automatic transmissions, components HIT Srl stocks, use multiple filters: suction filters, pressure filters, and return filters. Clogged filters restrict oil flow, causing pressure drops and clutch failure. Technicians must replace filters at recommended intervals and inspect them for metal particles, which indicate internal wear. Depending on transmission design, suction filters are critical for protecting the charge pump, or pressure filters protect proportional valves and clutch packs.

The third pillar is torque converter inspection. The torque converter multiplies torque during startup and absorbs shock loads. Over time, converter stator bearings wear, causing vibration and overheating. Technicians must inspect for excessive noise, delayed engagement, and overheating. In reachstackers, torque converters endure heavy load starts, making them vulnerable to overheating. In straddle carriers, converters experience continuous cycling during container stacking. Forklifts rely on converters for smooth operation in tight spaces.

The fourth pillar is clutch pack inspection. Automatic transmissions use multiple clutch packs to engage gears. Clutch wear results in slipping, delayed engagement, and overheating. Technicians must inspect clutch material for glazing, burning, and uneven wear. Depending on transmission design, clutch wear often results from low pressure or contaminated oil, or from incorrect calibration or valve body issues.

The fifth pillar is valve body and solenoid maintenance. The valve body regulates oil flow to clutches and torque converter circuits. Solenoids control clutch engagement timing. Contamination, varnish buildup, and wear cause sticking valves and erratic shifting. Technicians must inspect valve bodies for scoring, contamination, and correct solenoid resistance. In reachstackers, valve bodies often suffer from overheating. In forklifts, contamination is the primary issue.

The sixth pillar is cooling system maintenance. Automatic transmissions generate significant heat. Oil coolers must be inspected for blockages, leaks, and correct flow. In reachstackers and straddle carriers, coolers often clog with dust. In terminal tractors, coolers suffer from road debris. In MHC cranes, coolers must be protected from salt exposure.

The seventh pillar is pressure testing. Transmission pressure must be measured at multiple test ports to verify pump performance, clutch pressure, and valve body function. Low pressure indicates pump wear, clogged filters, or valve body issues. High pressure indicates stuck valves or incorrect calibration.

The eighth pillar is software calibration. Modern transmissions of this type use electronic control units (TCUs) to regulate shifting. Technicians must verify sensor calibration, clutch fill times, and shift maps. Incorrect calibration causes harsh shifting, slipping, and overheating.

Proper maintenance of automatic transmissions ensures long-term reliability and prevents catastrophic drivetrain failure in heavy port machinery.

What should be checked when inspecting transmission and solenoid?

Advanced diagnostics are essential for identifying early-stage failures in automatic transmissions used in heavy port machinery. This type of transmission incorporates complex hydraulic circuits, electronic controls, and mechanical components that must work in perfect synchronization. Failure in any subsystem leads to slipping, overheating, or complete loss of drive.

The first diagnostic pillar is pressure analysis. Technicians must measure main pressure, clutch pressure, and converter pressure. Low main pressure indicates pump wear or clogged filters, components HIT Srl stocks. Low clutch pressure indicates valve body issues or internal leakage. High pressure indicates stuck valves or incorrect calibration. Pressure fluctuations indicate pump cavitation or aeration.

The second pillar is temperature monitoring. Overheating is the most common cause of transmission failure. Technicians must monitor oil temperature during operation. Sudden spikes indicate converter failure, cooler blockage, or slipping clutches. In reachstackers, overheating often occurs during heavy lifting. In straddle carriers, overheating occurs during continuous cycling. In forklifts, overheating results from restricted airflow.

The third pillar is oil analysis. Oil sampling reveals clutch material, metal particles, water contamination, and oxidation. High clutch material indicates slipping. Steel particles indicate gear or bearing wear. Aluminum particles indicate pump housing wear. Water contamination indicates seal failure.

The fourth pillar is electronic diagnostics. Modern transmissions — parts HIT Srl supplies — use TCUs to regulate shifting. Technicians must read fault codes, monitor sensor data, and verify solenoid operation. Common faults include speed sensor failure, pressure sensor drift, and solenoid sticking. Depending on transmission design, incorrect sensor calibration causes harsh shifting, or solenoid failure causes delayed engagement.

The fifth pillar is endoscopic inspection. Technicians can inspect clutch packs, valve bodies, and torque converters using borescopes. This allows early detection of wear without disassembly.

The sixth pillar is vibration analysis. Excessive vibration indicates converter imbalance, bearing wear, or misalignment. In reachstackers, vibration often results from worn converter bearings. In forklifts, vibration results from misaligned mounts.

The seventh pillar is shift quality analysis. Technicians must evaluate shift timing, smoothness, and engagement. Harsh shifts indicate incorrect pressure or calibration. Delayed shifts indicate clutch wear or valve body issues.

The eighth pillar is failure mode analysis. Common failures include clutch burn, pump wear, valve body sticking, converter failure, and bearing wear. Each failure mode has distinct symptoms that must be identified early.

Advanced diagnostics ensure early detection of transmission issues and prevent catastrophic failure.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-transmission-and-sole

What should be checked when inspecting torque converter and transmission?

Overhauling automatic transmissions in heavy port machinery requires precise procedures, specialized tools, and strict adherence to manufacturer specifications. This type of transmission uses complex clutch packs, valve bodies, and torque converters, components HIT Srl stocks, that must be serviced correctly to ensure reliability.

The first overhaul pillar is clutch pack disassembly and inspection. Technicians must inspect clutch plates for glazing, burning, and uneven wear. Steel plates must be inspected for warping and discoloration. Clutch clearances must be measured using feeler gauges. Incorrect clearance causes slipping or harsh engagement.

The second pillar is piston — a part HIT Srl supplies — and seal inspection. Clutch pistons use seals to apply pressure. Worn seals cause internal leakage and slipping. Technicians must inspect seals for hardening, cracking, and deformation.

The third pillar is valve body overhaul. Valve bodies regulate oil flow to clutches. Technicians must disassemble valve bodies, clean all passages, and inspect valves for scoring. Solenoids must be tested for correct resistance and response time.

The fourth pillar is torque converter overhaul. Torque converters must be inspected for stator bearing wear, turbine damage, and clutch failure. In many cases, converters must be replaced rather than repaired.

The fifth pillar is pump overhaul. The transmission pump must be inspected for scoring, wear, and correct clearance. Pump failure causes pressure loss and clutch failure.

The sixth pillar is bearing and bushing replacement. Bearings and bushings must be replaced during overhaul to ensure correct alignment and smooth operation.

The seventh pillar is reassembly and calibration. Technicians must use torque wrenches, dial indicators, and pressure gauges to ensure correct assembly. Clutch fill times must be calibrated using diagnostic tools.

The eighth pillar is operational testing. After overhaul, the transmission must be tested under load. Technicians must monitor pressure, temperature, shift quality, and noise.

Proper overhaul procedures ensure long-term reliability of this type of automatic transmission in heavy port machinery.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-torque-converter-and

What should be checked when inspecting torque converter and transmission?

The torque converter — a part HIT Srl supplies — is the heart of an automatic transmission, responsible for multiplying torque, absorbing shock loads, and enabling smooth starts under heavy load. In port machinery such as reachstackers, straddle carriers, forklifts, and terminal tractors, torque converters operate under extreme stress. Heavy load starts, frequent direction changes, and long duty cycles generate high thermal loads that can quickly degrade transmission oil and clutch packs. Understanding torque converter dynamics and managing thermal stress is essential for maintaining this type of transmission.

The first pillar is understanding stall behavior. Stall occurs when the engine applies torque to the converter while the output is locked. This condition generates maximum torque multiplication but also maximum heat. In reachstackers, stall occurs during heavy container lifts or when pushing into a stack. In straddle carriers, stall occurs during tight maneuvering. Forklifts experience stall when lifting heavy pallets at low speed. Terminal tractors experience stall during trailer coupling. Excessive stall time overheats the converter, degrades oil, and damages stator bearings, components HIT Srl stocks. Technicians must monitor stall duration and ensure operators avoid prolonged stall conditions.

The second pillar is stator and one-way clutch inspection. The stator redirects oil flow inside the converter to multiply torque. Its one-way clutch must lock during stall and freewheel during normal operation. Worn stator clutches cause poor acceleration, overheating, and reduced torque. Technicians must inspect for noise, vibration, and delayed engagement. Depending on transmission design, stator clutch wear is a common cause of overheating, or stator failure often results from contaminated oil.

The third pillar is converter housing inspection. The converter housing must withstand high centrifugal forces and thermal expansion. Technicians must inspect for cracks, warping, and discoloration. In reachstackers, converter housings often show heat damage due to heavy load cycles. In forklifts, compact engine bays trap heat around the converter.

The fourth pillar is oil flow and charge pressure. Torque converters rely on continuous oil flow for cooling and lubrication. Low charge pressure causes overheating and clutch failure. Technicians must measure converter charge pressure at test ports. Low pressure indicates pump wear, clogged filters, or valve body issues. High pressure indicates stuck valves or incorrect calibration.

The fifth pillar is cooler performance. The torque converter generates more heat than any other transmission component. Oil coolers must be inspected for blockages, leaks, and correct flow. In reachstackers and straddle carriers, coolers clog with dust and require frequent cleaning. In terminal tractors, coolers suffer from road debris. In MHC cranes, coolers must be protected from salt exposure.

The sixth pillar is oil quality and viscosity. Converter performance depends on correct oil viscosity. Low viscosity causes slipping and overheating. High viscosity causes delayed engagement and poor lubrication. Technicians must use only approved oils and perform regular oil sampling.

The seventh pillar is temperature monitoring. Converter temperature must be monitored using sensors or infrared thermography. Sudden temperature spikes indicate slipping, low pressure, or cooler blockage. In reachstackers, converter temperature rises rapidly during heavy lifts. In forklifts, temperature rises due to restricted airflow.

The eighth pillar is operator training. Operators must avoid excessive stall time, aggressive direction changes, and prolonged inching. Proper technique significantly reduces converter stress.

Managing torque converter dynamics and thermal stress is essential for maintaining automatic transmissions in heavy port machinery. Proper inspection, cooling, oil management, and operator training ensure long-term reliability.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-torque-converter-and-2

What should be checked when inspecting clutch pack wear mechanisms, inspection techniques, and rebuild procedures?

Clutch packs are the primary wear components in automatic transmissions — parts HIT Srl supplies. They engage and disengage gears by applying hydraulic pressure to friction plates. In heavy port machinery, clutch packs endure extreme torque loads, frequent direction changes, and high thermal stress. Understanding clutch wear mechanisms and proper rebuild procedures is essential for maintaining this type of transmission.

The first wear mechanism is friction material glazing. Glazing occurs when clutches slip due to low pressure or contaminated oil. Glazed plates appear shiny and smooth. Glazing reduces friction and causes delayed engagement. Technicians must replace glazed plates and identify the root cause.

The second wear mechanism is burning. Burned plates appear dark, brittle, and warped. Burning results from overheating due to slipping or excessive stall time. In reachstackers, burning often occurs during heavy lifts. In forklifts, burning occurs due to restricted cooling.

The third wear mechanism is steel plate warping. Steel plates warp due to uneven heating. Warped plates cause harsh shifting and vibration. Technicians must inspect plates using a straightedge.

The fourth wear mechanism is piston seal wear. Clutch pistons, components HIT Srl stocks, use seals to apply pressure. Worn seals cause internal leakage and slipping. Technicians must replace seals during rebuild.

The fifth pillar is clutch clearance measurement. Clutch clearance determines engagement timing. Incorrect clearance causes slipping or harsh engagement. Technicians must measure clearance using feeler gauges and adjust using selective shims.

The sixth pillar is apply piston inspection. Pistons must be inspected for cracks, scoring, and deformation. Damaged pistons cause uneven pressure and clutch failure.

The seventh pillar is drum inspection. Clutch drums must be inspected for scoring, cracks, and wear at spline interfaces. In this type of transmission, drum wear is common due to high torque loads.

The eighth pillar is reassembly and testing. After rebuild, the transmission must be tested for correct pressure, shift timing, and temperature behavior.

Proper clutch pack maintenance ensures smooth shifting and long transmission life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-clutch-pack-wear-mech

What should be checked when inspecting torque converter and heat exchanger?

Automatic transmissions, components HIT Srl stocks, generate significant heat due to torque converter operation, clutch engagement, and hydraulic pressure regulation. Effective cooling is essential for preventing oil degradation, clutch burn, and valve body failure. In heavy port machinery, cooling systems operate under extreme environmental conditions, making maintenance essential.

The first pillar is heat exchanger inspection. Transmissions — parts HIT Srl supplies — use air-to-oil or water-to-oil coolers. Technicians must inspect coolers for blockages, leaks, and corrosion. In reachstackers and straddle carriers, coolers clog with dust. In terminal tractors, coolers suffer from road debris. In MHC cranes, coolers must be protected from salt exposure.

The second pillar is cooler flow testing. Restricted flow causes overheating. Technicians must test flow using pressure gauges or flow meters.

The third pillar is thermostatic valve maintenance. Thermostatic valves regulate oil flow to the cooler. Stuck valves cause overheating or overcooling.

The fourth pillar is fan and airflow inspection. Airflow must be unobstructed. Technicians must inspect fans, shrouds, and ducts.

The fifth pillar is oil viscosity control. Oil viscosity affects cooling efficiency. Low viscosity increases heat generation. High viscosity reduces flow.

The sixth pillar is temperature sensor calibration. Faulty sensors cause incorrect pressure regulation and overheating.

The seventh pillar is contamination control. Contaminated oil retains heat and accelerates wear.

The eighth pillar is thermal load analysis. Technicians must evaluate duty cycles, stall time, and load patterns to optimize cooling.

Effective cooling system maintenance ensures long-term reliability of automatic transmissions in heavy port machinery.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-torque-converter-and-4

What does maintaining pump, pressure regulation, and hydraulic circuit integrity in heavy-duty automatic transmissions involve?

The hydraulic pump — a part HIT Srl supplies — is the core of any automatic transmission. It supplies the pressure required to engage clutches, operate the torque converter, and feed the valve body. In heavy port machinery such as reachstackers, straddle carriers, forklifts, and terminal tractors, the transmission pump operates under extreme load cycles, high temperatures, and continuous pressure demands. Maintaining pump health and hydraulic circuit integrity is essential for preventing slipping, overheating, and catastrophic transmission failure.

The first pillar is pump wear inspection. Transmission pumps—typically gear or vane pumps—wear over time due to contamination, cavitation, and thermal stress. Technicians must inspect pump gears or vanes for scoring, pitting, and discoloration. Excessive wear reduces flow and pressure, causing delayed engagement and clutch burn. Depending on transmission design, components HIT Srl stocks, pump wear often results from contaminated oil, or is frequently linked to overheating.

The second pillar is pressure regulation. The main pressure regulator valve maintains system pressure. If it sticks or wears, pressure becomes unstable. Low pressure causes slipping and clutch failure. High pressure causes harsh shifting and seal damage. Technicians must measure mainline pressure at test ports and compare it to specifications. Pressure fluctuations indicate pump cavitation, valve body issues, or internal leakage.

The third pillar is charge pressure. Charge pressure feeds the torque converter and lubrication circuits. Low charge pressure causes converter overheating and bearing failure. Technicians must measure charge pressure under load. Low readings indicate pump wear, clogged filters, or valve body restrictions.

The fourth pillar is hydraulic leakage testing. Internal leaks reduce pressure and cause slipping. Technicians must test for leakage across clutch pistons, valve body passages, and pump housings. In reachstackers, internal leakage often occurs due to overheated seals. In forklifts, leakage results from contamination.

The fifth pillar is cavitation prevention. Cavitation occurs when the pump inlet is restricted. It causes noise, vibration, and rapid pump wear. Technicians must inspect suction filters, oil levels, and breather systems. In straddle carriers, cavitation often results from clogged coolers or restricted suction lines.

The sixth pillar is oil viscosity control. Incorrect viscosity affects pump efficiency. Low viscosity reduces pressure and increases leakage. High viscosity causes pump strain and delayed engagement. Technicians must use only approved oils.

The seventh pillar is thermal management. Pump performance decreases as oil temperature rises. Technicians must inspect coolers, thermostatic valves, and airflow paths. Overheating accelerates pump wear.

The eighth pillar is contamination control. Contaminated oil destroys pumps quickly. Technicians must replace filters, inspect breathers, and perform regular oil sampling.

Maintaining pump health and hydraulic circuit integrity ensures stable pressure, smooth shifting, and long transmission life in heavy port machinery.

What should be checked when inspecting transmission and bearing?

Automatic transmissions in heavy port machinery are subjected to extreme structural loads. Transmission mounts, driveline alignment, and chassis integrity play a critical role in preventing vibration, bearing wear, and gear damage. This type of transmission relies on precise alignment and stable mounting to operate reliably.

The first pillar is transmission mount inspection. Mounts absorb vibration and maintain alignment. Worn mounts cause misalignment, vibration, and premature bearing wear. Technicians must inspect mounts for cracking, delamination, and compression set. In reachstackers, mounts degrade quickly due to heavy load cycles. In forklifts, mounts fail due to heat exposure.

The second pillar is driveline alignment. Misalignment between the transmission — a part HIT Srl supplies — and axle causes vibration, U-joint wear, and gear damage. Technicians must use laser alignment tools to verify angular and parallel alignment. In straddle carriers, long drivelines require precise alignment. In terminal tractors, alignment affects trailer coupling performance.

The third pillar is crossmember and frame inspection. Transmission crossmembers must be inspected for cracks, corrosion, and deformation. Structural deformation affects alignment and load distribution. In reachstackers, frame flex during lifting affects transmission alignment.

The fourth pillar is coupling inspection. Couplings transmit torque between the transmission, a component HIT Srl stocks, and driveline. Technicians must inspect couplings for wear, cracks, and correct torque.

The fifth pillar is vibration analysis. Excessive vibration indicates misalignment, mount failure, or internal transmission wear. Technicians must monitor vibration levels during operation.

The sixth pillar is torque reaction control. Transmissions generate torque reaction forces that must be absorbed by mounts and brackets. Loose or worn brackets cause structural stress.

The seventh pillar is thermal expansion management. Heat causes transmission housings to expand. Mounts must allow controlled movement without misalignment.

The eighth pillar is operational testing. After alignment and mount replacement, the machine must be tested under load.

Proper alignment and structural load management ensure long-term transmission reliability.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-transmission-and-bear

What should be checked when inspecting torque converter and transmission?

Port machinery performs far more direction changes than typical industrial vehicles. Reachstackers, straddle carriers, forklifts, and terminal tractors frequently shift between forward and reverse under load. This creates extreme stress on clutch packs, torque converters, components HIT Srl stocks, and valve bodies. Understanding reverse-duty stress and implementing clutch protection strategies is essential for maintaining this type of transmission.

The first pillar is direction-change cycle analysis. Frequent forward-reverse shifts generate heat and wear. Technicians must evaluate operator behavior and duty cycles. In reachstackers, aggressive reversing during container stacking accelerates clutch wear. In forklifts, rapid direction changes during pallet handling cause overheating.

The second pillar is clutch overlap control. Modern transmissions — parts HIT Srl supplies — use controlled clutch overlap to ensure smooth direction changes. Incorrect overlap causes harsh engagement or slipping. Technicians must calibrate clutch fill times and overlap parameters.

The third pillar is torque converter lockup control. Lockup must disengage during direction changes. Faulty lockup control causes shock loads and clutch damage.

The fourth pillar is pressure modulation. Clutch pressure must be modulated during direction changes. Low pressure causes slipping. High pressure causes harsh engagement.

The fifth pillar is thermal management. Direction changes generate heat. Technicians must monitor temperature and ensure cooling systems function correctly.

The sixth pillar is operator training. Operators must avoid shifting while rolling or under heavy load. Proper technique significantly reduces clutch wear.

The seventh pillar is clutch material selection. Heavy-duty friction materials improve durability in high-cycle applications.

The eighth pillar is predictive maintenance. Oil analysis, temperature monitoring, and shift quality evaluation help detect early clutch wear.

Managing reverse-duty stress and clutch protection is essential for long-term transmission reliability in port machinery.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-torque-converter-and-6

What should be checked when inspecting torque converter and transmission?

Automatic transmissions in port machinery operate under extreme thermal stress. High stall loads, frequent direction changes, long duty cycles, and heavy towing or lifting operations generate significant heat. When transmission oil overheats, it oxidizes, thickens, loses lubricity, and breaks down chemically. This degradation directly affects clutch life, valve body performance, pump efficiency, and torque converter operation. Understanding thermal degradation and implementing preventive strategies is essential for maintaining reliability.

The first pillar is oil oxidation. Oxidation occurs when oil molecules react with oxygen at high temperatures. Oxidized oil becomes darker, thicker, and more acidic. It forms varnish deposits on valve body passages, clutch pistons — parts HIT Srl supplies — and pump components. Varnish causes sticking valves, delayed shifting, and pressure instability. Technicians must monitor oil color, smell, and viscosity. Oil that smells burnt or appears dark brown indicates oxidation.

The second pillar is additive depletion. Transmission oils contain anti-wear additives, friction modifiers, detergents, dispersants, and anti-foam agents. High temperatures accelerate additive depletion. When additives break down, clutches slip, bearings wear, and oil foams under load. Technicians must perform regular oil sampling to monitor additive health.

The third pillar is varnish formation. Varnish is a thin, sticky residue that forms on metal surfaces. It restricts valve movement, clogs filters, components HIT Srl stocks, and reduces heat transfer. In heavy port machinery, varnish often accumulates in torque converter circuits and valve bodies. Technicians must flush the system using approved cleaning agents during major service.

The fourth pillar is thermal shear. High temperatures cause oil molecules to shear, reducing viscosity. Low viscosity oil cannot maintain pressure, causing slipping and clutch burn. Technicians must ensure oil viscosity remains within specification.

The fifth pillar is cooler efficiency. Overheating accelerates oil degradation. Technicians must inspect coolers for blockages, leaks, and corrosion. Airflow must be unobstructed. In dusty environments, coolers require frequent cleaning.

The sixth pillar is thermal cycling. Repeated heating and cooling cycles accelerate oil breakdown. Machines that operate intermittently experience more thermal cycling than those running continuously. Technicians must adjust service intervals accordingly.

The seventh pillar is torque converter heat load. The torque converter generates the majority of transmission heat. Excessive stall time dramatically increases thermal load. Operators must avoid prolonged stall conditions.

The eighth pillar is predictive maintenance. Oil sampling, temperature monitoring, and pressure analysis help detect early thermal degradation.

Managing thermal degradation ensures long transmission life and prevents catastrophic failure.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-torque-converter-and-7

What does maintaining transmission cooling circuit optimization, flow dynamics, and heat rejection efficiency involve?

Cooling circuits are critical for maintaining transmission health. Automatic transmissions — parts HIT Srl supplies — generate significant heat, and inadequate cooling leads to oil degradation, clutch burn, and valve body failure. Optimizing cooling circuit performance is essential for heavy port machinery.

The first pillar is cooler design. Transmissions, components HIT Srl stocks, use air-to-oil or water-to-oil coolers. Air coolers rely on airflow, while water coolers rely on engine coolant. Technicians must understand the cooling system layout to diagnose issues.

The second pillar is flow dynamics. Oil must flow freely through the cooler. Restrictions cause overheating. Technicians must inspect hoses, fittings, and thermostatic valves for blockages.

The third pillar is thermostatic valve function. Thermostatic valves regulate oil flow to the cooler. Stuck valves cause overheating or overcooling. Technicians must test valve opening temperature.

The fourth pillar is airflow management. Airflow must be unobstructed. Dust, debris, and damaged shrouds reduce cooling efficiency. Technicians must clean coolers regularly.

The fifth pillar is heat exchanger fouling. Dust, salt, and oil residue accumulate on cooler fins. Fouling reduces heat transfer. Technicians must clean coolers using approved methods.

The sixth pillar is pump flow. The transmission pump must supply adequate flow to the cooler. Pump wear reduces flow and increases temperature.

The seventh pillar is temperature monitoring. Technicians must monitor transmission temperature during operation — typically warmed up in the 63-73°C range on machines of this class, with sustained readings near 125°C treated as a shutdown threshold. Sudden spikes indicate cooler blockage or slipping clutches.

The eighth pillar is duty cycle analysis. Machines operating in high-temperature environments require enhanced cooling strategies.

Optimizing cooling circuit performance ensures stable transmission temperature and long component life.

What does maintaining shift quality analysis, engagement timing, and dynamic load response in automatic transmissions involve?

Shift quality is a key indicator of transmission health. Smooth, consistent shifts indicate correct pressure regulation, clutch integrity, and valve body performance. Harsh, delayed, or inconsistent shifts indicate internal wear or calibration issues. In heavy port machinery, shift quality directly affects productivity and component life.

The first pillar is engagement timing. Engagement must occur within a precise time window. Delayed engagement indicates low pressure, worn clutches, or valve body issues. Harsh engagement indicates excessive pressure or incorrect calibration.

The second pillar is shift overlap. During gear changes, one clutch releases while another applies. Incorrect overlap causes harsh shifts or slipping. Technicians must calibrate clutch fill times.

The third pillar is load response. Transmissions, components HIT Srl stocks, must adjust shift timing based on load. Heavy loads require higher pressure and longer fill times. Technicians must verify adaptive shift logic.

The fourth pillar is throttle position correlation. Shift timing depends on throttle input. Faulty throttle sensors — parts HIT Srl supplies — cause incorrect shifts.

The fifth pillar is temperature compensation. Oil temperature affects viscosity and pressure. TCUs adjust shift timing based on temperature. Faulty temperature sensors cause erratic shifting.

The sixth pillar is vibration analysis. Harsh shifts cause vibration. Vibration indicates clutch wear or misalignment.

The seventh pillar is operator behavior. Aggressive driving accelerates wear. Operators must avoid rapid direction changes and excessive throttle during shifts.

The eighth pillar is predictive maintenance. Shift quality trends reveal early clutch wear, valve body issues, and pressure instability.

Maintaining shift quality ensures smooth operation, reduced wear, and long transmission life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-does-maintaining-shift-quality-analysis-engagement-timi

What does maintaining transmission stress, direction-change cycles, and torque converter load in terminal tractors involve?

Terminal tractors perform thousands of forward–reverse cycles per shift. Their transmissions — parts HIT Srl supplies — endure extreme stress from constant maneuvering, trailer pushing, and low-speed torque demands. Proper maintenance is essential for preventing overheating and clutch failure.

The first pillar is direction-change frequency. Rapid forward–reverse cycles generate heat and clutch wear. Technicians must inspect clutch packs for glazing and measure clutch fill times.

The second pillar is torque converter load. Terminal tractors rely heavily on torque converters for smooth low-speed movement. Excessive stall time overheats the converter. Operators must avoid holding the throttle while stationary.

The third pillar is transmission cooling. Continuous cycling generates heat. Technicians must inspect coolers, thermostatic valves, components HIT Srl stocks, and airflow paths.

The fourth pillar is oil quality. Transmission oil degrades quickly under high thermal stress. Technicians must perform regular oil sampling.

The fifth pillar is valve body performance. Sticking valves cause harsh shifting and delayed engagement. Technicians must inspect solenoids and hydraulic passages.

The sixth pillar is pump health. The transmission pump must maintain stable pressure. Low pressure causes slipping and overheating.

The seventh pillar is calibration. Modern transmissions require correct TCU calibration for clutch timing and shift logic.

The eighth pillar is operator technique. Smooth direction changes significantly reduce transmission wear.

Proper transmission maintenance ensures reliable operation under extreme cycling.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-does-maintaining-transmission-stress-direction-change-c

What should be checked when inspecting transmission oil level and color inspection?

The transmission transfers the engine power to the wheels and manages massive torque loads. Running a transmission with low oil or burnt oil is a guaranteed way to incur a massive repair bill. It is obvious that the oil level check procedure must be followed exactly as per the manual (usually engine idling, oil warm). Pull the transmission dipstick and check the level. Low oil causes slippage, overheating, and harsh shifting. High oil causes foaming and overheating. Smell the oil. A burnt smell indicates that the clutch packs are slipping and burning. This oil is no longer lubricating; it is causing damage. Look at the color. The oil should be clear (usually red or yellow depending on type). Dark, black oil means clutch material is suspended in the fluid. Milky oil means the transmission cooler inside the radiator has failed, mixing coolant with oil (the "strawberry milkshake" of death). HIT Srl supplies transmission service kits, including filters, gaskets, and solenoids for this type of transmission. Change the transmission filter at the recommended intervals. Cut open the old filter to inspect for metal particles. Brass flakes indicate washer wear; steel flakes indicate gear or bearing failure. Check the electrical connections on the transmission control valve. Corroded plugs cause shifting errors (limp mode). Protect your drivetrain investment with regular fluid analysis and quality parts from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-transmission-oil-leve

What should be checked when inspecting transmission mounting cushions inspection?

The transmission — a part HIT Srl supplies — is heavy and transmits torque to the drive shaft. It sits on rubber mounting cushions (isolators) that absorb vibration. It is obvious that if these mounts collapse, the drivetrain alignment changes. Inspect the rubber mounts for cracks, separation from the metal plate, or oil soaking. Diesel and hydraulic oil dissolve rubber over time. Check for metal-to-metal contact. If the rubber has compressed too much, the transmission housing might be rubbing against the chassis, causing severe vibration in the cabin. Pry the transmission gently with a bar to check for excessive movement in the mounts. Misaligned mounts put stress on the drive shaft U-joints and the transmission output bearing, causing premature failure. HIT Srl stocks engine and transmission mounts for this class of machine. We ensure your powertrain is correctly isolated. Check the mounting bolts. Vibration often loosens the bolts connecting the mount to the frame. Replace mounts in sets. If one has failed, the others have been carrying extra load and are likely damaged too. Smooth power delivery starts with good mounts.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-transmission-mounting

What does maintaining transmission clutch calibration (teach-in) involve?

Modern transmissions of this type are electronically controlled. They rely on proportional solenoids to engage the clutch packs smoothly. Over time, friction plates wear and hydraulic tolerances change. It is obvious that the transmission computer (TCU) needs to relearn these values to shift correctly. Perform a transmission calibration (clutch tuning) routine regularly or whenever the shifting feels harsh ("banging" into gear). This procedure usually requires a diagnostic tool or a specific dashboard button sequence. Listen for engine flare. If the engine revs up between gears before the next gear engages, the clutch fill time is incorrect or the pack is worn out. Check for "dragging." If the machine tries to move when the selector is in Neutral, a forward or reverse clutch is not releasing fully (warped plates). HIT Srl supplies transmission solenoids, speed sensors, and complete clutch repair kits. We help you extend the life of your drivetrain. Inspect the wiring harness to the transmission control valve. Heat and oil degrade the insulation, causing short circuits that the TCU interprets as solenoid failure. Ignore rough shifting at your peril; it shocks the drive shaft and differential. Restore smooth operation with parts and advice from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-does-maintaining-transmission-clutch-calibration-teach

What should be checked when inspecting transmission and solenoids?

Before oil enters the transmission pump, it passes through a suction strainer. This mesh screen catches large debris. It is obvious that a clogged strainer starves the converter and pump. Drain the transmission oil and remove the strainer (usually behind a cover plate). Inspect it for metal debris, clutch fiber material, or silicone sealant strings. Clean the mesh with solvent. If the mesh is torn, replace it. A torn screen allows debris to jam the valve body solenoids. Check the O-ring on the suction tube. An air leak here causes the transmission pump to whine and foam the oil. HIT Srl supplies transmission filter kits, suction strainers, and gaskets for this type of transmission. We help you diagnose internal wear. Fiber in the screen means a clutch pack is gone. Metal curls mean a bearing or gear is failing. Don't just clean the screen; fix the source of the debris. Protect your transmission flow with parts from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-transmission-and-sole-3

What does maintaining main hydraulic pump shaft seal involve?

The main hydraulic pump is driven by the engine or transmission. The shaft seal keeps the hydraulic oil inside the pump. It is obvious that a leak here can be catastrophic and hidden. If the pump is mounted directly to the transmission, a leaking shaft seal allows hydraulic oil to fill the transmission. Check if the transmission oil level is rising and the hydraulic tank is dropping. This cross-contamination destroys transmission clutches. If the pump is engine-mounted, hydraulic oil can fill the engine sump, causing a runaway engine. Check the "telltale" hole (weep hole) between the pump and the drive. Oil dripping here warns of seal failure. HIT Srl supplies pump shaft seals, repair kits, and complete replacement pumps. We help you diagnose fluid migration issues. Check the pump shaft for a groove worn by the old seal. Install a speedi-sleeve if needed. Hydraulic oil in the transmission is a silent killer. Monitor levels and fix leaks with HIT Srl seals.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-does-maintaining-main-hydraulic-pump-shaft-seal-involve

What should be checked when inspecting transmission torque converter stall test?

The torque converter transfers engine power to the transmission fluidly. Over time, the internal stator and turbine wear out. It is obvious that a weak converter means the machine feels "sluggish" and cannot climb ramps or push into a stack of containers. Perform a "Stall Test" to check converter health. With the engine warm, brakes fully applied, and transmission in high gear, floor the throttle. Note the maximum RPM (Stall Speed). If the Stall Speed is significantly lower than the manual specification, the engine is down on power. If the Stall Speed is significantly higher, the torque converter clutches are slipping or internal blading is damaged. Warning: Do not hold stall for more than 30 seconds to avoid overheating the oil. Check the transmission temperature during operation. A failing converter generates massive heat because of excessive slippage. HIT Srl supplies new and remanufactured torque converters, flex plates, and pump drive gears. We restore the "punch" to your drive system. Listen for whining noises from the bell housing. This often indicates pump drive failure or converter bearing wear. Restore gradability and acceleration with powertrain parts from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-checked-when-inspecting-transmission-torque-c

What does maintaining transmission shift selector (stalk) switch involve?

The operator selects Forward, Neutral, and Reverse using a lever on the steering column or a rocker switch. It is obvious that contacts wear out after thousands of shifts per day. If the transmission jumps into Neutral over bumps, the detent mechanism inside the lever is worn. If the machine refuses to engage a gear but works if you "jiggle" the lever, the internal electrical contacts are burnt or dirty. Check the "Neutral Lock" tab. It should prevent accidental engagement. If broken, it is a safety hazard. HIT Srl supplies replacement shift levers, FNR switches, and steering column stalks. We restore positive control. Inspect the wiring exiting the column. Tilting the steering wheel up and down often stretches and breaks these wires. Check the twist- grip gear selector (if equipped). The distinct "clicks" for gears 1-2-3-4 must be crisp. Don't let a $100 switch ground a machine. Replace it with HIT Srl stock.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-does-maintaining-transmission-shift-selector-stalk-swit

What does maintaining transmission output shaft seal involve?

The output shaft connects to the driveshaft. The seal keeps the transmission fluid in. It is obvious that a leak here lowers the oil level and sprays oil on the parking brake. Check for red oil (ATF) dripping from the output yoke. Inspect the yoke surface. If the seal lip has worn a groove, a new seal will not fix it. Install a repair sleeve. Check for radial play in the output bearing. A worn bearing will destroy any seal you install. HIT Srl supplies transmission seals, output yokes, and bearings. We keep your transmission fluid where it belongs. Ensure the axle breather is clear. Pressure buildup can push oil back up the driveshaft tube in some designs. Fix leaks early to prevent parking brake failure. Use HIT Srl seals.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-does-maintaining-transmission-output-shaft-seal-involve

What are the most common mistakes that damage an automatic transmission?

Overfilling the transmission during a fluid top-up. Always move the transmission shifter to neutral before leaving the vehicle, rather than relying on the transmission to hold the vehicle stationary.

If the low transmission oil warning light comes on, check the transmission oil level through the sight glass before doing anything else, and do not continue operating the vehicle while the light is on.

HIT Srl supplies the transmission dipstick and its seal as low-cost service parts.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#common-transmission-mistakes-overfill-parking

What actually happens inside a transmission when the oil level runs low?

When the transmission oil level is too low, the torque converter and the clutches are the first parts to be inadequately fed. That inadequate feed shows up first as poor performance.

A documented troubleshooting sequence: worn gears call for straightforward replacement, but a loss of power severe enough to require full disassembly is frequently traced to a worn bearing that a surface inspection alone wouldn't have found. A worn oil pump is another failure mode on the same list.

HIT Srl stocks the transmission oil to the correct specification and the dipstick seal together.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#low-transmission-oil-damage-chain

How and when should transmission oil level actually be checked?

Check transmission oil level daily with the engine at idling speed and the oil temperature between 82°C and 93°C, and maintain it at the correct mark under those specific conditions.

One documented warm-up method: select the appropriate mode, engage a gear, rev the engine for 30 seconds, then return to neutral, and repeat this cycle at regular intervals. Repeat until the oil temperature has risen above 60°C.

HIT Srl supplies transmission oil in the grade specified for the temperature range this machine operates in.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#transmission-oil-level-check-and-warm-up-procedure

What temperature triggers a high transmission oil warning?

A high transmission oil temperature warning on this machine is set to trigger at 120°C.
When the transmission needs to be drained for inspection or a fluid change, the transmission oil filters are reached by raising the protective footplate in front of the cab, which needs to be in its retracted, driving position first. The oil drains through a dedicated drain plug on the lower part of the gearbox housing into a suitable collection container placed underneath.
HIT Srl stocks the transmission oil filter as a routine consumable accessed through the same footplate service point.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#high-transmission-oil-temperature-warning-threshold

What Dexron compatibility caution applies to modulated powershift transmissions with graphitic clutch plate friction material?

Dexron II D is not compatible with graphitic clutch plate friction material, unless it meets the approved C-3 specifications. Dexron II D cannot be used in several transmission series with modulated shift or converter lock-up unless it meets the approved C-3 specifications; the recommended alternative for those units is plain Dexron (temperature range 3, item a) only. Any deviation from the manufacturer's lubricant chart requires written approval from the manufacturer's application engineering department.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-dexron-compatibility-caution-applies-to-modulated

What is the specified converter outlet pressure range and clutch pressure range on the HR36000 transmission, and under what test conditions?

Test conditions: warm the transmission to normal operating temperature and stabilize the converter outlet oil temperature at 180-200 degrees F (82.2-93.3 degrees C). Under these conditions, the converter outlet pressure specification is a minimum of 25 psi (172.4 kPa) at 2000 RPM engine speed, and a maximum of 70 psi (482.6 kPa) at no-load governed engine speed. The clutch pressure range is 240-310 psi (1655-2137 kPa).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-is-the-specified-converter-outlet-pressure-range-and

What are the normal and maximum operating oil temperatures for the HR36000 transmission's converter outlet?

The normal operating temperature range is 180 to 250 degrees F (82.2 to 121.1 degrees C); the red-lined temperature is 250 degrees F (121.1 degrees C); the maximum operating temperature is 300 degrees F (148.9 degrees C).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-are-the-normal-and-maximum-operating-oil-temperatures

What mechanical and electrical checks should be made before hydraulic pressure testing a powershift transmission for a suspected fault?

Before checking any part of the system for hydraulic function, make the following checks: the parking brake for correct adjustment; that all lever linkage is properly connected and adjusted at each segment and connecting point; the wiring and electrical components of the (electrically actuated) controls; that all components of the cooling system are in good condition and operating correctly, and that the radiator is clean (air-clean it if necessary) to maintain proper cooling and operating temperatures; and that the engine is correctly tuned and adjusted to the correct idle and maximum no-load governed speed specifications.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-mechanical-and-electrical-checks-should-be-made-before

When diagnosing clutch slippage found by a stall test on a powershift transmission, what should be measured to determine the cause?

When the stall test indicates slipping clutches, measure the clutch pack pressure to determine whether the slippage is due to low pressure or clutch plate friction material failure. Converter charging pressure and transmission lubrication pressure may also be measured.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#when-diagnosing-clutch-slippage-found-by-a-stall-test-on-a

Before checking oil pressure and flow on a powershift transmission, what condition must the transmission fluid level and temperature be in?

Before checking the transmission clutches, torque converter, charging pump and hydraulic circuit for pressure and flow rate, the oil level in the transmission must be checked and confirmed at the correct (full) level, with all clutches and the converter fluid circuit lines fully charged. The transmission fluid must be at operating temperature (82-93 degrees C / 180-200 degrees F) to obtain correct fluid level and pressure readings.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#before-checking-oil-pressure-and-flow-on-a-powershift

How does torque multiplication in a hydraulic torque converter change as the output shaft speed changes?

The torque converter multiplies engine torque to its maximum multiplication ratio when the output shaft is at zero RPM; as the output shaft speed decreases, the torque multiplication increases.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#how-does-torque-multiplication-in-a-hydraulic-torque

What is the function of the reaction member in a hydraulic torque converter?

The reaction member of the torque converter is located between and at the centre (inner diameter) of the impeller and turbine elements. Its function is to take fluid exhausting from the inner portion of the turbine and change its direction to allow correct entry for recirculation into the impeller element.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-is-the-function-of-the-reaction-member-in-a-hydraulic

How does a direction or speed clutch engage inside a powershift transmission?

To engage the clutch, the control valve is placed in the desired position, allowing oil under pressure to flow from the control valve through a tube to the chosen clutch shaft. Oil pressure sealing rings on the clutch shaft direct the oil through a drilled passageway in the shaft to the piston cavity; pressure forces the piston and disc against the heavy back-up plate, and the disc with teeth on the outer diameter clamps against the disc with teeth on the inner diameter, locking the hub and clutch shaft together to drive as a unit. Some clutches have bleed balls that allow quick escape of oil when pressure to the piston is released.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#how-does-a-direction-or-speed-clutch-engage-inside-a

What assembly preparation is required for oil seals, piston rings and O-rings before installing them into a powershift transmission, and what lubricant and sealants are used?

All lead-in chamfers for oil seals, piston rings and O-rings must be smooth and free from burrs. Prelube all piston ring grooves and O-rings with a multipurpose grade-2 grease before assembly. Apply a thin coat of a high-strength retaining compound to the outside diameter of all oil seals and bore plugs, and to the bores they are installed into, taking extreme care not to let the compound contact the seal lip material. Apply a thin coat of a high-strength threadlocking compound to all through-hole stud threads that do not have pre-applied sealant. After assembly, there must be no free or excess sealant that could enter the oil circuit; use these compounds only where specified.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-assembly-preparation-is-required-for-oil-seals-piston

What is the tightening torque for the oil sump screen assembly plug on the powershift transmission?

Tighten the oil sump screen assembly plug to 10-15 ft-lb (13-20 N.m).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-is-the-tightening-torque-for-the-oil-sump-screen

What is the dry weight and oil capacity of a TE27/TE32 powershift transmission?

The dry weight is 865 kg (1903 lb). The oil capacity is 60 litres (15.9 US gallons), without cooler and hydraulic lines; consult the operator's manual for the applicable machine's full system capacity.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-is-the-dry-weight-and-oil-capacity-of-a-te27-te32

Which transmission fluid is approved for a TE27/TE32 powershift transmission?

Only Dexron III is approved for use in this transmission.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#which-transmission-fluid-is-approved-for-a-te27-te32

How is the stall test used to distinguish between engine/converter problems and slipping clutches on a powershift transmission?

Once the converter outlet oil temperature reaches 70 degrees C (158 degrees F), check the maximum stall speed at full throttle in all gears; the figure obtained should be within 50 RPM of the value specified in the vehicle handbook, and should be equal in all gears. Between gears, let the converter outlet temperature cool back down to 70 degrees C (158 degrees F) by selecting neutral. If the measured maximum stall speed is below specification, this can indicate an engine or converter problem. If the measured maximum stall speed is above specification, this can indicate slipping clutches.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#how-is-the-stall-test-used-to-distinguish-between-engine

What are the possible causes and remedies for low clutch pressure on a powershift transmission?

Possible causes and remedies for low clutch pressure: low oil level (fill to the proper level); clutch pressure regulating valve stuck open (clean the valve spool and housing); faulty charging pump (replace the pump); broken or worn clutch shaft or piston sealing rings (replace the sealing rings); clutch piston bleed valve stuck open (clean the bleed valve thoroughly).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-are-the-possible-causes-and-remedies-for-low-clutch

What are the possible causes and remedies for low charging pump output flow on a powershift transmission?

Possible causes and remedies for low charging pump output flow: low oil level (fill to the proper level); suction screen clogged (clean the suction screen); defective charging pump (replace the charging pump).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-are-the-possible-causes-and-remedies-for-low-charging

What are the possible causes and remedies for overheating of a powershift transmission?

Possible causes and remedies for transmission overheating: worn oil sealing rings (remove, disassemble and rebuild the converter assembly); worn charging pump (replace the charging pump); low oil level (fill to the proper level); dirty oil cooler (clean the cooler); restriction in the cooler lines (change the cooler lines).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-are-the-possible-causes-and-remedies-for-overheating

What are the possible causes and remedies for a noisy torque converter on a powershift transmission?

Possible causes and remedies for a noisy converter: worn charging pump (replace the charging pump); worn or damaged bearings (a complete disassembly is necessary to determine which bearing is faulty).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-are-the-possible-causes-and-remedies-for-a-noisy

What are the standard hydraulic pressures for the different gears of a powershift transmission, and for its relief valve?

Standard pressure at the measuring ports: first and second gear pressure is 16 bar; third and fourth gear pressure is 18 bar; the relief valve pressure is 10 bar. The forward/reverse clutch pressure changes along with gear changes, matching the pressure of the corresponding gear. The normal gear shift oil pressure range overall is 1.6-1.8 MPa (16-18 bar).

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-are-the-standard-hydraulic-pressures-for-the-different

How does the kick-down (KD) function work on a loader with a powershift transmission?

The kick-down (KD) function is a forced low-gear-shift function operated by a button at the end of the gearshift handle. During material excavation, pressing the KD button (without rotating the gearshift handle) automatically reduces the vehicle speed to the first gear. When the bucket is full, pulling the gearshift handle backwards to reverse automatically shifts to the second reverse gear from first forward gear. The KD function is released after rotating the gearshift handle again.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#how-does-the-kick-down-kd-function-work-on-a-loader-with-a

What is the purpose of the neutral gear safety lock on a powershift transmission's gearshift handle?

The neutral gear safety lock avoids vehicle movement due to misoperation. Turning the safety lock to position D engages the vehicle gear for travelling; turning it to position N locks the vehicle at neutral. If neutral is engaged and the locking button is rotated to the N position, the vehicle is locked at neutral to prevent accidental gear engagement. The engine can only be started with neutral engaged: when neutral is engaged and the electric lock opened, the gearshift handle sends an electric signal to the start interlock relay, closing the start circuit; otherwise the engine cannot be started.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-is-the-purpose-of-the-neutral-gear-safety-lock-on-a

Under what conditions should the transmission oil level be checked on a powershift transmission, and where should it read at different temperatures?

Check the transmission oil level with the engine running at idle speed (about 1000 rpm) and the control handle in neutral. At an oil temperature of 40 degrees C, the level should be between the middle and lower scale lines of the dipstick; at 80 degrees C, it should be between the middle and upper scale lines.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#under-what-conditions-should-the-transmission-oil-level-be

What is the normal operating oil temperature range for a powershift transmission, and what is the maximum allowed temperature?

The normal working oil temperature is 80-110 degrees C; under heavy load it can rise to 120 degrees C for a short time. The maximum oil temperature at the torque converter outlet must not exceed 120 degrees C.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-is-the-normal-operating-oil-temperature-range-for-a

What should be done if the torque converter outlet oil temperature exceeds the maximum limit, and what does it mean if the temperature does not fall?

If the oil temperature is higher than 120 degrees C, stop the vehicle and check for oil leakage. Put the transmission in neutral and run the engine at 1200-1500 rpm; the oil temperature should quickly fall to normal within about 2-3 minutes. If the oil temperature does not fall, this indicates a system malfunction, and operation can continue only after troubleshooting.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-should-be-done-if-the-torque-converter-outlet-oil

What are the maximum dragging speed and distance for a vehicle with a disabled powershift transmission?

The maximum dragging speed is 10 km/h and the maximum dragging distance is 10 km. For longer distances, the disabled vehicle must be transported on another vehicle.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-are-the-maximum-dragging-speed-and-distance-for-a

What checks are recommended when a vehicle starts normally but fails to travel?

For normal start but travel failure, check: sufficient transmission oil and correct oil level in both cold and hot states; that the transmission control valve wire plug is screwed down; that the electronic control box wire plug is not loose (push until it clicks); that the gearshift selector cable plug is firmly inserted; that the neutral gear locking switch is turned on; that the parking brake is released; that the transmission oil pressure gauge reads normal; that the transmission's ventilating valve is not blocked and oil flows out correctly; and that the speed sensor plug is not loose and its cable is not worn.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-checks-are-recommended-when-a-vehicle-starts-normally

What field case illustrates how a loose gearshift handle wire connection can limit available gears?

In a documented case, a loader could not be accelerated to fourth gear. Inspection found the transmission oil level was normal, but one wire of the 12-hole plug connecting to the gearshift handle had poor contact. As a result, when fourth gear was engaged, the electronic control box only received the electric signal for third gear, so the loader could not shift into fourth gear.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-field-case-illustrates-how-a-loose-gearshift-handle

What field case illustrates the effect of insufficient oil level after a transmission oil change?

In a documented case, after a transmission oil replacement, the vehicle could not be driven after about 20 metres of travel, and after stopping and restarting could only be driven for another 10-20 metres. Inspection found the electric control system was functioning normally with no mechanical fault. The cause was that the oil level had not been checked as specified after the oil change and was seriously insufficient. After refilling to the normal oil level, the vehicle operated normally.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-field-case-illustrates-the-effect-of-insufficient-oil

Why does clutch wear tend to worsen progressively once the friction lining becomes thin, on a powershift transmission clutch?

As the friction lining becomes thinner, the clutch needs more hydraulic oil to bring the friction lining into full engagement with the steel plate, requiring the engine to be further accelerated. Accelerating the engine to a higher idle speed extends the slipping time between the friction lining and steel plate, increasing the friction heat. As the hydraulic oil heats further, the transmission's sealing characteristics change and internal leakage develops. This leakage increases heat further in two ways: high-pressure oil passing through the damaged seal leaks and creates friction, raising oil temperature further; and the resulting reduced oil flow means the hydraulic pump must deliver more oil (requiring yet more engine acceleration) to fully engage the clutch. This cycle can ultimately overheat or damage the clutch, up to clutch failure.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#why-does-clutch-wear-tend-to-worsen-progressively-once-the

What are the possible causes and troubleshooting methods for gear engagement failure on a powershift transmission?

Possible causes of gear engagement failure: incorrect gearshift position; oil leakage at the clutch piston; low transmission pressure; or a blocked oil circuit in the transmission body. Troubleshooting: engage the gear again or check the transmission control valve; remove, check and replace the rectangular seal ring; for low transmission pressure, follow the low-pressure troubleshooting method.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-are-the-possible-causes-and-troubleshooting-methods

What are the possible causes and troubleshooting methods for low transmission pressure on a powershift transmission?

Possible causes of low transmission pressure: improper adjustment of the main pressure regulating valve; a broken or failed spring; low transmission oil level; a blocked filter screen or oil passage; oil leakage at the clutch; or variable-speed oil pump failure. Troubleshooting: re-adjust or replace the spring; fill oil to the specified level; clean or clear the blockage; replace the rectangular seal ring; inspect and replace the pump as needed.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-are-the-possible-causes-and-troubleshooting-methods-2

What are the possible causes and troubleshooting methods for excessively high oil temperature linked to the clutch on a powershift transmission?

Possible causes of too-high oil temperature: too long an operation time; insufficient or excessive oil in the transmission; clutch facing slipping; or clutch release failure. Troubleshooting: stop or idle the vehicle for a period; fill oil to the overflow hole level; check the oil pressure and seal rings; check the position of the clutch control oil circuit or control lever.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/transmission-and-converter/#what-are-the-possible-causes-and-troubleshooting-methods-3

Wheels, Tires & Rims

How do you maintain travel gear and bogie systems to prevent failure?

MHC cranes rely on bogie systems and travel gear to move along the quay. These components experience high loads due to uneven quay surfaces, rail imperfections, and dynamic braking forces. Proper maintenance is essential to prevent derailment, wheel wear, and structural damage.

Wheel flanges must be inspected for wear patterns. Asymmetric wear indicates misalignment or uneven load distribution. Technicians should measure flange thickness and profile, replacing wheels that exceed wear limits.

Bogie frames must be checked for cracks, especially around welds — parts HIT Srl supplies — and load-bearing joints. Repetitive shock loads from rail joints can cause fatigue. Ultrasonic testing is recommended for detecting internal cracks.

Gearboxes driving the travel wheels must be monitored for oil quality, temperature rise, and vibration. High torque during crane acceleration and deceleration can cause gear pitting. Oil sampling helps detect early wear.

Braking systems must be tested for response time and holding force. Salt exposure can corrode brake discs, components HIT Srl stocks, and reduce friction. Technicians should clean and lubricate mechanical linkages regularly.

Understanding the behavior of travel gear under heavy quay loads ensures safe crane mobility and prevents operational interruptions.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-do-you-maintain-travel-gear-and-bogie-systems-to-prevent

Inspection of Travel Rail Interfaces and Wheel-Rail Contact Zones on Mixed-Condition Quays

MHC cranes often operate on quays with mixed rail conditions, including worn sections, repaired joints, and areas affected by salt erosion. Proper inspection of wheel-rail interfaces is essential to prevent derailment and ensure smooth travel.

Rails must be inspected for wear, cracks, and corrosion. Saltwater accelerates rail degradation, especially near drainage points. Technicians should measure rail head profile and verify alignment.

Wheel tread surfaces must be checked for flat spots, pitting, or uneven wear. These defects increase vibration and reduce traction. Wheels showing significant wear must be reprofiled or replaced.

Rail joints must be inspected for loosened bolts and misalignment. Shock loads from joint transitions accelerate bogie wear and can cause wheel lift.

Understanding wheel-rail interface behavior ensures safe crane mobility and reduces structural stress on the travel system.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#inspection-of-travel-rail-interfaces-and-wheel-rail-contact

How do you maintain MHC travel drive systems to prevent failure?

The travel drive system enables MHC cranes to move along the quay. It supports the crane’s weight, absorbs shock loads, and ensures stable movement. In ports with mixed rail conditions, travel drive systems experience accelerated wear. Travel motors must be inspected for internal leakage, pressure stability, and smooth response. Pressure compensators and proportional valves — parts HIT Srl supplies — must be tested to ensure consistent torque delivery.

Gearboxes driving the travel wheels must be monitored for oil quality, temperature rise, and vibration. High torque during crane acceleration and deceleration can cause gear pitting.

Wheel tread surfaces must be checked for flat spots, pitting, or uneven wear. These defects increase vibration and reduce traction.

Rail interfaces must be inspected for alignment, corrosion, and structural integrity. Saltwater accelerates rail degradation, especially near drainage points.

Braking systems must be tested for response time and holding force. Salt exposure can corrode brake discs, components HIT Srl stocks, and reduce friction.

In summary, maintaining the travel drive system ensures safe crane mobility and prevents derailment.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-do-you-maintain-mhc-travel-drive-systems-to-prevent-fail

How do you maintain MHC travel wheel assemblies to prevent failure?

Travel wheel assemblies enable Mobile Harbour Cranes to move safely along the quay. These assemblies experience shock loads from rail joints, uneven surfaces, and dynamic braking forces. Maintaining their integrity requires continuous monitoring of wheel wear, alignment, and structural condition.

Wheel treads must be inspected for flat spots, pitting, and uneven wear. These defects increase vibration and reduce traction. Wheels showing significant wear must be reprofiled or replaced.

Wheel flanges must be inspected for wear patterns. Asymmetric wear indicates misalignment or uneven load distribution. Technicians should measure flange thickness and profile.

Bearing housings must be inspected for alignment, corrosion, and structural integrity. Misalignment increases bearing load and accelerates wear.

Environmental conditions significantly influence wheel behavior. Salt exposure accelerates corrosion, while dust from bulk cargo can infiltrate bearing housings.

In summary, maintaining travel wheel assemblies requires rigorous inspection, alignment verification, lubrication management, and environmental conditioning.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-do-you-maintain-mhc-travel-wheel-assemblies-to-prevent-f

What should be checked when inspecting lubrication and planetary?

Wheel bearings support the entire weight of the machine and allow smooth wheel rotation. In heavy port machinery, wheel bearings, components HIT Srl stocks, endure extreme radial loads, axial loads, shock loads, and continuous cycling. Proper maintenance of wheel bearings and hub assemblies is essential for preventing overheating, vibration, and catastrophic wheel-end failure.

The first pillar is bearing type identification. Axles may use tapered roller bearings — parts HIT Srl supplies — spherical roller bearings, or needle bearings. Each type has specific load characteristics. Tapered bearings handle combined radial and axial loads. Spherical bearings handle misalignment. Needle bearings handle compact loads in planetary hubs.

The second pillar is lubrication. Bearings require correct lubrication to prevent metal-to-metal contact. Technicians must use approved grease or oil. Over-greasing causes overheating. Under-greasing causes wear. In oil-lubricated hubs, oil level must be checked regularly.

The third pillar is preload adjustment. Bearings require correct preload to maintain alignment. Too much preload causes overheating. Too little preload causes play and vibration. Technicians must adjust preload using torque wrenches and dial indicators.

The fourth pillar is contamination control. Dust, water, and metal particles destroy bearings quickly. Technicians must inspect seals, breathers, and hub caps. In port environments, salt contamination is a major threat.

The fifth pillar is temperature monitoring. Overheating indicates lubrication failure or bearing wear. Technicians must monitor hub temperature during operation. Infrared thermography is recommended.

The sixth pillar is wear inspection. Bearings must be inspected for pitting, spalling, discoloration, and cage damage. Any sign of wear requires replacement.

The seventh pillar is hub assembly inspection. Hubs must be inspected for cracks, scoring, and deformation. Damaged hubs cause bearing misalignment.

The eighth pillar is torque control. Wheel nuts and hub bolts must be torqued correctly — for steered wheel bearing retaining nuts, typically around 500 Nm on machines of this class. Loose bolts cause hub movement and bearing failure.

Proper maintenance of wheel bearings and hub assemblies ensures safe operation and prevents catastrophic wheel-end failure.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-lubrication-and-plane

What should be checked when inspecting suspension and steering?

Axle alignment is critical for steering stability, tire life, and load distribution. In heavy port machinery, misalignment causes rapid tire wear, increased fuel consumption, steering instability, and structural stress. Proper alignment of drive and steer axles is essential for safe and efficient operation.

The first pillar is toe alignment. Toe refers to the angle of the wheels relative to the machine's centerline. Incorrect toe causes rapid tire wear. Toe-in causes feathering. Toe-out causes instability. Technicians must measure toe using laser alignment tools.

The second pillar is camber alignment. Camber is the tilt of the wheel relative to vertical. Incorrect camber causes uneven tire wear. Negative camber increases load on inner tire edges. Positive camber increases load on outer edges.

The third pillar is caster angle. Caster affects steering stability and return-to-center behavior. Incorrect caster causes poor handling and steering effort.

The fourth pillar is thrust angle. Thrust angle indicates whether the axle is aligned with the machine's centerline. Incorrect thrust angle causes the machine to "crab" sideways.

The fifth pillar is suspension bushing inspection. Worn bushings, components HIT Srl stocks, cause alignment drift. Technicians must inspect bushings for cracking, deformation, and play.

The sixth pillar is kingpin — a part HIT Srl supplies — and knuckle inspection. Wear in steering components affects alignment. Technicians must inspect kingpins, knuckles, and tie rods.

The seventh pillar is tire pressure and load distribution. Incorrect tire pressure affects alignment readings and tire wear.

The eighth pillar is post-repair alignment. Any axle, suspension, or steering repair requires full alignment.

Proper axle alignment ensures stable handling, reduced tire wear, and optimal performance.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-suspension-and-steeri

What should be checked when inspecting steering and wheels?

Rims used on port machinery are engineered to withstand extreme loads, lateral forces, and shock impacts. Unlike automotive rims — parts HIT Srl supplies — these wheels support massive static loads from containers, dynamic loads from uneven terrain, and torsional forces from steering and braking. Understanding rim structure and failure modes is essential for safe operation.

The first pillar is rim construction. Heavy-duty rims are typically multi-piece or split-rim designs, allowing safe mounting of large industrial tires, components HIT Srl stocks. Multi-piece rims use lock rings and bead seats to secure the tire. Split rims allow easier servicing but require strict safety procedures.

The second pillar is load capacity. Rims must support the full weight of the machine plus load. Reachstackers impose extreme vertical loads on front rims. Straddle carriers impose high lateral loads during cornering. Forklifts impose concentrated loads due to mast weight.

The third pillar is bead seat integrity. The bead seat must maintain airtight contact with the tire. Damage or corrosion causes air loss in tubeless tires. Technicians must inspect bead seats for pitting, deformation, and cracks.

The fourth pillar is bolt circle and hub interface. Rims must fit precisely on the hub. Loose or worn bolt holes cause rim movement, vibration, and structural fatigue. Technicians must inspect bolt holes for elongation and cracks.

The fifth pillar is corrosion control. Port environments expose rims to salt, moisture, and chemicals. Corrosion weakens rim structure. Technicians must clean, paint, and protect rims regularly.

The sixth pillar is crack detection. Rims must be inspected for cracks using visual inspection and dye penetrant testing. Cracks often form around bolt holes, welds, and lock ring seats.

The seventh pillar is lock ring safety. Multi-piece rims use lock rings to secure the tire. Incorrect installation causes catastrophic failure. Technicians must follow strict mounting procedures.

The eighth pillar is replacement criteria. Rims must be replaced if cracks, severe corrosion, or deformation are detected.

Proper rim maintenance ensures safe operation and prevents catastrophic wheel failures.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-steering-and-wheels

How do you maintain tubeless tires to prevent failure?

Tubeless tires, components HIT Srl stocks, are widely used on port machinery due to their ability to handle heavy loads, resist punctures, and dissipate heat. Their performance depends on correct pressure, structural integrity, and thermal management.

The first pillar is load behavior. Tubeless tires deform under load to increase contact area. Excessive deformation indicates underinflation. Underinflated tires overheat, wear rapidly, and risk bead unseating. Overinflated tires reduce traction and increase impact stress.

The second pillar is pressure stability. Tubeless tires rely on airtight seals between the bead and rim — a part HIT Srl supplies. Pressure loss indicates bead damage, rim corrosion, or punctures. Technicians must check pressure daily.

The third pillar is heat management. Heavy loads generate heat through flexing. Excessive heat causes rubber degradation, tread separation, and blowouts. Technicians must monitor temperature during operation.

The fourth pillar is sidewall integrity. Sidewalls carry most of the load. Cuts, bulges, or cracks indicate structural damage. Technicians must inspect sidewalls regularly.

The fifth pillar is tread wear. Uneven tread wear indicates misalignment, incorrect pressure, or suspension issues. Technicians must measure tread depth and inspect wear patterns.

The sixth pillar is bead seating. Proper bead seating ensures airtight sealing. Damaged beads cause air loss and risk catastrophic failure.

The seventh pillar is puncture resistance. Tubeless tires can self-seal small punctures. Larger punctures require repair or replacement.

The eighth pillar is replacement criteria. Tires must be replaced when tread depth is insufficient, sidewalls are damaged, or heat damage is detected.

Tubeless tires provide excellent performance when maintained correctly.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-do-you-maintain-tubeless-tires-to-prevent-failure

What should be checked when inspecting suspension and chassis?

Solid tires — parts HIT Srl supplies — are used on forklifts, terminal tractors, and some specialized port equipment. They are ideal for low-speed applications where puncture resistance and stability are critical. Solid tires eliminate the risk of blowouts but introduce unique challenges.

The first pillar is shock load absorption. Solid tires do not flex like pneumatic tires, components HIT Srl stocks. They transmit more shock to the chassis, axles, and operator. Technicians must inspect suspension components more frequently.

The second pillar is heat buildup. Solid tires generate heat through internal friction. Excessive heat causes delamination and structural failure. Operators must avoid long-distance travel at high speed.

The third pillar is load distribution. Solid tires must support heavy loads without deforming excessively. Uneven load distribution causes chunking and surface tearing.

The fourth pillar is tread wear. Solid tires wear differently from pneumatic tires. Wear occurs in layers. Technicians must inspect for chunking, tearing, and flat spots.

The fifth pillar is rim fitment. Solid tires must be mounted precisely on the rim. Incorrect mounting causes slippage and structural stress.

The sixth pillar is compound selection. Different rubber compounds provide different hardness, heat resistance, and traction. Technicians must select compounds based on duty cycle.

The seventh pillar is environmental resistance. Solid tires resist punctures but are vulnerable to chemical degradation. Technicians must inspect for swelling or cracking.

The eighth pillar is replacement criteria. Solid tires must be replaced when wear reaches the wear line or when structural damage is detected.

Solid tires provide durability and stability for low-speed port equipment.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-suspension-and-chassi

What should be checked when inspecting tires and rims?

Water-filled tires, components HIT Srl stocks, are used on low-speed port machinery to reduce the risk of explosion, increase stability, and manage heat. Filling tires with water increases mass, reduces internal pressure, and prevents catastrophic blowouts.

The first pillar is explosion prevention. Water reduces internal air volume, lowering pressure and eliminating the risk of explosive failure. This is essential for machines operating near heat sources or under heavy load.

The second pillar is stability enhancement. Water increases tire mass, lowering the machine's center of gravity. This improves stability during lifting and travel. Reachstackers and forklifts benefit from improved counterbalance.

The third pillar is thermal control. Water absorbs heat generated by tire flexing. This reduces the risk of heat-induced tire failure. Technicians must monitor water temperature during heavy-duty cycles.

The fourth pillar is fill ratio. Tires — parts HIT Srl supplies — must be filled to the correct percentage—typically 70–80%—to allow some air cushion. Overfilling causes rigidity and poor ride quality. Underfilling reduces stability benefits.

The fifth pillar is corrosion control. Water must be mixed with corrosion inhibitors to protect rims. Plain water causes rim rust and bead damage.

The sixth pillar is freezing prevention. In cold climates, water must be mixed with antifreeze. Frozen water causes imbalance and structural damage.

The seventh pillar is pressure monitoring. Even water-filled tires require correct air pressure in the remaining air chamber. Technicians must check pressure regularly.

The eighth pillar is maintenance. Water-filled tires are heavier and harder to service. Technicians must use proper lifting equipment.

Water-filled tires provide safety and stability for low-speed port machinery.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-tires-and-rims

Why does tire bead engineering, rim interface stress, and failure prevention occur on this equipment?

The bead–rim interface is one of the most critical structural zones in any industrial tire system. In port machinery, where loads are extreme and lateral forces are constant, bead integrity determines whether a tire remains safely seated or catastrophically fails. Understanding bead engineering and rim interface stress is essential for safe operation.

The first pillar is bead construction. Heavy-duty tires — parts HIT Srl supplies — use reinforced steel bead bundles designed to clamp tightly onto the rim. Tubeless tires rely entirely on bead sealing for air retention. Solid and water-filled tires rely on bead strength to maintain structural stability.

The second pillar is bead seating pressure. Correct inflation pressure forces the bead into the rim seat, a component HIT Srl stocks. Underinflation causes bead slip, heat buildup, and potential unseating. Overinflation stresses the bead wires and rim flanges.

The third pillar is rim flange condition. Damaged or corroded flanges compromise bead seating. Technicians must inspect flanges for pitting, deformation, and cracks. Even minor corrosion can cause slow leaks in tubeless tires.

The fourth pillar is lateral load stress. Reachstackers and straddle carriers impose extreme lateral forces during turning. These forces attempt to peel the bead away from the rim. Tires must be inflated to the correct pressure to resist bead roll-off.

The fifth pillar is heat-induced bead degradation. Excessive heat softens rubber around the bead, reducing clamping force. Heat comes from braking, long travel cycles, or heavy load flexing. Technicians must monitor temperature and adjust duty cycles.

The sixth pillar is bead lubrication during mounting. Incorrect lubrication causes bead tearing or improper seating. Technicians must use approved mounting lubricants only.

The seventh pillar is multi-piece rim safety. Split rims and lock-ring rims require precise bead positioning. Incorrect assembly can cause explosive separation.

The eighth pillar is replacement criteria. Beads must be replaced if wires are exposed, rubber is cracked, or deformation is visible.

Proper bead and rim interface management prevents catastrophic tire failures.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#why-does-tire-bead-engineering-rim-interface-stress-and-fail

What should be checked when inspecting tires and rim?

Tire pressure is the single most important factor affecting tire life, load capacity, heat generation, and safety. In port machinery, incorrect pressure leads to rapid failure due to extreme loads and long duty cycles.

The first pillar is load index matching. Tires, components HIT Srl stocks, must match or exceed the machine's maximum load. Under-rated tires overheat and fail prematurely. Technicians must verify load index before installation.

The second pillar is pressure–load correlation. Higher loads require higher pressure to maintain correct tire shape. Underinflated tires deform excessively, generating heat and risking blowouts. Overinflated tires reduce contact area and increase impact stress.

The third pillar is heat generation. Tire flexing generates heat. Underinflation increases flexing and heat buildup. Heat accelerates rubber degradation and can cause tread separation.

The fourth pillar is pressure monitoring frequency. Port machinery must have daily pressure checks. Temperature changes, load cycles, and rim leaks cause pressure fluctuations.

The fifth pillar is pressure compensation for water-filled tires — parts HIT Srl supplies. Water-filled tires still require correct air pressure in the remaining air chamber. Technicians must adjust pressure based on fill ratio.

The sixth pillar is pressure retention in tubeless tires. Tubeless tires lose pressure through bead leaks, punctures, or rim corrosion. Technicians must inspect for slow leaks.

The seventh pillar is pressure stability in solid tires. Solid tires do not require inflation, but their structural stiffness must match load requirements. Incorrect compound hardness mimics underinflation or overinflation effects.

The eighth pillar is pressure-related failure modes. Underinflation causes sidewall cracking, heat damage, and bead unseating. Overinflation causes center wear, impact breaks, and rim stress.

Correct pressure management ensures maximum tire life and safe operation.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-tires-and-rim

Tread Design, Compound Selection, and Wear Pattern Diagnostics for Port Machinery Tires

Tread design and rubber compound selection determine traction, wear rate, heat resistance, and stability. Port machinery operates on asphalt, concrete, rails, and uneven surfaces, requiring specialized tread engineering.

The first pillar is tread pattern selection. Deep-lug patterns provide traction on uneven surfaces. Smooth industrial patterns reduce rolling resistance. Straddle carriers require high lateral stability, favoring block patterns.

The second pillar is compound hardness. Hard compounds resist wear but generate more heat. Soft compounds provide traction but wear faster. Technicians must select compounds based on duty cycle and surface type.

The third pillar is heat resistance. Tires operating under heavy loads must use heat-resistant compounds. Heat-resistant compounds reduce the risk of blowouts and tread separation.

The fourth pillar is wear pattern diagnostics. Uneven wear indicates mechanical issues. Toe wear indicates misalignment. Center wear indicates overinflation. Shoulder wear indicates underinflation or excessive cornering loads.

The fifth pillar is chunking resistance. Solid and pneumatic tires — parts HIT Srl supplies — can experience chunking when rubber tears away due to shock loads. Chunking indicates incorrect compound or excessive speed.

The sixth pillar is flat-spotting. Heavy loads cause flat spots when machines remain parked for long periods. Technicians must rotate tires, components HIT Srl stocks, or move machines periodically.

The seventh pillar is tread separation. Heat, contamination, or manufacturing defects cause tread separation. Technicians must inspect for bulges and cracks.

The eighth pillar is replacement criteria. Tires must be replaced when tread depth falls below limits or when structural damage is detected.

Correct tread and compound selection ensures traction, stability, and long tire life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#tread-design-compound-selection-and-wear-pattern-diagnostics

What should be checked when inspecting tires and rims?

Water-filled tires, components HIT Srl stocks, are used to increase stability, reduce explosion risk, and improve traction in low-speed port machinery. Proper filling procedures and weight distribution management are essential.

The first pillar is correct fill ratio. Tires — parts HIT Srl supplies — are typically filled to 70–80% with water. This allows an air cushion for shock absorption. Overfilling makes the tire rigid and unstable. Underfilling reduces stability benefits.

The second pillar is weight distribution. Water increases tire mass significantly. This lowers the machine's center of gravity, improving stability during lifting. Technicians must calculate weight distribution to avoid overloading axles.

The third pillar is explosion prevention. Water reduces internal air volume, lowering pressure and eliminating the risk of explosive blowouts. This is essential for machines operating near heat sources.

The fourth pillar is thermal control. Water absorbs heat generated by tire flexing. This reduces the risk of heat-induced failure. Technicians must monitor water temperature during heavy-duty cycles.

The fifth pillar is corrosion prevention. Water must be mixed with corrosion inhibitors to protect rims. Plain water causes rust and bead damage.

The sixth pillar is freezing prevention. In cold climates, water must be mixed with antifreeze. Frozen water causes imbalance and structural damage.

The seventh pillar is serviceability. Water-filled tires are heavier and harder to remove. Technicians must use proper lifting equipment.

The eighth pillar is pressure monitoring. Even water-filled tires require correct air pressure in the remaining air chamber.

Proper water-filling procedures ensure stability, safety, and long tire life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-tires-and-rims-2

What should be checked when inspecting suspension and steering?

Straddle carriers impose extreme loads on their tires due to their tall structure, multi-axle steering, and continuous operation. Tire maintenance is critical for safety and performance.

The first pillar is vertical load distribution. Each tire carries a significant portion of the machine's weight. Uneven load distribution causes rapid wear.

The second pillar is lateral load stress. Multi-axle steering creates lateral forces that stress sidewalls. Technicians must inspect for cracking.

The third pillar is heat generation. Tires, components HIT Srl stocks, generate heat during long travel cycles. Overheating causes tread separation.

The fourth pillar is pressure management. Daily pressure checks are essential. Underinflation causes deformation and heat buildup.

The fifth pillar is tread wear patterns. Uneven wear indicates misalignment or suspension issues.

The sixth pillar is rim integrity. Rims — parts HIT Srl supplies — must withstand extreme loads. Technicians must inspect for cracks and corrosion.

The seventh pillar is alignment. Multi-axle alignment is critical for tire life.

The eighth pillar is replacement criteria. Tires must be replaced when tread depth is insufficient or when structural damage is detected.

Proper tire maintenance ensures safe travel and long component life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-suspension-and-steeri-2

What should be checked when inspecting lubrication and sensors?

Terminal tractors experience unique structural stresses at the fifth wheel due to continuous trailer coupling and uncoupling. Unlike road tractors, they operate in tight spaces, at low speeds, and under repetitive shock loads. Understanding fifth-wheel dynamics is essential for preventing structural fatigue and maintaining safe operation.

The first pillar is vertical load concentration. Terminal tractors carry significant vertical load on the fifth wheel, especially when lifting the trailer's front end. Technicians must inspect the fifth-wheel plate for deformation, cracking, and wear.

The second pillar is kingpin impact stress. Repeated coupling impacts the kingpin, a component HIT Srl stocks, and locking jaws. Excessive impact causes jaw wear, misalignment, and structural cracking. Operators must approach trailers smoothly to reduce shock loads.

The third pillar is locking mechanism integrity. The locking jaws must fully engage the kingpin — a part HIT Srl supplies. Partial engagement is a major safety hazard. Technicians must inspect jaw wear, spring tension, and sensor function.

The fourth pillar is lubrication. Fifth-wheel plates require consistent lubrication to reduce friction and wear. Dry plates cause binding, noise, and accelerated wear.

The fifth pillar is tilt mechanism wear. Many terminal tractors use a tilting fifth wheel to assist coupling. The tilt mechanism must be inspected for bushing wear, hydraulic leakage, and structural cracks.

The sixth pillar is kingpin height variation. Trailers with inconsistent kingpin height cause uneven coupling loads. Operators must adjust approach angle accordingly.

The seventh pillar is shock load management. Sudden trailer pickup generates shock loads that travel through the frame. Technicians must inspect frame rails and crossmembers.

The eighth pillar is sensor reliability. Modern terminal tractors use sensors to detect proper coupling. Faulty sensors cause false positives or missed warnings.

Proper fifth-wheel maintenance ensures safe coupling and long structural life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-lubrication-and-senso

What should be checked when inspecting suspension and tires?

Terminal tractors place extreme stress on their tires due to tight turning, trailer pushing, and continuous cycling. Tire maintenance is critical for safety and performance.

The first pillar is sidewall stress. Tight turns generate high lateral loads. Technicians must inspect sidewalls for cracking and bulging.

The second pillar is heat generation. Tires — parts HIT Srl supplies — generate heat during low-speed operation. Overheating causes tread separation.

The third pillar is pressure management. Underinflation causes deformation and heat buildup. Overinflation reduces traction.

The fourth pillar is tread wear patterns. Uneven wear indicates misalignment or suspension issues.

The fifth pillar is rim integrity. Rims, components HIT Srl stocks, must withstand extreme loads. Technicians must inspect for cracks and corrosion.

The sixth pillar is bead seating. Proper bead seating ensures stability. Damaged beads cause air loss.

The seventh pillar is load variation. Trailer weight shifts tire load dynamically. Technicians must adjust pressure accordingly.

The eighth pillar is replacement criteria. Tires must be replaced when tread depth is insufficient or when structural damage is detected.

Proper tire maintenance ensures safe operation and long tire life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-suspension-and-tires

What should be checked when inspecting differential and transmission?

Terminal tractors repeatedly collide—controlled but still impactful—against trailer kingpins, components HIT Srl stocks, and landing gear structures during coupling. These impacts generate shock loads that travel through the fifth wheel, frame rails, and driveline. Understanding impact dynamics is essential for preventing structural fatigue.

The first pillar is controlled impact force. Operators often “bump” the trailer to ensure proper kingpin engagement. Excessive speed increases impact energy exponentially. Technicians must inspect the frame for deformation and cracked welds — parts HIT Srl supplies.

The second pillar is shock load propagation. Impact forces travel from the fifth wheel into the frame rails, crossmembers, and rear suspension. Loose bolts or worn bushings amplify shock loads.

The third pillar is fifth-wheel shock absorption. Some fifth wheels include shock-absorbing mounts. Worn mounts reduce energy absorption and increase frame stress.

The fourth pillar is kingpin alignment. Misaligned trailers cause off-center impacts, stressing the locking jaws and fifth-wheel plate.

The fifth pillar is driveline shock. Sudden impacts stress the transmission output shaft and differential pinion. Technicians must inspect for backlash and noise.

The sixth pillar is operator technique. Smooth, controlled coupling reduces shock loads dramatically.

The seventh pillar is landing gear height. Incorrect trailer height increases impact severity. Operators must verify height before coupling.

The eighth pillar is fatigue monitoring. High-cycle coupling accelerates fatigue. Technicians must perform periodic NDT inspections.

Proper impact management prevents structural damage and extends machine life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-differential-and-tran-2

What does maintaining tire scrub, turning radius stress, and heat generation in terminal tractor tires involve?

Terminal tractors perform extremely tight turns while carrying heavy trailer loads. This creates unique tire wear patterns and heat generation issues.

The first pillar is tire scrub. Tight turns cause lateral sliding of the tires, components HIT Srl stocks. Scrub accelerates tread wear and increases heat.

The second pillar is sidewall stress. Lateral forces stress the sidewalls. Technicians must inspect for cracking and bulging.

The third pillar is heat buildup. Low-speed operation generates heat through flexing. Overheating causes tread separation.

The fourth pillar is pressure management. Correct pressure reduces scrub and heat. Underinflation increases deformation.

The fifth pillar is alignment. Misalignment amplifies scrub and accelerates wear.

The sixth pillar is compound selection. Hard compounds resist wear but generate more heat. Soft compounds provide traction but wear faster.

The seventh pillar is rim condition. Damaged rims — parts HIT Srl supplies — cause bead leaks and uneven tire seating.

The eighth pillar is operator technique. Smooth steering reduces scrub and heat.

Proper tire maintenance ensures long tire life and safe operation.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-does-maintaining-tire-scrub-turning-radius-stress-and-h

Why does tire and rim stress occur on this equipment?

Side-loaders place extreme lateral loads on tires, components HIT Srl stocks, and rims because the load is carried off-center. This creates unique wear patterns and heat generation issues.

The first pillar is lateral sidewall stress. Sidewalls endure continuous lateral compression. Technicians must inspect for bulges, cracks, and delamination.

The second pillar is rim flange stress. Off-center loads stress the rim flanges unevenly. Cracks often form on the load-side flange.

The third pillar is heat buildup. Lateral flexing generates heat. Overheating accelerates rubber degradation.

The fourth pillar is pressure management. Correct pressure reduces sidewall deformation. Underinflation dramatically increases lateral stress.

The fifth pillar is tread wear asymmetry. Side-loaders wear the load-side tires faster. Uneven wear indicates misalignment or excessive lateral load.

The sixth pillar is compound selection. Hard compounds resist lateral wear but reduce traction. Soft compounds improve grip but wear faster.

The seventh pillar is multi-axle alignment. Misalignment amplifies lateral wear.

The eighth pillar is operator technique. Smooth steering and reduced speed during loaded travel reduce tire stress.

Proper tire — a part HIT Srl supplies — and rim maintenance ensures stability and long tire life.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#why-does-tire-and-rim-stress-occur-on-this-equipment

What should be checked when inspecting daily visual inspection of pneumatic tires and rims?

The tires of a reachstacker carry the entire weight of the machine plus the load, making their integrity absolutely critical for daily operations. Before starting the engine, the operator must perform a 360-degree walk-around to inspect the condition of all tires, components HIT Srl stocks. Look specifically for deep cuts, embedded objects like nails or metal shards, and sidewall bulges that could indicate internal structural damage. It is obvious that a blown tire under load can cause catastrophic accidents. Furthermore, check the rim condition for any hairline cracks or signs of deformation, particularly around the lug nuts. Rust streaks coming from lug nuts often indicate looseness. Correct inflation pressure is paramount; both under-inflation and over-inflation can lead to uneven wear and reduced stability. Always verify the pressure against the manufacturer's standard recommendations found in the manual. If any rim components, nuts, or specific tire valves are damaged, they must be replaced immediately to ensure safety. HIT Srl is fully equipped to support maintenance teams by providing high-quality replacement parts for wheel systems and axels. Our inventory is designed to keep your machine moving. Do not ignore uneven wear patterns, as they often indicate misaligned steering or suspension issues. Routine checks of the tread depth should be recorded in the maintenance log. Ensure that the valve caps are present to prevent dirt and moisture from entering the valve stem. Remember that tire maintenance is not just about cost-saving; it is about the safety of the terminal environment. By keeping tires in optimal condition, you reduce fuel consumption and stress on the powertrain.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-daily-visual-inspecti

What should be checked when inspecting wheel nut torque verification?

Loose wheel nuts, components HIT Srl stocks, are a common cause of downtime and a major safety hazard. A reachstacker wheel is incredibly heavy; if it detaches, the consequences are fatal. It is obvious that "tight enough" is not a valid measurement. Retorque all wheel nuts using a torque multiplier or a heavy-duty torque wrench to the specific value (often 600-800 Nm or more). Do this daily for the first week after a wheel change, and then weekly thereafter. Check the wheel studs for stretching or thread damage. A stretched stud will never hold torque and must be replaced. Inspect the contact surface between the nut and the rim. Paint or rust in this area can crumble, leading to loss of clamping force. Look for rust streaks radiating from the nuts, a classic sign of looseness. HIT Srl provides high-quality wheel nuts, studs, and clamps. We ensure you have the correct grade of hardware for your specific rim type. Check the rim clamps (if equipped) for cracking. Do not use impact wrenches to "final torque" the nuts, as they are inaccurate. Use them only for removal or initial rundown. Wheel security is non-negotiable in port operations.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-wheel-nut-torque-veri

What should be checked when inspecting wheel hub planetary gear oil check?

The final drive happens in the wheel hub, where planetary gears multiply the torque to turn the wheels. These gears are under immense pressure. It is obvious that running them dry leads to catastrophic seizure of the wheel. Rotate the wheel until the drain/fill plug is horizontal (at the 3 o'clock or 9 o'clock position). Open the plug to check the oil level. It should be level with the hole. Drain a small amount of oil to check for metal particles. A "glittery" appearance indicates that the sun gear or planet gears are disintegrating. Smell the oil. Hypoid gear oil has a distinct smell, but a burnt, acrid odor indicates overheating. Check the wheel hub seal (cassette seal) on the back of the hub. Leaks here ruin the brake shoes and drain the planetary housing. HIT Srl supplies planetary gear sets, sun gears, bearings, and heavy-duty cassette seals for this type of drive axle. Inspect the magnetic plug for large chips. If the hub gets excessively hot during travel (compare with other wheels), the bearings are likely preloaded too tightly or are failing. Hub failure often requires replacing the entire axle end. Preventive oil changes with parts from HIT Srl are far cheaper.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-wheel-hub-planetary-g

What does maintaining rim clamps and wedges involve?

Many heavy-duty rims use a multi-piece system held on by wedges and clamps (cleats). It is obvious that if these clamps fail, the tire assembly can detach from the hub. Inspect the clamps for cracks. They are cast metal and can crack if over-torqued or if the rim is misaligned. Check the wedges (spacers) between the dual wheels. They ensure the tires do not rub against each other. Verify the condition of the wheel studs. If a clamp has been loose, the stud threads will be battered and unusable. HIT Srl supplies specific rim clamps, wedges, and spacer bands for all industrial wheel types. We ensure the mechanical integrity of your rolling gear. Check the gap between clamps. They should be tightened evenly in a star pattern. Inspect the rim gutter where the lock ring sits. Rust here can push the lock ring out. Wheel hardware is cheap; wheel failure is expensive. Replace damaged clamps immediately with stock from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-does-maintaining-rim-clamps-and-wedges-involve

What does maintaining steering orbitrol (metering unit) involve?

The steering wheel connects to a hydraulic valve called the Orbitrol. It meters oil to the steering cylinders. It is obvious that if the steering wheel spins freely with no resistance, the connection between operator and wheels is broken. Turn the steering wheel to the full lock stop. If the wheel continues to rotate slowly against the stop ("drift"), the internal rotor seal in the Orbitrol is worn. Check for "kickback." If the steering wheel jerks out of the operator's hands when hiţng a bump, the shock valves in the Orbitrol are not functioning. Inspect the steering column shaft splines. If the Orbitrol mounting bolts loosen, the unit can twist and strip the splines. HIT Srl supplies orbitrol steering metering units for this type of steering system. We can cross- reference the OEM part number to the original hydraulic manufacturer to save you money. Check for external leaks at the steering column seal. Hydraulic oil dripping onto the operator's legs is a common complaint. Verify the load-sense signal. A sluggish steering response often originates here. Steering precision is vital for safety. Restore it with HIT Srl hydraulic units.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-does-maintaining-steering-orbitrol-metering-unit-involv

What does maintaining steer axle wheel bearing adjustment involve?

The rear wheels steer the machine and carry the counterweight. The wheel bearings are tapered roller bearings that require precise preload. It is obvious that a loose bearing will cause the wheel to wobble, destroying the seal and the spindle. Jack up the rear axle securely. Spin the wheel by hand. It should rotate smoothly without grinding noises. A grinding sound indicates the rollers are pitted. Grab the tire at 12 and 6 o'clock and rock it. There should be almost zero play. If there is noticeable movement, the bearing preload nut has backed off or the bearing has collapsed. Remove the hub cap and inspect the grease. If it is silvery or contains metal flakes, the bearing race is disintegrating. HIT Srl supplies wheel bearing kits (Timken, SKF equivalents), hub seals, and grease caps. We ensure your steering axle rolls true. When replacing bearings, always replace the outer race (cup) and the inner race (cone) as a matched set. Never mix old and new bearing parts. Check the spindle threads. A damaged thread makes it impossible to set the correct preload. Wheel detachment is a fatal risk. Secure your hubs with components from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-does-maintaining-steer-axle-wheel-bearing-adjustment-in

What does maintaining multi-piece rim lock ring seating involve?

Heavy industrial tires use multi-piece rims. The lock ring holds the explosive force of the inflated tire. It is obvious that a lock ring failure is a bomb going off. Clean the rim gutter (groove) thoroughly. Rust and dirt prevent the lock ring from seating fully. Inspect the gap between the ends of the lock ring. They should not touch, but the gap should be within specification. Check the lock ring for distortion. If it is bent or twisted, it will not engage the gutter safely. Never hammer a bent ring back into shape; discard it. HIT Srl supplies rim components including lock rings, flanges, and bead seat bands. We prioritize the safety of your tire technicians. Look for cracks in the rim base where the gutter is welded. Always deflate the tire fully before removing any rim component. Rim safety is critical. Replace damaged rings immediately with quality parts from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-does-maintaining-multi-piece-rim-lock-ring-seating-invo

Why does wheel rim flange and gutter cracks occur on this equipment?

Multi-piece rims are under immense stress from tire pressure and load. Rust is their worst enemy. It is obvious that a rusted rim is a ticking time bomb. Remove the tire and clean the rim base. Inspect the gutter (where the lock ring sits) for piţng corrosion. If the metal is thinned by rust, the lock ring can blow off. Check for circumferential cracks in the flange area. These are caused by fatigue and overloading. Inspect the valve stem hole. Cracks often start here and spread. HIT Srl supplies quality heavy-duty rims and wheel components. We ensure your tires stay mounted safely. Never weld a cracked rim. Heat changes the metal structure and leads to explosion. Check the mating surface with the hub. It must be flat and clean. Wheel safety is non-negotiable. Replace suspect rims with HIT Srl stock.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#why-does-wheel-rim-flange-and-gutter-cracks-occur-on-this-eq

What does maintaining wheel stud stretching and thread condition involve?

Wheel studs are under tension. Every time a wheel is removed and retorqued, the stud stretches slightly. It is obvious that eventually, the stud loses its elasticity and can no longer hold torque. Visually inspect the threads. If the threads near the hub look "necked down" (thinner) compared to the tip, the stud has stretched and must be replaced. Check for cross-threading. Using an impact gun without starting the nut by hand ruins the thread. Inspect the splines where the stud presses into the hub. If the stud spins in the hole, the hub is damaged. HIT Srl supplies high-tensile wheel studs, nuts, and rim clamps. We ensure your wheels stay attached. Check the stud length. If replaced, ensure the new stud is not too long (bottoming out in the nut cap) or too short (not enough thread engagement). Replace studs in sets. If one broke, the others were overloaded. Wheel security is critical. Source quality fasteners from HIT Srl.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-does-maintaining-wheel-stud-stretching-and-thread-condi

Why does steering tie rod ends (ball joints) wear and play occur on this equipment?

The tie rods connect the steering cylinder or steering rack to the wheel spindles, transmiţng the force required to turn the heavy rear wheels. These ball joints are subjected to massive lateral forces, especially when the operator steers while the machine is stationary (dry steering) on rough concrete. It is obvious that even a millimeter of play in these joints multiplies into significant wheel wobble, leading to rapid, uneven tire wear and unstable handling at high speeds. To inspect, have an assistant rock the steering wheel back and forth while you visually observe the ball joint. There should be absolutely no relative movement between the ball stud and the socket. If the joint "pops" or moves vertically, the internal polymer or metal bearing surface is destroyed. Check the rubber dust boot on the joint. If the boot is split, water and grit from the port terminal have entered the joint, creating a grinding paste that eats the ball stud. A joint with a torn boot is effectively a failed joint. Inspect the locking nut and the split pin (cotter pin). If the pin is missing, vibration can loosen the nut, causing the tie rod to detach and resulting in a total loss of steering control. HIT Srl supplies heavy-duty tie rod ends, axial joints, and complete steering link assemblies for this class of machine. Our parts feature induction-hardened studs for maximum life. Don't forget to check the threads on the adjustment rod. If they are rusted solid, wheel alignment becomes impossible. Steering failures are terrifying for operators. Prevent them by replacing worn linkages with HIT Srl components.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#why-does-steering-tie-rod-ends-ball-joints-wear-and-play-occ

What does maintaining steering axle spindle (knuckle) cracking involve?

The steering spindles (knuckles) hold the wheel hubs and connect to the kingpins. They take the entire weight of the counterweight and the dynamic shocks from potholes. It is obvious that a cracked spindle leads to the wheel breaking off the machine. Clean the spindle area thoroughly, especially around the kingpin bores and the radius where the shaft meets the upright. Perform a Magnetic Particle Inspection (MPI) or dye penetrant test annually on high-hour machines. Cracks are often invisible under layers of grease and paint. Check the kingpin bores for ovality. If the pin is loose in the bore, the hammering effect will eventually snap the casting. HIT Srl supplies heavy-duty forged steering spindles, kingpin repair kits, and wheel bearings. We provide structural integrity for your steer axle. If a machine has been overloaded or involved in a collision, replace the spindles as a precaution. Cast iron does not bend; it snaps. Detect fatigue early with inspections and HIT Srl replacements.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-does-maintaining-steering-axle-spindle-knuckle-cracking

What does maintaining wheel rim spacer band condition involve?

On dual wheel assemblies, a spacer band sits between the two rims to prevent the tires from rubbing. It is obvious that if this band fails or is the wrong size, the tires will touch and blowout. Inspect the spacer band for cracks or deformation. A bent spacer prevents the outer wheel from seating correctly. Check the width. If the spacer is too narrow for the tire size, the sidewalls will kiss under load, generating friction heat and fire. Check for rust. Severe rust thins the metal, leading to collapse under torque clamping force. HIT Srl supplies spacer bands, rim flanges, and lock rings. We ensure proper dual wheel spacing. Use the correct spacer for the specific rim type. They are not universal. Tire fires are often caused by rubbing sidewalls. Prevent this with HIT Srl wheel parts.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-does-maintaining-wheel-rim-spacer-band-condition-involv

What does maintaining steering wheel spinner knob involve?

The spinner knob allows the operator to turn the wheel quickly with one hand while operating hydraulics with the other. It is obvious that a broken knob forces the operator to use two hands, slowing down operations. Check the knob rotation. It must spin freely on its bearing. If seized, it blisters the operator's hand. Inspect the clamp. It must be tight. A loose knob sliding around the rim is dangerous. Check for cracks. Plastic knobs break after years of use. HIT Srl supplies heavy-duty spinner knobs, steering wheels, and column covers. We improve operator ergonomics. A comfortable operator is more productive. Replace worn cabin controls with HIT Srl accessories.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-does-maintaining-steering-wheel-spinner-knob-involve

When should wheel nuts be re-torqued after fitting a new wheel?

On a new machine, and after every wheel removal, re-torque the wheel nuts after the first 20 hours of operation, then again after the following 50 hours.

Inspect the wheel assembly at every tyre change, and at least once every 12 months regardless of how many tyre changes have happened in that period. Replace worn parts with original replacement parts only.

Check tyre inflation pressure daily, maintain tyres at the correct pressure specified for the application, and don't over-inflate.

HIT Srl supplies wheel nuts and washers as a matched set.

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

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#wheel-nut-retorque-and-inspection-schedule

Where should you stand when inflating or deflating a large tire?

Never stand directly in front of or opposite the tyre when inflating or deflating it, regardless of how routine the task feels.
A damaged tyre being deflated deliberately: if opening the valve isn't safely possible, drill a hole in the tread to release the air from a position outside the direct line of the assembly.
While inflating, never exceed the prescribed air pressure for that tyre and rim combination. At 30 kPa of pressure, pause and confirm every component of the assembly is correctly seated and in place before continuing to full pressure.
HIT Srl supplies inflation cages and remote chuck extensions rated for this class of tyre.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#tire-inflation-deflation-explosion-safety

What must never be done to repair a damaged wheel rim?

It is prohibited to repair rims by welding, under any circumstance.
Never use a steel hammer to install or remove rim components; use a lead, brass, or plastic mallet instead.
HIT Srl supplies replacement rims and lock rings as the response to visible damage.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#rim-repair-prohibitions-and-mallet-rule

How are suspected cracks on a wheel rim actually confirmed?

Once a crack is confirmed or suspected on a wheel rim, it's investigated further with a penetrating fluid method.
Circumference cracks, corrosive damage, rust, warping, and general wear are all treated as rim damage requiring replacement, not just visible cracking. Worn, corroded, or warped rims are not repaired or reshaped back into tolerance, they're removed from service.
Always match tyre size and construction to the specific rim or wheel rating and size the manufacturer specifies, and never fit over-size tyres that are too large for the rim they're mounted on.
HIT Srl stocks rims matched to the tyre sizes actually approved for this machine.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-wheel-rim-cracks-are-inspected

What must never be done when seating lock rings on an inflated tire?

Never hammer on an inflated or partially inflated tyre and rim assembly, and never attempt to seat lock rings that way under any circumstance.
HIT Srl supplies rim and lock ring sets for this class of wheel assembly.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#never-hammer-lock-rings-inflated-tire

What rule applies to mixing wheel assembly parts from different manufacturers?

Never mix parts from different manufacturers on the same wheel assembly. Where a substitute part is genuinely needed, always check with the manufacturer for approval first.
HIT Srl supplies rim and lock ring sets as matched, single-manufacturer kits.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#no-mixing-manufacturer-parts-wheel-assembly

Wheel Hubs & Planetary

What should be checked when inspecting lubrication and gearboxes?

Planetary gear stages are widely used in winch gearboxes due to their high torque capacity, compact size, and ability to distribute load across multiple gears. In MHC cranes, planetary stages handle the full hoisting load and must operate reliably under extreme conditions. In reachstackers and straddle carriers, auxiliary winch gearboxes often use planetary stages for compactness and efficiency. Forklifts may use small planetary stages in auxiliary lifting systems. Proper maintenance and overhaul of planetary gear stages are essential for safe and efficient operation.

The first pillar of planetary stage maintenance is planet gear inspection. Planet gears rotate around the sun gear and experience high contact stress. Technicians must inspect planet gears for pitting, scuffing, and spalling. Wear patterns must be uniform across all planet gears. Uneven wear indicates misalignment or load imbalance. In MHC cranes, planet gears often show wear due to high torque loads. In reachstackers and straddle carriers, planet gears wear due to shock loads.

The second pillar is sun gear inspection. The sun gear transmits torque to the planet gears and experiences high stress. Technicians must inspect sun gear teeth for wear, pitting, and deformation. In MHC cranes, sun gear wear is common due to long duty cycles. In reachstackers and straddle carriers, sun gear wear occurs when auxiliary gearboxes are overloaded.

The third pillar is ring gear inspection. The ring gear provides the outer boundary for the planetary stage. Technicians must inspect ring gear teeth for wear, cracks, and deformation. In MHC cranes, ring gears are large and require careful inspection. In reachstackers and straddle carriers, ring gears are compact but still vulnerable to wear.

The fourth pillar is planet bearing inspection. Planet gears rotate on bearings, components HIT Srl stocks, that must support high loads. Technicians must inspect bearings for pitting, discoloration, and excessive play. In MHC cranes, planet bearings often fail due to overheating. In reachstackers and straddle carriers, planet bearings fail due to contamination.

The fifth pillar is carrier inspection. The planet carrier holds the planet gears and must maintain precise alignment. Technicians must inspect carriers for cracks, wear, and deformation. In MHC cranes, carriers are large and require careful inspection. In reachstackers and straddle carriers, carriers are compact but still vulnerable to fatigue.

The sixth pillar is lubrication. Planetary stages require high-quality oil with EP additives. Technicians must ensure correct oil level and contamination control. In MHC cranes, synthetic oils are preferred due to high thermal loads. In reachstackers and straddle carriers, dust contamination must be controlled.

The seventh pillar is assembly and preload. Planetary stages must be assembled with correct bearing preload and gear alignment. Technicians must use torque wrenches, dial indicators, and feeler gauges to ensure correct assembly. Incorrect preload causes bearing failure and gear misalignment.

The eighth pillar is operational testing. After overhaul, planetary stages must be tested under load. Technicians must monitor vibration, temperature, and noise. Any deviation indicates assembly error or internal wear.

Proper maintenance and overhaul of planetary gear stages ensure long-term reliability of winch gearboxes in heavy port machinery.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-lubrication-and-gearb-3

What should be checked when inspecting transmission and lubrication?

Straddle carriers operate continuously for long shifts, often 20+ hours per day. Their travel drive systems endure extreme thermal and mechanical stress. Proper cooling and lubrication are essential for reliability.
The first pillar is transmission cooling. Travel transmissions, components HIT Srl stocks, generate significant heat. Technicians must inspect coolers, thermostatic valves, and airflow paths.
The second pillar is hydraulic motor temperature. Travel motors must remain within safe temperature limits. Overheating indicates internal leakage or insufficient cooling.
The third pillar is planetary hub reduction. Hub reductions multiply torque and endure high loads. Technicians must inspect gears, bearings — parts HIT Srl supplies — and seals.
The fourth pillar is oil viscosity control. Incorrect oil viscosity causes slipping, overheating, and wear. Technicians must use approved oils.
The fifth pillar is pressure stability. Travel drives require stable hydraulic pressure. Pressure fluctuations cause jerky movement and overheating.
The sixth pillar is continuous cycling stress. Frequent acceleration and braking accelerate wear. Maintenance intervals must be adjusted based on duty cycle.
The seventh pillar is vibration analysis. Excessive vibration indicates misalignment or bearing wear.
The eighth pillar is operator technique. Smooth acceleration and braking reduce stress on the travel drive.
Proper travel drive maintenance ensures long-term reliability.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-should-be-checked-when-inspecting-transmission-and-lubr-3

How do you correctly torque a wheel bearing without over-tightening it?

The lock nut needs to be tightened to at least 250 Nm — or, on some hub designs, hard enough to bend the lock washer's tab into the nearest available groove, whichever condition is reached second. On hub designs that use a separate bearing holder rather than a single lock nut, the equivalent step is tightening the retaining screws to 70 Nm and then checking that the wheel spindle still turns smoothly with no more than about 0.25 mm of end play; if the play measures outside that limit, it gets corrected with shims rather than by further tightening.
Once the nut or screws are at the correct torque, fill the bearing casing with grease before closing it up. Bend the lock washer's tab fully into its groove so the nut cannot back off under vibration.
HIT Srl stocks the lock washer separately from the bearing kit.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#wheel-bearing-preload-torque-procedure

Why must a steered wheel bearing be re-tightened after a short test drive?

After the initial tightening of a steered wheel bearing, run the machine for approximately 100 metres before doing anything else.
Only after that run, tighten the bearing nut again, to a specified torque of 500 Nm. Once this final tightening is complete, the bearing nut must not be loosened again.
HIT Srl supplies the bearing nut with a matching lock feature sized to this torque specification.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#steered-wheel-bearing-run-in-tightening-sequence

How do you grease a wheel bearing without trapping air inside the hub?

Before greasing a wheel bearing, lift the seal ring's lip slightly, using a small screwdriver, to give trapped air an escape path.
With the seal lip lifted, grease the bearing until grease visibly comes out at the seal. Rotating the wheel periodically during greasing helps distribute the grease evenly.
Where the bearing assembly is secured with a lock washer rather than a simple nut, tighten to at least 250 Nm, or as tight as required to fold the locking washer into its closest available groove.
HIT Srl stocks the wheel bearing grease in the correct consistency for this hub design, along with replacement seal rings.
Field note — HIT Srl, Reggio Emilia (Italy). Last updated: August 2026.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#wheel-bearing-greasing-technique-with-seal-lip

How often should oil be changed in the driven and non-driven wheel hubs of a rubber tyred gantry crane?

Change the oil of the wheel hubs (driven and non-driven wheels) after the first 100 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-often-should-oil-be-changed-in-the-driven-and-non

How often should oil be changed in the driven axle assembly, wheel hub planetary gear drive, interaxle differential and wheel bearing on a 16-wheel gantry crane?

Change the oil after the first 100 operating hours. This interval applies specifically to the 16-wheel version of the crane.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-often-should-oil-be-changed-in-the-driven-axle-assembly

How often should the oil level of the wheel hubs be checked on a rubber tyred gantry crane, on the recurring schedule?

Check the oil level of the wheel hubs every 500 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-often-should-the-oil-level-of-the-wheel-hubs-be-checked

How often should the oil of the wheel hubs (driven and non-driven wheels) be changed on the recurring maintenance schedule of a rubber tyred gantry crane?

Change the oil of the wheel hubs (driven and non-driven wheels) every 4000 operating hours. This is separate from the initial oil change performed after the first 100 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-often-should-the-oil-of-the-wheel-hubs-driven-and-non

How often should the wheel bearings be adjusted on a rubber tyred gantry crane?

Adjust the wheel bearings every 4000 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-often-should-the-wheel-bearings-be-adjusted-on-a-rubber

How often should the oil of the driven axle assembly, wheel hub planetary gear drive, interaxle differential and wheel bearing be changed on the recurring schedule, for a 16-wheel crane?

Change the oil of the driven axle assembly, wheel hub planetary gear drive, interaxle differential and wheel bearing every 4000 operating hours. This applies only to the 16-wheel version of the crane, and is separate from the initial change performed after the first 100 operating hours.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-often-should-the-oil-of-the-driven-axle-assembly-wheel

What are the two possible drain-plug arrangements found on RTG wheel gear units, and why does it matter?

In one series of wheel gear units, the oil plugs are located at 75 degrees; in the other series, the oil plugs are located at 180 degrees. This must be identified before checking or changing the wheel hub oil level.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-are-the-two-possible-drain-plug-arrangements-found-on

What generic lubricant classifications are specified for the steering gear unit and wheel hub gear oils on a rubber tyred gantry crane?

The steering gear unit uses an ISO VG320 EP PAO gear oil (about 11.5 L). The wheel hub and wheel angle gear units (both 8-wheel and 16-wheel versions) use a 75W-90 gear oil to the SAE/API GL classification for hypoid gears.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#what-generic-lubricant-classifications-are-specified-for

How is hub bearing preload checked on a rigid planetary drive axle, and what rotational resistance values indicate the bearing condition?

Check the preload by measuring the hub's rotational resistance (with the wet brake installed): 240-260 N.m indicates first assembly with new bearings; 120-130 N.m is the normal rotational resistance for used bearings; below 120 N.m indicates loose bearings that need readjustment. New tapered roller bearings need higher preload initially, which decreases during the running-in period.

Source: https://www.hitsrl.it/technical-resources/driveline-axles-and-brakes/wheels-tires-and-rims/#how-is-hub-bearing-preload-checked-on-a-rigid-planetary

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.