

Steering & Steer Axle

HIT SRL

72 procedures · 22 maintenance tips (pillole)

Technical Reference Document

Procedures

Wheels & rims

What is the correct sequence to inspect a dismantlable rim for wear?

1. Dismantle the rim according to the standard procedures.
2. Carefully clean the outside of the rim bead using a wire brush.
3. Look for a wear mark produced by the lock ring on the rim bead outside diameter, located between the ends of the lock ring.
4. Measure the depth of the wear at this point using a straight edge and feeler gauge; if the wear exceeds 0.5 mm, discard and replace the wheel, the lock ring, and the beadseat or loose flange.
5. If a wear mark cannot be found, measure the circumference of the rim bead with a measuring tape and calculate the diameter (circumference divided by 3.14).
6. If the diameter is below the specified minimum, discard the wheel, the lock ring, and the beadseat or loose flange.
7. Inspect the high-stress areas of the rim, marked separately, for circumferential cracks, fretting, corrosion pitting, distortion or wear at each tyre change.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-inspect-a-dismountable-rim-f>

What is the correct sequence for the safety crack-test performed when changing tyres?

1. Dismantle the loose components of the wheel.
2. Clean the test area on the wheel completely of paint residue using shot blasting.
3. Carry out the magnetic examination using AC electricity and a wet contrast paint test medium.
4. If no cracks are indicated in the magnetic examination, approve the wheel; if cracks are indicated, carry out the penetrance test.
5. Clean the test area with cleaning fluid.
6. Spray penetrant on the cleaned area and let it dry for approximately 10 minutes.
7. Clean off the penetrant with cleaning fluid, removing all excess.
8. Wipe off the cleaning fluid with a cloth, allowing the remaining penetrant to evaporate.
9. Spray developer on the test area and let it dry for 1-2 hours.
10. Inspect the lock ring groove visually.
11. Approve the wheel if the marked area shows no linear or dot-shaped cracks; reject the wheel if it does.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-for-the-safety-crack-test-perfo>

What is the correct sequence to check the tyres and rims?

1. Check the rims: that the lock ring and lugs are installed correctly, and that there are no cracks in the rim parts; if damaged, remove the tyre and rim for further checking.
2. Check the air pressure in the tyres against the specified pressure, inflating if necessary.
3. Check the tyres for uneven or fast wear (which may indicate a mechanical defect such as uneven brake action) and remove any penetrating objects such as glass, wood or metal filings; if a tyre is damaged, dismantle the wheel and change the tyre.
4. If the tyres and rims have no defects, check and tighten the wheel nuts crosswise to the specified torque (650 Nm).

Note: *Never stand in front of the tyre when deflating or inflating, since the lock ring and lugs may release and shoot off when pressure changes.*

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-check-the-tyres-and-rims>

What is the correct sequence to remove and fit a tyre and rim on the drive axle?

1. Put the machine in service position.
2. Lift the machine under the drive axle by the relevant wheel, supporting it securely.
3. Release the air from both tyres, using the valve, then the rim valve, then breaking/cutting the valve pipe, then as a last resort drilling a hole (max Ø5 mm) in the tread if the air cannot otherwise be released.
4. Secure the wheel safely with lifting equipment.
5. Remove all wheel nuts.
6. Lift the wheel away and position it safely.
7. Secure the inner drive wheel with lifting equipment.
8. Remove the spacer ring.
9. Remove the inner drive wheel and position it safely.
10. Fit the inner drive wheel, taking care not to damage the screw threads.
11. Fit the spacer ring.
12. Install the outer drive wheel, taking care not to damage the screw threads.
13. Fit the wheel nuts, tightening them crosswise in turn with increasing torque up to 650 Nm.
14. Inflate the tyres.
15. Lower the machine and remove the jack.
16. Test-drive the machine and check that the wheels are secure.
17. Check and re-tighten the wheel nuts crosswise to 650 Nm.
 - With double wheel fitting, both tyres must be deflated, otherwise the inner tyre may explode when the outer is removed, with fatal danger.
 - The spacer ring is heavy.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-remove-and-fit-a-tyre-and-ri>

What is the correct sequence to remove and fit a tyre and rim on the steering axle?

1. Put the machine in service position.
2. Lift the machine under the steering axle by the relevant wheel, supporting it securely.
3. Release the air from the tyre, using the valve, then the rim valve, then breaking/cutting the valve pipe, then as a last resort drilling a hole (max Ø5 mm) in the tread if the air cannot otherwise be released.
4. Secure the wheel safely with lifting equipment.
5. Remove the wheel nuts.
6. Remove the wheel and position it safely.
7. Fit the wheel.
8. Fit the wheel nuts, tightening them crosswise in turn with increasing torque up to 650 Nm.
9. Inflate the tyre.
10. Lower the machine and remove the jack.
11. Test-drive the machine and check that the wheels are secure.
12. Check and re-tighten the wheel nuts crosswise to 650 Nm.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-remove-and-fit-a-tyre-and-ri-2>

What is the correct sequence to inflate a tyre?

1. Make sure the lock ring and lock lugs are in the correct position before inflating.
2. Connect the compressor with a locking air-chuck to the nipple on the tyre.
3. Stand at an angle behind the tyre and remain there until inflating is complete, to avoid being hit by rim parts in the event of an explosion.
4. Inflate the tyre to the prescribed pressure.
 - Never install rim components by striking with a hammer while inflating, and never strike fully or partly inflated tyres or rim sets.
 - Never inflate tyres before all parts are in place; wheels must be inflated on the machine or in a protective device able to handle or dissipate a shock wave and catch ejected parts.
 - Never stand in front of the tyre when deflating or inflating.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-inflate-a-tyre-3>

What is the correct sequence to check a rim for wear and cracks?

1. Dismantle the rim.
2. Carefully clean the outside of the rim edge with a steel brush.
3. Measure the lock ring's wear mark on the tyre bead using a steel ruler and sliding gauge; if wear exceeds 0.5 mm, discard and replace the wheel rim, lock ring and tapered rim.
4. Measure the rim edge's circumference with a tape and calculate the diameter (circumference divided by 3.14); if the diameter is smaller than the specified minimum, discard and replace the wheel rim, lock ring and tapered rim.
5. Check the areas of high stress concentration for damage, first with the magnetic particle method and then, if cracks are indicated, with penetrating fluid.

Note: Always use the correct tyre size and rim design; replace all damaged, worn or corroded rims or mounting parts.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-check-a-rim-for-wear-and-cra>

What is the correct magnetic particle and penetrating fluid sequence to check a rim for cracks?

1. Blast the applicable area clean so it is completely free of paint residue.
2. Test using magnetic particle equipment with alternating current, a contrast colour, and a wet checking medium.
3. If no cracks are detected, approve the applicable area; if cracks are indicated, investigate further with penetrating fluid.
4. Clean the area with cleaning fluid.
5. Spray penetrating fluid on the cleaned area and let dry for 10 minutes.
6. Wash off the penetrating fluid with cleaning fluid, wiping it thoroughly with a drying cloth and letting any remainder evaporate.
7. Spray detection fluid on the area.
8. Let the sprayed area dry for 1-2 hours.
9. Visually inspect the area; approve it if there are no signs of linear or point-shaped cracks, and contact the machine manufacturer support if there are.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-magnetic-particle-and-penetrating-fluid>

What is the correct sequence to check the tyres?

1. Check the wear condition and inflation pressure of the tyres.
2. Check the tightness of the wheel nuts.
 - Inflation and pressure checks must be performed on cold tyres.
 - Never stand in front of the rim during tyre inflation or wheel nut tightness checks.
 - Never exceed the maximum permitted weight.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-check-the-tyres>

What is the correct sequence to remove a wheel?

1. Park the machine on flat, compact ground, without a load attached, with the parking brake applied and the engine off, and chock the wheels that remain on the ground.
2. With the wheel to be replaced still on the ground, partially loosen the fastening nuts.
3. Lift the wheel with a hydraulic jack (minimum capacity 45 t) positioned under the front axle (not at the centre) or at the centre of the rear axle, ensuring the jack's bearing surfaces are flat, then insert fixed support trestles as a safety measure.
4. Fully unscrew the fastening nuts.
5. Before removing the wheel from the hub, sling it with straps or chains supported by a crane or similar, to avoid an uncontrolled fall, taking care not to damage the stud threads.
 - Completely deflate the tyre before starting any work, including removing the wheel from the machine.
 - Never stand in front of the rim during tyre deflation or inflation.
 - Never place the jack under the centre of the front axle.
 - Do not weld or cut the rims; any repair work must be done at an authorised, qualified tyre workshop.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-remove-a-wheel>

What is the correct sequence to install a wheel?

1. Check that the tyre shows no abnormal bulges or cracks and is of the prescribed type.
2. Before mounting on the hub, clean and carefully inspect the wheel disc for any cracks or imperfections.
3. Clean the hub, the studs, and the fastening nuts.
4. Before closing the nuts, make sure the wheel rims sit flush against the contact surface with the hub.
5. Use the same type of nut originally fitted (same thread pitch and seating type: flat, spherical or conical) for secure and effective locking.
6. Mount the new wheel, taking care not to damage the stud threads.
7. Lightly tighten the nuts so the wheel is correctly seated on the hub.
8. Tighten the nuts following the indicated progression.
9. Lower the wheel to the ground and complete tightening the nuts to the specified torque.
 - Do not lubricate the nut seats or the stud threads.
 - Excessive tightening can be harmful; do not use makeshift tools such as pipes or extensions.
 - On a new machine, and after every wheel removal, re-tighten the wheel nuts after the first 20 hours and again after the following 50 hours.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-install-a-wheel>

What safety precautions must be followed when demounting a tyre?

1. Always exhaust all air from the tyre before removing any rim components such as nuts and rim clamps.
2. Remove the valve core to exhaust all air from the tyre.
3. Check the valve stem by running a piece of wire through it to make sure it is not plugged.

Note: Demounting tools apply pressure to rim flanges to unseat tyre beads; if the tool slips off, it can fly with enough force to kill, so always stand to one side when applying hydraulic pressure and keep fingers clear.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-safety-precautions-must-be-followed-when-demounting-a-t>

What must be checked when inspecting rim components?

1. Check rim components periodically for fatigue cracks, replacing all cracked, badly worn, damaged or severely rusted components.
2. Clean and repaint rims to stop the effects of corrosion, cleaning all dirt and rust from the lock ring gutter so the lock ring seats securely.
3. Check that a filter on the air inflation equipment is working properly, to remove moisture from the air line and prevent corrosion.
4. Make sure the correct parts are being assembled, checking with the distributor or manufacturer if in doubt.
 - Mixing rim parts from different manufacturers is potentially dangerous; always check for manufacturer approval.
 - If unsure about proper mating of rim and wheel parts, consult a wheel and rim expert rather than taking chances.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-must-be-checked-when-inspecting-rim-components>

What is the correct sequence to mount and inflate a tyre safely?

1. Do not inflate the tyre before all side and lock rings are in place; double-check that all components are properly seated.
2. Inflate in a safety cage or use safety chains during inflation.
3. Check components for proper assembly again after inflating to approximately 5 psi.
4. Continue inflating to the prescribed pressure, standing to the side throughout.
 - Never seat rings by hammering while the tyre is inflated, and never hammer on an inflated or partially inflated tyre/rim assembly.
 - Never sit on or stand in front of a tyre and rim assembly being inflated; use a clip-on chuck with a hose long enough to stand to the side.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-mount-and-inflate-a-tyre-saf>

What is the correct sequence to service a tyre and rim while still on the machine?

1. Block the tyre and wheel on the opposite side of the machine before placing the jack in position.
2. Put hardwood blocks under the jack regardless of how firm the ground appears, and crib up the machine with blocks in case the jack slips.
3. Remove the bead seat band slowly to prevent it dropping off and crushing your toes, supporting the band on your thigh and rolling it slowly to the ground.

Note: When using a cable sling, stand clear, since it might snap and lash out.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-service-a-tyre-and-rim-while>

Checking a wheel rim for cracks on a rubber tyred gantry crane

1. Deflate the tyre.
2. Remove the wheel.
3. Remove the tyre from the rim, and disassemble the rim; remove the loose lock ring and bead seat band.
4. Clean the marked areas of the rim, removing all paint.
5. Check the marked areas with magnetic particles. If there are no cracks, accept the rim for use.
6. If there are cracks, grind the cracked sections until they are smooth, not deeper than 0.5 mm, then perform a penetrant test with a solvent-based penetrant liquid. If there are no cracks after grinding, accept the rim for use; if there are cracks, discard the rim.
7. Protect the rim from rust, for example by painting it.
8. Reassemble the rim, and install the wheel, ensuring the rim components are properly in place.
9. Mark the rim, and record the procedure in the service log.

Note: *It is recommended that any inspection work on the rims, including non-destructive testing methods, be performed by an appropriate expert. Hairline cracks or larger cracks may form on the rims over a long period of time; it is recommended to check the rims annually using the magnetic particle testing method. The inspection can be performed on one rim at a time in conjunction with other tyre service procedures; checked rims can be marked with, for example, a colour that is changed each year.*

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#checking-a-wheel-rim-for-cracks-on-a-rubber-tyred-gantry>

Lever Steering

What checks should be performed when function-testing lever steering or the mini-wheel?

1. Perform all test-running with the lever steering or mini-wheel without load, since the steering axle is loaded the most and problems are felt most distinctly then.
2. Check that the lever steering/mini-wheel disengages when the steering wheel is turned; if the steering wheel is turned slowly, steering should not disengage.
3. Check that the mini-wheel has 6-8 turns from one end-position to the other, tested while the machine is rolling slowly (below 5 km/h) with sensitivity set to 10.
4. Check that, when the machine is operated slowly (below 5 km/h), a small deflection of the lever (or slow turning of the steering wheel) results in the steering axle changing position slowly, without jerking or delay; test both to the right and left.
5. Test-run in a realistic work operation (run at full speed forward, slow down and turn 90 degrees left, stop and reverse with a 90 degree right turn, run back the way you came) and check whether the machine follows the intended path, using cones to mark the intended path.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-checks-should-be-performed-when-function-testing-lever>

What is the correct sequence to replace the steering lever?

1. Put the machine in service position.
2. Remove the screws securing the top of the plastic panel for the mini-wheel.
3. Unplug the connector from the steering lever.
4. Replace the steering lever.
5. Fit in reverse order.
6. Calibrate the steering lever.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-steering-lever>

What is the correct sequence to start up a new lever-steering or mini-wheel system?

1. Download the program and setup.
2. Set the basic values for initiation.
3. Calibrate the steering.
4. Fine-tune the start currents for right and left, respectively.
5. Test-run and adjust.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-start-up-a-new-lever-steerin>

What is the correct sequence to replace the wheel angle sensor?

1. Put the wheels at an angle.
2. Put the machine in service position.
3. Remove the four screws securing the protective cover.
4. Undo the Allen screw and remove the nut securing the sensor.
5. Using a soldering iron, detach the cables from the sensor.
6. Replace the sensor.
7. Fit in reverse order.
8. Calibrate the new sensor.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-wheel-angle-sens>

What is the correct sequence to replace the mini-wheel/lever steering control valve?

1. Put the machine in service position.
2. Depressurise the hydraulic system.
3. Clean the control valve and its surrounding area.
4. Mark up and detach the hydraulic hoses from the control valve, plugging all connections immediately to protect the hydraulic system from impurities.
5. Mark up and detach the wiring from the control valve.
6. Remove the control valve: remove the connection adapter, then the attaching bolts, and lift away the valve, placing it on a clean and protected surface.
7. Transfer the connection adapters to the new control valve one at a time so the marking is not mixed up, checking that the O-rings are intact and correctly fitted.
8. Mark up the servo valves on the new control valve.
9. Fit the valve, lifting it into place and fitting the attaching bolts.
10. Connect the wiring to the control valve according to the marking.
11. Connect the hydraulic hoses to the control valve according to the marking, checking that the O-rings are intact and correctly fitted.
12. Turn on the main electric power and start the engine.
13. Check that the valve's hydraulic connections are sealed.
14. Remove the collection container, treating spills as environmentally hazardous waste.
15. Check that the steering is working.
16. Check the hydraulic oil level with all hydraulic cylinders fully retracted, and top up if needed.
17. Calibrate the steering lever/mini-wheel.
 - Read the safety instructions for oil before working.
 - The valve weighs approximately 30 kg.
 - Overfilling the oil can cause leakage and environmental damage; the hydraulic oil level is checked with all hydraulic cylinders fully retracted.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-mini-wheel-lever-2>

What is the correct sequence to find the correct start and final currents when adjusting lever steering or mini-wheel?

1. To find the start current, set the minimum and maximum current for steering left to the same value, starting at 300 mA.
2. Steer to the left with the lever or mini-wheel; the wheels should move slowly. If the wheels do not move, increase the current values a couple of steps and try again, standing on the footstep to assess how the wheels move.
3. Repeat for the control current on the right.
4. Check that the steering speed is the same in both directions.
5. Use the final value found as the minimum current for steering left and right.
6. To find the final current, set the maximum current for steering left and right to 510 mA.
7. Check that the machine has the same steering speed in both directions when the steering lever is fully deflected, or the mini-wheel is turned fast (approximately one turn per second), standing on the footstep to assess how the wheels move.
8. Test-run the machine and assess whether the steering capacity is sufficient at low speeds; if not, increase the final currents slightly and try again.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-find-the-correct-start-and-f>

What is the correct sequence to calibrate feedback lever steering?

1. Select calibration for lever steering from the setup menu.
2. Without touching the steering lever, confirm the lever's middle position when it is shown on the display.
3. Move the lever to the far left and confirm the position shown.
4. Move the lever to the far right and confirm the position shown.
5. If feedback is included, adjust the wheels until they are parallel with the machine (best achieved by running the machine straight with the normal steering wheel), then confirm the wheels' centre position.
6. Turn the steering wheel to maximum left and confirm the position shown.
7. Turn the steering wheel to maximum right and confirm the position shown.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-calibrate-feedback-lever-ste>

Wheel Hub

What is the correct sequence to replace the wheel hub and wheel bearings?

1. Put the machine in service position.
2. Remove the steering wheel.
3. Clean the hub cover and its surrounding area.
4. Remove the hub cover.
5. Remove excess grease with a rag, treating it as environmentally hazardous waste.
6. Open the lock washer with a screwdriver.
7. Remove the lock nut, lock washer and the bearing nut.
8. Remove the spacer washer from the bearing.
9. Remove the entire hub including the outer bearing.
10. Remove the inner bearing inner race from the wheel spindle.
11. Remove the bearings' outer races from the hub, using a drift to press them out.
12. Remove the seal.
13. Clean the hub and smear the inside with an NLGI EP2 universal grease.
14. Fit new seals and bearing races in the hub, using a drift to press in the bearing races (never applied directly on the bearings), fitting the outer bearings with the larger diameter outward.
15. Fit the inner bearing inner race and rollers on the wheel spindle, and pack the bearing with the NLGI EP2 universal grease.
16. Fill the empty space in the hub with the NLGI EP2 universal grease.
17. Fit the hub on the wheel spindle.
18. Fit the outer bearing, spacer washer and bearing nut, packing the bearing with grease and fitting the washer and bearing nut with the smooth surface facing inward towards the hub.
19. Torque the bearing nut: grease the thread on the side of the nut facing the bearing with SAE 80W140 oil; tighten the nut while rotating the hub; rotate the hub at least 10 revolutions; retighten the nut while rotating the hub; repeat the tightening and rotating until the nut does not move when retightened; then check the friction torque — the lower limit (no play) is reached when the bearing nut is tightened until no play can be felt when trying to wobble the wheel, and the upper limit is checked with a spring balance, which should give a maximum friction torque of approximately 14.5 Nm (checked by winding a cord a few times around the wheel bolts before the wheel is mounted, pulling with the spring balance, and reading the scale as the hub is rotated).
20. Grease the lock washer and fit it.
21. Fit the lock nut and tighten it to a minimum torque of 250 Nm, or as hard as necessary to be able to turn the lock washer into the nearest groove, then lock the bearing nut and lock nut with the lock washer.
22. Fill the bearing casing with grease and fit it.
23. Grease the wheel bearing through the grease nipple, rotating the wheel now and then to distribute the grease inside the hub, lifting the seal ring's lip with a small screwdriver to let air escape, and greasing until grease comes out at the seal.
24. Fit the wheel.
25. Remove the support and lower the steering wheel.

Note: Tyres should be regarded as pressurized containers and constitute fatal danger if handled incorrectly; parts can be thrown with explosive force and may cause severe injuries. Never repair damaged tyres, rims or lock rings — tyre repairs should only be performed by authorized personnel.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-wheel-hub-and-wh>

What is the correct sequence to replace a wheel bolt?

1. Put the machine in service position.
2. Lift the machine under the counterweight.
3. Remove the wheel.
4. Knock out the bolt with a sledge hammer.
5. Install the new bolt.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-a-wheel-bolt>

What is the correct sequence to check and reassemble the wheel hub bearing?

1. Clean the hub covers on the steering wheels.
2. Remove the hub cover.
3. Wipe grease off the hub cover and hub nut, handling it as environmentally hazardous waste.
4. Bend up the lock washer's tabs and remove the lock nut and lock washer.
5. Torque the bearing nut: lubricate the thread on the spindle and the side of the nut facing the bearing with SAE 80W/140 oil; tighten the nut to 250 Nm; rotate the hub at least 2 revolutions and tighten the nut a further 45 degrees; rotate the hub again at least 2 revolutions and tighten the nut a further 45 degrees.
6. Fit the lock washer and outer lock nut.
7. Tighten to at least 250 Nm, or as hard as needed to bend the lock washer into the closest groove.
8. Fill the bearing casing with grease and fit it.
9. Grease the wheel bearing through the grease nipple, lifting the seal ring's lip with a small screwdriver to let air escape, and greasing until grease comes out by the seal.

Note: *Work carefully so as not to damage the seal.*

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-check-and-reassemble-the-whe>

What is the correct sequence to check the wheel hub?

1. Clean the hub covers on the control wheels.
2. Remove the hub cover.
3. Wipe off grease from the hub cap and hub nut, handling it as environmentally hazardous waste.
4. Bend up the lock washer's tabs, remove the lock nut and the lock washer.
5. Torque the bearing nut: lubricate the spindle thread and the nut face facing the bearing with the specified oil, tighten the nut to 250 Nm, rotate the hub at least 2 revolutions and tighten the nut a further 45 degrees, then rotate again and tighten another 45 degrees.
6. Fit the lock washer and outer lock nut.
7. Tighten to at least 250 Nm, or as tight as required to fold the locking washer into the closest groove.
8. Fill the bearing cap with grease and fit it.
9. Grease the wheel bearing through the grease nipple, lifting the seal ring's lip with a small screwdriver to release trapped air, until grease comes out by the seal.

Note: *Be careful not to damage the seal when greasing the wheel bearing.*

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-check-the-wheel-hub>

What is the correct sequence to adjust the wheel hub bearing locking ring nuts?

1. Tighten the locking ring nut firmly (to a torque of 700-800 Nm) until the hub is packed, moving and rotating the hub while tightening so the bearings can settle.
2. Release the ring nut by backing it off half a turn, then free the hub by tapping it with a rubber mallet or levering between the hub and the stub axle.
3. Tighten the locking ring nut again to a torque of 500 Nm, then tighten the safety ring nut firmly.
4. Lock the two ring nuts together with the safety washer positioned between them.
5. Fit the hub cap, after filling it with enough grease to fill the space between the ring nuts, bearing, and cap once mounted.

Note: *This adjustment must be carried out only by qualified, documented personnel.*

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-adjust-the-wheel-hub-bearing>

What is the correct sequence to regrease the wheel hub bearings?

1. Clean the hub body before disassembly to prevent dirt from entering the bearings or the new grease during removal and refitting.
2. Extract the hub together with the complete outer bearing and the inner bearing's cup from the stub axle.
3. Remove all the used grease, since it would compromise the lubricating properties of the new grease.
4. Extract the inner bearing's inner ring with rollers and cage from the stub axle as well.
5. Wash all parts thoroughly with a suitable clean solvent.
6. Carefully inspect the bearings for damage or dents, replacing any bearing whose tracks, rollers or cage are damaged.
7. Grease the bearings immediately after washing and drying, since they otherwise rust quickly.
8. Mount and adjust the hub before the wheel is fitted, keeping the bearings in continuous rotation during adjustment so all rollers seat evenly and avoid measurement errors.
 - Assembly and disassembly must be done with maximum cleanliness, since dirt and brake dust would significantly reduce bearing service life.
 - If the bearing tracks, rollers or cage are damaged, always replace the whole bearing rather than remounting a damaged one.
 - The inner bearing must always be replaced (not just its cone) if the seal came out with it after long service or contact rust, since cage deformation from the removal force is not visible.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-regrease-the-wheel-hub-bearing>

Checking the wheel alignment on an 8- or 16-wheeled rubber tyred gantry crane

1. Unscrew the wheel nuts at the wheel hub's centreline level.
2. Fasten the alignment pins and the wire into position.
3. Remove paint from the head of the 4 end stop screws.
4. Turn the outer wheels so that the difference between the two reference lengths is within plus/minus 1 mm.
5. Screw the nuts of the outer end stop screws (under the bogie beam) onto the fork's support.
6. Tighten the nuts of the outer end stop screws.
7. Check that the inner inductive switch is halfway (9 mm) over the steering plate; if not, loosen the switch bracket screws to move the switch bracket.
8. Align the inner wheels by adjusting accordingly.

Note: *These instructions apply to both 8- and 16-wheeled RTGs. Before checking the wheel alignment, drive the crane in the gantry direction several times. Perform the wheel alignment on two supports. You need two alignment pins and a wire.*

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#checking-the-wheel-alignment-on-an-8-or-16-wheeled-rubber>

Disassembling and assembling a wheel with clamp-fixation rims on a driven axle

1. Actuate the parking brake and place the wheel chocks.
2. Release the wheel nuts partially while the wheel still contacts the ground.
3. Lift up the relevant axle.

Note: Before any operation, including a simple wheel change, the tyre inflation pressure has to be released completely. Never stay in front of the rim while deflating or inflating the tyre, due to danger of death.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#disassembling-and-assembling-a-wheel-with-clamp-fixation>

Steering Cylinder

What is the correct sequence to replace the steering cylinder?

1. Put the machine in service position.
2. Depressurise the hydraulic system.
3. Remove the steering wheels.
4. Release the link arms from the steering cylinder.
5. Mark up and detach the hydraulic hoses from the steering cylinder, plugging the connections immediately to protect the hydraulic system from impurities.
6. Remove the four screws securing the steering cylinder to the steering axle cradle.
7. Transfer the connection adapters to the new steering cylinder.
8. Fit the new steering cylinder, torqued to 600 Nm (oil).
9. Connect the hydraulic hoses to the steering cylinder according to the marking, checking that the O-rings are intact and fitted correctly.
10. Fit the link arms to the steering cylinder.
11. Fit the steering wheels.
12. Turn on the main electric power and start the engine; run the engine at idling speed.
13. Test the steering a couple of times.
14. Check that the steering cylinder's connections are sealed tightly.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-steering-cylind>

What is the correct sequence to replace the steering cylinder?

1. Disconnect the hydraulic connections from the steering cylinder, and protect the open ends of the cylinder and hoses with caps or plugs.
2. Release and remove the piston rod pivot spindles.
3. Remove the bolts retaining the cylinder on the steering cradle.
4. Remove the cylinder.
5. Fit the new cylinder, coating the mounting bolts with a suitable threadlocking compound.
6. Connect the piston rod ends to the link levers, securing the pivot spindles with the locking washers.
7. Connect the hydraulic hoses.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-steering-cylind-2>

What is the correct sequence to dismantle the steering cylinder?

1. Unscrew the end piece at the cylinder head.
2. Unscrew the connection nipple for the hydraulic hose.
3. Push in the piston rod with piston head until the O-ring is visible through the nipple hole.
4. Use a strong, bent steel wire to hook onto the O-ring.
5. Draw up the O-ring a little and get a grip on it with a pair of thin-nosed pliers.
6. Continue drawing out the O-ring through the hole.
7. Maintaining a grip on the O-ring, cut through it with a knife.
8. Rotate the piston rod while simultaneously drawing out the O-ring through the hole.
9. Remove the locking ring from the cylinder pipe.
10. Carefully draw out the piston rod from the cylinder pipe.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-dismantle-the-steering-cylinder>

What is the correct sequence to remove the steering cylinder?

1. Remove the bolts and washers from both sides of the cylinder rod.
2. Remove the O-rings from both sides of the rod.
3. Unthread the cylinder from the rod.
4. Change the gasket if necessary.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-remove-the-steering-cylinder>

What is the correct sequence to install the steering cylinder?

1. Install the steering cylinder by reversing the removal procedure.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-install-the-steering-cylinder>

Steering Cylinders

When should sharp steering be avoided to prevent tipping?

1. Avoid steering sharply while travelling at higher speeds.
2. Avoid steering sharply with the spreader elevated to mid-point or above.
3. Avoid steering sharply on uneven terrain.
 - Do not continue turning the wheel after reaching the turning limit, so as not to cause overheating of steering components.
 - Do not turn the steering wheel from one turning limit to another with the machine at a standstill, to prevent wear of tyres and floor.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#when-should-sharp-steering-be-avoided-to-prevent-tipping>

What safety precautions apply before servicing a steering axle?

1. Before starting the inspection, make sure the diesel engine is off, the power 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 front 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.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-safety-precautions-apply-before-servicing-a-steering-axle>

How often should the steering axle be inspected, greased, and its disc brakes checked?

1. Sight check: every 100 work hours, check the general condition of the axle.
2. Greasing: every 250 work hours, grease all parts of the axle featuring a lubricator.
3. Disc brakes: every 200 work hours, check the condition of the disc and brake pads.
 - Make sure the disc is not deformed and cracked; never fall below the minimum acceptable thickness.
 - In the event the brake disc has to be re-machined, never remove more than 2 mm on each side.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#how-often-should-the-steering-axle-be-inspected-greased-and>

Steering Column

What is the correct sequence to replace the steering wheel and steering column?

1. Put the machine in service position.
2. Remove the steering wheel, steering panel covers, direction indicators and the covers for the steering column.
3. Remove the six bolts securing the steering column.
4. Replace the steering column.
5. Fit in reverse order.
 - Torque the socket cap screws that hold the multi-function lever to the steering column to 2.5-3.0 Nm.
 - Torque the nut in the centre of the steering wheel to 40 Nm (± 5 Nm).

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-steering-wheel-a>

What is the correct sequence to remove the steering column and steering unit?

1. Remove the cap to release the steering wheel.
2. Use a proper puller to remove the steering wheel from the steering column.
3. Remove the bolts with washers to release the steering column from its support.
4. Remove the bolt with washers to release the steering column from the instrument panel.
5. Remove the bolt with washers to remove the steering column's upper cover.
6. Remove the steering column to a prepared work area.
7. Disconnect the hoses from the steering unit.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-remove-the-steering-column-a>

What is the correct sequence to install the steering column and steering unit?

1. With the hose assemblies connected, operate the system and check for leaks.
2. Check that the wheels travel through their entire turning radius.
3. If the system does not operate properly, check the hoses for proper installation.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-install-the-steering-column>

Mini Wheel

What is the correct sequence to replace the mini-wheel?

1. Put the machine in service position.
2. Remove the mini-wheel by undoing the socket cap screw.
3. Replace the mini-wheel.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-mini-wheel>

What is the correct sequence to replace the mini-wheel travel direction selector?

1. Put the machine in service position.
2. Remove the screws securing the top of the plastic panel for the mini-wheel.
3. Unplug the connector from the travel direction selector.
4. Replace the switch.
5. Fit in reverse order.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-mini-wheel-trave>

What is the correct sequence to replace the mini-wheel potentiometer?

1. Put the machine in service position.
2. Remove the steering wheel by undoing the Allen screw.
3. Remove the Allen screw and nut.
4. Remove the screws securing the top of the plastic panel for the mini-wheel.
5. Unplug the connectors from the potentiometer.
6. Replace the potentiometer.
7. Fit in reverse order.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-mini-wheel-poten>

Link Arm

What is the correct sequence to replace the link arm?

1. Put the machine in service position.
2. Remove the steering wheels.
3. Remove the screw and the securing plate holding the stub axle.
4. Remove the stub axles.
5. Replace the link arm, checking that the bearings in the link arm are correctly aligned before installing it.
6. Fit in reverse order.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-link-arm>

What is the correct sequence to grease the link arms and brake pedal every 500 hours?

1. Grease both link arms' outer and inner bearings with grease.
2. Grease the brake pedal's hinge with grease.
3. Wipe off surplus grease.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-grease-the-link-arms-and-bra>

What is the correct sequence to check the steering system's link arm?

1. Check the link arm's guide bearings, axles, and the bolts that lock the link arm's axles.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-check-the-steering-system-s>

Steering Axle Cradle

What is the correct sequence to replace the steering axle cradle?

1. Put the machine in service position.
2. Place supports under the counterweight under the machine.
3. Remove the steering wheels.
4. Raise the steering axle cradle slightly.
5. Release the cables from the steering angle sensor (only on machines with lever steering).
6. Place a receptacle under the hoses on the steering cylinder.
7. Mark up and detach the hydraulic hoses from the steering cylinder, plugging all connections immediately to protect the hydraulic system from impurities.
8. Remove the circlip from the stub axle in the front and rear attachment points.
9. Knock out the stub axle with a sledge hammer.
10. Move the steering axle cradle aside in a suitable way.
11. Lift the new steering axle into place under the frame.
12. Install the axle in the front and rear attachment points and install the circlips on the stub axles, lubricating the attachment points and axle with copper paste or equivalent to prevent corrosion.
13. Connect the hydraulic hoses to the steering cylinder according to the marking, checking that the O-rings are intact and fitted correctly.
14. Connect the cables to the steering angle sensor (only on machines with lever steering).
15. Remove the lifting equipment from the machine.
 - Steering axle and machine are very heavy; risk of crushing. It is not permissible to go under a machine which has been lifted by a jack or similar.
 - The steering axle may start to roll; make sure it does not start uncontrolled movement.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-steering-axle-cr>

How is the steering axle cradle checked?

1. Check that the bushings in the mountings are intact.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#how-is-the-steering-axle-cradle-checked>

What is the correct sequence to check the steering axle cradle's bushings for wear?

1. Put the machine in service position with transverse wheels.
2. Check that the bushings in the suspension are intact.
3. Measure the distance between the frame and the steering axle cradle and note the measurement.
4. Lift the machine under the rear counterweight.
5. Measure the distance between the frame and the steering axle cradle again and note the measurement.
6. Calculate the difference between the two measurements; replace the bushing if it exceeds 3 mm.

Note: Do not lift the machine under the steering axle.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-check-the-steering-axle-crad>

Wheel Spindle

What is the correct sequence to replace the wheel spindle and its bearings?

1. Put the machine in service position.
2. Remove the steering wheel.
3. Clean the wheel spindle and its surrounding area.
4. Detach the link arm from the wheel spindle.
5. Remove the wheel hub and wheel bearing.
6. Remove the six Allen screws securing the bearing holder to the wheel spindle.
7. Remove the bearing holder by screwing a bolt into the removal hole.
8. Release the bearing holder and shims from the wheel spindle.
9. Remove the wheel spindle.
10. Unscrew the three screws above the steering spindle's upper bearing, on top of the steering cradle, and depress the upper bearing outer race by screwing three screws (approximately 90 mm long) into the holes.
11. Remove the inner race of the upper and lower bearing from the wheel spindle.
12. Pull the lower bearing outer race from the bearing holder.
13. Tap the outer race of the upper bearing into the steering wheel cradle from below, using a piece of tube.
14. Fit the three screws back into their holes.
15. Attach the upper bearing's inner race and seal ring, protection ring, seal ring, lower bearing inner race and retaining ring to the wheel spindle.
16. Fit the wheel spindle.
17. Tap the outer race of the lower bearing into the bearing holder.
18. Position the bearing holder and tighten it with shims, torquing the six screws to 70 Nm.
19. Check that the wheel spindle rotates smoothly with a maximum play of 0.25 mm; if not, adjust with shims.
20. Lubricate the bearings by means of the grease nipples.
21. Fit the wheel hub and wheel bearing.
22. Fit the link arm to the wheel spindle.
23. Mount the wheel.

Note: Tyres should be regarded as pressurized containers and constitute fatal danger if handled incorrectly; parts can be thrown with explosive force and may cause severe injuries. Never repair damaged tyres, rims or lock rings — tyre repairs should only be performed by authorized personnel.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-wheel-spindle-an>

How is the wheel spindle bearing clearance checked?

1. Put the machine in service position.
2. Carefully pry up the O-ring.
3. Measure with a feeler gauge between the thrust bearing and thrust washer; maximum clearance is 1.5 mm.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#how-is-the-wheel-spindle-bearing-clearance-checked>

What is the correct sequence to check the wheel spindle bearing?

1. Put the machine in service position with transverse wheels.
2. Measure the relevant dimension with a feeler gauge and note the measurement.
3. Lift the machine under the rear counterweight.
4. Re-measure the same dimension.
5. Calculate the difference between the two measurements; if it exceeds 0.25 mm, shimming must be repeated.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-check-the-wheel-spindle-bear>

Steering Axle

What is the correct sequence to lubricate the steering axle?

1. Inject grease with a manual pump (never a high-pressure greasing pump) into the pressure fittings of the stub axles and steering levers.

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/steering-and-steer-axle/#what-is-the-correct-sequence-to-lubricate-the-steering-axle>

What is the correct sequence to check the steering axle?

1. Check the structure's integrity for signs of wear, deformation, or excessive play at the pins and pivots, contacting qualified service personnel if found.
2. Check the fastening of the pins and the condition of the silent blocks connecting the axle to the frame.
3. Check the locking of the wheel hub bearings by verifying the torque of the locking ring nut (after removing the hub cap), and check the presence and condition of the grease.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-check-the-steering-axle>

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

1. Check for oil leaks from the steering system's pipes, fittings and components.
2. Check the play in the steering pins/stub axles.
3. Check the play between pivots and frame.
4. Grease all pins and pivots.
5. Visually check the condition of the rims and tyres (steering axle).
6. Tighten the steering 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/steering-and-steer-axle/#what-steering-axle-operations-are-checked-during-the-500-hou>

Brakes

How often should the steering axle's general condition be checked?

1. Check the general condition of the axle every 100 work hours.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#how-often-should-the-steering-axle-s-general-condition-be-ch>

How often should the steering axle be greased?

1. Grease all parts of the axle with a lubricator every 250 work hours.
2. Keep the surfaces and articulations clean and free of grease.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#how-often-should-the-steering-axle-be-greased>

How often should the steering axle's disc brakes be checked, and what are the wear limits?

1. Every 200 work hours, check the condition of the disc and brake pads, making sure the disc is not deformed or cracked and never falls below the minimum acceptable thickness of 20 mm.
 - Radial cracks and continuous cracks on the brake disc are not acceptable; a formation of cracks or a surface irregularity under 1 mm is acceptable.
 - If the brake disc must be re-machined, never remove more than 2 mm on each side.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#how-often-should-the-steering-axle-s-disc-brakes-be-checked>

Knuckle Pin Bearings

What is the correct sequence to dismantle the knuckle pin bearings for replacement?

1. Jack up the steered wheel end of the machine and block it up in a safe manner.
2. Remove the retaining ring from the steered wheel and remove the wheel.
3. Secure a sling around the hub neck and lift until the hub is held in position.
4. Remove the protective cover from the upper bearing of the knuckle pin.
5. Release the tabs of the tab washer, remove the upper bearing nut, and remove the tab washer and plain washer.
6. Remove the protective cover from the lower bearing, remove the split pin from the bearing nut, and remove the nut; the inner race of the bearing is now loose and can be removed.
7. Remove the knuckle pin by tapping it upwards; the inner race of the upper bearing will come with the pin.
8. Use a trolley to lift out the wheel axle.
9. Remove the wipers from the steering cradle.
10. Remove the outer bearing races from the steering cradle with an internal puller.

Note: Use a trolley, pallet truck or similar tool with a rest for handling the wheel and hub securely.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-dismantle-the-knuckle-pin-be>

What is the correct sequence to reassemble the knuckle pin bearings after replacement?

1. Pack the outer races of the bearings with grease and press them into the steering cradle, fitting the inner races so the larger inside diameter faces outwards (these are taper bearings).
2. Fit new wipers to the steering cradle using a suitable ring to tap them in.
3. Lift the wheel axle into position with a hand trolley or hoist.
4. Make sure the contact surface of the wheel axle is clean and in proper contact with the knuckle pin; insert the knuckle pin, fit the spacer and lower bearing inner race (packed with grease), and fit the bearing nut.
5. Fit the upper bearing inner race (packed with grease), the plain washer, and the tab washer, greasing the tab washer to prevent damage by the nut.
6. Tighten the lower bearing nut to the specified torque and secure it with a split pin.
7. Tighten the upper bearing nut to the specified torque, releasing the lifting device as the nut is tightened so it does not prevent tightening.
8. Coat the covers with sealing compound, pack them with grease, and top up with grease through the grease nipple once the cover is in position and the sealing compound has dried.
9. Check the tightening torques every 1000 running hours.
 - Do not hammer the bearing races directly since they may not enter straight and may become jammed in the housing; use a round plate matched to each bearing size instead.
 - Do not tap the wipers in with a hammer directly, as this will damage them; use a suitable ring.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-reassemble-the-knuckle-pin-b>

Steered Wheel Bearings

What is the correct sequence to dismantle the steered wheel bearings for replacement?

1. Jack up the steered wheel end of the machine and block it up in a safe manner.
2. Remove the retaining ring from the steered wheel and remove the wheel.
3. Remove the hub cover.
4. Secure a lifting sling to the hub, preferably using one of the hub bolts with a nut to secure it, and use a hand trolley or pallet truck for lifting the hub.
5. Remove the tab washer, locknut and bearing nut; the plain washer is now loose.
6. Remove the hub off the wheel axle with the hand truck; the inner race of the outer bearing will come with the hub.
7. Withdraw the inner race of the inner bearing from the wheel axle.
8. Remove the seal, but leave the spacer in position.

Note: Use a trolley with a rest for handling the wheel securely.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-dismantle-the-steered-wheel>

What is the correct sequence to reassemble the steered wheel bearings after replacement?

1. Pack the outer races of the bearings with grease and press them into the hub, fitting the inner races so the larger inside diameter faces outwards (these are taper bearings).
2. Press a new seal into the hub using a suitable round plate.
3. Clean the spacer and pack it with grease.
4. Tap the inner race of the inner bearing onto the wheel axle using a suitable tube, and pack the inner race with grease.
5. Lift the hub onto the axle, fit the inner race of the outer bearing into position, and pack it with grease.
6. Fit the plain washer and bearing nut with the flat surface facing inwards, and tighten the bearing nut to the specified torque.
7. Fit the tab washer and locknut, greasing the tab washer to prevent damage by the nut, then tighten the locknut and lock both the bearing nut and locknut with the tabs.
8. Pack the outer bearing with grease, pack the bearing cover with grease, and fit it into position, topping up with grease through the grease nipple.
 - Do not hammer the bearing races directly since they may not enter straight and may become jammed in the housing; use a round plate matched to each bearing size instead.
 - Do not tap the seal itself with a hammer, as this will damage it; use a suitable round plate.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-reassemble-the-steered-wheel>

Steer Axle Removal

What is the correct sequence to install the steer axle?

1. Tighten the screw with the pivot.
2. Place the first bearing and fill it with grease until it leaks out.
3. Tighten the screw to a torque of 50 kg.
4. Insert the washer.
5. Fill with grease again.
6. Adjust the end travel of the steering cylinder with the plate, adding shims until the plate blocks the elements.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-install-the-steer-axle>

What is the correct sequence to remove the steer axle?

1. Remove the steer axle by reversing the installation procedure.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-remove-the-steer-axle>

Other Steering & Steer Axle procedures

What is the correct sequence to replace the mini-wheel/lever steering hydraulic pump?

1. Put the machine in service position.
2. Clean the hydraulic oil pump and the area around it.
3. Depressurise the hydraulic system.
4. Place a receptacle under the hydraulic oil pump to collect spilled oil.
5. Mark the hydraulic hoses and disconnect them from the pump.
6. Undo the vane pumps: remove the two screws securing the pump and pull it out.
7. Transfer the connection adapters to the new pump, checking that the O-rings are intact and fitted correctly.
8. Check the pump seals, replacing them if necessary.
9. Install the new pump, checking that the splines engage on the shaft, and install the pump fixing screws.
10. Connect the hydraulic hoses according to the marking, checking that the O-rings are intact and fitted correctly.
11. Close the drain valve on the accumulator charging valve.
12. Turn on the power supply and start the engine.
13. Check that the hose connections seal correctly.
14. Check the hydraulic oil level with all hydraulic cylinders fully retracted, and top up if needed.
 - Read the safety instructions for oil before working.
 - Pre-fill the pump with oil through the pressure connection before taking it into service; if necessary, vent the pump by loosening the hoses on the delivery side.
 - If the pump is replaced due to malfunction, also change the oil and filter in the hydraulic system.
 - Overfilling the oil can cause leakage and environmental damage; the hydraulic oil level is checked with all hydraulic cylinders fully retracted.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-mini-wheel-lever>

What is the correct sequence to replace the steering valve?

1. Put the machine in service position.
2. Depressurise the hydraulic system.
3. Remove the six screws securing the lower plastic steering column cover, and remove the cover.
4. Mark up and detach the hydraulic hoses from the steering valve, plugging the connections immediately to protect the hydraulic system from impurities.
5. Secure the steering valve.
6. Remove the four screws securing the steering valve to the cab floor.
7. Remove the steering valve by pulling it downward.
8. Transfer the connection adapters to the new steering valve.
9. Fit the new steering valve.
10. Connect the hydraulic hoses to the steering valve according to the marking, checking that the O-rings are intact and fitted correctly.
11. Turn on the main electric power and start the engine; run the engine at idling speed.
12. Test the steering a couple of times.
13. Check that the steering valve's connections are sealed tightly.

Note: Read the safety instructions for oil before working.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-steering-valve>

What is the correct sequence to replace the steering wheel movement sensor?

1. Put the machine in service position.
 2. Remove the steering wheel and the steering panel covers.
 3. Undo the screw securing the sensor.
 4. Unplug the connector from the sensor.
 5. Replace the sensor.
 6. Fit in reverse order.
- Do not tighten the screws which hold the sensor too hard, or the sensor will break.
 - The distance between the sensor and the metal plate must not be more than 1.5 mm.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-to-replace-the-steering-wheel-m>

What is the correct sequence for the 500-hour lubrication of the wheel hub, wheel spindle and link arms?

1. Put the machine in service position and clean the area around each grease cup before greasing.
 2. Lift the steering wheel with a jack so the wheel bearing and wheel spindle are unloaded, without letting the wheel hang freely.
 3. Grease the wheel hub until grease comes out at the seal on the hub's inside, lifting the seal ring's lip with a small screwdriver to release trapped air.
 4. Grease the wheel spindle's upper and lower bearings separately, since grease does not press between them.
 5. Lubricate both link arms' outer and inner bearings with grease.
 6. Lower the wheel.
 7. Repeat the same steps on the other steering wheel.
- Be careful not to damage the seal when greasing the wheel hub.
 - Do not lift the wheel so high that it hangs freely.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#what-is-the-correct-sequence-for-the-500-hour-lubrication-of>

Filling or changing the planetary gear oil of the steering system

1. Unscrew the plug.
2. Fill the gearbox with oil through the filling hole until it flows out from the other hole.
3. Plug the hole.
4. Complete the oil filling up to the proper oil level, checking the oil level through the glass eye.
5. To change the oil, remove the planetary gear in order to drain the oil; the drain plug is at the bottom of the gear.

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#filling-or-changing-the-planetary-gear-oil-of-the-steering>

Checking the tyre pressures manually with the tyre pressure monitoring system

1. Remove the sensor. The monitor shows "00" for that sensor and gives an audible alert.
2. Check the pressure, and inflate if necessary.
3. To reset a sensor's baseline pressure, remove the sensor for 60 seconds, then reinstall it.

Note: *This applies to cranes equipped with the optional tyre pressure monitoring system.*

Source: <https://www.hitsrl.it/technical-resources/procedures/steering-and-steer-axle/#checking-the-tyre-pressures-manually-with-the-tyre-pressure>

Maintenance Tips

Steering Cylinders

What can cause steering to become stiff, and how is each cause diagnosed?

Stiff steering traces back to a small number of distinct causes, each with its own fix. Low oil pressure calls for checking and regulating the hydraulic pressure. A faulty hydraulic pump means removing and replacing the pump. A faulty power-steering valve is replaced rather than repaired.

A separate fault — steering not operating well, traced to an internal leak in the steering cylinder — calls for removing the cylinder and overhauling it.

HIT Srl supplies the hydraulic pump and the power-steering valve for this class of steering system.

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

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#stiff-steering-cause-diagnosis>

What is the correct sequence for replacing a steering cylinder?

Disconnect the hydraulic connections from the steering cylinder, and protect the open ends of the cylinder and hoses with caps or plugs.

Remove the steering wheels, release the link arms from the steering cylinder, then mark up and detach the hydraulic hoses from the cylinder. Plug the connections immediately to protect the hydraulic system from impurities.

Remove the four screws securing the steering cylinder to the steering axle cradle, then transfer the connection adapters to the new steering cylinder.

HIT Srl supplies steering cylinders for this class of steered axle.

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

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#steering-cylinder-replacement-sequence>

How does the steering valve control oil flow to and from the steering cylinder?

The steering valve is a flow-control valve that supplies hydraulic fluid to the steering cylinder: oil is pressed into whichever side of the cylinder is needed to change direction, while on the other side of the piston, oil has to be evacuated back through the steering valve, which transports it back to the hydraulic tank.

A pressure reduction valve in the same circuit checks that the pressure supplied back to the steering valve never becomes more than 1.1 MPa higher than the load signal.

HIT Srl supplies the steering valve and pressure reduction valve for this class of steering system.

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

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#steering-valve-oil-flow-control>

What tyre pressure behaviour is considered normal on a rubber tyred gantry crane?

Check the tyre pressure and condition every 300 operating hours. A tyre pressure drop of 5% in a month is normal.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#what-tyre-pressure-behaviour-is-considered-normal-on-a>

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

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

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#how-often-should-the-air-gap-of-the-steering-brake-be>

How often should the brake of the steering gear brake motor be inspected and maintained?

Inspect and maintain the brake of the steering gear brake motor every 4000 operating hours.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#how-often-should-the-brake-of-the-steering-gear-brake-motor>

How often should the steering gear be checked for leakage on a rubber tyred gantry crane?

Check the steering gear for leakage every 4000 operating hours.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#how-often-should-the-steering-gear-be-checked-for-leakage>

How often should the oil level of the steering gear be checked?

Check the oil level of the steering gear every 4000 operating hours.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#how-often-should-the-oil-level-of-the-steering-gear-be-checked>

How often should the oil of the steering gear be changed?

Change the oil of the steering gear every 4000 operating hours.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#how-often-should-the-oil-of-the-steering-gear-be-changed>

How often should the fixing screws of the steering gear brake motor be checked for tightness?

Check the fixing screws of the steering gear brake motor for tightness at least once a year.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#how-often-should-the-fixing-screws-of-the-steering-gear-be-checked-for-tightness>

How often should the wheel nuts tightening torque be checked on a rubber tyred gantry crane?

Check the wheel nuts tightening torque every 500 operating hours.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#how-often-should-the-wheel-nuts-tightening-torque-be-checked>

How often should the condition of the outer shell of the wheel rim be checked?

Check the condition of the outer shell of the wheel rim at least once a year.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#how-often-should-the-condition-of-the-outer-shell-of-the-wheel-rim-be-checked>

Why is the air gap of the steering brake not periodically readjusted, unlike the other travel brakes?

On the steering brake, the air gap (nominal plus 0.1 mm) does not need to be readjusted.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#why-is-the-air-gap-of-the-steering-brake-not-periodically-readjusted>

How soon after a wheel change should the mounting nuts be retightened, and what can cause abnormal tyre wear?

The mounting nuts of changed wheels must be retightened after 4-5 hours of operation. Abnormal tyre wear can be caused by a fault, such as brakes that operate unevenly; repair any such faults immediately.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#how-soon-after-a-wheel-change-should-the-mounting-nuts-be-retightened>

What are the alert thresholds of the tyre pressure monitoring system's first and second stage low-pressure alerts?

The tyre pressure monitoring system's first stage low-pressure alert triggers at 12.5% pressure loss from the initial pressure recorded at installation, giving an audible beep and flashing the tyre location on the display until corrected or muted. The second stage low-pressure alert triggers at 25% pressure loss from the initial installation pressure, also with an audible beep, and continues until the pressure is corrected if not muted.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#what-are-the-alert-thresholds-of-the-tyre-pressure-monitoring-system>

What are the limitations of the tyre pressure monitoring system that the operator should be aware of?

The tyre pressure monitoring system does not prevent low tyre pressure; it only alerts of low tyre pressure. It does not prevent tyre or wheel overload, which is extremely dangerous and can cause failure of suspension components, not just tyres. Tyres can fail for other reasons besides low pressure or overloading, so the operator should remain alert for other tyre problems indicated by unusual noises, vibration, uneven tread wear, or bulges on the tyre.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#what-are-the-limitations-of-the-tyre-pressure-monitoring-system>

What tyre pressure is specified for the drive and non-drive axles of a rubber tyred gantry crane?

The specified tyre pressure is 10 bar (145 psi) for both the drive axle and the non-drive axle.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#what-tyre-pressure-is-specified-for-the-drive-and-non-drive>

When should the wheel nuts of a driven axle be checked and retightened with a torque wrench, after a tyre change?

After a tyre change, check and tighten the wheel nuts with a torque wrench after 50 km and again after 200 km.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#when-should-the-wheel-nuts-of-a-driven-axle-be-checked-and>

What are the maximum admitted loads per axle on a mobile harbour crane's undercarriage?

The maximum admitted load for each axle is 60,000 kg dynamic (up to 5 km/h travel speed) or 80,000 kg static.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#what-are-the-maximum-admitted-loads-per-axle-on-a-mobile>

What are the tyre inflation pressure and wheel bolt torque specifications for a mobile harbour crane, and when should the bolt torque be checked?

Tyres shall be inflated at 10 atm. Wheel bolt torque should be checked to 650 Nm; the first check should be carried out one month after the start of the contractual guarantee period, and following checks carried out every year.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#what-are-the-tyre-inflation-pressure-and-wheel-bolt-torque>

Steering Priority Valve

Why does the steering system always get hydraulic priority over other functions?

Between the hydraulic oil pump and the steering valve sits a priority valve, which gives priority to oil supply reaching the steering valve before any other function — load handling included.

In practice, this means the steering system always has pressure available first; only the flow left over after steering's needs are met is available to the control valve for lift and extension.

The steering wheel acts on the steering valve via the steering wheel shaft, which in turn directs the oil pressure to the steering cylinder.

HIT Srl supplies the priority valve for this class of steering system.

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

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#steering-priority-valve-hydraulic-precedence>

What safety precautions apply to tyre pressure before handling wheels on a rubber tyred gantry crane?

The machine must not be able to move during maintenance: before lifting and changing the wheels, always place wheel chocks in front of the jack and the machine wheels. Always deflate the tyres to 1 bar or less before handling them. Components of a wheel under pressure can be thrown off when the wheel is handled. Do not deflate a tyre through the valve if the tyre or rim is damaged. A damaged tyre can explode. Never stand directly in front of a tyre being inflated or deflated. Wheel components can be thrown off when the tyre pressure changes. Never install damaged tyres or rims, and never repair rims by welding. The machine must not be used if any tyre is deflated.

Source: <https://www.hitsrl.it/technical-resources/steering-and-steer-axle/#what-safety-precautions-apply-to-tyre-pressure-before>

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.