

OPERATION AND MAINTENANCE MANUAL

Serial No. : 5.3
Item : 50 T Telescopic rough terrain crane
Model : GRIL 8500T

GRIL 8500T



OPERATOR'S MANUAL

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1 USE OF THE MANUAL AND IMPORTANT INFORMATION

1.1 Explanation of the symbols used in the text

In this manual, some important passages of text are highlighted by the symbols listed below:



This symbol indicates that the warnings and the prescriptions must be carefully followed in order to prevent injuries to people and/or damage objects.



This symbol indicates the dangers linked to the operation described, which can lead to injury to people. For example: risk of injury or accident, or death.



This symbol indicates the risk of damage to objects. For example: damage to the crane, damage to the lifted load or environmental damage.



This symbol refers to other parts of the manual where further information and recommendations may be found for the safe use of the crane, or draws the reader's attention to important notes on the text.



This symbol refers to information about the lubrication, filling and greasing of certain components of the crane.



This symbol indicates the correct way to dispose of oils, liquids and waste lubricants that can pollute the environment.

1.2 Aim of the manual

The manual contains instructions regarding the use, the lubrication, the preventive maintenance and other necessary information in order to operate the crane from Locatelli Crane and always keep it in an efficient and safe condition.

The text is aimed at operators and personnel who are in charge of the crane's maintenance; therefore, before starting the machine, this manual must be read in all its parts and the instructions must be followed scrupulously. It is advisable to keep the manual inside the operator's cabin so that it can be consulted at any time.

By following the recommendations and the maintenance instructions contained in this manual, your Locatelli crane will always be in a perfect working condition.



The intervention procedures regarding the engine and the transmission, and their maintenance procedures, are contained in a separate manual, to which reference must be made for more detailed information.

1.3 Instructions for ordering spare parts



For best reliability and a longer duration for your crane, always use Locatelli original spare parts.

Follow the instructions given below to order spare parts; in this way you can be sure to receive the right piece as soon as possible.

1. Indicate the model of the crane and its serial number.
2. Indicate the quantity, the code number (or the position inside the spare parts catalogue) and the description of the requested item.
3. Give precise delivery instructions.
4. Send us a written confirmation for all verbal or phone orders.

1.3.1 How to order hose pipes

To order hose pipes:

1. Indicate the model of the crane and its serial number.
2. Indicate the code stamped on the tube (see Fig.1) and the position on the hydraulic diagram.



Fig.1

2 GENERAL SAFETY INSTRUCTIONS

2.1 Introduction



Locatelli's cranes are built in compliance with the safety legislation currently in force, however, improper use of the machine could put the user's safety or the safety of other persons in danger. The crane and other equipment could also be damaged.

Any variation or modification of the crane can only be performed following authorisation from Locatelli Crane S.r.l.

The crane can be used only in perfect working condition, considering the safety procedures and any eventual danger, and that it can only be used for the purposes which it has been built for. Any malfunctioning must be immediately repaired.

The crane is a machine for lifting built exclusively to lift loads that are freely attached to the shank hook, whose weight and centre of gravity are known. The rope must be correctly inserted into the hookblock and the applied lifting elements must be in compliance with EC Directives.

The crane must only be used in these conditions; any other use is not in compliance with Locatelli's specifications.

Before operating with the crane, follow the recommendations given below:

- Read the instructions supplied with the crane, especially the operational instructions, the lifting capacity charts, the reaction pressures of the ground and the safety instructions;
- Inspect the machine and perform the maintenance in agreement with the specifications reported in this manual.



The operations described below ARE NOT in compliance with the use which is approved by the manufacturer:

- *Pulling, pushing or lifting loads with outriggers.*
- *Pulling, pushing or lifting loads from the ground by slewing, with the boom lifting cylinder or with the boom extension cylinder.*
- *Leaving objects in the work area that could be struck during the use of the crane.*
- *Working with the crane that is not perfectly stabilised and out of the accepted work area.*
- *Using a program or the operational mode of the Load Moment Indicator (LMI) which does not correspond to the real lifting configuration.*
- *Excluding the Load Moment Indicator (LMI).*
- *Travelling on public roads with the crane not in compliance with legal regulations.*
- *Using equipment which is not approved by the manufacturer.*
- *Transporting or lifting persons.*

2.2 Recommended Personal Protective Equipment (P.P.E.)

Personal Protective Equipment (PPE) refers to any equipment designed to be worn and held by the worker to protect him against one or more hazards likely to endanger his safety or health at work, as well as any item or accessory designed for this purpose.

The use of PPE is required only when the adoption of preventive and/or organisational technical measures for collective protection is not sufficient to eliminate all risk factors. In other words, PPE is used only when it is not possible to eliminate the risk.

2.2.1 P.P.E. Symbols

The symbols below show the requirements for the use of appropriate personal protective equipment for specific work tasks.



Compulsory use of helmets



Compulsory use of protective glasses



Compulsory use of ear protectors



Compulsory use of work shoes



Compulsory use of gloves



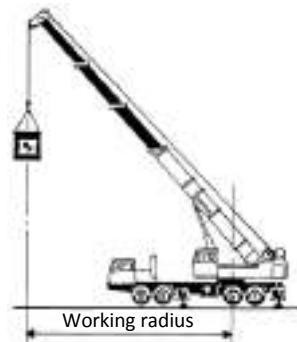
Compulsory use of protective clothing

2.3 Operational premises

1. Cranes with the CE marking are in compliance with the European Directives: 2006/42/EC (Machinery Directive), 2004/108/EC (Electro-magnetic Compatibility), 2000/14/EC (Directive on noise of machinery and equipment used outdoor).
They are also in compliance with the harmonised EN 13000 Standard (Mobile Cranes).
2. The use of the crane as a lifting equipment is provided in normal service of a DIN standard H1B3 class hook.
3. For journeys of more than 20-30 km it is recommended to transport the crane by a vehicle equipped with a loading platform.
4. Transportation on public roads is allowed in respect of the laws in force for exceptional public work vehicles.
5. If not declared otherwise, the use of the crane excludes:
 - a. the use of buckets, polyps, magnets and similar equipment;
 - b. the use of vibrating equipment;
 - c. the use of demolition balls.
6. The crane operator must be physically fit, with sufficient ability to understand the user manual and the lifting capacity charts. The operator must have specific experience in operating the crane or must have a sufficient basic training in and experience of driving motor vehicles. Fitness to drive is required in compliance with the laws in force.
7. The crane must always be in perfect working condition and must only be employed for the declared uses. The safety regulations relative to the environment in which the vehicle is operating must be duly considered.
8. For standard version cranes, the provided operational temperature conditions are those of mild climate countries (between -15°C and +35°C). Different operational temperature conditions can be authorised with suitable adjustments.
9. The use of lifting accessories – such as lattice swing-away extensions, derricks, auxiliary hoists, hookblocks, etc. – is allowed only if such accessories are original Locatelli Crane parts and, therefore, are considered in the lifting capacity charts and in the user manual.

2.4 Safety instructions relating to lifting

1. The use of the crane is restricted to authorised personnel who are familiar with the current regulations on hoists and the characteristics of use for the crane.
2. The capacities of the crane may refer to the operating area (e.g. 360°) or to a limited area (e.g. rear).
3. The boom length is intended as that measured from the centre of the single sheave of the head to the axis of the boom foot pin.
4. The boom angle is intended as the horizontal line and is read under load.
5. The working radius is the distance, measured horizontally, between the ground projection of the axis of rotation of the turret and the centre line of the ropes of the hookblock, measured with the applied load freely suspended.



6. The fall number is the number of sections of rope which supports the hookblock.
7. Do not operate if the instructions in the user manual have not been fully understood. Use the crane only for tasks and under the service conditions provided for by the manufacturer.
8. Read and fully understand the danger indications and the precautions to take, which are shown on the exposed panels on the crane.
9. Do not operate when the crane is not properly adjusted and if it has any faulty function.
10. Before operating the crane carry out all the checks provided by the user and maintenance manual and make sure the lifting capacity charts and operating notices are present in the cabin.
11. The correct operation of the safety devices must be checked on a daily basis, as well as the Load Moment Indicator present on mobile cranes as they do not relieve the operator from controlling the load and the working radius before derricking up.
12. Make sure that there are no persons or obstacles in the work area and focus your attention on the dangers that the work area presents. Ask the foreman about any measures to be taken in relation to local regulations or with regard to the hazardous nature of the site.
13. Position the crane on a firm and solid ground by completely removing the beams, levelling the machine and completely pulling the tyres off the ground. When the bearing plates of the crane have surfaces which are deemed insufficient for the actual bearing conditions that are available, place joists or wood or metal planks, of suitable resistance, under the plates. You will have to avoid placing the outriggers close to the excavations, embankments, in river beds, above underground pipelines and on uneven ground. During works you need to regularly check for proper levelling.
14. Check the lifting capacity chart and the user and maintenance manual for the maximum specific pressure, daN/cm^2 , provided on the most loaded outrigger under the worst conditions.

- From the assessments done by the site foreman for critical situations from the support ground apply the joists, planks or sheets referred to in paragraph 13.
15. Always check the weight of the load, measure the distance at which you have to lift it and make a comparison with the performance referred to in the lifting capacity chart for the crane.
 16. Make sure you have all the information to calculate the net load starting from the gross load (load table).
 17. Check that the number of falls you are using is correct.
 18. Check that the telescopic boom is extended correctly in accordance with the user manual.
 19. Operate the crane while sitting on the seat in the cabin: it is dangerous to operate while standing or partially out of the cabin.
 20. Before lifting the load, carry out all crane movements with no load in order to verify the proper alignment of the boom and the correct unwinding of the rope on the drum. Use slings and ropes in good condition and of adequate strength and hook the load so that it cannot slip and/or move. Never wrap the lifting rope directly around the load.
 21. Do not lift people. Lifting people is permitted only in cases provided for by the regulations in force in special baskets or platforms equipped with appropriate safety devices.
 22. Do not move loads over people, operate the audible device to warn them and move them away.
The work area must always be clear during the operation and, if possible, fenced or enclosed.
 23. Make sure that during the handling of the load there is sufficient visibility.
Stop the crane when you lose sight of the load. Get assistance from another person in making signals; always keep in contact visually or acoustically.
 24. Obey the signal to stop from whoever it comes from.
Use the hand signals provided by current standards.
 25. Do not operate when the temperature of the hydraulic fluid is too high.
 26. Do not add additional counterweights to the crane unless specifically provided for in the lifting capacity table.
If this operation is provided for, make sure the installation is carried out in accordance with the specific instructions.
 27. Use extreme caution when lifting submerged loads: water and mud may increase the weight.
 28. Do not pull sideways with the boom, do not pull buried objects or objects which may have heavy mounds of mud, cement or such like, make sure that ice has not frozen the load to the ground. In short, make sure that the load is not obstructed in any way and that it is directly under the head of the boom.
 29. Rotate the turret slowly, otherwise the load will move outwards due to centrifugal force. Do not rotate if there is someone on the carrier frame or on the turret.
 30. If it is windy you must check that the speed is less than the maximum allowable value in the user manual.
In the event of stronger wind, stop working, lower the load, bring the telescopic boom back in and lower it, stop the rotation of the turret.
In the event of a crane with a lattice-boom, rest the boom on the ground.
 31. Be careful when you lift the load from the ground, because the boom and the carrier frame flex towards the load; therefore the working radius tends to increase when the load is

hung.

The radius tends to increase also when moving from the rear area to the front or lateral area especially when working on tyres. The radius also increases if you operate on uneven ground and when you transverse on a sloping terrain.

Another element that prohibits operation on uneven ground is the danger that the slewing unit or its brake might not have enough strength to operate, or to hold the load: an uncontrolled slewing of the load may therefore occur.

32. Do not operate, even with no load, with a radius and boom length which do not have a capacity value in the lifting capacity table or are not authorised by the user manual.
33. Do not lift two loads simultaneously with the main hoist and the auxiliary one.
34. During the manoeuvre the load and the slings must not collide with any obstacle.
35. Do not use the telescopic boom on the crane for pulling or pushing.
36. Not all mobile cranes with telescopic boom are empowered to lift loads by extending the boom. When this manoeuvre is allowed, be careful because the radius of the load increases and the hook-block at the same time moves closer to the boom head.
37. Lowering the load by telescopically retracting the boom may cause dangerous oscillations.
38. Disconnecting the load from the ground with the boom derricking up cylinder can cause dangerous oscillations.
39. Tilting is not always the operational limit of the crane. For different configurations, the limit is provided by the structural resistance of one of the components, so it may result on a mechanical or structural breakdown before tilting.
40. Never carry loads on top of the operator's cabin.
Also take care in the handling of bulky loads: they may collide with the cabin.
41. When working in the vicinity of the minimum radius beware of the limit switch: forcing the mechanical limit switches can damage the structural parts of the crane.
42. When disassembling a boom on a lattice swingaway crane, pay particular attention to the procedures in the user and maintenance manual.
An error in the correct sequence of the required steps can cause in serious consequences.
43. Generally mobile cranes empowered for driving across sites with suspended loads, have a higher tyre inflation pressure than that envisaged for road travel. Always inflate your tyres to the correct operating pressure. These types of inflation operations must only be done by adopting suitable protection cages or the like.
44. Do not move on non-horizontal ground or on ground that is not very solid or however not suitably prepared. Carefully follow the warnings of the person in charge of the site.
45. Move with the load lifted off the ground the required minimum quantity, with the required minimum radius and boom length.
46. If necessary, during the travelling, extend the outrigger beams and bring the support plates to a suitable distance from the ground.
47. Do not travel with boom lengths greater than the maximum allowed by the table on tyres.
48. Before moving wait until there is enough pressure in the crane's brake system.
49. When travelling without a load keep the hookblock at a suitable height from the ground in order to reduce oscillations and avoid to accidentally hit someone present in the work zone.
50. When working on tyres in the side area do not raise the boom too close to the maximum possible extent as provided by the lifting capacity charts. The crane may even tilt backwards, from the part

of the counterweight.

51. Do not leave the crane unattended with a suspended load.
52. Keep an extinguisher available in the cabin or close by.
Operate with care in the presence of dust, fumes or fog: poor visibility can cause accidents.
53. Sparks can come out of the exhaust pipe: when you are in the presence of flammable materials, dusts or vapours that could ignite or explode, use appropriate safety devices.
54. Check that lifting with several hookblocks is allowed by the manufacturer. These lifts are only allowed under the following conditions:
 - a. that the ropes of the hookblocks are always vertical during derricking up.
 - b. that the total gross weight of the load can be lifted only by the weaker equipment (jib, lattice swingaway extension, etc..).
 - c. that derricking up is within the expected configurations provided by the diagrams for the equipment.



In the event these conditions are not fulfilled, derricking up must not be carried out.

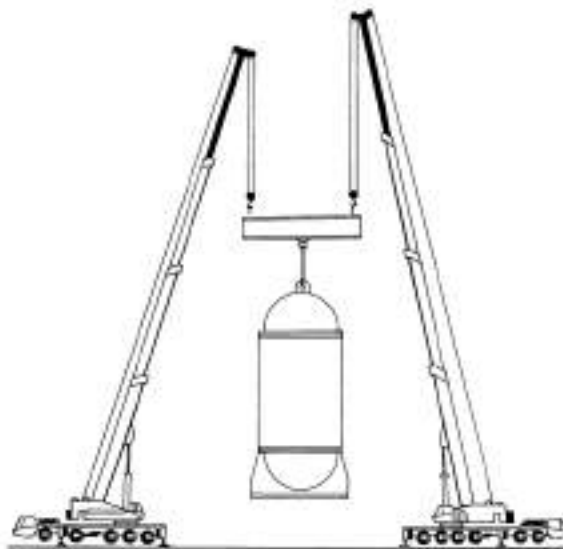
2.5 Hoisting with several mobile cranes.

Lifts involving two or more mobile cranes are complex operations that require considerable skill, training and careful planning.

It is absolutely necessary that a detailed plan is drawn up that takes into account every possible situation and which at least includes the requirements listed below:

1. Derricking up must be carried out under the direction of a supervisor in charge.
2. The ground should be level and firm: if it is not, all necessary vehicles should be used to obtain this result.
3. All cranes must be carefully levelled.
4. You must determine the exact weight of the load and its barycentre.
5. You must accurately measure the maximum working radius that can be achieved by each crane during the entire operation.
6. You must determine the exact length and angle of the boom.
7. You must determine the nominal capacity of each crane for all phases of the operation.
8. For a derricking up with multiple cranes, no crane should be loaded more than 75% of its net lifting capacity; greater reductions may be necessitated by the specific conditions of derricking up.
9. The speed of the hookblock, and the rotation of the boom of the cranes should be as equal as possible. This requirement is crucial.
10. Slewing, tilting and telescoping movements should be reduced to the minimum necessary.
11. It is dangerous to travel with the load, because the oscillations can cause load transfers of considerable magnitude from one crane to another.
12. Operators should know exactly what to do and what movements have to be carried out before you start derricking up.
13. If possible, do one or more trial runs without a load until everyone knows how to do that required.

14. All communications during derricking up must be done by radio (preferably a closed type, not a walkie-talkie).
15. It is essential that a single person directs and controls the operation. That person must be in a position to observe the whole operation and must remain in radio contact with the operators.
16. All crane movements must be carried out as gently as possible.
17. The ropes of the hookblocks must always be vertical. When the ropes are not vertical (example: load lifted by two cranes), the cranes become overloaded relative to one another and can cause very dangerous side slipping.
18. For these operations the proper functioning of the Load Moment Indicator must be checked beforehand with which all the mobile cranes involved in the operation must be equipped.
19. Also pay attention to the final resting of the load. It must take place in the manner illustrated by the figure below, simultaneously on all supports. Only rest one end of the beam, for example, this means loading the other end more than that permitted.



2.6 Warnings on movements

1. Before starting a transfer, check that all doors are closed, and all the guards are in place, that there are no objects or tools above, below or around the crane that constitute obstacles.
2. Check the tyres for cuts, abrasions or objects or stones wedged into the tyre tread and that they are inflated to the correct pressure prescribed for road transfer. Also run all the checks provided for by the specific user and maintenance manual.
3. The cabin windows must be intact and clean. Check the operation of the windscreen wipers, the headlights and the light and sound indicators.
4. The structure of the crane must be that provided by the approval of the Minister of Transport with all safety devices in place, as described in the technical annex to the Certificate of Registration or in the operator manual. Optional equipment or additional counterweights not provided for in the Technical Annex to the Certificate of Registration must be removed.
5. Do not carry people on board the crane unless explicitly permitted by the technical annex to the Certificate of Registration.
6. Request assistance from a person on the ground in the intersections or from a pilot vehicle when provided for by the technical annex to the Certificate of Registration. Use signals referring to the size and special lights in accordance with that provided by the current legislation in the Country.
7. Before operating the reverse, make sure there are no obstacles or people nearby.
8. Check, before embarking on a journey, that the road is passable with regard to the height, width and weight of the crane. Verify that there are no points to pass that are too weak, underpasses that are too low or roadside structures that are too narrow. Contact your local road authorities.
9. Do not attempt crossings or go over obstacles, very uneven terrain or ground that is not solid, in critical conditions, if you do not have absolute certainty of not being in danger.
10. When you stop the machine on a slope apply the parking brake and, if necessary, block the wheels with chocks. Do not park on soft ground or ground that can become so in the event of rain.
11. Do not leave the crane with the engine running. Lock the cabin when you leave it.

2.7 Transporting the crane on a trailer or a loading platform.

1. Use trailers or flatbeds of sufficient size and weight bearing capacity.
2. Rigidly lock the crane on the trailer by means of ropes in accordance with the user manual.
3. Do not deflate the tyres.
4. Attach the crane's hookblock to the trailer or to the loading platform and lock the rotation of the turret.
5. Check that the height of the platform is lower than the value allowed by current regulations or as requested by the owner entities of the roads issuing the transit permit.
6. If the outriggers are not laying on the platform, verify that the horizontal beams are locked in order to prevent accidental telescoping out.

2.8 Warnings relating to works close to power lines

Working with a crane in the vicinity of power lines is always extremely dangerous because of the natural mobility of the vehicle and its versatility of use.

It should be remembered that electrical discharges can occur even if the two bodies do not touch each other. If two bodies are closer than the minimum safety distance (5 metres), they can suffer serious damage.

Along with the mandatory compliance of minimum clearances required by law, we suggest a series of precautions to be taken to reduce the risk of accidents:

1. Ask the Electricity Company to interrupt the power supply and ground the line.
2. When it is not possible to interrupt the power supply, keep all parts of the crane and the load at a distance greater than 5 metres from the power lines, considering that these may oscillate in gusts of wind.
3. People that are not necessary for the operation should stay as far away as possible from the work area. Set up so that a supervisor equipped with an audible warning device can monitor the operations and immediately advise of the danger of discharges when the crane or the load gets close to the power line.
4. Operate with slow movements, with caution and prudence.
5. Adopt, whenever possible, appropriate safety devices such as:
 - a. *Insulation of the shank hook.*

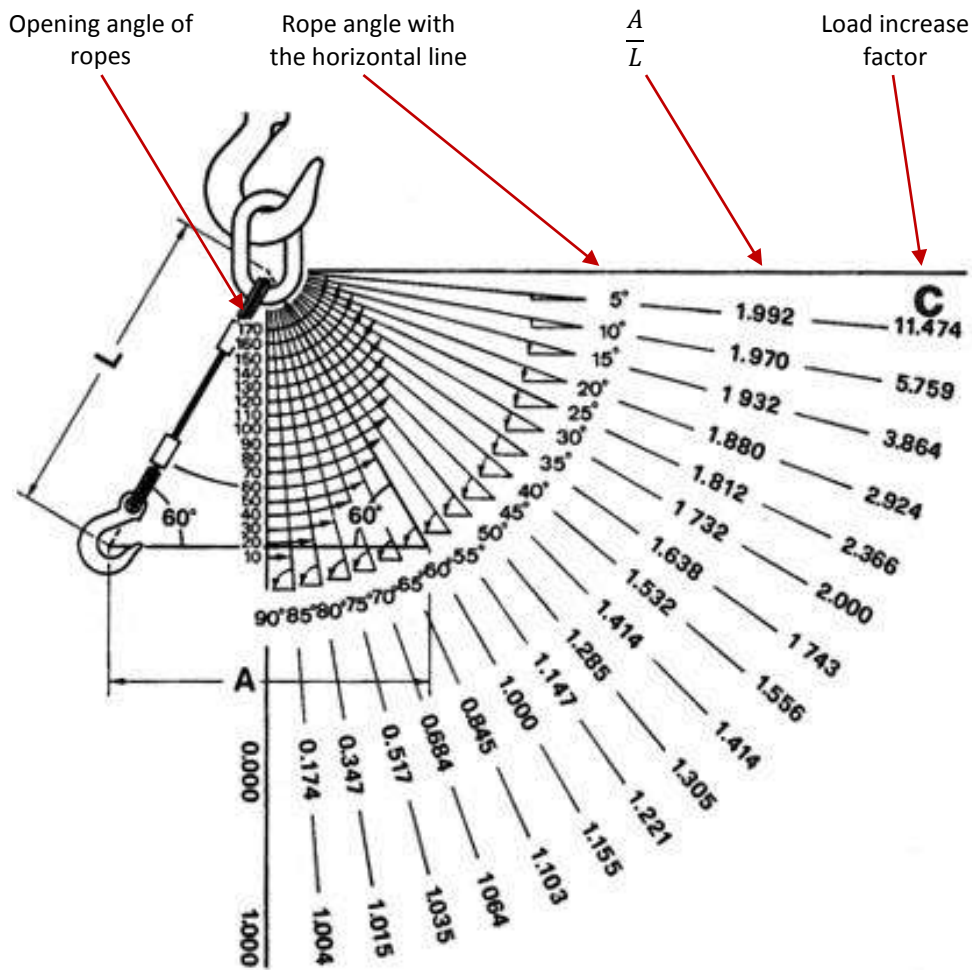
Keep in mind that moisture, dirt, oil, can reduce the insulating power of the device. Protection is provided only to what is beneath the insulation, but contact with the rope may cause electric shock.
 - b. *Line proximity signalling device.*

Keep in mind that if the contact is outside the coverage area of the sensors there will be no alarm signal.
 - c. Transversal and vertical boundaries along the route of the crane, to compel the operator to transit with the boom lowered.
 - d. *Use ropes in non-conductive material to hold the load.*

Keep in mind however that a rope, even if of non-conductive material, if it is very wet or soiled, can conduct electricity.
6. The grounding of a crane offers little or no protection against the risk of electric discharges.
7. The protections on the boom of the crane offer, especially for telescopic mobile cranes, little guarantees.
8. By working in the vicinity of radio or television stations the crane can get a high induced voltage which may cause electric shocks. Take appropriate measures in advance and talk to the engineers in charge.
9. What to do if the power line is in contact with the load or with the crane:
 - Warn people to stay away.
 - Move away from the electrical line with movement opposite to that which caused the contact: if you turned left, you must turn right. To stop the contact you must do a much larger detachment movement than that which created it.
 - When you are in the safety zone, stop the machine and inspect all parts before resuming work (especially ropes, tyres, slewing ring).
 - If you cannot detach yourself from the line and the machine does not catch fire and no arc is triggered through the cabin, stay where you are until the power line is excluded.
 - If you need to leave the machine do not use the steps. Jump away as much as you can from the machine. The ground around the electrified machine is electrified as well, to varying degrees. Move away by jumping with both feet together. If possible warn any rescuers not to approach until a floor of dry wood is put in place.

2.9 Warnings on load slinging

1. Slinging loads and performing manoeuvres should only be given to the dedicated person in charge.
2. When more than one worker is used for slinging loads, control of the operation and movement commands must be assigned to one person specifically trained and responsible for this task.
3. Manoeuvre orders must be given in accordance with a special code. It is necessary before starting work to check that all the operating parties refer to the same code.
4. The slinger must:
 - only use the ropes, chains and special equipment made available and eliminate deteriorated pieces;
 - check the weight of the load to be lifted, by consulting with his own supervisor if required;
 - choose the ropes and chains according to the weight to be lifted, taking into account the inclination of the bearing sections. (If the angle formed by the sections of the ropes or chains should exceed 120°, it is essential to use lifting beams);
 - between the ropes or chains and the piece to be lifted, place suitable wood shims or special protective profiles, especially when the piece has sharp edges;
 - check the balance of the harnessed load, slowly putting tension on the ropes before ordering the derricking up;
 - make sure that the load is raised to a correct height to overcome obstacles along the route;
 - when possible, precede the load during the travel to make sure any workers along the route are safe;
 - order the gradual descent of the load making it rest on a flat and strong surface, so that the slackening of the slings does not happen too quickly and does not give rise to a risk of the load falling;
 - ensure that, when manoeuvring the crane with no load, the suspended ropes or chains do not have any obstacles which they can hit against to;
 - neatly store the ropes and chains in the special racks.
5. The slinger must NOT:
 - allow other workers to stay or remain under suspended loads;
 - guide the loads with his hands; he must instead use the appropriate tools and only exercise limited tensile stresses;
 - order manoeuvres with a sideways pull, nor by jerking loads that are stuck or however constrained;
 - carry out the movement of the crane with wagons or other transport vehicles;
 - use the crane for derricking up and transporting compressed gas cylinders without using special containers.
 - use slings that are too short, as they may break.



For example: Having a sling with 2 arms with a vertical lifting capacity of 10000 kg and you want to know the lifting capacity with a vertex angle of 70° (the angle can be found on the table by knowing the ratio between the length of each arm L and the distance of the connections A). You divide the vertical lifting capacity (10000 kg) by the coefficient read on the diagram at the vertex angle of 70° (C = 1.221):

$$\text{effective lifting capacity with vertex angle of } 70^\circ = \frac{10000}{1.221} = 8190 \text{ kg.}$$

2.10 Manual signal



Derricking up of load
with forearm vertical and forefinger pointing up, make horizontal circles with your hand.



Load lowering:
with outstretched arm towards the boom and index finger also pointing down, make horizontal circles with your hand



Using the main lifting rope:
tap your fist lightly on your head, then use normal signals.



Using the auxiliary lifting rope:
tap your elbow lightly with your hand, then use normal signals.



Derricking up of the boom:
extend your arm with fingers closed and thumb pointing upwards.



Derricking down of the boom:
extend an arm with fingers closed and thumb pointed downward.



Slow movement:
use one hand to give any motion signal and place the other hand motionless making a signalling motion (slowly lift as given in the example).



Derricking up of boom and lowering of load:
with arm extended and thumb pointing upward, bend your fingers inward and outward until the movement of the load is requested.



Extension of the telescopic boom:
both fists are in front of your body with thumbs pointing outward.



Telescoping in of the boom:
both fists are in front of the body with the thumbs pointing toward each other.



Extension of the telescopic boom:
signal with one hand. A fist remains in front of the chest with the thumb which taps the chest.

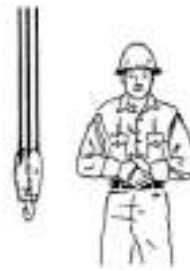


Telescoping in of the boom:
signal with one hand. A fist remains in front of the chest with the thumb pointed outward and the back taps on the chest.



Movement:

arm extended forward with hand open and slightly raised, make pushing motions in the direction of the move.



Hold everything:

clasp hands in front of body.

2.11 Effect of wind during crane operations



A strong wind leads to an overload of the crane.

The following table provides an indication of the wind speed:

wind intensity		Wind speed		Effects of wind inland
Beaufort degrees	Definition	m/s	Km/h	
0	Calm	0-0.2	1	No wind. Smoke rises vertically.
1	Light air	0.3-1.5	1-5	Wind direction shown by smoke drift, but it does not move the wind vane.
2	Light breeze	1.6-3.3	6-11	You feel the wind on your face. The leaves move. The wind vane moves slightly.
3	Gentle breeze	3.4-5.4	12-19	Leaves and shrubs move. Flags move.
4	Moderate breeze	5.5-7.9	20-28	The wind raises dust and paper. Small branches move.
5	Fresh breeze	8.0-10.7	29-38	Shrubs with leaves start to oscillate. Water on lakes ripples.
6	Strong breeze	10.8-13.8	39-49	Large branches move. Hiss of telegraph wires. Difficulty in using umbrellas.
7	Moderate gale	13.9-17.1	50-61	Whole trees move. Difficulty in walking against the wind.



In case of wind speed equal to or greater than 30 km/h, reduce the loads of the table and the operating parameters of the crane.

If the wind speed reaches 50 km/h stop all activities:

- *place the load on the ground;*
- *fully telescope in the boom;*
- *Lower the boom in a horizontal position;*
- *rotate the boom in the direction of the wind.*

If you need to operate in very windy areas it is recommended to equip the crane with an anemometer.

2.12 Information regarding noise and vibrations

2.12.1 Noise level

With door and windows closed the weighted sound pressure level, measured on the arc of eight hours is less than 80 dB(A) and depends on the severity of the working cycle.



In compliance with the provisions of the Legislative Decree 81/2008:

- *If the noise exposure should exceed 80 dB(A), the employer must make available hearing Personal Protection Devices (PPE) for all workers.*
- *If the noise exposure is equal to or greater than 85 dB(A), the employer obliges the employees to use the hearing Personal Protection Devices (PPE).*



2.12.2 Vibration level

Hand/Arm: the daily exposure value, normalised to a reference period of eight hours, is less than 2.5 m/s².

Entire body: the daily exposure value, normalized to a reference period of eight hours, does not exceed 0.5 m/s².

The measurements of noise and vibration have been obtained on a sample machine and with the engine running at 3/4 of its maximum power.

3 DESCRIPTION AND TECHNICAL DATA

3.1 Description of the crane

Locatelli's GRIL 8500T crane, described in this manual, is a self-propelled hydraulic rough terrain crane with a completely revolving cabin mounted on a high-resistant steel carriage with four drive steering wheels (4x4x4), adapt to operate in harsh conditions.

The crane has a 50 ton capacity at 2 metre radius from the centre of rotation.

The machine is equipped with a Caterpillar C6.6, six cylinder turbocharged intercooler diesel engine.

The diesel engine powers crane movement controls and allows road transfers.

A torque converter and power-shift gearbox with 6 forward gears and 6 reverse gears are connected to the engine; a button placed in the operator's cabin automatically selects the traction with four or two drive wheels.

The transmission shafts connect to the transmission unit to the differentials of the two axles, both steering as well as tractor (hydraulically) and equipped with planetary speed reducers on each hub.

The front axle is tightly mounted onto the carriage, while the rear axle is oscillating to ease transfer on rough terrain.

Two hydro-pneumatic blocking cylinders are applied to the rear axle which assure a rigid support base during lateral lifting on wheels. The block valves are engaged automatically when the crane turret is turned out of the carriage central axis.

The front and rear wheels are controlled by a normal automotive steering wheel. The wheels on the oscillating rear axle can be steered independently by using a control placed on the instrument panel in the operator's cabin. The independent control for the front and rear steering significantly increases the manoeuvrability of the crane when it is used in narrow spaces.

There are four steering modes: front wheels only; rear wheels only; four coordinated wheels, four crab wheels.

For road travel the type of steering used is always front wheels.

The braking is provided through a hydro-pneumatic independent dual circuit, activated by a pedal control which acts on all four wheels.

There is a disc brake fitted on the front axle for the parking brake. The emergency brake is through a hydro pneumatic system which acts on the discs of both axles.

The movements of the crane, of the outriggers and of the steering system, are alimented by four gear pumps driven by the two power take-offs placed on the converter and on the engine.

The movements of the crane are regulated by four-way hydraulic distributors provided with an automatic return of the spool to the central position, controlled by two joysticks that allow independent or simultaneous manoeuvres.

The hydraulic outriggers are activated by solenoid valves controlled by switches placed inside the cabin.

Pressure regulators protect the pumps and the structure from excessive hydraulic oil pressures. On all bearing cylinders lock valves are installed to prevent, in any position, an uncontrolled drop of the load, even in conditions of rupture of the external pipes.

Counter-balancing valves are installed on the hydraulic lifting, extension and hoist systems in order to allow a safe and effective checking during lifting, retracting or lowering movement under load.

The boom is lifted by a double-acting single hydraulic cylinder. The telescoping out of the boom is achieved by a double-acting cylinder which is fully synchronised to ensure the proportional telescoping out of the sections with a single joystick.

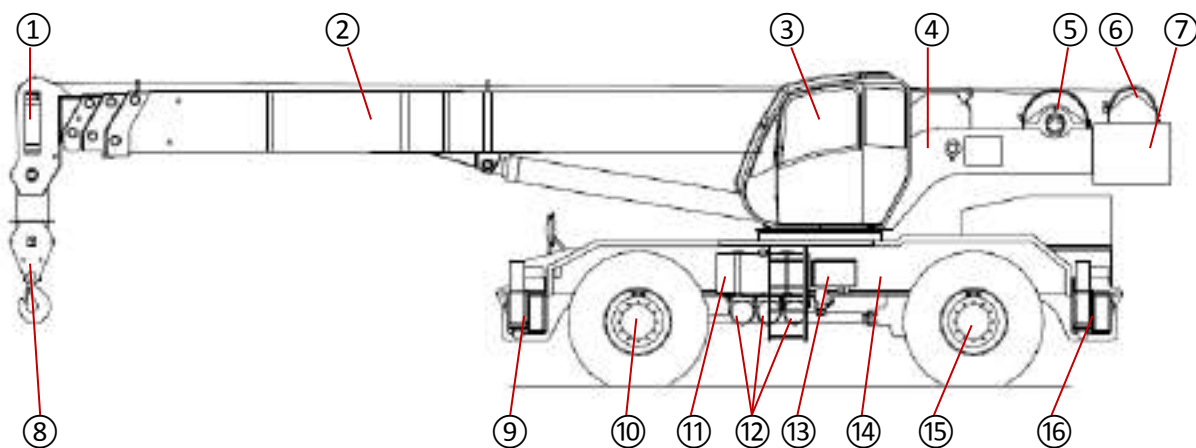
The hoist and the slewing are of the planetary reduction type comprising an automatic multi-disc brake and a counter-balance valve.

On the head of the boom and on the hoist drum limit switches are mounted in order to stop the raising and the lowering of the hookblock.

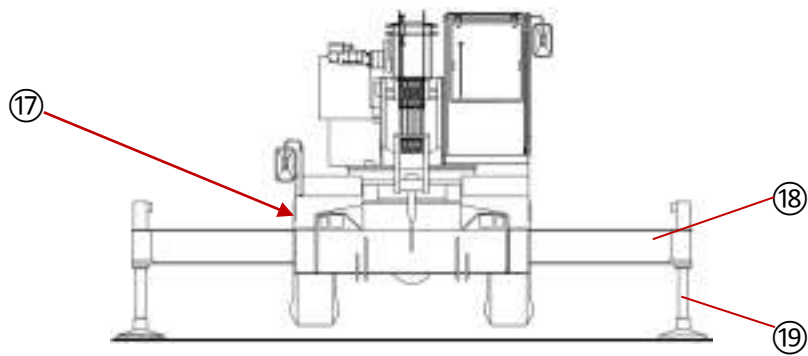
Four hydraulic outriggers, individually controlled with double-acting cylinders and jacks, support the crane for "on outrigger" capacities and can be used to level the machine while it is working on uneven ground. Possibility of partial extension of the outrigger beams.

The crane is equipped with an electronic Load Moment Indicator (LMI) which constantly indicates the load condition to the operator reporting the working radius, the applied load value, the angle and the length of the boom, with an acoustic and visual alarm and the arrest of the movement when overload conditions are reached.

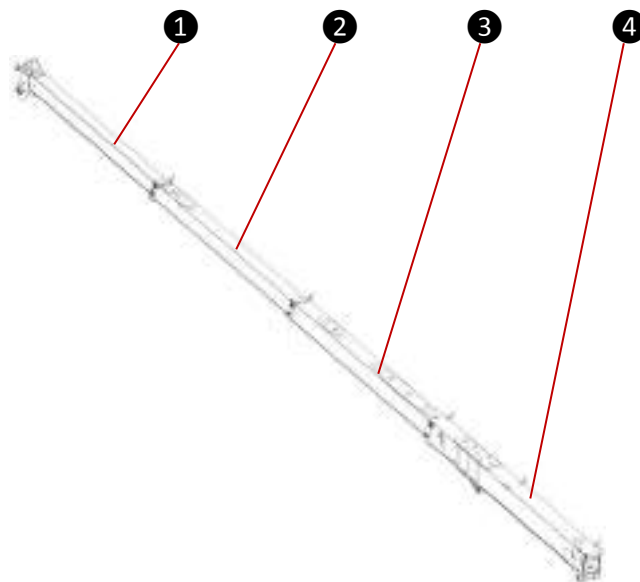
The crane is approved for travel on roads, in accordance with the laws in force, as an operating machine.



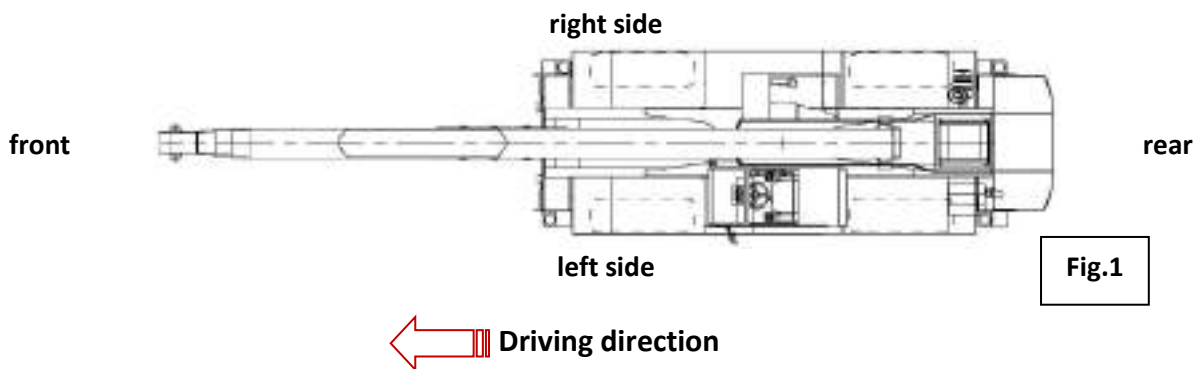
- | | |
|-------------------|--------------------|
| ① Boom head | ⑨ Front outriggers |
| ② Telescopic boom | ⑩ Front axle |
| ③ Control cabin | ⑪ Fuel tank |
| ④ Turret | ⑫ Air tank |
| ⑤ Auxiliary hoist | ⑬ Battery box |
| ⑥ Main hoist | ⑭ Carrier |
| ⑦ Counterweight | ⑮ Rear axle |
| ⑧ Hookblock | ⑯ Rear outriggers |



- ⑰ Hydraulic oil reservoir
- ⑱ Jack
- ⑱ Outrigger beam



- ① 4th element (or fly section)
- ② 3rd element (2nd telescopic section)
- ③ 2nd element (1st telescopic section)
- ④ 1st element (boom foot)





In the manual, when 'right', 'left', 'front' and 'rear' positions are mentioned, this refers to those received by the crane operator sitting in the driving seat with the crane in running order, as shown in Figure 1.

3.2 Hazard symbols



All adhesives regarding safety must be complete and legible.
If an adhesive is lost or no longer legible, repair it or replace it.



Attention: fire hazard



Attention: high temperatures



Attention: crushing hazard



Attention: scalding liquids



Attention: crushing hazard



Attention: battery case



Attention: crushing hazard



Warning: extinguisher



Warning: moving parts



Forbidden to move and/or stand under the boom



Attention: rope in motion



Access forbidden to unauthorised people



Attention: falling hazard



Access forbidden to pedestrians





Attention: moving belt

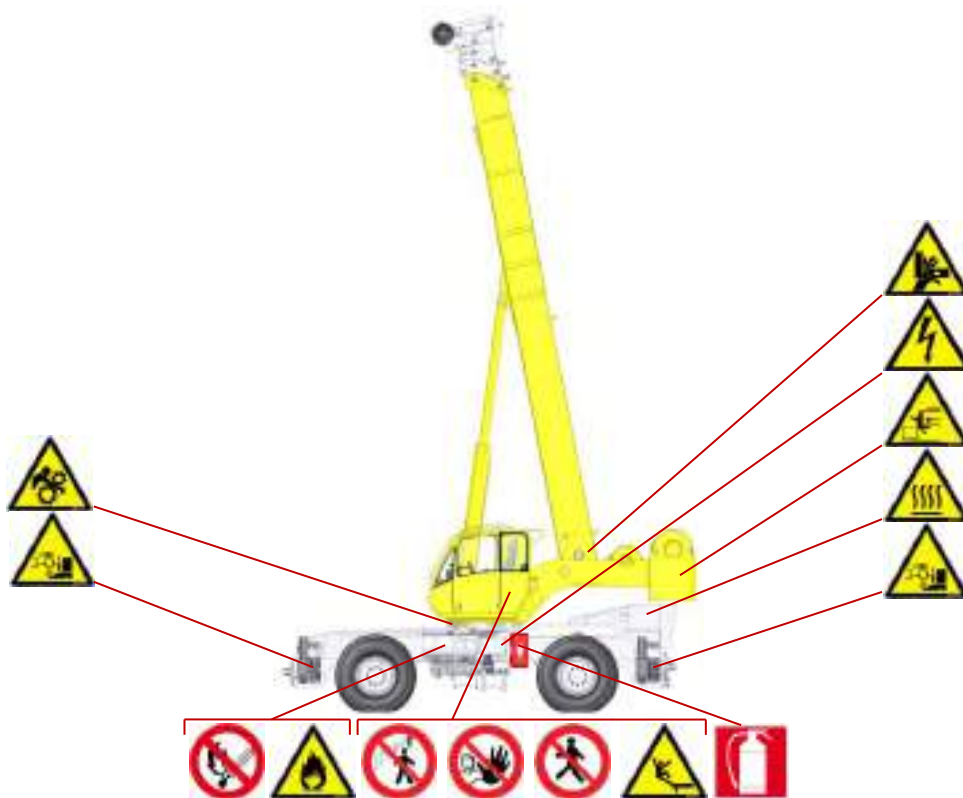
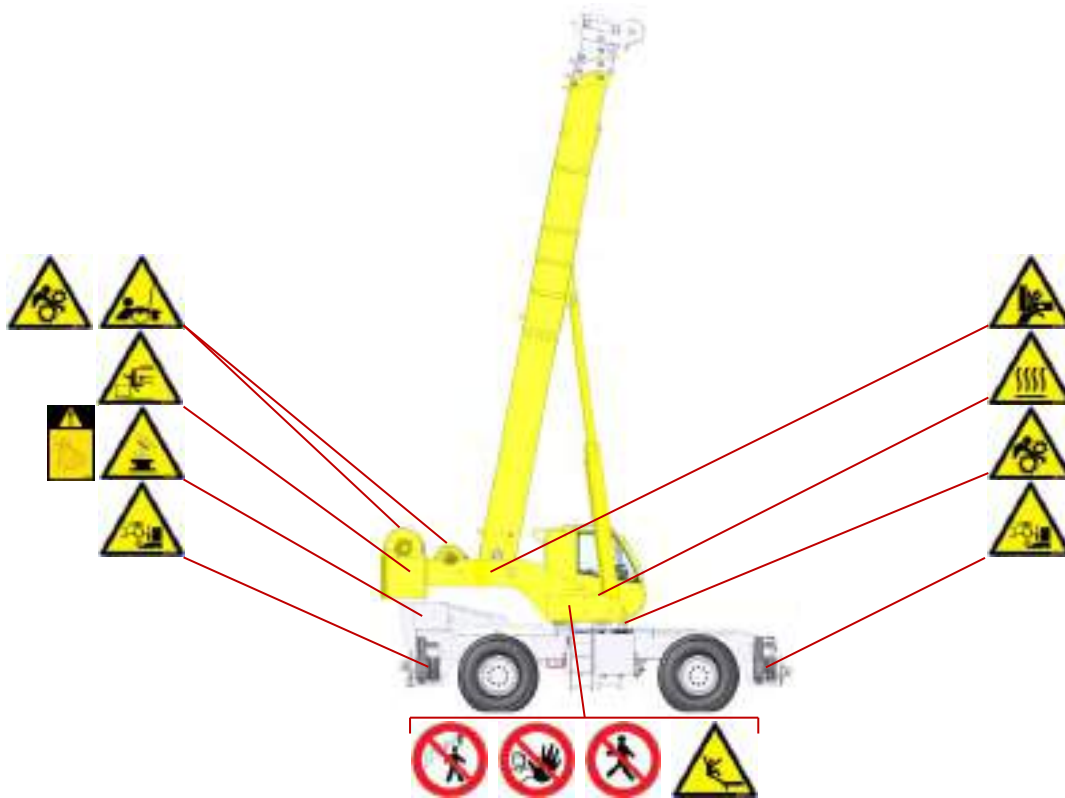


Smoking prohibited



The symbols  and  are respectively applied to the filler neck of the fuel tank and the hydraulic oil reservoir.

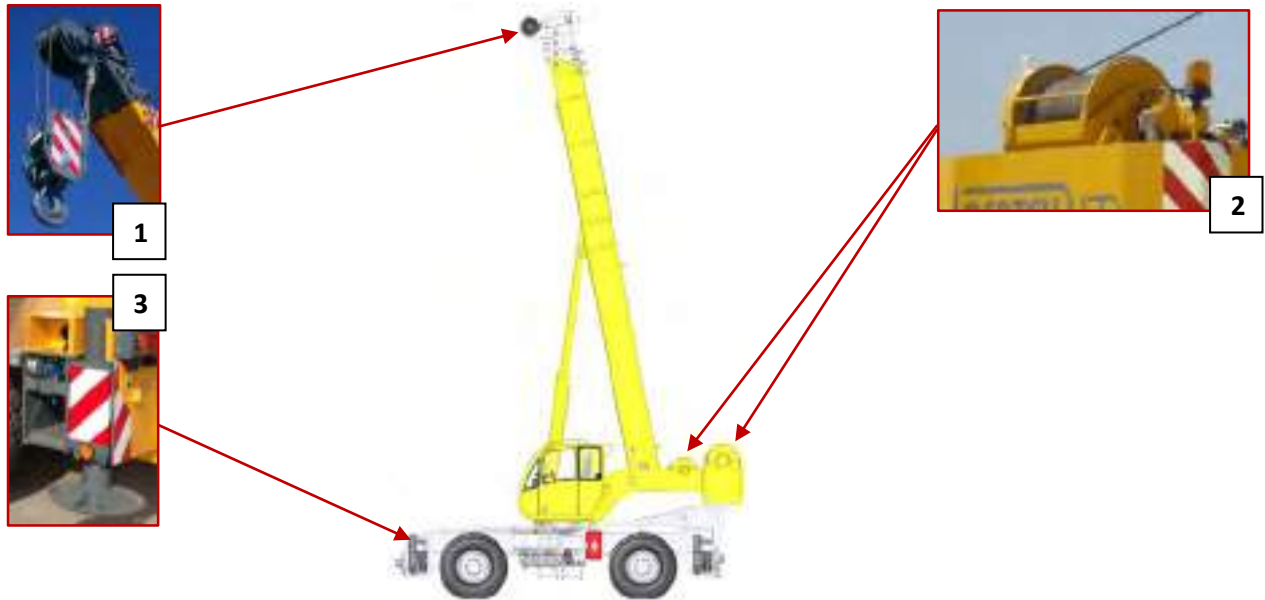
3.2.1 Positioning of the hazard symbols on the machine



3.2.2 Residual risks

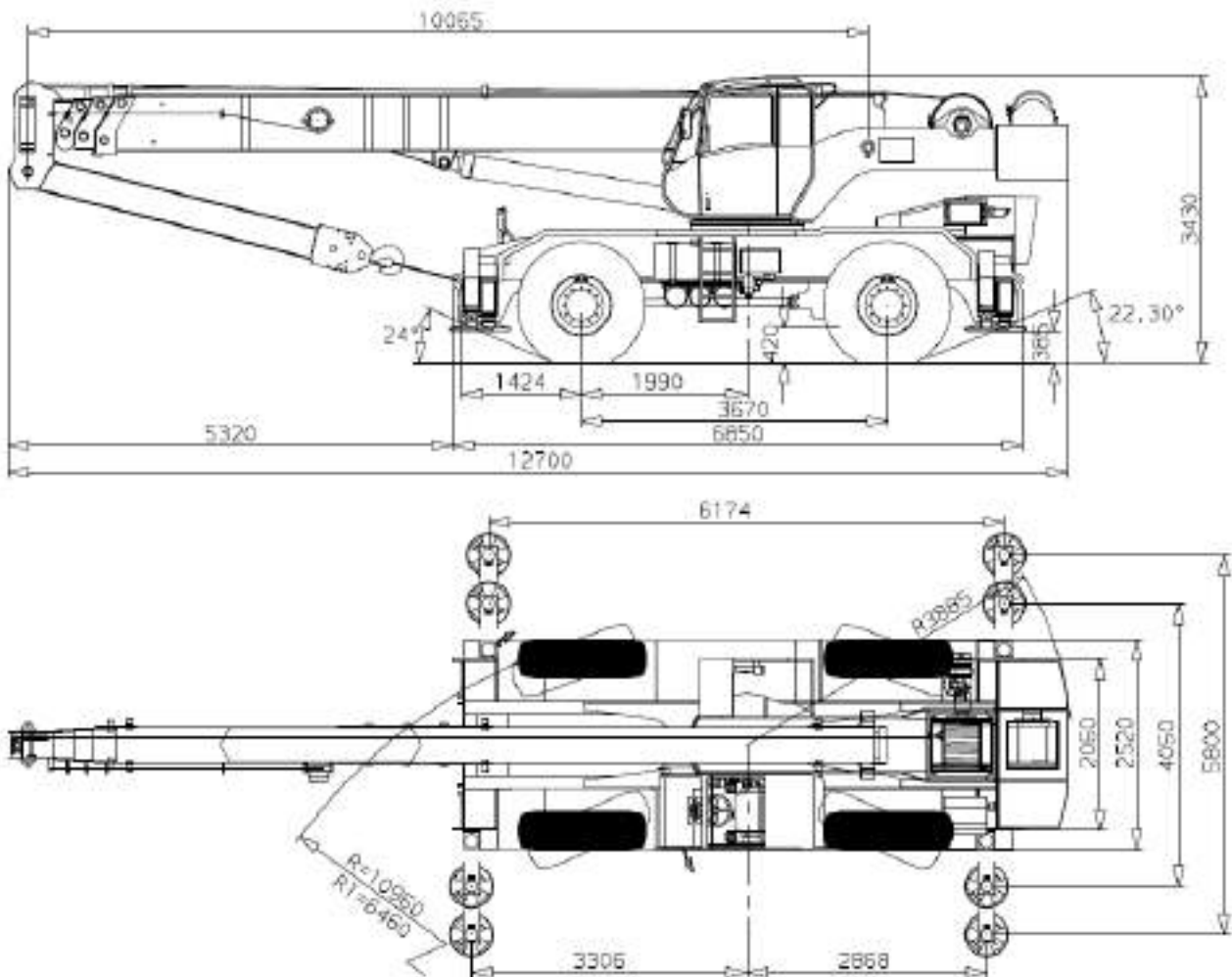
Residual risk refers to a potential danger, impossible to eliminate or partially remove, which can cause harm to the operator if he intervenes using incorrect methods and work practices.

Despite all the safety guards, safety devices and warning signs provided, there are still some residual risks for which the operator must take special care.



Pos.	Hazard	Description
1		Hookblock and boom head pulley: Attention: rope in motion.
2		Main and auxiliary hoist: Attention: rope in motion.
3		Outrigger beams and jacks: Attention crushing hazard.

3.3 Overall dimensions



Model	GRIL 8500T
Total mass ¹	29,800 kg
Load on front axle	14,500 kg
Load on rear axle	15,300 kg
Pitch	3,670 mm
Total length	12,700 mm
Total width	2,520 mm
Total height ²	3,430 mm

¹ weight including auxiliary hoist;

² with tyres 16.00R25.

3.4 Main technical data

Model	GRIL 8500T
Maximum lifting capacity	50T at 2 metres radius
Standard tyres	16.00R25 tubeless
Drive and steer wheels	4 x 4 x 4
Voltage electric system	24V
Engine:	
Model	Caterpillar C6.6
Power	116.5 kW at 2,200 RPM
Torque	683 Nm at 1,400 RPM
Fuel tank capacity	200 litres
Boom features:	
Number of sections	4
Boom extension	from 10.1 to 32.0 m
Boom elevation	from -2° to +79°
Manoeuvre speed:	
Turret slewing	2.7 RPM
Boom telescoping out	80 sec. (10.1-32.0 m)
Boom derricking up	55 sec.
Boom hoisting down	55 sec.
Outrigger beam extension	4 sec.
Outrigger jack extension	8 sec.

Performance main hoist:

Max speed under direct pull (last layer)	140 m/min
Maximum pull (first layer)	50 kN
Main hoist rope dimension	Ø18 mm x 175 m

Steering radius: (tyres 16.00R25)

Four wheel drive	6.460 m
Two wheel drive	10.960 m
Maximum road speed (without load)	25 km/h
Maximum site speed (without load)	37 km/h
Climbing capacity (theoretical without load)	97 %

Hydraulic system:

Main hoist <i>First section triple pump on converter</i>	71.9 cm ³
Boom manoeuvres (and auxiliary hoist) <i>Second section triple pump on converter</i>	63.4 cm ³
Turret slewing and outriggers <i>Third section triple pump on converter</i>	38.5 cm ³
Front axle steering <i>Single pump on engine</i>	20 cm ³
Hydraulic reservoir capacity	430 litres



The technical data of the optional accessories is given in the section 'Optional Accessories'.

3.5 Speed on road, slopes and effort at traction

Speed Range	Driving Wheels	Gear	Maximum speed on road (km/h)
Low	4	1	3.0
		2	5.5
		3	16.0
High	2	1	6.0
		2	12.0
		3	37.0

Important notes:

- the speed range must be selected with the machine at a standstill.
- stop the crane before inserting the forward or reverse gear lever.



Do not manoeuvre the gearbox with the engine above 1,000 RPM in order to prevent damage to the gears.

- the maximum speed for road travel has been calculated for cranes moving on flat ground.
- all data relative to the performances is based on the standard configuration of the machine and can vary by $\pm 10\%$ depending on the performance variations of the engine.

4 CRANE CONTROLS

This chapter describes the positions and the operation of all the controls, the instruments and the warning lights which are inside the operator's cabin and on the crane.

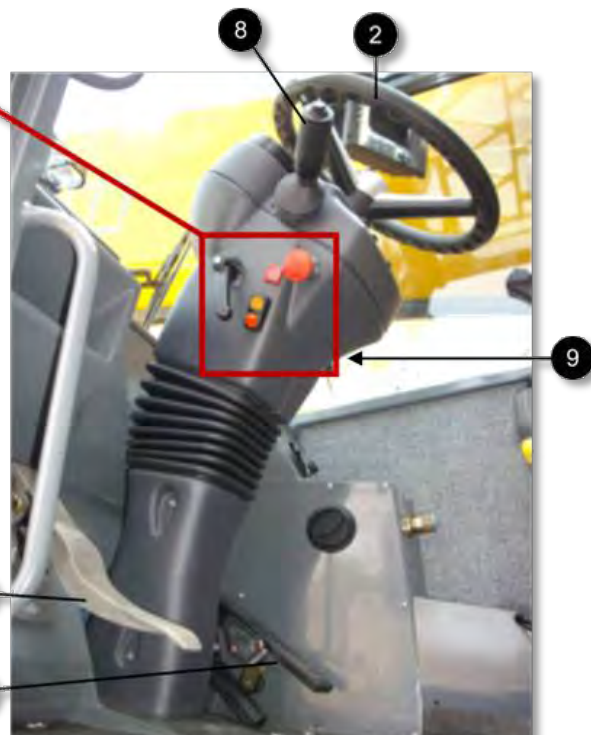
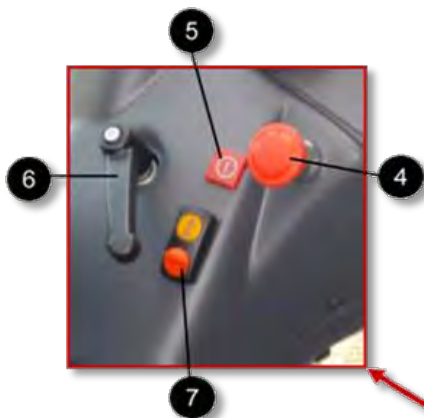


The list shows all the controls of the crane including the optional controls that may not be installed on this machine.

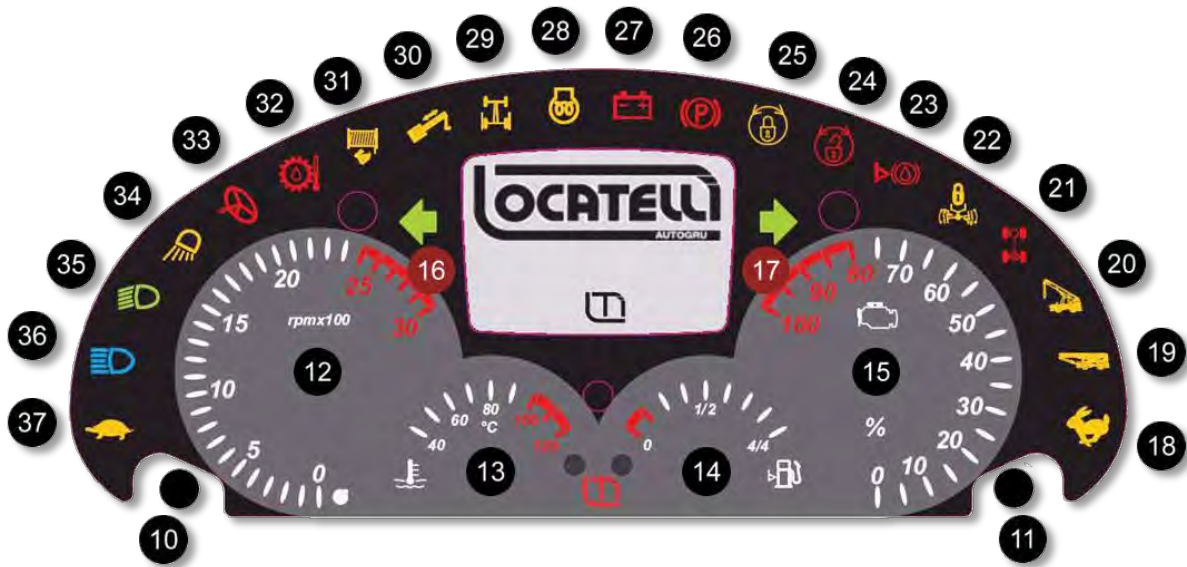


Before operating the crane, the operator must carefully study the information in this chapter and know the exact position and function of each control.

4.1 Position of the controls



- 1 Accelerator pedal
- 2 Automotive steering wheel
- 3 Brake pedal
- 4 Emergency stop push-button
- 5 Emergency stop push-button warning light
- 6 Steering column adjusting lever
- 7 Push-button to deactivate the crane controls for road travel
- 8 Multifunction lever: direction indicator, lights and horn
- 9 Ignition key



- | | | | |
|----|---|----|---|
| 10 | Left selector push button | 24 | Brake free rotation engaged warning light |
| 11 | Right selector push button | 25 | Slewing pin turret rotation engaged warning light |
| 12 | RPM gauge | 26 | Parking brake engagement warning light |
| 13 | Coolant fluid temperature gauge | 27 | Battery charge warning light |
| 14 | Fuel meter | 28 | Engine pre-heating warning light |
| 15 | Torque percent gauge | 29 | Rear wheel alignment warning light |
| 16 | Left indicator warning light | 30 | Boom extension mode warning light
<i>[NOT AVAILABLE ON THIS MODEL]</i> |
| 17 | Right indicator warning light | 31 | Hoist high speed engagement warning light |
| 18 | Fast gears engagement warning light (two-drive wheels) | 32 | Transmission oil high temperature warning light |
| 19 | Disabled crane controls warning light | 33 | Emergency steering engagement warning light |
| 20 | Enabled crane controls warning light | 34 | Floodlight warning light (optional) |
| 21 | Rear axle differential lock warning light | 35 | Side lights and low beam lights warning light |
| 22 | Rear axle oscillation lock warning light | 36 | High beam lights warning light |
| 23 | Insufficient braking circuit air pressure warning light | 37 | Slow gears engagement warning light (four-drive wheels) |



- 38 Strobe beacon push-button
- 39 Floodlight push-button (optional)
- 40 Differential lock push-button (optional)
[NOT AVAILABLE ON THIS MODEL]
- 41 Hazard warning lights push-button
- 42 Windscreen wiper push-button
- 43 Windscreen washer push-button
- 44 RPM manual regulator push-button



- 45 Slewing/telescopic boom joystick [aux. hoist (optional)]
- 46 Main hoist/boom lifting control joystick
- 47 Safety manoeuvre manipulator push-button (not illustrated)
- 48 Main hoist high speed engagement push-button
- 49 Horn
- 50 Free slew engagement push-button
- 51 Slow gear (4x4) and fast gear (4x2) selector
- 52 Alignment warning light for front and rear wheels [NOT AVAILABLE ON THIS MODEL]
- 53 Rear left outrigger extension/retraction switch selection
- 54 Front left outrigger extension/retraction switch selection
- 55 Front right outrigger extension/retraction switch selection
- 56 Rear right outrigger extension/retraction switch selection
- 57 Gearbox control lever
- 58 Boom elements extension exchange [NOT AVAILABLE ON THIS MODEL]
- 59 Boom pinning on/off switch [NOT AVAILABLE ON THIS MODEL]
- 60 Parking brake control lever
- 61 Boom aux. hoist switch
- 62 Oscillating axle lock/unlock push-button [NOT AVAILABLE ON THIS MODEL]
- 63 Push-button for increasing LMI capacities [NOT AVAILABLE ON THIS MODEL]
- 64 Beam/jack cylinder selector
- 65 Rear steering switch
- 66 Cabin tilt switch [NOT AVAILABLE ON THIS MODEL]
- 67 Slewing locking pin engagement push-button [NOT AVAILABLE ON THIS MODEL]
- 68 Engine failure warning light (amber) [NOT AVAILABLE ON THIS MODEL]
- 69 Engine stop warning light (red) [NOT AVAILABLE ON THIS MODEL]
- 70 Adjustable air vent escutcheon
- 71 24V electric plug
- 72 Heating/ventilator switch
- 73 Heater/defroster regulator
- 74 Turret slewing speed regulator

4.2 Multifunction display



With the ignition key turned in the first position (without starting the engine) the instrument carries out a self-diagnostic test. During the test, the Locatelli logo appears on the display for about 3 seconds while the warning lights light-up and an alarm buzzer starts beeping.

At the end of the test, after having started the engine, if there are no errors, by default the display will show a screen divided into four parts (A, B, C and D) shown below:



A Zone 13.7V

Battery charge voltage.

If charge voltage falls below 24V, the warning light (27) lights up on the control panel.

B Zone

There are different possible displays.

By pressing the right selection button (12) for three seconds, the following information is displayed in sequence:

- Total operational hours **00345.6 h**
- Partial operational hours **345.6 h**

In order to reset the partial hours counter, keep the right selection button (12) pressed for five seconds.

- Clock regulation (see § 4.3.5)
- Engine error code numbers






If the screen shows "NO ERROR", the control system has detected no engine anomaly.

In the case of an engine malfunction, the screen will display an "EXXX.XX" error code type and, at the same time, an acoustic alarm will start beeping. The current error will be displayed until eliminated. In the mean time, it will not be possible to scroll the display to other sections.

Consult the maintenance section in the manual to find the engine malfunction that corresponds to the displayed error code number.

C Zone

The following operational parameters are shown on two lines:

	1	Front brake air circuit pressure [bar].
	2	Rear brake air circuit pressure [bar].
		Engine oil pressure [bar].
		Engine air suction temperature [°C].
		Hourly fuel consumption [l/h].

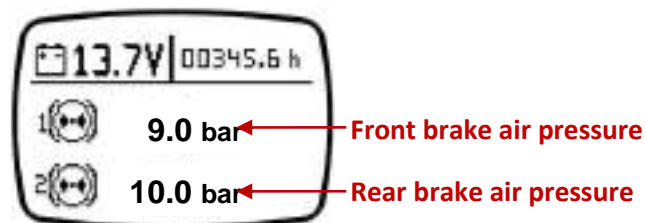
By pressing the left selection button (10) you change the parameter displayed on the upper line. By pressing the right button (11) you change the parameter shown in the bottom line.

Operational parameters can be displayed both in the top line and in the bottom line, but not at the same time.

D Zone

Programmed maintenance (see § 4.2.4).

4.2.1 Brake air circuit pressure



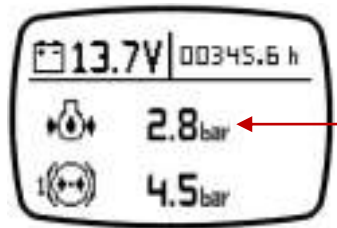
If the pressure in one or both brake circuits is below 5.5 bar, the related symbol flashes on the display, the warning light (23) lights-up and, at the same time, an intermittent acoustic alarm starts beeping.

By pressing the right button (11) the acoustic alarm is interrupted, but the icon on the display continues to flash and the warning light (23) remains lit until the circuit pressure goes back to normal values.



Do not move the crane when the brake circuit pressure is below 5.5 bar.

4.2.2 Engine oil pressure



If the engine oil pressure, with a running engine, is below 1 bar, the related symbol flashes on the display and, at the same time, an intermittent acoustic alarm starts beeping. By pressing the right button (11) the acoustic alarm is interrupted, but the icon on the display continues to flash until the oil pressure goes back to normal values.

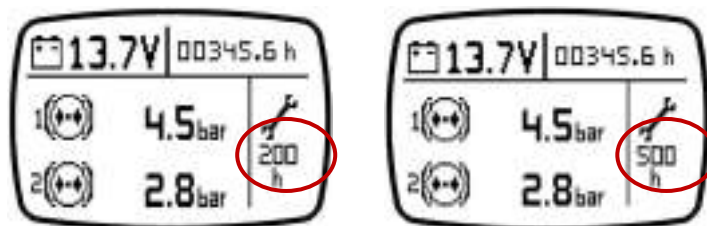
4.2.3 Engine air suction temperature



If the temperature of air entering the engine reaches 90°C, the related symbol flashes on the display and, at the same time, an intermittent acoustic alarm starts beeping. By pressing the right button (11) the acoustic alarm is interrupted, but the icon on the display continues to flash until the temperature goes back to normal values.

4.2.4 Programmed maintenance

In the D Zone of the display, programmed maintenance deadline warnings are shown after the first 200 hours of operation, and subsequently every 500 hours.



Starting 20 hours before the programmed maintenance, every time the control board is switched on, a warning message accompanied by an acoustic signal appears on the display. The message will be displayed for a few seconds and then disappears. Once the 20 hours before the programmed maintenance deadline have expired, the message is displayed permanently every time the control board is switched on. Contact an authorised after-sales assistance centre that will complete the required maintenance and reset the message.

4.2.5 Adjusting the clock

To adjust the clock, proceed as follows:

- Switch the control panel on keeping the right button (12) pressed during the entire self-diagnostic test.
- At the end of the test, the hour digits will start to flash.
- Press the left button (10) to increase the hours; then press the right button (11) to confirm.
- After confirming the hour, the minutes digits will start to flash.
- Press the left button (10) to increase the minutes; then press the right button (11) to confirm.

4.3 Direction indicators, lights and horn lever

The direction indicator lever is placed on the left side of the steering column. On the lever there is a three-position rotary switch.

The functions are:



Horn: push the lever in to activate the horn.



Direction indicator: move the lever upwards to engage the flashing indicators in order to signal that you are turning to the right.

Move the lever downwards to engage the flashing indicators in order to signal that you are turning to the left. By moving the lever, the direction indicator warning light (16 or 17) will start flashing.



Three-position rotary switch:



- **first position:** off



- **second position:** cabin instrumentation, side lights



- **third position:** low beam lights. The green light (35) illuminates on the dashboard.



- **High beam lights:** to engage the high beam lights, push the lever forward until you reach the fixed position. To flash the high beam lights, pull the lever backwards. Engaging the high beam lights, illuminates the blue light (36) on the dashboard.

4.4 Heater/defrosting control switch

The independent diesel powered heating/defrosting system is controlled by a thermostat which keeps the temperature constant in the cabin. The thermostat controls the heat output based on the selected temperature.

A fixed nozzle, on the front of the cabin, enables defrosting of the windscreen.

Before turning on the heating check that:

- there is sufficient fuel in the heating system tank;
- there are no leaks or damage to the fuel supply line;
- the filter and fuel pump inlet are not clogged or dirty;
- the connectors and the terminals of the electrical system are not damaged and are securely attached;
- the suction and exhaust pipes of the heater are not obstructed by mud, snow or whatever.



*Use only diesel as fuel. Never use petrol or heavy oil or a mixture of both.
Do not add anti-freeze to the fuel: it may cause incomplete combustion.*

If diesel is used for extreme cold (such as *Arctic*), you must adjust the air/fuel ratio though the combustion air; in fact, the heating system is designed for standard diesel.

Precautions: When the diesel of the vehicle is used as fuel for the heater, check the level and condition of it when the environmental conditions change (e.g. moving from a flat to a mountainous area at 1,500 m or more above sea level, or from a hot to a cold region).

If the standard diesel fuel is used at an outside temperature equal to or less than 0°C (32°F) the paraffin separates from the fuel before it freezes. This phenomenon occurs particularly early in units with low fuel consumption such as the heater and will develop relatively later in units with higher fuel consumption such as the main engine. It may therefore be that the same fuel will start the engine but not the heater.



Turn off the heater when refuelling.



Control element

Rotary knob for:
Switching on and off;
Setting the environment temperature;
Resetting after a fault cut-out.

Indicator / error warning light.



Heating/ventilation mode switch.

Switch-on and switch-off: To switch on, turn the rotary knob on the control element to the desired temperature.

To switch off, turn the rotary knob on the control element to position 0.

Heating/ventilation mode: A separate switch allows the user to choose between heating and ventilation mode.



Changes to the settings on the control element will be carried out with a time delay.

To prevent the hot and combustion air fan from blocking or counter circuiting, ensure that there are no objects leaning over or against the heater before switching it on.



Before starting the heater, remember to open the valve on the fuel tank placed behind the cabin.

Display of fault codes: The display of fault codes is done by flashing the fault code on the ignition/indicator control. After a rapid sequence of pulses, the error indication takes the form of a sequence of long flashing pulses according to the numbers contained in the following table.

Number of flashes	Meaning
F 00	ECU (Electronic Control Unit) fault
F 01	No start (after 2 attempts to start)
F 02	Fuel shutdown (at least > 3)
F 03	Under voltage or overvoltage
F 04	Anticipated fuel recognition
F 05	Indicator of fuel interruption or short circuit
F 06	Break or short-circuit of the temperature sensor
F 07	Break or short-circuit metering pump
F 08	Break or short-circuit of the fan or fan motor overload or blocked
F 09	Break or short-circuit of incandescent pin
F 10	Overheating
F 11	Break or short-circuit of overheating sensor
F 12	Heater blocked
F 14	Overheating sensor mounted incorrectly
F 15	Requested value sensor interrupted

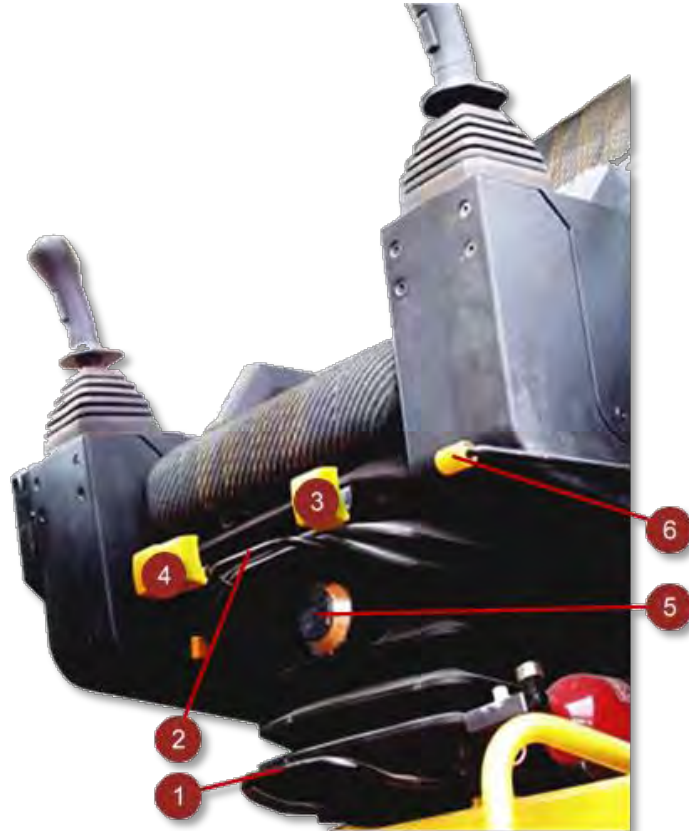
If there are repeated incidents of severe failures such as overheating or failure to start, the heater will lock permanently (error code F 12) and can be put back into operation by disconnecting the power supply with the heater on (e.g. by removing the fuse).

4.5 Seat adjustment

The seat of the cabin, mounted on hydraulic shock absorbers can be adjusted according to the weight and height of the operator.

The seat's armrest can be raised from the side of the door to facilitate access to the cabin. Afterwards, the armrest must be lowered and locked in its operating position. The height of the armrests can be changed by adjusting the fastening screws.

A two anchor points sub-abdominal safety belt completes the seat.



1. Horizontal adjustment of the entire seat

Lift the handle **1** and slide the entire seat forwards or backwards, including the armrests, to choose the most comfortable position in order to control the pedals.

2. Horizontal adjustment of the only sitting part

Lift the handle **2** and slide only the sitting part of the seat forwards or backwards, without the armrests, to choose the most comfortable position in order to control the joysticks.

3. Adjustment of the backrest

Pull the lever **3** upwards to adjust the position of the backrest.

4. Adjustment of the height and the inclination of the sitting part

Pull the two levers **4** to adjust the height and the inclination of the seat independently from the seat suspension.

5. Adjustment of the operator's weight

To adjust the rigidity of the seat suspension based on the operator's weight, turn the knob **5** until the red visual indicator shows the weight of the operator expressed in kilograms.

6. Release the armrest

To unhook the armrest pull the lever **6** upwards and lift the armrest folding it.



For road safety reasons, the driver's seat should be adjusted only when the vehicle is stationary.

4.5.1 Seatbelt

The safety belt, mounted on the seat, is of the two anchor points sub-abdominal type.



Before working with the crane fasten the seatbelt.

1. Before fastening the seatbelt, adjust the operator's seat in the driving position.
2. Pull the belt underneath the abdomen, as much as possible downwards on the hips until the metal terminal is inserted into the fixed snap buckle.



In normal conditions, the belt should move freely, locking in the event of a sudden shock.

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5 LOAD CAPACITY CHARTS

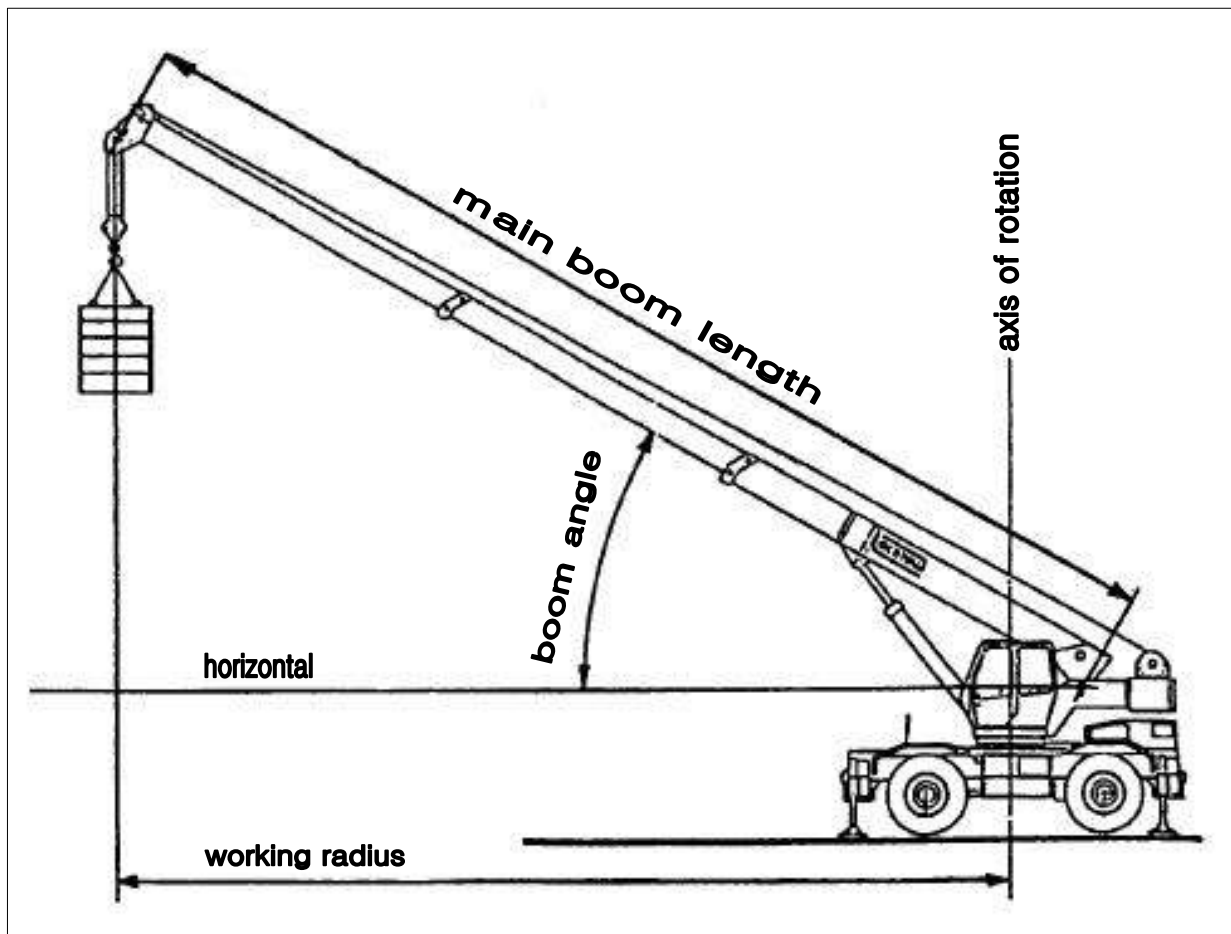
5.1 Introduction

The load capacity charts, the diagram of working radius and the important notes that follow are merely indicative and are only used as an explanation. When using the crane, the operator must refer to the load capacity charts, to the diagram and to the important notes applied inside the cabin.

Read the notes carefully before starting any lifting operation.

5.2 Definitions

- *Working radius*: this is the horizontal distance measured between the slewing axis of the turret and the virtual vertical line passing through the centre of the hookblock with a suspended load applied to it.
- *Boom angle*: this is the angle between the boom axis and the horizon.
- *Working area*: this is a circumference centred on the ground projection of the slewing axis of the turret with a radius equal to the working radius.
- *Freely suspended load*: this is intended as the suspended load on the hook on which no direct external forces act except for that force exerted by the hoist rope.
- *Lateral load*: this is a force applied horizontally to the lifted load, either on the ground as in the air.



5.3 How to read the load capacity charts

The load capacity charts report the maximum loads that can be lifted depending on the configuration of the crane. There are, therefore, load capacity charts for:

- crane on outriggers 360° main boom with fixed positions;
- crane on outriggers 360° main boom with intermediate positions;
- crane on tyres (front static capacities, 360° static, travelling at 3 km/h);
- crane on outriggers 360° with offsettable lattice swingaway extension (optional);

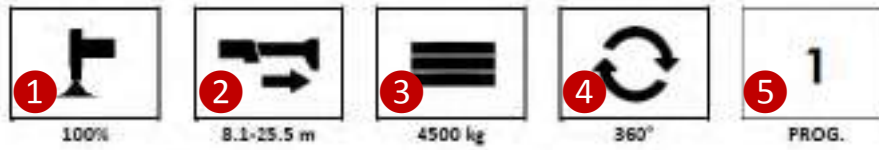
The load capacity charts are divided into load capacities limited by structural resistance and load capacities limited by stability. This distribution is shown by the bold line on the chart: the load capacities above this line are determined in function of structural strength; those below in function of tilting.

The load capacity chart shows the work radius on the external right and left columns, while the top horizontal line shows in sequence the various boom lengths, starting from the completely retracted boom up to the completely extended one. The intersection value between the work radius and boom length represents the maximum load that can be lifted for that given radius and boom length. For intermediate boom lengths that do not appear in the chart, for capacity purposes, the immediate next greater length must be used. For example: the chart indicates the load capacities for a boom length of 8.1 and 14 m. If you work with the boom extended at 9 m, the maximum capacity that can be lifted is the one that can be read in the column corresponding to the boom length of 14 m and not of 8.1 m.

Another important load capacity chart is the work diagram which shows the height that can be reached for each length of the boom, angle of the boom and working radius.

The charts are completed by the diagrams of the work area on tyres and on outriggers and the important notes relative to the load capacities. The diagram of the work area on wheels is used to determine the limits of the front work area and on 360°. The front capacities on wheels are valid for the boom positioned in the centre on the front part of the crane.

The charts and the notes also indicate the weights that must be subtracted when the machine is equipped with particular tools for moving the load, such as hookblocks, overhaul hooks, offsettable lattice swingaway extensions, etc., which must be considered as part of the load. Any other equipment for handling the load (for example: chains, slings, etc..) must be considered and its weight must be added to the weight of the load.

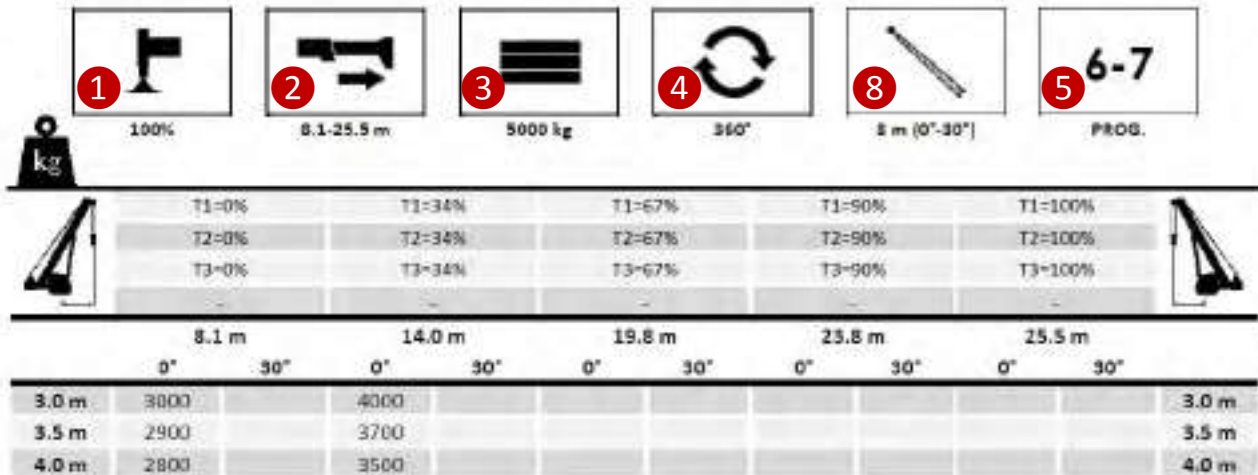


	T1=0%		T1=34%		T1=67%		T1=90%		T1=100%	
	T2=0%	T2=34%	T2=67%	T2=90%	T2=100%	T3=0%	T3=34%	T3=67%	T3=90%	T3=100%
	8.1 m	14.0 m	19.8 m	23.8 m	25.5 m					
3.0 m	30000					3.0 m				
3.5 m	26200	19000	12500			3.5 m				
4.0 m	22500	19000	12500	11700		4.0 m				
4.5 m	20200	18500	12500	11700		4.5 m				
5.0 m	18000	18000	11700	10800		5.0 m				
6.0 m	14500	14600	11100	9900	8200	6.0 m				
7.0 m		12500	10500	8500	7700	7.0 m				
8.0 m		9300	8400	7400	7200	8.0 m				
9.0 m		7500	7500	6600	6400	9.0 m				
10.0 m		6300	6300	5800	5700	10.0 m				
11.0 m		5400	5400	5200	5100	11.0 m				
12.0 m		4900	4900	4700	4600	12.0 m				
13.0 m		4000	4200	4200	4200	13.0 m				
14.0 m			3700	3700	3700	14.0 m				

« . . . »



	T1=0%		T1=34%		T1=67%	
	T2=0%	T2=34%	T2=67%	T3=0%	T3=34%	T3=67%
	8.1 m	14.0 m	19.8 m			
3.0 m	12200			3.0 m		
3.5 m	10800	9600	6000	3.5 m		
4.0 m	9600	9600	6000	4.0 m		



1. Outrigging modes:

- 100%: fully extended outriggers;
- 50%: partially extended outriggers;
- 0%: fully retracted outriggers.

2. Telescopic boom length: closed-extended.

3. Total weight of counterweight: sum of the standard counterweight.

4. Work area: 360° on outriggers - 360° / 0° on tyres.

5. Program code of the LMI (Load Moment Indicator): specific for each load chart.

6. Mode on tyres: tyre size and inflation pressure.

7. Front capacities on tyres – travelling speed at 3 km/h.

8. Configuration of the offsettable lattice swingaway extension: length and inclination (optional).

9. Main boom length.

10. Working radius.

11. Maximum load that can be lifted relative to the work radius and to the boom length.

5.4 How to find the "safe work load"

If the operator is aware of the working radius and the height requested for lifting, by using the work diagram he can quickly determine the length and the required angle of the boom. Vice versa if he knows the length and angle of the boom it is possible to find the required working radius and height.

You must then check on the load chart to see whether, for the specified length of the boom and the working radius, the crane is able to safely lift the required load.

For a better comprehension, an example is given below of how to calculate the lifting of the load.

Let's suppose we need to lift a load of 7,500 kg to a height of 20 m and with a working radius of 7 m. The work diagram shows, considering the clearance of the hookblock, that the boom must be extended to 22 m, a length that is not listed on the chart. The capacities will, therefore, be those indicated in the corresponding column to the immediately successive length of the boom of 23.8 m.

Checking the chart for the crane on fully extended outriggers over 360° at 7 m radius and with a boom length of 23.8 m the load capacity is equal to 8,500 kg.

Therefore, it seems that it is possible to lift 7,500 kg, but we have still to deduct the weight of the auxiliary equipment.

Firstly, all the equipment on the crane must be checked.

Let's suppose that the machine, equipped with a hookblock, also has an 8 m offsettable lattice swingaway extension mounted on the end of the boom head.

In the important notes of the load capacity chart it is recommended to deduct 750 kg for this equipment.

The machine is also provided with a hookblock that requires a weight reduction of 310 kg.

If slings, chains or similar fastenings are needed to lift the load, their weights must also be deducted; let's suppose that their weight is equal to 200 kg.

By adding the weights of the different auxiliary equipment we obtain 1,260 kg that must be subtracted from the load capacities indicated in the chart.

Therefore the weight that can be lifted in a safe condition is equal to: $8,500 \text{ kg} - 1,260 \text{ kg} = 7,240 \text{ kg}$.

Taking a look at the load capacity chart, it shows that our load cannot be lifted.

However, if the offsettable lattice swingaway extension is stowed laterally on the base section of the boom, the reduction of the weight to be applied to the load is only equal to 350 kg, therefore the total weight reduction for all the auxiliary equipment is equal to 860 kg.

Hence, $8,500 \text{ kg} - 860 \text{ kg} = 7,640 \text{ kg}$, which the crane can lift in a safe condition.

5.5 Main boom important notes

It is not allowed to operate outside the limits of the working radius and work angle reported in the load capacity chart.

The working radius and angles are considered under load.

The deformations of the boom and of the frame structure increase the working radius.

The safety loads also depend on the operational conditions, the working radius and the experience of the operator; even these factors must be taken into consideration.



Ensure a safe distance from the power lines.

The loads reported above the bold line are determined by structural stability factors; those below the bold line are determined by tilting factors.

The weight of hooks, sling and any other lifting equipment must be deducted from the load that is specified in the load capacity chart to obtain the net load that can be lifted.

The load capacities given in the chart refer to suspended loads and are valid as long as the outrigger beams are fully extended and the machine is standing steadily on a flat and uniformly solid ground.

For boom lengths which are not shown in the chart, use the expected capacity for the immediately greater length of the boom.



When operating with auxiliary equipment, reduce the load capacities of a value equal to the weight of the equipment that is being used.

In the event that the optional equipment is stowed laterally on the base section of the boom, reduce the loads of the weight value reported in the load charts.

5.5.1 Crane on tyres

The load capacities on tyres are valid if the tyre pressure is as prescribed by the chart and that the crane works on a flat, solid and horizontal ground.

Check the oscillation of the rear axle; the load capacities on tyres over 360° slewing are valid only if the oscillation of the rear axle is locked.

For work on tyres, frontal loads are valid only if the slewing manual lock pin is inserted.

The shifting of a suspended load must be performed keeping the load slightly raised from the ground, with the gear in first speed and the slewing of the turret locked.

The operator must perform the ignition and the stop of the crane in a gradual way to avoid the oscillation of the load.

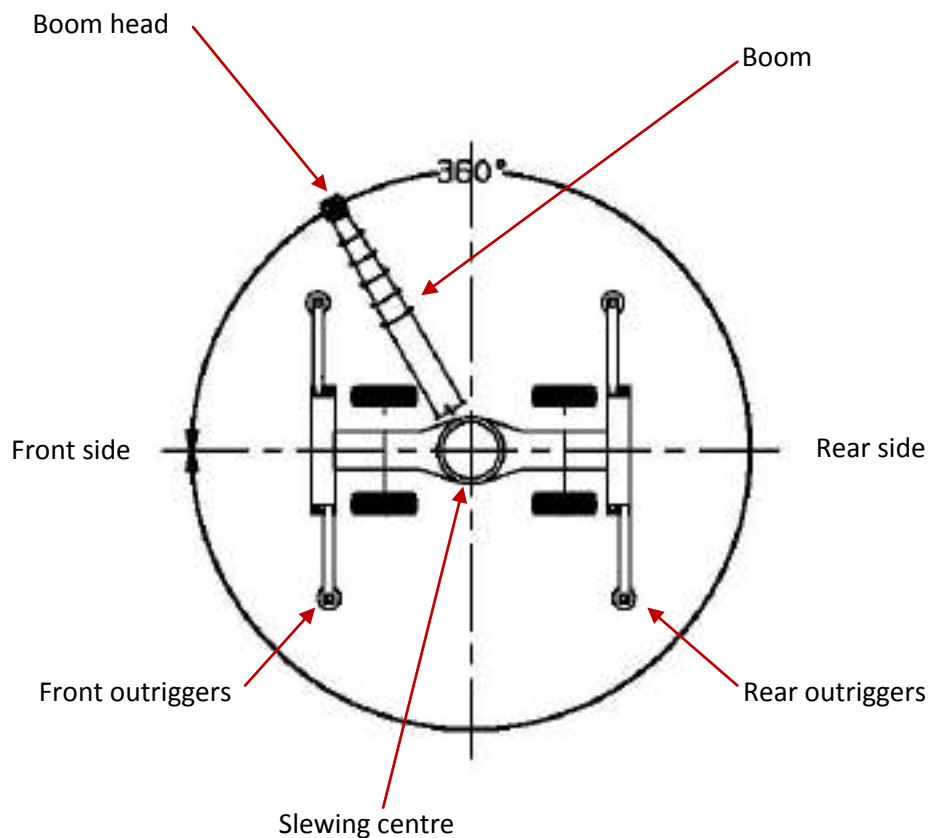


- *Properly program the Load Moment Indicator (LMI). For safety reasons it is advisable to keep the outriggers extended and the support feet detached 10-15 cm from the ground.*
- *Avoid swaying the load; perform the slewing manoeuvres with the load slightly detached from the ground proceeding very slowly.*
- *The working radius changes according to the compression of the tyres.*

The slewing manoeuvre with the suspended load should be performed taking into consideration the increasing of the working radius.

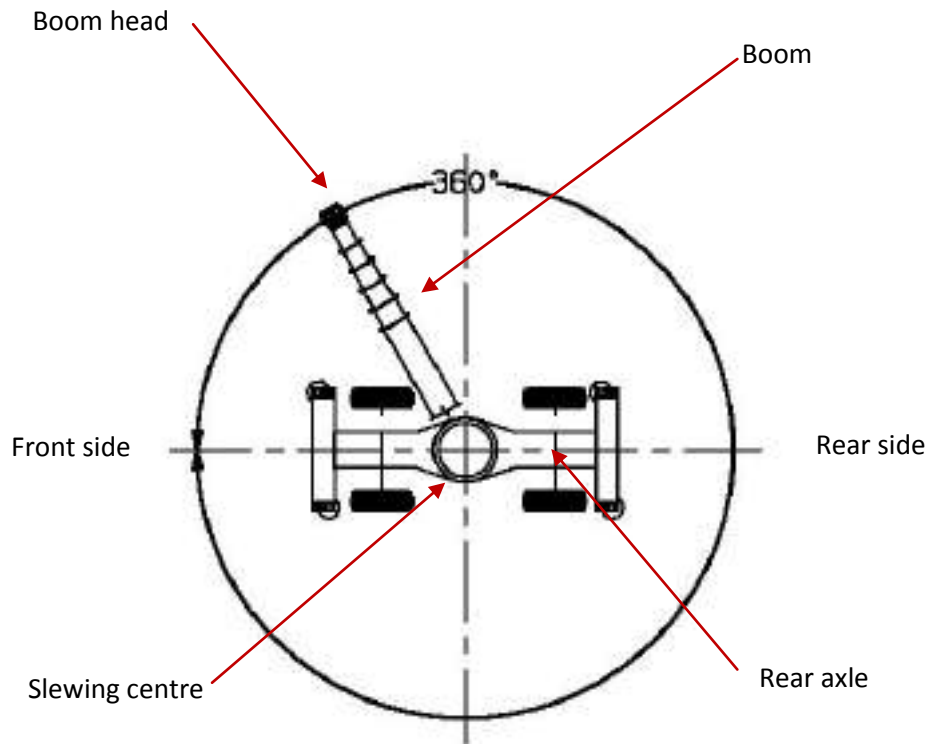
EXAMPLE: a load of 2,000 kg at 8 metres radius on the front of the crane can be lifted in a safe condition; when performing the slewing manoeuvre the load reaches the side of the vehicle, the load, due to the compression of the tyres will be at a larger radius of 8 metres and could bring the crane to a tip over.

5.6 Work area on outriggers



Operate with the outriggers extended to the desired position: retracted, middle position, fully extended.

5.7 Work area on tyres



To perform loads over 360° on tyres, there is a device that automatically locks the oscillating axle.

6 LOAD MOMENT INDICATOR (LMI)

The Tera8 Load Moment Indicator (from now on called LMI for short) is an electronic device designed to provide to the crane operator the information necessary to control the machine in safety conditions.

The LMI continuously, as the crane operational conditions change, supplies to the operator the information relating to angle and boom length, work radius, allowed load and total weight which can be lifted. When the crane is getting close to a dangerous condition, the LMI warns the operator with visual and acoustic signals and blocks the crane functions that may aggravate the safety conditions. In alarm conditions only the maneuvers that help to bring the crane back from the situation of danger are allowed.



- *The LMI is an auxiliary device that warns the crane operator of the approaching of overload conditions that may cause injury to the personnel or damage the equipment. The device is not and must not be used as a substitute for the operator's judgment and experience for a safe use of the machine. The crane operator remains the solely person who is responsible for the use of the crane in compliance with the safety regulations.*
- *Before starting to operate the crane, the operator must carefully read and learn the informations contained in this manual in order to be completely comfortable with the functions and the limits of the LMI and of the crane itself.*
- *The operator must be able to establish if the data provided by the LMI is correct and coherent with reality. He must also be able to use the data supplied by the indicator so that he can operate in safe conditions.*
- *The LMI, with it been an electronic device with many sensors, it can be subject to malfunctioning or defects. The operator must identify possible problems and take appropriate action: remove errors, if possible, or require the intervention of Locatelli's after-sales assistance.*

6.1 Important notes



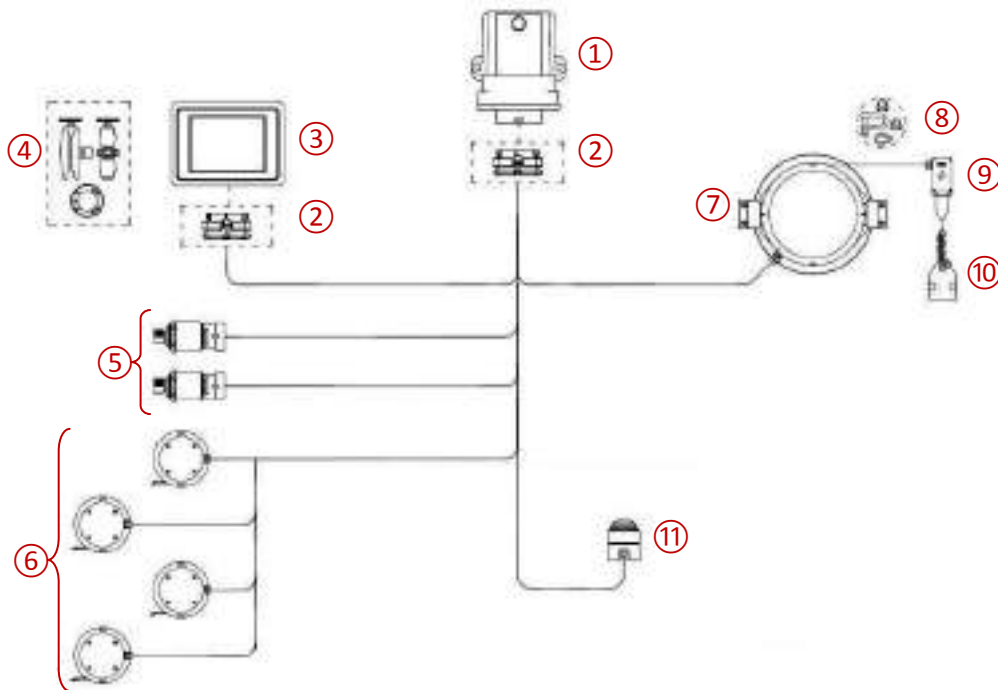
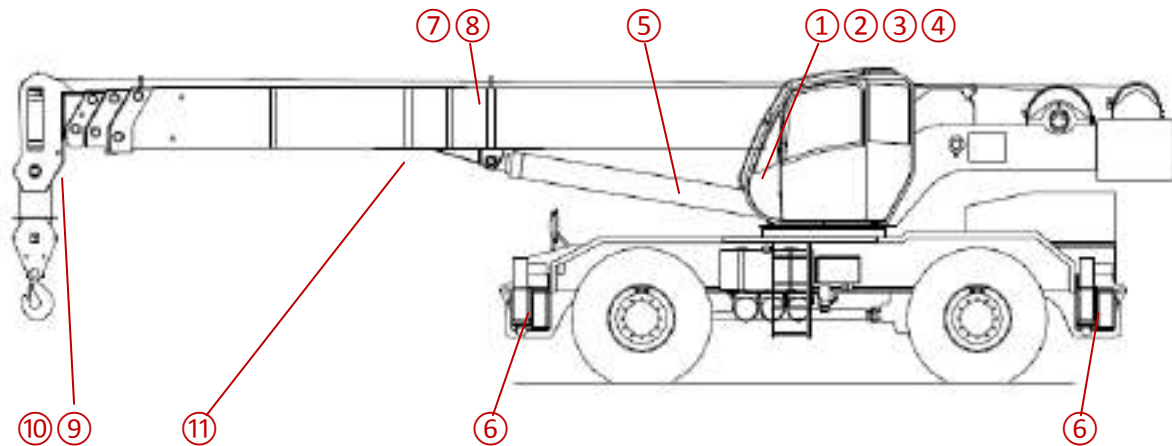
- *The correct functioning of the LMI is only possible if the operator has set the operative mode parameters and the number of falls that correspond to the actual status of the crane.*
- *In order to prevent from damage and serious or fatal injuries, it is necessary to verify that the LMI has been correctly set before starting to work with the machine, by lifting a known load and checking that there are no alarm messages or displayed indications, and that the stop maneuver device works properly.*
- *The LMI does not automatically change the settings under the varying of the operating conditions of the machine (load capacity charts). It has to be the operator, who is responsible for the variations of the operating modes of the machine, to modify them in the LMI system.*
- *Operational conditions change when:*
 - a. the number of rope sheaves changes (number of falls);*
 - b. the outriggers are extended or retracted;*
 - c. passing from operating on outriggers to operating on tires and vice versa;*
 - d. passing from operating in static conditions to operating on dynamic tires vice versa;*
 - e. manual lattice swing-away extensions are extended or retracted (telescopic);*
 - f. additional equipment is mounted or dismounted (lattices).*



- *The LMI is equipped with a self-diagnostic program which verifies the proper operation of the unit and of the transducers which are used. In case failure is detected, the LMI goes into a safety standby mode blocking the maneuvers.*
- *The LMI is equipped with an electronic key that temporarily excludes the limiter. During normal operation the key must be positioned so that the limiter is not excluded.*
- *The key must only be used in extreme cases: malfunctioning or dangerous situations that explain its use.*

The use of the electronic key is only permitted to authorized personnel and to all persons who are responsible for its use.

6.2 Layout of the system



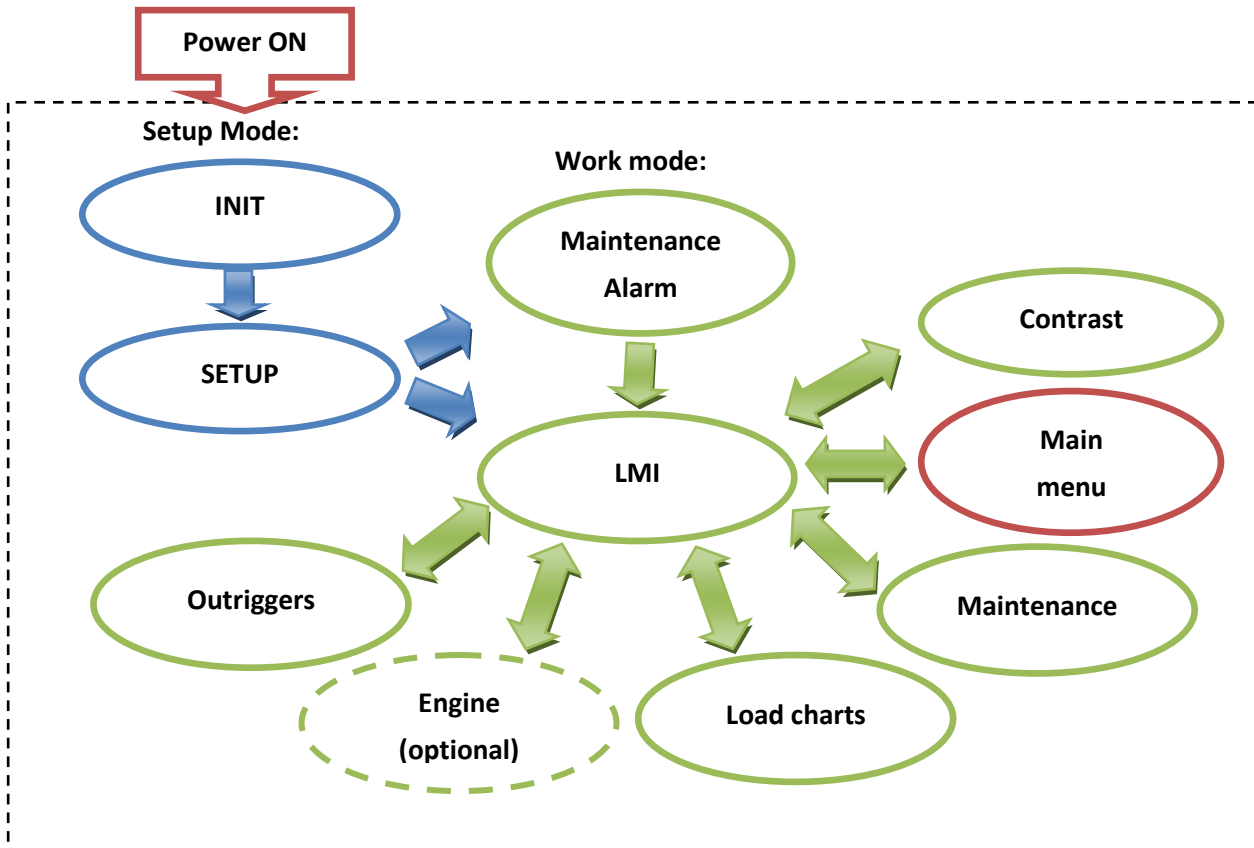
Rif	Descrizione
①	MIDAC+ main unit
②	Connector
③	TERA8 display
④	Bracket
⑤	Pressure transducer
⑥	Cable reel 2,5 m

Rif	Descrizione
⑦	Telescope cable reel 40 m AC MCP
⑧	Kit for AC MPC
⑨	A2B device
⑩	Weight and chain
⑪	Strobe beacon/red light + beeper

6.3 TERA8 pages

From the operative panel different languages allow the setting and visualisation of the information of the system.

6.3.1 Operative Pages



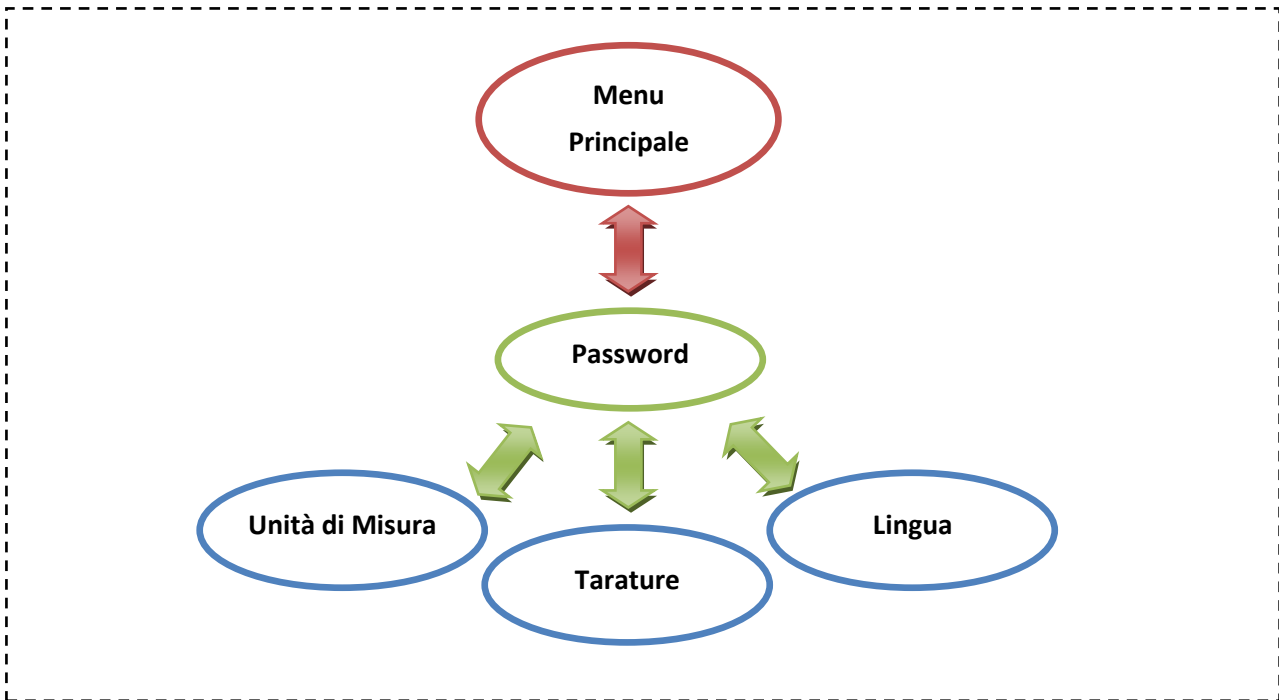
Setup Mode

- INIT screenshot: visualised for 5 seconds after the start-up, it is used to identify the software which has been loaded on the display device.
- SETUP screenshot: visualised automatically straight after the Initial Page, it is used to load the work settings (Machine Setup and Operative Mode). It is necessary to confirm the settings in order to access the Work Mode.

Work Mode

- LMI screenshot: used to monitor the actual state of the machine, the load percentages (SWL) and telescope, the system alarms.
- OUTRIGGERS screenshot: used to visualise the state of the outriggers.
- ENGINE screenshot (optional).
- LOAD CHARTS screenshot (optional).
- CONTRAST screenshot.
- DIAGNOSTICS MENU screenshot: used to visualise the inputs and the outputs.
- MAIN MENU screenshot: main page for the system settings. From the menu of this screenshot you access to the Setting, Configuration, Diagnostic, Data Logger and and Calibration screenshots of the system.

6.3.2 Diagnostics screenshots



Diagnostic screenshot

- DIAGNOSTICS MENU screenshot.
- INPUT STATE screenshot.
- OUTPUT STATE screenshot.

6.4 Initial screenshot (INIT)

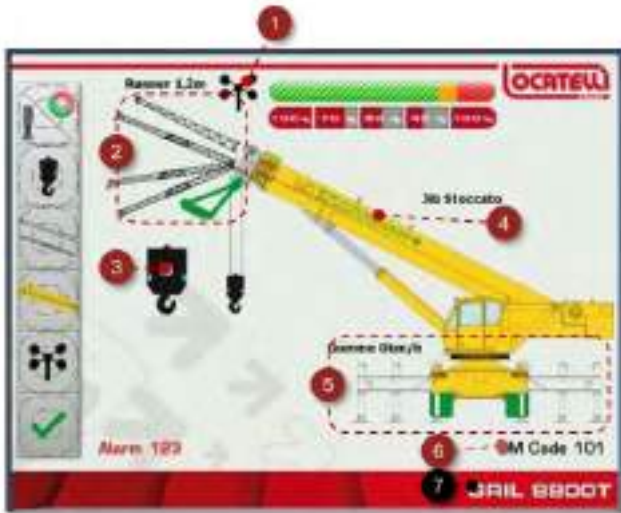
When the system starts-up, for the first 5 seconds the information about the software are visualised.



Ref	Description
1	Current time
2	Current date
3	Software version
4	Machine model
5	Series number

6.5 Setup screenshot

The Setup screenshot is automatically visualised straight after the Initial screenshot. In this screenshot you can set the configuration of the machine.



Ref	Description
1	Enabled anemometer
2	Main Boom/Lattice extension config.
3	Number of falls
4	Stowed lattice extension
5	Tire/Outrigger configuration
6	Current operative mode (automatic)
7	Machine model (automatic)

Machine Setup Buttons

Button	Description
	Tire/Outrigger configuration setting
	Number of falls setting
	Main Boom/lattice extension setting

Button	Description
	Stored lattice extension setting
	Enable/disable anemometer
	Confirm machine setup


6.5.1 Setup


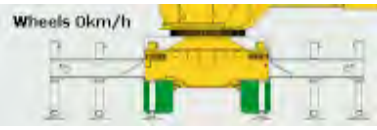
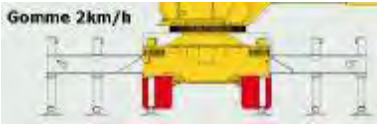
The system recognises the current operative mode and the model of the machine and automatically selects them.

- Set/modify the setup of the machine as described in the following paragraphs.
- Confirm by pressing .


The LMI main screenshot is visualised.


6.5.2 Outriggers/Tires

To change the configuration of the machine on tires/outriggers press .


Icon	Description
	Machine on outriggers
	Machine on static tires
	Machine on dynamic tires


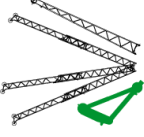



6.5.3 Number of falls

To select the number of falls press . The maximum number of falls depends on the operative mode.


Icon	Description
	Number of selected falls (example: 6)



6.5.4 Main Boom/Lattice extension

To select the work configuration with boom, lattice extension or runner press 

Icon	Description
	Main boom
	Runner
	9 meter extension <ul style="list-style-type: none"> • 0°
	10 meter extension <ul style="list-style-type: none"> • 0° • 30° • 45°
	17.5 meter extension <ul style="list-style-type: none"> • 0° • 30° • 45°

6.5.5 Extension storage


To select the position of the stored extension press 

Icon	Description
	Non stored extension
	Stored extension

6.5.6 Anemometer



To enable/disable the use of the wind sensor press .

Icon	Description
	Enabled anemometer

6.6 LMI screenshot

The LMI screenshot is the main screenshot where the information about the state of the machine are visualised.



Ref	Function
1	Hookblock heigh from ground [m]
2	Boom extension [m]
3	Boom angle [°]
4	Boom radius [m]

Ref	Function
5	Operative Mode Operative Mode code number taken from load charts.
6	Locking pins disengaged Spinatura OFF: boom locking pin disengagement indication.
7	Operative messages
8	Boom locking pins <ul style="list-style-type: none"> ◆ : boom locking pins disengaged (colour red); ◆ : boom locking pins engaged (colour green).

Ref	Function
9	A2B device state <ul style="list-style-type: none"> A2B: A2B engaged; BYPASS A2B: A2B bypass enabled.
10	Image area from camera
11	Work hour-counter [h]
12	Machine model
13	System current alarm code numbers

Icon	Description
	Telescoping The bar shows the percentage of the main boom extension. Red : boom extension percentage
	SWL The bar shows in percentage the lifted load in relation to the maximum allowed load that can be lifted (max 100%) Green: Regular (lifted load < 90%) Yellow: Pre-alarm (lifted load > 90% and <100%) Red: Blocked (lifted load > 100%)
	Crane Configuration <ol style="list-style-type: none"> 1. Main Boom/Lattice extension 2. Stored Lattice extension 3. Outriggers/Tires

Ref	Function
	Actual load [ton]
	Maximum load [ton] Indication of the applicable maximum load calculated according to the plant configuration
	LMI safety bypass warning light
	Wind speed 123 km/h

Ref	Function
	Hook-block number of falls Number of falls (e.g. 6). The maximum number depends on the selected operative mode.
	Turret position <ul style="list-style-type: none"> • : the turret is turned laterally or opposite to the drive direction; • : the turret is placed on the front of the machine.

Ref	Function
	Anti-2-block device <ul style="list-style-type: none"> • : A2B not engaged; • : A2B blocking; • : BYPASS A2B : A2B activ bypass.

Buttons

Button	Description
	Visualise the Setup screenshot
	Visualise the images taken from the camera
	Visualise the Load Carts screenshot (optional)

Button	Description
	Visualise the Engine screenshot (optional)
	Visualise the Outrigger screenshot
	Visualise the Main Boom screenshot

6.7 Outrigger screenshot




Ref	Function
1	Front left outrigger extension percentage
2	Rear left outrigger extension percentage
3	Front right outrigger extension percentage
4	Rear right outrigger extension percentage

Ref	Function
	Return to LMI screenshot

Ref	Function
	<p>Left side outrigger extension</p> <ul style="list-style-type: none"> Fully extended outrigger (100%) Partially extended outrigger (50÷99%) Retracted outrigger (0÷49%)

Ref	Function
	<p>Right side outrigger extension</p> <ul style="list-style-type: none"> Fully extended outrigger (100%) Partially extended outrigger (50÷99%) Retracted outrigger (0÷49%)



Ref	Function
	<p>Configuration on outriggers/tires</p>  <ul style="list-style-type: none"> • Machine on outriggers • Machine on static tires • Machine on dinamic tires



6.8 Load chart screenshot


This screenshot shows the load charts in PDF format.



Ref	Description
1	Actual load chart in PDF format.
2	Actual operative mode.
3	Outrigger extension [%]

Button	Function
	Scroll up
	Scroll down

Button	Function
	Scroll right
	Scroll left

Button	Function
	Return to LMI screenshot

6.9 Programmed maintenance screenshot



Ref	Description
1	Programmed maintenance table in PDF format

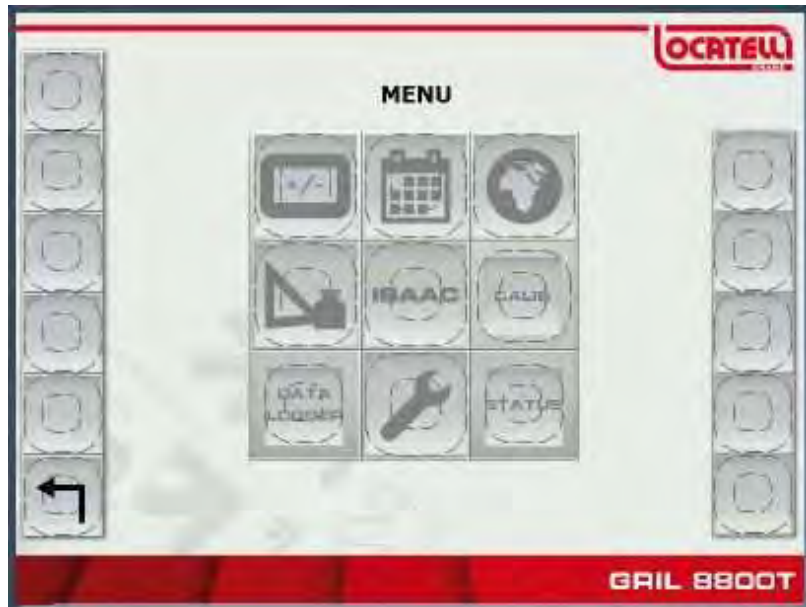
Button	Function
	Scroll right
	Scroll left
	Return to LMI screenshot

6.9.1 Maintenance alarm

This screenshot shows for 10 seconds, in the setup confirmation phase of the machine, if a programmed maintenance is empire. After which it the operative mode will return foreground (LMI screenshot).



6.10 Main Menu screenshot




Button	Function
	Not used
	Return to LMI screenshot
	Display Contrast Regulation screenshot






Functions accessible by password:

Button	Function
	Measure Unit
	Language
	Calibration

6.10.1 Display Contrast Regulation screenshot








Button	Function
	Contrast regulation display



Button	Function
	Not used
	Return to LMI screenshot
	Confirm machine setup
	Increase value
	Decrease value

6.11 Password

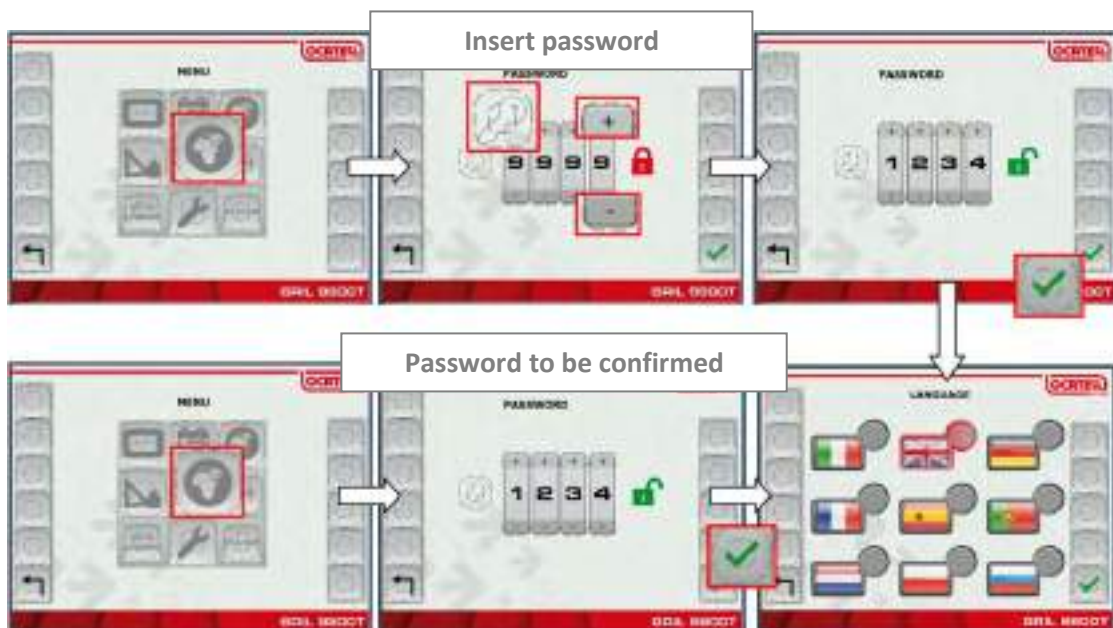


Button	Function
1	Password
2	Setup screenshot abilitation  Non confirmed/wrong password  Password ok

Button	Function
	Return to LMI screenshot
	Select menu
	Increase value














Button	Function
	Decrease value
	Confirm password

6.11.1 Setup access screenshot

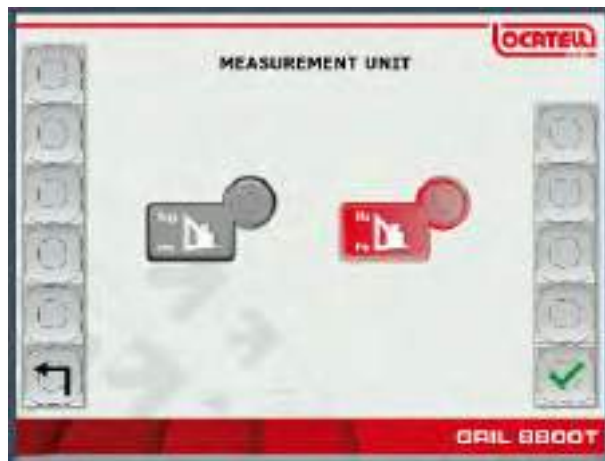


6.11.2 Language



Button	Function
	Return to LMI screenshot
	Select menu
	Set the language of the display: <ul style="list-style-type: none"> •  Italian •  English •  German •  French •  Spanish •  Portuguese •  Dutch •  Polish •  Russian
	Language setup

6.11.3 Measurement Unit screenshot



Button	Function
	Return to LMI screenshot
	Select menu
	Setup measure unit
	<p>Setup measure unit</p> <p> Metric System setup (kg - m)</p> <p> Imperial System setup (lb - ft)</p>

6.12 Controls before lifting the load

6.12.1 Preliminary inspection

Before activating the crane it is necessary to verify the electrical connections to make sure that the system is properly connected, in conformity to the configuration of the crane.

If the crane operates only with the main boom, without extension, additional connections are not necessary. But, if the crane works with a lattice swing-away extension mounted on the head of the boom, it is necessary to complete the following operations:

1. Disengage the anti-2-block cable connector from the junction box placed on the head of the boom and remove the anti-2-block switch with its weight.
2. Attach the connector for the lattice swing-away extension into the junction box on the head of the main boom.
3. Position the anti-2-block switch with its weight on the head of the lattice swing-away extension and attach the anti-2-block cable connector into the junction box placed on the head of the lattice swing-away extension.

6.12.2 Calibration controls and verifications

After having verified the electrical connections, to ensure that the system is properly connected for the configuration of the crane, the following verifications must be carried out:

1. Verify that the motion cut system (anti-2-block switch with its weight placed on the head of the boom or on the lattice swing-away extension) has been properly applied and is operational. With an even number of falls, the weight must slide through the portion of rope that ends with the rope anchorage on the head of the boom. With an odd number of falls, the weight must slide on the portion of rope that slides more slowly. In order to verify the correct function of the motion cut device, manually lift the weight connected to the anti-2-block switch. When the weight is lifted, the acoustic alarm starts ringing, the anti-2-block warning light must light up and the hoist lifting movement, the telescopic extension and the lowering of the crane boom must be blocked.
2. Check that the cable of the reel placed on the base of the boom is free to rotate, properly tensed and, once released, it winds up properly.
3. Verify that, with the boom completely retracted, the boom length shown on the display, is correct.
4. Verify that with the boom at the maximum inclination, the angle of the boom shown on the display corresponds to the value indicated by the work diagram.
5. Verify that with the completely retracted boom at its maximum inclination, the work radius shown on the display corresponds to the value indicated by the work diagram.
6. By lifting the hook-block, check that the value of the load shown on the display corresponds to the weight declared on the load capacity charts.



The performance verifications and tests that have been described, are necessary to prevent from damages of the machine and injuries of the personnel. The correct functioning of the system requires the completion of these tests before starting the machine. If the indicator and the acoustic alarm do not work as described and the movements of the crane are not interrupted, the system does not operate properly. It is necessary to repair the malfunction before using the crane.

6.13 Functioning

Once that the inspection has been correctly completed, the LMI is operational. The operator must be familiar with all LMI controls and know how to set the correct parameters before starting to operate the crane.

It is necessary to verify that the system is operating correctly by lifting a known load and comparing it to the information shown on the display of the LMI.

The allowable load comprises the weights of the hook-block, of the slings and of the auxiliary lifting devices. Their value must be subtracted from the allowable load value shown in the load capacity chart in order to obtain the maximum load that can be lifted.

6.14 Overload conditions

When the lifted load exceeds the limit value reported in the load capacity chart for the set work configuration the load limiter automatically blocks the boom extension, the hoist lifting and the boom lifting and lowering maneuvers. An acoustic alarm with start ringing.



In overload conditions it is possible to temporarily bypass the boom lifting maneuver block, in order to return into safety condition by pressing the push button (see §7.1.1, pos.62) on the operational console.



The push button allows to increase by 10% the maximum allowable lifting load in a given load configuration. The bypass button should be used with extreme caution and only if it is clearly needed. It should not be used to lift loads which are higher than those permitted by the load charts.

WARNING: *Improper use of this device can cause serious accidents.*



The functioning of this button is temporized. After about 6 seconds, even if the push button is kept pressed, the normal operation of the load limiter will be automatically restored. Any overload or exclusion of the limiter are stored in a data-logger internal to the system.

6.15 Maintenance

Daily maintenance of the LMI must include:

1. Inspection of electrical connections between the various devices that constitute the system. If some electrical cables should be damaged, they must be replaced immediately.
2. Verify that the anti-2-block weight moves freely.
3. Verify the correct tension of the reel drum cable placed on the base element of the boom.
4. Verify the presence of any oil leaks from the pressure transducers of the lifting cylinder and from the connection fittings or from the hoses pipes.

6.16 Load limiter exclusion



The machine is equipped with a load limiter exclusion device, placed inside underneath the cabin (accessible from the outside), which allows to perform the emergency maneuvers in case of failure of the system.

The exclusion device, activated by an override key, permits to re-enable the movements that have been blocked by the LMI for a pre-established amount of time, preventing however a continuous use.



The programmed functioning exclusion time is set at 5 minutes. An additional exclusion can only be repeated after 20 minutes.

To exclude the load limiter:

1. Insert the key into the exclusion device and turn it clockwise.
2. The exclusion of the LMI is indicated, not only by the exclusion indicator light on the display, but even by a warning device mounted externally on the boom which lights up and emits a continuous alarm tone to alert the operator and the nearby staff about the danger of the maneuver.



ATTENTION: *When the LMI is disabled by the override key, the speed of all crane operations (extension/retraction of the telescopic boom, lifting/lowering of the boom, lifting/lowering of the hook, slewing of the turret) are reduced to the 25% of the maximum speed (with the limiter active).*



ATTENTION:

- *It is forbidden to use the LMI exclusion device to lift loads that exceed the allowed capacities.*
- *The LMI exclusion device must be used only in case of system failure or in situations that justify its use.*
- *The use of the exclusion device is permitted only to authorized persons who are responsible for its use.*
- *Any overload or exclusion of the limiter is stored in a data-logger which is internal to the system.*
- *The activation override key of the exclusion device must not be left on board of the machine, but must be kept by duly authorized persons and responsible for its use.*

6.17 Alarms

The system recognises fails, errors and anomalies of the system.

In case the system records one of these conditions, the LMI arises in a safety state blocking the movements and visualising on the display the relative alarm or warning message (code number/description).

If more than one error is shown, the relative messages will be displayed cyclically in sequence. As soon as the error condition returns to normal, the system goes back to the operative mode.

Codice	Descrizione	Cosa fare
101	CRC Parameters Error verifying memory reserve for the parameters	Call for technical assistance!
102	CRC Program Error verifying memory reserve for the program	Call for technical assistance!
103	CRC Tables Error verifying memory reserve for the tables	Call for technical assistance!
104	CRC Run Error verifying memory reserve for the execution of the program	Call for technical assistance!
105	CRC Ram Error verifying Ram memory	Call for technical assistance!
110	Extension Sensor L1- CHA - Low Analog signal (cannel A) from the section1 extension sensor is below the lowest value allowed	<ul style="list-style-type: none"> • Check the functioning of the sensor • Check that the cabling is not interrupted If the alarm persists, call for technical assistance!
111	Extension Sensor L1- CHA – High Analog signal (cannel A) from the section1 extension sensor is higher than the maximum value allowed	<ul style="list-style-type: none"> • Check the functioning of the sensor • Check that the cabling is not interrupted If the alarm persists, call for technical assistance!
112	Extension Sensor L1- CHA - Min Reading (cannel A) from the section1 extension sensor is below the lowest value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
113	Extension Sensor L1- CHA - Max Reading (cannel A) from the section1 extension sensor is above the maximum value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
114	Extension Sensor L1- CHB - Low Analog signal (cannel B) from the section1 extension sensor is below the lowest value allowed	<ul style="list-style-type: none"> • Check the functioning of the sensor • Check that the cabling is not interrupted If the alarm persists, call for technical assistance!
115	Extension Sensor L1- CHB - High Analog signal (cannel B) from the section1 extension sensor is higher than the maximum value allowed	<ul style="list-style-type: none"> • Check the functioning of the sensor • Check that the cabling is not interrupted If the alarm persists, call for technical assistance!
116	Extension Sensor L1- CHB - Min Reading (cannel B) from the section1 extension sensor is below the lowest value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
117	Extension Sensor L1- CHB - Max Reading (cannel B) from the section1 extension sensor is above the maximum value	Check the functioning of the sensor If the alarm persists, call for technical assistance!

Codice	Descrizione	Cosa fare
119	Extension Sensor L2 - CHA - Low Analog signal (cannel A) from the section2 extension sensor is below the lowest value allowed	<ul style="list-style-type: none"> Check the functioning of the sensor Check that the cabling is not interrupted If the alarm persists, call for technical assistance!
120	Extension Sensor L2 - CHA - High Analog signal (cannel A) from the section2 extension sensor is higher than the maximum value allowed	<ul style="list-style-type: none"> Check the functioning of the sensor Check that the cabling is not interrupted If the alarm persists, call for technical assistance!
121	Extension Sensor L2 - CHA - Min Reading (cannel A) from the section2 extension sensor is below the lowest value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
122	Extension Sensor L2 - CHA - Max Reading (cannel A) from the section2 extension sensor is above the maximum value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
123	Extension Sensor L2 - CHB - Low Analog signal (cannel B) from the section2 extension sensor is below the lowest value allowed	<ul style="list-style-type: none"> Check the functioning of the sensor Check that the cabling is not interrupted If the alarm persists, call for technical assistance!
124	Extension Sensor L2 - CHB - High Analog signal (cannel B) from the section2 extension sensor is higher than the maximum value allowed	<ul style="list-style-type: none"> Check the functioning of the sensor Check that the cabling is not interrupted If the alarm persists, call for technical assistance!
125	Extension Sensor L2 - CHB - Min Reading (cannel B) from the section2 extension sensor is below the lowest value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
126	Extension Sensor L2 - CHB - Max Reading (cannel B) from the section2 extension sensor is above the maximum value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
146	Angle Sensor - CHA - MIN Reading (cannel A) from angle sensor is below the lowest value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
147	Angle Sensor - CHA - MAX Reading (cannel A) from the angle sensor exceeds the maximum value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
148	Angle Sensor - CHB - MIN Reading (cannel B) from angle sensor is below the lowest value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
149	Angle Sensor - CHB - MAX Reading (cannel B) from the angle sensor exceeds the maximum value	Check the functioning of the sensor If the alarm persists, call for technical assistance!
155	Error Difference Extension L1 Difference between the two readings (cannel A and B) of the section1 extension are too high	Check the corresponding extension values
156	Error Difference Extension L2 Difference between the two readings (cannel A and B) of the section2 extension are too high	Check the corresponding extension values
159	Error Difference Angle 1 Difference between the two readings (cannel A and B) of the boom angle are too high	Check the corresponding angle values

Codice	Descrizione	Cosa fare
164	Pressure Transducer 1 – Lower chamber - CHA - Low Signal (channel A) from the pressure transducer1 pad side is lower than the lowest value allowed	<ul style="list-style-type: none"> • Check that the cabling is not interrupted • Check the functioning of the transducer If the alarm persists, call for technical assistance!
165	Pressure Transducer 1 – Lower chamber - CHA - High Signal (channel A) from the pressure transducer1 pad side exceeds the maximum value allowed	<ul style="list-style-type: none"> • Check that the cabling is not short circuited • Check the functioning of the transducer If the alarm persists, call for technical assistance!
166	Pressure Transducer 1 – Lower chamber - CHA - Min Reading (channel A) from the pressure transducer1 pad side is lower than the lowest value allowed	<ul style="list-style-type: none"> • Check that the cabling is not interrupted • Check the functioning of the transducer If the alarm persists, call for technical assistance!
167	Pressure Transducer 1 – Lower chamber - CHA - Max Reading (channel A) from the pressure transducer1 pad side exceeds the maximum value allowed	<ul style="list-style-type: none"> • Check that the cabling is not short circuited • Check the functioning of the transducer If the alarm persists, call for technical assistance!
168	Pressure Transducer 1 – Lower chamber - CHB - Low Signal (channel B) from the pressure transducer1 pad side is lower than the lowest value allowed	<ul style="list-style-type: none"> • Check that the cabling is not interrupted • Check the functioning of the transducer If the alarm persists, call for technical assistance!
169	Pressure Transducer 1 – Lower chamber - CHB - High Signal (channel B) from the pressure transducer1 pad side exceeds the maximum value allowed	<ul style="list-style-type: none"> • Check that the cabling is not short circuited • Check the functioning of the transducer If the alarm persists, call for technical assistance!
170	Pressure Transducer 1 – Lower chamber - CHB - Min Reading (channel B) from the pressure transducer1 pad side is lower than the lowest value allowed	<ul style="list-style-type: none"> • Check that the cabling is not interrupted • Check the functioning of the transducer If the alarm persists, call for technical assistance!
171	Pressure Transducer 1 – Lower chamber - CHB - Max Reading (channel B) from the pressure transducer1 pad side exceeds the maximum value allowed	<ul style="list-style-type: none"> • Check that the cabling is not short circuited • Check the functioning of the transducer If the alarm persists, call for technical assistance!
173	Pressure Transducer 1 – Upper chamber - CHA - Low Signal (channel A) from the pressure transducer1 piston side is lower than the lowest value allowed	<ul style="list-style-type: none"> • Check that the cabling is not interrupted • Check the functioning of the transducer If the alarm persists, call for technical assistance!
174	Pressure Transducer 1 – Upper chamber - CHA - High Signal (channel A) from the pressure transducer1 piston side exceeds the maximum value allowed	<ul style="list-style-type: none"> • Check that the cabling is not short circuited • Check the functioning of the transducer If the alarm persists, call for technical assistance!
175	Pressure Transducer 1 – Upper chamber - CHA - Min Reading (channel A) from the pressure transducer1 piston side is lower than the lowest value allowed	<ul style="list-style-type: none"> • Check that the cabling is not interrupted • Check the functioning of the transducer If the alarm persists, call for technical assistance!

Codice	Descrizione	Cosa fare
176	Pressure Transducer 1 – Upper chamber - CHA - Max Reading (channel A) from the pressure transducer1 piston side exceeds the maximum value allowed	<ul style="list-style-type: none"> Check that the cabling is not short circuited Check the functioning of the transducer If the alarm persists, call for technical assistance!
177	Pressure Transducer 1 – Upper chamber - CHB - Low Signal (channel B) from the pressure transducer1 piston side is lower than the lowest value allowed	<ul style="list-style-type: none"> Check that the cabling is not interrupted Check the functioning of the transducer If the alarm persists, call for technical assistance!
178	Pressure Transducer 1 – Upper chamber - CHB - High Signal (channel B) from the pressure transducer1 piston side exceeds the maximum value allowed	<ul style="list-style-type: none"> Check that the cabling is not short circuited Check the functioning of the transducer If the alarm persists, call for technical assistance!
179	Pressure Transducer 1 – Upper chamber - CHB - Min Reading (channel B) from the pressure transducer1 piston side is lower than the lowest value allowed	<ul style="list-style-type: none"> Check that the cabling is not interrupted Check the functioning of the transducer If the alarm persists, call for technical assistance!
180	Pressure Transducer 1 – Upper chamber - CHB - Max Reading (channel B) from the pressure transducer1 piston side exceeds the maximum value allowed	<ul style="list-style-type: none"> Check that the cabling is not short circuited Check the functioning of the transducer If the alarm persists, call for technical assistance!
200	Pressure Difference – Lower Chamber Transducer 1 Difference between the two readings (channel A and B) of the pressure transducer 1 pad side is too high	<ul style="list-style-type: none"> Check low chamber pressure 1 transducer. Check the functioning of the transducer If the alarm persists, call for technical assistance!
201	Pressure Difference – Upper Chamber Transducer 1 Difference between the two readings (channel A and B) of the pressure transducer 1 piston side is too high	<ul style="list-style-type: none"> Check high chamber pressure 1 transducer. Check the functioning of the transducer If the alarm persists, call for technical assistance!
209	Scr1 fault (ch. A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
210	E2Prom Scr1 fault (ch. A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
211	Accelerometer fault (X-axis) from Scr1 (ch. A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
212	Accelerometer fault (Y-axis) from Scr1 (ch. A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
213	Accelerometer temperature alarm from Scr1 (ch. A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
214	5V output short circuit Scr1 (ch. A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
215	15V output short circuit Scr1 (ch. A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!

Codice	Descrizione	Cosa fare
216	A2B short circuited Scr1 (ch. A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
218	Scr1 fault (ch. B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
219	E2Prom Scr1 fault (ch. B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
220	Accelerometer fault (X-axis) from Scr1 (ch. B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
221	Accelerometer fault (Y-axis) from Scr1 (ch. B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
222	Accelerometer temperature alarm from Scr1 (ch. B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
223	5V output short circuit Scr1 (ch. B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
224	15V output short circuit Scr1 (ch. B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
225	A2B short circuited Scr1 (ch. B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
227	CANBus timeout 1 from SCR1 (channel A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
228	CANBus timeout 2 from SCR1 (channel A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
229	CANBus timeout 3 from SCR1 (channel A)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
230	CANBus timeout 1 from SCR1 (channel B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
231	CANBus timeout 2 from SCR1 (channel B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
232	CANBus timeout 2 from SCR1 (channel B)	<ul style="list-style-type: none"> Check the connection of the SCR sensor. Call for technical assistance!
245	Overload1	Release the lifted load Carry out the safety procedures
246	Overload2	
247	Overload3	
263	Rdn Encoder Encoder Redundancy Error	<ul style="list-style-type: none"> Check the connection of the Encoder
264	Timeout Encoder CANBus Encoder Communication Timeout	<ul style="list-style-type: none"> Check the connection of the Encoder

Codice	Descrizione	Cosa fare
267	Timeout IO-Core Cpu0 CANBus Encoder Communication Error of the IO-Core unit (cpu0)	<ul style="list-style-type: none"> • Check the connection of the IO-Core card • Call for technical assistance!
268	IO-Core Unit Timeout Cpu1 CANBus Encoder Communication Error of the IO-Core unit (cpu1)	<ul style="list-style-type: none"> • Check the connection of the IO-Core card • Call for technical assistance!
272	Pressure Trasducer 1 - Lower Chamber Out of range Signal from the pressure transducer 1 pad side out of range	<ul style="list-style-type: none"> • Check the connection of the low chamber pressure transducer • Call for technical assistance!
273	Pressure Trasducer 1 - Lower Chamber - CHA Invalid Reading (channel A) from pressure transducer 1 pad side invalid	<ul style="list-style-type: none"> • Check the connection of the low chamber pressure transducer • Call for technical assistance!
274	Pressure Trasducer 1 - Lower Chamber - CHB Invalid Reading (channel B) from pressure transducer 1 pad side invalid	<ul style="list-style-type: none"> • Check the connection of the low chamber pressure transducer • Call for technical assistance!
278	Pressure Trasducer 1 - Upper Chamber Out of range Signal from the pressure transducer 1 piston side out of range	<ul style="list-style-type: none"> • Check the connection of the high chamber pressure transducer • Call for technical assistance!
279	Pressure Trasducer 1 - Upper Chamber - CHA Invalid Reading (channel A) from pressure transducer 1 piston side invalid	<ul style="list-style-type: none"> • Check the connection of the high chamber pressure transducer • Call for technical assistance!
281	Pressure Trasducer 1 - Upper Chamber - CHB Invalid Reading (channel B) from pressure transducer 1 piston side invalid	<ul style="list-style-type: none"> • Check the connection of the high chamber pressure transducer • Call for technical assistance!
285	Extension Sensor L1 - Out of range Analog signal from the section1 extension sensor out of range	<ul style="list-style-type: none"> • Check the connection of the SCR sensor. • Call for technical assistance!
286	Extension Sensor L1 - CHA Invalid Reading (channel A) from the section1 extension sensor invalid	<ul style="list-style-type: none"> • Check the connection of the SCR sensor. • Call for technical assistance!
287	Extension Sensor L1 - CHB Invalid Reading (channel B) from the section1 extension sensor invalid	<ul style="list-style-type: none"> • Check the connection of the SCR sensor. • Call for technical assistance!
288	Extension Sensor L2 - Out of range Analog signal from the section2 extension sensor out of range	<ul style="list-style-type: none"> • Check the connection of the SCR sensor. • Call for technical assistance!
290	Extension Sensor L2 - CHA Invalid Reading (channel A) from the section2 extension sensor invalid	<ul style="list-style-type: none"> • Check the connection of the SCR sensor. • Call for technical assistance!
291	Extension Sensor L2 - CHB Invalid Reading (channel B) from the section2 extension sensor invalid	<ul style="list-style-type: none"> • Check the connection of the SCR sensor. • Call for technical assistance!
299	Angle Sensor - Out of range Analog signal from the angle sensor out of range	<ul style="list-style-type: none"> • Check the connection of the SCR sensor. • Call for technical assistance!
300	Angle Sensor - CHA Invalid Reading (channel A) from the angle sensor invalid	<ul style="list-style-type: none"> • Check the connection of the SCR sensor. • Call for technical assistance!
301	Angle Sensor - CHB Invalid Reading (channel B) from the angle sensor invalid	<ul style="list-style-type: none"> • Check the connection of the SCR sensor. • Call for technical assistance!

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7 ACCESSES TO THE CRANE

To get on board the crane there are different access ways.

The ladder on the left side of the crane allows the operator to access the control cabin. To climb aboard, the operator also has handholds placed on the mud guards.



To enter or exit the cabin, only use the appropriate ladder placed on the left side of the vehicle.



If the turret is opposite to the travel direction, to access the control cabin, use the ladder on the right side of the vehicle.

On all the accesses of the crane, there are gripping points to facilitate the ascent and the descent of the operator and/or authorised personnel.



- *The use of other access ways different from the ones that have been indicated, are prohibited because they could cause harm to people.*
- *Make sure to grab the handholds that are close to the accesses with both hands in order to have three points of support in getting on and off the crane.*
- *It is recommended, when performing maintenance on the vehicle, to use the slip resistant walkways to prevent falls.*
- *Do not walk on the edges, pipes or surfaces that are not particularly strong. Climb up and down from the crane only when it is completely stopped.*
- *Do not jump from the vehicle.*
- *Do not use the crane controls and the flexible pipes as handholds.*



Cabin access ladder (left side)



Handholds



**Machine access ladder
(right side)**

8 USE OF THE VEHICLE

8.1 Generalities



To ensure a longer life, a greater economy and best engine performance you must follow certain precautions:

- Do not run the engine for a long time at idle or at the maximum power.
- Stop the engine at the first sign of abnormal values signalled by the cabin instruments (see § 8.2 'Starting the engine').
- Check the oil and fluid levels as per the maintenance schedule (see 'Maintenance' chapter).



The engine exhaust fumes contain combustion products that can be harmful to health. Always start the engine and run it in a well-ventilated area. If this is not possible, convey the exhaust fumes outside.

8.2 Starting the engine



Before starting the engine, fasten your seat belt.

1. Lock the vehicle by operating the parking brake lever on the right hand side. When the parking brake is engaged, the lever is facing backwards.
2. Position the forward/reverse selector lever to neutral 'N'.
3. Check that the slow/fast gear selector is set to 'fast speed'.



The engine can only be started when the lever is in the neutral position 'N'



4. Insert the ignition key and turn it to the first position.

The system will automatically control the operation of the instrument panel, the warning/service indicators and the horn.

During the test, the "LOCATELLI" logo appears on the display for about 3 seconds while the warning lights light-up and an alarm buzzer starts beeping.

At the end of the test, in the absence of errors, the display will show 'NO ERROR' in the counter field on the main ignition screen shown here:



All the warning lights and horn should go off with the exception of the following warning lights:

- *Battery charge warning light:* the warning light stays on until the alternator generates power.
- *Engine pre-heating warning light:* the length of time the warning lights remains on varies according to the engine temperature.
- *Crane controls activation warning light.*
- *Fast gears engagement warning light (4x2).*
- *Parking brake on warning light.*



The presence of any previous engine failures is highlighted by a buzzer signal and the appearance of an error code of type 'EXXX.XX' (for fault codes see 'Maintenance' chapter).



In the event of a malfunction alert, stop the engine ignition and resolve the problem before trying to restart the engine.



Pressure alarm values of the brake circuits and engine oil are shown on the display, but they are not signalled by the blinking light or buzzer until after the engine has been started should the fault be still present.

5. Start the engine by turning the key further thus overcoming the resistance of the return spring. Keep the key in this position for a few seconds until full start-up, then release it.



Do not press the accelerator pedal while starting the engine. The Electronic Control Module (ECM) automatically provides the correct amount of fuel necessary for starting the engine.

If the engine does not start straight away, do not continue for more than 30 seconds with the ignition motor. If after 30 seconds the engine does not start, let the ignition motor cool down for 2 minutes before trying again. If the engine does not start after three attempts, consult the operating and maintenance manual and eliminate the defect before making a second attempt.

6. When the engine has started, check that the warning lights for the alternator, the converter oil temperature and the engine water temperature are off and no buzzer is sounding.

The alternator warning light will turn off within a few seconds after the engine has reached its normal speed. Check that the voltage shown on the master (see 'Crane controls' chapter) is between 24 and 28 Volts. If the warning light and buzzers corresponding to the alternator, the pressure and engine temperature do not turn off within 30 seconds, turn off the engine and resolve the problem before performing other start attempts.



Before starting make sure that there is no one working on, under or near the vehicle. Use the horn to warn people that you are about to start the engine.

7. Check that the warning light for the pre-heating of the engine spark plugs is on and that it goes out after a few seconds.
8. Once the cold start light has gone out, wait for 5 seconds before turning the key in the second position.



9. Turn the key in the second position and hold it in position for a few seconds and release it as soon as the engine starts.



Do not press the accelerator pedal while starting the engine. The Electronic Control Module (ECM) automatically provides the correct amount of fuel necessary for starting the engine.



If the engine does not start right away, do not continue for more than 30 seconds with the ignition motor. If after 30 seconds the engine does not start, let the ignition motor cool down for 2 minutes before trying again. If the engine does not start after three attempts, consult the operating and maintenance manual and eliminate the defect before making a second attempt.



After starting the engine, check that the warning lights and alarms are off. Do not move the vehicle until the alarm and the warning light for the brake air pressure are off.

8.3 Checks before starting-up the vehicle

Before you start to move the vehicle for travel on the road or in the work site:

- Check that the route that needs to be travelled has no low bridges, low power or telephone lines, or any other height restriction.
- Check the capacity of bridges before crossing them. The weight of the crane is shown on the plate of approval located in the cabin.
- Keep away from the edge of embankments, ditches, or soft ground.
- Do not carry passengers on board the vehicle.
- Maintain the speed limits allowed.
- Strictly adhere to the highway code.
- In accordance with road traffic laws relating to cranes on public roads, travel with the lights on, using warning flags and signs and using escort vehicles that precede and follow the vehicle.



Check that you have performed all scheduled maintenance procedures (see 'Maintenance' chapter).

1. Check that all outriggers are retracted and locked with the safety pin.
2. Check that the feet of the outriggers have been removed from the jacks and secured on the carrier in the special housings.

3. Check that the boom is correctly positioned on the front of the crane and the slewing locking pin is inserted.
4. Make sure that the boom extension and/or other optional accessories are properly housed and fixed in their appropriate housings.
5. Attention: if you are driving on the road, make sure that all boom sections are fully retracted and the boom is in the rest position.



Driving the vehicle without a load and the boom fully raised can cause the vehicle to tilt over.

6. Check that the hookblock is firmly secured to the front of the carrier (see § 8.6 'Securing the hookblock to the carrier').
7. Make sure that the wheels on the rear axle are aligned to the carrier and that the indicator light is off.
8. Check the inflation pressure of the tyres and the tightness of the wheel nuts.



The correct values of the inflation pressure of the tyres for working on site or for driving on the road and the tightening torque values of the wheel nuts are given on a sticker placed on all four sides of the carrier just above the wheels.

9. Check the fuel level.
10. Check the windscreen washer fluid level.
11. Check the fuel level in the heating tank.
12. Adjust the seat to fit the operator, so that, with your back against the backrest, you can fully press the pedals.



To adjust the seat, see the 'Crane controls' chapter.

13. Ensure that all cabin windows are clean.
14. Adjust the rear-view mirrors, as well as the mirror of the hoist, based on the physique and driving posture of the operator to ensure the best possible visibility from the cabin.
15. Fasten your seat belt.
16. Before driving on the road, select the appropriate push-button for the exclusion of the crane functions located in the cabin.



Before driving on the road, select the appropriate push-button for the exclusion of the crane functions. In this way low travel speed (4x4) will be automatically enabled.

The exclusion of crane functions must be done with the vehicle stationary.

17. Check that the gear lever is in the neutral position 'N'.



The engine can only be started when the gear lever is in the neutral position 'N'

18. Start the engine (see § 8.2 'Starting the engine').
19. Check that all warning lights - in particular headlights, direction indicator lights, side lights and stop lights, the flashing rotating beacon - are functioning properly.
20. Check the operation of the windscreen wipers, washers and horn.
21. With the engine running at normal speed, check on the master (see 'Crane controls' chapter) that the air pressure in the braking system reaches the correct operating values.



Do not move the vehicle until the pressure on the master has reached the correct operating values.

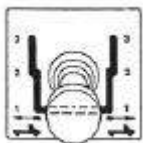
22. Check that the brake pedal is operating correctly.
23. Check that the warning light for the alignment of the rear wheels is on. If it stays off, operate the steering of the rear wheels via the control switch until the indicator light comes on.
24. Select the appropriate drive range: slow (4x4) or fast (4x2).



The transition from the slow drive range (4x4) to the fast drive range (4x2) and vice versa must be performed with the vehicle stationary.

Use the lower gears (4x4) only when greater traction is required.

25. Use a gear appropriate to the speed of the vehicle.



- Select the desired driving direction through the gear lever, bringing it from the neutral position 'N' to forward right for the forward gears, and forward left for reverse.
- To switch from one gear up to another, move the lever gradually forward until you reach the desired speed.
To downshift, reverse the movement of the gear lever.



Do not switch abruptly to a lower gear if the vehicle is travelling on the road at a speed greater than that permitted for the gear that you want to engage.

26. To move the vehicle from a stationary position, press the accelerator pedal and, at the same time, release the parking brake.



- *The indicator light for the parking brake must be turned off before moving the crane.*
- *Never let the crane move with the gear lever in neutral position 'N'.*
- *Only engage the reverse gear when the vehicle is completely stopped.*
- *When the engine is not running, the engaged gear has no braking effect.*

8.3.1 Additional warnings for driving on site with a suspended load.



The transport of suspended loads must only be carried out on flat, solid and horizontal ground. During the transport of loads on steep downhill ground, the increase in the working radius can cause overloading and the overturning of the vehicle.

1. Make sure the soil has a consistency suitable for supporting the maximum load borne by the wheels.
2. For safety reasons, extend the four outrigger beams, keeping the supporting feet slightly raised off the ground.
3. Refer to the load charts for handling on tyres to make sure that the load does not exceed the specified values.
4. Set the mode 'Capacities on tyres at 3 km/h' on the load limiter (LMI).
5. Set the correct number of falls (see 'Maintenance' chapter) on the Load Moment Indicator (LMI).
6. Lift the load, keeping it as close as possible to the ground, avoiding oscillations.
7. Select the slow driving range (4x4).
8. Engage a low-speed gear in the desired direction.

8.4 Engine warming

After starting, let the engine warm up by running it at idle speed for 3 to 5 minutes before applying a load. Slowly increase the engine speed to allow for proper bearing lubrication and stabilisation of the oil pressure.



Avoid abruptly accelerating the engine to shorten the warm-up phase.

8.4.1 Operating the engine at idle.



Idle running of the engine for prolonged periods causes, as a result of incomplete combustion, the formation of carbon deposits in the cylinders, the dilution of the lubricating oil with fuel, the seizing of the valves of the cylinder head and a reduction in performance.

8.4.2 Engine over-revving

Do not run the engine over the maximum control speed.

Take particular care to avoid over-revving during downhill driving or when shifting to lower gears.



Over-revving can cause serious damage to the bearings, pistons and valves of the engine.



Proceed to check the transmission oil level (see 'Maintenance' chapter. The specifications of the oil are given in 'Appendix A').

8.5 Stopping the engine

To stop the engine follow these steps:

1. Release the accelerator pedal.
2. Press the brake pedal.



The pedal acts on the brakes via a pneumatic valve. The braking effect on the wheels is proportional to the pressure exerted on the pedal.

3. Put the gear lever into the neutral position 'N'.
4. When the crane is stationary, engage the parking brake by pulling the lever all the way back.
5. Run the engine at idle speed for 5 minutes before turning it off to allow the lubricants and the coolant to dissipate heat.



Do not rev the engine before stopping.

6. Stop the engine by turning the key anticlockwise to the 'OFF' position and switch it off.
7. Disconnect the batteries by turning the switch for the batteries anti-clockwise.



The ignition key must not be left unattended in the vehicle.

8.6 Securing the hookblock to the carrier.

The hookblock is secured to a coupling plate on the front part of the crane by using a round sling.



*For road travel or site transfers the hookblock must be hooked to the carrier frame.
Check the condition of the rope of the round sling and replace it in the case of broken or crushed wires.*

To attach the hookblock to the carrier frame, proceed as follows:

1. Fully retract the boom.
2. Use an anchor shackle to secure the fastener round sling on to the carrier frame.
3. Raise the boom until the hookblock is vertically above the round sling.
4. Lower the hookblock and attach the shank hook to the round sling.
5. Move all personnel from the front of the vehicle.
6. Lower the boom to a height suitable for driving on the road while keeping the hookblock lifted from the ground.
7. Put the hoist in tension, until the hoist rope, the hookblock and the round sling are aligned.



Too much tension can cause the breakage of the round sling, with serious consequences for personnel.



Be careful not to damage the hoist rope during the operation.

To release the hookblock from the carrier frame, proceed as follows:

1. Loosen the ropes by using the hoist and, at the same time, raise the boom until it is vertical on the coupling point.
2. Remove the round sling from the shank hook.

8.7 Rear differential locking

The differential locking of the rear axle is standard on models 8700T and 8800T.

To prevent slippage of a wheel when it loses traction, the rear axle is equipped with a differential lock operated by a push-button placed in the cabin.

To lock the differential, press the push-button and keep it in this position until the drive returns.

The button automatically returns to the 'OFF' position once released, activating the switch-off of the differential lock.

The differential lock must be engaged only when the lack of drive is due to the presence of ice, snow, mud or other conditions of minimal traction.



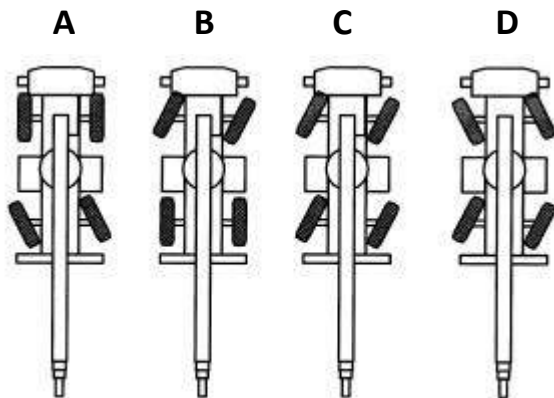
The insertion of the differential lock must be done with the vehicle stationary, with the 4-wheel drive engaged and the rear wheels aligned longitudinally.

Failure to follow these instructions can result in serious damage to the differential unit.

8.8 Steering

Steering can be carried out through the independent or combined use of the steering wheel and the rear steering control switch. The independent steering of the front and rear wheels allows you to alternately steer the front wheels only (A), the rear wheels only (B), the four crab wheels (C) and the four coordinate wheels (D).

A green light placed on the control column display lights up to warn the operator that the rear wheels are aligned.



- A. Front wheels steering;
- B. Rear wheels steering;
- C. Four-wheel crab steering;
- D. Four-wheel coordinate steering.

A. Front wheels steering

This is performed by turning the steering wheel. Turning the steering wheel clockwise the vehicle steers to the right; turning it anticlockwise the vehicle steers to the left.



If the turret is rotated on the rear side of the frame structure (engine side), the effect of the steering wheel is inverted.

B. Rear wheels steering

This is performed using the switch that is located on the left armrest of the seat. By moving the switch to the right, the rear wheels turn to the left steering the vehicle to the right. By moving the switch to the left, the rear wheels turn right steering the vehicle to the left. The movement of the wheels is proportional to the duration of the steering manoeuvre.

Releasing it, the switch returns to the neutral position.



The rear steering should only be used to improve the manoeuvrability in the working site. When driving on the road steering is only available in coordinated mode.

C. Four-wheel crab steering

This type of steering is obtained by using both steering controls (the steering wheel and the rear wheels steering switch).

For the four-wheel crab steering to the right:

Turn the steering wheel clockwise and simultaneously move the rear steering control switch to the left.

For the four-wheel crab steering to the left:

Turn the steering wheel anticlockwise and simultaneously move of the rear steering control switch to the right.



This way of steering allows you to move diagonally with a crab movement.

D. Coordinate steering

Even this type of steering is obtained by using both controls (the steering wheel and the rear wheels steering switch).

To steer the vehicle to the right:

- Turn the steering wheel clockwise and simultaneously move the rear steering control switch to the right.

To steer the vehicle to the left:

- Turn the steering wheel anticlockwise and simultaneously move the rear steering control switch to the left.



This steering system allows you to manoeuvre the crane in confined spaces.

8.9 Parking



To prevent the tipping over of the vehicle, causing serious damage to persons or property, before parking the crane make sure that the ground is solid and levelled, and that the machine is not near holes, depressions or soft ground.

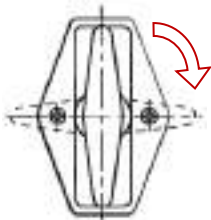
In order to park the crane:

1. Deposit the load on the ground.



Do not exit the cabin, leaving the suspended load hanging. Always lay the load on the ground before finishing the job.

2. Fully retract all the boom sections.
3. Lower the boom in the travelling position to keep the cylinder rod emerged in oil and protected.
4. Insert the slewing locking pin.
5. Fully retract the horizontal beams and the vertical jacks of the outriggers.
6. Exclude the controls of the crane by pressing the corresponding switch.
7. Park the crane on solid ground.
8. Stop the engine and remove the ignition key.
9. Close and lock all windows and the door.



10. Turn the handle of the battery switch horizontally to remove power from the vehicle.



Attention: to avoid damaging the electronic control unit of the engine before disconnecting the batteries, wait at least 60 seconds after turning off the machine.

11. Make sure that unauthorised personnel cannot operate the crane.

8.10 Transport of the crane on a trailer

Use trailers or platforms which are adequately dimensioned for the transportation and weight of the crane. The crane must be transported with the boom placed horizontally, the hookblock anchored to the frame structure, the slewing locked with the pin and the manual parking brake engaged. If the outriggers are not supported on the platform, verify that the horizontal beams are locked in order to prevent accidental extensions.

Rigidly fix the crane to the trailer by using chains or steel ropes.



The attachment points on the vehicle upon which it is possible to hook the steel ropes for a proper anchorage of the crane are indicated by the sticker you see here on the side.



Other attachment points which are not indicated are not to be used.

Make sure that the total height of the load is lower than the one permitted by the regulations in force, or by the motorway companies and, if necessary, that the transport permission and the road circulation certificates have been issued.



Never deflate the tyres in order to be within the overall dimensions.

To download the crane from the platform, perform the following procedure:

1. Check that the unloading ramps are able to withstand the weight of the crane.
2. Remove all chains and tying ropes.
3. Place the gear lever in neutral position.
4. Start the engine.
5. Fully retract the outrigger vertical jacks if they have been lowered for the transport.
6. Test the brakes.
7. Engage the reduced gear range and the first gear forwards or backwards as required.
8. Disengage the parking brake.
9. Slowly bring down the crane onto the ground.
10. Once the unloading is finished, stop the engine and engage the parking brake before leaving the cabin.



If the crane remains stuck, use a towing vehicle to release it thus avoiding any damage to the vehicle's transmission or axles.

8.11 Raising the vehicle for stowage

In order to raise the vehicle, follow these steps:

1. Extend the four outrigger beams by about 10-20 cm.
2. Sling the beams with chains or steel ropes that are able to withstand the weight of the crane.
3. Clear the work area of any personnel.
4. Raise the crane holding it as close as possible to the ground and make sure the vehicle is well balanced.
5. Move the crane slowly maintaining due care.
6. As soon as possible lower the crane until it is safely resting on the ground.

8.12 Refuelling

The fuel tank is placed on the left side of the vehicle, between the front and rear axles. Diesel fuel is injected through the filler neck, equipped with a lockable cap. The tank can be emptied via a drain plug located on the bottom of the tank itself. An indicator in the cabin indicates the fuel level in the tank.



Refuelling operations must be carried out carefully so that foreign particles or water don't get into the engine damaging it.



During the refuelling operation, keep the engine off, do not smoke and avoid naked flames.

8.13 Breakdown of the vehicle on public roads

The rules of the road require that when a vehicle stops on public roads, due to breakdown or for other reasons, the dangerous condition should be reported accordingly.

If the vehicle breaks down, the operator must observe the following procedure:

- Stop the vehicle, paying attention to traffic approaching from behind and park it in a safe location.
- If possible, do not stop in a tunnel or after a bend.
- Turn on the rotating beacons, lights and flashing indicators.
- Place the triangle as required by highway regulations.



Risk of accidents due to poor visibility: the triangle and the light signals must be clearly visible. Effectively circumscribe the parking area in order to avoid collisions, in particular in the proximity of bends.

- Try to repair the breakdown yourself. If this is not possible, contact the nearest service workshop or call roadside assistance.

8.13.1 Towing of the crane



- When towing use the attachment points of the carrier making sure that they are securely fixed before applying the pull.
- Do not remain in the vicinity of tow bars, ropes or chains that are under tension.

If the crane must be towed, observe the following precautions:

- The crane must be towed only with the use of a tow bar. The bar must be connected to the coupling devices on the carrier frame of the crane and to the hitch of the towing vehicle.

8.13.2 Towing with engine running

- When towing, the diesel engine must be running at idle speed.
- The gear lever must be in the neutral position.

8.13.3 Towing with engine failure

- The braking system has limited autonomy. You must then stop the vehicle and request the intervention of a roadside assistance vehicle.
- Try to repair any fault on the spot, otherwise proceed by towing the crane.
- To tow the crane, the parking brake must be released pneumatically.



Fig.1

- Connect the air intake of the towing vehicle with the external filler connection of the air tanks of the crane.
The filler connection (Fig.1) is set up on the air control unit mounted on the left side of the machine, near the air tanks.
- Ensure that the brake circuit pressure reaches at least 5.5 bar, so that the warning light goes off.

- Put the gear in neutral position.



If the towing distance is greater than 5 km, disconnect the cardan shafts from the front and rear axles.

- Release the parking brake. The parking brake warning light should go off. If after a few minutes the light doesn't go off, it means that the parking brake is broken.



Risk of accidents due to brake failure: the crane can be restrained only by the towing vehicle. Take the utmost care when towing.

- The towing vehicle must drive slowly as an abrupt or sudden movement may cause damage to the crane's carrier frame.



In these conditions, steering is very difficult: proceed at a reduced speed.

- Only brake if necessary.



During towing keep the air pressure of the tanks under control as it must not be less than 6.5 bar.

9 USING THE CRANE

9.1 General controls

Before operating the crane for the day's work, the operator must carry out a complete inspection of the crane to check that there is no structural damage, no loose parts, leaks, or other situations which may require an immediate fix to ensure safe operation.

1. Perform the checks required for starting the engine (see 'Use of the vehicle' chapter).
2. Check the fluid level in each of the two brake fluid reservoirs. Refill, if necessary.
3. Check the fluid level of the batteries, the contacts and for any signs of visible damage or corrosion. Add only pure distilled water. Check the closing caps of the elements.
4. Check that the tyres have no cuts, that tyre pressures are correct and that the bolts are tightened.



The correct tyre inflation pressure values for working on site or for driving on the road and the tightening torque values of the wheel nuts are given on a sticker placed on all four sides of the carrier just above the wheels.



Check that you have performed all scheduled maintenance procedures (see 'Maintenance' chapter).

5. Check that all lights are working, in particular the indicators and brake lights.
6. Visually inspect all ropes in order to evaluate their safety and the possible need for their replacement (see 'Maintenance' chapter).
7. Inspect the pulleys, protections, drums, etc., which come into contact with the rope, in order to consider whether there are conditions that could damage the rope.
9. Visually inspect the shank hook to ensure there are no cracks, cracking and any other obvious signs of damage. Make sure the safety latch is not damaged.
10. Make sure the extension is in good condition and is housed properly.
11. Check the operation of the oscillating axle lock. This check must be done by holding the outrigger beams extended and the vertical cylinders raised 10-15 cm off the ground, slew the turret by doing a full slewing and make sure that the axle locking cylinders are not subjected to any sudden failures.



If the automatic locking system of the rear axle does not work, it is forbidden to carry out slewing manoeuvres as the crane is not stabilised.

9.2 Checking functions without load

After having followed the steps for preparing the crane, check all of its functions without the load being applied.

Before you start operating, carefully read all the instructions regarding the operation of the crane:

- Carry out the checks by keeping the engine running at idle.
- Extend and retract the outrigger beams.
- Raise, lower the boom, slew the turret to at least 45° to the right and to the left.
- Extend and retract the boom.
- Raise and lower the hookblock several times, at different boom lengths.
- Make sure the rope is not twisted.
- Check the locking of the oscillating axle.
- Check the operation of the hookblock limit switch device (A2B) and the hoist limit switch.
- Check the operation of the Load Moment Indicator (LMI) by stopping movement.
- Set the program corresponding to the crane configuration (e.g.: on outriggers or on tyres, etc.).

9.3 Derricking hookblocks

Before you sling the load, make sure the shank hook spring safety latch has no obvious signs of wear.

Check before derricking up that the load is perfectly aligned with respect to the hookblock.

Lifts should never be carried out if they exceed the maximum capacity of the hookblock, indicated by the special plates placed on the same and stamped on the shank hook.

Hoisting with jolts is not allowed.

Keep in mind that the crane must work at temperatures between -20 and + 50°C.

Any changes of any kind made to the hookblock and the shank hook (welds are prohibited especially on the latter) relieves the manufacturer of all liability.

9.4 Operations with the crane

9.4.1 Checks before work on outriggers

Before you start working with the crane on outriggers, carry out the following checks:

1. Perform the checks required for starting the engine (see 'Use of the vehicle' chapter).
2. Check that all the outrigger beams are extended to the required length.
3. Check that the support feet of the outriggers are centred and supported so that the pressure exerted by the outriggers during work operations can never exceed the bearing capacity of the ground.
4. Check that all the wheels are raised off the ground.
5. Check that the crane is horizontally level with the ground using the bull's eye spirit level in the cabin.
6. Check that the code of the operating mode in which the crane is working is set correctly and that the relevant table number is visible on the LMI display.
7. Check that the number of rope bearing sections (falls) is set correctly on the LMI.
8. Check that the contrast of the LMI display is set to facilitate reading the data.
9. Check that the operator's seat is properly adjusted (see 'Crane controls' chapter).
10. Check that the operator's seat belt is fastened.
11. Check that all rear-view mirrors for monitoring the outriggers are adjusted correctly.
12. Check that the electrical system (floodlight, windscreen washer system, wipers, horn, etc..) has been checked for correct operation.

9.4.2 Checks before work on tyres

Before you start working with the crane on tyres, carry out the following checks:

1. Perform the checks required for starting the engine (see 'Use of the vehicle' chapter).
2. Check that the bearing capacity of the ground is sufficient to support the maximum load on the wheels.
3. Check that the tyre pressure is correct



The correct values of the inflation pressure of the tyres for working on site or for driving on the road are given on a sticker placed on all four sides of the carrier just above the wheels.

4. Check that all the outrigger beams are extended for safety and that the support feet of the outriggers are lowered and maintained slightly raised from the ground.
5. Check that the number of rope bearing sections (falls) is set correctly on the LMI.
6. Check that the contrast of the LMI display is set to facilitate reading the data.
7. Check that the code of the operating mode in which the crane is working is set correctly.
8. Check that the operator's seat is properly adjusted (see 'Crane controls' chapter).
9. Check that the operator's seat belt is fastened.
10. Check that all rear-view mirrors for monitoring the outriggers are adjusted correctly.

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11. Check that the electrical system (floodlight, windscreen washer system, wipers, horn, etc..) has been checked for correct operation.

9.5 Work manoeuvres

9.5.1 Outriggers

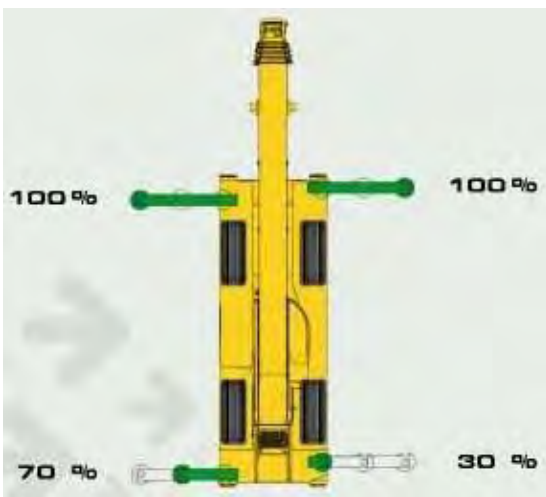
The crane's stabilisation system is made up of four horizontal beams which, electro-hydraulically driven, that can be completely or partially extended or retracted.

A vertical cylinder is mounted at the end of each beam. These cylinders are used for lifting, lowering and horizontally levelling the crane.

The crane can operate with three different openings of the outriggers. Each configuration corresponds to a certain lift capacity chart:

- capacities on fully extended outriggers (100%);
- capacities on outriggers in an intermediate position (50%);
- capacities on fully closed outriggers (0%).

9.5.2 Configuration of the outriggers



The configuration is correctly set when on the display of the LMI, on the Outrigger screenshot (see § 8.7), the positions of the outrigger beams are visualized, highlighted in green, with the relative beam extension percentages. Adhesive yellow strips are placed on the sides of the beams visually helping to determine the fully extended (100%), partially extended (50%) or completely retracted (0%) beam.



If one or more beams, front or rear, are not in one of the pre-determined positions (0%, 50% or 100%) the LMI system automatically limits the load capacities of the crane, for safety reasons, by considering the beam completely retracted.



If only one beam is positioned at a different extension from the other beams, the LMI system would automatically limit the capacities to the more conservative capacity configuration of the crane.

Example: *three beams extended to 100% and one to 95%. The program will enable the configuration corresponding to 50%.*

ATTENTION: *For a correct use of the crane on outriggers, the following conditions must be complied with:*

- *All outrigger beams extended at the opening specified in the relevant lifting capacity chart, the jacks lowered and the wheels fully raised off the ground.*



- *The crane levelled on firm and flat ground (check the levelling of the crane with the bull's eye spirit level in the cabin).*



- *The jacks centred on the support feet and secured with locking bolts and their safety stops (depending on the nature of the terrain, ensure that a support is placed under the outriggers to increase the support surface).*

9.5.3 Positioning of the crane

- Position the crane in order to operate with the lowest working radius possible.
- Check that there is sufficient distance between the crane and any levees, embankments, ditches, power lines or other obstacles that may be in the work area.
- Make sure the soil can withstand the pressure caused by the outriggers. Avoid soft, unstable or partially frozen ground.



ATTENTION: *the ground can withstand a definite specific pressure.*



- The outrigger feet transfer the reaction forces to the ground. If the specific pressure of the support feet is greater than the maximum allowable pressure of the ground, you have to increase the support area using properly sized plates which are to be placed under the feet of the outriggers.

The support surface required may be calculated according to the specific pressure of the soil and the reaction load of the outrigger:

$$A = \frac{F \times 1000}{P \times 98.1}$$

In which:

A = area of the support surface [cm²]

F = reaction load imposed on the outrigger [T]

P = specific pressure of the ground [daN/cm²]

- The value (F) of the maximum reaction that occurs on the outrigger is shown in the "Important notes" that accompany the load charts.



For special cases, ask the manufacturer for the reaction value.

The following table gives the values of the specific pressures for different types of terrain.

ALLOWABLE PRESSURES TO THE SOIL (extract from DIN 1054):

SOIL TYPE	daN/cm ²
a) Backfill, not compacted	0 – 1
b) Natural plot, intact	
1. Mud, peat, marshy	0
2. Non-aggregated land but sufficiently solid:	
• Fine to medium sand	1.5
• Large grain sand - gravel	2.0
3. Cohesive land:	
• Springy	0
• Soft	0.4
• Compact	1.0
• Semi rigid	2.0
• Hard	4.0
4. Solid rock with a few crevices, in good condition, not eroded and with good stratification:	
• With homogeneous layers	15.0
• Compact stratification or in columns	30.0



ATTENTION: in case of doubt about the soil solidity it is advisable to perform a test to determine its consistency.

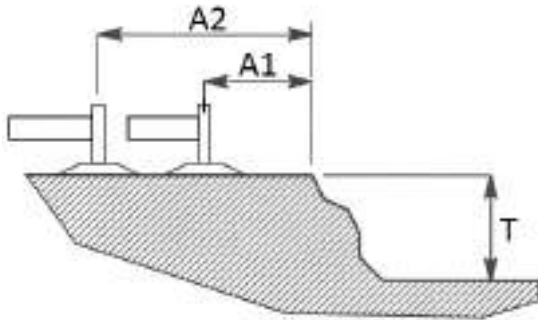
Do not operate if you do not know the solidity of the ground in the area where you intend to stabilise the crane.



Danger of overturning if the crane is working on a slope. In fact, when the boom is rotated in the direction of the slope, there is an increase in the working radius which can create an overload and the crane can overturn. For example, a crane with a boom of 30 m and a working radius of 10 m when levelled, in a tilted position of 5° undergoes an increase in the working radius of 2.5 m.

9.5.4 Safety distance from excavations and ditches

The crane must not be placed on soft soil or near embankments or excavations, because the ground could give way. It is necessary to maintain a safe working distance in relation to the type of terrain by following these rules of thumb:



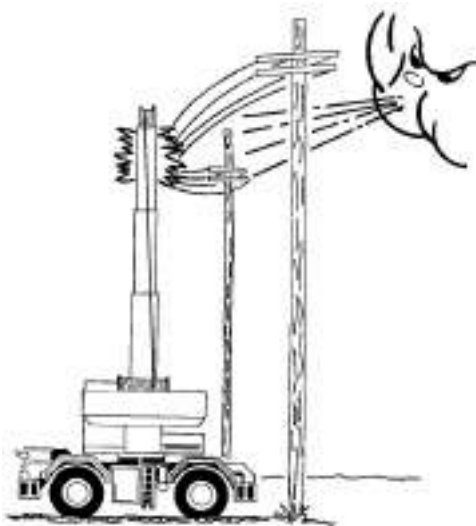
- *Backfill or not very compact ground:*
the safety distance A2 must be twice the depth of the ditch T
 $A2 = 2 \times T$
that is, if T = 1m then A2 must be = 2m
- *Solid ground:*
the safety distance A1 is equal to the depth of the ditch T
 $A1 = 1 \times T$
that is, if T = 1m then A1 must be = 1m

If the crane is working near an excavation or if you cannot keep at a safe distance, the excavation must be underpinned or filled with earth to prevent landslides.



Do not stabilise the crane on soft soil or near holes or channels to prevent overturning of the machine, resulting in harm to persons or property.

9.5.5 Safety distance from the power lines



It is very dangerous to operate the crane in the vicinity of power lines.

Before starting the job, for safety reasons, ask the entity responsible for the power lines to disconnect the power. In any case, position the crane in such a way that the load, the boom or any part or accessory of the machine maintains a safe distance of at least six metres from overhead lines or powered electrical equipment.

In the evaluation of the safety distance you must also take into account the oscillation amplitude of the electric lines as a result of wind.

Electrical discharges between the voltage lines and the metallic parts of the crane can also occur in the absence of a direct contact if the minimum safety distance is not respected.



Always keep a safe distance. An electric shock can cause serious or fatal injury.

- Always proceed slowly, cautiously and carefully and with the utmost attention.
- Keep the work area free from personnel not required for operations.

- Ensure that no worker involved in the manoeuvring of the load touches the crane or the load, so to prevent, in the event of accidental contact with power lines, serious injury or death.
- If, despite all precautions the crane should come into contact with live electrical lines, the operator must:
 - Stay inside the crane cabin.
 - Immediately notify personnel so that they keep at a distance and do not touch the crane or the load.
 - If the crane is able to operate, immediately move the contact parts of the machine from the live electrical line.
 - If the machine is no longer operating and you need to leave the cabin, jump from the crane in a single bound, being careful never to touch the crane and the ground simultaneously.
 - On the ground, move away with very short steps or by jumping with both feet together.



ATTENTION: Do not use the ladder to get down to the ground.

- If the crane is working on tyres, and should it be able to operate, immediately remove the contact parts of the crane from the live power line and provide for the replacement of the tyres.



After contact with a power line, tyres with a metal carcass no longer retain their mechanical resistance and insulating qualities. Very often, tyres burst, if not on contact, at a later time, after a short movement of the vehicle or after prolonged exposure to the sun.

9.5.6 Procedure for extending the outriggers

1. Extend all outrigger beams to the requested opening. Check the position on the display of the LMI.
2. Fully extend the vertical cylinders and make sure that the crane is level and that all four wheels are raised off the ground.

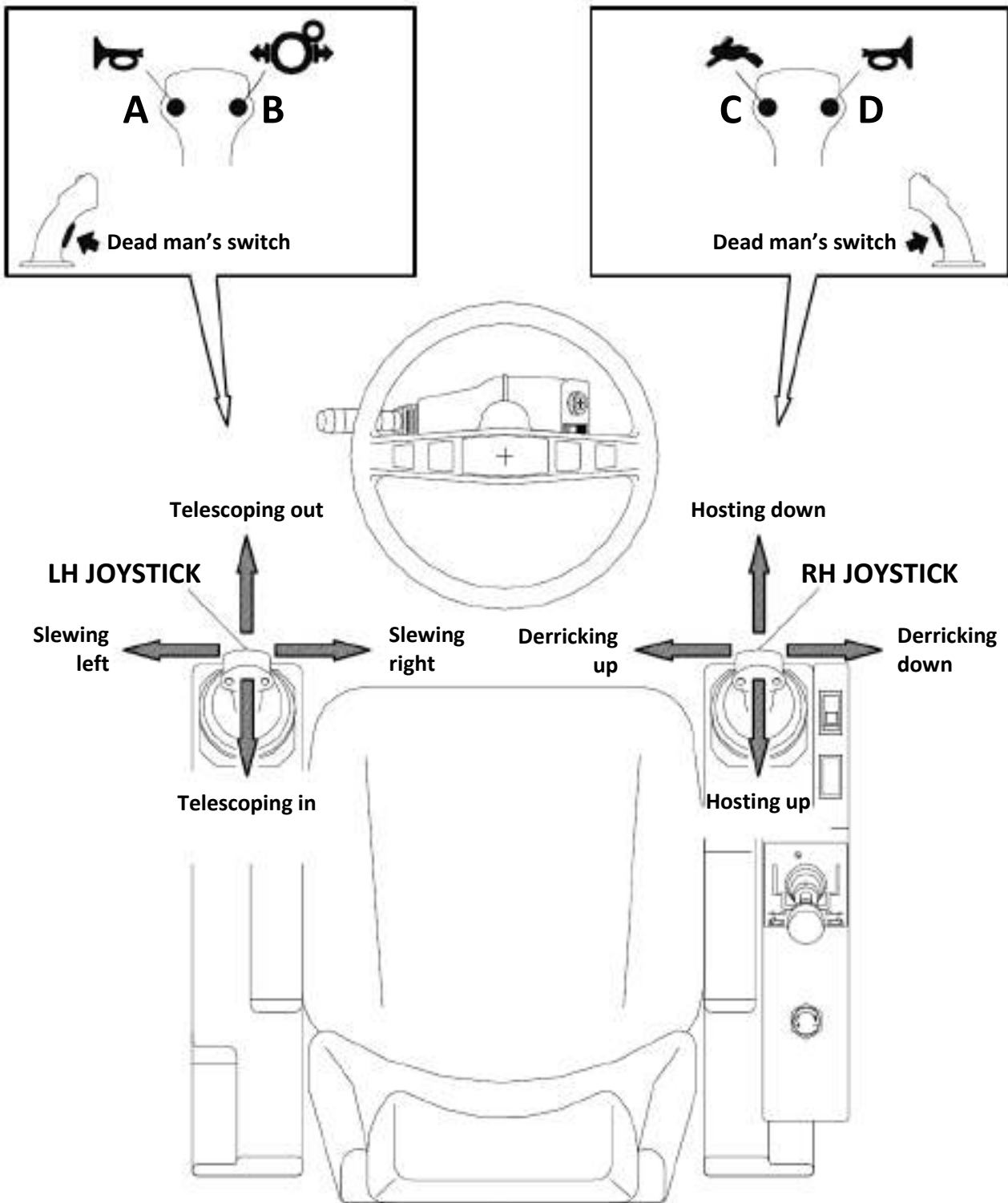
9.5.7 Procedure for retracting the outriggers

1. Fully retract the vertical outrigger cylinders.
2. Fully retract the outrigger beams.
3. If the vehicle has to travel by road put the support feet back to the transport position and lock them with the safety pins.



For road travel it is compulsory to secure the beams with the dedicated pins.

9.6 Crane controls



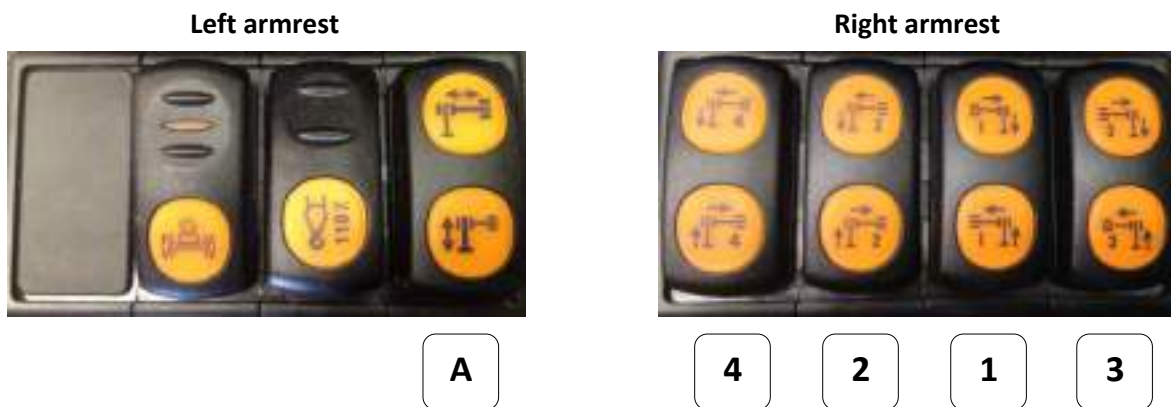
9.6.1 Outrigger controls

Each outrigger is composed of a horizontal cylinder, which controls the extension or the retraction of the beam, and a vertical cylinder (jack) which enables the lifting and levelling of the crane.

The horizontal beams and the outriggers jacks are controlled by push-buttons located on the two armrests of the seat.

Press and hold the selector switch for the beams/jacks (A), to choose whether to operate the horizontal beam or the vertical cylinder, then move the outrigger by holding the corresponding command button 1, 2, 3 or 4 to the planned extension.

The beams or jacks can be controlled individually or simultaneously.



A	Beams/jacks selector switch.	Beams selection
		Jacks selection
1	Front right extension/retraction outrigger control push-button.	Beam/jack extension
		Beam/jack retraction
2	Front left extension/retraction outrigger control push-button.	Beam/jack extension
		Beam/jack retraction
3	Rear right extension/retraction outrigger control push-button.	Beam/jack extension
		Beam/jack retraction
4	Rear left extension/retraction outrigger control push-button.	Beam/jack extension
		Beam/jack retraction



The movement of the beams or jacks may cause an accident when this happens outside of the operator's line of vision.

Closely monitor the movements of outriggers during operation.



During work operations check the pressure exerted by the outriggers on the ground.

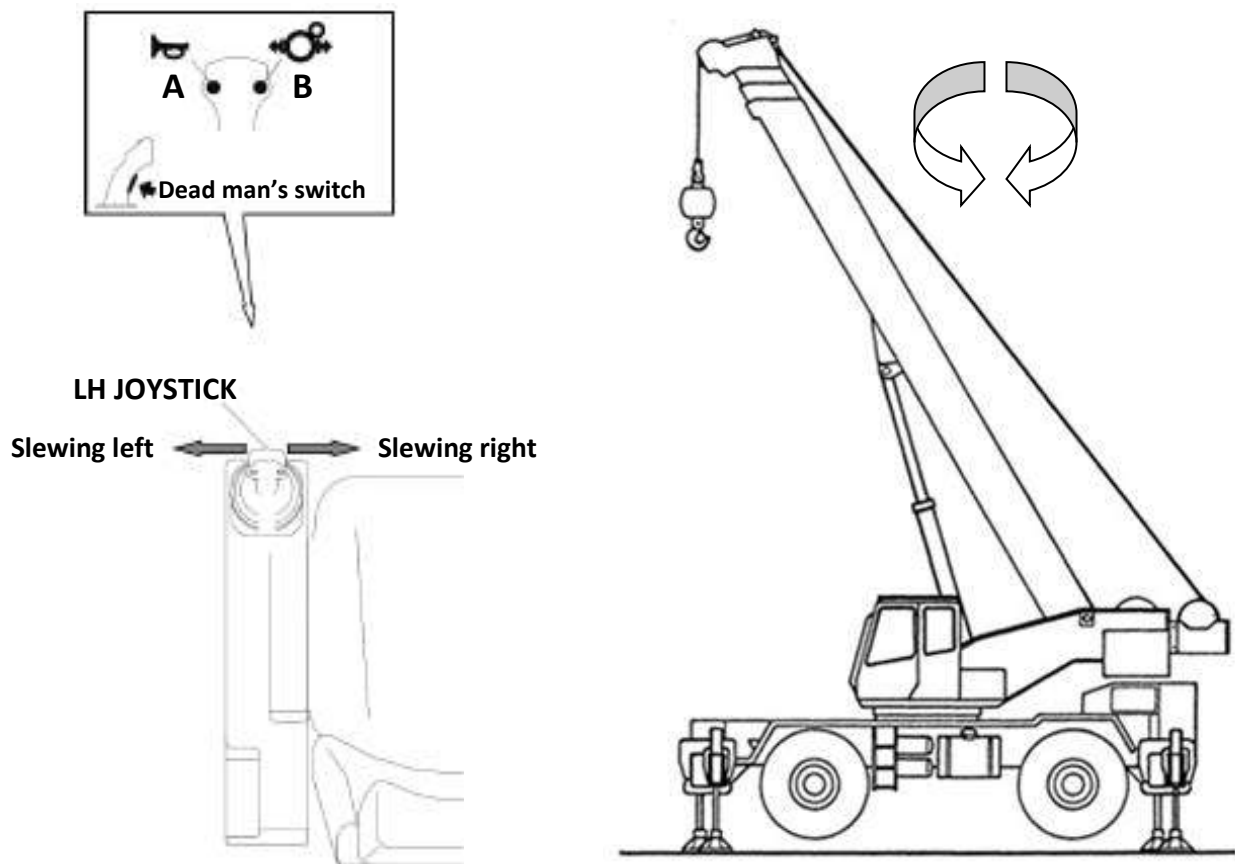


The extension of the beams on the right side of the crane can be controlled through the rear view mirror on the carrier frame, after raising the boom.



Before extending the outrigger beams make sure that you have removed the locking pins.

9.6.2 Superstructure slewing



- To rotate the turret clockwise hold the dead man's switch on the left joystick while moving the handle to the right.
- To slew the turret anti-clockwise hold the dead man's switch of the left joystick while moving the handle to the left.
- Use the joysticks by always exerting a slight and constant pressure on them.
- To decrease the slewing speed, move the handle closer to the neutral position or reduce engine speed by using the accelerator.
- To increase the slewing speed, move the handle away from the neutral position or increase engine speed by using the accelerator.



To stop slewing, avoid sharply reversing the slewing direction by pushing or pulling the control handle in the opposite position via the neutral position. The slewing movement is stopped gently by releasing the control handle.

9.6.3 Slewing speed controller

A slewing speed controller for the turret, mounted on the right side of the operator's seat, enables you to select the most appropriate slewing speed for the boom length and load applied.

- Turn the knob clockwise to increase the slewing speed.
- Turn the knob anti-clockwise to decrease the slewing speed.

- If the knob is turned fully anti-clockwise to the limit switch, the slewing is locked.

9.6.4 Free slew



- *To achieve free slew, and thus exclude the slewing brake of the turret, press and hold the left push-button of the left joystick.
This procedure allows you to better position the boom on the vertical axis of the load to be lifted.*
- *The automatic locking of the rear axle oscillation is activated when the boom slews out from the longitudinal axis on the front of the crane.*



The slewing brake is not engaged until the push-button is pressed.



ATTENTION:

- *Before slewing the boom make sure that the work area is clear of people or objects.*
- *Before slewing the turret, use the horn to warn personnel that you are about to perform the manoeuvre and make sure everyone is at a safe distance.*
- *Before slewing with a load, check the load chart for the maximum load allowed for the radius, the length and angle of the boom which you want to operate.*
- *Ensure that the slewing locking pin is engaged.*
- *Make sure that the load is freely suspended.*
- *When working on tyres, before starting the slewing ensure that the oscillating axle is locked and the warning light is turned on.*



*The working radius changes in accordance with the strain on the carrier frame and the tyres.
When you perform the slewing manoeuvre ensure that the increases in radius resulting from the strain on the tyres do not exceed the values stated in the load chart.*



It is prohibited to drive with the load on the side.

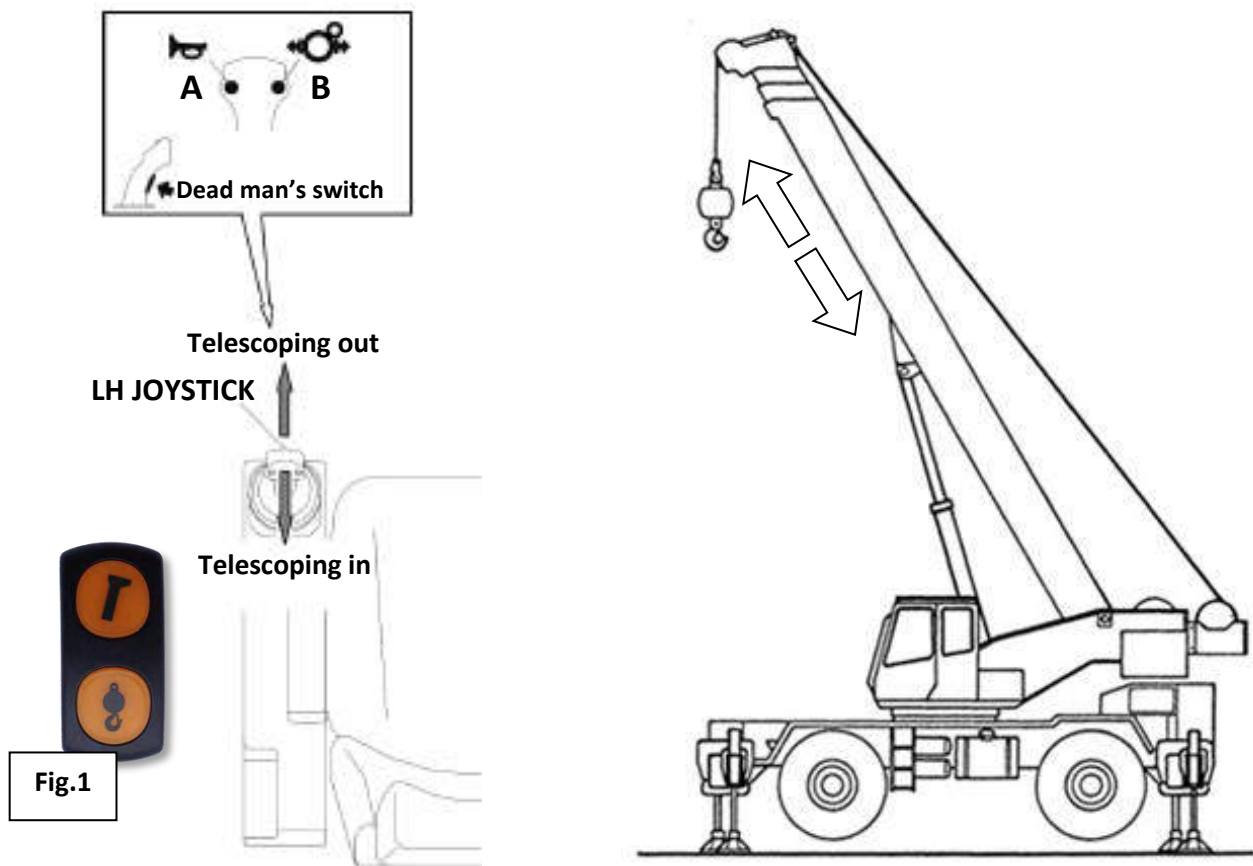


*It is prohibited to slew over the engine bonnet with the boom tilted below the horizontal line.
Failure to follow this procedure may result in damage to the vehicle.*



Slewing acoustic signal (optional): during the slewing manoeuvre an external buzzer sounds to warn the danger.

9.6.5 Boom telescoping out and telescoping in.



When the optional auxiliary hoist is mounted on the crane, to select the "telescopic boom" function press the selector switch for the boom/auxiliary hoist on the boom symbol [Fig.1] (see 'Crane controls' chapter).

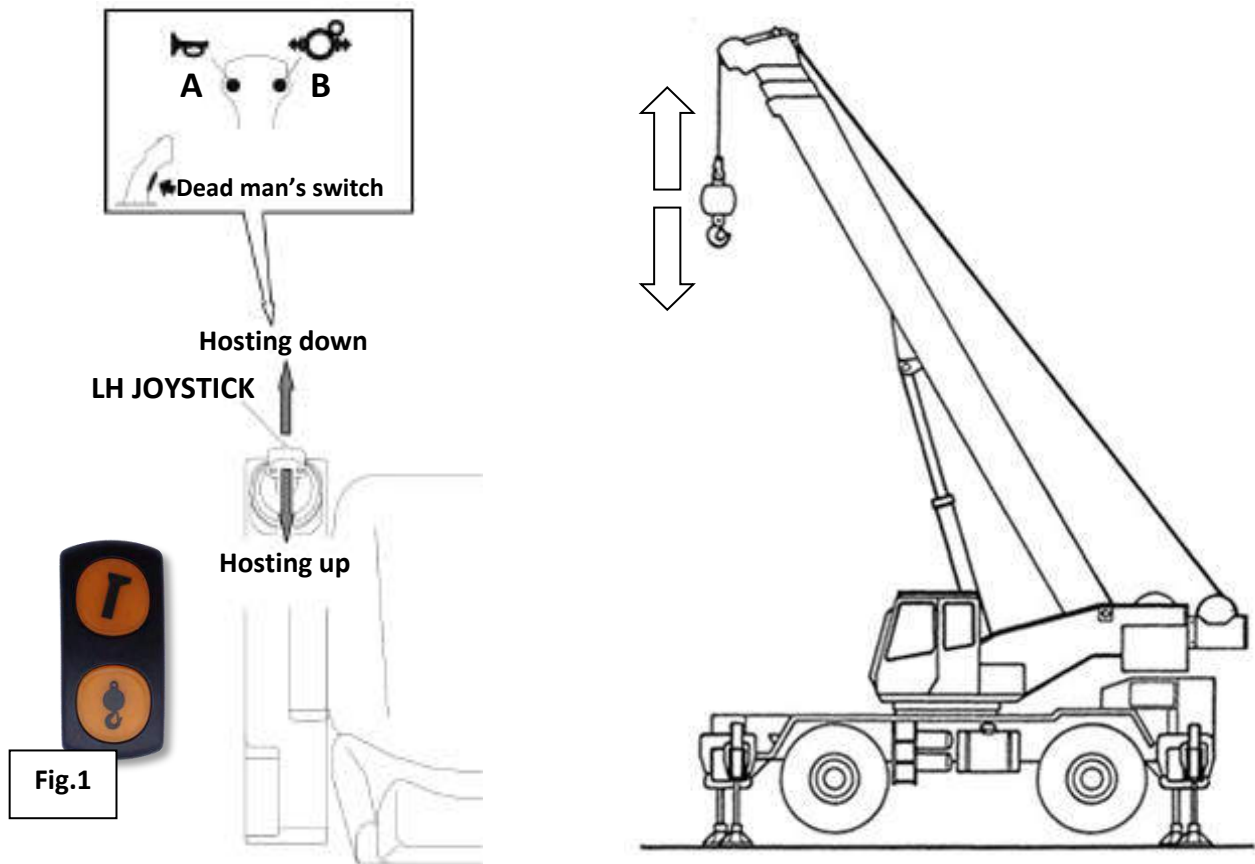
- To telescope out the boom, holding down the dead man's switch on the left joystick, move the control handle forward and hold it in place until you reach the desired length.
- To telescope in the boom, holding down the dead man's switch on the left joystick, pull the control handle back and hold it in place until you reach the desired length.
- The distance of the control handle from the neutral position and the accelerator action determine the speed of telescoping out and in of the boom.
- The distance between the hookblock and the boom head changes during the telescoping out and in of the boom. To maintain the position of the hookblock during the telescoping out, at the same time loosen the rope of the hoist and when telescoping in, rewind it.
- The extension movement is locked when, during the telescoping out, the hookblock comes into contact with the limit switch.



ATTENTION:

- *Before telescoping out the boom, make sure that the work area is clear of people or objects.*
- *Before telescoping out the boom, use the horn to warn personnel that you are about to perform the manoeuvre.*
- *Before telescoping out the boom, check the maximum allowable load on the load table for that particular radius, angle and boom length.*
- *Do not operate at boom lengths for which the load chart does not indicate the loading possibility. In this condition, the crane can overturn without any load.*
- *Do not try to move a load horizontally on the ground, simply by extending or retracting the boom. Do not pull or push sideways with the boom or use the same as a vehicle of thrust.*

9.6.6 Hoisting up and down of the auxiliary hoist (optional)



When the optional auxiliary hoist is mounted on the crane, to select the "auxiliary hoist" function press the selector switch for the boom/auxiliary hoist on the shank hook symbol [Fig.1] (see 'Crane controls' chapter).

- To lift the hookblock, holding down the dead man's switch of the left joystick, pull back on the control handle and hold it in position until the load reaches the desired height.
- To lower the hookblock, holding down the dead man's switch of the left joystick, bring the control handle forward and hold it in position until the load reaches the desired height.
- The distance of the control handle from the neutral position and the action of the accelerator determine the speed of the hoist, and therefore the derricking up and lowering of the rope.
- The load remains at the desired height as long as the control handle remains in the neutral position.



ATTENTION:

- Before raising or lowering the load make sure that the work area is clear of people or objects.
- Before raising or lowering the load, use the horn to warn personnel that you are about to perform the manoeuvre.
- Before lifting the load, make sure that the shank hook is perpendicular to the load to be lifted.



Press the "free slew" (B) push-button on the left joystick for automatic alignment of the boom head on the centre of gravity of the load when the hoist is in operation; then release the "free slew" (B) push-button.

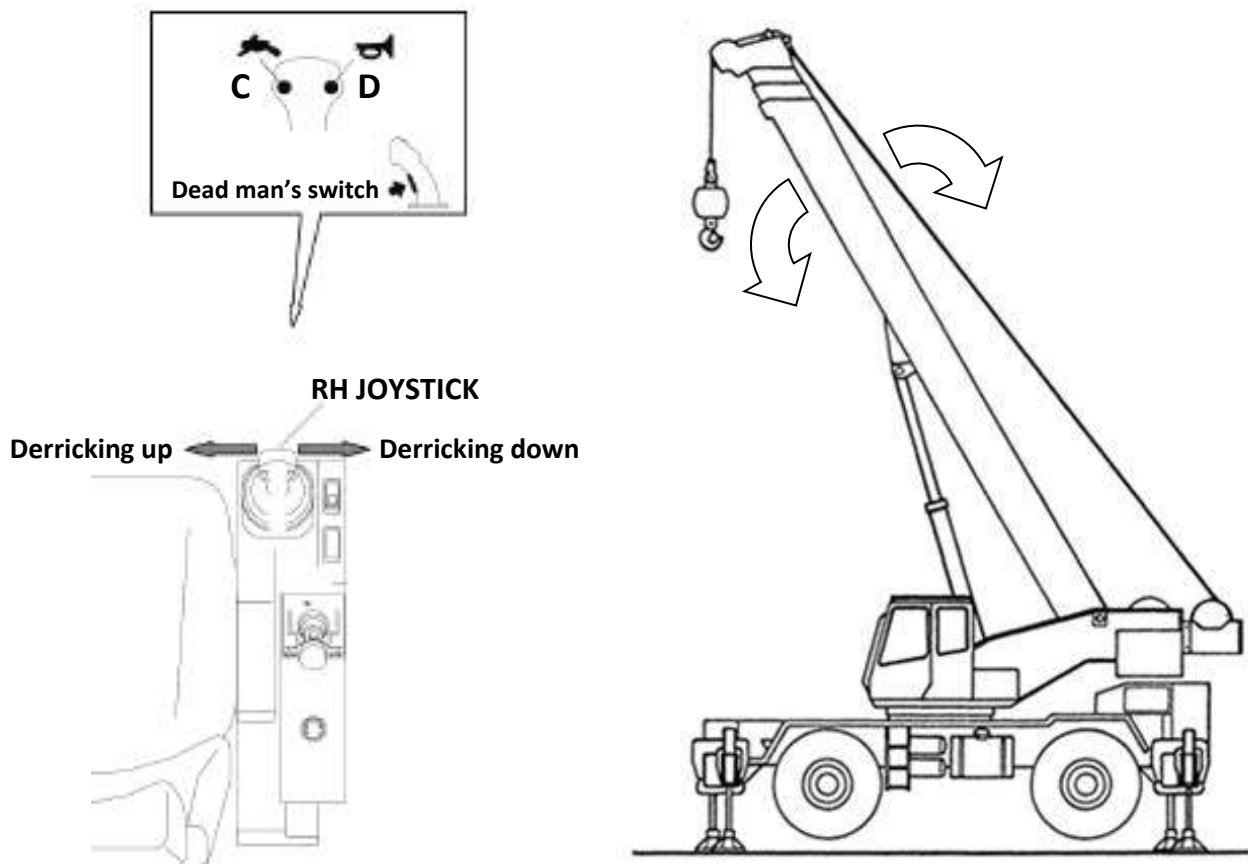
- Before lifting a load, check the allowable loads on the load chart.
- Use an appropriate number of falls:
 - Check that the number of falls of the rope are properly executed.
 - Check the functioning of the Anti2Block switches.
 - On the LMI select the program corresponding to the operating mode of the crane with extension and the number of falls installed.
- Starting or stopping the hoist, avoid sudden movements of the control handle of the joystick; this could cause overloads which may damage the crane.
- Do not leave the crane with a suspended load.
- Avoid fast rewinding of the rope when it is in tension because the hookblock is resting on the ground.



SIMULTANEOUS DERRICKING UP WITH MAIN HOIST AND AUXILIARY HOIST:

The maximum load that can be lifted at the same time as using the hookblock on the main boom and that on the boom extension, is equivalent to the maximum load that can be lifted by the sole extension. When working with two hookblocks at the same time the LMI must be set to extension or lattice mode.

9.6.7 Derricking up and down of the boom



- To raise the boom, holding down the dead man's switch of the right joystick, move the control handle to the left and hold it in place until you reach the desired elevation.
- To lower the boom, holding down the dead man's switch of the right joystick, move the control handle to the right and hold it in place until you reach the desired lowering.
- The distance of the control handle from the neutral position and the accelerator action determine the speed of derricking up and down of the boom.



ATTENTION:

- Before raising or lowering the boom make sure that the work area is clear of people or objects.
- Before raising or lowering the boom, use the horn to warn personnel that you are about to perform the manoeuvre.
- Before raising the boom, make sure that the shank hook is perpendicular to the load to be lifted.
- All loads within the limits of the load chart can be raised or lowered.



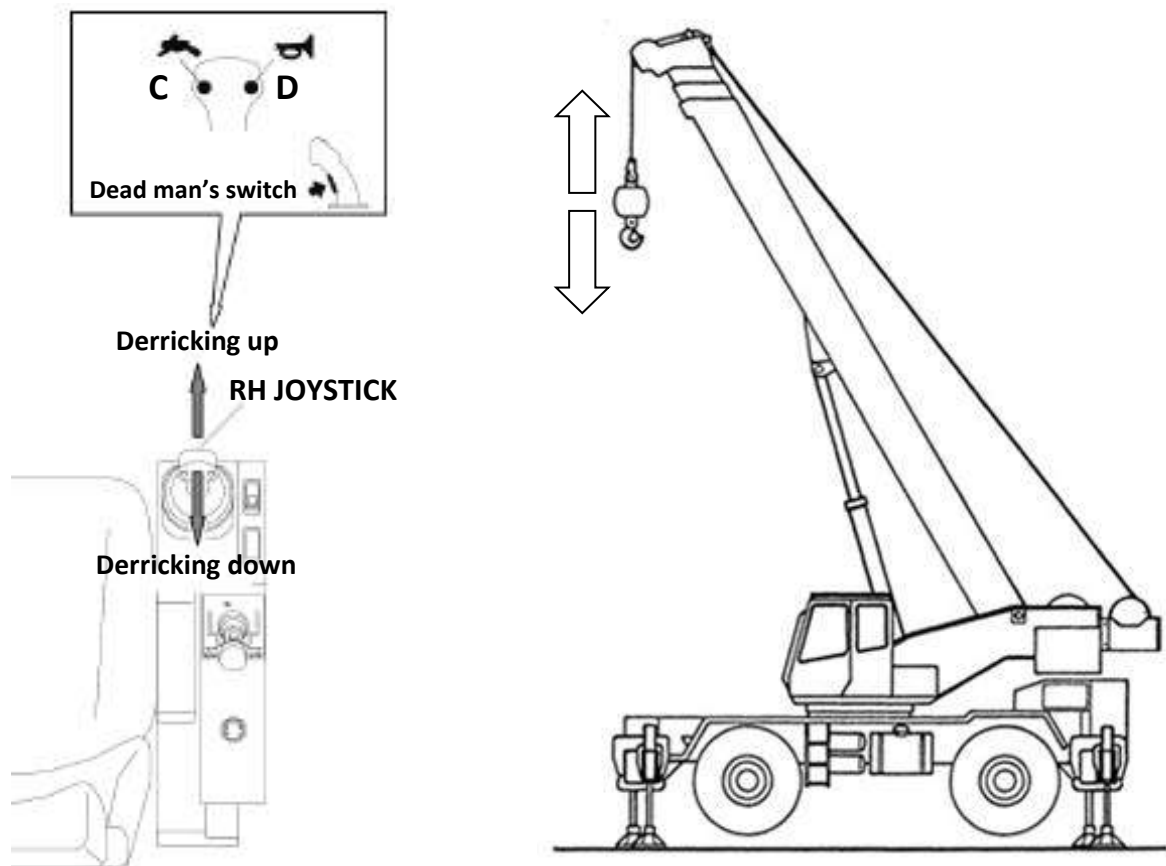
ATTENTION:

- *A long boom can create overturning conditions during derricking down. Retract the boom by referring to the load chart.*
- *Do not operate at a radius for which the chart does not indicate a loading option. In these conditions, the crane could overturn without any load on the shank hook.*
- *When lowering the boom, simultaneously loosen the rope to prevent contact between the shank hook and the head of the boom itself. Remember that the closer the shank hook is to the boom, the more it becomes necessary to extend the rope when lowering the boom.*



Lower the boom to a negative position on the engine bonnet can cause serious damage to the crane.

9.6.8 Lifting and lowering of the hookblock



- To lift the hookblock, holding down the dead man's switch of the right joystick of the main hoist, pull back on the control handle and hold it in position until the load reaches the desired height.
- To lower the hookblock, holding down the dead man's switch of the right joystick of the main hoist, bring the control handle forward and hold it in position until the load is lowered to the required level.
- The distance of the control handle from the neutral position and the action of the accelerator determine the speed of the hoist, and therefore the derricking up or lowering of the rope.
- To achieve a greater working speed, with the handle in the neutral position and the hookblock stopped, press the button (C) on the joystick and hold it during the manoeuvre.



The sudden change in speed or an abrupt stop of the manoeuvre can cause oscillations of the load which are dangerous for the stability and structure of the crane.

- The load is held at the desired height until the control handle remains in the neutral position.
- All loads can be raised or lowered with the main hoist, using the correct number of falls.



ATTENTION:

- Before raising or lowering the rope, make sure that the work area is clear of people or objects.
- Before raising or lowering the rope, use the horn to warn personnel that you are about to perform the manoeuvre.
- Before raising the rope, make sure that the shank hook is perpendicular to the load to be lifted.



Press the "free slew" (B) push-button on the left joystick for automatic alignment of the boom head on the centre of gravity of the load when the hoist is lifting the load. Then release the "free slew" push-button (B).

- Before lifting a load, check the allowable loads on the load chart.
- Use an appropriate number of falls:
 - Check that the number of falls of the rope are properly executed.
 - Check the functioning of the Anti2Block switches.
 - On the LMI select the program corresponding to the operating mode of the crane and the number of falls requested.
- Starting or stopping the hoist, avoid sudden movements of the control handle of the joystick; this could cause overloads which may damage the crane.
- Do not leave the crane with a suspended load.
- Avoid fast rewinding of the rope when it is in tension because the hookblock is resting on the ground.



SIMULTANEOUS DERRICKING UP WITH MAIN HOIST AND AUXILIARY HOIST:

The maximum load that can be lifted at the same time using the hookblock on the main boom and that on the boom extension, is equivalent to the maximum load that can be lifted by the sole extension. When working with two hookblocks at the same time the LMI must be set to extension or lattice mode.

10 OPTIONAL ACCESSORIES

10.1 Extensions

The offsettable lattice swingaway extension is used to reach greater lifting heights and working radiuses that may not be reached with just the length of the crane boom.

The offsettable lattice swingaway extension, when not in used, is housed along the right side of the base section of the boom. It is easily installed in-line to the main boom leading it up to the boom head by using four side pins. It is also possible to offset the lattice extension by 30° respect to the axis of the boom.



ATTENTION: for the load reductions of the main boom with the lattice extension mounted, read the notes in the load capacity charts.

10.1.1 Offsettable lattice swingaway extension

10.1.1.1 Installation of the extension in working position

1. With a fully retracted boom and lowered below the horizontal line, extend and position the outriggers. Align the boom with the axis of the crane and insert the slewing lock pin.
2. Partially retract the jacks of the front outriggers to tilt the crane forward to facilitate access to the head of the boom.
3. Prepare the rope for the pull in a single fall disengaging it from the hookblock;
4. Lift and fasten the support in a vertical position with a sheave at the base of the extension on the upper side (15).
5. Remove the split pin (1) and the four pins (2) from their housing at the base of the extension.
6. Remove the pin (3) which ensures the extension at the side of the boom.
7. Swing the head of the extension externally until the eyes at the base of the extension are completely superimposed to the anchor points of the boom (7) and (8).
8. Insert the two pins (2) in the upper and lower eyes assuring them with their split pins (1).
9. Remove the split pins (10) and pull out the pins (9) from the intermediate anchor points on the side of the boom.
10. Fully extend the front outrigger jacks to level the crane. Lift the boom in a horizontal position.
11. Attach a rope to the head of the extension and, through it, pull the extension out from its support and rotate it in a working position by engaging the fixing points at the base of the extension with the anchor points on the left side of the head of the boom;
12. Mount the Anti2Block switch complete with weight and plug it into an electrical outlet on the head of the lattice extension.
13. Lower the rope and pass it over the sheaves of the extension and in the hole of the Anti2Block weight. Check for proper functioning of the Anti2Block switch.
14. Select on the load moment indicator display the new configuration of the crane. The lattice extension is now ready for use.

10.1.1.2 Offset of the lattice extension

The lattice extension can be used in axis with the main boom or inclined at 30°. To offset the extension follow these steps:

1. With the boom fully retracted and lowered below the horizontal, extend and position the outriggers. Align the boom with the axis of the crane and engage the turret slewing lock pin.
2. Partially retract the jacks of the front outriggers to tilt the crane forward.
3. Extend the telescopic boom and lower it until the head of the lattice extension rests on the ground, interposing, if necessary, a bearing surface.
4. Remove the split pins ⑪ and extract the pins ⑫ at the base of the extension. Then slowly raise the boom until it is possible to insert the two rods ⑬. Fix them with the pins and the safety split pins ⑪ and ⑫.
5. Level the crane. The lattice extension is now inclined at 30° relative to the axis of the boom and is ready for use.

10.1.1.3 Retraction of the extension in the transport position

1. With the crane stabilised, fully retract the boom and lower it below the horizontal line. Align the boom with the axis of the crane and engage the turret slewing lock pin.
2. Remove the hookblock from the rope and pull out the rope from the sheaves of the extension.
3. Disconnect the cable of the Anti2Block switch on the head of the extension and remove the weight of the limit switch. Disconnect the electrical connection socket of the lattice extension from the head of the main boom.
4. Remove the two fixing pins at the base of the extension on the left side of the head of the boom.
5. With the help of a rope attached to the head of the extension, pull the extension towards the outside making it rotate until the holes coincide with the holes on the lateral support. Insert the specific pins and secure them with the corresponding split pins ⑨ and ⑩.
6. Remove the two pins ① and ② on the boom head. Push the head of the extension against the boom to bring the fastening point on the extension to the point of constraint on the boom. Insert the safety pin with the corresponding split pin ③ and ④.
7. The extension is now in a resting position. Pass the rope through the sheaves on the boom head and attach the hookblock, after pulling the rope through the limit switch weight. Reconnect the limit switch and set the correct work program on the LMI display



ATTENTION: before using the crane, check the correct operation of the limit switch.

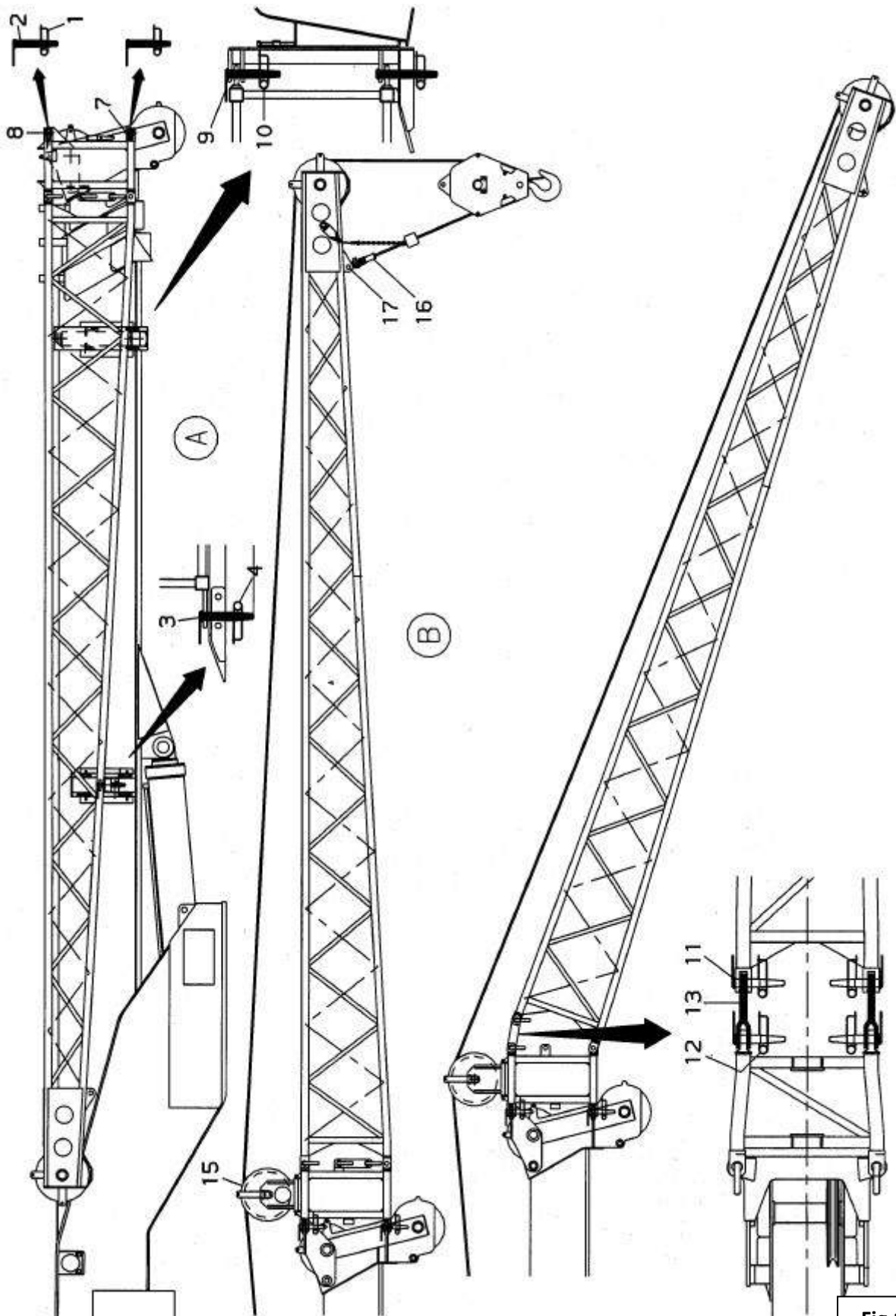


Fig.1

10.1.2 Telescopic offsettable lattice extension

10.1.2.1 Installation of the extension in working position

To carry out the installation procedure of the telescopic extension in the working position see §10.1.1.1.

10.1.2.2 Offset of the lattice extension

To carry out the offsetting procedure of the telescopic extension see §10.1.1.2.

10.1.2.3 Retraction of the extension in the transport position

Make sure that the telescopic extension is not extended before retracting it laterally to the boom. For the retraction procedure of the telescopic extension in the transport position see §10.1.1.3.

10.1.2.4 Elongation of the telescopic extension

1. Remove the pins ① that connect the two sides of the extension.
2. Pull out the inside extension by pulling it to align the holes ②.
3. Replace the pins ① in the anchor points ② by securely fixing the two parts.
4. Select the new configuration on the load moment indicator display.
5. To retract the telescopic section of the lattice extension, perform the steps in reverse order.

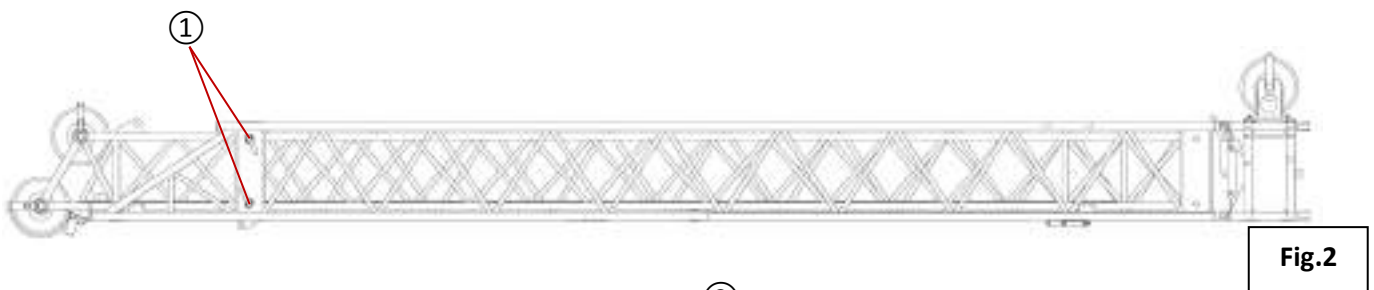


Fig.2

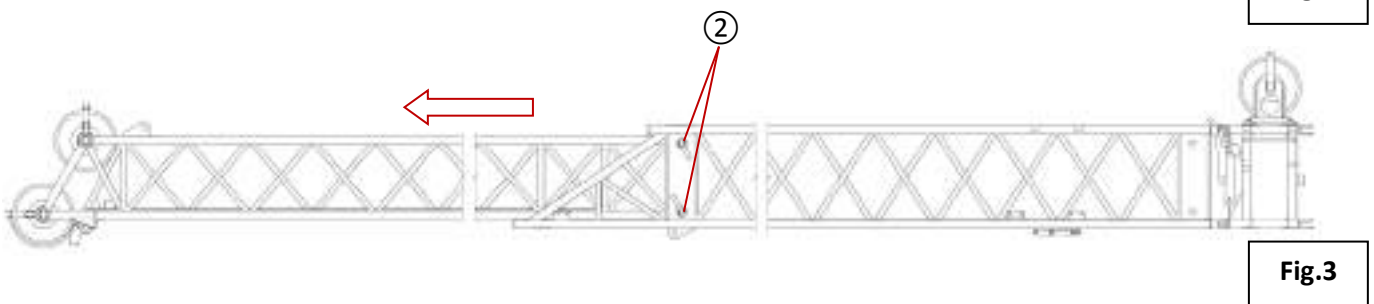


Fig.3



ATTENTION: before using the crane, check the correct operation of the limit switch.

10.2 Heavy duty jib

The heavy duty jib, when not in use, is housed on the right side of the last element of the boom.

The heavy duty jib can be easily put in line with the main boom and used to perform quick and fast lifts with the auxiliary hoist.



ATTENTION: the auxiliary hoist rope must always pass in the middle sheave of the head (position ⑦ of Fig.4) and in the sheave of the additional heavy duty jib (position ⑧ of Fig.4 and 5). It is not possible to operate with the lattice extension and the heavy duty jib installed simultaneously at the head of the boom.

1. Slightly extend the boom and lower it completely.
2. Remove the split pin ① from the pin ②. Take out the pin ② from position A.
3. Turn the heavy duty jib until the holes B and C coincide with those of the head.
4. Insert the pin ③ into the support B and secure it with the corresponding split pin ④.
5. Remove the pin ⑤ from the D position and place it in position C.
6. Secure the pin ⑤ with the corresponding split pin ⑥.
7. Feed the rope through the sheave ⑦, in the sheave ⑧ and in the limit switch ⑨.
8. Connect the limit switch electrically.
9. Attach the shank hook according to the procedures described for the specific shank hook.
10. Check that the anti-slippage pins are mounted ⑩ and are secured with the corresponding split pins.
11. Check the operation of the Anti2Block switch by bringing the shank hook in contact with the limit switch weight ⑨. The upward movement of the shank hook must stop.



ATTENTION: correctly program the LMI (Load Moment Indicator) in accordance with the instructions given in the load chart.

The derricking up of loads with both hoists is not allowed. The LMI (Load Moment Indicator) would not work properly.

To put the heavy duty jib back in the resting position:

1. Extend and lower the boom to facilitate the disassembly.
2. Remove the shank hook from the rope and the latter from the extension.
3. Remove the pin ⑤ from the support F.
4. Insert the pin ⑤ into the support G and secure it with the corresponding split pin ⑥.
5. Remove the pin ③ from the support E. Turn the heavy duty jib on the side of the head.
6. Secure the heavy duty jib using the pin ② and the split pin ①.
7. Secure the pin of the limit switch in the support securing it with the corresponding split pin.
8. Restore the limit switch connections and verify their operation.

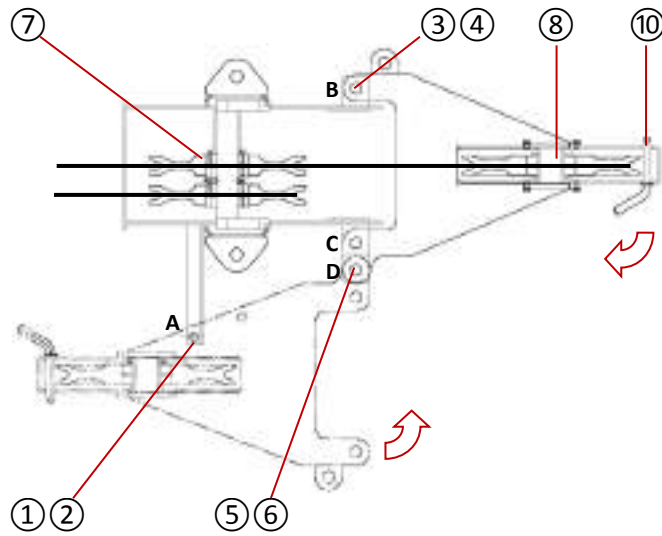


Fig.4

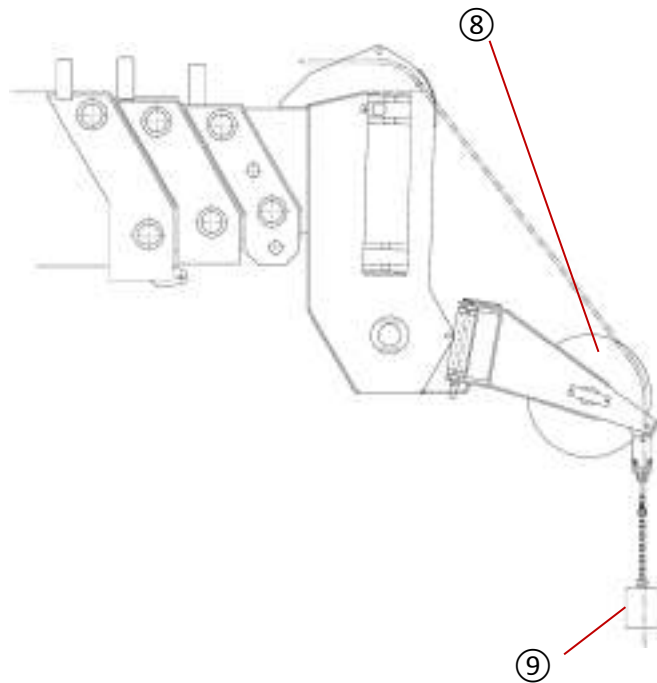


Fig.5

10.3 Additional hookblocks

Additional hookblocks are supplied for lifting, in special configurations of the telescopic boom, low loads, or else for lifting, under direct pull, with lattice extensions.



When using these hookblocks always refer to the load charts.

10.4 Auxiliary hoist

The auxiliary hoist is an accessory that is exclusively used for lifting loads while using extensions.



The auxiliary hoist must NEVER be used as the main hoist.



Before working with the auxiliary hoist, disassemble the hoisting up limit switch device (A2B), including the weight, from the head of the main boom and fit it at the head of the extension.

The technical characteristics of the auxiliary hoist are the following:

Rope diameter	Ø15 mm
speed	57 m/min
Max permissible pull	39.2 kN

The rope of the auxiliary hoist can be mounted in various number of falls according to the required lifting capacity. The lifting capacity of a crane depends on the traction force of the hoist and the number of supporting rope segments (falls), between the head of the boom and the hookblock.



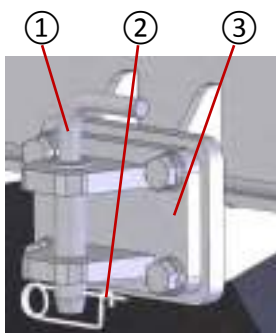
Always use a number rope segments suitable for the load that has to be lifted.

10.5 Transmission oil additional heat-exchanger

The application of an additional heat-exchanger for the transmission oil is recommended if the crane is used for long road journeys under harsh environmental conditions.

10.6 Towing device

The towing device is securely fitted to the rear of the carrier frame by four screws and is intended for off-road use. Its maximum pull capacity is 4 T.



To use the towing device follow this procedure:

1. Remove the safety pin ② and take out the pin ① from the support ③.
2. Put the connection of the trailer to be towed between the two support plates ③, locking it with the bolt ①. Secure the bolt with the safety pin ②.
3. To release the trailer, proceed as in step 1.

10.7 List of auxiliary equipment

Equipment	Weight [kg]	GRIL 8300T	GRIL 8400T	GRIL 8500T	GRIL 8500TL	GRIL 8700T	GRIL 8800T
Hookblock 12 T	180	•	•				
Hookblock 15 T	290			•	•	•	•
Overhaul hook 5 T	100	•	•	•	•	•	•
Lattice swingaway extension 7.6 metres	600			•			
Offsettable lattice swingaway extension 8.0 metres	750	•	•	•	•		
Offsettable lattice swingaway extension 9.0 metres	1,000					•	•
Offsettable lattice swingaway extension 9.0-16.1 metres	1,000		•	•			
Offsettable lattice swingaway extension - 10.0-17.5 metres	1,500					•	•
Heavy duty jib 6.0 T	80					•	
Heavy duty jib 7.5 T	210			•			
Heavy duty jib 9.0 T	210					•	
Auxiliary hoist 4.0 T	-			•		•	•
Spare wheel 16.00R25	-	•	•	•	•		
Spare wheel 23.50R25	-					•	
Spare wheel 26.50R25	-						•

11 TROUBLESHOOTING

11.1 Hydraulic plant

Problem	Probable cause	Solution
No oil flow in hydraulic circuit.	Low level of hydraulic oil.	Refill the tank.
	Obstructions or damage of suction pipes. Air in the suction pipes. The pump does not draw oil.	Clean or replace the pipes. Check the operation of the pipes. Tighten or replace the fixing fittings.
	Breakage or disconnection of the pump shaft.	Remove and repair or replace the shaft.
	Oil contamination.	Drain the contaminated oil, then refill the tank with the specified hydraulic oil.
Slow response of manoeuvres.	Low level of hydraulic oil.	Refill the tank.
	Hydraulic oil temperature too high.	Repair the fault of the heat-exchanger circuit.
	Hydraulic oil temperature too low.	Heat up the system. Repair the fault of the heat-exchanger circuit.
	Presence of faults in one or more sections of the pump.	Repair or replace one or sections of the pump.
Noise emission from the pump with foam formation in the hydraulic oil of the tank.	Low level of hydraulic oil.	Refill the tank.
	Engine speed too high.	Adjust the engine speed.
	Air inside the suction pipe.	Check the operation of the pipes, replace them if necessary. Tighten or replace the fittings.
Excessive pressure increase.	Calibration of the pressure-relief valve is abnormally high.	Adjust the system's pressure relief valve.
	Obstructions in the discharge pipe between the pump and the control valve.	Clean or replace the pipe.
A part of the hydraulic system is not working.	System leakage.	Repair the leak.
	Faults in the electrical controls/indicators.	Repair or replace the electrical controls/indicators.
	Fault in the distributor.	Replace the valve.
	Incorrect adjustment of the circuit control.	Repair the fault in the circuit. Adjust the hydraulic component.
	Faults in hydraulic cylinders, engine or valve.	Replace the faulty component.

11.2 Turret slewing

Problem	Probable cause	Solution
Slewing irregularity.	Faulty relief valve.	Replace the valve.
	Resistance of the parking brake (release insufficient).	Readjust or replace components.
	Low engine speed.	Increase the engine speed so that the slewing is smooth
	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Presence of lubricant in insufficient quantities on the slewing ring.	Lubricate sufficiently.
	Positioning of the crane off level.	Position the crane level.
	Fault in slewing engine.	Repair or replace the engine.
	Excessive load.	Reduce the load.
	Presence of obstructions, even partial, in hoses or fittings.	Replace the hose or fittings.
	Pump cavitation in the slewing section.	Tighten the suction hose or replace any damaged fittings; check the level in the hydraulic reservoir.
	Wear or damage to the slewing gearbox.	Remove the gearbox and fix it.
	Wear or damage to the pump.	Repair or replace the damaged pump.
	Problems with the slewing distributor.	Repair or replace the distributor.
No slewing.	Faulty relief valve.	Replace the valve.
	Fault in slewing engine.	Repair or replace the engine.
	Insufficient release of parking brake.	Repair.
	Presence of damage to the slewing distributor.	Repair or replace the distributor.
	Presence of internal damage to the slewing gearbox.	Remove or repair the slewing gearbox.
	Wear or damage to the hydraulic pump.	Replace the section of the pump.
	Breakage of the slewing pinion.	Replace the pinion.
	Damage to the slewing ring.	Replace the slewing ring.
	Excessive load.	Reduce the load.

Problem	Probable cause	Solution
Slewing slow.	Faulty relief valve.	Adjust, repair or replace the valve.
	Incorrect setting of slewing brake.	Readjust.
	Presence of damage to the slewing distributor.	Replace the distributor.
	Presence of lubricant in insufficient quantities on the slewing ring.	Lubricate sufficiently.
	Presence of obstructions in hoses or fittings.	Clean or replace the hose or fittings.
	Wear or damage on the output shaft bearings of the engine.	Replace the bearings.
	Wear or damage to the slewing motor.	Repair or replace the engine.
	Wear or damage to the hydraulic pump.	Repair or replace the pump.
	Positioning of the crane off level.	Position the crane level.
Irregularities in the operation of the slewing brake.	Incorrect brake setting.	Set the brake.
	Incorrect operation of the slewing brake valve.	Repair or replace the valve.
Slewing brake not working.	Presence of damage to the opening valve of the slewing brake.	Replace the valve.
	Presence of internal damage to the slewing brake unit.	Repair or replace the damaged components.

11.3 Telescopic boom

Problem	Probable cause	Solution
Fault in the boom extension.	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Faulty relief valves.	Repair or replace the relief valves.
	Air in the telescopic cylinder.	Vent the air contained in the cylinder.
	Low engine speed.	Increase the engine speed to the recommended value.
	No lubricant on pads and boom buffers.	Correctly lubricate all pads and buffers.
	Incorrect alignment of the boom caused by lateral load.	Adjust the side buffers.
	Worn pads and buffers.	Replace and grease the pads and buffers.
	Deformation of boom sections.	Replace the deformed section.
	Faulty telescopic cylinder.	Repair or replace the cylinder.
	Obstructions or hydraulic pipes or fittings broken or loose.	Clean, tighten or replace the pipes or fittings.
	Faulty locking and balancing valve.	Repair or replace the damaged valve.
Fault in the boom retraction.	Presence of damage to the distributor.	Repair or replace the distributor.
	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Faulty relief valves.	Repair or replace the relief valves.
	Air in the telescopic cylinder.	Vent the air contained in the cylinder.
	Low engine speed.	Increase the engine speed to the recommended value.
	No lubricant on pads and boom buffers.	Correctly lubricate all pads and buffers.
	Incorrect alignment of the boom caused by lateral load.	Adjust the side buffers.
	Worn pads and buffers.	Replace and grease the pads and buffers.
	Deformation of boom sections.	Replace the deformed section.
	Faulty telescopic cylinder.	Repair or replace the cylinder.
	Presence of grooves in the cylinder body.	Repair or replace the cylinder body.
	Damage to the seals of the cylinder piston rod.	Replace all seals.
	Presence of one or more damaged piston rods.	Replace all seals and replace one or more piston rods.
Faulty locking and balancing valve.	Repair or replace the damaged valve.	
Presence of damage to the distributor.	Repair or replace the distributor.	

Problem	Probable cause	Solution
No extension of the boom.	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Malfunction in the relief valve.	Repair or replace the relief valves.
	Excessive load.	Reduce the load.
	Presence of obstructions in hoses and fittings.	Replace the hoses or fittings.
	Damage to the seals of the cylinder piston rods.	Replace all the seals of the cylinder.
	Presence of one or more damaged piston rods.	Replace all seals and replace one or more piston rods.
	Bending of one or more sections of the boom.	Replace the deformed sections.
	Faulty connection of the hydraulic pump.	Replace the damaged fitting of the hydraulic pump.
	Wear or damage on a part of the hydraulic pump.	Repair or replace the pump part.
	Presence of damage to the distributor.	Repair or replace the distributor.
No retraction of the boom.	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Faulty relief valve on the distributor.	Repair or replace the damaged valve.
	Excessive load.	Reduce the load.
	Locking and balancing valve not working.	Replace the valve.
	Presence of obstructions in hoses and fittings.	Replace the hoses or fittings.
	Presence of one or more broken piston rods.	Replace the rods and all the seals of the cylinder.
	Damage to the seals of the piston rods.	Replace all the seals of the cylinder.
	Bending of one or more sections of the boom.	Replace the deformed sections.
	Faulty connection of the hydraulic pump.	Replace the damaged fitting of the hydraulic pump.
	Wear or damage on a part of the hydraulic pump.	Repair or replace the pump part.
Presence of damage to the distributor.	Repair or replace the distributor.	

Problem	Probable cause	Solution
Irregularity in the derricking up of the boom.	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Faulty relief valves.	Repair or replace the relief valves.
	Air in the telescopic cylinder.	Vent the air contained in the cylinder.
	Low engine speed.	Increase the engine speed to the recommended value.
	Presence of damage to the distributor.	Repair or replace the distributor.
Irregularity in the lowering of the boom.	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Faulty relief valves.	Repair or replace the relief valves.
	Air in the telescopic cylinder.	Vent the air contained in the cylinder.
	Low engine speed.	Increase the engine speed to the recommended value.
	Presence of damage to the distributor.	Repair or replace the distributor.
	Fault in a part of the hydraulic pump.	Repair or replace the pump part.
Derricking up of the boom slow.	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Faulty relief valves.	Repair or replace the relief valves.
	Low engine speed.	Increase the engine speed to the recommended value.
	Presence of damage to the distributor.	Repair or replace the distributor.
	Hydraulic oil very cold.	Bring the oil to temperature.
	Control of two operations simultaneously.	Perform manoeuvres individually.
	Presence of obstructions in the return hose.	Replace the hose.
	Leaks in the seals of the rods.	Replace all seals.
	Presence of grooves in the cylinder body.	Replace the cylinder body.
	Excessive wear of a part of the hydraulic pump.	Replace the pump part.
	Presence of damage to the distributor.	Repair or replace the distributor.

Problem	Probable cause	Solution
Lowering of the boom slow.	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Faulty relief valves.	Repair or replace the relief valves.
	Low engine speed.	Increase the engine speed to the recommended value.
	Control of two operations simultaneously.	Perform manoeuvres individually.
	Hydraulic oil very cold.	Bring the oil to temperature.
	Presence of obstructions in the return hose.	Replace the hose.
	Leaks in the seals of the rods.	Replace all seals.
	Presence of grooves in the cylinder body.	Replace the cylinder body.
	Excessive wear of a part of the hydraulic pump.	Replace the pump part.
	Presence of damage to the distributor.	Repair or replace the distributor.
No derricking up of the boom:	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Faulty relief valves.	Repair or replace the relief valves.
	Excessive load.	Reduce the load.
	Wear of a part of the hydraulic pump.	Repair or replace the pump part.
	Fault in pump shaft.	Replace pump shaft and seals.
	Faulty connection on the pump.	Replace the connection.
	Faulty locking and balancing valve.	Check the pilot pressure of the valve.
	Presence of damage to the distributor.	Repair or replace the distributor.
No derricking up of the boom:	Low level of hydraulic oil.	Fill the hydraulic oil to the proper level.
	Faulty relief valves.	Repair or replace the relief valves.
	Wear of a part of the hydraulic pump.	Repair or replace the pump part.
	Fault in pump shaft.	Replace pump shaft and seals.
	Faulty connection of the pump.	Replace the connection.
	Presence of damage to the distributor.	Repair or replace the distributor.

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12 MAINTENANCE

Regular maintenance is fundamental to ensure a long operative life of the machine.

The following information is intended to assist the operator or the personnel responsible for the maintenance, the use and the safety application of the maintenance procedures contained in this manual.



Before performing any maintenance procedure, you should have great knowledge of the machine functioning and of the instructions to work in safety conditions.

Do not perform any maintenance or repair work on the machine that you are not able to finish.

Always use appropriate tools and equipment for the intervention, replace or repair worn or damaged equipment.

When you disassemble or install a component or a plant, complete each step in sequence.

Make all adjustments as required. Check again the adjustments that have been carried out

12.1 General information of danger

- Carry out regularly and correctly all checks, maintenance, lubrication and greasing operations according to the procedures described in the operating and maintenance manual.
In carrying out these operations, carefully follow the instructions regarding the possible need to remove some protection or to intervene on exposed points.
- Prior to maintenance or leaving the machine at the end of work, unless advised otherwise, rest the load, lower the boom and bring it back in, dismantle the equipment, position the crane on a flat area and use the parking brake, block the wheels or lower the stabilisers.
- Before performing maintenance or any repairs, attach a warning sign inside the cabin.
- During maintenance operations, do not allow the presence of unauthorised personnel on the crane.
- Avoid wearing loose clothing, rings, bracelets and necklaces that can get caught in machine parts.
- Wear a helmet, gloves and any other necessary suitable personal protective equipment.
- Keep the cabin, the platforms, the mudguards, the bonnet and the access steps to the machine clean from oil, diesel or grease to prevent slipping.
- Keep the machine free of foreign materials. Remove all personal items, tools and rags, which could be soaked in grease and oil, used for the maintenance.
- Wear suitable protective clothing, boots and goggles when you clean the machine with compressed air or pressurised water. Particles and debris projected by air or pressurised water can cause injury.
The compressed air used for cleaning must not exceed pressure of 2 bar. The maximum water pressure must be less than 4 bar.
- Use all detergent solutions with care.
- Ensure that liquids do not come out during maintenance operations.

Be prepared to collect liquids in suitable containers before getting rid of any component that contains them.

- Recuperate and recycle all used fluids. Never store liquids that have been collected in glass containers, which can break and spill the contents. Drain all liquids into closed and properly labelled containers. Never pour flammable liquids into open, wide and low containers.
- Dispose of used liquids observing the regulations in force.
- Do not run the engine indoors, except if there is an effective exhaust fume extraction system.
- Keep away from all revolving and moving parts. Leave the protections installed until maintenance has been completed.
- Check the level of the coolant fluid with the engine turned off and with the radiator cold. Make sure that the radiator cap is cool before removing it. Slowly unscrew the cap to relieve pressure. Any contact with steam or coolant fluid at high temperatures can cause severe burns.
- Do not smoke when refuelling.
- Keep an extinguisher at hand when carrying out works which could cause flames.
- Clean the brake gaskets with specific non inflammable products.
- Do not touch the steel wire ropes with bare hands.
- When inflating tyres, protect yourself and those nearby from a possible slipping of the ring of the rim or from a tyre blowout.

12.1.1 Hydraulics

The hydraulic system of the crane operates at high pressure. Special care should be taken when dealing with a hydraulic system under pressure.



Do not work on a hydraulic system while it is running or until the system pressure has been fully discharged.

Do not check for leakages in the system with bare hands, but always use a cardboard sheet or a panel.



Leakage of oil under pressure, even from a tiny hole, may penetrate the skin causing serious injury. If this happens, you must immediately consult a doctor who is specialised in this type of injury.



- Before disconnecting hoses or hydraulic components, make sure that the circuit is de-pressurised.
Pressure can remain trapped in the hydraulic system for a long time after the engine has stopped. If the pressure has not been correctly discharged, the hydraulic oil or the hose pipe fittings can be violently projected causing serious accidents.
- Hot oil and hot lubricated components can cause burns. Pay particular attention that these do not come into contact with skin.

- Hydraulic oil is flammable, so avoid welding pipes, tanks or other components which contain hydraulic oil.
- Do not change the setting values of the pressure control valves of the hydraulic system. Higher calibration values may cause failure of the hydraulic components; lower values may be insufficient to operate the manoeuvres of the crane.

12.1.2 Electric plant

- Before performing any work on the electrical system, disconnect the batteries by turning the knob placed on the battery switch.
- Do not carry out connections or changes to the electrical system without knowing the wiring diagram of the machine.
An incorrect connection may cause serious personal injury and damage the machine.
- Batteries contain sulphuric acid which can cause severe burns and ruin clothing.
Always wear protective clothing, gloves and goggles when checking batteries or performing maintenance on them.
In case of accidental contact with skin or eyes with battery fluid, wash the affected area with water and immediately consult a doctor.
- Do not smoke when you perform maintenance on a battery. Batteries release flammable vapours which can cause explosions.
- Check the fluid level of the battery by using an electric torch. Keep the electrolyte at the maximum level indicated on the battery. If necessary, top up with distilled water.
- Do not short-circuit the battery terminals to check the charge. The sparks that are emitted may cause vapours to explode with consequent injuries to the people who are nearby.
To check the battery charge use a voltmeter or ammeter.
- If the electrolyte of a battery is frozen, the battery can explode if recharged or if the machine is started by using an auxiliary battery. In order to prevent the freezing of the electrolyte, always keep the batteries fully charged.
- When using an external battery to start the engine, connect the grounding cable last and disconnect it first, thus avoiding the formation of sparks that could cause the explosion of the battery with consequent injuries to people who are nearby.
- Before charging a battery, remove all the caps to allow the release of vapours.



12.1.3 Welding instructions

The engine installed on the crane is of the electronic control type. To prevent damage to the ECM of the engine, disconnect the sensor and its components whether you need to weld in an appropriate way.

When possible, remove the component from the machine and then weld it. If it is not possible to remove the component, to perform the welding take a look at the following procedures in order to minimize the risk of damage of electronic components.



Do not earth the welding machine by connecting it to electronic components such as the ECM or the sensors. An inadequate grounding can damage the transmission bearings, the hydraulic components, the electrical ones and other parts.

1. Stop the engine. Turn the ignition key to the OFF position.
2. Disconnect the batteries.
3. Unplug the connectors from the ECM.
4. Fix the grounding cable of the welding machine on the part that has to be welded, as close as possible to the welding area, in order to minimise the possibility that the current damages bearings and components of the hydraulic and electrical plants.
5. Protect the wiring from welding residues and splashes.
6. Follow the procedures for standard welding.

12.2 Maintenance operations list

The maintenance intervals are based on a normal use of the machine. If the crane operates in working conditions or more severe environmental conditions (marine or sandy environments, with temperatures approaching -20 or + 50°C), the operator must change the service intervals in half the time scheduled for the greasing of components and oil changes.

For some components the maintenance intervals of the machine depend on the operating hours recorded by the engine hour counter. However, there are other maintenances that are required to ensure the perfect functionality of the crane at the time that they must be performed at different intervals: monthly, half-yearly or annually, independently of the hours logged by the engine.

12.2.1 Symbols

This manual highlights, through the symbols below, that for certain maintenance procedures the requirement to use appropriate personal protective equipment.



Compulsory use of helmets.



Compulsory use of work shoes.



Compulsory use of gloves.



Compulsory use of protective clothing.



Compulsory use of protective glasses.

In the following summary tables of maintenance processes, in the first column the following explanatory icons are provided which define which maintenance processes are the responsibility, with the specific tasks, of the various maintenance technicians.



Process that should be supervised by a mechanical maintenance technician.



Process that should be supervised by a maintenance plumber.



Process that should be supervised by a maintenance electrician.

A - Inspection and maintenance list to be carried out every 10 hours or daily

	Maintenance process	P.P.E.
	Check radiator liquid level	
	Check engine oil level	
	Check air filter clogging indicator	
	Check transmission oil level	
	Check fuel tank level	
	Check hydraulic oil reservoir level	
	Check tyre inflation pressure and tyre condition	
	Check condition of the hoist rope	
	Check all the manoeuvres of the crane	
	Check shank hook safety latch	
	Check pneumatic brake circuit	
	Check the lights and the cabin instruments	
	Check the A2B device	
	Test the hoisting down limit switch	
	Drain the water/fuel separator filter	
	Drain condense from the air tanks	

**B - Inspection and maintenance list to be carried out every 50 hours or weekly
(to be performed in succession to list A)**

	Maintenance process	P.P.E.
	Check the brake liquid level	
	Check oil level of the differential	
	Check oil level of axle wheel hubs	

follows...

...precedes

**B - Inspection and maintenance list to be carried out every 50 hours or weekly
(to be performed in succession to list A)**

	Maintenance process	P.P.E.
	Check tightening of the wheel nuts	
	Check engine hose clamp tightening	
	Check for leaks of the hydraulic plant	
	Check the greasing of all pivot axis pins	
	Grease drive shaft joints	
	Oscillation lock cylinder greasing	
	Outrigger beam greasing	
	Slewing ring greasing	
	Slew rack and pinion greasing	
	Boom hinge pin greasing	
	Lifting cylinder pin greasing	
	Rope chain drum pin on the telescoping cylinder	
	Greasing of the hookblock	
	Grease all the boom sections	
	Drain the water and the deposits from the fuel tank	

**C - Inspection and maintenance list to be carried out every 200 hours
(to be performed in succession to list A and B)**

	Maintenance process	P.P.E.
	Check the tightening of the slewing ring bolts (1st time)	
	Check the tightening of slewing gearbox bolts (1st time)	
	Check slewing gearbox oil level	
	Check tightening of hoist gearbox bolts	
	Check hoist gearbox oil level	
	Check the hookblock	
	Clean the engine radiator	
	Clean the engine air filter	
	Replace oil of the wheel hub (1st time)	
	Replace oil of the differential (1st time)	
	Replace oil of the slewing gearbox (1st time)	
	Replace oil of the hoist gearbox (1st time)	

**D - Inspection and maintenance list to be carried out every 500 hours
(to be performed in succession to list A, B and C)**

	Maintenance process	P.P.E.
	Check that the boom extends proportionally	
	Check for leaks of the hydraulic circuit	
	Check for leaks of the air plant	
	Check the electrolyte battery level	
	Check tightening of slewing ring bolts (turret side)	
	Check the tightening of hoist and counter-weight bolts	
	Check tightening of engine bolts	

follows...

...precedes

**D - Inspection and maintenance list to be carried out every 500 hours
(to be performed in succession to list A, B and C)**

	Maintenance process	P.P.E.
	Check tightening of transmission bolts	
	Check tightening of axle bolts	
	Replace oil of the engine	
	Replace oil filter of the engine	
	Replace fuel primary filter	
	Replace fuel secondary filter	
	Replace air filter cartridge	
	Replace air filter safety cartridge	
	Replace transmission oil filter (1st time)	
	Replace hydraulic oil filter cartridge (1st time)	
	Replace compressed air filter (1st time)	
	Replace air-dryer filter	

**E - Inspection and maintenance list to be carried out every 1,000 hours or annually
(to be performed in succession to list A, B, C and D)**

	Maintenance process	P.P.E.
	Check the engine transmission belt	
	Replace hydraulic oil filter	
	Replace oil of the transmission	
	Replace oil of the wheel hubs	
	Replace oil of the differential	
	Replace oil of the hoist gearbox	

**F - Inspection and maintenance list to be carried out every 2,000 hours
(to be performed in succession to list A, B, C, D and E)**

	Maintenance process	P.P.E.
	Check deterioration of the vibration dampers	
	Adjust the pinion/slewing ring backlash	
	Replace coolant fluid of the engine	
	Replace the brake fluid	
	Replace oil of the hydraulic reservoir	
	Replace oil of the slewing gearbox	

**G - Inspection and maintenance list to be carried out every 3,000 hours or 2 years
(to be performed in succession to list A, B, C, D, E and F)**

	Maintenance process	P.P.E.
	Replace the engine transmission belt	
	Replace the water thermostat	
	Replace the hoses of the braking system	

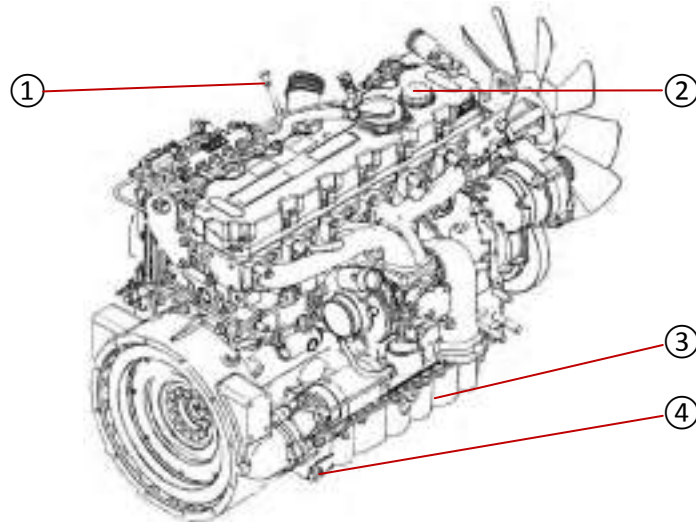
12.3 Maintenance of the main components

In the following paragraphs, the maintenance of the main components of the crane will be discussed in more detail.

12.3.1 Engine

Legend:

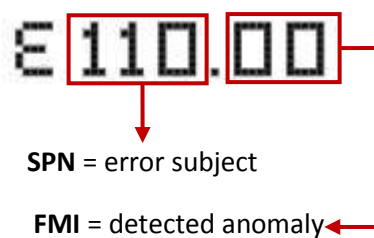
- ① dipstick
- ② refilling cap
- ③ oil sump
- ④ drainage valve



12.3.1.1 Engine diagnostic

The diesel engine of the crane is the electronic control type, equipped with diagnostic functions that ensure its proper operation.

The start-up of the instrument display, on the right top part of the multifunction display, in absence of errors shows the writing 'NO ERROR'. If, instead, there is an error, this is displayed continuously on the display by a code number similar to 'E`XXX.XX`' accompanied by an acoustic signal.



During the functioning of the crane, when the system detects a problem it sends an error message to the operator accompanied by an acoustic signal and, in case of important anomalies, automatically limits the speed and the torque of the engine.

The errors remain on the display until the CAN line stops sending them.

The diagnostic error code numbers are partially recorded in the error page of the multifunction display and are archived, completely, in the permanent memory of the ECM of the engine.

For example, in the following chart are reported some of the error code numbers of the engine and the correspondent failure.

SPN-FMI Code no.	Alarm/fault description
E172-1	Air filter clogged
E194-1	Exhaust gas high temperature
E360-1	Oil pressure low - alarm
E360-3	Oil pressure low - stop
E361-1	Coolant hot - alarm
E361-2	Coolant hot - power reduction
E361-3	Coolant hot - stop
E362-1	Engine over speed
E396-1	Common rail high pressure
E398-1	Common rail low pressure
E539-1	Air intake manifold hot - alarm
E539-2	Air intake manifold hot - power reduction
E2143-3	Coolant low

To enter the errors list of the display, keep the left button on the control frame pressed for 5 seconds. The error messages, up to a maximum of 10, are displayed in the following way:



The last error that has been received is inserted at position 1, scrolling downwards all the other ten messages.

After 20 seconds the display returns to show the main page.

To recall all the error code numbers that have been recorded in the permanent memory of the ECM, you must use a laptop equipped with a cable to connect to the engine and special software.

12.3.2 Cancelling the errors list

To cancel the list of the error code numbers recorded in the ECM carry out the following procedure:

1. Enter the errors list on the display by keeping the left button of the control frame pressed for 5 seconds.
2. When the 'ERROR LIST' screenshot is displayed, simultaneously press the right and left button on the display for 5 seconds.

12.3.2.1 Engine oil drainage

A seal valve ④ with a control lever is placed on the bottom of the sump ③ in order to allow the oil out-flow. Connect a hose extension and fix it to the valve to allow the oil discharge without smudging the components of the crane.



The engine oil must be drained when it is hot. With cold oil, particles of slag in suspension are deposited on the bottom of the sump and do not flow out with the oil during the discharge, with the result that the debris can enter again into circulation in the lubrication system of the engine.



The oil and the hot parts of the engine can cause serious injury. Avoid contact with the skin.



To discharge oil:

1. Run the engine until the water temperature reaches 80 °C.
2. Stop the engine.
3. Prepare a container with a capacity of at least 30 litres underneath the frame structure, in correspondence with the sump ③.
4. Open the valve ④ at the bottom of the sump to drain the oil.
5. Make sure that all the oil and the contaminants are removed from the engine.
6. When the oil is discharged, close the valve ④.



*Make sure that all the oils and liquids that are used are recovered and properly recycled, do not leave these products or containers without appropriate labels in unfit places.
Do not leave stains of any kind of liquid on the ground or floor.*

12.3.2.2 Engine oil refilling

For refilling, or topping up, pour the oil through the refiller hole ② placed on the top of the engine. Make sure that the level measured by the dipstick ① arrives to the upper notch.



Lubricant acronym (see table in Appendix A): EO (Engine Oil);

First service: 500 hours;

Subsequent services: every 500 hours or yearly;

Quantity: 13.1 litres;

Periodic visual inspections: check the level every 10 hours or daily;

Filter replacement: see table 'Filter replacement program' Appendix A..

12.3.3 Engine air filter

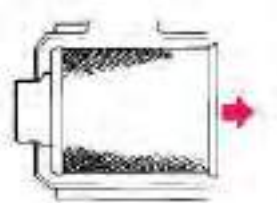


To prevent dirt from entering the engine, always perform the maintenance of the air filter while the engine is stopped.

12.3.3.1 FPG Radial Air Cleaner maintenance

Legend:

- ① service cover
- ② filter housing
- ③ primary filter
- ④ secondary filter
- ⑤ Vacuator™ valve



1. Unfasten the service cover. Because the filter fits tightly over the outlet tube to create the critical seal, there will be some initial resistance, similar to breaking the seal on a jar. Gently move the end of the filter back and forth to break the seal then rotate while pulling straight out. Avoid knocking the filter against the housing.



If your air cleaner has a safety filter, replace it every third primary filter change. Make sure to cover the air cleaner outlet tube to avoid any unfiltered contaminant dropping into the engine.



2. Clean both surfaces of the outlet tube and check the Vacuator™ valve.
Use a clean cloth to wipe the filter sealing surface and the inside of the outlet tube. Contaminant on the sealing surface could hinder an effective seal and cause leakage. Make sure that all the contaminant is removed before the new filter is inserted. Dirt accidentally transferred to the inside of the outlet tube will reach the engine and cause wear. Be careful not to damage the sealing area on the tube.



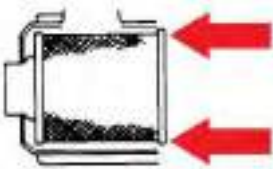
Visually check and physically squeeze the Vacuator™ valve to make sure the valve is flexible and not inverted, damaged or clogged.



3. Visually inspect the old filter for any signs of leaks. Visually inspect the old filter for any signs of leaks. A streak of dust on the clean side of the filter is a tell tale sign. Remove any cause of leaks before installing the new filter.



4. Inspect the new filter carefully, paying attention to the inside of the open end, which is the sealing area. Never install a damaged filter. New radial seal filters have a dry lubricant on the seal to aid installation.



5. Insert the new radial seal filter properly. If you are servicing the safety filter, this should be seated into position before installing the primary filter.

Insert the new filter carefully. Seat the filter by hand, making certain it is completely in the air cleaner housing before securing the cover in place.

The critical sealing area will stretch slightly, adjust itself and distribute the sealing pressure evenly. To complete an air tight seal, apply pressure by hand at the outer rim of the filter, not on the flexible centre (avoid pushing on the centre of the urethane end cap). No cover pressure is required to hold the seal.



Never use the service cover to push the filter into place! Using the cover to push the filter could cause damage to the housing, the cover fasteners and it will void the warranty.

If the service cover hits the filter before it is fully in place, remove the cover and push the filter (by hand) further into the air cleaner and try again. The cover should go on with no extra force.

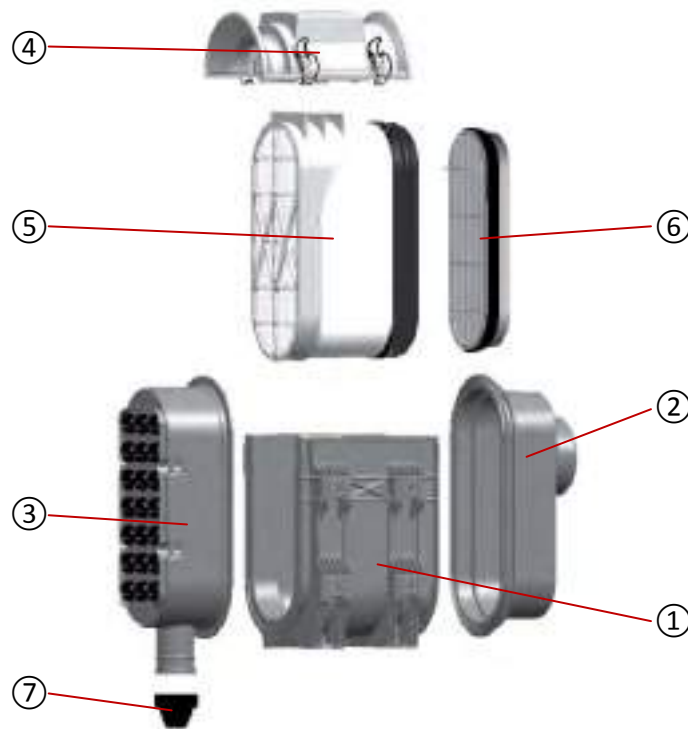
Once the filter is in place, secure the service cover.

6. Check the connectors and the tight fit. Make sure that all mounting bands, clamps, bolts and connections in the entire air cleaner system are tight. Check for holes in the piping and repair if needed. Any leakages in your intake piping will send dust directly to the engine.

12.3.3.2 PSD Air Cleaner service instructions

Legend:

- ① casing
- ③ inlet side
- ② outlet side
- ④ cover
- ⑤ primary filter
- ⑥ secondary filter
- ⑦ Vacuator™ valve



1. Shut off the engine. Unlatch and remove the housing service cover.
2. Remove the primary filter. Pull the filter out of the housing. You must first loosen the filter gasket seal. Using the handle, push down on the filter to loosen the seal, which will tilt the filter to approximately a 5° angle.



Remove any dirt excess and clean out the housing before removing the secondary filter.

3. Remove the secondary filter. Using the plastic handle on the face of the safety filter, pull the filter towards the centre of the housing and remove it.



A secondary filter only needs to be replaced at every third primary air filter change.



4. Insert the new filter before installing. Visually check for cuts, tears, or indentation of the sealing surfaces before installation. If any damage is visible, do not install.



5. If replacing the secondary filter, use the plastic handle on the safety filter, slide the filter at an angle into the outlet side and push in place until the filter seats firmly and evenly within the housing.



Insert the safety filter tab into the positioning slot before pushing the filter in place.



6. Insert the primary filter.
Slide the filter down at approximately a 5° angle until it hits the end of the housing. Rotate the filter towards the outlet section to complete the seal.



7. Replace the service cover.
Place the service cover in position and fasten the latches.



If the cover does not seat, remove and re-check the filter position. The cover will be difficult to install if the filter is not installed correctly.



8. Visually inspect the inlet and outlet connections. Inspect the Vacuator™ valve. Replace if any signs of wear or damage are visible.



12.3.4 Engine air filter clogging indicator



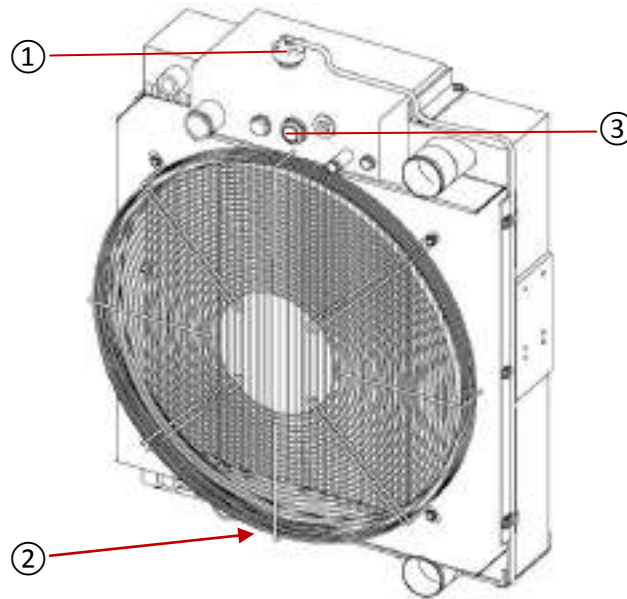
The clogging indicator shows a red colour signal in the clogging window when the clogging limit has been reached.

Manually reset by pressing the push-button, located above the indicator, after having cleaned and/or replaced the air filter.

12.3.5 Radiator

Legend:

- ① refiller cap
- ② drainage valve
- ③ visual level indicator



12.3.5.1 Radiator liquid drainage

Remove the refiller cap ① placed on the top of the radiator, open the valve ② placed on the bottom to discharge the coolant liquid.

Once that the liquid has been drained, close the drainage valve.



Make sure that the engine is not warm and that the coolant liquid is at room temperature.



12.3.5.2 Radiator liquid refilling

Check that the drainage valve ③ is closed.

Unscrew the refiller cap ① and pour the coolant liquid through the refiller hole. The anti-freeze liquid is made by a solution of comprising 50% coolant liquid and 50% water (see table reported in Appendix A).

Check the level of the coolant liquid and add, if necessary, water or anti-freeze liquid until the level is up to 2 cm from the edge of the refiller hole.

Screw back again the refiller cap ①.

Start the engine letting it run at idle for a few minutes checking the temperature indicator placed on the control board inside the cabin to prevent eventual overheating.

Stop the engine, wait for a few minutes to cool down the engine, unscrew the cap, verify the level of the liquid and eventually top up until the liquid reaches the previous liquid level.

Screw the refiller cap back on again and repeat the last two operations until the level of the coolant liquid is stable.



Lubricant acronym (see table in Appendix A): CAL (Cooling Anti-freeze Liquid);
Filling: until the level is 2 cm from the edge of the refiller hole;
Periodic visual inspections: check the level every 10 hours or daily.



- Carefully handle the coolant liquid, remember that overheated components and hot oil can cause skin burns.
- Never add cold coolant liquid when the engine is overheated.

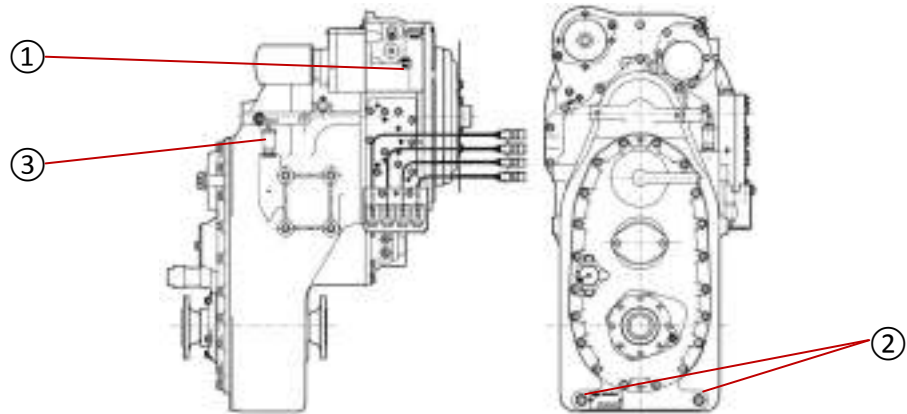


Make sure that all the oils and liquids are used, recovered and properly recycled, do not leave these products or containers without appropriate labels in unfit places.
Do not leave stains of any kind of liquid on the ground or floor.

12.3.6 Transmission

Legend:

- ① breather
- ② drainage cap
- ③ oil dipstick



12.3.6.1 Transmission Oil level check-up

The transmission oil level checking procedure must be carried out with an oil temperature comprised between 83 and 94 °C and the engine at 800 RPM.

Refill the oil if necessary.

To bring the transmission oil to temperature carry out the following manoeuvres:

1. Insert the parking brake.
2. Select the fast gears.
3. Put the gear into neutral position 'N'.
4. Run the engine at idle for at least two minutes.
5. Put it into third forward gear.
6. Run the engine at 1,000-1,500 RPM for 30 seconds.
7. Put it into reverse gear for 5 seconds.
8. Return the gear lever to the neutral position 'N'.
9. Let the engine run at idle to check the transmission oil level.

The oil level is indicated on the transmission dipstick. Top up, if necessary, to the 'FULL' level of the dipstick.



The specifications of the transmission oil are given in 'Appendix A'.

12.3.6.2 Transmission oil change

The normal drainage of the oil and the replacement of the filter are calculated for cranes that work in average environmental conditions and working cycles.

Cranes that work at very high temperatures and for prolonged periods or very dusty environments, are subject to an accelerated deterioration and contamination of the lubricant liquid.

Proceed by discharging the oil when the oil has reached a temperature comprised between 65 and 93°C:

1. Disassemble and dispose the filter. Install the new filter.
2. Refill the transmission with oil up to the maximum level sign.

3. Run the engine at 800 RPM to allow the oil to circulate in the converter and in the pipes.
4. Check again the level with the engine at 800 RPM and add oil until it reaches the minimum level sign.
5. When the oil temperature is comprised between 82.2 and 93.3 °C carry out a final check-up and re-fill if necessary until the oil level reaches the maximum level sign.



Lubricant acronym (see table in Appendix A): TO (Transmission circuit Oil);
Services: every 1,000 hours or yearly;
Quantity: 22 litres;
Periodic visual inspections: check the level every 10 hours or daily (see §12.3.6.1);
Filter replacement: see table 'Filter replacement program' Appendix A.



Make sure that all the oils and liquids that are used are recovered and properly recycled, do not leave these products or containers without appropriate labels in unfit or open places.
 Do not leave stains of any kind of liquid on the ground or floor.

12.3.6.3 Cardan shaft lubrication

Check the lubrication and if necessary lubricate again.
 The cardan shafts are equipped with greasers to allow a good lubrication.
 Mildly lubricate the universal joint placed near the parking brake disc.

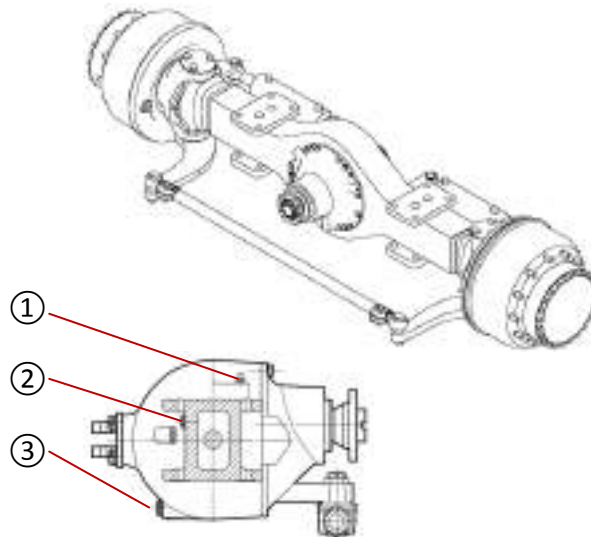


Lubricant acronym (see table in Appendix A): EP-GEG (Extreme Pressure – General Greasing);
Lubrication frequency: every 50 hours or weekly.

12.3.7 Axles

Legend:

- ① oil refiller/breather
- ② oil level
- ③ oil drainage cap



12.3.7.1 Differential oil drainage

Drain the oil through the cap placed on the lower side of the case and through the one placed on the lower side of the gearbox.

At each check-up verify the efficiency of the breather placed on the upper side of the case, by clearing it with gas oil and drying it with compressed air.



It is advisable to drain the oil from the differential when it is still warm.



The oil and hot components of the differential can cause serious injuries. Avoid contact with the skin.



*Make sure that all the oils and liquids that are used are recovered and properly recycled, do not leave these products or containers without appropriate labels in unfit places.
Do not leave stains of any kind of liquid on the ground or floor.*

12.3.7.2 Differential refilling

Make sure that the drainage cap ③ is screwed on tightly.

Unscrew the refiller cap/breather ① and pour in it the lubricant.

Check the oil level through the oil level gauge ② until the oil reaches the maximum oil level.

Screw back again the refiller cap/breather ①.



Lubricant acronym (see table in Appendix A): EP-GBO (Extreme Pressure – GearBox Oil);

First service: 500 hours;

Subsequent services: every 2,000 hours or yearly;

Quantity: 19 litres;

Periodic visual inspections: check the level every 50 hours or weekly.

12.3.7.3 Wheel hubs oil drainage

Draining the oil through the inferior cap of the two hubs with the level notch in horizontal position.



*Make sure that all the oils and liquids that are used are recovered and properly recycled, do not leave these products or containers without appropriate labels in unfit places.
Do not leave stains of any kind of liquid on the ground or floor.*

12.3.7.4 Wheel hubs refilling

With the level notch in horizontal position, proceed to refill until the oil reaches the lower part of the refiller hole/level.



Lubricant acronym (see table in Appendix A): EP-GBO (Extreme Pressure – GearBox Oil);
First service: 500 hours;
Subsequent services: every 2,000 hours or yearly;
Quantity: 1.2 litres x 4;
Periodic visual inspections: check the level every 50 hours or weekly.

12.3.7.5 Brake liquid refilling

In case that the brake liquid level has gone below the maximum level marked on the brake liquid reservoir, refill until the liquid reaches the maximum level.



Lubricant acronym (see table in Appendix A): EP-GEG (Extreme Pressure – General Greasing);
Lubrication frequency: every 2,000 hours or annually;
Quantity: 1.7 litres x 2;
Periodic visual inspections: check the level every 50 hours or weekly.

12.3.8 Tyres

12.3.8.1 Tyre pressure check-up

The tyre pressure should be checked daily - while the tyres are cold and without any hanging load - and, if necessary, corrected for the different applications according to the following chart. Values, together with the tightening torques of the wheel nuts are reported over the four wheel mudguards of the mobile crane.

Dimensions	Inflating pressure		Tightening torque
	Static lifting	Driving on road	
16.00R25	1.000 kPa (10 bar)	900 kPa (9 bar)	650 Nm (66kgm)

In the case of long journeys, after 60 minutes of travel, take at least 30 minutes of rest to cool the tyres. At your destination, allow the tyre to cool to room temperature before working on tyres.



Never deflate hot tyres.

12.3.8.2 Tyre inflating procedure

To allow inflation of the tyres, the crane is equipped with an air inflation plug incorporated into the air dyer unit, on the left side of the machine.

The inflation should always be carried out with cold tyres, or after a few hours of rest of the machine.



Always use a protective inflation cage when the tyre to be inflated is not mounted on the crane.

To inflate the tyres use a hose with, at one end, a fast-on and, at the other end, an inflation gun with pressure gauge, long enough to enable the operator to maintain a safety distance from the tyre.



The bursting of a tyre or the eventual slipping of the wheel disc ring can cause serious injury.

1. Remove the valve cap of the tyre.
2. Connect the fast-on of the inflating hose pipe to the upper air inflation plug of the air dryer unit and the extension of the inflation gun to the tyre valve.
3. Reduce the pressure by pressing and releasing, once or twice, the brake pedal.
4. Start the engine.
5. Inflate the tyre pressing the trigger of the gun. The pressure gauge indicates the pressure of the tyre. Check and adjust the pressure until you get the correct values.
6. Screw the valve cap. The cap is essential to ensure a perfect seal and protect the mechanism of the valve.

12.3.8.3 Wheel replacement

Disassembly

1. Loosen the nuts of the wheel, but not enough to let them turn freely on the threading of the struts.
2. Lift the crane onto the outriggers, with the wheels lifted from the ground.
3. Remove the wheel from the struts and slide it off the wheel hub.

Reassembly

1. Prepare the wheel in the position for inserting it onto the wheel hub. Use two metal bars to lift it up to the hub, paying attention that it does not fall forwards.
2. Position the wheel on the struts.
3. Screw the nuts without tightening them completely.
4. Retract the outriggers to lower the crane on wheels.
5. Tighten the nuts a little bit at a time, at their torque value, acting crosswise. The value of the final coupling torque is 650 Nm (66 kgm)



When a wheel is removed or re-mounted, pay attention not to damage the threaded part of the wheel struts.

12.3.9 Fuel tank

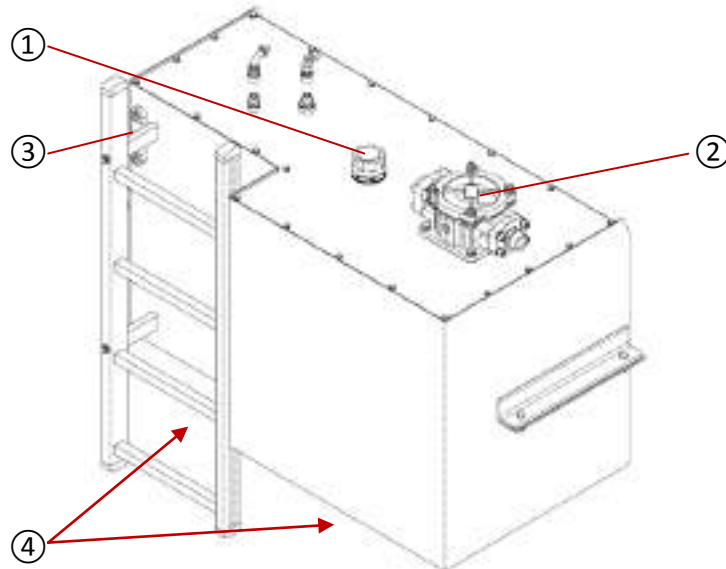


Drain water and sediments from the separator filter daily, by turning by hand, anti-clockwise, the drain valve.

12.3.10 Hydraulic oil reservoir

Legend:

- ① breather
- ② filter
- ③ visual level
- ④ drainage caps



12.3.10.1 Hydraulic oil tank checks

Check-up daily the level of the hydraulic oil contained inside the reservoir when the crane is in a horizontal position, the outriggers are fully retracted, the telescopic boom is retracted and lowered and the oil is cold.

12.3.10.2 Hydraulic oil drainage

To drain the hydraulic oil from the reservoir, unscrew the two drainage caps placed on the bottom of the reservoir.



*Make sure that all the oils and liquids that are used are recovered and properly recycled, do not leave these products or containers without appropriate labels in unfit places.
Do not leave stains of any kind of liquid on the ground or floor.*

12.3.10.3 Refilling the hydraulic oil reservoir

The hydraulic oil reservoir, 430 litres capacity, must be filled, until the oil reaches the maximum level shown on the level gauge, through the filter which is mounted on the upper side of the reservoir.

The filling of the reservoir must be carried out when the telescopic boom is retracted and lowered and the outriggers and the jacks are retracted.



Lubricant acronym (see table in Appendix A): HYDO (HYDraulic circuit Oil);
First service: 500 hours;
Subsequent services: every 2,000 hours or yearly;
Quantity: 430 litres;
Periodic visual inspections: check the level every 10 hours or daily;
Filter replacement: see table 'Filter replacement program' Appendix A.

12.3.10.4 Hydraulic oil filter clogging indicator

The hydraulic oil filter is equipped with a clogging indicator which is divided in two areas – green (clean filter) and red (clogged filter) – that allows to directly read the clogging condition of the filtering element.



The inspection of the filter should be done after the hydraulic circuit has reached its normal operating temperature, since it is possible that a higher viscosity oil in cold creates a pressure differential sufficient to move the pointer in the red zone.

If the indicator is in the red area, while the hydraulic circuit is operating at normal temperature, it is necessary to replace the element with a new one, because the counter-pressure caused by the clogged filter element enables the bypass, placed inside the head of the filter, to open and let the oil to flow directly into the reservoir without passing through the filter element.

The filter must be checked daily. On a new crane, the first replacement of the filter element must be performed after 500 hours. After that, it is recommended to replace the elements every 1,000 hours or once a year.

Replacement of the filter and of the breather

Procedure for the removal of the filter element and the breather:

1. Stop the hydraulic plant.
2. Clean the cover and the head of the filter.
3. Put a container near the oil reservoir to collect the oil that spills out of the element.
4. Loosen and remove the cover of the filter.
5. Remove the bridge and the filtering element from the container of the filter.
6. Remove the encasement of the breather from the cover of the filter by loosening the central M8 screw.
7. Remove the filter of the breather
8. Remove the filtering element and the air filter and put them in a container.
9. Clean the magnetic pre-filtering column.

Installation of the filter element and of the breather filter

1. Mount a new element in the container of the filter.
2. Mount the bridge taking care that it is centred on the element of the filter.
3. Mount on the cover a new filter of the breather and tighten the screw that holds the encasement of the breather.
4. Install a new gasket on the cover.
5. Screw the cap on the head of the filter.

6. Start the engine and operate the controls in order to discharge the air.
7. Check for the eventual presence of leakages and carry out the eventual reparations.

12.3.11 Air tanks



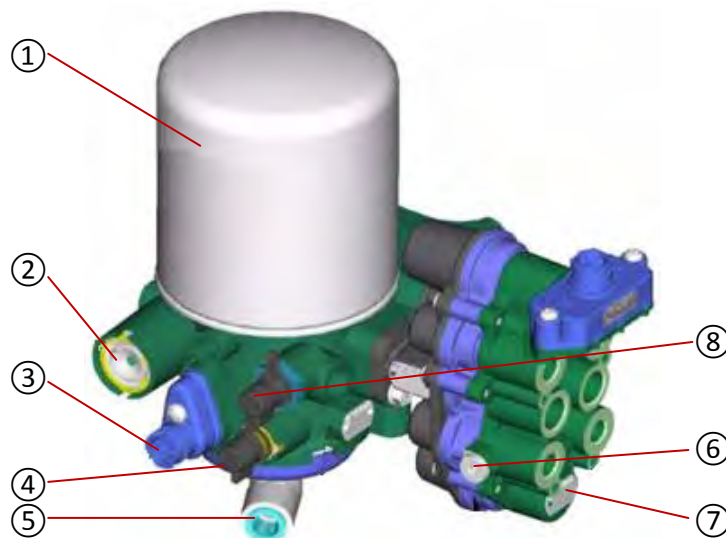
Purge daily, at the end of every working day, the air reservoirs and discharge sediments and condensation.

12.3.12 Air treatment unit

The air treatment unit integrates into a single group, combining all the functions of treatment, control and distribution of compressed air of the braking system of the mobile crane.

Legend:

- ① cartridge
- ② pressure governor
- ③ heater
- ④ pressurised air plug
- ⑤ external air plug
- ⑥ pressure valve
- ⑦ pressure limiting valve
- ⑧ inlet air plug



The maintenance of the unit requires the replacement of the dryer cartridge every 500 hours, depending on the operating conditions and oil content of the air delivered by the compressor.

The replacement of the cartridge is needed when, during the daily check up, in a period of normal operation of the machine, is found in many times in succession the presence of water in the air tanks.

12.3.13 Slewing ring



12.3.13.1 Slewing ring bolt tightening

To guarantee functioning safety, duration and efficiency of the crane, great care must be taken when servicing the bearing and checking the correct tightening of the fixing bolts.

On this crane model the fixing bolts are of the high-resistance type (grade 10.9) and must be fastened at the specific torque values (see 'Screw coupling and torque chart', Appendix A).

Repeated tightening can cause stretching of the bolts, making their replacement necessary.

When a high-resistance bolt is removed, it must be replaced with a new one of the same grade and size.



After the first 200 hours of functioning of the crane you must inspect the slewing ring fixing bolts in order to verify their tightening and, if necessary, tighten them again.

Subsequently you need to check the proper tightening of the bolts every 500 hours, as it is possible for the bolts to loosen during operation of the crane due to vibrations, jerking of the load and sudden temperature changes.

Tighten the bolts with a torque wrench equipped with a torque limiting device that can be pre-set to the required values.



Dynamometric wrenches are precision instruments that must be handled with care and periodically calibrated to ensure precise tightening torque values.

The dynamometric wrench is not comprised in the equipment of the crane.

The bolts must be tightened at diametrically opposite torques, working in sequence from one side of the ring to the opposite side.



First of all tighten to 50%, then tighten to the final torque value.

The external ring of the slewing ring is attached to the carriage structure by 60 M30x150, 10.9 grade bolts. The internal ring of the slewing ring is attached to the superstructure by 60 M30x150, 10.9 grade bolts. Tighten all the bolts of the slewing ring at the same value that is reported in the 'Screw coupling torque chart' (Appendix A) by using a torque wrench.

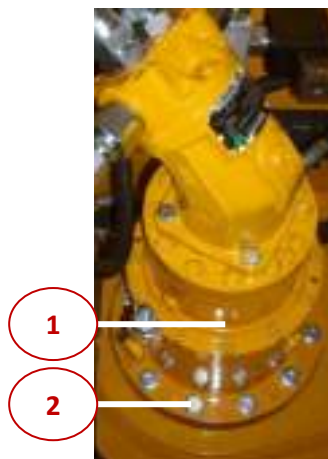
12.3.13.2 Slewing ring lubrication

For a correct lubrication of the slewing ring, pump grease until it spills out of the slewing ring raceway, then turn of 90° and repeat the operation. Repeat the operation until the entire bearing is greased.



Lubricant acronym (see table in Appendix A): EP-GEG (Extreme Pressure – General Greasing);
Lubrication frequency: every 50 hours or weekly.

12.3.14 Slewing ring/pinion backlash



The backlash adjustment between the pinion tooth and the slewing ring teeth is obtained by turning the gear of the slewing gearbox.

To carry out the backlash adjustment:

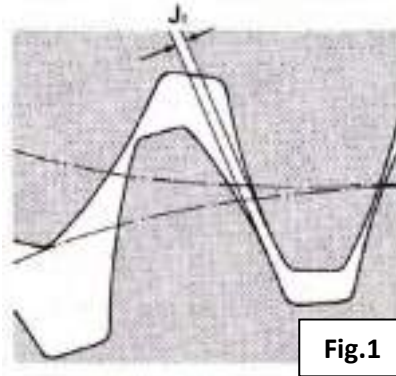
1. Extend and position the outriggers. Make sure that the crane is perfectly levelled.
2. Insert the turret slew locking pin.



The non-insertion of the locking pin can cause serious or fatal accidents when the slewing brake is disengaged.

3. Disconnect the hose from the attachment on the slewing brake and connect a hand pump to the brake.
4. Pump pressurised oil to loosen the slewing brake.
5. Remove the outer bolts ② which fasten the slewing gearbox ① to the turret.
6. Turn the slewing gearbox CW until the pinion tooth comes in contact with the teeth of the slewing ring.

The acceptable backlash [$J_t = 0.03 \times \text{teeth module}$] (see fig.1) between the side of the three green coloured slewing ring teeth (point of maximum ovalisation) and the pinion, in the narrowest point must not measure more than 0.3 mm.



7. Reposition the flange outer bolts and tighten them to the specific torque (see 'Screw coupling torque chart' Appendix A).
8. Connect the hose to the slewing brake.
9. Check the backlash by turning the turret in both directions.

12.3.14.1 Slewing gearbox refilling

In case the level of the lubricant should need to be topped up, proceed by topping up through the refiller hole placed on the upper part of the gearbox.



Lubricant acronym (see table in Appendix A): EP-GBO (Extreme Pressure – GearBox Oil);
First service: 200 hours;
following services: every 1,000 hours and afterwards 2,000 hours or yearly;
Quantity: 9 litres;
Periodic visual inspections: check the level every 50 hours or weekly;
Filter replacement: see table 'Filter replacement program' Appendix A.

12.3.14.2 Pinion and slewing ring teeth lubrication

In order to minimise the friction between the slewing ring and the turret slewing gearbox pinion, proceed by abundantly greasing the pinion teeth and of the slewing ring by using a spatula to apply the lubricant.



Lubricant acronym (see table in Appendix A): RPL (slew Rack and Pinion Lubricant);
Lubrication frequency: every 50 hours or weekly.

12.3.15 Metal ropes

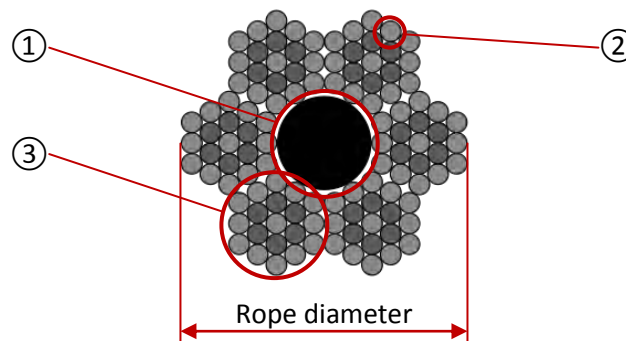
12.3.15.1 Rope check-up

The metal ropes are one of the main mechanical components of the crane, on which are used to lift the load and to telescope out and telescope in the boom.

A rope is made of many spiral bound metal strands wrapped around a metal core; the strands are made by multiple metal wires arranged in helical shape around a central core made of metal wires.

Legend:

- ① core
- ② wire
- ③ strand



The rope used to lift the load is an 'anti-rotation' type, made of two or more layers of strands corded in alternate direction to block the unwinding rotation of the rope respect to its own axis due to the helix winding used in the manufacturing.

The boom extension and retractions ropes are 'right cross' lay type, made in polished steel with a high ultimate tensile strength.

Metal ropes always require special attention starting from their installation on the machine, to their operational and maintenance check-up.

12.3.15.2 Lifting rope

The lifting rope must be visually checked every day in order to detect and monitor wear and deformation signs, particularly in the areas that are subject to quick deterioration, such as those in correspondence with the end attachments or the sheaves where the movement of the rope is limited. Even the damaging of the boom sheaves and the hookblock, or the grooves of the hoist drums, can accelerate wear and deterioration of the metal ropes.

The checking of the rope to detect any damage that require its replacement must evaluate the following considerations:

- a. number and position of broken wires that are visible on the outside of the rope;
- b. flattening of the wires as a result of wear;
- c. reduction of rope diameter due to external and internal corrosion;
- d. other rope damage or deterioration of the rope.



By law, rope conditions and any replacement must be reported in a control register of the machine during the periodical three monthly inspections.



All metal ropes are subject to a wear limit after which they must be replaced.

An anti-rotation rope must be replaced when one of the following conditions occur:

- a. The number of visible broken wires is more than 2 on a length equal to 6 times the diameter of the rope, or more than 4 on a length equal to 30 times its diameter.
- b. Presence of a reduction in the nominal rope diameter, even in just one point, more than the 7% due to internal or external corrosion.
- c. Presence of crushing, torsion, bending or other permanent deformation of the rope structure.
- d. When the rope core comes out, even if only in one point.
- e. Presence of one or more loosened and jutting strands even when the rope is in traction.

12.3.15.3 Typical examples of rope wear

The photographs shown here below illustrate a few examples of rope deterioration and the safety measures to be carried out.



Breaking and moving of wires on two adjacent strands.
The rope has to be replaced.



Severe wear and considerable number of broken wires.
The rope has to be replaced.



Breakage of wires on one strand and light wear.
Remove the broken wires to make the rope smooth.



Broken wires in a number of strands close to a return sheave.
The rope has to be replaced.



Broken wires in two strands due to bending stress associated to a serious localised wear.
The rope has to be replaced.



Nest deformation of a multi-strand rope (anti-revolving type) caused by forced rotation due to a too narrow groove or an excessive deflection angle.



Expulsion of the metal core generally associated to a nest deformation.



Only one strand is concerned by the expulsion of wires. The examination of one section of rope shows that the deformation is visible at regular intervals, normally equal to the winding pitch.



Aggravation of the previous defect with expulsion of the internal wires of the strands. Serious local defect caused by the application of pulsing loads.



Local increasing of the diameter of a parallel winding rope, caused by distortion of the metal core, due to a sudden load.



Metal rope which has been twisted during the installation phase, but used the same for lifting and now subjected localised wear and loosening of the strands.



Flattened area caused by the local squashing due to mechanical action that leads to disequilibrium in the strands. Simultaneous presence of broken wires.



Flattened area of a multi-strand rope due to mechanical action on a long section of the rope, caused by an incorrect winding from a drum.



Example of severe bending of the rope.



Typical example of rope that has come out the groove of a sheave and got stuck in the sheave itself. The result is a flat deformation with localised wear and many broken wires.



Rope section with a severe internal corrosion. The rope has to be replaced.

12.3.15.4 Head and hookblock sheaves

The use of plastic sheaves compared to the use of metal ones significantly extends the duration of the rope, but makes more difficult to estimate its replacement because the wear of the rope takes place internally and cannot be seen from the outside, making replacement criteria inadequate based exclusively on visible ruptures of wires and strands.

12.3.15.5 Lifting rope replacement

The rope is fixed to the hoist drum by an anchoring wedge and wound around the drum for a minimum of three complete spirals before passing along the boom and then between the head and hookblock sheaves.

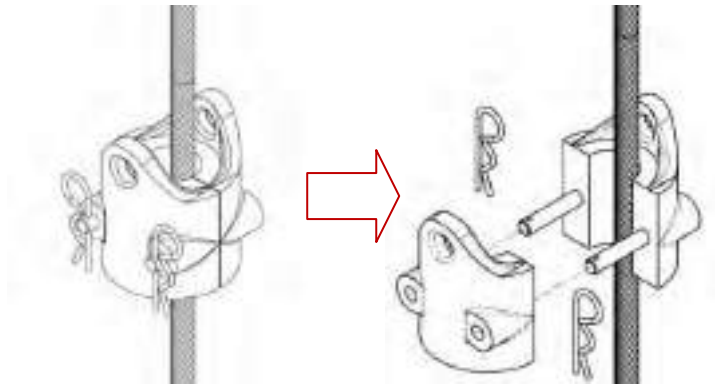
For an even number of falls, the rope is fixed to the head of the boom, while when there is an uneven number of falls it is fastened to the hookblock. The mounting of the various falls is shown later (§ 12.3.15.7).

The winding and unwinding limits of the hoist rope are controlled by two limit switches that stop the movement. The first switch is applied to the head of the boom, the second to the hoist drum.

Rope removal

to remove from the machine the rope that has to be replaced follow the procedure:

1. Completely lower the boom and position it with the head on the front side of the machine.
2. Rest the hook-block on the ground.
3. Separate the two semi-blocks of the hookblock limit switch weight to free the rope.



4. Remove the rope lug from the head of the boom or from the hookblock, depending on the number of set falls. Free the end of the rope by removing the wedge from the lug.
5. Slowly rotate the hoist to unwind the rope from the drum and, at the same time, wind it onto a suitable support.
6. When on the drum there are only a few remaining spirals, to completely unwind the rope, lift the hoist limit switch system roller in order to avoid that the drum stops.
7. Remove the protection carter from the left side of the hoist to access the rope fixing seat.



Pay maximum attention when working without the protection carter. The drum, revolving, can cause serious injury.

- Free the end of the rope by removing the anchoring wedge from the seat on the outside of the drum flange.
- Properly mark the replaced rope in order to identify it as the rope that has been removed from service and can no longer be used.



Never touch the rope with bare hands. Always wear protective gloves. Broken wire on a rope can cause serious injuries.



Rope Installation



When you need to fully unwind the rope from the hoist drum, during the subsequent rewinding operation, a minimum tension is recommended which is equal to 3% of the breaking load of the rope under direct pull.

The rope that has been chosen for the replacement must have the same characteristics of the original one, whose data is reported in the certificates attached to the crane control register.

The rope must be clean and must not show any signs of deterioration or corrosion.

Before installing a new rope you need to make sure that the grooves and flanges of the head and the hook-block sheaves are not worn or deformed by the passing of the old rope, and that all sheaves rotate freely. Damaged sheaves cause quick deterioration of the rope.

To install a new rope on the hoist drum follow the procedure:

- Completely retract the boom and position it on the front side of the crane.

Position the hookblock on the ground, directly underneath the head of the boom. Unwind the rope following the instructions illustrated below to avoid the forming of loops form that may irreversibly damage the rope.

INCORRECT UNWINDING



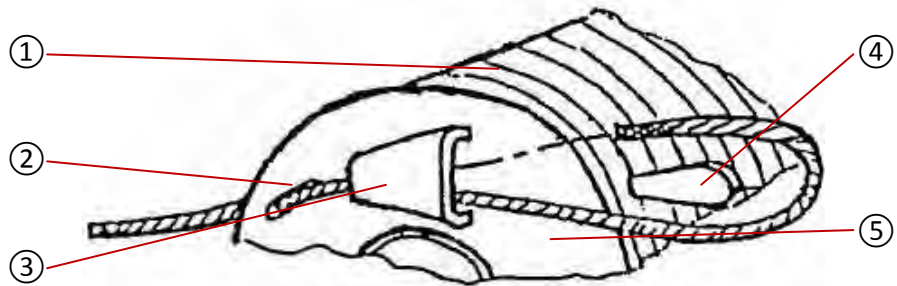
CORRECT UNWINDING



2. Remove the rope restraint pin on the head of the boom and slide the rope on the upper head sheave and along the base section of the boom, up to the hoist drum.
3. Rotate the drum of the hoist so that the side pocket of anchorage of the rope on the drum flange is positioned at the top.

Legend:

- ① drum
- ② slot
- ③ pocket
- ④ wedge
- ⑤ flange



Pay maximum attention when working without the protection carter. The drum, revolving, can cause serious injury.

4. Pass the end of the rope through the side slot on the drum flange and wind it around the anchoring wedge. The end of the rope must adapt perfectly with the bottom of the groove of the wedge.
5. Insert the anchoring wedge inside the side pocket of the drum. Pull with force the free end of the rope to block the wedge inside the pocket. Hit with a rubber mallet the wedge to fix it even tighter.



Fastening the rope improperly or using a wedge that does not couple with the pocket can damage the rope or cause the rope to slide out of its fixing pocket, causing the load to fall with serious consequences.

6. Replace the hoist protective carter.
7. Slowly rotate the drum making sure that the first layer of rope is uniformly wrapped on the drum. Use a brass or rubber mallet to align the spirals with light taps.
8. Winding the second layer of rope, pay attention that the spirals are tight against one another to avoid overlapping or crossing of the rope in the next layer.
9. Install the remaining part of the rope according to your necessity.

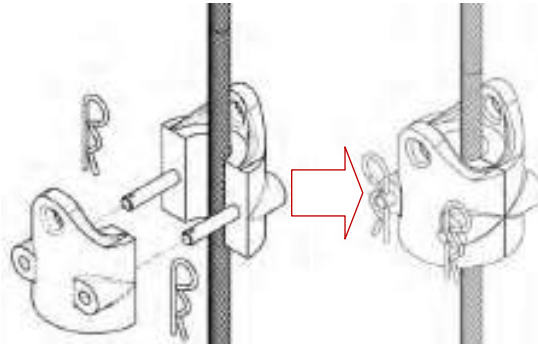


Wind or unwind the rope keeping it always pulled. Never wind on the drum more than the appropriate amount of rope.

During the winding or unwinding phase it is recommended to maintain a minimum tension of the rope equal to 3% of the breaking load of the rope under direct pull.

10. Pass the rope over the upper sheave of the head of the boom and then between the lower sheaves and the hookblock, according to the number of falls desired.

11. Pass the last segment of rope between the two semi-blocks of the limit switch weight. Connect and lock the two semi-blocks.



12. Fasten the free end of the rope to the lug and then to the anchoring point.
13. Lift the boom to work position with a suspended test load to definitively settle the wedge and the rope inside the lug and check the correct mounting of the falls.

Free end of the rope fastening

After having mounted the rope on the hoist, the free end must be fastened to the head of the boom or to the hookblock according to the number of falls.

The fastening system is based on the use of a self-blocking wedge swaging socket. The wedge socket can be quickly and easily mounted and taken apart, but it requires the correct mounting of the rope.



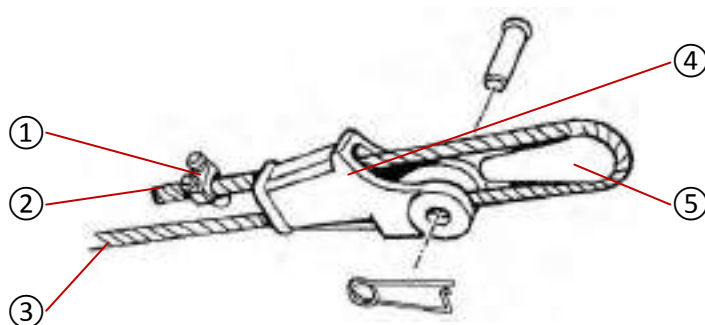
Fastening the rope improperly or using a wedge that does not couple with the swaging socket can damage the rope or make the rope slide out from the socket, causing the falling of the load with serious consequences.

To fasten the rope to the swaging socket:

1. Make sure that the wedge to insert and the socket are suitable for the diameter of the rope used.
2. Make sure that the end of the rope to be inserted is braze welded or well tied with carbon steel wire, in order to prevent it from coming undone and avoiding the opening of the steel wires of the rope and the core to come out.
3. Insert the end of the rope in the socket and make it get out once again, forming a loop, making sure that the part of the pulled rope is positioned along the axis of the socket fork, and that the length of the terminal part of the rope (dead end) that extends after the final blocking is at least 15 cm long.

Legend:

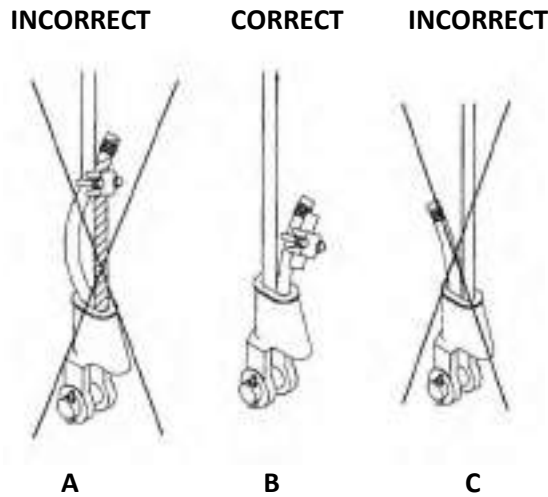
- ① wire rope clip
- ② dead end
- ③ free end
- ④ swaging socket
- ⑤ wedge



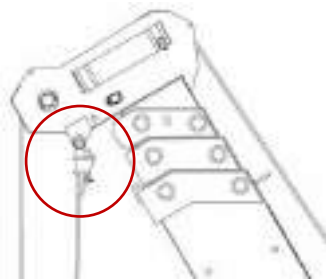
4. Insert the wedge in the ring and pull the free end of the rope. The wedge and the rope must move freely until they adhere against the walls inside the socket, locking themselves.
5. Fasten a wire rope clip to the dead end of the rope as an additional safety measure avoiding the rope to slip out of the swaging socket.



An incorrectly fastening of the rope as shown in figures A and C may cause the sliding of the rope until its complete detaching, with serious consequences.



6. Permanently settle the wedge and the rope in the swaging socket by lifting a load.



When the swaging socket is fastened to the boom, it must be mounted with the dead end of the rope towards the boom of the crane, as shown in the figure.



The fixing of the free end of the rope must be made with great care and should be checked often because, being subject to stresses and accidental blows, is one of the most sensitive issues.

12.3.15.6 Testing and adapting of the rope

Running of the rope is an important operation. In fact, a new rope settles during the first load cycles. After having mounted the rope and checked its attachments, lift a few light loads with the boom completely extended and lifted.

It is possible that the hookblock has a tendency to rotate on itself and, once that the load is released, the supporting segment ropes get twisted. This is caused by the winding direction of the strands that, even in anti-revolving ropes, causes an internal rope settling with a tendency to twist. In order to obviate this inconvenient, after a certain number of load cycles with gradually increasing loads, rest the hookblock on the ground and disconnect the rope swaging socket from its attachment. Twist the rope two or three times in the opposite direction to the winding direction of the external strands in order to discharge the rope tension. Re-connect the swaging socket and complete a few hookblock raising cycles without load, with the ex-

tended and lifted boom. In this way the rope can settle and you can verify if it still has a tendency to twist. Repeat this sequence of rope loading and swaging socket rotation until the rope has not settled.

12.3.15.7 Supporting rope segments mounting procedure (falls)

The main hoist is equipped with a steel rope with the following characteristics:

- Type: anti-revolving
- Diameter: 18 mm
- Length: 175 m
- Minimum tensile strength: 26.700 daN

Complete rope characteristics are included in the certificate of conformity attached to the audit register of the machine.

The rope can be mounted in various number of falls according to the required lifting capacity. The lifting capacity of a crane depends on the traction force of the hoist and the number of supporting rope segments, between the head of the boom and the hookblock.

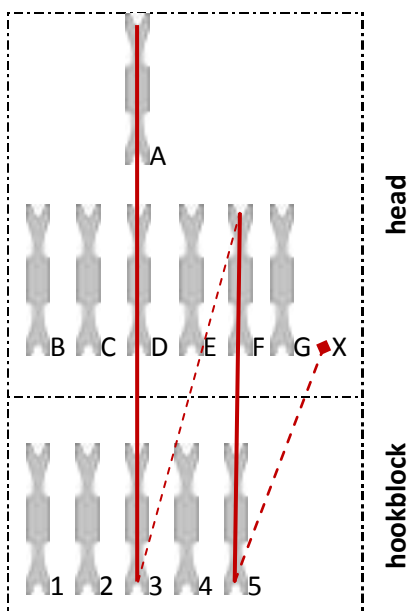


Always use a number rope segments suitable for the load that has to be lifted.

No. of falls	1	2	3	4	5	6
Permissible load [kg]	4545	9091	13636	18182	22727	27273

No. of falls	7	8	9	10	11
Permissible load [kg]	31818	36364	40909	45455	50000

The following figures illustrate the procedures for installing the hookblock in fourth, eighth, tenth and eleventh fall. The sheaves indicated by the letters A, B, C, D, E, F and G are the ones that are mounted on the head of the boom; the sheaves indicated by the numbers 1, 2, 3, 4 and 5 are the ones of the hookblock. Position X corresponds to the swaging socket placed on the boom head.



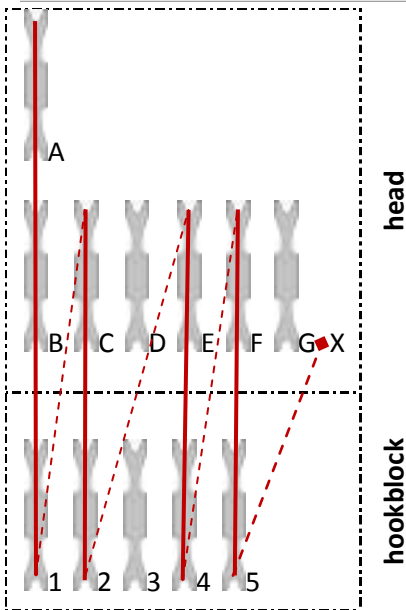
Four falls

From sheave A pass the rope over sheave D.

From sheave D pass the rope underneath sheave 3.

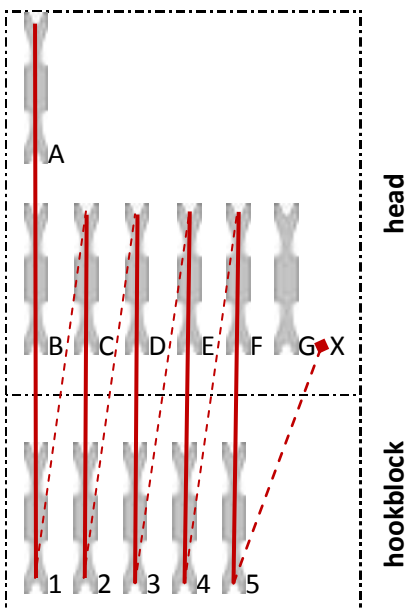
From sheave 3 cross and pass the rope over sheave F.

From sheave F pass the rope underneath sheave 5; anchor the end of the rope to the wedge and fix it to the anchor point X placed on the boom head.



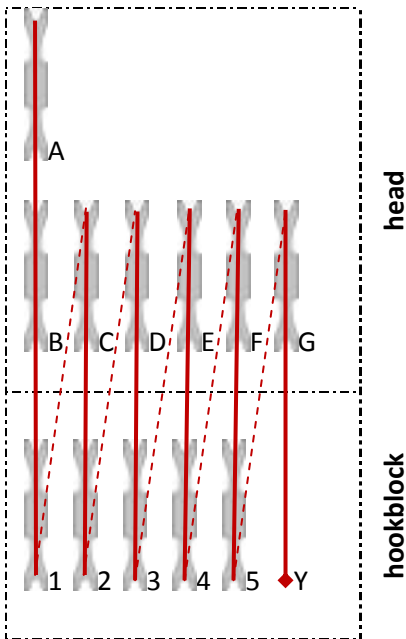
Eight falls

From sheave A pass the rope over sheave B.
 From sheave B pass the rope underneath sheave 1.
 From sheave 1 cross and pass the rope over sheave C.
 From sheave C pass the rope underneath sheave 2.
 From sheave 2 cross and pass the rope over sheave E.
 From sheave E pass the rope underneath sheave 4.
 From sheave 4 cross and pass the rope over sheave F.
 From sheave F pass the rope underneath sheave 5; anchor the end of the rope to the wedge and fix it to the anchor point X placed on the boom head.



Ten falls

From sheave A pass the rope over sheave B.
 From sheave B pass the rope underneath sheave 1.
 From sheave 1 cross and pass the rope over sheave C.
 From sheave C pass the rope underneath sheave 2.
 From sheave 2 cross and pass the rope over sheave D.
 From sheave D pass the rope underneath sheave 3.
 From sheave 3 cross and pass the rope over sheave E.
 From sheave E pass the rope underneath sheave 4.
 From sheave 4 cross and pass the rope over sheave F.
 From sheave F pass the rope underneath sheave 5; anchor the end of the rope to the wedge and fix it to the anchor point X placed on the boom head.



Eleven falls

- From sheave A pass the rope over sheave B.
- From sheave B pass the rope underneath sheave 1.
- From sheave 1 cross and pass the rope over sheave C.
- From sheave C pass the rope underneath sheave 2.
- From sheave 2 cross and pass the rope over sheave D.
- From sheave D pass the rope underneath sheave 3.
- From sheave 3 cross and pass the rope over sheave E.
- From sheave E pass the rope underneath sheave 4.
- From sheave 4 cross and pass the rope over sheave F.
- From sheave F pass the rope underneath sheave 5.
- From sheave 5 pass the rope underneath sheave G; anchor the end of the rope to the wedge and fix it to the anchor point Y placed on the hookblock.



- When the installation is completed, before starting to work, raise the boom in working position with a test load suspended for securely tighten the rope and the anchoring wedge against the seat of the swaging socket.
- To maintain a stable positioning of the hookblock during the lifting, perform the rope winding procedures on the sheaves in order to have an equal distribution of rope tension.



To maximise the life span of the rope and to reduce the rotation of the hookblock use, if possible, an equal number of bearing segments of the rope.

12.3.15.8 Lifting rope maintenance



For a long life span of the rope, for the safety of load lifting and of personal safety, it is fundamentally important to keep the ropes in an optimal condition.

The rope is internally lubricated during manufacturing in order to ease reciprocal wire sliding during bending and inhibit oxidation.

This lubrication cannot last the entire operational lifespan of the metal rope; therefore it is necessary to periodically lubricate using a good rope lubricant with the following characteristics:

- corrosion resistance
- water repellency
- capacity to penetrate between strands and adhesion
- chemically neutral
- stability to temperature variations

A layer of dust or mud on the surface of the rope can block lubricant from penetrating deeply, allowing dampness to act inside of the rope, causing corrosion. For this reason the rope must be dried and cleaned with a metal brush from any encrustation, accumulation of dry grease, dust or mud, before lubricating it.

The grease must be applied uniformly and in small quantities in order to create a thin, continual and transparent layer that makes it possible to see the surface of the external wire of the rope.

In very dusty environments, besides the quantity, care is also needed when choosing the viscosity and adhesiveness of grease, in order to avoid that accumulations form on the rope, increasing wear and making the inspection impossible.

The lubricant can be applied with different methods: spreading it along the rope with a brush or a sprayer, or making it drip down the rope.



To promote penetration, the lubrication should be performed in an area where the rope is bent, such as the one in correspondence of a sheave. The lubricant must be applied on top of the curvature, because at this point the strands are opened by the bend and it is easier to make it penetrate inside.



Lubricant acronym (see table in Appendix A): WRL (Wire Rope Lubricant);
Lubrication frequency: every 500 hours;
Periodic visual inspections: check the level every 10 hours or daily.



Avoid laying the rope on muddy or dusty floors.



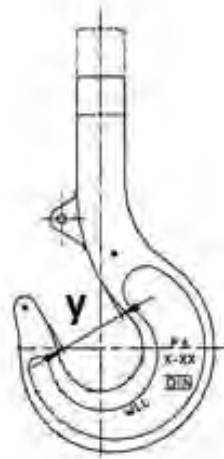
Always wear protective gloves when handling a rope.



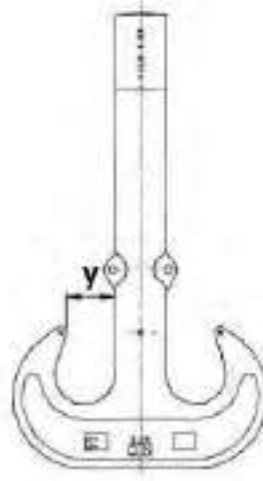
12.3.16 Hookblocks



- Before lifting a load, make sure that the return spring of the safety latch is not damaged, and that it pushes the latch against the hook closing its opening. Never use hooks where the safety latches are bent or damaged.
- Do not lift with jolts, but do it in the most continuous way as possible.
- Never lift loads that are heavier than those allowed by the maximum hookblock lifting capacity. Maximum lifting capacity is reported on the plate fixed to the hookblock and embossed on the hook. If a load that exceeds the maximum allowed lifting capacity is lifted accidentally, it is necessary to immediately verify the measurement of the "y" dimension of the shank hook opening, before going back to work. The measured value must be compared to the one indicated on the certificate issued by the manufacturer and reported shown in the audit register of the machine. If the value measured is different from the certified one, immediately suspend work and promptly warn the person in charge of maintenance. The hook must be replaced.



SHANK HOOK



RAMSHORN SHANK HOOK

Capacity [T]	Sheaves	Falls	Weight [kg]
50	5	11	550
15	1	3	290
5	-	1	100

12.3.16.1 Periodic Hookblock check-up

Inspection and maintenance list to be carried out every 50 hours or weekly:

	Maintenance process	P.P.E.
	Check tightening of the lock nuts for the junction tie rods on the hookblock shoulders	
	Check tightening of the ring-nut of the shank hook	
	Check that the lifting capacity plate is present and legible. Replace it if illegible	

Inspection and maintenance list to be carried out every 200 hours or monthly:

	Maintenance process	P.P.E.
	Check the clearance of the sheaves on their axis.	
	Check for eventual wear of the hook seat and its opening	

12.3.16.2 Hookblock lubrication

Grease the axial bearing and lubricate the cross pin on each axial joint of the hookblock until the grease comes out.



Lubricant acronym (see table in Appendix A): EP-GEG (Extreme Pressure – General Greasing);
Periodic visual inspections: every 50 hours or weekly.

12.3.17 Limit switch devices

12.3.17.1 A2B device



The limit switch is mounted on the head of the boom in order to prevent the latter to come in contact with the hookblock when the rope is lifted or the boom is extended.

The device is made of a watertight switch connected to a chain and a weight block. When the hookblock, moving upwards, hits the weight block, the switch opens the electrical circuit and, through a solenoid valve discharges the joysticks hydraulic circuit, causing the movements to stop.

The same limit switch device is alternatively used for working with the main boom and for the heavy duty jib or the lattice extension.

When mounting the auxiliary hoist an additional limit switch is provided for the auxiliary equipment.

Before starting the crane make sure that:

1. the limit switch is fixed to the specific support attachment on the head of the boom and fastened with a restraint.
2. The Anti2Block device is connected to the electric socket placed on the head of the boom.
3. The weight block is linked through the chain to the metal cable of the switch and it is closed around the last rope segment of the swaging socket.



The minimum length for the chain of the counterweight for the limit switch device must be at least 80 cm long.

Moderate the hoist lifting speed when working with the hookblock near the limit switch.

The limit switch counterweight is made out of two detachable semi-blocks kept in position with two reference pins and two retaining R-clips.

To insert the rope in the limit switch counterweight:

1. Remove the two R-clips from the block and separate it into two parts.
2. Close the two semi-blocks around the swaging socket rope segment and fasten it with the R-clips.

12.3.17.2 Lifting intervention and exclusion of the limit switch mode

The limit switch stops the lifting movement of the hookblock and the extension of the telescopic boom.

When the limit switch starts to work, all the movements that increase the loading moment are blocked, and the Load Moment Indicator (LMI) lights a warning light and emits a continual acoustic signal. No error message appears on the LMI display. The blocking of the movements and the alarm signals continue until the related joystick is moved to invert the movement.



The lifting limit switch is disengaged when the LMI is excluded: danger of accident.

Check daily the functioning of the hookblock limit switch.

12.3.17.3 Hoist hook limit switch

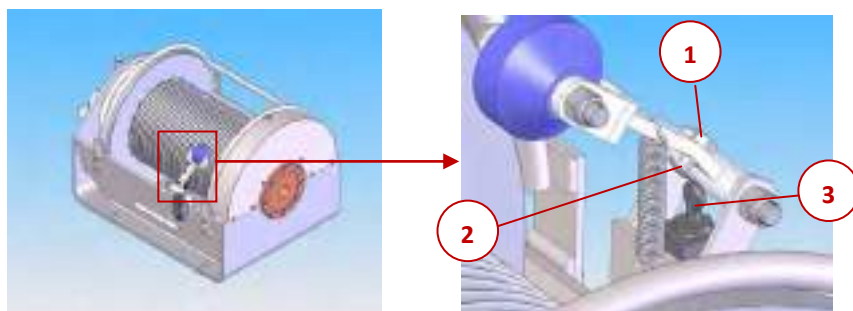
The rope descent limit switch is mounted on the drum of the main and auxiliary hoist - if provided - to stop the descent movement by the hoist when only three spirals of rope remain on the drum.

The device is made of a watertight switch mounted on a support, by a roller probe hinged on the support and by a spring which keeps the roller presses against the rope winded around the hoist drum.

When on the drum there are just three spirals of rope winded on the drum, the roller, pressed down by the spring, spins until it comes in contact with the drum, by engaging the switch that cuts off the electrical circuit blocking, through the discharge solenoid valve of the joysticks hydraulic circuit, the rope descent movement.

To adjust the rope descent limit switch device:

1. Lift and extend the boom. Unwind the rope until only three spirals remain winded on the hoist drum. The descent movement should stop automatically.



If that does not occur:

2. Loosen the nut ① and adjust the screw ② so that, with the roller pressed against the drum, the cam ③ gets pressed until it engages the switch.
3. Rewind the rope in various layers on the drum and check the safety of the rope descent limit switch device.
4. Periodically check the wear of the limit switch device by adjusting, or in case, replacing it.

12.3.17.4 Main and auxiliary hoist refilling

The refilling has to be carried out through the refiller cap placed in the upper part of the hoist gearbox.



Lubricant acronym (see table in Appendix A): EP-GBO (Extreme Pressure – GearBox Oil);

First service: 100 hours;

Subsequent services: every 1,000 hours or yearly;

Quantity main hoist: 3 litres;

Quantity auxiliary hoist: 2.6 litres;

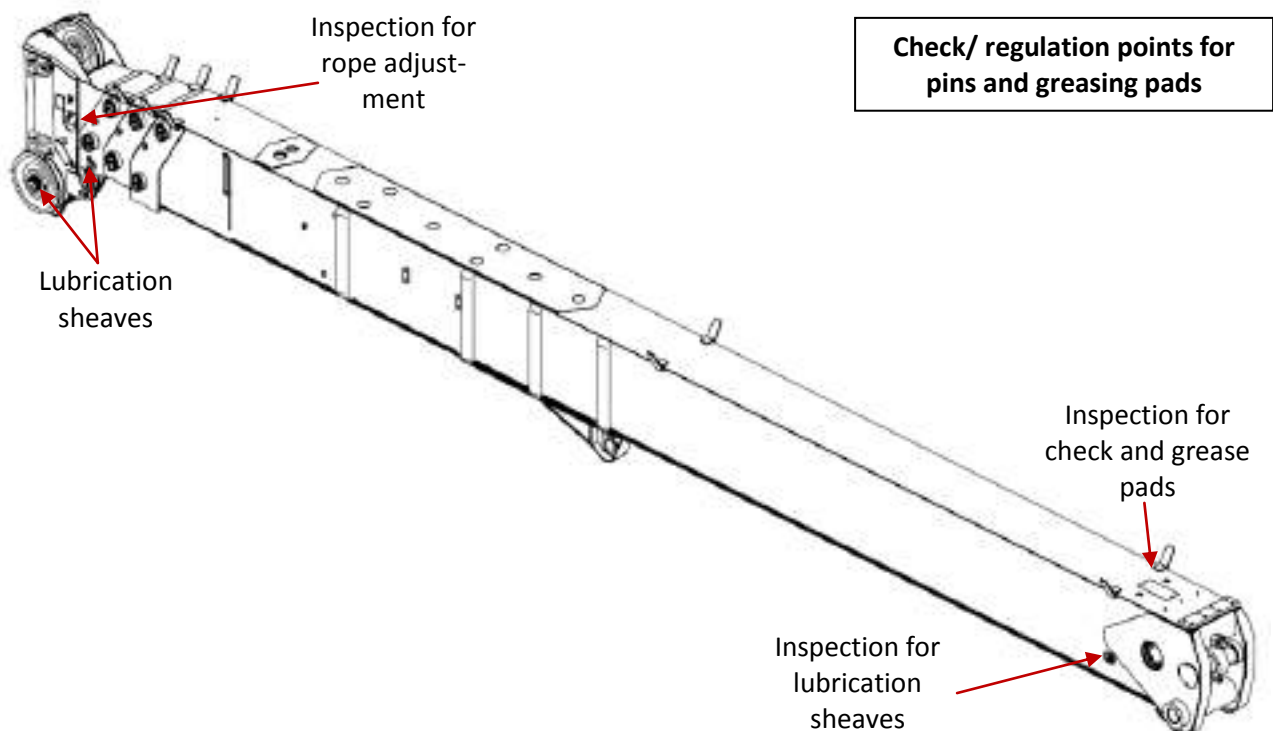
Periodic visual inspections: every 200 hours.

12.3.17.5 Dead man's switch



Every day, before operating the crane and without hanging a load, make sure that the dead man's switches are working by slightly moving one of the two joysticks, without pressing the switches: manoeuvres shall not be activated.

12.3.18 Telescopic boom ropes and slide pads



12.3.18.1 Boom extension and retraction ropes

The extension and retraction of the first telescopic section of the boom are controlled by a double effect hydraulic cylinder, while the second and third sections are moved by a system of steel chains/ropes. All the chains/ropes of the extension and retraction cinematic system are designed with a safety coefficient equal to 4.

It is necessary to periodically check the correct tension of the rope and chains of the boom by checking if, in the extension and retraction phase, all three telescopic sections start moving simultaneously without any synchronisation delay.



In case there should be a synchronisation delay of one or more telescopic sections, contact the manufacturer.



It is recommended to replace the extension and retraction multiple and single ropes of the boom at least every 7 years.

12.3.18.2 Lubrication of ropes and chains

The boom internal ropes and chains must be checked through the inspection shafts of the boom to verify that they are lubricated.

The lubrication, that usually is carried out during the boom overhaul, will have to be done after an accurate clearing. The rope cleaning must be done by using a metal brush in order to remove dust, dry grease, deposits or any other impurities that could prevent an efficient lubrication of the ropes.



For the lubrication of ropes:

Lubricant acronym (see table in Appendix A): *WRL (Wire Rope Lubricant)*;

Lubrication frequency: *during the general overhaul.*



For the lubrication of chains:

Lubricant acronym (see table in Appendix A): *EP-GEG (Extreme Pressure – General Greasing)*;

Lubrication frequency: *during the general overhaul.*

12.3.18.3 Boom slide pads lubrication

The internal slide pads of the boom must be checked through the inspection shafts of the boom to verify that they are lubricated.

For a correct lubrication, first of all, pull out the slide pads from their seats, clean them with a metal brush to remove eventual impurities from the surface of the slide pads and afterwards grease them before putting them back in their seats again. In case there should be some profiled slide pads with greasers fixed on them, pump grease in the greasers until the grease spills out.



Lubricant acronym (see table in Appendix A): *EP-BEG (Extreme Pressure – Boom Element Grease)*;

Lubrication frequency: *every 50 hours or weekly.*

12.3.19 Hinge pins

12.3.19.1 Hinge pin lubrication

On the hinge pins which are equipped with greasers, pump grease inside the greasers until the grease spills out.



Lubricant acronym (see table in Appendix A): EP-GEG (Extreme Pressure – General Greasing);
Lubrication frequency: every 50 hours or weekly.

12.3.20 Battery

Keep the electrolyte level to the 'MAX' sign printed on the battery. If necessary, top up with distilled water. Check the fluid level more frequently during the summer months.

If the crane remains unused for a long time or, in winter, if you run the engine for short periods, the batteries may not be fully recharged. Make sure that the batteries are fully charged to prevent them from freezing.

Keep the batteries clean by wiping them with a solution of sodium bicarbonate and clean water. Dry up the terminals and protect the terminals and the clips by spreading on them a silicone based lubricant, petroleum jelly or grease.



Do not dispose the exhausted batteries in the environment, but send them to an authorized collector waste plant.

12.3.21 Heating system

During the summer season, empty the fuel tank of the heating system. The tank is placed on the cabin. Keep clean the filter placed on the diesel feeding pipe attachment placed on the base of the tank.

12.3.22 Calibration of pressure relief valves

To distribute the oil to the different circuits of the hydraulic plant, three distributors are used.

Each distributor has a main relief valve which limits the operating pressure of the corresponding component. In addition to this, circuit and cavitation pressure relief valves regulate the pressure, as required by the hydraulic diagram.

The chart below shows the setting of the main and circuit pressure relief valves.



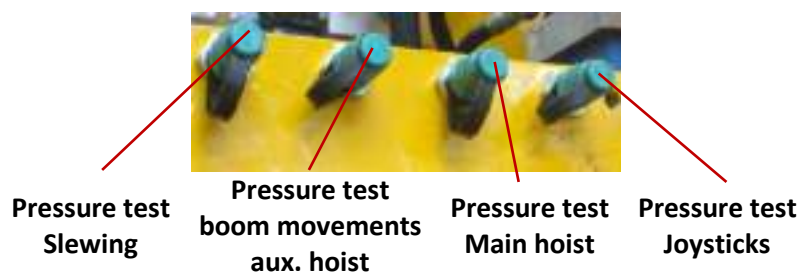
Check the setting of the main and circuit pressure relief valve of the joysticks/free slew before adjusting the pressure of the other valves.

Component	Main relief valve setting [bar]	Reduction valve setting [bar]
Joysticks / free slewing	35	-
Hoist distributor	245	-
Boom lifting distributor	195	Lowering: 100
Boom telescoping distributor	195	Retraction: 175
Slewing distributor	170	160
Outrigger beams	190	Extension: 115
Vertical outrigger jacks	190	-
Front axle steering	140	-
Rear axle steering	190	175
A/C unit	145	-

To check the settings of the pressure relief valves the circuit is equipped with pressure test plugs. Connecting a pressure gauge to the pressure test plugs you can check the value of the pressure relief valves of the different circuits.

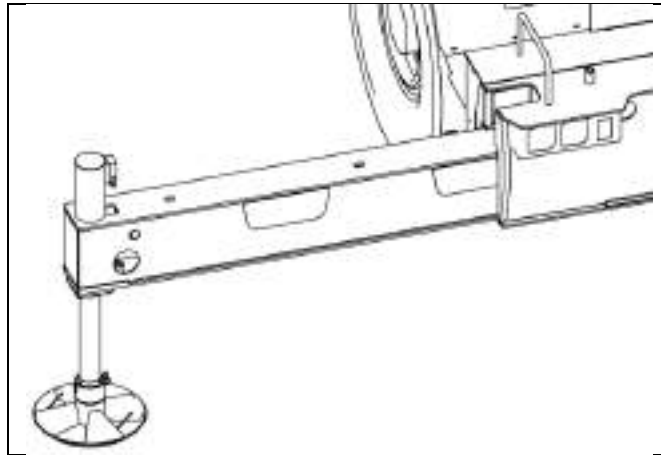


Stop the engine before connecting the pressure gauge to one of the pressure test plugs.



12.3.23 Outrigger beams

12.3.23.1 Outrigger beams lubrication



Grease the inferior and superior surfaces of the outrigger beams by applying four layers of grease for each beam by using a spatula.



Lubricant acronym (see table in Appendix A): EP-GEG (Extreme Pressure – General Greasing);
Lubrication frequency: every 50 hours or weekly.

13 DELIVERY OF THE CRANE

Before unloading the crane, make sure that it has not been damaged during the transport. The list of the equipment supplied should be carefully checked and any damage or missing parts must be immediately reported to the carrier.



Before starting the engine, or proceeding with unloading the crane, check the controls and devices, check the levels of oil, fuel, engine coolant liquid, brake fluid and make sure that all hinge points are well lubricated. Check that the batteries are connected, that none of the slewing ring bolts have loosened in transport and that the tyres are inflated to the correct pressure (see 'Maintenance' chapter).

13.1 Unloading of the crane

13.1.1 Unloading from the semi-trailer

Before unloading the crane from the lorry semi-trailer, carry out the following procedure:

1. Remove all locks and ties;
2. Place the shift lever in the neutral position;
3. Start the engine;
4. Test the brakes;
5. Insert the low speed and the 1st gear (forward or reverse) as shown on the lever;
6. Move the crane slowly;
7. Once that the unloading is finished, stop the engine and engage the parking brake before leaving the cabin.

13.1.2 Unloading from the hold



*To lift the crane, we suggest using a lifting beam and webbing slings, to balance the loads during the lifting operation and to prevent damaging the crane.
For the choice of the lifting equipment capacity you must consider an overload coefficient equal to 1.5 in order to consider the possible dynamic effects during the lifting procedures.*

1. Put the crane in the road travelling configuration, with the boom completely retracted and lowered;
2. Anchor the hookblock to the frame;
3. Lock the slewing of the turret by engaging the appropriate pin;
4. Extend the outrigger beams by 10-20 cm;
5. Sling the crane by passing webbing slings underneath each of the four outrigger beams;
6. Lift the crane.

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Appendix A

I. Introduction

The lubrication table contains information on the types of lubricants to be used, the location of lubricating points, recommended lubrication frequency, the lubricant amount and the mode of application.

Maintenance intervals are based on a normal use of the machine, in moderate climates. If the machine operates in harsh working or environmental conditions, the operator must modify the maintenance intervals and the lubricant specifications changing them in order to adapt them to the existing employment conditions.

For some components, the maintenance intervals of the machine depend on the operating hours recorded by the engine hour counter. There are, however, other maintenance procedures which are required to ensure the perfect functionality of the crane, that must be performed at the various monthly, half-yearly or annually scheduled intervals, independently from the hours logged by the engine.

II. Lubricants

The following chart reports the lubricant specifications provided for the maintenance of the crane components according to the prevailing temperatures of the working environment.

The crane is filled, directly in the factory, with Total S.A. lubricants which trademarks are also shown in the chart.

The crane is filled, directly in the factory, with Total S.A. lubricants. To facilitate an alternative choice, please find attached a list of equivalent lubricants from other manufacturers. Ask the advice of your local supplier on the most suitable lubricant. Before choosing an equivalent lubricant for special applications or conditions, refer to the lubrication chart.

Locatelli recommends using the same lubricants used on the machine at the time of delivery. However, according to different climatic conditions in which the vehicle needs to operate, it may be necessary to use lubricants with a higher or a lower viscosity degree. In such cases, the original oil should be drained and replaced with an approved lubricant which is locally available.



It is advisable not to mix oils of the same type but from different brands.



Lubricant oil chart (Total S.A.)

ACRONYM	COMPONENT DESCRIPTION	SPECIFICATION	VISCOSITY DEGREE [environment temperature]		
			< -15 °C	-15 → +35 °C	> +35 °C
EO	Engine oil	ACEA-E7 API CI-4 (*)	SAE 5W30	SAE 15W40	SAE 15W40
			RUBIA TIR 9200 FE 5W30	RUBIA TIR 7400 15W40	RUBIA TIR 7400 15W40
TO	Transmission oil	CAT TO-4 G.M. ATF	DEXRON II	SAE 30	SAE 50
			FLUIDE ATX	DYNATRANS AC30	DYNATRANS AC50
EP-GBO	Axles and gearbox oil	API GL 5 MIL-L-2105D	SAE HD 75W90	SAE HD 80W90	SAE HD 85W140
			TRANSMISSION SYN FE 75W90	TRANSMISSION SYN TM 80W90	TRANSMISSION SYN TM 85W140
HYDO	Hydraulic circuit oil	ISO 6743-4-HV DIN 51524-3-HVLP	ISO VG 32	ISO VG 46	ISO VG 68
			EQUIVIS ZS 32	EQUIVIS ZS 46	EQUIVIS ZS 68
BF	Brake fluid	FMVSS 116 DOT 4 SAE J 1704	-	-	-
			HBF 4	HBF 4	HBF 4
CAL	Antifreeze fluid	ASTM D 4985 VWTL774D	WATER MIXTURE AT 50%	WATER MIXTURE AT 50%	WATER MIXTURE AT 50%
			GLACELF AUTO SUPRA	GLACELF AUTO SUPRA	GLACELF AUTO SUPRA
EP-GBL	Hoist gearbox oil	ISO 12925-1 DIN 51517-3CLP	ISO VG 150	ISO VG 220	ISO VG 220
			CARTER BIO 150	CARTER BIO 220	CARTER BIO 220

(*) CAT ECT-1 specifications



Grease chart (Total S.A.)

ACRONYM	COMPONENT DESCRIPTION	SPECIFICATION	NLGI DEGREE [environment temperature]		
			< -15 °C	-15 → +35 °C	> +35 °C
EP-BEG	Sliding pads grease	DIN 51502 : MPF2K-25	NLGI EP2	NLGI EP2	NLGI EP2
			MULTIS MS2	MULTIS MS2	MULTIS MS2
EP-GEG	General gears	DIN 51502 : MP2K-25	NLGI EP2	NLGI EP2	NLGI EP2
			LICAL EP2	LICAL EP2	LICAL EP2
RPL	Slewing ring and pinion grease	DIN 51502 : KPF1R-20	NLGI 1	NLGI 1	NLGI 1
			CERAN MS	CERAN MS	CERAN MS
WRL	Metal ropes lubricant	ISO 6743-6CKJ	-	-	-
			CARTER ENS 250 I	CARTER ENS 250 I	CARTER ENS 250 I

Lubricants / greases multi-brand chart

	CHEVRON TEXACO 	MOBIL 	ESSO 	BP 	SHELL 	AGIP
Engine oil	URSA SUPER TD	DELVAC MX EXTRA	ASSOLUBE XT 501	VANELUS E7	RIMULA SUPER	SIGMA TRUCK PLUS
Transmission oil	TEXTRAN HD	MOBILTRANS HD	TORQUE FLUID	AUTRAN TO-4	DONAX TC	ROTRA CT
Axles and gearboxes	GEARTEX EP-C	MOBILUBE HD	GEAR OIL GX	ENERGEAR HYPO	SPIRAX A	ROTRA MP
Hydraulic circuit oil	RANDO HD-Z	DTE 10M SERIES	UNIVIS N	BARTRAN HV	TELLUS T	ARNICA
Brake fluid	BRAKE FLUID DOT 4	BRAKE FLUID DOT 4	BRAKE FLUID DOT 4	SUPER DISC BRAKE FLUID	DONAX UB	BRAKE FLUID DOT 4
Sliding pads grease	MOLITEX EP2	MOBILGREASE XHP 222	MULTIPOSE GREASE (MOLY)	ENERGREASE L21M	RETINAX HDX2	GREASE MS2
General gears	MULTIFAK EP2	MOBILUX EP2	BEACON EP2	ENERGREASE LTX-EP2	RETINAX EP2	GREASE MU EP2
Slewing ring and pinion	OPEN GEAR LUBRICANTS NC	MOBILGEAR OGL	DYNAGER EXTRA	OGL III	MALLEUS GREASE OGH	FIN 332/F
Metal ropes	OPEN GEAR LUBRICANTS NC	MOBILARMA 798	SURETT FLUID	WIRE ROPE PROTECTANT	MALLEUS GL	ROCOL WIRE-ROPE DRESSING
Hoist gearbox oil	TEGRA SYNTHETIC GEAR	MOBILGEAR SHC XMP	SPARTAN S EP	ENERSYN EPX	OMALA HD	BLASIA SX

III. Filter replacement program

Description	Q.ty	First service[hours]	Normal service [hours]
<i>Engine oil filter</i>	1	500	500
<i>Primary fuel filter</i>	1	500	500
<i>Secondary fuel filter</i>	1	500	500
<i>Primary air engine filter</i>	1	500	500
<i>Air engine safety filter</i>	1	500	500
<i>Air compressor filter</i>	1	500	500
<i>Hydraulic oil filter</i>	2	500	1,000
<i>Transmission oil filter</i>	1	500	500
<i>Air dryer filter</i>	1	500	500
<i>Air conditioner external filter</i>	1	500	500
<i>Air conditioner internal filter</i>	1	500	500

IV. Screw coupling torque chart

The tightening torque depends on several factors, in particular the friction exerted on the thread and on the contact surface underneath the bolt or nut head. The following chart reports the coupling torque values M and the pre-load values P with tolerance of $\pm 10\%$. These values were calculated using an average friction coefficient of 0.14. For fixing, a torque wrench should be used.

M torque moment [Nm]

P axial pre-load [N]

M 90% tightening torque with a torque wrench [Nm]

d nominal diameter of the thread [mm]

K twist coefficient

K has been calculated by using a friction coefficient, between the sliding surfaces, equal to 0.14

$$M = \frac{K \times d \times P}{1000}$$

$$P = 0.7 \times R_s \times S_r$$

$$10 \text{ Nm} \cong 1 \text{ kgm}$$

$d \times p$	S_r	K	8.8		10.9		12.9	
			0.7Rs = 448		0.7Rs = 630		0.7Rs = 756	
mm	mm ²		P N	M Nm	P N	M Nm	P N	M Nm
3x0.5	5.03	0,198	2550	1.9	3170	1.9	3800	2.3
4x0.7	8.78	0,195	3930	4.3	5530	4.3	6640	5.2
5x0.8	14.2	0,189	6360	8.5	8950	8.5	10700	10.1
6x1	20.1	0,192	9000	14.6	12700	14.6	15200	17.5
8x1.25	36.6	0,188	16400	34.7	23100	34.7	27700	41.6
8x1	39.2	0,185	17600	36.6	24700	36.6	29600	43.9
10x1.5	58	0,193	26000	70.5	36500	70.5	43900	84.6
10x1.25	61.2	0,191	27400	73.6	38500	73.6	46300	88.4
12x1.75	84.3	0,187	37800	119	53000	119	63700	143
12x1.25	92.1	0,183	41300	127	58000	127	69600	153
14x2	115	0,187	51500	190	72500	190	86900	228
14x1.5	125	0,183	56000	202	78800	202	94500	242
16x2	157	0,182	70300	288	98900	288	119000	346
16x1.5	167	0,179	74800	302	105000	302	126000	362
18x2.5	192	0,183	86000	398	121000	398	145000	478
18x1.5	216	0,177	96800	434	136000	434	163000	520
20x2.5	245	0,182	110000	562	154000	562	185000	674
20x1.5	272	0,177	122000	607	171000	607	206000	728
22x2.5	303	0,178	136000	748	191000	748	229000	897
22x1.5	333	0,174	149000	803	210000	803	252000	964
24x3	353	0,182	158000	971	222000	971	267000	1170
24x2	384	0,177	172000	1030	242000	1030	290000	1230
27x3	459	0,182	206000	1420	289000	1420	347000	1700
27x2	496	0,178	222000	1500	312000	1500	375000	1800
30x3.5	561	0,182	251000	1930	353000	1930	424000	2310
30x2	621	0,177	278000	2080	391000	2080	469000	2490

Always use screws with an appropriate length. A screw that is too long can touch the bottom of the hole before its head reaches the piece to be tightened. On the other hand, if the screw is too short, the number

of threads screwed can be insufficient to hold the two parts together. In case of replacement, only use screws with the same or equivalent features to the original ones.

It is very important to use appropriate coupling torque values.



In the event that the maximum recommended torque values are exceeded, replace the fixing element.

V. Specific weight chart

Material	ton/m ³
Clay (dry)	1,6 – 1,8
Clay (wet)	2,0 – 2,1
Fireclay	1,8
Concrete with limestone	2,0
Concrete with granite	2,2
Concrete with brick debris	1,8
Hydraulic lime	1,2
Cement (dust)	1,4
Portland cement	1,7
Ash coke	0,7 – 0,9
Retort coke	0,45
Chalk	1,25
Construction debris	1,8 – 2,0
Mortar (sand and lime)	1,7 – 1,9
Ordinary bricks	1,8

Material	ton/m ³
Blast furnace bars	4,5
Gypsum stones	1,9
Basalt gravel	2,0
Average gravel	0,3 – 0,6
Blast furnace dust	1,5
Quartz	1,8 – 2,4
Mixed scrap	1,2
Heavy scrap	1,8 – 2,0
Sand, clay, limestone (dry)	1,6
Sand, clay, limestone (wet)	2,1
Blast furnace slag	1,2 – 1,4
Dephosphorization slag	2,2
Mill slag	2,5
Grinded tuff	0,95
Sulphur	1,2

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