TECHNICAL COURSE

LightLift 19.65/100

LightLift 19.65/200

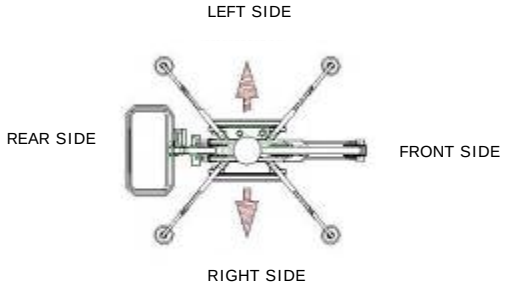
DMALL196520107

CONTENTS OF THE COURSE

1. INTRODUCTION

The aim of this paper is to describe the Hinowa LightLift 19.65 aerial platform from the technical standpoint, dealing with its safety devices, electrical system and hydraulic system. This paper does not describe the use of the machine, which is dealt with in the relevant **User and Maintenance Manual**.
The number of the name “LightLift 19.65” identifies its maximum working height (first two digits – 19 – in meters) and its maximum work range (last two digits – 65 – in decimetres).
The aerial platform is provided with interacting hydraulic and electrical systems, in order to ensure a safe use of the machinery under any condition. These two systems are illustrated hereby, especially with respect to their interaction features.

Do not forget that the driver’s cab is positioned inside the basket, in the rear part. Its diagram is as follows:



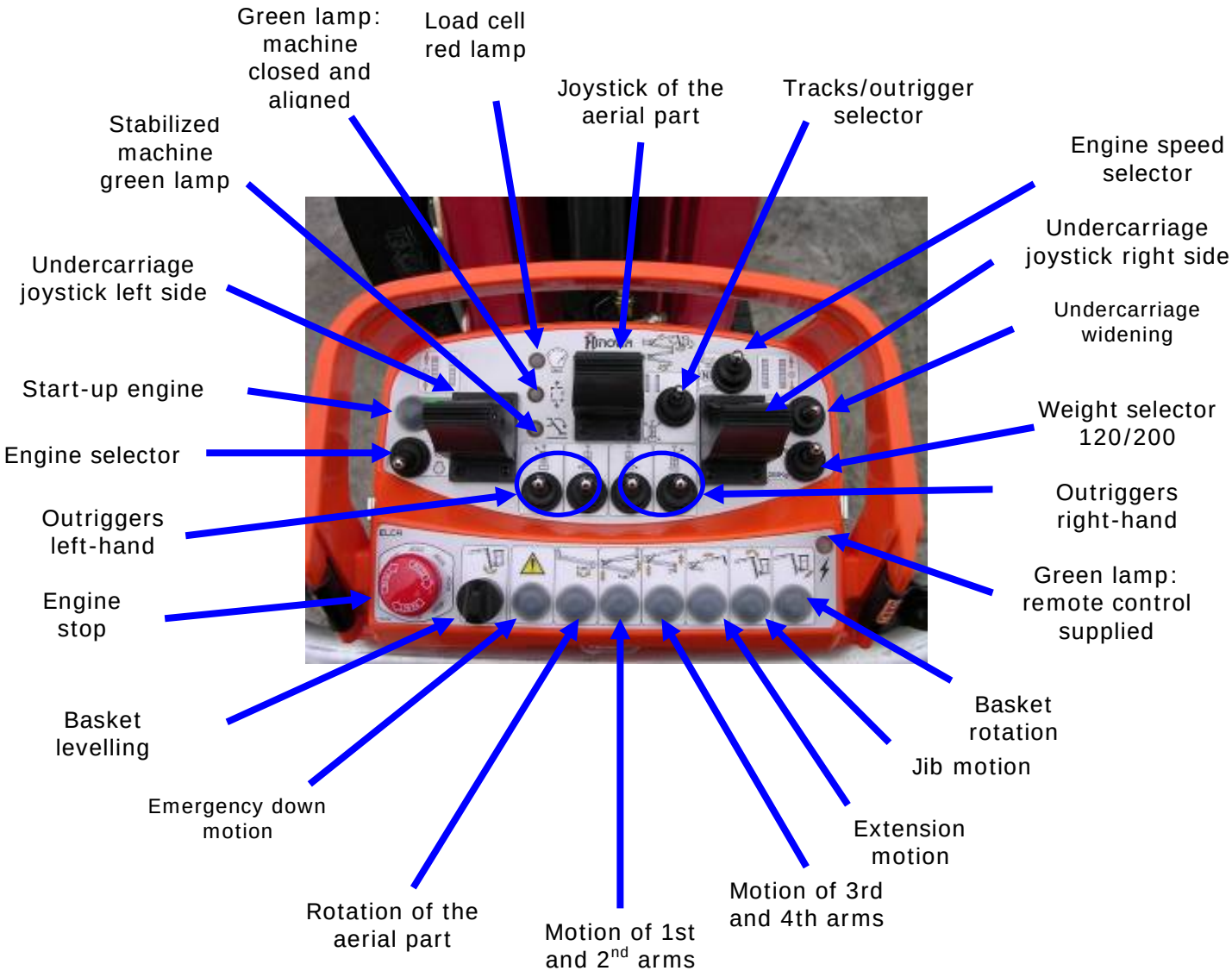
All the movements of the machine are driven by the remote control provided. As a rule the remote control shall be positioned in the dedicated support situated inside the basket; other possibilities are feasible and will be illustrated and commented later.

2. DATA SHEET OF LIGHTLIFT 19.65

	CAPACITY: 200 kg	**CAPACITY: 120 kg**
PLATFORM HEIGHT (walkway surface)	16.67 m	19.96 m
MAX. WORKING HEIGHT	17.06 m	18.77 m
STANDARD BASKET DIMENSIONS	1330 x 770 mm H 1100 mm	
HORIZONTAL RANGE	4.50 m	6.10 m
MAX. HORIZONTAL WORK RANGE	4.80 m	6.40 m
ROTATION (non continuous)	360°	360°
BASKET ROTATION	124° (+/- 62°)	
PLATFORM CAPACITY	200 kg	120 kg
MAX. REACTION AGAINST GROUND FOR EACH OUTRIGGER	1200 daN	
MAX. PRESSURE AGAINST GROUND FOR EACH OUTRIGGER	1.7 daN/cm^2	
No. OF OPERATORS	2	1
No. OF OPERATORS WITH OPTIONAL 1-MAN BASKET	1	1
JIB – TYPE OF ARTICULATED JOINT	/	82.7° (+0° / -82.7°)
MAX. WORKING INCLINATION	1° / 1,75 %	
MAX. STABILIZATION INCLINATION	11°	
OVERALL WEIGHT IN TRANSPORT CONFIGURATION	2098 kg	
ENGINE	HONDA Igx440 - 15CV - 3600rpm - PETROL	
ELECTRIC MOTOR	P_n=2.2 KW - 230V - 50Hz - 1500rpm	
ELECTRICAL SYSTEM VOLTAGE	12 V	
PUMPS	2 x 3.15 cc (for each motor)	
MAX. TRANSLATION SPEED (engine)	1.3 km/h	
MAX. TRANSLATION SPEED (engine WITH ANOTHER OPTIONAL SPEED)	1.7 / 3.3 km/h	
PRESSURE OF TRANSLATION/STABILIZATION SYSTEM	165 bar	
PRESSURE OF THE AERIAL PART SYSTEM	220 bar	
MAX. SLOPE THAT CAN BE OVERCOME WHEN DRIVING	21° / 38,4%	
MAX. ADMISSIBLE WIND SPEED	12.5 m/s	
MAX. ADMISSIBLE MANUAL FORCE	400 N	

3. REMOTE CONTROL FUNCTIONS

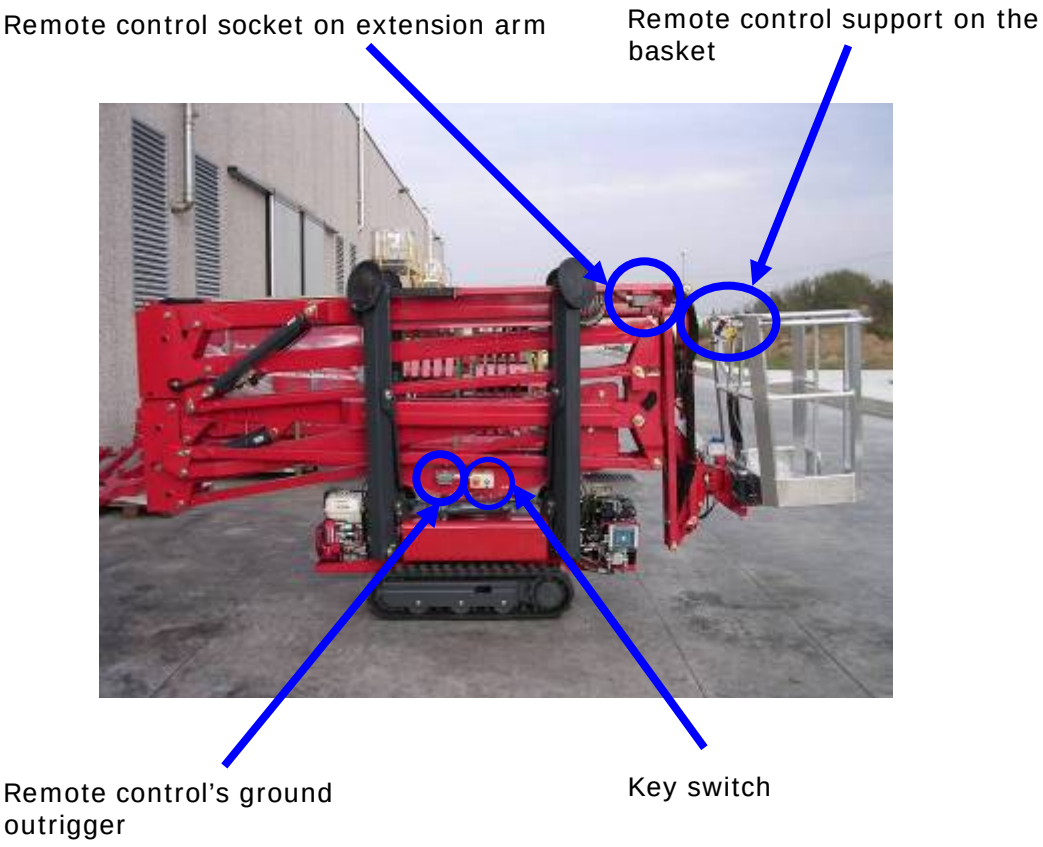
The remote control functions (controls and signals) are briefly summed-up below.



4. CONTROL STATION SELECTION

The machine is equipped with two control stations, identified by two sockets, one on the extension arm and the other (the “emergency socket”) near the ground.
The socket to be used shall be selected by the key switch positioned on the turret.
The capacity of the machine depends on the connection in use and on the position of the remote control. Therefore, the following operating conditions can be identified:

a) Remote control connected to the ground outrigger and not inserted into the support = All functions are ON (Note: for maintenance or trade fairs only)
b) Remote control connected to the ground outrigger and inserted into the support on the basket = The aerial part cannot move; only the undercarriage can be driven.
c) Remote control connected to the socket on the extension arm and inserted into the support = All functions are ON
d) Remote control connected to the socket on the extension arm and not inserted into the support on the basket = The aerial part cannot move; only the undercarriage can be driven.

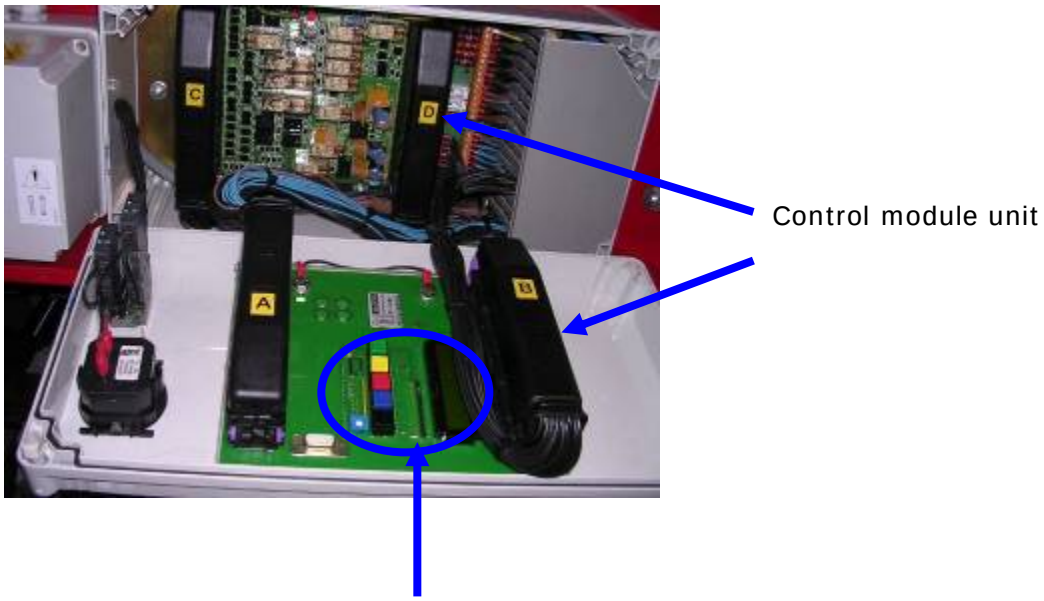


5. OPERATION AND SAFETY DEVICES

The LightLift 19.65 aerial platform consists of two main parts:

1. The lower part, or undercarriage
2. The aerial part

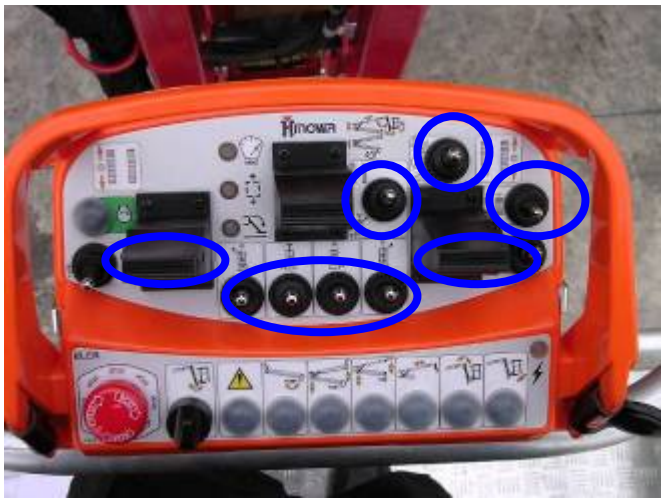
If you are working in translation or stabilization mode, the undercarriage shall be controlled, whilst if you are working in the rotation mode the aerial part is activated.
The operation of the undercarriage or of the aerial part is controlled by a control module consisting of two interlocked electronic units, interacting with the sensors and actuators placed on the machine. Both units are located inside the electrical components' compartment, on the left-hand side of the platform. The first unit includes control relays for actuators, whilst the other (which is the true "brain" of the platform) is provided with a hardware apparatus (display and keyboard), that makes it possible to display all control parameters. The use of this instrument is described in detail in Chapter X (software control panel).



5.1 OPERATION OF THE LOWER PART

Translation and stabilization operations are controlled by the remote control via the left/right Joysticks.
With the *track/outrigger* selector in the track position (UP) the Joysticks can directly control the tracks; if the selector is in the outrigger position (DOWN) the left-hand Joystick controls the left-hand outriggers, whilst the right-hand joystick controls the right-hand outriggers. The outriggers can be moved providing that the relevant push-button is pressed together with the joystick.

UNDERCARRIAGE'S MOTION CONTROLS



Translation and stabilization are allowed only if the machine is aligned and perfectly closed; this condition is checked by two photocells positioned on the rear column of the machine, and is signalled to the operator by the switching on of the green lamp – *machine closed and aligned* – on the remote control. Photocells are of the reflection type: they can transmit a signal reflected by two retroreflectors positioned on the jib arm. If the platform is not perfectly closed or has been made rotate (the alignment arrows do not overlap), the photocells do not close the circuit that connects them to the control module. Due to the presence of a series connection, if a single photocell does not receive the return signal from the retroreflector, the circuit remains open. If the control module does not receive any signal from the photocells, the undercarriage cannot be moved (the signal lamp closed and aligned on the remote control is OFF).

Therefore:

ALIGNMENT LAMP OFF = THE UNDERCARRIAGE CANNOT BE MOVED

The switching-on of the lamp is subject to the position of the three *STOP EMERGENCY* switches (turret – remote control – basket), which prevent the start-up of the engine.

Alignment arrows

Photocells

Retroflectors (version 1)

Reflectors (version 2)

5.2 OPERATION OF THE AERIAL PART

The handling of the aerial part is driven by the remote control via the central joystick.
The aerial part can be moved after pressing the push-button to obtain the desired motion; then, move the joystick in the desired direction. If the joystick or the push-button are released, motion is stopped.
Only a movement at a time is permitted.

AERIAL PART'S MOTION CONTROLS

The aerial part can be moved only if the machine is stabilized and levelled (1° max.).
Stabilization is signalled to the operator by 4 blinking lamps (one on each outrigger). Each lamp is turned on by a microswitch located on the outrigger, that closes also a circuit coming from the control module.
Levelling shall be checked by the operator via the dedicated spirit level positioned on the turret (1° max.). For safety reasons, the platform is provided with an electronic level as well, so that the aerial part cannot be moved if the inclination of the machine exceeds the permissible range.

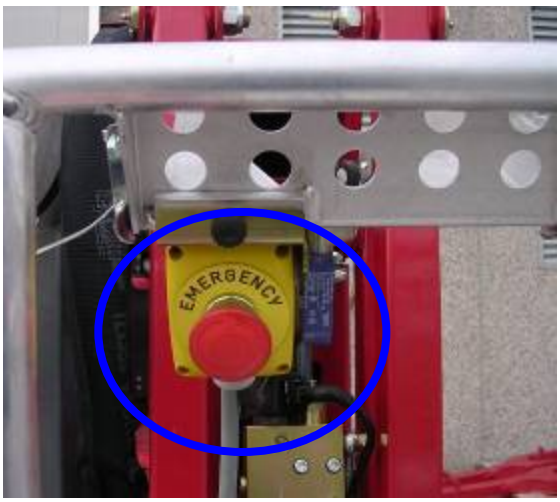
The outriggers' micro switches and the electronic level are connected in series; therefore, if one of these micros does not close the circuit, the control module prevents any movement of the aerial part.

ELECTRONIC LEVEL

OUTRIGGER LIGHT

Other conditions that shall be met to allow the control module to move the aerial part are the following:

- the stop emergency switch must be properly positioned on the basket (it can be removed before taking off the basket)



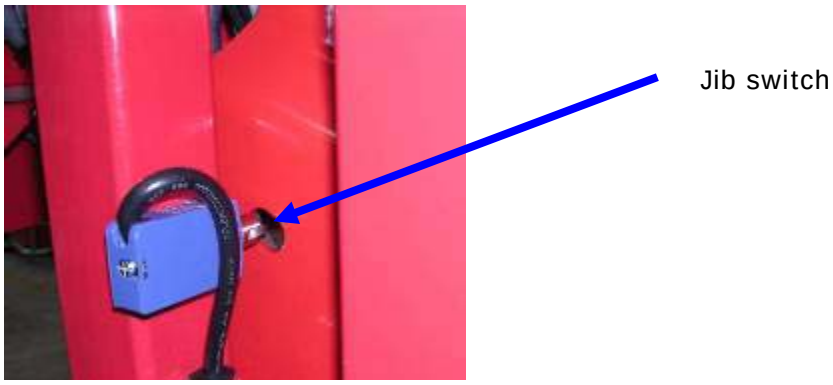
- the remote control must be positioned properly with respect to the selected socket (see the Chapter 4 “Control station selection”)

- the load cell shall be capable of being moved. To do this, the maximum weight inside the basket shall not be exceeded (120 or 200 kg), as checked by a dedicated electronic unit. If this condition is not met, the operator is informed also by a red blinking lamp and a buzzer. More information on the load control unit is available in Chapter 10 “Load cell”.

The four micro-switches on the stabilisers, the electronic level, the sensor for the correct positioning of the *emergency stop* switch on the cage, the sensor detecting the presence of the remote control on the cage and the contact enabling the load cell from the control module, are all connected in series. Therefore, if any of them opens the circuit, the control module will keep the *stabilized machine* green lamp OFF, preventing the aerial part from being moved.

With the selector on 120 kg (1 operator = 80 kg + equipment = 40 kg), the aerial part can be moved according to all the available functions.
With the selector on 200 kg (2 operators = 160 kg + equipment = 40 kg), only the jib arm is prevented from moving.

NOTE: If you select the 200 kg option with the jib not perfectly closed, the aerial part of the machine is stopped even if the weight inside the basket is lower; in this case the outrigger lamp will be OFF, while the load cell lamp will start blinking, and a buzzer will be activated as well. With the switch on 200 kg the Jib shall be perfectly closed. A dedicated microswitch notifies the Jib position to the control module.



Therefore:

- OUTRIGGER LAMP OFF = THE AERIAL PART CANNOT BE MOVED
- LOAD CELL'S LAMP BLINKING = THE AERIAL PART CANNOT BE MOVED

The switching-on of the green lamp (*machine stabilized and aligned*) is subject to the position of the three *STOP EMERGENCY* switches (turret – remote control – basket), which prevent the start-up of the engine.

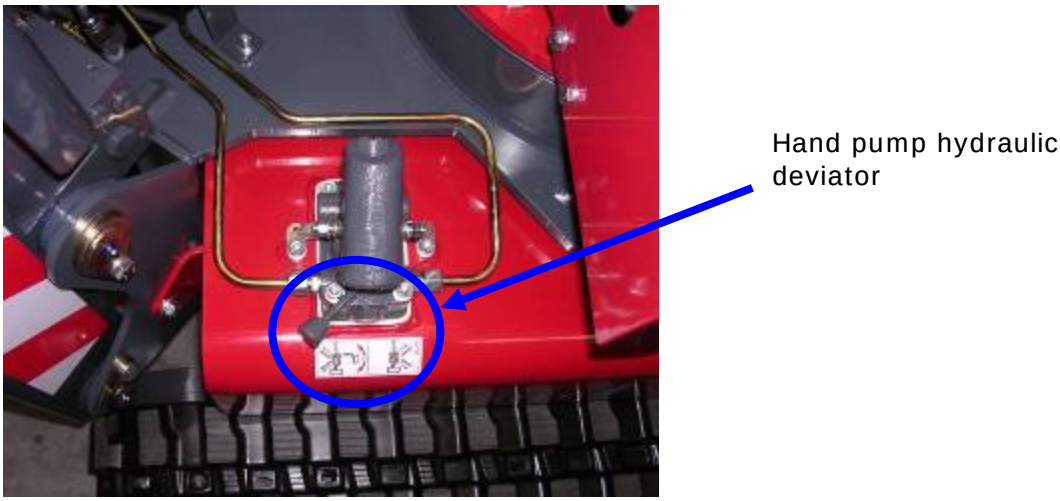
5.3 EMERGENCY STOP

The LightLift 19.65 aerial platform is provided with three emergency stop push-buttons: on the undercarriage, on the basket (it can be removed to take off the basket) and on the remote control.
When the undercarriage and basket emergency stop switches are used to turn off the engine or the electric motor, with the platform closed and aligned (the green "alignment" lamp is ON), an intermittent sound informs the operator that the key of the motor/engine is in the ON position. The remote control switch can be used, as a rule, to turn off the motor/engine while the machine is running.

NOTE: Do not use the engine selector to switch off the engine

5.4 HYDRAULIC HAND PUMP

The hand pump will put oil under pressure, so as to operate the machine also in an emergency, following a failure of the main hydraulic system.
This pump is equipped with a manual hydraulic deviator, in order to select and drive the two right-hand outriggers (Position 1) or the two left-hand outriggers and the aerial part (Position 2).



6. EMERGENCY MOTION

The machine has been designed taking into account any possible emergency situations, such as mechanical and electrical faults, a sudden illness of the operator etc. In all these cases, you can always try to move the basket down to earth in full safety.
In an emergency, and as required, the basket can be moved down from the basket itself or from the ground level. All possible cases and the relevant solutions (i.e. how to move down the basket in an emergency) are listed below.

NOTE: Please remember that, while the platform is being operated, some operators shall be present on the ground.

6.1 EMERGENCY DOWNWARD MOTION BY GRAVITY

OPERATING CONDITIONS:

- *Faulty engine and/or electric motor*: The hydraulic system is not under pressure, because the engines does not work. This situation may occur after a failure of the electric motor, if the machine has run out of fuel (engine) or in case of power failure (electric motor) etc.
- *Stabilisers off light*: The control module has disabled the movement of the aerial part due, for example, to the absence of load on one stabiliser.
- *Electrical system working perfectly*. To use the emergency descent by gravity, the electrical system must be working perfectly.

PROCEDURE:

Press the emergency DOWN push-button on the remote control, together with the push-button dedicated to the arms that should be closed.

Note: being descent by gravity, obviously the cage and the aerial part cannot be rotated nor the extension retracted; these movements can be performed using the hand pump (chapter 6.3) or by disabling the safety devices (chapter 7.2). If necessary, the aerial part can be made rotate by the personnel on the ground, using the screw positioned on the hydraulic motor. In order to obtain a movement, press at the same time the knob of the ON-OFF solenoid valve (rotation) or the aerial part rotation push-button available on the remote control and the Joystick that moves the aerial part.

WARNING: After an emergency downward movement by gravity has been completed and the engines have been reactivated, the aerial platform can be used normally. Anyway, the arms' down motion is likely to be delayed by a few seconds, to let the oil be put under pressure again. This situation is absolutely normal and does not indicate a failure.

6.2 EMERGENCY DOWN MOTION WITH THE MACHINE RUNNING

OPERATING CONDITIONS:

- *Sudden illness of the operator or faulty remote control*
- *Engine and/or electric motor ON*
- *The electrical system is working properly.*

The emergency down motion can be enabled from the ground only to help the operator(s) in the basket, by making it reach the ground. Any other application is forbidden.

To perform this operation under the conditions described above, proceed as follows:

a) Remove the proportional valve's adjusting knob from the electric components' compartment and insert it into the relevant adjusting screw

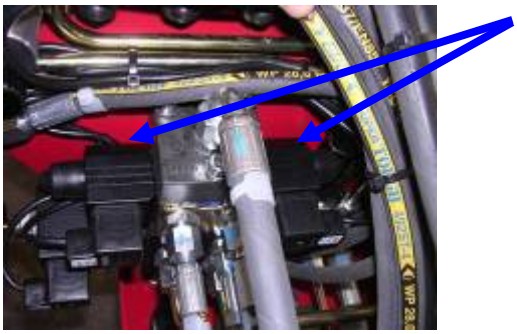
b) Screw the knob. The position of the knob adjusts the speed (i.e. screw the knob to increase the speed).

c) With the engine or the electric motor running, press the push-buttons or the levers of the ON-OFF coils (accessible from the lower part of the protection device of the aerial part's distributor) to enable the desired movement, according to the instructions provided on the sticker near the controls. The sequence of the necessary movements is as follows: - extension retracted – jib closed – 1st and 2nd arms closed – 3rd and 4th arms closed -

Levers of ON-OFF coils

d) If needed, the cage can be rotated: follow the instructions described in points "A" and "B" and use the ON-OFF valve corresponding to the rotation of the cage. Make sure that the position of the knob or the movement of the lever corresponds to the desired movement (clockwise or anticlockwise).

e) If necessary, the aerial part can be made rotate: follow the instructions described in the points "A" and "B". The ON-OFF valve which permits the motion of the aerial part is located next to the proportional valve, instead of on the distributor. Check that, by pressing the knob, you have completed the desired manoeuvre (clockwise or anticlockwise).



ON-OFF solenoid valve for the aerial part rotation

f) On completion of this operation, unscrew the knob on the proportional valve and place it in its original position.

6.3 EMERGENCY DOWNWARD MOTION WITH THE HAND PUMP

OPERATING CONDITIONS:

- *Faulty engine and/or electric motor:*
- *Electrical system faulty*

The emergency down motion can be enabled from the ground only in order to face a system failure, by making the basket reach the ground. Any other application is forbidden.

To obtain the desired movement, pump oil by hand and use, at the same time, the arm motion controls available on the ground.

It is strictly forbidden to perform any manoeuvre other than the one mentioned above, such as extending the telescopic arm, lifting the jib, moving the outriggers and, more generally, all those manoeuvres that may compromise stability.

To perform this operation under the conditions described above, proceed as follows:

a) Remove the proportional valve's adjusting knob from the electric components compartment and insert it into the relevant adjusting screw
b) Screw the knob.
c) Move the switch located on the hand pump to the aerial part motion position
d) Press the push-buttons or the levers of the ON-OFF coils (accessible from the lower part of the protection device of the aerial part's distributor) to enable the desired movement, according to the instructions provided on the sticker near the controls; at the same time, use the hand pump to feed some oil. The sequence of the necessary movements is as follows: - extension retracted – jib closed – 1st and 2nd arms closed – 3rd and 4th arms closed -

e) If necessary, the basket can be made rotate: follow the instructions described the points "A", "B" and "C" and use the ON-OFF valve which moves the basket; at the same time, use the hand pump to feed some oil. Check that, by pressing the knob, you have completed the desired movement (clockwise or anticlockwise).

f) If necessary, the aerial part can be made rotate: follow the instructions described in the points “A”, “B” and “C” and use the ON-OFF valve which moves the aerial part; at the same time, use the hand pump to feed some oil. The ON-OFF valve which permits the rotation of the aerial part is located next to the proportional valve, instead of on the distributor. Check that, by pressing the knob, you have completed the desired movement (clockwise or anticlockwise).

g) On completion of this emergency operation, unscrew the knob on the proportional valve and place it in its original position. Place the hand pump’s switch in its original position.

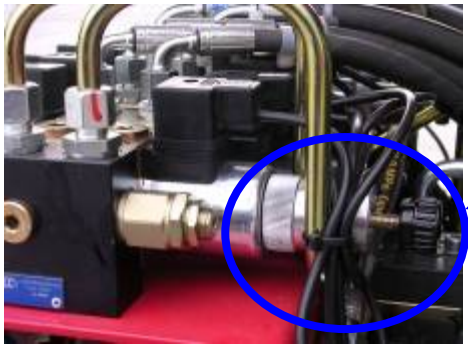
6.4 EMERGENCY MOTION OF THE LOWER PART WITH THE HAND PUMP

OPERATING CONDITIONS:

- *Faulty engine and/or electric motor:*
- *Electrical system faulty*

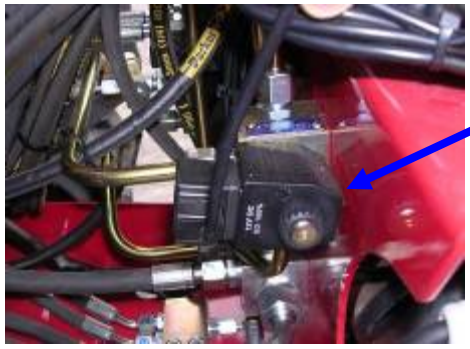
Warning: Perform the operations described below after closing the aerial part, and only to close the outriggers and ensure that the machine is ready for transportation.

a) Make sure that the platform is perfectly closed and aligned.
b) Screw with great care the black knobs of the proportional valves mounted on the two distributors of the undercarriage.



Black knob on the proportional valve

c) To move the left-hand part of the undercarriage, place the diverter on the hydraulic hand pump in the relevant position; switch over by hand the left-hand aerial part/undercarriage diverter, by working on the small fuse at the centre of the magnet, by the dedicated handwheel available in the electric components' compartment



Aerial part/undercarriage switch – left hand

Handwheel

e) Press the push-buttons of the distributor's ON-OFF coils, on the left side of the undercarriage, so as to enable the desired movement, and at the same time use the hand pump to feed some oil

f) In order to move the right-hand part of the undercarriage, place the diverter on the hydraulic hand pump in the relevant position

g) Press the push-buttons of the distributor's ON-OFF coils, on the right side of the undercarriage, so as to enable the desired movement, and at the same time use the hand pump to feed some oil

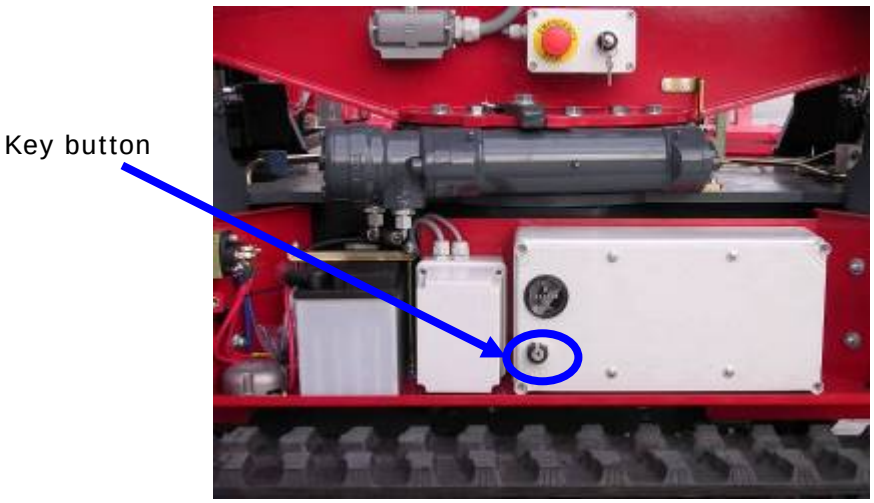
h) At the end of these emergency operations, unscrew the knob on the proportional valves of the two undercarriage distributors, undercarriage side. Remove the aluminium knob on the left-hand aerial part/undercarriage diverter.

7. DISABLING THE SAFETY DEVICES

Where necessary, the Hinowa Light Lift 19.65 platform makes it possible to bypass the safety devices, so that it can be moved although all control apparatuses are locked.

Warning: This operation is very dangerous and must be performed only by qualified personnel in case of emergency.

The safety devices are disabled by the key button located on the electrical components box.
Turn the key button to the left to disable the undercarriage's safety devices, and to the right to disable those of the aerial part.
Since these operations are emergency manoeuvres, the operator must hold the button turned while the safety devices are being disabled.



NOTE: If the safety devices are disabled by untrained personnel, this operation is likely to become very dangerous. For this reason, the control module records the date and time of all the operations carried out under this condition; a dedicated software allows Hinowa personnel to display on a PC the complete list of all movements performed with the safety devices disabled.

7.1 DISABLING THE UNDERCARRIAGE'S SAFETY DEVICES

OPERATING CONDITIONS:

- *The "machine closed and aligned" lamp is OFF:* This lamp could be off due to, for example, a failure in a photocell, even though the platform is perfectly closed and aligned.

Turn the key button to the left (the "machine aligned" lamp on the remote control switches on) and use, at the same time, the translation controls

WARNING: Disabling the undercarriage's safety devices makes it possible to enable translation only; you are not allowed to work on the outriggers' cylinders

7.2. DISABLING THE AERIAL PART'S SAFETY DEVICES

OPERATING CONDITIONS:

- *The "machine stabilized" lamp is OFF:* This lamp could be off due to, for example, the subsidence of the ground, resulting in a pressure drop in a outrigger.

Disabling the aerial part's safety devices could be useful to make the basket reach the ground in the event that the control module has stopped the aerial part and it is necessary to perform movements that are not possible by gravity, in an emergency (see Chapter 6.1) - such as, for example, the rotation of the aerial part or the extension retraction.

Another situation in which disabling the aerial part's safety devices is particularly useful occurs when, due to the movements the platform has been subjected to during transportation, the jib remains slightly open or the aerial part is rotating. Under these conditions the photocells cannot detect the return signal, and accordingly the control module does not allow translational motion. Disabling all the safety devices of the aerial part makes it possible to close the jib or rotate the platform, up until the machine is perfectly closed and aligned.

Turn the key button to the right (the "machine stabilized" lamp on the remote control switches on) and use, at the same time, the aerial part motion control devices.

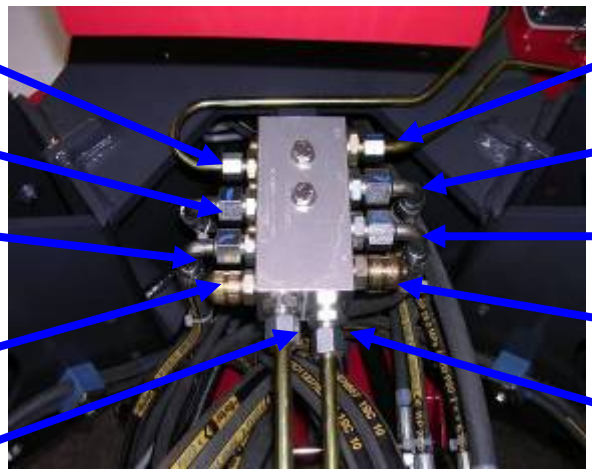
8. HYDRAULIC SYSTEM

For a description of the hydraulic system please refer to annex “1”. The numbers in brackets identify the hydraulic circuit’s components.

The hydraulic circuit of the LightLIft 19.65 aerial platform is supplied by three pump units:

1. Pump unit (4) connected to the engine (3) - 2 pumps (3.15cc/rev each), 3600 rpm-.
2. Pump unit (4) connected to the electric motor (2) - 2 pumps (3.15cc/rev each), 1500 rpm-.
3. Emergency hand pump (1). Since there is only a single pump, a switch (1) is installed on the delivery line, in order to select the flow direction.

The outlets of the three pump assemblies run to through a manifold (5) into two main delivery hoses, A and B. Six one-way valves prevent the pressurised oil flowing from one pump assembly from returning to the tank through an unused pump assembly.



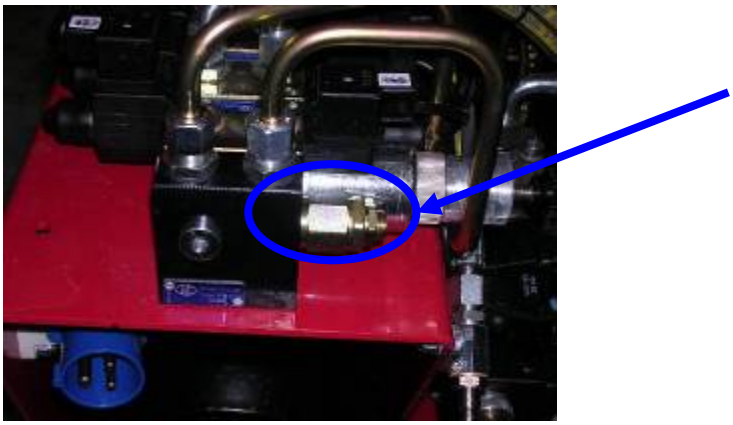
Line “B” conveys oil under pressure to the distributor of the undercarriage - right-hand side (8).
Line “A” conveys oil under pressure to directional solenoid valve (14), which is directly controlled by the control module and conveys the oil under pressure to the distributor of the undercarriage – left-hand side (9) or to the overhear part rotation distributor (15). Then the oil is conveyed to the aerial part motion distributor (18).

NOTE: If the coil of the solenoid directional valve (14) is not energised, the oil supplies the aerial part of the machine.

8.1 OPERATION OF THE LOWER PART.

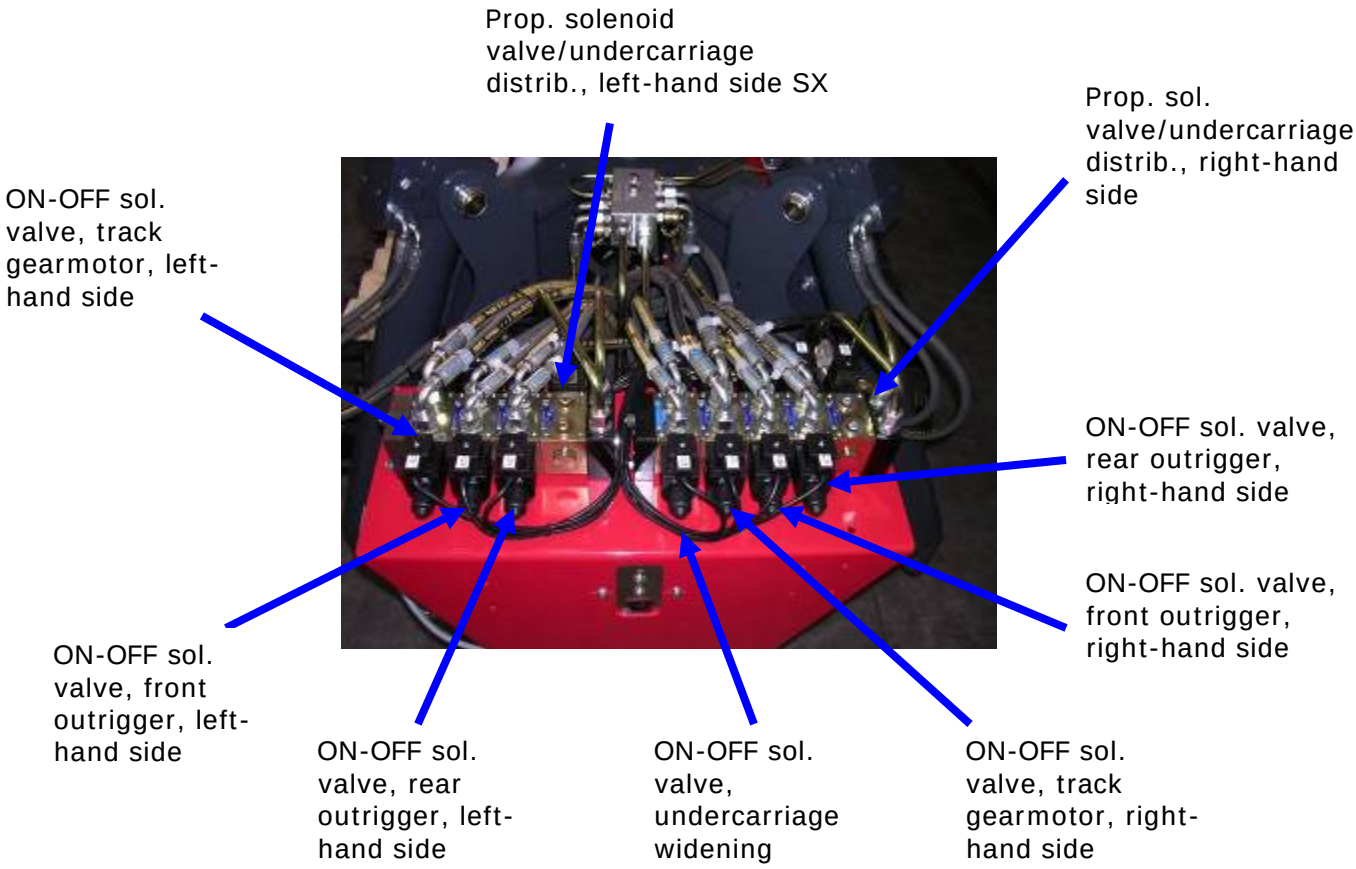
The undercarriage can be operated only with the machine aligned; this situation is signalled to the operator by a green lamp on the remote control.

The oil from line “B” is conveyed to the hydraulic distributor of the undercarriage – right-hand side (8). Then, via a proportional valve driven by the control module and ON-OFF solenoid valves (one for each movement), it controls the two right-hand outriggers, the right-hand translation hydraulic motor, and the track widening cylinders.
When the proportional solenoid valve is in standby, the oil is directly drained and then conveyed to the tank. The maximum pressure inside the distributor is controlled by a dedicated max. pressure valve.



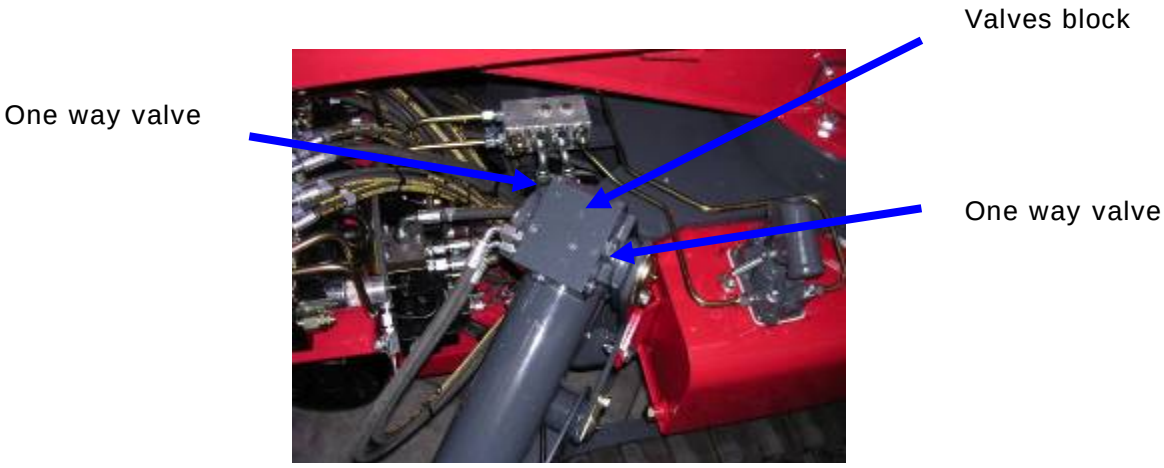
Maximum pressure valve for the ground part located on a distributor

The oil from line “A”, when the coil of directional solenoid valve (14) is excited by the control module, is conveyed to the hydraulic distributor of the undercarriage – left-hand side (9). Then, via a proportional valve driven by the control module and ON-OFF solenoid valves (one for each movement), it controls the two left-hand outriggers and the left-hand translation hydraulic motor. When the proportional solenoid valve is in standby, the oil is directly drained and then conveyed to the tank. The maximum pressure inside the distributor is controlled by a dedicated max. pressure valve.



8.1.1 Outrigger operation

When the stabiliser is lowered, the oil is held under pressure by two pilot-operated stop valves fitted in series and located in the block welded onto the cylinder. The engine speed set for the operation of the stabilisers is 3600 rpm, with the selector in position “N” on the remote control, and 1500 rpm with the selector in the “tortoise” position.



8.1.2 Gearmotor operation

Gearmotors allow forward/reverse motion according to the oil supply direction determined by the distributor. Each gearmotor is provided with a brake which is actuated only in standby conditions, i.e. when the oil is not under pressure. When the forward/reverse motion is started, the brake is disabled by the oil under pressure, and controlled by a dedicated 2-way single-acting valve.
The engine speed set for the operation of the gear motors is 3600 rpm with the selector in position “N” on the remote control, and 1500 rpm with the selector in the “tortoise” position.

8.1.3 Operation with extended undercarriage

The tracks are widened and narrowed by two double-acting cylinders driven directly by the distributor.
The engine speed set for the operation of the undercarriage gauge extension cylinders is 3600 rpm with the selector in position “N” on the remote control, and 1500 rpm with the selector in the “tortoise” position.

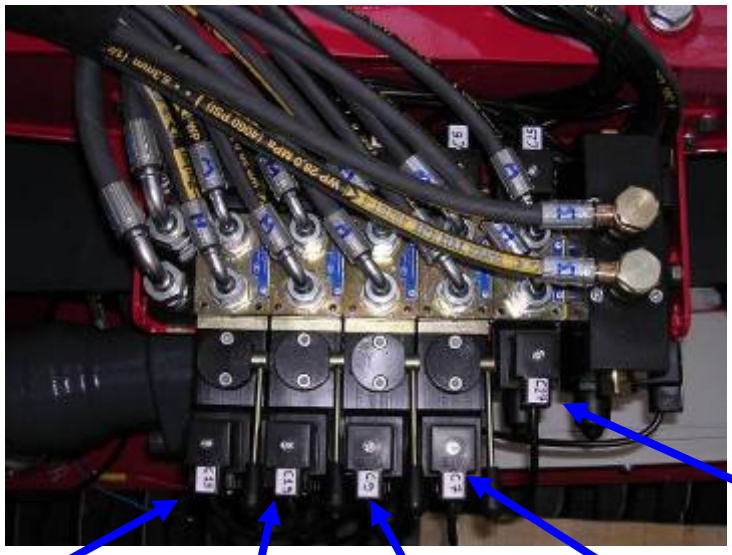
8.2 OPERATION OF THE AERIAL PART

Line “A” is connected to a solenoid directional valve (14). When the control module enables the movement of the aerial part, the solenoid directional valve (14) is not energised, deviating the flow of oil to the rotation distributor (15). A pressure-compensated proportional solenoid valve, controlled by the control unit, sends the oil to the distributor for the aerial part Then, via a balanced proportional solenoid valve, the oil is conveyed to the distributor of the aerial part. This condition is signalled to the operator by the switching on of the “outrigger” lamp on the remote control. When the proportional solenoid valve is in standby, the oil is directly drained and then conveyed to the tank. The maximum pressure inside the system is controlled by a dedicated max. pressure valve.

Distributor for aerial part rotation

Maximum pressure valve for the aerial part located on the rotation distributor

Aerial part distributor



Basket rotation ON-OFF solenoid valve

ON-OFF sol.valve – 1st and 2nd arms

ON-OFF sol.valve – 3rd and 4th arms

Extension arm ON-OFF solenoid valve

Jib arm ON-OFF solenoid valve

The oil in the distributor for the aerial part controls, via a pressure-compensated proportional valve installed in the rotation distributor and the ON-OFF solenoid valves (one for each movement), the cylinder for the movement of the 1st and 2nd arms (23), the cylinders for the movement of the 3rd and 4th arms (24), the extension cylinder (25), jib cylinder (26), the cage rotation cylinder (27) and the circuit for levelling the cage (28-29).

The rotation motor for the aerial part (17), is managed both by the pressure-compensated proportional solenoid valve for the aerial part, and by an ON-OFF solenoid valve not installed on the distributor for the aerial part, but rather located to the side of the proportional solenoid valve.

The cylinder for the 1st arm and the 2nd arm (23), the cylinders for the 3rd arm and the 4th arm (24) and the jib cylinder (26) are equipped with a driven balancing valve and a solenoid valve in case of emergency downward motion.
The pilot-controlled balance valve also carries out the function of stop and anti-shock valve. The solenoid valve for the emergency down motion is driven by the control module by pressing the “emergency down motion” push-button on the remote control. This opens a calibrated aperture that connects the bottom of the cylinder to the tank, passing through the ON-OFF solenoid valves; if these have also been energised by the movement buttons on the remote control, the oil can then flow out and return to the tank. This situation occurs as the cylinder lock is disabled and this can consequently close due to the force of gravity (weight).

The extension cylinder is provided with only one driven balancing valve, and accordingly the down motion by gravity is not allowed.

The basket rotation cylinder is provided with a circuit that has a double driven balancing valve.

The basket levelling circuit is provided with two separate cylinders forming a closed circuit, by which the basket is kept levelled while the third arm and the fourth arm are being operated. Pressure is maintained inside the cylinder chambers by a double driven balancing valve. There are also two anti-cavitation valves that prevent air from entering if the operator adjusts the levelling of the cage and then the equilibrium changes between the travel of the driving cylinder and the following cylinder.

8.2.1 Operation of the first and second arms

The 1st arm and the 2nd arm are moved by a single cylinder, directly actuated by the aerial part distributor.
This cylinder can move two arms by a connecting-rod system.
The cylinder is provided with a driven balancing valve and an emergency solenoid valve.
The revolutions per minute preset for the operation of the first two arms are 3600 (UP) and 2200 (DOWN).
The engine speed set for the operation of the first and second arm with the selector in position “N” is 3600 rpm when raising and 2200 rpm when lowering, while it is 1500 rpm in both cases with the selector in the “tortoise” position.

8.2.2 Operation of the third and fourth arms

The 3rd arm and the 4th arm are driven by two external cylinders connected in parallel and acting as a single central cylinder.
They can move two arms by a connecting-rod system and are driven directly by the aerial part distributor.
Both of them are provided with a driven balancing valve and an emergency solenoid valve (connected in parallel).
The revolutions per minute preset for the operation of the 3rd arm and the 4th arm are 2200 (UP) and 1500 (DOWN).
The engine speed set for the operation of the third and fourth arm with the selector in position “N” is 3600 rpm when raising and 2200 rpm when lowering, while it is 1500 rpm in both cases with the selector in the “tortoise” position.

8.2.3 Extension operation

The extension is moved by an internal cylinder directly actuated by the aerial part’s distributor.
It is provided with a driven balancing valve.
The revolutions per minute preset for the extension operation are 3600.
The engine speed set for the operation of the extension is 3600 rpm with the selector in position “N”, and 1500 rpm with the selector in the “tortoise” position.

8.2.4 Jib operation

The jib is moved by a cylinder directly actuated by the aerial part’s distributor, according to the selected operating mode (120 or 200 kg)
The cylinder is provided with a driven balancing valve and an emergency solenoid valve.
The revolutions per minute preset for the jib operation are 1500.

8.2.5 Basket levelling operation

During the motion of the first two arms and the Jib, the basket is levelled mechanically by a parallelogram system.

When operating with the 3rd arm and the 4th arm, the basket is levelled hydraulically, by two cylinders, with the chambers connected in parallel. The first, with drive function, is located on the transmission for the third and fourth arm, while the second is located underneath the cage and has a follower function.

The oil fed by the first cylinder through the motion of the 3rd and 4th arms is conveyed to the second cylinder, which is equipped with a double driven balancing valve (one per chamber).

If the basket position is to be modified, the oil can be conveyed to or removed from the two chambers of the two cylinders. Of course this involves a change in the oil volumes available in the circuit, between the chambers connected in parallel. For this reason, two driven balancing valves are available to operate as max. pressure valves, as well as two single-acting valves performing an anti-cavitation function.

The revolutions per minute preset for the engine are 1500.

8.2.5 Basket rotation operation

The basket is made rotate by a special cylinder provided with two driven balancing valves (one per chamber).
The maximum permissible rotation is 62° in both directions (totalling 124°).
The revolutions per minute of the engine during basket rotation are 1500.

8.2.6 Rotation of the aerial part

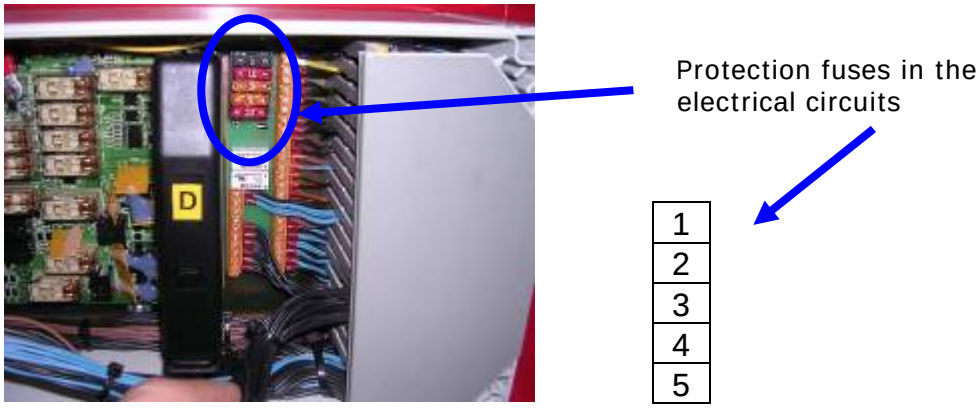
The rotation of the aerial part is controlled by a dedicated distributor, provided with an ON-OFF solenoid valve. Motion is ensured by a slewing engine directly connected directly to the slew ring
The revolutions per minute of the engine during the aerial part rotation are 1500.

9. ELECTRICAL SYSTEM

The description of the electrical system refers to the wiring diagram illustrated in annexes “2”, “3”, “4” and “5". Connections are shown in the diagram available in the User and Maintenance Manual that accompanies each vehicle.

The electrical system is controlled by a control module which consists of two cards located inside the electric components compartment. They are interlocked and interact with the sensors/actuators available on the platform.
One of these cards is provided with display and keyboard, in order to access the relevant menus and verify/adjust the operation of the platform.
More information for consulting the control module’s menus is detailed in the “Instruction manual for the use of the aerial platform control software”.
Control cards are designed and produced according to specific standards applicable to automotive components, and accordingly are provided with self-protection systems.

The electric components’ compartment includes also a third card, with protection fuses for electric circuits.



FUSE SUMMARY TABLE

FUSE No.	FUSE TYPE	CIRCUITS PROTECTED
1	1 A	Power supply to software control logic
2	10 A	Power supply output to control module
3	5 A	Power supply to safety systems
4	5 A	Power supply to relay control module
5	10 A	Power supply for emergency descent

NOTE1: In the system description the letter K always indicates a relay or a component which performs a relay function. After the letter K, the relay is identified by a number or by a number and a letter. The last letter identifies the relay contact: A is always the coil, B, C etc. are contacts which may be NC or NO contacts, according to the relevant drawing.

NOTE2: Three or four capital letters, followed by two numbers, indicate the PIN or inputs/outputs from the control module units.

9.1 UNDERCARRIAGE OPERATION AND SAFETY DEVICES

See annex “3”.

The undercarriage (tracks and outriggers) can be moved only if no *emergency stop* switch is pressed and both photocells enable the motion, i.e. if the machine is perfectly closed and aligned. Alternatively, the tracks only can be moved by disabling the undercarriage’s safety devices by the relevant key button. Of course no emergency switch shall have been pressed.

A positive signal from the battery (VBATD) and the fuse F3 runs through the “emergency stop” switch on the ground, the “cage control selector” on the ground and the “stop” switch on the remote control, thus sending the control module the status of the control and emergency switches for enabling movement using the GPAI2

The same signal then runs through the remote control position switch on the cage before being received by DIN16; this signal is not actually used for the safety devices on the undercarriage, but rather to disable the use of the aerial part if the position of the remote control is not compatible with the connector used for the remote control itself. More detailed explanations will be provided further on.

DIN15 tells the control module the position of the *emergency stop* on the cage. Power is supplied to this switch irrespective of the position of the remote control sensor on the cage, due to the diodes connected upstream of the sensor.

VBATD also runs through the two photoelectric cells connected together in series and downstream of the *emergency stop* on the remote control. In this case too, the power supply to the photoelectric cells is guaranteed irrespective of whether the remote control is on the cage, due to the diodes mentioned above; if the photoelectric cells close the line, GPAI5 tells the control module that the machine is aligned and closed.

Downstream of the photoelectric cells and upstream of GPAI5, a diode ensures the power supply to the CBENA line (global enabling of movements of the undercarriage) so as to be able to energise the coil of relay K7 (see enclosure 2).
Relay K7 thus closes contact K7B (enclosure 2) located downstream of all the ON-OFF solenoid valves relating to the movements of the undercarriage, that is, forwards and backwards for both gear motors, up and down of all the stabiliser cylinders.
It can thus be claimed that the undercarriage can only move if relay K7 is energised, and relay K7 is only energised if the power supply to the VBAT line runs simultaneously through the *ground emergency stop* (button released), the *emergency stop on the remote control* (button released), and the closed contacts on both photoelectric cells; in addition, the OUL15 enabling signal must be provided by the entire safety chain described above, via GPAF5.

It should be remembered that when not enabled by the photoelectric cells, the undercarriage cannot move, while any *emergency stop* that is not released either stops both the engine and the electric motor or prevents them form starting.
<u>When the engine is running, therefore, the only event that can disable the movement of the tracks and the stabilisers is: machine not perfectly closed and aligned.</u>

Enclosure “2” also describes how the movement of the stabilisers (not the tracks) is also managed by contacts K6B and K6C on relay K6.
The function of relay K6 is to check the direction of movement of the stabilisers. Note that one single output powers both coils of each stabiliser, that is, for both raising and lowering. The definition of movement is established by the closing of the negative on the dedicated coils, and the check is performed by contact K6B on relay K6.
Considering that all the movements of the stabilisers are managed by K6, as a result one or more stabilisers can only be moved in one direction at the same time.

When the safety devices are disabled by the key switch, relay K7 is no longer energised via the two photoelectric cells that close the circuit, but rather through the “disable undercarriage safety devices” key itself, which as well as connecting GPAI5 and DIN14, energises the coil of relay K7 on the CBENA line with power supplies directly from the VBTAD line.
In this case, as well as deactivating the safety devices on the undercarriage, the control module records the events.
Disabling the safety devices on the undercarriage means that only the movements corresponding to the gear motors are possible, and not those corresponding to the stabiliser cylinders, that is, OUTPUTS 06 – 07 – 10 – 11 are not powered.

The power supply to the ON-OFF solenoid valves (enclosure 2) is managed by the control module via the OUTPUTS that close the circuit, allowing the power supply from the VBATC line. The negative contacts of the ON-OFF solenoid valves are managed by the relays described above.

9.2 AERIAL PART OPERATION AND SAFETY DEVICES

See annex “2” and enclosure “3”

The motion of the aerial part can be enabled only if no emergency stop switch is pressed, the machine is perfectly aligned (as checked by the electronic level), stabilized (as checked by all of the outriggers' microswitches), with a weight, on the lower basket, not exceeding the weight selected by switch 120/200 (as checked by the load cell's control unit), the emergency stop switch on the basket is positioned properly, and the position of the remote control is compatible with the selected connection (see Chapter 4). Alternatively, the aerial part can be moved by disabling the relevant safety devices by the dedicated key button (emergency only).

The line of the aerial part's safety devices consists of two sectors:
P) Positive part of the chain
N) Negative part of the chain

These sectors carry out the same checks and were created to ensure a double check and stop the machine when any fault occurs. In the following description, the letter “P” will be used to indicate the section of the sensors connected to the positive part of the safety chain, and the letter “N” the section of the sensors connected to the negative part of the safety chain.

The ON-OFF solenoid valves for the movement of the aerial part receive the positive signal VBATB or VBATC (fuse F2) directly from the OUT originating from and managed by the control module (enclosure 2). All the negative signals required to energise the solenoid valves for the movement of the aerial part converge in the PAENA line (global enabling of movements of the aerial part).

The PAENA line is closed by contact K8D only when K8A is not energised; the positive to K8A is supplied directly by VBATB, while the negative is managed by the control module via OUL15, which also controls the undercarriage safety chain.
Once K8D is closed, the ON-OFF solenoid valves can receive the negative only if KS3E, KS2E and KS1E (enclosure 3) are closed at the same time. These three contacts are part of a circuit called the “intrinsic safety module for enabling aerial movements” integrated into control module inside the relay unit.

The control module checks the coherence between DIN15 and DIN16, that is, checks the compatibility between the connector used for the remote control and the position of the remote control itself (whether or not it is inside the special support on the cage). If there is compatibility (see chapter 4) a positive signal is sent from OUH27 that runs through the electronic level; from here, if the machine is correctly levelled, the positive will energise coil KS1A via contacts KS3C and KS2C.

The power supply to relay KS1 causes contacts KS1B and KS1C to close, and at the same time contacts KS1D and KS1E open, the latter located on the PAENA line.

If all the conditions are right to be able to operate using the remote control, all the “N” contacts are closed, KS2A is energised and closes KS2B, KS2D, KS2E (located on the PAENA), and at the same time contact KS2C opens, cutting off the power supply to coil KS1A.
At this stage, contact KS1C opens again, KS2A however remains powered due to contact KS2B.

The power supply to KS3A depends on the positive from “P”, while the negative is directly to earth.
If all the “P” contacts are closed, the positive OUH27 can reach upstream of contact KS1B, which will be closed after KS1A is energised, thus powering KS3A.
KS3A therefore closes contacts KS3B, KS3D, and KS3E, and at the same time opens KS3C, cutting off power to KS1A, which as a consequence opens KS1B.
KS3A however remains powered due to KS3B.

If “P” and “N” are closed, the following situation will occur:

- The PAENA line will be closed as contact KS1E is closed (KS1A is not powered), and contacts KS2E and KS3E are closed (KS2A and KS3A are powered)
- DIN12 tells the control module that the aerial movements are enabled, as KS1D, KS2D and KS3D are closed;

Below is a detail analysis of the positive part of the safety chain “P” and the negative part of the safety chain “N”. These both involve a series of double contact sensors and switches connected in series in such a way that even if one is disabled the circuit opens and the aerial movements of the platform cannot be performed.
The system of two safety chains that power the control relays in the PAENA line has been designed to ensure a double check on each sensor and/or switch and to guarantee the level of safety identified by the standards as “cat 4”.

From the level, the positive OUH27 is connected to “P”, that is, to the line that must supply the positive to KS3A. OUH27 must run through the four micro-switches on the stabilisers connected in series; this is possible only when the stabilisers are correctly resting on the ground. Downstream of the last micro-switch, a special signal tells the control module via GPAI4 that the machine is stabilised. Consequently if just one stabiliser does not provide the enabling signal (=circuit not closed), the entire chain will not be closed.

OUH27 then runs through the micro-switch on the jib arm; in fact, selecting 200 kg mode using the special switch on the remote control when the jib arm is open immediately disables the movements of the aerial part. This type of check is performed using both a normal switch for detecting the “completely closed position of the arm”, and using a bridge managed by relay K29 so as to be able to use the jib in 120 kg. More details will be provided further on.

Following the micro-switch on the jib arm, the positive OUH27 runs through the switch that checks whether the emergency stop on the cage and the *emergency switch* on the cage are in position, then runs through the load cell enabling contact and the *emergency stop* on the ground. The load cell enabling contact is closed in “P” only if the weight on the cage is less than the value selected by the 120/200 kg selector on the remote control.

If and only if all the contacts of the components mentioned above are closed, OUH27 can finally arrive upstream of contacts KS3B and KS1B.

The negative part of the chain (enclosure 3), that is, the part that supplies the negative to KS2A, unlike “P” does not run through the four micro-switches on the stabilisers, but rather four contacts of four relays, each connected to the switch on one stabiliser.
The micro-switches on the stabilisers are in fact fitted with double contacts, the first contact is used to close the “P”, the second is used to power the lights on the stabilisers, and to power the coil of a relay (K10A, K11A, K12A, K13A). The NO contact of this relay is the contact that closes the “N”; the four contacts of the relays are connected in series so as to make the system uniform with the “P” line.

Following the relay contacts on the stabilisers, excepting the contact on pin GPAI4, the “N” line follows the same path as “P” to the load cell enabling contact. The load cell enabling contact in fact closes a contact for the “P” line, while the other is closed to power the coil of relay K14 (enclosure 3). In practice, the system allows, via a connection upstream of DIN15, the positive VBATD to run to both GPAI3 and K14A; if the weight on the cage is less than the value selected, K14B can close, ensuring the continuity of the “N” line.

The control module knows whether the aerial movements are enabled via contacts KS3D, KS2D, KS1D; running OUH27 to DIN12. This can only occur if “P” and “N” are closed at the same time.

It should be highlighted that the complete closing of the “P” and “N” lines is not sufficient on its own to enable the aerial part; the control module in fact must also check the compatibility between the power supply connector to the remote control and the position of the remote control (see chapter 4).
This occurs by analysing the coherence between the signal at DIN16 and the signal at DIN15 (enclosure 3)

The positive and the negative to the relays on the “intrinsic safety module for enabling aerial movements” can be supplied without the “P” and “N” lines, using the special key switch for disabling the aerial safety devices (emergency only - see chapter 7.2).
In this way, the positive from OUH27 is connected directly upstream of contacts KS3B and KS1B, while the negative is located downstream of KS3A. In this case, the event recording function is activated.

The movement of the jib arm is only allowed when selecting 120 kg mode on the remote control.
The two solenoid valves for the movement of the jib (enclosure 1) can receive the negative only if the PAENA line is closed and only if contact K9B is closed. For this to occur, K9A must be powered, that is, the SLPNV line must be powered (enable jib movements from cage weight selector), which also supplies relay K29.

The cage weight selector (enclosure 4), closes two different contacts:

- Voltage-free contact on the load cell for variation of the 120/200 threshold. This is used by the load cell control unit to know the maximum weight admissible on the cage. If the weight measured is greater than the allowed weight, the load cell will open the “P” line and the “N” line (enclosure 3), as a consequence, the PAENA line will also be open and all the movements corresponding to the aerial part will be disabled.
- SLPNV line contact. This allows the SLPNV line to be powered via the positive VBATE, thus energising K9A and K29A. Contact K9B will consequently be closed, allowing the jib ON-OFF solenoid valves to connect to the PAENA line. At the same time, contacts K29B and K29C will be closed (enclosure 3), thus closing the “P” and “N” lines and bypassing the switch for detecting the position of the jib.

9.3 EMERGENCY DESCENT OPERATION

The emergency descent is managed by the special switch located on the remote control (enclosure 5). Pressing the button powers, via VBATF (fuse F5), K16A, which as a consequence closes K16B to allow VBATF to also power the solenoid valves for the emergency descent.
When the PAENA line is open, however, all of the ON-OFF solenoid valves for the aerial part have no negative signal, and thus energising K16A also closes K16C, which connects the coils for the emergency descent to earth.

To perform the emergency descent, the button relating to the desired movement needs to be pressed; when the aerial part has been disabled, however, the OUTPUTS that normally supply the ON-OFF solenoid valves for the emergency descent are inactive and as a consequence do not provide the positive.

To be able to power the solenoid valves, the buttons for the movements of the jib, the 1st and 2nd arm and the 3rd and 4th arm, allow VBATF to power the relay coils: K17A for the jib, K18A for the 1st and 2nd arm, K19A for the 3rd and 4th arm (enclosure 5).

When performing these movements, pressing the corresponding buttons closes contacts K17B, K18B and K19B, which allow the control module to interpret the request from the operator and activate the corresponding ON-OFF solenoid valve, using contacts K17C, K18C and K19C (enclosure 2). The latter, via the DEALV line (power supply to valves for the emergency descent), supply the ON-OFF solenoid valves used during the emergency descent, even if the corresponding OUTPUTS do not provide the positive.

10. LOAD CELL

The load cell consists of two main units: a sensor and a control module.

The first one is positioned under the basket and is made up of two sensors, that send a signal to the control module.

The control module, located on the Jib arm, processes these signals and compares them, in order to check that both of them indicate the same load. If this condition is met and the load does not exceed the one selected by the operator (120-200 kg), the control module closes two distinct electric circuits that enable the motion of the aerial part.
Otherwise, these circuits remain open and the aerial part cannot be moved.

If necessary, you can calibrate the control module by storing the values identified, after duly calibrated weights have been placed inside the basket. This procedure is described below in detail.

10.1 LOAD CELL CALIBRATION

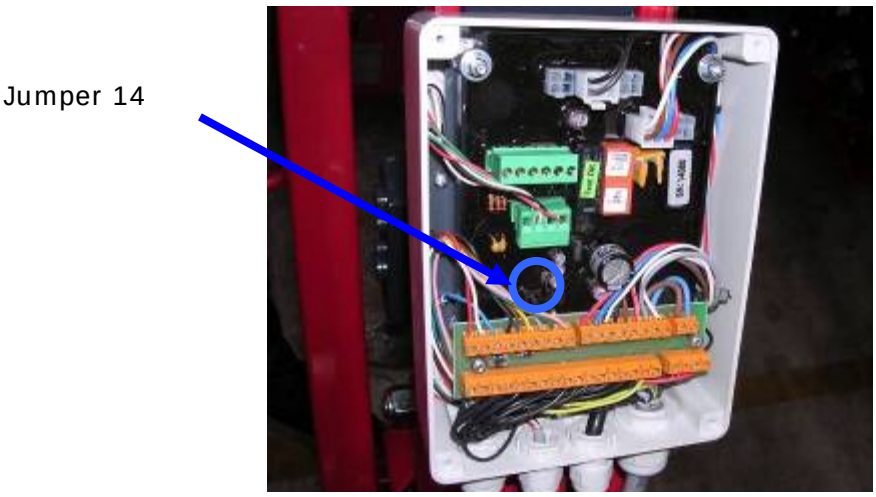
This operation must be performed when the load cell has lost the maximum load references, for example due to an overvoltage that damaged the card of the load cell, or when the sensor under the basket shall be replaced. However, it's unlikely that these situations may occur.

PROCEED AS FOLLOWS:

1. Switch off the card, by turning the key in the motor block to ‹‹**O**›› (OFF)

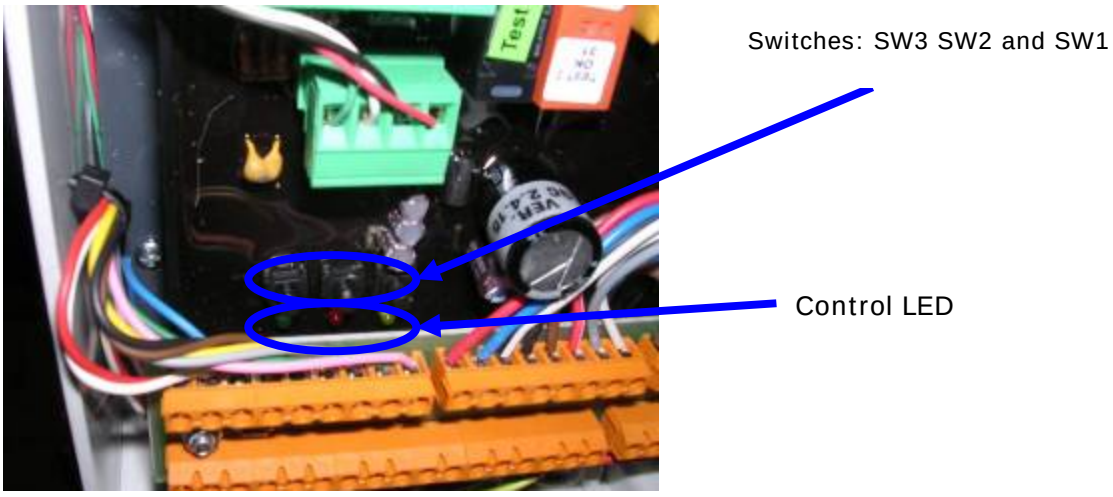
2. Remove the cover of the "load cell" card

3. Insert the bridge provided (see the back of the cover) on jumper J14



4. Power the card (turn the key mentioned above to position ‹‹**I**››; the green LED (D3) will switch on, and the red LED (D20) could be ON; anyway, proceed with the calibration

CALIBRATION START:



5. Press SW1; the yellow LED (D21) will switch on, with the red LED (D20) blinking

6. *TRANSDUCER ZERO*: the system shall be in standby (minimum load on the sensor). Press SW2: while you are holding down the button, the red LED (D20) will become more and more bright

7. *200kg ALARM LEVEL CALIBRATION*: with the selector in 200 Kg position, place 210 kg (maximum load) in the basket. Press SW3: the green LED (D19) will switch on for a short time

8. press SW1

9. *120kg ALARM LEVEL CALIBRATION*: with the selector in 120 Kg position, place 125kg (maximum load) in the basket. Press SW3: the green LED (D19) will switch on for a short time

10. *CALIBRATION COMPLETED*. Press SW1 to quit the calibration mode; the yellow LED (D21) will switch off. The red LED (D20) is switched on: reset the alarm and make sure that the red LED (D20) switches off

11. Turn off the card by turning the key of the motor block

12. Remove the bridge from jumper J14

13. Switch on the system again and check its operation: activate an alarm and make sure that the red LED (D20) switches on

10.2. ZERO CALIBRATION

The system can be calibrated automatically, without using the calibration load used before to update the system zero.
Self-calibration is always possible, except when a sensor is faulty, an event signalled by the green LED (D19), that starts blinking.

PROCEED AS FOLLOWS:

1. Switch off the card, by turning the key in the motor block to OFF.
2. Insert the bridge on jumper J14 (refer to the figure above).
3. Power the card by turning the key mentioned above to ON: the green LED (D3) will switch on.

4. SELF-CALIBRATION: the system shall be in standby (minimum load on the sensor), like in the zero calibration situation.

5. Press SW2: while you are holding down the button, the red LED (D20) will become more and more bright.

6. Turn off the card.

7. Remove the bridge from jumper J14.

8. Restart the system and check its operation: activate the alarm and make sure that the red LED (D20) switches on.

Perform the zero calibration procedure properly, for the security of the system depends on it.
Once the zero calibration procedure has been completed, make sure that the system is working properly and stops when an alarm is activated.

10.3. LOAD CELL DIAGNOSTIC SYSTEM

The load cell's control module is provided with a self-diagnosis system. The operator can thus check, through some blinking codes, whether there are any anomalies affecting the sensors or the electronic control unit.
The meaning of the blinking LEDs is explained below.

GREEN LED (D19) = Sensor failure code

BLINKS ...	MEANING
0	NO ERROR
1	ERROR – LINE OF SENSOR 1
2	ERROR – LINE OF SENSOR 2
5	SIGNAL VALUE LOWER THAN THE PERMISSIBLE VALUE
7	IMPROPER STORAGE OF THE CALIBRATION

YELLOW LED (D21) = Card failure code

BLINKS ...	MEANING
0	NO ERROR
1	CARD ERROR
2	CARD ERROR
3	CHECK POLARITY OF CONNECTIONS (TERMINAL J4)
4	CHECK THAT ALL INPUTS OF THE CARD ARE CONNECTED TO SERVICE DEVICES AND NOT TO THE BATTERY + DIRECTLY
5	REPLACE THE CARD
7	SENSOR DIFFERENCE ERROR

11. ENGINE CONTROL

The Honda iGX440 engine used on the Hinowa LightLift 19.65 platform is directly controlled by the control software, and accordingly the accelerator cable has not been provided.

The control module is interfaced with an electronic unit located on the carburettor of the Honda engine, that, via a stepping motor, can control and keep constant the rpm, by working on the butterfly valve directly.

The Hinowa software communicates with the Honda electronic unit through relays K4 and K5 (see annex X3), that close two contacts, through which the pre-determined rpm are preset. More specifically, if these two contacts are named SW1 e SW2, the following conditions will occur:

SW1	SW2	RPM
OFF	OFF	1500
ON	OFF	2200
OFF	ON	3600

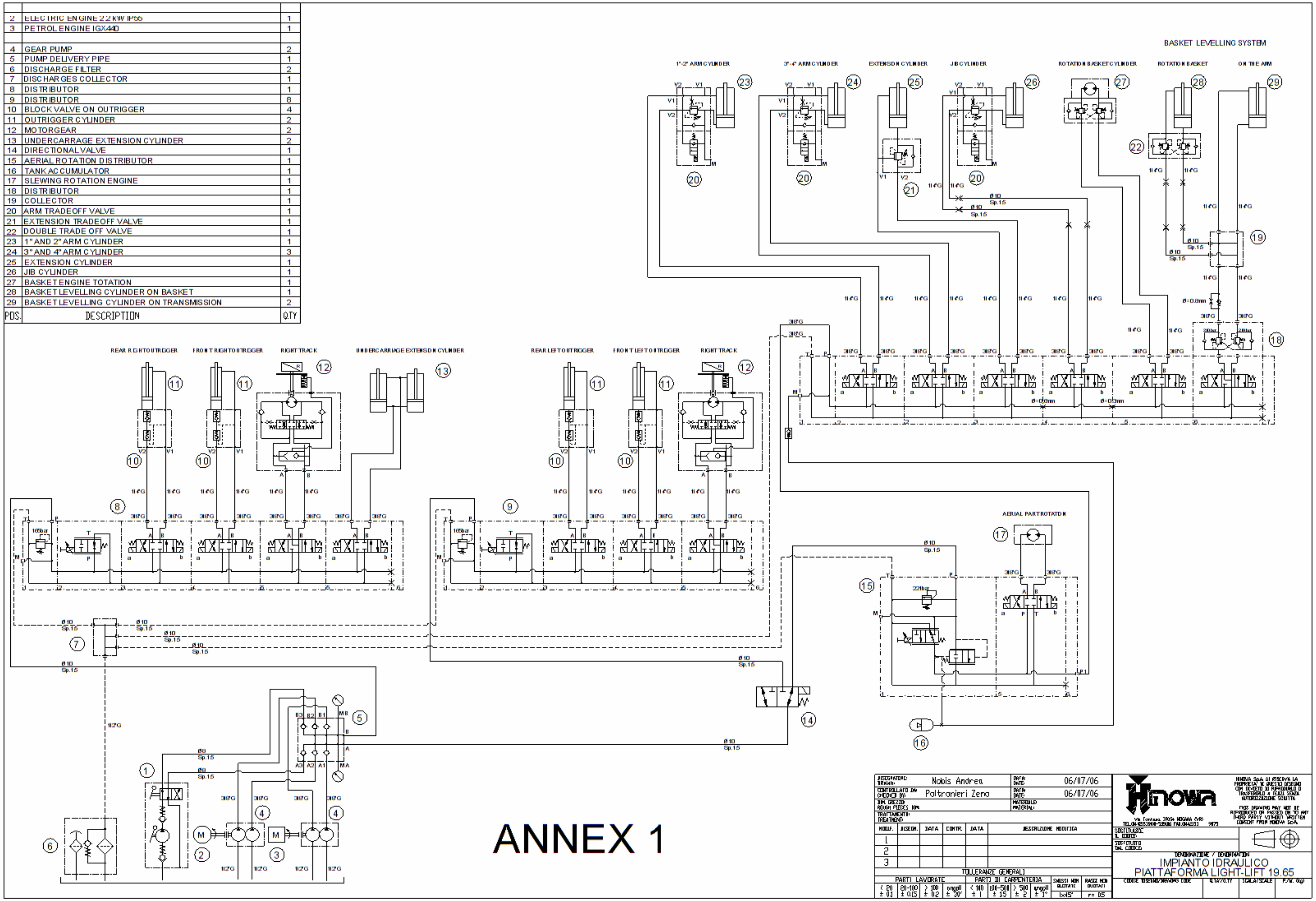
The control software will make the engine run at a different rpm, according to the manoeuvres performed by the operator; all the working conditions that are likely to occur are summed-up below

RPM	MOVEMENT
1500	None
	3rd, 4th arm ↓
	Jib ↑↓
	Basket levelling ↑↓
	Basket rotation←→
	Aerial part rotation ←→
2200	1st, 2nd arm ↓
	3rd, 4th arm ↑
3600	Tracks ←→
	Outriggers ↑↓
	1st, 2nd arm ↑
	Extension ←→

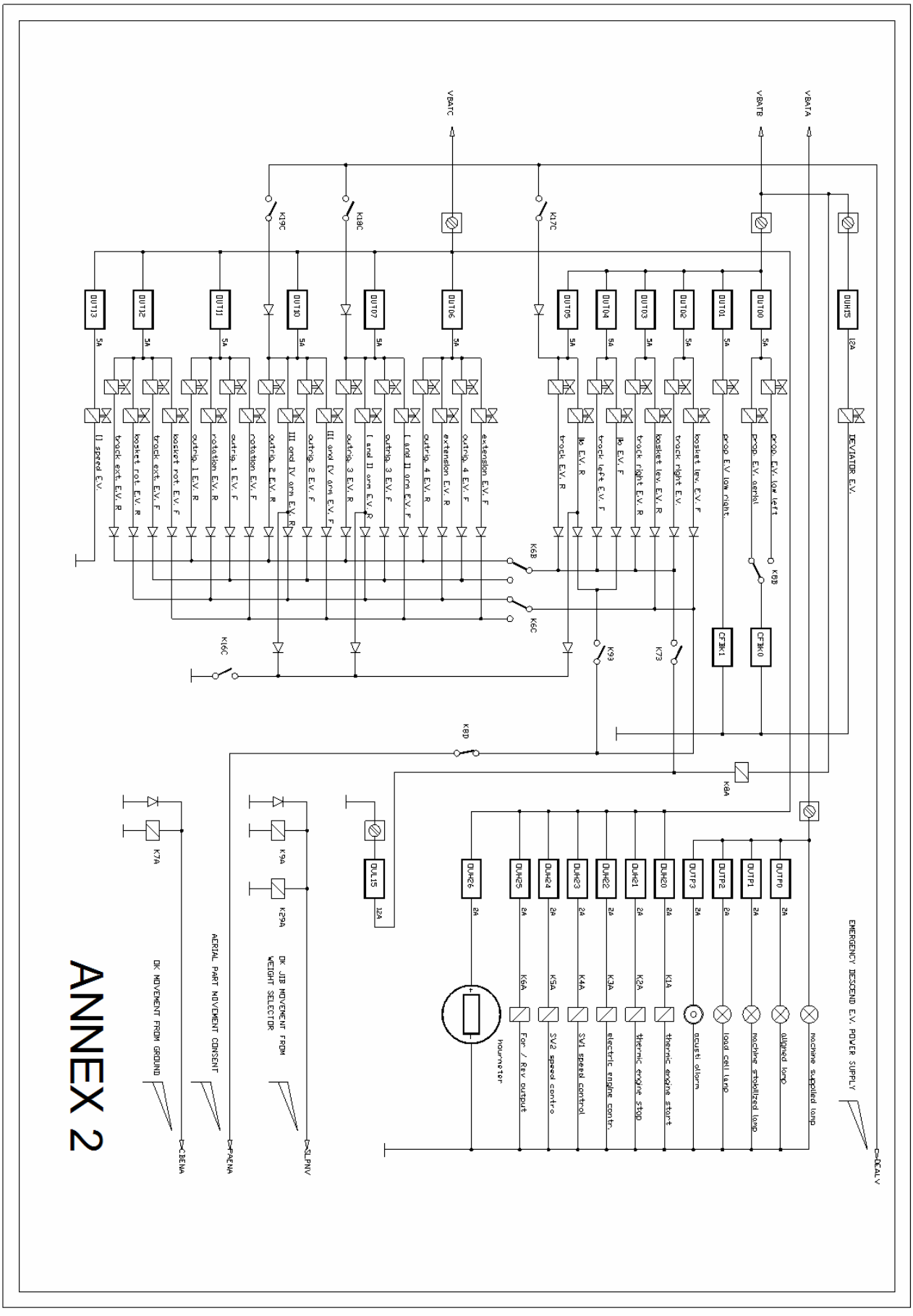
This system delivers a variety of advantages, from a reduction in noise level and consumption during operation to a more careful and precise motion control, because the rpm of the engine are automatically optimized according to the selected movement.

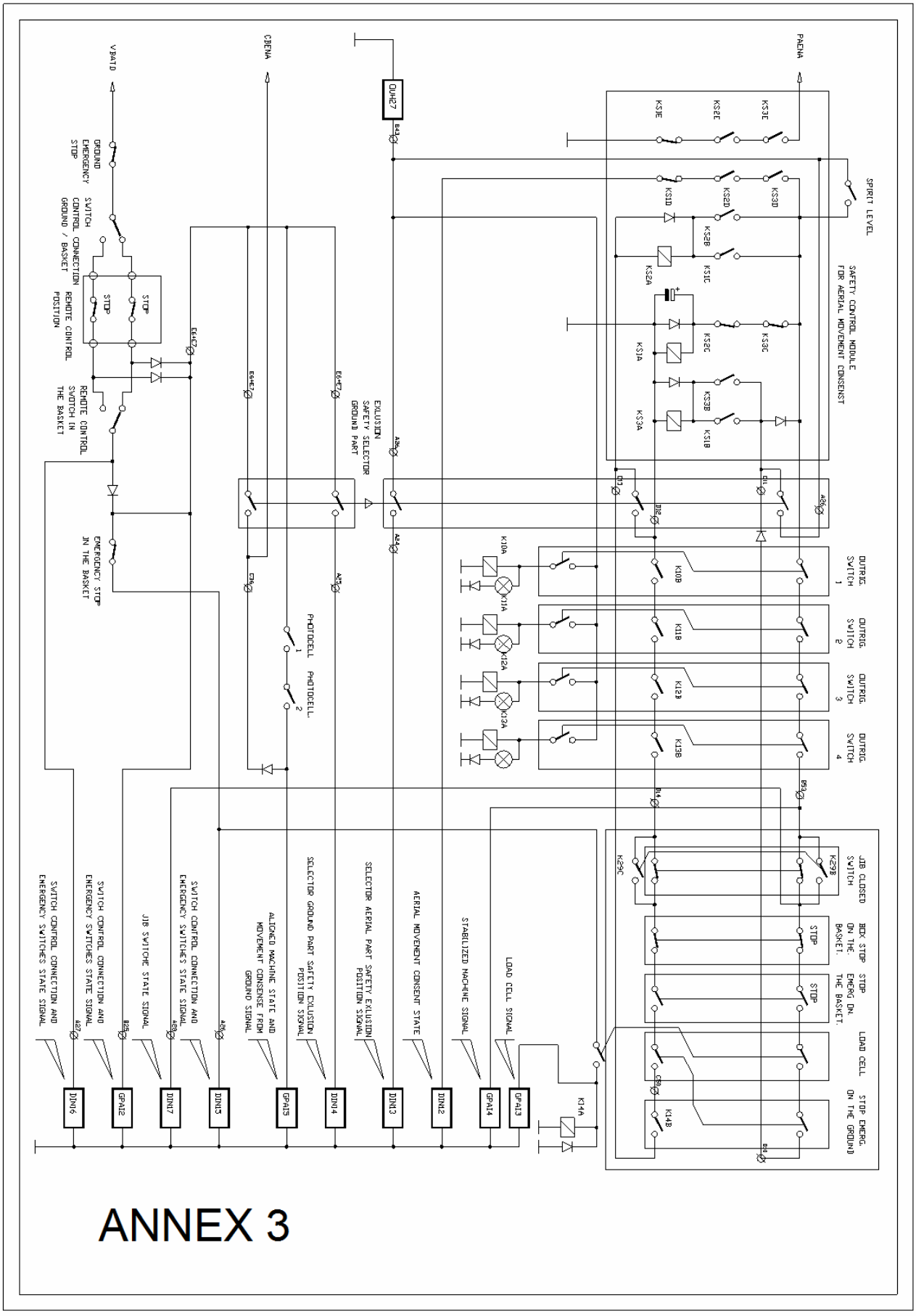
The presetting of the rpm is calibrated through a dedicated software, directly by Hinowa. If the carburettor is to be replaced, the engine's electronic unit shall be parameterized once again, via a dedicated software, a specific interface and a safety code.

ANNEX 1

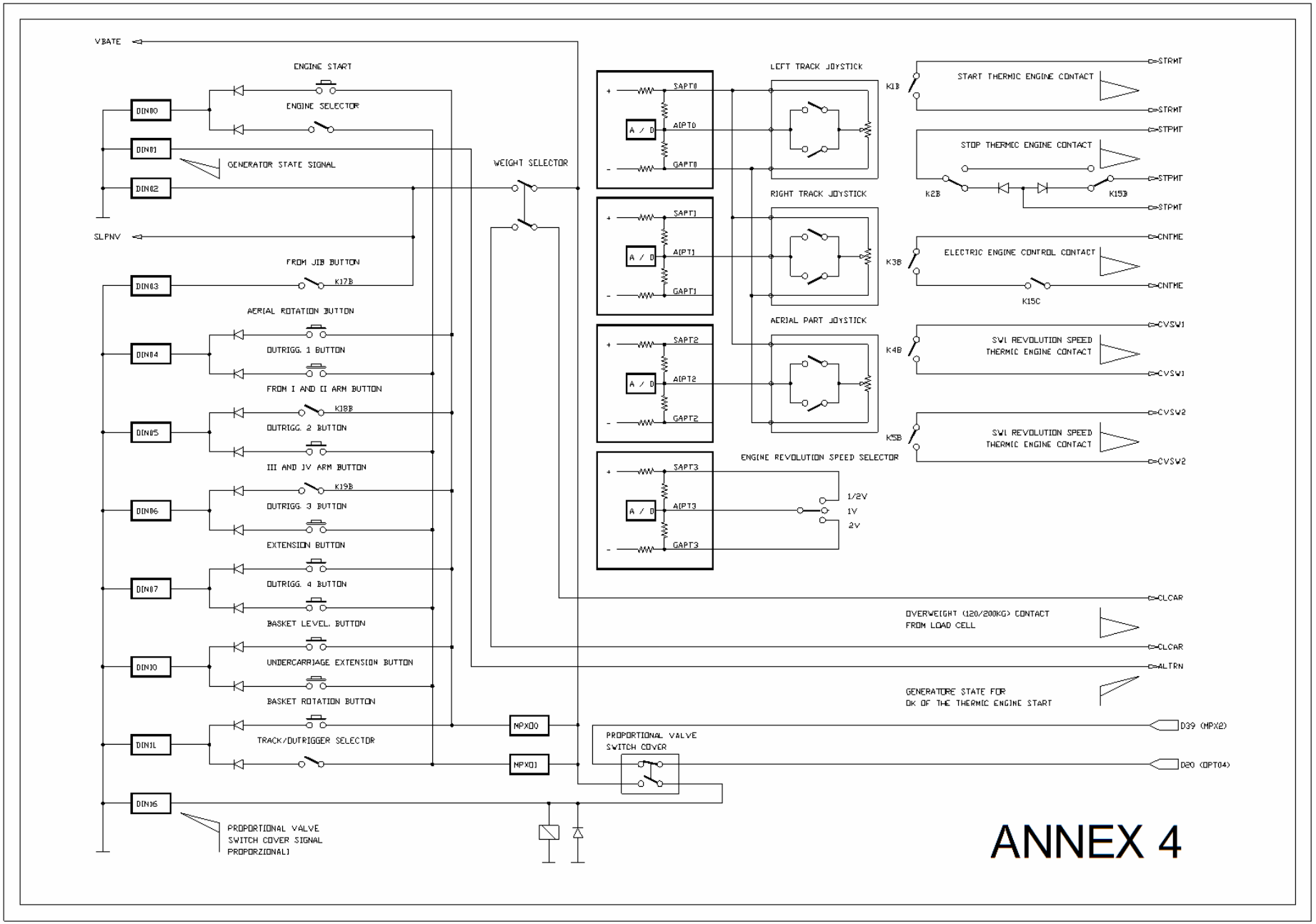


POS.	DESCRIPTION	Q.TY
2	ELECTRIC ENGINE 2.2 kW IP55	1
3	PETROL ENGINE IGX440	1
4	GEAR PUMP	2
5	PUMP DELIVERY PIPE	1
6	DISCHARGE FILTER	2
7	DISCHARGES COLLECTOR	1
8	DISTRIBUTOR	1
9	DISTRIBUTOR	8
10	BLOCK VALVE ON OUTRIGGER	4
11	OUTRIGGER CYLINDER	2
12	MOTORGEAR	2
13	UNDERCARRAGE EXTENSION CYLINDER	2
14	DIRECTIONAL VALVE	1
15	AERIAL ROTATION DISTRIBUTOR	1
16	TANK ACCUMULATOR	1
17	SLEWING ROTATION ENGINE	1
18	DISTRIBUTOR	1
19	COLLECTOR	1
20	ARM TRADEOFF VALVE	1
21	EXTENSION TRADEOFF VALVE	1
22	DOUBLE TRADE OFF VALVE	1
23	1° AND 2° ARM CYLINDER	1
24	3° AND 4° ARM CYLINDER	3
25	EXTENSION CYLINDER	1
26	JIB CYLINDER	1
27	BASKET ENGINE TOTATION	1
28	BASKET LEVELLING CYLINDER ON BASKET	1
29	BASKET LEVELLING CYLINDER ON TRANSMISSION	2

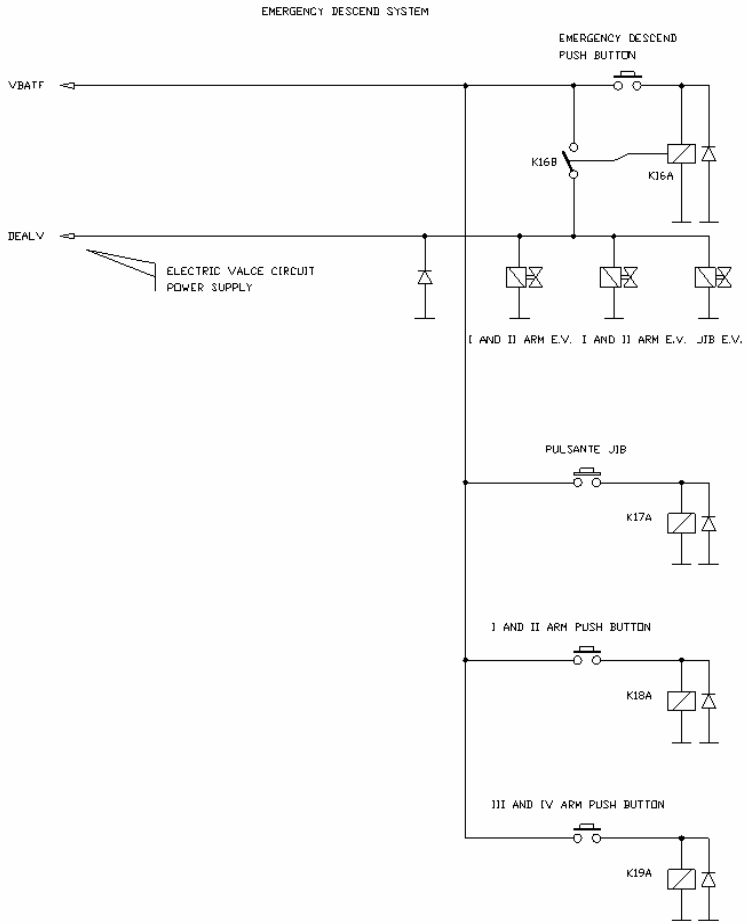

ANNEX 2
VBATA
VBATB
VBATC
DEVIATOR E.V.
EMERGENCY DESCEND E.V. POWER SUPPLY
machine supplied lamp
alarmed lamp
machine stabilized lamp
load cell lamp
acusti alarm
thermic engine start
thermic engine stop
electric engine contr.
SV1 speed control
SV2 speed contro
For / Rev output
Hourmeter
DK JIB MOVEMENT FROM WEIGHT SELECTOR
AERIAL PART MOVEMENT CONSENT
DK MOVEMENT FROM GROUND
DCALV
DLNIV
DENA
PENA


SPIRIT LEVEL
SAFETY CONTROL MODULE FOR AERIAL MOVEMENT CONSENST
PACNA
CBENA
VPA10
OUTRIG. SWITCH 1
OUTRIG. SWITCH 2
OUTRIG. SWITCH 3
OUTRIG. SWITCH 4
JIB CLOSED SWITCH
BOX STOP ON THE BASKET
STOP EMERG ON THE BASKET
LOAD CELL ON THE BASKET
STOP EMERG. ON THE GROUND
EXCLUSION SAFETY SELECTOR GROUND PART
PHOTOCELL 1
PHOTOCELL 2
REMOTE CONTROL SWITCH IN THE BASKET
EMERGENCY STOP IN THE BASKET
GROUND EMERGENCY STOP
SWITCH CONTROL CONNECTION GROUND / BASKET
REMOTE CONTROL POSITION
ALIGNED MACHINE STATE AND MOVEMENT CONSENSE FROM GROUND SIGNAL
SELECTOR GROUND PART SAFETY EXLUSION POSITION SIGNAL
SELECTOR AERIAL PART SAFETY EXLUSION POSITION SIGNAL
AERIAL MOVEMENT CONSENT STATE
STABILIZED MACHINE SIGNAL
LOAD CELL SIGNAL
JIB SWITCHE STATE SIGNAL
SWITCH CONTROL CONNECTION AND EMERGENCY SWITCHES STATE SIGNAL
SWITCH CONTROL CONNECTION AND EMERGENCY SWITCHES STATE SIGNAL
SWITCH CONTROL CONNECTION AND EMERGENCY SWITCHES STATE SIGNAL
DIN6
GPA12
DIN7
DIN5
GPA15
DIN4
DIN3
DIN2
GPA14
GPA13

ANNEX 3


VBATE
ENGINE START
ENGINE SELECTOR
DIN00
DIN01
GENERATOR STATE SIGNAL
DIN02
SLPNV
WEIGHT SELECTOR
FROM JIB BUTTON
K17B
DIN03
AERIAL ROTATION BUTTON
DIN04
OUTRIGG. 1 BUTTON
FROM I AND II ARM BUTTON
K18B
DIN05
OUTRIGG. 2 BUTTON
III AND IV ARM BUTTON
K19B
DIN06
OUTRIGG. 3 BUTTON
EXTENSION BUTTON
DIN07
OUTRIGG. 4 BUTTON
BASKET LEVEL. BUTTON
DIN10
UNDERCARRIAGE EXTENSION BUTTON
BASKET ROTATION BUTTON
DIN1L
TRACK/OUTRIGGER SELECTOR
DIN16
PROPORTIONAL VALVE
SWITCH COVER SIGNAL
PROPORZIONALI
SAPT0
A(PT0
GAPT0
SAPT1
A(PT1
GAPT1
SAPT2
A(PT2
GAPT2
SAPT3
A(PT3
GAPT3
A / D
LEFT TRACK JOYSTICK
RIGHT TRACK JOYSTICK
AERIAL PART JOYSTICK
ENGINE REVOLUTION SPEED SELECTOR
1/2V
1V
2V
K1B
K2B
K3B
K4B
K5B
K15B
K15C
START THERMIC ENGINE CONTACT
STOP THERMIC ENGINE CONTACT
ELECTRIC ENGINE CONTROL CONTACT
SWI REVOLUTION SPEED
THERMIC ENGINE CONTACT
SWI REVOLUTION SPEED
THERMIC ENGINE CONTACT
STRMT
STRMT
STPMT
STPMT
STPMT
CNTME
CNTME
CVSW1
CVSW1
CVSW2
CVSW2
CLCAR
OVERWEIGHT (120/200KG) CONTACT
FROM LOAD CELL
CLCAR
ALTRN
GENERATORE STATE FOR
OK OF THE THERMIC ENGINE START
MPX00
MPX01
PROPORTIONAL VALVE
SWITCH COVER
D39 (MPX2)
D20 (OPT04)

ANNEX 4



LEGENDA

the item with the big line are in the contro module logic and included in the electronic schedule

VBATx	power supply
	ground
DEALV	emergency descend valve power supply
SLPNV	jib movement consent from weight 120/200 selector
PAENA	aerial movement consent (cat. 3)
CBENA	ground part movement consent (cat. 2)
PAEST	consent aerial part movement state signal and consent of aerial movement from aerial movement push button
CRBST	consent ground part movement state signal and consent of gruond movement from ground movement push button
STRMT	thermic engine start
STPMT	stop motore termico
CNTME	electric engine control
CVSW1	SWL engine revolution speed control
CVSW2	SWL engine revolution speed control
ALTRN	generator state

ANNEX 5