

**4 – MAINTENANCE HANDBOOK****4.0 - INTRODUCTION****4.0.1 – General prescriptions**

- This handbook is thought for describing all the operations of maintenance and lubrication of the crane, in order to keep it in good condition. The intervals are given considering normal condition of working.
- In case of harder work and particular environment (maritime area, particularly dusty environment, etc.), the maintenance operations must properly be increased.
- Each maintenance operation should be authorized by the user.
- The operator or the assembler will record and give the user a document containing the descriptions of the maintenance operations he carried out. The record should contain:
  - ◆ Any failure or defect found during the periodical checks.
  - ◆ Defects or failures found in any other moment.

**4.0.2 – Crane arrangement**

If the crane can run on rail tracks, bring it to the special maintenance area.

- Before carrying out any maintenance operation, disconnect the master switch of the crane (except for the operations of calibration and functioning check);
- Warn the personnel working in the yard and prepare a sign "out of order";
- Do not carry out maintenance operations if the wind can make the crane turn.

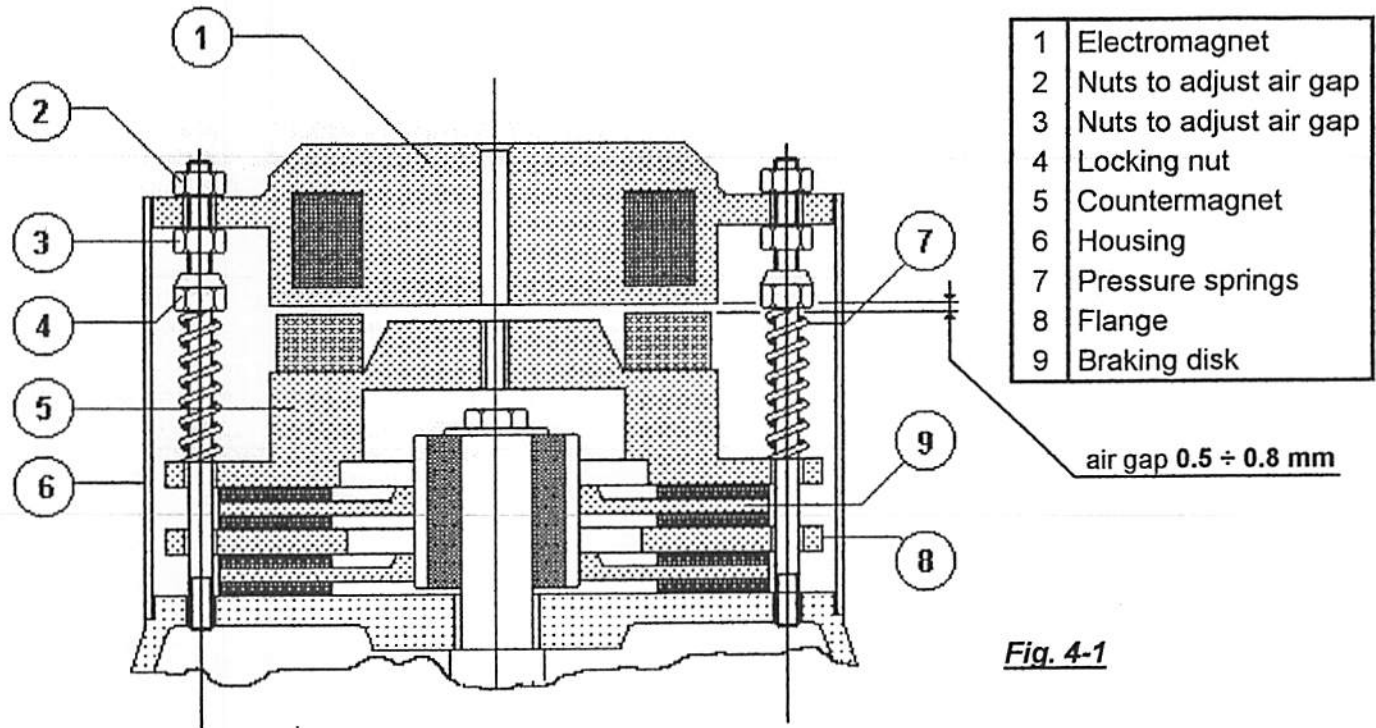
**4.1 – MAINTENANCE BEFORE THE FIRST USE**

Be sure of the perfect working of:

- Hoisting gear brake
- Travel gear brake
- Slewing motor brake
- Sliding gears brake (if the crane can run on rail tracks)
- Moment limiting devices
- Load limiting devices
- Hoisting limit-switch
- Travel limit-switch
- Slewing limit-switch
- Sliding limit-switch (if the crane can run on rail tracks)
- Pulley block slewing
- Check the oil level in the reduction gears

## 4.2 – ADJUSTMENT OF THE BRAKES

### 4.2.1 – Hoisting brake



**Fig. 4-1**

(see § 1.7.1.1.2 for the electric features)

#### CALIBRATION OF THE AIR GAP

In order to make the brake work rightly, the air gap must be kept constant with a value of **0,5 - 0,8 mm**.

The adaptation and wear of the brake disks can cause the growing, even sensible, of this measure. We recommend to check periodically the measure of the air gap by means of a thickness gauge and if necessary bring it back to the right value acting as follows (see **Fig. 4-1**):

- a) Disassemble the protection cover "6" and act on the blocking nuts "2" loosening the counter-nut "3" till you reach the right air gap measure. For a right calibration it's advisable to use three linings with the suitable thickness placed at 120° one with the others.
- b) Block the nuts "2"- "3" being sure that by exciting the electromagnet the surfaces leaning to the brake don't rub.
- c) Assemble again the protection cover "6".

#### CALIBRATION OF THE TORQUE

In some cases it is possible to modify, within certain limits, the values of the braking torque. The operations you need to carry out are listed here below (see **Fig. 4-1**):

- a) Disassemble the protection cover "6".

- b) In order to increase the braking torque, wind up the pressure springs "7" by screwing the locking nuts "4". The angular displacements (rotation) of the nuts should be the same in order to keep constant the pressure of the springs.
- c) Be sure that the electromagnet "1", when excited, succeeds in attracting effectively the counter magnet "5" without making any hum.
- d) Be sure that exciting the electromagnet the rotor of the engine runs without any rubbing between the surfaces leaning to the brake.
- e) Assemble again the protection cover "6".

#### 4.2.2 – Trolley travel brake

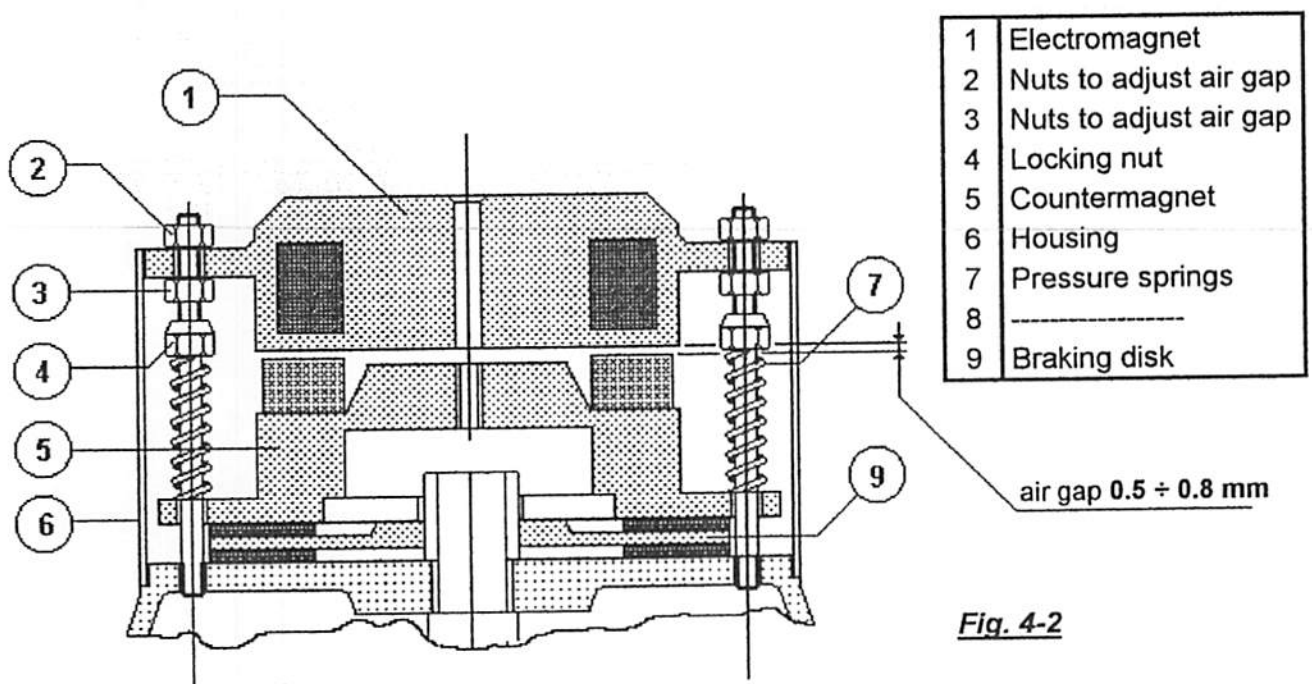


Fig. 4-2

(see § 1.7.2.1.2 for the electric features)

#### CALIBRATION OF THE AIR GAP

In order to make the brake work rightly, the air gap must be kept constant with a value of **0,5 - 0,8 mm**.

The adaptation and wear of the brake disks can cause the growing, even sensible, of this measure. We recommend to check periodically the measure of the air gap by means of a thickness gauge and if necessary bring it back to the right value acting as follows (see Fig. 4-2):

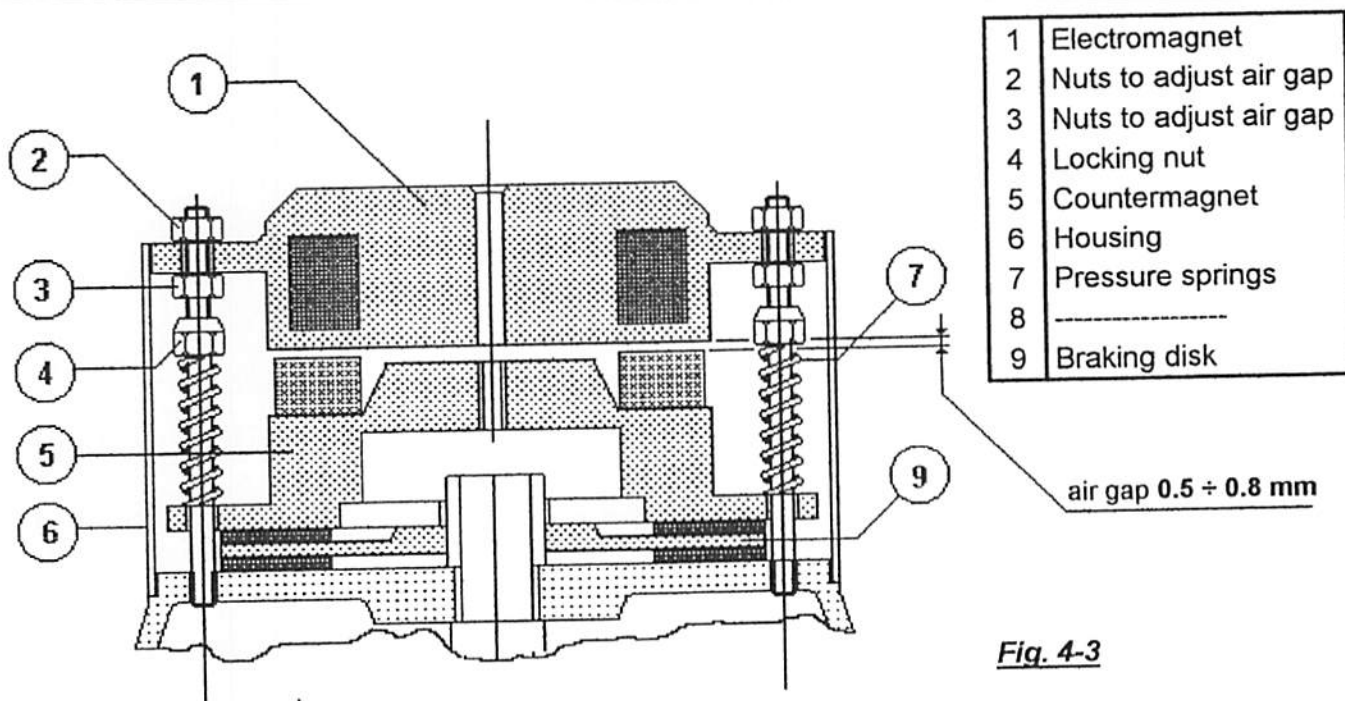
- a) Disassemble the protection cover "6" and act on the blocking nuts "1" and "3" till you reach the right air gap measure. For a right calibration it's advisable to use three linings with the suitable thickness placed at 120° one with the others.
- b) Block the nuts "1" and "3" being sure that exciting the electromagnet the surfaces leaning to the brake don't rub.
- c) Assemble again the protection cover "6".

**CALIBRATION OF THE TORQUE**

In some cases it is possible to modify, within certain limits, the values of the braking torque. The operations you need to carry out are listed here below (see Fig. 4-2):

- a) Disassemble the protection cover "6".
- b) In order to increase the braking torque, wind up the pressure springs "7" by screwing the locking nuts "4". The angular displacements (rotation) of the nuts should be the same in order to keep constant the pressure of the springs.
- c) Be sure that the electromagnet "1", when excited, succeeds in attracting effectively the counter magnet "5" without making any hum.
- d) Be sure that exciting the electromagnet the rotor of the engine runs without any rubbing between the surfaces leaning to the brake.
- e) Assemble again the protection cover "6".

**4.2.3 – Slewing brake**



**Fig. 4-3**

(see § 1.7.3.2 for the electric features)

**CALIBRATION OF THE AIR GAP**

In order to make the brake work rightly, the air gap must be kept constant with a value of **0,5 - 0,7 mm**.

The adaptation and wear of the brake disks can cause the growing, even sensible, of this measure. We recommend to check periodically the measure of the air gap by means of a thickness gauge and if necessary bring it back to the right value acting as follows (see Fig. 4-3):

- a) Disassemble the protection cover "6" and act on the blocking nuts "1" and "3" till you reach the right air gap measure. For a right calibration it's advisable to use three linings with the suitable thickness placed at 120° one with the others.
- b) Block the nuts "1" and "3" being sure that exciting the electromagnet the surfaces leaning to the brake don't rub.
- c) Assemble again the protection cover "6".

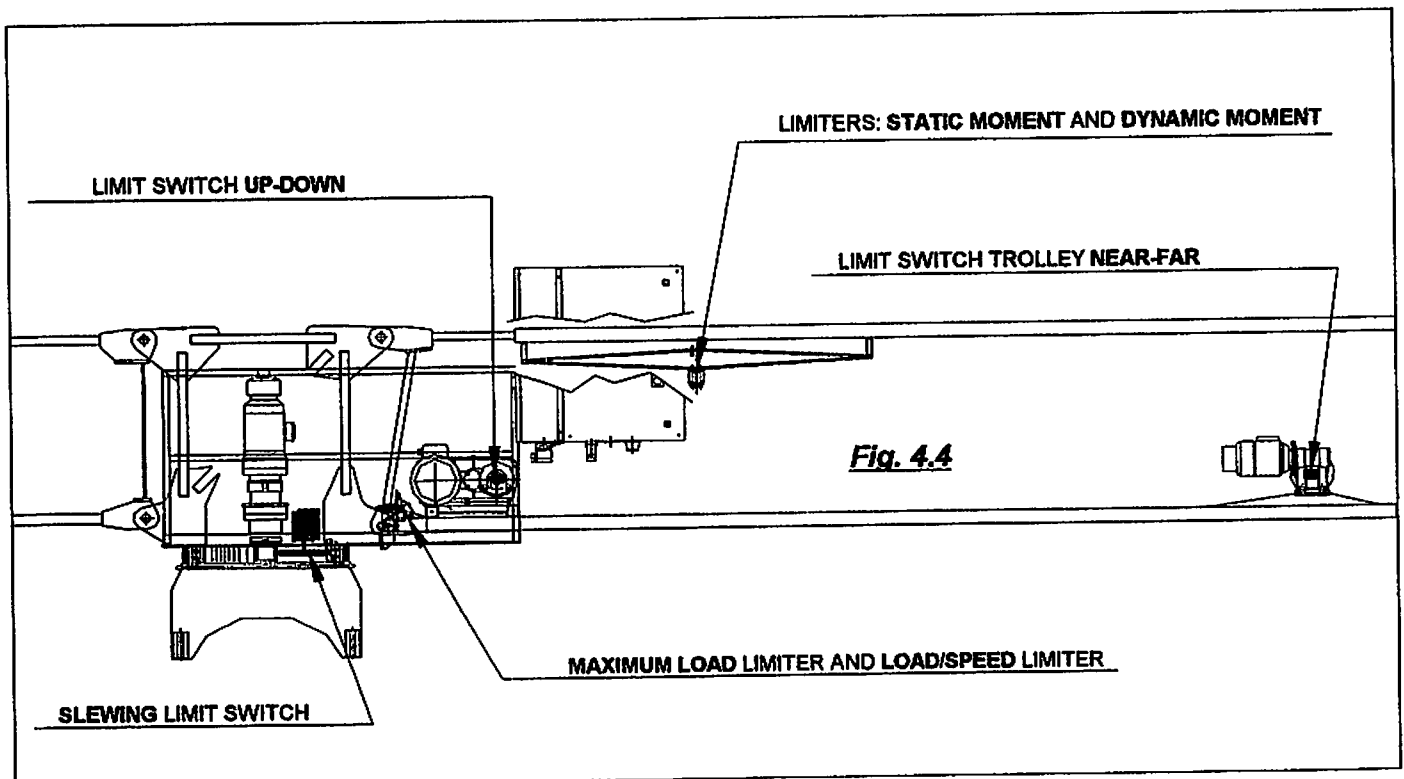
### CALIBRATION OF THE TORQUE

In some cases it is possible to modify, within certain limits, the values of the braking torque. The operations you need to carry out are listed here below (see *Fig. 4-3*):

- a) Disassemble the protection cover "6".
- b) In order to increase the braking torque, wind up the pressure springs "7" by screwing the locking nuts "4". The angular displacements (rotation) of the nuts should be the same in order to keep constant the pressure of the springs.
- c) Be sure that the electromagnet "1", when excited, succeeds in attracting effectively the counter-magnet "5" without making any hum.
- d) Be sure that exciting the electromagnet the rotor of the engine runs without any rubbing between the surfaces leaning to the brake.
- e) Assemble again the protection cover "6".

### **4.3 – SAFETY DEVICES AND HOW TO ADJUST THEM**

*Fig. 4.4* shows the position of the safety devices mounted on the crane. See also § 1.6.4.

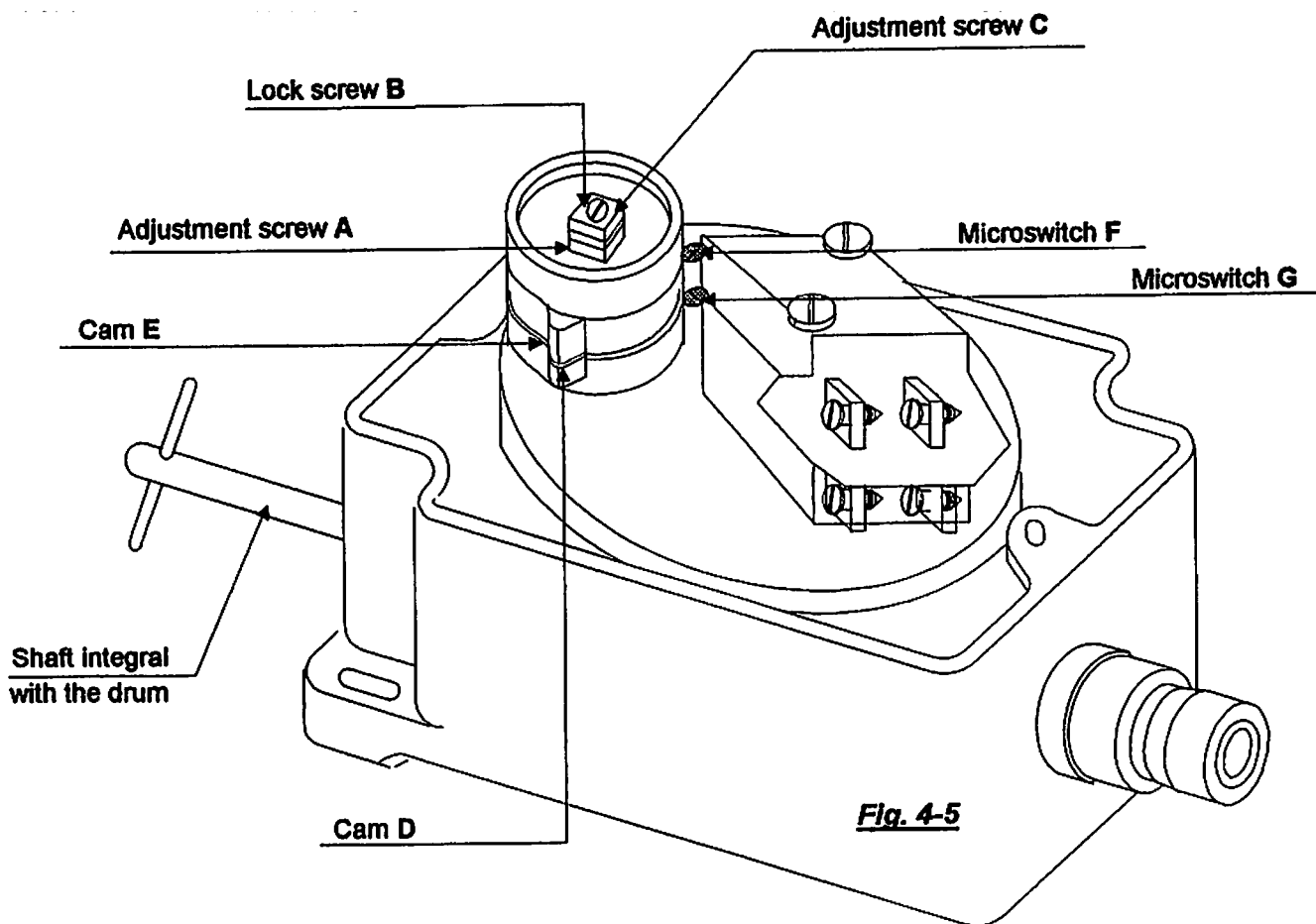


Key to symbols: (see Fig. 4.4)

SLEWING limit switch	RPM limiting device + gear wheel
Limit switch UP-DOWN	RPM limiting device on drum
Limit switch TROLLEY NEAR-FAR	RPM limiting device on drum
LOAD / SPEED limiter	Piston microswitch
MAXIMUM LOAD limiter	Piston microswitch
STATIC MOMENT limiter	Piston microswitch
DYNAMIC MOMENT limiter	Piston microswitch

### 4.3.1 – RPM LIMITING DEVICE

Opening the cover of the limit-switch, you find a device, represented here below in Fig. 4.5.



**Note!** Cams are adjusted by loosening the lock screw "B" and turning the screw "A" and "C"; after the adjustment lock the screw "B" again and close the cover.

### 4.3.2 – ADJUSTMENT OF UP / DOWN LIMIT SWITCH

See § 1.7.1.1 in *Fig. 1.21 – Part 06* for its position on the crane and § 1.7.1.1.6 for its functioning.

For the regulation of UP/DOWN limit-switch act following the instructions with reference to *Fig. 4.5*:

- Raise the pulley block up to around **0.9 meters** below the trolley.
- Remove the cover of the limiting device.
- Turn the cam "D" until the microswitch "F" trips (interrupts the contacts UP and keeps the contacts DOWN).
- Lower the pulley block up to the required height (at least **4 turns** of rope must be wound on the drum) and turn the cam "E" until the microswitch "G" trips (interrupts the contacts DOWN and keeps the contacts UP).
- Close the cover.
- Test adjustments with a few movements.

### 4.3.3 – ADJUSTMENT OF SLEWING RIGHT / LEFT LIMIT SWITCH

See § 1.7.3 in *Fig. 1.28 – Part 06* for its position on the crane and § 1.7.3.6 for its functioning

For the regulation of RIGHT/LEFT limit-switch act following the instructions with reference to *Fig. 4.5*:

- Remove the cover of the limiting device.
- Turn the crane two turns to the RIGHT.
- Turn the cam "D" until the microswitch "F" trips (interrupts the contacts RIGHT and keeps the contacts LEFT).
- Turn the crane two turns to the LEFT.
- Turn the cam "E" until the microswitch "G" trips (interrupts the contacts LEFT and keeps the contacts RIGHT).
- Close the cover.
- Test adjustments with a few rotations.

### 4.3.4 – ADJUSTMENT OF TROLLEY FAR / NEAR LIMIT SWITCH

See § 1.7.2.1 in *Fig. 1.25 – Part 06* for its position on the crane and § 1.7.2.2 for its functioning.

For the regulation of TROLLEY FAR/NEAR limit-switch act following the instructions with reference to *Fig. 4.5*:

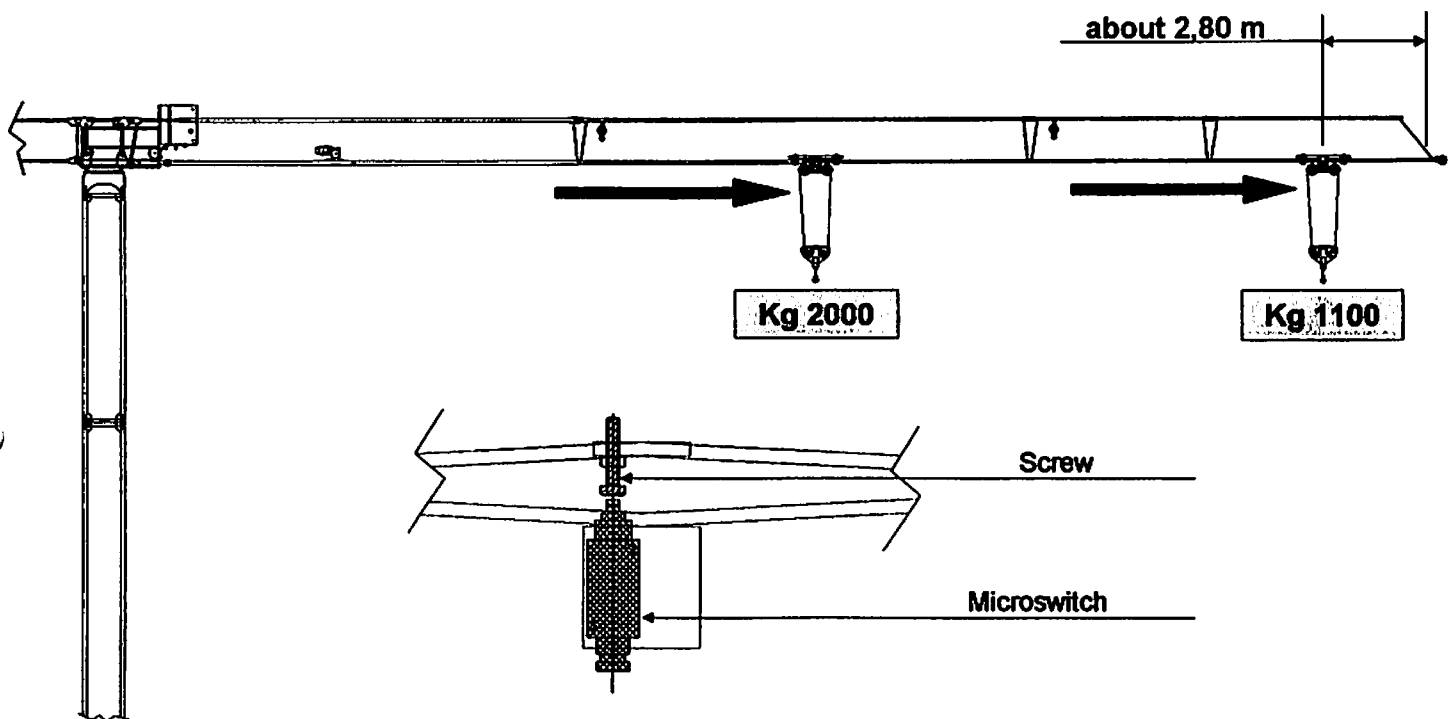
- Remove the cover of the limit-switch.
- Bring the trolley to jib nose, about **60 cm** far from the limit-switch stops.
- Turn the cam "D" until the microswitch "F" trips (interrupts the contacts TROLLEY FORWARDS and keeps the TROLLEY BACKWARDS contacts).
- Bring the trolley back to jib tower, about **60 cm** far from the limit-switch stops.
- Turn the cam "E" until the microswitch "G" trips (interrupts the contacts TROLLEY BACKWARDS and keeps the TROLLEY FORWARDS contacts)
- Close the cover.
- Test the adjustment with a few rotations paying attention that the trolley doesn't go against the limit-switch stops but stops about **10 - 15 cm** far.

#### 4.3.5 – ADJUSTMENT OF THE STATIC MOMENT LIMITER

See § 1.7.4 in *Fig. 1.30* for its position on the crane and § 1.7.4.2 for its functioning.

This limit-switch acts on the TROLLEY FAR movement.

- Lift the nominal load (1,000 kg) to jib-foot-section then bring it towards jib nose till the TROLLEY FAR limit-switch trips up.
- Bring back the trolley and add 10% to the nominal load (= 1,100 Kg).
- Make the trolley move again towards the jib nose .
- Adjust the screw shown at *Part 03 – Fig. 1.30* against the end of the microswitch (shown at *Part 02 – Fig. 1.30*) in order to stop the trolley inside the third last area of the jib-nose-section, it is to say about 2,80 meters far from the position where the TROLLEY FAR limit-switch should trip.
- Test the adjustment with several movements. Test also the adjustment of the maximum load, which should stop the FAR movement of the trolley near the sign on the jib.



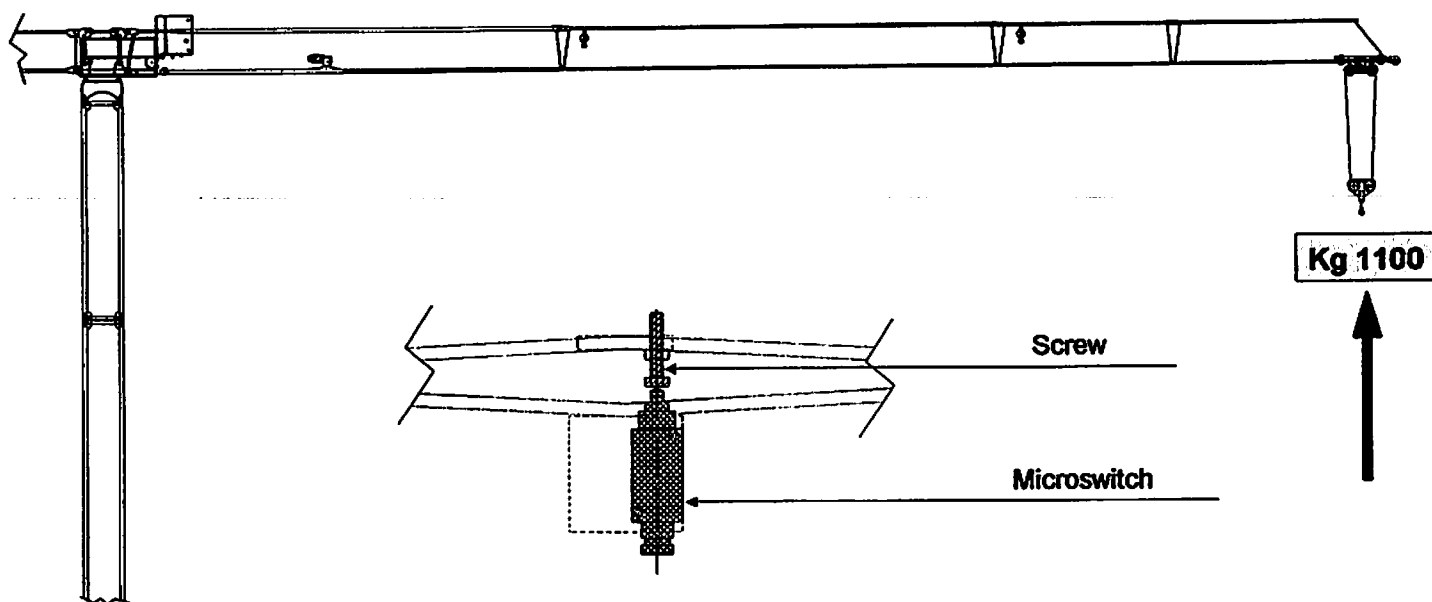
#### 4.3.6 – ADJUSTMENT OF THE DYNAMIC MOMENT LIMITER

See § 1.7.4 in *Fig. 1.30* for its position on the crane and § 1.7.4.1 for its functioning.

This limit-switch acts on the UP movement.



- Bring the trolley to the tip of the jib, till the FAR trolley limit-switch trips up.
- Lift the nominal load (1,000 kg) increased by 10% at the tip of the jib (= 1,100 Kg).
- Adjust the screw shown at *Part 03 – Fig. 1.30* against the end of the microswitch (shown at *Part 02 – Fig. 1.30*) in order to stop the UP movement.
- Adjustment must be set exactly on the nominal load plus 10%, otherwise it will be impossible to lift the nominal load, since the weight is increased by the dynamic effect of detachment from the ground.
- Test the adjustment with several movements, test also the adjustment of the maximum load, which should stop the UP movement of the trolley near the sign on the jib.

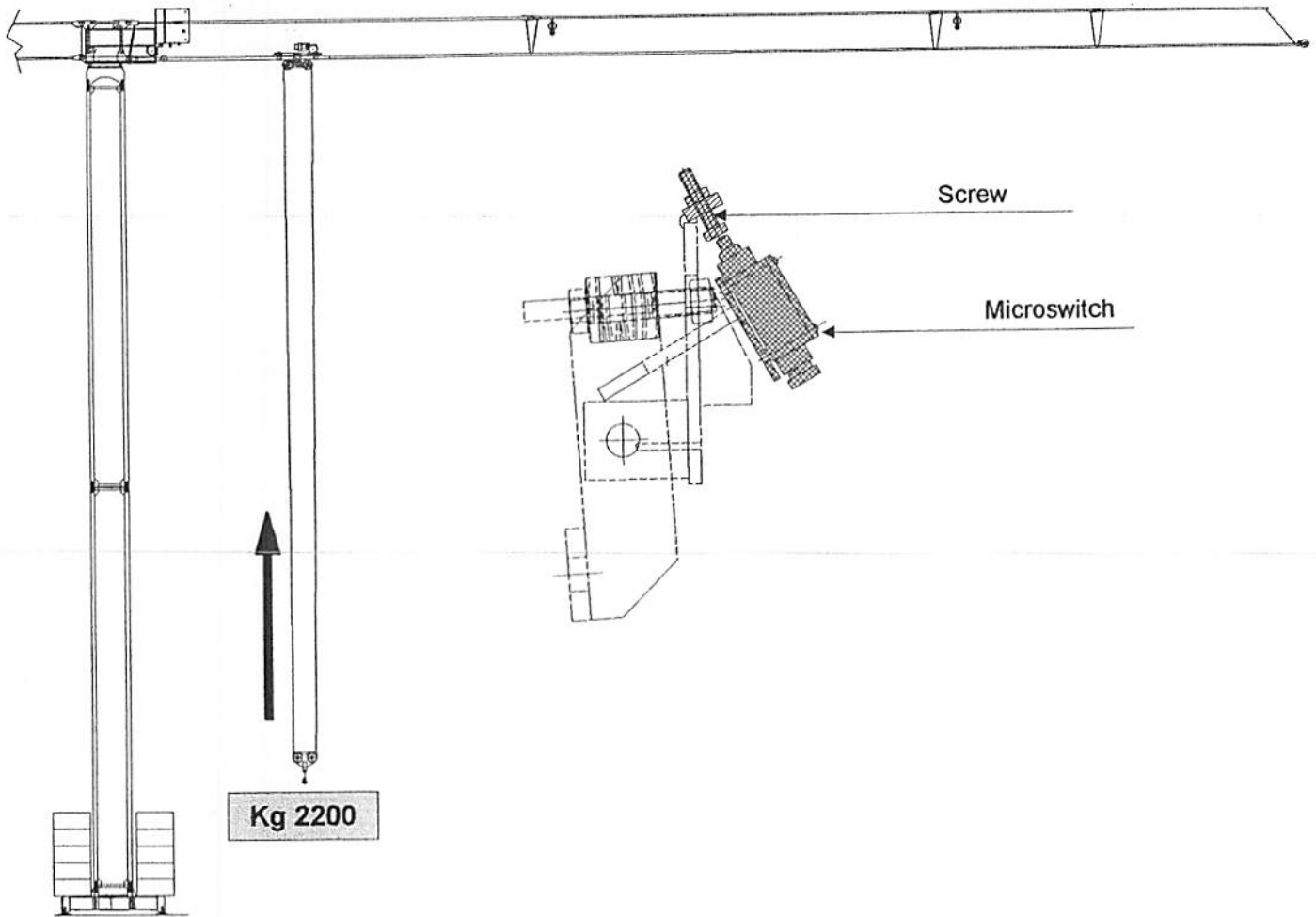


#### 4.3.7 – ADJUSTMENT OF THE MAXIMUM LOAD LIMITER

See § 1.7.1.2 in *Fig. 1.23* for its position on the crane and § 1.7.1.2.1 for its functioning.

This limiter is activated only on the UP movement.

- Bring the trolley 4 +5 meters from the tower.
- Lift the maximum load (2000 kg) a few feet from the ground.
- Add the additional load of 10% (=2200 kg)
- Adjust the screw shown at *Part 06 – Fig. 1.23* against the end of the microswitch indicated at *Part 05 – Fig. 1.23* in order to stop the UP movement.
- Test the adjustment with several movements.

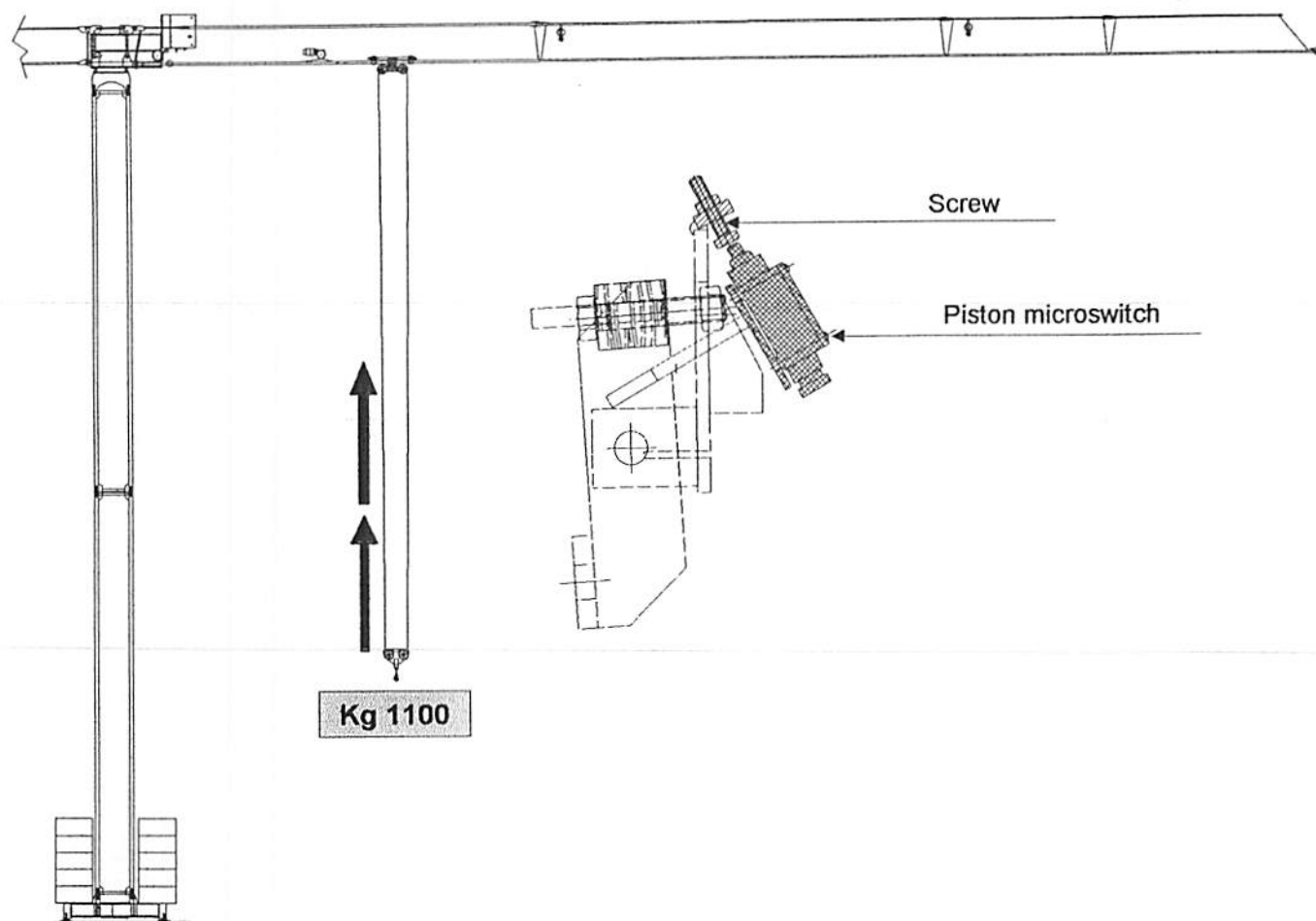


#### 4.3.8 – ADJUSTMENT OF THE LOAD/SPEED LIMITER

See § 1.7.1.2 in *Fig. 1.23* for its position on the crane and § 1.7.1.2.2 for its functioning.

This limiter acts only on the UP-FAST movement.

- Lift in the permitted area of the jib the maximum load admitted with fast movement (**1000 kg**) and try the movement of UP FAST. Lower the load up to near the ground and add an additional load of 10% (**1100 kg in total**).
- Adjust the screw shown at *Part 06 – Fig. 1.23* against the end of the microswitch indicated at *Part 05 – Fig. 1.23* in order to stop the movement UP FAST and set UP SLOW.
- Test the adjustment with several movements.



#### 4.3.9 – ADJUSTMENT OF THE SLEWING SPEED

The crane is not normally equipped with speed regulations since the motors are only threephase asynchronous. Starts and stops are controlled with the brakes (self-braking motors) on lifting and distribution (trolley) while on slewing there is power supply controlled by variation of the motor supply frequency (INVERTER).

This device is adjusted by the manufacturer at the final testing of the crane.

**No work may be carried out on this device unless by specialized technicians. The manufacturer is not responsible for any damage caused by any modification of the original adjustment.**

In such a case see the additional manual supplied by the manufacturer and placed in the electric cabinet.

#### 4.3.10 – STOP OF LIMIT-SWITCH AND BUFFERS

They are available for the trolley only since the crane does not move horizontally.

The end-stops are welded to the jib, while the buffers are made of rubber pads installed on the trolley.

**4.3.11 – Alarm**

The alarm is a hooter you can activate by means of a special button on the control box (see § 1.8.1 – Fig. 1.31) or on the manipulator (see § 1.8.3 – Fig. 1.32).

**4.4 – LUBRICATION AND MAINTENANCE**

Frequency is indicated for each item.

In case other lubricants are used, they must have the same features of those indicated in the following table:

PART	INSTRUCTION	AGIP	ESSO	SHELL
REDUCTION GEARS	Check oil level every 50 hours of operation, top up if needed. Change lubricant every erection.	F1 ROTRA 85W/90	TERESSO 56	TELLOS 33
ROPES	Check condition weekly, keep them always greased. Every erection wash away any deposit with Diesel oil.	FIN 360 EP/F	SHIELD GREASE N.2 FLUID	CADIUM COMPOUND D
UNPROTECTED GEARING AND SLEWING RING TEETH	Grease every 50 hours of operation. Every erection wash away any deposit with Diesel oil.	SPRAYDOSEN ROCOL OPEN GEAR	SHIELD GREASE N.2 FLUID	CADIUM COMPOUND D
GREASERS	Grease every 50 hours of operation.	GR-MU/EP 3	BEACON 2 SURRET FLUID 30	ALVANIA GREASE 3
BEARINGS OR BUSHING	Reinstate grease after every erection.	GR-MU/EP 3	SHIELD 650	ALVANIA GREASE 3

**4.4.1 - Ropes**

Current regulations require that, at least once every three months, the ropes are checked and the results are noted down in a special crane checking register.

The maintenance operator must read the checking register in order to understand the cause of damage to the rope and decide advisedly if the rope can still be used.

In general, the causes of deterioration of a rope may be classified in two groups:

- Mechanical causes: static loads, dynamic loads, bending and denting.
- Chemical causes: natural oxidation because of humidity, gases or fumes in the work environment.

The condition of the rope may be evaluated in the first instance from some visual elements especially breaking and oxidation of wires.

- a) **Breaking of wires** – The breaking surface may be examined to deduct if breakage was due to fatigue, overload or wear. In the first case the surface is smooth and there is no neck-in or wear; in the second case there is neck-in, it is to say the diameter gets smaller in the area of breakage; in the third case the wire is flattened.
- b) **Oxidation** – This examination requires considerable practice, especially for the internal part. We recommend not to try to open the rope with a screwdriver to inspect inside, since some wires may be damaged and the structure of the rope may be disrupted. Just tap it lightly and listen to the sound. In case of oxidation, since the contact between the wires is no more tight because of the oxidised layer, the sound will be weak and dull: you can try the difference of sound with a new rope and an oxidised rope.

#### 4.4.1.1 – Replacement of the ropes

In order to decide if the rope should be replaced, take into account the following facts:

- Number of broken wires and their positions
- Wear of the wires
- External and internal corrosion

The three conditions should be taken into account at the same time: it often happens that the general situation makes replacement necessary, even if the three elements have not reached the minimum limit each on its own.

##### 4.4.1.1.1 – Number of broken wires and their positions

It would be very practical to set the maximum number of broken wires in a rope, as a percentage of all the wires which make up the rope. This is possible, with caution, only for some types of ropes whose wires are all of the same type. In general type and lay of the rope should be taken into account.

The following table lists **14 types** of rope and, for each, according to the type of lay, the maximum acceptable number of **broken wires in a length 6 or 30 times the diameter of the rope**.

Of course, the number of broken wires should be counted in the most damaged spot.

As you can see in the table, we take into account ropes with more than **8 strands** too; in this case only external wires should be counted.

In case of ropes other than those in the table, the total number of broken wires in a section 6 times long the diameter of the rope, should not exceed **10%** of the wires which make up the external strand for cross-shaped ropes and **4%** for parallel ropes.

Previous data, although based on reasonable expectancies, are intended as general guidance and may be confirmed by practical testing only.

ROPE LAY							Maximum number of visible broken wires on ropes with:			
STRANDED				NON ROTATION			Ordinary lay rope on long section		Lang lay rope on long section	
Normal		Special		type	Number of wires		6 d	30 d	6 d	30 d
Type	No of wires	Type	No of wires		in the rope	in external strands				
				126 E	18x7=126	12x7=84	5	10	2	4
144 N	6x19=114	114 S 114 W 114 F	6x19=114				8	16	3	6
		152 S 152 W 152 F					18	36	6	12
				252 E	36x7=252	18x7=126	15	30	5	10
		150 F	6x31=186				8	16	3	6
222 N	6x37=222	222 S	6x37=222				30	60	10	20
		246	6x41=246				35	70	11	22
336 N	6x61=366						40	80	12	24

S=SEALE W=WARRINGTON F=FILLER

Pitch of wires in the strand  $= (8+12)\delta$  where  $\delta = \Phi$  of the strand

Pitch of the strand in the rope  $= (6+10)d$  where  $d = \Phi$  of the rope

In case a strand gets broken or its minimum section on a rope step is decreased by 40%, the rope must be replaced. Replace the rope also in case of dents, neck-in, irregular reduction of diameter, slots (eyes), torsion knots or other serious damage. The ropes of bridge crane winches may not be used, according to the regulations, when on a rope section 4 times long the step of the helix of the strand wire, the number of visible broken wires exceeds the 10% of the wires which make up the rope.

#### 4.4.1.2 – Lubrication of the ropes

Each wire of a rope adheres to the others on many points (ordinary lay) or on lines (Lang lay) and, because of the movements of the rope, each wire slides on the other wires, which cause in a short time severe damage.

In order to reduce the problems mentioned above, the manufacturer provides initial lubrication of the rope to protect the wires and the core which is often made of vegetal fibers; this way the core does not impregnate with humidity and wires do not start to decompose and oxidise. The protection of the lubricant must be kept and renovated in time; therefore scheduled lubrication is required to get adequate protection.

A good lubricant for ropes must not contain mineral or organic acid substances, nor alkaline residue; it must be fluid, with good density and absorbability, in addition it must not emulsify with water. Before lubrication, clean the rope of all deposits on strand interstices, which are due to the dust in the environment which is absorbed by the lubricant.

The rope may be cleaned with a wire brush or with air jet, as long as the rope had been impregnated for one or two days with petroleum.

The lubricant may be poured on the rope or spread with a brush. A modern spray product is available which is highly recommended since the lubricant can better penetrate the interstices of the rope; this should be carried out on the rope sections which are wound on the drums where the rope is always a little open.

**4.4.2 - Lubrication and maintenance of the slewing ring**

As for the slewing ring, the maintenance must include also the check of the bolts.

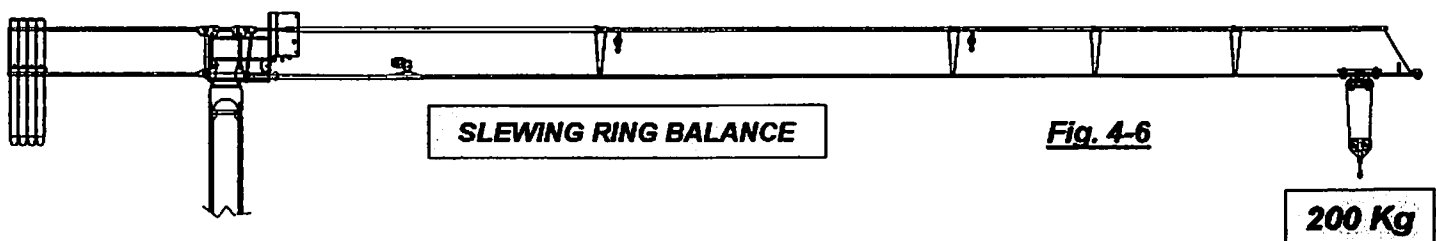
In order to counterbalance the settlings, it is necessary to check that the tightening of the fixing bolts is in keeping with the following torque values.

**BOLT TIGHTENING TORQUE**

MATERIAL	M14	M16	M18	M20	M22	M24	THREAD
8.8 (8G)	12	19	26	37	50	64	daNm
10.9 (10K)	17	26.5	36.5	52	70	90	daNm

Check also the condition of the flat or elastic washers under the head of the screw or the nut.

During this operation, the bolted connection should be discharged from traction stress due to external forces. You have to counterbalance the slewing ring by charging the crane with a load of 200 kg on jib tip as suggested in the following picture:



This check should be carried out with a dynamometric spanner within the first 100 hours of operations and then it is advisable to carry out this check every **600 hours** or every **3 months** of work. These intervals should be reduced in case of particular conditions of use or in case of machines subject to special check rules.

The bolts must be tightened with the cross procedure . Do not carry out the tightening of the bolts by means of a pneumatic gun.

The linking screws must be replaced in any case by original screws every **3 years** by the technical assistance of Benazzato Gru S.p.A.. All screws must be replaced also in case one of them is purposely or accidentally loosened or removed.

After erection, lubricate the slewing system and the teeth.

In order to carry out any lubrication use only lubricants free from acids and resin, not hygroscopic, with long life and temperature range suitable for the use of the bearing.

**SUGGESTED SLEWING RING LUBRICANTS**

ARAL	ARALUB HLP 2	BP	GREASE LTX-EP2	CASTROL	SPHEROL WRL	ELF	EPEXA 2
	ARALUB LFZ1		ENERGOL WRL		GRIPPA 33S		CARDREXA DC1
ESSO	BEACON EP2	IP	ATHESIA EPGREASE2	MOBIL	MOBILUX EP 2	SHELL	ALVANA GREASE 2
	SURETT FLUID 4K		CLUSIUM FLUID D		MOBILTAC 81		MALLEUS FLUID C

The purpose of complete greasing is the reduction of friction, sealing and protection from corrosion.

We recommend to grease until the grease comes out from the labyrinths of the bearing or from the seals. During greasing the bearing should rotate.

Frequency of greasing should be in keeping with operating conditions.

Usually, lubrication would be carried out every **100 hours** of operation.

We recommend to lubricate more often in tropical environments, in very humid, dusty, impurity-filled places, in case of large and sudden changes of temperature or in case of continuous slewing.

After and before a long period out of service, lubrication is mandatory, especially after the winter break.

Make sure during washing that no detergent enters the slewing system or damages the seals.

**4.5 – CHECKS AND MAINTENANCE OF THE STRUCTURE**

Check daily:

- The structure is perfectly level
- The ground, on which the plinths are laid, does not sink
- The good contact of the plates of the stabilizers



In order to carry out such checks, lift the nominal load on jib tip and carry out a complete rotation: no kind of sinking of the stabilizers should be visible.

In case a support needs to be restored, operate in a way that does not overload the other stabilizers. The crane operator has to check the structure visually every day.

Qualified technicians have to inspect every month all the structural components of the crane in order to check that:

- Welding is not damaged
- All the structural parts are well preserved and with consistent geometric shape 'without visible change'
- The condition of preservation of the structure. Schedule any needed reconditioning and maintenance work.

A complete check has to be carried out after every erection, disassembling, testing with overload and after any exceptional event such as collisions, backlash, etc.

Check always after erection that the single parts are not deformed or dented because of transport, loading, unloading or wrong warehousing.

Every time the crane is dismantled, retouch paint to protect suitably all exposed metal surfaces.

Check weekly the good condition and efficiency of welded, bolted and linked by pins connections.

It is advisable to check weekly the tightening of bolted connections after every erection; then you can check it monthly.

You have to carry out the tightening of the screws by means of a dynamometric spanner and following the table here below.

**BOLT TIGHTENING TORQUE**

MATERIAL SCREWS (NUTS)	M14	M16	M18	M20	M22	M24	THREAD
8.8 (8G)	12	19	26	37	50	64	daNm
10.9 (10K)	17	26.5	36.5	52	70	90	daNm

See the supplier's instructions for the correct usage of the dynamometric spanner.

Make sure that the plain or spring washers under the head of the bolt or the nut are not damaged.

Do not use the crane in case the steel structural parts are buckled or corroded for more than 5% of their thickness. The holes housing the pins cannot be strongly ovalized.

The eccentricity cannot be 3+4% more than the diameter.

It would be good, once in crane's life, to clean it from rust and then put on an undercoat with antirust and two coats of enamel.

**4.6 – ELECTRICAL SYSTEM**

Check often that ground circuits are continuous.

We remind that resistance should be measured from the point where the crane starts, it is to say at the hook, to the point where the crane finishes, it is to say the stabilizer plates.

Check frequently the condition of insulation too, especially cable clamps, terminal boards and electric board of the equipment.

Make sure the motors are in perfect condition and clean regularly the external parts (protection cases, gills). After the crane has been out of service for a long time, check the insulation and the condition of bearings, terminal board covers and protection cases.  
Inspect weekly the safety contact block, make sure they work perfectly and check that all contactors are serviceable.

#### 4.7 – CRANE OUT OF SERVICE AND WAREHOUSING

In case the crane is out of service for a long time, house it in a sheltered place to protect it from weather. Never leave the crane on tired wheels for a long time. It is better to secure it on its supports as in operating condition.

When the crane is out of service for a long time, fill with lubricating oil all reduction gears (lifting, slewing, trolley) in order to avoid condensate inside the equipment with the consequence of oxidation of unprotected parts.

Top-up oil level when the crane has to be put into service.

#### 4.8 – ELECTRIC SCHEME

In the following pages you find the scheme of the electric system (from sheet 1/9 to sheet 9/9) delivered by the manufacturer "S.I.C.I.E. s.n.c." – Castano Primo (Milan).

*N.B.!* You find in sheet 9/9 describing how to link the electric cables coming from the crane's electric board to the terminal board of the slewing motor. In this sheet are indicated the line connection, the brake connection and the unlocking brake device. *We remind that the connection to the terminal board of the slewing motor have already been carried out by the manufacturer of the crane during the test of the machine. This way, the assembler will find 2 bundles of cables connected to the SLEWING MOTOR and endowed with terminal pins (one having 6 poles and the other with 10 poles). During the assembly, he will insert them in the corresponding pins placed in the lower part of the electric board (see § 5.10.1) according to what is shown at sheet 7/9 of the electric scheme.*

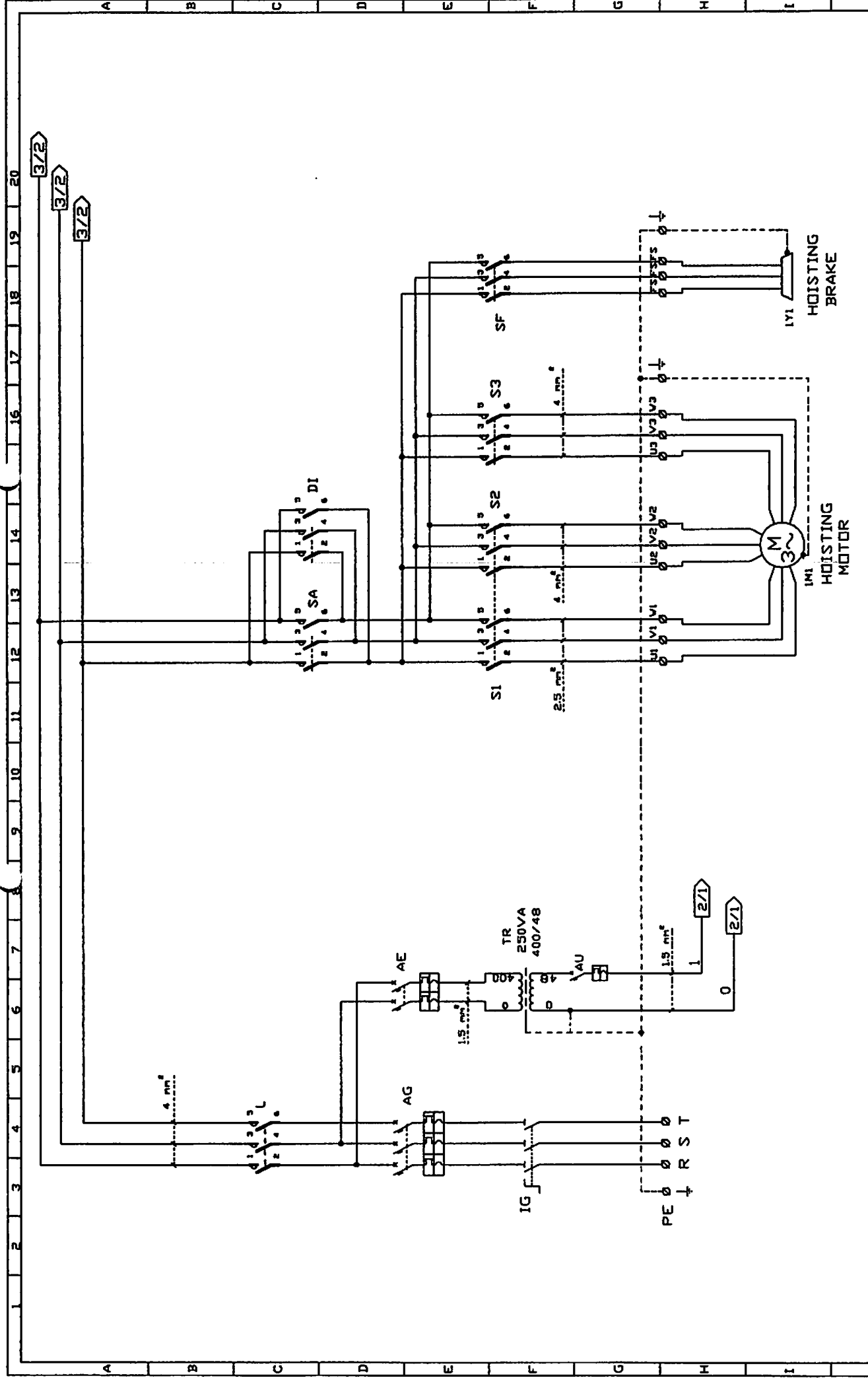
*N.B.!* In order to keep the crane in good condition, pay attention to the following note.

#### **WARNING!**

Slewing is regulated by means of a frequency variation device (INVERTER).  
This device is adjusted by the manufacturer at the final testing of the crane.

No work may be carried out on this device unless by specialised technicians. The manufacturer is not responsible for any damage caused by any modification of the original adjustment.

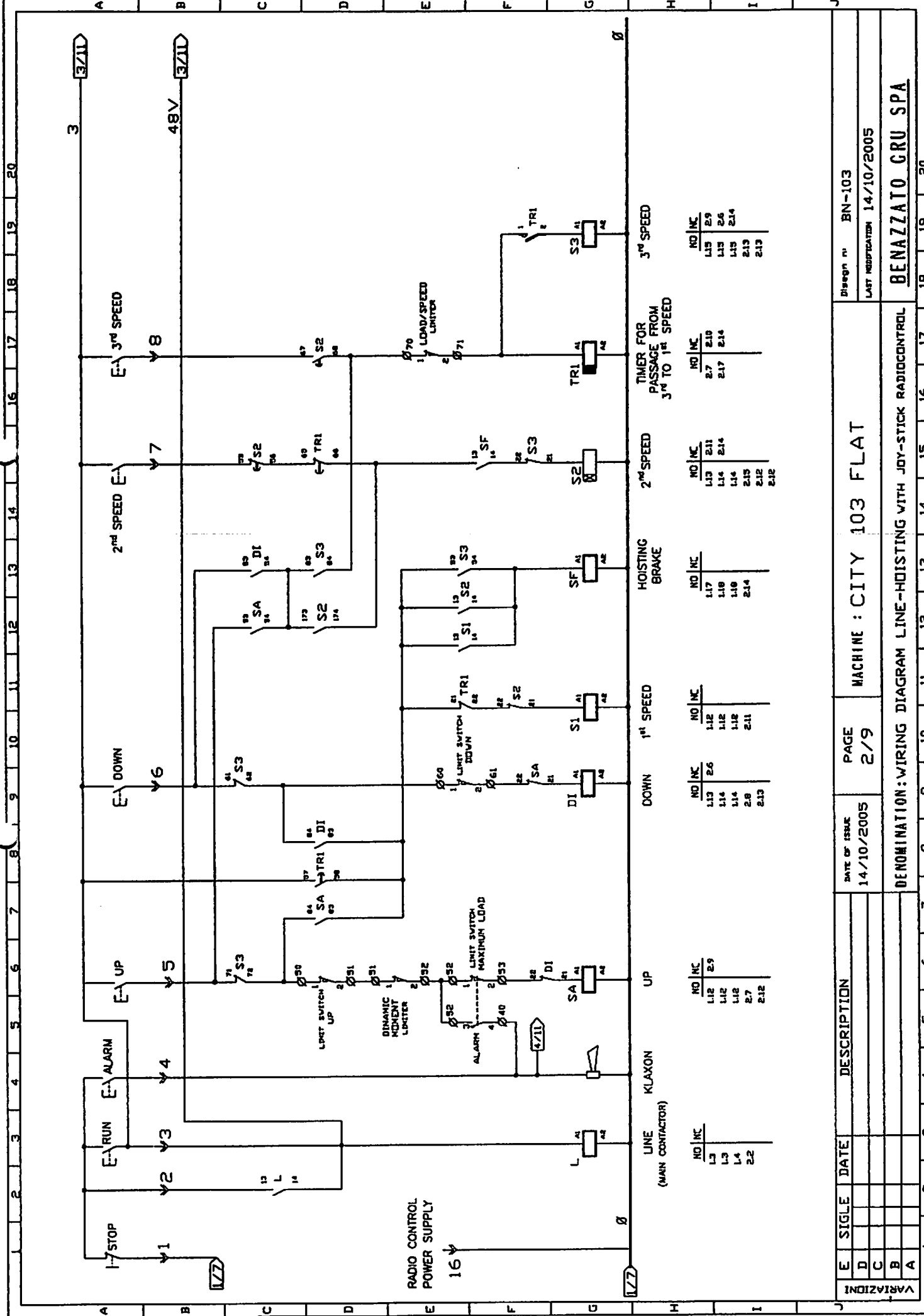
However you can find the Operation Instruction Manuals of variation devices inside the electrical cabinet.



VARIAZIONI	E	SIGLE	DATE	DESCRIPTION	DATE OF ISSUE	PAGE	MACHINE	CITY	FLAT
D					14/10/2005	1/9			
C									
B									
A									

Design n°	BN-103
LAST MODIFICATION	14/10/2005
<b>BENAZZATO GRU SPA</b>	



NO	INC
1.19	2.9
1.15	2.6
1.13	2.14
1.13	2.13

NO	INC
2.7	2.10
2.17	2.14

NO	INC
1.13	2.11
1.14	2.14
1.14	2.15
2.15	2.12

NO	INC
1.17	2.14
1.18	2.14
1.18	2.14

NO	INC
1.12	2.6
1.12	2.11

NO	INC
1.13	2.6
1.14	2.8
2.8	2.13

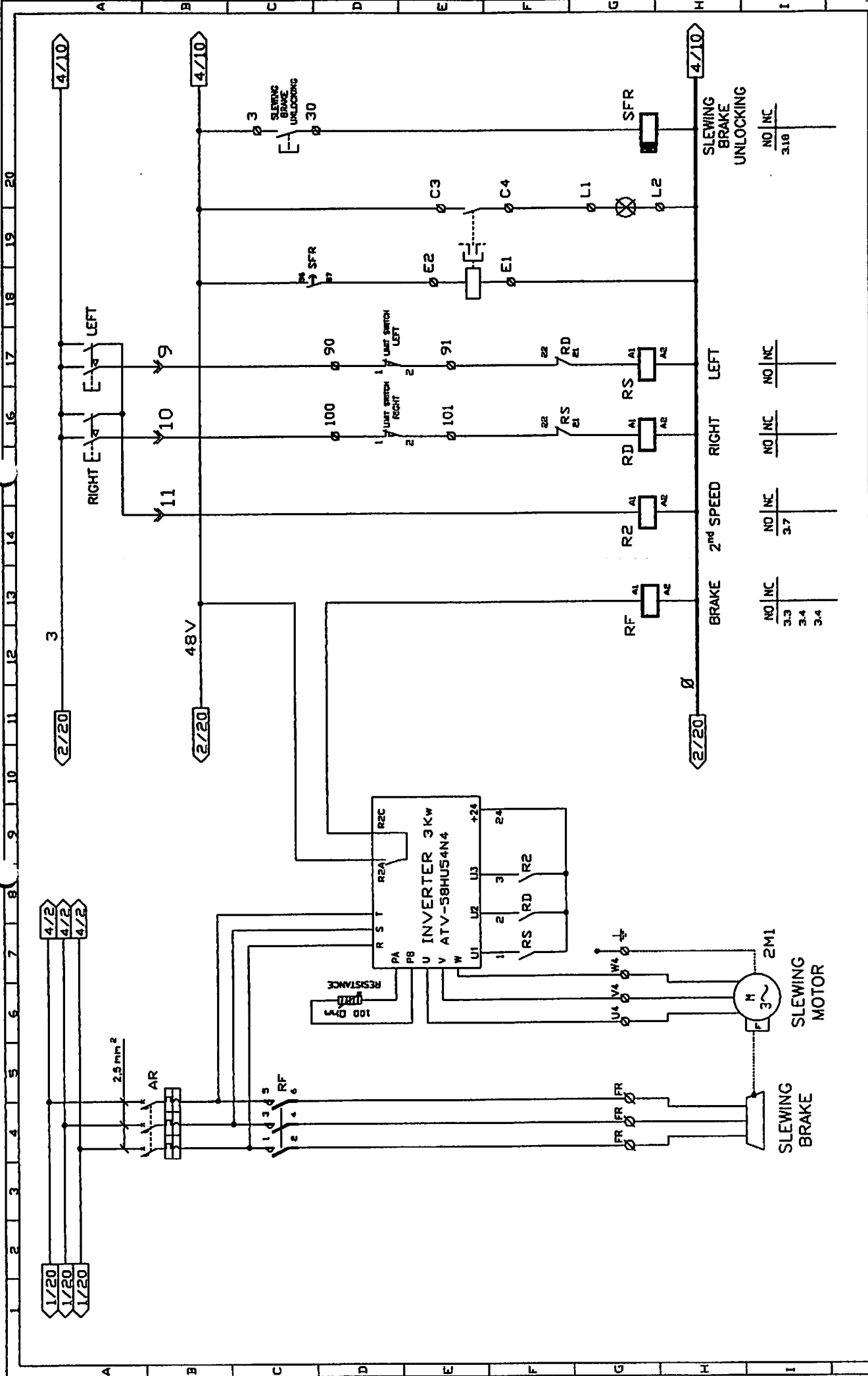
NO	INC
1.12	2.9
1.12	2.7
1.12	2.12

NO	INC
1.3	2.2
1.4	2.2

E	SIGLE	DATE	DESCRIPTION
D			
C			
B			
A			

Disegn n°	BN-103
LAST MODIFICATION	14/10/2005
<b>MACHINE : CITY 103 FLAT</b>	
<b>DENOMINATION: WIRING DIAGRAM LINE-HOISTING WITH JOY-STICK RADIOCONTROL</b>	
Disegn n°	BN-103
LAST MODIFICATION	14/10/2005
<b>BENZAZATO CRU SPA</b>	



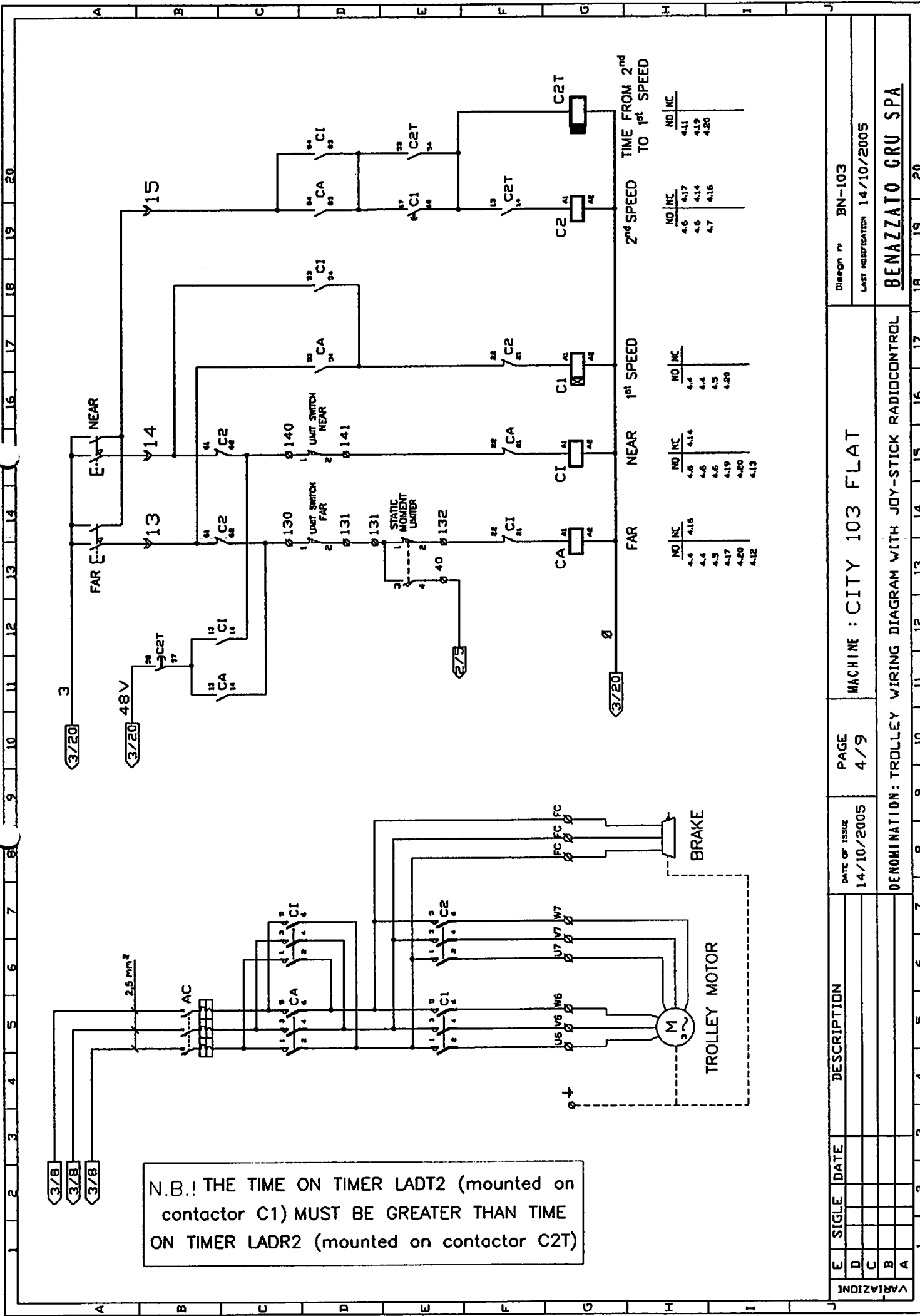
E	SIGLE	DATE	DESCRIPTION	DATE OF ISSUE	PAGE	MACHINE : CITY 103 FLAT	Design n°
D				14/10/2005	3/9		BN-103
C							LAST MODIFICATION 14/10/2005
B							
A							

VARIAZIONI	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	

DENOMINAZIONE : SLEWING WIRING DIAGRAM																		
BENAZZATO GRU SPA																		

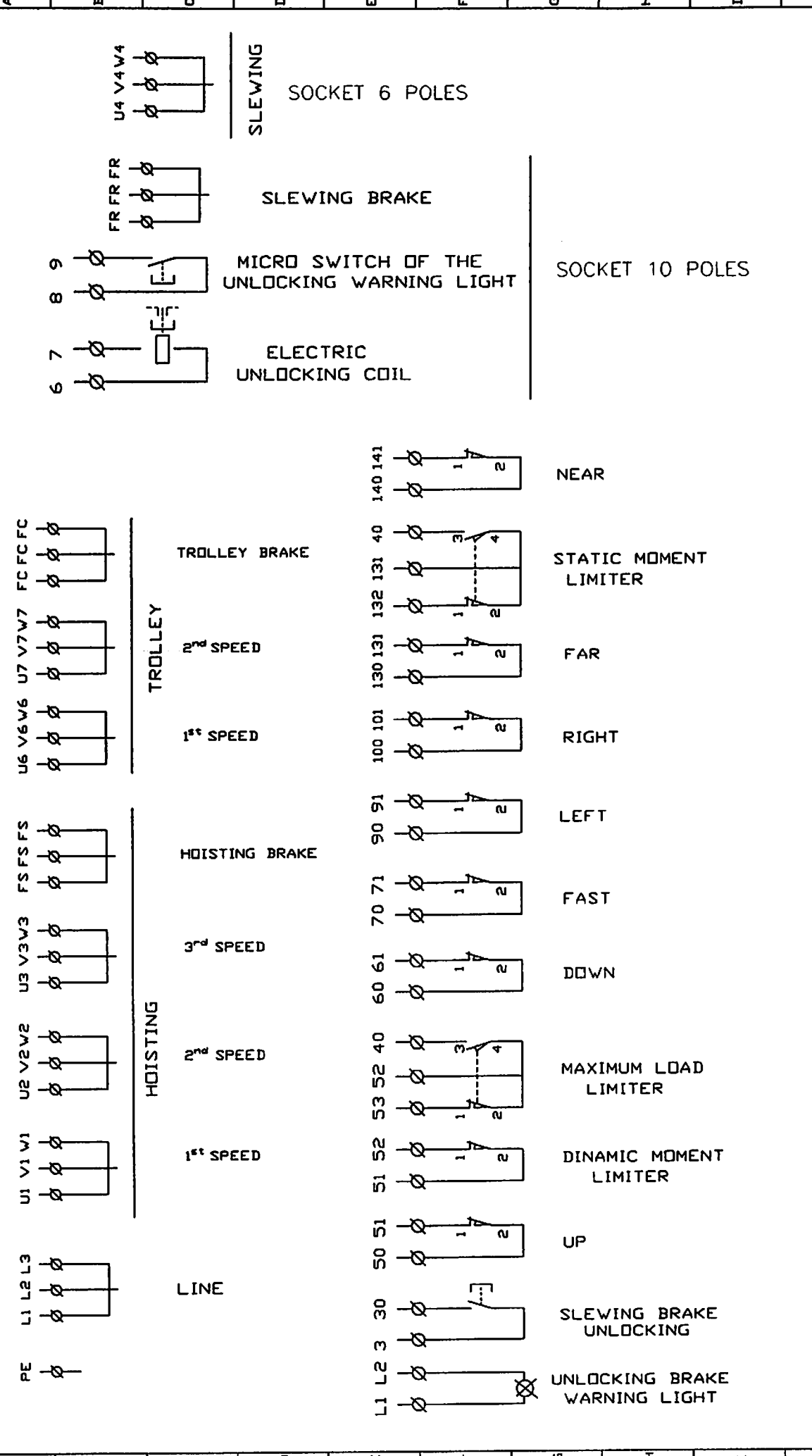


N.B.: THE TIME ON TIMER LADT2 (mounted on contactor C1) MUST BE GREATER THAN TIME ON TIMER LADR2 (mounted on contactor C2T)

E	SIGLE	DATE	DESCRIPTION	DATE OF ISSUE	PAGE	MACHINE	Design n°
D				14/10/2005	4/9	CITY 103 FLAT	BN-103
C							Last modification 14/10/2005
B							
A							

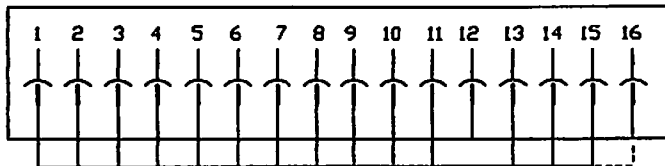
DENOMINATION: TROLLEY WIRING DIAGRAM WITH JOY-STICK RADICCONTROL

BENAZZATO CRU SPA

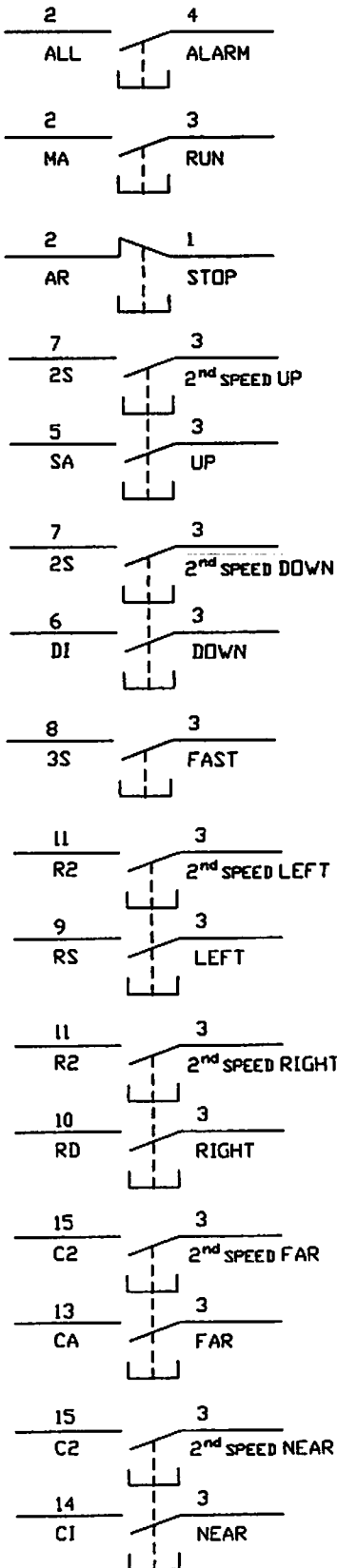


VARIAZIONI	E	D	C	B	A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
DESCRIPTION																										
DATE OF ISSUE																										
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PAGE																										
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MACHINE: CITY 103 FLAT																										
Design n°																										
Design n°																										
LAST MODIFICATION																										
LAST MODIFICATION																										
DENOMINAZIONE : TERMINAL BOARD SCHEME																										
BENAZZATO CRU SPA																										

SOCKET 16 POLES



BUTTON CONTROL BOX



Design No. BN-103

LAST MODIFICATION 14/10/2005

MACHINE: CITY 103 FLAT

PAGE 6/9

DATE OF ISSUE 14/10/2005

BENAZZATO GRU SPA

DENOMINATION: BUTTON CONTROL BOX WIRING

DESCRIPTION

DATE

SIGLE

VARIAZIONI

D

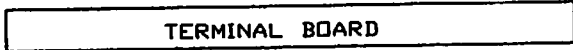
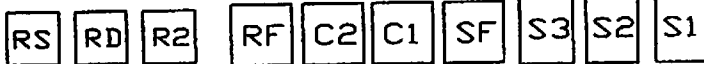
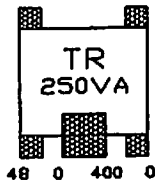
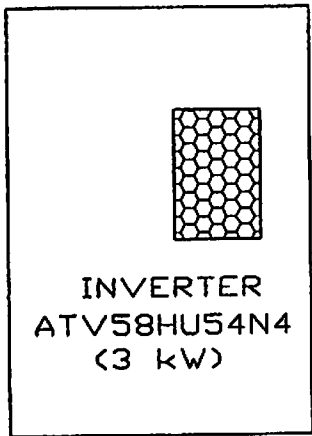
C

B

A



RESISTANCE  
100 OHM  
250 V



KLAXON

PP2  
SOCKET  
6 POLES

PP1  
SOCKET  
10 POLES

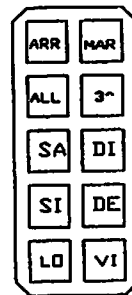
CABLE ENTRY

PP  
SOCKET  
16 POLES

TO SLEWING MOTOR BRAKE  
TO ELECTRIC UNLOCKING COIL  
TO MICROSWITCH OF THE UNLOCKING WARNING LIGHT

TO SLEWING WIRING POWER

BUTTON CONTROL BOX



DESCRIPTION

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14/10/2005

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MACHINE: CITY 103 FLAT

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BENAZZATO GRU SPA

VARIAZIONI

E  
D  
C  
B  
A

SIGLE DATE

DENOMINAZIONE: CABINET LAYOUT

POS.	DEFINITION	AMPER.	NOTES	TYP	No
	CABINET		INOX	ST6-1025	1
IG	MAIN SWITCH	A 25	BRETER	LA7-25-1753	1
AG	MAIN AUTOMATIC SWITCH	A 32	TELEMECAN.	GV2-LE32	1
AC	AUTOMATIC SWITCH TROLLEY	A 10	"	GV2-LE14	1
AR	" SLEWING	A 14	"	GV2-LE16	1
AE	AUTOMATIC SWITCH PRIMARY TRANSFORMER	A 4	AEG	Elfa E92E - C4	1
AU	" SECONDARY TRANSFORMER	A 4	"	Elfa E91E - C4	1
TR	MONOPHASE TRANSFORMER	VA 250	MARTIGNONI	0/400 V - 0/48 V	1
L	CONTACTOR LINE	A 25	TELEMECAN.	LC1-D25	1
SA	" UP	A 25	"	LC1-D25	1
			"	LA-DN20	1
DI	" DOWN	A 25	"	LC1-D25	1
			"	LA-DN20	1
S1	" 1 <sup>st</sup> SPEED HOISTING	A 12	"	LC1-D12	1
S2	" 2 <sup>nd</sup> SPEED HOISTING	A 18	"	LC1-D18	1
			"	LADT2	1
			"	LA8-DN20	1
S3	" 3 <sup>rd</sup> SPEED HOISTING	A 25	"	LC1-D25	1
			"	LA-DN22	1
TR1	" TIMER FROM 3 <sup>rd</sup> SPEED TO 1 <sup>st</sup> SPEED	A 9	"	LC1D09	1
			"	LADR2	1
SF	" HOISTING BRAKE	A 9	"	LC1-K09	1
RS	RELAY LEFT	A 5	CARLO GAVAZZI	RMI A 4-5	1
RD	" RIGHT	A 5	"	RMI A 4-5	1
R2	" 2 <sup>nd</sup> SPEED SLEWING	A 5	"	RMI A 4-5	1
RF	CONTACTOR SLEWING BRAKE	A 9	TELEMECAN.	LC1-K09	1
CA	" FAR	A 9	"	LC1-D09	1
			"	LA-DN20	1
CI	" NEAR	A 9	"	LC1-D09	1
			"	LA DN20	1
C1	" TROLLEY SLOW	A 9	"	LC1-D09	1
			"	LADT2	1
C2	" TROLLEY FAST	A 9	"	LC1-D09	1
			"	LADN22	1
C2T	" TIMER FROM 2 <sup>nd</sup> SPEED TO 1 <sup>st</sup> SPEED	A 9	"	LC1D09	1
			"	LADR2	1
SFR	" SLEWING BRAKE UNLOCK	A 9	"	LC1-D09	1
			"	LADR2	1
	SLEWING INVERTER	3 kW	TELEMECAN.	ATV-58 HU54N4	1
RES	RESISTANCE SLEWING INVERTER	100 Ohm	SIR	SRF250 100 RJ 250 W	1
KL	KLAXON	V 48	FOGLIANI	GI37048	1
PP	BUTTON CONTROL BOX SOCKET	A 16	ILME	16 poles	1
PP1	SLEWING MOTOR BRAKE SOCKET	A 10	"	10 poles	1
PP2	SLEWING MOTOR LINE SOCKET		"	6 poles	1
	CABLE		I. CAVI	16 X 1	25
	BUTTON CONTROL BOX SOCKET 16 + T		RAVIOLI	PKE 10	1

**Motors**

**Hoisting** HP 7.5/7.5/1.75 2800/1400/330 r.p.m  
**Slewing** HP 3 0/1400 r.p.m. regulated by Inverter 3 Kw  
**Trolley** HP 3/3 2800/1400 r.p.m

Disegn. n. BN-103

Last registration 14/10/2005

MACHINE : CITY 103 FLAT

PAGE

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DATE OF ISSUE

14/10/2005

DENOMINATION : LEGENDE

BENAZZATO GRU SPA

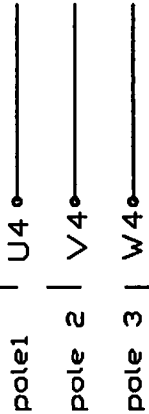
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VARIAZIONI

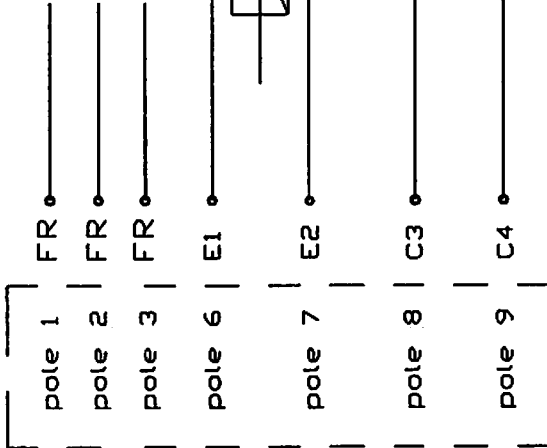
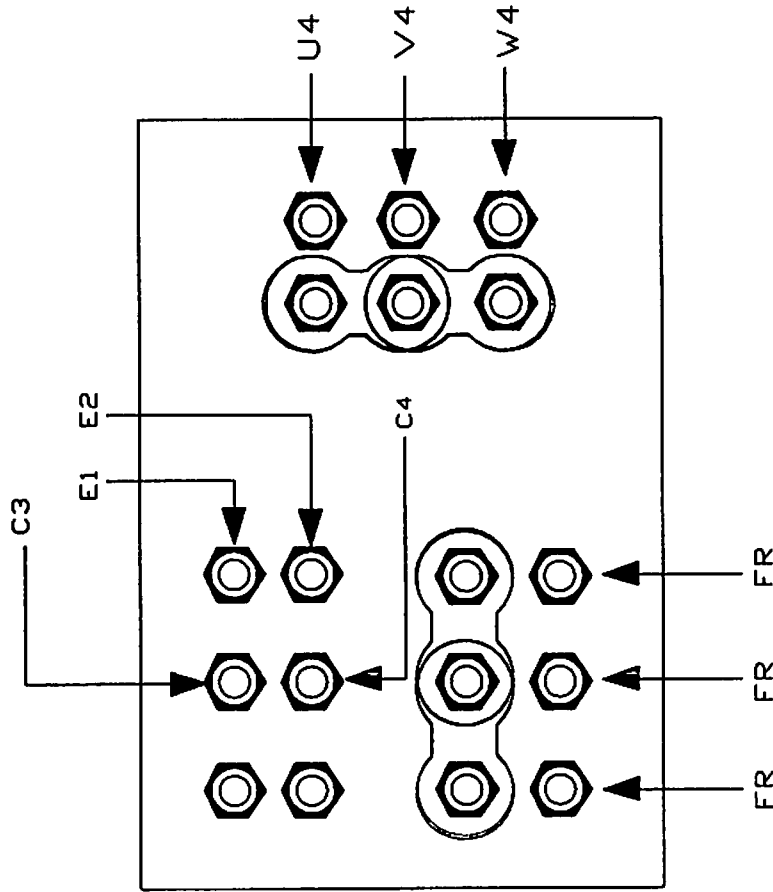
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

6 POLES CONNECTION  
TO THE CRANE'S ELECTRIC BOARD



E1-E2: ELECTRIC UNLOCKING COIL

C3-C4: MICROSWITCH



10 POLES CONNECTION  
TO THE CRANE'S ELECTRIC BOARD

N.B.: FOR WORKING SEE PAGES 3/9 AND 5/9

VARIAZIONI	SIGLE	DATE	DESCRIPTION	DATE OF ISSUE	PAGE	MACHINE:	Discep n°
	D			14/10/2005	9/9	CITY 103 FLAT	BN-103
	C						UL-TM numero 14/10/2005
	B						
A							DENOMINAZIONE : TERMINAL STRIP CONNECTION OF THE SLEWING MOTOR
						BENAZZATO GRU SPA	

## 4.9 – OPERATIONAL FAILURES

This chapter concerns the most common problems and failures which can be solved with ordinary repair works.

In case these suggestions are not successful, please contact **BENAZZATO GRU S.p.A.**

### 4.9.1 – The crane does not work

Check that:

- the crane is powered correctly.
- the switch is positioned on "1".
- the button "RUN" on the push-button panel has been pressed.
- the automatic switches didn't trip.
- the cable of the push-button panel is intact.
- the push-button panel is intact.
- the line contactor works correctly.

### 4.9.2 - The trolley does not travel

Check that:

- The trolley motor runs.
- the travel trolley rope is not entangled and is taut correctly.
- the pulleys are not blocked.
- the "TROLLEY" protection fuses have not blown.
- cable, plug and socket of the push-button panel are intact.
- the push-button panel is intact.
- the brake of trolley motor is intact.
  - ◆ the coils of the magnet may have blown (replace them)
  - ◆ the brake lining disc may be stuck to the countermagnet (remove the protection case and play on between disc and countermagnet by means of two screwdrivers).
- the "NEAR" and "FAR" trolley limit-switch is adjusted correctly.
- the "FAR" moment limiter is intact and calibrated correctly (in case the "TROLLEY FAR" movement does not work).
- the load is in keeping with the capacity diagram.
- "FAR" and "NEAR" contactors work correctly.

### 4.9.3 – Hoisting does not work

Check that:

- the hoisting motor is working.
- "UP" or "DOWN" limit-switch is adjusted correctly.
- the brake on the hoisting motor is intact.

- ◆ the coils of the magnet may have blown (replace them)
- ◆ the brake lining disc may be stuck to the countermagnet (remove the protection case and play on between disc and countermagnet by means of two screwdrivers).
- the hoisting rope is not entangled.
- the protection fuses have not blown.
- cable, plug and socket of the push-button panel are intact.
- the push-button panel is intact.
- the moment limiter **"UP"** and **"MAXIMUM LOAD"** is intact and adjusted correctly (in case the crane does not carry out the **"UP"** movement).
- the load is in keeping with the capacity diagram.
- **"UP"** and **"DOWN"** contactors work correctly.

#### 4.9.4 – "FAST" hoisting does not work

Check that:

- the load does not exceed.
- **"FAST"** contactor works correctly.

#### 4.9.5 – The "LEFT" or "RIGHT" movement does not work

Check that:

- the slewing motor works correctly.
- the **"SLEWING"** limit-switch is adjusted correctly.
- the inverter is not in error.
- the slewing protection fuses have not blown.
- cable, plug and socket of the push-button panel are intact.
- the push-button panel is intact.
- the brake on the slewing motor is intact.
  - ◆ the coils of the magnet may have blown (replace them)
  - ◆ the brake lining disc may be stuck to the countermagnet (remove the protection case and play on between disc and countermagnet by means of two screwdrivers).
- **"RIGHT"** and **"LEFT"** contactors work correctly.

#### 4.9.6 – The pulley block tends to turn round itself

- Check that the turning rope end at jib-foot section is not blocked.

#### 4.9.7 – The pulley block tends to go down irregularly

- One of the pulleys or one of the bearings are blocked.