

## **7      MAINTENANCE**



## 7.1 General instructions



### Warning

*Personnel in charge of L 120 maintenance and cleaning might work anywhere in the dangerous zone, therefore it is mandatory to follow the instructions herein reported.*

Routine inspections and maintenance, which should be taken record of, are necessary not only to ensure continuous efficiency but also to safeguard all the employees working on and around the launching girder.

The following sections describe the general maintenance standards, which, if methodically followed, are a determining factor to achieve longer duration, better functioning and maximum efficiency of the equipment.

All maintenance, repairing, adjustment and cleaning operations must be carried out exclusively by qualified and adequately trained personnel, who should have read this manual.



### Prescription

*Personnel safety must always be guaranteed by all necessary precautions as detailed in Section 3.*



### Prohibition

*Personnel that does not meet the requirements specified in Section 3.13 are NOT allowed to carry out any maintenance intervention on the equipment.*



### Prescription

*For safety reasons all maintenance operations must be performed with the machine at standstill condition and with the power supply disconnected.*

*Inspection operations which may exceptionally require machinery functioning must be performed with extreme care in observance of all necessary accident prevention procedures.*



### Prescription

*Prior to any intervention set clear and visible signs MAINTENANCE IN PROGRESS wherever necessary.*



### Prescription

*Maintenance operators must always wear the mandatory PPE as indicated in Section 3.10.*

**Prescription**

*Should the guards to be removed to ease the maintenance procedure the fixing systems must remain attached to the guards or to the machinery. After maintenance intervention the operator must guarantee that all the guards are repositioned and adequately fixed.*

**Prescription**

*Before re-connecting the machinery to the energy source make sure that all safety devices are correctly set and in good working order.*

**Warning**

*Once a maintenance or cleaning intervention has been performed and is over, all technicians must be warned of the restarting of the equipment.*

In order to perform the better operation continuity, operators shall keep the record of irregularities on the record book to be later used by maintenance staff. The following irregularity shall be recorded:

- environmental overheating;
- smells indicating overheating or burn-outs in the appliances;
- anomalous noises, sizzles, vibrations, whistles or screeches during working of electric motors, switches, contactors and other electric and electro-mechanical devices;
- any other anomaly that cannot be classified.

Operators who daily operate on the machine should constantly survey the equipment and check its proper functioning. These checks can result in useful information that indicate which parts need to be examined and eventually adjusted.

A systematic collection of data that will tell the story of the plant, such as the periodical adjustment of measurement and control instruments, the adjustment of main maneuvers and alarms, maintenance interventions, checks and data concerning bad operating conditions will be of great help.

### 7.1.1 Cleaning

A correct and adequate cleaning allows the equipment to work much longer. It is extremely important that where needed a periodic, complete and accurate cleaning is to be carried out.



#### Prescription

*Operators must proceed with caution when cleaning the equipment with aggressive detergents or acid products and must wear adequate protective clothing and PPE as reported in Section 3.10. Comply with the product instructions.*



#### Prohibition

*Do NOT clean electrical components with water or other conductive fluids.  
Do NOT clean electrical or electronic components using compressed air.*



#### RESIDUAL RISK

*Should cleaning activities require chemical agents, although in relatively small amounts which are generally used in the open air, the owner shall carry out a risk assessment according to the local safety and health surveillance and environmental monitoring laws.*

### 7.1.2 Inspection

A scheduled inspection of all components to make sure of their proper functioning is fundamental for a safe and longer duration of the equipment.

#### 7.1.2.1 General check list

A check list such as the one herein enclosed shall be draft to ease the organization of the intervention procedures.

COMPONENT: Component identification

TYPE OF INTERVENTION: specific maintenance intervention

FREQUENCY

CONDITION

ES = Every Shift

M = Machinery in motion

D = Daily

S = Machinery stopped

W = Weekly

MS = Machinery stopped and device in motion

M = Monthly

### 7.1.2.2 Check list

POS.	COMPONENT	INTERVENTION	FREQ.	COND
1	LIFTING GIRDER	Check that L120 is kept clean & in good working order.	D	S
		Make sure that no obstacles are interfering with runways.	D	S
		At the end of each working cycle the equipment must be thoroughly checked and cleaned.	W	S
		Carry out a visual inspection of all structure to make sure that components are protected from oxidation.	M	S
		Check if any component of the equipment shows a wear out and provide for its replacement, if necessary.	M	S
		Visual inspect wire ropes for deterioration or deformation.	D	S
2	ALL PARTS IN MOTION	Check all parts in motion to verify that their movement is fluent and continuous.	D	M
3	ALL FIXING DEVICES	Check that screws and bolts are properly tightened as per bolt tightening procedure reported in Section 4.7.	M	S
4	ALL PARTS SUBJECT TO LUBRICATION	Check all parts subject to lubrication such as bearings, pins with greasers verifying the correct functioning.	W	S
		Carry out lubrication procedure as reported in Section 7.6.		
		Grease all points with grease pump	160 h	S
5	GEAR BOXES	Check the lubricant level of reduction gears. Replace oil as reported in Section 7.6.	W	S
6	HYDRAULIC UNITS	Check the oil level.	ES	S
7	SUPPORTS	Check for oil leakage from the hydraulic plant	D	S
		Check greasing of sliding pads	W	S
		Check all bolts on rope anchoring/support fixings etc.	M	S
8	MAIN MOVEMENT SYSTEM	Visual inspect wire ropes for deterioration or deformation.	W	S
		Check that screws and bolts are properly tightened as per bolt tightening procedure reported in Section 4.7.	4M	S
9	GUARDS	Inspect fixed protections that are to be removed only by means of spanner.	M	S

### 7.1.3 Break down maintenance

Should an anomaly be detected, the operator in charge of the ordinary use of the machine shall:

- immediately stop the machine, setting the main switch to OFF position,
- NOT perform any operations other than those he is familiar with and are his duties,
- warn the supervisor and request the intervention of an expert technician,
- NOT perform any activity that shall be carried out by the authorized maintenance technician.

### 7.1.4 Replacement

Whenever a single component presents a wear out which can compromise the equipment proper use, it is necessary to provide for its replacement.

**Prescription**

*A suitable stock of spare parts must be available on the site. Refer to spare parts list.*

Only qualified maintenance technicians are authorized to carry out replacement.

**Warning**

*Although the implementation of protective measures, residual risk might be present. Refer to Section 3.8 for specific countermeasures to be taken against the residual risk that might occur.*

## 7.2 Electrical maintenance



### Prescription

*ONLY authorized, specialized and trained personnel shall carry out the electrical maintenance.*



### Prescription

*Prior to any electrical maintenance operation:*

- *disconnect all electrical feeding lines;*
- *lock the switches on the switchboard in OFF position with padlocks and display the "OUT OF ORDER" and "MAINTENANCE IN PROGRESS" notices;*
- *check, by means of a voltmeter, if there are induced voltages on busway. If in doubt, ground both the power and the control feed connections.*

In order to guarantee a long duration and a top-level performance of starters, they are to be subjected to maintenance operations as any other part of equipment. The best way to obtain a good maintenance is to prepare a systematic inspection program.

The list of interventions of programmed maintenance varies with the type of operation carried out by the equipment and with the environmental condition; however, in most cases the following general criteria can be followed.



### Warning

*Always, anywhere and in all circumstances all safety precautions shall be followed.*

### 7.2.1 Maintenance temporary shutdowns

Clear the power supply lines.

Lock with padlocks the circuit brakes levers, the disconnecting switches upstream, the switchboards, locate signs of out of service and operation prohibition.

Verify any possible induced current on the bars.

Ground connect, if not sure, both power and control supply lines.

### 7.2.2 Maintenance and repairs

For longer working lifetime and ideal working conditions, contactor starters must be maintained as any other equipment.

The best maintenance is achieved by implementing programmed maintenance.

The list of interventions of programmed maintenance varies with the type of operation carried out by the equipment and with the environmental condition; however, in most cases the following general criteria can be followed:

- 1) always, everywhere and in all circumstances all safety precautions shall be followed,
- 2) equipment shall be easily accessible for possible inspections and repair,
- 3) an adequate number of spare parts shall be available,
- 4) contactor starter shall be always dry and clean,
- 5) contacts of braking or control devices shall be replaced in order to guarantee equal contact pressure,
- 6) contacts shall be kept clean and their shape shall not be modified by filing or grinding,
- 7) contacts between bar and bar, bar and cable shall be securely tight,
- 8) the moving parts of circuit brakes, contactors on relays shall not be lubricated unless so specified by manufacturer,
- 9) coils shall work at the rated voltage. Higher or lower voltages shorten the coil lifetime and cause vibration noises and overheating,
- 10) any condition, which may generate overheating of the equipment, shall be eliminated or at least minimized within acceptable limits. Temperatures shall be monitored in case of suspect of overheating,
- 11) always detect and promptly eliminate any leakage; a further leakage could cause a short circuit.

Routine maintenance can be scheduled to be implemented at the same time as the general shut down of the plant.

Six months can be considered an average frequency. Routine maintenance frequency shall be calibrated in accordance to the actual environmental and working conditions and to the records of the results of the spot checks.



### 7.2.3 Routine maintenance

After all the safety operations described in the above paragraph proceed as follows:

- a. Visual check of the switchboard and the relevant equipment.
- b. Write on record book (reporting date of check) any news about:
  - conditions of circuit brakes, relays, etc.,
  - signs of wet spots or general humidity,
  - excess of dust,
  - signs of animal presence (In such case insulation value must be accurately checked both in terms of conductors integrity and of insulation distances which might be affected by the actions of animals).
- c. Remove dust from everywhere.
- d. Check all bolts are properly tight on:
  - electrical connection with bars,
  - power and auxiliary cable connections.
- e. Measure with Megger device the insulation value of control circuits, and compare the found values with the ones found at the time of start up.
- f. Test by simulated operations the good condition of control, protection and interlock circuits.
- g. Check continuity and verify the value of grounding.

#### 7.2.4 Special maintenance

As a good practice every two years in standard working conditions and medium values of humidity a complete cycle of special maintenance operations shall be carried out on the switchboard.

Said period of time shall be shortened in case of heavy duty conditions (metallic dust, aggressive gas, and high temperature).

After a general visual check each group of components shall be verified and checked as follows:

- remove by vacuum cleaner dust and dirt especially from insulators and from insulated supports, then clean accurately,
- avoid blowing dust by pressure air because this will only displace the dust without removing it. Small metal particles could damage the insulation of circuits and could deposit on magnetic circuits,
- special care must be taken of the horizontal insulating surfaces because conducting dust could reduce the insulation,
- measure by Megger the insulation value between phases and ground. If values are found to be much lower than the ones recorded at the start up phase (switchboard new) is good practice to repeat insulation measure with reduced voltage (about 75%),
- check all connections and clamps on all the equipment are properly tight.

##### 7.2.4.1 Circuit brakes, contactors and power relays

All maintenance operations recommended by manufacturer shall be carried out (see relevant equipment manuals), make sure all mechanical movements are free from excessive friction, check the wear condition of all articulated joints. Lubricate all joints if so required by manufacturer, check the wear of contacts and replace them if wear is found to be uneven or severe.

##### 7.2.4.2 Auxiliaries

Vacuum clean the dust from equipment.

Check the good operations in no load condition; verify frictions and mechanical integrity of the various components.

Check fuses cartridge integrity and lifetime.

##### 7.2.4.3 Socket controls relays, measuring devices, etc.

Remove covers. Remove dusts and check electrical contact condition.

#### 7.2.4.4 Electronic equipment

Remove dust. Properly clean strictly following manufacturers' recommendation regarding the use of cleaning agents to be used. Unsuitable solvents could seriously damage the electronic components.

Due to the minor sections of conductors of the equipment, special attention must be paid to the connections after cleaning in respect of possible damages.

#### 7.2.4.5 Cabling

Clean and remove dust especially at the cable identification tags. Clean and check connection and terminal boards.

#### 7.2.4.6 Painting

Check at least yearly painting condition and touch up paint if required.

#### 7.2.4.7 Check book

Check book shall be made of four sections:

- **Start up notes:** checks and preliminary tests at start up.
- **Operation notes:** normal operation data complete with dates, weather and environmental conditions data.
- **Fault notes:** any information regarding troubles and faults such as circuit brakes and relays activated, relevant calibration values, fault consequences and effects. Corrective actions and replaced parts, date of interventions.
- **Maintenance notes:** check results, inspection and measures results date of check.

The above notes will give the history of the events and the actions carried out on the plant.

They allow focusing on the parts of the plant, which require special monitoring.

They allow making statistic assessment of the spare parts to be available on the plant.

Keeping record of the meggerings on various switchboard sections at the time of cleaning and maintenance provides the history of the insulation values and will allow monitoring of possible insulation decrease.

### 7.2.5 Post maintenance shutdown

Replaced parts shall be securely mechanically fixed. Electrical circuit connections and original cabling must be restored.

Debris from maintenance works (cable sections, copper wires, screws, bolt washers, tape, etc.) shall be removed; clean wherever is necessary.

Overall visual inspection of the job shall be carried out after completion.

All tools shall be removed.

Reinstate all the protections previously removed to access the internal parts. Key locks all opened cabinets.

Remove control locks previously activated.

Remove "OUT OF SERVICE" and "DO NOT OPERATE" signs previously installed.

Feed power and control circuits.

Restart normal operation.

### 7.2.6 Start-up after a long term shutdown

Visual check of the general equipment condition shall be carried out.

Clean all components.

Remove any possible object left on the plant from previous operations.

Check insulation value: in presence of humidity and/or wet spots operate coils and do not power the equipment until it has completely dried up.

Gradually proceed powering by closing the feeding lines one by one in order to detect possible anomalies, which could produce malfunctioning or dangerous faults.

Make sure all circuit brakes are in the open position.

Check fuses cartridge integrity and lifetime.

Restart normal operation.

## 7.3 Safety devices inspection

The operator shall periodically check the integrity and efficiency of safety devices L120 is provided with.



### Prescription

*For a list of safety devices see Section 3.9.*

The inspection shall occur monthly for fixed protections that are to be removed only by means of spanner.



### Prescription

*Interventions of maintenance, repairing, replacement and checks of safety devices installed on the machine are to be carried out only by qualified and trained personnel.*

POS.	COMPONENT	INTERVENTION	FREQ.	COND
1	MAIN SWITCH	The intervention of the main switch grants the isolation of the machine from any source of electric or hydraulic power. Therefore the operator must open the electrical main switch verifying the machine and all its moving parts are completely stopped; start again the main switch to ensure that all controls are activated.	W	S
2	EMERGENCY PUSHBUTTONS	Operating the emergency push button guarantees the immediate stop of the launching girder. Check that the push button stays locked in pressed condition, its reset is performed only by means of procedure described in section 6.3.1 and no restarting of machine will occur unless a relevant control has been activated from the main board.	W	S
3	ENCODERS	Check the coupling between the encoder and the relevant coupling joint.	2W	S
4	LIMIT SWITCHES	Verify the functioning of translation/rotation limit switches.	2W	MS

## 7.4 Hydraulic plant maintenance

A hydraulic plant correctly installed, assembled and started up ensures a long functioning without troubles or particular maintenance interventions.

Therefore, periodic checks of hydraulic fluid quality and quantity must be carried out in order to obtain the best functioning, avoiding component mechanical breakdown.

Hydraulic plant maintenance consists of scheduled easy inspections and checks operations indicated and reported on a maintenance register.

The most worn out components can, then, be replaced following scheduled procedures, avoiding undesired stopping of machinery.



### Prescription

*For replacement of hydraulic oil refer to Section 7.4.2 of this manual of this manual.*



### Prescription

*For detailed information about each unit refer to the manual of the manufacturer, see Section 10.2 of this manual.*



### Warning

*Prior to any intervention on the hydraulic power unit and/or the plant, make sure that every branch of the circuit has no residual pressure which might create uncontrolled movements and oil spills whenever a component or fitting is to be removed.*

### 7.4.1 Hydraulic plant checklist



### Prescription

*The information reported in this section are general and applicable to all hydraulic units. For detailed information about each unit refer to the manual of the manufacturer, refer to Section 10.2 of this manual.*

POS.	COMPONENT	INTERVENTION	FREQ.	COND.
1	OIL TANK FILTER	Check filter cartridge condition.	W	S
2	HYDRAULIC UNIT	Check oil level.	W	S
		Check oil quality and carry out oil test	M	
3	OVERALL PLANT	Check hoses, fittings, pipes, hydraulic motors and all the other hydraulic devices against oil leakage.	W	S
		Check the required working pressure.	M	S

### 7.4.2 Hydraulic oil replacement

Hydraulic oil level must be checked weekly and tested once a year. For each hydraulic unit detailed oil replacement schedule and oil characteristics refer to manufacturer manuals in Section 10.2.



#### RESIDUAL RISK

*As hydraulic oil replacement requires the handling of chemical agents, the owner shall carry out a risk assessment according to the local safety and health surveillance and environmental monitoring laws.*

## 7.5 Maintenance of lifting ropes

### 7.5.1 Greasing of wire rope

When a wire rope is used the individual wires and strands are close to each other and this will cause wear at contact points. To reduce this internal wear to a minimum the ropes are greased by the manufacturer. A superficial relubrication is request in case of dry rope or in presence of oxidations to prevent corrosion.

It is known from tests that the life of an adequately lubricated rope with respect to a non lubricated one is as much as three times longer.

When installing a new rope, it is desirable to relubricate it especially if the rope has been stored for some time.

For lubrication of a wire rope an acid free lubricant with good creep characteristic and which will not form a hard crust on the outside of the wire rope, drums and sheaves must be used.

Dust will contain certain amounts of moisture, which will gradually work itself into the rope causing the grease to emulsify. Under this condition the grease itself causes corrosion. No flammable solvents must be used for cleaning of wire ropes; a material such as jute is the best.

The workman should use gloves for protection. In extreme corrosive or damp atmosphere, inspection and lubrication must be more frequently carried out.

### 7.5.2 Inspection of sheaves and drums

Each time installing a new wire rope, the drum and sheaves should be inspected and, if necessary, repaired. The shearing grooves are more susceptible to wear than the drum; hence they should be carefully examined for uneven wear, excessive groove radius and free running of bearings.

Check groove for proper size. Corrugated and worn grooves as indicated on Figure 7-1 would seriously damage the wire rope.

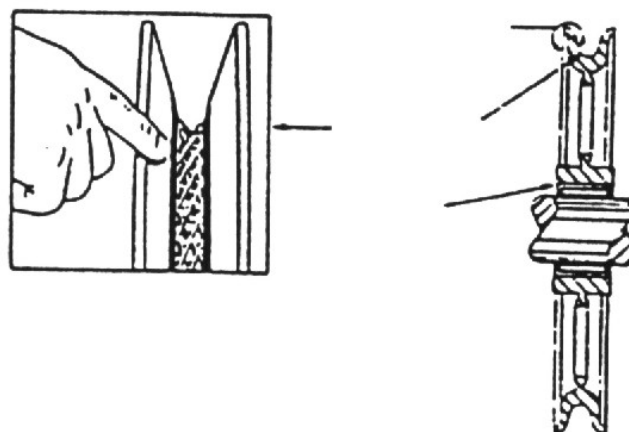


Figure 7-1: inspection of sheaves



### 7.5.3 When the wire rope should be renewed

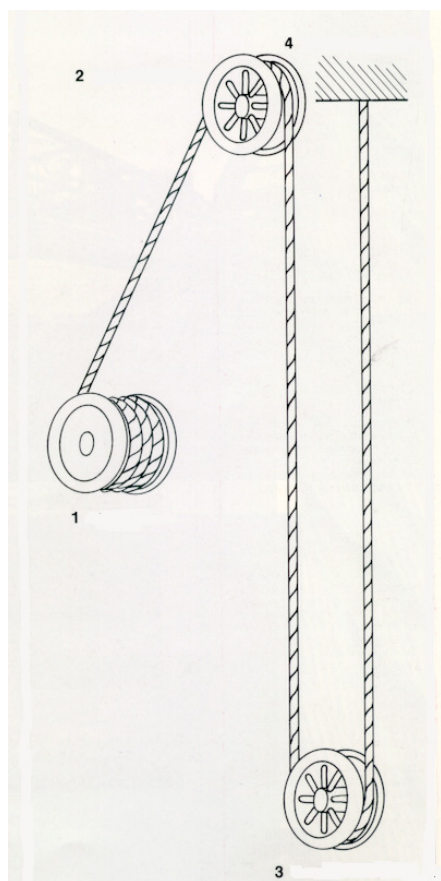
A worn or damaged wire rope is extremely dangerous. If there is any doubt as to whether a wire rope should be renewed, local standards must be consulted. The following is a general guide representative of the most common norms. However, local regulations should be consulted and given priority.

If over a length to 8 times the wire rope diameter, there are a number of broken wires which together are more than 10% of the total number of wires (shown in chart of wire certification), then the wire should be renewed.

If a strand is broken the rope shall be replaced immediately.

The rope shall be replaced as soon as swelling, bruises, permanent bends, kinks or other serious damage (severe rust formation) and especially heavy wear has occurred.

Figure 7-2 shows points where wire rope has to be checked (together with a complete global rope inspection):



POS.1:

check the rope fixing point to the drum,  
check possible defective windings of the drum,  
search for the wire breakages,  
check the corrosion,  
search for deformations due to load.

POS. 2:

check the rope part which winds on pulley in order to find out possible wear breakages and wear.

POS. 3:

examine carefully the part which winds on ropes and, in particular, the part which is on the pulley when the equipment is under load,  
search for the wire break and superficial wear,  
examine the corrosion.

POS. 4:

fixing point,  
check wire breakages,  
search for deformations,  
check the rope diameter.

Figure 7-2: points to check

To ensure safety during work operations, every cable must be checked at three-month intervals. Cable replacement depends on the number of broken elementary wires, corrosion and other condition indicating deterioration.

In relation to the most worn section of the cable, count the visible broken wires on the exterior of the cable. The following table indicates the maximum number of broken wires which can be accepted over a cable length 6 diameters and 30 diameters of the cable itself, depending on the type and the winding. Both conditions must be respected.

Type of rope	Nr. of wires	Ordinary lay type		Lang lay type	
		6xd	30xd	6xd	30xd
S1-E1	114	8	16	3	6
S3-E3	150	8	16	3	6
S5-S9	210	14	29	7	14
S6-S10	216	14	29	7	14
S8-S11	246	18	35	-	-
S12	227	12	26	-	-
S12	275	14	29	-	-
S12	313	14	29	-	-
S12	476	16	32	-	-
S13	109	5	10	-	-
7 ALC	238/292	5	10	-	-
A7	265	5	10	-	-
S4	152	8	16	-	-

For cables not mentioned in table, the total number of external broken wires over a length of 6 diameters must not exceed 3% of the wires composing all the strands for ordinary lay cables and 2% for Lang lay cables.

## 7.6 Lubrication

Lubrication is a factor of vital importance for good machine performance and long life. The procedures indicated in the following lubrication program must be scrupulously observed, as well as the following specifications.

**Prescription**

*Always use the indicated type of oil, or equivalent, and make sure that there are no impurities (dust, sand, water, etc.) which may damage lubricated components.*

**Prescription**

*Oil level top-ups must be performed using the same type of oil as used; when replacing the oil already in the tank must be completely replaced.*




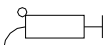


Avoid lubricant deterioration during storage, transport and filling operations in order to prevent wear out damage.







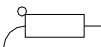
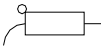

Enclosed is the intervention chart, detailing the frequency and the type of intervention to be performed on the equipment.

**RESIDUAL RISK**

*As lubrication activities require the handling of chemical agents, the owner shall carry out a risk assessment according to the local safety and health surveillance and environmental monitoring laws.*

### 7.6.1 Lubrication chart

OIL LUBRICATION	
SYMBOL	MEANING
	REFILL/ REPLACEMENT WITH REFILL
	LUBRICATION
	CHECK OF OIL LEVEL
GREASE LUBRICATION	
	PUMP GREASING
	MANUAL GREASING
	NO GREASING REQUIRED: THE ITEM HAS ALREADY BEEN GREASED FOR ITS LIFE

	LOCATION	TYPE OF LUBRICATION	FREQUENCY			
			weekly	monthly	every 3 months	yearly
1	Erection support's sliding pads L120DUADC011			X		
2	Erection support's screw jacks L120DUADC031			X		
3	Auxiliary support's sliding pads L120DUADC012			X		
4	Auxiliary support's screw jacks L120DUADC032			X		
5	Main movement system's winch bearings L120DUADG011				X	
6	Main movement system's rope rollers L120DUADG012				X	
7	Main movement system's pulleys L120DUADG021 L120DUADG022				X	
13	Spreader beam's main pins L120DUADM011				X	
13	Spreader beam's telescopic arms sliding pads L120DUADM011			X		

### 7.6.2 Gear reducer oil – brand comparison chart

Refer to recommendation of manufacturer in Section 10.1 for lubricant to be used in the relevant gear reducer.

### 7.6.3 Grease for bearings – brand comparison chart

Environment temperature range	AGIP	ESSO	MOBIL	IP	VANGUARD	FIAT
+40 °C -15 °C	GR MU EP 2	BEACON EP2	MOBILPLEX EP460	ATHESIA EP2	LIK0 EP2	JOTA 2/S

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## 7. MAINTENANCE

### WINCH GANTRY MAINTENANCE MANUAL

### 7.1 GENERAL INSTRUCTIONS

Due to the large and heavy objects being transported by hoist machines, routine inspections are necessary to ensure continued operation of the winch gantry and safety of the employees working around it. An initial inspection of the winch gantry prior to initial use is necessary.

Once placed into service, hoist machine will require two different types of inspections. Frequent inspections are done at daily to monthly intervals, while periodic inspections are completed at monthly to annual intervals. The purpose of the two inspection types is to identify critical components of the winch gantry and to determine the extent of their wear, deterioration or fault.

All maintenance, repairing, adjustment and cleaning operations must be carried out exclusively by qualified and adequately trained personnel, who should have read this manual.



#### **Prescription**

*Personnel safety must always be guaranteed by all necessary precautions as detailed in Section 3.*



#### **Prohibition**

*Personnel who does not meet the requirements specified in Section 6.2 are NOT allowed to carry out any maintenance intervention on the equipment.*



#### **Prescription**

*For safety reasons, all maintenance operations must be performed with the equipment in standstill condition and with the power supply disconnected as described in section 7.6.1.*

*Inspection operations which may exceptionally require machinery functioning must be performed with extreme care in observance of all necessary accident prevention procedures.*



#### **Prescription**

*Prior to any intervention, set a clearly visible signs MAINTENANCE IN PROGRESS wherever necessary.*



#### **Prescription**

*Before re-connecting the machinery to the energy source make sure that all safety devices are correctly set and in good working order.*

The first paragraph of this Section describes the general maintenance standards, which, if methodically followed, are a determining factor to achieve longer duration,

## USE AND MAINTENANCE MANUAL

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better functioning and maximum efficiency of the equipment. The other paragraphs provide indications for maintaining each equipment's group components.

It is advisable, for the continuity of usage, that operators in charge of the hoist machine when working (i.e., not the maintenance personnel) take note on a register of anomalies they might detect such as:

- excessive environment temperatures;
- smells indicating overheating or burn-outs in the appliances;
- anomalous noises, sizzles, vibrations, whistles or screeches during working of electric motors, switches, contactors and other electric and electro-mechanical devices;
- any other anomaly that cannot be classified.

Operators who daily operate on the machine should constantly survey the equipment and check its proper functioning. This check can result in useful information that indicate which parts need to be examined and eventually adjusted.

A systematic collection of data that will tell the story of the plant, such as the periodical adjustment of measurement and control instruments, the adjustment of main manoeuvres and alarms, maintenance interventions, checks and data concerning bad operating conditions will be of great help.

The main verifying interventions as well as the procedures and the interventions schedule are indicated in a check list with specific reference:

COMPONENT → Component identification

TYPE OF INTERVENTION → Specific maintenance intervention

CHECK PROCEDURE → Specific maintenance intervention procedure

### FREQUENCY

ES = Every Shift  
D = Daily  
W = Weekly  
M = Monthly  
Y = Yearly

### CONDITION

m = Machinery in motion  
s = Machinery stopped  
m/s = Machinery stopped and device in motion



### **Warning**

*Besides the instructions carried in the check list, also follow the annexed suppliers maintenance instructions.*

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## 7.2 CLEANING

A correct and adequate cleaning allows the equipment to work much longer. It is extremely important that a periodic cleaning is carried out in a complete and accurate manner where requested.



### **Prohibition**

*Steam casting or solvents use which might damage the equipment must not be used.*

## 7.3 CONTROL

In order to guarantee a safe and longer duration of the equipment it is necessary to control that each component is well operating. Each group of the equipment is inter-dependent with others, so the correct functioning of every single part is extremely important.

## 7.4 REPLACEMENT

Whenever a single component presents a wear out which can compromise the equipment proper use, it is necessary to provide for its replacement.



### **Prescription**

*A suitable stock of spare parts must be available on the site. Refer to Section 8 for spare parts list..*

Qualified maintenance technicians must carry out replacement. In order to specify and purchase the correct replacement part, consult trade components documentation enclosed in Section 11 of this manual.



### **Warning**

*There are several risks during replacement procedures:  
dangerous sharp edges;  
danger of falling down of operators and devices.*



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### 7.5 GENERAL CHECK LIST

POS.	COMPONENT	CHECK LIST	FREQ.	COND.
1	HOIST MACHINE	Check if hoist machine is kept clean and in good working order.	D	s
		Make sure that no obstacles are interfering with runways.	ES	s
		At the end of the working cycle the equipment must be thoroughly checked and cleaned.	W	s
		Check if any component of the equipment presents a wear out as and provide for its replacement if necessary.	M	s
		Visual inspection of all structure to make sure components are protected from oxidation.	M	s
		Check proper functioning of limit switches.	W	s
2	ALL PARTS IN MOTION	Check all parts in motion to verify that their movement is fluent and continuous.	D	s
3	ALL FIXING DEVICES	Check that the screws and bolts are properly tightened.	M	s
4	ALL PARTS SUBJECT TO LUBRICATION	Check all parts subject to lubrication such as bearings, pins with greaser, verifying the correct functioning.	W	s
		Grease all points with grease pump.	160 h	s
5	REDUCTION GEARS	Check the lubricant content of reduction gears.	W	s
		Replace oil in gear reducers.	160 h	s
6	HYDRAULIC UNITS	Check oil level.	D / 8h	s
7	TROLLEY	Check for oil leakage from the hydraulic plant.	D	s
		Check that the trolley traversing characteristic are functioning correctly and that the brakes are operating satisfactorily.	D	s
		Check that all the limit switches are functioning correctly.	W	s
		Check greasing of sliding pads.	W	s
		Check all bolts on wheels, motors, etc.	M	s
		Check chain proper tensioning.	W	S
8	WINCH DRUMS AND LIFTING SYSTEM	Check that wire rope has been damaged in any way.	W	s
		Check that the wire shows no sign of abnormal wear.	M	s
		Check the correct winding of the rope on the drum	M	s
		Check wire clamps on rope anchorage.	M	s
		Check all nuts and bolts connections. Any bolt/nut damaged should be replaced.	4M	s
		Gearbox should be checked for grease/oil and topped up.	4M	s
9	PROTECTED WALKWAYS, LADDERS AND PLATFORMS	Make sure that there are no obstacles on walkways and equipment access.	W	s
		Make sure that there are no liquids or lubricants on walkways and on equipment access	W	s

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## 7.6 ELECTRICAL MAINTENANCE OPERATIONS

### 7.6.1 Putting the equipment out of service for maintenance interventions



#### *Prescription*

*Before electrical maintenance operations, do the following:*

- *disconnect all electrical feeding lines;*
- *lock the switches on the switchboard in OFF position with padlocks and put on OUT OF ORDER and MANOEUVRE IMPEDIMENT notices.*
- *check, by means of a voltmeter, if there are induced voltages on busway. If in doubt, ground both the power and the control feed connections.*

In order to guarantee a long duration and a top-level performance of starters, they are to be subjected to maintenance operations as any other part of equipment. The best way to obtain a good maintenance is to prepare a systematic inspection program.

The exact details of a preventive maintenance program can vary according to the conditions of specific usage, nevertheless the following general criteria must be followed, since they apply to almost all conditions:

- Starters must be kept clean and dry.
- The contacts of worn, burnt and/or pitted break and/or manoeuvre appliances must be immediately substituted. If they work in couples, in order to keep contact pressure even both have to be substituted.
- Contact must be kept clean and their original shape must not be changed by filing or by grinding.
- Contacts within connections (busway-busway, busway-cable, cable-cable) must be sufficiently tight.
- The joints of switches, of the contactors and of relays must not be lubricated, but they must be kept clean in order to avoid excessive frictions, unless the manufacturer gives different instructions.
- Coils must work with their voltage rating. Over-feeding and under-feeding shorten the duration of coils and cause vibrations, noise and overheating.
- The arc extinguishing device of circuit-breakers and of contactors must be always in the proper position when working and be kept in good condition; otherwise the appliance can break down.
- Conditions leading to excessive temperature are to be avoided or reduced to acceptable limits. If over temperatures are expected, we suggest temperature monitoring by means of adequate measurement.
- It is absolutely necessary to detect current leakages towards earth and eliminate them as soon as possible: a second leakage can cause a short circuit.

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## 7.6.2 General maintenance interventions

Make a visual inspection of the switchboards and of all appliances they contain.

Record in a dedicated register (with the date of the intervention) any information about switches, contactors, relays, etc., about possible traces of humidity (whether they are limited to a spot or spread to a larger surface), about anomalous dust deposits, about tracks of animals; in this case verify with attention both the active insulation (for instance, cable sheaths) and the passive insulation (for instance, insulation distances that can be reduced for the above-mentioned reasons). Remove any possible dust deposit.

Verify the bolts clamping:

- of the couplings between bars and between bars and cable terminals;
- of the connections of power and auxiliary cables to the circuit breakers, to the contactors and to terminal boards.

Verify, with an insulation tester, the insulation of control circuits and compare these values with those detected during starting.

Verify the efficiency of control and protection circuits and of electrical blocks through functional blank tests.

Verify the continuity and the efficiency of grounding circuits.

In normal working conditions and with a high average humidity rate, it is advisable to carry out an extraordinary maintenance intervention on boards approximately every two years. Obviously, this time interval has to be reduced in case of adverse environmental conditions due to work (e.g., frequent overloads) or to environmental problems (e.g., metallic dust, corrosive gases or high temperatures).

Apart from visual inspections of the whole boards, the following operations and checks – specified according to component groups – shall be carried out.

With an aspirator, remove dust and dirt especially from insulators and from insulated supports and clean them accurately. We do not recommend to use compressed air blowing because it simply moves dust from one place to another without removing it and because small metallic particles contained in dust can cause abrasions to insulating circuits or (especially iron) they can gather on magnetic circuits. Particular attention has to be paid to horizontal insulating surfaces because conducting dusts that have deposited on them can reduce considerably the insulation distances, since conducting metallic bridges can arise.

Check the insulation resistance with insulation tester between line phases and towards earth. If the detected values are considerably lower than those noted in the special register at the beginning (i.e. when boards were new) it is advisable to carry out an insulation test with voltage values reduced indicatively by 75 %.

Verify the clamping of joints and connection terminals of all appliances.

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### 7.6.3 Electrical safety devices

The following maintenance operations must be weekly performed on all electrical safety devices:

- Check the proper functioning of all the limit switches; in case of malfunction or damage, immediately replace the faulty device.
- Check the efficiency of the load cell; check that the load value displayed is coherent with the lifted load.
- Check the efficiency of anti-collision system.

### 7.6.4 Emergency push-buttons

The following maintenance operations must be weekly performed on all emergency push-buttons:

- Check the proper mechanical functioning of all the emergency push-buttons; in case of malfunction or damage, immediately replace the faulty device.
- Test proper electrical functioning of all emergency buttons, pushing them one by one during a hoist machine movement. Verify that an immediate and safe arrest occurs. In case of malfunction or damage, immediately replace the faulty device.

### 7.6.5 Remote radio control

Always keep the remote radio control clean and dry.

During work-rest periods, keep the remote radio control unit in a place protected against bad weather conditions and any other potential source of damage, such as falling rocks, passing vehicles, excessive dust, etc.

Batteries of remote radio control unit should be recharged at the end of each work shift. Refer to remote radio control instruction handbook for details.

### 7.6.6 Emergency control push button

Always keep the emergency control push-button clean and dry.

During work-rest periods, keep the emergency control push-button unit in a place protected against bad weather conditions and any other potential source of damage, such as falling rocks, passing vehicles, excessive dust, etc.

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### 7.7 ELECTRICAL CHECK LIST

POS.	COMPONENT	CHECK LIST	FREQ.	COND.
1	ELECTRIC PLANT	Visual check starters to be clean and dry.	W	s
		Visual check of break and/or manoeuvre appliances contacts to be worn out and if necessary replaced.	W	s
		Check contacts to be clean and make sure their original shape has not changed by filing or by grinding.	W	s
		Check contacts with connections (busway-busway, busway-cable, cable-cable) to be sufficiently tight.	W	s
		Visual inspection of all structure to make sure components are protected from oxidation.	M	s
		Check the joints of switches, of contactors and relays, to be clean in order to avoid excessive frictions.	W	s
		Check coils to work with the voltage rating.	W	s
		Make sure the arc extinguished device of switches and of contactors is always in the right position when working and kept in good condition.	W	s
		Verify leakage towards earth.	W	s
2	ELECTRIC BOARDS	Verify the bolts clamping of the electrical couplings to bars of the connections of power and auxiliary cables.	M	s
		Verify the bolts clamping of the connections of power and auxiliary cables.	M	s
		Verify (with insulation tester) the insulation of control circuits and compare these values with those detected during starting.	M	s
		Verify the efficiency of control and protection circuits and of electrical blocks through functional blank tests.	W	s
		Verify the continuity and the efficiency of grounding circuits.	W	s
		Perform an extraordinary maintenance intervention on boards.	Y	s
		With an aspirator, remove dust and dirt especially from insulators and from insulated supports and clean them accurately.	W	s
		Check the insulation resistance with insulation tester between phases and towards earth.	M	s
3	SWITCHES CONTACTORS AND POWER RELAYS	Verify that mechanical movements do not cause excessive frictions.	W	s
		Check the integrity of fuse cartridges and make sure they do not show signs of obsolescence.	W	s
4	ELECTRONIC APPLIANCES	Carefully remove dust. After carrying out these operations, check that the harness, which is usually composed of conductors of the minimum section, is not damaged or torn.	W	s
5	HARNESS	Clean them with particular attention to cables with identification stripes. Clean terminal boards and verify their anchoring and the connections of all cables (bolts end/or terminals).	M	s
		Check the conditions of the varnishing at least once a year and retouch it if necessary.	Y	s

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## **7.8 ELECTRIC PLANT TROUBLESHOOTING**

For electrical plant troubleshooting please refer to Section 11.12

## **7.9 HYDRAULIC PLANT MAINTENANCE**

For hydraulic plant maintenance please refer to Section 11.13

## **7.10 MECHANICAL MAINTENANCE**

### **7.10.1 Protection against corrosion**

The equipment must be protected from oxidation.

When using the hoist machine all parts with no protection paint as well as all bolts and screws must be protected from oxidation in order to guarantee the functionality and facilitate any disassembly of the equipment.

It is convenient, at least every month, to perform a visual inspection of all the structure from top to bottom: should bolt loosening be noticed, verify the correct tightening of the structure itself.

### **7.10.2 Maintenance of wire ropes and sheaves**

On receipt of the wire rope an initial check should be carried out to see if it has sustained any damage during transit.

When unloading the rope, care should be taken so that the coil or reel is not allowed to drop from the truck on to the ground since, in that case, the coil or reels or the core of the reel is liable to collapse, which can lead to permanent deformation of the rope. When rolling coils or reels are laying on the ground they should never be allowed to hit in any obstruction, as this may result in serious damage to the rope.

A rope should never come into contact with sand, grit or mud since this will creep between the strands and cause abrasion of the wires when the rope is in operation.

#### **7.10.2.1 Storage**

Care must be taken whilst storing a wire rope so that it does not come into contact with water, moisture or corrosive agents. A rope must always, when possible, be stored in a dry and well ventilated place.

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Ropes must not be stored on concrete floors; coils must be placed on wooden pallets. Ropes delivered on reels shall not get in contact with the floor and the reels should be stored standing on their flanges.

It is recommended to inspect stored wire ropes periodically for corrosion; especially in damp and humid climates they should be regularly lubricated.

### 7.10.2.2 *Uncoiling and handling*

Wire ropes are supplied in one of two ways, coil or on reel, the best method being the latter. There are many ways of uncoiling a wire rope from a coil or reel but there are only a few methods, which do not damage the rope.

**COIL:** lay the free end of coil on the floor, stand the coil on edge and unroll it. Take care that the coil does not hit any sharp object. The coil may also be placed flat on a rotary table while pulling off the rope. In this case the coil must be braked or otherwise the wraps will drop down and get damaged. A coil should never be round from the inside since this will inevitably cause kinking.

**REEL:** if the rope is supplied on a wooden reel it should be unwound by mounting a reel on a shaft, supported in a manner that the reel will turn freely. The rope can now be drawn off, making sure that the rope is kept taut. This is to avoid loops falling over the reel flanges, which can cause kinking.

### 7.10.2.3 *Lubrication of wire rope*

When a wire rope is used, the individual wires and strands are close to each other, and this will cause wear at points of contact. To reduce this internal wear to a minimum and to prevent corrosion ropes are greased inside strands by the manufacturer. This lubrication is enough to guarantee the rope life in this application.

Greasing the rope on outside strands reduces friction factor on driven pulleys and can cause dangerous sliding of rope.



**Prohibition**  
*DO NOT grease the ropes.*

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## 7.10.2.4 Inspection of sheaves

When installing a new wire rope, the capstan and the sheaves should be inspected, and, if necessary, repaired. Grooves should be carefully examined for uneven wear, excessive groove radius and free running of bearings.

Check groove for proper size. Corrugated and worn grooves as indicated on figure would seriously damage the wire rope.

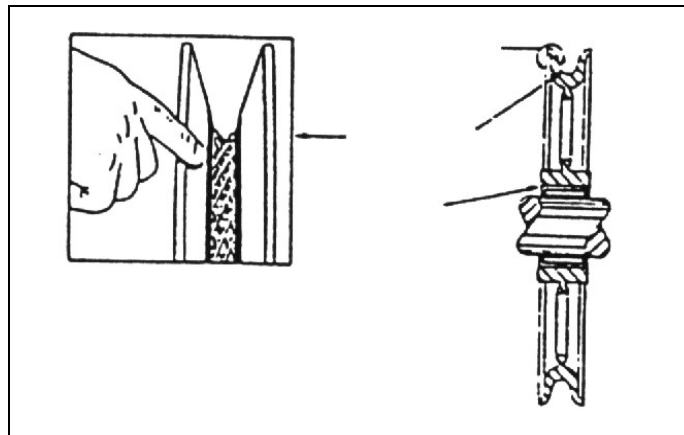


Figure 7.1 – Inspection of sheaves

## 7.10.2.5 When a wire rope should be replaced

Please be aware that a worn or damaged wire rope is extremely dangerous. If there is any doubt as to whether a wire rope should be renewed, local standards must be consulted. The following is a general guide representative of the most common norms. However, local regulations should be consulted and given priority.

To ensure safety during work operations, every rope must be checked at three-month intervals. The rope shall be replaced as soon as swelling, bruises, permanent bends, kinks or other serious damage (severe rust formation) and especially heavy wear has occurred. Rope replacement depends on the number of broken elementary wires, corrosion and other condition indicating deterioration.

If over a length of 8 times the wire rope diameter there is a number of broken wires which together are more than 10 % of the total number of wires (shown in chart of wire certification), then the wire should be renewed.

If a strand is broken the rope shall be replaced immediately.

In relation to the most worn section of the cable, count the visible broken wires on the exterior of the cable. Table 7.3 indicates the maximum number of broken wires which can be accepted over a cable length 6 diameters and 30 diameters of the cable itself, depending on the type and the winding. Both conditions must be respected (Reference ISO 4309).



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For ropes not mentioned in table, the total number of external broken wires over a length of 6 diameters must not exceed 3 % of the wires making of all the strands for ordinary lay cables and 2 % for Lang lay cables.

Rope type	N° of bearing wires in the external strands	Maximum number of broken wires			
		Machine classification groups			
		M1 - M2 - M3 - M4		M5 - M6 - M7 - M8	
		Number of broken wires on a length equal to:			
		6d	30d	6d	30d
SPIN 12P d. 8 - 12	51 - 75	3	6	6	12
S1 PPC - S2 - S4 114 S12	101 -120	5	10	10	20
S12 / SPIN 12P 13/60 SPIN 12KP 8-40 S9 - S10 AR/ALC S5 - S6	161 - 180	4	14	14	28
S8 - S11 AR/ALC	201 - 220	9	18	19	38
M4 - S7 - S12 8KP	221 - 240	10	21	21	42
SPIN 12KP 42 - 60	261 - 280	11	22	22	45

Non-rotating ropes	6d	30d	6d	30d
A4 L - A4 ALC - A6 < 30 A6 ALC < 34 - A7 ALC < 34 - A24	1	2	2	4
A6 > 32 - A6 ALC > 34 - A7 ALC > 36 A7 ALC-P < 34 - A7 ALC-P > 34	2	4	4	8

*Table 7.3 – Wire rope acceptance criteria (Reference ISO 4309)*

### 7.10.2.6 Installing a new rope

Check that the wire rope has the correct dimension (diameter and length) and also meets the specification of the original wire rope (check wire rope certificates and part list).

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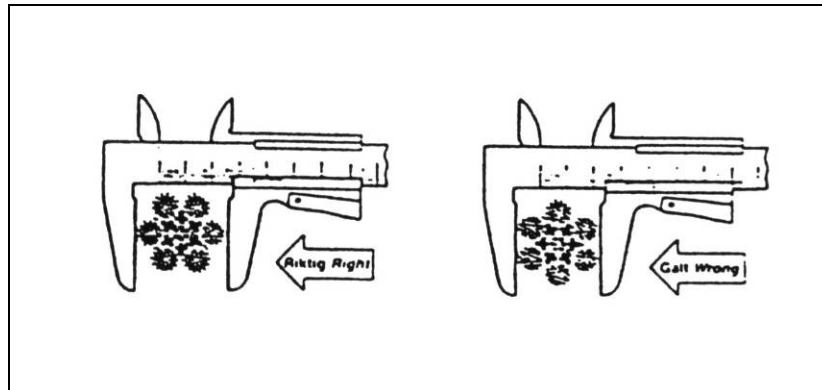


Figure 7.2 – Wire rope dimensional check

Seizing of wire ropes end before cutting must be done. Ref. figure for one to accepted methods of applying seizing. The seizing itself should be a soft or annealed wire or strand. The seizing wire diameter and the length on the seize will depend of the diameter of the rope. The length of the seizing should never be less than the diameter of the rope being seized.

It' s very important that no twist is induced in the rope as this would mean that the rope would have to be removed rewound again.

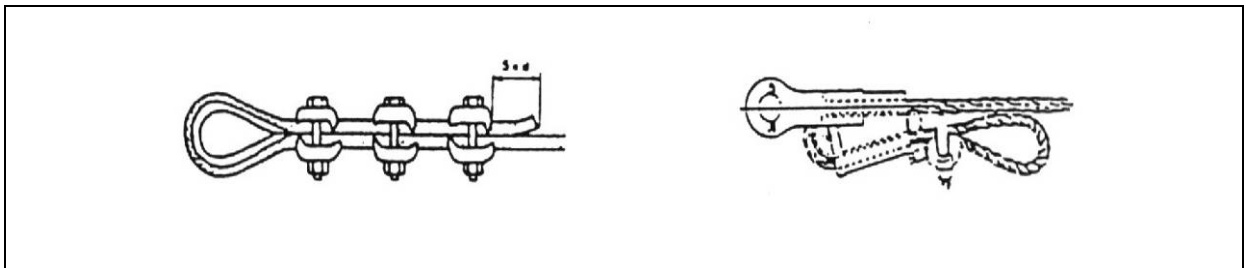


Figure 7.3 – Wire rope seizing

## 7.11 LUBRICATION

Lubrication is a factor of vital importance for good hoist machine performance and long life. The procedures indicated in the following lubrication program must be scrupulously observed, as well as the following specifications.



### **Prescription**

*Always use the indicated type of oil, or equivalent, and make sure that there are no impurities (dust, sand, water, etc.) which may damage lubricated components.*



### **Prescription**

*Oil level top-ups must be performed using the same type of oil as used, when replacing the oil already in the tank must be completely replaced.*

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Avoid lubricant deterioration during storage, transport and filling operations in order to prevent wear out damage.

### 7.11.1 Lubrication frequency

	LUBRICATION FREQUENCY			
	weekly	monthly	Every 3 months	yearly
Bearings of end-carriages wheels-grease	x			
Bearing of lifting drum - grease	x			
Lifting gearbox - replace oil				x
Travelling gearboxes - replace oil				x
Sliding pads on trolley – grease		x		
Bearings of pulleys – grease		x		

### 7.11.2 Gear reducers oil – brand comparison chart

Oil type	Viscosity Factor ISO	Temperature factor	AGIP	BP	ESSO	MOBIL	SHELL
Mineral	VG220	0 +40	Blasia 220	Energol GR-XP 220	Spartan EP 220	Mobilgear 630	Omala oil 220
Mineral	VG150	-15 +25	Blasia 100	Energol GR-XP 100	Spartan EP 150	Mobilgear 629	Omala oil 100
Synthetic	VG220	-25 +40	Blasia S220	Energol GR-XP 220	-	Glycoyle 30	Tivela OEL WB

### 7.11.3 Grease for bearings – brand comparison chart

Environment temperature range	AGIP	ESSO	MOBIL	IP	VANGUARD	FIAT
+40°C -15° C	GR MU EP 2	BEACON EP2	MOBILPLEX EP460	ATHESIA EP2	LIKO EP2	JOTA 2/S

### 7.11.4 Grease for screws and sliding pads – brand comparison chart

AGIP	Q8	MOBIL	SHELL
SAGUS 60	REMBRANT MOLY	MOBILTAC 81	MALLEUS OGH

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### 7.12 USE AND MAINTENANCE OF THE TRADING COMPONENTS

Maintenance operations of trading components must be carried out exclusively by qualified and adequately trained personnel, who should have read this manual.



#### **Prescription**

*Personnel safety must always be guaranteed by all necessary precautions as detailed in Section 3.*



#### **Prohibition**

*Personnel who does not meet the requirements specified in Section 6.2 are NOT allowed to carry out any maintenance intervention on the equipment.*

Refer to Section 11 for use and maintenance manuals of single trading components. Scrupulously follow the instructions supplied by the manufacturers in the annexed documents.