

# MANUFACTURER'S MANUAL

CRANE MODEL

**11 LC 150**

SERIAL NUMBER



MANUAL REFERENCE

**COM 080 0011 IB**

DATE OF ISSUE

**08/38**

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8	VARIOUS		





# MANUFACTURER'S MANUAL

# 11 LC 150







# MANUFACTURER'S MANUAL

# 1 GENERAL



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The purpose of this Instructions Manual is to provide the user with useful information regarding crane handling, transportation, erection, operation, maintenance, disassembling and repairing. This information not only will allow the user to operate the crane with the maximum safety but also, bearing in mind all its capacities, obtain a better performance.

To make information retrieval easier, the Instructions Manual is divided into chapters as described in the following sheets. Prior to crane operation read carefully those parts related to your duty and do not hesitate to request any clarification or additional information if you should not understand the existing information or if it should not be sufficient.

! Crane operation is restricted to qualified personnel having received proper specialised training and specific crane information. Apart from the operating instructions, applicable regulations must be taken into account, specifically those related to safety precautions such as personal protection and hazard prevention rules.

! Prior to crane operation, the owner or user must make sure that any person involved in crane maintenance or operation is conversant with the safety and operating instructions regarding his duty, described in this Manual, as well as with applicable standards and regulations.



Crane safety devices must be closely monitored. Check regularly their correct operation and, in case of any failure or malfunction, prohibit crane operation.

## **ACCIDENTS MIGHT OCCUR IF THESE INSTRUCTIONS ARE NOT FOLLOWED**

Subsequent to receiving this manual data concerning the crane can be sent in the form of Technical Information or Maintenance Reports. It is important that these documents are taken into account and added to this Manual.

This manual has been issued for a specific crane model and serial number. If based on the modular design of the crane range, crane model and set-up is changed to other model not contemplated in this manual, complementary instructions for the new set-up must be applied for.

*The Instructions Manual is an important part of the crane and it must be always attached to the crane in good condition and updated.*

Illustrations on this manual do not necessarily correspond with actual product set-up.

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## COMANSA GENERAL PRODUCT WARRANTY

1. Comansa stands warranty for its products against any material and manufacturing defects. This warranty covers use and service in normal conditions for one year as from the date of delivery of the product to the customer, or for 1800 hours of operation of the equipment, whichever is shorter.
2. This warranty does not cover normal wear and tear of consumable elements, steel cables and electrical wiring.
3. This warranty does not cover equipment maintenance and adjustment work.
4. Comansa provides no warranty for malfunction or damage to motors, brake coils, electronic circuit boards, speed variators or electrical components in general as a result of defects in electricity supplies. With the crane at rest and when it is operating with its motors at full load or full speed the power supply at the base of the crane must be between 95 and 105% of the voltage specified in the Comansa instruction manual.
5. The general warranty does not cover defects arising in products as a result of:
  - Improper or negligent use of equipment.
  - Use of equipment by persons not legally authorised and/or not trained for such use.
  - Improper or insufficient erection, installation, maintenance or use of equipment in any way other than that indicated in the Comansa instruction manual and in standard UNE 58-101-92 part 2; the points made in standard EN 60204-32 concerning the area around the installation must also be considered.
  - Overloads.
  - Temporary or permanent removal of the safety systems of the equipment.
  - Modifications to the equipment made without the consent of Comansa or made with its consent but improperly by personnel not answerable to Comansa.

6. Comansa's warranty obligations are binding only in the following cases
  - When defects covered by the warranty are reported in writing within 30 calendar days of the date when they are detected.
  - When the faulty parts are shipped to Comansa properly packaged and insured within the period indicated by Comansa. Shipping costs are payable always by the customer, and requests by Comansa for parts or equipment to be shipped to do not in themselves constitute an acknowledgement of liability.
  - When the customer, at the request of Comansa, allows access of personnel answerable to the latter so that they may inspect allegedly faulty equipment or materials on-site and take possession of such parts as they may require for analysis by Comansa or by third parties.
7. Comansa is responsible for supplying parts after defects have been detected, and may at its own discretion repair faulty parts or equipment under warranty or replace them by new parts. In the latter case the faulty parts or equipment shall become the property of Comansa.
8. In no case shall Comansa be held liable under this warranty for damage that arises as a direct or indirect consequence of defects covered by the warranty, even though the customer may incur loss of profit due to the interruption or cessation of its activities or those of third parties working for or with it. The liability of Comansa shall be limited to the supply of parts following the detection of defects.
9. Comansa's product warranty extends only to its own customers. Comansa shall therefore not be bound to provide warranty cover to third parties, even if they are users of its products under any title.
10. Should any of the limitations laid down in this warranty be declared null and void under applicable legislation, so that the warranty is therefore applicable, the warranty period shall be reduced to six months.

These operating instructions comprise eight chapters. Chapters contain the following subjects.

## **1 GENERAL**

This chapter gives information on the composition and use of the operating instructions, as well as general and safety symbols there referred to.

Contents of the "Introduction" document at the beginning of this chapter are of great importance and must strictly be respected.

## **2 TECHNICAL SPECIFICATIONS**

This chapter contains technical information on the crane, i.e. technical data sheet, load diagrams, weight and dimensions, construction features and guidance on overall crane design.

## **3 ERECTION / DISMANTLING**

This chapter contains documents on crane erection, from jib assembling, including assembly design dimensions, through the erection of different crane parts, to the calibration and checking of crane limiters and safety devices for commissioning. Also, crane dismantling instructions are included, as well as guidance on the transportation of different crane parts.

## **4 ELECTRICAL INSTALLATION**

This chapter contains additional electrical information, complementary to information given in chapters ERECTION / DISMANTLING, CRANE OPERATION AND MAINTENANCE, which enable a correct crane electrical installation and give ample knowledge on crane electrical system.

## **5 CRANE OPERATION**

This chapter contains necessary information for a correct crane operation.

## **6 MAINTENANCE**

This chapter informs on checks and adjustments to be performed periodically after crane erection.

## **7 SPARE PARTS**

Different machine parts arranged into various construction groups are listed in this chapter. This information helps to a better understanding of mechanical parts and thus to an easier identification of spare parts. Also, precise information on how to place purchase orders for the required spare parts is given.

## **8 OTHER INFORMATION**

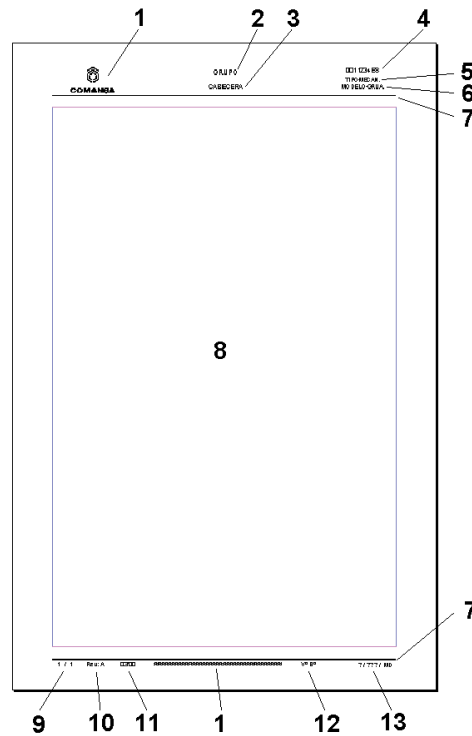
Other crane information whether manufacturer or owner's information could be incorporated into this chapter.





Document identification for queries shall be as follows:

- STATE CHAPTER AND DOCUMENT CODE or else
- CRANE MODEL, SERVICE INSTRUCTION NUMBER and SHEET CODE.



Sheets of these service instructions are laid out as follows.

- 1 COMANSA LOGO**
- 2 CHAPTER NAME**
- 3 DOCUMENT TITLE**  
Regarding chapter SPARE PARTS, sections 2 and 3 are available in several languages.
- 4 DOCUMENT CODE**  
COMANSA internal code, for document filing purposes.
- 5,6 IDENTIFICATION DATA**  
Data regarding crane type, section, part or other data, intended to ease document retrieval and filing.
- 7 DIVISION LINES**  
Border lines of different document areas, such as heading, contents and footer.
- 8 CONTENTS**  
Texts, drawings and tables regarding instruction of applicable service instruction sheets.  
For spare parts sheets, detail drawings and parts lists in several languages.
- 9 SHEET NUMBER OF TOTAL NUMBER OF SHEETS**  
Sheet number and number of sheets in document.
- 10 REVISION**  
Letter stating document revision; revisions start by letter A.
- 11 DATE**  
Document drawing up date.
- 12 APPROVAL**  
Document "O.K." only in the Spanish version.
- 13 SHEET CODE**  
Gives sheet position in service instructions.  
x / yyy / zzz  
x Chapter.  
yyy Chapter group (first three digits of DOCUMENT CODE)  
zzz Sheet

**0 CONTENTS**

<b>1</b>	<b>GENERAL DEFINITIONS</b>
<b>2</b>	<b>CRANE DEFINITIONS BASED ON FEATURES</b>
<b>3</b>	<b>PROCESS DEFINITIONS</b>
<b>4</b>	<b>PARAMETER DEFINITIONS</b>
<b>5</b>	<b>COMPONENT DEFINITIONS</b>

**1 GENERAL DEFINITIONS**

- **Crane**  
Discontinuous operation device used to hoist and distribute loads suspended from a hook over an area.
- **Slewing tower crane**  
Top slewing tower crane with slewing support on tower top end and with lower support connected to the crane foot.
- **Removable tower crane for worksites**  
Temporary slewing tower crane, used in construction sites, designed to cope with frequent erection and dismantling operations, as well as transfers between different locations.

**2 CRANE DEFINITIONS BASED ON FEATURES**

- **Top slewing crane**  
Crane with the slewing system on tower top end.
- **Horizontal jib crane**  
Crane where the jib is parallel to the ground.
- **Travelling crane**  
Crane with foot equipped with own means for travelling on a track.
- **Stationary**  
Crane without any travelling means or which, even featuring travelling means, may not move during site construction work.  
Crane anchored in a foundation or baseplate.

**3 PROCESS DEFINITIONS**

- **CONDITION OF SERVICE**
  - **Operational**  
Crane working under given operating conditions (crane setup, load reach, etc.) or ready to move the loads for which it has been designed.
  - **Out of service**  
Unloaded crane left in stable position, in conditions specified by the manufacturer, without performing any work, and ready to get into operation when circumstances so require and allow.
- **Crane erection**  
The actual process of erecting the crane in the worksite, to perform as required. It includes preliminary works such as foundations, track construction works, etc.
- **Installed crane**  
Crane erected in the worksite, subject to design loads for crane out of service, but without the requirement of being ready for operation.
- **Commissioning**  
Set of crane checks and operations needed for making the crane operational.

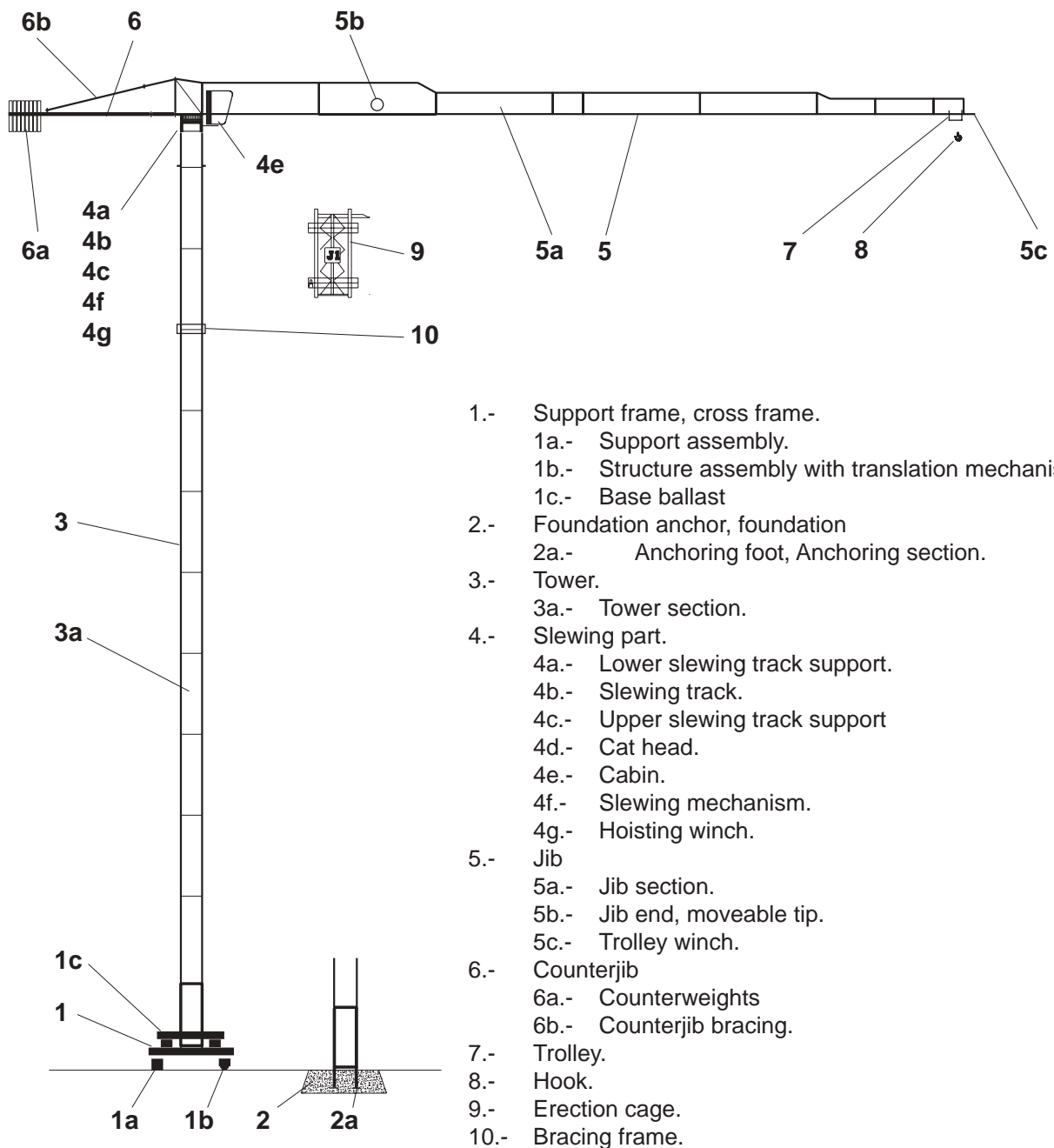
#### 4 PARAMETER DEFINITIONS

- **Reach or radius**  
Horizontal distance measured between crane slewing axis and the vertical centerline of the hook without load, when the crane is erected on horizontal ground.
- **Lifting range**  
Vertical distance between upper and lower hook positions for the actual work.
  - **Lift**  
Vertical distance between hook rest level and upper hook position for the actual work.
  - **Lowering depth**  
Vertical distance between hook rest level and lowest position.
- **Travelling speed**  
Speed of crane translation movement on the track for the type of work involved.
- **Slewing speed**  
Angular speed of the slewing part of the crane for the type of work involved.
- **Trolley speed**  
Speed of trolley translation movement for the type of work involved.
- **Hoisting speed**  
Speed of the vertical movement of the load for the type of work involved.
  - **Positioning speed**  
Minimum load speed in erection or suspension processes, for the type of work involved.
- **Tip load**  
Maximum load that can be hoisted at maximum reach.
- **Maximum load**  
Maximum load that can be lifted according to crane manufacturer data.

#### 5 COMPONENT DEFINITION, VOCABULARY













- **Support frame**  
Structural assembly supporting the slewing part or the fixed part of the crane tower.
- **Ballast**  
Mass attached to the support frame for crane stability.
- **Tower**  
Vertical structure of crane which supports the slewing part and allows for the required lift to be met.
- **Slewing section**  
Structure including the slewing track and the slewing mechanism and the hoisting mechanism and comprising the elements for the transition between the fixed and the moving part of the crane.
- **Operator's cabin**  
Cabin destined to normal control of the crane that houses the controls and the crane operator.
- **Jib**  
Structural component of the crane, supporting the trolley and the hook, ensuring this way the required reach and lift. One section includes the trolley winch.
- **Counterjib**  
Structure able to support the crane counterweight.
- **Counterweight**  
Mass fixed to the counterjib, that helps compensate load actions.
- **Trolley**  
Structure destined to the translation of suspended loads.
- **Hook**  
Device for suspending the load.
- **Erection cage**  
Structure placed on the tower upper part, that allows for hoisting the crane slewing part.
- **Bracing frame**  
Structure, arranged on the tower, for transmitting loads derived from a tower extension.
- **Travelling mechanism**  
Mechanism for crane translation on track.
- **Slewing mechanism**  
Mechanism for turning the slewing part of the crane in a horizontal plane.

- **Trolley winch**  
Mechanism for the translation of loads along the jib.
- **Hoisting winch**  
Mechanism for hoisting and lowering loads.
- **Limiter**  
Device for stopping or limiting crane movements or functions.
- **Indicator**  
Device for furnishing the crane operator with necessary information for a perfect crane operation within the operating parameter table.



- 1.- Support frame, cross frame.
  - 1a.- Support assembly.
  - 1b.- Structure assembly with translation mechanism
  - 1c.- Base ballast
- 2.- Foundation anchor, foundation
  - 2a.- Anchoring foot, Anchoring section.
- 3.- Tower.
  - 3a.- Tower section.
- 4.- Slewing part.
  - 4a.- Lower slewing track support.
  - 4b.- Slewing track.
  - 4c.- Upper slewing track support
  - 4d.- Cat head.
  - 4e.- Cabin.
  - 4f.- Slewing mechanism.
  - 4g.- Hoisting winch.
- 5.- Jib
  - 5a.- Jib section.
  - 5b.- Jib end, moveable tip.
  - 5c.- Trolley winch.
- 6.- Counterjib
  - 6a.- Counterweights
  - 6b.- Counterjib bracing.
- 7.- Trolley.
- 8.- Hook.
- 9.- Erection cage.
- 10.- Bracing frame.

A NUMBER OF SYMBOL ARE USED IN THIS MANUAL TO DESCRIBE DIFFERENT IMPORTANT OPERATIONS.

<i>Symbol</i>	<i>Meaning</i>
	Information to be considered when erecting, dismantling and operating the crane.
	Important information for accident prevention.
	Information, instructions and banning for damage and accident prevention.
	See maintenance instructions. Information contained in maintenance instructions.
	Earthing. The part involved must be connected to ground in accordance with specified instructions.
	Voltage hazard. Electric shock hazard.
	Indicator of number of falls. Single reeving.
	Indicator of number of falls. Single / double reeving.
	Travelling. Translation mechanism.
	Hoisting. Hoisting winch.
	Trolley translation. Trolley winch.
	Slewing. Slewing mechanism.

**Units which are used in the manual**

MEASURE	SYMBOL	NAME
length	m mm	metre millimetre
masa	kg t	kilogramme ton
time	s min h	second minute hour
temperature	°C	degree Celsius
speed	m/s m/min km/h min <sup>-1</sup> rpm	metre per second metre per minute kilometre per hour return per minute return per minute
force	N kN	Newton kilonewton
pressure	kg/cm <sup>2</sup> Pa bar	kilogramme per square centimetre Pascal (N/m <sup>2</sup> ) 100 kPa
work	Nm kNm kgm	Newton per metre kilonewton per metre kilogramme per metre
elektric output	W kW CV	watt kilowatt horsepower (0,736 kW)
volume	l	litre



# MANUFACTURER'S MANUAL

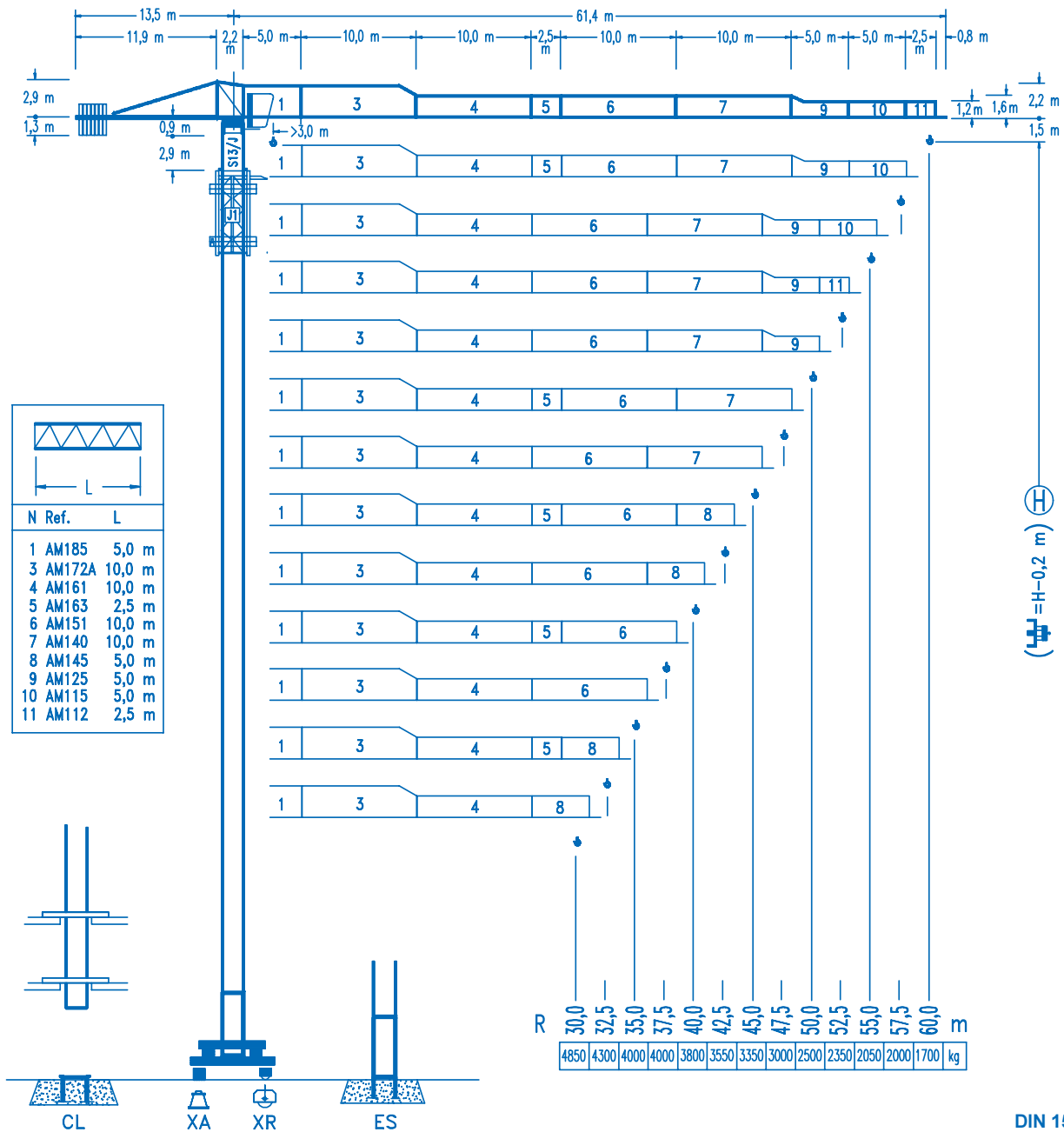
## 2 TECHNICAL SPECIFICATIONS





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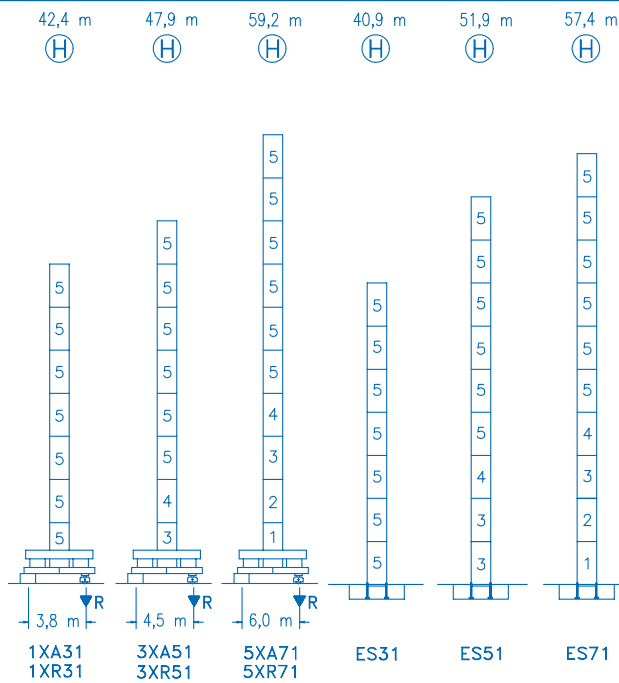


**CE**  
DIN 15018 H1 B3

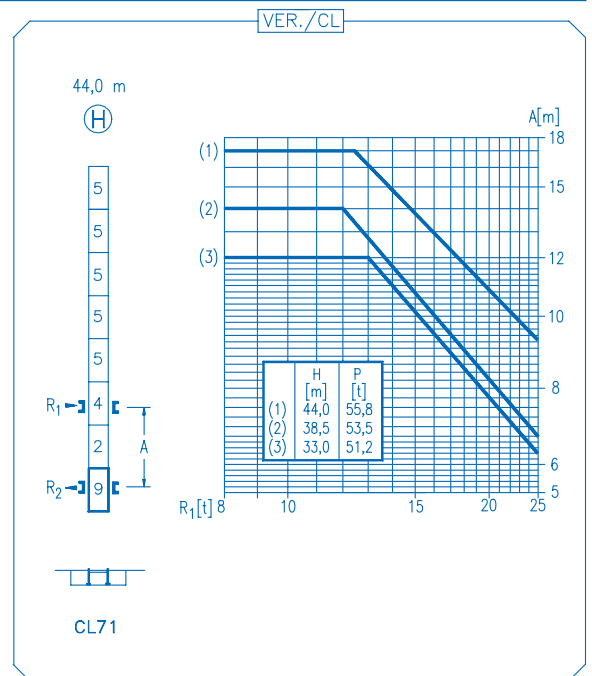
R	⌋																⌋																					
60,0	14,8	20	23	26,5	28,8	30	32,5	35	37,5	40	42,5	45	47,5	50	52,5	55	57,5	60	m	8000	5610	4750	4000	4000	3820	3490	3210	2970	2760	2570	2400	2250	2120	2000	1890	1790	1700	kg
57,5	16,1	20	23	25	28,9	31,5	32,5	35	37,5	40	42,5	45	47,5	50	52,5	55	57,5	m	8000	6210	5270	4770	4000	4000	3870	3560	3290	3060	2850	2670	2510	2360	2230	2110	2000	kg		
55,0	15,7	20	23	25	28,2	30,8	32,5	35	37,5	40	42,5	45	47,5	50	52,5	55	m	8000	6040	5120	4630	4000	4000	3760	3460	3200	2980	2770	2600	2440	2300	2170	2050	kg				
52,5	16,8	20	23	25	28	30,2	32,9	35	37,5	40	42,5	45	47,5	50	52,5	m	8000	6520	5540	5020	4380	4000	4000	3740	3460	3220	3000	2810	2640	2490	2350	kg						
50,0	16,8	20	23	25	28	30,2	33,1	35	37,5	40	42,5	45	47,5	50	m	8000	6550	5560	5030	4390	3880	4000	3760	3480	3230	3020	2820	2650	2500	kg								
47,5	18,6	23	25	28	30	33,5	36,8	37,5	40	42,5	45	47,5	m	8000	6270	5690	4980	4580	4000	3920	3640	3400	3190	3000	kg													
45,0	19,4	23	25	28	30	32,5	35	38,4	40	42,5	45	m	8000	6580	5970	5230	4820	4370	4000	4000	3820	3570	3350	kg														
42,5	19,3	23	25	28	30	32,5	34,8	38,2	40	42,5	m	8000	6530	5930	5190	4780	4340	4000	4000	3800	3550	kg																
40,0	19,3	23	25	28	30	32,5	34,7	38,2	40	m	8000	6520	5920	5180	4770	4330	4000	4000	3800	kg																		
37,5	18,9	23	25	28	30	32	34	37,5	m	8000	6380	5790	5060	4660	4310	4000	kg																					

$(t) \Delta$   
4  
8  
 $H = H - 0,4 t$   
m

m	30	28	25	23	19,2	30,0	
kg	4850	5170	5910	6510	8000		
m	32,5	30	28	25	23	18,9	
kg	4300	4660	5060	5780	6370	8000	
m	35	34,2	30	28	25	23	19,0
kg	4000	4690	5090	5820	6410	8000	



N	Ref.	h
1	S15	5,5 m
2	TS15	5,5 m
3	S14	5,5 m
4	TS14	5,5 m
5	S13	5,5 m
9	CLS15	3,1 m



<b>R. máx.</b>	En servicio	<b>1XR31</b> ..... <b>76,5 t</b>
	In operation	<b>3XR51</b> ..... <b>73,6 t</b>
	En service	<b>5XR71</b> ..... <b>67,0 t</b>
	In Betrieb	

<b>R. máx.</b>	Fuera de servicio	<b>1XR31</b> ..... <b>91,7 t</b>
	Out of service	<b>3XR51</b> ..... <b>100,1 t</b>
	Hors service	<b>5XR71</b> ..... <b>104,4 t</b>
	Ausser Betrieb	

**CFU-4.0**  
4 kW  
0 ⇄ 90 m/min

**GR-7.5**  
2 x 75 Nm  
0 ⇄ 0,7 rpm

**TS2-5.5** | **TRA-7.5**  
2 x 55 Nm | 2 x 75 Nm  
0 ⇄ 20 m/min  
1XR31 | 3XR51 | 5XR 71

**TRA-7.5VC**  
2 x 75 Nm  
0 ⇄ 20 m/min  
5XR71

**EFU2-24-20**  
440 m | 24 kW  
0 ⇄ 90 m/min  
Graphs: 1.6 m and 3.2 m


**EFU2-37-20**  
620 m | 37 kW  
0 ⇄ 90 m/min  
Graphs: 1.2 m and 2.4 m

**EFU4-45-20**  
1000 m | 45 kW  
0 ⇄ 90 m/min  
Graphs: 0.8 m and 1.6 m


Tensión de alimentación	<b>400 V</b>
Operating voltage	<b>3 ph</b>
Tension de service	<b>50 Hz</b>
Betriebsspannung	

Opcional	<b>*</b>
Optional	
En option	
Kaufoption	


**LOAD CHART**

 TWO FALLS								
Distance trolley (m)	Hook radius (m)							
	60	57,5	55	52,5	50	47,5	45	42,5
12	4000	4000	4000	4000	4000	4000	4000	4000
13	4000	4000	4000	4000	4000	4000	4000	4000
14	4000	4000	4000	4000	4000	4000	4000	4000
15	4000	4000	4000	4000	4000	4000	4000	4000
16	4000	4000	4000	4000	4000	4000	4000	4000
17	4000	4000	4000	4000	4000	4000	4000	4000
18	4000	4000	4000	4000	4000	4000	4000	4000
19	4000	4000	4000	4000	4000	4000	4000	4000
20	4000	4000	4000	4000	4000	4000	4000	4000
21	4000	4000	4000	4000	4000	4000	4000	4000
22	4000	4000	4000	4000	4000	4000	4000	4000
23	4000	4000	4000	4000	4000	4000	4000	4000
24	4000	4000	4000	4000	4000	4000	4000	4000
25	4000	4000	4000	4000	4000	4000	4000	4000
26	4000	4000	4000	4000	4000	4000	4000	4000
27	4000	4000	4000	4000	4000	4000	4000	4000
28	4000	4000	4000	4000	4000	4000	4000	4000
29	3970	4000	4000	4000	4000	4000	4000	4000
30	3820	4000	4000	4000	4000	4000	4000	4000
31	3680	4000	3970	4000	4000	4000	4000	4000
32	3560	3930	3830	4000	4000	4000	4000	4000
32,5	3490	3870	3760	4000	4000	4000	4000	4000
33	3430	3800	3700	3990	4000	4000	4000	4000
34	3320	3680	3580	3860	3880	4000	4000	4000
35	3210	3560	3460	3740	3760	4000	4000	4000
36	3110	3450	3350	3620	3640	4000	4000	4000
37	3010	3340	3250	3510	3530	3980	4000	4000
37,5	2970	3290	3200	3460	3480	3920	4000	4000
38	2920	3240	3150	3410	3420	3860	4000	4000
39	2840	3150	3060	3310	3330	3750	3930	3910
40	2760	3060	2980	3220	3230	3640	3820	3800
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43	2530	2810	2740	2960	2980	3360	3530	
44	2470	2740	2670	2880	2900	3270	3440	
45	2400	2670	2600	2810	2820	3190	3350	
46	2340	2600	2530	2740	2750	3110		
47	2280	2540	2470	2670	2690	3040		
47,5	2250	2510	2440	2640	2650	3000		
48	2230	2480	2410	2610	2620			
49	2170	2420	2350	2550	2560			
50	2120	2360	2300	2490	2500			
51	2070	2310	2240	2430				
52	2020	2250	2190	2380				
52,5	2000	2230	2170	2350				
53	1980	2200	2140					
54	1930	2160	2100					
55	1890	2110	2050					
56	1850	2060						
57	1810	2020						
57,5	1790	2000						
58	1770							
59	1740							
60	1700							


**LOAD CHART**

 TWO FALLS								
Distance trolley (m)	Hook radius (m)							
	40	37,5	35	32,5	30			
12	4000	4000	4000	4000	4000			
13	4000	4000	4000	4000	4000			
14	4000	4000	4000	4000	4000			
15	4000	4000	4000	4000	4000			
16	4000	4000	4000	4000	4000			
17	4000	4000	4000	4000	4000			
18	4000	4000	4000	4000	4000			
19	4000	4000	4000	4000	4000			
20	4000	4000	4000	4000	4000			
21	4000	4000	4000	4000	4000			
22	4000	4000	4000	4000	4000			
23	4000	4000	4000	4000	4000			
24	4000	4000	4000	4000	4000			
25	4000	4000	4000	4000	4000			
26	4000	4000	4000	4000	4000			
27	4000	4000	4000	4000	4000			
28	4000	4000	4000	4000	4000			
29	4000	4000	4000	4000	4000			
30	4000	4000	4000	4000	4000			
31	4000	4000	4000	4000				
32	4000	4000	4000	4000				
32,5	4000	4000	4000	4000				
33	4000	4000	4000					
34	4000	4000	4000					
35	4000	4000	4000					
36	4000	4000						
37	4000	4000						
37,5	4000	4000						
38	4000							
39	3910							
40	3800							
41								
42								
42,5								
43								
44								
45								
46								
47								
47,5								
48								
49								
50								
51								
52								
52,5								
53								
54								
55								
56								
57								
57,5								
58								
59								
60								

**LOAD CHART**

 <b>FOUR FALLS</b>								
Distance trolley (m)	Hook radius (m)							
	60	57,5	55	52,5	50	47,5	45	42,5
12	8000	8000	8000	8000	8000	8000	8000	8000
13	8000	8000	8000	8000	8000	8000	8000	8000
14	8000	8000	8000	8000	8000	8000	8000	8000
15	7850	8000	8000	8000	8000	8000	8000	8000
16	7290	8000	7830	8000	8000	8000	8000	8000
17	6790	7500	7300	7870	7900	8000	8000	8000
18	6350	7030	6830	7370	7400	8000	8000	8000
19	5960	6600	6420	6920	6950	7820	8000	8000
20	5610	6210	6040	6520	6550	7370	7730	7670
21	5300	5870	5710	6160	6180	6970	7310	7250
22	5010	5560	5400	5840	5860	6600	6930	6870
23	4750	5270	5120	5540	5560	6270	6580	6530
24	4510	5010	4870	5270	5290	5970	6260	6210
25	4290	4770	4630	5020	5030	5690	5970	5930
26	4090	4550	4420	4790	4800	5430	5700	5660
27	3900	4350	4220	4570	4590	5200	5460	5410
28	3730	4160	4040	4380	4390	4980	5230	5190
29	3570	3980	3870	4190	4210	4770	5010	4980
29,6	3420	3820	3710	4020	4040	4580	4820	4780
31	3280	3670	3560	3860	3880	4400	4630	4590
32	3150	3530	3420	3720	3730	4240	4460	4420
32,1	3090	3460	3350	3640	3660	4160	4370	4340
33	3030	3390	3290	3580	3590	4080	4290	4260
34	2920	3270	3170	3440	3460	3940	4140	4110
34,6	2810	3150	3050	3320	3330	3800	4000	3960
36	2700	3030	2940	3200	3220	3670	3860	3830
37	2610	2930	2840	3090	3110	3540	3730	3700
37,1	2560	2880	2790	3040	3050	3490	3670	3640
38	2520	2830	2740	2990	3000	3430	3610	3580
39	2430	2730	2650	2890	2900	3320	3500	3470
39,6	2350	2640	2560	2800	2810	3210	3390	3360
41	2270	2560	2480	2710	2720	3110	3280	3250
42	2200	2480	2400	2620	2630	3020	3180	3160
42,1	2160	2440	2360	2580	2590	2970	3140	3150
43	2120	2400	2320	2540	2550	2930	3090	
44	2060	2330	2250	2460	2470	2840	3000	
44,6	1990	2250	2180	2390	2400	2760	2950	
46	1930	2190	2110	2320	2330	2680		
47	1870	2120	2050	2250	2260	2610		
47,1	1840	2090	2020	2220	2230	2600		
48	1810	2060	1990	2190	2200			
49	1760	2000	1930	2130	2130			
49,6	1710	1940	1880	2070	2100			
51	1660	1890	1820	2010				
52	1610	1840	1770	1950				
52,4	1590	1810	1750	1950				
53	1560	1790	1720					
54	1520	1740	1680					
54,6	1480	1690	1650					
56	1440	1650						
57	1400	1600						
57,1	1380	1600						
58	1360							
59	1320							
59,6	1300							

**LOAD CHART**

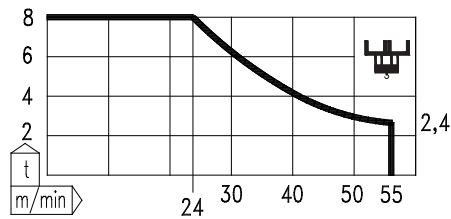
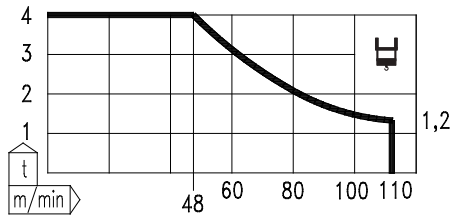
 <b>FOUR FALLS</b>								
Distance trolley (m)	Hook radius (m)							
	40	37,5	35	32,5	30			
12	8000	8000	8000	8000	8000			
13	8000	8000	8000	8000	8000			
14	8000	8000	8000	8000	8000			
15	8000	8000	8000	8000	8000			
16	8000	8000	8000	8000	8000			
17	8000	8000	8000	8000	8000			
18	8000	8000	8000	8000	8000			
19	8000	7940	7990	7940	8000			
20	7660	7490	7540	7490	7650			
21	7240	7080	7130	7080	7240			
22	6870	6710	6750	6710	6860			
23	6520	6380	6410	6370	6510			
24	6210	6070	6110	6070	6200			
25	5920	5790	5820	5780	5910			
26	5650	5530	5560	5520	5650			
27	5410	5290	5320	5280	5400			
28	5180	5060	5090	5060	5170			
29	4970	4860	4890	4850	4960			
29,6	4770	4660	4690	4660	4850			
31	4590	4480	4510	4480				
32	4420	4310	4340	4310				
32,1	4330	4230	4260	4300				
33	4250	4150	4180					
34	4100	4010	4030					
34,6	3960	3870	3950					
36	3830	3730						
37	3700	3610						
37,1	3640	3600						
38	3580							
39	3460							
39,6	3400							
41								
42								
42,1								
43								
44								
44,6								
46								
47								
47,1								
48								
49								
49,6								
51								
52								
52,4								
53								
54								
54,6								
56								
57								
57,1								
58								
59								
59,6								





**HOISTING**

Mechanism type ..... **EFU2-37-20-06**



**Motor**  
 Make ..... LETAG  
 Power ..... 37 kW  
**Brake**  
 Type ..... BFK458  
 Model ..... BFK.458.25/600 Nm  
**Drum**  
 Drum capacity ..... 660 m in 3 layers  
 Max. huh SR ..... 330 m  
 Max. huh DR ..... 165 m  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**TROLLEY**

Mechanism type ..... **CFU-4.0-04**

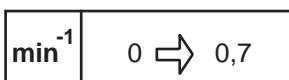


**Motor**  
 Make ..... LEROY SOMMER  
 Power ..... 4 kW  
**Brake**  
 Type ..... FCO  
 Model ..... FCO 112  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**SLEWING**

Mechanism type ..... **(2) GR-7.5-14**

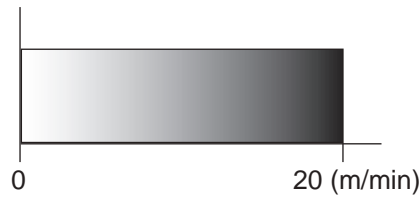
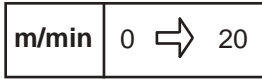


**Motor**  
 Make ..... BESOZZI  
 Power ..... (2) 7,5 kgm  
**Brake**  
 Type ..... S  
 Model ..... 110 MS  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**TRAVELLING (3,8 m)**

**Mechanism type ..... TS2-5.5-01**

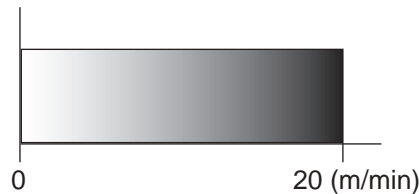
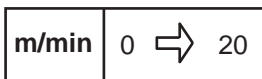


**Motor**  
 Make .....BESOZZI  
 Power ..... 2 x 5,5 kgm  
**Brake**  
 Type..... S  
 Model ..... 100 S  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**TRAVELLING (4,5 m)**

**Mechanism type ..... TS2-5.5-02**

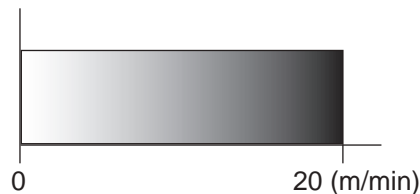
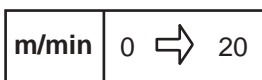


**Motor**  
 Make .....BESOZZI  
 Power ..... 2 x 5,5 kgm  
**Brake**  
 Type..... S  
 Model ..... 100 S  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**TRAVELLING (6,0 m, VR)**

**Mechanism type ..... TRA-7.5-02**

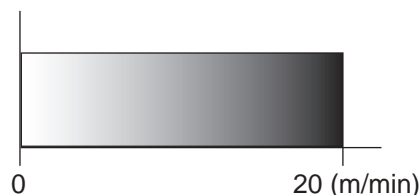
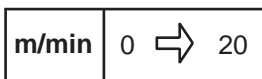


**Motor**  
 Make .....BESOZZI  
 Power ..... 2 x 7,5 kgm  
**Brake**  
 Type..... S  
 Model ..... 100 MS  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz

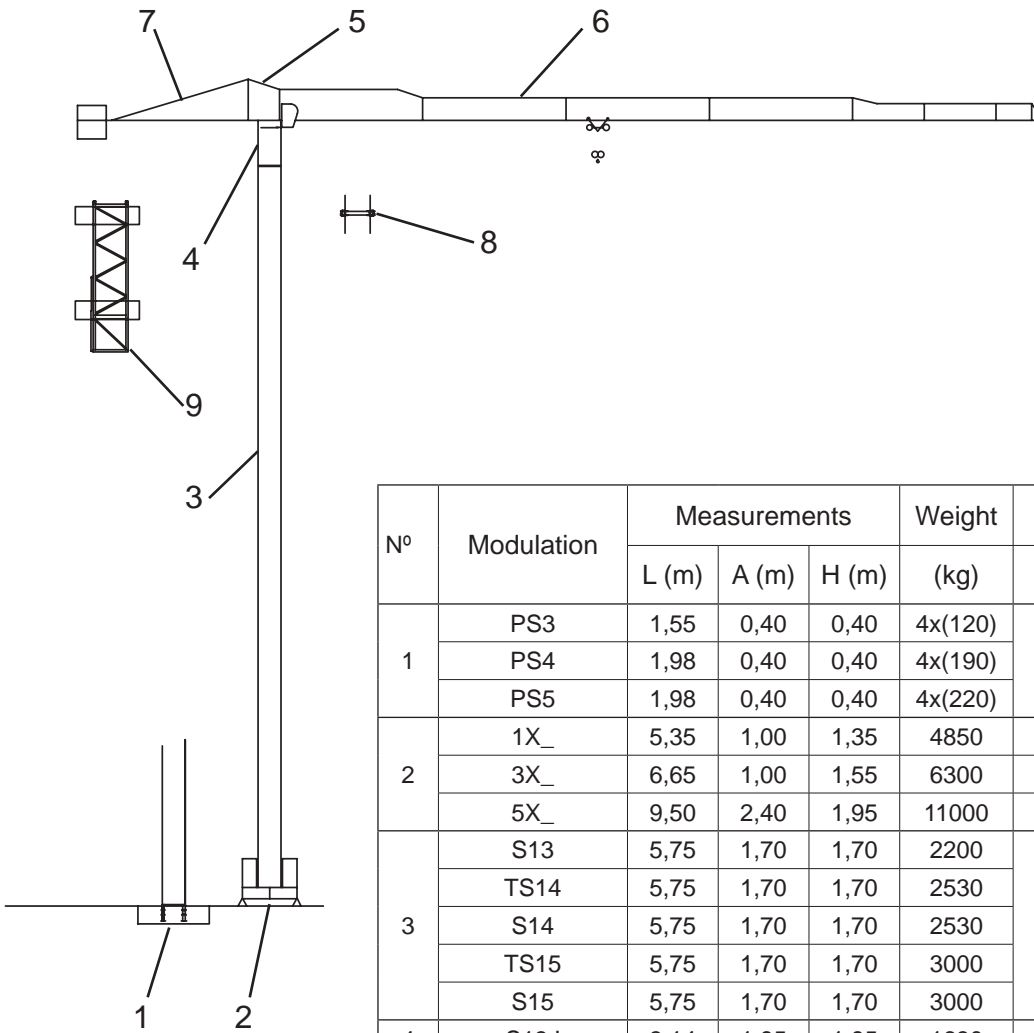


**TRASLACIÓN (6,0 m, VC)**

**Mecanismo tipo ..... TRA-7.5-05**



**Motor**  
 Fabricante.....BESOZZI  
 Power ..... 2 x 7,5 kgm  
**Brake**  
 Type..... S  
 Model ..... 100 MS  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



Nº	Modulation	Measurements			Weight (kg)	Document	
		L (m)	A (m)	H (m)		Reference	Rev.
1	PS3	1,55	0,40	0,40	4x(120)	040 0011 IB	A
	PS4	1,98	0,40	0,40	4x(190)		
	PS5	1,98	0,40	0,40	4x(220)		
2	1X_	5,35	1,00	1,35	4850	040 0017 IB	A
	3X_	6,65	1,00	1,55	6300	040 0016 IB	A
	5X_	9,50	2,40	1,95	11000	040 0018 IB	A
3	S13	5,75	1,70	1,70	2200	040 0098 IB	A
	TS14	5,75	1,70	1,70	2530		
	S14	5,75	1,70	1,70	2530		
	TS15	5,75	1,70	1,70	3000		
	S15	5,75	1,70	1,70	3000		
4	S13J	3,14	1,95	1,95	1630	040 0106 IB	A
5	CM111/S13	3,95	2,50	2,20	8800	040 0102 IB	A
6	AM185	5,25	1,20	2,40	1070	040 0104 IB	A
	AM172A	10,25	1,20	2,35	2030		
	AM161	10,25	1,20	1,75	1420		
	AM163	2,70	1,20	1,75	320		
	AM151	10,20	1,20	1,75	1000		
	AM140	10,25	1,20	1,70	725		
	AM145	5,20	1,20	1,70	330		
	AM125	5,20	1,20	1,70	270		
	AM115	5,15	1,20	1,30	230		
	AM112	2,65	1,20	1,30	125		
	JE101	0,95	1,35	0,45	80		
	TCL04-00	1,20	1,50	0,65	120		
	TCL08-02	0,96	1,50	0,90	105		
	GA04-02	0,70	0,50	0,80	250		
GA08-01	1,10	0,60	0,90	330			
7	EC06	11,99	1,65	0,55	3000	040 0105 IB	A
8	MA01	2,21	1,00	0,38	670	040 0014 IB	A
9	J1	2,10	2,30	8,90	5150	040 0013 IB	A

**PS3**

FOOT

0,40  
1,55  
0,40  
*4 x 120 kg*

**PS4**

FOOT

0,40  
1,98  
0,40  
*4 x 190 kg*

**PS5**

FOOT

0,40  
1,98  
0,40  
*4 x 220 kg*

UNDERCARRIAGE

*Complete*

*Transport*

SUPPORT (Opcional)

SUPPORT

CETA

PLATFORM

UNDERCARRIAGE

*Complete*

*Transport*

TRAVELLING

TRAVELLING

FASTENING

ARM

DIAGONAL

CETA

PLATFORM

PLATFORM

GUARD RAIL

LADDER

UNDERCARRIAGE

*Complete*

*Transport*

SUPPORT (Opcional)

SUPPORT

CETA

PLATFORM

UNDERCARRIAGE

*Complete*

*Transport*

TRAVELLING

TRAVELLING

FASTENING

ARM

DIAGONAL

CETA

PLATFORM

PLATFORM

GUARD RAIL

LADDER



## UNDERCARRIAGE

Complete

Transport

ARM

PLATFORM

PLATFORM

LADDER

---

**UNDERCARRIAGE**

TRAVELLING

TRAVELLING

CROSSTIE

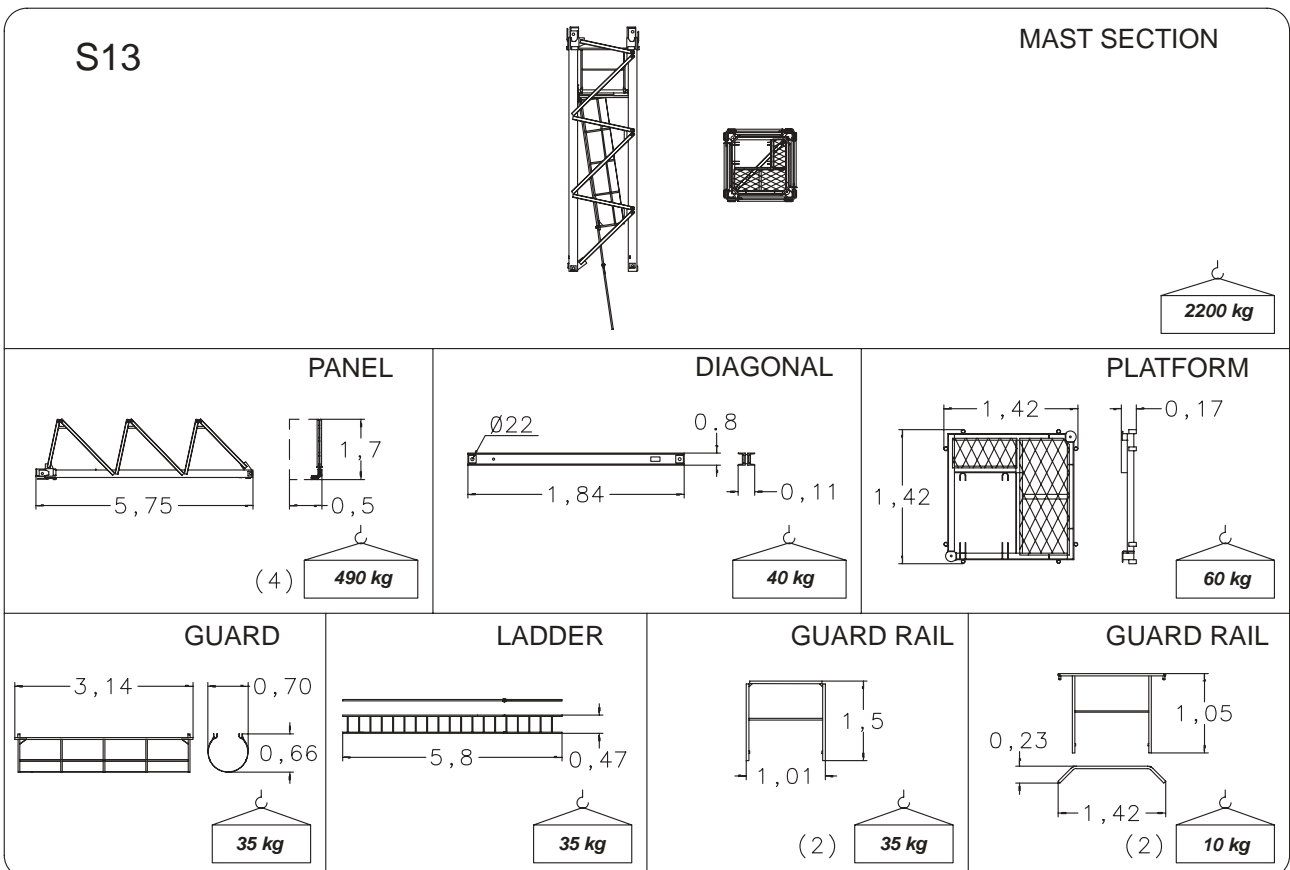
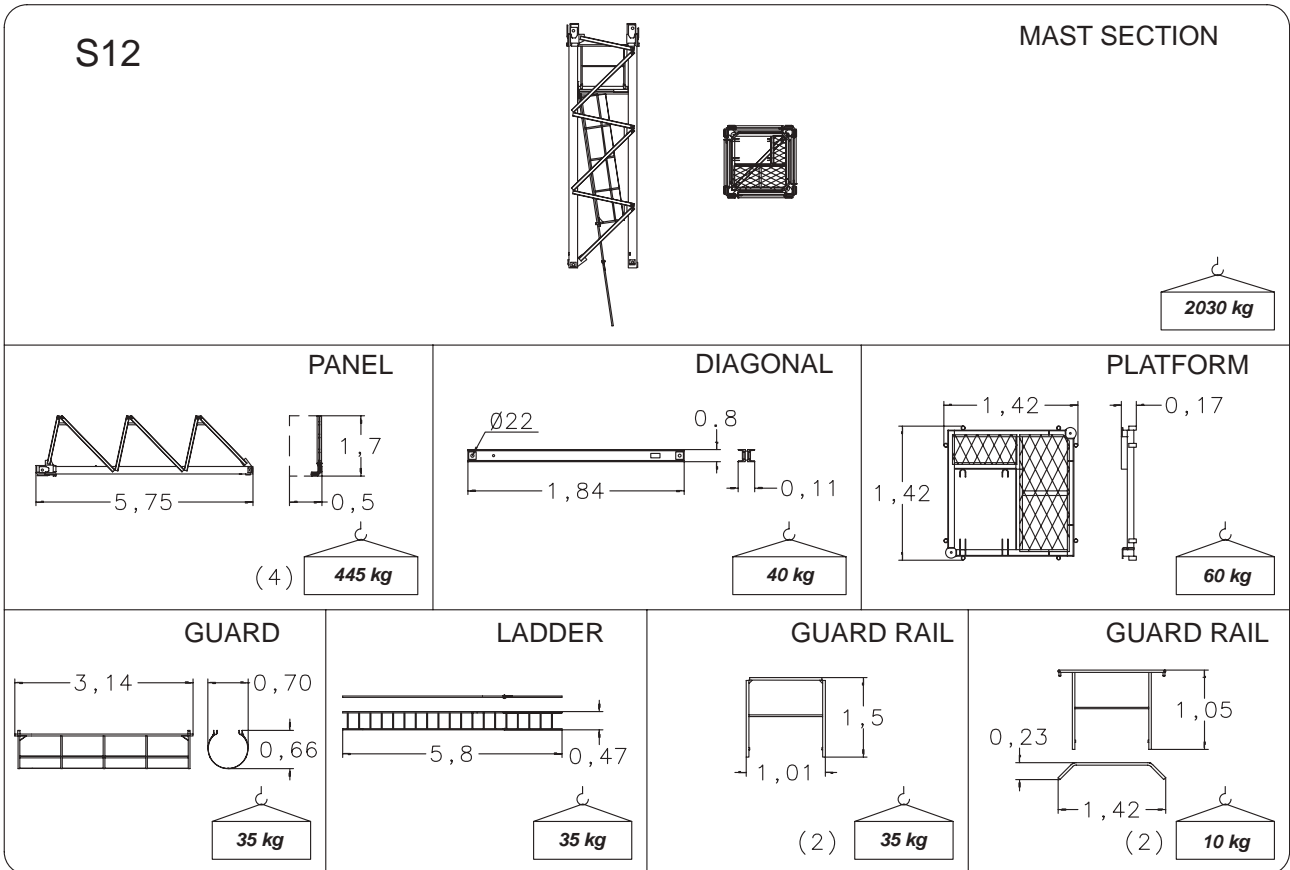
Transport

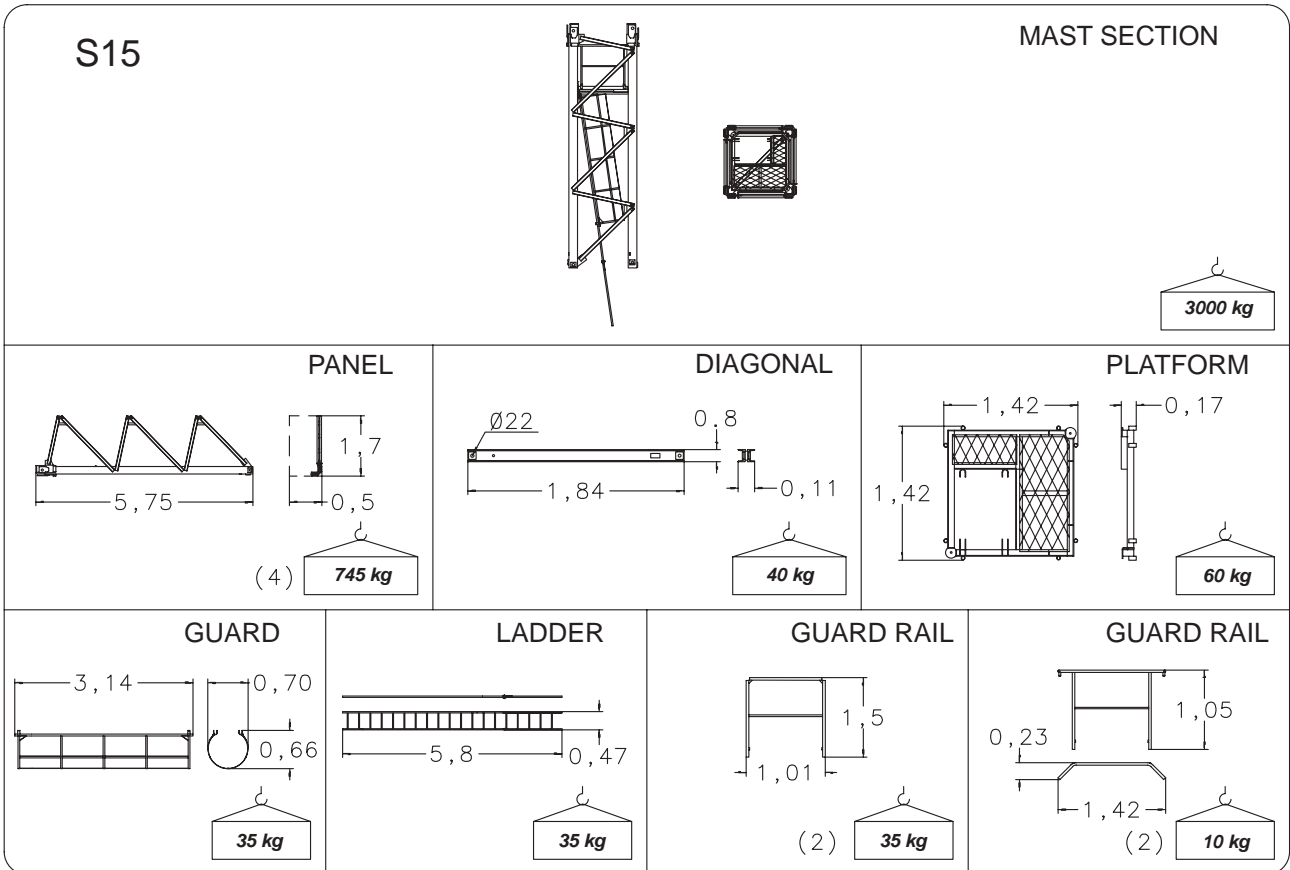
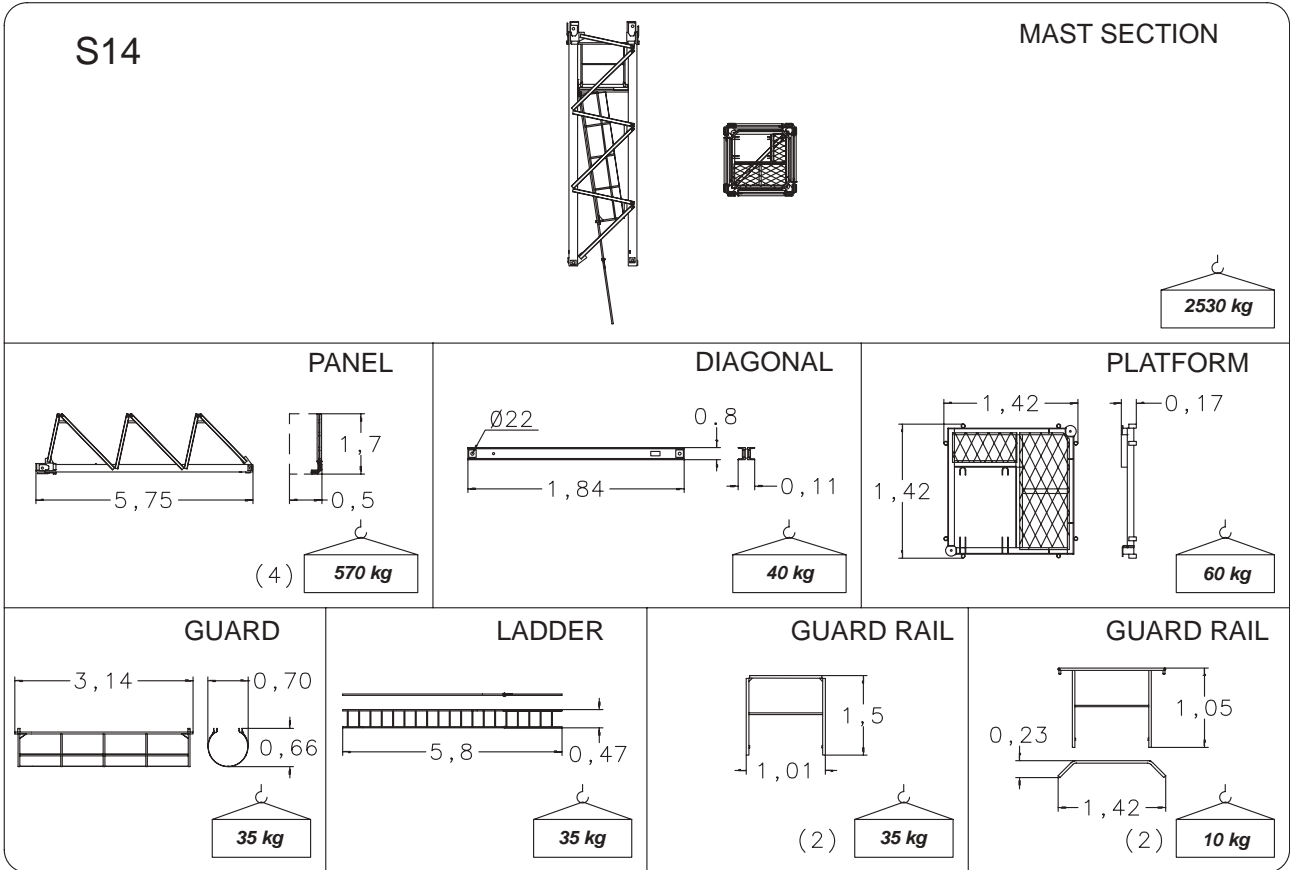
ARM

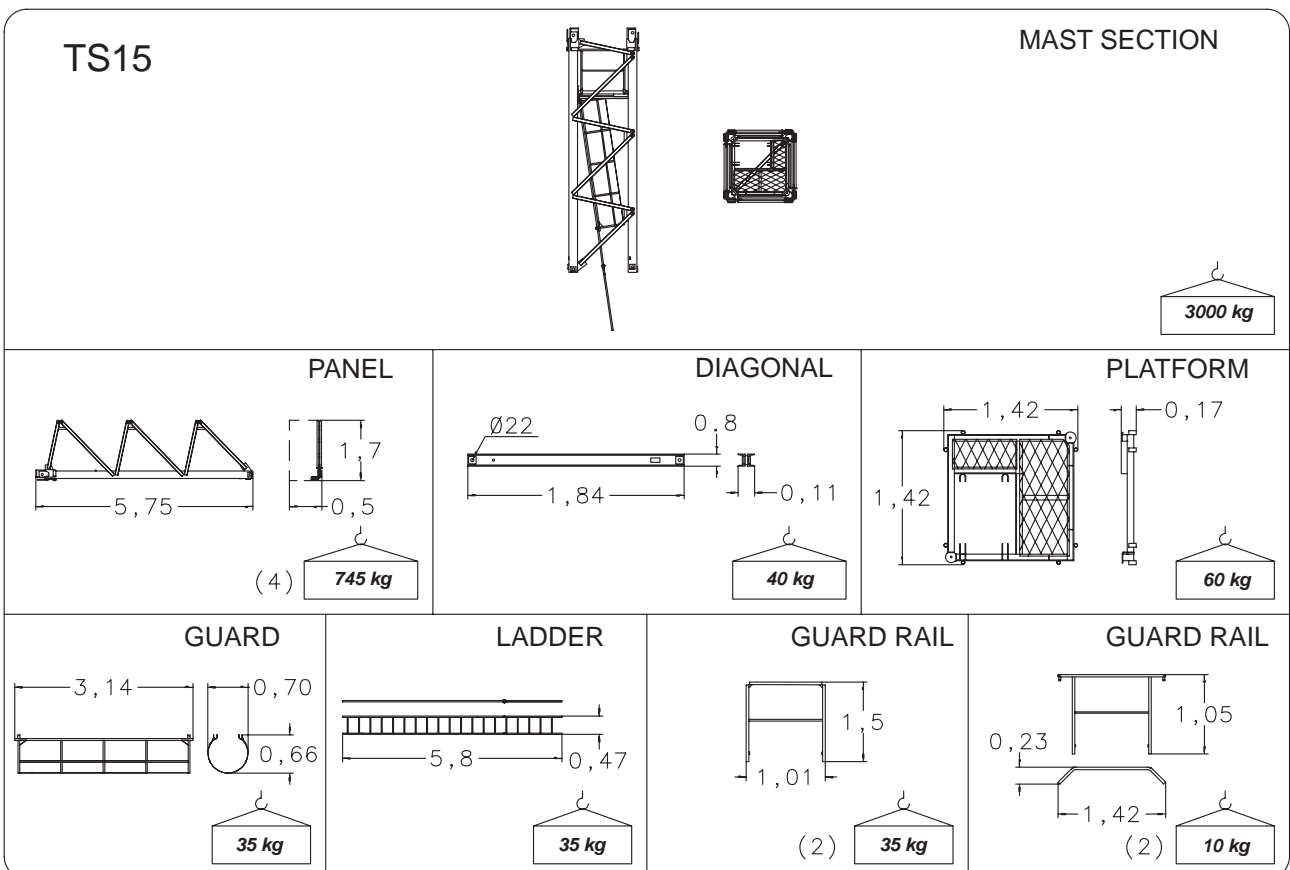
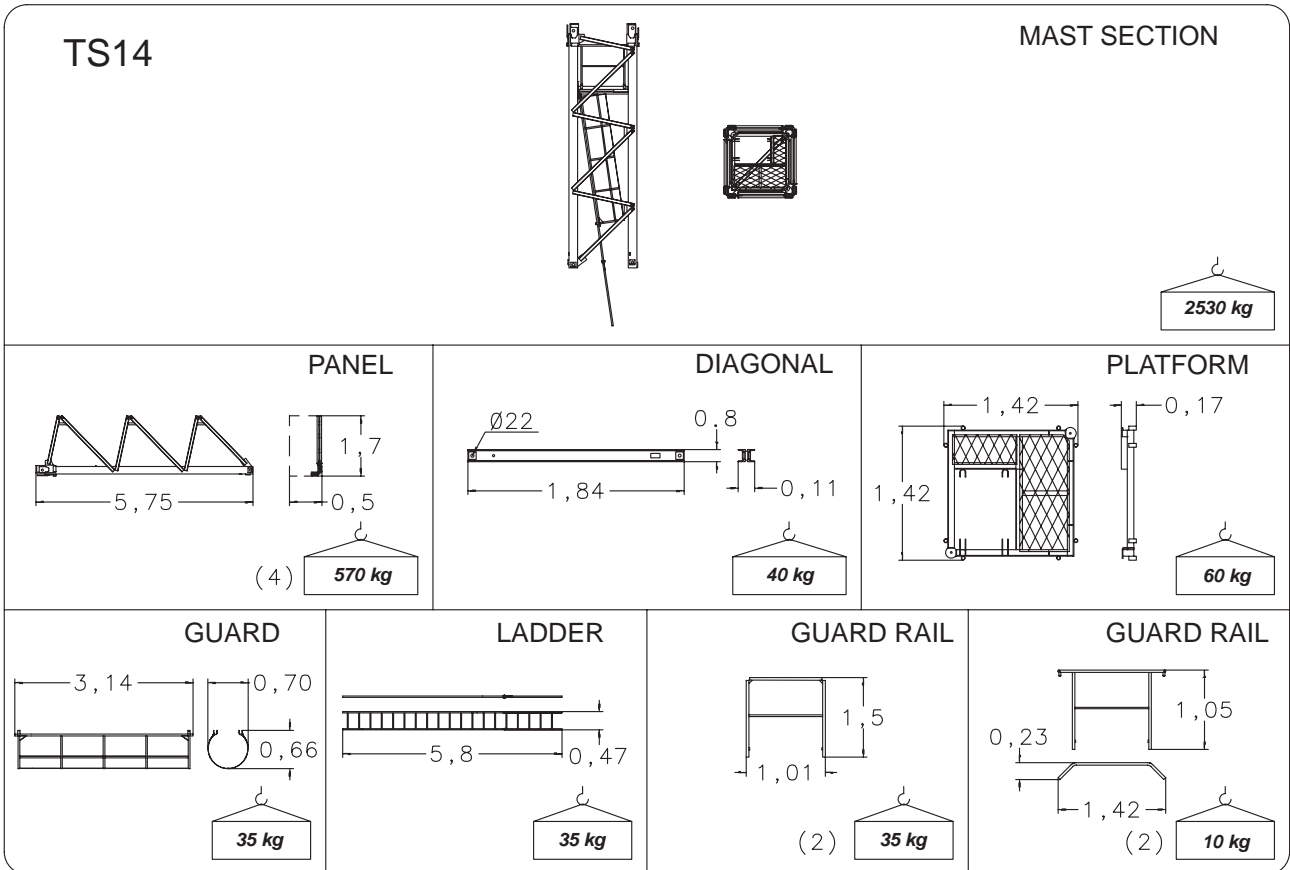
PLATFORM

PLATFORM

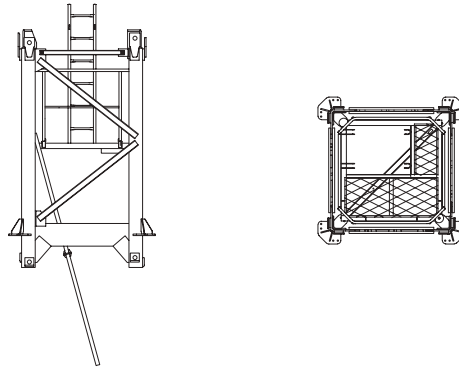
LADDER





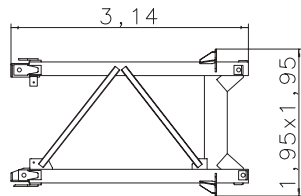


S13J



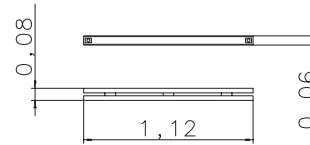
1630 kg

SECTION



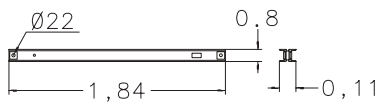
1385 kg

DIAGONAL



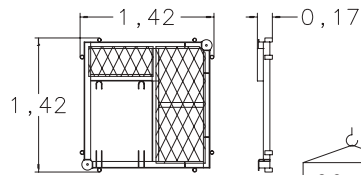
4x 13 kg

DIAGONAL



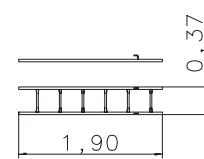
35 kg

PLATFORM



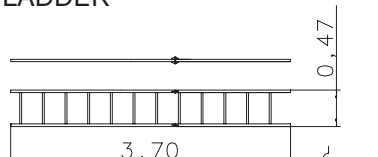
66 kg

LADDER



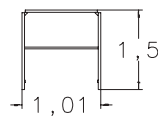
11 kg

LADDER



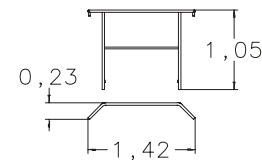
27 kg

GUARD RAIL



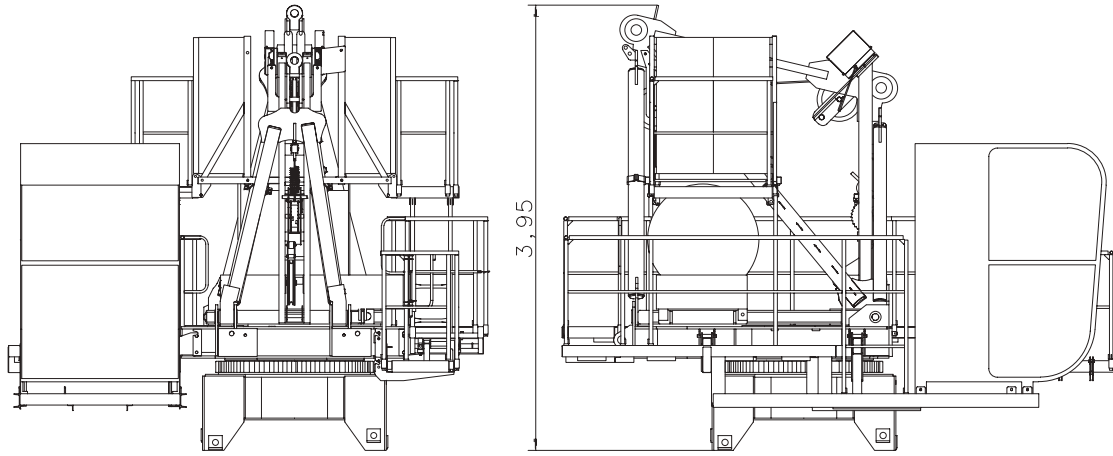
(2) 8 kg

GUARD RAIL



(2) 9 kg

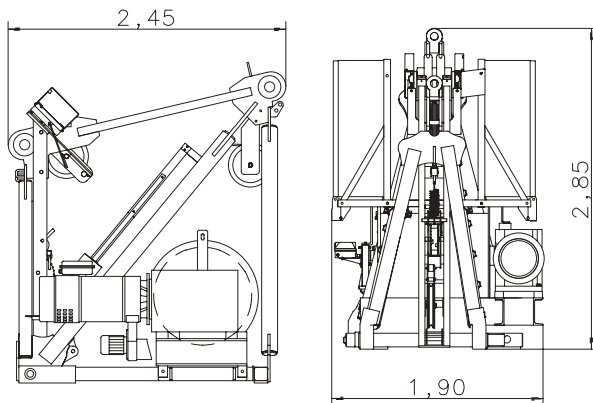
CM111/S13



WITHOUT MECHANISM

6500 kg

CAT HEAD



EFU2-24

1600 kg

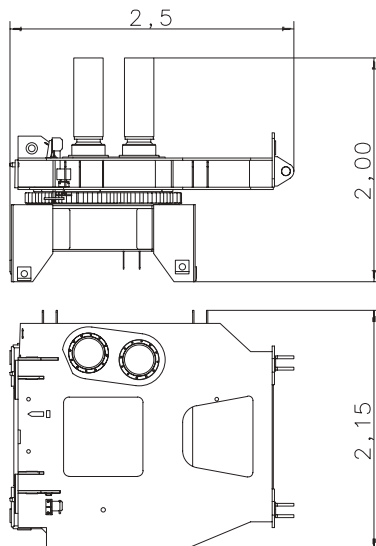
EFU2-37

2300 kg

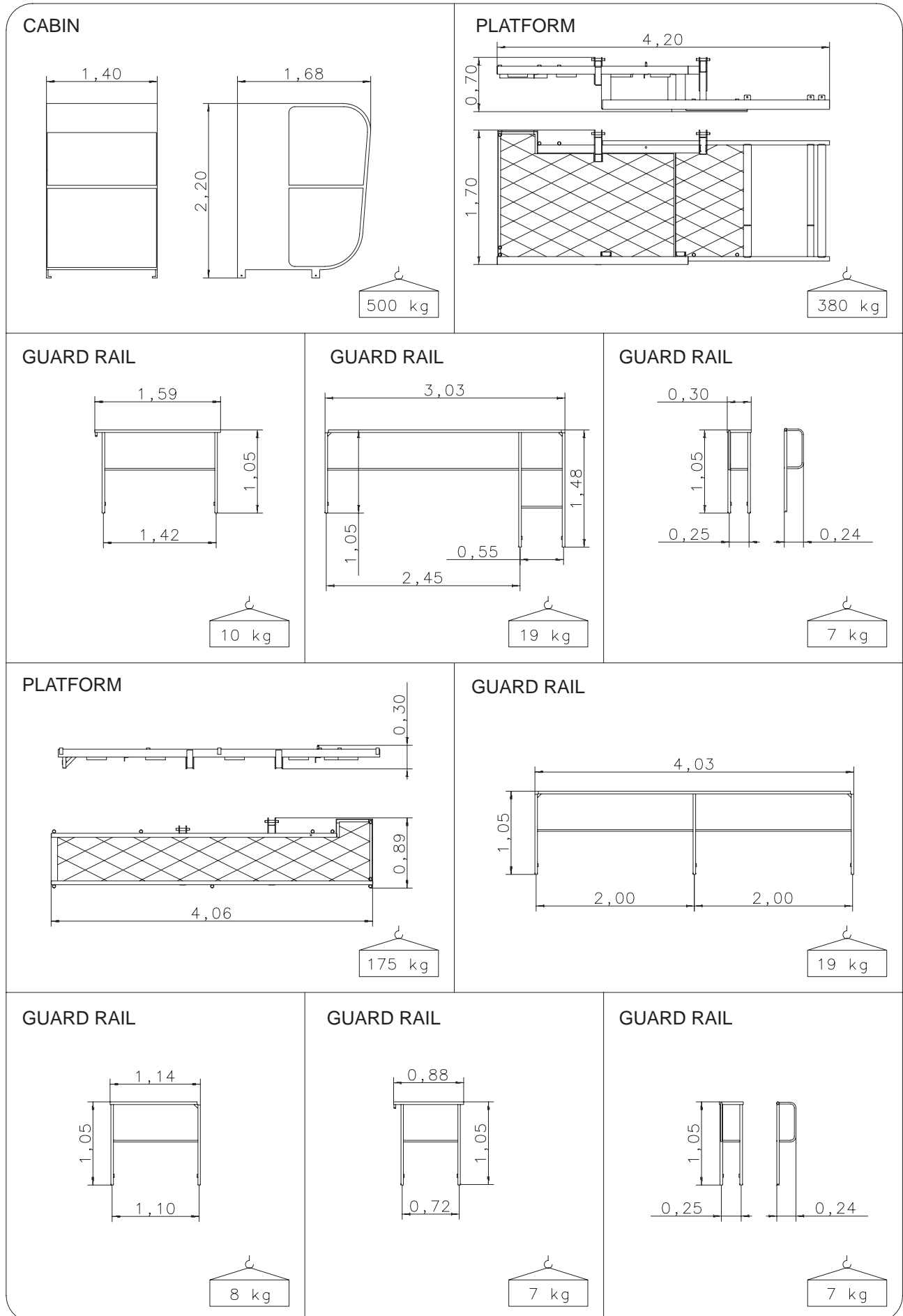
WITHOUT MECHANISM

1500 kg

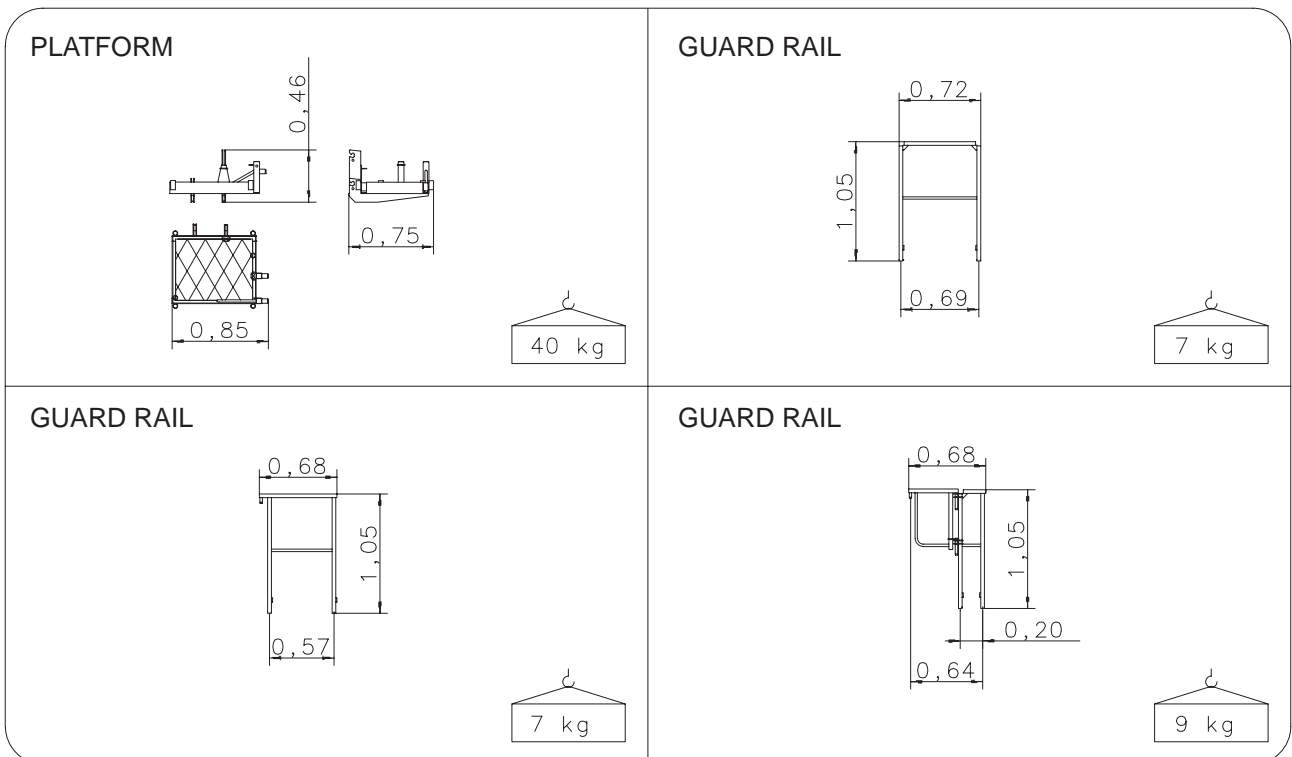
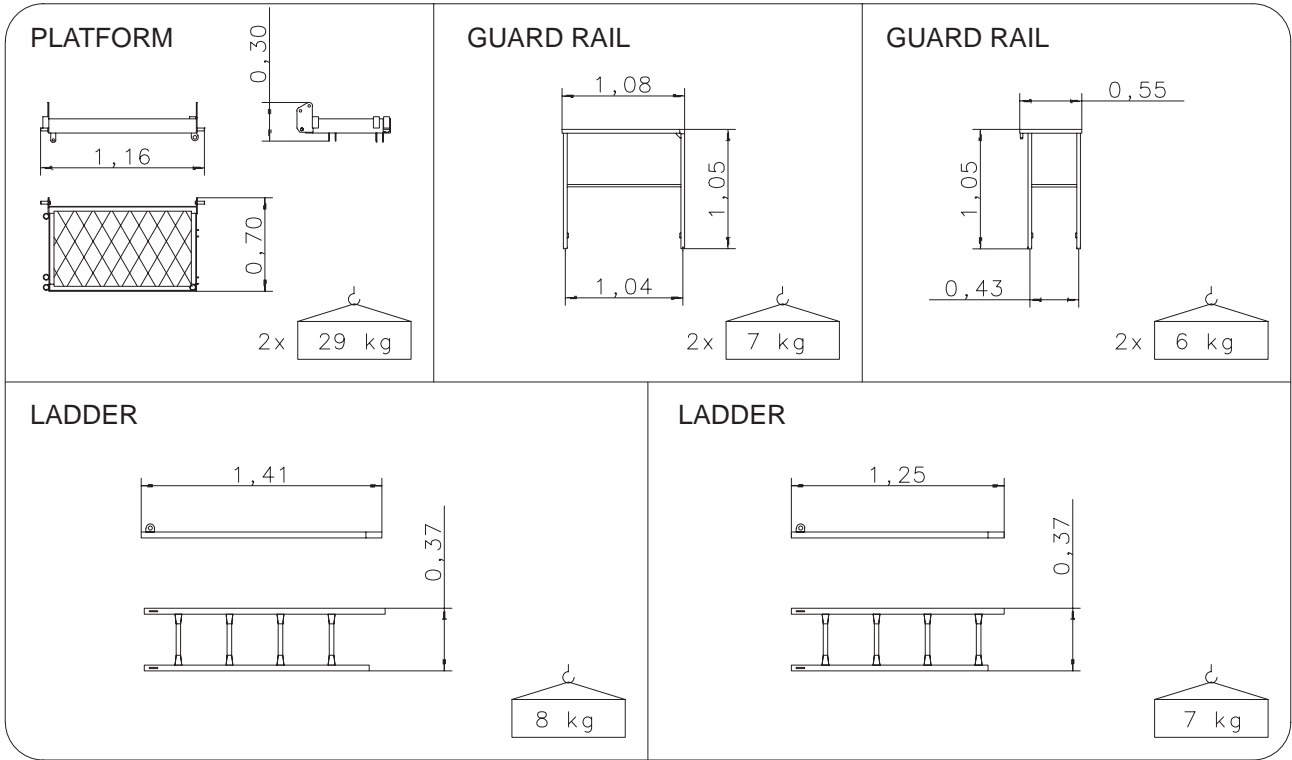
SLEWING RING SUPPORT



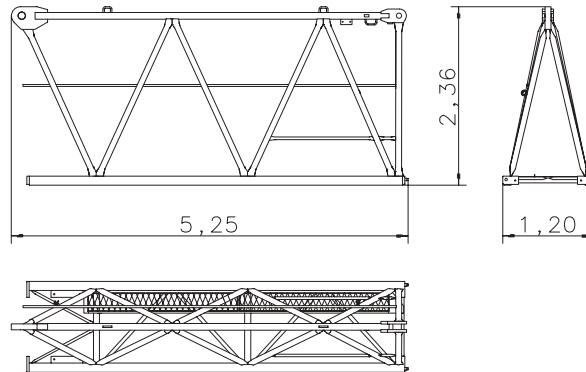
3700 kg





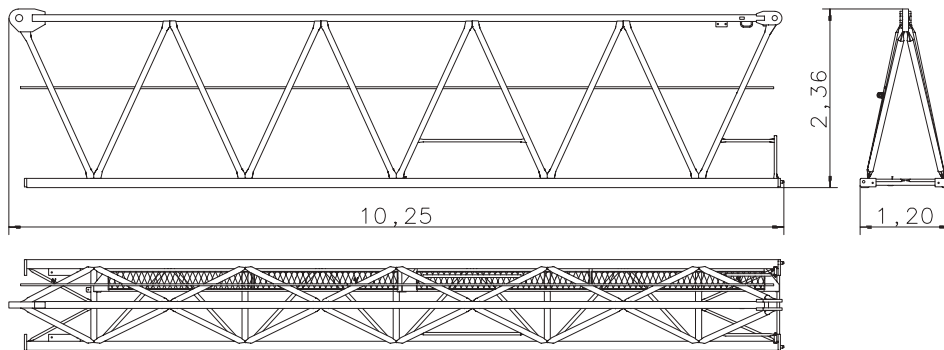


AM185



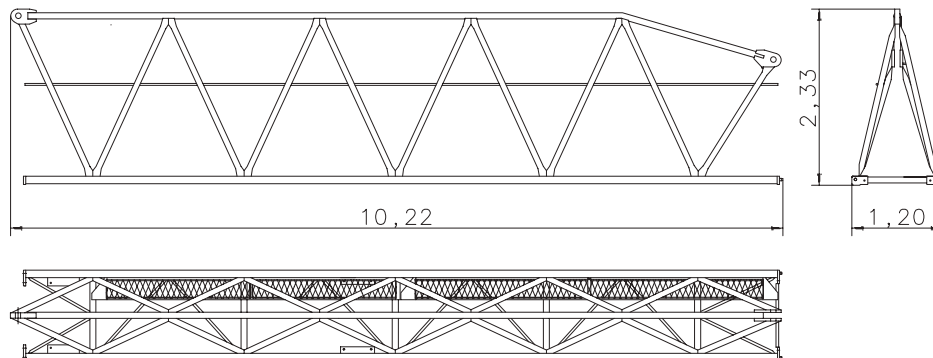
1070 kg

AM183



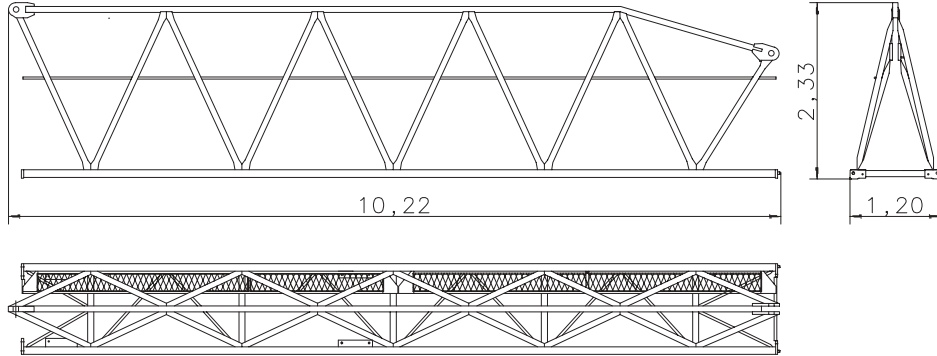
2000 kg

AM172A SECTION FIRST



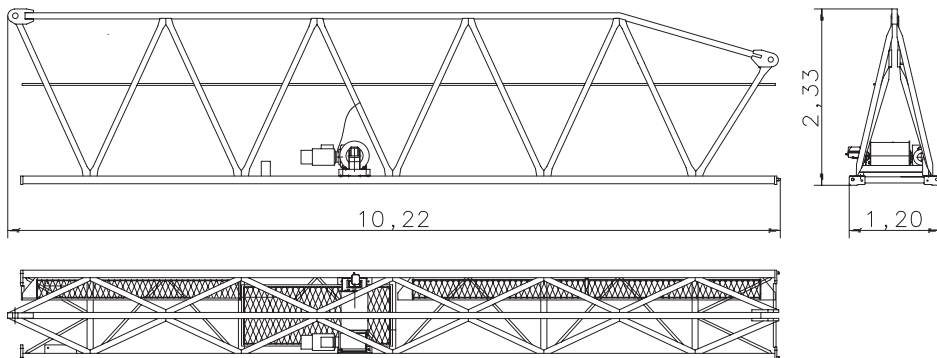
1700 kg

**AM172A INTERMEDIATE SECTION**



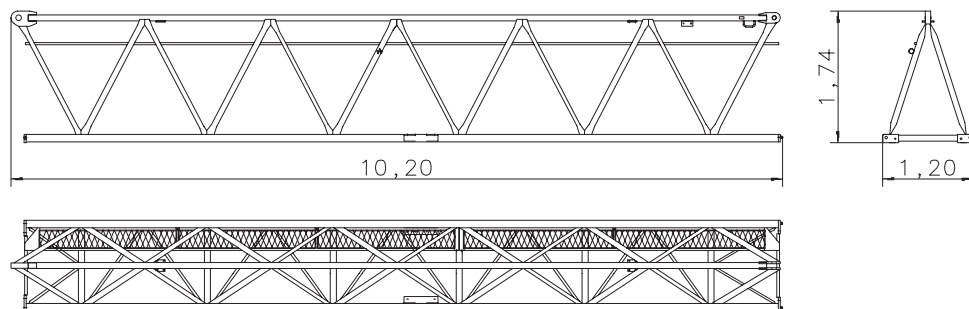
1710 kg

**AM172A WITH TROLEY MECHANISM**



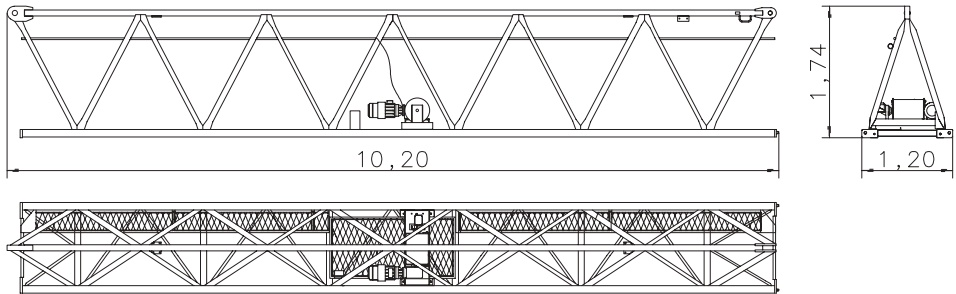
2030 kg

**AM161 INTERMEDIATE SECTION**



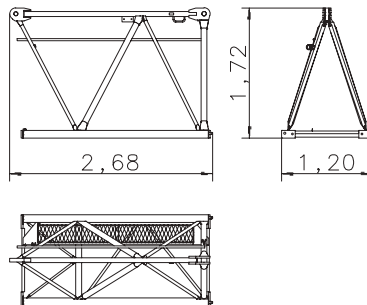
1420 kg

**AM161 WITH TROLEY MECHANISM**



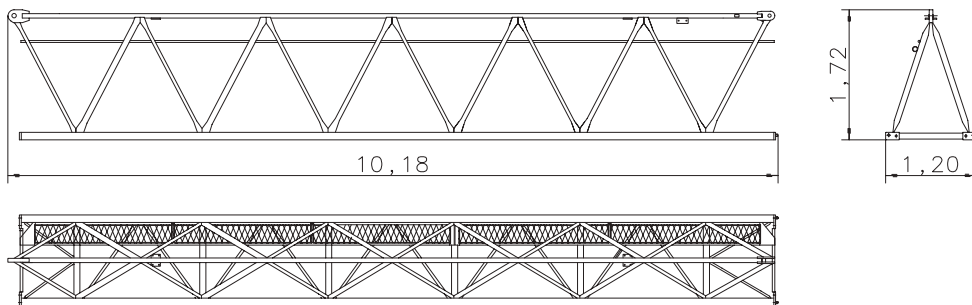
1580 kg

**AM163**



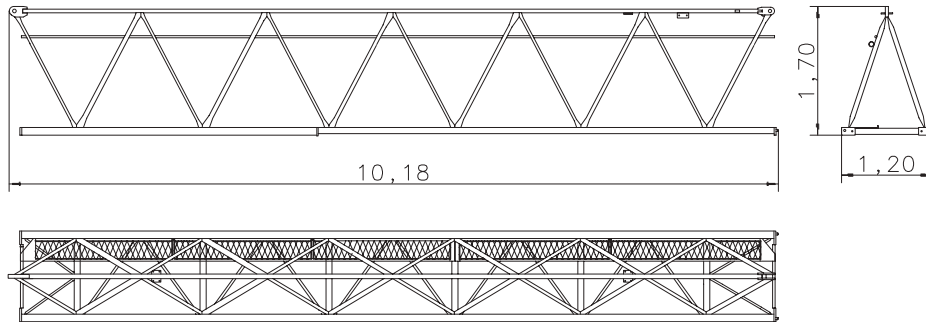
320 kg

**AM151**



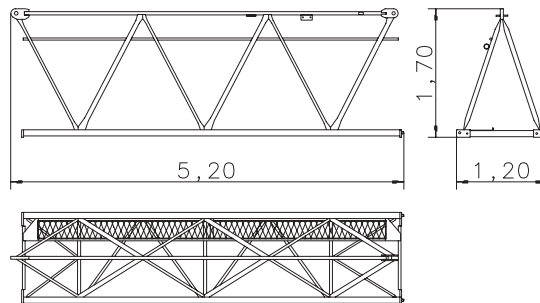
1000 kg

AM140



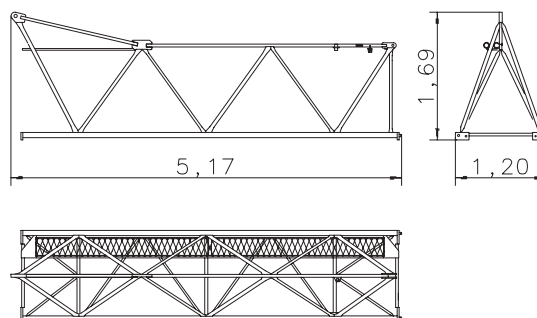
725 kg

AM145



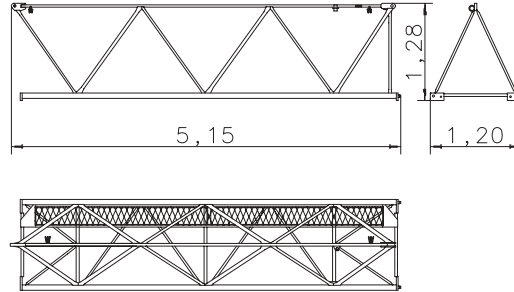
330 kg

AM125



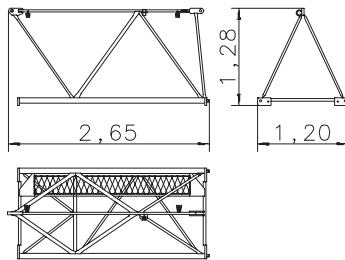
270 kg

AM115



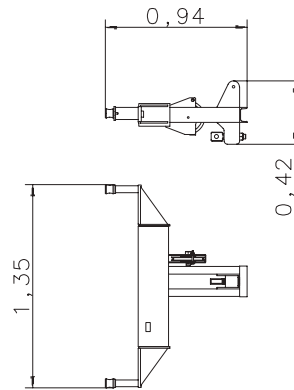
230 kg

AM112



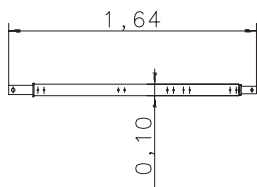
125 kg

JE101



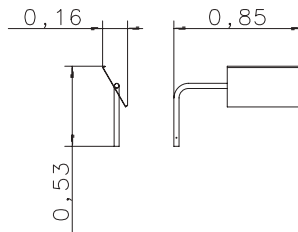
80 kg

STRUT



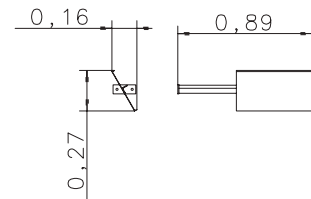
20 kg

INDICATOR



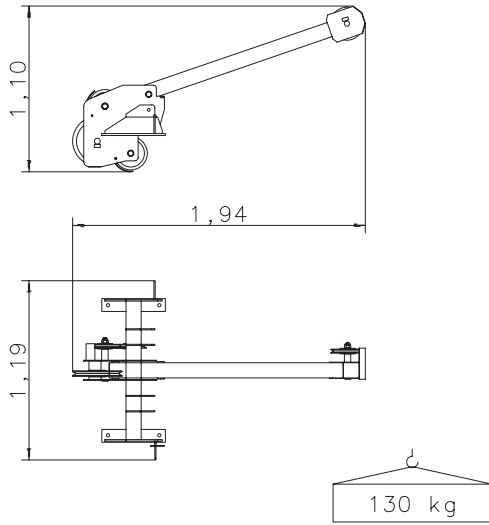
5 kg

INDICATOR

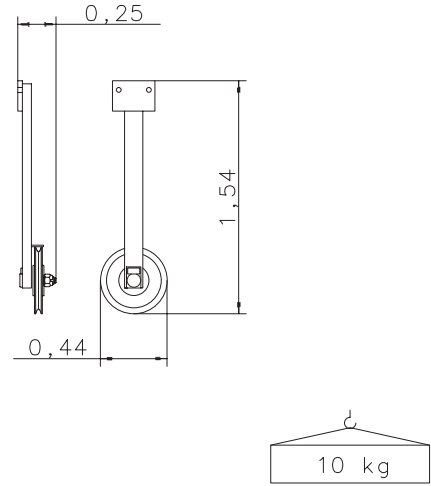


5 kg

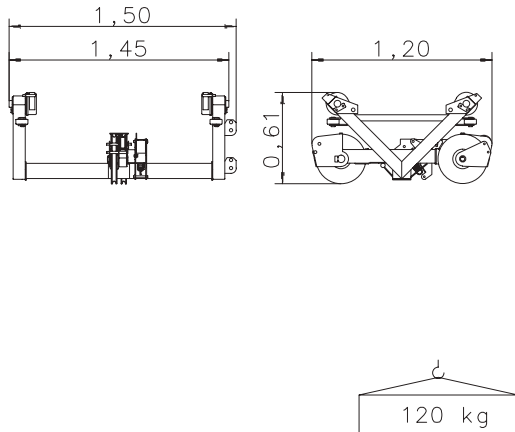
PULLEY SUPPORT



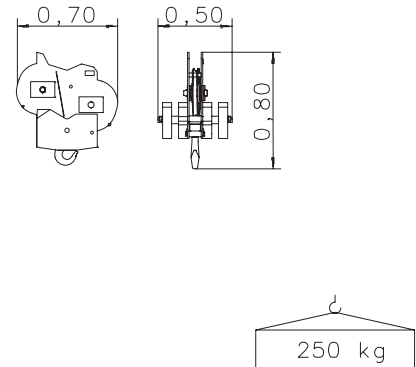
PULLEY SUPPORT



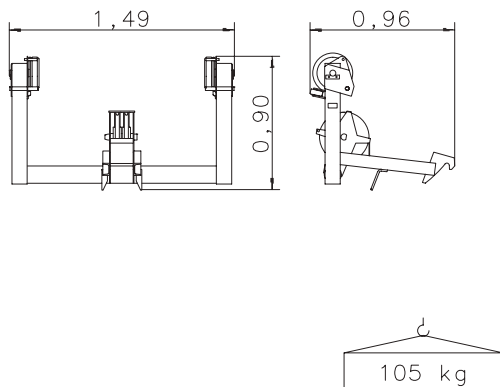
FRONT TROLLEY



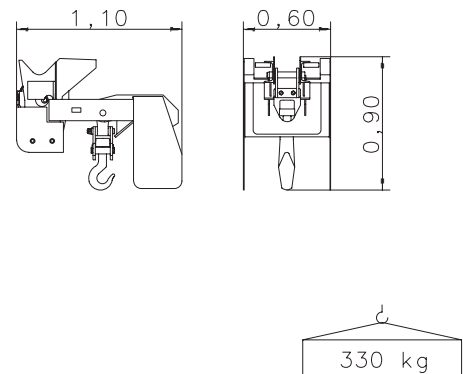
FRONT HOOK



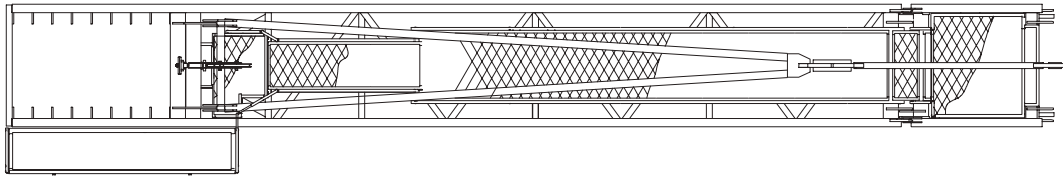
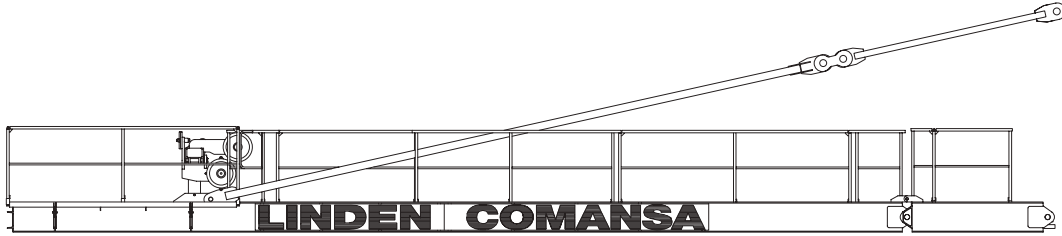
BACK TROLLEY



BACK HOOK

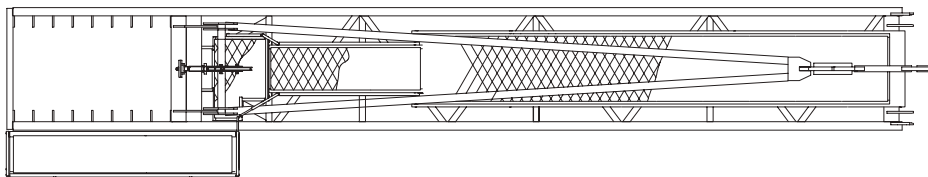
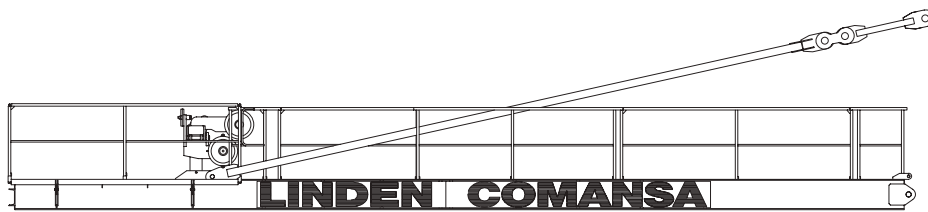


### COUNTERJIB EC06 + EC07



3750 kg

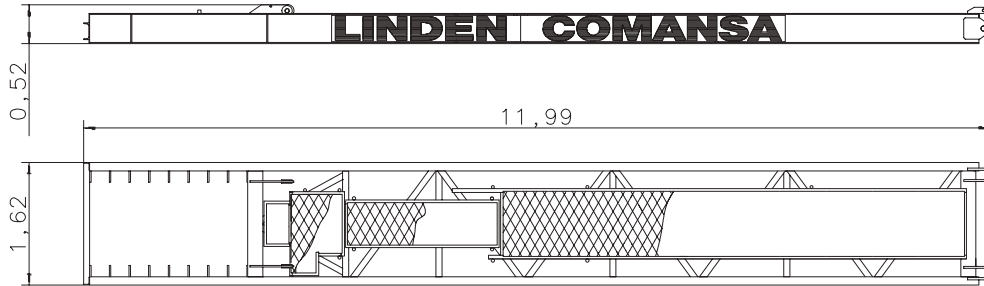
### COUNTERJIB EC06



3000 kg

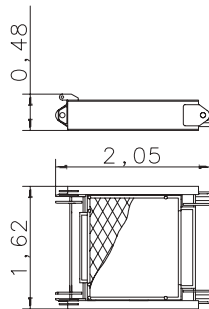


**EC06 COUNTERJIB SECTION**



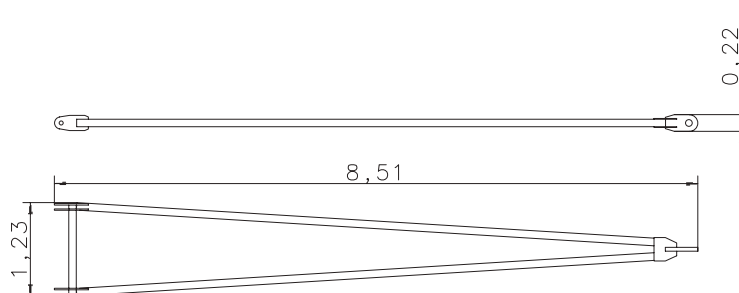
2500 kg

**EC07 COUNTERJIB SECTION**



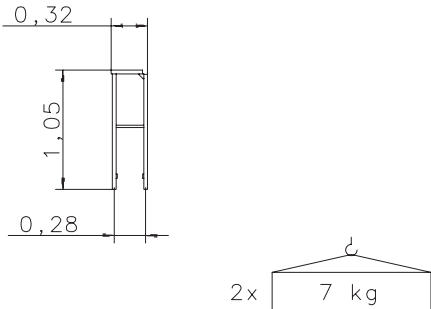
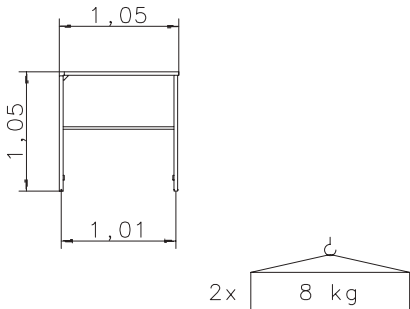
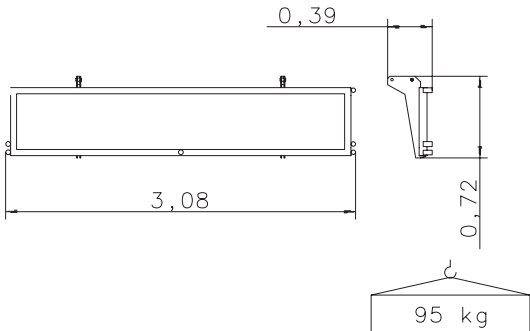
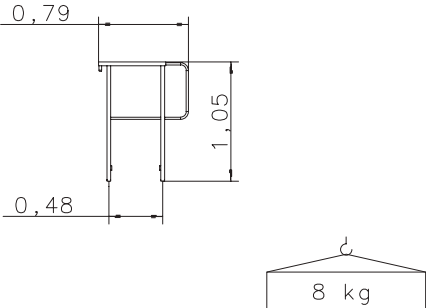
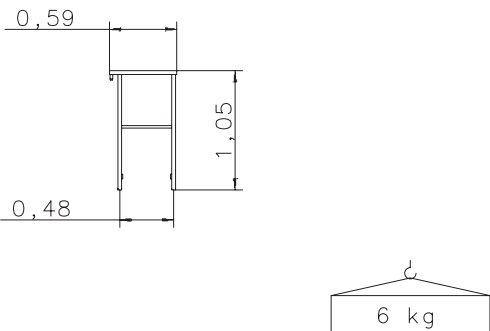
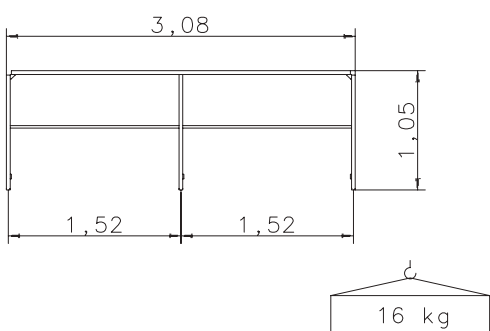
650 kg

**COUNTERJIB STRUT**



535 kg

<p><b>COUNTERJIB STRUT</b></p> <p>85 kg 155 kg</p>	<p><b>PULLEY SUPPORT</b></p> <p>170 kg</p>
<p><b>GUARD RAIL</b></p> <p>6 kg</p>	<p><b>GUARD RAIL</b></p> <p>5 kg</p>
<p><b>GUARD RAIL</b></p> <p>2x 11 kg</p>	<p><b>GUARD RAIL</b></p> <p>2x 16 kg</p>
<p><b>GUARD RAIL</b></p> <p>16 2x 16 kg</p>	<p><b>GUARD RAIL</b></p> <p>2x 7 kg</p>

<p>GUARD RAIL</p> 	<p>GUARD RAIL</p> 
<p>PLATFORM</p> 	<p>GUARD RAIL</p> 
<p>GUARD RAIL</p> 	<p>GUARD RAIL</p> 
Empty section for additional specifications	

J1

CLIMBING SECTION

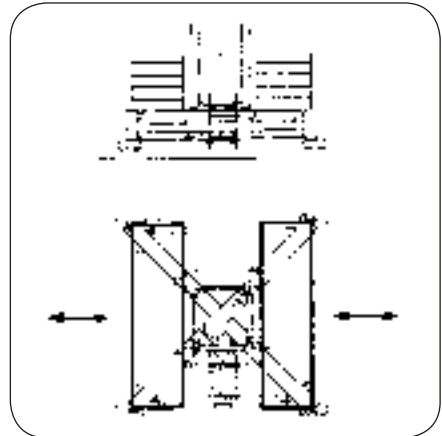
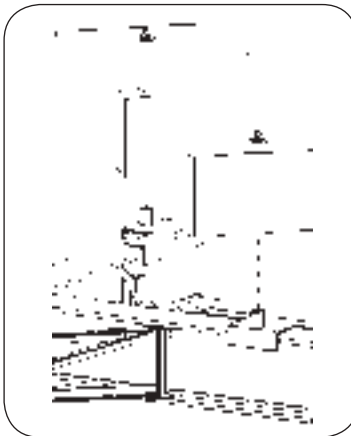
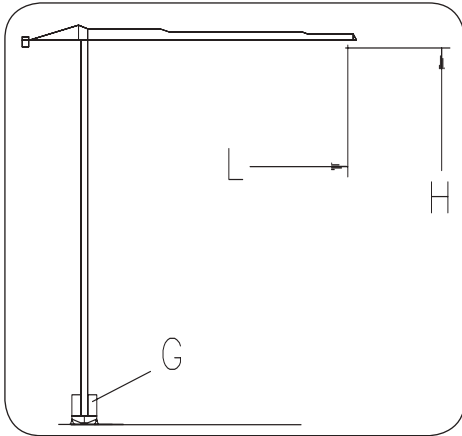
			2,30	
	8,90		2,10	<b>Complete 5150 kg</b>
				<b>Frame 1 x 2700 kg</b>
	MONORAIL CABLE SUPPORT HOOK CABLE SUPPORT HOOK			LADDER
3,58				0,47
	0,75	0,33	1,77	6,30
	<b>1 x 130 kg</b>	<b>1 x 25 kg</b>	<b>1 x 30 kg</b>	<b>1 x 50 kg</b>
	PLATFORM	PLATFORM	PLATFORM	PLATFORM
	0,99	0,80	0,80	0,80
2,13	3,51		2,13	3,51
	<b>1 x 50 kg</b>	<b>1 x 85 kg</b>	<b>1 x 50 kg</b>	<b>1 x 85 kg</b>
	PLATFORM	PLATFORM	PLATFORM	GUARD RAIL
	0,80	0,80	0,63	1,10
3,41	3,41		2,25	3,44
	<b>1 x 65 kg</b>	<b>1 x 80 kg</b>	<b>1 x 55 kg</b>	<b>2 x 20kg</b>
	GUARD RAIL	GUARD RAIL	GUARD RAIL	GUARD
				0,70
	1,10	1,10	1,10	
2,10	3,12		0,56	4,82
	<b>3 x 15 kg</b>	<b>2 x 20 kg</b>	<b>10 x 7 kg</b>	<b>1 x 50 kg</b>

MA1

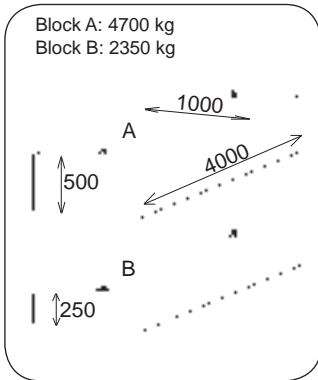
FRAME

					<b>670 kg</b>
	STRINGER		CROSSTIE		STRINGER
					0,11
	0,38		0,38		
2,21				1,27	0,11
	0,28	1,71	0,15		
					<b>4 x 30 kg</b>
	<b>2 x 160 kg</b>		<b>2 x 105 kg</b>		

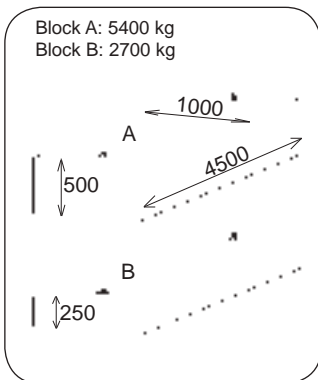
**BALLAST SUMMARY**



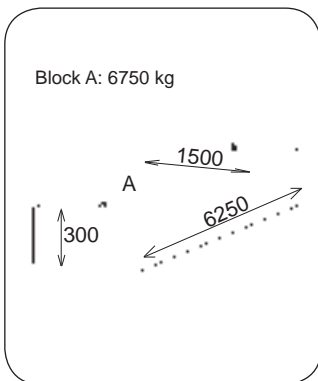
QUANTITY AND TYPE OF BALLAST BLOCKS (G) REQUIRED AS A FUNCTION OF JIB HEIGHT H (m) AND LENGTH L(m) (\*)



1XA31 / 1XR31						
<b>H(m)</b>	42,4	36,9	31,4	25,9	20,4	
<b>G</b>	22 x A	20 x A	16 x A	12 x A 2 x B	12 x A	



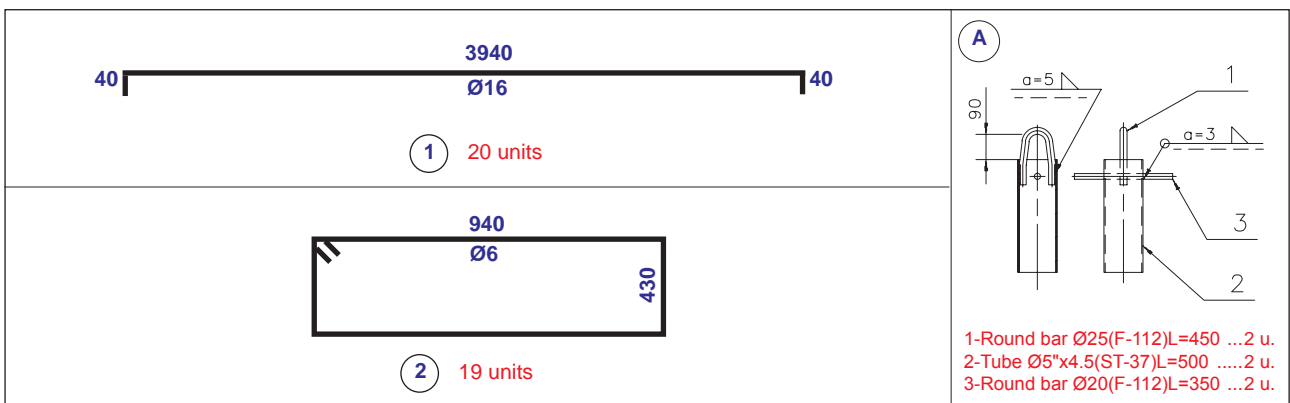
3XA51 / 3XR51						
<b>H(m)</b>	47,9	42,4	36,9	31,4	25,4	20,4
<b>G</b>	18 x A	16 x A	12 x A 2 x B	10 x A	8 x A	8 x A



5XA71 / 5XR71						
<b>H(m)</b>	59,2	53,7	48,2	42,7	37,2	31,7
<b>G</b>	12 x A	10 x A	10 x A	8 x A	6 x A	6 x A

**(\*) Note: Base ballast configurations are common for every jib length.**

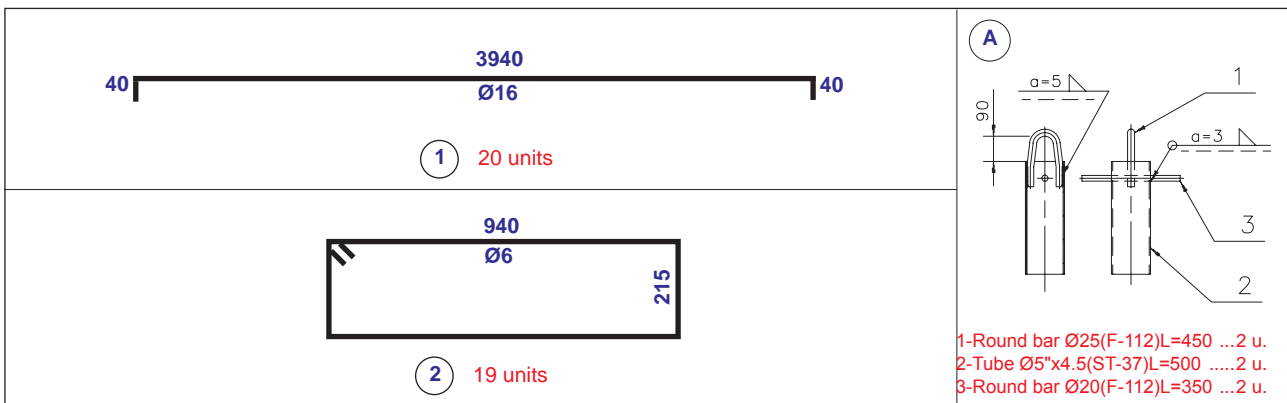
**3201P1767-1**  
**Block: 4700 kg**



Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE .....HH-300 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY) ..... **4700 kg ± 2%**  
QUALITY OF RE-BAR ..... AEH 500S

**3201P1767-2**  
**Block: 2350 kg**

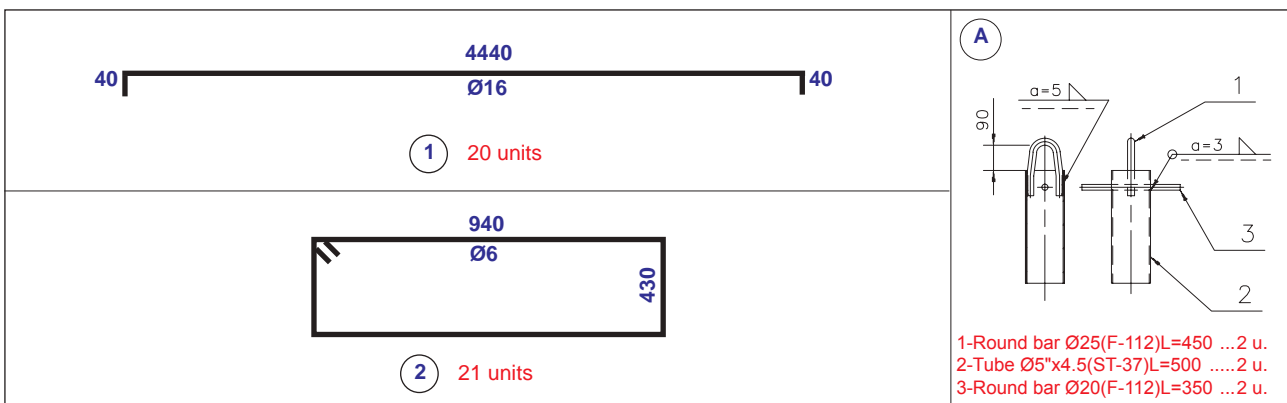


Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE ..... HH-300 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY)..... **2350 kg  $\pm$  2%**  
QUALITY OF RE-BAR..... AEH 500S



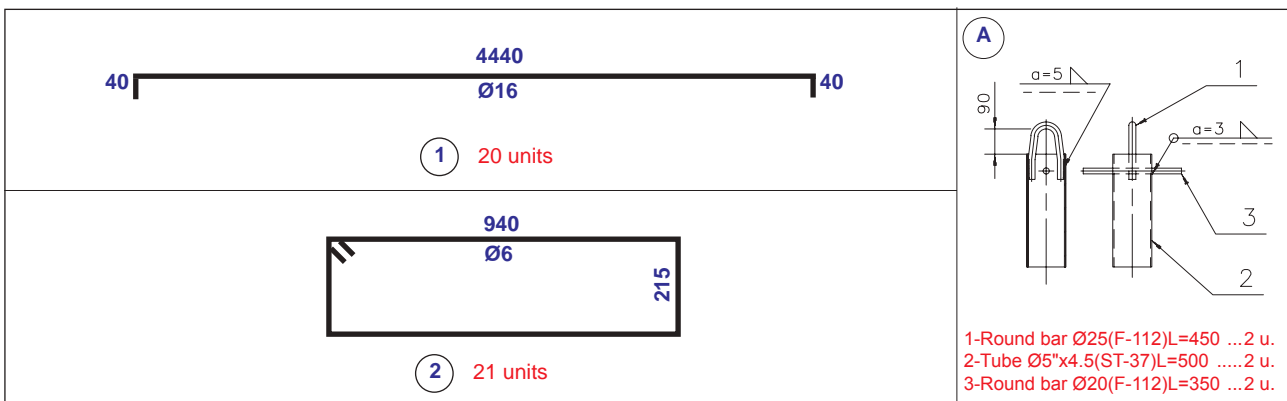
**3201P1816-1**  
**Block: 5400 kg**



Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE .....	HH-300 kg/cm <sup>2</sup>
DIMENSION OF AGGREGATE.....	19 mm
WEIGHT PER SLAB (DRY).....	<b>5400 kg ± 2%</b>
QUALITY OF RE-BAR.....	AEH 500S

**3201P1816-2**  
**Block: 2700 kg**

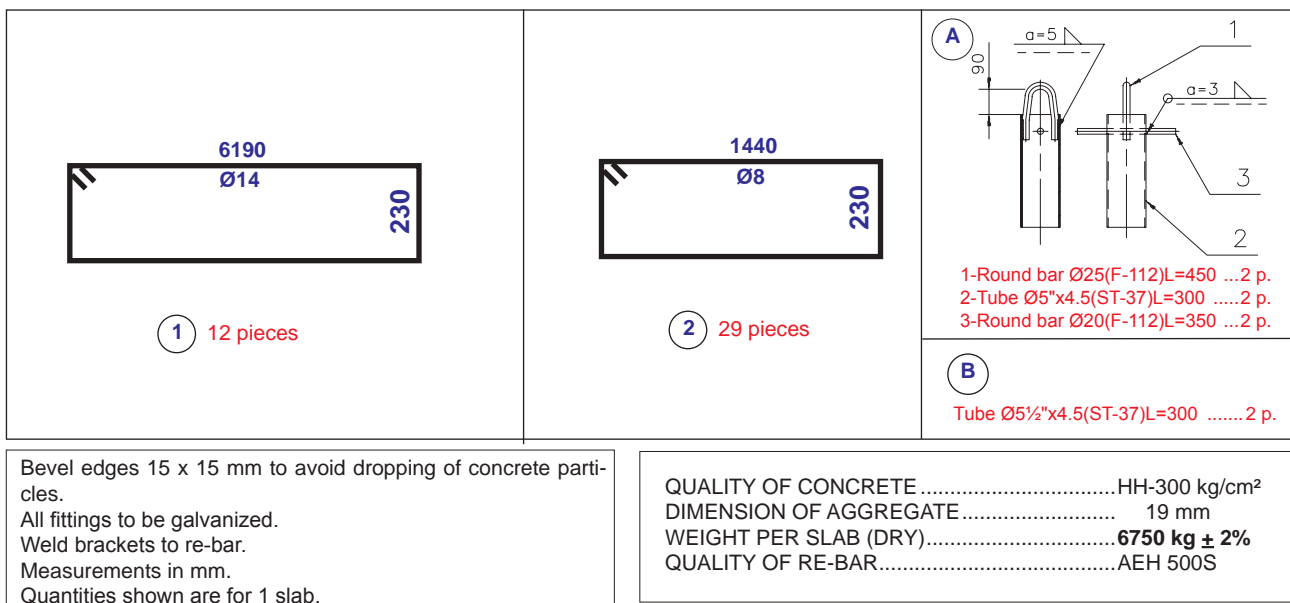


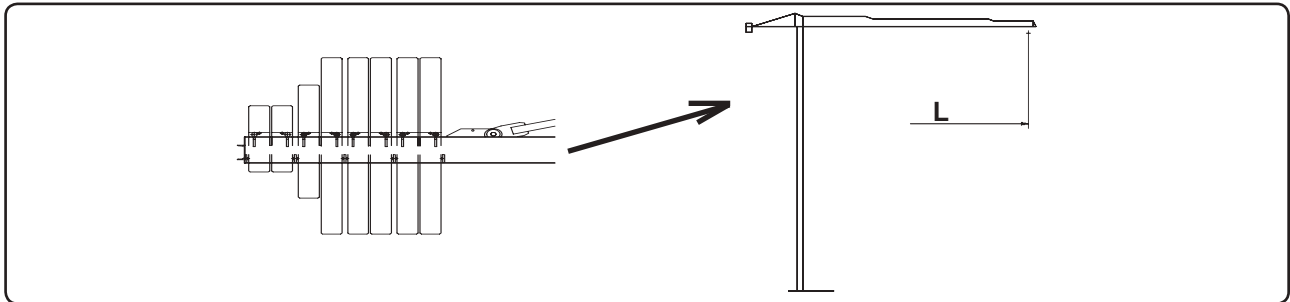
Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE .....HH-300 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY).....**2700 kg  $\pm$  2%**  
QUALITY OF RE-BAR.....AEH 500S



**3201M2034**  
**Block : 6750 kg**



Mark the slab weight in an  
indeleble way






BLOCK	WEIGHT (kg)
A	2200
B	1400
C	800

11LC150 (EFU2-24-20)													
	Lib lenght (m)												
	60	57,5	55	52,5	50	47,5	45	42,5	40	37,5	35	32,5	30
	7 x A 1 x C	7 x A 1 x C	7 x A	6 x A 1 x C	6 x A 1 x C	7 x A	6 x A 1 x C	6 x A 1 x C	6 x A	6 x A	5 x A 1 x C	4 x A 1 x C	4 x A
	7 x A 1 x C	7 x A 1 x C	7 x A	6 x A 1 x C	6 x A 1 x C	7 x A	6 x A 1 x C	6 x A 1 x C	6 x A	6 x A	5 x A 1 x C	5 x A	4 x A 1 x C

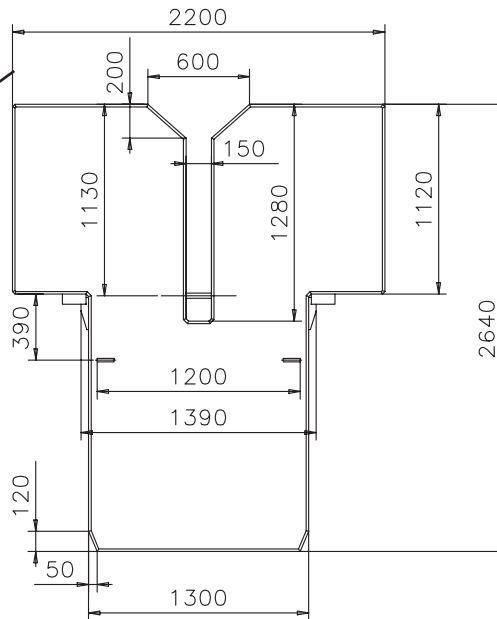
11LC150 (EFU2-37-20)													
	Lib lenght (m)												
	60	57,5	55	52,5	50	47,5	45	42,5	40	37,5	35	32,5	30
	7 x A 1 x C	7 x A 1 x C	7 x A	6 x A 1 x C	6 x A 1 x C	7 x A	6 x A 1 x C	6 x A 1 x C	6 x A	6 x A	5 x A	4 x A 1 x C	4 x A
	7 x A 1 x C	7 x A 1 x C	7 x A	6 x A 1 x C	6 x A 1 x C	7 x A	6 x A 1 x C	6 x A 1 x C	6 x A	6 x A	5 x A	5 x A	4 x A 1 x C

 Block position in counterjib is defined in documents "COUNTERWEIGHT ERECTION, BLOCK POSITION" in chapter "ASSEMBLY / DISMANTLING" and is a function of hoist drive, jib length and reeving.

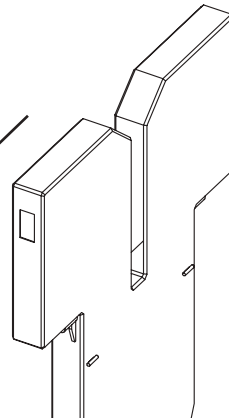
**3207-20463**



MARK THE SLAB WEIGHT  
IN AN INDELEBLE WAY.

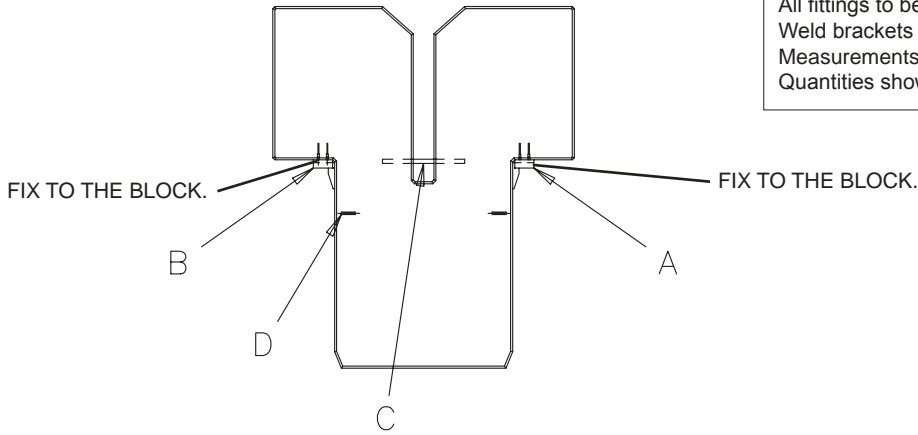


MARK THE SLAB WEIGHT  
IN AN INDELEBLE WAY.

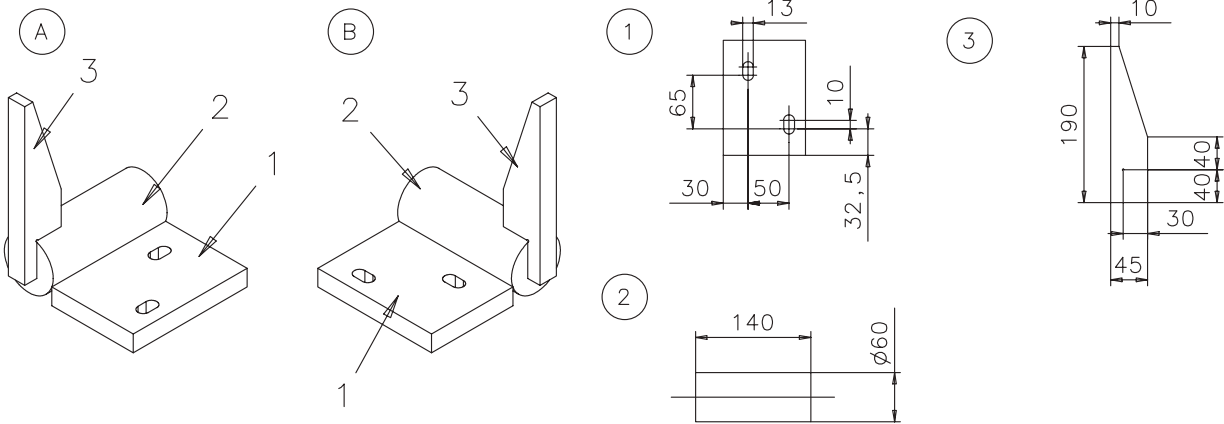


Bevel edges 20 x 20 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE ..... HH-250 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY) ..... 2200 kg + 2%  
WEIGHT OF THE STEEL ..... 180 kg  
ALL MESH ..... Ø10 (AEH 4005)

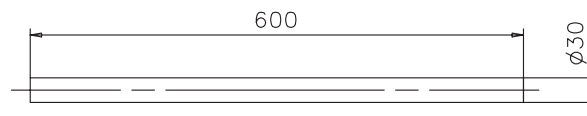


All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.



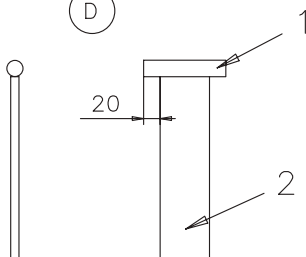
1-	Support plate	100x20	(S275JR)	L=140	1 p.
2-	Round bar	Ø60	(S355JO)	L=140	1 p.
3-	Support	190x45	(S275JR)		1 p.

(C)

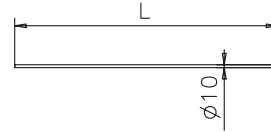
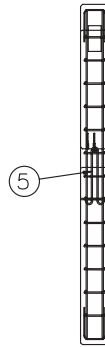
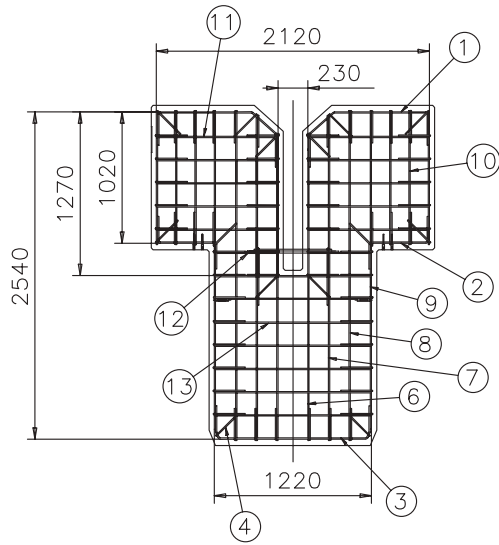


1-	Round bar	Ø30	(S355JO)	L=600	1 p.
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(D)

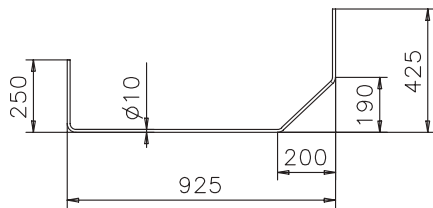


1-	Round bar	Ø20	(S355JO)	L=100	1 p.
2-	Support plate	60x10	(S275JR)	L=218	1 p.



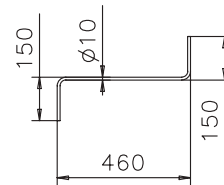
Bar number	Length	quantity
6	2380	4
7	2525	4
8	2560	4
9	2475	4
10	1040	12
11	960	20
12	510	4
13	1220	14

1



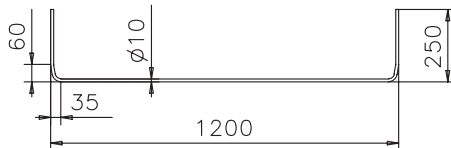
(4 Pieces)

2



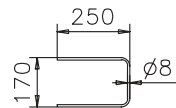
(4 Pieces)

3



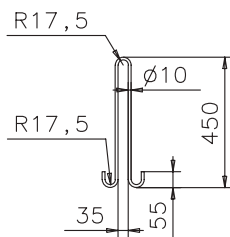
(2 Pieces)

4



(72 Pieces)

5

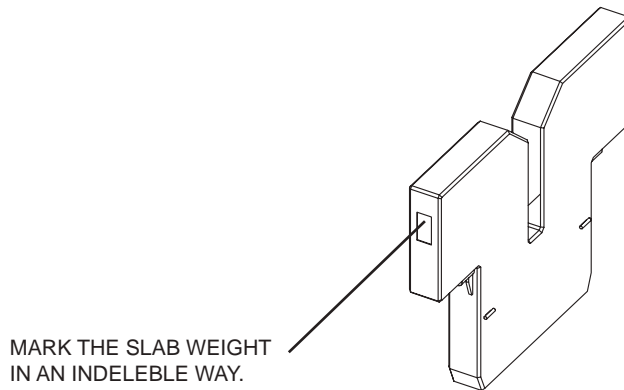
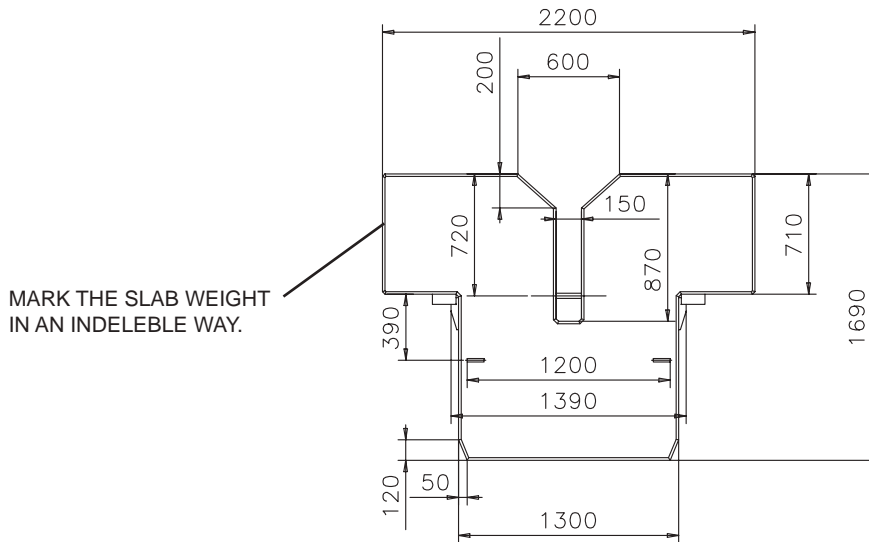


(2 Pieces)

All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

WEIGHT OF THE STEEL.....95 kg  
ALL MESH.....Ø10 (AEH 4005)

**3207-20670**

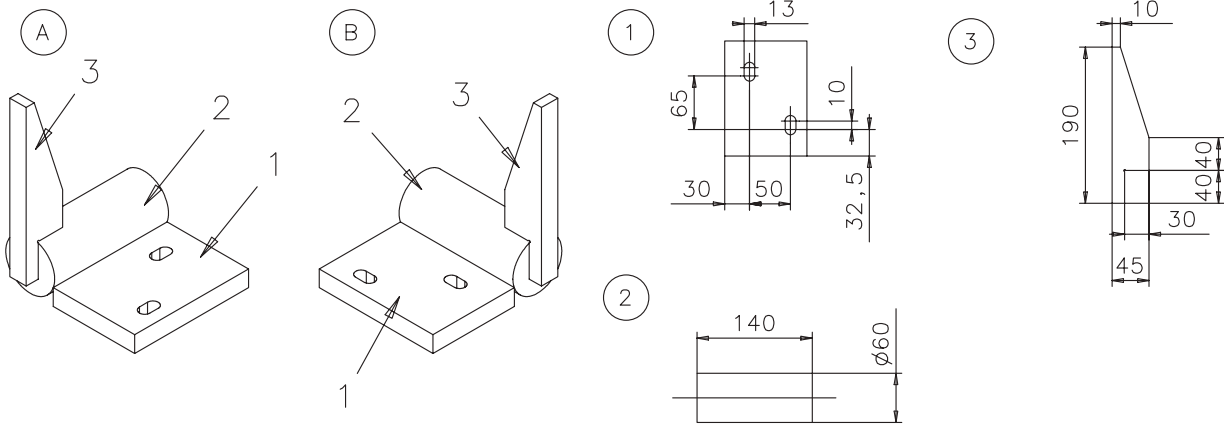
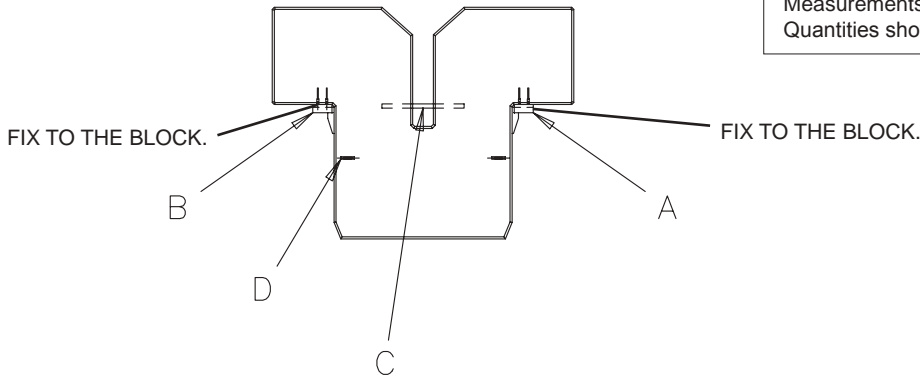


Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE ..... HH-250 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY) ..... 1400 kg + 2%  
WEIGHT OF THE STEEL ..... 76 kg  
ALL MESH ..... Ø10 (AEH 4005)

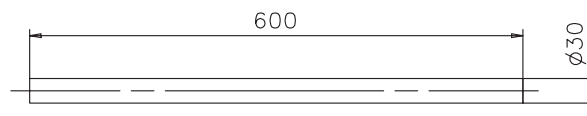


All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.



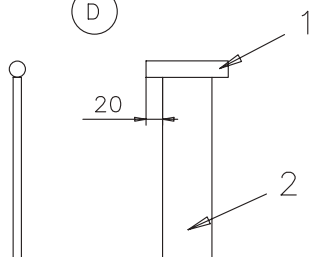
- |    |               |        |          |       |      |
|----|---------------|--------|----------|-------|------|
| 1- | Support plate | 100x20 | (S275JR) | L=140 | 1 p. |
| 2- | Round bar     | Ø60    | (S355JO) | L=140 | 1 p. |
| 3- | Support       | 190x45 | (S275JR) |       | 1 p. |

(C)

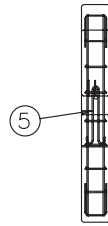
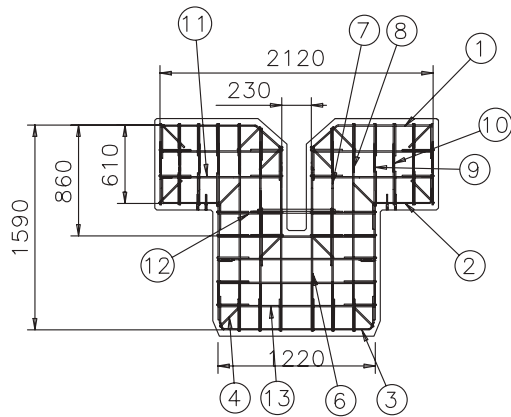


- |    |           |     |          |       |      |
|----|-----------|-----|----------|-------|------|
| 1- | Round bar | Ø30 | (S355JO) | L=600 | 1 p. |
|----|-----------|-----|----------|-------|------|

(D)

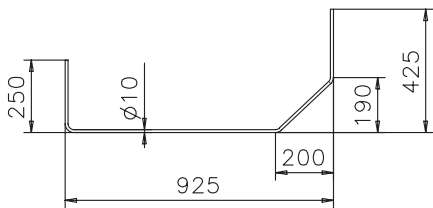


- |    |               |       |          |       |      |
|----|---------------|-------|----------|-------|------|
| 1- | Round bar     | Ø20   | (S355JO) | L=100 | 1 p. |
| 2- | Support plate | 60x10 | (S275JR) | L=218 | 1 p. |



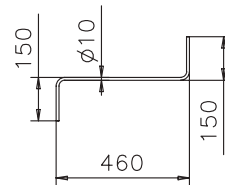
Bar number	Length	quantity
6	1430	4
7	1575	4
8	1610	4
9	1520	4
10	630	12
11	960	8
12	510	4
13	1220	8

1



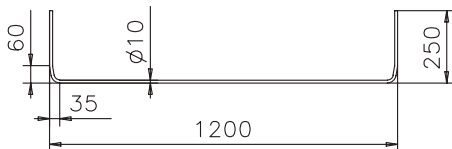
(4 Pieces)

2



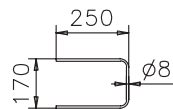
(4 Pieces)

3



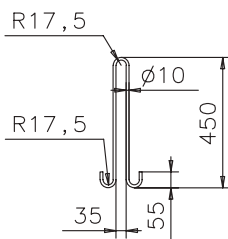
(2 Pieces)

4



(58 Pieces)

5

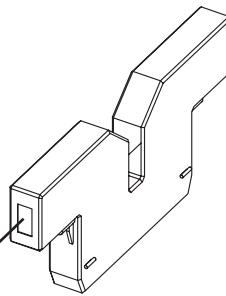
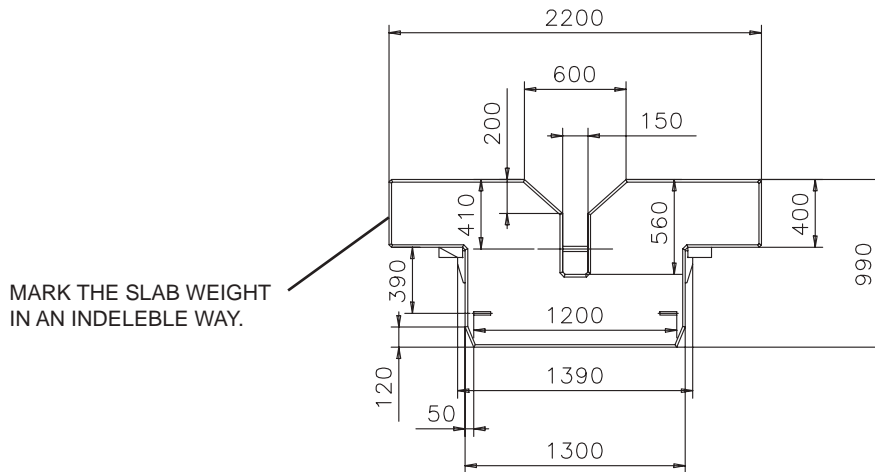


(2 Pieces)

All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

WEIGHT OF THE STEEL.....76 kg  
ALL MESH.....Ø10 (AEH 4005)

**3207-20665**

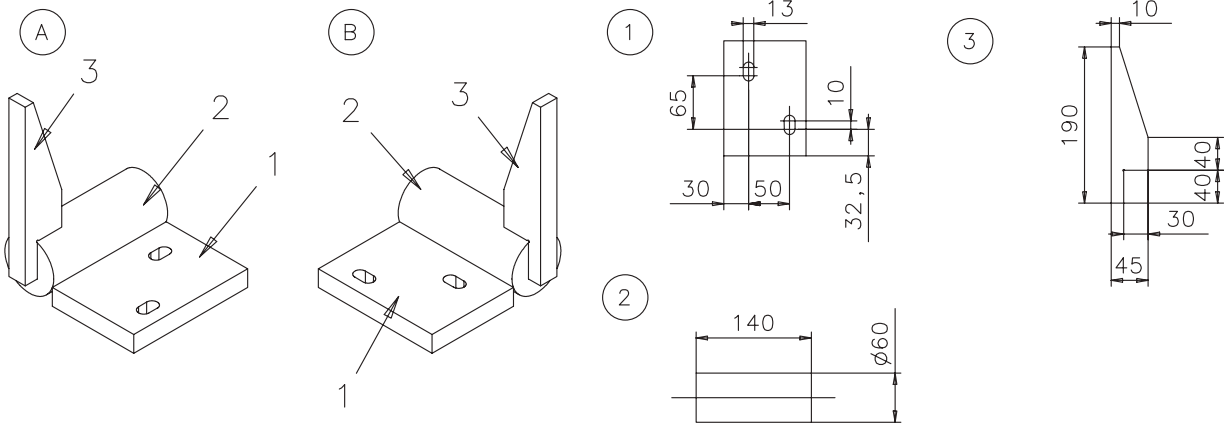
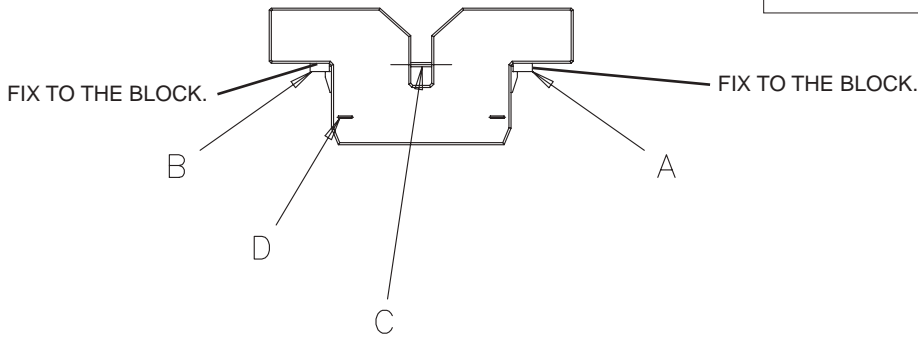


MARK THE SLAB WEIGHT  
IN AN INDELEBLE WAY.

Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

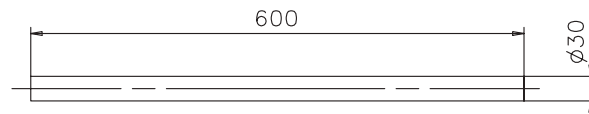
QUALITY OF CONCRETE ..... HH-250 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY) ..... 800 kg + 2%  
WEIGHT OF THE STEEL ..... 58 kg  
ALL MESH ..... Ø10 (AEH 4005)

All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.



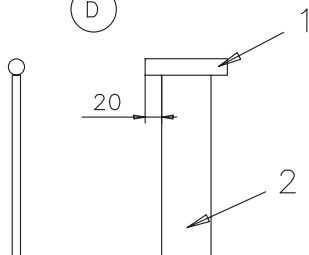
1-	Support plate	100x20	(S275JR)	L=140	1 p.
2-	Round bar	Ø60	(S355JO)	L=140	1 p.
3-	Support	190x45	(S275JR)		1 p.

(C)

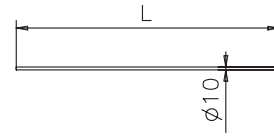
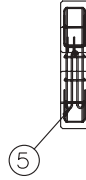
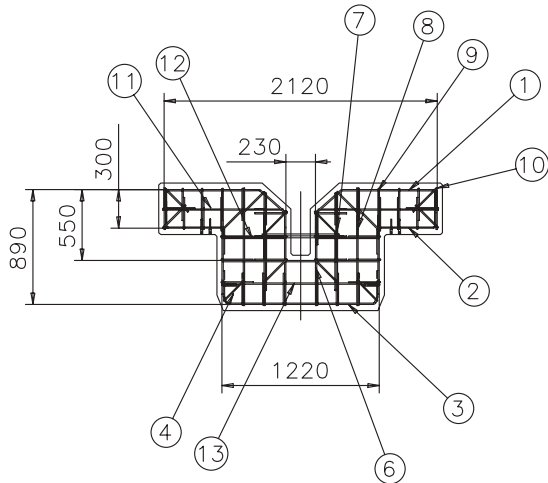


1-	Round bar	Ø30	(S355JO)	L=600	1 p.
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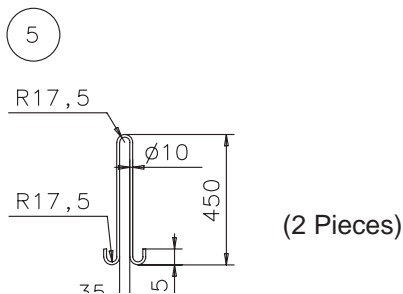
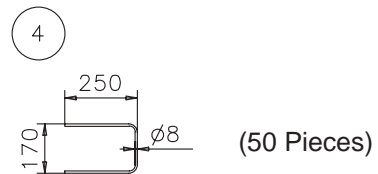
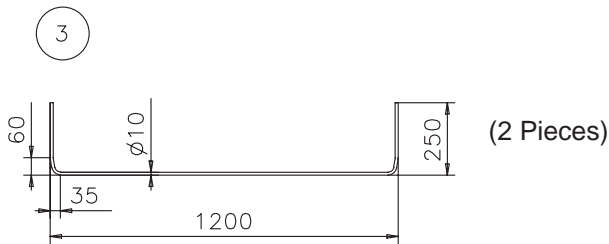
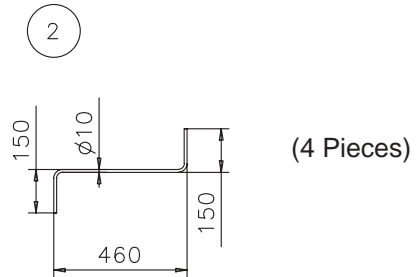
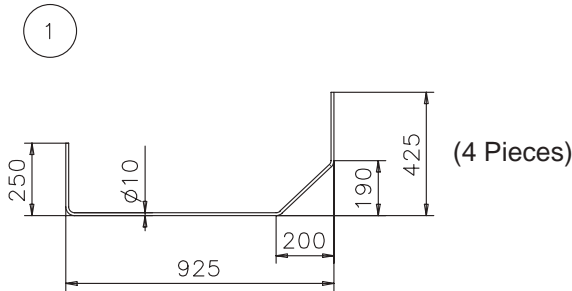
(D)



1-	Round bar	Ø20	(S355JO)	L=100	1 p.
2-	Support plate	60x10	(S275JR)	L=218	1 p.



Bar number	Length	quantity
6	730	4
7	875	4
8	910	4
9	820	4
10	320	4
11	940	4
12	510	4
13	1220	4



All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

WEIGHT OF THE STEEL.....58 kg  
ALL MESH.....Ø10 (AEH 4005)

## CRANE'S DENOMINATION:

TOWER CRANES FOR CONSTRUCTION

## SAFETY STANDARDS:

Machinery Directive: 98/37/CE  
F.E.M. 1001 (1998) (Notebook 7)  
Directive 73/23/CEE  
Directive 89/336/CEE  
Directive 2000/14/CE

## CALCULATION STANDARDS:

DIN 15018 (1984)  
DIN 15019 (1979)  
DIN 15020 (1974)

## CALCULATIONS GROUPS:

H1 B3 (s/DIN 15018)

## WIND CALCULATIONS:

Wind in service:	72 km/h	(45 mph.)
Wind out of service:	150 km/h	(93 mph.) (*)

(\*) For special wind applications, solutions could be provided as attachment.

## STEEL STANDARDS:

EN 10025  
EN 10083-1



# MANUFACTURER'S MANUAL

## 3 ASSEMBLY DISMANTLING





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Ties .....	120 0009 IB	A	151
Crane dismantling.....	140 0001 IB	A	153

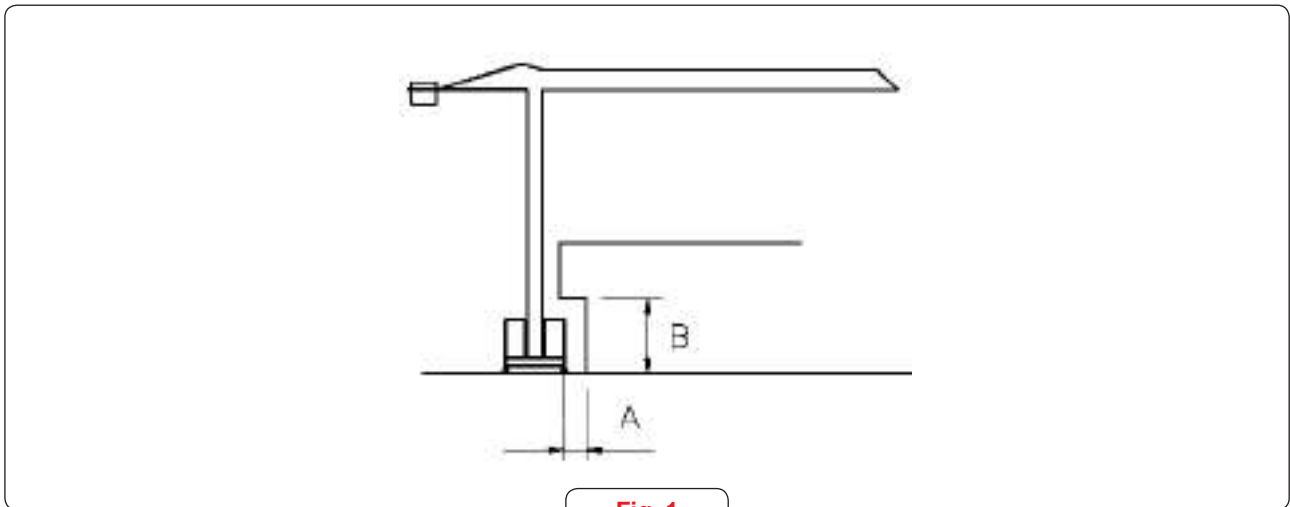
**! AN APPROPRIATE CRANE SITE IS A KEY POINT FOR A PERFECT CRANE OPERATION IN OPTIMAL SAFETY CONDITIONS**

Several points must be taken into account before selecting the crane site:

- Requirements inherent to the construction work
- Crane characteristics
- National and local regulations applicable in the site location

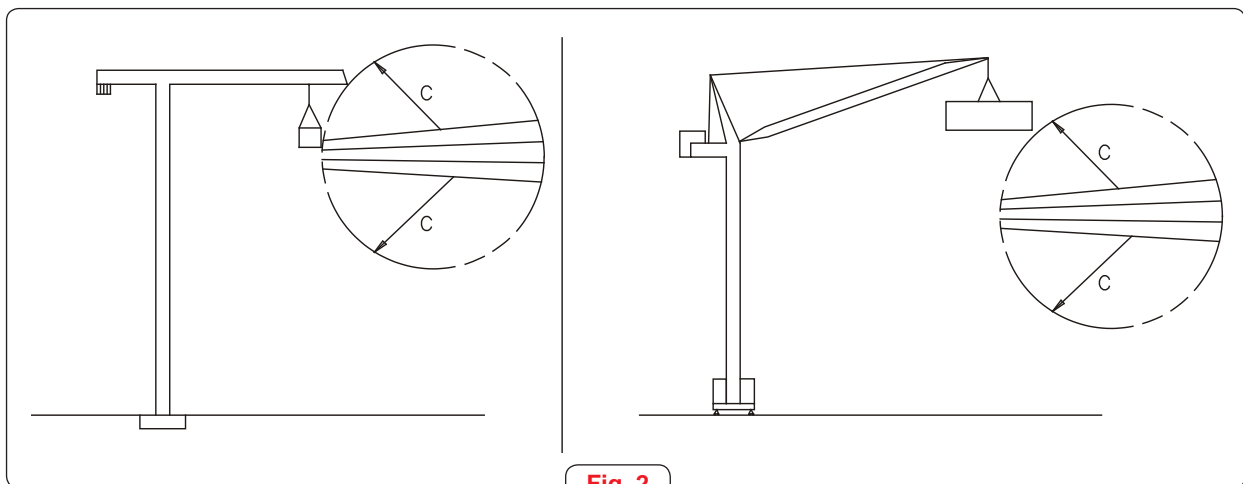
As a general rule, the following requirements shall be complied with

- 1 Minimum clear space for personnel passage between most outreaching crane parts and any obstacle must be  $A=0,60$  m width by  $B= 2,50$  m height (Fig. 1)  
In case this condition cannot be met, access of personnel to this hazardous area shall be prohibited.



**Fig. 1**

- 2 Parts of the crane or suspended loads may not at any time get into contact with overhead power lines. If lines are high voltage lines a minimum safety space of 5 m measured in the horizontal plane must exist between the lines and said elements (Fig. 2)



**Fig. 2**

- 3 If two cranes are close together, their location must be established such that there is a minimum distance of  $D = 2$  m between jib and mast parts subject to collide. The minimum vertical distance between the lowest point (hook at the top position, or overhead counterweight) of the highest crane and the highest point, subject to collide, of the other crane shall be  $E = 3$  m.

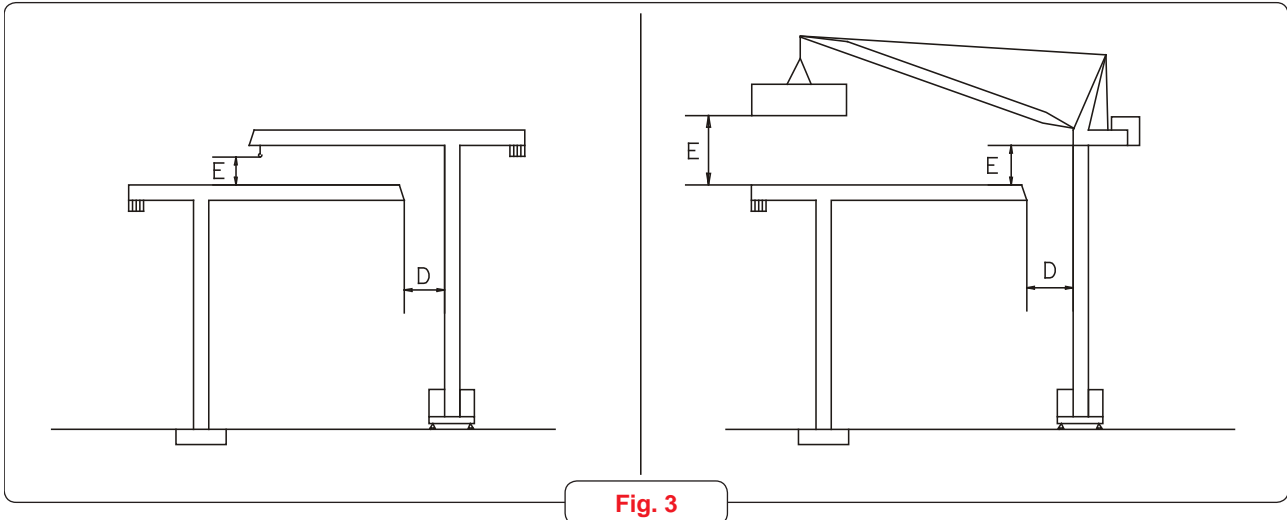


Fig. 3

- 4 For travelling cranes, an appropriate system must be provided to prevent cranes from getting closer than any of the distances mentioned in the previous paragraph.
- 5 In case of cranes working on top of others, adequate measures must be taken to prevent the hoisting cable or the load from colliding with any part of the lower crane.
- 6 If the crane is located near a slope, minimum safety distances must be kept for protection against slips. If keeping safety distances should not be possible, the slope must be reinforced to withstand the loads transmitted by the crane. (Fig. 4)

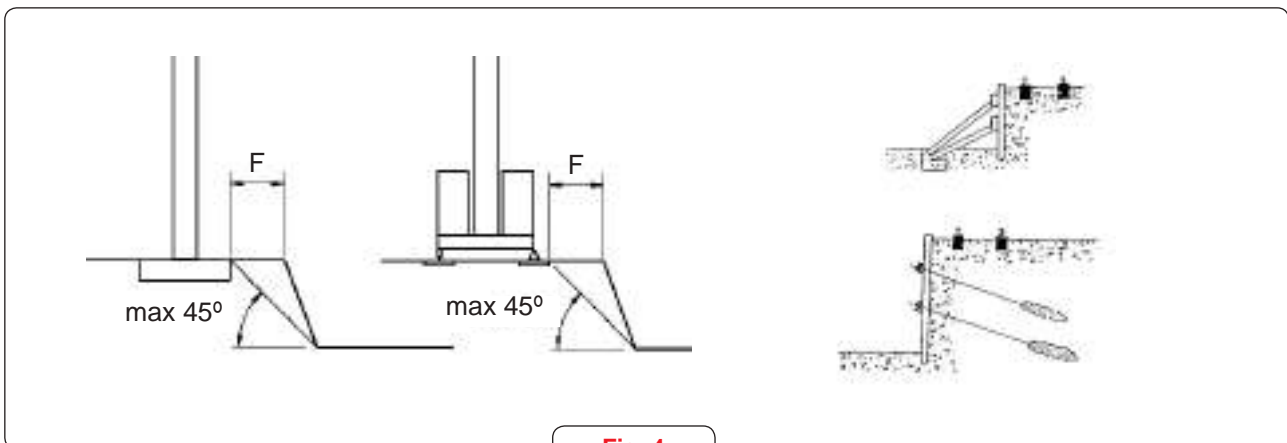
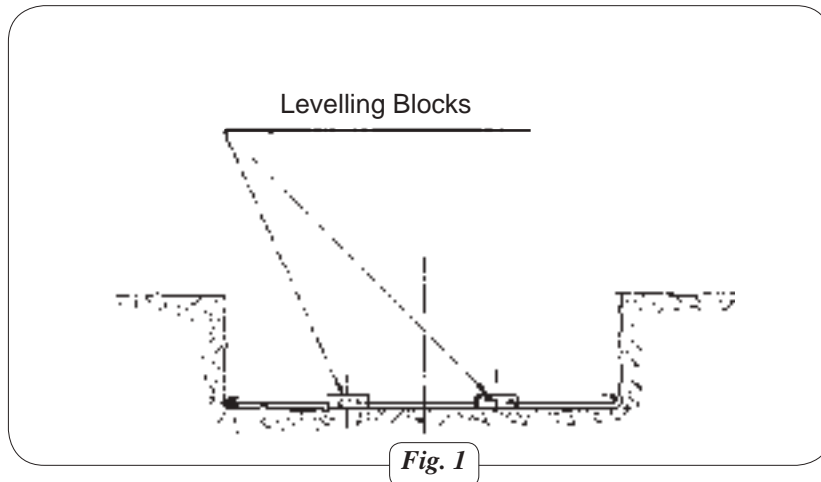


Fig. 4

- 7 The site must allow for safe erection and dismantling operations.
- 8 All crane conditions both initial and with later tower extensions and possible stays must be taken into account.
- 9 Also, crane-dismantling operations must be taken into account.

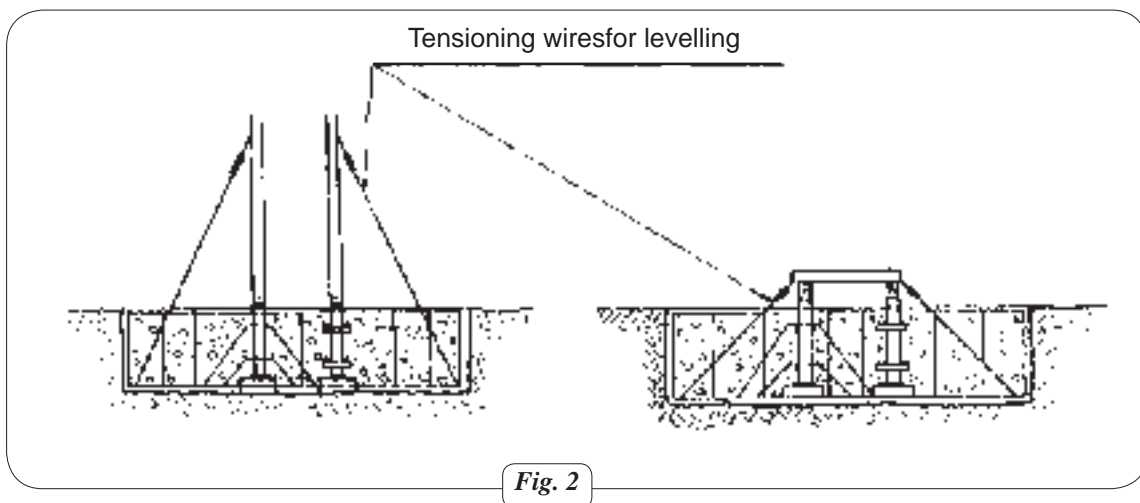
- 1 Excavate.  
Prepare 4 levelling blocks for the fixing angles. (Fig. 1)



- 2 Place fixing angles and locate re-bars.  
Level.

**! Levelling can be either done using a template or a mast section (Fig. 2)**

- 3 Pour concrete, vibrate to eliminate air-pockets and settle correctly.
- 4 Before erecting crane, ensure that concrete is duly cured to prevent possibility of movement.
- 5 Connect to ground the anchor base. See instructions in chapter "ELECTRICAL INSTALLATION"



## SELECTION OF FOUNDATION BASE PADS

<u>SET-UP</u> <u>CRANE</u>	E2	E3
11 LC 90 / 5 t 11 LC 90 / 6 t	EPH21 EPH21	EPH31 EPH31

<u>FIXING</u> <u>ANGLES</u> <u>MAST</u> <u>SECTIONS</u>	PH2	PH3-1
MH124A	EPH21	-
MT123	-	EPH31

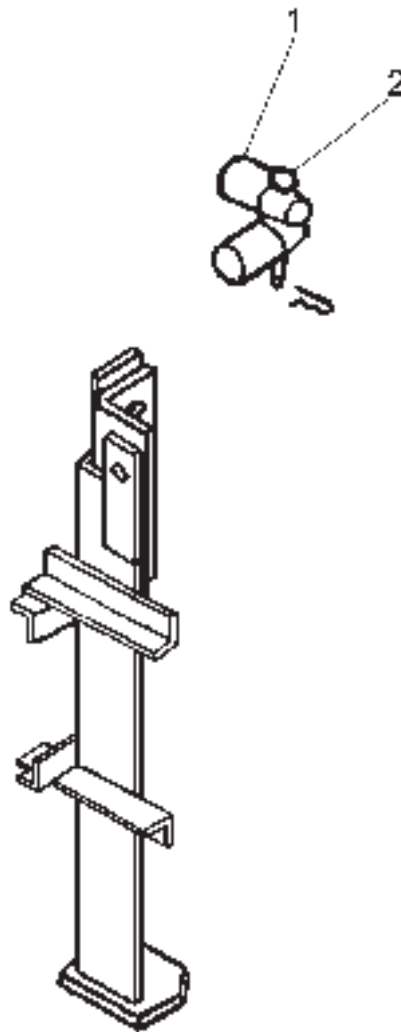
To establish foundation dimensions see documents "REACTIONS / PRESSURE UNDER FOUNDATION" und "REACTIONS ON FIXING ANGLES" in following pages.

## SELECTION OF FOUNDATION BASE PADS

<u>SET-UP</u> <u>CRANE</u>	<i>ES31</i>	<i>ES51</i>	<i>ES71</i>
11 LC 132 / 5 t	EPS31	EPS41	EPS51
11 LC 132 / 6 t	EPS31	EPS41	EPS51
11 LC 150	EPS31	EPS41	EPS51
11 LC 160	EPS31	EPS41	EPS51

<u>FIXING</u> <u>ANGLES</u> <u>MAST</u> <u>SECTIONS</u>	<i>PS3</i>	<i>PS4</i>	<i>PS5</i>
S13	EPS31	-	-
TS14	-	EPS41	-
S14	-	EPS41	-
TS15	-	-	EPS51
S15	-	-	EPS51

To establish foundation dimensions see documents "REACTIONS / PRESSURE UNDER FOUNDATION" und "REACTIONS ON FIXING ANGLES" in following pages.



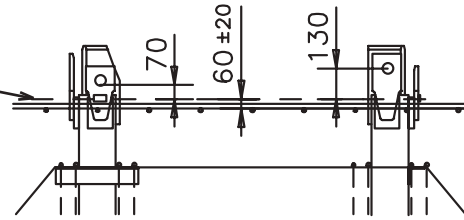
Ø Diameter (mm)  
 L Length (mm)  
 Q Quantity

	1			2		
	Ø	L	Q	Ø	L	Q
PS3	55	135	8	16	120	4
PS4	60	135	8	16	160	4
PS5	60	135	8	16	160	4

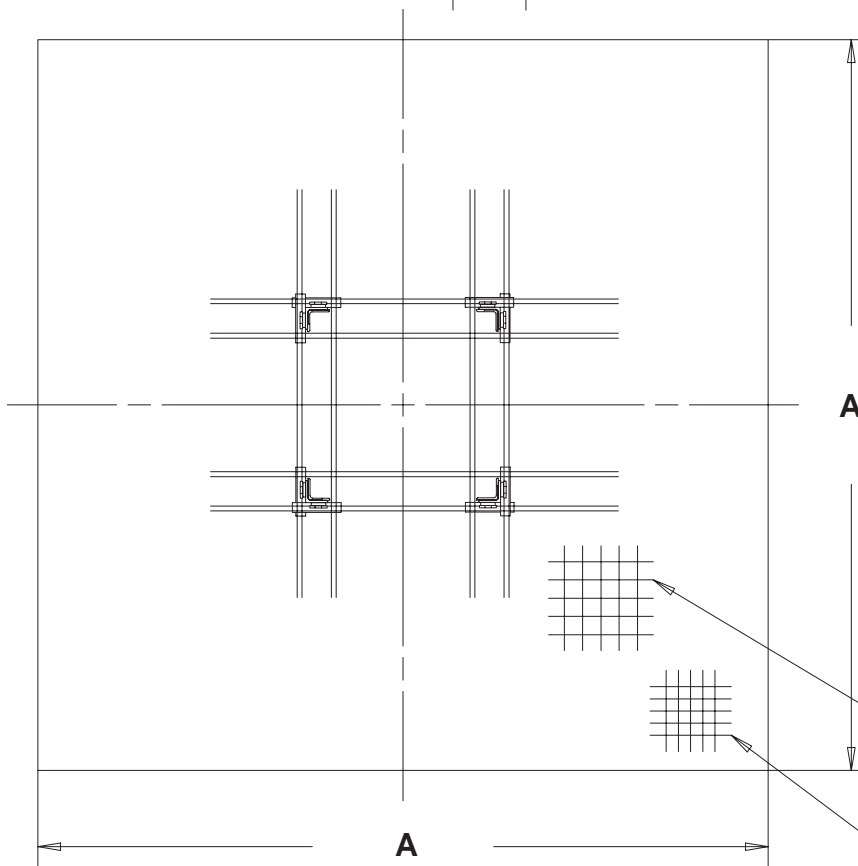
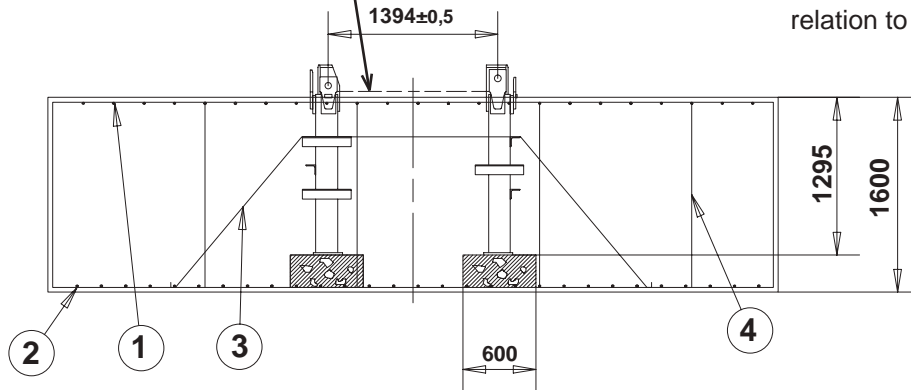


Max. permitted height tolerance  
between feet in any axis:  $\pm 1$  mm

ALWAYS use either a mast section or  
COMANSA - built template to locate the fixing  
angles.



ATTENTION:  
Check the anchoring feet position in  
relation to the X and Y axes.



A x A	Q
(m)	(t)
4,0x4,0	62
4,5x4,5	73
5,0x5,0	96
5,5x5,5	116
6,0x6,0	138
6,5x6,5	162

- 1  $\square$  UPPER  
RODS  
300 x 300
- 2  $\square$  LOWER  
RODS  
250 x 250

ALL MEASUREMENTS ARE IN MILLIMETRES

CONCRETE RESISTANCE.....HH-250 kg/cm<sup>2</sup>  
MIN. CONCRETE DENSITY .....2400 kg/m<sup>3</sup>  
MIN. STEEL RESISTANCE .....B 500 S  
WEIGHT OF FOUNDATIONS .....Q t

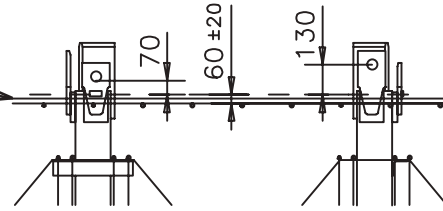
ALL MEASUREMENTS ARE IN MILLIMETRES



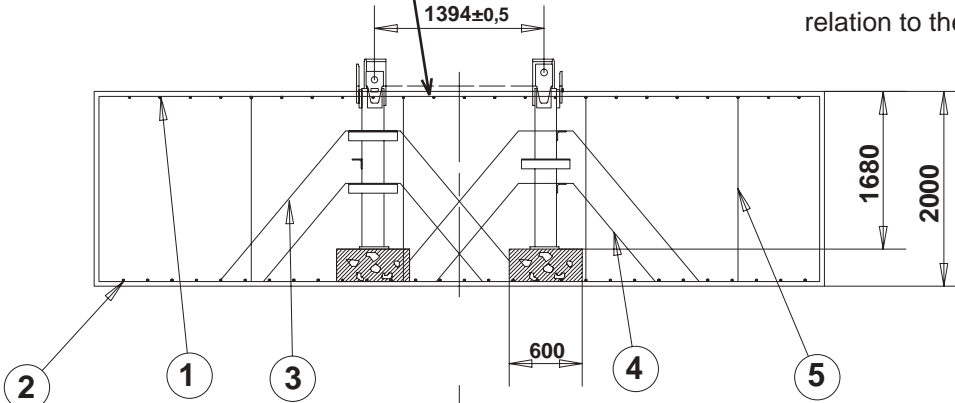
AxA (m)	1		2		3	4
	Material Quantity	L	Material Quantity	L	Material Quantity Length	Material Quantity Length
4,0x4,0	Round Ø 16 (B 500 S) Mesh 300 x 300	3900	Round Ø 20 (B 500 S) Mesh 250 x 250	3900	Round Ø 20 (B 500 S) 16 units L=1600	Round Ø 10 (B 500 S) 16 units L=1500
4,5x4,5		4400		4400		
5,0x5,0		4900		4900		
5,5x5,5		5400		5400		
6,0x6,0		5900		5900		
6,5x6,5		6400		6400		

Max. permitted height tolerance  
between feet in any axis:  $\pm 1$  mm

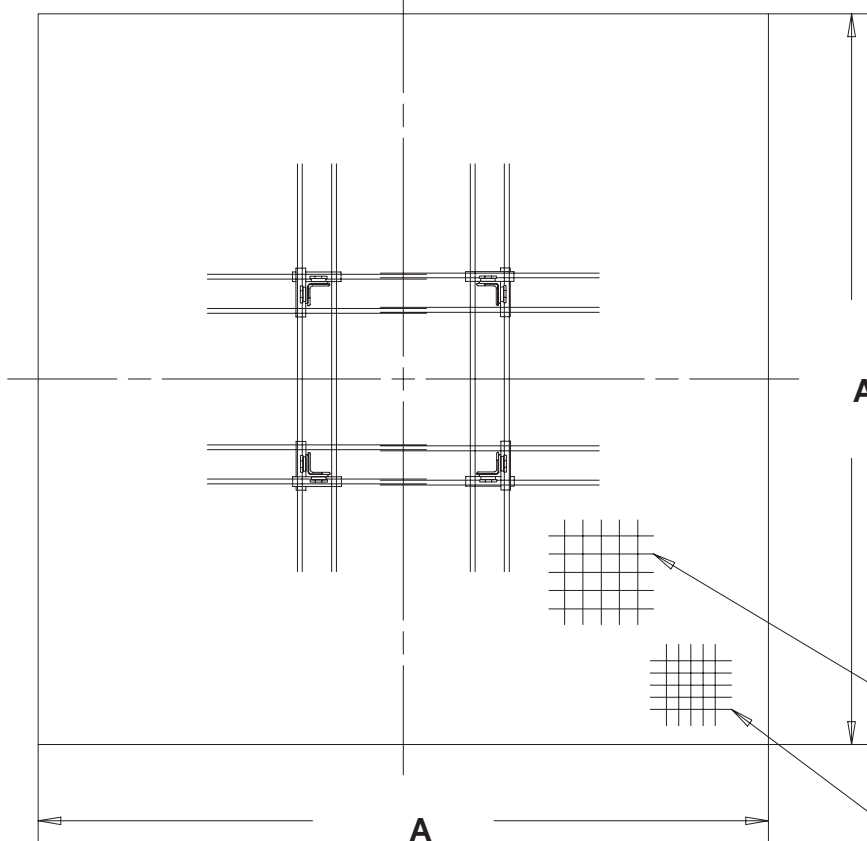
ALWAYS use either a mast section or  
COMANSA - built template to locate the fixing  
angles.



ATTENTION:  
Check the anchoring feet position in  
relation to the X and Y axes.



A x A	Q
(m)	(t)
4,0x4,0	77
4,5x4,5	97
5,0x5,0	120
5,5x5,5	145
6,0x6,0	173
6,5x6,5	203



- 1  UPPER  
RODS  
250 x 250
- 2  LOWER  
RODS  
150 x 150

ALL MEASUREMENTS ARE IN MILLIMETRES

CONCRETE RESISTANCE.....HH-250 kg/cm<sup>2</sup>  
MIN. CONCRETE DENSITY .....2400 kg/m<sup>3</sup>  
MIN. STEEL RESISTANCE .....B 500 S  
WEIGHT OF FOUNDATIONS .....Q t

# PS4

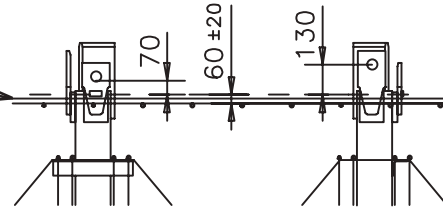
ALL MEASUREMENTS ARE IN MILLIMETRES



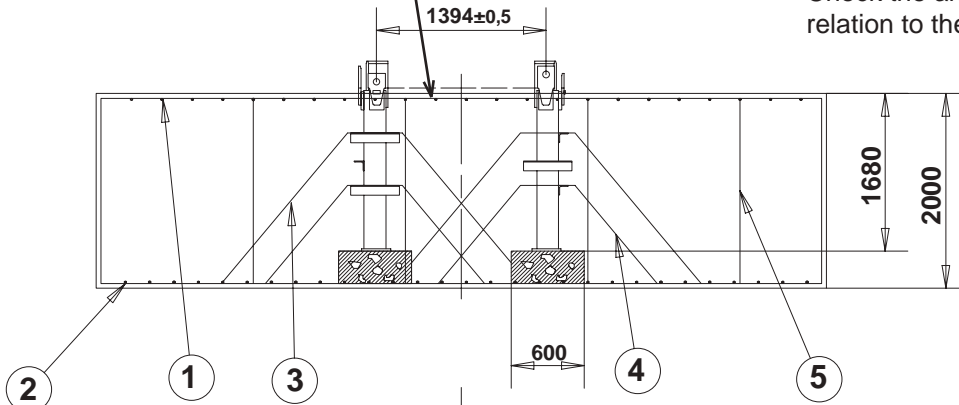
AxA (m)	1		2		3	4	5
	Material Quantity	L	Material Quantity	L	Material Quantity Length	Material Quantity Length	Material Quantity Length
4,0x4,0	Round Ø 16 (B 500 S) Mesh 250 x 250	3900	Round Ø 20 (B 500 S) Mesh 150 x 150	3900	Round Ø 20 (B 500 S) 16 units L=2000	Round Ø 20 (B 500 S) 16 units L=1230	Round Ø 10 (B 500 S) 16 units L=1900
4,5x4,5		4400		4400			
5,0x5,0		4900		4900			
5,5x5,5		5400		5400			
6,0x6,0		5900		5900			
6,5x6,5		6400		6400			

Max. permitted height tolerance  
between feet in any axis:  $\pm 1$  mm

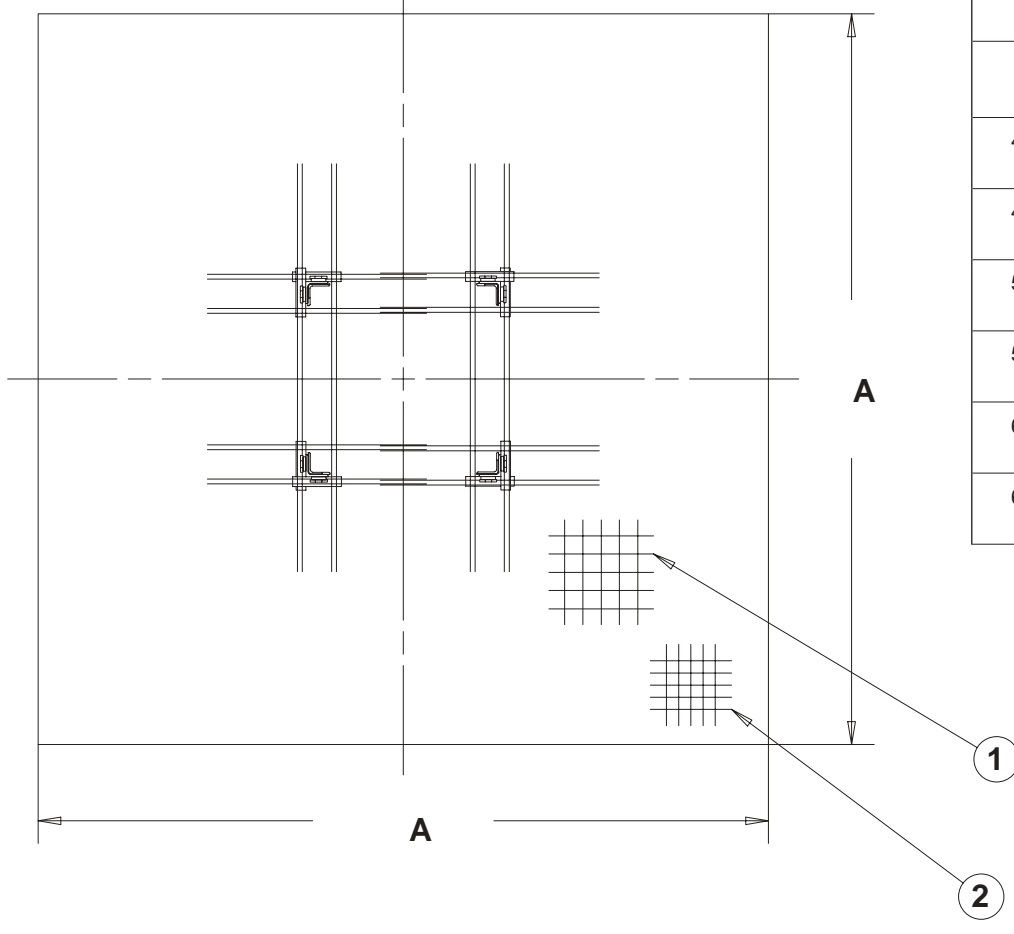
ALWAYS use either a mast section or  
COMANSA - built template to locate the fixing  
angles.



**ATTENTION:**  
Check the anchoring feet position in  
relation to the X and Y axes.



A x A	Q
(m)	(t)
4,0x4,0	77
4,5x4,5	97
5,0x5,0	120
5,5x5,5	145
6,0x6,0	173
6,5x6,5	203



- 1 **UPPER  
RODS  
250 x 250**
- 2 **LOWER  
RODS  
150 x 150**

ALL MEASUREMENTS ARE IN MILLIMETRES

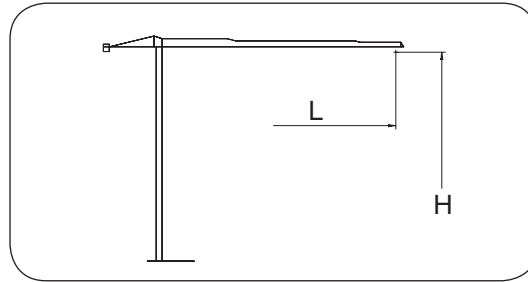
CONCRETE RESISTANCE.....HH-250 kg/cm<sup>2</sup>  
MIN. CONCRETE DENSITY .....2400 kg/m<sup>3</sup>  
MIN. STEEL RESISTANCE .....B 500 S  
WEIGHT OF FOUNDATIONS .....Q t

# PS5

ALL MEASUREMENTS ARE IN MILLIMETRES



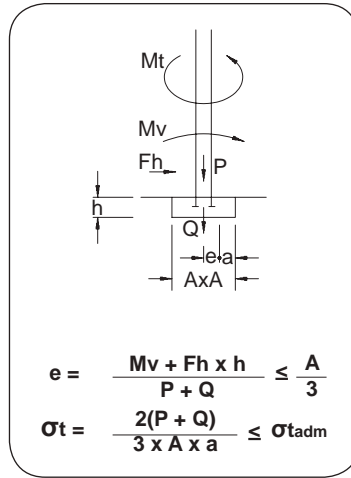
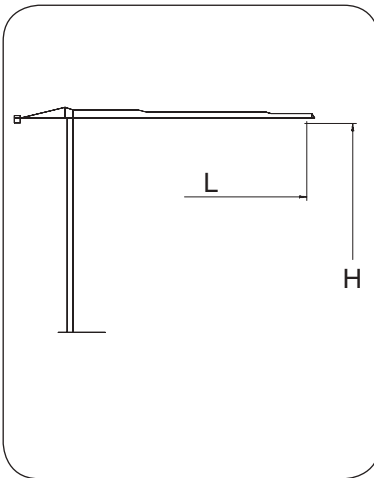
AxA (m)	1		2		3	4	5
	Material Quantity	L	Material Quantity	L	Material Quantity Length	Material Quantity Length	Material Quantity Length
4,0x4,0	Round Ø 16 (B 500 S) Mesh 250 x 250	3900	Round Ø 20 (B 500 S) Mesh 150 x 150	3900	Round Ø 20 (B 500 S) 16 units L=2000	Round Ø 20 (B 500 S) 16 units L=1230	Round Ø 10 (B 500 S) 16 units L=1900
4,5x4,5		4400		4400			
5,0x5,0		4900		4900			
5,5x5,5		5400		5400			
6,0x6,0		5900		5900			
6,5x6,5		6400		6400			



<b>Designation</b>	<b>Code</b>	<b>Reference</b>	<b>Rev.</b>
Reactions on fixing angles	<b>ES31</b>	MTJ 020 0287 IB	A
Reactions on fixing angles / pressure under foundation	<b>ES31</b>	MTJ 020 0307 IB	A
Reactions on fixing angles	<b>ES51</b>	MTJ 020 0288 IB	A
Reactions on fixing angles / pressure under foundation	<b>ES51</b>	MTJ 020 0308 IB	A
Reactions on fixing angles	<b>ES71</b>	MTJ 020 0289 IB	A
Reactions on fixing angles / pressure under foundation	<b>ES71</b>	MTJ 020 0309 IB	A

# ES31

# SR/DR 8000 kg



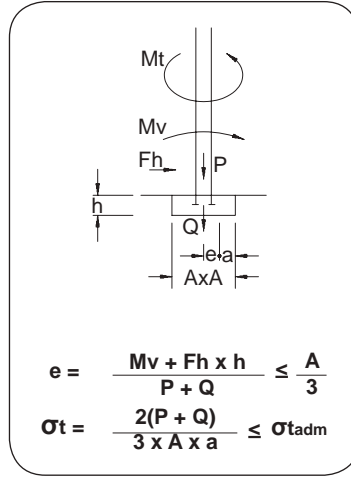
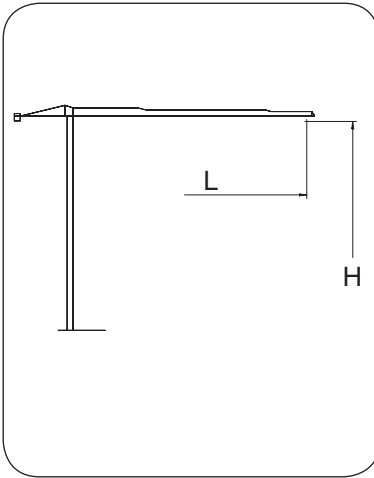
- Mt** -Torsional moment. (kNm)
- Mv** -Overturning moment. (kNm)
- P** -Weight of crane (kN)
- Fh** -Horizontal reaction (kN)
- Q** -Mass of foundation concrete (kN)
- e** -Excentricity (m)
- $\sigma_t$**  -Pressure on ground (kN/m<sup>2</sup>)
- $\sigma_{tadm}$**  -Permissible ground pressure (kN/m<sup>2</sup>)
- L** -Max. hook radius
- H** -Hook height
- A** -Foundation dimensions

H (m)	TOWER COMPOSITION	IN SERVICE								OUT OF SERVICE							
		L (m)								L (m)							
		60,0	57,5	55,0	52,5	50,0	47,5	45,0		60,0	57,5	55,0	52,5	50,0	47,5	45,0	
40,9 7xS13	Mv	1686	1763	1740	1835	1762	1909	1895		2814	2881	2871	2823	2880	2953	2971	
	Fh	24	25	24	24	24	25	25		78	78	77	77	77	77	76	
	P	515	517	505	493	494	514	499		498	497	485	470	469	484	466	
35,4 6xS13	Mv	1586	1662	1639	1734	1662	1804	1792		2560	2627	2618	2571	2629	2702	2721	
	Fh	23	23	23	23	23	23	23		73	73	73	72	72	72	72	
	P	503	505	494	482	482	502	488		486	485	473	458	457	472	454	
29,9 5xS13	Mv	1423	1497	1477	1570	1500	1636	1626		2143	2211	2204	2158	2217	2291	2311	
	Fh	21	21	21	21	21	21	21		65	65	65	64	64	64	64	
	P	482	484	472	460	461	481	466		465	464	452	437	436	451	433	
24,4 4xS13	Mv	1283	1355	1336	1429	1360	1491	1482		1770	1839	1834	1789	1849	1923	1946	
	Fh	19	19	19	19	19	19	19		57	57	57	56	56	56	56	
	P	460	462	451	439	439	459	445		443	442	430	415	414	429	411	
18,9 3xS13	Mv	1164	1234	1217	1308	1240	1367	1359		1441	1511	1509	1464	1526	1600	1625	
	Fh	16	16	16	16	16	16	16		49	49	49	48	48	48	48	
	P	439	441	429	417	418	438	423		422	421	409	394	393	408	390	
	Mv																
	Fh																
	P																
	Mv																
	Fh																
	P																
	Mt	170	170	170	170	170	170	170		0	0	0	0	0	0	0	



# ES31

# SR/DR 8000 kg

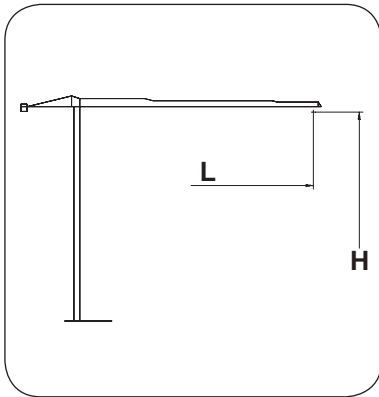


- Mt** -Torsional moment. (kNm)
- Mv** -Overturning moment. (kNm)
- P** -Weight of crane (kN)
- Fh** -Horizontal reaction (kN)
- Q** -Mass of foundation concrete (kN)
- e** -Eccentricity (m)
- $\sigma_t$**  -Pressure on ground (kN/m<sup>2</sup>)
- $\sigma_{tadm}$**  -Permissible ground pressure (kN/m<sup>2</sup>)
- L** -Max. hook radius
- H** -Hook height
- A** -Foundation dimensions

H (m)	TOWER COMPOSITION	IN SERVICE							OUT OF SERVICE							
		L (m)							L (m)							
		42,5	40,0	37,5	35,0	32,5	30,0		42,5	40,0	37,5	35,0	32,5	30,0		
40,9 7xS13	Mv	1878	1964	1927	1775	1839	1876		2958	2898	2890	2868	2860	2878		
	Fh	25	25	25	24	24	25		76	76	76	75	75	74		
	P	502	493	495	473	474	461		467	455	455	433	431	413		
35,4 6xS13	Mv	1775	1860	1824	1676	1739	1776		2709	2650	2643	2621	2614	2633		
	Fh	23	23	23	23	23	23		71	71	71	71	70	70		
	P	491	481	484	462	462	450		455	443	444	422	419	401		
29,9 5xS13	Mv	1609	1693	1657	1515	1577	1614		2301	2244	2238	2218	2213	2234		
	Fh	21	21	21	21	21	21		63	63	63	63	62	62		
	P	469	460	462	440	441	428		434	422	422	400	398	380		
24,4 4xS13	Mv	1465	1548	1513	1377	1437	1474		1938	1882	1877	1859	1857	1880		
	Fh	19	19	19	19	19	19		55	55	55	54	54	54		
	P	448	438	441	419	419	407		412	400	401	379	376	358		
18,9 3xS13	Mv	1343	1425	1390	1258	1317	1354		1618	1565	1560	1545	1544	1569		
	Fh	16	16	16	16	16	16		47	47	47	46	46	46		
	P	426	417	419	397	398	385		391	379	379	357	355	337		
	Mv															
	Fh															
	P															
	Mv															
	Fh															
	P															
	Mt	170	170	170	170	170	170		0	0	0	0	0	0		

**ES31**

See document "ANCHOR BASE ERECTION": (MTJ 020 0047)



	A x A x h (m)
<b>D1</b>	4,0 x 4,0 x 1,6
<b>D2</b>	4,5 x 4,5 x 1,6
<b>D3</b>	5,0 x 5,0 x 1,6
<b>D4</b>	5,5 x 5,5 x 1,6
<b>D5</b>	6,0 x 6,0 x 1,6
<b>D6</b>	6,5 x 6,5 x 1,6

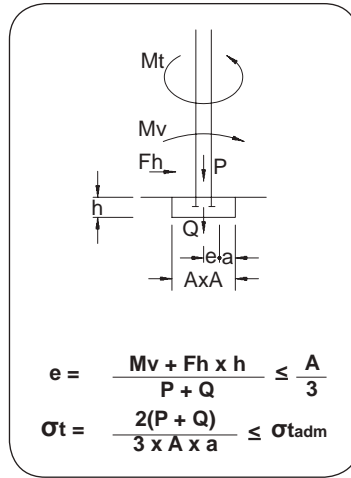
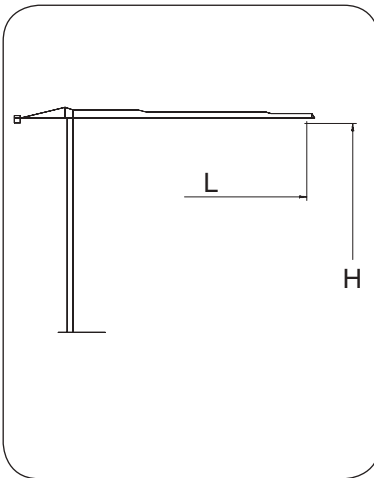
A x A x h -Foundation dimensions  
 H -Hook height  
 SR -Single reeving  
 DR -Double reeving

**PRESSURE UNDER FOUNDATION IN  
 kg/cm<sup>2</sup>**

	H	D1	D2	D3	D4	D5	D6		
<b>SR SR/DR</b>	40,9	-	-	-	-	1,5	1,2		
	35,4	-	-	-	2,0	1,4	1,1		
	29,9	-	-	-	1,6	1,2	1,0		
	24,4	-	-	1,8	1,3	1,1	1,0		
	18,9	-	2,2	1,5	1,1	1,0	1,0		

# ES51

# SR/DR 8000 kg

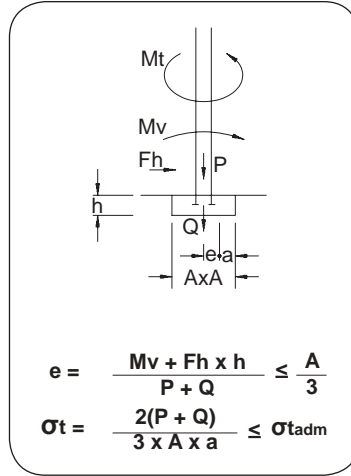
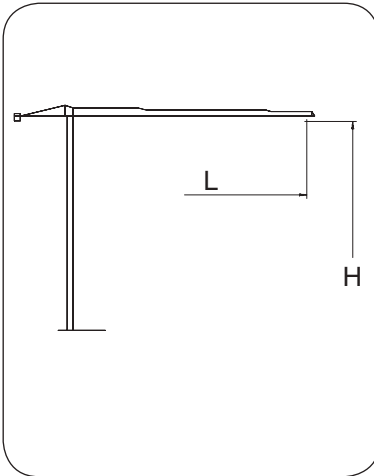


- Mt** -Torsional moment. (kNm)
- Mv** -Overturning moment. (kNm)
- P** -Weight of crane (kN)
- Fh** -Horizontal reaction (kN)
- Q** -Mass of foundation concrete (kN)
- e** -Excentricity (m)
- $\sigma_t$**  -Pressure on ground (kN/m<sup>2</sup>)
- $\sigma_{tadm}$**  -Permissible ground pressure (kN/m<sup>2</sup>)
- L** -Max. hook radius
- H** -Hook height
- A** -Foundation dimensions

H (m)	TOWER COMPOSITION	IN SERVICE								OUT OF SERVICE								
		L (m)								L (m)								
		60,0	57,5	55,0	52,5	50,0	47,5	45,0		60,0	57,5	55,0	52,5	50,0	47,5	45,0		
51,9	6xS13 + TS14 + 2xS14	Mv	1957	2037	2010	2108	2032	2188	2172		3780	3690	3657	3681	3600	3648	3663	
	Fh	28	28	28	28	28	28	28	28		136	135	135	134	134	89	89	
	P	552	554	543	531	531	551	537		535	534	522	507	506	521	503		
46,4	5xS13 + TS14 + 2xS14	Mv	1838	1917	1892	1989	1914	2065	2051		3346	3293	3282	3251	3289	3362	3378	
	Fh	27	27	27	27	27	27	27	27		129	86	85	128	85	85	84	
	P	541	543	531	519	520	540	525		524	523	511	496	495	510	492		
40,9	4xS13 + TS14 + 2xS14	Mv	1759	1837	1812	1908	1835	1983	1969		3047	3094	3083	3035	3092	3164	3181	
	Fh	26	26	26	26	26	26	26	26		124	82	82	82	81	81	81	
	P	532	534	522	510	511	531	516		515	514	502	487	486	501	483		
35,4	3xS13 + TS14 + 2xS14	Mv	1576	1651	1629	1724	1652	1793	1781		2567	2634	2625	2578	2636	2709	2728	
	Fh	24	24	24	24	24	24	24	24		74	74	74	74	73	73	73	
	P	510	512	501	489	489	509	495		493	492	480	465	464	479	461		
29,9	2xS13 + TS14 + 2xS14	Mv	1417	1490	1470	1563	1493	1628	1618		2150	2218	2211	2165	2224	2297	2318	
	Fh	21	21	21	21	21	21	21	21		66	66	66	66	65	65	65	
	P	489	491	479	467	468	488	473		472	471	459	444	443	458	440		
24,4	S13 + TS14 + 2xS14	Mv	1279	1351	1332	1424	1356	1485	1477		1777	1846	1841	1796	1856	1930	1953	
	Fh	19	19	19	19	19	19	19	19		58	58	58	58	57	57	57	
	P	467	469	458	446	446	466	452		450	449	437	422	421	436	418		
	Mv																	
	Fh																	
	P																	
	Mv																	
	Fh																	
	P																	
	Mt	170	170	170	170	170	170	170		0	0	0	0	0	0	0		

# ES51

# SR/DR 8000 kg

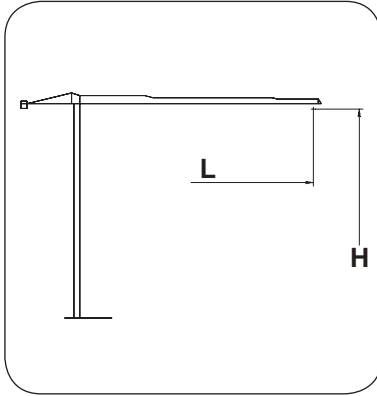


- Mt** -Torsional moment. (kNm)
- Mv** -Overturning moment. (kNm)
- P** -Weight of crane (kN)
- Fh** -Horizontal reaction (kN)
- Q** -Mass of foundation concrete (kN)
- e** -Excentricity (m)
- $\sigma_t$**  -Pressure on ground (kN/m<sup>2</sup>)
- $\sigma_{tadm}$**  -Permissible ground pressure (kN/m<sup>2</sup>)
- L** -Max. hook radius
- H** -Hook height
- A** -Foundation dimensions

H (m)	TOWER COMPOSITION	IN SERVICE							OUT OF SERVICE									
		L (m)							L (m)									
		42,5	40,0	37,5	35,0	32,5	30,0		42,5	40,0	37,5	35,0	32,5	30,0				
51,9	6xS13 + TS14 + 2xS14	Mv	2154	2241	2204	2043	2109	2145			3648	3585	3576	3551	3540	3555		
	Fh	28	28	28	28	28	28			89	88	88	88	87	87			
	P	540	530	533	511	511	499			504	492	493	471	468	450			
46,4	5xS13 + TS14 + 2xS14	Mv	2033	2120	2083	1926	1991	2028			3364	3302	3293	3269	3259	3276		
	Fh	27	27	27	27	27	27			84	84	84	83	83	82			
	P	528	519	521	499	500	487			493	481	481	459	457	439			
40,9	4xS13 + TS14 + 2xS14	Mv	1952	2037	2001	1847	1911	1948			3168	3107	3098	3075	3066	3083		
	Fh	26	26	26	26	26	26			81	80	80	80	79	79			
	P	519	510	512	490	491	478			484	472	472	450	448	430			
35,4	3xS13 + TS14 + 2xS14	Mv	1764	1849	1813	1667	1729	1766			2716	2657	2649	2628	2621	2640		
	Fh	24	24	24	24	24	24			73	72	72	72	71	71			
	P	498	488	491	469	469	457			462	450	451	429	426	408			
29,9	2xS13 + TS14 + 2xS14	Mv	1601	1685	1649	1509	1570	1607			2308	2251	2245	2225	2220	2241		
	Fh	21	21	21	21	21	21			65	64	64	64	63	63			
	P	476	467	469	447	448	435			441	429	429	407	405	387			
24,4	S13 + TS14 + 2xS14	Mv	1460	1543	1508	1373	1432	1469			1944	1889	1884	1866	1864	1887		
	Fh	19	19	19	19	19	19			57	56	56	56	55	55			
	P	455	445	448	426	426	414			419	407	408	386	383	365			
	Mv																	
	Fh																	
	P																	
	Mv																	
	Fh																	
	P																	
	Mt	170	170	170	170	170	170			0	0	0	0	0	0			

# ES51

See document "ANCHOR BASE ERECTION": (MTJ 020 0048)



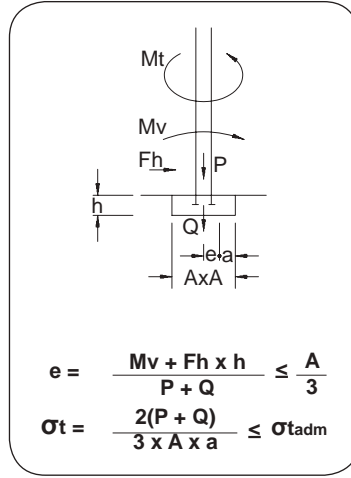
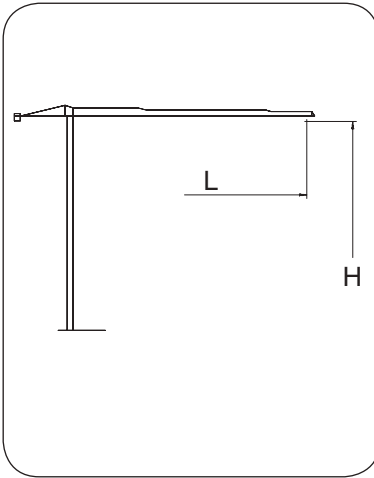
	A x A x h (m)
<b>D1</b>	4,0 x 4,0 x 2,0
<b>D2</b>	4,5 x 4,5 x 2,0
<b>D3</b>	5,0 x 5,0 x 2,0
<b>D4</b>	5,5 x 5,5 x 2,0
<b>D5</b>	6,0 x 6,0 x 2,0
<b>D6</b>	6,5 x 6,5 x 2,0

<b>A x A x h</b>	-Foundation dimensions
<b>H</b>	-Hook height
<b>SR</b>	-Single reeving
<b>DR</b>	-Double reeving
<b>PRESSURE UNDER FOUNDATION IN kg/cm<sup>2</sup></b>	

	H	D1	D2	D3	D4	D5	D6		
<b>SR SR/DR</b>	51,9	-	-	-	-	2,1	1,6		
	46,4	-	-	-	2,5	1,8	1,4		
	40,9	-	-	-	2,3	1,7	1,3		
	35,4	-	-	-	1,9	1,4	1,2		
	29,9	-	-	2,2	1,6	1,3	1,1		
	24,4	-	2,7	1,8	1,4	1,2	1,0		

# ES71

# SR/DR 8000 kg

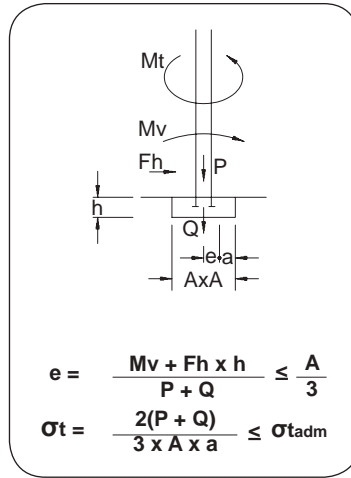
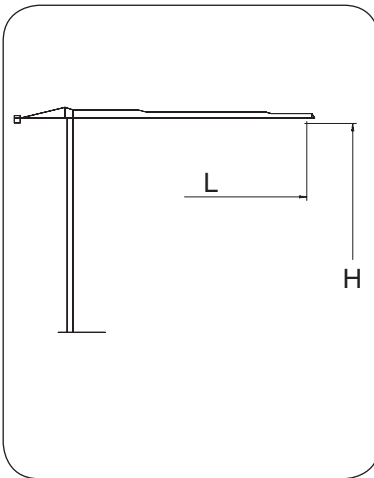


- Mt** -Torsional moment. (kNm)
- Mv** -Overturning moment. (kNm)
- P** -Weight of crane (kN)
- Fh** -Horizontal reaction (kN)
- Q** -Mass of foundation concrete (kN)
- e** -Eccentricity (m)
- $\sigma_t$**  -Pressure on ground (kN/m<sup>2</sup>)
- $\sigma_{tadm}$**  -Permissible ground pressure (kN/m<sup>2</sup>)
- L** -Max. hook radius
- H** -Hook height
- A** -Foundation dimensions

H (m)	TOWER COMPOSITION	IN SERVICE							OUT OF SERVICE								
		L (m)							L (m)								
		60,0	57,5	55,0	52,5	50,0	47,5	45,0	60,0	57,5	55,0	52,5	50,0	47,5	45,0		
57,4	6xS13 + TS14 + S14 + TS15 + S15	Mv	2310	2394	2364	2463	2385	2551	2532		5163	5070	5032	5054	4971	4888	4822
	Fh	32	32	32	32	32	32	32	32		157	157	156	156	155	155	155
	P	603	605	594	582	582	602	588		586	585	573	558	557	572	554	
51,9	5xS13 + TS14 + S14 + TS15 + S15	Mv	2170	2253	2224	2323	2245	2406	2389		4667	4575	4538	4561	4478	4396	4332
	Fh	31	31	31	31	31	31	31	31		150	150	149	149	148	148	148
	P	592	594	582	570	571	591	576		575	574	562	547	546	561	543	
46,4	4xS13 + TS14 + S14 + TS15 + S15	Mv	1942	2022	1996	2093	2018	2170	2155		3842	3752	3719	3743	3662	3689	3704
	Fh	29	29	29	29	29	29	29	29		138	138	137	137	136	91	90
	P	570	572	561	549	549	569	555		553	552	540	525	524	539	521	
40,9	3xS13 + TS14 + S14 + TS15 + S15	Mv	1741	1818	1795	1890	1817	1962	1949		3084	3119	3108	3060	3116	3189	3206
	Fh	26	26	26	26	26	27	27		126	84	83	83	83	83	82	
	P	549	551	539	527	528	548	533		532	531	519	504	503	518	500	
35,4	2xS13 + TS14 + S14 + TS15 + S15	Mv	1565	1639	1618	1712	1641	1779	1768		2592	2659	2650	2602	2660	2734	2752
	Fh	24	24	24	24	24	24	24		76	76	75	75	75	75	74	
	P	527	529	518	506	506	526	512		510	509	497	482	481	496	478	
29,9	S13 + TS14 + S14 + TS15 + S15	Mv	1411	1483	1464	1556	1487	1620	1610		2175	2243	2236	2189	2249	2322	2343
	Fh	22	22	22	22	22	22	22		68	68	67	67	67	67	66	
	P	506	508	496	484	485	505	490		489	488	476	461	460	475	457	
	Mv																
	Fh																
	P																
	Mv																
	Fh																
	P																
	Mt	170	170	170	170	170	170	170		0	0	0	0	0	0	0	

# ES71

# SR/DR 8000 kg

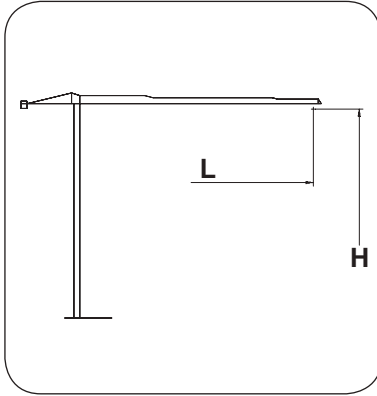


- Mt** -Torsional moment. (kNm)
- Mv** -Overturning moment. (kNm)
- P** -Weight of crane (kN)
- Fh** -Horizontal reaction (kN)
- Q** -Mass of foundation concrete (kN)
- e** -Excentricity (m)
- $\sigma_t$**  -Pressure on ground (kN/m<sup>2</sup>)
- $\sigma_{tadm}$**  -Permissible ground pressure (kN/m<sup>2</sup>)
- L** -Max. hook radius
- H** -Hook height
- A** -Foundation dimensions

H (m)	TOWER COMPOSITION	IN SERVICE							OUT OF SERVICE									
		L (m)							L (m)									
		42,5	40,0	37,5	35,0	32,5	30,0		42,5	40,0	37,5	35,0	32,5	30,0				
57,4	6xS13 + TS14 + S14 + TS15 + S15	Mv	2514	2602	2564	2392	2460	2497			4797	4809	4794	4769	4727	4661		
	Fh	32	32	32	32	32	32			154	154	153	153	152	152			
	P	591	581	584	562	562	550			555	543	544	522	519	501			
51,9	5xS13 + TS14 + S14 + TS15 + S15	Mv	2371	2459	2421	2255	2321	2358			4308	4322	4307	4284	4243	4179		
	Fh	31	31	31	31	31	31			147	147	147	146	145	145			
	P	579	570	572	550	551	538			544	532	532	510	508	490			
46,4	4xS13 + TS14 + S14 + TS15 + S15	Mv	2138	2224	2187	2030	2094	2132			3689	3626	3616	3591	3579	3595		
	Fh	29	29	29	29	29	29			90	90	90	89	89	89			
	P	558	548	551	529	529	517			522	510	511	489	486	468			
40,9	3xS13 + TS14 + S14 + TS15 + S15	Mv	1932	2017	1981	1831	1894	1931			3193	3132	3123	3100	3090	3108		
	Fh	27	26	26	26	26	26			82	82	82	81	81	81			
	P	536	527	529	507	508	495			501	489	489	467	465	447			
35,4	2xS13 + TS14 + S14 + TS15 + S15	Mv	1751	1835	1800	1656	1718	1755			2741	2682	2674	2653	2646	2665		
	Fh	24	24	24	24	24	24			74	74	74	73	73	72			
	P	515	505	508	486	486	474			479	467	468	446	443	425			
29,9	S13 + TS14 + S14 + TS15 + S15	Mv	1594	1677	1642	1504	1564	1601			2333	2276	2269	2250	2245	2266		
	Fh	22	22	22	22	22	22			66	66	66	65	65	64			
	P	493	484	486	464	465	452			458	446	446	424	422	404			
	Mv																	
	Fh																	
	P																	
	Mv																	
	Fh																	
	P																	
	Mt	170	170	170	170	170	170			0	0	0	0	0	0			

# ES71

See document "ANCHOR BASE ERECTION": (MTJ 020 0049)



	A x A x h (m)
<b>D1</b>	5,0 x 5,0 x 2,0
<b>D2</b>	5,5 x 5,5 x 2,0
<b>D3</b>	6,0 x 6,0 x 2,0
<b>D4</b>	6,5 x 6,5 x 2,0
<b>D5</b>	7,0 x 7,0 x 2,0
<b>D6</b>	7,5 x 7,5 x 2,0
<b>D7</b>	8,0 x 8,0 x 2,0

A x A x h -Foundation dimensions  
 H -Hook height  
 SR -Single reeving  
 DR -Double reeving

**PRESSURE UNDER FOUNDATION IN  
 kg/cm<sup>2</sup>**

	H	D1	D2	D3	D4	D5	D6	D7
<b>SR SR/DR</b>	57,4	-	-	-	2,3	1,7	1,4	1,2
	51,9	-	-	-	2,0	1,5	1,3	1,2
	46,4	-	-	2,1	1,6	1,3	1,2	1,1
	40,9	-	2,3	1,7	1,4	1,2	1,1	1,0
	35,4	-	1,9	1,5	1,2	1,1	1,0	1,0
	29,9	2,2	1,6	1,3	1,1	1,0	1,0	1,0



The cross shaped undercarriage consists of one beam and two arms that open having the form of an X. They are fixed by rods and bolts. To the cross shaped undercarriage are screwed anchorage feet for the different types of masts.

To each end of the X is fitted a stabilising base, (fig. 1) a rail travelling. (fig. 2).

These bases must be supported on four concrete platforms or on a single continuous base, and must be big enough to take the whole undercarriage suitably.

Foundation size is given by the characteristics of the ground and the pressure per corner (see sheets on "BALLAST & REACTIONS") in following pages.

In case of rail travelling, it is mounted on the travelling. In order to realise the rail travelling, see documents "Installation of the crane and of the travelling" and "TRACK ERECTION" in following pages.

- ! The soil must be firm and resistend, and must be adequate to withstand the loads transmitted to the base.
- ! The crane site must be big enough to allow erection manoeuvres, and any obstacles such as buildings or power lines nearby should be taken into account
- ! Base must be electrically connected to ground, see instruction "ELECTRIC WIRING AND GROUNDING" in chapter ELECTRICAL INSTALLATION of this manual.

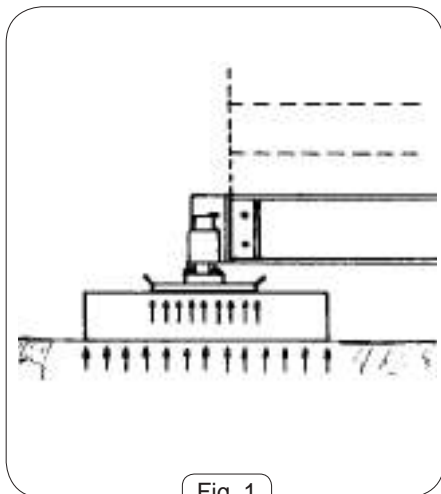


Fig. 1

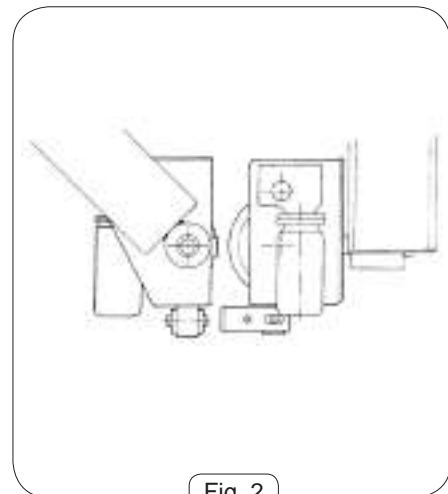


Fig. 2

L=3,2 m  
 L=3,8 m    L x L depending on the base  
 L=4,5 m

SUPPORT

PYRAMID  
 (Optional)

<b>A x A x h (m)</b>
1,0 x 1,0 x 0,5
1,2 x 1,2 x 0,5
1,4 x 1,4 x 0,5
1,6 x 1,6 x 0,5
1,8 x 1,8 x 0,5
2,0 x 2,0 x 0,5

Millimetre dimension all

CONCRETE RESISTANCE.....HH-250 kg/cm<sup>2</sup>  
 MIN. CONCRETE DENSITY .....2400 kg/m<sup>3</sup>  
 MIN. STEEL RESISTANCE .....B 500 S

PYRAMID

A x A x h (m)
1.6 x 1.6 x 0.6
1.8 x 1.8 x 0.6
2.0 x 2.0 x 0.6
2.2 x 2.2 x 0.6
2.4 x 2.4 x 0.6
2.6 x 2.6 x 0.6

Measurements in mm

CONCRETE RESISTANCE.....HH-250 kg/cm<sup>2</sup>  
 MIN. CONCRETE DENSITY .....2400 kg/m<sup>3</sup>  
 QUALITY OF RE-BAR.....B 500 S

**0 CONTENTS**

**1 GENERAL**

**2 TRACK ERECTION**

**3 TRACK TOLERANCES**

**4 TRACK END**

## 1 GENERAL

! AN APPROPRIATE TRACK ERECTION IS A KEY POINT FOR A PERFECT CRANE OPERATION IN OPTIMAL SAFETY CONDITIONS.

When selecting the crane site, recommendations given in "SITE, WARNINGS" document at the beginning of this chapter, must be taken into account.

As a general rule, standard UNE 58-101-92 part 2 must be complied with, notwithstanding other applicable regulations or standards required in the crane site location.

## 2 TRACK ERECTION

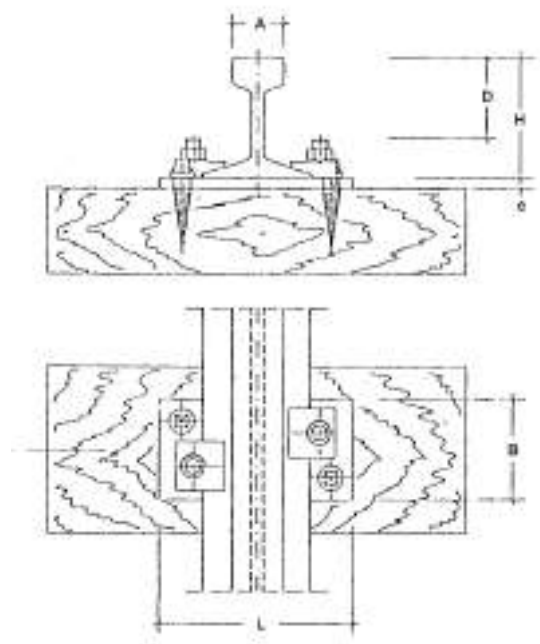
Soil resistance must guarantee track stability.

The user must make sure (through certified documentation on soil characteristics or geotechnical surveys) that the soil where the crane is erected, as well as the foundations are adequate to correctly withstand the maximum loads specified by the manufacturer.

Track rails and other track elements shall be designed and installed in such a manner as to guaranteeing an effective transmission of the maximum loads specified by the manufacturer without permanent deflections.

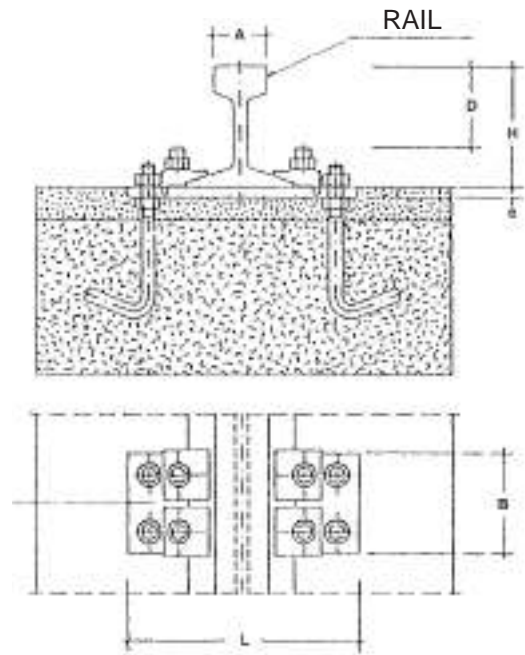
### Rails on wooden slippers

RAIL kg/m	L	B	e	A	H	D
30	230	120	12	53	110	48
35	230	120	12	60	123	61
45	230	120	12	66	142	80



### Rails on concrete slippers

CARRIL kg/m	L	B	e	A	H	D
30	260	120	12	53	110	48
35	260	120	12	60	123	61
45	260	120	12	66	142	80



### Prefab track

## 3 TRACK TOLERANCES

Tolerances accepted for straight tracks are as follows.

### Longitudinal levelling.

Rolling surface of the same rail shall be levelled to a maximum of 1/1000 of the track width "L".

### Transversal levelling

Difference in height between track rails shall not be more than 1/1000 of track width "L".

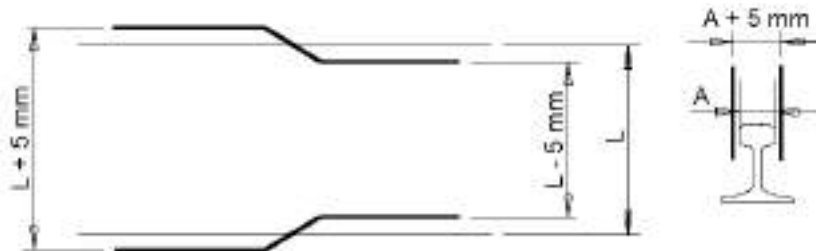


Track width (m)	t (mm)
3,2	3,2
3,8	3,8
4,5	4,5
6,0	6,0
10,0	10,0

### Distance between rail centerlines

Shall be equal to theoretical track width "L" +/- 5 mm.

Railheads must be enclosed in the space between two parallel vertical planes separated by a distance equal to the nominal width "A" of said heads plus 5 mm.

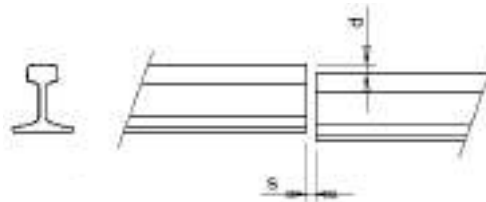


### Offset between rail sections at the joint

Shall be 2 mm maximum.

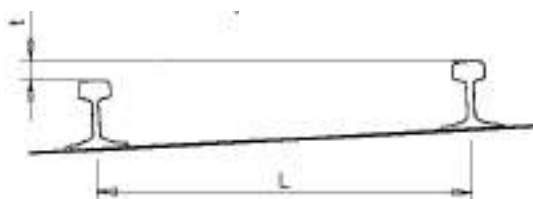
### Rail joint separation

Shall be 5 mm maximum.



### Transversal levelling of rail flange

Shall be 3/1000 of L in a horizontal plane



Track width (m)	t (mm)
3,2	9,6
3,8	11,4
4,5	13,5
6,0	18,0
10,0	30,0

### Track condition

If used rails are employed, the flat worn surface of the head shall be fairly centered on the rail plane of symmetry.



IF DURING OPERATION ANY OF THESE TRACK TOLERANCES ARE EXCEEDED IN MORE THAN 20% NECESSARY ACTION MUST BE TAKEN.

In case of bends, in slopes, or under special circumstances, the user must comply with the instructions and applicable specifications given by the manufacturer for the specific case.

#### **4 TRACK ENDS.**

Track ends will be provided with:

- End of travel limiter actuator (limiter ramp) for the crane to stop at a minimum distance of 0,5 m from the track stops.
- Bumpers placed at least 1 m before the end of the track.

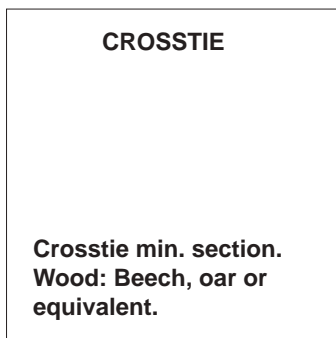
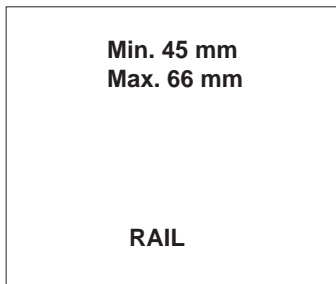
Necessary data for material acquisition and erection shall be given by the manufacturer for each type of crane.



Track rails must be electrically connected to ground see instruction "ELECTRIC WIRING AND GROUNDING" in chapter ELECTRICAL INSTALLATION of this manual.

**3,8 m**

**Concrete bearing shoe**



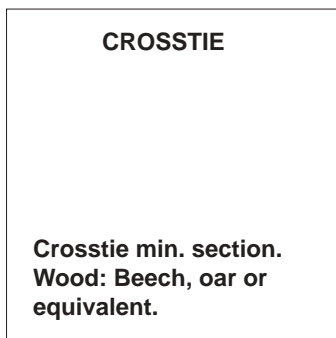
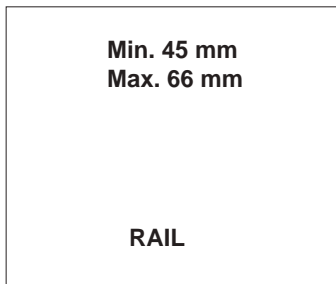


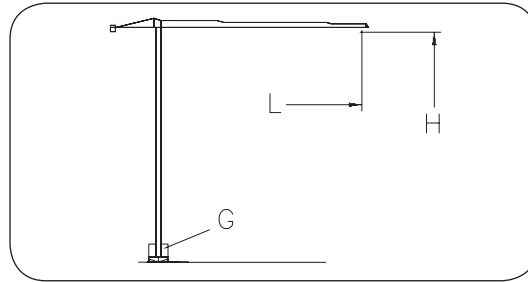


Track rails must be electrically connected to ground see instruction "ELECTRIC WIRING AND GROUNDING" in chapter ELECTRICAL INSTALLATION of this manual.

**4,5 m**

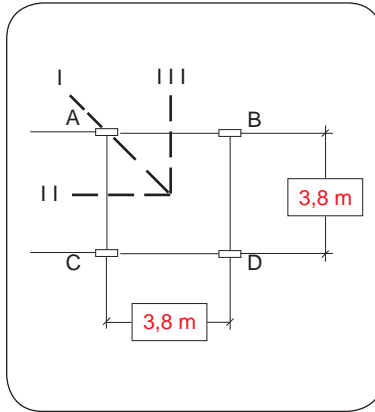
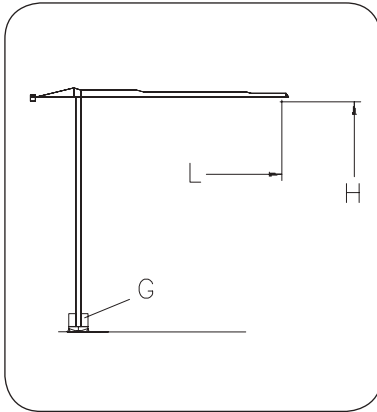
**Concrete bearing shoe**





DESIGNATION	CODE	Reference	Rev.
Reactions	1XA31; 1XR31	MTJ 030 0276 IB	A
Reactions / pressure under foundation	1XA31	MTJ 030 0296 IB	A
Reactions	3XA51; 3XR51	MTJ 030 0277 IB	A
Reactions / pressure under foundation	3XA51	MTJ 030 0297 IB	A
Reactions	5XA71; 5XR71	MTJ 030 0278 IB	A
Reactions / pressure under foundation	5XA71	MTJ 030 0298 IB	A

REACTIONS



- S .....In service
- FS .....Out of service
- L .....Hook radius (m)
- H .....Height under hook (m)
- G .....Base ballast (t)
- SR .....Two falls
- SR/DR .....Two/four falls
- Z .....Max. FS pressure (kN)
- X .....Max. S pressure (kN)
- V .....Horizontal force FS (kN)
- W .....Horizontal force S (kN)

H ↓		42,4	36,9	31,4	25,9	20,4			
60,0	TOWER COMPOSITION	7xS13	6xS13	5xS13	4xS13	3xS13			
	G	103,4	94,0	75,2	61,1	56,4			
	Z	917	783	598	463	368			
	X	719	674	591	524	484			
	V	116	111	101	91	81			
	W	30	29	27	25	22			
57,5	G	103,4	94,0	75,2	61,1	56,4			
	Z	882	748	580	446	381			
	X	734	688	605	537	497			
	V	116	110	100	90	80			
	W	31	29	27	25	22			
	55,0	G	103,4	94,0	75,2	61,1	56,4		
Z		870	737	573	440	379			
X		727	681	598	531	491			
V		116	110	100	90	80			
W		30	29	27	25	22			
52,5		G	103,4	94,0	75,2	61,1	56,4		
	Z	880	748	575	442	368			
	X	742	696	613	546	505			
	V	115	110	100	90	80			
	W	30	29	27	25	22			
	50,0	G	103,4	94,0	75,2	61,1	56,4		
Z		849	718	560	427	380			
X		728	683	600	532	493			
V		115	109	99	89	79			
W		30	29	27	25	22			
47,5		G	103,4	94,0	75,2	61,1	56,4		
	Z	817	706	548	416	397			
	X	760	714	630	569	522			
	V	115	109	99	89	79			
	W	31	29	27	25	22			
	45,0	G	103,4	94,0	75,2	61,1	56,4		
Z		794	690	534	417	399			
X		754	708	625	565	519			
V		115	109	99	89	79			
W		31	29	27	25	22			

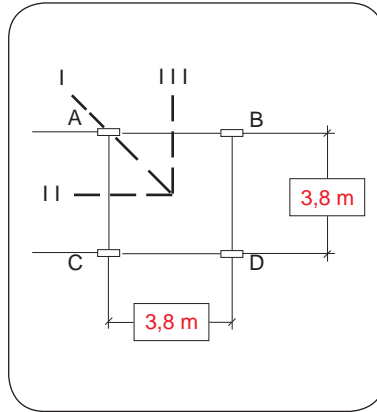
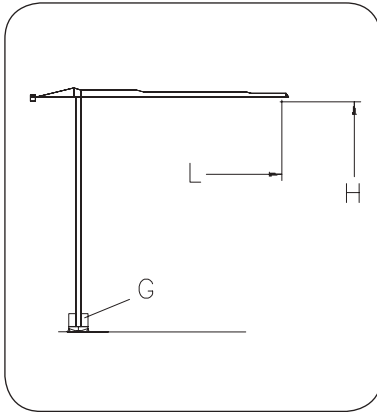
L ↓		60,0	57,5	55,0	52,5	50,0	47,5	45,0	
IN SERVICE	I	A	719	734	727	742	728	760	754
		B	397	398	395	392	392	397	393
		C	397	398	395	392	392	397	393
		D	75	61	63	42	56	34	32
	II	A	616	626	620	630	620	645	639
		B	179	169	169	154	163	149	147
		C	616	626	620	630	620	645	639
		D	179	169	169	154	163	149	147
	III	A	616	626	620	630	620	645	639
		B	616	626	620	630	620	645	639
		C	179	169	169	154	163	149	147
		D	179	169	169	154	163	149	147

**1XA31**      **1XR31**

**SR/DR 8000 kg**

L ↓		60,0	57,5	55,0	52,5	50,0	47,5	45,0	
OUT OF SERVICE	I	A	917	882	870	880	849	817	794
		B	327	345	344	332	347	370	373
		C	327	345	344	332	347	370	373
		D	0	0	0	0	0	0	0
	II	A	679	666	659	659	647	640	627
		B	107	119	120	113	124	139	143
		C	679	666	659	659	647	640	627
		D	107	119	120	113	124	139	143
	III	A	679	666	659	659	647	640	627
		B	679	666	659	659	647	640	627
		C	107	119	120	113	124	139	143
		D	107	119	120	113	124	139	143

REACTIONS



- S .....In service
- FS .....Out of service
- L .....Hook radius (m)
- H .....Height under hook (m)
- G .....Base ballast (t)
- SR .....Two falls
- SR/DR .....Two/four falls
- Z .....Max. FS pressure (kN)
- X .....Max. S pressure (kN)
- V .....Horizontal force FS (kN)
- W .....Horizontal force S (kN)

H ↕		42,4	36,9	31,4	25,9	20,4			
↕	TOWER COMPOSITION	7xS13	6xS13	5xS13	4xS13	3xS13			
	42,5	G	103,4	94,0	75,2	61,1	56,4		
Z		787	688	532	417	399			
X		752	706	622	559	514			
V		114	109	98	88	78			
W		31	29	27	25	22			
40,0	G	103,4	94,0	75,2	61,1	56,4			
	Z	797	690	534	406	388			
	X	765	719	645	590	543			
	V	114	108	98	88	78			
	W	31	29	27	25	22			
37,5	G	103,4	94,0	75,2	61,1	56,4			
	Z	793	688	533	406	388			
	X	759	713	632	577	530			
	V	114	108	98	88	78			
	W	31	29	27	25	22			
35,0	G	103,4	94,0	75,2	61,1	56,4			
	Z	786	680	525	400	381			
	X	725	680	598	531	491			
	V	113	107	97	87	77			
	W	30	29	27	25	22			
32,5	G	103,4	94,0	75,2	61,1	56,4			
	Z	774	674	520	400	382			
	X	737	692	609	549	503			
	V	113	107	97	87	77			
	W	30	29	27	25	22			
30,0	G	103,4	94,0	75,2	61,1	56,4			
	Z	751	658	505	402	384			
	X	741	696	615	562	517			
	V	112	106	96	86	76			
	W	31	29	27	25	22			
	G								
	Z								
	X								
	V								
	W								

L ↕		42,5	40,0	37,5	35,0	32,5	30,0		
IN SERVICE	I	A	752	765	759	725	737	741	
		B	394	392	392	387	387	384	
		C	394	392	392	387	387	384	
		D	36	18	25	48	37	27	
	II	A	638	647	643	617	626	627	
		B	150	137	142	157	148	140	
		C	638	647	643	617	626	627	
		D	150	137	142	157	148	140	
	III	A	638	647	643	617	626	627	
		B	638	647	643	617	626	627	
		C	150	137	142	157	148	140	
		D	150	137	142	157	148	140	

**1XA31**

**1XR31**

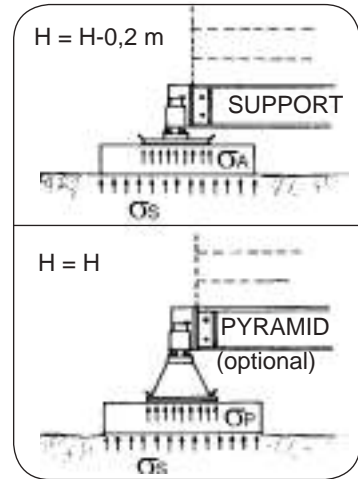
**SR/DR 8000 kg**

L ↕		42,5	40,0	37,5	35,0	32,5	30,0		
OUT OF SERVICE	I	A	787	797	793	786	774	751	
		B	377	366	368	361	365	368	
		C	377	366	368	361	365	368	
		D	0	0	0	0	0	0	
	II	A	625	626	625	617	612	599	
		B	145	139	140	137	140	144	
		C	625	626	625	617	612	599	
		D	145	139	140	137	140	144	
	III	A	625	626	625	617	612	599	
		B	625	626	625	617	612	599	
		C	145	139	140	137	140	144	
		D	145	139	140	137	140	144	

# 1XA31

	A x A x h (m)
<b>D1</b>	1,0 x 1,0 x 0,5
<b>D2</b>	1,2 x 1,2 x 0,5
<b>D3</b>	1,4 x 1,4 x 0,5
<b>D4</b>	1,6 x 1,6 x 0,5
<b>D5</b>	1,8 x 1,8 x 0,5
<b>D6</b>	2,0 x 2,0 x 0,5

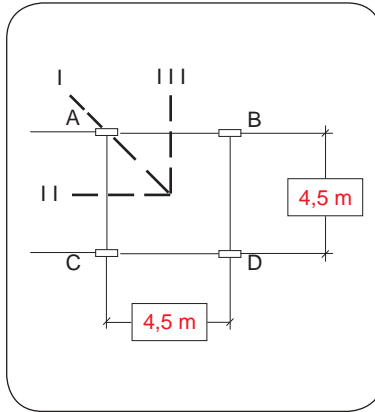
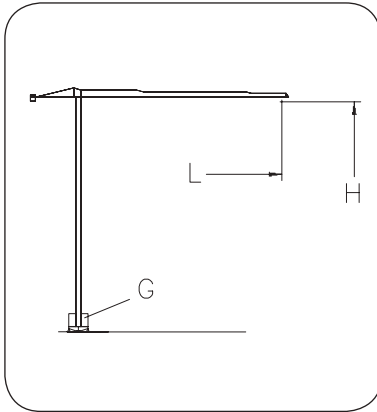
- A x A x h** -Foundation dimensions. (m)
- H** -Hook height. (m)
- SR** -Single reeving.
- SR/DR** -Double reeving.
- $\sigma_s$  -Pressure under foundation. (kg/cm<sup>2</sup>)
- $\sigma_A$  -Pressure under plates. (kg/cm<sup>2</sup>)
- $\sigma_P$  -Pressure under support cones. (kg/cm<sup>2</sup>)



☞ See document "FOUNDATION'S EXECUTION": **(MTJ 030 0014)**

				$\sigma_s$					
<b>SR SR/DR</b>	<b>H</b>	$\sigma_A$	$\sigma_P$	<b>D1</b>	<b>D2</b>	<b>D3</b>	<b>D4</b>	<b>D5</b>	<b>D6</b>
	<b>42,4</b>	57,3	14,3	9,3	6,5	4,8	3,7	3,0	2,4
	<b>36,9</b>	48,9	12,2	8,0	5,6	4,1	3,2	2,5	2,1
	<b>31,4</b>	40,3	10,1	6,6	4,6	3,4	2,6	2,1	1,7
	<b>25,9</b>	36,9	9,2	6,0	4,2	3,1	2,4	1,9	1,6
	<b>20,4</b>	33,9	8,5	5,6	3,9	2,9	2,2	1,8	1,5

REACTIONS



S .....In service  
 FS .....Out of service  
 L .....Hook radius (m)  
 H .....Height under hook (m)  
 G .....Base ballast (t)  
 SR .....Two falls  
 SR/DR .....Two/four falls  
 Z .....Max. FS pressure (kN)  
 X .....Max. S pressure (kN)  
 V .....Horizontal force FS (kN)  
 W .....Horizontal force S (kN)

H ↓		47,9	42,4	36,9	31,4	25,9	20,4	
60,0	G	97,2	86,4	70,2	54,0	43,2	43,2	
	Z	1001	873	667	512	401	327	
	X	698	650	575	503	449	425	
	V	133	127	117	107	97	87	
	W	35	33	31	29	27	24	
	57,5	G	97,2	86,4	70,2	54,0	43,2	43,2
		Z	970	842	638	498	387	337
X		711	663	587	515	461	436	
V		133	127	117	107	97	87	
W		35	34	31	29	27	24	
55,0		G	97,2	86,4	70,2	54,0	43,2	43,2
		Z	958	832	629	491	381	335
	X	704	656	581	509	455	431	
	V	132	126	116	106	96	86	
	W	35	33	31	29	27	24	
	52,5	G	97,2	86,4	70,2	54,0	43,2	43,2
		Z	966	840	638	492	382	325
X		716	668	593	521	466	442	
V		132	126	116	106	96	86	
W		35	33	31	29	27	24	
50,0		G	97,2	86,4	70,2	54,0	43,2	43,2
		Z	938	813	614	480	370	335
	X	704	656	581	510	456	431	
	V	132	126	116	106	96	86	
	W	35	33	31	29	27	24	
	47,5	G	97,2	86,4	70,2	54,0	43,2	43,2
		Z	911	787	604	470	361	350
X		733	685	609	536	481	456	
V		132	126	116	106	96	86	
W		35	34	31	29	27	24	
45,0		G	97,2	86,4	70,2	54,0	43,2	43,2
		Z	890	766	591	458	357	351
	X	727	679	603	531	478	451	
	V	131	125	115	105	95	85	
	W	35	34	31	29	27	24	

L ↓		60,0	57,5	55,0	52,5	50,0	47,5	45,0	
IN SERVICE	I	A	698	711	704	716	704	733	727
		B	395	396	393	390	390	395	391
		C	395	396	393	390	390	395	391
		D	93	80	82	63	75	56	55
	II	A	599	608	603	610	602	624	619
		B	191	183	183	169	177	166	164
		C	599	608	603	610	602	624	619
		D	191	183	183	169	177	166	164
	III	A	599	608	603	610	602	624	619
		B	599	608	603	610	602	624	619
		C	191	183	183	169	177	166	164
		D	191	183	183	169	177	166	164

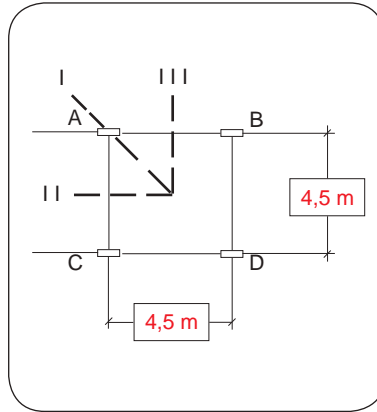
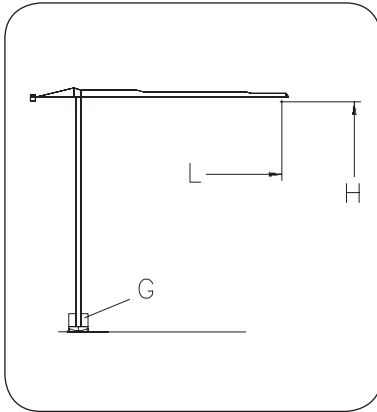
**3XA51**

**3XR51**

**SR/DR 8000 kg**

L ↓		60,0	57,5	55,0	52,5	50,0	47,5	45,0	
OUT OF SERVICE	I	A	1001	970	958	966	938	911	890
		B	281	296	296	285	298	319	321
		C	281	296	296	285	298	319	321
		D	0	0	0	0	0	0	0
	II	A	702	691	684	683	673	667	655
		B	79	90	91	84	94	107	110
		C	702	691	684	683	673	667	655
		D	79	90	91	84	94	107	110
	III	A	702	691	684	683	673	667	655
		B	702	691	684	683	673	667	655
		C	79	90	91	84	94	107	110
		D	79	90	91	84	94	107	110

REACTIONS



- S .....In service
- FS .....Out of service
- L .....Hook radius (m)
- H .....Height under hook (m)
- G .....Base ballast (t)
- SR .....Two falls
- SR/DR .....Two/four falls
- Z .....Max. FS pressure (kN)
- X .....Max. S pressure (kN)
- V .....Horizontal force FS (kN)
- W .....Horizontal force S (kN)

H ↕		47,9	42,4	36,9	31,4	25,9	20,4
↕	TOWER COMPOSITION	6xS13 + TS14 + S14	5xS13 + TS14 + S14	4xS13 + TS14 + S14	3xS13 + TS14 + S14	2xS13 + TS14 + S14	S13 + TS14 + S14
	G	97,2	86,4	70,2	54,0	43,2	43,2
42,5	Z	884	761	589	456	357	351
	X	725	677	601	529	474	450
	V	131	125	115	105	95	85
	W	35	34	31	29	27	24
	G	97,2	86,4	70,2	54,0	43,2	43,2
40,0	Z	890	768	590	457	349	341
	X	736	688	612	544	499	460
	V	130	125	115	105	95	84
	W	35	34	31	29	27	24
	G	97,2	86,4	70,2	54,0	43,2	43,2
37,5	Z	887	765	589	456	349	341
	X	731	683	607	535	488	455
	V	130	124	114	104	94	84
	W	35	34	31	29	27	24
	G	97,2	86,4	70,2	54,0	43,2	43,2
35,0	Z	879	758	581	449	342	334
	X	701	653	579	508	453	429
	V	130	124	114	104	94	84
	W	35	33	31	29	27	24
	G	97,2	86,4	70,2	54,0	43,2	43,2
32,5	Z	868	748	576	445	341	335
	X	711	664	589	517	464	439
	V	129	123	113	103	93	83
	W	35	33	31	29	27	24
	G	97,2	86,4	70,2	54,0	43,2	43,2
30,0	Z	847	728	562	432	342	336
	X	714	666	591	520	476	441
	V	129	123	113	103	93	83
	W	35	34	31	29	27	24
	G	97,2	86,4	70,2	54,0	43,2	43,2
Z	847	728	562	432	342	336	
X	714	666	591	520	476	441	
V	129	123	113	103	93	83	
W	35	34	31	29	27	24	

L ↕		42,5	40,0	37,5	35,0	32,5	30,0	
IN SERVICE	I	A	725	736	731	701	711	714
		B	392	390	390	385	385	382
		C	392	390	390	385	385	382
		D	59	43	49	68	58	49
	II	A	618	625	621	598	606	607
		B	166	154	159	171	164	157
		C	618	625	621	598	606	607
		D	166	154	159	171	164	157
	III	A	618	625	621	598	606	607
		B	618	625	621	598	606	607
		C	166	154	159	171	164	157
		D	166	154	159	171	164	157

**3XA51**

**3XR51**

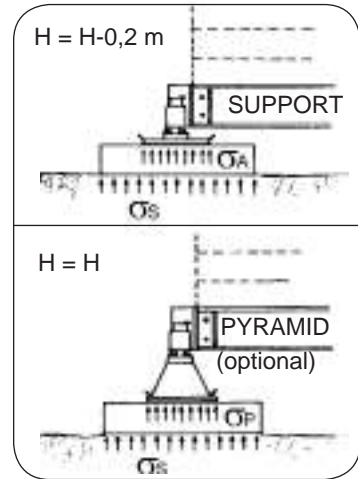
**SR/DR 8000 kg**

L ↕		42,5	40,0	37,5	35,0	32,5	30,0	
OUT OF SERVICE	I	A	884	890	887	879	868	847
		B	324	315	317	310	314	316
		C	324	315	317	310	314	316
		D	0	0	0	0	0	0
	II	A	653	653	652	644	639	627
		B	113	107	109	106	109	112
		C	653	653	652	644	639	627
		D	113	107	109	106	109	112
	III	A	653	653	652	644	639	627
		B	653	653	652	644	639	627
		C	113	107	109	106	109	112
		D	113	107	109	106	109	112

# 3XA51

	A x A x h (m)
<b>D1</b>	1,0 x 1,0 x 0,5
<b>D2</b>	1,2 x 1,2 x 0,5
<b>D3</b>	1,4 x 1,4 x 0,5
<b>D4</b>	1,6 x 1,6 x 0,5
<b>D5</b>	1,8 x 1,8 x 0,5
<b>D6</b>	2,0 x 2,0 x 0,5

- A x A x h** -Foundation dimensions. (m)
- H** -Hook height. (m)
- SR** -Single reeving.
- SR/DR** -Double reeving.
- $\sigma_s$**  -Presure under foundation. (kg/cm<sup>2</sup>)
- $\sigma_A$**  -Presure under plates. (kg/cm<sup>2</sup>)
- $\sigma_P$**  -Presure under support cones. (kg/cm<sup>2</sup>)

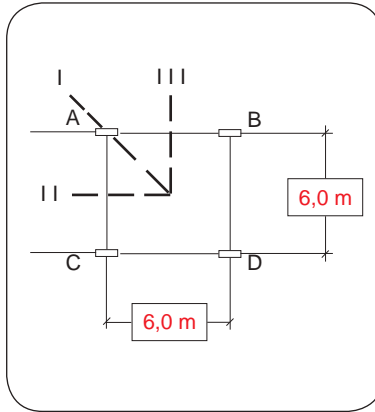
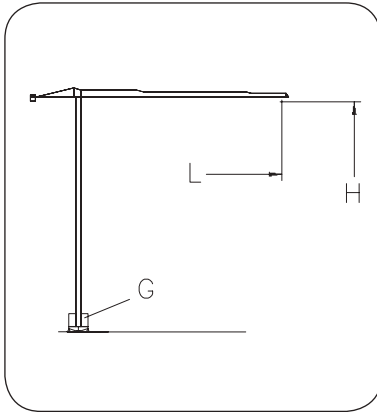


☞ See document "FOUNDATION'S EXECUTION": **(MTJ 030 0014)**

				<b><math>\sigma_s</math></b>					
<b>SR SR/DR</b>	<b>H</b>	<b><math>\sigma_A</math></b>	<b><math>\sigma_P</math></b>	<b>D1</b>	<b>D2</b>	<b>D3</b>	<b>D4</b>	<b>D5</b>	<b>D6</b>
	<b>47,9</b>	62,6	15,6	10,1	7,1	5,2	4,0	3,2	2,6
	<b>42,4</b>	54,6	13,6	8,9	6,2	4,6	3,5	2,8	2,3
	<b>36,9</b>	41,7	10,4	6,8	4,8	3,5	2,7	2,2	1,8
	<b>31,4</b>	34,0	8,5	5,6	3,9	2,9	2,2	1,8	1,5
	<b>25,9</b>	31,2	7,8	5,1	3,6	2,7	2,1	1,7	1,4
	<b>20,4</b>	28,8	7,2	4,7	3,3	2,5	1,9	1,5	1,3



REACTIONS



S .....In service  
 FS .....Out of service  
 L .....Hook radius (m)  
 H .....Height under hook (m)  
 G .....Base ballast (t)  
 SR .....Two falls  
 SR/DR .....Two/four falls  
 Z .....Max. FS pressure (kN)  
 X .....Max. S pressure (kN)  
 V .....Horizontal force FS (kN)  
 W .....Horizontal force S (kN)

H ↓		59,2	53,7	48,2	42,7	37,2	31,7		
60,0	G	81,0	67,5	67,5	54,0	40,5	40,5		
	Z	1044	931	855	680	526	443		
	X	641	589	576	512	452	427		
	V	162	156	152	142	132	122		
	W	43	41	40	38	36	34		
57,5	G	81,0	67,5	67,5	54,0	40,5	40,5		
	Z	1019	907	831	658	505	432		
	X	652	599	586	522	461	436		
	V	162	156	152	142	132	122		
	W	43	41	40	38	36	34		
55,0	G	81,0	67,5	67,5	54,0	40,5	40,5		
	Z	1009	897	822	650	499	426		
	X	645	593	580	516	455	431		
	V	162	156	151	141	131	121		
	W	43	41	40	38	36	34		
52,5	G	81,0	67,5	67,5	54,0	40,5	40,5		
	Z	1013	903	827	656	505	426		
	X	654	601	588	525	464	439		
	V	161	155	151	141	131	121		
	W	43	41	40	38	36	34		
50,0	G	81,0	67,5	67,5	54,0	40,5	40,5		
	Z	991	881	806	636	488	417		
	X	645	593	580	516	455	431		
	V	161	155	151	141	131	121		
	W	43	41	40	38	36	34		
47,5	G	81,0	67,5	67,5	54,0	40,5	40,5		
	Z	971	861	786	616	482	411		
	X	669	616	603	538	477	452		
	V	161	155	151	141	131	121		
	W	43	42	41	38	36	34		
45,0	G	81,0	67,5	67,5	54,0	40,5	40,5		
	Z	952	843	769	601	471	400		
	X	663	611	597	533	472	447		
	V	160	155	150	140	130	120		
	W	43	42	41	38	36	34		

		L ⇨	60,0	57,5	55,0	52,5	50,0	47,5	45,0
IN SERVICE	I	A	641	652	645	654	645	669	663
		B	374	375	372	369	369	374	370
		C	374	375	372	369	369	374	370
		D	107	98	99	84	93	79	77
	II	A	552	560	555	560	553	572	567
		B	196	190	189	178	185	176	174
		C	552	560	555	560	553	572	567
		D	196	190	189	178	185	176	174
	III	A	552	560	555	560	553	572	567
		B	552	560	555	560	553	572	567
		C	196	190	189	178	185	176	174
		D	196	190	189	178	185	176	174

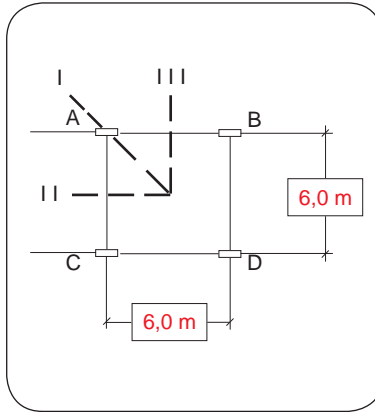
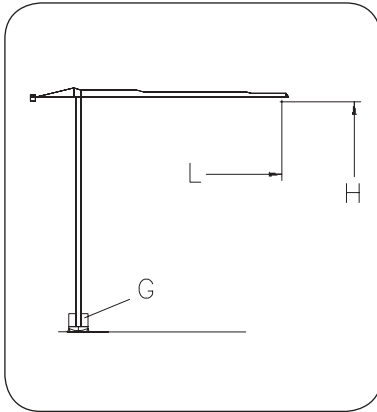
**5XA71**

**5XR71**

**SR/DR 8000 kg**

		L ⇨	60,0	57,5	55,0	52,5	50,0	47,5	45,0
OUT OF SERVICE	I	A	1044	1019	1009	1013	991	971	952
		B	218	230	229	220	230	248	248
		C	218	230	229	220	230	248	248
		D	0	0	0	0	0	0	0
	II	A	694	685	678	676	668	665	654
		B	46	55	55	50	57	68	70
		C	694	685	678	676	668	665	654
		D	46	55	55	50	57	68	70
	III	A	694	685	678	676	668	665	654
		B	694	685	678	676	668	665	654
		C	46	55	55	50	57	68	70
		D	46	55	55	50	57	68	70

REACTIONS



- S .....In service
- FS .....Out of service
- L .....Hook radius (m)
- H .....Height under hook (m)
- G .....Base ballast (t)
- SR .....Two falls
- SR/DR .....Two/four falls
- Z .....Max. FS pressure (kN)
- X .....Max. S pressure (kN)
- V .....Horizontal force FS (kN)
- W .....Horizontal force S (kN)

H ↕		59,2	53,7	48,2	42,7	37,2	31,7	
↕	TOWER COMPOSITION	6xS13 + TS14 + S14 + TS15 + S15	5xS13 + TS14 + S14 + TS15 + S15	4xS13 + TS14 + S14 + TS15 + S15	3xS13 + TS14 + S14 + TS15 + S15	2xS13 + TS14 + S14 + TS15 + S15	S13 + TS14 + S14 + TS15 + S15	
	G	81,0	67,5	67,5	54,0	40,5	40,5	
42,5	Z	947	838	764	597	469	399	
	X	662	609	596	532	471	446	
	V	160	154	150	140	130	120	
	W	43	42	41	38	36	34	
	G	81,0	67,5	67,5	54,0	40,5	40,5	
40,0	Z	950	842	769	602	470	399	
	X	670	617	604	539	478	453	
	V	160	154	150	140	130	120	
	W	43	41	41	38	36	34	
	G	81,0	67,5	67,5	54,0	40,5	40,5	
37,5	Z	947	840	766	600	469	398	
	X	666	613	600	536	475	450	
	V	159	154	149	139	129	119	
	W	43	41	41	38	36	34	
	G	81,0	67,5	67,5	54,0	40,5	40,5	
35,0	Z	939	832	760	595	461	392	
	X	641	589	576	513	452	428	
	V	159	153	149	139	129	119	
	W	43	41	40	38	36	34	
	G	81,0	67,5	67,5	54,0	40,5	40,5	
32,5	Z	929	823	751	587	457	388	
	X	649	597	584	520	459	435	
	V	158	153	148	138	128	118	
	W	43	41	40	38	36	34	
	G	81,0	67,5	67,5	54,0	40,5	40,5	
30,0	Z	911	806	734	572	446	377	
	X	650	598	585	521	461	436	
	V	158	152	148	138	128	118	
	W	43	41	40	38	36	34	
	G	81,0	67,5	67,5	54,0	40,5	40,5	
Z	911	806	734	572	446	377		
X	650	598	585	521	461	436		
V	158	152	148	138	128	118		
W	43	41	40	38	36	34		

L ↕		42,5	40,0	37,5	35,0	32,5	30,0		
IN SERVICE	I	A	662	670	666	641	649	650	
		B	371	369	369	364	364	361	
		C	371	369	369	364	364	361	
		D	80	68	73	87	79	72	
	II	A	566	571	569	549	555	555	
		B	176	166	170	179	173	167	
		C	566	571	569	549	555	555	
		D	176	166	170	179	173	167	
	III	A	566	571	569	549	555	555	
		B	566	571	569	549	555	555	
		C	176	166	170	179	173	167	
		D	176	166	170	179	173	167	

**5XA71**

**5XR71**

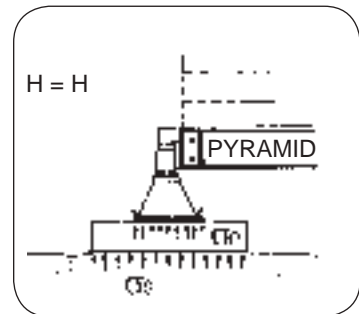
**SR/DR 8000 kg**

L ↕		42,5	40,0	37,5	35,0	32,5	30,0		
OUT OF SERVICE	I	A	947	950	947	939	929	911	
		B	251	243	245	238	242	242	
		C	251	243	245	238	242	242	
		D	0	0	0	0	0	0	
	II	A	652	650	649	641	637	626	
		B	73	68	69	67	70	71	
		C	652	650	649	641	637	626	
		D	73	68	69	67	70	71	
	III	A	652	650	649	641	637	626	
		B	652	650	649	641	637	626	
		C	73	68	69	67	70	71	
		D	73	68	69	67	70	71	

# 5XA71

	A x A x h (m)
<b>D1</b>	1.6 x 1.6 x 0.6
<b>D2</b>	1.8 x 1.8 x 0.6
<b>D3</b>	2.0 x 2.0 x 0.6
<b>D4</b>	2.2 x 2.2 x 0.6
<b>D5</b>	2.4 x 2.4 x 0.6
<b>D6</b>	2.6 x 2.6 x 0.6

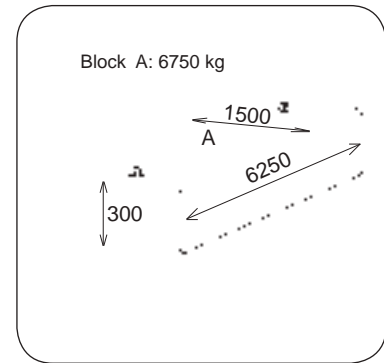
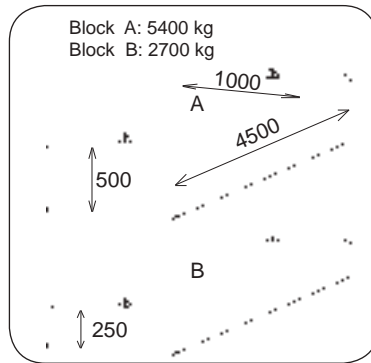
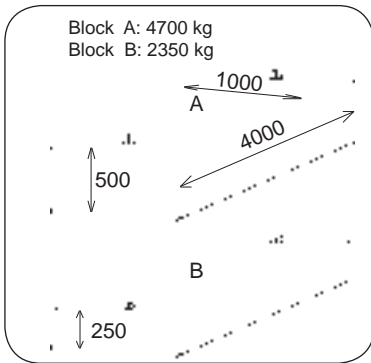
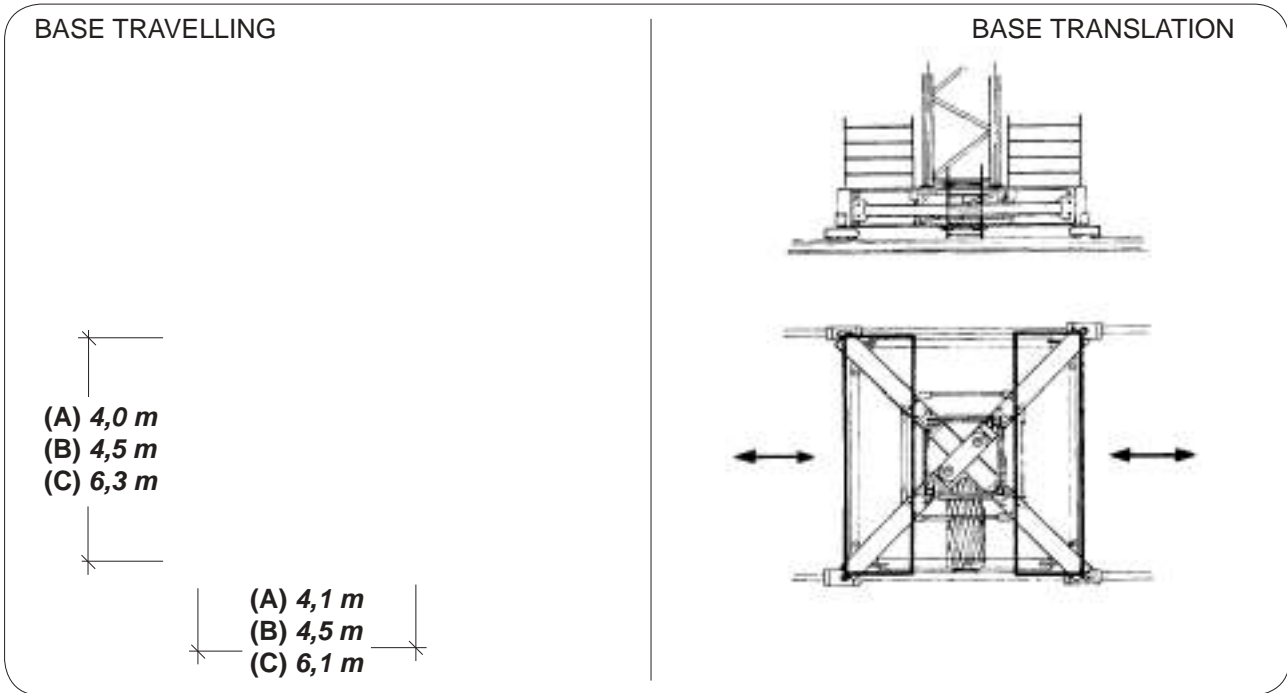
- A x A x h** -Foundation dimensions. (m)
- H** -Hook height. (m)
- SR** -Single reeving.
- SR/DR** -Double reeving.
- $\sigma_s$  -Pressure under foundation. (kg/cm<sup>2</sup>)
- $\sigma_A$  -Pressure under plates. (kg/cm<sup>2</sup>)
- $\sigma_P$  -Pressure under support cones. (kg/cm<sup>2</sup>)



☞ See document "FOUNDATION'S EXECUTION": **(MTJ 030 0069)**

		$\sigma_s$						
<b>SR SR/DR</b>	<b>H</b>	$\sigma_P$	<b>D1</b>	<b>D2</b>	<b>D3</b>	<b>D4</b>	<b>D5</b>	<b>D6</b>
	<b>47,9</b>	8,6	4,2	3,4	2,8	2,3	2,0	1,7
	<b>42,4</b>	7,7	3,8	3,0	2,5	2,1	1,8	1,5
	<b>36,9</b>	7,1	3,5	2,8	2,3	1,9	1,6	1,4
	<b>31,4</b>	5,6	2,8	2,2	1,8	1,5	1,3	1,1
	<b>25,9</b>	4,3	2,2	1,8	1,5	1,2	1,1	0,9
	<b>20,4</b>	3,7	1,9	1,5	1,3	1,1	0,9	0,8

## POSITION BLOCKS BALLAST

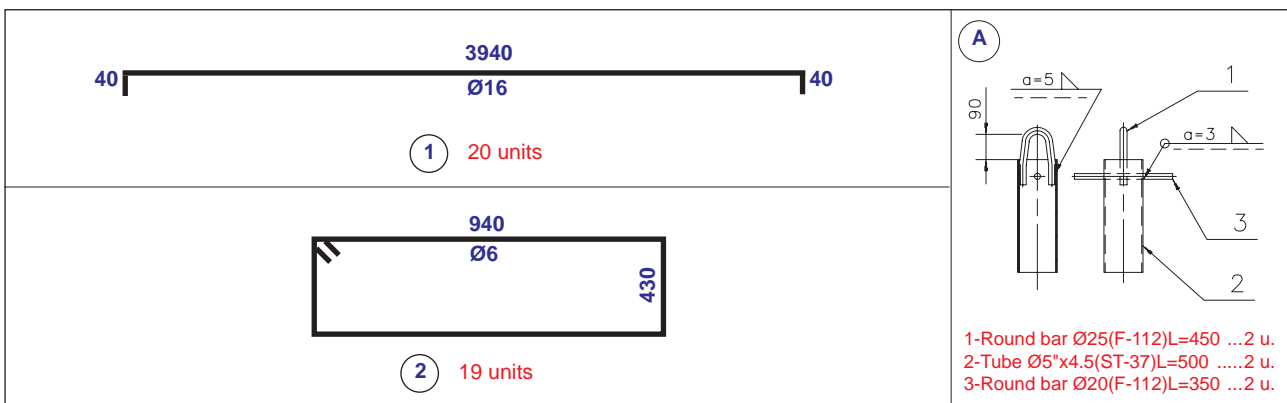


1XA31 / 1XR31	
Base ballast (t)	Composition blocks
94,0	20 x A
89,3	18 x A + 2 x B
84,6	18 x A
79,9	16 x A + 2 x B
75,2	16 x A
70,5	14 x A + 2 x B
65,8	14 x A
61,1	12 x A + 2 x B
56,4	12 x A
51,7	10 x A + 2 x B
47,0	10 x A
42,3	8 x A + 2 x B
37,6	8 x A

3XA51 / 3XR51	
Base ballast (t)	Composition blocks
91,8	16 x A + 2 x B
86,4	16 x A
81,0	14 x A + 2 x B
75,6	14 x A
70,2	12 x A + 2 x B
64,8	12 x A
59,4	10 x A + 2 x B
54,0	10 x A
48,6	8 x A + 2 x B
43,2	8 x A
37,8	6 x A + 2 x B
32,4	6 x A

5XA71 / 5XR71	
Base ballast (t)	Composition blocks
148,5	22 x A
135,0	20 x A
121,5	18 x A
108,0	16 x A
94,5	14 x A
81,0	12 x A
67,5	10 x A
54,0	8 x A
40,5	6 x A
27,0	4 x A

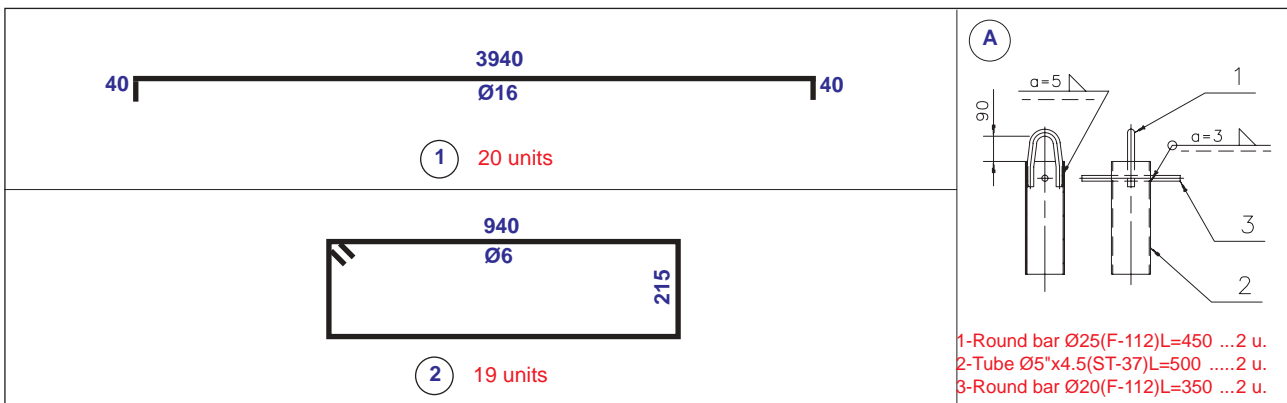
**3201P1767-1**  
**Block: 4700 kg**



Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE.....HH-300 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE..... 19 mm  
WEIGHT PER SLAB (DRY).....**4700 kg ± 2%**  
QUALITY OF RE-BAR.....AEH 500S

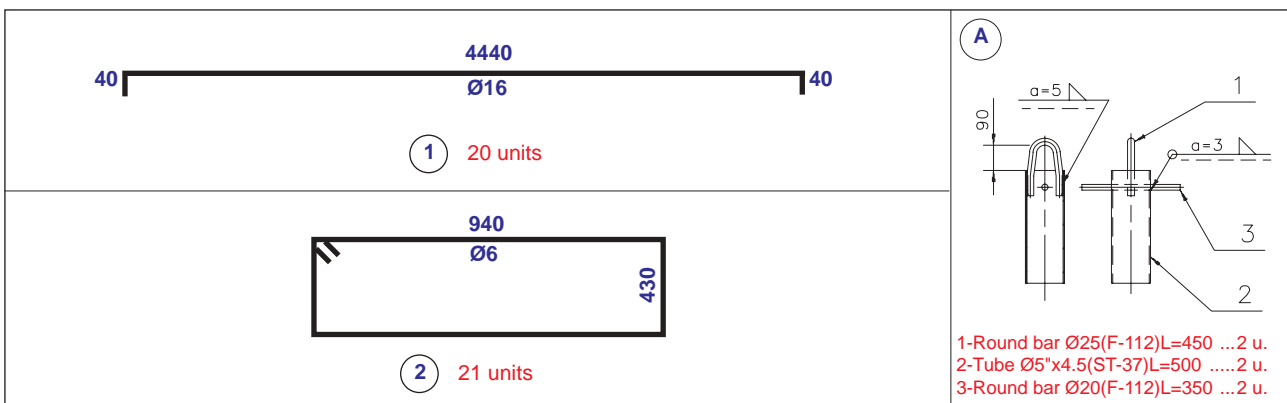
**3201P1767-2**  
**Block: 2350 kg**



Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE ..... HH-300 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY) ..... **2350 kg ± 2%**  
QUALITY OF RE-BAR ..... AEH 500S

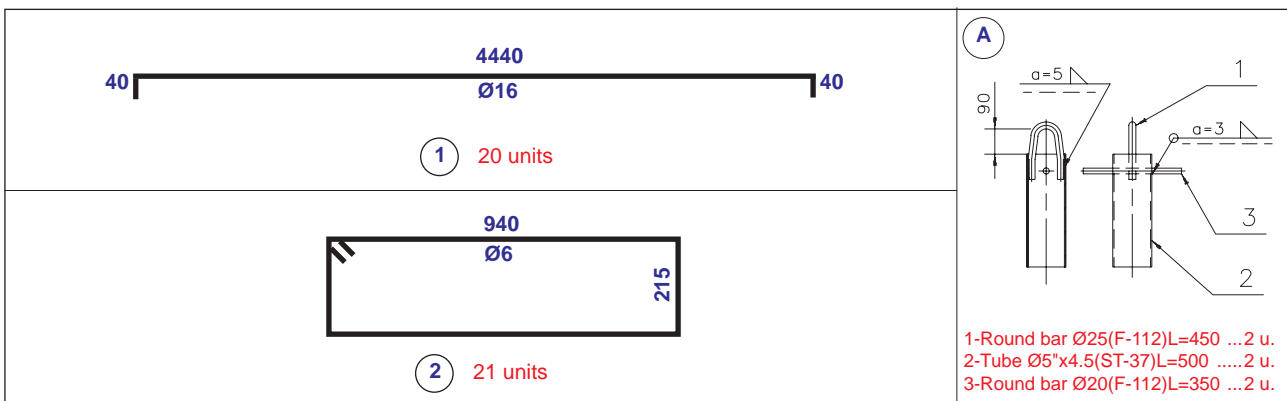
**3201P1816-1**  
**Block: 5400 kg**



Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE ..... HH-300 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY) ..... **5400 kg ± 2%**  
QUALITY OF RE-BAR ..... AEH 500S

**3201P1816-2**  
**Block: 2700 kg**



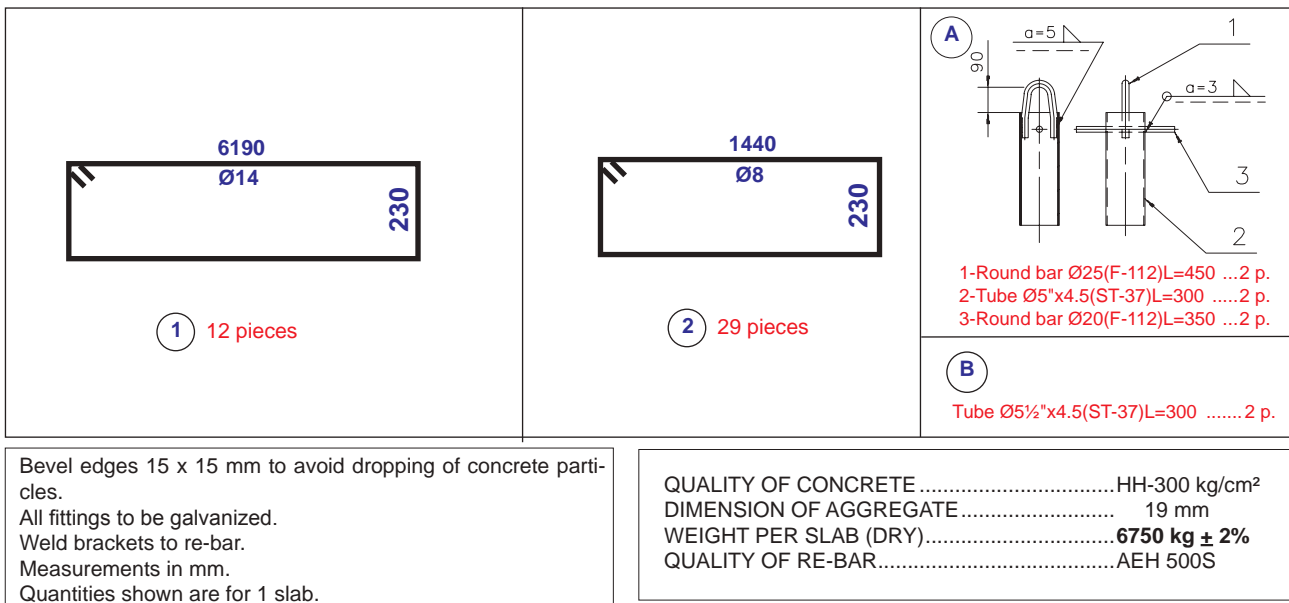
Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE .....HH-300 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY).....**2700 kg  $\pm$  2%**  
QUALITY OF RE-BAR.....AEH 500S



**3201M2034**  
**Block : 6750 kg**

Mark the slab weight in an  
indeleble way

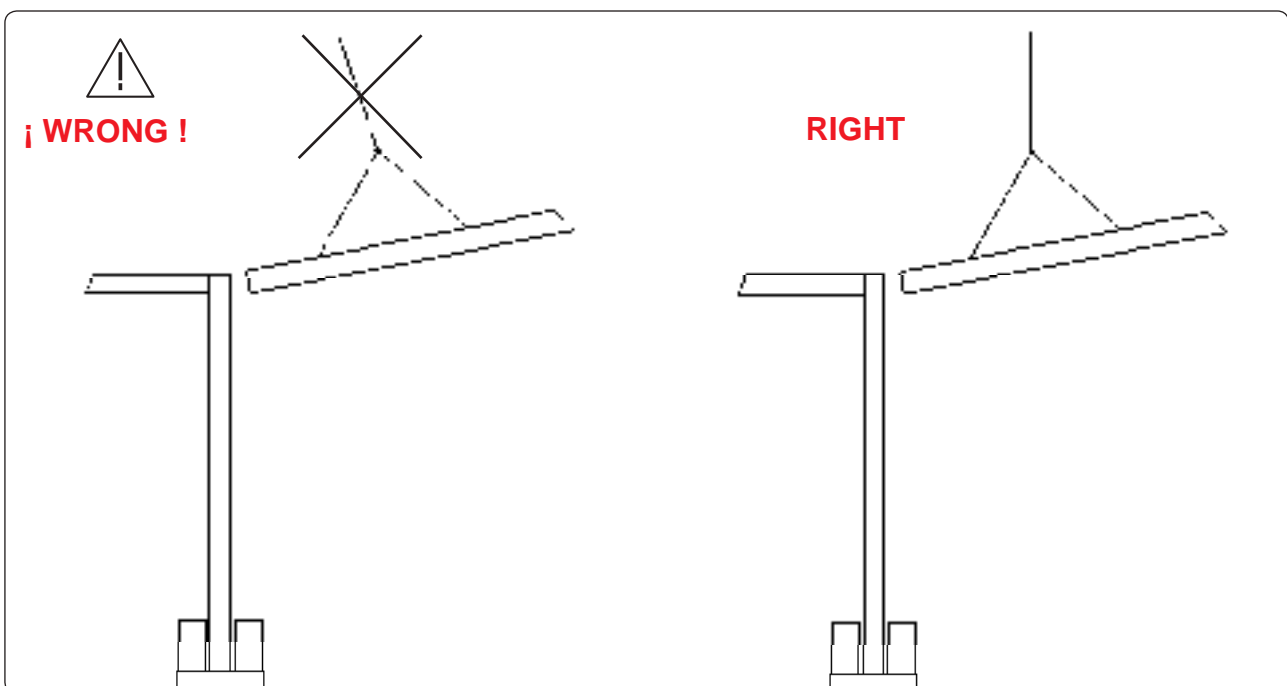


- 1 Erections and dismantling operations shall be carried out by qualified personnel complying with applicable regulations related to their function and the location where said operations are being carried out.
- 2 The user must make sure that erection setup complies with applicable Regulations and Standards. This is to say:
  - Crane position must keep safety distances to other cranes or buildings.
  - Foundations, supports and tracks erected in accordance with the loads transmitted by the crane setup and required alignment and levelling tolerances.
  - Power supply and earth connections in accordance with current regulations and crane electrical data.
  - Accessibility and provision of enough space to carry out erection activities in a safe manner.
- 3 Keep operation sequences, safety warnings and instructions given in this manual.
- 4 Use approved personal protection equipment required for the job.
- 5 If a mobile crane is used for erection make sure it is adequate for handling the heaviest part taking into account its dimensions and the position of the mobile crane on site.
- 6 Hoisting accessories used for erection must be duly approved for the loads to be handled. Load slinging and part handling must be done with care (see document "tackle and slings" in chapter Crane Operation of this manual)

## **WARNING**

**SPECIAL ATTENTION SHALL BE GIVEN TO AVOID SIDE PULLING FROM PARTS TO BE ERECTED OR ALREADY INSTALLED.**

**¡ SIDE PULLING IS TOTALLY FORBIDDEN !**



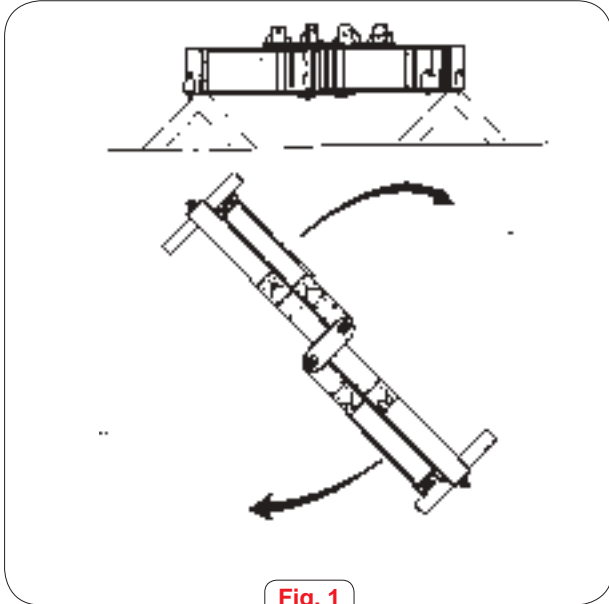
**ASSEMBLY OF FOLDING CROSS-BASE**

- 1 Rest base on two ends. (Fig. 1).

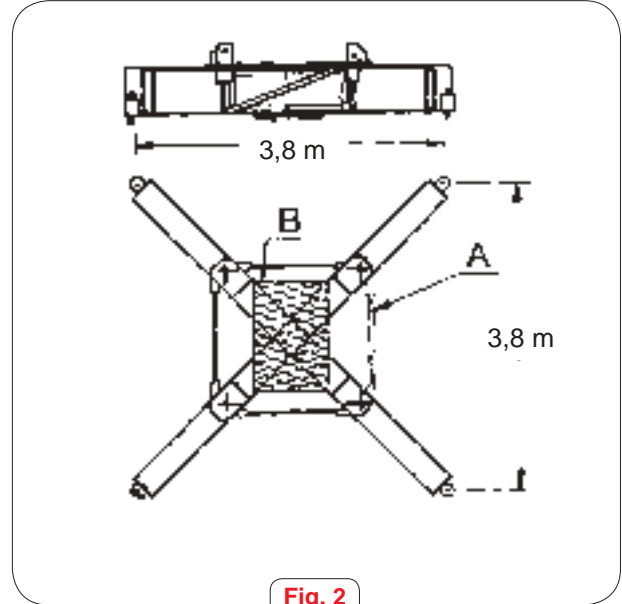


To prevent accidental unfolding of "arms" do not remove the transport fixing plates until the base is suitably supported.

- 2 Remove transport fixing plates and open both arms simultaneously, (to avoid imbalance and possible toppling of base) and immediately position braces A and B. (Fig. 2).

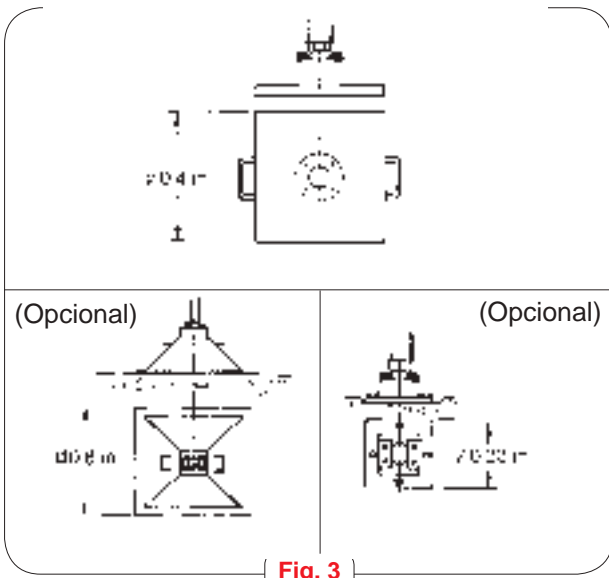


**Fig. 1**

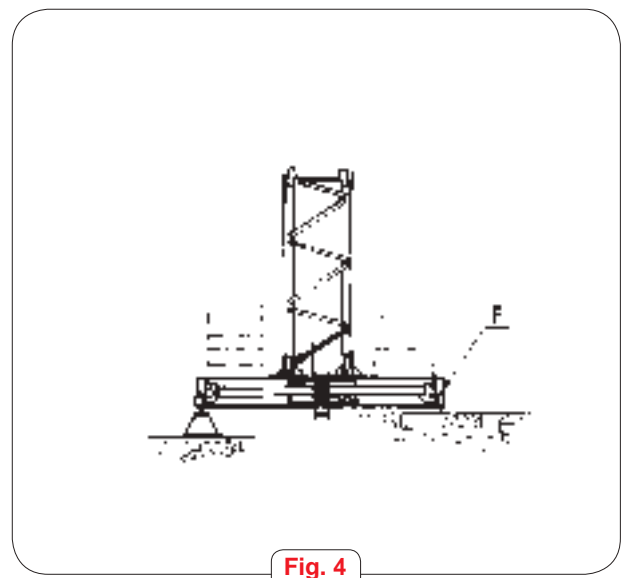


**Fig. 2**

- 3 Fit the con-rods. (B) (Fig. 2).
- 4 Fit stabilizer bases (E) or support bases and fix them in place. (Fig. 3).
- 5 Place base onto support cones or plates and level with screw jacks (F), using only machined surfaces for level checking.



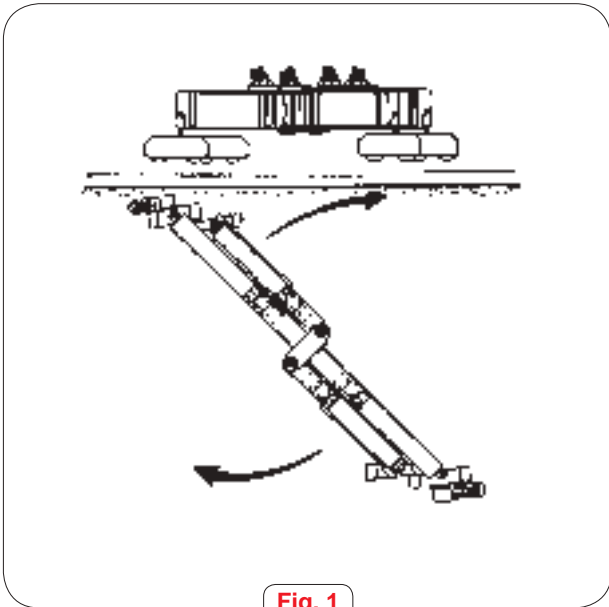
**Fig. 3**



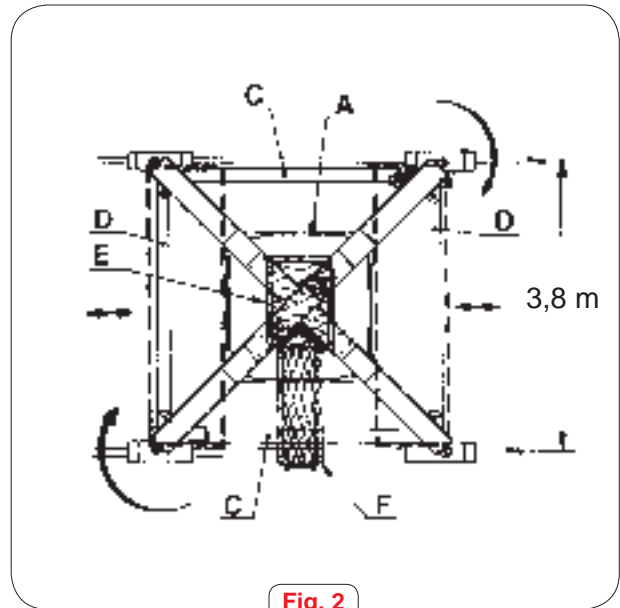
**Fig. 4**

- 6 Position first mast section and pin to base feet. (Fig. 4).
- 7 The crane base must be electrically connected to ground. See instructions in chapter "ELECTRICAL INSTALLATION".

**ASSEMBLY OF FOLDING CROSS-BASE (Travelling)**



**Fig. 1**

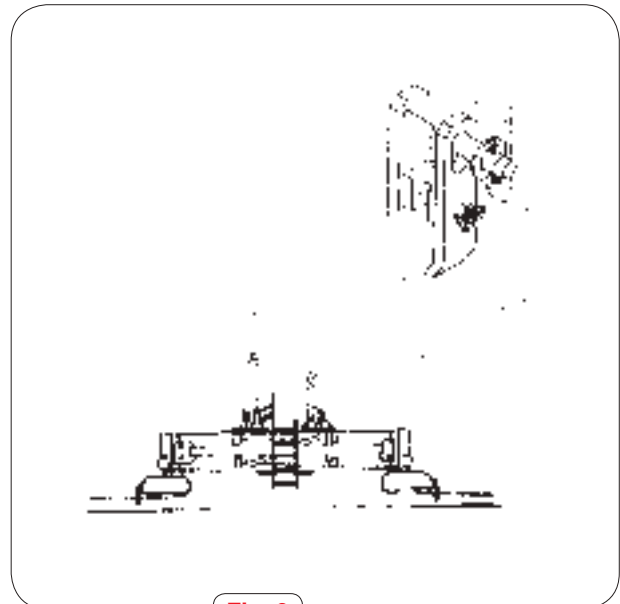


**Fig. 2**



To prevent accidental unfolding of "arms" do not remove the transport fixing plates until the base is suitably supported

- 1 Before resting the base on the ground, open the arms.(Fig. 1).
- 2 Rest the wheels on the rails and set the two horizontal tubing bars "C" in place, securing them at one end only. (Fig. 2).
- 3 Set the horizontal IPE bars "D" and bolt them at both ends. (Fig. 2).
- 4 Bolt the connecting rods "A" and the tubing bars "C". (Fig. 2).
- 5 The IPE bars "D" must be set at 90° to the rail.
- 6 Set the platforms "E" and "F" and the initial section "G", etc. in place (fig. 3)
- 7 The crane base must be electrically connected to ground. See instructions in chapter "ELECTRICAL INSTALLATION".



**Fig. 3**

## ASSEMBLY OF FOLDING CROSS-BASE

- 1 Rest base on two ends. (Fig. 1).



To prevent accidental unfolding of "arms" do not remove the transport fixing plates until the base is suitably supported.

- 2 Remove transport fixing plates and open both arms simultaneously, (to avoid imbalance and possible toppling of base) and immediately position braces A and B. (Fig. 2).

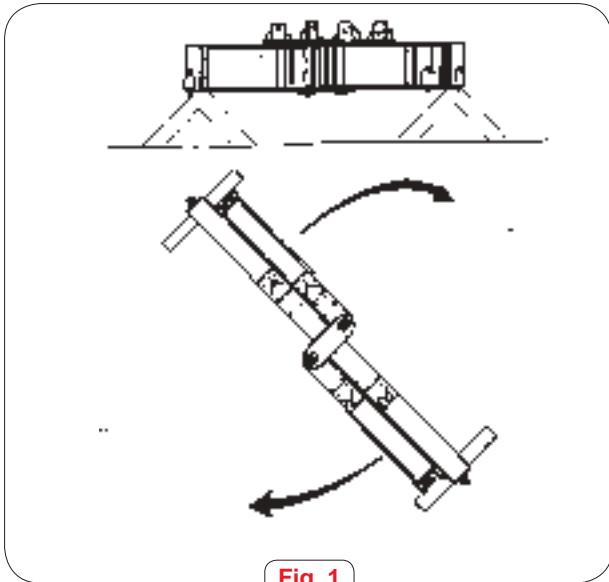


Fig. 1

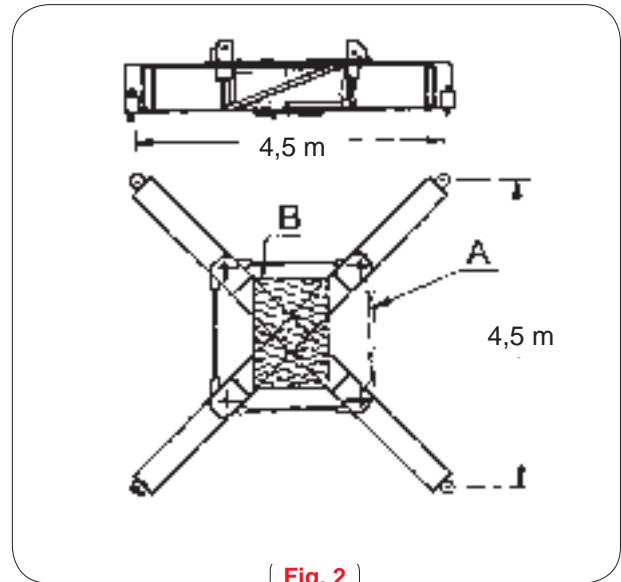


Fig. 2

- 3 Fit the con-rods. (B) (Fig. 2).
- 4 Fit stabilizer bases (E) or support bases and fix them in place. (Fig. 3).
- 5 Place base onto support cones or plates and level with screw jacks (F), using only machined surfaces for level checking.

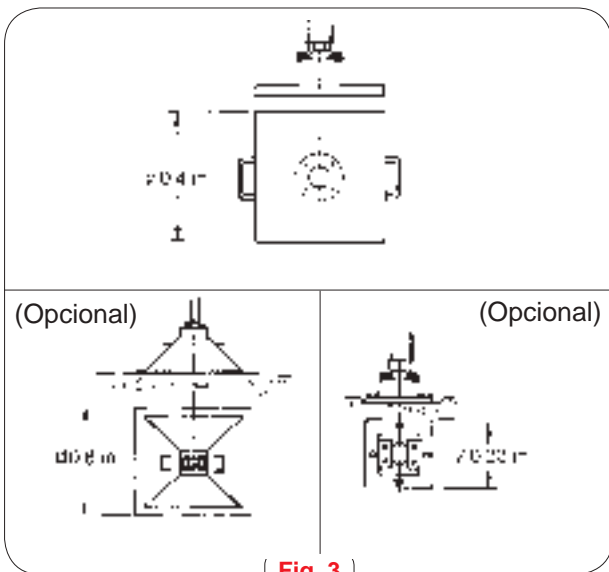


Fig. 3

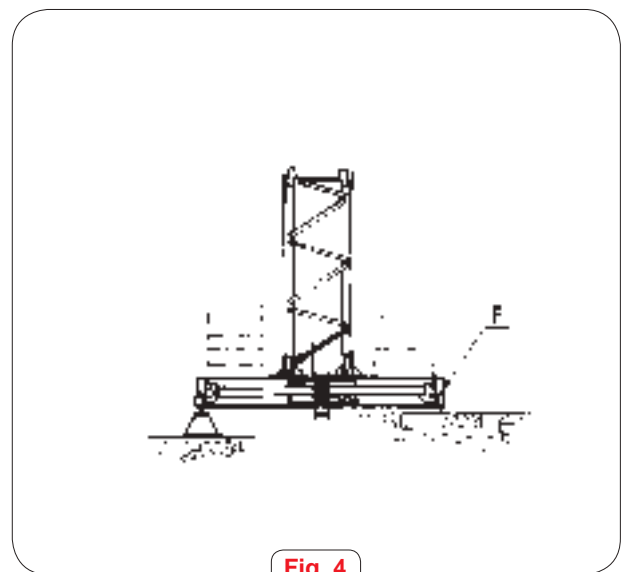
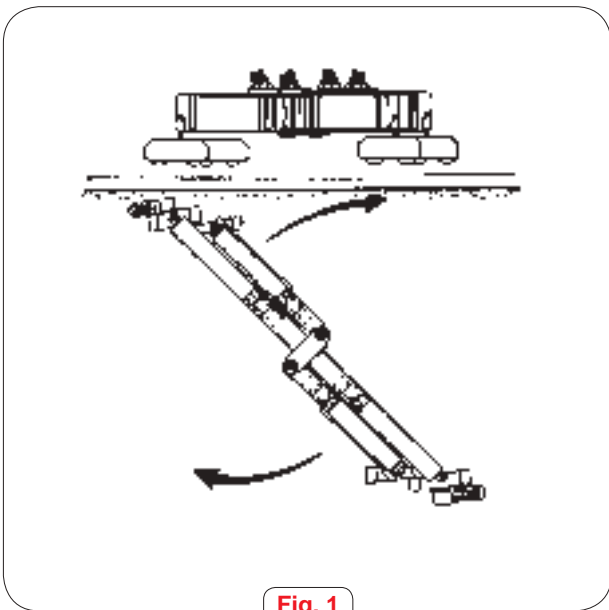


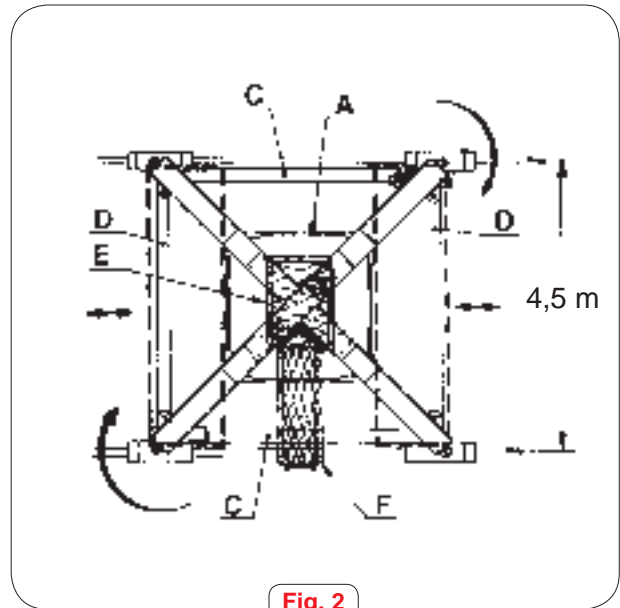
Fig. 4

- 6 Position first mast section and pin to base feet. (Fig. 4).
- 7 The crane base must be electrically connected to ground. See instructions in chapter "ELECTRICAL INSTALLATION".

## ASSEMBLY OF FOLDING CROSS-BASE (Travelling)



**Fig. 1**

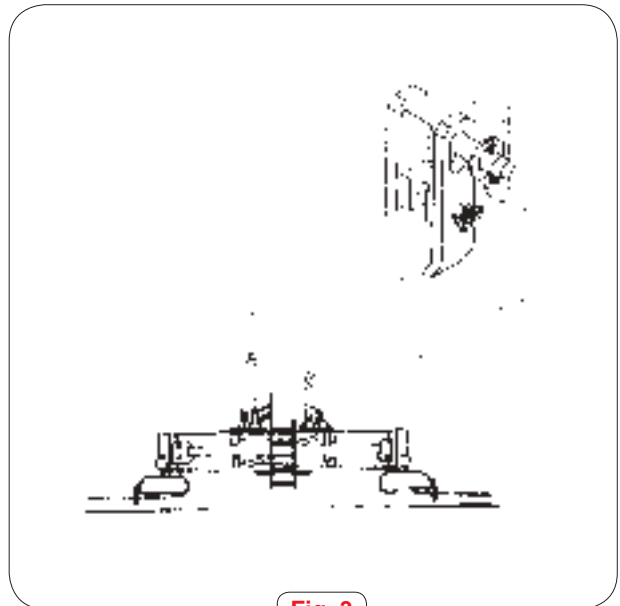


**Fig. 2**



To prevent accidental unfolding of "arms" do not remove the transport fixing plates until the base is suitably supported.

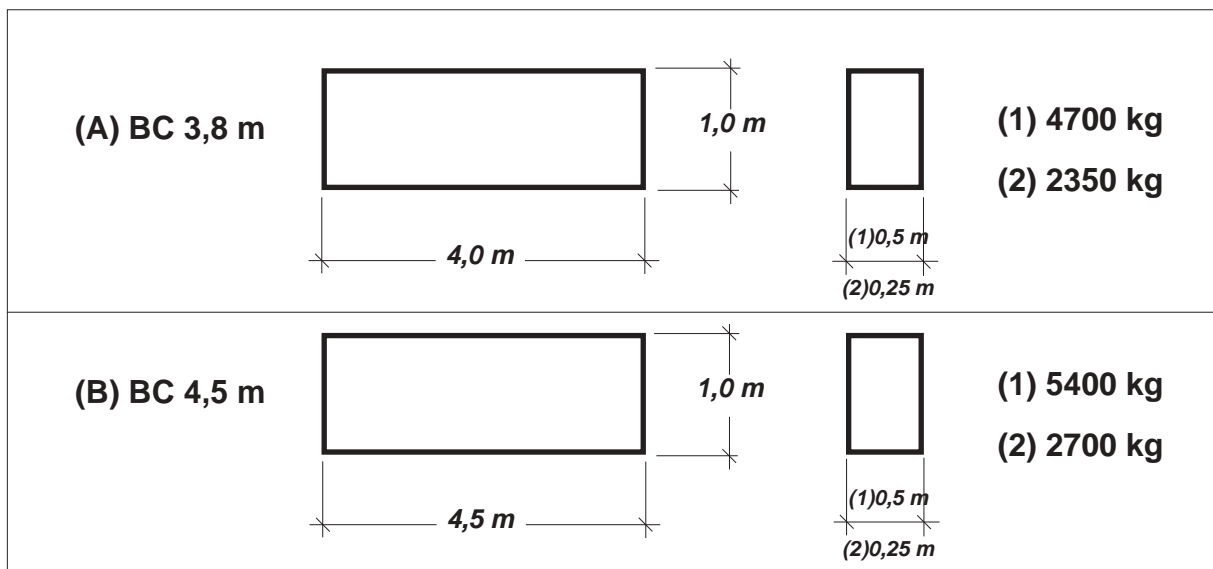
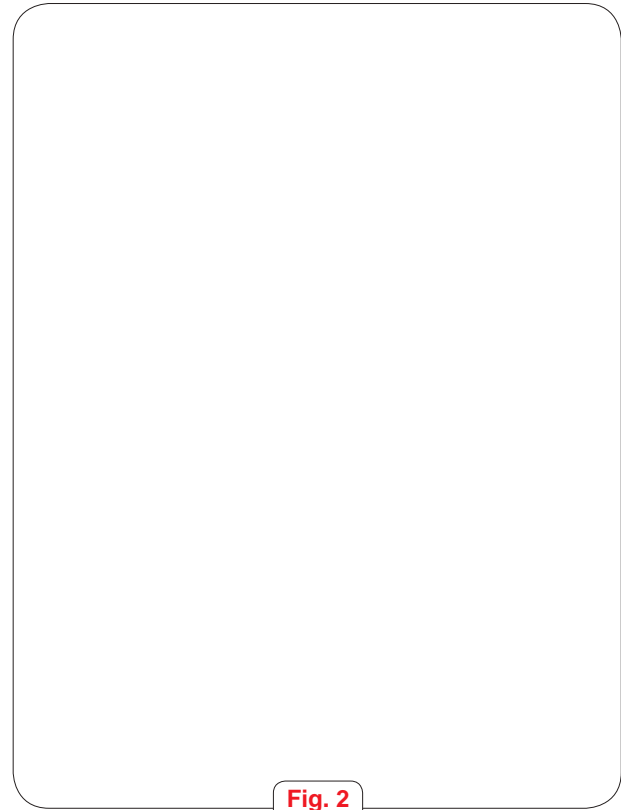
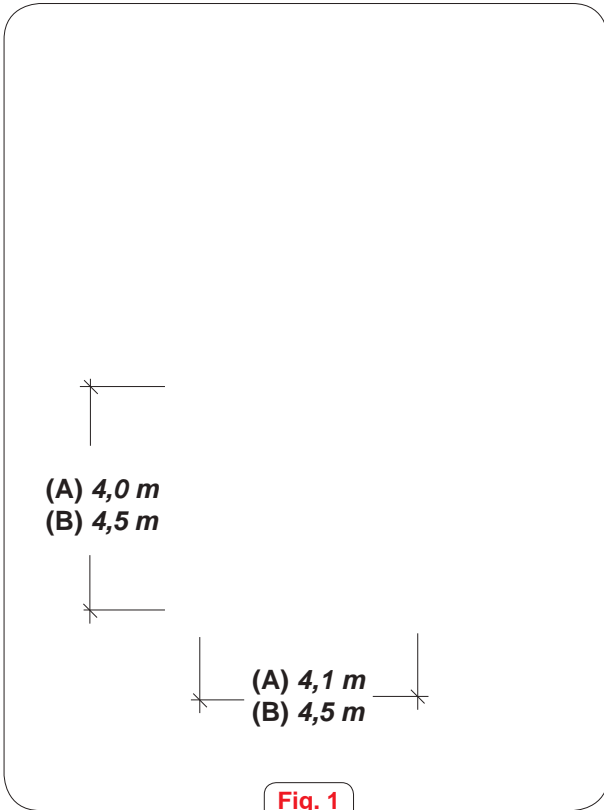
- 1 Before resting the base on the ground, open the arms.(Fig. 1).
- 2 Rest the wheels on the rails and set the two horizontal tubing bars "C" in place, securing them at one end only. (Fig. 2).
- 3 Set the horizontal IPE bars "D" and bolt them at both ends. (Fig. 2).
- 4 Bolt the connecting rods "A" and the tubing bars "C". (Fig. 2).
- 5 The IPE bars "D" must be set at 90° to the rail.
- 6 Set the platforms "E" and "F" and the initial section "G", etc. in place (fig. 3)
- 7<sup>o</sup>- The crane base must be electrically connected to ground. See instructions in chapter "ELECTRICAL INSTALLATION".



**Fig. 3**

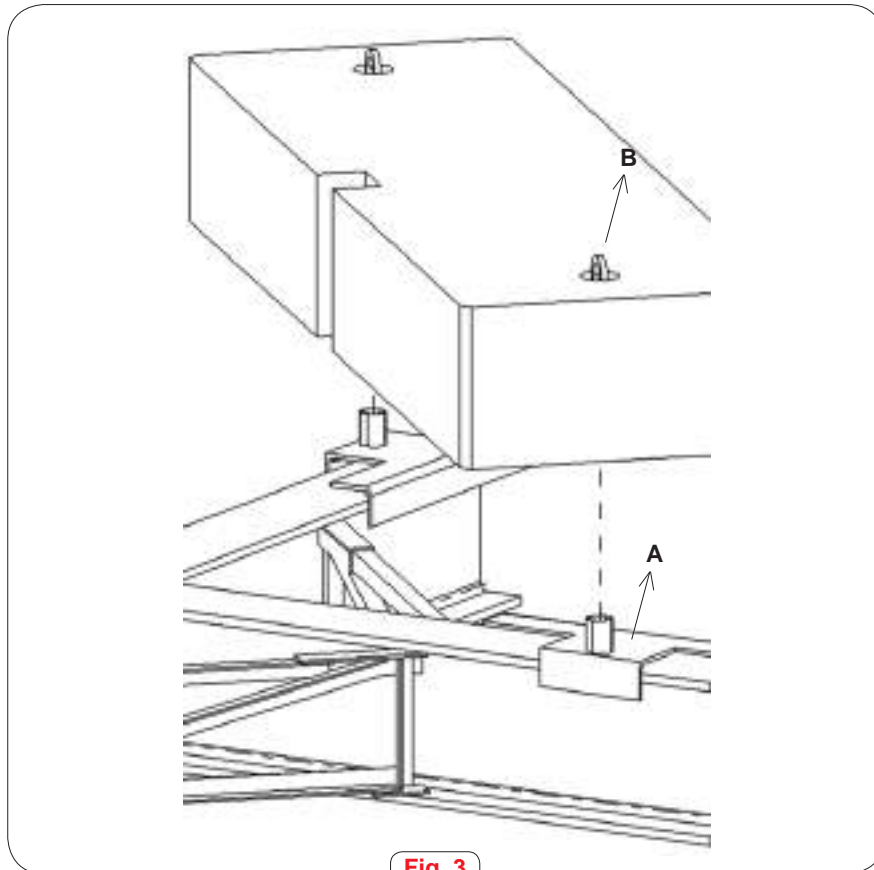
**ASSEMBLY BALLAST (Supported)**

**ASSEMBLY BALLAST (Travelling)**



**POSITION OF BASE BALLAST:**

- Base ballast block sizes and weights are as per the table above for each type of base.
- They are placed directly onto the cross-base arms and beam.
- The first block lodges into the fastening A (Fig. 3).
- The remaining blocks fit one onto another through the anchors B.

**DETAIL TO FIX****Fig. 3**



## VERSIONS AND POSITIONS OF BASE FEET

- The base consist of fixed beam with two folding arms, which open out to form a “cross”. The arms are locked in position by pinned cross-beams.
- The base has four machined surfaces prepared to receive different types of base-feet, according to the different mast sections it is intended to use.

**Fig. 1**  
*Position of base feet and  
platforms for  $\square$  1,6 m  
Towers.*

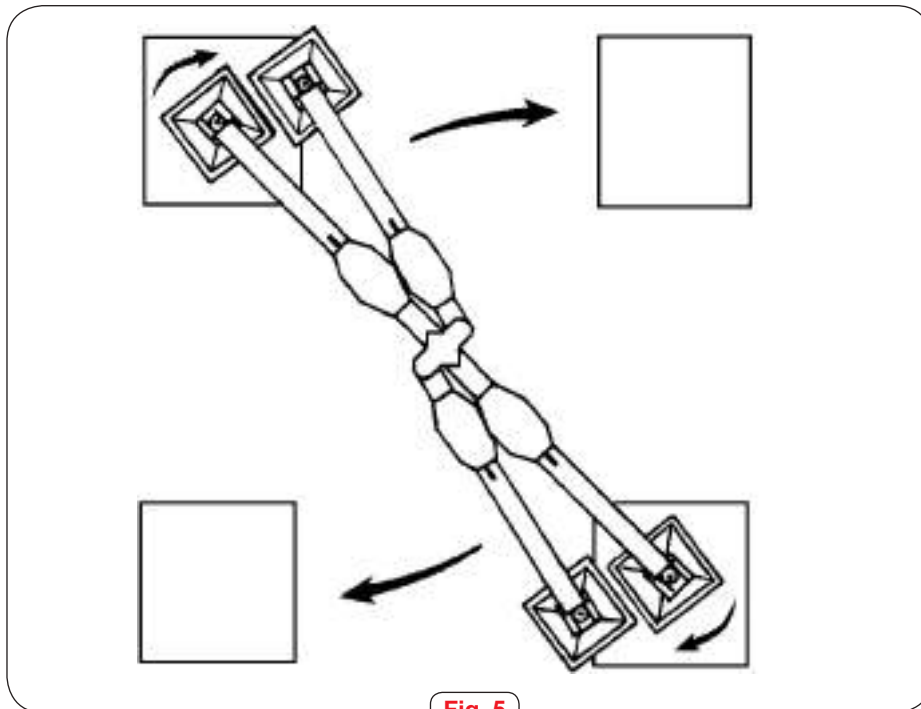
**Fig. 2**  
*Position of base feet and  
platforms for  $\square$  2,0 m  
Towers.*

**Fig. 3**  
*Position of base feet and  
platforms for  $\square$  2,5 m  
Towers.*

**Fig. 4**  
*Position of base feet and  
platforms for  $\square$  2,15 m  
Towers.*

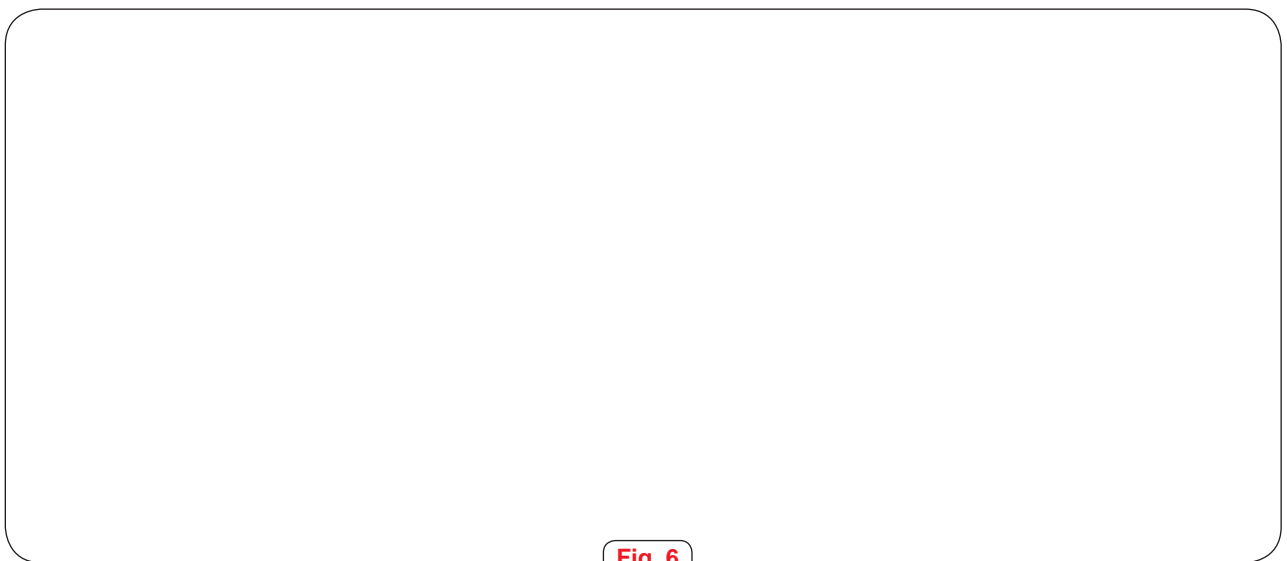
### SEQUENCE OF FIXED CROSS-BASE

- Raise base with assist crane and place the two fixed beam feet on support slabs or prepared foundations (Fig.5)



**Fig. 5**

- Remove transport fixing plates, and, with help from assist crane, open out the arms and lock with cross-beams "A" (Fig.6). Level the base using screw jacks in each corner of base.  
Note: Level tolerance is  $\pm 1$  mm at each corner of tower.
- Place platform "B" on cross-beams "A".
- Bolt platform "C" to platform "B".
- Bolt ladder "D" to platform "B".
- Ensure alignment of 1st Mast section ladder to permit correct access (See page 1)



**Fig. 6**

**POSITION OF BASE BALLAST:**

- The ballast slabs are 6,25 m x 1,5 m x 0,3 m and weigh 6750 kg each.
- They are placed directly onto the cross-base arms and beam.
- The first slabs are fixed to the base with parts "A" (Fig.7)

**Fig. 7**

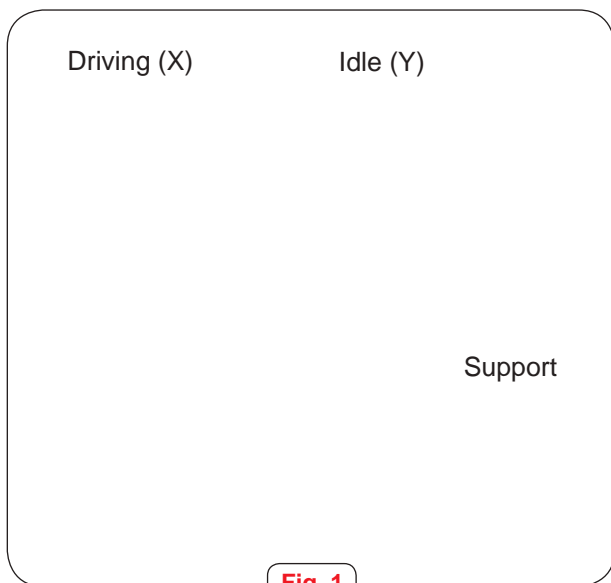
**ASSEMBLY SEQUENCE TRAVELING BASE.**

- Fit the transfer assemblies on the tracks (Fig. 1), fit supports to prevent them from moving and join them together via the relevant beams (Fig. 2). Beams must always be positioned perpendicular to the tracks.

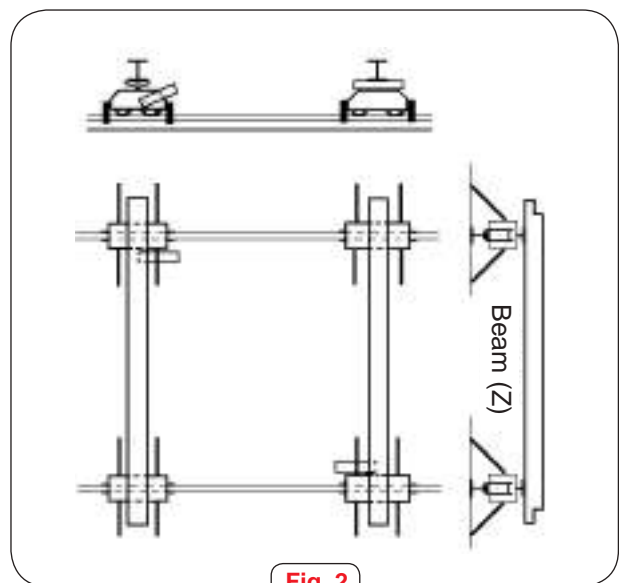


Do not remove the supports until the whole base is assembled.

Identification of assembling pieces		
		Weight driving .....1390 kg Weight idle..... 1240 kg Weight beam .....980 kg



**Fig. 1**

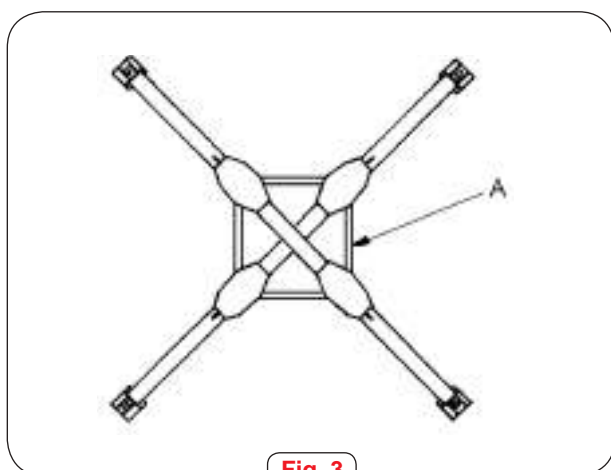


**Fig. 2**

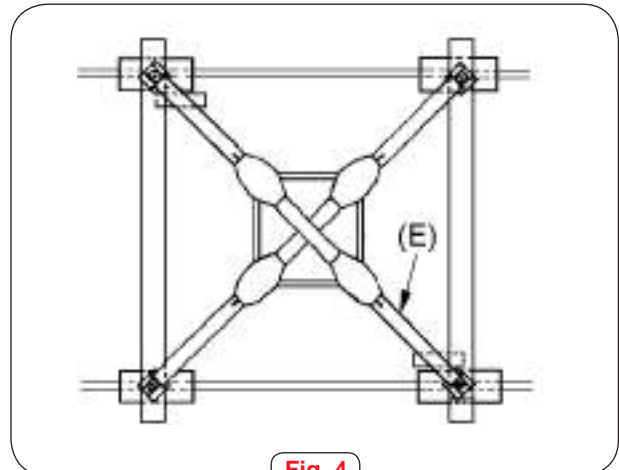
- Raise base with assist crane, remove transport fixing plates, open out the arms and lock with cross-beams "A" (Fig. 3). Once the base is assembled, place it on the beams, with the full diagonal «E» on the driver transfer assembly (Fig. 4).



While handling the base, keep a close eye on the arms to prevent accidents in case of sudden opening.



**Fig. 3**



**Fig. 4**

- Place platform "B" on cross-beams "A".(Fig. 5).
- Bolt platform "C" to platform "B".
- Bolt ladder "D" to platform "B".
- Ensure alignment of 1st Mast section ladder to permit correct access

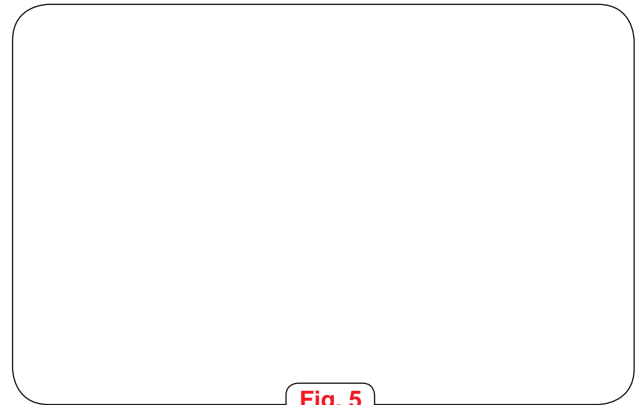


Fig. 5

### POSITION OF BASE BALLAST

- The ballast slabs are 6,25 m x 1,5 m x 0,3 m and weigh 6750 kg each.
- They are placed directly onto the cross-base arms and beam.
- The first slabs are fixed to the base with parts "A" (Fig.7)
- The base ballast blocks must be fitted perpendicular to the rails of the track.

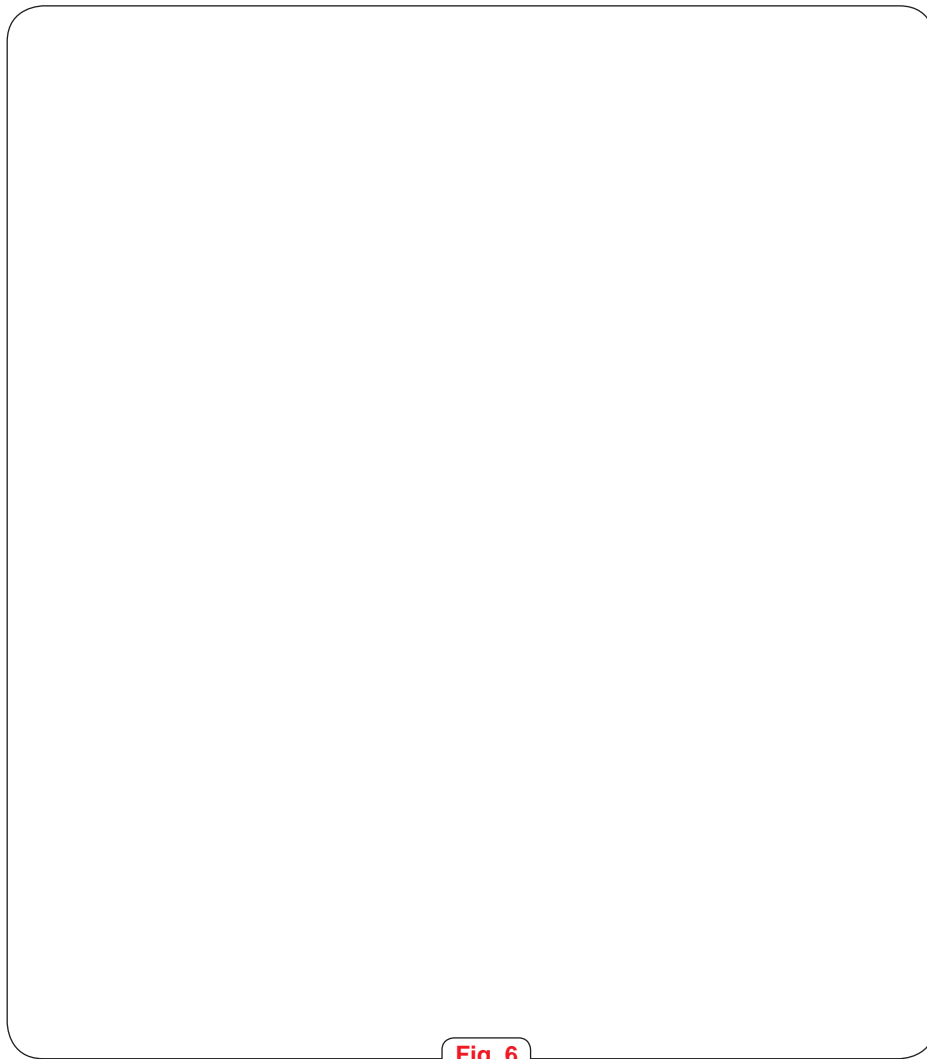


Fig. 6

## VERSIONS AND POSITIONS OF BASE FEET

- The base consist of fixed beam with two folding arms, which open out to form a “cross”. The arms are locked in position by pinned cross-beams.
- The base has four machined surfaces prepared to receive different types of base-feet, according to the different mast sections it is intended to use.

**Fig. 1**  
*Position of base feet and  
platforms for  $\square$  1,6 m  
Towers.*

**Fig. 2**  
*Position of base feet and  
platforms for  $\square$  2,0 m  
Towers.*

**Fig. 3**  
*Position of base feet and  
platforms for  $\square$  2,5 m  
Towers.*

**Fig. 4**  
*Position of base feet and  
platforms for  $\square$  2,15 m  
Towers.*



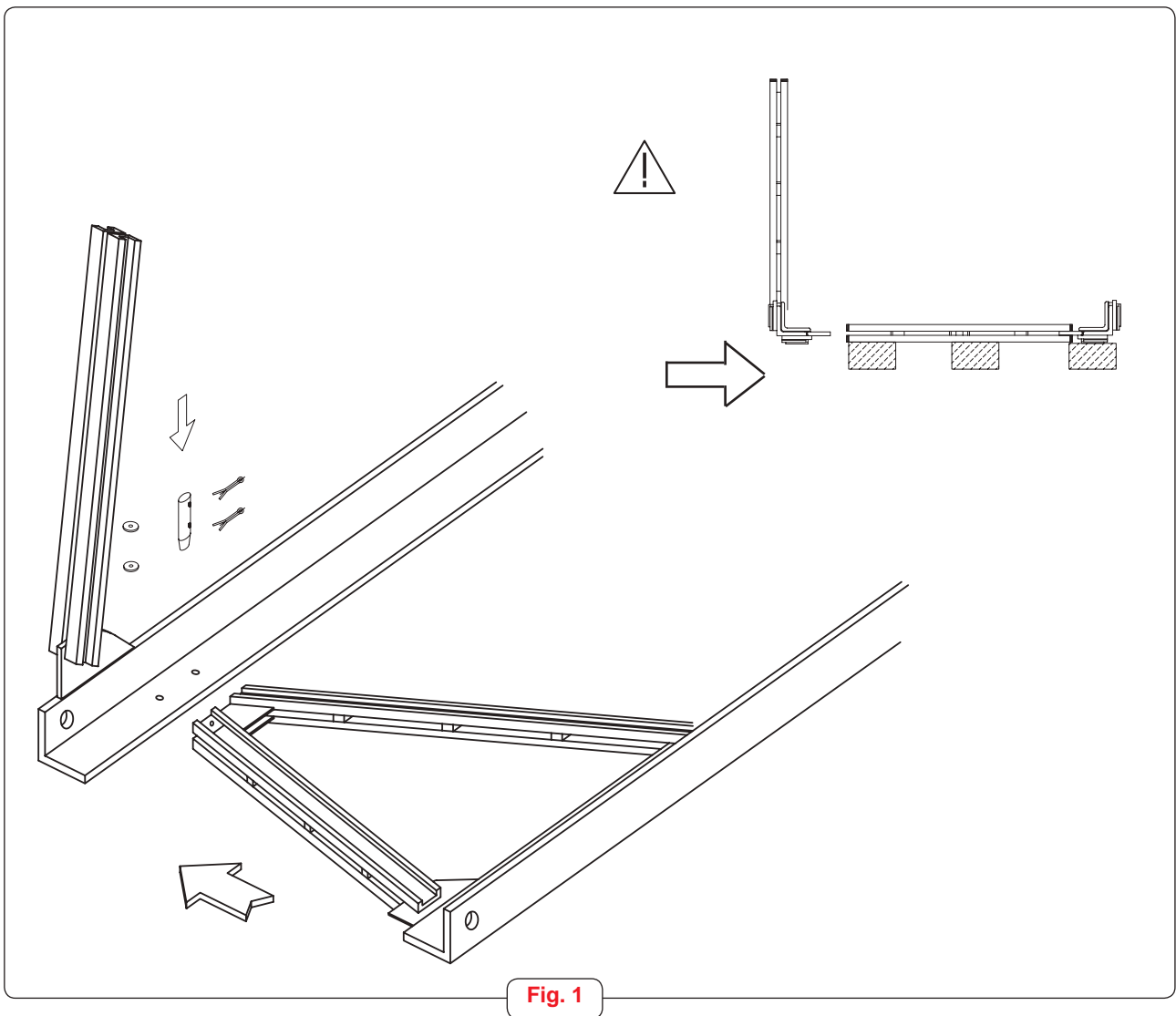
DURING ALL THE ERECTION PROCESS, WATCH ALL THE POSSIBLE MOVEMENTS OF THE LOADS TO AVOID ACCIDENTS.

**0 CONTENT**

- 1 Erection secuence**
- 2 Possible section combinations**
- 3 General dimensions**

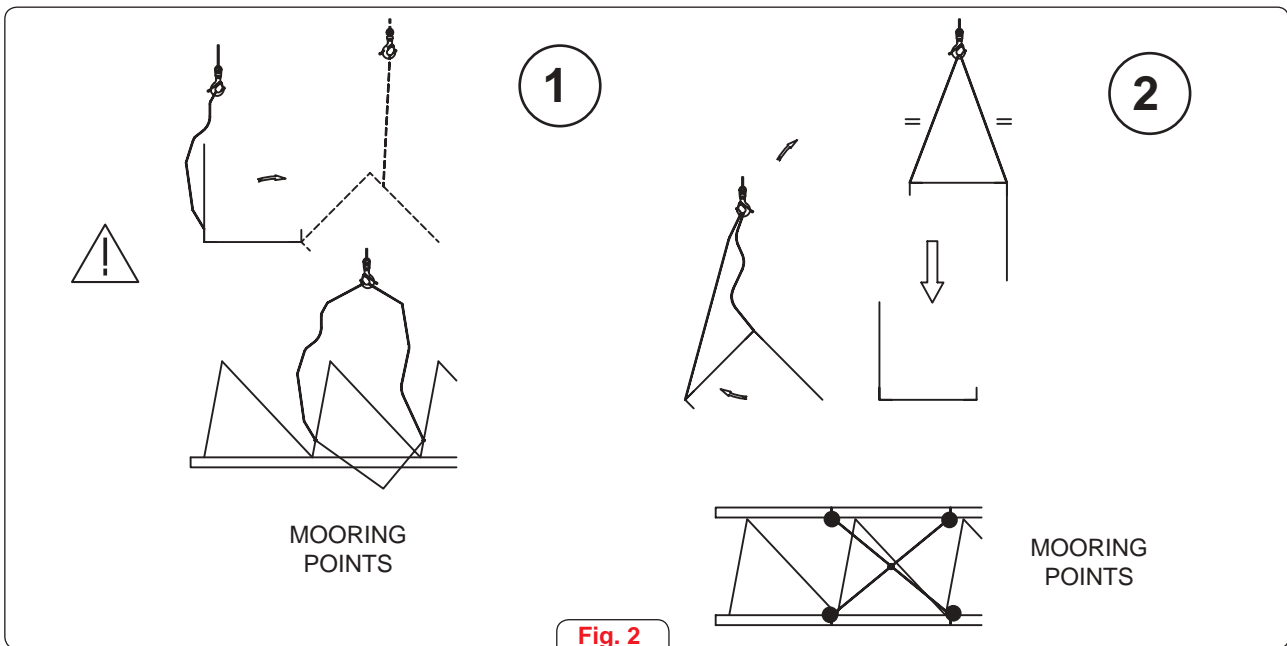
**1 Erection secuence**

- Put a panel on some balanced supports and assembly another one by pins, forming a right angle with the first one. Fig 1.

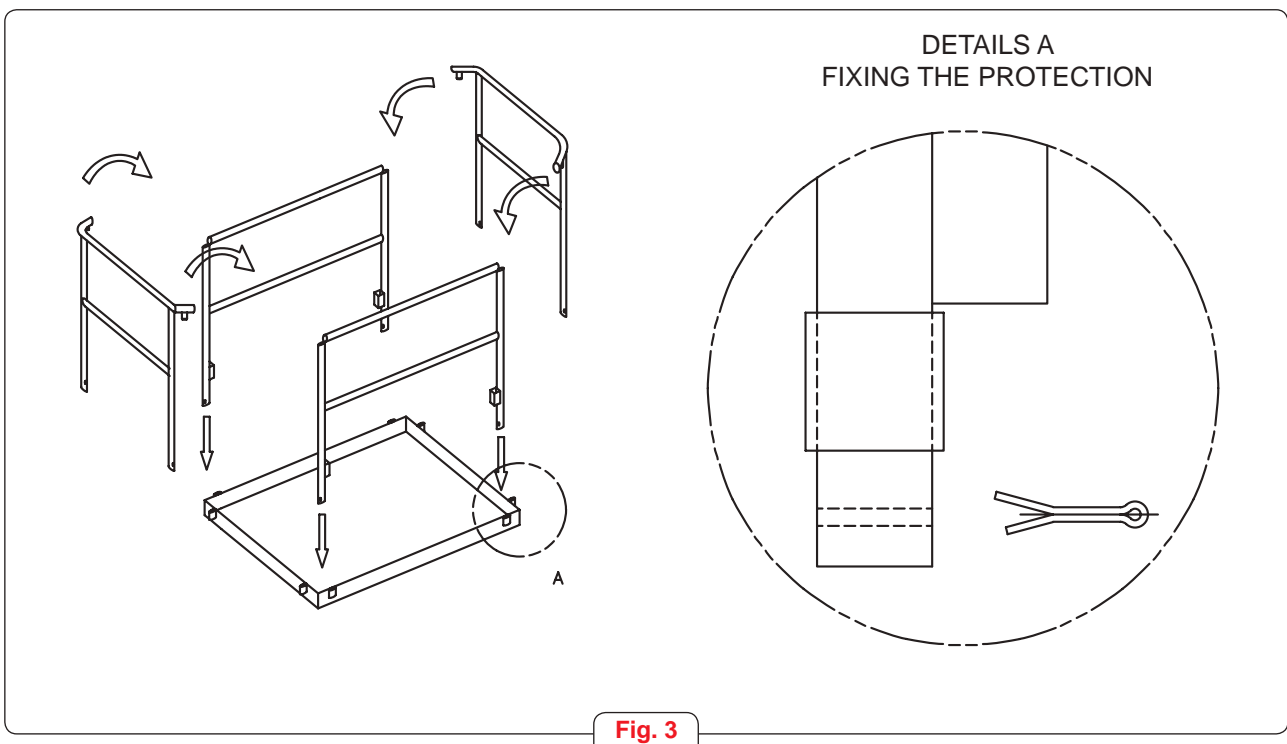


- Repeat the process to complete two " L "

- Following the instructions of fig. 2, turn one of the "L" for its later erection.
  - 1º- To proceed to the section preparation putting it in a way which forms a triangle on the floor. Fix slings through panel lattice window.
  - 2º- Hang the "L" with cables of the same leng and taking as mooring points the corner beams, as it indicates in figure 2.
  - 3º- Finish the erection of the section assembly the two "L" by pins.

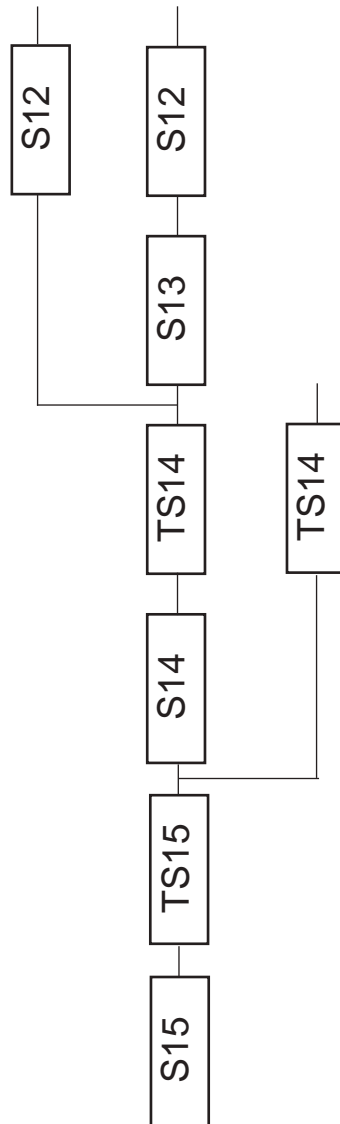


- 4º- Assemble the guard-rails and platforms. Fig 3.





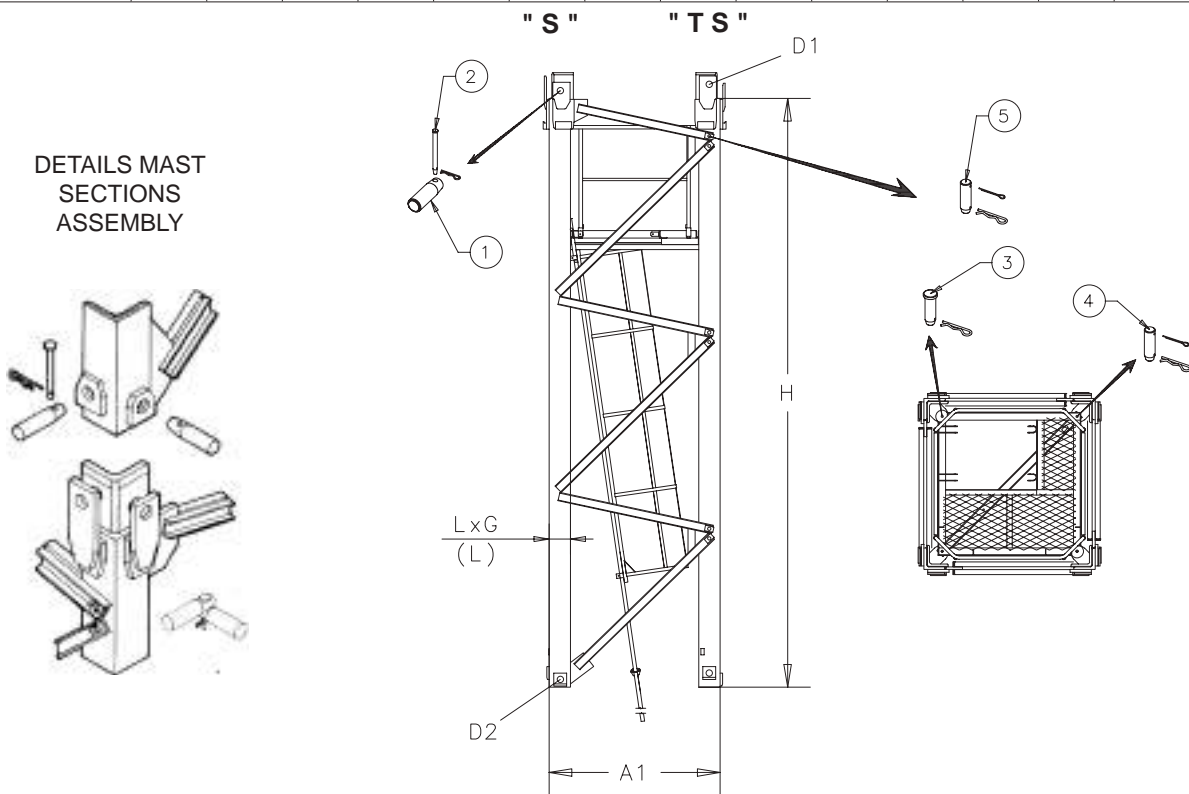
## 2 Possible section combinations



See pins and bolts in the following page.

**3 General dimensions**

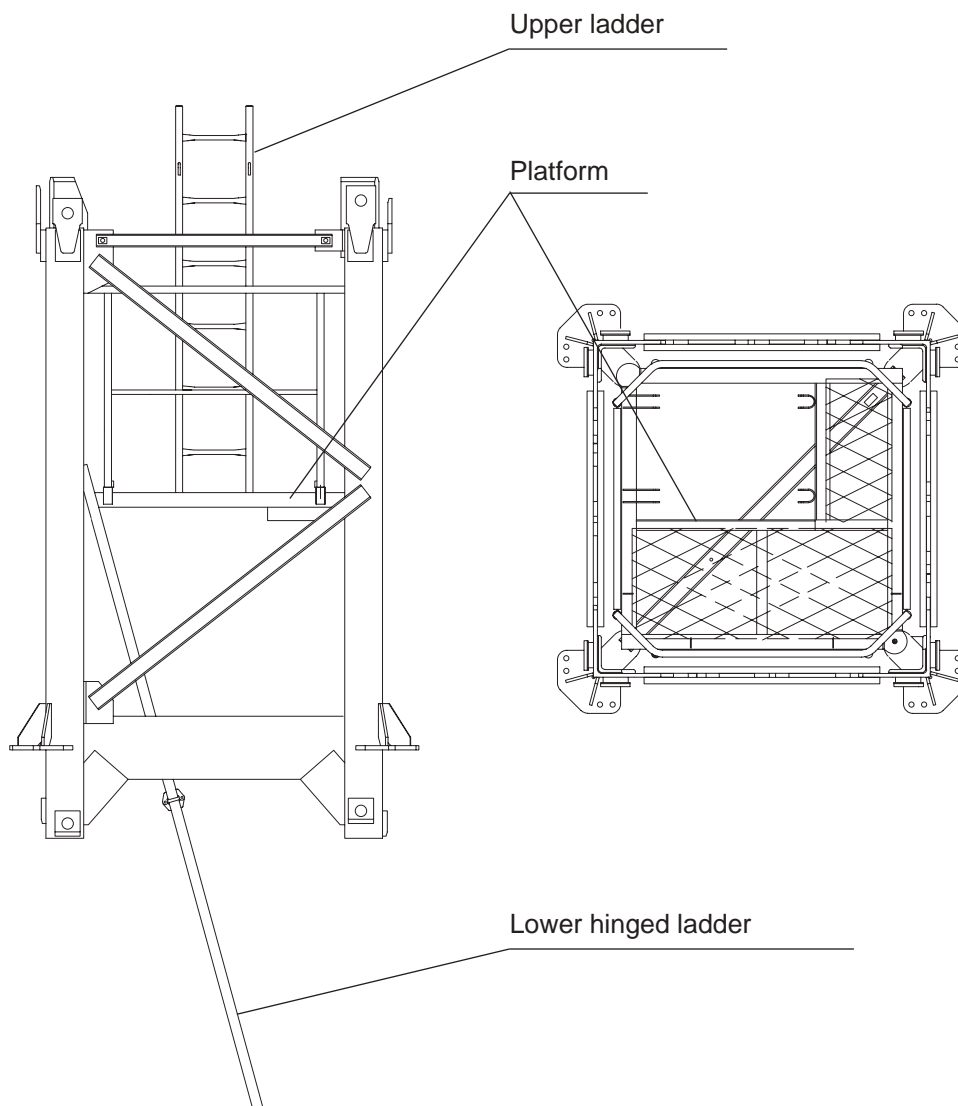
	1			2			3			4			5		
	Ø	L	Q	Ø	L	Q	Ø	L	Q	Ø	L	Q	Ø	L	Q
<b>S12</b>	55	160	8	16	120	4	20	30	2	20	70	2	20	70	24
<b>S13</b>	55	160	8	16	160	4	20	30	2	20	70	2	30	80	24
<b>S14</b>	60	160	8	16	160	4	20	30	2	20	70	2	30	80	24
<b>S15</b>	60	160	8	16	120	4	20	30	2	20	70	2	30	80	24
<b>TS14</b>	55	160	8	16	160	4	20	30	2	20	70	2	30	80	24
<b>TS15</b>	60	160	8	16	160	4	20	30	2	20	70	2	30	80	24



	H	A1	A2	L x G	D1	D2
<b>S12</b>	5500	1600	1394	150x18	55	55
<b>S13</b>	5500	1600	1394	180x18	55	55
<b>S14</b>	5500	1600	1394	200x20	60	60
<b>S15</b>	5500	1600	1394	200x26	60	60
<b>TS14</b>	5500	1600	1394	200x20	55	60
<b>TS15</b>	5500	1600	1394	200x26	60	60

The section S13J is imperative when you are going to elevate the crane using the cage J1.

- Fit the mast section in the vertical position.
- Verify the platform and the access ladders are installed.  
The lower ladder is hinged to facilitate the introduction of sections in the cage J1.  
The upper ladder connects to the lower turntable.
- Use the mobile crane to lift it and join it to the tower.

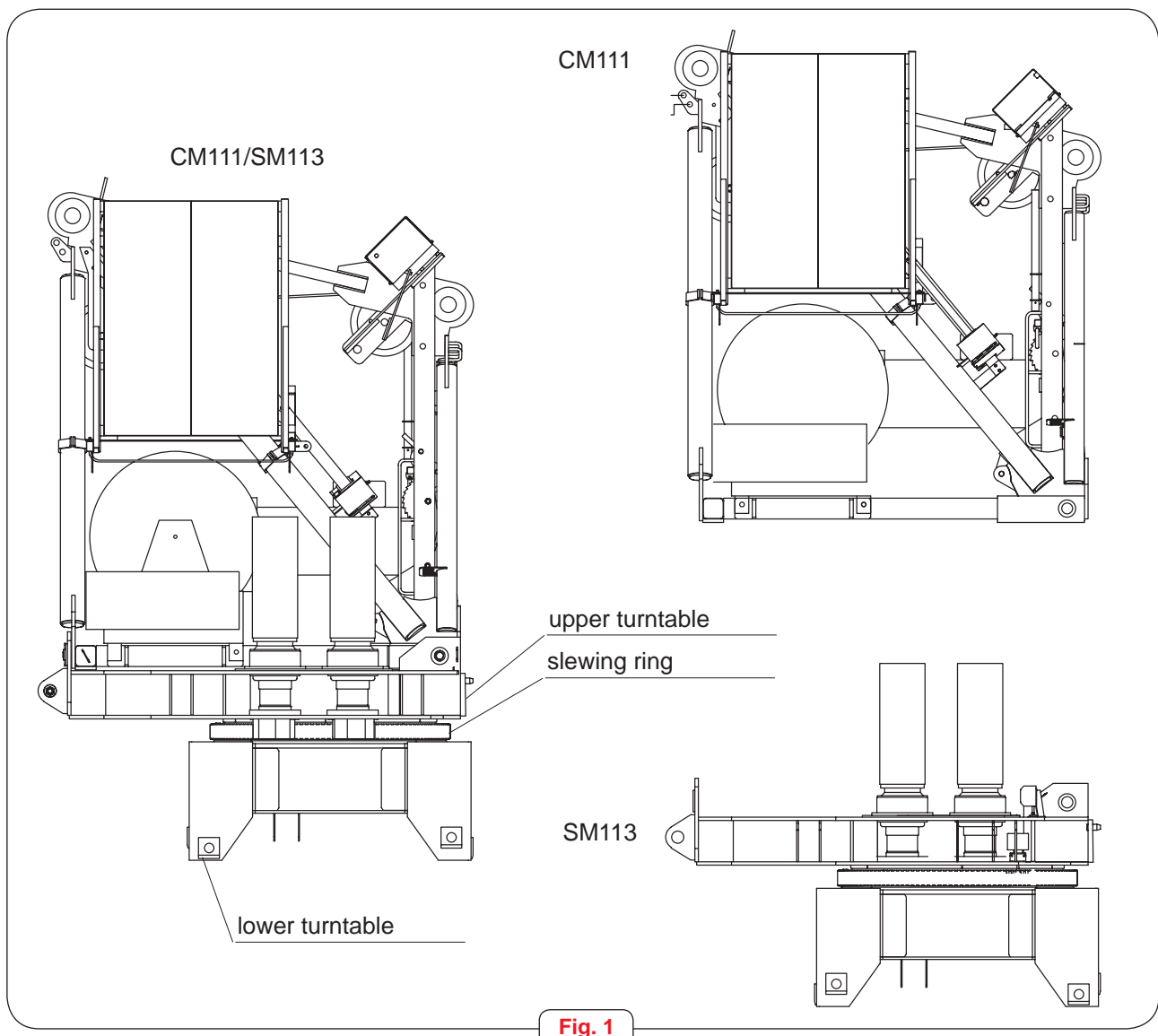


## 0 CONTENTS

- 1 **PREPARATION CM111/SM113**
- 2 **POSITIONING THE COUNTER-JIB PENDANT LINE**
- 3 **ASSEMBLY**
- 4 **POSITIONING THE CAB PLATFORM**

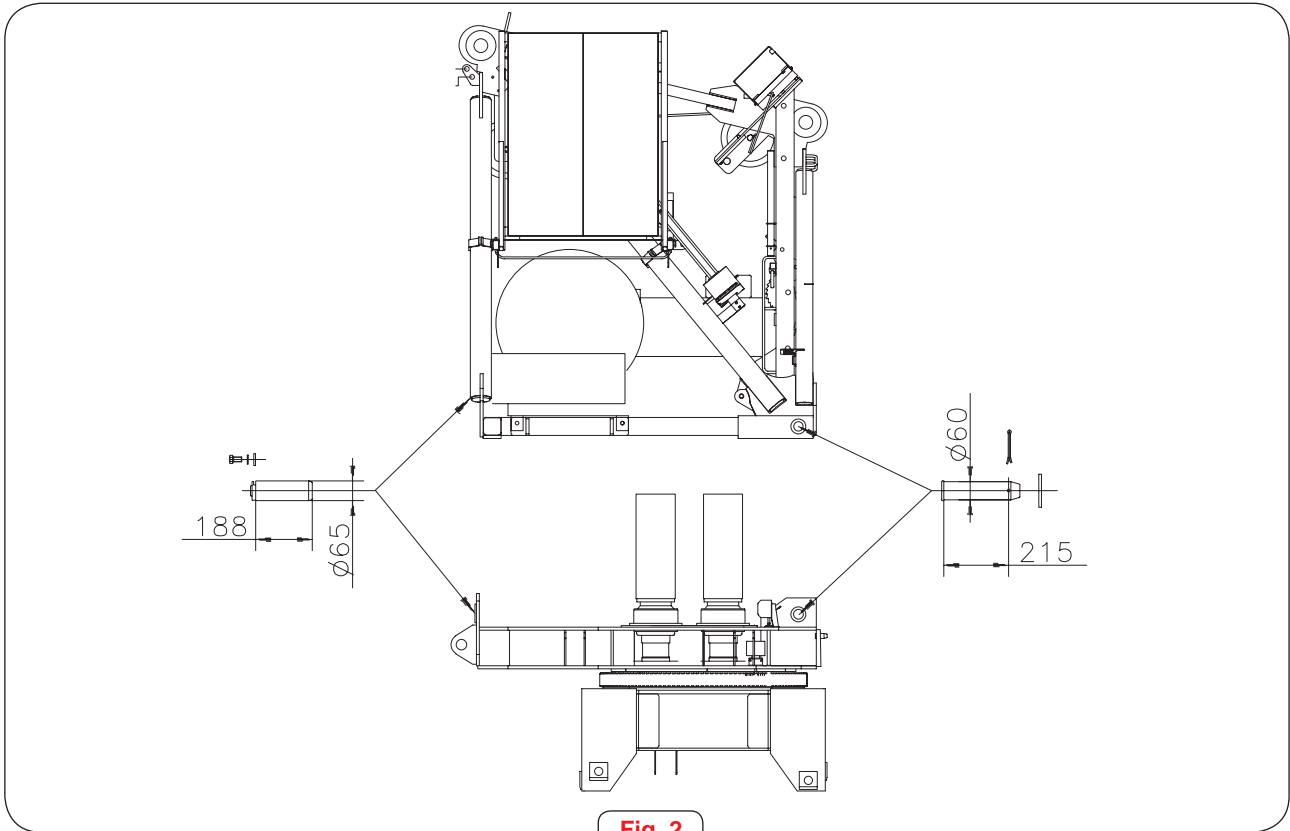
### 1 PREPARATION CM111/SM113

- The assembly can be transported and erected as a single element CM111/SM113 or split into two independent elements CM111 and SM113.
- SM113 consists of the lower turntable, the slewing ring and the upper turntable and has the rotation mechanisms and the rotation limiter pre-assembled.
- CM111 has the hoisting mechanism, the load and moment limiter, the cable tensing system and the cat head cabinets.



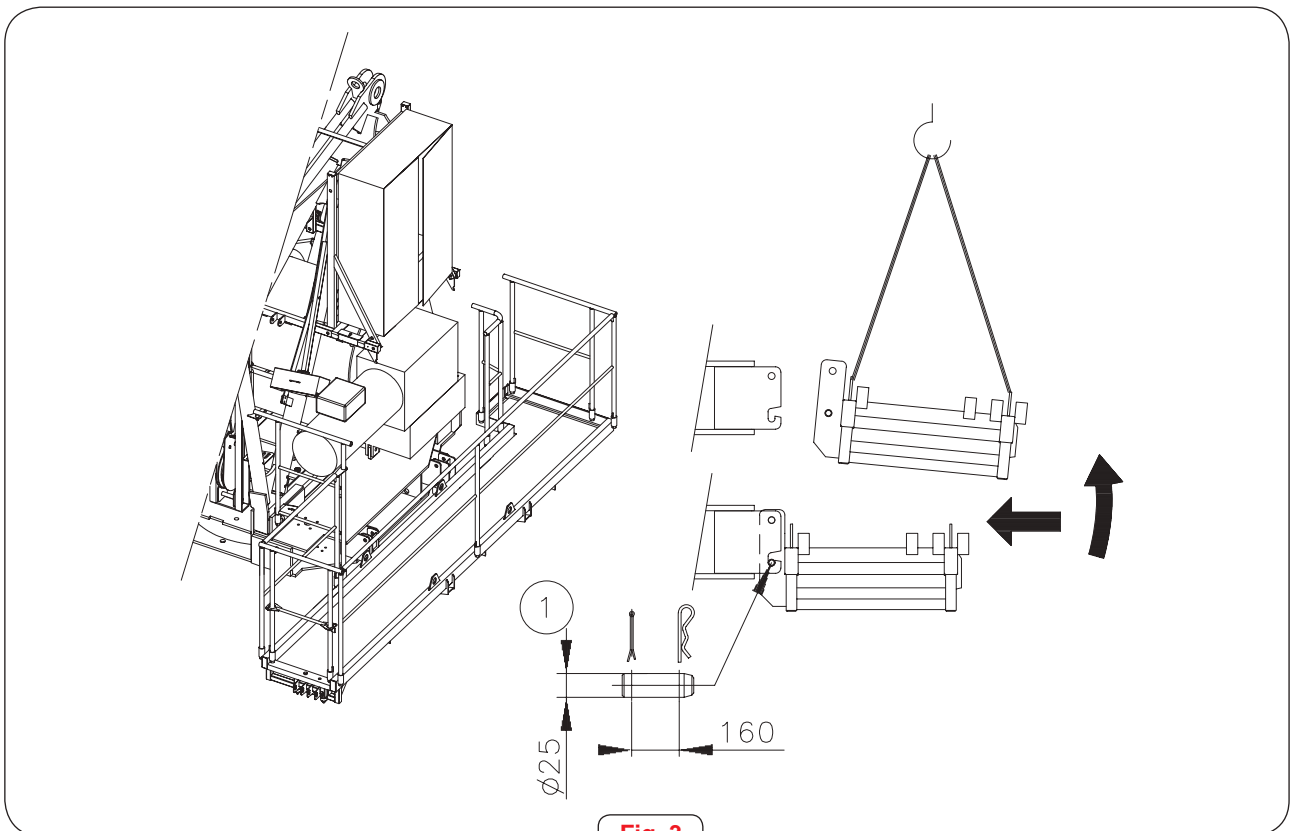
**Fig. 1**

- If it has been transported in two independent elements CM111 and SM113, join them with the corresponding pins. Use the mobile crane to lift the CM111 and place it on the upper turntable, line up the holes and join them.



**Fig. 2**

- Fit the cat head balcony.  
Fasten to the upper turntable using the pins "1".



**Fig. 3**

### CHECKS

- To monitor the bolts or change the rotation mechanism, see the document "Tightness of bolts in slewing mechanism" in the "MAINTENANCE" section.
- To monitor the bolts in the slewing ring, see the document "Tightness of bolts in slewing ring" in the "MAINTENANCE" section.
- To grease the slewing ring, see the document "Greasing instructions (slewing ring)" in the "MAINTENANCE" section.
- To grease the slewing mechanism, see the document "Greasing instructions (slewing mechanism)" in the "MAINTENANCE" section.
- To grease the hoisting mechanism, see the document "Greasing instructions (hoisting mechanism)" in the "MAINTENANCE" section.

## 2 POSITIONING THE COUNTER-JIB BRACING

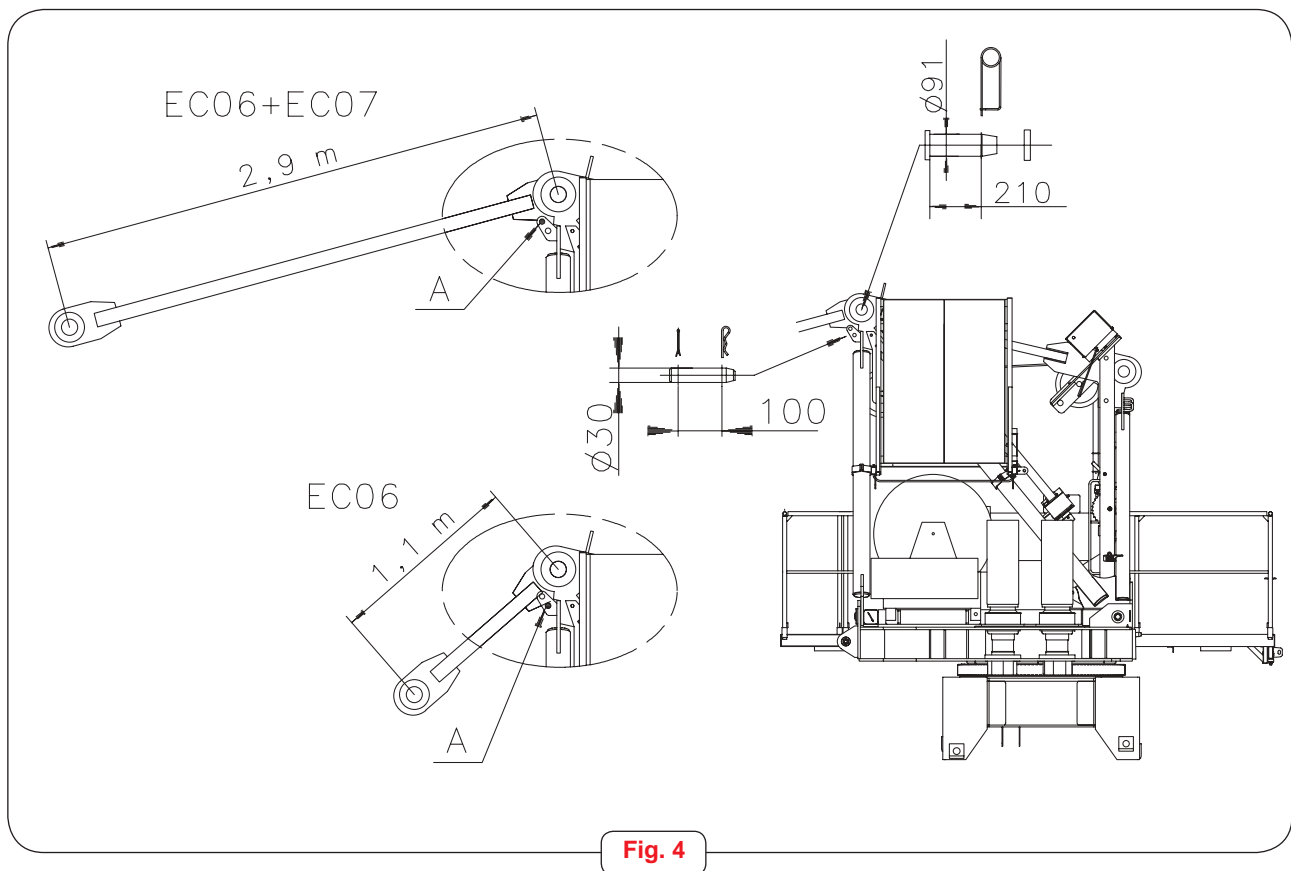
Before lifting the rotating part, the counter-jib bracing spacer.

Fasten the bracing supplement to the cat head and position it with the support pin "A".

This bracing supplement varies depending on the length of the counter-jib.

For the short counter-jib the bracing supplement is short and is positioned by placing the support pin "A" in the lower position.

For long counter-jib EC06+EC07 the bracing supplement is long and is positioned by placing support pin "A" in the upper position.



**Fig. 4**

## 3 ASSEMBLY

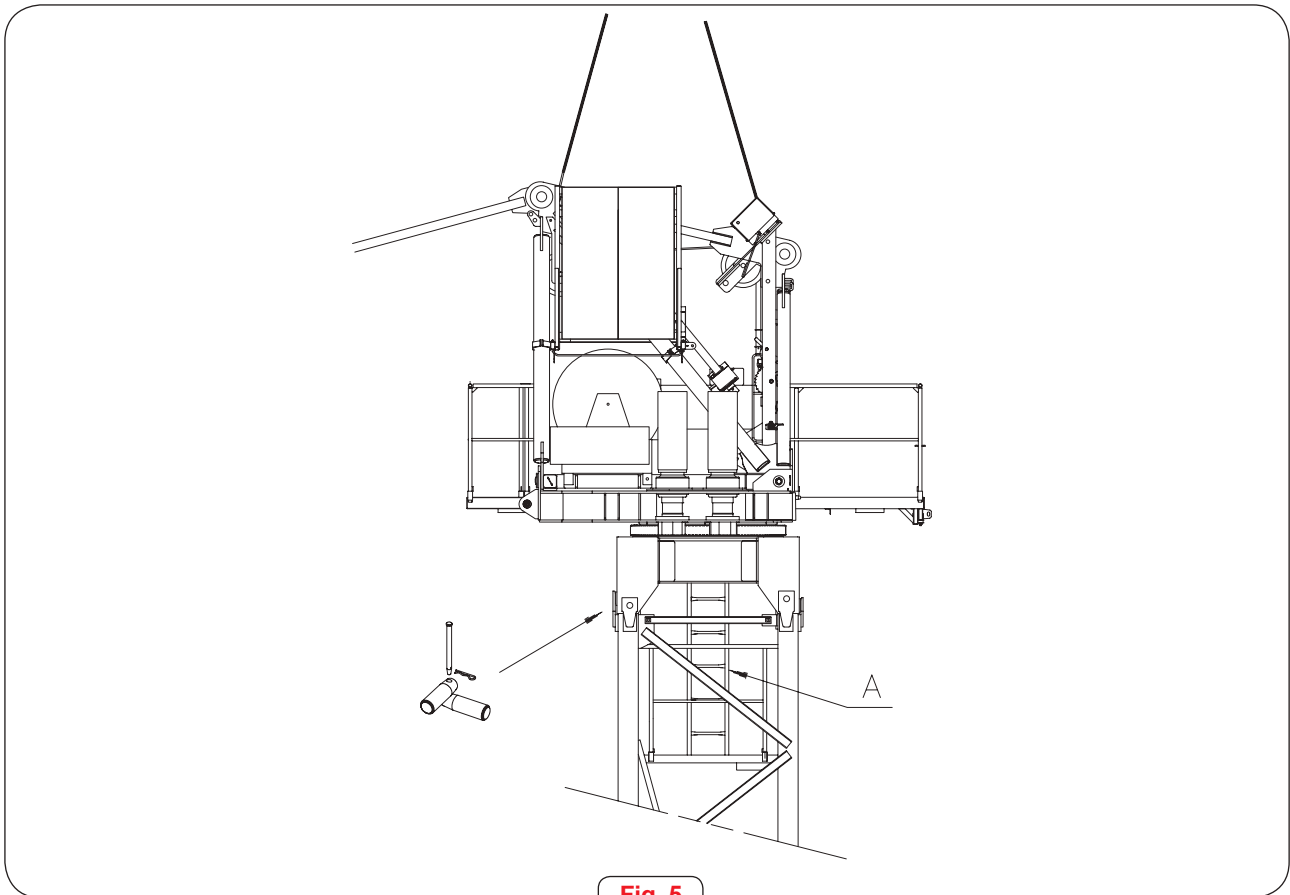


**DURING THE ASSEMBLY/DISASSEMBLY WORK USE A SAFETY HARNESS TO AVOID ACCIDENTS.**

Use the mobile crane to lift the ensemble and assemble it to the last mast section.

Once assembled, place the access ladder "A" in position.

Once assembled, make the connections indicated in the document "ELECTRICAL ASSEMBLY" in the "ELECTRICAL INSTALLATION" section.



**Fig. 5**

#### **4 POSITIONING THE CAB PLATFORM**



Although the cab platform with the cab can be assembled on the ground, due to the imbalance it causes in the assembly, we recommend you assemble it off the ground, once you have fitted the lower turntable onto the last mast section.

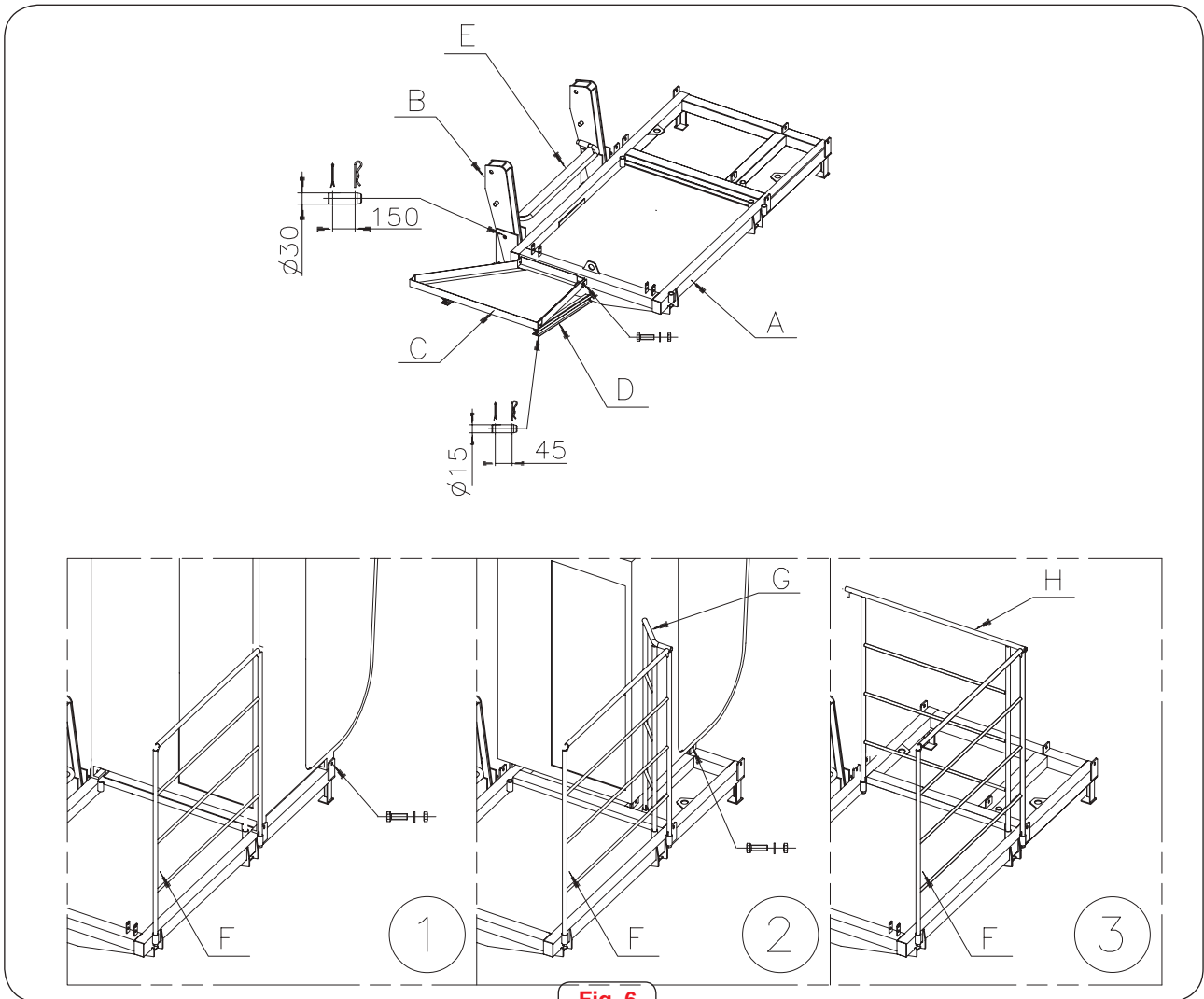
Prepare the cab platform on the ground (Fig. 6).

- Pin the support arms "B" to cab platform "A".
- Fit step "E" joining the support arms "B".
- Secure the platform "C" to cab platform "A" using the struts "D" and the corresponding pins.

When assembling the cab, there are three versions:

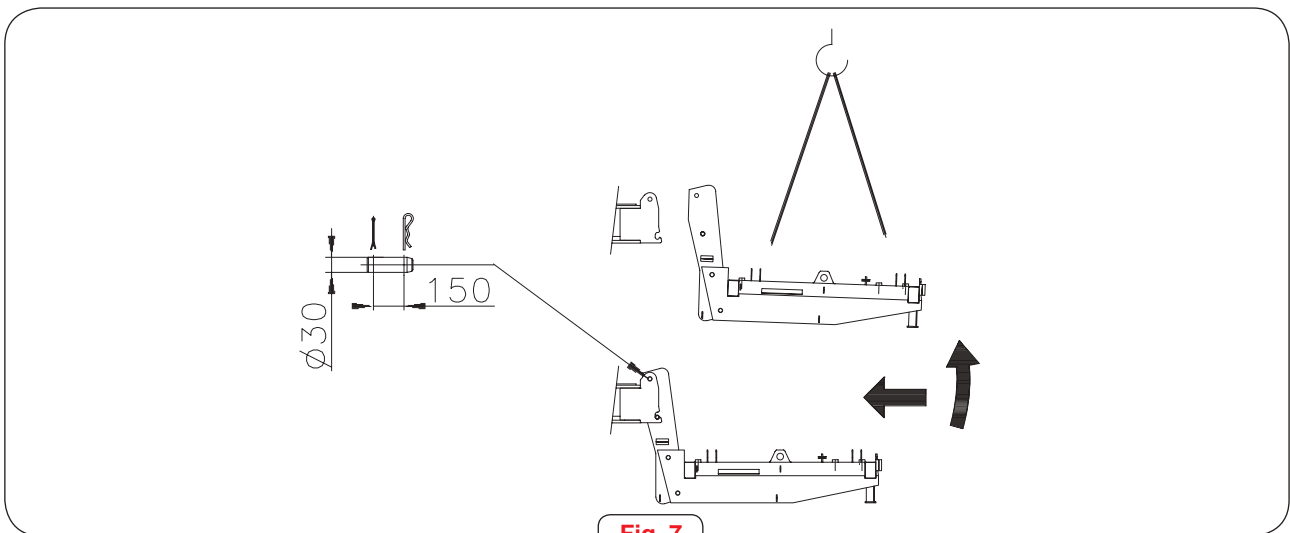
- Option 1: large cab (Fig.6.1).  
Position the cab and bolt it to the platform.  
Fit the handrail "F".
- Option 2: small cab (Fig.6.2).  
Position the cab and bolt it to the platform.  
Fit the handrails "F" and "G".

- Option 3: without cab (Fig.6.3).  
Fit the handrail "F".  
Once you have positioned the platform in the cat head, fit the handrail "H".



**Fig. 6**

Suspend it with the mobile crane and fix it to the upper turntable using the pins.

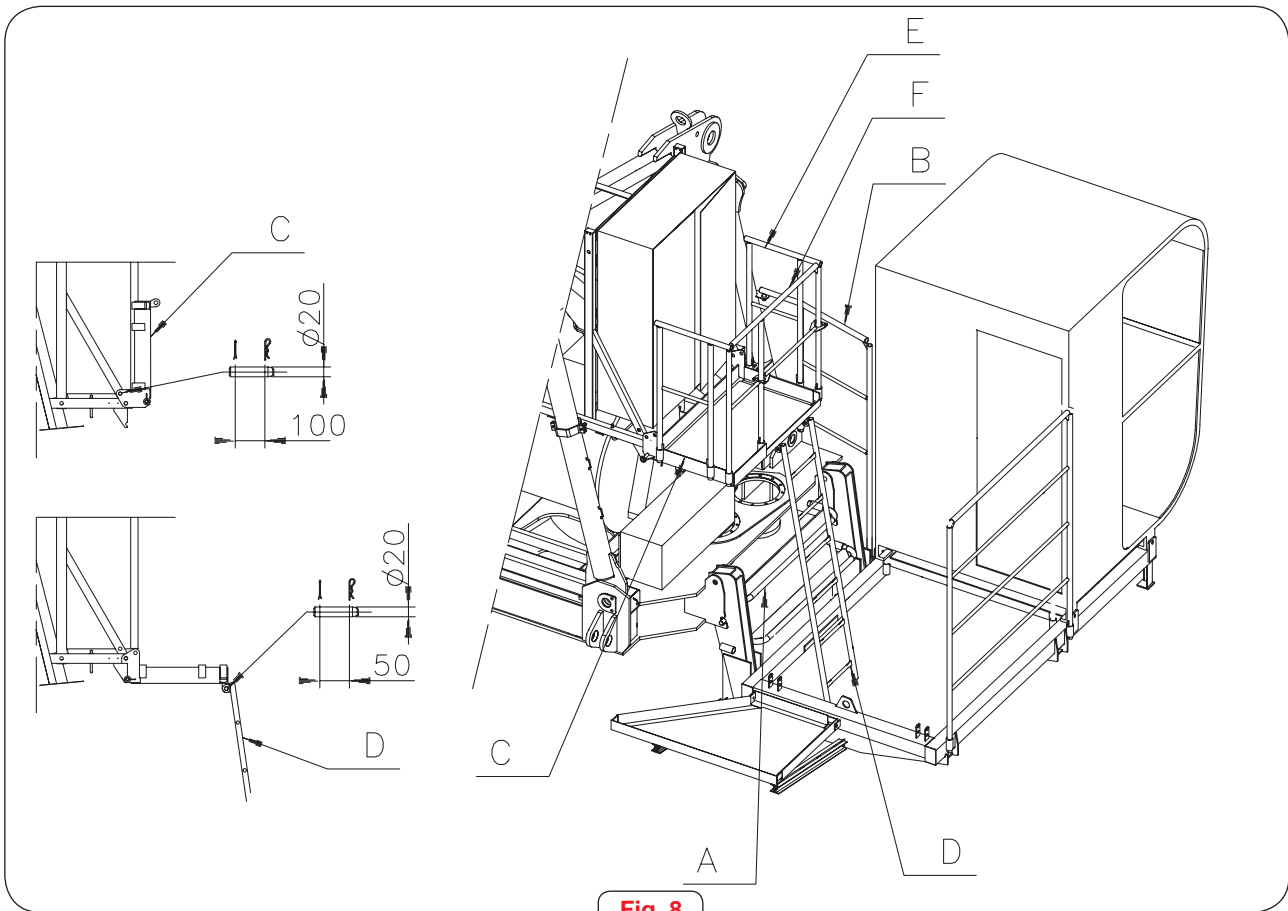


**Fig. 7**



Fit electric cabinet platform.

- Fit the step "A" into the slots in the cab platform support arms.
- Position the closing rail "B" between the cat head and the cab platform.
- Disassemble the platform "C".  
Remove the securing pin, disassemble the platform and replace the pin in its initial position.
- Position ladder "D".  
Pin the ladder to the hinged platform; the lower end of the ladder rests on the cab platform.
- Fit the handrails "E" and "F" of the hinged platform.



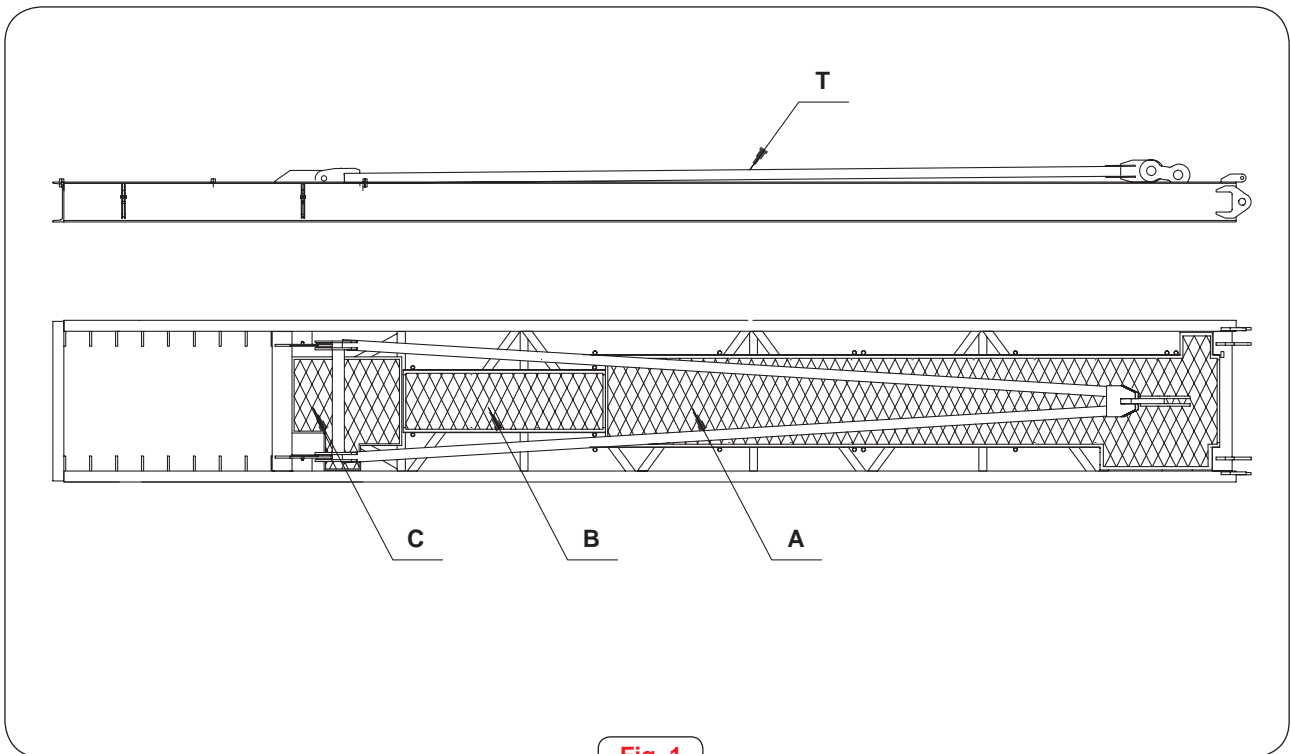
**Fig. 8**

## 0 CONTENTS

- 1 **SHORT COUNTER-JIB EC06**
- 2 **LONG COUNTER-JIB EC06 + EC07**

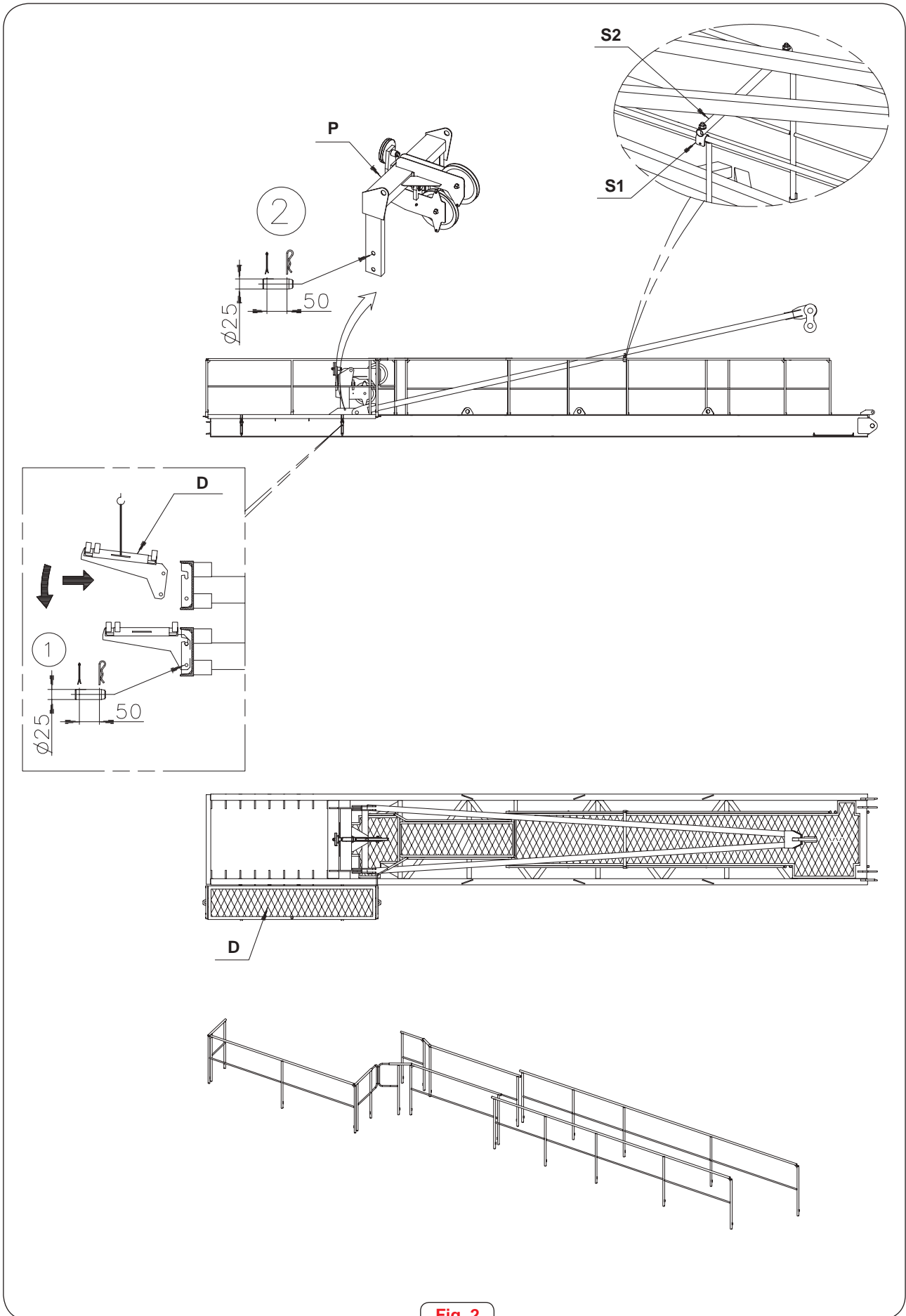
### 1 SHORT COUNTER-JIB EC06

- The counter-jib is composed of an EC06 structure section.  
 It leaves the factory with gangways "A", "B" and "C" pre-assembled and the counter-jib bracing "T" in position (Fig. 1).



**Fig. 1**

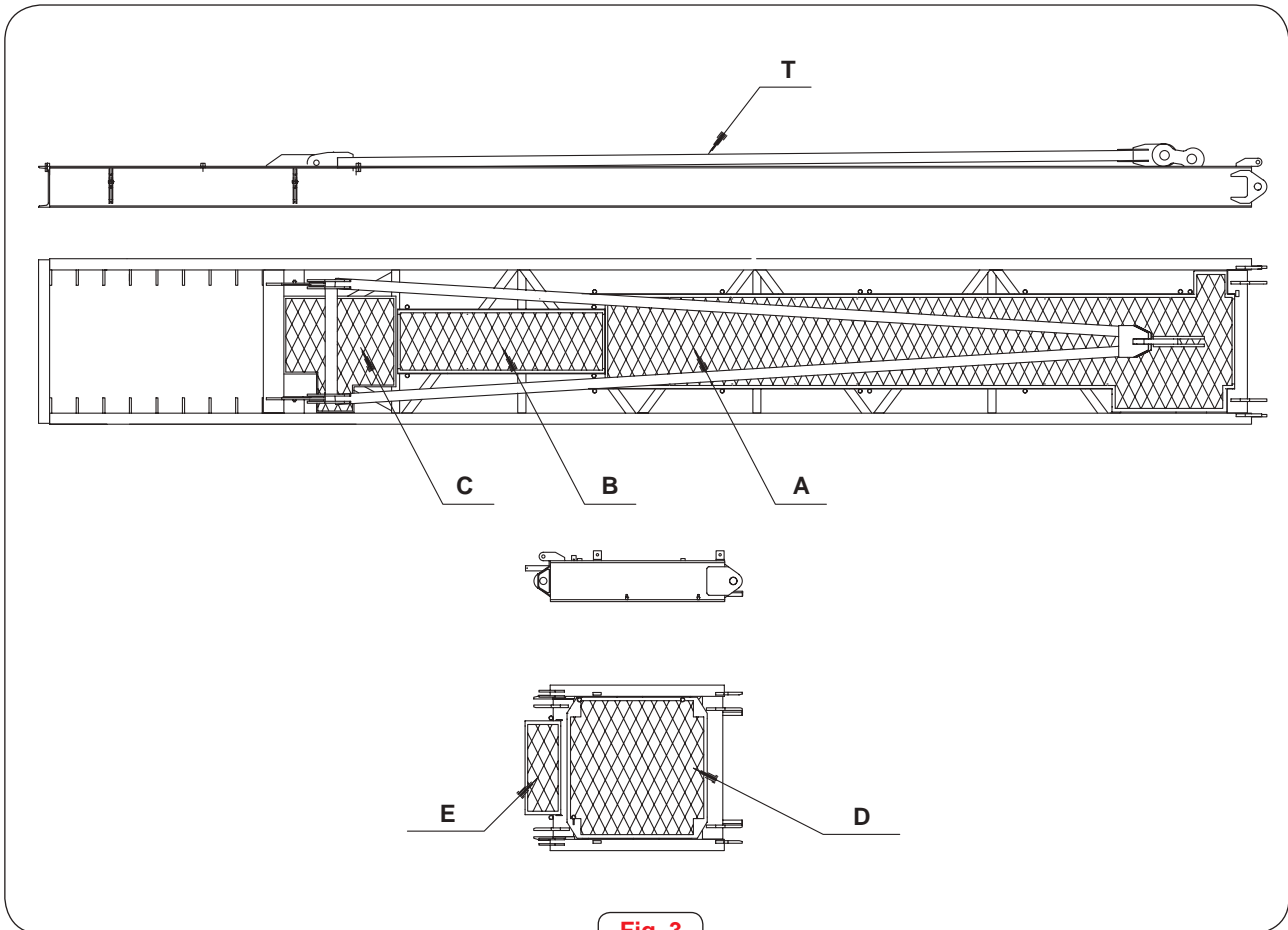
- Fit the counterweight platform "D" using the pins "1" (Fig.2).
- Fit the oscillating pulley housing "P" and secure it with the pins "2" (Fig.2).
- Fit the handrails and secure them in position with the corresponding pin (Fig.2).
- With the help of the mobile crane, lift the counter-jib bracing turning it on its anchors.  
 Fit the bracing supports "S1" on the handrails supporting the bolt against the handrail post.  
 Fit the support crossbar "S2" into the support "S1" and secure with the nuts.  
 Lower the counter-jib bracing and support it on the support crossbeam "S2" (Fig.2).



**Fig. 2**

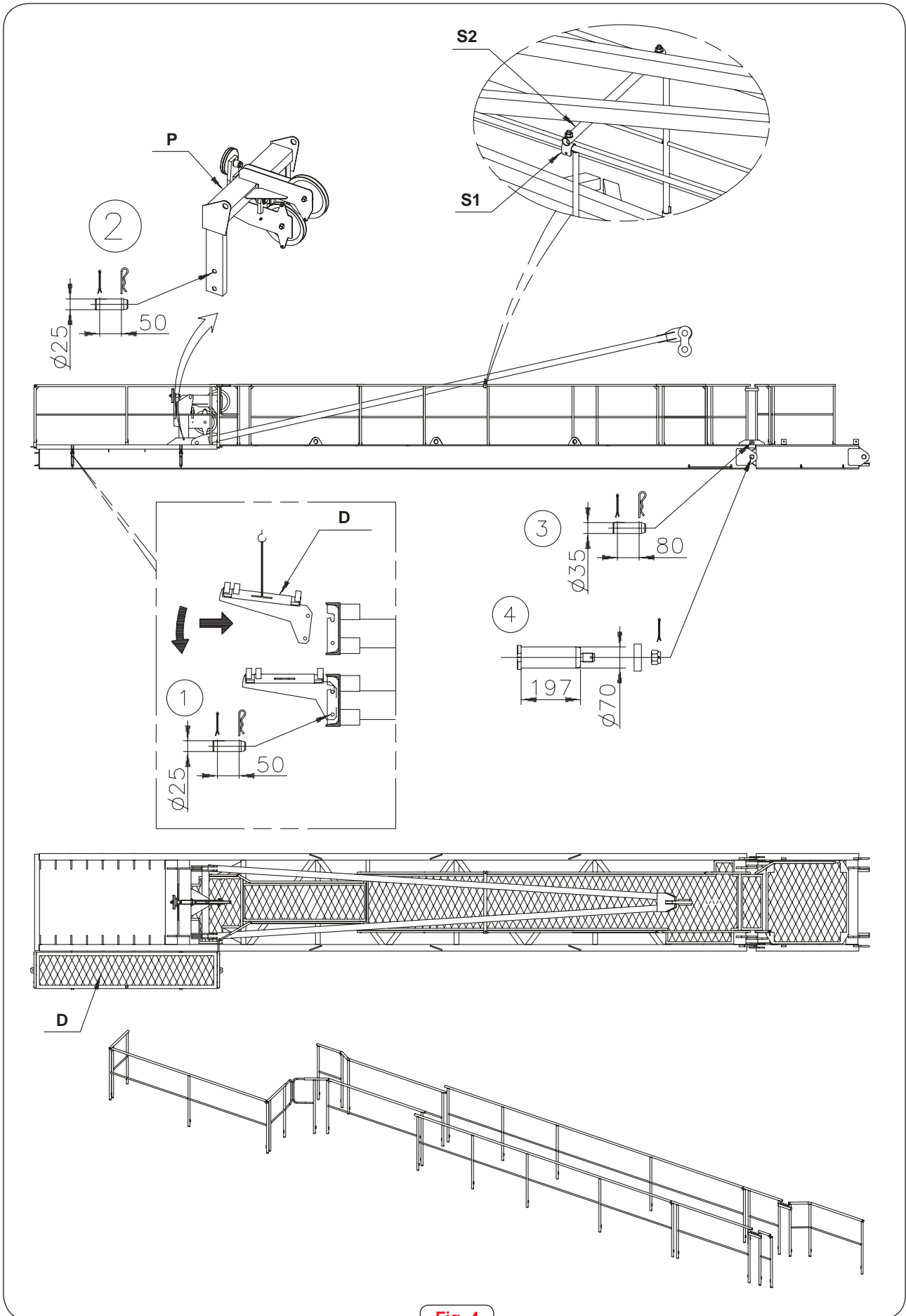
## 1 LONG COUNTER-JIB EC06 + EC07

- The counter-jib is composed of two structure sections, EC06 and EC07.
- The EC06 section leaves the factory with gangways "A", "B" and "C" pre-assembled and the counter-jib bracing "T" in position (Fig. 3).
- The EC07 section leaves the factory with gangway "D" assembled, safety walk "E" assembled and balanced on gangway "D" and the counter-jib bracing "T" in position (Fig. 3).



**Fig. 3**

- Fit the counterweight platform "D" using the pins "1" (Fig.4).
- Fit the oscillating pulley housing "P" and secure it with the pins "2" (Fig.4).
- Join the counter-jib elements EC06 and EC07 with the pins "3" and "4" (Fig. 4).
- Fit the handrails and secure them in position with the corresponding pin (Fig.4).
- With the help of the mobile crane, lift the counter-jib bracing turning it on its anchors. Fit the bracing supports "S1" on the handrails supporting the bolt against the handrail post. Fit the support crossbar "S2" into the support "S1" and secure with the nuts. Lower the counter-jib bracing and support it on the support crossbeam "S2" (Fig.4).



**Fig. 4**

## 0 CONTENTS

### 1 GENERAL

### 2 ASSEMBLING THE SHORT COUNTER-JIB EC06

### 3 ASSEMBLING THE LONG COUNTER-JIB EC06+EC07

### 4 ASSEMBLING THE SAFETY WALK

## 1 GENERAL



DURING THE ASSEMBLY/DISASSEMBLY WORK USE A SAFETY HARNESS TO AVOID ACCIDENTS.



THE WIND SPEED DURING THE ASSEMBLY/DISASSEMBLY WORK MUST NOT BE TOO HIGH TO SAFELY MANAGE THE ELEMENTS OF THE CRANE, APPROXIMATELY 25 km/HOUR.



YOU MUST FOLLOW THE ORDER OF ASSEMBLY FOR THE STRUCTURAL ELEMENTS AS DESCRIBED IN THE DOCUMENT "ASSEMBLING THE JIB (SEQUENCES)" IN THE FOLLOWING PAGES OF THIS CHAPTER.

## 2 ASSEMBLING THE SHORT COUNTER-JIB EC06

- Use the mobile crane to lift the counter-jib assembly up to the rotating part.  
Pin the counter-jib to upper turntable wing.  
Balance the counter-jib on this pin with the mobile crane, pin the counter-jib bracing to the bracing supplement of the cat head.  
Lower the mobile crane to tense the bracing.

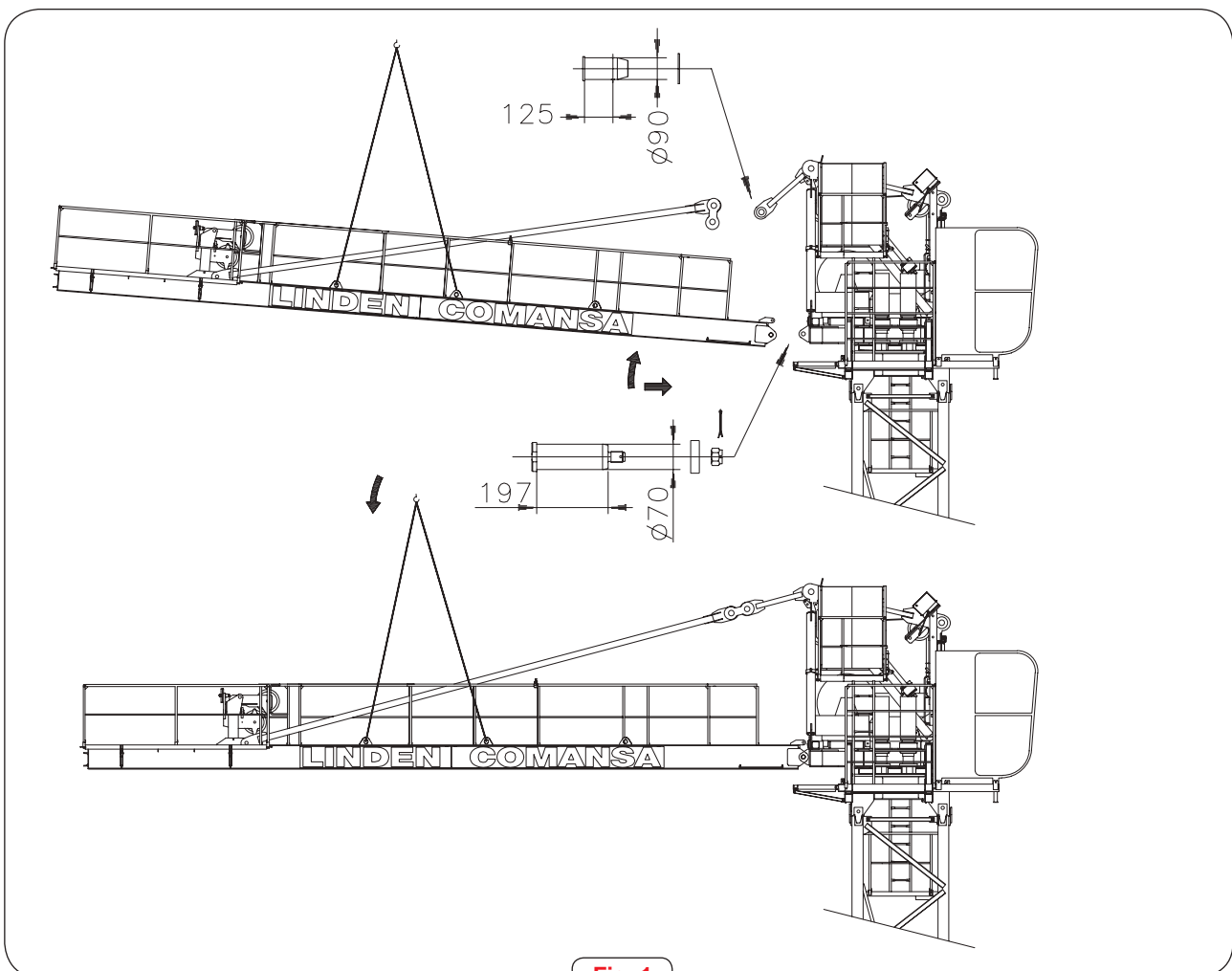


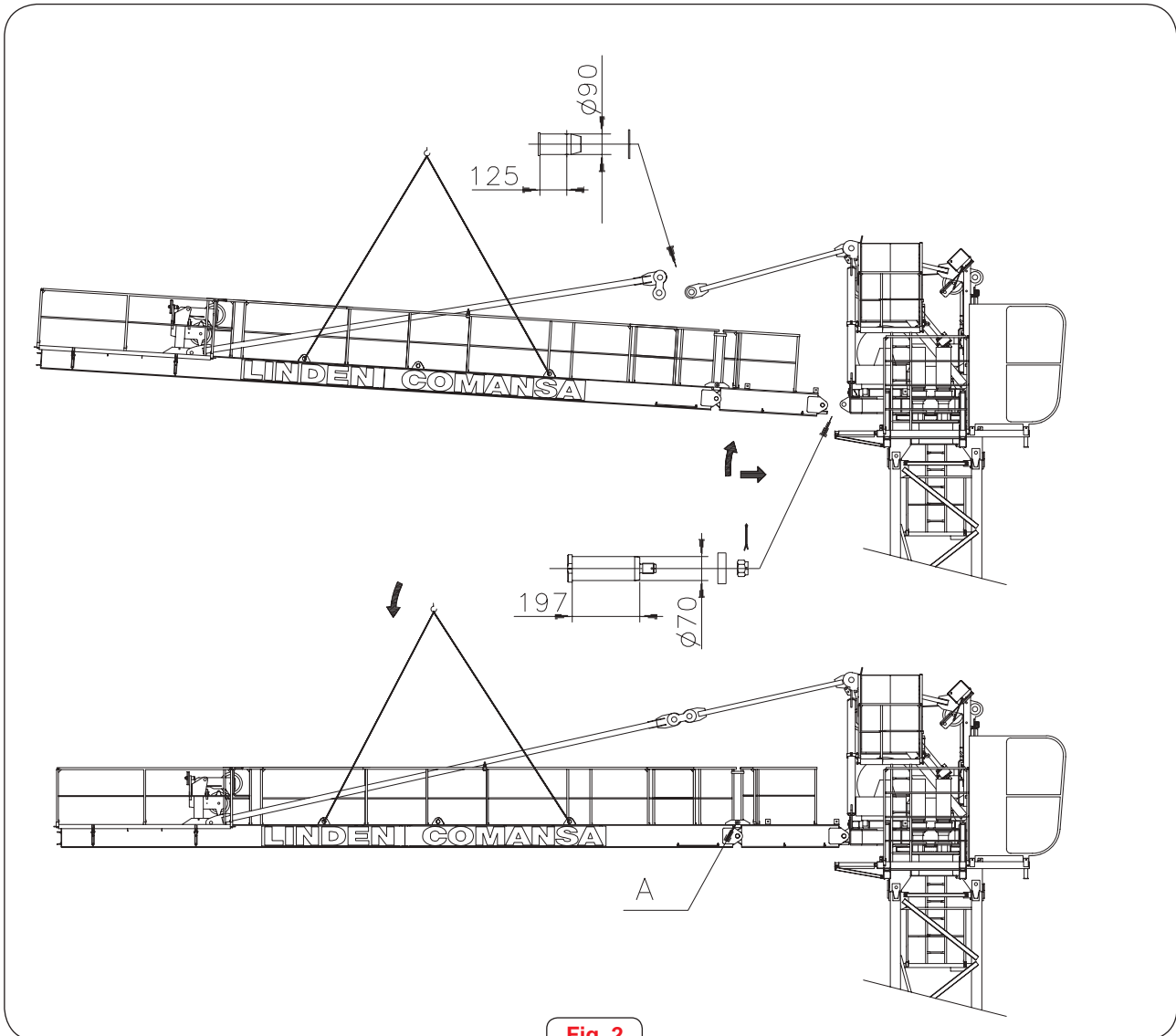
Fig. 1

### 3 ASSEMBLING THE LONG COUNTER-JIB EC3+EC06

- Use the mobile crane to lift the counter-jib assembly up to the rotational part.  
 Pin the counter-jib to upper turntable wing.  
 Balance the counter-jib on this pin with the mobile crane, pin the counter-jib bracing to the bracing supplement of the cat head.  
 Lower the mobile crane to tense the bracing.



DO NOT REMOVE THE PIN FROM JOINT "A" BETWEEN THE EC06 AND THE EC07.  
 REMOVING THIS PIN CAN CAUSE ACCIDENTS.

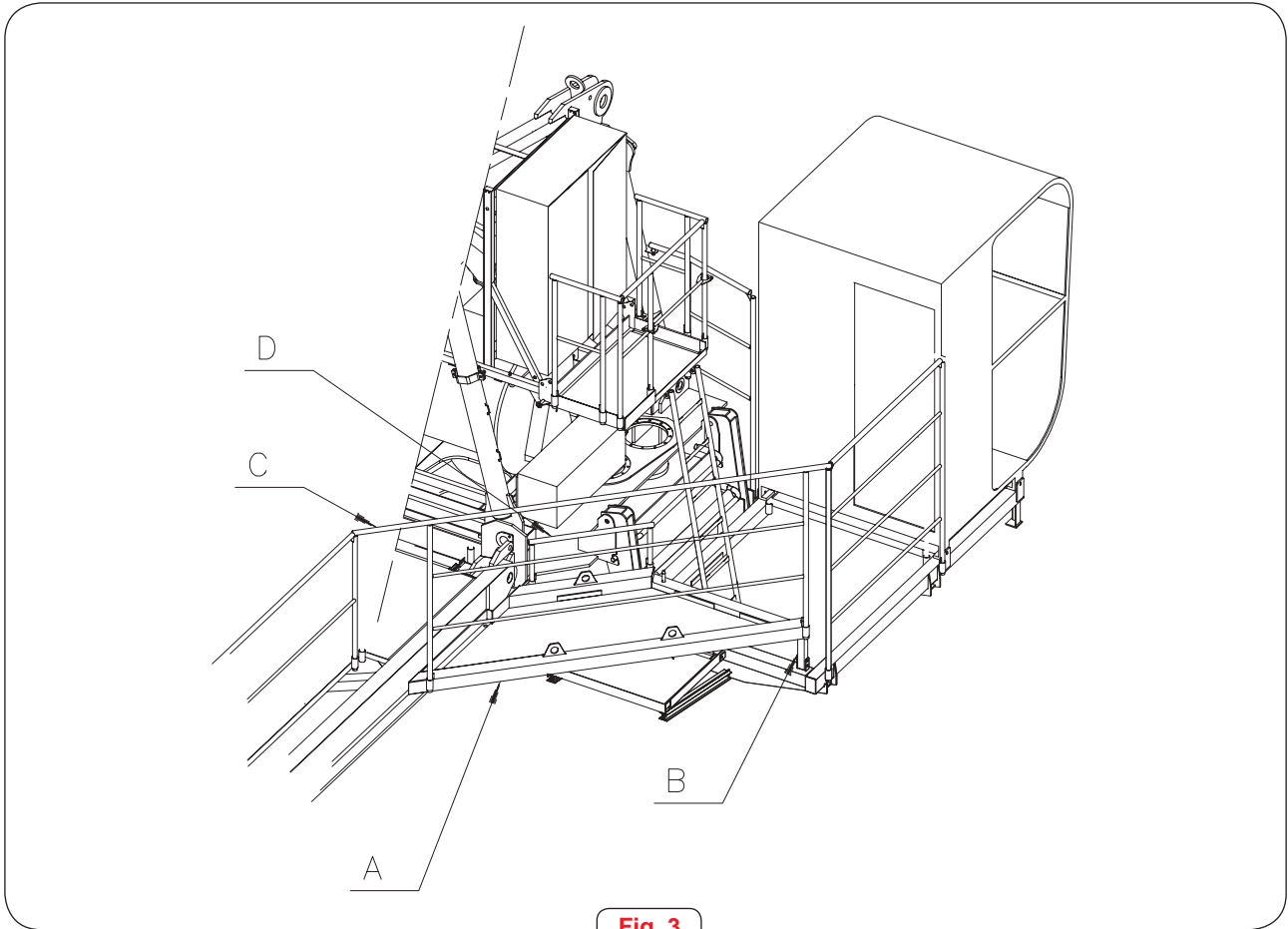


**Fig. 2**

### 4 ASSEMBLING THE SAFETY WALK

Once you have finished the assembly, complete the access between the counter-jib and the cat head.

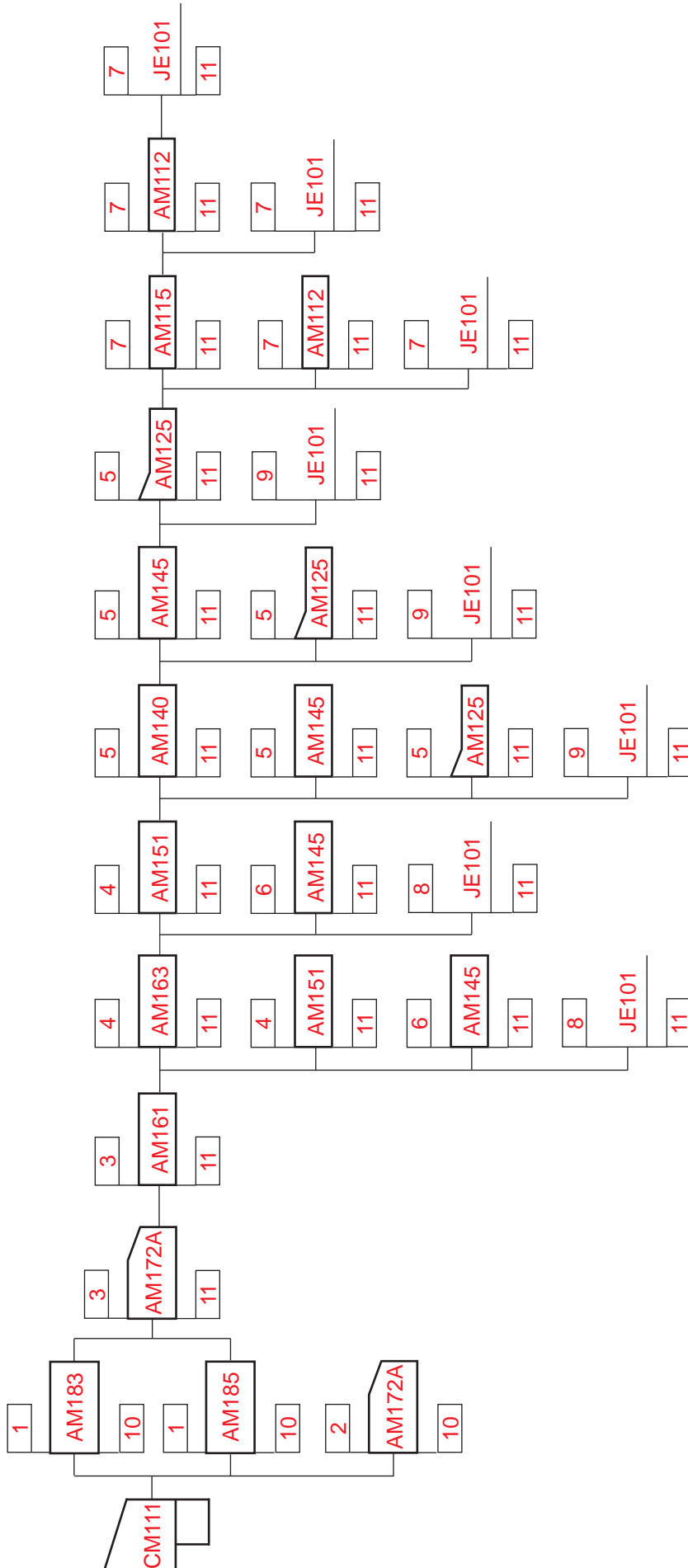
- Fit the safety walk "A" into the pivots of the counter-jib and in the pivots of the strut "B" of the cab platform.
- Fit the handrail "C" between the counter-jib and cat head handrails.
- Fit the handrail "D".

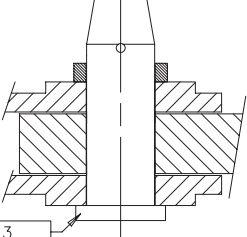
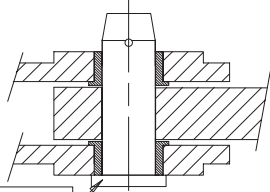
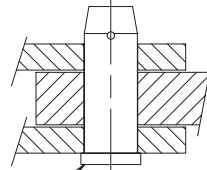
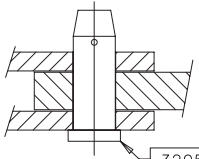
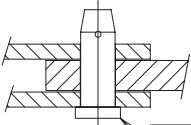
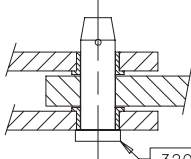
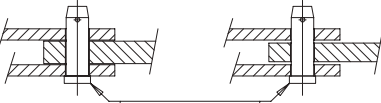
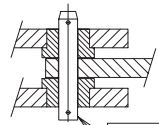
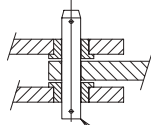
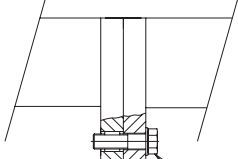
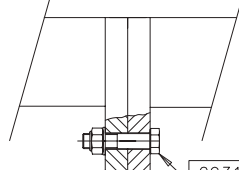


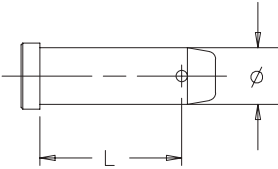
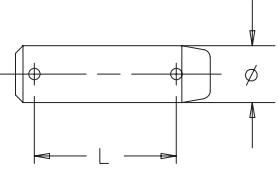
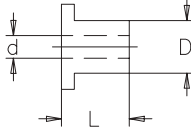
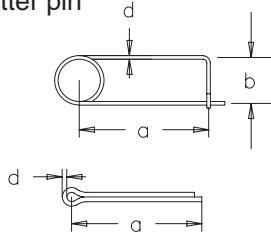
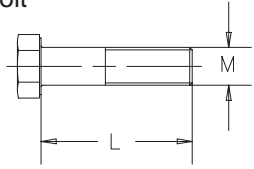
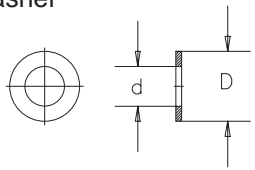
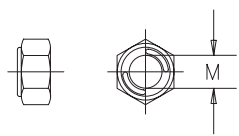
**Fig. 3**

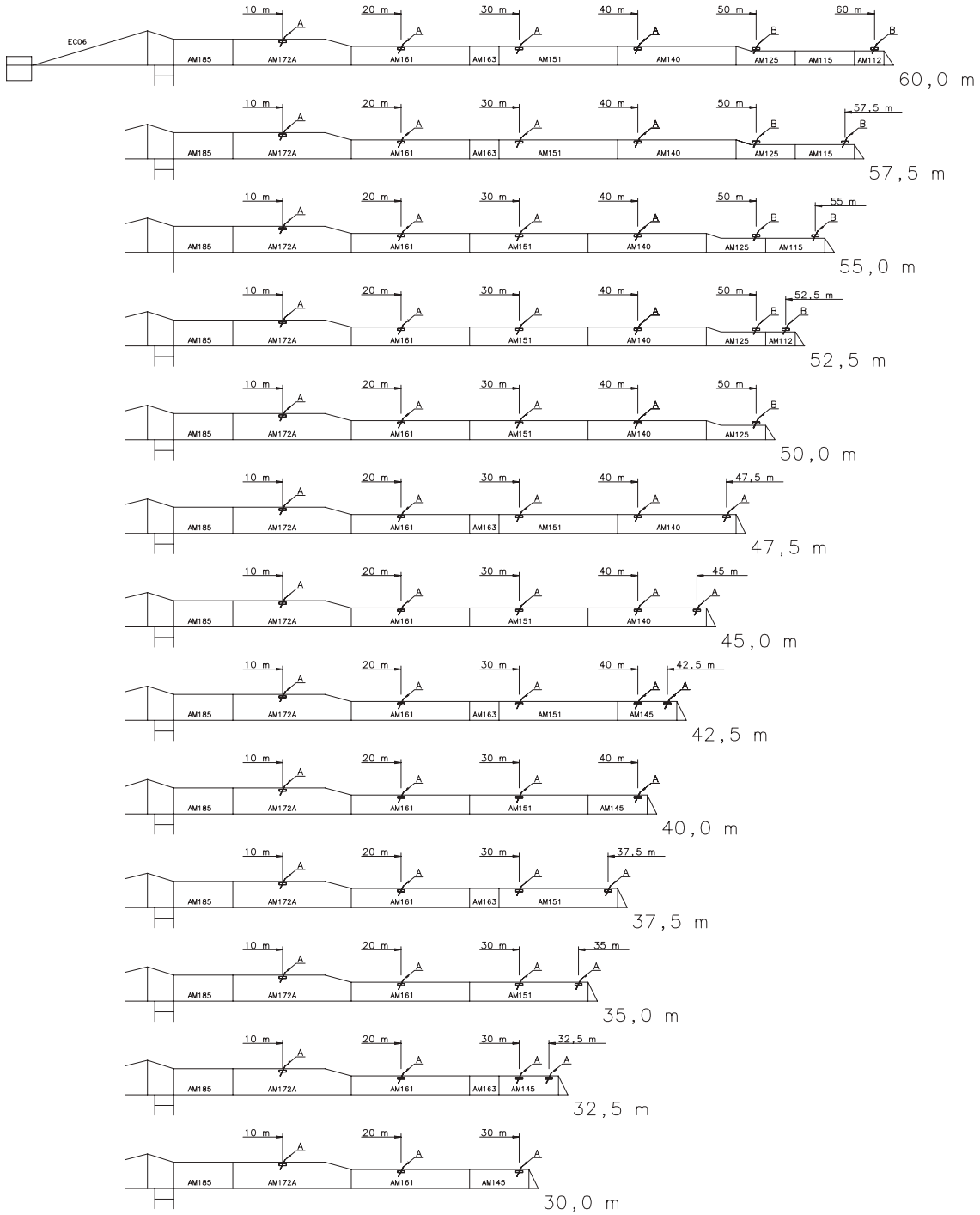


**POSSIBLE COMBINATIONS OF JIB SECTIONS**

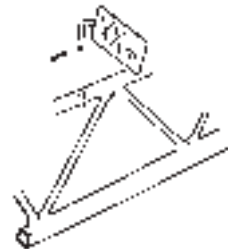


<p>1</p>  <p>3205M993 PS16*70*170 3205P1722</p>	<p>2</p>  <p>3215-10140 PS16*70*170 3205-11002</p>	<p>3</p>  <p>3205M997 PS16*70*170</p>
<p>4</p>  <p>3205P998 PS15*40*105</p>	<p>5</p>  <p>3205P999 PS15*40*105</p>	<p>6</p>  <p>3205P1048 PS15*40*105 3205P948</p>
<p>7</p>  <p>3215-10107 PS14*25*85</p>	<p>8</p>  <p>10250120.14 3205P951 PS14*25*85 PSA5*60</p>	<p>9</p>  <p>10250120.14 3205P1006 PS14*25*85 PSA5*60</p>
<p>10</p>  <p>093120250070088 ARP21D6916</p>	<p>11</p>  <p>093120250090088 ARP21D6916 0985202508</p>	

Designation	Reference	Dimension
<b>Pin</b> 	3205M993	$\phi$ 91 L=210
	3215-10140	$\phi$ 71 L=179
	3205M997	$\phi$ 71 L=157
	3205P998	$\phi$ 56 L=117
	3205P999	$\phi$ 46 L=97
	3205P1048	$\phi$ 46 L=117
	3215-10107	$\phi$ 30 L=75
	10250120.14	$\phi$ 25 L=120
<b>Bushing</b> 	3205-11002	D= 92 d= 72 L= 47
	3205P948	D= 57 d= 47 L= 30
	3205P951	D= 57 d= 26 L= 34
	3205P1006	D= 60 d= 26 L= 26
<b>Cotter pin</b> 	PSI6*70*170	d= 6 b= 70 a= 170
	PSI5*40*105	d= 5 b= 40 a= 105
	PSI4*25*85	d= 4 b= 25 a= 85
	PSA5*60	d= 5 a= 60
<b>Bolt</b> 	093120250070088	M= 20 L= 70 DIN0931
	093120250090088	M= 20 L= 90 DIN0931
<b>Washer</b> 	3205P1722	D= 125 d= 92 L= 25
	ARP21D6916	$\phi$ 21 DIN6916
<b>Nut</b> 	0985202508	M=20 DIN0985



Indicator type A



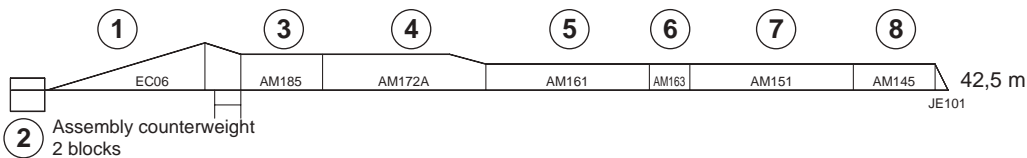
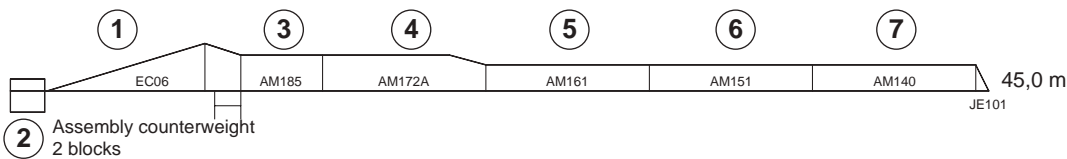
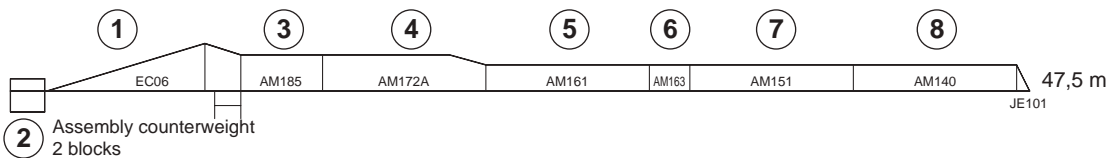
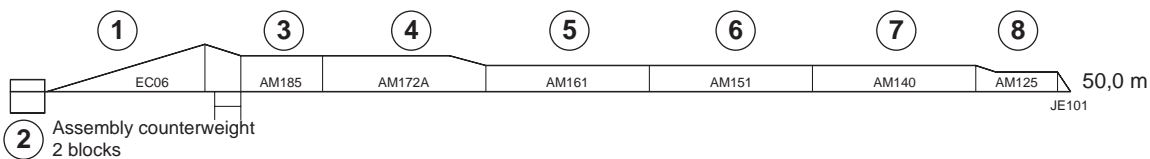
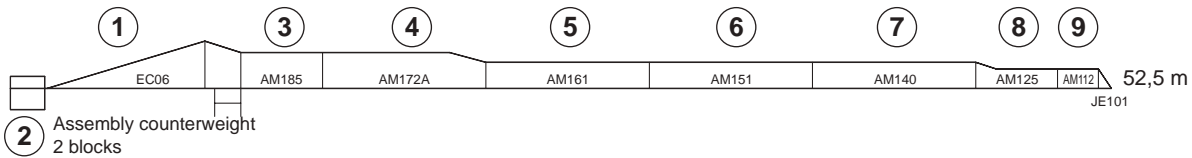
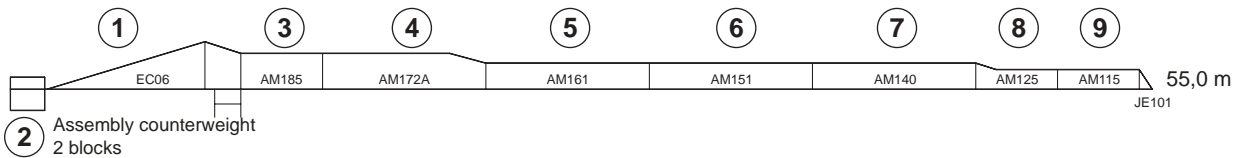
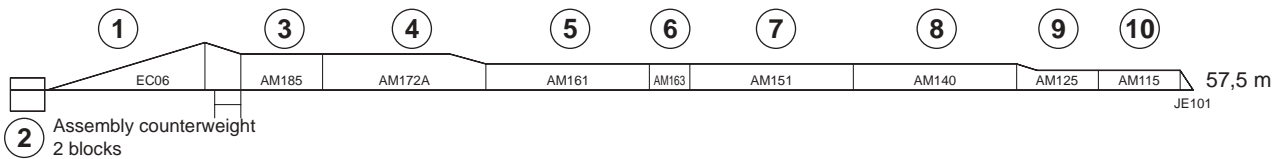
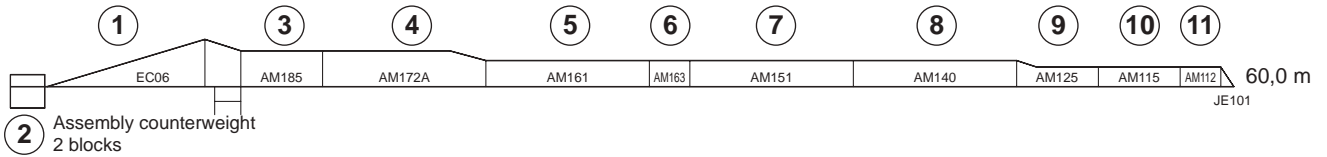
Indicator type B

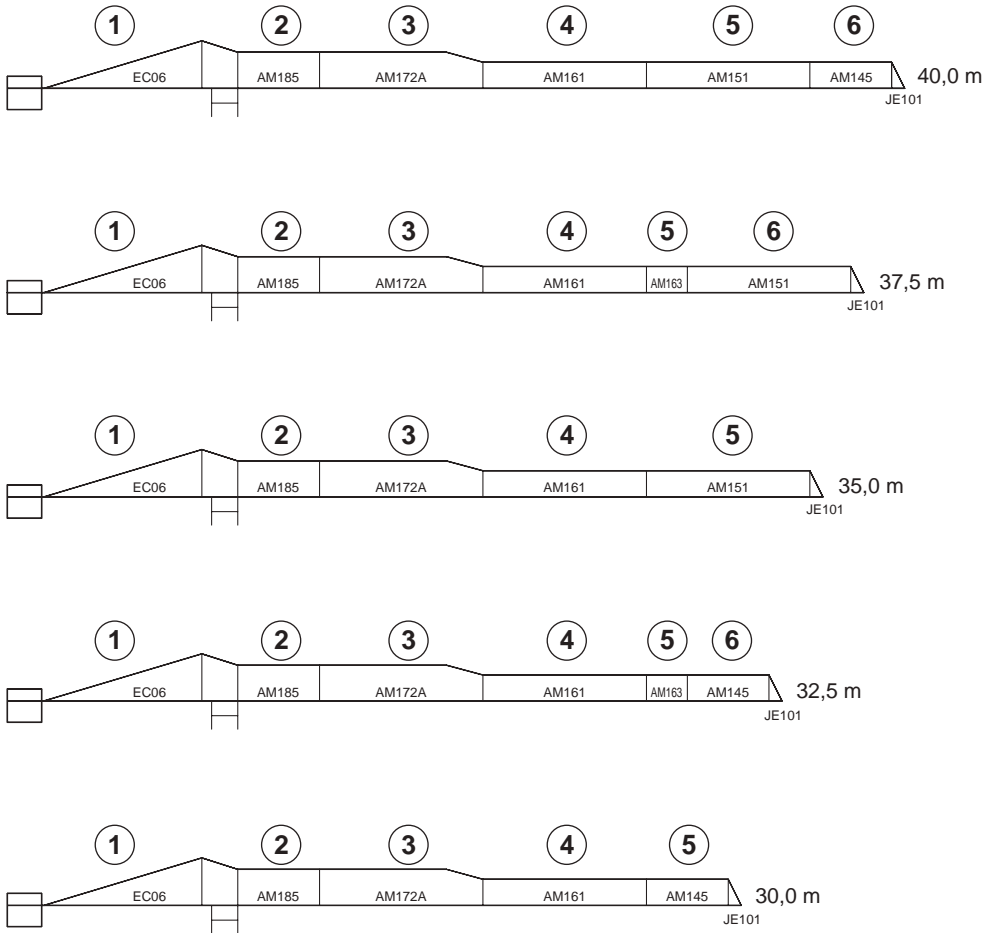
**NOTE:** Load indicator flags to be located on right hand side of jib as seen from the centre of the crane.

 DURING THE ERECTION AND DISMANTLING IS NECESSARY TO USE SAFETY HARNESS IN ORDER TO AVOID ACCIDENTS.

 THE ASSEMBLY SEQUENCES EXPLAINED HERE BELOW SHOULD BE CARRIED OUT AVOIDING LONG INTERRUPTIONS.

 THE ERECTING ORDER OF STRUCTURAL ELEMENTS MUST BE FOLLOWED EXACTLY AS DESCRIBED.





THE LAST STEP WILL BE TO POSITION THE AERIAL COUNTERWEIGHT IN ITS PLACE AT THE EC06.



**ENSURE THAT THE TOTAL BALLAST FOR THE TRAVELLING OR FIXEND BASE (IF APPLICABLE) IS IN PLACE BEFORE STARTING THE ERECTION OF JIB AND COUNTERJIB.**



TROLLEY AND HOOK SHOULD ALWAYS BE FITTED ON TO THE FASTENING SECTION TO THE CM111.



COUNTERWEIGHT BLOCKS SHOULD ALWAYS BE FITTED STARTING FROM THE REAR OF THE COUNTERJIB AND WORKING TOWARDS THE TOWER.



ASSEMBLY COUNTERWEIGHT BLOCKS IN THE RIGHT ORDER. SEE QUANTITY & POSITION IN "MOUNTING COUNTERWEIGHT BLOCK POSITION".

THE SEQUENCE FOR DISMANTLING IS INVERSE TO ERECTION.

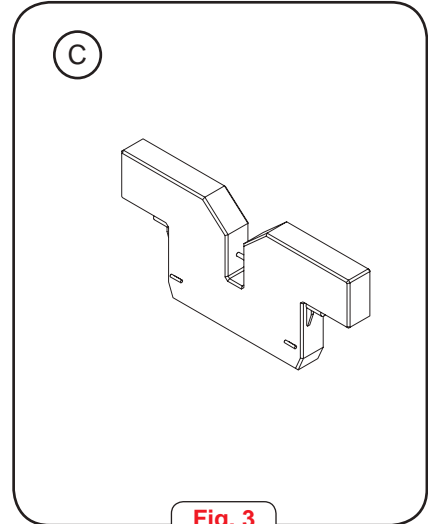
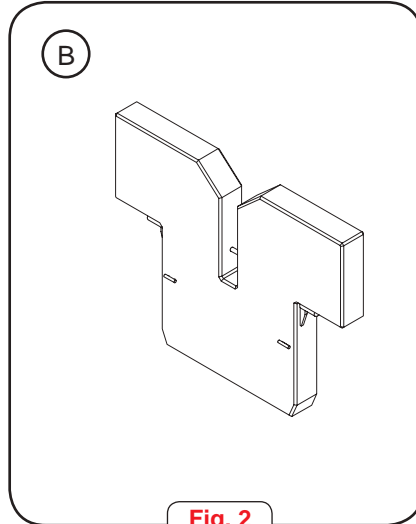
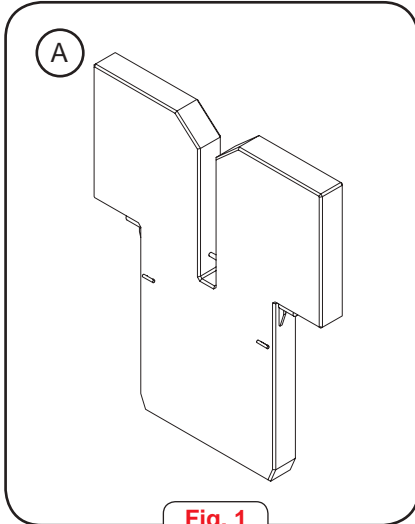


**THE WIND SPEED DURING THE ERECTION PROCESS SHOULD BE LOW ENOUGH AS TO ALLOW THE SAFE HANDLING OF THE CRANE ELEMENTS, I.E. APPROX. LESS THAN 25 km/HORA.**

**0**    **CONTENS**  
**1**    **AERIAL COUNTERWEIGHT**  
**2**    **ERECTION**

**1**    **AERIAL COUNTERWEIGHT**

- The overhead counterweight is made up of 2200 kg (Fig. 1), 1400 kg (Fig. 2) and 800 kg (Fig. 3) blocks.



- The number of blocks and their position on the counterjib are defined in the following sheets entitled "COUNTERWEIGHT ERECTION. BLOCK POSITION", and depend on the hoisting mechanism and jib length.



Safety harness must be used during erection operations.

- Blocks must be secured at a balanced position so as to allow tilting for transportation.

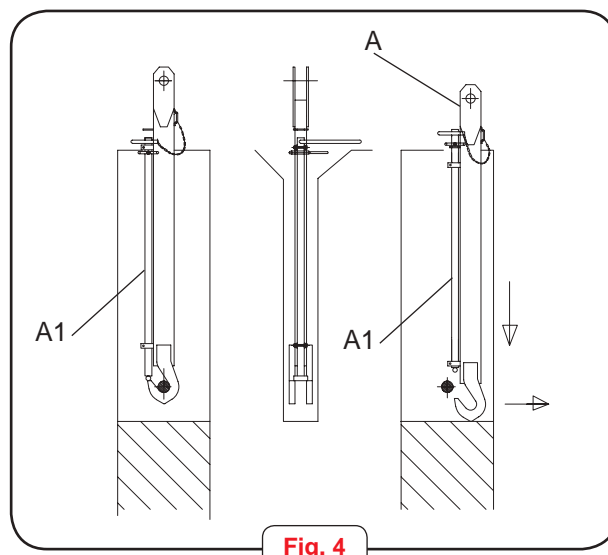


Blocks must be looked at during erection operations preventing them from swinging and causing (by any circumstances) any accident (knocking against stationary parts of the crane).

**2**    **ERECTION**

- The blocks are fitted to the counterjib using an auto-crane, with the aid of the block lifting hook (A).

The hoisting hook incorporates a safety catch A1, retained in its position by means of A2 pin.



- The blocks are positioned on the counterjib and rock on round part "B" until coming to a stop up against the bottom stop "C".
- Round part "D" must rest on the bottom stop "C".
- Keep a check on block position to see that they are fitted correctly.

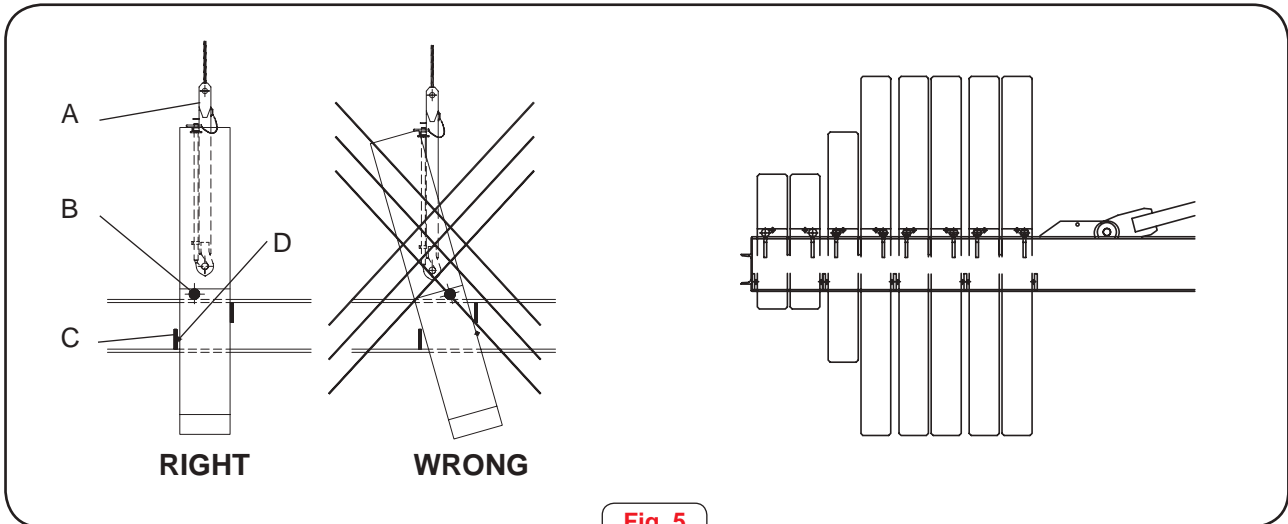
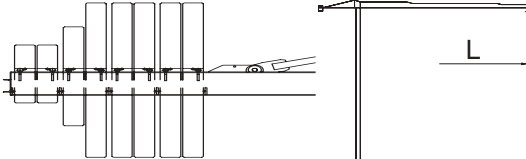
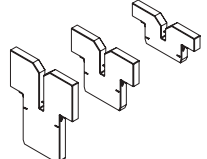


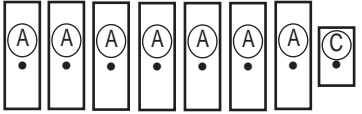
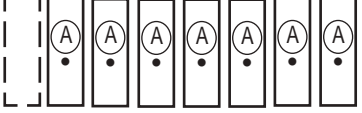
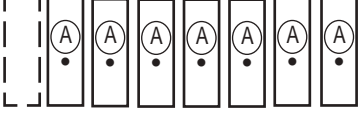
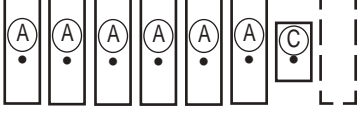
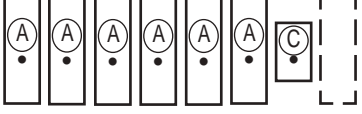
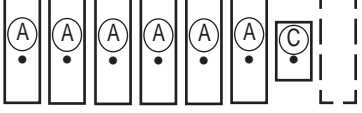
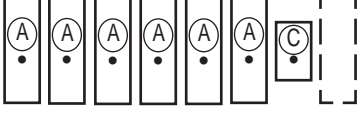
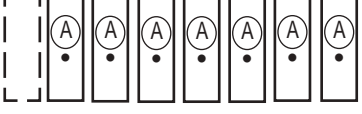
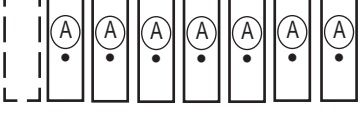
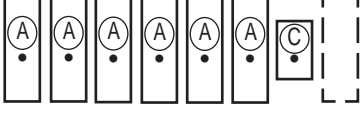
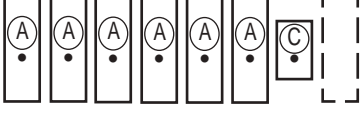
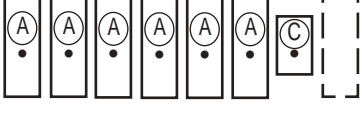
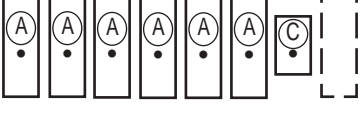
Fig. 5

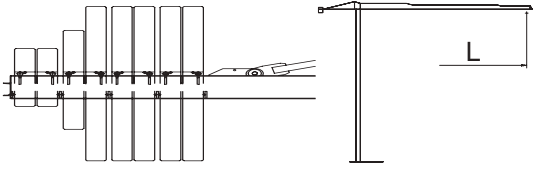




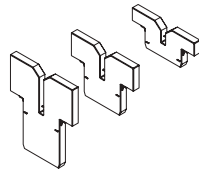
BLOCK	WEIGHT (kg)
<b>A</b>	<b>2200</b>
<b>B</b>	<b>1400</b>
<b>C</b>	<b>800</b>

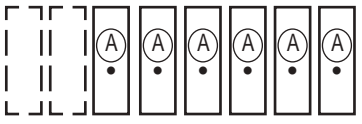
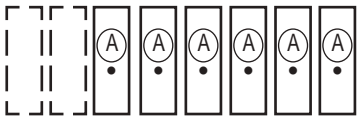
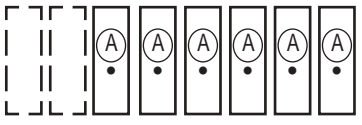
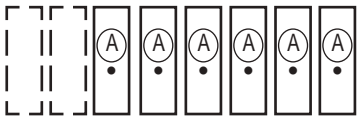
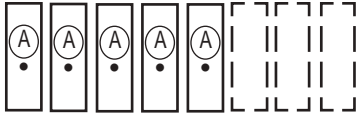
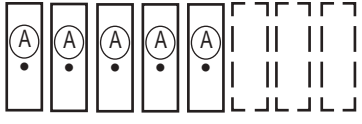
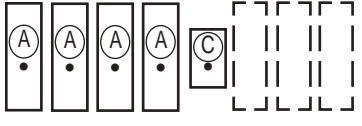
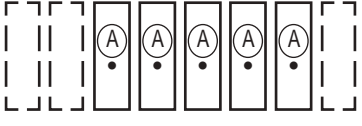
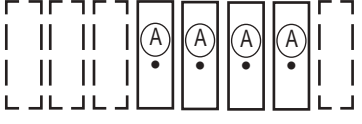
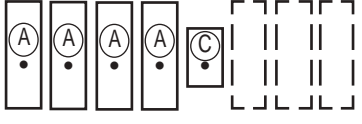


Weight (kg)	SR	JIB (m)	SR/DR	Weight (kg)
<b>16200</b>		<b>60,0</b>		<b>16200</b>
<b>16200</b>		<b>57,5</b>		<b>16200</b>
<b>15400</b>		<b>55,0</b>		<b>15400</b>
<b>14000</b>		<b>52,5</b>		<b>14000</b>
<b>14000</b>		<b>50,0</b>		<b>14000</b>
<b>15400</b>		<b>47,5</b>		<b>15400</b>
<b>14000</b>		<b>45,0</b>		<b>14000</b>
<b>14000</b>		<b>42,5</b>		<b>14000</b>



BLOCK	WEIGHT (kg)
<b>A</b>	<b>2200</b>
<b>B</b>	<b>1400</b>
<b>C</b>	<b>800</b>

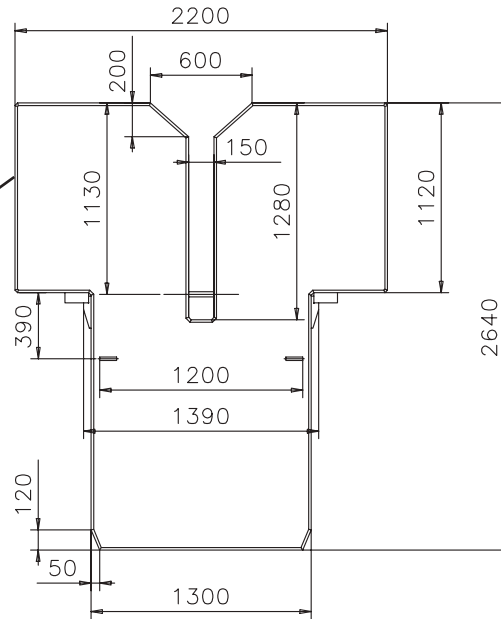


Weight (kg)	SR	JIB (m)	SR/DR	Weight (kg)
13200		40,0		13200
13200		37,5		13200
11000		35,0		11000
9600		32,5		11000
8800		30,0		9600

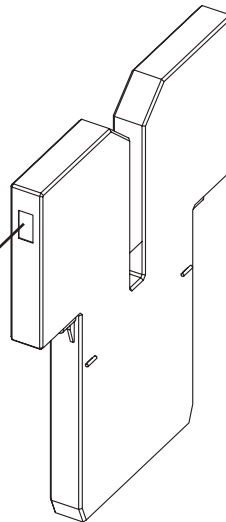
**3207-20463**



MARK THE SLAB WEIGHT  
IN AN INDELEBLE WAY.

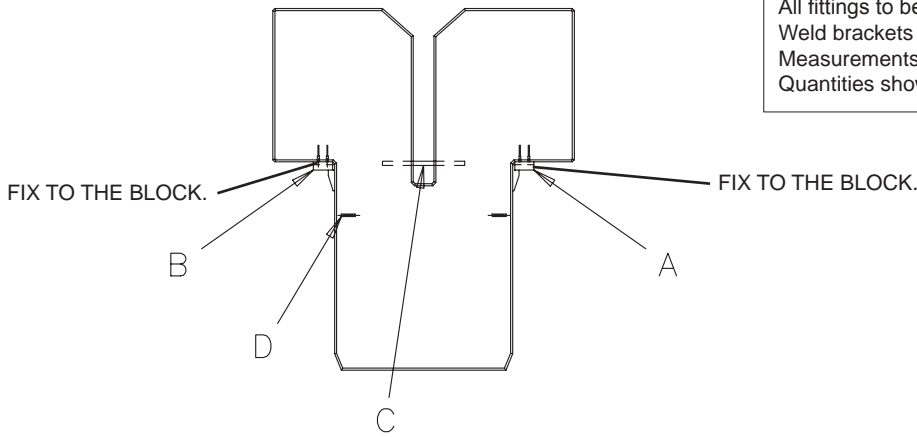


MARK THE SLAB WEIGHT  
IN AN INDELEBLE WAY.

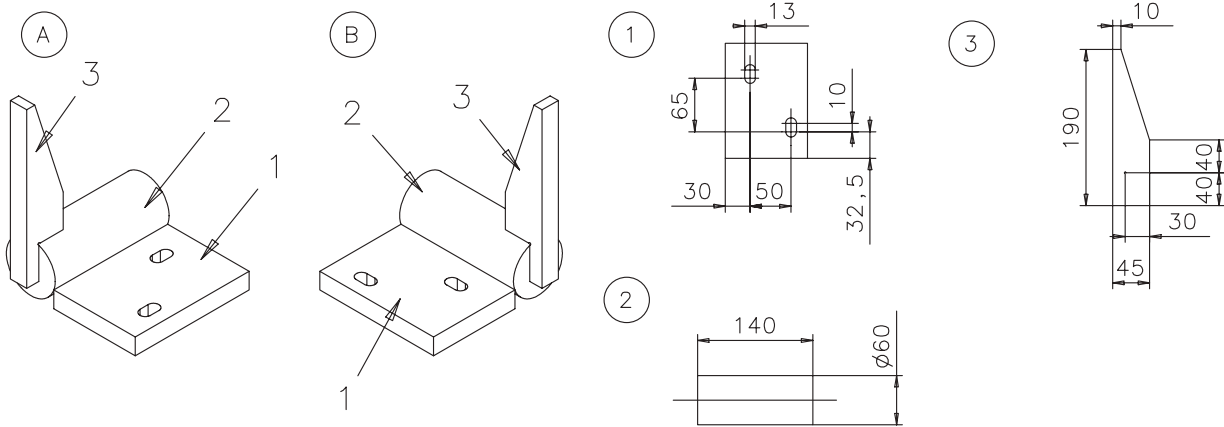


Bevel edges 20 x 20 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

QUALITY OF CONCRETE ..... HH-250 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY) ..... 2200 kg + 2%  
WEIGHT OF THE STEEL ..... 180 kg  
ALL MESH ..... Ø10 (AEH 4005)

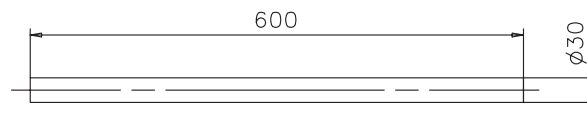


All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.



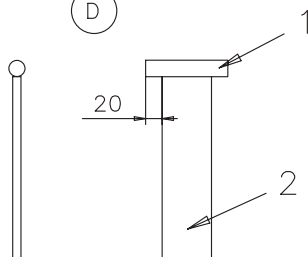
1-	Support plate	100x20	(S275JR)	L=140	1 p.
2-	Round bar	Ø60	(S355JO)	L=140	1 p.
3-	Support	190x45	(S275JR)		1 p.

(C)

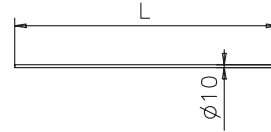
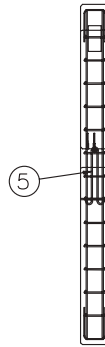
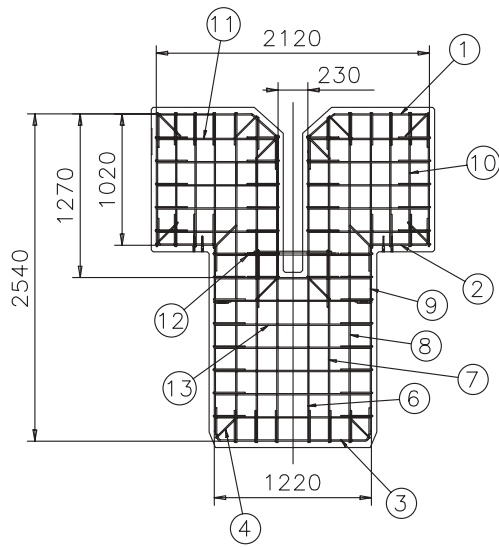


1-	Round bar	Ø30	(S355JO)	L=600	1 p.
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(D)

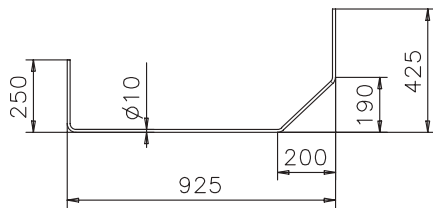


1-	Round bar	Ø20	(S355JO)	L=100	1 p.
2-	Support plate	60x10	(S275JR)	L=218	1 p.



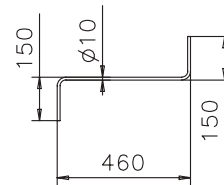
Bar number	Length	quantity
6	2380	4
7	2525	4
8	2560	4
9	2475	4
10	1040	12
11	960	20
12	510	4
13	1220	14

1



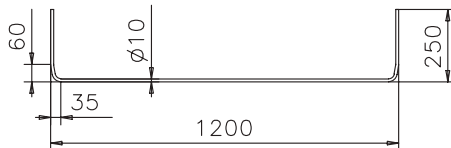
(4 Pieces)

2



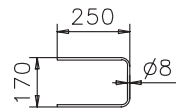
(4 Pieces)

3



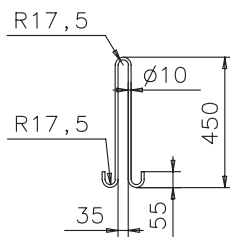
(2 Pieces)

4



(72 Pieces)

5

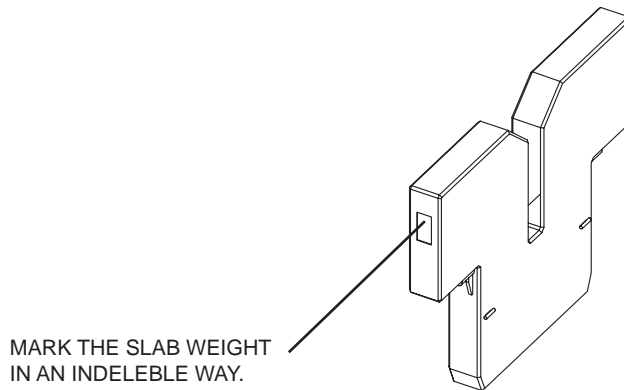
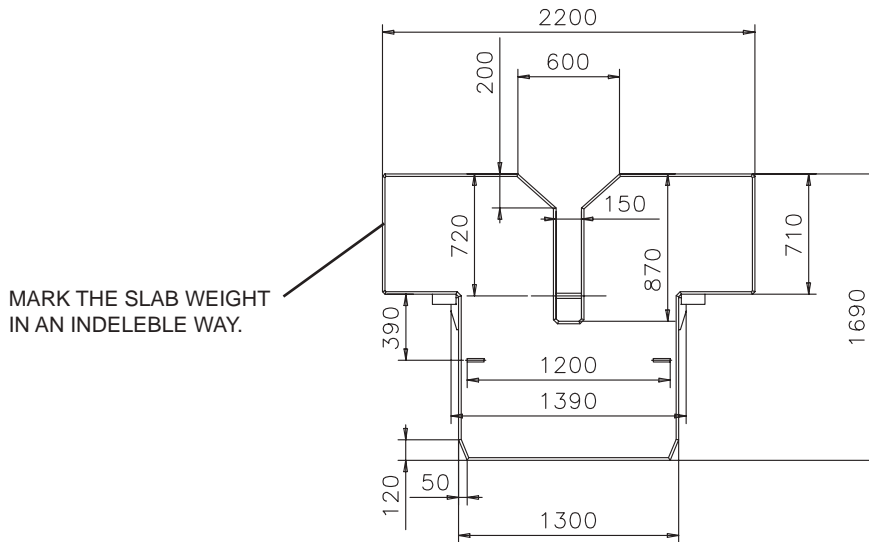


(2 Pieces)

All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

WEIGHT OF THE STEEL.....95 kg  
ALL MESH.....Ø10 (AEH 4005)

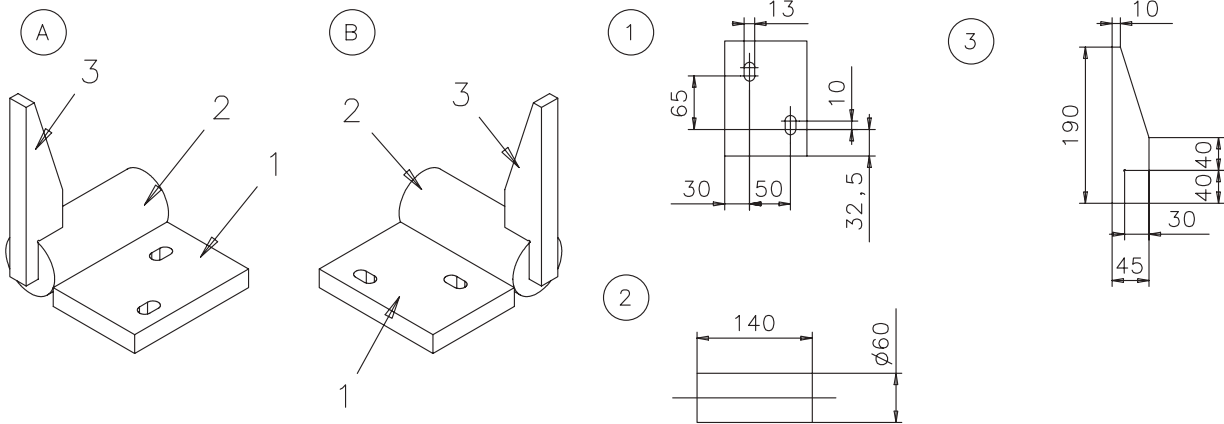
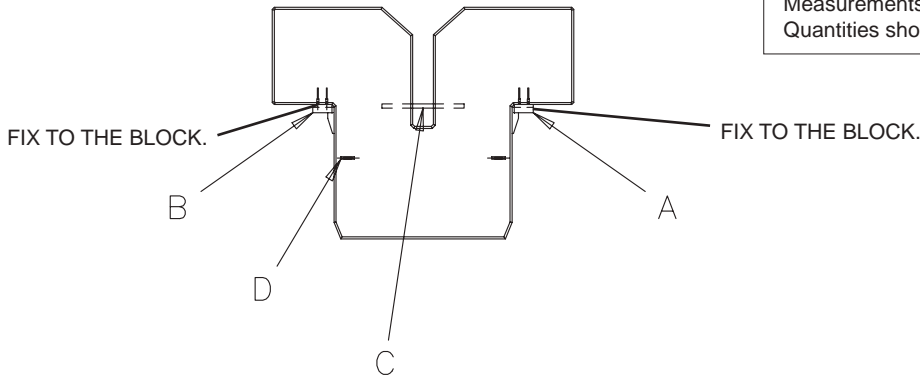
**3207-20670**



Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

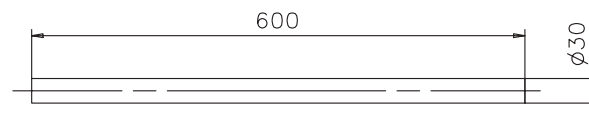
QUALITY OF CONCRETE ..... HH-250 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY) ..... 1400 kg + 2%  
WEIGHT OF THE STEEL ..... 76 kg  
ALL MESH ..... Ø10 (AEH 4005)

All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.



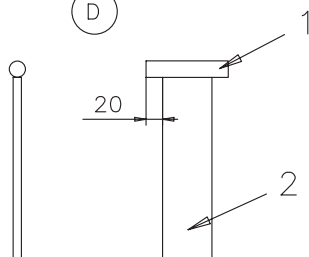
- |    |               |        |          |       |      |
|----|---------------|--------|----------|-------|------|
| 1- | Support plate | 100x20 | (S275JR) | L=140 | 1 p. |
| 2- | Round bar     | Ø60    | (S355JO) | L=140 | 1 p. |
| 3- | Support       | 190x45 | (S275JR) |       | 1 p. |

(C)

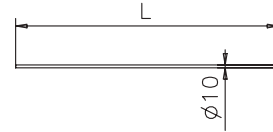
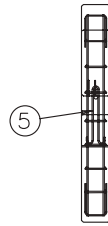
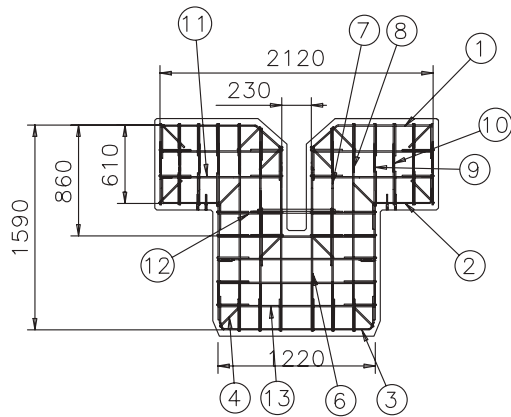


- |    |           |     |          |       |      |
|----|-----------|-----|----------|-------|------|
| 1- | Round bar | Ø30 | (S355JO) | L=600 | 1 p. |
|----|-----------|-----|----------|-------|------|

(D)

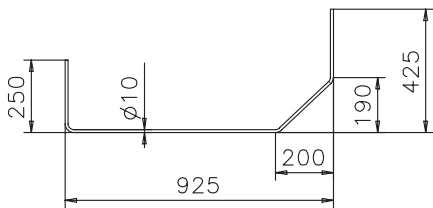


- |    |               |       |          |       |      |
|----|---------------|-------|----------|-------|------|
| 1- | Round bar     | Ø20   | (S355JO) | L=100 | 1 p. |
| 2- | Support plate | 60x10 | (S275JR) | L=218 | 1 p. |



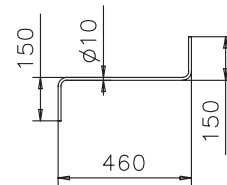
Bar number	Length	quantity
6	1430	4
7	1575	4
8	1610	4
9	1520	4
10	630	12
11	960	8
12	510	4
13	1220	8

1



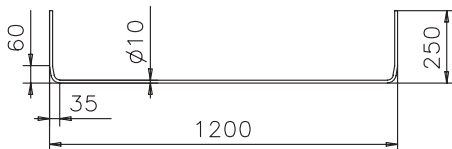
(4 Pieces)

2



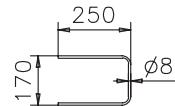
(4 Pieces)

3



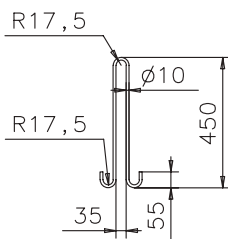
(2 Pieces)

4



(58 Pieces)

5



(2 Pieces)

All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

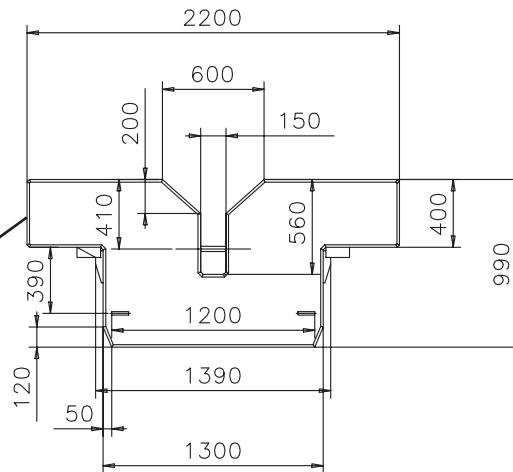
WEIGHT OF THE STEEL.....76 kg  
ALL MESH.....Ø10 (AEH 4005)



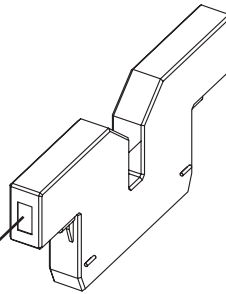
**3207-20665**



MARK THE SLAB WEIGHT  
IN AN INDELEBLE WAY.



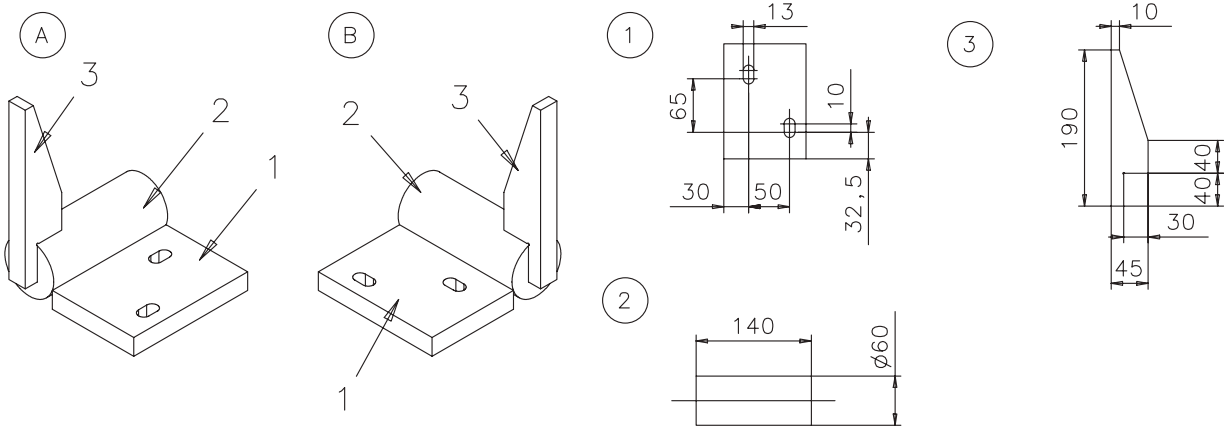
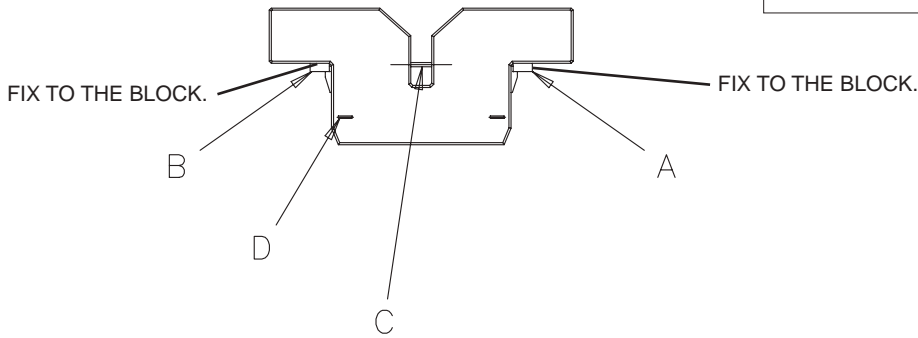
MARK THE SLAB WEIGHT  
IN AN INDELEBLE WAY.



Bevel edges 15 x 15 mm to avoid dropping of concrete particles.  
All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.

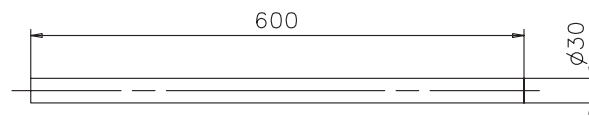
QUALITY OF CONCRETE ..... HH-250 kg/cm<sup>2</sup>  
DIMENSION OF AGGREGATE ..... 19 mm  
WEIGHT PER SLAB (DRY) ..... 800 kg + 2%  
WEIGHT OF THE STEEL ..... 58 kg  
ALL MESH ..... Ø10 (AEH 4005)

All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.



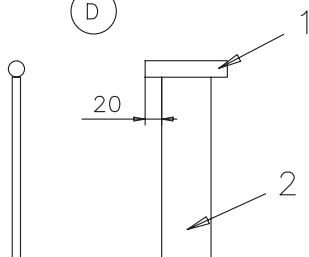
1-	Support plate	100x20	(S275JR)	L=140	1 p.
2-	Round bar	Ø60	(S355JO)	L=140	1 p.
3-	Support	190x45	(S275JR)		1 p.

(C)

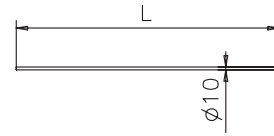
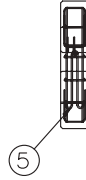
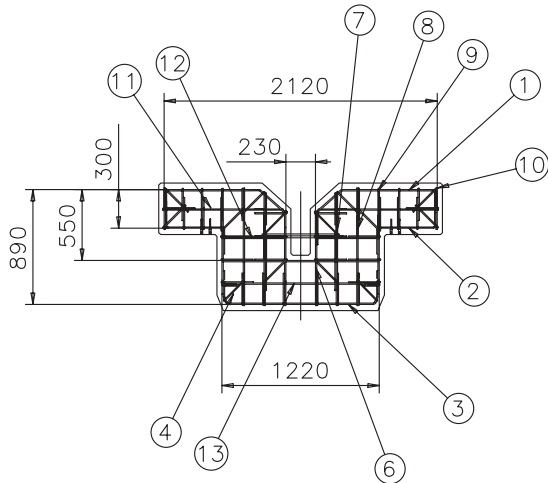


1-	Round bar	Ø30	(S355JO)	L=600	1 p.
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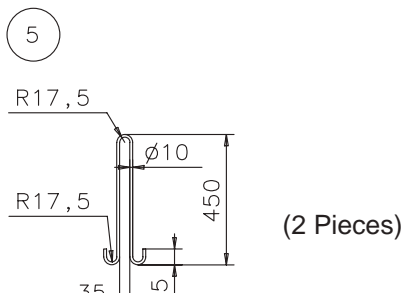
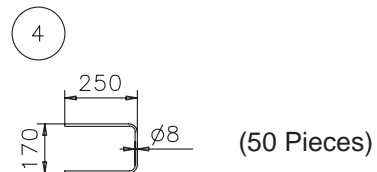
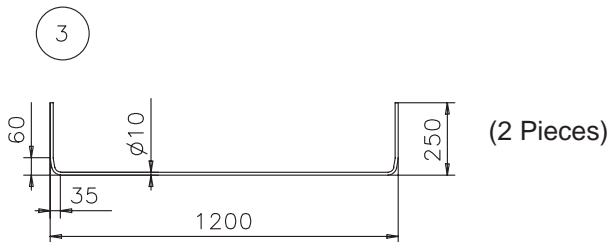
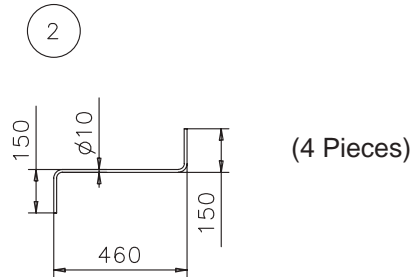
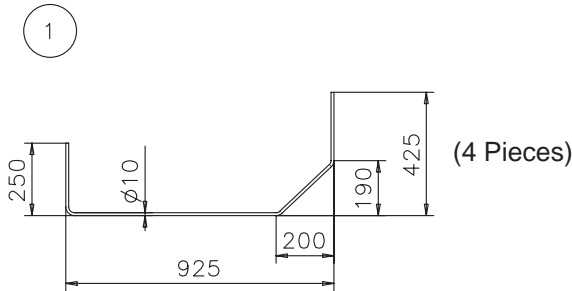
(D)



1-	Round bar	Ø20	(S355JO)	L=100	1 p.
2-	Support plate	60x10	(S275JR)	L=218	1 p.



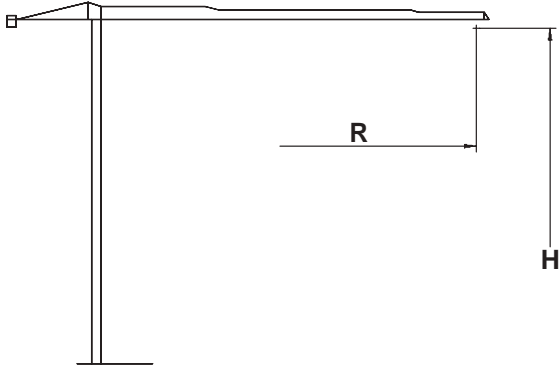
Bar number	Length	quantity
6	730	4
7	875	4
8	910	4
9	820	4
10	320	4
11	940	4
12	510	4
13	1220	4



All fittings to be galvanized.  
Weld brackets to re-bar.  
Measurements in mm.  
Quantities shown are for 1 slab.


WEIGHT OF THE STEEL.....58 kg  
ALL MESH..... $\phi 10$  (AEH 4005)



LENGTHS OF THE TROLLEY ROPES													
Side	JIB LENGTHS (m)												
	60	57,5	55	52,5	50	47,5	45	42,5	40	37,5	35	32,5	30
Tower	110	100	100	90	90	80	80	70	70	70	60	60	60
Jib-end	85	85	80	80	80	80	70	70	70	70	60	60	60
Diameter 8 mm Resistence 1770 N/mm <sup>2</sup>													

LENGTHS OF THE WIRE ROPES	
LENGTH (m)	
<p><b><math>L = (H + 1,5) \times n + R + 40</math></b></p> <p>L = Total rope length.            H = Height under hook.            n = Number of extension parts.            R = Max. working radius.</p> <p>Maximum capacity of the winch depending on mechanism. (see technical data sheet).</p>	
Diameter 12 mm Resistence 1960 N/mm <sup>2</sup>	

! See type of ropes in next page.

! For use and maintenance of ropes see "INSTRUCTIONS FOR WIRE ROPES" (MAN\_120.0001) of this manual.

<b>Type: TROLLEY ROPES</b>		
<b>Type</b>	<b>Characteristics</b>	<b>Make</b>
<b>6 x 19 + FC</b> 	Right-hand lay Galvanised With grease	YEONSIN KISWIRE

<b>Type: WIRE ROPES</b>		
<b>Type</b>	<b>Characteristics</b>	<b>Make</b>
<b>NHRD 24</b> 	Non-rotating cable Galvanised With grease	TREFILEUROPE
<b>Endurance 35 LS</b> 	Non-rotating cable Galvanised With grease	BRIDON



DURING THE OPERATIONS TO CARRY OUT THE FALL, A SAFETY HARNESS MUST BE USED.



FOR HANDLING THE CABLES, SEE THE RELEVANT SPECIFICATIONS IN THE "MAINTENANCE" CHAPTER OF THE DOCUMENT "STEEL CABLES".



NEXT TO THE TROLLEY MECHANISM THERE IS AN EMERGENCY STOP BUTTON.

## 0 CONTENTS

- 1 CABLE FALL
- 2 RECOMMENDED ASSEMBLY SEQUENCE
- 3 TENSIONING THE TROLLEY CABLE
- 4 TROLLEY CABLE BREAKAGE SAFETY DEVICE
- 5 RECOMMENDED DISASSEMBLY SEQUENCE

## 1 CABLE FALL

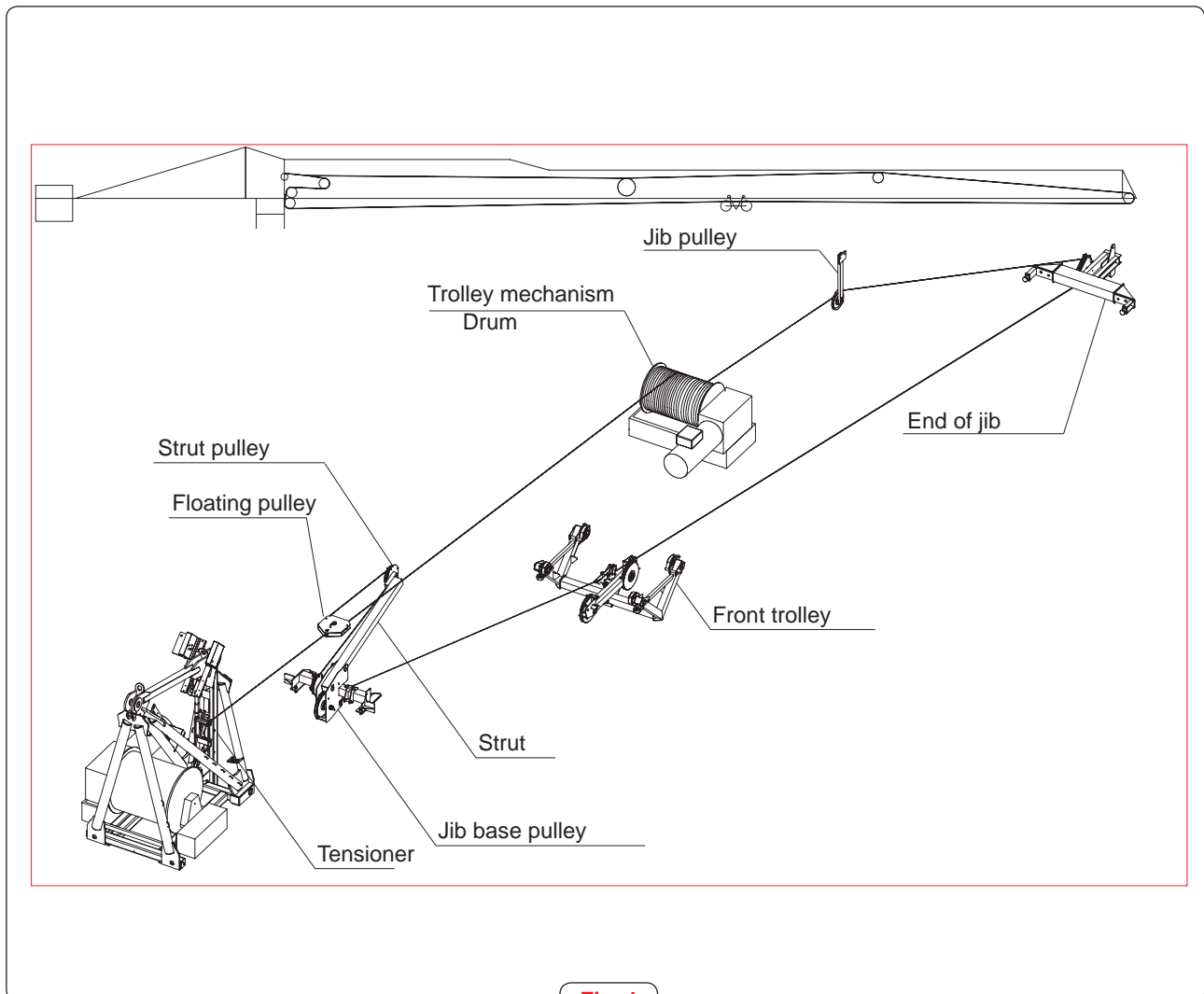


Fig. 1

- Verify that the pulleys necessary for the trolley cable fall are in place on the jib (see document "TROLLEY CABLE FALL").
- Once the whole jib is assembled, connect the trolley plugs in the cat head control panel.

## 2 RECOMMENDED ASSEMBLY SEQUENCE

### 2.1 Starting assembly with the rear cable

#### 2.1.1 Rear cable (Fig. 2)

- Fasten one end of the rear trolley cable to the trolley mechanism drum using the clamps "1" and wind the cable around the drum.
- Bring the trolley up to the start of the jib.
- Prepare the floating pulley "2". Position it beside the jib base strut pulley "3" hung from the upper rib of the jib.
- Pass the end of the trolley cable through the floating pulley "2" of the trolley cable tensing system, return it to the strut pulley "3" and pass it through the jib base trolley pulley "4". Fasten the end of the cable to the trolley using the terminal "5".

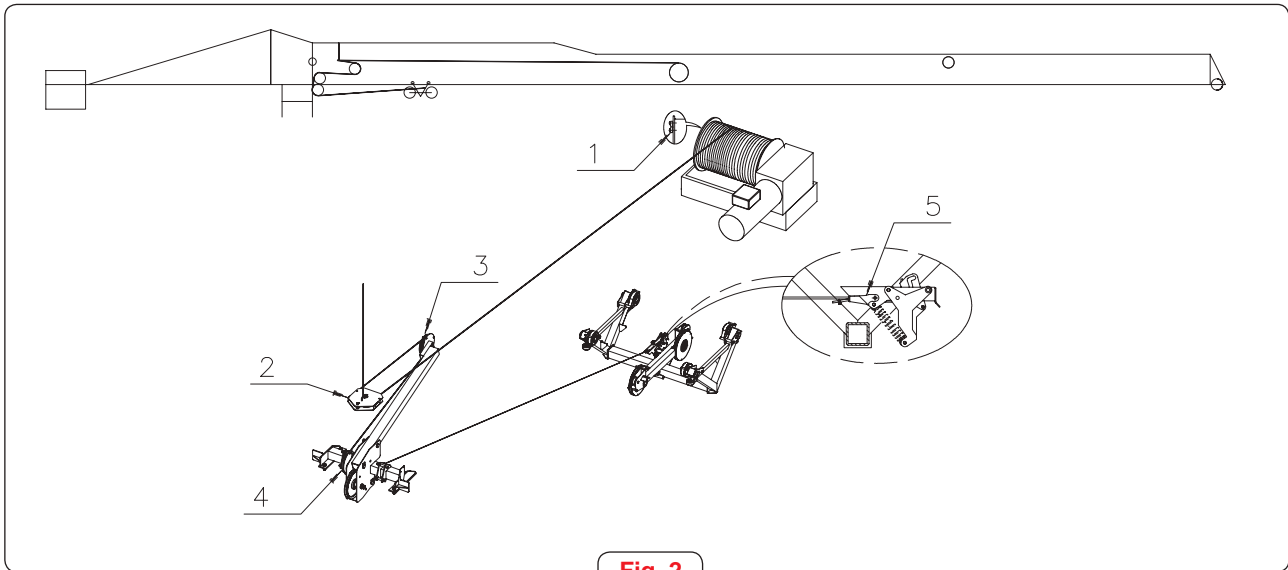


Fig. 2

#### 2.1.2 Front cable (Fig. 3)

- Prepare the fall of the front cable by passing the cable through the corresponding pulleys inside the jib "6" and through those of the mobile nose "7".
- Take the end up to the trolley at the start of the jib. If necessary, fix the cable to the jib using cable ties. Fasten the end of the cable to the trolley using the terminal "5".
- Wind the front cable a minimum of 3 turns around the drum and fix the end to the drum using clamps "1".

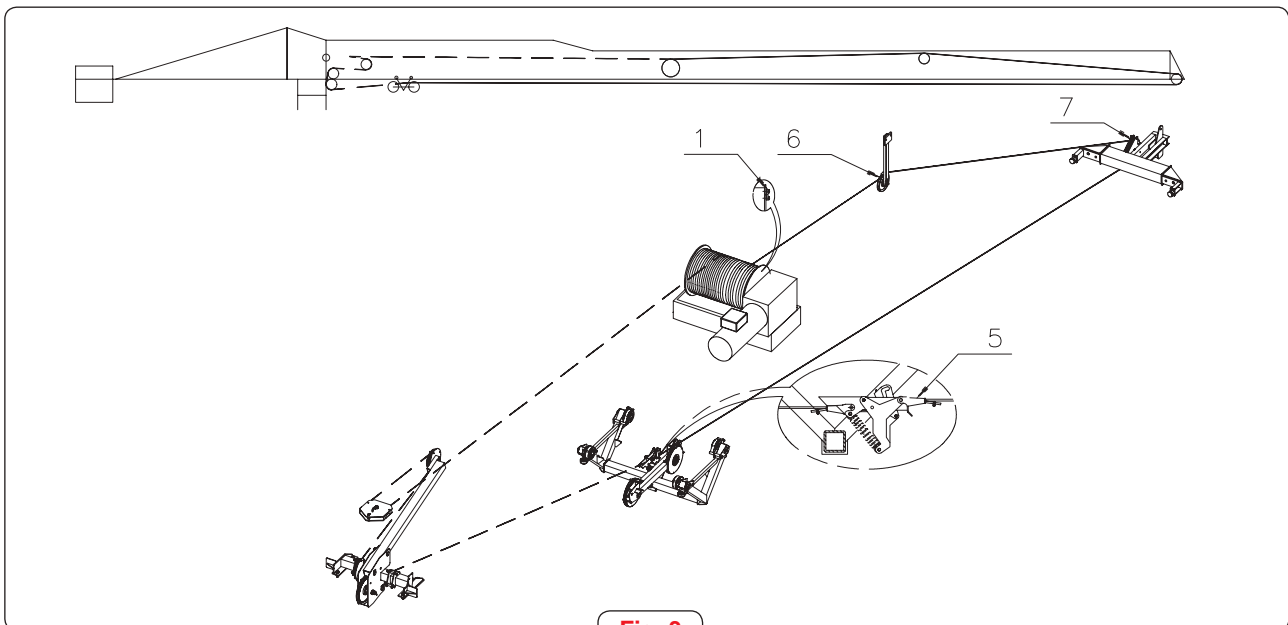


Fig. 3

### 2.1.3 Final operations

- Secure the floating pulley "2" to the cable of the ratchet "8" and tighten, unfasten the floating pulley from the upper rib of the jib.
- Remove the cable ties securing the front cable to the jib, if you used them.
- Tighten the cable fall. See section 3.

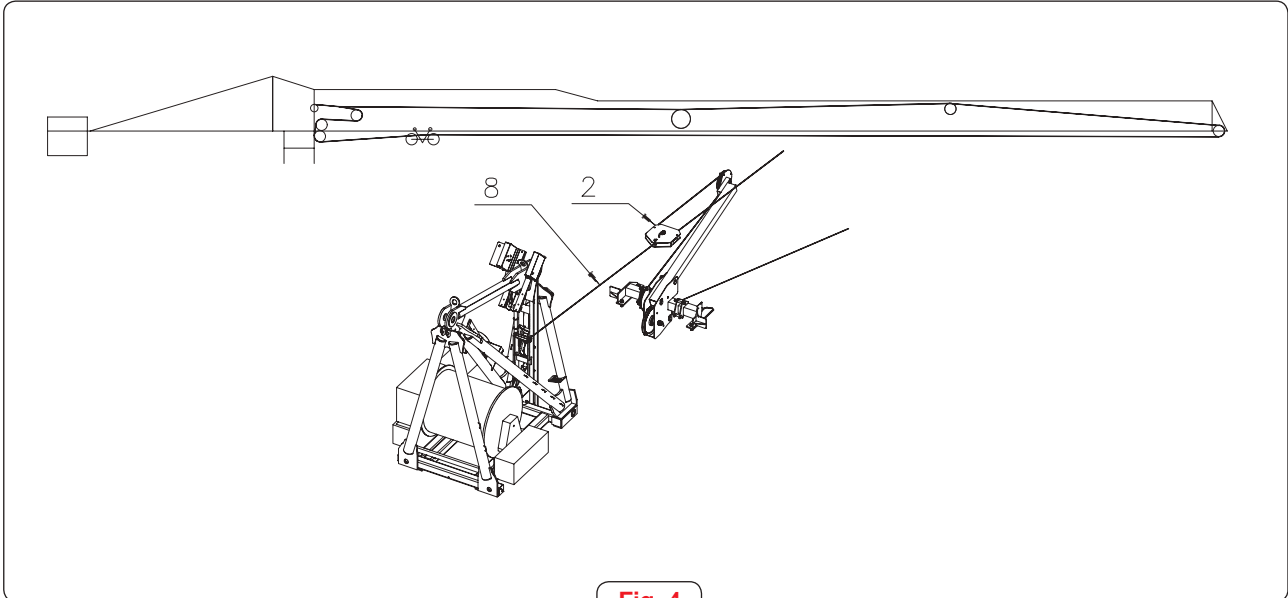


Fig. 4

## 2.2 Starting assembly with the front cable

### 2.2.1 Front cable (Fig. 5)

- Position the front trolley at the start of the jib and fix it to the same.
- Unroll the cable from the nose and pass it through the corresponding pulleys inside the jib "6" and through the mobile nose "7".

Bring the end up to the trolley at the start of the jib. If necessary, fix the cable to the jib using cable ties.

Fasten the end to the front trolley using the cable terminal "5".

Actuate the trolley mechanism so the trolley moves forwards until the catenary of the cable is eliminated but without tightening the cable excessively.

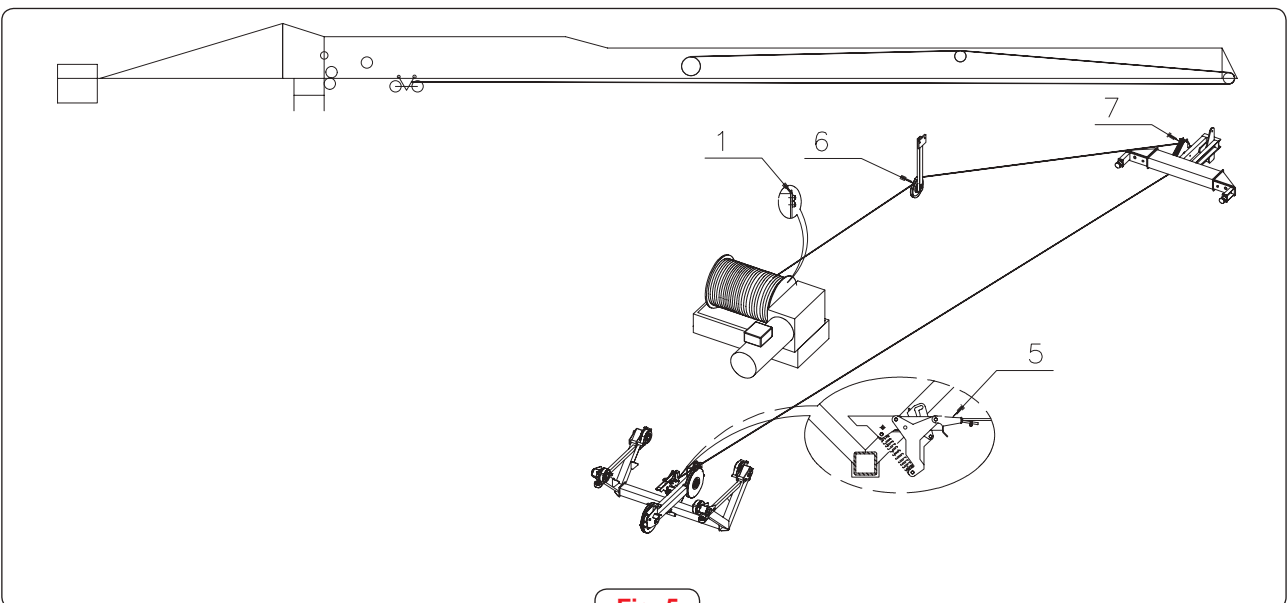
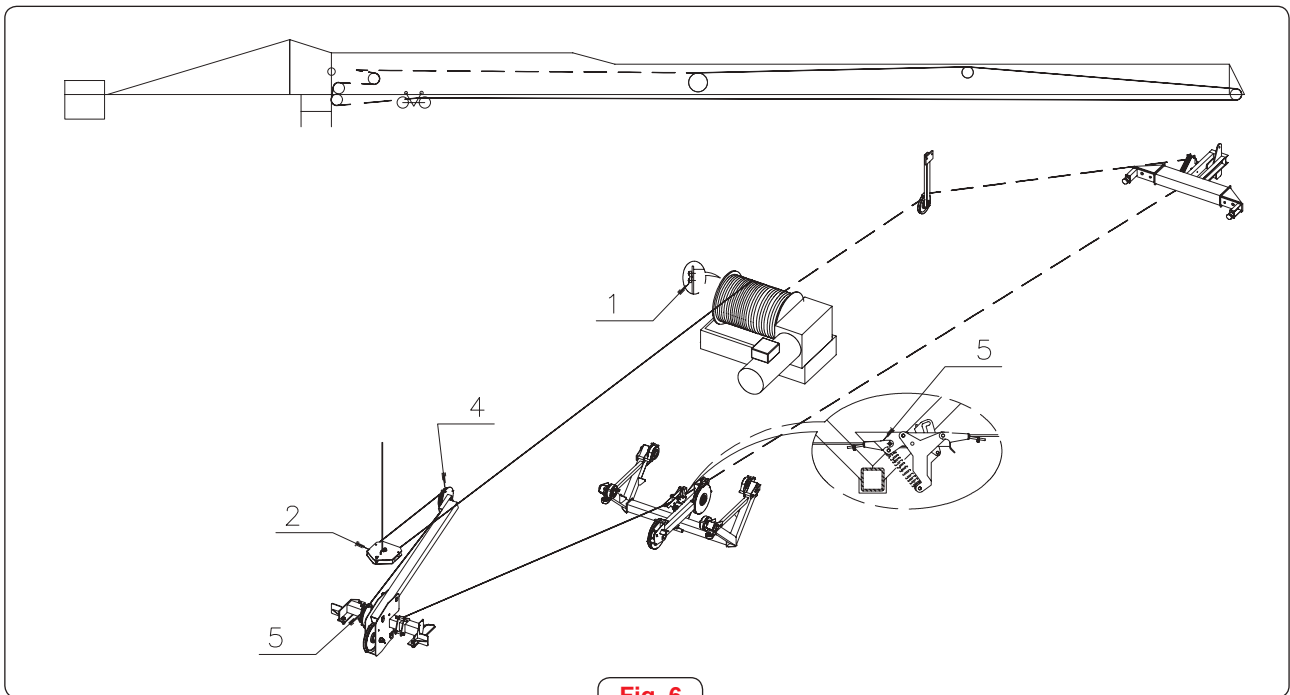


Fig. 5



**2.2.2 Rear cable (Fig.6)**

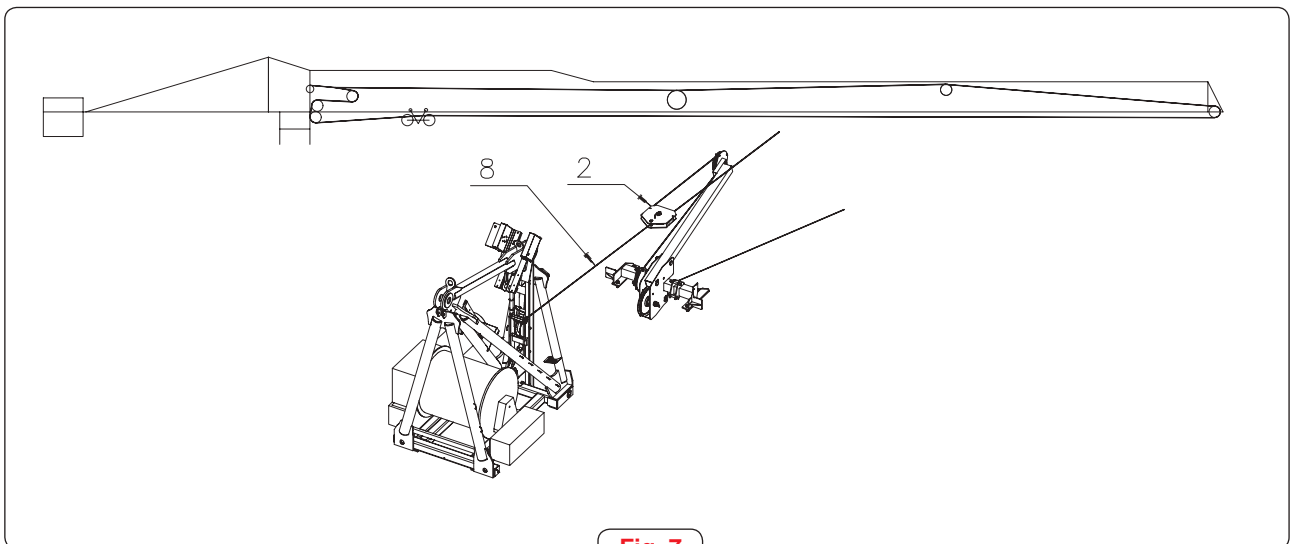
- Wind the rear cable a minimum of 3 turns around the drum and fix the end to the drum using clamps "1".
- Prepare the floating pulley "2". Position it beside the jib base strut pulley "3" hung from the upper rib of the jib.
- Pass the end of the trolley cable through the floating pulley "2" of the trolley cable tensing system, return it to the strut pulley "3" and pass it through the jib base trolley pulley "4". Fasten the end of the cable to the trolley using the terminal "5".
- Perform the ratchet cable fall.



**Fig. 6**

**2.2.3 Final operations**

- Secure the floating pulley "2" to the cable of the ratchet "8" and tighten, unfasten the floating pulley from the upper rib of the jib.
- Release the trolley from the jib crossbar.
- Remove the cable ties securing the front cable to the jib, if you used them.
- Tighten the cable fall. See section 3.



**Fig. 7**

### 3 TENSIONING THE TROLLEY CABLE

#### 3.1 Manual tensioning



In the initial assembly of the trolley cable fall, the first tensioning must be carried out manually.

The system consists of a lever "1" joined to the actuator arm "2" of the ratchet "3".

Moving the lever rotates the ratchet and retracts the retention cable of the floating pulley "5" and tenses the trolley cable fall.

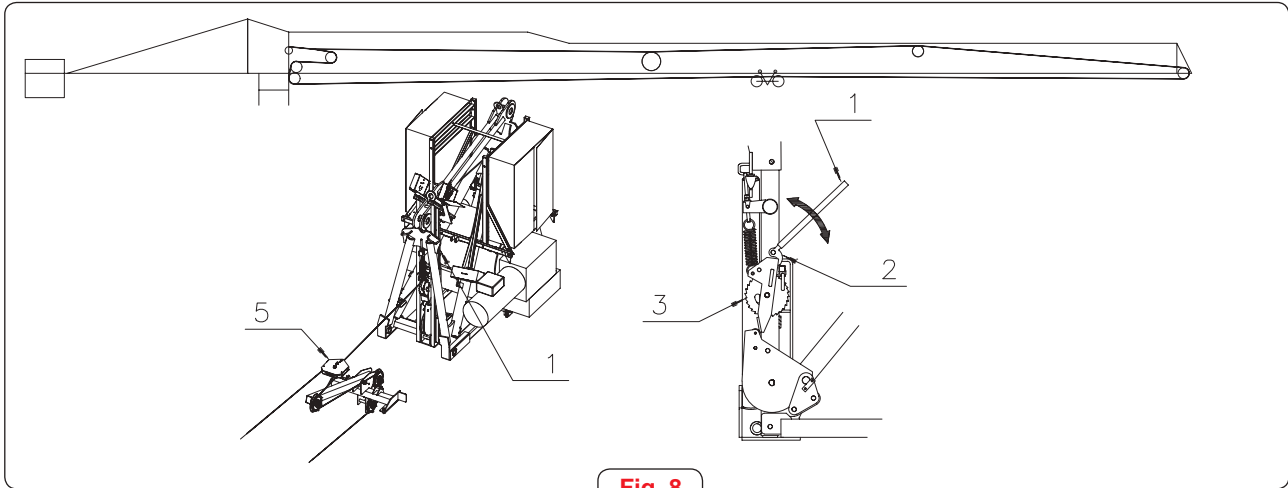


Fig. 8

#### 3.2 Automatic tensioning

The trolley cable tensioner is a system that provides tension in the trolley cable through the elevation cable when you lift loads with the crane.



The trolley cable must only be tensioned by lifting a load when necessary, generally when commissioning the crane and during maintenance operations.

Process:

- With the hook with no load, remove the securing pin "B" from the trolley cable tensioning pulley "1". Suspend a load from the hook and lift it. The pulley "1" rotates and operates the actuator arm "2" of the ratchet "3". Deposit the load on the ground, the pulley "1" in conjunction with the actuator arm "2" recover their position while the ratchet is held by the catch "6".
- Repeat the process as many times as necessary until the trolley cable fall is taut.
- After tensioning, lock the tensioning pulley "1" in its working position using the securing pin "B".

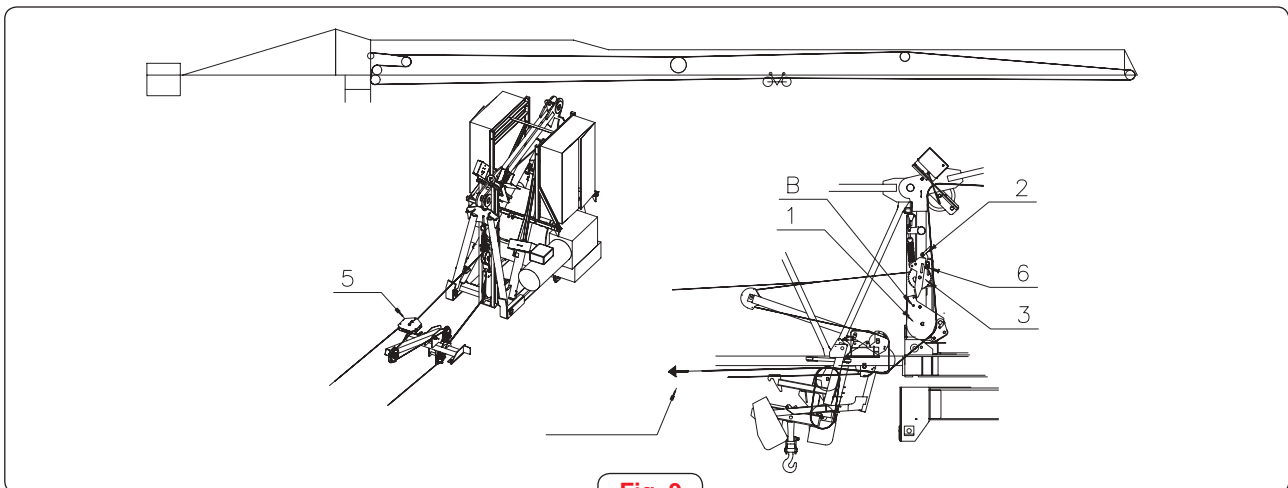


Fig. 9



Leaving the pulley "1" in the tensioning position may cause excessive tension in the trolley cable that can lead to it breaking.

#### 4 TROLLEY CABLE BREAKAGE SAFETY DEVICE

- The trolley has a safety system for locking the trolley the cable breaks.
  - The system is prepared in the factory and is held in this position by the pin (R).
  - It consists of a number of connecting rods and a spring connected to the trolley cables, and kept in its working position by their tension.
  - To activate the system once the fall has been completed and the cables tensioned, remove the pin (R) and place it in its housing.
  - If the cable breaks, the spring closes and displaces the limit (T), which collides with the lattice of the jib making the trolley stop.
- If the breakage safety device has been activated, before working with the crane again, check the structure of the trolley and the jib and repair or replace the elements necessary.

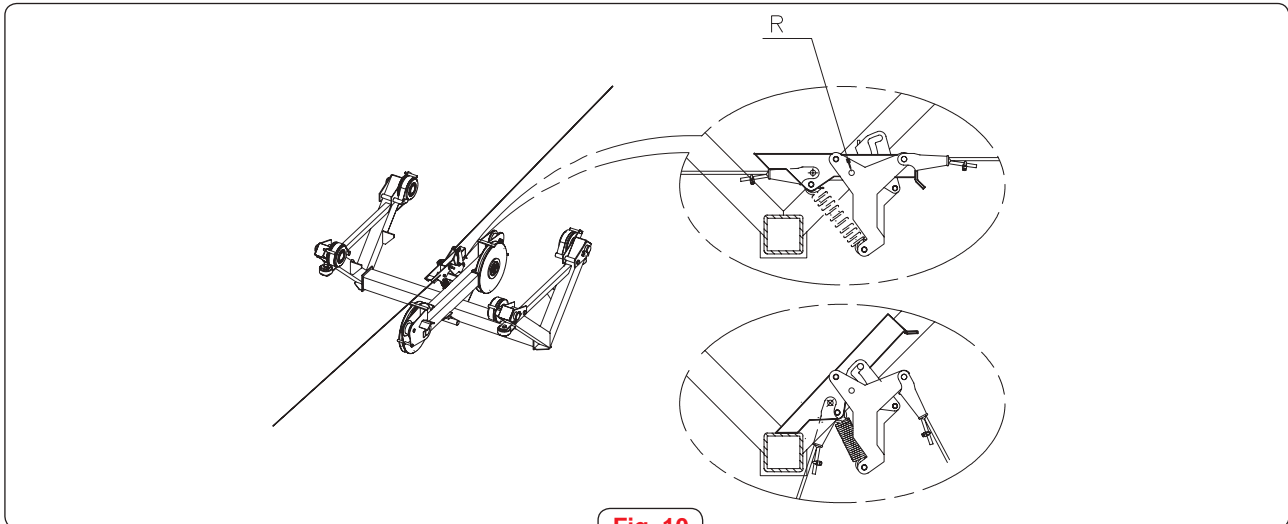


Fig. 10

#### 5 RECOMMENDED DISASSEMBLY SEQUENCE

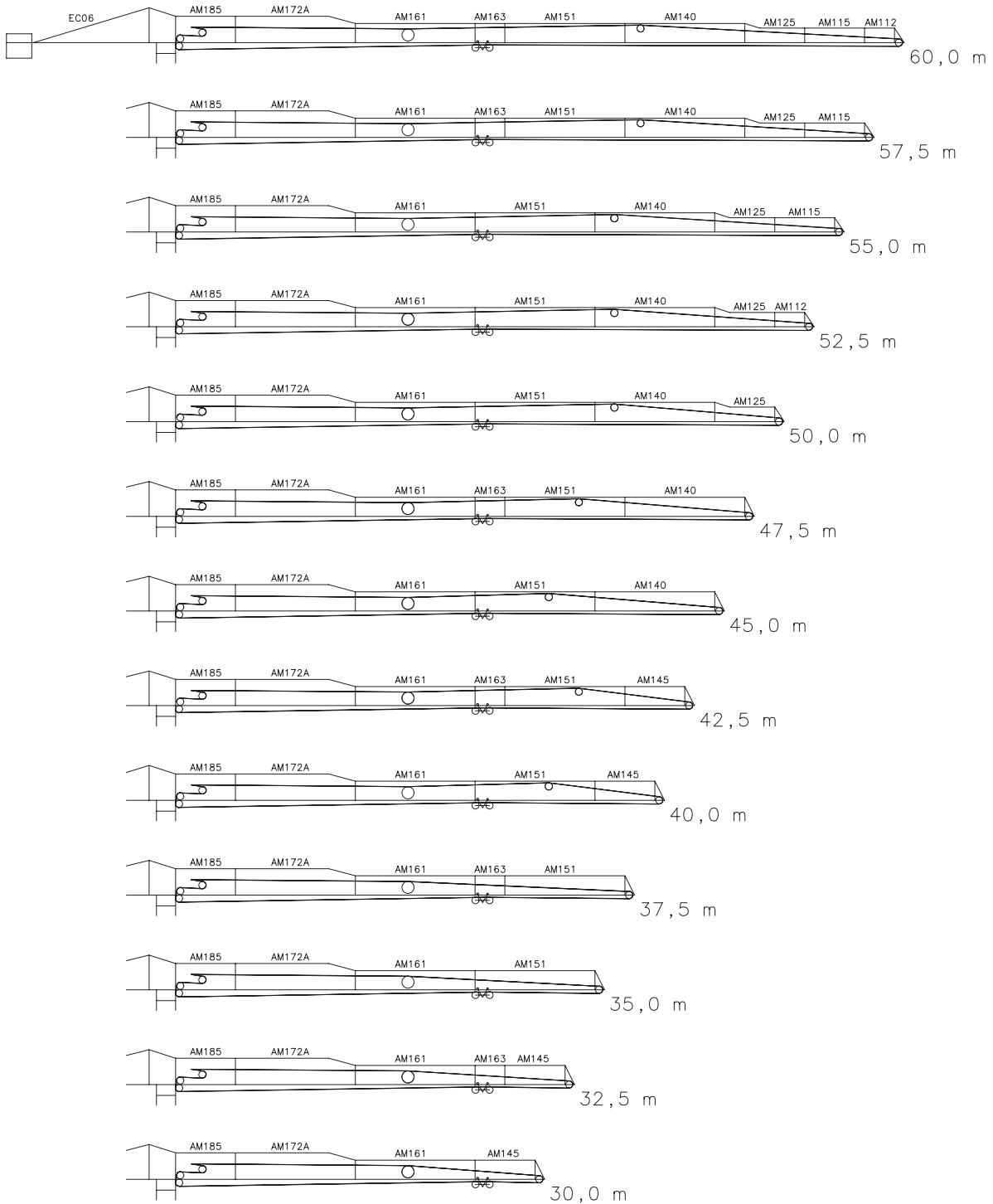


BEFORE DISASSEMBLING THE TROLLEY CABLE, YOU MUST REMOVE THE ELEVATION CABLE.


To remove the trolley cable safely, first you need to release the tension in it.


- Lock the trolley cable breakage safety device by replacing the retention pin (R) in the connecting rod. (See point 4.)
- Use the manual tensioning lever "2" to tension the cable to remove the ratchet retention catches "3". Rotate the lever in the opposite direction releasing the cable from the ratchet. Replace the catch retaining the ratchet. Repeat the operation until the cable is fixed. (See point 3.1)
- Fasten the floating pulley and unfasten the cable from the trolley terminals. (See point 2)
- Retract the cable on the trolley mechanism drum for transport.

Disposition of trolley cable



 FOR HANDLING THE CABLES, SEE THE RELEVANT SPECIFICATIONS IN THE "MAINTENANCE" CHAPTER OF THE DOCUMENT "INSTRUCTIONS FOR WIRE ROPES".

 DURING THE OPERATIONS TO CARRY OUT THE FALL, A SAFETY HARNESS MUST BE USED.

 NEXT TO THE ELEVATION MECHANISM THERE IS AN EMERGENCY STOP BUTTON.

**0 CONTENTS**

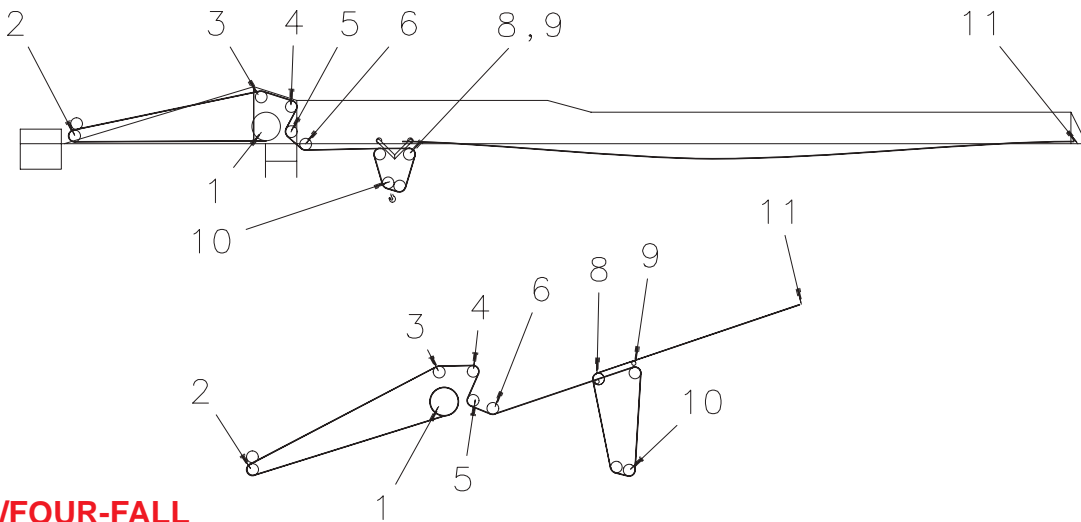
**1 ELEVATION CABLE RUN**

**2 RECOMMENDED ASSEMBLY SEQUENCE**

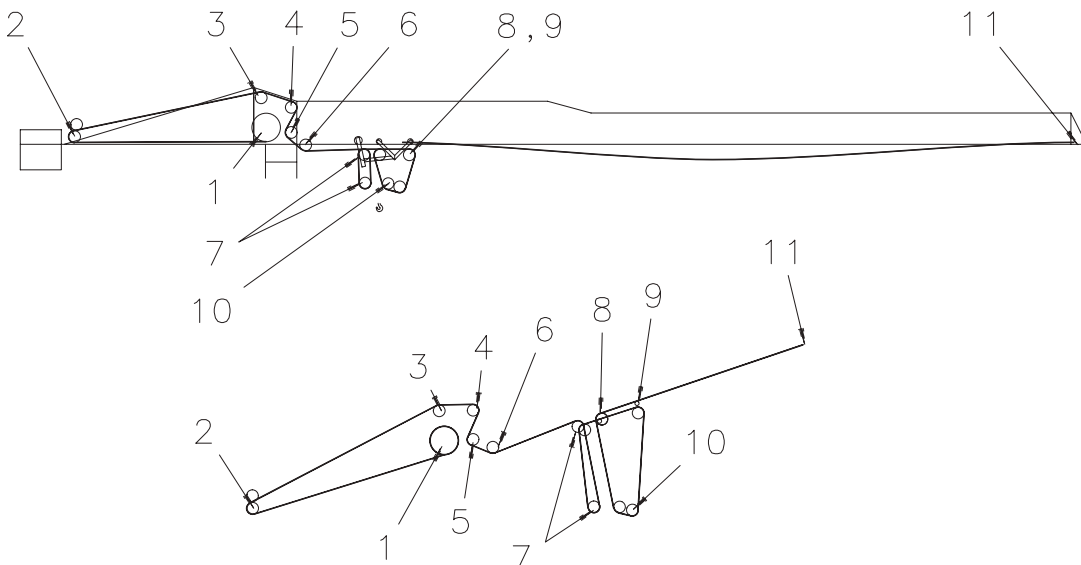
**3 RECOMMENDED DISASSEMBLY SEQUENCE**

**1 ELEVATION CABLE RUN**

**TWO-FALL**



**TWO/FOUR-FALL**



- 1- .....Elevation drum
- 2- .....Swinging pulley
- 3- .....Cat head pulley
- 4- .....Load limiter
- 5- .....Trolley cable tension pulley
- 6- .....Jib base pulley
- 7- .....Rear trolley-hook pulleys
- 8- .....Rear trolley-hook pulleys
- 9- .....Front trolley cable guide
- 10- .....Front hook pulleys1
- 11- .....Cable terminal, rotating point

**Fig. 1**

## 2 RECOMMENDED ASSEMBLY SEQUENCE

- ! The crane will be delivered from the factory with the elevation cable wound around the drum "1".
- Release the cable at minimum speed and pass the end of the cable through the swinging pulley "2".
- Take the end of the cable up to the pulley "4" (maximum load limiter) passing through the support pulley "3" inside the cat head.
- Lower the cable to the trolley cable tensioning pulley "5" and then up to the jib base pulley "6"
- Use an auxiliary cable joining the pulleys "7" of the rear trolley and hook rear to carry out the fall.
- Bring the front trolley and hook to the start of the jib and use an auxiliary cable that passes through the pulleys "8" and "10", guides "9" of the front trolley and hook to perform the fall.



Respect the position of the cables for the fall to be correct.

- Pass approximately 5 m of elevation cable through and position it in the cable terminal "11" at the end of the cable.  
Fasten the elevation cable to the front trolley.
  - Using the movement of the trolley take the end of the elevation cable to the tip of jib and fasten the terminal of cable "11" at the end of the jib, at the rotating point.
  - Unfasten the elevation cable from the trolley.
  - Move the trolley and the elevation several times to check the cable is correctly placed, the movement of the swinging pulley and the rotational movement of the cable terminal.
- ! The swinging pulley must rotate gently without resistance. For this purpose it has sealed bearings, greased for life.  
If it does not run normally, remove it for replacement or cleaning.

## 3 RECOMMENDED DISASSEMBLY SEQUENCE


- Put the crane in two-fall position.
- Tie the rear hook to the hook support at the base of the jib. Fasten the hook to its support.
- Bring the front trolley towards the tip to approximately 5 m from the end of the jib, retrieve the elevation cable until you can fasten the hook to the trolley.  
Fasten the dead end of the elevation cable to the trolley, move the trolley forward, loosen the elevation cable and free up the cable terminal at the end of the jib.
- Move the trolley back and, at the same time, retrieve the excess cable on the elevation drum. Unfasten the cable from the trolley and remove the cable terminal, retrieve the whole cable winding it around the elevation drum.

## 0 CONTENTS


- 1 **PASSING FROM 1 TO 2 TROLLEYS (CHANGING FROM 2- TO 4-FALL)**
- 2 **PASSING FROM 2 TO 1 TROLLEY (CHANGING FROM 4- TO 2-FALL)**
- 3 **CANCELLING/REPOSITIONING THE FOUR-FALL TROLLEY**

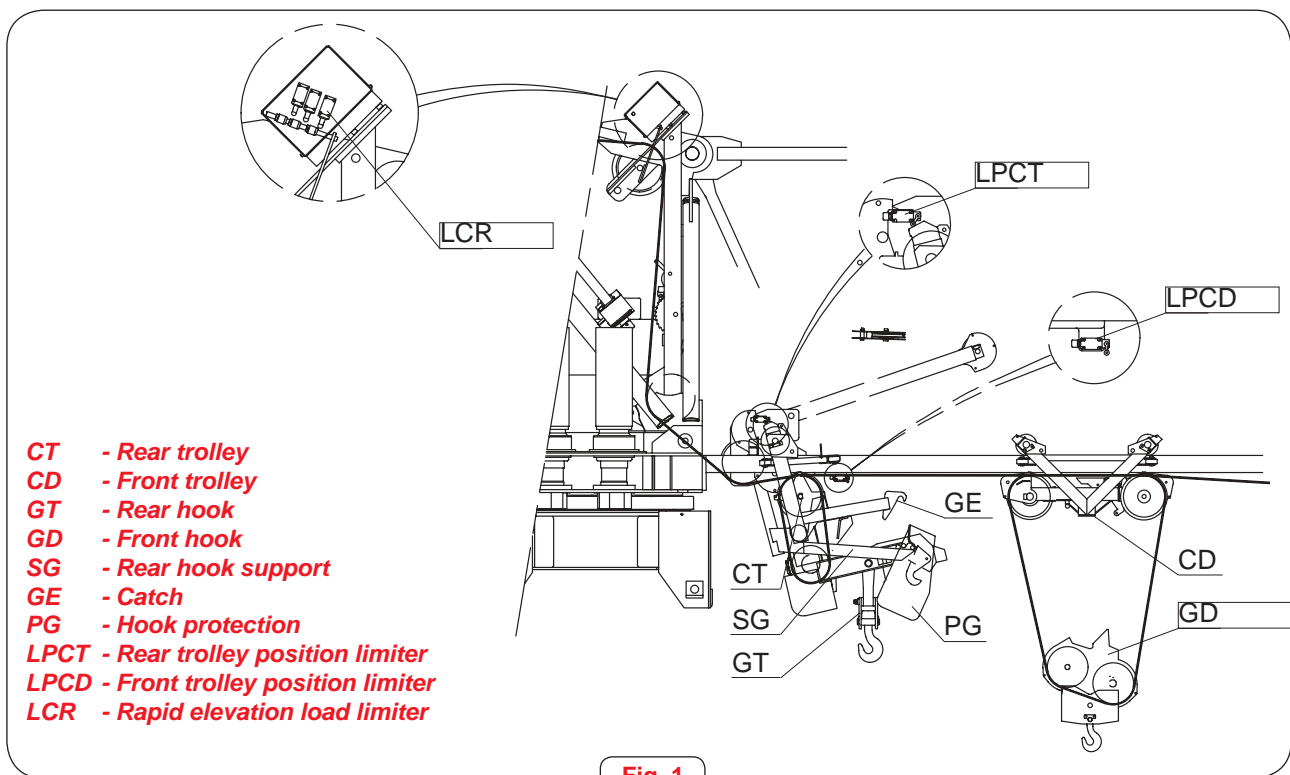
### 1 PASSING FROM 1 TO 2 TROLLEYS (CHANGING FROM 2- TO 4-FALL)

 ALWAYS CHANGE THE FALL FROM A POSITION THAT ALLOWS THE PERSON MAKING THE CHANGE TO VISUALLY CHECK THE OPERATION PROPERLY, TO PREVENT ANY ANOMALY OR MALFUNCTION THAT MAY ENTAIL A RISK SITUATION.

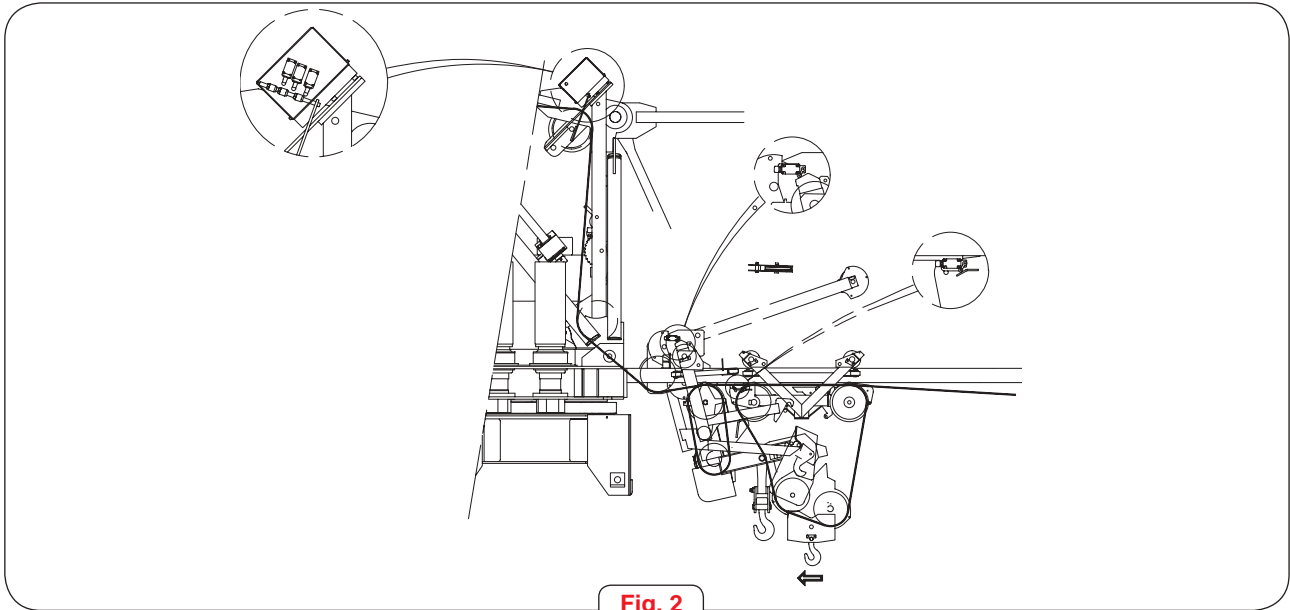
 TO CHANGE THE FALL, THE HOOK MUST BE FREE OF LOADS, SLINGS AND TACKLE FOR SUSPENDING LOADS.

 THE CRANE'S ELECTRIC EQUIPMENT INCLUDES A SAFETY SYSTEM THAT PREVENTS BAD MANOEUVRES DURING THE FALL CHANGE CAUSING RISK SITUATIONS.

 ALL THE LIMITERS OF THE CRANE MUST BE CORRECTLY REGULATED. THIS OPERATION INVOLVES THE UPPER HOOK AND REAR TROLLEY LIMITS AND THE LOAD LIMITER. SEE DOCUMENTS "LIFTING STROKE LIMITER", "TROLLEYLIMITER" AND "LOAD LIMITER" IN THE CHAPTER "ASSEMBLY / DISMANTLING".



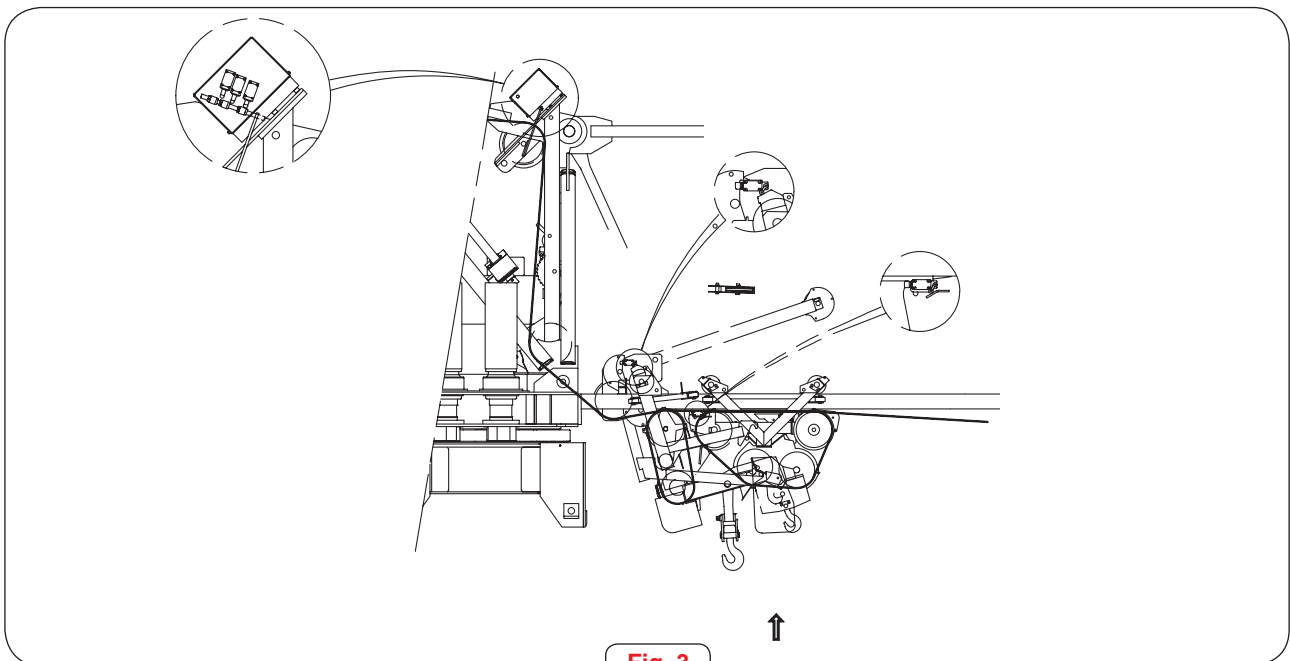
- The crane is working with a single trolley and hook: the front. (TWO-FALL).
- The rear trolley and hook are housed at the start of the jib, in the rear hook support (SG).
- The rear trolley activates a position limiter (LPCT), which detects it is in the position where the fall can be changed.



**Fig. 2**

- Raise the hook until the hook limiter acts at the top.
- Bring the front trolley and hook to the start of the jib until the trolley limiter acts at the back.
- From the crane control, cancel the rear trolley limiter and move the front trolley towards the start of the jib until the front trolley position limiter (LPCD) is activated, which allows you to continue with the change.

**!** ONCE YOU HAVE PRESSED THE "TROLLEY BACK" BUTTON TO EXCEED THE LIMITER, THE MOVEMENT OF HOOK AT THE TOP IS BLOCKED UNTIL THE FRONT TROLLEY POSITION LIMITER IS ACTIVATED.



**Fig. 3**

- From the crane control, cancel the upper hook limiter and raise the front hook slowly until it is housed in the rear hook and can go no further.

**!** ONCE YOU HAVE PRESSED THE "HOOK UP" BUTTON TO EXCEED THE LIMIT, THE MOVEMENT OF THE FRONT TROLLEY IS BLOCKED UNTIL THE RAPID LOAD ELEVATION LIMITER IS ACTIVATED. (LCR).



- Continue raising the set of hooks. The rear trolley tilts on its wheel, the front hook goes as far as the front trolley, the protection "PG" tilts hiding the anchor of the front hook and secures the two hooks.
- As you continue raising, the elevation cable tightens and the quick elevation load limiter (LCR) cuts off the movement.

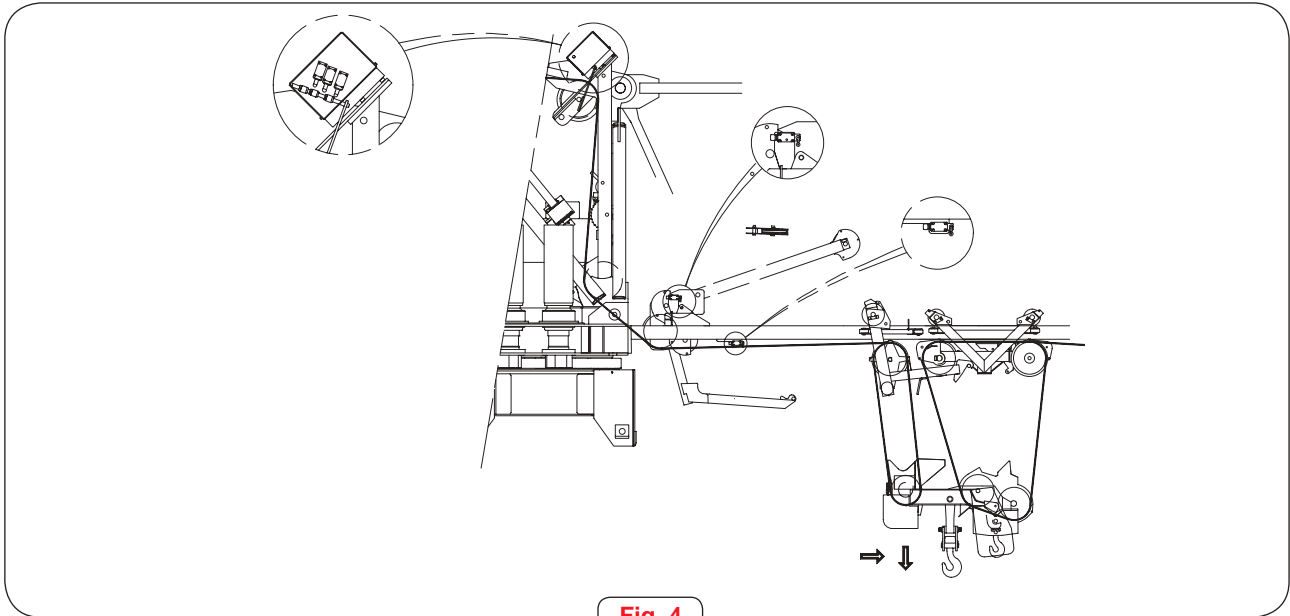


Fig. 4

- Move the set of trolleys and hooks forward until it leaves the rear hook support.
- Continue moving the trolley forward until you are out of the rear trolley limit area.
- From the crane control, activate descent. The rear trolley will tilt until the ratchet catch rests on the front trolley and the two trolleys stay together. Continue lowering until you are out of the upper hook limit area.
- The crane is now ready to work with the two trolleys and the two hooks together. (FOUR-FALL).
- The loads must be suspended from the anchor of the rear hook.



IT IS PROHIBITED TO REMOVE THE GUARD FROM THE FRONT HOOK ANCHOR TO SUSPEND LOADS WHEN WORKING IN FOUR-FALL. IGNORING THIS CAN CAUSE ACCIDENTS.



If, when changing the fall, it is necessary to make any movement prohibited by the fall change safety system, this safety system can be cancelled using the switch with a key (ID) in the cat head electric cabinet.

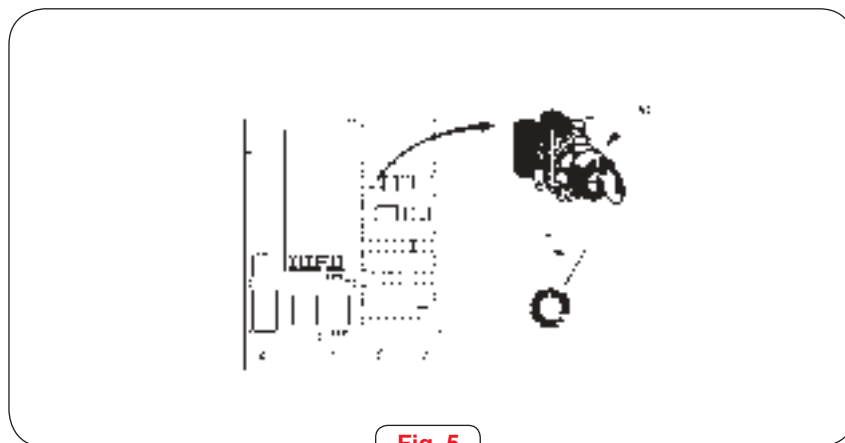








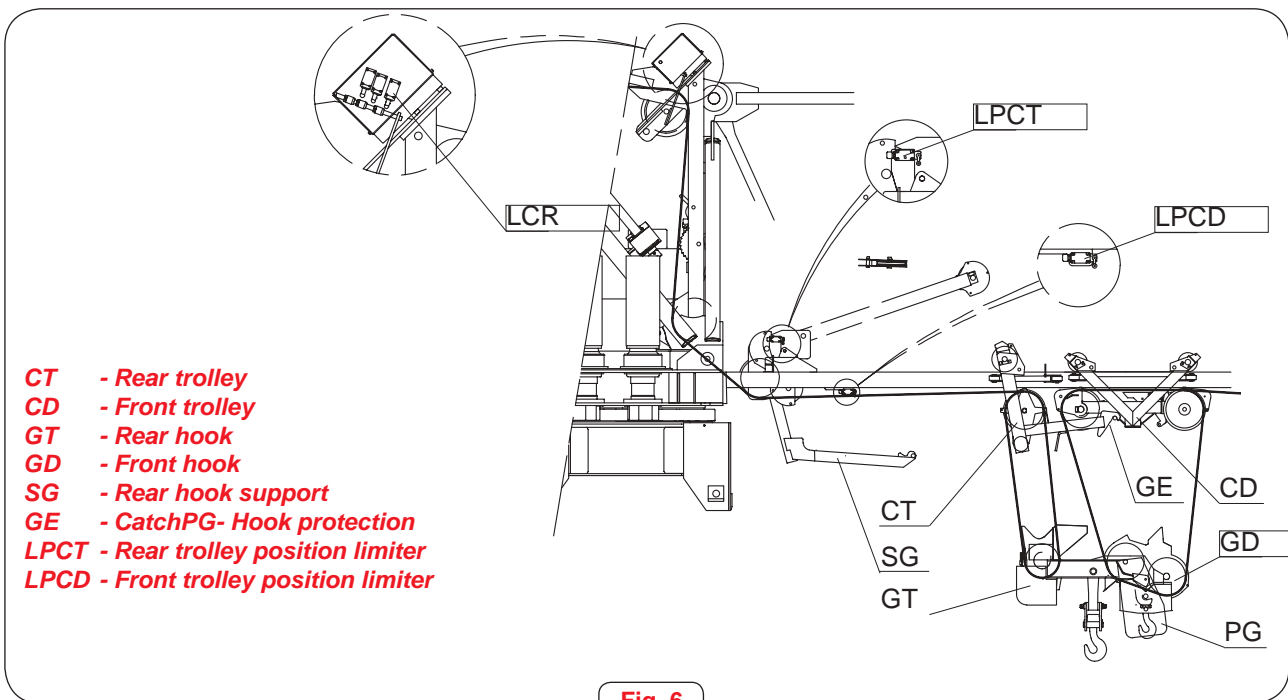


Fig. 5

-  The ID switch for cancelling the safety system when changing the fall must only be used by service staff that know the scope of the cancellation of the safety system.
-  All operations made with the safety system cancelled must be specially supervised to avoid any dangerous situations.
-  Once you have finished the operation for which you cancelled the safety system, you must stop the crane and reset the crane operation.
-  IF YOU OBSERVE ANY IRREGULARITY WHILE CHANGING THE FALL, NOTIFY THE MAINTENANCE SERVICES TO REVISE AND REGULATE IT.

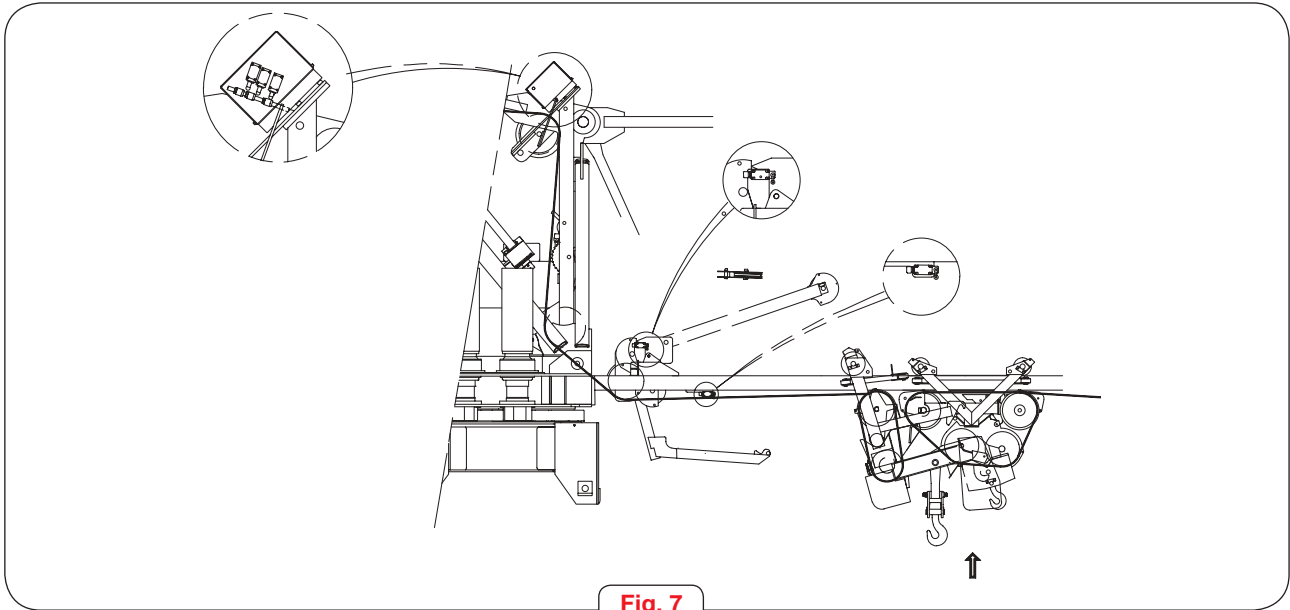
## **2 PASSING FROM 2 TO 1 TROLLEY (CHANGING FROM 4- TO 2-FALL)**

-  ALWAYS CHANGE THE FALL FROM A POSITION THAT ALLOWS THE PERSON MAKING THE CHANGE TO VISUALLY CHECK THE OPERATION PROPERLY, TO PREVENT ANY ANOMALY OR MALFUNCTION THAT MAY ENTAIL A RISK SITUATION.
-  TO CHANGE THE FALL, THE HOOK MUST BE FREE OF LOADS, SLINGS AND TACKLE FOR SUSPENDING LOADS.
-  THE CRANE'S ELECTRIC EQUIPMENT INCLUDES A SAFETY SYSTEM THAT PREVENTS BAD MANOEUVRES DURING THE FALL CHANGE CAUSING RISK SITUATIONS.
-  ALL THE LIMITERS OF THE CRANE MUST BE CORRECTLY REGULATED.  
THIS OPERATION INVOLVES THE UPPER HOOK AND REAR TROLLEY LIMITS AND THE LOAD LIMITER. SEE DOCUMENTS "ELEVATION LIMITER", "TROLLEY LIMITER" AND "LOAD LIMITER" IN THE CHAPTER "ASSEMBLY/DISASSEMBLY".



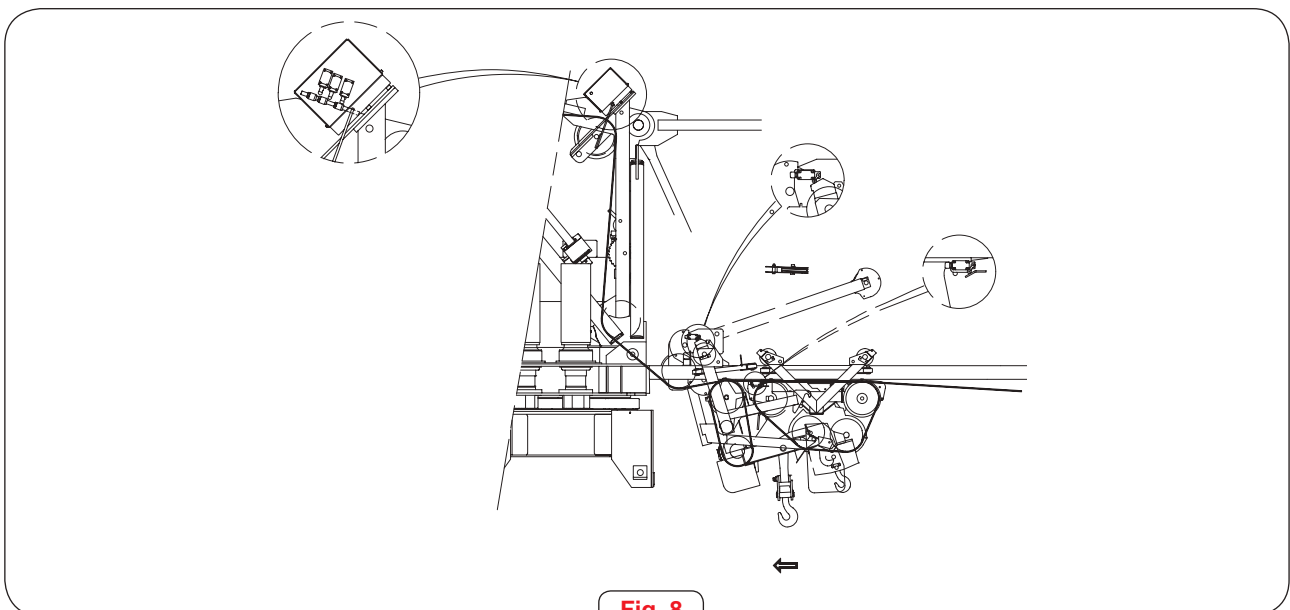
**Fig. 6**

- The crane is working with the two trolleys and the two hooks together (FOUR-FALL).



**Fig. 7**

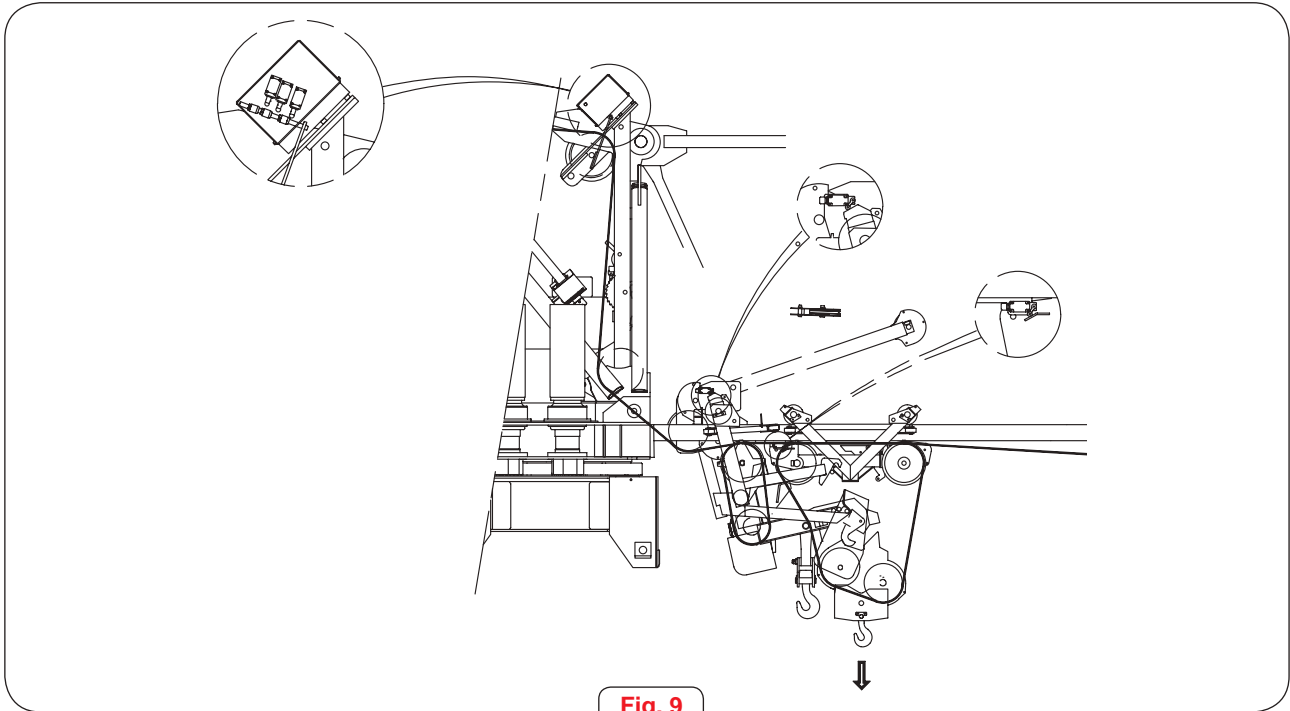
- From the crane control, cancel the upper hook limiter, at slow elevation speed, bring the hooks to the trolleys until the rear hook makes contact with the rear trolley.
- !** ONCE YOU HAVE PRESSED THE "HOOK UP" BUTTON TO EXCEED THE LIMIT, THE MOVEMENT OF THE FRONT TROLLEY IS BLOCKED UNTIL THE RAPID LOAD ELEVATION LIMITER IS ACTIVATED. (LCR)
- Continue raising. The hook tilts on the rear trolley until the front hook reaches the front trolley.
  - Continue raising. The rear trolley tilts on its wheel, freeing the trolley ratchet catch. The elevation cable tightens and the quick elevation load limiter (LCR) cuts off the movement.



**Fig. 8**

- From the crane control, cancel rear trolley limiter, and move the trolleys towards the start of the jib.
- Continue moving the trolley back until the fall change position limiters (LPCT) and (LPCD).

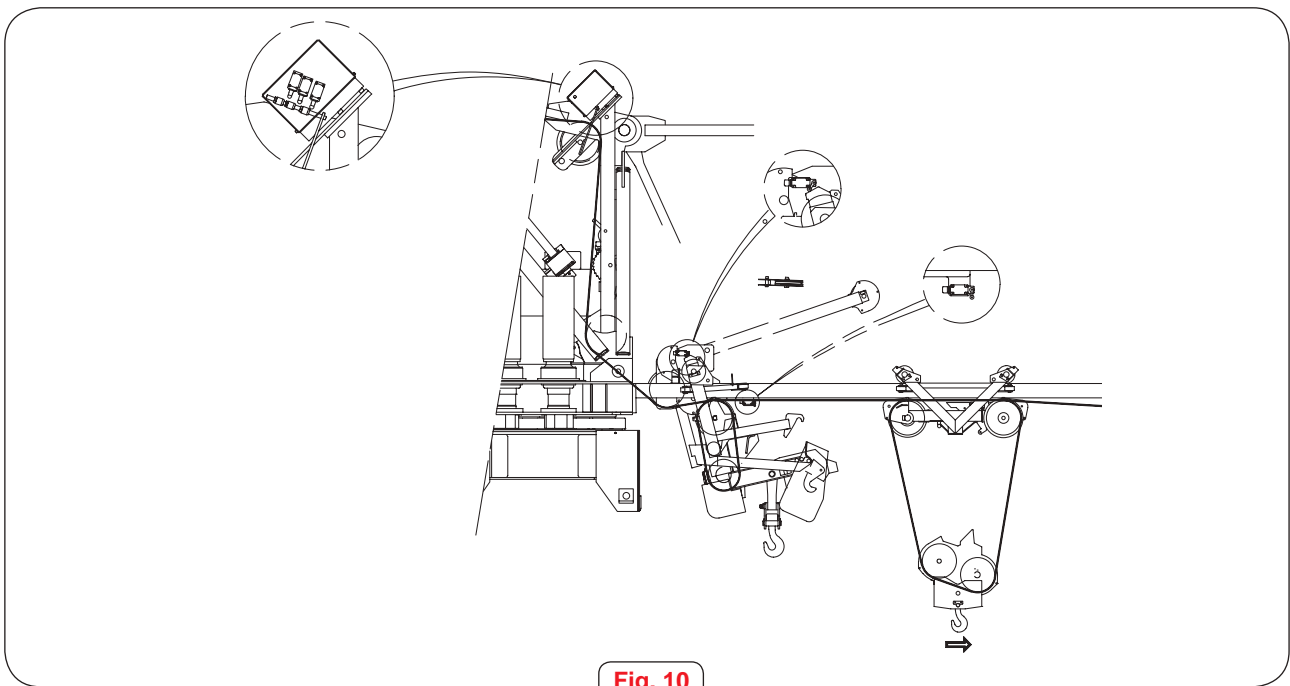
! ONCE YOU HAVE PRESSED THE "TROLLEY BACK" BUTTON TO EXCEED THE LIMIT, THE MOVEMENT OF HOOK AT THE TOP IS BLOCKED UNTIL THE TROLLEY POSITION LIMITERS ARE ACTIVATED.



**Fig. 9**

- Activate the slow descent. The rear trolley tilts on its wheel until the rear hook is housed in the rear hook support (SG); the trolley union catch (GE) is raised allowing the front trolley out.
- The anchor guard (PG) of the front hook tilts and liberates the union of the front and rear hooks.

! IT IS NOT POSSIBLE TO MOVE THE TROLLEY WHILE THE FRONT HOOK IS ABOVE THE UPPER HOOK LIMITER.



**Fig. 10**

- Continue lowering until the front hook is below the elevation limiter, "hook up".
- Move the trolley forward until it leaves the rear trolley limiter. The crane is ready to work with a single trolley and hook, the front. (TWO-FALL)



If, when changing the fall, it is necessary to make any movement prohibited by the fall change safety system, this safety system can be cancelled using the switch with a key (ID) in the cat head electric cabinet.



The ID switch for cancelling the safety system when changing the fall must only be used by service staff that know the scope of the cancellation of the safety system.

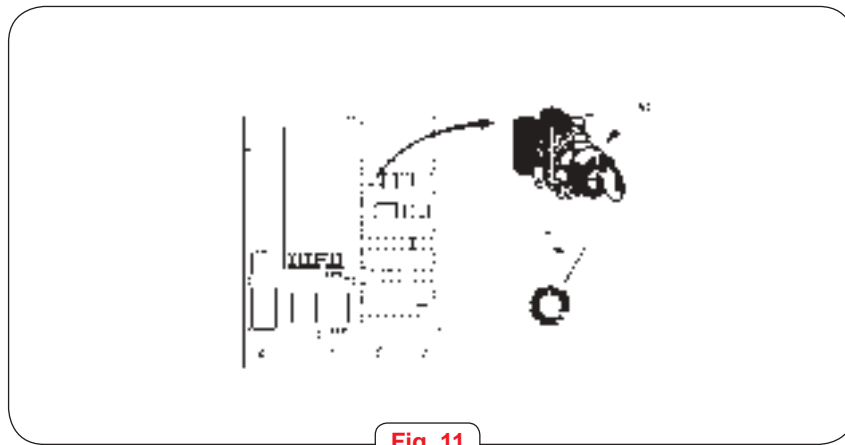


Fig. 11



All operations made with the safety system cancelled must be specially supervised to avoid any dangerous situations.



Once you have finished the operation for which you cancelled the safety system, you must stop the crane and reset the crane operation.



IF YOU OBSERVE ANY IRREGULARITY WHILE CHANGING THE FALL, NOTIFY THE MAINTENANCE SERVICES TO REVISE AND REGULATE IT.

### 3 CANCELLING/REPOSITIONING THE FOUR-FALL TROLLEY

If you wish to leave a crane with a single trolley (removing the possibility of the 2nd trolley "four-fall"), in addition to removing the trolley and modifying the cable fall (see ASSEMBLY/DISASSEMBLY) you must:

- a) Physically remove the trolley position limiters (LPCT and LPCD) installed in the jib.
- b) Electrically disconnect these limiters (removing plugs in the electric cabinet or disconnecting the terminals in the junction box, depending on the case).
- c) Place jumpers in the cat head control panel
  - 43-44 contact AID
  - 53-54 contact AID
  - 14 contact ABCT and 14 contact ALCT
  - 13-14 contact ALCDE.
- d) Check the functioning of the SR trolley against the end limiters with the trolley back.

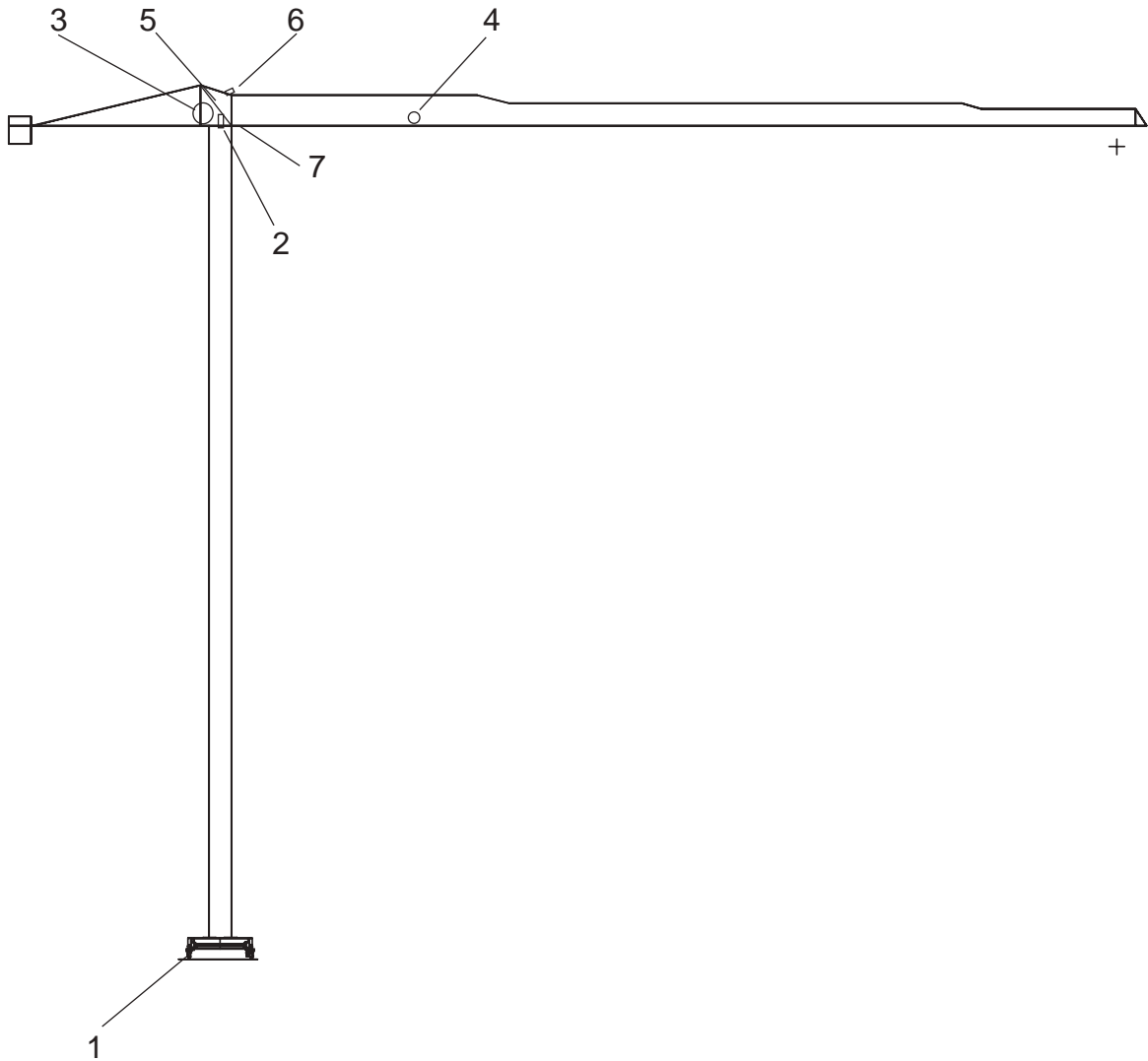
If you wish to replace the 2nd trolley to have the possibility of four-fall, proceed in reverse order (points a, b and c) and check the single to double and vice versa trolley change system works correctly (see points 1 and 2 of this instruction).



After erection is completed, having obtained permits for crane operation, the instructions described in this section must be complied with prior to commissioning.

Following these instructions will guarantee the safety of crane operation.

- 1.- For travelling cranes, check crane translation limiter.  
See instruction "TRANSLATION MOVEMENT LIMITER" later.
- 2.- Adjust hoisting limit switch.  
See instruction "LIFTING STROKE LIMITER" later.
- 3.- Adjust trolley limit switch.  
See instruction "TROLLEY LIMITER" later.
- 4.- Adjust slewing limit switch in cranes without slip ring.  
See instruction "SLEWING LIMITER" later.
- 5.- Adjust load-limiting system.  
See instruction "LOAD LIMITER" later.
- 6.- Adjust torque-limiting system.  
See instruction "MOMENT LIMITER" later.
- 7.- Check safety system against trolley cable failure.  
See instruction "TROLLEY CABLE FITTING SEQUENCE" in this chapter.
- 8.- Check correct operation of trolley cable tensioning.  
See instruction "TROLLEY CABLE FITTING SEQUENCE" in this chapter.
- 9.- For cranes equipped with single hook/double reeving, check correct operation of the re-reeving system.  
See instruction "REEVING CHANGE / TROLLEY CHANGE" in this chapter.
- 10.- Check correct operation of all crane movements at different speeds.
- 11.- Check correct operation of motor brakes and load hold.  
Refer to brake maintenance instructions if required.  
See Maintenance chapter in this Manual.
- 12.- Check correct operation of switching the slewing motors to free-slewing mode.  
See Maintenance chapter in this Manual.
- 13.- Check that all maintenance operations set down for every crane after erection have been carried out
- 14.- Make sure that all requirements for crane power supply and electrical installation are complied with.  
See chapter Electrical Installation in this Manual.
- 15.- Carry out all instructions set forth for crane commissioning other than the above stated points.  
See chapter Operation in this Manual.



- 1 Travelling limiter
- 2 Rotation limiter or Slip-ring unit
- 3 Lifting limiter
- 4 Trolley limiter
- 5 Moment limiter
- 6 Load limiter
- 7 Trolley change system



**NOTE:** See instructions about the adjustment of limiters on the following pages.



THE CRANE SHOULD NOT BE USED UNTIL THIS LIMITER HAS BEEN APPROPRIATELY ADJUSTED AND FULLY COMPLIES WITH THE PURPOSE FOR WHICH IT HAS BEEN INSTALLED

<b>0</b>	<b>CONTENTS</b>
<b>1</b>	<b>LOCATION</b>
<b>2</b>	<b>OVERVIEW</b>
<b>3</b>	<b>TRANSLATION MOVEMENT LIMITS</b>
<b>4</b>	<b>CHECKING</b>

## 1 LOCATION

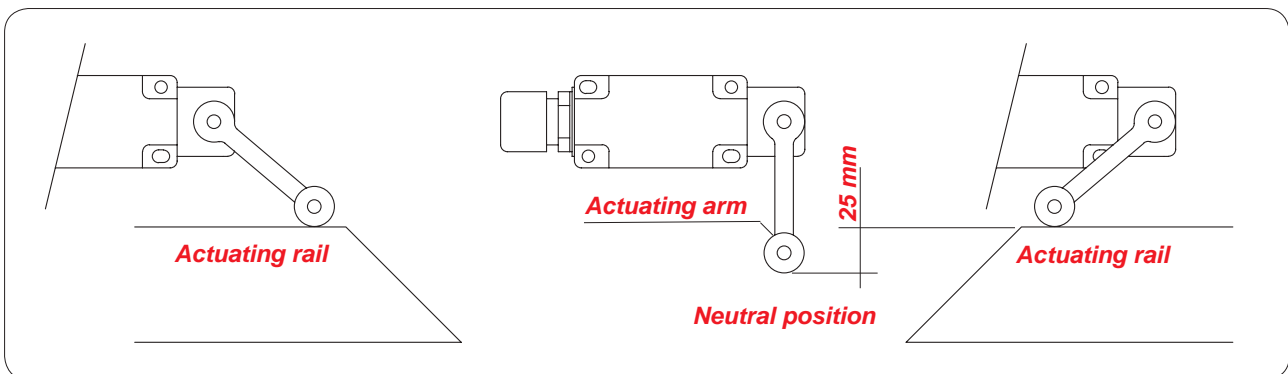
Normally the limiter is located in one of the driving trolleys or by default in the head girder.

## 2 OVERVIEW

The translation movement limiter stops the movement in both directions.

On the two track ends, mechanical stops and a limiter actuating rail must be provided, so that the limiter is actuated and the crane stopped before impacting against the mechanical stops. In order for the limiter to operate properly, it is important that the 25 mm height coordinate be respected.

The limiter actuating arm height can be adjusted.



## 3 TRANSLATION MOVEMENT LIMITS

The limiter actuating rail, which must feature a sturdy design, should be located in such a way that the distance from the crane's most external part, once stopped, to the mechanical stop in question is at least 0.5 m.

Note that movement should be stopped before the limiter reaches the actuating rail end. In cranes with more than one translation speed setting, make sure that there is full compliance with this when the crane is travelling at its maximum speed, when the limiter is actuated.

Normally, movement is stopped progressively in these cases.

## 4 CHECKING

Make sure the hook is free and is not loaded.

Make sure the limiter is not physically damaged and that the actuating arm returns to the neutral position of the limiter when it moves towards the sides manually.

Move the crane to the translation movement limiting positions and make sure that the movement is stopped at the positions described in Section 3.

During these operations the crane operator should be ready to stop the movement suddenly if required.

If the system does not work as previously explained, the cause should be found and corrected.





THE CRANE MUST NOT BE USED UNTIL THIS LIMITER IS CORRECTLY ADJUSTED AND MEETS ALL THE REQUIREMENTS FOR WHICH IT IS INSTALLED

<b>0</b>	<b>CONTENTS</b>
<b>1</b>	<b>SITING</b>
<b>2</b>	<b>GENERAL DESCRIPTION</b>
<b>3</b>	<b>MOVEMENT LIMITS</b>
<b>4</b>	<b>CHECKING</b>
<b>5</b>	<b>ADJUSTMENT</b>

## 1 SITING

On the slewing ring, which transmits the slewing movement to the limiter via a cog wheel. This is a counter type limiter.

## 2 GENERAL DESCRIPTION

The limiter has two limiting positions: one for each slewing direction.

## 3 MOVEMENT LIMITS

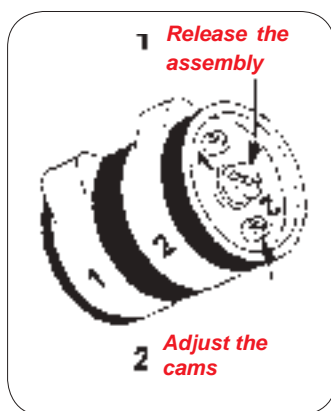
The slewing limiter is normally used to prevent the crane rotating more times than permitted. The crane should not turn more than two complete rotations in each slewing direction, counting as from a position in which the electric cables passing through the slewing ring are not twisted. This is stipulated to prevent damage to electric cables as a result of twisting.

**Note:** The crane is delivered from factory with the slewing limiter already prepared for carrying out one and a half turn in each sense of the slewing. Nevertheless, it is necessary to verify its correct functioning during the assembly. The slew limiter on this machine is factory set to two turns in each slewing direction.

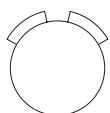
## 4 CHECKING

Ensure that the hook is free and not under load. Slew the crane to the limit positions and check that the limiter stops slewing there. If slewing continues beyond the limit position or stops early, adjust the limiter as per point 5 below.

## 5 ADJUSTMENT



- 5.1 Remove the protective cover from the limiter.
- 5.2 Ensure that the hook is free and the crane can slew freely through 360 degrees (complete rotation).
- 5.3 Slew the crane clockwise to the limit position.
- 5.4 Unscrew the adjuster cam locking screw.
- 5.5 Adjust the cam for the clockwise slewing limiter contact block (1).
- 5.6 Slew the crane anti-clockwise to the limit position.
- 5.7 Adjust the cam for the anti-clockwise slewing limiter contact block (2).
- 5.8 Tighten the cam locking screw and fit the cover on the limiter
- 5.9 Check limiter operation as indicated in point 4 above.



Right



Wrong



**NOTE:** Cams should never be superimposed



THE CRANE MUST NOT BE USED UNTIL THIS LIMITER IS CORRECTLY ADJUSTED AND MEETS ALL THE REQUIREMENTS FOR WHICH IT IS INSTALLED.

<b>0</b>	<b>CONTENTS</b>
<b>1</b>	<b>LOCATION</b>
<b>2</b>	<b>GENERAL DESCRIPTION</b>
<b>3</b>	<b>HOOK MOVEMENT LIMITS</b>
<b>4</b>	<b>CHECKING</b>
<b>5</b>	<b>ADJUSTMENT</b>

## **1 LOCATION**

This rev-counter type limiter is located on the hoisting winch.

## **2 GENERAL DESCRIPTION**

The limiter is activated by the hoisting drum.

The drum and the limiter are mechanically linked, usually by direct coupling but sometimes by pinions or chains. The job of the limiter is to stop the hook movement before it exceeds the working limits set for it.

For instance when the hook is moving up this means before the hook block hits the trolley.

The limiter also includes the device for preventing fast hoisting speeds when the hook is close to the point where its movement is limited.

## **3 HOOK MOVEMENT LIMITS**

The limiter must stop the hoisting winch when the hook rises to around 1 m below the trolley, and on its downward travel also if necessary so that at least two turns of rope remain on the hoisting drum when the hook is at its lowest point.

Remember that on some sites ground level will not coincide with the base of the crane. It must therefore be ensured that the hoisting cable is long enough for the work to be done and that the required two turns are left on the drum when the hook is at its lowest point.

## **4 CHECKING**

Ensure that the hook is free and under no load. Move the hook to the upper and lower limits of its travel and check that the limiter stops it at the required positions. Check also that rapid hoisting speed is not permitted close to the limit points. While making these checks the crane operator should be ready to stop hook movement suddenly if necessary.

If the hoisting winch continues to work beyond the set working limits the limiter must be adjusted as per section 5 of this chapter.

## **5 ADJUSTMENT**

IF THE HOOK MUST BE LIMITED ON ITS DOWNWARD TRAVEL FOR REASONS OTHER THAN THE MAINTAINING OF THE MINIMUM NUMBER OF TURNS ON THE DRUM THIS SYSTEM MUST BE ADJUSTED AFTER EACH OPERATION TO CHANGE THE NUMBER OF HOOK REEVINGS.

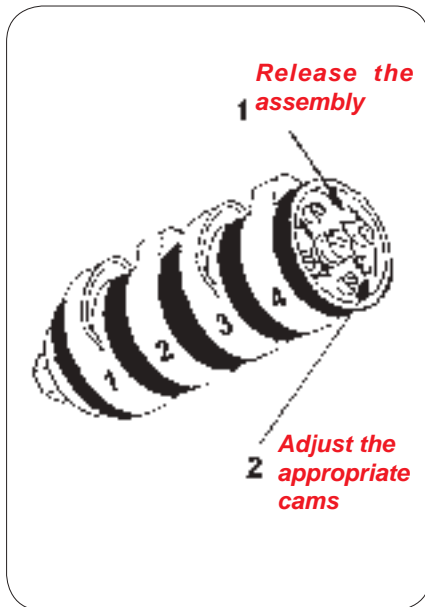
Upward travel limitation does not need to be adjusted after changing hook reevings.

The limiter has four independent contact blocks:

- Blocks 4 and 2 are used to limit hook travel at the top and bottom, respectively.
- Blocks 3 and 1 are used to limit top speed.



IF THE CRANE IS TO WORK WITH BOTH 2 AND 4 REEVINGS, THE UPPER AND LOWER HOOK LIMIT SHOULD BE DONE WITH DOUBLE REEVING.



- 5.1 Remove the limiter protection cover.
- 5.2 Ensure that the hook is free and under no load.
- 5.3 Hoist the hook carefully to the top limit point (see section 3).
- 5.4 Release the locking screw on the regulating cams.
- 5.5 Adjust the cams for the top hook limit block (nº 4) and the top speed block (nº 3) to the required positions.

! When limiting high speed, take into account the travel required to slow down from top speed (on cranes with hoisting speed range selection, select top speed to adjust and check the high speed limiter)

IF THE CRANE DOES NOT REQUIRE LIMITING AT THE BOTTOM OF HOOK TRAVEL, GO TO POINT 5.8.

- 5.6 Lower the hook to the bottom limit point.
- 5.7 Adjust the cams for the bottom hook limit block (nº 2) and the top speed block (nº 1) to the required positions.
- 5.8 Tighten the cam locking screw.
- 5.9 Fit the limiter protection cover.
- 5.10 Check that the limiter works properly as per section 4.



**THE CRANE MUST NOT BE USED UNTIL THIS LIMITER IS CORRECTLY ADJUSTED AND MEETS ALL THE REQUIREMENTS FOR WHICH IT IS INSTALLED**

## 0 CONTENTS

- 1 LOCATION
- 2 GENERAL DESCRIPTION
- 3 MOVEMENT LIMITS
- 4 CHECKING
- 5 ADJUSTMENT

### 1 LOCATION

This rev-counter type limiter is located on the trolley winch.

### 2 GENERAL DESCRIPTION

The limiter is activated by the trolley rope drum. The drum and the limiter are mechanically linked, usually by direct coupling but sometimes by chains.

The job of the limiter is to stop the trolley's movement before it hits the mechanical stops at the end of the jib.

### 3 MOVEMENT LIMITS

The purpose of the limiter is to stop the trolley winch before the trolley reaches the stop.

The limiter triggering point is a function of the type of braking, inertia, etc.

Trolley must stop at a minimum distance of 0,3 m from the stop, when the maximum travelling speed is used. Top speed must be limited earlier, and the trolley must be in low gear when approximately 5 m from the mechanical stops.

### 4 CHECKING

Check working whenever the trolley rope is tensioned, and ensure that the hook is free and under no load. Move the trolley in low gear to the forward and backward limits of its travel and check that the limiter stops it at the required positions before the stops are reached.

Check also that rapid trolley speed is not permitted close to the limit points. While making these checks the crane operator should be ready to stop trolley movement suddenly if necessary.

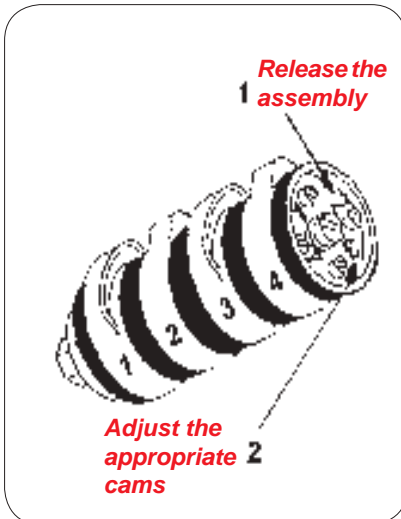
If the trolley winch continues to work beyond the set working limits the limiter must be adjusted as per section 5 of this chapter.

### 5 ADJUSTMENT

The limiter must also be adjusted whenever the trolley rope is changed.

The limiter has four independent contact blocks:

- blocks 2 and 4 are used to limit hook travel towards the tower and tip respectively;
- blocks 1 and 3 are used to limit top speed. Block 1 is for trolley backward movement and block 3 for forward movement.



- 5.1 Remove the limiter protection cover.
- 5.2 Ensure that the hook is free and under no load.
- 5.3 Take the trolley carefully to the backward limit point (tower side of jib)
- 5.4 Release the locking screw on the regulating cams.
- 5.5 Adjust the cams for the backward trolley limit block (n° 2) and the top speed block (n° 1) to the required positions.
- 5.6 Take the trolley to the forward limit point (jib tip).
- 5.7 Adjust the cams for the forward trolley limit block (n° 4) and the top speed block (n° 3) to the trolley positions indicated in section 3.
- 5.8 Tighten the cam locking screw.
- 5.9 Fit the limiter protection cover.
- 5.10 Check that the limiter works properly as per section 4.

**! THE CRANE MUST NOT BE USED until THIS SYSTEM IS CORRECTLY ADJUSTED AND FULLY COMPLIES WITH THE TASK FOR WHICH IT HAS BEEN PLACED.**

**! ADJUST THE LOAD LIMITER SYSTEM BEFORE ADJUSTING THIS LIMITER**

**0 CONTENTS**

- 1 GENERAL DESCRIPTION**
- 2 STANDARD MOMENT LIMITER SYSTEM**
- 3 OPTIONAL MOMENT LIMITER SYSTEM**
- 4 SYSTEM INHIBITER (OPTIONAL)**

**1 GENERAL DESCRIPTION**

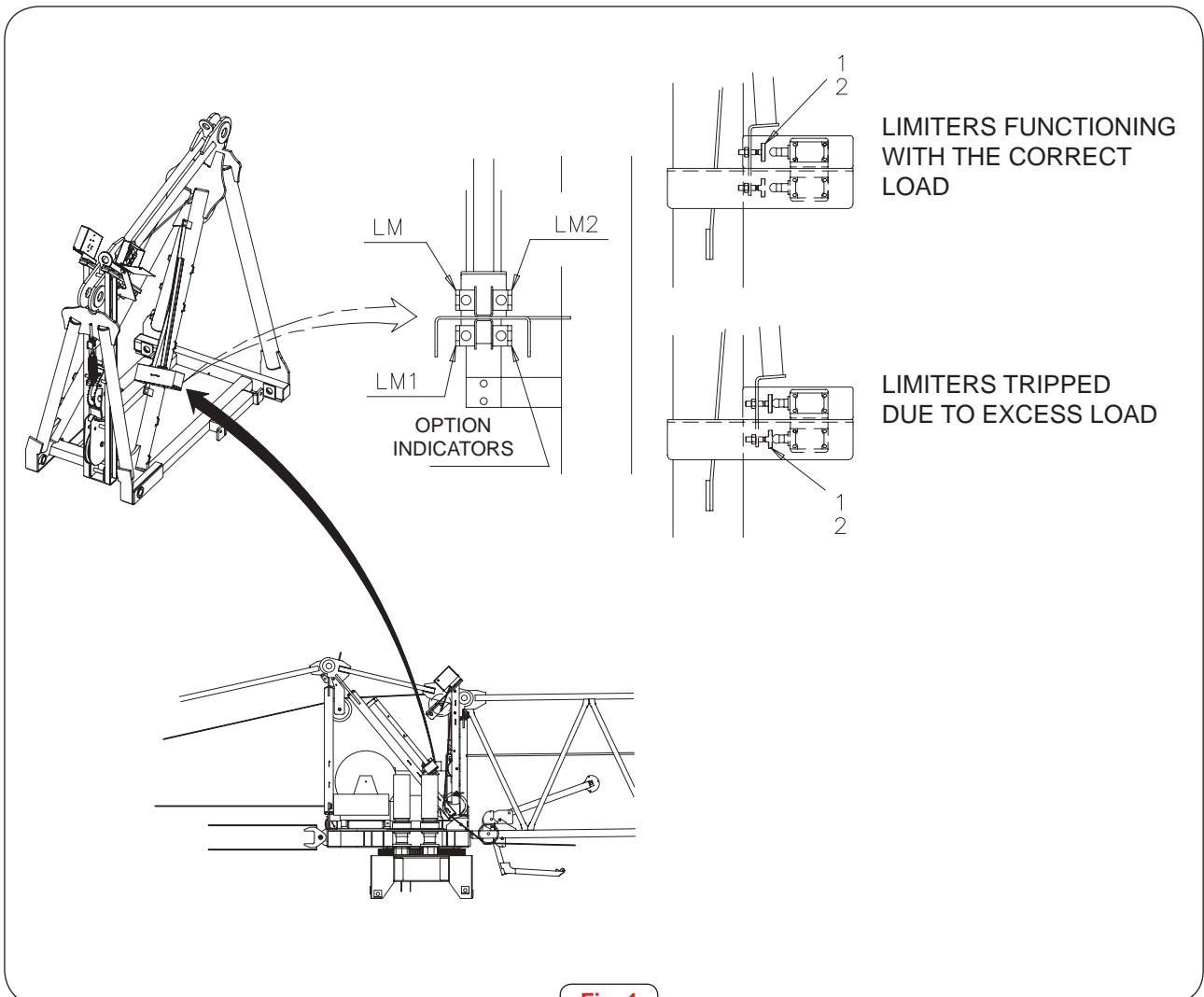
The moment limiter is of the type with a plate spring associated with a set of position limiter switches. It is in the cat head of the crane (fig. 1).

The load-moment request to which the crane is subjected is transmitted through the structure of the cat head which involves a compression of the structural tubes to which the plate spring of the limiter system is secured.

The compression of the structural pipes amplified by the plate spring becomes a movement of the actuators at the end of it.

The position of the actuators "1" can be regulated by the nuts "2".

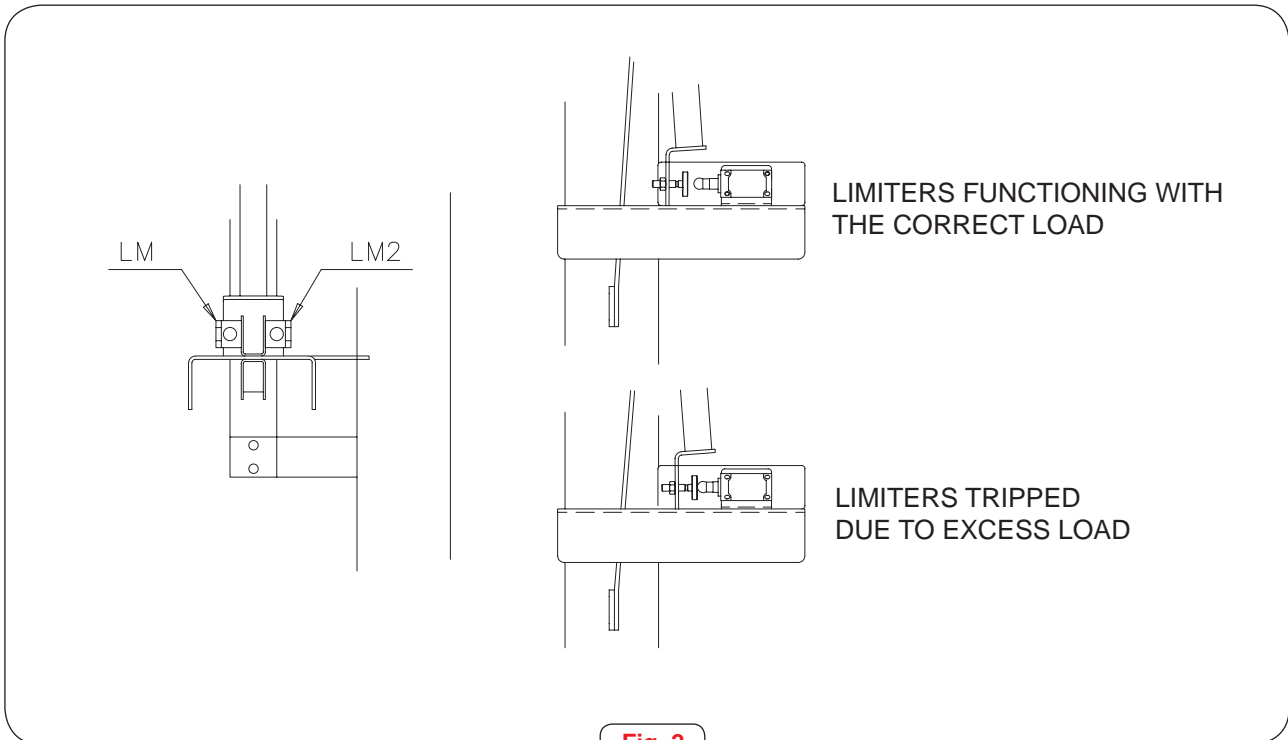
The actuators activate or deactivate the electromechanical limiters depending on their position



**Fig. 1**

## 2 STANDARD MOMENT LIMITER SYSTEM

### 2.1 Limiters



**Fig. 2**

The system has 2 limiters

**LM** Maximum moment limiter.

It is activated when the maximum moment permitted for the crane is exceeded.

This prevents the hook being raised and the trolley moved forward.

It activates the crane's horn to give a continuous sound.

In cranes with cabs and the controls integrated in the seat, a warning light lights up on the control (red).

**LM2** Maximum moment approach limiter.

It is set by default to 90% of the maximum moment permitted, but may be adjusted to the value indicated by the local regulations (for example 85%).

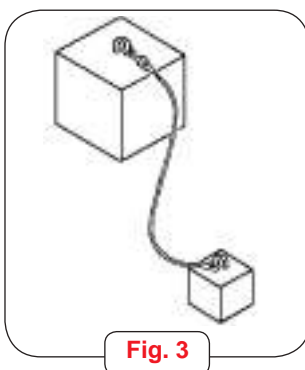
It impedes the trolley moving at fast speed.

In cranes with cabs and the controls integrated in the seat, a warning light lights up on the control (amber).

The horn of the crane sounds intermittently.

! The maximum load limiter system generates analogue warnings.  
 See the instruction "LOAD LIMITER"

### 2.2 Test loads



**Fig. 3**

On the construction site, there will be the following test loads (fig. 2):

**Load A:** Maximum moment approach load.  
 This is 90% of the value of the tip load at the reach at which the crane is erected.

**Load B:** Overload.  
 Load that together with load A adds up to 100% of the value of the tip load at the reach at which the crane is erected.

**Load C:** Overload.  
 Load that together with load A adds up to 110% of the value of the tip load at the reach at which the crane is erected.

! The value of loads "A" "B" and "C" can be adjusted to comply with the local regulations applicable where the crane is installed (for example, the local regulations may establish that these switches act before reaching 105% and 100% respectively).

! The value of the loads is obtained from the crane's data sheet, according to the number of falls and the length of the crane's jib.

! **The test loads must be manufactured according to the national and local regulations.**

### 2.3 Checking the system

! In cranes with SR/DR hooks, perform the test preferably in four-fall.

! The test shall be made with the trolley in the maximum reach position.

Check, lifting the corresponding loads, that the system works correctly.

Load	Limiters on	Amber lamp	Red lamp	Siren	Hoist upwards Trolley forward
None	None	-	-	-	Yes
A	LM2	Yes	-	intermittent	Yes
A+B	LM2	Yes	-	intermittent	Yes
A+C	LM2 - LM	Yes	Yes	continuous	No

### 2.4 Adjustment

! The adjustment shall be made with the trolley in the maximum reach position.



Before adjusting the moment limiter system, check the reach limiter works correctly.

! In cranes with SR/DR hooks, perform the test preferably in four-fall (DR).



To avoid the pressure exerted by the position switches on the plate spring may distort the functioning of the maximum load limiter, the order in which you must adjust the moment limiters is:

1. Maximum moment approach limiter
2. Maximum moment limiter

#### Regulating the maximum moment limiter

- 1.- With the trolley in the maximum reach position, lift the test load "A+B".
- 2.- Regulate the actuator screw (1) that acts on the limiter (LM), so that it allows you to just lift the load at the maximum speed permitted (fig 1).
- 3.- Block the actuator screw (1) with the nut (2) (fig 1).
- 4.- Deposit the load on the ground.
- 5.- Check the adjustment by following that summarised in section 2.3.
- 6.- Verify that the system prevents you from lifting test load "A+C".

#### Regulating the maximum moment approach limiter

- 1.- With the trolley in the maximum reach position, lift the test load "A".
- 2.- Regulate the actuator screw (1) that acts on the limiter LM2 just so that the orange warning light in the cab and the crane's horn sounds intermittently.
- 3.- Block the actuator screw (1) with the nut (2) fig.1
- 4.- Deposit the load on the ground.
- 5.- Check the adjustment by following that summarised in section 2.3.



- ! If you only have a test load that weigh equivalent to "A+B" (100% of the maximum tip load) you can adjust the maximum moment approach limiter with this load.  
To do this, place the load "A+B" at a distance "D":

$$D = (\%M) \times \text{Maximum reach}$$

For example:

Maximum reach = 40 m

tip load = "A+B" = 1.5 t

Approach limiter of 90% of the maximum moment.

$$D(90\%M) = 0.9 \times 40 = 36 \text{ m}$$

### 3 OPTIONAL MOMENT LIMITER SYSTEM

#### 3.1 Status indication beacon

The configuration of optional moment limiters includes a beacon with amber and red lights and a siren that function depending on the load status of the crane.

#### 3.2 Limiters

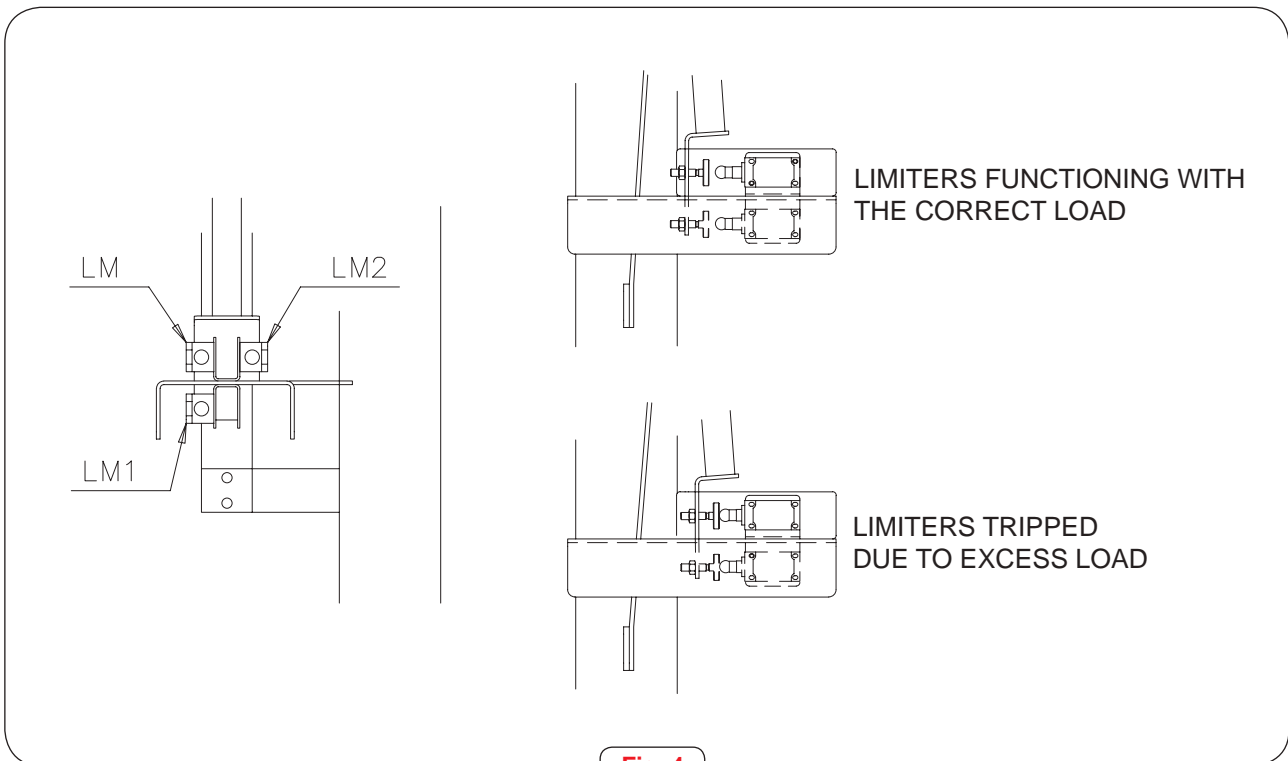


Fig. 4

The system has 3 limiters:

- LM** Maximum moment limiter
- LM2** Maximum moment approach limiter
- LM1** Overload limiter reached



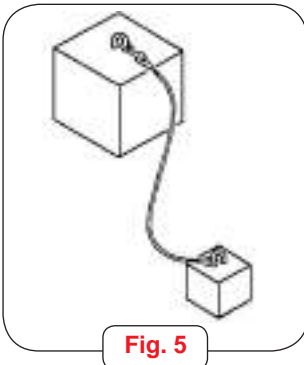
The limit value is set by default to 90%, 100% and 110% of the maximum moment permitted, but may be adjusted to the value indicated by the applicable local regulations (for example 85%, 100% and 105%).



The warnings and operations of the optional moment limiting system are described in section 3.4.

- ! The maximum load limiter system generates analogue warnings.  
See the instruction "LOAD LIMITER"

### 3.3 Test loads



On the construction site, there will be the following test loads (fig. 2):

- Load A:** Maximum moment approach load.  
This is 90% of the value of the tip load at the reach at which the crane is erected.
- Load B:** Overload.  
Load that together with load A adds up to 100% of the value of the tip load at the reach at which the crane is erected.
- Load C:** Overload.  
Load that together with load A adds up to 110% of the value of the tip load at the reach at which the crane is erected.

! The value of loads "A" "B" and "C" can be adjusted to comply with the local regulations applicable where the crane is installed (for example, the local regulations may establish that these switches act before reaching 85%, 100% and 105% respectively).

! The value of the loads is obtained from the crane's data sheet, according to the number of falls and the length of the crane's jib.

! **The test loads must be manufactured according to the national and local regulations.**

### 3.4 Checking the system

! In cranes with SR/DR hooks, perform the test preferably in four-fall (DR).

! The test shall be made with the trolley in the maximum reach position.

Check, lifting the corresponding loads, that the system works correctly.

	Limiters on	Amber lamp	Red lamp	Siren	Hoist upwards Trolley forward
	None	-	-	-	Yes
	LM2	Yes	-	-	Yes
	LM	Yes	-	Yes	Yes
	LM1	Yes	Yes	Yes	No

### 3.5 Adjustment

! The adjustment shall be made with the trolley in the maximum reach position.



Before adjusting the moment limiter system, check the reach limiter works correctly.

! In cranes with SR/DR hooks, perform the test preferably in four-fall (DR).



To avoid the pressure exerted by the position switches on the plate spring may distort the functioning of the maximum load limiter, the order in which you must adjust the moment limiters is:

- 1 Maximum moment approach limiter.
- 2 Overload limiter reached.
- 3<sup>o</sup> Maximum moment limiter.

#### Regulating the maximum moment limiter

- 1.- With the trolley in the maximum reach position, lift the test load "A+B".
- 2.- Regulate the actuator screw (1) that acts on the limiter (LM), so that it allows you to just lift the load at the maximum speed permitted (fig 1).
- 3.- Block the actuator screw (1) with the nut (2) (fig 1).

- 4.- Deposit the load on the ground.
- 5.- Check the adjustment by following that summarised in section 3.4.
- 6.- Verify that the system prevents you from lifting test load "A+C"

### **Regulating the maximum moment approach limiter**

- 1.- With the trolley in the maximum reach position, lift the test load "A".
- 2.- Regulate the actuator screw (1) that acts on the limiter LM2 just so that the orange warning light in the cab and the crane's horn sounds intermittently.
- 3.- Block the actuator screw (1) with the nut (2) fig.1
- 4.- Deposit the load on the ground.
- 5.- Check the adjustment by following that summarised in section 3.4.

! If you only have a test load that weigh equivalent to "A+B" (100% of the maximum tip load) you can adjust the maximum moment approach limiter with this load.  
To do this, place the load "A+B" at a distance "D":

$$D = (\%M) \times \text{Maximum reach}$$

For example:

Maximum reach = 40 m

tip load = "A+B" = 1.5 t

Approach limiter of 90% of the maximum moment.

$$D(90\%M) = 0.9 \times 40 = 36 \text{ m}$$

## **4 SYSTEM INHIBITER (OPTIONAL)**

As an optional element, the crane can be fitted with a manual switch with a key and automatic reset (IACM). It is located in the cat head electric cabinet and allows the load and maximum moment limiters to be jumped for supervision work.



Always ensure it is deactivated for normal work.



This system may be explicitly contraindicated by the applicable standards in the country or region where the crane is used.



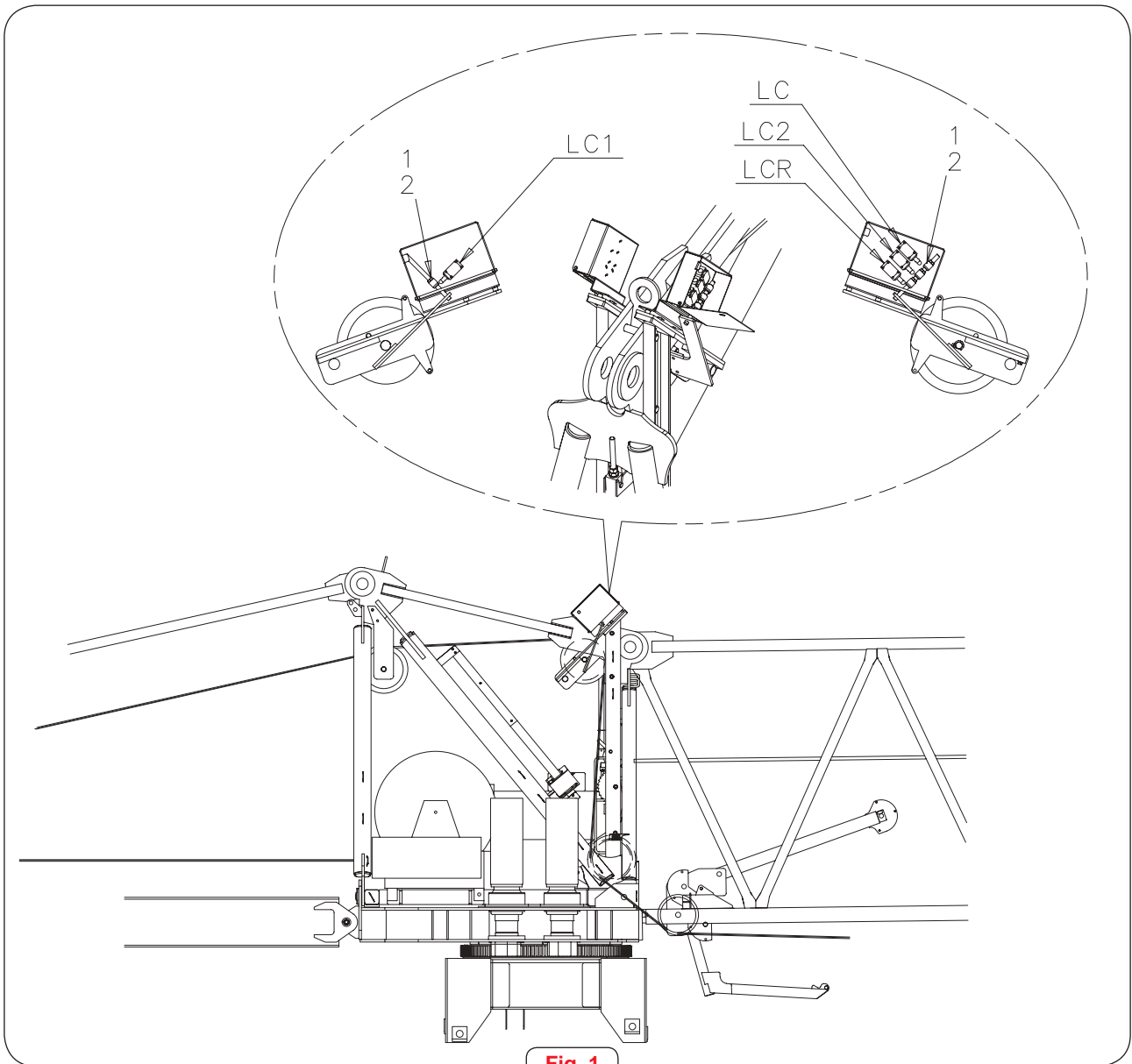
THE CRANE MUST NOT BE USED UNTIL THIS SYSTEM IS CORRECTLY ADJUSTED AND FULLY COMPLIES WITH THE TASK FOR WHICH IT HAS BEEN PLACED.

**0 CONTENTS**

- 1 GENERAL DESCRIPTION**
- 2 STANDARD LOAD LIMITER SYSTEM**
- 3 OPTIONAL LOAD LIMITER SYSTEM**
- 4 SYSTEM INHIBITER (OPTIONAL)**

**1 GENERAL DESCRIPTION**

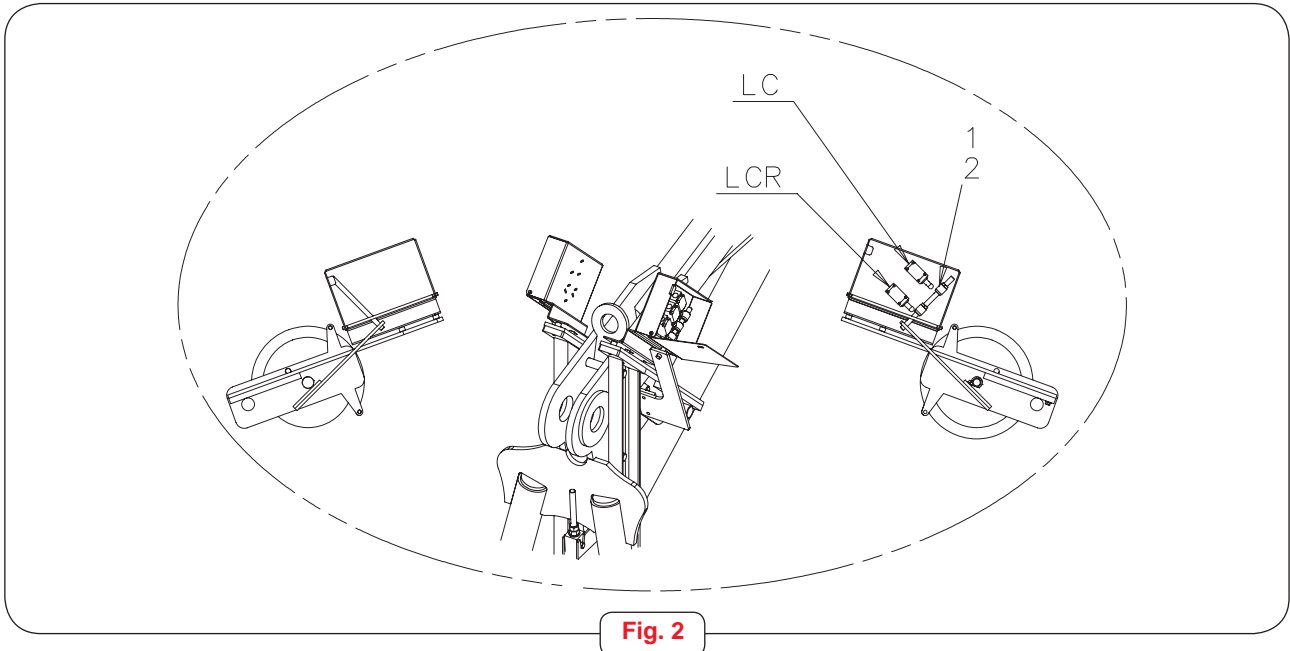
The load limiter is in the cat head of the crane, coupled to the upper pulley the lifting cable passes through. The pull of the load suspended under the hook is transmitted through the lifting cable and drives the movement of the adjustable actuators of the system with regard to the position limiter on which it acts. The position of the actuators "1" can be regulated by the milled nuts "2". The actuators activate or deactivate the electromechanical limiters depending on their position.



**Fig. 1**

## 2 STANDARD LOAD LIMITER SYSTEM

### 2.1 Limiters



**Fig. 2**

The system has 2 limiters:

**LC** Maximum load limiter.

This prevents the hook being raised and the trolley moved forward.

It activates the crane's horn to give a continuous sound.

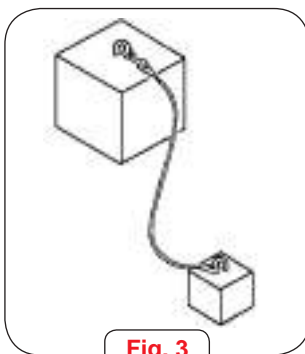
In cranes with cabs and the controls integrated in the seat, a warning light lights up on the control (red).

**LCR** Quick lifting load limiter.

This prevents the load being lowered too quickly (it limits the frequency of the converter).

! The moment limiter system generates analogue warnings.  
! See the instruction "MOMENT LIMITER"

### 2.2 Test loads



**Fig. 3**

On the construction site, there will be the following test loads (fig. 2):

**Load A:** Maximum load permitted for the crane.

**Load B:** Overload used during the tests.  
Its value is 10% of load "A".

**Load C:** Overload used during the tests.  
Its value is 50% of load "A".

! A speed limiter with a load greater than that named "C" could cause emergency trips in the frequency converter as it will let you lower greater loads than it should at higher speeds.

! The value of the loads is on the data sheet of the crane, according to of the number of falls with which you perform the setting.

! **The test loads must be manufactured according to the national and local regulations.**

## 2.3 Checking the system

### 2.3.1 Maximum load limiter

The system must allow you to lift load **A**, but not loads **A + B** together. Otherwise, adjust it according to section 2.4.

### 2.3.2 Lifting speed load limiter

Verify that the fast speed when lowering (maximum frequency of the converter) is possible for load **C** but not for loads **C + B** together. Otherwise, adjust the system.



The checks shall be made with the trolley back and the hook in two-fall.



The functioning of the load limiter must be checked daily before starting the normal work of the crane.

## 2.4 Adjustment.



The checks shall be made with the trolley back and the hook in two-fall (SR).

### 2.4.1 Adjusting the maximum load limiter.

- 1 With the trolley back, lift load **A**.
- 2 Regulate the limiter "LC" with the corresponding bushing (1), so that it allows you to just lift the load.  
Block the bushing (1) with the lock-nut (2).
- 3 Check the adjustment according to that indicated in section 2.3.1

### 2.4.2 Adjusting the lifting speed load limiter

- 1 With the trolley back, lift loads **C + B** until load **C** is in the air and the cable that joins it to **B** is taut but load **B** has not yet lifted off the ground.
2. Act on the limiter "LCR" until that the micro is in the open position.
3. Block the bushing with the lock-nut.
- 4 Check the adjustment according to that indicated in section 2.3.2.

## 3 OPTIONAL LOAD LIMITER SYSTEM

### 3.1 Status indication beacon

The configuration of optional load limiters includes a beacon with amber and red lights and a siren that function depending on the load status of the crane.

### 3.2 Limiters

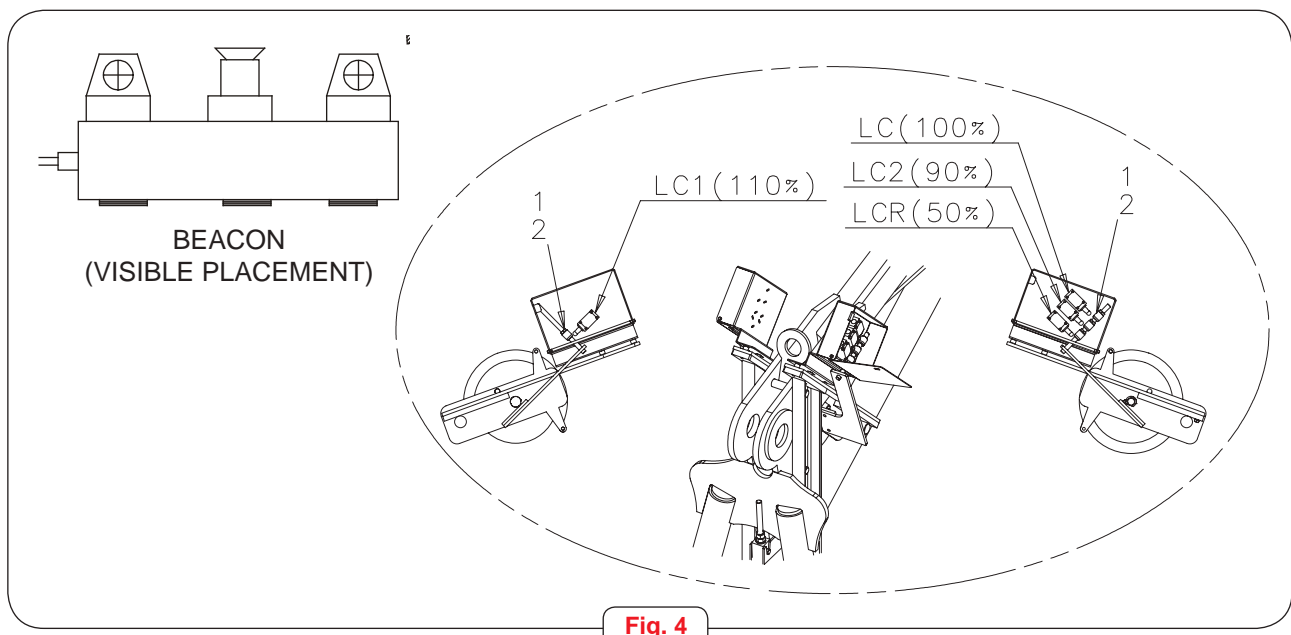


Fig. 4

The system has 4 limiters:

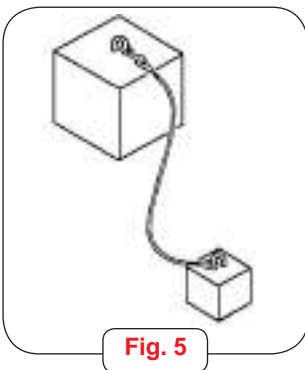
- LC** Maximum load limiter
- LCR** Quick lifting load limiter
- LC1** Overload limiter reached
- LC2** Maximum load approach limiter

! The values of loads associated with LC1 and LC2 can be adjusted to meet the applicable local regulations (for example 110% and 90% respectively).

☞ The warnings and operations of the optional moment limiting system are described in section 3.4.

! The moment limiter system generates analogue warnings.  
! See the instruction "MOMENT LIMITER"

### 3.3 Test loads



On the construction site, there will be the following test loads:

- Load A:** Maximum load permitted for the crane.
- Load B:** Overload used during the tests.  
Its value will depend on the local regulation where it is applied. (For example 0.5%-10% of the load).
- Load C:** Maximum loading in fast speed:  
50% of the maximum load permitted for the crane.

! The value of the loads is on the data sheet of the crane, according to of the number of falls with which you perform the setting.

! **The test loads must be manufactured according to the national and local regulations.**

### 3.4 Checking the system.



The functioning of the load limiter must be checked daily before starting the normal work of the crane.



The checks shall be made with the trolley back and the hook in two-fall.

Check, lifting the corresponding loads, that the system works correctly.

Limiters on	Amber lamp	Red lamp	Siren	Fast hoist Trolley forward
None	-	-	-	Yes
LC2	Yes	-	-	Yes
LC1	Yes	-	Yes	Yes
LC	Yes	Yes	Yes	No
LCR	Max. descent speed is limited (Frequency limited in the converter)			



Regulate the LC limiter in such a way that the crane does not allow you to lift a load greater than the maximum load at high speed.



To regulate the LCR limiter, suspend load "C" from the hook and regulate the limiter so that the micro is just in the open position.



A speed limiter with a load greater than that named "C" could cause emergency trips in the frequency converter as it will let you lower greater loads than it should at higher speeds.

### 3.5 Adjustment



The checks shall be made with the trolley back and the hook in two-fall (SR).



With the trolley back, lift the test load corresponding to the limiter to regulate.

Set the limiter with the actuator "1" and block it with the lock-nut "2".

Deposit the load on the ground.

Check the adjustment according to that indicated in section 3.4.



The moment limiter system generates analogue warnings.

See the instruction "MOMENT LIMITER"

## 4 SYSTEM INHIBITER (OPTIONAL)

As an optional element, the crane can be fitted with a manual switch with a key and automatic reset (IACM).

It is located in the cat head electric cabinet and allows the load and maximum moment limiters to be jumped for supervision work.



Always ensure it is deactivated for normal work.



This system may be explicitly contraindicated by the applicable standards in the country or region where the crane is used.




- THE MAXIMUM SLEWING PERMITTED DURING THESE OPERATIONS IS 10° IN EACH DIRECTION, IN 1ST GEAR ONLY

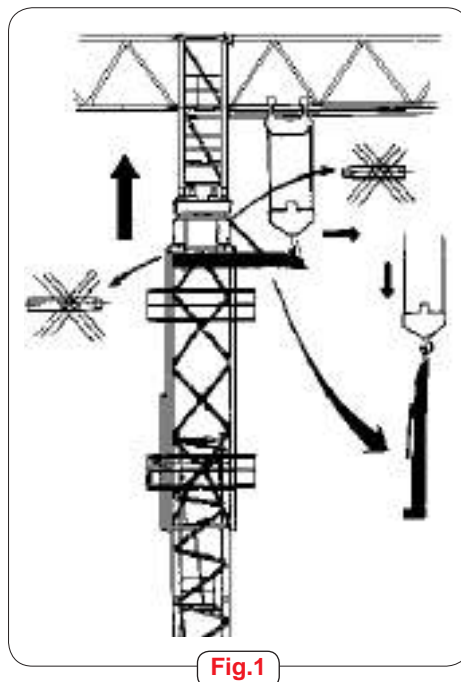
## 0 CONTENTS

- 1 REMOVAL OF SINGLE RAIL
- 2 REMOVAL OF BALANCING WEIGHT
- 3 LOWERING OF CLIMBING SECTION
- 4 REMOVAL OF CLIMBING SECTION

### 1 REMOVAL OF SINGLE RAIL

 BEFORE STARTING THIS OPERATION ENSURE THAT THE TOWER AND SLEWING RING SUPPORT ARE JOINED BY WORKING BOLTS, NOT ERECTION BOLTS.

- Remove single rail (Fig. 1).



## 2 REMOVAL OF BALANCING WEIGHT

- Suspend the balancing weight & lower it to the ground (see «Balancing» in this chapter)

## 3 LOWERING OF CLIMBING SECTION (Fig.2)

- Tension the cylinder & release the screws securing the climbing section to the slewing ring support (A)
- Lower the climbing section at least 3 tower sections by reversing the steps taken to raise it
- Fit a transverse stop on the trolley on the jib (B)
- Bolt the bottom end of the climbing section ladder (C)
- Hook up slings to the climbing section (D), raise until the climbing section is free (1, 2, 3), attach the head of the ladder to the climbing section and lower the climbing section.



Fig. 2

#### 4 REMOVAL OF THE CLIMBING SECTION (Fig.3)

- Remove the accessories: ladder, access points and electrical switchboard
- Attach the safety locks to the tower section and climbing section (2)
- Suspend the climbing section from the locks
- Dismount the top cross-tie and bottom panel (3)

! It is advisable to secure the climbing section to the tower by some other means also, as it could move suddenly when the safety locks are removed.

- Release the safety locks
- Hook up slings to the climbing section and tension (4)
- Release the tower locks (5)
- Remove the climbing section

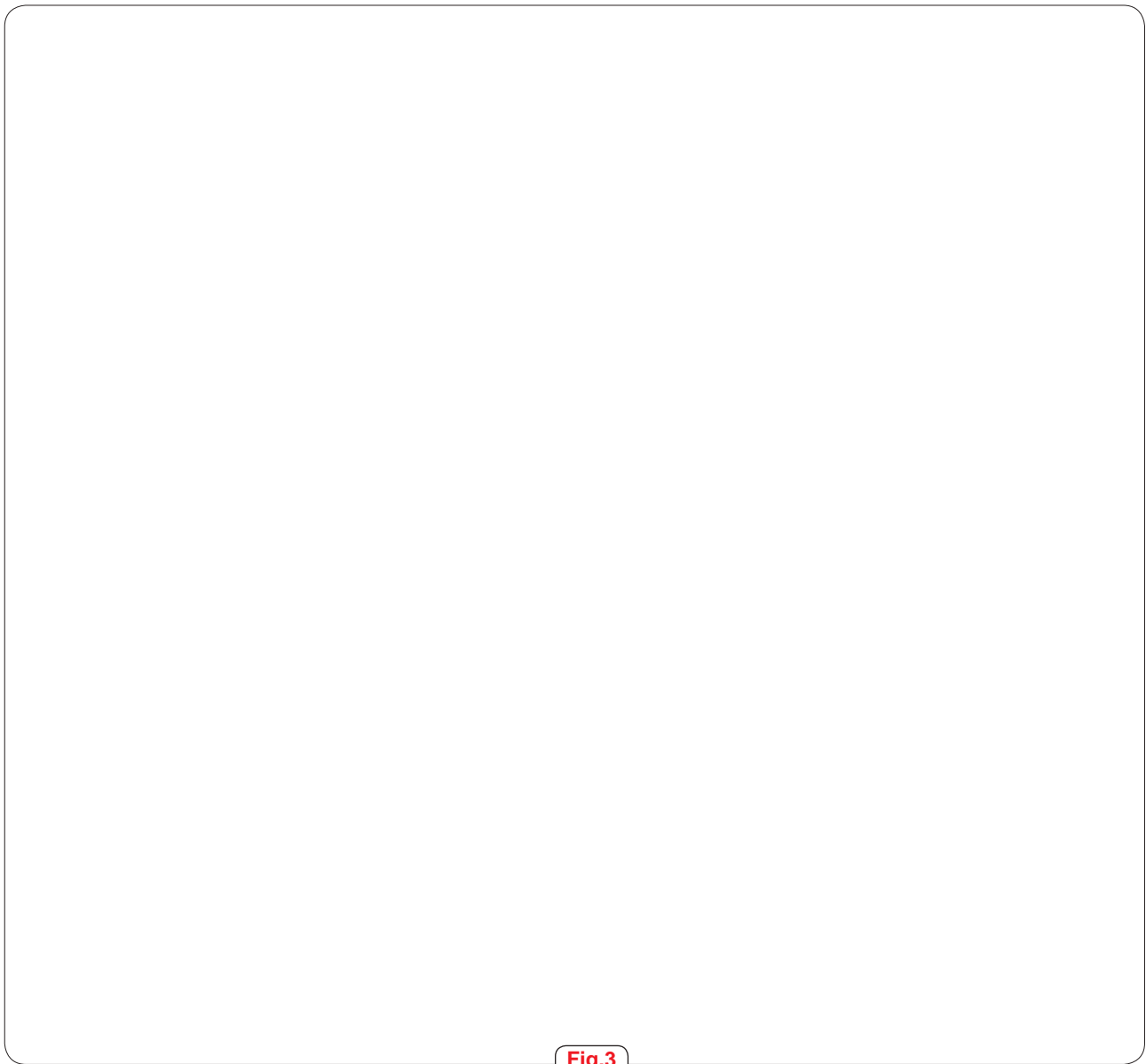


Fig.3

- THE MAXIMUM SLEWING PERMITTED DURING THESE OPERATIONS IS 10° IN EACH DIRECTION, IN 1ST GEAR ONLY
- FOR UNDER-HOOK HEIGHTS GREATER THAN 50 M THE CLIMBING SECTION MUST BE BROUGHT DOWN
- COMANSA ADVISES THAT THE CLIMBING SECTION BE BROUGHT DOWN IN ANY EVENT.

<b>0</b>	<b>CONTENTS</b>
<b>1</b>	<b>ERECTING THE CLIMBING SECTION</b>
1.1	<b>INITIAL SECTION</b>
1.2	<b>WITH THE CRANE ERECTED</b>
<b>2</b>	<b>PLACING WEIGHT ON THE JIB</b>
<b>3</b>	<b>RAISING THE CLIMBING LADDER</b>
<b>4</b>	<b>FITTING TOWER SECTIONS ON THE SINGLE RAIL</b>
<b>5</b>	<b>BALANCING</b>
<b>6</b>	<b>PLACING THE CLIMBING SECTION FOR TELESCOPING</b>
<b>7</b>	<b>TELESCOPING</b>
<b>8</b>	<b>INSERTING THE TOWER SECTION</b>
<b>9</b>	<b>SECURING THE TOWER SECTION</b>
<b>10</b>	<b>REPEAT STEPS 3 – 9</b>
<b>11</b>	<b>FINAL OPERATIONS</b>

## 1 ERECTING THE CLIMBING SECTION

### 1.1 INITIAL SECTION (Crane with cross-shaped base or embedded) (Fig.1-2-3)

- Erect two tower sections
- Raise the climbing section with the autocrane & fit it onto the sections
- Erect tower sections as necessary to enable the slewing ring support to be bolted to the last section
- Raise the slewing ring support and bolt to the tower section
- Hook up slings to the climbing section, raise with the autocrane & secure to the slewing ring support

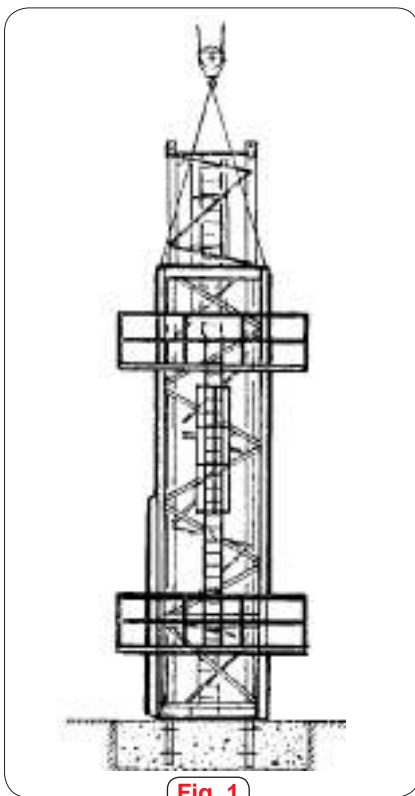


Fig. 1

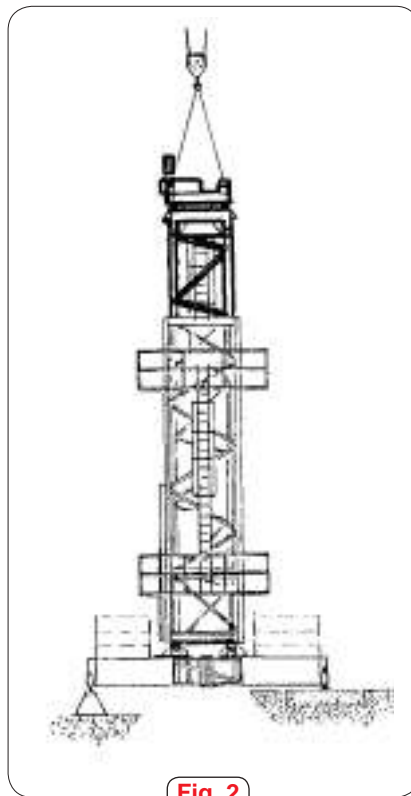


Fig. 2

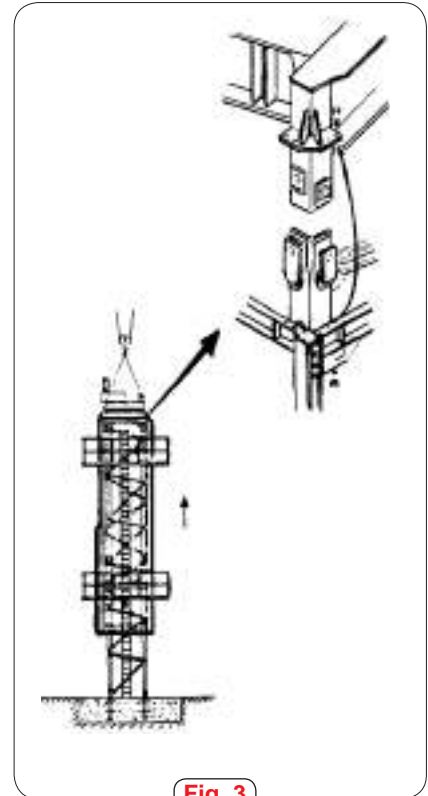


Fig. 3

### 1.2 WITH THE CRANE ERECTED

- Erect the accessories: ladder, access points & electrical switchboard
- Release the safety locks
- Fit the top cross-tie and the bottom panel
- Hook up the hook slings on the climbing section & tension them
- Set the tower locks
- Remove the climbing section



To erect the unit reverse the steps listed for removing the climbing section (see MTJ 110.0029)

## 2 PLACING WEIGHT ON THE JIB

- Place a weight at a certain distance along the jib to balance the crane (see «Balancing» below)

## 3 RAISING THE CLIMBING LADDER (Fig.4)

- Fit the accessories required to raise the ladder (cable reeving (A) & lifting bar (B))
- Fit the auxiliary hook to the bar and tension the system with the main hook (C)
- Conceal the slide and pawl (D, E)
- Raise the climbing ladder & hook onto the top section (1, 2, 3)

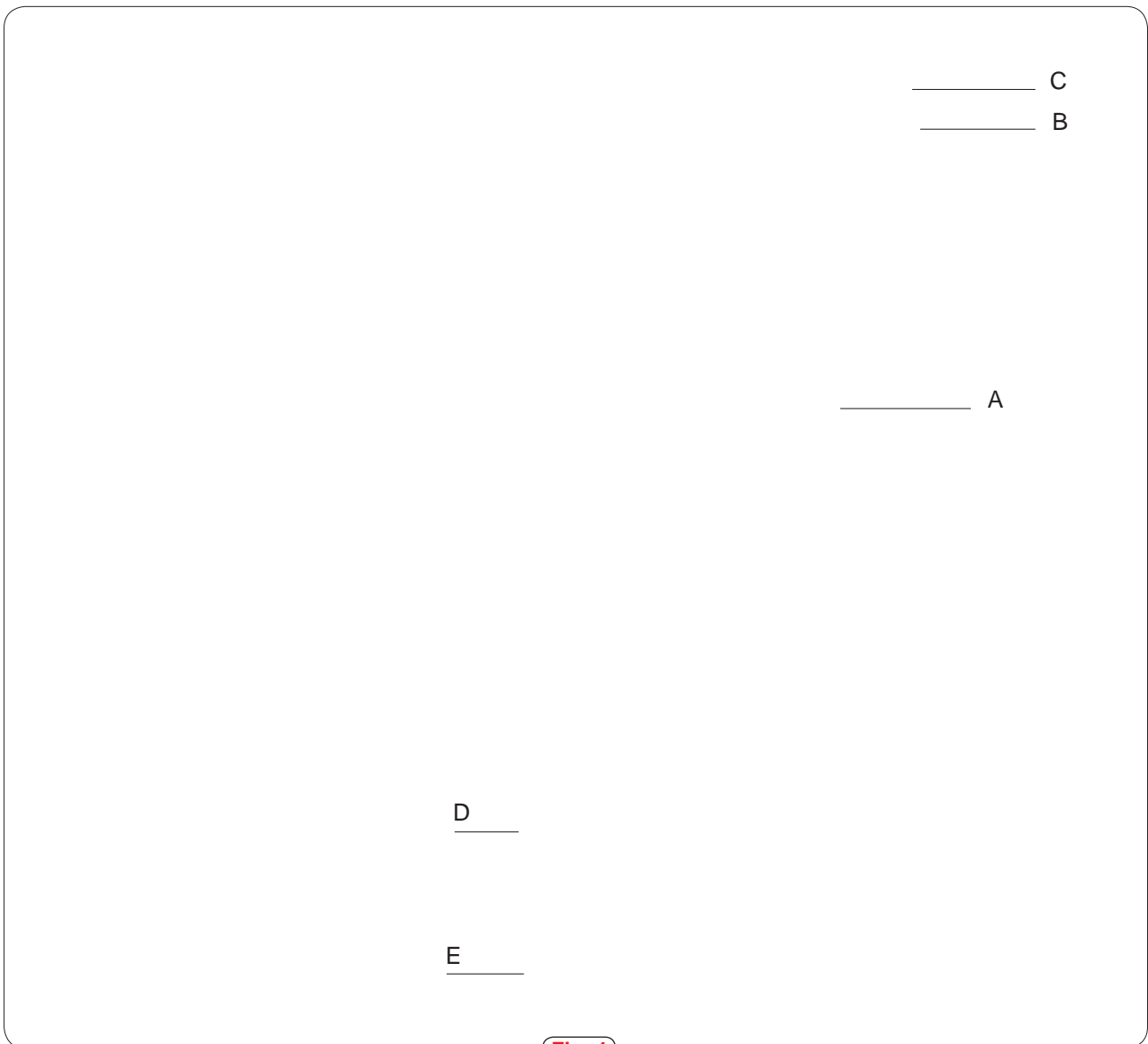


Fig. 4

#### 4 FITTING TOWER SECTIONS ON THE SINGLE RAIL (Fig.5)



The maximum slewing permitted during these operations is 10° in each direction, in 1st gear only. The trolley must be located on the job no more than 10 m from the tower centre.

- Suspend the auxiliary hook (A) and section erection trolley (C) from the main hook (A)
- The four slings (B) must be of equal length
- Hook up the slings to the trolley on the section
- Hoist & house the trolley on the single rail
- Unhook & remove the auxiliary hook



Fig. 5

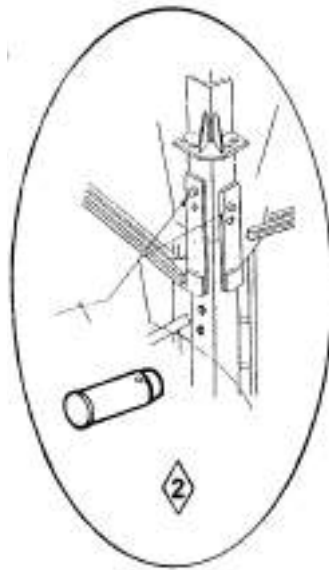
## 5 BALANCING

☞ See «Balancing» in this chapter.

- Place a weight at a certain distance along the jib to balance the crane
- The slewing part of the crane must be perfectly balanced on the cylinder before telescoping
- To ensure this, move the trolley & hook under no load until it is balanced.

## 6 Placing the climbing section for telescoping (Fig.6)

- Lower the slide (A) and rest it on the last support of the climbing ladder
- Operate the cylinder until the bolts securing the last tower section to the slewing ring support are extracted
- Climb until the recovery pawl (B) is resting on the same support as the slide



\_\_\_\_\_ A

\_\_\_\_\_ B

**Fig.6**



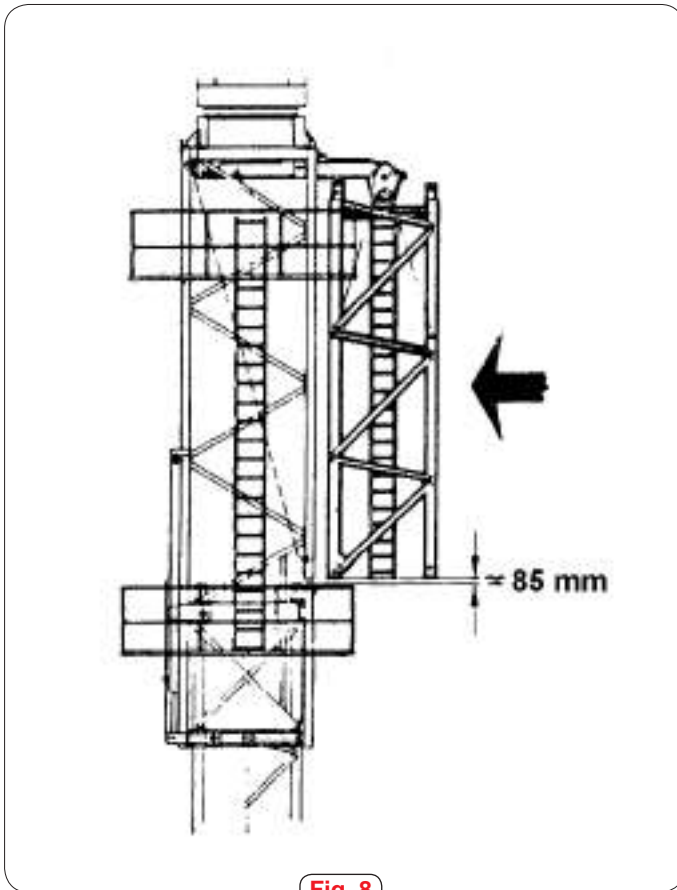
## 7 TELESCOPING (Fig.7)

- Bring in the cylinder until the slide rests on the next support
- Climb until the recovery pawl is resting on the same support as the slide
- Repeat these two steps until the end of the climbing ladder is reached.

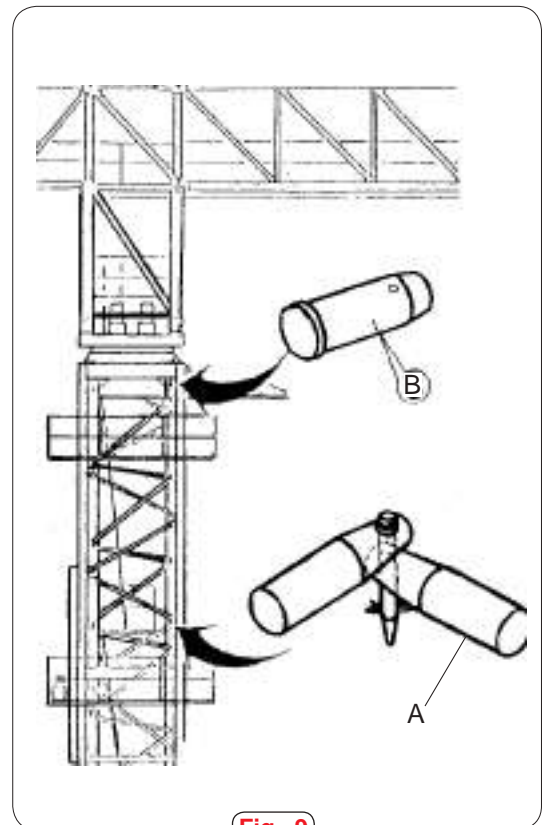
A small red-bordered box containing the text "Fig. 7" in red, positioned at the bottom center of a large, empty rectangular frame that occupies most of the page.

## 8 INSERTING THE TOWER SECTION (Fig.8)

- Insert the tower section into the climbing section
- Lower the climbing section until the tower section is fitted inside it
- Release the slings
- Take the erection trolley to the end of the single rail



**Fig. 8**



**Fig. 9**

## 9 SECURING THE TOWER SECTION (Fig.9)

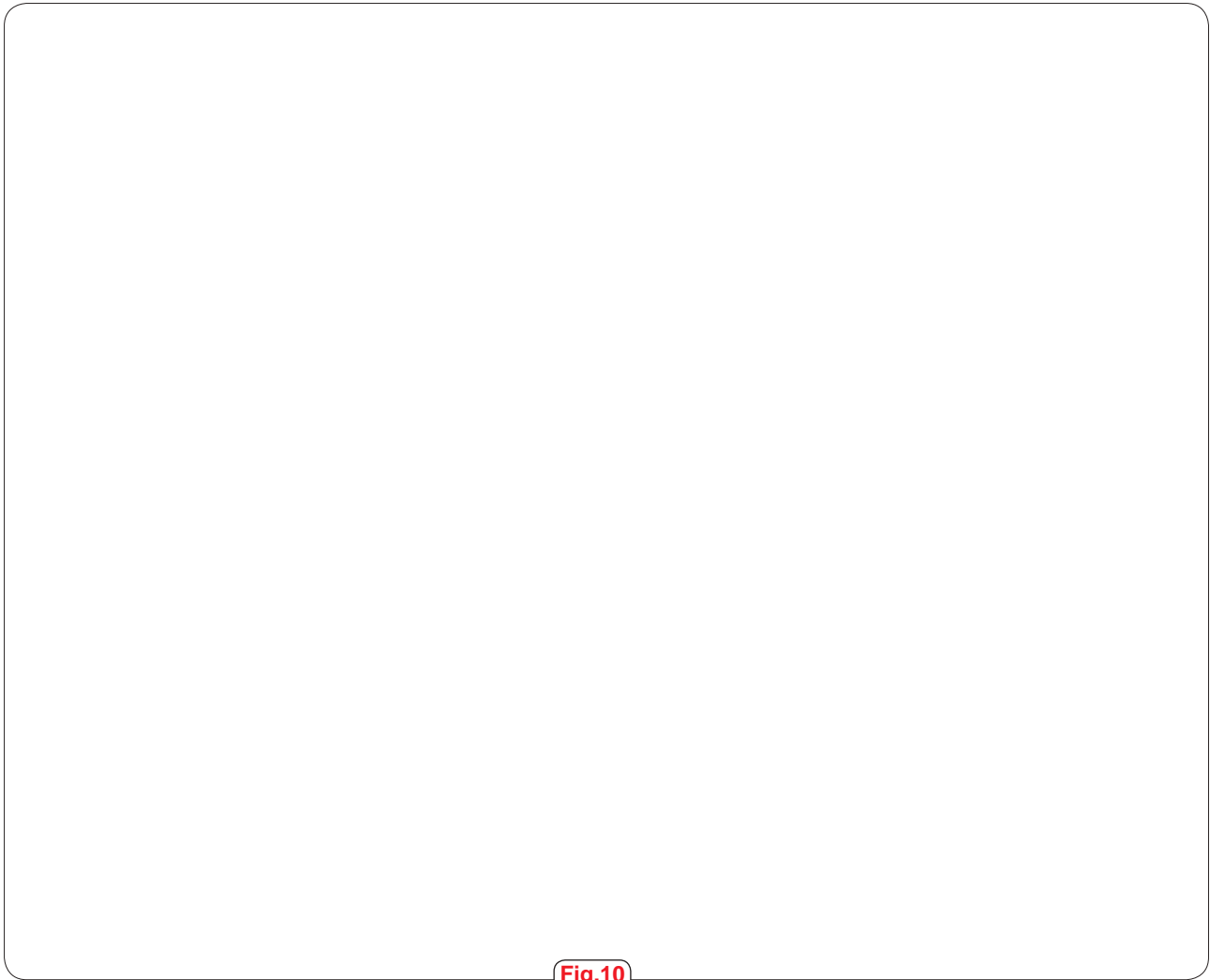
- Secure the bottom with working bolts (A)
- Lower the climbing section until the top fits into the slewing ring support
- Fit telescoping bolts (B) (during telescoping only)

**10 REPEAT STEPS 3-9**

- Repeat steps 3 – 9 until the desired height is reached.

**11 FINAL OPERATIONS (Fig.10)**

- Replace the climbing bolts with working bolts at the join between the last tower section and the slewing ring support
- Remove the balancing weight

**Fig.10**

**BRACED CRANE**

If a crane needs to be erected at a height greater than its free-standing height (H), it must be braced via a frame which embraces the tower section.

Bracing is fitted at the join between standard sections.

Cranes can be braced against buildings or from the ground.

Bracing against a building: connection to beams in the structure of the building.

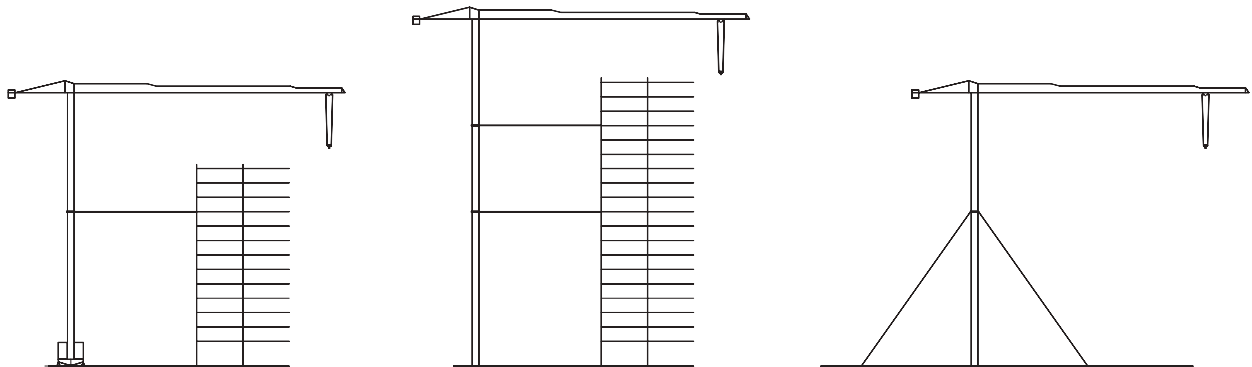
Bracing from the ground: connection to the ground via steel cables.

Depending on the final height under hook, several tie-frames may be necessary

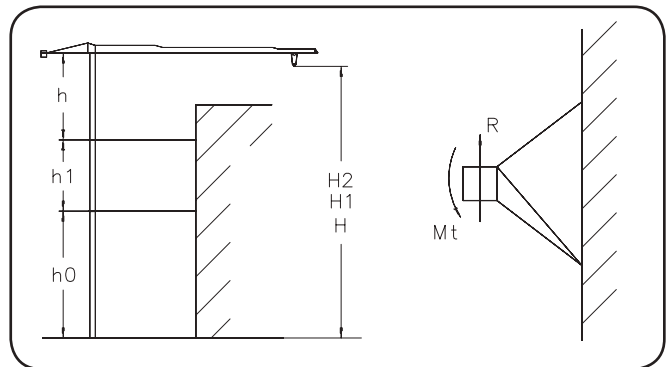


For heights above 100 m, contact COMANSA.

For special assemblies contact COMANSA.



<b>A</b>	1XA31	3XA51	5XA71	ES31	ES51	ES71
<b>H</b>	42,4	47,9	59,2	40,9	51,9	57,4
<b>H1</b>	64,4	69,9	81,2	62,9	73,9	79,4
<b>H2</b>	86,4	91,9	103,2	84,9	95,9	101,4
<b>B</b>	4	4	4	4	4	4
<b>C</b>	6	6	6	6	6	6
<b>D</b>	4	4	4	4	4	4
<b>E</b>	6	6	6	6	6	6



- A** Base/tower version. (See "Data Sheet").
- H** Free-standing height.
- H1** Max. height with 1 level of bracing.
- H2** Max. height with 2 levels of bracing.
- B** Nº of sections between bracing frames.(Heights below 100 m).
- C** Nº of sections above top bracing frame.(Heights below 100 m).
- D** Nº of sections between bracing frames.(Heights above 100 m).
- E** Nº of sections above top bracing frame.(Heights above 100 m).

	Document	Rev.
Braced Crane (1XA31)		
Braced Crane (3XA51)		
Braced Crane (5XA71)		
Braced Crane (ES31)		
Braced Crane (ES51)		
Braced Crane (ES71)		

**MOUNTING THE TIE-FRAME**

 TIE-FRAME MUST BE PLACED IN THE UNION OF MAST SECTIONS

**Level union-mast sections**

**Axle tie-frame**

**TYPICAL DETAILS OF TIE-FRAME AND TIE-BRACES****NOTE:**

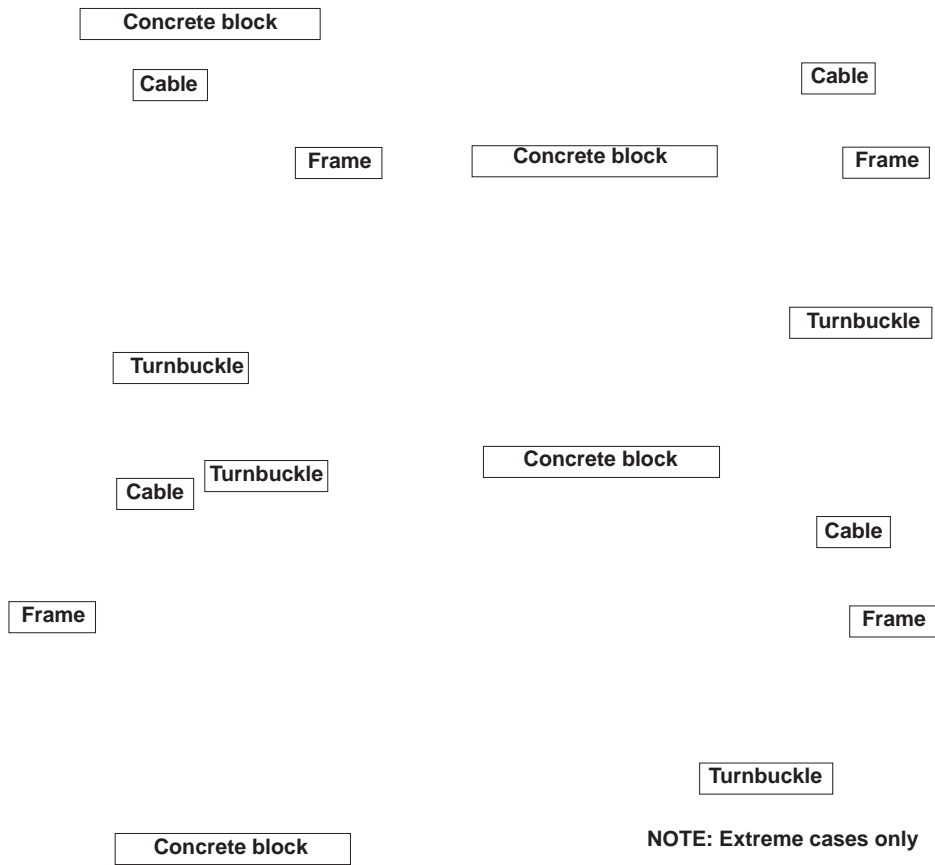
**MANUFACTURERS  
SUPPLIES ONLY ITEMS**

**A Inner frame**

**B Tie-frame**

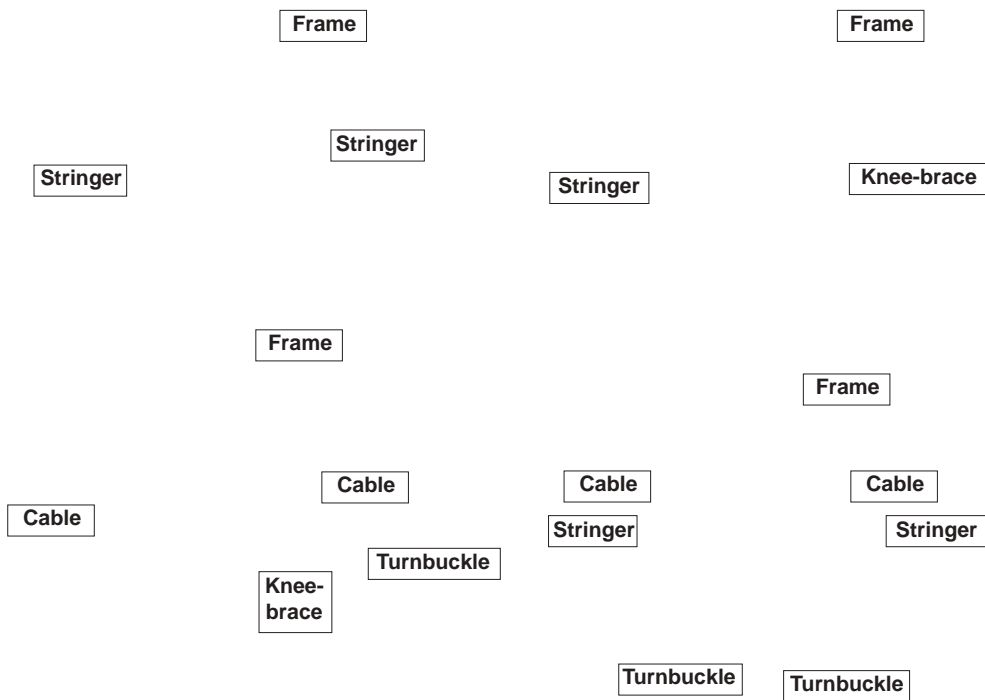
**C Tie-pin**

**TYPICAL DETAILS OF TIE-FRAME ON THE GROUND WITH WIRES**



NOTE: Extreme cases only

**TYPICAL DETAILS OF RIGID TIE-FRAME AND TIE-BRACES**



NOTE: For other solutions, please contact COMANSA.

! DURING CRANE DISMANTLING OPERATIONS WEARING SAFETY HARNESS IS COMPULSORY.



Crane dismantling sequence will be opposite to that used for erection

- 1.- If crane height is greater than self-stable height, with stays, tower sections will be removed by means of the climbing cage until reaching a height such that the mobile crane may be used (see documents regarding CLIMBING SECTION ERECTION).  
Remove the cage.
- 2.- Unreeve the lifting cable.  
Override lift hook travel limiter and hoist it at a low speed to fix it to the trolley or hang the hook from the mobile crane to bring it to ground level.  
Bring the trolley to the jib end untying the cable from the jib end, fixing it to the trolley.  
Actuate on the hoisting drive to reel the cable while bringing it toward the tower.  
Release the cable end from the trolley and reel all the cable on the hoisting drum, fixing it to avoid unreeling.  
Fix the trolley to the first jib section for dismantling both as a unit.
- 3.- Unreeve the trolley cable.  
If the jib is being dismantled as a whole, cable unreeving can be made with the jib at ground level.  
If the jib is dismantled in sections, unreeve the cable overhead, release cable terminals from the trolley and gather the cables inside the jib.  
Remove trolley drive electrical connection.
- 4.- Remove jib safety cable (guardrail).
- 5.- Remove counterweight blocks and jib elements
- 6.- Dismantle the counterjib.
- 7.- Dismantle the slewing part.  
Remove electrical connection of base box, remove hose to tower attachment fasteners  
Arrange electrical hoses such that they can be lowered together with the slewing part  
Using adequate slings, suspend the slewing part from the mobile crane, remove the connecting bolts of the lower crown wheel holder to the last tower section and bring down to ground level
- 8.- Dismantle the tower
- 9.- Remove base ballast
- 10.- Dismantle the base







# MANUFACTURER'S MANUAL

## 4 ELECTRICAL INSTALLATION



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Electrical assembly.....	040 0015 IB	A	13
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Travelling system - electrical installation .....	060 0001 IB	C	19
Travelling system - electrical installation .....	060 0003 IB	A	22
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Hoisting system -electrical part- .....	080 0002 IB	C	33
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**THIS SECTION CONTAINS INSTRUCTIONS TO BE FOLLOWED BY THE CONTRACTOR FOR CRANE PROPER POWER SUPPLY AND EARTHING. NOT COMPLYING WITH THESE INSTRUCTIONS COULD CAUSE DAMAGE TO PERSONS OR MATERIALS.**

**!** Mains supply must guarantee 480 V rated voltage with less than  $\pm 5\%$  deviation.

## **0 CONTENTS**

- 1 Regulations**
- 2 Site switchboard**
- 3 Power supply cable**
- 4 Equipment electrical data**
- 5 Earthing (power supply)**
- 6 Earthing of crane structure**

## **1 Regulations**

The following regulations have been complied with

- IEC 364-4-41:1982, Protection against electric shocks
- IEC 364-4-47:1981, Application of protective measures for safety
- IEC 364-5-54:1980, Earthing arrangements and protective conductors

Also, other regulations and standards might be applicable and must be complied with as a function of the crane site.

## **2. Site switchboard**

Electrical supply to the crane must be taken from the site switchboard (standards IEC 60439; EN60439-4). This switchboard must be provided with a protective enclosure adequate for the actual environment. IP447 minimum protection made of insulating material is recommended.

The electrical supply cable from site switchboard to the crane shall be provided with short-circuit and thermal circuit breakers. This protection can be accomplished by:

- Line protection fuses, characteristic curve gL.  
Fuses must be selected in accordance with the cross section of the cable to be protected ( See manufacturer's specific tables with data of cables used). Design cable current shall never be higher than fuse rated current.
- Line protection thermal magnetic circuit breaker, tripping curves B and C, or above (curves D or K or motor overload protection)  
Breaker current may not be higher than maximum line working current

A differential circuit breaker must also be provided for protection against indirect contacts. This protection and the earthing of the electrical supply line must comply with national standards and regulations applicable at the site.

Some crane electric devices like inverters include filters to bring voltage supply quality to a sufficient level. These filters are passive components which "clean" the supply voltage by blocking high frequency current harmonics and diverting them to earth. Under some circumstances, these leakage currents can make the RCD (residual current device) to trip. If such is the case, immunized RCD devices must be used instead.

## **3 Electrical supply cable**

The electrical supply cable must be adequate for the working voltage, the installed power, the distance to the crane and the environment.

Cable type RVK-06/1kV (UNE 21123 –IEC 502) for indoor or outdoor stationary overhead or underground installations is recommended provided site conditions do not require a special cable.

#### 4. Electrical data for the installation

Below please find a table with electrical data for the installation to assist in selecting the cable and other elements of the electrical supply :

Model	POWER				POWER SUPPLY 3 x 480 V 60 Hz			GENERATOR (4)	ELECTRICAL SUPPLY		
	Hoist kW	Trolley kW	Slewing kW	TravelkW	Current. (1) Total (A)	Current. (2) Crest (A)	Fuse (3) (A)	kVA	Cable (5) Type	Length. (6) Total (m)	Length. (7) minimun
11LC90	18 kW 3 v.	1,8	2 x 2,2	2 x 2,2 2 x 2,7	52	181	63	107	16	110	14
	18 kW FU.	2,2			61	94	63	63	16	115	15
	24	4			73	115	125	75	35	203	30
11LC132	18 kW 3 v.	1,8	2 x 2,7	2 x 2,7 2 x 3,7	53	182	63	107	16	109	14
	18 kW FU.	2,2			62	95	63	65	16	117	15
	24	4			74	303	250	75	70	202	60
	37				100	423	315	100	95	149	80
11LC150 11LC160	37	4	2 x 3,7	2 x 2,7	80	124	125	85	35	185	30
	45			2 x 3,7	106	173	125	110	35	140	30

**NOTES:**

1. Total current is the sum of all motor rated currents with a simultaneity coefficient of 0.8
2. Peak current is the sum of hoist motor maximum current (at speed change) and the rated currents of the rest of the motors.
3. Line protection fuse gL or magnetic thermal circuit breaker (see par. 2 – site switchboard)
4. The generator must be able to start with hoist motor maximum current (at speed change) and with the breaking power related to lowering of maximum load at maximum speed.
5. Electrical supply cable may not be smaller than size stated in table.
6. This length is the maximum allowable for the cable stated. The length is the sum of the electrical supply to the crane foot plus the length of cable installed in the tower.  
This cable has been designed for 4% voltage drop at rated current.  
If the total length of the electrical supply cable plus the tower cable should be above the stated value, a cable with more cross section shall be installed. Cable cross section selection must also take into account the voltage drop through tower cable (cross section of this cable is table stated cross section) and table stated currents.
7. Electrical supply cable length plus tower cable length must always be above this value.

## 5. Earthing (electrical supply cable)

Crane must be earthed through the protection conductor provided in the crane electrical supply cable.

This protection conductor, of green yellow colour  shall have the minimum cross section stated in the following table:

INSTALLATION PHASE CONDUCTOR CROSS SECTIONS (mm <sup>2</sup> )	MINIMUM CROSS SECTION OF PROTECTION CONDUCTOR (mm <sup>2</sup> )
$S \leq 16$	S
$16 < S \leq 35$	16
$S > 35$	S/2

Earthing must be done by a qualified engineer, and must be adequate for the selected differential protection against indirect contacts, complying at the same time with local current regulations in force.

## 6. Earthing of the structure

Prior to crane start up, the contractor must check the need for earthing of the crane structure as well as protection measures against lightning (applicable regulations for accident hazard prevention – insurance company's or owner's requirements – etc.)

Earthing the structure is recommended as a precaution measure against electrostatic discharge, although this will not guarantee full protection against lightning.

If the crane should need full protection against lightning, it shall comply with jobsite local regulations in force. If this should be the case, installing lightning arrestors at the power supply connection is recommended for the protection of crane electrical equipment.

The following instructions must be followed when earthing the structure:

- Minimum earthing lead cross section shall be 35 mm<sup>2</sup> for copper conductors, or 30 mm x 3,5 mm galvanised strip.
- Earth electrodes must be driven to a minimum depth of 2 m.
- Leads shall be connected through M10 bolts with lock nuts and washers
- Earth resistance above 20 ohms is not recommended
- Crane structure earthing surface must be ground for a better electric contact
- For cranes on track: Rail ends must be earthed through earth electrodes. Rails longer than 20 m, must have an earth connection every 20 m. Rail sections must be electrically linked and all rail ends must have a direct earth connection.



<b>0</b>	<b>CONTENTS</b>
<b>1</b>	<b>BLOCK DIAGRAM</b>
<b>2</b>	<b>TOWER FOOT BOX AND TOWER CABLE</b>
<b>3</b>	<b>SWITCHGEAR CABINET</b>
<b>3.1</b>	<b>Low temperatures</b>
<b>4</b>	<b>SWITCHGEAR CABINET</b>
<b>5</b>	<b>CRANE CONTROL</b>
<b>6</b>	<b>LIMIT SWITCHES AND LIMITERS</b>

## 1 BLOCK DIAGRAM

ACG	Top cabinet	E4/2	Slewing plug 2
AE	Hoisting cabinet	E5	Cabin power plug
AN	Wind speed control block	E8	Aux. jib / climbing section plug
AT	Travelling cabinet	E9	Cabin control socket
BO	Hooter	E91	Remote control socket or cabin seat controls
CAB	Operator cabin	E92	Zoning socket
CJA	Cable con. box with switch	E93	Black box socket
CJC	Trolley winch distribution box	E933	Events register function socket
DBG1	Slewing motor release (1)	FMC	Trolley motor brake
DBG2	Slewing motor release (2)	FME	Hoist motor brake
E	Crane power supply socket	FMG1	Slewing motor brake (1)
E1/1	Trolley socket	FMG2	Slewing motor brake (2)
E1/2	Trolley socket	IAG	Box (Crane switch)
E34	Trolley back permission limit-switch socket	IM45	Zoning central unit (Optional)
E35	Trolley forward permission limit-switch socket	IMDL46	Indicators central unit (Optional)
E4/1	Slewing plug 1	LB	Hoist down limiter
		LBR	Hoist up limiter



LC	Maximum load limiter	MBL	Washes windshields pump motor
LC1	Load limiter (105-110%)	MC	Trolley motor
LC2	2° level intermediate load limiter	ME	Hoisting motor
LCA	Trolley forward limiter	MG1	Slewing motor (1)
LCAR	Trolley fast forward limiter	MG2	Slewing motor (2)
LCB	Cabin light	ML	Cabin windscreen-wiper motor
LCR	Level fast load limiter	MTR1	Travelling motor (1)
LCT	Trolley back limiter	MTR2	Travelling motor (2)
LCTR	Trolley fast backward limiter	MVG1	Slewing fan motor (1)
LGD	Right slewing limiter	MVG2	Slewing fan motor (2)
LGI	Left slewing limiter	PPC	Hoisting emergency stop
LM	Maximum torque limiter	PPE	Trolley emergency stop
LM2	Moment limiter (105-110%)	RC	Trolley resistor
LM2	Moment limiter (90%)	RE	Hoisting resistor
LPCD	Trolley forwards permission limit-switch	SG	Crane circuit breaker
LPCT	Trolley backwards permission limit-switch	STX	Temperature probe (-25° C) (Optional)
LS	Hoist up limiter	TEL	Remote control
LSR	Fast hoist up limiter	UAA	Equipped air system (Optional)
LTA	Forward travelling limiter	UCDL45	Indicators display (Optional)
LTT	Backward travelling limiter		


## 2 TOWER FOOT BOX AND CRANE CABLE

The electrical equipment starts at the power supply terminals of the crane foot box (CJA).

This box is provided with crane tower cable protecting fuses and with an isolator for isolating the electric equipment of the crane from the power supply.

If it should be required, the isolator may be locked in the off position "0", by means of a lock with key.

 The tower cable to be connected to the top cabinet by a quick connect plug comes from this box.

 When the crane is used with the internal climbing system, the electric connection box CJA has an electric terminal for the electric supply of the hydraulic equipment of the crane.

## 3 ELECTRICAL CABINET & SWITCHGEAR

The crane's electric switchgear is distributed in two cabinets located in the cat head of the crane.

Trolley/slewing cabinet.

Is located in the side of the cabin and receives the electric power of the crane..

It contains the common switchgear of the crane, trolley and slewing.

Hoisting cabinet.

Is located in the opposed side to the cabin.

It contains the switchgear of the hoisting mechanism.

The trolley/slewing cabinet is equipped with an isolator located in the door which disconnects the electric power supply from the power and movement control circuits.

! Isolating switch fails to cut out:

- Erection circuit.
- Cabin power circuit.
- Aux. jib power circuit.
- Climbing cage power circuit.
- Auxiliary socket 230 V, 10 A in trolley/slewing cabinet.
- Auxiliary socket 230 V, 1 A in trolley/slewing cabinet and hoisting cabinet.
- Trolley/slewing and hoisting cabinet heating and ventilating circuit.
- Accountant of hours (optional)

In these circuits the wiring is realised in color orange.

Cabinet doors can only be opened with the proper key and with the isolator in off position "0".

The crane is provided with two emergency stop buttons (mushroom type) situated close to the hoisting winch and trolley winch, for use in case necessary during crane maintenance operations.

The electric cabinets (trolley/slewing and hoisting) are provided with one 2 x 230 V - 1 A outlet, for the computer connection.

The trolley/slewing cabinet is also provided with another 2 x 230 V -10 A outlet, for other applications.

### 3.1 LOW TEMPERATURES



To prevent electronic equipment from operating at extremely low temperatures or with condensation from sharp changes in temperature, electrical cabinets are fitted with heating elements and fans to warm up and renew the air inside them. These units are run by thermostats that monitor the temperature inside the cabinet so that the heating elements cut in when the temperature drops below 0 °C, heating elements and fans run simultaneously when it is between 0 °C and 5 °C, and only the fan runs when it is more than 5 °C.

Electronic equipment may malfunction at low temperatures.



If the ambient temperature is below 0 °C it is advisable to leave the electrical cabinet heating systems on when the crane is not operating. To do this, leave the electrical power to the crane on, keep the isolating switch at the foot of the crane connected and disconnect the isolating switch on the cathead cabinet (this cuts off the electricity to the power and control circuits of the crane).

### Ambient temperature probe (STX)

The crane incorporates an ambient temperature probe (STX) located outside the cab that prevents the crane from operating below -25° C.

If the ambient temperature falls below -25° C while the crane is in operation, all crane movements stop in a controlled fashion (similar to the resetting of the joystick) Under this situation a switch is available at the cab control panel (ITEX) that allows the crane operator to unlock the controls to unload and bring the crane out of service.

## 4 TOP ASSEMBLY / SLEWING PART

This structural assembly includes the trolley/slewing cabinet, slewing and hoisting mechanisms, trolley and hoisting resistance and moment and load limit system.

All these elements are interconnected.

The electric power connections of the elements which are not wired at the factory can be easily connected through quick-connect plugs.

Optional elements such as the spindle drive unit or auxiliary jib are also connected to the cat head cabinet through quick-connect plugs.

## 5 CRANE CONTROL

The control of the crane is carried out from the cabin through a quick-connect plug connected to the trolley/slewing cabinet

In case the portable control is used from the ground, the control cable is connected at the foot of the tower to a remote control, which in turn is connected to the trolley/slewing cabinet outlet.

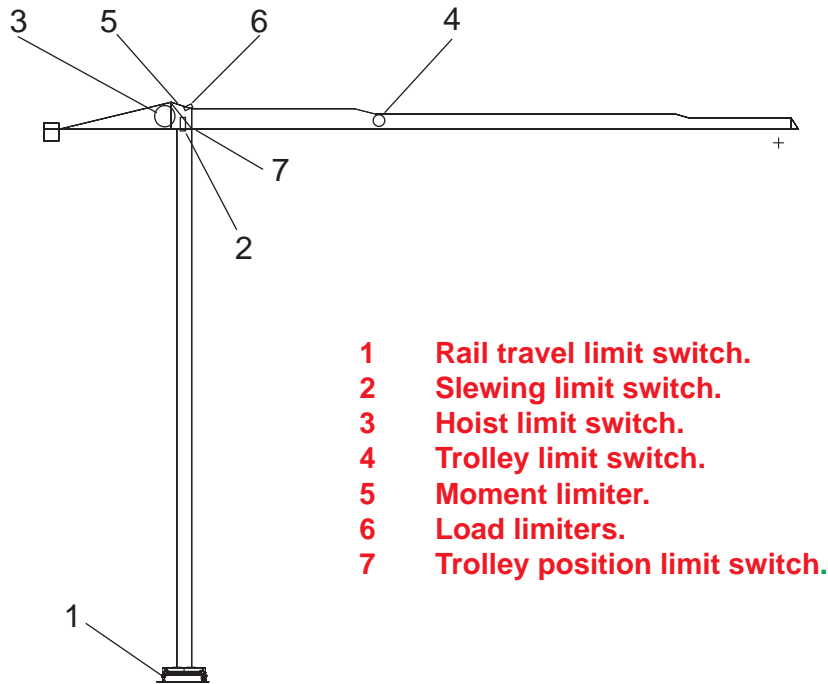
The joystick controls can be equipped with a deadman system or zero mechanical interlock, depending on the applicable standard or owner's requirements.

When joy-sticks are used, these can also be provided with dead man system or zero mechanical interlock depending on regulations and user requirements.

For remote control operation, the remote control receiver is connected to the switchgear cabinet instead of the control cable, using the quick connect plug provided on the cabinet. Thus, only one control mode can be active.

## 6 LIMIT SWITCHES AND LIMITERS

The crane is provided with the following limit switches and limiters:



- 1 Rail travel limit switch.
- 2 Slewing limit switch.
- 3 Hoist limit switch.
- 4 Trolley limit switch.
- 5 Moment limiter.
- 6 Load limiters.
- 7 Trolley position limit switch.

### 6.1 Rail travel limit switch.

It is a position limiter located on the translation frame.  
Its purpose is to stop crane translation at runway limits in both directions.

### 6.2 Slewing limit switch.

It is a revolution counter located at the slewing ring.  
Its purpose is to limit the slewing movement to a given number of revolutions in order to prevent the electric cables going through the slewing part from torsional damage.



This limit switch may not be used to limit crane movement in a slewing forbidden area.



Cranes with slip ring unit are not provided with this limit switch.

### 6.3 Hoist limit switch.

It is a revolution counter located at the hoisting winch drum.  
Its purpose is to stop the hook at hoisting limits in both directions.  
Also provided with fast speed limiters before reaching the limit switches.

### 6.4 Trolley limit switch.

It is a revolution counter located at the trolley winch drum.  
Its purpose is to stop trolley translation at runway limits in both directions.  
Also provided with fast speed limiters before reaching the limit switches.

## 6.5 Moment limiter.

Two position limiters are provided on the cathead.

The first limiter LM prevents the crane from being overloaded due to load moment. It cuts off the elevation movements of the hook and trolley to the jib point. In addition, it indicates the limit condition by illuminating a red light and sounding the claxon continuously.

The second limiter LM2 warns the cab operator that a moment of 90% or more has been reached, and the fast forward movement of the trolley is disabled. In addition, it indicates the approach to maximum moment by illuminating an amber light and intermittently sounding the claxon.

### switch IACM (optional)

For inspection purposes, load and moment limiters can be overridden by means of a key-operated switch (IACM) located in the trolley/slewing cabinet.



Make sure this switch is always off in normal operation.

## 6.6 Load limiters.

Two position limiters are provided on the cathead.

Its prevent the crane from being overloaded.

When the maximum permitted load is exceeded, one limiter stops the hook hoisting and the movement of the trolley toward the jib end and a lamp in the cab lights up (100%).

The second limiter is actuated at 50% maximum load to limit fast hoisting speed.

### switch IACM (optional)

For inspection purposes, load and moment limiters can be overridden by means of a key-operated switch (IACM) located in the trolley/slewing cabinet.



Make sure this switch is always off in normal operation.

## 6.7 Trolley position limit switch.

Two position limiters are provided in the beginning of the jib.

Detect the trolley position to realise the change of reeving.



GOOD CONDITION AND PROPER OPERATION AND CALIBRATION OF LIMITERS AND LIMIT SWITCHES ARE A MUST FOR GUARANTEEING A SAFE CRANE OPERATION.



For more details on limiters and limit switches, see inspection and calibrating instructions in chapter "ASSEMBLY / DISMANTLING" of this manual, and "CHECKS PRIOR TO START UP".


## O CONTENTS

- 1 FACTORY MADE INTERCONNECTIONS
- 2 ELECTRICAL ASSEMBLY SEQUENCE

### 1 FACTORY MADE INTERCONNECTIONS

The crane leaves the factory with the following connections made:

- Power supply assembly in base  
Composed of:
  - Switch with fuses in CJA junction box.
  - Mast section power cable with intermediate suspension that is pluggable using connector E in the rotation assembly.

 When the crane has a climbing unit, the junction box has a power outlet to which the hydraulic unit of the crane is connected.

- Cat head assembly  
Composed of:
  - Control cabinet of trolley/rotation ACG and elevation AE
  - Load limiter system LC, LCR, LC1 and LC2 (LC1 and LC2 optional)
  - Moment limiter system LM, LM2 and LM1 (LM1 optional)
  - Elevation mechanism with run limiter
  - Rotation system with run limiter
  - Connector E for the power supply to the whole crane

! All these elements are wired together.

- Trolley limiter and mechanism assembly.  
These elements in the jib are connected electrically in an intermediate box with its output through two conduits and the connectors E1/1 for the trolley motor and E1/2 for the rest (probe, brake and run limiters).  
These connectors must be connected to the trolley/rotation control panel in the assembly process.
- Fall change limiters assembly.  
Rear trolley position limiter LPCT pluggable using E34 and front trolley position limiter LPCD pluggable using E35.  
These two limiters must be connected using their respective connectors to the elevation control panel in the assembly process.
- Pluggable cab assembly.  
It incorporates the following connectors:
  - E5 for cab power
  - E9 for crane manoeuvre
  - E933 for the IMDL46 cab recorder (optional)
- Portable control set, pluggable using connector E9 (optional)
- Extension set pluggable using E9 in base (optional)
- Auxiliary nib set pluggable using E8 (optional)
- Assembly set, which incorporates connections of the hydraulic unit to the control box using connector E8 (optional)
- Radio control emitter/receptor set with support pluggable using E9 (optional)

- Anemometric set (optional)



All the plugs are marked with their name and coded, i.e., they cannot be placed in the wrong position.

<b>Trolley/rotation control panel</b>
E1/1 trolley motor
E1/2 trolley manoeuvre
E4/1 rotation motor plug 1
E4/2 rotation motor plug 2
E8 auxiliary nib / assembly unit plug

<b>Elevation control panel</b>
E34 fall change limiter plug
E35 fall change limiter plug

<b>Cab</b>
E5 cab power plug
E9 cab control plug
E933 IMDL46 recorder signals plug

## 2 ELECTRICAL ASSEMBLY SEQUENCE

- Install the CJA junction box using its support in the base of the crane.  
The junction box comes connected to the power cable.  
To install it, pull the inner end of the cable roll using the suspension to which it is fixed.



If the machine is equipped with the auxiliary transformer T22 (optional for use with power supply frequency 60Hz) connect this transformer's input to the input voltage available at the connection point. You can choose between values from 480V to 520V, which guarantees that the transformer output provides a voltage of 460V 60Hz for the crane to function.

- Install the power supply in the tower by fixing the intermediate suspension with a maximum of around 40 metres between suspension points.
- Connect plug E in its corresponding socket inside the turntable.




The power cable must be connected by qualified staff and according to the instructions indicated in this manual for the **"ELECTRIC WIRING AND GROUNDING"**.



At this moment, once the electric power supply is switched on and by connecting the control E9, E5 and E933, you can rotate the rotation assembly to facilitate assembly of the jib and counter-jib.



To make this operation without the trolley plug E1/2 connected, you must connect the overhead plug E1/2 that is in the lower part of the trolley/rotation control panel to its corresponding E1/2 in the base of the control panel.

- 
- Once the jib is fitted to the rotation assembly, connect the trolley mechanism using the pluggable conduits E1/1 and E1/2.  
Connect the fall change limiters E34 and E35.
  -  Now the crane is ready for operation and fine-tuning.
  - If you are dealing with a mobile crane, connect it from the cat head control panel to the transport control panel in the base, both for potential and manoeuvre, passing the cables through the same place as the current supply of the crane. Install the run limiter in its working position and connect the conduits of the transport motors.

## 0 CONTENTS

1	<b>START UP SYSTEM</b>
2	<b>PHASE PROTECTION RELAY</b>
3	<b>START STOP SAFETY RELAY</b>

### 1 START UP SYSTEM

For start up press the start up button located in the crane control panel  
This operation can only be done if:

- Power supply isolating switches are in "On" position "I".  
Existen dos seccionadores en la grúa:
  - In cabinet at crane foot
  - On door of top electrical cabinet.
- Emergency stop pushbuttons must be unlocked.  
There are three emergency stop pushbuttons:
  - In crane control panel
  - Outside the electrical cabinet
  - Near trolley mechanism

! The two latter pushbuttons are provided in case they are needed during crane erection and maintenance operations

- Power supply phase sequence must be correct.  
See phase protection relay in this chapter.
- A permissive start up signal is given by the safety relay as a function of a number of external conditions.  
See start stop safety relay in this chapter.

In case the permissive signal is present, pressing the start pushbutton entails the connection of the main switch in electrical cabinet (power and control), the crane being ready for operation.

### 2 PHASE PROTECTION RELAY

(Refer to electrical diagram RCF)

OPERATION DESCRIPTION	
Three phase grid phase sequence is controlled by this relay.	
Failure of one or more phases is detected by this relay.	
Connections	Power supply.....L1, L2, L3 Relay output.....11-14



<b>DISPLAY AND OPERATION</b>	
AMBER LED ON	Phase sequence O.K.
	Three phases connected.
	Relay connected.
	Main switch connects when pressing start, the crane being operative.
AMBER LED OFF	Incorret phase sequence.
	At least one phase not connected.
	Cranne cannot operate.
	Main switch would not connect when pressing start. <b>Swap two phases of crane power supply strip.</b>

<b>TROUBLE SHOOTING</b>	
<b>Anomaly Symptom</b>	<b>Cause/Solution</b>
Main switch would not connect with crane powersupplied and start button pressed.  AMBER relay pilot off. .	Power supply phase sequence wrong. (this will reverse movement direction)
	At least one supply phase failed.
	<b>Swap two phases of power supply.</b>  <b>Check likely phase connection failure</b>
No crane movement is possible. Any movement operating is stopped automatically via a controlled stop. The amber light on the relay is off	Loss of at least 1 phase of power supply, so relay cuts in.
	Check likely supply phase failure.

3 start stop safety relay  
(Refer to electrical diagram RSM)

<b>OPERATION DESCRIPTION</b>	
Emergency stop mushroom button operative state is controlled by this relay.	
Control and stop circuit failures are controlled by this relay.	
Connections	<ul style="list-style-type: none"> <li>- 24 V a.c. supply.....A1, A2</li> <li>- Stop circuit A.....S11, S12</li> <li>- Stop circuit B.....S21, S22</li> <li>- Start.....S12, S39</li> <li>- Relay K1 output.....13, 14</li> <li>- Relay K2 output.....23, 24</li> <li>- Bridge between.....13, 23</li> </ul>

<b>DISPLAY AND OPERATION</b>	
Yellow led A1 / A2 on.	24 V a.c. supply O.K.
Yellow led K1 on	Stop circuit A, O.K. Relay 1 O.K
Yellow led K2 on.	Stop circuit B, O.K Relay 2 O.K
Yellow led A1 / A2 off.	24 V a.c. supply wrong. No voltage.
Yellow led K1 off.	Stop circuit A, open. Relay 1 wrong.
Yellow led K2 off.	Stop circuit B, open. Relay 2 wrong.

<b>TROUBLE SHOOTING</b>	
<b>Anomaly / Symptom</b>	<b>Cause / Solution</b>
Yellow led A1 / A2 off.	24 V a.c. supply wrong No voltage between A1, A2 If voltage O.K. relay faulty, change relay.
Yellow led K1 off	Stop circuit A open. Bridge S11, S12, if led lights up, check stop circuit A. Relay 1 wrong. If it does not light up, relay faulty, change relay.
Yellow led K2 off.	Stop circuit B open Bridge S21, S22, if led lights up, check stop circuit B. Relay 2 wrong. If it does not light up, relay faulty, change relay.

## 0 CONTENTS

1	SYSTEM DESCRIPTION
2	POWER BLOCK BPR10
3	OPERATING TABLES

## 1 SYSTEM DESCRIPTION

Travelling is accomplished by two squirrel cage electric motors.

Travelling is extremely smooth both during acceleration and deceleration stages.

There are two travelling speeds for each direction. For this purpose, the most adequate stator voltage values are selected. The special motor design philosophy enables a very low first speed without excessive heating.

Command signals from the operator cab are adequately controlled through switchgear. This way the following functions are obtained:

- progressive speed change, attaining an exceptionally smooth travelling acceleration.
- protection against a sudden change in travelling direction from the controls.
- adjustment of first speed value
- brake action through injection of direct current into the motors and later actuation of yard electromechanical brakes.
- adjustment of travel braking torque value.

Switchgear and power are protected by magnetic thermal relays.

Crane movement is prevented through motor electromechanical brake. The brake is actuated when the crane comes to rest.

An intermittent sound alarm situated at the base of the crane is activated when a travel movement is carried out, to warn personnel in the immediate vicinity.

## 2 POWER BLOCK BRP10

### 2.1 Description

- The power block supplies different voltage values to motor stators as a function of crane operator commands
- A reduced voltage value is supplied for the first speed and a full grid voltage is supplied for the fast speed.

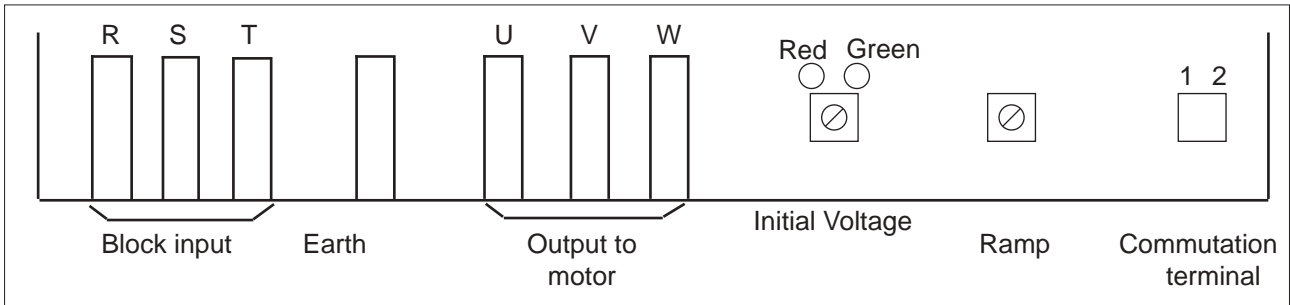
### 2.2 Safety

- Temperature limiter  
If the electronic board temperature is above a safety limit, the motor power supply from the power block is interrupted.
- Input phase failure.  
The motor power supply from the power block is interrupted
- The card is provided with two indicating Leds:
  - Green led:
    - Continuous = operating
    - Intermittent = reverse operation
    - Off = one phase missing in input supply
  - Red led:
    - Off = normal operation
    - Continuous = input supply phase failure
    - Intermittent = temperature limit

**2.3 Regulation.**

The block controls two parameters:

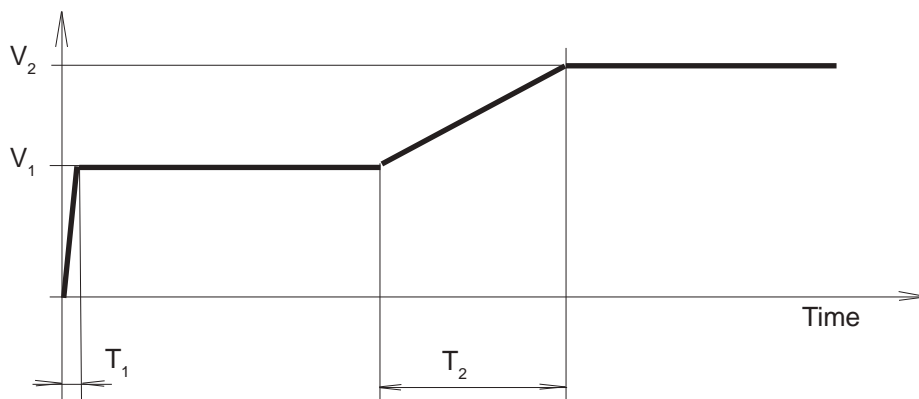
- Motor stator voltage supply.
- Acceleration ramp during fast speed change.



POT1 Controls stator supply voltage value for first speed and consequently the motor torque at this speed.  
Less voltage (less motor torque)  
More voltage (more motor torque)

POT2 Changes the voltage ramp value when changing from first speed low value to fast speed grid rated voltage.

Output voltage



- V1 = Low value (first speed). Controlled by POT1
- V2 = Grid rated voltage
- T1 = First speed setup time (fixed and very low value)
- T2 = Ramp time for grid rated voltage setup. Controlled by POT2.



**Potentiometers POT1 & POT2 are adjusted at the factory to optimum values for the specific crane.**

**If it should be required, adjustment can be carried out being fully aware of what is being done and its consequences. Please contact the factory before taking action.**

For doing this, the following points must be taken into account:

**POT1** Adjustment must be carried out such that a proper first speed is attained for the site work conditions.

Because of high starting torques and wherefore high mechanism, driving crown and structural stresses, going above 300 V in 400 V 50 Hz grids or 360 V in 480 V 60 Hz is not recommended.

**POT2** Makes change to fast speed more progressive.

Adjustment range 0.4 – 8 sec.

Adjusting the potentiometer to middle position is advisable.

### 3 OPERATION TABLES

Control position	Contactor state							Terminals in BPR10 (1)		
	TAD	TAT	2T	FT	TT	DT	FTD	1-2	R-S-T	U-V-W
At rest	--	--	--	--	--	X	--	NO	--	--
Forward travel 1	X	--	--	X	X	X	--	NO	400 Vac	200-300 Vac
Forward travel 2	X	--	X	X	X	X	--	NC	400 Vac	400 Vac
During braking towards zero (2)	--	--	--	X	X	X	X	NO	--	--
Travel backward 1	--	X	--	X	X	X	--	NO	400 Vac	
Travel backward 2	--	X	X	X	X	X	--	NC	400 Vac	400 Vac
(1) Output to motor U-V-W can be adjusted through block BPR10										
(2) Changing the control to zero causes travel braking through the current injection into the motor stator during time lapse TT. When this time is over, the injection is terminated (FTD = OFF) and the electro-mechanical brake is actuated (FT = OFF). Braking intensity can be varied through operating on transformer output to braking rectifier RTT. The higher the voltage the higher the braking intensity										
Contactors X = energized Ñ = rest						1-2 (BPR10) NO = Normally open NC = Normally closed				

## 0 CONTENTS

<b>1</b>	<b>DESCRIPTION OF SYSTEM</b>
<b>2</b>	<b>BCR30 CONTROL CARD</b>
<b>3</b>	<b>BPR POWER BLOCK</b>
<b>4</b>	<b>OPERATING TABLES</b>

### 1 DESCRIPTION OF THE SYSTEM

Travelling movement is effected by several resistive rotor motors in short circuit with decelerator (eddy-current brake). The motors drive through speed reducing gearboxes which, in turn, drive the travelling boogies. Movement is very smooth during both acceleration and deceleration.

There are three speeds in either direction. The most suitable values for stator supply and decelerator voltages are selected to achieve this. The special concept of the motors allows a really reduced first speed without the need for high braking values, thereby avoiding excessive heating.

The control signals from the crane operator's control are received in the BCR30 control card, which governs both the power stages of the motors, control gear and BPR power blocks, as well the decelerators and electromechanical parking brakes.

The following functions are possible as a result:

- gradual shift between speeds, producing a high degree of smoothness during acceleration
- protection against a sharp reversal in operating direction from the control
- adjustment of first speed value
- adjustment of second speed value
- movement braking via supply to decelerator and subsequent actuation of electromechanical parking brake
- adjustment of movement braking torque value
- protection against supply phase fault

Power and control gear are protected by magneto-thermal relays.

Movement is blocked by electromechanical brakes located in the motors. These brakes are actuated once movement has been stopped by the motor decelerator braking. In case of need, there is a pushbutton to actuate the brakes.

Both mechanical and electrical design is strong and simple.

While transfer movement is taking place an alarm siren at the foot of the crane sounds intermittently to warn anyone in the vicinity.

## 2 BCR30 CONTROL CARD

### 2.1 Description.

This card receives the signals from the operators' control and provides suitable supplies to the motor stator and for decelerator braking.

It covers the following functions:

- Supply for decelerator braking, depending on the speed selected by the operator.
- Control of the BPR power changer for supply of the motor stator.
- Timing, steps between speeds.
- Intelligent anti-reverse protection, distinguishing the speed point from when reverse starts.
- Timing the actuation of the motor's electromechanical brake.

The BCR30 card can control one or several "BPR" power blocks, depending on the number of motors involved in a movement.

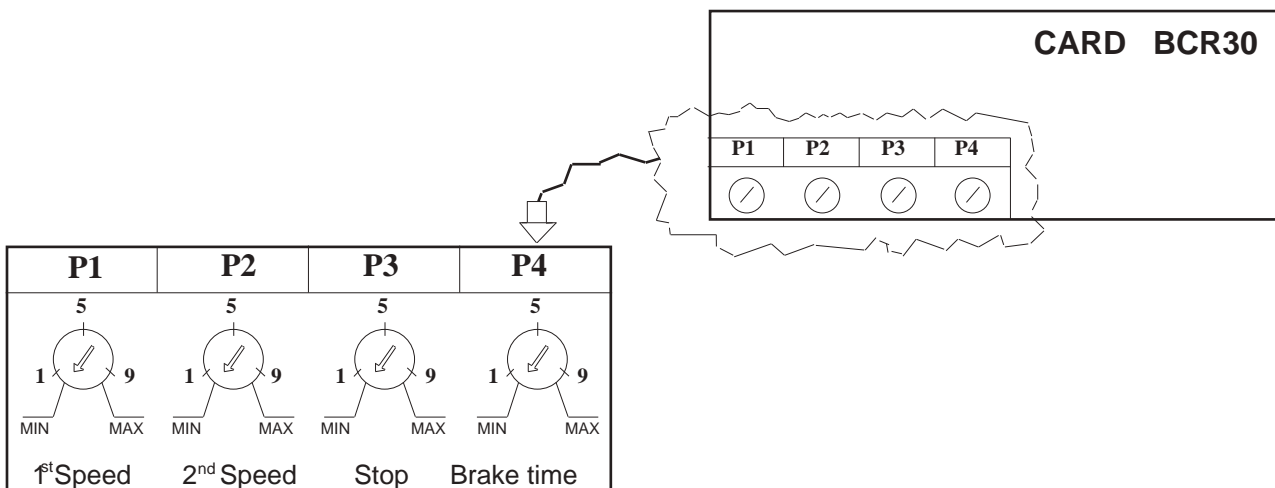
### 2.2 Safety devices

- Thermal limitation.  
If the temperature of the electronic circuit exceeds a certain safety level, then the maximum voltage which may be supplied for decelerator braking is reduced to 10 Vdc.
- Incorrect control.  
If the card receives commands to operate in both directions, no output will be produced, and the slewing system will remain at rest.
- The card incorporates a green indicator Led:  
On (steady) = normal operation.  
Flashing = operation with thermal limitation.  
Off = failure of supply to card.

### 2.3 Regulation.

The system includes the facility to set four parameters, each with its own potentiometer located in the "BCR30" control card.

See P1-P2-P3- y P4 in the figure below:



- P1** "1 Speed." controls the first movement speed.  
"MAX" means higher deceleration braking, and therefore lower speed.  
Decelerator output between 3 and 15 Vdc (10 Vdc in the event of thermal limitation).
- P2** "2 Speed" controls the second movement speed.  
As in P1, "MAX" means higher deceleration, i.e. lower speed.  
Decelerator output between 0 and 6 Vdc.
- P3** "Stop" controls the progressiveness of dynamic movement braking.  
"MAX" means higher deceleration, and therefore higher braking.  
Decelerator output between 3 and 15 Vdc (10 Vdc in the event of thermal limitation).
- P4** "Brake time" controls the time for each actuation of the electromechanical brake.  
"MAX" means greater time.  
Electromechanical brake actuation time between 2 and 20 sec.



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The potentiometers P1, P2, P3, P4 are adjusted at the COMANSA factory to the theoretically ideal average values for the crane in question.  
Should adjustment be considered necessary, this should be carried out with full knowledge of the procedure and its consequences. Do not hesitate to consult with the factory.

---

In any event the following considerations should be borne in mind:

**first speed (P1)**

It is not a good idea for this to be very short (high deceleration), especially if use is to be frequent and held, as motor cooling may not be sufficient.  
Neither should it be too long (low deceleration), as this would reduce the precision of short travelling movements.

**second speed (P2)**

This should not be very long (low or nil braking), as the third speed point would not be distinguished.

**dynamic braking (P3)**

A balance should be reached where movement braking as the joy-stick passes zero does not cause shocks to the crane structure (excessive braking), but neither should it be too long (low braking), leading to a reduction in crane precision during use.

As a general rule, stopping all movement when passing zero from maximum speed should take place within a period of between 5 and 8 seconds.

**electromechanical brake actuation time (P4)**

The electromechanical brake incorporated in the motor must always operate once movement of the motor has been stopped by dynamic braking. If not, roughness in the crane would be the logical results.

This system incorporates a pushbutton in the operator's control to brake movement. The button cancels the delay in the actuation of the electromechanical brake, and may be used, for example, to lock crane travelling once it has already been stopped by dynamic braking, and there is a strong wind prevailing.



### 3 BPR POWER BLOCK

#### 3.1 Description.

- The power block supplies different voltage values to the motor stator depending on the commands it receives from the BCR30 control block.
- In the first speeds, it provides the motor with a reduced supply voltage, while in fast speed it supplies the motor with the rated mains voltage.
- Each motor is governed by a power block.

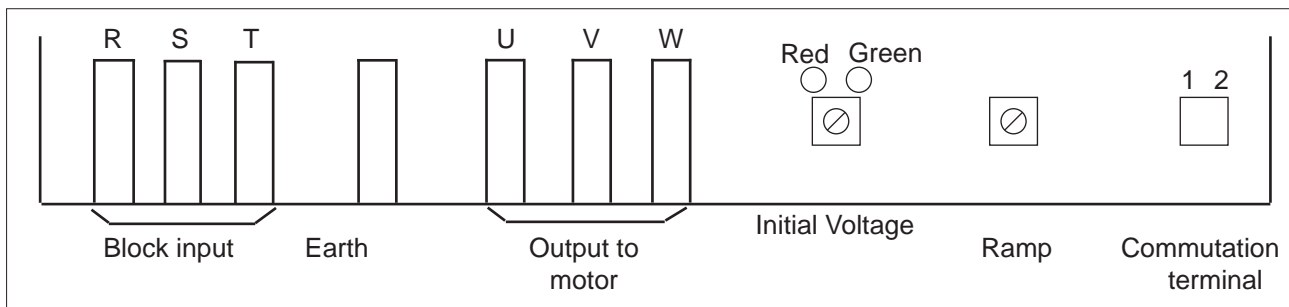
#### 3.2 Safety devices.

- Thermal limitation.  
If the temperature of the electronic circuit exceeds a certain safety level, the block stops supplying the motor.
- Input phase fault.  
The block stops supplying the motor.
- The card incorporates two indicator Leds:
  - + Green led:
    - On (steady) = normal operation.
    - Flashing = operation in reverse direction
    - Off = phase fault in supply input.
  - + Red led:
    - Off = normal operation.
    - On (steady) = phase fault in supply input.
    - Flashing = thermal limitation.

#### 3.3 Regulation.

The block can regulate two parameters:

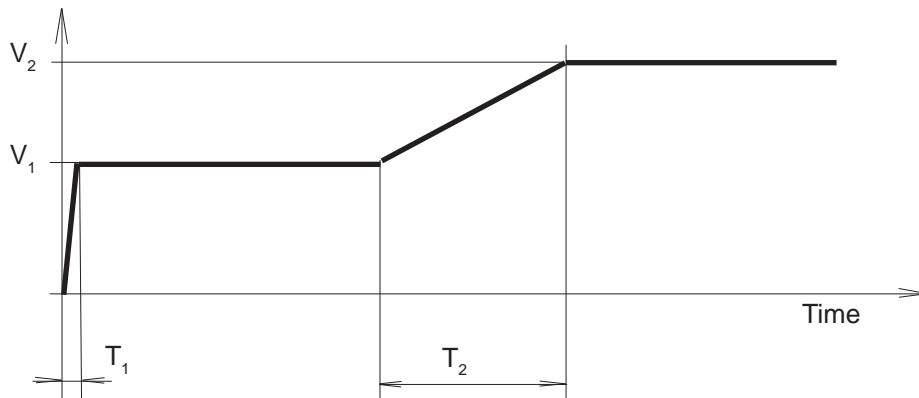
- Motor stator supply voltage.
- Acceleration ramp in step to fast speed.



POT1 Controls the value of stator supply voltage in the first speeds, and therefore the torque applied by the motors at these speeds.  
Less voltage (less motor torque).  
More voltage (more motor torque).

POT2 Changes the value of the voltage ramp in the step between the reduced value of the first speeds and the rated mains voltage corresponding to fast speed.

Output voltage



$V_1$  = Reduced voltage (first speeds). Regulated by POT1.

$V_2$  = Rated mains voltage.

$T_1$  = Time to establish first speeds voltage (fixed and very short value).

$T_2$  = Time for ramp to establish rated mains voltage. Regulated by POT2.



The potentiometers POT1 and POT2 are adjusted at the COMANSA factory to the theoretically ideal average values for the crane in question.

Should adjustment be considered necessary, this should be carried out with full knowledge of the procedure and its consequences. Do not hesitate to consult with the factory.

In any event the following considerations should be borne in mind:

**POT1** This should be set to obtain a good first speed for the working conditions on site. It is inadvisable to exceed 300 V with 400 V 50 Hz mains, or 360 V with 480 V 60 Hz mains, because:

- A greater deceleration is needed to have a small 1st speed.
- Motor consumption, and therefore heating, is greater at low speeds.
- Slewing starting torques are greater, so that the demands on mechanisms, and crane structure are greater.

**POT2** Provides a more progressive step to fast speed.  
Adjustment range 0.4-8 sec.  
It is advisable to locate the potentiometer in middle position.

! Power block output voltage values should be similar, to avoid motors working out of balance.

## 4 OPERATING TABLES

Control position	Contactor status			
	TAD	TAT	FT	RT
Rest	--	--	--	--
Travelling forwards 1	X	--	X	X
Travelling forwards 2	X	--	X	X
Travelling forwards 3	X	--	X	X
During braking (2) on passing zero	--	--	X	X
Travelling back 1	--	X	X	X
Travelling back 2	--	X	X	X
Travelling back 2	--	X	X	X

X = Working  
-- = Rest

( 2) When the joy-stick passes zero, movement is braked by the motor decelerator during the time set in card BCR30. After this time has elapsed, supply to the decelerators is cut off (contactor RG = OFF) and the electromechanical brake is actuated (FG = OFF)

Control position	BCR30 Card terminals												BPR Terminals (1)	
	1-2	1-3	1-4	1-5	1-6	2-7	1-8	1-9	1-10	11-12	13-14	15-16 (1)	R-S-T	U-V-W
Rest	48 Va	--	--	--	--	--	--	--	--	NO	48 Va	(3)	--	--
Travelling forwards 1	48 Va	48 Va	--	--	--	--	48 Va	--	48 Va	NO	48 Va	6-9 Vdc	400 Vac	250-310 Va
Travelling forwards 2	48 Va	48 Va	--	48 Va	--	--	48 Va	--	48 Va	NO	48 Va	0,5-2 Vdc	400 Vac	250-310 Va
Travelling forwards 3	48 Va	48 Va	--	48 Va	48 Va	--	48 Va	--	48 Va	NC	48 Va	--	400 Vac	400 Vac
During braking (2) on passing zero	48 Va	--	--	--	--	--	--	--	48 Va	NO	48 Va	6-9 Vdc	--	--
Travelling back 1	48 Va	--	48 Va	--	--	--	--	48 Va	48 Va	NO	48 Va	6-9 Vdc	400 Vac	250-310 Va
Travelling back 2	48 Va	--	48 Va	48 Va	--	--	--	48 Va	48 Va	NO	48 Va	0,5-2 Vdc	400 Vac	250-310 Va
Travelling back 2	48 Va	--	48 Va	48 Va	48 Va	--	--	48 Va	48 Va	NC	48 Va	--	400 Vac	400 Vac
On pressing travelling brake with control at 0 (4)	48 Va	--	--	--	--	48 Va	--	--	--	NO	48 Va	(3)	--	--

( 1) Voltage values for the decelerator and motor may be adjusted via card BCR30 and block BPR respectively

( 2) When the joy-stick passes zero, movement is braked by the motor decelerator during the time set in card BCR30. After this time has elapsed, supply to the decelerators is cut off and the electromechanical brake is actuated

( 3) If the decelerator circuit is not under load, the voltage reading on the direct current side (terminals 15-16) is not significant.

( 4) The travelling brake pushbutton cancels timing of the electromechanical brake actuation when the joy-stick is a rest.

<b>0</b>	<b>CONTENTS</b>
<b>1</b>	<b>DESCRIPTION OF SYSTEM</b>
<b>2</b>	<b>BCR30 CONTROL CARD</b>
<b>3</b>	<b>BPR POWER BLOCK</b>
<b>4</b>	<b>OPERATING TABLES</b>

## **1 DESCRIPTION OF THE SLEWING SYSTEM**

Slewing movement is effected by one or more resistive rotor motors in short circuit with decelerator (eddy-current brake). The motors drive through speed reducing gearboxes which, in turn, drive the slewing ring. Movement is very smooth during both acceleration and deceleration.

There are three speeds in either direction. Mechanisms governed by the pushbutton unit have two speeds, the intermediate speed being a step prior to maximum speed. The most suitable values for stator supply and decelerator voltages are selected to achieve this. The special concept of the motors allows a really reduced first speed without the need for high braking values, thereby avoiding excessive heating.

The control signals from the crane operator's control are received in the BCR30 control card, which governs both the power stages of the motors, control gear and BPR power blocks, as well the decelerators and electromechanical parking brakes.

The following functions are possible as a result:

- gradual shift between speeds, producing a high degree of smoothness during acceleration
- protection against a sharp reversal in operating direction from the control
- adjustment of first speed value
- adjustment of second speed value
- movement braking via supply to decelerator and subsequent actuation of electromechanical parking brake
- adjustment of movement braking torque value
- protection against supply phase fault

Power and control gear are protected by magneto-thermal relays.

Movement is blocked by electromechanical brakes located in the motors. These brakes are actuated once movement has been stopped by the motor decelerator braking. In case of need, there is a pushbutton to actuate the slewing brake.

Weather vaning is carried out remotely from the crane operator's control, and may be effected manually in the event of a power cut.

Both mechanical and electrical design is strong and simple.

## **2 BCR30 CONTROL CARD.**

### **2.1 Description.**

This card receives the signals from the operator's control and provides suitable supplies to the motor stator and for decelerator braking.

It covers the following functions:

- Supply for decelerator braking, depending on the speed selected by the operator.
- Control of the BPR power changer for supply of the motor stator.
- Timing, steps between speeds.
- Intelligent anti-reverse protection, distinguishing the speed point from when reverse starts.
- Timing the actuation of the motor's electromechanical brake.

The BCR30 card can control one or several "BPR" power blocks, depending on the number of motors involved in a movement.

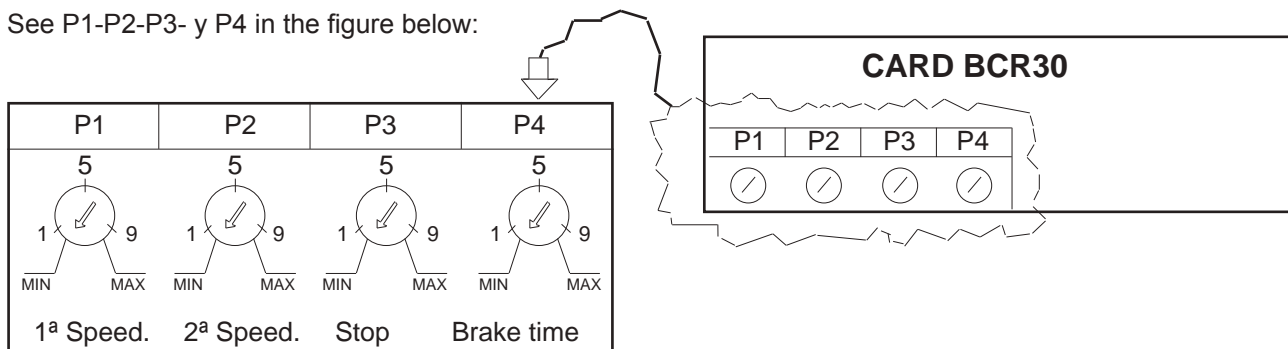
## 2.2 Safety devices

- Thermal limitation.  
If the temperature of the electronic circuit exceeds a certain safety level, then the maximum voltage which may be supplied for decelerator braking is reduced to 10 Vdc.
- Incorrect control.  
If the card receives commands to operate in both slewing directions, no output will be produced, and the slewing system will remain at rest.
- The card incorporates a green indicator Led:  
On (steady) = normal operation.  
Flashing = operation with thermal limitation.  
Off = failure of supply to card.

## 2.3 Regulation.

The system includes the facility to set four parameters, each with its own potentiometer located in the "BCR30" control card.

See P1-P2-P3- y P4 in the figure below:



- P1 "1 Speed." controls the first movement speed.  
"MAX" means higher deceleration braking, and therefore lower speed.  
Decelerator output between 3 and 15 Vdc (10 Vdc in the event of thermal limitation).
- P2 "2 Speed" controls the second movement speed.  
As in P1, "MAX" means higher deceleration, i.e. lower speed.  
In 2-speed mechanisms, this point is the step prior to maximum speed).  
Decelerator output between 0 and 6 Vdc.
- P3 "Stop" controls the progressiveness of dynamic movement braking.  
"MAX" means higher deceleration, and therefore higher braking.  
Decelerator output between 3 and 15 Vdc (10 Vdc in the event of thermal limitation).
- P4 "Brake time" controls the time for each actuation of the electromechanical brake.  
"MAX" means greater time.  
Electromechanical brake actuation time between 2 and 20 sec.



**The potentiometers P1,P2,P3,P4 are adjusted at the COMANSA factory to the theoretically ideal average values for the crane in question.  
Should adjustment be considered necessary, this should be carried out with full knowledge of the procedure and its consequences. Do not hesitate to consult with the factory.**

In any event the following considerations should be borne in mind:

### firt speed (P1)

It is not a good idea for this to be very short (high deceleration), especially if use is to be frequent and held, as motor cooling may not be sufficient. Neither should it be too long (low deceleration), as this would reduce the precision of short slewing movements.

### second speed (P2)

This should not be very long (low or nil braking), as the third speed point would not be distinguished. (In 2-speed mechanisms, this point is the step prior to maximum speed).

### dynamic braking (P3)

A balance should be reached where movement braking as the joy-stick passes zero does not cause shocks to the crane structure (excessive braking), but neither should it be too long (low braking), leading to a reduction in crane precision during use. As a general rule, stopping all movement when passing zero from maximum speed should take place within a period of between 5 and 8 seconds.

### electromechanical brake actuation time (P4)

The electromechanical brake incorporated in the motor must always operate once movement of the motor has been stopped by dynamic braking. If not, roughness in the crane and load swinging would be the logical results.

- ! This system incorporates a pushbutton in the operator's control to brake movement. The button cancels the delay in the actuation of the electromechanical brake, and may be used, for example, to lock crane slewing once it has already been stopped by dynamic braking, and there is a strong wind prevailing.

## 3 BPR POWER BLOCK.

### 3.1 Description.

- The power block supplies different voltage values to the slewing motor stator depending on the commands it receives from the BCR30 control block.
- In the first speeds, it provides the motor with a reduced supply voltage, while in fast speed it supplies the motor with the rated mains voltage.
- Each motor is governed by a power block.

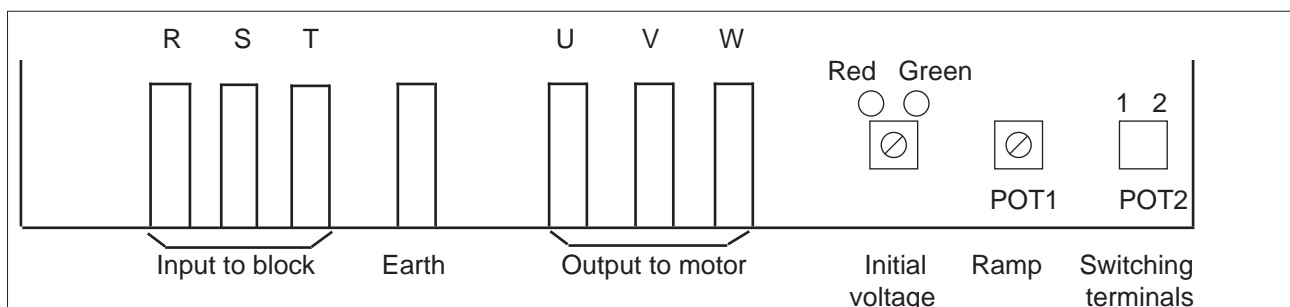
### 3.2 Safety devices.

- Thermal limitation.  
If the temperature of the electronic circuit exceeds a certain safety level, the block stops supplying the motor.
- Input phase fault.  
The block stops supplying the motor.
  - The card incorporates two indicator Leds:
  - + Green led:
    - On (steady) = normal slewing operation.
    - Flashing = slewing operation in reverse direction
    - Off = phase fault in supply input.
  - + Red led:
    - Off = normal operation.
    - On (steady) = phase fault in supply input.
    - Flashing = thermal limitation.

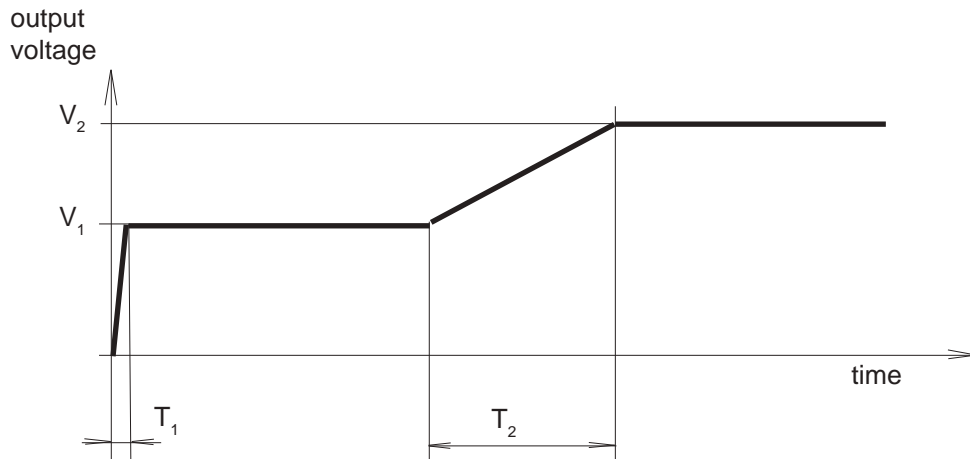
### 3.2 Regulation.

The block can regulate two parameters:

- Motor stator supply voltage.
- Acceleration ramp in step to fast speed.



- POT1 Controls the value of stator supply voltage in the first speeds, and therefore the torque applied by the slewing motors at these speeds.  
Less voltage (less motor torque).  
More voltage (more motor torque).
- POT2 Changes the value of the voltage ramp in the step between the reduced value of the first speeds and the rated mains voltage corresponding to fast speed.



$V_1$  = Reduced voltage (first speeds). Regulated by POT1.

$V_2$  = Rated mains voltage.

$T_1$  = Time to establish first speeds voltage (fixed and very short value).

$T_2$  = Time for ramp to establish rated mains voltage. Regulated by POT2.



**The potentiometers POT1 and POT2 are adjusted at the COMANSA factory to the theoretically ideal average values for the crane in question.**

**Should adjustment be considered necessary, this should be carried out with full knowledge of the procedure and its consequences. Do not hesitate to consult with the factory.**

In any event the following considerations should be borne in mind:

- POT1 This should be set to obtain a good first speed for the working conditions on site.  
It is inadvisable to exceed 300 V with 400 V 50 Hz mains, or 360 V with 480 V 60 Hz mains, because:
- A greater deceleration is needed to have a small 1st slewing speed.
  - Motor consumption, and therefore heating, is greater at low speeds.
  - Slewing starting torques are greater, so that the demands on mechanisms, slewing ring and crane structure are greater.
- POT2 Provides a more progressive step to fast speed.  
Adjustment range 0.4-8 sec.  
It is advisable to locate the potentiometer in middle position.

! Power block output voltage values should be similar for cranes with more than one slewing mechanism, to avoid motors working out of balance.

## 4 OPERATING TABLES

Control position	Contactor status			
	GI	GD	FG	RG
Rest	--	--	--	--
Left slew 1	X	--	X	X
Left slew 2	X	--	X	X
Left slew 3	X	--	X	X
During braking (2) on passing zero	--	--	X	X
Right slew 1	--	X	X	X
Right slew 2	--	X	X	X
Right slew 3	--	X	X	X

X = Working  
-- = Rest

(2) When the joy-styck passes zero, movement is braked by the motor decelerator during the time set in card BCR30. After this time has elapsed, supply to the decelerators is cut off (contactor RG = OFF), and the electromechanical brake is actuated (FG = OFF).

Control position	BCR30 Card terminals												BPR terminals (1)	
	1-2	1-3	1-4	1-5	1-6	2-7	1-8	1-9	1-10	11-1	13-1	15-16 (1)	R-S-T	U-V-W
Rest	48 Va	--	--	--	--	--	--	--	--	NO	48 Va	(3)	--	--
Left slew 1	48 Va	48 Va	--	--	--	--	48 Va	--	48 Va	NO	48 Va	6-9 Vdc	400 Vac	250-310 Va
Left slew 2	48 Va	48 Va	--	48 Va	--	--	48 Va	--	48 Va	NO	48 Va	0,5-2 Vdc	400 Vac	250-310 Va
Left slew 3	48 Va	48 Va	--	48 Va	48 Va	--	48 Va	--	48 Va	NC	48 Va	--	400 Vac	400 Vac
During braking (2) on passing zero	48 Va	--	--	--	--	--	--	--	48 Va	NO	48 Va	6-9 Vdc	--	--
Right slew 1	48 Va	--	48 Va	--	--	--	48 Va	48 Va	NO	48 Va	48 Va	6-9 Vdc	400 Vac	250-310 Va
Right slew 2	48 Va	--	48 Va	48 Va	--	--	48 Va	48 Va	NO	48 Va	48 Va	0,5-2 Vdc	400 Vac	250-310 Va
Right slew 3	48 Va	--	48 Va	48 Va	48 Va	--	48 Va	48 Va	NC	48 Va	48 Va	--	400 Vac	400 Vac
On pressing slewing brake with control at 0 (4)	48 Va	--	--	--	--	48 Va	--	--	--	NO	48 Va	(3)	--	--

NO = Contact open  
NC = Contact closed

(1) Voltage values for the decelerator and motor may be adjusted via card BCR30 and block BPR respectively

(2) When the joy-styck passes zero, movement is braked by the motor decelerator during the time set in card BCR30. After this time has elapsed, supply to the decelerators is cut off and the electromechanical brake is actuated.

(3) If the decelerator circuit is not under load, the voltage reading on the direct current side (terminals 15-16) is not significant

(4) The slewing brake pushbutton cancels timing of the electromechanical brake actuation when the joy-stick is at rest

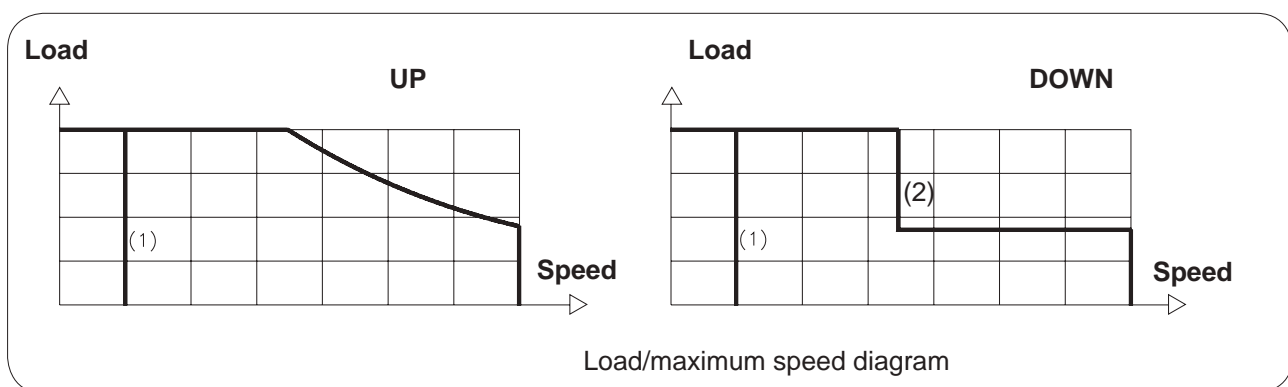


**0 CONTENTS**  
**1 DESCRIPTION OF OPERATION**  
**2 LIMITATIONS ON MOVEMENT**  
**3 TROUBLESHOOTING**

**1 DESCRIPTION OF OPERATION**

Winch movement is governed by the frequency inverter to provide completely progressive motion, free from sudden changes in speed, and in accordance with the command given by the crane operator's control sender. The control has 4 stepped speed points from minimum to maximum permitted speed, depending on hook position and load demand on the crane at that particular moment. (See load/speed diagrams).

As the hook approaches the end of travel, the maximum hoisting speed is automatically reduced (fast speed pre-limitation).



- (1) Mechanism on pre-limiting of high speed status or in positioning mode  
(2) Limitation of load/ fast descent speed or moment limiter engaged

**smoothness and safety of electromagnetic brake operation**

The inverter controls the opening and closing of the electromagnetic holding brake.

At the start of the movement, the brake is only open if the inverter has checked that sufficient torque is being delivered to the motor. The brake is actuated at zero speed, avoiding possible jerkiness arising out of brake operation. At the end of the movement, the inverter reduces the speed of the mechanism until it is practically zero, and at this moment it instructs the brake to operate.

As it is a holding brake and not a working brake, wear on the brake and therefore maintenance are minimal. In spite of the above, emergency stops made by the crane operator from the control, or protective tripping of the frequency inverter mean that the brake has to operate with a moving load, and if this occurs with a certain frequency the brakes must be checked to ensure correct operation. (See brake adjustment instructions).

**operating modes**

The mechanism has two operating modes:

- normal
- positioning

Positioning mode allows high precision at low hoisting speeds. Selecting positioning mode reduces the maximum speed and automatically steps the 4 speed points down to this new value.

Changes in operating mode (normal to positioning or vice versa) may be made during hoisting with no problem whatsoever.

## 2 LIMITATIONS ON MOVEMENT

The following limiters can act on the hoisting system.

- Hoisting limit switch.  
 Four (4) limiter microswitches
  - Rapid ascent (LSR).  
 This reduces the range of speeds before final ascent limitation is reached.
  - Ascent (LS).  
 This halts the upward movement of the hook.
  - Rapid descent (LBR).  
 This reduces the range of speeds before final descent limitation is reached.
  - Descent (LB)  
 This halts the downward movement of the hook.
- Maximum load (LC) and maximum moment (JM) limiters.  
 These prevent upward movement.
- High speed descent load limiter (LCR).  
 This reduces the range of speeds during hook descent.

## 3 TROUBLESHOOTING

### use of frequency inverter terminals

L1-L2-L3	Input terminals (Inverter supply).
U-V-W	Output terminals (Motor supply).
++/PB	Output for discharge resistance of direct BUS.
T1-T2	Motor thermal probe connection.
24-26	Inverter fault relay contact.
10-11	Logic inputs for speed selected on control.
12-13	Inputs for maximum and positioning speed limitation value.
14	Input hook direction up.
15	Input hook direction down.
18	Output motor brake control.
22	(0 V)
20	Electrical supply for external entries (24 V).
16	Input for inverter enable.
17	Input for inverter reset.

### display messages

When the inverter is supplied in a normal situation, the display can show:

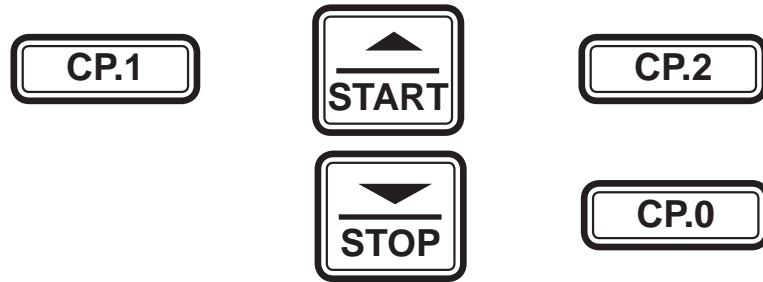
<b>LS</b>	The inverter is ready to work. There is no Start command from the crane operator's control.
<b>A numerical value</b>	The inverter is working. It shows the frequency of the output signal (motor supply).
<b>noP</b>	The inverter is not enabled for working, and therefore does not respond to control commands. Check supply terminal 16.
<b>E....</b>	Shows the inverter trip code. The inverter cannot be switched on without pressing the RESET button in the electrical cabinet and shifting to LS on the display (See trip code table).

### screen in CP mode

The inverter display may show information other than the above which can be of use during operation. When voltage is supplied to the inverter, the value of parameter CP.1 appears on screen. The function key (FUNC) is used to change from parameter value to parameter number and vice versa.



The UP ( ▲ ) and DOWN ( ▼ ) keys are used to increase or decrease the parameter number or parameter value.



A total of 25 CP parameters may be displayed.  
They are:

CP parameter	Parameter	Description
0	ud1	Password input
1	ru3	Actual frequency display
2	ru1	Set frequency display
3	ru0	Inverter status display
4	ru15	Aparent current
5	ru16	Aparent current/Peak value
6	ru13	Utilization
7	ru18	Intermediate circuit voltage
8	ru19	Intermediate circuit voltage/Peak value
9	ru20	Output voltage
10	ru38	Power module temperature
11	ru14	Peak utilization
12	ru26	Active parameter set
13	ru40	Power on counter
14	in26	EOC Error counter
15	in27	EOL Error counter
16	in28	EOP Error counter
17	in29	EOH Error counter
18	in30	EOHI Error counter
19	in01	Rated inverter current
20	in06	Software version
21	in10	Serial no.(date)
22	in11	Serial no. (counter)
23	in22	User parameter 1
24	in23	User parameter 2
25	ru41	Modulation on counter
26	ru16	Peak aparent current
27	ru17	Active current
28	ru21	Input terminal state
29	ru25	Output terminal state
30	ru39	OL counter display
31	in00	Inverter type
32	in25	Error diagnosis

### inverter trip codes

Error messages appear on screen with a flashing E—. Error codes, together with possible causes and solutions, are given later.

There are two ways of resetting the inverter:

- Press the reset button in the electrical cabinet.
- Press Crane Stop press Start.

If this happens, the stop-start sequence must be repeated.

In any case, when the inverter trips off it is a good idea to note down the on-screen message and check the cause.



Consecutive trips with a high frequency may cause excessive wear of the motor brake and a loss in braking torque.

### Trip due to load racing.

The crane is fitted with a safety system to guard against the load racing if the frequency converter malfunctions.

A speed detector in the hoisting mechanism shaft sends the speed signal to a programmable automaton (AEQ - in the hoisting cabinet), so that hoisting is locked if the speed is higher than it should be for the under-hook load.

If the safety system goes off, the reset button before mentioned has to be pressed in order to start again.



The load limiter system must be correctly adjusted for the safety system to be able to work effectively.

	FAULT	EXPLANATION	CAUSE	SOLUTION
E.UP	- Low voltage	- Appears when the supply voltage is lower than the permissible limit (voltage equal to or less than 305 V)	- Unstable supply voltage - Failure of a supply phase - Volt drop due to losses in cables	- Check wiring - Check supply voltage
E.OP	- Overvoltage	- Appears when the intermediate circuit voltage is higher than the maximum permissible limit (800 Vdc)	- Supply voltage too high - Voltage spikes or disturbances in supply lines - Braking transistor fault - Braking resistance fault	- Check supply voltage - Check dynamic braking resistance
E.OC	- Overcurrent	- Appears when the current momentarily exceeds the present value (180-200 % of rated current depending on size of equipment)	- Shortcircuit or earth fault in motor or motor supply line - Excess motor load (peak). - Transistor shortcircuit	- Check motor wiring and possible by-path - Check hoisting load - If E.OC fault is repeated without load, replace inverter
E.OL	- Overload	- Appears when output current exceeds equipment safety values for a determined time. E.g. 150 % for over 30 sec. 130 % for over 2 min. Etc.	- Overload in hoisting weights - Mechanical overload, motor overstressed - Motor locked / seizure	- Check mechanical variables: load, possible locking etc.
E.nOL	- Indicates end of overload	- Appears when system cooling time has elapsed. Any E.OL fault needs a waiting time before E.nOL appears	- E.OL fault	- Reset inverter when E.nOL appears on screen
E.OH	- Converter overheating	- Appears when the inverter radiator temperature exceeds 70°C	- Ambient temperature too high - Inverter cooling not working or obstructed	- Check electrical cabinet cooling - Check inverter cooling
E.dOH	- Motor overheating	- Appears when the motor probe switches or its value is higher than 1650 Ohm	- Broken probe cable - Motor temperature too high	- Check thermal probe resistance - Check motor.

	FAULT	EXPLANATION	CAUSE	SOLUTION
<b>E.nOH</b>	- Indicates end of overheating	- Appears when the inverter or motor temperature error has disappeared	- Inverter temperature has stabilised - Motor probe value returns to below 500 Ohm	- Reset inverter when E.nOH appears on screen
<b>E.LSF</b>	- Load resistance error	- Appears when the inverter load resistance is not connected	- Supply voltage unstable or low - Braking resistance cut off or badly connected - Defective braking module	- Check braking resistance - Check supply voltage
<b>E.EF</b>	- External fault error	- Appears when the external fault condition is activated	- Disconnection of 2 or more hoist motor power cables	- Check motor wiring
<b>E.UPh</b>	- Loss of one phase at the variator input	- Appears when the variator does not detect all three phases in the power input.	- Wrong power input connection.	- Check power input connections.
<b>E.OHI</b>	- Overheating in the power stage.	- Appears when the power IGBT reaches the maximum working temperature.	- Ambient temperature too high. - Converter cooling not operating or obstructed.	- Check electric cabinet cooling. - Check converter cooling.
<b>E.nOHI</b>	- End of overheating of power stage indication.	- Appears when the cooling period of the IGBT transistors ends. - Any E.OHI failure requires a waiting time until E.nOHI appears.	- E.OHI failure.	- Reset the converter when the E.nOHI appears on the screen.
<b>E.Pu</b>	- Power stage error.	- Appears when the identity of the power circuit is INVALIDATED.	- Equipment malfunction.	- Replace equipment.
<b>E.Puci</b>	- Power stage error.	- Failure in a power stage element.	- Equipment malfunction.	- Replace equipment.
<b>E.Puch</b>	- Power stage error.	- Failure in a power stage element.	- Equipment malfunction.	- Replace equipment.
<b>E.dri</b>	- Error in connection current limiter relay.	- Appears when the connection current limiter circuit does not operate.	- Relay governing this circuit is malfunctioning.	- Remove supply to variator and reconnect several times; replace the equipment if the error is not eliminated.
<b>E.iEd</b>	- Error in self-test.	- Appears in the self-test on connecting and disconnecting the variator.	- The result of the self-test is not satisfactory.	- Replace equipment.
<b>E.br</b>	- Error in brake opening operation.	- Appears when the conditions for brake opening are not reached.	- Failure in any of the motor-supply phases.	- Check continuity from the power circuit, from the variator to the motor.
<b>E.Inl</b>	- Error in the control micro-processor	- Control microprocessor damaged.	- Microprocessor malfunction.	- Replace equipment.

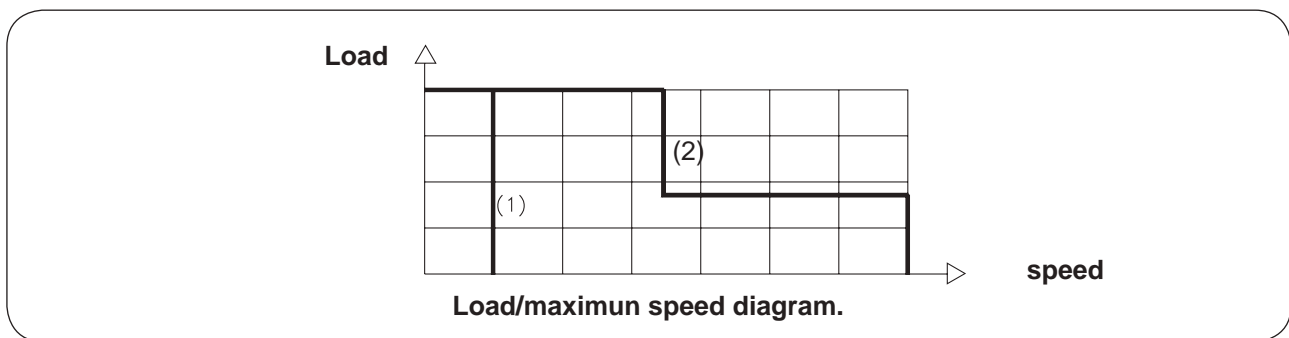
## 0 CONTENTS

- 1 DESCRIPTION OF OPERATION
- 2 LIMITATIONS ON MOVEMENT
- 3 TROUBLES HOOTING

### 1 DESCRIPTION OF OPERATION

Winch movement is governed by the frequency inverter to provide completely progressive motion, free from sudden changes in speed, and in accordance with the command given by the crane operator's control sender. The control has 4 stepped speed points from minimum to maximum permitted speed, depending on trolley position and load demand on the crane at that particular moment. (See load/speed diagrams).

If the crane approaches the limit of its travel or the crane is loaded to more than 90% of the maximum permitted moment maximum speed is automatically curtailed (pre-limiting of fast speed).



- (1) Mechanism in fast speed pre-limitation situation.
- (2) Trolley back movement with load or moment limitation engaged

### smoothness and safety of electromagnetic brake operation

The inverter controls the opening and closing of the electromagnetic load-holding brake.

At the start of the movement, the brake is only open if the inverter has checked that sufficient torque is being delivered to the motor.

The brake is actuated at zero speed, avoiding possible jerkiness arising out of brake operation. At the end of the movement, the inverter reduces the speed of the mechanism until it is practically zero, and at this moment it instructs the brake to operate.

As it is a holding brake and not a working brake, wear on the brake and therefore maintenance are minimal.

### 2 LIMITATIONS ON MOVEMENT

The following limiters act on the trolley system:

- Trolley limit switch.  
Four (4) limiter microswitches.
  - High-speed trolley forward (LCAR).  
This reduces the range of speeds before the limit on trolley forward movement is reached.
  - Trolley forward (LCA).  
This halts the forward movement of the trolley.
  - High-speed trolley back (LCTR).  
This reduces the range of speeds before the limit on trolley backward movement is reached.
  - Trolley back (LCT).  
This halts the backward movement of the trolley.  
The trolley back limit switch can be overridden from the crane controls. In this case, only low speed movement is possible.
- Maximum load limiter (LC) and maximum moment limiter (LM).  
These prevent trolley forward and hook ascent movements.

- Moment limiter 90% (LM2)  
Reduce speed ranges

### 3 TROUBLES HOOTING use of frequency inverter terminals

L1-L2-L3	Input terminals (Inverter supply).
U-V-W	Output terminals (Motor supply).
++/PB	Output for discharge resistance of direct BUS.
T1-T2	Motor thermal probe connection.
24-26	Inverter fault relay contact.
10-11	Entradas logicas para velocidad seleccionada en mando.
12-13	Logic inputs for speed selected on control.
12-13	Inputs for maximum speed limitation value.
14	Input trolley out.
15	Input trolley return.
18	Output motor brake control.
22	(0 V)
20	Electrical supply for external entrys (15 V).
16	Input for inverter enable.
17	Input for inverter reset.

### display messages

When the inverter is supplied in a normal situation, the display can show:

<b>LS</b>	The inverter is ready to work. There is no Start command from the crane operator's control.
<b>A numerical value</b>	The inverter is working It shows the frequency of the output signal (motor supply).
<b>noP</b>	The inverter is not ready to work, and therefore does not respond to control commands. Check supply terminal 16.
<b>E.....</b>	Shows the inverter trip code. The inverter cannot be switched on without pressing the RESET button in the electrical cabinet and shifting to LS on the display (See trip code table).

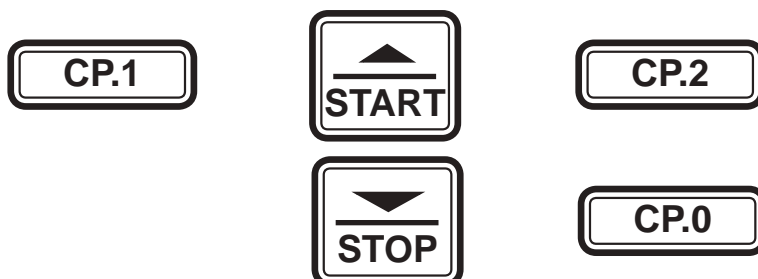
### screen in CP mode

The inverter display may show information other than the above which can be of use during operation. When voltage is supplied to the inverter, the value of parameter CP.1 appears on screen.

The function key (FUNC) is used to change from parameter value to parameter number and vice versa.



The UP (▲) and DOWN (▼) keys are used to increase or decrease the parameter number or parameter value.





A total of 25 CP parameters may be displayed.  
They are:

CP parameter	F5 Parameter	Description
0	ud1	Password input
1	ru3	Actual frequency display
2	ru1	Set frequency display
3	ru0	Inverter status display
4	ru15	Aparent current
5	ru16	Aparent current/Peak value
6	ru13	Actual inverter load
7	ru18	Actual DC voltage
8	ru19	Peak DC voltage
9	ru20	Output voltage
10	ru38	Power module temperature
11	ru14	Load peak
12	ru26	Existing set of parameters
13	ru40	Inverter connection time counter
14	in26	EOC error counter
15	in27	EOL error counter
16	in28	EOP error counter
17	in29	EOH error counter
18	in30	EOHI error counter
19	in01	Rated inverter current
20	in06	Versión Software.
21	in10	Serial no.(date)
22	in11	Serial no. (counter)
23	in22	Code programme installation (1ª message)
24	in23	Code programme installation (2ª message)
25	ru41	Inverter modulation time counter
26	ru16	Peak aparent current
27	ru17	Active current
28	ru21	Input terminal state
29	ru25	Output terminal state
30	ru39	OL counter display
31	in00	Inverter type
32	in25	Error diagnosis

### inverter trip codes

Error messages appear on screen with a flashing E—. Error codes, together with possible causes and solutions, are given on the next page.

There are two ways of resetting the inverter:

- Press the reset button in the electrical cabinet.
- Press the crane stop button, and then the start button after about 10 seconds.

One thing to take into account is that when voltage is removed from the invertors, they enter a period of disconnection when their incorporated capacitors discharge. If the crane start button is pressed during this period, the inverter might not start up properly and may remain in the trip situation. If this happens, the stop-start sequence must be repeated.

In any case, when the inverter trips off it is a good idea to note down the on-screen message and check the cause.

! Consecutive trips with a high frequency may cause excessive wear of the motor brake and a loss in braking torque.



	FAULT	EXPLANATION	CAUSE	SOLUTION
<b>E.UP</b>	- Low voltage	- Appears when the supply voltage is lower than the permissible limit (voltage equal to or less than 305 V)	- Unstable supply voltage - Failure of a supply phase - Volt drop due to losses in cables	- Check wiring - Check supply voltage
<b>E.OP</b>	- Overvoltage	- Appears when the intermediate circuit voltage is higher than the maximum permissible limit (800 Vdc)	- Supply voltage too high - Voltage spikes or disturbances in supply lines - Braking transistor fault - Braking resistance fault	- Check supply voltage - Check dynamic braking resistance
<b>E.OC</b>	- Overcurrent	- Appears when the current momentarily exceeds the present value (180-200 % of rated current depending on size of equipment)	- Shortcircuit or earth fault in motor or motor supply line - Excess motor load (peak). - Transistor shortcircuit.	- Check motor wiring and possible by-path - Check hoisting load - If E.OC fault is repeated without load, replace inverter
<b>E.OL</b>	- Overload	- Appears when output current exceeds equipment safety values for a determined time. E.g. 150 % for over 30 sec. 130 % for over 2 min. Etc.	- Overload in hoisting weights - Mechanical overload, motor overstressed - Motor locked / seizure	- Check mechanical variables: load, possible locking etc.
<b>E.nOL</b>	- Indicates end of overload	- Appears when system cooling time has elapsed. Any E.OL fault needs a waiting time before E.nOL appears	- E.OL fault	- Reset inverter when E.nOL appears on screen
<b>E.OH</b>	- Converter overheating	- Appears when the inverter radiator temperature exceeds 70°C	- Ambient temperature too high - Inverter cooling not working or obstructed	- Check electrical cabinet cooling - Check inverter cooling
<b>E.dOH</b>	- Motor overheating	- Appears when the motor probe switches or its value is higher than 1650 Ohm	- Broken probe cable - Motor temperature too high	- Check thermal probe resistance - Check motor.
<b>E.nOH</b>	- Indicates end of overheating	- Appears when the inverter or motor temperature error has disappeared	- Inverter temperature has stabilised - Motor probe value returns to below 500 Ohm	- Reset inverter when E.nOH appears on screen
<b>E.LSF</b>	- Load resistance error	- Appears when the inverter load resistance is not connected	- Supply voltage unstable or low - Braking resistance cut off or badly connected - Defective braking module	- Check braking resistance - Check supply voltage
<b>E.UPh</b>	- Loss of one phase at the variator input	- Appears when the variator does not detect all three phases in the power input.	- Wrong power input connection.	- Check power input connections.


	FAULT	EXPLANATION	CAUSE	SOLUTION
<b>E.OHI</b>	- Overheating in the power stage.	-Appears when the power IGBT reaches the maximum working temperature.	- Ambient temperature too high. - Converter cooling not operating or obstructed.	- Check electric cabinet cooling. - Check converter cooling.
<b>E.nOHI</b>	- End of overheating of power stage indication.	- Appears when the cooling period of the IGBT transistors ends. - Any E.OHI failure requires a waiting time until E.nOHI appears.	- E.OHI failure.	- Reset the converter when the E.nOHI appears on the screen.
<b>E.Pu</b>	- Power stage error.	- Appears when the identity of the power circuit is INVALIDATED.	- Equipment malfunction.	- Replace equipment.
<b>E.Puci</b>	- Power stage error.	- Failure in a power stage element.	- Equipment malfunction.	- Replace equipment.
<b>E.Puch</b>	- Power stage error.	- Failure in a power stage element.	- Equipment malfunction.	- Replace equipment.
<b>E.dri</b>	- Error in connection current limiter relay.	- Appears when the connection current limiter circuit does not operate.	- Relay governing this circuit is malfunctioning.	- Remove supply to variator and reconnect several times; replace the equipment if the error is not eliminated.
<b>E.iEd</b>	- Error in self-test.	- Appears in the self-test on connecting and disconnecting the variator.	- The result of the self-test is not satisfactory.	- Replace equipment.
<b>E.br</b>	- Error in brake opening operation.	- Appears when the conditions for brake opening are not reached.	- Failure in any of the motor-supply phases.	- Check continuity from the power circuit, from the variator to the motor.
<b>E.Inl</b>	- Error in the control microprocessor	- Control microprocessor damaged.	- Microprocessor malfunction.	- Replace equipment.


**0 CONTENTS**


- 1 PASSING FROM 1 TO 2 TROLLEYS (CHANGING FROM 2- TO 4-FALL)**
- 2 PASSING FROM 2 TO 1 TROLLEY (CHANGING FROM 4- TO 2-FALL)**
- 3 CANCELLING/REPOSITIONING THE FOUR-FALL TROLLEY**

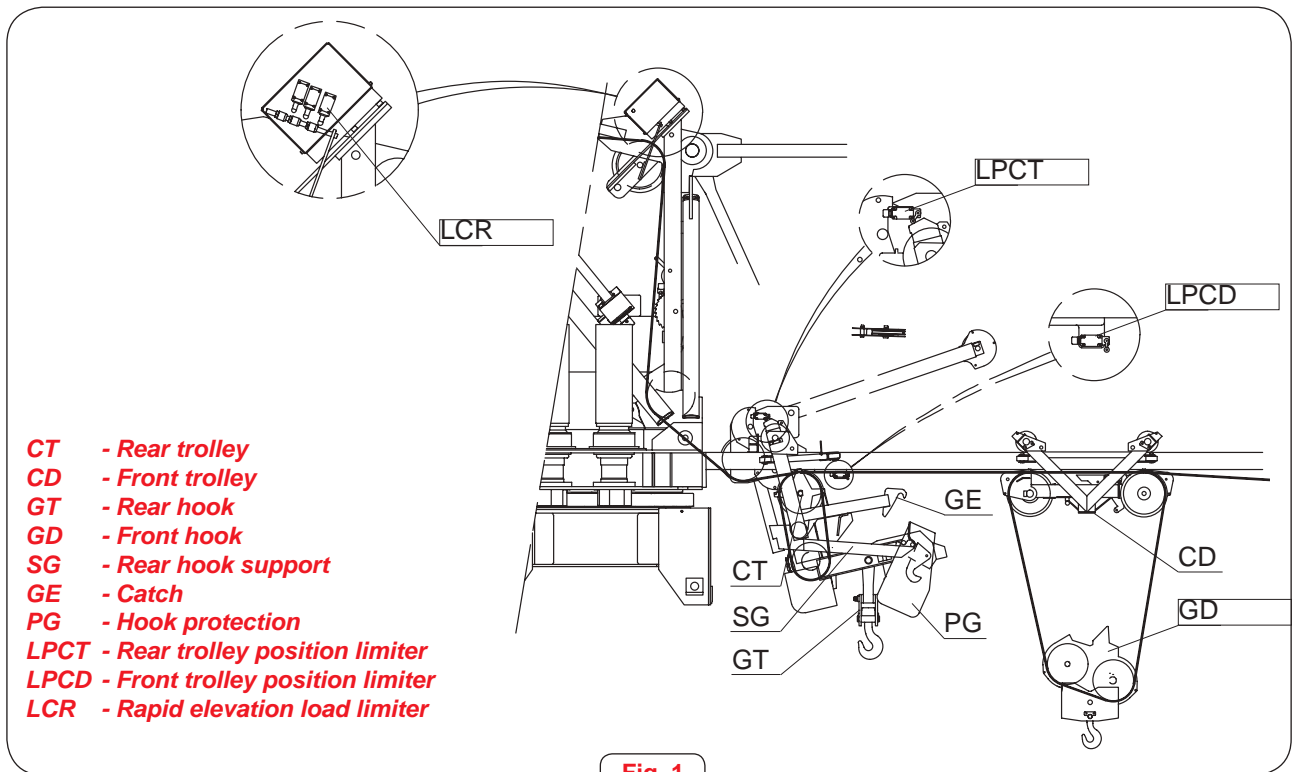
**1 PASSING FROM 1 TO 2 TROLLEYS  
(CHANGING FROM 2- TO 4-FALL)**

 ALWAYS CHANGE THE FALL FROM A POSITION THAT ALLOWS THE PERSON MAKING THE CHANGE TO VISUALLY CHECK THE OPERATION PROPERLY, TO PREVENT ANY ANOMALY OR MALFUNCTION THAT MAY ENTAIL A RISK SITUATION.

 TO CHANGE THE FALL, THE HOOK MUST BE FREE OF LOADS, SLINGS AND TACKLE FOR SUSPENDING LOADS.

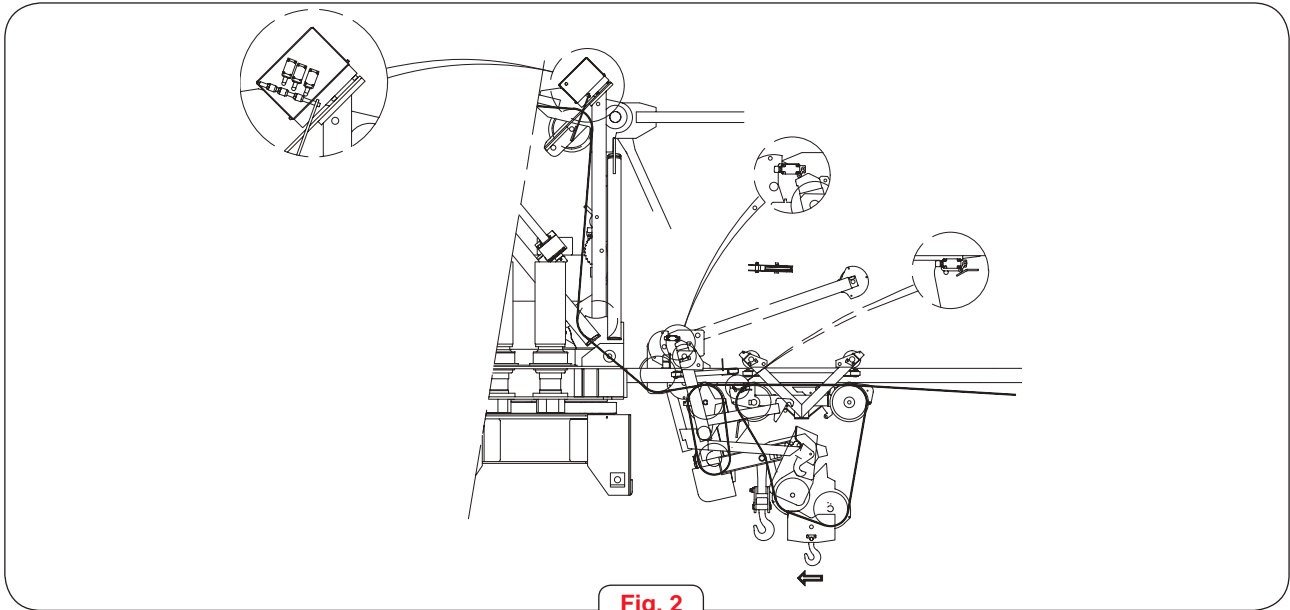
 THE CRANE'S ELECTRIC EQUIPMENT INCLUDES A SAFETY SYSTEM THAT PREVENTS BAD MANOEUVRES DURING THE FALL CHANGE CAUSING RISK SITUATIONS.

 ALL THE LIMITERS OF THE CRANE MUST BE CORRECTLY REGULATED. THIS OPERATION INVOLVES THE UPPER HOOK AND REAR TROLLEY LIMITS AND THE LOAD LIMITER. SEE DOCUMENTS "LIFTING STROKE LIMITER", "TROLLEYLIMITER" AND "LOAD LIMITER" IN THE CHAPTER "ASSEMBLY / DISMANTLING".



**Fig. 1**

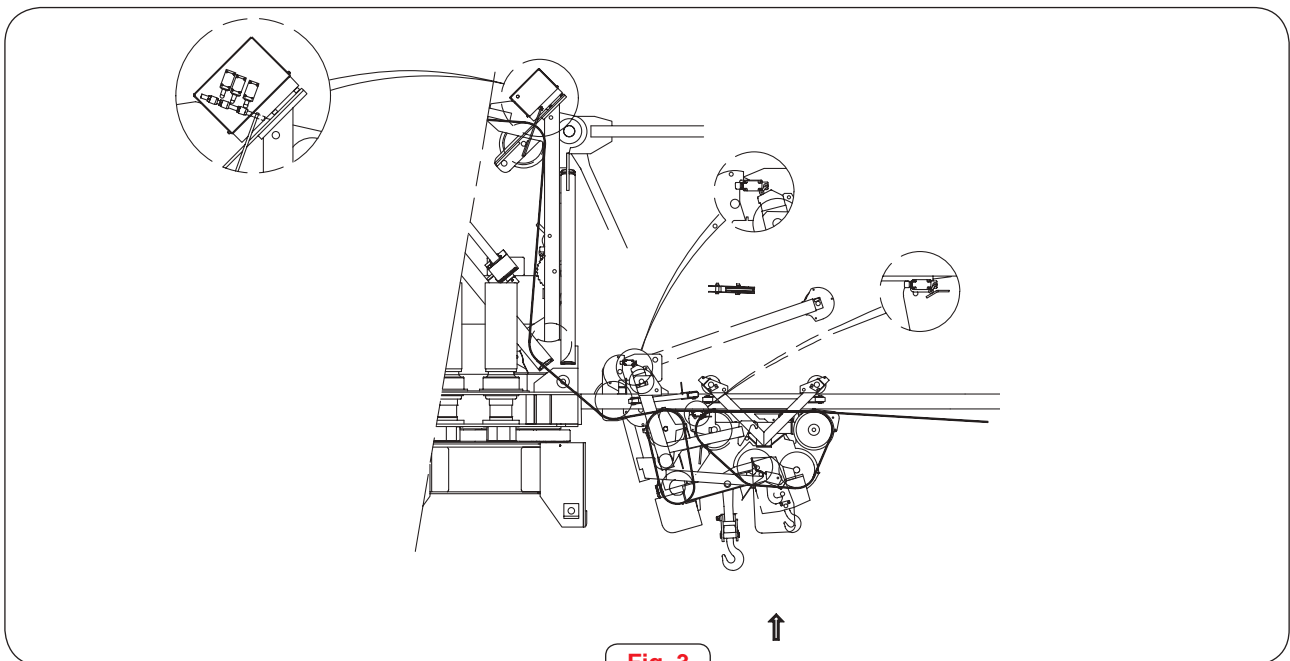
- The crane is working with a single trolley and hook: the front. (TWO-FALL).
- The rear trolley and hook are housed at the start of the jib, in the rear hook support (SG).
- The rear trolley activates a position limiter (LPCT), which detects it is in the position where the fall can be changed.



**Fig. 2**

- Raise the hook until the hook limiter acts at the top.
- Bring the front trolley and hook to the start of the jib until the trolley limiter acts at the back.
- From the crane control, cancel the rear trolley limiter and move the front trolley towards the start of the jib until the front trolley position limiter (LPCD) is activated, which allows you to continue with the change.

! ONCE YOU HAVE PRESSED THE "TROLLEY BACK" BUTTON TO EXCEED THE LIMITER, THE MOVEMENT OF HOOK AT THE TOP IS BLOCKED UNTIL THE FRONT TROLLEY POSITION LIMITER IS ACTIVATED.

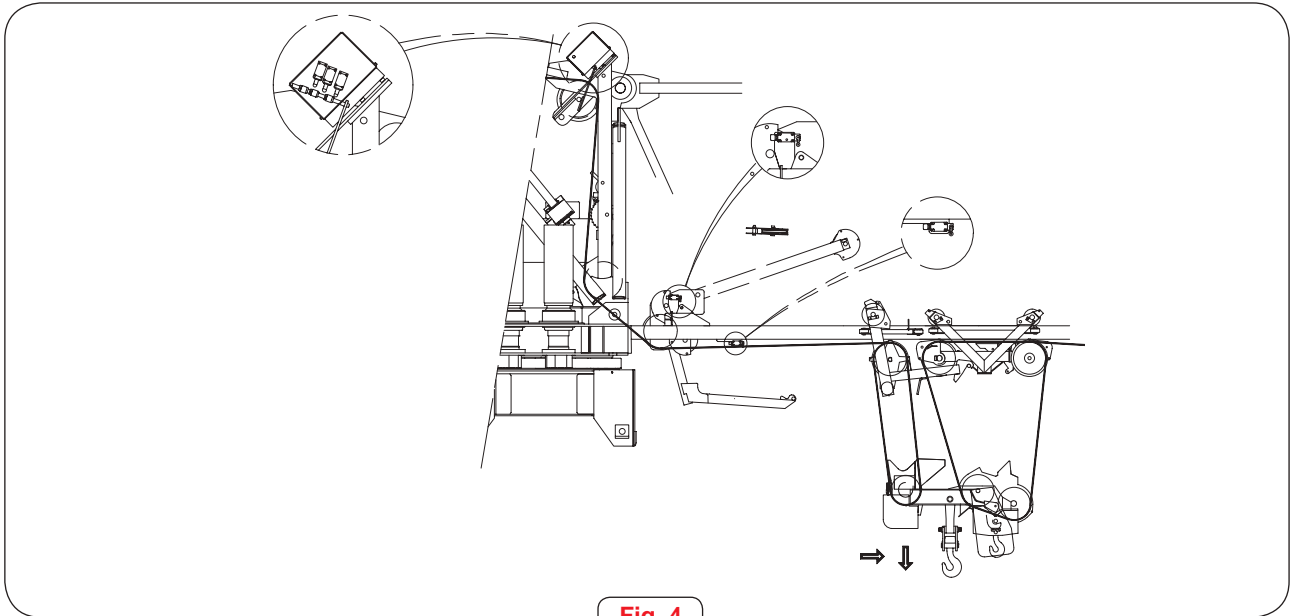


**Fig. 3**

- From the crane control, cancel the upper hook limiter and raise the front hook slowly until it is housed in the rear hook and can go no further.

! ONCE YOU HAVE PRESSED THE "HOOK UP" BUTTON TO EXCEED THE LIMIT, THE MOVEMENT OF THE FRONT TROLLEY IS BLOCKED UNTIL THE RAPID LOAD ELEVATION LIMITER IS ACTIVATED. (LCR).

- Continue raising the set of hooks. The rear trolley tilts on its wheel, the front hook goes as far as the front trolley, the protection "PG" tilts hiding the anchor of the front hook and secures the two hooks.
- As you continue raising, the elevation cable tightens and the quick elevation load limiter (LCR) cuts off the movement.



**Fig. 4**

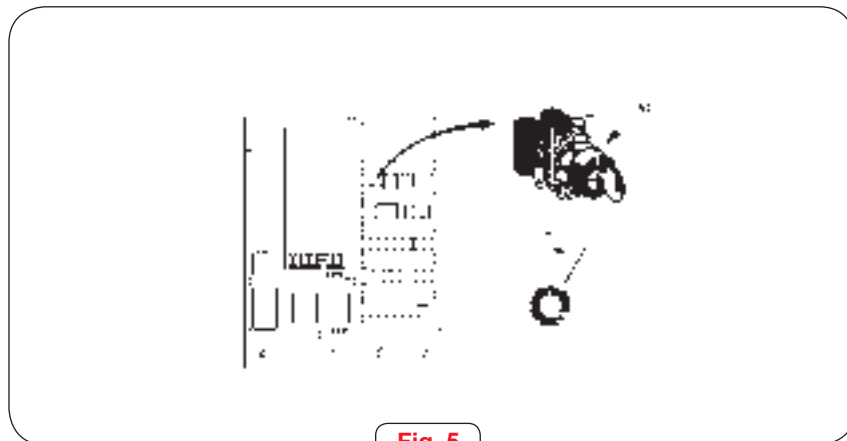
- Move the set of trolleys and hooks forward until it leaves the rear hook support.
- Continue moving the trolley forward until you are out of the rear trolley limit area.
- From the crane control, activate descent. The rear trolley will tilt until the ratchet catch rests on the front trolley and the two trolleys stay together. Continue lowering until you are out of the upper hook limit area.
- The crane is now ready to work with the two trolleys and the two hooks together. (FOUR-FALL).
- The loads must be suspended from the anchor of the rear hook.



IT IS PROHIBITED TO REMOVE THE GUARD FROM THE FRONT HOOK ANCHOR TO SUSPEND LOADS WHEN WORKING IN FOUR-FALL. IGNORING THIS CAN CAUSE ACCIDENTS.



If, when changing the fall, it is necessary to make any movement prohibited by the fall change safety system, this safety system can be cancelled using the switch with a key (ID) in the cat head electric cabinet.

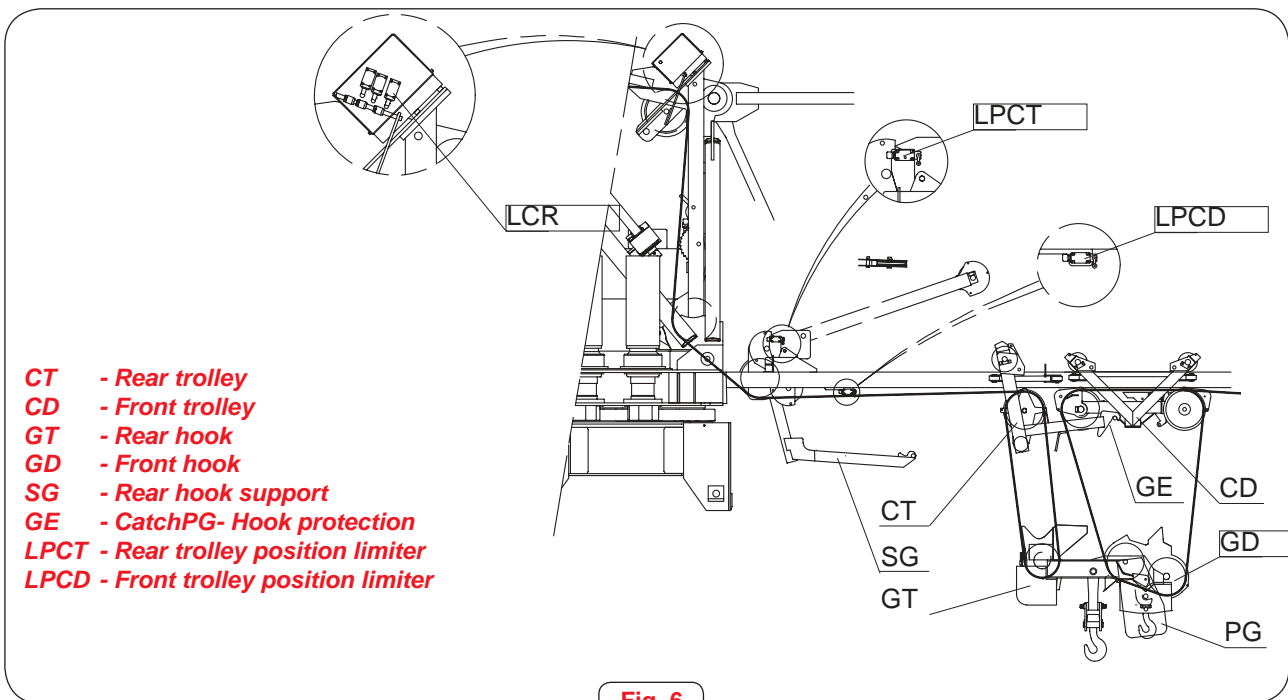


**Fig. 5**

- ⚠ The ID switch for cancelling the safety system when changing the fall must only be used by service staff that know the scope of the cancellation of the safety system.
- ⚠ All operations made with the safety system cancelled must be specially supervised to avoid any dangerous situations.
- ⚠ Once you have finished the operation for which you cancelled the safety system, you must stop the crane and reset the crane operation.
- ⚠ IF YOU OBSERVE ANY IRREGULARITY WHILE CHANGING THE FALL, NOTIFY THE MAINTENANCE SERVICES TO REVISE AND REGULATE IT.

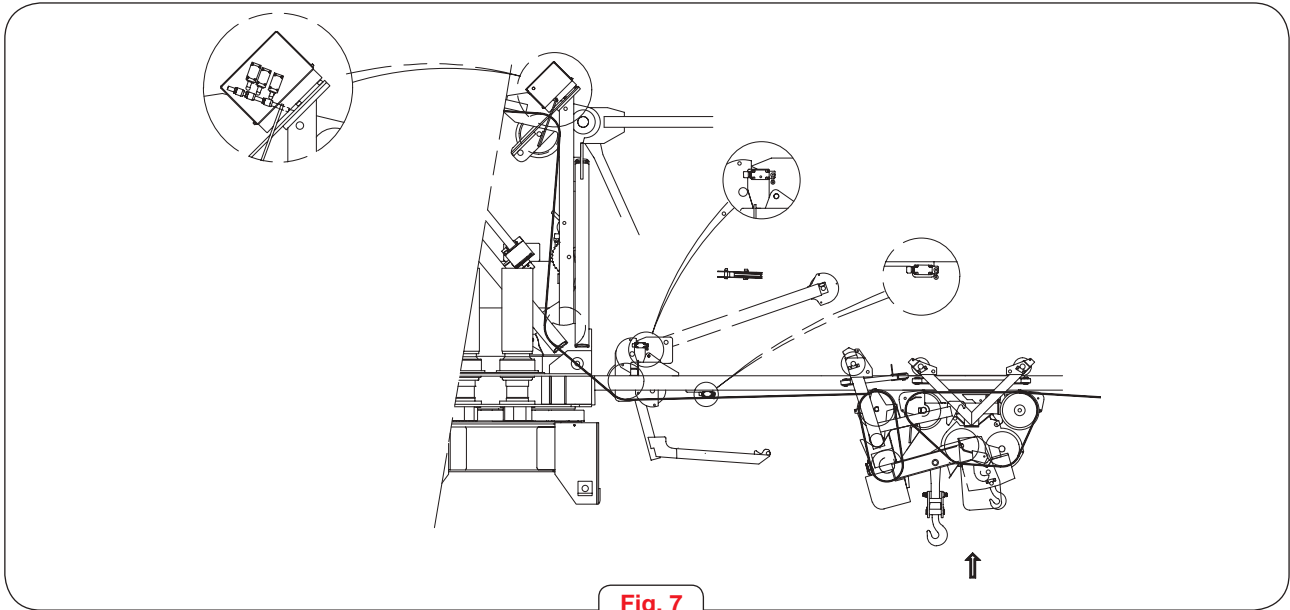
## 2 **PASSING FROM 2 TO 1 TROLLEY (CHANGING FROM 4- TO 2-FALL)**

- ⚠ ALWAYS CHANGE THE FALL FROM A POSITION THAT ALLOWS THE PERSON MAKING THE CHANGE TO VISUALLY CHECK THE OPERATION PROPERLY, TO PREVENT ANY ANOMALY OR MALFUNCTION THAT MAY ENTAIL A RISK SITUATION.
- ⚠ TO CHANGE THE FALL, THE HOOK MUST BE FREE OF LOADS, SLINGS AND TACKLE FOR SUSPENDING LOADS.
- ⚠ THE CRANE'S ELECTRIC EQUIPMENT INCLUDES A SAFETY SYSTEM THAT PREVENTS BAD MANOEUVRES DURING THE FALL CHANGE CAUSING RISK SITUATIONS.
- ⚠ ALL THE LIMITERS OF THE CRANE MUST BE CORRECTLY REGULATED.  
THIS OPERATION INVOLVES THE UPPER HOOK AND REAR TROLLEY LIMITS AND THE LOAD LIMITER. SEE DOCUMENTS "ELEVATION LIMITER", "TROLLEY LIMITER" AND "LOAD LIMITER" IN THE CHAPTER "ASSEMBLY/DISASSEMBLY".



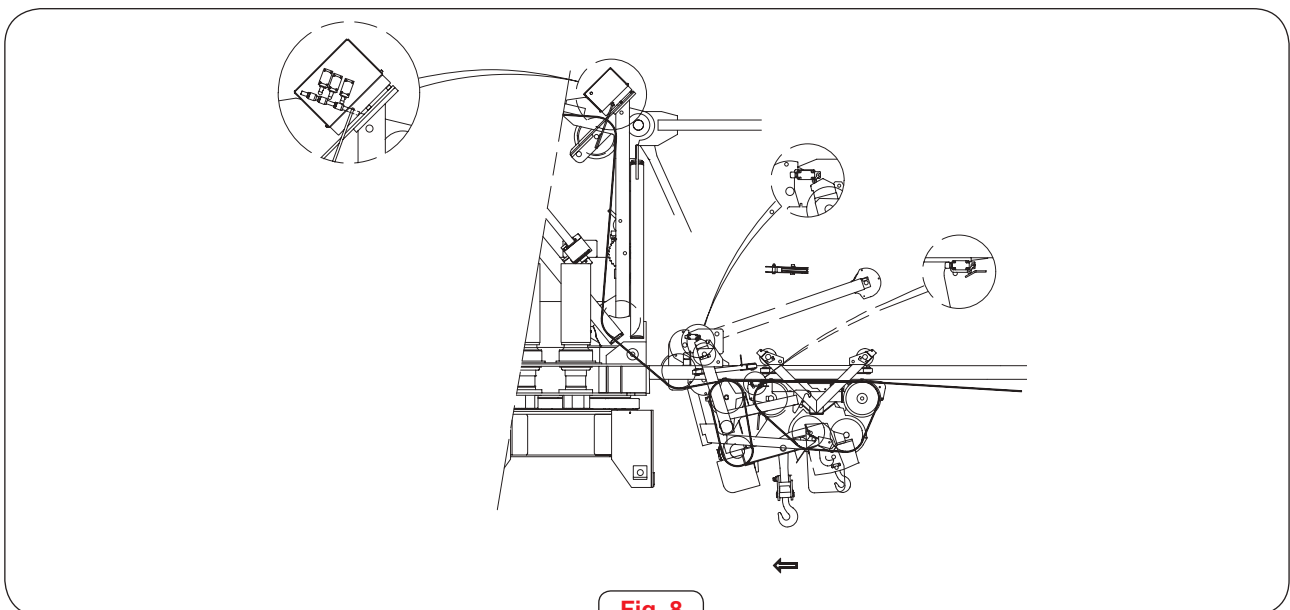
**Fig. 6**

- The crane is working with the two trolleys and the two hooks together (FOUR-FALL).



**Fig. 7**

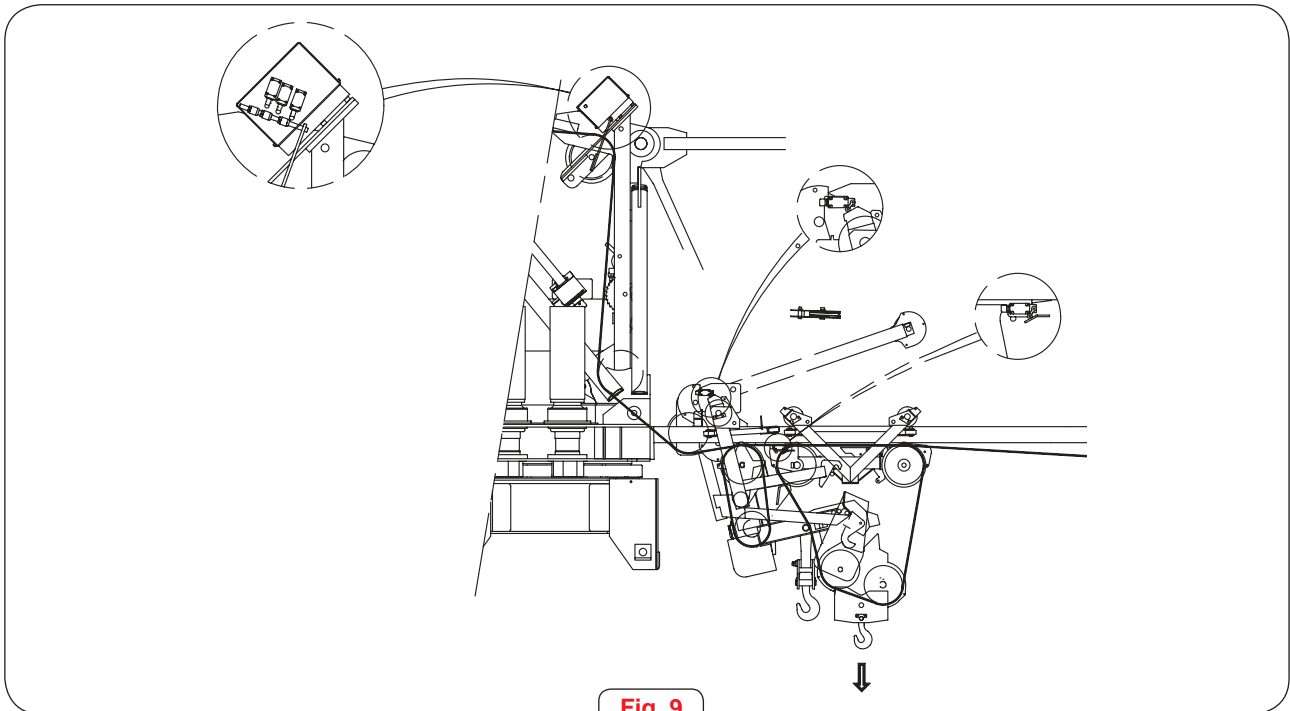
- From the crane control, cancel the upper hook limiter, at slow elevation speed, bring the hooks to the trolleys until the rear hook makes contact with the rear trolley.
- !** ONCE YOU HAVE PRESSED THE "HOOK UP" BUTTON TO EXCEED THE LIMIT, THE MOVEMENT OF THE FRONT TROLLEY IS BLOCKED UNTIL THE RAPID LOAD ELEVATION LIMITER IS ACTIVATED. (LCR)
- Continue raising. The hook tilts on the rear trolley until the front hook reaches the front trolley.
  - Continue raising. The rear trolley tilts on its wheel, freeing the trolley ratchet catch. The elevation cable tightens and the quick elevation load limiter (LCR) cuts off the movement.



**Fig. 8**

- From the crane control, cancel rear trolley limiter, and move the trolleys towards the start of the jib.
- Continue moving the trolley back until the fall change position limiters (LPCT) and (LPCD).

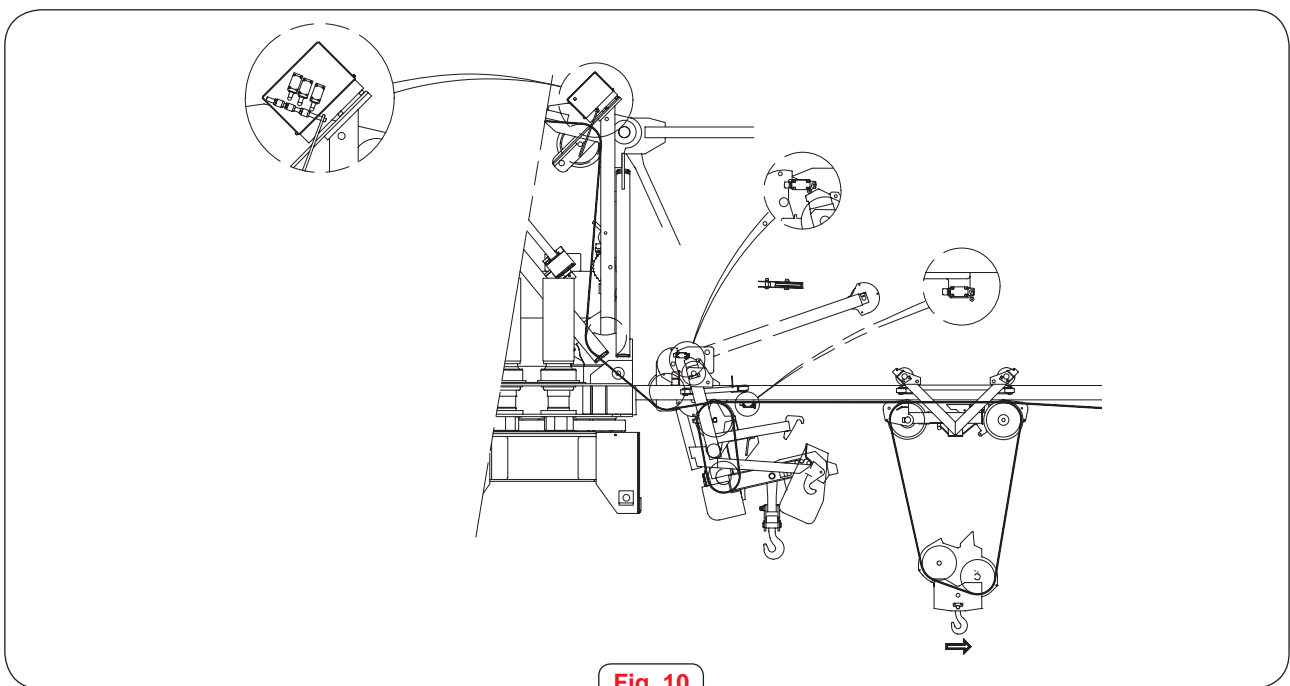
! ONCE YOU HAVE PRESSED THE "TROLLEY BACK" BUTTON TO EXCEED THE LIMIT, THE MOVEMENT OF HOOK AT THE TOP IS BLOCKED UNTIL THE TROLLEY POSITION LIMITERS ARE ACTIVATED.



**Fig. 9**

- Activate the slow descent. The rear trolley tilts on its wheel until the rear hook is housed in the rear hook support (SG); the trolley union catch (GE) is raised allowing the front trolley out.
- The anchor guard (PG) of the front hook tilts and liberates the union of the front and rear hooks.

! IT IS NOT POSSIBLE TO MOVE THE TROLLEY WHILE THE FRONT HOOK IS ABOVE THE UPPER HOOK LIMITER.



**Fig. 10**



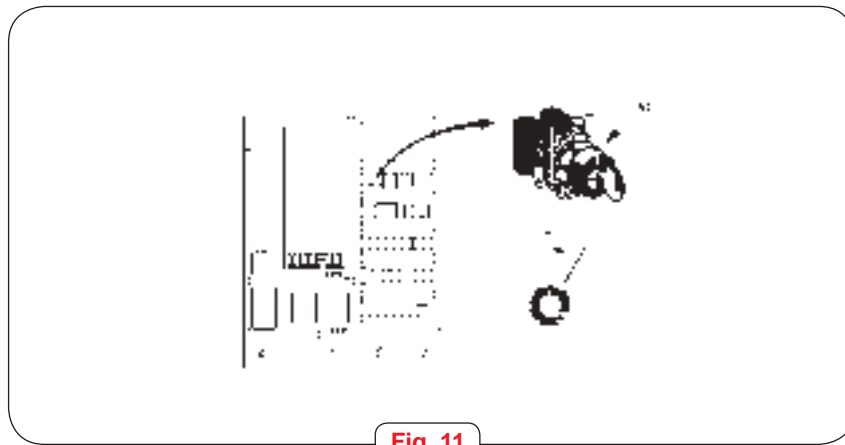
- Continue lowering until the front hook is below the elevation limiter, "hook up".
- Move the trolley forward until it leaves the rear trolley limiter. The crane is ready to work with a single trolley and hook, the front. (TWO-FALL)



If, when changing the fall, it is necessary to make any movement prohibited by the fall change safety system, this safety system can be cancelled using the switch with a key (ID) in the cat head electric cabinet.



The ID switch for cancelling the safety system when changing the fall must only be used by service staff that know the scope of the cancellation of the safety system.



**Fig. 11**



All operations made with the safety system cancelled must be specially supervised to avoid any dangerous situations.



Once you have finished the operation for which you cancelled the safety system, you must stop the crane and reset the crane operation.



IF YOU OBSERVE ANY IRREGULARITY WHILE CHANGING THE FALL, NOTIFY THE MAINTENANCE SERVICES TO REVISE AND REGULATE IT.

### 3 CANCELLING/REPOSITIONING THE FOUR-FALL TROLLEY

If you wish to leave a crane with a single trolley (removing the possibility of the 2nd trolley "four-fall"), in addition to removing the trolley and modifying the cable fall (see ASSEMBLY/DISASSEMBLY) you must:

- a) Physically remove the trolley position limiters (LPCT and LPCD) installed in the jib.
- b) Electrically disconnect these limiters (removing plugs in the electric cabinet or disconnecting the terminals in the junction box, depending on the case).
- c) Place jumpers in the cat head control panel
  - 43-44 contact AID
  - 53-54 contact AID
  - 14 contact ABCT and 14 contact ALCT
  - 13-14 contact ALCDE.
- d) Check the functioning of the SR trolley against the end limiters with the trolley back.

If you wish to replace the 2nd trolley to have the possibility of four-fall, proceed in reverse order (points a, b and c) and check the single to double and vice versa trolley change system works correctly (see points 1 and 2 of this instruction).

<b>0</b>	<b>CONTENTS</b>
<b>1</b>	<b>DESCRIPTION</b>
<b>2</b>	<b>OPERATION</b>
<b>3</b>	<b>MANUAL OPERATION</b>
<b>4</b>	<b>WIRING</b>
<b>5</b>	<b>ADJUSTMENT</b>
<b>6</b>	<b>CHECKING OPERATION</b>

## 1 DESCRIPTION

The crane is prepared for weather vaning by releasing the brake on the slewing motor(s), leaving the upper crane free to move with the wind. The brakes are released remotely via the release units on the brake cover of each slewing motor.

A control box in the operator's cabin (or at the base of the crane when there is no cabin) governs the release units.

In case of a power cut-off or malfunction in the release system, weather vaning can be done manually.

## 2 OPERATION

### Weathervaning sequence (Fig. 1)

- 1 Opening the motor brake causes the manual lever (1) to move upwards
- 2 The electromagnet (5) attracts the moving armature (2) and positions it below the manual lever (1).
- 3 When the brake drops the manual lever (1) rests against the moving armature (2), preventing the brake from closing and weathervaning the crane.

### Activating weathervaning

- 1 The crane must be in operation.
- 2 Press the weathervaning button on the crane control panel and wait 5-10 seconds. If the crane siren is still blowing after that time, the crane is weathervaned.
- 3 Press Stop to cut the siren.
- 4 Press Start. The siren should continue to blow when the Start button is released.
- 5 Press stop to cut the siren.

### Deactivating weathervaning.

- 1 Engage the slewing control with the crane in operation.



### IMPORTANT:

- Steps 4 and 5 are essential, as they ensure that weathervaning has actually taken place.
- If the weathervaning button is pressed by accident during normal operation, just engage the slewing control to deactivate it.
- Do not hold down the weathervaning button more than 30 seconds.

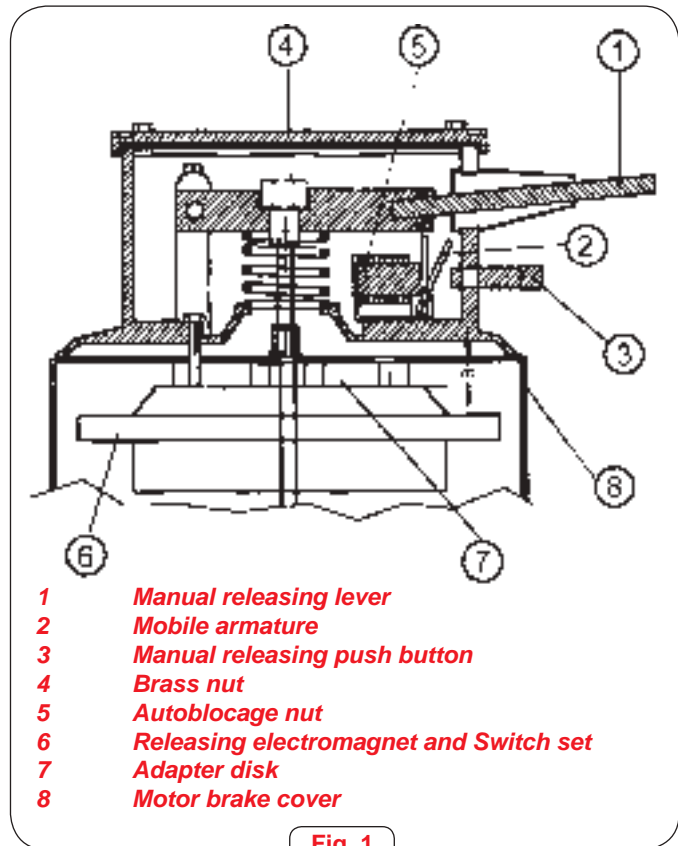


Fig. 1

! Some cranes have a lamp on the weathervaning button to indicate that weathervaning is engaged. el dispositivo de veleta está activado.

### 3 MANUAL OPERATION

If there is a malfunction or power cut-off the slewing motor brakes can be released manually.

- 1- Lift the lever, overcoming the resistance of the brake springs, and keep it lifted.
- 2- Press and hold down the button.
- 3- Release the lever.
- 4- Release the button.

This procedure should be repeated with each release unit.

Repeat the process on each release unit

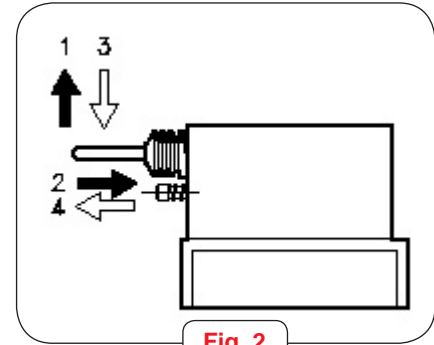


Fig. 2

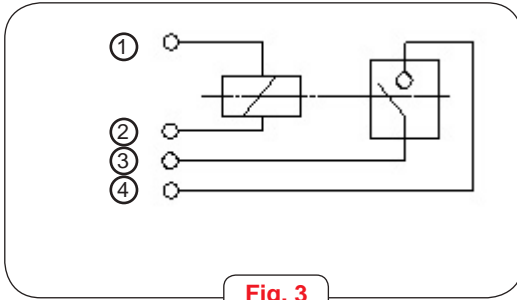


Fig. 3

### 4 WIRING

- |     |  |
|-----|--|
| 1-2 | 48V (50/60 Hz) electro-magnet power              |
| 3-4 | Electro-magnet operating indicator micro-switch. |

### 5 ADJUSTMENT

To regulate the unblocking weather vaning, proceed as follows:

- 1- Manually lift the unblocking lever (1).
- 2- Push the button (3) until the mobile armature (2) comes inside under the lever (1).
- 3- Unscrew the nut (4) in such a way that the distance "a" between armature (2) and lowr part of the lever (1) when this is lifted at its highest be approximatively 0.5 mm.
- 4- Check electrical operation: the armature (2) should enter freely when the weathervaning button is pressed on the crane controls, and should release when slewing movement is commanded. If it does not, slacken the self-locking nut (4) 1/12 of a turn (half a facet) and try again.

NOTE: Between the position of maximum regulation and minimum the brass nut (4) turns 4/6 of return (4faces).

IMPORTANTE: The brake gap should not be less than 1 mm if weathervaning is to be regulated correctly.

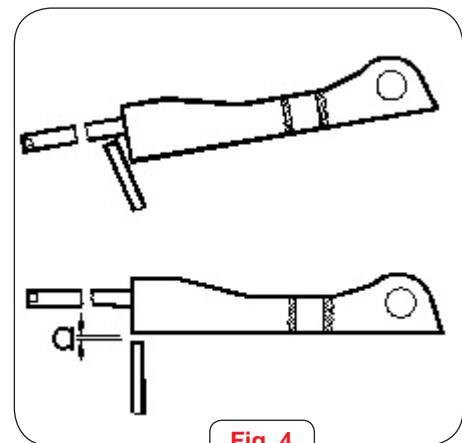


Fig. 4

### 6 CHECKING OPERATION

Weathervaning must be used in windy conditions: if the jib points in the direction of the wind then the weathervaning system is working correctly.

To check weathervaning when it not windy, proceed as follows:



- 1- Ensure that the crane can turn freely with no obstacles in its path.
- 2- With the trolley back and the hook raised and under no load, engage first gear and slew slowly.
- 3- Still in first gear, press the weathervaning button (the crane siren will sound).
- 4- Still slewing in first gear and with the weathervaning button engaged, press the stop control and check that the jib continues to turn freely under its own inertia.
- 5- If it does not do so, readjust the brake gap (which should be 1 mm) and adjust the weathervaning system..

## CONTENTS

- 1 SYSTEM OVERVIEW
- 2 OPERATION CHECK
- 3 ALARM AND TEST PROGRAMMING
- 4 RS 485 WIND-SPEED OUTPUT
- 5 HEATING SYSTEM FOR THE WIND-SPEED SENSOR

### 1 SYSTEM OVERVIEW

The basic configuration has a wind-speed sensor (1), which is connected to the control and signalling unit (2).

The system operates as follows:

- The control and signalling unit is electrically powered from the crane electric cabinet.
- The orange luminous beacon is activated when the wind-speed exceeds 50 km/h.
- The red luminous beacon and warning siren are activated when the wind-speed exceeds 70 km/h..

If the crane is no in operation, the wind alarm indication syste is no operable.



In case of disconnection of the crane, this should be placed in an out-of-service condition (including the weathervaning).

It should be considered that the radio controls automatically disconnect the cran whe it is unused for a certain period. When the crane is not supervised, it should be placed in an out-of-service condition.

- 1 *Wind-speea sensor*
- 2 *Control and signalling unit*
- 4 *Fastening magnets*
- 5 *Orange and red beacons*
- 6 *Siren*
- 7 *Line fastening to the structure*
- 8 *Cabin display*

Fig. 1

### 2 OPERATION CHECK

#### 2.1 Indication and control unit

- Check the operation of the beacons and siren as follows:
  - Check the crane is powered.
  - The switches at the bottom of the crane and the general switch on the electrical cabinet are in the ON position.
  - Press the stop button in the crane control and then press the start button (radiocontrol, telecontrol or seat).
- This procedure allows to detect a problem in:
  - Orange or red beacons.
  - Siren.
  - Unit power supply.

The device checks the proper operation of the red and orange beacons and of the siren by switching the beacons and the siren (each beacon should blink twice and the siren must horn once).

- If one or several elements do not operate, this is because there is a problem in the electric supply or in the elements themselves.

During this test, physically cover the siren to prevent being deafened by the noise this produces.

- Double check that the control and signal code units are properly fixed by the magnets and check that the unit is appropriately secured to the crane structure with the fastening line (7) which is supplied.
- Check that the unit is visible from the crane operator's control position.

## 2.2 Wind-speed sensor.

- Check that it turns freely.
- Check that it is not affected by the shielding of the structure.
- Check that the cable between the sensor and the control unit is not cut or disconnected.

## 2.3 Wind velocity detection system check.

The correct operation of the wind velocity detection system can be checked at three levels of complexity, according to what needs to be checked:

### Level 1. Checking of operation

The system is correctly connected and detects the wind velocity.

It is not checked whether the wind signal is correctly calibrated or whether the alarm system is activated at preset values.

Necessary material:

- Cabin wind velocity display.

Instructions:

- Connect the cabin wind velocity display to the control unit (See Point 4).
- Move the wind velocity detector cups either through the action of the wind or by turning them by hand.
- Check that there is a velocity reading on the cabin wind velocity display.

### Level 2. Check the operation and quality of the signal detected

The system is correctly connected, is detecting the wind velocity and the signal detected is correct.

It is not checked whether the wind signal is 100% correctly calibrated or whether the alarm system is activated at preset values.

Necessary materials:

- Cabin wind velocity display.
- One complete portable anemometer with built-in display.

Instructions:

- Connect the cabin wind velocity display to the control unit (See Point 4).
- Install the portable anemometer pickup near the crane pickup and under the same wind reception conditions.
- Compare the wind velocity readings on the two displays (the check will be much more effective if the auxiliary anemometer is calibrated).

### Level 3. Calibration of the apparatus

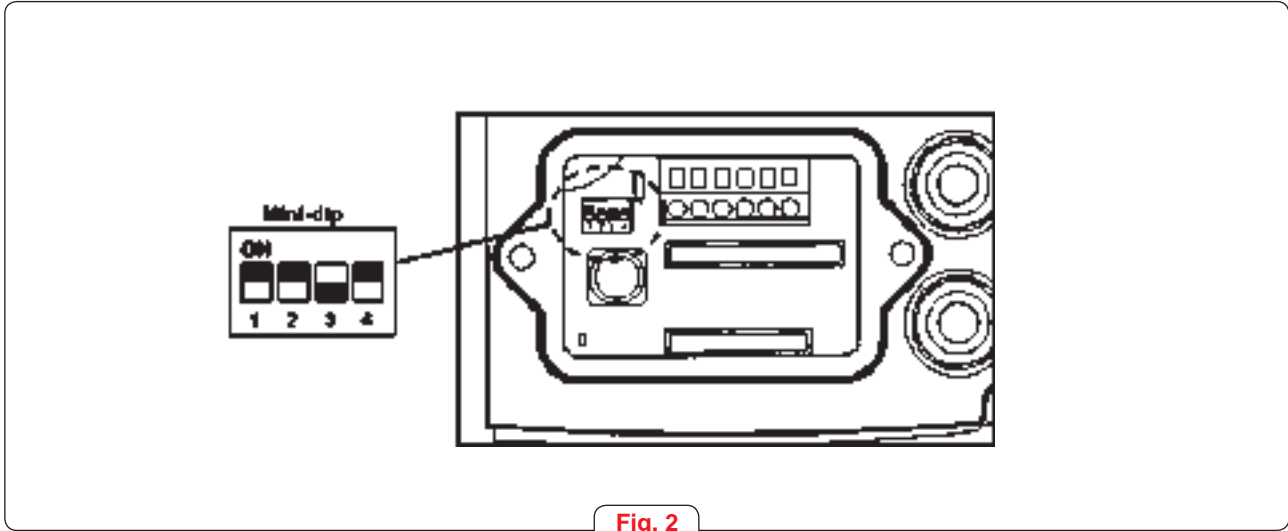
The system correctly detects the wind velocity and checks that the signal and alarm limits are correctly calibrated.

It is necessary to send the anemometer to the equipment manufacturer for this check. This manufacturer has a certified test bed for checking and calibrating the anemometer.

### 3 PROGRAMMING OF TEST AND ALARM MODES.

The equipment is set by the manufacturer to be configured in different ways in the alarm test and operating modes.

! The equipment is configured by COMANSA, as is indicated in Fig.2.



**Fig. 2**

The device can be configured in different ways, by changing a set of 4 mini-switches 4 placed inside it. The different functions that can be activated or deactivated are: autotest function, configuration in which the device must be reinitialized after the 70km/h alarm is activated, cancel the acoustic warning when working close to low noise areas like hospitals, residenciales...

To access to the connections or configuration, loose the screws that fix the small bottom cover.

#### 3.1 Test and alarm configuration modes..

DIP1	ON (1)	Autotest ON
	OFF	Autotest OFF.

DIP2	ON (1)	Siren ON.
	OFF	Siren OFF.

DIP3	ON	After the wind-speed goes above 70 km/h , the ALARM remains activated , even if the speed goes to 0 km/h (The alarm will be deactivated only after the unit supply is switched off for more than 15 seconds).
	OFF (1)	The ALARM is deactivated immediately after the speed goes below 70 km/h.

! The DIP4 configuration is exclusively to be changed by an authorised person. Its proper position is ON. Otherwise, the device indicates a "SENSOR FAILURE"

DIP4	ON (1)	Normal operation.
	OFF	Maintanance operation.

(1) Standard factory settings.

! Before changing the position of the switches, ensure that it complies with the required standard for the installation and that the new alarm method (sound and visual) is understood by the crane operators.

### 3.2 Test modes.

The test allows to check the proper operation of the device.

This device allows two operation modes:

- Switch-on autotest: it is done during a few seconds immediately after supplying the device.
- No switch-on autotest.

The default factory setting is with the switch on Autotest enabled.

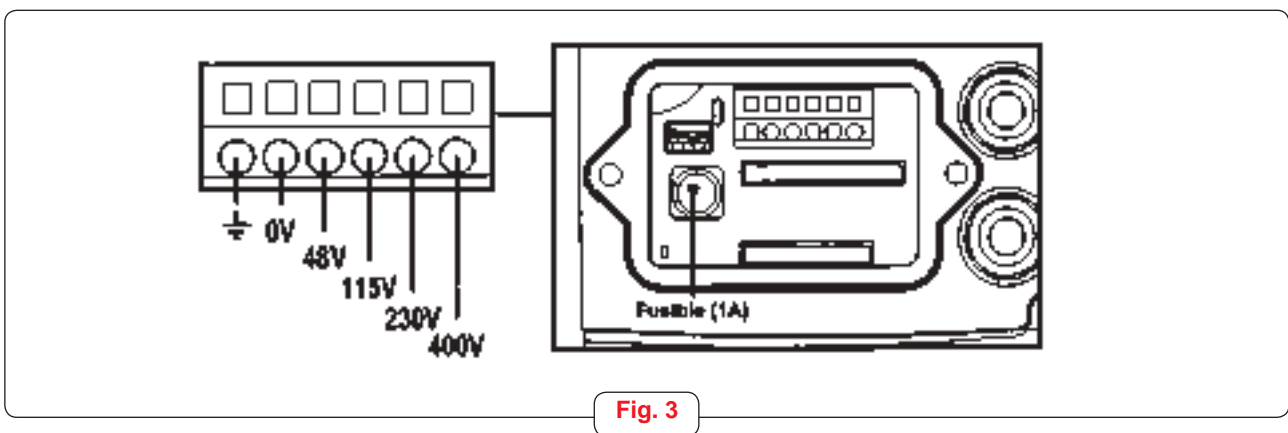
### 3.3 Alarms.

The device includes the following alarm modes:

- At 50 km/h only amber light, and at 70 km/h only red light.
- At 50 km/h only amber light, and at 70 km/h red light + siren.

The default factory setting is "at 50 km/h only amber light, and at 70 km/h red light + siren".

### 3.4 Anemometer internal wiring



**Fig. 3**

! The device is prepared for 48 V 50/60 Hz.

Once the wiring is done:

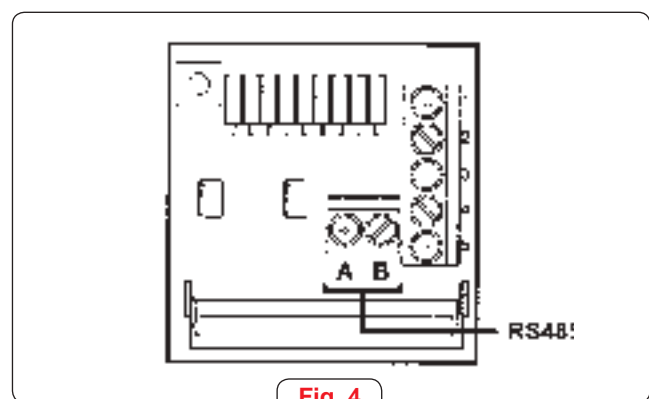
- 1.- Tightly screw the gland to the cable to seal the interior of the unit against liquids or dust.
- 2.- Check the proper closing of the bottom cover to keep IP65 inside.

### 3.5 Sensor failure detection

In case there is any abnormal behaviour signal at the sensor, a cable that has been cut or an improper connection, the system beacons intermittently blink until the problem is solved.

## 4 RS 485 WIND-SPEED OUTPUT

The control and signalling unit (Fig. 4) is equipped with an RS 485 output that allows a fast connection to the indicator system in the cabin. Refer to the crane wiring schematic for more details.



**Fig. 4**

## **5 HEATING SYSTEM FOR THE WIND-SPEED SENSOR**

It is placed within the wind-speed sensor. A heater is switched on whenever the temperature goes below a preset value. This heater melts the frost which would otherwise prevent the sensor rotor motion.

This heater system is supplied from a point which is placed before the general crane contactor G (see wiring schematic). If the general switch of the crane (IG) is ON and the crane bottom switch is ON, the heating system will be operative, regardless the stop control is pressed or not. This allows the system to melt the frost even when the crane controls are switched off.



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### **2 INTRODUCTION TO THE SYSTEM.**

- 2.1 System overview.
- 2.2 Basic configuration and optional functions.
- 2.3 System features and functions.
- 2.4 Safety hints for installation and adjustment.

### **3 SYSTEM INSTALLATION.**

- 3.1 General description and location of the system on the crane (complete system).
- 3.2 System basic technical specifications.
- 3.3 Description of the devices.

### **4 USE OF UC46 DISPLAY.**

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### **8 APPENDICES**

- Appendix 1– Geometric parameters for forbidden zones configuration.
- Appendix 2– Geometric parameters for sensor configuration .
- Appendix 3– Reading the event log from a PC using the USB key.
- Appendix 4– Event list and failure codes.

## 1 IMPORTANT NOTES

-  INDICATORS SHOULD NEVER BE USED AS A DETERMINANT AID IN CRANE WORK AT POINTS WHERE THE OPERATOR CANNOT PERFECTLY SEE THE LOAD AND SURROUNDINGS. ON SUCH SITUATION, THE INDICATIONS OF A SIGNAL-MAN ARE COMPULSORY.
-  INDICATORS SHALL NEVER REPLACE A SCALE AND SHOULD NEVER BE USED AS A SUBSTITUTE FOR THE CRANE LOAD AND MOMENT LIMITERS.
-  DATA DISPLAYED ARE SIMPLY INDICATIONS AND CANNOT REPLACE THE PERSONAL SUPERVISION OF THE OPERATOR AND HIS OWN IMPRESSION OF THE SIZE OF THE LOAD BEING HANDLED.
-  FOR THE SYSTEM TO WORK PROPERLY, IT IS NECESSARY TO PERFORM CORRECTLY THE COMPLETE SET UP AND ADJUSTMENT OF THE UNIT.
-  ANY CHANGE ON THE CRANE CONFIGURATION MAY RESULT IN A BAD OPERATION OF THE INDICATION, DATA LOGGING OR FORBIDDEN ZONES SYSTEM. AFTER ANY CRANE CONFIGURATION CHANGE, IT IS NECESSARY TO READJUST THE SYSTEM AND CHECK THAT THE UNIT IS FULLY OPERATIVE AND PROPERLY WORKING.
-  IT IS FORBIDDEN TO RELY EXCLUSIVELY ON THE SAFETY LEVEL PROVIDED BY THE ZONING SYSTEM WHENEVER THE CONSEQUENCE OF A FORBIDDEN ZONES SYSTEM FAILURE MIGHT LIKELY RESULT IN SEVERE DAMAGE FOR PEOPLE OR PROPERTY.
-  THE FORBIDDEN ZONES SYSTEM ALONE SHOULD NOT BE USED TO AVOID TO DRIVE THE CRANE ABOVE PIPE INSTALLATIONS THAT MIGHT CONTAIN FLAMMABLE LIQUIDS OR GASES. THE FORBIDDEN ZONES SYSTEM SHALL NOT BE USED TO AVOID TO DRIVE THE CRANE ABOVE ELECTRIC CABLES. ON SUCH SITUATIONS, IT IS NECESSARY TO MAKE A SAFETY ASSESSMENT AND TAKE ADDITIONAL MEASURES (I.E. MOUNTING THE CRANE SO THAT THERE IS NO POSSIBILITY OF INTERFERENCE WITH THE CABLE) THAT LEAD TO A PROPER RISK REDUCTION.
-  IT IS COMPULSORY TO CHECK THE PROPER OPERATION OF THE FORBIDDEN ZONES SYSTEM AND THAT EVERY FORBIDDEN ZONE IS ACTIVATED AND WORKING PROPERLY, EVERY DAY BEFORE BEGINNING TO WORK.


## 2 INTRODUCTION TO THE SYSTEM

### 2.1 System overview.

DLZ341 system must be used as an aid to operate the crane. It does not and cannot replace the ability, experience and common sense of the crane operator.

The system offers visual and alphanumerical information that allows faster and more integrated perception of the crane situation and other parameters that affect its behaviour (wind speed, load...). The proper understanding and the judgement of the information and its reliability is a responsibility of the crane operator, who is also responsible for the control and proper and careful drive of the crane.

**! Before beginning to use the system, it is compulsory to properly train the operator. Furthermore, the maintainer of the crane or whoever performs any adjustment or change on it, must carefully read this manual until he understands the working principle and the procedures for its adjustment.**

 The indication screens on this document may suffer some change as a result of any improvement of the system software.

## 2.2 Basic configuration and optional functions.

DLZ341 system includes the following functions as standard:


- Basic indications (trolley radius, height under hook, load, moment...).
- Data logger.

DLZ341 may optionally include the following special functions (on demand):

- Extended indication (the system can be supplied with additional information like slewing position or travelling position).
- Forbidden zones system (prevents the hook from entering the areas defined by the user. If the system is equipped with forbidden zones, it must include the slewing sensor and the travelling sensor, if needed, to properly perform the forbidden zone function).


The addition of new functions to a crane with the system basic configuration is possible through addition of an upgrade kit (contact factory for more details). The kit is made up of an informatic software upgrade and of additional hardware (slewing and travelling sensors, electrical cabinet IM45 interface...).

Additional functions are always based on the basic system configuration. It is not possible to install an optional function without previously installing the basic system.

 COMANSA does not supply anticollision system (a system which avoids the risk of collision between working cranes), however, a dedicated plug which gives access to the proper electrical points where the connections of such a system must be done is supplied.

## 2.3 System features and functions.

The indication screen (see 3.3.2) allows the user to access the system information and configuration. The screen is a colour antireflective one and is provided with an ergonomic design that improves the comfort and usability to the crane operator.

 Screen messages use pictograms recommended by FEM1003 standard which list the symbols to be used on tower crane indications, so that an effective and error-free communication is achieved.

The indication function offers an instantaneous and intuitive sight that shows the load state of the crane and the crane position. The data are represented in numerical format and also as a progress bar, allowing a faster and easier understanding.

Further information on the indication function may be found in point 5 of this document.

The data logger function supplies information referred to the crane operation (number of working hours of each winch, number of overloads, information on the last movements, alarms...).

Further information on the data logger function may be found in point 6 of this document.

The forbidden zones function allows the user to define a number of zones where the hook will be prevented from entering. Once the system is properly adjusted, the crane stores the zones information in memory and operates in an intelligent way, automatically preventing the hook from entering into the forbidden areas.

Further information on the forbidden zones function may be found in point 7 of this document.

## 2.4 Safety hints for installation and adjustment

- The installation and setting up of the DLZ341 system must be performed by qualified people, specially trained and with a good understanding of this document.

There is no element within the DLZ341 system that needs any maintenance by the crane operator.



Any change in the crane configuration may demand a readjustment on the DLZ341 system (see 4.9). The commissioning of the unit should be done at the same time as the commissioning of the crane.

The UC DL46 indicator screen shows a question mark in the indication numerical field of a sensor if the associated sensor is bad adjusted or is not properly sending the signal. It will also be represented by an error code in the left zone of the screen (see appendix 4).

### 3 SYSTEM INSTALLATION.

#### 3.1 General description and location of the system on the crane (complete system).

The complete system (indicators, data logger and forbidden zones) comprises the following devices :

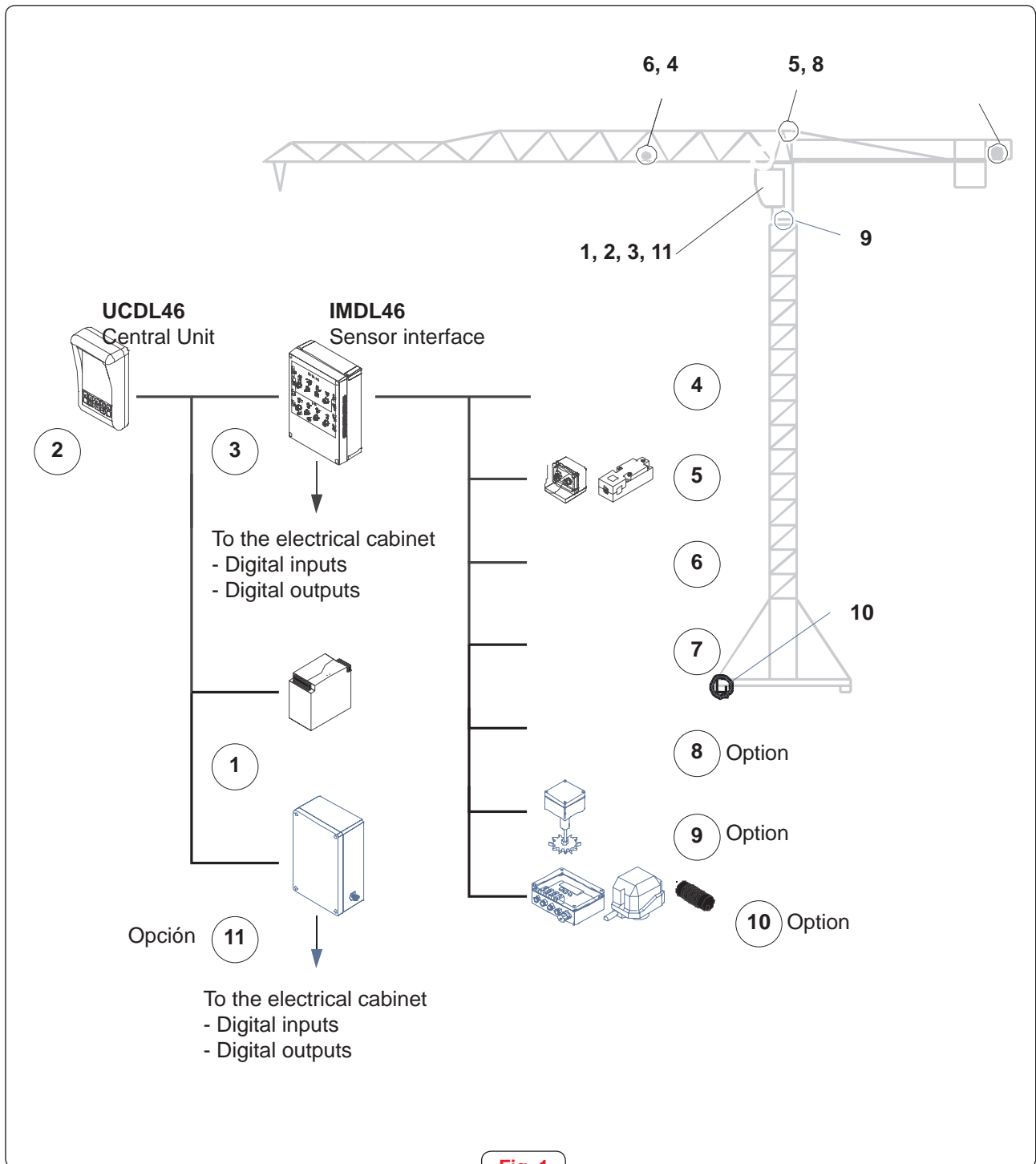


Fig. 1

Basic configuration devices:

- 1 Stabilized power source.
- 2 Central processing unit and display UC DL46.
- 3 Signal interface and digital input registering unit IMDL46.
- 4 Load cell.
- 5 Moment sensor.
- 6 Trolley position sensor.
- 7 Hoisting position sensor.
- 8 Anemometer signal (option).

The forbidden zones system (option) includes the devices of the above list and also the following:

- 9 Slewing position sensor BROR45C.
- 10 Travelling position sensor (if the crane is allowed to move on a railtrack).
- 11 IM45 relays interface unit for the intelligent movement stop.



Picture.1 is a sketch and the real position of the devices on the crane may change depending on crane models.

UDCL46 screen is the only interface between the system and the crane operator. It can also be used to program and adjust the unit and to diagnose the system state.

The IMDL46 terminal box supplies and links every subsystem (sensors, IM45, UC DL...), and acts as a sensor signals and electrical cabinet signals hub.

Communication flow between each element and the central unit (which lies inside the UC DL46) always goes through the IMDL46 unit and is done by means of a CAN bus network protocol (Control Area Network).

The CANANA units are electronic modules which convert the trolley, hoisting and moment analog signals into digital signals, that can be transmitted and understood through the CAN network.

The load cell contains an amplifier that transforms the strain gauge mVolts signal into Volts. The Volts signal is later converted into a digital signal within the IMDL46 unit.

The anemometer is an optional device. The anemometer signal is sent to the IMDL46 unit and is transformed to a special digital format different than the CAN format.

DLZ341 allows to integrate the reading of the windspeed on the indication screen. The installation of the anemometer and the way to connect it to the DLZ341 system is further described in the anemometer document.

The travelling sensor also sends the information to the IMDL46 in CAN bus digital format.

The following table shows the elements description, their location and the configuration option that includes them.

INFORMATION PROCESS AND DISPLAY UNITS		
REFERENCE	LOCATION	COFIGURATION
Stabilized power source 400V-24Vdc	Cab	Basic system
UC DL46 Bracket	Cab	Basic system
UC DL46 Display/CPU	Cab electrical cabinet	Basic system
IMDL46 interface unit	Cab electrical cabinet	Basic system
IMDL46 system to electrical cabinets interface plug	Cab electrical cabinet	Basic system
IM45 system to seat-radiocontrol interface	Cab electrical cabinet	Forbidden zones
IM45 system to seat-radiocontrol interface plug	Cab electrical cabinet	Basic system
USB memory stick	Cab	Basic system
Anemometer	Cat head	Anemometer option

HOISTING SIGNAL DEVICES		
DESIGNATION	LOCATION	CONFIGURATION
Hoisting limiter potentiometer	Hoisting mechanism	Basic system
Hoisting limiter integrated CANANA	Hoisting mechanism	Basic system

TROLLEY SIGNAL DEVICES		
DESIGNATION	LOCATION	CONFIGURATION
Trolley limiter potentiometer	Trolley mechanism	Basic system
Trolley limiter integrated CANANA	Trolley mechanism	Basic system

LOAD SIGNAL DEVICES		
DESIGNATION	LOCATION	CONFIGURATION
Load cell with integrated amplifier	Hoisting rope	Basic system

MOMENT SIGNAL DEVICES		
DESIGNATION	LOCATION	CONFIGURATION
Inductive sensor 4-20m A	Moment leaf spring	Basic system
Inductive sensor CANANA	Moment leaf spring	Basic system

SLEWING SIGNAL DEVICES		
DESIGNATION	LOCATION	CONFIGURATION
BROR45C slewing signal (encoder+CAN digital converter)	Slewing ring	Forbidden zones

TRAVELLING SIGNAL DEVICES		
DESIGNATION	LOCATION	CONFIGURATION
Travelling sensor with incremental encoder connected to a travelling winch axle.	Travelling winch	Travelling option
CAD40 travelling electronic board with digital output	Travelling winch	Travelling option
Reset signal device for travelling wheel slip correction	Travelling winch	Travelling option

### 3.2 System basic technical specifications.

REFERENCE	POWER SUPPLY	IP	OPERATING TEMPERATURE	STORAGE TEMPERATURE
Power source	3x320-575 Vac (1)	IP33	-25 °C to +60 °C	-40 °C to +85 °C
UCDL46	24 Vdc	IP33	-20 °C to +60 °C (2)	-20 °C to +70 °C
IM45LC	24 Vdc	IP33	-33 °C to +45 °C	-40 °C to +70 °C
IMDL46	24 Vdc	IP33	-25 °C to +60 °C	-40 °C to +70 °C
BROR45C	24 Vdc	IP33	-20 °C to +60°C	-40 °C to +70 °C
CAD40	24 Vcd	IP33	-33 °C to +55 °C	-40 °C to +70 °C
Luffing angle sensor	24 Vdc	IP67	-20 °C to +60 °C	-40 °C to +75 °C
CANANA	24 Vdc	IP33	-25 °C to +60 °C	-40 °C to +70 °C
Load cell	24 Vdc	IP67	-25 °C to +60 °C	-25 °C to +60 °C
Trolley sensor	24 Vdc	IP65	-25 °C to +60 °C	-40 °C to +70 °C
Hoisting sensro	24 Vdc	IP65	-25 °C to +60 °C	-40 °C to +70 °C

- (1) The power source supplies a 24Vdc stabilized voltage to the system.
- (2) UCDL46 integrates its own heating and cooling system. UCDL46 CPU can work from -20 °C up to 60°C, however, the screen does not begin to work before the display is heated above -5 °C. When the internal temperature of the units approaches to the maximum operation temperature, the fan starts so as to keep the temperature below the maximum switch off temperature.

### 3.3 Description of the devices

#### 3.3.1 General description of the sensors (complete system)

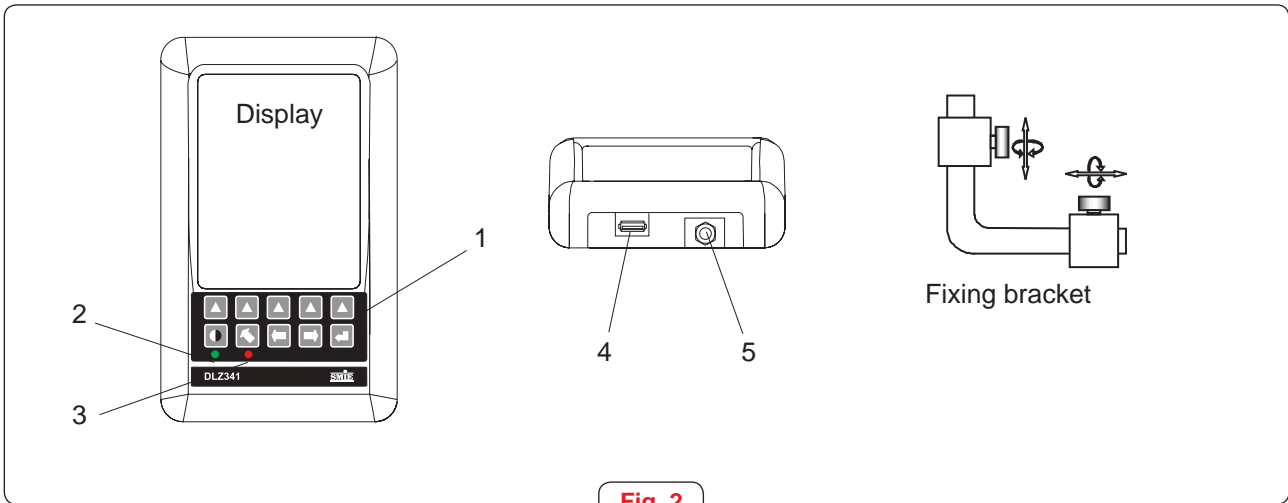
The following table shows the transformation of the sensor signals.

REFERENCE	SENSOR TYPE	LOCATION	SIGNAL	A/D CONVERSION
Hoisting	Pot. 0-10 kOhms	Hoisting winch	0-5 Vdc	CANANA
Trolley	Pot. 0-10 kOhms	Trolley winch	0-5 Vdc	CANANA
Moment	Inductive 4-20mA	Moment leaf spring	4-20 mA	CANANA
Load	Load cell	Hoisting wire rope	0-5 Vdc	IMDL46
Slewing (option)	Absolute encoder	Slewing ring	DIGITAL CAN	BROR45C
Travelling (option)	Incremental encoder	Travelling winch	DIGITAL CAN	CAD40
Anemometer (option)	Pulse counter	Anemometer	DIGITAL	IMDL46

#### 3.3.2 UCDL46 Central processing unit and display.

UCDL46 central processing unit and display unit lies inside the cab, in front of the crane operator seat, and is fixed to the cab by means of a bracket. (Fig. 2).

- 1 Navigation and data feed keyboard.
- 2 UCDL46 power on green LED (it switches on a few seconds after connecting the CAN M12 plug to the unit).
- 3 Failure on the system red LED (see Appendix 4).
- 4 USB port.
- 5 CAN M12 plug.



**Fig. 2**

☞ When UCDL46 internal temperature goes below -10°C or above +60°C, the screen is switched off and the power supply green LED blinks. The functions of the system keep working but the screen is automatically switched off to avoid damages.

! The display must be stored in a clean and dry place.

The UCDL46 unit is mounted inside the cabin on a fixing bracket that permits several rotations and movements. It allows the crane operator to set an optimal position from an ergonomic point of view.

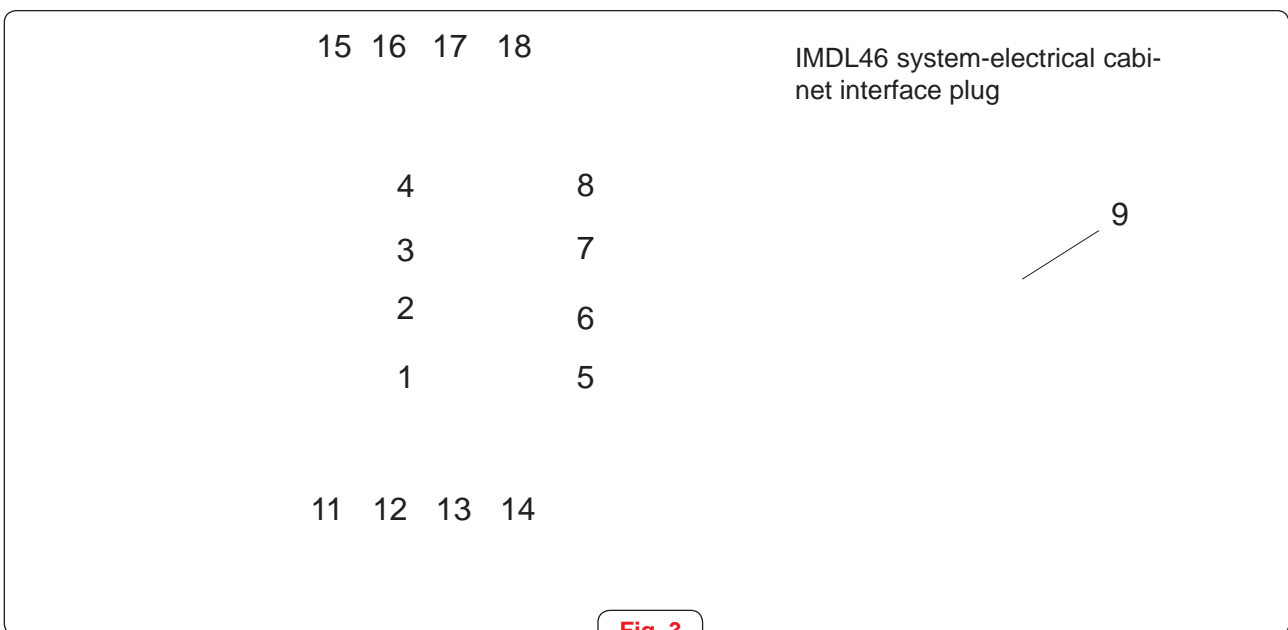
To adjust the display position and orientation, loose both swivels, set the unit to the desired position and tighten them again (Fig.2).

### 3.3.3 IMDL46 interface unit

IMDL46 is fixed to the cab electrical cabinet by means of 4 magnets on its back.

IMDL46 is a signal hub which receives and interconnects all the devices.









Every sensor signal (analogic and digital) are connected to IMDL46. Every 100ms the IMDL46 sends all the information to the central processing unit (CPU) which is inside the UCDL46.



**Fig. 3**




The sensor signals are connected to the IMDL46 front through CAN M12 plugs as indicated in the following table.

REFERENCE	FUNCTION
1	 Load cell signal
2	 Not used
3	 Not used
4	 Not used
5	 Trolley or luffing angle signal
6	 Hoisting signal
7	 Moment signal
8	 Slewing signal (option)
9	- Electrical cabinet digital inputs and outputs interface plug

Digital signals coming or going into the crane electrical cabinet go through the multipole fast plug (9) connected at the bottom of the IMDL46. This plug carries the signals needed for the data logger function.

The green fast terminal connectors on both sides of the IMDL46 connect devices which are permanently inside the cabin and, therefore, do not need to be connected or disconnected every time the crane is erected or dismantled (power source, IMDL46 to UC46 connection...). They are also used to connect some optional devices (anemometer, travelling...)

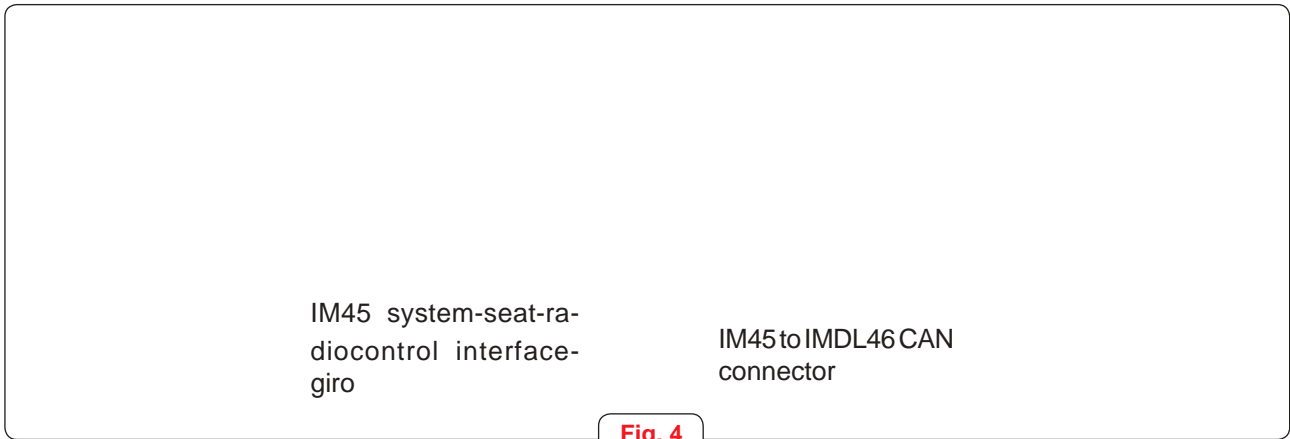
The following table describes the functions of the various devices which are connected to the IMDL46 through green fast connectors:

SIMBOLO	FUNCIÓN
11	 RS485 connection for the ITOWA anemometer speed sensor signal (anemometer option).
12	SHUNT KEY Not used.
13	UCDL IMDL46 to UDCL46 connection.
14	FREE Not used. Free CAN bus connection .
15	POWER IMDL46 to 24 Vdc power source connection.
16	IM45 IMDL46 to IM45 CAN connection (option).
17	UC35 Not used.
18	CAD40 IMDL46 to travelling CAD40 CAN sensor (option).

Further information on the connection of each device and on the electrical cabinet signals to the IMDL46, is available in the electrical wiring diagram.

### 3.4.3 IM45 system to seat-radiocontrol interface (forbidden zones option)

IM45 is fixed to the cab electrical cabinet by means of 4 magnets on its back.

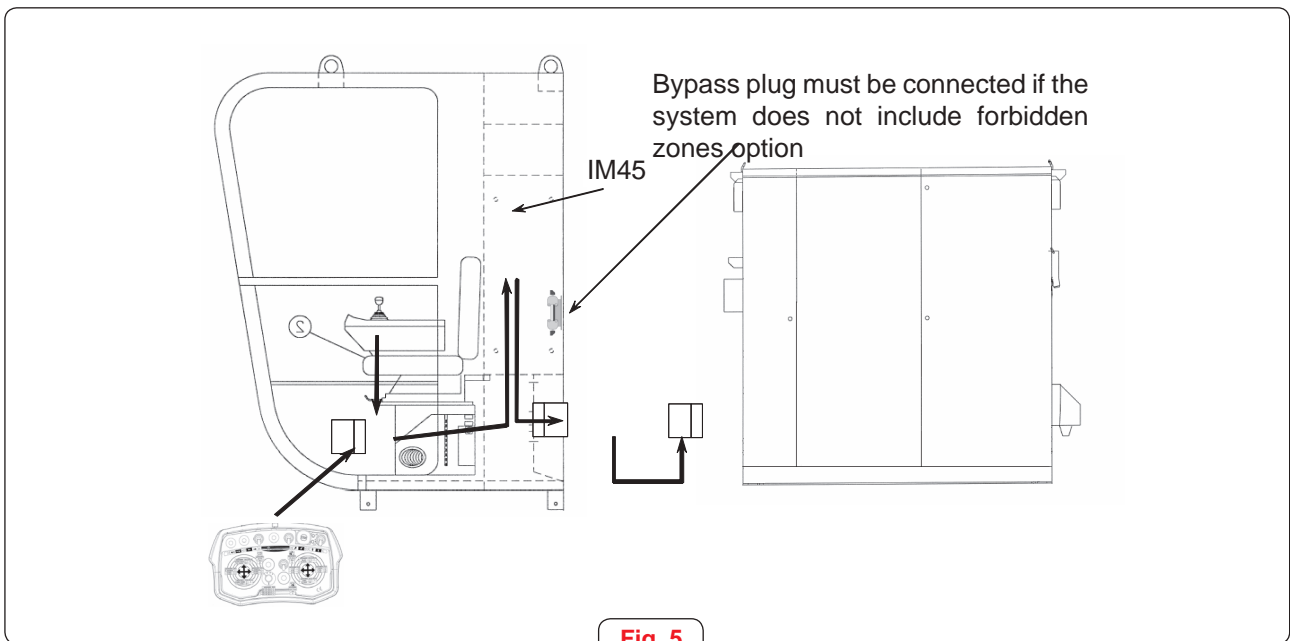


**Fig. 4**

IM45 consists of a relays interface that decelerate and stops the crane movements when the crane approaches to any of the forbidden zones (see 7).

The relays contained in IM45 can stop the signals going from the seatcontrol or radiocontrol to the electrical cabinet.

The following sketch shows the concept which allows the system to control the crane movements. The cabin is wired (Fig.5) in such a way that allows the IM45 to selectively stop the crane movements . Further information on the connection of each device and on the electrical cabinet signals to the IM45, is available in the electrical wiring diagram.



**Fig. 5**

If the system does not include the forbidden zones function, a bypass plug replaces the IM45. This bypass plug re-establishes the path between IM45 and the electrical cabinet, thus allowing the normal work of the crane.

**IMPORTANT NOTE:** the removal of the bypass plug stops the crane immediately as when pressing the emergency stop button. Do not remove the plug when moving the crane. A bad connection of the IM45 or of the bypass plug leads to the stop or prevention of some or every movement.

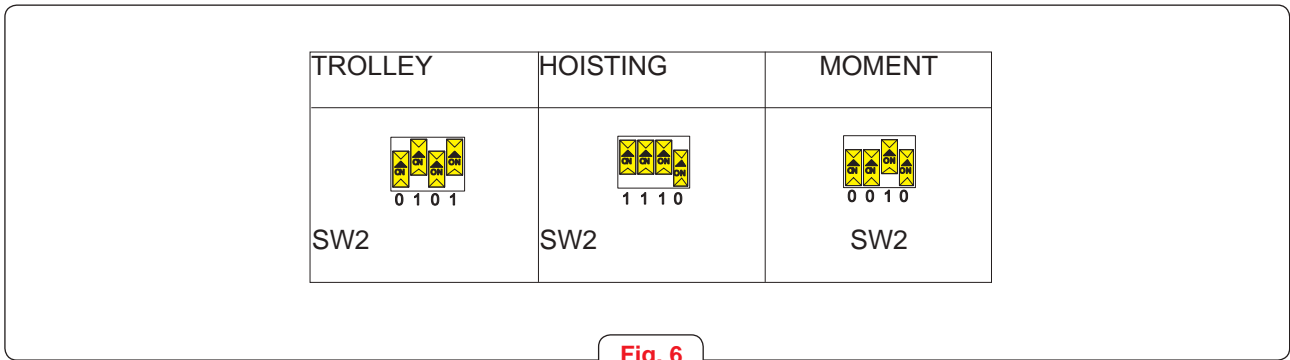
### 3.3.4 CANANA analog to digital signal conversion

CANANA is a device which translates the analog signal emitted by the trolley, hoisting and moment sensor to a digital signal comprehensible by the CAN network.

The trolley and hoisting sensors CANANAs are screwed inside the hoisting and trolley limiter.

The moment sensor CANANA is placed close to the moment inductive sensor and is fixed to the crane structure by means of a magnet. Moment CANANA must be vertically placed and must be close to the inductive sensor to prevent water from entering.

It is necessary to identify the CANANAs on the CAN network, so that the IMDL46 knows which sensor corresponds to each signal. To do so, every CANANA has got a switch set named SW2 that must be adjusted as per picture. 6.

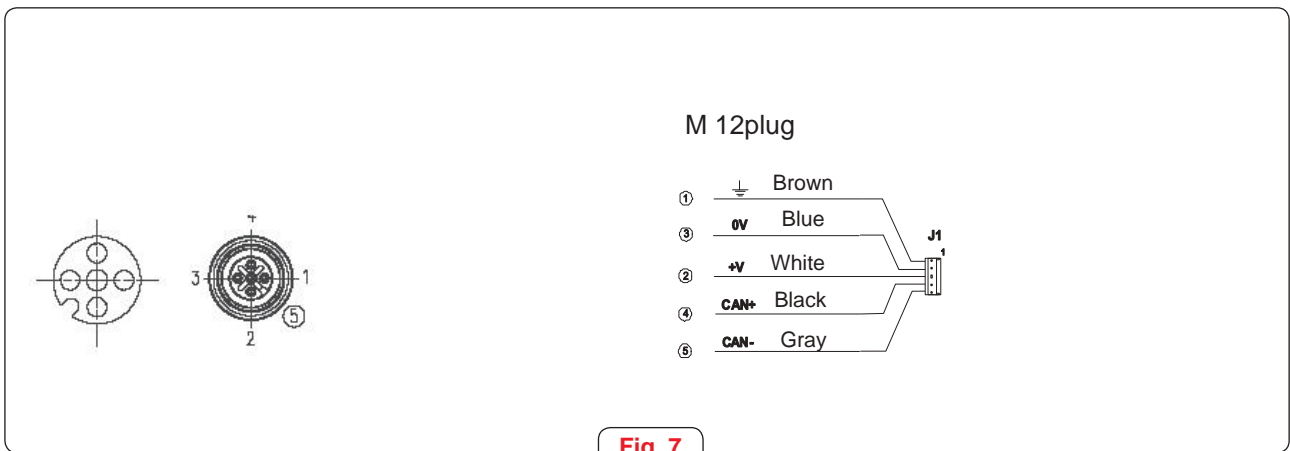


The amber D3 LED on indicates that the CANANA is powered ON.  
The green D4 LED on indicates that the communication between CANANA and IMDL46 unit is correct.

### 3.3.5 CAN cables

Each CAN cable is shielded to avoid electromagnetic interference.  
The following picture shows the wiring inside the CAN cable.

CAN M12 plugs are plastic injected to achieve a good sealing when properly connected.



### 3.3.6 Trolley and hoisting sensors

Trolley and hoisting sensors are of the same type.

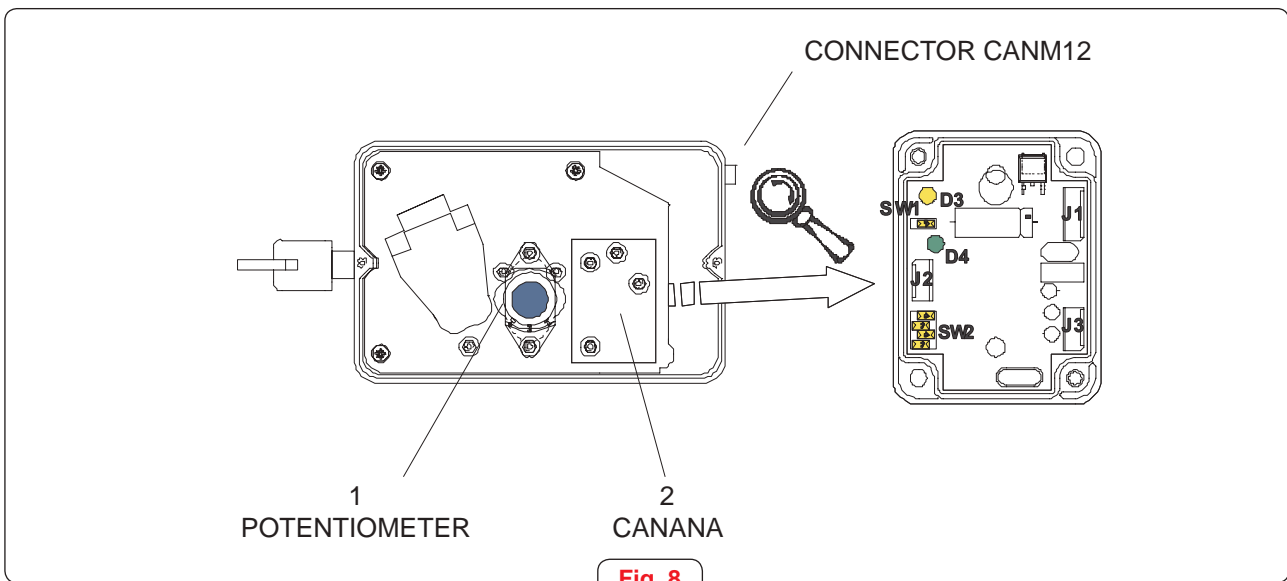
These sensors and their associated CANANAS are placed inside the trolley and hoisting limiters respectively.

Both limiters have got CANM12 connectors.

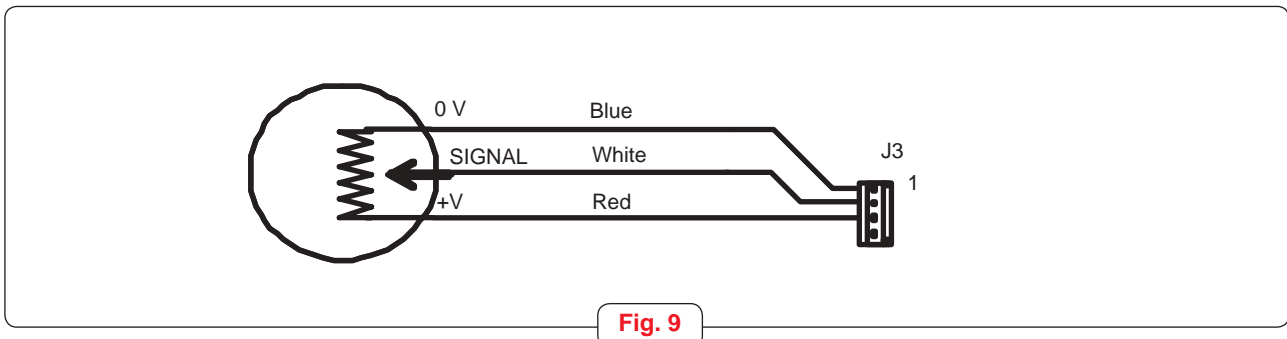
To connect the trolley and hoisting sensors to the IMDL46, it is enough to connect the cable CAN M12 connectors to the trolley and hoisting limiter CAN M12 connectors.

The trolley and hoisting analog signals come from a potentiometer of resistance between 0 and 10 kOhms (1, in picture 8). The potentiometer axle is connected through a gearbox to the rotating axle of the mechanism (trolley or hoisting). The analog signal is then translated to a digital signal comprehensible by the CAN network through a CANANA unit (2 in Fig. 8). (See 3.3.4).

The following picture identifies the potentiometer and the CANANA position within the limiter. The potentiometer adjustment is independent of the limit switches adjustment.

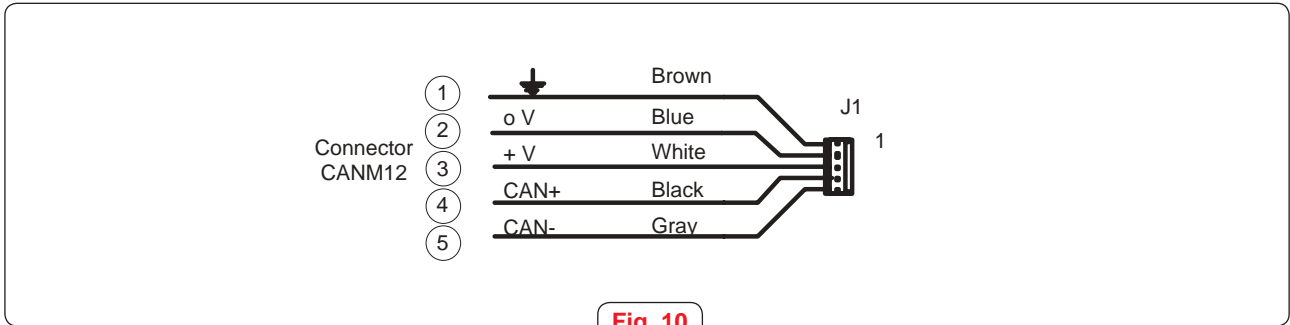


! The connection between the potentiometer and the CANANA is shown in the following picture.



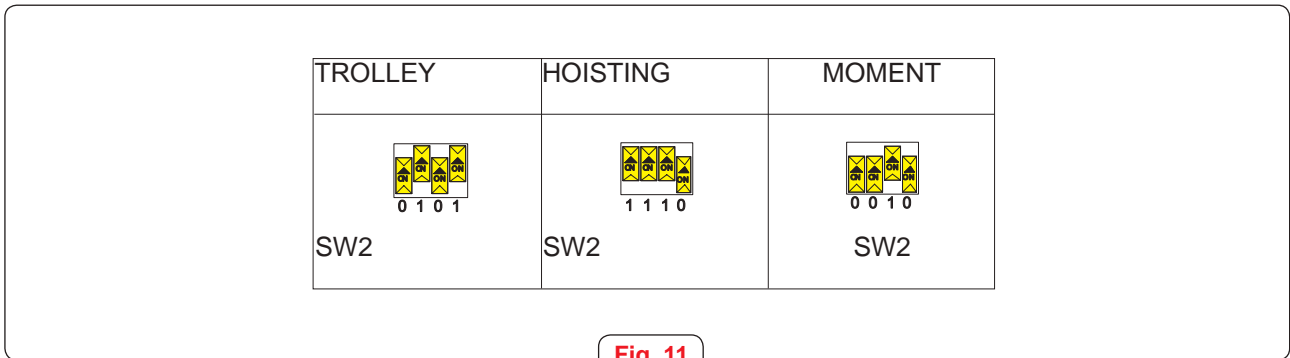
The digital signal generated by the CANANA is sent to IMDL46 unit through a CAN cable. This cable is connected to the limiter through a female CAN M12 connector.

The connection between the CANANA and the CAN M12 female plug is shown in Fig. 10.



**Fig. 10**

It is necessary to set up each CANANA so that the IMDL46 can identify to which sensor corresponds each signal received. To do so, the SW2 switches of the CANANA must be set up as shown in 3.3.4.

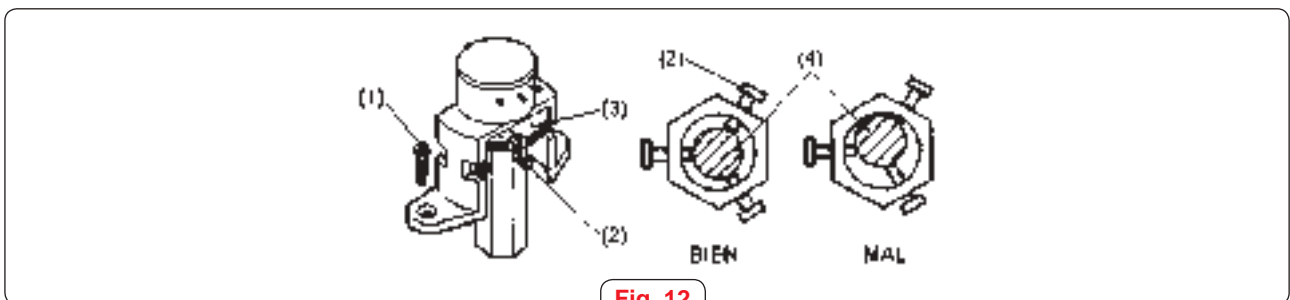


**Fig. 11**

### 3.3.7 Potentiometer manual adjustment (Fig.12)

If the potentiometer span is not enough, it may be necessary to disconnect and readjust it. Follow the following procedure:

- 1.- Loose two of the three screws (2) from the coupling of the pontentiometer. In case that you have a bad access to the screws (2) loose the complete assembly with the screws (1) and mount the same complete assembly in such a way that the accessibility is good to the two screws (2).Loose the two screws (2)
- 2.- Move the wheel (3) until you have reached the required value.
- 3.- Tighten again the two screws (2) in such a way, that the axle of the potentiometer remains in the middle of the coupling (see picture below).



**Fig. 12**

### 3.3.8 Moment sensor

The moment sensor is placed on the moment leaf spring, next to the moment limiters. The connection between the moment CANANA and the IMDL46 unit is done through a CAN M12 cable.

The moment is indirectly estimated by measuring the movement of the moment leaf spring. The movement of the leaf spring increases as the moment exerted by the load on the crane increases. The movement is measured through the inductive sensor drawn in Fig. 13.

The inductive sensor generates an analog signal (4-20 mA) which is then translated to a digital signal through a CANANA (see 3.3.4).

The CANANA digital signal is sent to the IMDL46.

The connection between the moment inductive sensor and the CANANA is shown in Fig.13.

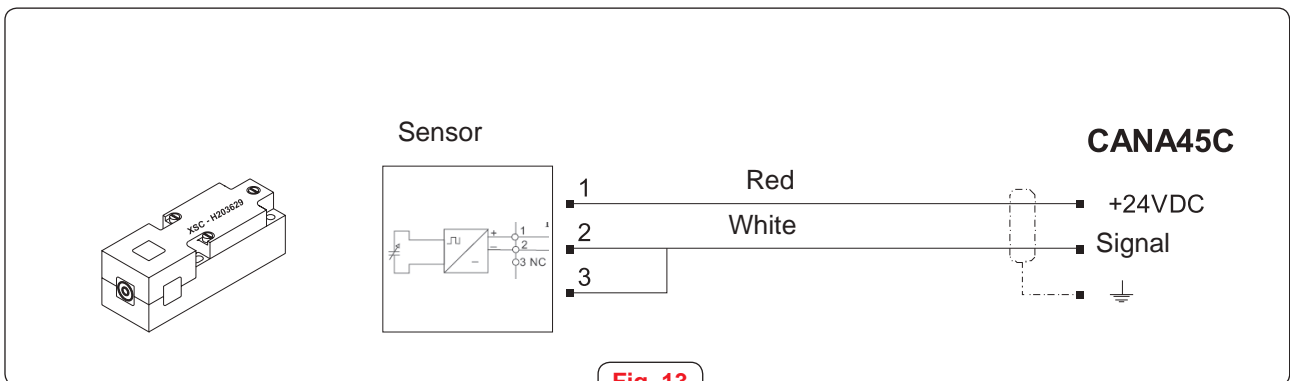


Fig. 13

It is necessary to set up each CANANA so that the IMDL46 can identify to which sensor corresponds each signal received. To do so, the SW2 switches of the CANANA must be set up as shown in 3.3.4.

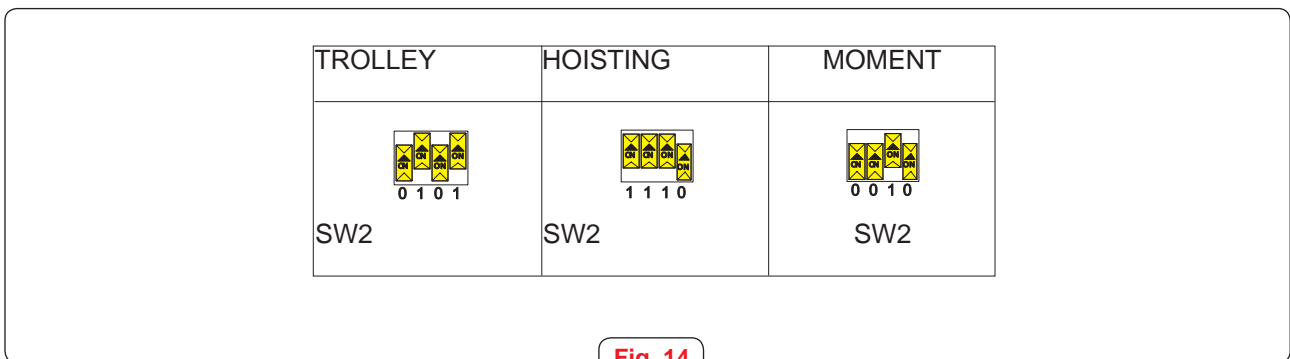


Fig. 14



WHEN ADJUSTING THE MOMENT SENSOR IT IS NECESSARY TO CHECK THAT THERE IS NO POSSIBILITY OF GEOMETRICAL CONTACT BETWEEN THE INDUCTIVE SENSOR AND THE MOMENT LEAF SPRING OF THE CRANE, UNDER ANY CIRCUMSTANCE.

### 3.3.9 Load cell

The lifted load is measured through a load cell. The load cell is placed next to the load limiter and undergoes directly or indirectly the stress of the hoisting cable.

To connect the load cell to the IMDL46, it is enough to connect the cable with the fast CANM12 connectors to the load cell.

The signal is generated in the load cell by means of a gauge bridge. The signal conditioning is done through an amplifier, inside the load cell.  
The load cell translates the strain applied on it to a voltage signal which goes from 0 to 5 Vdc. This signal is sent to the IMDL46.

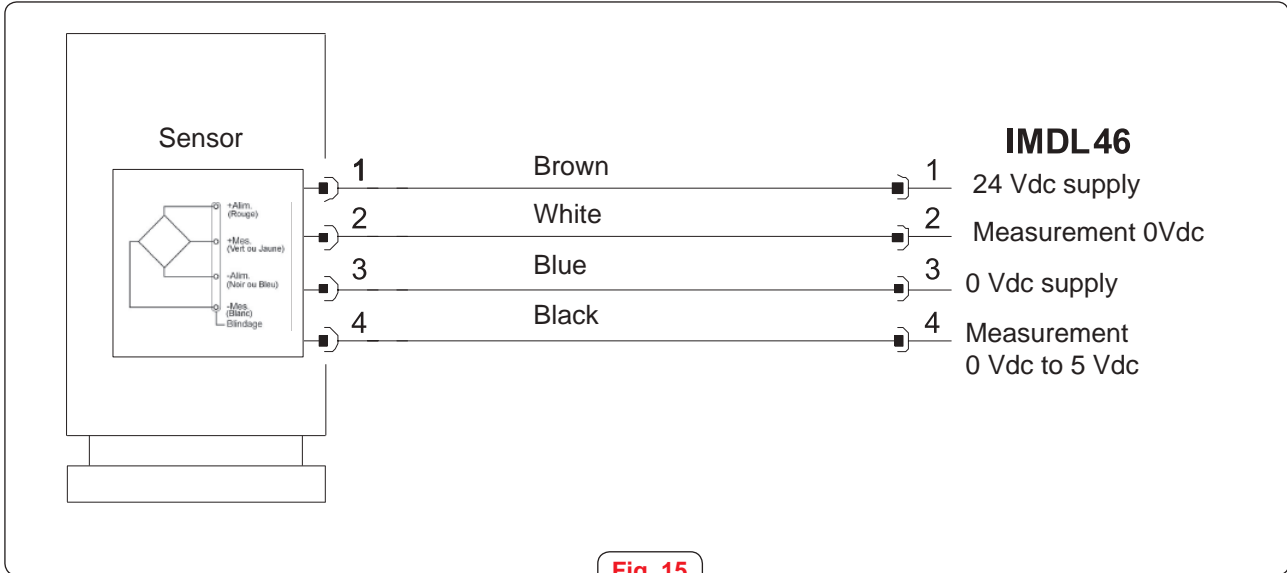


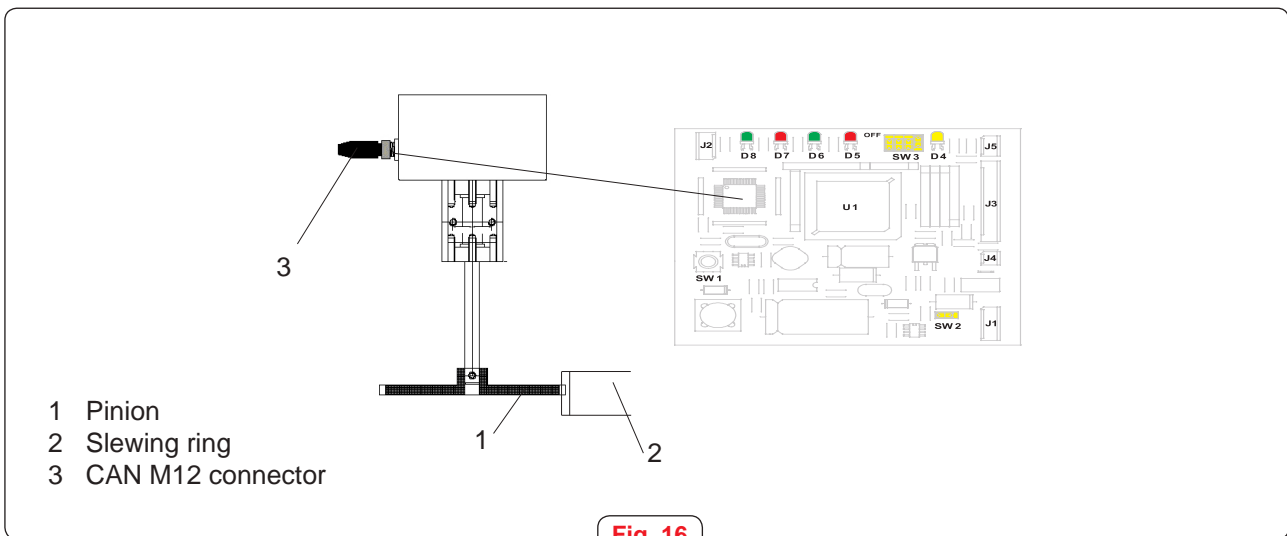
Fig. 15

### 3.3.10 Slewing sensor (option)

The slewing sensor measures the angle of the crane.

The connection between the Slewing sensor and the IMDL46 is done through a CAN M12 cable.  
The slewing angle is transmitted to the sensor through a pinion connected to the luffing ring.  
The pinion transfers the slewing movement to an axle which is reduced through a gear inside the slewing sensor box, and then it is transferred to an absolute encoder in a 1:1 ratio.  
The absolute encoder signal is transformed into a CAN signal inside the slewing sensor box by means of an electronic board.

The slewing sensors are different depending on the crane models as the gear ratio and the teeth number and modulus depends on the slewing ring model.



REFERENCE	EXPLANATION
D4	Power on LED.
D5	CAN bus error LED.
D6	CAN bus error LED.
D7	Sensor error LED.
D8	Communication error LED
J1	Power and CAN bus connector.
J2	Microcontroller programming connector.
J3	12 and 14 bits encoder connector
J4	Encoder heating resistor connector.
J5	Temperature PTC connector.
SW1	Reset button.
SW2	120 Ohms CAN Network end indicator
SW3	Encoder type selection
U1	Microcontroller.

### 3.3.11 Travelling sensor (option)

#### Working principle

CAD40 comprises the set of devices needed to properly measure the distance travelled by the crane on a railtrack.

It is placed on the basement of the crane, close to the travelling mechanism.

It performs the following functions.

- Indication of the travelling distance.  
An incremental encoder, placed inside a TER GF4C limiter, and connected to one of the travelling rotating axles, generates a train of pulses that are then read by the electronic CAD40 module. The processing unit of CAD40 integrates a pulse counter which determines the sense of the movement and allows calculating the position of the crane on the track after properly adjusting the scale. The information is sent through the CAN bus to the IMDL46.  
CAD40 allows to measure movements of up to 250 m.
- Correction of the deviation due to the slip on the track-wheel contact.  
An inductive sensor detects a thin metal sheet fixed to a known position on the track and allows the electronic CAD40 module to readjust the scale according to the actual situation if needed.

This function allows the correction of the deviation due to the slip on the track-wheel contact every time the crane passes through this railtrack position.

When the railtrack is long, an additional reset sensor can be supplied so that the readjustment can be done in two positions of the track.



### Devices that make up the CAD40 travelling sensor

CAD40 includes the devices shown in Fig.17.

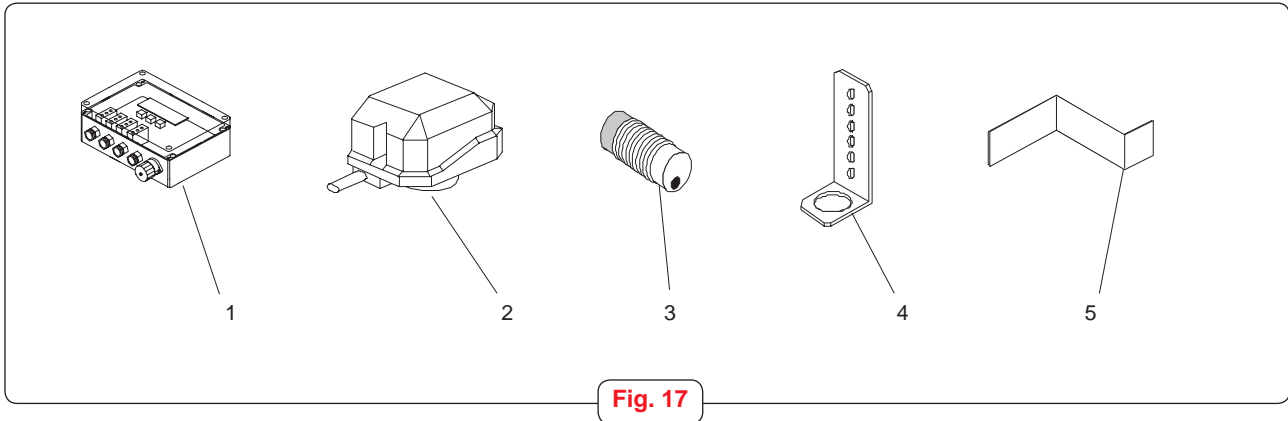


Fig. 17

- 1 CAD40 electronic board is the processing unit for the signals received from the inductive sensors. It determines the sense of the movement and the crane position on the track and transmits it to the IMDL46 through the a CAN cable (the length of the cable depends on the crane height)
- 2 Limit switch TER GF4C equipped with an incremental encoder to count the turns of the travelling wheel.
- 3 An inductive sensor for repositioning, to reset the error due to the slip in the contact between wheel and track.  
For long tracks, a second repositioning sensor may be necessary.
- 4 A bracket for the repositioning sensor and its screws and bolts. A second bracket is delivered when two repositioning sensors are used.
- 5 A repositioning flag to weld along the track. A second repositioning flag is necessary when two repositioning sensors are used.

### Installation of the components

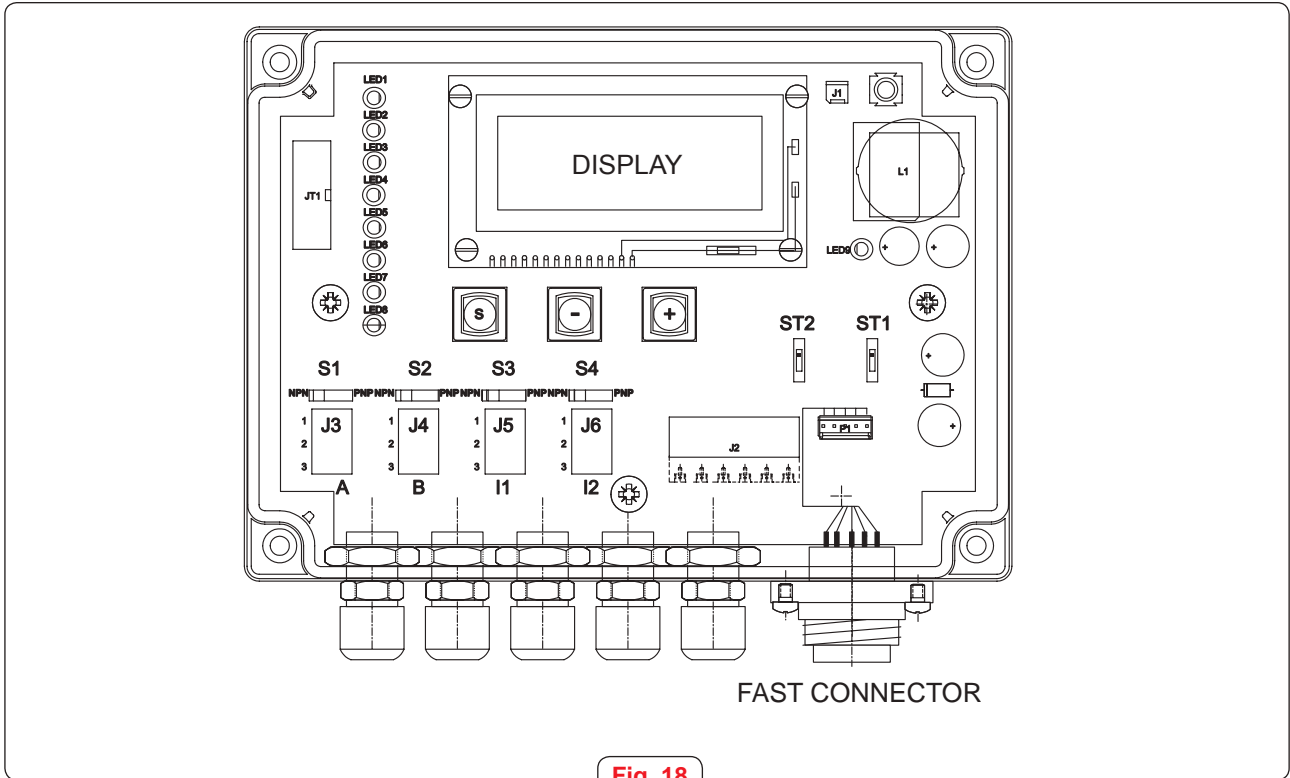


Some of the following steps imply an important crushing danger. DO NOT hesitate to lock the travelling winch when necessary and to ensure a good and permanent communication with the crane driver.

- Encoder:  
The encoder is mounted in a TER GF4C limiter. It generates spaced pulses when the wheel rotates. TER GF4C limiter is fixed by means of a bracket and is connected to the wheel or gear axle depending on the bogie type.
- Repositioning sensors and indicators:  
Weld the repositioning indicators on a side of the track so that they pass close enough to the repositioning sensors when the desired resetting point is reached.  
Choose a repositioning point that it lies in a place, which the crane is usually passing through. A proper choice will result in smaller error accumulation. Install the optional indicator and repositioning sensor in the other track.

- CAD40 electronic board :  
Install the electronic board close to the travelling limiter on a place where it is free from shocks, for example in a proper placed on the bogie.  
The magnets allow it to be fixed to any steel sheet of the bogie. Place it vertically with the glands upside to avoid water from entering.

**CAD40 electronic board description**

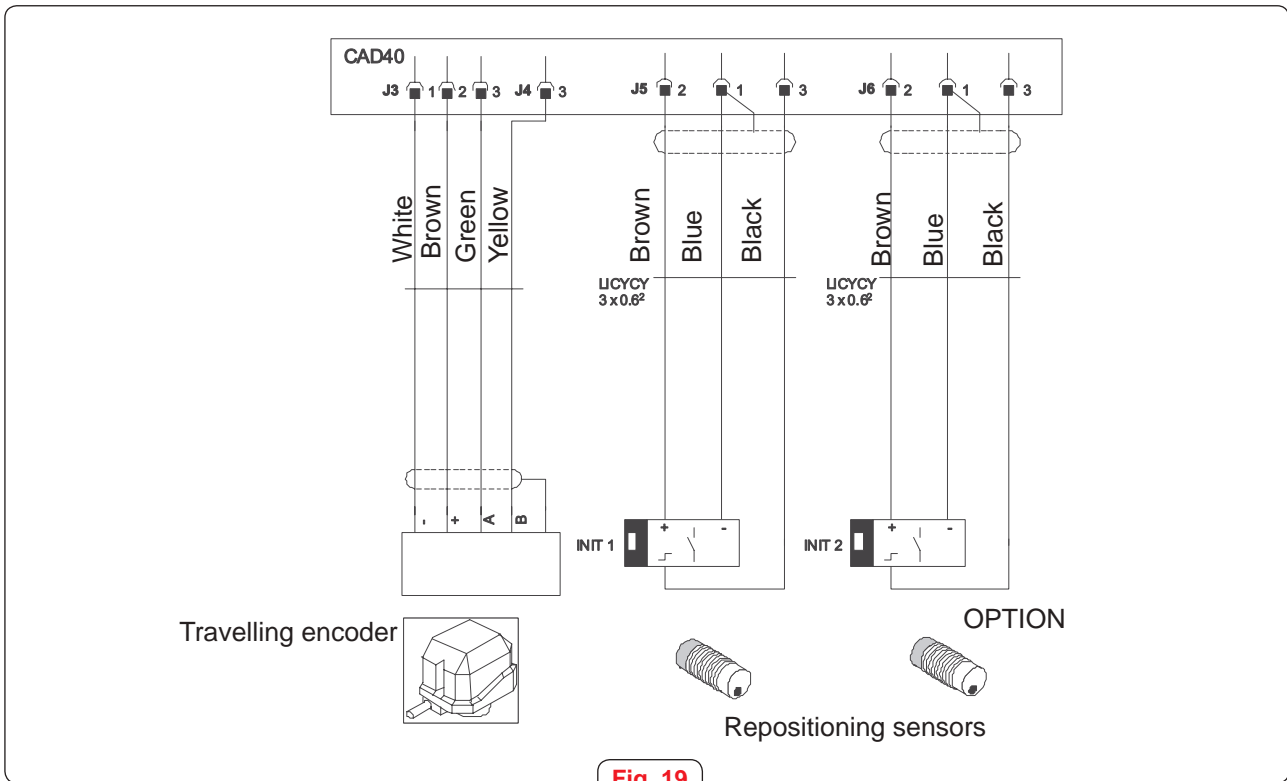


**Fig. 18**

SYMBOL	FUNCTION
DISPLAY	It is the programming interface to CAD40 electronic module.
J2	Radio link (not used).
J3	TER GF4C Encoder connection.
J4	TER GF4C Encoder connection.
J5	First repositioning sensor I1 (init 1).
J6	Second repositioning sensor I2 (init 2) (option).
LED1	(amber) «A channel detector» : ON when the encoder sends a pulse.
LED2	(amber) «B channel detector» : ON when the encoder sends a pulse.
LED3	(amber) «I1 detector» : ON when the I1 repositioning sensor is reached.
LED4	(amber) «I2 detector» : ON when the I2 repositioning sensor is reached.

SIMBOLO	FUNCIÓN
LED5	(amber) «positive» : ON when counting is upwards
LED6	(green) «can bus» : ON if messages are correctly received over the CAN bus.
LED7	(red) «RS485» : ON if messages are correctly received over the RS485 link.
LED8	(red) «default» : ON when the CAD40 software detects a fault.
LED9	(red) «power on» : ON when the unit is powered on.
S3	Selection of the repositioning type of signal expected at J5 or J6 (NPN o PNP).
S4	Selection of the repositioning sensor type (NPN o PNP).
FAST CONNECTOR	It establishes the link between CAD40 electronic board and IMDL46 through the CAN bus network.
ST1	This 120 Ohms resistor must be enabled (ON) if the distance between the travelling mechanism to IMDL46 is bigger than the distance to the trolley. If so, the trolley 120Ohms resistor SW1 must be switched off.
ST2	ST2 enables(ON) or disables(OFF) the RS485 120 Ohms resistor.
S, -, +	Display navigation keyboard.

**Wiring of CAD40**



**Fig. 19**

Connect the devices as indicated in Fig. 19.

### Using the programming keyboard

Program CAD40 using the 3 pushbuttons labelled «S», «-» y «+»

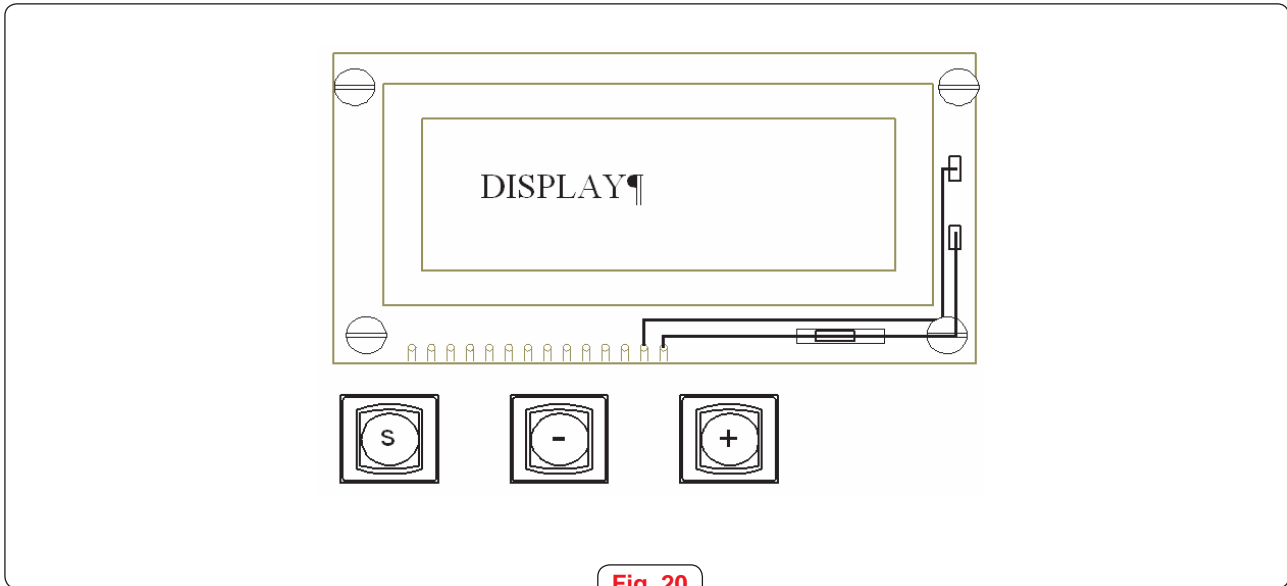


Fig. 20

- «S» allows selecting a menu, a reply to a question, or a value.
- The «+» key allows to go to the next menu, to the next question, or to increment a value.
- The «-» key allows to go to the previous menu, to the previous question, or to decrement a value.

### Unit programming

Before any new programming, restore the default values. The *CAD40* restarts, and you must type the secret code again to be able to change settings.

The value is adjusted one digit at a time, starting from the most left digit. Press «S» to go to the next digit.

The last «S» validates the complete value.

To enter the values of inits 1 and 2, it is possible to directly take the value by simultaneously pressing «+» and «S», starting with «+».

The complete programming menu is the following : (the chapter numbers are for guidance only in this document)

1. Setting:
  - 1.1 Secret code: (from 000 to FFF)
  - 1.2 Language: (F / GB / D)
  - 1.3 Sensor type: (travelling/trolley/hoisting)
  - 1.4 Use of inits: (none/ 1 / 2 / double 1 (secure))
  - 1.5 Init values:
    - 1.5.1 Init 1 : (from 0 to 1023)
    - 1.5.2 Init 2 : (from 0 to 1023)
2. Options:
  - 2.1 Max acceptable reset on reinit:V (1 to50)
  - 2.2 Pre-division factor: not used(de to 100)
3. Information:
  - 3.1 Software information
  - 3.2 Average offset
  - 3.3 Last error
  - 3.4 CAN bus status
4. Restore all default settings (confirmation is requested)

## Configuration menu description

### 1. Setting

#### 1.1 Secret code.

Enter the secret code to to change values in any menu, except for language selection.

In this software version, the secret code is unique to all CAD40s and is:

« 34A »

Do not disclose

After you have entered the secret code, you can change the values.

After 30 minutes without pressing any key, or in case of power supply failure or reset, the CAD40 locks.

To change values, you must type the secret code again.

#### 1.2 Language.

Menu for the language selection. Only the error messages are always in English.

After restoring the default values, the language is French.

#### 1.3 Sensor type.

Sensor type selection: travelling, trolley or lifting. This selection changes the value of «init1», which becomes 500 for a travelling sensor and 200 for a trolley sensor. This value can be adjusted later.

After restoring the default values, the CAD40 is in the travelling mode.

#### 1.4 Use of inits.

Use this menu to define the desired init type.

«None»: No init, the detector inputs I1 and I2 are not used.

«1 init»: For a single init detector connected to I1, with I2 unassigned.

«2 inits»: For 2 detectors connected to I1 and I2, with 2 flags at 2 points of the track.

«Double»: For 2 detectors connected to I1 and I2 with a single flag to make the init secure.

After restoring the default values, the CAD40 is on «init 1»

#### 1.5 Init values.

##### Init 1

Use it to set the value of init 1.

If no init is used, this value is unnecessary. For 1, 2 or a double init, this value is taken into account.

It is possible to define the current value as the init value by simultaneously pressing «+» and «S», starting with «+».

After restoring the default values, the CAD40 is defined as a travelling sensor and init 1 is set to 500.

##### Init 2

Use it to the value of init 2.

If using a single init , or if using double init is used, this value is unnecessary.

It is possible to define the current value as the init value by simultaneously pressing «+» and «S», starting with «+».

After restoring the default values, init 2 is always 0.

### 2. Options

#### 2.1 Max acceptable reset on re-init: 1 to 50.

Used to set the max slip beyond which a fault is generated.

At the level of the init marker, the software determines the correction to be applied to the value it has in memory to reset the init value. If the difference is greater than this «max reset», an internal fault is generated. The red LED comes on and an error message can be read.

After restoring the default values, the max reset is 15.

#### 2.2 Pre-division factor: 1 to 100

This function is used reduce the number of flags. If «N» is the value of this factor, the CAD40 will increment by 1 every N flags only. This function is to be used only in special cases.

After restoring the default values, the pre-division factor is 1.

3 Information  
3.1 Software information.  
Software version and checksum.

3.2 Average offset.  
Average of the last 10 offset values (see «max reset»). If nothing is displayed, then the value is not yet available (if less than 10 inits have been recorded for the time being)

3.3 Last error.  
Message corresponding to the last recorded error. Pressing «S» clears this message and turns off the red LED.

3.4 CAN bus status.  
Information on the local status of the CAN bus. The possible values are:  
Good, average, bad and bus off. This information may be useful for diagnosis.

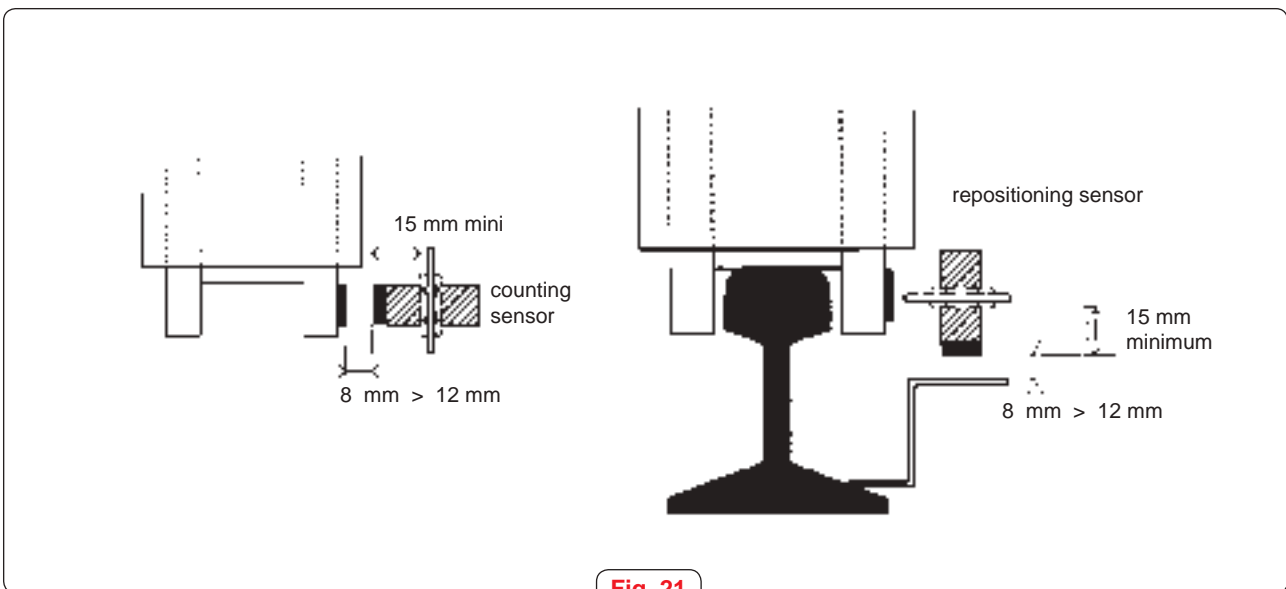
4 Restore all default settings.  
Pressing «S» in this menu resets the CAD40 to the default values. A validation will be requested before action.

**Repositioning sensor adjustment**

The inductive sensors detect a metal piece at a distance of 8mm to 12mm toward the front of the detection face and 15mm toward the back, for instance the support of the sensor (see drawings below):

The sensors have a LED on their back to check their status (detection or not). This status can also be checked on LED 1 to 4 in the CAD40.

It is necessary to take the slack of the wheel on its axis into account. Depending on the travelling track this slack can be very important and modify the distance flag/sensor you may have adjusted. It is then required to check that both sensors detect all flags and only the flags all along the track to avoid any error in the counting and then the positioning of the crane.



**Fig. 21**

To achieve it, while you travel the crane from one side to the other of the track, look at the LED 5 (SENS POSITIF) in the CAD40. This one must be permanently ON (or OFF, depending on the direction of travelling). If the LED5 flashes even a short while during the crane travelling it means that one of the sensors didn't detect a counting flag (gap between flag and sensor to big), or detected the wheel (gap between flag and sensor to small). If this is the case, readjust the sensor and then repeat the previous operation several times to ensure a good counting all along the track.

**CAD40 electronic board adjustment**

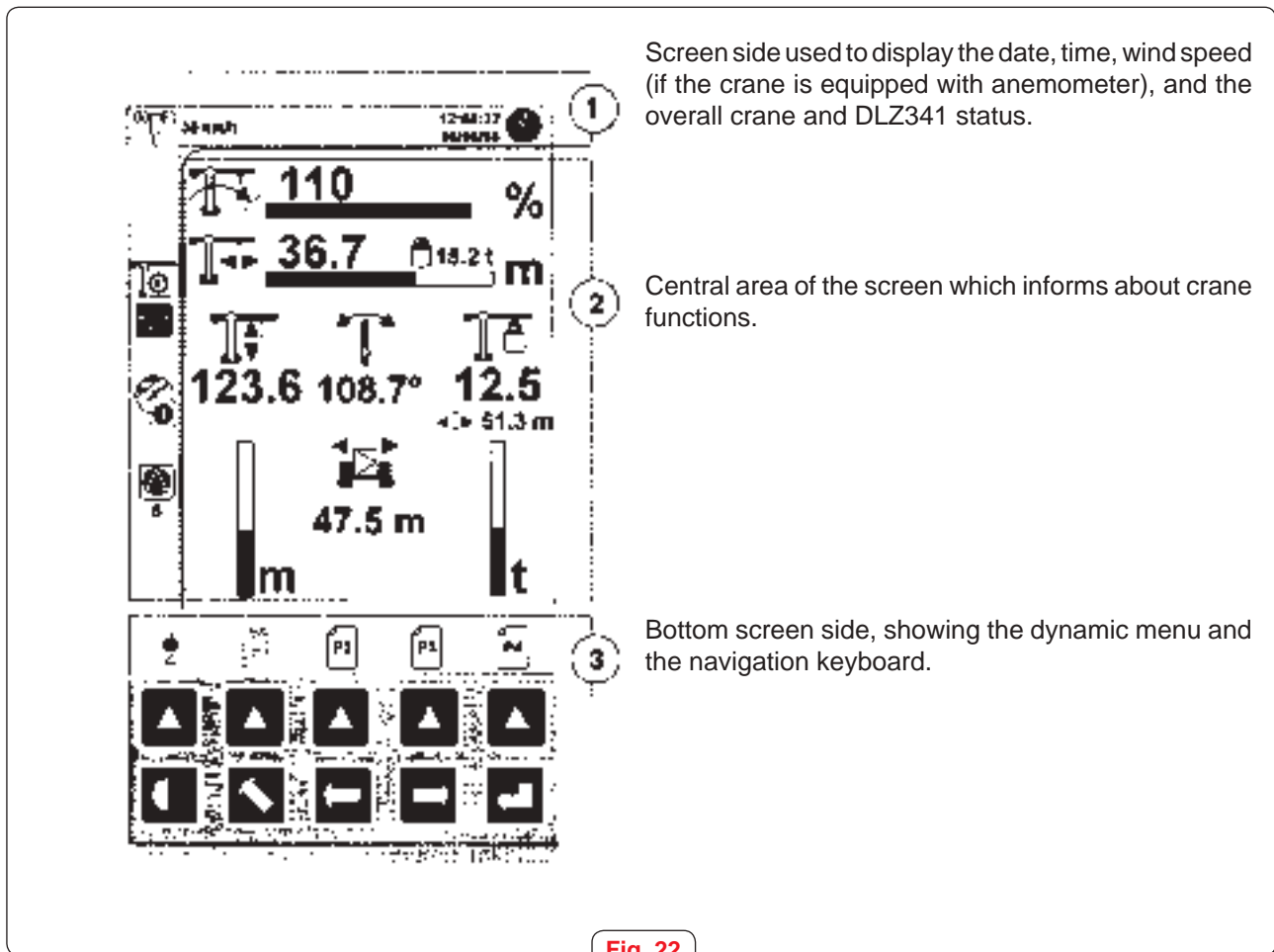
First, place the crane at the centre of its travelling track and disconnect the repositioning sensors in the CAD40.

- Enter the CAD40 menus with «S», «+» et «-».
- Re-initialise the CAD40 with menu 4. Restore all default settings.
- Enter menu 1. Setting.
- Type in the Secret code.
- Then in the menus choose the desired Language and the type of sensor you are using the CAD40 for : « travelling ».
- Finally, enter the number of init used in Use of inits.
- In menu 2.Options, enter your value for the Max acceptable reset on reinit (Usually, this value equals the number of impulsions corresponding to a positioning error of about 1m).

While keeping the repositioning sensor(s) disconnected in the CAD40, move the crane till the repositioning sensor is completely above the repositioning flag (Fig.21). Setting and for the corresponding sensor (I1 or I2) enter the Init value. You can either read this value in the main screen (number of impulsions) or learn it directly. Re-plug the set sensor. Repeat this step for the second repositioning sensor if necessary.





**4 USE OF UC DL46 DISPLAY.**

**4.1 Information on the screen and use of the keyboard.**









**Fig. 22**

The following table shows the pictograms in this page and their meaning.








SIDE BAND PICTOGRAMS			
PICTOGRAM	EXPLANATION	CONFIGURATION	
1		Wind speed.	Option
2		Wind speed prealarm (threshold defined by the user).	Option
3		Wind speed alarm (threshold defined by the user).	Option
4		Anemometer signal fault	Option
5		Crane switched on.	Basic system
6		Crane switched off.	Basic system
7		Weathervaning on.	Basic system
8		Forbidden zones ON.	Forbidden zones
9		Forbidden zones OFF.	Forbidden zones
10		Internal system fault (see appendix 4)	Basic system

The following table shows the function of each keyboard key.



NAVIGATION AND DATA FEEDING KEYBOARD		
KEY	EXPLANATION	
1		Pushbutton associated to the dynamic menu.
2		Enter.
3		Move right or increase value.
4		Move left or decrease value.
5		Escape.
6		Screen backlight control (in Page P1). In some other pages it is a help button.

#### 4.2 Dynamic menu.

Depending on the active page and the navigation level, the dynamic menu changes and offers different choices between the associated pictograms. To choose any option use the pushbuttons associated to the dynamic menu.

DYNAMIC MENU PICTOGRAMS			
PICTOGRAM	EXPLANATION	CONFIGURATION	
1		Accesible menu page.	Basic system
2		Active page.	Basic system
3		Page under programming or configuration mode.	Basic system
4		Move right to hidden dynamic menu elements	Basic system
5		Move left to hidden dynamic menu elements.	Basic system
6		Navigate through additional pages of the event log.	Basic system
7		Export to USB.	Basic system
8		Import from USB.	Basic system
9		Delete information.	Basic system



DYNAMIC MENU PICTOGRAMS		
PICTOGRAM	EXPLANATION	CONFIGURATION
10	Restore factory settings.	Basic system
11	Save current settings.	Basic system
12	Activate/Deactivate forbidden zones.	Forbidden zones
13	Show advanced forbidden zones parameter configuration	Forbidden zones
14	 Show the version information and software upgrading page	Basic system
15	 Current reeving and manual reeving change.	Basic system

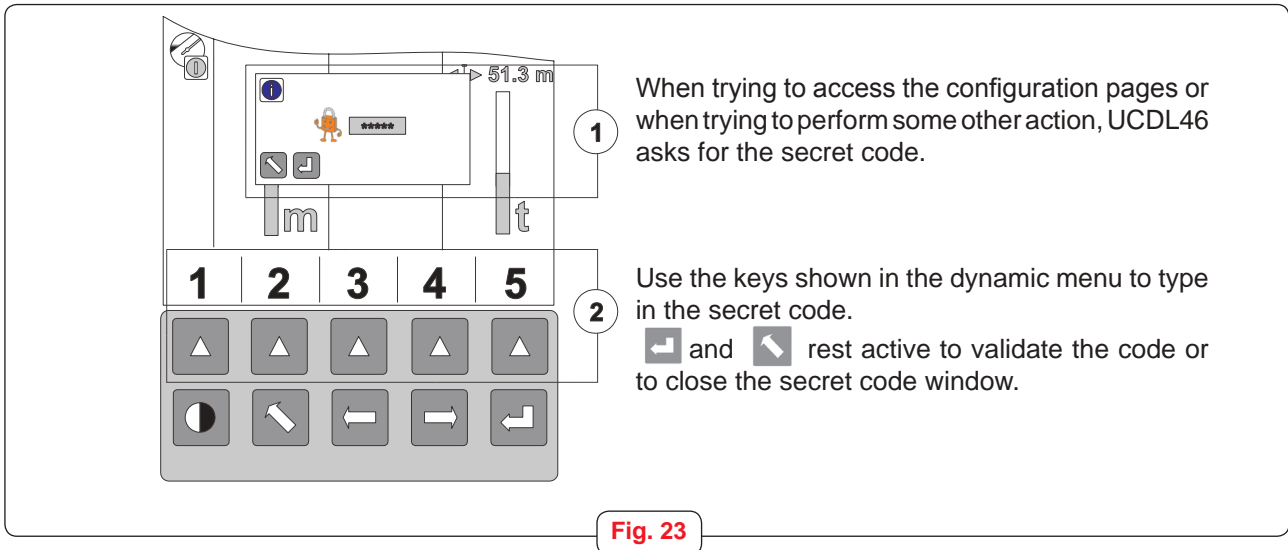
### 4.3 Secret code.

A code is necessary to get access and modify some of the system options and parameters. This is a way to avoid that an error of the user causes further damage. It is the responsibility of the crane owner not to communicate this code.








There are four different acces levels, and each of them has got a different secret code:

- N0 SMIE's access level.
- N1 COMANSA's access level.
- N2 crane owner's level (the code is 13524, and cannot be changed. Do not disclose it).
- N3 crane users' level (not used)

To type in the secret code:

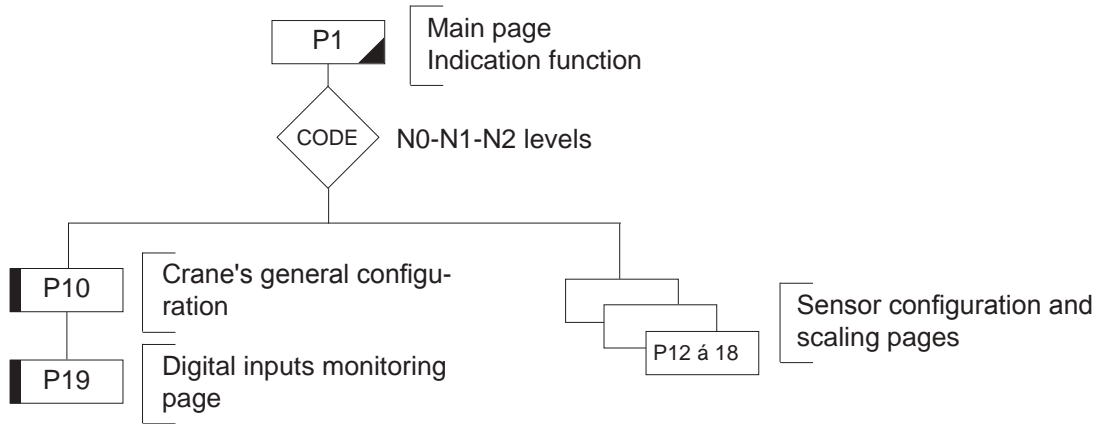


### 4.4 Editable fields.

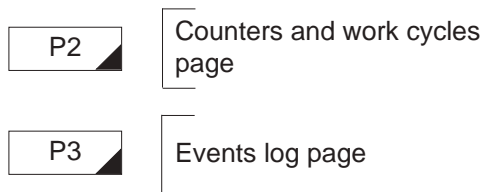
	FIELD	KEYS	EXPLANATION
1	<input type="text" value="000.00"/> m	 	Allows to move from a field to the next or previous one through the configuration pages. The active field is highlighted in a blue frame.
2	<input type="text" value="000.00"/> m		Enter the field to modify.
3	<input type="text" value="500.00"/> m	 	Choose the alphanumerical value of the current digit
4	<input type="text" value="500.00"/> m		Confirm the current digit value and pass to the next one.
5	<input type="text" value="000.00"/> m		Exit the field.

### 4.5 Pages' hierarchy.

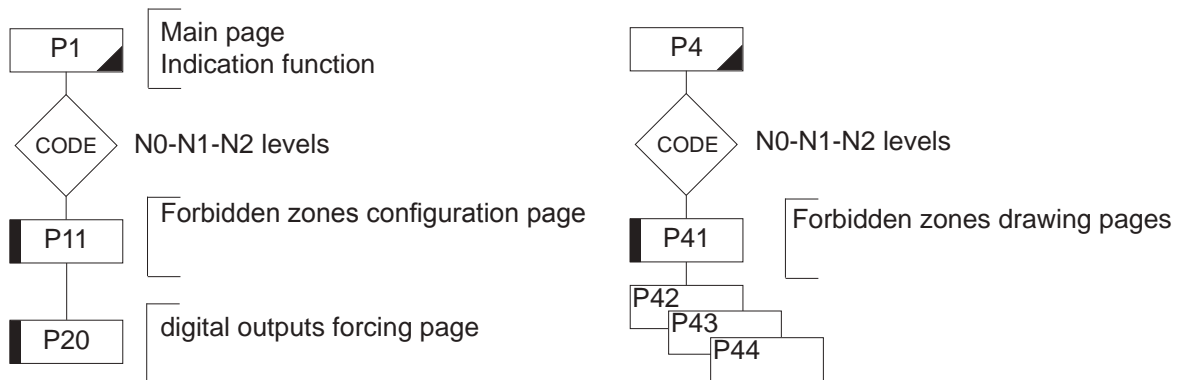
Indication function (see 5):



Black box function (see 6):



Forbidden function page (see 7):





### 4.6 Exporting or importing UC DL46 configuration files.

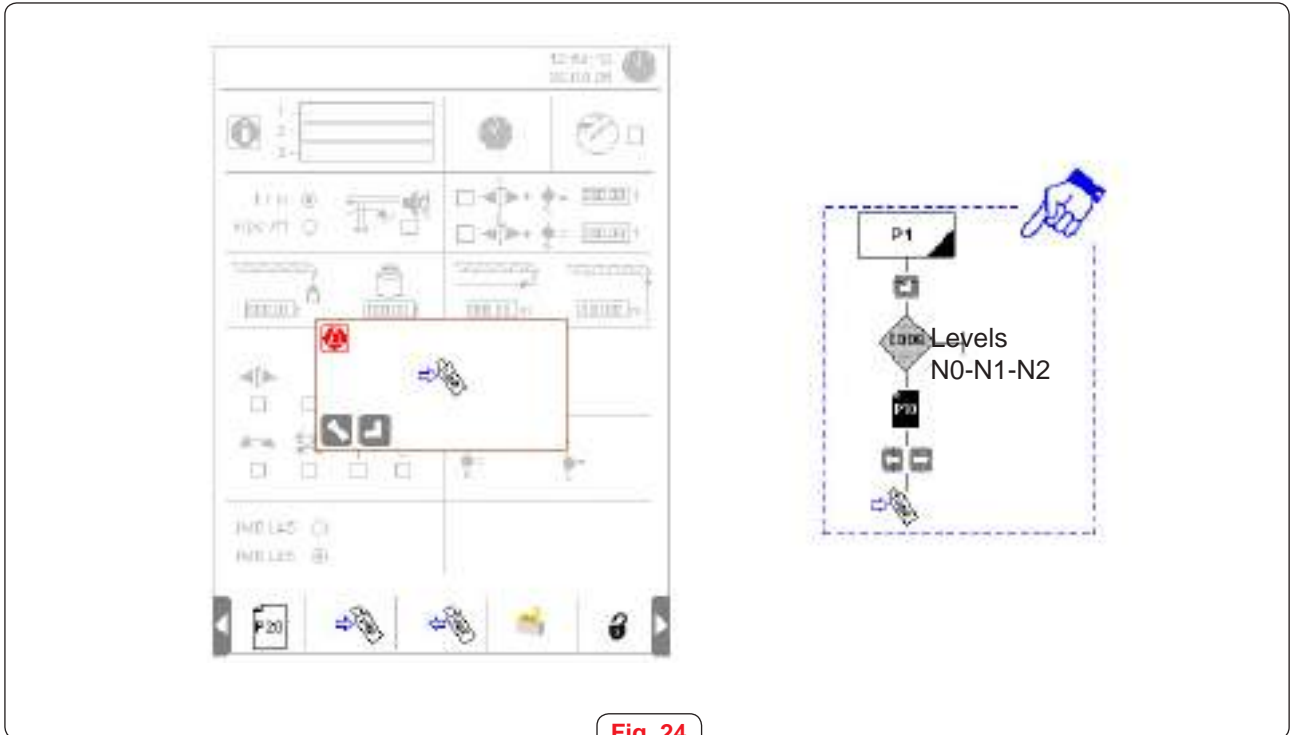
For maintaining or especial purposes (eg, to replace the UC DL46 central and display unit), it may be useful to export the complete configuration of the UC DL46 old unit to the new one.

The configuration export operation consists on saving to the USB key all the registered parameters of page [P10] an also the current scaling of the sensors for the indication and also the registered parameters and zones of forbidden zones option [P11] / [P41]. The configuration import consist on downloading the configuration file contained on the USB key to the UC DL46.




To export or import the UC DL46 configuration to or from the USB key:


Insert the USB key in the UC DL46 port (see 3.3.2), then follow the process visually described below, until reaching the transfer confirmation screen. The process is the other way for exporting importing the data.

Use the  button for exporting the configuration to a USB key or the  button to import a configuration from a USB key.



**Fig. 24**

Press  to confirm the transfer or  to cancel. Once the transfer is done,  indicates that it has been successfully performed and the USB key can be removed.

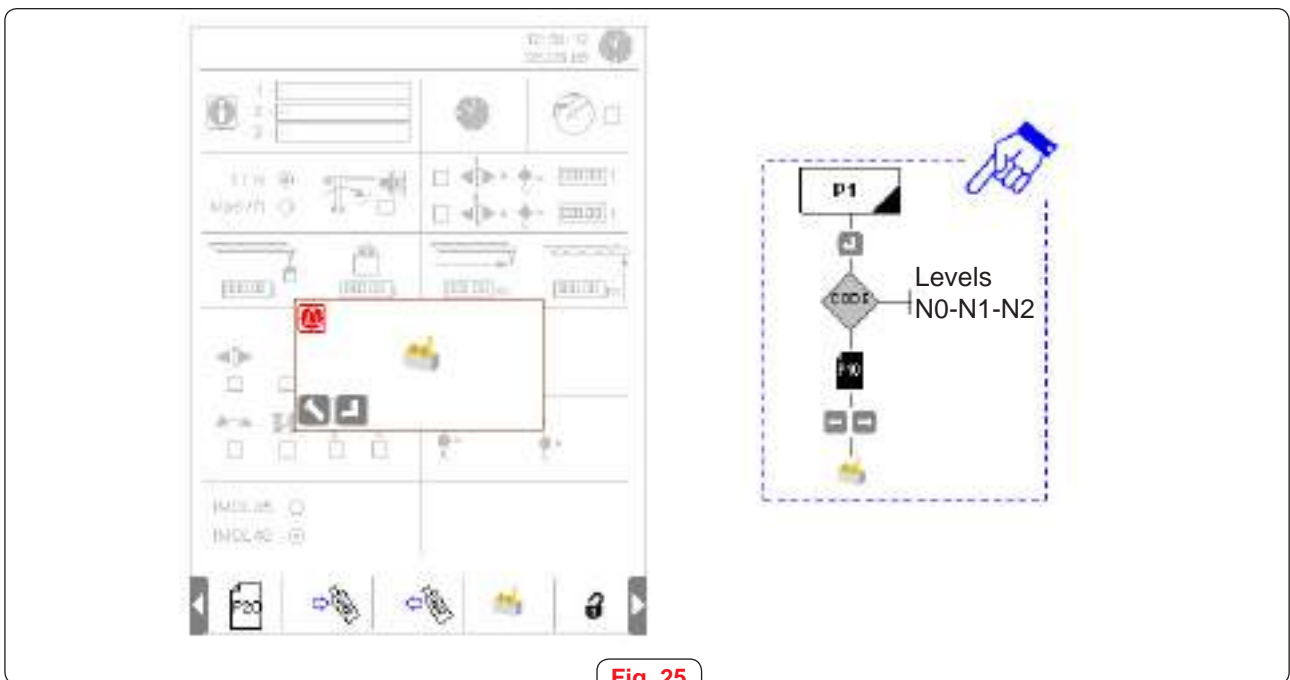
 indicates that the transfer failed. Check that the key has been properly inserted and that the available memory is enough to complete the operation and try again.

Note: it is not guaranteed that any USB will properly work with the UC46. It is recommended that you ask the factory for a USB if the one supplied from factory is lost.

#### 4.7 Default factory configuration.

It allows to go back to the default factory configuration and readjust it. Once the unit has been restored to factory default configuration it must be readjusted.

Before going to default factory parameter consider that every parameter must be set again to get the unit to work properly-



**Fig. 25**

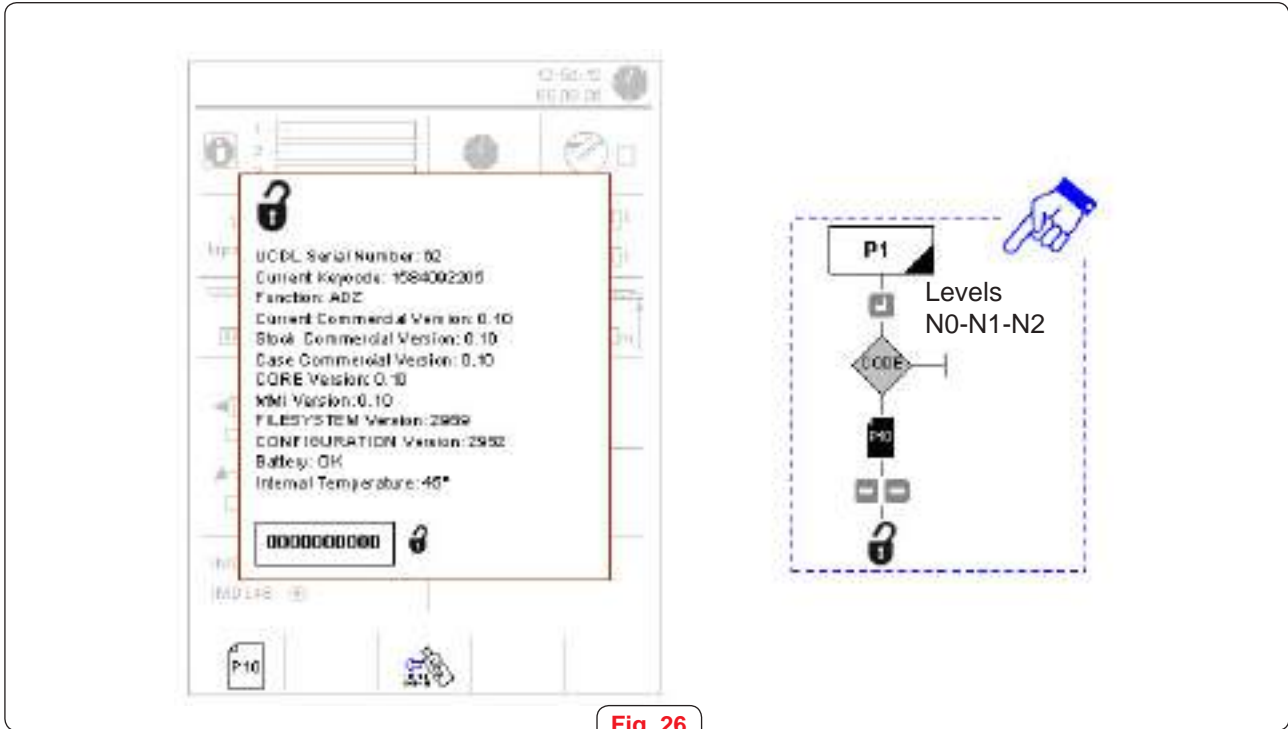
Press  to restore the factory configuration  to can  indicates that restoration was successful that the USB key can be removed.



Restoring the factory settings, completely erases the previous configuration, including the forbidden zones configuration. Events data log are not deleted.

**4.8 Firmware update and activation of a new function.**

This page allows to control the current version in the UC46 unit. It also allows to upgrade the firmware to a newer version or to add a new function not installed in the original system configuration (eg, forbidden zones).



**Fig. 26**


EXPLANATION	
1	UC46 serial number.
2	Current activation code.
3	Current active functions. Every function are preinstalled in the UC46 unit, however, only the chosen functions are active.(see 4.8.1) A = Indication. D = Data logger. Z = Forbidden zones.
4	Current unit version. The firmware version is identified by a decimal number: - The integer places refer to major firmware revision (also to different functions). - The decimal places indicate the minor firmware revision. eg. Version 01.10 integer                      decimal
5	Available preinstalled firmware.
6	Battery status.
7	UC46 internal temperature.
8	Activation code for adding a new function or for a firmware upgrade. (see 4.8.1 and 4.8.2)


### 4.8.1 New function activation.

DLZ341 integrates the indication and data logger function as a standard.

The forbidden zones option can be activated through a 10 digits code (contact the factory to demand more information if you want to add this function).

If it is asked for, the unit can come with the complete system preinstalled from the factory.

Fill in the active field; validate the  field to register the code.

Once the process finishes,  indicates that it has been successfully performed and the new function is active.

There is a different code for each UCCL46 unit and that means that this code can only be used with that particular unit.



Once the activation process is finished, the UCCL46 CAN M12 plug must be removed and reconnected to reinitialize the system.

To add the new function it can be necessary to use additional hardware and sensor (e.g., forbidden zones).

### 4.8.2 Firmware upgrade.

The firmware upgrade is done in two steps:


- Load the new firmware version to the UCCL by means of the USB key:


Insert the USB key into the UCCL46 unit USB port and choose  (Fig. 26).

Once it is successfully saved to the UCCL46,  indicates there is a new available firmware version in the unit.

- Activate the new available firmware version:

Check that the new available version is the proper upgrade (compare its number to the current version number). (Fig. 26).

- If the new available version is lower than the current one, it can be activated by typing in [0000000000] and pressing  to confirm. (Fig. 26).

Once it is successfully saved to the UCCL46,  indicates firmware version has been upgraded.

- If the upgrade is a higher version, it can be activated by typing in the code supplied with the new available firmware, and following the process indicated above.



Once the activation process is finished, the UCCL46 CAN M12 plug must be removed and reconnected to reinitialize the system.

### 4.9 Events that demand to reset the system settings.



Any crane configuration change may demand a system readjustment.

The good operation of the system depends on the consistency between the parameters in the DLZ341 system and the crane and environment actual situation.


It is compulsory to assess if a crane or environmental change demand the readjustment of the DLZ341 system.

The following table shows a list some of the changes that demand a readjustment of the DLZ341 system.

CRANE/ENVIRONMENTAL CHANGE	REQUIRED ACTION	SEE
Daylight saving time DST change	Date and time adjustment	5.2.1
Time zone change	Date and time adjustment	5.2.1
International system/imperial units change	Configuration change	5.2.1
Anemometer alarm thresholds	Configuration change	5.2.8
Anemometer connection/disconnection	Configuration change	5.2.1

CRANE/ENVIRONMENTAL CHANGE	REQUIRED ACTION	SEE
Jib length	Basic parameters change P10 Forbidden zones parameter change P41 Trolley sensor scaling Hoisting sensor scaling Slewing stop readjustment	5.2.1 7.2.1 5.2.2 5.2.3 7.2.5
Counterjib length	Basic parameters change P10 Forbidden zones parameter change P41 Trolley sensor scaling Hoisting sensor scaling Slewing stop readjustment	5.2.1 7.2.1 5.2.2 5.2.3 7.2.5
Trolley mechanism change (motor, gear, limiter,...) Trolley rope change	Trolley sensor scaling	5.2.2
Hoisting mechanism change (motor, gear, limiter,...) Hoisting rope change	Hoisting sensor scaling	5.2.3
Change in the capacity diagram of the crane (eg, jib length change)	Basic parameters change P10 Load cell scaling Moment scale readjustment	5.2.1 5.2.5 5.2.4
Reeving system	Basic parameters change P10 Hoisting sensor scaling	5.2.1 5.2.3
Hoisting rope elongation	Hoisting sensor scaling	5.2.3
Trolley rope elongation	Trolley sensor scaling	5.2.2
Crane height under hook	Basic parameters change P10 Hoisting sensor scaling	5.2.1 5.2.3
Add the forbidden zones function	Basic parameters change P10 Forbidden zones parameter change P41 Trolley sensor scaling Hoisting sensor scaling Slewing sensor scaling	5.2.1 7.2.1 5.2.2 5.2.3 7.2.5
Add or activate a forbidden zone	Define a forbidden zone Activate a forbidden zone	7.3.1 7.3.4
Redefine a forbidden zone	Redefine a forbidden zone	7.3.2
Delete or deactivate a forbidden zone	Deactivate a forbidden zone Delete a forbidden zone	7.3.4 7.3.3
Add a new sensor	Basic parameters change P10 Trolley sensor scaling Hoisting sensor scaling Moment sensor scaling Load cell scaling Travelling scaling Slewing sensor scaling	5.2.1 5.2.2; 7.2.2 5.2.3; 7.2.3 5.2.4 5.2.5 5.2.6; 7.2.4 5.2.7; 7.2.5
Jib/ counterjib width	Forbidden zones parameter change P41	7.2.1

## 5 USE AND CONFIGURATION OF THE INDICATION FUNCTION.

 THE INDICATION SCREENS SHOWN IN THIS DOCUMENT MAY SUFFER SOME CHANGE DUE TO ANY SYSTEM SOFTWARE IMPROVEMENT.

### 5.1 Introduction to the indication page [P1].

This screen displays the status of the crane and the position of several crane movements. Each indication is associated to a sensor connected to the IMDL46 unit.

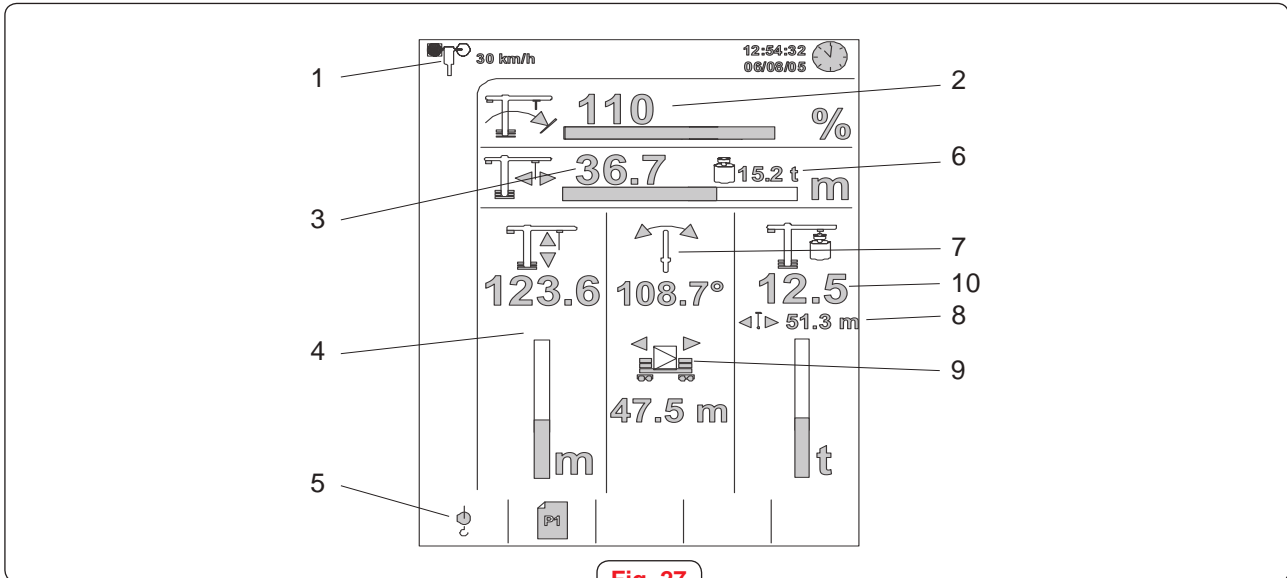




Fig. 27

- 1 Real-time wind speed. (anemometer option).  
A prealarm and an alarm warning indication on the screen can be set, to warn the crane operator when wind speed goes beyond the chosen thresholds.  
To disable or enable the wind speed indication see 5.2.1.  
To set the prealarm and alarm levels see 5.2.8.
- 2 Moment exerted by the load on the crane  
It is indicated as a percentage with respect to the nominal maximum moment.  
This value can be measured through the moment sensor or can be automatically estimated from the load cell and trolley indications, see 5.2.1.  
The indication can be a intermittent sound warning when the moment goes beyond 80%, and it becomes continuous from 100% on.  
To enable the sound indication, see 5.2.1.  
The maximum value shown by the display is 133%.
- 3 Trolley position.  
With respect to the tower mast central axis.
- 4 Hoisting position.  
Indicated with respect to a chosen ground level (0 meters).  
This value can be positive or negative depending on wheter the hook can go below the chosen ground level or not.
- 5 Reeving state.  
Displays the current crane reeving state.  
The system does not automatically detect the reeving number. To indicate the proper number of reevings, press the reeving change button (see 4.2).


 An incorrect number of reeving choice may lead to an incorrect hook height and load indication and thus to a possible incorrect operation of the forbidden zones height limitation.




- 6 Maximum load at current trolley position.  
This value is attained through calculations based on the crane parameters of [P10] (see 5.2.1) and on the measured values .

 This indication is just a rough value and only pretends to be an aid to the crane operator. It is compulsory that the crane operator knows and refers to the load chart diagrams of the crane and never lifts loads above the crane capacity indicated on the chart.

- 7 Angle between current jib position and another reference position. The angle must be increased when the crane turns clockwise (slewing sensor option).
- 8 Maximum permitted reach for the current load.  
This value is attained through calculations based on the crane parameters of [P10] (ver punto 5.2.1) and on the measured values .

 This indication is just a rough value and only pretends to be an aid to the crane operator. It is compulsory that the crane operator knows and refers to the load chart diagrams of the crane and never lifts loads above the crane capacity indicated on the chart.

- 9 Travelling position (option).
- 10 Load under hook.

 Movement commands are indicated on the screen.




The arrow corresponding to the sense of movement blinks as the winch moves.



If there is a failure on any of the sensors or on its configuration, the screen shows this pictogram and an error code (see Appendix 4).

**5.2 Setting up the indication function.**

 The indication set up must be done in the order explained below. To configure the unit, the necessary information must be available so that it can be correctly set during the configuration process (load chart and technical sheets).

The indication set up is done in two steps.

The first step consists on getting into the main page of the unit configuration [P10] and type in the general crane parameters according to the current crane assembly (number of luffing and counterjib sections, sensors installed...).

The second step consists on configuring and escalating the sensor signals on pages [P12] and [P18].

**5.2.1 Page [P10] configuration.**

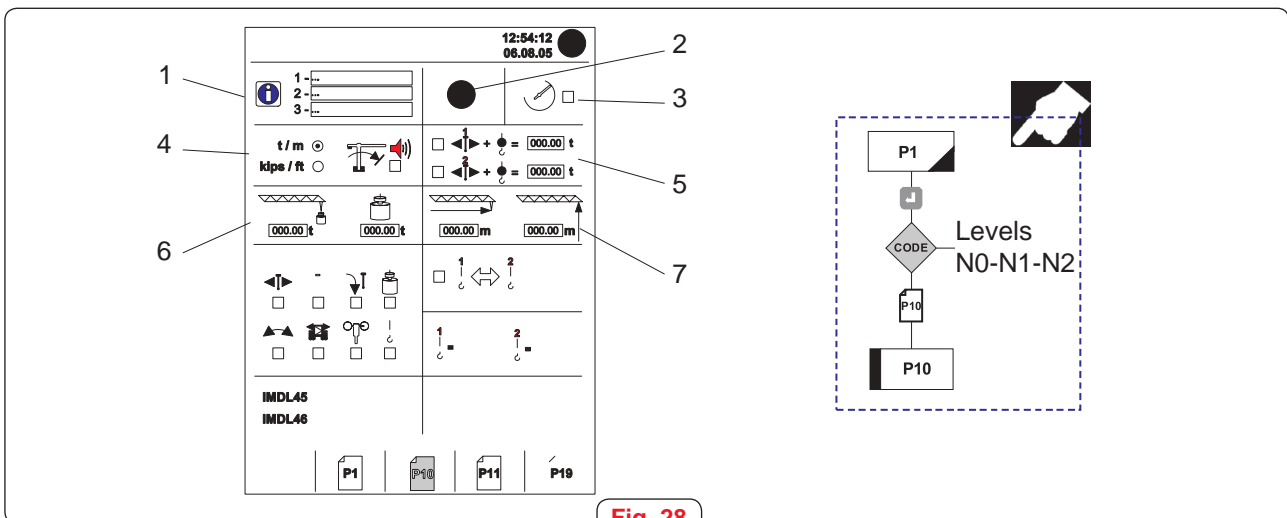

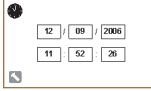






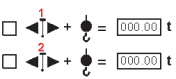
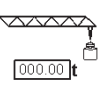





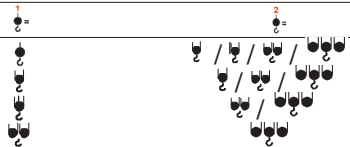










Fig. 28



PICTOGRAM	EXPLANATION	NOTE	
1	Crane general data field.	1 Configuration program. 2 Crane model. 3 Crane serial number.	
2	 	Date and time adjustment window. Window to modify the date and time.(1)	Press  to modify. Press  to cancel. Press  to save the changes.
3		Forbidden zones activate and deactivate checkbox.	Available when Forbidden zones option is installed.
4		Unit System choice buttons.	- International system units. - Imperial units.
5		Moment threshold warning sound activation/deactivation checkbox.	
6		Moment calculation method checkboxes and related fields. If any of them is checked, the calculation is done by multiplying the estimated load by the trolley position. Otherwise, the signal coming from the moment sensor is used.	Both fields must be always filled in with the sum of the trolley and hook, in single reeving (1) and in double reeving (2), regardless the method of calculation of the moment.
7		Maximum permitted end jib load for the current crane assembly.	It depends on the number of jib sections.
8		Maximum load.	
9		Maximum distance from the tower mast axis to the end jib trolley position for the current crane assembly.	It depends on the number of jib sections.
10		Maximum height under hook from ground level for the current crane assembly.	It changes when assembling additional tower mast sections.
11		Reeving change registering method checkbox.	It must be checked if the crane includes automatic reeving change.
12		Reeving configurations available in the crane.	
13		Page [P1] Trolley indication activation checkbox.	
14		Page [P1] Hoisting indication activation checkbox.	
15		Page [P1] Moment indication activation checkbox.	This option can be activated only if the function 6 of this list is disabled.



PICTOGRAM	EXPLANATION	NOTE
16 	Page [P1] Load cell indication activation checkbutton.	This option can be activated only if the function 6 of this list is disabled. Otherwise the function is active.
17 	Page [P1] Slewing indication activation checkbutton.	Slewing sensor is an option
18 	Page [P1] Travelling indication activation checkbutton.	Travelling indication is an option.
19 	Page [P1] Wind speed indication activation checkbutton.	Anemometer is an option.
20 	Manual reeving change checkbutton.	It must be unchecked if the reeving change is to be indicated manually by the crane operator. In the case of automatic reeving change detection, the signal comes from IMDL46 unit.
21 IMDL45 <input type="radio"/> IMDL46 <input checked="" type="radio"/>	Sensor interface choicebutton.	It will always be set to IMDL46.

(1) The calendar does not automatically change to Daylight Saving Time. It must be manually changed.

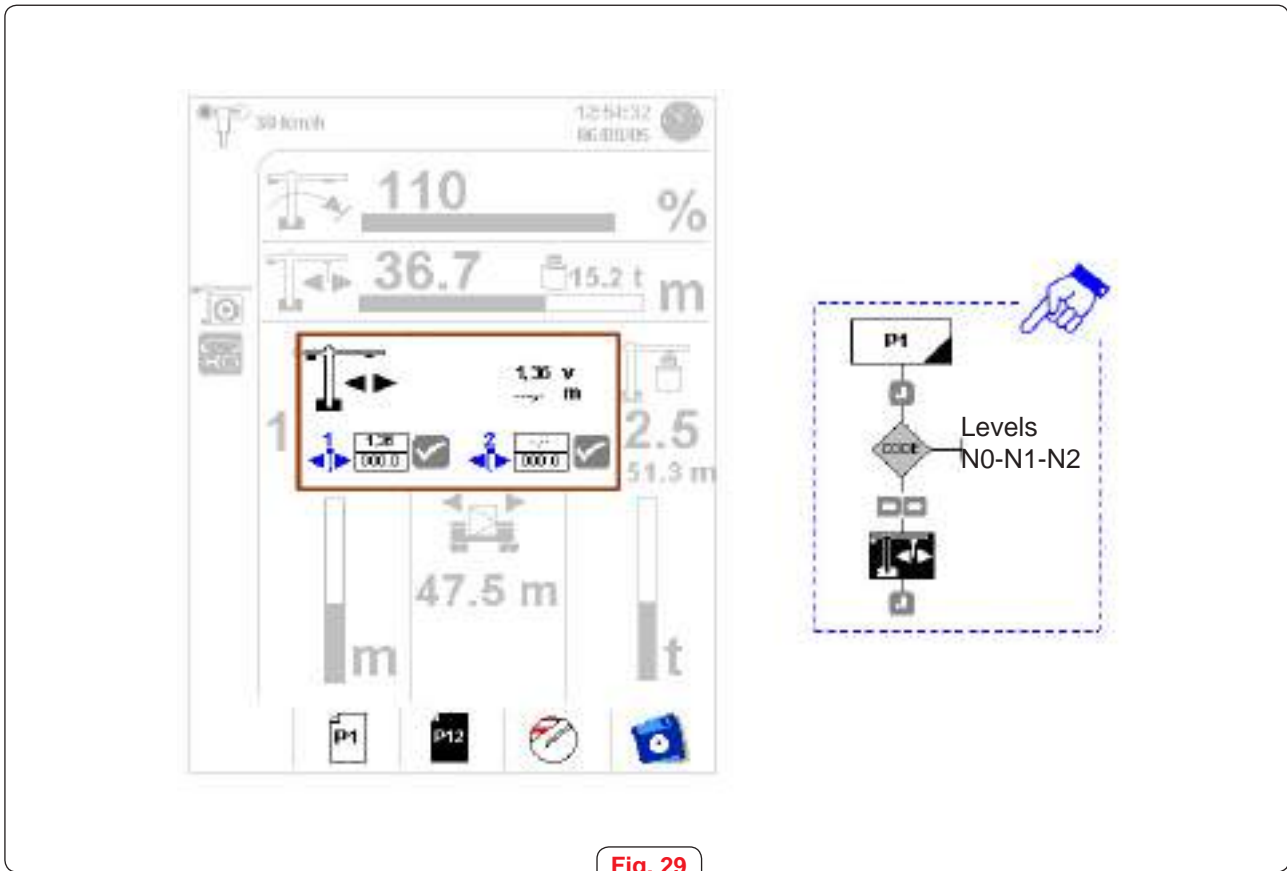


The UCDL46 comes from factory with basic adjustments which correspond to a crane assembled with the maximum jib and counterjib length, with the self supporting height and with double reeving. The moment alarm and the anemometer alarm are disconnected.



Do not forget to save the settings before leaving [P10] by pressing . Once the new data are saved, use  to exit from [P10] and go back to [P1].

**5.2.2 Trolley sensor scaling [P12].**



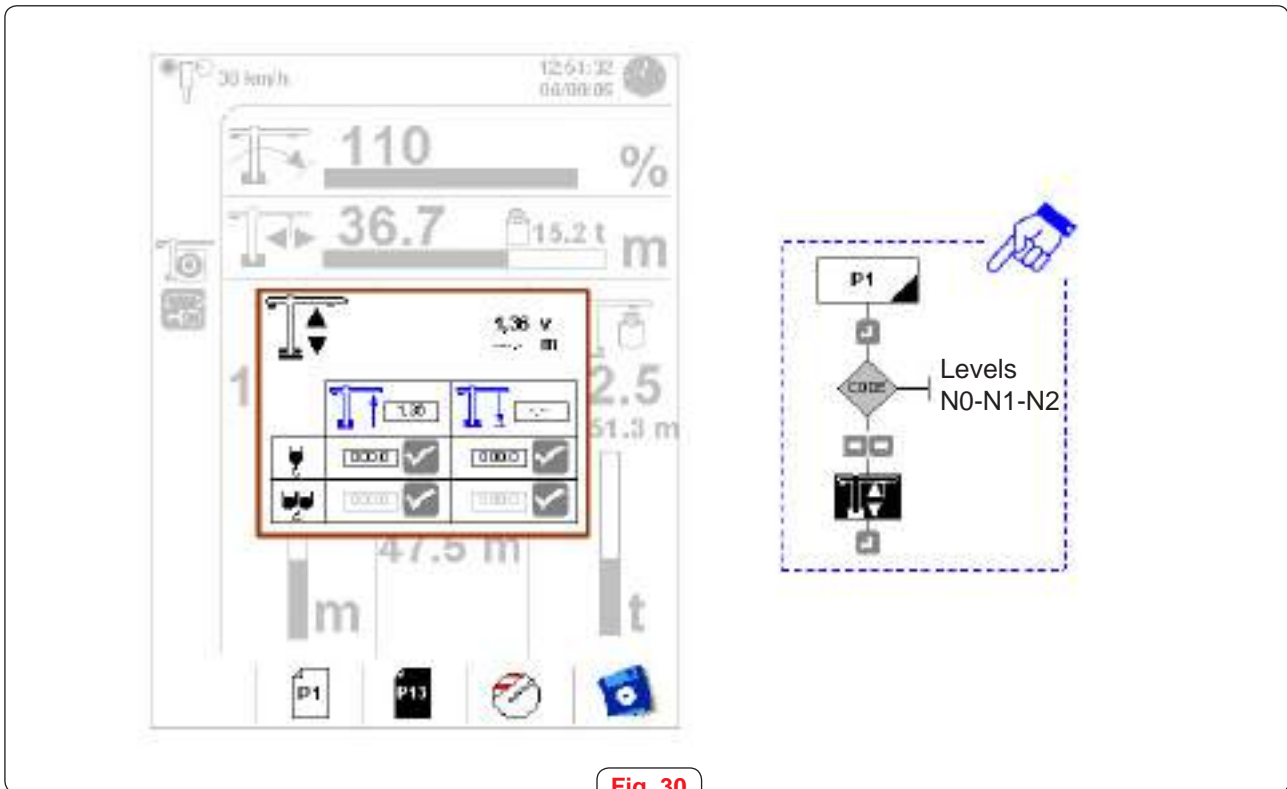
**Fig. 29**

REFERENCE	EXPLANATION
See 3.5.6 for the sensor installation instructions.	
1	<p>Trolley limiter potentiometer voltage indication . The trolley distance in meters or feet is indicated once the scaling is completed.</p> <p>Move the trolley backward to the closest possible position to the tower mast and adjust the potentiometer to get a value close to 0.30 V. Move the trolley forward to the closest possible position to the jib end and check that the voltaje is not more than 4.85 V.</p>
2	<p>First position. Trolley backward capture.</p> <p>Move the trolley to the closest possible position to the tower mast P12-1 (see annex 2) and measure the distance between the tower mast axis and the trolley centered vertical axis. Type the distance measured on proper units in the field under the voltage indication and confirm pressing ✓ .</p>
3	<p>Second position. Trolley forward capture.</p> <p>Move the trolley to the closest possible position to the jib end P12-2(see annex 2) and measure the distance between the tower mast axis and the trolley centered vertical axis. Type the distance measured on proper units in the field under the voltage indication and confirm pressing ✓ .</p>
Once the second position has been captured, the escale will be set. Do not forget to save the settings before leaving [P12] by pressing .	



If the jib lenght is modified, it is necessary to perform trolley scaling again . (see 4.9).

**5.2.3 Hoist sensor scaling [P13].**



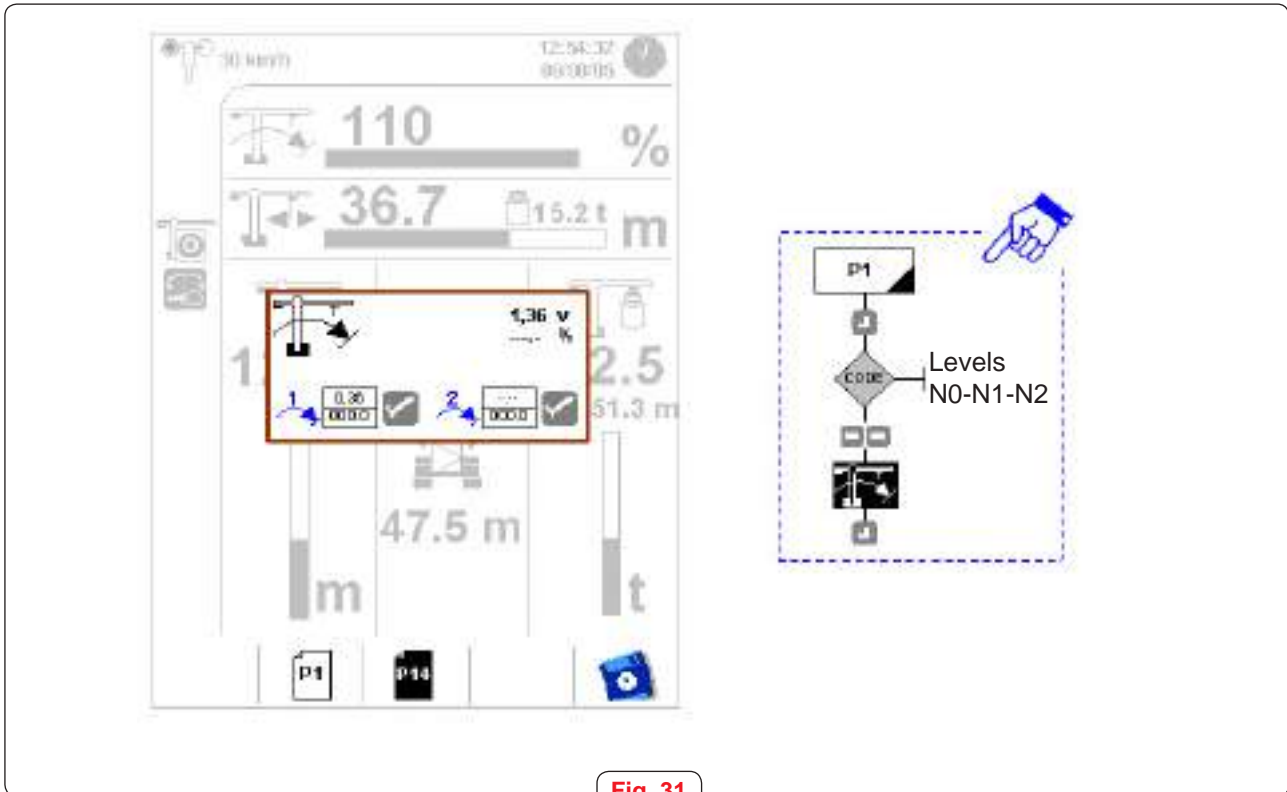
**Fig. 30**

REFERENCE	EXPLANATION
<p>See 3.5.6 for the sensor installation instructions. The hoist scaling process must be done once for each of the reeving states available in the crane as defined in the configuration menu [P10]. The scaling must follow the order established in the scaling window from left to right. If there is no reeving change defined in [P10] the scaling can be done just once.</p>	
1	<p>Hoist limiter potentiometer voltage indication . The hook height in meters or feet is indicated once the escalating is completed.</p> <p>Move the hook to the closest possible position below the jib and adjust the potentiometer to get a value close to 0.30 V. Lower the hook to the lowest position possible and check that the voltaje is not more than 4.85 V.</p>
2	<p>First position. Hook up capture.</p> <p>Move the hook to the closest possible position to the jib P13-1 (see annex 2) and measure the distance under hook to the chosen ground level. Type the distance measured on proper units in the field under the voltage indication and confirm pressing ✓ .</p>
3	<p>Second position. Hook down capture.</p> <p>Move the hook to the position that wants to be defined as ground level <b>P13-2</b>(see annex 2). Type the distance measured on proper units in the field under the voltage indication and confirm pressing ✓ .</p>
<p>Repeat the above procedure after changing the reeving number. Once the second position has been captured, the escale will be set. Do not forget to save the settings before leaving [P13] by pressing .</p>	



If the crane height is modified, it is necessary to perform hoisting scaling again . (see 4.9).

**5.2.4 Moment sensor scaling [P14].**



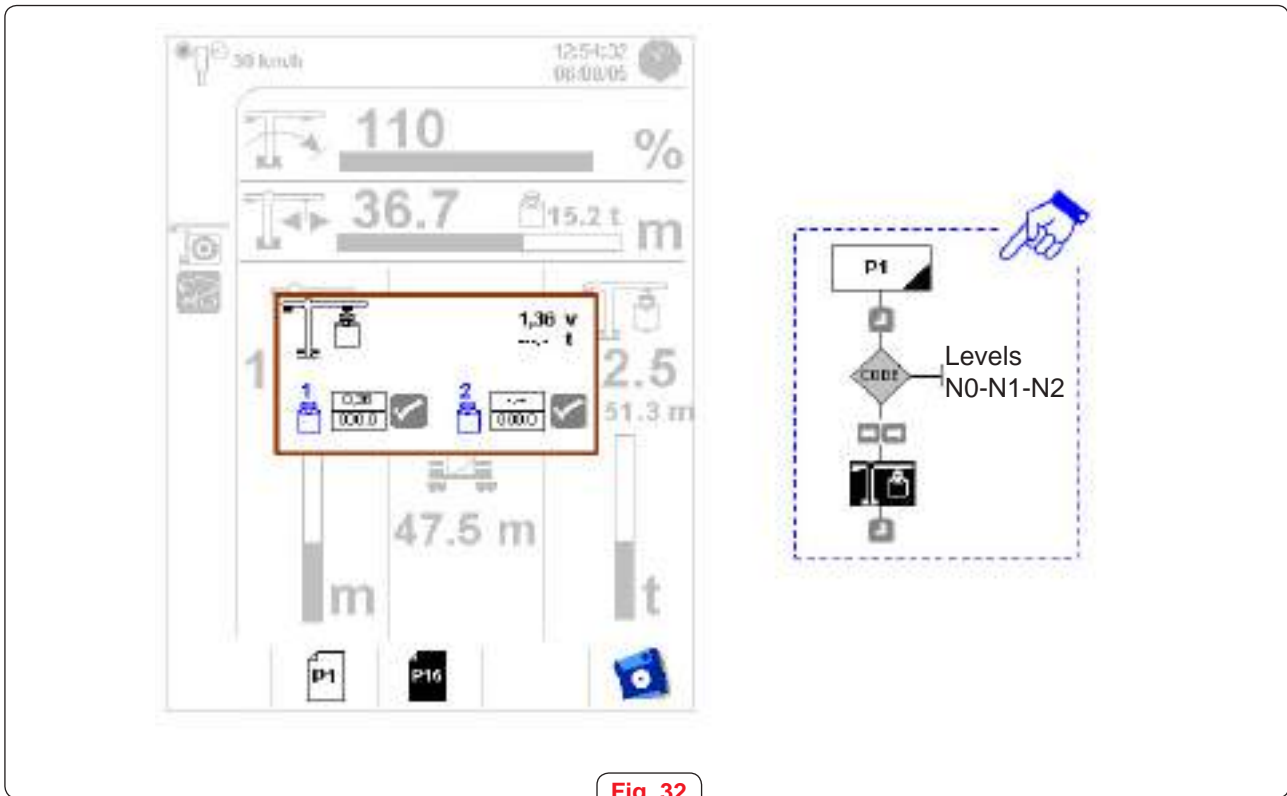
**Fig. 31**

REFERENCE	EXPLANATION
Access to page [P14] is possible if a moment sensor is used to measure the crane moment. If the moment is not measured but calculated(see point 6 of table on 5.2.1), this page will not be available.	
1	<p>Moment sensor voltage indication</p> <p>The moment in % is indicated once the escalating is completed.</p> <p>Move the empty hook to the upper position and the trolley to the closest possible position to the tower mast and adjust the potentiometer to get a value close to 0.30 V. Lift the maximum jib end permitted load and check that the voltage is not more than 4.5 V.</p>
2	<p>First position. No load moment capture.</p> <p>Move the empty hook to the upper position and the trolley to the closest possible position to the tower mast. Type "0" in the field in the field under the voltage indication and confirm pressing ✓.</p>
3	<p>Second position. Maximum load moment capture.</p> <p>Lift the maximum end jib permitted load or a load that makes the 100% moment limiter to activate. Type "100" in the field in the field under the voltage indication and confirm pressing ✓.</p>
Once the second position has been captured, the escale will be set. Do not forget to save the settings before leaving [P14] by pressing .	



If the jib length is modified, it is necessary to perform moment scaling again. (see 4.9).

**5.2.5 Load cell scaling [P15].**



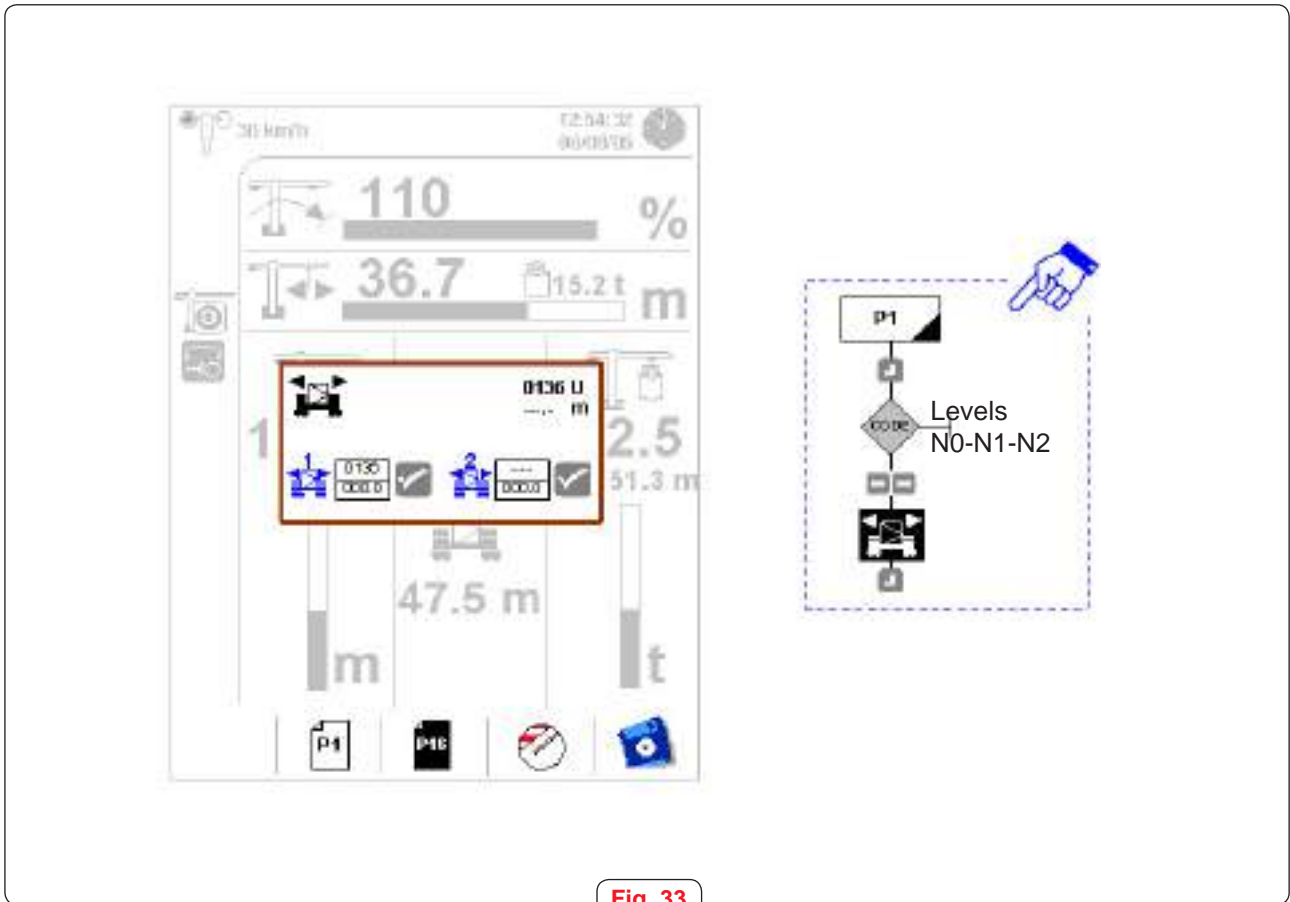
**Fig. 32**

REFERENCE	EXPLANATION
<p>To get higher precision, the scaling should be done with the maximum permitted load for the reeving used. Check that the reeving chosen in the screen when performing the setting up is the same as the one actually being used on the crane.</p>	
1	<p>Load cell sensor voltage indication</p> <p>The load in tons is indicated once the scaling is completed</p>
2	<p>First position. No load capture.</p> <p>Move the empty hook to the upper position. Type "0" in the field in the field under the voltage indication and confirm pressing ✓.</p>
3	<p>Second position. Maximum load capture.</p> <p>Lift the known load. Type the load value (including the weight of the chains and container) in the field in the field under the voltage indication and confirm pressing ✓.</p>
<p>Once the second position has been captured, the scale will be set. Do not forget to save the settings before leaving [P15] by pressing .</p>	



If the crane height is modified, it is necessary to perform load cell scaling again . (see 4.9).

**5.2.6 Travelling sensor scaling [P16].**



**Fig. 33**

REFERENCE	EXPLANATION
	See 3.3.11 for the sensor installation instructions. The maximum distance is 250 m.
1	Indication of pulses detected by the travelling sensor. The travelling position in meters or feet is indicated once the escalating is completed.
2	First position capture.
3	Second position capture..

It is better to set the «zero» out of the track.

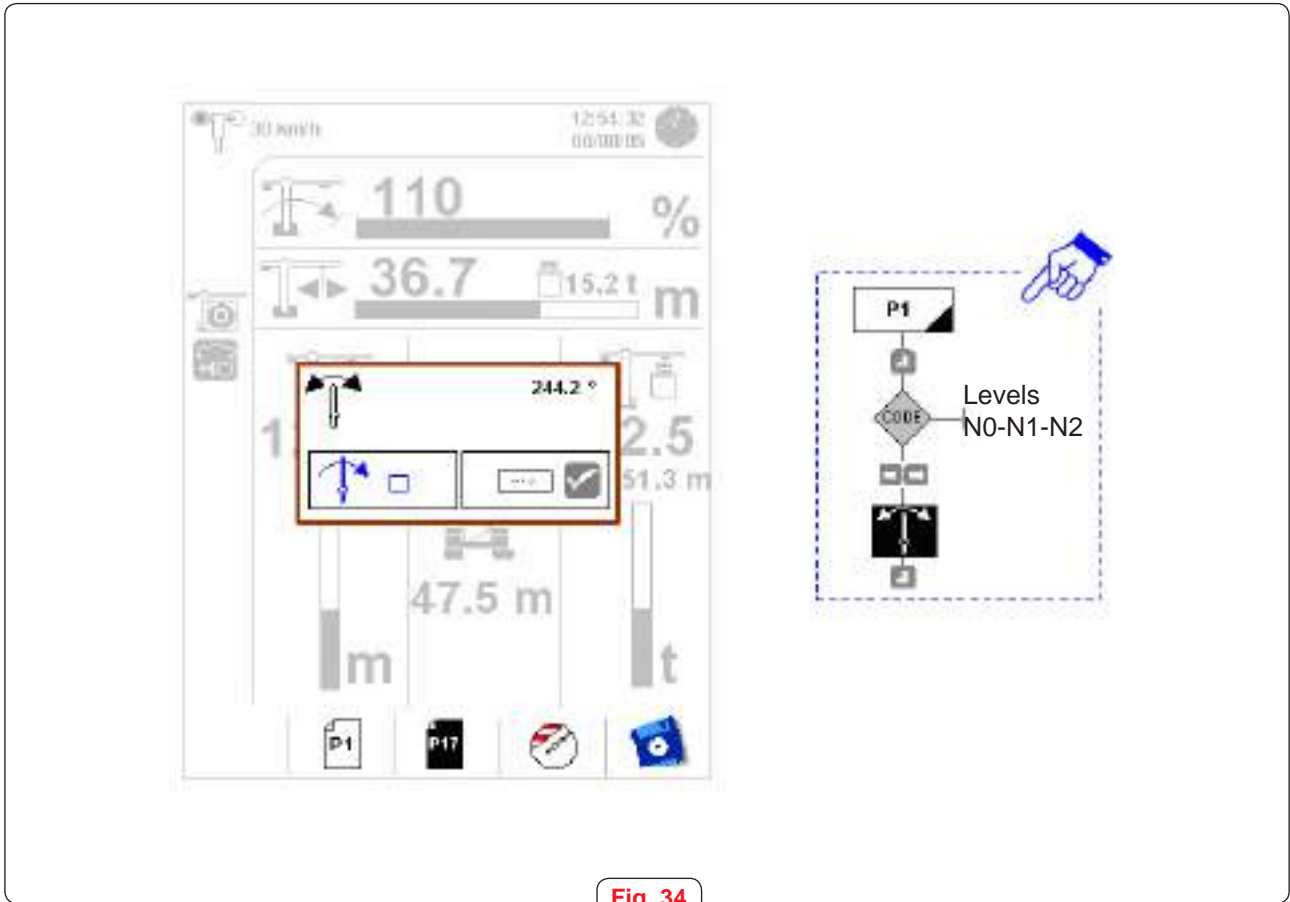
Move the crane to a point in the track and measure the distance between the tower mast axis and the point chosen as "zero".  
Type the distance measured on proper units in the field under the voltage indication and confirm pressing ✓ .

Move the crane to a second point in the track as far as possible from the previous one and measure the distance between the tower mast axis and the point chosen as "zero".  
Type in the distance measured on proper units in the field under the voltage indication and confirm pressing ✓ .

Once the second position has been captured, the escale will be set. Do not forget to save the settings before leaving [P16] by pressing .



**5.2.7 Slewing sensor escaling [P17].**

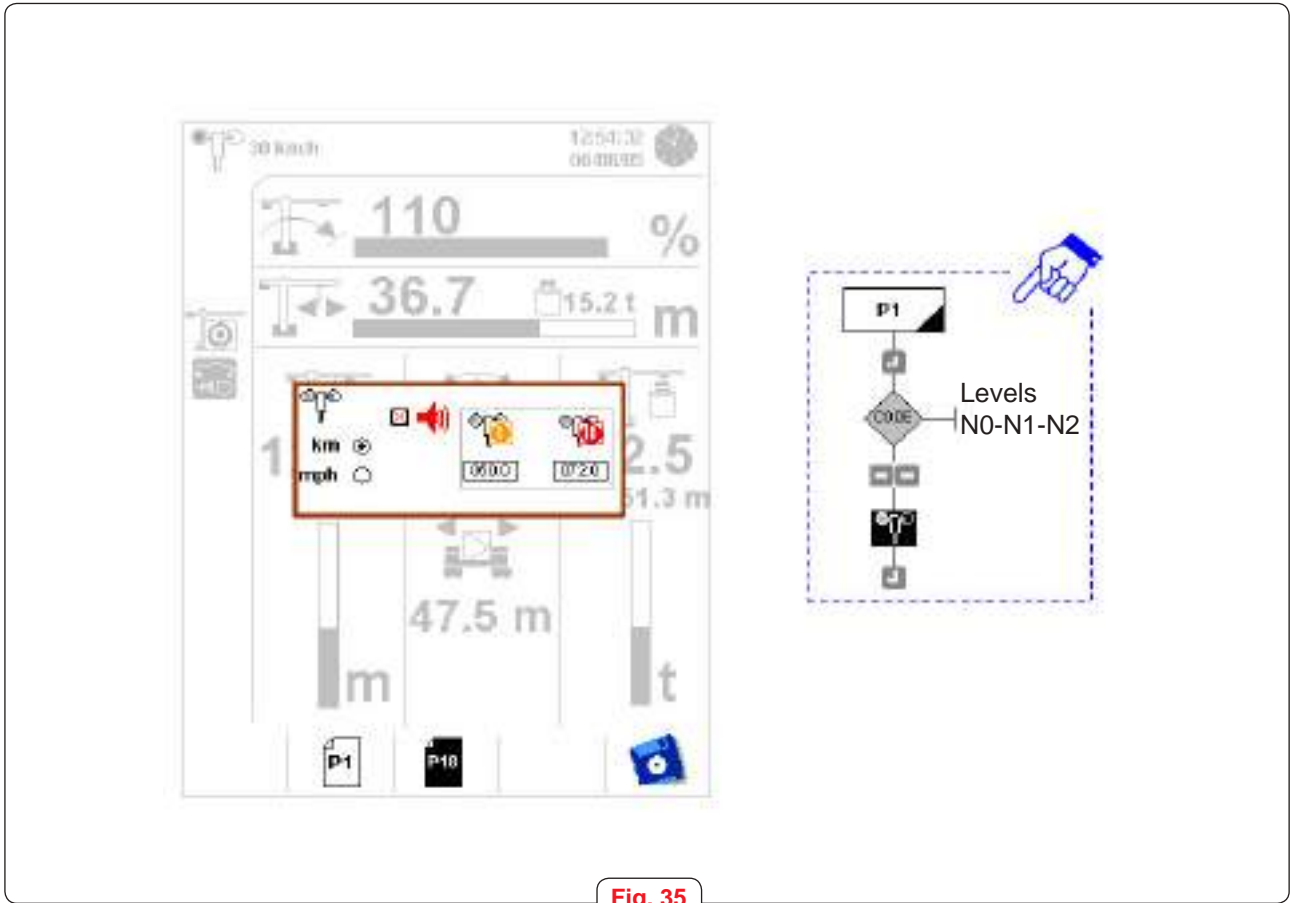


**Fig. 34**

REFERENCE	EXPLANATION
See 3.3.10 for the sensor installation instructions	
1	<p>Angle indication detected by the slewing sensor, in degrees.</p> <p>The slewing angle must increase when the crane moves clockwise (right).</p>
2	<p>Signal Inversion.</p> <p>If the sense of rotation is anticlockwise (left), change it to clockwise by pressing this key.</p>
3	<p>First position. 0° capture.</p> <p>If the system includes travelling sensor, place the jib parallel to the track. If the system does not include travelling, set the 0° on a position easy to be remembered (north, in line with a fixed and big thing, frequent wind direction...).</p> <p>Confirm pressing ✓.</p>
Once the second position has been captured, the escale will be set. Do not forget to save the settings before leaving [P17] by pressing .	



**5.2.8 Anemometer options adjustment [P18].**



**Fig. 35**

REFERENCE	EXPLANATION
See "ANEMOMETER" instructions document for the installation.	
1	<p>Wind speed prealarm and alarm configuration.</p> <p>Prealarm speed field. When winds peed goes beyond this value, the unit will show this amber pictogram in page [P1] together with an intermittent prealarm sound.</p> <p>Alarm speed field. When wind speed goes beyond this value, the unit will show this red pictogram in page [P1] together with a continuous alarm sound.</p>
2	<p>Indication units.</p> <p>Imperial or international units.</p>
3	<p>Alarm activation / deactivation.</p> <p>This checkbutton activate/deactivate the visual and sound alarm and prealarm.</p>
Do not forget to save the settings before leaving [P18] by pressing .	

### 5.3 Digital inputs monitoring screen page [P19].

Page [P19] shows the state of the digital inputs to the IMDL46 unit. Each input represents the state of a part of the crane. It allows to check the digital input signals (hoisting, lowering...)

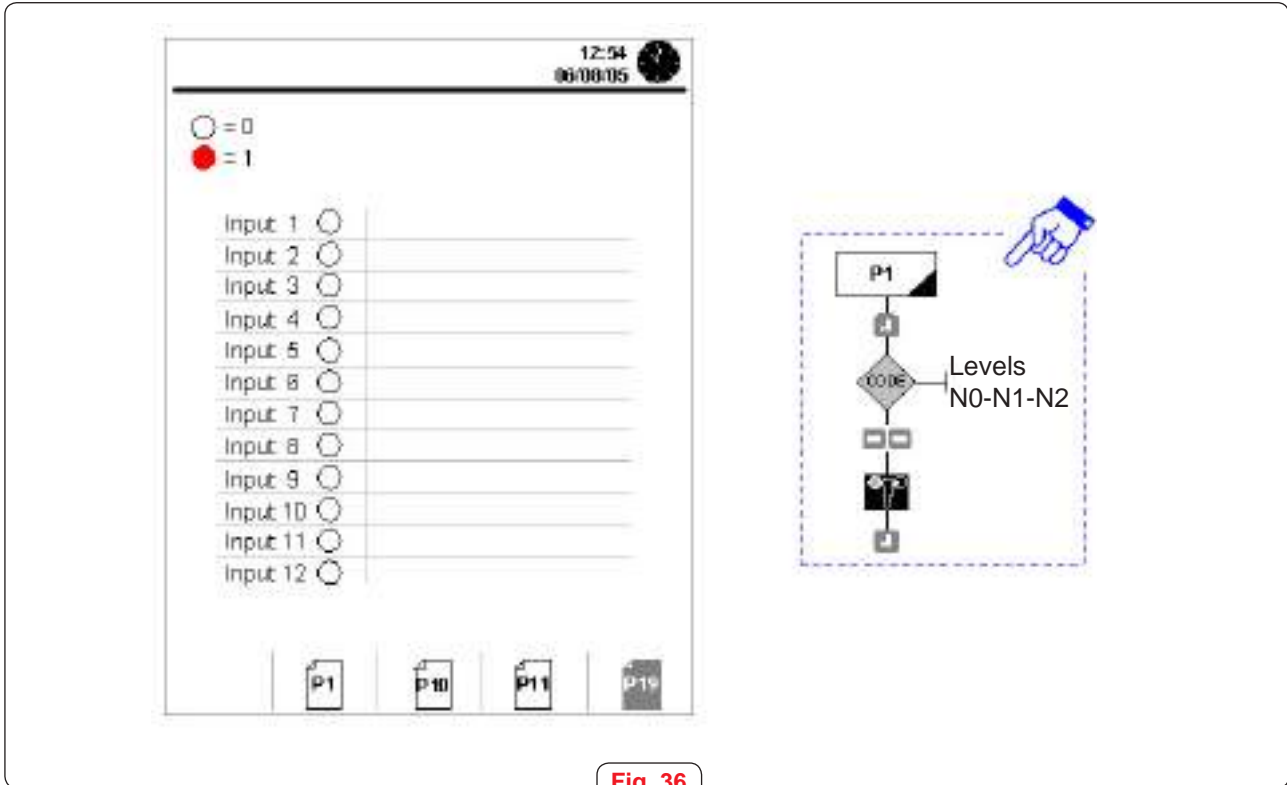


Fig. 36

PICTOGRAM	FUNCTION
1	Crane switched on (ON when general contactor energized).
2	Reeving state (only works if automatic reeving state detection is installed).
3	Trolley forward (ON when trolley forward contactor energized).
4	Trolley backward (ON when trolley backward contactor energized).
5	Hoisting (ON when hoisting contactor energized).
6	Lowering (ON when lowering contactor energized).
7	Weathervaning on (ON when weathervaning sequence detected).
8	Slewing right or left (ON when Slewing right or left contactor energized).
9	Travelling backward or forward (ON when Travelling forward or backward contactor energized).
10	Moment or load limitation detected (ON when Load-moment limit contactor deenergized)..

THE INDICATION SCREENS SHOWN IN THIS DOCUMENT MAY SUFFER SOME CHANGE DUE TO ANY SYSTEM SOFTWARE IMPROVEMENT.

## 6 USE AND CONFIGURATION OF THE DATA LOGGING FUNCTION.

### 6.1 Permanent events indication page [P2].

Page [P2] displays the permanent information of the system. Permanent information is a set of accumulated values that are not reset, unless an authorized user reset them on purpose.

They are counters which inform about the overall crane activity.

These values are updated everytim there is a crane event that affects their value (movements, load limitation...).

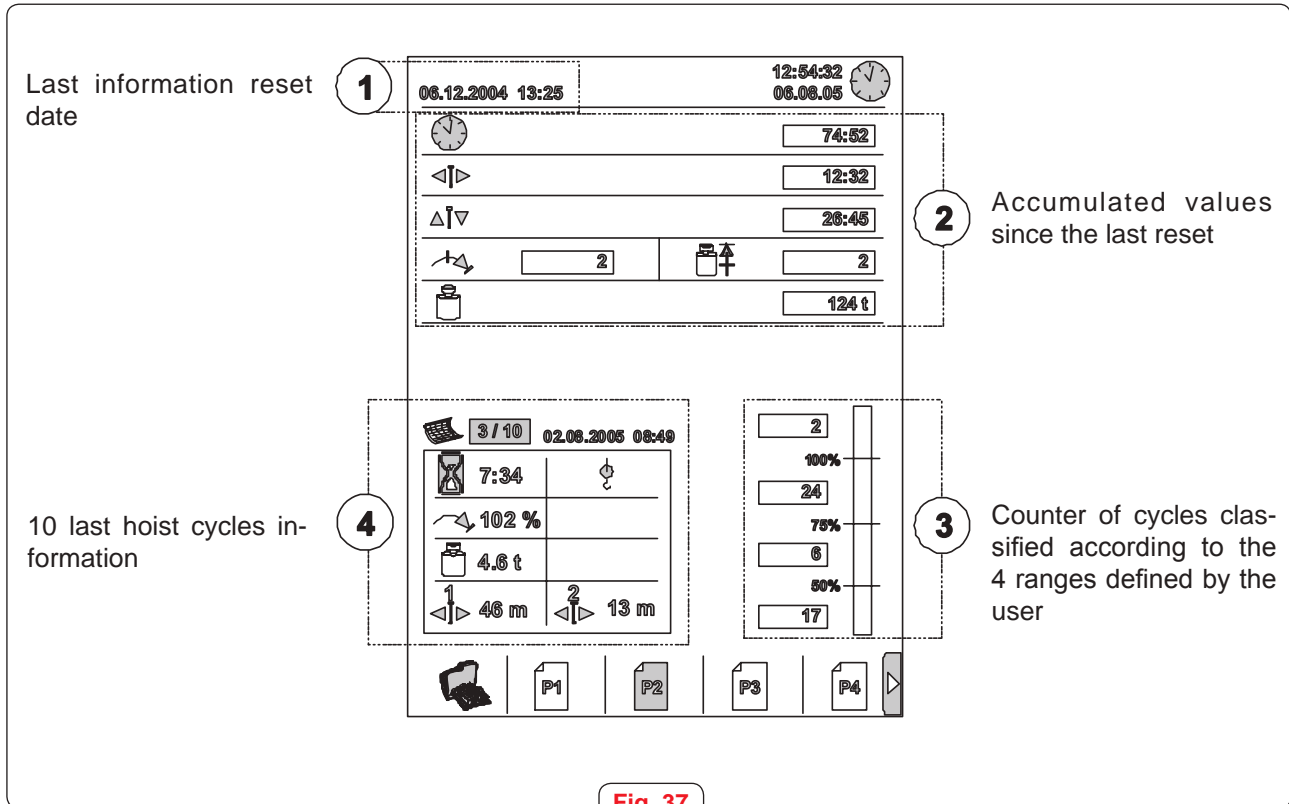


Fig. 37

#### 6.1.1 Accumulated values since the last reset.

Zone 2 on page [P2] (Fig. 37) registers and displays the values accumulated since the last reset (see 6.2.1) All the information listed below, except the total load, is calculated by processing the activation/deactivation information coming from the digital inputs received by the IMDL46 (see 5.3).

PICTOGRAM	EXPLANATION
1  74:52	Crane switched on total time (in hours : minutes).
2  12:32	Total trolley work time (in hours : minutes).
3  26:45	Total hoist work time (in hours : minutes).
4  2	Times the crane reached a moment limit situation.
5  2	Times the crane reached a load limit situation.
6  124 t	Total lifted load (in tons).

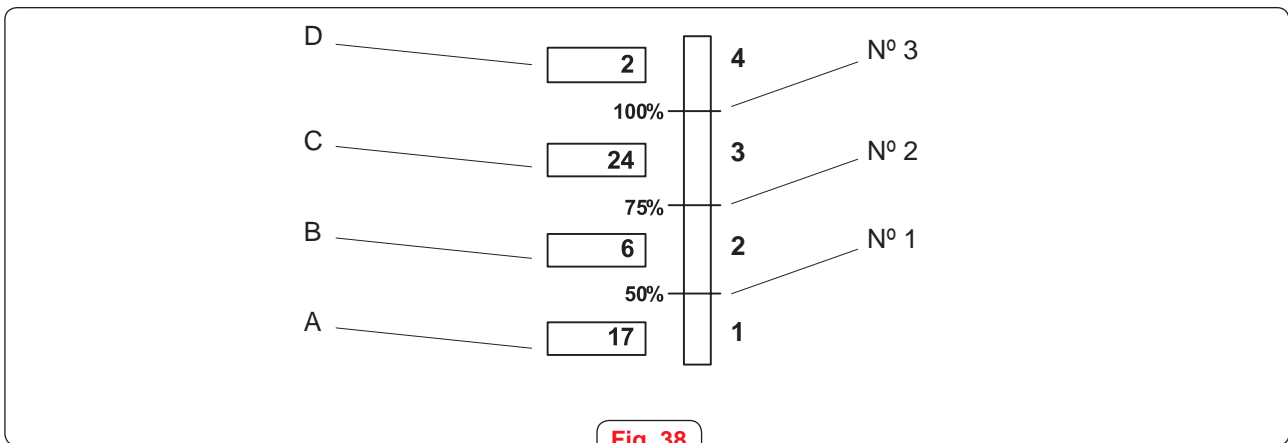
**6.1.2 Hoist cycles.**

DLZ341 system continuously calculates the lifted load and registers the cycle information in 2 different screen zones (zones 3 and 4 of page [P2]) (Fig. 37).

- ☞ A cycle begins when the lifted load goes beyond 5% of the crane maximum load specified in [P10] during more than 5 seconds.
- A cycle ends when the lifted load goes below at 5% of the crane maximum load specified in [P10] during more than 5 seconds.

Zone 3 (Fig.37) -Cycle counter:

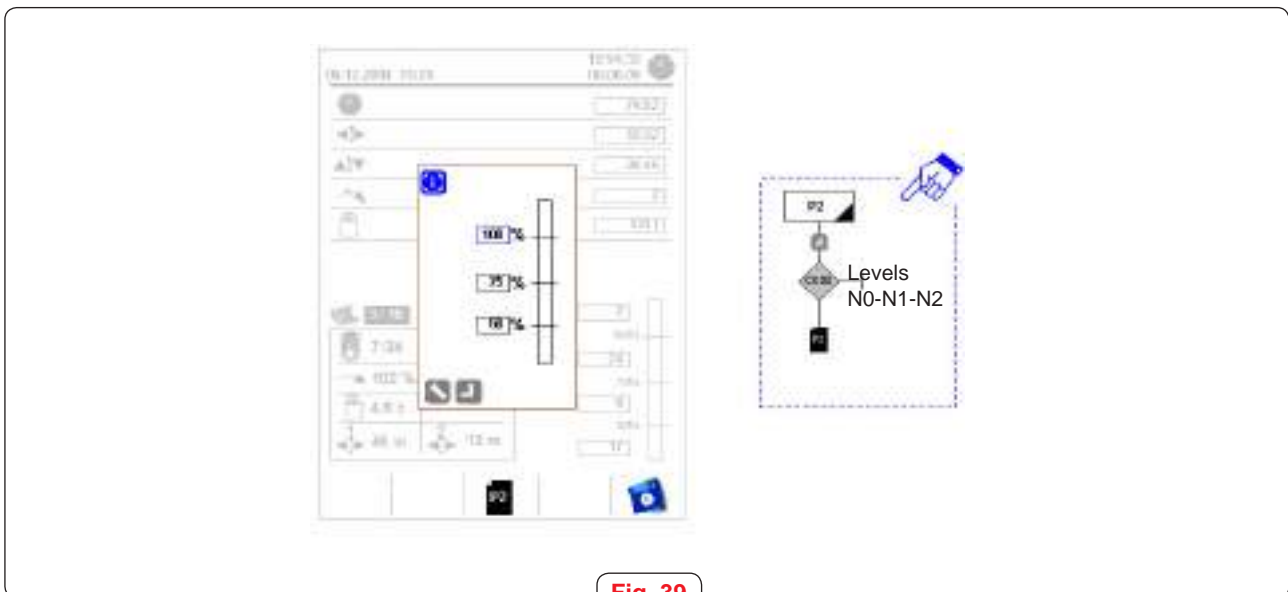
This zone shows the number of accumulated cycles classified according to 4 ranges. The ranges may be changed by the user .



**Fig. 38**

	EXPLANATION
A	Number of cycles with moment % below N°1.
B	Number of cycles with moment % between N°1 and N°2.
C	Number of cycles with moment % between N°2 and N°3.
D	Number of cycles with moment % beyond N°3.

To choose the moment % ranges thresholds, follow the procedure shown in Fig.39.



**Fig. 39**

Do not forget to save the settings before leaving [P2] by pressing .

Zone 4 (Fig.37) - 10 last hoist cycles information:

This screen zone displays detailed information of the 10 last hoist cycles, ordered in a FIFO list (The list always contains 10 cycles. When detecting a new cycle, it is placed in position 1, the rest are moved to the next position, and the one in position 12 is deleted)

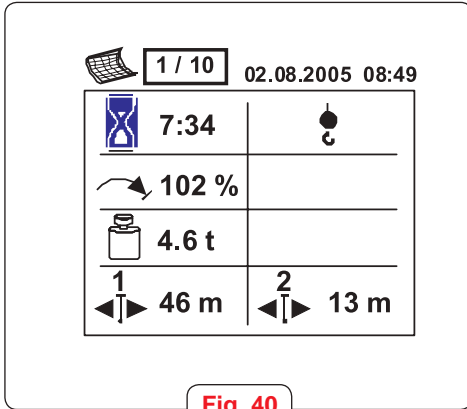


Fig. 40

	EXPLANATION
1 / 10	Cycle number.
08:49	Beginning of the cycle time.
🕒	Cycle length (minutes : seconds).
🔗	Reeving state.
↩️	Maximum moment during the cycle.
📦	Maximum load during the cycle.
1 🚲	Trolley position at the beginning of the cycle.
2 🚲	Trolley position at the end of the cycle.

Press to access the field **1/10**, and use to go through the cycle list.  
Press to exit.

## 6.2 Events log page [P3].

Page [P3] shows the events recorded in the DLZ341 database.

The event log records the last 2000 events since the last reset, ordered in a FIFO list (The list always contains 2000 events. A new event is placed in position 1, the rest are moved to the next position, and the one in position 2000 is deleted)

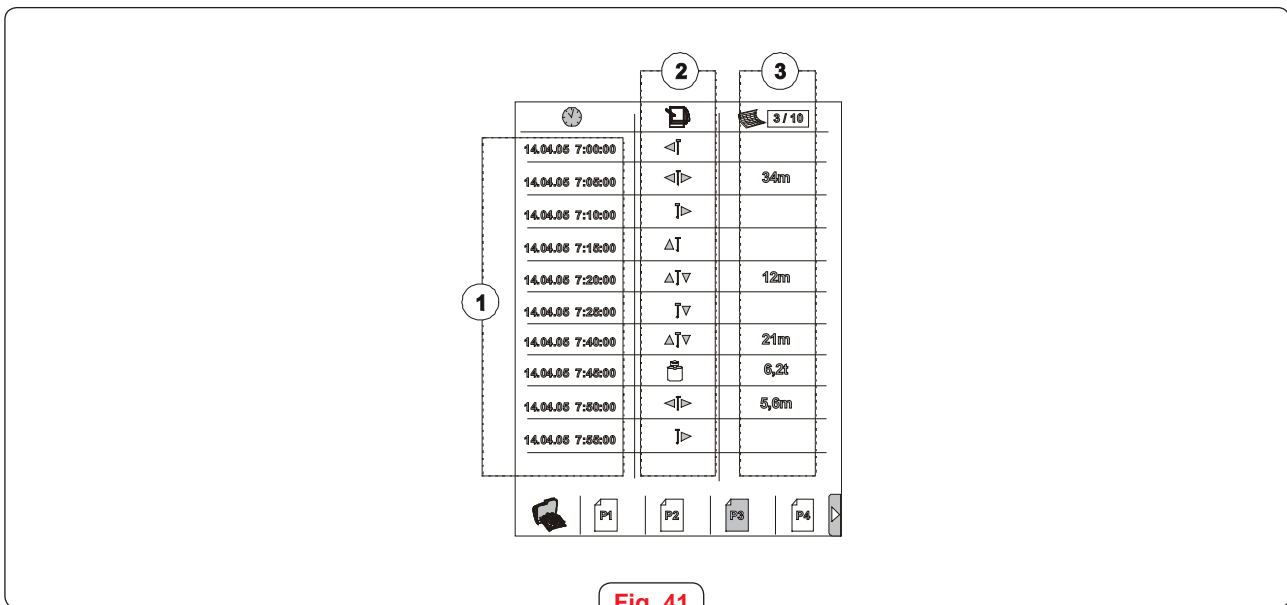


Fig. 41

- 1 Chronology of the events.
- 2 Event identification page (see Appendix 4).
- 3 Complementary info (see Appendix 4).

Press to access the field **1/10**, and use to go through the cycle list.  
Press to exit.

### 6.2.1 Data log reset.

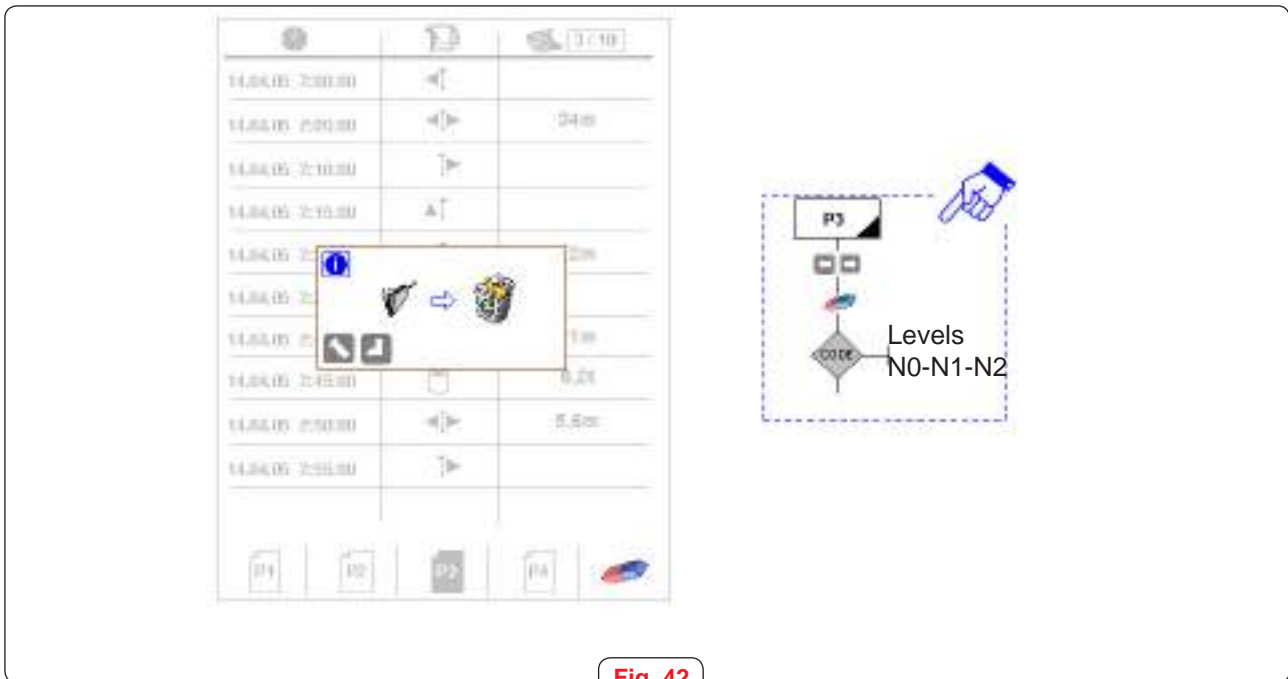


Fig. 42

Press to confirm or to cancel.  
Once the process finishes, indicates that it has been successfully performed  
 indicates that the process has not been completely performed.

### 6.3 Exporting the database to a USB key.

It is possible to export the the data logger information to a personal computer, to analyze or store it (see Appendix 3).

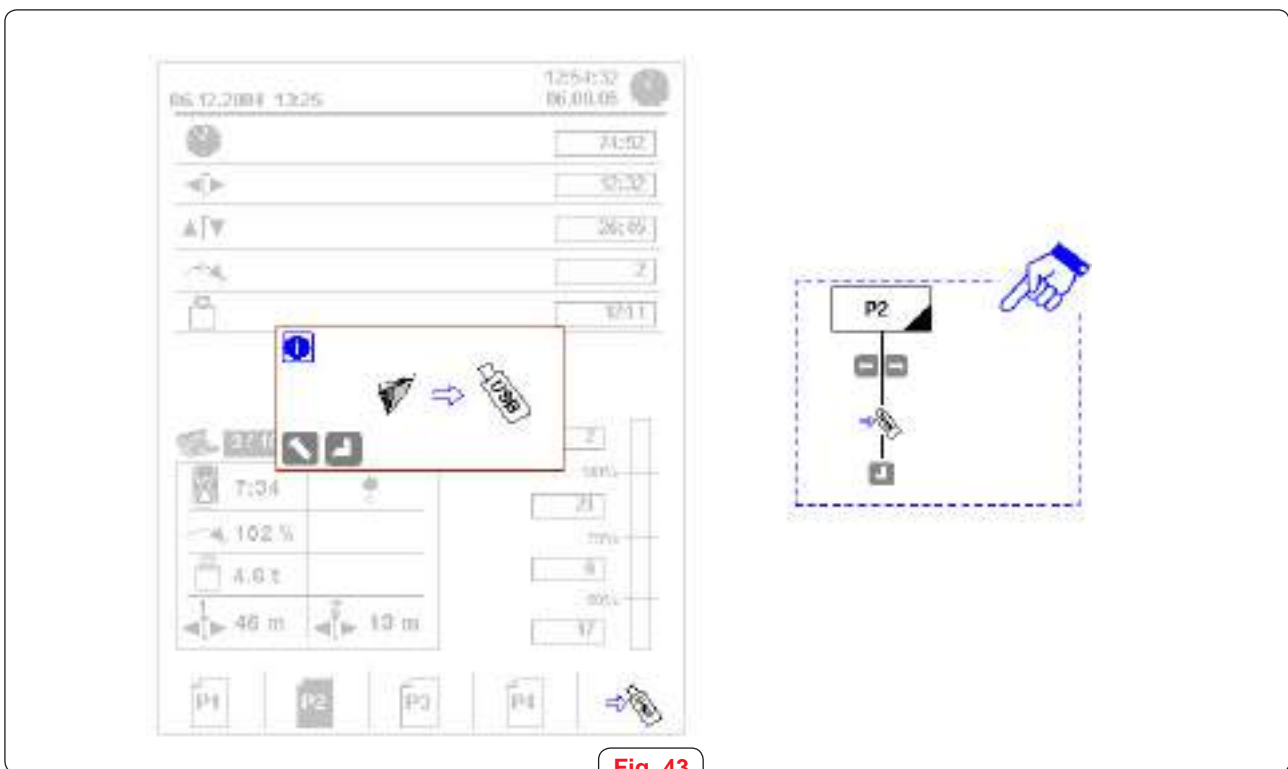






Fig. 43


Press  to confirm or  to cancel.  
Once the process finishes,  indicates that it has been successfully performed


The  pictogram indicates that the transfer has not been done.

Check that the USB key is properly inserted in the UCDL USB port and that there is free memory enough in the USB key.

The data are exported in MS Excel format and it is necessary to have a license of the program to display the information in a PC.

## 7 USE AND CONFIGURATION OF THE FORBIDDEN ZONES FUNCTION

 An improper adjustment or scaling of the forbidden zones function may lead to an undesired behaviour of the crane or to a loss of safety.  
It is compulsory that the configuration and scaling is done by a trained maintainer.

 THE INDICATION SCREENS SHOWN IN THIS DOCUMENT MAY SUFFER SOME CHANGE DUE TO ANY SYSTEM SOFTWARE IMPROVEMENT.

### 7.1 Forbidden zones indication page [P4].

This page displays a view of the forbidden zones shapes locations with respect to the crane. In this page, the forbidden zones change dynamically with respect to the crane (the zones rotate around the crane as it moves)

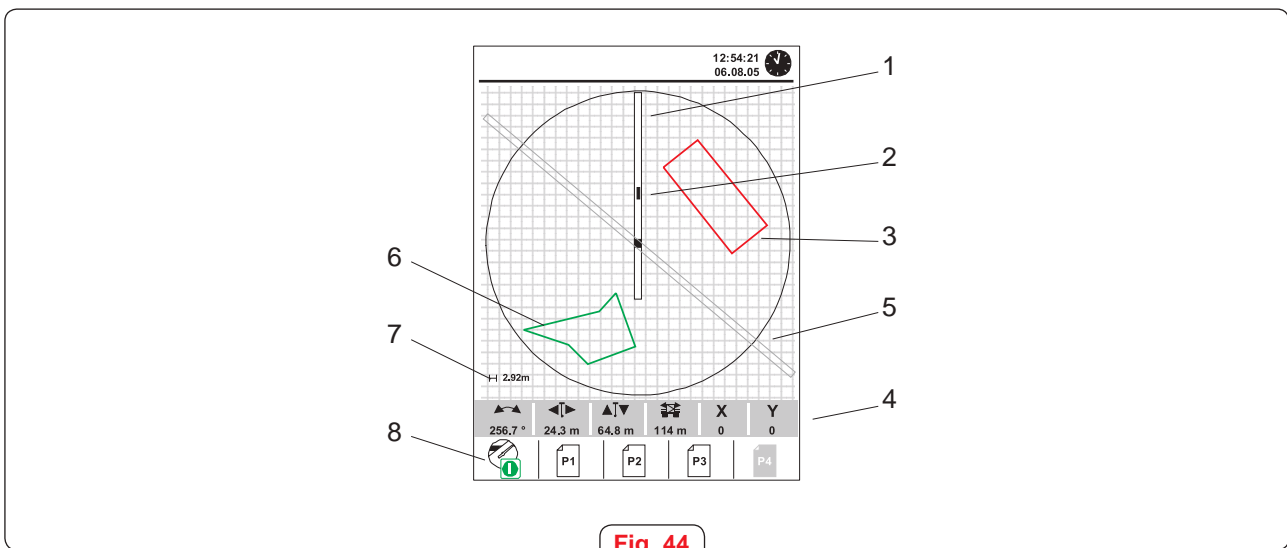







Fig. 44

- 1 Jib and counterjib drawing, scaled proportionally to the parameters in page [P11].
- 2 Trolley drawing, scaled proportionally to the parameters in page [P11].
- 3 Active forbidden zone drawing (red coloured line).  
A zone can be activated or deactivated selectively.
- 4 Band indicating the current crane position coordinates.
- 5 Travelling track drawing (option).
- 6 Deactivated forbidden zone (green coloured line).  
The deactivated zone is recorded, but the crane is allowed to enter inside.
- 7 Scaled grid.
- 8 Global forbidden zones activation or deactivation pressbutton.

### 7.1.1 Hook position coordinates indication.

The band at the bottom of page [P4] (Fig. 44) displays the hook position coordinates referred to the set of axis defined during the sensor scaling (height under hook, trolley position...) (see 5.2.2 to 5.2.7)

PICTOGRAMA	EXPLICACIÓN
1  256.7°	Slewing angle referred to the "zero" set during the slewing sensor scaling.
2  24.3 m	Trolley position.
3  64.8 m	Height under hook referred to the ground level set on the hoist sensor scaling
4  114 m	Travelling position referred to the "zero" set on the travelling sensor scaling.
5  X Y 3.4 28.2	Hook position referred to cartesian absolute axis. The intersection of x and y axis is set on the mast center.











The arrows associated to each movement in [P1] will blink in red when the DLZ system stops the movement.

### 7.1.2 Movement stop indications in page [P1].

Every time the system stops a movement to avoid entering a forbidden zone, it warns the operator . This warning is done by showing a pictogram, both in page [P4] and in page [P1].

The movement stop pictograms are listed in the following list.

PICTOGRAMA	FUNCIÓN
1 	Trolley forward stop.
2 	Trolley backward stop.
3 	Hoisting stop.
4 	Lowering stop.
5 	Clockwise slewing stopped Slewing.
6 	Anticlockwise slewing stopped Slewing.
7 	Travelling forward stop.
8 	Travelling backward stop.

## 7.2 Forbidden zones function configuration.



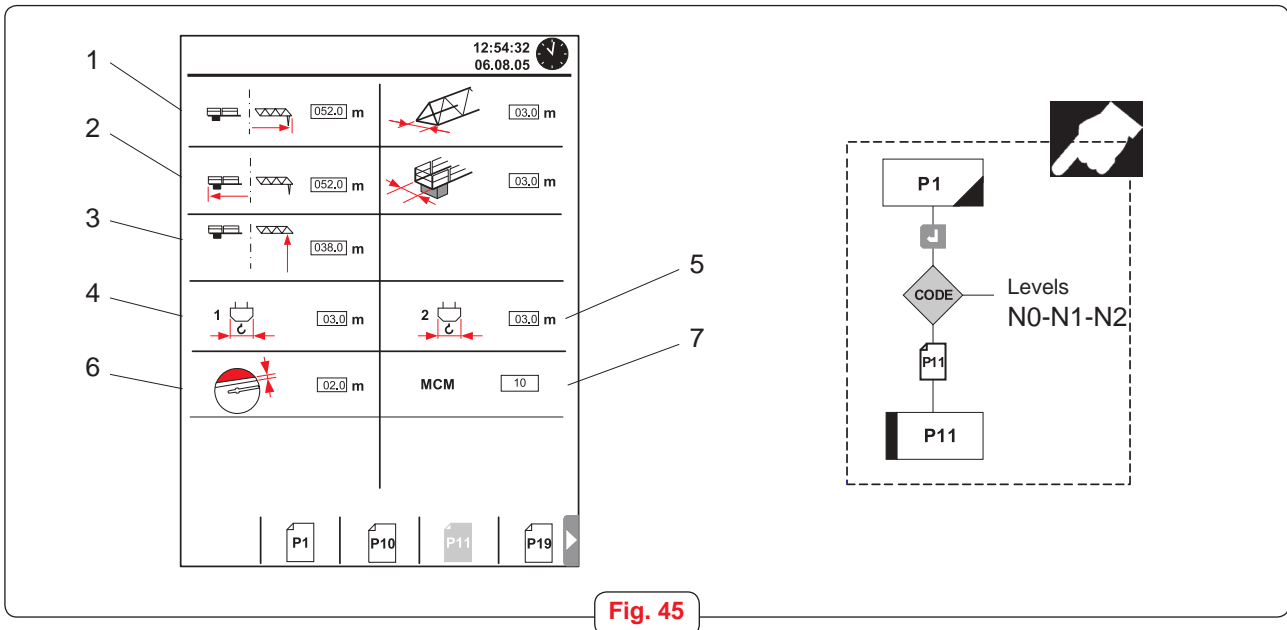
The forbidden zones set up must be done in the order explained below. To configure the unit, the necessary information must be available so that it can be correctly set during the configuration process (load chart and technical sheets).

The forbidden zones configuration consists on three steps:

- 1 Type in the crane geometric parameters in main page [P11] (see 7.2.1).
- 2 Scale the sensors in pages [P12] to [P18] and the stopping times (see 7.2.2 to 7.2.5).
- 3 Define the forbidden zones shapes in page [P41] (see 7.3).



**7.2.1 Configuration page [P11]**



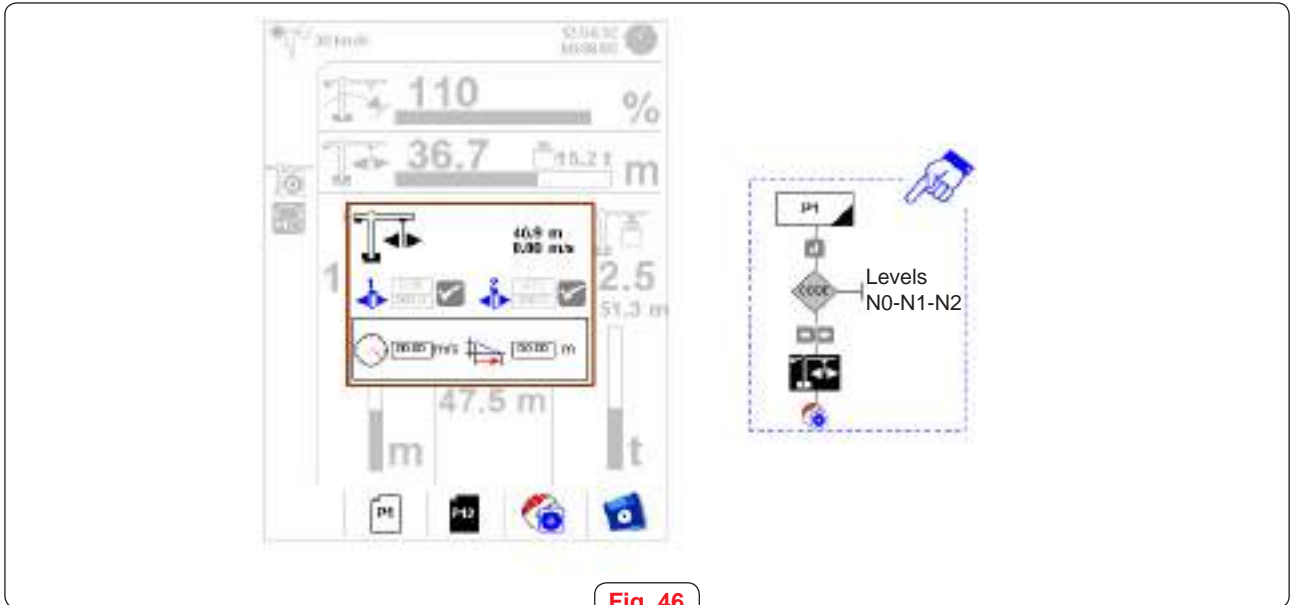
**Fig. 45**

PICTOGRAM	EXPLANATION	NOTE
1	Total jib length from the mast center to the jib end.	See Appendix 1
2	Total counterjib length from the mast center to the counterjib end.	See Appendix 1
3	Total height under hook	See Appendix 1
4	Single reeving hook width.	
5	Double reeving hook width.	
6	Maximum jib width.	Including accesories
7	Maximum counterjib width.	Including accesories
8	Safety distance to apply all around the forbidden zone shape. It must be a value between 2 m y 10 m.	Take it into account when defining the zones.
9 <b>MCM</b>	Machine control mode	do not change

Do not forget to save the settings before leaving [P11] by pressing . Once the data are saved, press to exit page [P11] and return to [P1].

**7.2.2 Trolley sensor adjustment**

Follow the instructions on 5.2.2 to scale the sensor. Once the sensor is scaled, press to enter the additional trolley parameters that need to be defined.




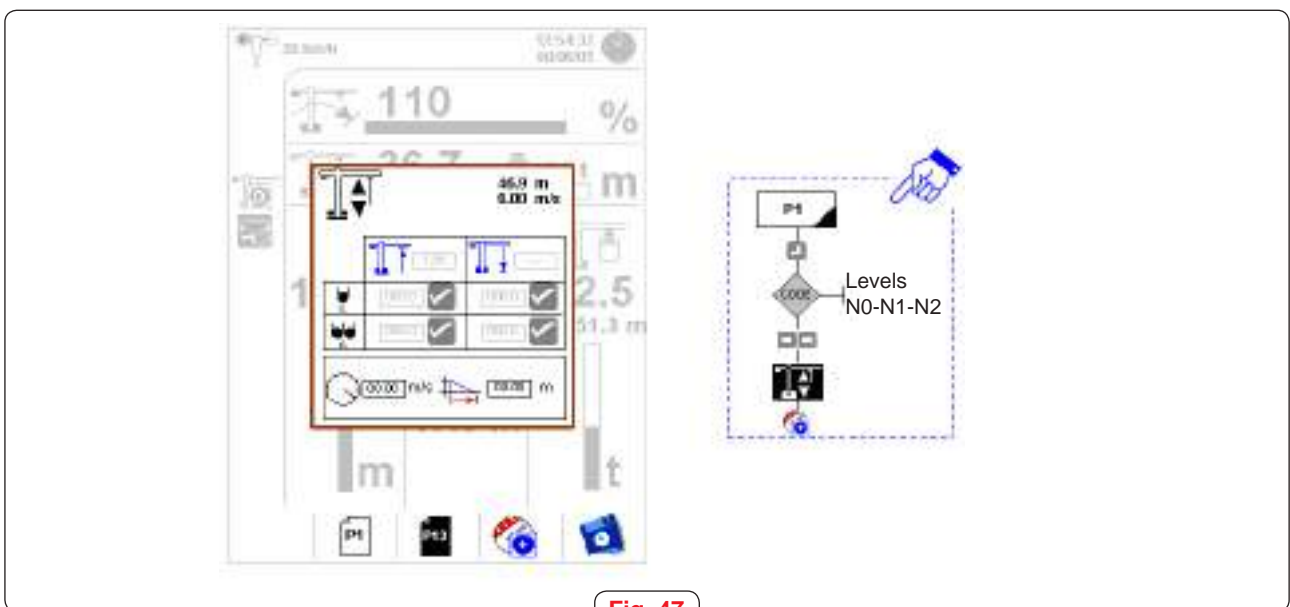
**Fig. 46**

REFERENCE	EXPLANATION	
1	Trolley position and speed indicator	
2	Maximum trolley speed.	Move the trolley at maximum speed and write down the maximum speed reached shown in the indicator 1 (Fig. 46). Type the value in the field 2 (Fig. 46).
3	Maximum distance travelled by the trolley before stopping from maximum speed to zero.	Estimate the trolley maximum stop distance and type the value in field 3 (Fig. 46).

Once the second value has been set, do not forget to save the settings before leaving [P12] by pressing .

### 7.2.3 Hoisting sensor adjustment [P13].

Follow the instructions on 5.2.3 to scale the sensor. Once the sensor is scaled, press  to enter the additional trolley parameters that need to be defined.




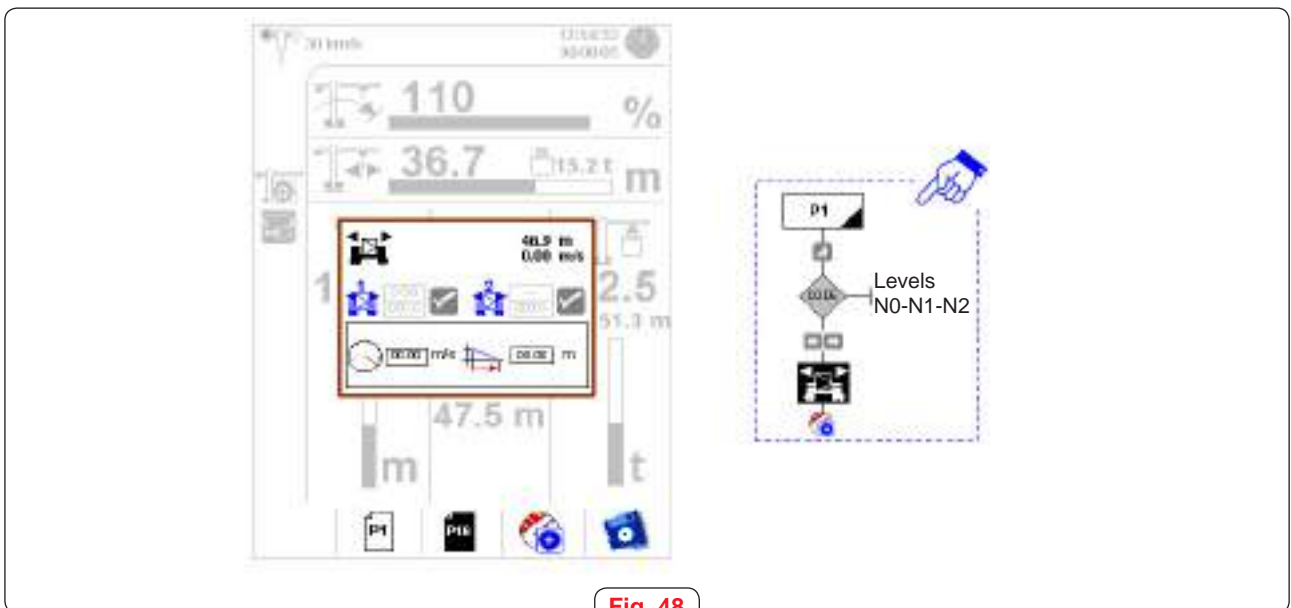
**Fig. 47**

	REFERENCE	EXPLANATION
1	Hook position and speed indicator	
2	Maximum hook speed.(in the fastest reeving case).	Move the hook at maximum speed in the fastest reeving case and write down the maximum speed reached shown in the indicator 1 (Fig. 47). Type the value in the field 2 (Fig. 47).
3	Maximum distance travelled by the hook before stopping from maximum speed to zero.(in the fastest reeving case).	Estimate the hook maximum stop distance and type the value in field 3 (Fig. 47). (in the fastest reeving case).

Once the second value has been set, do not forget to save the settings before leaving [P13] by pressing .

### 7.2.4 Travelling sensor adjustment [P16] (option).

Follow the instructions on 5.2.6 to scale the sensor. Once the sensor is scaled, press  to enter the additional trolley parameters that need to be defined.




**Fig. 48**

	REFERENCE	EXPLANATION
1	Travelling position and speed indicator	
2	Maximum travelling speed.	Move the travelling at maximum speed and write down the maximum speed reached shown in the indication 1 (Fig. 48). Type the value in the field 2 (Fig. 48).
3	Maximum distance travelled by the travelling before stopping from maximum speed to zero.	Estimate the travelling maximum stop distance and type the value in field 3 (Fig. 48).

Once the second value has been set, do not forget to save the settings before leaving [P16] by pressing

### 7.2.5 Slewing sensor adjustment[P17].

Follow the instructions on 5.2.7 to scale the sensor. Once the sensor is scaled, press  to enter the additional trolley parameters that need to be defined.

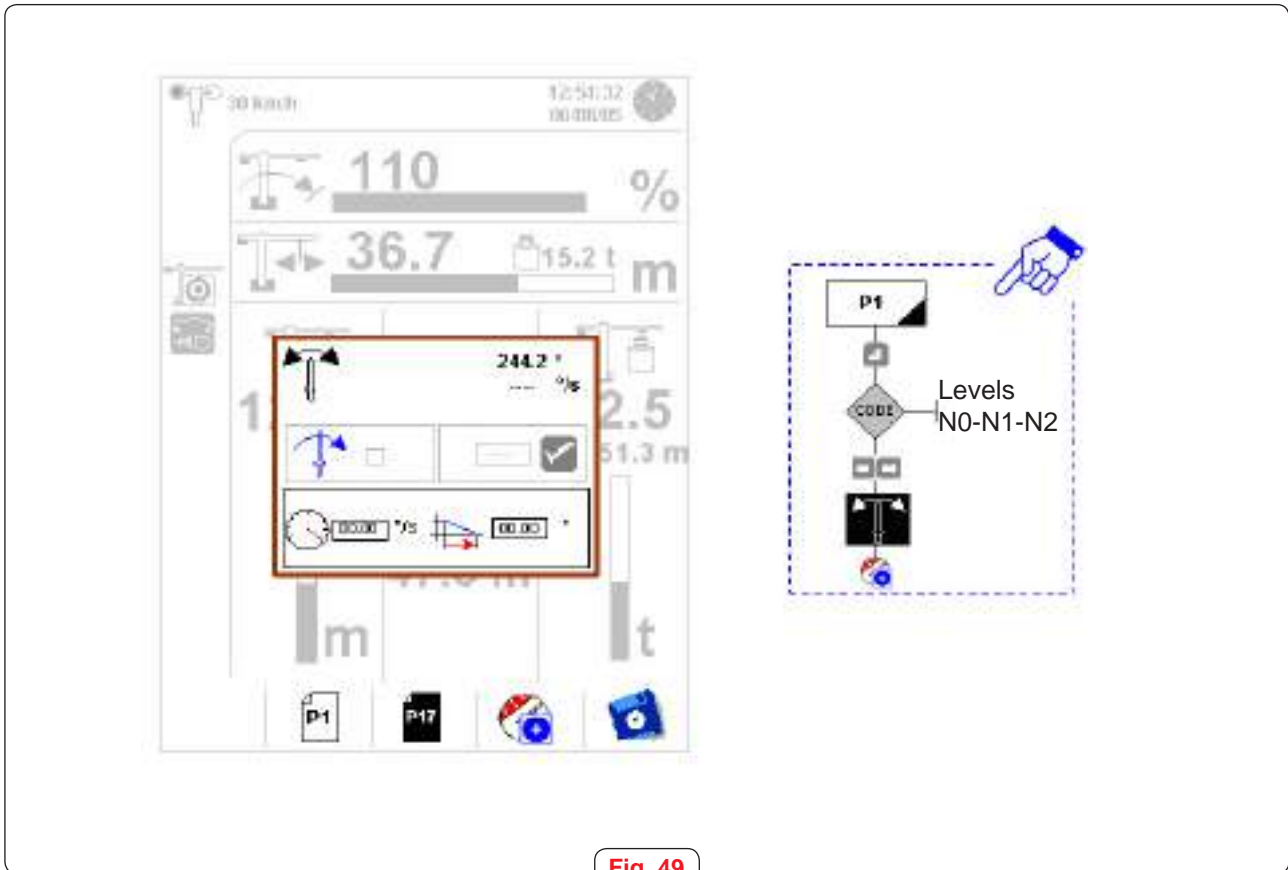



Fig. 49

### 7.3 Defining the geometric shape of a forbidden zone in [P41].

The first step to define a forbidden zone is to choose its shape type and some options which affect its definition.

The starting point to define the zone is page [P41].

	REFERENCE	EXPLANATION
1	Slewing position and angular speed indicator	
2	Maximum slewing speed.	Move the slewing at maximum speed and write down the maximum speed reached shown in the indication 1 (Fig. 49). Type the value in the field 2 (Fig. 49).
3	Maximum angle travelled by the jib before stopping from maximum speed to zero.	Estimate the maximum stop angle and type the value in field 3 (Fig. 49).

Once the second value has been set, do not forget to save the settings before leaving [P17] by pressing .

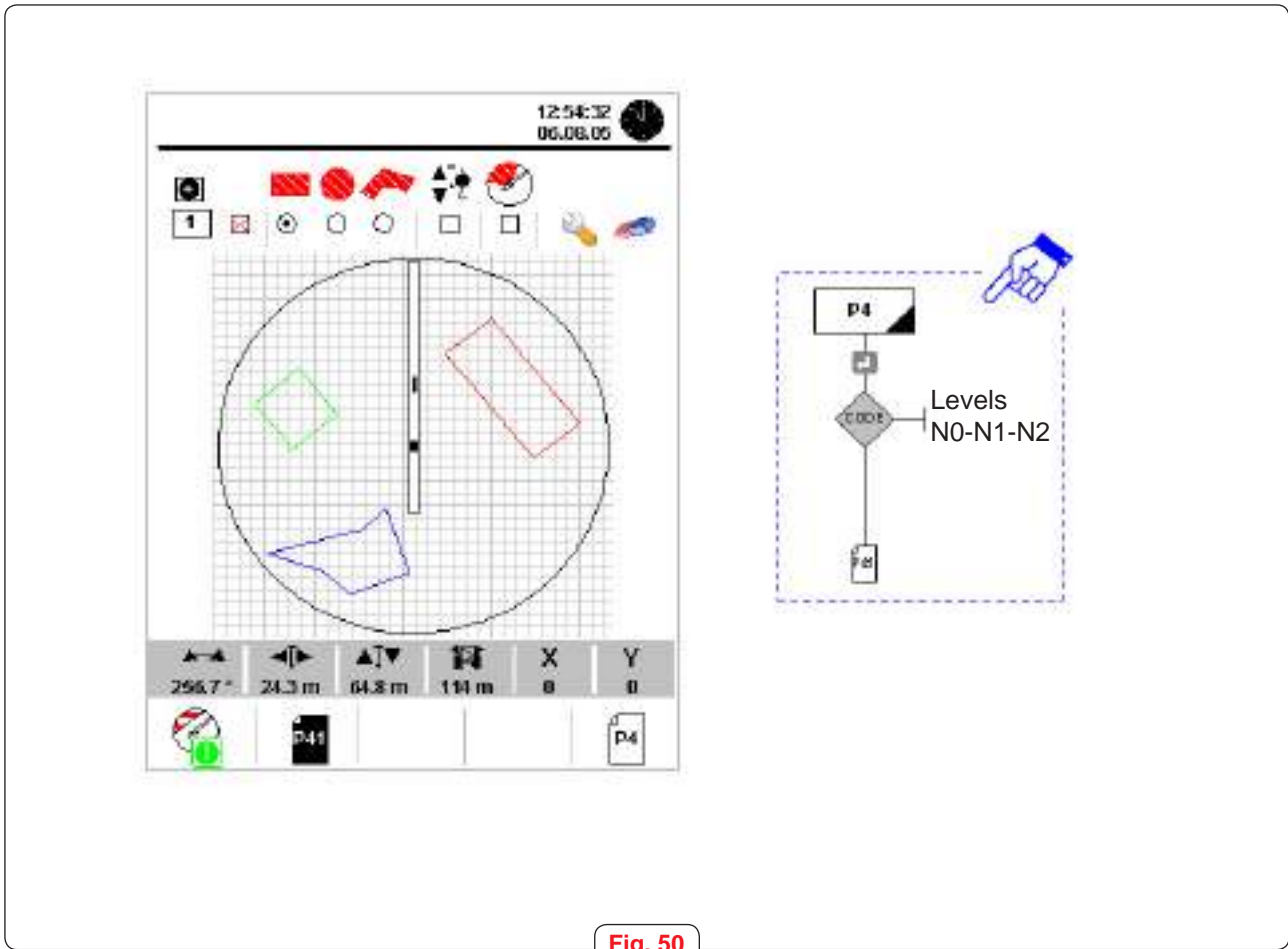
















Fig. 50

	PICTOGRAM	EXPLANATION
1		Adds a new zone (up to 12).
2		To modify a zone enter this field
3		Activates a zone which checked.
4		Rectangular forbidden zone shape.
		Circular forbidden zone shape ( <i>not enabled</i> ).
		Polygonal or point by point forbidden zone shape.
5		Enables the height limitation mode (three dimensional forbidden zones).
6		Avoids the jib and counterjib from entering the forbidden zone instead of only the hook.
7		To draw or modify the selected forbidden zone.
8		Deletes the selected forbidden zone.





### 7.3.1 Defining a new forbidden zone area

	PICTOGRAM	EXPLANATION
1		Select it and confirm by pressing  to add a new zone.
2		Once the zone has been added, it is possible to choose its type, to draw it and to define the rest of options.
3		Choose the zone shape.
4		Choose any of the additional options, if required.
5		Select it and confirm by pressing  to access the page to draw the zones. - Rectangular shape [P42]. - Circular shape [P43]. (not to be used). - Polygonal or point by point shape [P44].
 Once the options have been set, do not forget to save the settings before leaving [P41] by pressing  .		

### 7.3.2 Modifying an existing forbidden zone.





	PICTOGRAM	EXPLANATION
1		Choose the zone selection field. The field will be highlighted in blue. Select the zone.
2		It is not possible to modify part of the drawing of an already saved zone. The zone shape of a saved zone cannot be modified.
3		Choose any of the following additional options, if required.
4		Select it and confirm by pressing  to access the drawing page and redefine the zone drawing.
 Once the options have been set, do not forget to save the settings before leaving [P41] by pressing  .		

### 7.3.3 Deleting an existing zone.

	PICTOGRAM	EXPLANATION
1		Choose the zone selection field. The field will be highlighted in blue. Select the zone.
2		Select it to delete the selected zone.
 Once the zone has been deleted, do not forget to save the settings before leaving [P41] by pressing  .		

### 7.3.4 Forbidden zones activation and deactivation.

 This action will be automatically registered in the event log on page [P3].

	PICTOGRAM	EXPLANATION
1		Choose the zone selection field. The field will be highlighted in blue. Select the zone.
2		Check the box to activate the zone or uncheck it to deactivate. The deactivated zones will be green coloured on page [P4].
 Once the activation or deactivation has been performed, do not forget to save the settings before leaving [P41] by pressing  .		

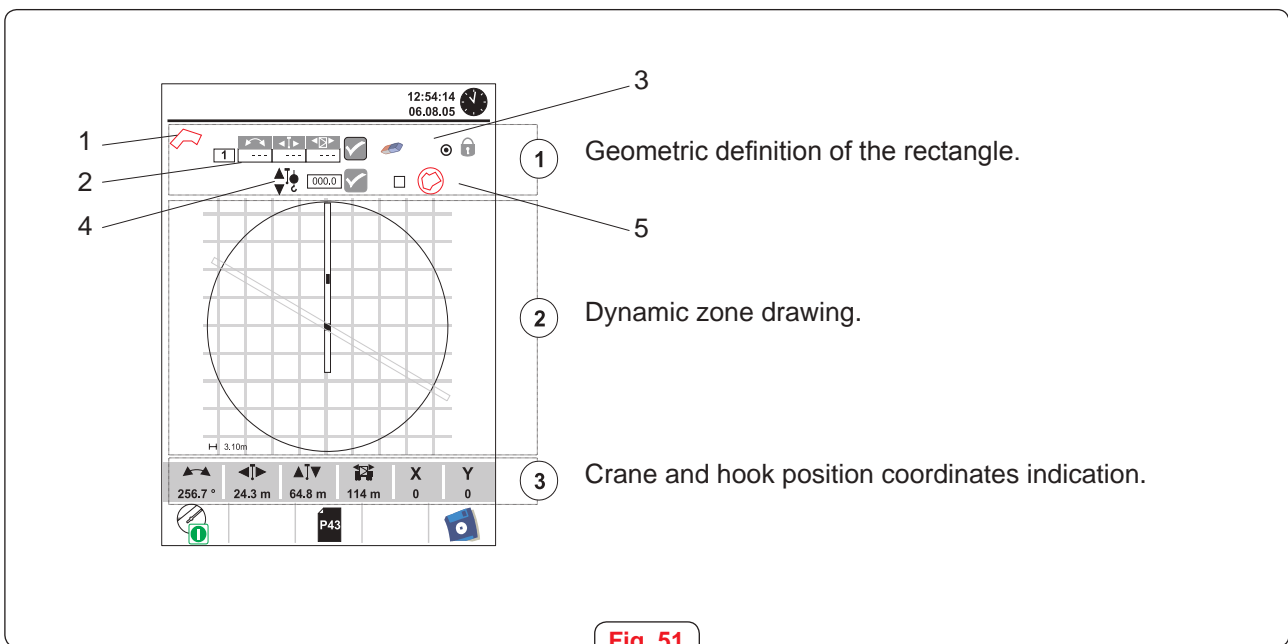
**7.3.5 Forbidden zones override.**

! This action will be automatically registered in the event log in page [P3].

	PICTOGRAM	EXPLANATION
1		Press it to completely override the zoning function. This action may also be done on page [P4].
2		Press it to re-activate the forbidden zones function.

! The forbidden zones state pictogram is also shown at page [P1].

**7.4 Drawing a rectangular forbidden zone on page [P42].**



**Fig. 51**

The rectangle geometry is defined by 3 points:

- P1* to define the first point of any of the rectangle sides (move the hook to the desired position).
- P2* to define the second point of the same rectangle side.
- P3* to define the rectangle depth.

At each point, the system registers the slewing , the trolley and travelling (option) coordinates .

If the hook height forbidden zones management is chosen, it is necessary to define a fourth point named *Pz* to define the minimum hook height allowed in each zone.

	PICTOGRAM	EXPLANATION
1		Indicates that a rectangular zone is being drawn or modified.
2		Coordinates of the 3 registered points <i>P1</i> , <i>P2</i> and <i>P3</i> .
3		Rectangle depth (point <i>P3</i> ).
4		Hook lowest position allowed in the forbidden zone(point <i>Pz</i> ).
5		Select it to define the zone outside the drawn rectangle as forbidden and allow the zone inside the rectangle.

### 7.4.1 Drawing the rectangle [P42].



It is important to take into account the safety distance ( $d$ ) defined at page [P11] to set the points of the rectangle.

The safety distance is automatically applied all around the defined zone perimeter by the software. The drawings on the screen show the zone to which the hook access is prevented. However, the crane movements are stopped ( $d$ )m before.

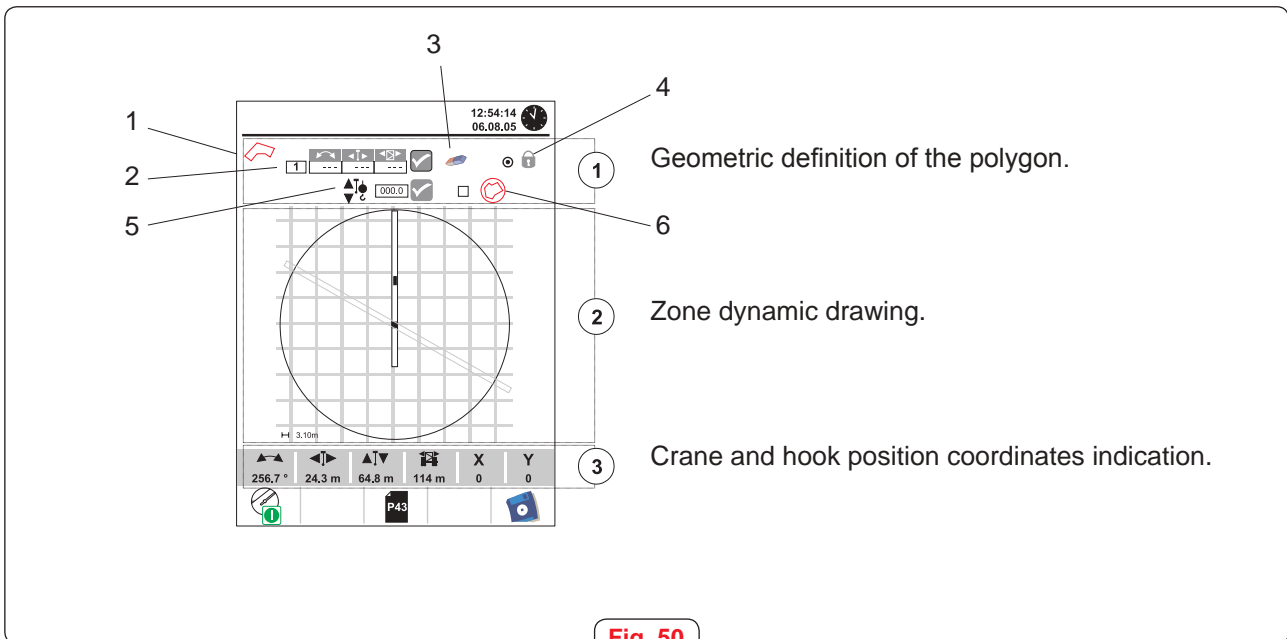
	PICTOGRAM	EXPLANATION	
1		Place the hook at the first rectangle vertex $P1$ . Register the point by pressing V. The point coordinates are shown a few seconds after registering the point and the point number will change to $P2$ .	
2		Place the hook at the second rectangle vertex $P2$ . Register the point by pressing V.	
3		Place the hook at the third rectangle vertex $P3$ . Register the point by pressing V.	
4		If height management is selected, move the hook to the desired limit $Pz$ . Register the point by pressing V.	
		Once the above process is finished, the zone definition is done. However, the zone will not be closed and saved until the zone is saved pressing .	

During the drawing of the zones, it is possible to modify any of the previously defined points. It is not possible to do so after saving the points.

	PICTOGRAMA	EXPLANATION
1		To modify the points $P1$ or $P2$ , first select the desired point in the selection field.
2		Place the hook at the desired point and register it by pressing V.
3		To modify $P3$ , enter the field and manually modify the depth value. It is possible to invert the depth sense with respect to $P1$ - $P2$ by using the fields  or
4		Move the hook to the desired limit $Pz$ and check its coordinate. Enter $Pz$ field and adjust manually to the desired value.
		Once the options have been set, do not forget to save the settings before leaving [P42] by pressing .




## 7.5 Point to point drawing of a polygonal forbidden zone [P43]









**Fig. 50**

It is possible to define a polygon of up to 20 points (from  $P1$  to  $P21$ ).

At each point, the system registers the slewing , the trolley  and travelling (option) coordinates .

If the hook height forbidden zones management is chosen, it is necessary to define a fourth point named  $Pz$  to define the minimum hook height allowed in each zone.

	PICTOGRAM	EXPLANATION
1		Indicates that a polygonal zone is being drawn or modified.
2		Coordinates of the registered points $P1$ to $P21$ .
3		Select it to delete the selected point.
4		Select it to indicate that the system will automatically close the polygon by drawing a line between the first and the last point. Select it always.
5		Hook lowest position allowed in the forbidden zone(point $Pz$ ).
6		Select it to define the zone outside the drawn polygon as forbidden and allow the zone inside the polygon.

### 7.5.1 Drawing of the Point to point polygon [P43].



It is important to take into account the safety distance ( $d$ ) defined at page [P11] to set the points of the rectangle.

The safety distance is automatically applied all around the defined zone perimeter.

The screen drawing indicates the exact zone to which the hook access is prevented. However, the crane movements are stopped ( $d$ )m before.

	PICTOGRAM	EXPLANATION	
1		Place the hook at the first polygon vertex <i>P1</i> . Register the point by pressing V. The point coordinates are shown a few seconds after registering the point and the point number will change to P2.	
2		Place the hook at the second polygon vertex <i>P2</i> . Register the point by pressing V.	
3		Place the hook at the next polygon vertex. Register the point by pressing V. Repeat the process with the following points	
4		If height management is selected, move the hook to the desired limit <i>Pz</i> . Register the point by pressing V.	
Once the above process is finished, the zone definition is done. However, the zone will not be closed and saved until the zone is saved pressing .			

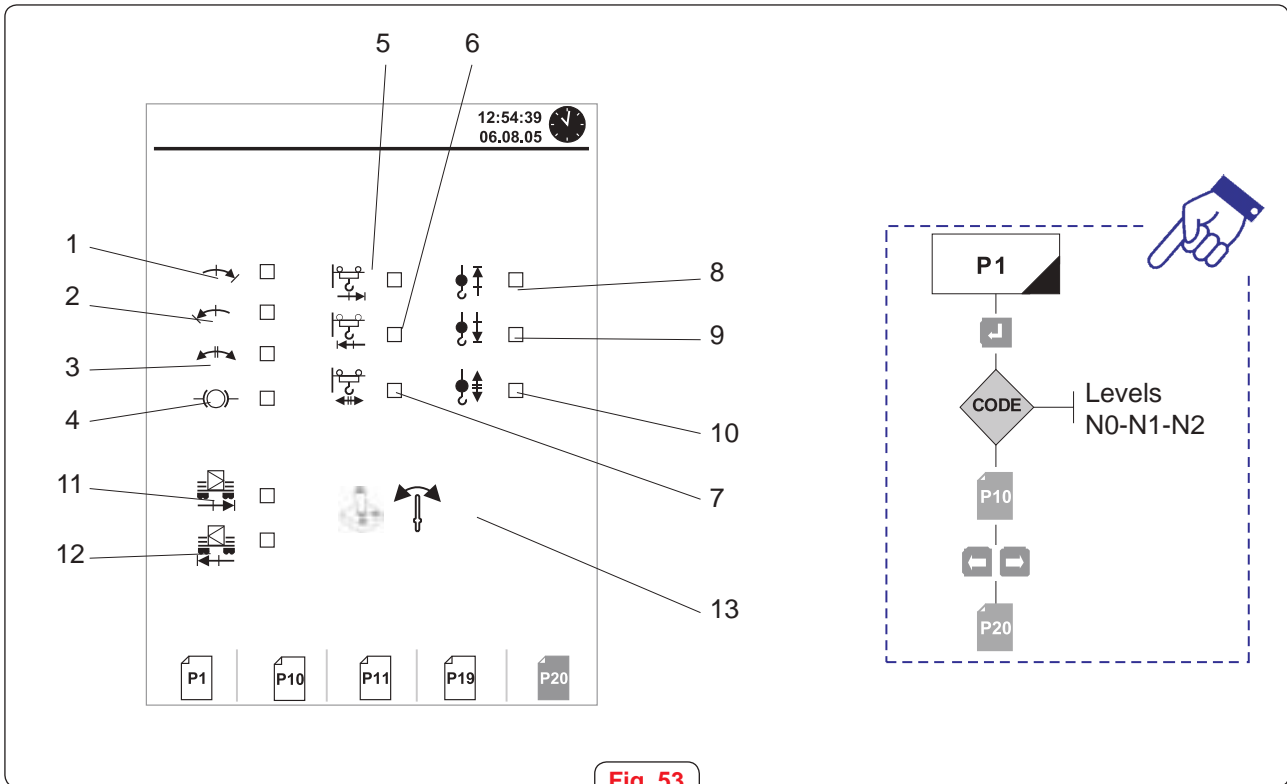
During the drawing of the zones, it is possible to modify any of the previously defined points. It is not possible to do so after saving the points.

	PICTOGRAM	EXPLANATION	
1		To modify the points P1 to P21, first select the desired point in the selection field.	
2		Place the hook at the desired point and register the point by pressing V.	
3		It is possible to delete one of the points (e.g. point P4 in the right figure). After confirming the deletion, the system will calculate again the segment between the points previous and following to the deleted point.	 
4		Move the hook to the desired height limit <i>Pz</i> and check its coordinate. Select <i>Pz</i> field and adjust manually to the desired value.	
Once the options has been determined, do not forget to save the settings before leaving [P43] by pressing .			

### 7.6 IM45 Digital output control [P20].

Page [P20] allows to simulate the forbidden zones dynamic movement stop and prevention. It is possible to activate IM45 relays through this page and thus to stop selectively the crane movements.

Before beginning to use the Forbidden zones option it is compulsory to check that DLZ341 forbidden zones system is able to stop each of the crane movements through the proper relay output.

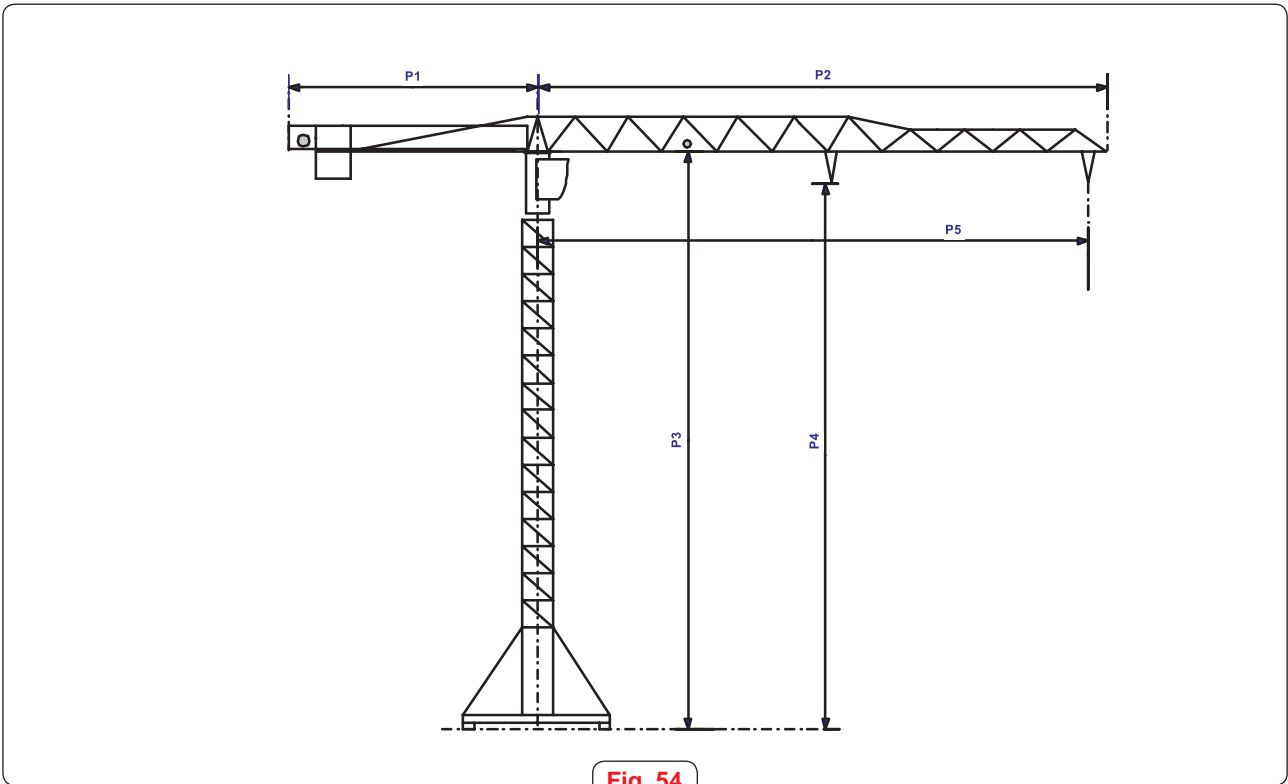


**Fig. 53**

	PICTOGRAM	EXPLANATION
1		Stops and prevents clockwise slewing movements.
2		Stops and prevents anticlockwise slewing movements.
3		Sets a reduced speed for slewing movements (clockwise and anticlockwise)
4		Applies the slewing brake.
5		Stops and prevents trolley forward movements.
6		Stops and prevents trolley backward movements.
7		Sets a reduced speed for trolley movements (clockwise and anticlockwise)
8		Stops and prevents hoisting movements.
9		Stops and prevents lowering movements.
10		Sets a reduced speed for hoist movements (hoisting and lowering)
11		Stops and prevents travelling forward movements.
12		Stops and prevents travelling backward movements.
13		Indicates detection of a zero position of slewing control (not used)

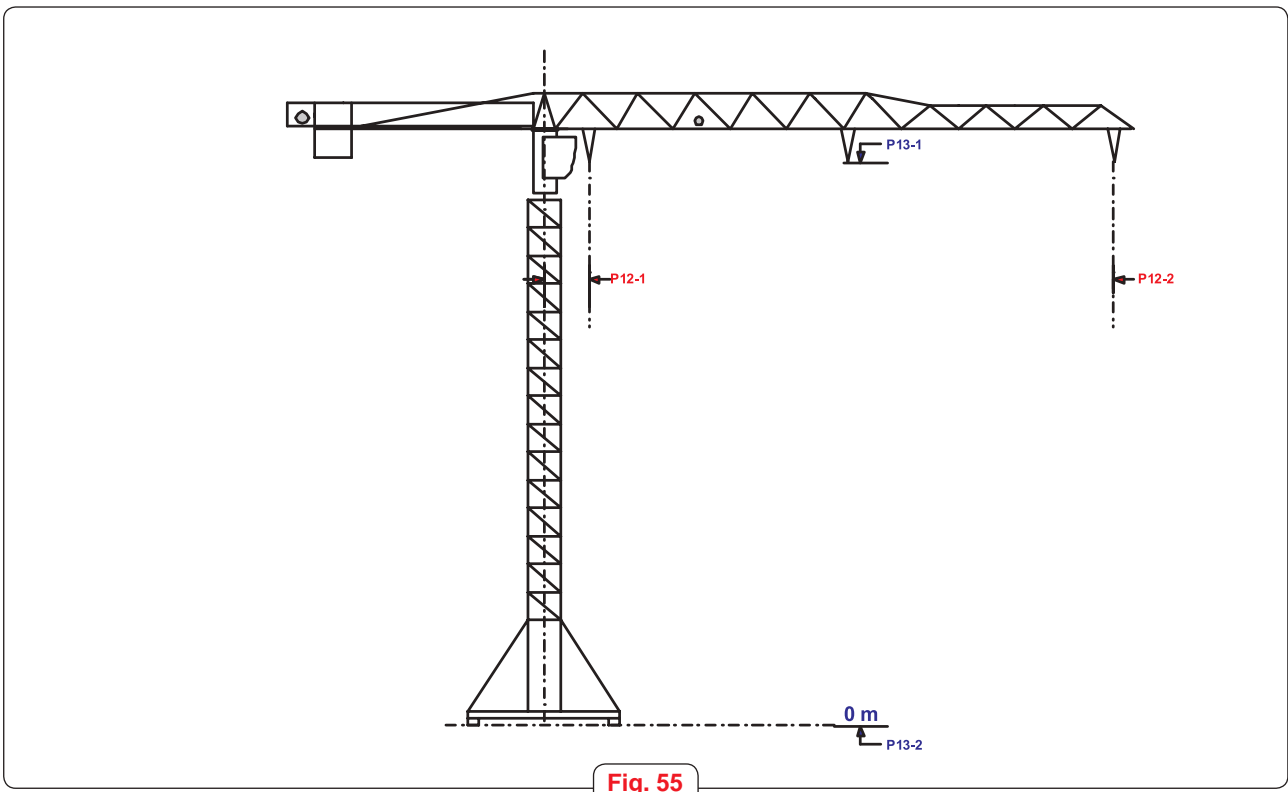
**8 APPENDICES**

**Appendix 1 – Geometric parameters for forbidden zones configuration.**



**Fig. 54**

**Appendix 2 – Geometric parameters for sensors configuration.**



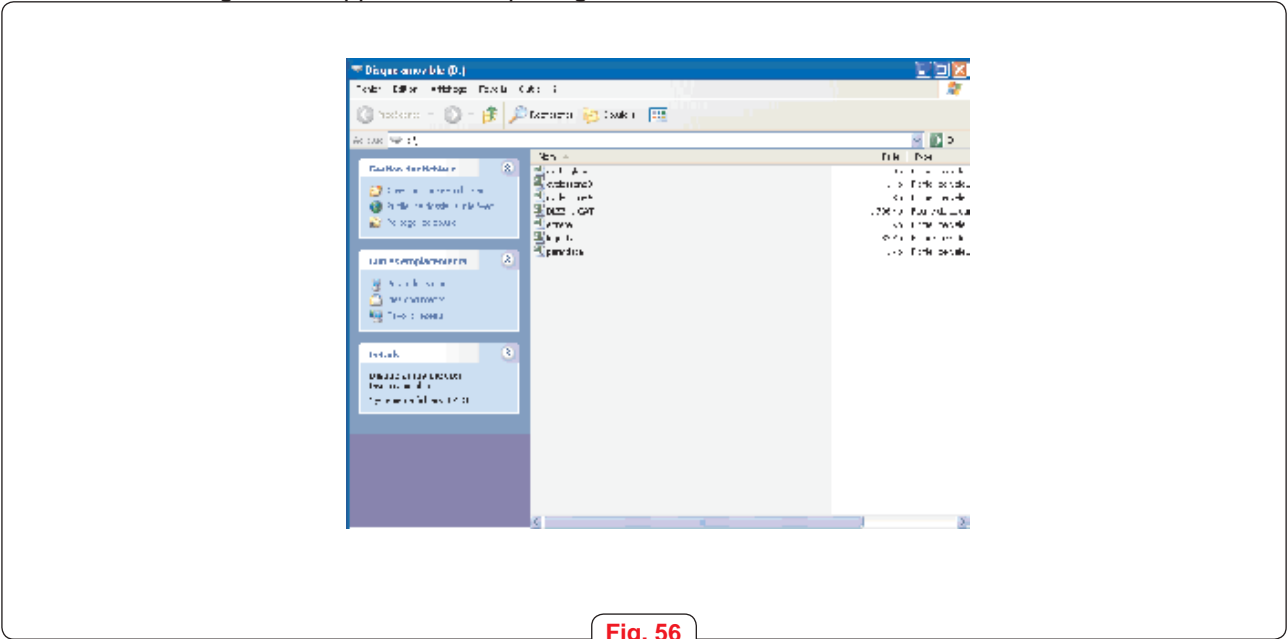
**Fig. 55**

**Appendix 3– Reading the event log from a PC using the USB key.**

A USB key is supplied with the DLZ341 system. The USB stores the application DLZ341-GAT.xls that works under MS Excel. This application allows to view and print the information registered by the Data logger. To do so, it is necessary a personal computer and the program MS Excel.

**1. Opening an event log file.**

- 1 Once the information has been transferred from UCDL46 into the USB key (see 6.3), plug it to PC USB port.  
The following screen appears after opening the USB folder.



**Fig. 56**

! To open the folder, it may be necessary to use the system explorer.

- 2 When opening DLZ-GAT.xls the following sheet appears:



**Fig. 57**

! To open the file, it is necessary that MS Excel is configured at a low safety level, so that it allows to run Macros. If an error message appears on the screen when trying to open the excel file, check the safety level in the menu Tools/Macro/Safety settings, or in the MS Excel equivalent version menu. If the safety level is too high, decrease it so that it does not interfere with the program.

3 After opening the file, choose the language:



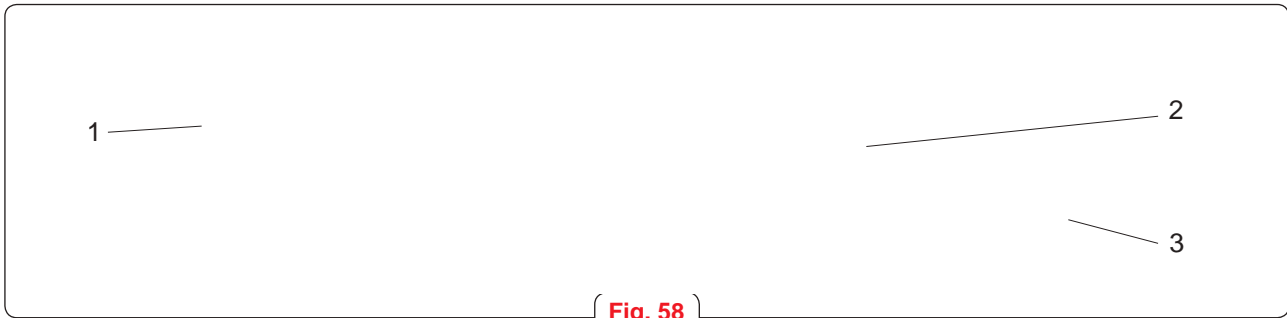
Application use:

The report is made up of the data registered in the three sheets described below.

	PICTOGRAM	EXPLANATION
1		Previous page.
2		Print report.
3		Next page.

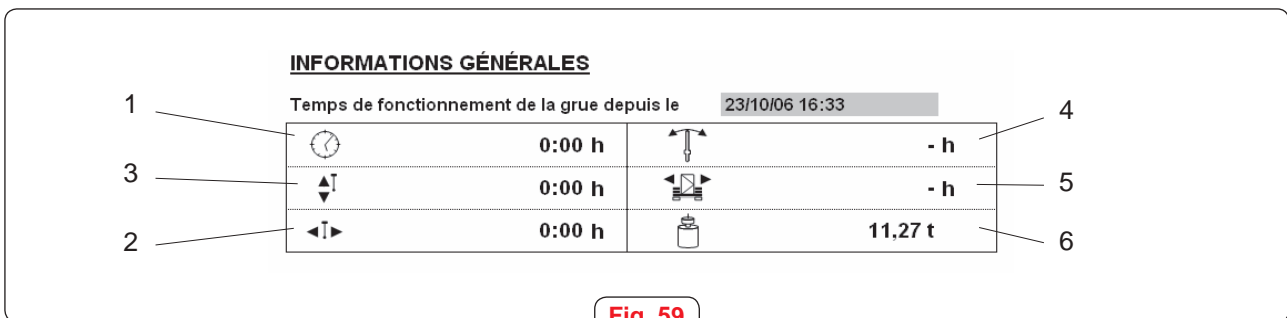
To navigate through the sheets use the buttons placed at the bottom of the sheet.

## 2 Report sheet 1 :



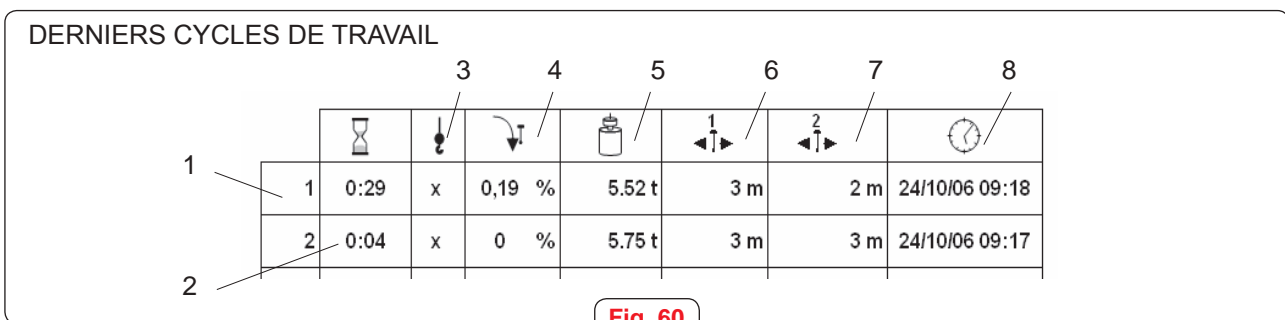
**Fig. 58**

REFERENCE	EXPLANATION
1	UCDL serial number
2	Time and date of the UCDL to USB key event log download
3	Crane identification -Grue: Configuration program -Modèle: Model -NS: Crane serial number



**Fig. 59**

REFERENCE	EXPLANATION
1	Total crane connection time (hours : minutes).
2	Total trolley work time (hours : minutes).
3	Total hoist work time (hours : minutes).
4	Total slewing work time (hours : minutes). (option)
5	Total travelling work time (hours : minutes). (option)
6	Total lifted load.



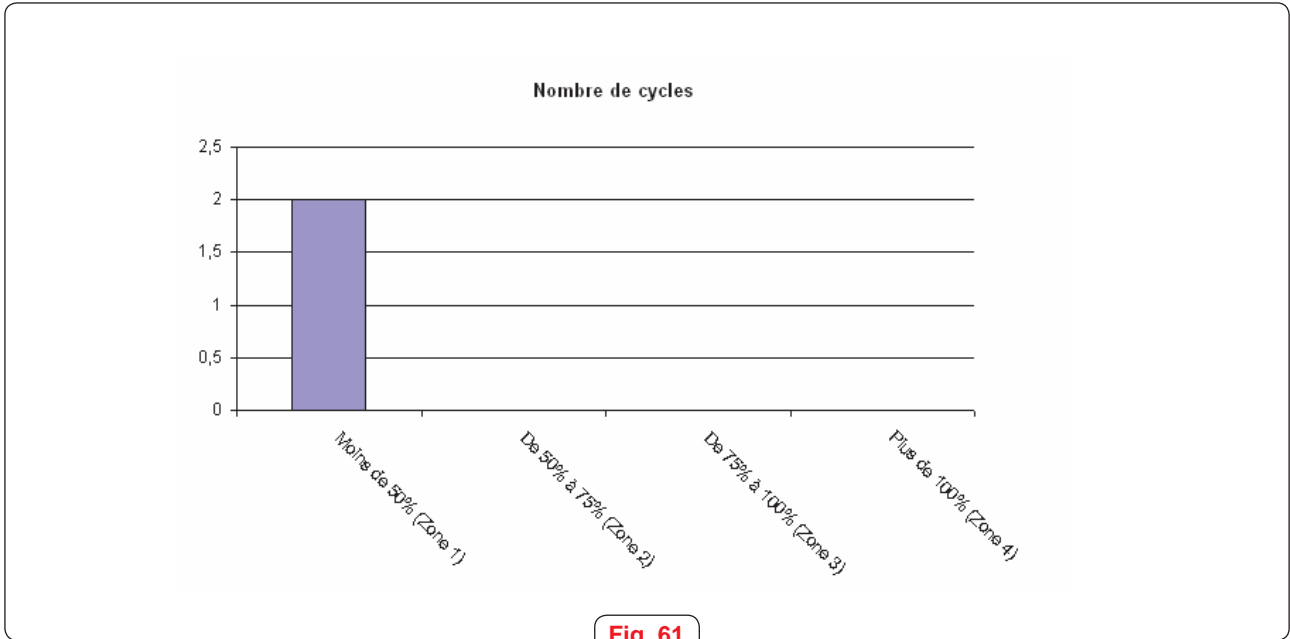
The table registers the last 10 lift cycles.

REFERENCE	EXPLANATION	
1	Cycle number	Being the cycle 1 the most recent cycle.
2	Cycle duration.	Hours and minutes.
3	Reeving state during the cycle.	
4	Maximum moment within the cycle.	Percentage with respect to the maximum moment of the crane.
5	Load lifted within the cycle.	Tons.
6	Trolley position at cycle start.	Meters.
7	Trolley position at cycle end.	Meters.
8	Date and time at cycle start.	

### 3 Page 2 .

The page shows a bargraph which indicates the number of registered cycles classified in four ranges depending on the moment exerted on the crane during the cycle.

- Zone 1 : Less than 50% of the maximum admissible moment.
- Zone 2 : Between the 50% and the 74% of the maximum admissible moment.
- Zone 3 : Between the 75% and the 100% of the maximum admissible moment.
- Zone 4 : More than the 100% of the maximum admissible moment.



**Fig. 61**



The ranges can be modified in page [P2] by changing the threshold values (see 6.1.2). The cycles indicated by the bargraphs correspond to the ranges defined at [P2], though the side inscriptions indicate the default ranges.

**Journal des 10 derniers cycles en Zone 3 (std entre 75% et 100%)**

1				%			
2				%			
3				%			
4				%			
5				%			

**Journal des 10 derniers cycles en Zone 4 (std entre 100% et 125%)**

1				%			
2				%			
3				%			
4				%			
5				%			

**Fig. 62**

These tables register details of the last 10 cycles in the 3rd and 4th ranges.

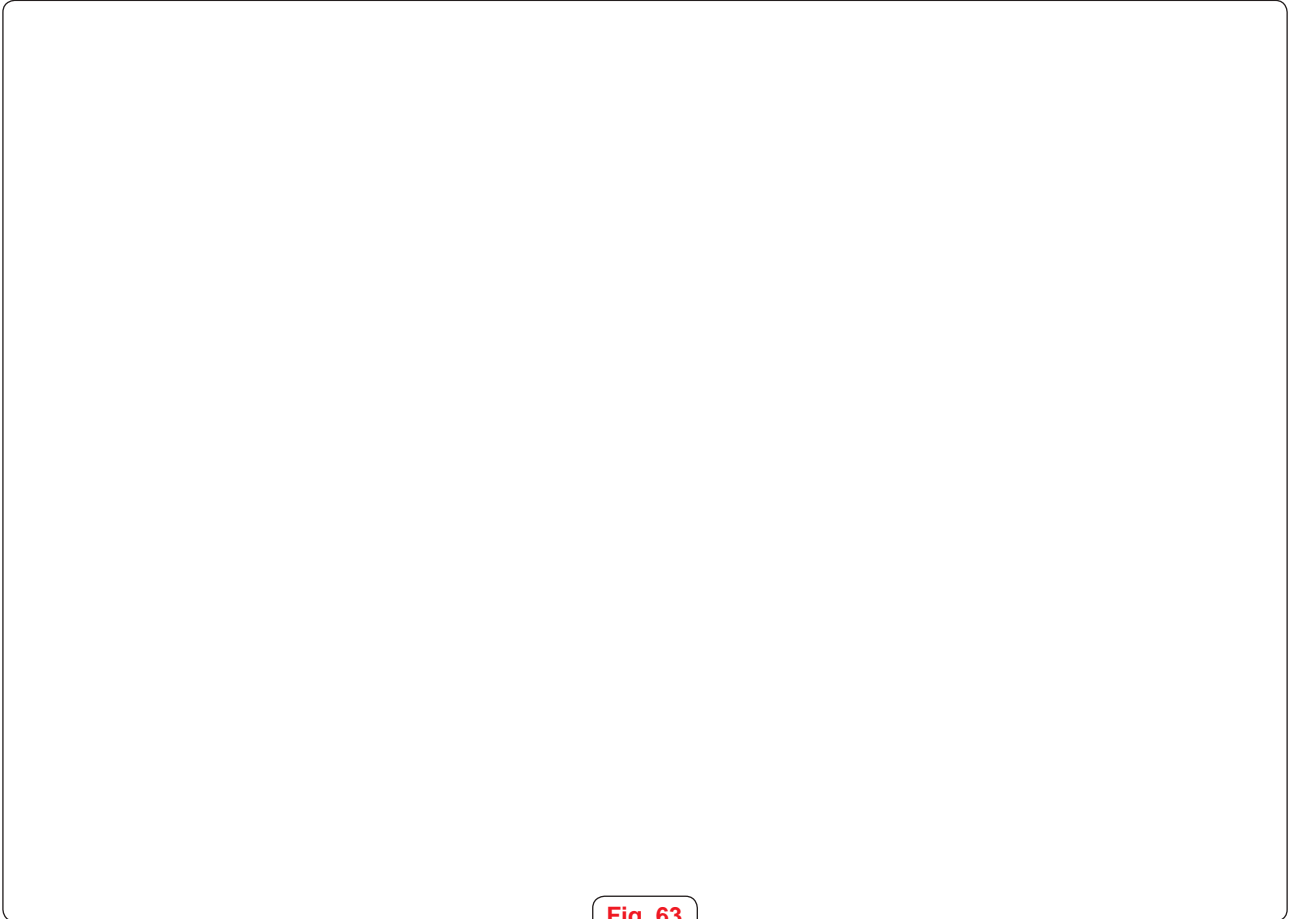
! The information of this table is the same as that in the table «last cycles» of the 1st page of the report (see 2 of this Appendix).



**3 Page 3 description :**

Page 3 shows the events log registered in the DLZ341 system database.





















The event log records the last 2000 events since the last reset, ordered in a FIFO list (The list always contains 2000 events. A new event is placed in position 1, the rest are moved to the next position, and the one in position 2000 is deleted)























**Fig. 63**

REFERENCE	EXPLANATION	
1	Event number.	The left arrow allows to go through the whole list of events.
2	Event time and date	Hours and minutes.
3	Event icon (see appendix 4)	
4	The last column indicates a value associated to the registered event, if any.	eg: lifted load, trolley position

**Annex 4 – Events list and failure codes.**

EVENT	FUNCTION	NOTE	
1		Reeving state.	
2		Reeving state.	
3		Reeving state.	
4		Reeving state	
5		Reeving state	
6		Wind speed rise above prealarm threshold	
7		Wind speed fall below prealarm threshold	
		Wind speed rise above alarm threshold	
		Wind speed fall below alarm threshold.	
8		Anemometer signal fault.	
9		Trolley backward start.	
10		Trolley backward stop.	
11		Trolley forward start.	
12		Trolley forward stop.	
13		Trolley stopped state start.	When the trolley mechanism is stopped at the same position for more than 5 seconds. The position is also registered.
14		Hoisting start.	
15		Hoisting stop.	
16		Lowering start .	
17		Lowering stop.	
18		Hoist stopped state start.	When the hoist mechanism is stopped at the same position for more than 5 seconds. The position is also registered.
19		Load hung state start.	When the hoist mechanism is stopped at the same position for more than 5 seconds. The load value is also registered.
20		Moment limitation state start.	
21		Moment limitation state stop.	
22		Load limitation state start.	

EVENT	FUNCTION	NOTE
23		Load limitation state stop.
24		Crane switched on.
25		Crane switched off.
26		Weathervaning on.
27		Weathervaning off.
28		Forbidden zones on.
29		Forbidden zones on.
30		UCDL46 on.
31		UCDL46 off.
32		UCDL46 date and/or clocktime change.
33		UCDL46 software change.

FAILURE CODE	FUNCTION	NOTE
41	 1	Luffing angle sensor badly scaled or sensor failure.
42	 2	Trolley sensor badly scaled or sensor failure
43	 3	Load cell badly scaled or load cell failure.
44	 4	Moment sensor badly scaled or sensor failure
45	 5	Hoisting sensor badly scaled or sensor failure
46	 6	Anemometer sensor badly scaled or sensor failure
47	 7	Slewing sensor badly scaled or sensor failure
48	 8	Travelling sensor badly scaled or sensor failure
49	 9	System error
50	 10	Data logger failure
51	 11	Memory corruption.
52	 12	Data logger information restoring error.



ELECTRICAL MAINTENANCE WORKS MUST ALWAYS BE CARRIED OUT UNDER NO VOLTAGE. MAKE SURE THAT ELECTRICAL SUPPLY WILL NOT BE RECONNECTED WITHOUT NOTICE.

## 0 CONTENTS

1	SWITCHGEAR CABINET
2	ELECTRIC MOTORS
3	RESISTORS
4	ELECTRICAL CABLES
5	LIMITERS
6	SLIP-RING UNIT
7	ANEMOMETER
8	FORBIDDEN ZONES SYSTEM

## 1 SWITCHGEAR CABINET

Periodically check that

- The enclosure is watertight and doors close properly
- Cabinet hinges are properly greased
- Ventilating and heating elements, if any, work properly
- Cabinet door switch is easily operated
- There are no loose cable connections in terminal boxes or switchgear terminals.
- Cabinet internals are clean and free from foreign material
- Starter contacts are in good condition. Replace the contacts or the starter only if any of the contacts is completely worn out (Silver plating practically inexistent) or if marks show some welding. Contact surface shall not be filed.
- Stickers placed outside the cabinet are in good condition and legible.



IN CASE OF A SHORT CIRCUIT CHECK STARTER CONTACTS THAT MIGHT BE INVOLVED. CONTACTS MAY HAVE BEEN WELDED.

## 2 ELECTRIC MOTORS

Periodically check that

- The enclosure is watertight.
- Glands are properly tightened (gland nuts fully tightened)
- Cooling windows are free from obstructions
- Cooling of fan cooled motors works properly and is free from obstructions
- Terminal connexions are fully tightened.

## 3 RESISTORS

Periodically check that

- Screwed connections for terminal boxes and internal resistor connections are properly tightened.
- Tubes and resistor components are free from damage.

#### 4 ELECTRICAL CABLES

Periodically check that

- Cable sheathing is free from damage
- Cables are not subject to tensional or torsional loads
- Cables are not forced through points of entry to equipment (motors, distribution boxes, etc.)

#### 5 LIMITERS



FOR SAFE OPERATION, LIMITERS AND LIMIT SWITCHES MUST BE IN GOOD OPERATING CONDITION

Periodically check that

- Position limiter actuators work properly (smooth actuation and back to rest without seizing), cable sheathing free from damage.
- Enclosures and covers guarantee limiter tightness.
- Glands are properly tightened (gland nuts fully tightened) and cables properly placed on glands (glands actuate on cable sheathing and cables are not pulled at an angle against the gland)

#### 6 SLIP-RING UNIT

Periodically check that

- Brushes and rings are in good condition
- Electrical connections are properly made
- The enclosure is watertight
- Glands are properly tightened (gland nuts fully tightened) and cables properly placed on glands (glands actuate on cable sheathing and cables are not pulled at an angle against the gland)

#### 7 ANEMOMETER

Periodically check the operation of the anemometer and alarm indication:

- Operation of the beacons and siren (operate the TEST button).
- Anemometer sensor turns freely and is not affected by the shielding of the structure.
- The cable between the sensor and the control/signalling unit is not cut or disconnected.
- The signalling unit is visible from the operator's position.
- The signalling unit is conveniently secured to the structure with the chain provided.

See «Anemometer - Wind Speed Indication / Alarm» instruction for further details.

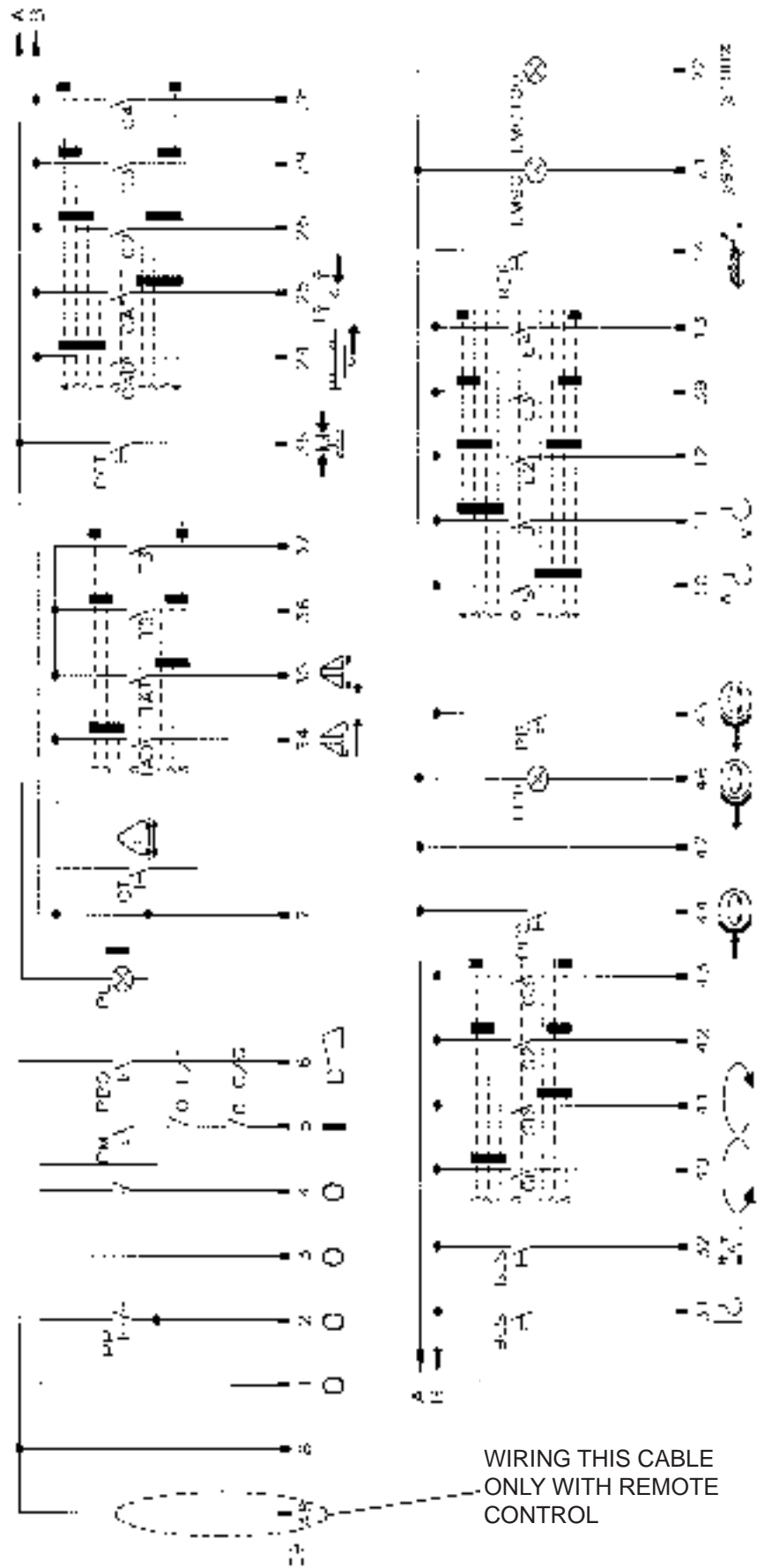
#### 8 FORBIDDEN ZONES SYSTEM

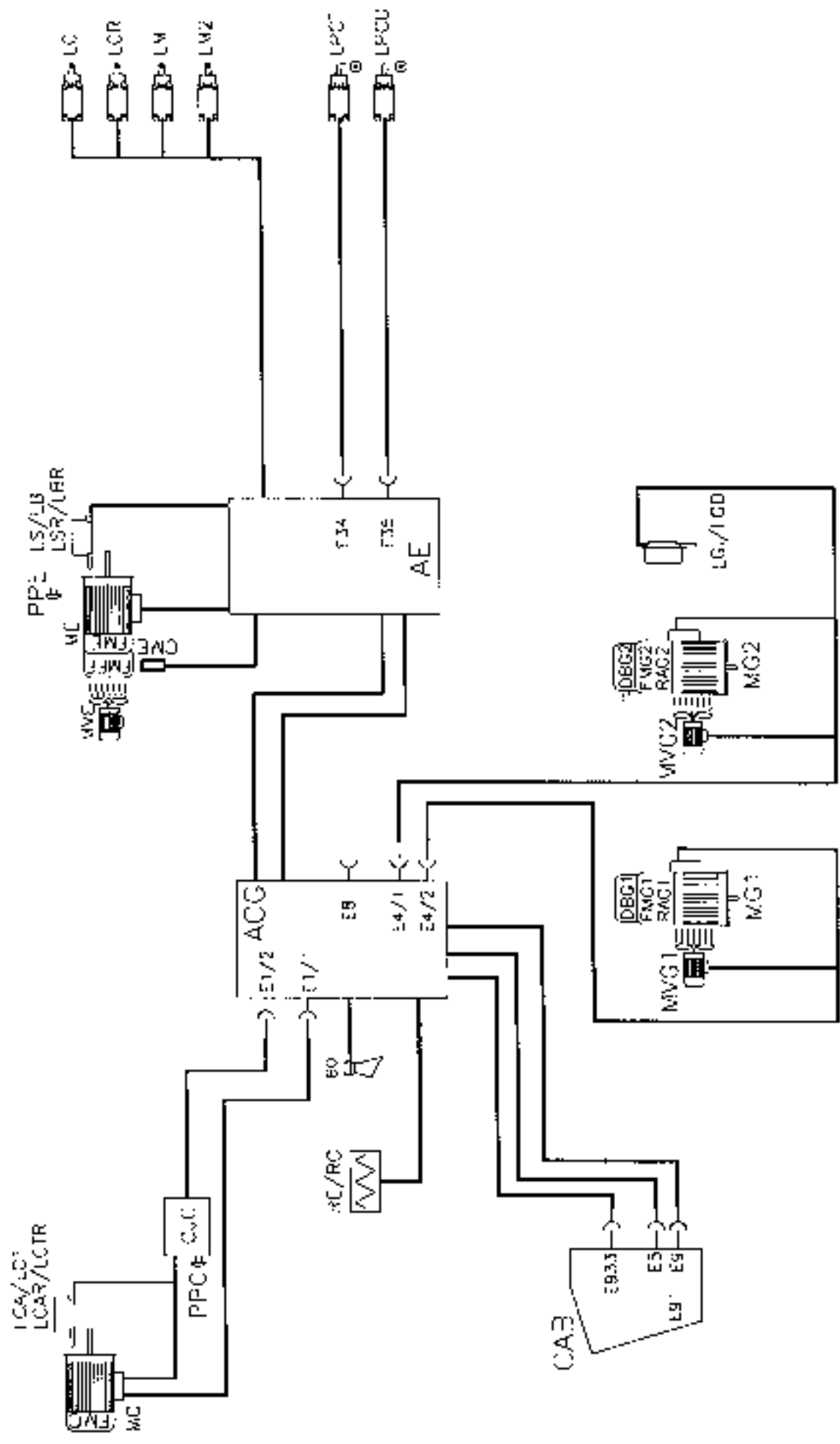



For a good and safe performance of the crane, the indication and forbidden zones system must be properly adjusted and configured.

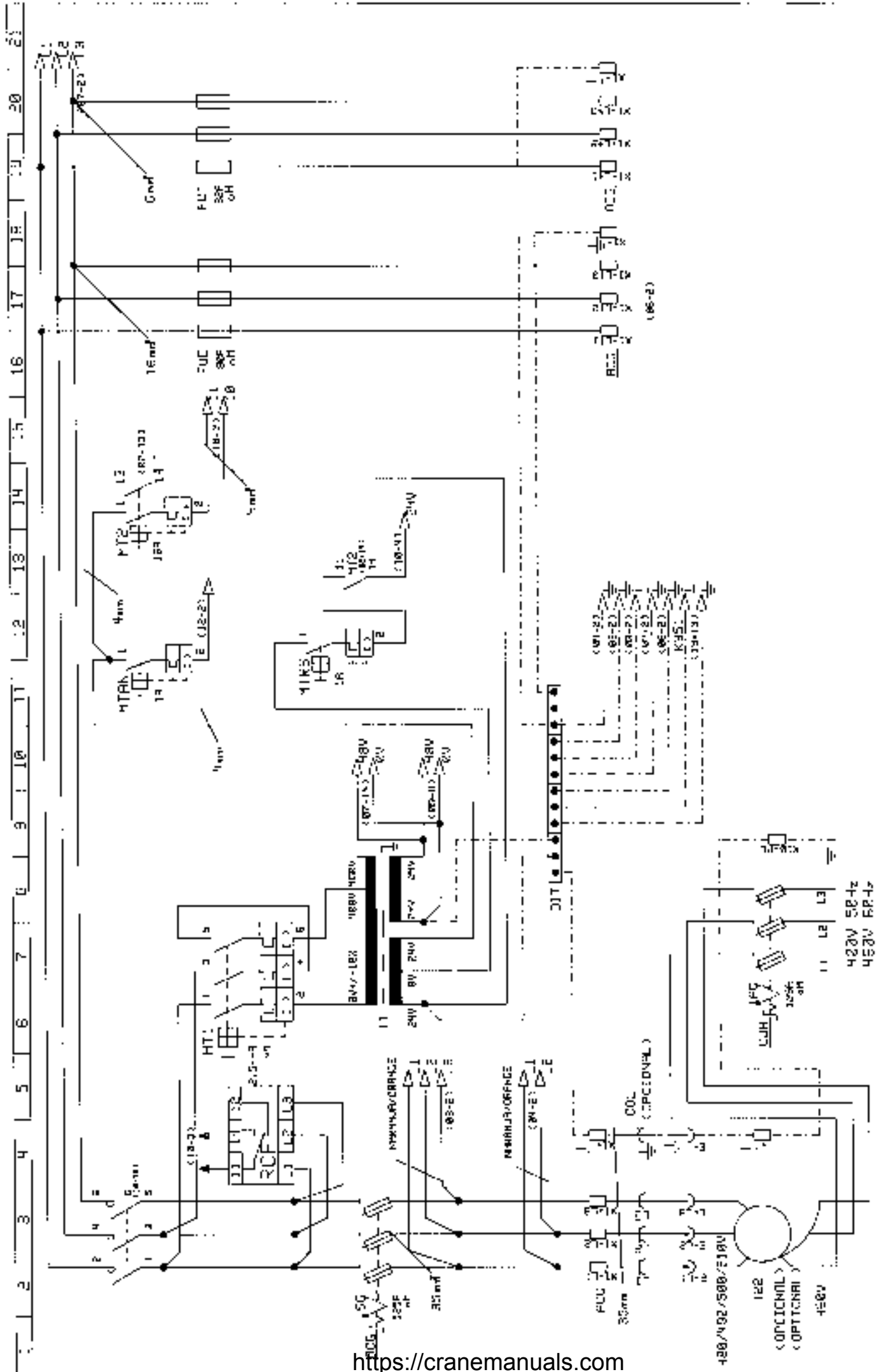
Check periodically that the forbidden zones system is properly working:

- The movement stopping relays within IM45 unit properly open and close the contacts, preventing or stopping the correspondent the movements.
- The sensors are well adjusted or the accumulated error is not enough to prevent the system from performing its intended function.





Dibujado	Revisado	Aprobado	Fecha	Firma
J. Fdez. L. J. Fdez.	L. Simon	2/7/08	2/7/08	
 <b>CONSTRUTORA</b>				
Edificio 1115 - P.O. Box 1115 - Lima 18, Peru <b>DISTRIBUCION GENERAL</b>				
GENERAL LAY-3.IT			Sheet number part:	
FS&MH '1 14271023004 Hoja 2 de 4				

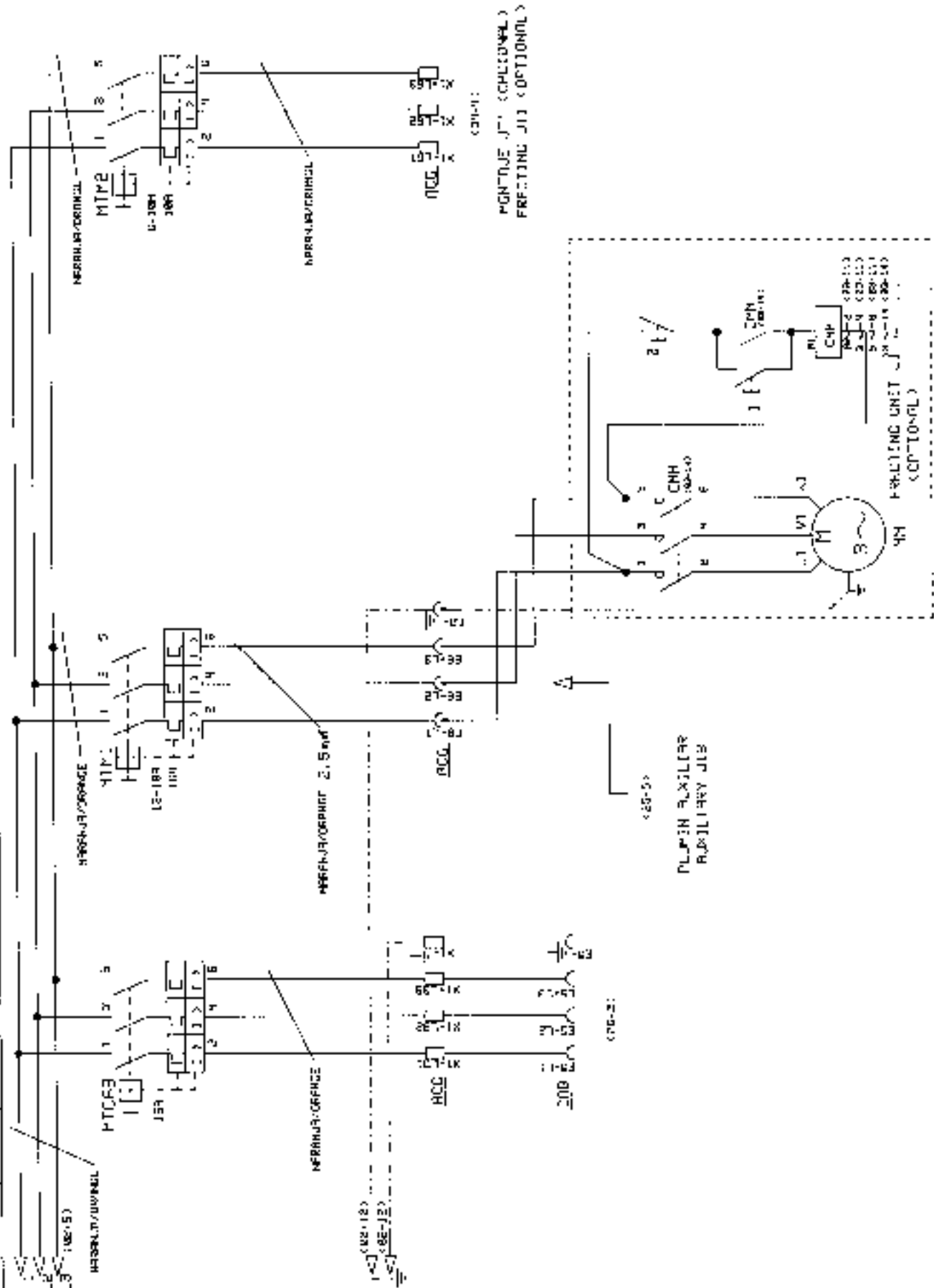


<https://cranemanuals.com>

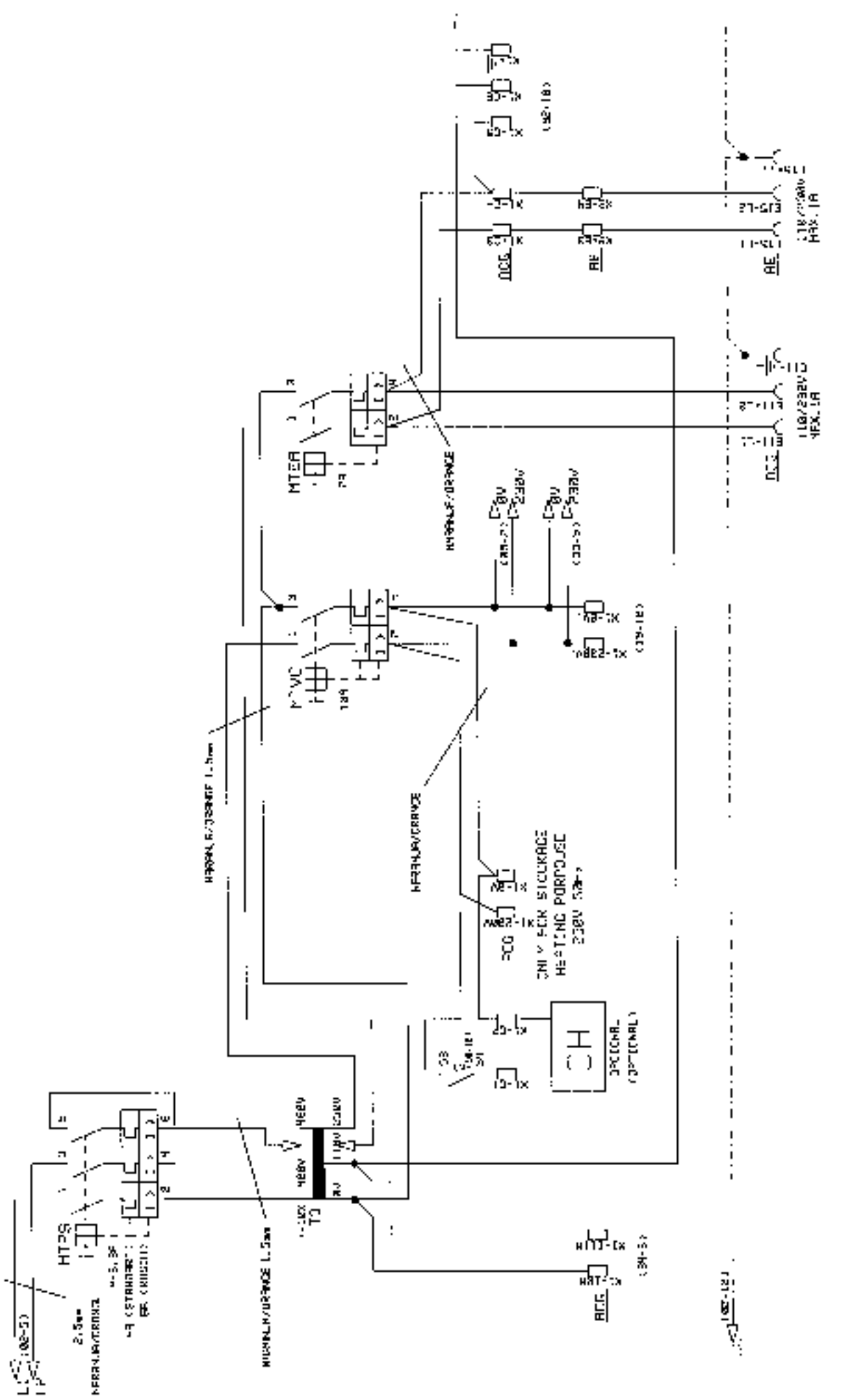
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

Libujoso	Revisado	Aprobado	Requiere IILC-- FL 24/37e4	Source/valido para:	F5M05-P N
Fecha 2/7/08	2/7/08	2/7/08	FITMEN-ICION GRUP	PC-ER SUPPLY	1127102304
Libujoso	Fdez.	J. Fdez.	L. Simon	COMANDA	Hoja 02 De 10

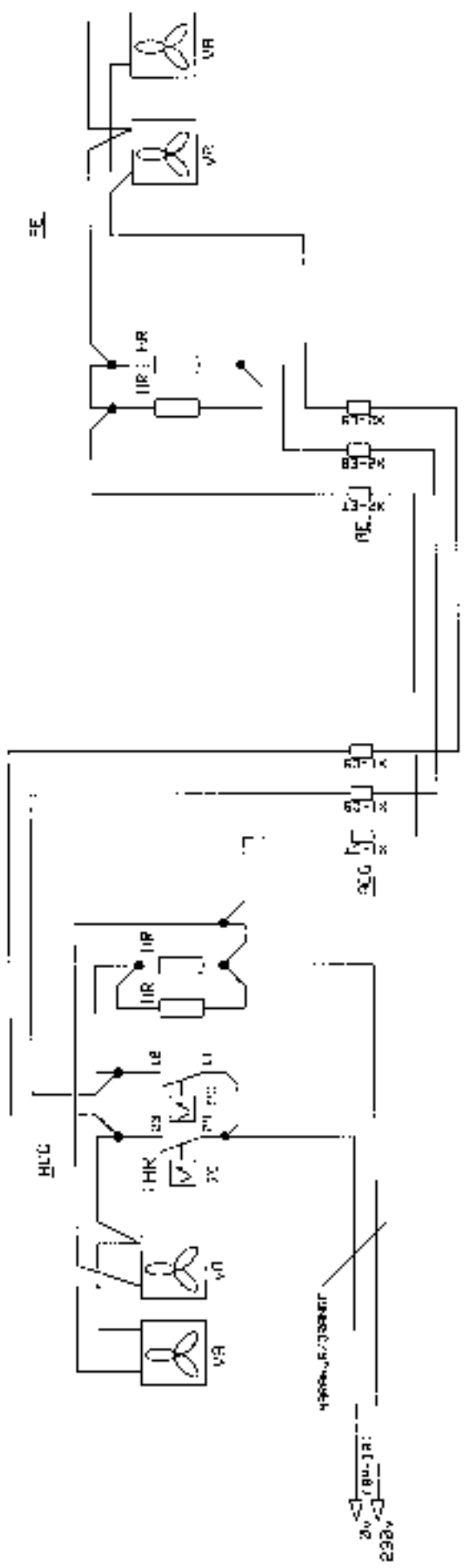





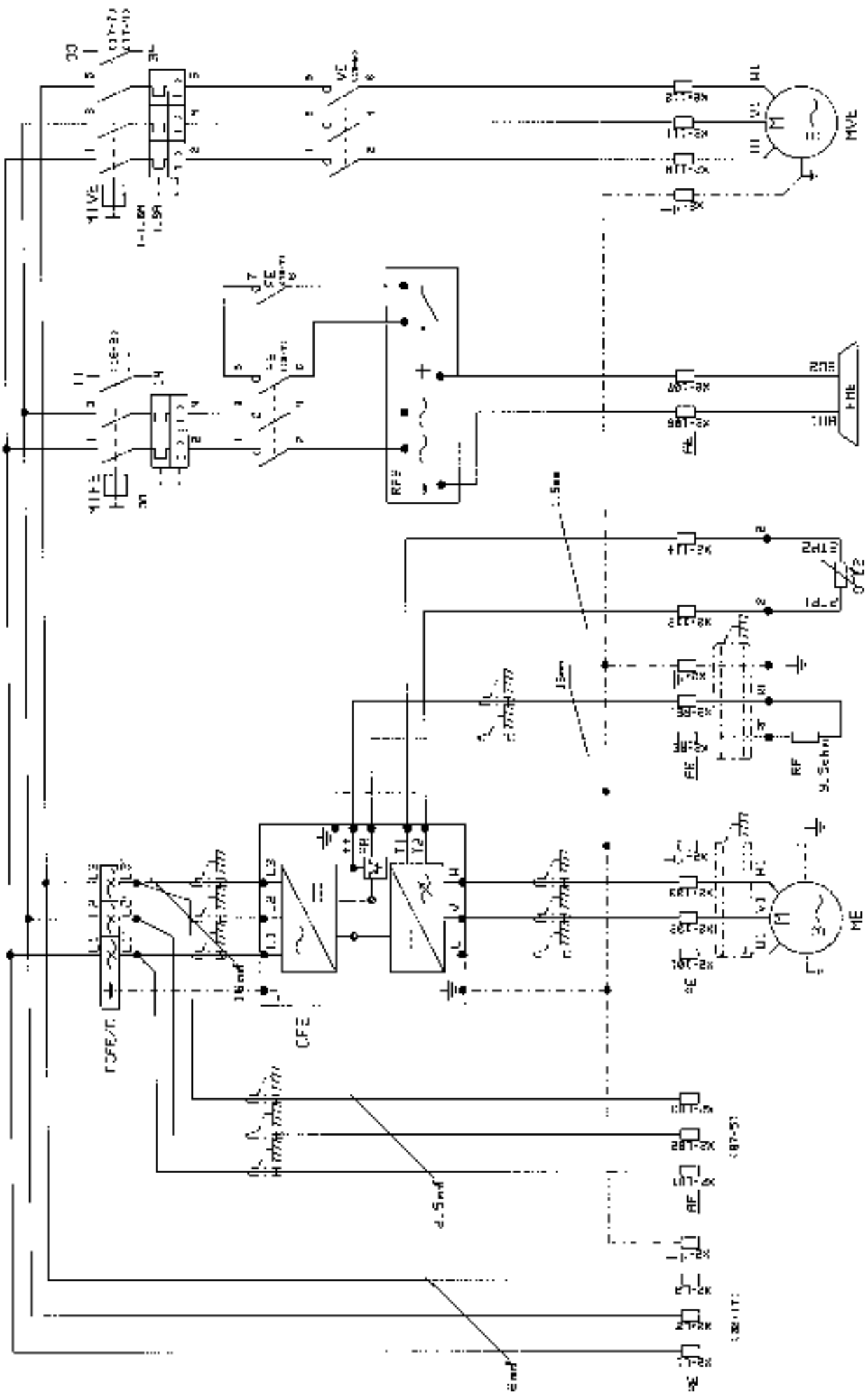
Libro de 7/7/08	Revisado 2/7/08	Aprobado 2/7/08	Maquina J11C-10 U 24/237K4	Substituto de parte INT J11 PDU POWER CF31N	ESQUEMA N +07F0804
Auto J. Fdez.	Auto J. Silva	Auto J. Simón	Equipo MONTAJE Y POTENCIA CIBLINH		Rev. 03 De 43



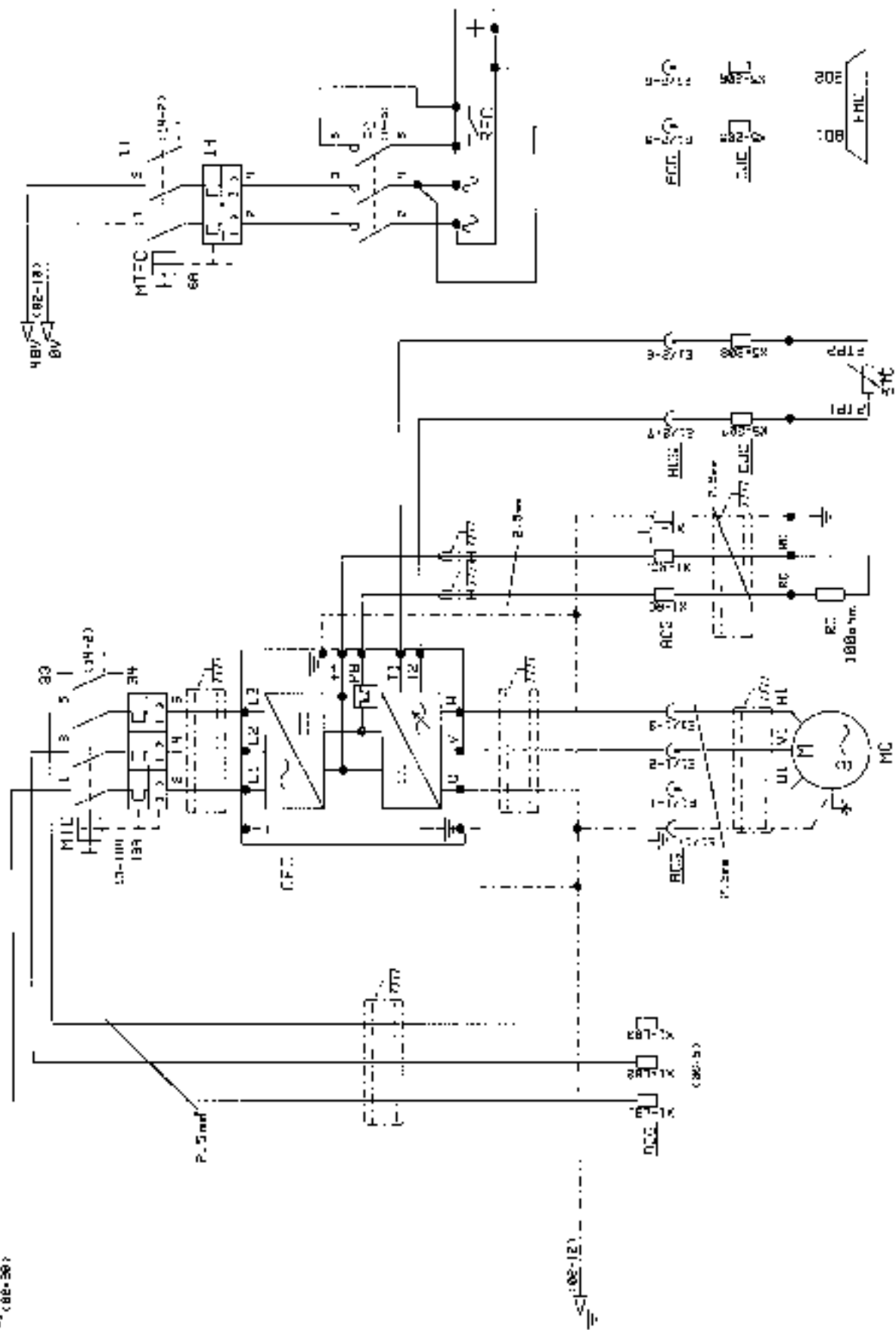
<https://cranemanuals.com>



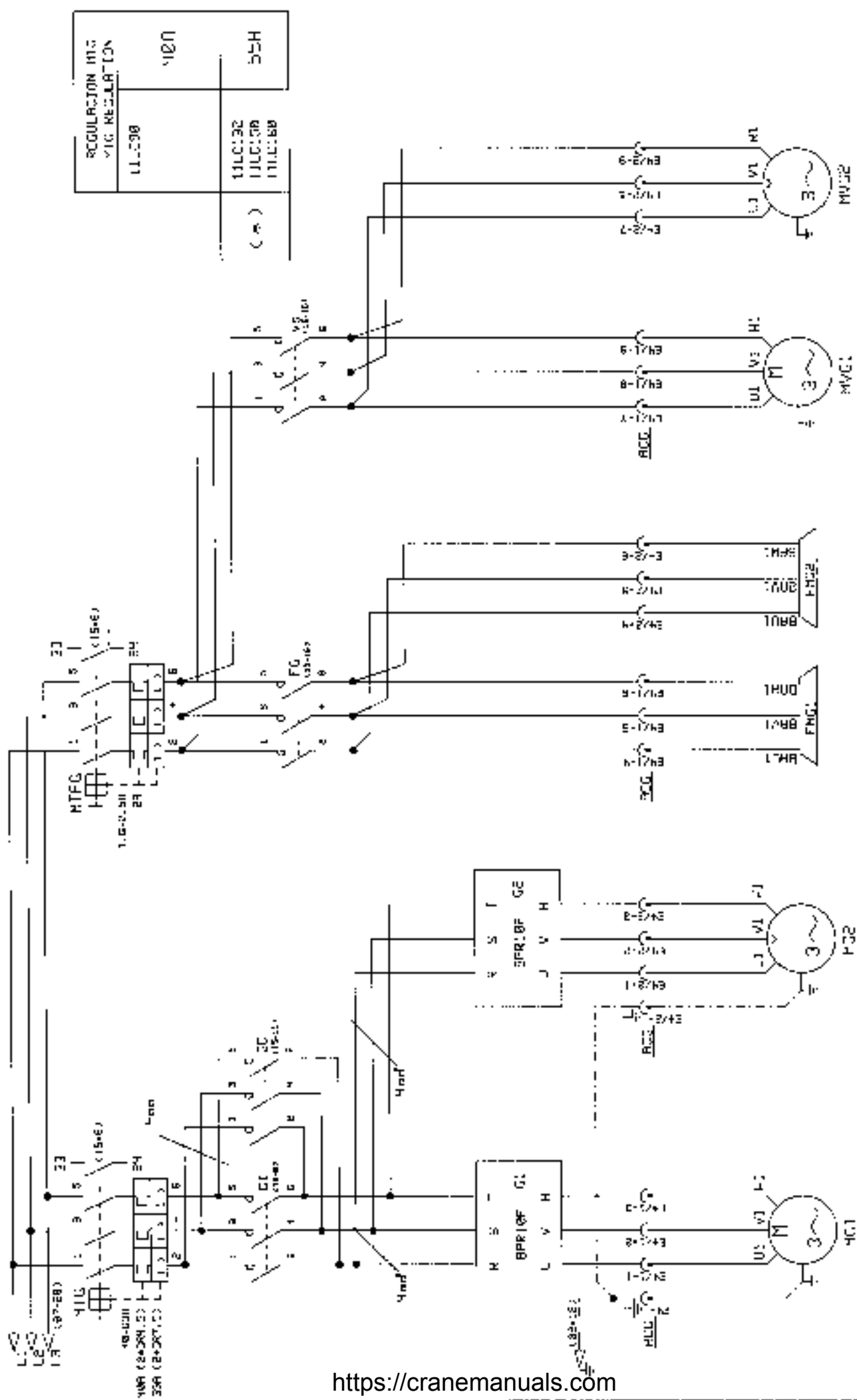
Fecha: 2/7/08 Firmo: J. Fdez. J. Fdez.	Jibocaria Saviolasa Penabeco 2/7/08 2/7/08 2/7/08 J. Fdez. J. Fdez. J. Fdez.	 COMANSA	Modelo: L.L.C. - FIJ 14/37x4 VFN - LIFLION/CALEFACCION ARMERIOUS	Sujeto de obra: CUPAJARDE : (M/F/E/T)	COMANSA S.A. +07P2360 25 de 49
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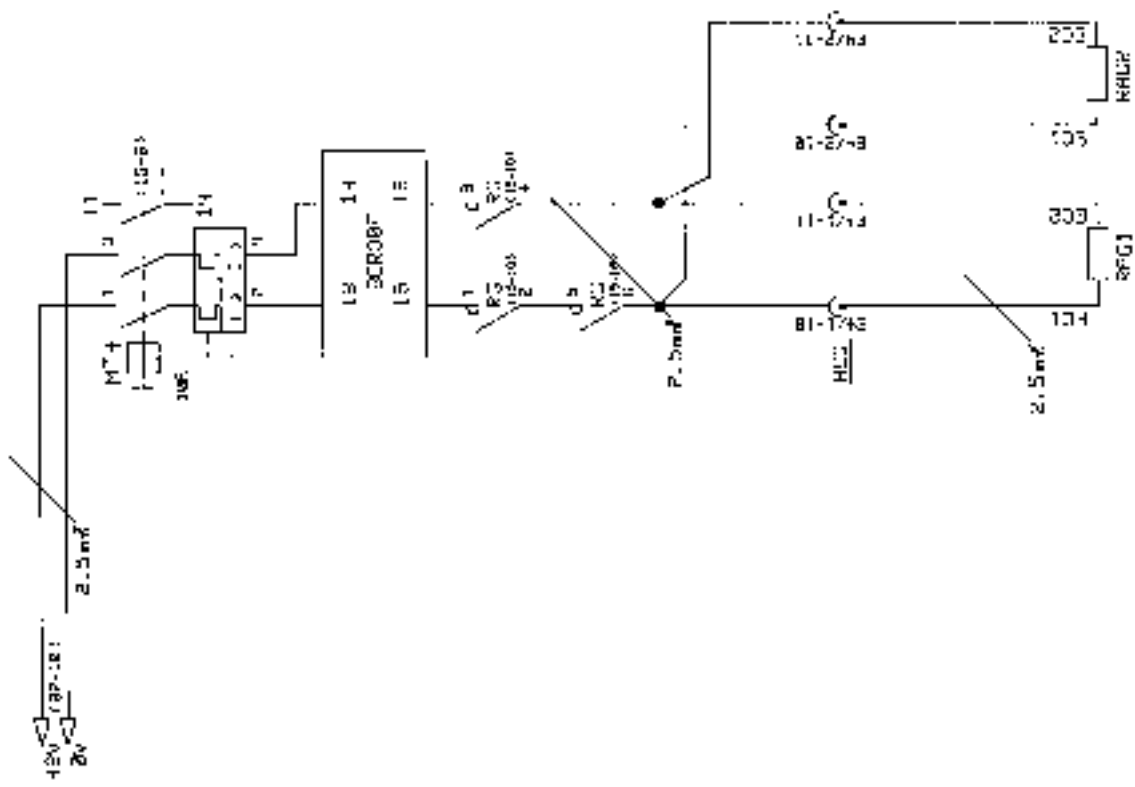


		Máquina 110C -- PU 24/374W POTENCIA FIFMILION		Servitudo para ILICITING POWER		EQUIPE N 1407200124 Hoja 06 de 49	
D. Inj. J. J. J. 2/7/89	Rev. J. J. J. 2/7/89	Harobido 2/7/89					
Firmo J. J. J. J. J. J.	J. J. J. J. J. J.						

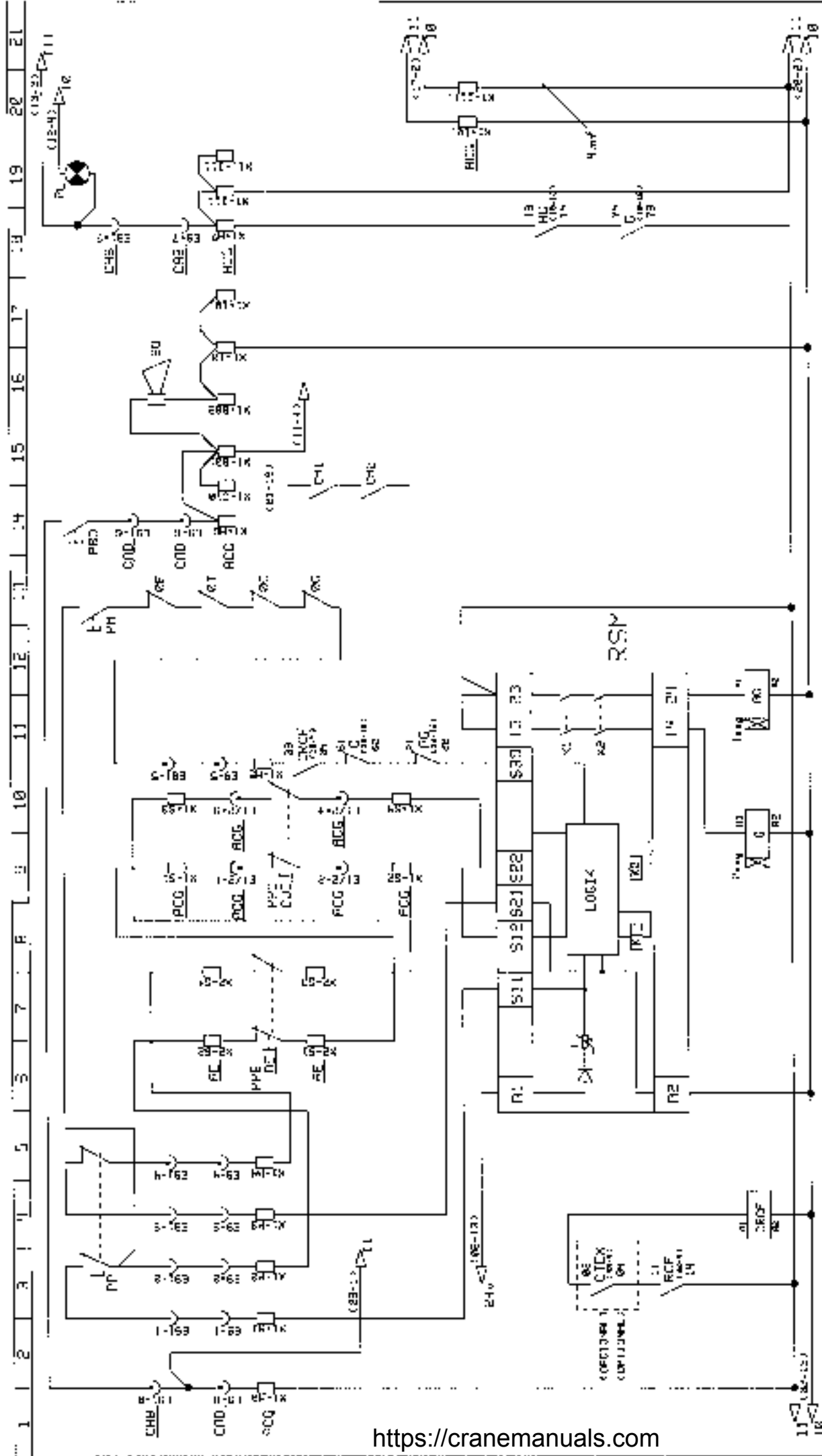


<https://cranemanuals.com>



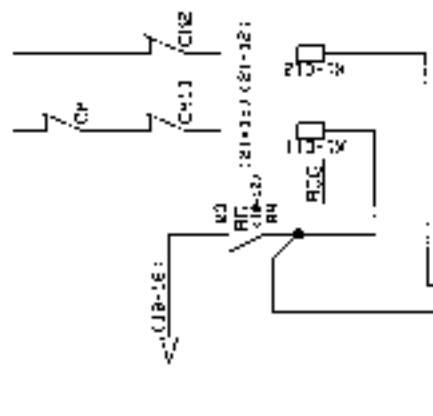
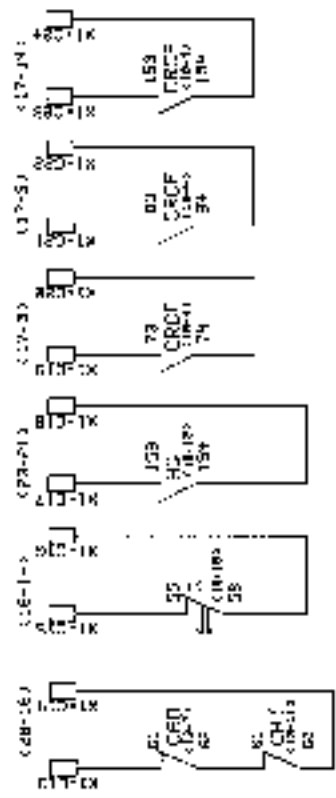


Urb. Jado	Rev. Jado	Aprobado	Maquina ILLC-- FU 24/37kA	Sumilla de obra	ESQUEMA N
7/7/83	27/7/88	27/7/88	PT.FUNCION GIRON I I	SLEPING FC-ER II	407P00B21
J. Fdez.	v. Fdez.	J. Simon			17/09/89 R. A. -8

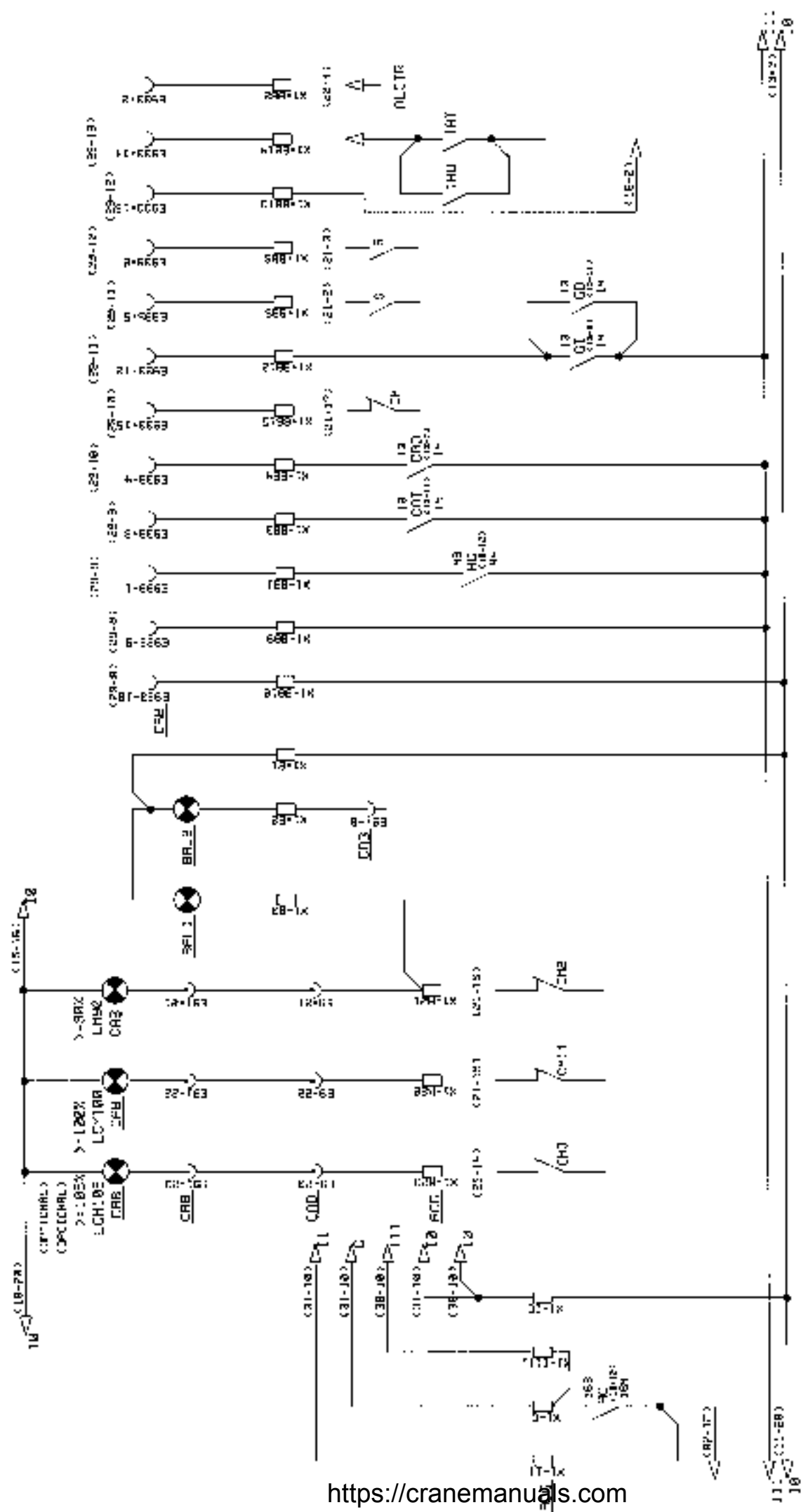


- |    |      |         |
|----|------|---------|
| 1  | CHB  | 100V-11 |
| 2  | CND  | 100V-11 |
| 3  | ACC  | 100V-11 |
| 4  | RST  | 100V-11 |
| 5  | RSM  | 100V-11 |
| 6  | CH1  | 100V-11 |
| 7  | CH2  | 100V-11 |
| 8  | CH3  | 100V-11 |
| 9  | CH4  | 100V-11 |
| 10 | CH5  | 100V-11 |
| 11 | CH6  | 100V-11 |
| 12 | CH7  | 100V-11 |
| 13 | CH8  | 100V-11 |
| 14 | CH9  | 100V-11 |
| 15 | CH10 | 100V-11 |
| 16 | CH11 | 100V-11 |
| 17 | CH12 | 100V-11 |
| 18 | CH13 | 100V-11 |
| 19 | CH14 | 100V-11 |
| 20 | CH15 | 100V-11 |
| 21 | CH16 | 100V-11 |

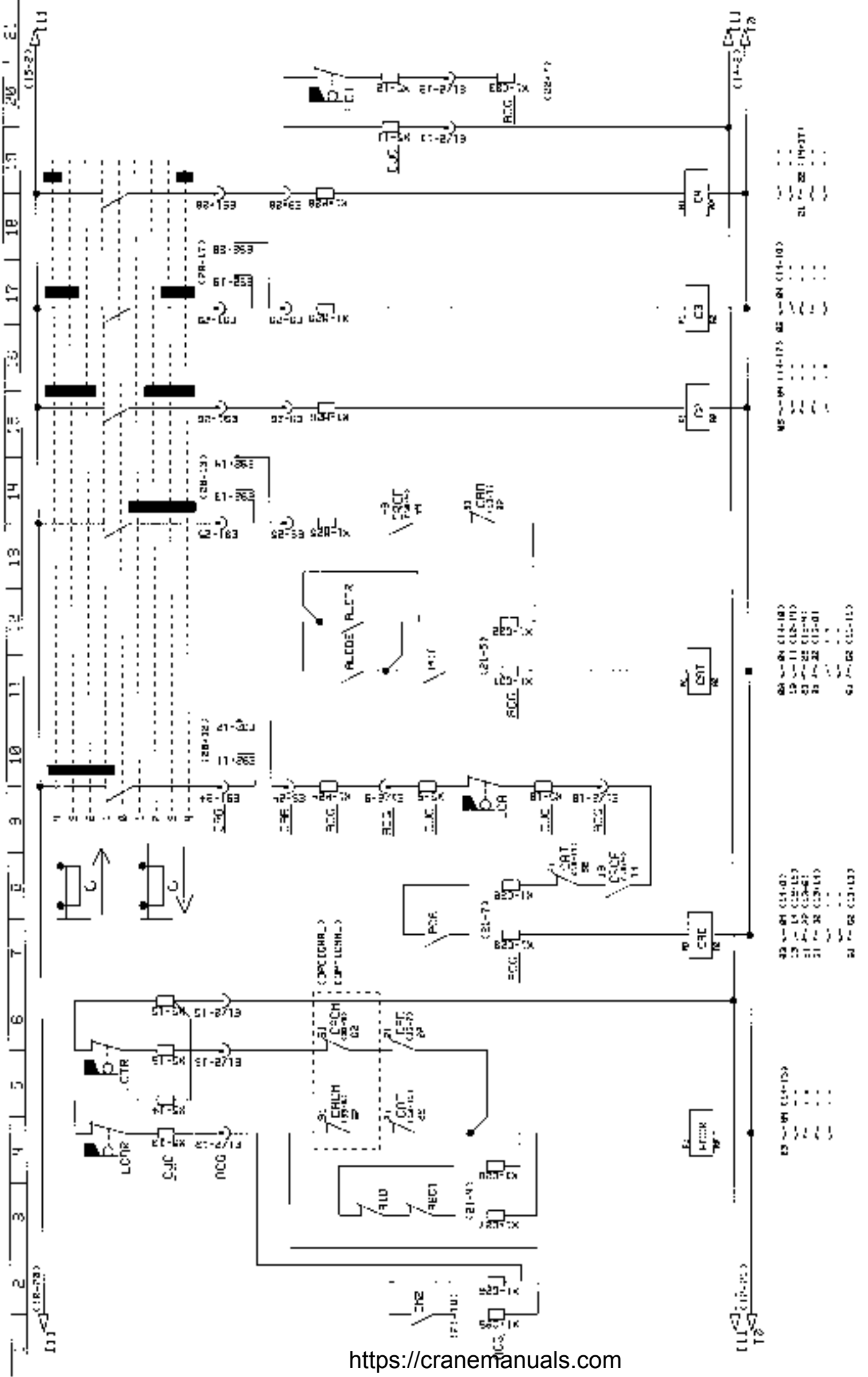




Fecha	2/7/08	Revisado	2/7/08	Elaborado	J. L. 24/07KH	Software para:	CIRCUITS STEER/SIDE II	ESQUEMA N	1427PARRA1
Elaborado	J. L. 24/08	Revisado	I. Simón	COMANDA	MANICERA PERCHA/PARD II				
Fecha	2/7/08	Revisado	2/7/08	Elaborado	J. L. 24/07KH	Software para:	CIRCUITS STEER/SIDE II	ESQUEMA N	1427PARRA1
Elaborado	J. L. 24/08	Revisado	I. Simón	COMANDA	MANICERA PERCHA/PARD II				



Tilp. adu : Kevilaoca	Revisi : 01/2020	Moqu. No : 11.C	FJ 24/37KH	Sheet Inside no :	F50.EMA 4
Fecha : 8/7/08	2/7/08	LAMPARAS AVISC. Y REFLECTORIJUK	LAMPARAS MARXING / REGISTRADOR		1-B/12280-
Drawn : J. Perez, J. Pdez.	I. Simon				Hoja 17 de 17



13	14	15	16	17	18	19	20
21-01 (C1-01)	21-02 (C1-02)	21-03 (C1-03)	21-04 (C1-04)	21-05 (C1-05)	21-06 (C1-06)	21-07 (C1-07)	21-08 (C1-08)

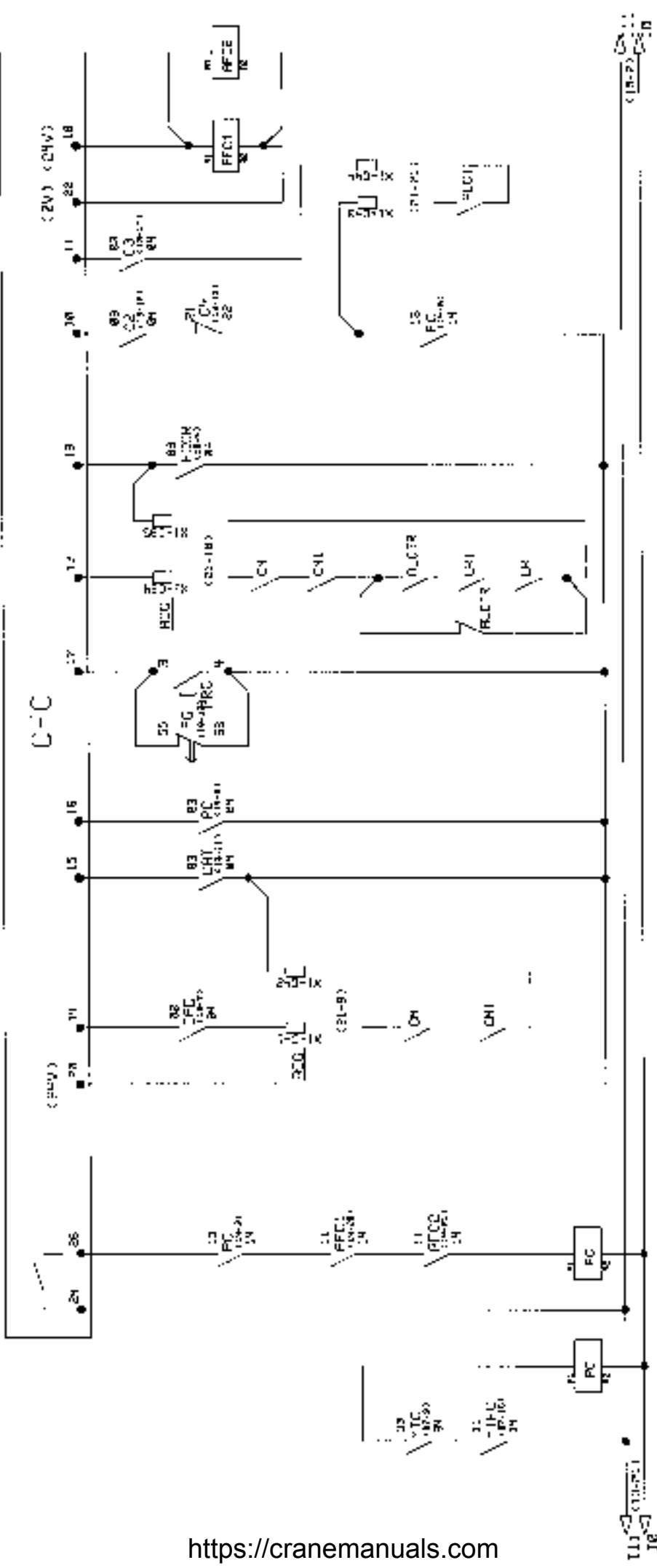
21-09 (C1-09)	21-10 (C1-10)	21-11 (C1-11)	21-12 (C1-12)	21-13 (C1-13)	21-14 (C1-14)	21-15 (C1-15)	21-16 (C1-16)
---------------	---------------	---------------	---------------	---------------	---------------	---------------	---------------

21-17 (C1-17)	21-18 (C1-18)	21-19 (C1-19)	21-20 (C1-20)	21-21 (C1-21)	21-22 (C1-22)	21-23 (C1-23)	21-24 (C1-24)
---------------	---------------	---------------	---------------	---------------	---------------	---------------	---------------

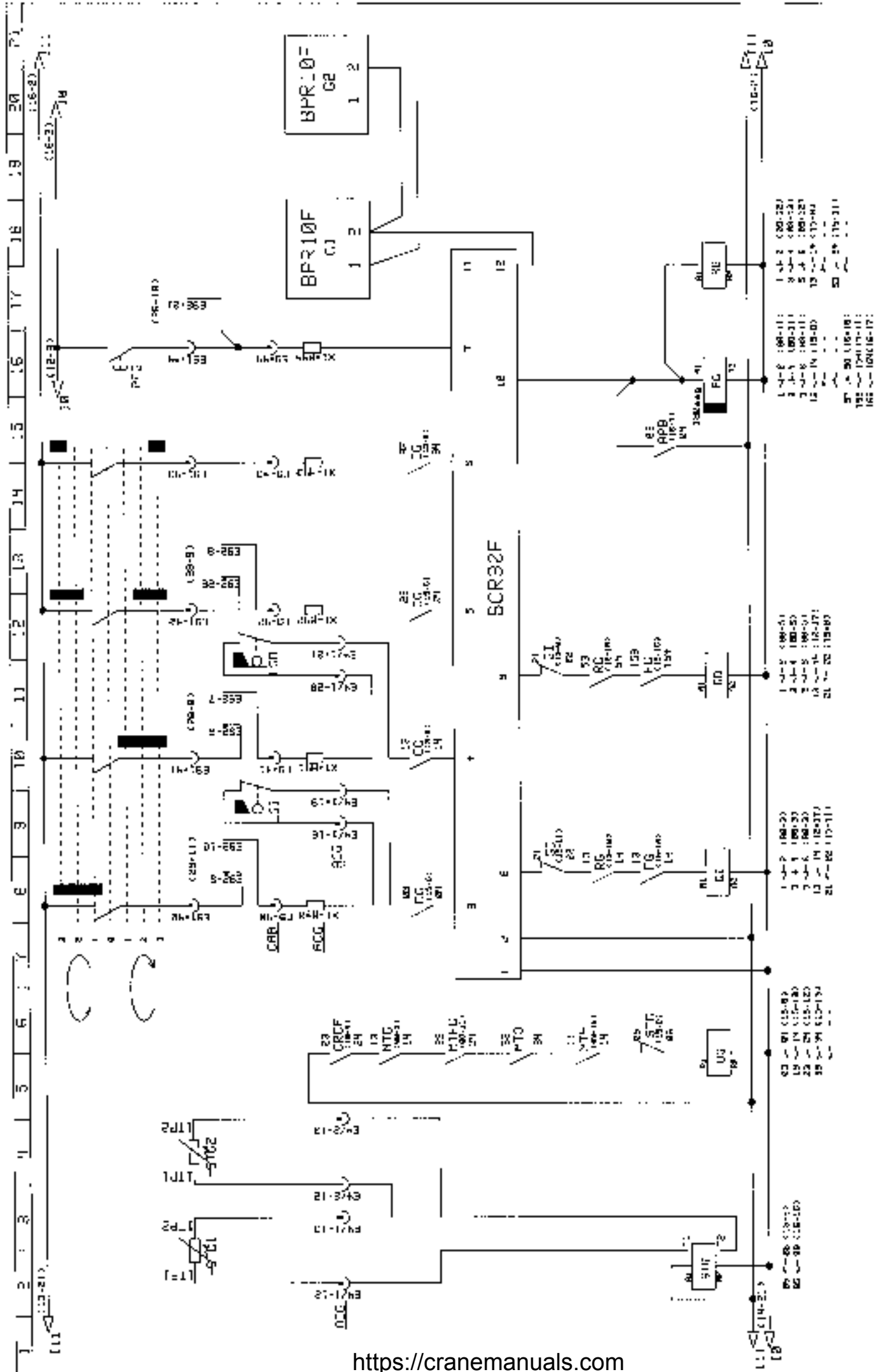
21-25 (C1-25)	21-26 (C1-26)	21-27 (C1-27)	21-28 (C1-28)	21-29 (C1-29)	21-30 (C1-30)	21-31 (C1-31)	21-32 (C1-32)
---------------	---------------	---------------	---------------	---------------	---------------	---------------	---------------

CABLES CL VARIADOR CON Torno

VELOCIDAD RPM	ARRANQUE TERMINAL L1	RANGO VELOCIDAD MÁXIMO / MÍNIMO RPM	SEÑAL / TERMINAL L2	EDUKNAY TERMINAL L3
1	0	30Hz	0	0
2	1	30Hz	1	0
3	1	50Hz	0	1
4	0	50Hz	1	1

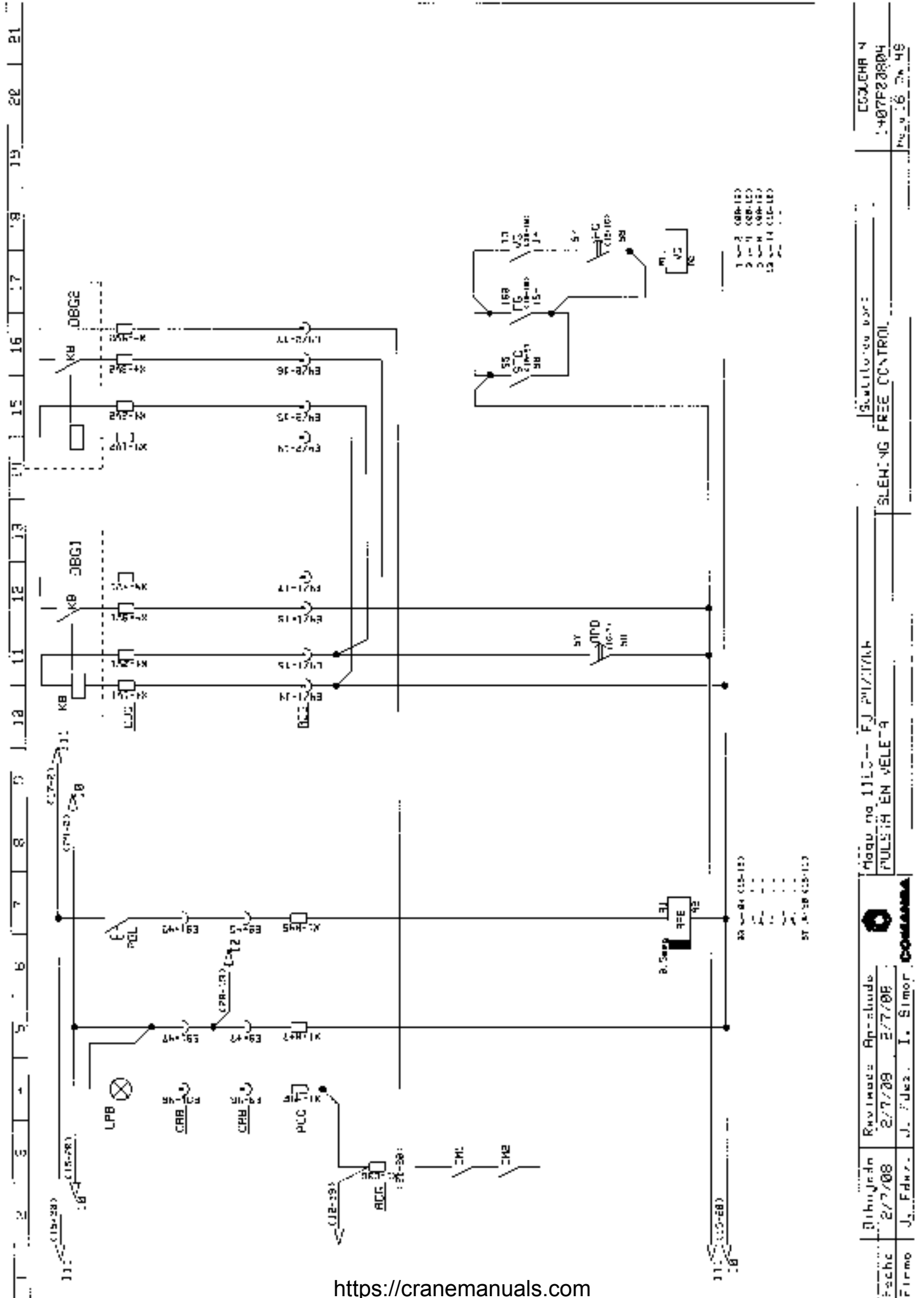


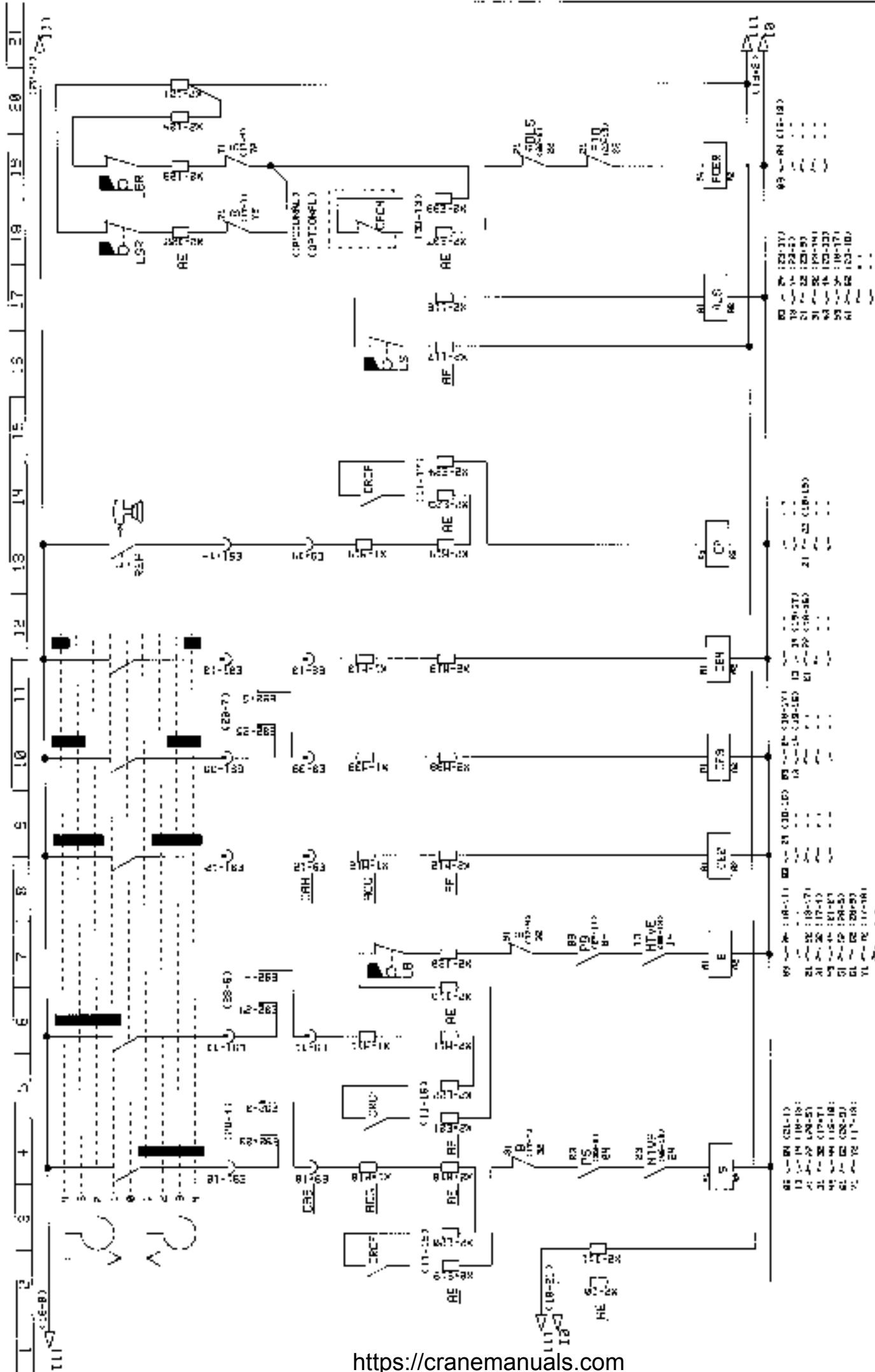
- 01 - 01 (L1-11) 1-2 (L2-18)
- 02 - 02 (L1-11) 2-2 (L2-18)
- 03 - 03 (L1-11) 3-2 (L2-18)
- 04 - 04 (L1-11) 4-2 (L2-18)
- 05 - 05 (L1-11) 5-2 (L2-18)
- 06 - 06 (L1-11) 6-2 (L2-18)
- 07 - 07 (L1-11) 7-2 (L2-18)
- 08 - 08 (L1-11) 8-2 (L2-18)
- 09 - 09 (L1-11) 9-2 (L2-18)
- 10 - 10 (L1-11) 10-2 (L2-18)
- 11 - 11 (L1-11) 11-2 (L2-18)
- 12 - 12 (L1-11) 12-2 (L2-18)
- 13 - 13 (L1-11) 13-2 (L2-18)
- 14 - 14 (L1-11) 14-2 (L2-18)
- 15 - 15 (L1-11) 15-2 (L2-18)
- 16 - 16 (L1-11) 16-2 (L2-18)
- 17 - 17 (L1-11) 17-2 (L2-18)
- 18 - 18 (L1-11) 18-2 (L2-18)
- 19 - 19 (L1-11) 19-2 (L2-18)
- 20 - 20 (L1-11) 20-2 (L2-18)
- 21 - 21 (L1-11) 21-2 (L2-18)
- 22 - 22 (L1-11) 22-2 (L2-18)
- 23 - 23 (L1-11) 23-2 (L2-18)
- 24 - 24 (L1-11) 24-2 (L2-18)
- 25 - 25 (L1-11) 25-2 (L2-18)
- 26 - 26 (L1-11) 26-2 (L2-18)
- 27 - 27 (L1-11) 27-2 (L2-18)
- 28 - 28 (L1-11) 28-2 (L2-18)
- 29 - 29 (L1-11) 29-2 (L2-18)
- 30 - 30 (L1-11) 30-2 (L2-18)
- 31 - 31 (L1-11) 31-2 (L2-18)
- 32 - 32 (L1-11) 32-2 (L2-18)
- 33 - 33 (L1-11) 33-2 (L2-18)
- 34 - 34 (L1-11) 34-2 (L2-18)
- 35 - 35 (L1-11) 35-2 (L2-18)
- 36 - 36 (L1-11) 36-2 (L2-18)
- 37 - 37 (L1-11) 37-2 (L2-18)
- 38 - 38 (L1-11) 38-2 (L2-18)
- 39 - 39 (L1-11) 39-2 (L2-18)
- 40 - 40 (L1-11) 40-2 (L2-18)
- 41 - 41 (L1-11) 41-2 (L2-18)
- 42 - 42 (L1-11) 42-2 (L2-18)
- 43 - 43 (L1-11) 43-2 (L2-18)
- 44 - 44 (L1-11) 44-2 (L2-18)
- 45 - 45 (L1-11) 45-2 (L2-18)
- 46 - 46 (L1-11) 46-2 (L2-18)
- 47 - 47 (L1-11) 47-2 (L2-18)
- 48 - 48 (L1-11) 48-2 (L2-18)
- 49 - 49 (L1-11) 49-2 (L2-18)
- 50 - 50 (L1-11) 50-2 (L2-18)
- 51 - 51 (L1-11) 51-2 (L2-18)
- 52 - 52 (L1-11) 52-2 (L2-18)
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- 55 - 55 (L1-11) 55-2 (L2-18)
- 56 - 56 (L1-11) 56-2 (L2-18)
- 57 - 57 (L1-11) 57-2 (L2-18)
- 58 - 58 (L1-11) 58-2 (L2-18)
- 59 - 59 (L1-11) 59-2 (L2-18)
- 60 - 60 (L1-11) 60-2 (L2-18)
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- 100 - 100 (L1-11) 100-2 (L2-18)



<https://cranemanuals.com>

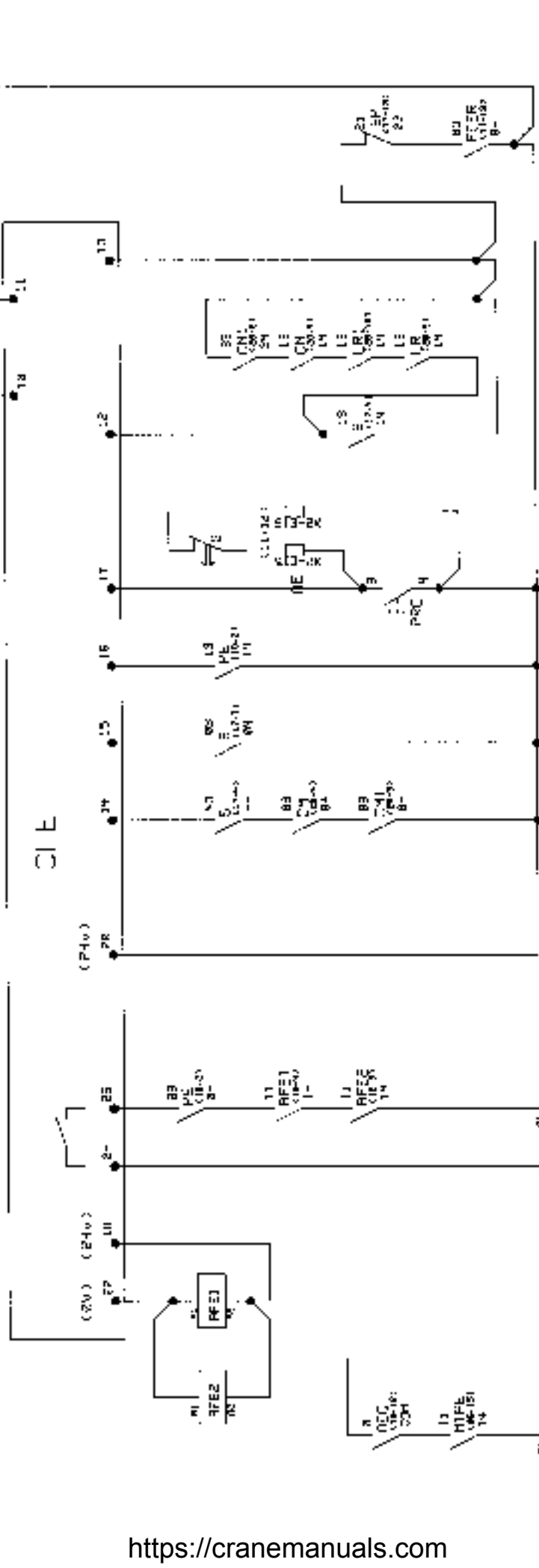
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Firma	J. L. deza, J. Fdez.			MR. TORRE GJKU	SLEIGHING CONTR.	Hoja 15 De 19





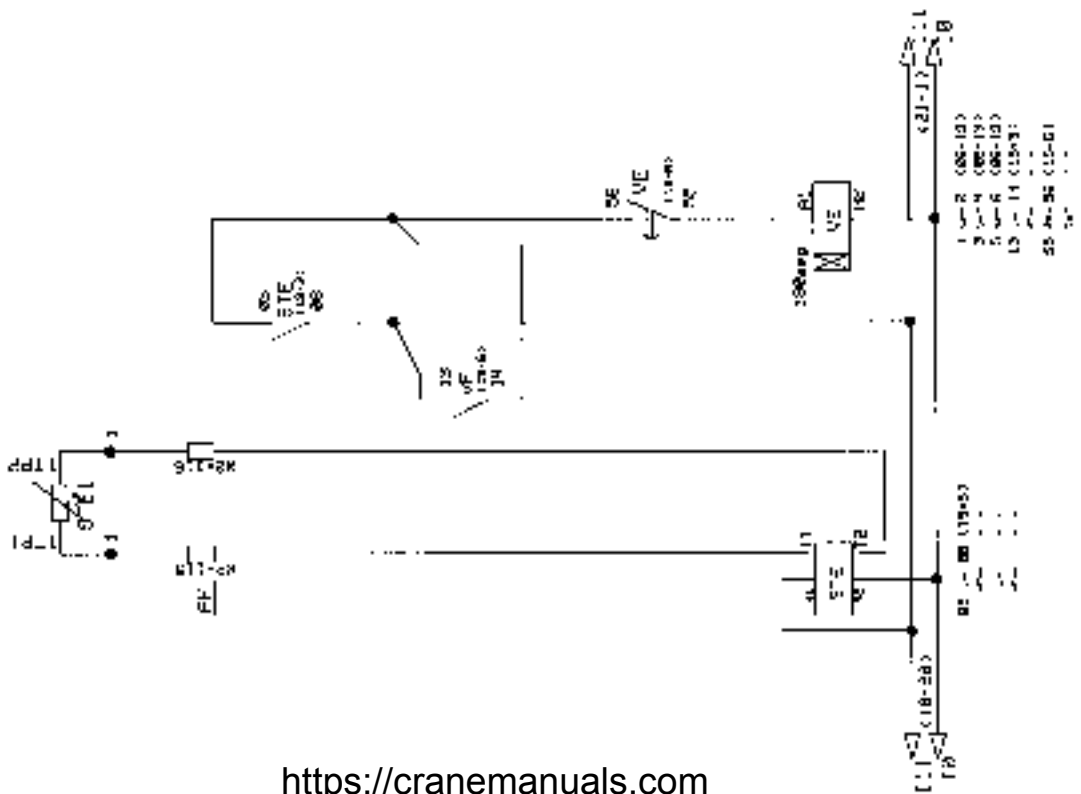
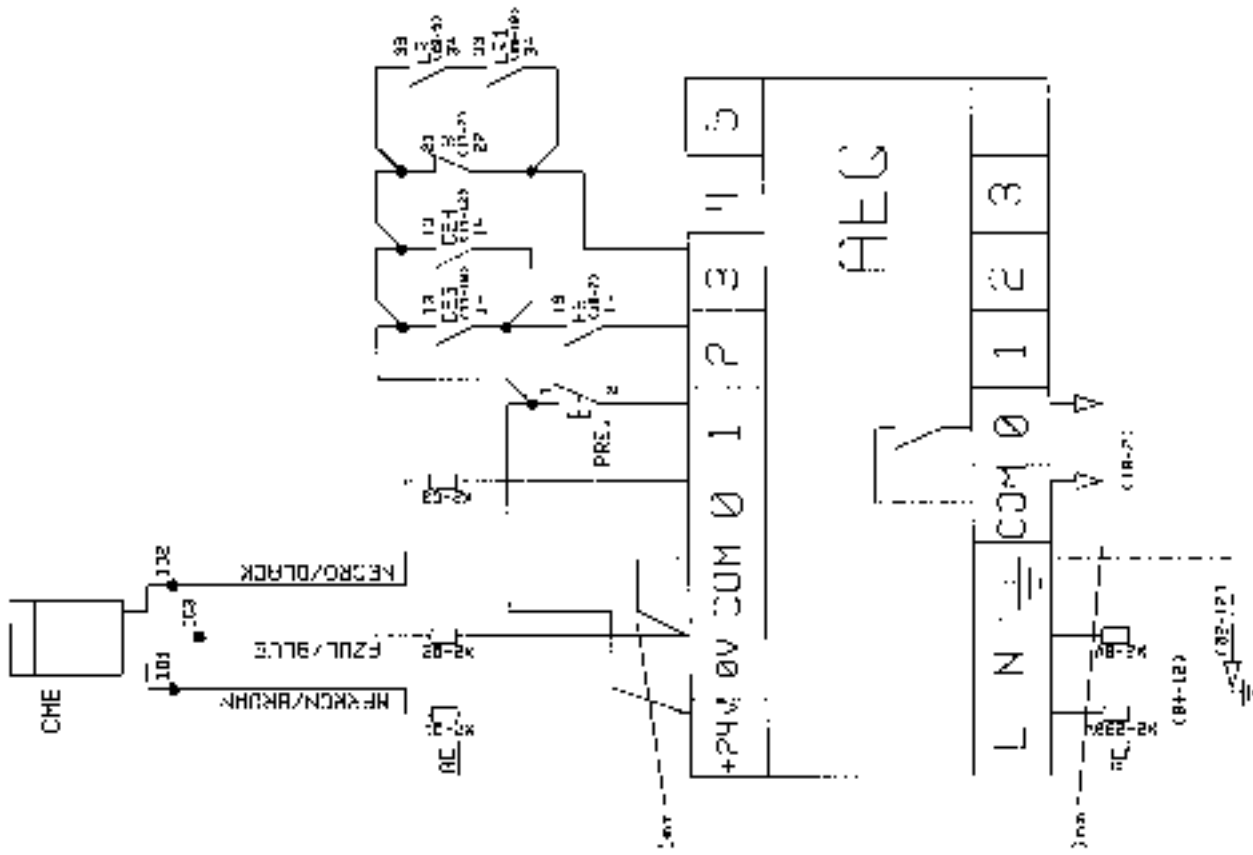
VELOCIDAD SPEED CONTR. CL.	BORNE/ TERMINAL L2	BORNE/ TERMINAL L1
1	0	0
2	1	0
3	1	1
4	0	1

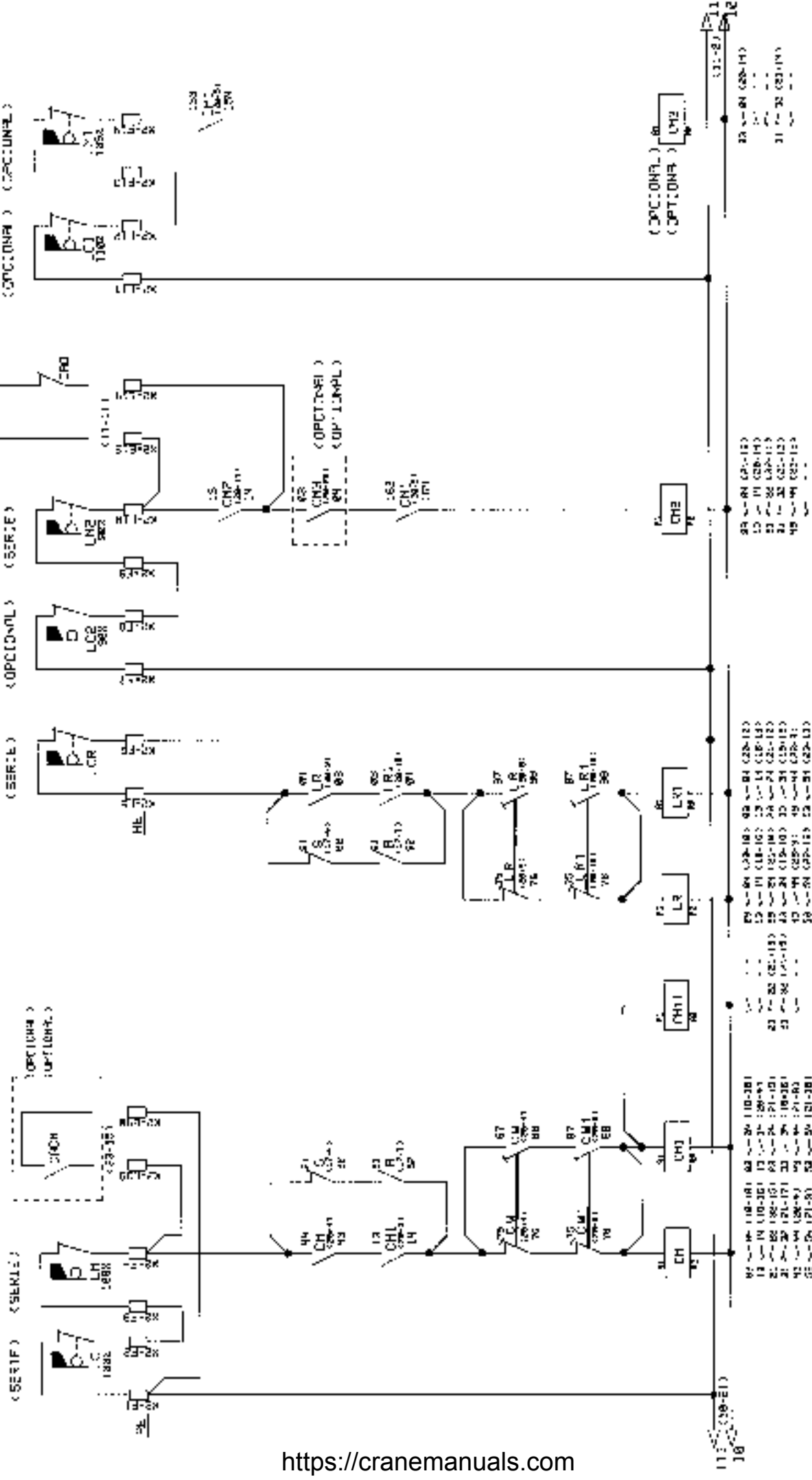
RANGO MÁX. VARIACION VELOCIDAD/ MAXIMUM SPEED VARIATION	BORNE/ TERMINAL L2	BORNE/ TERMINAL L1
20Hz	0	0
40Hz	.	0
60Hz	0	1
150Hz	.	1





CAPTADOR

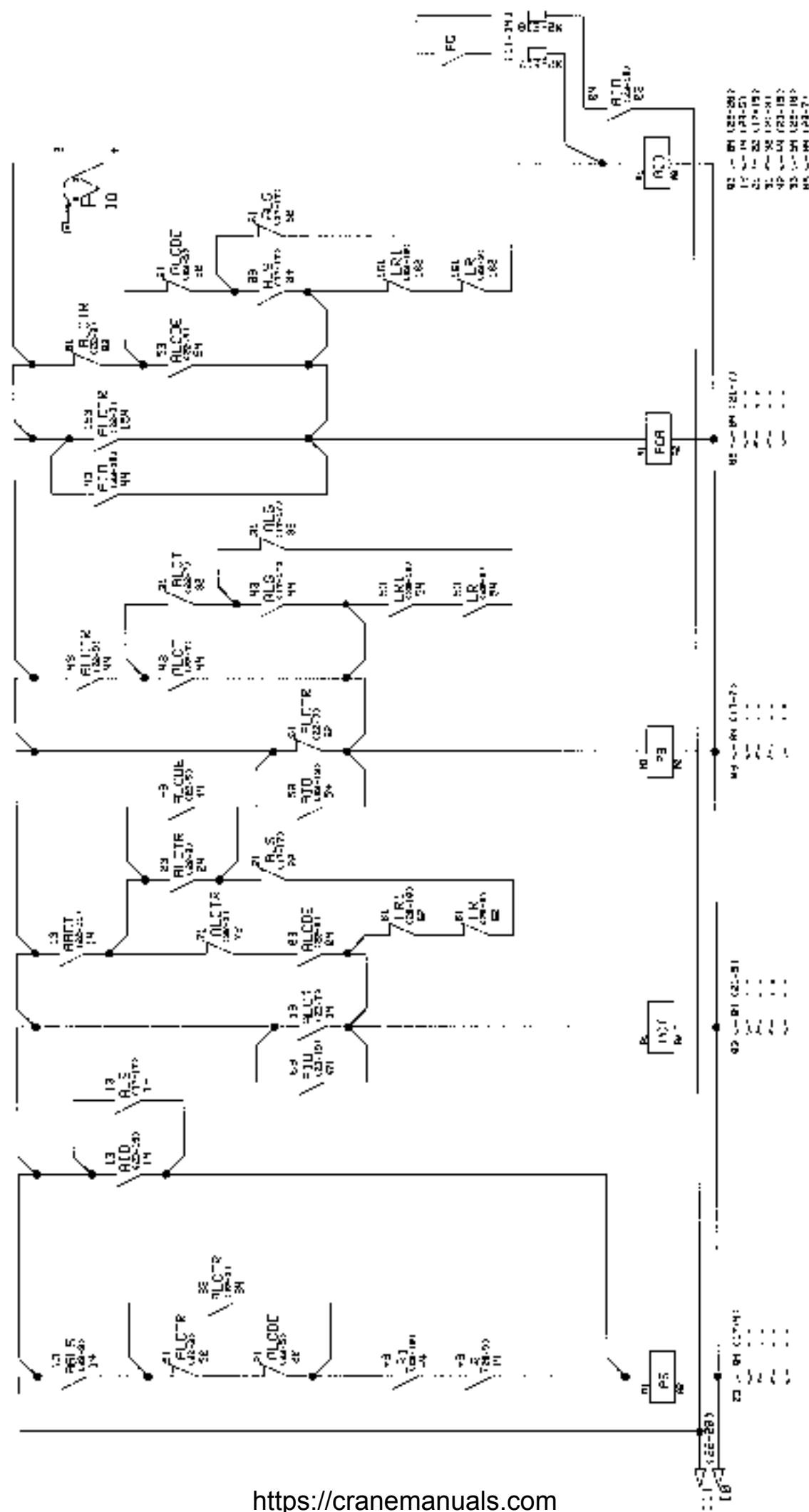





85 100-101 (20-110)	86 110-281	87 100-102 (20-110)	88 110-281
89 100-103 (20-110)	90 110-282 (20-110)	91 100-104 (20-110)	92 110-283 (20-110)
93 100-105 (20-110)	94 110-284 (20-110)	95 100-106 (20-110)	96 110-285 (20-110)
97 100-107 (20-110)	98 110-286 (20-110)	99 100-108 (20-110)	100 110-287 (20-110)
101 100-109 (20-110)	102 110-288 (20-110)	103 100-110 (20-110)	104 110-289 (20-110)
105 100-111 (20-110)	106 110-290 (20-110)	107 100-112 (20-110)	108 110-291 (20-110)
109 100-113 (20-110)	110 110-292 (20-110)	111 100-114 (20-110)	112 110-293 (20-110)
113 100-115 (20-110)	114 110-294 (20-110)	115 100-116 (20-110)	116 110-295 (20-110)
117 100-117 (20-110)	118 110-296 (20-110)	119 100-118 (20-110)	120 110-297 (20-110)
121 100-119 (20-110)	122 110-298 (20-110)	123 100-120 (20-110)	124 110-299 (20-110)
125 100-121 (20-110)	126 110-300 (20-110)	127 100-122 (20-110)	128 110-301 (20-110)

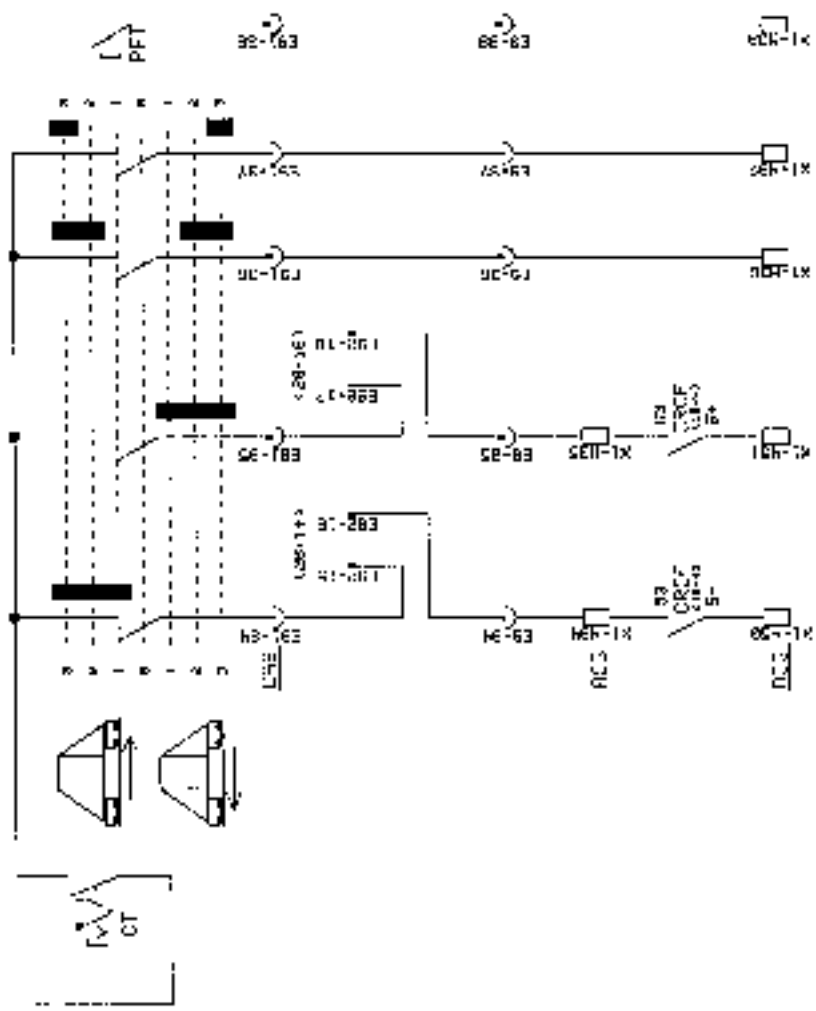




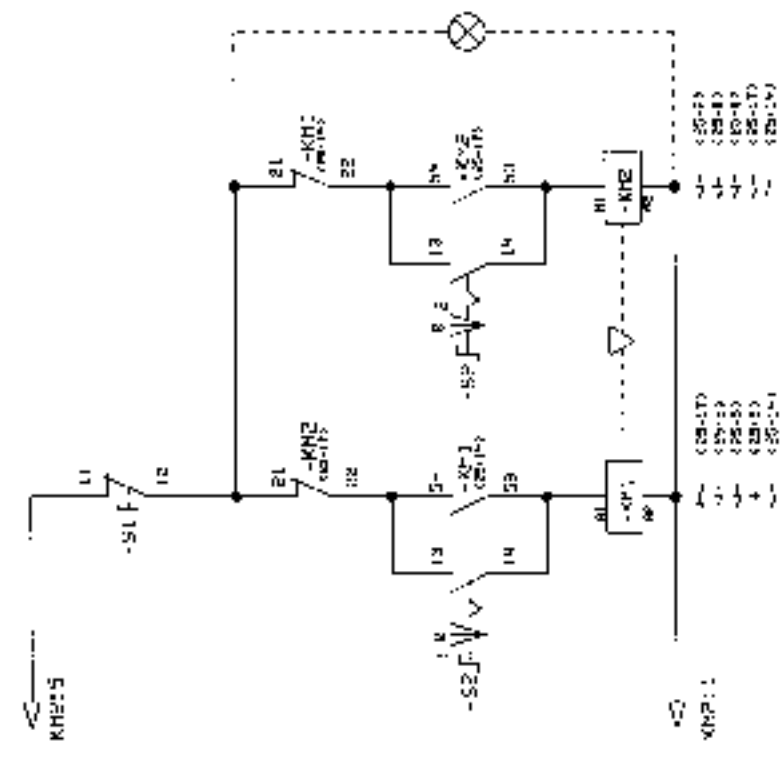
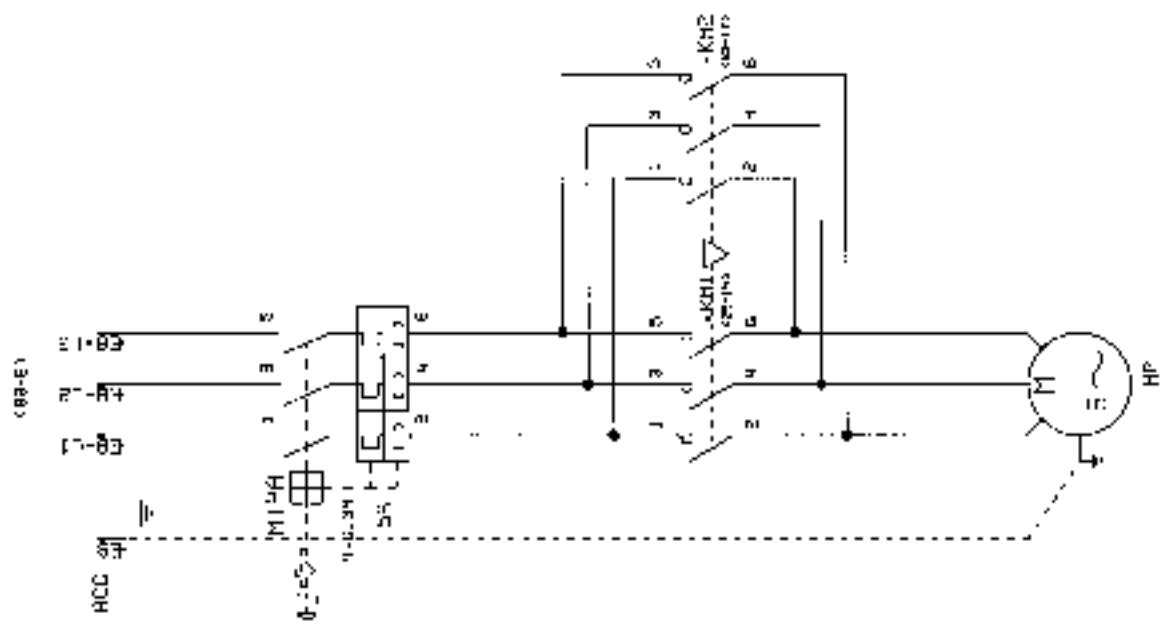


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Revisado	2/7/08	Rev. 001	2/7/08	Aprobado	2/7/08											
Fecha	2/7/08	Elaborado	J. Pérez	Dibujado	J. Simon											

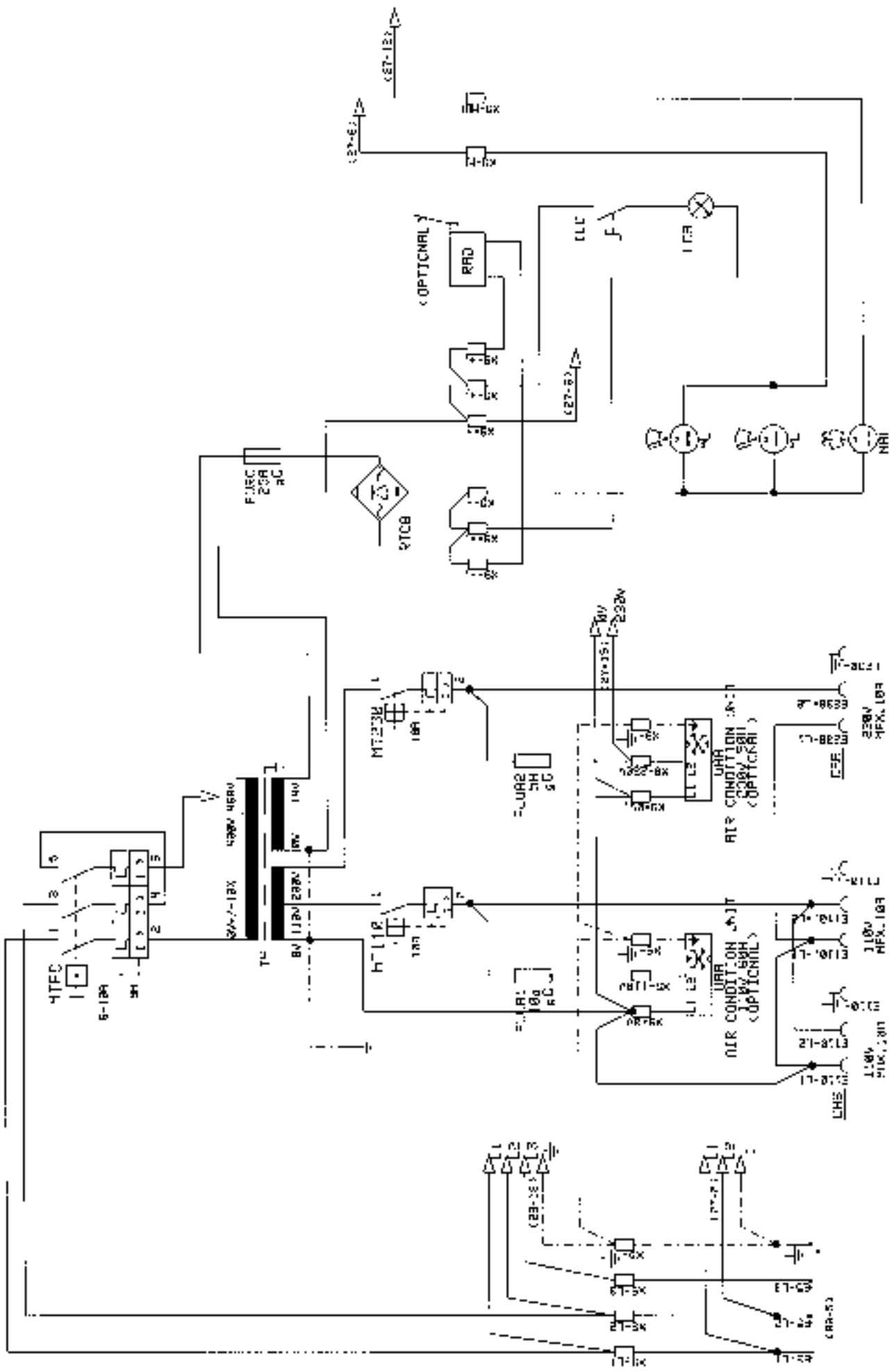
118 (EE-21)  
 118 (EE-21)



U. Ejecuto	Revisado	Parobazo	Mojalina : LLC -- FU 2-37kA MF10BRF TRRE. ACILIN	Suministrado por:	ESQUEMA N
Fecha	7/7/83	2/7/89	TRAFF-LINJ CON-ROL		142-P00824
Firma	J. Fdez.	J. Simón			Hoja 1 de 11



Libro: jcz0	Revisado: Apr 2006	Maquina IILC -- FU 24/37kW	Substitución por:	CSJLCHRA
Fecha: 2/7/08	2/7/08	PLUJTA AUXILIAR (OPCIONAL)		+07F2380
Firma: J. Fdez.	J. Fdez.			Page 25 of 49

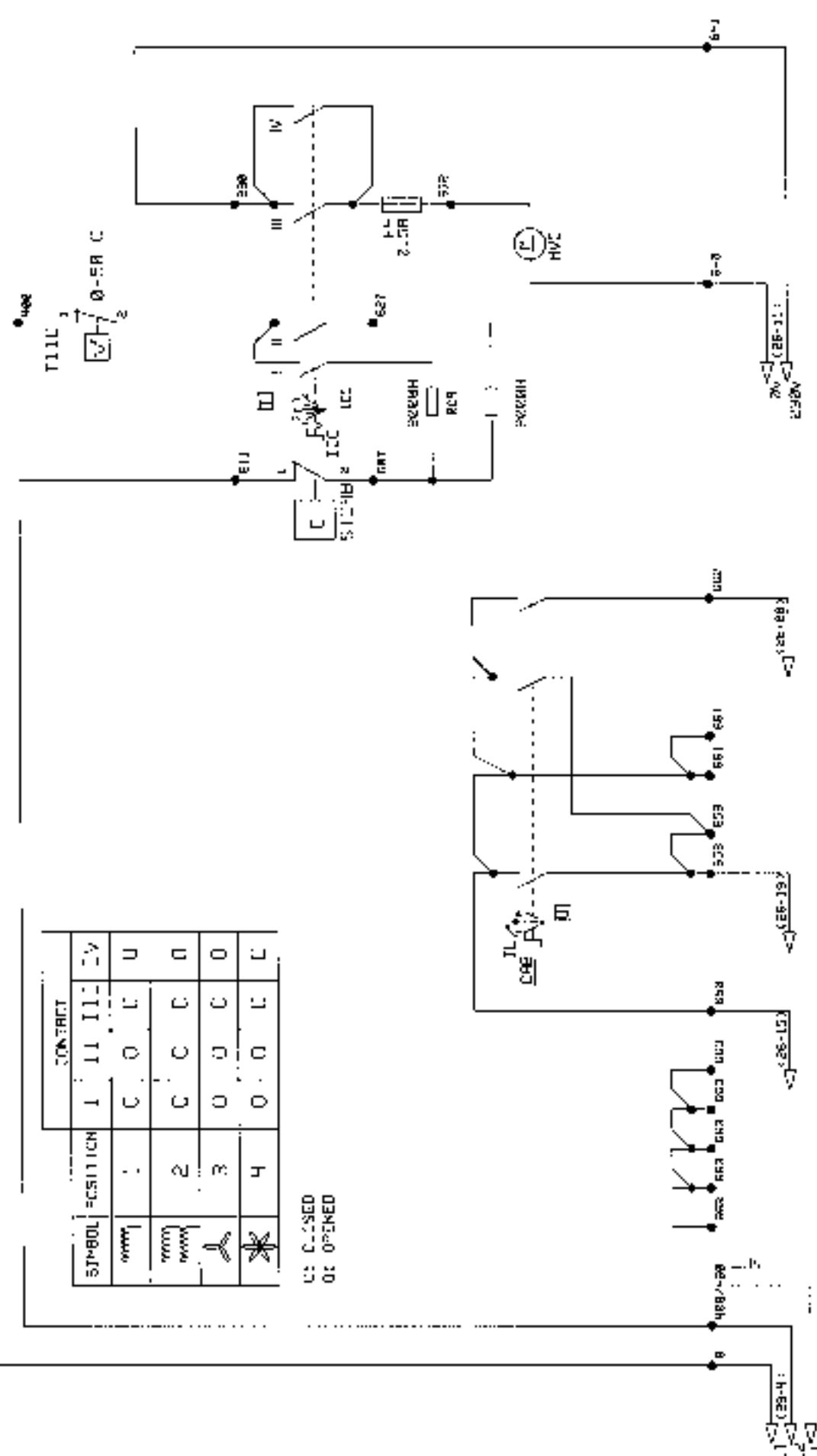


<p>Elaborado: J. Fdez. v. Fdez.</p> <p>Revisado: 2/7/88</p>	<p>Proyecto: 2/7/88</p>	<p>Maquina: LC-2-37k4</p> <p>Potencia: 30kW</p>	<p>Substituido por: 1107-00E24</p>	<p>Hoja: 25 de 43</p>
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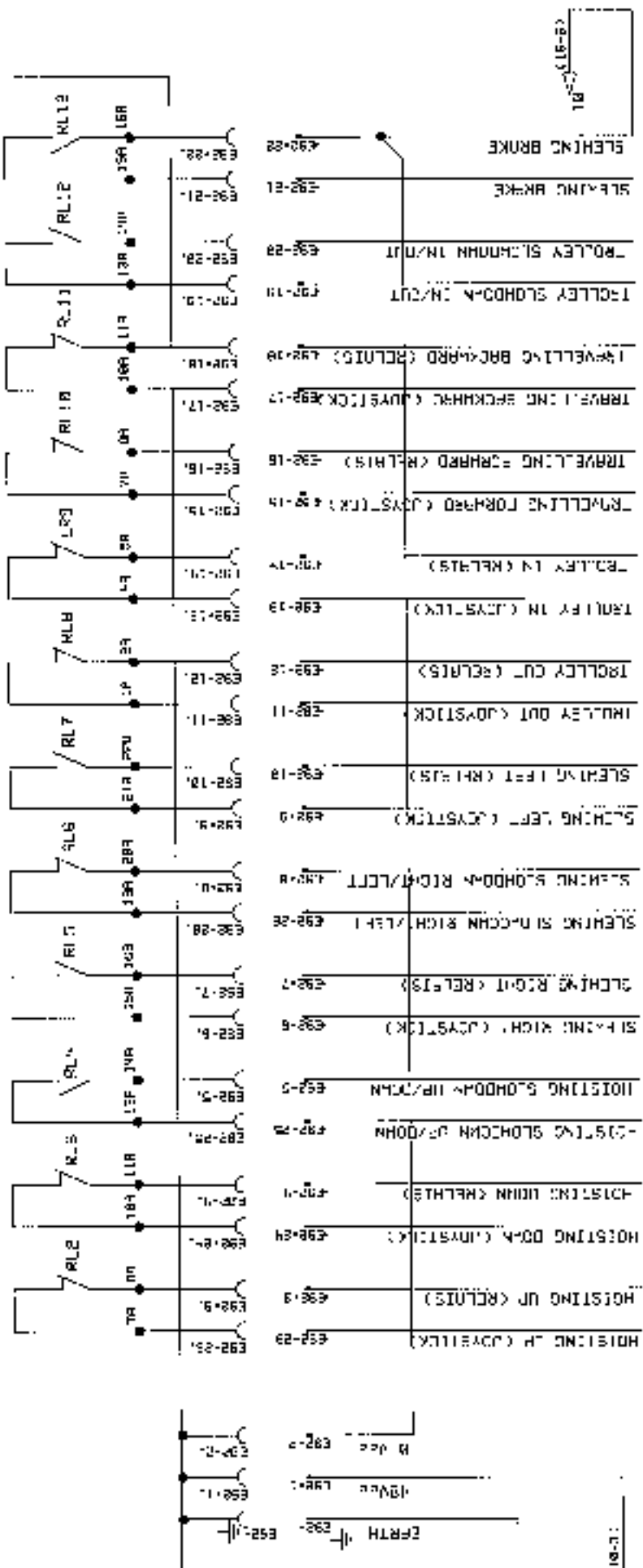
SYMBOL	DESCRIPTION	CONTACT			
		1	11	111	24
	C	C	O	C	U
	2	C	C	C	O
	3	O	O	C	O
	4	O	O	C	C

U: CLOSED  
O: OPENED

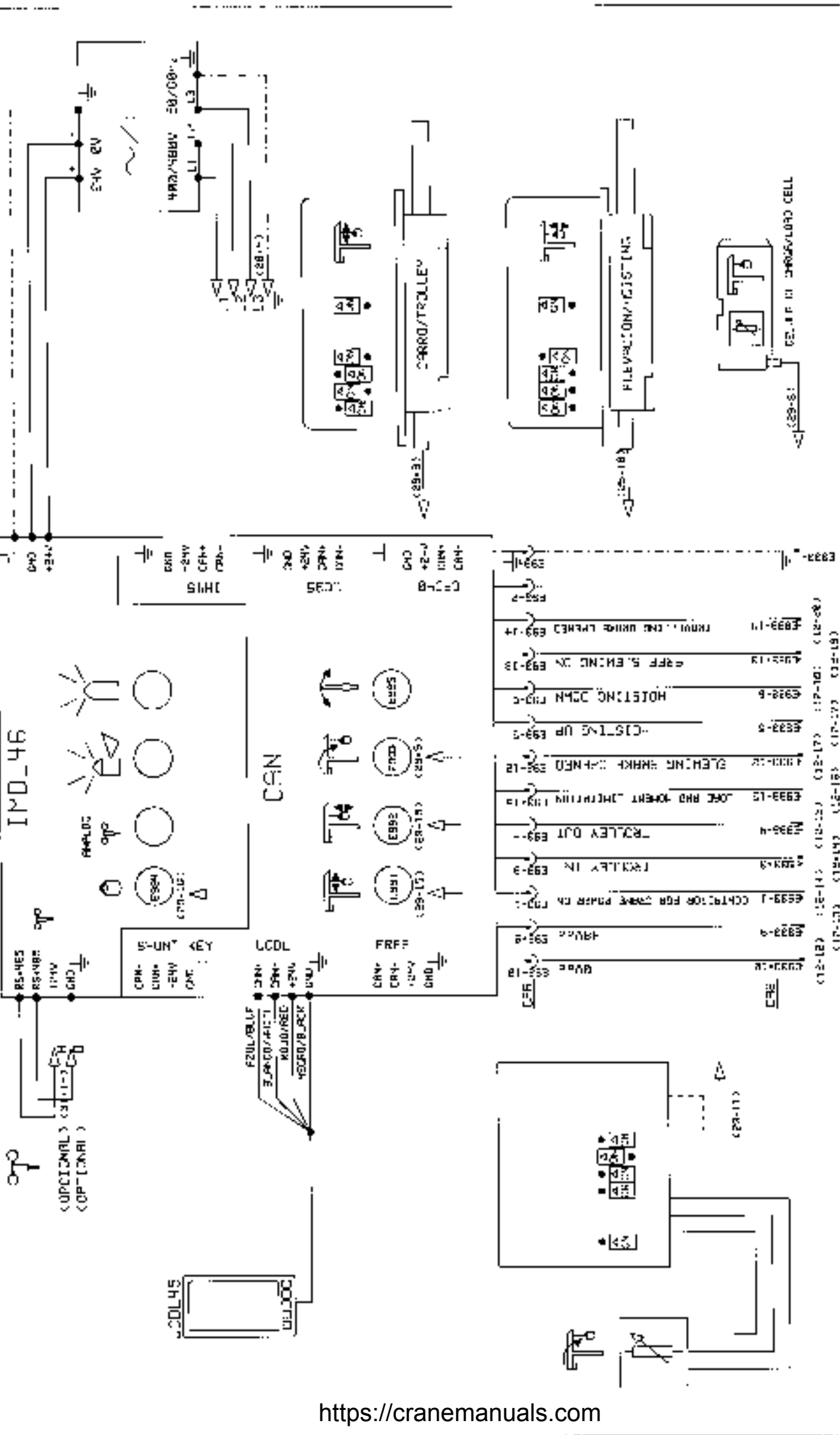


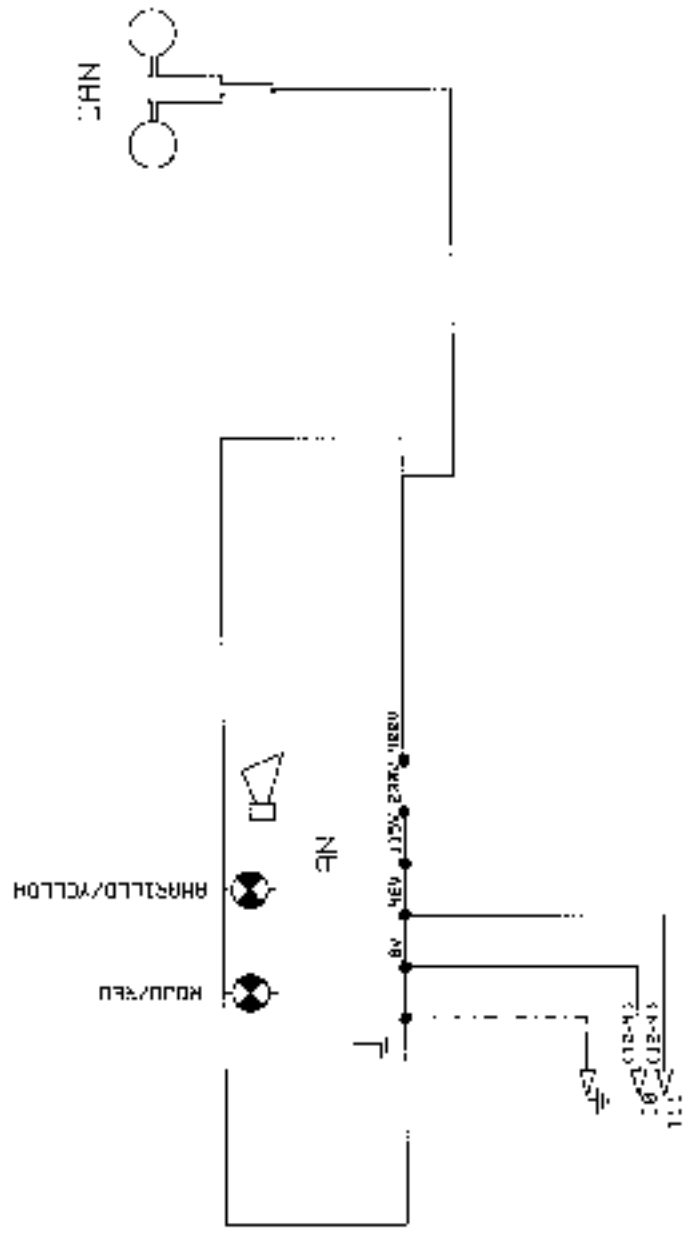
Fecha: 2/7/08 Firmo: L. Pdez. J. Fdez.	Rev. sado: 2/7/08 P/7/08	Proyecto: IL 24/274H POTENCIA ASIENIC	Sistema: SEAT OPERATOR FDKER	ESO,FMH N 1-07P08001 Hoja 27 De 49
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IM45

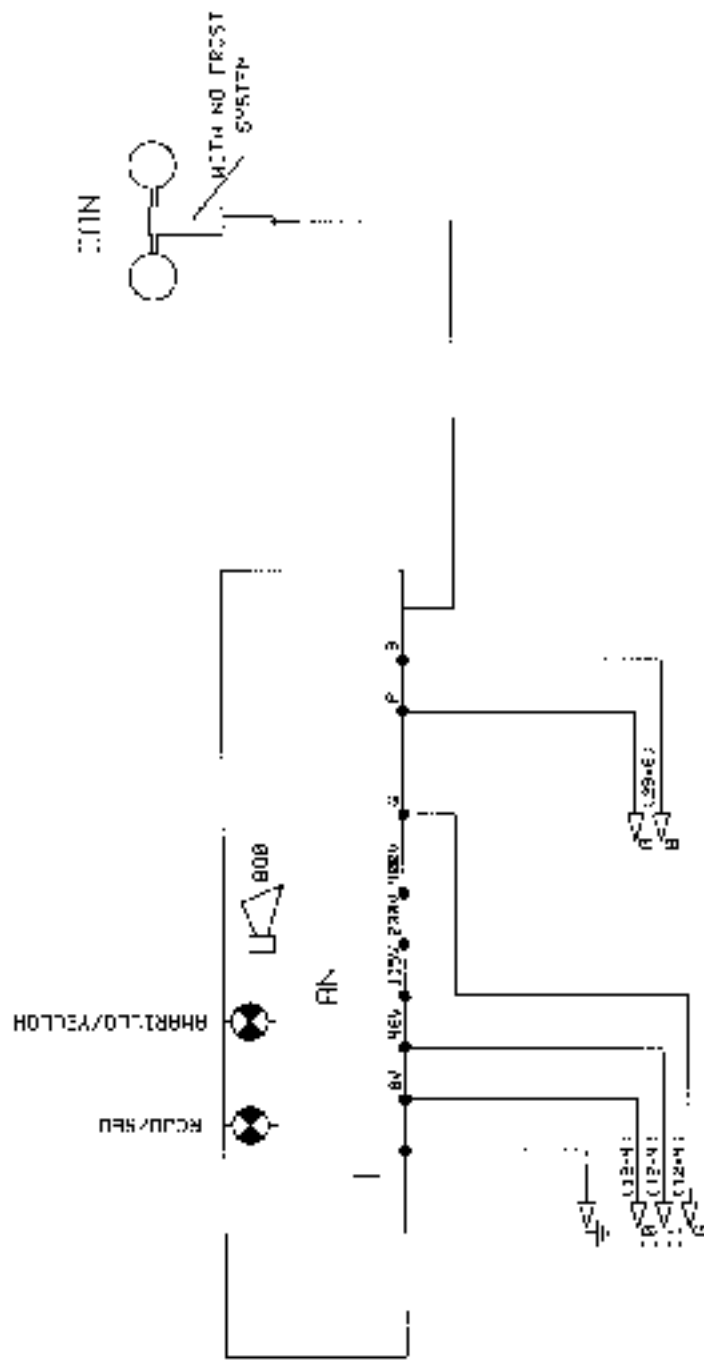


Terminal	Component	Terminal	Component
492-23	HOISTING UP (COYSTEK)	492-23	HOISTING UP (COYSTEK)
492-24	HOISTING DOWN (COYSTEK)	492-24	HOISTING DOWN (COYSTEK)
492-25	HOISTING UP (RHYS)	492-25	HOISTING UP (RHYS)
492-26	HOISTING DOWN (RHYS)	492-26	HOISTING DOWN (RHYS)
492-27	SLEWING RIGHT (COYSTEK)	492-27	SLEWING RIGHT (COYSTEK)
492-28	SLEWING LEFT (COYSTEK)	492-28	SLEWING LEFT (COYSTEK)
492-29	SLEWING RIGHT (RHYS)	492-29	SLEWING RIGHT (RHYS)
492-30	SLEWING LEFT (RHYS)	492-30	SLEWING LEFT (RHYS)
492-31	TRAVELING FORWARD (COYSTEK)	492-31	TRAVELING FORWARD (COYSTEK)
492-32	TRAVELING BACKWARD (COYSTEK)	492-32	TRAVELING BACKWARD (COYSTEK)
492-33	TRAVELING FORWARD (RHYS)	492-33	TRAVELING FORWARD (RHYS)
492-34	TRAVELING BACKWARD (RHYS)	492-34	TRAVELING BACKWARD (RHYS)
492-35	TRAVELING FORWARD (COYSTEK)	492-35	TRAVELING FORWARD (COYSTEK)
492-36	TRAVELING BACKWARD (COYSTEK)	492-36	TRAVELING BACKWARD (COYSTEK)
492-37	TRAVELING FORWARD (RHYS)	492-37	TRAVELING FORWARD (RHYS)
492-38	TRAVELING BACKWARD (RHYS)	492-38	TRAVELING BACKWARD (RHYS)
492-39	TRAVELING FORWARD (COYSTEK)	492-39	TRAVELING FORWARD (COYSTEK)
492-40	TRAVELING BACKWARD (COYSTEK)	492-40	TRAVELING BACKWARD (COYSTEK)
492-41	TRAVELING FORWARD (RHYS)	492-41	TRAVELING FORWARD (RHYS)
492-42	TRAVELING BACKWARD (RHYS)	492-42	TRAVELING BACKWARD (RHYS)
492-43	TRAVELING FORWARD (COYSTEK)	492-43	TRAVELING FORWARD (COYSTEK)
492-44	TRAVELING BACKWARD (COYSTEK)	492-44	TRAVELING BACKWARD (COYSTEK)
492-45	TRAVELING FORWARD (RHYS)	492-45	TRAVELING FORWARD (RHYS)
492-46	TRAVELING BACKWARD (RHYS)	492-46	TRAVELING BACKWARD (RHYS)
492-47	TRAVELING FORWARD (COYSTEK)	492-47	TRAVELING FORWARD (COYSTEK)
492-48	TRAVELING BACKWARD (COYSTEK)	492-48	TRAVELING BACKWARD (COYSTEK)
492-49	TRAVELING FORWARD (RHYS)	492-49	TRAVELING FORWARD (RHYS)
492-50	TRAVELING BACKWARD (RHYS)	492-50	TRAVELING BACKWARD (RHYS)
492-51	TRAVELING FORWARD (COYSTEK)	492-51	TRAVELING FORWARD (COYSTEK)
492-52	TRAVELING BACKWARD (COYSTEK)	492-52	TRAVELING BACKWARD (COYSTEK)
492-53	TRAVELING FORWARD (RHYS)	492-53	TRAVELING FORWARD (RHYS)
492-54	TRAVELING BACKWARD (RHYS)	492-54	TRAVELING BACKWARD (RHYS)
492-55	TRAVELING FORWARD (COYSTEK)	492-55	TRAVELING FORWARD (COYSTEK)
492-56	TRAVELING BACKWARD (COYSTEK)	492-56	TRAVELING BACKWARD (COYSTEK)
492-57	TRAVELING FORWARD (RHYS)	492-57	TRAVELING FORWARD (RHYS)
492-58	TRAVELING BACKWARD (RHYS)	492-58	TRAVELING BACKWARD (RHYS)
492-59	TRAVELING FORWARD (COYSTEK)	492-59	TRAVELING FORWARD (COYSTEK)
492-60	TRAVELING BACKWARD (COYSTEK)	492-60	TRAVELING BACKWARD (COYSTEK)
492-61	TRAVELING FORWARD (RHYS)	492-61	TRAVELING FORWARD (RHYS)
492-62	TRAVELING BACKWARD (RHYS)	492-62	TRAVELING BACKWARD (RHYS)
492-63	TRAVELING FORWARD (COYSTEK)	492-63	TRAVELING FORWARD (COYSTEK)
492-64	TRAVELING BACKWARD (COYSTEK)	492-64	TRAVELING BACKWARD (COYSTEK)
492-65	TRAVELING FORWARD (RHYS)	492-65	TRAVELING FORWARD (RHYS)
492-66	TRAVELING BACKWARD (RHYS)	492-66	TRAVELING BACKWARD (RHYS)
492-67	TRAVELING FORWARD (COYSTEK)	492-67	TRAVELING FORWARD (COYSTEK)
492-68	TRAVELING BACKWARD (COYSTEK)	492-68	TRAVELING BACKWARD (COYSTEK)
492-69	TRAVELING FORWARD (RHYS)	492-69	TRAVELING FORWARD (RHYS)
492-70	TRAVELING BACKWARD (RHYS)	492-70	TRAVELING BACKWARD (RHYS)
492-71	TRAVELING FORWARD (COYSTEK)	492-71	TRAVELING FORWARD (COYSTEK)
492-72	TRAVELING BACKWARD (COYSTEK)	492-72	TRAVELING BACKWARD (COYSTEK)
492-73	TRAVELING FORWARD (RHYS)	492-73	TRAVELING FORWARD (RHYS)
492-74	TRAVELING BACKWARD (RHYS)	492-74	TRAVELING BACKWARD (RHYS)
492-75	TRAVELING FORWARD (COYSTEK)	492-75	TRAVELING FORWARD (COYSTEK)
492-76	TRAVELING BACKWARD (COYSTEK)	492-76	TRAVELING BACKWARD (COYSTEK)
492-77	TRAVELING FORWARD (RHYS)	492-77	TRAVELING FORWARD (RHYS)
492-78	TRAVELING BACKWARD (RHYS)	492-78	TRAVELING BACKWARD (RHYS)
492-79	TRAVELING FORWARD (COYSTEK)	492-79	TRAVELING FORWARD (COYSTEK)
492-80	TRAVELING BACKWARD (COYSTEK)	492-80	TRAVELING BACKWARD (COYSTEK)
492-81	TRAVELING FORWARD (RHYS)	492-81	TRAVELING FORWARD (RHYS)
492-82	TRAVELING BACKWARD (RHYS)	492-82	TRAVELING BACKWARD (RHYS)
492-83	TRAVELING FORWARD (COYSTEK)	492-83	TRAVELING FORWARD (COYSTEK)
492-84	TRAVELING BACKWARD (COYSTEK)	492-84	TRAVELING BACKWARD (COYSTEK)
492-85	TRAVELING FORWARD (RHYS)	492-85	TRAVELING FORWARD (RHYS)
492-86	TRAVELING BACKWARD (RHYS)	492-86	TRAVELING BACKWARD (RHYS)
492-87	TRAVELING FORWARD (COYSTEK)	492-87	TRAVELING FORWARD (COYSTEK)
492-88	TRAVELING BACKWARD (COYSTEK)	492-88	TRAVELING BACKWARD (COYSTEK)
492-89	TRAVELING FORWARD (RHYS)	492-89	TRAVELING FORWARD (RHYS)
492-90	TRAVELING BACKWARD (RHYS)	492-90	TRAVELING BACKWARD (RHYS)
492-91	TRAVELING FORWARD (COYSTEK)	492-91	TRAVELING FORWARD (COYSTEK)
492-92	TRAVELING BACKWARD (COYSTEK)	492-92	TRAVELING BACKWARD (COYSTEK)
492-93	TRAVELING FORWARD (RHYS)	492-93	TRAVELING FORWARD (RHYS)
492-94	TRAVELING BACKWARD (RHYS)	492-94	TRAVELING BACKWARD (RHYS)
492-95	TRAVELING FORWARD (COYSTEK)	492-95	TRAVELING FORWARD (COYSTEK)
492-96	TRAVELING BACKWARD (COYSTEK)	492-96	TRAVELING BACKWARD (COYSTEK)
492-97	TRAVELING FORWARD (RHYS)	492-97	TRAVELING FORWARD (RHYS)
492-98	TRAVELING BACKWARD (RHYS)	492-98	TRAVELING BACKWARD (RHYS)
492-99	TRAVELING FORWARD (COYSTEK)	492-99	TRAVELING FORWARD (COYSTEK)
492-100	TRAVELING BACKWARD (COYSTEK)	492-100	TRAVELING BACKWARD (COYSTEK)

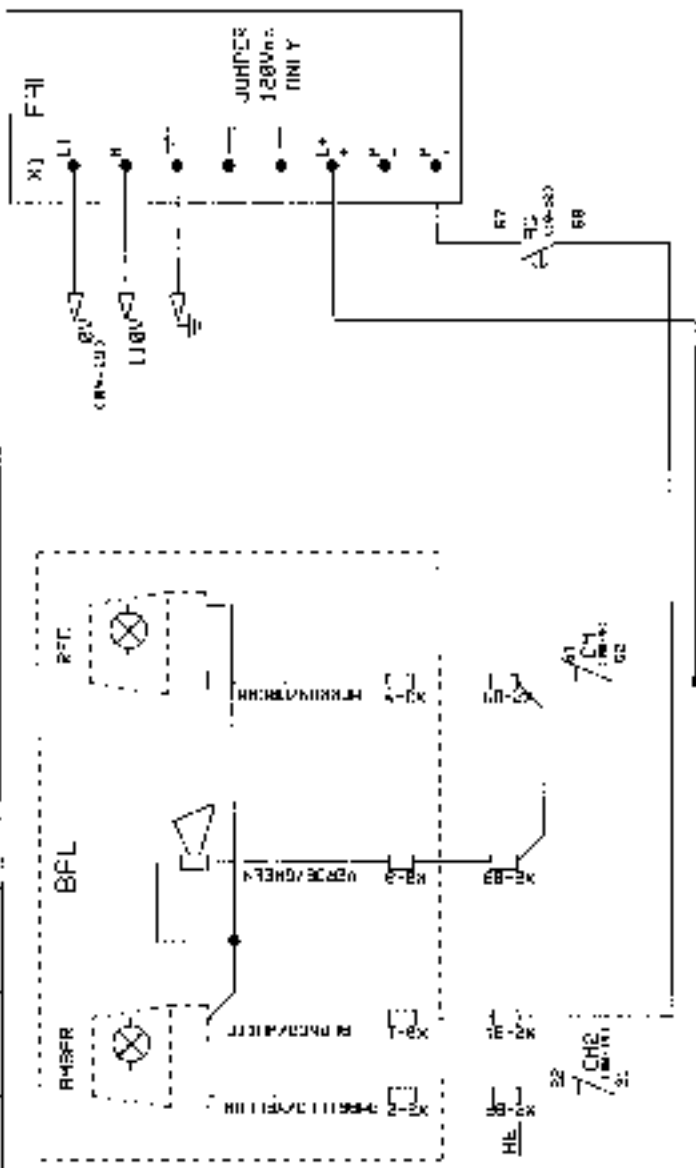




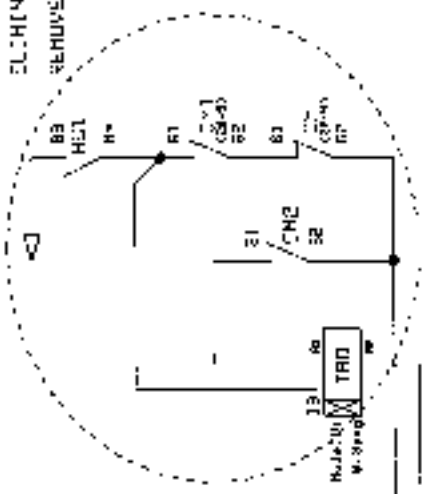
D. Ejecutor	Rmv. realu	Quirado	1500500 N
2/7/89	2/7/88	2/7/88	1427P02304
J. Fdez.	J. Lpez.	L. S. tom	Heja 32 Dv 49
Haguing LILC -- FU 24/2/88		5vol. outside par.	
ANEHOMETRE STINKART (DPC:CNAL)		ANEHOMETRE STINKART (OPTIONAL)	
<b>COMANSA</b>			



Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado	Revisado
Fecha	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08	2/7/08
Firma	Idaz, J.	Fdez, J.	Simon	COMANDA	Maglina D.C.	SU 25/3746	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)	ANFOMLINE INDICADORES (OPTICNL)
										Substitucion part INDICADOR INDICADORES (OPTICNL) ESCALERA N 1-010128804 Hoja 31 De 45									

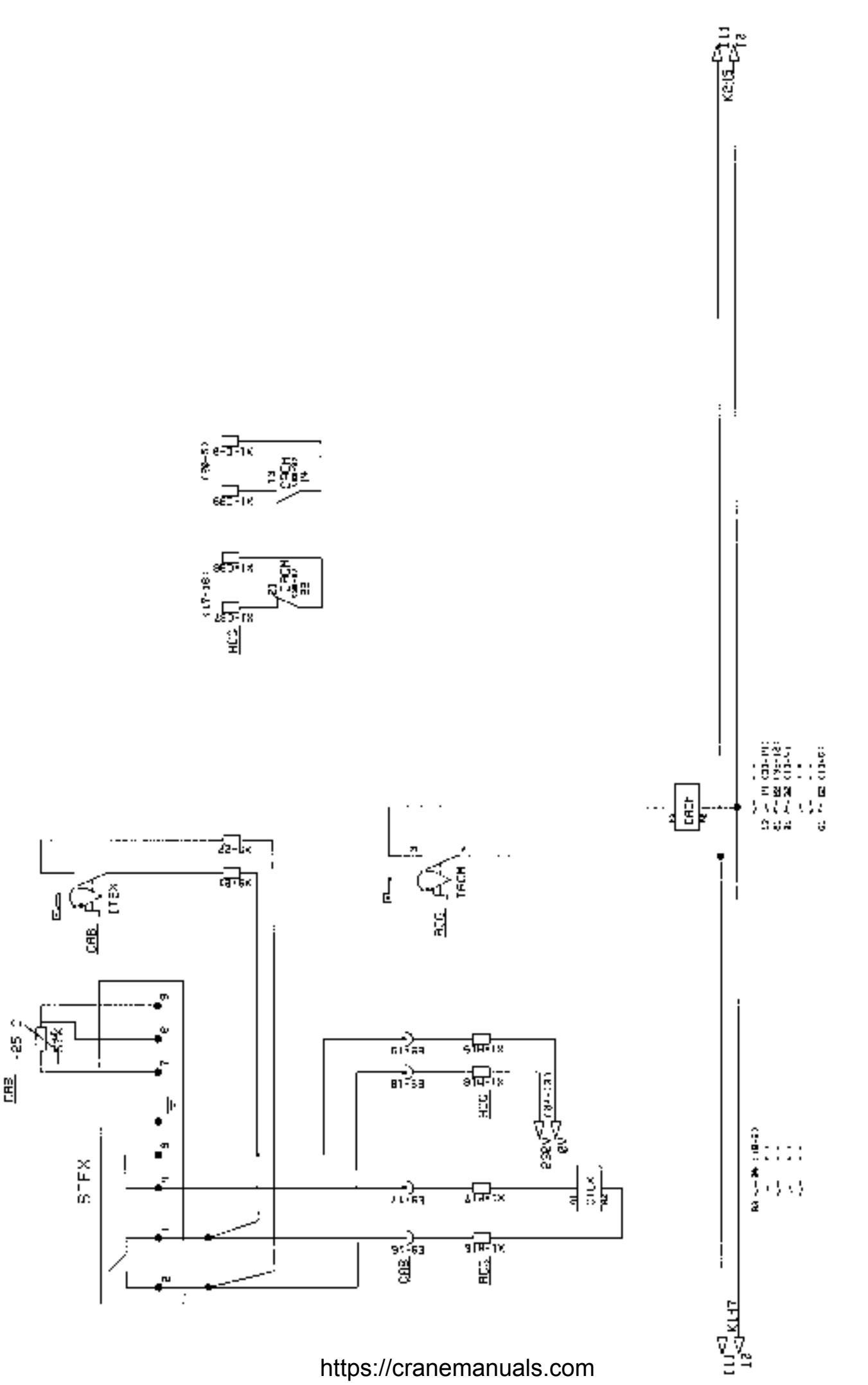


ELIMINER ESTE CIRCUITO DEL ESQUEMA ORIGINAL.  
 REMOVE THAT CIRCUITS OF ORIGINAL SCHEM



1003  
1803

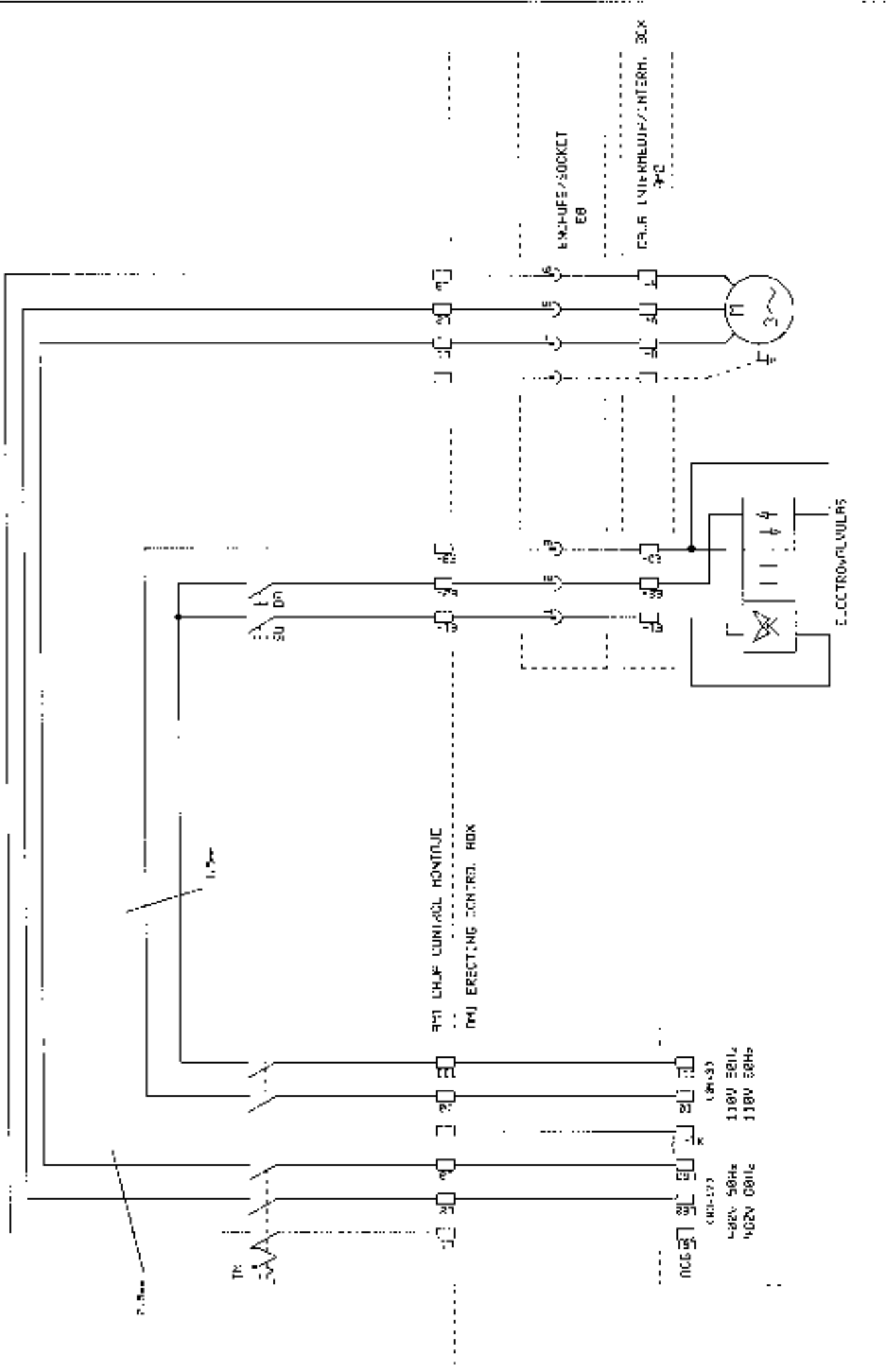
Libro de Revisión	Revisores	Fecha	Firma	Edm. J. Simar	COMANDA	Maqu no 1110 - FJ 24/2014	FLASHING LIGHTS (OPTIONAL)	ESQUEMA N 1427PAR1011
2/7/08	2/7/08	2/7/08	J. Simar					Hoja 52 de 49



<https://cranemanuals.com>

<p>Дibu.ado Rev.1.000, Ap.3.000.5 27/08 27/08</p> <p>J. Ferraz, J. Silva, L. Simon</p>	<p>Maqu. no 1112-- FJ 24/37kW SONER TRERICH TUBINI (OPTION RUSIA)</p>	<p>Скет. inside no. 1 СВТН ТЕРМ. СИНД. ОПТИЧ. РУСИЯ</p>	<p>F50.FHA 4 J-07P830M Hoje 23 De 45</p>
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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23



Revisado	2/7/78	Aprobado	2/7/78
Fecha	J. Fez.	Fecha	L. S. SUD
Auto	J. Fez.	Auto	L. S. SUD
EQUIPO 1116 1U 24/57, H		EQUIPO 1116 1U 24/57, H	
SALA DE CONTROL		SALA DE CONTROL	
ERECTING JTI (CPT113HII)		ERECTING JTI (CPT113HII)	
EQUIPO DE PART.		EQUIPO DE PART.	
1407P003R01		1407P003R01	
ESQUEMA N		ESQUEMA N	
Hoja 34 de 49		Hoja 34 de 49	



12  
02  
E  
91  
21  
3  
51  
11  
E  
31  
31  
21  
3  
9  
5  
3  
E  
3

PARA REGULAR LOS ELEMENTOS DE ESTA TABLA VER EL ESQUEMA ELÉCTRICO  
 TO REGULATE THE ELEMENTS ON THIS TABLE SEE ELECTRICAL DRAWING  
 FÜR DIE REGULIERUNG DER ELEMENTE SEHEN SIE DAS ELEKTRISCHE DIAGRAMM

POUR REGLER DES APPAREILS FIGURANT DANS LE TABLEAU CI-DESSOUS SE REPORTER SCHEMA ELECTRIQUE

TRANSFORMADORES/Transformers/Transformatoren/Transformateurs  
 MAGNETOTERMICOS/Magnetic contactors/Magnetische Schaltrelais/magnétique thermiques  
 TEMPORIZADORES/Timers/Zeitgeber/Temporisateurs

REGULACION DE TARJETAS ELECTRONICAS/ELECTRONIC DEVICES REGULATION/ REGELUNG DER ELEKTRONISCHE KARTE/REGLAGE DES CARTES ELECTRONIQUES		P1	P2	P3	P4
CIRCUITO STOP/Stopping/Stoppen/Arrêt Realización/Idy/Realizacja/Realisation/Realisierung	UCR30 P1 P2 P3 P4 Ø Ø Ø Ø	8V <sub>dc</sub>	1.5V <sub>dc</sub>	9V <sub>dc</sub>	12V <sub>dc</sub>
CIRCUITO STOP/Stopping/Stoppen/Arrêt Voltaje motor/Motor voltage/Motorspannung/Moteurspannung	BPR10 P1 P2 0 0	3.0V <sub>dc</sub>	NT	-	-
TRASLAC. ONI/Traveling/Fahrwerk/Fraselion Voltaje motor/Motor voltage/Motorspannung/Moteurspannung	BPR10 P1 P2 0 0	3.0V <sub>dc</sub>	NT	-	-

- P1: Primera velocidad/First Stop1. Speed/ Première vitesse
- P2: Segunda velocidad/Second Stop2. Speed/ Deuxième vitesse
- P3: Frenado/Brake/Bremsen/Frictionage
- P4: Tiempo de frenado/Braking time/ Bremszeit/ Temps de freinage
- NT: (NO TOUCH) no touch/Non verdoetm/Ne pas toucher

Los valores son aproximados y pueden variar en función de la longitud de pista montada. En su caso deben ser ajustados para un funcionamiento óptimo/These values are mean values and might need some adjustment depending on the jib length mounted. Ade vorgegeben Werte können sich mit der Länge des Auslegers ändern. Im diesem Fall sollten die Werte für eine optimale Funktion des Krans Justizien werden. Les valeurs sont données à titre indicatif car elles peuvent varier en fonction des différences de piste. Elles seront donc à ces ajuster pour un bon fonctionnement.

REGULACIÓN DE FRENSOS/PAKE REGULATION/ BREMSREGLIERUNG/REGLAGE DES FREINS	Emax	Emin	K	h	
				Color B	Color A
37KW FRENSO ELEVACIÓN/Stopping brake/Höhenbremse/Frémis levage Tipo/Type/Typ/Type: BFK Modelo/Modelo/Modèle/Modèle: BFK458 25N-FRCC	0.75mm	0.5mm	≤ 4.5mm	-	-
24KW FRENSO ELEVACIÓN/Stopping brake/Höhenbremse/Frémis levage Tipo/Type/Typ/Type: BFK Modelo/Modelo/Modèle/Modèle: BFK455 25N-FR53	1.25mm	0.5mm	≤ 4.5mm	-	-
4KW FRENSO GARRA/Stopping brake/Laufkatzenbremse/Frémis cranio Tipo/Type/Typ/Type: BFK Modelo/Modelo/Modèle/Modèle: BFK458.12N46	0.45mm	0.3mm	≤ 2.5mm	-	-
FRENO CIRCULO/Stopping brake/Rebremsen/Frémis rotation Tipo/Type/Typ/Type: S Modelo/Modelo/Modèle/Modèle: 100S ó 110MS (17) 110C9 (2x 5kgm) 100S (17) 110C13 (2x 5kgm) 100S (17) 110C150 & 110C160 (2x 7.5kgm) 110MS	1.2mm	0.7mm	≤ 4.5mm	1.5mm** 19.5mm***	11mm***
FRENO TRASLACION/Stopping brake/Rebremsen/Frémis traslación Tipo/Type/Typ/Type: (1) 3 ó 4 ó 5m (1) 6 m Modelo/Modelo/Modèle/Modèle: (1) 100S (1) 110MS Motor/Motor: (1) 4,5kgm ó 5,5kgm (1) 7,5kgm	1.2mm	0.7mm	≤ 4.5mm	18,5mm**	12mm**

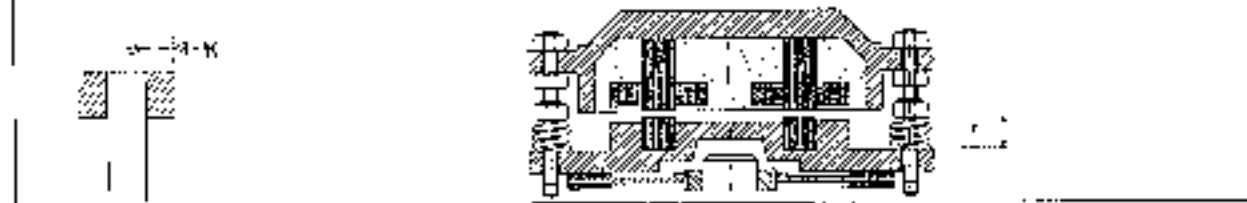
Emax: Entfänger máximo/Maximum gap/Höhe des Aufhänger für die maximale  
 Emin: Entfänger mínimo/Minimum gap/Abstand des Aufhänger für die minimale

K: Camisa la pastilla del disco o la pastilla de freno es inferior a "K" lining pad thickness. If "K" is larger any value the disk must be replaced/Bei Bremsenbelägen oder aufstehend: wenn der Bremsbelag dicker ist als "K" Länger la disco o la pastilla de freno es inferior a "K"

h: Distancia para el ajuste del par de frenos (el eje desmontado y motor frenado). Eligi según el color del resorte/Distance for adjusting the parking brake with the brake coil dismounted and the motor brake. Choose according to the spring colour/Bremsenstellungen mit Motor gelöst/ wählen Sie der Feder Farbe / distance pour ajuster la norme de levage (ajuster avec un couple de levage sans tension el motor frenado). Choisir le color de ressort.

Color B. Muelle de color blanco/White colored spring/Weiß Feder/Fresson blanc  
 Color A. Muelle de color amarillo/Yellow colored spring/Gelb Feder/Fresson jaune

ADVERTENCIA/WARNING/ACHTUNG/ATTENTION: los valores de h están son válidos para la grúa que corresponde al esquema y no debe aplicarse a la regulación de otros grúas./The values on the table are only valid for the crane supplied with it and should be applied exclusively to this crane generation. Niéne sind nur für diesen Krant gültig/les valeurs indiquées ne sont valables que pour la grue livrée. Ne pas utiliser ailleurs pour une autre machine



L11C 24-37KW 4 IDIOMAS

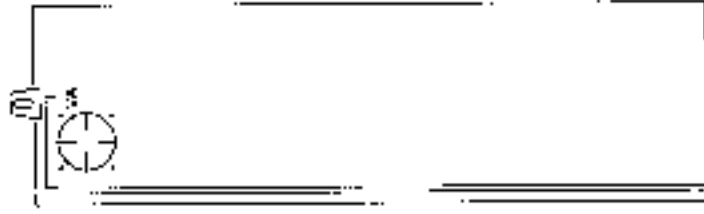
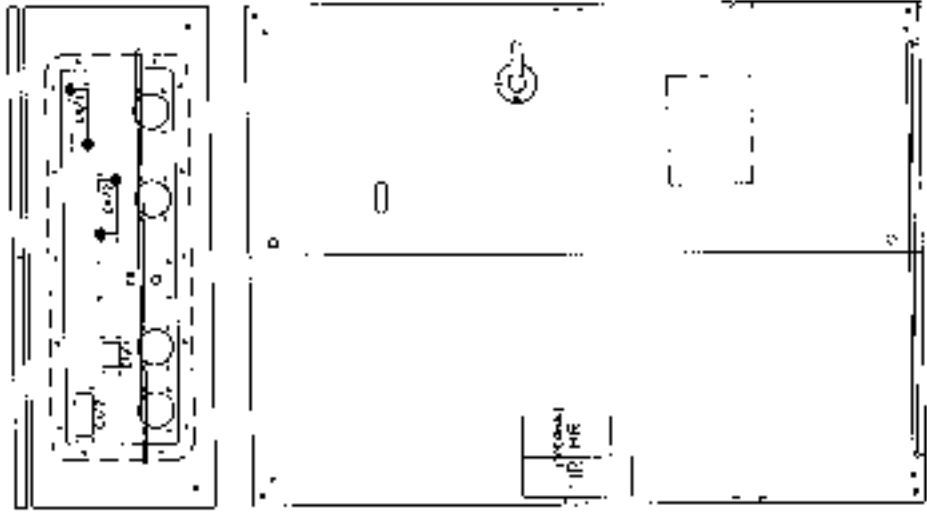
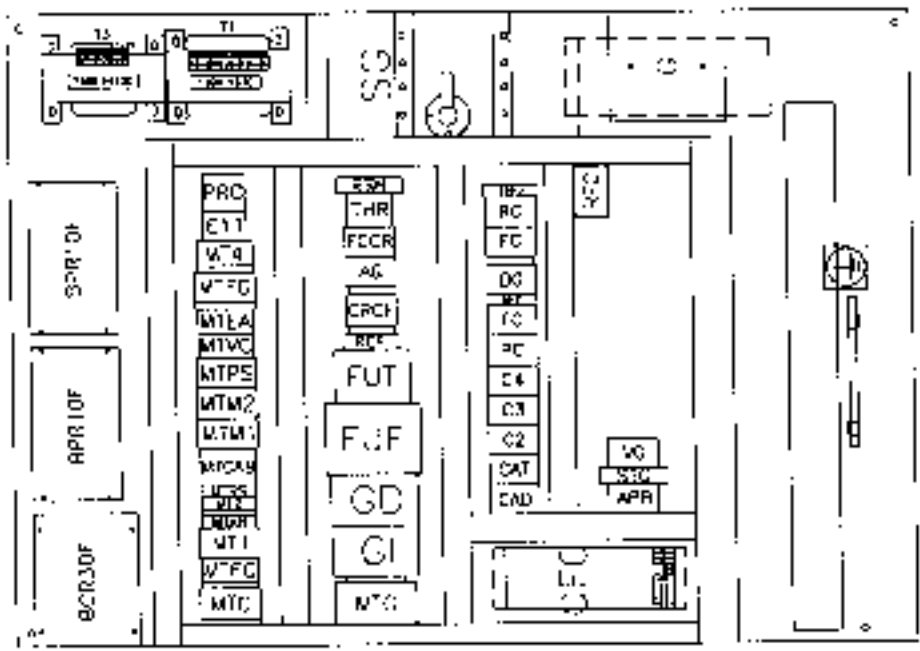
ESQUEMA N  
 1427122/308  
 Hoja 35 de 45

Equipado por:  
 EQUIPAMIENTO: CONIK

Resistencia: ILC -- FU 24/37,4  
 RESISTENCIA L11C -- FU 24/37,4

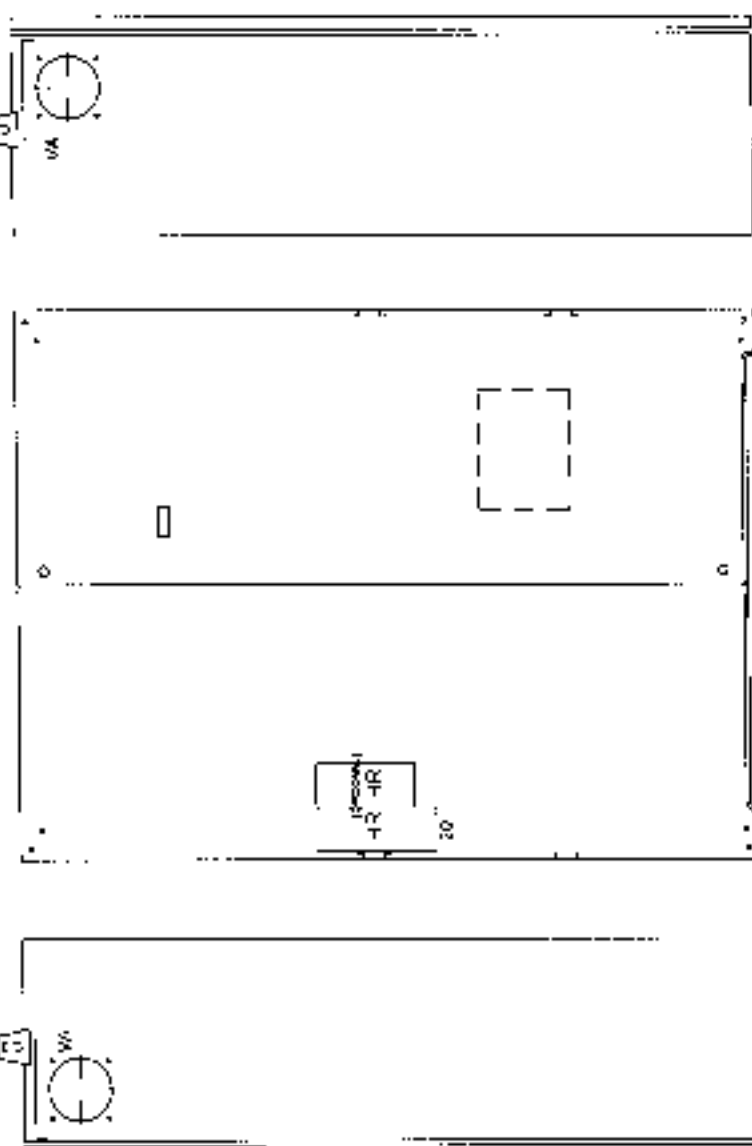
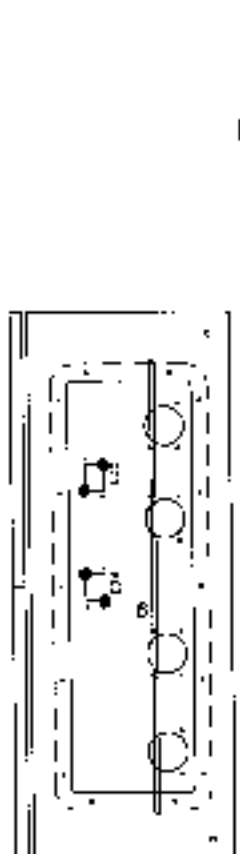
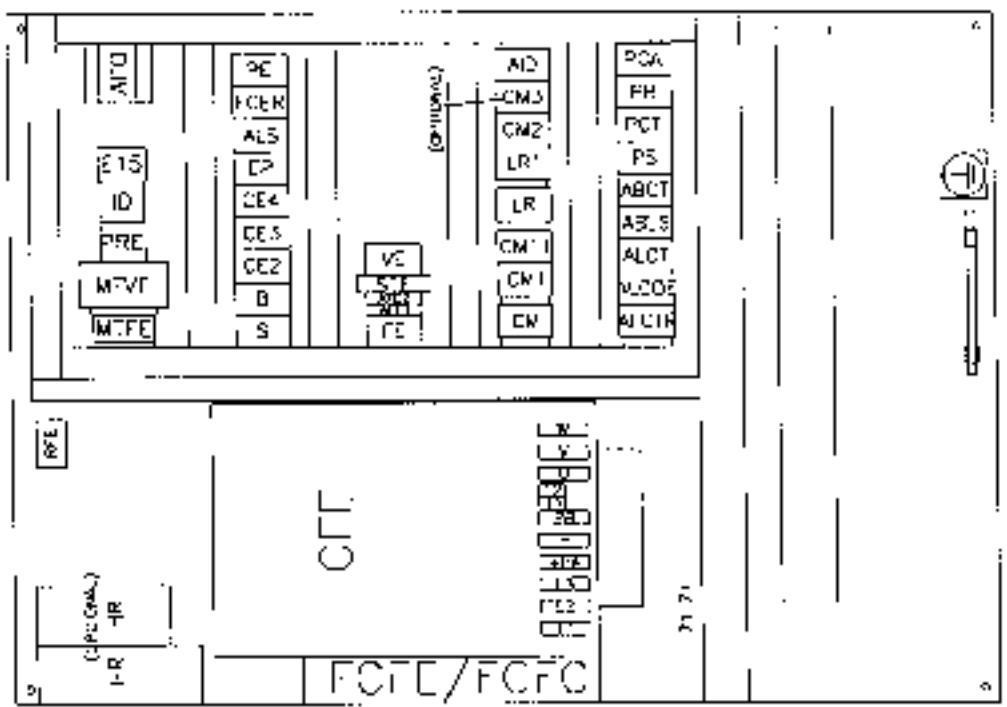


Modelo: ILC 24-37KW 4 IDIOMAS  
 Fecha: 2/7/88  
 Firmado: J. Fdez. S. Simón

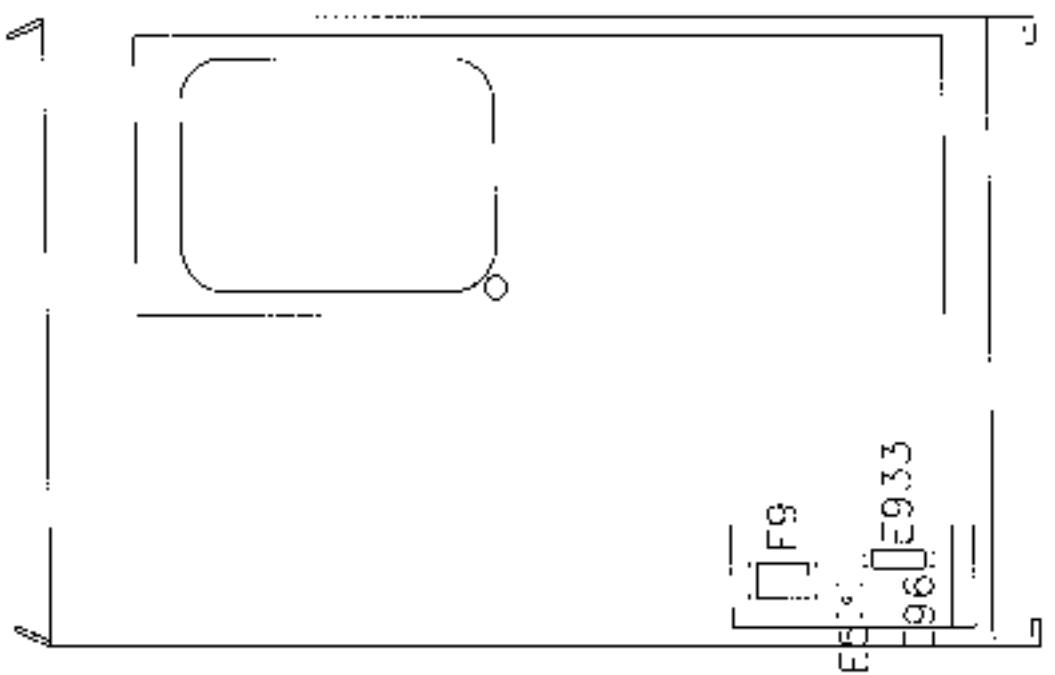
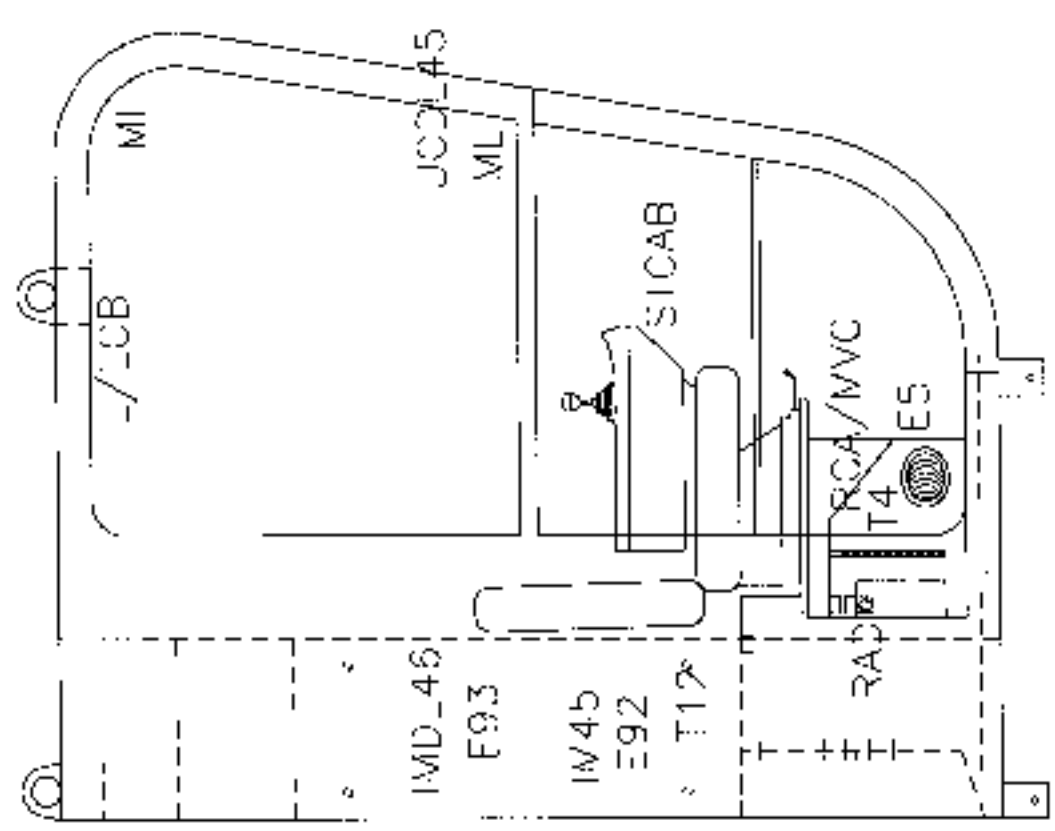


Distribución 2/7/08 Fecha J. Fdez. Firma	Revisado: [ ] 2/7/08 J. Fdez.	Proyecto: [ ] 7/7/08 J. Fdez.	Lugar de [ ] FERRIS OPERO/GIRO TROLLY/SLEING CIPRINO	Especificación parte: 652000 :407F2280- 2000 36 2 45
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2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21



Dibujado	Kav. Szdo	Revisado	Paroboso	Requisito	TR- PU 24/30kV	Costo	COQUEVA N
Fecha	2/7/89	2/7/86	2/7/89	DESCRIPCION	INDUSTRIAL CUPERTINO	142700904	
Cinta	J. J. J. J.	G. Fdez.	J. Simón				Hoja 27 de 49





NOMBRE NAME	DESCRIPCION DESCRIPTION
BAL	BALIZA BUOY
BAL1	BALIZA BUOY
BAL2	BALIZA BUOY
BCH30F	TARJETA CONTROL MOTOR GIRO SLEWING CONTROL BLOCK
BCT	MANDO HABILITACION CARRO ATRÁS BACK TROLLEY ENABLE CONTROL
BLS	MANDO HABILITACION ELEVACION SUBIR UP HOISTING ENABLE CONTROL
BO	BOCINA HOOTER
BPH30F	BLOQUE CONTROL POTENCIA MOTOR GIRO SLEWING POWER BLOCK
CB	CONTACTOR CARRO 2ª VELOCIDAD AUX.CONTACTOR FOR 50% LIMIT OUTGO
CA	CONTACTOR CARRO 1ª VELOCIDAD 1st SPEED TROLLEY CONTACTOR
CA4	CONTACTOR CARRO 4ª VELOCIDAD 4 SLEWING SPEED CONTACTOR
CAB	CAJINA OPERADOR OPERATORS CABIN
CACM	CONTACTOR ANULACION LIMITACION CARGA/MOMENTO LOAD/MOMENT LIMIT ANULATION CONTACTOR
CAD	CONTACTOR CARRO ADELANTE CONTACTOR, TROLLEY OUT
CAN	CAPTAOR VELOCIDAD VIENTO WINDSPEED SENSOR
CAT	CONTACTOR CARRO ATRAS CONTACTOR TROLLEY BACK
CE2	CONTACTOR ELEVACION 2ª VELOCIDAD 2ND HOISTING SPEED CONTACTOR
CE3	CONTACTOR ELEVACION 3ª VELOCIDAD 3RD HOISTING SPEED CONTACTOR
CE4	CONTACTOR ELEVACION 4ª VELOCIDAD 4ND HOISTING SPEED CONTACTOR
CFC	CONVERTIDOR DE FRECUENCIA MOTOR CARRO TROLLEY MOTOR FREQUENCE CONVERTER
CFE	CONVERTIDOR DE FRECUENCIA MOTOR ELEVACION HOIST MOTOR FREQUENCY CONVERTER
CJA	CAJA ALIMENTADA CON INTERRUPTOR MAINS SUPPLY BOX WITH INTERRUPTOR

ESQUEMA H	1427P000001	16 Jun 98 16:49
Regulador L11 L-- FU 24/37M	GENERAL LAY-0011	
DESCRIPCION COMPONENTES		
Dib. Julio 2/7/89	Revisado 2/7/89	Aprobado 2/7/89
Firma J. Jimenez	D. Simon	
Fdes.		



COMARSA

NOMBRE NAME	DESCRIPCION DESCRIPTION
CM	CAJA DERIVACION CABLES/TANTE CARRÓ TROLLEY WINDING TERMINATION BOX
CM	CONTACTOR 100% CARGA/MOMENTO & 100% MOMENTO 100% LOAD/MOMENT CONTACTOR OR 100% MOMENT
CM1	CONTACTOR 100% CARGA/MOMENTO & 100% MOMENTO 100% LOAD/MOMENT CONTACTOR OR 100% MOMENT
CM11	CONTACTOR 100% MOMENTO MOMENT 100% CONTACTOR
CM2	CONTACTOR SEGURIDAD CARGA/MOMENTO NIVEL 2 AUX.CONTACTOR FOR OVERLOAD LEVEL 2
CM3	CONTACTOR SEGURIDAD CARGA/MOMENTO NIVEL 1 AUX.CONTACTOR FOR OVERLOAD LEVEL 1
CM4	CAPTADOR MOTOR LLEVACION HOISTING MOTOR CAPTATOR
CM5	CONTACTOR MOTOR SUMP/PAJE PUMP MOTOR CONTACTOR
CRCT	CONTACTOR RELE CONTROL 12 FASES BALANCED PHASES CONTROL RELAY CONTACTOR
CT	COMUTADOR CONTROL DE TRASLACION RAIL TRAVEL COMUTATOR SWITCH
CTEX	CONTACTOR RELE SONDA TERMICA EXTERIOR OUTSIDE THERMICAL SONDE RELAY CONTACTOR
GH	HORÓMETRO HOUR-METER
D60	DESHELOCUBO MOTOR TIRO 1 FREE SLEWING UNIT 1
D6	CONTACTOR DEFECTO EN GIRO SLEWING FAILURE CONTACTOR
DT	TOMA DE TIERRA ELECTRIC GROUNDING
E	ENCHUFE ALIMENTACION GRUA MAINS SUPPLY FOR CRANE
E11	ENCHUFE POTENCIA CARRÓ TROLLEY POWER PLUG
E12	ENCHUFE CARRÓ TROLLEY PLUG
E11	ENCHUFE FUERZA AUXILIAR AUXILIARY SOCKET
E12	ENCHUFE AUXILIAR 110V AUXILIARY SOCKET 110V
E13	ENCHUFE AUXILIAR 220V AC AUXILIARY SOCKET 220V AC
E20	ENCHUFE AUXILIAR 230V AUXILIARY SOCKET 230V

FRUENH N  
140711R280-  
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Santill de surt

GENERAL I PV-DUT

Módulo 11C -- FU 2-/3TK  
DESCRIPCION COMPONENTES



**COMANSA**

Cibuljan	Ravilaco	Rencoboz	
Fecha: 27/08	27/08	27/08	
Por: J. Fdez.	J. Fdez.	J. Siman	

NOMBRE NAME	DESCRIPCION DESCRIPTION
E34	ENCUITE LIMITADOR PERMISO CARRIL ATRAS TROLLEY BACK PERMISSION LIMIT-SWITCH SOCKET
E35	ENCUITE LIMITADOR PERMISO CARRIL ADELANTE TROLLEY FORWARD PERMISSION LIMIT-SWITCH SOCKET
E41	ENCUITE MOTOR GIRO 1 SLEWING MOTOR 1 PLUG
E42	ENCUITE MOTOR GIRO 2 SLEWING MOTOR 2 PLUG
E5	ENCUITE FUERZA CABINA CABIN POWER PLUG
E6	ENCUITE CENTRALITA HIDRAULICA HYDRAULIC UNIT SOCKET
E9	ENCUITE MANDO EN CABINA CABIN CONTROL SOCKET
E91	ENCUITE MANDO ASIENTO CABINA CABIN SEAT CONTROL SOCKET
E92	ENCUITE LIMITACION DE ZANAS XONING SOCKET
E93	ENCUITE CAJA NEGRA BLACK BOX SOCKET
E953	ENCUITE INDICADORES CABINA CABIN INDICATORS SOCKET
EP	CONTACTOR POSICIONAMIENTO ELEVACION HOIST PLACING ROTATING CONTACTOR
FAC	FUENTE DE ALIMENTACION SOURCE OF FEEDING
EC	CONTACTOR FRENO CARRIL TROLLEY BRAKE CONTACTOR
ECCK	CONTACTOR LIMITACION CARRIL RAPIDA FAST TROLLEY LIMITATION CONTACTOR
ECER	CONTACTOR LIMITACION VELOCIDAD ELEVACION RAPIDA FAST HOIST SPEED LIMITATION CONTACTOR
ECFC	FILTRO CONVERTIDOR FRECUENCIA MOTOR CARRIL TROLLEY MOTOR FREQUENCY CONVERTER FILTER
ECFE	FILTRO CONVERTIDOR FRECUENCIA ELEVACION FILTER HOIST MOTOR FREQUENCY CONVERTER
EB	CONTACTOR FRENO ELEVACION HOISTING BRAKE CONTACTOR
EO	CONTACTOR FRENO GIRO SLEWING BRAKE CONTACTOR
EMC	FRENO MOTOR CARRIL TROLLEY MOTOR BRAKE
EME	FRENO MOTOR ELEVACION HOIST MOTOR BRAKE




NOMBRE NAME	DESCRIPCION DESCRIPTION
FM01	FRENO MOTOR GIRO 1 SLEWING MOTOR BRAKE 1
FM02	FRENO MOTOR GIRO 2 SLEWING MOTOR BRAKE 2
FUI	FUSIBLES GENERALES ACOMETIDA MAIN SUPPLY FUSES
FURC	FUSIBLES RECTIFICADOR CABINA CABIN RECTIFIER FUSE
FUT	FUSIBLES SISTEMA TRASLACION TRANSLATION FUSES SYSTEM
FUA1	FUSIBLE UNIDAD AIRE ACONDICIONADO EQUIPPED AIR SYSTEM FUSE
FUA2	FUSIBLE UNIDAD AIRE ACONDICIONADO EQUIPPED AIR SYSTEM FUSE
G	CONTACTOR GENERAL MAIN CONTACTOR
GD	CONTACTOR GIRO DERECHA SLEWING CONTACTOR, RIGHT
GL	CONTACTOR GIRO IZQUIERDA SLEWING CONTACTOR, LEFT
HR	CALEFACCION ARMARIO ELECTRICO CUPBOARD HEATING
IACM	INTERRUPTOR ANULACION LIMITADORES CARGA/MOMENTO LOAD/MOMENT LIMITERS ANULATION SWITCH
IAI	INTERRUPTOR CAJA ACOMETIDA MAINS SUPPLY BOX INTERRUPTOR SWITCH
IC	INTERRUPTOR CALEFACCION CABINA CABIN HEATING INTERRUPTOR SWITCH
ID	COMUTADOR DESBLOQUEO MONTAJE BLOCKING DE-BLOCKING COMUTATOR
II	INTERRUPTOR LIMPIAPARABRISAS WINDSCREEN-WIPER INTERRUPTOR SWITCH
IC	INTERRUPTOR LUZ CABINA CABIN LIGHT INTERRUPTOR SWITCH
IM	INTERRUPTOR EQUIPO DE MONTAJE TELESCOPING UNIT INTERRUPTOR SWITCH
IM15	UNIDAD CENTRAL ZONAS PROHIBIDAS ZONING CENTRAL UNIT
IM146	UNIDAD CENTRAL INDICADORES INDICATORS CENTRAL UNIT
ITCX	INTERRUPTOR ANULACION RELE SONDA TERMICA EXTERIOR OUTSIDE THERMICAL SONDE RELAY ANULATION SWITCH
K2	ELECTROMAN DESBLOQUEO GIRO FREE SLEWING ELECTRO-ARMANT

ECUADOR 4  
 1-877-022804  
 Hoja 13 De 45

ECUADOR 4  
 GENERAL LAY-1111

Yaguajay 111C -- F3 21/3/14W  
 RESECCION COMPONENTES


**COMANSA**

C. Guayaquil    Revisado    2/7/08  
 Fecha    2/7/08  
 F. P.    J. P.    J. P.


Aprobado    2/7/08  
 T. Simon

NOMBRE NAME	DESCRIPCION DESCRIPTION
KM1	CONTACTOR SUPER PLUMBIN AUXILIAR AUX. JIB UP CONTACTOR
KM2	CONTACTOR BAJAR PLUMBIN AUXILIAR AUX. JIB DOWN CONTACTOR
LB	LIMITADOR ELEVACION BAJAR HOOK DOWN LIMIT SWITCH
LBR	LIMITADOR BAJAR RAPIDA FAST SPEED "DOWN" LIMITER
LC	LIMITADOR CARGA MAXIMA MAX. LOAD LIMIT CUT-OUT
LC1	LIMITADOR CARGA 105-110% 105-110% LOAD LIMITER
LC2	LIMITADOR CARGA INTERMEDIA 2° NIVEL 2° LEVEL INTERMEDIATE LOAD LIMITER
LCA	LIMITADOR CARRO ADELANTE TROLLEY FORWARDS LIMITER
LCAR	LIMITADOR CARRO ADELANTE RAPIDA TROLLEY DEL. FAST SPEED LIMITER
LCB	LUZ DE CABINA CABIN LIGHT
LCM100	LAMPARA CARGA/MOVIMIENTO MAXIMO MAXIMUM LOAD/MOMENT LAMP
LCM105	LAMPARA CARGA/MOVIMIENTO 105% 105% LOAD/MOMENT LAMP
LCR	LIMITADOR CARGA VELOCIDAD SPEED LOAD LIMITER
LCT	LIMITADOR CARRO ATRAS TROLLEY BACKWARDS LIMIT-SWITCH
LCTR	LIMITADOR CARRO ATRAS RAPIDA FAST SPEED LIMITER, TROLLEY BACK
LGD	LIMITADOR GIRO DERECHA SLEW RIGHT LIMITER
LGI	LIMITADOR GIRO IZQUIERDA SLEW LEFT LIMITER
LM	LIMITADOR MOMENTO MAXIMO LOAD/MOMENT LIMIT CUT-OUT
LM1	LIMITADOR MOMENTO 105-110% 105-110% MOMENT LIMITER
LM2	LIMITADOR MOMENTO 90% 90% MOMENT LIMITER
LM90	LAMPARA MOMENTO 90% 90% MOMENT LAMP
LPB	LAMPARA DESBLOQUEO MOTOR GIRO FREE SLEWING UNIT LAMP

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 1-10712482-  
 46/01/11 24/03

Rev. Estado post  
 GENERE. (RY-301)

No. de LIC. 1 J 24/374H  
 DESCRIPCION COMPONENTES


  
 COMARSA

Dibujo de Revisión de Apellido  
 Fecha 27/08 27/08 E/T/RE  
 Firma J. Fdez. J. S. S. I. S. S.

NOMBRE NAME	DESCRIPCION DESCRIPTION
LPCD	LIMITADOR PERMISO CARRO ADELANTE TROLLEY FORWARDS PERMISSION LIMIT SWITCH
LPCT	LIMITADOR PERMISO CARRO ATRAS TROLLEY BACKWARDS PERMISSION LIMIT SWITCH
LR	CONTACTOR LIMITACION VELOCIDAD ELEVACION RAPIDA FAST HOIST SPEED LIMITATION CONTACTOR
LRI	CONTACTOR LIMITACION VELOCIDAD ELEVACION RAPIDA FAST HOIST SPEED LIMITATION CONTACTOR
LS	LIMITADOR ELEVACION SUBIR HOOK UP LIMIT SWITCH
LSR	LIMITADOR SUBIR RAPIDA HOISTING UP LIMITER FAST
MRI	MOTOR BOMBA LAVA PARABRISAS WASHES WINDSHIELD PUMP MOTOR
MC	MOTOR CARRO TROLLEY MOTOR
ME	MOTOR ELEVACION HOISTING MOTOR
MGI	MOTOR GIRO 1 SLEWING MOTOR 1
MG2	MOTOR GIRO 2 SLEWING MOTOR 2
MI	MOTOR LIMPIA PARABRISAS CABINA CABIN WINDSCREEN-WIPER MOTOR
MX	MOTOR MONTAIE ERECTING MOTOR
MP	MOTOR PLUMIN AUXILIARY JIB MOTOR
M11	MAGNETOTERMICO PRIMARIO TRANSFORMADOR MANIOBRA 11 11 OPERATING TRANSFORMER 1st CIRCUIT BREAK
M11D	MAGNETOTERMICO UTILIZACION 110V 110V UTILIZATION EDDY-CURRENT
M12	MAGNETOTERMICO SECUNDARIO TRANSFORMADOR MANIOBRA 11 11 OPERATING TRANSFORMER 2nd CIRCUIT BREAK
M12D	MAGNETOTERMICO UTILIZACION 230V 230V UTILIZATION EDDY CURRENT
M14	MAGNETOTERMICO SALIDA RALENTIZADOR GIRO 12 12 TRANSFORMER CIRCUIT BRAKER
MTAN	MAGNETOTERMICO ANEMOMETRO WIND SPEED CONTROL EDDY-CURRENT
MTC	MAGNETOTERMICO MOTOR CARRO TROLLEY CIRCUIT BRAKER
MTCAR	MAGNETOTERMICO FUENTE CABINA CABIN MAINS SUPPLY CIRCUIT BRAKER

ESQUEMA N  
142/P02804  
Hoja 11 de 15

Substituido por:  
GENERAL LRY-DL


Hoisting Unit C-10 24/37kV  
DESCRIPCION COMPONENTE:



Dibu. Jodo | Revisado | Elaborado  
 Fecha: 27/08 | E/7/06 | P/7/08  
 Firma: J. J. J. | Edg. | S. S.

NOMBRE NAME	DESCRIPCION DESCRIPTION
MTEA	MAGNETOTERMICO ENCHUFAS AUXILIARES 110/230V 110/230V AUXILIARY PLUG EDDY-CURRENT
MTFC	MAGNETOTERMICO FRENO CARRO TROLLEY BRAKE CIRCUIT BRAKER
MTFE	MAGNETOTERMICO FRENO ELEVACION HOIST BRAKE THERMAL CUT-OUT
MTG	MAGNETOTERMICO GIRO SLEWING CIRCUIT BRAKER
MTV1	MAGNETOTERMICO MONTAJE MONTAGE CIRCUIT BRAKER
MTM2	MAGNETOTERMICO MONTAJE MONTAGE CIRCUIT BRAKER
MTF1	MAGNETOTERMICO PRIMARIO TRANSFORMADOR CABINA CABIN TRANSFORMER 1st EDDY-CURRENT
MTFS	MAGNETOTERMICO PRIMARIO TRANSFORMADOR SERVICIO SERVICE TRANSFORMER 1st EDDY CURRENT
MTRS	MAGNETOTERMICO RELE SEGURIDAD MARCHA/PARO ON/OFF SAFETY RELAY EDDY-CURRENT
MTVC	MAGNETOTERMICO VENTILACION Y/O CALEFACCION ARMARIO CIRCUIT BOARD VENTILATION AND/OR HEATING CIRCUIT BRAKER
MTVE	MAGNETOTERMICO VENTILADOR ELEVACION HOIST VENTILATOR CUT-OUT
MVC	MOTOR VENTILACION CABINA CABIN VENTILATION MOTOR
MVG1	MOTOR VENTILADOR GIRO 1 SLEWING 1 VENTILATION MOTOR
MVG2	MOTOR VENTILADOR GIRO 2 SLEWING 2 VENTILATION MOTOR
CC	CONTACTO MANDO ELEVACION HOISTING CONTROL M/C CONTACT
PS	PULSADOR DESBLOQUEO GIRO FREE-SLEWING PUSH-BUTTON
PH	PULSADOR DESBLOQUEO GIRO FREE-SLEWING PUSH-BUTTON
PBO	PULSADOR DOCNA HORN PUSH-BUTTON
XC	CONTACTOR DEFECTO CARRO TROLLEY FAILURE CONTACTOR
PIA	CONTACTOR PERMISO CARRO ADELANTE DET TROLLEY PERMISSION CONTACTOR
PCF	CONTACTOR PERMISO CARRO ATRAS BACK TROLLEY PERMISSION CONTACTOR
PH	CONTACTOR DEFECTO ELEVACION HOISTING FAILURE CONTACTOR

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

		Modulo de Control de Tensión / 374H DESCRIPCION COMPONENTES	Sustituida por: GENERAL LRY-OL	F50057H N 1127020000 Hoja 46 De 49
Dibuñado: Revisado:	Parobaca: 27/28	Firmo: J. Echeverría	Fecha: 27/08	OCELANOVA


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

NOMBRE NAME	DESCRIPCION DESCRIPTION
PEG	PULSADOR FRENO GIRO SLEWING BRAKE PUSH-BUTTON
PEF	PULSADOR FRENO TRASLACION TRANSLATION BRAKE PUSH-BUTTON
PL	PIEDOTOLINEA LINE PIVOT
PM	PULSADOR MARCHA ON PUSH-BUTTON
PP	PULSADOR FARGO OFF PUSH-BUTTON
PPF	PULSADOR FARGO EN CAJA CARRO TROLLEY TERMINAL BOX OFF PUSH-BUTTON
PPH	PULSADOR FARGO EN MECANISMO ELEVACION HOISTING MECHANISM OFF PUSH-BUTTON
PR1	PULSADOR RESET MANIOBRA CARRO RESET TROLLEY OPERATION PUSH-BUTTON
PR2	PULSADOR RESET MANIOBRA ELEVACION RESET HOIST OPERATION PUSH-BUTTON
PS	CONTACTOR PERMISO ELEVACION SUPER UP HOISTING PERMISSION CONTACTOR
RAD	RADIO CADENA CABIN RADIO
RAG1	RALENTIZADOR MOTOR GIRO SLEWING MOTOR EDDY-CORRANT
RAG2	RALENTIZADOR MOTOR GIRO SLEWING MOTOR EDDY-CORRANT
RC	RESISTENCIA CARRO TROLLEY RESISTOR
SCA	RESISTENCIA CALEFACCION CASINA CABIN HEATING RESISTOR
RF	RELE CONTROL DE FASES BALANCED PHASES CONTROL RELE
RE	RESISTENCIA ELEVACION HOIST RESISTOR
REP	PULSADOR POSICIONAMIENTO ELEVACION HOIST PLACING PUSH-BUTTON
REC	RECTIFICADOR FRENO MOTOR CARRO TROLLEY MOTOR BRAKE RECTIFIER
REF	RECTIFICADOR FRENO MOTOR ELEVACION HOISTING MOTOR BRAKE RECTIFIER
RG	CONTACTOR RALENTIZADOR GIRO SLEWING EDDY-CORRANT CONTACTOR
RS	RELE SEGURIDAD MARCHA/FARGO ON-OFF SAFETY RELAY

Esquema  
 : 407F2082-  
 : 11/04/11 De 13  
 Suministrado por:  
 : 407F2082-  
 : 11/04/11 De 13  
 Descripción Componentes  
 : 407F2082-  
 : 11/04/11 De 13  
 Aprobado  
 : 27/08  
 Revisado  
 : 27/08  
 Emitido  
 : 27/08  
 Firmado  
 : 27/08  
 Fidej.


21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1

NOMBRE NAME	DESCRIPCION DESCRIPTION
REC3H	RECTIFICADOR CABINA CABIN RECTIFIER
S	CONTACTOR ELEVACION SUBIR HOISTING CONTACTOR
SG	INTERRUPTOR GENERAL GENERAL INTERRUPTOR SWITCH
ST1	RELE SONDA TERMICA MOTOR CARGA THERMOC SONDE RELAY TROLLEY MOTOR
STCA	SONDA TERMICA CABINA CABIN THERMICAL SONDE
STF	RELE SONDA TERMICA MOTOR ELEVACION THERMOC SONDE RELAY HOISTING MOTOR
STF1	SONDA TERMICA 1 MOTOR ELEVACION HOIST MOTOR THERMAL LINE 1
STF2	SONDA TERMICA 2 MOTOR ELEVACION HOIST MOTOR THERMAL LINE 2
STEX	RELE SONDA TERMICA EXTERIOR OUTSIDE THERMICAL SONDE RELAY
STG	RELE SONDA TERMICA MOTOR GIRO SLEWING MOTOR THERMIC COUPLE RELAY
STG1	SONDA TERMICA MOTOR GIRO 1 THERMAL LINE SLEWING MOTOR 1
STG2	SONDA TERMICA MOTOR GIRO 2 SLEWING 2 MOTOR THERMICAL SONDE
STX	SONDA TERMICA EXTERIOR OUTSIDE THERMICAL SONDE
SC	PULSADOR SUBIR EQUIPO DE MONTAJE MONTAGE GROUP UP PUSH BUTTON
T1	TRANSFORMADOR MANIOBRA O MANIOBRA/TALENZIZADOR GIRO CONTROL LINE TRANSFORMER OR CONTROL LINE/EDDY COURSE/PT
T2	TRANSFORMADOR GENERAL GENERAL TRANSFORMER
T3	TRANSFORMADOR SERVICIO SERVICE TRANSFORMER
T4	TRANSFORMADOR CABINA CABIN TRANSFORMER
TBO	TEMPORIZADOR BOCHNA HOOKER TIMER
TR	TERMOSTATO ARMARIO ELECTRICO CIPHERBOARD THERMOSTAT
UAA	UNIDAD AIRE ACONDICIONADO EQUIPPED AIR SYSTEM
UI12.45	DISPLAY INDICADORES INDICATORS DISPLAY

6th Ed. de			No. de Documento: U-11-3744		Actualizado por:
N.º de Hoja: 2			DESCRIPCION COMPONENTES		G. N. RUIZ RAY-CET
Fecha:	Revisada:	Fabricada:	J. Simón COCOLANDA		
27/28	27/28	27/28			
Firma:	Fecha:				

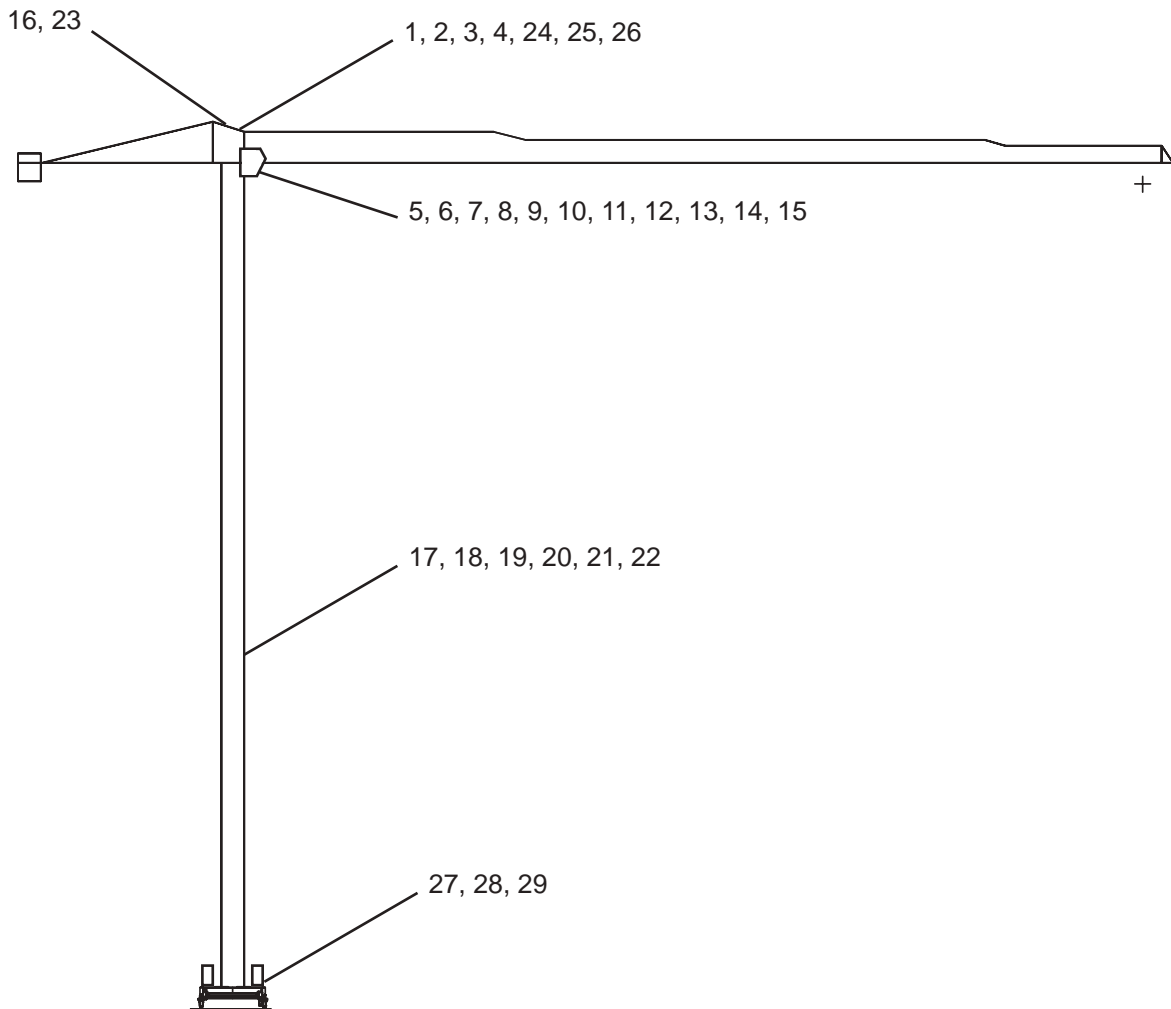
21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

NOMBRE NAME	DESCRIPCION DESCRIPTION
VA	MOTOR VENTILACION ARMARIO CLIPBOARD VENTILATION MOTOR
VB	CONTACTOR VENTILACION ELEVACION HOIST VENTILATION CONTACTOR
VC	CONTACTOR VENTILACION GIRO SLEWING FAN CONTACTOR
XI	BORNERO ARMARIO CARGADERO O MANIOBRA GENERAL OR TROLLEY SLEWING CLIPBOARD TERMINAL-BOX
XII	BORNERO ARMARIO ELEVACION O POTENCIA POWER OR EXISTING CLIPBOARD TERMINAL-BOX

ESQUEMA N°		1407/2080-	
Señalado por:		Page 13 of 13	
GENERAL LFP-0117			
Título: FU 24/37M4		DESCRIPCION COMPONENTES	
		COMARMA	
Dibujado	Revisado	Habrado	
27/08	27/20	27/08	
J. Pérez	J. Pérez	J. Pérez	







<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>P. / S.</i>
1	160 0251 A ES	ARMARIO ELECTRICO	ARMOIRE ELECTRIQ.	CONTROL CABINET	SCHALTSCHRANK	1
2	160 0284 A ES	ARMARIO ELECTRICO	ARMOIRE ELECTRIQ.	CONTROL CABINET	SCHALTSCHRANK	1
3	160 0253 A ES	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
4	160 0281 A ES	RESISTENCIA	RESISTANCE	RESISTANCE	WIDERSTAND	1
5	160 0255 A ES	CABINA CHAPA	CABINE	CABIN	KABINE	1
6	160 0256 A ES	CABINA CHAPA	CABINE	CABIN	KABINE	1
7	160 0257 A ES	CABINA CHAPA	CABINE	CABIN	KABINE	1
8	160 0258 A ES	CABINA CHAPA	CABINE	CABIN	KABINE	1
9	160 0259 A ES	CABINA CHAPA	CABINE	CABIN	KABINE	1
10	160 0260 A ES	CABINA CHAPA	CABINE	CABIN	KABINE	1
11	160 0261 A ES	CABINA CHAPA	CABINE	CABIN	KABINE	1
12	160 0262 A ES	ASIENTO CON MAND.	SIEGE DE CONTROLE	CONTROL CABIN SEA	SITZ MIT STEUERUN	1
13	160 0263 A ES	CONJ. INDICADORES	INDICATEURS CABIN	CABIN INDICATORS	KABINENANZEIGE	1
14	160 0264 A ES	CONJ. INDICADORES	INDICATEURS CABIN	CABIN INDICATORS	KABINENANZEIGE	1
15	160 0265 A ES	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
16	160 0246 A ES	ANEMOMETRO	ANEMOMETRE	ANEMOMETER	WINDMESSER	1
17	160 0266 A ES	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
18	160 0267 A ES	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
19	160 0268 A ES	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
20	160 0269 A ES	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
21	160 0270 A ES	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
22	160 0271 A ES	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
23	160 0278 A ES	ANEMOMETRO	ANEMOMETRE	ANEMOMETER	WINDMESSER	1
24	160 0272 A ES	RADIO CONTROL	RADIO CONTROLE	RADIO CONTROL	FUNKSTEUERUNG	1
25	160 0273 A ES	RADIO CONTROL	RADIO CONTROLE	RADIO CONTROL	FUNKSTEUERUNG	1
26	160 0274 A ES	RADIO CONTROL	RADIO CONTROLE	RADIO CONTROL	FUNKSTEUERUNG	1
27	160 0275 A ES	TELEMANDO	TELECOMMANDE	REMOTE ONTROL	FERNSTEUERUNG	1
28	160 0276 A ES	TRASLACION	TRANSLATION	TRAVELLING	FAHRWERK	1
29	160 0056 B ES	TRASLACION	TRANSLATION	TRAVELLING	FAHRWERK	1



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1408P30790	ARMARIO CHAPA	ARMOIRE VIDE	CUBICLE	METALLSCHRANK	1
2	1407P70050	ETIQUETA	ETIQUETTE	MARKING PLATE	BESCHILDERUNG	1
3	TCTE.0101	ENCHUFE	PRISE DE COURANT	POWER SOCKET	STECKER	1
4	CTOR.0001	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
5	CTOR.0023	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
6	CTOR.0024	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	2
7	CTOR.2023	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
8	PNSA.A025	TAPON	BOUCHON	PLUG	STÖPSEL	1
9	SIRG.0001	SIRGA	CABLE DE LEVAGE	HOISTING CABLE	HUBSEIL	500
10	1408P30421	EMBUDO PASACABLES	PASSE-FIL	CABLE BUSH	KABELTRICHTER	4
11	VENT.1011	VENTILADOR	VENTILATEUR	VENTILATOR	LÜFTER	2
12	VENT.A001	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	2
13	VENT.A002	FILTRO	FILTRE	FILTER	FILTER	1
14	1408P30791	ARMARIO CHAPA	ARMOIRE VIDE	CUBICLE	METALLSCHRANK	1
15	1408P30792	ARMARIO CHAPA	ARMOIRE VIDE	CUBICLE	METALLSCHRANK	1
16	LAMP.0100	LAMPARA	LAMPE	LAMP	LAMPE	1
17	CTOR.A003	TORNILLO	VIS	SCREW	SCHRAUBE	4
25	VDOR.1252F	BLOQUE POTENCIA	BLOC DE PUISSANCE	POWER BLOCK	LEISTUNGSBLOCK	2
26	TRTA.0201F	TARJETA CONTROL	CARTE DE CONTROLE	CONTROL CARD	KONTROLLKARTE	1
27	RECT.1014	RECTIFICADOR	REDRESSEUR	RECTIFIER	GLEICHRICHTER	1
28	RCIA.5016	RESISTENCIA	RESISTANCE	RESISTANCE	WIDERSTAND	1
29	INTE.3510	INTERRUPTOR	INTERRUPTEUR	SWITCH	AUSSCHALTER	1
30	INTE.A201	MANETA	MANETTE	HANDLE	SCHALTHEBEL	1
31	INTE.A301	CUBREBORNE	COUVERCLE	TERMINAL COVER	KLEMMSCHUTZ	1
32	INTE.A321	CUBREBORNE	COUVERCLE	TERMINAL COVER	KLEMMSCHUTZ	1
33	VDOR.3414	CONVERTIDOR FREC.	CONVERT. FREQUEC.	FREQUENCY INVERT.	FREQUENZUMFORMER	1
34	VDOR.A055	UNIDAD FRENADO	UNITE FREIN	BRAKE UNIT	BREMSEINHEIT	1
35	TDOR.5465E	TRASFORMADOR	TRANSFORMATEUR	TRANSFORMER	TRANSFORMATOR	1
36	TDOR.1163E	TRASFORMADOR	TRANSFORMATEUR	TRANSFORMER	TRANSFORMATOR	1
37	CONT.A009	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
38	CONT.0605	CONTACTOR	CONTACTEUR	CONTACTOR	SCHÜTZ	1
39	CONT.A023	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
40	CONT.A302	CUBREBORNE	COUVERCLE	TERMINAL COVER	KLEMMSCHUTZ	1
41	CONT.A044	BOBINA	BOBINE	COIL	SPULE	1
42	INMT.0013	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1
43	INMT.1602	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	2
44	INMT.1610	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1
45	INMT.A008	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	3
46	INMT.1410	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1
47	INMT.0026	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	2
48	INMT.0014	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1
49	INMT.1503	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	2
50	INMT.1514	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1
51	INMT.A024	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
52	INMT.1501	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1
53	INMT.0032	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1
54	INMT.A032	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
55	TCTE.4003	ENCHUFE	PRISE DE COURANT	POWER SOCKET	STECKER	1
56	PULS.0025	PULSADOR	POUSSOIR	PUSHBUTTON	TASTER	1
57	GUIA.A005	SOPORTE	SUPPORT	SUPPORT	HALTER	1
58	INMT.0021	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1
59	INMT.A024	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
60	INVR.0602	INVERSOR	CONTACTEUR INVER.	REVERSING CONTACT	UMSCHALTER	1
61	PFUS.0013	PORTAFUSIBLE	PORTE-FUSIBLE	FUSE HOLDER	SICHERUNGSTRÄGER	1
62	FBLE.0209	FUSIBLE	FUSIBLE	FUSE	SICHERUNG	3
63	PFUS.0012	PORTAFUSIBLE	PORTE-FUSIBLE	FUSE HOLDER	SICHERUNGSTRÄGER	1
64	FBLE.0106	FUSIBLE	FUSIBLE	FUSE	SICHERUNG	3
65	CONT.0511	CONTACTOR	CONTACTEUR	CONTACTOR	SCHÜTZ	2

Nº	Referencia	Designación	Designation	Designation	Benennung	Q
66	CONT.A004	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
67	CONT.A012	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	3
68	CONT.0512	CONTACTOR	CONTACTEUR	CONTACTOR	SCHÜTZ	9
69	CONT.A023	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
70	CONT.A001	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	3
71	TERM.0002	TERMOESTATO	THERMOSTAT	THERMOSTAT	THERMOSTAT	1
72	CONT.0501	CONTACTOR	CONTACTEUR	CONTACTOR	SCHÜTZ	4
73	RELE.9999/24	RELE	RELAIS	RELAY	RELAIS	2
74	RELE.1105	RELE TERMICO	RELAIS THERMIQUE	THERMAL RELAY	THERMORELAIS	1
75	CONT.A026	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
76	RELE.0200	RELE	RELAIS	RELAY	RELAIS	1
77	CONT.A024	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
78	RELE.1111	RELE	RELAIS	RELAY	RELAIS	1
79	RELE.5002	RELE	RELAIS	RELAY	RELAIS	1
80	BRNE.A954	BORNA	BORNE	TERMINAL	KLEMME	1
82	1407P35236	REGLETERO	BORNIER	TERMINAL STRIP	KLEMMLEISTE	1
83	GUIA.A001	SOPORTE	SUPPORT	SUPPORT	HALTER	2
84	GUIA.A002	SOPORTE	SUPPORT	SUPPORT	HALTER	4
85	BRNE.A130	BORNA	BORNE	TERMINAL	KLEMME	500
86	BRNE.1300	BORNA	BORNE	TERMINAL	KLEMME	2
87	1408P30661	ETIQUETA	ETIQUETTE	MARKING PLATE	BESCHILDERUNG	1
88	BRNE.A953	BORNA	BORNE	TERMINAL	KLEMME	1
90	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	745
91	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	675
92	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	675
93	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	515
94	CLTA.0010	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	745
95	CLTA.0009	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	763
96	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	335
97	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	763
98	CLTA.0009	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	185
99	GUIA.0001	GUIA	GUIDE	GUIDE	FÜHRUNG	675
100	GUIA.0001	GUIA	GUIDE	GUIDE	FÜHRUNG	675
101	GUIA.0001	GUIA	GUIDE	GUIDE	FÜHRUNG	515
102	GUIA.0001	GUIA	GUIDE	GUIDE	FÜHRUNG	515
104	INMT.0025	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1





Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1408P30790	ARMARIO CHAPA	ARMOIRE VIDE	CUBICLE	METALLSCHRANK	1
2	1407P70050	ETIQUETA	ETIQUETTE	MARKING PLATE	BESCHILDERUNG	1
3	1408P30421	EMBUDO PASACABLES	PASSE-FIL	CABLE BUSH	KABELTRICHTER	3
4	VENT.1011	VENTILADOR	VENTILATEUR	VENTILATOR	LÜFTER	2
5	VENT.A001	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	2
6	VENT.A002	FILTRO	FILTRE	FILTER	FILTER	1
7	1408P30793	ARMARIO CHAPA	ARMOIRE VIDE	CUBICLE	METALLSCHRANK	1
8	1408P30792	ARMARIO CHAPA	ARMOIRE VIDE	CUBICLE	METALLSCHRANK	1
9	LAMP.0100	LAMPARA	LAMPE	LAMP	LAMPE	1
10	CTOR.A003	TORNILLO	VIS	SCREW	SCHRAUBE	4
11	CTOR.0001	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	2
20	RCIA.5016	RESISTENCIA	RESISTANCE	RESISTANCE	WIDERSTAND	1
21	VDOR.3422	CONVERTIDOR FREC.	CONVERT. FREQUEC.	FREQUENCY INVERT.	FREQUENZUMFORMER	1
22	VDOR.A055	UNIDAD FRENADO	UNITE FREIN	BRAKE UNIT	BREMSEINHEIT	1
23	VDOR.A423	FILTRO	FILTRE	FILTER	FILTER	1
24	INMT.1515	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1
25	INMT.A008	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
26	RECT.1009	RECTIFICADOR	REDRESSEUR	RECTIFIER	GLEICHRICHTER	1
27	INMT.0042	INTERRUPTOR MAGN.	DISJONCTEUR	CIRCUIT BREAKER	MAGNETSCHALTER	1
28	INMT.A032	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
29	PULS.0025	PULSADOR	POUSSOIR	PUSHBUTTON	TASTER	1
30	GUIA.A005	SOPORTE	SUPPORT	SUPPORT	HALTER	2
31	PULS.A008	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
32	CONM.0010	CONMUTADOR	COMMUTATEUR	SWITCH	UMSCHALTER	1
33	TCTE.4003	ENCHUFE	PRISE DE COURANT	POWER SOCKET	STECKER	1
34	AUTO.0002	AUTOMATA	AIUTOMATE	PLC	SPS	1
35	CONT.0512	CONTACTOR	CONTACTEUR	CONTACTOR	SCHÜTZ	20
36	CONT.A007	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	2
37	CONT.A006	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
38	CONT.0902	CONTACTOR	CONTACTEUR	CONTACTOR	SCHÜTZ	1
39	RELE.9999/24	RELE	RELAIS	RELAY	RELAIS	2
40	RELE.1105	RELE TERMICO	RELAIS THERMIQUE	THERMAL RELAY	THERMORELAIS	1
41	CONT.0501	CONTACTOR	CONTACTEUR	CONTACTOR	SCHÜTZ	1
42	CONT.A025	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
43	CONT.A013	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	4
44	CONT.A016	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	4
45	CONT.A012	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
46	CONT.0511	CONTACTOR	CONTACTEUR	CONTACTOR	SCHÜTZ	5
47	CONT.A001	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	2
48	CONT.A005	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
49	CONT.A006	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
50	CONT.A002	CONTACTO AUXILIAR	CONTACT AUXILIAIR	AUXILIARY CONTACT	HILFSKONTAKT	1
51	1407P35237	REGLETERO	BORNIER	TERMINAL STRIP	KLEMMLEISTE	1
52	GUIA.A001	SOPORTE	SUPPORT	SUPPORT	HALTER	2
53	GUIA.A002	SOPORTE	SUPPORT	SUPPORT	HALTER	4
54	BRNE.1300	BORNA	BORNE	TERMINAL	KLEMME	2
55	BRNE.A130	BORNA	BORNE	TERMINAL	KLEMME	500
56	1408P30661	ETIQUETA	ETIQUETTE	MARKING PLATE	BESCHILDERUNG	1
57	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	500
58	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	420
59	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	420
60	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	420
61	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	420
62	CLTA.0010	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	940
63	CLTA.0009	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	900
64	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	860
65	CLTA.0008	CANALETA	GOULOTTE CABLES	CABLE DUCT	KABELKANAL	860
66	GUIA.0001	GUIA	GUIDE	GUIDE	FÜHRUNG	420



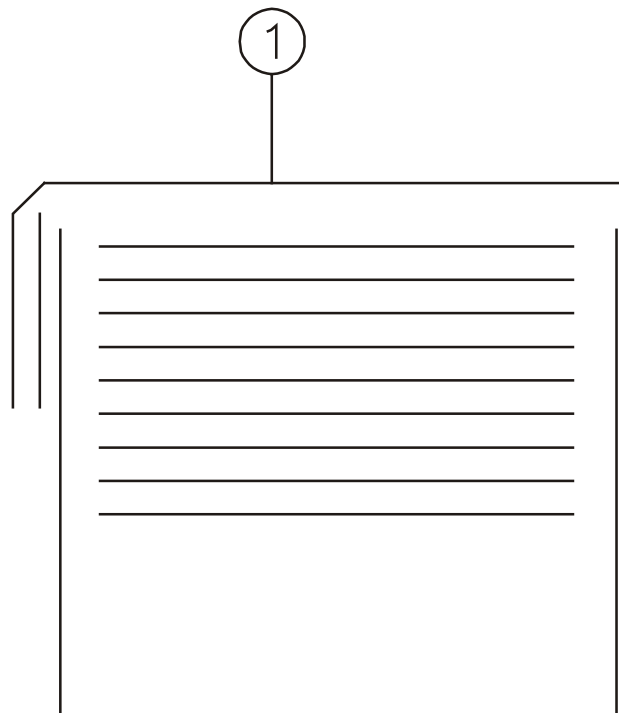
<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
67	GUIA.0001	GUIA	GUIDE	GUIDE	FÜHRUNG	420
68	GUIA.0001	GUIA	GUIDE	GUIDE	FÜHRUNG	420
69	GUIA.0001	GUIA	GUIDE	GUIDE	FÜHRUNG	420
70	GUIA.0001	GUIA	GUIDE	GUIDE	FÜHRUNG	420
71	BRNE.A952	BORNA	BORNE	TERMINAL	KLEMME	7
72	1408P30780	ETIQUETA	ETIQUETTE	MARKING PLATE	BESCHILDERUNG	1

&amp;A7880.19V&amp;A 757.07H29/08





Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	091205080035088	TORNILLO	VIS	SCREW	SCHRAUBE	6
2	091205080045088	TORNILLO	VIS	SCREW	SCHRAUBE	12
3	093306100016088	TORNILLO	VIS	SCREW	SCHRAUBE	2
4	093306100025088	TORNILLO	VIS	SCREW	SCHRAUBE	2
5	0934050808	TUERCA	ECROU	NUT	MUTTER	18
6	0934061008	TUERCA	ECROU	NUT	MUTTER	4
7	1407P25044	CAJA DERIVACIÓN	BOITE DERIVATION	DISTRIBUTION BOX	KRAFTVERTEILUNG	1
8	1407P61456	MANGUERAS	CABLES	HOSES	KABEL	1
9	ARP5.3F111D125	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	20
10	ARP6.4F111D125	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	4
11	ARS5.3D6798A	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	18
12	ARS6.4D6798A	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	4
13	CTOR.0606	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
14	CTOR.2001	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	3
15	CTOR.2023	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
16	CTOR.2024	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	2
17	CTOR.A003	TORNILLO	VIS	SCREW	SCHRAUBE	10
18	CXON.0054	BOCINA	KLAXON	HORN	HUPE	1
19	LMCV.3122SL35	LIMITADOR CUENTAV	COMPTE TOURS	REV COUNTER LIMIT	ENDABSCHALTER	1
20	LMMC.4002	LIMITADOR POSICI.	FIN DE COURSE	LIMIT SWITCH	GRENZTASTER	2
21	LMMC.4003	LIMITADOR POSICI.	FIN DE COURSE	LIMIT SWITCH	GRENZTASTER	4
22	PNSA.0103M20	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	7
23	PNSA.0104	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	1
24	PNSA.0105	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	2
25	PNSA.0106	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	3
26	PNSA.0108	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	1
27	PNSA.1005	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	1
28	PNSA.A002M20	CODO	COUDE	ELBOW BEND	KRÜMMER	1
29	PULS.0121	PULSADOR	POUSSOIR	PUSHBUTTON	TASTER	1
30	PULS.A311	ETIQUETA	ETIQUETTE	MARKING PLATE	BESCHILDERUNG	1
31	TCTE.0201	TOMA CORRIENTE	PRISE DE COURANT	PLUG IN SOCKET	STECKDOSE	1
32	TRCA.0006	TUERCA	ECROU	NUT	MUTTER	1



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<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	RCIA.2028	RESISTENCIA	RESISTANCE	RESISTANCE	WIDERSTAND	1

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<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	1407P60461	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
2	CABI.0001	VIDRIO	VITRE	GLASS	GLAS	2
3	CABI.0002	VIDRIO	VITRE	GLASS	GLAS	2
4	CABI.0003	VIDRIO	VITRE	GLASS	GLAS	1
5	CABI.0005	VIDRIO	VITRE	GLASS	GLAS	1
6	CABI.0010	VIDRIO	VITRE	GLASS	GLAS	1
7	CABI.0050	BRAZO LIMPIAPARA.	BALAI ESSUIE-GLAC	WINDSH. WIPER ARM	SCHEIBENWISCHERAR	2
8	CABI.0055	LIMPIAPARABRISAS	ESSUIE-GLACE	WINDSHIELD WIPER	SCHEIBENWISCHER	2
9	CABI.0060	MOTOR LIMPIAPARA.	MOTEUR ESSUIE-GLA	WIND.WIPER ENGINE	SCHEIBENWIS.MOTOR	2
10	CABI.0151	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
11	CABI.0154	MANETA	MANETTE	HANDLE	SCHALTHEBEL	1
12	CABI.0155	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
13	CABI.0201	PLAFON	PLAFONNIER	SOFFIT	SOFFIT	1
14	CABI.0202	LAMPARA	LAMPE	LAMP	LAMPE	2
15	CABI.0203	RADIO	RADIO	RADIO	RADIO	1
16	CABI.0204	ALTAVOZ	HAUT-PARLEUR	SPEAKER	LAUTSPRECHER	1
17	CABI.0205	ANTENA	ANTENNE	AERIAL	ANTENNE	1
18	CABI.0206	FUENTE ALIMENTAC.	SOURCE ALIMENTAT.	POWER SUPPLY	SPANNUNGSQUELLE	1
19	CABI.0801	AMORTIGUADOR	AMORTISSEUR	DAMPER	DAEMPFER	1
20	CABI.0803	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
21	CABI.0804	EXTINTOR	EXTINCTEUR	EXTINGUISHER	FEUERLÖSCHER	1
22	1407P70203	BASTIDOR	CHASSIS	FRAME	RAHMEN	1





Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1407P60461	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
2	CABI.0001	VIDRIO	VITRE	GLASS	GLAS	2
3	CABI.0002	VIDRIO	VITRE	GLASS	GLAS	2
4	CABI.0003	VIDRIO	VITRE	GLASS	GLAS	1
5	CABI.0005	VIDRIO	VITRE	GLASS	GLAS	1
6	CABI.0010	VIDRIO	VITRE	GLASS	GLAS	1
7	CABI.0050	BRAZO LIMPIAPARA.	BALAI ESSUIE-GLAC	WINDSH. WIPER ARM	SCHEIBENWISCHERAR	2
8	CABI.0055	LIMPIAPARABRISAS	ESSUIE-GLACE	WINDSHIELD WIPER	SCHEIBENWISCHER	2
9	CABI.0060	MOTOR LIMPIAPARA.	MOTEUR ESSUIE-GLA	WIND.WIPER ENGINE	SCHEIBENWIS.MOTOR	2
10	CABI.0151	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
11	CABI.0154	MANETA	MANETTE	HANDLE	SCHALTHEBEL	1
12	CABI.0155	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
13	CABI.0201	PLAFON	PLAFONNIER	SOFFIT	SOFFIT	1
14	CABI.0202	LAMPARA	LAMPE	LAMP	LAMPE	2
15	CABI.0203	RADIO	RADIO	RADIO	RADIO	1
16	CABI.0204	ALTAVOZ	HAUT-PARLEUR	SPEAKER	LAUTSPRECHER	1
17	CABI.0205	ANTENA	ANTENNE	AERIAL	ANTENNE	1
18	CABI.0206	FUENTE ALIMENTAC.	SOURCE ALIMENTAT.	POWER SUPPLY	SPANNUNGSQUELLE	1
19	CABI.0801	AMORTIGUADOR	AMORTISSEUR	DAMPER	DAEMPFER	1
20	CABI.0803	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
21	CABI.0804	EXTINTOR	EXTINCTEUR	EXTINGUISHER	FEUERLÖSCHER	1
22	CABI.0207	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
23	1407P70203	BASTIDOR	CHASSIS	FRAME	RAHMEN	1



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1407P60461	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
2	CABI.0001	VIDRIO	VITRE	GLASS	GLAS	2
3	CABI.0002	VIDRIO	VITRE	GLASS	GLAS	2
4	CABI.0003	VIDRIO	VITRE	GLASS	GLAS	1
5	CABI.0005	VIDRIO	VITRE	GLASS	GLAS	1
6	CABI.0010	VIDRIO	VITRE	GLASS	GLAS	1
7	CABI.0050	BRAZO LIMPIAPARA.	BALAI ESSUIE-GLAC	WINDSH. WIPER ARM	SCHEIBENWISCHERAR	2
8	CABI.0055	LIMPIAPARABRISAS	ESSUIE-GLACE	WINDSHIELD WIPER	SCHEIBENWISCHER	2
9	CABI.0060	MOTOR LIMPIAPARA.	MOTEUR ESSUIE-GLA	WIND.WIPER ENGINE	SCHEIBENWIS.MOTOR	2
10	CABI.0151	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
11	CABI.0154	MANETA	MANETTE	HANDLE	SCHALTHEBEL	1
12	CABI.0155	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
13	CABI.0201	PLAFON	PLAFONNIER	SOFFIT	SOFFIT	1
14	CABI.0202	LAMPARA	LAMPE	LAMP	LAMPE	2
15	CABI.0203	RADIO	RADIO	RADIO	RADIO	1
16	CABI.0204	ALTAVOZ	HAUT-PARLEUR	SPEAKER	LAUTSPRECHER	1
17	CABI.0205	ANTENA	ANTENNE	AERIAL	ANTENNE	1
18	CABI.0206	FUENTE ALIMENTAC.	SOURCE ALIMENTAT.	POWER SUPPLY	SPANNUNGSQUELLE	1
19	CABI.0801	AMORTIGUADOR	AMORTISSEUR	DAMPER	DAEMPFER	1
20	CABI.0803	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
21	CABI.0804	EXTINTOR	EXTINCTEUR	EXTINGUISHER	FEUERLÖSCHER	1
22	CABI.0208	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
23	1407P70203	BASTIDOR	CHASSIS	FRAME	RAHMEN	1



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	CABI.0001	VIDRIO	VITRE	GLASS	GLAS	2
2	CABI.0002	VIDRIO	VITRE	GLASS	GLAS	2
3	CABI.0004	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
4	CABI.0006	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
5	CABI.0010	VIDRIO	VITRE	GLASS	GLAS	1
6	CABI.0050	BRAZO LIMPIAPARA.	BALAI ESSUIE-GLAC	WINDSH. WIPER ARM	SCHEIBENWISCHERAR	2
7	CABI.0055	LIMPIAPARABRISAS	ESSUIE-GLACE	WINDSHIELD WIPER	SCHEIBENWISCHER	2
8	CABI.0060	MOTOR LIMPIAPARA.	MOTEUR ESSUIE-GLA	WIND.WIPER ENGINE	SCHEIBENWIS.MOTOR	2
9	CABI.0151	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
10	CABI.0154	MANETA	MANETTE	HANDLE	SCHALTHEBEL	1
11	CABI.0155	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
12	CABI.0201	PLAFON	PLAFONNIER	SOFFIT	SOFFIT	1
13	CABI.0202	LAMPARA	LAMPE	LAMP	LAMPE	2
14	CABI.0801	AMORTIGUADOR	AMORTISSEUR	DAMPER	DAEMPFER	1
15	CABI.0803	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
16	CABI.0804	EXTINTOR	EXTINCTEUR	EXTINGUISHER	FEUERLÖSCHER	1
17	1407P70202	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
18	CALF.0001	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
19	1408P30752	CHAPA SOPORTE	PLAQUE SUPPORT	SUPPORT PLATE	BLECHSTÜTZE	1



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1407P60461	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
2	CABI.0001	VIDRIO	VITRE	GLASS	GLAS	2
3	CABI.0002	VIDRIO	VITRE	GLASS	GLAS	2
4	CABI.0004	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
5	CABI.0006	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
6	CABI.0010	VIDRIO	VITRE	GLASS	GLAS	1
7	CABI.0050	BRAZO LIMPIAPARA.	BALAI ESSUIE-GLAC	WINDSH. WIPER ARM	SCHEIBENWISCHERAR	2
8	CABI.0055	LIMPIAPARABRISAS	ESSUIE-GLACE	WINDSHIELD WIPER	SCHEIBENWISCHER	2
9	CABI.0060	MOTOR LIMPIAPARA.	MOTEUR ESSUIE-GLA	WIND.WIPER ENGINE	SCHEIBENWIS.MOTOR	2
10	CABI.0151	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
11	CABI.0154	MANETA	MANETTE	HANDLE	SCHALTHEBEL	1
12	CABI.0155	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
13	CABI.0201	PLAFON	PLAFONNIER	SOFFIT	SOFFIT	1
14	CABI.0202	LAMPARA	LAMPE	LAMP	LAMPE	2
15	CABI.0801	AMORTIGUADOR	AMORTISSEUR	DAMPER	DAEMPFER	1
16	CABI.0803	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
17	CABI.0804	EXTINTOR	EXTINCTEUR	EXTINGUISHER	FEUERLÖSCHER	1
18	1407P70202	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
19	1408P30757	CABINA CHAPA	CABINE	CABIN	KABINE	1





Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1407P60461	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
2	CABI.0001	VIDRIO	VITRE	GLASS	GLAS	2
3	CABI.0002	VIDRIO	VITRE	GLASS	GLAS	2
4	CABI.0004	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
5	CABI.0006	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
6	CABI.0010	VIDRIO	VITRE	GLASS	GLAS	1
7	CABI.0050	BRAZO LIMPIAPARA.	BALAI ESSUIE-GLAC	WINDSH. WIPER ARM	SCHEIBENWISCHERAR	2
8	CABI.0055	LIMPIAPARABRISAS	ESSUIE-GLACE	WINDSHIELD WIPER	SCHEIBENWISCHER	2
9	CABI.0060	MOTOR LIMPIAPARA.	MOTEUR ESSUIE-GLA	WIND.WIPER ENGINE	SCHEIBENWIS.MOTOR	2
10	CABI.0151	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
11	CABI.0154	MANETA	MANETTE	HANDLE	SCHALTHEBEL	1
12	CABI.0155	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
13	CABI.0201	PLAFON	PLAFONNIER	SOFFIT	SOFFIT	1
14	CABI.0202	LAMPARA	LAMPE	LAMP	LAMPE	2
15	CABI.0801	AMORTIGUADOR	AMORTISSEUR	DAMPER	DAEMPFER	1
16	CABI.0803	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
17	CABI.0804	EXTINTOR	EXTINCTEUR	EXTINGUISHER	FEUERLÖSCHER	1
18	CABI.0207	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
19	1407P70202	BASTIDOR	CHASSIS	FRAME	RAHMEN	1



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1407P60461	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
2	CABI.0001	VIDRIO	VITRE	GLASS	GLAS	2
3	CABI.0002	VIDRIO	VITRE	GLASS	GLAS	2
4	CABI.0004	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
5	CABI.0006	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
6	CABI.0010	VIDRIO	VITRE	GLASS	GLAS	1
7	CABI.0050	BRAZO LIMPIAPARA.	BALAI ESSUIE-GLAC	WINDSH. WIPER ARM	SCHEIBENWISCHERAR	2
8	CABI.0055	LIMPIAPARABRISAS	ESSUIE-GLACE	WINDSHIELD WIPER	SCHEIBENWISCHER	2
9	CABI.0060	MOTOR LIMPIAPARA.	MOTEUR ESSUIE-GLA	WIND.WIPER ENGINE	SCHEIBENWIS.MOTOR	2
10	CABI.0151	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
11	CABI.0154	MANETA	MANETTE	HANDLE	SCHALTHEBEL	1
12	CABI.0155	CERRADURA	SERRURE	DOOR HANDLE LOCK	SCHLOSS	1
13	CABI.0201	PLAFON	PLAFONNIER	SOFFIT	SOFFIT	1
14	CABI.0202	LAMPARA	LAMPE	LAMP	LAMPE	2
15	CABI.0801	AMORTIGUADOR	AMORTISSEUR	DAMPER	DAEMPFER	1
16	CABI.0803	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
17	CABI.0804	EXTINTOR	EXTINCTEUR	EXTINGUISHER	FEUERLÖSCHER	1
18	CABI.0207	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	1
19	1407P70202	BASTIDOR	CHASSIS	FRAME	RAHMEN	1





Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	ASTO.0201	ASIENTO CABINA	SIEGE CABINE	CABIN SEAT	KABINENSITZ	1
2	ASTO.A009	SONDA	SONDE	SENSOR	SENSOR	1
6	ASTO.A004	VENTILADOR	VENTILATEUR	VENTILATOR	LÜFTER	1
7	ASTO.A005	CALEFACCION	CHAUFFAGE	HEATER	HEIZUNG	2
8	ASTO.A003	REJILLA	GRILLE	GRILL	SCHUTZGITTER	2
9	PNSA.0103M20	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	6
10	ASTO.A007	REGLETERO	BORNIER	TERMINAL STRIP	KLEMMLEISTE	1
12	PNSA.0107M32	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	2
13	COMB.2015	COMBINADOR	COMBINA TEUR	JOY-STICK	MEISTERSCHALTER	1
14	COMB.2016	COMBINADOR	COMBINA TEUR	JOY-STICK	MEISTERSCHALTER	1
15	CONM.2001	CONMUTADOR	COMMUTATEUR	SWITCH	UMSCHALTER	1
16	PILO.0305	PILOTO	VOYANT LUMINEUX	INDICATOR LAMP	KONTROLLLEUCHTE	1
17	PILO.A305	PILOTO	VOYANT LUMINEUX	INDICATOR LAMP	KONTROLLLEUCHTE	1
18	PILO.0304	PILOTO	VOYANT LUMINEUX	INDICATOR LAMP	KONTROLLLEUCHTE	1
19	PILO.A304	PILOTO	VOYANT LUMINEUX	INDICATOR LAMP	KONTROLLLEUCHTE	1
20	PULS.0022	PULSADOR	POUSSOIR	PUSHBUTTON	TASTER	3
21	PULP.0001	PULSADOR	POUSSOIR	PUSHBUTTON	TASTER	1
22	PULS.0111	PULSADOR	POUSSOIR	PUSHBUTTON	TASTER	1
23	PULS.A007	MANETA	MANETTE	HANDLE	SCHALTHEBEL	1
24	CONM.0001	CONMUTADOR	COMMUTATEUR	SWITCH	UMSCHALTER	1
25	PULP.0002	PULSADOR	POUSSOIR	PUSHBUTTON	TASTER	1
26	ASTO.A002	TERMOESTATO	THERMOSTAT	THERMOSTAT	THERMOSTAT	1
27	CONM.0102	CONMUTADOR	COMMUTATEUR	SWITCH	UMSCHALTER	1
30	CTOR.2706	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
31	PNSA.0057	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	1
32	RCON.0016	REDUCCION	REDUCTION	REDUCER	VERRINGERUNG	1







<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	INDI.0200	UNIDAD CENTRAL	UNITE CENTRALE	CENTRAL UNIT	KOMPLETTER SATZ	1
2	INDI.0235	CABLE ELECTRICO	CABLE ELECTRIQUE	CABLE	ELEKTROKABEL	1
3	INDI.0230	FUENTE ALIMENTAC.	SOURCE ALIMENTAT.	POWER SUPPLY	SPANNUNGSQUELLE	1
4	INDI.0210	CELULA DE CARGA	CELLULE DE CHARGE	LOAD CELL	LASTZELLE	1
6	INDI.0215	DETECTOR PROXIMI.	DETECT. PROXIMITE	PROXIMITY DETECT.	NÄHERUNGSSCHALTER	1
7	INDI.0220	CABLE ELECTRICO	CABLE ELECTRIQUE	CABLE	ELEKTROKABEL	1
9	INDI.A205	LIMITADOR CUENTAV	COMPTE TOURS	REV COUNTER LIMIT	ENDABSCHALTER	1
10	INDI.A200	LIMITADOR CUENTAV	COMPTE TOURS	REV COUNTER LIMIT	ENDABSCHALTER	1
12	INDI.0240	MEMORIA USB	MÉMOIRE USB	USB MEMORY	GEDÄCHTNIS USB	1
13	INDI.0255	SOPORTE	SUPPORT	SUPPORT	HALTER	1
14	INDI.0206	INDICADOR	INDICATEUR	INDICATOR	ANZEIGER	1
15	INDI.A240	CABLE ELECTRICO	CABLE ELECTRIQUE	CABLE	ELEKTROKABEL	2
16	INDI.A255	CABLE ELECTRICO	CABLE ELECTRIQUE	CABLE	ELEKTROKABEL	1
17	INDI.A291	CABLE ELECTRICO	CABLE ELECTRIQUE	CABLE	ELEKTROKABEL	1



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	INDI.A216	LIMITADOR CUENTAV	COMPTE TOURS	REV COUNTER LIMIT	ENDABSCHALTER	1
2	INDI.A250	CABLE ELECTRICO	CABLE ELECTRIQUE	CABLE	ELEKTROKABEL	1
3	INDI.0245	UNIDAD DE RELES	UNITE DE RELAIS	RELAY UNIT	RELAISEINHEIT	1
4	INDI.0250	CABLE ELECTRICO	CABLE ELECTRIQUE	CABLE	ELEKTROKABEL	1



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	1407P61442	CABLE ELECTRICO	CABLE ELECTRIQUE	CABLE	ELEKTROKABEL	1
2	PNSA.0106	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	1
3	CTOR.0603	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1



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<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	1407P11366	ANEMÓMETRO	ANEMOMETRE	ANEMOMETER	WINDMESSER	1

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Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1407P61472-047	MANGUERAS	CABLES	HOSES	KABEL	1
2	1407P25024	CAJA ACOMETIDA	BOITE BRANCHEMENT	CABLE CON. BOX	KABELANSCHL.STUTZ	1
3	1408P30523	SOPORTE	SUPPORT	SUPPORT	HALTER	1
4	1408P30694	SOPORTE	SUPPORT	SUPPORT	HALTER	2
5	1408P30763	SOPORTE	SUPPORT	SUPPORT	HALTER	1
7	PREF.0005	SUJETACABLE	SERRE-CABLE	CABLE HOLDER	KABELKLEMME	3
8	PNSA.0108	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	2
10	0934050808	TUERCA	ECROU	NUT	MUTTER	12
11	ARS4.3D6798A	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	12
12	ARP5.3F111D125	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	12
13	TCTE.2104	TOMA CORRIENTE	PRISE DE COURANT	PLUG IN SOCKET	STECKDOSE	1
14	TCTE.0204	TOMA CORRIENTE	PRISE DE COURANT	PLUG IN SOCKET	STECKDOSE	1
15	RCON.0019	REDUCCION	REDUCTION	REDUCER	VERRINGERUNG	2
16	FBLE.1012	FUSIBLE	FUSIBLE	FUSE	SICHERUNG	9



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1407P61472-058	MANGUERAS	CABLES	HOSES	KABEL	1
2	1407P25024	CAJA ACOMETIDA	BOITE BRANCHEMENT	CABLE CON. BOX	KABELANSCHL.STUTZ	1
3	1408P30523	SOPORTE	SUPPORT	SUPPORT	HALTER	1
4	1408P30694	SOPORTE	SUPPORT	SUPPORT	HALTER	2
5	1408P30763	SOPORTE	SUPPORT	SUPPORT	HALTER	1
7	PREF.0005	SUJETACABLE	SERRE-CABLE	CABLE HOLDER	KABELKLEMME	3
8	PNSA.0108	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	2
10	0934050808	TUERCA	ECROU	NUT	MUTTER	12
11	ARS4.3D6798A	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	12
12	ARP5.3F111D125	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	12
13	TCTE.2104	TOMA CORRIENTE	PRISE DE COURANT	PLUG IN SOCKET	STECKDOSE	1
14	TCTE.0204	TOMA CORRIENTE	PRISE DE COURANT	PLUG IN SOCKET	STECKDOSE	1
15	RCON.0019	REDUCCION	REDUCTION	REDUCER	VERRINGERUNG	2
16	FBLE.1012	FUSIBLE	FUSIBLE	FUSE	SICHERUNG	9



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	1407P61472-063	MANGUERAS	CABLES	HOSES	KABEL	1
2	1407P25024	CAJA ACOMETIDA	BOITE BRANCHEMENT	CABLE CON. BOX	KABELANSCHL.STUTZ	1
3	1408P30523	SOPORTE	SUPPORT	SUPPORT	HALTER	1
4	1408P30694	SOPORTE	SUPPORT	SUPPORT	HALTER	2
5	1408P30763	SOPORTE	SUPPORT	SUPPORT	HALTER	1
7	PREF.0005	SUJETACABLE	SERRE-CABLE	CABLE HOLDER	KABELKLEMME	3
8	PNSA.0108	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	2
10	0934050808	TUERCA	ECROU	NUT	MUTTER	12
11	ARS4.3D6798A	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	12
12	ARP5.3F111D125	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	12
13	TCTE.2104	TOMA CORRIENTE	PRISE DE COURANT	PLUG IN SOCKET	STECKDOSE	1
14	TCTE.0204	TOMA CORRIENTE	PRISE DE COURANT	PLUG IN SOCKET	STECKDOSE	1
15	RCON.0019	REDUCCION	REDUCTION	REDUCER	VERRINGERUNG	2
16	FBLE.1012	FUSIBLE	FUSIBLE	FUSE	SICHERUNG	9



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	CTOR.0606	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
2	CTOR.2706	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
3	1407P61476-047	MANGUERAS	CABLES	HOSES	KABEL	1
4	PNSA.0108	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	2
5	PREF.0006	SUJETACABLE	SERRE-CABLE	CABLE HOLDER	KABELKLEMME	2
6	093305080020088	TORNILLO	VIS	SCREW	SCHRAUBE	4
7	0934050808	TUERCA	ECROU	NUT	MUTTER	4
8	ARG5D127B	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	4
9	1408P30725	SOPORTE	SUPPORT	SUPPORT	HALTER	1





<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	CTOR.0606	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
2	CTOR.2706	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
3	1407P61476-058	MANGUERAS	CABLES	HOSES	KABEL	1
4	PNSA.0108	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	2
5	PREF.0006	SUJETACABLE	SERRE-CABLE	CABLE HOLDER	KABELKLEMME	2
6	093305080020088	TORNILLO	VIS	SCREW	SCHRAUBE	4
7	0934050808	TUERCA	ECROU	NUT	MUTTER	4
8	ARG5D127B	ARANDELA	RONDELLE	WASHER	UNTERLEGSCHIEBE	4
9	1408P30725	SOPORTE	SUPPORT	SUPPORT	HALTER	1



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	CTOR.0606	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
2	CTOR.2706	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
3	1407P61476-063	MANGUERAS	CABLES	HOSES	KABEL	1
4	PNSA.0108	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	2
5	PREF.0006	SUJETACABLE	SERRE-CABLE	CABLE HOLDER	KABELKLEMME	2
6	093305080020088	TORNILLO	VIS	SCREW	SCHRAUBE	4
7	0934050808	TUERCA	ECROU	NUT	MUTTER	4
8	ARG5D127B	ARANDELA	RONDELLE	WASHER	UNTERLEGSCHIEBE	4
9	1408P30725	SOPORTE	SUPPORT	SUPPORT	HALTER	1



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<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	1407P11380	ANEMÓMETRO	ANEMOMETRE	ANEMOMETER	WINDMESSER	1

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<i>Nº Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
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<i>Nº Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
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<i>Nº Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
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<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	CTOR.2706	CONECTOR	CONNECTEUR	CONNECTOR	STECKER	1
2	PNSA.0108	PRENSAESTOPAS	PRESSE-ETOUPE	CABLE GLAND	KABELVERSCHRAUB.	1
3	1407P61469	MANGUERAS	CABLES	HOSES	KABEL	1
4	TELE.2008	TELEMANDO	TELECOMMANDE	REMOTE ONTROL	FERNSTEUERUNG	1
5	1407P70050	ETIQUETA	ETIQUETTE	MARKING PLATE	BESCHILDERUNG	1



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	1407P20262	ARMARIO ELECTRICO	ARMOIRE ELECTRIQ.	CONTROL CABINET	SCHALTSCHRANK	1
2	1407P61066	MANGUERAS	CABLES	HOSES	KABEL	1
3	1407P00763	ESQUEMA ELECTRICO	SCHEMA ELECTRIQUE	CIRCUIT DIAGRAM	SCHALTBILD	1
4	LMMC.0001	LIMITADOR POSICI.	FIN DE COURSE	LIMIT SWITCH	GRENZTASTER	1
5	PREF.0003	SUJETACABLE	SERRE-CABLE	CABLE HOLDER	KABELKLEMME	6
6	1408P30523	SOPORTE	SUPPORT	SUPPORT	HALTER	1
7	1408P30707	SOPORTE	SUPPORT	SUPPORT	HALTER	2





<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	1407P20140	ARMARIO ELECTRICO	ARMOIRE ELECTRIQ.	CONTROL CABINET	SCHALTSCHRANK	1
2	1407P60343	CONJ. MANGUERAS	ENSEMBLE CABLES	CABLE SET	KABELSATZ	1
3	1407P00764	ESQUEMA ELECTRICO	SCHEMA ELECTRIQUE	CIRCUIT DIAGRAM	SCHALTBILD	1
4	1408P30523	SOPORTE	SUPPORT	SUPPORT	HALTER	1
5	1408P30707	SOPORTE	SUPPORT	SUPPORT	HALTER	1
6	PREF.0003	SUJETACABLE	SERRE-CABLE	CABLE HOLDER	KABELKLEMME	4



# MANUFACTURER'S MANUAL

## 5 CRANE OPERATION



Title .....	Ref.	Rev.	Pag.
Frontispiece .....	000 0001 IB	A	1
Table of contents .....	000 0199 IB	A	3
Introduction for the crane operator .....	010 0001 IB	A	5
Symbols .....	010 0002 IB	A	6
Technical data sheet .....	DS.0810.05		7
Load chart .....	020 0027 IB	A	9
Mechanisms specifications .....	030 0108 IB	A	13
Operating instructions .....	040 0001 IB	D	15
Rules for safety .....	050 0001 IB	A	18
Daily checks .....	060 0001 IB	A	19
Commissioning instructions .....	070 0001 IB	A	20
Crane control .....	080 0025 IB	A	21
Crane control .....	080 0026 IB	A	27
Data display unit .....	085 0001 IB	A	33
Reeving system .....	090 0007 IB	A	45
Taking the crane out of service .....	100 0001 IB	B	52
Weather vaning .....	110 0001 IB	C	53
Anemometer .....	110 0004 IB	B	55
Locking of the crane in a fixed position .....	120 0001 IB	A	60
Stopping work because of wind .....	130 0001 IB	B	61
Load surface .....	130 0002 IB	A	62
Inspection and maintenance plan .....	140 0001 IB	A	63
Hand signals for crane operations .....	150 0001 IB	A	67
Slings & tackle .....	160 0001 IB	A	71
Terminals and wire rope clamp .....	160 0002 IB	A	76
Terminology .....	170 0006 IB	A	80



This chapter contains useful information leading to a better crane performance under safety conditions. Read this information thoroughly and bear in mind the recommendations and warnings given herein.

Crane operation is restricted to properly trained and qualified personnel, complying with the applicable regulations and being conversant with the Safety Rules relative to his task. Being familiar with crane operation and operating limits is crane operator responsibility.



***Not complying with the Rules may cause accidents***















Never operate the crane if the **SAFETY SYSTEMS** are not working or work incorrectly. Be always alert toward anomalies in crane performance and immediately report them to the applicable responsible person. The approach should be:

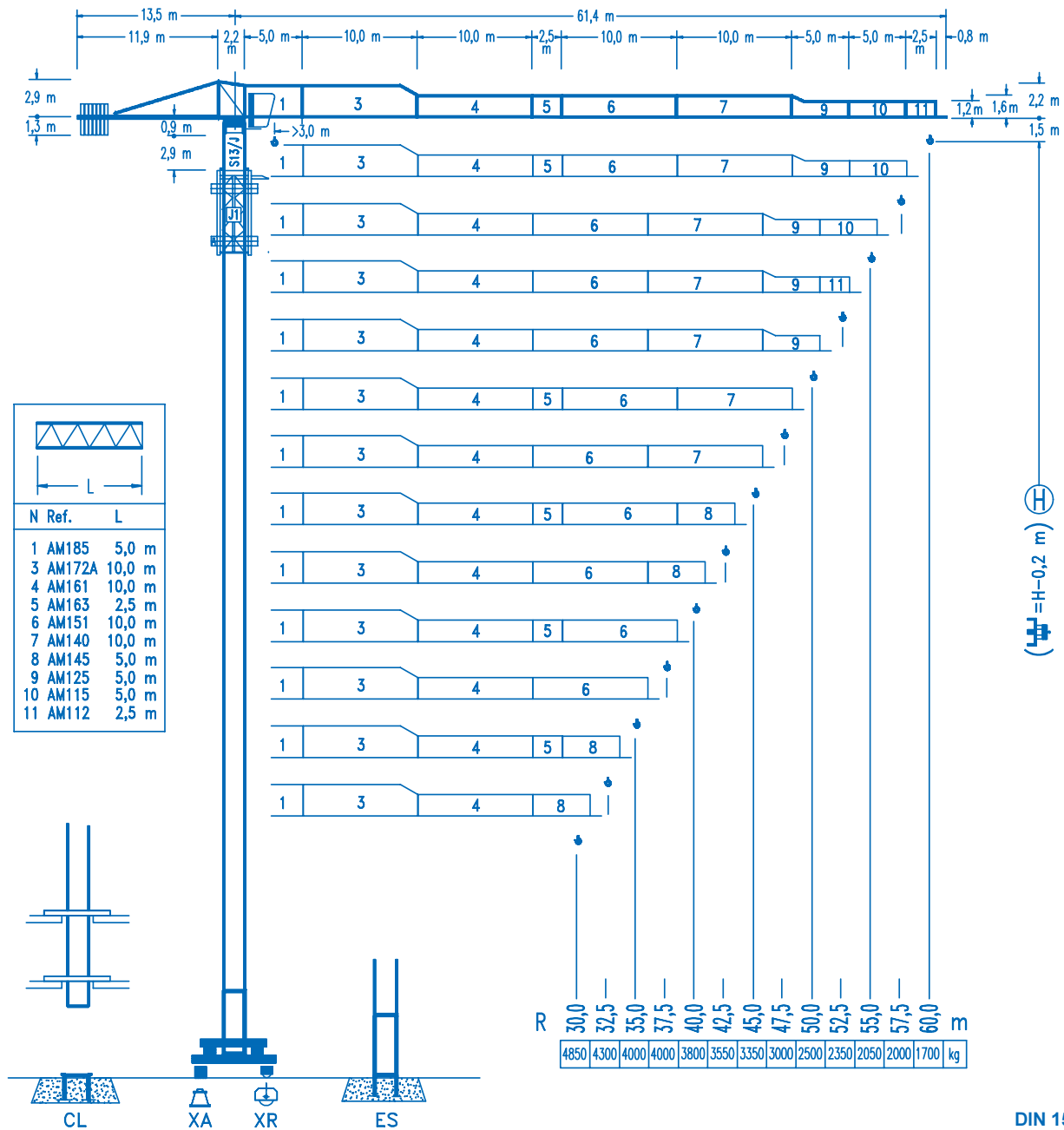
## ***SAFETY FIRST***

Later, additional information can be sent (i.e. technical maintenance bulletins) which must be read thoroughly attaching it to the appropriate section.

A NUMBER OF SYMBOL ARE USEDIN THIS MANUAL TO DESCRIBE DIFFERENT IMPORTANT OPERATIONS.

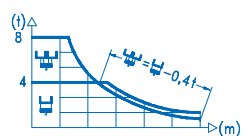
<b>Symbol</b>	<b>Meaning</b>
	Information to be considered when erecting, dismantling and operating the crane.
	Important information for accident prevention.
	Information, instructions and banning for damage and accident prevention.
	See maintenance instructions. Information contained in maintenance instructions.
	Earthing. The part involved must be connected to ground in accordance with specified instructions.
	Voltage hazard. Electric shock hazard.
	Indicator of number of falls. Single reeving.
	Indicator of number of falls. Single / double reeving.
	Travelling. Translation mechanism.
	Hoisting. Hoisting winch.
	Trolley translation. Trolley winch.
	Slewing. Slewing mechanism.

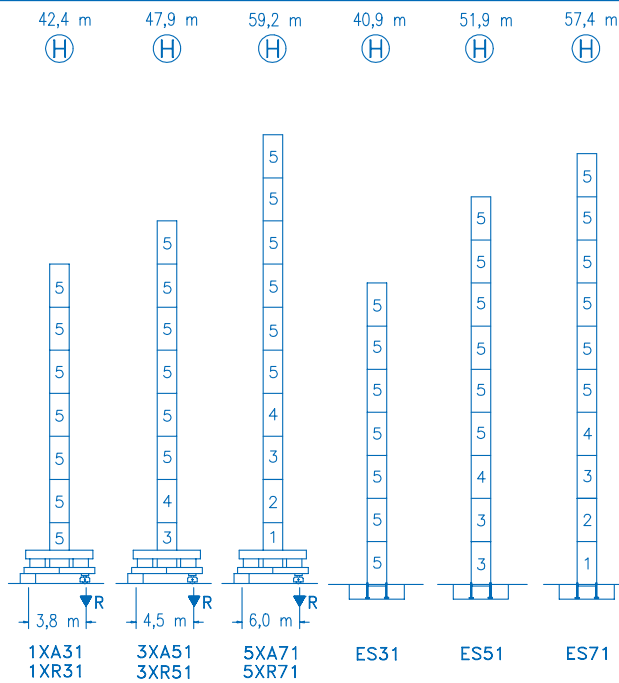




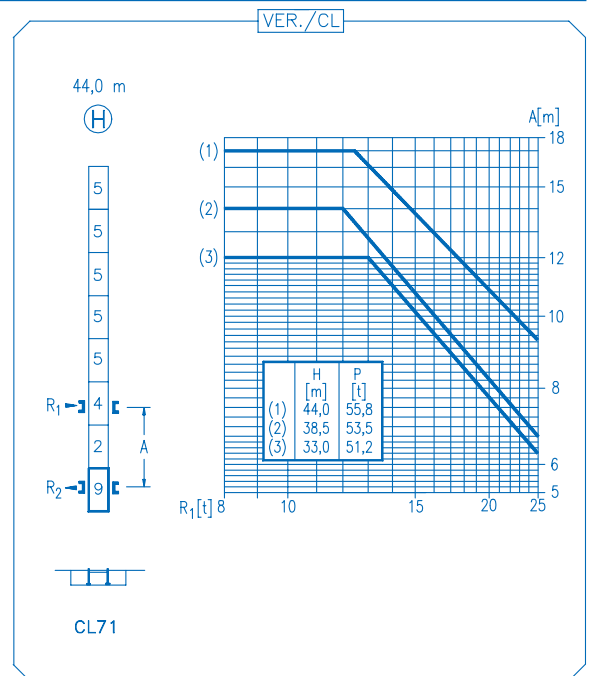
CE  
DIN 15018 H1 B3

R	Dimensions (m)																Weights (kg)																			
60,0	14,8	20	23	26,5	28,8	30	32,5	35	37,5	40	42,5	45	47,5	50	52,5	55	57,5	60	8000	5610	4750	4000	4000	3820	3490	3210	2970	2760	2570	2400	2250	2120	2000	1890	1790	1700
57,5	16,1	20	23	25	28,9	31,5	32,5	35	37,5	40	42,5	45	47,5	50	52,5	55	57,5	60	8000	6210	5270	4770	4000	4000	3870	3560	3290	3060	2850	2670	2510	2360	2230	2110	2000	1700
55,0	15,7	20	23	25	28,2	30,8	32,5	35	37,5	40	42,5	45	47,5	50	52,5	55	60	60	8000	6040	5120	4630	4000	4000	3760	3460	3200	2980	2770	2600	2440	2300	2170	2050	2000	1700
52,5	16,8	20	23	25	28	30,2	32,9	35	37,5	40	42,5	45	47,5	50	52,5	60	60	60	8000	6520	5540	5020	4380	4000	4000	3740	3460	3220	3000	2810	2640	2490	2350	2050	2000	1700
50,0	16,8	20	23	25	28	30,2	33,1	35	37,5	40	42,5	45	47,5	50	60	60	60	60	8000	6550	5560	5030	4390	3880	4000	3760	3480	3230	3020	2820	2650	2500	2050	2000	1700	1700
47,5	18,6	23	25	28	30	33,5	36,8	37,5	40	42,5	45	47,5	60	60	60	60	60	60	8000	6270	5690	4980	4580	4000	4000	3920	3640	3400	3190	3000	2650	2500	2050	2000	1700	1700
45,0	19,4	23	25	28	30	32,5	35	38,4	40	42,5	45	60	60	60	60	60	60	60	8000	6580	5970	5230	4820	4370	4000	4000	3820	3570	3350	3000	2650	2500	2050	2000	1700	1700
42,5	19,3	23	25	28	30	32,5	34,8	38,2	40	42,5	60	60	60	60	60	60	60	60	8000	6530	5930	5190	4780	4340	4000	4000	3800	3550	3000	2650	2500	2050	2000	1700	1700	1700
40,0	19,3	23	25	28	30	32,5	34,7	38,2	40	60	60	60	60	60	60	60	60	60	8000	6520	5920	5180	4770	4330	4000	4000	3800	3000	2650	2500	2050	2000	1700	1700	1700	1700
37,5	18,9	23	25	28	30	32	34	37,5	60	60	60	60	60	60	60	60	60	60	8000	6380	5790	5060	4660	4310	4000	4000	3000	2650	2500	2050	2000	1700	1700	1700	1700	1700





N	Ref.	h
1	S15	5,5 m
2	TS15	5,5 m
3	S14	5,5 m
4	TS14	5,5 m
5	S13	5,5 m
9	CLS15	3,1 m



<b>R. máx.</b>	En servicio	<b>1XR31 ..... 76,5 t</b>
	In operation	
	En service	
	In Betrieb	
		<b>3XR51 ..... 73,6 t</b>
		<b>5XR71 ..... 67,0 t</b>

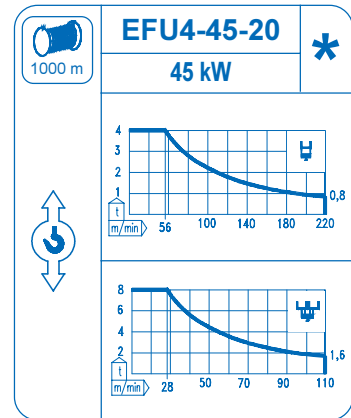
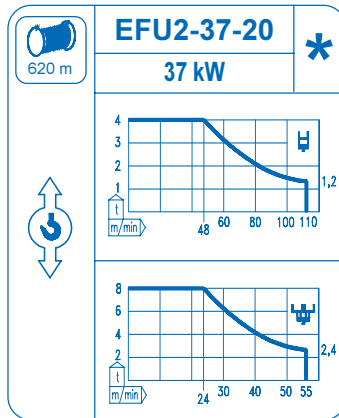
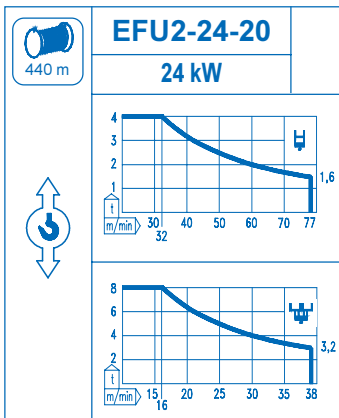
<b>R. máx.</b>	Fuera de servicio	<b>1XR31 ..... 91,7 t</b>
	Out of service	
	Hors service	
	Ausser Betrieb	
		<b>3XR51 ..... 100,1 t</b>
		<b>5XR71 ..... 104,4 t</b>

**CFU-4.0**  
4 kW  
0 ⇄ 90 m/min

**GR-7.5**  
2 x 75 Nm  
0 ⇄ 0,7 rpm

**TS2-5.5** | **TRA-7.5**  
2 x 55 Nm | 2 x 75 Nm  
0 ⇄ 20 m/min  
1XR31 | 3XR51 | 5XR 71


**TRA-7.5VC**  
2 x 75 Nm  
0 ⇄ 20 m/min  
5XR71




Tensión de alimentación	<b>400 V</b>
Operating voltage	<b>3 ph</b>
Tension de service	<b>50 Hz</b>
Betriebsspannung	


Opcional	<b>*</b>
Optional	
En option	
Kaufoption	

TWO FALLS								
Distance trolley (m)	Hook radius (m)							
	60	57,5	55	52,5	50	47,5	45	42,5
12	4000	4000	4000	4000	4000	4000	4000	4000
13	4000	4000	4000	4000	4000	4000	4000	4000
14	4000	4000	4000	4000	4000	4000	4000	4000
15	4000	4000	4000	4000	4000	4000	4000	4000
16	4000	4000	4000	4000	4000	4000	4000	4000
17	4000	4000	4000	4000	4000	4000	4000	4000
18	4000	4000	4000	4000	4000	4000	4000	4000
19	4000	4000	4000	4000	4000	4000	4000	4000
20	4000	4000	4000	4000	4000	4000	4000	4000
21	4000	4000	4000	4000	4000	4000	4000	4000
22	4000	4000	4000	4000	4000	4000	4000	4000
23	4000	4000	4000	4000	4000	4000	4000	4000
24	4000	4000	4000	4000	4000	4000	4000	4000
25	4000	4000	4000	4000	4000	4000	4000	4000
26	4000	4000	4000	4000	4000	4000	4000	4000
27	4000	4000	4000	4000	4000	4000	4000	4000
28	4000	4000	4000	4000	4000	4000	4000	4000
29	3970	4000	4000	4000	4000	4000	4000	4000
30	3820	4000	4000	4000	4000	4000	4000	4000
31	3680	4000	3970	4000	4000	4000	4000	4000
32	3560	3930	3830	4000	4000	4000	4000	4000
32,5	3490	3870	3760	4000	4000	4000	4000	4000
33	3430	3800	3700	3990	4000	4000	4000	4000
34	3320	3680	3580	3860	3880	4000	4000	4000
35	3210	3560	3460	3740	3760	4000	4000	4000
36	3110	3450	3350	3620	3640	4000	4000	4000
37	3010	3340	3250	3510	3530	3980	4000	4000
37,5	2970	3290	3200	3460	3480	3920	4000	4000
38	2920	3240	3150	3410	3420	3860	4000	4000
39	2840	3150	3060	3310	3330	3750	3930	3910
40	2760	3060	2980	3220	3230	3640	3820	3800
41	2680	2970	2890	3130	3140	3540	3720	3700
42	2600	2890	2810	3040	3060	3450	3620	3600
42,5	2570	2850	2770	3000	3020	3400	3570	3550
43	2530	2810	2740	2960	2980	3360	3530	
44	2470	2740	2670	2880	2900	3270	3440	
45	2400	2670	2600	2810	2820	3190	3350	
46	2340	2600	2530	2740	2750	3110		
47	2280	2540	2470	2670	2690	3040		
47,5	2250	2510	2440	2640	2650	3000		
48	2230	2480	2410	2610	2620			
49	2170	2420	2350	2550	2560			
50	2120	2360	2300	2490	2500			
51	2070	2310	2240	2430				
52	2020	2250	2190	2380				
52,5	2000	2230	2170	2350				
53	1980	2200	2140					
54	1930	2160	2100					
55	1890	2110	2050					
56	1850	2060						
57	1810	2020						
57,5	1790	2000						
58	1770							
59	1740							
60	1700							

 TWO FALLS								
Distance trolley (m)	Hook radius (m)							
	40	37,5	35	32,5	30			
12	4000	4000	4000	4000	4000			
13	4000	4000	4000	4000	4000			
14	4000	4000	4000	4000	4000			
15	4000	4000	4000	4000	4000			
16	4000	4000	4000	4000	4000			
17	4000	4000	4000	4000	4000			
18	4000	4000	4000	4000	4000			
19	4000	4000	4000	4000	4000			
20	4000	4000	4000	4000	4000			
21	4000	4000	4000	4000	4000			
22	4000	4000	4000	4000	4000			
23	4000	4000	4000	4000	4000			
24	4000	4000	4000	4000	4000			
25	4000	4000	4000	4000	4000			
26	4000	4000	4000	4000	4000			
27	4000	4000	4000	4000	4000			
28	4000	4000	4000	4000	4000			
29	4000	4000	4000	4000	4000			
30	4000	4000	4000	4000	4000			
31	4000	4000	4000	4000				
32	4000	4000	4000	4000				
32,5	4000	4000	4000	4000				
33	4000	4000	4000					
34	4000	4000	4000					
35	4000	4000	4000					
36	4000	4000						
37	4000	4000						
37,5	4000	4000						
38	4000							
39	3910							
40	3800							
41								
42								
42,5								
43								
44								
45								
46								
47								
47,5								
48								
49								
50								
51								
52								
52,5								
53								
54								
55								
56								
57								
57,5								
58								
59								
60								

**LOAD CHART**

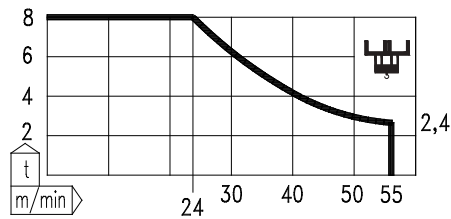
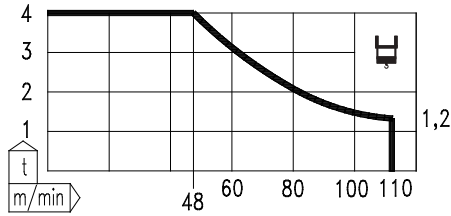
 <b>FOUR FALLS</b>								
Distance trolley (m)	Hook radius (m)							
	60	57,5	55	52,5	50	47,5	45	42,5
12	8000	8000	8000	8000	8000	8000	8000	8000
13	8000	8000	8000	8000	8000	8000	8000	8000
14	8000	8000	8000	8000	8000	8000	8000	8000
15	7850	8000	8000	8000	8000	8000	8000	8000
16	7290	8000	7830	8000	8000	8000	8000	8000
17	6790	7500	7300	7870	7900	8000	8000	8000
18	6350	7030	6830	7370	7400	8000	8000	8000
19	5960	6600	6420	6920	6950	7820	8000	8000
20	5610	6210	6040	6520	6550	7370	7730	7670
21	5300	5870	5710	6160	6180	6970	7310	7250
22	5010	5560	5400	5840	5860	6600	6930	6870
23	4750	5270	5120	5540	5560	6270	6580	6530
24	4510	5010	4870	5270	5290	5970	6260	6210
25	4290	4770	4630	5020	5030	5690	5970	5930
26	4090	4550	4420	4790	4800	5430	5700	5660
27	3900	4350	4220	4570	4590	5200	5460	5410
28	3730	4160	4040	4380	4390	4980	5230	5190
29	3570	3980	3870	4190	4210	4770	5010	4980
29,6	3420	3820	3710	4020	4040	4580	4820	4780
31	3280	3670	3560	3860	3880	4400	4630	4590
32	3150	3530	3420	3720	3730	4240	4460	4420
32,1	3090	3460	3350	3640	3660	4160	4370	4340
33	3030	3390	3290	3580	3590	4080	4290	4260
34	2920	3270	3170	3440	3460	3940	4140	4110
34,6	2810	3150	3050	3320	3330	3800	4000	3960
36	2700	3030	2940	3200	3220	3670	3860	3830
37	2610	2930	2840	3090	3110	3540	3730	3700
37,1	2560	2880	2790	3040	3050	3490	3670	3640
38	2520	2830	2740	2990	3000	3430	3610	3580
39	2430	2730	2650	2890	2900	3320	3500	3470
39,6	2350	2640	2560	2800	2810	3210	3390	3360
41	2270	2560	2480	2710	2720	3110	3280	3250
42	2200	2480	2400	2620	2630	3020	3180	3160
42,1	2160	2440	2360	2580	2590	2970	3140	3150
43	2120	2400	2320	2540	2550	2930	3090	
44	2060	2330	2250	2460	2470	2840	3000	
44,6	1990	2250	2180	2390	2400	2760	2950	
46	1930	2190	2110	2320	2330	2680		
47	1870	2120	2050	2250	2260	2610		
47,1	1840	2090	2020	2220	2230	2600		
48	1810	2060	1990	2190	2200			
49	1760	2000	1930	2130	2130			
49,6	1710	1940	1880	2070	2100			
51	1660	1890	1820	2010				
52	1610	1840	1770	1950				
52,4	1590	1810	1750	1950				
53	1560	1790	1720					
54	1520	1740	1680					
54,6	1480	1690	1650					
56	1440	1650						
57	1400	1600						
57,1	1380	1600						
58	1360							
59	1320							
59,6	1300							

 <b>FOUR FALLS</b>								
Distance trolley (m)	Hook radius (m)							
	40	37,5	35	32,5	30			
12	8000	8000	8000	8000	8000			
13	8000	8000	8000	8000	8000			
14	8000	8000	8000	8000	8000			
15	8000	8000	8000	8000	8000			
16	8000	8000	8000	8000	8000			
17	8000	8000	8000	8000	8000			
18	8000	8000	8000	8000	8000			
19	8000	7940	7990	7940	8000			
20	7660	7490	7540	7490	7650			
21	7240	7080	7130	7080	7240			
22	6870	6710	6750	6710	6860			
23	6520	6380	6410	6370	6510			
24	6210	6070	6110	6070	6200			
25	5920	5790	5820	5780	5910			
26	5650	5530	5560	5520	5650			
27	5410	5290	5320	5280	5400			
28	5180	5060	5090	5060	5170			
29	4970	4860	4890	4850	4960			
29,6	4770	4660	4690	4660	4850			
31	4590	4480	4510	4480				
32	4420	4310	4340	4310				
32,1	4330	4230	4260	4300				
33	4250	4150	4180					
34	4100	4010	4030					
34,6	3960	3870	3950					
36	3830	3730						
37	3700	3610						
37,1	3640	3600						
38	3580							
39	3460							
39,6	3400							
41								
42								
42,1								
43								
44								
44,6								
46								
47								
47,1								
48								
49								
49,6								
51								
52								
52,4								
53								
54								
54,6								
56								
57								
57,1								
58								
59								
59,6								



**HOISTING**

Mechanism type ..... **EFU2-37-20-06**



**Motor**  
 Make ..... LETAG  
 Power ..... 37 kW  
**Brake**  
 Type ..... BFK458  
 Model ..... BFK.458.25/600 Nm  
**Drum**  
 Drum capacity ..... 660 m in 3 layers  
 Max. huh SR ..... 330 m  
 Max. huh DR ..... 165 m  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**TROLLEY**

Mechanism type ..... **CFU-4.0-04**

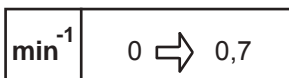


**Motor**  
 Make ..... LEROY SOMMER  
 Power ..... 4 kW  
**Brake**  
 Type ..... FCO  
 Model ..... FCO 112  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**SLEWING**

Mechanism type ..... **(2) GR-7.5-14**

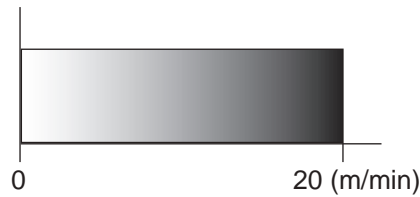
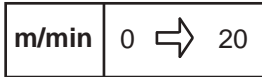


**Motor**  
 Make ..... BESOZZI  
 Power ..... (2) 7,5 kgm  
**Brake**  
 Type ..... S  
 Model ..... 110 MS  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**TRAVELLING (3,8 m)**

**Mechanism type ..... TS2-5.5-01**

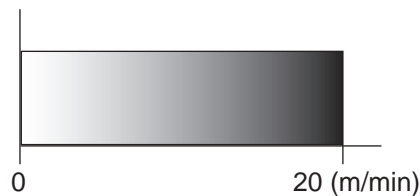
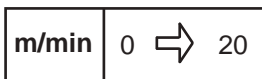


**Motor**  
 Make ..... BESOZZI  
 Power ..... 2 x 5,5 kgm  
**Brake**  
 Type ..... S  
 Model ..... 100 S  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**TRAVELLING (4,5 m)**

**Mechanism type ..... TS2-5.5-02**

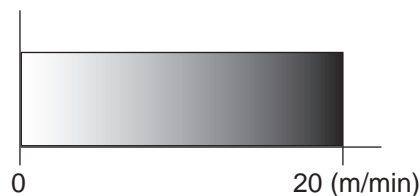
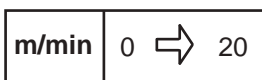


**Motor**  
 Make ..... BESOZZI  
 Power ..... 2 x 5,5 kgm  
**Brake**  
 Type ..... S  
 Model ..... 100 S  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**TRAVELLING (6,0 m, VR)**

**Mechanism type ..... TRA-7.5-02**

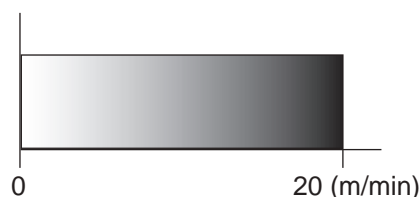
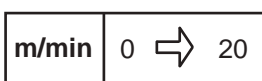


**Motor**  
 Make ..... BESOZZI  
 Power ..... 2 x 7,5 kgm  
**Brake**  
 Type ..... S  
 Model ..... 100 MS  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



**TRASLACIÓN (6,0 m, VC)**

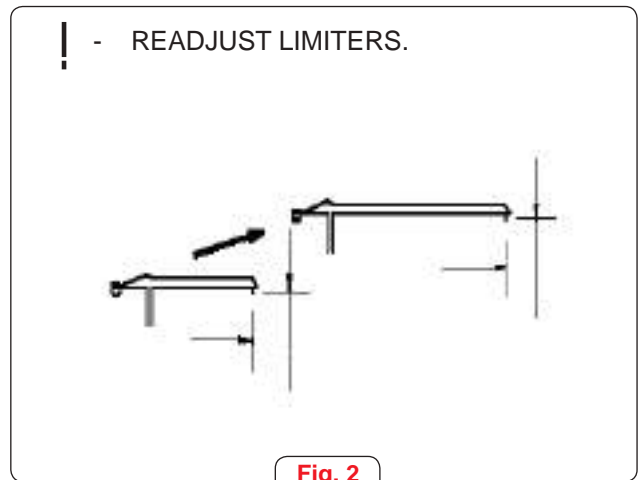
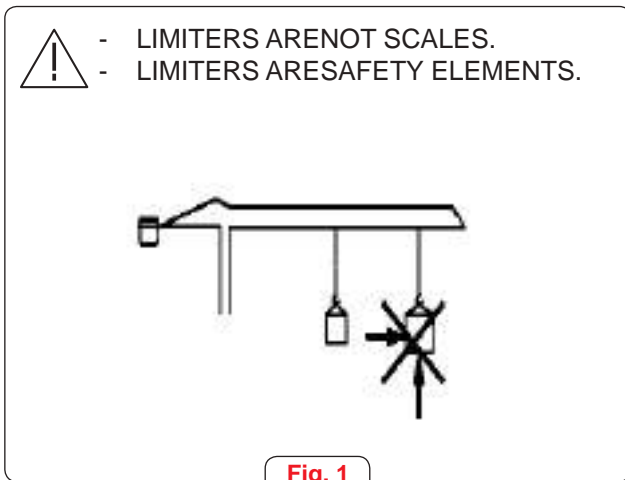
**Mecanismo tipo ..... TRA-7.5-05**



**Motor**  
 Fabricante ..... BESOZZI  
 Power ..... 2 x 7,5 kgm  
**Brake**  
 Type ..... S  
 Model ..... 100 MS  
**Operating voltage**  
 Voltage ..... 400 V, 3 ph, 50 Hz



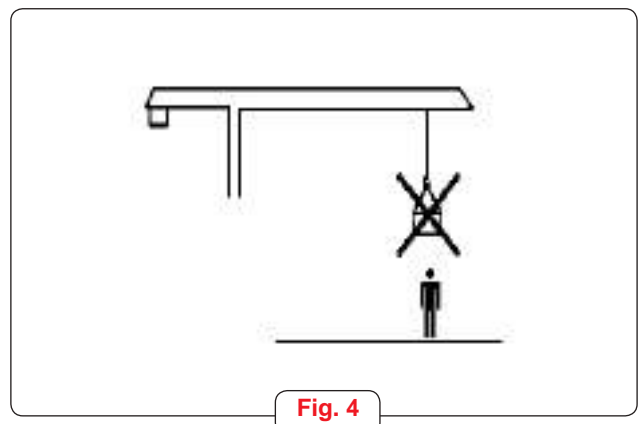
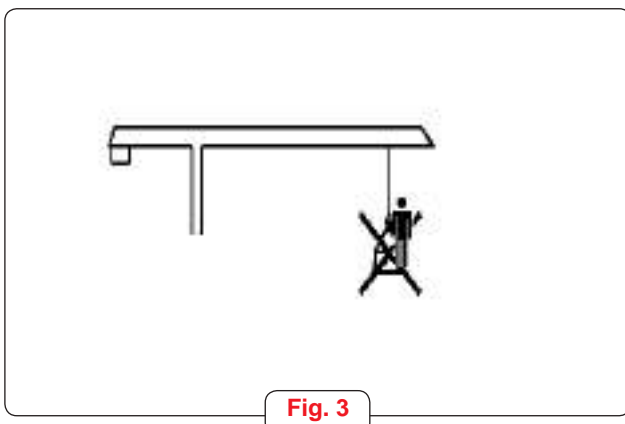
1. Only duly qualified personnel complying with current Regulations in force and familiar with Safety Rules relative to his task is authorised to operate the crane.
2. Never work on safety devices in order to override or modify their calibration out of range. (Fig. 1)
3. Never use a load limiter as normal stopping device. These devices are not load measuring scales but safety elements. (Fig. 1)
4. Never operate the crane before all protections and safety devices are installed and in correct working order.
5. If changes in crane setup are introduced (jib length, height, etc), make sure that load limiters and limit switches are readjusted for the new setup. (Fig. 2)



6. No unauthorised persons may have access to the crane.
7. Transporting persons is forbidden (Fig. 3)

! As a last alternative to reach areas not accessible by other means the tower crane may be used to raise and lower personnel to that area, provided the following criteria is met.  
The device that will carry the personnel being transported shall be manufactured and approved for that purpose, and all procedures related to the crane operation and the transportation of personnel shall be in accordance with all Local, State and Government standards.

8. Loads shall not be handled over persons or transit areas (Fig. 4)



9. The following operations affecting crane stability are forbidden:
  - Sudden manoeuvres causing the load and the structure to swing (Fig. 5)
  - Side pulling of the load (Fig. 6)
  - Lifting loads above specified capacity
  - Drawing out objects firmly attached to the floor. Care shall be taken when ice formation is likely, when the object has been in the same position for long, or when it is hooked or tangled to other objects (i.e. concrete reinforcing bar bundles) (Fig 6)
  - Dragging loads over the floor (Fig 7)
  - Adding loads onto suspended loads
10. Do not rest the hook on the load or any other surface as lifting cables must never be loose.
11. If during a lifting operation the steel cables become loose, the operation must be interrupted until the cause of loosening is found and check the proper winding of the cable and that it is not out of pulleys or guides.
12. The emergency stop should not be used for stopping during normal operations.



In case of repeated emergency stops within a short period of time, the brakes should be checked immediately by qualified personnel, since they may be adversely affected and lose their braking power and load-retaining capabilities.

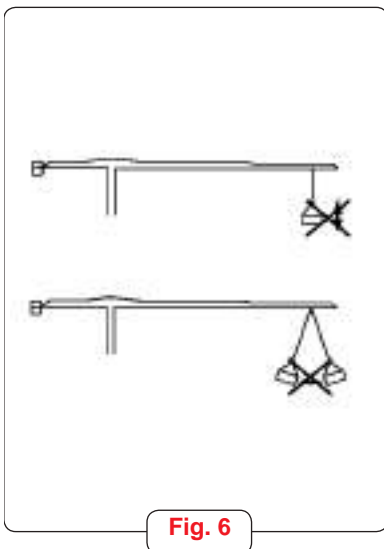


Fig. 6

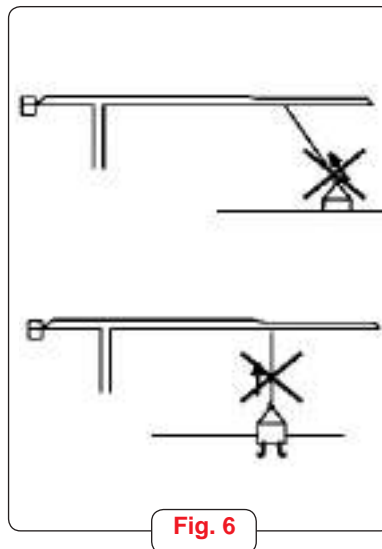


Fig. 6

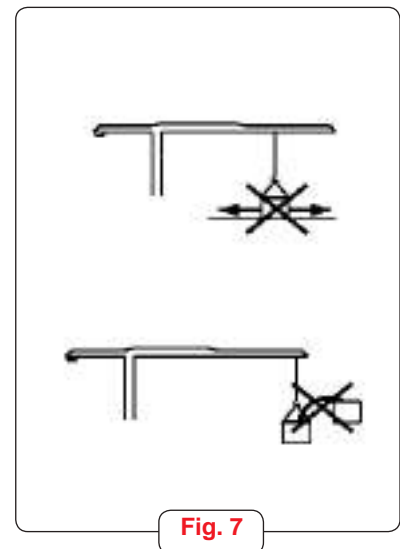


Fig. 7

13. If the work is interrupted, never leave loads in suspension or the crane running.
14. Load slinging must be done by qualified personnel.  
Never lift any load if not properly tied up and the ready signal has been given.
15. The operator must have a perfect view of the working area and the load (Fig 8)
16. When lack of view is due to poor light, floodlights covering the full working area shall be used.
17. A signal man must direct the operation if lack of view is due to physical obstacles. (Fig 9)
18. Signals given by the signal man must be based on specific systems (national standards, if any, shall be used) (Fig 10)

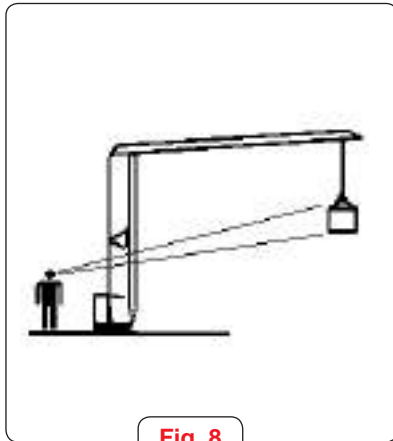


Fig. 8

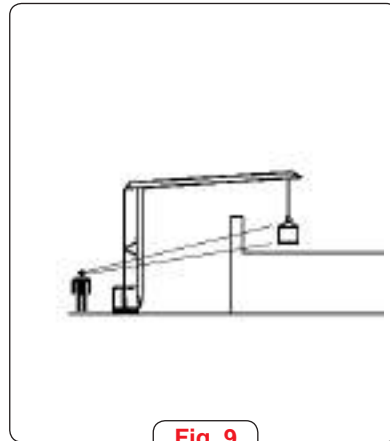


Fig. 9

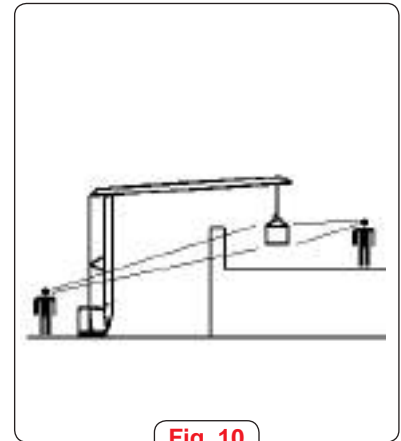


Fig. 10

19. When the crane is operated from the cabin, visibility conditions must be maintained by window cleaning avoiding any view limiting objects. Keep the wipers in good condition.



Cleaning of cabin windows must be done by using exclusively those accessories enabling it with no need for going outside passages or access platforms to the cabin.

20. Maximum operating wind velocity is 72 km/h  
When wind velocity is near 45 km/h, gusts to 72 km/h are possible.  
In order to cease the activity in time, the time required to bring the crane into out of service condition must be born in mind.
21. The crane operator must be kept informed about the existing wind velocity. Anemometers give this information and are very useful in windy areas.
22. As a general rule, work must cease if wind velocity makes handling loads difficult with hazard to persons.
23. Make sure there are no hazards to persons prior to starting the crane (See checks prior to commissioning)
24. Before work commencement, the operator must be familiar with condition existing at the site such as main obstacles, traffic areas, interferences, etc.
25. Crane travelling, when required, must not be used in conjunction with any other movement and then, the jib and counterjib must be placed in the direction of the truck.
26. Every day check for damage or visible defects.  
If a malfunction is found, crane operation must be interrupted until said malfunction is repaired and permission from the responsible person is obtained.
27. Make sure that safety signs and warnings are in good condition and in the right place.
28. Keep access and working platforms in good condition and free from tools or objects that can fall down.
29. Follow all regulations in force at the work location
30. Use personal protection equipment required by the regulations

! Instructions in this section are given for complementary guidance; therefore they do not replace current safety regulations in force, national and international laws, local regulations or of the insurance companies.

- 1 Carry out standard inspections and specific inspections prior to start up and after major crane modifications.
- 2 Periodic inspections must be carried out by qualified personnel at standard frequencies.
- 3 Inspection reports must be recorded and duly documented.
- 4 Crane documents (Instructions Manual, certificates, records, etc.) must be kept at the crane in an accessible place.
- 5 All personnel involved with crane erection, dismantling, operation and maintenance must be conversant with the instructions given in this Manual. Should the information contained in any paragraph be incomplete or confusing, applicable clarification shall be requested before carrying out any action.
- 6 The crane must be free from permanent deformations, fractures, cracks or other defects affecting its safety.
- 7 Foreign elements not being part of the crane are not allowed provided they have not been authorised by the manufacturer.
- 8 Personnel appointed for crane operation (crane operators) must have appropriate qualifications and be conversant with the instructions and specific features of the crane being operated.
- 9 Before beginning crane operation, the crane operator must proceed with all the checks mentioned in this Manual for commissioning stage.
- 10 When crane work has been finalised, the operator shall follow the instructions for taking the crane out of service. Thus:



ENABLING FREE SLEWING IS OF VITAL IMPORTANCE

- 11 The crane operator must know the wind conditions to be able to discontinue crane work if necessary. For a direct knowledge of the real wind velocity, the provision of an anemometer at the site is advisable.

**0 CONTENTS**

<b>1</b>	<b>POWER SUPPLY</b>
<b>2</b>	<b>CRANE TRACK</b>
<b>3</b>	<b>CLEARANCES</b>
<b>4</b>	<b>BASE BALLAST AND OVERHEAD COUNTERWEIGHTS</b>
<b>5</b>	<b>LIGHTNING ARRESTERS</b>
<b>6</b>	<b>BARE GEARS</b>
<b>7</b>	<b>STEEL CABLES AND PULLEYS</b>
<b>8</b>	<b>MAINTENANCE</b>

**1 POWER SUPPLY**

Make sure that power supply source is adequate for the crane and that fluctuations are less than  $\pm 5\%$  of rated value. See chapter Electrical Installation.

**2 CRANE TRACK**

Check that rails are in good condition and correctly mounted and the track is free from foreign objects. Check that rail ties are in good condition and that end of track bumpers are correctly placed.

**3 CLEARANCE**

Check that the crane can move free from obstacles keeping minimum safe clearances between the crane or the load and possible obstacles (at least 0,5 m). In case electric lines are present, check that the safety distance is in accordance with the line voltage.

**4 BASE BALLAST AND OVERHEAD COUNTERWEIGHTS**

Check that base ballast quantity and block fastening are correct

**5 LIGHTNING ARRESTERS**

If lightning arresters are installed check that the structure earthing connection is properly made.

**6 BARE GEARS**


Check that bare gears are properly greased

**7 STEEL CABLES AND PULLEYS**

Check position of cables through pulleys, look for damage and check proper greasing of cables, as well as proper cable winding on drums.

**8 MAINTENANCE**

Check that all required maintenance operations have been carried out.

- 1 Check that crane movements are obstruction-free
  - 2 Put main switch at crane foot to position I
  - 3 Lift the stop pushbutton on the crane controls
  - 4 Press the start pushbutton
- ! Crane siren will sound meaning that the crane is free slewing
- 5 Check the operation of crane siren by pressing the pushbutton on the crane controls
  - 6 Check that crane controls operate properly.  
Joy-sticks or pushbuttons come back to zero when released, stop the movement, and are in good working order.
  - 7 Check that all movements and brakes work properly.
-  If any crane malfunction is detected, stop the crane (pressing the stop button) and call for service.
- 8 Check the operation of the stop button.  
No movement may be possible with the button pressed
  - 9 Operate the crane in accordance with instructions in document "CRANE CONTROL" in this chapter

## 0 CONTENTS

1	<b>IMPORTANT NOTES</b>
2	<b>OPERATOR STAND</b>
3	<b>BUTTONS &amp; SWITCHES</b>
4	<b>LEFT HAND JOYSTICK</b>
5	<b>RIGHT HAND JOYSTICK</b>

### 1 IMPORTANT NOTES



The crane must be put out of service on any of the following circumstances:

- When there is a malfunction of any movement or movement retaining brakes
- When limit switches at movement limit points would not actuate
- When loads above maximum allowable loads can be lifted.



In case of repeated emergency stops within a short period of time, the brakes should be checked immediately by competent personnel, since they may be adversely affected and lose their braking power and load-retaining capabilities.



In periods with temperatures below zero, check that crane mobile parts (brakes, crown wheel, commutator, etc) are not blocked due to ice formation. Under these circumstances, the first manoeuvres must be done with precaution



Crane operation must be stopped when wind velocity makes load handling hazardous for persons. See document "Operation stop due to Wind" y "Anemometer - Wind Speed Indication / alarm" in this chapter of the manual



If the crane is not in operation, the wind speed indication / alarm system is not operable.

In case of a disconnection of the crane, this should be placed in an out-of-service condition (including the weather vaning).

When the crane is not supervised, it should be placed in an out-of-service condition. It should be considered that the radio controls automatically disconnect the crane when it is unused for a certain period.



Crane operator must know the loads being handled and crane loading capacity so that the crane will not be overloaded



Load and torque limiters must not be used for operation purposes, they being safety elements, which normally should not be actuated.



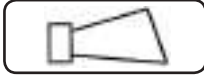

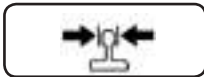






All movements must be stopped before reaching their limits. Limit switches are safety elements and should normally not be activated.

## 2 OPERATOR STAND



### 3 BUTTONS & SWITCHES

- 1  **Illuminated on button**  
Used to switch the crane on.  
Pressing this button switches the main contactor in and illuminates the button pilot light.  
By supplying the crane via the main contactor, the hoist and carriage contactors begin a process of checking for errors and self-checking, which takes a few seconds.  
Hoist and trolley movements are not possible during this period of time.
- 2  **Off button**  
This button is normally used to disconnect the supply of current to the crane when it is not in use, or prior to disconnecting the main crane isolating switch when stopping work.  
It may also be used as an emergency stop in any contingency which requires it during crane operation.
- 3  **Alarm button**  
Pressing this button sounds the audible alarm fitted to the crane.
- 4  **Travelling control switch**  
This is used to disconnect the travelling movement of the crane, and thereby stop unwanted starting of the travelling function.
- 5  **Travelling brake switch**  
This is used in those mechanisms which include the option of cancelling the delay in actuation of the travelling motor electromechanical brakes. Under normal working, once the joy-stick reaches the zero point then travelling movement is gradually stopped. The electromechanical brake is a parking brake which is actuated afterwards.
- 6  **Slewing brake button**  
Cancels the delay in actuation of the slewing motor electromechanical brake.  
Under normal working, once the joy-stick reaches the zero point then jib movement is gradually stopped by the motor. The electromechanical brake is a parking brake which is actuated afterwards.  
However, on certain occasions when the wind is strong, the jib has to be held once movement has stopped, at which time this button is used.
- 7  **Weathervaning button**  
This releases the slewing motor brake of the crane  
If this button is pressed while the crane is working it will be weathervaned (slewing brake off) and the siren will sound. To disengage weathervaning, press slew left or slew right.  
For more details see "Weathervaning" in this chapter.
- 8  **Limiter cancel switch**  
This is a three-way switch with return to middle position.

In middle position:	0	No action.
In left position:		Cancels the hook up limiter to be able to make a reeving change. When this button is activated, the trolley can only move at reduced speed.

In right position:



Cancels the trolley back limiter to be able to make a reeving change.  
When this button is activated, the trolley can only move at reduced speed.

- ! During the reeving change operation, and once the trolley back and hook up limits have been exceeded, then depending on trolley and hook position some movements such as trolley forward or hoisting up or down may be prevented owing to the reeving change operation having been started but not carried out properly.

For further details, see the instruction entitled “Reeving Change”, in this chapter..

9







**Cabin windscreen wiper control switch**

- In left position: Windshield wiper with water ejectors.
- In middle position: Rest.
- In right position: Windshield wiper

10

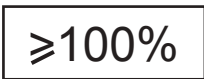


**Cabin heating control switch**

- Position 0 : Heating off
- Position  : Fan
- Position  : Fan
- Position  : Fan + heater (4000 W).
- Position  : Fan + heater (2000 W).

A thermostat is fitted at the bottom (on the outside) of the control to adjust the level of heating.

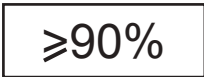
15



**Warning lamp**

Load or moment greater than 100%. Hook hoisting and forward movement of trolley disabled.

16



**Warning lamp**

Moment greater than 90%. Fast speed of forward movement of the trolley disabled (pre-limitation of fast movement)

17



**Switch (optional equipment)**

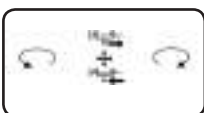
Switch for releasing crane movements at temperatures below -25° C.



It must only be used to unload and bring the crane out of service when the temperature falls below -25° C when the temperature probe has stopped all crane movements..

**4 LEFT HAND JOYSTICK**

13



**Trolley/slewing joy-stick**



The joy-stick is equipped with a zero return device.

**ORIENTATION.**

Movement acceleration and deceleration are controlled by varying the supply to the motor stator and decelerator, resulting in perfect behaviour and prevention of swinging loads.

Movement braking is carried out automatically by either changing speeds or shifting the joy-stick to the zero point, via supplying the decelerator.

A pushbutton exists to cancel the delay in actuation of the electromagnetic brake. See section 3 point 6 for further details.

MOVEMENT	SPEED POINT	MACHINERY SITUATION
 LEFT SLEW	3	motor at maximum speed
	2	motor at medium speed
	1	motor at microspeed
	0	motor at rest, brake interlocked
 RIGHT SLEW	1	motor at microspeed
	2	motor at medium speed
	3	motor at maximum speed

**TROLLEY OPERATION.**

Trolley movement is achieved through a frequency converter governed by the control panel joystick.

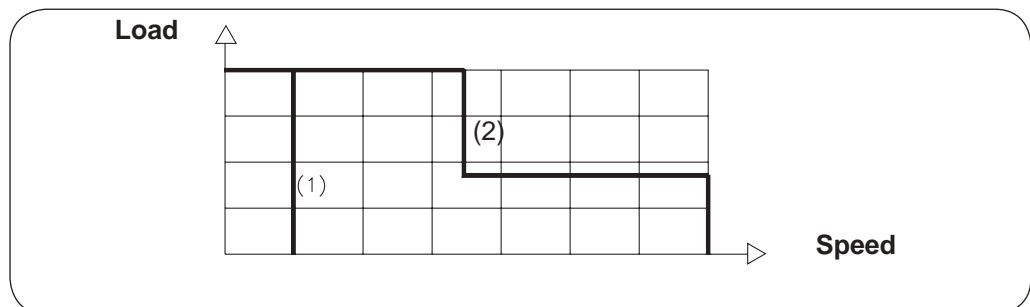
The control has 4 speed settings stepped from practically zero speed to maximum allowable speed.

Maximum allowable speed is a function of the trolley position on the jib as well as crane actual load. See speed vs load diagram.

Maximum speed is automatically reduced when the trolley reaches the proximity of the limit switch.

Movement accelerations and decelerations are fully progressive and jerkless.

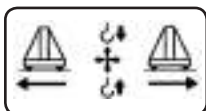
The electromechanic brake locks the movement when the motor has fully stopped (frequency converter control).



- (1) Machine in fast speed limitation mode
- (2) Trolley backward movement with load or bending moment limiter activated.

**5 RIGHT HAND JOYSTICK**

14



**Hoisting/travelling joy-stick**

The joy-stick is equipped with a zero return device

**HOISTING - UP AND DOWN**

Hoisting movement is achieved through a frequency converter governed by the control panel joystick.

The control has 4 speed settings stepped from practically zero speed to maximum allowable speed as a function of hook position as well as crane actual load. (See speed vs load diagram).

Maximum hoisting speed is automatically reduced when the hook reaches the proximity of the limit switch.

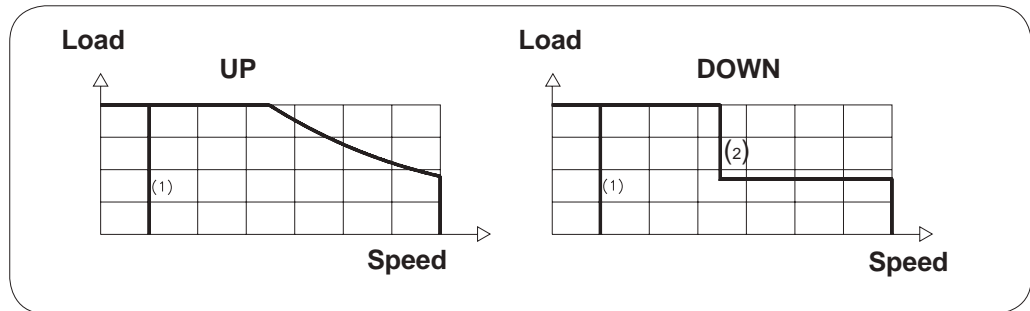
Movement accelerations and decelerations are fully progressive and jerkless.

The electromechanic brake locks the movement when the motor has fully stopped (frequency converter controlled as converter frequency translates into motor speed).

The hoisting mechanism has two operating modes:

- Normal MODE
- Approach mode

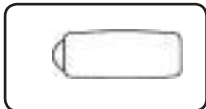
Pressing pushbutton and operating at the same time the hoisting joystick, achieve the approach mode.



- (1) Machine in fast speed limitation mode or approach mode.
- (2) Load / Fast lowering speed limiter or bending moment limiter activated.

When the lever is released the hoisting movement stops and the electromechanical brake goes in.

The hoisting speed (both upwards and downwards) is automatically adjusted at the right setting as a function of the load and the number of cables.



#### APPROACH MODE HOISTING PUSHBUTTON

Pressing pushbutton and operating at the same time the hoisting joystick, achieve the approach mode.

It is very accurate in low hoisting speeds.

Switching between operating modes (from normal mode to approach mode or vice versa) can be done while hoisting without any problems. If the pushbutton is pressed while working on normal mode, the hoist motor speed is automatically reduced. The motor speed is increased when switching from approach to normal mode (button released).

#### TRAVELLING

There are 2 or 3 speed points depending on the particular travelling mechanism.

Movement acceleration and deceleration are controlled by varying motor supply, resulting in smooth, progressive motion.

Movement braking is carried out automatically by either changing speeds or shifting the joy-stick to the zero point.

A pushbutton exists to cancel the delay in actuation of the electromagnetic brake. See section 3-5 for further details.

An alarm siren at the foot of the crane sounds intermittently while transfer movement is taking place. It sounds different from the normal crane siren.

## 0 CONTENTS

1	<b>IMPORTANT NOTES</b>
2	<b>CONTROL PANEL</b>
3	<b>LEFT JOYSTICK (TROLLEY-SLEWING)</b>
4	<b>RIGHT JOYSTICK (HOISTING – TRAVELLING)</b>
5	<b>POSITIONING MODE HOIST PUSHBUTTON</b>
6	<b>LIGHTED PUSHBUTTON (START – ALARM)</b>
7	<b>STOP PUSHBUTTON</b>
8	<b>SLEWING MOTION BRAKE PUSHBUTTON</b>
9	<b>RE-REEVING PUSHBUTTON</b>
10	<b>LIGHTED PUSHBUTTON FOR FREE SLEWING</b>
11	<b>TRAVEL CONTROL COMMUTATOR</b>

## 1 IMPORTANT NOTES



The crane must be put out of service on any of the following circumstances:

- When there is a malfunction of any movement or movement retaining brakes
- When limit switches at movement limit points would not actuate
- When loads above maximum allowable loads can be lifted.



In case of repeated emergency stops within a short period of time, the brakes should be checked immediately by competent personnel, since they may be adversely affected and lose their braking power and load-retaining capabilities.



In periods with temperatures below zero, check that crane mobile parts (brakes, crown wheel, commutator, etc) are not blocked due to ice formation. Under these circumstances, the first manoeuvres must be done with precaution



Crane operation must be stopped when wind velocity makes load handling hazardous for persons. See document "Operation stop due to Wind" y "Anemometer - Wind Speed Indication / alarm" in this chapter of the manual



If the crane is not in operation, the wind speed indication / alarm system is not operable.

In case of a disconnection of the crane, this should be placed in an out-of-service condition (including the weather vaning).

When the crane is not supervised, it should be placed in an out-of-service condition. It should be considered that the radio controls automatically disconnect the crane when it is unused for a certain period.



Crane operator must know the loads being handled and crane loading capacity so that the crane will not be overloaded



Load and torque limiters must not be used for operation purposes, they being safety elements, which normally should not be actuated.



All movements must be stopped before reaching their limits. Limit switches are safety elements and should normally not be activated.

## 2 CONTROL PANEL

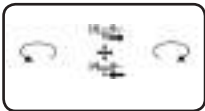


OPTIONAL (REMOTE CONTROL IKUSI MANIPULATORS TM60)



OPTIONAL (REMOTE CONTROL IKUSI MANIPULATORS)

### 3 LEFT JOYSTICK (Trolley-Slewing)





Joystick is provided with zero reset device.

#### 3.1. Jib orientation

Movement acceleration and deceleration are accomplished by varying the current supplied to the motor stator and motor idler so that a perfect performance against load swinging is obtained.

Movement braking is automatically done, during speed change or when the joystick is brought to the zero position, through the current supplied to the idler.

There is a bushbutton for overriding the delay of the electromechanical brake. See par. 8 for operation instructions.

MOVEMENT	SPEED POINT	MACHINERY SITUATION
 LEFT SLEW	3	motor at maximum speed
	2	motor at medium speed
	1	motor at microspeed
 RIGHT SLEW	0	motor at rest, brake interlocked
	1	motor at microspeed
	2	motor at medium speed
	3	motor at maximum speed

### 3.2 Trolley operation

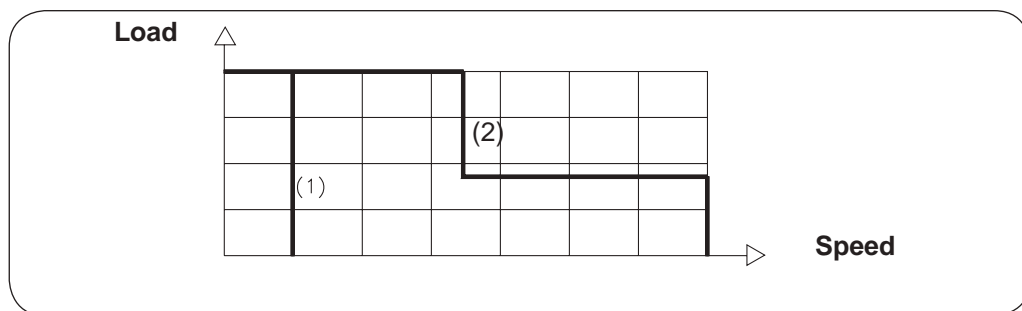
Trolley movement is achieved through a frequency converter governed by the control panel joystick.

The control has 4 speed settings stepped from practically zero speed to maximum allowable speed. Maximum allowable speed is a function of the trolley position on the jib as well as crane actual load. See speed vs load diagram.

Maximum speed is automatically reduced and sets off the crane siren intermittently when the trolley reaches the proximity of the limit switch or when 90% of maximum permitted moment is exceeded.

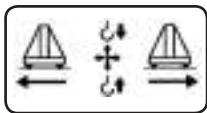
Movement accelerations and decelerations are fully progressive and jerkless.

The electromechanic brake locks the movement when the motor has fully stopped (frequency converter control).



- (1) Machine in fast speed limitation mode
- (2) Trolley backward movement with load or bending moment limiter activated.

## 4 RIGHT JOYSTICK (Hoisting-Travelling)



Joy-sticks provided with zero reset device.

### 4.1 Hoisting

Hoisting movement is achieved through a frequency converter governed by the control panel joystick.

The control has 4 speed settings stepped from practically zero speed to maximum allowable speed as a function of hook position as well as crane actual load. (See speed vs load diagram).

Maximum hoisting speed is automatically reduced when the hook reaches the proximity of the limit switch.

Movement accelerations and decelerations are fully progressive and jerkless.

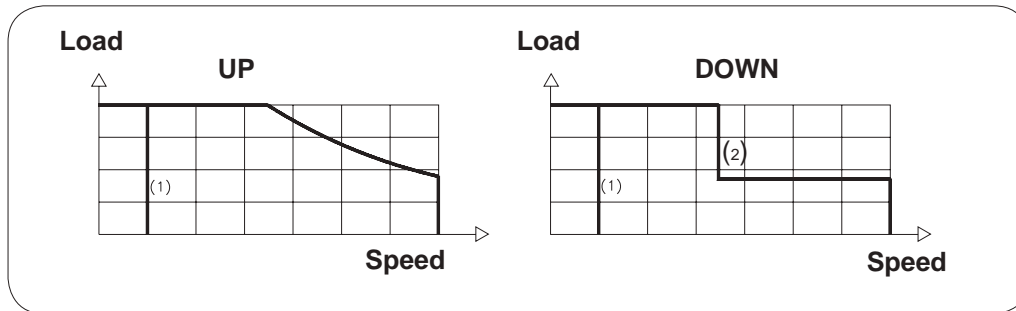
The electromechanic brake locks the movement when the motor has fully stopped (frequency converter controlled as converter frequency translates into motor speed).

The hoisting mechanism has two operating modes:

- Normal mode
- Approach mode



Pressing pushbutton no. 3 and operating at the same time the hoisting joystick, achieve the approach mode (See par. 5).



- (1) Machine in fast speed limitation mode or approach mode.
- (2) Load / Fast lowering speed limiter or bending moment limiter activated.

When the lever is released the hoisting movement stops and the electromechanical brake goes in. The hoisting speed (both upwards and downwards) is automatically adjusted at the right setting as a function of the load and the number of cables.

## 4.2 Travelling

Travelling movement has 3 speed settings.

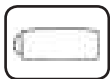
The acceleration and deceleration are achieved by changing the motor power supply, leading to a progressive movement.

Movement braking is automatically carried out by speed changing or bringing the joystick to zero setting.

An alarm siren at the foot of the crane sounds intermittently while transfer movement is taking place. It sounds different from the normal crane siren.

A pulser exists that annuls the retardation in the fall of the electromechanical brake. Its use to consult section 5.

## 5 APPROACH MODE HOISTING PUSHBUTTON



Pressing pushbutton no. 3 and operating at the same time the hoisting joystick, achieve the approach mode.

It is very accurate in low hoisting speeds.

Switching between operating modes (from normal mode to approach mode or vice versa) can be done while hoisting without any problems. If the pushbutton is pressed while working on normal mode, the hoist motor speed is automatically reduced. The motor speed is increased when switching from approach to normal mode (button released).

## 6 LIGHTED PUSHBUTTON (Working-Alarm)



Use for crane start up.

Pressing the pushbutton means switching on the main contactor and the light goes on.

When the crane is power supplied through the main contactor, the hoist and trolley frequency converters go into a self-test checking for errors. This takes a few seconds.

Hoisting and trolley movements are not possible during this time.

## 7 STOP PUSHBUTTON



The normal use of the stop pushbutton is disconnecting the power supply to the crane when no work is being done, or as a previous measure to switching off the main contactor prior to leaving the work place at the end of the shift.

Also, it may be used as an emergency stop when crane work so requires.

## 8 Slewing brake button



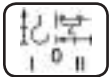
Cancels the delay in actuation of the slewing motor electromechanical brake.

Under normal working, once the joy-stick reaches the zero point then jib movement is gradually stopped by the motor. The electromechanical brake is a parking brake which is actuated afterwards.

However, on certain occasions when the wind is strong, the jib has to be held once movement has stopped, at which time this button is used.

## 9 Limiter cancel switch

This is a three-way switch with return to middle position.



In middle position:

0

No action.

In left position:



Cancels the hook up limiter to be able to make a reeving change. When this button is activated, the trolley can only move at reduced speed.

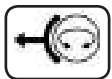
In right position:



Cancels the trolley back limiter to be able to make a reeving change. When this button is activated, the trolley can only move at reduced speed.

- ! During the reeving change operation, and once the trolley back and hook up limits have been exceeded, then depending on trolley and hook position some movements such as trolley forward or hoisting up or down may be prevented owing to the reeving change operation having been started but not carried out properly.

## 10 Lighted pushbutton for free slewing mode



With button, the slewing motor brakes are unlocked.

When pressing this pushbutton with the crane working, the crane is set to free slewing (slewing brake unlocked) and the horn sounds. For deactivating the free slewing mode press either left slewing or right slewing.

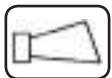
See "Weathervaning" in this chapter.

## 11 Travelling control commutator



It serves the purpose of switching off the crane travelling movement, this way preventing an accidental travelling movement start.

## 12 Alarm button



Pressing this button sounds the audible alarm fitted to the crane.

## 0 CONTENTS

- 1 **IMPORTANT NOTES**
- 2 **INTRODUCTION TO THE SYSTEM.**
  - 2.1 System overview.
  - 2.2 Basic configuration and optional functions.
  - 2.3 System features and functions.
- 3 **USE OF UC DL46 DISPLAY**
  - 3.1 Information on the screen and use of the keyboard.
  - 3.2 Dynamic menu.
  - 3.3 Editable fields.
- 4 **USE OF THE INDICATION FUNCTION.**
  - 4.1 Introduction to the indication page [P1].
- 5 **USE OF THE DATA LOGGER FUNCTION.**
  - 5.1 Permanent events indication page [P2].
  - 5.2 Events log page [P3].
- 6 **USE OF THE FORBIDDEN ZONES FUNCTION**
  - 6.1 Forbidden zones indication page [P4].
- 7 **APPENDICES** – Event list and failure codes.

## 1 IMPORTANT NOTES



INDICATORS SHOULD NEVER BE USED AS A DETERMINANT AID IN CRANE WORK AT POINTS WHERE THE OPERATOR CANNOT PERFECTLY SEE THE LOAD AND SURROUNDINGS. ON SUCH SITUATION, THE INDICATIONS OF A SIGNAL-MAN ARE COMPULSORY.



INDICATORS SHALL NEVER REPLACE A SCALE AND SHOULD NEVER BE USED AS A SUBSTITUTE FOR THE CRANE LOAD AND MOMENT LIMITERS.



DATA DISPLAYED ARE SIMPLY INDICATIONS AND CANNOT REPLACE THE PERSONAL SUPERVISION OF THE OPERATOR AND HIS OWN IMPRESSION OF THE SIZE OF THE LOAD BEING HANDLED.



FOR THE SYSTEM TO WORK PROPERLY, IT IS NECESSARY TO PERFORM CORRECTLY THE COMPLETE SET UP AND ADJUSTMENT OF THE UNIT.



ANY CHANGE ON THE CRANE CONFIGURATION MAY RESULT IN A BAD OPERATION OF THE INDICATION, DATA LOGGING OR FORBIDDEN ZONES SYSTEM. AFTER ANY CRANE CONFIGURATION CHANGE, IT IS NECESSARY TO READJUST THE SYSTEM AND CHECK THAT THE UNIT IS FULLY OPERATIVE AND PROPERLY WORKING.



IT IS FORBIDDEN TO RELY EXCLUSIVELY ON THE SAFETY LEVEL PROVIDED BY THE ZONING SYSTEM WHENEVER THE CONSEQUENCE OF A FORBIDDEN ZONES SYSTEM FAILURE MIGHT LIKELY RESULT IN SEVERE DAMAGE FOR PEOPLE OR PROPERTY.



THE FORBIDDEN ZONES SYSTEM ALONE SHOULD NOT BE USED TO AVOID TO DRIVE THE CRANE ABOVE PIPE INSTALLATIONS THAT MIGHT CONTAIN FLAMMABLE LIQUIDS OR GASES. THE FORBIDDEN ZONES SYSTEM SHALL NOT BE USED TO AVOID TO DRIVE THE CRANE ABOVE ELECTRIC CABLES. ON SUCH SITUATIONS, IT IS NECESSARY TO MAKE A SAFETY ASSESSMENT AND TAKE ADDITIONAL MEASURES (I.E. MOUNTING THE CRANE SO THAT THERE IS NO POSSIBILITY OF INTERFERENCE WITH THE CABLE) THAT LEAD TO A PROPER RISK REDUCTION.



IT IS COMPULSORY TO CHECK THE PROPER OPERATION OF THE FORBIDDEN ZONES SYSTEM AND THAT EVERY FORBIDDEN ZONE IS ACTIVATED AND WORKING PROPERLY, EVERY DAY BEFORE BEGINNING TO WORK.


## 2 INTRODUCTION TO THE SYSTEM

### 2.1 System overview.

DLZ341 system must be used as an aid to operate the crane. It does not and cannot replace the ability, experience and common sense of the crane operator.

The system offers visual and alphanumerical information that allows faster and more integrated perception of the crane situation and other parameters that affect its behaviour (wind speed, load...). The proper understanding and the judgement of the information and its reliability is a responsibility of the crane operator, who is also responsible for the control and proper and careful drive of the crane.

**! Before beginning to use the system, it is compulsory to properly train the operator. Furthermore, the maintainer of the crane or whoever performs any adjustment or change on it, must carefully read this manual until he understands the working principle and the procedures for its adjustment.**

 The indication screens on this document may suffer some change as a result of any improvement of the system software.

### 2.2 Basic configuration and optional functions.

DLZ341 system includes the following functions as standard:


- Basic indications (trolley radius, height under hook, load, moment...).
- Data logger.

DLZ341 may optionally include the following special functions (on demand):

- Extended indication (the system can be supplied with additional information like slewing position or travelling position).
- Forbidden zones system (prevents the hook from entering the areas defined by the user. If the system is equipped with forbidden zones, it must include the slewing sensor and the travelling sensor, if needed, to properly perform the forbidden zone function).

### 2.3 System features and functions.

The indication screen allows the user to access the system information and configuration. The screen is a colour antireflective one and is provided with an ergonomic design that improves the comfort and usability to the crane operator

 Screen messages use pictograms recommended by FEM1003 standard which list the symbols to be used on tower crane indications, so that an effective and error-free communication is achieved.

The indication function offers an instantaneous and intuitive sight that shows the load state of the crane and the crane position. The data are represented in numerical format and also as a progress bar, allowing a faster and easier understanding.

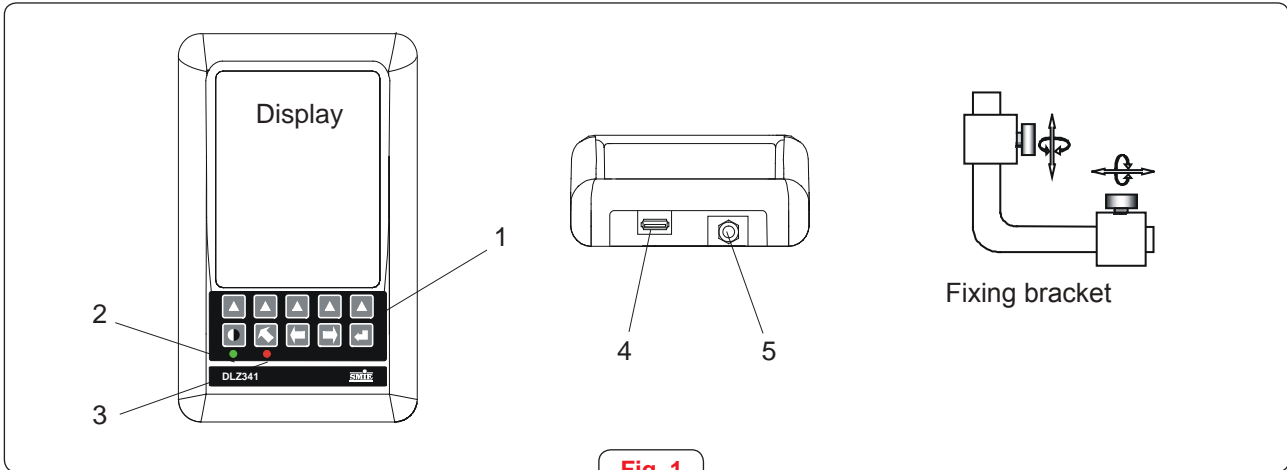
Further information on the indication function may be found in point 4 of this document.

The data logger function supplies information referred to the crane operation (number of working hours of each winch, number of overloads, information on the last movements, alarms...).

Further information on the data logger function may be found in point 5 of this document.

The forbidden zones function allows the user to define a number of zones where the hook will be prevented from entering. Once the system is properly adjusted, the crane stores the zones information in memory and operates in an intelligent way, automatically preventing the hook from entering into the forbidden areas.

Further information on the forbidden zones function may be found in point 6 of this document.



**Fig. 1**

☞ When UCDL46 internal temperature goes below  $-10^{\circ}\text{C}$  or above  $+60^{\circ}\text{C}$ , the screen is switched off and the power supply green LED blinks. The functions of the system keep working but the screen is automatically switched off to avoid damages.

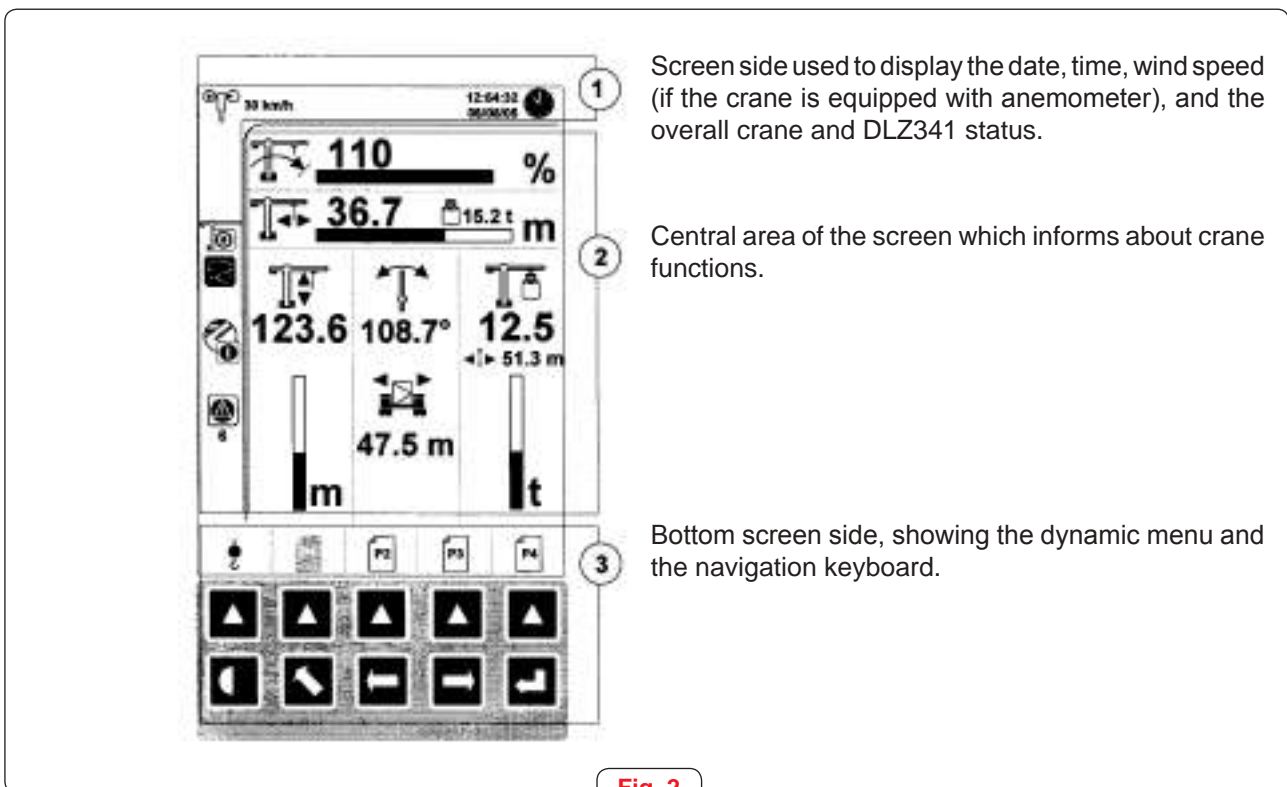
! The display must be stored in a clean and dry place.

The UCDL46 unit is mounted inside the cabin on a fixing bracket that permits several rotations and movements. It allows the crane operator to set an optimal position from an ergonomic point of view.

To adjust the display position and orientation, loose both swivels, set the unit to the desired position and tighten them again (Fig.1).





### 3 USE OF UCDL46 DISPLAY.

#### 3.1 Information on the screen and use of the keyboard.









**Fig. 2**

The following table shows the pictograms in this page and their meaning.








SIDE BAND PICTOGRAMS			
PICTOGRAM	EXPLANATION	CONFIGURATION	
1		Wind speed.	Option
2		Wind speed prealarm (threshold defined by the user).	Option
3		Wind speed alarm (threshold defined by the user).	Option
4		Anemometer signal fault	Option
5		Crane switched on.	Basic system
6		Crane switched off.	Basic system
7		Weathervaning on.	Basic system
8		Forbidden zones ON.	Forbidden zones
9		Forbidden zones OFF.	Forbidden zones
10		Internal system fault (see appendix 4)	Basic system



The following table shows the function of each keyboard key.

NAVIGATION AND DATA FEEDING KEYBOARD		
KEY	EXPLANATION	
1	 Pushbutton associated to the dynamic menu.	
2	 Enter.	
3	 Move right or increase value.	
4	 Move left or decrease value.	
5	 Escape.	
6	 Screen backlight control (in Page P1). In some other pages it is a help button.	








### 3.2 Dynamic menu.

Depending on the active page and the navigation level, the dynamic menu changes and offers different choices between the associated pictograms. To choose any option use the pushbuttons associated to the dynamic menu.

DYNAMIC MENU PICTOGRAMS			
PICTOGRAM	EXPLANATION	CONFIGURATION	
1		Accesible menu page.	Basic system
2		Active page.	Basic system
3		Page under programming or configuration mode.	Basic system
4		Move right to hidden dynamic menu elements	Basic system
5		Move left to hidden dynamic menu elements.	Basic system
6		Navigate through additional pages of the event log.	Basic system
7		Export to USB.	Basic system
8		Import from USB.	Basic system
9		Delete information.	Basic system

DYNAMIC MENU PICTOGRAMS		
PICTOGRAM	EXPLANATION	CONFIGURATION
10	Restore factory settings.	Basic system
11	Save current settings.	Basic system
12	Activate/Deactivate forbidden zones.	Forbidden zones
13	Show advanced forbidden zones parameter configuration	Forbidden zones
14	 Show the version information and software upgrading page	Basic system
15	 Current reeving and manual reeving change.	Basic system

### 3.3 Editable fields.

	FIELD	KEYS	EXPLANATION
1	<input type="text" value="000.00"/> m	 	Allows to move from a field to the next or previous one through the configuration pages. The active field is highlighted in a blue frame.
2	<input type="text" value="000.00"/> m		Enter the field to modify.
3	<input type="text" value="500.00"/> m	 	Choose the alphanumerical value of the current digit
4	<input type="text" value="500.00"/> m		Confirm the current digit value and pass to the next one.
5	<input type="text" value="000.00"/> m		Exit the field.

## 4 USE OF THE INDICATION FUNCTION.

 THE INDICATION SCREENS SHOWN IN THIS DOCUMENT MAY SUFFER SOME CHANGE DUE TO ANY SYSTEM SOFTWARE IMPROVEMENT.

### 4.1 Introduction to the indication page [P1].

This screen displays the status of the crane and the position of several crane movements. Each indication is associated to a sensor connected to the IMDL46 unit.

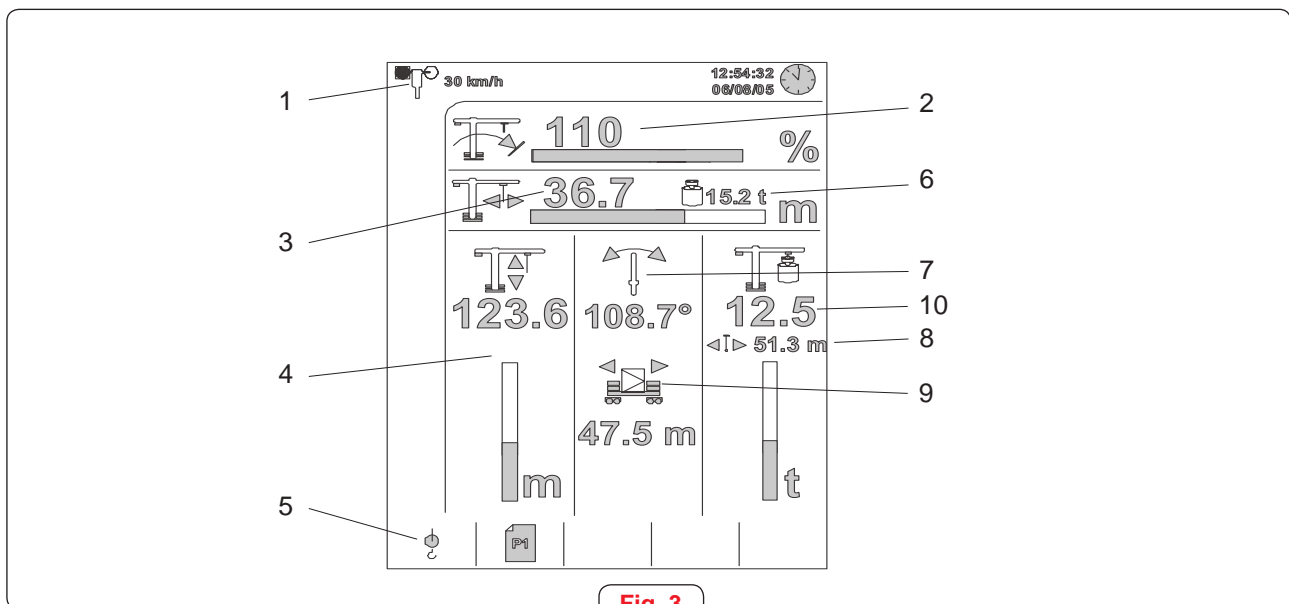


Fig. 3

- 1 Real-time wind speed. (anemometer option).  
A prealarm and an alarm warning indication on the screen can be set, to warn the crane operator when wind speed goes beyond the chosen thresholds.
- 2 Moment exerted by the load on the crane  
It is indicated as a percentage with respect to the nominal maximum moment.  
The maximum value shown by the display is 133%.
- 3 Trolley position.  
With respect to the tower mast central axis.
- 4 Hoisting position.  
Indicated with respect to a chosen ground level (0 meters).  
This value can be positive or negative depending on whether the hook can go below the chosen ground level or not.
- 5 Reeving state.  
Displays the current crane reeving state.  
The system does not automatically detect the reeving number. To indicate the proper number of reevings, press the reeving change button 5.



An incorrect number of reeving choice may lead to an incorrect hook height and load indication and thus to a possible incorrect operation of the forbidden zones height limitation.

- 6 Maximum load at current trolley position.  
This value is attained through calculations based on the crane parameters and on the measured values



This indication is just a rough value and only pretends to be an aid to the crane operator. It is compulsory that the crane operator knows and refers to the load chart diagrams of the crane and never lifts loads above the crane capacity indicated on the chart.


- 7 Angle between current jib position and another reference position. The angle must be increased when the crane turns clockwise (slewing sensor option).
- 8 Maximum permitted reach for the current load.  
This value is attained through calculations based on the crane parameters and on the measured values



This indication is just a rough value and only pretends to be an aid to the crane operator. It is compulsory that the crane operator knows and refers to the load chart diagrams of the crane and never lifts loads above the crane capacity indicated on the chart.

- 9 Travelling position (option).

- 10 Load under hook

 Movement commands are indicated on the screen.



The arrow corresponding to the sense of movement blinks as the winch moves.



If there is a failure on any of the sensors or on its configuration, the screen shows this pictogram and an error code (see Appendix).



THE INDICATION SCREENS SHOWN IN THIS DOCUMENT MAY SUFFER SOME CHANGE DUE TO ANY SYSTEM SOFTWARE IMPROVEMENT.



## 5 USE OF THE DATA LOGGING FUNCTION.

### 5.1 Permanent events indication page [P2].

Page [P2] displays the permanent information of the system. Permanent information is a set of accumulated values that are not reset, unless an authorized user reset them on purpose.

They are counters which inform about the overall crane activity.

These values are updated everytim there is a crane event that affects their value (movements, load limitation...).

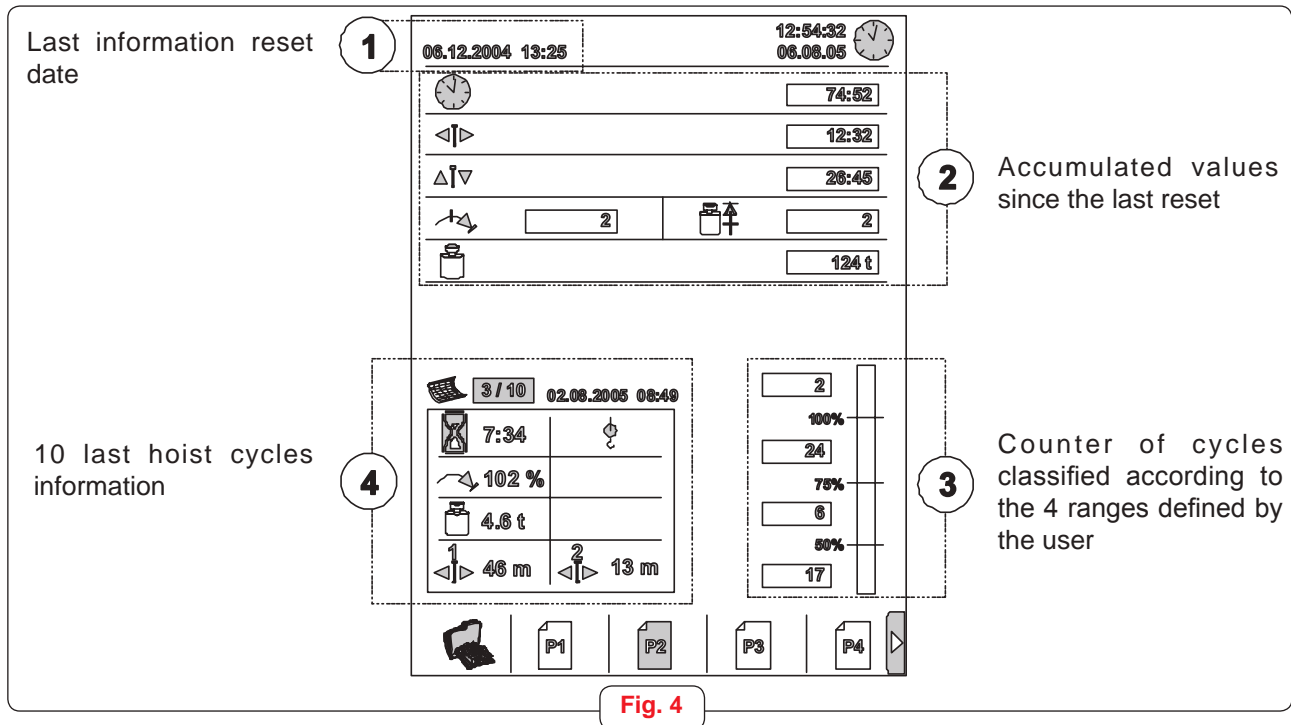








Fig. 4

#### 5.1.1 Accumulated values since the last reset.

Zone 2 on page [P2] (Fig. 4) registers and displays the values accumulated since the last reset

PICTOGRAM	EXPLANATION
1  74:52	Crane switched on total time (in hours : minutes).
2  12:32	Total trolley work time (in hours : minutes).
3  26:45	Total hoist work time (in hours : minutes).
4  2	Times the crane reached a moment limit situation.
5  2	Times the crane reached a load limit situation.
6  124 t	Total lifted load (in tons).

#### 5.1.2 Hoist cycles.

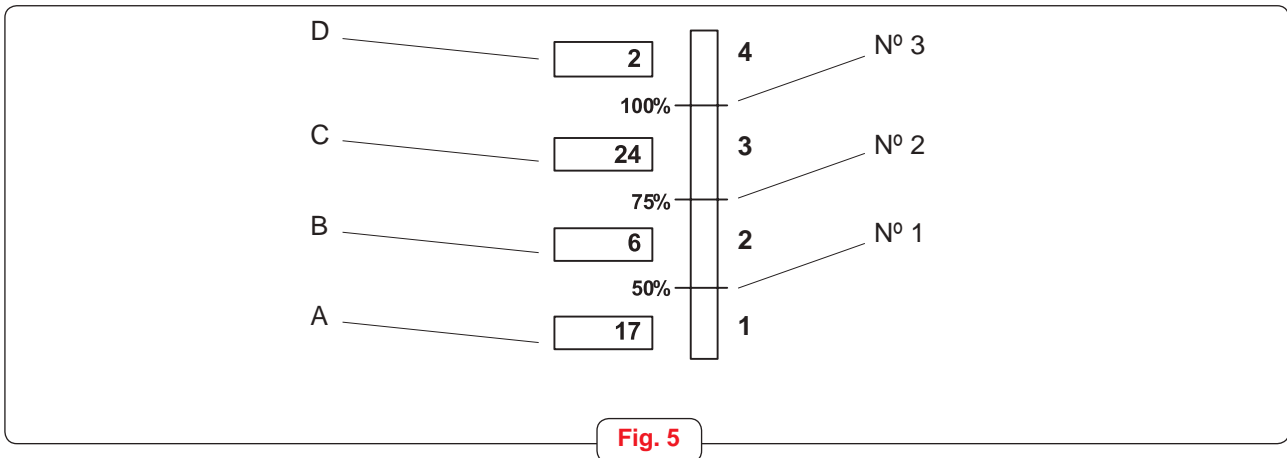
DLZ341 system continuously calculates the lifted load and registers the cycle information in 2 different screen zones (zones 3 and 4 of page [P2]) (Fig. 4).

A cycle begins when the lifted load goes beyond 5% of the crane maximum load specified in [P10] during more than 5 seconds.

A cycle ends when the lifted load goes below al 5% of the crane maximum load specified in [P10] during more than 5 seconds.

Zone 3 (Fig.4) -Cycle counter:

This zone shows the number of accumulated cycles classified according to 4 ranges. The ranges may be changed by the user.

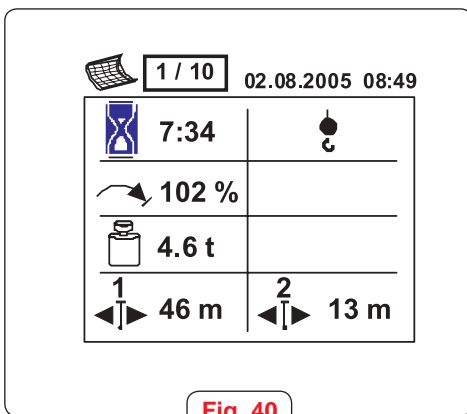


**Fig. 5**

	EXPLANATION
A	Number of cycles with moment % below N°1.
B	Number of cycles with moment % between N°1 and N°2.
C	Number of cycles with moment % between N°2 and N°3.
D	Number of cycles with moment % beyond N°3.





Zone 4 (Fig.37) - 10 last hoist cycles information:

This screen zone displays detailed information of the 10 last hoist cycles, ordered in a FIFO list (The list always contains 10 cycles. When detecting a new cycle, it is placed in position 1, the rest are moved to the next position, and the one in position 12 is deleted)



**Fig. 40**

	EXPLANATION
1 / 10	Cycle number.
08:49	Beginning of the cycle time.
7:34	Cycle length (minutes : seconds).
hook icon	Reaving state.
102 %	Maximum moment during the cycle.
4.6 t	Maximum load during the cycle.
1	Trolley position at the beginning of the cycle.
2	Trolley position at the end of the cycle.





Press  to access the field , and use   to go through the cycle list.  
Press  to exit.

## 5.2 Events log page [P3].

Page [P3] shows the events recorded in the DLZ341 database.

The event log records the last 2000 events since the last reset, ordered in a FIFO list (The list always contains 2000 events. A new event is placed in position 1, the rest are moved to the next position, and the one in position 2000 is deleted)

- 1 Chronology of the events.
- 2 Event identification page (see Appendix).
- 3 Complementary info (see Appendix).

Press  to access the field 1/10, and use   
and  to go through the cycle list.  
Press  to exit.

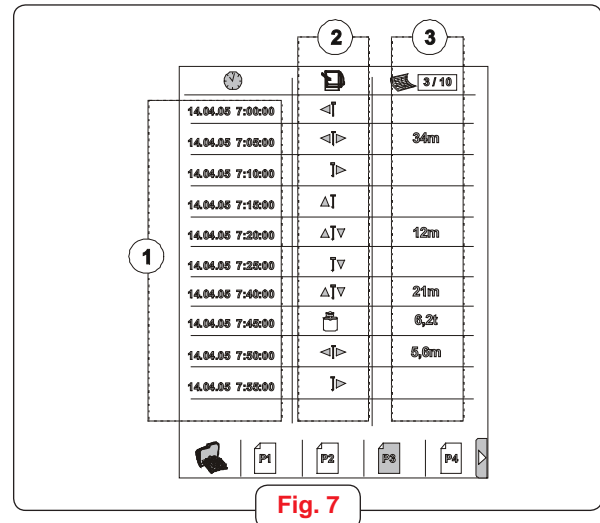


Fig. 7

## 6 USE OF THE FORBIDDEN ZONES FUNCTION



An unproper adjustment or scaling of the forbidden zones function may lead to an undesired behaviour of the crane or to a loss of safety.

It is compulsory that the configuration and scaling is done by a trained maintainer.



THE INDICATION SCREENS SHOWN IN THIS DOCUMENT MAY SUFFER SOME CHANGE DUE TO ANY SYSTEM SOFTWARE IMPROVEMENT.

### 6.1 Forbidden zones indication page [P4].

This page displays a view of the forbidden zones shapes locations with respect to the crane. In this page, the forbidden zones change dynamically with respect to the crane (the zones rotate around the crane as it moves)

- 1 Jib and counterjib drawing.
- 2 Trolley drawing.
- 3 Active forbidden zone drawing (red coloured line). A zone can be activated or deactivated selectively.
- 4 Band indicating the current crane position coordinates.
- 5 Travelling track drawing (option).
- 6 Deactivated forbidden zone (green coloured line).  
The deactivated zone is recorded, but the crane is allowed to enter inside.
- 7 Scaled grid.
- 8 Global forbidden zones activation or deactivation pressbutton.

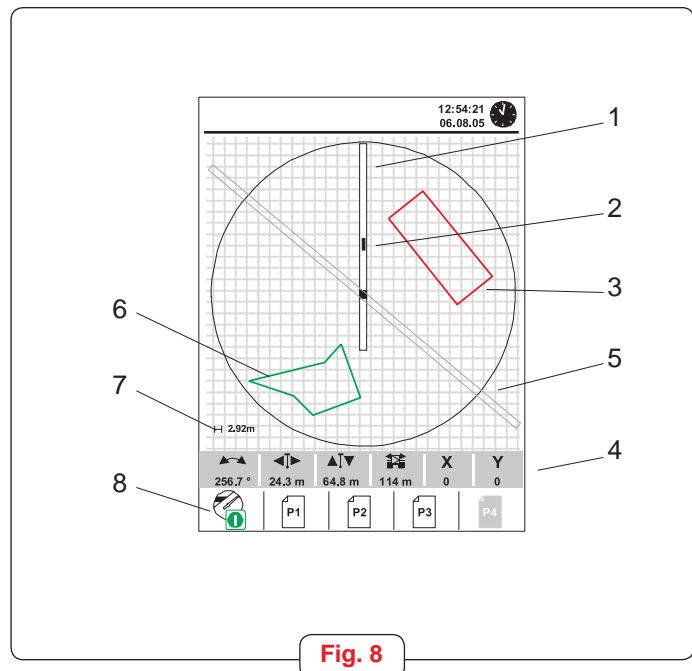






Fig. 8

#### 6.1.1 Hook position coordinates indication.

The band at the bottom of page [P4] (Fig. 8) displays the hook position coordinates referred to the set of axis defined during the sensor scaling (height under hook, trolley position...)

PICTOGRAMA	EXPLICACIÓN
1  256.7°	Slewing angle referred to the "zero" set during the slewing sensor scaling.
2  24.3 m	Trolley position.
3  64.8 m	Height under hook referred to the ground level set on the hoist sensor scaling
4  114 m	Travelling position referred to the "zero" set on the travelling sensor scaling.
5 X Y 3,4 28,2	Hook position referred to cartesian absolute axis. The intersection of x and y axis is set on the mast center.











The arrows associated to each movement in [P1] will blink in red when the DLZ system stops the movement.





















### 6.1.2 Movement stop indications in page [P1].









Every time the system stops a movement to avoid entering a forbidden zone, it warns the operator . This warning is done by showing a pictogram, both in page [P4] and in page [P1].













The movement stop pictograms are listed in the following list.

PICTOGRAMA	FUNCIÓN
1 	Trolley forward stop.
2 	Trolley backward stop.
3 	Hoisting stop.
4 	Lowering stop.
5 	Clockwise slewing stopped Slewing.
6 	Anticlockwise slewing stopped Slewing.
7 	Travelling forward stop.
8 	Travelling backward stop.

**7 APPENDICES – Event list and failure codes.**

EVENT	FUNCTION	NOTE	
1		Reeving state.	
2		Reeving state.	
3		Reeving state.	
4		Reeving state	
5		Reeving state	
6		Wind speed rise above prealarm threshold	
7		Wind speed fall below prealarm threshold	
		Wind speed rise above alarm threshold	
		Wind speed fall below alarm threshold.	
8		Anemometer signal fault.	
9		Trolley backward start.	
10		Trolley backward stop.	
11		Trolley forward start.	
12		Trolley forward stop.	
13		Trolley stopped state start.	When the trolley mechanism is stopped at the same position for more than 5 seconds. The position is also registered.
14		Hoisting start.	
15		Hoisting stop.	
16		Lowering start .	
17		Lowering stop.	
18		Hoist stopped state start.	When the hoist mechanism is stopped at the same position for more than 5 seconds. The position is also registered.
19		Load hung state start.	When the hoist mechanism is stopped at the same position for more than 5 seconds. The load value is also registered.
20		Moment limitation state start.	
21		Moment limitation state stop.	
22		Load limitation state start.	

EVENT	FUNCTION	NOTE
23		Load limitation state stop.
24		Crane switched on.
25		Crane switched off.
26		Weathervaning on.
27		Weathervaning off.
28		Forbidden zones on.
29		Forbidden zones on.
30		UCDL46 on.
31		UCDL46 off.
32		UCDL46 date and/or clocktime change.
33		UCDL46 software change.


FAILURE CODE	FUNCTION	NOTE
41	 1	Luffing angle sensor badly scaled or sensor failure.
42	 2	Trolley sensor badly scaled or sensor failure
43	 3	Load cell badly scaled or load cell failure.
44	 4	Moment sensor badly scaled or sensor failure
45	 5	Hoisting sensor badly scaled or sensor failure
46	 6	Anemometer sensor badly scaled or sensor failure
47	 7	Slewing sensor badly scaled or sensor failure
48	 8	Travelling sensor badly scaled or sensor failure
49	 9	System error
50	 10	Data logger failure
51	 11	Memory corruption.
52	 12	Data logger information restoring error.

## 0 CONTENTS


- 1 **PASSING FROM 1 TO 2 TROLLEYS (CHANGING FROM 2- TO 4-FALL)**
- 2 **PASSING FROM 2 TO 1 TROLLEY (CHANGING FROM 4- TO 2-FALL)**
- 3 **CANCELLING/REPOSITIONING THE FOUR-FALL TROLLEY**

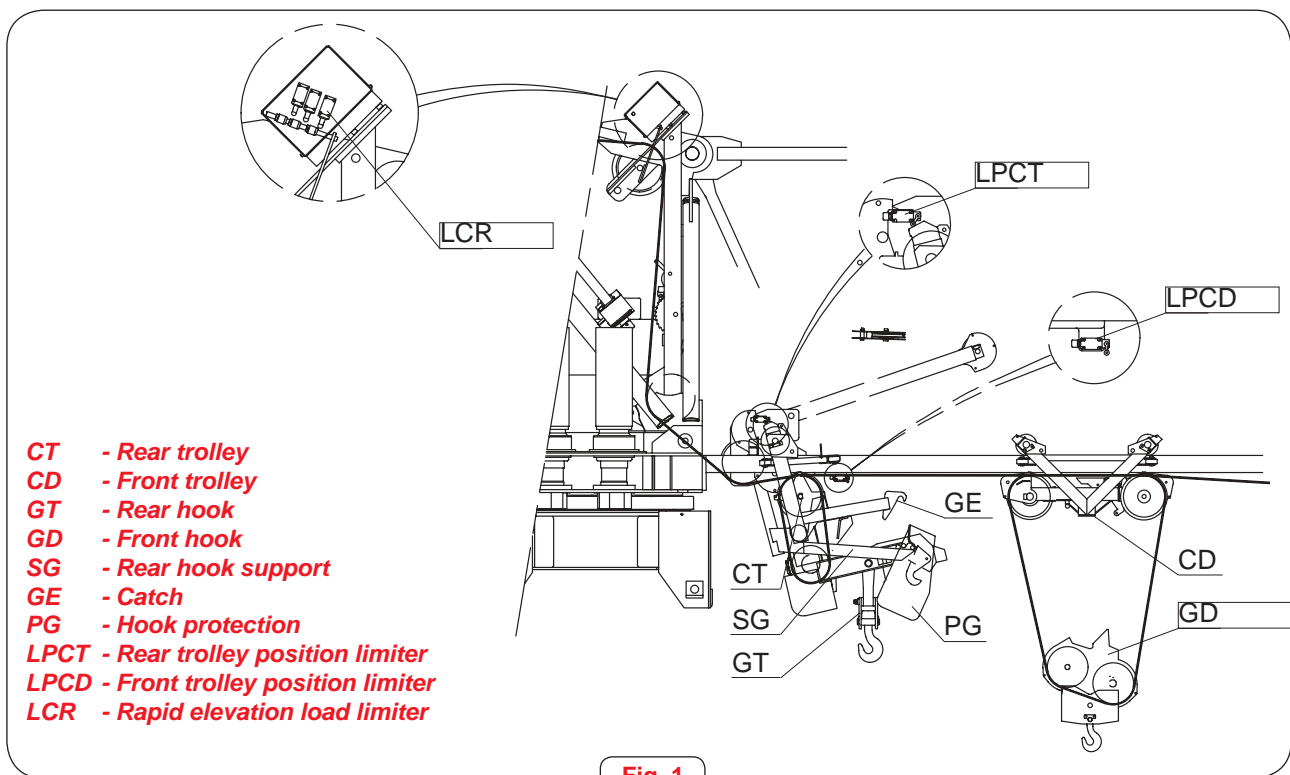
### 1 PASSING FROM 1 TO 2 TROLLEYS (CHANGING FROM 2- TO 4-FALL)

 ALWAYS CHANGE THE FALL FROM A POSITION THAT ALLOWS THE PERSON MAKING THE CHANGE TO VISUALLY CHECK THE OPERATION PROPERLY, TO PREVENT ANY ANOMALY OR MALFUNCTION THAT MAY ENTAIL A RISK SITUATION.

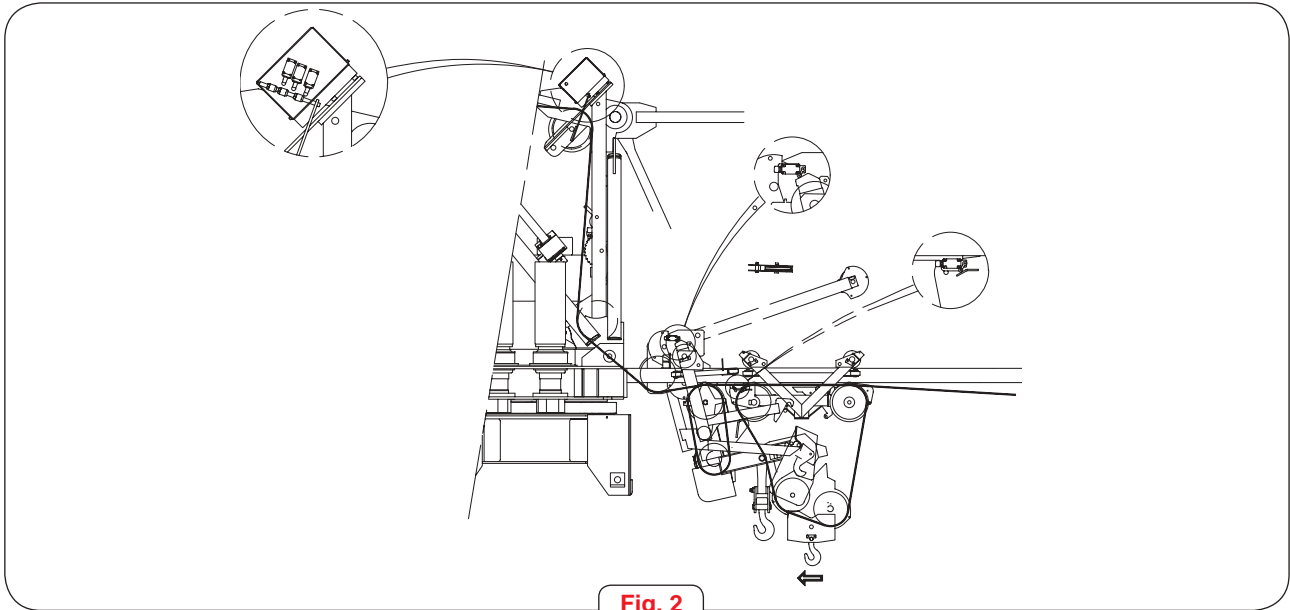
 TO CHANGE THE FALL, THE HOOK MUST BE FREE OF LOADS, SLINGS AND TACKLE FOR SUSPENDING LOADS.

 THE CRANE'S ELECTRIC EQUIPMENT INCLUDES A SAFETY SYSTEM THAT PREVENTS BAD MANOEUVRES DURING THE FALL CHANGE CAUSING RISK SITUATIONS.

 ALL THE LIMITERS OF THE CRANE MUST BE CORRECTLY REGULATED. THIS OPERATION INVOLVES THE UPPER HOOK AND REAR TROLLEY LIMITS AND THE LOAD LIMITER. SEE DOCUMENTS "LIFTING STROKE LIMITER", "TROLLEY LIMITER" AND "LOAD LIMITER" IN THE CHAPTER "ASSEMBLY / DISMANTLING".



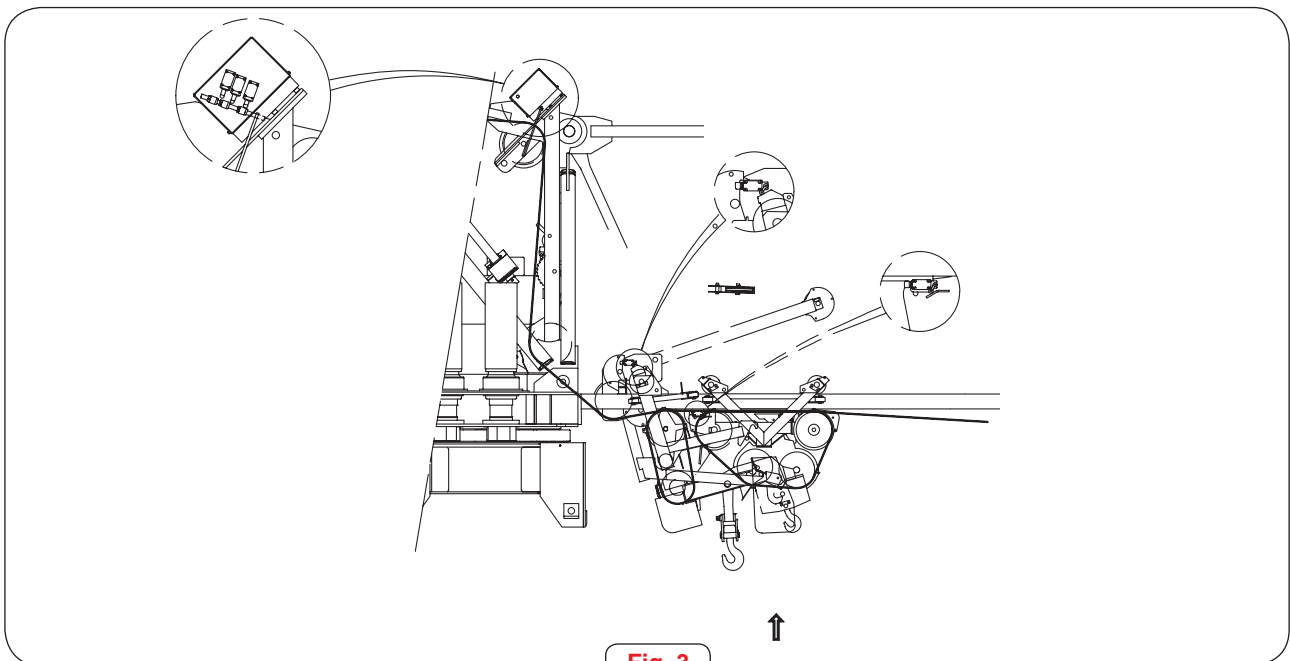
- The crane is working with a single trolley and hook: the front. (TWO-FALL).
- The rear trolley and hook are housed at the start of the jib, in the rear hook support (SG).
- The rear trolley activates a position limiter (LPCT), which detects it is in the position where the fall can be changed.



**Fig. 2**

- Raise the hook until the hook limiter acts at the top.
- Bring the front trolley and hook to the start of the jib until the trolley limiter acts at the back.
- From the crane control, cancel the rear trolley limiter and move the front trolley towards the start of the jib until the front trolley position limiter (LPCD) is activated, which allows you to continue with the change.

**!** ONCE YOU HAVE PRESSED THE "TROLLEY BACK" BUTTON TO EXCEED THE LIMITER, THE MOVEMENT OF HOOK AT THE TOP IS BLOCKED UNTIL THE FRONT TROLLEY POSITION LIMITER IS ACTIVATED.



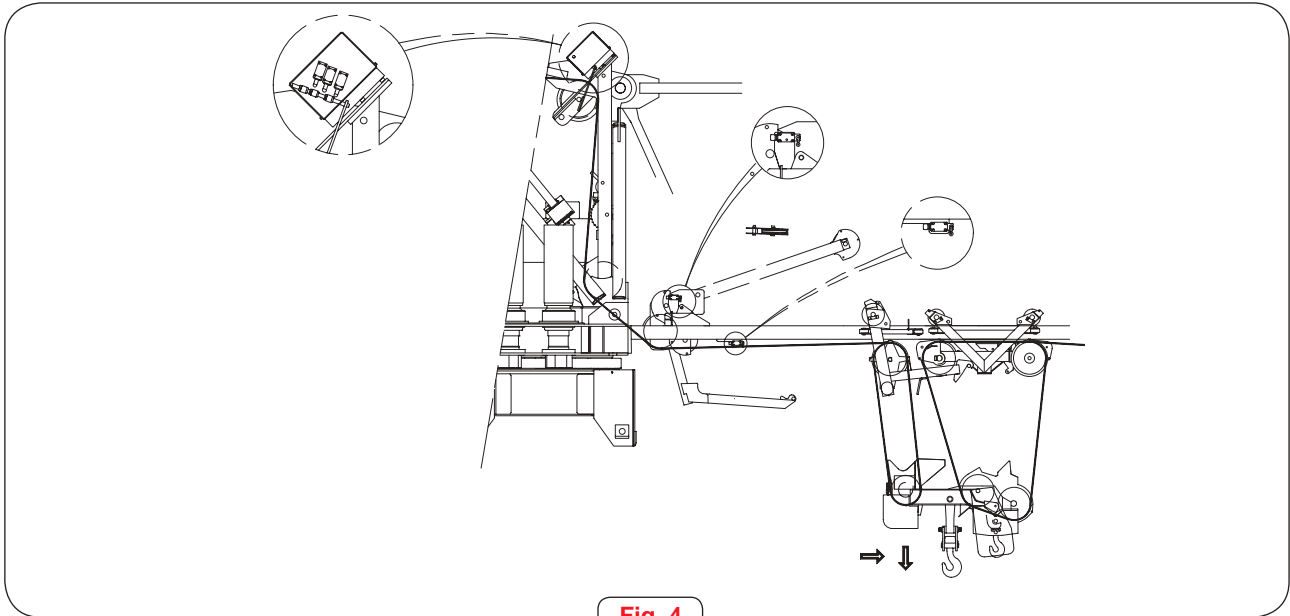
**Fig. 3**

- From the crane control, cancel the upper hook limiter and raise the front hook slowly until it is housed in the rear hook and can go no further.

**!** ONCE YOU HAVE PRESSED THE "HOOK UP" BUTTON TO EXCEED THE LIMIT, THE MOVEMENT OF THE FRONT TROLLEY IS BLOCKED UNTIL THE RAPID LOAD ELEVATION LIMITER IS ACTIVATED. (LCR).



- Continue raising the set of hooks. The rear trolley tilts on its wheel, the front hook goes as far as the front trolley, the protection "PG" tilts hiding the anchor of the front hook and secures the two hooks.
- As you continue raising, the elevation cable tightens and the quick elevation load limiter (LCR) cuts off the movement.



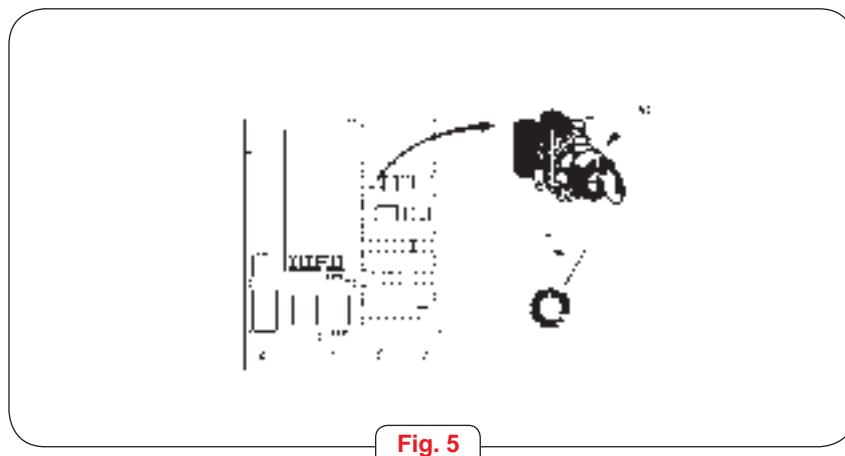
- Move the set of trolleys and hooks forward until it leaves the rear hook support.
- Continue moving the trolley forward until you are out of the rear trolley limit area.
- From the crane control, activate descent. The rear trolley will tilt until the ratchet catch rests on the front trolley and the two trolleys stay together. Continue lowering until you are out of the upper hook limit area.
- The crane is now ready to work with the two trolleys and the two hooks together. (FOUR-FALL).
- The loads must be suspended from the anchor of the rear hook.



IT IS PROHIBITED TO REMOVE THE GUARD FROM THE FRONT HOOK ANCHOR TO SUSPEND LOADS WHEN WORKING IN FOUR-FALL. IGNORING THIS CAN CAUSE ACCIDENTS.



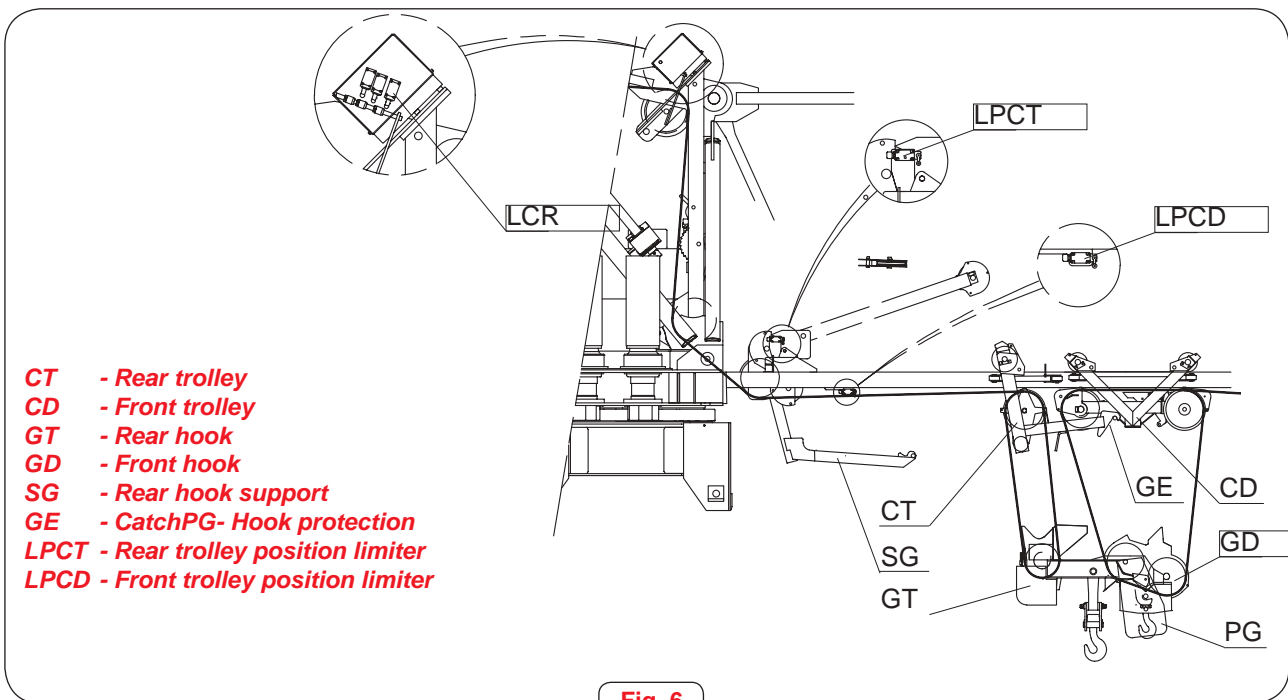
If, when changing the fall, it is necessary to make any movement prohibited by the fall change safety system, this safety system can be cancelled using the switch with a key (ID) in the cat head electric cabinet.



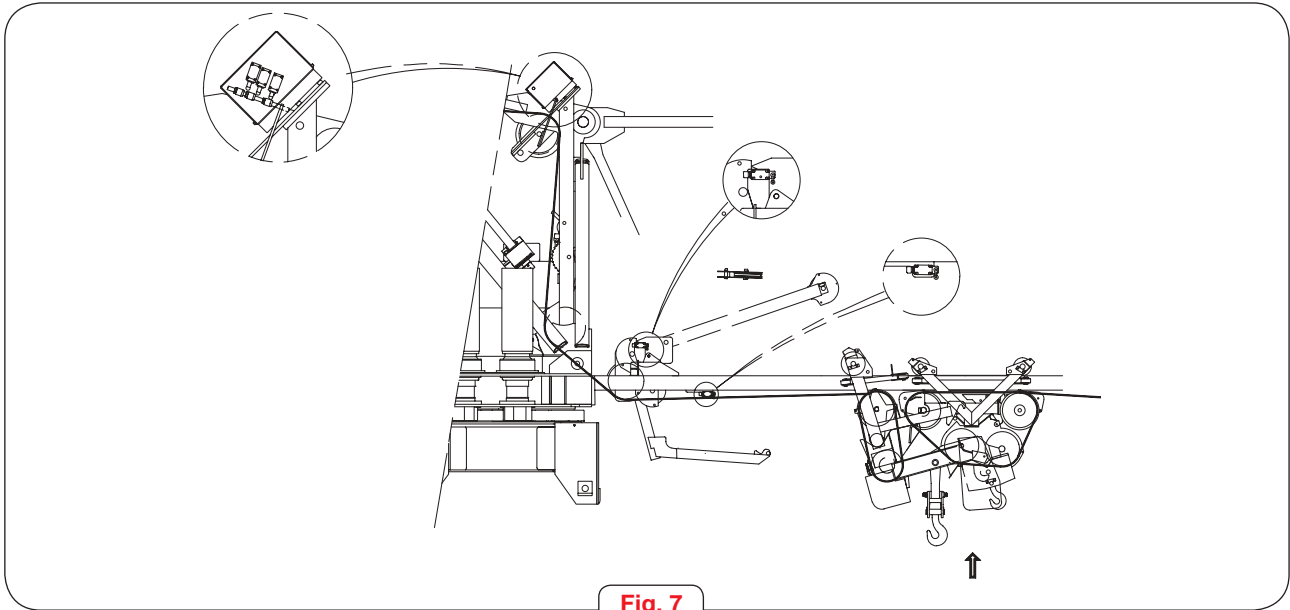
- ⚠ The ID switch for cancelling the safety system when changing the fall must only be used by service staff that know the scope of the cancellation of the safety system.
- ⚠ All operations made with the safety system cancelled must be specially supervised to avoid any dangerous situations.
- ⚠ Once you have finished the operation for which you cancelled the safety system, you must stop the crane and reset the crane operation.
- ⚠ IF YOU OBSERVE ANY IRREGULARITY WHILE CHANGING THE FALL, NOTIFY THE MAINTENANCE SERVICES TO REVISE AND REGULATE IT.

## **2 PASSING FROM 2 TO 1 TROLLEY (CHANGING FROM 4- TO 2-FALL)**

- ⚠ ALWAYS CHANGE THE FALL FROM A POSITION THAT ALLOWS THE PERSON MAKING THE CHANGE TO VISUALLY CHECK THE OPERATION PROPERLY, TO PREVENT ANY ANOMALY OR MALFUNCTION THAT MAY ENTAIL A RISK SITUATION.
- ⚠ TO CHANGE THE FALL, THE HOOK MUST BE FREE OF LOADS, SLINGS AND TACKLE FOR SUSPENDING LOADS.
- ⚠ THE CRANE'S ELECTRIC EQUIPMENT INCLUDES A SAFETY SYSTEM THAT PREVENTS BAD MANOEUVRES DURING THE FALL CHANGE CAUSING RISK SITUATIONS.
- ⚠ ALL THE LIMITERS OF THE CRANE MUST BE CORRECTLY REGULATED.  
THIS OPERATION INVOLVES THE UPPER HOOK AND REAR TROLLEY LIMITS AND THE LOAD LIMITER. SEE DOCUMENTS "ELEVATION LIMITER", "TROLLEY LIMITER" AND "LOAD LIMITER" IN THE CHAPTER "ASSEMBLY/DISASSEMBLY".

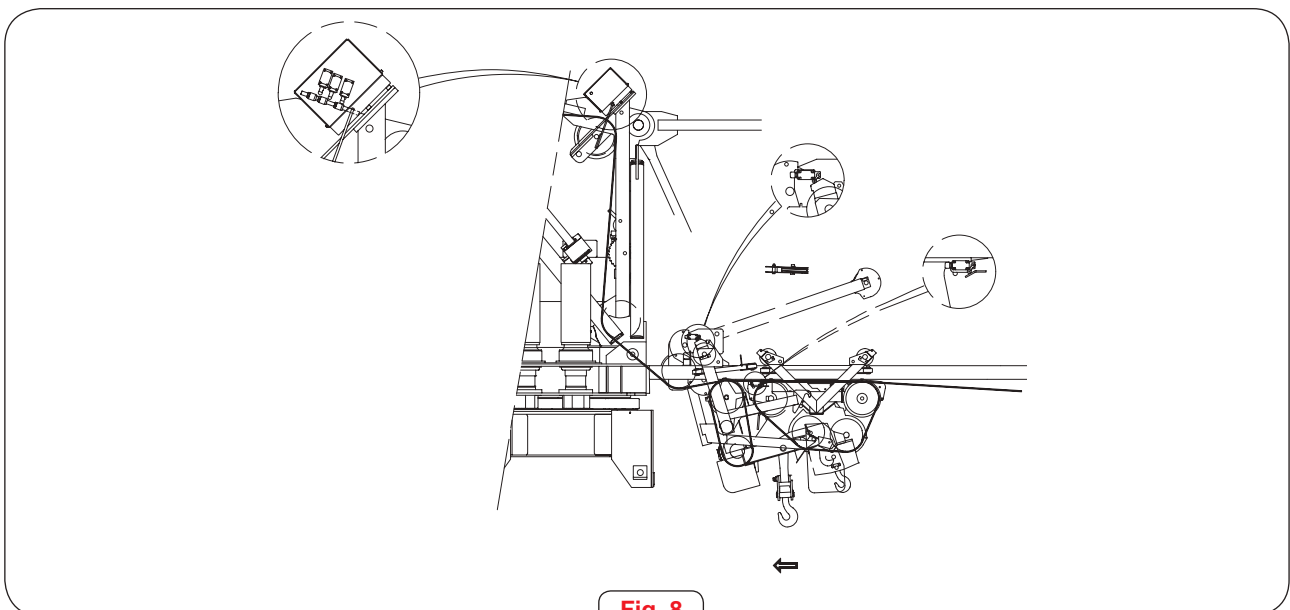


- The crane is working with the two trolleys and the two hooks together (FOUR-FALL).



**Fig. 7**

- From the crane control, cancel the upper hook limiter, at slow elevation speed, bring the hooks to the trolleys until the rear hook makes contact with the rear trolley.
- ! ONCE YOU HAVE PRESSED THE "HOOK UP" BUTTON TO EXCEED THE LIMIT, THE MOVEMENT OF THE FRONT TROLLEY IS BLOCKED UNTIL THE RAPID LOAD ELEVATION LIMITER IS ACTIVATED. (LCR)
- Continue raising. The hook tilts on the rear trolley until the front hook reaches the front trolley.
- Continue raising. The rear trolley tilts on its wheel, freeing the trolley ratchet catch. The elevation cable tightens and the quick elevation load limiter (LCR) cuts off the movement.



**Fig. 8**

- From the crane control, cancel rear trolley limiter, and move the trolleys towards the start of the jib.
- Continue moving the trolley back until the fall change position limiters (LPCT) and (LPCD).

! ONCE YOU HAVE PRESSED THE "TROLLEY BACK" BUTTON TO EXCEED THE LIMIT, THE MOVEMENT OF HOOK AT THE TOP IS BLOCKED UNTIL THE TROLLEY POSITION LIMITERS ARE ACTIVATED.

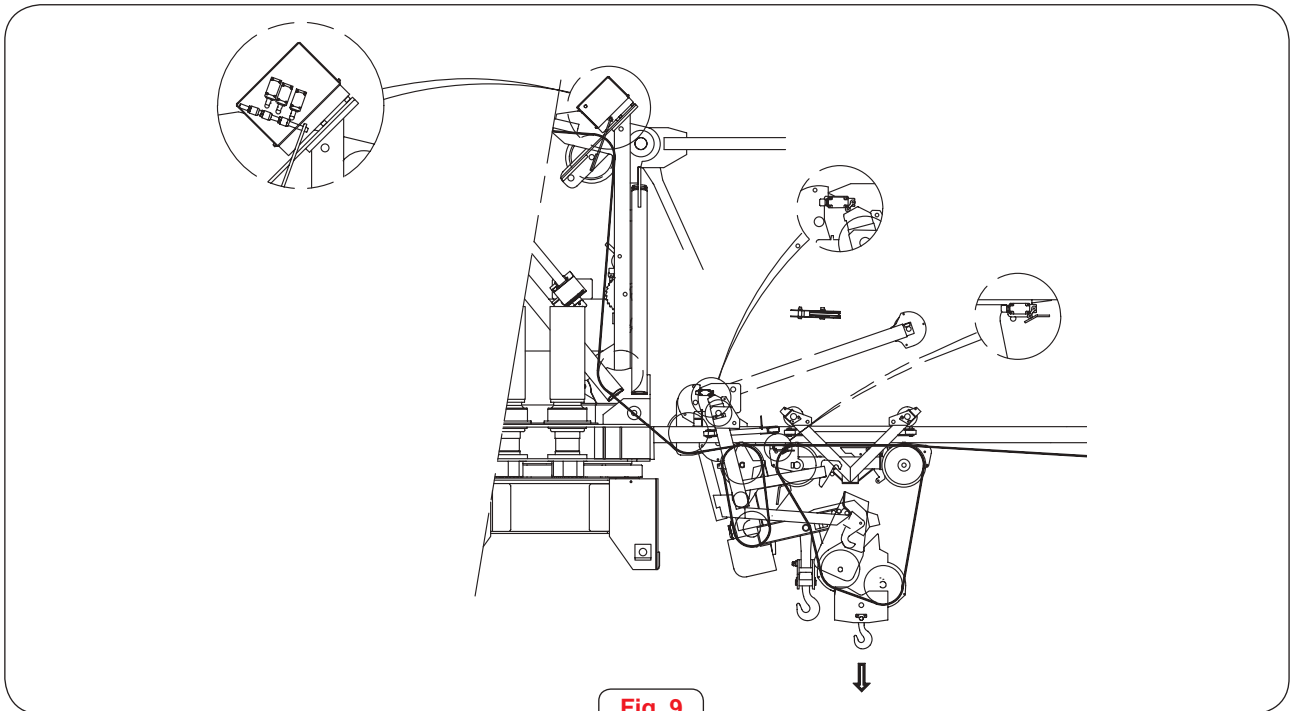


Fig. 9

- Activate the slow descent. The rear trolley tilts on its wheel until the rear hook is housed in the rear hook support (SG); the trolley union catch (GE) is raised allowing the front trolley out.
- The anchor guard (PG) of the front hook tilts and liberates the union of the front and rear hooks.

! IT IS NOT POSSIBLE TO MOVE THE TROLLEY WHILE THE FRONT HOOK IS ABOVE THE UPPER HOOK LIMITER.

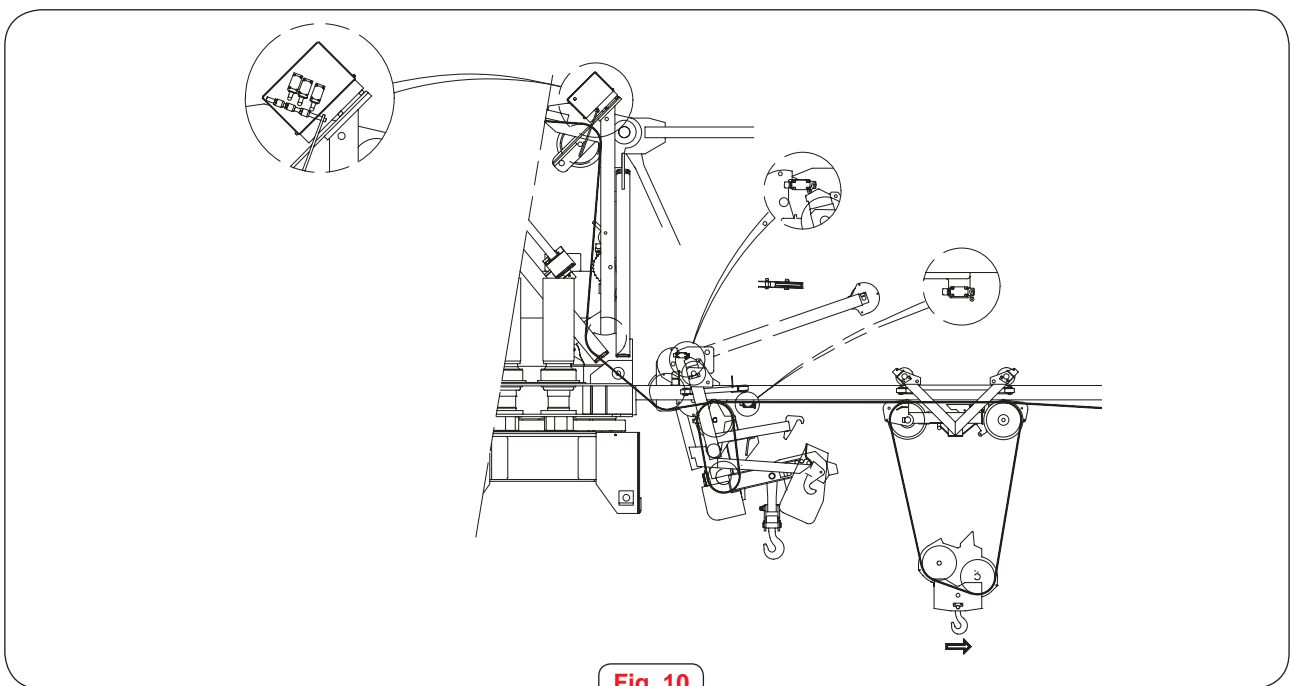


Fig. 10

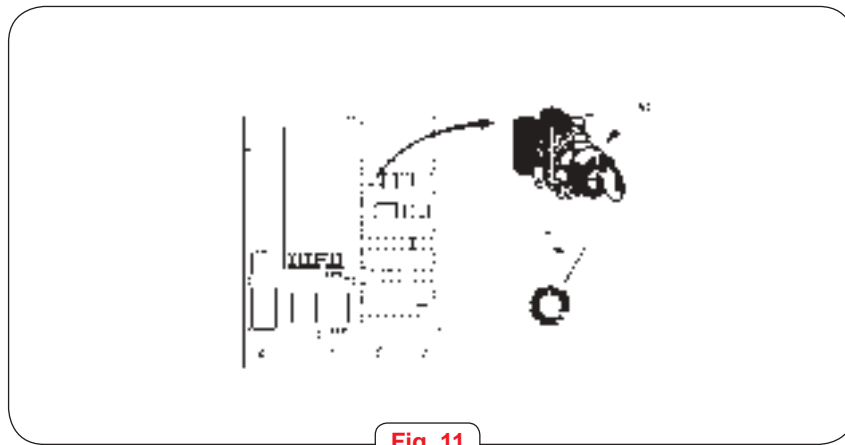
- Continue lowering until the front hook is below the elevation limiter, "hook up".
- Move the trolley forward until it leaves the rear trolley limiter. The crane is ready to work with a single trolley and hook, the front. (TWO-FALL)



If, when changing the fall, it is necessary to make any movement prohibited by the fall change safety system, this safety system can be cancelled using the switch with a key (ID) in the cat head electric cabinet.



The ID switch for cancelling the safety system when changing the fall must only be used by service staff that know the scope of the cancellation of the safety system.



**Fig. 11**



All operations made with the safety system cancelled must be specially supervised to avoid any dangerous situations.



Once you have finished the operation for which you cancelled the safety system, you must stop the crane and reset the crane operation.



IF YOU OBSERVE ANY IRREGULARITY WHILE CHANGING THE FALL, NOTIFY THE MAINTENANCE SERVICES TO REVISE AND REGULATE IT.

### 3 CANCELLING/REPOSITIONING THE FOUR-FALL TROLLEY

If you wish to leave a crane with a single trolley (removing the possibility of the 2nd trolley "four-fall"), in addition to removing the trolley and modifying the cable fall (see ASSEMBLY/DISASSEMBLY) you must:

- a) Physically remove the trolley position limiters (LPCT and LPCD) installed in the jib.
- b) Electrically disconnect these limiters (removing plugs in the electric cabinet or disconnecting the terminals in the junction box, depending on the case).
- c) Place jumpers in the cat head control panel
  - 43-44 contact AID
  - 53-54 contact AID
  - 14 contact ABCT and 14 contact ALCT
  - 13-14 contact ALCDE.
- d) Check the functioning of the SR trolley against the end limiters with the trolley back.

If you wish to replace the 2nd trolley to have the possibility of four-fall, proceed in reverse order (points a, b and c) and check the single to double and vice versa trolley change system works correctly (see points 1 and 2 of this instruction).

## 0 CONTENTS

- 1 TROLLEY AND HOOK POSITION
- 2 CLEARANCE
- 3 FREE SLEWING
- 4 CONTROL VOLTAGE DISCONNECTION
- 5 POWER SUPPLY DISCONNECTION
- 6 FASTEN THE CRANE TO THE TRACK (if crane on rails)
- 7 ACCESS TO CRANE CONTROLS

### 1 TROLLEY AND HOOK POSITION

Remove the load from the hook and the lifting accessories  
Place the trolley back to minimum reach position and the hook up to top position

### 2 CLEARANCE

Make sure the crane can slew a complete turn with no obstructions.

### 3 FREE SLEWING

Set the crane free slewing by pressing the applicable pushbutton on the crane controls.  
The siren will sound to indicate that the crane is free slewing.  
By pressing the crane stop button, the siren will cease.  
Press again the start button; the siren will indicate that free slewing has correctly been activated.

### 4 CONTROL VOLTAGE DISCONNECTION

Press the stop button on the controls. The siren indicating that the crane is free slewing will cease to sound. Check that no movement is possible when acting on levers and buttons and that these reset to zero.

### 5 POWER SUPPLY DISCONNECTION

Put power supply switch at crane foot to position 0.  
Lock out in this position if necessary.  
Also, disconnecting the power supply line from mains to crane is recommended.



Electronic equipment may malfunction at low temperatures.  
If the ambient temperature is below 0 °C it is advisable to leave the electrical cabinet heating systems on when the crane is not operating. To do this, leave the electrical power to the crane on, keep the isolating switch at the foot of the crane connected and disconnect the isolating switch on the cathead cabinet (this cuts off the electricity to the power and control circuits of the crane).

### 6 FASTEN THE CRANE TO THE TRACK (if crane on rails)

Anchor the crane to the rails by means of the applicable jaws. See document "RESTRICT CRANE MOVEMENT" in this chapter of the Manual

### 7 ACCESS TO CRANE CONTROLS

If necessary, make sure that persons foreign to crane operation do not have access to the crane controls.



If compliance with any of the above instructions should not be possible, notify the maintenance personnel to take corrective action before taking the crane out of service.

! On line outage or electrical system malfunction, acting on devices installed on slewing motors can set free slewing manually. See document "FREE SLEWING" in this chapter of the Manual.

<b>0</b>	<b>CONTENTS</b>
<b>1</b>	<b>DESCRIPTION</b>
<b>2</b>	<b>OPERATION</b>
<b>3</b>	<b>MANUAL OPERATION</b>
<b>4</b>	<b>WIRING</b>
<b>5</b>	<b>ADJUSTMENT</b>
<b>6</b>	<b>CHECKING OPERATION</b>

## 1 DESCRIPTION

The crane is prepared for weather vaning by releasing the brake on the slewing motor(s), leaving the upper crane free to move with the wind. The brakes are released remotely via the release units on the brake cover of each slewing motor.

A control box in the operator's cabin (or at the base of the crane when there is no cabin) governs the release units.

In case of a power cut-off or malfunction in the release system, weather vaning can be done manually.

## 2 OPERATION

### Weathervaning sequence (Fig. 1)

- 1 Opening the motor brake causes the manual lever (1) to move upwards
- 2 The electromagnet (5) attracts the moving armature (2) and positions it below the manual lever (1).
- 3 When the brake drops the manual lever (1) rests against the moving armature (2), preventing the brake from closing and weathervaning the crane.

### Activating weathervaning

- 1 The crane must be in operation.
- 2 Press the weathervaning button on the crane control panel and wait 5-10 seconds. If the crane siren is still blowing after that time, the crane is weathervaned.
- 3 Press Stop to cut the siren.
- 4 Press Start. The siren should continue to blow when the Start button is released.
- 5 Press stop to cut the siren.

### Deactivating weathervaning.

- 1 Engage the slewing control with the crane in operation.



#### IMPORTANT:

- Steps 4 and 5 are essential, as they ensure that weathervaning has actually taken place.
- If the weathervaning button is pressed by accident during normal operation, just engage the slewing control to deactivate it.
- Do not hold down the weathervaning button more than 30 seconds.

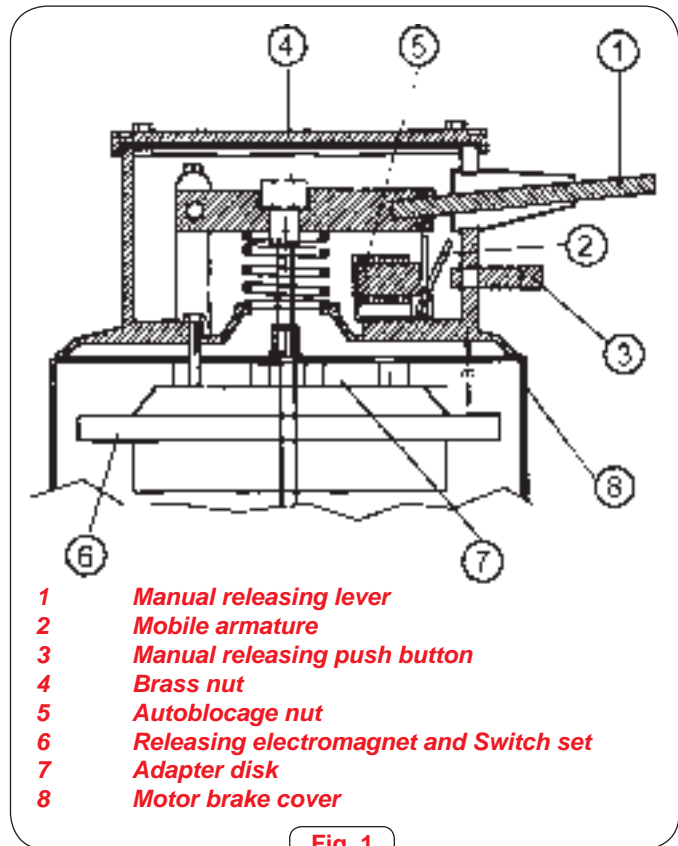


Fig. 1

! Some cranes have a lamp on the weathervaning button to indicate that weathervaning is engaged.  
el dispositivo de veleta está activado.

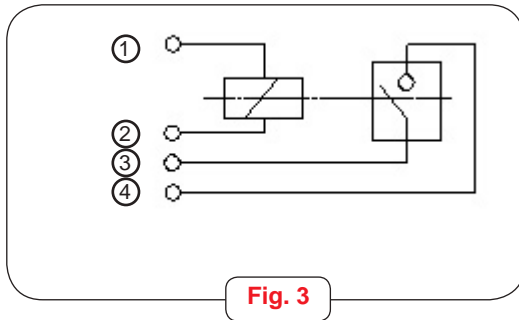
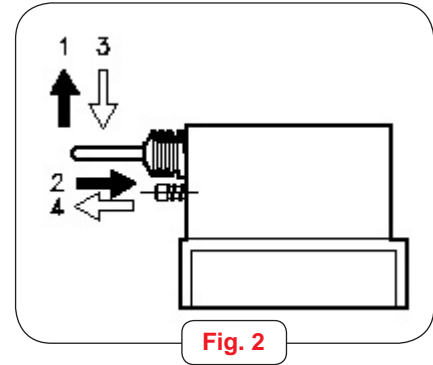
### 3 MANUAL OPERATION

If there is a malfunction or power cut-off the slewing motor brakes can be released manually.

- 1- Lift the lever, overcoming the resistance of the brake springs, and keep it lifted.
- 2- Press and hold down the button.
- 3- Release the lever.
- 4- Release the button.

This procedure should be repeated with each release unit.

Repeat the process on each release unit



### 4 WIRING

- |     |  |
|-----|--|
| 1-2 | 48V (50/60 Hz) electro-magnet power              |
| 3-4 | Electro-magnet operating indicator micro-switch. |

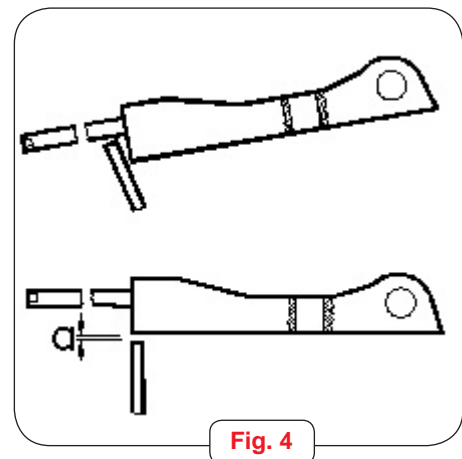
### 5 ADJUSTMENT

To regulate the unblocking weather vaning, proceed as follows:

- 1- Manually lift the unblocking lever (1).
- 2- Push the button (3) until the mobile armature (2) comes inside under the lever (1).
- 3- Unscrew the nut (4) in such a way that the distance "a" between armature (2) and lowr part of the lever (1) when this is lifted at its highest be approximatively 0.5 mm.
- 4- Check electrical operation: the armature (2) should enter freely when the weathervaning button is pressed on the crane controls, and should release when slewing movement is commanded. If it does not, slacken the self-locking nut (4) 1/12 of a turn (half a facet) and try again.

NOTE: Between the position of maximum regulation and minimum the brass nut (4) turns 4/6 of return (4faces).

IMPORTANTE: The brake gap should not be less than 1 mm if weathervaning is to be regulated correctly.



### 6 CHECKING OPERATION

Weathervaning must be used in windy conditions: if the jib points in the direction of the wind then the weathervaning system is working correctly.

To check weathervaning when it not windy, proceed as follows:



- 1- Ensure that the crane can turn freely with no obstacles in its path.
- 2- With the trolley back and the hook raised and under no load, engage first gear and slew slowly.
- 3- Still in first gear, press the weathervaning button (the crane siren will sound).
- 4- Still slewing in first gear and with the weathervaning button engaged, press the stop control and check that the jib continues to turn freely under its own inertia.
- 5- If it does not do so, readjust the brake gap (which should be 1 mm) and adjust the weathervaning system..



## CONTENTS

- 1 SYSTEM OVERVIEW
- 2 OPERATION CHECK
- 3 ALARM AND TEST PROGRAMMING
- 4 RS 485 WIND-SPEED OUTPUT
- 5 HEATING SYSTEM FOR THE WIND-SPEED SENSOR

### 1 SYSTEM OVERVIEW

The basic configuration has a wind-speed sensor (1), which is connected to the control and signalling unit (2).

The system operates as follows:

- The control and signalling unit is electrically powered from the crane electric cabinet.
- The orange luminous beacon is activated when the wind-speed exceeds 50 km/h.
- The red luminous beacon and warning siren are activated when the wind-speed exceeds 70 km/h..

If the crane is no in operation, the wind alarm indication system is no operable.



In case of disconnection of the crane, this should be placed in an out-of-service condition (including the weathervaning).

It should be considered that the radio controls automatically disconnect the crane when it is unused for a certain period. When the crane is not supervised, it should be placed in an out-of-service condition.

- 1 *Wind-speed sensor*
- 2 *Control and signalling unit*
- 4 *Fastening magnets*
- 5 *Orange and red beacons*
- 6 *Siren*
- 7 *Line fastening to the structure*
- 8 *Cabin display*

Fig. 1

### 2 OPERATION CHECK

#### 2.1 Indication and control unit

- Check the operation of the beacons and siren as follows:
  - Check the crane is powered.
  - The switches at the bottom of the crane and the general switch on the electrical cabinet are in the ON position.
  - Press the stop button in the crane control and then press the start button (radiocontrol, telecontrol or seat).
- This procedure allows to detect a problem in:
  - Orange or red beacons.
  - Siren.
  - Unit power supply.

The device checks the proper operation of the red and orange beacons and of the siren by switching the beacons and the siren (each beacon should blink twice and the siren must horn once).

- If one or several elements do not operate, this is because there is a problem in the electric supply or in the elements themselves.

During this test, physically cover the siren to prevent being deafened by the noise this produces.

- Double check that the control and signal code units are properly fixed by the magnets and check that the unit is appropriately secured to the crane structure with the fastening line (7) which is supplied.
- Check that the unit is visible from the crane operator's control position.

## 2.2 Wind-speed sensor.

- Check that it turns freely.
- Check that it is not affected by the shielding of the structure.
- Check that the cable between the sensor and the control unit is not cut or disconnected.

## 2.3 Wind velocity detection system check.

The correct operation of the wind velocity detection system can be checked at three levels of complexity, according to what needs to be checked:

### Level 1. Checking of operation

The system is correctly connected and detects the wind velocity.

It is not checked whether the wind signal is correctly calibrated or whether the alarm system is activated at preset values.

Necessary material:

- Cabin wind velocity display.

Instructions:

- Connect the cabin wind velocity display to the control unit (See Point 4).
- Move the wind velocity detector cups either through the action of the wind or by turning them by hand.
- Check that there is a velocity reading on the cabin wind velocity display.

### Level 2. Check the operation and quality of the signal detected

The system is correctly connected, is detecting the wind velocity and the signal detected is correct.

It is not checked whether the wind signal is 100% correctly calibrated or whether the alarm system is activated at preset values.

Necessary materials:

- Cabin wind velocity display.
- One complete portable anemometer with built-in display.

Instructions:

- Connect the cabin wind velocity display to the control unit (See Point 4).
- Install the portable anemometer pickup near the crane pickup and under the same wind reception conditions.
- Compare the wind velocity readings on the two displays (the check will be much more effective if the auxiliary anemometer is calibrated).

### Level 3. Calibration of the apparatus

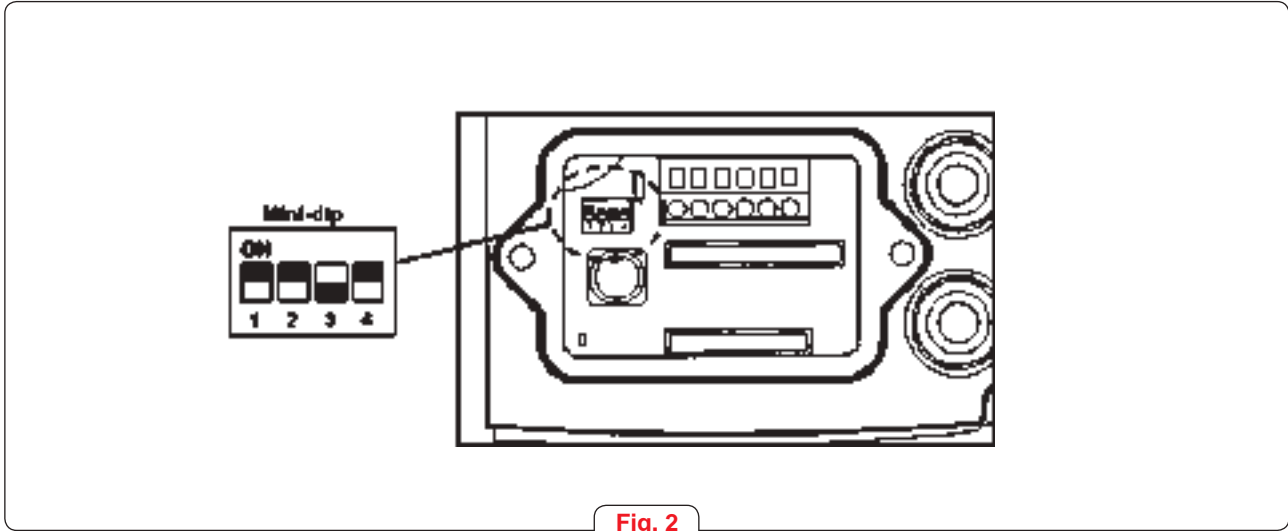
The system correctly detects the wind velocity and checks that the signal and alarm limits are correctly calibrated.

It is necessary to send the anemometer to the equipment manufacturer for this check. This manufacturer has a certified test bed for checking and calibrating the anemometer.

### 3 PROGRAMMING OF TEST AND ALARM MODES.

The equipment is set by the manufacturer to be configured in different ways in the alarm test and operating modes.

! The equipment is configured by COMANSA, as is indicated in Fig.2.



**Fig. 2**

The device can be configured in different ways, by changing a set of 4 mini-switches 4 placed inside it. The different functions that can be activated or deactivated are: autotest function, configuration in which the device must be reinitialized after the 70km/h alarm is activated, cancel the acoustic warning when working close to low noise areas like hospitals, residenciales...

To access to the connections or configuration, loose the screws that fix the small bottom cover.

#### 3.1 Test and alarm configuration modes..

DIP1	ON (1)	Autotest ON
	OFF	Autotest OFF.

DIP2	ON (1)	Siren ON.
	OFF	Siren OFF.

DIP3	ON	After the wind-speed goes above 70 km/h , the ALARM remains activated , even if the speed goes to 0 km/h (The alarm will be deactivated only after the unit supply is switched off for more than 15 seconds).
	OFF (1)	The ALARM is deactivated immediately after the speed goes below 70 km/h.

! The DIP4 configuration is exclusively to be changed by an authorised person. Its proper position is ON. Otherwise, the device indicates a "SENSOR FAILURE"

DIP4	ON (1)	Normal operation.
	OFF	Maintanance operation.

(1) Standard factory settings.

! Before changing the position of the switches, ensure that it complies with the required standard for the installation and that the new alarm method (sound and visual) is understood by the crane operators.

### 3.2 Test modes.

The test allows to check the proper operation of the device.

This device allows two operation modes:

- Switch-on autotest: it is done during a few seconds immediately after supplying the device.
- No switch-on autotest.

The default factory setting is with the switch on Autotest enabled.

### 3.3 Alarms.

The device includes the following alarm modes:

- At 50 km/h only amber light, and at 70 km/h only red light.
- At 50 km/h only amber light, and at 70 km/h red light + siren.

The default factory setting is "at 50 km/h only amber light, and at 70 km/h red light + siren".

### 3.4 Anemometer internal wiring

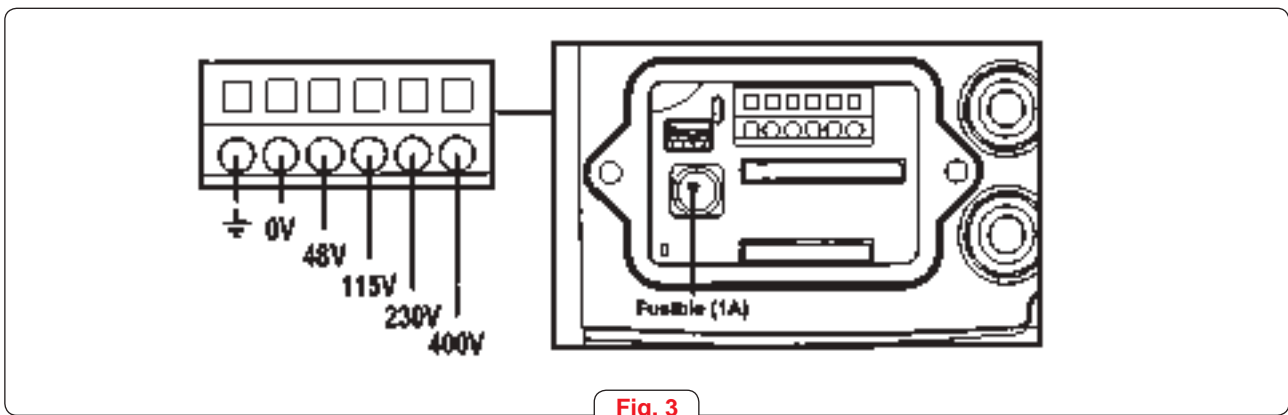


Fig. 3

! The device is prepared for 48 V 50/60 Hz.

Once the wiring is done:

- 1.- Tightly screw the gland to the cable to seal the interior of the unit against liquids or dust.
- 2.- Check the proper closing of the bottom cover to keep IP65 inside.

### 3.5 Sensor failure detection

In case there is any abnormal behaviour signal at the sensor, a cable that has been cut or an improper connection, the system beacons intermittently blink until the problem is solved.

## 4 RS 485 WIND-SPEED OUTPUT

The control and signalling unit (Fig. 4) is equipped with an RS 485 output that allows a fast connection to the indicator system in the cabin. Refer to the crane wiring schematic for more details.

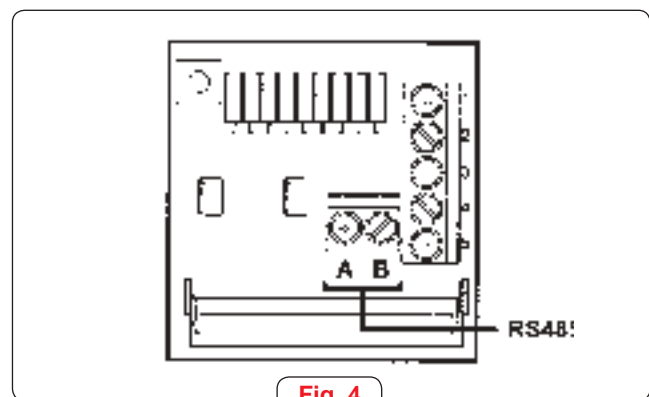


Fig. 4

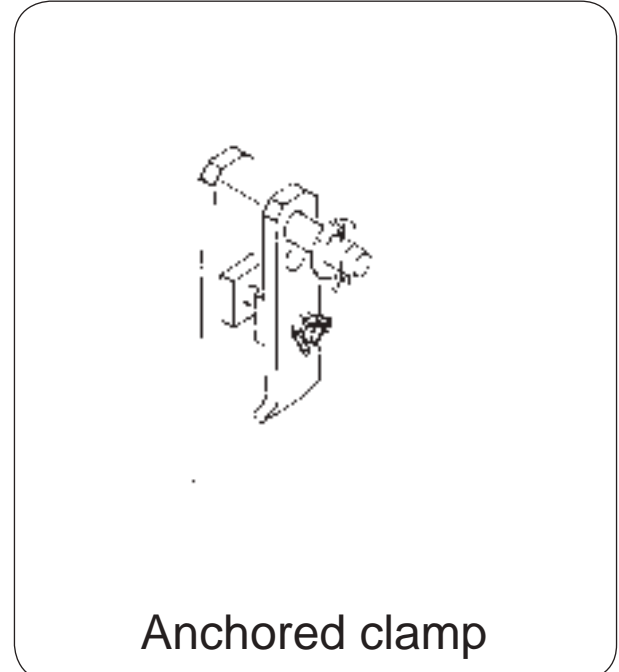
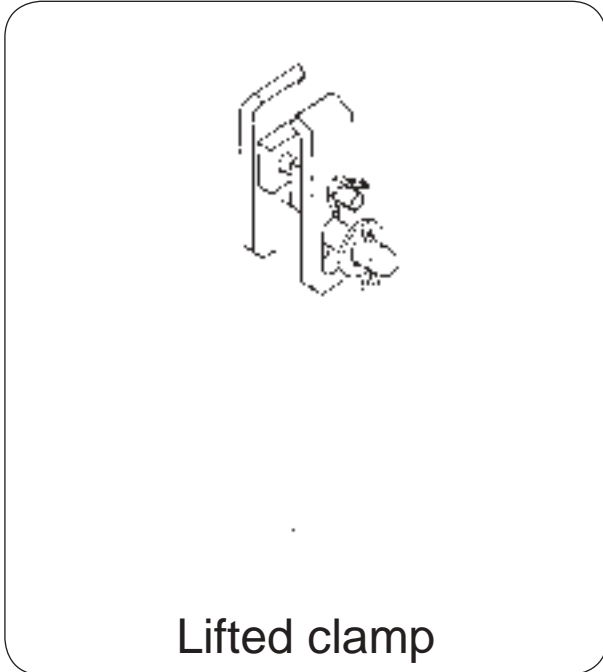
## 5 HEATING SYSTEM FOR THE WIND-SPEED SENSOR

It is placed within the wind-speed sensor. A heater is switched on whenever the temperature goes below a preset value. This heater melts the frost which would otherwise prevent the sensor rotor motion.

This heater system is supplied from a point which is placed before the general crane contactor G (see wiring schematic). If the general switch of the crane (IG) is ON and the crane bottom switch is ON, the heating system will be operative, regardless the stop control is pressed or not. This allows the system to melt the frost even when the crane controls are switched off.



TYING UP THE CRANE WHEN OUT OF SERVICE IS COMPULSORY.  
NOT COMPLYING WITH THIS RULE CAN LEAD TO SEVERE ACCIDENTS.



To carry out this operation, swing the clamps by loosening the mounting.  
Once the clamps have been positioned embracing the rail, they should be mounted with the fittings.

! IN STATIONARY CRANES, CLAMPS ARE PERMANENTLY INSTALLED. NEVERTHELESS, THEY SHOULD BE PERIODICALLY CHECKED TO ENSURE THAT THEY ARE CLAMPING PROPERLY

**Crane's operations should be interrupted whenever the wind velocity endangers the handling of the load for the operating staff.**

According to the calculation standard (DIN 15019-1), the crane has to be taken out of service when the wind velocity  $V_0$  corresponding to the dynamic pressure limit  $q_0$ , determined from a 10 seconds average, is exceeded.

$V_0$  and  $q_0$  are determined according to the following formulas:

$$q_0 \leq q - 30\sqrt{t}$$

$$q_0 = V_0^2 / 1.6$$

- $q_0$  Dynamic pressure limit (N/m<sup>2</sup>)
- $q$  Calculated operational dynamic pressure for cranes in use (250 N/m<sup>2</sup>)
- $t$  Time in minutes from dynamic pressure to limit  $q_0$  being exceeded to completion of safety measures. (See "PROCEDURE FOR TAKING UNITS OUT OF SERVICE" in this chapter.)
- $V_0$  Wind velocity (m/s) registered within 10 seconds.

t (min)	$V_0$	
	m/s	km/h
5	17	61
10	16	58
15	15	54
20	14	50
25	13	47

**Example:** If 15 minutes will be needed for the fulfillment of safety measures (Procedure for taking units out of service), the crane's operations have to be interrupted when the wind velocity reaches 54 km/h. registered within 10 seconds.

**NOTE:** Cranes working in areas where wind velocity is likely to be above design limit must be provided with anemometers.  
See "ANEMOMETER - WIND SPEED INDICATION / ALARM" instruction in this manual.



Work with the crane must stop when the wind speed makes manipulating loads hazardous for people.



In cranes that are going to work in areas where winds can reach service limits, the user must install an anemometer. (ITC "MIE-AEM-2" 2003).  
See instruction "ANEMOMETER" in this manual.

The maximum surface permitted for a load exposed to wind is obtained by the formula:

$$A = \frac{0,03 \times P}{q \times 1,2}$$

A = Surface exposed to wind (m<sup>2</sup>).  
P = Weight of the load (kg).  
q = Pressure coefficient = v<sup>2</sup>/16 (kg/m<sup>2</sup>).  
v = Wind speed (m/s).

Permitted service wind speeds depending on the surface of the load (km/h)															
Surface of the load (m <sup>2</sup> ) \ Load (t)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	72	51	42	36	32	29	27	25	24	23	22	21	20	19	19
2	72	72	59	51	46	42	38	36	34	32	31	29	28	27	26
3	72	72	72	62	56	51	47	44	42	39	38	36	25	33	32
4	72	72	72	72	64	5	54	51	48	46	43	42	40	38	37
5	72	72	72	72	72	66	61	57	54	51	49	46	45	43	42
6	72	72	72	72	72	72	6	62	59	56	53	51	49	47	46
7	72	72	72	72	72	72	72	67	63	60	57	55	53	51	49
8	72	72	72	72	72	72	72	72	68	64	61	59	56	54	53
9	72	72	72	72	72	72	72	72	72	68	65	62	60	58	56
10	72	72	72	72	72	72	72	72	72	72	69	66	63	61	59
11	72	72	72	72	72	72	72	72	72	72	72	69	66	64	62
12	72	72	72	72	72	72	72	72	72	72	72	72	69	67	64
13	72	72	72	72	72	72	72	72	72	72	72	72	72	69	67
14	72	72	72	72	72	72	72	72	72	72	72	72	72	72	70
15	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
16	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
17	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
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22	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
23	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
24	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72



0	CONTENTS
1	GENERAL
2	DAILY INSPECTION
3	MONTHLY AND SEMIANNUAL INSPECTIONS
4	YEARLY INSPECTION
5	SPECIAL INSPECTIONS
6	SUMMARY

## 1 GENERAL

The purpose of the instructions below is to describe the operations required to keep the crane in safe condition. It serves as a guidance for detecting defects, taking necessary action to overcome the situation.

Apart from these inspections, National or Local Regulations must also be complied with.

## 2 DAILY INSPECTIONS

Visual inspection without part removal and checking the operation of the various mechanisms.

These must be done by personnel involved with the crane, e.g. the crane operator.

The inspection is carried out prior to starting crane work and must include:

- Observation of apparent defects in crane supports, cables, structure, etc.
- Operation of drives, movements and brakes, with no load.
- Operation of limiters and indicators

Any defect must be reported to the crane supervisor.

He will decide to keep the crane working, repair the defects, go into a deeper inspection or stop the crane. Defect causes must be investigated and recorded into the crane log.

## 3 MONTHLY AND SEMIANNUAL INSPECTIONS

Based on visual inspection, generally without part removal and checking the operation of the various mechanisms

Inspections must be carried out by qualified experienced technical personnel.

Monthly inspections must include:

- Checking lubricants, levels, grease on crown wheel teeth, etc.
- Checking hydraulic equipment, hydraulic fluid levels.
- Checking hooks and hook safety latches, deformation, fracture, etc.
- Checking connections, screw and bolt corrosion, etc.

Semi-annual inspections must include:

- Checking brakes, operation, wear.
- Checking hydraulic hoses, oil leakage, hose condition.
- Checking electric installation, see "ELECTRICAL MAINTENANCE" in chapter "ELECTRICAL INSTALLATION".
- Checking crane anchorage.

Defects must be reported to the crane supervisor.

He will decide to keep the crane working, repair the defects, go into a deeper inspection or stop the crane. Defect causes must be investigated and recorded into the crane log.

## 4 YEARLY INSPECTIONS

This inspection must be carried out every time the crane is erected or every year if the crane is still operating at the site.

Yearly inspections are based on visual inspection, generally without part removal. Prior to every erection some inspections can more easily be done with the parts on ground level and other inspections with the crane erected.

Inspections must be carried out by qualified technical personnel. The inspector must be provided with the previous inspection report and must be informed on the type of crane work.

Inspection includes:

- Monthly and semi-annual inspections
- Checking for presence of nameplates
- Checking for presence of instructions manual
- Checking reports of previous inspections
- Checking that installed components coincide with components stated in documents
- Checking equipment condition for damage prevention
  - Check for leaks of oil or grease
  - Check for any damage in couplings
  - Check for abnormal noise during operation
  - Check for abnormal equipment temperature in operation
  - Check that connecting bolts are tightened and free from cracks and defects.
  - Check that brakes are not worn out or damaged
  - Check that the machine is in overall good condition, clean, without critical corrosion, etc.
  - Check that the electrical installation is free from damage.
  - Check that cables are free from wear or critical deformations.
  - Check that hooks are free from deformations or cracks.
- Checking drive operation
  - Load limiters
  - Indicator operation
  - Brake operation
- Overall inspection of the structure, welds condition, corrosion, deformations, etc.
- Inspection of crane support (foundations, track), check for any settlement

Defects must be reported to the crane supervisor.

He will decide to keep the crane working, repair the defects, go into a deeper inspection or stop the crane. Defect causes must be investigated and recorded into the crane log.

## 5 SPECIAL INSPECTIONS

Inspections carried out at the following intervals:

- Every two years after crane commissioning
- Yearly after 14 year operation
- After detecting major defects
- After major modifications of crane features

Qualified technical personnel who will decide on actions to be taken as a function of the inspection outcome must carry out inspections.

The inspector must be provided with the previous inspection report and must be informed on the type of crane work.

Special inspections must take into account:

- All checks described for yearly inspections
- Equipment vibration, noise and high temperature
- Machine overall condition, corrosion, cleanness, etc
- Equipment fastening
- Brake operation
- Connecting screws and bolts.

Special inspections may require part removal and non-destructive tests if deemed necessary as a function of:

- Result of previous inspections
- Result of load and braking tests, etc.
- Result of visual inspections

Defects must be reported to the crane supervisor.

He will decide to keep the crane working, repair the defects, go into a deeper inspection or stop the crane.

Defect causes must be investigated and recorded into the crane log.

## 6 SUMMARY

ELEMENT	WHAT	WHEN
Base	Overall condition, supports track.	Daily
	Corrosion	Monthly
	Fastening screws, connecting bolts	Yearly
Tower access	Deformation	Semi-annual Yearly
	Overall condition	Daily
	Corrosion Connecting bolts	Monthly Yearly
Slewing part	Deformation	Semi-annual Yearly
	Overall condition	Daily
	Corrosion Connecting bolts	Monthly Yearly
Jib	Deformation	Semi-annual Yearly
	Overall condition	Daily
	Corrosion Connecting bolts	Monthly Yearly
Counterjib	Deformation	Semi-annual Yearly
	Overall condition	Daily
	Corrosion Connecting bolts	Monthly Yearly
Trolley and hook	Deformation	Semi-annual Yearly
	Overall condition	Daily
	Corrosion Connecting bolts	Monthly Yearly

ELEMENT	WHAT	WHEN
Travelling drive	Overall condition Motors and brakes	Daily, yearly
	Fastening Greasing Gear condition	Monthly, semi-annual, yearly
Slewing drive	Overall condition Motors and brakes	Daily, yearly
	Fastening Greasing Gear condition	Monthly, semi-annual, yearly
Hoisting drive	Overall condition Motors and brakes	Daily, yearly
	Fastening Greasing	Monthly, semi-annual, yearly
Trolley drive	Overall condition Motors and brakes	Daily, yearly
	Fastening Greasing	Monthly, semi-annual, yearly
Cables	Overall condition Greasing	Daily Monthly
Ballast and counterweight blocks	Overall condition	Yearly
Electrical installation	See instructions in "ELECTRICAL MAINTENANCE" in chapter "Electrical Installation"	Semi-annual

<b>0</b>	<b>CONTENTS</b>
<b>1</b>	<b>GENERAL</b>
<b>2</b>	<b>PERSONNEL DUTIES</b>
<b>3</b>	<b>PRINCIPLES FOR ESTABLISHING A SIGNAL CHART</b>
<b>4</b>	<b>SIGNAL DEFINITION</b>



Prior to performing any operation check that the load being moved is perfectly fastened and ready for movement.

Make sure that neither persons nor materials that could be damaged are present in the load area. Do not allow persons along the load path while operations are being carried out.

## 1 GENERAL

THIS INSTRUCTION IS BASED ON STANDARD UNE 58000 (JUNE 2003)

- Persons involved are: Operations Superintendent, Signalman, and Crane Operator
- Signals to be used by the signalman are established to direct the crane operator
- Signals must be coded to avoid confusion

## 2 PERSONNEL DUTIES

### 2.1 OPERATIONS SUPERINTENDENT

Person in charge of appointing a team to perform load preparation operations, this team includes the signalman.

### 2.2 SIGNALMAN

This person reports to the operations superintendent

He takes over as chief of the crane operator since the "take control" signal is made until the "Quit control" signal is made.

The signalman is fully responsible for directing the crane operator since the load starts moving, through load transfer, until the load arrives to its final position as well as securing the slings around the load from the start to the end of the operation.

Communication with the crane operator will be through hand signals with the arm(s) and signals must not be repeated except for slow approach movements or if the crane operator so demands.

The signalman must always be in the crane operator field of view, see the load at all times, remain outside the load path and keep personnel out of the load path.



In case he cannot see both the crane operator and the load, the operations superintendent shall appoint an assistant.

Signalman and crane operator must know each other and maintain their functions during the job, and due to the relevance of this function, training courses and physical examinations are required (Standard UNE58158)

### 2.3 CRANE OPERATOR

He must follow the instructions given by the signalman after taking control (acoustic or short light signal)

Repetition of signals shall not be expected except for slow approach or joined movements

Once started, movements shall not be interrupted except when:

- A different command or a stop signal is given.
- Safety reasons dictate to interrupt the movement
- Signals are not clear
- Command signals are being given by other persons at the same time
- Signals do not coincide with the specified standard signals

New instructions must be requested for restarting (two short acoustic or light signals)

### 3 PRINCIPLES FOR ESTABLISHING A SIGNAL CHART


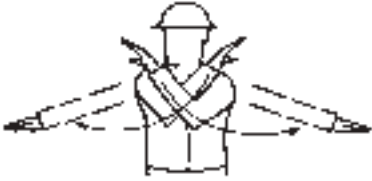
- "Take control" and "Quit control" signals determine the moment from which the crane operator effectively depends on the signalman.
- Signals must be made:
  - Using ample and vigorous movements perfectly differentiated.
  - Using ample hand and finger movements recognised under any condition (lighting, distance)
  - In two well differentiated planes
    - a) In a vertical plane, to the right or to the left of the signalman body
    - b) In a horizontal plane, above or below

! To command a movement or a stop, the signalman must always move the arm or forearm with no repetition nor keeping on the movement (once the "understood" signal has been received) except for approach or joined movements.





- When lighting is not adequate white bracelets on arms must be used
- There is no need for the signalman to constantly watch the crane operator (except at operation start and stop). But the load must always be watched at. The crane operator must watch the signalman.

### 4 SIGNAL DESCRIPTION

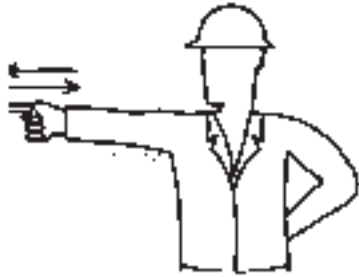



#### 4.1 TAKE AND QUIT CONTROL

Meaning	Description	Ilustracion
Take control	One hand on hip. The other arm extended up above the head and palm forward	
Quit control	Facing the crane operator, starting with both arms crossed under the face, extend the arms to the sides at chest level	

4.2 VERTICAL MOVEMENTS

Meaning	Description	Illustration
Hoist (lift the load)	Forearm vertical, forefinger pointing up, move finger in circle.	
Hoist slowly	Forefinger pointing up moving finger in circle and place the palm of the other hand motionless in front of it (as if placing a top).	
Lower hook (Lower the load)	With arm extended downward forefinger pointing down moving in circle.	
Lower hook slowly	Forefinger pointing down moving finger in circle. Palm of the other hand motionless in front of it (as if placing a top).	

4.3 OTHER MOVEMENTS

Meaning	Description	Ilustracion
Slew the jib in finger direction	Arm extended and finger pointing out the slewing direction.	
Move in direction given by signalman	Direction indicated by movement of extended hand (Palm direction).	
Stop (Stop the previous movement)	Hand extended at head level with palm forward.	
Overall stop Emergency stop	Arms in cross, palms downward.	



## 0 CONTENTS

1	MAIN TYPES OF SLING
2	CHOOSING A SLING
3	USING SLINGS
4	CONNECTIONS
5	HOOKS
6	TRANSVERSE SHAFTS OR GANTRIES
7	GENERAL CONDITIONS OF USE
8	GENERAL CONDITIONS OF STORAGE

### 1 MAIN TYPES OF SLING

Slings may be made of rope, cable or chain (Fig. 1).



Sling breakage almost always causes serious accidents, injuring personnel and damaging goods. Good quality slings must therefore be used, constructed with the utmost care.

Accidents involving sling breakage are often caused not by technical faults but by human error.

The site foreman and the hooker on must therefore know how to choose slings suited to each manoeuvre and how to use them according to safety rules.

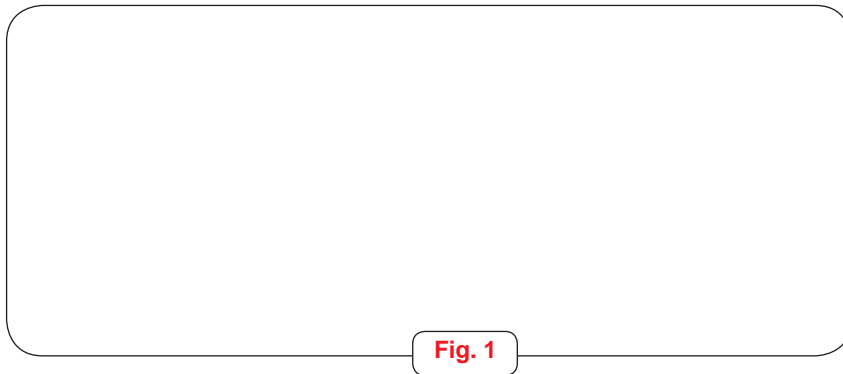


Fig. 1

### 2 CHOOSING A SLING

Slings must be chosen on the basis of the following points:

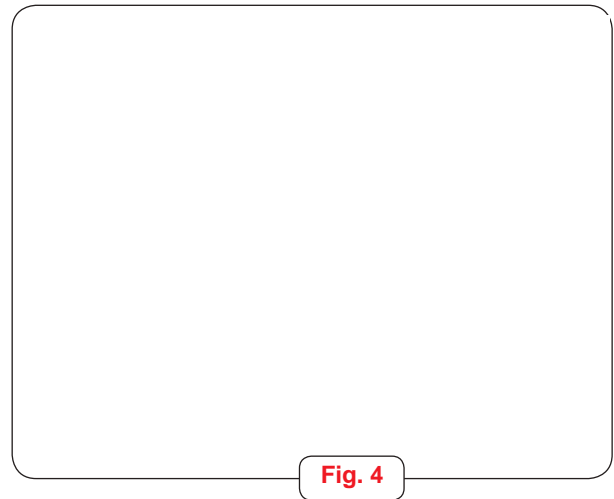
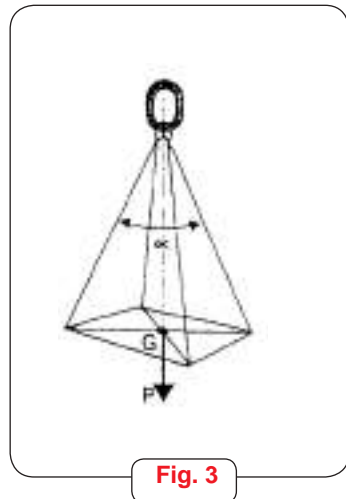
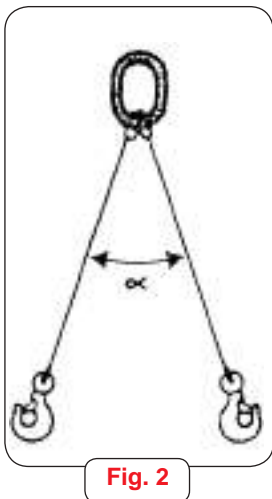
- Weight of the load to be hoisted  
If in doubt calculate high.  
To calculate the weight of a load, multiply its volume by the density of the product involved.  
The following approximate densities should be remembered:
  - wood 0.8,
  - stone & concrete 2.5,
  - steel, iron and cast iron 8.

- Working load of the sling  
The working load of a cable is the load which it can support safely. This load must be marked legibly in words on the sling ring or on a plate pressure fitted onto one of its strands. The working loads of the most widely used cables are shown below. The minimum tensile strength of the sling is 160 kg/mm<sup>2</sup>.

Working loads in kg. of most widely used cables					
Diam. in mm	8	10	14	20	26
Load in kg	560	850	1700	3550	6000

- The angle formed by the strands of a sling reduces its strength. For the sake of illustration we provide coefficients below by which sling strength must be divided according to the angle between the strands when the sling is in working position (Fig. 3 and 4).

Angle of strands	0°	45°	60°	90°	120°
Coefficient	1	1,08	1,15	1,41	2



### Observations:

When a load is supported by a 4 strand sling the angle must be measured as indicated in figure 4, and the sling strength calculated on the basis of total weights being supported by

- 2 strands if the load is rigid,
- and 3 strands if it is flexible.

For a 2 strand sling with a given strength (Pm), capacity decreases as the angle between the ends increases (Fig.4).

## 3 USING SLINGS

When working with slings you need to know:

### - Why strength decreases

There are many reasons. Apart from wear, knots, welds in cables and the devices used in connections must be taken into account.

- Knots reduce sling strength by 30-50%.
- Welds in final rings or eyelets, even if technically very well done, reduce strength by between 15 and 20%.
- Connections made with cable holders, even when they are used properly and in sufficient numbers, reduce sling strength by around 20%.

**- The right way to arrange sling strands**

Welds or areas joined with cable holders should never be placed on the hook of the hoisting equipment or at edges. Joins or splices should be used only in free areas, where they can work only with traction. Strands from two different slings should not be crossed on the hook, as one of them will compress the other (Fig.5). If the strand angle exceeds 90° longer slings or transverse shafts (gantries) must be used, as per figure 6.

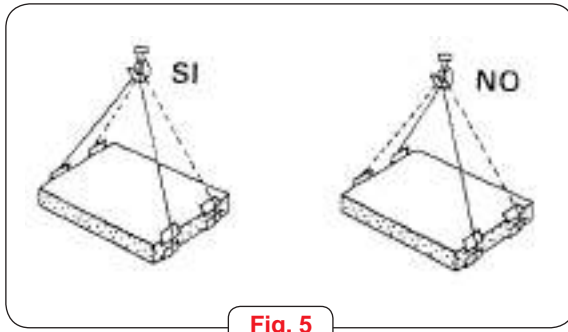


Fig. 5

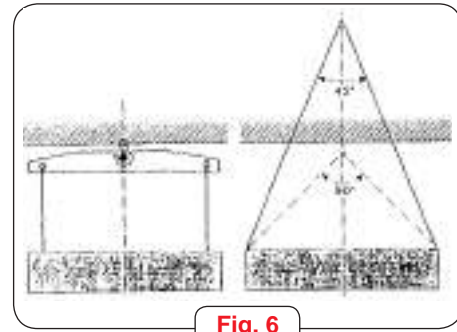


Fig. 6

**4 CONNECTIONS**

Hooks, rings and eyes are used to connect hoisting equipment to loads.

**- Eyes**

These are made of forged steel, and comprise U-bolt and a fitted shaft, which is usually screwed onto one arm of the U-bolt (Fig. 7).

**- Working load of eyes**

This should be indicated by the manufacturer, and will depend on the steel used and the heat treatments applied.

The shaft of an eye should therefore never be replaced by a bolt, however good its quality.

**- Rings**

These come in various shapes, though they are usually circular in cross section. As with eyes the load they can support depends on their cross section, on their shape and on the steel from which they are made (fig. 9). It is essential to check that they retain their shape over time.

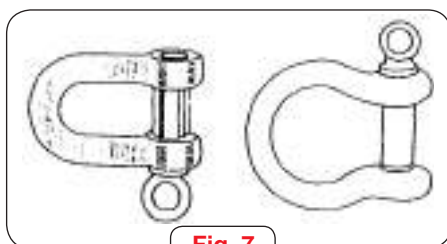


Fig. 7

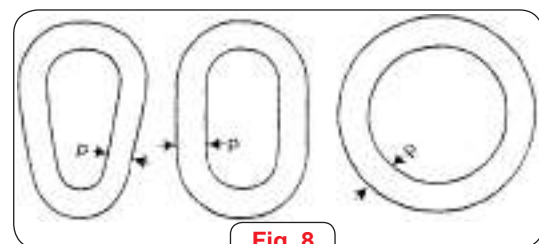


Fig. 8

**5 HOOKS**

Their shape enables loads to be attached rapidly.

**- Description**

There are many types of hook. The most widely used are beaked hooks (Fig.8), which are connected by a hole or rod.

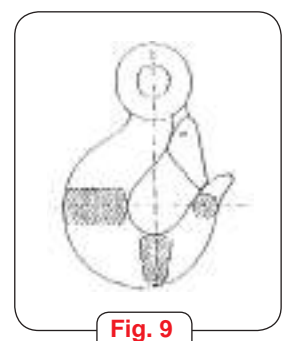


Fig. 9

- **Hook construction**

Unlike rings and eyes, hooks work by flexion, and are therefore designed and built to very severe standards.

- Hook shapes are therefore perfectly described in construction standards.
- And hooks must always be made of heat treated steel completely free from internal stresses.



You should therefore never attempt to build your own hoisting hooks.

- **Using hooks**

Never try to widen the shape of a hook so that it will take a larger cable. Likewise, never heat hooks for any reason, as heating will change the properties of the steel.



Open or bent hooks should be discarded.

While hooking up a load, ensure:

- that stress is taken by the bottom of the hook and not by the beak (fig. 10);
- that the safety piece works perfectly to prevent accidental unhooking; and
- that there are no external forces which might deform the hook opening.

In some cases mere swinging of the load may produce such forces.

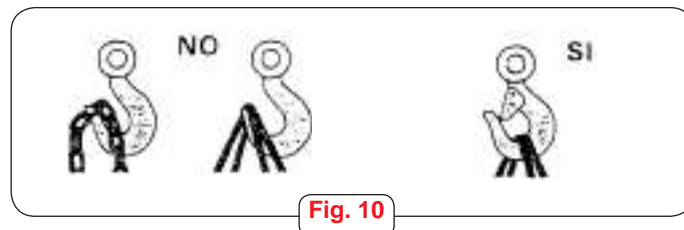


Fig. 10

**6 TRANSVERSE SHAFTS OR GANTRIES**

Using gantries to lift long loads enables sling length to be reduced and therefore allows lower lifting equipment to be used (fig. 11 and 12).

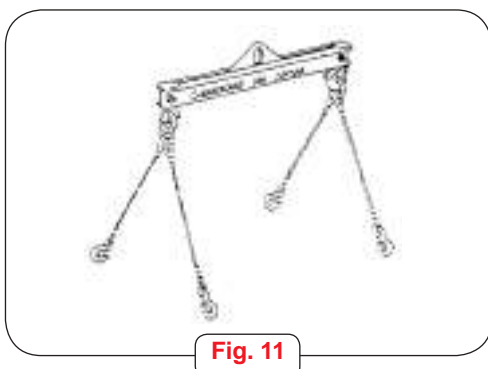


Fig. 11

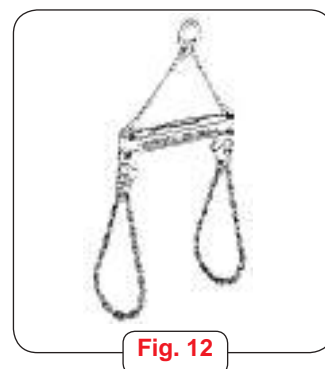


Fig. 12

Semi-gantries are used for normal loads, and they prevent or reduce any bending stresses in loads at the level of the points where they are supported.

Never exceed the loading capacity of these gantries, which should be indicated on them.

## 7 GENERAL CONDITIONS OF USE

- Use only items of suitable strength.
- Do not use lifting equipment in such a way that sharp angles are formed, or on sharp edges. The following should be done in such cases:
  - protect edges with rags, sacking or preferably with protective angle pieces (fig. 13).
  - Fit cable and rope end rings with thimbles (fig. 14)
  - Do not use knotted ropes, cables or chains.

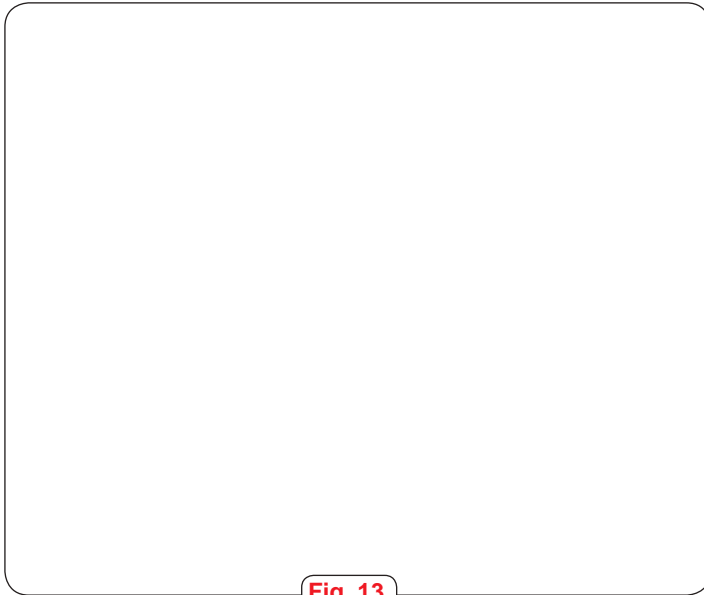


Fig. 13

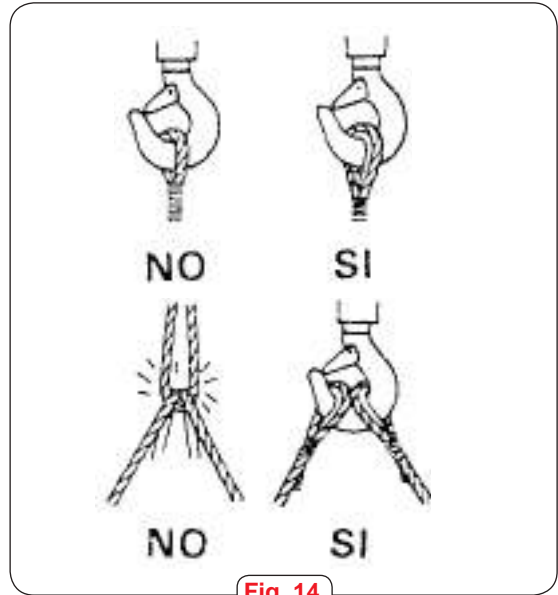


Fig. 14

- Choose attachment points on the load to be hoisted which do not allow the sling to slip. Ensure that these points are properly arranged around the centre of gravity of the load. The load must be stably balanced, and a gantry should be used if necessary to balance the forces in the slings, whose strands should form the smallest possible angles.
- Take the following precautions:
  - when a sling must be moved, slacken it enough to move it without its rubbing against the load;
  - do not stand under a load when trying to move a sling; and
  - do not hoist loads sharply.
- Cables and ropes should not have rings or welds except at their ends.
- The ends of cables and ropes must be secured with ties to prevent fraying.
- Lifting equipment must be protected against fire, heat, corrosives (acids, solvents, cements, etc), moisture and light in the case of synthetic fibre ropes.

## 8 GENERAL CONDITIONS OF STORAGE

- Store in dry places sheltered from the effects of the weather. Natural fibre ropes should be protected against sunlight and other sources of ultraviolet light.
- Store cables as per the manufacturer's recommendations.
- Chains should be suitably lubricated with a grease recommended by the manufacturer.
- Ropes should be dried before storage.
- Load capacity should be marked on all lifting equipment.
- All lifting equipment should be stored so that it is not in direct contact with the ground. It should be suspended from rounded wooden supports or deposited on stakes or palettes. It should also be kept well away from corrosive products.

**0 CONTENTS**

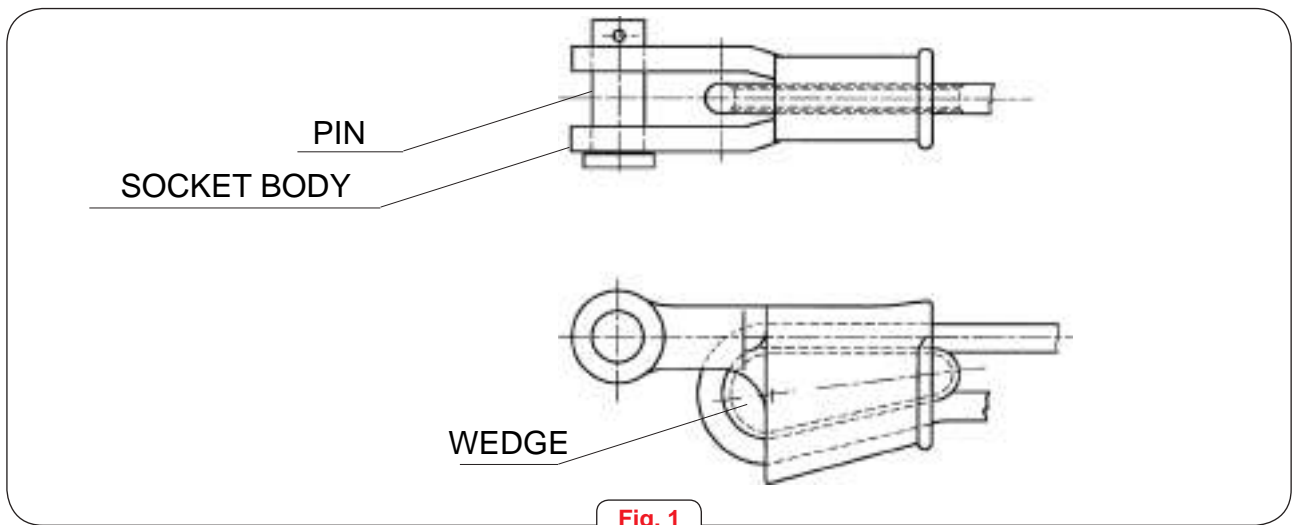
- 1 TERMINALS, ASYMMETRIC WEDGE SOCKET**
- 2 WIRE ROPE CLAMP, U-BOLT CLAMPS**

**1 TERMINALS, ASYMMETRIC WEDGE SOCKET**

See Standard EN 13411-6.

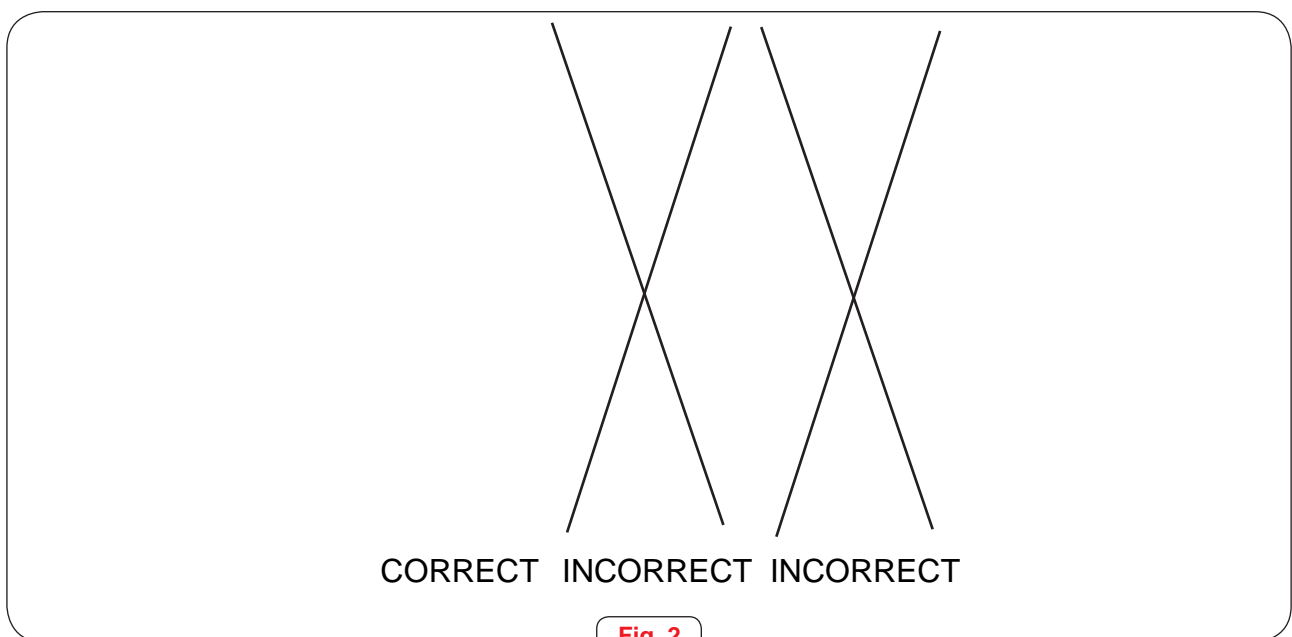
**1.1 Use of cable terminals**

Check that the terminal is free from defects before assembling it.



**Fig. 1**

It is essential that the appropriate terminal is used, and that it is checked that the wedge and socket body are those indicated for the cable. A large wedge or one with an incorrect angle will not enter the socket body sufficiently to provide a secure fastening; a small wedge will enter too far causing an excess load over the socket body of the terminal, damaging it.

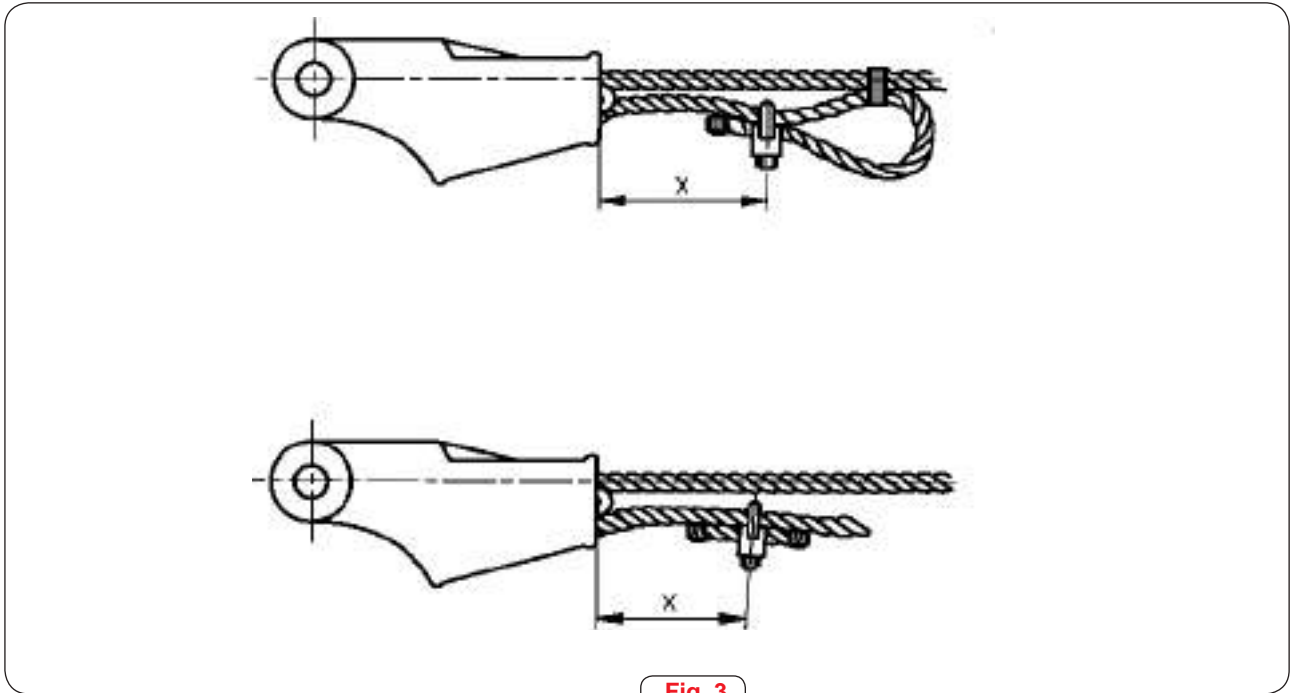


**Fig. 2**

Terminals of an appropriate strength for the pull to be transmitted should be used.

The cables should be placed such that the active leg is over the straight part of the terminal.

The inactive leg should have the necessary length to allow a safety system to be attached.



**Fig. 3**

Distance X between the cable-fastening clamp and the terminal should be less than 75% of the length of the wedge.

When it is necessary to re-install the terminal, should be located over a part of the cable which has not been previously used for the same purpose.

After each assembly, check that the wedge and cable are correctly seated in the socket body of the terminal, to prevent cable slip and stop the wedge from slipping out of the socket body of the terminal.

Antirotation cables tend to become deformed on being bent over the wedge; to prevent this, it is recommended that the cable be lined, for example, with adhesive tape, during the mounting of the terminal. The lining should be removed to the extent possible to permit inspection of the cable.

## 1.2 INSPECTION OF TERMINALS

:Attention should be given to the following:

- Appearance of cracks in the socket body.
- Wedge protruding too far or inserted too far on mounting
- Deformation of the terminal.
- Imperfections in the cable, ruptured wires or excessive cable\_deformation.
- Condition of the fastening pin.
- Installation of the safety system on the inactive leg of the cable.

If any defect is found in the terminal as well as in the cable, replace it.

## 2 WIRE ROPE CLAMP, U-BOLT CLAMPS

(See Standard EN 13411-5)

The cable-fastening clamps manufacturer should provide information on the diameter and type of cable for which each clamp is appropriate, in addition to the number of clamps, the method of installation and the strength of the clamp.

The cable-fastening clamps are formed of a fork threaded at its ends, a connector and two nuts. Castings can be distinguished from forgings by the way in which they are manufactured.

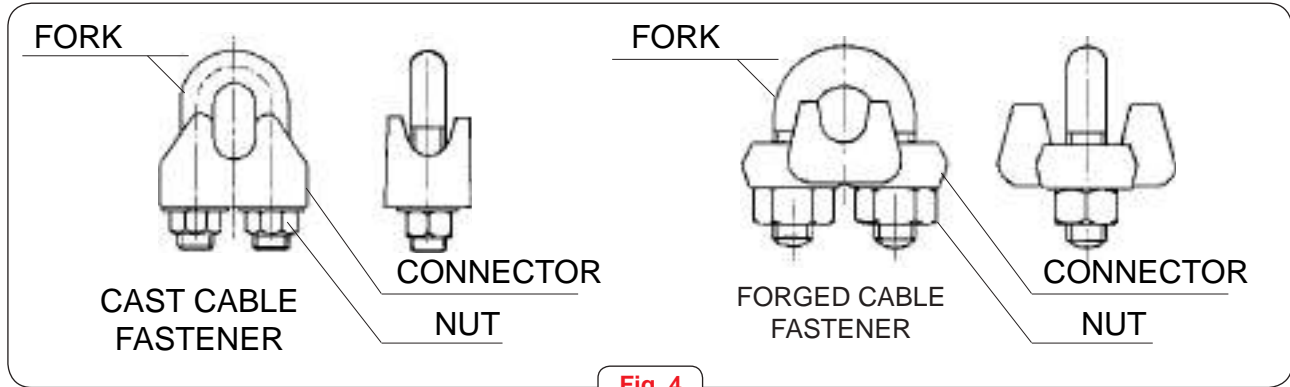


Fig. 4

### 2.1 USE OF CAST CABLE FASTENERS

The number of clamps and the distance «e» between them are indicated in the table.

The connector should be located on the active leg of the cable.

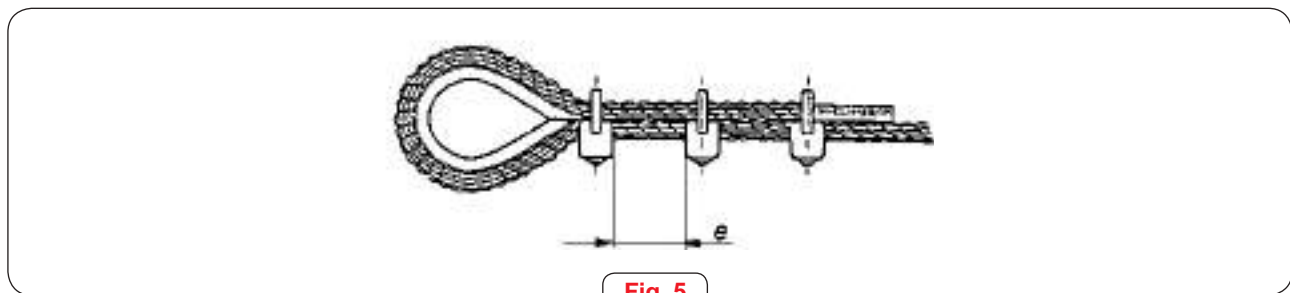


Fig. 5

When a thimble is used in making the grommet, the first clamp should be located against the thimble.

The tightening torques indicated in the table are for greased threads.

The tightening of the clamps should be checked on application of the initial load.

Cable diameter (mm)	e (mm)	Number of clamps	Tightening torque (Nm)
8	30 / 60	4	6,0
10	30 / 60	4	9,0
12	36 / 72	4	20
14	42 / 84	4	33
16	48 / 96	4	49
18	48 / 96	4	68



## 2.2 USE OF FORGED CABLE FASTENERS

This clamp is used with standard and antirotation cables.

The distance between clamps and the number of clamps are indicated in the table.

The connector should be located on the active leg of the cable.

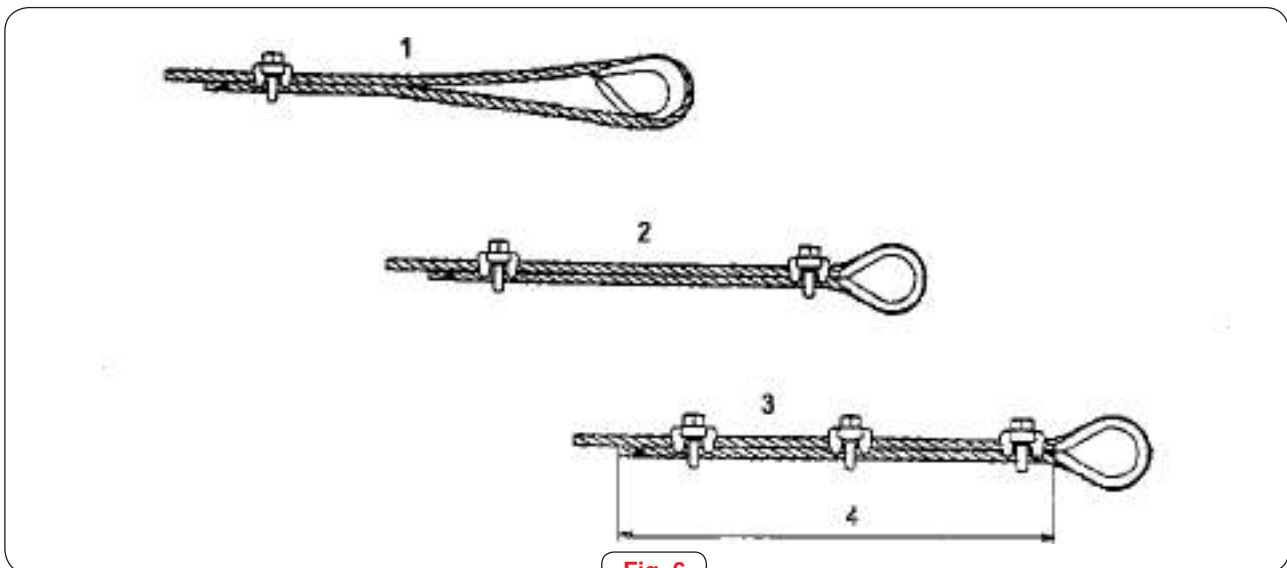
The tightening torques indicated in the cable are for clean, dry and ungreased threads.

The tightening of the clamps should be checked on application of the initial load.

Cable diameter (mm)	e (mm)	Number of clamps	Tightening torque (Nm)
8	133	3	40,7
10	165	3	61,0
12	178	3	88,0
14	305	3	129,0
16	305	3	129,0
18	460	4	176,0

Clamp assembly sequence:

- The cable length specified at 4 in the table is bent.
- The connector is located over the active leg of the cable, at a distance from the end of the inactive leg equal to the width of the connector.
- The nuts are tightened uniformly and alternately up to the tightening torque.
- The second clamp is placed against the thimble and the nuts are tightened without locking them.
- The remaining clamps are installed distributed between the first two.
- The nuts of all the cable fasteners are tightened uniformly and alternately up to the tightening torque indicated in the table.



**Fig. 6**

## 0 CONTENTS

1	GENERAL DEFINITIONS
2	CRANE DEFINITIONS BASED ON FEATURES
3	PROCESS DEFINITIONS
4	PARAMETER DEFINITIONS
5	COMPONENT DEFINITIONS

### 1 GENERAL DEFINITIONS

- **Crane**  
Discontinuous operation device used to hoist and distribute loads suspended from a hook over an area.
- **Slewing tower crane**  
Top slewing tower crane with slewing support on tower top end and with lower support connected to the crane foot.
- **Removable tower crane for worksites**  
Temporary slewing tower crane, used in construction sites, designed to cope with frequent erection and dismantling operations, as well as transfers between different locations.

### 2 CRANE DEFINITIONS BASED ON FEATURES

- **Top slewing crane**  
Crane with the slewing system on tower top end.
- **Horizontal jib crane**  
Crane where the jib is parallel to the ground.
- **Travelling crane**  
Crane with foot equipped with own means for travelling on a track.
- **Stationary**  
Crane without any travelling means or which, even featuring travelling means, may not move during site construction work.  
Crane anchored in a foundation or baseplate.

### 3 PROCESS DEFINITIONS

- **CONDITION OF SERVICE**
  - **Operational**  
Crane working under given operating conditions (crane setup, load reach, etc.) or ready to move the loads for which it has been designed.
  - **Out of service**  
Unloaded crane left in stable position, in conditions specified by the manufacturer, without performing any work, and ready to get into operation when circumstances so require and allow.
- **Crane erection**  
The actual process of erecting the crane in the worksite, to perform as required. It includes preliminary works such as foundations, track construction works, etc.
- **Installed crane**  
Crane erected in the worksite, subject to design loads for crane out of service, but without the requirement of being ready for operation.
- **Commissioning**  
Set of crane checks and operations needed for making the crane operational.

#### 4 PARAMETER DEFINITIONS

- **Reach or radius**

Horizontal distance measured between crane slewing axis and the vertical centerline of the hook without load, when the crane is erected on horizontal ground.

- **Lifting range**

Vertical distance between upper and lower hook positions for the actual work.

- **Lift**

Vertical distance between hook rest level and upper hook position for the actual work.

- **Lowering depth**

Vertical distance between hook rest level and lowest position.

- **Travelling speed**

Speed of crane translation movement on the track for the type of work involved.

- **Slewing speed**

Angular speed of the slewing part of the crane for the type of work involved.

- **Trolley speed**

Speed of trolley translation movement for the type of work involved.

- **Hoisting speed**

Speed of the vertical movement of the load for the type of work involved.

- **Positioning speed**

Minimum load speed in erection or suspension processes, for the type of work involved.

- **Tip load**

Maximum load that can be hoisted at maximum reach.

- **Maximum load**

Maximum load that can be lifted according to crane manufacturer data.

#### 5 COMPONENT DEFINITION, VOCABULARY

- **Support frame**

Structural assembly supporting the slewing part or the fixed part of the crane tower.

- **Ballast**

Mass attached to the support frame for crane stability.

- **Tower**

Vertical structure of crane which supports the slewing part and allows for the required lift to be met.

- **Slewing section**

Structure including the slewing track and the slewing mechanism and the hoisting mechanism and comprising the elements for the transition between the fixed and the moving part of the crane.

- **Operator's cabin**

Cabin destined to normal control of the crane that houses the controls and the crane operator.

- **Jib**

Structural component of the crane, supporting the trolley and the hook, ensuring this way the required reach and lift. One section includes the trolley winch.

- **Counterjib**

Structure able to support the crane counterweight.

- **Counterweight**

Mass fixed to the counterjib, that helps compensate load actions.

- **Trolley**

Structure destined to the translation of suspended loads.

- **Hook**

Device for suspending the load.

- **Erection cage**

Structure placed on the tower upper part, that allows for hoisting the crane slewing part.

- **Bracing frame**

Structure, arranged on the tower, for transmitting loads derived from a tower extension.

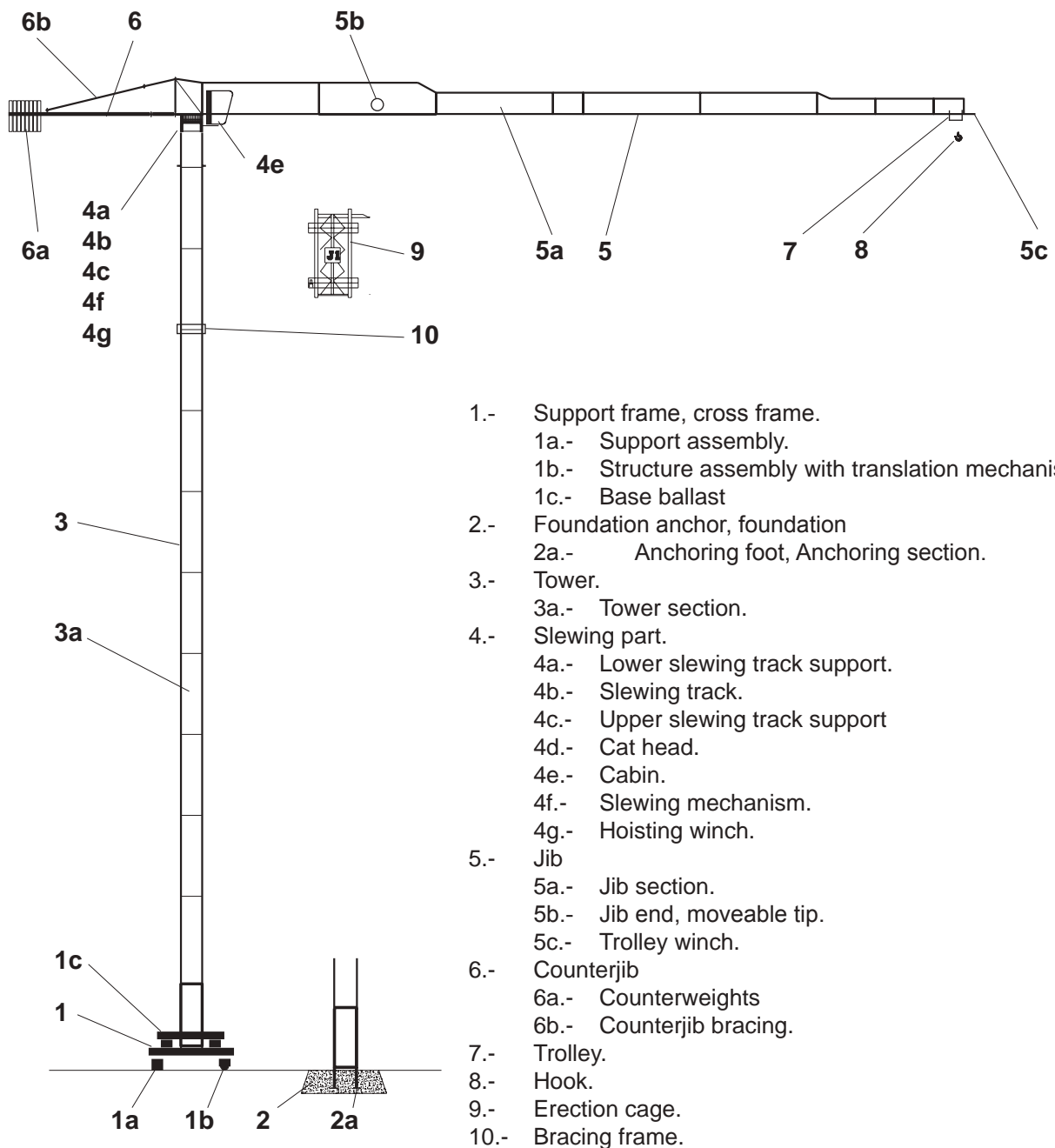
- **Travelling mechanism**

Mechanism for crane translation on track.

- **Slewing mechanism**

Mechanism for turning the slewing part of the crane in a horizontal plane.

- **Trolley winch**  
Mechanism for the translation of loads along the jib.
- **Hoisting winch**  
Mechanism for hoisting and lowering loads.
- **Limiter**  
Device for stopping or limiting crane movements or functions.
- **Indicator**  
Device for furnishing the crane operator with necessary information for a perfect crane operation within the operating parameter table.





# MANUFACTURER'S MANUAL

## 6 MAINTENANCE



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This chapter contains information on crane periodical checks and calibrations after commissioning.

Qualified personnel must carry out these operations after reading and understanding the instructions given in this manual.

National regulations call for controls and inspections that must be duly documented, but these controls do not exempt the user from regular crane maintenance.

For all maintenance works the following points must be taken into account:

- 1 Crane safety systems must never be worked on.
- 2 Always use a safety harness when working at heights over 2m and, as a general rule, use personal protection equipment adequate for the job.
- 3 Take special precautions when working on crane moving parts. Use adequate garments without loose onhanging parts that can be caught by moving parts (avoid clocks, rings, chains, etc.).
- 4 Never work alone.
- 5 When working on stationary crane parts:
  - Switch the control voltage off
  - Place controls on zero position
  - Isolate crane power supply by switching the power inlet isolator to the OFF position fixing it in place by means of a lock
  - Place on the crane and the control cabinet easily noticeable and legible warning signs on the current works being carried out.
  - Do not operate the crane before the responsible person gives the ready signal.
  - Make sure that all protection equipment is in place before the crane starts.
- 6 Make sure there is no voltage present prior to working with electrical components.
  - Never work alone.
- 7 Make sure no relevant changes have taken place after the last inspection.
- 8 Immediately report to the responsible person any detected malfunction. Stop crane operation and take necessary measures.
- 9 During draining operations, oil and other fluids must be collected into a suitable container.
- 10 Oil and grease must only be stored in places meant for lubricating materials. Remove any oil or grease residues to avoid skidding.

This instruction is a maintenance plan.  
It is complementary to the instructions given along the manual.

WHEN	WHAT
Daily Before start up	<ul style="list-style-type: none"> <li>- Check cables, inspect general condition.</li> <li>- Check pulleys, check for jams.</li> <li>- Check the structure, inspect general condition.</li> <li>- Check supports, track clear of obstructions, rail condition.</li> <li>- Check movement of all mechanisms.</li> <li>- Check brake operation.</li> <li>- Check limiters operation.</li> <li>- Check indicators operation.</li> </ul>
Weekly	<ul style="list-style-type: none"> <li>- Translation mechanism, grease teeth.</li> <li>- Crown wheel and slewing mechanism, grease teeth.</li> <li>- Check cables and pulleys.               <ul style="list-style-type: none"> <li>- Inspect reeving.</li> <li>- Inspect winding on drum</li> </ul> </li> <li>- Check electrical installation, inspect general condition.</li> </ul>
Monthly	<ul style="list-style-type: none"> <li>- Grease mechanisms.               <ul style="list-style-type: none"> <li>- Check levels, fill up if necessary.</li> </ul> </li> <li>- Grease slewing crown wheel.</li> <li>- Grease hydraulic group .               <ul style="list-style-type: none"> <li>- Check levels, fill up if necessary.</li> </ul> </li> <li>- Check hook, distortions, safety catch condition, etc.</li> <li>- Check connections.               <ul style="list-style-type: none"> <li>- Appearance, corrosion, etc.</li> <li>- Clearances, movements, etc</li> </ul> </li> </ul>
Every three months	<ul style="list-style-type: none"> <li>- Check brakes.               <ul style="list-style-type: none"> <li>- Check operation.</li> <li>- Adjustment</li> </ul> </li> <li>- Inspection of hydraulic equipment               <ul style="list-style-type: none"> <li>- Hose condition</li> <li>- Leaks, etc.</li> </ul> </li> </ul>
Every six months	<ul style="list-style-type: none"> <li>- Inspection of electrical installation.               <ul style="list-style-type: none"> <li>- See "ELECTRICAL MAINTENANCE" in chapter 4</li> </ul> </li> <li>- Inspection of crane anchorage, general condition.</li> </ul>
Yearly Every new erection	<ul style="list-style-type: none"> <li>- Check bolted connections.</li> <li>- Check connections.</li> <li>- Check limiters, calibration.</li> <li>- Check brakes, adjustment.</li> <li>- General inspection of structure.</li> </ul>
Every 2500 hour operation	<ul style="list-style-type: none"> <li>- Replace lubricant in:               <ul style="list-style-type: none"> <li>- Hoist drive mechanism.</li> <li>- Trolley drive mechanism.</li> <li>- Hydraulic group.</li> </ul> </li> </ul>
Every 4000 hour operation	<ul style="list-style-type: none"> <li>- Replace lubricant in :               <ul style="list-style-type: none"> <li>- Translation mechanism.</li> <li>- Slewing mechanism.</li> </ul> </li> </ul>
Regular maintenance	<ul style="list-style-type: none"> <li>- Cables, terminals.</li> <li>- Pulleys and hook.</li> <li>- Crane control.</li> <li>- Access.</li> </ul>

Any detected mal function must be reported to machine responsible personnel

## 0 CONTENTS

- 1 GENERAL
- 2 FREQUENCY
- 3 REGULAR MAINTENANCE

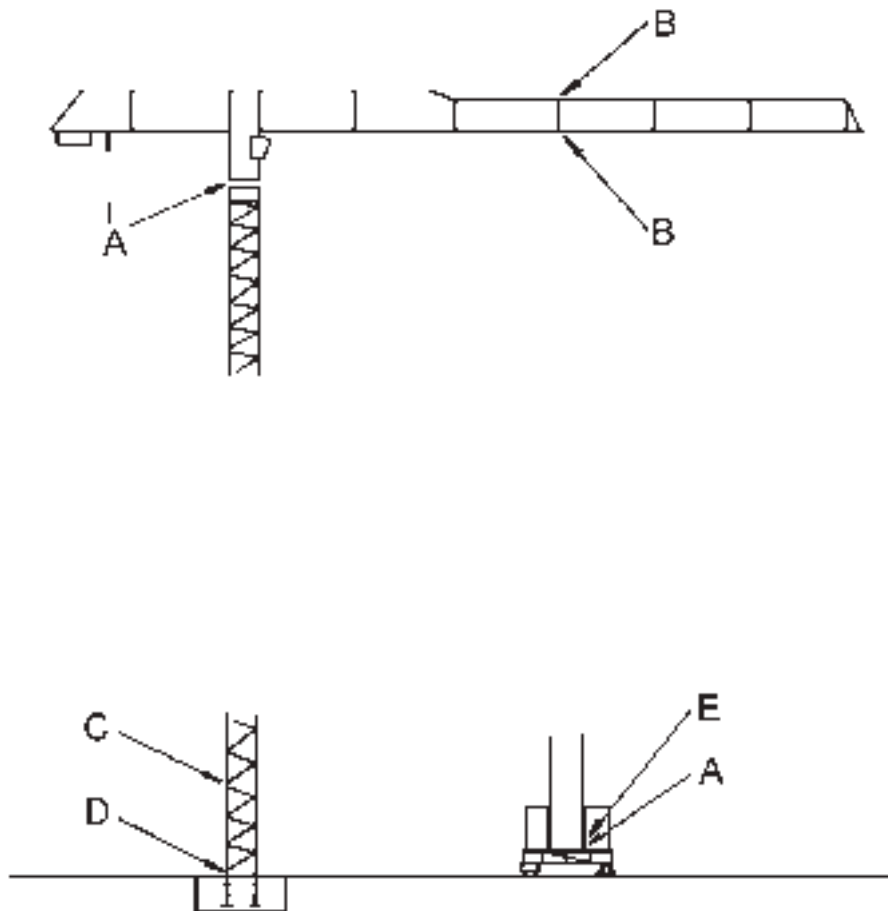
## 1 GENERAL

All crane member connections must be checked regularly and, if needed, corrective action shall be taken:

- Connections must be free from damage that might affect negatively their function and strength.
- Checking unions which use high strength screws with controlled tightening torque
- See specific documents for bolted connections with specified tightening torque.
- Unless otherwise stated, bolted connections shall be tightened to a torque level in accordance with mechanical good practice.
- All bolts and screws must be adequately secured.
- All securing elements must be tight enough as to prevent loosening

## 2 FREQUENCY

This instruction service must be carried out after the first 100-hour operation and then every 500-hour operation or every six months provided a lower compulsory frequency period has not been established.



### 3 REGULAR MAINTENANCE

During compulsory regular maintenance the following points shall be checked:

#### A Bolted connections

- Equipment anchorage to structure.
- Gear reducer, drum support and motor frame anchorage
- Auxiliary jib fixing. (optional)
- Electrical cabinet fixing
- Slewing crown wheel bolts
- Bolts for anchoring tower foot to base

#### B Jib and Counterjib:

- Bolts and pins for section upper connections
- Bolts for section lower connections

#### C TOWER

- Bolts are continuously subject to loads and must be replaced by new ones if corrosion or wear damage exceeding 0,3 mm in depth are detected
- In any case they must be replaced after 6-year operation.

#### D ANCHORAGE FOOTING

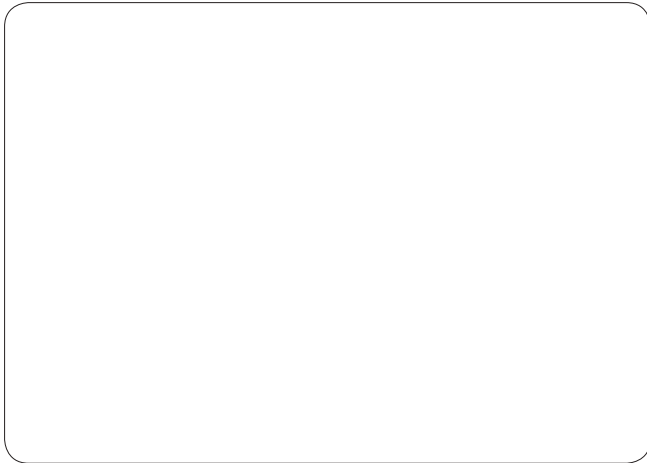
- Make sure that anchorage footing does not move.
- This is done by lowering and lifting the test load, used for limiting crane operation, in both tower diagonal directions.

#### E BASE

- Section anchorage to base
- Fastening of translation parts (driving mechanisms, shafts, wheels, rail fastening clamps, etc.)
- Fastening of supports (spindles, plates, pyramids)

#### Other connecting elements

- Connecting elements not mentioned in this or other sections must be checked with adequate frequency, as a function of the conditions under which the crane is working.



LUBRICANTS		
place	type	capacity
A- Reduction box B- Bell-housing	TIVELA COMPOUND-A MOLYKOTE KGP-2M	1,1 kg -

LUBRICANT CHANGES	
initial	maintenance
A- B- 50 hours	A- 4000 hours B- 100 hours

**A) SLEWING RED. GEAR BOX**

Boxes are supplied ready lubricated, filled with lubricant approximately to half-way up the inside. Gearboxes are sealed and require no maintenance.

Grease changes

The grease will be changed according to the changes of the lubricant. Recommendation, change lubricants in general each 4000 time from to work with temperature external higher 50° C, in general each 8000 time from to work or more from 3 year from life. In this case, a very careful cleaning with petroleum of all the gears should be made. The purpose of this is to eliminate all metallic particles which might cause a faster erosion, pitting and scratching of the teeth surface. Besides, these particles work as a catalisator in the oxidation of the grease.

Quality level of the grease

Semi-fluid, synthetic, extreme pressure (Fort E.P.) grease should be used, with anti-oxidant, anti-corrosive additives. The grease should have high oxydation stability and high dripping and channelling resistance, together with a wide range of service temperatures and low friction coefficients.

**B) LUBRICATION OF THE TEETH**

Teeths are lubricated in order to create a lubricant surface film which avoids direct metallic contact.

**PERIODS OF LUBRICATION**

Establish the lubrication periods depending on the working conditions.








Generally, it should be lubricated every 100 working hours. These periods should be shorter in case the crane works in tropical ambient, with high humidity, with high levels of dust and dirt, in case there are big temperature changes and when the travelling is being used for long periods of time.

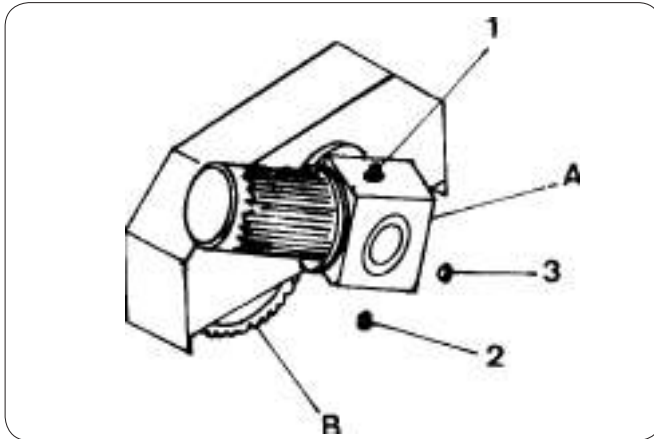
The crane should be lubricated before and after long periods of time when it is going to be out of service.



In case it is used another lubricant different from those specified on the table, the manufacturer or the supplier should give a written confirmation that the chosen lubricant is also appropriated for that determined use, and that its qualities comply at least with those indicated in the mentioned table.

Special greases or lubricants will be required in case the crane will be used at a very low temperatures (<-20°C)

EQUIVALENCE OF GREASE							
							
A	-	ENERGREASE	EPEXELF	GREASE	-	GLYGOYLE	TIVELA
-	HT-EP00	00	S-420	-	GREASE-00	COMPOUND-A	
B	-	ENERGOL	CARDREXA	SURETT	MOLYKOTE	MOBILTAC	CARDIUM
-	WRL	DC1	FLUID 4k	KGP-2M	81	FLUID C	



<b>1-Filling plug</b>	<b>2-Dumping plug</b>	<b>3-Finder</b>
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LUBRICANTS		
place	type	capacity
A- Reduction box	ENGRANAJES HP-220	4 l
B- Bell-housing	MOLYKOTE KGP-2M	-

LUBRICANT CHANGES	
initial	maintenance
A- 150 hours	A- 2500 hours
B- 50 hours	B- 100 hours

**SLEWING RED. GEAR BOX**

Reduction gear boxes should be refilled whenever the oil level goes below the “normal” level of the level indicator. This minimum level guarantees a correct lubrication of gears and bearings as long as a lubricant with an adequate quality is used.

The level marked as “normal” should not be exceeded when refilling the red. gear box.

Bearings should not be lubricated separately, since they are lubricated by the sprinkling of oil coming from the gears.

**Oil changes**

The oil will be changed according to the changes specified before, or depending on the conditions of the lubricant (inadequate viscosity, oil oxidation, contamination with silica, etc.). In this case, a very careful cleaning with petroleum of all the gears should be made. The purpose of this is to eliminate all metallic particles which might cause a faster erosion, pitting and scratching of the teeth surface. Besides, these particles work as a catalyst in the oxidation of the oil.

**Quality level of the oil**

**Lubricating oils**

It should be used oils with a great capacity to reduce the coefficient of friction, big thermal and oxidation stability, good properties against corrosion and rust with high humidity, nonfoaming, easy to separate from water, and with extreme good behaviour under high pressures and against erosion.

All lubricants should comply with the specifications DIN 51517 part 3, U.S. Steel 224, AGMA 250.04 and Cincinnati Milacron P-35 and P-59.

**LUBRICATION OF THE TEETH**

Teeth are lubricated in order to create a lubricant surface film which avoids direct metallic contact.

**PERIODS OF LUBRICATION**

Establish the lubrication periods depending on the working conditions.

Generally, it should be lubricated every 100 working hours. These periods should be shorter in case the crane works in tropical ambient, with high humidity, with high levels of dust and dirt, in case there are big temperature changes and when the travelling is being used for long periods of time.

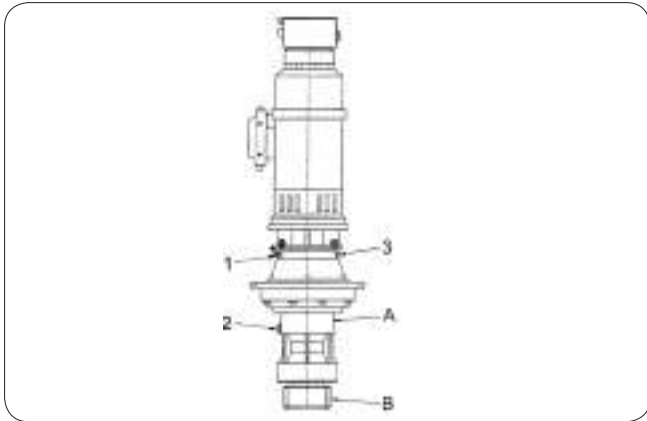
The crane should be lubricated before and after long periods of time when it is going to be out of service.

In case it is used another lubricant different from those specified on the table, the manufacturer or the supplier should give a written confirmation that the chosen lubricant is also appropriated for that determined use, and that its qualities comply at least with those indicated in the mentioned table.



Special greases or lubricants will be required in case the crane will be used at a very low temperatures (<-20°C)

EQUIVALENCE OF GREASE							
A	ENGRANAJES	ENERGOL HP-220	REDUCTELF GRXP-220	SPARTAN SP-220	- EP-220	MOBIL GEAR -	OMALA OIL 630 220
B	-	ENERGOL WRL	CARDREXA DC1	SURETT FLUID 4k	MOLYKOTE KGP-2M	MOBILTAC 81	CARDIUM FLUID C



1-Filling plug    2-Dumping plug    3-Inspection plug

LUBRICANTS		
place	type	capacity
A- Reduction box	CEPSA ENGRANAJES HP-220	complet
B- Bell-housing	MOLYKOTE KGP-2M	-

LUBRICANT CHANGES	
initial	maintenance
A-	A- Every 4000 hours
B- Every 50 hours	B- Every 100 hours

**A) SLEWING RED. GEAR BOX**

Reduction gear boxes should be refilled whenever the oil level goes below the “normal” level of the level indicator. This minimum level guarantees a correct lubrication of gears and bearings as long as a lubricant with an adequated quality is used.

The level marked as “normal” should not be exceeded when refilling the red. gear box.

Bearings should not be lubricated separately, since they are lubricated by the sprinkling of oil coming from the gears.

**GREASE CHANGES**

The grease will be changed according to the changes specified before, or depending on the conditions of the lubricant (inadequated viscosity, grease oxidation, contamination with silica, etc.). In this case, a very careful cleaning with petroleum of all the gears should be made. The purpose of this is to eliminate all metallic particles which might cause a faster erosion, pitting and scratching of the teeth surface. Besides, these particles work as a catalisator in the oxidation of the grease.

**QUALITY LEVEL OF THE GREASE**

Semi-fluid, synthetic, extreme pressure (Fort E.P.) grease should be used, with anti-oxidant, anti-corrosive additives. The grease should have high oxydation stability and high dripping and channelling resistance, together with a wide range of service temperatures and low friction coefficients.

**B) LUBRICATION OF THE TEETH**

Teeths are lubricated in order to create a lubricant surface film which avoids direct metallic contact.

**PERIODS OF LUBRICATION**

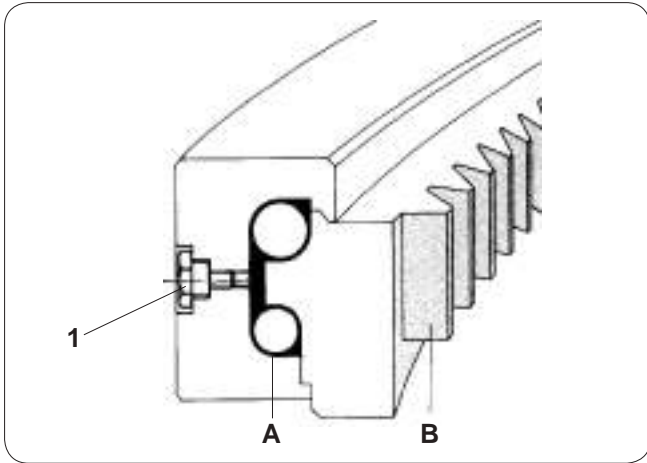
Establish the lubrication periods depending on the working conditions.

Generally, it should be lubricated every 100 working hours. These periods should be shorter in case the crane works in tropical ambient, with high humidity, with high levels of dust and dirt, in case there are big temperature changes and when the travelling is being used for long periods of time.

The crane should be lubricated before and after long periods of time when it is going to be out of service. In case it is used another lubricant different from those specified on the table, the manufacturer or the supplier should give a written confirmation that the chosen lubricant is also appropriated for that determined use, and that its qualities comply at least with those indicated in the mentioned table. Special greases or lubricants will be required in case the crane will be used at a very low temperatures (<-20°C)

EQUIVALENC OF GREASE							
A	ENGRANAJES HP-220	ENERGOL GRXP-220	REDUCTELF SP-220	SPARTAN EP-220	-	MOBILUX 630	OMALA OIL 220
B	-	ENERGOL DC1	CARDREXA FLUID 4k	SURETT KGP-2M	MOLYKOTE 81	MOBILTAC FLUID C	CARDIUM
-	WRL						





**1-Nipple**

LUBRICANTS		
place	type	capacity
A- Rolling strip	MOLYKOTE BR-2	-
B- Teeth	MOLYKOTE KGP-2M	-

GREASE CHANGES	
initial	maintenance
A- 50 hours	A- 100 hours
B- 50 hours	B- 100 hours

**A) LUBRICATION OF THE ROLLING STRIP**

The purpose of filling with grease is to diminish the friction, in addition to making tight and to protect against corrosion. Enough grease should be injected in order to create a collar of fresh grease around the whole perimeter of the slot between the rings and in the joints. The gear must be rotated during the lubrication process. Use only greases of the type KP 2 K. That means mineral greases saponified with lithium, belonging to the class NLGI-2, with additives EP.

**B) LUBRICATION OF THE TEETH**

Teeth are lubricated in order to create a lubricant surface film which avoids direct metallic contact.

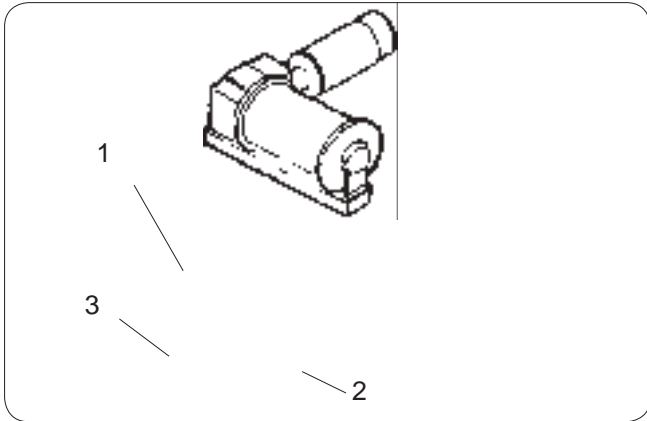
**PERIODS OF LUBRICATION**

Establish the lubrication periods depending on the working conditions. Generally, it should be lubricated every 100 working hours. These periods should be shorter in case the crane works in tropical ambient, with high humidity, with high levels of dust and dirt, in case there are big temperature changes and when the travelling is being used for long periods of time. The crane should be lubricated before and after long periods of time when it is going to be out of service. When the gear is being cleaned, special care must be taken in order to avoid that the detergent may damage the joints, and that it does not slip into the rolling strips.

In case it is used another lubricant different from those specified on the table, the manufacturer or the supplier should give a written confirmation that the chosen lubricant is also appropriated for that determined use, and that its qualities comply at least with those indicated in the mentioned table. Special greases or lubricants will be required in case the crane will be used at a very low temperatures (<-20°C).

EQUIVALENCE OF GREASE							
A BR-2	MOLYKOTE LS-EP2	ENERGREASE 2	EPEXELF EP2	GREASE MP-2	RENOLIT EP2	MOBILUX SREASE EP-2	ALVANIA
B KGP-2M	MOLYKOTE WRL	ENERGOL DC1	CARDREXA FLUID 4k	SURETT -	- 81	MOBILTAC FLUID C	CARDIUM





1-Filling plung 2-Dumping plug 3-Inspection plug

LUBRICANTS		
place	type	capacity
Reduction box	MYSTIK JT-7	25 l

LUBRICANT CHANGES	
initial	maintenance
150 hours	2500 hours

If the motor is to be dismantled a container must be placed under the motor/ gearbox join to catch the oil that may flow out due to the design of the components of the mechanism.

Reduction gear boxes should be refilled whenever the oil level goes below the “normal” level of the level indicator. This minimum level guarantees a correct lubrication of gears and bearings as long as a lubricant with an adequated quality is used.

The level marked as “normal” should not be exceeded when refilling the red. gear box.

Bearings should not be lubricated separately, since they are lubricated by the sprinkling of oil coming from the gears.

**OIL CHANGES**

The oil will be changed according to the changes specified before, or depending on the conditions of the lubricant (inadequated viscosity, oil oxidation, contamination with silica, etc.). In this case, a very careful cleaning with petroleum of all the gears should be made. The purpose of this is to eliminate all metallic particles which might cause a faster erosion, pitting and scratching of the teeth surface. Besides, these particles work as a catalisator in the oxidation of the oil.

**QUALITY LEVEL OF THE OIL**

Lubricating oils

Oils highly capable to reduce the friction coefficient with high thermal and corrosion stability, high corrosion resistance and rust proof in the presence of moisture, resistant to foam formation, with good capability for water separation and outstanding features for withstanding very high pressure and wear shall be used.

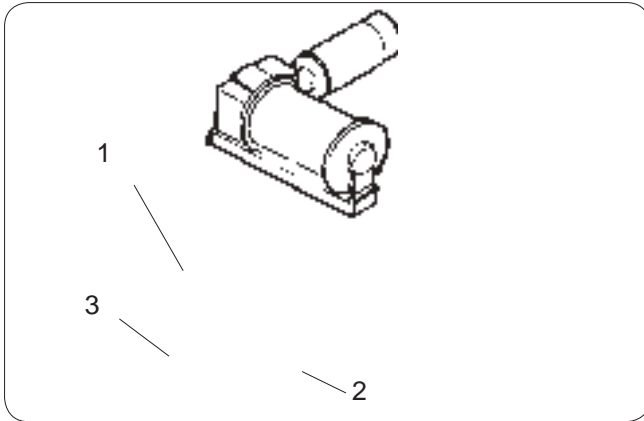
Lubricants used must comply with DIN 51517 part 3, U.S. Steel 224, AGMA 250.04 and Cincinnati Milacron P-35 y P-59 specifications.

Make sure that the selected oil is compatible with actual oil in mechanism, otherwise, proceed with a deep cleaning before oil replacement.

If the lubricant used differs from the ones shown in the table, seek confirmation from the lubricant manufacturer or supplier that the lubricant selected is appropriate for the application and complies at least with the quality requirements shown in the table.

Special greases or lubricants will be required in case the crane will be used at a very low temperatures (<-20°C ).


EQUIVALENCE OF GREASE							
MYSTIK JT-7	ENERGOL GRXP 150	REDUCTELF SP 150	SPARTAN EP 150	RENEP COMPOUND 104	MOBIL GEAR 629	OMALA OIL 150	



1-Filling plung 2-Dumping plug 3-Inspection plug

LUBRICANTS		
place	type	capacity
Reduction box	MYSTIK JT-7	5 l

LUBRICANT CHANGES	
initial	maintenance
150 hours	2500 hours

 If the motor is to be dismantled a container must be placed under the motor/ gearbox join to catch the oil that may flow out due to the design of the components of the mechanism.

Reduction gear boxes should be refilled whenever the oil level goes below the “normal” level of the level indicator. This minimum level guarantees a correct lubrication of gears and bearings as long as a lubricant with an adequated quality is used.

The level marked as “normal” should not be exceeded when refilling the red. gear box.

Bearings should not be lubricated separately, since they are lubricated by the sprinkling of oil coming from the gears.

**OIL CHANGES**


The oil will be changed according to the changes specified before, or depending on the conditions of the lubricant (inadequated viscosity, oil oxidation, contamination with silica, etc.). In this case, a very careful cleaning with petroleum of all the gears should be made. The purpose of this is to eliminate all metallic particles which might cause a faster erosion, pitting and scratching of the teeth surface. Besides, these particles work as a catalisator in the oxidation of the oil.


**QUALITY LEVEL OF THE OIL**

Lubricating oils








Oils highly capable to reduce the friction coefficient with high thermal and corrosion stability, high corrosion resistance and rust proof in the presence of moisture, resistant to foam formation, with good capability for water separation and outstanding features for withstanding very high pressure and wear shall be used.

Lubricants used must comply with DIN 51517 part 3, U.S. Steel 224, AGMA 250.04 and Cincinnati Milacron P-35 y P-59 specifications.

 Make sure that the selected oil is compatible with actual oil in mechanism, otherwise, proceed with a deep cleaning before oil replacement.

 If the lubricant used differs from the ones shown in the table, seek confirmation from the lubricant manufacturer or supplier that the lubricant selected is appropriate for the application and complies at least with the quality requirements shown in the table.

Special greases or lubricants will be required in case the crane will be used at a very low temperatures (<-20°C ).

EQUIVALENCE OF GREASE							
							
MYSTIK JT-7	ENERGOL GRXP 150	REDUCTELF SP 150	SPARTAN EP 150	RENEP COMPOUND 104	MOBIL GEAR 629	OMALA OIL 150	

The brake types are described according to the motor model or type installed at the crane in the "TECHNICAL SPECIFICATIONS" section, in the Chapter entitled "MECHANISM SPECIFICATIONS".

The following pages contain, maintenance instructions for each brake model.

Nevertheless, in general it is practical to establish the following:

- Brakes are an important feature for crane operation safety. Their operation should be checked every working day before operating the machine. Any disturbance noted, either during this inspection or during the normal operation of the crane, should be reported to the site foreman, and, if necessary, crane operation should be stopped.
  
- When the crane is installed for the first time or when the motors or brakes are new, the brakes should be checked after approximately one working week and adjusted if necessary.



In case of repeated emergency stops within a short period of time, the brakes should be checked immediately by qualified personnel, since they may be adversely affected and lose their braking power and load-retaining capabilities.

- Under poor weather conditions or after a long period of inoperation, the brake disc may get stuck to the friction surface. As a result, the brake opening should be controlled before starting again, and, the disc should be released, if necessary.

TO IDENTIFY BRAKE TYPE FITTED, CONSULT CHAPTER "TECHNICAL SPECIFICATIONS" – SECTION – MOTOR SPECIFICATIONS.

**0 CONTENTS**

- 1 GENERAL DESCRIPTION**
- 2 CONTINUOUS SERVICING**
- 3 ADJUSTMENT OF BRAKING TORQUE**
- 4 ADJUSTMENT OF AIR GAP**
- 5 CHANGING BRAKE DISC**
- 6 MANUAL UNLOCKING**

**IMPORTANT NOTE**



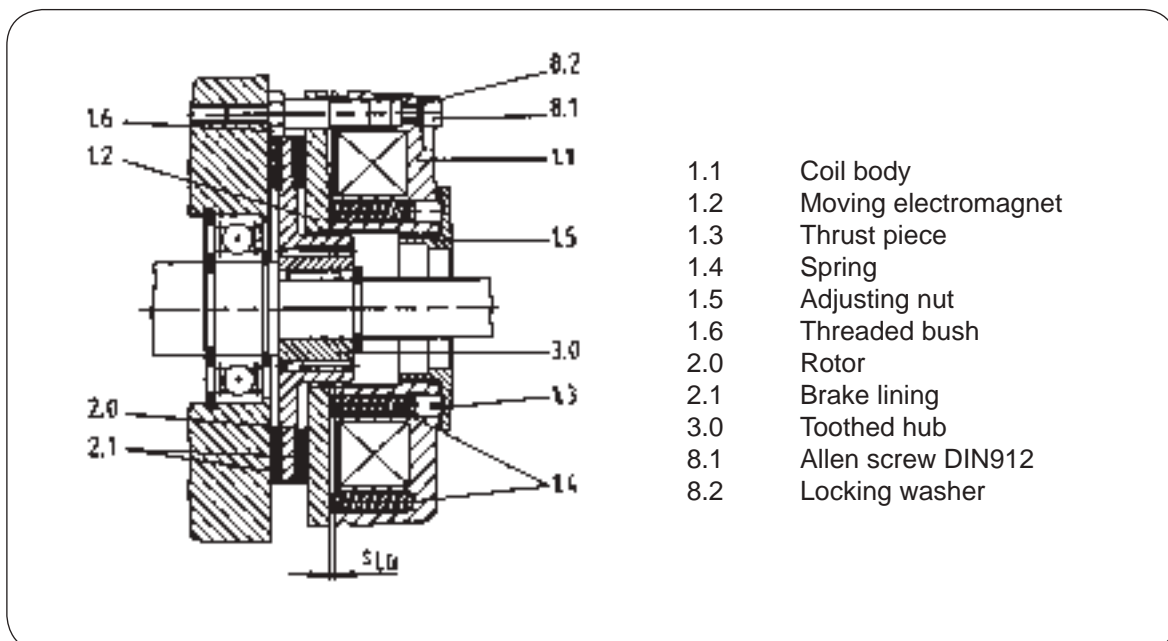
Certain operations described below involve leaving the motor without the locking brake, changing the electromagnet or brake disc, for example. In these cases, the mechanism must be appropriately immobilised to make sure the motor cannot slip before proceeding. In any case, these operations should always be carried out with no load on the hook.

**1 GENERAL DESCRIPTION**

The brake is of electromagnetic type using a brake disc with two braking surfaces. Spring pressure ensures braking torque through friction. The brake is opened by supplying direct current to the brake coil.

During braking the rotor (2.0), which moves axially on the pinion (3.0), is pressed against the friction surface by the moving electromagnet (1.2) by means of springs (1.4).

When the brake is applied there is an air gap  $SLü$  between the coil body (1.1) and the moving electromagnet (1.2). When the brake is opened, direct current is supplied to the coil (1.1); the magnetic force generated attracts the moving electromagnet (1.2) towards the coil body (1.1), overcoming the force of the springs. The braking disc is freed and the motor rotor may turn freely.



## 2 CONTINUOUS SERVICING

Wear on the braking surface of the brake disc depends on operating conditions. There is a gradual reduction in friction until brake adjustment becomes necessary.

It is recommended to check the air gap SLü a week after putting into service, and thereafter every three months. Checking the brake lining thickness and brake operation is also recommended every three months.

Type	Brake torque (Nm)	Air gap (mm)		Bolt tightening torque (Nm)	Disk thickness (mm)		Omax (mm)
		Nominal	max		max	min	
06	4	0,2	0,5	2,8	6,0	4,5	4,5
08	8	0,2	0,5	5,5	7,0	5,5	4,5
10	16	0,2	0,5	9,5	9,0	7,5	7,5
12	32	0,3	0,75	9,5	10,0	8,0	9,5
14	60	0,3	0,75	23	10,0	7,5	11
16	80	0,3	0,75	23	11,5	8,0	10
18	150	0,4	1,0	23	13,0	10,0	15
20	260	0,4	1,0	46	16,0	12,0	17
25	400	0,5	1,25	46	20,0	15,5	19,5
25	600	0,5	0,75	46	20,0	15,5	19,5

### 2.1 INSPECTION OF BRAKE LINING THICKNESS

The disc must not turn during this inspection.

1. Remove the brake cover.
2. Measure brake lining thickness using a calibre.
3. Compare the measurements taken with the minimum permitted thickness (see table: depends on type of brake).
4. If necessary, change the brake disc.

### 2.2 INSPECTION OF AIR GAP

The motor must not turn during this inspection.

1. Measure the air gap SLü between the moving electromagnet and the coil body using feeler gauges.
2. Compare the measurement taken with the maximum permitted, depending on brake size (see table).
3. If necessary, adjust the air gap to the recommended value.

### 2.3 INSPECTION DURING OPERATION

Do not touch either brake disc or connecting cables where not insulated.

1. Observe the air gap during operation. It should be zero.
2. Measure the voltage of the direct current in the brake coil during operation. The figure should be indicated on the maker's plate. A variation of 10% is permissible.

## 3 ADJUSTMENT OF BRAKING TORQUE

Spring pressure and therefore braking torque may be changed using the adjusting nut (1.5).

To reduce torque, the adjusting nut should be turned anti-clockwise.

Note the stops when turning the nut. Positions between stops are not permitted.

Never exceed the value Omax (see table).

Do not exceed the maximum permitted air gap SLü.

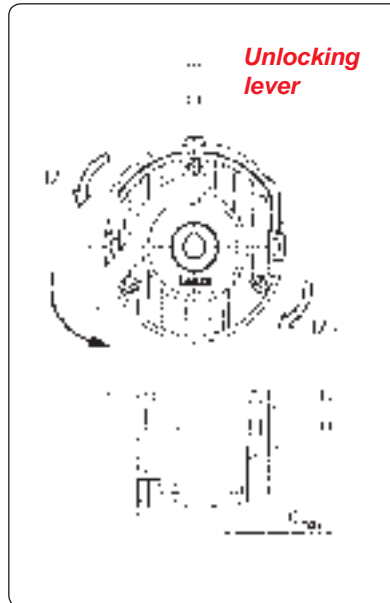
! This regulation of the torque by means of adjustment nut is only possible in elevation the connected motor brakes.

## 4 ADJUSTMENT OF AIR GAP

Disconnect the electrical supply to the brake.

The brake must be free from torque.

1. Loosen the screws (8.1).
2. Tighten the threaded bushes (1.6) in towards the coil body. 1/6 of a turn reduces the air gap by about 0.15 mm.
3. Tighten the screws (see table for tightening torque).
4. Check the air gap near the screws using feeler gauges. Consult the table for the recommended air gap value.
5. If the difference between the measured and recommended values is too large, repeat the adjustment.



## 5 CHANGING THE BRAKE DISC

Disconnect the electrical supply to the brake.

The brake must be free from torque.

1. Disconnect the supply cable.
2. Remove the screws (8.1).
3. Remove the coil body, taking care with the supply cable.
4. Remove the brake disc and check that the pinion teeth are not damaged. If they are worn, the pinion must also be replaced.
5. Loosen the threaded bushes to adapt the air gap to the new brake disc thickness.
6. Fit the new disc and the coil body.
7. Adjust the air gap to the value recommended in the table.
8. Reconnect the supply cable.

## 6 MANUAL UNLOCKING



This operation may only be carried out, in case of need, by competent personnel aware of the consequences of working on the brake unlocking mechanism.

To release the brake, push the release lever towards the motor.



The unfreezing normal is only included in elevation the connected motor brakes.

TO LEARN WHICH STANDARD BRAKE IS INCLUDED SEE THE SECTION ON MOTOR CHARACTERISTICS IN THE CHAPTER "TECHNICAL SPECIFICATIONS"

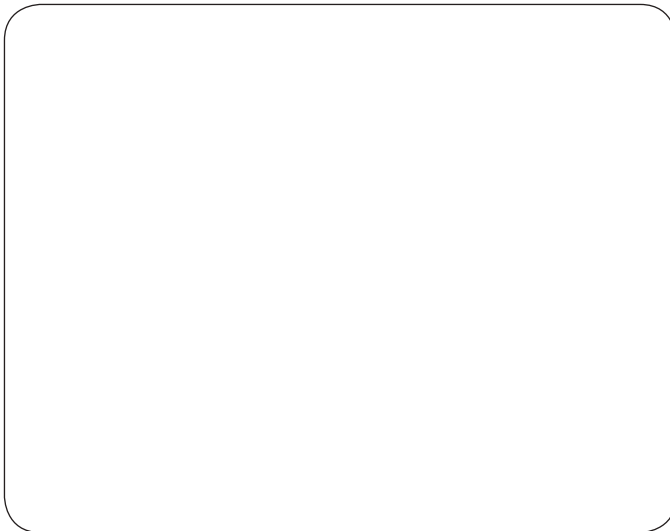
## 0 CONTENTS

1	GENERAL DESCRIPTION
2	CONTINUOUS SERVICE
3	GAP ADJUSTMENT
4	BRAKING TORQUE
5	DISASSEMBLY/ASSEMBLY
6	MANUAL RELEASE

### IMPORTANT NOTE:

Some of the operations below (e.g. changing the electro-magnet) will lead to the motor being left without a locking brake. In such cases, ensure that the motor cannot slip, causing for instance free fall of the hook on hoisting motors or trolley displacement. Block any movements before carrying out the operation. In any event these operations should always be performed with no load on the hook.

## 1 GENERAL DESCRIPTION



- 1 Brake cover
- 2 Armature
- 4 Nut
- 5 Lock nut
- 6 Brake spring
- 8 Gap adjustment screw
- 9 Fixed electro-magnet
- 10 Fixed brake ring
- 11 Brake disc
- 12 Brake endshield
- 13 Rotor shaft

An electro-magnetic brake is used to brake the movement of the electric motor. It is normally activated electrically (open brake) when the manipulator controlling the movement to which the motor belongs is moved out of the neutral position by the crane operator.

It is deactivated electrically (close brake) when the manipulator is returned to the neutral position. However on some occasions brake action may be delayed for smoother braking.

When the fixed electro-magnet (9) is powered it opens the armature (2) which compresses the spring (6) and frees the disc (11). The brake is then open.

When power is disconnected the armature (2) is free, and under pressure from the spring (6) it presses the crown wheel (10) onto the disc (11).

The crown wheel (10) is prevented from spinning by the brake endshield (12).

## 2 CONTINUOUS SERVICE

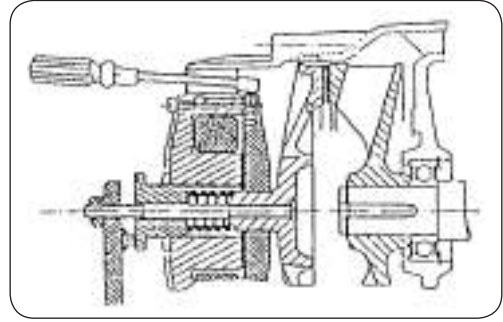
**Every 3 months:** check that the brake works properly. If opening speed is too slow, adjust the gap.

**Each time the brake is disassembled:** clean it carefully.



### 3 GAP ADJUSTMENT

The gap must be adjusted as soon as release is observed not to take place properly (brake opening too slowly or not at all). Unscrew the positioning screw (8) and take it out of the holes in the armature (2). Using a screwdriver on the slotted exterior, fully unscrew the armature so that it rests on the electro-magnet (9). Screw up the armature (2) again, resting on the screw (7) in the third hole.



### 4 BRAKING TORQUE

Braking torque is factory set and cannot be adjusted on site.

### 5 DISASSEMBLY/ASSEMBLY

#### 5.1 Disassembly

Cut the power. Open the terminal box and identify the cables and their positions (motor and brake power, probes, etc.). Then disconnect the power cables.

Dismount the brake motor using suitable tools (extractors, plastic body maces, calibrated screwdrivers & wrenches, grips for circlips, etc.)

Remove the lock nut (5) and unscrew the nut (4).

Unscrew the three fixing screws on the electro-magnet and remove the magnet carefully so as not to damage the power cables.

Remove the armature (2) and lined crown wheel (11) assembly, and unscrew the armature from the crown wheel.

Clean the components.

Use only an air jet for electrical components (no solvents or wet products), white spirit or a similar cleaner for mechanical parts, and a scraper for connections.

If necessary degrease the brake disc(s) and lining(s).

Change the seals and check the condition of the bearings. Disconnect the rectifier bridge and check the stator insulation (> 100 megohms).

Identify any faulty item so that a replacement can be ordered.

#### 5.2 Assembly

Open bearings must be re-greased before assembly with grease suitable for their working conditions. Shafts and bearing boxes should be lightly lubricated. The lips of seals should be lined with grease and re-fitted with care (using the key slot protection bushes). Connections which must be leak-tight must be coated with a fine layer of sealing paste.

Screw the armature (2) onto the lined crown wheel (11) with the flat side outwards. Remove the electro-magnet positioning screw (8), and position the crown/armature assembly and the spring stop in the electro-magnet. Fit the spring (6) and the nut (7) on the release bar, and screw the nut onto the electro-magnet a few turns. Assemble on the brake endshield (12) and attach via the three screws and washers, tightening them alternately until they are locked.

Adjust the gap and the braking torque (see sections 3 & 4).

Screw up the lock nut (5).

Re-connect the rectifier bridge and the probes if necessary, then the motor, ensuring that the cables are correctly placed. Close the terminal box.

Check that the whole unit works properly and ensure, if necessary, that the release lever is properly fitted before mounting the unit on the machine.

### 6 MANUAL RELEASE

To release the brake manually, turn the lock nut (5) clockwise. This operation should only be carried out when really necessary, and should be left to competent personnel familiar with the effects of releasing or braking the motor.

Unscrew the lock nut (5) again before returning to normal operation.



FOR DETAILS ON BUILT-IN BRAKE REFER TO CHAPTER "TECHNICAL SPECIFICATIONS", PARAGRAPH "CHARACTERISTICS OF MOTORS"

<b>O</b>	<b>CONTENTS</b>
1	DESCRIPCION GENERAL
2	SERVICIO CONTINUO
3	AJUSTE DEL PAR DE FRENADO
4	COMPROBACION Y AJUSTE DEL ENTREHIERRO
5	CAMBIO DE BOBINA
6	CAMBIO DEL DISCO DE FRENO

### IMPORTANT NOTE:

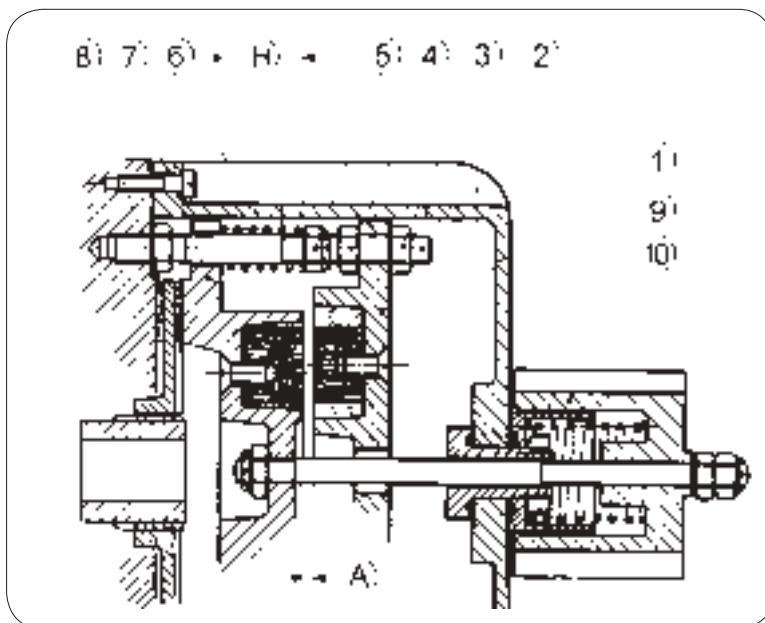


Some of the operations described below, for instance, replacing the magnet, will require to leave the motor with the locking brake inoperative. In this case, make sure that the motor will not rotate, for instance, preventing the hook to fall freely or the trolley to move. If this is not possible, suitably lock any possible movement before proceeding to carry out the required maintenance operation. In any case, these maintenance operations shall be performed with no load suspended from the hook.



On cranes that can be weathervaned remotely from the control panel, this system loses its adjustment when the release device is dismantled so the brake can be accessed. It must therefore be readjusted when the device is re-mounted, as per points 3 and 4 of these instructions.

## 1 GENERAL DESCRIPTION



- |    |                               |
|----|-------------------------------|
| 1  | Brake protection              |
| 2  | Column                        |
| 3  | Coil fixing nut               |
| 4  | Air gap adjustment nut        |
| 5  | Braking torque adjustment nut |
| 6  | Brake spring                  |
| 7  | Moving magnet                 |
| 8  | Brake disc                    |
| 9  | Coil                          |
| 10 | Manual releasing              |

The brake is of electromagnetic type.

Its function is to brake the movement of electric motor.

Normally, it is electrically actuated (brake open) when the control which governs the movement of the system driven by the motor is moved by the crane operator out of its neutral position.

On the contrary, the brake is electrically released (brake closed) when the control is returned to its neutral position. However, in some cases the brake action may be delayed in order to obtain a smoother braking effect.

## 2 PERIODICAL SERVICE

### Every three months:

Verify for a correct air gap ("A" distance) between moving magnet (7) and brake coil (9). Adjust air gap if required: refer to paragraph 4.

### If the brake is disassembled or adjusted:

Thoroughly clean all brake components using pressure air.

After disassembling the brake, apply a thin grease layer on moving magnet pegs.

### Important:

Make sure that all friction surfaces are free from grease.

## 3 BRAKING COUPLE ADJUSTMENT

Electromagnetic brakes are perfectly adjusted at factory. However, it is advisable in some cases to increase or reduce the braking pressure according to the conditions of work site.

To reduce the braking force, adjust the three nuts (5) by rotating them in the direction required to release the pressure applied by springs (6).

To increase the braking force, adjust nuts (5) in reverse direction.

When increasing the braking force, prevent applying excessive pressure on the springs, making sure that the electromagnetic field generated by the brake coil is sufficient to overcome the spring forces.

The following contains the information to adjust the braking torque of the trolley, slewing and traveling motor brakes:

Movement	Motor	Manufacturer	Brake	Yellow Spring	White Spring
SLEWING	4,5 kgm	BESOZZI	100S	-	(*) H=16,0
	5,5 kgm		100S	-	(*) H=17,5
	6,5 kgm		100S	H=16,0	(*) H=17,5
	7,5 kgm		110MS	H=33,0	(*) H=19,5
	9,0 kgm		110MS	H=32,5	(*) H=18,0
	12,0 kgm		110MS	(*) H=31,5	H=16,5
TROLLEY	0,7/2,6 CV	BESOZZI	100S	-	(*) H=18,5
	2,2 kW		100S	-	(*) H=18,5
TRAVELLING	3,0 kgm	BESOZZI	80S	-	(*) H=12,0
	4,5 kgm		100S	-	(*) H=18,5
	5,5 kgm		100S	-	(*) H=18,5
	7,5 kgm		110MS	(*) H=32,0	

H= Length of the brake springs (6) when it is applied (braking)

(\*) Current equipment.



Before adjusting the spring, check its color and choose the appropriate valve from the table.

### Important:

Make sure that braking force adjustment is made by actuating on the three nuts (5). Spring pressure must be suitably balanced.

Do not actuate on nuts (3 and 4) when performing this adjustment operation.

## 4 AIR GAP CHECKING AND ADJUSTMENT

### Checking:

The use of brake involves wear of friction surface of brake disc (8), causing the air gap to increase. Verify dimension "A" by means of a set of feeler gauges every three months.

Brake type	Air gap	
	minimum	maximum
60	0,3	1,2
70 - 80 - 90	0,5	1,2
100 - 110 - 120	1,0	1,5
140 - 160 - 180 - FM158/1	1,0	1,5

Adjust air gap whenever dimension "A" exceeds the maximum allowable value.

### Adjustment:

If dimension "A" exceeds the maximum allowable value:

- 4.1 Loosen the three nuts (4)
- 4.2 Tighten the three nuts (3), moving the coil toward the moving magnet.
- 4.3 Verify for a correct air gap and make sure that dimension "A" is within the allowable range and is evenly distributed along the entire coil circumference.
- 4.4 Tighten the three nuts (4) to keep the coil locked.

## 5 COIL REPLACEMENT

The coil is covered with a solid resin, making up a compact block which must be totally replaced if required.

- 5.1 Disconnect coil supply wires from motor terminal box.
- 5.2 Remove manual brake releasing assembly, if any.
- 5.3 Remove brake protection cover.
- 5.4 Remove the three nuts (3) and then the coil.
- 5.5 Replace the coil by a new one.
- 5.6 Assemble the brake by following a reverse procedure, taking care to adjust the air gap as described in paragraph 4.

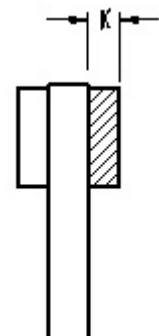
## 6 BRAKE DISC REPLACEMENT

Brake disc is made of steel and a friction material and its is fixed to motor shaft by means of a pinion.

- 6.1 Disconnect coil supply wires from motor terminal box.
- 6.2 Remove manual brake releasing assembly, if any.
- 6.3 Remove brake protection cover.
- 6.4 Remove the three nuts (3).
- 6.5 Remove coil (9).
- 6.6 Loosen nuts (4 and 5), remove brake springs (6) and then moving magnet (7).
- 6.7 Replace brake disc by a new one.
- 6.8 Assemble the brake by following a reverse procedure, taking care to adjust the air gap as described in paragraph 4.

The disc should be changed when the thickness of the brake lining is inferior to the value indicated in the table.

Brake type	Minimum Thickness of Brake lining (K)
80	1
100 - 110 - 120	1,5
140 - 160 - FM158/1	1,7



<b>0</b>	<b>CONTENTS</b>
<b>1</b>	<b>DESCRIPTION</b>
<b>2</b>	<b>OPERATION</b>
<b>3</b>	<b>MANUAL OPERATION</b>
<b>4</b>	<b>WIRING</b>
<b>5</b>	<b>ADJUSTMENT</b>
<b>6</b>	<b>CHECKING OPERATION</b>

## 1 DESCRIPTION

The crane is prepared for weather vaning by releasing the brake on the slewing motor(s), leaving the upper crane free to move with the wind. The brakes are released remotely via the release units on the brake cover of each slewing motor.

A control box in the operator's cabin (or at the base of the crane when there is no cabin) governs the release units.

In case of a power cut-off or malfunction in the release system, weather vaning can be done manually.

## 2 OPERATION

### Weathervaning sequence (Fig. 1)

- 1 Opening the motor brake causes the manual lever (1) to move upwards
- 2 The electromagnet (5) attracts the moving armature (2) and positions it below the manual lever (1).
- 3 When the brake drops the manual lever (1) rests against the moving armature (2), preventing the brake from closing and weathervaning the crane.

### Activating weathervaning

- 1 The crane must be in operation.
- 2 Press the weathervaning button on the crane control panel and wait 5-10 seconds. If the crane siren is still blowing after that time, the crane is weathervaned.
- 3 Press Stop to cut the siren.
- 4 Press Start. The siren should continue to blow when the Start button is released.
- 5 Press stop to cut the siren.

### Deactivating weathervaning.

- 1 Engage the slewing control with the crane in operation.



### IMPORTANT:

- Steps 4 and 5 are essential, as they ensure that weathervaning has actually taken place.
- If the weathervaning button is pressed by accident during normal operation, just engage the slewing control to deactivate it.
- Do not hold down the weathervaning button more than 30 seconds.

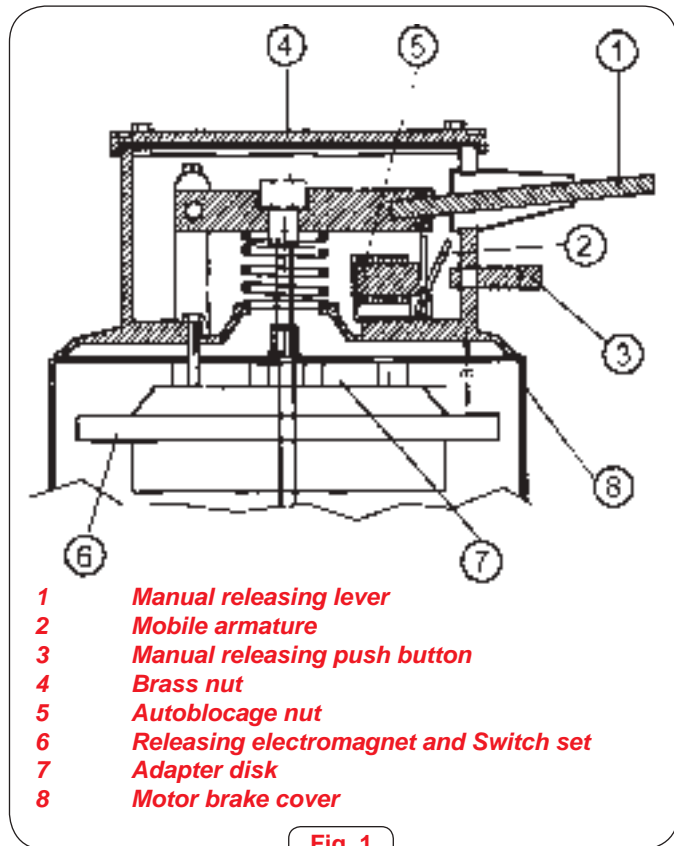


Fig. 1

! Some cranes have a lamp on the weathervaning button to indicate that weathervaning is engaged. el dispositivo de veleta está activado.

### 3 MANUAL OPERATION

If there is a malfunction or power cut-off the slewing motor brakes can be released manually.

- 1- Lift the lever, overcoming the resistance of the brake springs, and keep it lifted.
- 2- Press and hold down the button.
- 3- Release the lever.
- 4- Release the button.

This procedure should be repeated with each release unit.

Repeat the process on each release unit

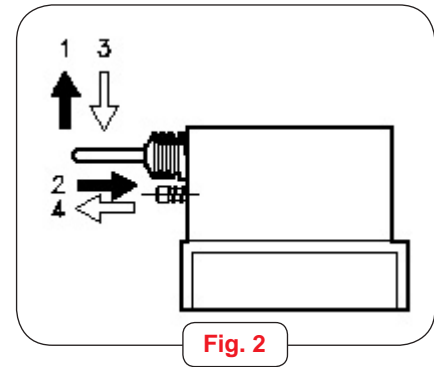


Fig. 2

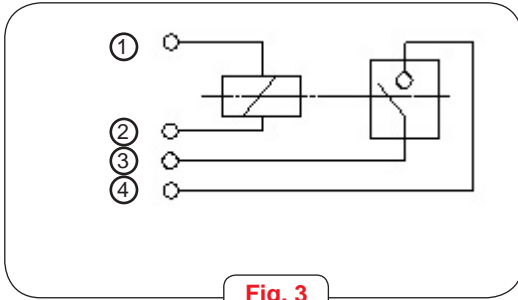


Fig. 3

### 4 WIRING

- |     |  |
|-----|--|
| 1-2 | 48V (50/60 Hz) electro-magnet power              |
| 3-4 | Electro-magnet operating indicator micro-switch. |

### 5 ADJUSTMENT

To regulate the unblocking weather vaning, proceed as follows:

- 1- Manually lift the unblocking lever (1).
- 2- Push the button (3) until the mobile armature (2) comes inside under the lever (1).
- 3- Unscrew the nut (4) in such a way that the distance "a" between armature (2) and lowr part of the lever (1) when this is lifted at its highest be approximatively 0.5 mm.
- 4- Check electrical operation: the armature (2) should enter freely when the weathervaning button is pressed on the crane controls, and should release when slewing movement is commanded. If it does not, slacken the self-locking nut (4) 1/12 of a turn (half a facet) and try again.

NOTE: Between the position of maximum regulation and minimum the brass nut (4) turns 4/6 of return (4faces).

IMPORTANTE: The brake gap should not be less than 1 mm if weathervaning is to be regulated correctly.

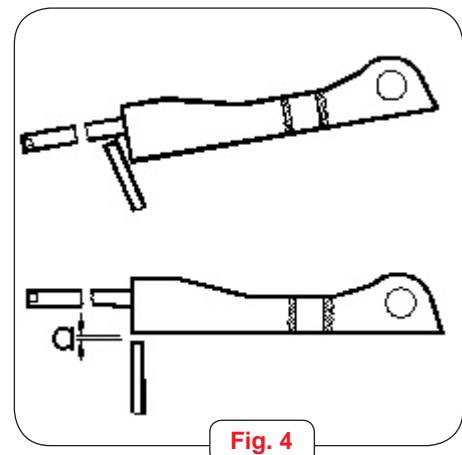


Fig. 4

### 6 CHECKING OPERATION

Weathervaning must be used in windy conditions: if the jib points in the direction of the wind then the weathervaning system is working correctly.

To check weathervaning when it not windy, proceed as follows:



- 1- Ensure that the crane can turn freely with no obstacles in its path.
- 2- With the trolley back and the hook raised and under no load, engage first gear and slew slowly.
- 3- Still in first gear, press the weathervaning button (the crane siren will sound).
- 4- Still slewing in first gear and with the weathervaning button engaged, press the stop control and check that the jib continues to turn freely under its own inertia.
- 5- If it does not do so, readjust the brake gap (which should be 1 mm) and adjust the weathervaning system..

## CONTENTS

- 1 SYSTEM OVERVIEW
- 2 OPERATION CHECK
- 3 ALARM AND TEST PROGRAMMING
- 4 RS 485 WIND-SPEED OUTPUT
- 5 HEATING SYSTEM FOR THE WIND-SPEED SENSOR

### 1 SYSTEM OVERVIEW

The basic configuration has a wind-speed sensor (1), which is connected to the control and signalling unit (2).

The system operates as follows:

- The control and signalling unit is electrically powered from the crane electric cabinet.
- The orange luminous beacon is activated when the wind-speed exceeds 50 km/h.
- The red luminous beacon and warning siren are activated when the wind-speed exceeds 70 km/h..

If the crane is no in operation, the wind alarm indication system is no operable.



In case of disconnection of the crane, this should be placed in an out-of-service condition (including the weathervaning).

It should be considered that the radio controls automatically disconnect the crane when it is unused for a certain period. When the crane is not supervised, it should be placed in an out-of-service condition.

- 1 *Wind-speed sensor*
- 2 *Control and signalling unit*
- 4 *Fastening magnets*
- 5 *Orange and red beacons*
- 6 *Siren*
- 7 *Line fastening to the structure*
- 8 *Cabin display*

Fig. 1

### 2 OPERATION CHECK

#### 2.1 Indication and control unit

- Check the operation of the beacons and siren as follows:
  - Check the crane is powered.
  - The switches at the bottom of the crane and the general switch on the electrical cabinet are in the ON position.
  - Press the stop button in the crane control and then press the start button (radiocontrol, telecontrol or seat).
- This procedure allows to detect a problem in:
  - Orange or red beacons.
  - Siren.
  - Unit power supply.

The device checks the proper operation of the red and orange beacons and of the siren by switching the beacons and the siren (each beacon should blink twice and the siren must horn once).

- If one or several elements do not operate, this is because there is a problem in the electric supply or in the elements themselves.

During this test, physically cover the siren to prevent being deafened by the noise this produces.

- Double check that the control and signal code units are properly fixed by the magnets and check that the unit is appropriately secured to the crane structure with the fastening line (7) which is supplied.
- Check that the unit is visible from the crane operator's control position.

## 2.2 Wind-speed sensor.

- Check that it turns freely.
- Check that it is not affected by the shielding of the structure.
- Check that the cable between the sensor and the control unit is not cut or disconnected.

## 2.3 Wind velocity detection system check.

The correct operation of the wind velocity detection system can be checked at three levels of complexity, according to what needs to be checked:

### Level 1. Checking of operation

The system is correctly connected and detects the wind velocity.

It is not checked whether the wind signal is correctly calibrated or whether the alarm system is activated at preset values.

Necessary material:

- Cabin wind velocity display.

Instructions:

- Connect the cabin wind velocity display to the control unit (See Point 4).
- Move the wind velocity detector cups either through the action of the wind or by turning them by hand.
- Check that there is a velocity reading on the cabin wind velocity display.

### Level 2. Check the operation and quality of the signal detected

The system is correctly connected, is detecting the wind velocity and the signal detected is correct.

It is not checked whether the wind signal is 100% correctly calibrated or whether the alarm system is activated at preset values.

Necessary materials:

- Cabin wind velocity display.
- One complete portable anemometer with built-in display.

Instructions:

- Connect the cabin wind velocity display to the control unit (See Point 4).
- Install the portable anemometer pickup near the crane pickup and under the same wind reception conditions.
- Compare the wind velocity readings on the two displays (the check will be much more effective if the auxiliary anemometer is calibrated).

### Level 3. Calibration of the apparatus

The system correctly detects the wind velocity and checks that the signal and alarm limits are correctly calibrated.

It is necessary to send the anemometer to the equipment manufacturer for this check. This manufacturer has a certified test bed for checking and calibrating the anemometer.



### 3 PROGRAMMING OF TEST AND ALARM MODES.

The equipment is set by the manufacturer to be configured in different ways in the alarm test and operating modes.

! The equipment is configured by COMANSA, as is indicated in Fig.2.

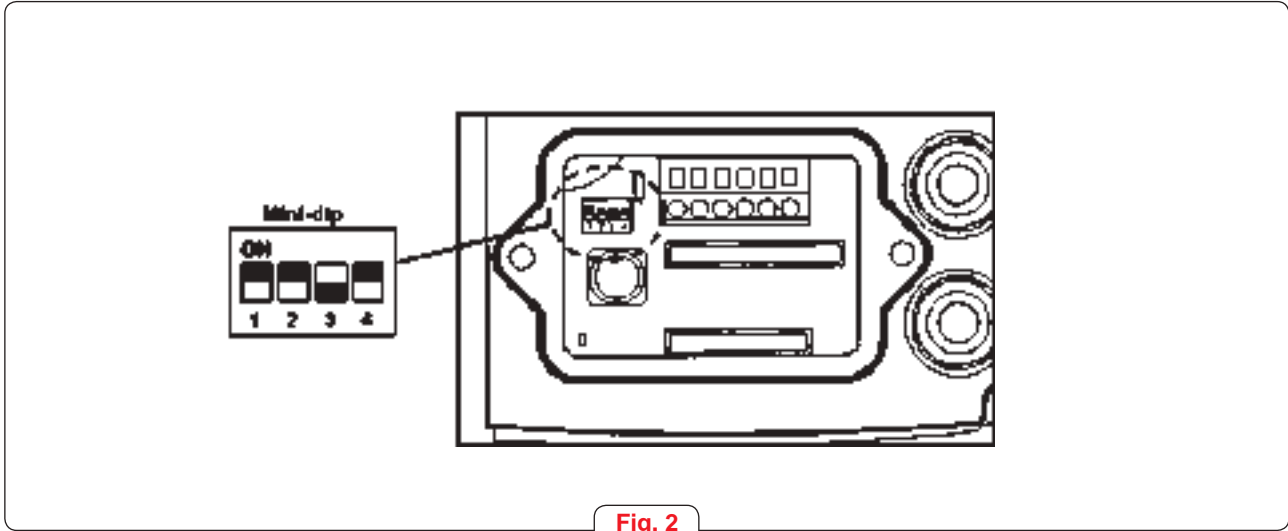


Fig. 2

The device can be configured in different ways, by changing a set of 4 mini-switches 4 placed inside it. The different functions that can be activated or deactivated are: autotest function, configuration in which the device must be reinitialized after the 70km/h alarm is activated, cancel the acoustic warning when working close to low noise areas like hospitals, residenciales...

To access to the connections or configuration, loose the screws that fix the small bottom cover.

#### 3.1 Test and alarm configuration modes..

DIP1	ON (1)	Autotest ON
	OFF	Autotest OFF.

DIP2	ON (1)	Siren ON.
	OFF	Siren OFF.

DIP3	ON	After the wind-speed goes above 70 km/h , the ALARM remains activated , even if the speed goes to 0 km/h (The alarm will be deactivated only after the unit supply is switched off for more than 15 seconds).
	OFF (1)	The ALARM is deactivated immediately after the speed goes below 70 km/h.

! The DIP4 configuration is exclusively to be changed by an authorised person. Its proper position is ON. Otherwise, the device indicates a "SENSOR FAILURE"

DIP4	ON (1)	Normal operation.
	OFF	Maintanance operation.

(1) Standard factory settings.

! Before changing the position of the switches, ensure that it complies with the required standard for the installation and that the new alarm method (sound and visual) is understood by the crane operators.



### 3.2 Test modes.

The test allows to check the proper operation of the device.

This device allows two operation modes:

- Switch-on autotest: it is done during a few seconds immediately after supplying the device.
- No switch-on autotest.

The default factory setting is with the switch on Autotest enabled.

### 3.3 Alarms.

The device includes the following alarm modes:

- At 50 km/h only amber light, and at 70 km/h only red light.
- At 50 km/h only amber light, and at 70 km/h red light + siren.

The default factory setting is "at 50 km/h only amber light, and at 70 km/h red light + siren".

### 3.4 Anemometer internal wiring

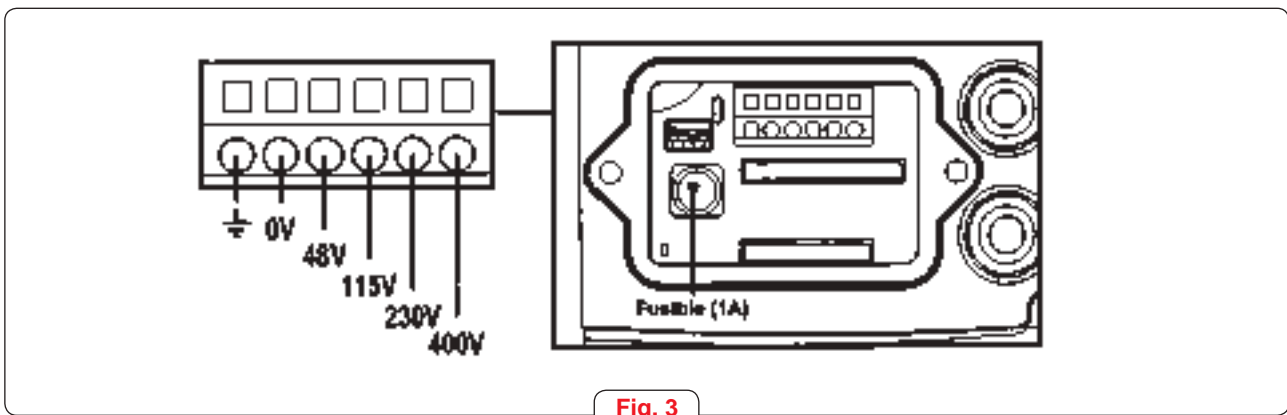


Fig. 3

! The device is prepared for 48 V 50/60 Hz.

Once the wiring is done:

- 1.- Tightly screw the gland to the cable to seal the interior of the unit against liquids or dust.
- 2.- Check the proper closing of the bottom cover to keep IP65 inside.

### 3.5 Sensor failure detection

In case there is any abnormal behaviour signal at the sensor, a cable that has been cut or an improper connection, the system beacons intermittently blink until the problem is solved.

## 4 RS 485 WIND-SPEED OUTPUT

The control and signalling unit (Fig. 4) is equipped with an RS 485 output that allows a fast connection to the indicator system in the cabin. Refer to the crane wiring schematic for more details.

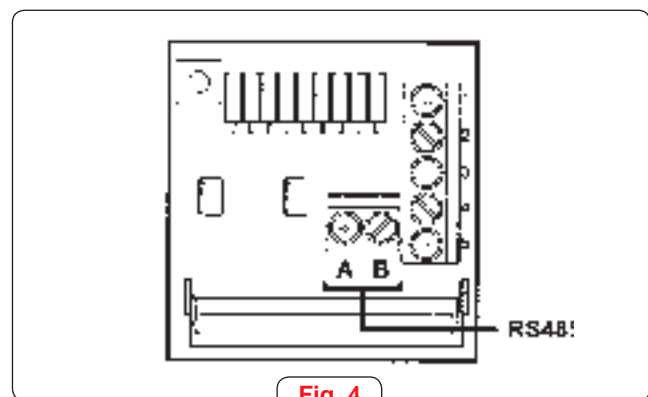


Fig. 4

## 5 HEATING SYSTEM FOR THE WIND-SPEED SENSOR

It is placed within the wind-speed sensor. A heater is switched on whenever the temperature goes below a preset value. This heater melts the frost which would otherwise prevent the sensor rotor motion.

This heater system is supplied from a point which is placed before the general crane contactor G (see wiring schematic). If the general switch of the crane (IG) is ON and the crane bottom switch is ON, the heating system will be operative, regardless the stop control is pressed or not. This allows the system to melt the frost even when the crane controls are switched off.

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IT IS MOST IMPORTANT TO TAKE GOOD CARE OF THE OIL IN AN OIL-HYDRAULIC SYSTEM, AS IT NOT ONLY TRANSMITS POWER BUT ALSO LUBRICATES MOVING PARTS

---

## 0 CONTENTS

- 1 OIL CLEANING
- 2 FILTER CLEANING
- 3 OIL CHANGES
- 4 CHECKING FOR LEAKS
- 5 CLEANING RAM RODS
- 6 TROUBLESHOOTING

## 1 OIL CLEANING

Oil can deteriorate due to the combined action of high running temperatures, air, water and contaminant particles. This can cause the system to run poorly, and may lead to pump cavitation, jerky movements, increased wear, valve failures, etc.

Before assembly, always check the condition of the oil and change it if necessary.

## 2 FILTER CLEANING

To prevent oil from becoming contaminated hydraulic groups have return and air filters, which must be cleaned or replaced as necessary.

The intake filter (item 4 on the hydraulic layout) must always be cleaned before oil is changed and when the noise characteristic of pump cavitation is detected. Clean it as follows:

- a) Remove the screws from the cover of the mini-hydraulic group and thoroughly clean the cover, edges and screws with before fully unscrewing them with compressed air.
- b) Remove the cover, unscrew the filters and remove them from the tank.
- c) Submerge the filters in petroleum, trichloroethylene or a similar solvent. Clean the inside with compressed air. Remove all traces of solvent before re-fitting.
- d) Screw them back into their housings.
- e) Fit the clean cover, changing the seals if necessary, and screw it down.

How often air filters (item 2 on the hydraulic layout) need to be checked will depend on the surrounding environment.

## 3 OIL CHANGES

Before assembly always top up the oil in the tank to the maximum level, using oil of the same characteristics as that used by the manufacturer.

Recommended oil types are listed in the lubrication instructions.

Change oil every 2500 hours or more often if it is seen to be deteriorated or contaminated.

Completely eliminate the old oil.

Ensure that the inside of the system is completely clean before filling it with new oil.

The cleaner a system is, the longer those parts subject to wear will last.

Do not attempt to clean the tank with cotton or similar materials: use white cloths free from dust and fluff, or preferably foam-rubber sponges.

New oil should preferably be added through a portable pump unit with a filter to prevent dirty oil getting in.

NO HYDRAULIC SYSTEM HAS EVER FAILED BECAUSE IT WAS TOO CLEAN.

ALWAYS USE THE SPECIFIED OILS

#### 4 CHECKING FOR LEAKS

Before assembly always check for leaks in the circuit. Leaks may occur after operation for a time, and are usually caused by three things:

- a) loosening of connectors due to pressure points and vibrations;
- b) wear of dynamic seals; and
- c) deterioration of the elastomer due to high oil temperatures or oil contamination.

To stop leaks their cause must be eliminated: tighten connectors, and change seals or elastomers as necessary. The surfaces of the hydraulic circuit should be kept clean to prevent accidents and contamination and to enable leaks to be detected.

Check that hoses are not cut, trapped or deteriorated. Defects of this type affect the properties of the hose and therefore its safety coefficients. If defects are found, change the hose.

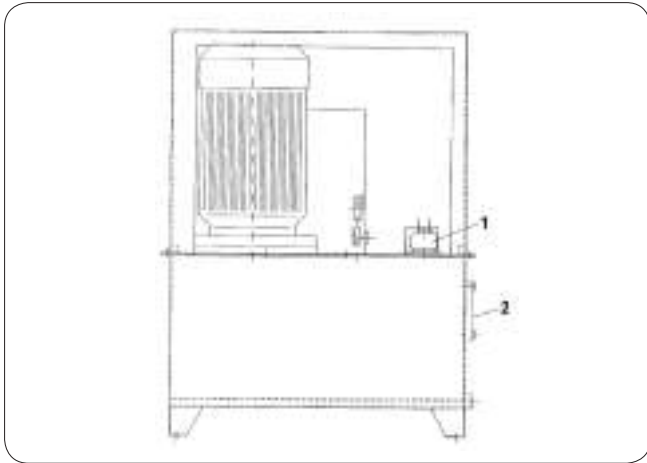
#### 5 CLEANING RAM RODS

Once the machine is erected in its working position, protect the rod from atmospheric agents with a coat of anticorrosion material such as TECTYL 506-EH by VALVOLINE or an equivalent product, especially if the crane is to remain mounted for a long time.

Before dismantling the machine, clean the corrosion protector and any traces of dust, concrete, sand, etc. off the surface of the rod using a scale remover (solvent or degreaser).

#### 6 TROUBLESHOOTING

<i>Problem</i>	<i>Cause</i>	<i>Solution</i>
<i>Excessive noise</i>	Air in circuit Due to low oil level Or dirty intake filter	Re-fill tank Clean filter
<i>Little or no pressure</i>	Oil level low Reversed pump spin Limiting valve out of adjustment Filter dirty Pump malfunction	Re-fill tank Change motor phases Reset Clean filter Change pump



**1-Filter 2-Inspection plug**

LUBRICANTS		
location	type	capacity
Deposit	VESTA HV-32	125 l.

LUBRICANT CHANGES	
initial	maintenance
	every 2500 hours

The tank must be topped up whenever its level drops below the “normal” mark on the level indicator. This is the level required to ensure proper operation of the hydraulic system. Do not top up to above the “normal” mark with the cylinder withdrawn.

**CLEAN OIL**

Oil may become dirty due to a combination of high working temperatures, air, water and contaminant particles. All this leads the system to run poorly, with brusque movements, increased wear, valve failures, etc. Before assembly, check the condition of the oil and change it if necessary. To prevent oil from getting dirty an air filter is fitted. Check this at intervals, depending on the environment.

**OIL CHANGES**



Change the oil at the times indicated or when its viscosity or oxidation levels make this advisable. Ensure that the inside of the system is completely clean before pouring in new oil. The cleaner the system, the longer wear parts will last. Do not try to clean the tank with cotton rags or similar: use white cloth free from dust and frayed threads, or preferably a foam rubber sponge. Add new oil with a portable pump unit fitted with a filter to prevent any dirt getting in at the same time.

**CLEANING CYLINDER RODS**

If the rod is held extended due to the working position of the machine, protect it from atmospheric agents with a coat of anti-corrosive protector (e.g. VALVOLINE TECTYL 508-EH).



If lubricants other than those shown in the table are used, confirm with the manufacturer or supplier that they are suitable for the intended use and meet the minimum requirements for those listed.

EQUIVALENT GREASES							
							
HIDROLEO 32	VESTA HV-32						

<b>0</b>	<b>CONTENS</b>
<b>1</b>	<b>OPERATION INSTRUCTIONS</b>
<b>2</b>	<b>REGULATION OF THE MAXIMUN PRESSURE</b>
<b>3</b>	<b>REGULATION OF THE CYLINDER SPEED</b>

## 1 OPERATION INSTRUCTIONS

Before making operational the hydraulic equipment, check the oil level and condition. Also check the hoses, valves and bends.

## 2 REGULATION OF THE MAXIMUN PRESSURE OF THE EQUIPMENT. (Fig. 1)

The equipment is already adjusted to the correct pressure when it leaves the factory. The pressure is stated on the characteristics plate of the unit.

Should a new regulation be necessary, please proceed as follows:

- 1º- Deregulate the safety valve (11) located in the distributor by loosening the nut (A) and roating the stud (B) in the opposite to clockwise sense.
- 2º- Start the hydraulic equipment and check the pressure gage (10) by opening the key (9).
- 3º- Rotate the stud (B) clockwise to increase the pressure, checking on the pressure gage until the maximunpressure stated on the characteristics plate is good. Then, block the stud position (B) by means of the counternut (A).
- 4º- It is recommended to close the key (9) to protect the pressure gage. Open it only for pressure checkings.

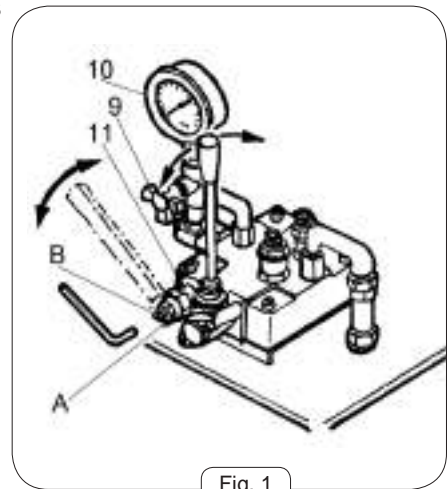


Fig. 1



**IN ORDER TO AVOID BREAKINGS OF THE PARTS OF THE EQUIPMENT, DO NOT EXCEED THE INDICATED PRESSURE.**

## 3 REGULATION OF THE CYLINDER SPEED. (Fig. 2)

La válvula reguladora de caudal (12) está dispuesta en el cilindro (Fig. 2), para regulación de la velocidad de descenso.

The flow regulation is made by means of a flow valve (fig.2) placed in the cylinder to control the descent speed. This regulation is made by loosening the counternut (A) and rotating the valve's body in the clockwise sense, in order to increase the speed. To decrease the speed, proceed on the contrary, i.e. unclockwise. Once the regulation has been made, the valve will be blocked with the counternut (A).

To get the correct speed, please note:

- 1º- If the descent speed of the cylinder is increased too much, the cylinder will go down striking, which will produce oscilations in no way favourable for the structure of the crane.
- 2º- An excessive throttle of the flow increases the pressure, heat excessively the oil may poduce annoying noise.

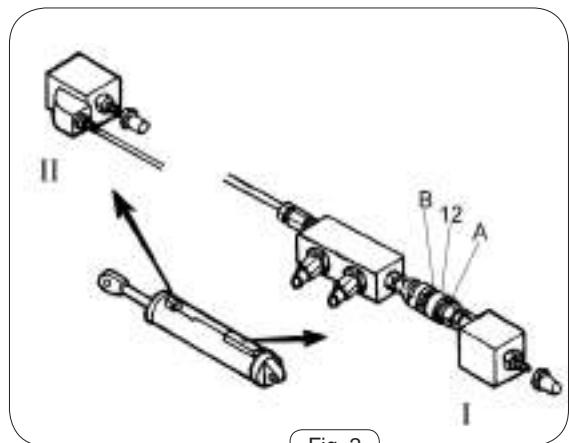


Fig. 2



**THE MANIPULATION OF THE REGULATIONS OF THE HYDRAULIC EQUIPMENT SHALL ALWAYS BE CARRIED OUT BY SKILLED PERSONNEL DULY TRAINED.**

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<b>8</b>	<b>INSPECTION POINTS</b>
<b>9</b>	<b>CRITERIA FOR REPLACEMENT</b>
<b>10</b>	<b>CABLE LIFE</b>
<b>11</b>	<b>VERIFICATION OF AUXILIARY EQUIPMEN</b>

## 1 GENERAL

Nonspinning cables are made up of several layers of strands twisted alternately in one or other direction. By this way, the opposite torsion moments generated when suspending a load from the cable are balanced. Because their construction, wire ropes are very delicate and should be only used if necessary. They must be handled and installed with extreme care to prevent serious problems. Because of this, we recommend to strictly follow the instructions given in UNE standard 58-111-91 **WIRE ROPES FOR HOISTING DEVICES, EXAMINATION CRITERIA AND REPLACEMENT OF ROPES**.

## 2 CABLE HANDLING

### **Forms of supply:**

Cables may be supplied in rolls, X-reels or flanged reels as required by the user.

### **Roll**

The most economic form of supply is in rolls, but cable unwinding is cumbersome and should be only used in case of thin, short cables. (Fig. 1)

### **X-Reel**

It prevents the cable becoming tangled, but their transport is more difficult. (Fig. 1)

### **Flanged reel**

It prevents the cable becoming tangled and handling is very easy. It also prevents the cable touching the floor, thus preventing being fouled. It also protects the cable during loading, unloading and transport operations. (Fig. 1)

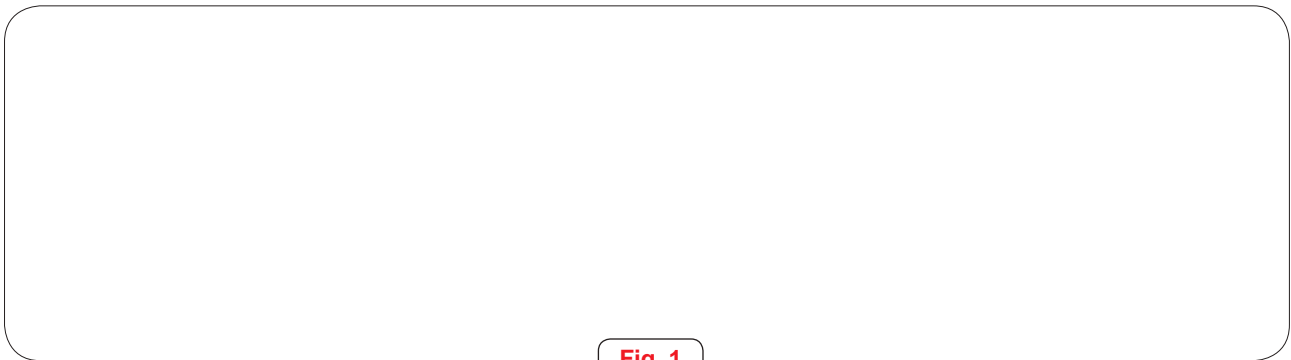


Fig. 1

## 3 STORAGE AND PRESERVATION

The environment of cable warehouse shall be dry, well ventilated and free from corrosive or dusty atmospheres. Do not rest the cables on the floor as otherwise the moisture on the floor could be cause of corrosion. Exposing the cables to direct sunlight or high temperatures should be prevented as otherwise the grease coating could be lost.

If storing the cables in an outdoor location is indispensable, we recommend to use supports in such a way that reel bottom will be at 25 or 30 mm from floor level. Use a suitably cover to protect the external surface of cable windings. We recommend to periodically inspect the cables, for instance every month, for rust signals. If any rusting is observed, apply a sufficient amount of grease to prevent further corrosion.

#### 4 CABLE UNWINDING

We are sure that the users know the procedures for installing and handling the cables and that they also know, from their own experience, that if the required precautions are not taken a premature failure could occur. However, we believe that it would be very useful to recall these precautions, especially because they are often neglected, in spite that they are well known.

The figures below show the correct procedures, as well as the incorrect procedures, to be followed, or avoided, when unwinding a cable. (Fig. 2)

If the procedure is not correct, the initial twisting of the cable proper is modified and its structure significantly altered in some positions.

Sometimes, if unsuitably handled, the cable is subjected to an overtwisting effect which will make it difficult to handle, causing kinks. Another times there is a risk of loosening and opening the strands because the twisting effect of strands is partially lost, impairing also the balance of the cable.

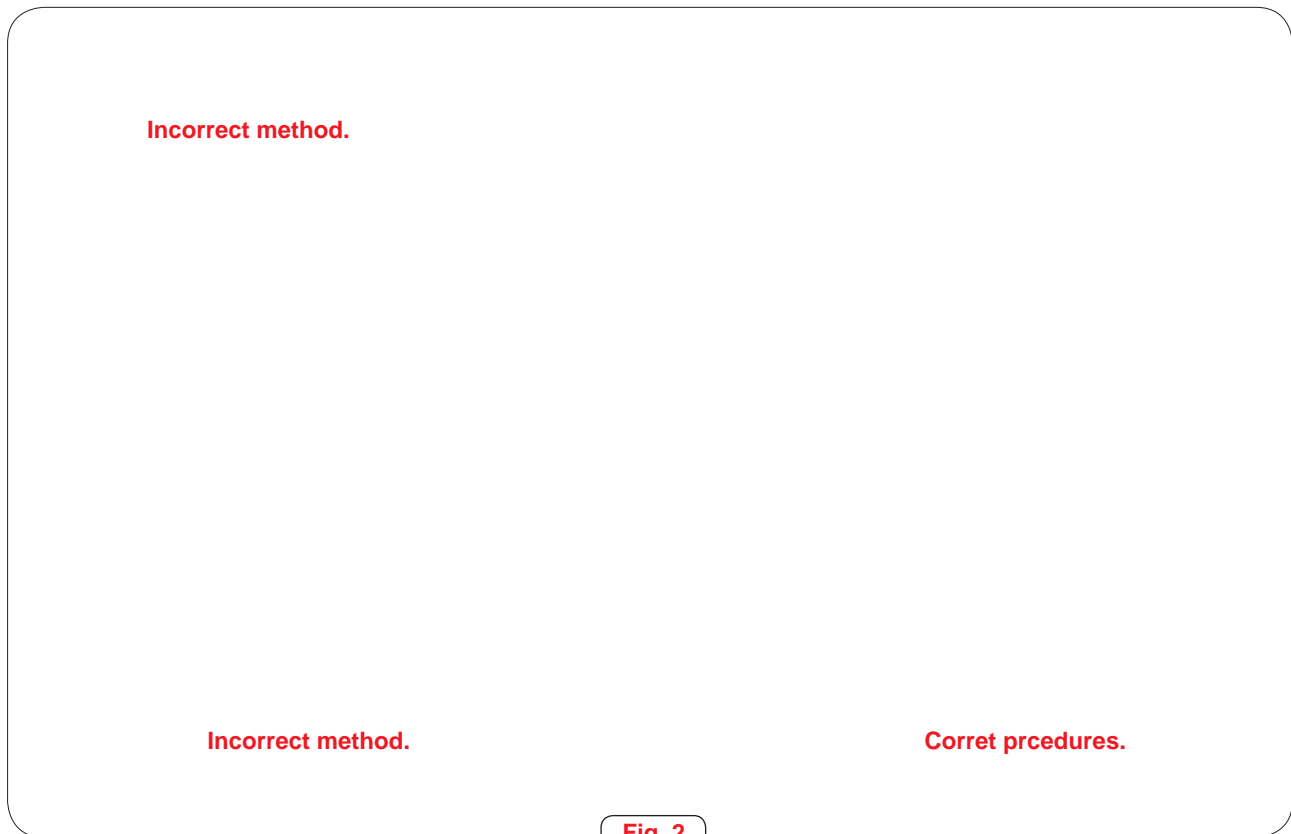


Fig. 2

#### 5 INSTALLATION INSTRUCTIONS

- 1.- When replacing a cable, use a new cable of the type specified by the manufacturer. If other type of cable is used, make sure that the specifications given by the same manufacturer are strictly complied with.
- 2.- Cable ends shall be suitably bound in order to prevent cable strands being untwisted.
- 3.- Before installing a new cable verify that drum and sheave slots are of suitable size.
- 4.- Suitably unwind the cable according to the instructions given below.
- 5.- When being installed, prevent the cable being twisted about its axis, as otherwise the concentric strand layers would become separated, facilitating the formation of kinks and swellings.
- 6.- When installing a cable on a crane, unwind the cable from the reel and at the same time wind it on the crab drum while applying a slight tension on the cable between reel and crab drum. It is of paramount importance that the cable will be unwound and wound in the same direction, that is, that the reel and crab drum will rotate in the same direction.
- 7.- Before putting a cable recently installed into service, make sure that all auxiliary devices are correctly mounted and ready for operation.
- 8.- Perform several operations with a load 10% the nominal load to allow the cable to stabilize.
- 9.- Avoid applying sudden stresses.



## 6 LUBRICATION

The lubrication of a cable is as important as the lubrication of a car engine. The lubricant will reduce wear and will protect the cable against corrosion.

When a load is suspended from a cable, the internal wires move and rub against each other and the external wires are subjected to wear when sliding on sheaves and drums. The lubricant will reduce wear of both internal and external wires.

During the manufacture of a cable, the fiber core, wire and strands are suitably lubricated with an adequate hot lubricant. When a cable is put into service, the pressure of strands against the core makes the lubricant to be forced outward, thus being lost more or less quickly depending on the viscosity and movement of cable.

Because of this, all cables must be periodically lubricated during their working life.

If when a cable is being lubricated, the core does not receive the amount of grease required to compensate the grease lost, the grease applied during the manufacturing process will continue being lost, becoming increasingly dry and finally being decomposed. As a result, the strands will be without support, being excessively pressed against each other, the pitch of strands will become longer and the cable will quickly deteriorate.

The cable should be lubricated during its working life with the same attention and extreme care as during its manufacturing process.

For the lubrication of an installed cable to be efficient, the following points must be observed:

- Previously clean the cable. This cleaning operation may be carried out using either rushes or pressure air. Use a solvent to easily remove old grease residues.
- Thoroughly lubricate the cable. The lubricant should be suitably applied. If the lubricant is simply applied as a external coating on cable surface, without penetrating into the core, the cable would be improperly lubricated.
- Use a suitable lubricant of the following characteristics:
  - a.- High viscosity
  - b.- Resistant to the working environment, neither generating corrosive products nor hardening
  - c.- To remain on the cable for a long time. Lubrication frequency will depend on the working conditions. This frequency may be determined through inspections.

## 7 INSPECTIONS (Excerpt of UNE standard 58-111-91)

### Frequency:

#### *Daily inspections.*

Whenever possible, daily examine all exposed parts of cables in order to verify for signals of deterioration or deformations. Pay special attention to the points in which the cable is fastened to the device. Any sensible change in the cable condition should be identified, followed by an examination by a qualified technician.

#### *Regular Inspections.*

In determining inspection intervals, take the following into account:

- a.- Requirements of law.
- b.- Type of apparatus & conditions of use.
- c.- Group in which the apparatus is classified.
- d.- Results of previous inspections.
- e.- Time of use of cable.

#### *Periodical special.*

In any case, when an incident may be cause of wear of cable and/or fastening points, or in such cases as when a cable is put into service after being reassembled, the cable should be newly inspected.

When a hoisting device has been out of service for a certain time, the cables should be inspected before putting then newly into service.

In any event, inspections must be made by qualified personnel.

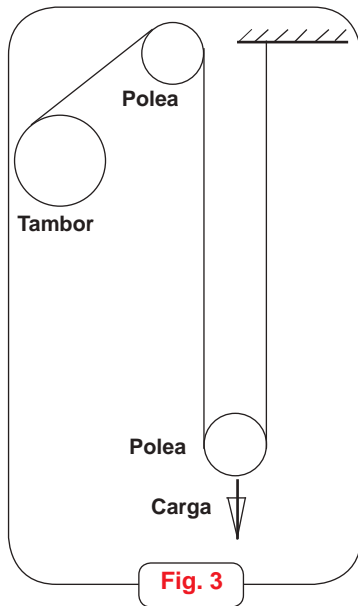
Apart from these inspections, those laid down in national or local regulations applicable to the place of installation of the crane must be carried out, as must those recommended in «Schedule of Inspections & Maintenance» in the chapter on Use of the Crane chapter and "Maintenance Plan" in the chapter on Maintenance.

## 8 INSPECTION POINTS

### General

When a cable is examined on its entire length, the following points should be inspected with special care:

- Fastening points at the ends of both working cables and idle cables.
- Parts of cable wound on sheaves of sheave block and return sheaves. For devices performing operations, parts of cable passing on the sheaves at the point from which the load is suspended. Schematic diagram showing the possible defects to be considered when examining the different parts of a cable



- 1.- Inspect the point at which the cable is fastened to the drum.
- 2.- Verify for any faulty winding causing deformations (cable flattening) or wear, especially at the points in which cable direction changes.
- 3.- Check for broken wires.
- 4.- Check for corrosion signals.
- 5.- Check for deformations caused by intermittent stresses.
- 6.- Examine the part of the cable wound on a sheave to check for broken wires or wear.
- 7.- Verify fastening points
  - check for broken wires or corrosion
  - inspect also the part of the cable incontact to or near compensation sheaves
- 8.- Verify for any deformation
- 9.- Verify cable diameter
- 10.- Carefully inspect the part of the cable wound on the sheave block, especially the point from which the load is suspended.
- 11.- Check for broken wires or surface wear.
- 12.- Check for corrosion.

- Parts of cable passing on compensation sheaves.
- Parts of cable which may be subjected to external abrasion.
- Examination of internal parts for corrosion and fatigue.
- Cable ends, excepting slings. Cables should be examined on those areas in which cable end fastenings are located, as those areas are critical for wire breakage and corrosion. Thimbles on cable ends should be examined for deformation or wear of both the thimble and the cable.
- Cable fastenings using clamping bushes should be examined in a similar manner as for cable thimbles, verifying for bush cracking and sliding.
- Moving unions of cable ends (cable hangers, cable pincers, etc.) should be examined for broken wires, sliding of unions or loose clamping screws. This examination should verify that all requirements of applicable standards and regulations are complied with.
- Cable end unions made by splicing shall be examined to verify for broken wires and sliding of joined strands. For this, let the union exposed by removing any coating or textile tie.
- If broken wires are observed in a cable end, it should be possible to cut the cable in order to newly fastening it. If any sliding or loosen screw is observed, proceed to tighten it. However, the remaining cable length should be sufficient to allow the cable to be properly wound on the drum.

## 9 CRITERIA FOR REPLACEMENT (Excerpt of UNE standard 58-111-91)

The following criteria can be used as a basis to determine the safety degree of a cable in service:

- a) **Nature and number of wire breakages**
- b) **Wires broken on cable ends**
- c) **Nests caused by broken wires**
- d) **Gradual breakage of wires with the time**
- e) **Strand breakage**
- f) **Reduction of cable diameter caused by core breakage**
- g) **Loss of elasticity**
- h) **External or internal wear**
- i) **External or internal corrosion**
- j) **Deformation**
- k) **Deterioration caused by heat or electric effects**
- l) **Permanent elongation increasing rate**

All the above criteria should be separately examined. However, the juxtaposition of certain alterations on certain areas may be cause of a cumulative effect which should be kept in mind when deciding whether a cable is to be replaced.

In any case, it should be determined whether the defects are caused by a faulty device and if so, to repair the faulty device before installing a new cable.

### a) Nature and number of wire breakages

The design of hoisting devices does not permit an indefinite use of cables. Thus, when establishing the criteria for replacing nonspinning cables, the components, service length and way in which the cable is used should be considered. The number of visible broken wires which determine the immediate replacement of a wire is given in the table below for guidance only (Table 1).

Special attention should be paid to any surface dry or having the lubricant altered.

<b>Tabla - 1 -</b>			
Number of visible broken wires on nonspinning cables working on steel sheaves			
Classification groups of mechanisms M1, M2, M3 and M4		Classification groups of mechanisms M5, M6, M7 and M8	
On a length 1) of		On a length 1) of	
6d	30d	6d	30d
2	4	4	8

1) d = cable diameter.

**NOTE: If a cable is totally or in part working on synthetic sheaves or metallic sheaves with synthetic slots, breakage of internal wires with no visible breakage or wear of external wires could occur.**

### b) Wires broken on cable ends

A number, even small, of wires broken in or near a cable end indicates that high stresses are applied on the cable, perhaps caused by an incorrect assembly of cable end. You should determine the exact cause of this deterioration and, if possible, carefully rebuild the cable end, making sure that the remaining length after cutting the cable is sufficient for subsequent use.

**c) Nests caused by broken wires**

When broken wires are near each other, breakage nests are formed requiring to replace the cable. If a breakage nest is limited to a cable length below  $6d$  or is concentrated in a single strand, replacing the cable may be necessary even if the number of broken wires is below the number given on Table 1.

**d) Gradual breakage of wires with the time**

If the main cause of a deterioration is cable fatigue, breakage of wires only begins after a certain operation time, the rate of wire breakage increasing from this moment.

In this case it will be necessary to closely control the increase of wire breakages as a function of time. An "increase law" for wire breakage may be determined and, to a certain extent, the date at which the cable should be replaced.

**e) Strand breakage**

If a strand is broken, the cable must be replaced.

**f) Reduction of cable diameter caused by core deterioration**

Cable diameter reduction because of core deterioration may be caused by:

- f.1.- internal wear and notches
- f.2.- internal wear resulting from friction between individual strands and cable wires, in particular when subjected to bending.
- f.3.- deterioration of textile fiber core
- f.4.- breakage of wire core
- f.5.- breakage of internal layers on multi-strand cables.

If because any of the above causes, cable diameter (mean value of two orthogonal measurements) is reduced with respect to nominal diameter by 3% for nonspinning cables or 10% for other cables, the cable must be removed even if there is no visible broken wire.

A small deterioration may not be detected through a normal examination, in particular if the stresses are evenly distributed across the strands. However, this may be cause of a significant loss of strength, which should be determined by means of external examination procedures. If this deterioration is confirmed, the cable must be removed.

NOTE: The actual diameter of a new cable may be greater than nominal diameter. In this case, the allowable wear under the same conditions will be also greater.

**g) Loss of elasticity**

In some cases, related to the work site, cable elasticity may be significantly reduced, involving a serious risk when subjected to high stresses.

Loss of elasticity is very difficult to detect. In case of doubt, contact a specialized technician. This fault shows in most case the following symptoms:

- g.1.- reduction of cable diameter
- g.2.- cable elongation
- g.3.- lack of clearance between individual wires and between strands, caused by compression between components.
- g.4.- appearance of brownish dust between strands
- g.5.- if wire breakage is not visible, cable handling may be sensibly more difficult and diameter reduction will be higher than when caused by wear of individual wires.

This cable condition may lead to a sudden breakage when subjected to dynamic loads and must be replaced.

### **h) External wear**

Wear of filler wires of external strands of a cable is caused by friction of cable against sheave and drum slots. This effect is especially evident at the contact points of moving cables with sheaves during acceleration and slowdown periods, and results in a variation of thickness of external wires.

Wear is promoted by an insufficient or improper lubrication as well as by the presence of dust. When, as a result of wear, the external diameter of cable is reduced by 7% or more with respect to nominal diameter, the cable must be removed even if there is no visible broken wire.

### **i) External and internal corrosion**

Corrosion will mainly occur in marine atmospheres and highly polluted industrial atmospheres, and may be cause of not only a reduction of static strength because a reduction of metal cross-section of cable but also of an acceleration of cable fatigue because surface irregularities which are cause of cracks when subjected to high stresses. A severe corrosion may lead to a reduction of cable elasticity.

#### **i.1.- External corrosion.**

Corrosion of external wires can be visually verified.

#### **i.2.- Internal corrosion.**

Internal corrosion is more difficult to detect than external corrosion, the latter appearing often together with the first one, though the following effects may be observed:

- 1.- Changes in cable diameter: a reduction of cable diameter occurs normally on the cable portion wound on sheaves. However, on stationary cables, it not unusual to observe an increase of diameter because of the rust deposited under the external layers of cable wires.
- 2.- Lack of clearance between strands in external cable thimbles, often appearing together with wire breakage.

If you suspect of internal corrosion, the cable may be subjected to internal examination, performed by a qualified technician.

If internal corrosion is confirmed, the cable must immediately removed.

### **j) Deformation**

The apparent alteration of a cable structure is called deformation.

The different types of deformation are in general identified by a loosening of cable structure, at least in the vicinity of deformed parts, resulting in a uneven distribution of stresses.

The deformations are classified as follows according to its appearance:

- |      |  |
|------|--|
| j.1  | curl-shaped deformation                    |
| j.2  | basket-shaped deformation                  |
| j.3  | strand extrusion                           |
| j.4  | wire extrusion                             |
| j.5  | local increase of cable diameter           |
| j.6  | local decrease of cable diameter           |
| j.7  | flattening                                 |
| j.8  | kinks                                      |
| j.9  | elbows                                     |
| j.10 | damages caused by heat or electric effects |

#### **j.1 Curl-shaped deformation (refer to Fig. 4, Fig 5)**

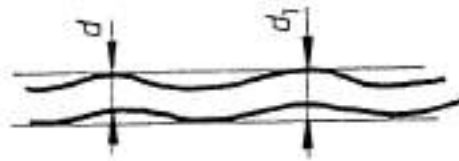
Cable axis takes the shape of a helix. Even if this deformation does not result in a weakening of cable, it can be cause of irregular movements when operated, in such a way that, after a long operation period, wear and wire breakage can result.

If a curl-shaped deformation is detected, the cable should be removed whenever:

$d_1 > \frac{4d}{3}$	where d is the nominal cable diameter and d1 the diameter of deformed cable evolvent when not subjected to stresses, and provided the length of cable considered does not exceed 25d.
----------------------	---

**Fig. 4 - Curl-shaped deformation: cable longitudinal axis takes the shape of a helix.  
If the deformation exceeds the value given in a, the cable should be removed**

**Fig. 5 - Curl-shaped deformation**



**Fig. 6 - Basket-shaped deformation of a cable with several strand layers,  
Cable should be immediately removed.**

**Fig. 7- Breakage or extrusion of wire core commonly resulting from a  
basket-shaped deformation occurred in an adjacent area.  
Cable should be immediately removed.**

**j.2 Basket-shaped deformation (Refer to Fig. 6)**

This deformation occurs in cables with a wire core when the external layer of wires is dislocated or when external strands are longer than internal strands. This condition may result in a sudden load on a loose cable.

When a basket-shaped deformation is detected, the cable should be immediately removed.

**j.3 Strand extrusion (Refer to Fig. 7)**

This type of deformation is often related to a basket-shaped deformation when the unbalance of cable results in an extrusion of core.

If a strand extrusion is observed, the cable should be immediately removed.

**j.4 Wire extrusion (Refer to Fig. 8 and 9)**

In this case, some wires or groups of wires come off from the side opposite to the sheave slot, forming loops, often as a result of an impact.

If the deformation observed is serious, the cable should be removed.

Fig. 8- A single strand is affected by the extrusion of wires, even though the examination of a greater length of cable shows that the defect is repeated in a regular way on the same strand at distances of one pitch.



Fig. 9- Worsening of the above defect by one degree will require the cable to be removed

Fig. 10- Local increase of diameter of a cable with a filler layer, caused by the extrusion of a multi-strand wire core as a result of impacts.  
Cable should be immediately removed.

Fig. 11- Local increase of cable diameter caused by a knottiness of textile fibre core whose fibers are spread among the strands  
Cable should be removed.

Fig. 12- Local decrease of cable diameter, external strands tending to occupy core position.  
Note that broken wires are present. Cable should be immediately removed.

*j.5 Local increase of cable diameter (Refer to Fig. 10 and 11)*

A local increase of cable diameter may occur, affecting a cable length relatively significant. This will lead to a distortion of core (in certain environments a rusting of cable core may be observed) causing a unbalance of external strands, becoming improperly orientated.

If a significant increase of cable diameter is observed, the cable should be rejected.

*j.6 Local decrease of cable diameter (Refer to Fig. 12)*

A local reduction of cable diameter is commonly related to a core breakage. The areas near cable ends should be carefully examined.



Fig. 13-Flattening caused by a mechanical action. Cable should be removed.

Fig. 14- Flattening caused by a mechanical action applied on a certain length of a cable with several strand layers. Note the flattening and elongation of pitch of external strands as well as their loosening. Cable should be removed.

Fig. 15- Very serious kink. Note the expansion of textile fibre core. Cable should be immediately removed.

Fig. 16- Cable put into service in spite of having a kink and which are now subjected to local wear as well as to typical deformation.



Fig. 17- Very distinct elbow. Cable should be removed.

*j.7 Flattening (Refer to Fig. 13 and 14)*

Flattening is caused by a mechanical damage of cable and if serious the cable should be immediately removed.

*j.8 Kinks (Refer to Fig. 15 and 16)*

Kinks are cable deformations caused when a cable is pulled in straight direction forming a loop and without having sufficient freedom to compensate the deformation through a rotation about its axis.

*j.9 Elbows (Refer to Fig. 17)*

Elbows are angular deformations caused by external violent causes. Cables with elbows should be immediately removed.



*j.10 Damages caused by heat or electric effects*

Cables we have been subjected to high temperatures, visually detected by burning marks, should be removed.

**10 CABLE LIFE**

After the user has acquired sufficient practical experience, an estimation can be made about the life expectancy of a cable. However, these estimations should be only used for stock management purposes and in no case affect the frequency of inspections or be used to extend the life of a cable beyond specifications.

**11 VERIFICATION OF AUXILIARY EQUIPMENT**

Periodically verify drums and sheaves to make sure that all components properly rotate on their bearings. Sheaves which rotate improperly or are blocked are subjected to uneven, high wear resulting in wear of cable wires by friction. Compensation pulleys blocked are cause of uneven loads on cable branches. Slot bottom radius shall be compatible with cable nominal diameter. If the radius is too great or too small, the slot should be machined or the sheave replaced.

FAILURE TO COMPLY WITH THESE STANDARDS COULD BE CAUSE OF DAMAGES OR PERSONAL INJURES

## GENERAL

Screws, nuts and washers used for HV unions should comply with COMANSA standard NP11-01-03.

High strength screws with controlled tightening torque should be tightened using a torque wrench. The tightening torque required is given in the section for assembling.

Torque wrenches should be periodically checked for proper operation.

Tightening torques should be within  $\pm 10\%$  the value given in table (1).

Strength class according ISO 898 part 1 and 2 must be stamped on screw head, nut and washer as shown in fig. 1, 2 and 3.

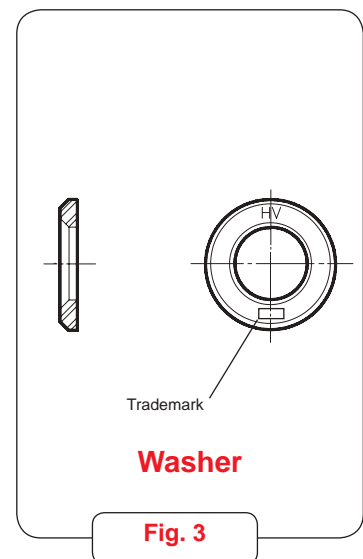
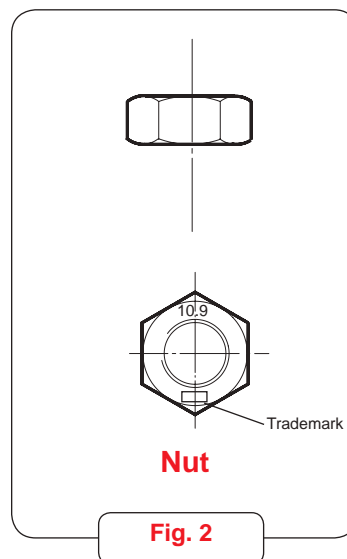
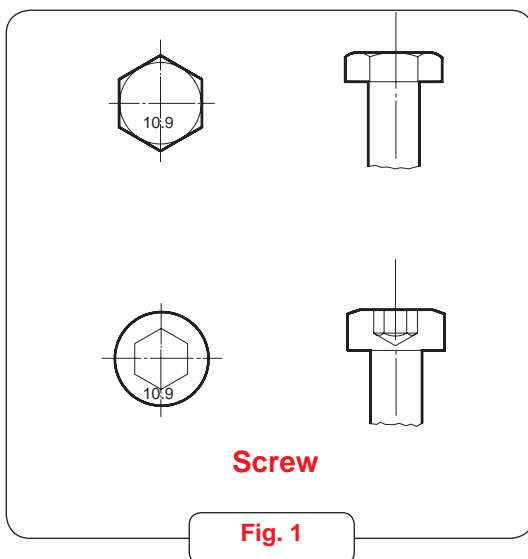
Strength class of screws, nuts and washers will be specified for each crane. Strength classes shown in the figures are only for illustration purposes.

Seating surfaces and screw holes must be free from dirt, paint and other foreign particles.

HV washers should be located with the bevels outward, facing screw head or nut.



For the screws in the slewing ring, see specific section for the slewing ring.



**Checking unions which use high strength screws with controlled tightening torque:**

1.- Check unions every time the crane is disassembled or before assembling it again, but never later than 1 year after last check-out.

Screws tightened according to a controlled tightening torque and then dismantled may be reused in subsequent assemblies provided that both screw head and thread are not damaged and free from rust. DIN 6914 screws and related DIN 6915 nuts have a width across flats greater than DIN 931 screws and related DIN 934 nuts (Refer to table II).

When selecting the nuts, verify that nut strength is the same as screw strength.

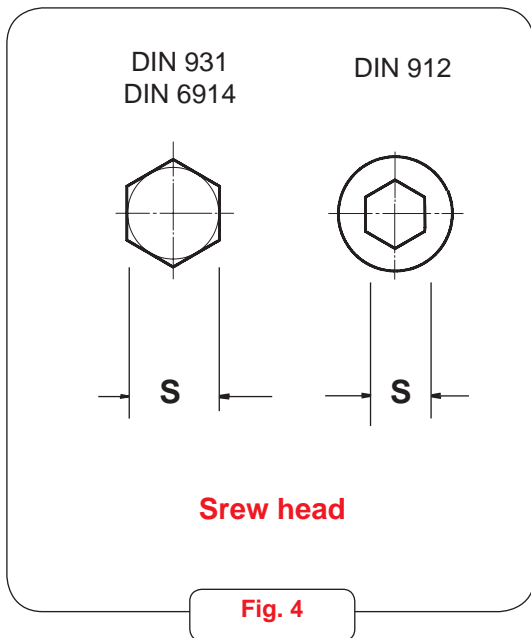
For instance: A nut 8 will require a screw 8.8  
 A nut 10 will require a screw 10.9  
 A nut 12 will require a screw 12.9

Washers used on unions with HV screws should be high strength washers of the same material as screws and nuts used.

**Avoid using:**

Screws with rusty shank or thread as well as nuts with rusty thread and screws or nuts damaged or with damage signals.

If a broken or elongated (loosened) screw is observed in a union, replace all screws in that union.



Nominal Thard Diameter	DIN931 screw DIN934 nut	DIN6914 screw DIN6915 nut	DIN912 screw (6 internal flats)
mm	mm	mm	mm
M 12	19	22	10
M 14	22	-	12
M 16	24	27	14
M 18	27	-	14
M 20	30	32	17
M 22	32	36	17
M 24	36	41	19
M 27	41	46	19
M 30	46	50	22
M 33	50	-	24
M 36	55	60	27
M 39	60	-	-
M 42	65	-	32
M 45	70	-	-
M 48	75	-	36
M 56	85	-	

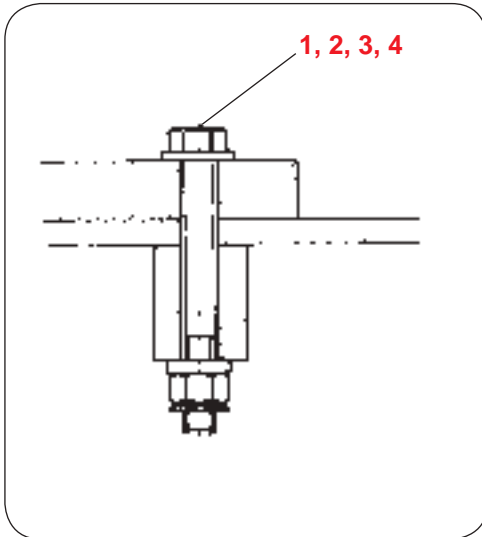
**These checking and tightening operations can be done more easily with the crane disassembled.**

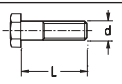
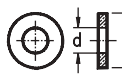


Yield point L.E. (N/mm <sup>2</sup> )		640	940	1100
Bolt quality		8.8	10.9	12.9
		8G	10K	12K
Bolt size	Tightening force $F_A[N] = 0,7 \times L.E. \times S$			
	Tightening torque $M_a [N] = (0,16 \times M \times F_a) \times 0,9/1000$			
M-6 S = 20,1 mm <sup>2</sup>	Fa Ma	9005 8	13225 11	15480 13
M-8 S = 36,6 mm <sup>2</sup>	Fa Ma	16400 19	24085 28	28180 32
M-10 S = 58,0 mm <sup>2</sup>	Fa Ma	25985 37	38165 55	44660 64
M-12 S = 84,3 mm <sup>2</sup>	Fa Ma	37765 65	55470 96	64910 110
M-14 S = 115,0 mm <sup>2</sup>	Fa Ma	51520 105	75670 155	88550 180
M-16 S = 157,0 mm <sup>2</sup>	Fa Ma	70335 160	103305 240	120890 280
M-18 S = 193,0 mm <sup>2</sup>	Fa Ma	86464 225	126995 330	148610 385
M-20 S = 245,0 mm <sup>2</sup>	Fa Ma	109760 315	161210 465	188650 545
M-22 S = 303,0 mm <sup>2</sup>	Fa Ma	135745 430	199375 630	233310 740

- The figures on the above chart are only applicable to the fixing elements which comply with NP11-01-03 COMANSA standard.
- The torque ratings are obtained by means of torque wrench and must be accurate to  $\pm 10\%$ .
- The torque ratings are intended for fixing elements free from lubricant, dust, dirt, paint or other foreign bodies. In case of any other conditions, different to the indicated, the torque should be adjusted to these new conditions.
- The torque of the unions HV are shown on the erection sheets.
- See document "HIGH STRENGTH UNION ELEMENTS (HV)".

Cross bases consist of a cross-beam plug two arms which fold out to form a cross, secured by pinned, vertical panels.

Different anchor feet are bolted the cross-base for each type of mast section



Description	Nº	Dimension	Grade	Norm	Q
	1	M:33 L:260	10.9	3215P1063	16
	2	D:60 d:34	HV	D6916	16
	3	D:60 d:34 L:110		3301P191.01	16
	4	M:33	10	D934	16

**ASSEMBLY TORQUE (M)**

(NIC\9603-01)

Bolt 1 ..... 2170 Nm

**CHECKING TORQUE (C)**

Bolt 1 ..... 1950 Nm

- (M) The given torque corresponds to the specified type of bolt, DACROMET type 320A surface protection, WITHOUT GREASE, and is applied to bearing surfaces and holes free from grease, dirt, paint and other foreign objects. For any other condition than that described above, the torque should be adjusted accordingly.
- (C) The Checking torque applied during inspections and maintenance, to detect if any bolts have lost their torque to below the permitted tolerance, should be 10% less than that applied during the initial installation of the ring, so as to avoid overtightening the bolts as a result of different conditions from those existing at the time of initial installation.

**Procedure for checking torque of cross-base anchor feet bolts on erected crane:**

A. Visual Inspection:

- A.1 Observe carefully the visual aspect of the bolts and nuts, insofar as to establish that they are all in place and have no appreciable defects (noticeable loosening, damaged nuts or bolts, rust stains,...)
- A.2 Check that the seating of the anchor feet on the cross-base is correct and that no play or movement is apparent. This can be best controlled by slewing the crane, without load, and observing the seating on the side of the ring facing the jib.

**! N.B. A visual inspection carried out in a professional manner can detect important defects more effectively than a spot checking of the torque.**

B.- Mechanical Inspection:

If the visual inspection was satisfactory, then check mechanically as follows:

- B.1 Suspend the corresponding jib-end load from the hook and trolley out to the jib end.
- B.2 Slew jib and bring to stop over one of the four corners as shown.
- B.3 Check the torque as per (C) above of the bolts on the Jib side.
- B.4 Remove load from hook and trolley in to minimum radius.
- B.5 Check the torque of remaining bolts on the counter-jib side.

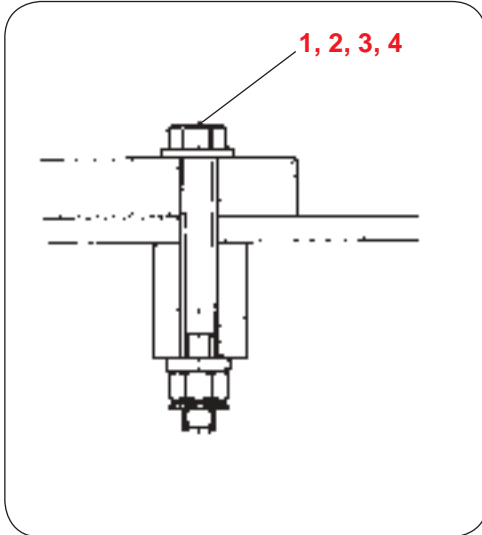


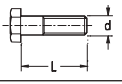
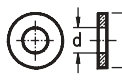


**! With the crane dismantled, on the ground, checking of slewing ring bolt torque can be carried out much more simply and evenly, in sequence.**

Cross bases consist of a cross-beam plug two arms which fold out to form a cross, secured by pinned, vertical panels.

Different anchor feet are bolted the cross-base for each type of mast section

Mast section 1,2 m	Mast section 1,6 m		Mast section 2,0 m	
PMH13	PMS3	PMS4	PMS4	PMS5



Description	Nº	Dimension	Grade	Norm	Q
	1	M:33 L:260	10.9	3215P1063	16
	2	D:60 d:34	HV	D6916	16
	3	D:60 d:34 L:110		3301P191.01	16
	4	M:33	10	D934	16

**ASSEMBLY TORQUE (M)**

(NIC\9603-01)

Bolt 1 ..... 2170 Nm

**CHECKING TORQUE (C)**

Bolt 1 ..... 1950 Nm

- (M) The given torque corresponds to the specified type of bolt, DACROMET type 320A surface protection, WITHOUT GREASE, and is applied to bearing surfaces and holes free from grease, dirt, paint and other foreign objects. For any other condition than that described above, the torque should be adjusted accordingly.
- (C) The Checking torque applied during inspections and maintenance, to detect if any bolts have lost their torque to below the permitted tolerance, should be 10% less than that applied during the initial installation of the ring, so as to avoid overtightening the bolts as a result of different conditions from those existing at the time of initial installation.

**Procedure for checking torque of cross-base anchor feet bolts on erected crane:**


A. Visual Inspection:

- A.1 Observe carefully the visual aspect of the bolts and nuts, insofar as to establish that they are all in place and have no appreciable defects (noticeable loosening, damaged nuts or bolts, rust stains,...)
- A.2 Check that the seating of the anchor feet on the cross-base is correct and that no play or movement is apparent. This can be best controlled by slewing the crane, without load, and observing the seating on the side of the ring facing the jib.

**! N.B. A visual inspection carried out in a professional manner can detect important defects more effectively than a spot checking of the torque.**

B.- Mechanical Inspection:

If the visual inspection was satisfactory, then check mechanically as follows:

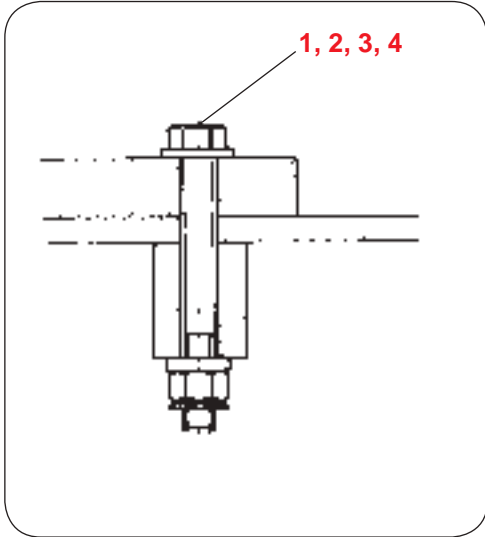
- 
- B.1 Suspend the corresponding jib-end load from the hook and trolley out to the jib end.
- B.2 Slew jib and bring to stop over one of the four corners as shown.
- B.3 Check the torque as per (C) above of the bolts on the Jib side.
- B.4 Remove load from hook and trolley in to minimum radius.
- B.5 Check the torque of remaining bolts on the counter-jib side.

**! With the crane dismantled, on the ground, checking of slewing ring bolt torque can be carried out much more simply and evenly, in sequence.**

Cross bases consist of a cross-beam plug two arms which fold out to form a cross, secured by pinned, vertical panels.

Different anchor feet are bolted the cross-base for each type of mast section

Mast section 1,6 m	Mast section 2,0 m		Mast section 2,5 m
PMS5-1	PMS5-1	PMD3-2	PMD3-2



Description	Nº	Dimension	Grade	Norm	Q
1	1	M:36 L:280	10.9	D931	24
2	2	D:66 d:37	HV	D6916	24
3	3	D:65 d:37 L:140		3301P191.01	24
4	4	M:36	10	D934	24

**ASSEMBLY TORQUE (M)**

(NIC\9603-01)

Bolt 1 .....2790 Nm

**CHECKING TORQUE (C)**

Bolt 1 .....2510 Nm

- (M) The given torque corresponds to the specified type of bolt, DACROMET type 320A surface protection, WITHOUT GREASE, and is applied to bearing surfaces and holes free from grease, dirt, paint and other foreign objects. For any other condition than that described above, the torque should be adjusted accordingly.
- (C) The Checking torque applied during inspections and maintenance, to detect if any bolts have lost their torque to below the permitted tolerance, should be 10% less than that applied during the initial installation of the ring, so as to avoid overtightening the bolts as a result of different conditions from those existing at the time of initial installation.

**Procedure for checking torque of cross-base anchor feet bolts on erected crane:**

A. Visual Inspection:

- A.1 Observe carefully the visual aspect of the bolts and nuts, insofar as to establish that they are all in place and have no appreciable defects (noticeable loosening, damaged nuts or bolts, rust stains,...)
- A.2 Check that the seating of the anchor feet on the cross-base is correct and that no play or movement is apparent. This can be best controlled by slewing the crane, without load, and observing the seating on the side of the ring facing the jib.

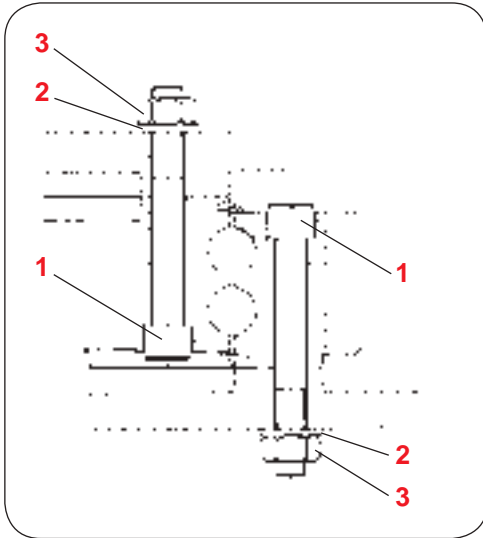
**! N.B. A visual inspection carried out in a professional manner can detect important defects more effectively than a spot checking of the torque.**


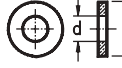

B.- Mechanical Inspection:

If the visual inspection was satisfactory, then check mechanically as follows:

- 
- B.1 Suspend the corresponding jib-end load from the hook and trolley out to the jib end.
  - B.2 Slew jib and bring to stop over one of the four corners as shown.
  - B.3 Check the torque as per (C) above of the bolts on the Jib side.
  - B.4 Remove load from hook and trolley in to minimum radius.
  - B.5 Check the torque of remaining bolts on the counter-jib side.

**! With the crane dismantled, on the ground, checking of slewing ring bolt torque can be carried out much more simply and evenly, in sequence.**



Description	Nº	Dimension	Grade	Norm	Q
	1	M:20 L:160	10.9	D912	126
	2	D:37 d:21	HV	D6916	126
	3	M:20	10	D934	126

**ASSEMBLY TORQUE (M)**

(NIC\9603-01)

Bolt 1 ..... 465 Nm

**CHECKING TORQUE (C)**

Bolt 1 ..... 419 Nm

- (M) The given torque corresponds to the specified type of bolt, DELTATONE surface protection, WITHOUT GREASE, and is applied to bearing surfaces and holes free from grease, dirt, paint and other foreign objects. For any other condition than that described above, the torque should be adjusted accordingly.
- (C) The Checking torque applied during inspections and maintenance, to detect if any bolts have lost their torque to below the permitted tolerance, should be 10% less than that applied during the initial installation of the ring, so as to avoid overtightening the bolts as a result of different conditions from those existing at the time of initial installation.

**Procedure for checking torque of slewing ring bolts on erected crane:**

**A Visual Inspection:**

- A.1 Observe carefully the visual aspect of the bolts and nuts, insofar as to establish that they are all in place and have no appreciable defects (noticeable loosening, damaged nuts or bolts, rust stains,...)
- A.2 Check that the seating of the slewing ring on the turntable is correct and that no play or movement is apparent. This can be best controlled by slewing the crane, without load, and observing the seating on the side of the ring facing the jib.

**A visual inspection carried out in a professional manner can detect important defects more effectively than a spot checking of the torque.**

**B Mechanical Inspection:**

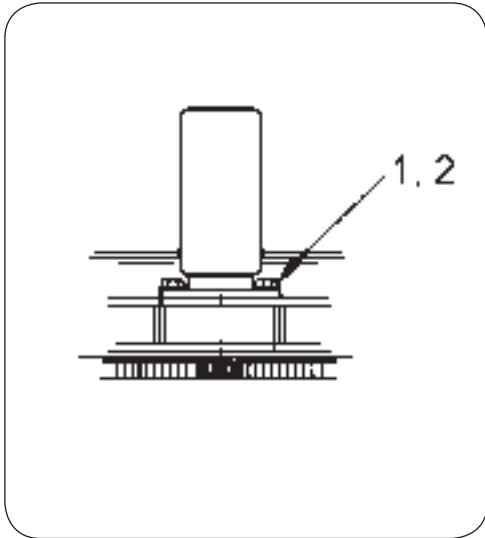
If the visual inspection was satisfactory, then check mechanically as follows:


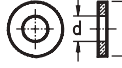
- B.1 Suspend load from the hook and trolley out to the corresponding safe load radius.
- B.2 Lock (brakes applied) slewing in a determined position.
- B.3 Check the torque (as per (C) above) of the bolts on the Jib side of the ring (half the bolts).
- B.4 Remove load from hook and trolley in to minimum radius.
- B.5 Check the torque of remaining half of the bolts on the counter-jib side of the ring.

**With the crane dismantled, on the ground, checking of slewing ring bolt torque can be carried out much more simply and evenly, in sequence.**



**TIGHTNESS OF SCREWS ON SLEWING MECHANISM**



Description	Nº	Dimension	Grade	Norm	Q
	1	M:14 L:50	8.8	D931	12
	2	D:28 d:15	HV	D6916	12

<b>ASSEMBLY TORQUE (M)</b>
(NIC\9603-01)
Bolt 1 ..... 105 Nm

<b>CHECKING TORQUE (C)</b>
Bolt 1 ..... 94,5 Nm

- (M) The given torque corresponds to the specified type of bolt, with superficial zinc protection, deoxydised, gloss bichromate brilliant A3L, in accordance with DIN 267 section 9, WITHOUT GREASE, and is applied to bearing surfaces and holes free from grease, dirt, paint and other foreign objects. For any other condition than that descrubed above, the torque should be adjusted accordingly.
- (C) The Checking torque applied during inspections and maintenance, to detect if any bolts have lost their torque to below the permitted tolerance, should be 10% less than that applied during the initial installation of the ring, so as to avoid overtightening the bolts as a result of different conditions from those existng at the time of initial installation.

**1.- Procedure for checking tightness of slewing mechanism fixing screws.**

A.- Visual Inspection:

- A.1 Observe carefully the visual aspect of the bolts and nuts, insofar as to establish that they are all in place and have no appreciable defects (noticeable loosening, damaged nuts or bolts, rust stains,...)
- A.2 Check that the seating of the slewing ring on the turntable is correct and that no play or movement is apparent. This can be best controlled by slewing the crane, without load, and observing the seating on the side of the ring facing the jib.

**! N.B. A visual inspection carried out in a professional manner can detect important defects more efectively than a spot checking of the torque.**

B.- Mechanical Inspection:

If no problems are revealed by a visual inspection, carry out the checking operations on the screws.

**2.- Changing the slewing mechanism**

To change the mechanism proceed as follows:

2.1: Dismounting

- Use the threaded extractor bolt holes in the clamping ring of the mechanism.  
Tighten the pressure screws successively until the mechanism is released.



**NEVER SUSPEND THE MECHANISM AND PULL WITHOUT RELEASING IT FIRST**

2.2: Mounting

- Contact surfaces must be completely free from oil and grease. Use degreasers to clean them.
- Tighten the slewing mechanism fixing screws.





# MANUFACTURER'S MANUAL

## 7 SPARE PARTS



**INDEX**

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Title.....	Ref.	Rev.	Pag.
Frontispiece.....	000 0001 IB	A	1
Table of contents .....	000 0043 IB	A	3
Instructions when ordering spare parts .....	010 0010 IB	A	5
General assembly.....	020 0045 ES	A	7



CRANE MODEL <b>COMANSA</b> .....	<b>11LC</b>
CRANE SERIAL NUMBER .....	(            )
DEPARTURE DATE .....	(            )

If you look at the drawing of any assembly, you will note that each part has a number which, as per the list attached to the drawing, provides the necessary data to place an order.

Example:

In order to find the hook sheave, or pulley, the followings steps must be followed:

- 1º- In the GENERAL ASSEMBLY page you can find out that the HOOK is marked with the reference 030 0562
- 2º In the HOOK ASSEMBLY page you can see that the sheave is given number 2. Its corresponding reference is CPOL3215P949.
- 3º Purchase Order.

PURCHASE ORDER	
CRANE MODEL	11 LC ---
CRANE SERIAL NUMBER	(a)
ASSEMBLY	030 0562
DESCRIPTION	SHEAVE
REFERENCE	CPOL3215P949
QUANTITY	(b)

- (a) Indicate the serial number of your crane.
- (b) Indicate the required quantity.

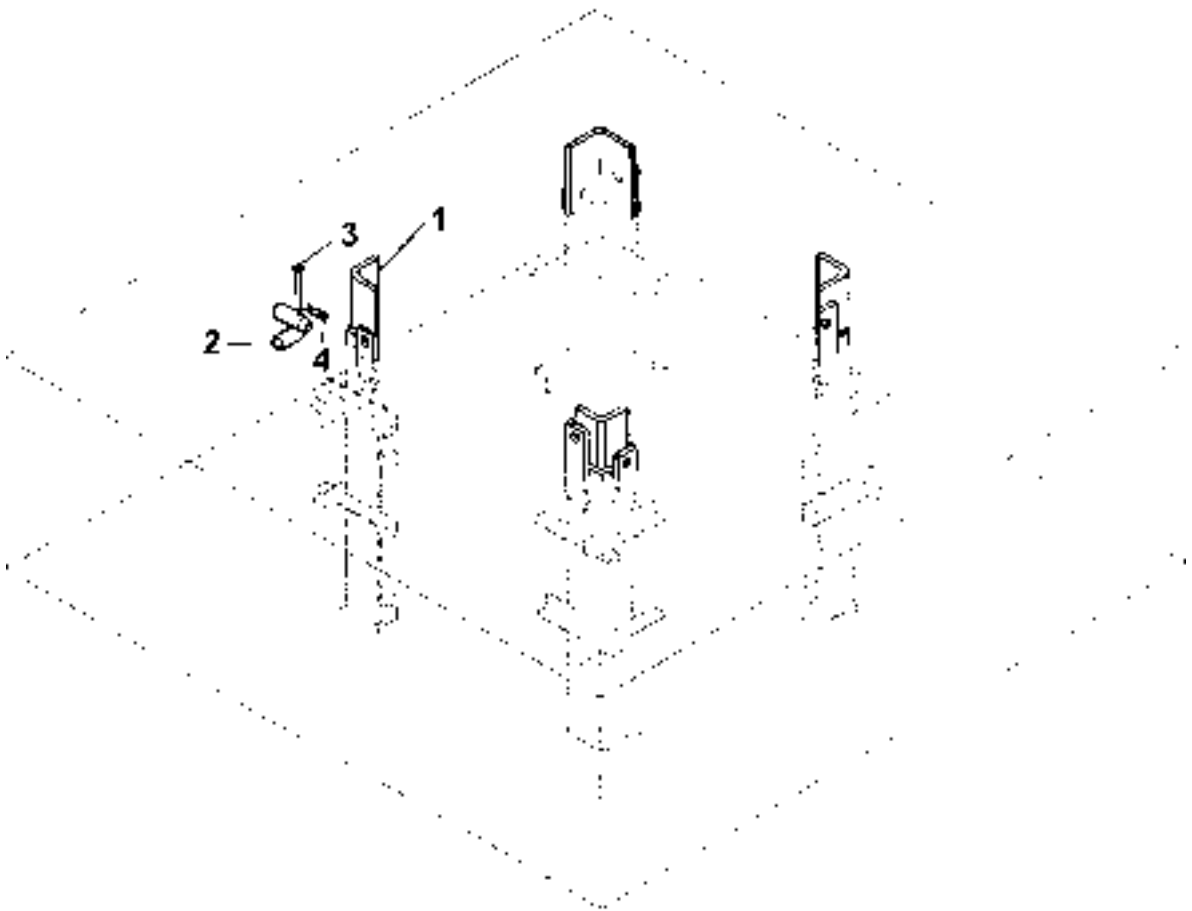






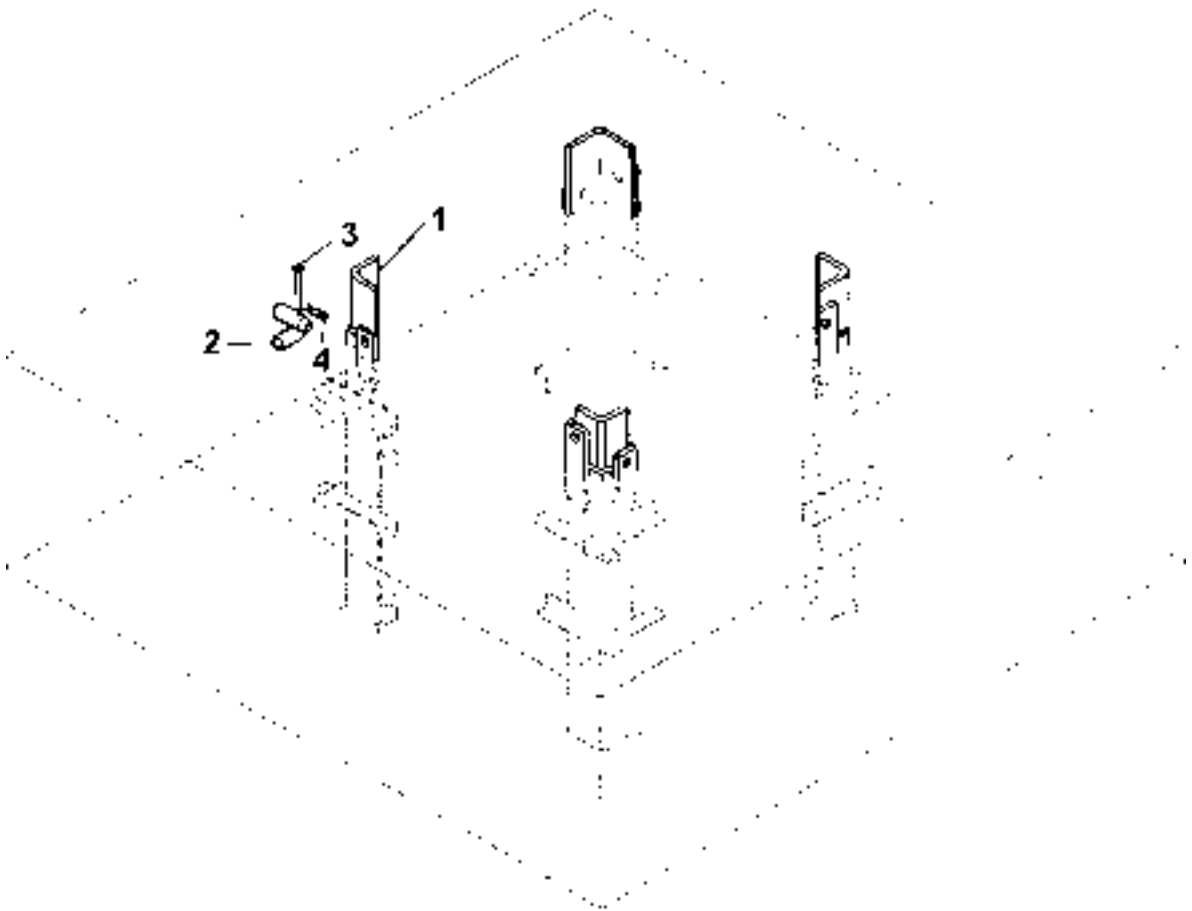
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Nº	REFERENCIA	DESIGNACIÓN	DESIGNATION	DESIGNATION	BENENNUNG	P. / S.
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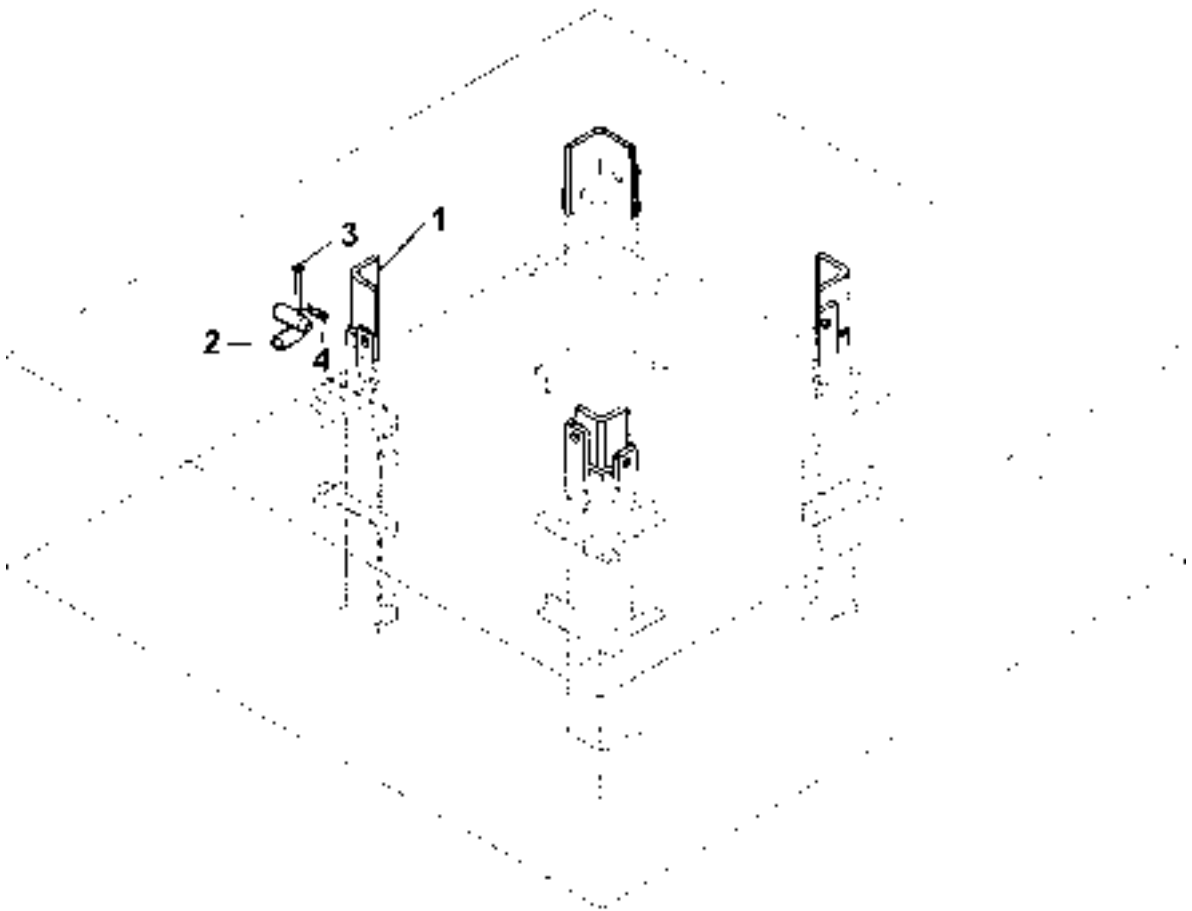


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<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3214M337	PIE	PIED	FOOT	FUSS	4
2	10550185E.25	BULON	AXE	PIN	BOLZEN	8
3	20160120.25	BULON	AXE	PIN	BOLZEN	4
4	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4



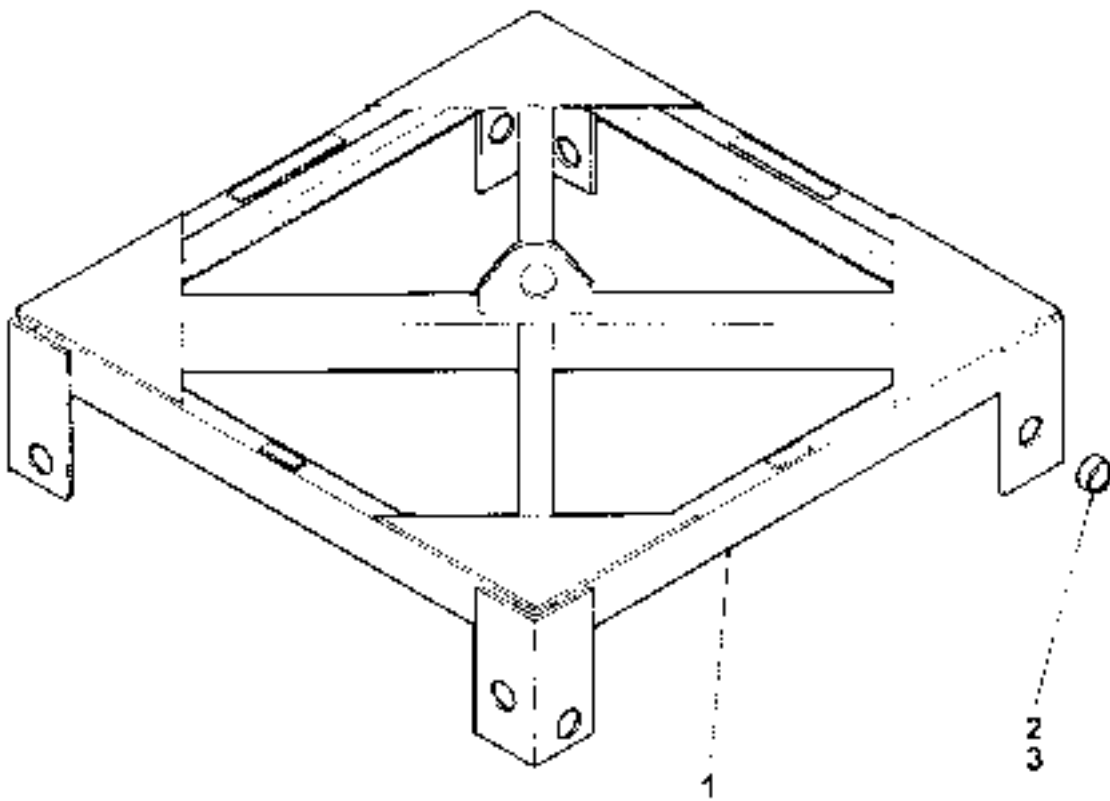
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1	3214M190	PIE	PIED	FOOT	FUSS	4
2	10600185E.25	BULON	AXE	PIN	BOLZEN	8
3	20160160.25	BULON	AXE	PIN	BOLZEN	4
4	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4



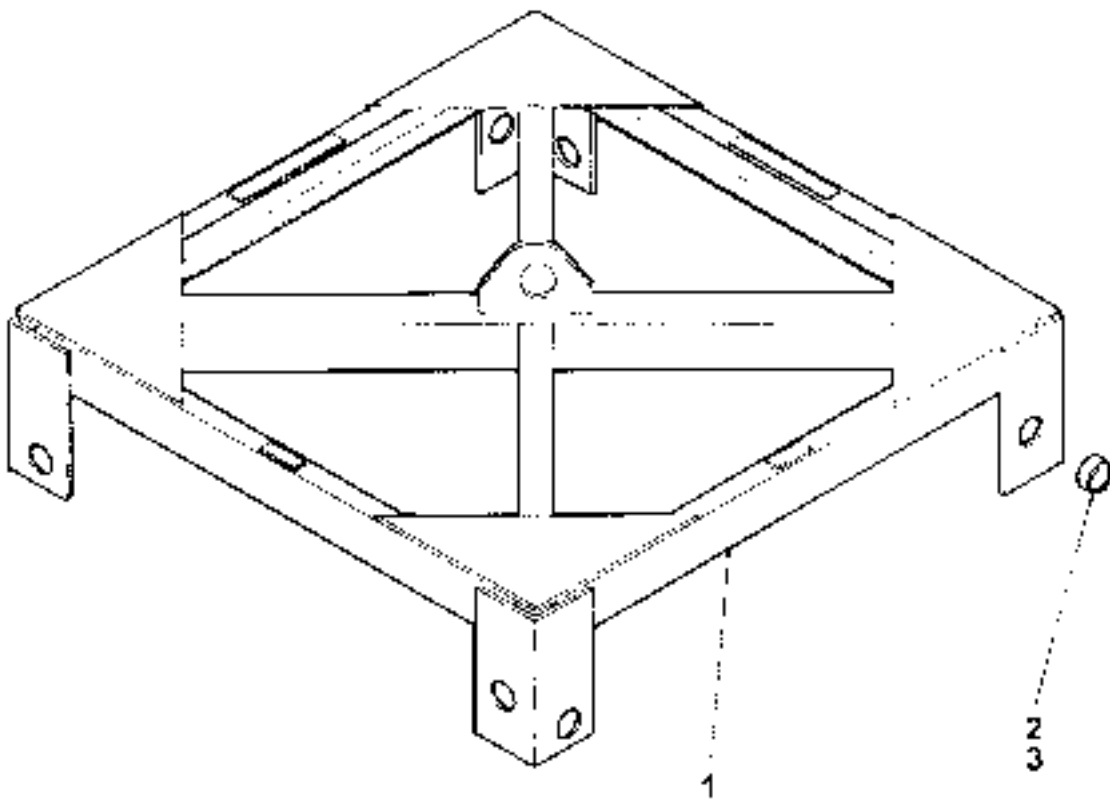
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<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3214M330	PIE	PIED	FOOT	FUSS	4
2	10600185E.25	BULON	AXE	PIN	BOLZEN	8
3	20160160.25	BULON	AXE	PIN	BOLZEN	4
4	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4

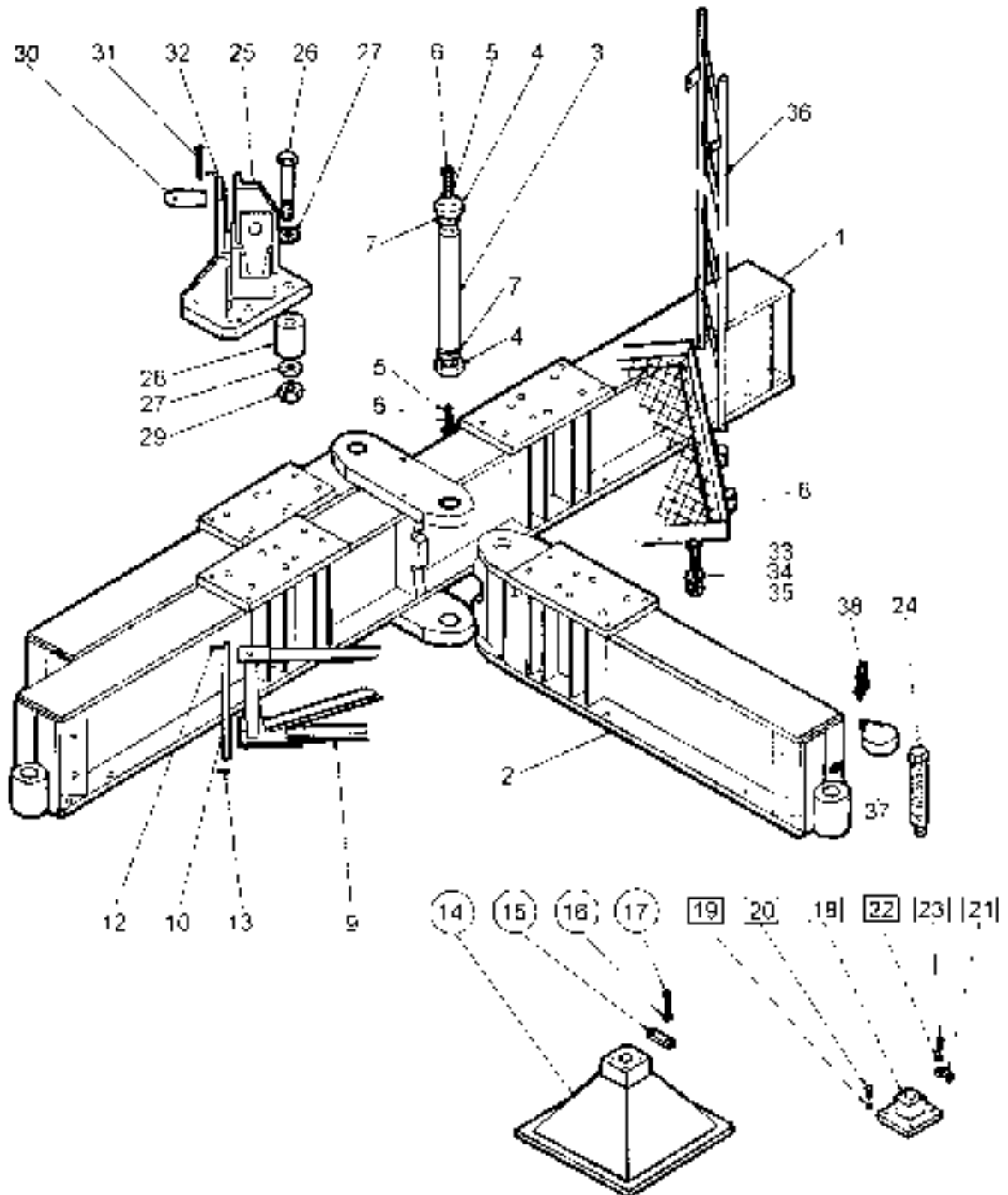




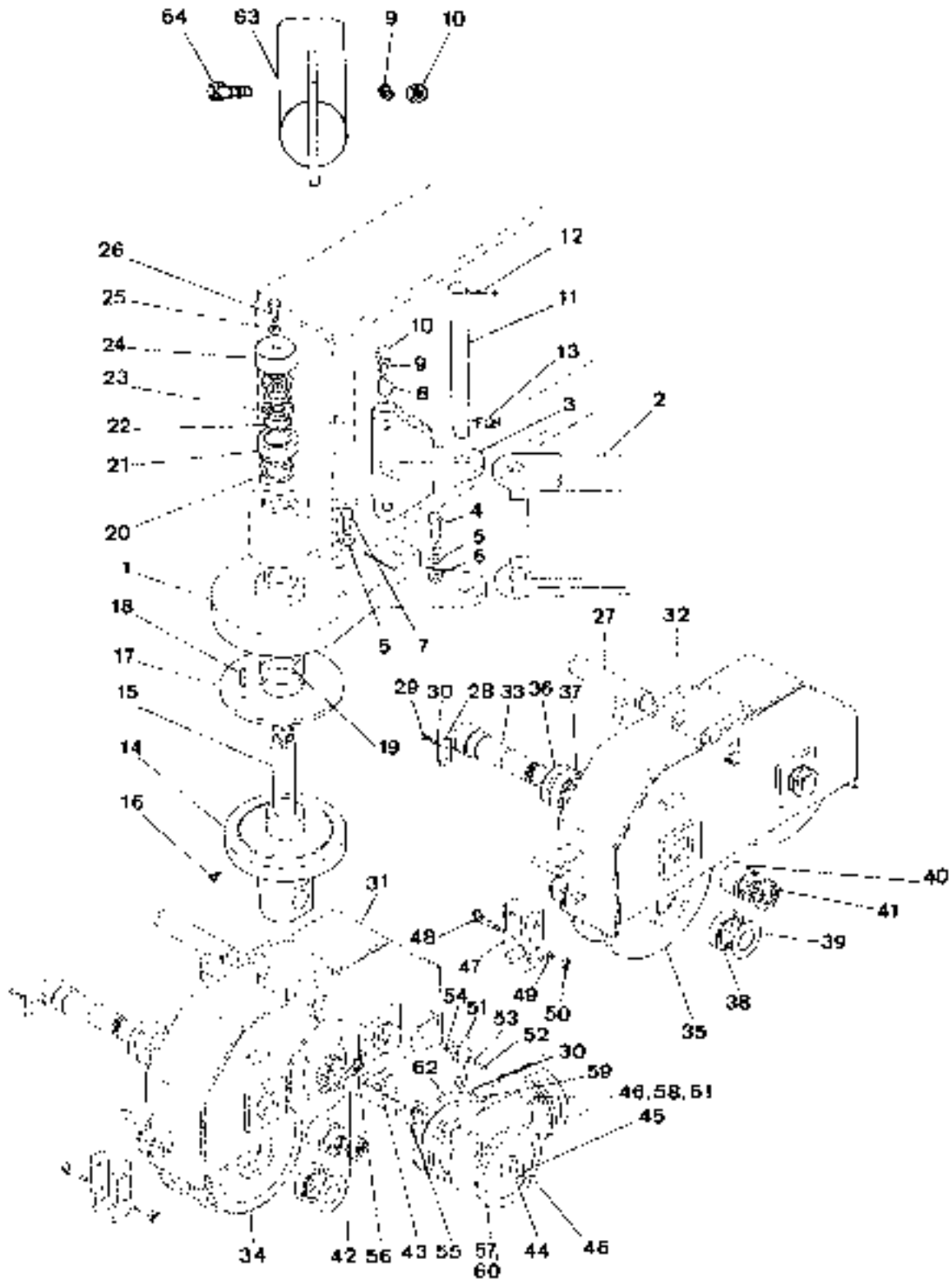
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1	3214K329-A	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	3214K329-2	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	8



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3214K329-A	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	3214K329-2	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	8



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	3201M1536	LARGUERO	LONGERON	STRINGER	LAENGSTRAEGER	1
2	3201M1538	BRAZO	BRAS	ARM	HALTEARM	2
3	3215P1047	BULON	AXE	PIN	BOLZEN	2
4	OL10006	BRIDA	BRIDE	FLANGE	FLANSCH	4
5	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
6	093120250050088	TORNILLO	VIS	BOLT	SCHRAUBE	8
7	GLY.PG10010550F	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
8	3201M1826	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
9	3201M1533	DIAGONAL	DIAGONALE	DIAGONAL	DIAGONALE	4
10	10250690.14	BULON	AXE	PIN	BOLZEN	8
12	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
13	PSR5	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
14	3201P443	APOYO	APPUI	SUPPORT	AUFLAGE	4
15	1408P146	CHAVETA	CLAVETTE	KEY	PASSFEDER	8
16	ARP15F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
17	093314200030088	TORNILLO	VIS	BOLT	SCHRAUBE	16
18	3201M1460	APOYO	APPUI	SUPPORT	AUFLAGE	4
19	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
20	093316200040088	TORNILLO	VIS	BOLT	SCHRAUBE	16
21	OL110.1149.00	BRIDA	BRIDE	FLANGE	FLANSCH	8
22	ARP15F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
23	093314200030088	TORNILLO	VIS	BOLT	SCHRAUBE	16
24	3215P1046	HUSILLO	VIS	SPINDLE	SPINDEL	4
25	3201M1516	PIE	PIED	FOOT	FUSS	4
26	3215P1063	TORNILLO	VIS	BOLT	SCHRAUBE	16
27	ARP34D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	32
28	3215P1072	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	16
29	09343335010	TUERCA	ECROU	NUT	MUTTER	16
30	10550185E.25	BULON	AXE	PIN	BOLZEN	8
31	20160120.25	BULON	AXE	PIN	BOLZEN	4
32	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
33	093116200070088	TORNILLO	VIS	BOLT	SCHRAUBE	4
34	ARP17F111D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
35	0934162008	TUERCA	ECROU	NUT	MUTTER	4
36	3201P1674	ESCALERA	ECELLE	LADDER	LEITER	1
37	3215P1156	TAPA	COUVERCLE	COVER	DECKEL	4
38	PSI4*25*85	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4

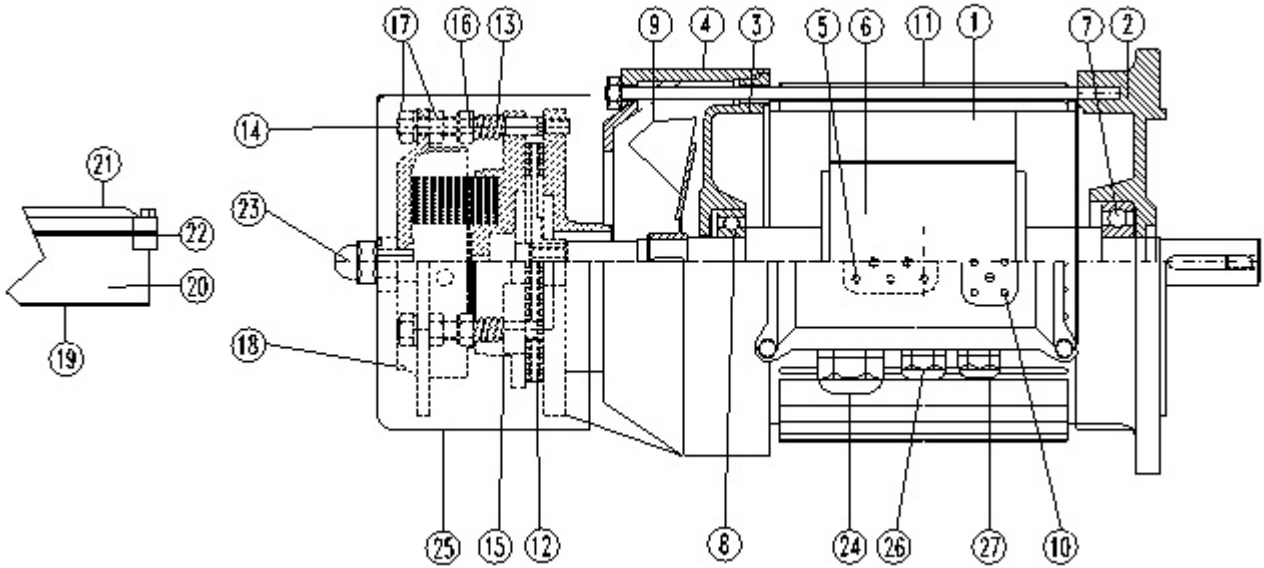


Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1408H8453	PLACA	PLAQUE	PLATE	SCHILD	4
2	1408M8459	TRAVIESA	TRAVERSE	CROSSTIE	TRAVERSE	2
3	1408P8456	PLACA	PLAQUE	PLATE	SCHILD	4
4	093120250130088	TORNILLO	VIS	BOLT	SCHRAUBE	8
5	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
6	0934202508	TUERCA	ECROU	NUT	MUTTER	8
7	093120250060088	TORNILLO	VIS	BOLT	SCHRAUBE	8
8	1408P3644	TORNILLO	VIS	BOLT	SCHRAUBE	8
9	ARP23D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
10	0934222508	TUERCA	ECROU	NUT	MUTTER	16
11	10450410.25	BULON	AXE	PIN	BOLZEN	4
12	PSA8*90	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
13	PSI5*40*105	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
14	1408M8462	TACO	CALE	BLOCK	HOLZBLOCK	4
15	1408P8461	VASTAGO	TIGE DE CYLINDRE	RAM-ROD	KOLBENSTANGE	4
16	ECM10*100D71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	4
17	1408P8465	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
18	PSE10*20	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
19	GLY.PG10511050F	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	4
20	JT95.74*5.33	JUNTA	JOINT	GASKET	DICHTUNG	4
21	1408P8463	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	4
22	ARMB10	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
23	TUKM10	TUERCA	ECROU	NUT	MUTTER	8
24	1408P8464	TAPA	COUVERCLE	COVER	DECKEL	4
25	JT12.81*1.78	JUNTA	JOINT	GASKET	DICHTUNG	4
26	093310150025088	TORNILLO	VIS	BOLT	SCHRAUBE	4
27	1408P1391	BULON	AXE	PIN	BOLZEN	4
28	1408P146	CHAVETA	CLAVETTE	KEY	PASSFEDER	12
29	093314200030088	TORNILLO	VIS	BOLT	SCHRAUBE	24
30	ARG14D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	32
31	1408K8055	PORTARUEDAS	BOGGIE	BOGIE	RADKASTEN	2
32	1408K8056	PORTARUEDAS	BOGGIE	BOGIE	RADKASTEN	2
33	1408P873	EJE	AXE	AXLE	ACHSE	8
34	1408P884	RUEDA	ROUE	WHEEL	RAD	4
35	1408P886	RUEDA	ROUE	WHEEL	RAD	4
36	1408P875	GUARDA-POLVO	CACHE POUSSIERE	DUST GUARD	STAUBMANTEL	8
37	ROD33216A	RODAMIENTO	ROULEMENT	BEARING	LAGER	8
38	ROD32212A	RODAMIENTO	ROULEMENT	BEARING	LAGER	8
39	1408P878	GUARDA-POLVO	CACHE POUSSIERE	DUST GUARD	STAUBMANTEL	8
40	1408P874	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	8
41	TUKM16	TUERCA	ECROU	NUT	MUTTER	16
42	1408M8091	EJE	AXE	AXLE	ACHSE	2
43	CHVP12*8*140A	CHAVETA	CLAVETTE	KEY	PASSFEDER	2
44	1408P7499	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
45	796712175	TUERCA	ECROU	NUT	MUTTER	2
46	093312175035088	TORNILLO	VIS	BOLT	SCHRAUBE	10
47	3212P013	MORDAZA	MACHOIRE	CLAMP	KLEMMBACKE	8
48	3212P067	TORNILLO	VIS	BOLT	SCHRAUBE	4
49	ARP25F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
50	0934243008	TUERCA	ECROU	NUT	MUTTER	4
51	LMMC.0001	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	2
52	093305080050088	TORNILLO	VIS	BOLT	SCHRAUBE	4
53	ARG5D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
54	0934050808	TUERCA	ECROU	NUT	MUTTER	4
55	ROD6210.2RS	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
56	AEE50	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
57	REDBI.MA54	REDUCTOR	REDUCTEUR	GEAR-BOX	GETRIEBE	2

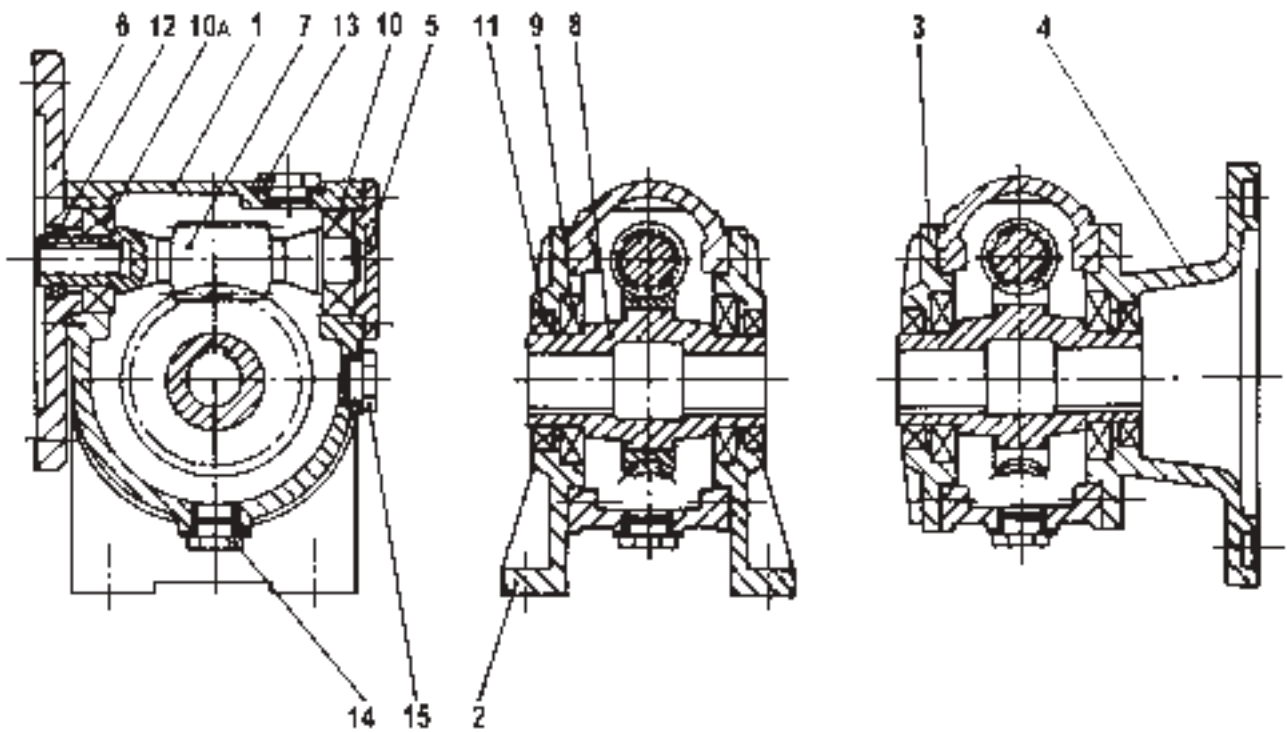


<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
58	ARG12D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
59	093314200060088	TORNILLO	VIS	BOLT	SCHRAUBE	8
60	MTRCF1334-1	MOTOR	MOTEUR	MOTOR	MOTOR	2
61	0934121758	TUERCA	ECROU	NUT	MUTTER	8
62	1408P8092	BRIDA	BRIDE	FLANGE	FLANSCH	2
63	3201M1510	DIAGONAL	DIAGONALE	DIAGONAL	DIAGONALE	2
64	1408P1807-A	TORNILLO	VIS	BOLT	SCHRAUBE	8

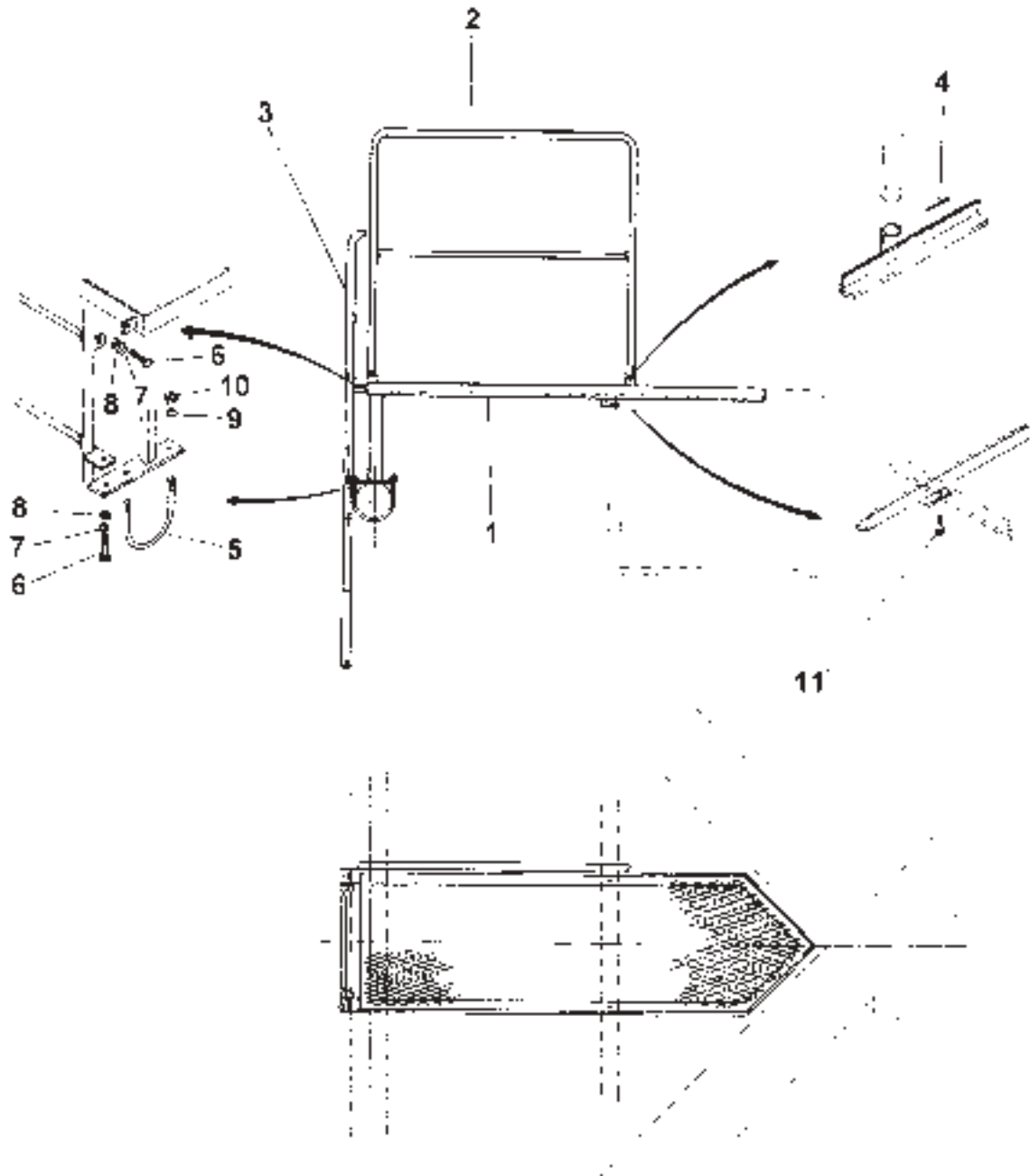




Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		CARCASA	CARCASSE	CASING	GEHAEUSE	1
2		BRIDA DELANTERA	FLASQUE AVANT	DRIVE-ENDSHIELD	A-LAGERSCHILD	1
3		BRIDA FRENO	FLASQUE FREIN	BRAKE-ENDSHIELD	BEMSE-LAGERSCHILD	1
4		TAPA FRENO	CAPOT FREIN	BRAKE COVER	BREMSGEHAUSE	1
5		CAJA DE BORNES	BOITE A BORNES	TERMINAL BOX FRAME	KLEMMENKASTEN	1
6		ROTOR	ROTOR	ROTOR	ROTOR	1
7		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
8		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
9		VENTILADOR	VENTILATEUR	FAN	LUFTER	1
10		CAJA DE BORNES	BOITE A BORNES	TERMINAL BOX FRAME	KLEMMENKASTEN	1
11		VARILLA	TIGE	ROD	STANGE	4
12		DISCO FRENO	DISQUE FREIN	BRAKE DISC	BREMSSCHEIBE	1
13		MUELLE FRENO	GUIDE	GUIDE	FUEHRUNG	3
14		COLUMNA FRENO	COLONNE DE FREIN	BRAKE COLUMN	FUHRUNGSSAULE BREMSE	3
15		ELECTROIMAN MOVIL	ARMATURE	ARMATURE	BREMSANKER	1
16		TUERCA	ECROU	NUT	MUTTER	3
17		TUERCA	ECROU	NUT	MUTTER	6
18		BOBINA FRENO	ELECTRO-AIMANT	BRAKE COIL	BREMSPULE	1
19		JUNTA	JOINT	GASKET	DICHTUNG	1
20		CAJA DE BORNES	BOITE A BORNES	TERMINAL BOX FRAME	KLEMMENKASTEN	1
21		TAPA	COUVERCLE	COVER	DECKEL	1
22		JUNTA	JOINT	GASKET	DICHTUNG	1
23		TUERCA	ECROU	NUT	MUTTER	1
24		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	1
25		TAPA FRENO	CAPOT FREIN	BRAKE COVER	BREMSGEHAUSE	1
26		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	1
27		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	1

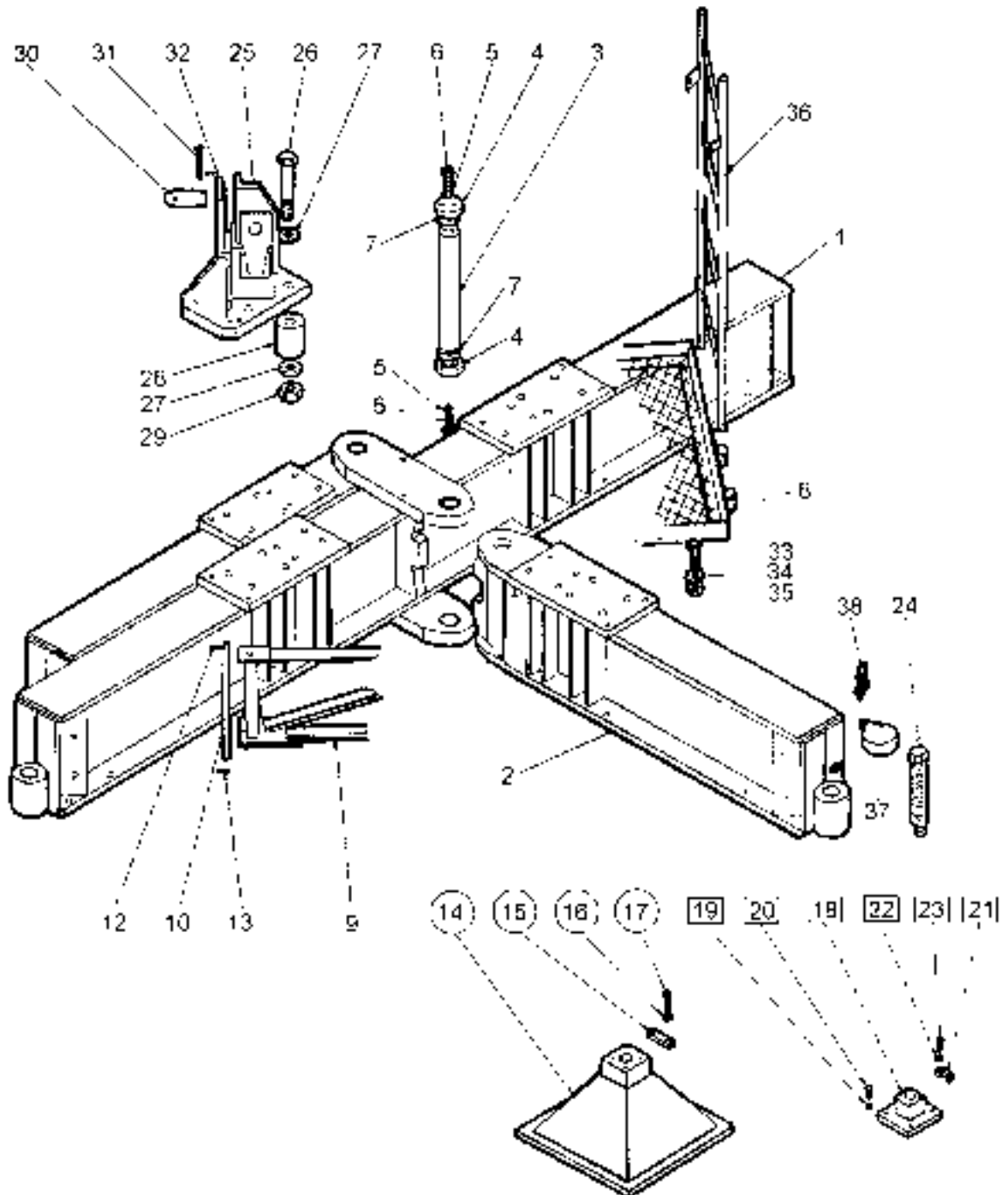


<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1		CARCASA	CARCASSE	CASING	GEHAEUSE	1
2		TAPA	COUVERCLE	COVER	DECKEL	2
3		TAPA	COUVERCLE	COVER	DECKEL	1
4		BRIDA	BRIDE	FLANGE	FLANSCH	1
5		TAPA	COUVERCLE	COVER	DECKEL	1
6		BRIDA	BRIDE	FLANGE	DECKEL	1
7		SINFIN	VIS SANS FIN	WORM-GEAR	GETRIEBESCHNECKE	1
8		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
9		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
10		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
10A		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
11		RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
12		RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
13		TAPON	BOUCHON	PLUG	STOEPSSEL	1
14		TAPON	BOUCHON	PLUG	STOEPSSEL	1
15		NIVEL	NIVEAU	LEVEL	NIVEAU	1

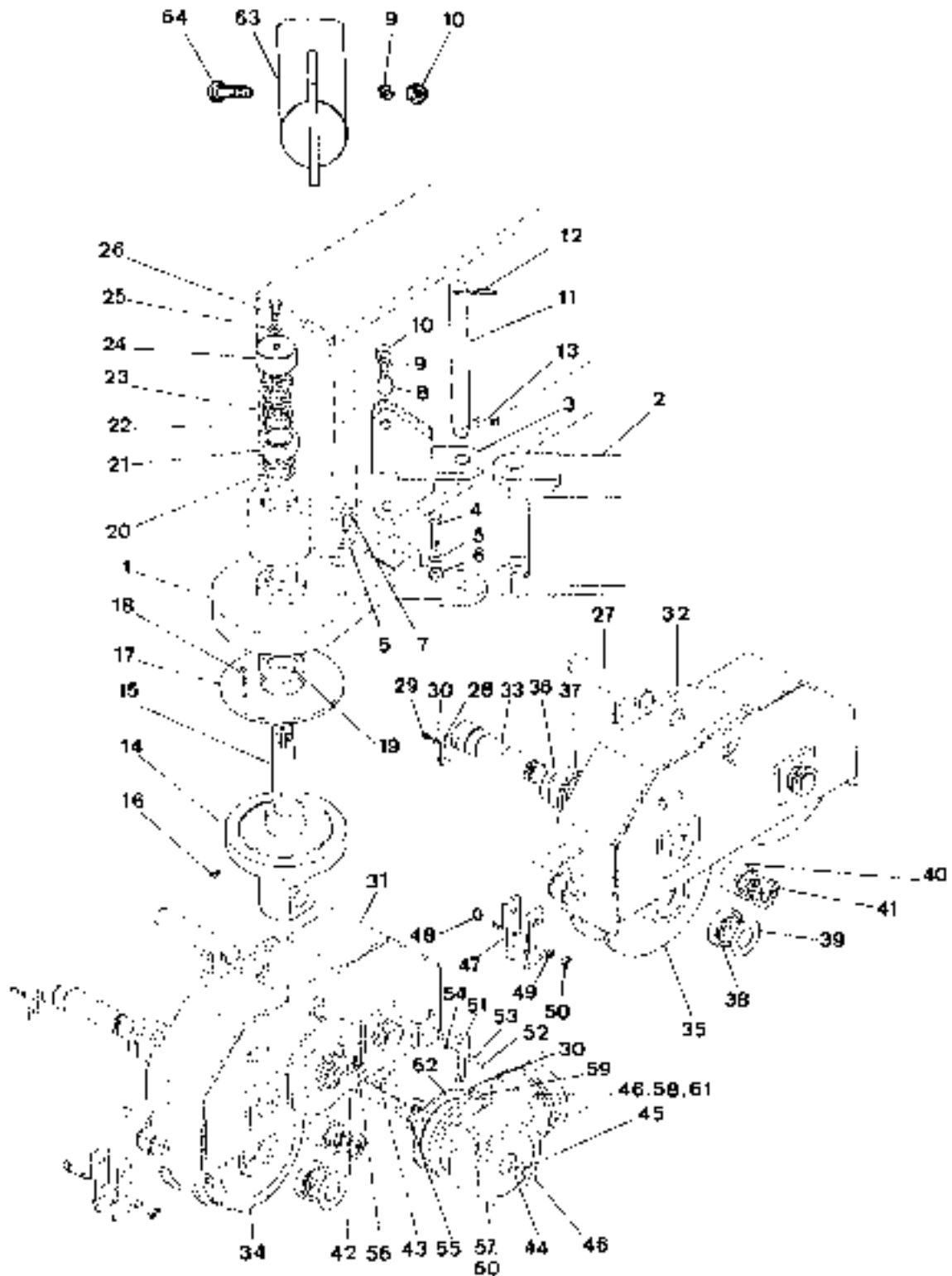


<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3201M1785	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
2	3201P1733	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
3	3201M1789	ESCALERA	ECELLE	LADDER	LEITER	1
4	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
5	3301P166.02	ABARCON	ATTACHE	U-CLAMP	U-KLAMMER	2
6	093312175035088	TORNILLO	VIS	BOLT	SCHRAUBE	4
7	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
8	0934121758	TUERCA	ECROU	NUT	MUTTER	4
9	ARP15F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
10	0934142008	TUERCA	ECROU	NUT	MUTTER	4
11	093314200040088	TORNILLO	VIS	BOLT	SCHRAUBE	2





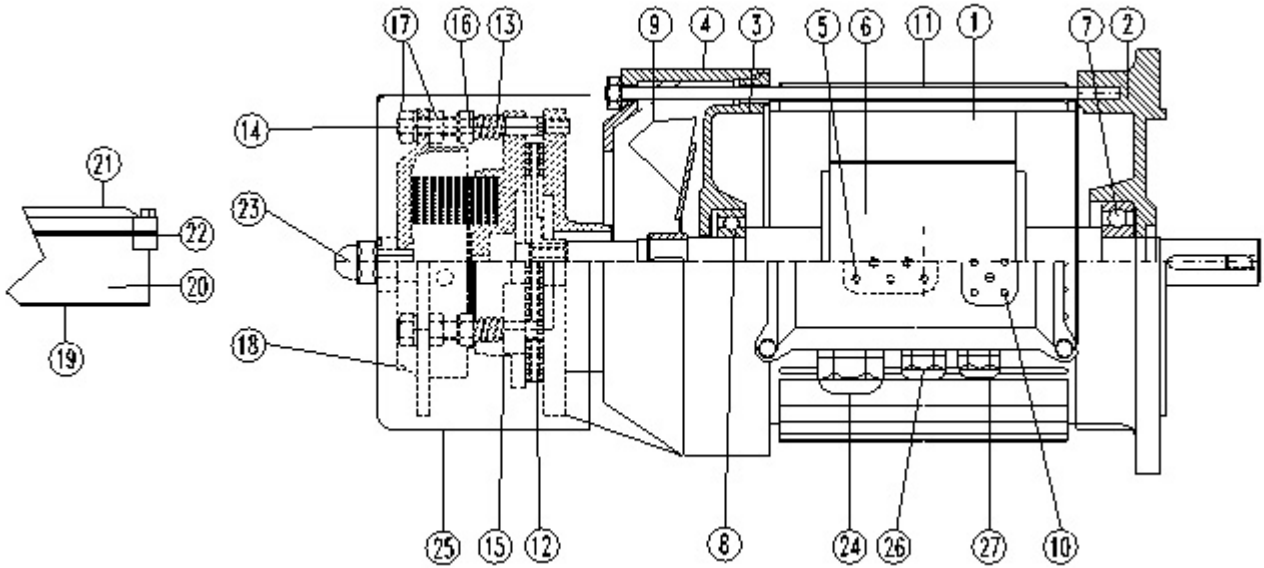
Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	3201M1703	LARGUERO	LONGERON	STRINGER	LAENGSTRAEGER	1
2	3201M1707	BRAZO	BRAS	ARM	HALTEARM	2
3	3215P1099	EJE	AXE	AXLE	ACHSE	2
4	OL10006	BRIDA	BRIDE	FLANGE	FLANSCH	4
5	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
6	093120250050088	TORNILLO	VIS	BOLT	SCHRAUBE	8
7	GLY.PG10010550F	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
8	3201M1826	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
9	3201M1720	DIAGONAL	DIAGONALE	DIAGONAL	DIAGONALE	4
10	10250900.14	BULON	AXE	PIN	BOLZEN	8
12	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
13	PSR5	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
14	3201P443	APOYO	APPUI	SUPPORT	AUFLAGE	4
15	1408P146	CHAVETA	CLAVETTE	KEY	PASSFEDER	8
16	ARP15F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
17	093314200030088	TORNILLO	VIS	BOLT	SCHRAUBE	16
18	3201M1460	APOYO	APPUI	SUPPORT	AUFLAGE	4
19	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
20	093316200040088	TORNILLO	VIS	BOLT	SCHRAUBE	16
21	OL110.1149.00	BRIDA	BRIDE	FLANGE	FLANSCH	8
22	ARP15F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
23	093314200030088	TORNILLO	VIS	BOLT	SCHRAUBE	16
24	3215P1046	HUSILLO	VIS	SPINDLE	SPINDEL	4
25	3201M1710	PIE	PIED	FOOT	FUSS	4
26	3215P1063	TORNILLO	VIS	BOLT	SCHRAUBE	16
27	ARP34D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	32
28	3215P1072	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	16
29	09343335010	TUERCA	ECROU	NUT	MUTTER	16
30	10600185E.25	BULON	AXE	PIN	BOLZEN	8
31	20160160.25	BULON	AXE	PIN	BOLZEN	4
32	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
33	093116200070088	TORNILLO	VIS	BOLT	SCHRAUBE	2
34	ARP17F111D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
35	0934162008	TUERCA	ECROU	NUT	MUTTER	2
36	3201P1674	ESCALERA	ECELLE	LADDER	LEITER	1
37	3215P1156	TAPA	COUVERCLE	COVER	DECKEL	4
38	PSI4*25*85	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1408K8503	PLACA	PLAQUE	PLATE	SCHILD	4
2	1408M8506	TRAVIESA	TRAVERSE	CROSSTIE	TRAVERSE	2
3	1408P8496	PLACA	PLAQUE	PLATE	SCHILD	4
4	093120250140109	TORNILLO	VIS	BOLT	SCHRAUBE	8
5	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
6	09342025010	TUERCA	ECROU	NUT	MUTTER	8
7	093120250060109	TORNILLO	VIS	BOLT	SCHRAUBE	8
8	1408P3644	TORNILLO	VIS	BOLT	SCHRAUBE	8
9	ARP23D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
10	0934222508	TUERCA	ECROU	NUT	MUTTER	16
11	10450410.25	BULON	AXE	PIN	BOLZEN	4
12	PSA8*90	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
13	PSI5*40*105	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
14	1408M8509	TACO	CALE	BLOCK	HOLZBLOCK	4
15	1408P8495	VASTAGO	TIGE DE CYLINDRE	RAM-ROD	KOLBENSTANGE	4
16	ECM10*100D71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	4
17	1408P8505	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
18	PSE10*24	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
19	GLY.PG12012550F	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	4
20	JT95.74*5.33	JUNTA	JOINT	GASKET	DICHTUNG	4
21	1408P8493	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	4
22	ARMB12	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
23	TUKM12	TUERCA	ECROU	NUT	MUTTER	8
24	1408P8492	TAPA	COUVERCLE	COVER	DECKEL	4
25	JT12.81*1.78	JUNTA	JOINT	GASKET	DICHTUNG	4
26	093310150025088	TORNILLO	VIS	BOLT	SCHRAUBE	4
27	1408P1391	BULON	AXE	PIN	BOLZEN	4
28	1408P146	CHAVETA	CLAVETTE	KEY	PASSFEDER	12
29	093314200030088	TORNILLO	VIS	BOLT	SCHRAUBE	24
30	ARG14D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	32
31	1408K8055	PORTARUEDAS	BOGGIE	BOGIE	RADKASTEN	2
32	1408K8056	PORTARUEDAS	BOGGIE	BOGIE	RADKASTEN	2
33	1408P873	EJE	AXE	AXLE	ACHSE	8
34	1408P884	RUEDA	ROUE	WHEEL	RAD	4
35	1408P886	RUEDA	ROUE	WHEEL	RAD	4
36	1408P875	GUARDA-POLVO	CACHE POUSSIERE	DUST GUARD	STAUBMANTEL	8
37	ROD32216A	RODAMIENTO	ROULEMENT	BEARING	LAGER	8
38	ROD32212A	RODAMIENTO	ROULEMENT	BEARING	LAGER	8
39	1408P878	GUARDA-POLVO	CACHE POUSSIERE	DUST GUARD	STAUBMANTEL	8
40	1408P874	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	8
41	TUKM16	TUERCA	ECROU	NUT	MUTTER	16
42	1408M8091	EJE	AXE	AXLE	ACHSE	2
43	CHVP12*8*140A	CHAVETA	CLAVETTE	KEY	PASSFEDER	2
44	1408P7499	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
45	796712175	TUERCA	ECROU	NUT	MUTTER	2
46	093312175035088	TORNILLO	VIS	BOLT	SCHRAUBE	10
47	3212P013	MORDAZA	MACHOIRE	CLAMP	KLEMMBACKE	8
48	3212P067	TORNILLO	VIS	BOLT	SCHRAUBE	4
49	ARP25F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
50	0934243008	TUERCA	ECROU	NUT	MUTTER	4
51	LMMC.0001	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	2
52	093305080050088	TORNILLO	VIS	BOLT	SCHRAUBE	4
53	ARG5D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
54	0934050808	TUERCA	ECROU	NUT	MUTTER	4
55	ROD6210.2RS	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
56	AEE50	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
57	REDBI.MA54	REDUCTOR	REDUCTEUR	GEAR-BOX	GETRIEBE	2

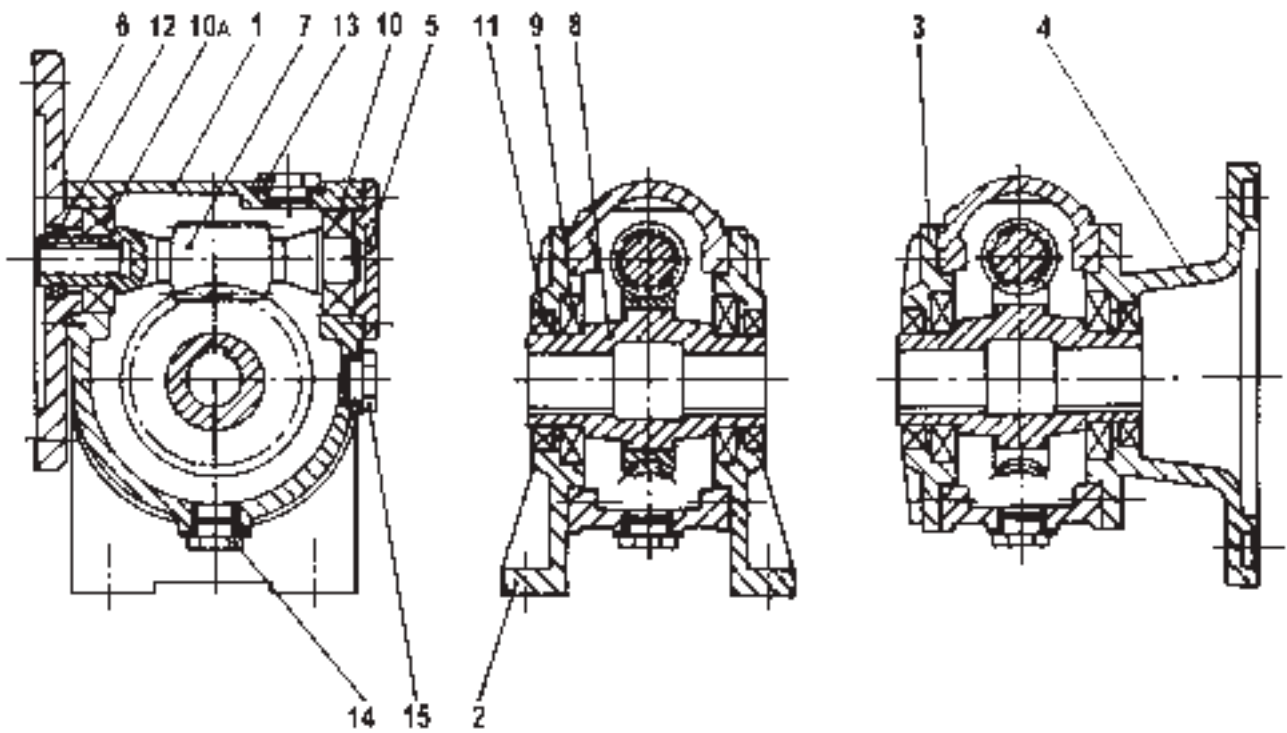
<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
58	ARG12D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	10
59	093314200060088	TORNILLO	VIS	BOLT	SCHRAUBE	8
60	MTRCF1334-1	MOTOR	MOTEUR	MOTOR	MOTOR	2
61	0934121758	TUERCA	ECROU	NUT	MUTTER	10
62	1408P8092	BRIDA	BRIDE	FLANGE	FLANSCH	2



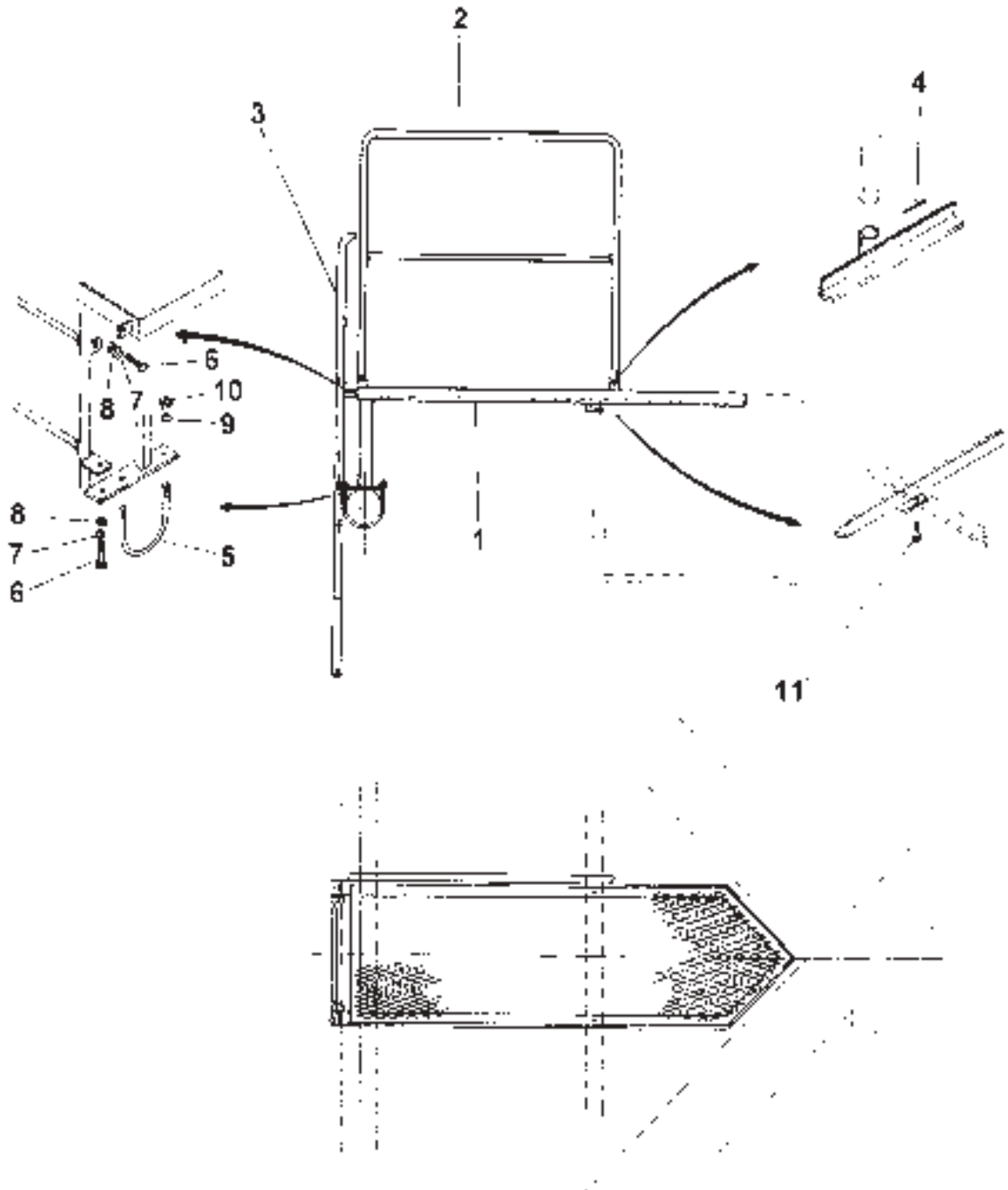


Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		CARCASA	CARCASSE	CASING	GEHAEUSE	1
2		BRIDA DELANTERA	FLASQUE AVANT	DRIVE-ENDSHIELD	A-LAGERSCHILD	1
3		BRIDA FRENO	FLASQUE FREIN	BRAKE-ENDSHIELD	BEMSE-LAGERSCHILD	1
4		TAPA FRENO	CAPOT FREIN	BRAKE COVER	BREMSGEHAUSE	1
5		CAJA DE BORNES	BOITE A BORNES	TERMINAL BOX FRAME	KLEMMENKASTEN	1
6		ROTOR	ROTOR	ROTOR	ROTOR	1
7		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
8		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
9		VENTILADOR	VENTILATEUR	FAN	LUFTER	1
10		CAJA DE BORNES	BOITE A BORNES	TERMINAL BOX FRAME	KLEMMENKASTEN	1
11		VARILLA	TIGE	ROD	STANGE	4
12		DISCO FRENO	DISQUE FREIN	BRAKE DISC	BREMSSCHEIBE	1
13		MUELLE FRENO	GUIDE	GUIDE	FUEHRUNG	3
14		COLUMNA FRENO	COLONNE DE FREIN	BRAKE COLUMN	FUHRUNGSSAULE BREMSE	3
15		ELECTROIMAN MOVIL	ARMATURE	ARMATURE	BREMSANKER	1
16		TUERCA	ECROU	NUT	MUTTER	3
17		TUERCA	ECROU	NUT	MUTTER	6
18		BOBINA FRENO	ELECTRO-AIMANT	BRAKE COIL	BREMSPULE	1
19		JUNTA	JOINT	GASKET	DICHTUNG	1
20		CAJA DE BORNES	BOITE A BORNES	TERMINAL BOX FRAME	KLEMMENKASTEN	1
21		TAPA	COUVERCLE	COVER	DECKEL	1
22		JUNTA	JOINT	GASKET	DICHTUNG	1
23		TUERCA	ECROU	NUT	MUTTER	1
24		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	1
25		TAPA FRENO	CAPOT FREIN	BRAKE COVER	BREMSGEHAUSE	1
26		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	1
27		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	1





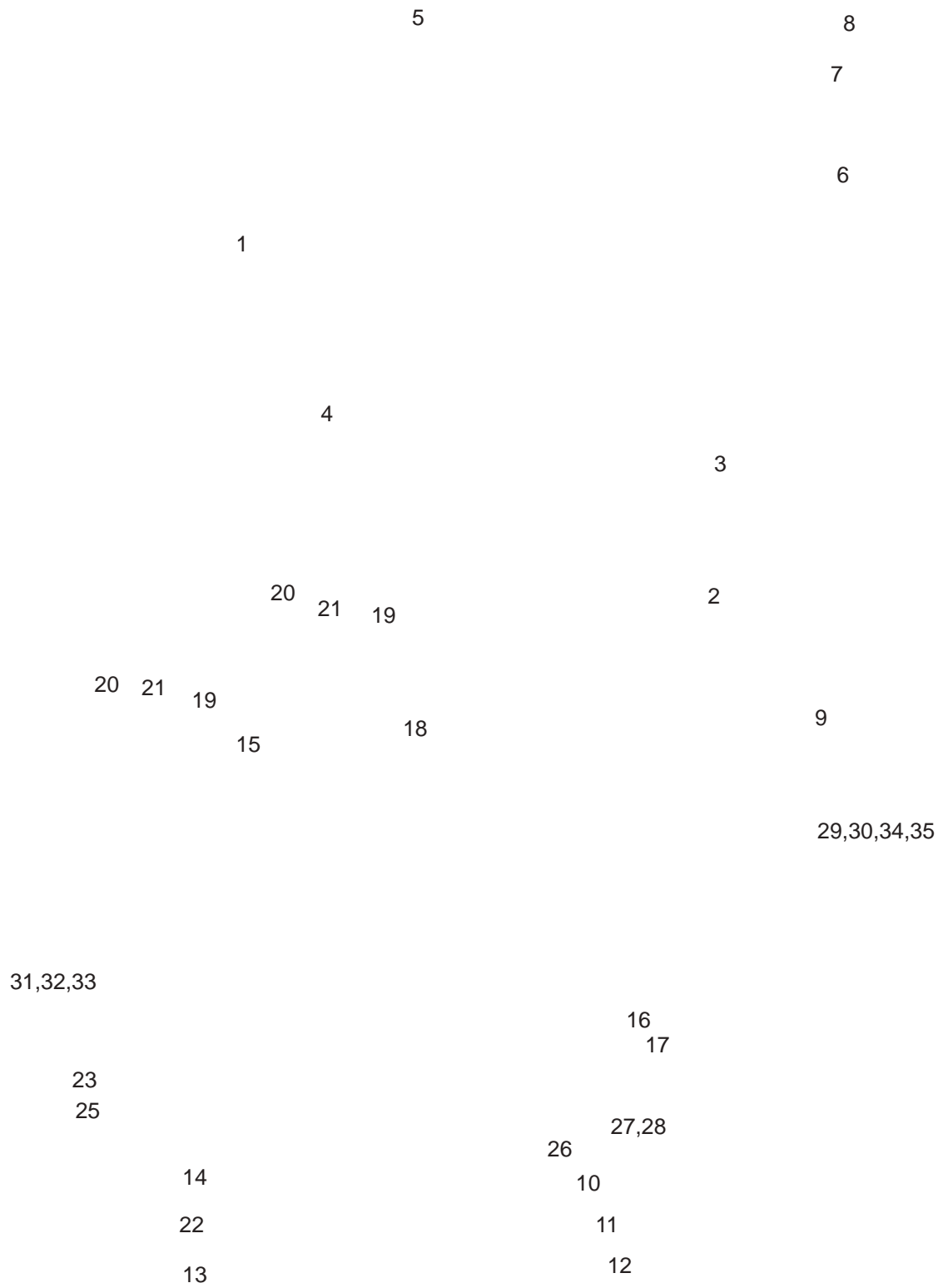
<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1		CARCASA	CARCASSE	CASING	GEHAEUSE	1
2		TAPA	COUVERCLE	COVER	DECKEL	2
3		TAPA	COUVERCLE	COVER	DECKEL	1
4		BRIDA	BRIDE	FLANGE	FLANSCH	1
5		TAPA	COUVERCLE	COVER	DECKEL	1
6		BRIDA	BRIDE	FLANGE	DECKEL	1
7		SINFIN	VIS SANS FIN	WORM-GEAR	GETRIEBESCHNECKE	1
8		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
9		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
10		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
10A		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
11		RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
12		RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
13		TAPON	BOUCHON	PLUG	STOEPSSEL	1
14		TAPON	BOUCHON	PLUG	STOEPSSEL	1
15		NIVEL	NIVEAU	LEVEL	NIVEAU	1



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3201M1726	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
2	3201P1733	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
3	3201M1730	ESCALERA	ECHELLE	LADDER	LEITER	1
4	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
5	3301P166.02	ABARCON	ATTACHE	U-CLAMP	U-KLAMMER	2
6	093312175035088	TORNILLO	VIS	BOLT	SCHRAUBE	4
7	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
8	0934121758	TUERCA	ECROU	NUT	MUTTER	4
9	ARP15F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
10	0934142008	TUERCA	ECROU	NUT	MUTTER	4
11	093314200040088	TORNILLO	VIS	BOLT	SCHRAUBE	2



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3201M2013	LARGUERO	LONGERON	STRINGER	LAENGSTRAEGER	1
2	3201M2016	BRAZO	BRAS	ARM	HALTEARM	2
3	3215P1241	BULON	AXE	PIN	BOLZEN	4
4	3215P1242	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
5	0935525008	TUERCA	ECROU	NUT	MUTTER	4
6	PSA8*100	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
7	EAM1/4GASD71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	4
8	GNP300F233	TAPON	BOUCHON	PLUG	STOEPSSEL	4
9	3201M2017	BRAZO	BRAS	ARM	HALTEARM	4
10	10350420.25	BULON	AXE	PIN	BOLZEN	8
11	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	16
12	3203M2350	PIE	PIED	FOOT	FUSS	4
13	093136400280109	TORNILLO	VIS	BOLT	SCHRAUBE	24
14	3301P199.01	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	24
15	ARP37D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	24
16	09343640010	TUERCA	ECROU	NUT	MUTTER	24
17	10600185E.25	BULON	AXE	PIN	BOLZEN	8
18	20160160.25	BULON	AXE	PIN	BOLZEN	4
19	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
20	3201M2018	ESTABILIZADOR	STABILISATEUR	ELEPHANT'S FOOT	ABSTUETZUNG	4
21	3215P1248	HUSILLO	VIS	SPINDLE	SPINDEL	4
22	3201P2022	BRIDA	BRIDE	FLANGE	FLANSCH	8
23	093116200050088	TORNILLO	VIS	BOLT	SCHRAUBE	4
24	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
25	3215P1249	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	4
26	PSI4*25*85	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
27	3201M2027	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
28	3201M2029	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
29	3201M2026	ESCALERA	ECELLE	LADDER	LEITER	1
30	093310150035088	TORNILLO	VIS	BOLT	SCHRAUBE	6
31	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
32	0934101508	TUERCA	ECROU	NUT	MUTTER	6
33	10150120.14	BULON	AXE	PIN	BOLZEN	4
34	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1408K7507	APOYO	APPUI	SUPPORT	AUFLAGE	1
2	1408P5272	BULON	AXE	PIN	BOLZEN	1
3	1408P5303	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
4	EAM06*100D71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	1
5	AEE130	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
6	093130350090088	TORNILLO	VIS	BOLT	SCHRAUBE	8
7	ARP31F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
8	0934303508	TUERCA	ECROU	NUT	MUTTER	8
9	1404-10447	CARCASA	CARCASSE	CASING	GEHAUSE	1
10	1408M1135	RUEDA	ROUE	WHEEL	RAD	2
11	ROD32216A	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
12	1408P875	GUARDA-POLVO	CACHE POUSSIERE	DUST GUARD	STAUBMANTEL	2
13	ROD32316A	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
14	1408P7498	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
15	1408P7497	EJE	AXE	AXLE	ACHSE	2
16	ARMB16	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
17	TUKM16	TUERCA	ECROU	NUT	MUTTER	4
18	1408P1391	BULON	AXE	PIN	BOLZEN	1
19	1408P1394	CHAVETA	CLAVETTE	KEY	PASSFEDER	3
20	093316200050088	TORNILLO	VIS	BOLT	SCHRAUBE	6
21	ARG16D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
22	1408P8748	MORDAZA	MACHOIRE	CLAMP	KLEMMBACKE	4
23	093122250170088	TORNILLO	VIS	BOLT	SCHRAUBE	2
24	EAM10*100D71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	2
25	1408P8762	TUERCA	ECROU	NUT	MUTTER	2
26	LMMC.0001	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
27	093306100020056	TORNILLO	VIS	BOLT	SCHRAUBE	2
28	ARG6D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
29	ROD62082RS	RODAMIENTO	ROULEMENT	BEARING	LAGER	8
30	AEE40	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	4
31	10400180.14R	BULON	AXE	PIN	BOLZEN	2
32	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
33	ARP41F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
34	1408P8682	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	4
35	1408P8674	RODILLO	GALET	ROLLER	ROLLE	4

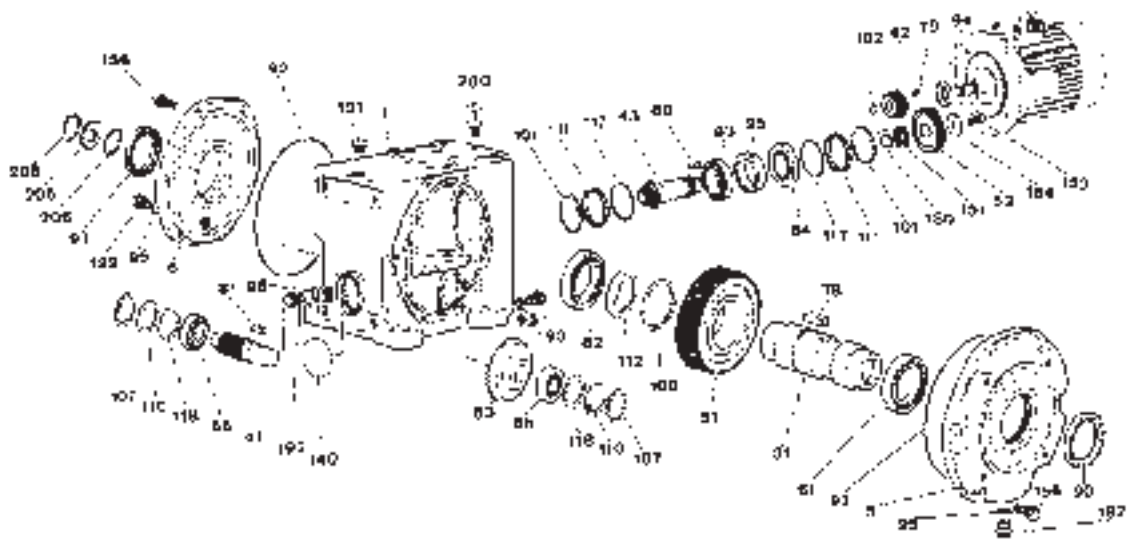




Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	REDOC.LS24	REDUCTOR	REDUCTEUR	GEAR-BOX	GETRIEBE	1
2	1408P1394	CHAVETA	CLAVETTE	KEY	PASSFEDER	3
3	1408P7497	EJE	AXE	AXLE	ACHSE	2
4	1408P1399	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
5	1408P7498	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
6	1408P8748	MORDAZA	MACHOIRE	CLAMP	KLEMMBACKE	4
7	1408P875	GUARDA POLVO	CACHE POUSSIÈRE	DUST GUARD	STAUBMANTEL	2
8	1408M1134	RUEDA	ROUE	WHEEL	RAD	2
9	1404-10204	CARCASA	CARCASSE	CASING	GEHÄUSE	1
10	1408P1391	BULON	AXE	PIN	BOLZEN	1
11	1408P5303	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
12	MTRCF3336-1	MOTOR	MOTEUR	MOTOR	MOTOR	1
13	1408K7507	APOYO	APPUI	SUPPORT	AUFLAGE	1
14	1408P5272	BULON	AXE	PIN	BOLZEN	1
15	AEE130	ANILLO ELASTICO	ANNEAU D'ARRÊT	CIRCLIP	SICHERUNGSRING	1
16	EAM06*100D71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	1
17	TUKM16	TUERCA	ECROU	NUT	MUTTER	4
18	ARMB16	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
19	ROD32216A	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
20	ROD32316A	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
21	1408P8762	TUERCA	ECROU	NUT	MUTTER	2
22	093316200050088	TORNILLO	VIS	BOLT	SCHRAUBE	6
23	ARG16D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
24	093122250170088	TORNILLO	VIS	BOLT	SCHRAUBE	2
25	093312175035088	TORNILLO	VIS	BOLT	SCHRAUBE	4
26	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
27	1408K8651	BRIDA	BRIDE	FLANGE	FLANSCH	1
28	ROD22212HL	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
29	1408M8655	EJE PIÑÓN	AXE DENTE	PINION AXLE	RITZELWELLE	1
30	AEE60	ANILLO ELASTICO	ANNEAU D'ARRÊT	CIRCLIP	SICHERUNGSRING	1
31	CHVP14*9*100	CHAVETA	CLAVETTE	KEY	PASSFEDER	1
32	093312175030088	TORNILLO	VIS	BOLT	SCHRAUBE	4
33	ARG12D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
34	093314200050088	TORNILLO	VIS	BOLT	SCHRAUBE	4
35	ARG14D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
36	1408P8682	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	4
37	1408P8674	RODILLO	GALET	ROLLER	ROLLE	4
38	ROD6208.2RS	RODAMIENTO	ROULEMENT	BEARING	LAGER	8
39	AEE40	ANILLO ELASTICO	ANNEAU D'ARRÊT	CIRCLIP	SICHERUNGSRING	4
40	LMMC.0001	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
41	093306100020056	TORNILLO	VIS	BOLT	SCHRAUBE	2
42	ARG6D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
43	93314200090088	TORNILLO	VIS	BOLT	SCHRAUBE	1
44	093414200	TUERCA	ECROU	NUT	MUTTER	1
45	093130350090088	TORNILLO	VIS	BOLT	SCHRAUBE	8
46	ARP31F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
47	0934303508	TUERCA	ECROU	NUT	MUTTER	8
48	ARG14D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
49	10400180.14R	BULON	AXE	PIN	BOLZEN	2
50	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECCKER	4
51	ARP41F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
52	EAM10*100D71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	2



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		ESTATOR	STATOR	STATOR	STATOR	1
2		BRIDA DELANTERA	FLASQUE AVANT	DRIVE-ENDSHIELD	A-LAGERSCHILD	1
3		BRIDA FRENO	FLASQUE FREIN	BRAKE-ENDSHIELD	BEMSE-LAGERSCHILD	1
4		CARCASA	CARCASSE	CASING	GEHAEUSE	1
5		CARCASA RALENTIZAD.	CARTER RALENTISSEUR	EDDY C.BRAKE HOUSING	WIRBELSTROMB.GEHAUSE	1
6		ROTOR	ROTOR	ROTOR	ROTOR	1
7		BLOQUE	BLOC	BLOCK	BLOCK	1
8		BLOQUE	BLOC	BLOCK	BLOCK	1
9		BOBINA RALENTIZADOR	BOBINE RALENTISSEUR	EDDY C,-BRAKE COIL	WIRBELSTROMB. SPULE	1
10		VENTILADOR	VENTILATEUR	FAN	LUFTER	1
11		VARILLA	TIGE	ROD	STANGE	4
12		DISCO FRENO	DISQUE FREIN	BRAKE DISC	BREMSSCHEIBE	1
13		MUELLE	RESSORT	SPRING	BREMSFEDER	3
14		COLUMNA FRENO	COLONNE DE FREIN	BRAKE COLUMN	FUHRUNGSSAULE BREMSE	3
15		ELECTROIMAN MOVIL	ARMATURE	ARMATURE	BREMSANKER	1
16		TUERCA	ECROU	NUT	MUTTER	3
17		TUERCA	ECROU	NUT	MUTTER	6
18		BOBINA FRENO	ELECTRO-AIMANT	BRAKE COIL	BREMSPULE	1
19		JUNTA	JOINT	GASKET	DICHTUNG	1
20		CAJA DE BORNES	BOITE A BORNES	TERMINAL BOX FRAME	KLEMMENKASTEN	1
21		TAPA	COUVERCLE	COVER	DECKEL	1
22		JUNTA	JOINT	GASKET	DICHTUNG	1
23		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NABE, VIELKEILVERZHN	1
24		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	1
25		TAPA FRENO	CAPOT FREIN	BRAKE COVER	BREMSGEHAUSE	1
26		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	3
27		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	2
28		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
29		RODAMIENTO	ROULEMENT	BEARING	LAGER	2
30		BORNE	BORNE	TERMINAL	KLEMME	1
31		BORNE	BORNE	TERMINAL	KLEMME	1
32		DESBLOQUEO	DEBLOCAGE	RELEASE	FREISTELLUNG	1
33		CARCASA	CARCASSE	CASING	GEHAEUSE	1
34		BRIDA	BRIDE	FLANGE	FLANSCH	1
35		RETÉN DE ACEITE	BAGUE DÉTANCHEITE	SEAL	DICHTRING	1
36		CANCAMO	CHEVILLE A `OEILLET	EYEBOLT	ZUGOESE	1
37		GUÍA	GUIDE	GUIDE	FÜHRUNG	1
38		MUELLE	RESSORT	SPRING	BREMSFEDER	1
39		CANCAMO	CHEVILLE A `OEILLET	EYEBOLT	ZUGOESE	1



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		CARCASA	CARCASSE	CASING	GEHAEUSE	1
5		TAPA	COUVERCLE	COVER	DECKEL	1
6		TAPA	COUVERCLE	COVER	DECKEL	1
25		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
31		EJE	AXE	AXLE	ACHSE	1
41		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
42		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
43		EJE	AXE	AXLE	ACHSE	1
51		RUEDA	ROUE	WHEEL	RAD	1
52		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NABE, VIELKEILVERZHN	1
53		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
61	22211	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
62	NJ 208 E	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
63	30306	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
64	30306	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
65	30305	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
66	32305	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
78		CHAVETA	CLAVETTE	KEY	PASFEDER	1
79		CHAVETA	CLAVETTE	KEY	PASFEDER	1
80		CHAVETA	CLAVETTE	KEY	PASFEDER	1
81		CHAVETA	CLAVETTE	KEY	PASFEDER	1
90	65*85*13 AS	RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
91	65*85*13 AS	RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
92	240*3	RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	2
94		RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
95		ARANDELA	RONDELLE	WASHER	SCHEIBE	4
100		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
101		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	2
102		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
107		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	2
110		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	
111		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	
117		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
118		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
140		TAPA	COUVERCLE	COVER	DECKEL	1
150		ARANDELA	RONDELLE	WASHER	SCHEIBE	1
151		TUERCA	ECROU	NUT	MUTTER	1
153		TORNILLO	VIS	BOLT	SCHRAUBE	1
154		ARANDELA	RONDELLE	WASHER	SCHEIBE	1
156		TORNILLO	VIS	BOLT	SCHRAUBE	12
191		TAPON	BOUCHON	PLUG	STOEPSSEL	1
192		NIVEL	NIVEAU	LEVEL	NIVEAU	3
193		TAPON	BOUCHON	PLUG	STOEPSSEL	1
200		CANCAMO	CHEVILLE A'OEILLET	EYEBOLT	ZUGOESE	1
205		ARANDELA	RONDELLE	WASHER	SCHEIBE	1
206		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	2



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1408K7504	APOYO	APPUI	SUPPORT	AUFLAGE	1
2	1408K7503	APOYO	APPUI	SUPPORT	AUFLAGE	1
3	1408P7506	EJE	AXE	AXLE	ACHSE	2
4	1408P7505	RODILLO	GALET	ROLLER	ROLLE	2
5	GLY.PG9510060F	EJE	AXE	AXLE	ACHSE	4
6	ARG30D127B	TORNILLO	VIS	BOLT	SCHRAUBE	8
7	1408P5632	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
8	1408P7508	ESPARRAGO	GOUJON	SHANK	STEBOLZEN	2
9	ARP21F11D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
10	0934202508	TUERCA	ECROU	NUT	MUTTER	4
11	1408P7509	GUIA	GUIDE	GUIDE	FUEHRUNG	4
12	093330350055088	TORNILLO	VIS	BOLT	SCHRAUBE	8
13	ARP31F11D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
14	1408P5303	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
15	EAM06*100D71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	1
16	AEE130	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	2
17	1408P5272	BULON	AXE	PIN	BOLZEN	1
18	1404-10447	CARCASA	CARCASSE	CASING	GEHAEUSE	1
19	1408M1135	RUEDA	ROUE	WHEEL	RAD	2
20	ROD32216A	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
21	1408P875	GUARDA-POLVO	CACHE POUSSIERE	DUST GUARD	STAUBMANTEL	2
22	ROD32316A	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
23	1408P7498	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
24	1408P7497	EJE	AXE	AXLE	ACHSE	2
25	ARMB16	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
26	TUKM16	TUERCA	ECROU	NUT	MUTTER	4
28	1408P1391	BULON	AXE	PIN	BOLZEN	1
29	1408P1394	CHAVETA	CLAVETTE	KEY	PASSFEDER	3
30	093316200050088	TORNILLO	VIS	BOLT	SCHRAUBE	6
31	ARG16D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
32	1408P8748	MORDAZA	MACHOIRE	CLAMP	KLEMMBACKE	4
33	093122250170088	TORNILLO	VIS	BOLT	SCHRAUBE	2
34	EAM10*100D71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	2
35	1408P8762	TUERCA	ECROU	NUT	MUTTER	2
36	LMMC.0001	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
37	093306100020056	TORNILLO	VIS	BOLT	SCHRAUBE	2
38	ARG6D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
39	ROD62082RS	RODAMIENTO	ROULEMENT	BEARING	LAGER	8
40	AEE40	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	4
41	10400180.14R	BULON	AXE	PIN	BOLZEN	2
42	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
43	ARP41F11D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
44	1408P8682	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	4
45	1408P8674	RODILLO	GALET	ROLLER	ROLLE	4

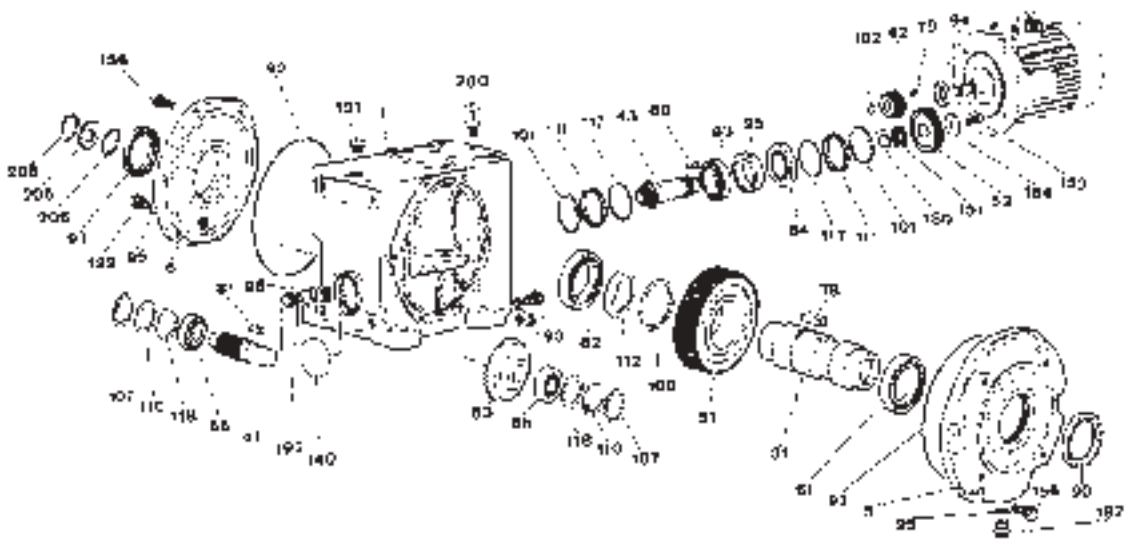




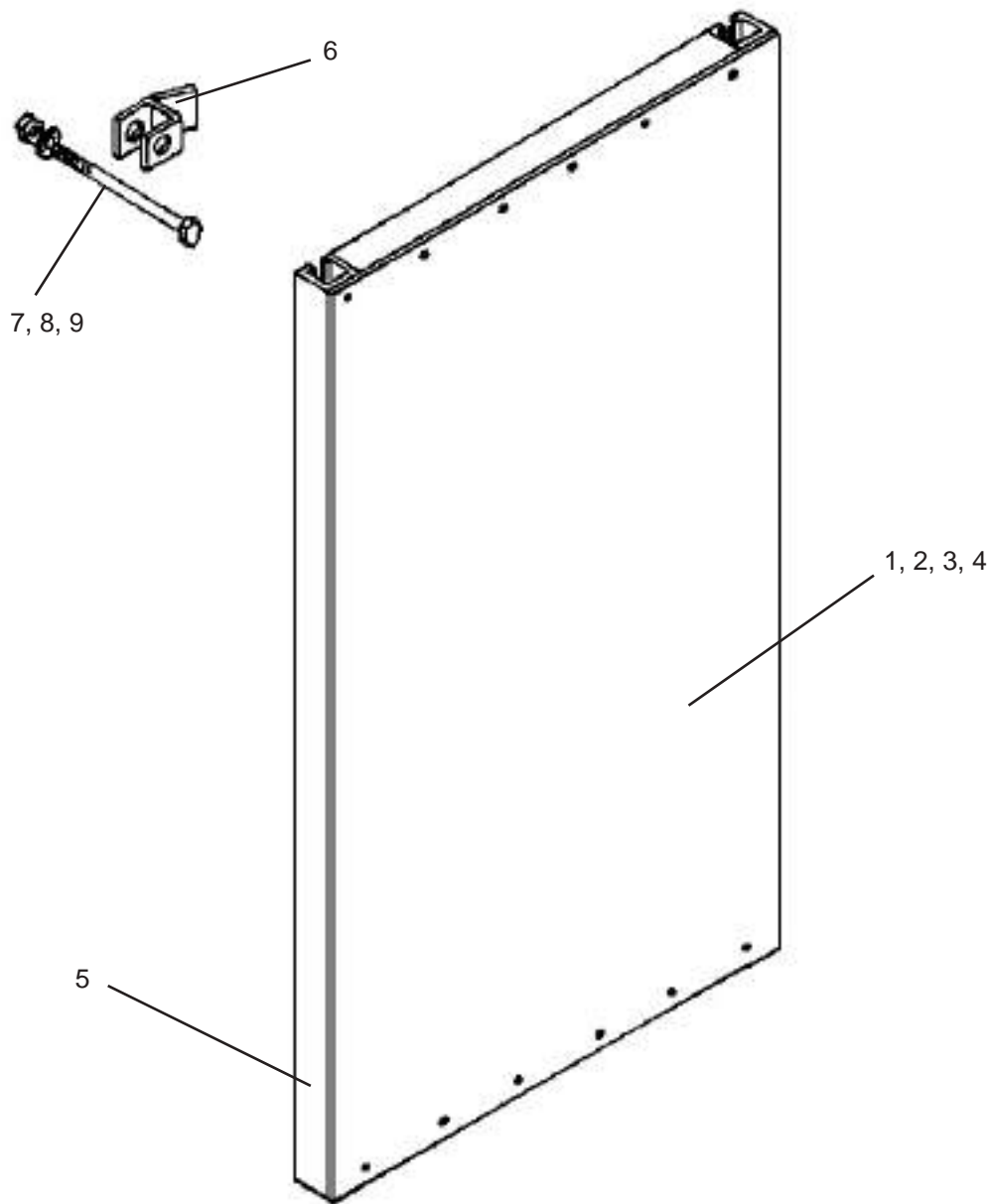
Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	REDOC.LS24	REDUCTOR	REDUCTEUR	GEAR-BOX	GETRIEBE	1
2	1408P1394	CHAVETA	CLAVETTE	KEY	PASSFEDER	3
3	1408P7497	EJE	AXE	AXLE	ACHSE	2
4	1408P1399	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
5	1408P7498	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
6	1408P8748	MORDAZA	MACHOIRE	CLAMP	KLEMMBACKE	4
7	1408P875	GUARDA POLVO	CACHE POUSSIÈRE	DUST GUARD	STAUBMANTEL	2
8	1408M1134	RUEDA	ROUE	WHEEL	RAD	2
9	1404-10204	CARCASA	CARCASSE	CASING	GEHÄUSE	1
10	1408P1391	BULON	AXE	PIN	BOLZEN	1
11	1408P5303	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
12	MTRCF3336-1	MOTOR	MOTEUR	MOTOR	MOTOR	1
13	1408K7507	APOYO	APPUI	SUPPORT	AUFLAGE	1
14	1408P5272	BULON	AXE	PIN	BOLZEN	1
15	AEE130	ANILLO ELASTICO	ANNEAU D'ARRÊT	CIRCLIP	SICHERUNGSRING	1
16	EAM06*100D71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	1
17	TUKM16	TUERCA	ECROU	NUT	MUTTER	4
18	ARMB16	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
19	ROD32216A	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
20	ROD32316A	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
21	1408P8762	TUERCA	ECROU	NUT	MUTTER	2
22	093316200050088	TORNILLO	VIS	BOLT	SCHRAUBE	6
23	ARG16D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
24	093122250170088	TORNILLO	VIS	BOLT	SCHRAUBE	2
25	093312175035088	TORNILLO	VIS	BOLT	SCHRAUBE	4
26	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
27	1408K8651	BRIDA	BRIDE	FLANGE	FLANSCH	1
28	ROD22212HL	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
29	1408M8655	EJE PIÑON	AXE DENTE	PINION AXLE	RITZELWELLE	1
30	AEE60	ANILLO ELASTICO	ANNEAU D'ARRÊT	CIRCLIP	SICHERUNGSRING	1
31	CHVP14*9*100	CHAVETA	CLAVETTE	KEY	PASSFEDER	1
32	093312175030088	TORNILLO	VIS	BOLT	SCHRAUBE	4
33	ARG12D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
34	093314200050088	TORNILLO	VIS	BOLT	SCHRAUBE	4
35	ARG14D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
36	1408P8682	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	4
37	1408P8674	RODILLO	GALET	ROLLER	ROLLE	4
38	ROD6208.2RS	RODAMIENTO	ROULEMENT	BEARING	LAGER	8
39	AEE40	ANILLO ELASTICO	ANNEAU D'ARRÊT	CIRCLIP	SICHERUNGSRING	4
40	LMMC.0001	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
41	093306100020056	TORNILLO	VIS	BOLT	SCHRAUBE	2
42	ARG6D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
43	93314200090088	TORNILLO	VIS	BOLT	SCHRAUBE	1
44	093414200	TUERCA	ECROU	NUT	MUTTER	1
45	093130350090088	TORNILLO	VIS	BOLT	SCHRAUBE	8
46	ARP31F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
47	0934303508	TUERCA	ECROU	NUT	MUTTER	8
48	ARG14D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
49	10400180.14R	BULON	AXE	PIN	BOLZEN	2
50	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
51	ARP41F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
52	EAM10*100D71412	ENGRASADOR	GRAISSEUR	NIPPLE	SCHMIERNIPPEL	2



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		ESTATOR	STATOR	STATOR	STATOR	1
2		BRIDA DELANTERA	FLASQUE AVANT	DRIVE-ENDSHIELD	A-LAGERSCHILD	1
3		BRIDA FRENO	FLASQUE FREIN	BRAKE-ENDSHIELD	BEMSE-LAGERSCHILD	1
4		CARCASA	CARCASSE	CASING	GEHAEUSE	1
5		CARCASA RALENTIZAD.	CARTER RALENTISSEUR	EDDY C.BRAKE HOUSING	WIRBELSTROMB.GEHAUSE	1
6		ROTOR	ROTOR	ROTOR	ROTOR	1
7		BLOQUE	BLOC	BLOCK	BLOCK	1
8		BLOQUE	BLOC	BLOCK	BLOCK	1
9		BOBINA RALENTIZADOR	BOBINE RALENTISSEUR	EDDY C,-BRAKE COIL	WIRBELSTROMB. SPULE	1
10		VENTILADOR	VENTILATEUR	FAN	LUFTER	1
11		VARILLA	TIGE	ROD	STANGE	4
12		DISCO FRENO	DISQUE FREIN	BRAKE DISC	BREMSCHIEBE	1
13		MUELLE	RESSORT	SPRING	BREMSFEDER	3
14		COLUMNA FRENO	COLONNE DE FREIN	BRAKE COLUMN	FUHRUNGSSAULE BREMSE	3
15		ELECTROIMAN MOVIL	ARMATURE	ARMATURE	BREMSANKER	1
16		TUERCA	ECROU	NUT	MUTTER	3
17		TUERCA	ECROU	NUT	MUTTER	6
18		BOBINA FRENO	ELECTRO-AIMANT	BRAKE COIL	BREMSPULE	1
19		JUNTA	JOINT	GASKET	DICHTUNG	1
20		CAJA DE BORNES	BOITE A BORNES	TERMINAL BOX FRAME	KLEMMENKASTEN	1
21		TAPA	COUVERCLE	COVER	DECKEL	1
22		JUNTA	JOINT	GASKET	DICHTUNG	1
23		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NABE, VIELKEILVERZHN	1
24		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	1
25		TAPA FRENO	CAPOT FREIN	BRAKE COVER	BREMSGEHAUSE	1
26		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	3
27		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	2
28		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
29		RODAMIENTO	ROULEMENT	BEARING	LAGER	2
30		BORNE	BORNE	TERMINAL	KLEMME	1
31		BORNE	BORNE	TERMINAL	KLEMME	1
32		DESBLOQUEO	DEBLOCAGE	RELEASE	FREISTELLUNG	1
33		CARCASA	CARCASSE	CASING	GEHAEUSE	1
34		BRIDA	BRIDE	FLANGE	FLANSCH	1
35		RETÉN DE ACEITE	BAGUE DÉTANCHEITE	SEAL	DICHTRING	1
36		CANCAMO	CHEVILLE A `OEILLET	EYEBOLT	ZUGOESE	1
37		GUÍA	GUIDE	GUIDE	FÜHRUNG	1
38		MUELLE	RESSORT	SPRING	BREMSFEDER	1
39		CANCAMO	CHEVILLE A `OEILLET	EYEBOLT	ZUGOESE	1



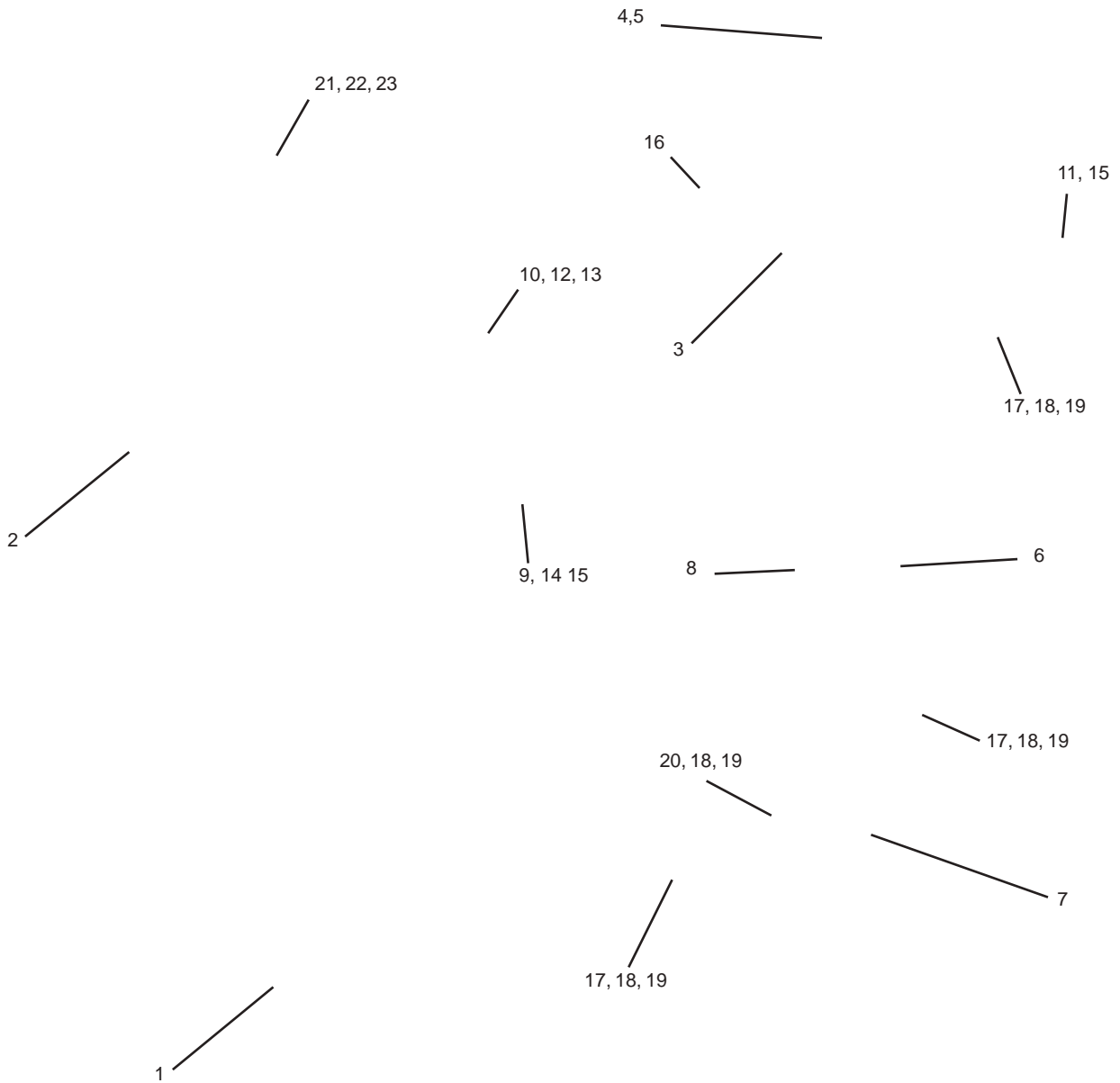
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1		CARCASA	CARCASSE	CASING	GEHAEUSE	1
5		TAPA	COUVERCLE	COVER	DECKEL	1
6		TAPA	COUVERCLE	COVER	DECKEL	1
25		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
31		EJE	AXE	AXLE	ACHSE	1
41		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
42		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
43		EJE	AXE	AXLE	ACHSE	1
51		RUEDA	ROUE	WHEEL	RAD	1
52		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NABE, VIELKEILVERZHN	1
53		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
61	22211	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
62	NJ 208 E	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
63	30306	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
64	30306	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
65	30305	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
66	32305	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
78		CHAVETA	CLAVETTE	KEY	PASFEDER	1
79		CHAVETA	CLAVETTE	KEY	PASFEDER	1
80		CHAVETA	CLAVETTE	KEY	PASFEDER	1
81		CHAVETA	CLAVETTE	KEY	PASFEDER	1
90	65*85*13 AS	RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
91	65*85*13 AS	RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
92	240*3	RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	2
94		RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
95		ARANDELA	RONDELLE	WASHER	SCHEIBE	4
100		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
101		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	2
102		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
107		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	2
110		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	
111		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	
117		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
118		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
140		TAPA	COUVERCLE	COVER	DECKEL	1
150		ARANDELA	RONDELLE	WASHER	SCHEIBE	1
151		TUERCA	ECROU	NUT	MUTTER	1
153		TORNILLO	VIS	BOLT	SCHRAUBE	1
154		ARANDELA	RONDELLE	WASHER	SCHEIBE	1
156		TORNILLO	VIS	BOLT	SCHRAUBE	12
191		TAPON	BOUCHON	PLUG	STOEPSSEL	1
192		NIVEL	NIVEAU	LEVEL	NIVEAU	3
193		TAPON	BOUCHON	PLUG	STOEPSSEL	1
200		CANCAMO	CHEVILLE A'OEILLET	EYEBOLT	ZUGOESE	1
205		ARANDELA	RONDELLE	WASHER	SCHEIBE	1
206		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	2



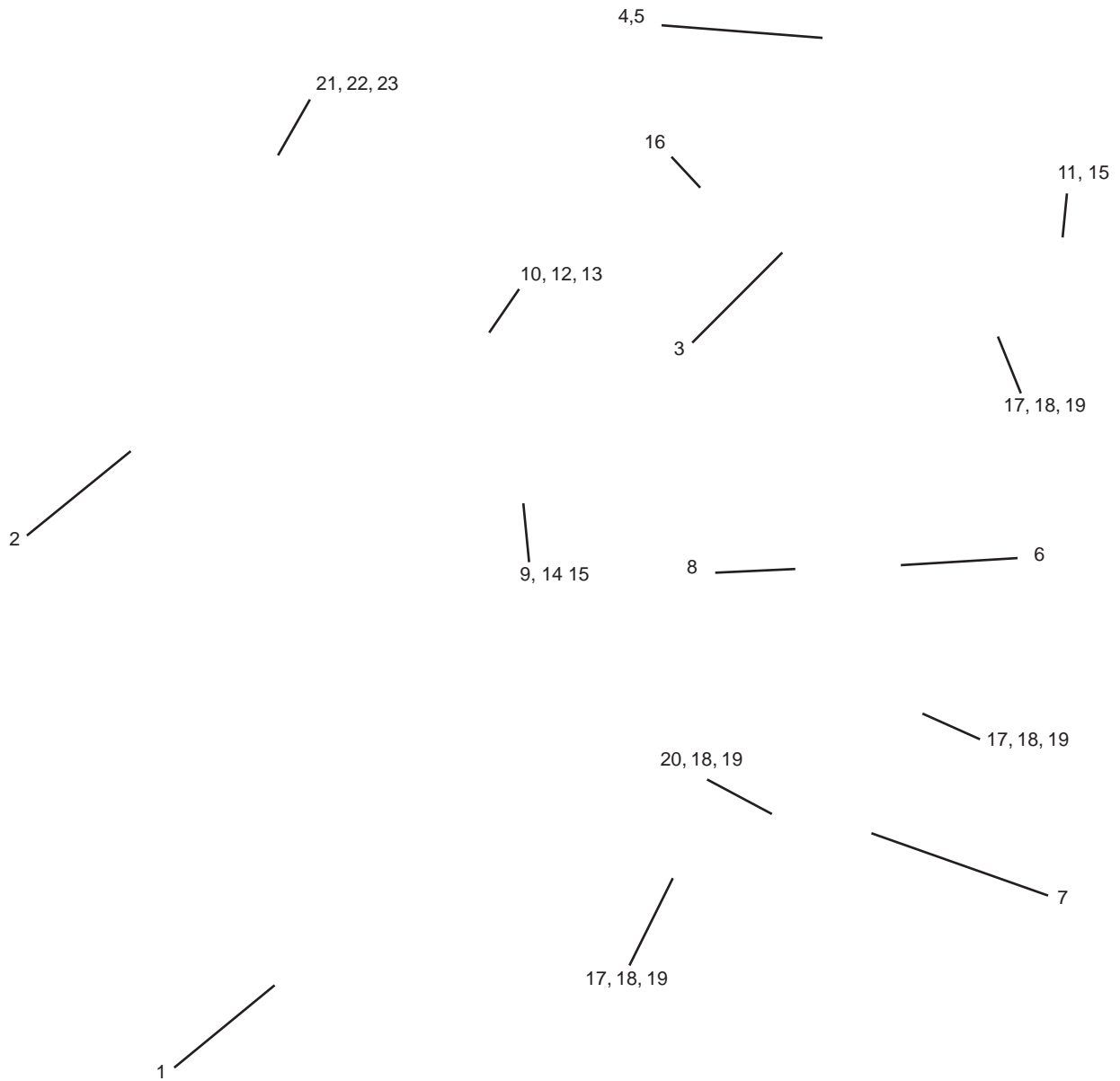
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<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3201-10314	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
2	3201-10315	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
3	3201-10316	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
4	3201-10317	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
5	3201-10320	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
6	3201-10235	BRIDA	BRIDA	FLANGIA	FLENS	4
7	093110150150088	TORNILLO	VIS	BOLT	SCHRAUBE	4
8	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
9	0934101508	TUERCA	ECROU	NUT	MUTTER	4

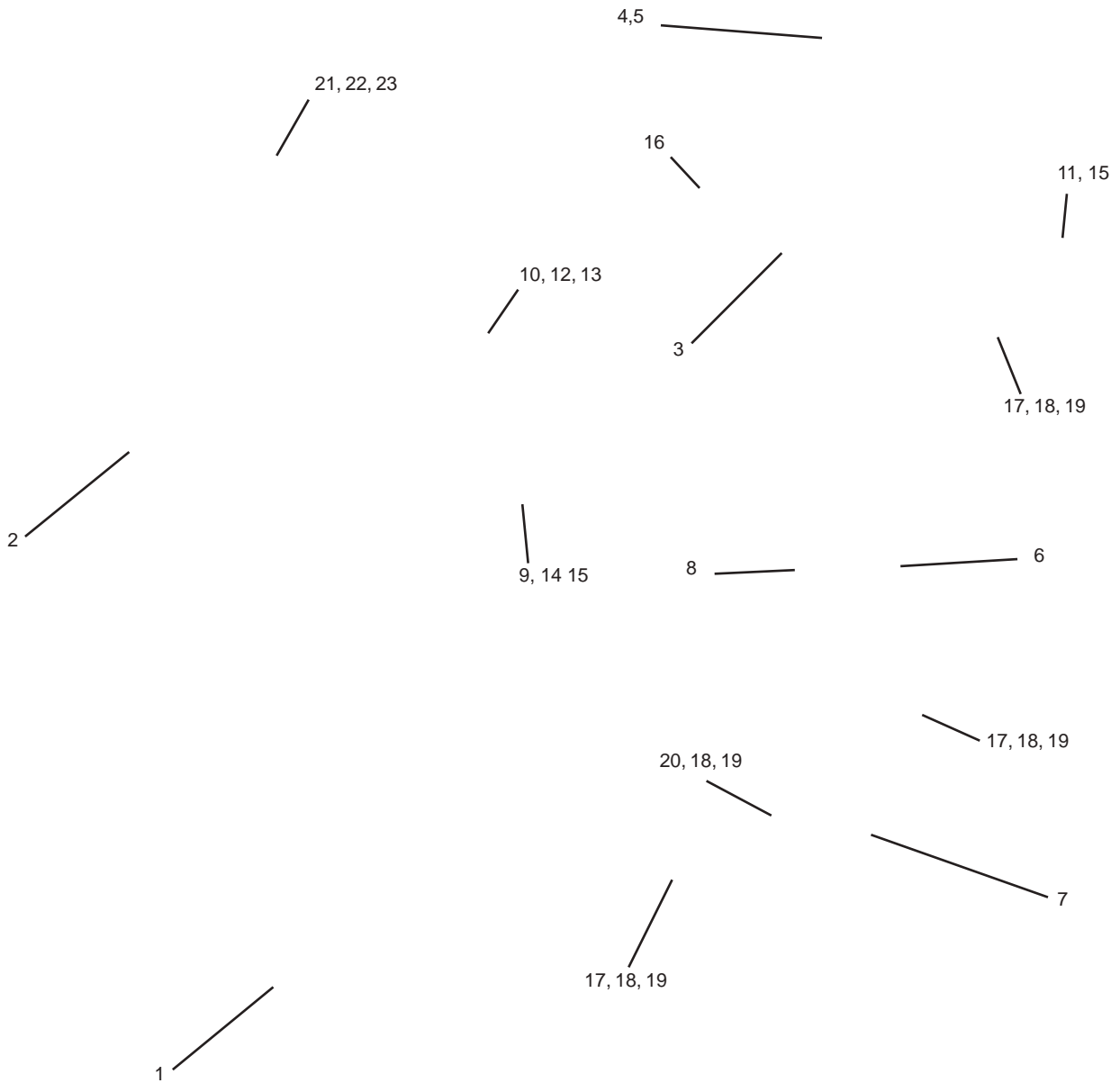




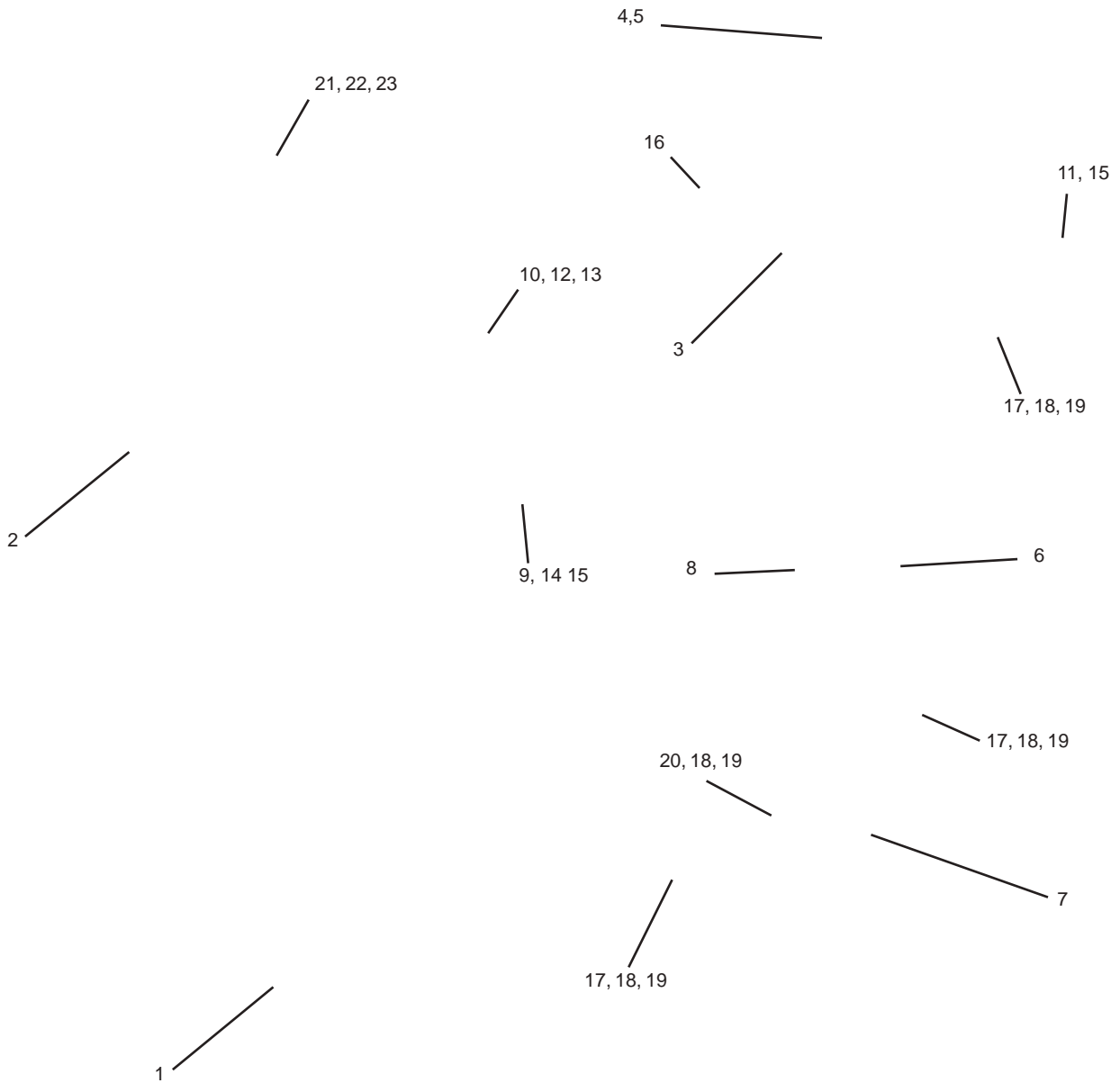
<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3203M2022	PANEL	PANNEAU	PANEL	TAFEL	4
2	3203-10737	DIAGONAL	DIAGONALE	DIAGONAL	DIAGONALE	1
3	3203-10671	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
4	3202-10082	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
5	3202-10083	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
6	3202-10084	ESCALERA	ECELLE	LADDER	LEITER	1
7	3202-10086	ESCALERA	ECELLE	LADDER	LEITER	1
8	3203K972	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
9	10200070.14	BULON	AXE	PIN	BOLZEN	2
10	10300080.14	BULON	AXE	PIN	BOLZEN	24
11	20200030.11	CLAVIJA	GOUPILLE	PIN	VORSTECKER	2
12	ARP31F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	48
13	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	48
14	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
15	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
16	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
17	093110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	8
18	ARG10D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	12
19	0934101508	TUERCA	ECROU	NUT	MUTTER	12
20	093310150025088	TORNILLO	VIS	BOLT	SCHRAUBE	4
21	10600185E.25	BULON	AXE	PIN	BOLZEN	8
22	20160160.25	CLAVIJA	GOUPILLE	PIN	VORSTECKER	4
23	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3203M2396	PANEL	PANNEAU	PANEL	TAFEL	4
2	3203-10737	DIAGONAL	DIAGONALE	DIAGONAL	DIAGONALE	1
3	3203-10671	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
4	3202-10082	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
5	3202-10083	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
6	3202-10084	ESCALERA	ECELLE	LADDER	LEITER	1
7	3202-10086	ESCALERA	ECELLE	LADDER	LEITER	1
8	3203K972	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
9	10200070.14	BULON	AXE	PIN	BOLZEN	2
10	10300080.14	BULON	AXE	PIN	BOLZEN	24
11	20200030.11	CLAVIJA	GOUPILLE	PIN	VORSTECKER	2
12	ARP31F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	48
13	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	48
14	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
15	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
16	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
17	093110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	8
18	ARG10D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	12
19	0934101508	TUERCA	ECROU	NUT	MUTTER	12
20	093310150025088	TORNILLO	VIS	BOLT	SCHRAUBE	4
21	10600185E.25	BULON	AXE	PIN	BOLZEN	8
22	20160160.25	CLAVIJA	GOUPILLE	PIN	VORSTECKER	4
23	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4

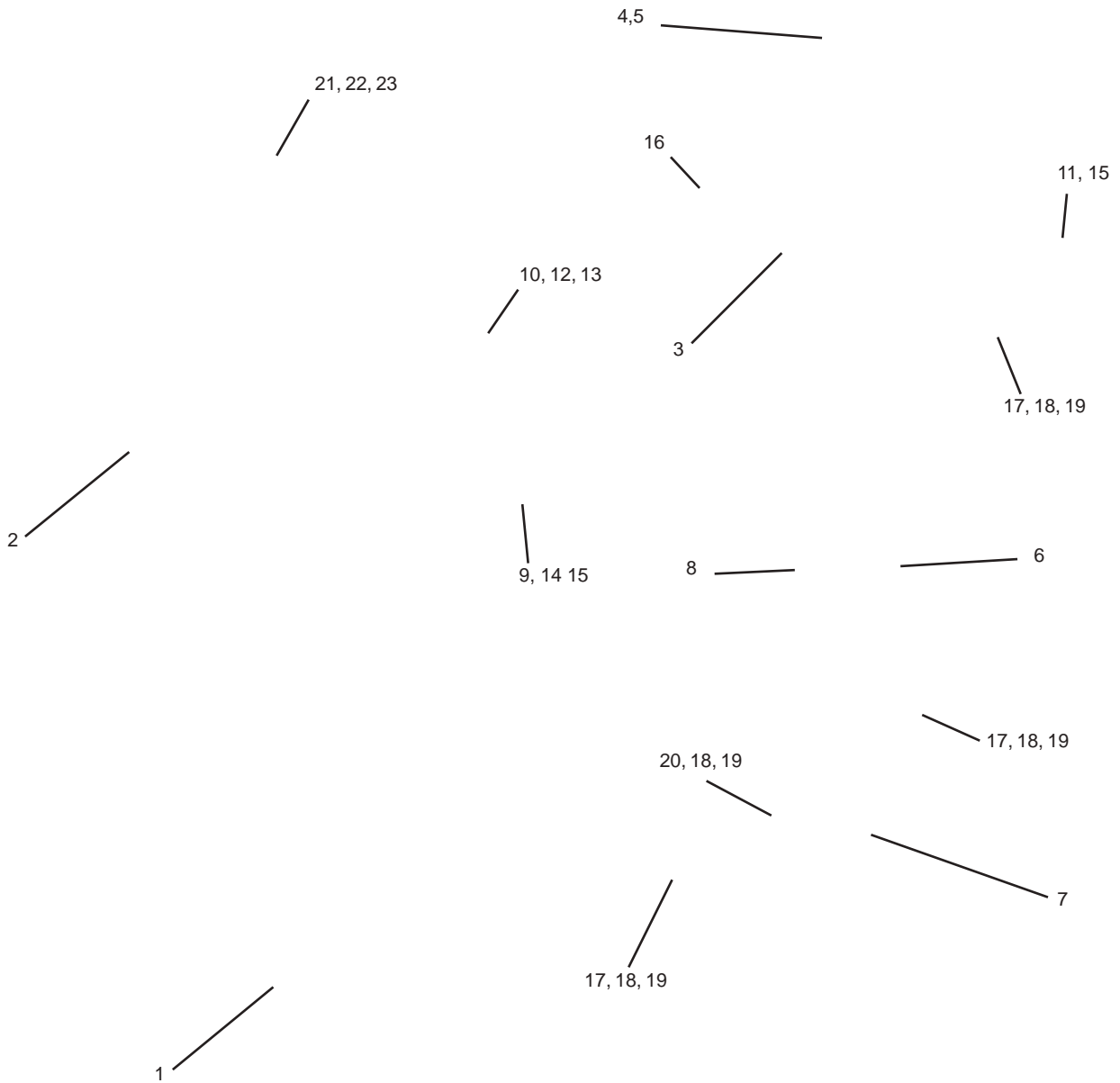


<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3203M1675	PANEL	PANNEAU	PANEL	TAFEL	4
2	3203-10737	DIAGONAL	DIAGONALE	DIAGONAL	DIAGONALE	1
3	3203-10671	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
4	3202-10082	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
5	3202-10083	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
6	3202-10084	ESCALERA	ECELLE	LADDER	LEITER	1
7	3202-10086	ESCALERA	ECELLE	LADDER	LEITER	1
8	3203K972	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
9	10200070.14	BULON	AXE	PIN	BOLZEN	2
10	10200070.14	BULON	AXE	PIN	BOLZEN	24
11	20200030.11	CLAVIJA	GOUPILLE	PIN	VORSTECKER	2
12	ARP21F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	48
13	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	48
14	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
15	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
16	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
17	093110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	8
18	ARG10D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	12
19	0934101508	TUERCA	ECROU	NUT	MUTTER	12
20	093310150025088	TORNILLO	VIS	BOLT	SCHRAUBE	4
21	10600185E.25	BULON	AXE	PIN	BOLZEN	8
22	20160160.25	CLAVIJA	GOUPILLE	PIN	VORSTECKER	4
23	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4

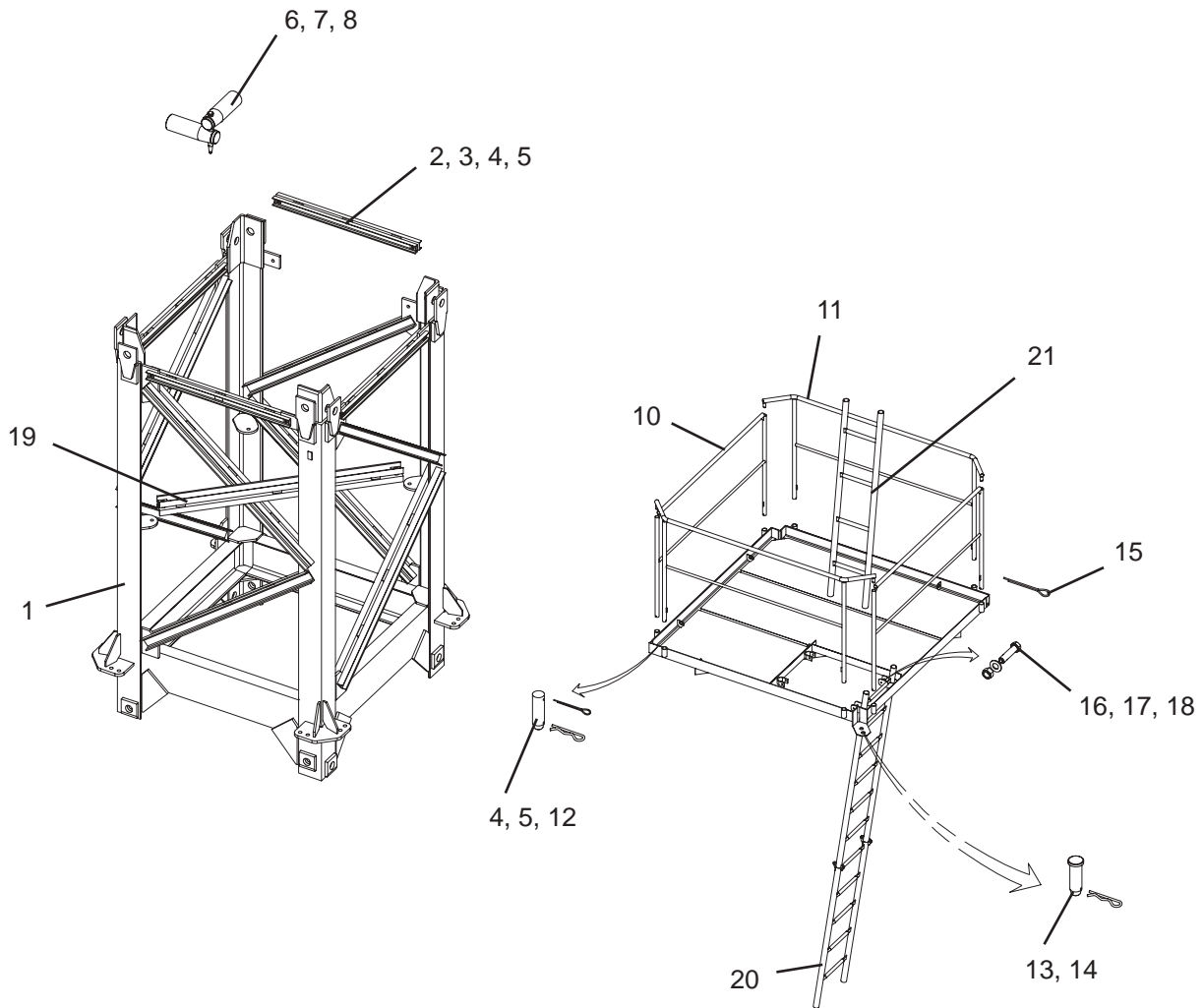


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1	3203M1694	PANEL	PANNEAU	PANEL	TAFEL	4
2	3203-10737	DIAGONAL	DIAGONALE	DIAGONAL	DIAGONALE	1
3	3203-10671	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
4	3202-10082	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
5	3202-10083	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
6	3202-10084	ESCALERA	ECELLE	LADDER	LEITER	1
7	3202-10086	ESCALERA	ECELLE	LADDER	LEITER	1
8	3203K972	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
9	10200070.14	BULON	AXE	PIN	BOLZEN	2
10	10200070.14	BULON	AXE	PIN	BOLZEN	24
11	20200030.11	CLAVIJA	GOUPILLE	PIN	VORSTECKER	2
12	ARP21F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	48
13	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	48
14	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
15	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
16	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
17	093110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	8
18	ARG10D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	12
19	0934101508	TUERCA	ECROU	NUT	MUTTER	12
20	093310150025088	TORNILLO	VIS	BOLT	SCHRAUBE	4
21	10550185E.25	BULON	AXE	PIN	BOLZEN	8
22	20160120.25	CLAVIJA	GOUPILLE	PIN	VORSTECKER	4
23	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4

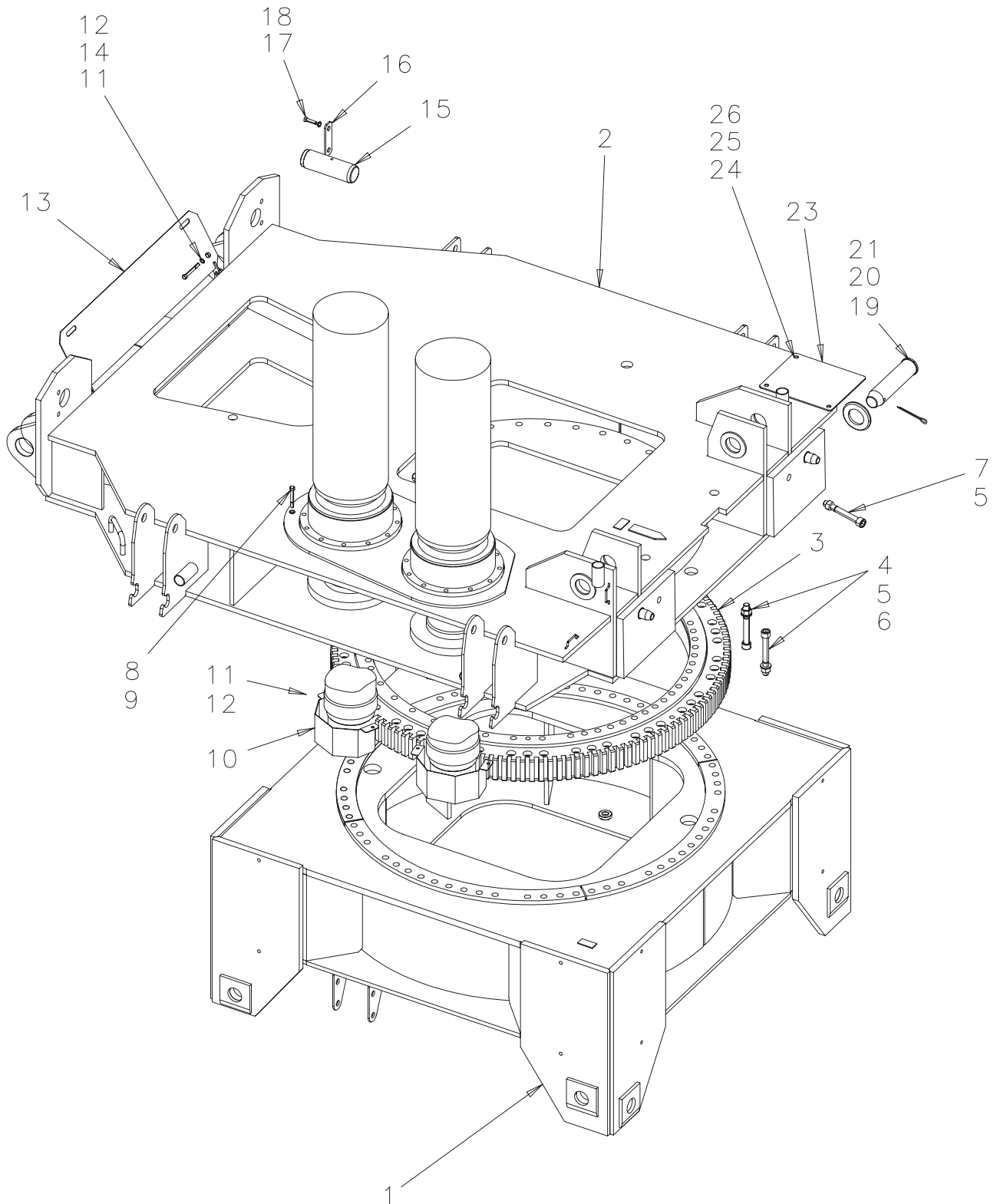




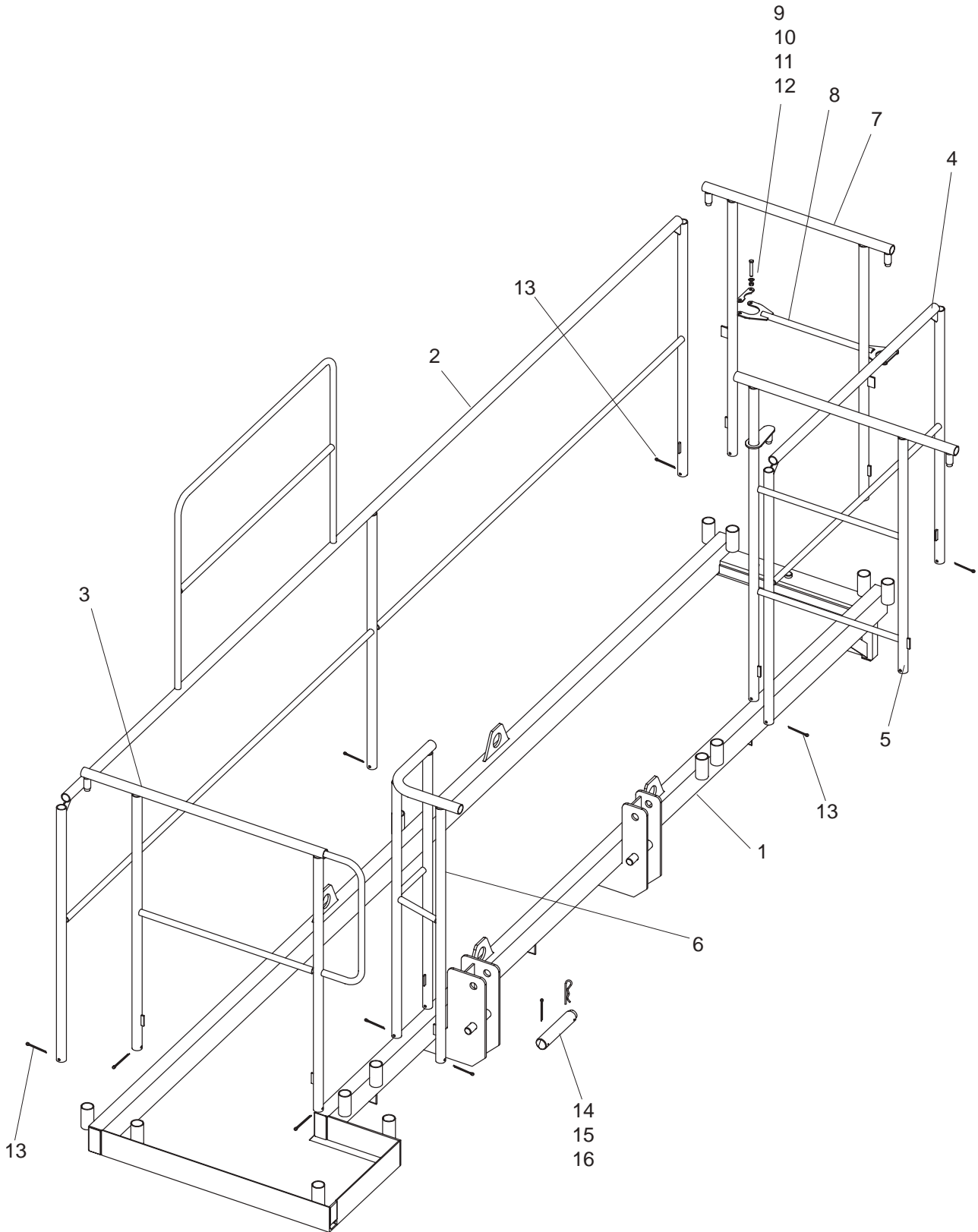
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1	3203M1598	PANEL	PANNEAU	PANEL	TAFEL	4
2	3203-10737	DIAGONAL	DIAGONALE	DIAGONAL	DIAGONALE	1
3	3203-10671	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
4	3202-10082	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
5	3202-10083	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
6	3202-10084	ESCALERA	ECELLE	LADDER	LEITER	1
7	3202-10086	ESCALERA	ECELLE	LADDER	LEITER	1
8	3203K972	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
9	10200070.14	BULON	AXE	PIN	BOLZEN	2
10	10200070.14	BULON	AXE	PIN	BOLZEN	24
11	20200030.11	CLAVIJA	GOUPILLE	PIN	VORSTECKER	2
12	ARP21F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	48
13	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	48
14	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
15	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
16	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
17	093110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	8
18	ARG10D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	12
19	0934101508	TUERCA	ECROU	NUT	MUTTER	12
20	093310150025088	TORNILLO	VIS	BOLT	SCHRAUBE	4
21	10550185E.25	BULON	AXE	PIN	BOLZEN	8
22	20160120.25	CLAVIJA	GOUPILLE	PIN	VORSTECKER	4
23	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3203-20574	MONTANTE	MONTANT	CORNER BEAM	ECKSTUETZE	1
2	3203-20679	DIAGONAL	DIAGONALE	DIAGONAL	DIAGONALE	4
3	1020070.14	BULON	AXE	PIN	BOLZEN	8
4	ARP21F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
5	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	18
6	10550185E.25	BULON	AXE	PIN	BOLZEN	8
7	20160120.25	CLAVIJA	GOUPILLE	PIN	VORSTECKER	4
8	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
9	3203-10671	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
10	3202-10082	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
11	3202-10083	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
12	10200070.14	BULON	AXE	PIN	BOLZEN	2
13	20200030.11	BULON	AXE	PIN	BOLZEN	2
14	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
15	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
16	03110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	4
17	ARG10D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
18	0934101508	TUERCA	ECROU	NUT	MUTTER	4
19	3203-10737	DIAGONAL	DIAGONALE	DIAGONAL	DIAGONALE	1
20	3202-20178	ESCALERA	EHELLE	LADDER	LEITER	1
21	3202-20695	ESCALERA	EHELLE	LADDER	LEITER	1



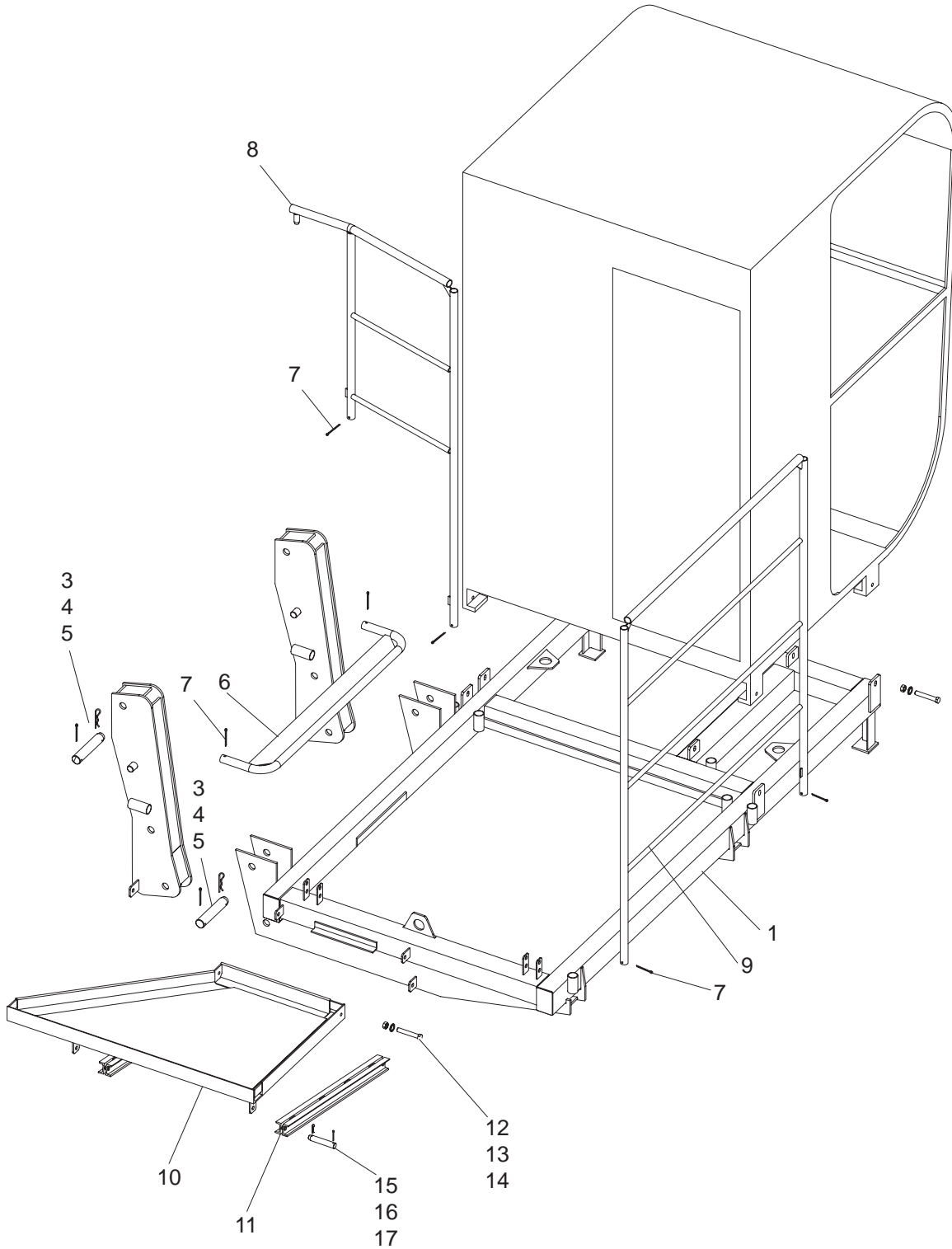
Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	3204-20620	PORTACORONA	CHASSIS-COURONNE	SLEWING RING SUPPORT	DREHRADHALTERUNG	1
2	3203-21355	PORTACORONA	CHASSIS-COURONNE	SLEWING RING SUPPORT	DREHRADHALTERUNG	1
3	CORE1360.03B3	CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
4	091220250160109	TORNILLO	VIS	BOLT	SCHRAUBE	126
5	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	128
6	0934202508	TUERCA	ECROU	NUT	MUTTER	126
7	091220250070109	TORNILLO	VIS	BOLT	SCHRAUBE	2
8	093114200045088	TORNILLO	VIS	BOLT	SCHRAUBE	24
9	ARP15D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	24
10	OL10423	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	2
11	093310150025088	TORNILLO	VIS	BOLT	SCHRAUBE	8
12	ARG10D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
13	3204-21497	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
14	0934162008	TUERCA	ECROU	NUT	MUTTER	2
15	BULÓN-20157	BULON	AXE	PIN	BOLZEN	2
16	3204-21058	BRIDA	BRIDE	FLANGE	FLANSCH	2
17	093116200003088	TORNILLO	VIS	BOLT	SCHRAUBE	4
18	ARP17D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
20	BULÓN-20159	BULON	AXE	PIN	BOLZEN	2
21	ARP62F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
22	PSA10*100	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
23	3204-21583	TAPA	COUVERCLE	COVER	DECKEL	1
24	093314200060088	TORNILLO	VIS	BOLT	SCHRAUBE	3
25	ARP15F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	3
26	0934142008	TUERCA	ECROU	NUT	MUTTER	3



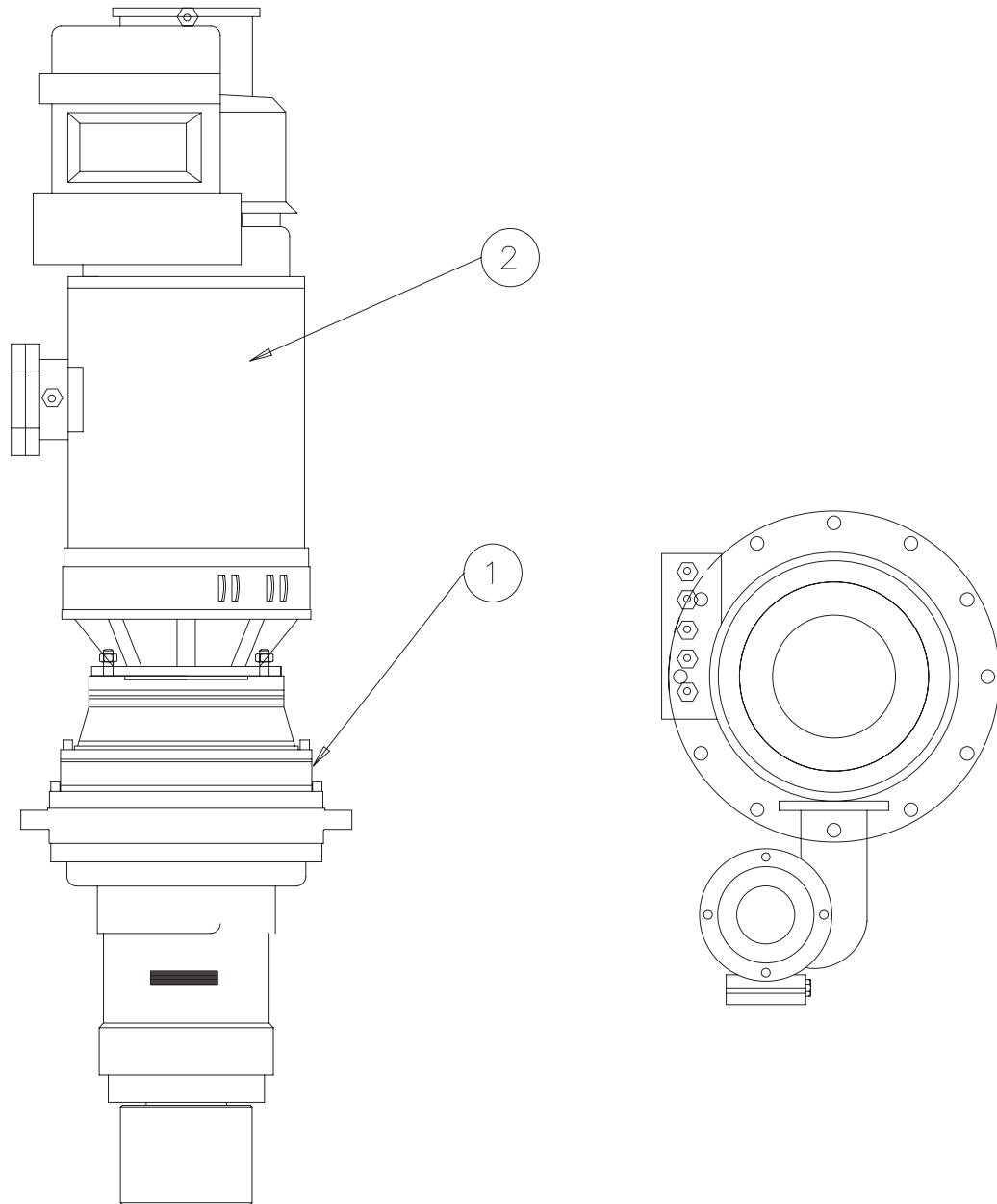
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1	3204-21100	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
2	3204-21173	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
3	3204-21141	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
4	3204-21145	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
5	3204-21509	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
6	3204-21149	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
7	3204-21155	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
8	3204-21506	TRAVIESA	TRAVERSE	CROSSTIE	TRAVERSE	1
9	OL-20427	BRIDA	BRIDE	FLANGE	FLANSCH	2
10	093108125020088	TORNILLO	VIS	BOLT	SCHRAUBE	4
11	ARP8.4F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
12	0934081258	TUERCA	ECROU	NUT	MUTTER	4
13	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	14
14	10250160.14	BULON	AXE	PIN	BOLZEN	2
15	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
16	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2

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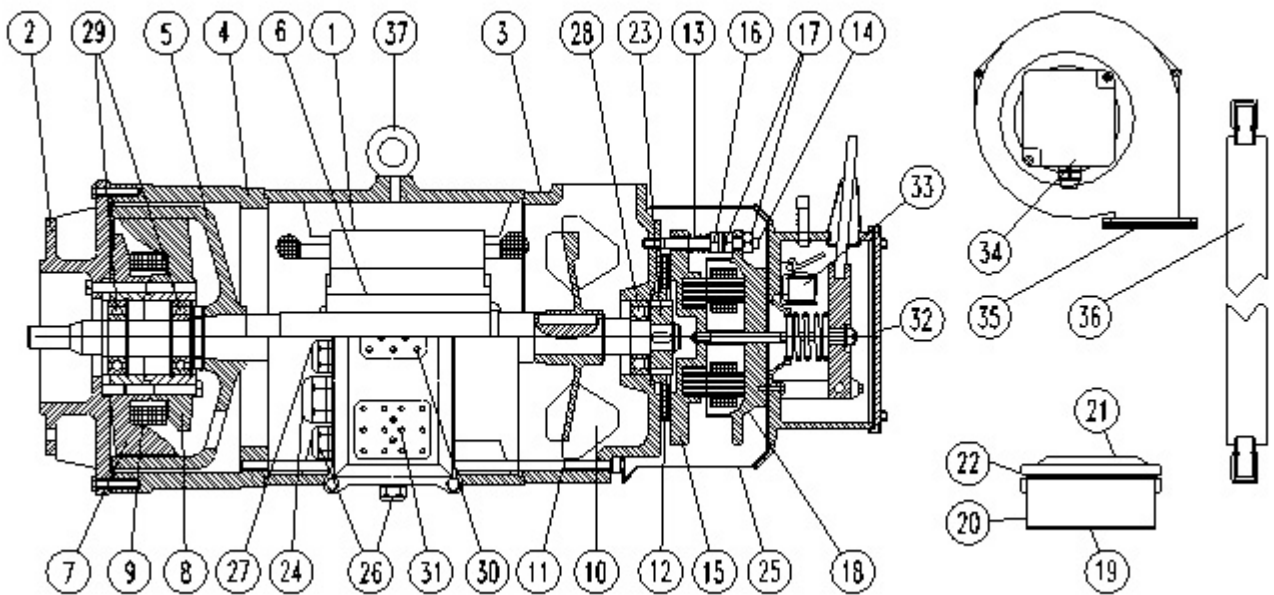




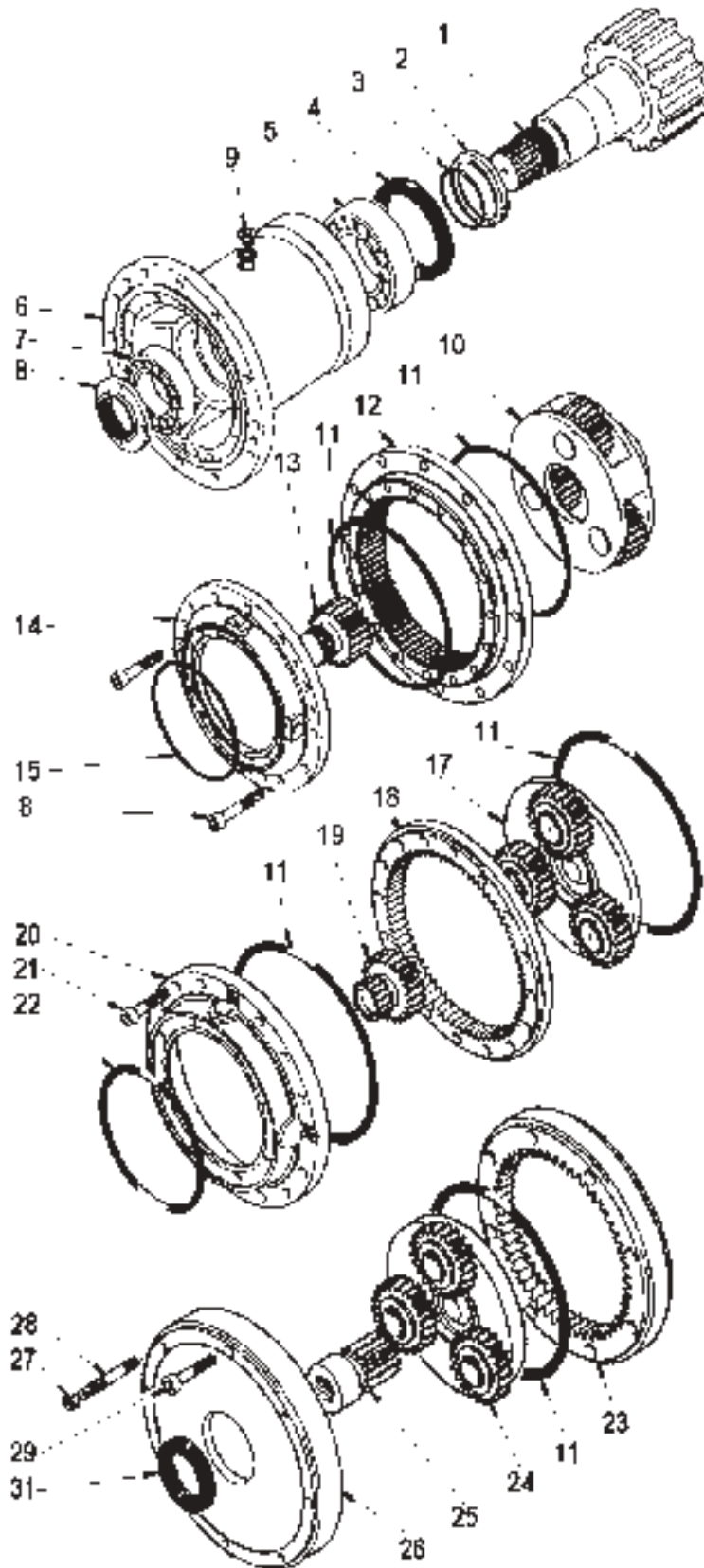
<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3204-21378	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
2	3204-21529	PUNTAL	BRACON	KNEE-BRACE	BINDER	2
3	10300150.14	BULON	AXE	PIN	BOLZEN	6
4	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	6
5	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	6
6	3204-21539	ESCALERA	ECELLE	LADDER	LEITER	1
7	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	6
8	3204-21478	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
9	3204-21453	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
10	3204-21558	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
11	3204-21572	PUNTAL	BRACON	KNEE-BRACE	BINDER	2
12	093112175050088	TORNILLO	VIS	BOLT	SCHRAUBE	2
13	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
14	0934121758	TUERCA	ECROU	NUT	MUTTER	2
15	10150045.11	BULON	AXE	PIN	BOLZEN	4
16	PSA3*0	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
17	PSR3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	REDPL.TE21	REDUCTOR	REDUCTEUR	GEAR-BOX	GETRIEBE	1
2	MTRCF3336-3D	MOTOR	MOTEUR	MOTOR	MOTOR	1

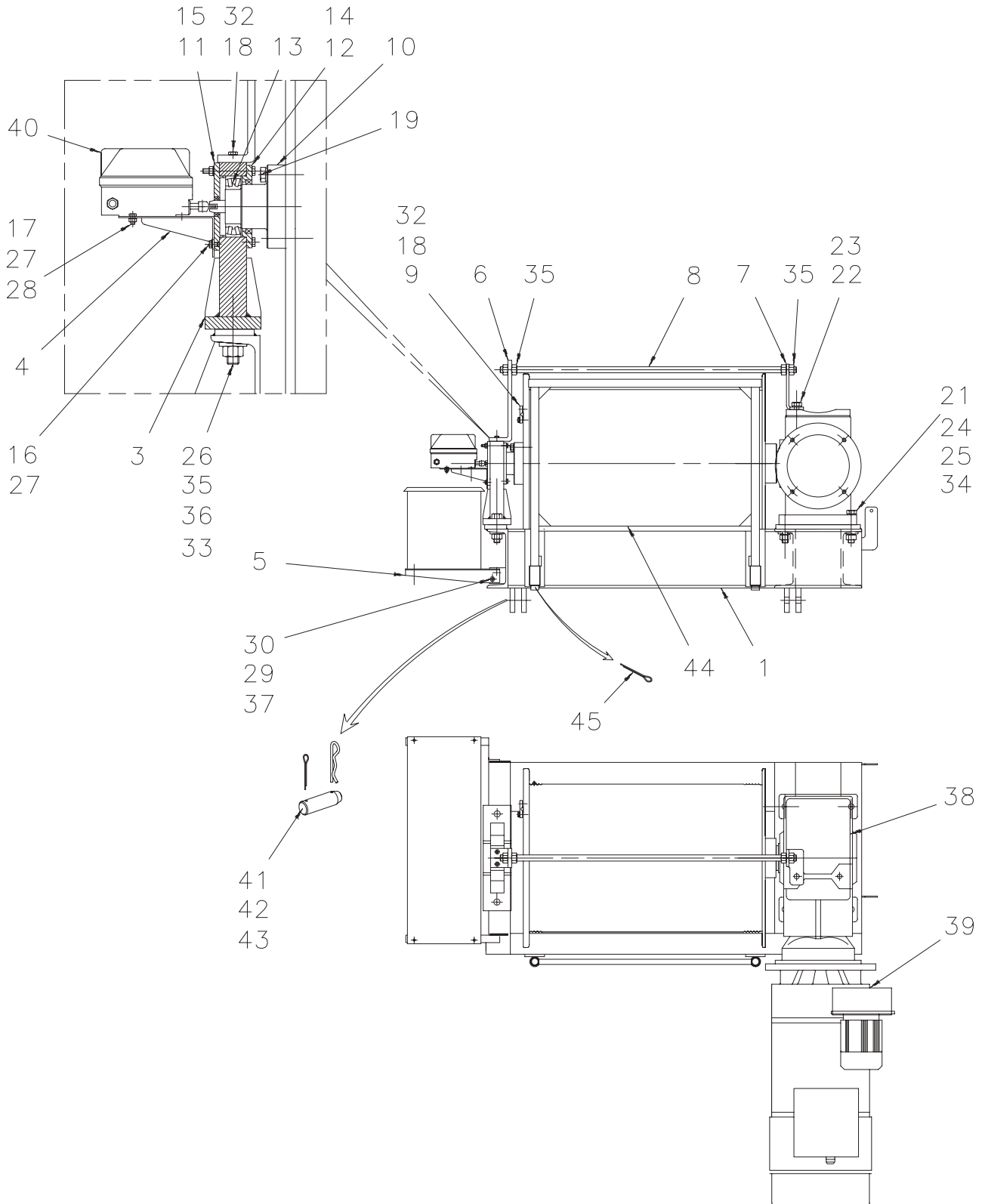


Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		ESTATOR	STATOR	STATOR	STATOR	1
2		BRIDA DELANTERA	FLASQUE AVANT	DRIVE-ENDSHIELD	A-LAGERSCHILD	1
3		BRIDA FRENO	FLASQUE FREIN	BRAKE-ENDSHIELD	BEMSE-LAGERSCHILD	1
4		CARCASA	CARCASSE	CASING	GEHAEUSE	1
5		CARCASA RALENTIZAD.	CARTER RALENTISSEUR	EDDY C.BRAKE HOUSING	WIRBELSTROMB.GEHAUSE	1
6		ROTOR	ROTOR	ROTOR	ROTOR	1
7		BLOQUE	BLOC	BLOCK	BLOCK	1
8		BLOQUE	BLOC	BLOCK	BLOCK	1
9		BOBINA RALENTIZADOR	BOBINE RALENTISSEUR	EDDY C,-BRAKE COIL	WIRBELSTROMB. SPULE	1
10		VENTILADOR	VENTILATEUR	FAN	LUFTER	1
11		VARILLA	TIGE	ROD	STANGE	4
12		DISCO FRENO	DISQUE FREIN	BRAKE DISC	BREMSSCHEIBE	1
13		MUELLE	RESSORT	SPRING	BREMSFEDER	3
14		COLUMNA FRENO	COLONNE DE FREIN	BRAKE COLUMN	FUHRUNGSSAULE BREMSE	3
15		ELECTROIMAN MOVIL	ARMATURE	ARMATURE	BREMSANKER	1
16		TUERCA	ECROU	NUT	MUTTER	3
17		TUERCA	ECROU	NUT	MUTTER	6
18		BOBINA FRENO	ELECTRO-AIMANT	BRAKE COIL	BREMSPULE	1
19		JUNTA	JOINT	GASKET	DICHTUNG	1
20		CAJA DE BORNES	BOITE A BORNES	TERMINAL BOX FRAME	KLEMMENKASTEN	1
21		TAPA	COUVERCLE	COVER	DECKEL	1
22		JUNTA	JOINT	GASKET	DICHTUNG	1
23		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NABE, VIELKEILVERZHN	1
24		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	1
25		TAPA FRENO	CAPOT FREIN	BRAKE COVER	BREMSGEHAUSE	1
26		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	2
27		PRENSAESTOPAS	PRESSE-ETOUPE	GLAND	BUCHSE	1
28		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
29		RODAMIENTO	ROULEMENT	BEARING	LAGER	2
30		BORNE	BORNE	TERMINAL	KLEMME	1
31		BORNE	BORNE	TERMINAL	KLEMME	1
32		TOPE	BUTTOIR	STOP	ANSCHLAG	1
33		ELECTRIMAN	ELECTRO-AIMANT	ELECTRO-MAGNET	ELEKTROMAGNET	1
34		VENTILADOR	VENTILATEUR	FAN	LUFTER	1
35		CARCASA	CARCASSE	CASING	GEHAEUSE	1
36		CARCASA	CARCASSE	CASING	GEHAEUSE	1
37		CANCAMO	CHEVILLE A `OEILLET	EYEBOLT	ZUGOESE	1



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
2		CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	1
3		JUNTA	JOINT	GASKET	DICHTUNG	1
4		RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1
5		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
6		CARCASA	CARCASSE	CASING	GEHAEUSE	1
7		RODAMIENTO	ROULEMENT	BEARING	LAGER	1
8		TUERCA	ECROU	NUT	MUTTER	1
9		TAPON	BOUCHON	PLUG	STOEPSEL	1
10		REDUC. COMPLETA	ENSEMBLE REDUCT.	REDUCT. ASSEMBLY	UNTERSETZUNGSSRUF	1
11		JUNTA	JOINT	GASKET	DICHTUNG	5
12		ANILLO DENTADO	ANNEAU DENTEE	TOOTHED RING	ZAHNKRANZ	1
13		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
14		TAPA	COUVERCLE	COVER	DECKEL	1
15		JUNTA	JOINT	GASKET	DICHTUNG	1
16		TORNILLO	VIS	BOLT	SCHRAUBE	4
17		REDUC. COMPLETA	ENSEMBLE REDUCT.	REDUCT. ASSEMBLY	UNTERSETZUNGSSRUF	1
18		ANILLO DENTADO	ANNEAU DENTEE	TOOTHED RING	ZAHNKRANZ	1
19		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
20		TAPA	COUVERCLE	COVER	DECKEL	1
21		TORNILLO	VIS	BOLT	SCHRAUBE	12
22		JUNTA	JOINT	GASKET	DICHTUNG	1
23		ANILLO DENTADO	ANNEAU DENTEE	TOOTHED RING	ZAHNKRANZ	1
24		REDUC. COMPLETA	ENSEMBLE REDUCT.	REDUCT. ASSEMBLY	UNTERSETZUNGSSRUF	1
25		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
26		TAPA	COUVERCLE	COVER	DECKEL	1
27		TUERCA	ECROU	NUT	MUTTER	4
28		ESPARRAGO	GOUJON	SHANK	STEBOLZEN	4
29		TORNILLO	VIS	BOLT	SCHRAUBE	4
30		RETEN	BAGUE D'ETANCHEITE	SEAL	DICHTRING	1

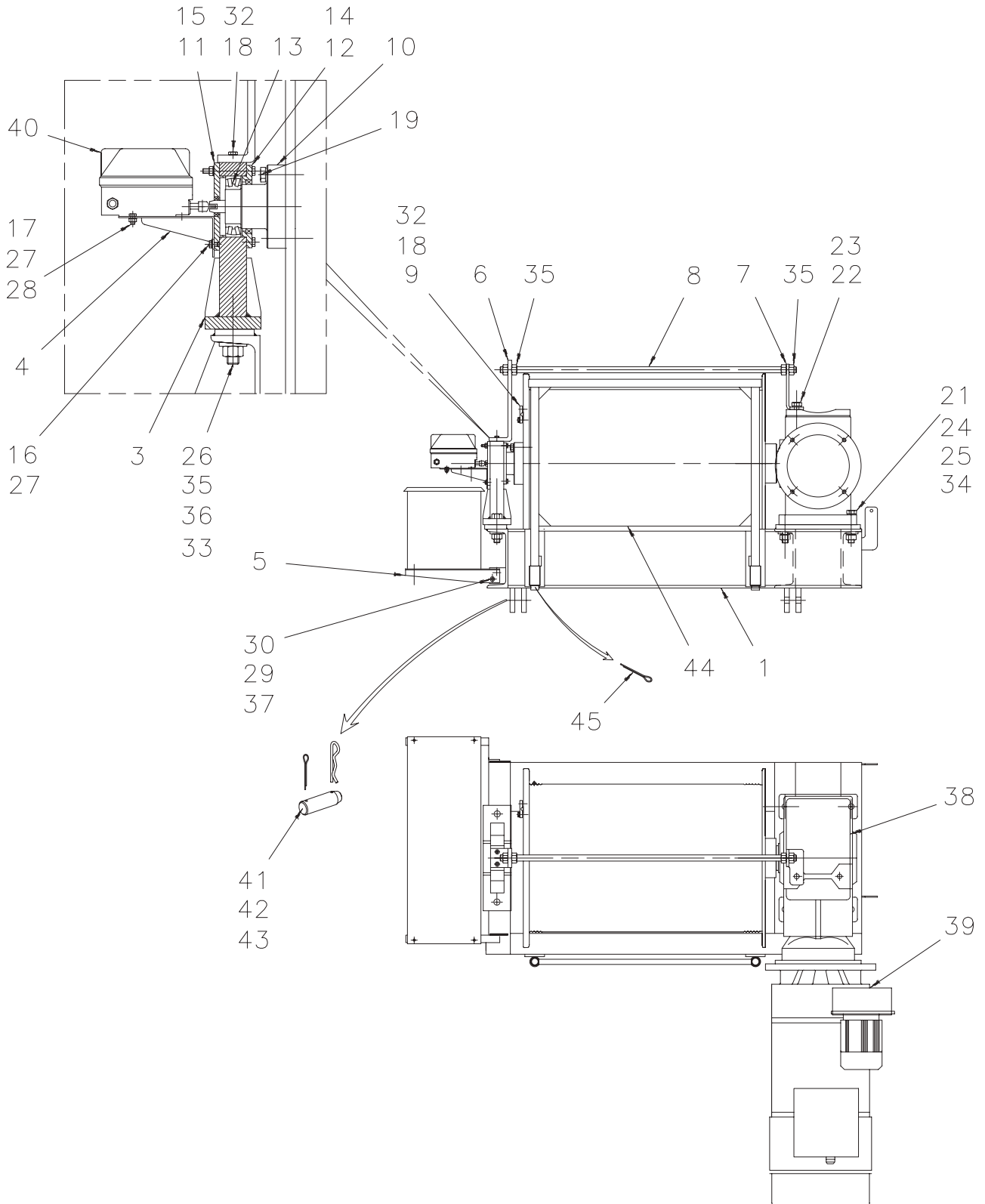




Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1404-10577	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	1404-10571	TAMBOR	TAMBOUR	DRUM	TROMMEL	1
3	1408M8516	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
4	1408P1243-G	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
5	1404-10559	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
6	1404-10583	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
7	OL-11359	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
8	1408P8248	VARILLA	TIGE	ROD	STANGE	1
9	3301P195-03	BRIDA	BRIDE	FLANGE	FLANSCH	2
10	1406-10028	EJE	AXE	AXLE	ACHSE	1
11	1408P8273	TAPA	COUVERCLE	COVER	DECKEL	1
12	1408P8274	TAPA	COUVERCLE	COVER	DECKEL	1
13	ROD22214HL	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
14	RTN110*90*12	RETEN DE ACEITE	BAGUE D'ETANCHEITE	SEAL	DICHtring	1
15	RTN40*25*7	RETEN DE ACEITE	BAGUE D'ETANCHEITE	SEAL	DICHtring	1
16	093308125012088	TORNILLO	VIS	BOLT	SCHRAUBE	2
17	093308125015088	TORNILLO	VIS	BOLT	SCHRAUBE	2
18	093312175035088	TORNILLO	VIS	BOLT	SCHRAUBE	6
19	093318250075088	TORNILLO	VIS	BOLT	SCHRAUBE	6
20	093110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	4
21	093322250110088	TORNILLO	VIS	BOLT	SCHRAUBE	4
22	093320250030088	TORNILLO	VIS	BOLT	SCHRAUBE	1
23	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
24	0934222508	TUERCA	ECROU	NUT	MUTTER	4
25	ARP23D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
26	093324300110088	TORNILLO	VIS	BOLT	SCHRAUBE	2
27	ARP8.4F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
28	0934081258	TUERCA	ECROU	NUT	MUTTER	2
29	0934101508	TUERCA	ECROU	NUT	MUTTER	8
30	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
31	ARP19D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
32	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
33	ARCD25D6918	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
34	ARCD23D6918	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
35	0934243008	TUERCA	ECROU	NUT	MUTTER	6
36	ARP25D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
37	093310150020088	TORNILLO	VIS	BOLT	SCHRAUBE	4
38	REDOC.MA90	REDUCTOR	REDUCTEUR	GEAR-BOX	GETRIEBE	1
39	MTRCF5674-4	MOTOR	MOTEUR	MOTOR	MOTOR	1
40	LMCV3876/SL35	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
41	10250070.14	BULON	AXE	PIN	BOLZEN	4
42	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
43	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
44	3204-21585	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
45	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		TORNILLO	VIS	SCREW	SCHRAUBE	8
2		BRIDA	BRIDE	FLANGE	FLANSCH	1
3		TUERCA	ECROU	NUT	MUTTER	1
4		ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	1
5		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
6		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
7		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
8	ROD32310	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
9	ROD32310	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
10		CHAVETA	CLAVETTE	KEY	PASFEDER	1
11		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
12		CARCASA	CARCASSE	CASING	GEHÄUSE	1
13		TAPON	BOUCHON	PLUG	STÖPSEL	1
14		JUNTA	JOINT	GASKET	DICHTUNG	1
15		TAPA	COUVERCLE	COVER	DECKEL	1
16		TORNILLO	VIS	SCREW	SCHRAUBE	10
17		TAPA	COUVERCLE	COVER	DECKEL	1
18		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
19		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
20	ROD30311	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
21		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
22		CHAVETA	CLAVETTE	KEY	PASFEDER	1
23		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
24		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
26	ROD30311	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
27		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
28		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
29		TAPA	COUVERCLE	COVER	DECKEL	1
30		JUNTA	JOINT	GASKET	DICHTUNG	1
31		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
33	ROD32024	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
34		CHAVETA	CLAVETTE	KEY	PASFEDER	1
35		EJE	AXE	AXLE	ACHSE	1
36		CHAVETA	CLAVETTE	KEY	PASFEDER	1
37		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
38		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
39	ROD32024	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
40		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
41		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
42		TAPA	COUVERCLE	COVER	DECKEL	1
43		JUNTA	JOINT	GASKET	DICHTUNG	1

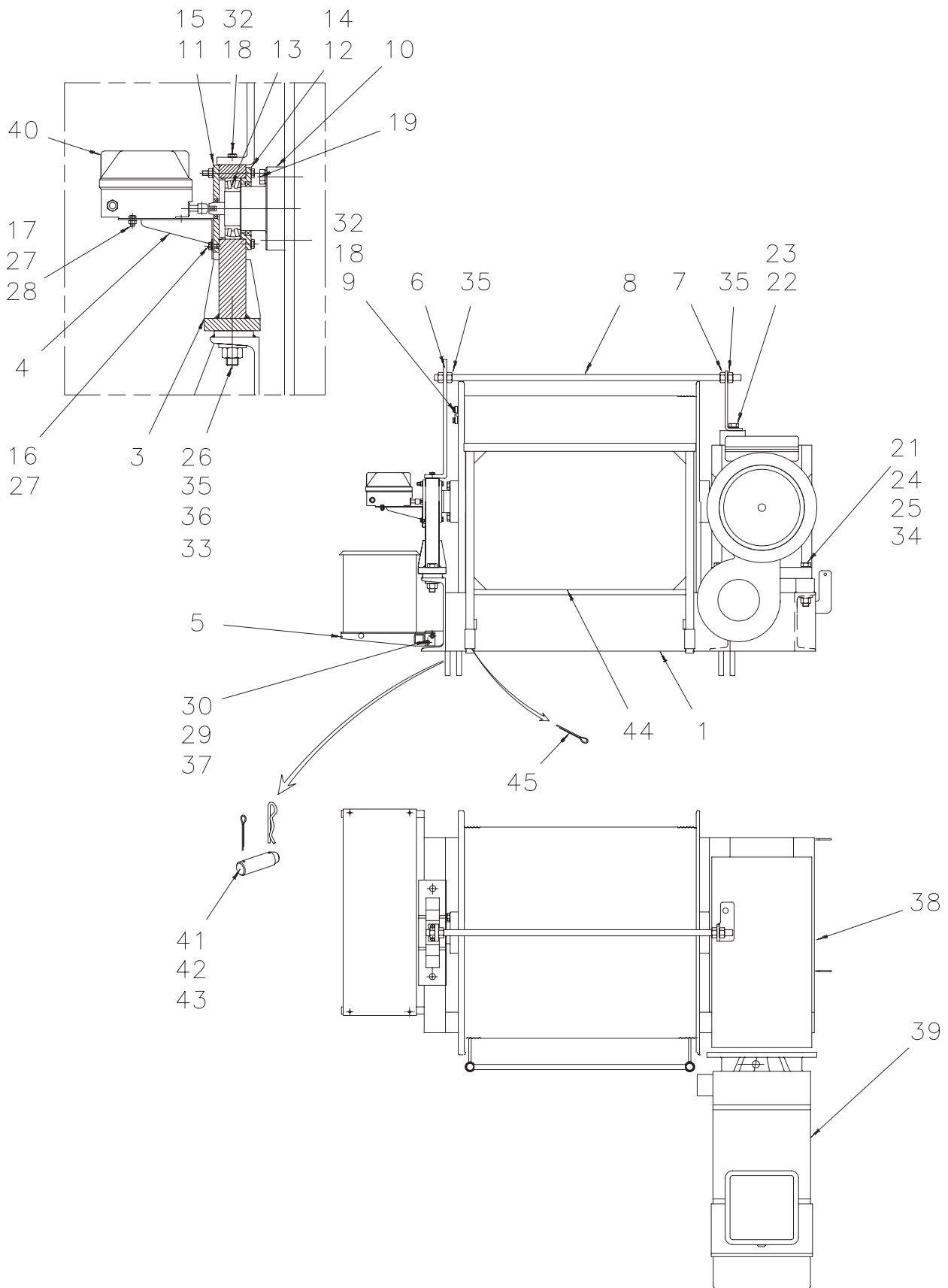


Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1404-10577	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	1404-10571	TAMBOR	TAMBOUR	DRUM	TROMMEL	1
3	1408M8516	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
4	1408P1243-G	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
5	1404-10559	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
6	1404-10583	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
7	OL-11359	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
8	1408P8248	VARILLA	TIGE	ROD	STANGE	1
9	3301P195-03	BRIDA	BRIDE	FLANGE	FLANSCH	2
10	1406-10028	EJE	AXE	AXLE	ACHSE	1
11	1408P8273	TAPA	COUVERCLE	COVER	DECKEL	1
12	1408P8274	TAPA	COUVERCLE	COVER	DECKEL	1
13	ROD22214HL	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
14	RTN110*90*12	RETEN DE ACEITE	BAGUE D'ETANCHEITE	SEAL	DICHtring	1
15	RTN40*25*7	RETEN DE ACEITE	BAGUE D'ETANCHEITE	SEAL	DICHtring	1
16	093308125012088	TORNILLO	VIS	BOLT	SCHRAUBE	2
17	093308125015088	TORNILLO	VIS	BOLT	SCHRAUBE	2
18	093312175035088	TORNILLO	VIS	BOLT	SCHRAUBE	6
19	093318250075088	TORNILLO	VIS	BOLT	SCHRAUBE	6
20	093110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	4
21	093322250110088	TORNILLO	VIS	BOLT	SCHRAUBE	4
22	093320250030088	TORNILLO	VIS	BOLT	SCHRAUBE	1
23	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
24	0934222508	TUERCA	ECROU	NUT	MUTTER	4
25	ARP23D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
26	093324300110088	TORNILLO	VIS	BOLT	SCHRAUBE	2
27	ARP8.4F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
28	0934081258	TUERCA	ECROU	NUT	MUTTER	2
29	0934101508	TUERCA	ECROU	NUT	MUTTER	8
30	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
31	ARP19D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
32	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
33	ARCD25D6918	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
34	ARCD23D6918	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
35	0934243008	TUERCA	ECROU	NUT	MUTTER	6
36	ARP25D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
37	093310150020088	TORNILLO	VIS	BOLT	SCHRAUBE	4
38	REDOC.MA90	REDUCTOR	REDUCTEUR	GEAR-BOX	GETRIEBE	1
39	MTRCF5674-4	MOTOR	MOTEUR	MOTOR	MOTOR	1
40	INDI.A200	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
41	10250070.14	BULON	AXE	PIN	BOLZEN	4
42	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
43	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
44	3204-21585	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
45	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		TORNILLO	VIS	SCREW	SCHRAUBE	8
2		BRIDA	BRIDE	FLANGE	FLANSCH	1
3		TUERCA	ECROU	NUT	MUTTER	1
4		ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	1
5		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
6		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
7		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
8	ROD32310	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
9	ROD32310	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
10		CHAVETA	CLAVETTE	KEY	PASFEDER	1
11		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
12		CARCASA	CARCASSE	CASING	GEHÄUSE	1
13		TAPON	BOUCHON	PLUG	STÖPSEL	1
14		JUNTA	JOINT	GASKET	DICHTUNG	1
15		TAPA	COUVERCLE	COVER	DECKEL	1
16		TORNILLO	VIS	SCREW	SCHRAUBE	10
17		TAPA	COUVERCLE	COVER	DECKEL	1
18		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
19		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
20	ROD30311	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
21		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
22		CHAVETA	CLAVETTE	KEY	PASFEDER	1
23		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
24		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
26	ROD30311	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
27		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
28		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
29		TAPA	COUVERCLE	COVER	DECKEL	1
30		JUNTA	JOINT	GASKET	DICHTUNG	1
31		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
33	ROD32024	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
34		CHAVETA	CLAVETTE	KEY	PASFEDER	1
35		EJE	AXE	AXLE	ACHSE	1
36		CHAVETA	CLAVETTE	KEY	PASFEDER	1
37		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
38		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
39	ROD32024	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
40		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
41		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
42		TAPA	COUVERCLE	COVER	DECKEL	1
43		JUNTA	JOINT	GASKET	DICHTUNG	1

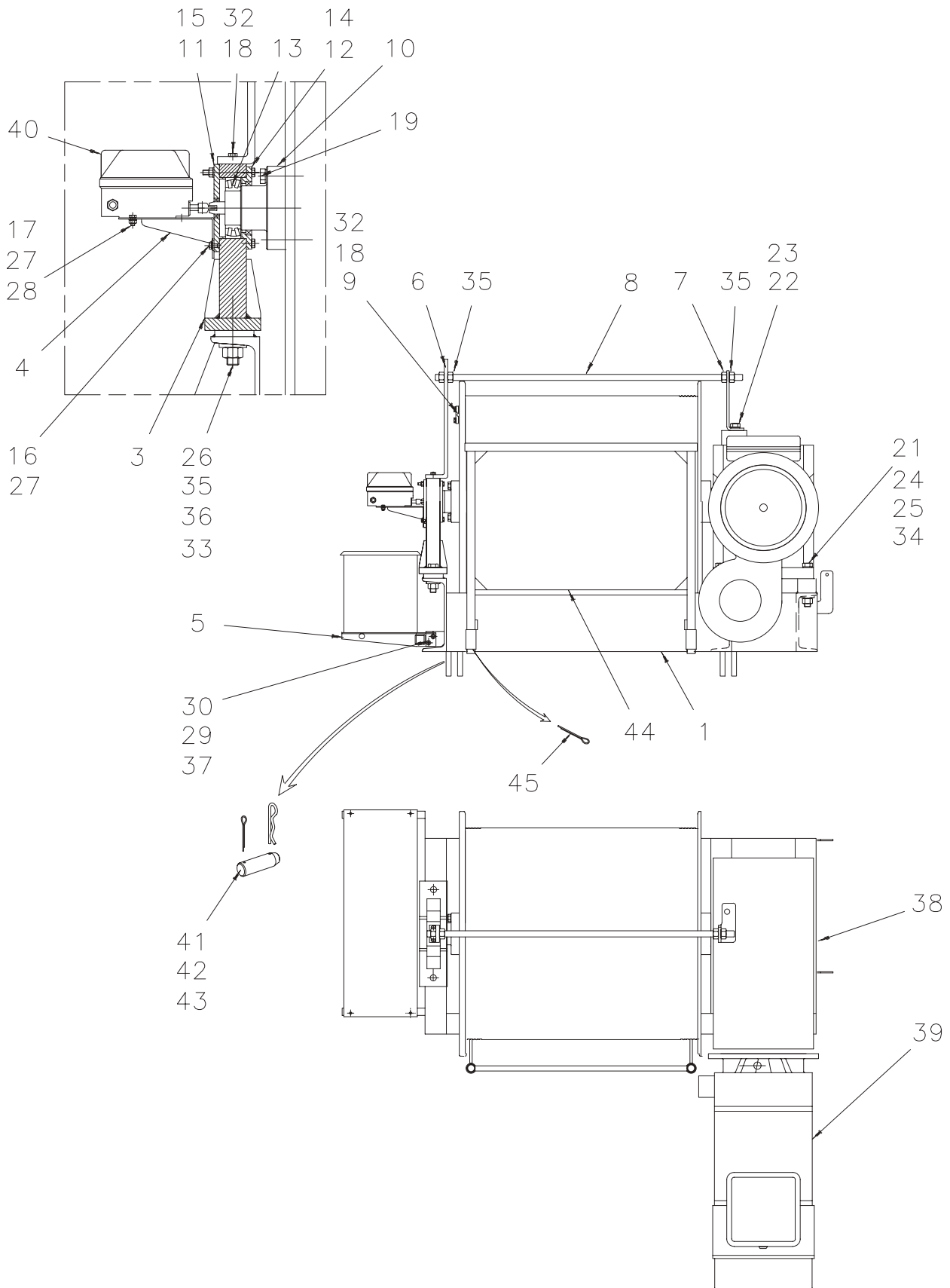




Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1404-10544	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	1404-10540	TAMBOR	TAMBOUR	DRUM	TROMMEL	1
3	1408M8422	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
4	1408P1243-G	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
5	1404-10559	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
6	1404-10311	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
7	1404-10363	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
8	1406-10029	VARILLA	TIGE	ROD	STANGE	1
9	3301P195-03	BRIDA	BRIDE	FLANGE	FLANSCH	2
10	1406-10028	EJE	AXE	AXLE	ACHSE	1
11	1408P8273	TAPA	COUVERCLE	COVER	DECKEL	1
12	1408P8274	TAPA	COUVERCLE	COVER	DECKEL	1
13	ROD22214HL	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
14	RTN110*90*12	RETEN DE ACEITE	BAGUE D'ETANCHEITE	SEAL	DICHtring	1
15	RTN40*25*7	RETEN DE ACEITE	BAGUE D'ETANCHEITE	SEAL	DICHtring	1
16	093308125012088	TORNILLO	VIS	BOLT	SCHRAUBE	2
17	093308125015088	TORNILLO	VIS	BOLT	SCHRAUBE	2
18	093312175035088	TORNILLO	VIS	BOLT	SCHRAUBE	6
19	093318250075088	TORNILLO	VIS	BOLT	SCHRAUBE	6
20	093110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	4
21	093324300160088	TORNILLO	VIS	BOLT	SCHRAUBE	4
22	093320250040088	TORNILLO	VIS	BOLT	SCHRAUBE	1
23	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
24	0934243008	TUERCA	ECROU	NUT	MUTTER	4
25	ARP25D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
26	093324300110088	TORNILLO	VIS	BOLT	SCHRAUBE	2
27	ARP8.4F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
28	0934081258	TUERCA	ECROU	NUT	MUTTER	2
29	0934101508	TUERCA	ECROU	NUT	MUTTER	8
30	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
31	ARP19D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
32	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
33	ARCD25D6918	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
34	ARCD23D6918	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
35	0934243008	TUERCA	ECROU	NUT	MUTTER	6
36	ARP25D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
37	093310150020088	TORNILLO	VIS	BOLT	SCHRAUBE	4
38	REDOC.MA100	REDUCTOR	REDUCTEUR	GEAR-BOX	GETRIEBE	1
39	MTRCF5682-4	MOTOR	MOTEUR	MOTOR	MOTOR	1
40	INDI.A200	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
41	10250070.14	BULON	AXE	PIN	BOLZEN	4
42	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
43	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
44	3204-21585	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
45	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		TORNILLO	VIS	SCREW	SCHRAUBE	8
2		BRIDA	BRIDE	FLANGE	FLANSCH	1
3		TUERCA	ECROU	NUT	MUTTER	1
4		ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	1
5		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
6		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
7		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
8	ROD32311	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
9	ROD32311	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
10		CHAVETA	CLAVETTE	KEY	PASFEDER	1
11		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
12		CARCASA	CARCASSE	CASING	GEHÄUSE	1
13		TAPON	BOUCHON	PLUG	STÖPSEL	1
14		JUNTA	JOINT	GASKET	DICHTUNG	1
15		TAPA	COUVERCLE	COVER	DECKEL	1
16		TORNILLO	VIS	SCREW	SCHRAUBE	10
17		TAPA	COUVERCLE	COVER	DECKEL	1
18		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
19		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
20	ROD30312	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
21		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
22		CHAVETA	CLAVETTE	KEY	PASFEDER	1
23		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
24		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
26	ROD30312	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
27		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
28		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
29		TAPA	COUVERCLE	COVER	DECKEL	1
30		JUNTA	JOINT	GASKET	DICHTUNG	1
31		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
33	ROD32026	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
34		CHAVETA	CLAVETTE	KEY	PASFEDER	1
35		EJE	AXE	AXLE	ACHSE	1
36		CHAVETA	CLAVETTE	KEY	PASFEDER	1
37		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
38		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
39	ROD32026	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
40		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
41		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
42		TAPA	COUVERCLE	COVER	DECKEL	1
43		JUNTA	JOINT	GASKET	DICHTUNG	1

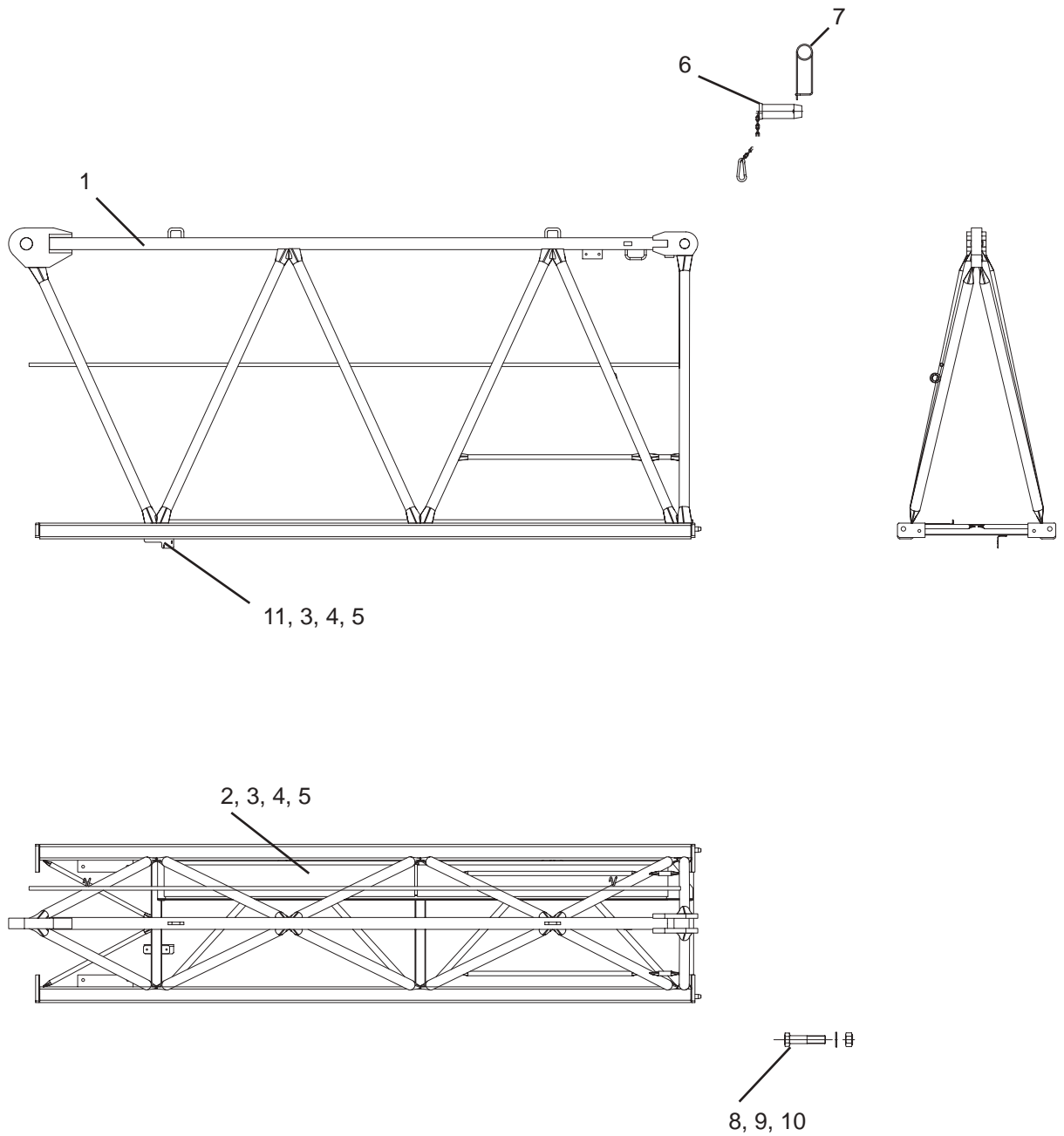


Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1404-10544	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	1404-10540	TAMBOR	TAMBOUR	DRUM	TROMMEL	1
3	1408M8422	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
4	1408P1243-G	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
5	1404-10559	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
6	1404-10311	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
7	1404-10363	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
8	1406-10029	VARILLA	TIGE	ROD	STANGE	1
9	3301P195-03	BRIDA	BRIDE	FLANGE	FLANSCH	2
10	1406-10028	EJE	AXE	AXLE	ACHSE	1
11	1408P8273	TAPA	COUVERCLE	COVER	DECKEL	1
12	1408P8274	TAPA	COUVERCLE	COVER	DECKEL	1
13	ROD22214HL	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
14	RTN110*90*12	RETEN DE ACEITE	BAGUE D'ETANCHEITE	SEAL	DICHtring	1
15	RTN40*25*7	RETEN DE ACEITE	BAGUE D'ETANCHEITE	SEAL	DICHtring	1
16	093308125012088	TORNILLO	VIS	BOLT	SCHRAUBE	2
17	093308125015088	TORNILLO	VIS	BOLT	SCHRAUBE	2
18	093312175035088	TORNILLO	VIS	BOLT	SCHRAUBE	6
19	093318250075088	TORNILLO	VIS	BOLT	SCHRAUBE	6
20	093110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	4
21	093324300160088	TORNILLO	VIS	BOLT	SCHRAUBE	4
22	093320250040088	TORNILLO	VIS	BOLT	SCHRAUBE	1
23	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
24	0934243008	TUERCA	ECROU	NUT	MUTTER	4
25	ARP25D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
26	093324300110088	TORNILLO	VIS	BOLT	SCHRAUBE	2
27	ARP8.4F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
28	0934081258	TUERCA	ECROU	NUT	MUTTER	2
29	0934101508	TUERCA	ECROU	NUT	MUTTER	8
30	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
31	ARP19D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
32	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
33	ARCD25D6918	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
34	ARCD23D6918	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
35	0934243008	TUERCA	ECROU	NUT	MUTTER	6
36	ARP25D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
37	093310150020088	TORNILLO	VIS	BOLT	SCHRAUBE	4
38	REDOC.MA100	REDUCTOR	REDUCTEUR	GEAR-BOX	GETRIEBE	1
39	MTRCF5682-4	MOTOR	MOTEUR	MOTOR	MOTOR	1
40	LMCV3876/SL35	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
41	10250070.14	BULON	AXE	PIN	BOLZEN	4
42	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
43	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
44	3204-21585	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
45	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2

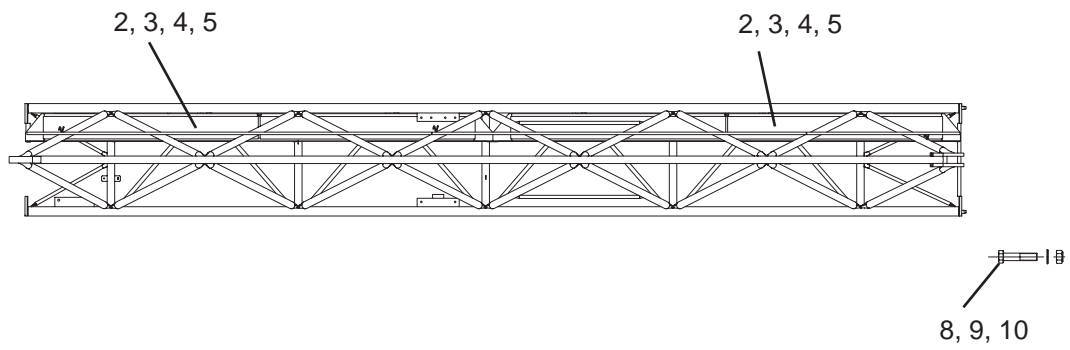
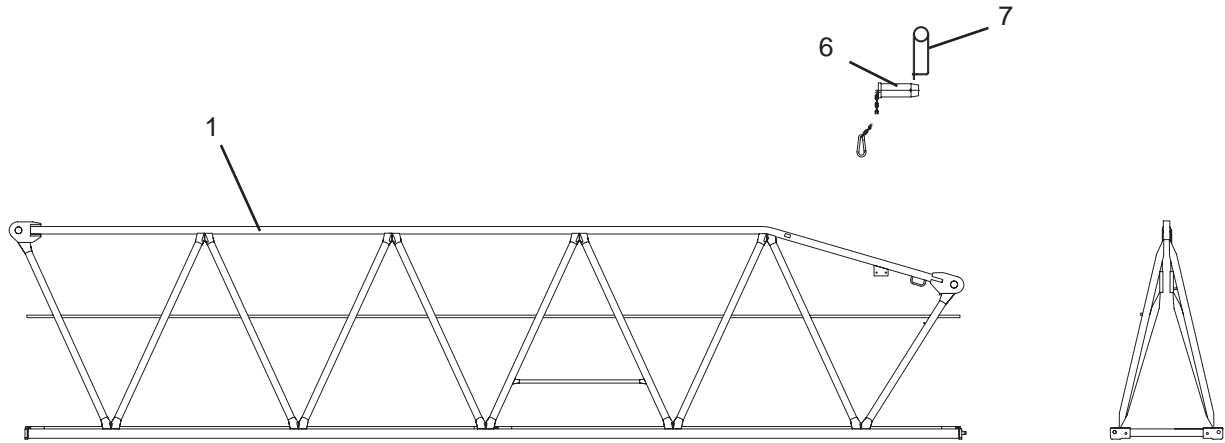


Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		TORNILLO	VIS	SCREW	SCHRAUBE	8
2		BRIDA	BRIDE	FLANGE	FLANSCH	1
3		TUERCA	ECROU	NUT	MUTTER	1
4		ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	1
5		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
6		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
7		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
8	ROD32311	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
9	ROD32311	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
10		CHAVETA	CLAVETTE	KEY	PASFEDER	1
11		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
12		CARCASA	CARCASSE	CASING	GEHÄUSE	1
13		TAPON	BOUCHON	PLUG	STÖPSEL	1
14		JUNTA	JOINT	GASKET	DICHTUNG	1
15		TAPA	COUVERCLE	COVER	DECKEL	1
16		TORNILLO	VIS	SCREW	SCHRAUBE	10
17		TAPA	COUVERCLE	COVER	DECKEL	1
18		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
19		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
20	ROD30312	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
21		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
22		CHAVETA	CLAVETTE	KEY	PASFEDER	1
23		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
24		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
26	ROD30312	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
27		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
28		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
29		TAPA	COUVERCLE	COVER	DECKEL	1
30		JUNTA	JOINT	GASKET	DICHTUNG	1
31		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
33	ROD32026	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
34		CHAVETA	CLAVETTE	KEY	PASFEDER	1
35		EJE	AXE	AXLE	ACHSE	1
36		CHAVETA	CLAVETTE	KEY	PASFEDER	1
37		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
38		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
39	ROD32026	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
40		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
41		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
42		TAPA	COUVERCLE	COVER	DECKEL	1
43		JUNTA	JOINT	GASKET	DICHTUNG	1

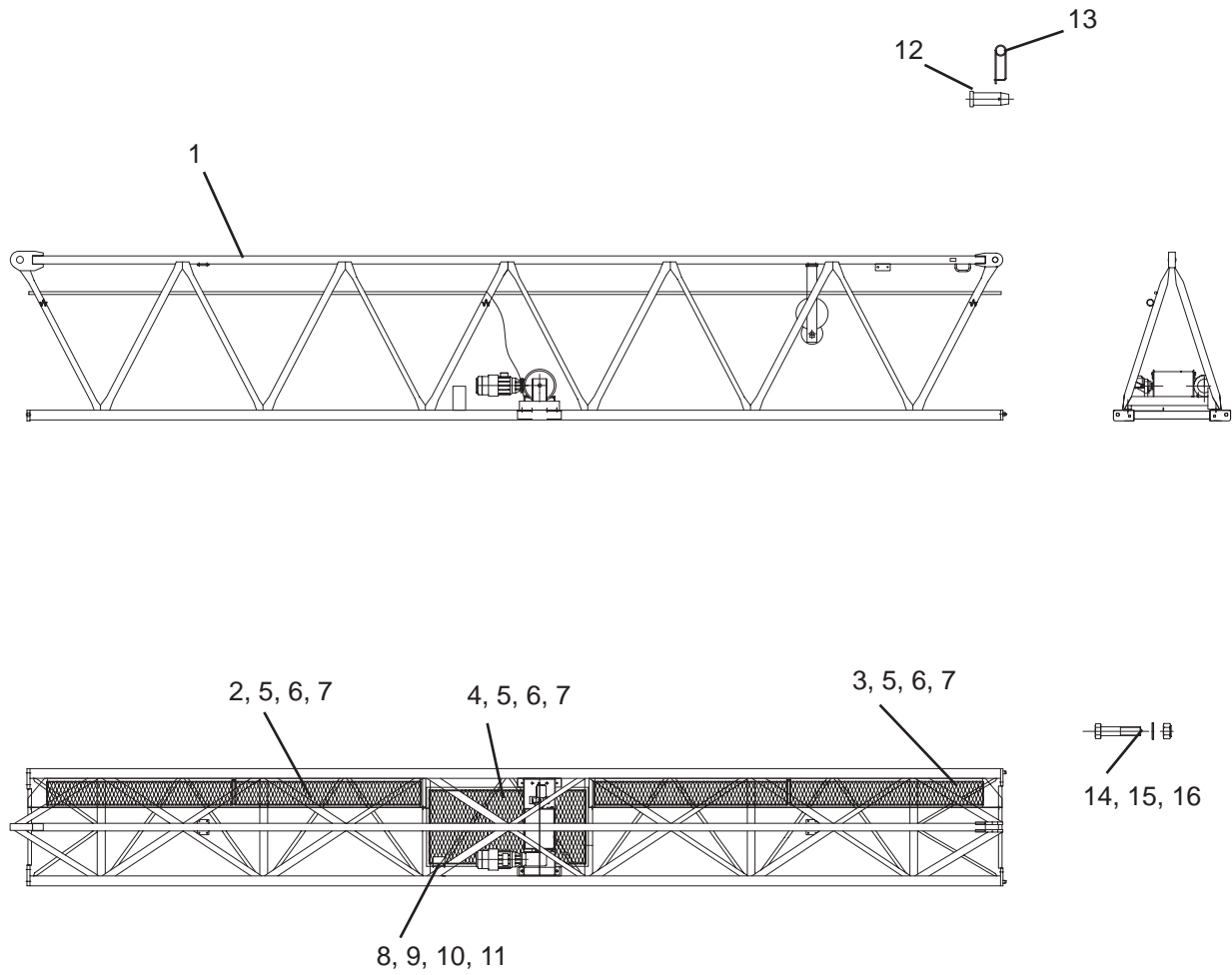




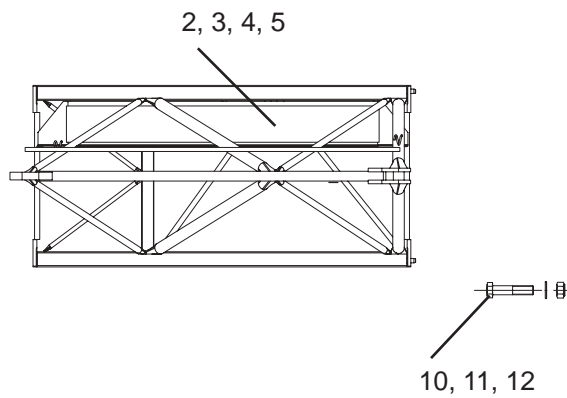
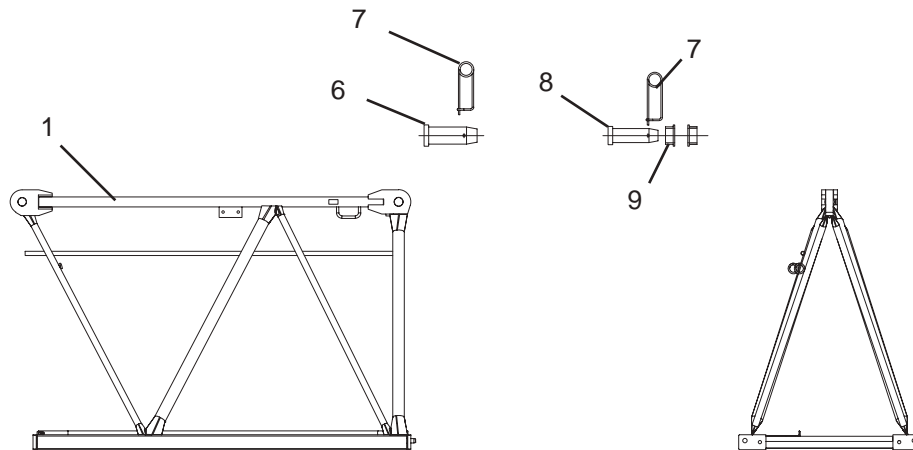
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1	3205-20880	TRAMO	ELEMENT	SECTION	MODUL	1
2	3205-21240	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
4	093308125025088	TORNILLO	VIS	BOLT	SCHRAUBE	4
5	ARP8.4F1D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
6	0934081258	TUERCA	ECROU	NUT	MUTTER	4
7	3205P997	BULON	AXE	PIN	BOLZEN	1
8	PSI6*60*170	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
9	093120250090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
10	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
11	0985202508	TUERCA	ECROU	NUT	MUTTER	2
12	3205-21161	SOPORTE	SUPPORT	SUPPORT	HALTER	1



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205-21170	TRAMO	ELEMENT	SECTION	MODUL	1
2	3205-10915	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	2
3	093308125025088	TORNILLO	VIS	BOLT	SCHRAUBE	5
4	ARP8.4F1D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	10
5	0934081258	TUERCA	ECROU	NUT	MUTTER	5
6	3205P997	BULON	AXE	PIN	BOLZEN	1
7	PSI6*70*170	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
8	093120250090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
9	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
10	0985202508	TUERCA	ECROU	NUT	MUTTER	2



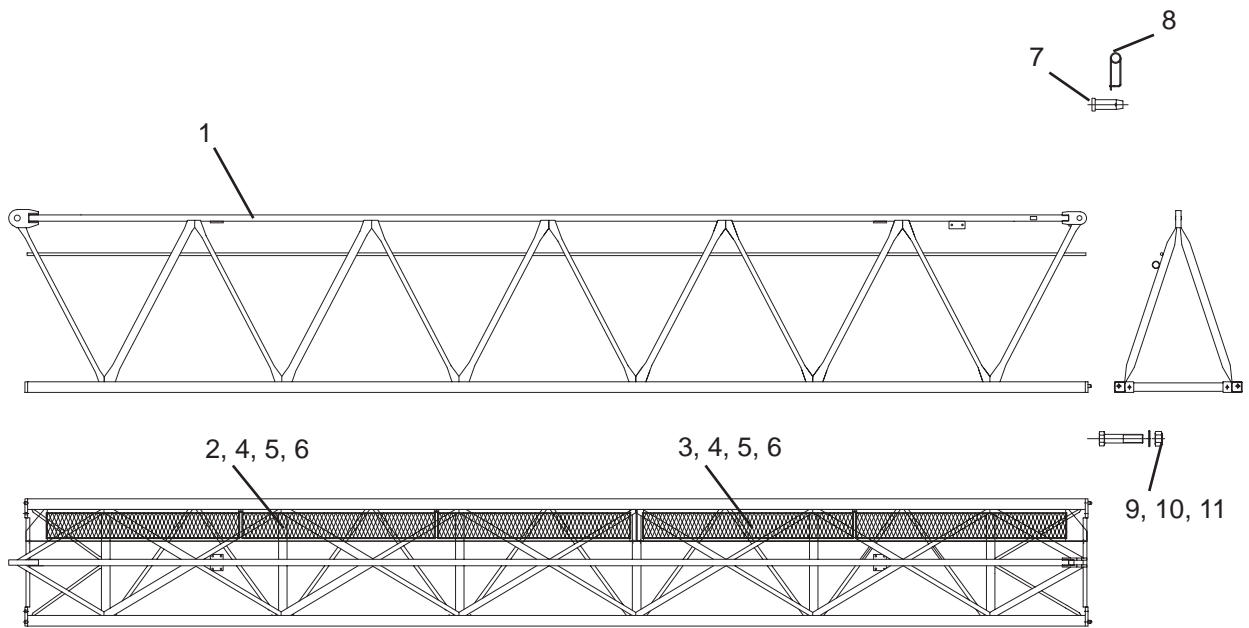
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1	3205-10759	TRAMO	ELEMENT	SECTION	MODUL	1
2	3205-10917	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
3	3205-10916	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
4	3205-10969	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
5	093308125025088	TORNILLO	VIS	BOLT	SCHRAUBE	8
6	ARP8.4F1D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
7	0934081258	TUERCA	ECROU	NUT	MUTTER	8
8	3204P982	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
9	093305080020088	TORNILLO	VIS	BOLT	SCHRAUBE	2
10	ARP5.3F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
11	0934050808	TUERCA	ECROU	NUT	MUTTER	2
12	3205P998	BULON	AXE	PIN	BOLZEN	1
13	PSI5*40*105	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
14	093120250090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
15	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
16	0985202508	TUERCA	ECROU	NUT	MUTTER	2



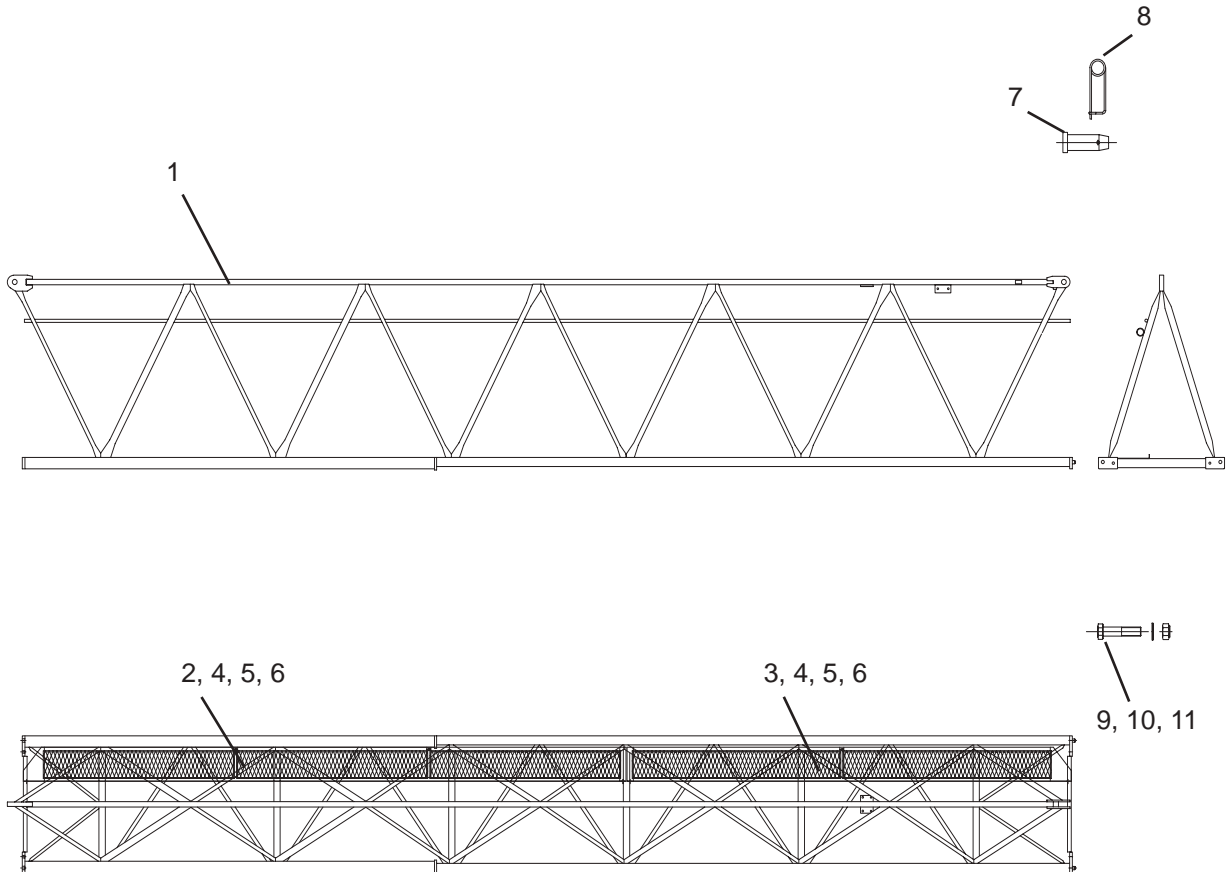
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7	1	1
8	-	1
9	-	2

<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205-20938	TRAMO	ELEMENT	SECTION	MODUL	1
2	3205-10629	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
3	093308125025088	TORNILLO	VIS	BOLT	SCHRAUBE	2
4	ARP8.4F1D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
5	0934081258	TUERCA	ECROU	NUT	MUTTER	2
6	3205P998	BULON	AXE	PIN	BOLZEN	1
7	PSI5*40*105	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
8	3205P1048	BULON	AXE	PIN	BOLZEN	1
9	3205P948	CASQUILLO	DOUILLE	BUSHING	BUCHSE	2
10	093120250090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
11	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
12	0985202508	TUERCA	ECROU	NUT	MUTTER	2

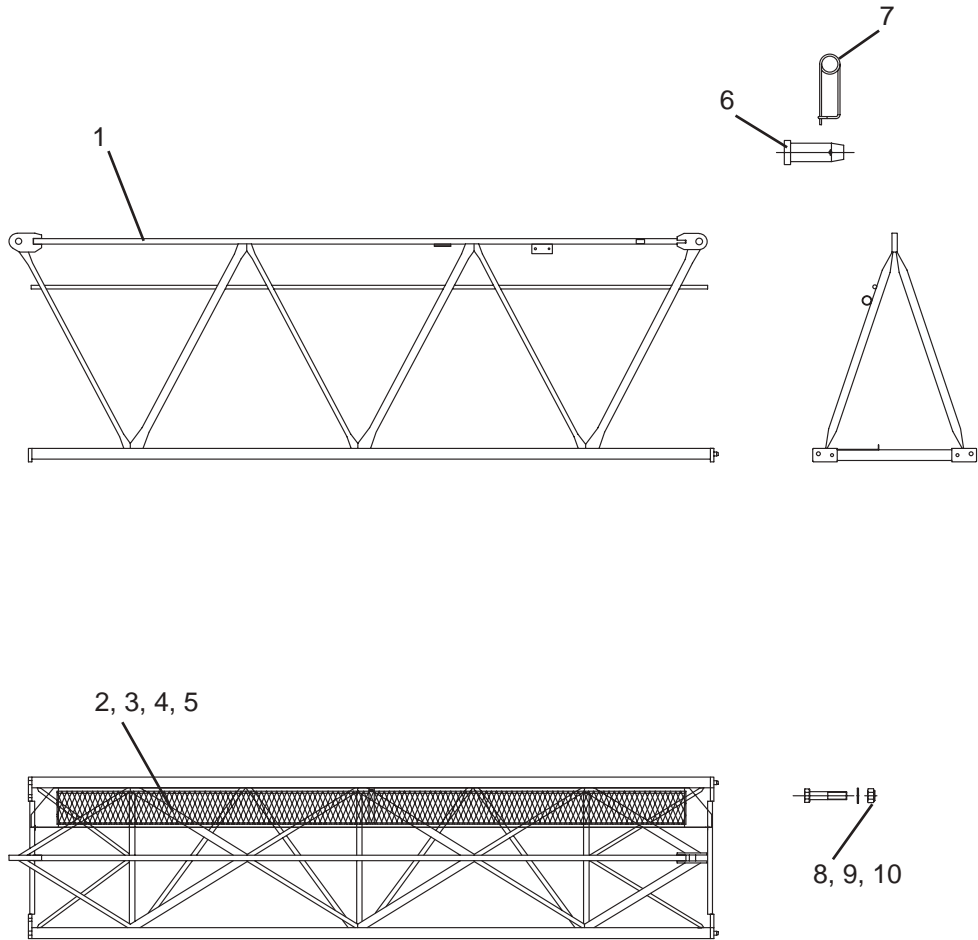




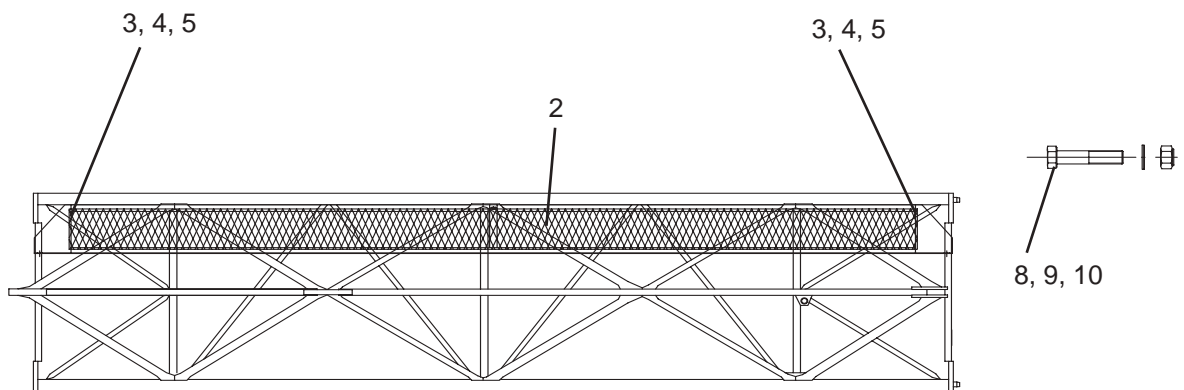
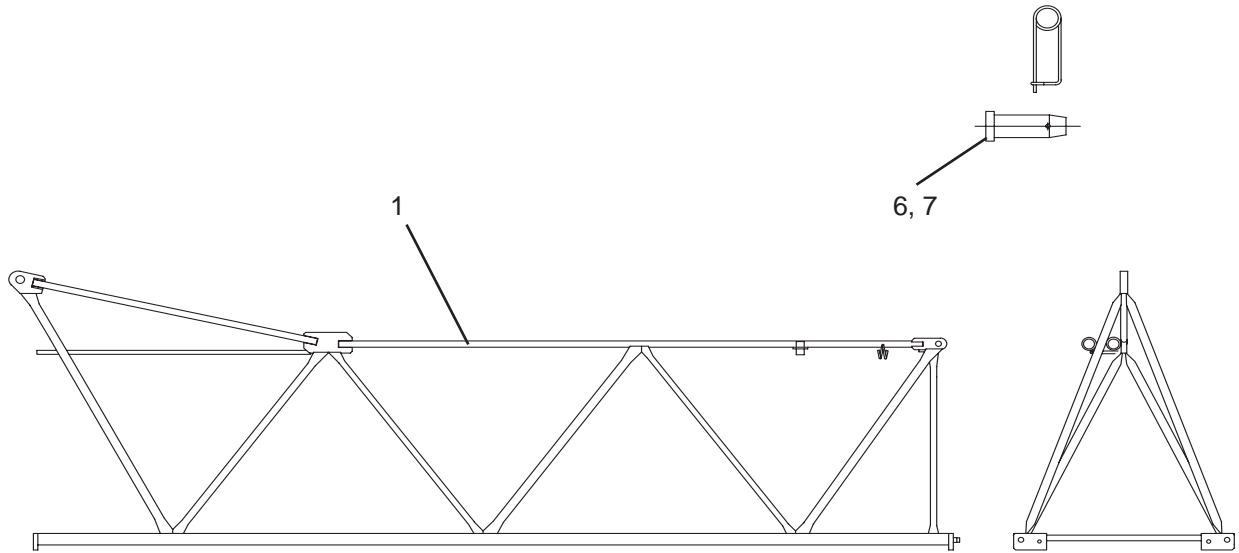
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1	3205-10766	TRAMO	ELEMENT	SECTION	MODUL	1
2	3205-10914	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
3	3205-10916	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
4	093308125025088	TORNILLO	VIS	BOLT	SCHRAUBE	7
5	ARP8.4F1D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	14
6	0934081258	TUERCA	ECROU	NUT	MUTTER	7
7	3205P999	BULON	AXE	PIN	BOLZEN	1
8	PSI5*40*105	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
9	093120250090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
10	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
11	0985202508	TUERCA	ECROU	NUT	MUTTER	2



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205H889	TRAMO	ELEMENT	SECTION	MODUL	1
2	3205-10914	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
3	3205-10916	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
4	093308125025088	TORNILLO	VIS	BOLT	SCHRAUBE	7
5	ARP8.4F1D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	14
6	0934081258	TUERCA	ECROU	NUT	MUTTER	7
7	3205P999	BULON	AXE	PIN	BOLZEN	1
8	PSI5*40*105	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
9	093120250090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
10	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
11	0985202508	TUERCA	ECROU	NUT	MUTTER	2

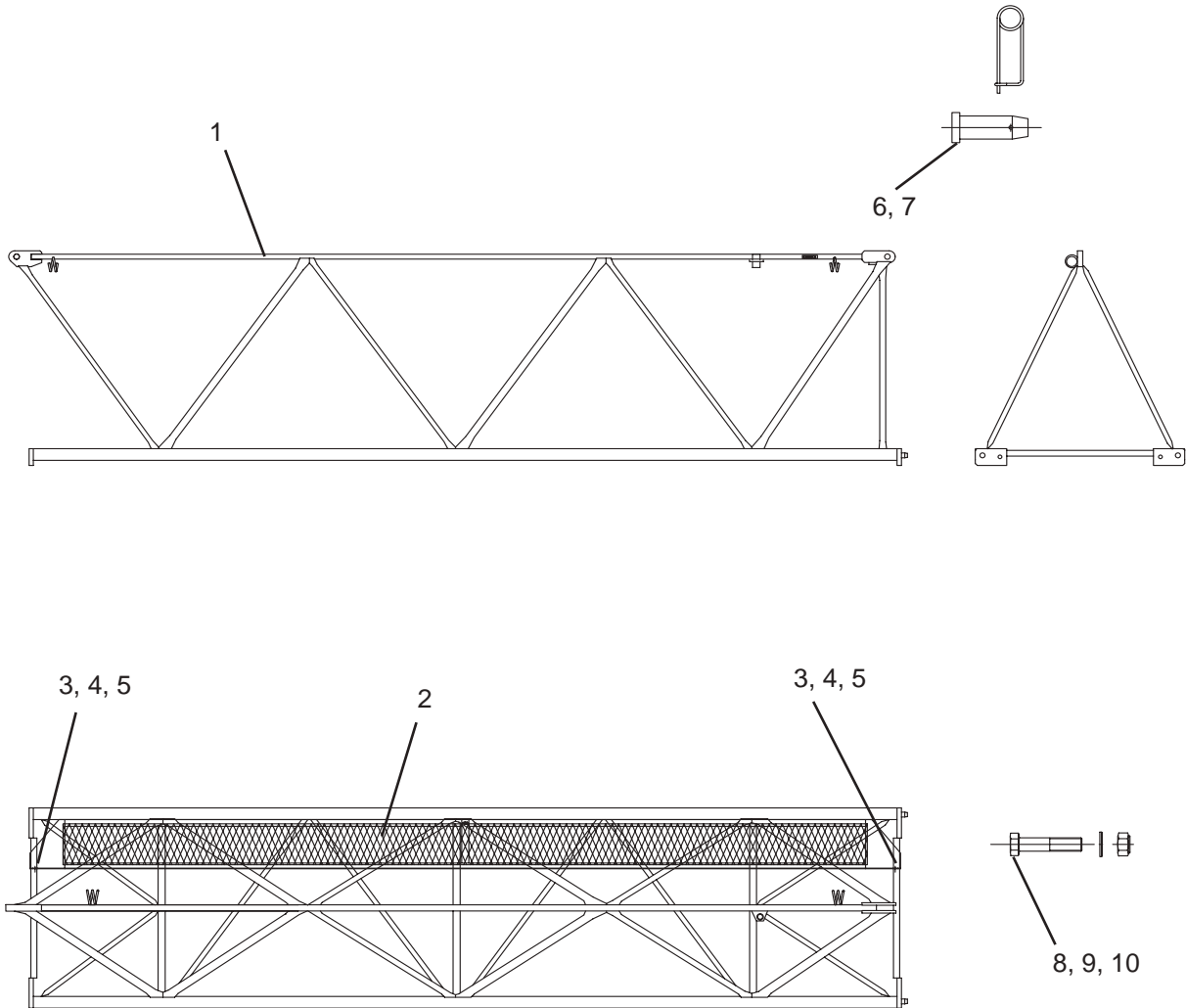


<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205H1629	TRAMO	ELEMENT	SECTION	MODUL	1
2	3205-10915	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
3	093308125030088	TORNILLO	VIS	BOLT	SCHRAUBE	3
4	ARP8.4F1D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
5	0934081258	TUERCA	ECROU	NUT	MUTTER	3
6	3205P999	BULON	AXE	PIN	BOLZEN	1
7	PSI5*40*105	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
8	093120250090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
9	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
10	0985202508	TUERCA	ECROU	NUT	MUTTER	2

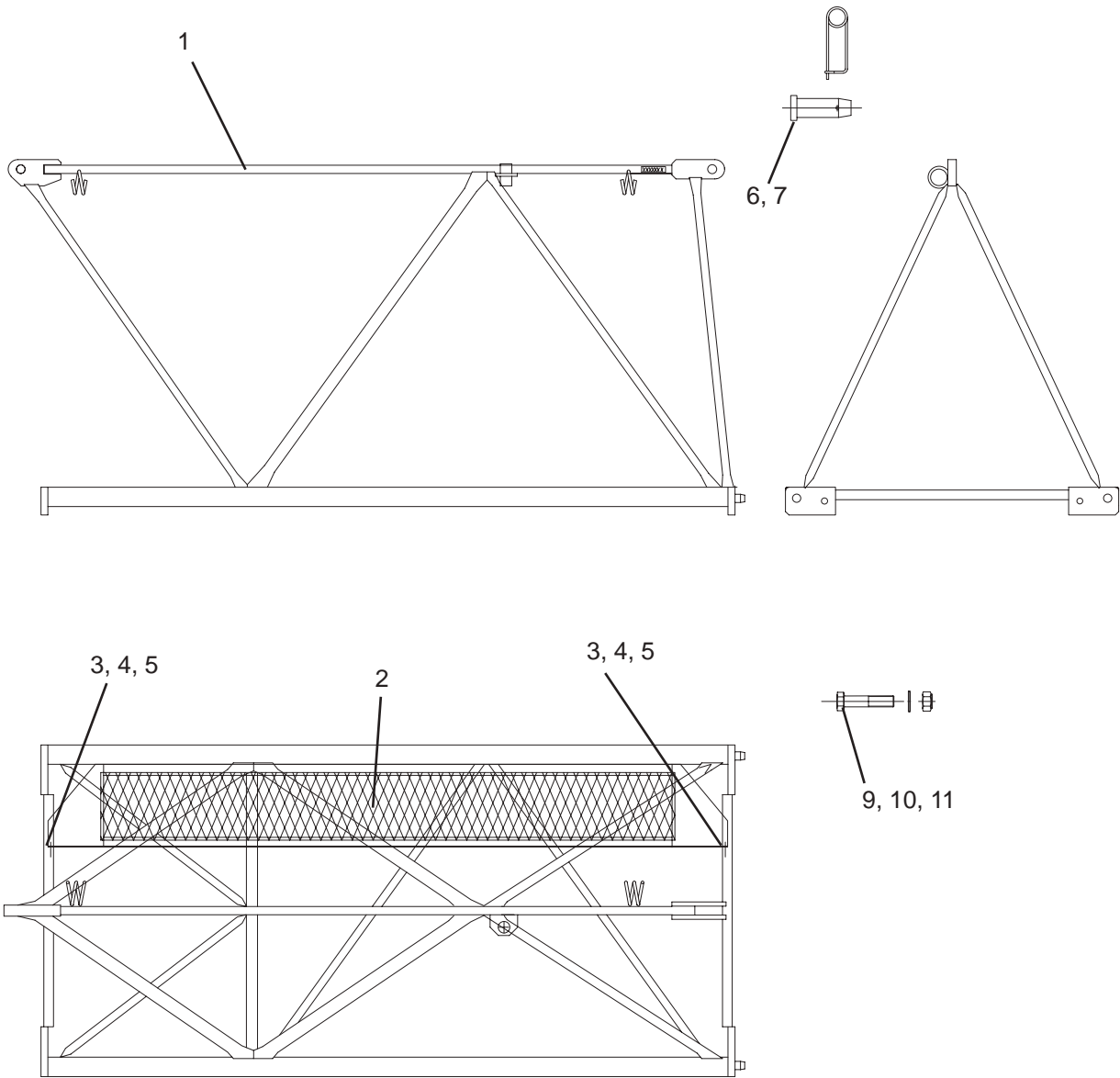


<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205-10664	TRAMO	ELEMENT	SECTION	MODUL	1
2	3205-10915	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
3	093308125025088	TORNILLO	VIS	BOLT	SCHRAUBE	3
4	ARP8.4F1D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
5	0934081258	TUERCA	ECROU	NUT	MUTTER	3
6	3215-10107	BULON	AXE	PIN	BOLZEN	1
7	PSI4*25*85	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
8	093120250090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
9	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
10	0985202508	TUERCA	ECROU	NUT	MUTTER	2

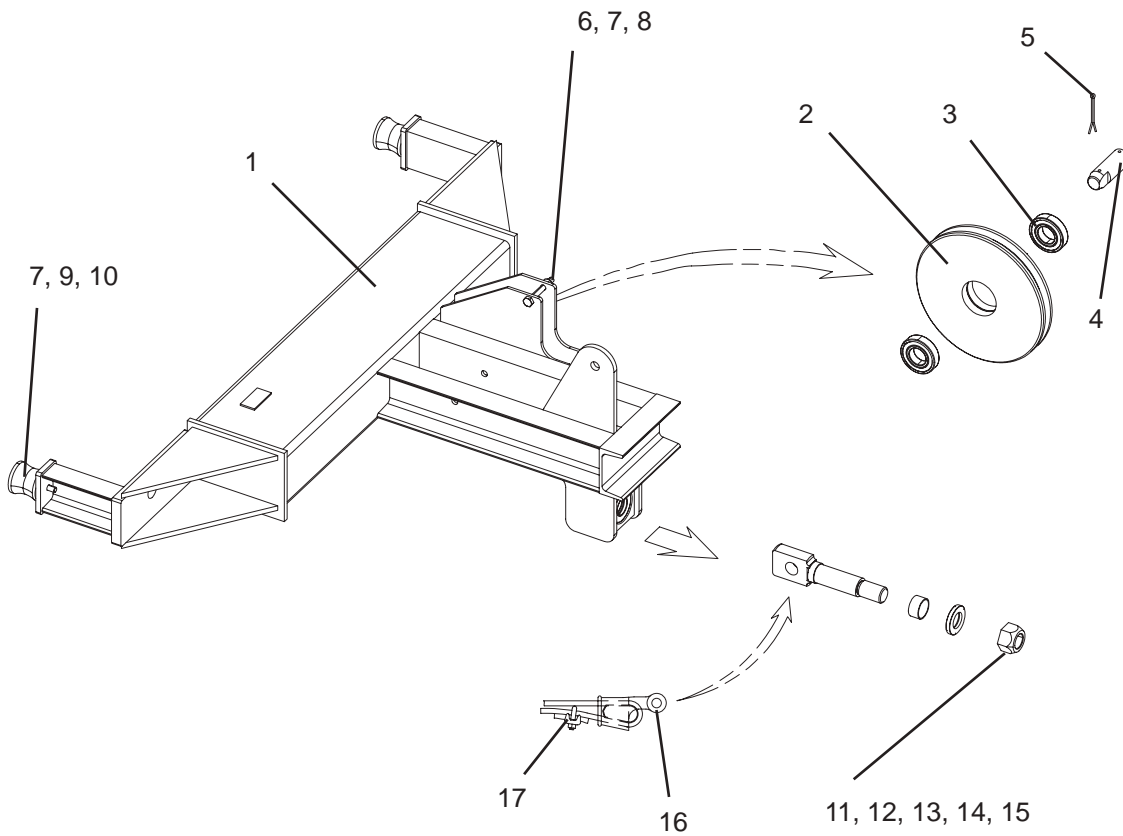




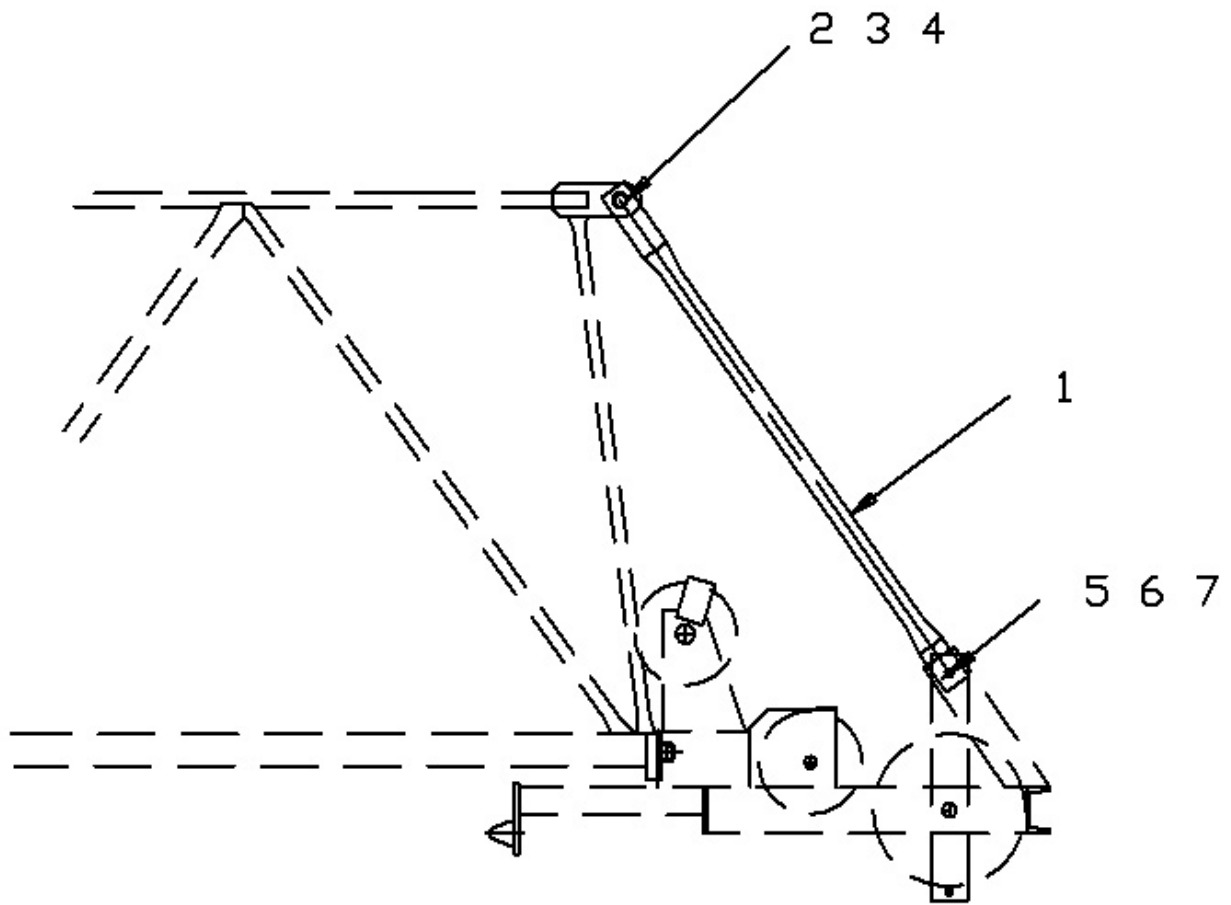
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1	3205-10673	TRAMO	ELEMENT	SECTION	MODUL	1
2	3205-10915	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
3	093308125025088	TORNILLO	VIS	BOLT	SCHRAUBE	3
4	ARP8.4F1D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
5	0934081258	TUERCA	ECROU	NUT	MUTTER	3
6	3215-10107	BULON	AXE	PIN	BOLZEN	1
7	PSI4*25*85	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
8	093120250090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
9	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
10	0985202508	TUERCA	ECROU	NUT	MUTTER	2



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205-10696	TRAMO	ELEMENT	SECTION	MODUL	1
2	3205-10629	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
3	093308125025088	TORNILLO	VIS	BOLT	SCHRAUBE	2
4	ARP8.4F1D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
5	0934081258	TUERCA	ECROU	NUT	MUTTER	2
6	3215-10107	BULON	AXE	PIN	BOLZEN	1
7	PSI4*25*85	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
8	093120250090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
9	ARP21D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
10	0985202508	TUERCA	ECROU	NUT	MUTTER	2

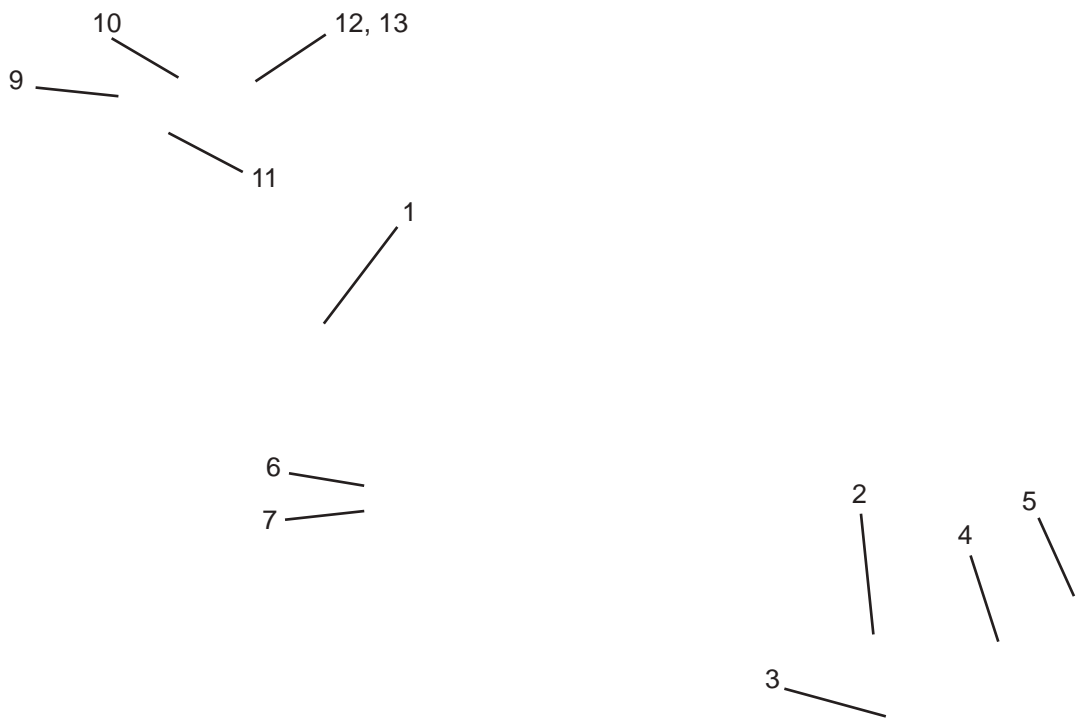


<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205-20990	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	3215-20105	POLEA	POULIE	SHEAVE	SEILROLLE	1
3	CASQ563502	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	2
4	BULON-20151	BULON	AXE	PIN	BOLZEN	1
5	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
6	093110150080088	TORNILLO	VIS	BOLT	SCHRAUBE	1
7	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	3
8	0985101508	TUERCA	ECROU	NUT	MUTTER	1
9	TPD60*60M10*25	TOPE	BUTTOIR	STOP	ANSCHLAG	2
10	0934101508	TUERCA	ECROU	NUT	MUTTER	2
11	3204-1416	EJE	AXE	AXLE	ACHSE	1
12	0985302008	TUERCA	ECROU	NUT	MUTTER	1
13	3205-21154	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
14	ROD51207	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
15	GLYPG.353920F	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	1
16	TER550D-C.18-19	TERMINAL CON CUÑA	ATTACHE A COIN	WEDGE ANCHOR	KEILENDKLEMME	1
17	SJC3/4"	SUJETA-CABLES	SERRE-CABLE	WIRE ROPE CLAMP	DRAHTSEILKLEMME	1



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205-10705	TIRANTE	TIRANT	STRUT	ABSPANNUNG	1
2	10250110.14	BULON	AXE	PIN	BOLZEN	1
3	PS14*25*85	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
4	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
5	093116200050088	TORNILLO	VIS	BOLT	SCHRAUBE	1
6	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
7	0934162008	TUERCA	ECROU	NUT	MUTTER	1





	AM140	AM145	AM151	AM161
11	1	1	1	1
12	2	2	2	-
13	-	-	-	2

<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205P953	TIRANTE	TIRANT	STRUT	ABSPANNUNG	1
2	3205P943	TIRANTE	TIRANT	STRUT	ABSPANNUNG	1
3	093116200050088	TORNILLO	VIS	BOLT	SCHRAUBE	1
4	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
5	0985162008	TUERCA	ECROU	NUT	MUTTER	1
6	10100100.14	BULON	AXE	PIN	BOLZEN	2
7	PSA3*40	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
9	PSI4*25*85	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
10	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	1
11	10250120.14	BULON	AXE	PIN	BOLZEN	1
12	3205P1006	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
13	3205P951	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205P984	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	093314200040088	TORNILLO	VIS	BOLT	SCHRAUBE	2
3	0985142008	TUERCA	ECROU	NUT	MUTTER	2
4	3205K1007.10	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
5	3205K1007.20	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
6	3205K1007.30	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
7	3205K1007.40	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
8	3205K1007.50	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
9	3205K1007.60	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
10	3205K1007.70	LETRERO	INDICATEUR	INDICATOR	SCHILD	1



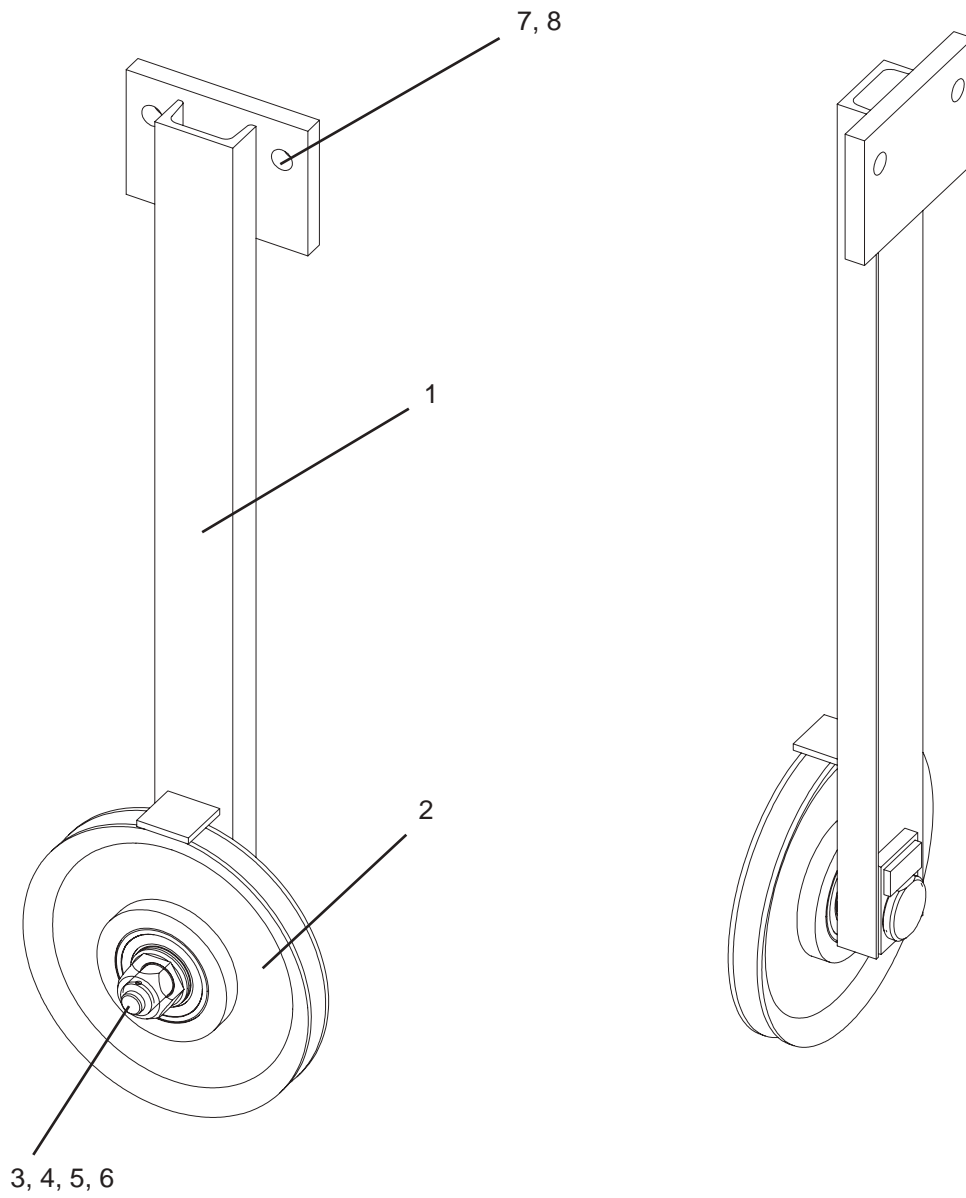
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1	3205P984	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	093314200040088	TORNILLO	VIS	BOLT	SCHRAUBE	2
3	0985142008	TUERCA	ECROU	NUT	MUTTER	2
4	3205K1007.10	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
5	3205K1007.20	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
6	3205K1007.30	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
7	3205K1007.40	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
8	3205K1007.50	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
9	3205K1007.60	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
10	3205K1007.70	LETRERO	INDICATEUR	INDICATOR	SCHILD	1

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**2**

<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205-10671	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
2	PSA7*80	PASADOR	GOUPILLE	COTTERPIN	VORSTECKER	1
3	3205K1007-35	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
4	3205K1007-375	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
5	3205K1007-40	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
6	3205K1007-425	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
7	3205K1007-45	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
8	3205K1007-475	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
9	3205K1007-50	LETRERO	INDICATEUR	INDICATOR	SCHILD	1
10	3205K1007-525	LETRERO	INDICATEUR	INDICATOR	SCHILD	1





<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3205-21132	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	3215-20084	POLEA	POULIE	SHEAVE	SEILROLLE	1
3	BULON-20209	BULON	AXE	PIN	BOLZEN	1
4	CASQ563505	CASQUILLO	DOUILLE	BUSHING	BUCHSE	1
5	0985243008	TUERCA	ECROU	NUT	MUTTER	1
6	ARP25F111D125	ARANDELA	RONDELLE	WASHER	UNTERLEGSSCHEIBE	1
7	093314200040088	TORNILLO	VIS	SCREW	SCHRAUBE	2
8	0985142008	TUERCA	ECROU	NUT	MUTTER	2



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	1404-10550	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	REMO.C.MA60	MOTORREDUCTOR	MOTOREDUCTEUR	REDUCTION MOTOR	GETRIEBEMOTOR	1
3	093116200080088	TORNILLO	VIS	BOLT	SCHRAUBE	4
4	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
5	0934162008	TUERCA	ECROU	NUT	MUTTER	4
6	1404-10547	TAMBOR	TAMBOUR	DRUM	TROMMEL	1
7	1408P7381	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
8	SPROD.08	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
9	093312175040088	TORNILLO	VIS	BOLT	SCHRAUBE	4
10	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
11	0934121758	TUERCA	ECROU	NUT	MUTTER	6
12	093112175060088	TORNILLO	VIS	BOLT	SCHRAUBE	2
13	1408P1243-D	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
14	093308125020088	TORNILLO	VIS	BOLT	SCHRAUBE	2
15	ARP8.4F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
16	0934081258	TUERCA	ECROU	NUT	MUTTER	2
17	LMCV3636SL35	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
18	093306100020088	TORNILLO	VIS	BOLT	SCHRAUBE	2
19	ARP6.4F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
20	0934061008	TUERCA	ECROU	NUT	MUTTER	2
21	3301P195.01	BRIDA	BRIDE	FLANGE	FLANSCH	4
22	093310150030088	TORNILLO	VIS	BOLT	SCHRAUBE	8
23	093316200040088	TORNILLO	VIS	BOLT	SCHRAUBE	4
24	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
25	0985162008	TUERCA	ECROU	NUT	MUTTER	4



Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		TORNILLO	VIS	SCREW	SCHRAUBE	10
2		BRIDA	BRIDE	FLANGE	FLANSCH	1
5		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
6		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
7		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
8	ROD32305	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
8A		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
8B		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
9	ROD32305	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
10		CHAVETA	CLAVETTE	KEY	PASFEDER	1
11		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
12		CARCASA	CARCASSE	CASING	GEHÄUSE	1
13		TAPON	BOUCHON	PLUG	STÖPSEL	1
14		JUNTA	JOINT	GASKET	DICHTUNG	1
15		TAPA	COUVERCLE	COVER	DECKEL	1
16		TORNILLO	VIS	SCREW	SCHRAUBE	10
17		TAPA	COUVERCLE	COVER	DECKEL	1
18		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
19		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
20	ROD30306	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
21		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
22		CHAVETA	CLAVETTE	KEY	PASFEDER	1
23		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
24		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
26	ROD30306	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
27		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
28		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
29		TAPA	COUVERCLE	COVER	DECKEL	1
30		JUNTA	JOINT	GASKET	DICHTUNG	1
31		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
33	ROD32014	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
34		CHAVETA	CLAVETTE	KEY	PASFEDER	1
35		EJE	AXE	AXLE	ACHSE	1
36		CHAVETA	CLAVETTE	KEY	PASFEDER	1
37		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
38		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
39	ROD32014	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
40		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
41		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
42		TAPA	COUVERCLE	COVER	DECKEL	1
43		JUNTA	JOINT	GASKET	DICHTUNG	1
44		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
45		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
46		TORNILLO	VIS	SCREW	SCHRAUBE	4
47		EJE	AXE	AXLE	ACHSE	1

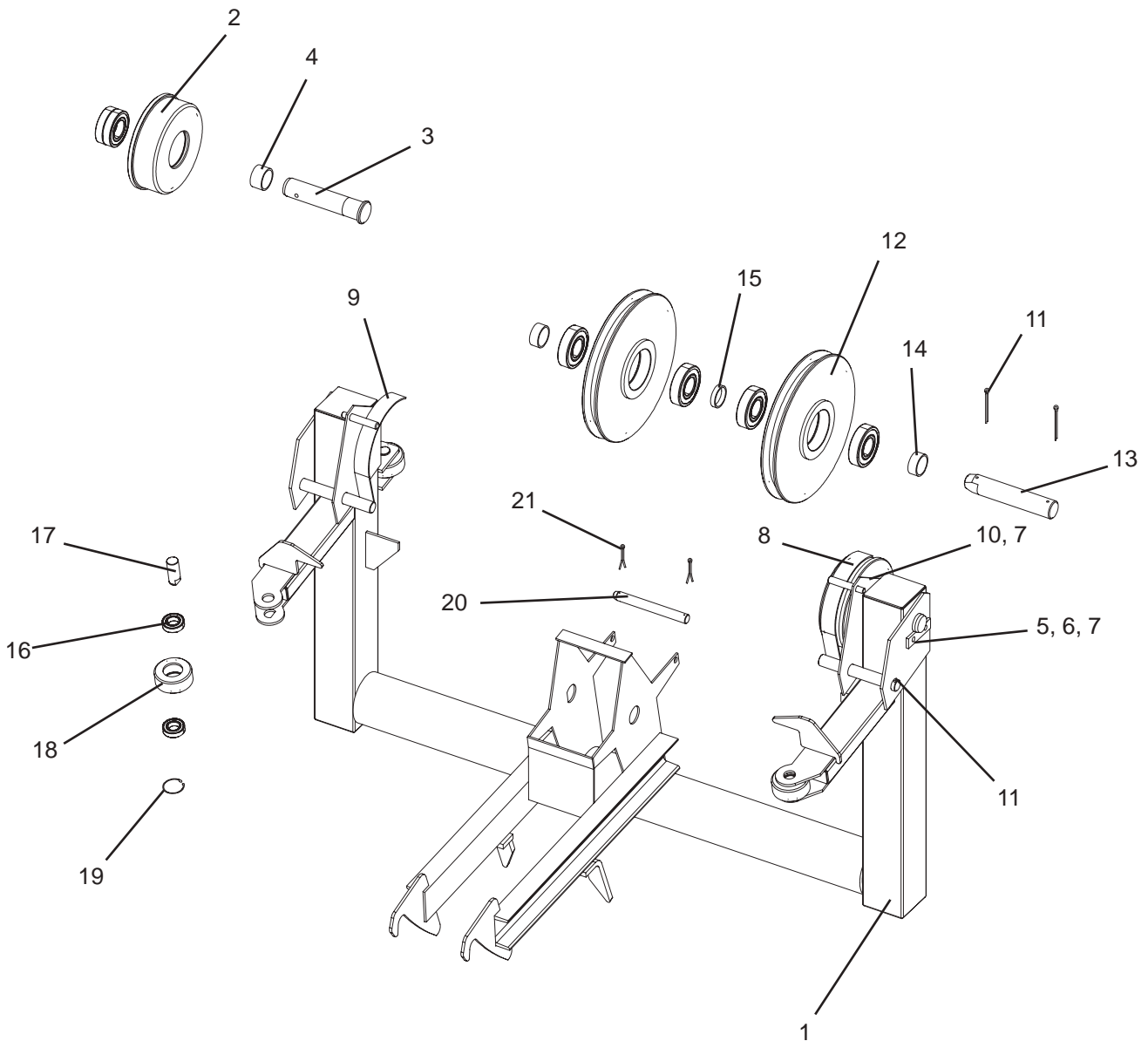


Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	1404-10550	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	REMOC.MA60	MOTORREDUCTOR	MOTOREDUCTEUR	REDUCTION MOTOR	GETRIEBEMOTOR	1
3	093116200080088	TORNILLO	VIS	BOLT	SCHRAUBE	4
4	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
5	0934162008	TUERCA	ECROU	NUT	MUTTER	4
6	1404-10547	TAMBOR	TAMBOUR	DRUM	TROMMEL	1
7	1408P7381	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
8	SPROD.08	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
9	093312175040088	TORNILLO	VIS	BOLT	SCHRAUBE	4
10	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
11	0934121758	TUERCA	ECROU	NUT	MUTTER	6
12	093112175060088	TORNILLO	VIS	BOLT	SCHRAUBE	2
13	1408P1243-D	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
14	093308125020088	TORNILLO	VIS	BOLT	SCHRAUBE	2
15	ARP8.4F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
16	0934081258	TUERCA	ECROU	NUT	MUTTER	2
17	INDI.A200	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
18	093306100020088	TORNILLO	VIS	BOLT	SCHRAUBE	2
19	ARP6.4F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
20	0934061008	TUERCA	ECROU	NUT	MUTTER	2
21	3301P195.01	BRIDA	BRIDE	FLANGE	FLANSCH	4
22	093310150030088	TORNILLO	VIS	BOLT	SCHRAUBE	8
23	093316200040088	TORNILLO	VIS	BOLT	SCHRAUBE	4
24	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
25	0985162008	TUERCA	ECROU	NUT	MUTTER	4

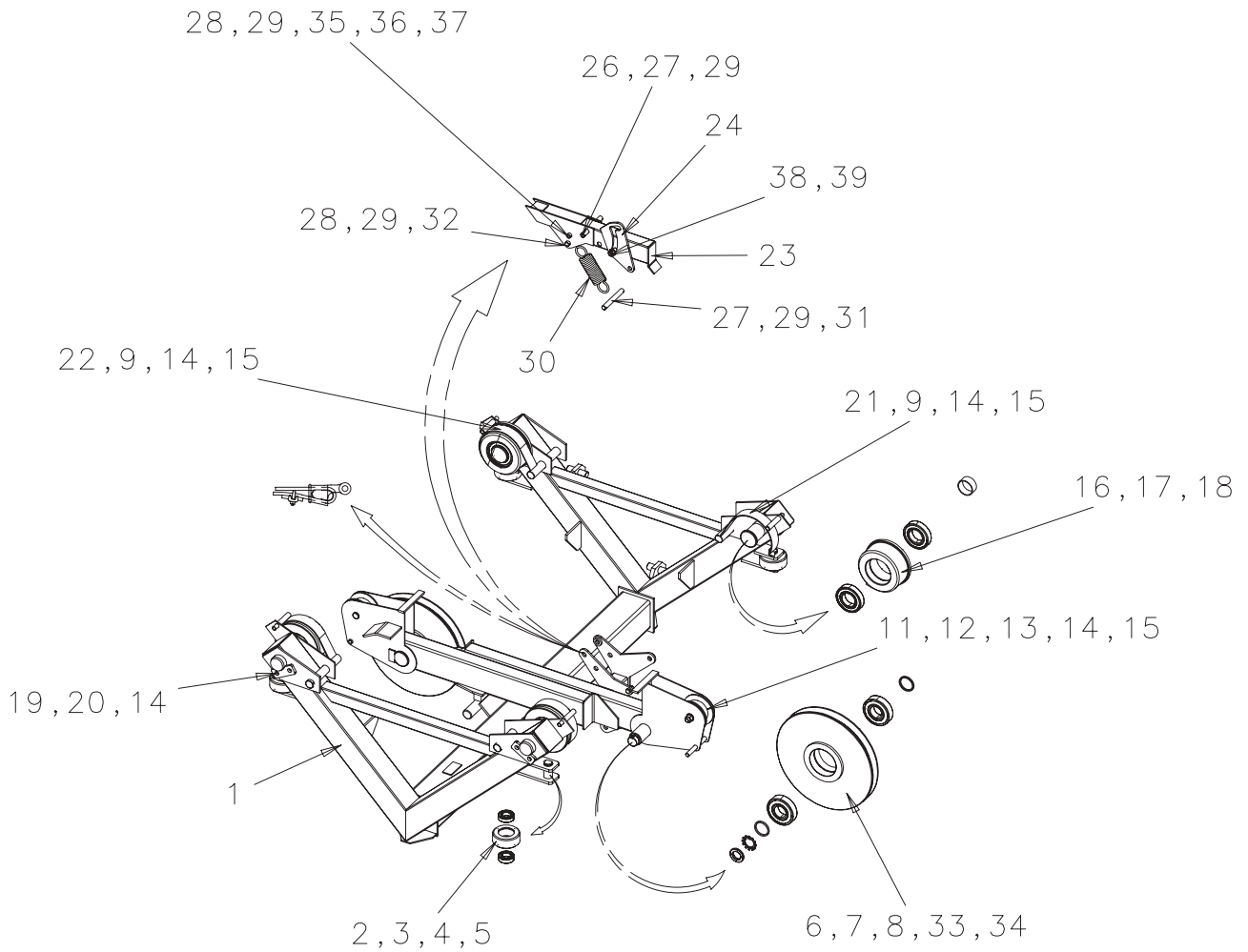




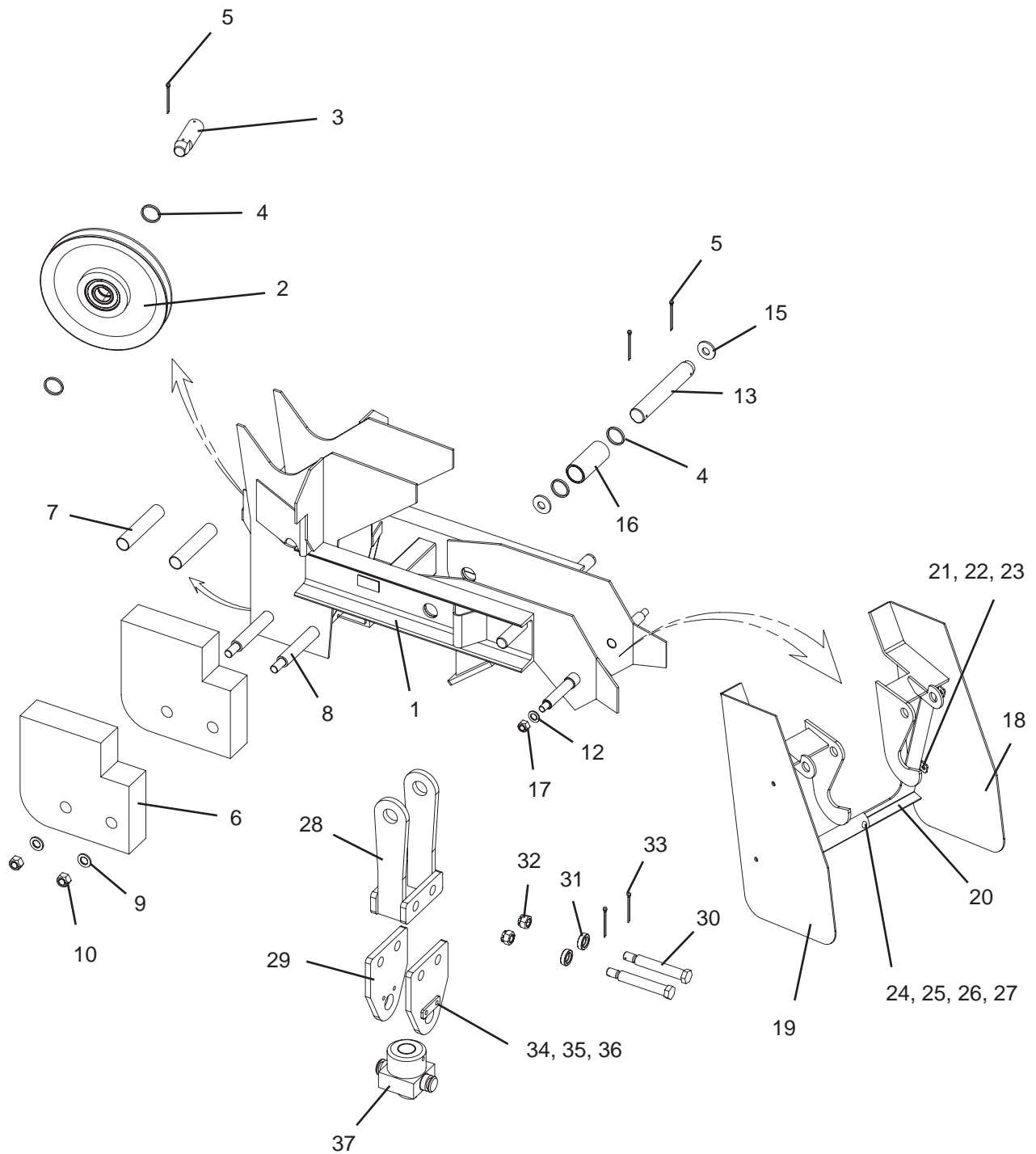
Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1		TORNILLO	VIS	SCREW	SCHRAUBE	10
2		BRIDA	BRIDE	FLANGE	FLANSCH	1
5		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
6		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
7		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
8	ROD32305	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
8A		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
8B		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
9	ROD32305	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
10		CHAVETA	CLAVETTE	KEY	PASFEDER	1
11		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
12		CARCASA	CARCASSE	CASING	GEHÄUSE	1
13		TAPON	BOUCHON	PLUG	STÖPSEL	1
14		JUNTA	JOINT	GASKET	DICHTUNG	1
15		TAPA	COUVERCLE	COVER	DECKEL	1
16		TORNILLO	VIS	SCREW	SCHRAUBE	10
17		TAPA	COUVERCLE	COVER	DECKEL	1
18		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
19		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
20	ROD30306	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
21		PIÑÓN	MOYEU CANNELE	SPLINED HUB	NAVE, VIELKEILVERZHN	1
22		CHAVETA	CLAVETTE	KEY	PASFEDER	1
23		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
24		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
26	ROD30306	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
27		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
28		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
29		TAPA	COUVERCLE	COVER	DECKEL	1
30		JUNTA	JOINT	GASKET	DICHTUNG	1
31		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
33	ROD32014	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
34		CHAVETA	CLAVETTE	KEY	PASFEDER	1
35		EJE	AXE	AXLE	ACHSE	1
36		CHAVETA	CLAVETTE	KEY	PASFEDER	1
37		CORONA	COURONNE	CROWN WHEEL	STRINRAD	1
38		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
39	ROD32014	RODAMIENTO	ROULEMENT	BEARING	LAGER	1
40		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
41		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
42		TAPA	COUVERCLE	COVER	DECKEL	1
43		JUNTA	JOINT	GASKET	DICHTUNG	1
44		SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	1
45		ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
46		TORNILLO	VIS	SCREW	SCHRAUBE	4
47		EJE	AXE	AXLE	ACHSE	1



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3209-20074	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	3209-20100	RODILLO	GALET	ROLLER	ROLLE	2
3	BULON-20096	EJE	AXE	AXLE	ACHSE	2
4	CASQ564027	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
5	3301P156.02	CHAVETA	CHAVETA	CHIAVE	PEN	2
6	093310150020088	TORNILLO	PARAFUSO	VITE	SCHROEF	4
7	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	6
8	3209-20104	PROTECCION	PROTECÇÃO	PROTEZIONE	BESCHERMING	1
9	3209-20108	PROTECCION	PROTECÇÃO	PROTEZIONE	BESCHERMING	1
10	0934101508	TUERCA	ECROU	NUT	MUTTER	2
11	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	3
12	3215-20068	POLEA	POULIE	SHEAVE	SEILROLLE	2
13	BULON-20100	EJE	AXE	AXLE	ACHSE	1
14	CASQ564020	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	2
15	CASQ564010	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	1
16	3209-10216	RODILLO	GALET	ROLLER	ROLLE	4
17	3215-10087	EJE	AXE	AXLE	ACHSE	4
18	CASQ562506	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	8
19	AEE25	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	4
20	10120170.14	BULON	PARAFUSO	PERNO	BOUT	1
21	PSA3*40	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2

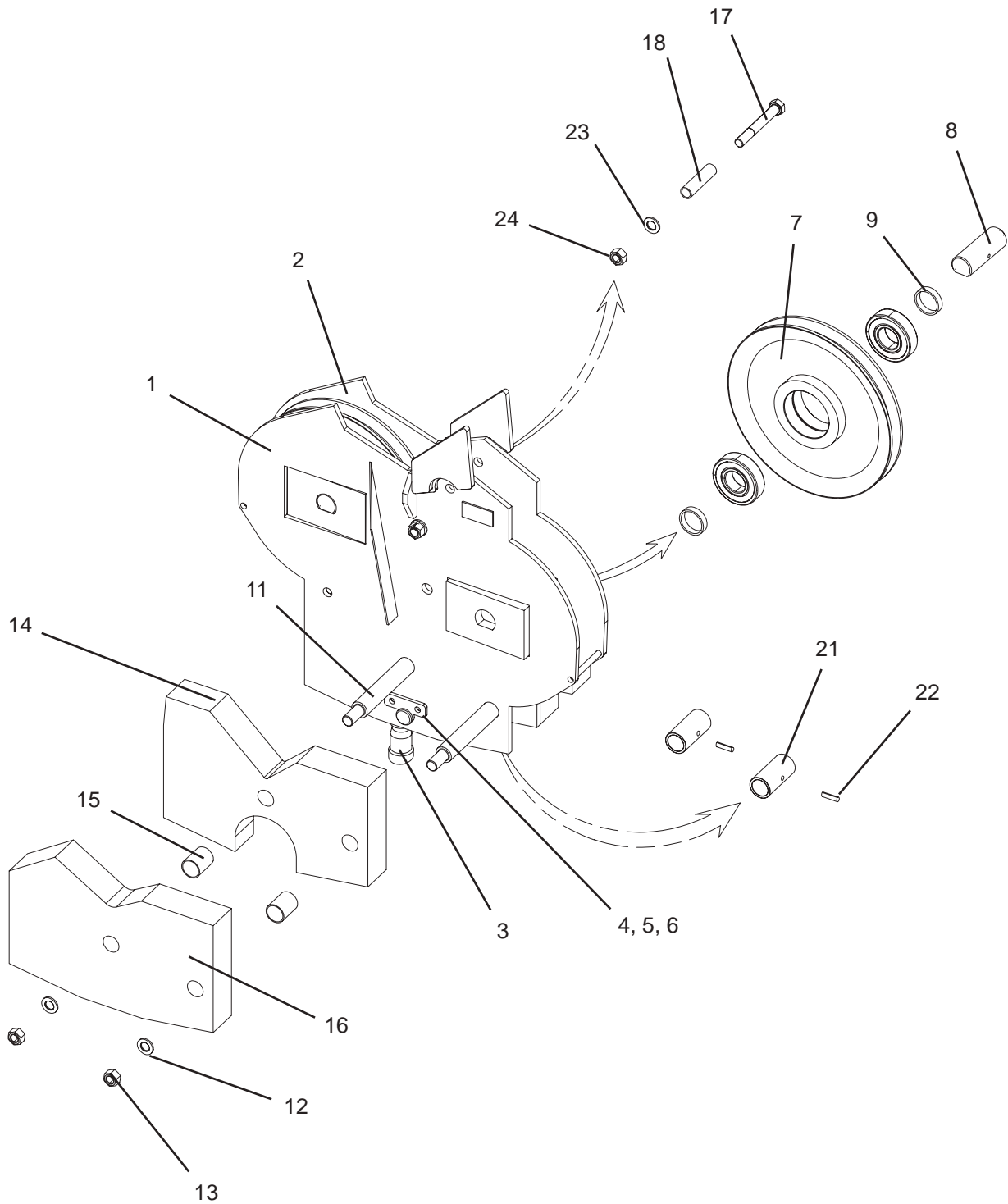


Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	3209-20003	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	3209-10216	RODILLO	GALET	ROLLER	ROLLE	4
3	3215-10087	EJE	AXE	AXLE	ACHSE	4
4	CASQ562506	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	8
5	AEE25	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	4
6	3215-20068	POLEA	POULIE	SHEAVE	SEILROLLE	2
7	BULON-20085	EJE	AXE	AXLE	ACHSE	2
8	CASQ564004	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	4
9	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
11	3209-20048	RODILLO	GALET	ROLLER	ROLLE	2
12	CASQ561502	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	4
13	BULON-20087	EJE	AXE	AXLE	ACHSE	2
14	ARP13F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
15	0985121758	TUERCA	ECROU	NUT	MUTTER	8
16	3209-20050	RODILLO	GALET	ROLLER	ROLLE	4
17	BULON-20089	EJE	AXE	AXLE	ACHSE	4
18	CASQ564523	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	4
19	OL-20247	CHAVETA	CHAVETA	CHIAVE	PEN	4
20	093312175020088	TORNILLO	PARAFUSO	VITE	SCHROEF	8
21	3209-20055	PROTECCION	PROTECÇÃO	PROTEZIONE	BESCHERMING	2
22	3209-20059	PROTECCION	PROTECÇÃO	PROTEZIONE	BESCHERMING	2
23	3209-20061	BRAZO	BRAÇO	BRACCIO	ARM	1
24	OL-20249	TOPE	TOPE	PUNTA	AANSLAG	1
25	AEE12	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	1
26	CASQ561510	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
27	BULON-20205	EJE	AXE	AXLE	ACHSE	2
28	BULON-20207	EJE	AXE	AXLE	ACHSE	2
29	PSA3*40	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
30	3209-20184	MUELLE	MOLA	MOLLE	VEER	1
31	CASQ561535	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
32	CASQ561517	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
33	TUKM6	TUERCA	ECROU	NUT	MUTTER	2
34	ARMB6	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
35	TER43148.8	TERMINAL CON CUÑA	ATTACHE A COIN	WEDGE ANCHOR	KEILENDKLEMME	2
36	SJC5/16"	SUJETA-CABLES	SERRE-CABLE	WIRE ROPE CLAMP	DRAHTSEILKLEMME	2
37	CASQ561505	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
38	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
39	0985101508	TUERCA	ECROU	NUT	MUTTER	1

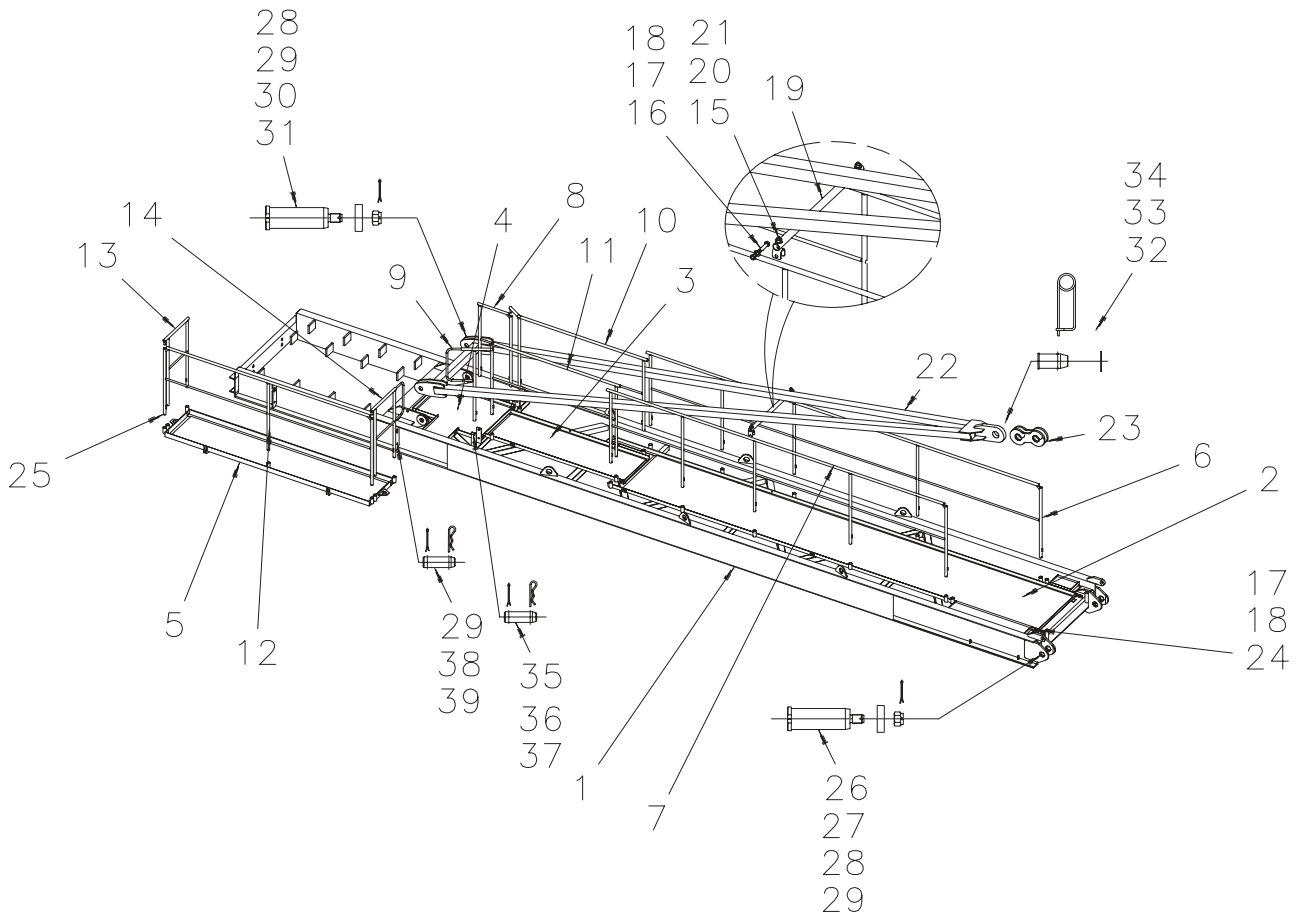


Nº	Referencia	Designación	Designation	Designation	Benennung	Q
1	3211-20197	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	CPOL3215P949	POLEA	POULIE	SHEAVE	SEILROLLE	1
3	BULON-20104	EJE	AXE	AXLE	ACHSE	1
4	CASQ564005	CASQUILLO	DOUILLE	BUSHING	BUCHSE	4
5	PSA5*40	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	3
6	3211-20275	CONTRAPESO	CONTREPOIDS	COUNTERWEIGHT	GEGENGEWICHT	4
7	CASQ5630168	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
8	3211-20227	VARILLA	TIGE	ROD	STANGE	2
9	ARP21F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
10	0985202508	TUERCA	ECROU	NUT	MUTTER	4
12	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
13	10400210.14	BULON	AXE	PIN	BOLZEN	1
15	ARP41F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
16	3211-20308	RODILLO	GALET	ROLLER	ROLLE	1
17	0985162008	TUERCA	ECROU	NUT	MUTTER	2
18	3211-20231	GATILLO	VERROU	PAWL	SPENHAKEN	1
19	3211-20237	GATILLO	VERROU	PAWL	SPENHAKEN	1
20	OL-20293	SOPORTE	SUPPORT	SUPPORT	HALTER	1
21	093310150025088	TORNILLO	VIS	BOLT	SCHRAUBE	4
22	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	8
23	0985101508	TUERCA	ECROU	NUT	MUTTER	4
24	3211-20326	APOYO	APPUI	SUPPORT	AUFLAGE	1
25	091208125020088	TORNILLO	VIS	BOLT	SCHRAUBE	2
26	ARP8.4F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
27	0934081258	TUERCA	ECROU	NUT	MUTTER	2
28	3211-20244	SOPORTE	SUPPORT	SUPPORT	HALTER	1
29	3211-20253	SOPORTE	SUPPORT	SUPPORT	HALTER	2
30	BULON-20107	BULON	AXE	PIN	BOLZEN	2
31	3211-20255	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
32	0985202508	TUERCA	ECROU	NUT	MUTTER	2
33	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
34	3211-20167	CHAVETA	CLAVETTE	KEY	PASSFEDER	2
35	093310150020088	TORNILLO	VIS	BOLT	SCHRAUBE	4
36	ARG10D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
37	GANCHO.3005	GANCHO	CROCHET	HOOK	HAKEN	1

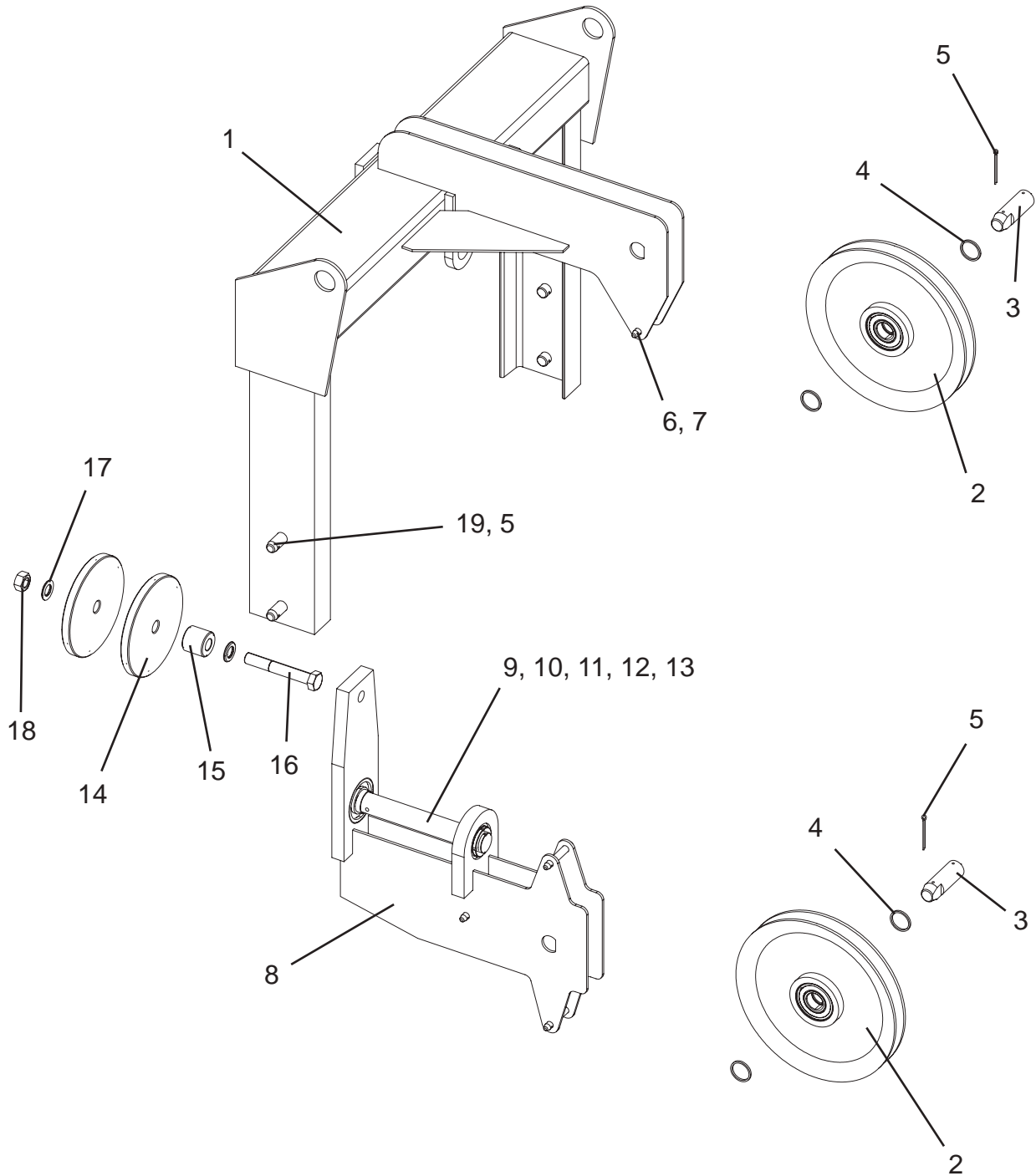




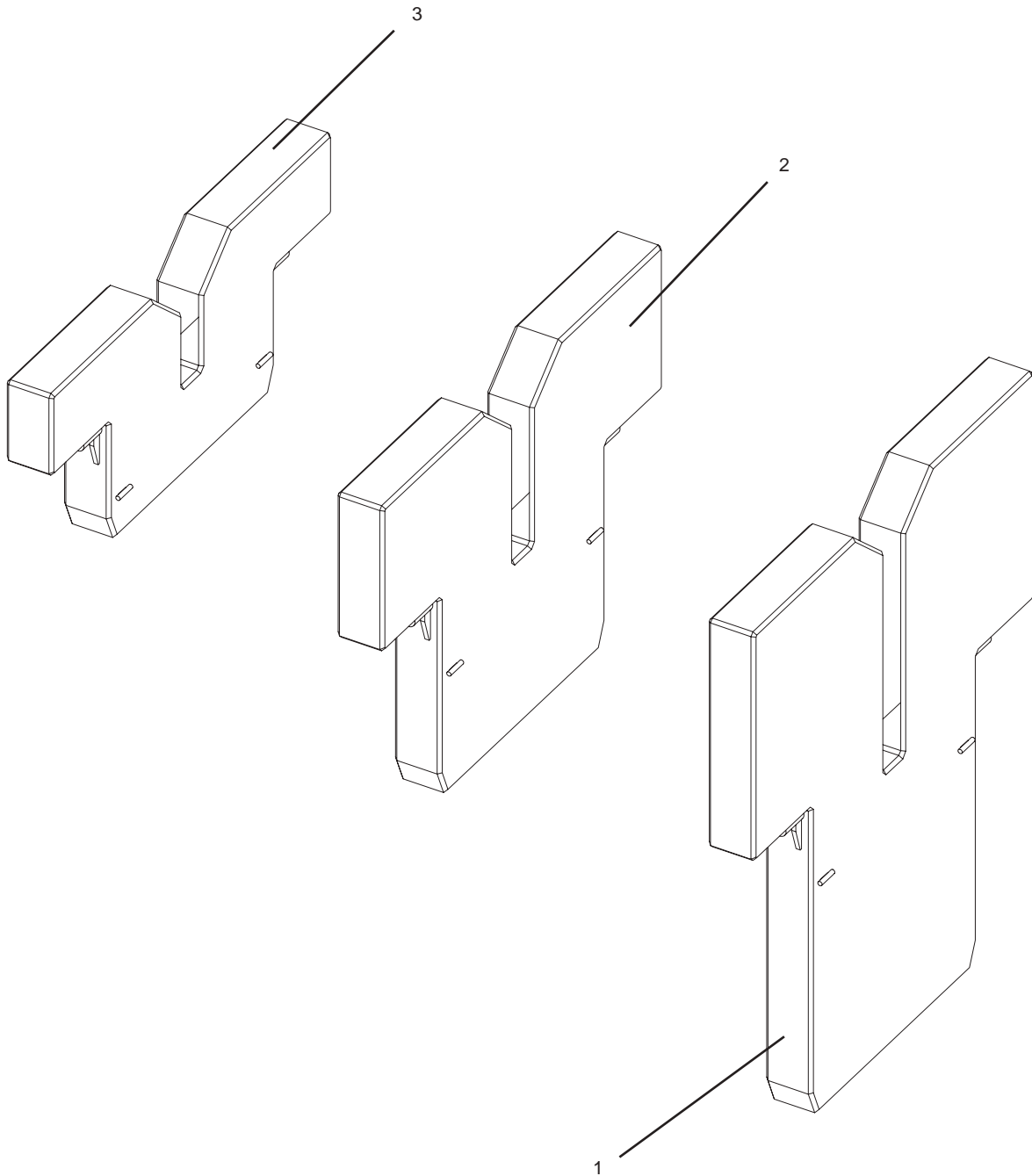
<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3211-20171	CHAPA SOPORTE	PLAQUE SUPPORT	SUPPORT PLATE	BLECHSTÜTZE	1
2	3211-20176	CHAPA SOPORTE	PLAQUE SUPPORT	SUPPORT PLATE	BLECHSTÜTZE	1
3	GANCHO.3002	GANCHO	CROCHET	HOOK	HAKEN	1
4	3211-20167	CHAVETA	CLAVETTE	KEY	PASSFEDER	2
5	093310150015088	TORNILLO	VIS	BOLT	SCHRAUBE	4
6	ARG10D127	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
7	CPOL3215P949	POLEA	POULIE	SHEAVE	SEILROLLE	2
8	BULON-20220	EJE	AXE	AXLE	ACHSE	2
9	CASQ564011	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	4
11	3211-20184	EJE	AXE	AXLE	ACHSE	2
12	ARP21F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
13	0985202508	TUERCA	ECROU	NUT	MUTTER	4
14	3211-20269	CONTRAPESO	CONTREPOIDS	COUNTERWEIGHT	GEGENGEWICHT	2
15	CASQ563045	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	4
16	3211-20272	CONTRAPESO	CONTREPOIDS	COUNTERWEIGHT	GEGENGEWICHT	2
17	093116200120088	TORNILLO	VIS	BOLT	SCHRAUBE	2
18	CASQ561682	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
21	3211-20262	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
22	PSE8*40	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
23	ARP17F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
24	0934162008	TUERCA	ECROU	NUT	MUTTER	2



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3207-20432	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	3207-20553	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
3	3207-20545	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
4	3207-20524	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
5	3207-20498	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
6	3202-20582	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
7	3202-20696	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
8	3202-20561	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
9	3202-20568	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
10	3202-20708	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
11	3202-20573	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
12	3202-20511	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
13	3202-20515	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
14	3202-20519	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	1
15	3207-20684	ABARCÓN	ATTACHE	U-CLAMP	U-KLAMMER	2
16	093310150070088	TORNILLO	VIS	BOLT	SCHRAUBE	2
17	ARP10.5F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
18	0934101508	TUERCA	ECROU	NUT	MUTTER	16
19	3207-20683	APOYO	APPUI	SUPPORT	AUFLAGE	1
20	0985202508	TUERCA	ECROU	NUT	MUTTER	2
21	ARP21F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
22	3208-20011	TIRANTE	TIRANT	STRUT	ABSPANNUNG	1
23	3208-20044	BIELA	BIELLE	LINK	VERBINDUNGSSTUECK	2
24	093310150030088	TORNILLO	VIS	BOLT	SCHRAUBE	14
25	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	23
26	BULON-20182	BULON	AXE	PIN	BOLZEN	2
27	3301-20061	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
28	0935303508	TUERCA	ECROU	NUT	MUTTER	4
29	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	6
30	BULON-20180	BULON	AXE	PIN	BOLZEN	2
31	3301P163-13	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
32	BULON-20184	BULON	AXE	PIN	BOLZEN	2
33	3208-20050	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
34	PSI6*70*170	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
35	10200170.14	BULON	AXE	PIN	BOLZEN	4
36	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	6
37	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
38	10250050.14	BULON	AXE	PIN	BOLZEN	2
39	PSR5	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2



<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3207-20437	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	3215-20075	POLEA	POULIE	SHEAVE	SEILROLLE	2
3	BULON-20104	EJE	AXE	AXLE	ACHSE	2
4	CASQ56404	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	4
5	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	10
6	10150080.14	BULON	AXE	PIN	BOLZEN	4
7	PSA3*40	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8
8	3207-20447	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
9	BULON-20148	EJE	AXE	AXLE	ACHSE	1
10	ROD6309.2RS	RODAMIENTO	ROULEMENT	BEARING	LAGER	2
11	CASQ564512	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
12	ARMB9	ARANDELA	RONDELLE	WASHER	SCHEIBE	1
13	TUKM9	TUERCA	ECROU	NUT	MUTTER	1
14	3207-20459	CONTRAPESO	CONTREPOIDS	COUNTERWEIGHT	GEGENGEWICHT	2
15	3207-20461	TOPE	BUTTOIR	STOP	ANSCHLAG	1
16	09312430016008	TORNILLO	VIS	BOLT	SCHRAUBE	1
17	ARP25F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
18	0934243008	TUERCA	ECROU	NUT	MUTTER	1
19	10250050.14	BULON	AXE	PIN	BOLZEN	4

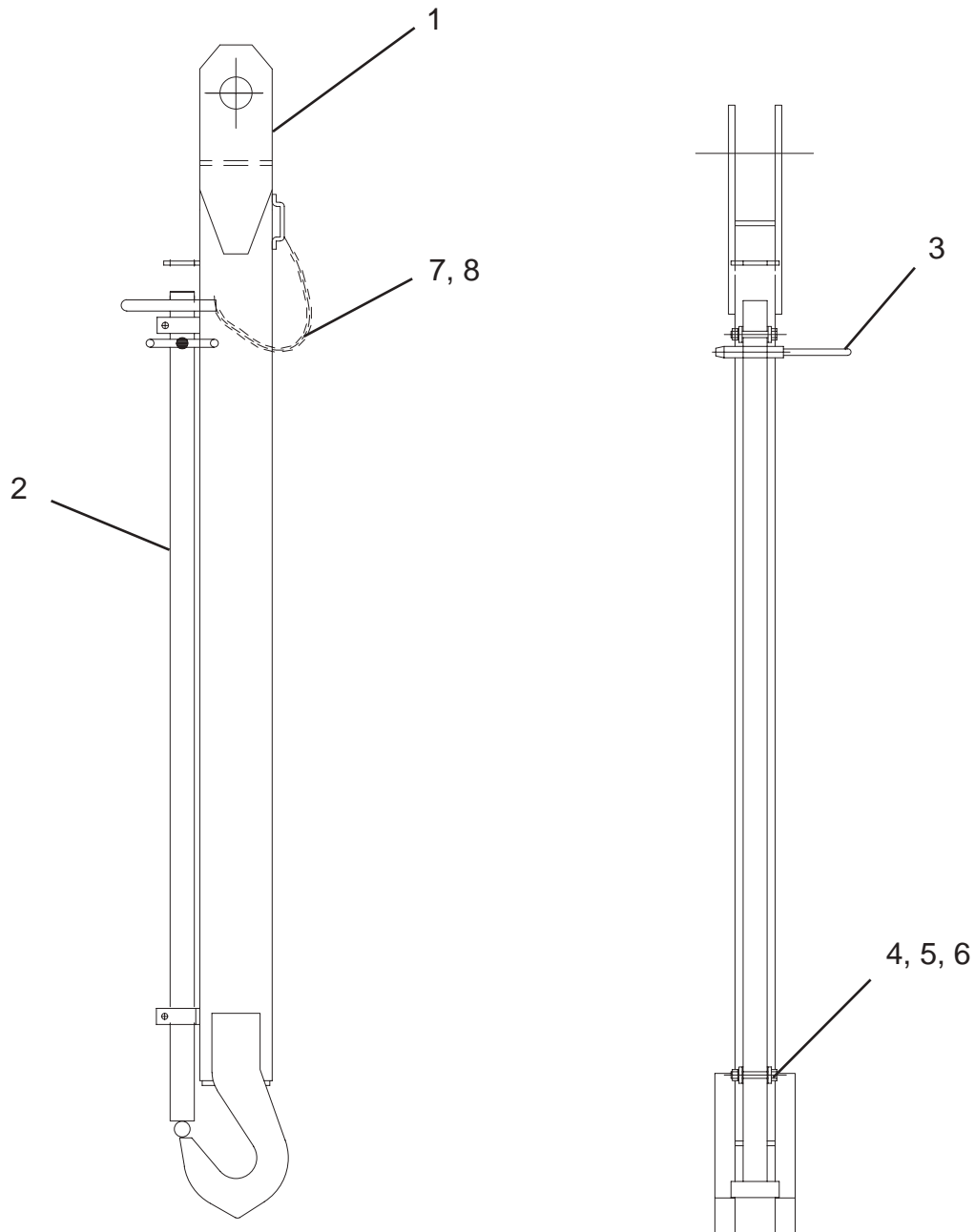


- 1..... 2200 kg
- 2..... 1400 kg
- 3..... 800 kg

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<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3207-20463	CONTRAPESO	CONTREPOIDS	COUNTERWEIGHT	GEGENGEWICHT	
2	3207-20670	CONTRAPESO	CONTREPOIDS	COUNTERWEIGHT	GEGENGEWICHT	
3	3207-20665	CONTRAPESO	CONTREPOIDS	COUNTERWEIGHT	GEGENGEWICHT	

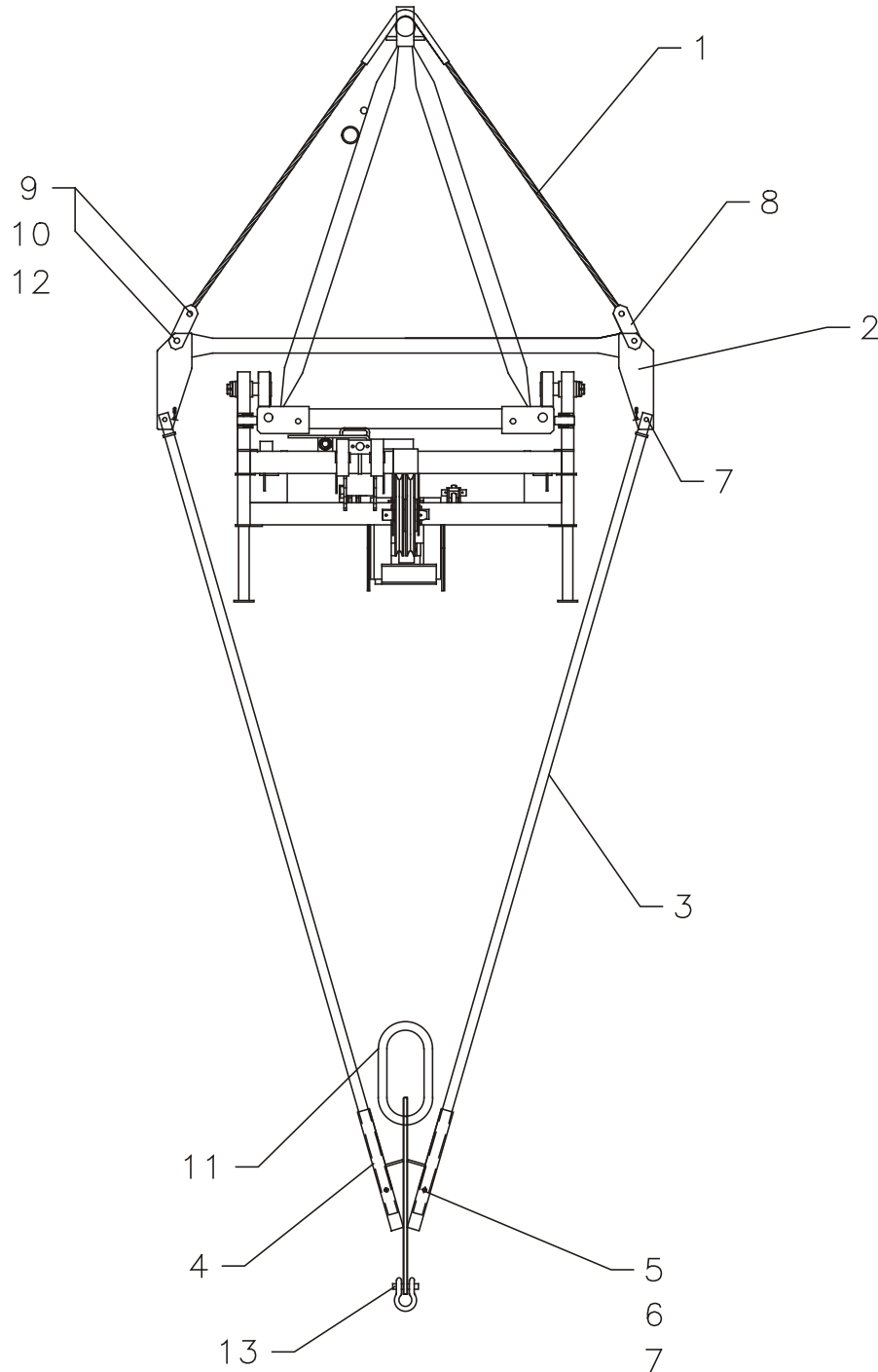




<i>Nº</i>	<i>Referencia</i>	<i>Designación</i>	<i>Designation</i>	<i>Designation</i>	<i>Benennung</i>	<i>Q</i>
1	3207-10352	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	1
2	3207-10346	LIMITADOR	LIMITEUR	LIMITER	SCHALTER	1
3	3207-10350	FIJACION	FIXATION	FASTENING	BEFESTIGUNG	1
4	093108125055088	TORNILLO	VIS	BOLT	SCHRAUBE	2
5	0934081258	TUERCA	ECROU	NUT	MUTTER	2
6	ARP8.5F111C125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
7	3301P179-08	CADENA	CHAINE	CHAIN	KETTE	1
8	MOSQ7*70	ANILLA	ANNEAU	RING	RING	2



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1	3214K172	LARGUERO	LONGERON	STRINGER	LAENGSTRAEGER	2
2	3214M173	TRAVIESA	TRAVERSE	CROSSTIE	TRAVERSE	2
3	3215P1023	HUSILLO	VIS	SPINDLE	SPINDEL	8
4	3214P404	SUPLEMENTO	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	8
5	OL-1101	BRIDA	BRIDE	FLANGE	FLANSCH	4
6	093308125025088	TORNILLO	VIS	BOLT	SCHRAUBE	12
7	ARG8D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
8	1408P1386	TORNILLO	VIS	BOLT	SCHRAUBE	16
9	0934273008	TUERCA	ECROU	NUT	MUTTER	16
10	3214P352.01	ARANDELA	RONDELLE	WASHER	SCHEIBE	32
11	3214M227	LARGUERO	LONGERON	STRINGER	LAENGSTRAEGER	4
12	3214P432	MORDAZA	MACHOIRE	CLAMP	KLEMMBACKE	4
13	3215P710	HUSILLO	VIS	SPINDLE	SPINDEL	4
14	0936424508	TUERCA	ECROU	NUT	MUTTER	12
15	PSE6*45	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	8



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1	3210-10223	TIRANTE	TIRANT	STRUT	ABSPANNUNG	1
2	3210-10120	TRAVIESA	TRAVERSE	CROSSTIE	TRAVERSE	1
3	3210-10123	SOPORTE	SUPPORT	SUPPORT	HALTERUNG	2
4	3210P251	GANCHO	CROCHET	HOOK	HAKEN	1
5	10150060.14	BULON	AXE	PIN	BOLZEN	2
6	PSA3*40	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
7	PSR*3.2	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
8	4310P014	BIELA	BIELLE	LINK	VERBINDUNGSSTUECK	2
9	10200060.14	BULON	AXE	PIN	BOLZEN	4
10	PSA5*40	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
11	4315P009	ANILLA	CHASSIS	FRAME	RAHMEN	1
12	PSR4	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
13	GRILLA 3/4 D82101	GRILLETE	MANILLE	SHACKLE	SCHAECKEL	1



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1	3210M514	GATILLO	VERROU	PAWL	SPENHAKEN	1
2	3210M511	FIJACION	FIXATION	FASTENING	BEFESTIGUNG	1
3	3210M513	GATILLO	VERROU	PAWL	SPENHAKEN	1
4	3210M510	FIJACION	FIXATION	FASTENING	BEFESTIGUNG	1
5	093316200050088	TORNILLO	VIS	BOLT	SCHRAUBE	2
6	0934162008	TUERCA	ECROU	NUT	MUTTER	2





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1	3210H124	BASTIDOR	CHASSIS	FRAME	RAHMEN	1
2	3210K126	TRAVIESA	TRAVERSE	CROSSTIE	TRAVERSE	1
3	3210M135	LARGUERO	LONGERON	STRINGER	LAENGSTRAEGER	1
4	3210H128	PANEL	PANNEAU	PANEL	TAFEL	1
5	3210H133	LARGUERO	LONGERON	STRINGER	LAENGSTRAEGER	1
6	3210M129	TRAVIESA	TRAVERSE	CROSSTIE	TRAVERSE	1
9	3210H114	GATILLO	VERROU	PAWL	SPENHAKEN	1
10	3210M115	GATILLO	VERROU	PAWL	SPENHAKEN	1
11	3210P130	TRAVIESA	TRAVERSE	CROSSTIE	TRAVERSE	1
12	3210M122	ESCALERA	ECELLE	LADDER	LEITER	1
13	3203K972	PROTECTOR	PROTECTEUR	GUARD	SCHUTZ	1
14	3210H132-F	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
15	3210H132-G	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
16	3210H132-E	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
17	3210H131-A	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
18	3210H131-D	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
19	3210H131-C	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
20	3210H131-B	PLATAFORMA	PLATEFORME	PLATFORM	BUEHNE	1
21	3210H132-J4	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
22	3210H132-J5	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	3
23	3210H132-J6	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	10
24	3210H131-B5	BARANDILLA	RAMBARDE	GUARD RAIL	BRUESTUNG	2
25	3210P138	GANCHO	CROCHET	HOOK	HAKEN	1
26	3210H136	CARRITO	CHARIOT	TROLLEY	LAUFKATZE	1
27	1408P030	TORNILLO	VIS	BOLT	SCHRAUBE	8
28	ARP19F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	40
29	0934182508	TUERCA	ECROU	NUT	MUTTER	40
30	1408P922	TORNILLO	VIS	BOLT	SCHRAUBE	32
34	093122250065109	TORNILLO	VIS	BOLT	SCHRAUBE	16
35	ARP23D6916	ARANDELA	RONDELLE	WASHER	SCHEIBE	16
36	09342225010	TUERCA	ECROU	NUT	MUTTER	16
37	3301P123.01	ABARCON	ATTACHE	U-CLAMP	U-KLAMMER	48
38	093110150070088	TORNILLO	VIS	BOLT	SCHRAUBE	24
39	ARG10D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	32
40	0934101508	TUERCA	ECROU	NUT	MUTTER	36
41	093110150100088	TORNILLO	VIS	BOLT	SCHRAUBE	6
42	1408P8923	POLEA	POULIE	SHEAVE	SEILROLLE	4
43	ROD6004.2RS	RODAMIENTO	ROULEMENT	BEARING	LAGER	4
44	AEI42	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	8
45	AEE20	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	6
46	10200167E.11	BULON	AXE	PIN	BOLZEN	1
47	3215P675	RODILLO	GALET	ROLLER	ROLLE	4
48	30250029E.14	BULON	AXE	PIN	BOLZEN	4
49	0985182508	TUERCA	ECROU	NUT	MUTTER	4
50	3215P670	RODILLO	GALET	ROLLER	ROLLE	16
51	GLY.PG252830F	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	16
52	10250071E.25	BULON	AXE	PIN	BOLZEN	16
53	055108125025088	TORNILLO	VIS	BOLT	SCHRAUBE	16
54	10600320E.14	BULON	AXE	PIN	BOLZEN	2
55	093312175030088	TORNILLO	VIS	BOLT	SCHRAUBE	2
56	0934121758	TUERCA	ECROU	NUT	MUTTER	2
57	20700125E.14	BULON	AXE	PIN	BOLZEN	1
58	3215P677	EJE	AXE	AXLE	ACHSE	1
59	3215P680	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
60	3215P676	RUEDA	ROUE	WHEEL	RAD	4
61	GLY.PG455040F	CASQUILLO	COUSSINET	BUSHING	LAGERBUCHSE	4
62	AEE45	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	4

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63	3215P678	EJE	AXE	AXLE	ACHSE	1
64	3215P679	SEPARADOR	ENTRETOISE	SPACER	DISTANZRING	2
65	10600248E.25	BULON	AXE	PIN	BOLZEN	1
66	3215P671	TAPA	COUVERCLE	COVER	DECKEL	1
67	093308125016088	TORNILLO	VIS	BOLT	SCHRAUBE	2
68	ARG8D127B	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
69	10800250.14	BULON	AXE	PIN	BOLZEN	1
70	PSA12*160	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	2
71	10250240.14	BULON	AXE	PIN	BOLZEN	1
72	PSA5*60	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	3
73	PSA7*80	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	46
74	1408P5555	RUEDA	ROUE	WHEEL	RAD	4
75	1408P5556	EJE	AXE	AXLE	ACHSE	4
76	ROD6306.2RS	RODAMIENTO	ROULEMENT	BEARING	LAGER	4
77	AEI72	ANILLO ELASTICO	ANNEAU D'ARRET	CIRCLIP	SICHERUNGSRING	4
78	ARMB6	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
79	TUKM6	TUERCA	ECROU	NUT	MUTTER	4
80	CN08.0RCGA.1	CABLE	CABLE	CABLE	KABEL	3
81	SJC5/16"	SUJETA-CABLES	SERRE-CABLE	WIRE ROPE CLAMP	DRAHTSEILKLEMME	28
82	GRILLA5/8D82101	GRILLETE	MANILLE	SHACKLE	SCHAECKEL	8
83	CN06.0XBGS.1	CABLE	CABLE	CABLE	KABEL	1
84	SJC1/4"	SUJETA-CABLES	SERRE-CABLE	WIRE ROPE CLAMP	DRAHTSEILKLEMME	4
85	1408P6924	TIRADOR	POIGNEE	HANDLE	GRIFF	1
86	CN08.0RCGA.1	CABLE	CABLE	CABLE	KABEL	40
87	10150110.14	BULON	AXE	PIN	BOLZEN	2
88	PSA4*50	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	4
89	10250070.14	BULON	AXE	PIN	BOLZEN	2
90	093110150090088	TORNILLO	VIS	BOLT	SCHRAUBE	2
91	093310150025088	TORNILLO	VIS	BOLT	SCHRAUBE	4
92	ARP27F111D125	ARANDELA	RONDELLE	WASHER	SCHEIBE	2
93	PSR5	PASADOR	GOUPILLE	COTTER PIN	VORSTECKER	6
94	ARP13F111D9021A	ARANDELA	RONDELLE	WASHER	SCHEIBE	4
95	20400090E.14	BULON	AXE	PIN	BOLZEN	4
96	20540135.25	BULON	AXE	PIN	BOLZEN	4
97	3210P537	CENTRADOR	CENTRAGE	DRIFT	ZENTRIERGERAET	4

