



CRANE SMH 420

TRIVERTER 444

INSTRUCTION MANUAL

ERECTION

DISMANTLING

OPERATION

MAINTENANCE

ORIGINAL INSTRUCTIONS (2006/42/EC)

EDITION 02/2008 – FROM CRANE SERIAL NUMBER 420/107
SAN MARCO INTERNATIONAL – EVEN PARTIAL REPRODUCTION PROHIBITED





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01. DESCRIPTION

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INTRODUCTION

- a) All crane erection, dismantling and maintenance operations shall be always carried out by skilled, properly trained and qualified operators only, aware of the crane characteristics and familiar with the contents of the present instruction Manual.
- b) Should the instructions of the present manual not be strictly followed or properly carried out, the Manufacturer declines all responsibility for any damages occurred to or caused by the crane.
- c) During erection operations, with moving structures, operators and all exposed persons shall keep out of the danger zone. Should it be necessary to approach the crane for inspections or adjustments, stop the crane and check that the structural parts are stable and well balanced before operating.
- d) Only qualified, trained and skilled personnel with the necessary qualifications to operate in total safety and familiar with the content and prescriptions of the present instruction Manual are allowed to operate the crane. For any information or instruction not available in the present Manual, please immediately contact the Technical Department of the manufacturer.
- e) With the purpose of keeping the crane in good operating conditions, the building yard manager shall preserve the present Manual in its integrity in a safe place as close as possible to the machinery, easily accessible and known to all operators. Moreover, it is recommended to consult it whenever required, strictly following the instructions contained therein. In case of loss or deterioration, please contact the manufacturer for a second copy of the Manual.

CRANE MANUFATURER:	SAN MARCO INTERNATIONAL S.r.L. Via Principe Umberto, 42/b 28021 Borgomanero (Novara - Italy)
MARK:	CE
CRANE MODEL:	SMH 420
VERSION:	TRIVERTER 444
CRANE SERIAL NUMBER:	_____
YEAR OF MANUFACTURE:	_____
OWNER:	_____

WARNING: this crane is sold and delivered in an English-speaking Country and the User Manual is written in English. The crane may be subsequently installed in or re-sold to another Country. If this is the case, the re-seller or the contractor shall request a further copy to SAN MARCO INTERNATIONAL duly translated into the official language of the Country in which the crane will be operated.



01.1. UNITS OF MEASUREMENT

- 1.1 You can find here reported the units of measurement in use in this Manual, with the conversion factors from **International System (SI)** to **Imperial System** and vice versa.
- 1.2 The quantities reported in this Manual are given with the double unit. Where needed to explain clearly, information is duplicated and given first in the International System and then in the Imperial System (drawings, tables, etc.).

01.1.1. INTERNATIONAL SYSTEM – UNITS IN USE

LENGTH	
meter	m
centimeter	cm (10 ⁻² m)
millimeter	mm (10 ⁻³ m)
MASS	
kilogram	kg
ton (metric ton)	t (10 ³ kg)
TEMPERATURE	
Celsius degree	°C
AREA	
square meter	m ²
square millimeter	mm ²
VOLUME	
cubic meter	m ³
CAPACITY	
liter	l (10 ⁻³ m ³)
DENSITY	
kilogram / square meter	kg/m ³
VELOCITY	
meter / minute	m/min
kilometer / hour	km/h
MASS/AREA	
kilogram / square centimeter	kg/cm ²
FORCE	
newton	N
decanewton	daN (10 N)
kilonewton	kN (10 ³ N)
TORQUE	
newton x meter	Nm
POWER	
kilowatt	kW
PRESSURE AND FORCE/AREA	
bar	bar (10 ⁵ Pa)
newton / square millimeter	N/mm ² (10 ⁶ Pa)



01.1.2. IMPERIAL SYSTEM – UNITS IN USE

LENGTH	
foot	ft
inch	in (ft/12)
MASS	
pound	lb
TEMPERATURE	
Fahrenheit degree	°F
AREA	
square foot	ft ²
square inch	in ²
VOLUME	
cubic foot	ft ³
CAPACITY	
gallon	gal
DENSITY	
pound / cubic foot	lb/ft ³
VELOCITY	
foot / minute	fpm
mile / hour	mph
MASS/AREA	
pound / square inch	lb/in ²
FORCE	
pound	lb
TORQUE	
pound x foot	lb·ft
POWER	
horsepower	HP
PRESSURE AND FORCE/AREA	
pound / square inch (psi)	psi
pound / square inch	lb/in ²



01.1.3. CONVERSIONS – FROM INTERNATIONAL SYSTEM TO IMPERIAL SYSTEM

LENGTH
1 in = 0.0254 m
1 ft = 12 in
1 in = 2.54 cm
1 in = 25.4 mm
MASS
1 lb = 0.4535924 kg
1 lb = 0.0004535924 t
TEMPERATURE
1°F = (1°C x 1.8) + 32
AREA
1 ft² = 0.09290304 m²
1 in² = 0.064516 mm²
VOLUME
1 ft³ = 0.0283685 m³
CAPACITY
1 gal = 3.785412 l
DENSITY
1 lb/ft³ = 16.01846 kg/m³
VELOCITY
1 fpm = 0.3048 m/min
1 mph = 1.609344 km/h
MASS/AREA
1 lb/in² = 0.07030696 kg/cm²
FORCE
1 lb = 4.448222 N
1 lb = 0.448222 daN
1 lb = 0.00448222 kN
TORQUE
1 lb·ft = 1.355818 Nm
POWER
1 HP = 0.746 kW
PRESSURE AND FORCE/AREA
1 psi = 0.06894757 bar
1 lb/in² = 0.006894757 N/mm²



01.1.4. CONVERSIONS – FROM IMPERIAL SYSTEM TO INTERNATIONAL SYSTEM

LENGTH
1 m = 1/0.0254 in
1 cm = 1/2.54 in
1 mm = 1/25.4 in
MASS
1 kg = 1/0.4535924 lb
1 t = 1/0.0004535924 lb
TEMPERATURE
1°C = (1°F -32)/1.8
AREA
1 m ² = 1/0.09290304 ft ²
1 mm ² = 1/0.064516 in ²
VOLUME
1 m ³ = 1/0.0283685 ft ³
CAPACITY
1 l = 1/3.785412 gal
DENSITY
1 kg/m ³ =1/16.01846 lb/ft ³
VELOCITY
1 m/min = 1/0.3048 fpm
1 km/h = 1/1.609344 mph
MASS/AREA
1 kg/cm ² =1/0.07030696 lb/in ²
FORCE
1 N = 1/4.448222 lb
1 daN = 1/0.448222 lb
1 kN = 1/0.00448222 lb
TORQUE
1 Nm = 1/1.355818 lb·ft
POWER
1 kW = 1/0.746 HP
PRESSURE AND FORCE/AREA
1 bar = 1/0.06894757 psi
1 N/mm ² = 1/0.006894757 ln/in ²

01.2. CRANE IDENTIFICATION

CE MARK ON ELECTRIC CABINET DOOR

CE

NAMEPLATE ON ROTARY BASE FRAME

SAN MARCO INTERNATIONAL S.R.L.

TIPO **SMH 420**

N° DI FABBRICA

J 17

TABLES ON ELECTRIC CABINET DOOR

MADE IN EUROPE

TEL. 0322-82601
FAX 0322-846035
Via PRINCEPI UMBERTO 42/B
28021 BORGOMANERO (NO)
ITALIA

E-MAIL: sanmarco@sanmarco.it
WWW: <http://www.sanmarco.it>

CRANE TYPE / TYPE DE CRANE SMH **PRODUCTION YEAR / ANNÉE DE CONSTRUCTION**

MAX. LOAD CHARGE MAX. CARGO MASSIMO	lb	kg	lb	kg	lb	kg

LOAD CURVE / COURBE DES CHARGES / DIAGRAMMA DI CARICO

		H MAX. / ALT. MAX.	
(lb)	(kg)	1000	1100
2205	2425	2646	2866
3086	3527	3968	4409
6614	8818		

CONSTANT CAPACITY WITH RAISED JIB / CAPACITÀ DI CARGO COSTANTE BRACCIO ALZATO

lb	kg

CONSTANT CAPACITY WITH CLOSED JIB / CAPACITÀ DI CARGO COSTANTE BRACCIO CHIUSO

lb	kg

HOISTING SPEEDS / VITESSES DE LÈVAGE / VELOCITÀ DI SOLLICAMENTO

kW	kW

NECESSARY ELECTRIC POWER / PUISSANCE ÉLECTRIQUE TOTALE / POTENZA ELETTRICA NOMINALE

kW	kW

ROTATION-RESISTANT HOISTING CABLE / CABLE DE LÈVAGE RÉSISTANT À LA ROTATION / FUNE DI SOLLICAMENTO ANTIGIRO

lb	kg

BREAKING LOAD / CARICO DI ROTTURA / CARICO DI ROTTURA

lb	kg

J 10 C

BASIC INSTRUCTIONS FOR USE

- All use, erection, dismantling and crane maintenance operations shall always be executed by a qualified operator, who is aware of all the characteristics of the structure and familiar with the contents of the user's Manual.
- Test all controls and safety devices at the start of a new shift.
- When erecting, if the structure is moving, the operator, workers and the public shall keep out of the danger zone. If it is necessary to get closer to the machine, for any check and setting, do it when the machine is not working, and after making sure that the structures are stable.
- Use the crane only for its intended use as specified in the User's Manual.
- Only loads of known and allowed weight should be lifted, within the hoist's range and at the recommended speeds.
- The load block should always work vertically, without side pulls or horizontal pulls or swings; the crane shall not be used for dragging loads or for pulling any restrained object.
- The danger zone as well as the loading and unloading area and the load rating charts shall be clearly visible from the operator's control station.
- Access to the danger zone within the hoist's range of rotation is forbidden and the area shall be enclosed.
- Always wait for the movement under way to be completed before reversing it.
- Hoist and load limiting devices are safety devices, when in normal operating conditions they shall not be used as operating stops.
- Always check that load is accurately slung and balanced.
- Never stress suspended load over the operator, workers and the public, within the crane range of rotation. The warning signal provided shall be used to alert all persons in the vicinity of any load lifting and handling operations.
- Get the electric power supply switch to open when the crane is out-of-service or is being serviced.
- Follow maintenance instructions and do all that is recommended to keep the crane in good operating conditions.
- Personal shall not ride a load, hoists or slings suspended by the crane. Use of the crane for lifting dangerous materials is forbidden.
- All use, erection, dismantling and crane maintenance operations shall be executed strictly following the instructions, prescriptions and prohibitions specified in the User's Manual.
- Prior to erecting or taking down the crane check all level in the hydraulic system, check cylinders and the hydraulic equipment (valves, pumps, hoses, etc.) for working order. Act on the push buttons UP - DOWN and NEAR - FAR by using the pressure gauge to its calibration pressure setting zero, through 100 adjustments in other ways, that the two chambers in each cylinder are filled with oil. The way one cannot dismantle the crane.
- Never crane operation shall be taken out of service when the temperature reaches the minimum operating temperature i.e. -20°C (-4°F).
- If the crane is not in perfect working order, it shall not be placed into service.

LUBRICATION

- Regularly check oil level in gearboxes and hydraulic equipment; top up as needed or replace if it has lost its viscosity.
- Weekly grease the slewing ring and the balls inside it through the grease nipples supplied.
- Periodically (see User's Manual) grease bearings and lubricate all moving parts of the crane, with special care being paid to articulated joints and cylinder pins.

MAINTENANCE (According with User's Manual)

- Inspect stabilizers and rest beams; make sure structures and ground show no yields.
- Inspect grounding connections, ground plates and electrical connections; inspect cables condition and the insulation of the electrical equipment.
- Daily check setting of limiting devices and of all safety devices.
- Daily check ropes, fittings, terminations and the load block.
- Weekly check all lifting accessories and hoists.
- Weekly lubricate chains, ropes and fittings.
- Make sure balls are tightened down and inspect pins, split and collar pins.
- Visually inspect that crane structures show no abnormal deformations or yields and that all sheaves can run freely.
- Every time you dismantle the crane accurately check all structural, hydraulic, electrical and mechanical parts.
- Carry out maintenance with extreme accuracy; to reach the upper part of the crane use supplied means of access and all personal protection equipments.
- To carry out maintenance, the crane shall be removed from service and all controllers shall be in the OFF position.
- Should any structural, mechanical, hydraulic or electric part need replacing, use SAN MARCO original spares only.

SAN MARCO INTERNATIONAL

SM-01C

IDENTIFICATION DATA

METAL NAMEPLATE AFFIXED TO THE ELECTRIC CABINET DOOR

o Name of the crane Manufacturer

o Crane model

o Crane serial number

o Year of manufacture

o Crane main characteristics

o Reference standards for structural work calculation

o CE mark

METAL NAMEPLATE AFFIXED TO THE ROTARY BASE FRAME

o Name of the crane Manufacturer

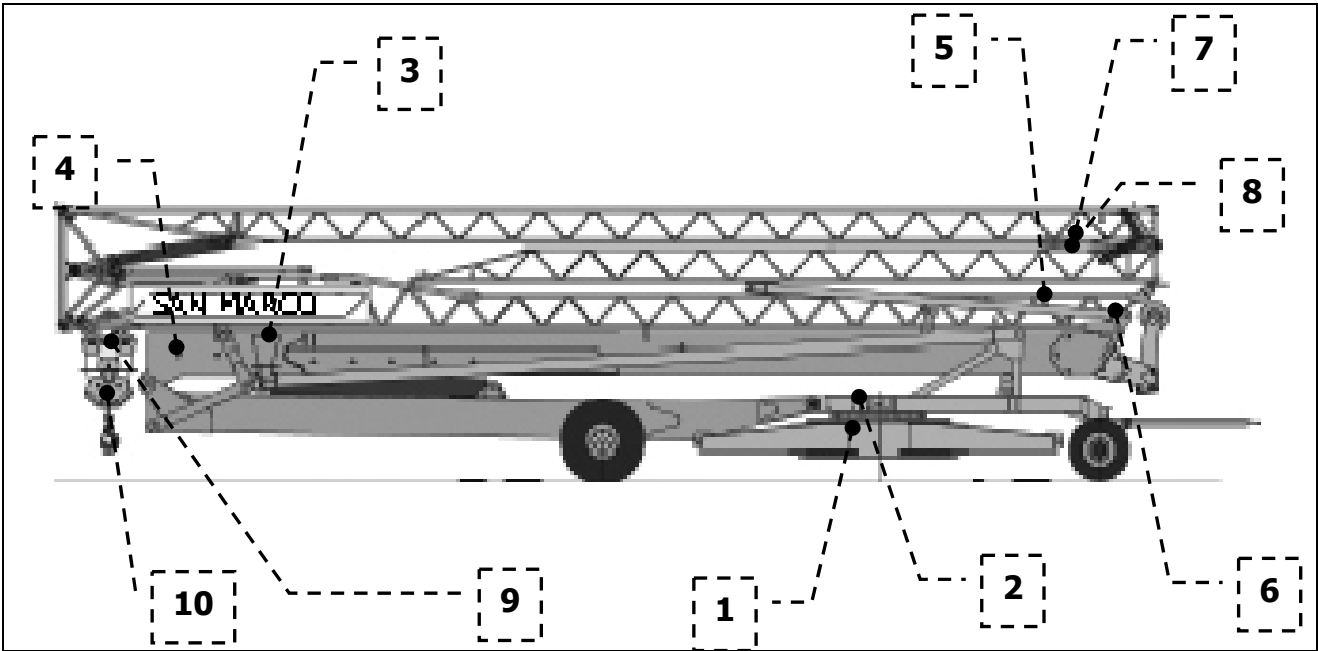
o Crane model

o Crane serial number



01.2.1. MAIN COMPONENTS IDENTIFICATION

- 2.1 The main components of the crane are stamped with a **code**, connected with crane serial number, in order to identify them.
- 2.2 To easily find the stampings, they are covered with red paint, and they are all made on the same side of the crane in transporting position.
- 2.3 The picture below gives the broad locations of the stampings.

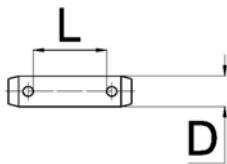


NR.	COMPONENT	STAMPED CODE
1	Lower base frame	
2	Upper base frame	
3	Lower tower	
4	Upper tower	
5	Boom brace	
6	Boom first section	
7	Boom second section	
8	Boom third section	
9	Trolley	
10	Block	

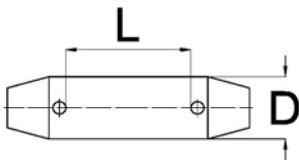


01.2.2. PINS IDENTIFICATION

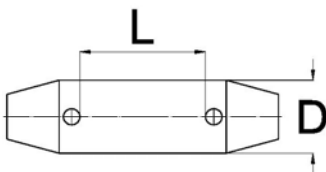
- 2.4 Some pins of the crane require being removed and reassembled during crane erection, operation and dismantling. Some other pins are supplied in the tool kit to be used during crane erection, operation and dismantling.
- 2.5 These pins are described in this paragraph, in order to identify them and not to mix them up. For each pins code, shape, length, diameter, employ and quantity are given.
- 2.6 In this manual, each time that a pin reported in this paragraph is mentioned, its code is quoted too, so that you can refer to this paragraph to identify the pin.
- 2.7 All the other pins, that might be removed only in case of special maintenance and replacement interventions, are not described in this paragraph. It is recommended to work with due caution when removing these pins, in order to reassemble them in their correct locations.
- 2.8 For each pin, use the relevant cotter or hitch pins, according with the instructions given at the paragraph 07.2.



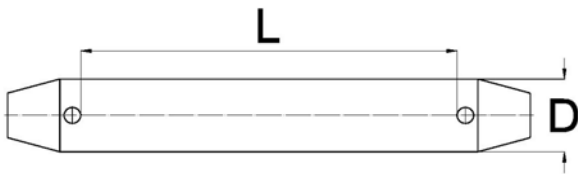
Code	n1.35.15
Length "L"	35 mm (1.38 in)
Diameter "D"	15 mm (0.591 in)
Employ	Shifting the ladder into the different operating configurations.
Quantity	8



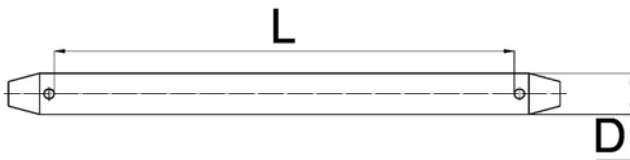
Code	n1.60.30
Length "L"	60 mm (2.36 in)
Diameter "D"	30 mm (1.18 in)
Employ	Assembly of the front axle to the base frame.
Quantity	4



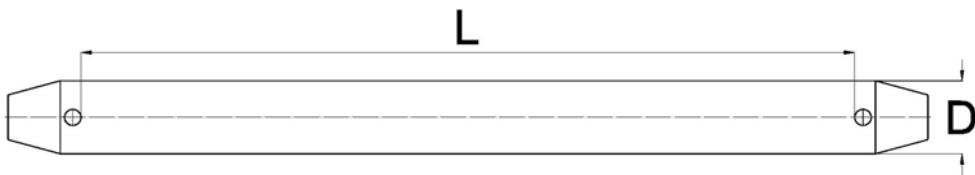
Code	n1.60.35
Length "L"	60 mm (2.36 in)
Diameter "D"	35 mm (1.38 in)
Employ	Assembly of the rear axle to the lower tower.
Quantity	4



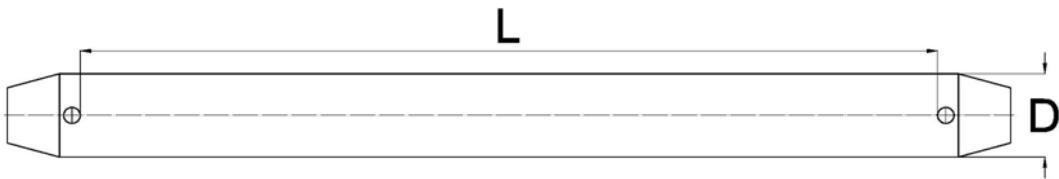
Code	n1.180.35
Length "L"	180 mm (7.09 in)
Diameter "D"	35 mm (1.38 in)
Employ	Connection tie rod B – tie rod C (concerned to erect the crane with inclined boom).
Quantity	1



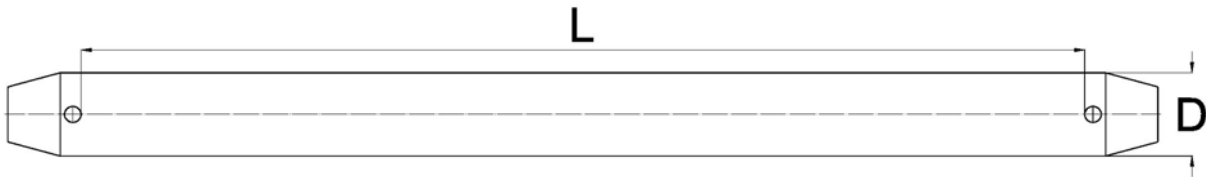
Code	n1.220.20
Length "L"	220 mm (8.66 in)
Diameter "D"	20 mm (0.787 in)
Employ	Locking of the front axle drawbar into horizontal position.
Quantity	1



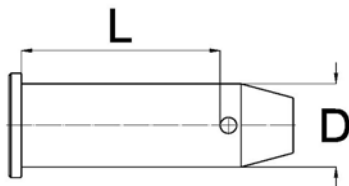
Code	n1.370.35
Length "L"	370 mm (14.6 in)
Diameter "D"	35 mm (1.38 in)
Employ	Connection tie rod H – tie rod G (concerned to erect the crane with inclined boom).
Quantity	1



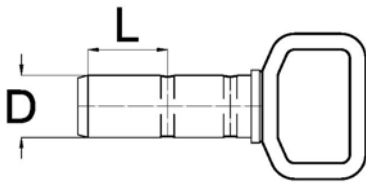
Code	n1.410.40
Length "L"	410 mm (16.1 in)
Diameter "D"	40 mm (1.58 in)
Employ	Locking of the final part to the intermediate one for the rear cusp with wheel into transporting or operation position.
Quantity	1



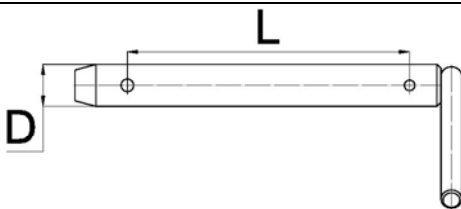
Code	n1.480.40
Length "L"	480 mm (18.9 in)
Diameter "D"	40 mm (1.58 in)
Employ	Locking of the intermediate part to the fixed one for the rear cusp with wheel into transporting or operation position.
Quantity	1



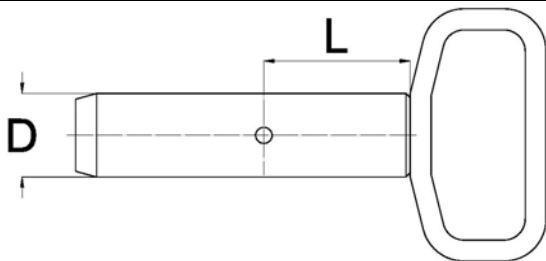
Code	r1.95.40
Length "L"	95 mm (3.74 in)
Diameter "D"	40 mm (1.58 in)
Employ	Locking of the stabilizer arms in the different configurations.
Quantity	4



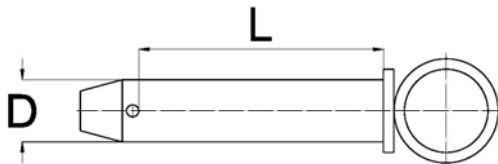
Code	x1.38.30
Length "L"	38 mm (1.50 in)
Diameter "D"	30 mm (1.18 in)
Employ	Locking of the hoisting drum.
Quantity	1



Code	x1.135.20
Length "L"	135 mm (5.32 in)
Diameter "D"	20 mm (0.787 in)
Employ	Locking of front axle rotation.
Quantity	1



Code	x2.70.90.40
Length "L"	70 mm (2.76 in)
Diameter "D"	40 mm (1.58 in)
Employ	Locking of base frame rotation.
Quantity	1



Code	x3.117.30
Length "L"	117 mm (4.61 in)
Diameter "D"	30 mm (1.18 in)
Employ	Connection main block – block for 4-pull line.
Quantity	1



01.3. INTENDED USE

- 3.1 The crane model **SMH 420** for building yard shall be used only and exclusively for the intended purposes of this crane type and in compliance with the service factors prescribed by standards UNI 7670 and ISO 4301 further on indicated.
- 3.2 The crane shall be employed for the vertical hoisting (lifting and lowering) of unitary loads, and for their handling within the area covered by the crane arc of swing and by the traverse radius of the boom trolley.
- 3.3 Any lifting device eventually supplied with the crane shall be used in strict respect of the prescribed employ limits, and precisely:
- o **Bucket**, for lifting concrete, mortar or sand;
 - o **Box**, for lifting bricks, roofing and wall tiles;
 - o **Fork**, only and exclusively for downloading pallets from vehicles onto the ground or vice versa with a maximum allowed lifting height of **1.5 meters (4'-11")**.

In any case, the lifted loads shall be perfectly balanced and never spill over the lifting device.

- 3.4 The erection (and dismantling) devices supplied with the crane have the only purpose to handle the structural parts the crane is composed of at the erection (and dismantling) stage; it is strictly forbidden to employ them for any other purpose or as ancillary lifting means. In particular, the tower and the boom can be unfolded or folded only with no load on the hook.
- 3.5 **It is forbidden to use the crane for any purpose other than specified. In particular, it is absolutely forbidden to employ the crane for lifting up persons.**
- 3.6 The use conditions of **H1** hoisting structures (DIN 15018) require that every **200,000 working cycles**, the crane shall undergo complete overhauling and worn-out components replacement.
- 3.7 The use conditions of **M4**-class lifting mechanisms (ISO 4301) establish a limit of **3,200 service hours** with frequent lifting at maximum load and usual lifting at moderate load. After said service time, the lifting mechanisms shall be fully overhauled and worn-out components replaced.

	WARNING
➤	Non-observation of the given instructions and improper use of the crane might cause serious damages to the crane structure and to its electrical and mechanical components.

- 3.8 During crane handling, erection, dismantling, operation and maintenance, the operators and all exposed persons shall wear the personal protection equipment (**PPE**, i.e. helmet, gloves, safety shoes, belts, etc.) in any case prescribed by laws and regulations to ensure the required safety levels.
- 3.9 Crane operation is allowed to qualified, trained and skilled personnel only, specially trained and duly authorised to operate the crane.
- 3.10 To control the crane, it is possible to arrange, at user's care, a type-approved remote wireless control board, suitable to the technical features of the crane.



- 3.11 The crane can be operated within a limit temperature of **-20°C (-4°F)**. Below this temperature the crane shall be taken out of service. The lowest temperature allowed for crane erection (and dismantling) is **-10°C (14°F)**. The lowest temperature for storage is **-40°C (-40°F)**.
- 3.12 The greatest wind speed allowed to operate the crane is **72 km/h (44,7 mph)**. The speed shall be gauged at the highest point of the crane. When the wind speed exceeds the limit, the crane shall be taken out of service with the swing brake unlocked.

OPERATION LIMIT CONDITIONS	
OPERATION LIMIT TEMPERATURES	-20°C to +40°C -4°F to 104°F
ERECTION AND DISMANTLING LIMIT TEMPERATURES	-10°C 14°F
STORAGE LIMIT TEMPERATURES	-40°C to +50°C -40°F to 122°F
IN-SERVICE GREATEST WIND SPEED	72 km/h 44.7 mph

- 3.13 Hosting winch, trolley winch and swing motors are equipped with electric automatic brakes. The free fall of the load is not allowed.



01.4. CRANE GENERAL DATA

- 4.1 Fast self-erecting crane with rotary base frame, variable speed drive-controlled operation movements, equipped with:
 - o four load hoisting variable speeds;
 - o four swing variable speeds;
 - o four trolley variable speeds.
- 4.2 Main load capacities and boom radii of the crane:

RADIUS with horizontal boom	LOAD	
41.7 m	1,000 kg	
23.64 m	2,000 kg	CRANE WITH 2-LINE PULL
13.46 m	4,000 kg	CRANE WITH 4-LINE PULL CONNECTED

RADIUS with horizontal boom	LOAD	
136'-9"	2,204 lbs	
77'-6"	4,409 lbs	CRANE WITH 2-LINE PULL
44'-1"	8,818 lbs	CRANE WITH 4-LINE PULL CONNECTED

Possibility of operating the crane with the boom end section folded:

REDUCED MAX. RADIUS with boom end section folded	LOAD
30.85 m	1,400 kg

REDUCED MAX. RADIUS with boom end section folded	LOAD
101'-2"	3,086 lbs

- 4.3 Possibility of operating the crane with raised boom and max. load constant along the whole boom length.

RAISED BOOM	
HEIGHT AT THE BOOM TIP	CONSTANT MAX. LOAD
26.70 m	1,000 kg

RAISED BOOM	
HEIGHT AT THE BOOM TIP	CONSTANT MAX. LOAD
87'-7"	2,205 lbs



4.4 Possibility of operating the crane with folded boom and max. load capacity along the whole boom length.

MAX. RADIUS with folded boom (axis of swing – horizontal projection of the boom)	CONSTANT MAX. LOAD	
15.5 m	2,000 kg	CRANE WITH 2-LINE PULL
	3,000 kg	CRANE WITH 4-LINE PULL CONNECTED

MAX. RADIUS with folded boom (axis of swing – horizontal projection of the boom)	CONSTANT MAX. LOAD	
50'-10"	4,409 lbs	CRANE WITH 2-LINE PULL
	6,613 lbs	CRANE WITH 4-LINE PULL CONNECTED

4.5 The crane is equipped with three-phase motors. Power supplying is as follows:

FEEDING	POWER
Three-phase 480 V 60 Hz	20 kW 26.8 HP

4.6 Crane erection is possible with the rotary base frame oriented in any direction. Boom folding and unfolding are allowed with the crane erected and fully ballasted only.

4.7 The crane is equipped with ready-to-use ropes and safety devices.

4.8 Crane equipped with cement ballast. The ballast is composed as follows:

- o erection ballast **7,700 kg (16,976 lbs)**: 2 blocks weighing 1,850 kg (4,079 lbs) each one, 2 blocks weighing 2,000 kg (4,409 lbs) each one;
- o operation ballast **24,700 kg (54,454 lbs)**: 19 blocks weighing 1,300 kg (2,866 lbs) each one;
- o total ballast: **32,400 kg (71,430 lbs)**.

4.9 Equipped with rubberised axles, capable of supporting the crane weight without the cement erection ballast, for transporting the crane around the building yard. The axles, fixed to the upper base frame and to the tower, can be removed.

4.10 The crane may be equipped with a building yard headlight **OPTIONAL**.

4.11 The crane is finished with a double coat of paint. Tower and boom are hot galvanized.

4.12 It is forbidden to employ the crane in a potentially explosive or corrosive or oxidative atmosphere, or in the risk of fire. When calculating the structures, seismic effects and snow loads have not been taken into consideration.



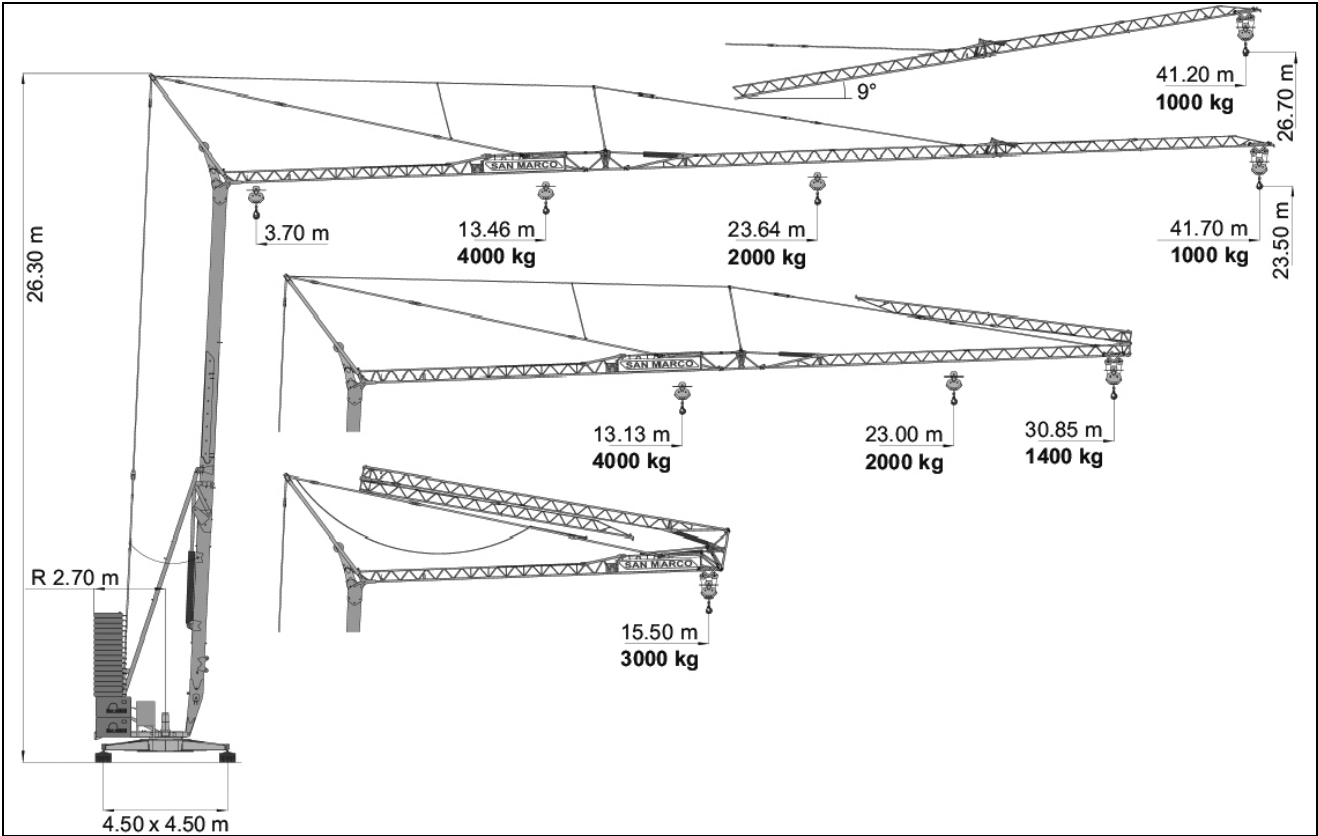
01.4.1. TOOL KIT

4.13 The crane is supplied complete with a tool kit inside a casing, consisting of:

- o electric cabinet opening key;
- o padlock for the electric cabinet;
- o pliers;
- o screwdriver;
- o wrench 17/19 for safety devices adjustment;
- o wrench 24 for operation ballast tie rods;
- o wrench 50 for erection ballast tie rods;
- o wrench 60 for stabilizer arms;
- o load indicator flags (if not already fitted on the boom).



01.5. TECHNICAL FEATURES



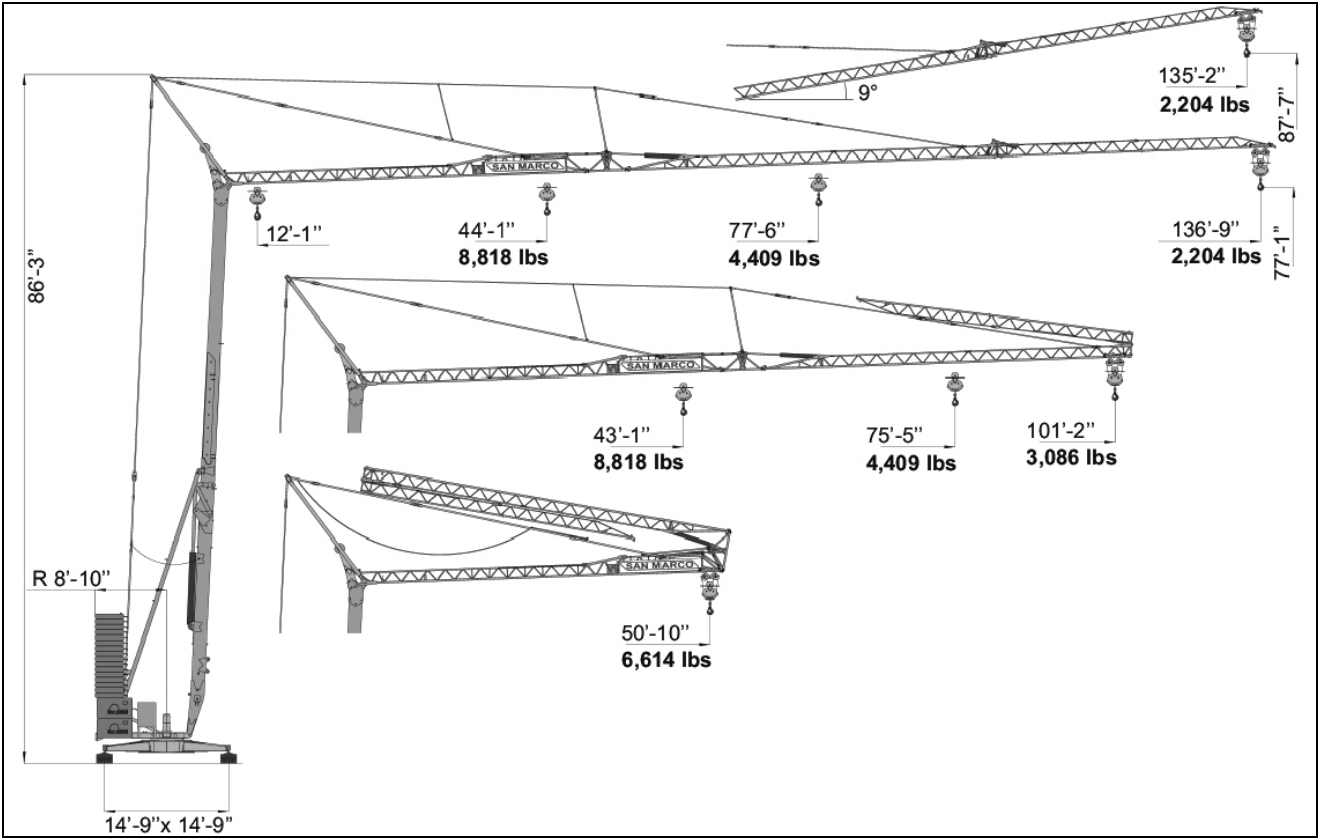
Employ class of frames and structures	H1 B3 DIN 15018
Hoisting class	H1
Average loading rate	B3
Machine class (ISO 4301/1)	A4-Q2 (Kp=0.25) U4 (250,000 working cycles)
Hoisting mechanism class	M4 (ISO 4301/3)
Operating condition	T4 (3,200 hours)
Load rate	L2 (Km = 0.25) subject to frequent max. load but generally moderate load
Swing mechanism class	M4 (ISO 4301/3)
Operating condition	T3 (1,600 hours)
Load rate	L3 (Km=0.50)
Trolley mechanism	M2 (ISO 4301/3)
Operating condition	T2 (800 hours)
Load rate	L2 (Km=0.25)



TECHNICAL FEATURES	
Rated load	2,000 kg / 4,000 kg
Load at the boom tip	1,000 kg – 1,400 kg
Constant max. load with folded boom	2,000 kg / 3,000 kg
Constant max. load with raised boom	1,000 kg
Max. load at the micro speed	2,000 kg / 4,000 kg
Max. load at the slow speed	2,000 kg / 4,000 kg
Max. load at the middle speed	1,400 kg / 2,800 kg
Max. load at the fast speed	1,000 (800) kg / 2,000 (1,600 kg)
Erection motor power	4 kW
Hoisting motor power	8.8 kW with variable speed drive
Swing motor power	3 kW with variable speed drive
Trolley motor power	2.5 kW with variable speed drive
Hoisting micro speed	12 m/min / 6 m/min
Hoisting slow speed	25 m/min / 12.5 m/min
Hoisting middle speed	38 m/min / 19 m/min
Hoisting fast speed	50 m/min / 25 m/min
Swing speeds	0.25-0.5-0.75-1 rpm
Trolley speeds	10-20-30-40 m/min
Rated power	20 kW (three-phase)
Feeding voltage	480 V 60 Hz $\pm 5\%$ (three-phase)
Control circuit voltage	48 V
Measured A-weighted sound pressure level	86.6 dB(A)
Ensured A-weighted sound pressure level	92.0 dB(A)
Height under hook	23.50 – 26.70 m
Maximum radius	41.7 – 31.85 – 15.5 m
Total ballast weight	32,400 kg
Crane total weight with erection ballast	26,800 kg
Crane total weight without erection ballast	19,100 kg
Front axle total load without erection ballast	3,760 kg
Rear axle total load without erection ballast	15,340 kg
Maximum crane displacement speed	25 km/h
Maximum in-service wind speed allowed	72 km/h
Maximum out-of-service wind speed	102/130/150 km/h
Maximum erection (dismantling) wind speed	10 km/h
Acoustic level measurements with a 2,000 kg maximum load at lifting and lowering speeds of 25 m/min (slow speed with 2-line pull).	
The values separated by a slash "/" (for example: "Rated load") refer to the crane with 2-line pull (first value) and to the crane with 4-line pull (second value).	



CRANE SMH 420 – EDITION 02/2008



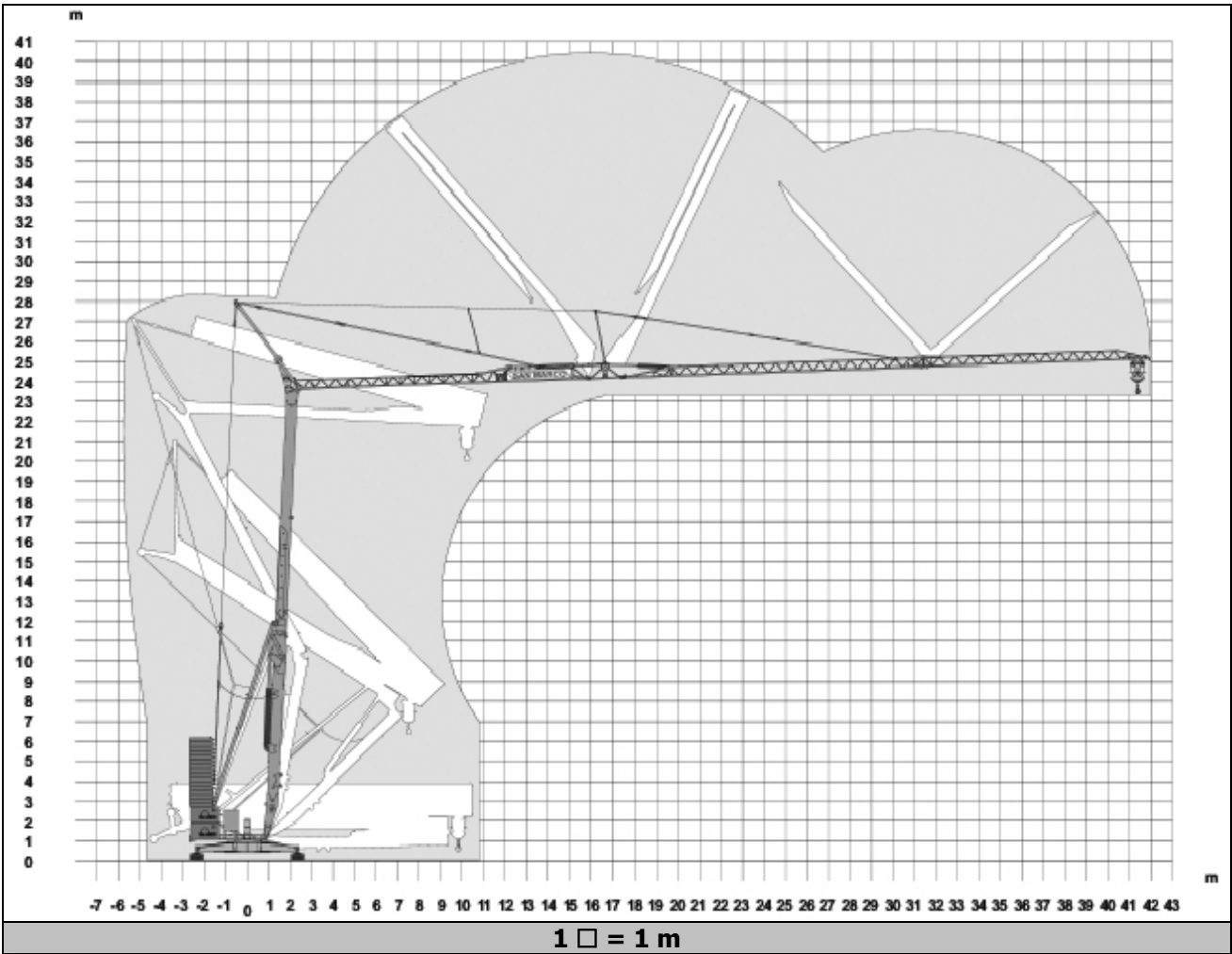
Employ class of frames and structures	H1 B3 DIN 15018
Hoisting class	H1
Average loading rate	B3
Machine class (ISO 4301/1)	A4-Q2 (Kp=0.25) U4 (250,000 working cycles)
Hoisting mechanism class	M4 (ISO 4301/3)
Operating condition	T4 (3,200 hours)
Load rate	L2 (Km = 0.25) subject to frequent max. load but generally moderate load
Swing mechanism class	M4 (ISO 4301/3)
Operating condition	T3 (1,600 hours)
Load rate	L3 (Km=0.50)
Trolley mechanism	M2 (ISO 4301/3)
Operating condition	T2 (800 hours)
Load rate	L2 (Km=0.25)

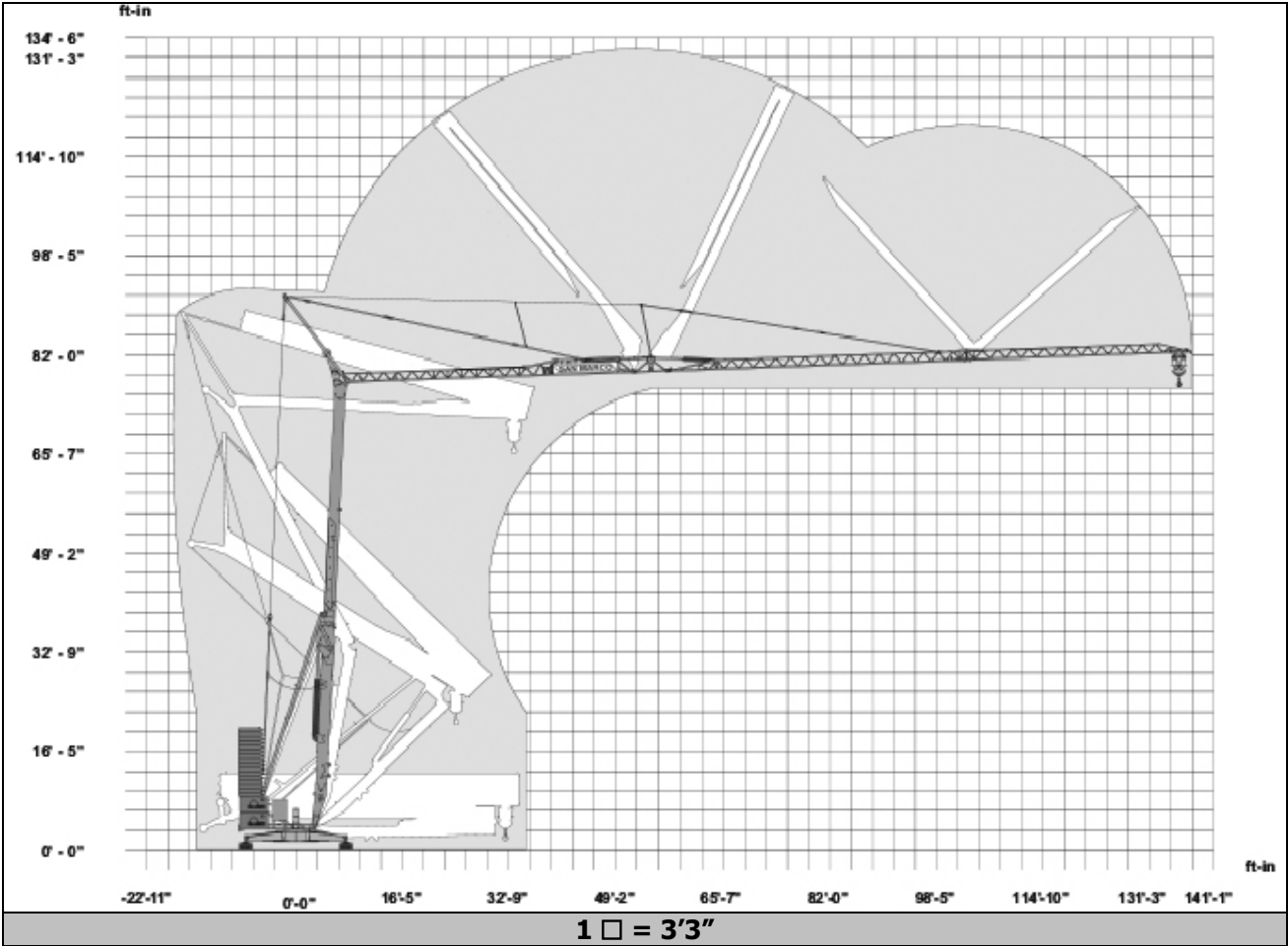


TECHNICAL FEATURES	
Rated load	4,409 lbs / 8,818 lbs
Load at the boom tip	2,204 lbs – 3,086 lbs
Constant max. load with folded boom	4,409 lbs / 6,613 lbs
Constant max. load with raised boom	2,204 lbs
Max. load at the micro speed	4,409 lbs / 8,818 lbs
Max. load at the slow speed	4,409 lbs / 8,818 lbs
Max. load at the middle speed	3,086 lbs / 6,172 lbs
Max. load at the fast speed	2,204 (1,763) lbs / 4,409 (3,527) lbs
Erection motor power	5.4 HP
Hoisting motor power	11.8 HP with variable speed drive
Swing motor power	4.0 HP with variable speed drive
Trolley motor power	3.4 HP with variable speed drive
Hoisting micro speed	39.4 fpm / 19.7 fpm
Hoisting slow speed	82.0 fpm / 41.0 fpm
Hoisting middle speed	124.7 fpm / 62.3 fpm
Hoisting fast speed	164.0 fpm / 82.0 fpm
Swing speeds	0.25-0.5-0.75-1 rpm
Trolley speeds	32.8-65.6-98.4-131.2 fpm
Rated power	26.8 HP (three-phase)
Feeding voltage	480 V 60 Hz $\pm 5\%$ (three-phase)
Control circuit voltage	48 V
Measured A-weighted sound pressure level	86.6 dB(A)
Ensured A-weighted sound pressure level	92.0 dB(A)
Height under hook	77'-1" – 87'-7"
Maximum radius	136'-9" – 101'-2" – 50'-10"
Total ballast weight	71,430 lbs
Crane total weight with erection ballast	59,084 lbs
Crane total weight without erection ballast	42,109 lbs
Front axle total load without erection ballast	8,289 lbs
Rear axle total load without erection ballast	33,820 lbs
Maximum crane displacement speed	15.5 mph
Maximum in-service wind speed allowed	44.7 mph
Maximum out-of-service wind speed	102/130/150 km/h
Maximum erection (dismantling) wind speed	6.2 mph
Acoustic level measurements with a 4,409 lbs maximum load at lifting and lowering speeds of 82.0 fpm (slow speed with 2-line pull).	
The values separated by a slash "/" (for example: "Rated load") refer to the crane with 2-line pull (first value) and to the crane with 4-line pull (second value).	



01.6. ERECTION DIMENSIONS







01.7. CRANE TRANSPORTING AND TOWING

	WARNING
➤ Before starting any transport or towing operations, check that the lower section of the base frame is firmly secured to the upper section by means of the swing lock pin (paragraph 07.3). ➤ All the crane displacement, transporting or towing operations shall be carried out only by qualified, trained and informed operators, who know about the technical characteristics of the crane.	

A) CRANE TRANSPORTING

- 7.1 The crane can be transported by a vehicle of adequate dimensions and capacity. To reduce crane height during transport, the axles could be disassembled.

B) CRANE TOWING

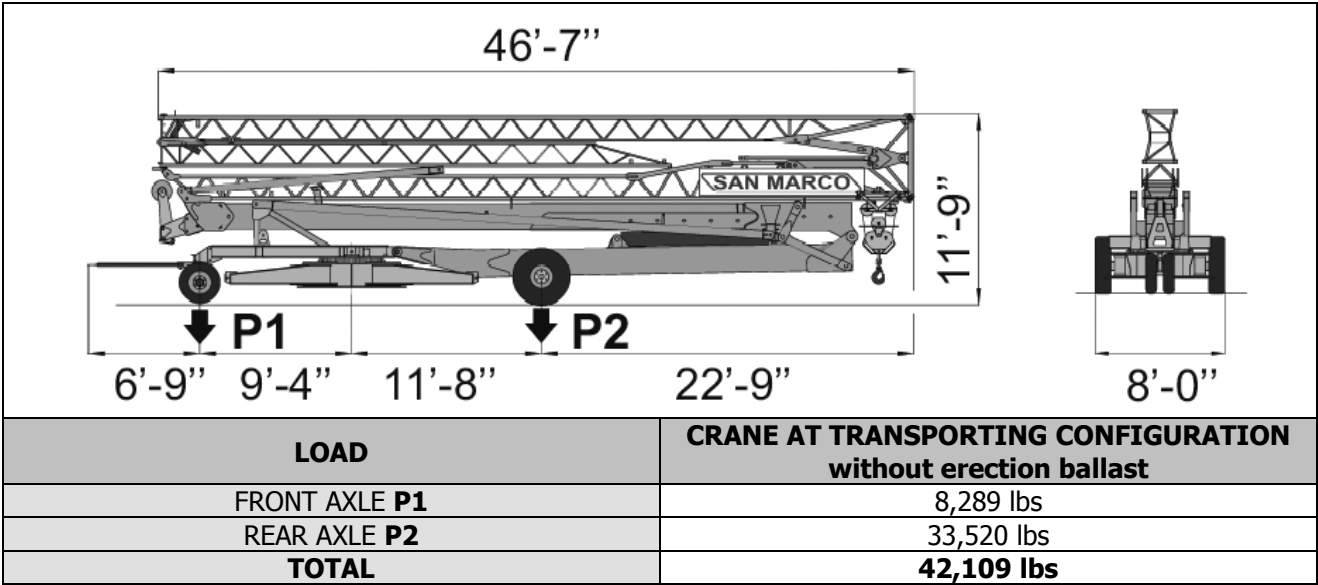
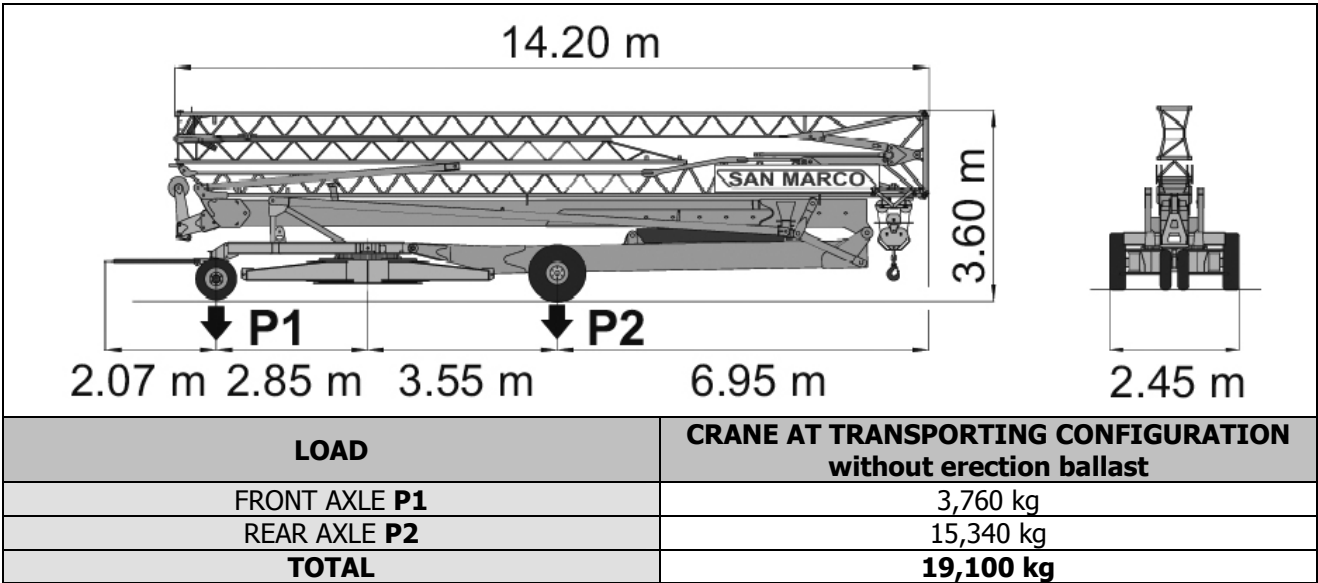
- 7.2 Crane towing is allowed within the building yard only (do not tow the crane on the road) by means of a vehicle of adequate dimensions.
- 7.3 The crane shall be towed without ballast and for short distances only.
- 7.4 Before starting crane towing, the following tasks shall be accomplished:
- o carefully secure all the mobile parts of the crane;
 - o unload the complete ballast;
 - o check the locking pins **r1.95.40** of the stabilizers arms anf their relevant hitch pins;
 - o check the tyres pressure;
 - o check the tightness of the wheel nuts;
 - o check the fixing pins **n1.60.30** base frame – front axle and its relevant hitch pins;
 - o check the fixing pins **n1.60.35** lower tower – rear axle and its relevant hitch pins;
 - o check the fixing pin axle – drawbar and its relevant hitch pins.
- 7.5 Check that all warnings and indicator signs, in compliance with regulations relating to crane towing, are correctly placed.
- 7.6 In no case towing speed of **25 km/h (15.5 mph)** shall be exceeded In presence of uneven ground, speed shall be considerably reduced to avoid damaging the crane or the axles. Do not tow the crane on rough or loose ground. Max. gradient allowed **5%**.
- 7.7 During crane transport frequently check the tyres temperature, stop frequently to allow the tyres to cool down and check for tightness of wheel nuts.



	WARNING
➤ Never carry out swing operations being the crane dismantled, without removing the lock pin x2.70.90.40 between upper base frame and lower base frame. ➤ Equally, never transport the crane without locking the two parts of the base frame. ➤ An improper crane towing on the road, besides being subject to road traffic code penalties, might seriously damage wheels, axles etc; ➤ Transporting the ballasted crane would cause breakages or deformations to its structural parts. ➤ Excessive speeds, crashess against kerbs and holes might seriously damage the driving devices and components.	



01.7.1. LOAD ACTING ON THE AXLES



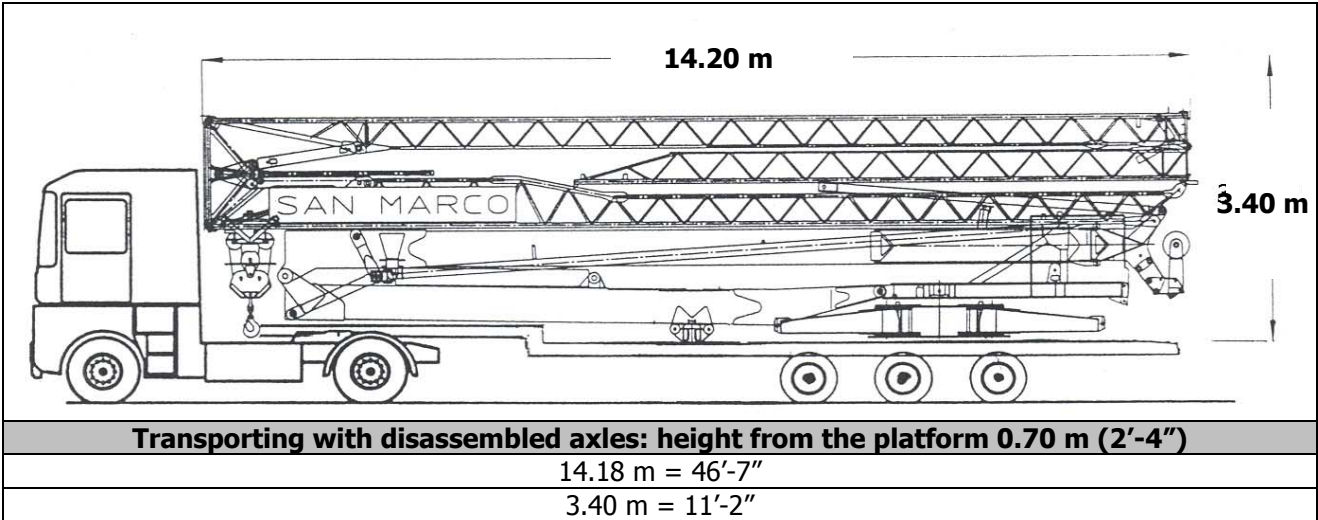
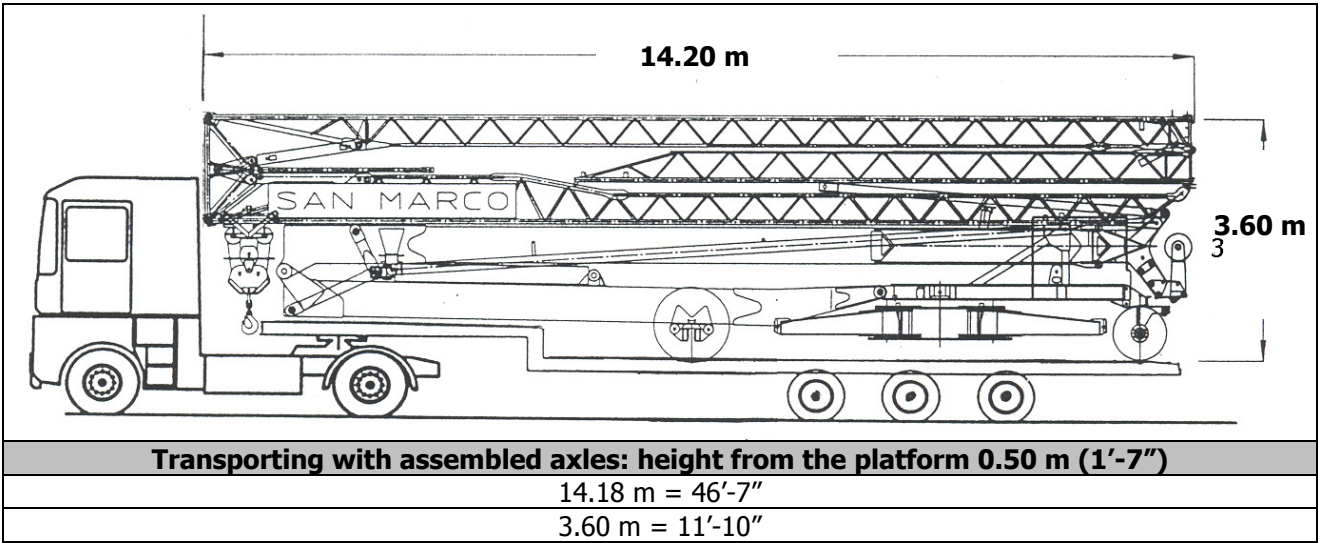


	WARNING
➤ For transporting on the road, the crane shall be equipped with suitable braking axles. ➤ The towing drawbar eyelet shall be securely fixed to the towing hook of the vehicle by means of a sturdy pin, vertically positioned and secured by a spring pin preventing it from accidentally slipping off. ➤ When towing the crane, remove the pin n1.220.20 locking the drawbar vertically and the pin x1.135.20 locking the front axle horizontally; these lock-pins shall only be inserted when hitching and unhitching the front axle from the base frame.	

ESTIMATED EFFORTS AT THE TOWING HOOK	
Max. traction effort	20,000 N (4,496 lbs)
Max. vertical effort	2,000 N (450 lbs)



01.7.2. TRANSPORTING ON TRUCK





01.8. CRANE LIFTING

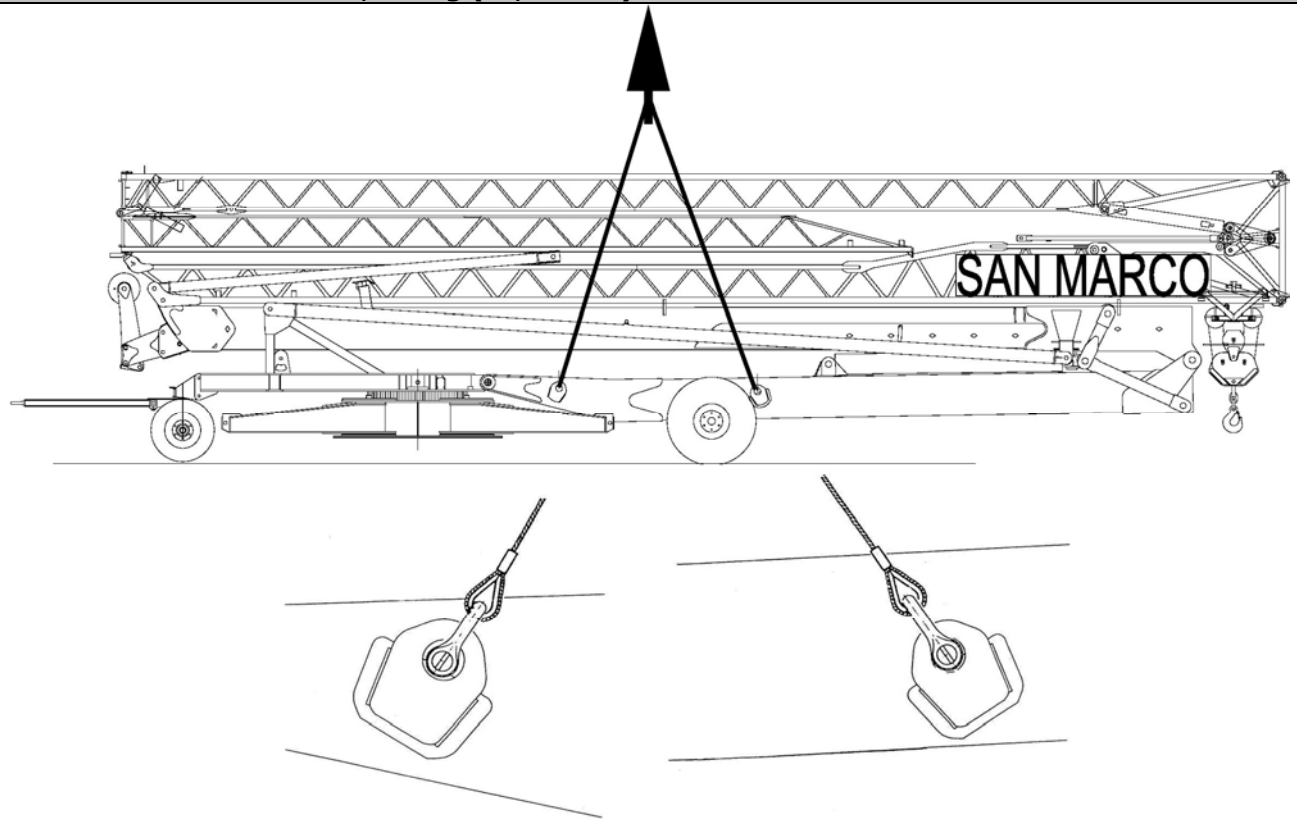


WARNING

- All the crane hooking and lifting operations shall be carried out only by **qualified, trained and informed operators**, who know about the technical characteristic of the crane. No operator shall pass or stand under the lifted load.

- 8.1 The crane can be lifted by means of a hoisting device of adequate dimension and capacity.
- 8.2 The crane is provided with hooking plates; apposite stickers affixed to the machine indicate hooking and slinging points.

Wt. = 19,100 kg (42,109 lbs) WITHOUT ERECTION BALLAST



- 8.3 Lift the crane by means of four metal ropes, 6-8 meters (19'-9" – 26'-3") long, min. breaking load value 35,000 kg (77,162 lbs) each one, equipped at each end with U-clamps of the same capacity.
- 8.4 Before lifting up, make sure the load is perfectly balanced.





02. PRELIMINARY INSTRUCTIONS

02.1. PRELIMINARY INSTRUCTIONS FOR CRANE ERECTION	02-1
02.2. PRELIMINARY CRANE INSPECTIONS	02-3
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02.1. PRELIMINARY INSTRUCTIONS FOR CRANE ERECTION

- 1.1 To select a suitable positioning site for the crane, take into consideration the mechanical strength the ground shall have to withstand the stresses transmitted by the crane’s structure and its supports.
- 1.2 Verify the ground strength and, if insufficient, take all the necessary measures to prevent any subsidence, such as adding gravel or concrete castings of adequate thickness.

GROUND MIN. STRENGHT
3.5 kg/cm ² (49.8 lbs/in ²)

- 1.3 In the table above there’s the ground minimum strength value. Never install the crane on loose made ground, in presence of filtering or flowing waters, by slopes and excavations, etc.
- 1.4 The crane shall be installed and operated so that no part of the crane or of the suspended load enters into the danger zone created by energized conductors. The distance from these conductors, as a function of current voltage, is reported in the following table. When operating near overhead high voltage lines, the size of the dangee zone grows, because the wind can move the wires both horizontally and vertically. Please refer to CSA-Z448-04 standard, to know the precautions to be taken when the crane is operated near energized conductors.

MIN. DISTANCE FROM ENERGIZED CONDUCTORS	
VOLTAGE	MIN. REQUIRED DISTANCE
Lower than 50 kV	3.0 m (10 ft)
50 kV to 200 kV	4.6 m (15 ft)
200 kV to 250 kV	7.6 m (25 ft)
250 kV to 750 kV	10.7 m (35 ft)
Greater than 750 kV	13.7 m (45 ft)
When operating near overhead high voltage lines, the size of the dangee zone grows.	

- 1.5 All along its circumference of rotation, any structural parts of the crane shall not crash into any obstacle.
- 1.6 The crane shall be positioned in such a manner during the swing of its moveable part, along the entire circumference, the distance between its farthest reach point and the building or any other obstacle (i.e. poles, trestles, scaffolding, machinery, heaps of material) is not lower than the value reported in the following table.

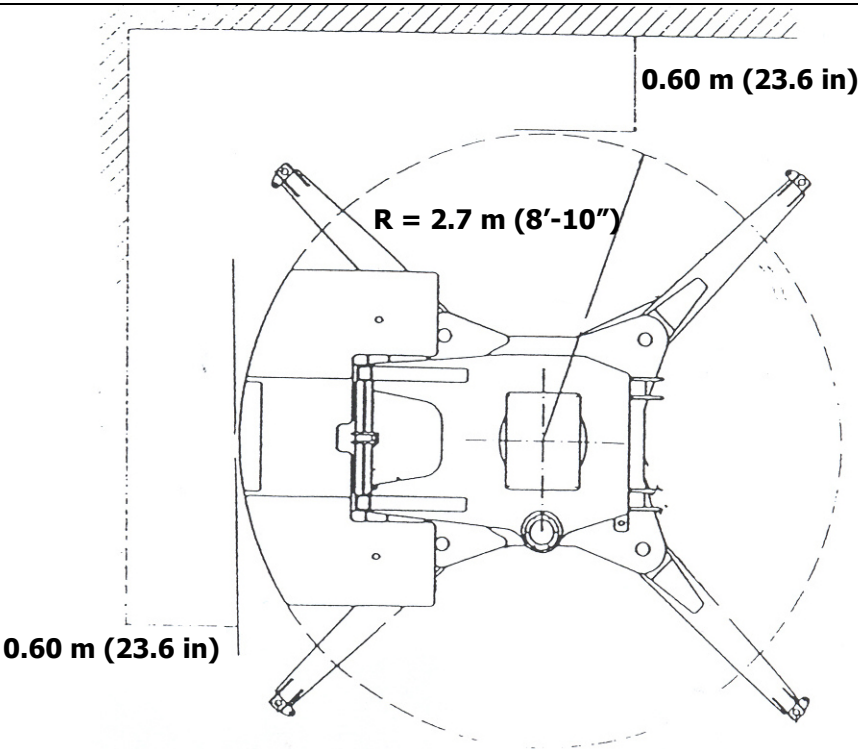
MIN. DISTANCE FROM THE BUILDING AND FROM ANY OTHER OBSTACLE (along the entire swing circumference, for the point with max. space occupied)
60-70 cm (23.6-26.7 in)

- 1.7 It is the responsibility of the purchaser of the crane to choose a suitable installation site.
- 1.8 When two or more cranes are installed at a short distance from each other, the min. range between their structurals parts never shall be lower than **2 meters (6’-7”)**. When this prescription cannot be respected because of binding technical reasons, it takes to resort and implement appropriate devices in order to prevent the interference between the structural parts, the ropes or the lifted loads.



WARNING

➤ **IT IS STRICTLY FORBIDDEN TO ACCESS DANGER ZONE "A" WITHIN THE SWING AREA OF THE BALLAST (PARAGRAPH 07.1).**





02.2. PRELIMINARY CRANE INSPECTIONS

	WARNING
➤ Before starting the first crane erection, as well as before any following one, it is compulsory to carry out all the following checks and inspections.	

- 2.1 **General checks of the electrical system.** In particular, check that the electrical components have not been damaged during transport or use. Check that the connecting cables are efficient and their connections intact. Verify that all connections have been correctly made and are properly tightened. Check that the brakes of the electric motors are efficient and properly set.
- 2.2 **Check the hoisting and trolley ropes, as well as the load and ballast pulling ropes.** Specifically, check that ropes show no sign of damages suffered during transport or operation on their whole lengths. Check good efficiency of end wedge clips and thimbles. Make sure that all ropes are clean and greased, that their path is correct, and finally that the ropes are correctly engaged in the grooves of their respective sheaves.
- 2.3 **Check hoisting and trolley sheaves.** In particular, check that all sheaves rotate freely and show no signs of rust or scales. Make sure that there are no sign of breaks or cracks due to use or transport. Check that hooks safety locks are present and in good working efficiency.
- 2.4 **Check winches.** In particular, inspect oil level inside gearboxes and make sure that the bolts fastening the gear reduction units to their supports are securely tightened. Check that there are no oil leaks and that the ropes are correctly wound on their drums; carefully check bearings condition.
- 2.5 **General structural inspection.** Particularly check that none of the frames has suffered any abnormal deformation caused by use or transport. Make sure that all mechanical parts are protected by grease and that everything is ready for a quick and safe erection. Check the connecting elements; make sure that the pins are locked by the relevant cotter and hitch pins and that nuts are firmly tightened. Check that the water drains from galvanised pipes are free from any foreign matter.
- 2.6 **After 3,200 service hours** of hoisting gears and mechanisms, the winch shall undergo a complete overhaul, and all worn-out or over-stressed components shall be replaced with original ones.
- 2.7 **Carry out a general and complete crane lubrication,** with particular care for ropes, sheaves, bearings, bronze bushings, articulated pins and for all those components subject to excessive wear and tear.
- 2.8 **Inspect the hydraulic equipment.** Lubricate the lock pins of the hydraulic cylinders by means of the apposite grease nipples; check the oil level inside the station tank. Check rubber pipes for integrity, make sure the valves are in working order and check the pressure set point of the hydraulic station **Pmax = 390 bar (5,656 psi).**
- 2.9 **Check that the position limit switches enabling unfolding and folding of the boom sections is efficient.** Inspect that the trolley is placed by micro switch enabling its operation.

	WARNING
➤ If the crane is not in perfectly working order, it shall not be placed into service.	



02.3. ERECTION PREPARATORY WORKS

- 3.1 Select the most suitable place for positioning the crane (paragraph 02.1).
- 3.2 If required, consolidate the ground with gravel or concrete (paragraph 02.1).
- 3.3 If not supplied with the crane, provide the cement blocks for the ballast, as indicated in the attached drawings.
- 3.4 Provide 28 hard wood beams of the size indicated in the table below. The beams are used as a base for the stabilizers at the crane erection stage.

HARD WOOD BEAMS FOR THE STABILIZERS			
QUANTITY	LENGTH	WIDTH	HEIGHT
28	100 cm (39.4 in)	25 cm (9.8 in)	20 cm (7.9 in)

- 3.5 Provide what needed to connect the grounding terminal of the crane to the grounding network of the building site.
- 3.6 Arrange what needed to connect the crane to the building site electric cabinet, fully respecting the safety rules. In particular, respect what indicated by the standard. Arrange a cable **H07RN-F** to connect the building site electric cabinet to the derivation box placed on the lower base frame of the crane, according with the following table.

CABLE CONNECTING BUILDING SITE ELECTRIC CABINET – CRANE ELECTRIC CABINET			
DISTANCE	WITHOUT HEADLIGHT	WITH HEADLIGHT	OPTIONAL
	4-WIRE CABLE (R+S+T+PE)	5-WIRE CABLE (R+S+T+PE+N)	
	CABLE SECTION	CABLE SECTION	
To 50 m (164')	4xAWG6	5xAWG6	
From 50 m (164') to 100 m (328')	4xAWG4	5xAWG4	

- 3.7 The cable way between branching and user points shall be the shortest possible, with no useless turns or rolls of excess cable.
- 3.8 Make sure that the supply voltage **480 V 60 Hz** (three-phase) and that the mains upstream are such not to cause any voltage variations of the motors, at maximum absorption conditions. Measure the feeding power with and without load: voltage variations shall not exceed **±5% with and without load**.
- 3.9 Erection and dismantling operations shall be carried out in windless conditions. Maximum wind speed allowed: **10 km/h (6.2 mph)**. At the middle boom opening stage, never swing the crane.

	WARNING
➤ Non-observance of the safety distance from electrical lines might engender the risk of electro shock. It is reminded here that an electric discharge between the aerial conductor and the crane may occur even without physical contact, since an electric arc may strike even when the crane parts are at a certain distance from the conductor. ➤ Non-observance of the safety distance from obstacles may cause the risk of crushing. ➤ Feeding voltages higher or lower than the max. rated tolerances may lead to crane malfunctioning as well as to serious damages of the electric equipment i.	



02.4. RIGGERS' HELPERS

- 4.1 During CRANE ERECTION PREPARATION, ERECTION, DISMANTLING PREPARATIONS and DISMANTLING, it may be necessary that the building contractors concerned by the crane erection, place some operators at riggers' disposal. These operators are called **RIGGERS' HELPERS**.
- 4.2 These operators shall:
- o be chosen and charged to the specific task of riggers' helpers by the responsible of the building site, designated by the building contractors and regular employees of the building contractors;
 - o have the task of riggers' helpers included in the tasks that the operator may perform and be qualified to;
 - o have the physical and psychical characteristics necessary to operate in conditions of safety;
 - o be trained and informed about the specific operations to carry out, in particular about the risks that may occur;
 - o have available and use the personal protection equipment, necessary in order to preserve their health and safety;
 - o perform operations at ground level only; the operations to be carried out never shall require to climb the structural parts of the crane at a level higher than 2 meters (6'-7").





03. ELECTRICAL EQUIPMENT

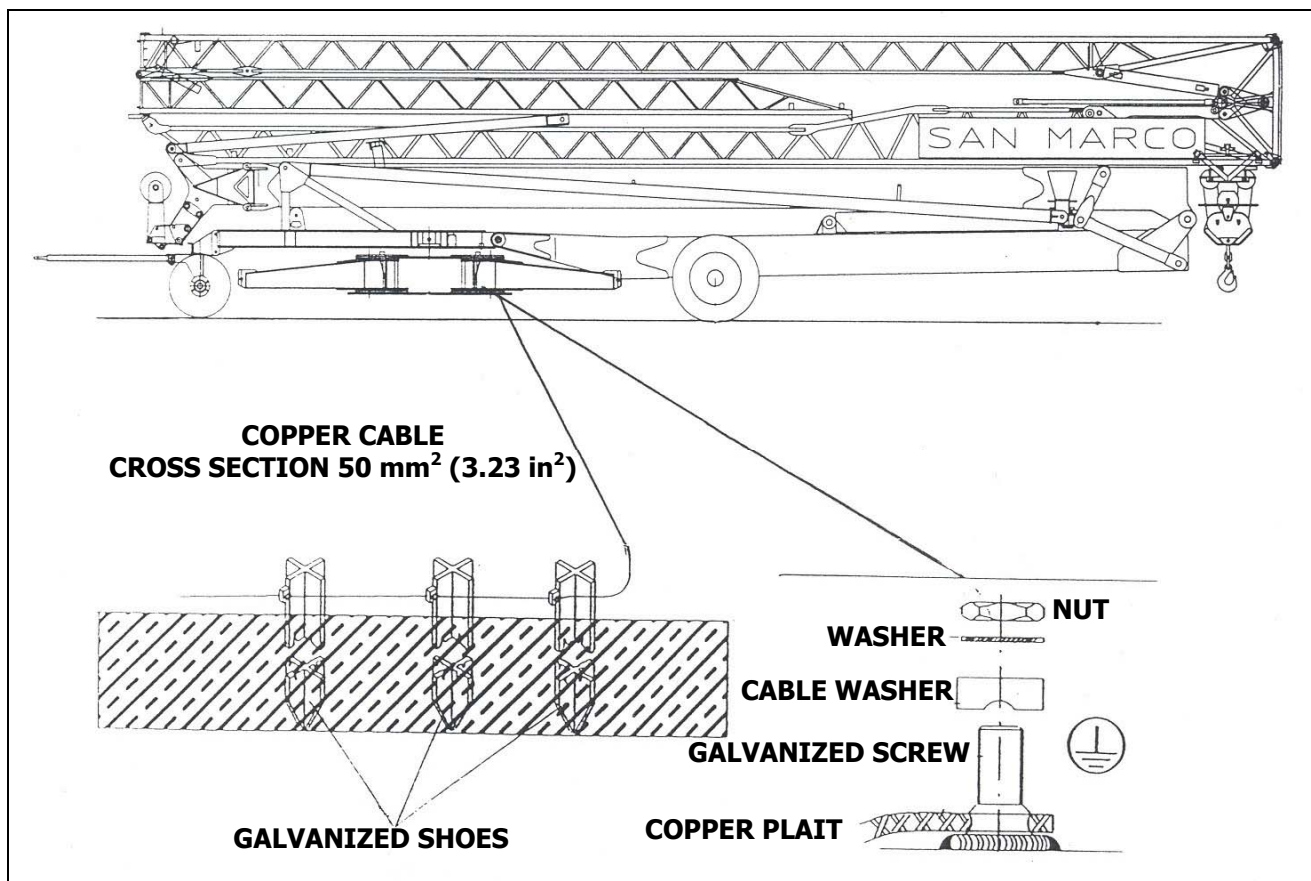
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03.1. GROUNDING

- 1.1 Grounding shall be carried out according to Canadian Electrical Code, Part 1, and to CSA C22.2-06 n°33 standard and shall be to the satisfaction of the Authority having jurisdiction.
- 1.2 To carry out crane grounding, use **galvanized shoes 1.5 m (4'-11") long**. Use, to connect the shoes to the galvanized terminal fixed to the crane frame, **copper cable having a crosse section of 50 mm² (3.23 in²)**.
- 1.3 Setting up of the ground plate network shall be in conformity with standards and regulations in force and it shall be carried out by qualified, trained and skilled personnel only.
- 1.4 The ground resistance value shall comply with the values prescribed by regulations and shall be controlled before and after crane erection at regular intervals thereafter, and during crane operation.
- 1.5 In particular, special care shall be taken in ensuring that contact surfaces are perfectly clean and free from scale, rust, paint, concrete, etc.
- 1.6 Carry out the grounding connection before connecting the crane electrical equipment to the electric cabinet of the building site. Furthermore, the ground wire of the cable connecting the crane to the electric cabinet of the building site shall be connected to the grounding system of the building site.
- 1.7 To protect the crane from lightning follow the procedure indicated by the standard.





03.2. ELECTRICAL CONNECTIONS

WARNING

➤ **The electrical connections of the crane shall be carried out by a qualified operator.**

- 2.1
- The connection of the crane power supply cable to the building site electric cabinet shall be made according to the laws in force. The power supply cable shall ensure the safety of all the concerned persons, according with the laws in force. To protect the line and the electric equipment of the crane, a suitable device shall be employed, according to UL-CSA standards (UL-489 or UL-98). The **current limit** shall be **50 A**.
- 2.2
- Connect to the switch a cable type **H07RN-F**, according with the characteristics reported in the table.

CABLE CONNECTING BUILDING SITE ELECTRIC CABINET – CRANE ELECTRIC CABINET			
DISTANCE	WITHOUT HEADLIGHT		WITH HEADLIGHT OPTIONAL
	4-WIRE CABLE (R+S+T+PE)		5-WIRE CABLE (R+S+T+PE+N)
	CABLE SECTION		CABLE SECTION
To 50 m (164')	4xAWG6		5xAWG6
From 50 m (164') to 100 m (328')	4xAWG4		5xAWG4

- 2.3
- Open the cover of the derivation box placed on the lower base frame.
- 2.4
- Insert the rubber connecting cable into the derivation box, passing by the provided cable gland. Then connect the three wires **R S T** of the phases and the fourth wire of protection earth **PE** to the corresponding terminals of the terminal board of the derivation box.
- 2.5
- For the crane functioning, the wires **R S T** shall be connected in the right sequence, scheduled for the testing. If the crane doesn't work, invert two wires.
- 2.6
- Carefully tighten the screws of the terminal and close the cover of the derivation box.
- 2.7
- Closing the switch of the building site electric cabinet, these parts become live:

o

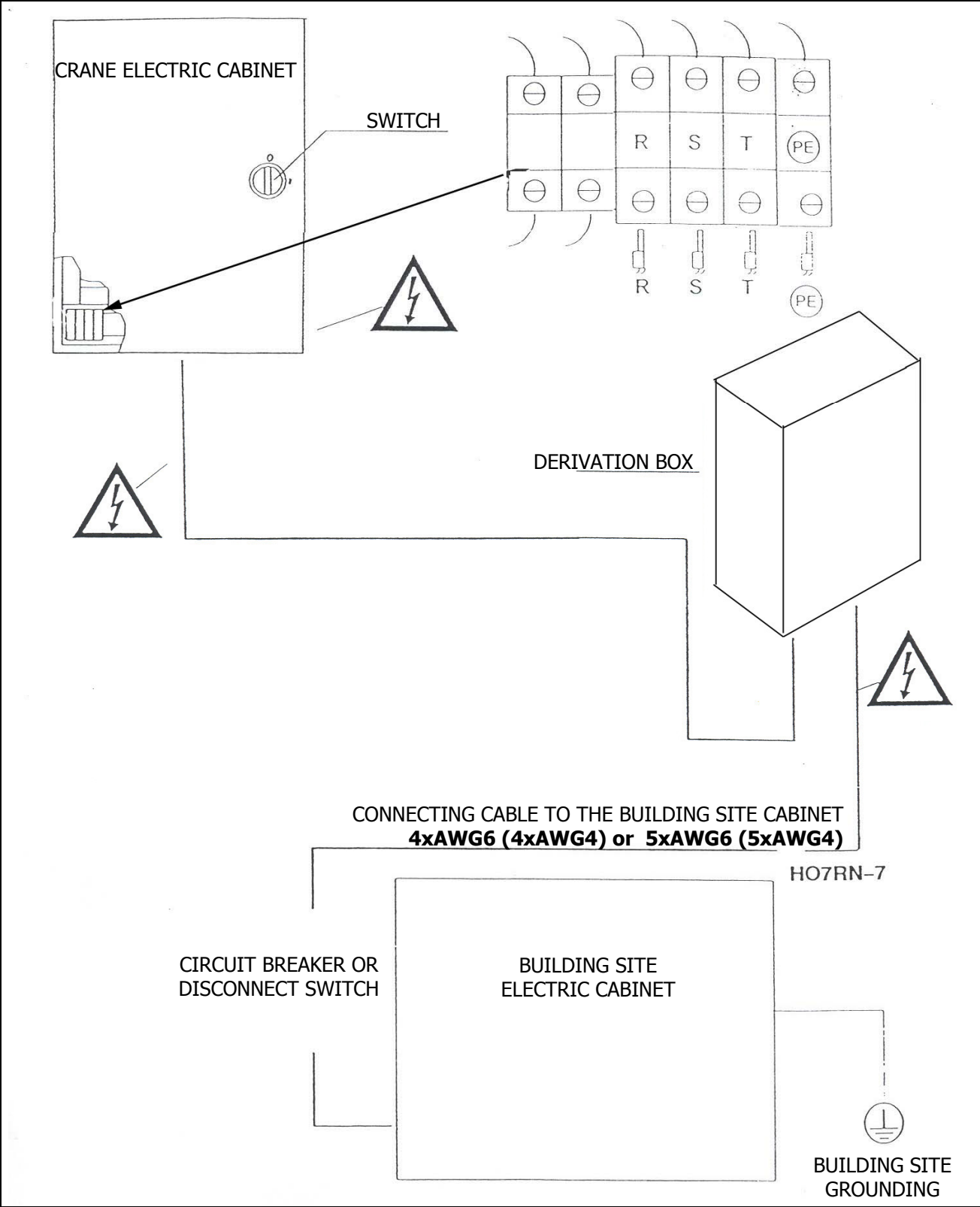
connecting cable between the building site cabinet and the derivation box, to the inlet terminals of the crane electric cabinet.
- 2.8
- Closing the switch of the crane cabinet, these parts become live:

o

connecting cable between the building site cabinet and the derivation box, to the inlet terminals of the crane electric cabinet;

o

the components inside the crane electric cabinet.





	WARNING	
➤ The electrical equipment has been designed and manufactured for an operating temperature between -20°C (-4°F) and +40°C (104 °F). Should the temperature exceed this range, it is responsibility of the user to install suitable shields in order to maintain the specified environmental temperature limits. The crane storing temperature is comprised between -40°C (-40°F) and +50°C (122°F).		
LIMIT TEMPERATURES FOR THE CRANE		
Crane in-service	Crane in-service	Crane in-service
Crane out-of-service	Crane out-of-service	Crane out-of-service

➤	The crane electric cabinet shall always be locked with the provided padlock, whose key shall always be kept by the building site manager.
➤	The feeding voltage shall have, both with load and without load, a max. tolerance of ±5% . A lower or a higher voltage – as regards to the limit values – may damage the electric equipment.
➤	The electrical power supply, in full details, shall be carried out according to <u>Canadian Electrical Code, Part 1</u> , and to <u>CSA C22.2-06 n°33</u> standard and shall be to the satisfaction of the Authority having jurisdiction.

	WARNING
➤ All the above prescriptions shall be carefully respected. Failure in respecting them causes the following risks.	
➤	The use of a supply cable with an incorrect cross-section will result in an excessive voltage drop with consequent possible malfunctioning of the hoisting winch and the whole electrical equipment.
➤	An unsuitable power supply cable will make correct connections impossible, with consequent possible malfunctions of the electrical equipment and risks of electric shock for the exposed persons.
➤	An excessive voltage drop – leading to malfunctioning for all the electric equipment – may be caused as follows: - o the electric cable has useless turns and it doesn't follow the shortest distance between the building site electric cabinet and the crane electric cabinet; - o the electric cable is too long and rolled.
➤	A faulty insulation of the crane feeding cable will engender the risk of electroshocks to the exposed persons.
➤	By switching off (or on) the switch on the crane electric cabinet door, the following parts are disconnected (or energized): o all the components down the switch (of the electric cabinet).
➤	By switching off (or on) the building site electric cabinet switch, the following parts are disconnected (or energized): - o the connecting cable between the building site electric cabinet and the crane derivation box; - o the connecting cable between the derivation box and the electric cabinet of the crane; - o all the components down these elements.
➤	Failure in connecting the metallic mass of the crane to the ground plates generates a condition of extreme danger in case of leaks in the electrical system. The same hazard situation is produced in



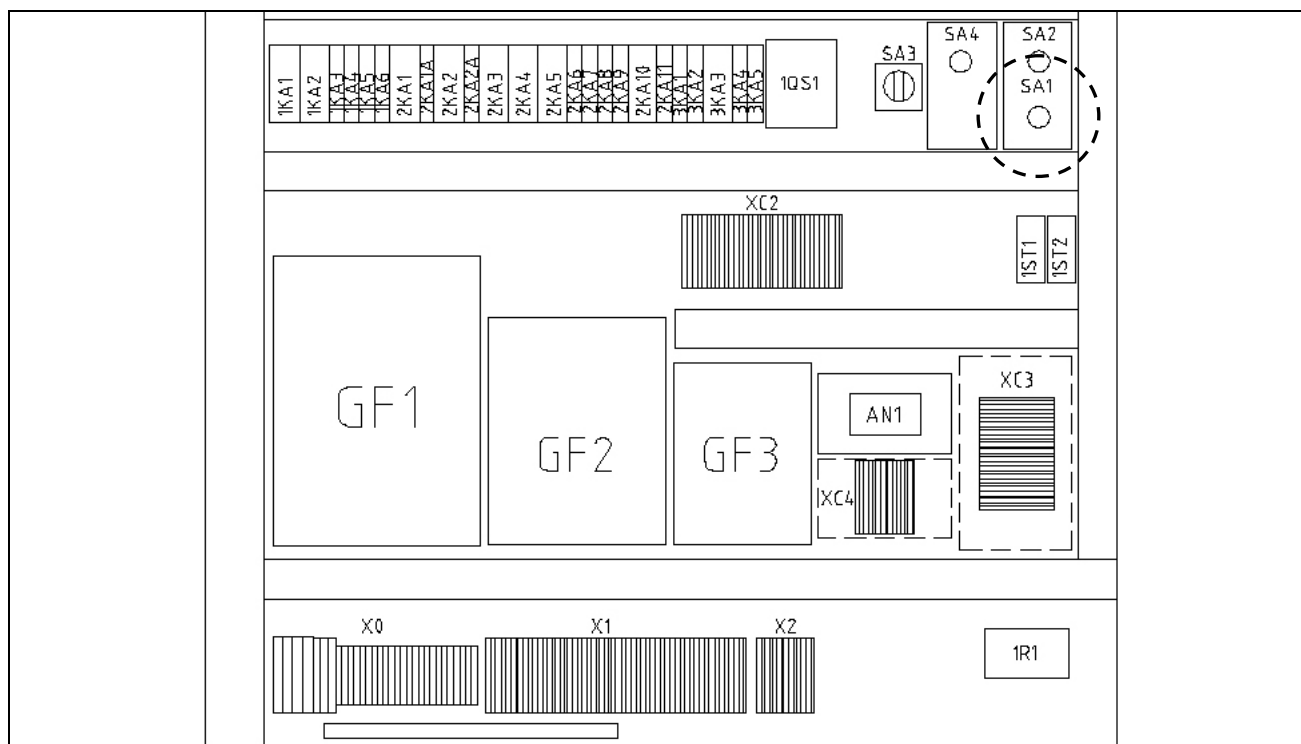
case of inefficient connection or a lack of continuity of the grounding system.

- Failure in locking the electric cabinet doors by means of the apposite padlock makes it possible for unauthorised personnel to tamper with the electrical components, with the consequent risk of serious problems.
- The missing installation of protection devices against lightning may engender the risk of electroshock for all exposed persons.



03.3. OPERATION – ERECTION SA1 SELECTOR SWITCH

- 3.1 The cabinet houses the three-position selector switch **SA 1: OPERATION (1) e ERECTION (2 – 3)**.
- o By turning the selector switch to position **1**, all controls relevant to the operation functions of the crane fitted on the control board are enabled.
 - o By turning the same selector switch to position **2**, all controls for tower erection and second boom section unfolding are enabled.
 - o By turning the same selector switch to position **3**, all controls for third boom section unfolding are enabled.
- 3.2 The push buttons on the relevant control board available in the three different operating conditions are described at the following pages.



- 3.3 To erect (or to dismantle) the tower and to unfold (or to fold) the second boom section:
- o turn "OFF" (**0** position) the power switch on the cabinet door;
 - o turn the outer key to open the door;
 - o turn the selector switch to position **2** to erect (or to dismantle) the tower and to unfold (or to fold) the second boom section;
 - o close the door and turn the main selector switch back to "ON" (**1** position);
 - o turn the outer key to close the door;
 - o depress the green "START" push button on the control board to start the hydraulic unit pump at high speed.



- 3.4 By acting on "UP" or "DOWN" push buttons, extend or retract the hydraulic cylinders for tower erection. Act on "NEAR" and "FAR" push buttons to fold or unfold, as the case may be, the second section of the boom.
- 3.5 To unfold (or to fold) the third boom section:
- o depress the "STOP" push button on the control board;
 - o turn "OFF" (**0** position) the power switch on the cabinet door;
 - o turn the outer key to open the door;
 - o turn the selector switch to position **3**;
 - o close the door and turn the main selector switch back to "ON" (**1** position);
 - o turn the outer key to close the door;
 - o depress the green "START" push button on the control board to start the hydraulic unit pump at slow speed.
- 3.6 Act on "NEAR" and "FAR" push buttons to fold or unfold, as the case may be, the third section of the boom.
- 3.7 Completed the erection, to enable operation controls of the control board of the crane:
- o depress the "STOP" push button on the control board;
 - o turn "OFF" (**0** position) the power switch on the cabinet door;
 - o turn the outer key to open the door;
 - o turn the selector switch to position **1**;
 - o close the door and turn the main selector switch back to "ON" (**1** position);
 - o turn the outer key to close the door;
 - o depress the green "START" push button on the control board.
- 3.8 Act on "UP" or "DOWN" push buttons to lift or lower the load block. Act on "NEAR" or "FAR" push buttons to displace the trolley near to or away from the tower.



WARNING

- The crane can be correctly erected, dismantled and operated if all switches and selectors installed on the machine are in the function positions indicated in the present instruction Manual. Failure in complying with the given instructions will cause abnormal operations or machine stops, thus prejudicing its integrity and proper functioning.



03.3.1. SELECTOR SWITCH SA1 POSITIONS

SA1 – POSITION 1

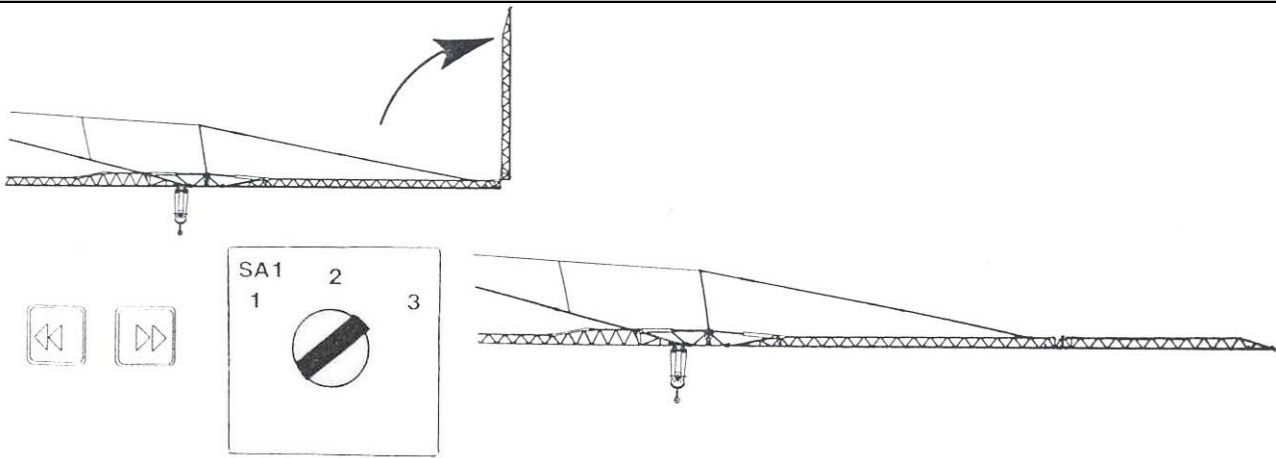
All normal operation movements (hoisting – swing – trolley displacement – acoustic warning – emergency stop) are operated from the control board.

SA1 – POSITION 2

"UP" and "DOWN" push-buttons operate tower erection or dismantling; "FAR" and "NEAR" push-buttons operate folding or unfolding of the second section of the boom (acoustic warning and emergency push button always available).



SA1 – POSITION 3



"FAR" and "NEAR" push-buttons operate folding or unfolding of the third section of the boom (acoustic warning and emergency push button always available).



03.3.2. CONTROL BOARD – OPERATION CONTROLS (1)

	1SB1) LINE STOP It disconnects power supply to the electric equipment. TURN TO RELEASE. 1SB2) LINE START AND ACOUSTIC WARNING It switches the power on and actuates the acoustic warning. DEPRESS TO SWITCH THE POWER ON AND TO SIGNAL. 2SB1) LOAD BLOCK UP By depressing it, the block is lifted up. I pressing position micro speed; II pressing position slow speed. 2SB2) LOAD BLOCK DOWN By depressing it, the block is lowered down. I pressing position micro speed; II pressing position slow speed. 2SB3) HOISTING By depressing it after starting a lifting or a lowering operation at slow speed, it switches the current movement speed to: middle speed (I pressing position) or fast speed (II pressing position). 3SB1) LEFT SWING By depressing it, the crane swings leftwards. I pressing position: micro speed; II pressing position: slow speed. 3SB2) RIGHT SWING By depressing it, the crane swings rightwards. I pressing position: micro speed; II pressing position: slow speed. 3SB3) SWING By depressing it after starting a left or right swing at slow speed, it switches the current movement speed to: middle speed (I pressing position) or fast speed (II pressing position). 4SB1) TROLLEY NEAR By depressing it, the trolley is displaced towards the tower. I pressing position: micro speed; II pressing position: slow speed. 4SB2) TROLLEY FAR By depressing it, the trolley is displaced towards the boom tip. I pressing position: micro speed; II pressing position: slow speed. 4SB3) TROLLEY By depressing it, after starting a far / near displacement of the trolley at slow speed, it switches the current movement speed to: middle speed (I pressing position) or fast speed (II pressing position).
	WARNING ➤ The red push-button on the top of the control board is an EMERGENCY STOP. If depressed, the power supply to the equipment is disconnected and all motors instantly stopped. ACTUATE IMMEDIATELY IN ANY EMERGENCY SITUATION.



03.3.3. CONTROL BOARD – ERECTION CONTROLS (2)

1SB1 1SB2 2SB1 2SB2 2SB3 3SB1 3SB2 3SB3 4SB1 4SB2 4SB3 TOWER ERECTION BOOM UNFOLDING	1SB1) LINE STOP It disconnects power supply to the electric equipment. TURN TO RELEASE. 1SB2) LINE START AND ACOUSTIC WARNING It switches the power on and actuates the acoustic warning. DEPRESS TO SWITCH THE POWER ON AND TO SIGNAL. 2SB1) TOWER ERECTION – UP By depressing it, the tower is lifted up. I pressing position: it causes the hydraulic cylinder stem, which lifts the tower, to emerge. II pressing position: disabled. 2SB2) TOWER ERECTION – DOWN By depressing it, the tower is lowered. I pressing position: it causes the hydraulic cylinder stem to retract. II pressing position: disabled. 2SB3) DISABLED 3SB1) LEFT SWING By depressing it, the crane swings leftwards. I pressing position: micro speed; II pressing position: slow speed. 3SB2) RIGHT SWING By depressing it, the crane swings rightwards. I pressing position: micro speed; II pressing position: slow speed. 3SB3) SWING By depressing it after starting a left or right swing at slow speed, it switches the current movement speed to: middle speed (I pressing position) or fast speed (II pressing position). 4SB1) BOOM UNFOLDING – NEAR It operates boom second section folding. II pressing position: disabled. 4SB2) BOOM UNFOLDING – FAR It operates boom second section unfolding. II pressing position: disabled. 4SB3) DISABLED
WARNING ➤ The red push-button to the left on the top of the control board is an EMERGENCY STOP. If depressed, the power supply to the equipment is disconnected and all motors instantly stopped. ACTUATE IMMEDIATELY IN ANY EMERGENCY SITUATION.	



03.3.4. CONTROL BOARD – ERECTION CONTROLS (3)

1SB1 1SB2 2SB1 2SB2 2SB3 3SB1 3SB2 3SB3 4SB1 4SB2 4SB3 BOOM UNFOLDING	1SB1) LINE STOP It disconnects power supply to the electric equipment. TURN TO RELEASE. 1SB2) LINE START AND ACOUSTIC WARNING It switches the power on and actuates the acoustic warning. DEPRESS TO SWITCH THE POWER ON AND TO SIGNAL. 2SB1) DISABLED 2SB2) DISABLED 2SB3) DISABLED 3SB1) LEFT SWING By depressing it, the crane swings leftwards. I pressing position: micro speed; II pressing position: slow speed. 3SB2) RIGHT SWING By depressing it, the crane swings rightwards. I pressing position: micro speed; II pressing position: slow speed. 3SB3) SWING By depressing it after starting a left or right swing at slow speed, it switches the current movement speed to: middle speed (I pressing position) or fast speed (II pressing position). 4SB1) BOOM UNFOLDING – NEAR It operates boom third section folding. II pressing position: disabled. 4SB2) BOOM UNFOLDING – FAR It operates boom third section unfolding. II pressing position: disabled. 4SB3) DISABLED
WARNING	
➤ The red push-button to the left on the top of the control board is an EMERGENCY STOP. If depressed, the power supply to the equipment is disconnected and all motors instantly stopped. ACTUATE IMMEDIATELY IN ANY EMERGENCY SITUATION.	



03.3.5. REMOTE CONTROL BOARD (OPTIONAL) – OPERATION CONTROLS (1)

	A) LINE STOP It disconnects power supply to the electric equipment. TURN TO RELEASE. B) LINE START AND ACOUSTIC WARNING It switches the power on and actuates the acoustic warning. DEPRESS TO SWITCH THE POWER ON AND TO SIGNAL.
	1) LOAD BLOCK UP By depressing it, the block is lifted up. I pressing position micro speed; II pressing position slow speed. 2) LOAD BLOCK DOWN By depressing it, the block is lowered down. I pressing position micro speed; II pressing position slow speed.
	3) HOISTING By depressing it after starting a lifting or a lowering operation at slow speed, it switches the current movement speed to: middle speed (I pressing position) or fast speed (II pressing position). 4) SWING By depressing it after starting a left or right swing at slow speed, it switches the current movement speed to: middle speed (I pressing position) or fast speed (II pressing position).
	5) LEFT SWING By depressing it, the crane swings leftwards. I pressing position: micro speed; II pressing position: slow speed. 6) RIGHT SWING By depressing it, the crane swings rightwards. I pressing position: micro speed; II pressing position: slow speed.
	7) TROLLEY FAR By depressing it, the trolley is displaced towards the boom tip. I pressing position: micro speed; II pressing position: slow speed. 8) TROLLEY NEAR By depressing it, the trolley is displaced towards the tower. I pressing position: micro speed; II pressing position: slow speed.
	9) TROLLEY By depressing it, after starting a far / near displacement of the trolley at slow speed, it switches the current movement speed to: middle speed (I pressing position) or fast speed (II pressing position). 10) FREE



WARNING

- The red push-button on the top of the control board is an **EMERGENCY STOP**. If depressed, the power supply to the equipment is disconnected and all motors instantly stopped. **ACTUATE IMMEDIATELY IN ANY EMERGENCY SITUATION.**



03.3.6. REMOTE JOYSTICK (OPTIONAL) – OPERATION CONTROLS (1)

A) LEFT LEVER: controls trolley and swing.

- o Lever forwards: trolley towards the boom tip.
- o Lever backwards: trolley towards the tower.
- o Lever rightwards: swing right.
- o Lever leftwards: swing left.

B) RIGHT LEVER: controls lifting and lowering of the load block.

- o Lever forwards: load block lifting.
- o Lever backwards: load block lowering.

BOTH THE LEVERS have four releases.

- o **First pressure:** movement at the micro speed.
- o **Second pressure:** movement at the slow speed.
- o **Third pressure:** movement at the middle speed.
- o **Fourth pressure:** movement at the fast speed.

1) Key switch (left side): in the position **I** enables the remote control, in position **O** disables the remote control.

2) Signalling LED: flashes slowly when the battery is charged; flashes faster when the battery is half-charged; flashes faster and the alarm rings when the charge is draining away.

3) Green START push-button (left side): operate the acoustic warning (when needed to signal the operations).

4) Disabled.

5) Disabled.

6) RED PUSH-BUTTON: actuating it, the power supply to the equipment is disconnected and all motors instantly stopped.



WARNING

- The red push-button on the center of the control board is an **EMERGENCY STOP**. If depressed, the power supply to the equipment is disconnected and all motors instantly stopped. **ACTUATE IMMEDIATELY IN ANY EMERGENCY SITUATION.**



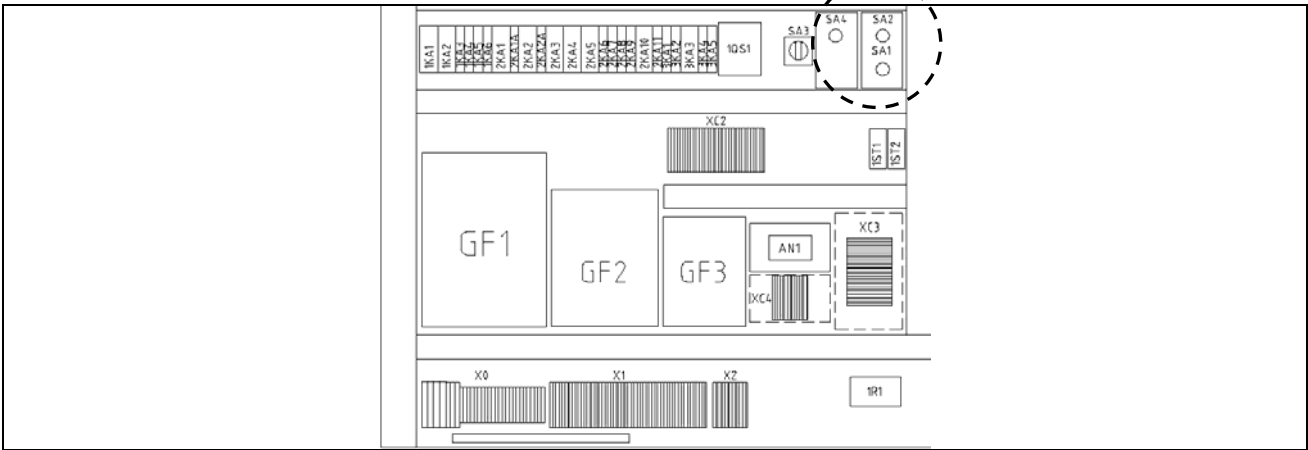
03.4. BOOM CONFIGURATION SA2 SELECTOR SWITCH

- 4.1 The electrical cabinet houses the three-position **SA2** selector switch: **BOOM UNFOLDED (1)** – **BOOM PARTIALLY FOLDED (2)** – **BOOM FOLDED (3)**.
- o By turning the selector switch lever into position **1**, the limit switch for trolley forward displacement, situated next to boom tip (end of the third boom section), is enabled.
 - o By turning the selector switch lever into position **2**, the limit switch for trolley forward displacement, situated next to end of the second boom section, is enabled.
 - o By turning the selector switch lever into position **3**, the limit switch for trolley forward displacement, situated next to end of the first boom section, is enabled.

WARNING

➤ To ensure that the position limit switch controls the trolley forward displacement in all possible boom configurations, the lever shall be moved to the position corresponding to the operating configuration in use.

➤ For the locations of the trolley limit switch, see paragraph 10.9.



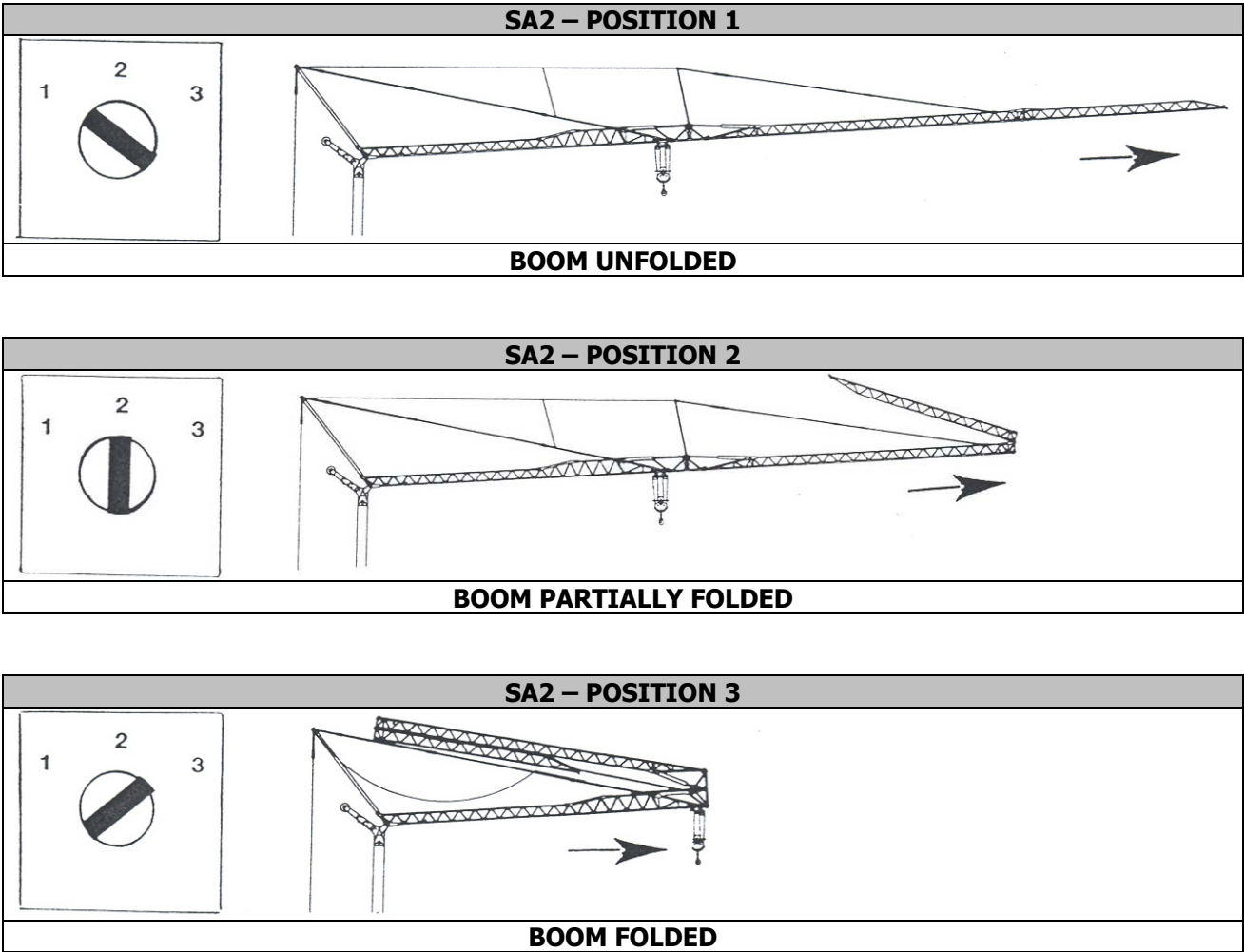
- 4.2 To commute the selector switch **SA2**, proceed as it follows:
- o turn "OFF" (**0** position) the power switch on the cabinet door;
 - o turn the outer key to open the door;
 - o move the lever of the selector switch **SA2** into position **1** or **2** or **3**, corresponding to operation boom configuration;
 - o close the door and turn the main selector switch back to "ON" (**1** position);
 - o turn the outer key to close the door;
 - o depress the green "START" push button on the control board.

WARNING

➤ Should the **SA2** selector switch not be in the position corresponding to the operating boom configuration in use, the limit switch would not control correctly the trolley forward displacement, thus causing the trolley to crash against the end stops, an over-traction on the trolley rope and its possible breakage.



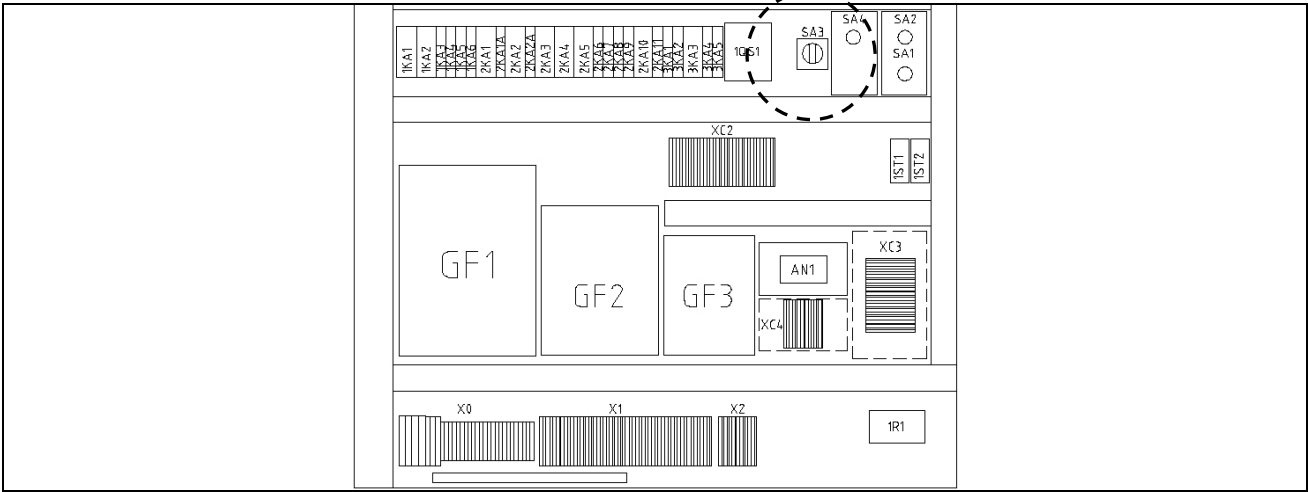
03.4.1. SELECTOR SWITCH SA2 POSITIONS





03.5. 2-PULL LINE – 4-PULL LINE SA3 SELECTOR SWITCH

- 5.1
- The electrical cabinet houses the two-position **SA3** selector switch: **2-PULL LINE – 4-PULL LINE**.
- 5.2
- The hoisting limit switch is equipped with a series of micro switches, two of them actuated in case of crane operated with 2-pull line, the other two in case of crane operated with 4-pull line.



- 5.3
- After setting the hoisting position limit switch (paragraph 10.2), when shifting from 2-pull line to 4-pull line or vice versa, simply turn the **SA3** selector switch to the corresponding position, 2-pull or 4-pull line, to render the required UP and DOWN limit switches operative, without any further adjustments.

WARNING

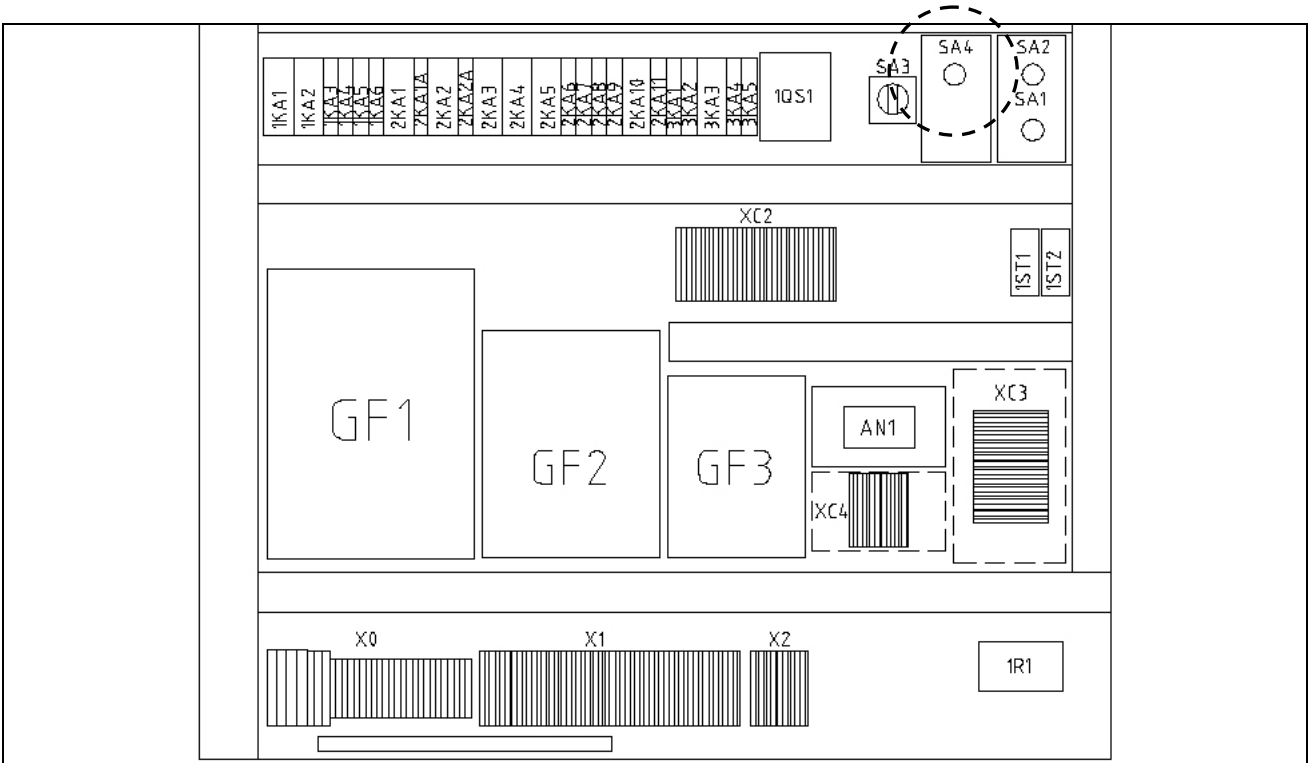
> The position of the **SA3** selector switch shall always correspond to the operating configuration in use. On the contrary, the limit switch, even if correctly set, **will not stop the movement in the specified limit positions**, thus causing the rope to slacken or to break.

2-PULL LINE	4-PULL LINE
SELECTOR SWITCH IN POSITION "2-PULL LINE"	SELECTOR SWITCH IN POSITION "4-PULL LINE"



03.6. HOISTING LIMIT SWITCH BYPASS SA4 SELECTOR SWITCH (OPTIONAL)

- 6.1 The crane may be equipped with the **SA4** selector switch **OPTIONAL**, hoisting limit switch bypass, placed inside the electric cabinet.



- 6.2 **SA4** selector switch is employed **during crane dismantling only**, to allow the block to remain at the max. height and to prevent shocks against the ground and the structural parts during tower lowering.
- 6.3 **SA4** selector switch is equipped with a key and functions only if actuated by an operator. When it is not actuated, a spring brings it back to its disabled position automatically, and the hoisting limit switch works normally.

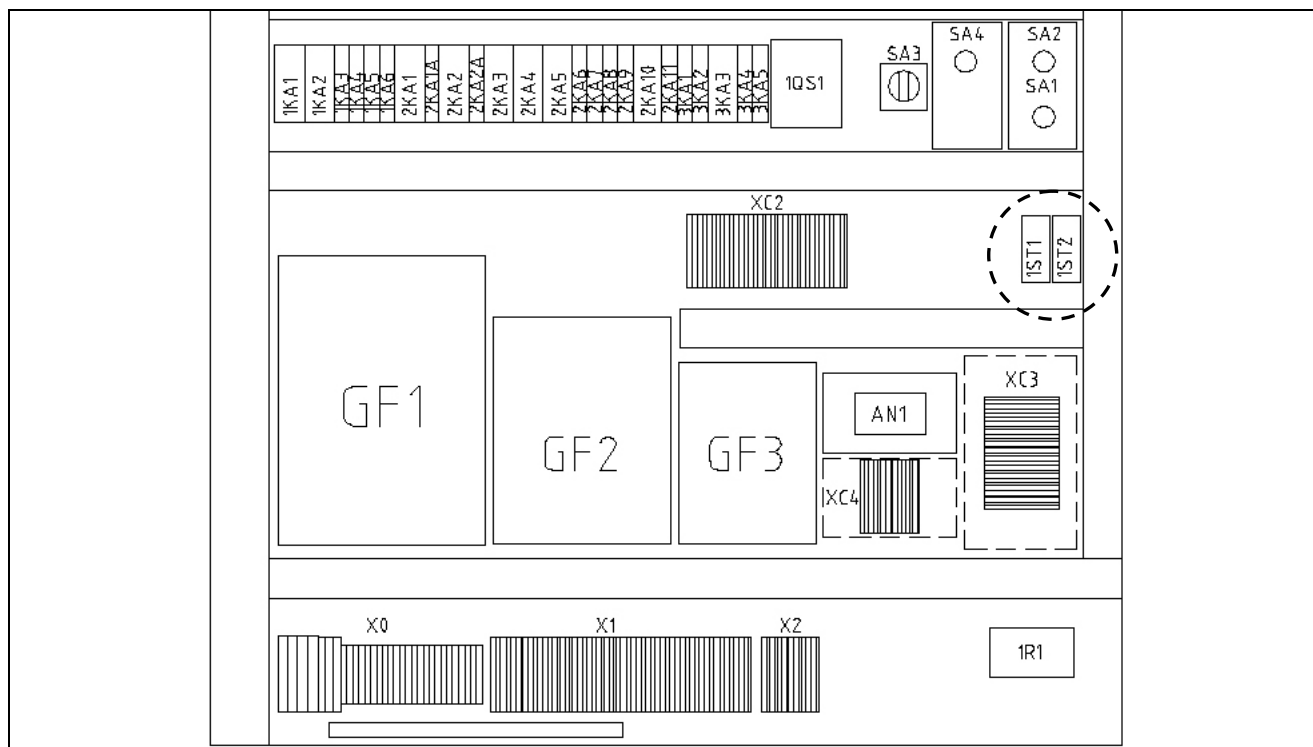


WARNING

- **Never actuate SA4 selector switch during normal crane operation:** the hoisting limit switch will be disabled, causing the shock of the block against the trolley, with risk of breakage to the rope, of falling of the load, and of serious damages to the structures. **SA4** selector switch shall be actuated during crane dismantling only, when required to lift the block to the max. height.
- When it is not required to actuate **SA4** selector switch, remove the key and keep it in a safe place, so that it may not be used by not-authorized personnel.

03.7. THERMOSTATS

- 7.1 Inside the electric cabinet there are the thermostats SUMMER – WINTER that enable, alternatively, the electrical connection to a fan or to a resistor placed inside the electric cabinet.



- 7.2 The thermostat **1ST1** WINTER (red setting button) enables the resistor: it warms the cabinet preventing the formation of condensation. The thermostat is normally set to **10°C (50°F)**; when the temperature inside the electric cabinet drops under this value, the resistor is enabled to warm the electrical devices.
- 7.3 The thermostat **1ST2** SUMMER (blue setting button) enables the fan: it cools the electric cabinet. The thermostat is normally set to **30°C (86°F)**; when the temperature inside the electric cabinet exceeds this value, the fan is enabled to cool the electrical devices.
- 7.4 In the interval between **10°C (50°F)** and **30°C (86°F)** neither the fan nor the resistor are enabled.

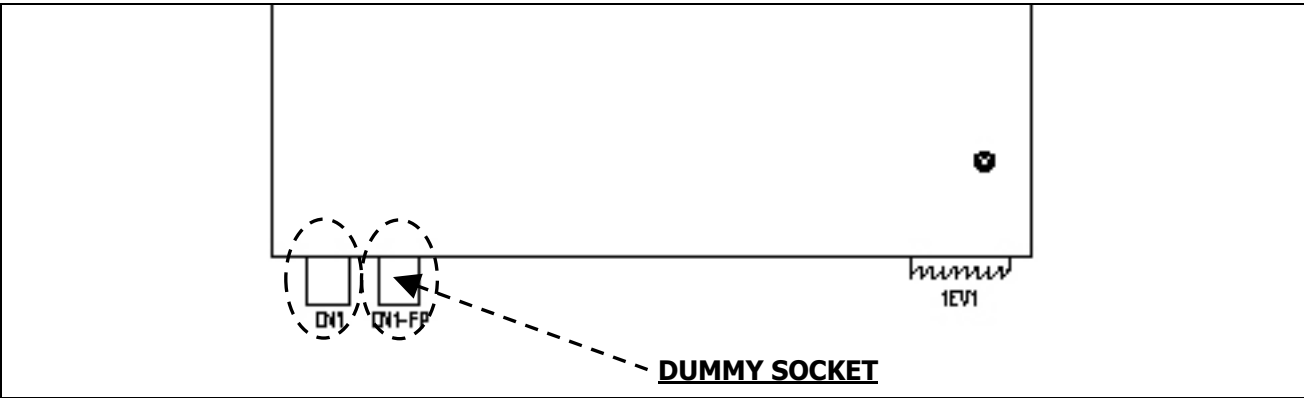


- The temperature set on the thermostats shall always be such to ensure a suitable functioning according with the season. Warming the cabinet in the summertime or cooling it in the wintertime may endanger the functioning of the equipment or damaging it.

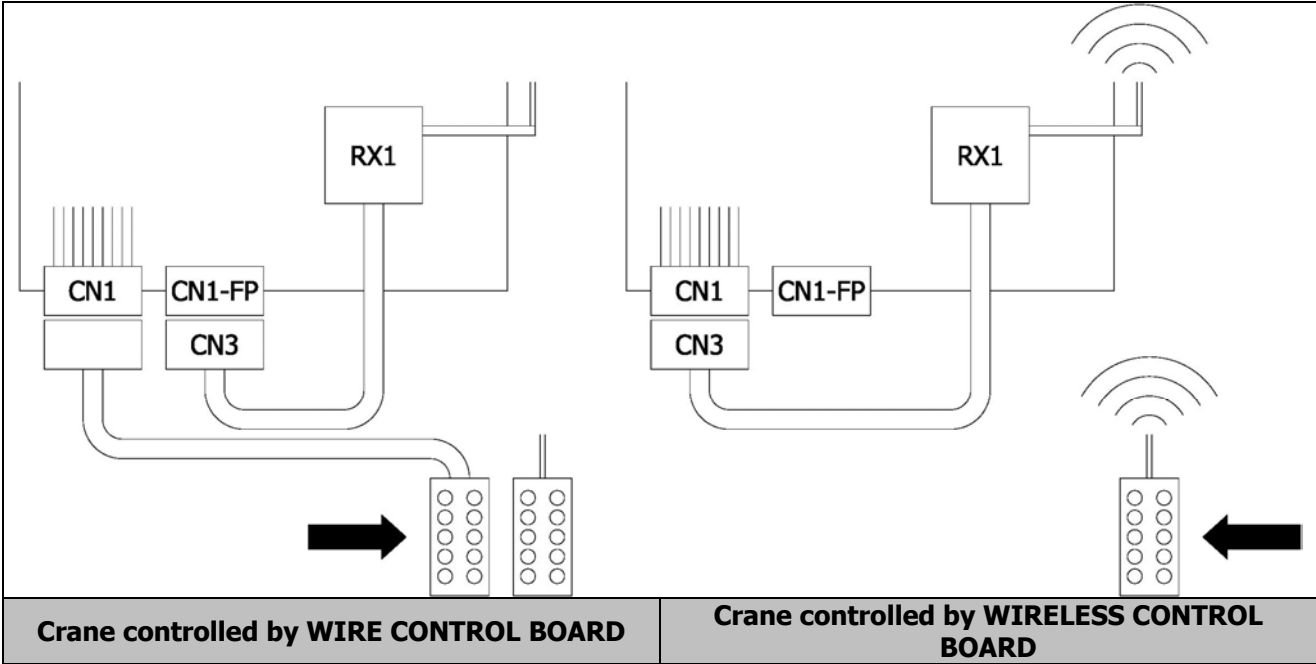


03.8. INTEGRATED REMOTE CONTROL (OPTIONAL)

- 8.1 The electric cabinet is equipped with integrated remote control; the receiver is marked with the indication **RX1**.
- 8.2 When the crane is delivered, the wire control board connection plug is plugged in socket **CN1**. The wireless control board plug **CN3** is plugged in the **dummy socket CN1-FP**, situated on the right of the socket **CN1**. **In this configuration, the crane is controlled by wire control board.**



- 8.3 **To control the crane by wireless control board**, remove the wire control board plug from the socket **CN1**; remove the plug **CN3** from the dummy socket **CN1-FP**; plug the plug **CN3** in the socket **CN1**.





- 8.4 Should the crane not be equipped with integrated radio controls (for Customer’s choice), the electric cabinet is supplied without receiver **RX1**, while the plug **CN3** is supplied all the same.
- 8.5 Should the customer require the installation of an outer radio control on a crane supplied without it, the outer radio control equipment shall be plugged in **CN1** for connecting the cable remote control board.

	WARNING
➤ ➤ ➤	The radio control board shall be employed only for operating the crane. Crane erection and dismantling shall be carried out by the wire control board only. The positions and functions of the single push buttons arranged on the remote control board are described in the present manual (<u>paragraph 03.3.5</u>). For any further information, refer to the use and maintenance manual, specific for the wireless device, jointed to the technical documentation of the crane.



03.9. SWING SPEED ADJUSTMENT

- 9.1 The variable speed drive controlling the swing motor is pre-set for each crane model and is controlled and eventually set-up, if required, at the erection test of each single crane.
- 9.2 It is not generally required to proceed with subsequent variable speed drives set-up, unless, due special crane applications, the variation of one or more parameters is needed to modify the standard performance of the equipment.
- 9.3 The particular instructions enclosed to the present technical documentation provide all the required information to set the variable speed drives; before each intervention it is recommended to refer to the particular instructions by the manufacturer.
- 9.4 The standard values of all parameters for the **ALTIVAR 31** variable speed drives the crane is equipped with are shown on the following pages. Every modification to the parameters changes swing performances.

	WARNING
➤ The selected acceleration and deceleration times shall always be such so as not to cause oscillations of the suspended loads and excessive stress to the structures; the brakes intervention shall always be progressive until the crane slows down. ➤ Every intervention on the variable speed drive shall be carried out only and exclusively by qualified, trained and skilled personnel capable of perfectly setting the equipment. ➤ An incorrect variable speed drive setting may result in its malfunctioning with possible damages to the electrical equipment, excessive stress to the structures with consequent damages, abnormal wear, breakage of the swing system and finally damages to the hoisting mechanisms. ➤ The variable speed drive is equipped with internal capacitors with a discharge time of fifteen minutes. In case of maintenance interventions requiring the removal of the variable speed drive outer casings, before removing the guards and handling the internal components, wait at least fifteen minutes after switching the equipment off, as indicated on the outer casing and in the instruction manual. Failure in operating in the indicated way will cause the risk of electric shocks.	

**03.9.1. SWING SPEED ADJUSTMENT TABLE**

SWING SPEED ADJUSTMENT TABLE				
User menu				
Code	Short label	Current Value	Default value	User n
AC2	Acceleration2	20.0 s	5.0 s	1
ACC	Acceleration	9.0 s	3.0 s	2
AI1A	Config.AI1	Configuration reference 1, Ch. in forced local mode	Configuration reference 1	3
BFR	Std.Motor F.	60 Hz	50 Hz	4
BRA	Dec.RampAdapt	No	Yes	5
DE2	Deceleration2	10.0 s	5.0 s	6
DEC	Deceleration	18.5 s	3.0 s	7
FRT	SwitchRamp2	3.0 Hz	0.0 Hz	8
FTD	Mot.Freq.Thr.	3.0 Hz	60.0 Hz	9
HSP	High Speed	50.0 Hz	60.0 Hz	10
LAC	FunAccessLv	Adv. func. & mixed ctrl.	Access to std. functions	11
LI5A	Config.LI5	Select 16 preset speeds	Not configured	12
LSP	Low Speed	10.0 Hz	0.0 Hz	13
PS16	16PresetSpeed	Logic input LI5	Not assigned	14
R2	Relay R2	Freq. threshold reached	Not assigned	15
SP2	PresetSpeed2	20.0 Hz	10.0 Hz	16
SP3	PresetSpeed3	10.0 Hz	15.0 Hz	17
SP4	PresetSpeed4	30.0 Hz	20.0 Hz	18
TFR	MaxOutputFreq	50.0 Hz	72.0 Hz	19
UNS	Nom.Mot.Volt	480 V	460 V	20



03.10. HOISTING SPEED ADJUSTMENT

- 10.1 The variable speed drive controlling the hoisting motor is pre-set for each crane model and is controlled and eventually set-up, if required, at the erection test of each single crane.
- 10.2 It is not generally required to proceed with subsequent variable speed drives set-up, unless, due special crane applications, the variation of one or more parameters is needed to modify the standard performance of the equipment.
- 10.3 The particular instructions enclosed to the present technical documentation provide all the required information to set the variable speed drives; before each intervention it is recommended to refer to the particular instructions by the manufacturer.
- 10.4 The standard values of all parameters for the **ALTIVAR 71** variable speed drives the crane is equipped with are shown on the following pages. Every modification to the parameters changes hoisting performances.
- 10.5 The safety detectors **2S5** (paragraph 10.3) controls the swing speed of the drum and, if it detects an abnormal functioning, it stops the rotation of the drum.

	WARNING
➤ The selected acceleration and deceleration times shall always be such so as not to cause oscillations of the suspended loads and excessive stress to the structures; the brakes intervention shall always be progressive until the crane slows down. ➤ Every intervention on the variable speed drive shall be carried out only and exclusively by qualified, trained and skilled personnel capable of perfectly setting the equipment. ➤ An incorrect variable speed drive setting may result in its malfunctioning with possible damages to the electrical equipment, excessive stress to the structures with consequent damages, abnormal wear, breakage of the hoisting system and finally damages to the hoisting mechanisms. ➤ The variable speed drive is equipped with internal capacitors with a discharge time of fifteen minutes. In case of maintenance interventions requiring the removal of the variable speed drive outer casings, before removing the guards and handling the internal components, wait at least fifteen minutes after switching the equipment off, as indicated on the outer casing and in the instruction manual. Failure in operating in the indicated way will cause the risk of electric shocks.	

**03.10.1. HOISTING SPEED ADJUSTMENT TABLE**

HOISTING SPEED ADJUSTMENT TABLE (1/2)					
User menu					
Code	Short label	Current Value	Default value	User menu	Protected
ACC	Acceleration	4.0 sec	3.0 sec	1	-
ADC	Auto DC injection	No DC injected current	DC inj braking selected	2	-
BET	Brake engage time	0.10 sec	0.00 sec	3	-
BFR	Standard mot. freq	60Hz Motor frequency	50Hz Motor frequency	4	-
BIP	Brake impulse	Brake impulse Fwd	No	5	-
BLC	Brake assignment	Relay R2	No	6	-
BRA	Dec ramp adapt.	Braking cmd transistor	Dec ramp adapt assigned	7	-
BRT	Brake Release time	0.10 sec	0.00 sec	8	-
DEC	Deceleration	2.0 sec	3.0 sec	9	-
HSP	High speed	100.0 Hz	60.0 Hz	10	-
IBR	Brake release I FW	16.0 A	0.0 A	11	-
IDA	Idw	10.6 A	0.0 A	12	-
L2D	LI2 On Delay	100 ms	0 ms	13	-
L3A	LI3 assignment	Select 2 preset speeds	Not assigned	14	-
L4A	LI4 assignment	Select 4 preset speeds	Not assigned	15	-
L5A	LI5 assignment	Select 8 preset speeds	Not assigned	16	-
LAC	ACCESS LEVEL	Advanced access	Standard access	17	-
LFA	Lfw	3.37 mH	0.00 mH	18	-
LSP	Low speed	25.0 Hz	0.0 Hz	19	-
NCR	Rated mot. current	16.0 A	21.0 A	20	-
NPR	Rated motor power	12.0 HP	15.0 HP	21	-
NSP	Rated motor speed	1738 rpm	1766 rpm	22	-
PS2	2 preset speeds	Logic input LI3	Not assigned	23	-
PS4	4 preset speeds	Logic input LI4	Not assigned	24	-

**HOISTING SPEED ADJUSTMENT TABLE (2/2)**

PS8	8 preset speeds	<u>Logic input LI5</u>	Not assigned	25	-
R2	R2 Assignment	<u>Brake control command</u>	Not assigned	26	-
RSA	Cust stator resist.	<u>275 mOhm</u>	0 mOhm	27	-
SP2	Preset speed 2	<u>50.0 Hz</u>	10.0 Hz	28	-
SP3	Preset speed 3	<u>75.0 Hz</u>	15.0 Hz	29	-
SP4	Preset speed 4	<u>75.0 Hz</u>	20.0 Hz	30	-
SP5	Preset speed 5	<u>50.0 Hz</u>	25.0 Hz	31	-
SP6	Preset speed 6	<u>50.0 Hz</u>	30.0 Hz	32	-
SP7	Preset speed 7	<u>50.0 Hz</u>	35.0 Hz	33	-
SP8	Preset speed 8	<u>100.0 Hz</u>	40.0 Hz	34	-
TCT	2 wire type	<u>Level triggered</u>	Edge triggered	35	-
TFR	Max frequency	<u>100.0 Hz</u>	72.0 Hz	36	-
TRA	Cust. rotor t const.	<u>130 ms</u>	0 ms	37	-
TTR	Time to restart	<u>0.10 sec</u>	0.00 sec	38	-
UNS	Rated motor volt.	<u>480 V</u>	460 V	39	-



03.11. TROLLEY SPEED ADJUSTMENT

- 11.1 The variable speed drive controlling the trolley motor is pre-set for each crane model and is controlled and eventually set-up, if required, at the erection test of each single crane.
- 11.2 It is not generally required to proceed with subsequent variable speed drives set-up, unless, due special crane applications, the variation of one or more parameters is needed to modify the standard performance of the equipment.
- 11.3 The particular instructions enclosed to the present technical documentation provide all the required information to set the variable speed drives; before each intervention it is recommended to refer to the particular instructions by the manufacturer.
- 11.4 The standard values of all parameters for the **ALTIVAR 31** variable speed drives the crane is equipped with are shown on the following pages. Every modification to the parameters changes trolley performances.

	WARNING
➤ The selected acceleration and deceleration times shall always be such so as not to cause oscillations of the suspended loads and excessive stress to the structures; the brakes intervention shall always be progressive until the crane slows down. ➤ Every intervention on the variable speed drive shall be carried out only and exclusively by qualified, trained and skilled personnel capable of perfectly setting the equipment. ➤ An incorrect variable speed drive setting may result in its malfunctioning with possible damages to the electrical equipment, excessive stress to the structures with consequent damages, abnormal wear, breakage of the trolley system and finally damages to the hoisting mechanisms. ➤ The variable speed drive is equipped with internal capacitors with a discharge time of fifteen minutes. In case of maintenance interventions requiring the removal of the variable speed drive outer casings, before removing the guards and handling the internal components, wait at least fifteen minutes after switching the equipment off, as indicated on the outer casing and in the instruction manual. Failure in operating in the indicated way will cause the risk of electric shocks.	

**03.11.1. TROLLEY SPEED ADJUSTMENT TABLE****TROLLEY SPEED ADJUSTMENT TABLE**

User menu				
Code	Short label	Current Value	Default value	User menu
AC2	Acceleration2	<u>3.5 s</u>	5.0 s	1
ACC	Acceleration	<u>2.0 s</u>	3.0 s	2
BFR	Std.Motor F.	<u>60 Hz</u>	50 Hz	3
BRA	Dec.RampAdapt	<u>No</u>	Yes	4
DE2	Deceleration2	<u>2.0 s</u>	5.0 s	5
DEC	Deceleration	<u>1.0 s</u>	3.0 s	6
FRT	SwitchRamp2	<u>15.0 Hz</u>	0.0 Hz	7
FTD	Mot.Freq.Thr.	<u>1.0 Hz</u>	60.0 Hz	8
HSP	High Speed	<u>50.0 Hz</u>	60.0 Hz	9
LI5A	Config.LI5	<u>Select 16 preset speeds</u>	Not configured	10
LI6A	Config.LI6	<u>Freewheel stop via LI</u>	Not configured	11
LSP	Low Speed	<u>20.0 Hz</u>	0.0 Hz	12
NCR	Nom.MotorCur	<u>10.0 A</u>	6.2 A	13
NST	FreewheelStop	<u>Logic input LI6</u>	Not assigned	14
PS16	16PresetSpeed	<u>Logic input LI5</u>	Not assigned	15
R2	Relay R2	<u>Freq. threshold reached</u>	Not assigned	16
SP2	PresetSpeed2	<u>30.0 Hz</u>	10.0 Hz	17
SP3	PresetSpeed3	<u>30.0 Hz</u>	15.0 Hz	18
SP4	PresetSpeed4	<u>40.0 Hz</u>	20.0 Hz	19
TCT	Type2WireCtrl	<u>Level triggered</u>	Edge triggered	20
TFR	MaxOutputFreq	<u>50.0 Hz</u>	72.0 Hz	21
UNS	Nom.Mot.Volt	<u>480 V</u>	460 V	22



03.12. WIRING DIAGRAMS

Wiring diagrams enclosed on the following pages.

Wiring diagrams for anemometer **OPTIONAL** enclosed on the following pages.





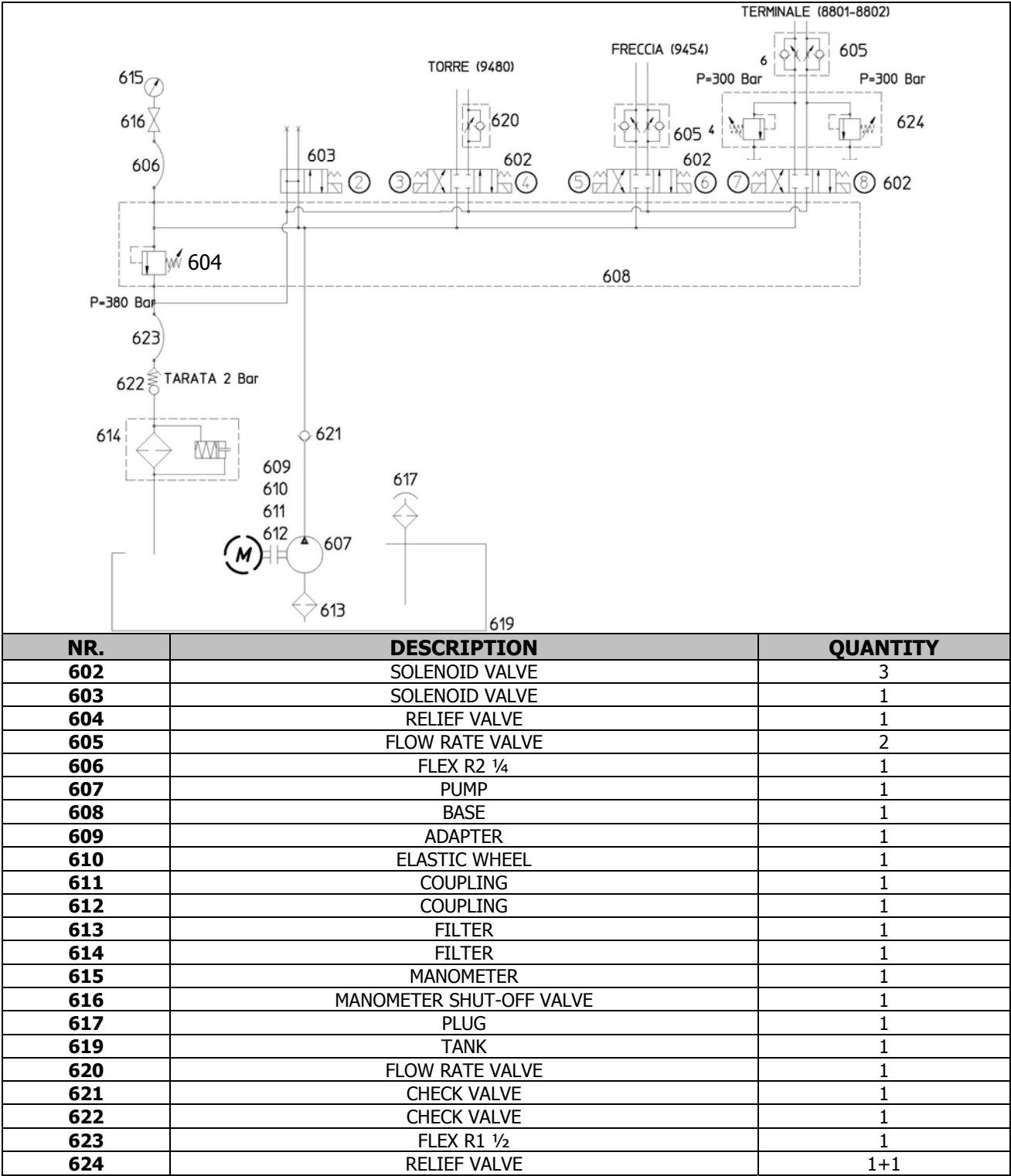
04. HYDRAULIC EQUIPMENT

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04.1. HYDRAULIC DIAGRAM



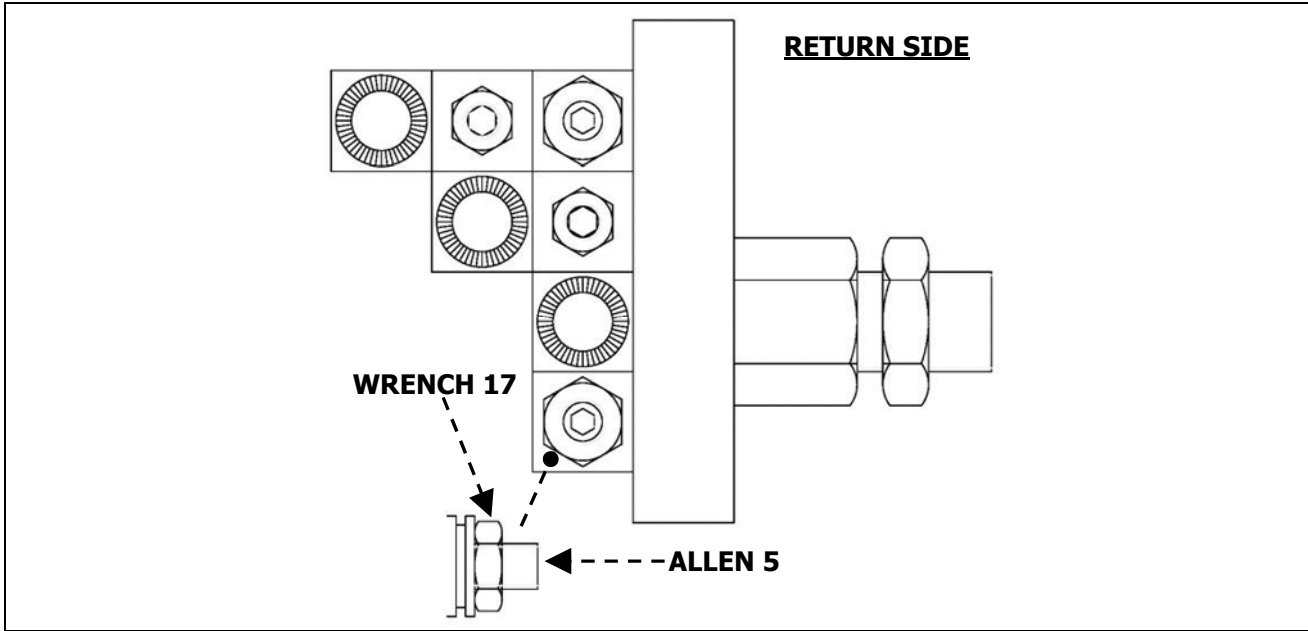


04.2. ADJUSTMENT OF THE HYDRAULIC SYSTEM MAX. PRESSURE

2.1 The crane hydraulic system has been designed and sized for max. operating pressures of **390 bar (5,656 psi)**.

HYDRAULIC SYSTEM MAX. PRESSURE
390 bar (5,656 psi)

2.2 Should the system pressure gauge indicate a service pressure other than the machine setting, the pressure can be regulated.



- 2.3 To adjust the hydraulic system max. pressure, it takes to act on the adjustment screw placed at the base of the hydraulic unit motor. Proceed as it follows:
- o remove the protection cover of the hydraulic unit;
 - o loosen the lock nut, **wrench 17**;
 - o act on the hexagon set screw, **Allen 5**;
 - o loosen the screw to reduce the max. pressure, tighten the screw to increase the max. pressure;
 - o once completed the adjustment, tighten the lock nut to lock the screw.

2.4 Should crane erection or dismantling operations be carried out in hot weather, remove the hydraulic station motor cover to allow for its cooling down.

	WARNING
➤ Valves adjustment shall be carried out with the crane at stand still (the hydraulic station can be on, but the hydraulic cylinders shall be at rest). ➤ To ensure proper functioning of the hydraulic station, check for motor direction of rotation, verifying that it corresponds to the sense indicated by the arrow on the on the motor's rear air grating. ➤ Incorrect setting of the maximum pressure may cause damages to the crane structures, to its hydraulic parts or lead to crane malfunctioning at its erection and dismantling stage. ➤ Only qualified, trained and skilled personnel shall perform adjustment interventions. Please bear in	



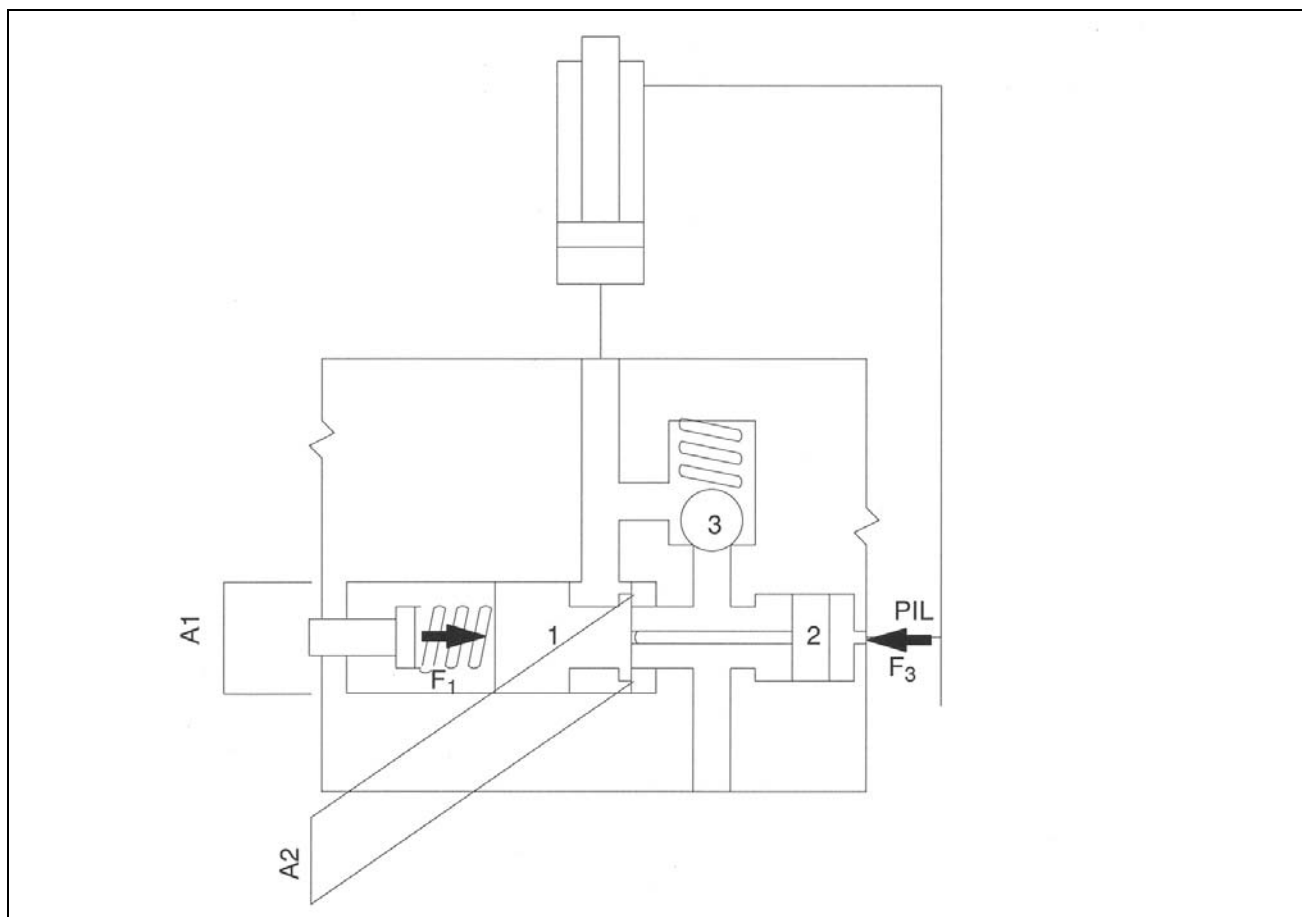
mind that the max. set pressure shall not exceed **390 bar (5,656 psi)**.

- Setting the hydraulic system at a pressure higher than the limit value of **390 bar (5,656 psi)** may seriously damage the hydraulic or structural components of the crane.



04.3. OVERCENTER VALVES ADJUSTMENT

- 3.1 The overcenter valves fitted on the hydraulic cylinders have the function to control the load, to prevent any uncontrolled movements and to stop them in any position.
- 3.2 They consist of a maximum pressure valve **1**, a pilot system **2** and check valve **3**. At the lifting stage, the oil flows freely through the check valve **3**; to lower the load the oil is conveyed into the other cylinder chamber and to the pilot system. The pilot pressure generates an F_3 force opposing the spring force of F_1 , which keeps the cylinder closed (counterforce); the counterforce can be adjusted by acting on the outer socket head screw.



- 3.3 For correct system functioning, the maximum pressure valve **1** shall be generally set at a pressure value 20-30% higher than that induced by the maximum load.
- 3.4 To set the valve, proceed as it follows:
- o loosen the lock nut, **wrench 13**;
 - o act on the central screw by means of an **Allen 4**, loosening to reduce the valve opening pressure, tightening to increase the pressure.



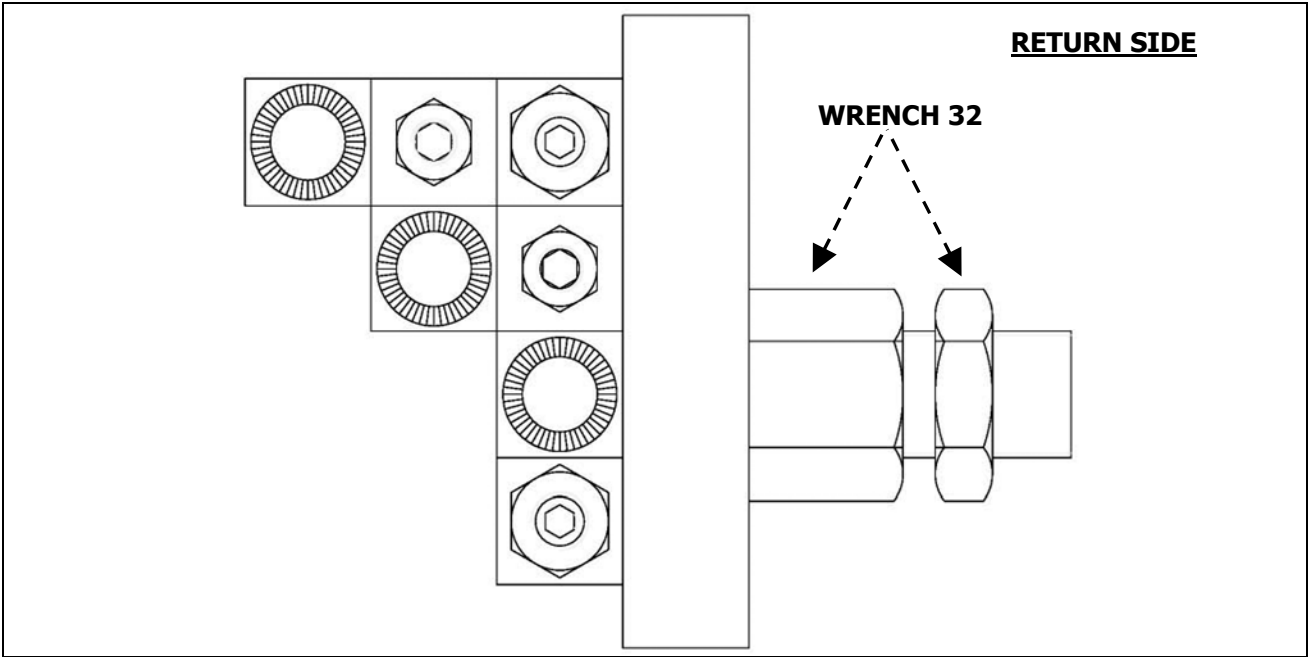
WARNING

- Valves adjustment shall be carried out with the crane at stand still (the hydraulic station can be on, but the hydraulic cylinders shall be at rest).



04.4. OIL FLOW ADJUSTMENT (TOWER LOWERING)

- 4.1 The valve for oil flow adjustment arranged on the support of the pump solenoid valves is fitted on the return pipe of the tower cylinder and has the purpose to control the cylinder lowering speed.
- 4.2 The adjusting device is composed of a nut **wrench 32**, locked by a lock nut **wrench 32**.
- 4.3 To adjust, proceed as follows:
 - o remove the protection cover of the hydraulic unit;
 - o loosen the lock nut, turning it for few complete turns and moving it away from the nut; this way, the nut is unlocked;
 - o turn the nut: bring it closer to the lock nut (counter clockwise turn) in order to increase the flow (and the lowering speed of the tower); move it away from the lock not (clockwise turn) in order to reduce the flow (and the lowering tower speed);
 - o once reached the suited adjustment, turn the lock nut until is locked against the nut.



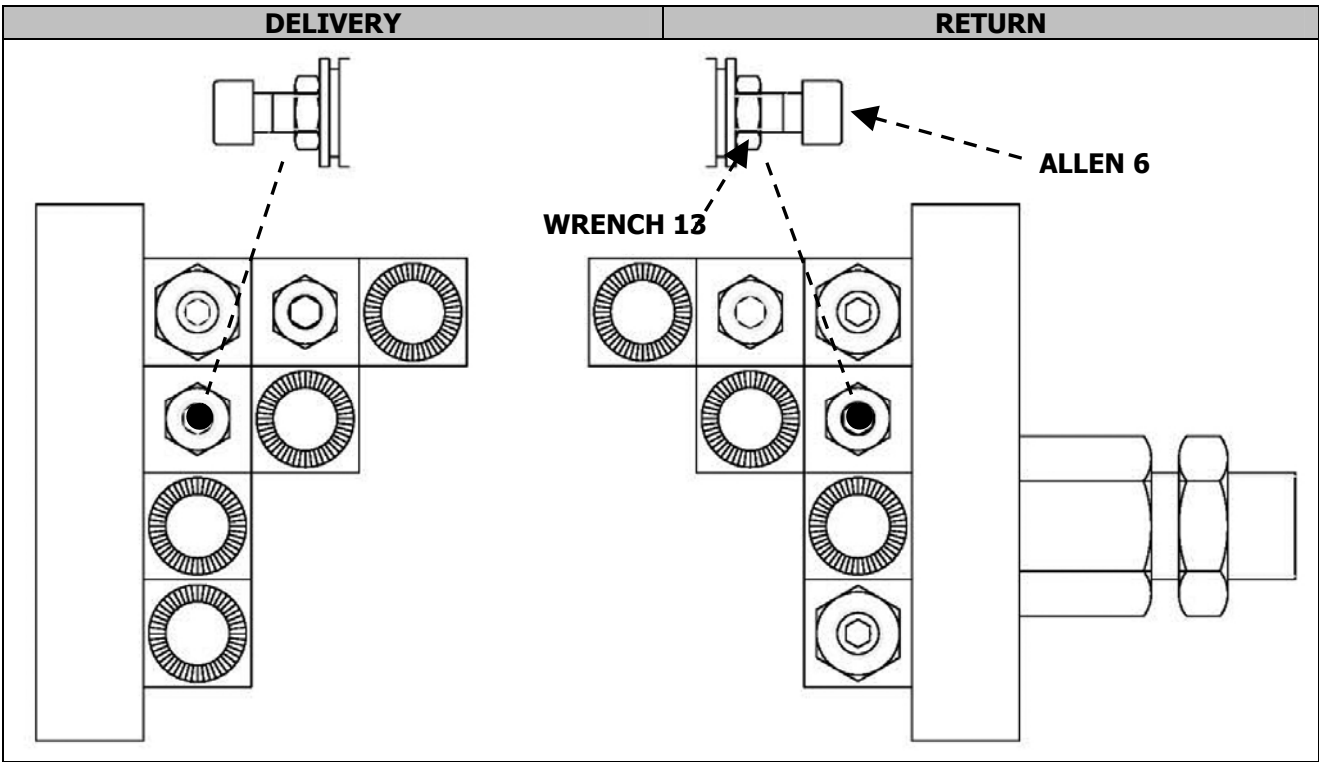
WARNING

- The adjustment of the tower cylinder speed shall be such that the movements are regular and don't cause counterblows.
- Valves adjustment shall be carried out with the crane at stand still (the hydraulic station can be on, but the hydraulic cylinders shall be at rest).



04.5. CYLINDER SPEED ADJUSTMENT (SECOND BOOM SECTION)

- 5.1 The adjustment device is controlled by a pair of screws, acting respectively on the delivery and the return pipes of the cylinderS actuating the second section of the boom. The screws are arranged underneath the support of the corresponding solenoid valve.
- 5.2 One screw controls the delivery side, the other screw controls the return side (side with the tower oil flow valve).
- 5.3 To adjust the opening-closing speed of the boom second section cylinder, loosen the lock nut with a **wrench 13** and then tighten or loosen the socket head **Allen 6**, fitted on the block next to the solenoid valve of the boom second section cylinders:
- o remove the protection cover of the hydraulic unit;
 - o remove the caps of the screws;
 - o tighten the screw acting on the delivery pipe, to reduce the oil flow delivered to the cylinders and, consequently, the opening speed of the cylinder;
 - o loosen the screw acting on the delivery pipe, to increase the oil flow delivered to the cylinders and, consequently, the opening speed of the cylinder;
 - o tighten the screw acting on the return pipe, to reduce the oil flow returning from the cylinders and, consequently, the closing speed of the cylinder;
 - o loosen the screw acting on the return pipe, to increase the oil flow returning from the cylinders and, consequently, the closing speed of the cylinder.
- 5.4 After carrying out the adjustment, firmly tighten the nuts to lock the screws.



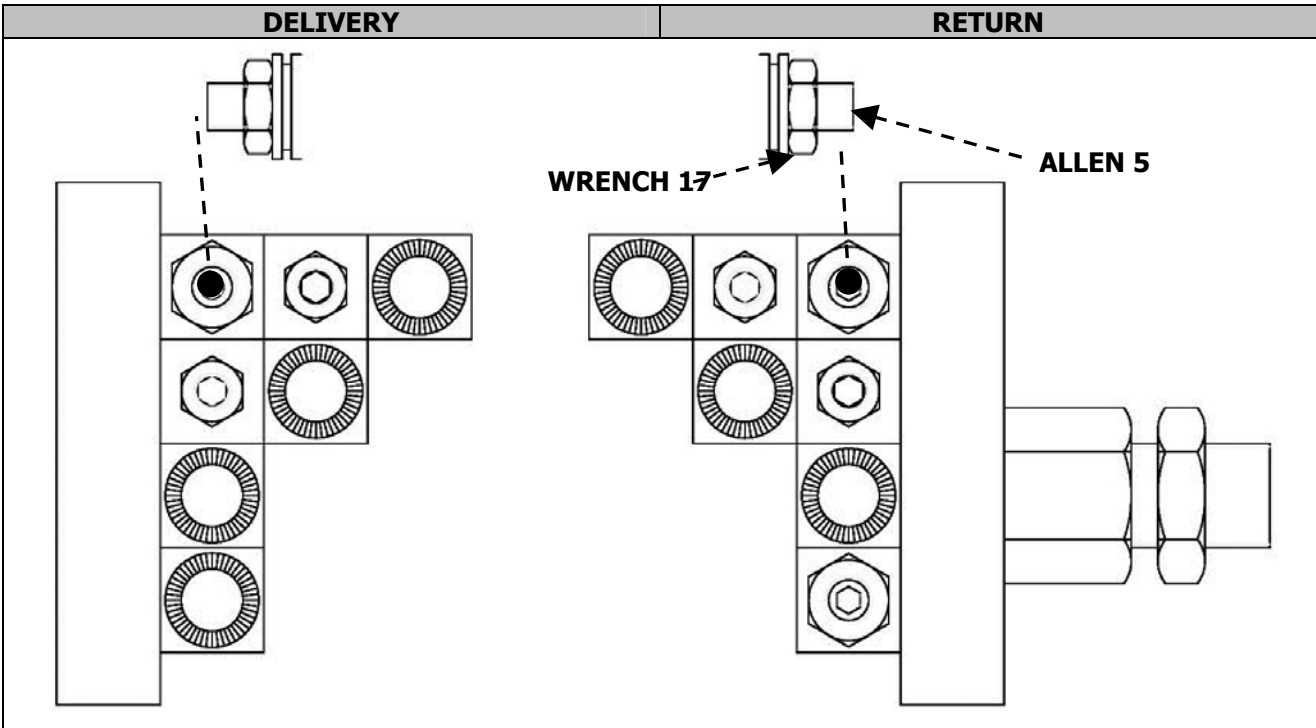
WARNING

- Adjust the cylinder speed so that the movements are regular and don't cause counterblows.



04.6. ADJUSTMENT OF THE THIRD BOOM SECTION MAX. PRESSURE

- 6.1 The delivery and return lines of the third boom section are equipped with two relief valves, controlling the max. pressure of the oil flow delivered to the cylinders actuating the unfolding and the folding of this boom section.
- 6.2 The max. pressure of these lines is set to **300 bar (4,351 psi)**.
- 6.3 During the folding or unfolding of the third boom section, if it's needed to increase (or to reduce) this value of pressure, it takes to actuate the adjustment screws placed at the base of the hydraulic unit motor. Proceed as it follows:
 - o loosen the lock nut, **wrench 17**;
 - o act on the hexagon set screw, **Allen 5**;
 - o the screw placed at the delivery side controls the pressure of the third boom section unfolding; the screw placed on the return side (side with the tower oil flow valve) controls the pressure of the third boom section folding.
 - o loosen the screw to reduce the max. pressure, tighten the screw to increase the max. pressure;
 - o once completed the adjustment, tighten the lock nut to lock the screw.



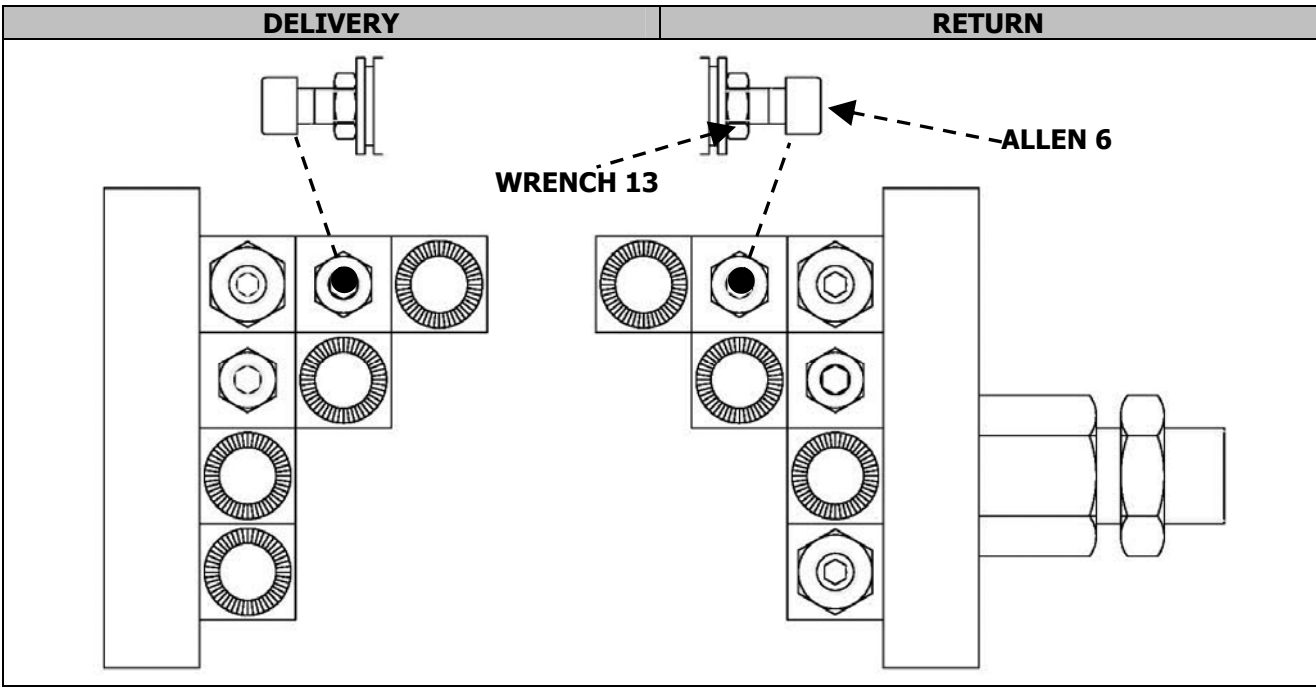
WARNING

- The max. pressure of these lines is set **300 bar (4,351 psi)**.
- It is reminded that the max. pressure of the hydraulic system, controlled by the relief valve connected with the delivery pump, is **390 bar (5,656 psi)**.



04.7. CYLINDER SPEED ADJUSTMENT (THIRD BOOM SECTION)

- 7.1 The adjustment device is controlled by a pair of screws, acting respectively on the delivery and the return pipes of the cylinders actuating the third section of the boom. The screws are arranged underneath the support of the corresponding solenoid valve.
- 7.2 One screw controls the delivery side, the other screw controls the return side (side with the tower oil flow valve).
- 7.3 To adjust the opening-closing speed of the boom third section cylinders, loosen the lock nut with a **wrench 13** and then tighten or loosen the socket head **Allen 6**, fitted on the block next to the solenoid valve of the boom third section cylinders:
- o remove the protection cover of the hydraulic unit;
 - o remove the caps of the screws;
 - o tighten the screw acting on the delivery pipe, to reduce the oil flow delivered to the cylinders and, consequently, the opening speed of the cylinders;
 - o loosen the screw acting on the delivery pipe, to increase the oil flow delivered to the cylinders and, consequently, the opening speed of the cylinders;
 - o tighten the screw acting on the return pipe, to reduce the oil flow returning from the cylinders and, consequently, the closing speed of the cylinders;
 - o loosen the screw acting on the return pipe, to increase the oil flow returning from the cylinders and, consequently, the closing speed of the cylinders.
- 7.4 After carrying out the adjustment, firmly tighten the nuts to lock the screws.



WARNING

- Adjust the cylinder speed so that the movements are regular and don't cause counterblows.



04.8. CHECKS OF THE HYDRAULIC SYSTEM

04.8.1. CHECKS PRIOR TO CRANE ERECTION

- 8.1 Prior to crane erection or dismantling, it is necessary, especially if the hydraulic system of the crane has been idle for a long time, to make sure there is no air or water inside it. The presence of air inside the system may be due to slight leakages from the check valves, or after eventual maintenance interventions carried out to the system.
- 8.2 Firstly, check for oil level inside the hydraulic unit and make sure there is no water inside.

	WARNING
➤ The presence of water or air inside the station or the hydraulic system may lead to crane uncontrolled movements, which might result in damages to the structures or in the risk of crane overturning.	

- 8.3 Turn the selector switch **SA1** (paragraph 03.3.1) into position **2** (controlling the tower and the second boom section), then depress "START" push-button on the control board to start the hydraulic unit.
- 8.4 After few seconds of functioning of the hydraulic unit, actuate few little movements of boom unfolding and folding, acting on the "FAR" and "NEAR" push-buttons, raising (and lowering) the boom about **10-15°** from its transport position, in order to fill up with oil the cylinder chambers.
- 8.5 Further, actuate few little movements of tower erection and lowering, acting on the "UP" and "DOWN" push-buttons, raising the tower about **4-5°** from its transport position, in order to fill up with oil the cylinder chambers.
- 8.6 Meanwhile, make sure of the service pressure inside the hydraulic unit: check the readings of the pressure gauge and inspect that the movements are regular.

	WARNING
➤ Failure in carrying out all the recommended checks on the hydraulic equipment before and during crane erection and dismantling may result in its faulty or non-operation, thus causing uncontrolled movements of the crane structures and possible damages or breakages to the crane.	



04.8.2. CHECKS DURING CRANE ERECTION

- 8.7 Prior to crane erection or dismantling, it is necessary, especially if the hydraulic system of the crane has been idle for a long time, to make sure there is no air or water inside it. The presence of air inside the system may be due to slight leakages from the check valves, or after eventual maintenance interventions carried out to the system.
- 8.8 Firstly, check for oil level inside the hydraulic unit and make sure there is no water inside.

	WARNING
➤ The presence of water or air inside the station or the hydraulic system may lead to crane uncontrolled movements, which might result in damages to the structures or in the risk of crane overturning.	

- 8.9 The check of the cylinders actuating the third boom section shall be carried out when the crane is erected (tower in a vertical position and boom second section unfolded), before unfolding the boom third section
- 8.10 Turn the selector switch **SA1** (paragraph 03.3.1) into position **3** (controlling the third boom section).
- 8.11 Actuate few little movements of boom third section unfolding and folding, acting on the "FAR" and "NEAR" push-buttons, raising (and lowering) the boom about **10°** from its transport position, in order to fill up with oil the cylinder chambers.
- 8.12 Meanwhile, make sure of the service pressure inside the hydraulic unit: check the readings of the pressure gauge and inspect that the movements are regular.

	WARNING
➤ Failure in carrying out all the recommended checks on the hydraulic equipment before and during crane erection and dismantling may result in its faulty or non-operation, thus causing uncontrolled movements of the crane structures and possible damages or breakages to the crane.	



04.8.3. CHECKS PRIOR TO CRANE DISMANTLING

- 8.13 Prior to crane erection or dismantling, it is necessary, especially if the hydraulic system of the crane has been idle for a long time, to make sure there is no air or water inside it. The presence of air inside the system may be due to slight leakages from the check valves, or after eventual maintenance interventions carried out to the system.
- 8.14 Firstly, check for oil level inside the hydraulic unit and make sure there is no water inside.

	WARNING
➤ The presence of water or air inside the station or the hydraulic system may lead to crane uncontrolled movements, which might result in damages to the structures or in the risk of crane overturning.	

- 8.15 Turn the selector switch **SA1** (paragraph 03.3.1) into position **3** (controlling the third boom section), then depress "START" push-button on the control board to start the hydraulic unit.
- 8.16 After few seconds of functioning of the hydraulic unit, actuate few little movements of boom third section folding and unfolding, acting on the "NEAR" and "FAR" push-buttons, raising (and lowering) the boom about **10°** from its operatin position, in order to fill up with oil the cylinder chambers
- 8.17 Meanwhile, make sure of the service pressure inside the hydraulic unit: check the readings of the pressure gauge and inspect that the movements are regular.

	WARNING
➤ Failure in carrying out all the recommended checks on the hydraulic equipment before and during crane erection and dismantling may result in its faulty or non-operation, thus causing uncontrolled movements of the crane structures and possible damages or breakages to the crane.	



04.8.4. CHECKS DURING CRANE DISMANTLING

- 8.18 Prior to crane erection or dismantling, it is necessary, especially if the hydraulic system of the crane has been idle for a long time, to make sure there is no air or water inside it. The presence of air inside the system may be due to slight leakages from the check valves, or after eventual maintenance interventions carried out to the system.
- 8.19 Firstly, check for oil level inside the hydraulic unit and make sure there is no water inside.



WARNING

- The presence of water or air inside the station or the hydraulic system may lead to crane uncontrolled movements, which might result in damages to the structures or in the risk of crane overturning.

- 8.20 Turn the selector switch **SA1** (paragraph 03.3.1) into position **2** (controlling the tower and the second boom section).
- 8.21 Actuate few little movements of the second boomsection folding and unfolding, acting on the "NEAR" and "FAR" push-buttons, raising (and lowering) the boom about **10°** from its operation position, in order to fill up with oil the cylinder chambers.
- 8.22 Proceeding with dismantling procedure, after folding the boom second section till it rests on the boom tie rod, actuate few little movements of tower lowering and erection, acting on the "DOWN" and "UP" push-buttons, in order to fill up with oil the cylinder chambers.
- 8.23 Meanwhile, make sure of the service pressure inside the hydraulic unit: check the readings of the pressure gauge and inspect that the movements are regular.



WARNING

- Failure in carrying out all the recommended checks on the hydraulic equipment before and during crane erection and dismantling may result in its faulty or non-operation, thus causing uncontrolled movements of the crane structures and possible damages or breakages to the crane.



05. BALLAST

- 05.1. BALLAST BLOCKS 05-1
 - 05.1.1. TOTAL BALLAST..... 05-1
 - 05.1.2. ERECTION BALLAST 05-2
 - 05.1.3. OPERATION BALLAST..... 05-5





05.1. BALLAST BLOCKS

05.1.1. TOTAL BALLAST

1.1 The ballast, ensuring stability to the crane, consists of cement blocks and is composed as it follows:

	BLOCK TYPE	BLOCK WEIGHT	QUANTITY	TOTAL WEIGHT
ERECTION BALLAST	400/1 D (right)	1,850 kg	1	1,850 kg
	400/1 S (left)	1,850 kg	1	1,850 kg
	400/2 D (right)	2,000 kg	1	2,000 kg
	400/2 S (left)	2,000 kg	1	2,000 kg
	TOTAL ERECTION BALLAST			7,700 kg
OPERATION BALLAST	400/3	1,300 kg	19	24,700 kg
	TOTAL OPERATION BALLAST			24,700 kg
TOTAL BALLAST				32,400 kg

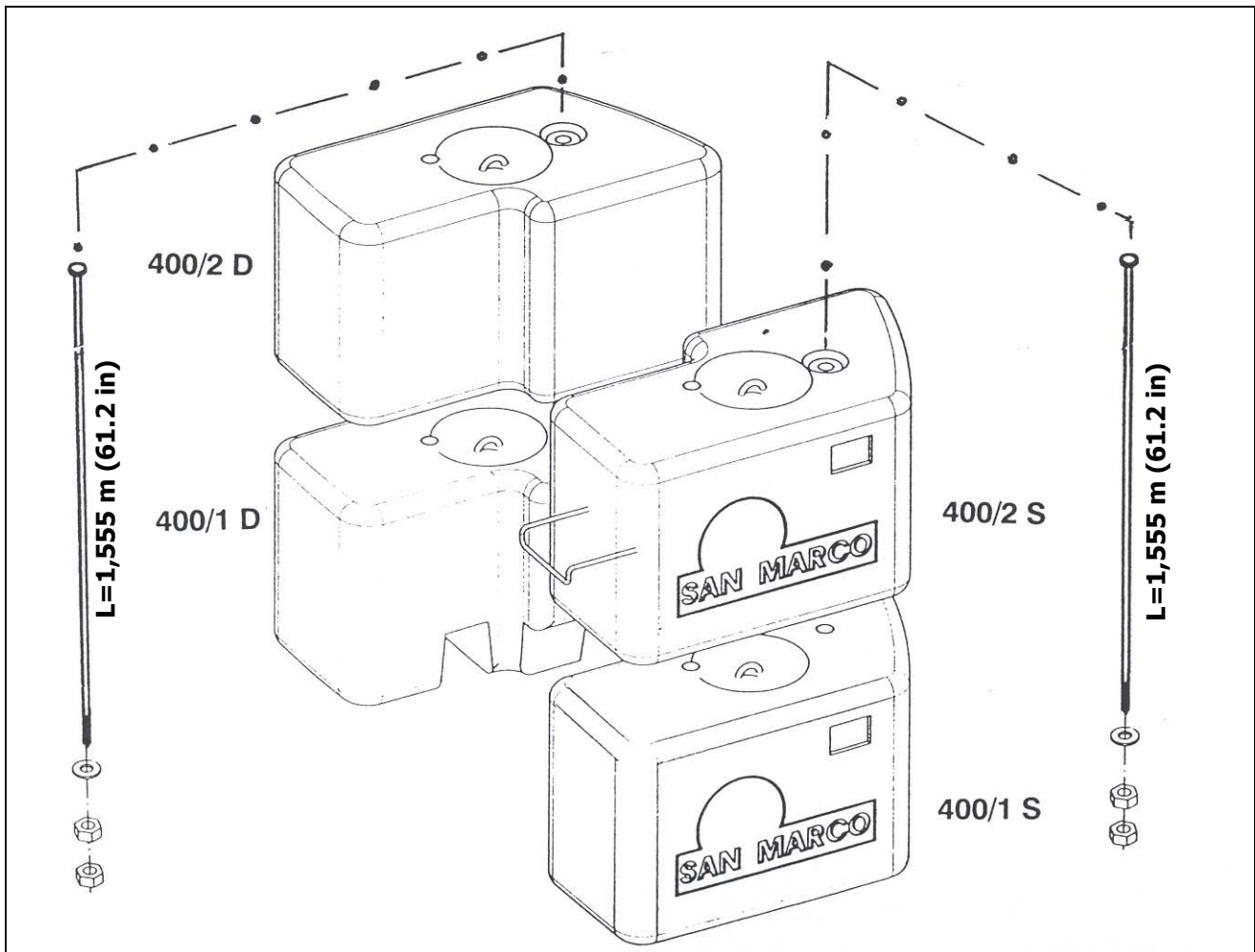
	BLOCK TYPE	BLOCK WEIGHT	QUANTITY	TOTAL WEIGHT
ERECTION BALLAST	400/1 D (right)	4,079 lbs	1	4,079 lbs
	400/1 S (left)	4,079 lbs	1	4,079 lbs
	400/2 D (right)	4,409 lbs	1	4,409 lbs
	400/2 S (left)	4,409 lbs	1	4,409 lbs
	TOTAL ERECTION BALLAST			16,976 lbs
OPERATION BALLAST	400/3	2,866 lbs	19	54,454 lbs
	TOTAL OPERATION BALLAST			54,454 lbs
TOTAL BALLAST				71,430 lbs

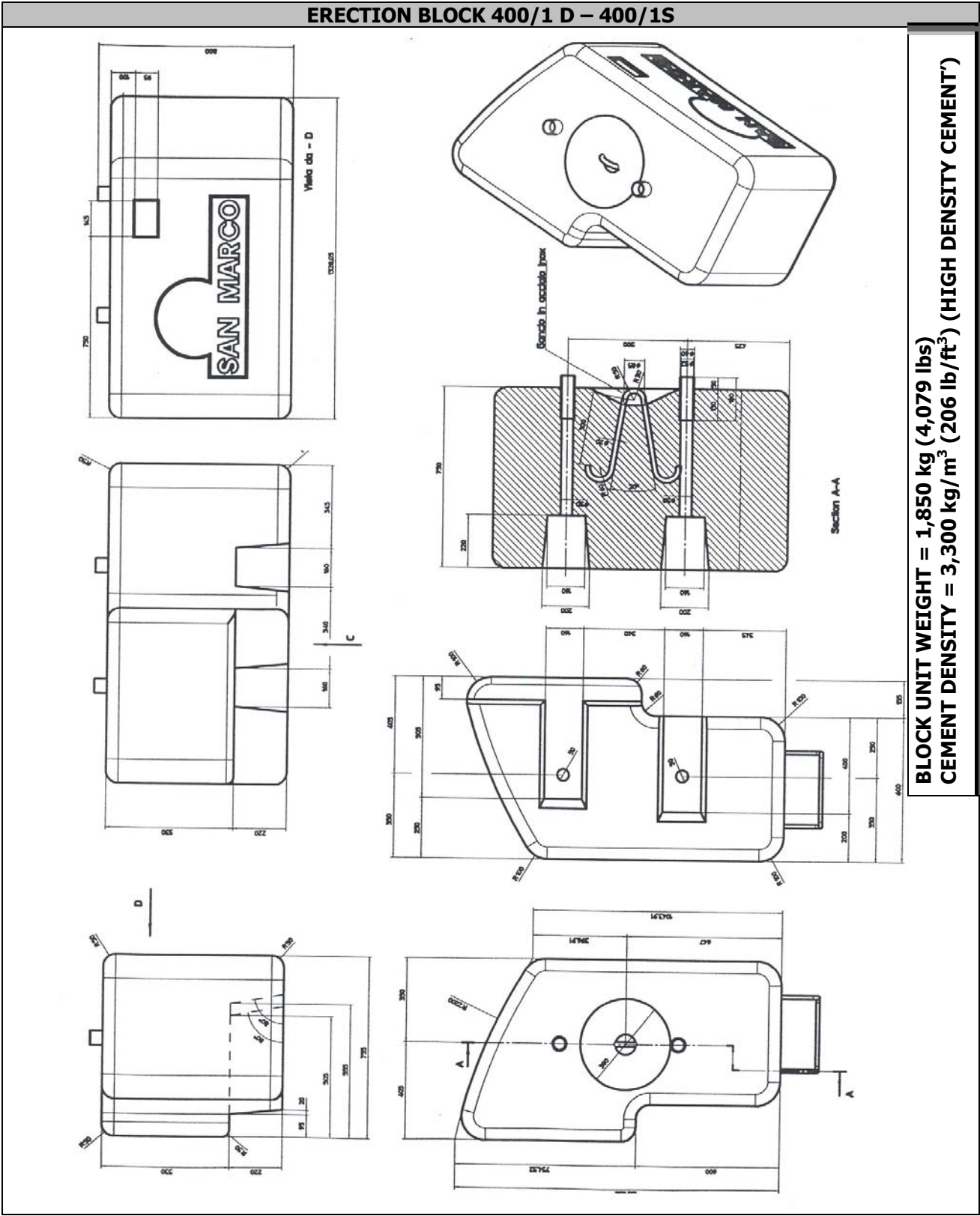
- 1.2 If not delivered by the crane Manufacturer along with the machine, the blocks shall be built according to the drawings supplied and strictly meet the specified dimensions, reinforcements and weights. **In particular, consider that all the ballast blocks are in HIGH DENSITY CEMENT 3300 kg/m³ (206 lb/ft³). See following drawings.**
- 1.3 Never install any block on the crane when transporting it. The erection ballast shall be installed on the base frame **before crane levelling and erection**. The erection ballast blocks shall be lifted and positioned by means of a suitable lifting means.
- 1.4 With the only erection ballast installed, the crane is stable in windless conditions, without load, and with the boom folded at those stages in which the tower is erected. After erecting the tower and before unfolding the boom, immediately fit the remaining ballast blocks.



05.1.2. ERECTION BALLAST

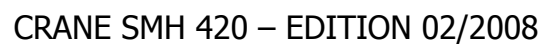
- 1.5 The erection ballast is formed by two blocks type **400/1** right and left, **1,850 kg (4,079 lbs)** each one and by two blocks type **400/2** right and left, **2,000 kg (4,409 lbs)** each one.
- 1.6 Never install any block on the crane when transporting it.
- 1.7 The erection ballast shall be installed on the base frame **before crane levelling and erection**.
- 1.8 After installing the erection ballast on the crane, secure it to the base frame by the appropriate tie rods with relevant nuts and washers, by means of the **wrench 50** supplied in the tool kit.





WARNING

- All the ballast blocks are built with **high-density cement 3,300 kg/m³ (206 lb/ft³)**. Never build blocks with a lower-density cement: danger for the stability of the crane.



ERECTOR BLOCK 400/2 D – 400/2S

BLOCK UNIT WEIGHT = 2000 kg (4,409 lbs)
CEMENT DENSITY = 3300 kg/m³ (206 lb/ft³) (HIGH DENSITY CEMENT*)



- All the ballast blocks are built with **high-density cement 3,300 kg/m³ (206 lb/ft³)**. Never build blocks with a lower-density cement: danger for the stability of the crane.



05.1.3. OPERATION BALLAST

- 1.9 Besides the erection ballast blocks type **400/1** and **400/2**, **19** operation ballast blocks shall be installed on the crane, of the type **400/3**, weighing **1,300 kg (2,866 lbs)** each one, for a total weight of **24,700 kg (54,454 lbs)**. **Total ballast: 32,400 kg (71,430 lbs)**.
- 1.10 Blocks type **400/3** shall be placed onto the **400/2** blocks one at the time by means of the derrick equipping the crane, max. load **1,300 kg (2,866 lbs)**. By alternative, lifting means suited to their size and weight can be employed.
- 1.11 After installing them on the crane, secure the ballast blocks **400/3** to one another and to the upper base frame by the apposite tie rods, locked with nuts and washers, by means of the **wrench 24** supplied in the tool kit.



WARNING

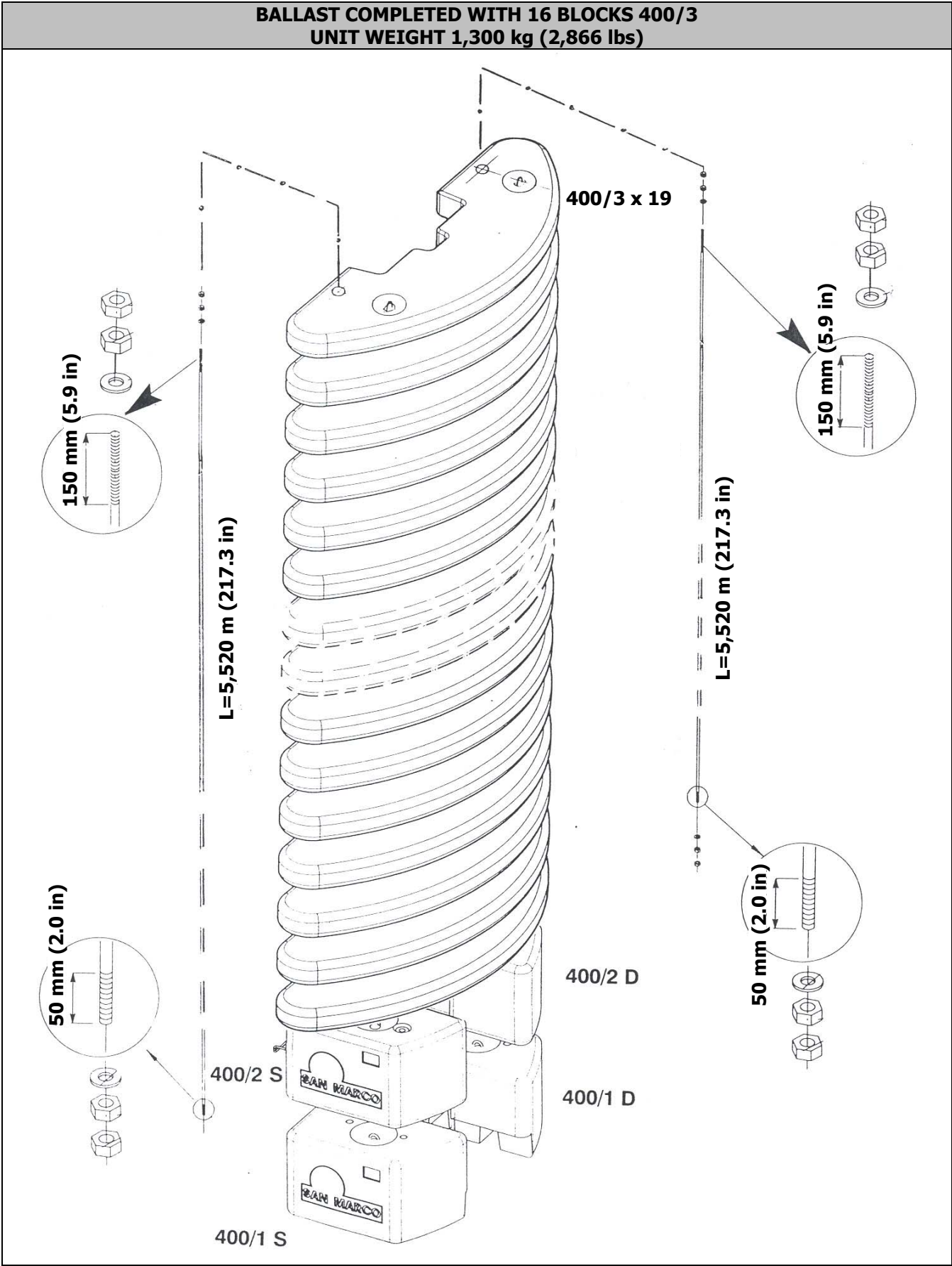
- None of the tie rods shall protrude more than 40 mm (1.6 in) over the lower line of the base block.

- 1.12 During crane dismantling, all **400/3** type blocks shall be removed by means of the derrick supplied only after fully folding the boom. By alternative, lifting means suited to their size and weight can be employed, anyway the boom shall be folded first.



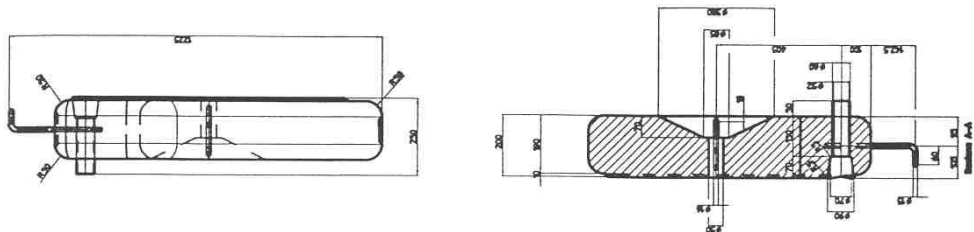
WARNING

- During the ballast blocks movement, hook a nylon rope to the block lifted by the derrick, in order to pull it sideways and to manage it.
- Blocks not secured by means of tie rods, as prescribed, may fall, with consequent danger for all the exposed persons and for the crane stability.
- Failure in checking the weight of the blocks after their manufacturing might result in ballast weight different than indicated, with consequent danger of crane overturning.
- After erection, do not leave the crane with the erection ballast only. Do not operate the crane unless all the ballast blocks have been fitted on it. Risk of crane overturning. The same risk subsists in case the boom is unfolded without all ballast blocks fitted.
- To secure or move the operation ballast blocks while lifting them by the derrick, grasp handles.
- When the crane tower has been erected (operation possible with the erection blocks **400/1** and **400/2** only) it is absolutely necessary to complete the full ballast loading before unfolding the boom.
- To access the upper level of the blocks, at a height of 2 meters (6'-7") from the ground, the operators are required to wear a double-lock safety belt firmly secured to the hooking points.
- When lifting, lowering and positioning operation blocks type **400/3**, it is strictly forbidden to walk or stand underneath or nearby the suspended load. Risk of crushing and collision should these fall.
- The handles of the blocks shall always be kept in perfect working order. Should the handles warp or damage during use or movement, they shall never be straightened. **Replace the entire block**; a cracked handle might fall off, with consequent risks of falling and crushing for the exposed persons.

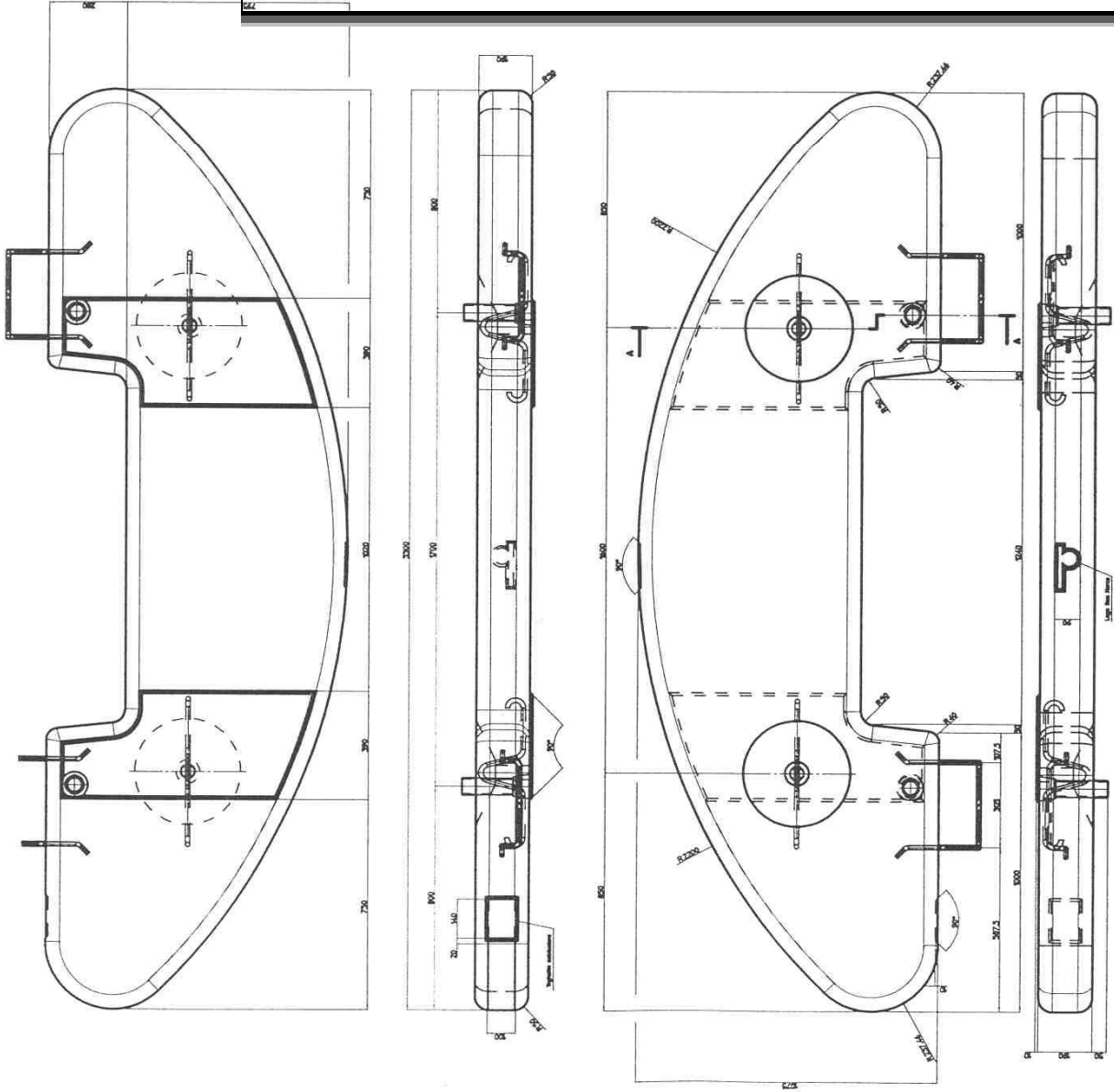




OPERATION BLOCK 400/3



BLOCK UNIT WEIGHT = 1,300 kg (2,866 lbs)
CEMENT DENSITY = 3,300 kg/m³ (206 lb/ft³) (HIGH DENSITY CEMENT)



WARNING

- All the ballast blocks are built with **high-density cement 3,300 kg/m³ (206 lb/ft³)**. Never build blocks with a lower-density cement: danger for the stability of the crane.



06. CRANE POSITIONING AND
LEVELLING

06.1. CRANE POSITIONING

06-1

06.2. LEVELLING THE CRANE.....

06-10





06.1. CRANE POSITIONING

- 1.1 Once selected the crane’s positioning place (paragraph 02.1), on solid-base ground, tow the crane there.
- 1.2 Provide 28 hard wood beams, according with the min. dimensions indicated in the table below.

HARD WOOD BEAMS FOR THE STABILIZERS			
QUANTITY	LENGTH	WIDTH	HEIGHT
28	100 cm (39.4 in)	25 cm (9.8 in)	20 cm (7.9 in)

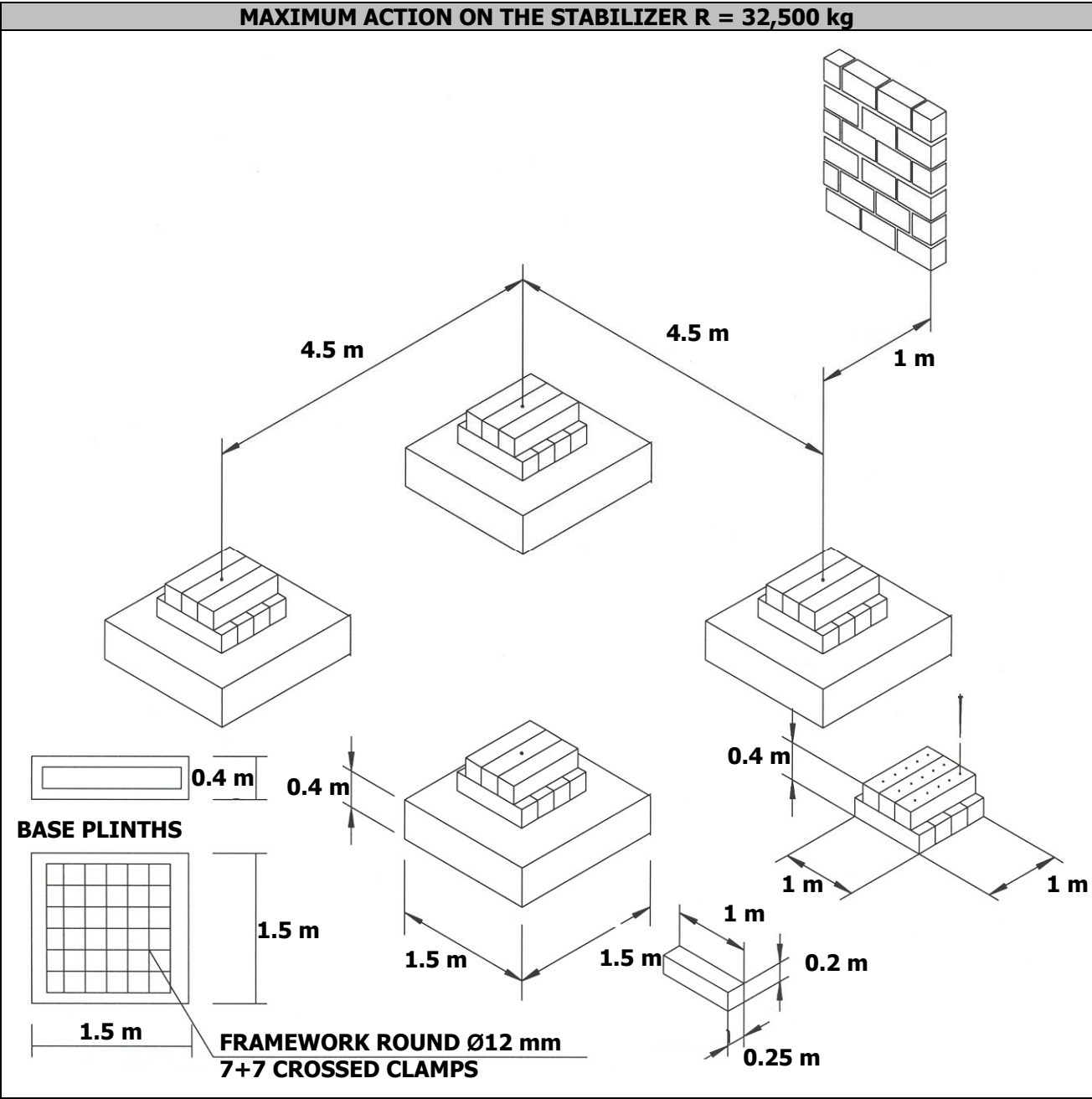
As an alternative 2 long hard wood beam may be used, according with the min. dimensions indicated in the table below.

LONG HARD WOOD BEAMS FOR THE STABILIZERS (as an alternative to 28 little beams)			
QUANTITY	LENGTH	WIDTH	HEIGHT
2	5.5 m (18'-1")	50 cm (19.7 in)	40 cm (15.7 in)

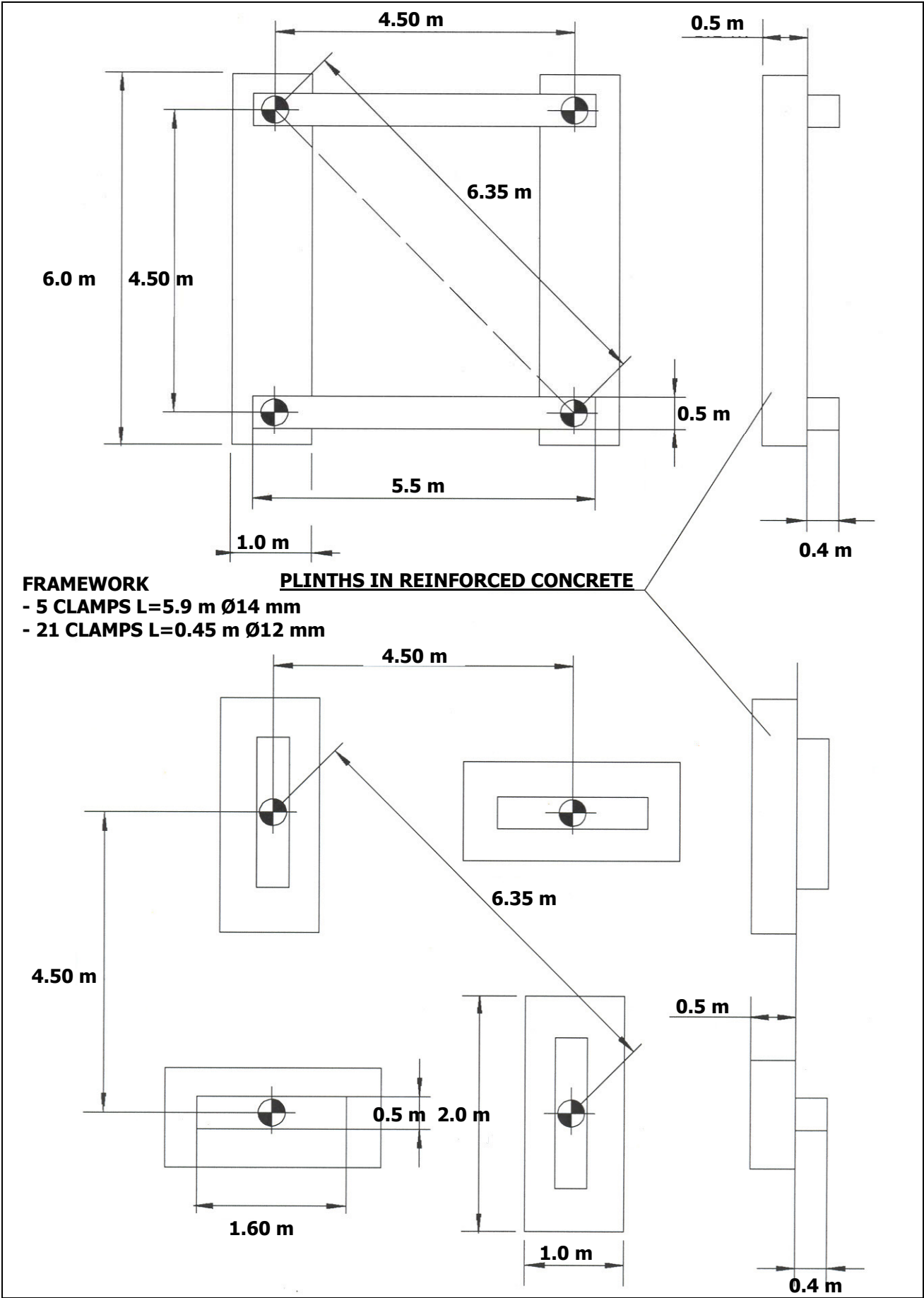
As an alternative too, 4 hard wood beam may be used, according with the min. dimensions indicated in the table below.

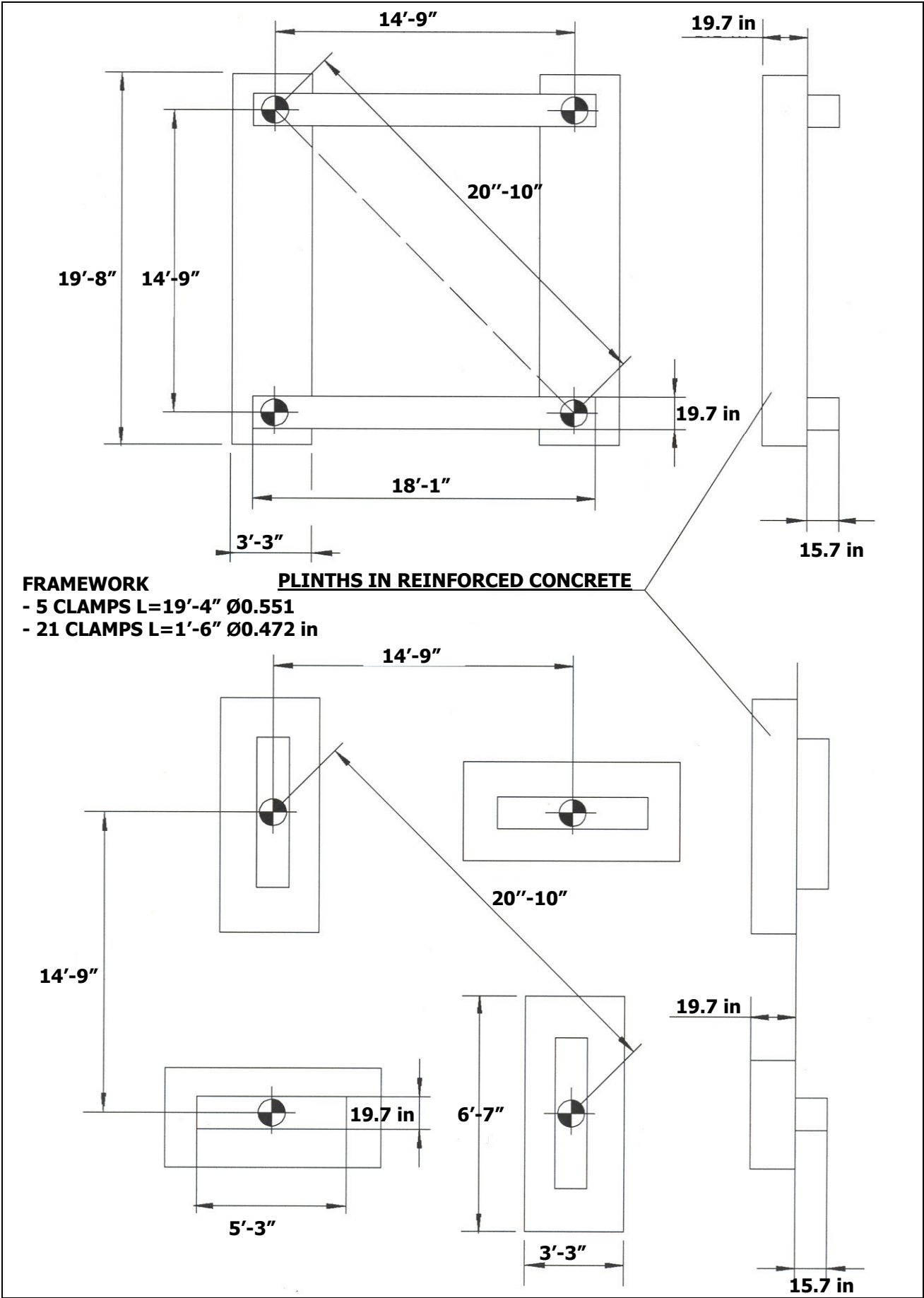
HARD WOOD BEAMS FOR THE STABILIZERS (as an alternative to 28 little beam and 2 long beams)			
QUANTITY	LENGTH	WIDTH	HEIGHT
4	1.6 m (5'-3")	50 cm (19.7 in)	45 cm (17.7 in)

- 1.3 Place the wooden beams under the crane base frame, exactly underneath the stabilizers, as shown in the above picture and then nail the beams together by means of nails of suitable diameter and length.

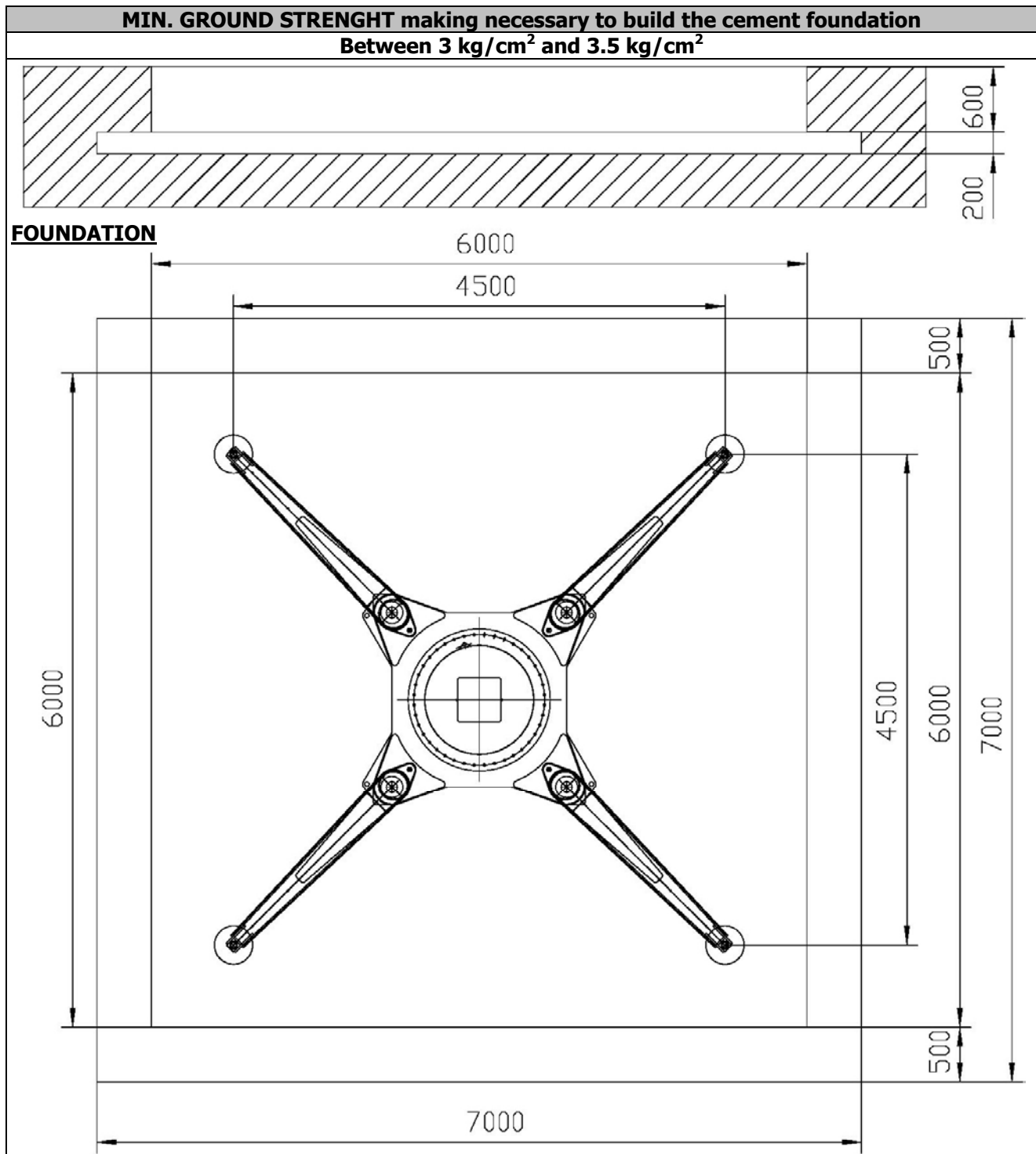




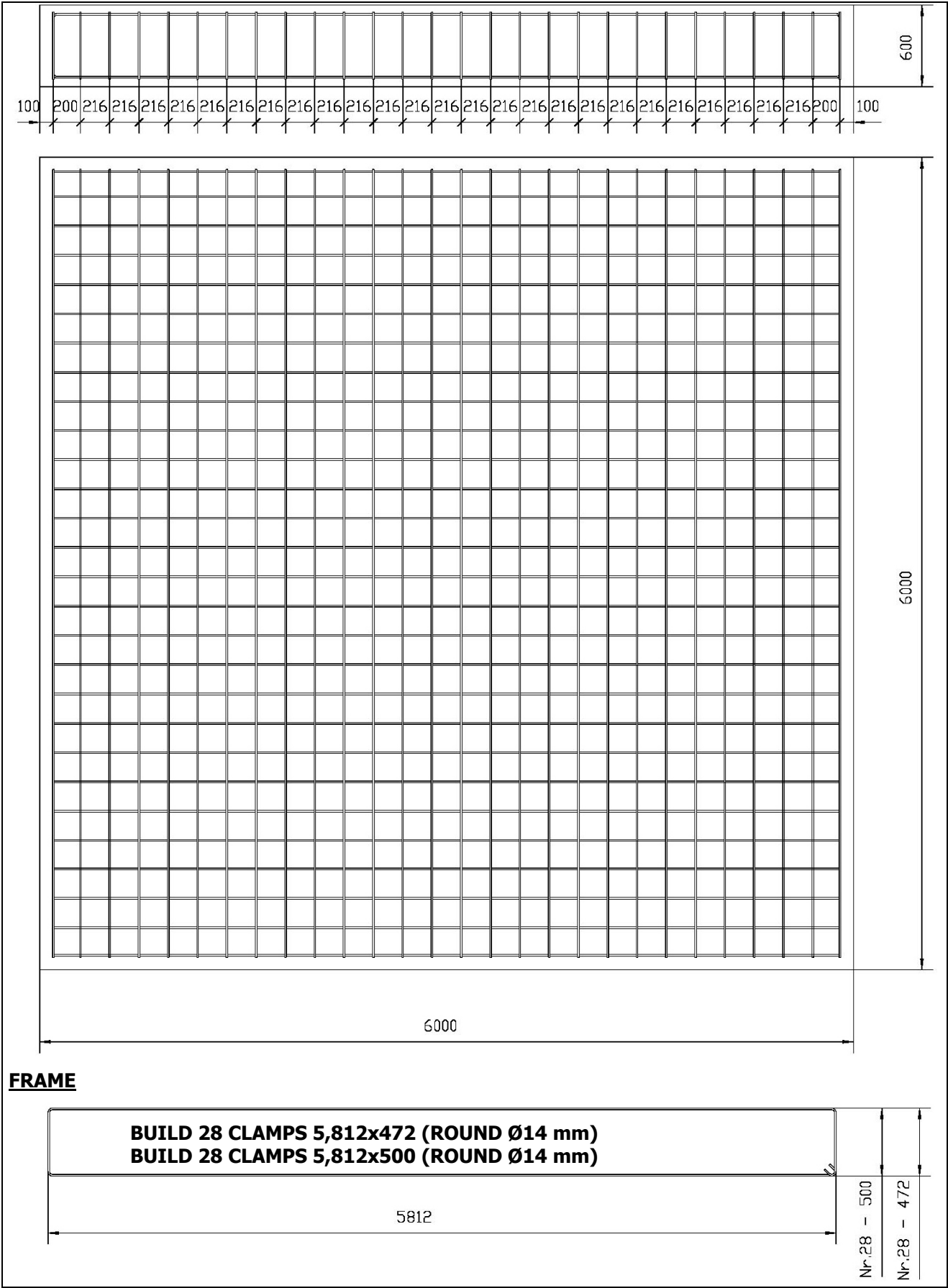


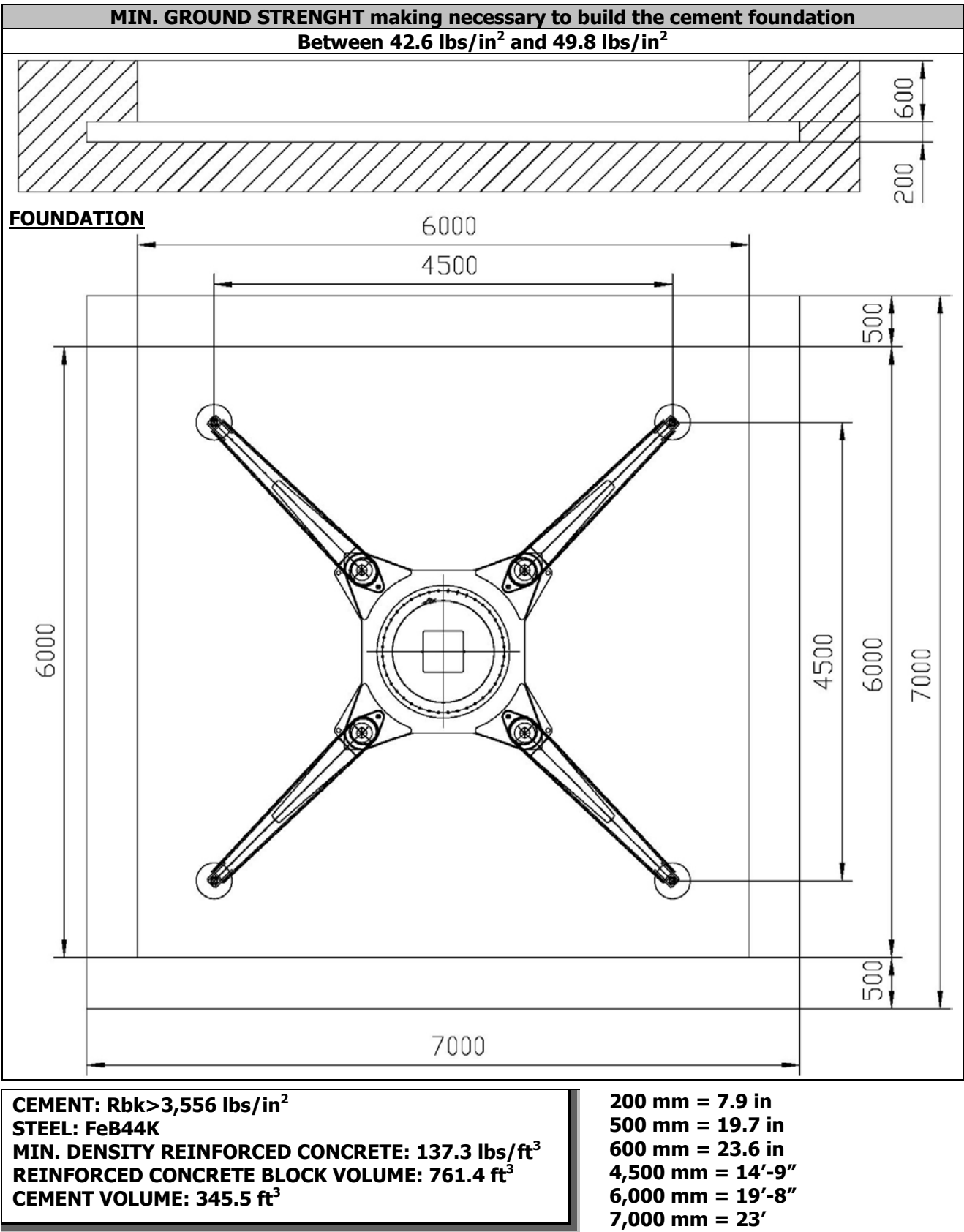


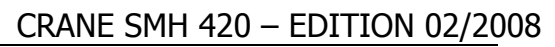
- 1.4 To erect on grounds with min. strength reported in the table below, it is necessary to build a foundation supporting structure of the size indicated below. Anyway, arrange the 28 wooden beams between the stabilizers support plates and the cement foundation structure.



CEMENT: $R_{bk} > 250 \text{ kg/cm}^2$
STEEL: FeB44K
MIN. DENSITY REINFORCED CONCRETE: $2,200 \text{ kg/m}^3$
REINFORCED CONCRETE BLOCK VOLUME: 21.60 m^3
CEMENT VOLUME: 9.80 m^3





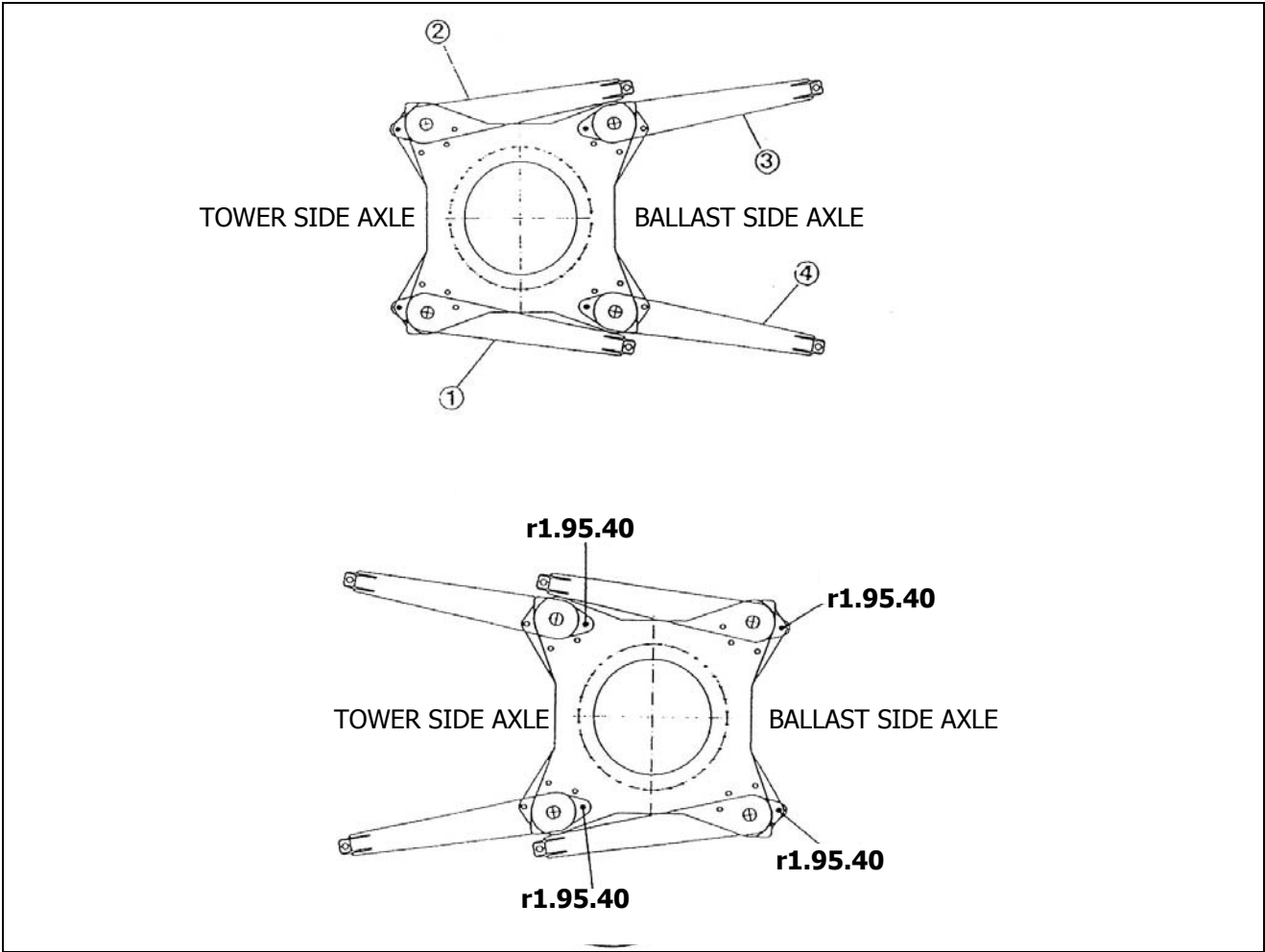




06.2. LEVELLING THE CRANE

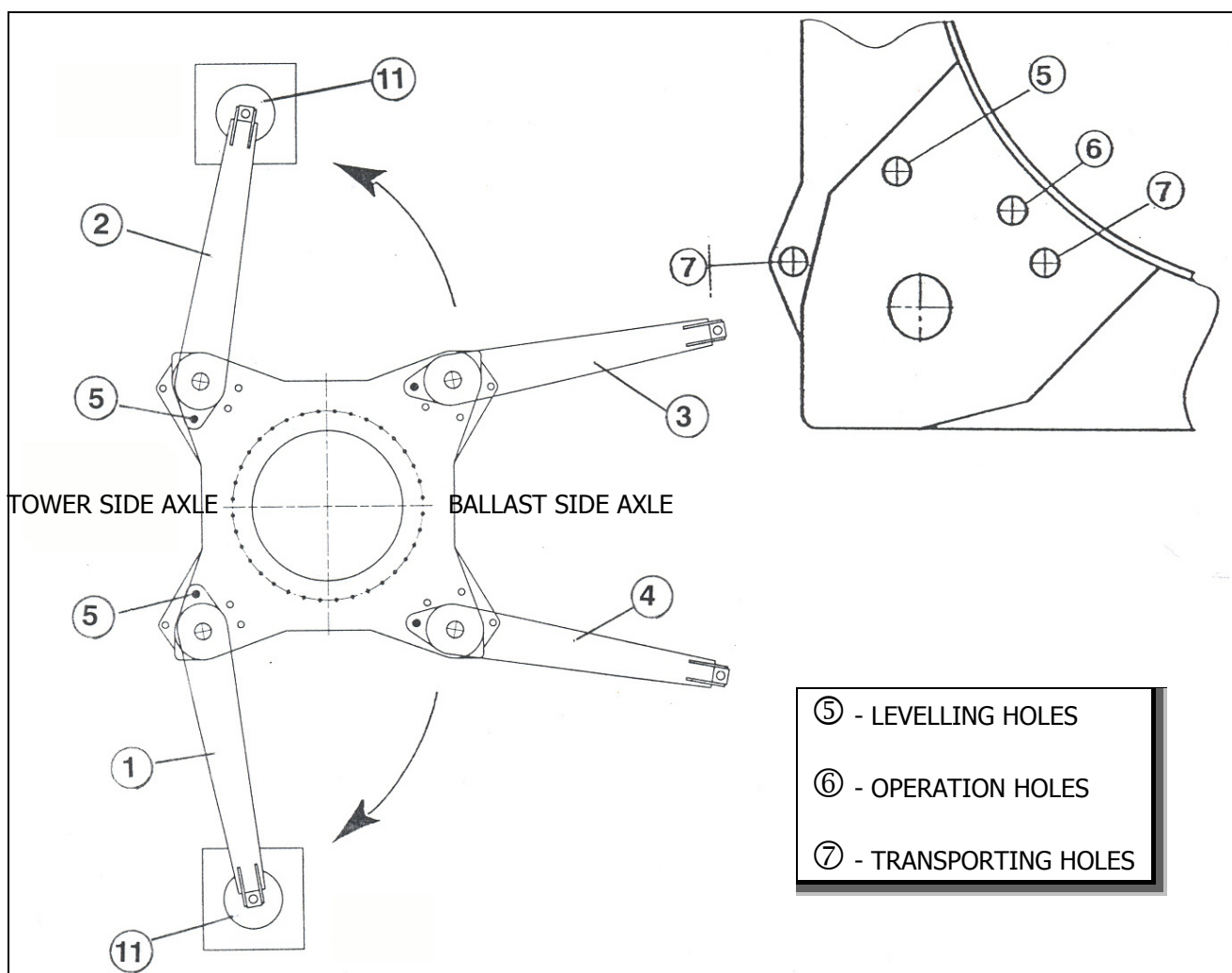
	WARNING
➤ Before starting crane levelling, fit the erection ballast blocks type 400/1 and 400/2 on the base frame (paragraph 05.1.2) and fix them with their relevants tie rods. The crane, resting on its stabilizers and without erection blocks onboard, may overturn. ➤ When the first block 400/1 weighing 1,850 kg (4,079 lbs), is loaded on the rotary base frame, the crane is unbalanced and tends to bend on the side where the block has been installed. It's recommended to do this operation on a plain and solid ground, keeping to a safety distance, consistent with the operation. The second block 400/1 shall be loaded immediately after the first one, in order to balance the crane. It takes to follow the same prescriptions and procedure for the loading of the blocks type 400/2 weighing 2,000 kg (4,409 lbs).	

- 2.1 Crane levelling is carried out by properly employing the stabilizer arms and the axles.
- 2.2 Tow the crane to the selected erection point (paragraph 02.1) and arrange the wooden beams to rest the stabilizers on (paragraph 06.1).
- 2.3 To ease the following erection operations, place under the rear wheels (tower side axle) some wooden beams, to lift wheels up of **20-25 cm (7.9-9.8 in)**.
- 2.4 In transporting position, the four stabilizers arms **1, 2, 3** and **4** are folded towards the front or the rear axle and firmly secured in the selected position by means of pins **r1.95.40** inserted between the rear hole of each stabilizer and one of the holes on the lower base frame plate.





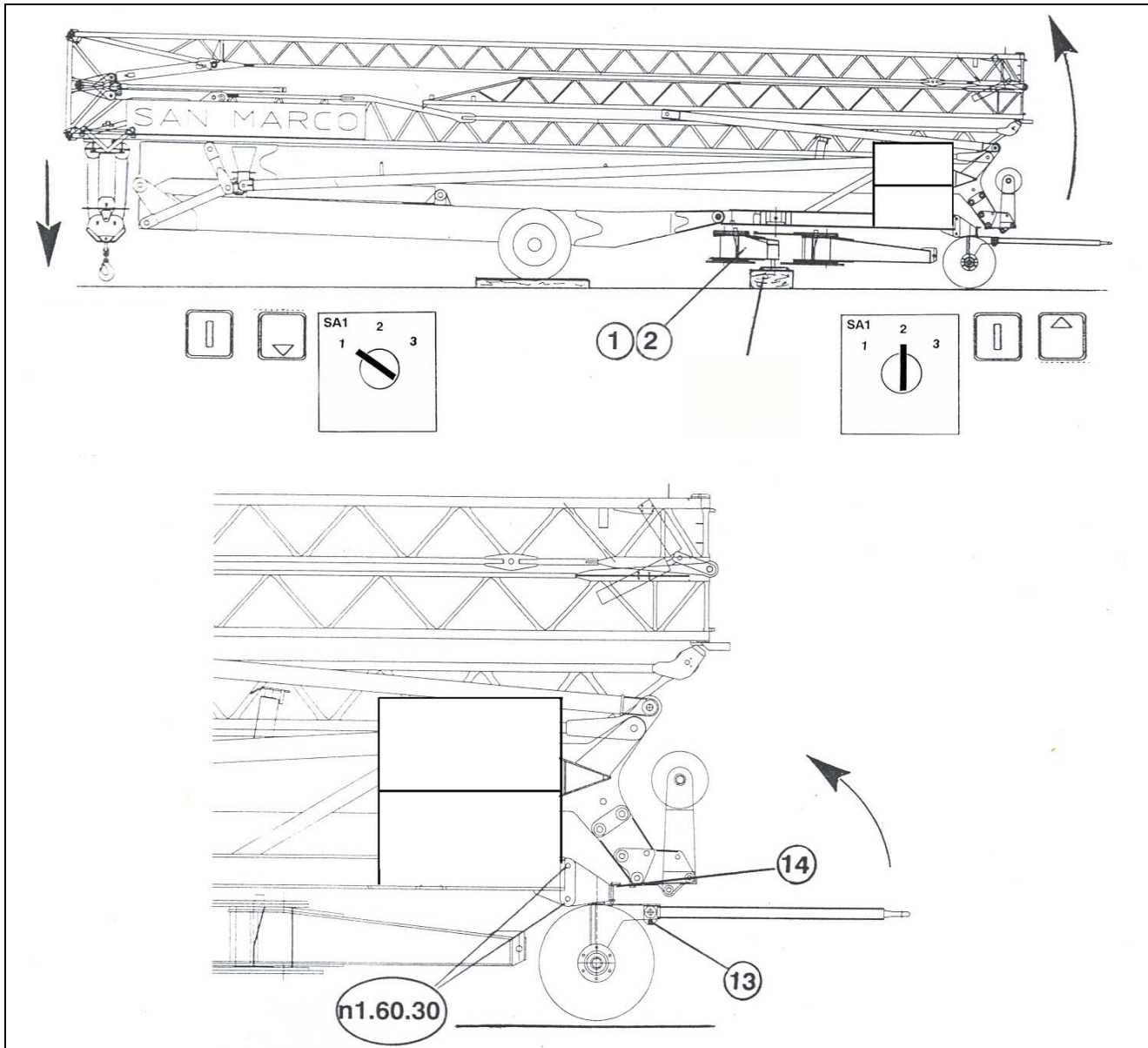
- 2.5 Remove locking pins **r1.95.40** and rotate stabilizer arms **1** and **2** as shown in the attached picture until the fixing hole on each stabilizer matches the position of the corresponding levelling hole **5** on the lower base frame plate.
- 2.6 Lock arms **1** and **2** by means of the pins **r1.95.40** inserted into the holes **5** and relevant cotter pins.
- 2.7 Connect the crane to the grounding system (paragraph 03.1) and to the electric cabinet of the building yard (paragraph 03.2) as indicated in the present manual, then connect the control board to the relevant socket on the crane lower base frame. Turn the selector switch **SA1** inside the crane cabinet to **1** position, and then lower the block of **1-1.5 m (3'-3" – 4'-11")** under the trolley. Place the selector switch **SA1** in **2** position.
- 2.8 Place underneath the stabilizers of arms **1** and **2** two preliminary wooden beams of a lower height than indicated in paragraph 06.1, and the two metal support plates **11**. Loosen screws **12** until the stabilizers rest on the support plates.

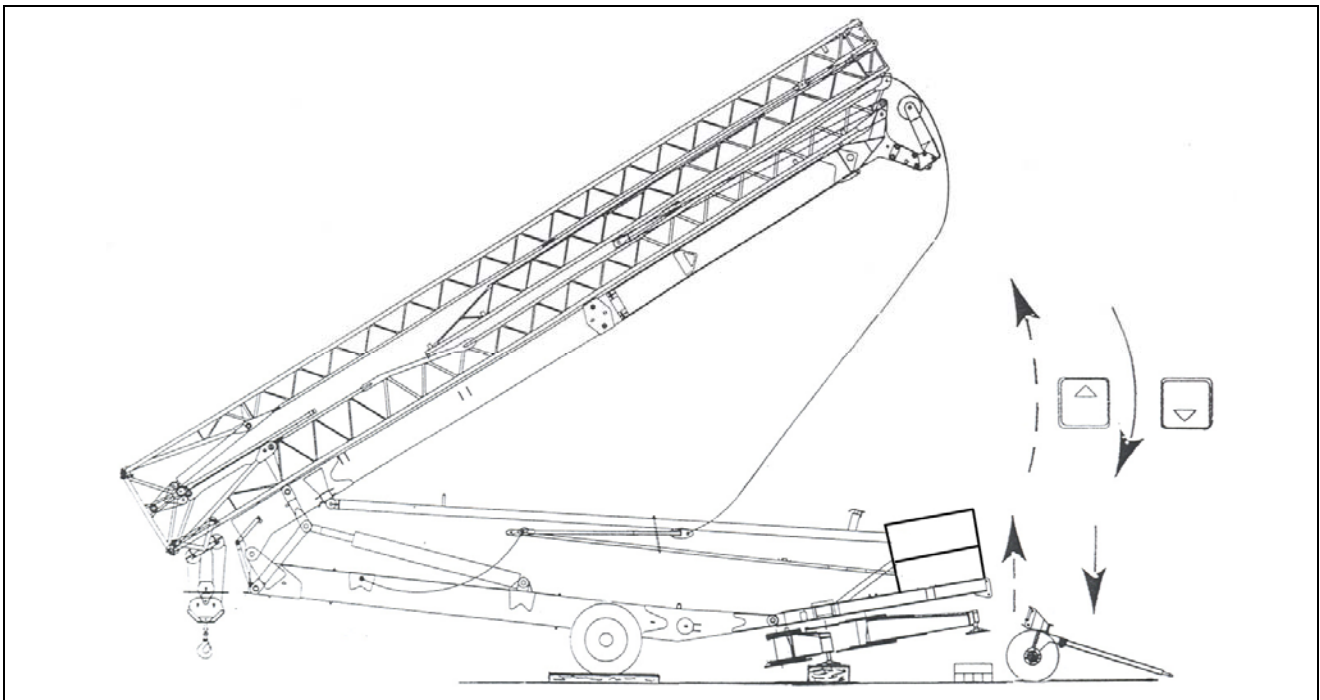


- 2.9 Depress "START" push-button to switch the hydraulic station on. After a few seconds, depress "UP" push-button. By pivoting on the stabilizers of arms **1** and **2** resting on the preliminary base-plates, the crane is lowered on its rear side (tower axle side) and lifted up on its front side (ballast axle side).
- 2.10 As soon as the front axle wheels are lifted from the ground lock the vertical drawbar rotation by inserting lock pin **13 n1.220.20** in the corresponding holes; then lock the rotation of the axle moving section by pushing pin **14 x1.135.20** down.

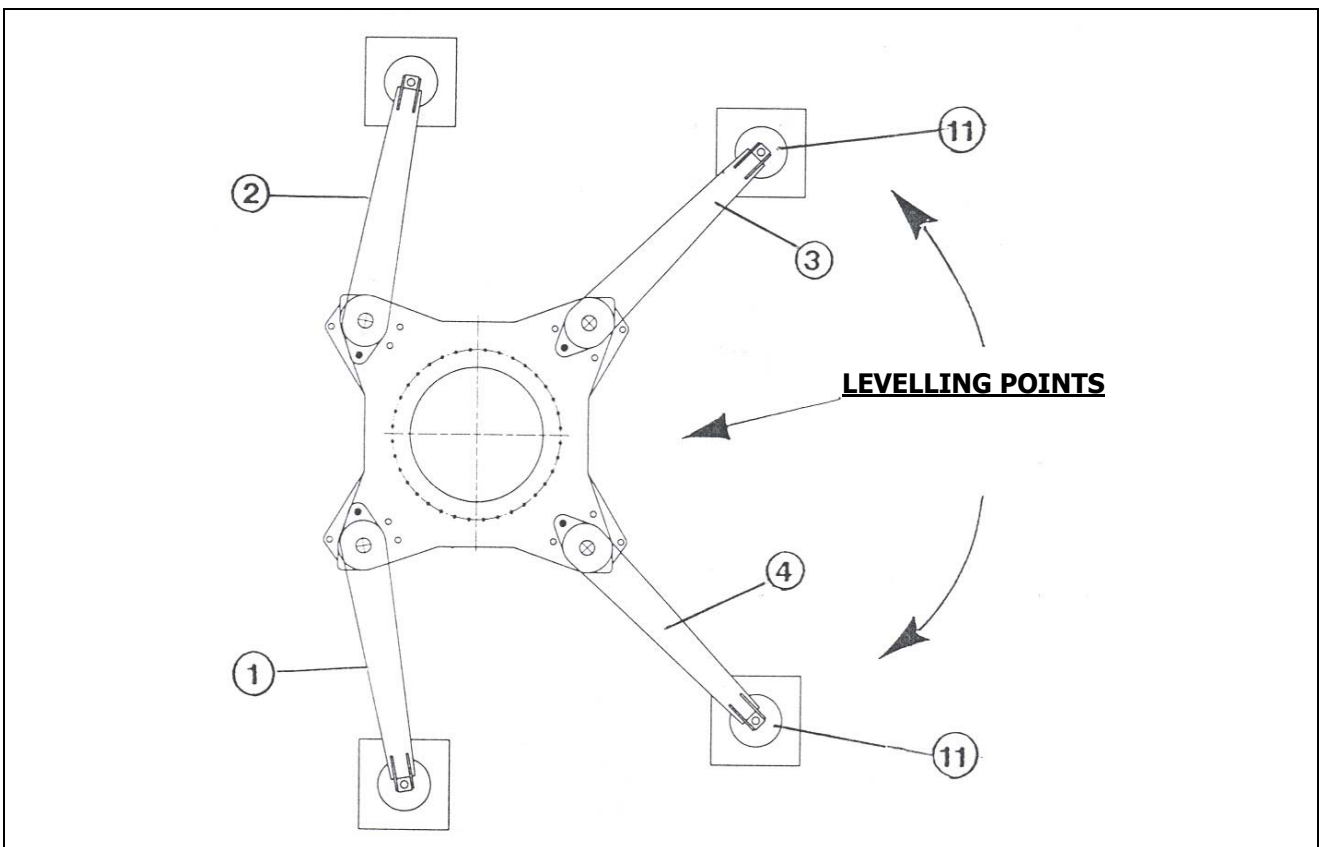


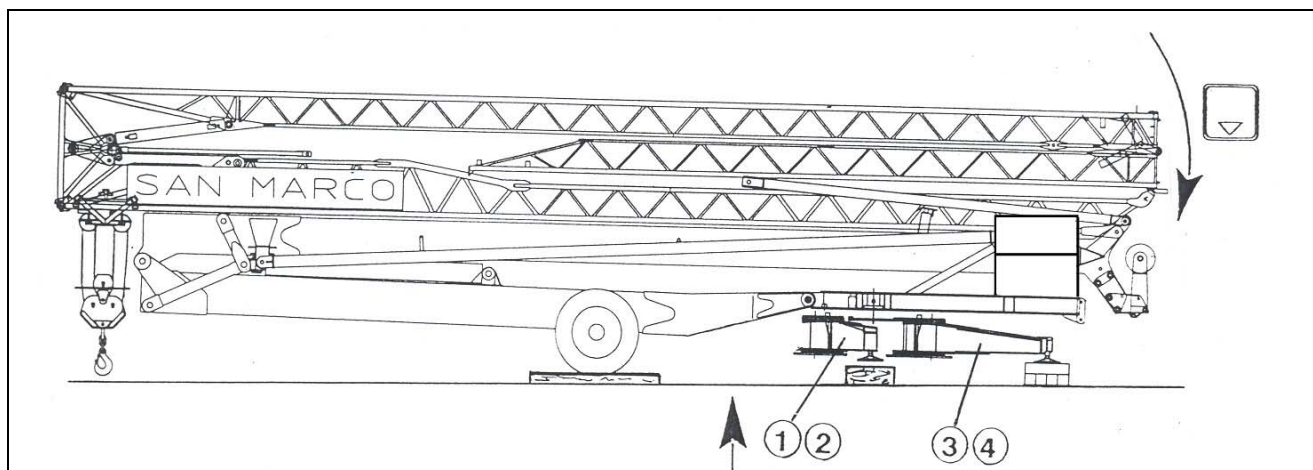
- 2.11 Remove the pins **n1.60.30** locking the front axle to the base frame and disassemble the front axle. Open arms **3** and **4**, and proceed with lifting the front part of the crane up as much as required to easily fit under the corresponding stabilizers the wooden bases and the metal rest plates. Lock stabilizer arms **3** and **4** by inserting pins **r1.95.40** in holes **6**.



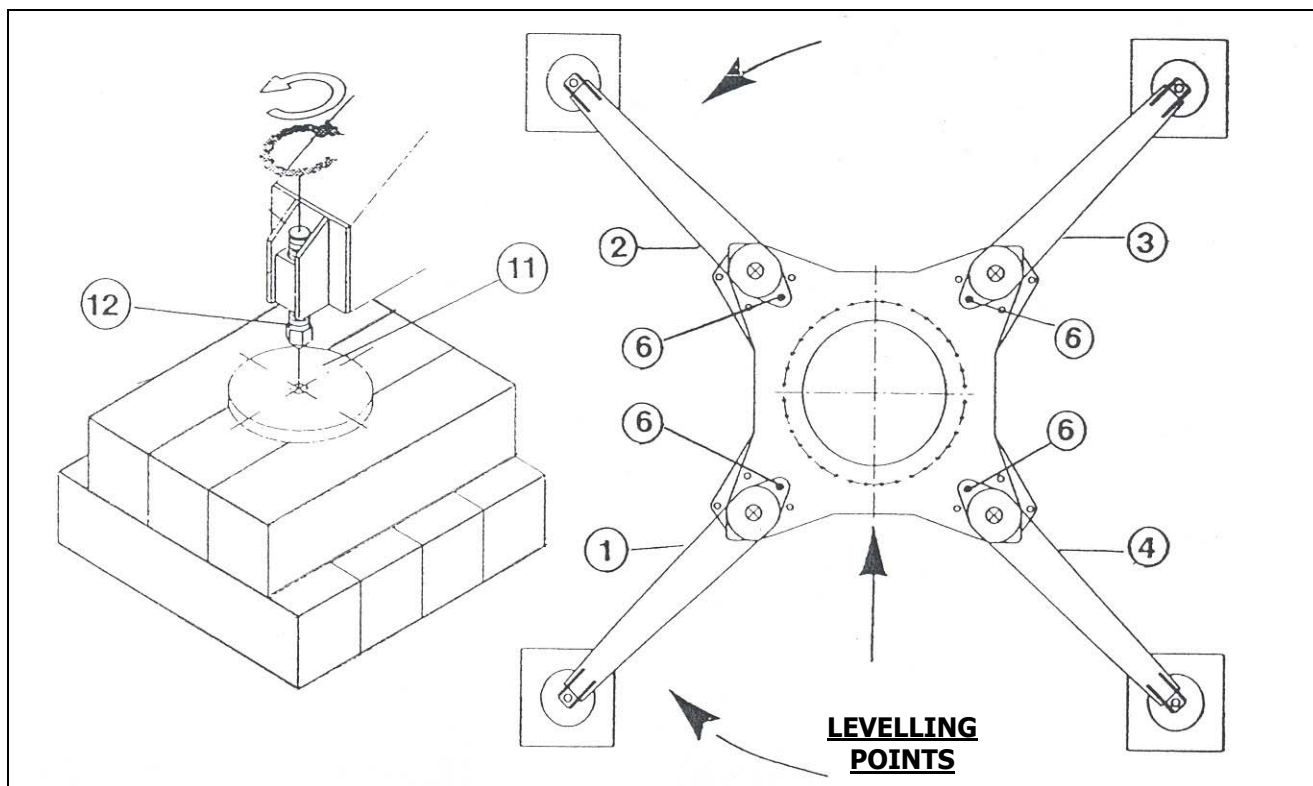


- 2.12 Depress "DOWN" push-button to lower the crane front section, carefully checking that the ends of stabilizer arms **3** and **4** are inserted in the centring bushes of the corresponding rest plates.
- 2.13 Place a level on the base frame between arms **3** and **4** and check for perfect level of the resting plane. Eventually adjust levelling as required by loosening or tightening the stabilizers.





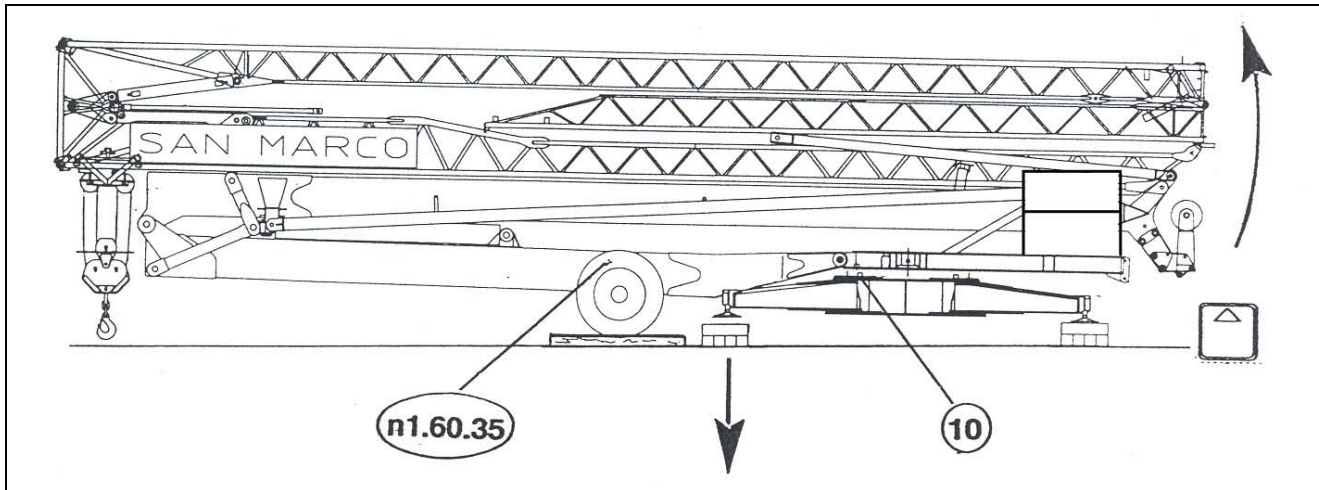
- 2.14 Lower the crane front side, which is now resting on stabilizers of arms **3** and **4** and on rear axle wheels, until the front part of the base frame rises and the stabilizers of arms **1** and **2** are lifted up from their temporary rest-bases. Rotate stabilizer arms **1** and **2**, now free, in operation position.
- 2.15 Lock stabilizer arms **1** and **2** in operation position by means of pins **r1.95.40** inserted in holes **6**. Place the wooden beams and the metal rest plates **11** under the stabilizer arms and then depress **UP** push-button to lower arms **1** and **2** so that the stabilizer ends are inserted in the centring bushes of the corresponding rest plates.
- 2.16 Place a level on the base frame between arms **1** and **4** or **2** and **3**, and then check for perfect levelling of the resting plane. Eventually adjust the level as required by loosening or tightening the stabilizers.



- 2.17 By acting on the stabilizers screws carefully check for crane levelling with the level placed in the indicated points of the lower base frame. Remove the wooden boards from under the wheels; eventually depress "UP" push-button to lift the rear part of the crane.



- 2.18 Remove pins **n1.60.35** locking the rear axle to the lower tower and remove it from the crane. Extract rotation lock pin **x2.70.90.40**.
- 2.19 Once levelled, the crane is ready for the following erection operations.

**WARNING**

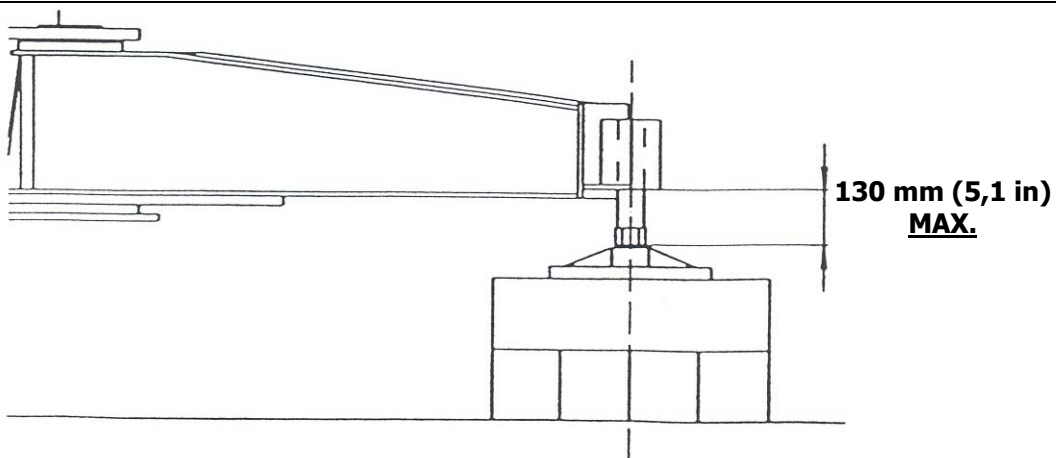
- All erection operations shall be carried out by skilled, trained and qualified operators only, well aware of the crane characteristics and familiar with the contents of the present instruction Manual. The riggers may be supported by riggers' helpers, corresponding to the characteristics explained at the paragraph 02.4.
- During all erection operations, the technicians in charge of it along with all exposed persons shall wear the Personal Protection Equipment prescribed by laws and regulations to constantly ensure safety.
- During the erection operations, the building site personnel shall stand clear of danger zones (paragraph 07.1). When structures are moving, the erection technicians shall stand as far away as possible and get closer to the crane only with stationary and safely stable structures.
- Prior to crane levelling, check tyres for correct inflation pressure (paragraph 01.7) and good conditions.
- All lock pins shall be secured by the corresponding cotter and hitch pins; hitch pins may be re-utilized, whereas cotter pins shall be replaced each time, since their ends are bent for erection and straightened for dismantling (paragraph 07.2).
- Swing of the crane during its erection engenders the risk of crushing and shearing for all exposed persons.
- Swinging the crane without removing the front axle first may cause structural damages to the crane.
- Failure in inserting the cotter and hitch pins to lock pins **r1.95.40** fixing the stabilizer arms in position at any leveling stage, may lead to uncontrolled movements of the structure, with consequent risk of crushing and cutting for the exposed persons.
- **Without the rear axle fitted and without the erection ballast blocks 400/1 and 400/2 on board the crane, resting on the stabilizers, IS NOT STABLE and will fall forwards.**
- Inaccurate crane levelling may cause damages to the swing organs or prejudice crane stability with consequent risk of crushing and collision for the exposed persons.
- Excessively loosened stabilizer screws, only partially engaged inside the bushings, may causes excessive pressure on the screw thread, which would result in damages to the crane or in its poor stability.



- Failure in employing the hardwood beams as the crane resting bases may lead to dangerous base yielding, with consequent risk of crane overturning.
- In case stabilizer screws are not tightened with the same torque value, the crane may jolt when operating.
- Failure in maintaining the prescribed safety distance between fixed obstacles and the crane swing parts may cause the risks of crushing and cutting for exposed persons.
- Failure in carrying out a periodical check of the crane levelling when operated may cause a progressive height increase, and may lead to crane instability.
- At the crane erection stage, when the prescribed safety barrier around **danger zone A** has not yet been arranged (paragraph 07.1). The technicians in charge of erection and all exposed persons shall pay extreme attention and strictly follow the prescribed safety practices when in proximity of moving components not or only partially protected, and when gaining access to the cutting zone. They shall pay extreme care to avoid the risks of crushing, cutting and shearing.

**WARNING**

- The upper part of the stabilizer screw is hidden by a protection – lubrication pipe. Remove this screw from the nut screw welded to the frame as little as possible. If in “all-out” position, the upper part of the stabilizer screw shall still be engaged inside the nut screw for the full length of the latter.
Max. screwing out length: 130 mm (5.1 in).





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07.1. DANGER ZONES

- 1.1 The presence of the crane on the building site engenders a danger zone, whose extension varies depending on whether the crane is being erected, operated or serviced.
- 1.2 The danger zone around the crane is divided into three different areas.
- 1.3 **Danger zone A**, extending over the ballast arc of rotation with a radius, from the crane centre of swing, of about **3 meters (9'-10")**. Once erection has been completed, this zone shall compulsorily be enclosed and marked. Access is absolutely forbidden whether the crane is operated or not.

**WARNING**

➤ At crane erection or dismantling stages, when the safety enclosure has not yet been assembled or removed, mark the boundary of the danger zone with coloured tapes suitable for identifying it. In this case, it is care and responsibility of the building site's manager to make sure that nobody enters the danger zone while these operations are underway.

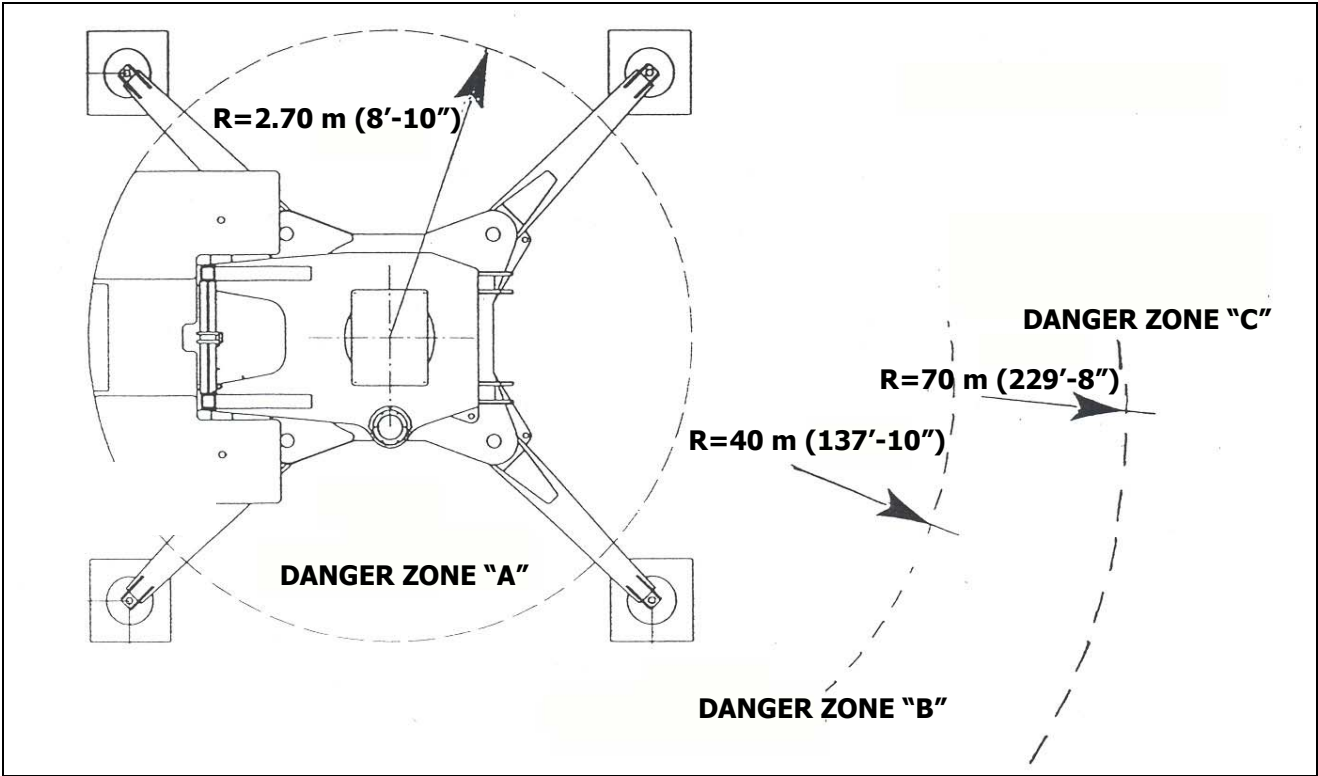
- 1.4 **Danger zone B** extends over the swing arc of the crane boom with a radius, from the crane centre of swing, of about **42 meters (137'-10")**. This zone should preferably be kept free when the crane is in service. Passage of the boom, of the crane and of suspended loads above workers eventually present shall be signalled by the crane acoustic warning, so that the personnel may immediately leave the area the boom and/or the suspended load are due to travel above.
- 1.5 **Danger zone C** is the area in which the crane would fall in case of eventual overturning; it extends over a **70 meters (229'-8")** radius circle around the swing axis of the crane. The zone may be precautionary increased in presence of piles of material or buildings, which, should the crane overturn, would cause a dangerous material fall or scattering. Personnel shall absolutely stand clear of this zone during erection and maintenance operations, in case of exceptionally strong winds, landslips, landslides, torrential rains and any other event prejudicial to the crane stability.
- 1.6 "Parking forbidden" and "No entry" signs shall be placed at the boundary of the danger zones.

SUMMARY OF DANGER ZONES		
DANGER ZONE	RADIUS	DEFINITION
A	3 m (9'-10")	Ballast rotation
B	42 m (137'-10")	Boom rotating circumference
C	70 m (229'-8")	Danger of crane overturning

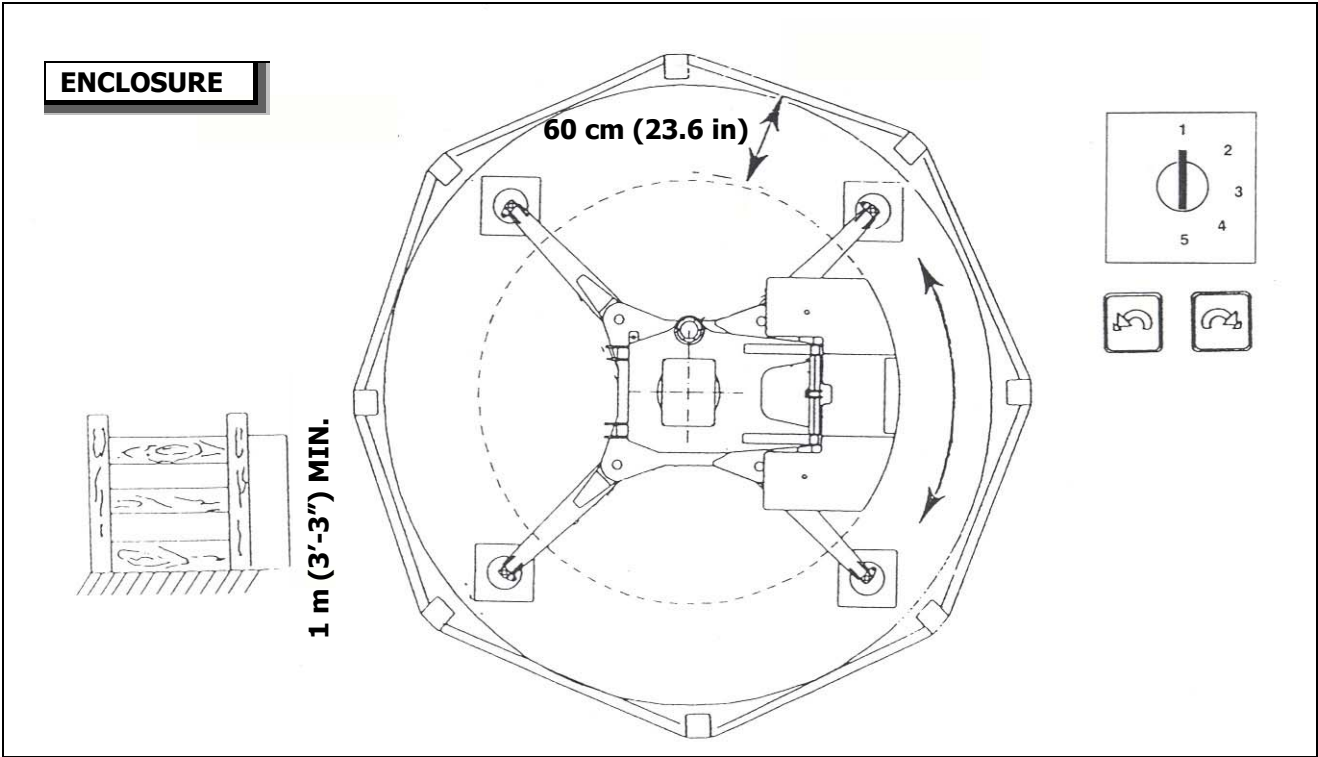
**WARNING**

➤ Failure in enclosing danger zone **A** will cause the risks of crushing, shearing, collision and drawing-in for exposed persons.

➤ Operating in disregard of the instructions given for danger zones **B** and **C** may cause the risk of crushing and collision for exposed persons.



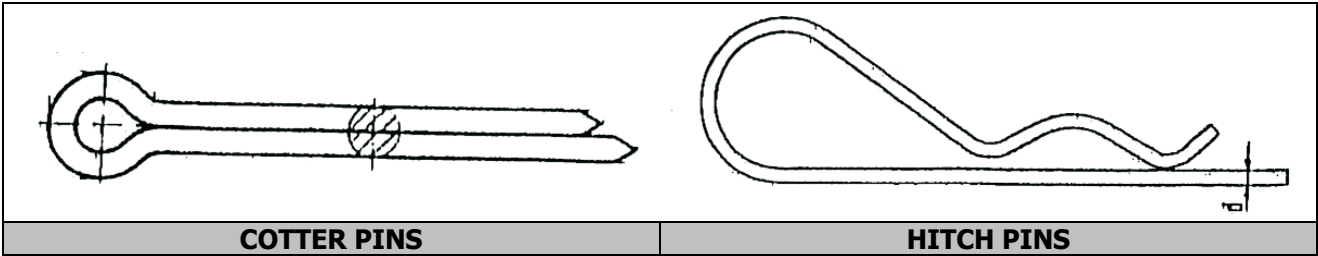
- 1.7 The enclosure around danger zone **A**, to be assembled as soon as the crane is erected and prior to put it into service, can be built as shown in the sketch below. Use vertical poles driven in the ground and wooden boards secured horizontally to create a safe barrier around the danger zone. It should be **at least 1 meter (3'-3") high and set at least 60 centimeters (23,6 in) from the rotating parts of the crane.**



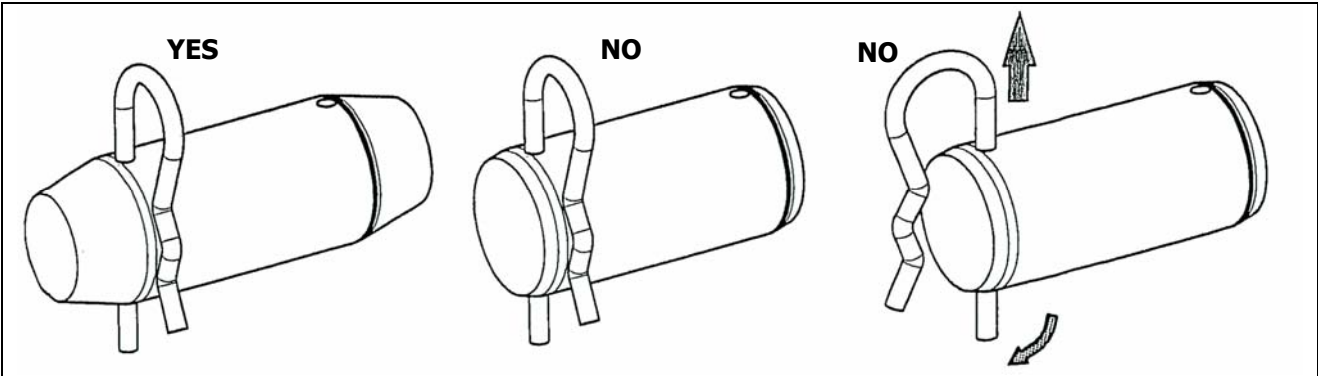


07.2. COTTER AND HITCH PINS

- 2.1 All the pins of the crane shall be set and locked by cotter or hitch pins having the scheduled diameters and lengths.
- 2.2 Two kinds of cotter and hitch pins are in use:
 - o cotter pins (standard ISO 1234);
 - o hitch pins (standard UNI 8833).

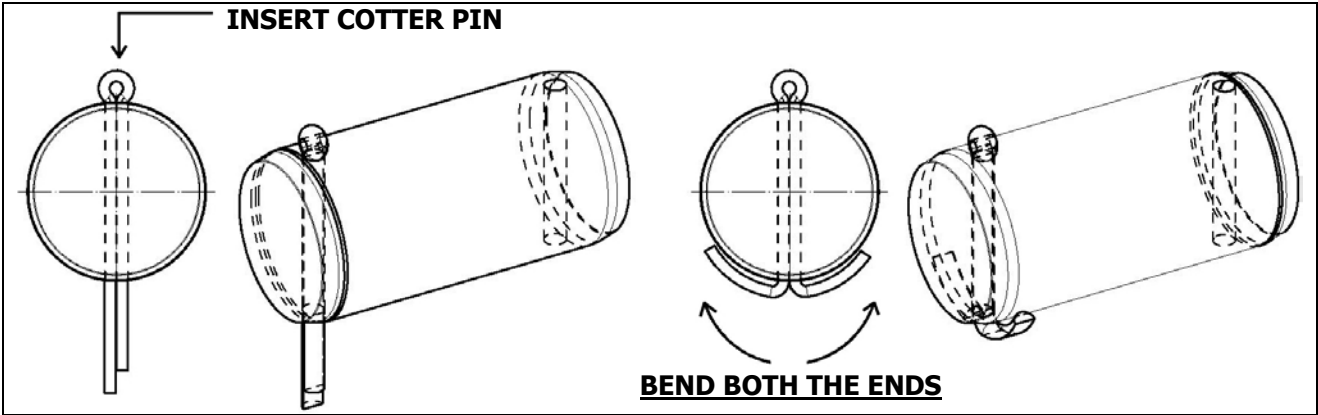


- 2.3 **Hitch pins** may be used to lock joint frequently disassembled, **but only for the pins whose shape prevents the rotation and the possible unthreading of the hitch pin.** Therefore, they cannot be used for the pins with short ends and holes for cotter pin next to the tips, that may allow the rotation and the unthreading of the hitch pin.





- 2.4 **Cotter pins** scheduled by the Manufacturer have diameters and lengths proportional to the diameter of the pin to lock. Never use cotter pin with lower diameter or different length.
- 2.5 Cotter pin, after setting shall be locked **bending both the ends so that they wind the pins** (see next picture) to prevent the unintentional unthreading.



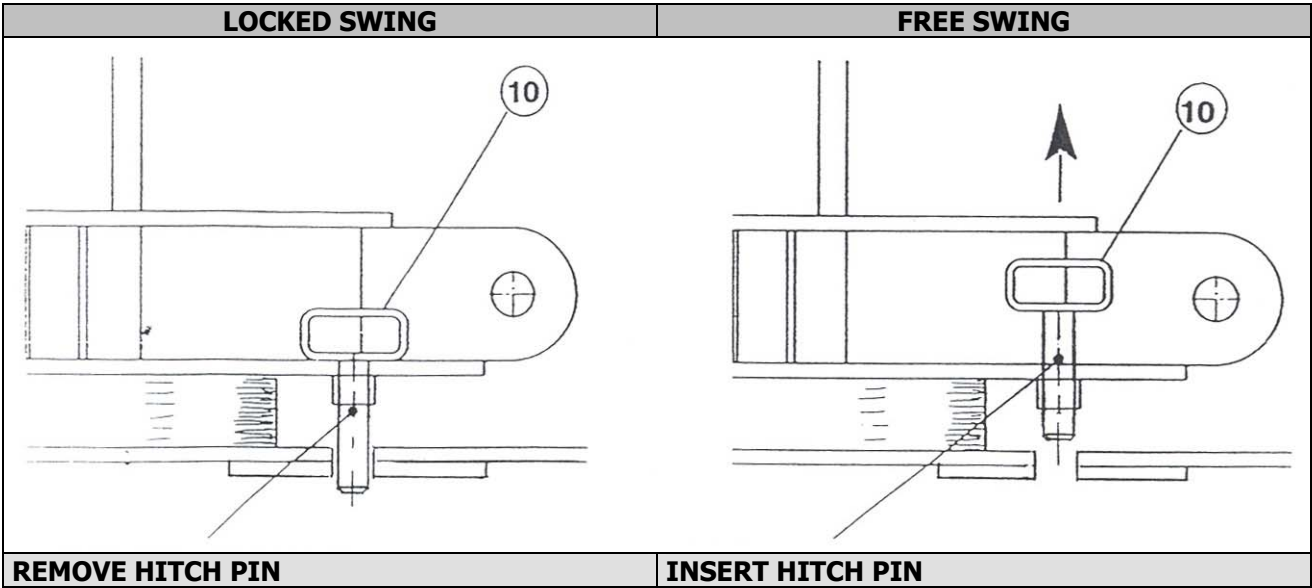
WARNING

- Always check that the bent ends of cotter pins cannot be damaged in case of pin rotation and that they cannot entangle in ropes or cables.
- Before any further crane erection, check that the bending and the next redressing of the ends of cotter pins didn't damage or crack them. In case of any doubt **replace** the cotter pin before setting it.



07.3. SWING RELEASE

- 3.1 During crane transporting, the upper part of the base frame is secured to the lower part by means of lock-pin **10 x2.70.90.40** inserted in the bushes of the upper and lower base frame.
- 3.2 The pin **x2.70.90.40** shall always be locked by inserting a hitch pin in the hole situated half-way up its length between the bushes of the upper and lower base frame. Never transport the crane without this safety hitch pin, as this could cause the pin to accidentally fall off and the lower base frame to rotate uncontrolled.
- 3.3 To release crane swing, remove the hitch pin and partially drive pin **x2.70.90.40** out, to allow the hitch pin to be replaced when the corresponding hole matches the bushing of the upper base frame. Place the hitch pin back in the hole to keep the pin **x2.70.90.40** partially out, thus enabling crane.



WARNING

- Never operate base frame rotation movements unless pin **x2.70.90.40** has been released; failure in releasing the swing may seriously damage the swing mechanisms.



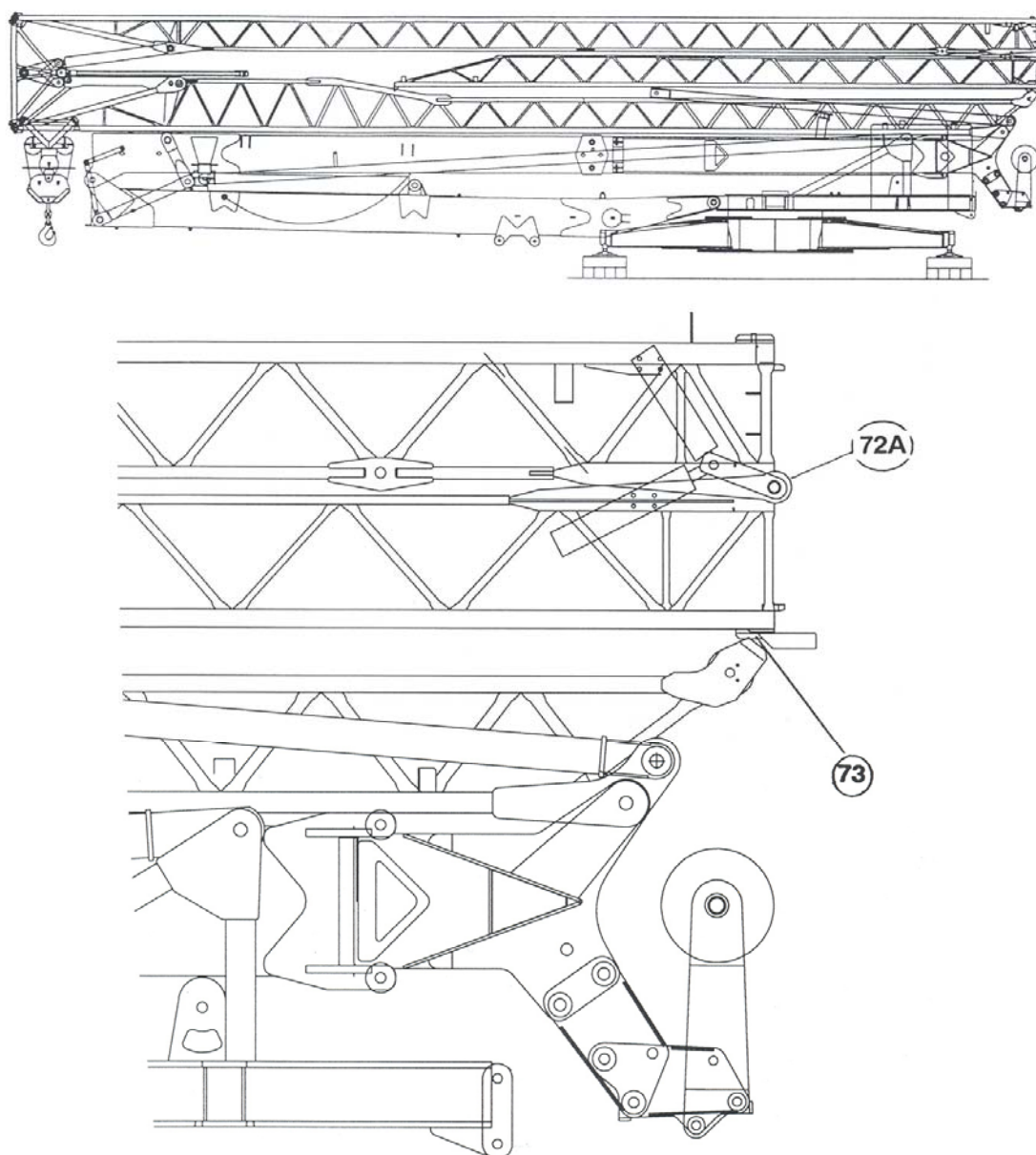
07.4. BOOM AT TRANSPORT POSITION



WARNING

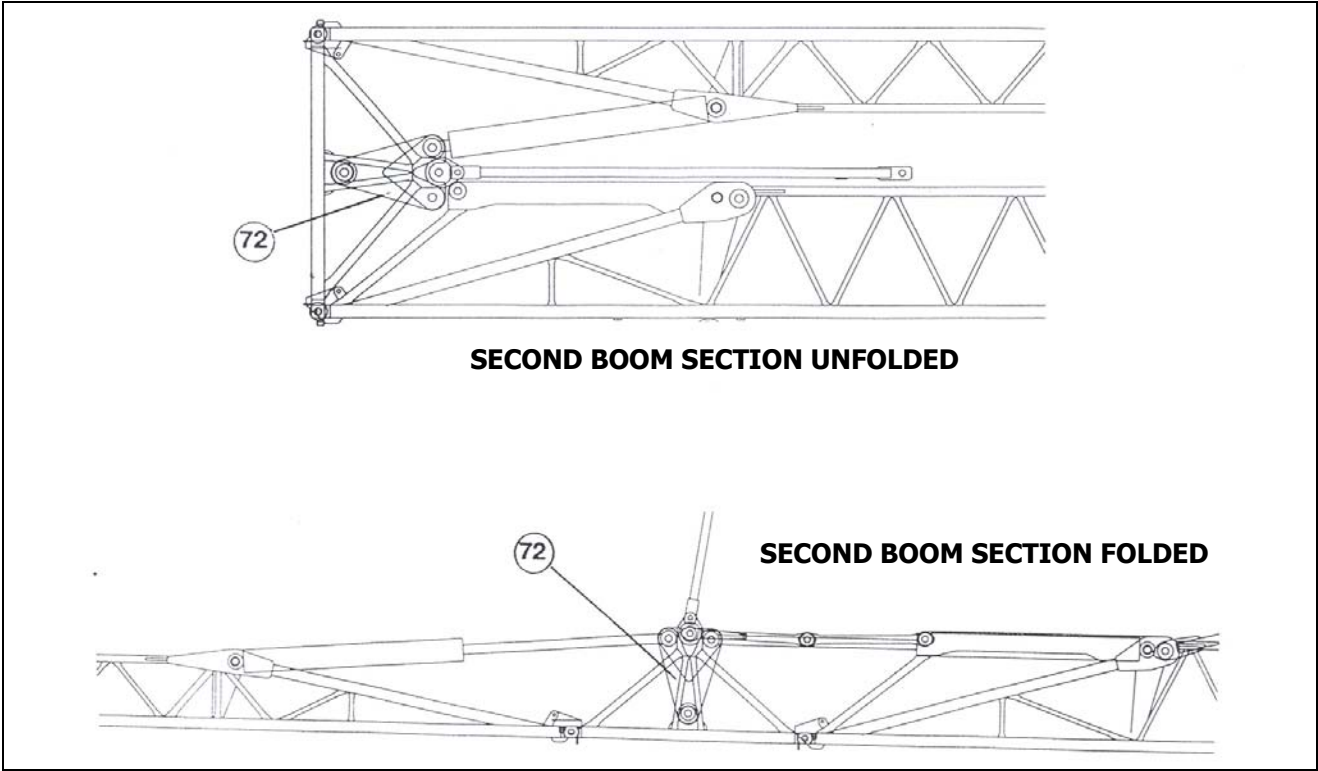
- **At the erection stage, when the structures are moving, operators and all exposed persons shall stand clear of the danger zone. Should it be necessary to approach the crane to carry out inspections or regulations, they will be allowed to enter the danger zone only with the crane stopped, and after verifying the structures are well stable.**
- All erection operations shall always be carried out by an expert, trained and skilled operator only, well aware of all the machine characteristics and familiar with the contents of the present instruction Manual. The riggers can be supported by riggers' helpers, corresponding to the characteristics described at the paragraph 02.4.

- 4.1 During crane transporting, being the crane dismantled, the second section of the boom is folded on the first one and its front end, in correspondence of the joint of the two sections, rests on the rear end of the first section by means of the support **73**.





- 4.2 The boom third section is folded between the second section and the first one; a horizontal-axis hinge **72A** connects the boom second and third sections.
- 4.3 The second boom section is connected with the first one by an intermediate element whose central connecting rod **72** two opposed hydraulic cylinders act on; the cylinder upstroke and return stroke cause the unfolding or the folding of the boom second section.



- 4.4 The unfolding and folding movements of the boom third section are driven by a pair of connecting rods and a pair of hydraulic cylinders.
- 4.5 To unfold the second and the third boom sections, it is recommended to strictly follow the unfolding procedure sequence described in the following pages.
- 4.6 Boom unfolding (during crane erection) or folding (during crane dismantling) shall be carried out only being the tower completely erected and the ballast complete.

	WARNING
➤ Failure in locking all pins with the cotter and hitch pins supplied may cause pins falling out during crane erection or operation, thus seriously prejudicing the stability of all structures. ➤ Erecting and dismantling the crane in disregard of the prescribed unfolding and folding sequences of the second and the third sections of the boom will cause interference between structural parts, with possibility of serious damages. The sequences are partially controlled by micro switches (<u>paragraph 07.5</u>) that shall be always kept perfectly efficient. ➤ Fully unfolding of the boom with the crane dismantled, erected or at the intermediate erection stages without the complete ballast loaded will cause the crane to overturn. ➤ Should it be required to gain access to the upper parts of the dismantled crane to carry out checks and inspection, the operators shall wear a double-lock safety belt properly secured to the hooking	



points, so that at least one hook is always locked to the structure.

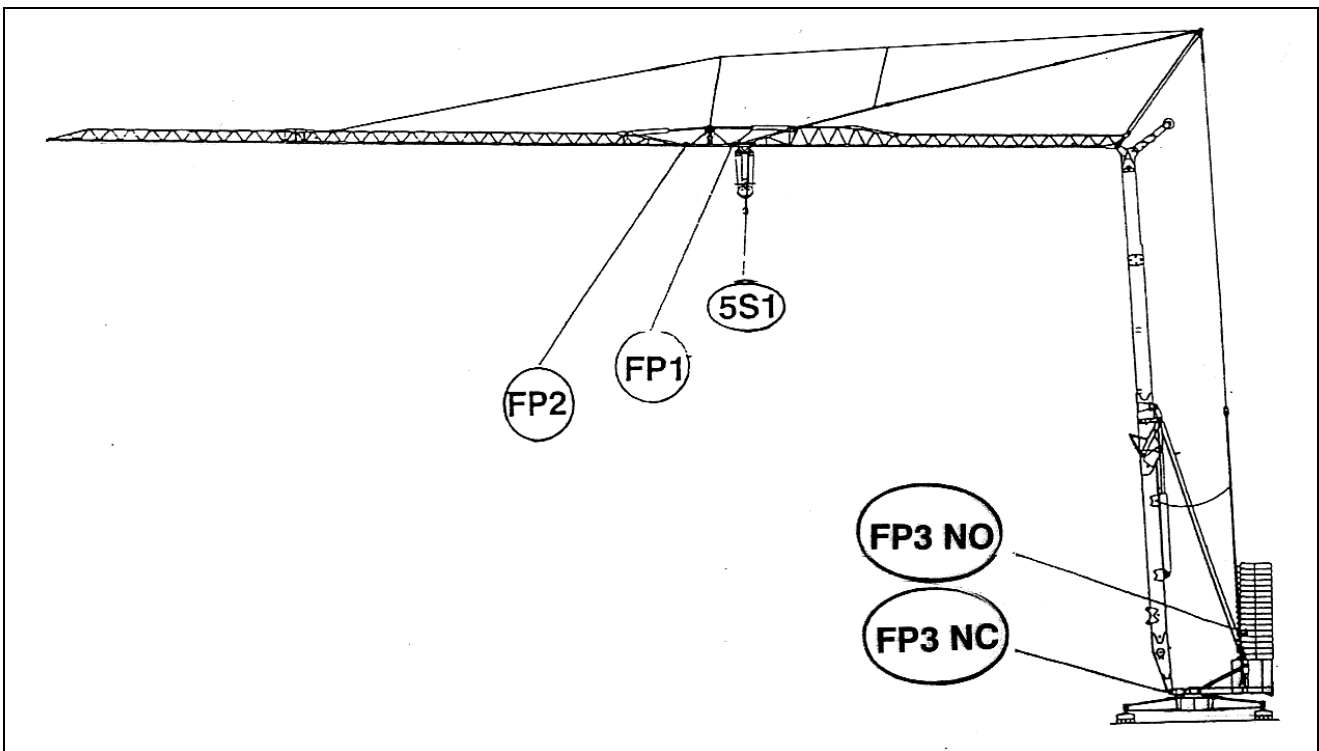
- **Should an extra-ordinary intervention require the boom to be unfolded being crane dismantled, it shall be necessary to rest the end of the lower tower to prevent the crane from overturning. Carefully rest it on a pile of wide section wooden beams, a metal gantry or an auxiliary lifting means. With the boom fully unfolded, the resting part shall ensure a minimum reaction of at least 4,000 kg (8,818 lbs).**



07.5. BOOM SAFETY DEVICES

07.5.1. SAFETY DEVICES DURING CRANE ERECTION

- 5.1 All the movements of the crane structures necessary to change from dismantled crane configuration to completely erected crane configuration shall be controlled at sight and stopped when needed according with the erection sequence.
- 5.2 To ensure the correct carrying out of the main operations and sequences, the crane is equipped with several positioning limit switch, that intervene when, because of a misake of the procedure or of the evaluation, the extent of the movements go over the scheduled limits.
- 5.3 Location of the safety devices employed during crane erection.
 - o Positioning limit switch **FP1** installed on the first boom section close to the articulation.
 - o Positioning limit switch **FP2** installed on the second boom section close to the articulation.
 - o Positioning limit switch **FP3 "NO"** installed on the brace tower – base frame.
 - o Positioning limit switch **FP3 "NC"** installed on the brace tower – base frame.
 - o Positioning limit switch **5S1** installed on the first boom section close to the articulation.





07.5.2. POSITIONING LIMIT SWITCH FUNCTIONS – ERECTION SEQUENCE

- 5.4 **FP1** controls the second boom section unfolding on the first articulation and prevents the continuation of the movement over a certain position if **FP3 "NO"** and **FP3 "NC"** (ballast on board) don't enable the continuation.
- 5.5 **FP2** controls the second boom section unfolding on the second articulation and prevents the continuation of the movement over a certain position if **FP3 "NO"** and **FP3 "NC"** (ballast on board) don't enable the continuation.

	WARNING
➤ Both FP1 and FP2 enable boom unfolding along an angle slightly greater than the min. unfolding needed to permit the easy rotation of the cusp with wheel. Both the cylinders actuating the articulation between the first and the second boom sections unfolding may open without distinction one or the other and for a little while or for the whole opening angle, the max. unfolding allowed will be to the utmost the double of the min. unfolding needed.	

- 5.6 **FP3 "NO"** interacts with **FP1** and **FP2** enabling the unfolding of the boom over the max. angle permitted by **FP1** and **FP2** only when the complete operation ballast has been loaded on the base frame, to assure crane stability with the boom partially or completely unfolded.
- 5.7 **FP3 "NC"** interacts with **FP1** and **FP2** enabling the unfolding of the boom over the max. angle permitted by **FP1** and **FP2** only when the complete operation ballast has been loaded on the base frame, to assure crane stability with the boom partially or completely unfolded.
- 5.8 **5S1** controls the position of the trolley of the boom enabling the unfolding of the second and the third boom sections only when the trolley is placed on **5S1**.
- 5.9 Micro switches **FP3** enable boom opening only if the ballast blocks **400/3**, loaded on the crane, actuate the micro switch sliding block situated on the tower brace. If the sliding block has not a perfect contact with the ballast blocks, adjust the screw equipping the sliding block.

	WARNING
➤ Once completed the tower erection, next stages of the second and the third boom section unfolding are not controlled by any other device; all the movements shall be checked by sight to control their beginning and their end. ➤ All the erection and dismantling movements may be carried out only when the trolley is in its scheduled position and its slide block actuates the lever of the enabling micro switch 5S1, placed on the first boom section close to the articulation with the second section. Before starting crane dismantling, remember that the positioning of the trolley on 5S1 is actuated moving the trolley from the tower towards the articulation between the first and the second boom section. ➤ The boom may be unfolded only being the crane completely erected and the ballast complete, with all the 32,400 kg (71.430 lbs) scheduled for the operation stages. ➤ During crane erection, the second boom section shall be only partially open, to allow the rotation of the cusp that, under the effect of the pulling of tie rods, rotates to reach the position it has being the crane completely erected. ➤ Before starting crane dismantling, check for the boom safety devices to be efficient.	



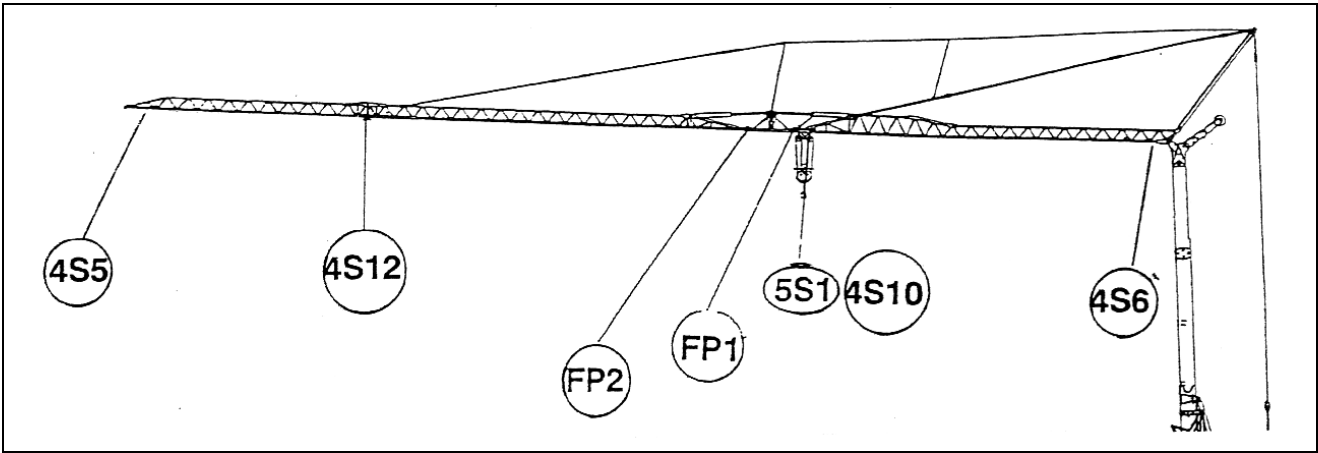
07.5.3. POSITIONING LIMIT SWITCH FUNCTIONS – DISMANTLING SEQUENCE

- 5.10 **FP1 is not employed during crane dismantling.**
- 5.11 **FP2 is not employed during crane dismantling.**
- 5.12 **FP3 "NO" is not employed during crane dismantling.**
- 5.13 **FP3 "NC" is not employed during crane dismantling.**
- 5.14 **5S1** controls the position of the trolley of the boom enabling crane dismantling only when the trolley is placed on **5S1**.

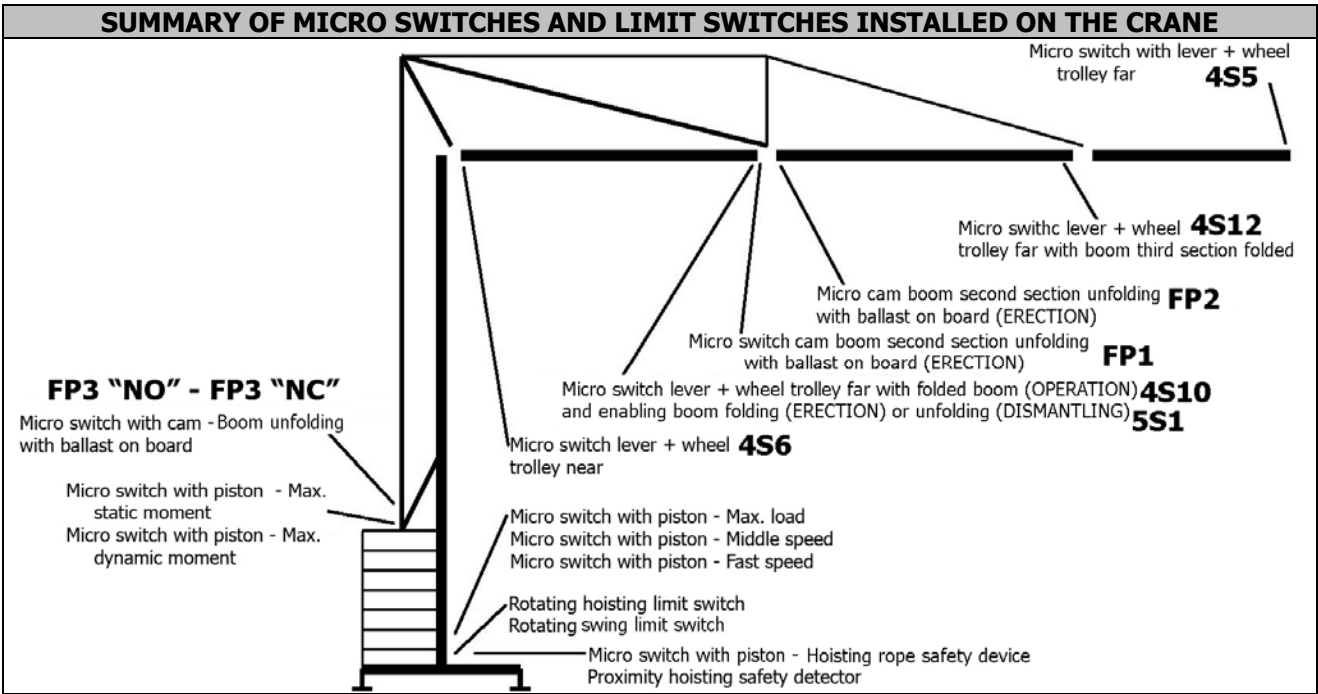
	WARNING
➤ The beginning stages of crane dismantling i.e. the third and the second boom sections unfolding are not controlled by any other device; all the movements shall be checked by sight to control their beginning and their end. ➤ All the erection and dismantling movements may be carried out only when the trolley is in its scheduled position and its slide block actuates the lever of the enabling micro switch 5S1, placed on the first boom section close to the articulation with the second section. Before starting crane dismantling, remember that the positioning of the trolley on 5S1 is actuated moving the trolley from the tower towards the articulation between the first and the second boom section.	



07.5.4. TROLLEY SAFETY DEVICES DURING CRANE OPERATION

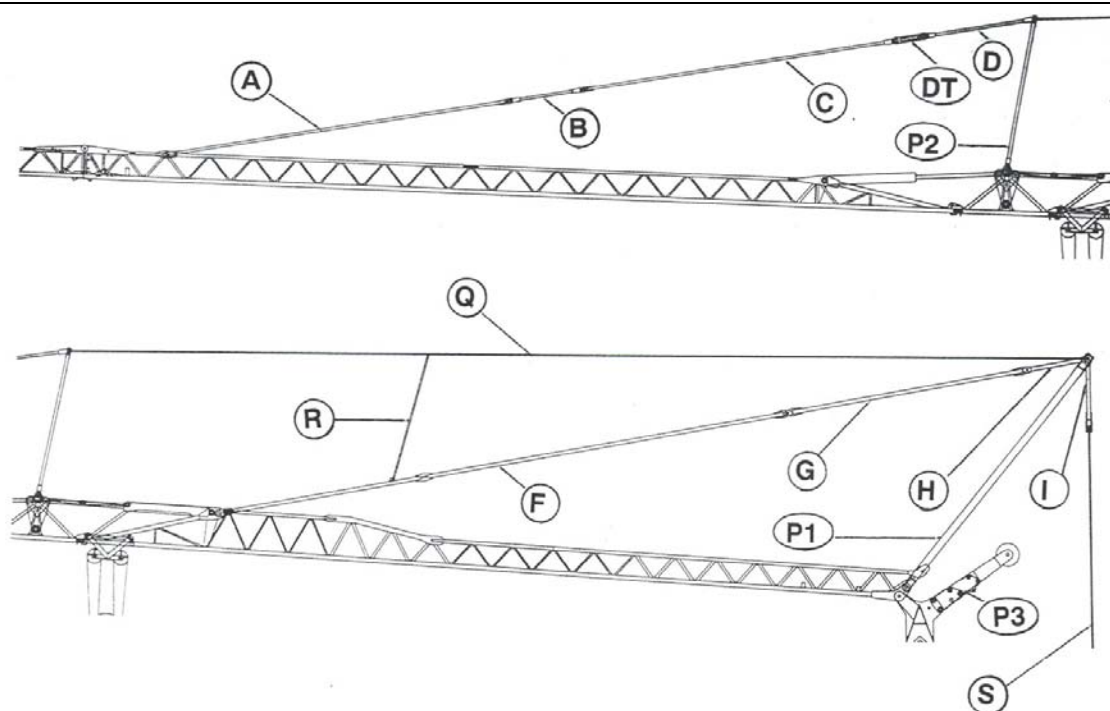


- 5.15 The position limit switches **4S5** at **41.7 meters (139'-9")** and **4S6** close to the tower intervene when the crane is operated with unfolded boom, and are activated placing the selector switch **SA2** into position **1**. Check for efficiency and positioning of the spring rods.
- 5.16 The middle limit switch **4S12**, placed at **30.85 meters (101'-2")**, intervene when the crane is operated with the third boom section folded and is activated placing the selector switch **SA2** into position **2**. The function of **4S6** remains unchanged. Check for efficiency and positioning of the spring rods.
- 5.17 The middle limit switch **4S10**, placed at the tip of the first boom section at **15.5 meters (50'-10")**, intervene when the crane is operated with folded boom and is activated placing the selector switch **SA2** into position **3**. The function of **4S6** remains unchanged. Check for efficiency and positioning of the spring rods.

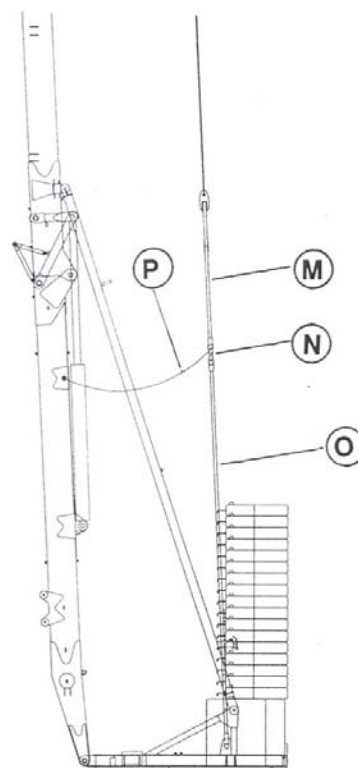




07.6. TIE RODS, BRACES AND CUSPS



TIE ROD A	L = 6,100 mm (20'-0")
TIE ROD B	L = 1,200 mm 3'-11")
TIE ROD C	L = 4,467 mm (14'-8")
TIE ROD DT	L = 100 – 425 mm (3.94 – 16.7 in)
TIE ROD D	L = 1,760 mm (5'-9")
TIE ROD F	L = 9,500 mm (31'-2")
TIE ROD G	L = 3,986 mm (13'-1")
TIE ROD H	L = 1,009 mm (3'-4")
TIE ROD I	L = 1,100 mm (3'-7")
TIE ROD M	L = 2,700 mm (8'-10")
TIE ROD N	L = 200 mm (7.87 in)
BRACE P1	
BRACE P2	
BRACE P3	
BRACE R	
TIE ROD O	L = 6,540 mm (21'-6")
STAY ROPE P	L = 2,750 mm (9'-0") Ø = 20 mm (0.787 in) x 2
STAY ROPE Q	L = 16,700 mm (54'-10") Ø = 26 mm (1.02 in)
STAY ROPE S	L = 13,755 mm (45'-2") Ø 38 mm (1.50 in)

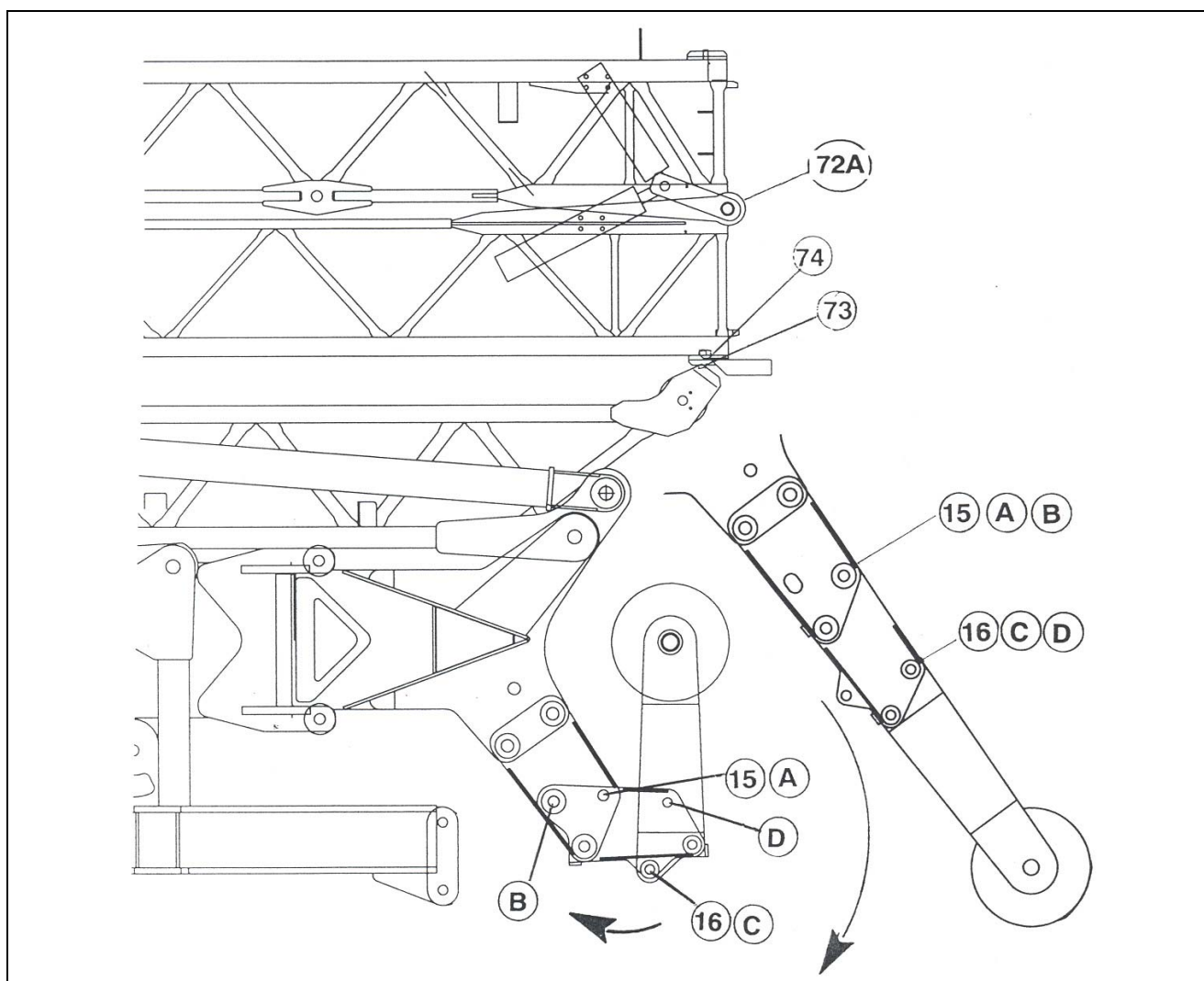


WARNING

- All the connection pins shall be secured with their relevant hitch and cotter pins; the ends shall be plied so that the cotter pin cannot slip away from the pin and to cause its axial sliding (paragraph 07.2).
- Any modification in the tie rods sequence may cause serious damages to the crane during erection and operation.

**07.6.1. TURNING THE CUSP WITH ROLLER IN OPERATION POSITION**

- 6.1 The rear cusp with the stay rope roller is folded upwards with two articulated section; the middle section is held by the pin **15 n1.480.40** inserted in the holes **A**, the final section with the wheel is held by the pin **16 n1.410.40** inserted in the hole **C**.
- 6.2 Remove the pin **15 n1.480.40** from the holes **A** and turn the middle section of the cusp downwards, till the holes **B** of the middle section are placed above the holes **A** of the fixed section. Connect the middle section to the fixed one inserting the pin **n1.480.40** into the holes **A** of the fixed section and the holes **B** of the middle section. Lock the pin **n1.480.40** with its hitch pins.
- 6.3 Remove the pin **16 n1.410.40** from the holes **C** and turn the final section of the cusp downwards, till the holes **C** of the final section are placed above the holes **D** of the middle section. Connect the middle section to the fixed one inserting the pin **n1.410.40** into the holes **C** of the fixed section and the holes **D** of the middle section. Lock the pin **n1.410.40** with its hitch pins.

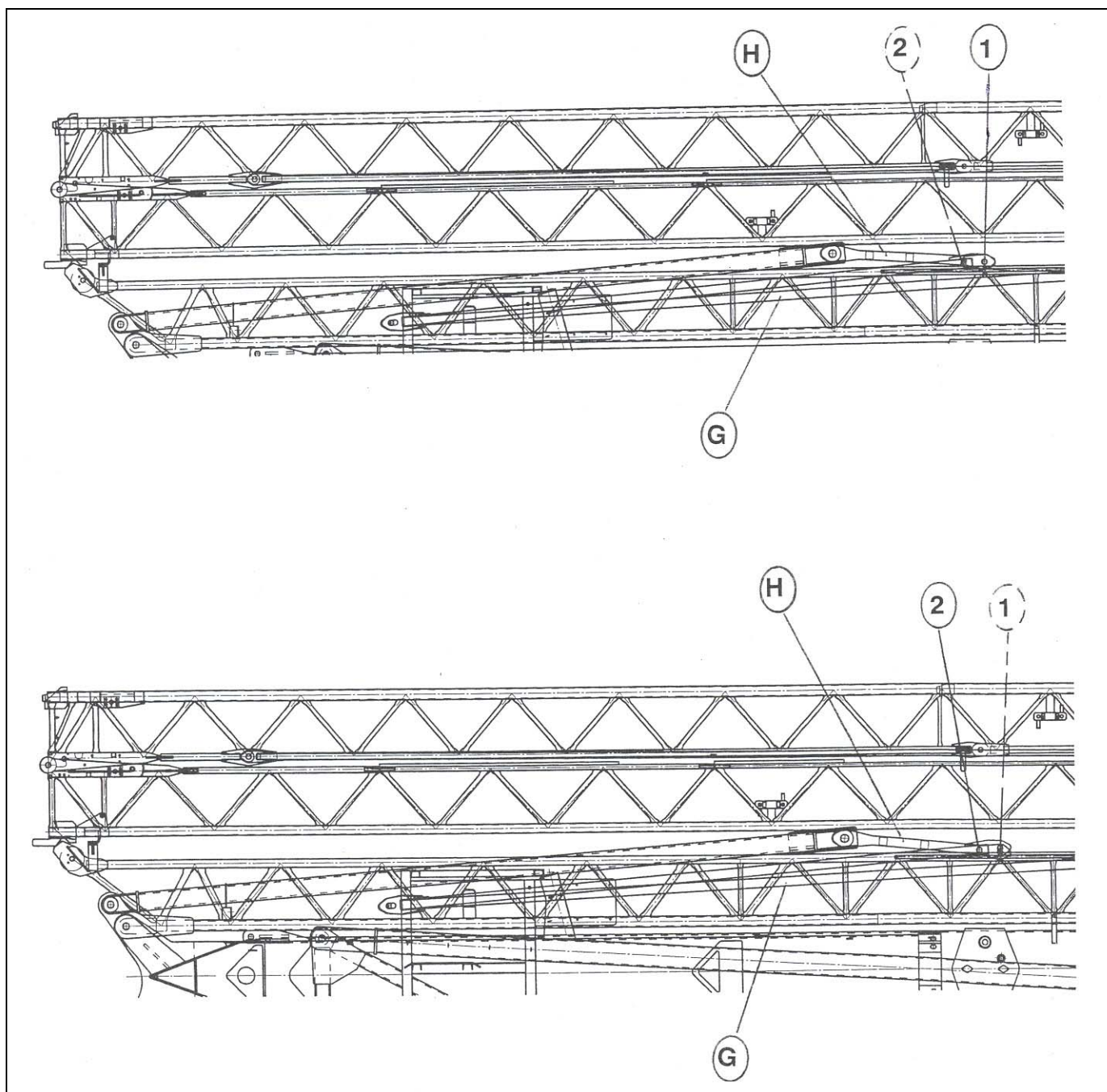
**WARNING**

- When aligning the rotating part of the cusp, adequately support the cusp with the roll to prevent any uncontrolled movements that may cause the risk of crushing and shearing for all exposed persons along with damages to the crane structures.



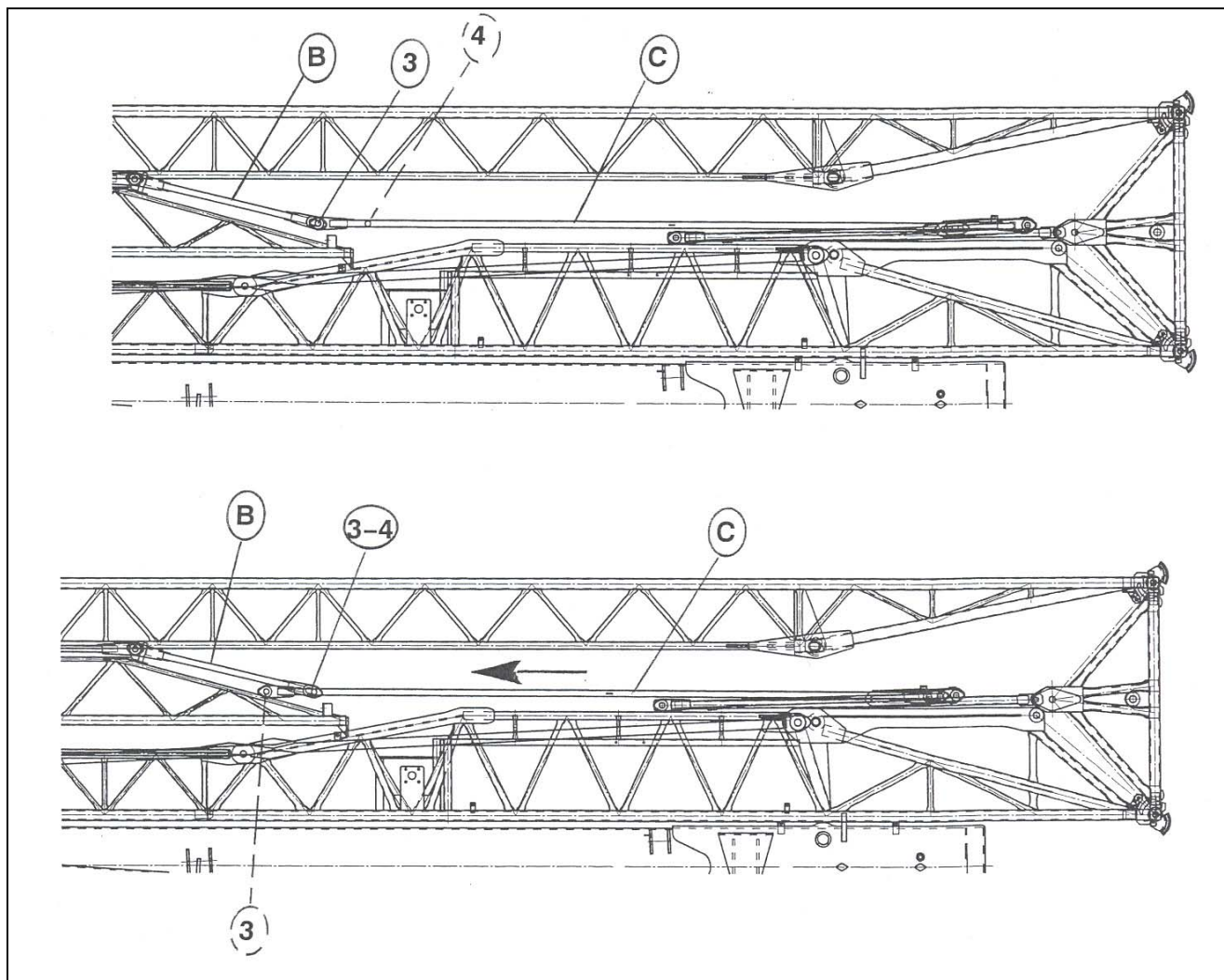
07.7. OPERATING THE CRANE WITH INCLINED BOOM

- 7.1 To erect the crane with inclined boom, no structural element has to be removed from the tie rods sequence. It takes just to move the pins of some element from some holes to other ones, to shorten the tie rod and to cause the boom inclination.
- 7.2 To erect the crane with inclined boom, being the crane dismantled, proceed as it follows:
- o remove the pin **n1.370.35** connecting the tie rod **H** to the tie rod **G** from the holes **1**, placed at the ends of both the tie rods (used to erect the crane with horizontal boom);
 - o align the holes **2** of both the tie rods and insert the connecting pin **n1.370.35** with its relevant hitch pins, so that the tie rod is as a whole shortened.





- 7.3 Being the crane dismantled, these operations have to be carried out too:
- o remove the pin **n1.180.35** connecting the tie rod **B** to the tie rod **C** from the holes **3**, placed at the ends of both the tie rods (used to erect the crane with horizontal boom);
 - o slide the tie rod **C**; align the hole **3** of the tie rod **B** and the hole **4** of the tie rod **C**;
 - o insert the connecting pin **n1.180.35** into the holes **3** and **4** and lock it with its relevant hitch pins, so that the tie rod is as a whole shortened.

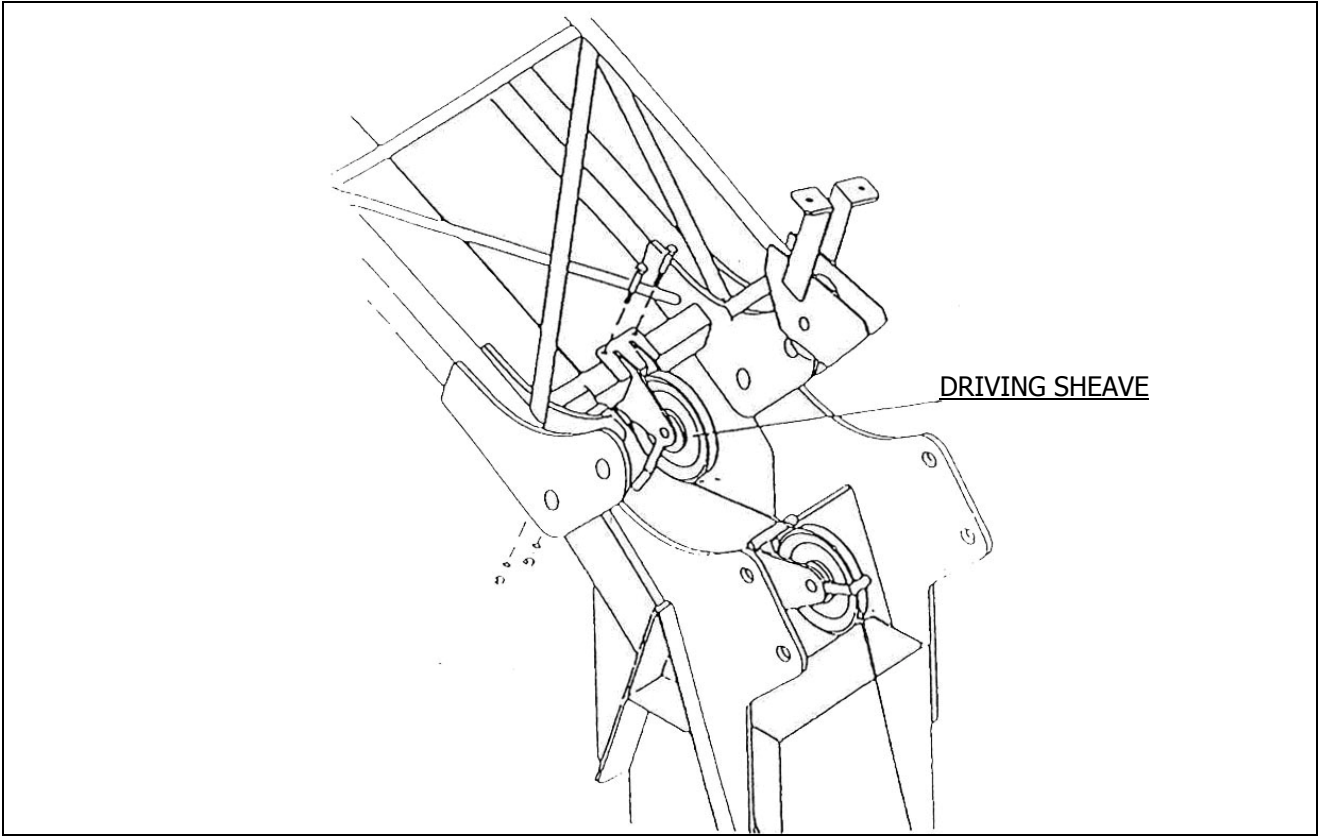


WARNING

- All the connection pins shall be secured with their relevant cotter and hitch pins; the ends shall be plied so that the split pin cannot slip away from the pin and to cause its axial sliding (paragraph 07.2).
- Any modification in the tie rods sequence may cause serious damages to the crane at the erecting and operation stage.
- Never assemble the boom with an inclination exceeding the specified degree.



- 7.4 To erect the crane with inclined boom carry out the following operations:
- o **tie rods shortening**, according with the instructions given at the top of this paragraph;
 - o **load indicator flags removal**: remove the flags for operating with horizontal boom and **leave at the boom tip the one indicating the load 1,000 kg (2,204 lbs) only**, constant along the whole boom (paragraph 07.12.3);
 - o **driving sheave assembly on the boom**, as indicated below;
 - o **adjustment of load and torque limiters** with to the new load (Chapter 10);
 - o **increasing of the braking torque** of the trolley motor brake.
- 7.5 **When operating the crane with inclined boom, the max. load is 1,000 kg (2,204 lbs), constant all along the whole boom.**
- 7.6 The driving sheave shall be assembled only when the crane is erected with inclined boom. To assemble it:
- o insert the two sheave fixing plates on the terminal crosspiece of the boom in middle position, aligned with the tower sheave;
 - o firmly secure it by tightening the nuts of the **M12x100** screws with their relevant washers.



WARNING

- Should the boom tie rod not be properly shortened, the crane will be unable to reach the required height.
- Failure in removing the load flags, leaving only the one indicating **1,000 kg (2,204 lbs)** at the



boom tip might cause the risk of lifting overloads.

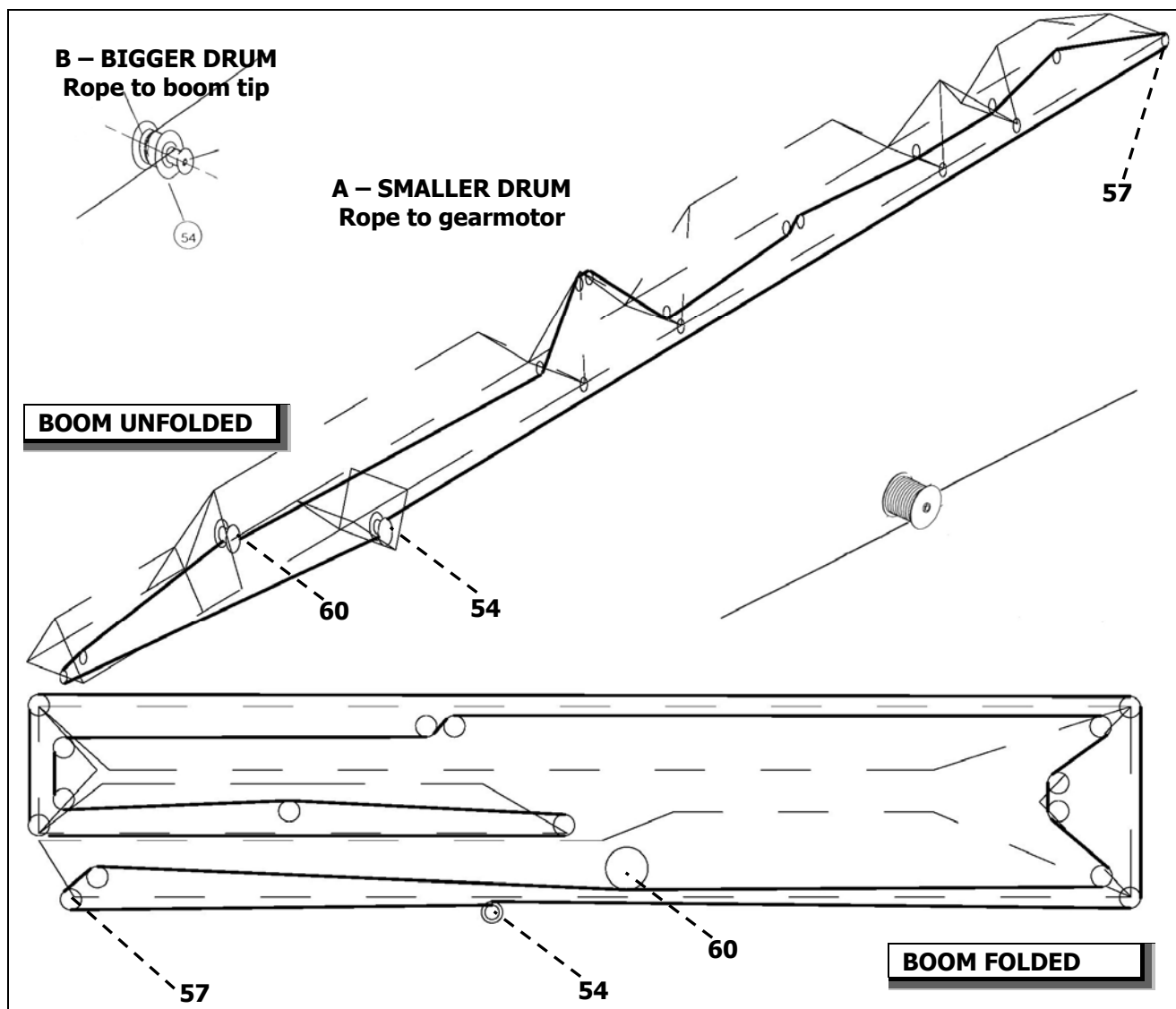
- If the driving sheave is not assembled, the hoisting rope will scrape against the crosspieces.
- If the limiters are not properly set, the crane may be employed to lift up overloads.
- Failure in increasing the trolley braking effect may cause the risk of crane uncontrolled movements.

7.7 If the crane is operated with inclined boom and it is intended to operate the machine with horizontal boom, it takes to dismantle the crane and to carry out the reverse of the previous instructions.



07.8. TROLLEY ROPE

- 8.1 The rope for trolley displacement is always taut on the boom, even during transporting when the second section of the boom rests onto the first one.
- 8.2 Before erecting the crane, make sure the rope is only slightly taut; the trolley automatic tensioner **54** will stretch it to the required tension when the machine is operated by unwinding the rope from the smaller drum **A** and winding it on the bigger drum **B**.
- 8.3 Make sure the rope runs correctly in all the sheaves and that all rope guards are suitable and efficient. Make sure that several rope wraps are wound on the drum **A** of automatic tensioner **54**; make sure that the clips securing the rope to tensioner **54** and to drum **60** are firmly tightened and that the locking ratchet is efficient.
- 8.4 Periodically check for good conditions of the trolley rope and grease it; lack of grease on the rope may lead to its quick wearing.
- 8.5 During the various operations for boom unfolding and folding, spring **57** compensates the slight difference in rope length eventually occurring.



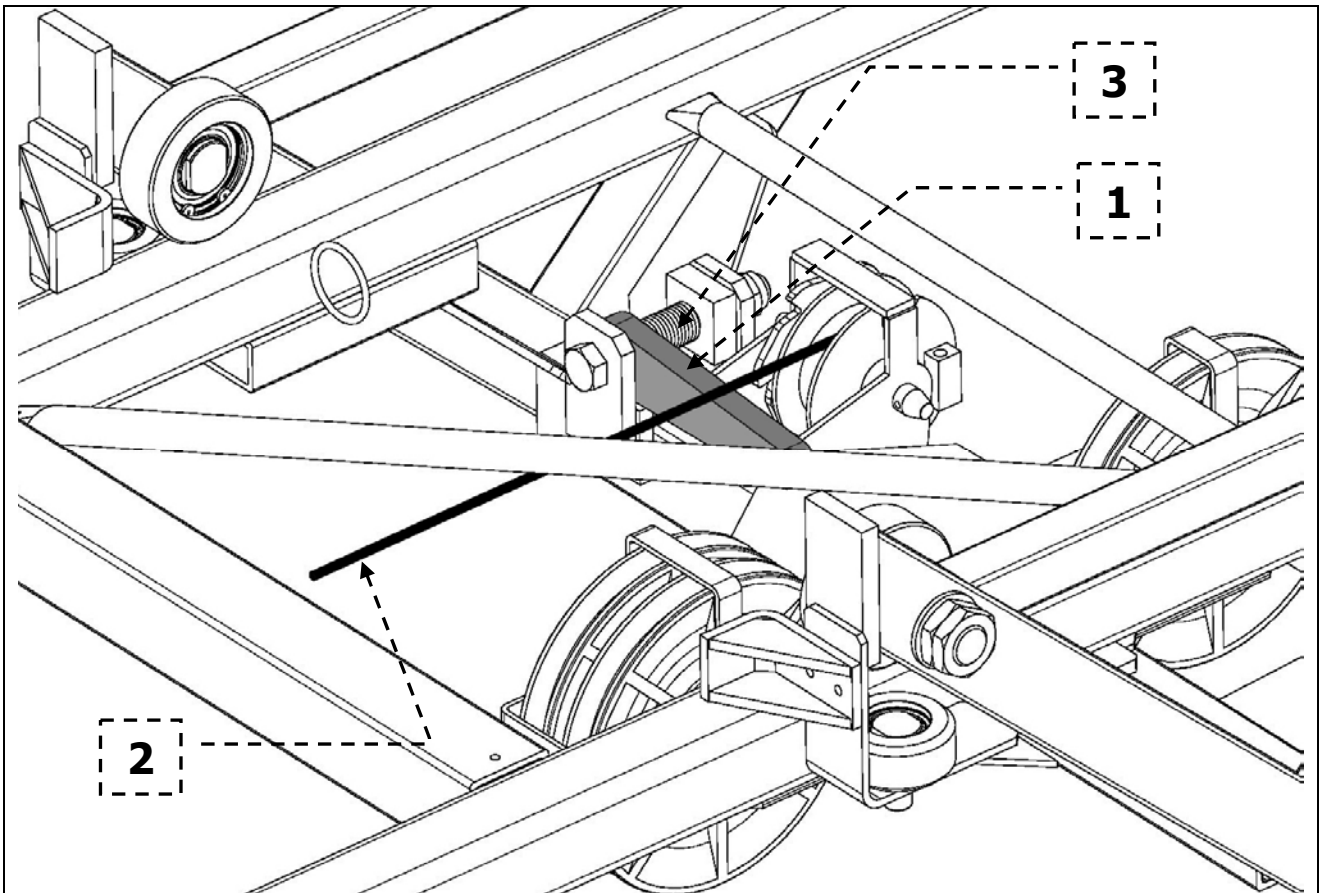


	WARNING
➤ The automatic tensioner 54 performs its function only if some rope is wound on drum A; should the rope be completely unwound, lower the crane, unwind the rope from drum B and rewind it on drum A. At least one wrap of rope shall always be wound both on drum A and on drum B. ➤ Excessively tensioned ropes might break or damage the mechanical parts when operating the crane and when unfolding and folding the boom. ➤ If the rope locking devices on drums of tensioner 54 or on flanges of drum 60 are not properly tightened, the ropes may off, thus causing uncontrolled movements of the trolley. Risks for crane stability and danger of overturning. ➤ The rope for trolley displacement is automatically stretched by the pull exerted by the rope length going from the trolley tensioner to the boom gear-motor during trolley displacement. Rope tensioning shall never be carried out by locking the trolley against a fixed obstacle (stops at boom tip; stops half-way along the boom with folded boom, bars placed in between the link studs with crane down or with locked trolley at any rate); if this were the case the resulting excessive rope tension might damage the crane and its structures. ➤ When erecting the crane with inclined boom, increase the braking effect of the trolley motor brake.	



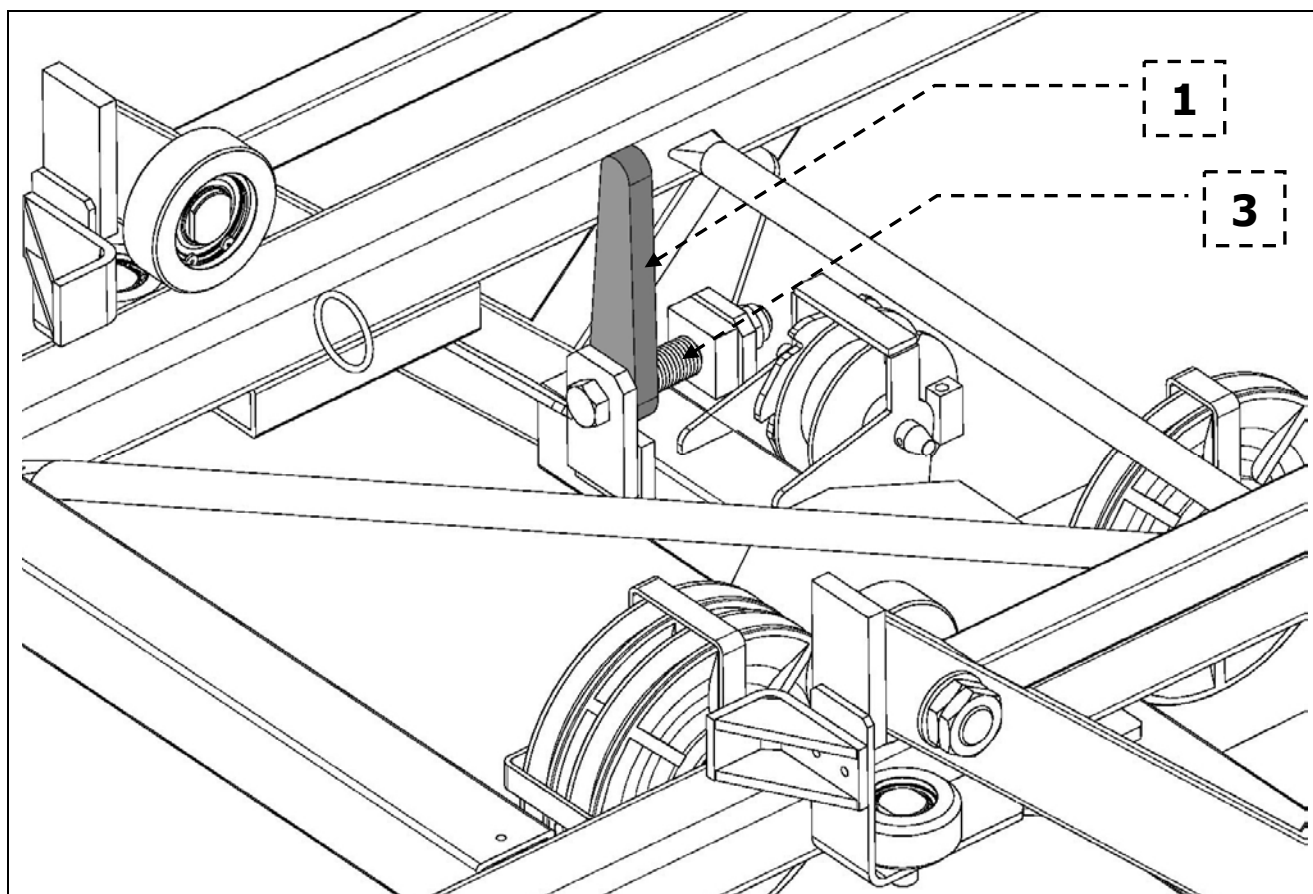
07.8.1. TROLLEY ROPE SAFETY

- 8.6 The trolley is equipped with a safety device, that automatically intervenes in the event of the sudden rope breakage during crane operation.
- 8.7 The device is composed by a plate **1** that, during the ordinary functioning, rests on the trolley rope **2** and it is kept tensioned by the torsion spring **3**.





- 8.8 In the event of the sudden trolley rope breakage, the plate **1** is not locked by the rope any more, and it is brought to vertical position by the torsion spring **3**. The plate **1**, interfering with the crossbar of the boom, causes the slowing down and the stop of the trolley, preventing the uncontrolled movement of the trolley, that is dangerous in particular when a load is suspended by the hook.

**WARNING**

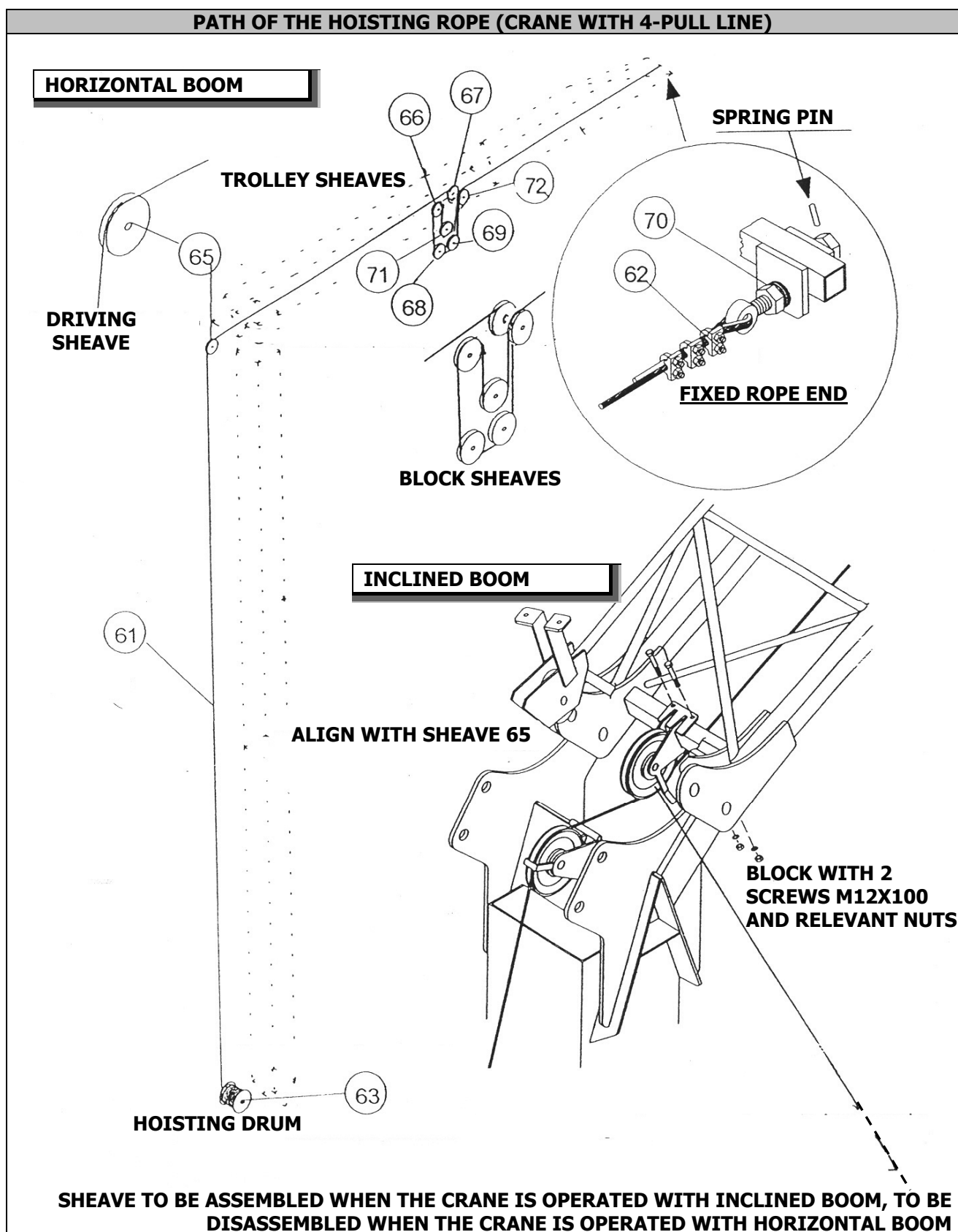
- In the event of the intervention of the trolley safety device, it takes to quickly quit the danger zone of the crane, because there subsists the serious risk of crane overturning under the effect of the inertia forces.
- The trolley safety device intervenes only in the exceptional event of sudden breakage of the trolley rope. It is recommended to take all the needed precautions, described at the paragraph 12.1.2 and at the paragraph 12.1.3, in order to prevent this azardous condition.
- In the event of the intervention of the trolley safety device, **before putting the crane into service again, it takes to carry out a strict check of structures and mechanisms**, carrying out the repairs or the replacements of the components that may have been damage because of the intervention of the device.



07.9. HOISTING ROPE

- 9.1 During crane transporting, the hoisting rope is always assembled and ready for use.
- 9.2 During the various erection stages, check that rope **61** runs freely and that the load block does never come into contact with the trolley sheaves **66-67** or with the ground.
- 9.3 When the crane is erected with **horizontal boom**, the hoisting rope follows this paths:
- o it is fixed to the drum **63**;
 - o it winds on the boom sheave **65**;
 - o it engages the trolley sheave **67**;
 - o it winds up on the main block sheaves **69-68**;
 - o it engages the trolley sheave **66**;
 - o it engages the block sheave for the 4-pull line **71**;
 - o it engages the trolley sheave **72**;
 - o it reaches the fixed rope end, rotary with its relevant thimble, at the boom tip.
- 9.4 The hoisting rope is the one subjected to maximum stress and shall be checked and maintained with greater care. Grease it to reduce friction between the rope wraps wound on the drum.

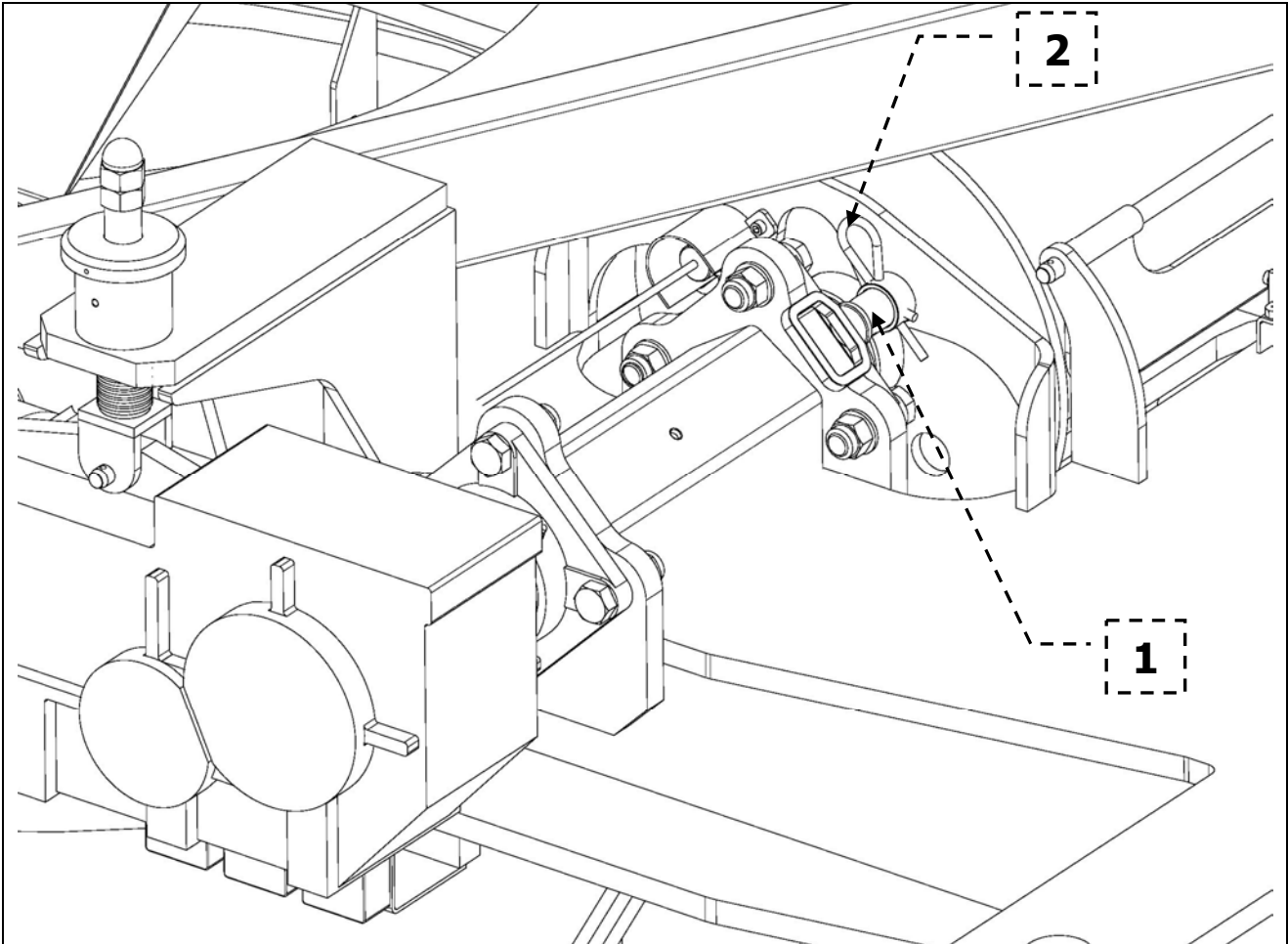
	WARNING
➤ Locking the fixed rope end to the boom tip is an extremely important operation, to be carried out with the utmost care. ➤ Check that: - o all rope paths are correct; - o the rope correctly runs through all sheaves; - o the rope guards are suitable and efficient; - o the fixed rope end freely rotates on bearings 70; - o the safety split pin or locking spring pin has been correctly assembled. ➤ Failure in tightening clips 62 may cause rope ends to slide off the clips and the load to fall. For the correct clips assembly, refer to <u>paragraph 07.11</u>. ➤ The fixed rope end shall turn freely, following the rope rotation around its axis; should the fixed rope end not turn, the rope quickly wears out. ➤ Out of place or damaged rope guards may lead to hoisting rope crashing and breaking. ➤ Irregulare rope winding on the winch drum leads to quick rope wear and causes the non-intervention of the hoisting load limiting device.	



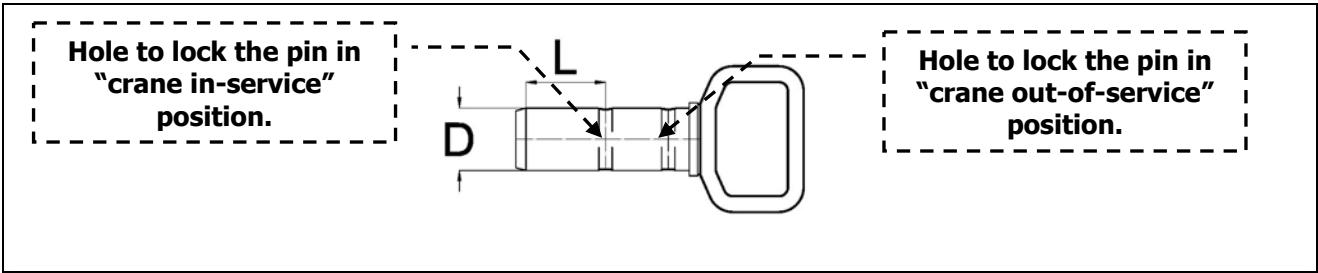


07.9.1. HOISTING DRUM LOCK – CRANE OUT-OF-SERVICE

9.5 The hoisting winch is equipped with a pin **x1.38.30**, employed in case of need being the crane out-of-service, that is a further safety in order to prevent the uncontrolled rotation of the drum, when this function cannot be assured by the hoisting motor brake (e.g. when the hoisting motor is serviced or replaced).



9.6 The pin **x1.38.30** is equipped with two holes, for the hitch pin. The hole close to the handle is for locking the pin in "crane out-of-service" position. The hole close to the pin tip is for locking the pin in "crane in-service" position. The locking is made by means of an hitch pin, passing through the hole of the pin.





9.7 **CRANE OUT-OF-SERVICE.** Remove the hitch pin **2**. Insert the pin **x1.38.30** deeper, so that it can be lock into "crane out-of-service" position: the pin shall match with the hole in the hoisting drum clamp; if it doesn't match, slightly turn the drum. Lock the pin by means of hitch pin **2**. The pin **x1.38.30** is a mechanical lock to prevent the uncontrolled rotation of the hoisting drum.

1) Pin x1.38.30 in "crane in-service" position.	2) Remove hitch pin.	3) Insert the pin.	4) Lock by means of hitch pin. Pin x1.38.30 in "crane out-of-service" position.

9.8 **BEFORE PUTTING THE CRANE INTO SERVICE AGAIN.** Remove the hitch pin **2**. Slightly exit the pin **x1.38.30** (not completely), so that it can be lock into "crane in-service" position. Lock the pin by means of hitch pin **2**.

1) Pin x1.38.30 in "crane out-of-service" position.	2) Remove hitch pin.	3) Slightly exit the pin (not completely).	4) Lock by means of hitch pin. Pin x1.38.30 in "crane in-service" position.



WARNING

- Failure in moving the pin **x1.38.30** into "crane in-service" position before putting the crane into service again, there subsists the risk of damaging the hoisting drum.
- During the ordinary operation, the hoisting motor brake assures the lock of the drum for the crane out-of-service. Always check the brake to be efficient.



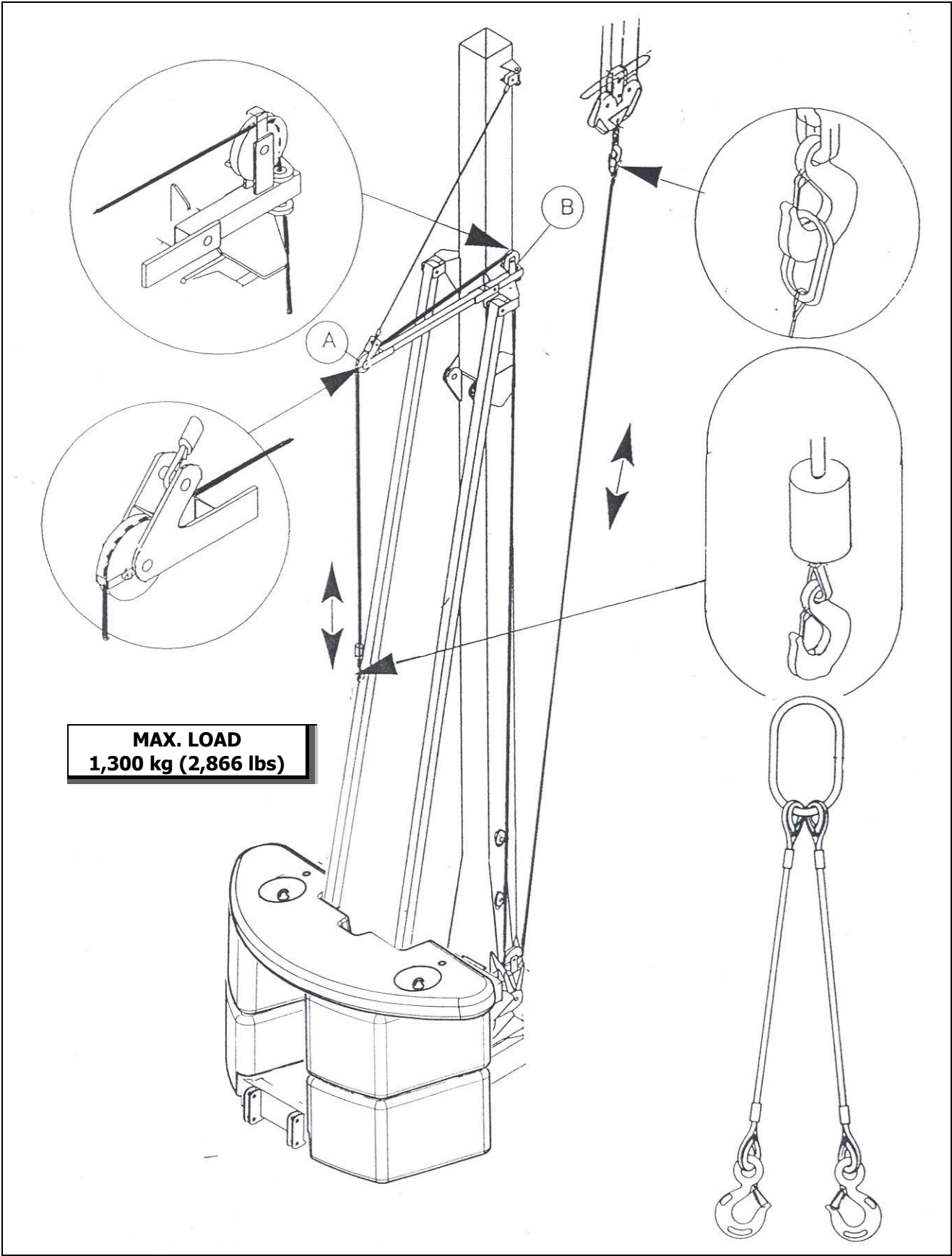
07.10. DERRICK ROPE FOR LIFTING BALLAST BLOCKS

- 10.1 During crane transporting, the derrick rests on its support placed beside the erection brace.
- 10.2 Before erecting the crane, if the derrick is not assembled:
 - o run the derrick lifting rope through the groove of sheaves **A** and **B** placed on the crane upper part, as specified in the following picture;
 - o make sure all derrick and tie rod fixing pins are properly inserted and carefully secured with the relevant cotter and hitch pins;
 - o make sure the counterweight is positioned above the lifting hook.
- 10.3 During crane transporting, the rope for lifting the ballast blocks may be wound on the apposite hooks or taken off the derrick.
- 10.4 To assemble the derrick rope, if taken off, proceed as follows:
 - o run the rope along the path shown on the scheme at the next page, placing the free end of the rope in the seat of the derrick sheaves;
 - o place the grommet supplied on the rope free end; secure it by the three clips and thimble supplied.

	WARNING
➤ Please refer to scheme <u>paragraph 07.11</u> for correct clips assembly.	

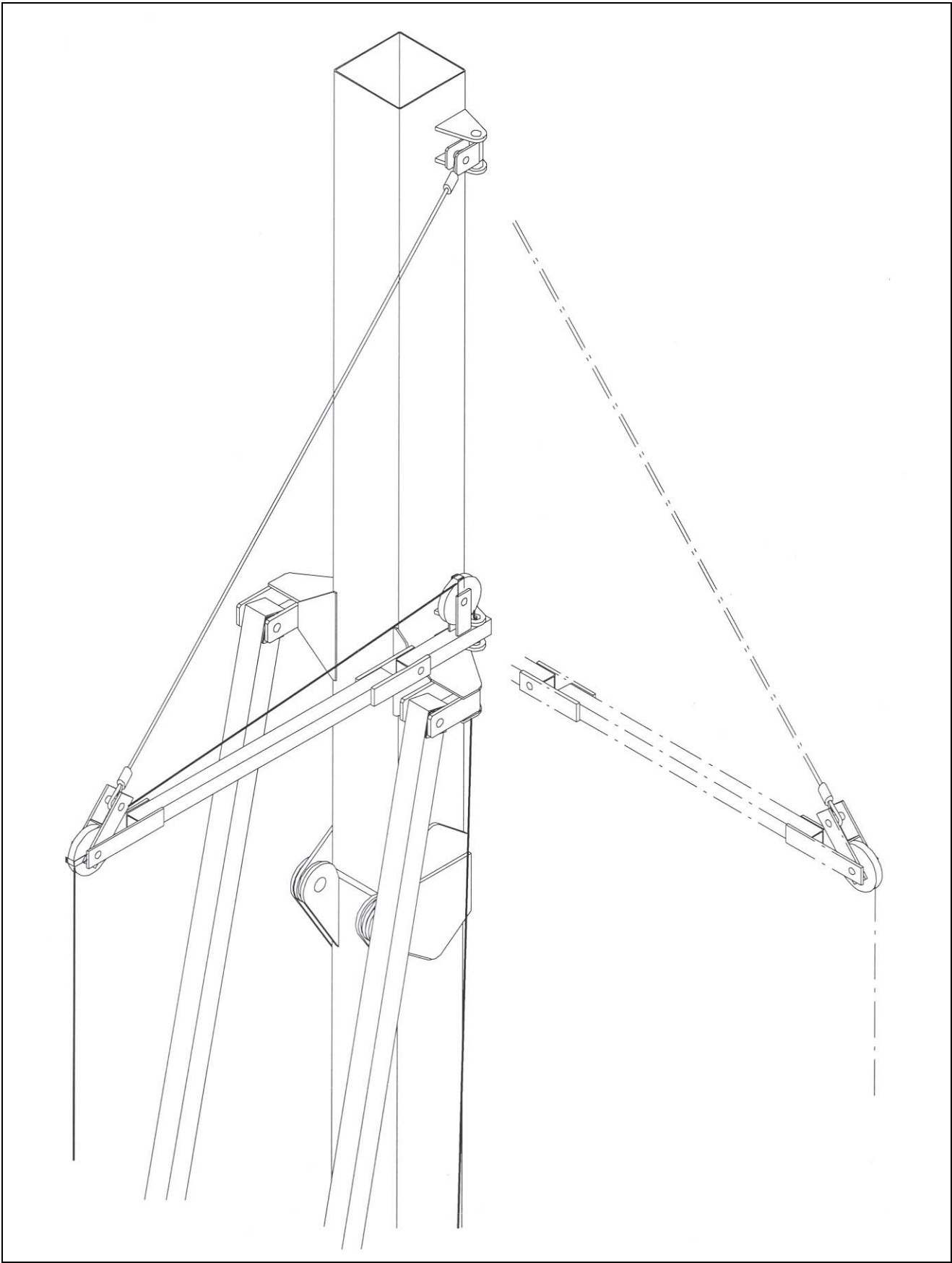
- 10.5 To lift up the ballast blocks, place the crane block hook inside the grommet of the derrick rope end. Lifting the crane block will cause the lifting of the derrick hook.

	WARNING
➤ Any improper use of the derrick may cause serious accidents and damages. ➤ During the ballast blocks movement, hook a nylon rope to the block lifted by the derrick, in order to pull it sideways and to manage it. ➤ During crane erection and dismantling, make sure the derrick does not interfere with and the rope is not caught in any element of the crane. ➤ The derrick shall only be employed to load and unload ballast blocks of 1,300 kg (2,866 lbs). max. from the ground onto the crane and vice versa. The blocks shall be unloaded by a different lifting mean beside the crane and within the operating range of the derrick; never pull ropes slantwise. ➤ Lift the blocks up at slow speed only or, if necessary, at micro speed. ➤ Always and only sling the blocks by means of two 12 mm (0.472 in) rope tie rod and the two hooks supplied with the crane. Hook up the tie rod to the appropriate metal eyelets on the blocks and insert the tie rod grommet in the hook of the load block.	



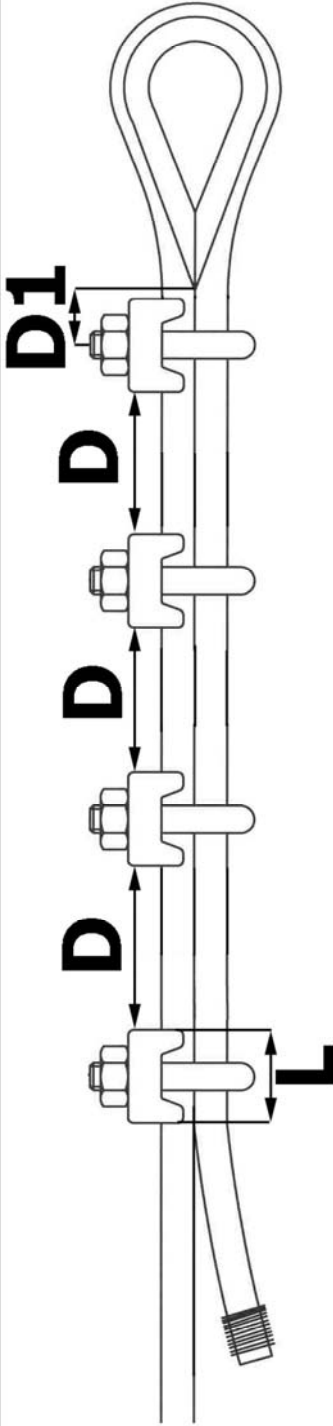
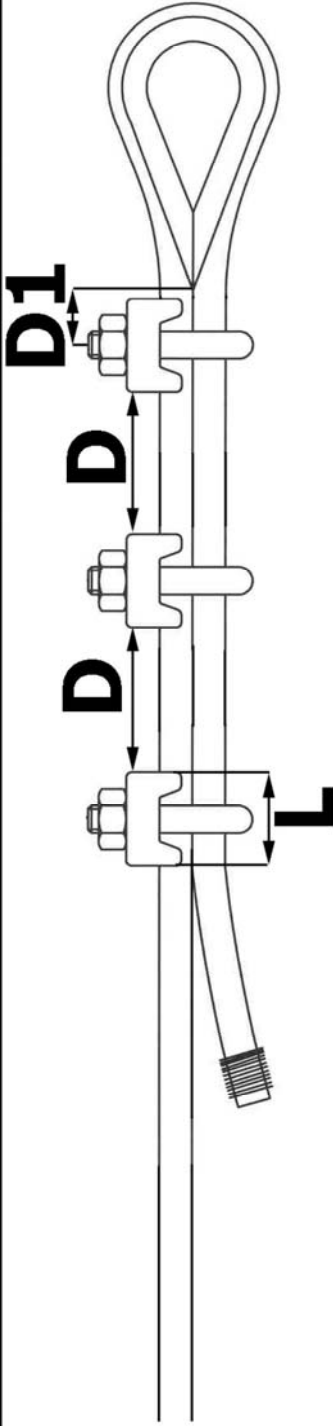


07.10.1. DERRICK ASSEMBLY



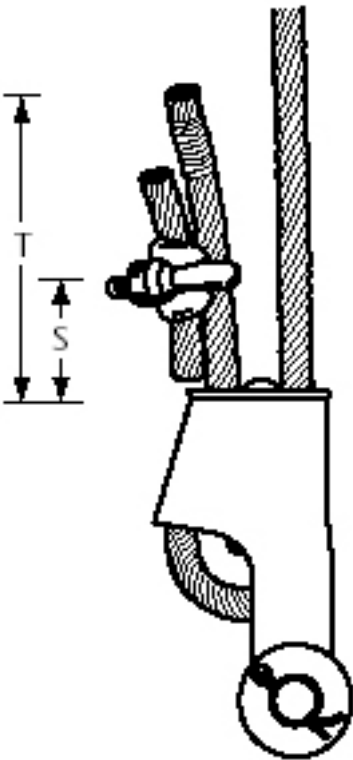


07.11. ROPE ENDS

ROPES – DIAMETER 8-9-10-11 mm (0.315-0.354-0.394-0.433 in)				
				
NUMBER OF CLIPS	DISTANCE "D1" BETWEEN FIRST CLIP AND THIMBLE	ROPE DIAMETER	DISTANCE "D" BETWEEN CLAMPS [mm]	TIGHTENING TORQUE
4	As small as possible	8 mm (0.315 in)	32 mm (1.26 in) MIN. – 64 mm (2.52 in) MAX.	4.24 Nm (3.13 lbs·ft)
		9 mm (0.354 in)	36 mm (1.42 in) MIN. – 73 mm (2.87 in) MAX.	10.20 Nm (8.90 lbs·ft)
		10 mm (0.394 in)	36 mm (1.42 in) MIN. – 73 mm (2.87 in) MAX.	10.20 Nm (8.90 lbs·ft)
		11 mm (0.433 in)	38 mm (1.50 in) MIN. – 76 mm (2.99 in) MAX.	10.20 Nm (8.90 lbs·ft)
ROPES – DIAMETER 6-7 mm (0.236-0.276 in)				
				
NUMBER OF CLIPS	DISTANCE "D1" BETWEEN FIRST CLIP AND THIMBLE	ROPE DIAMETER	DISTANCE "D" BETWEEN CLAMPS [mm]	TIGHTENING TORQUE
3	As small as possible	6 mm (0.236 in)	24 mm (0.95 in) MIN. – 48 mm (1.89 in) MAX.	4.24 Nm (3.13 lbs·ft)
		7 mm (0.276 in)	27 mm (1.06 in) MIN. – 54 mm (2.13 in) MAX.	4.24 Nm (3.13 lbs·ft)
CLIPS ALWAYS ON THE LIVE PART OF THE ROPE				



11.1 To assemble wedge socket end, a small piece of rope is cut and clipper to the dead end.



DISTANCE "T"	MAX. VALUE between	
	3 x rope diameter	150 mm (6 in)
DISTANCE "S"	MIN. VALUE between	
	3 x rope diameter	75 mm (3 in)



WARNING

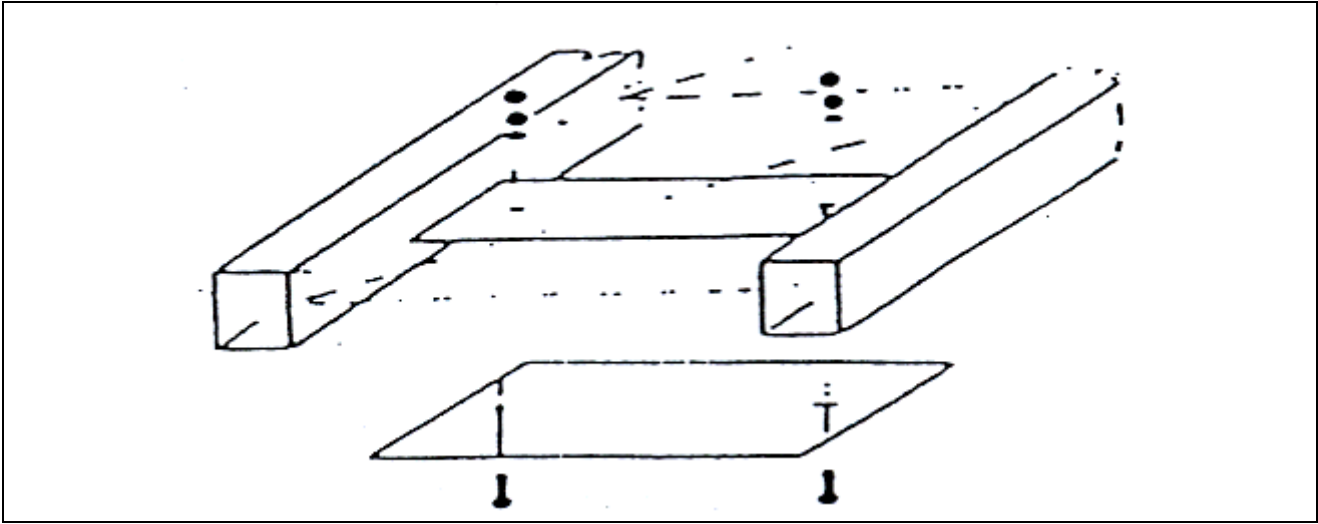
- Regularly inspect the integrity of wire rope at the point of exit at the dead-end side, where the effect of fatigue are more relevant and may lead the rope to break off. This inspection shall be part of the inspections described at the paragraph 12.1.2.



07.12. LOAD INDICATOR FLAGS

07.12.1. ASSEMBLING THE LOAD INDICATOR FLAGS

- 12.1 Arrange on the crane boom the flags indicating the maximum loads permitted according to the radius.
- 12.2 Load flags shall be installed in their correct positions, the numbers being readable from the ground.
- 12.3 Safely lock them with screws, washers and nuts. Tighten the fixing bolts carefully.



- 12.4 Check that the load flags are intact and readable from the ground, and that the indicated loads are correct (refer to the tables below). Check that the load flags are visible from the control point of the crane.

	WARNING
➤ Failure in fitting the max. load indicator flags on the boom, will cause the risk of overloading the crane if permitted radii or maximum loads are exceeded. ➤ Failure in carefully fixing the load flags will cause the risk of their detachment and falling from up above, that is a danger for the exposed persons.	



07.12.2. LOAD INDICATOR FLAGS WITH HORIZONTAL BOOM

A) BOOM 41.7 M (136'-9")

BOOM 39.4 m – HORIZONTAL BOOM	
LOAD FLAG kg	RADIUS
1000	41.7 m (boom tip)
1200	35.9 m
1400	31.7 m
1600	28.4 m
2000	23.6 m
3000	16.9 m
4000	13.4 m (rated load)

BOOM 136'-9" – HORIZONTAL BOOM	
LOAD FLAG lbs	RADIUS
2204	136'-9" (boom tip)
2645	117'-9"
3086	104'-0"
3527	93'-2"
4409	77'-5"
6614	55'-5"
8818	43'-11" (rated load)



WARNING

- Failure in fitting the max. load indicator flags on the boom, will cause the risk of overloading the crane if permitted radii or maximum loads are exceeded.



B) THIRD BOOM SECTION FOLDED

- 12.5 **Operating the crane with boom 30.85 m (101'-2")** third boom section folded, the load **1,400 kg (3,086 lbs)** can be move forward to the boom tip. All the load may be displaced slightly forward as regards to load flag locations, according with the adjustment of the max. moment limiter.

	WARNING
➤	Failure in fitting the max. load indicator flags on the boom, will cause the risk of overloading the crane if permitted radii or maximum loads are exceeded.



07.12.3. LOAD INDICATOR FLAGS WITH INCLINED BOOM

BOOM 41.7 m – INCLINED BOOM	
LOAD FLAG kg	RADIUS
1000	41.7 m (boom tip)

BOOM 139'-9" – INCLINED BOOM	
LOAD FLAG lbs	RADIUS
2204	139'-9" (boom tip)

12.6 **Operating the crane with inclined boom**, it takes to remove all the load flags uses with horizontal boom, and to leave the load flag indicating **1000 (2204)** at the boom tip only. In this configuration the max. load is **1,000 kg (2,204 lbs)** along the whole boom.

	WARNING
➤ Failure in removing the load flags used with horizontal boom and failure in leaving the load flag indicating 1000 (2204) at the boom tip, will cause the risk of overloading the crane if permitted radii or maximum loads are exceeded. ➤ Failure in fitting the max. load indicator flags on the boom, will cause the risk of overloading the crane if permitted radii or maximum loads are exceeded.	



07.12.4. LOAD INDICATOR FLAGS WITH FOLDED BOOM

12.7 When operating the crane with **folded boom – boom 15.5 m (50'-10")**, remove the load flag indicating **4000 (8818)**. The rated load is **3,000 kg (6,614 lbs)**, along the whole boom length.

	WARNING
➤ Failure in removing the load flag indicating 4000 (8818), operating the crane with folded boom, will cause the risk of overloading the crane if permitted radii or maximum loads are exceeded. ➤ Failure in fitting the max. load indicator flags on the boom, will cause the risk of overloading the crane if permitted radii or maximum loads are exceeded.	



07.13. LOAD CURVES

07.13.1. LOAD CURVES WITH HORIZONTAL BOOM



A) BOOM 41.7 M (136'-9")

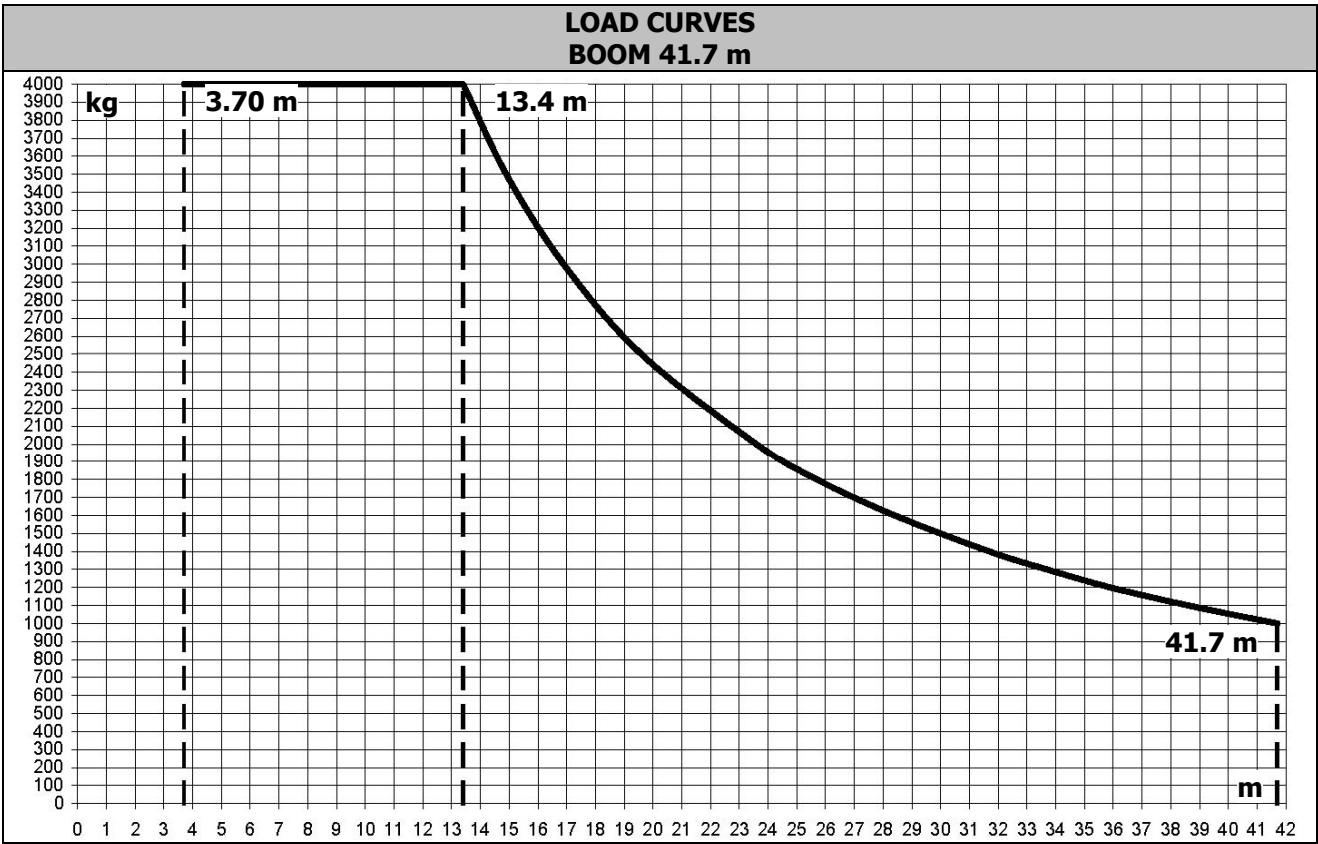
HORIZONTAL BOOM BOOM 41.7 m	
LOAD	RADIUS
4,000 kg*	3.70 m (min. radius)
	13.4 m (rated load)
3,500 kg*	14.9 m
3,000 kg*	16.9 m
2,500 kg*	19.6 m
2,000 kg	23.6 m
1,800 kg	25.7 m
1,600 kg	28.4 m
1,400 kg	31.7 m
1,300 kg	33.7 m
1,200 kg	35.9 m
1,100 kg	38.6 m
1,000 kg	41.7 m (boom tip)
* LOADS ALLOWED WITH 4-PULL LINE CONNECTED ONLY	

13.1 With 4-pull line connected, the rated load is **4,000 kg**. When the crane is operated with 2-pull line (4-pull line disconnected), the rated load is reduced to **2,000 kg**.



WARNING

➤ Slings and lifting attachments are part of the load.





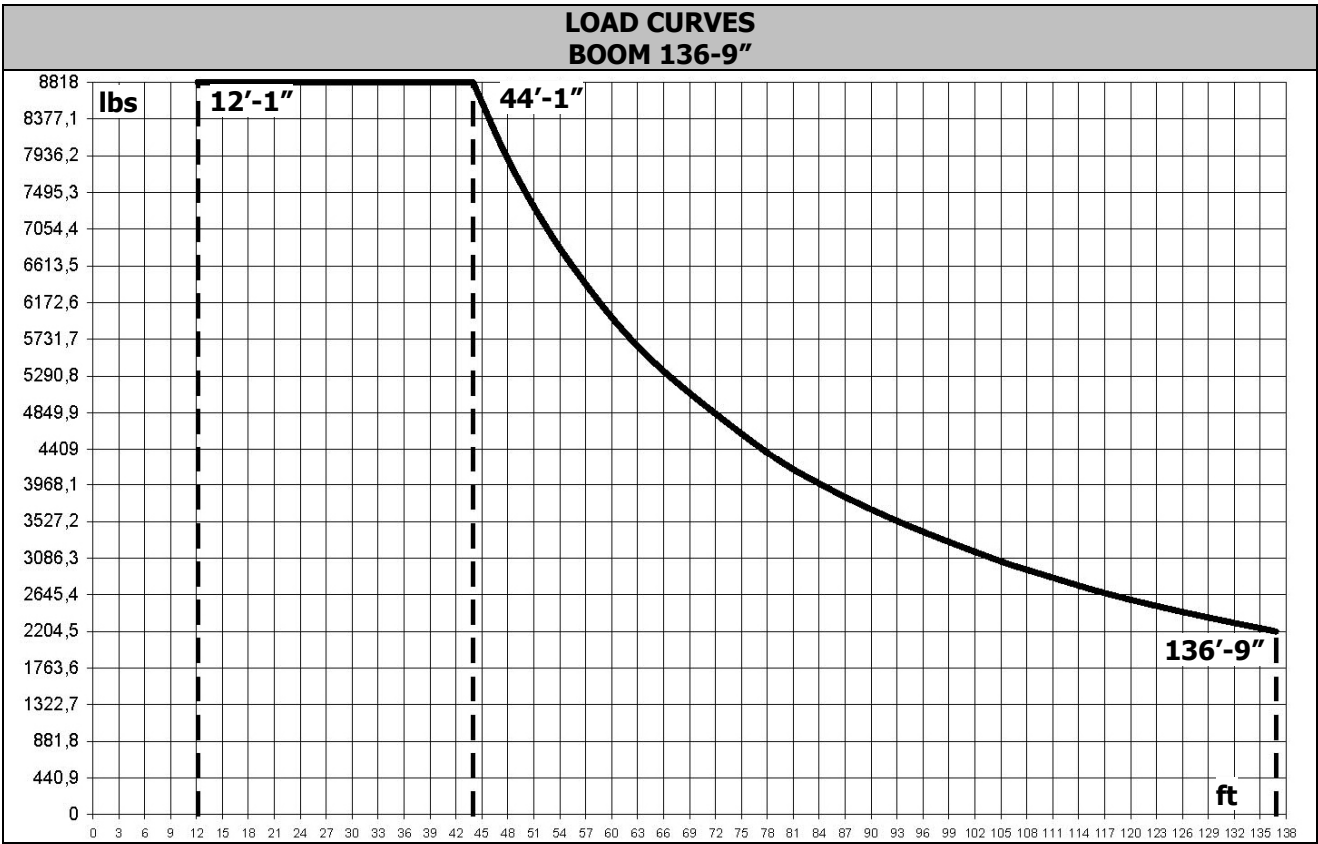
HORIZONTAL BOOM BOOM 136'-9"	
LOAD	RADIUS
8,818 lbs*	12'-1" (min. radius)
	44'-1" (rated load)
7,716 lbs*	48'-10"
6,614 lbs*	55'-5"
5,511 lbs*	64'-3"
4,409 lbs	77'-5"
3,968 lbs	84'-3"
3,527 lbs	93'-2"
3,086 lbs	104'-0"
2,866 lbs	110'-6"
2,645 lbs	117'-9"
2,425 lbs	126'-7"
2,204 lbs	136'-9" (boom tip)
* LOADS ALLOWED WITH 4-PULL LINE CONNECTED ONLY	

13.2 **With 4-pull line connected**, the rated load is **8,818 lbs**. When the crane is operated **with 2-pull line** (4-pull line disconnected), the rated load is reduced to **4,409 lbs**.



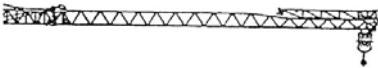
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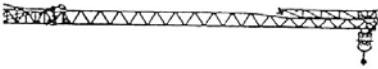
➤ Slings and lifting attachments are part of the load.





B) THIRD BOOM SECTION FOLDED

	
HORIZONTAL BOOM	
BOOM 30.85 m – THIRD BOOM SECTION FOLDED	
LOAD	RADIUS
4,000 kg*	3.70 (min. radius)
	13.1 m (rated load)
3,500 kg*	14.5 m
3,000 kg*	16.5 m
2,500 kg*	19.1 m
2,000 kg	23.0 m
1,800 kg	25.0 m
1,600 kg	27.6 m
1,400 kg	30.85 m (boom tip)
* LOADS ALLOWED WITH 4-PULL LINE CONNECTED ONLY	

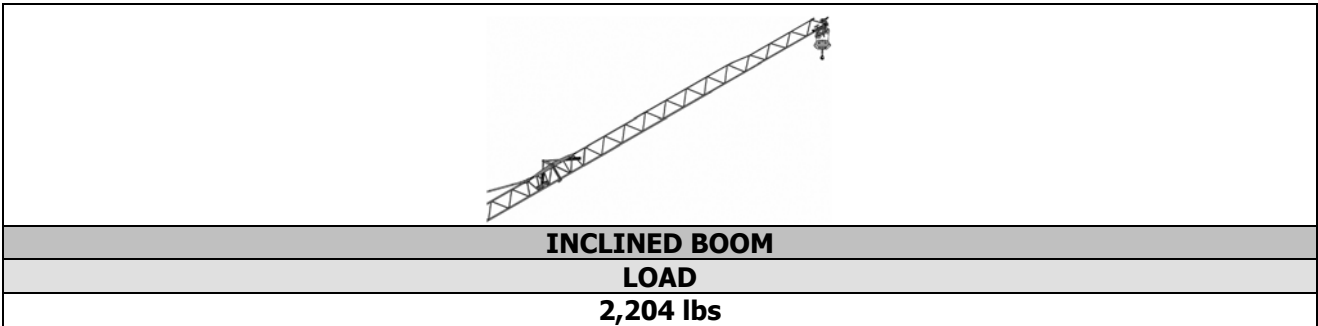
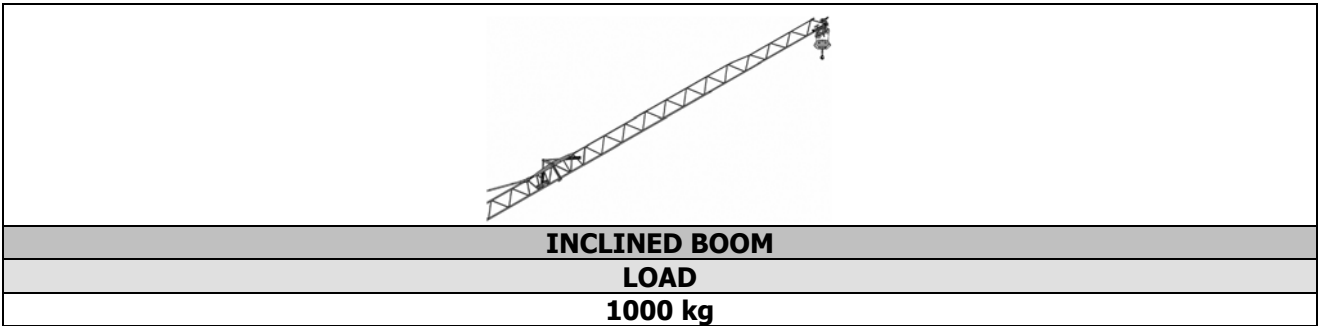
	
HORIZONTAL BOOM	
BOOM 101'-2" – THIRD BOOM SECTION FOLDED	
LOAD	RADIUS
8,818 lbs*	12'-1" (min. radius)
	42'-11" (rated load)
7,716 lbs*	47'-6"
6,614 lbs*	54'-1"
5,511 lbs*	62'-8"
4,409 lbs	75'-5"
3,968 lbs	82'-0"
3,527 lbs	90'-6"
3,086 lbs	101'-2" (boom tip)
* LOADS ALLOWED WITH 4-PULL LINE CONNECTED ONLY	

13.3 With 4-pull line connected, the rated load is 4,000 kg (8,818 lbs). When the crane is operated with 2-pull line (4-pull line disconnected), the rated load is reduced to 2,000 kg (4409 lbs).

	WARNING
➤ Slings and lifting attachments are part of the load.	



07.13.2. LOAD CURVES WITH INCLINED BOOM



13.4 **Operating the crane with inclined boom**, the rated load is **1,000 kg (2,204 lbs)** all along the whole boom.

	WARNING
➤ Slings and lifting attachments are part of the load.	



07.13.3. LOAD CURVES WITH FOLDED BOOM

	
FOLDED BOOM	
LOAD	RADIUS
3,000 kg*	3.70 (min. radius)
	15.5 m (boom tip)
2,000 kg	15.5 m (boom tip)
* LOADS ALLOWED WITH 4-PULL LINE CONNECTED ONLY	

	
FOLDED BOOM	
LOAD	RADIUS
6,614 lbs*	12'-1" (min. radius)
	50'-10" (boom tip)
4,409 lbs	50'-10" (boom tip)
* LOADS ALLOWED WITH 4-PULL LINE CONNECTED ONLY	

13.5 With 4-pull line connected, the rated load with folded boom is **3,000 kg (6,614 lbs)**. When the crane is operated with 2-pull line (4-pull line disconnected), the rated load with folded boom is reduced to **2,000 kg (4,409 lbs)**.

	WARNING
➤ Slings and lifting attachments are part of the load.	



08. CRANE ERECTION

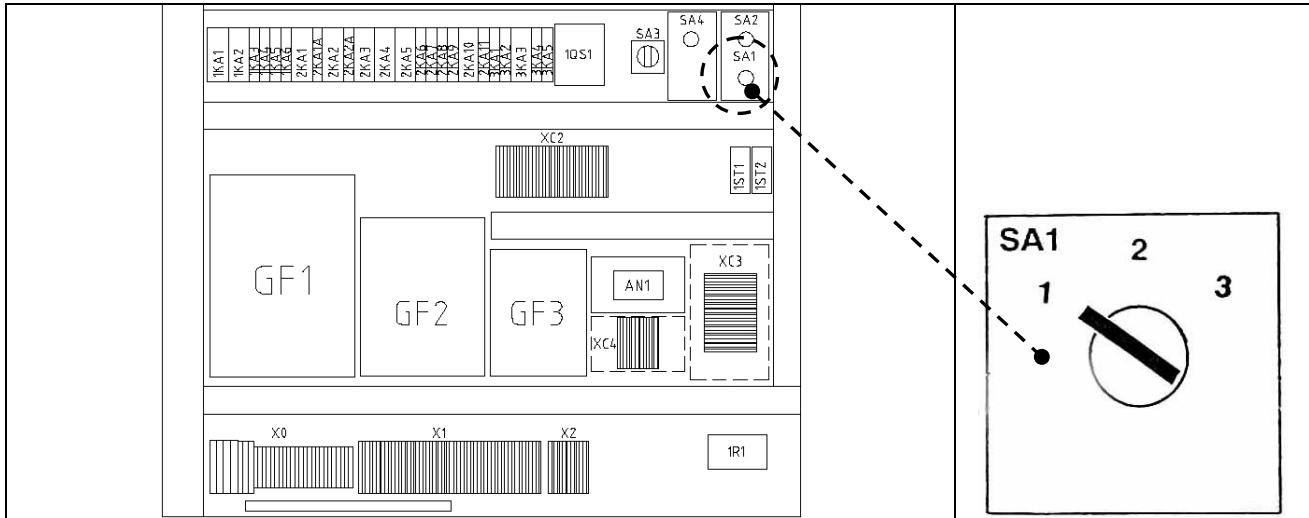
- 08.1. ERECTION PREPARATION 08-1
- 08.2. TOWER ERECTION..... 08-3
- 08.3. OPERATION BALLAST LOADING..... 08-14
- 08.4. BOOM UNFOLDING 08-19
 - 08.4.1. BOOM SECOND SECTION UNFOLDING 08-19
 - 08.4.2. BOOM THIRD SECTION UNFOLDING..... 08-25
- 08.5. PREPARATION FOR CRANE OPERATION 08-27
- 08.6. BOOM CONFIGURATIONS..... 08-29
- 08.7. 2-PULL LINE – 4-PULL LINE 08-30
 - 08.7.1. FROM 4-PULL LINE TO 2-PULL LINE..... 08-30
 - 08.7.2. FROM 2-PULL LINE TO 4-PULL LINE..... 08-31



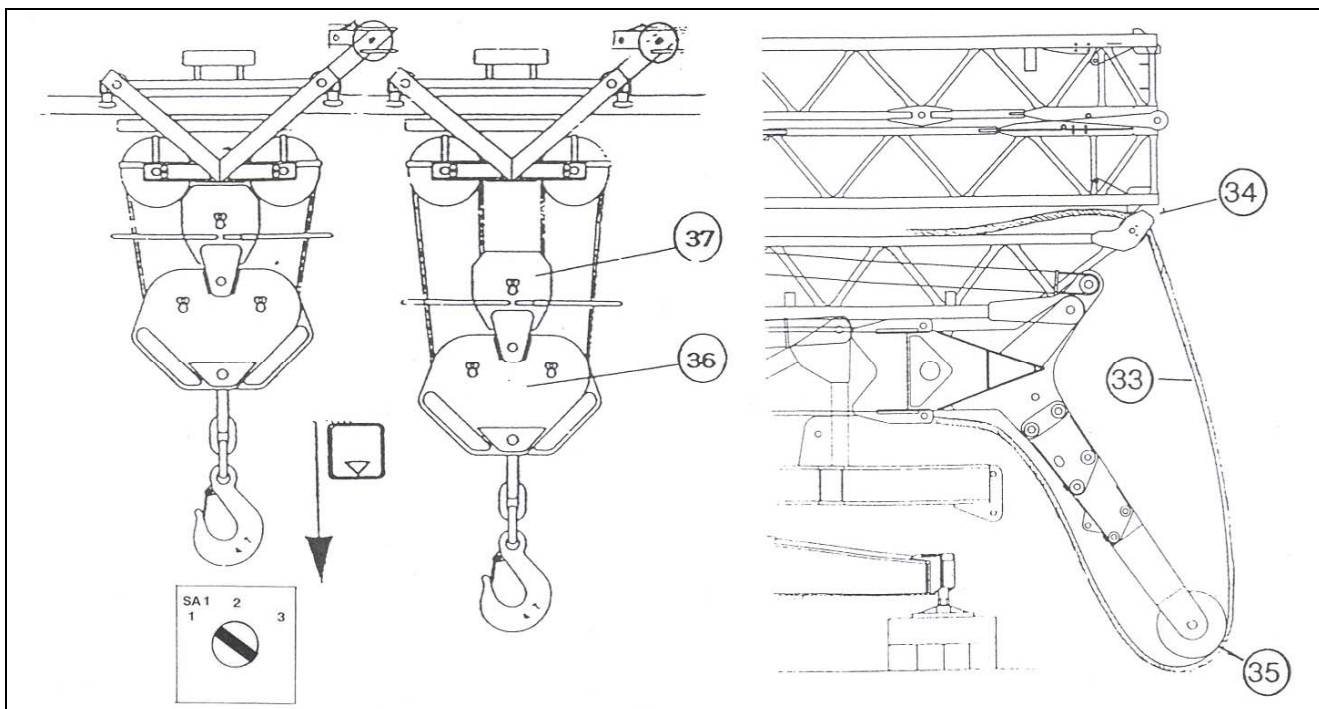


08.1. ERECTION PREPARATION

- 1.1 Open the crane electric cabinet and turn the selector switch **SA1** to position **1**.



- 1.2 Depress "DOWN" push-button to lower the block for a short distance and without resting it onto the ground.
- 1.3 Make sure that the derrick rests on its support so that, during crane erection, it will not interfere with the tower structure or with the braces.
- 1.4 Check that the rear stay rope **33** travels on the support roller **34** and rests in a central position on wheel **35** of the rear brace.



WARNING

- All erection operations shall always be carried out by an expert, trained and skilled operator only, well aware of all the machine characteristics and familiar with the contents of the present instruction



manual. The riggers can be supported by riggers' helpers, corresponding to the characteristics described at the paragraph 02.4.

- At the crane erection stage, the operator shall stand as far from the crane as allowed by the control board. Should it be required to approach the machine, for checks and inspections, the intervention shall be carried out with the crane at stand still, after making sure that the entire structure is stable.
- Erect the tower in windless conditions; maximum wind speed allowed **10 km/h (6.2 mph)**.
- When erecting the tower (selector switch **SA1** in position **2**) the load block moves towards the trolley, due to the shortening of the hoisting rope it hangs on. If required, and at any rate before two blocking, release push-button "UP" to stop erection. Turn the main power switch on the electric cabinet door to "OFF" position, open the cabinet door and turn selector switch **SA1** into position **1**. Close the cabinet door, switch the power on, depress "START" push-button and then "DOWN" push-button to lower the load block **4-5 m (13'-" – 16'-5")** under the trolley. At this point, switch the power off, open the cabinet door and turn selector switch **SA1** to position **2**. Close the door and switch the power on. Now depress "START" and then "UP" push buttons to continue with the erection operations.
- With selector switch **SA1** in position **1** and the boom second section unfolded or anyway not aligned with the first one, never depress trolley push buttons "NEAR" and "FAR", as this would start the trolley displacement with consequent releasing of enabling micro switch **5S1**, making it impossible to erect the machine.
- The hydraulic devices shall be used only for erection and dismantling. **Never use the hydraulic erection devices when the crane has a load suspended to the hook.** Danger of great damages for the hydraulic devices.

- 1.5 Should it be required to erect the crane with **inclined boom** (paragraph 07.7), and 2-pull line (paragraph 08.7.1), disassemble the movable rope guiding bracket **44** fitted on the load block for 4-pull line **37** towards the tower. Extract the two hitch pins and remove the bracket; failure in carrying out this operation would cause the inclined boom to scrape against bracket **44**.

**WARNING**

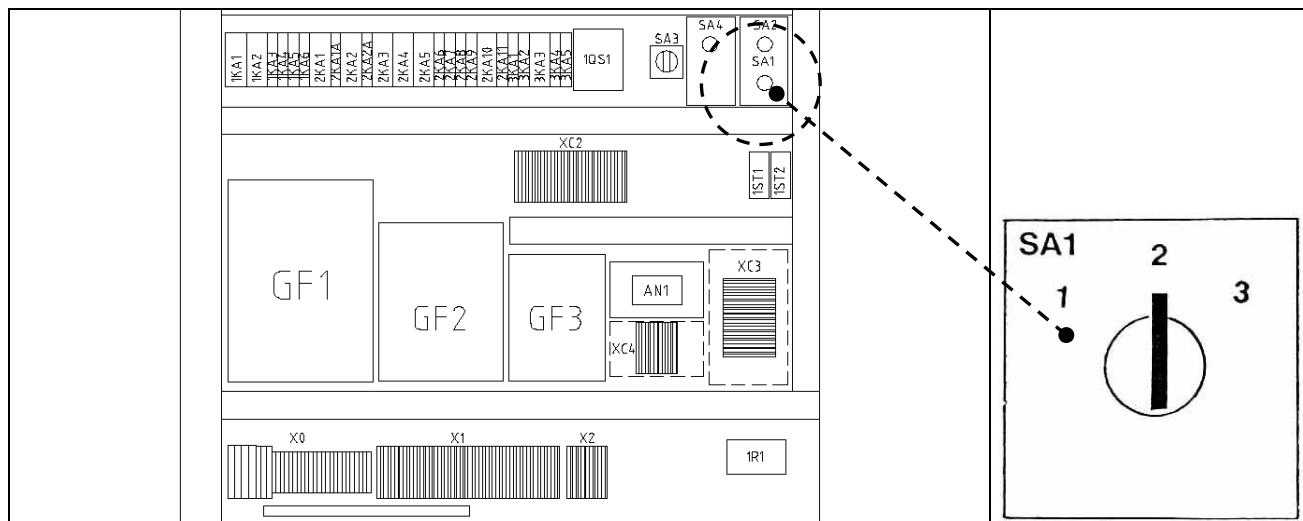
- **Before starting the operations for tower erection, make sure nobody is gaining access or standing in danger zones A, B, C. Moreover, carefully verify that nobody enters to these zones for the whole duration of the erecting operation, until the crane is fully up and erected.**
- **Operations for crane erection and dismantling shall be controlled exclusively by the wire control board and not by the remote control.**

- 1.6 If it is intended to operate the crane with **inclined boom**, make sure to have carried out all the instructions of the paragraph 07.7.



08.2. TOWER ERECTION

- 2.1 Open the crane electric cabinet and turn selector switch **SA1** into position **2** "ERECTION".

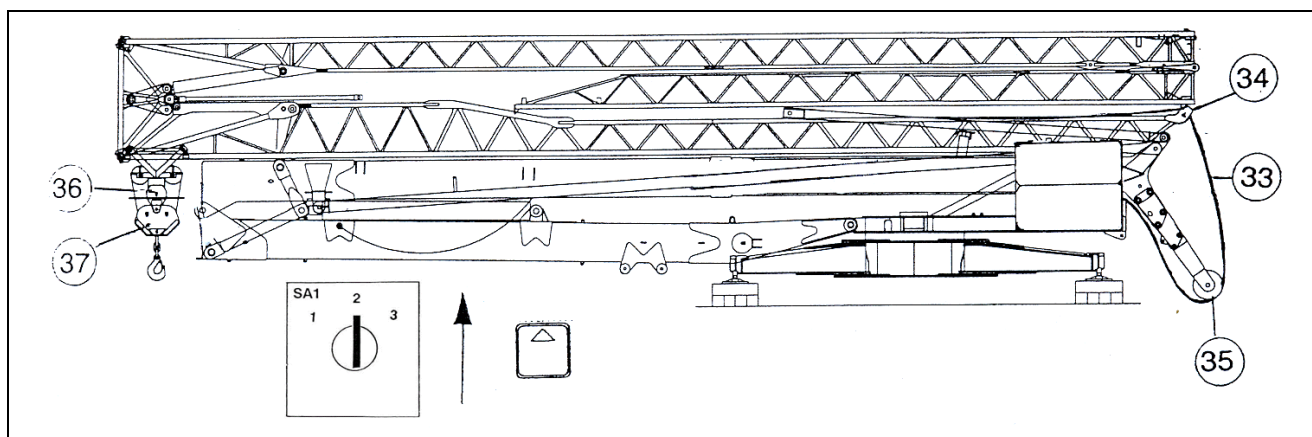


- 2.2 Prior to start crane erection go through the following checks.
- o Check the oil level inside the hydraulic station through the level indicator hole or by dipstick.
 - o Check for efficiency of the hydraulic cylinders and of hydraulic equipment in general (valves, pump, pipes, flexible hoses, etc.), verifying the integrity of all components. If any component should show any signs of damage, immediately call the technical assistance for component or part replacement.
 - o Make sure there is no water or air inside the hydraulic circuit (paragraph 04.8.1).
 - o Make sure the the load block has been lowered and the screws locking the first and the second boom sections have been removed.
- 2.3 **Erection can be carried out only after going through the above checks and inspections. Carrying it out on disregard of the operations indicated in paragraph 04.8.1 may lead to uncontrolled movements, with consequent damages to the machine structural parts, and risk of machine overturning.**
- 2.4 Switch the power on by the main switch fitted on the electric cabinet of the building site. Turn the main power switch of the electric cabinet of the crane to "1" position.

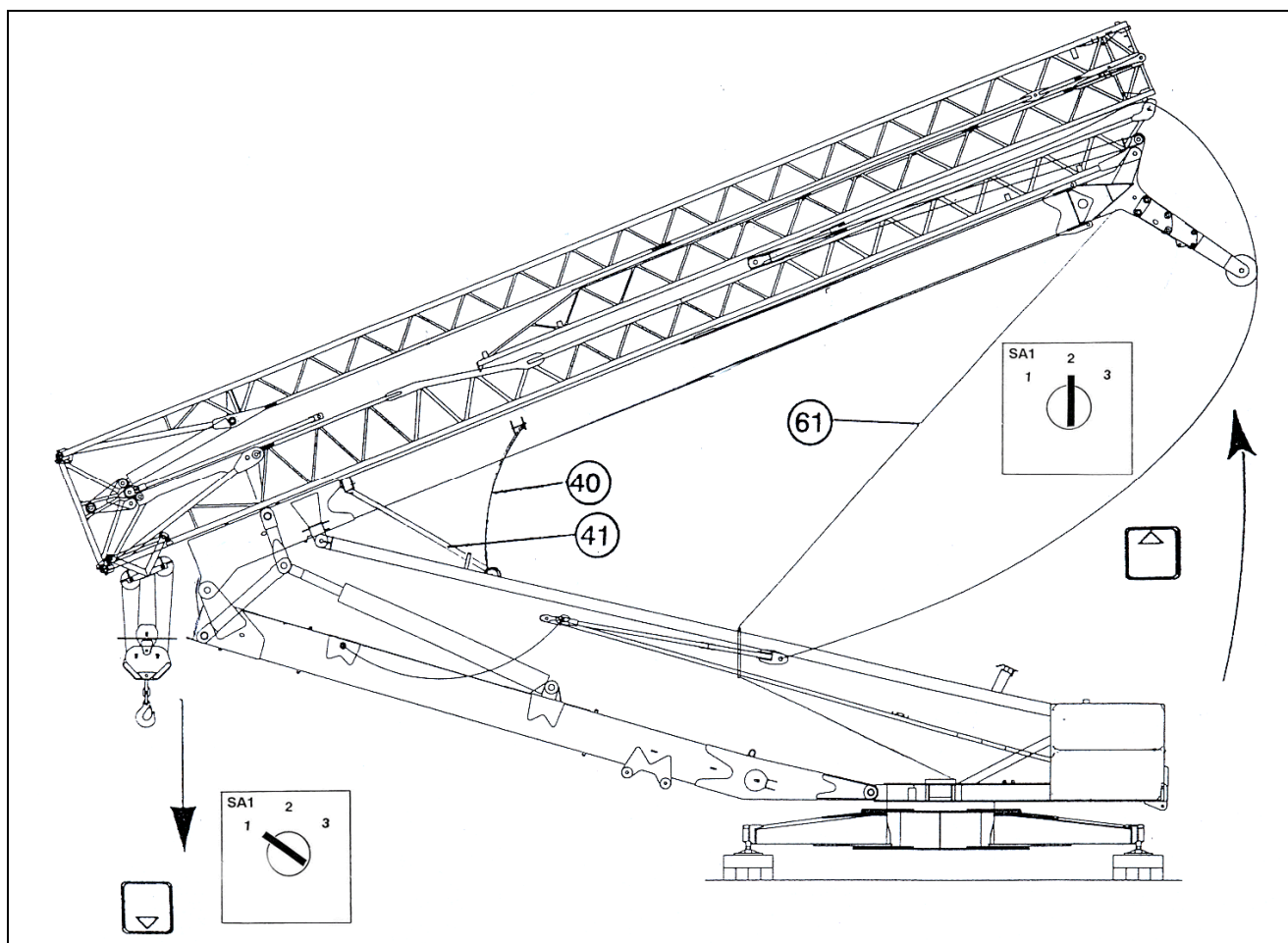


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- 2.5 Depress "START" push-button on the control board to start the hydraulic station motor, which will be stopped, if required, by means of the "STOP" push-button.
- 2.6 Run the hydraulic unit for a few seconds, then depress "UP" push-button and start erecting the tower.

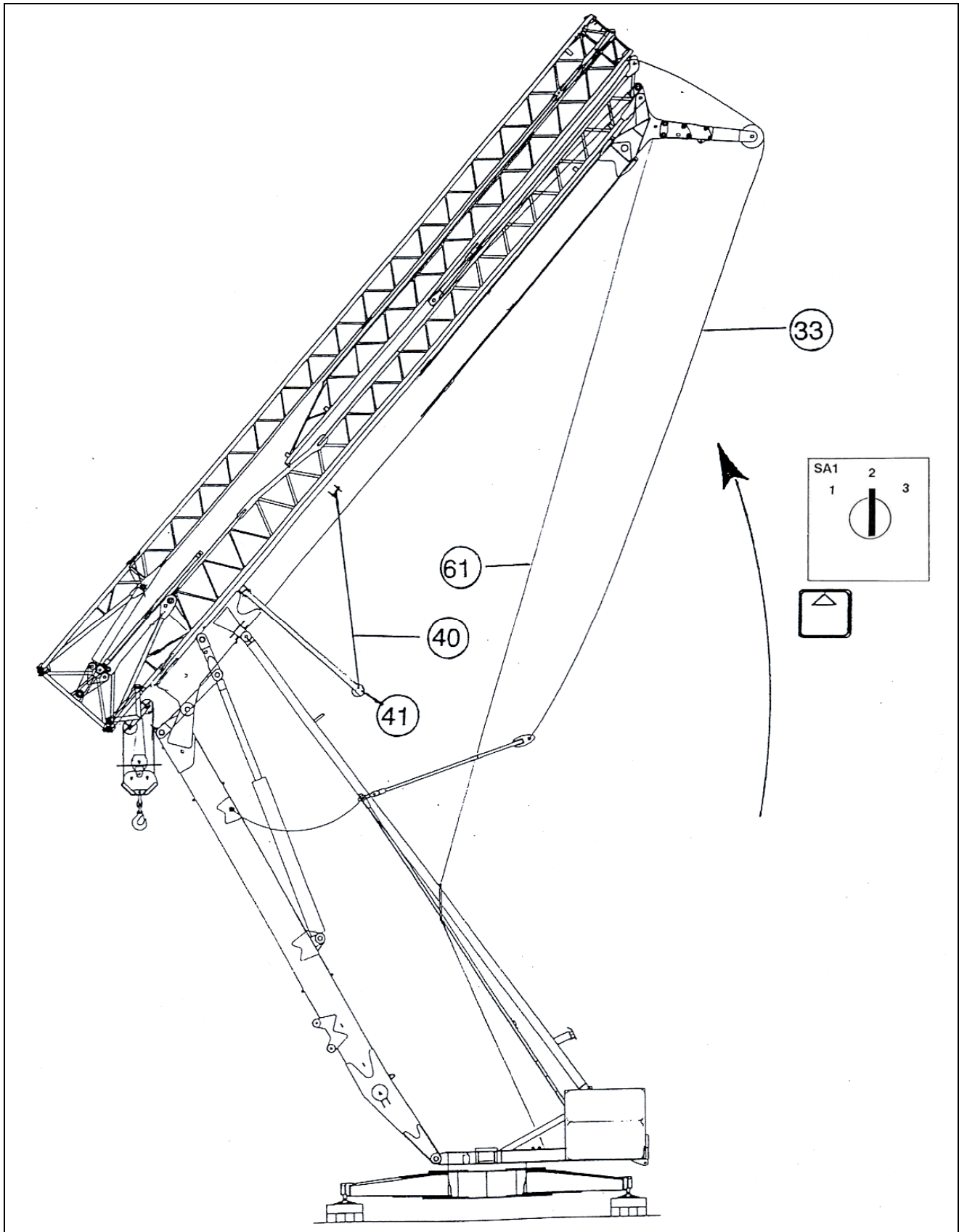


- 2.7 Proceed erecting the tower making sure that nothing prevents its free movement and that the tie rods do not entangle. When required, stop the "UP" movement of the tower and lower the load block to the ground, so that it will not crash against the trolley. As soon as the front extremity of the tower rises above the ballast blocks **400/2**, move the access ladder **A-B-C** (if installed) into their operation positions (paragraph 16.2).





- 2.8 Continue erecting the tower, checking the correct progress of the operation. Rising the tower, the stay rope **33** is going to be tensioned, while the boom is going to lift from the tower.



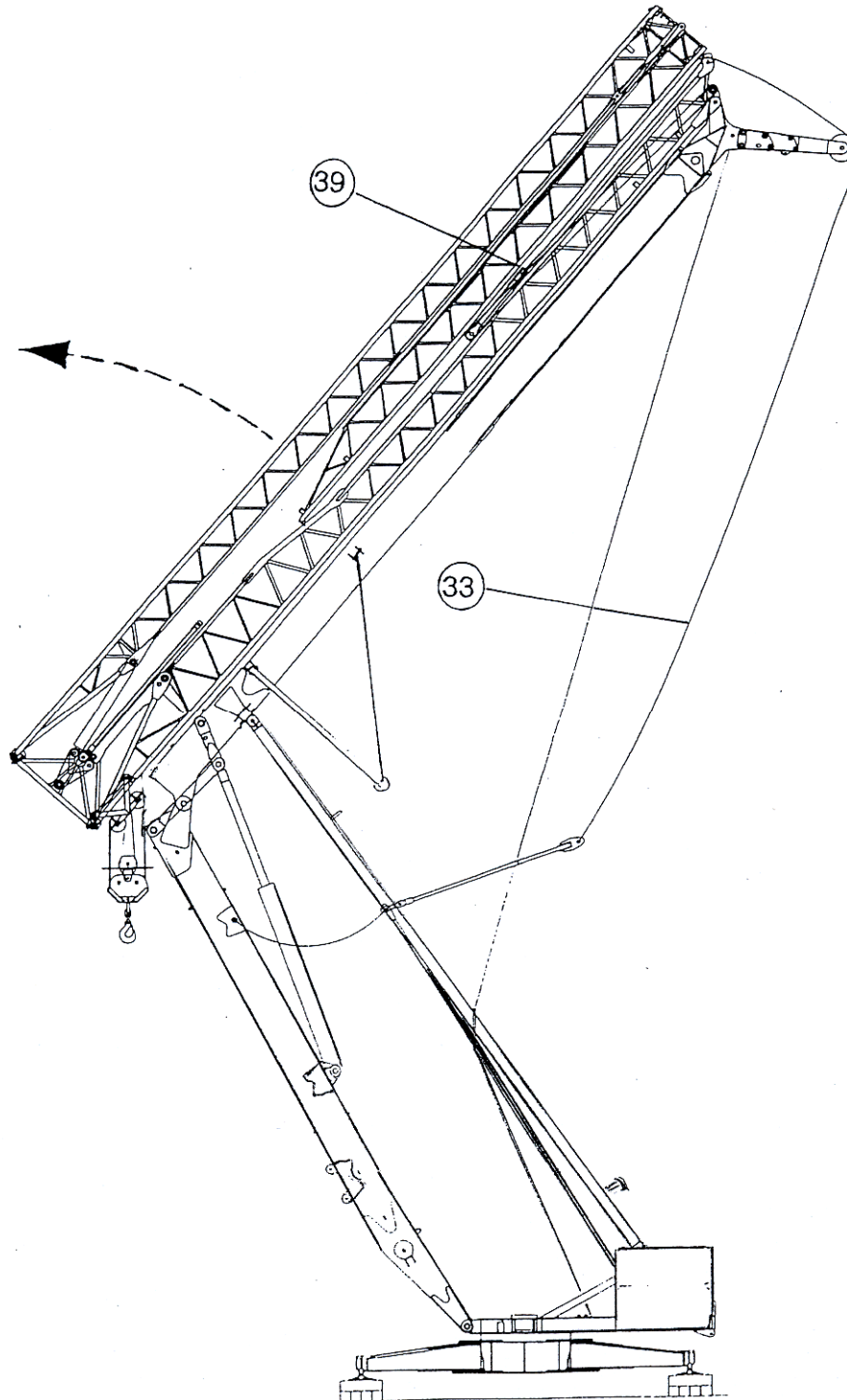


- 2.9 Continue erecting the tower, until the rear stay rope **33** is going to be tensioned. To allow the rotation of the brace **39**, it takes to partially unfold the boom.



WARNING

- The boom shall be unfolded before the rear stay rope **33** is tensioned to prevent serious damages to the crane structure.



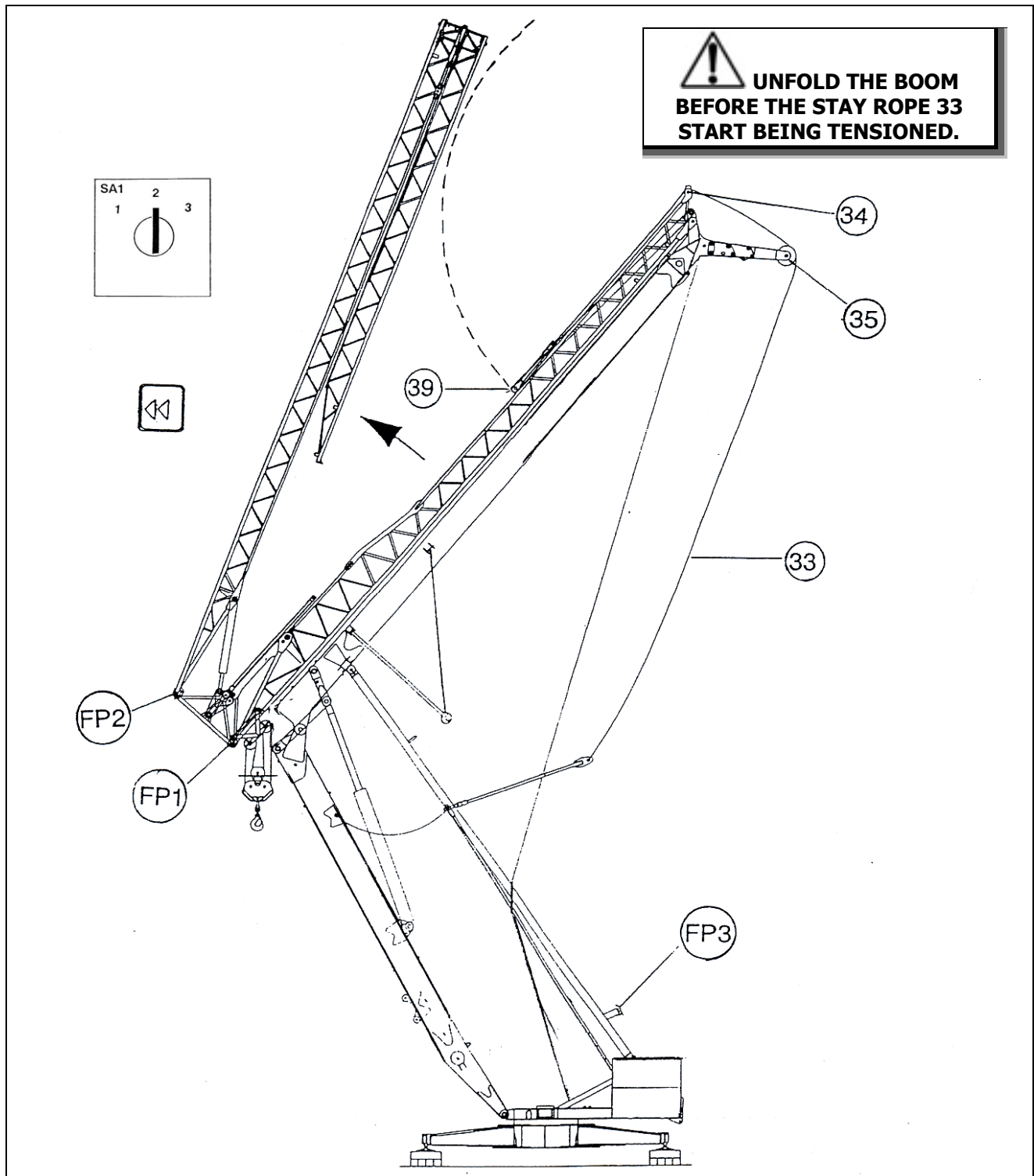


- 2.10 Depress "FAR" push button to unfold the boom to an inclination of **20°** to the upper tower axis, or anyway so much as to allow the brace **39** to turn during the further operations due to the effect of the rear stay rope **33**. The maximum unfolding position is signalled by the acoustic warning.



WARNING

- Without enabling from micro switches **FP1**, **FP2** and **FP3**, given only when the operation ballast blocks **400/3** are loaded on the base frame, the boom will not open beyond a certain angle.



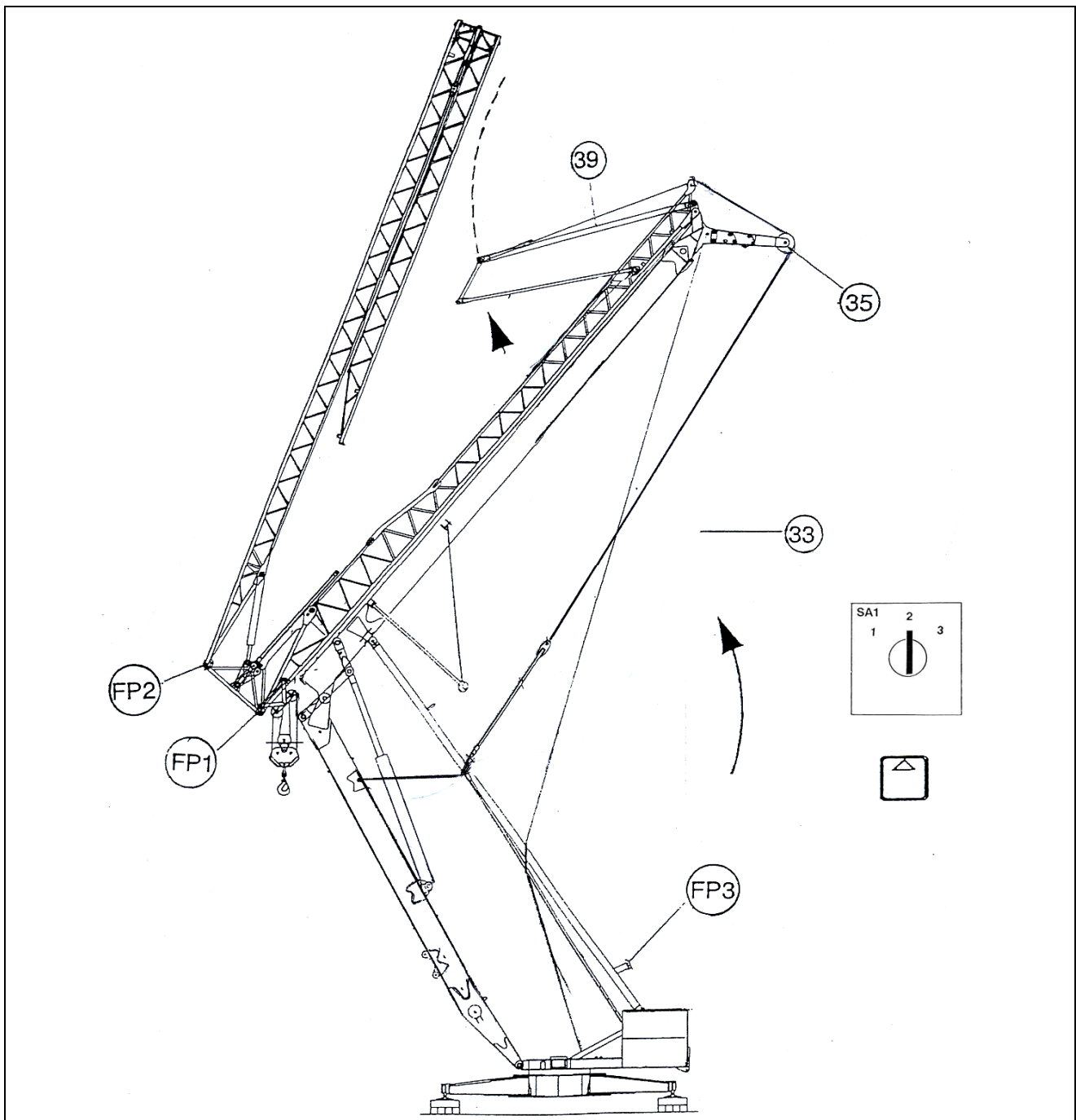


- 2.11 Act on "UP" push-button to proceed with crane erection. When the rear tier rod **33** start being tensioned, the brace **39** turns till it tensions the boom tie rod **38**.



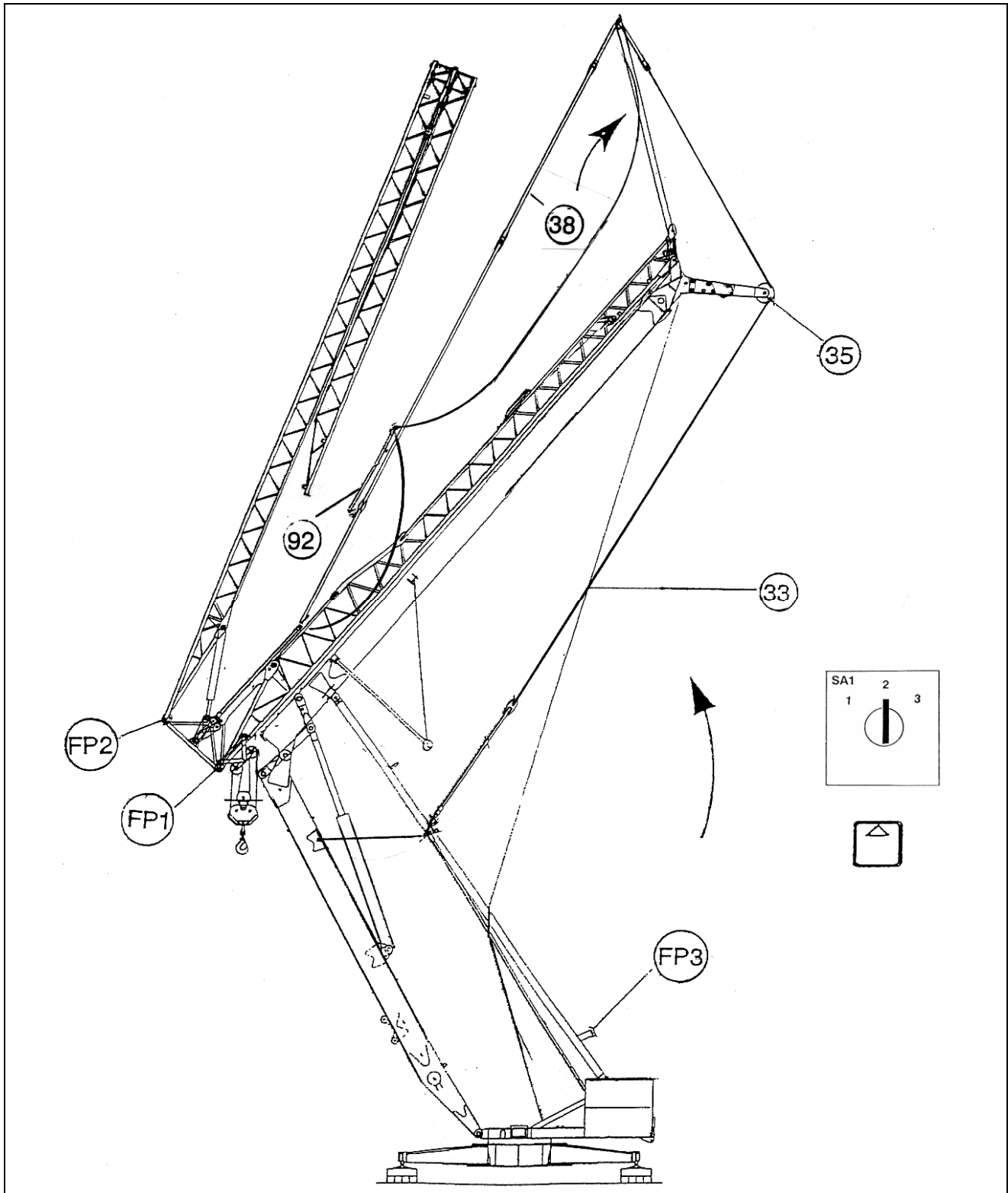
WARNING

- Serious damages to the crane structures may derive from the boom not unfolded to such a position to allow cusp **39** to rotate, as well as from failure in checking that, during the various operations, tie rods, braces, ropes and all structural elements rotate freely or move without any interference.



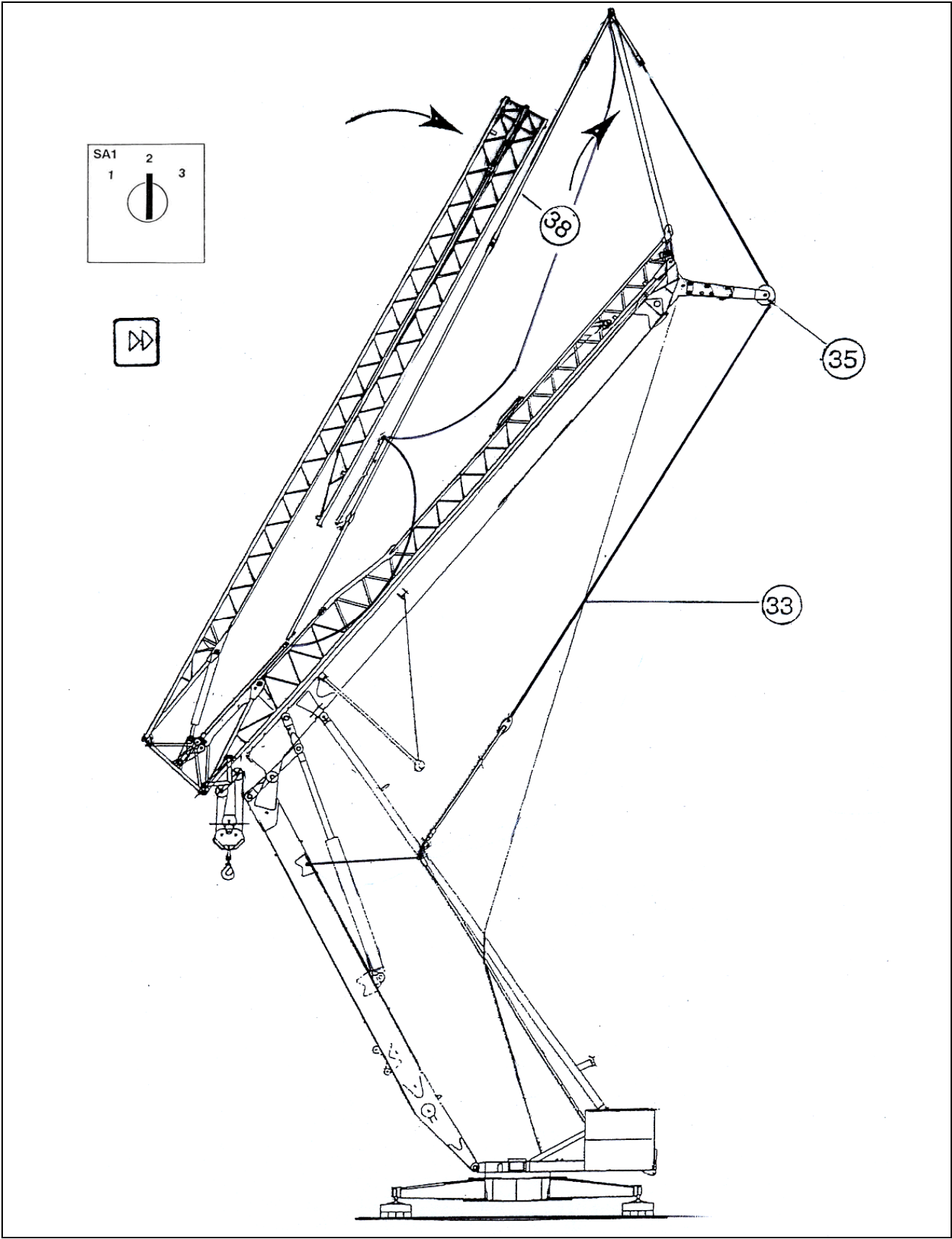


- 2.12 Continue erecting the tower. The rotation of the cusp **39** causes the tension of the tie rod **38**; the auxiliary brace **92**, supporting the tie rod **43** keep on resting on the tie rod **38**.
- 2.13 Continue erecting the tower, until the brace **39** is in its final position and the tie rod **38** is tensioned.



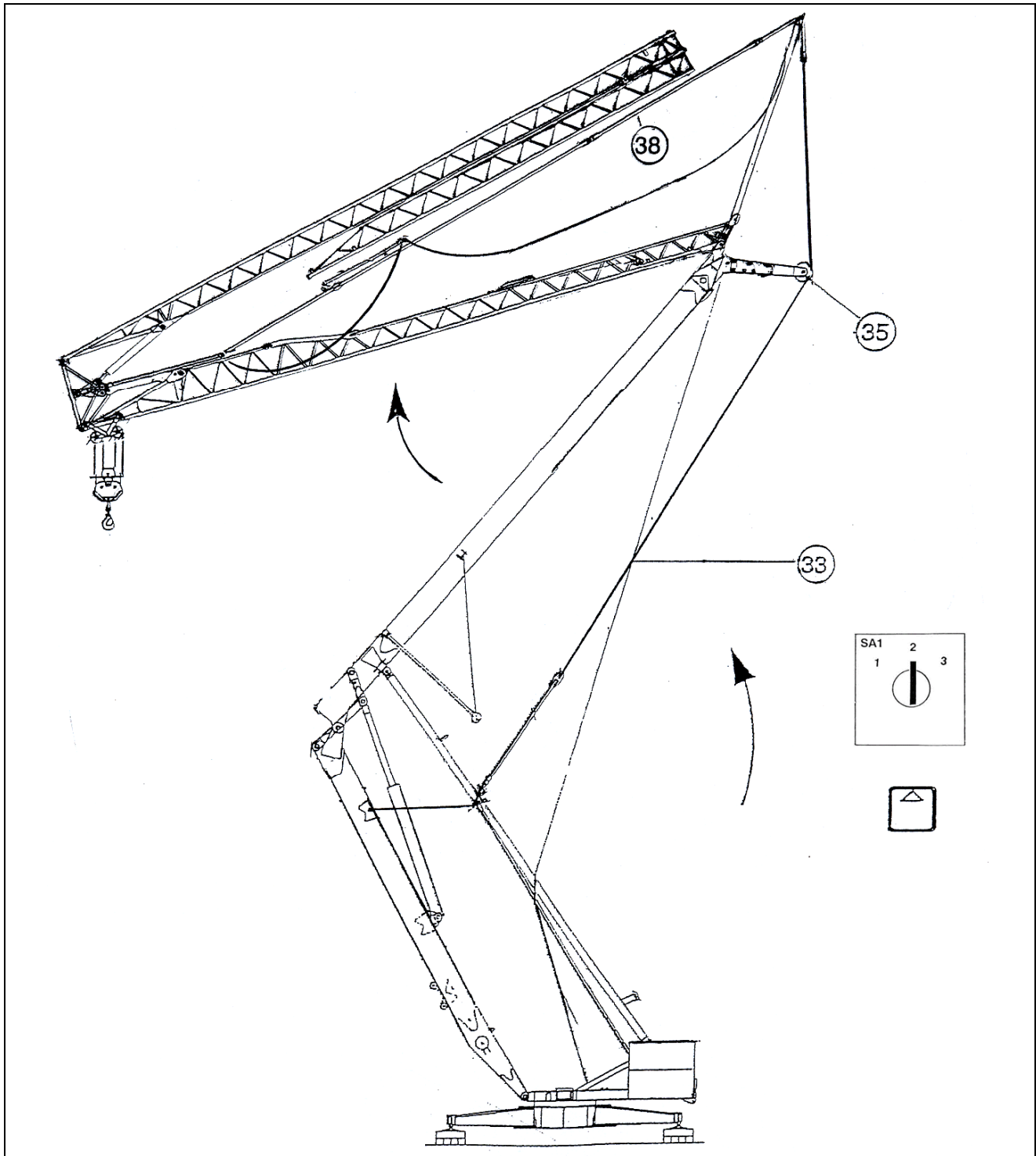


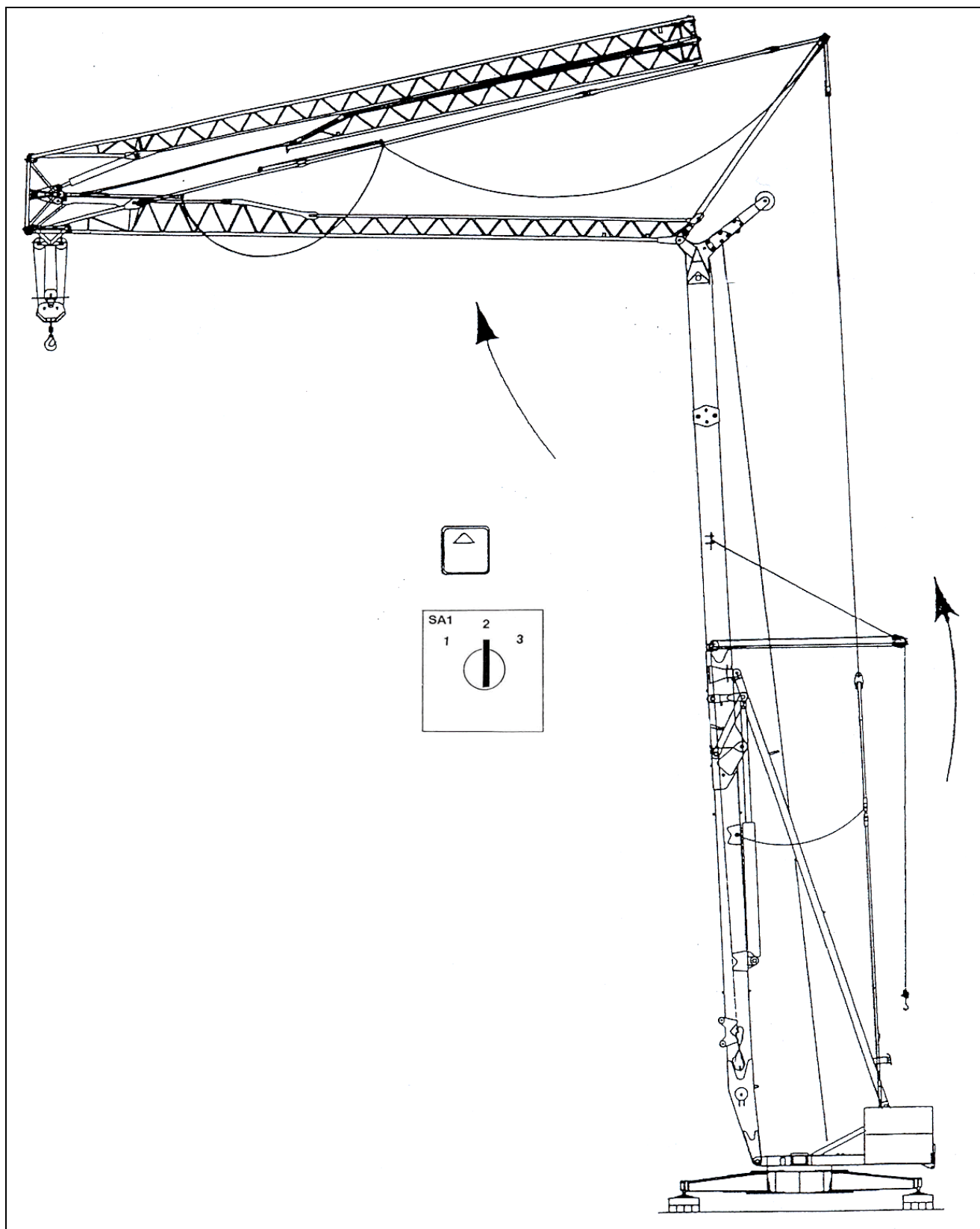
- 2.14 Before proceeding further with crane erection, push the button "NEAR" to fold the boom until it slightly rests on the tie rod **38**.





- 2.15 Continue erecting the tower. Owing to the tension of stay rope **33** and tie rod **38**, the boom is going to lift from the tower rotating around the articulated joint at its end. Check the regularity of this movement, and that it happens with no obstacle.
- 2.16 When the detachment of the boom from the tower takes places, this is the condition of main stress for the tower erection cylinder. If needed, increase the pressure of the pump of the hydraulic installation.





- 2.17 Proceed with crane erection until the two tower elements are vertical and aligned. Slightly depress the "UP" push-button until the hinge, joining the two elements, is fully closed.
- 2.18 When the tower has been erected, load the ballast on the crane base frame (paragraph 08.3) before unfolding the boom.



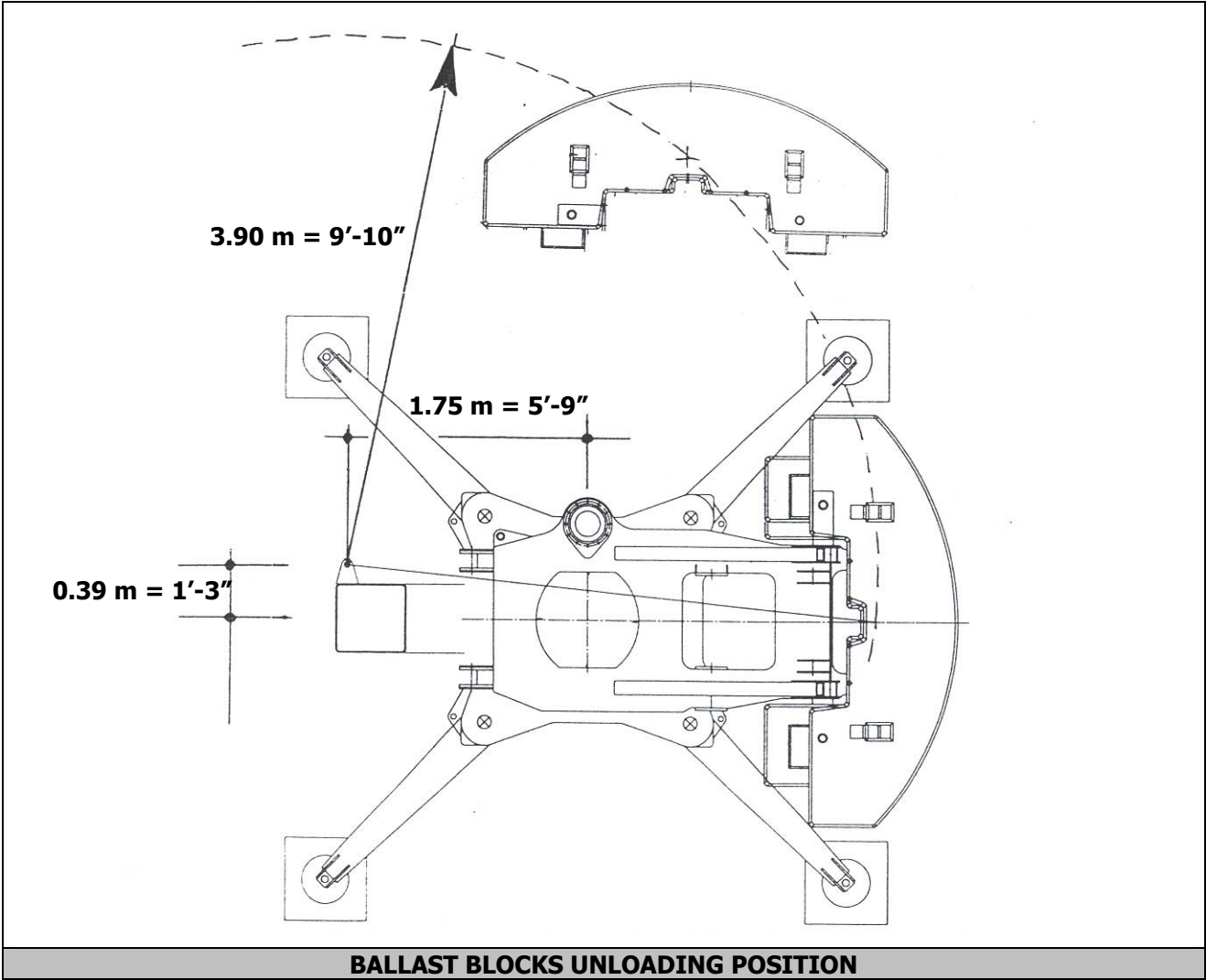
- 2.19 If it's meant to operate the crane with folded boom, turn the selector **SA2** into position **3**, to enable the trolley far limit switch **4S10** at the end of the first boom section. **Anyway, before operating the crane, load the complete ballast**, according with the instructions of the [paragraph 08.3](#).

	WARNING
➤ If the load block is not lowered when required during tower erection, there subsists a risk of damages to the rope or structures. ➤ The crane cannot be left unattended without ballast. Should it be not possible to complete ballasting immediately after erection, lower the tower back. On the contrary, even a light wind may overturn the crane. ➤ Prior to ballast loading, check that the tower is perfectly vertical; if required, adjust level by acting on screw stabilizers.	



08.3. OPERATION BALLAST LOADING

- 3.1 The operation ballast is formed by **19 blocks 400/3**; each block weighs **1,300 kg (2,866 lbs)**, giving a total weigh of **24,700 kg (54,454 lbs)**.
- 3.2 Unload the blocks from the truck in the building site by means of an auxiliary lifting mean that allows to lift the blocks from the trucks and to place them close to the crane along the rotation circumference of the derrick.
- 3.3 To prevent the derrick rope to pull slantwise, the center of gravity of the unloaded blocks shall be on the vertical line that the derrick end can reach in its circumference of rotation. To sling the block always use only the two-rope tie rod diameter **12 mm (0.472 in)** with two hooks, supplied with the crane, that shall be hooked to the hook of the derrick.



WARNING

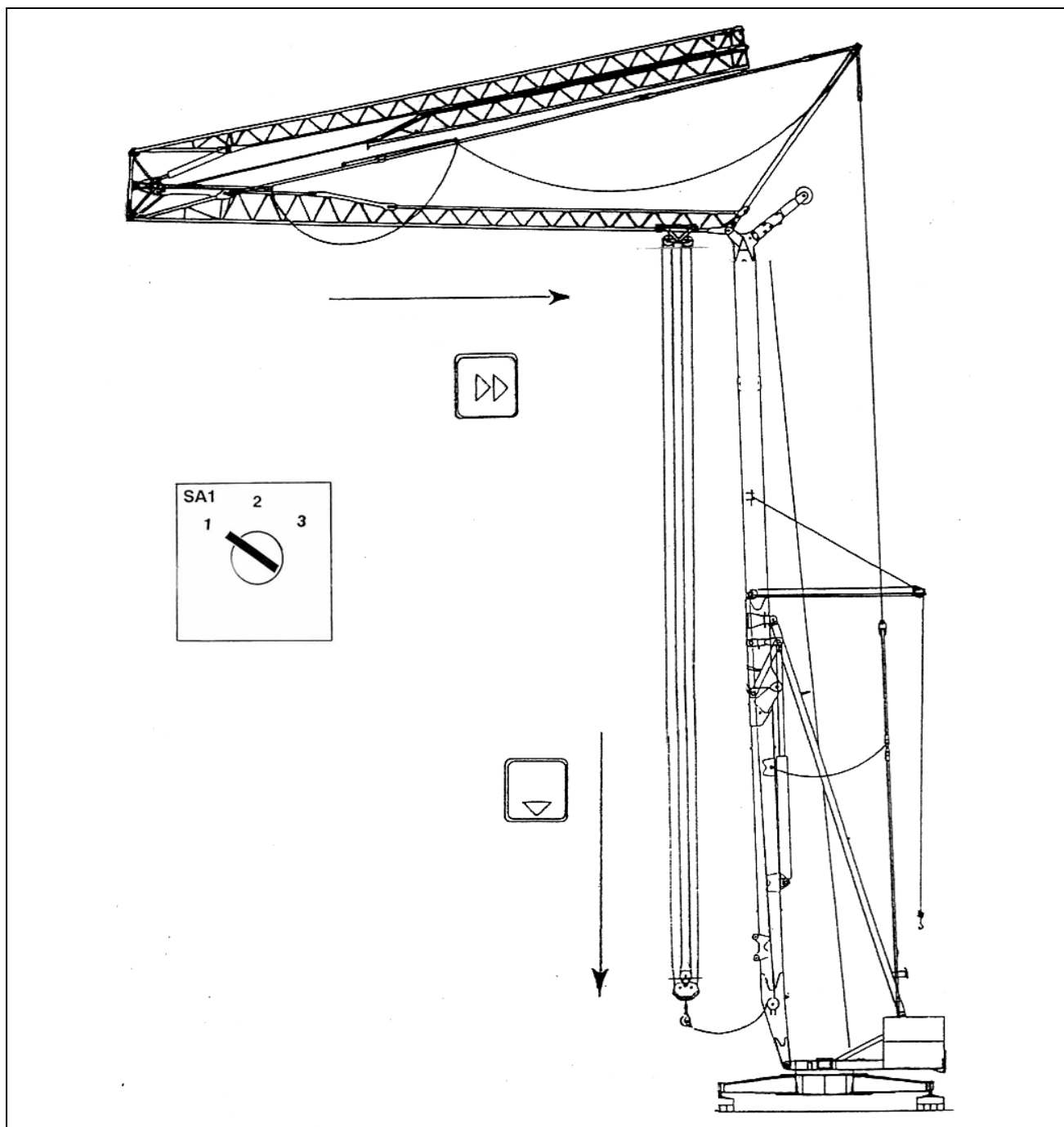
- During the ballast blocks movement, hook a nylon rope to the block lifted by the derrick, in order to pull it sideways and to manage it.
- Before displace the ballast blocks, make sure of their integrity, in particular for what concerns the hooking eyelets. A sudden breakage during the lifting engenders a danger for the exposed persons



and may impair crane stability.

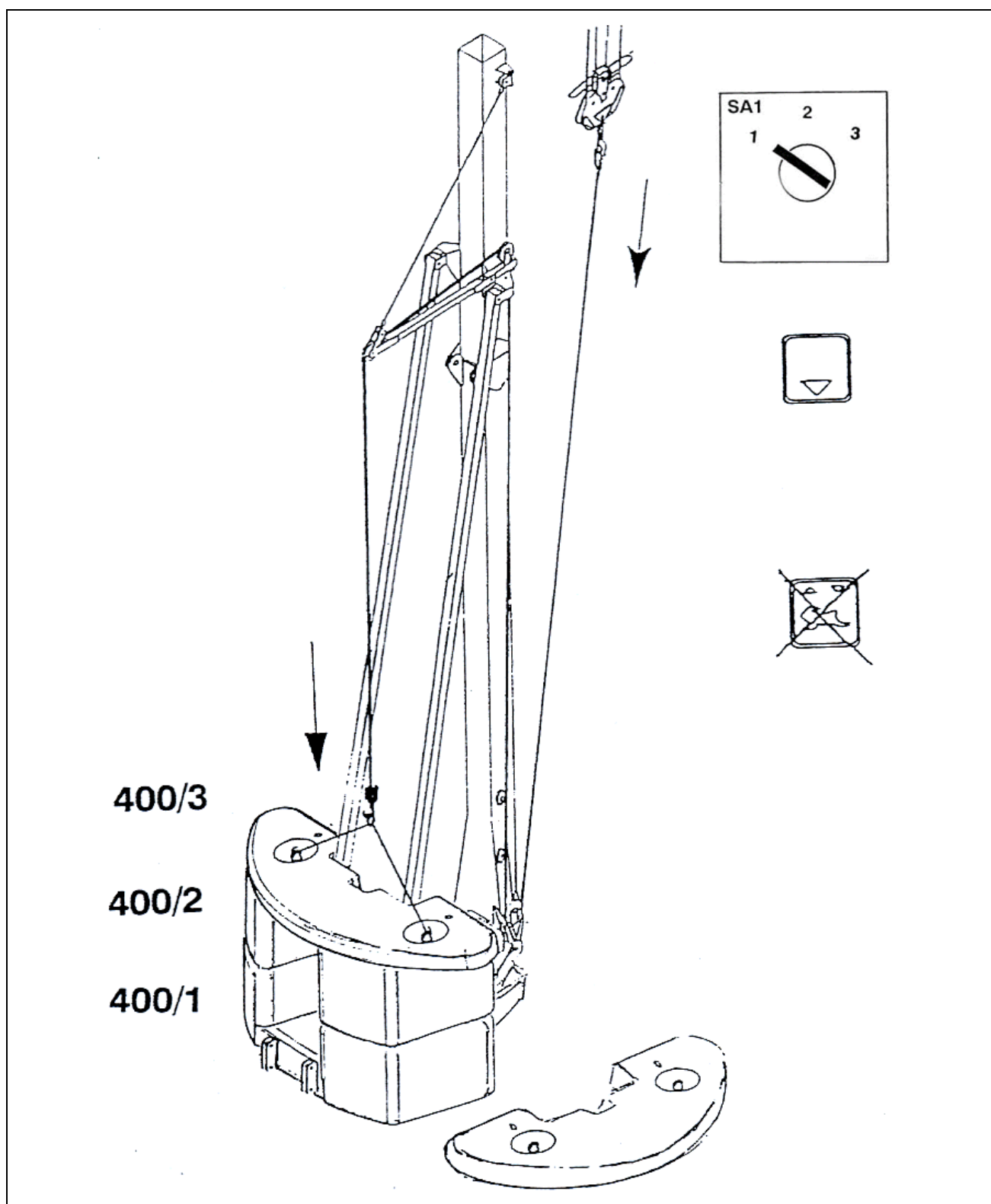
- Should the handles warp or damage during use or movement, they shall never be straightened.
Replace the entire block.

- 3.4 Turn the selector switch **SA1** inside the electric cabinet into position **1 OPERATION**.
- 3.5 Action on the control board lower the hoisting hook at **1.5 meters (4'-11")** from the round and move the trolley back near the tower till it's stopped by the limit switch. Unwind the derrick rope from the hooks and hook the grommet of the hoisting rope.
- 3.6 Check the correct assembly of the block lifting rope.
- 3.7 Make sure that the hoisting hook of the derrick, rotating around the articulation on the tower in the horizontal plan, is on the vertical line of the center of gravity of the blocks that shall be loaded on the crane.



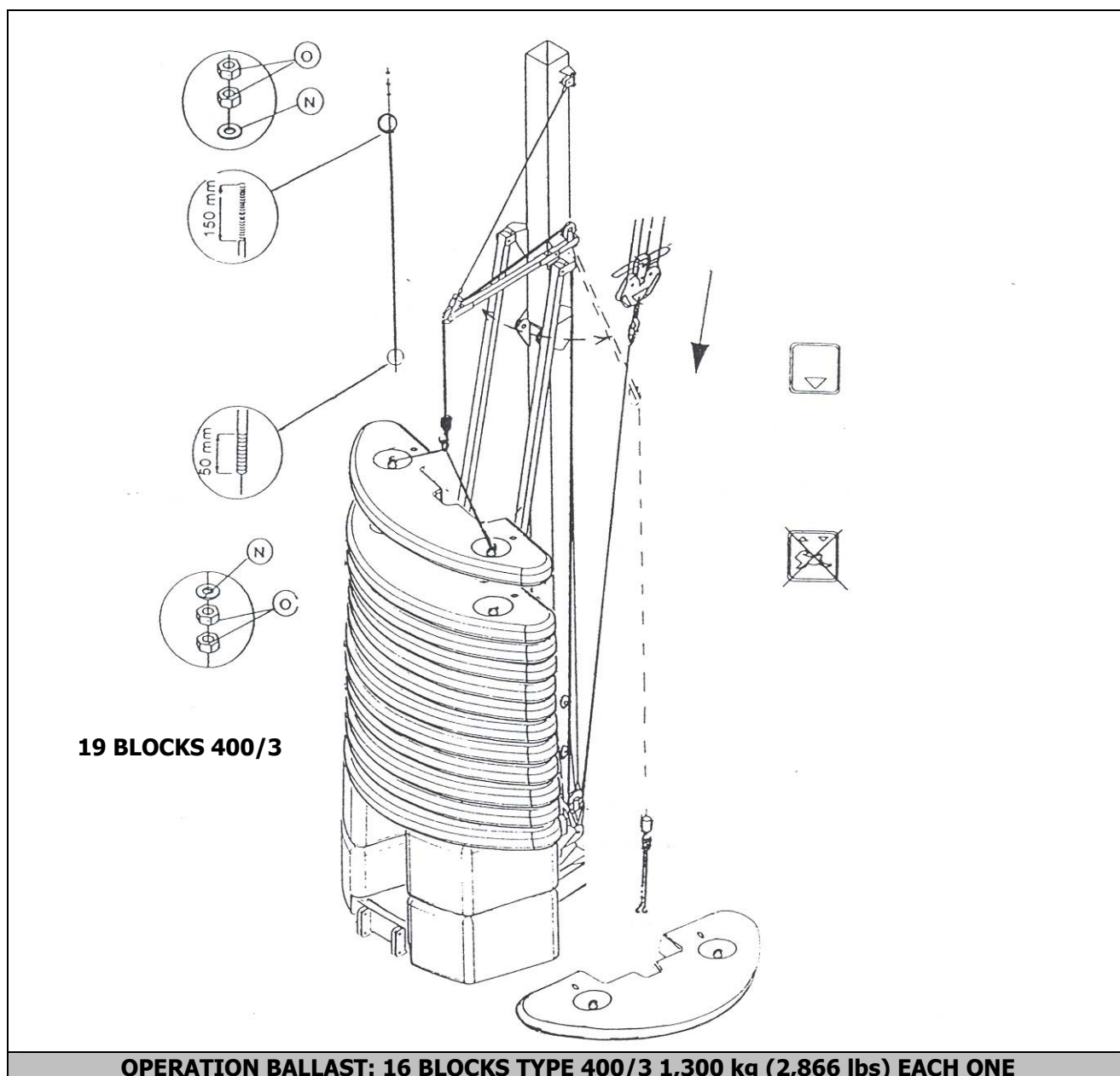


- 3.8 Hook with the derrick hook the first block weighing **1,300 kg (2,866 lbs)** and, acting on the control board with the hoisting micro speed, lift it to a sufficient height to place it over the blocks **400/2**; pushing it sideways, make the derrick rotate moving the block **400/3** over the blocks **400/2** already installed on the base frame.
- 3.9 Make the block **400/3** lower onto the blocks **400/2**, always at the micro speed; check the alignment of the block **400/3** with the block below. The operator handling the block shall hold the provided side handles.





- 3.10 Lift and lower the second block **400/3**.
- 3.11 Proceed with the same procedure with loading all the **19** blocks type **400/3**; check the correct alignment of the block with the ones below and the alignment of the centring holes.
- 3.12 After loading a certain number of blocks **400/3**, when the operator needs it to handle the blocks, it takes to assemble on the internal part of the blocks the platform that allows the operator to carry out his task easily.
- 3.13 In any case, when the operator needs to a height over **2 meters (6'-7")** from the ground, he shall wear a safety belt with double hook so that at least one of the hook is fixed to the provided hooking points.



- 3.14 After loading the last block, fix the block stack by means of the two passing tie rods **M** (paragraph 05.1.2) fixing them with nuts and washers.
- 3.15 Fix the derrick against the rear tie rod. Wind the derrick rope on the supports placed in the lower part of the tower.



	WARNING
➤ The use of fast hoisting speed may cause deformations or breakages. ➤ The operator pushing the block shall remain sideways displaced to prevent the risk to be involved in an accidental falling of the block. ➤ If the trolley is not moved back near the tower to lift the ballast blocks, there subsists the risk of crane overturning. ➤ Never use the crane hoisting hook, even if the crane is partially ballasted, to move other ballast blocks inside the derrick rotation area; there subsists the risk of overturning. ➤ If the rope pulls slantwise, there may have deformations or the rope may slip out of sheaves. ➤ Never swing the crane being a ballast block suspended to the derrick; danger of deformation for the structures or for the rope to slip out of the sheaves. ➤ If it's needed to access to the upper parts of the crane or of the ballast at a height over 2 meters (6'-7") from the ground, use a safety belt with double hook. ➤ As an alternative, the ballast blocks may be loaded by a lifting mean with suitable load. If the operation is carried out this way, don't damage the block and remember: load the complete ballast, check the stability of the stack and fix the block by means of the tie rod supplied.	



08.4. BOOM UNFOLDING

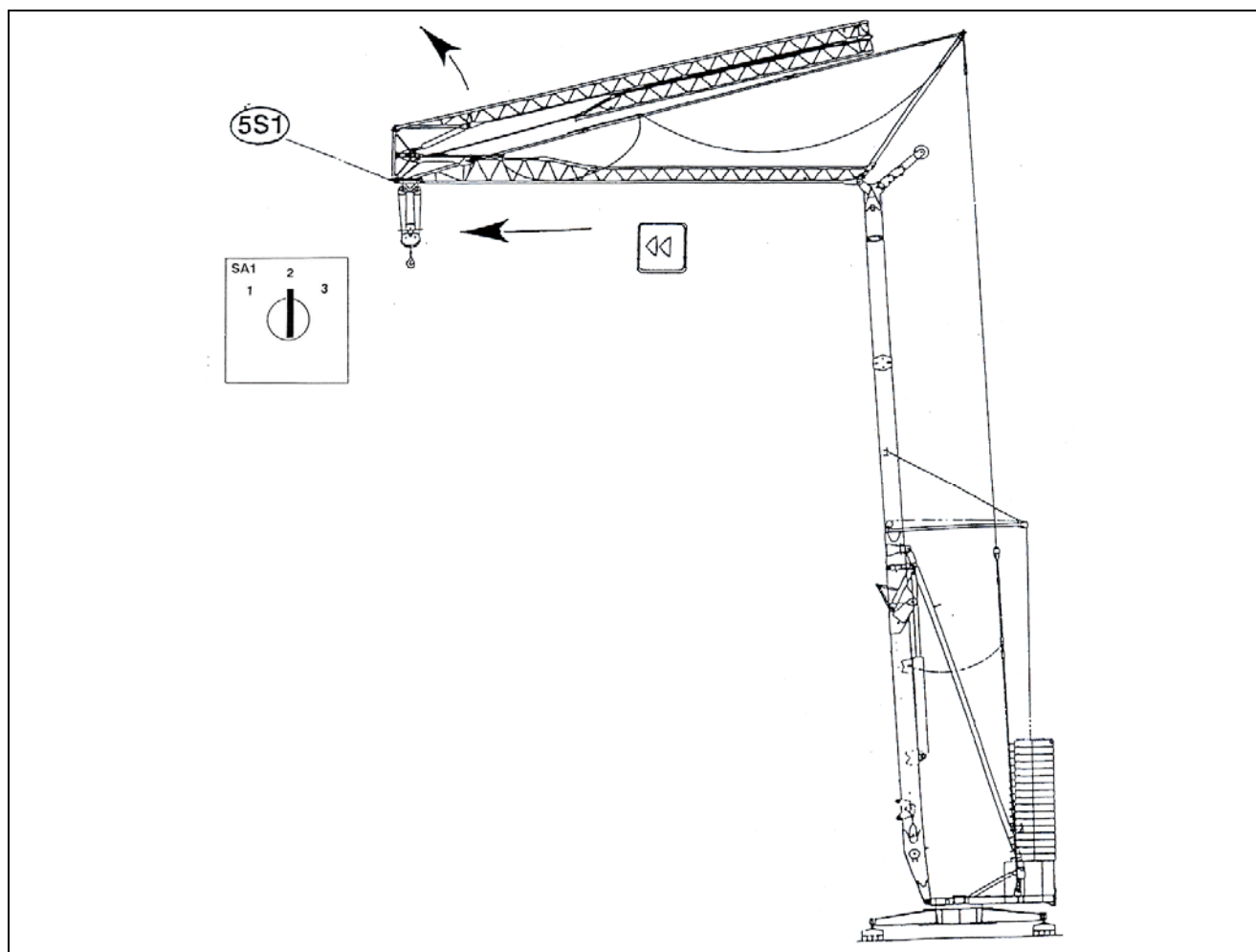
08.4.1. BOOM SECOND SECTION UNFOLDING



WARNING

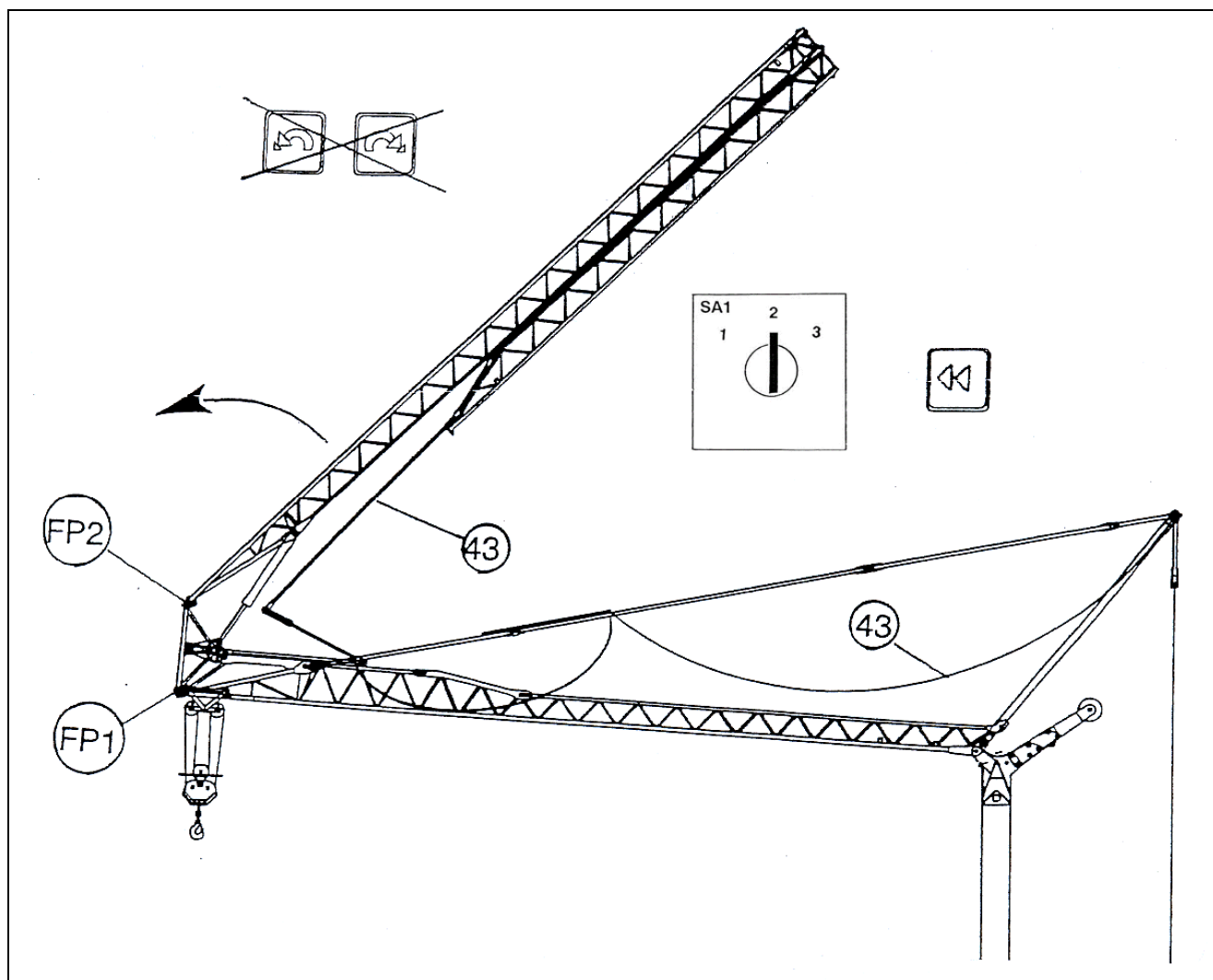
- **The boom may be unfolded only if the complete ballast has been loaded onto the base frame (paragraph 08.3) and with the enabling of the micro switch FP3 (ballast on board). If the ballast is not complete, danger of crane overturning.**
- Boom may be unfolded **without wind** only, max. wind speed allowed **10 km/h (6.2 mph)**.
- Before starting boom unfolding, complete the hydraulic equipment checks (paragraph 04.8.1).

- 4.1 Once completed the loading of the complete ballast, proceed with boom unfolding.
- 4.2 Turn selector switch **SA1** to position **2 ERECTION**.
- 4.3 Press "FAR" on the control board to move the trolley forwards on the boom to reach the micro switch **5S1** (paragraph 07.5) by the articulation between the first and the second boom section, where it will be automatically stopped.
- 4.4 Keep the "FAR" push-button depressed to start unfolding the second section of the boom. Proceed with this operation, always making sure that the movement is regular, that tie rods and ropes don't entangle, that the braces and the mobile elements slide regularly.





- 4.5 **It is forbidden to swing the crane at any intermediate stage of boom unfolding.** The oscillations caused by the swing may seriously damage the machine structural and mechanical parts.
- 4.6 With the enabling of the positioning micro switch **FP3**, boom unfolding may proceed over the position limited by micro switches **FP1** and **FP2** when the complete ballast is not on board.

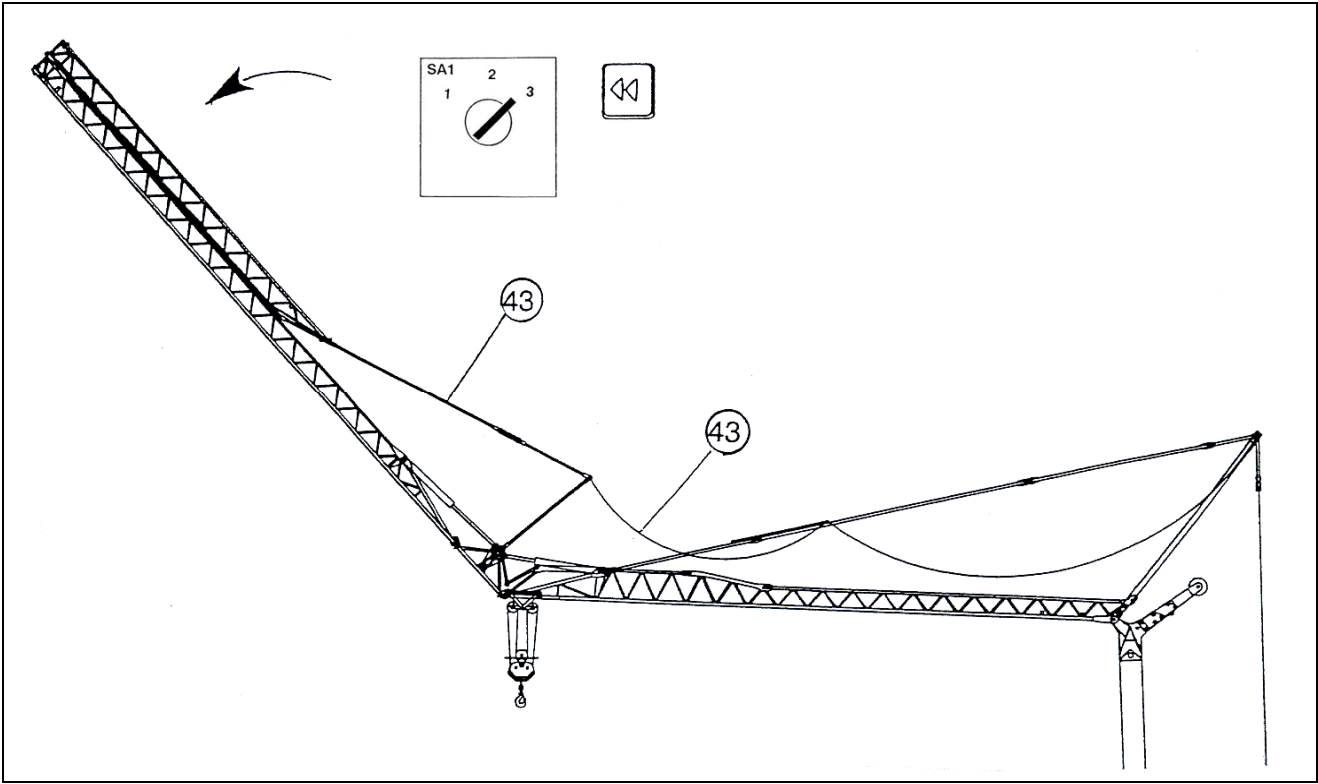


WARNING

- When unfolding, check that tie rods and ropes do not entangle and that all movements of the structural parts are carried out without any abnormal resistance or friction.
- The unfolding of the boom shall be led in the absence of wind, especially side wind. In case of sudden gusts of wind, bring the boom back, in its starting position, resting on the tie rod **38** and wait that the weather turns better to allow the operation.



- 4.7 Continue unfolding the boom, until the front part of the stay rope **43** is going to be tensioned, forcing against the third section of the boom (following picture).



- 4.8 To be allowed to continue boom unfolding over the position shown in the previous picture, it takes to open along a certain angle the third section of the boom so that, when the stay rope **43** starts tensioning, there are no interferences with the third section of the boom.

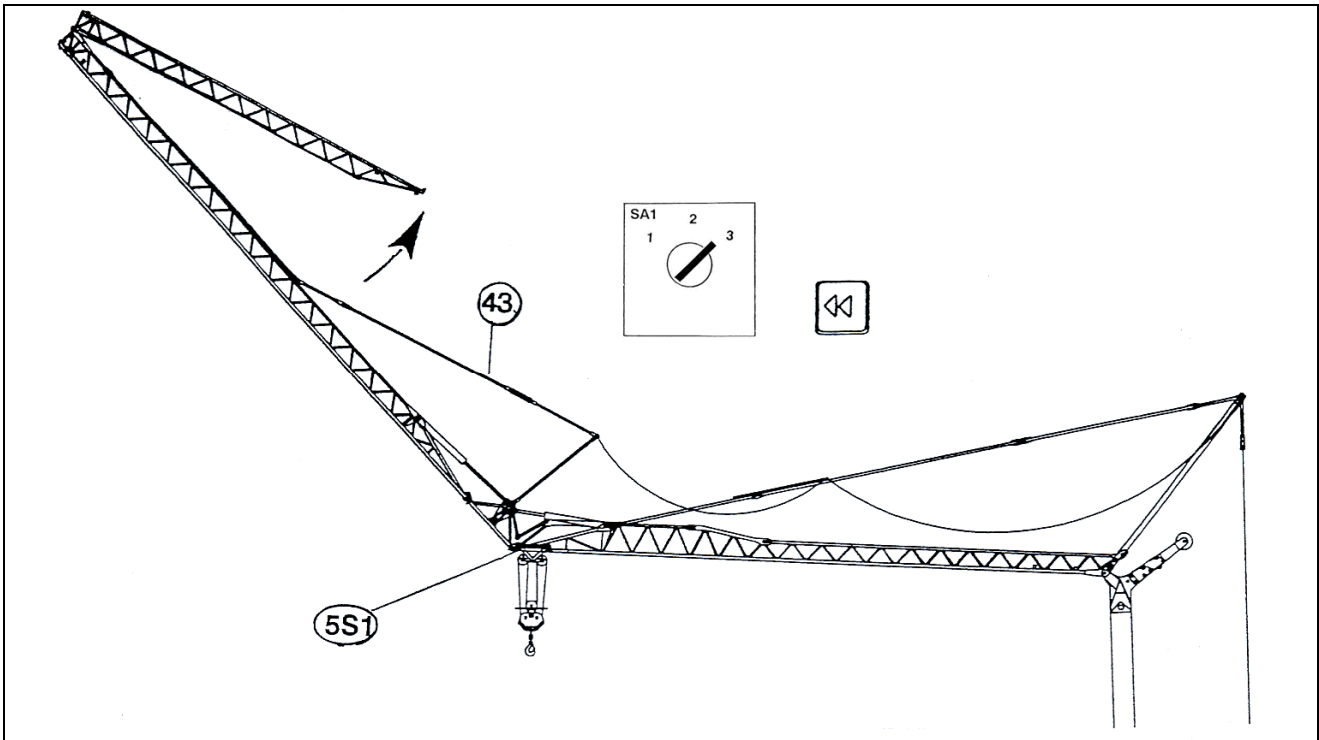


WARNING

- When unfolding, check that tie rods and ropes do not entangle and that all movements of the structural parts are carried out without any abnormal resistance or friction.



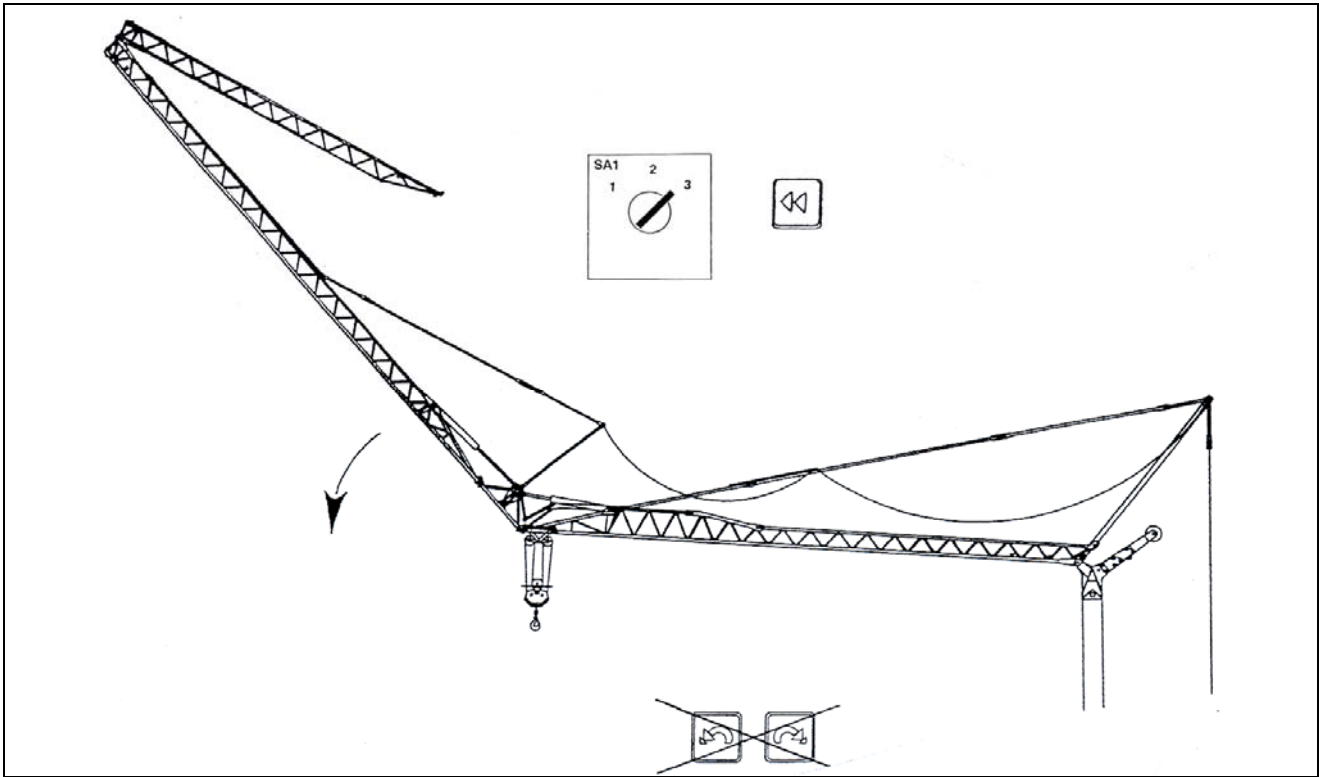
- 4.9 Turn the selector switch **SA1** into position **3 ERECTION** (control of the boom third section).
4.10 Depress "FAR" to actuate the boom third section unfolding (following picture).



- 4.11 Depressing the push button "FAR", start unfolding the third section of the boom. During all these operations, the trolley shall actuate the limit switch **5S1**, to allow its enabling.
4.12 Proceed unfolding the third section of the boom, in order to reach a position of the section that allows the complete tensioning of the stay rope **43** with no interferences with the structure of the boom third section, as it is shown in the previous picture.



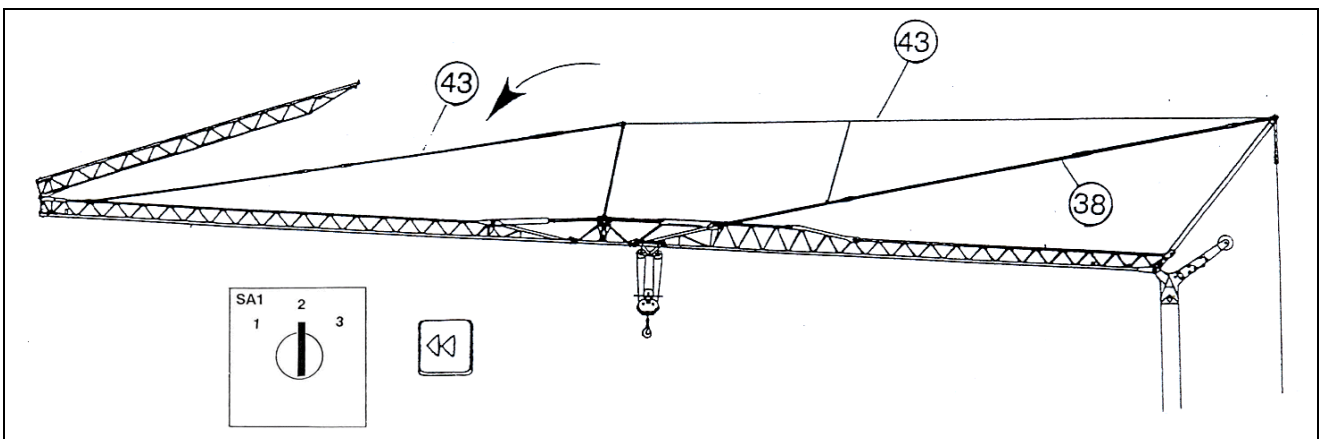
- 4.13 To proceed and to complete boom unfolding, turn the selector switch **SA1** into position **2** **ERECTION**. Depressing the push button "FAR", boom unfolding is controlled.



- 4.14 Proceed with boom unfolding, until the boom second section is aligned with the first one and all the tie rods are tensioned.

**WARNING**

- When unfolding, check that tie rods and ropes do not entangle and that all movements of the structural parts are carried out without any abnormal resistance or friction.
- **The boom unfolding movement is not equipped with an electrical limiting device** that stops its continuation. **During the final stages of the movement, check the mutual position of the boom first section and the second one, and stop the movement when the two section are aligned.** Anyway, this position is the end-of-stroke position of the cylinders of the first and the second sections of the boom.





- 4.15 If it's meant to operate the crane with the boom third section folded, it takes to fold it until it rests on the tie rod **43**.
- 4.16 Turn the selector switch **SA1** into position **3 ERECTION** and depress "NEAR", to fold the boom third section. Proceed very carefully, till the third section of the boom rests on the tie rod **43**.



WARNING

- The boom third section unfolding is not controlled by limiting devices. The movement shall be carefully checked, and the boom third section shall slightly rest onto the tie rod **43**, to prevent structural damages.

- 4.17 If it's meant to operate the crane with the boom third section folded, turn the selector **SA2** into position **2**, to enable the trolley far limit switch **4S12** at the end of the second boom section.
- 4.18 If it's meant to operate the crane with the boom completely unfolded, unfolding the third section, follow the instructions of the paragraph 08.4.2.



WARNING

- Failure in strictly following the instructions relating to crane erection in general and to boom unfolding in particular may seriously damage the machine.
- If selector switches are not set in the specified position and if the operating procedures prescribed by micro switches are not observed, it will not be possible to open the boom.
- Failure in checking that structural parts, ropes and tie rods can freely move at the boom unfolding stage may cause serious damages to the machine structures.



08.4.2. BOOM THIRD SECTION UNFOLDING



WARNING

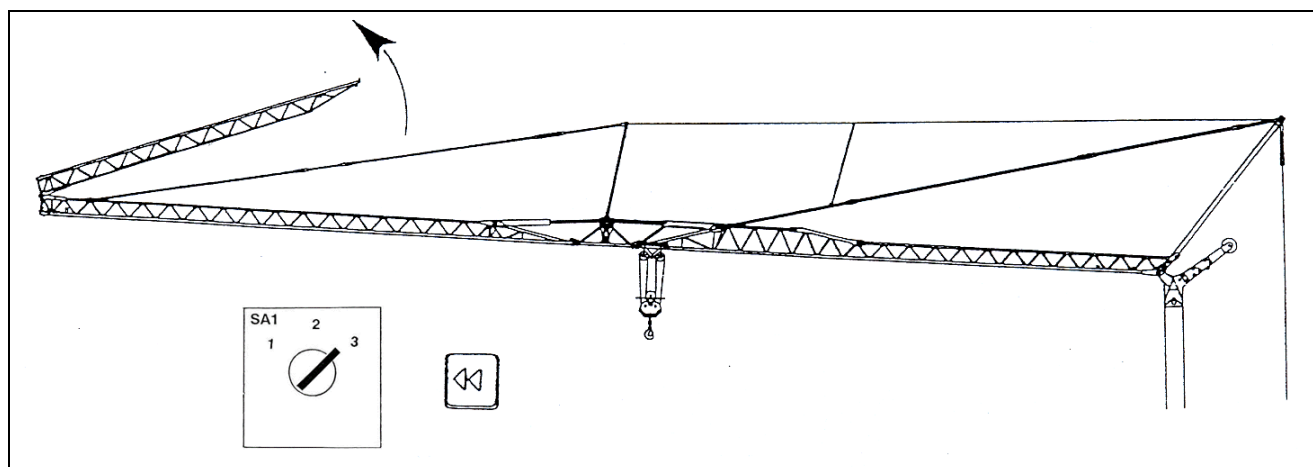
- Before starting the boom third section unfolding, complete the hydraulic equipment checks (paragraph 04.8.2).

4.19 Turn the selector switch **SA1** into position **3 ERECTION** (control of the third section of the boom) and depress "FAR" to complete the boom third section unfolding, till this section is aligned with the second one.

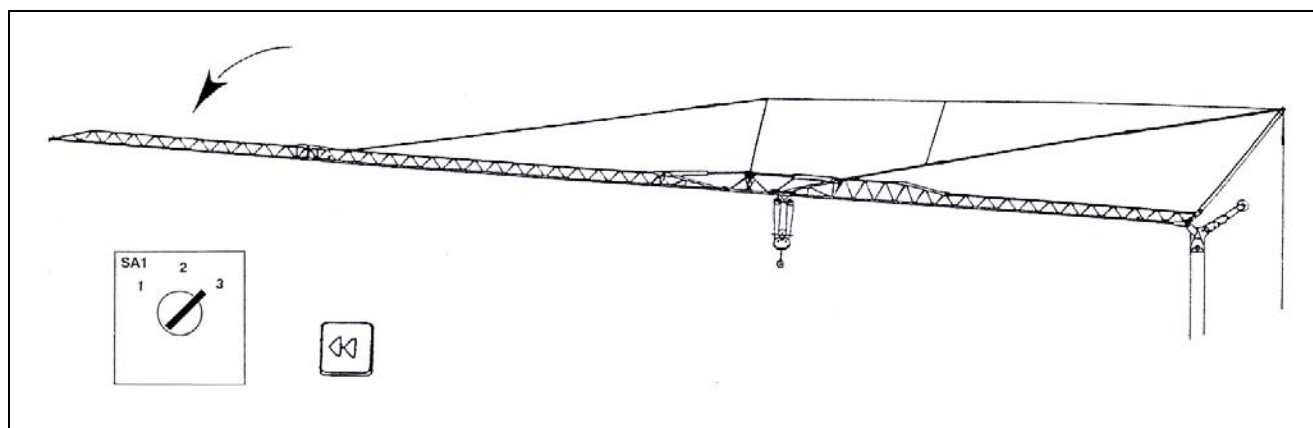


WARNING

- When unfolding, check that tie rods and ropes do not entangle and that all movements of the structural parts are carried out without any abnormal resistance or friction.
- **The boom third section unfolding movement is not equipped with an electrical limiting device that stops its continuation. During the final stages of the movement, check the mutual position of the boom second section and the third one, and stop the movement when the two section are aligned.** Anyway, this position is the end-of-stroke position of the cylinders of the second and the third sections of the boom.



4.20 Proceed with the boom third section unfolding, till it's aligned with the first and the second sections.





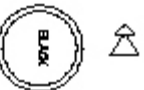
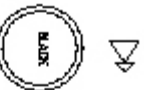
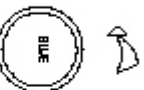
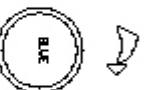
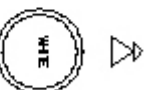
4.21 If it's meant to operate the crane with the boom unfolded, turn the selector **SA2** into position **1**, to enable the trolley far limit switch **4S5** at boom tip.

	WARNING
➤ Failure in strictly following the instructions relating to crane erection in general and to boom unfolding in particular may seriously damage the machine. ➤ If selector switches are not set in the specified position and if the operating procedures prescribed by micro switches are not observed, it will not be possible to open the boom. ➤ Failure in checking that structural parts, ropes and tie rods can freely move at the boom unfolding stage may cause serious damages to the machine structures.	



08.5. PREPARATION FOR CRANE OPERATION

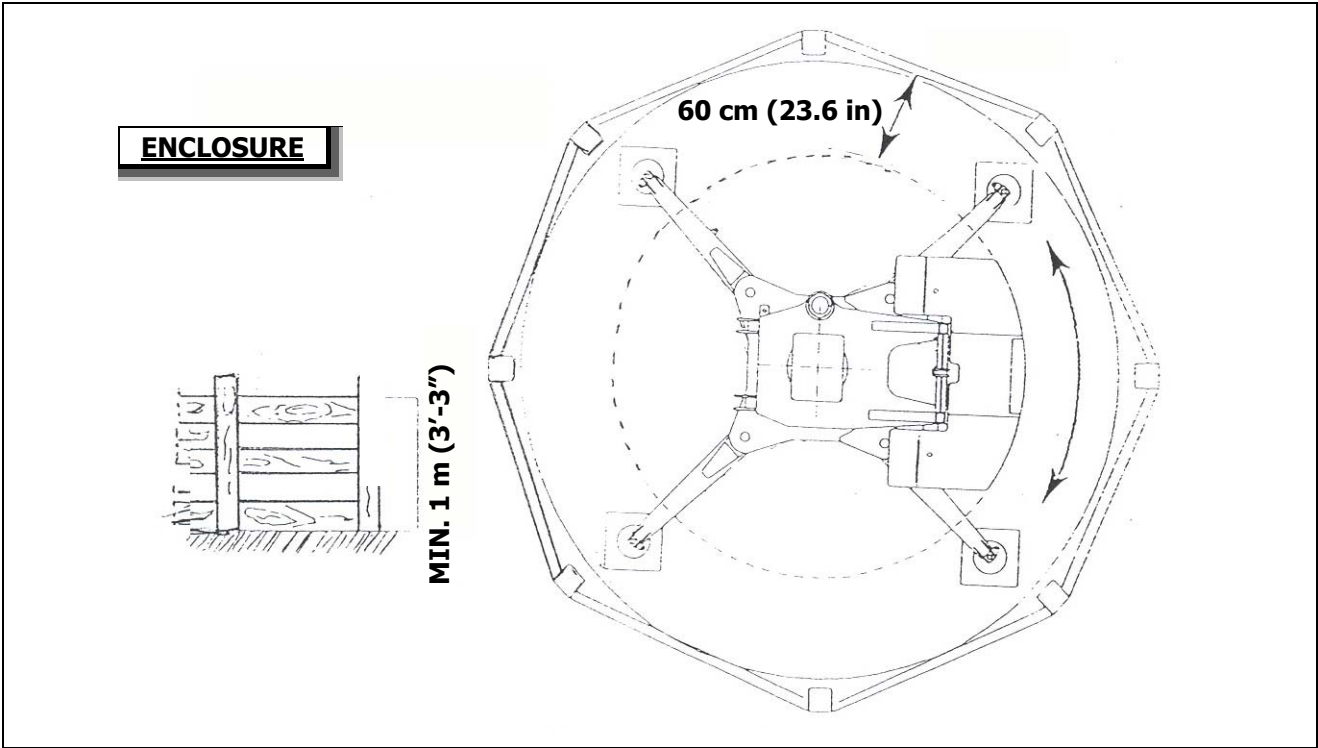
- 5.1 Once completed crane erection, open the cabinet door and turn the selector switch **SA1** into position **1 OPERATION**. By acting on the push-buttons on the control board, check that all the requested crane functions and movements correspond to those indicated on each push-button.

2SB1		LOAD BLOCK UP I pressing pos. micro speed II pressing pos. slow speed
2SB2		LOAD BLOCK DOWN I pressing pos. micro speed II pressing pos. slow speed
2SB3		HOISTING I pressing pos. middle speed II pressing pos. fast speed
3SB1		LEFT SWING I pressing pos. micro speed II pressing pos. slow speed
3SB2		RIGHT SWING I pressing pos. micro speed II pressing pos. slow speed
3SB3		SWING I pressing pos. middle speed II pressing pos. fast speed
4SB1		TROLLEY NEAR I pressing pos. micro speed II pressing pos. slow speed
4SB2		TROLLEY FAR I pressing pos. micro speed II pressing pos. slow speed
4SB3		TROLLEY I pressing pos. middle speed II pressing pos. fast speed

- 5.2 Carry out load tests, according with the instructions of the [Chapter 09](#).
- 5.3 After carrying out the load tests, carry out a further and careful check of structures, mechanical components, ropes, etc.
- 5.4 Adjust the safety devices, according with the instructions of the [Chapter 10](#).
- 5.5 Adjust the brakes according with the instructions of this Manual ([paragraph 10.11](#), [paragraph 10.12](#), [paragraph 10.12](#)).
- 5.6 Check for perfect tower verticality in every position along its entire arc of swing and, if necessary, align it until it is exactly vertical by acting on the screw stabilizers.



- 5.7 Arrange the safety enclosure around **danger zone A** as shown in the scheme below. Use vertical poles driven in the ground and wooden boards secured horizontally to create a safe barrier around the danger zone.



- 5.8 **Carry out HOISTING ROPE TENSIONING**, in order to prevent the lower layers of the rope to slacken on the drum, and the upper layers of the rope to penetrate the lower layers during rope rewinding.
- o When the crane is erected to the max. height, place the trolley in such a position that it is allowed to lift a load corresponding to the rated load of the crane.
 - o Lower the load block with 4-pull line connected till the min. height.
 - o Lift a load corresponding to the rated load of the crane and lower it to the ground.
 - o After this procedure, the hoisting rope is tensioned. **Repeat the procedure periodically.**



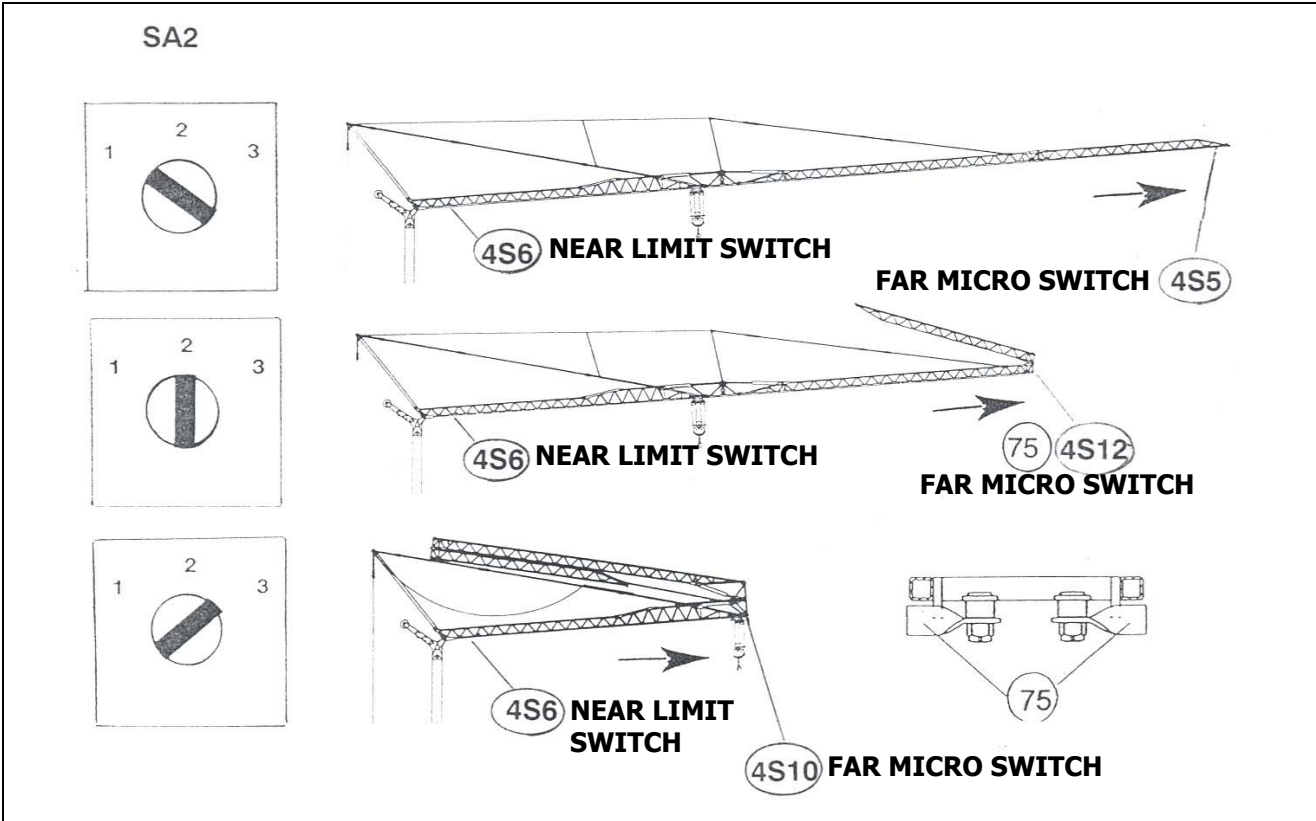
WARNING

- Failure in strictly following the instructions relating to crane erection in general and to boom opening in particular may seriously damage the crane.
- Failure in verifying the correspondence of controls-movements may cause manoeuvring mistakes on the part of the crane operator.
- Should danger zone **A** be left unprotected without the prescribed safety enclosure, there would subsists the risks of crashing and shearing for all exposed persons.
- Failure in carrying out the adjustment of the safety devices and brakes may cause the risk of serious accidents.
- Shouldn't the hoisting rope tensioning carried out **periodically**, the lower layers wound on the drum are not enough tensioned. During rope rewinding, the upper layers could penetrate the lower layers, damaging hoisting rope.



08.6. BOOM CONFIGURATIONS

- 6.1 The crane is designed to be operated with the boom third section folded, or with the boom completely folded. **The second and the third sections of the boom may be folded and unfolded only being the crane unladen, i.e. with no load suspended.**
- 6.2 To fold the boom, refer to [paragraph 13.2](#) and [paragraph 13.3](#), enclosed in the procedure of crane dismantling, exposed further in this Manual.
- 6.3 The different sections of the boom are equipped with mobile **mechanical stops**, automatically actuated when two sections are out of alignment, to prevent the trolley to slide out of its runways.
- 6.4 To operate the crane with the chosen boom configuration, it takes to conform the functions of the **electrical limiting switches** to the boom configuration. The commutation is realized turning the selector switch **SA2** into the fit position, according with the following drawings and the instructions of the [paragraph 03.4](#).



- 6.5 Mechanical stops **75** automatically intervene. Electrical limiting switches shall be correctly enabled before starting crane operation in each configuration.
- 6.6 Before starting crane operation in a new configuration, it takes to adjust again the hoisting limit switch, because of the rope shortening or lengthening, caused by boom folding or unfolding.



WARNING

- Should the **SA2** selector switch not be in the position corresponding to the operation configuration in use, the limit switch would not control correctly the trolley forward displacement, thus causing the trolley to crash against the end stoppers, an over-traction on the trolley rope and its possible breakage.

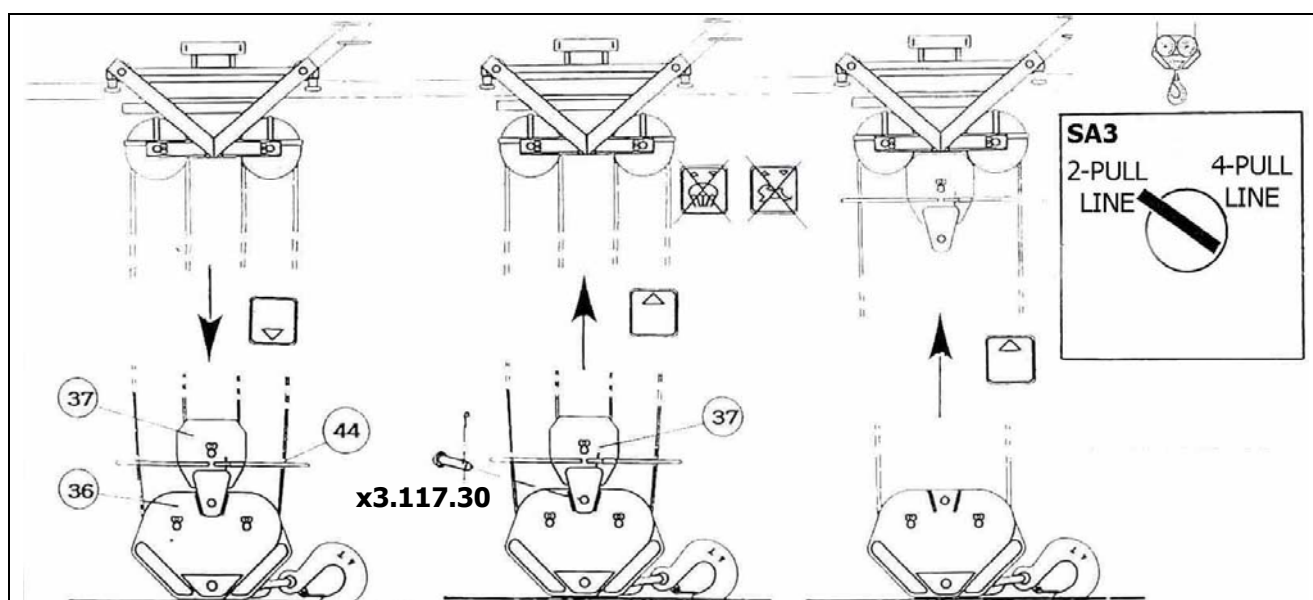


08.7. 2-PULL LINE – 4-PULL LINE

- 7.1 The crane, **equipped with 4-pull line**, may be operated with 2-pull line (two pulling lines of the hoisting rope) or with 4-pull line (four pulling lines of the hoisting rope). Place the selector switch **SA3** (paragraph 03.5) into the fit position according with the operation configuration.
- 7.2 In case of hosting with 4-pull line, the block for 4-pull line **37** and the main block **36** are connected by the pin **x3.117.30**, inserted between the plates of the two blocks and locked by one hitch pin.

08.7.1. FROM 4-PULL LINE TO 2-PULL LINE

- 7.3 Place the selector switch **SA1** into position **1 OPERATION**.
- 7.4 Lower the two connected blocks **36** and **37** to the ground, carefully resting the hook but preventing the hoisting rope to slacken.

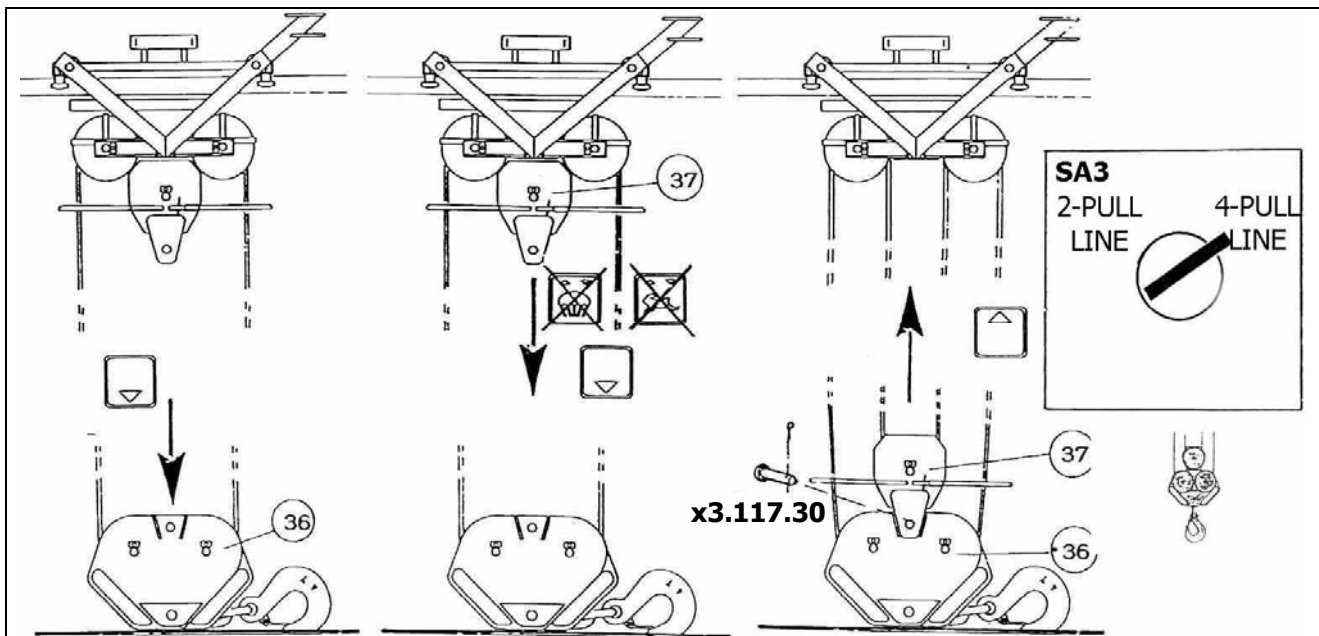


- 7.5 Remove the pin **x3.117.30**, connecting the two blocks.
- 7.6 Pushing the button "UP" of the control board, lift the block for 4-pull line **37** towards the trolley.
- 7.7 Proceed with lifting, till the block for 4-pull line is against the trolley. **In the starting and final stages of this operation, use the hoisting micro speed.** Always check the the rope winds up regularly on the drum.
- 7.8 Proceeding with lifting, being the block for 4-pull line kept by the rope against the trolley, the main block **36** will be lifted from the ground and will be available for the hoisting operatins.
- 7.9 Before operating the crane, move the selector switch **SA3** into position "2-PULL LINE".



08.7.2. FROM 2-PULL LINE TO 4-PULL LINE

- 7.10 Place the selector switch **SA1** into position **1 OPERATION**.
- 7.11 Lower the main block **36** to the ground, resting it carefully so that the rope may run freely on the sheaves.
- 7.12 **Using the hoisting micro speed**, proceed with lowering. The block for 4-pull line **37** will move away from the trolley and lower to the ground.
- 7.13 Proceed with the lowering of the block for 4-pull line, **using the micro speed**, so that the rope unwinds regularly from the winch drum.
- 7.14 When the block for 4-pull line **37** rests onto the main block **36**, make sure that the connecting plates fit in the main block **36**.
- 7.15 Lock the two blocks with the pin **x3.117.30**. Lock the pin with its **hitch pin**.



- 7.16 Before operating the crane, move the selector switch **SA3** into position "4-PULL LINE". Pushing the "UP" button, the two blocks, now connected, allow the 4-pull line.



WARNING

- The **2-pull line** (main block only) allows a rated load of **2,000 kg (4,409 lbs)**. The **4-pull line** (the two block connected) allows a rated load of **4,000 kg (8,818 lbs)**, being the hoisting speed half of the speed obtained with 2-pull line.
- Operating the equipment in a situation of overload is very dangerous and engenders the risk of damages to structures and mechanisms.
- Use pin **x3.117.30** only to connect the two load blocks; unsuitable pins will cause the load to fall.
- If the pin **x3.117.30** is not secured by means of the **hitch pin**, the block for 4-pull line may part, thus causing the load to fall.





09. LOAD TESTS

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09.1. BLOCKS FOR LOAD TESTS

- 1.1 **Before putting the crane into service load tests** shall be carried out, according with the directions of the standard CSA Z248-04.
- 1.2 **Test blocks** for the load tests shall be prepared, designed by a qualified engineer. The test blocks are made of cement, according with the characteristics reported in the following table.

TEST BLOCK "A"	
BLOCK	WIEGHT
Block "A1"	Exact weight of the crane max. load at the boom tip
Block "A2"	5% of the crane max. load at the boom tip

TEST BLOCK "B"	
BLOCK	WIEGHT
Block "B1"	Exact weight of the crane rated load
Block "B2"	5% of the crane load at the boom tip

- 1.3 The test blocks for the load tests shall be weighted and their weights shall be recorded on each block. The blocks shall be a part of the crane equipment of the crane.

	WARNING
➤ The use of blocks not correctly designed, or whose weight is not known, may cause the risk of crane overloading, with danger for crane stability, and the possibility of damaging structures and mechanisms.	



09.2. CARRYING OUT THE LOAD TESTS

09.2.1. LOAD AT THE BOOM TIP

- 2.1 The aim of the test concerning the load at the boom tip is to test the resistance of the crane to load moment and the intervention efficiency of the max. moment limiter.
- 2.2 Move the trolley to the boom tip and lower the block.
- 2.3 Hook the test block "A1" (same weight of the max. load at the boom tip), using lifting hardware having a **minimum safety factor of 3**. Lift the test block "A1". Make sure that the max. moment limiter doesn't function.
- 2.4 Lower the load to the ground. Hook the test block "A2" (5% of the max. load at the boom tip), by means of a short length chain or other suitable flexible method. Lift the whole formed by the test blocks "A1" and "A2".
- 2.5 When the rope is tensioned by the load "A1", lifting it, the max. moment limiter **shall not** function.
- 2.6 When the lifting of the block "A2" starts, the max. moment limiter **shall** function.
- 2.7 Make sure that the max. moment limiter functions, but only when the whole formed by the test blocks "A1" (max. load at the boom tip) and "A2" (5% of the max. load at the boom tip). The load "A1", equal to the max. load at the boom tip shall be lifted freely, without the intervention of the max. moment limiter.

	WARNING
➤ During load tests check the stability of structures. Check that the crane doesn't undergo deformations. In case of any danger, immediately stop the test, lower the load and move away from the crane. ➤ Shouldn't the lifting hardware be suitable, there subsists the serious risk of falling of the load.	



09.2.2. RATED LOAD

- 2.8 The aim of the test concerning the rated load is to test the resistance of the crane to rated load and the intervention efficiency of the rated load limiter. This test shall be carried out immediately after the boom tip load test.
- 2.9 Move the trolley to the min. radius and lower the block.
- 2.10 Hook the test block "B1" (same weight of rated load), using lifting hardware having **a minimum safety factor of 3**. Lift the test block "B1". Make sure that the rated load limiter doesn't function
- 2.11 Lower the load to the ground. Hook the test block "B2" (5% of the rated load), by means of a short length chain or other suitable flexible method. Lift the whole formed by the test blocks "B1" and "B2".
- 2.12 When the rope is tensioned by the load "B1", lifting it, the rated load limiter **shall not** function.
- 2.13 When the lifting of the block "B2" starts, the rated load limiter **shall** function.
- 2.14 Make sure that the rated load limiter functions, but only when the whole formed by the test blocks "B1" (rated load) and "B2" (5% of the rated load). The load "B1", equal to the rated load shall be

	WARNING
➤ During load tests check the stability of structures. Check that the crane doesn't undergo deformations. In case of any danger, immediately stop the test, lower the load and move away from the crane. ➤ Shouldn't the lifting hardware be suitable, there subsists the serious risk of falling of the load.	



09.3. CONCLUSION OF THE LOAD TESTS

- 3.1 Once completed the load tests, **carry out a careful check of the crane**, to verify the integrity of structures and mechanisms, and the correct functioning of all the devices.
- 3.2 Check the mechanisms couplings and junctions; the functioning of the electrical devices, of the control devices, of the safety devices; the functioning of the acoustic warnig; the functioning of the crane in all its functions.
- 3.3 **If the crane is not in perfectly working order, it shall not be placed into service.**
- 3.4 Before proceed with crane operation, adjust all the safety devices, according with the instructions of Chapter 10.



10. SAFETY DEVICES

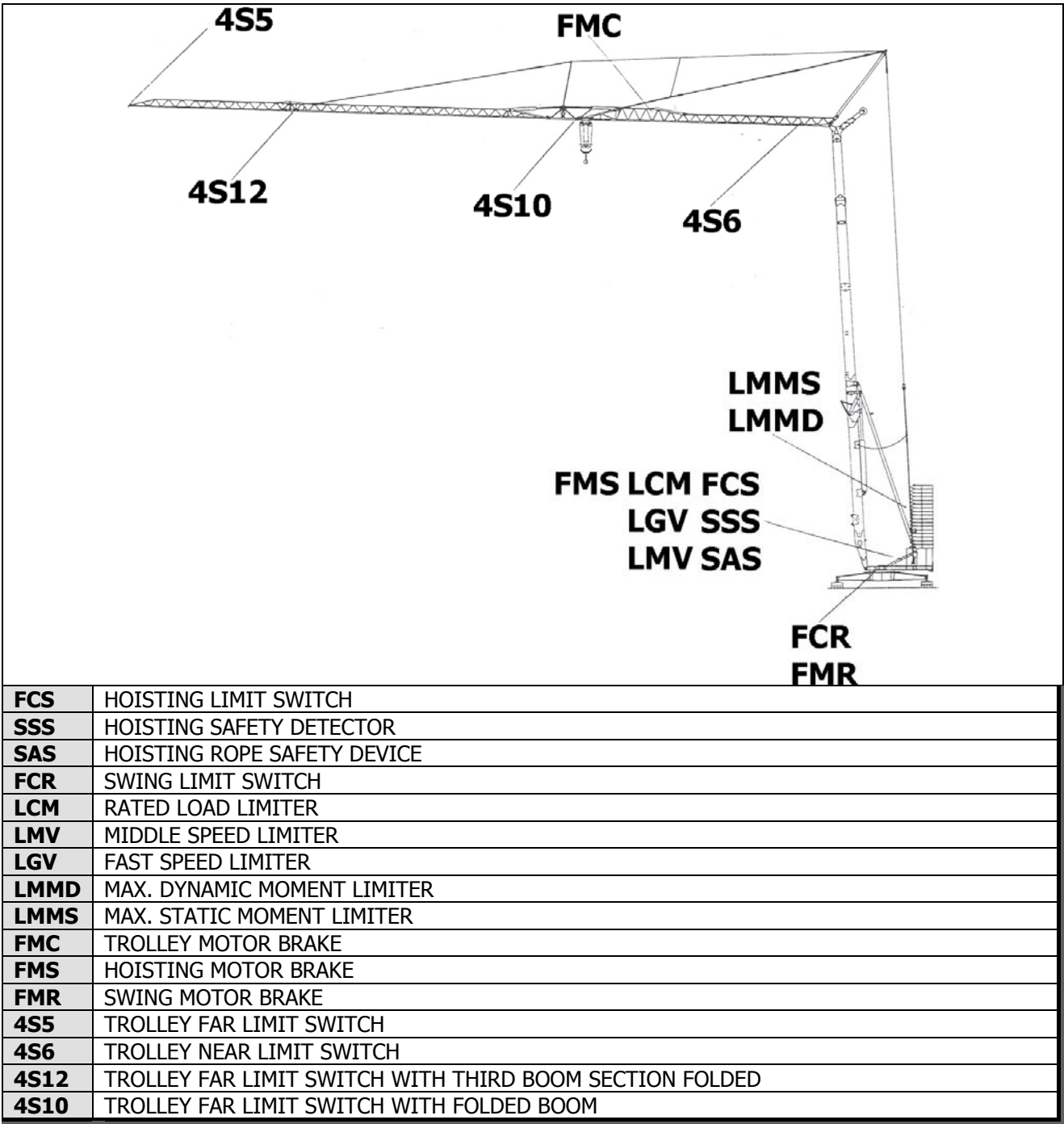
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10.1. SAFETY DEVICES

- 1.1 The adjustments of the safety devices shall be carried out before placing the crane into service, and frequently repeated during crane operation. They shall be carried out being the crane at standstill, or limiting its movement to the device to be adjusted only, always taking great care to the moving mechanisms.



WARNING

- The emergency stop button, the acoustic warning, the hoisting safety detector, the enabling and position micro switches, the hoisting rope safety device, don't require any adjustment but they shall always be kept in perfect and complete working order.



10.2. ADJUSTMENT OF THE HOISTING LIMIT SWITCH (FCS)

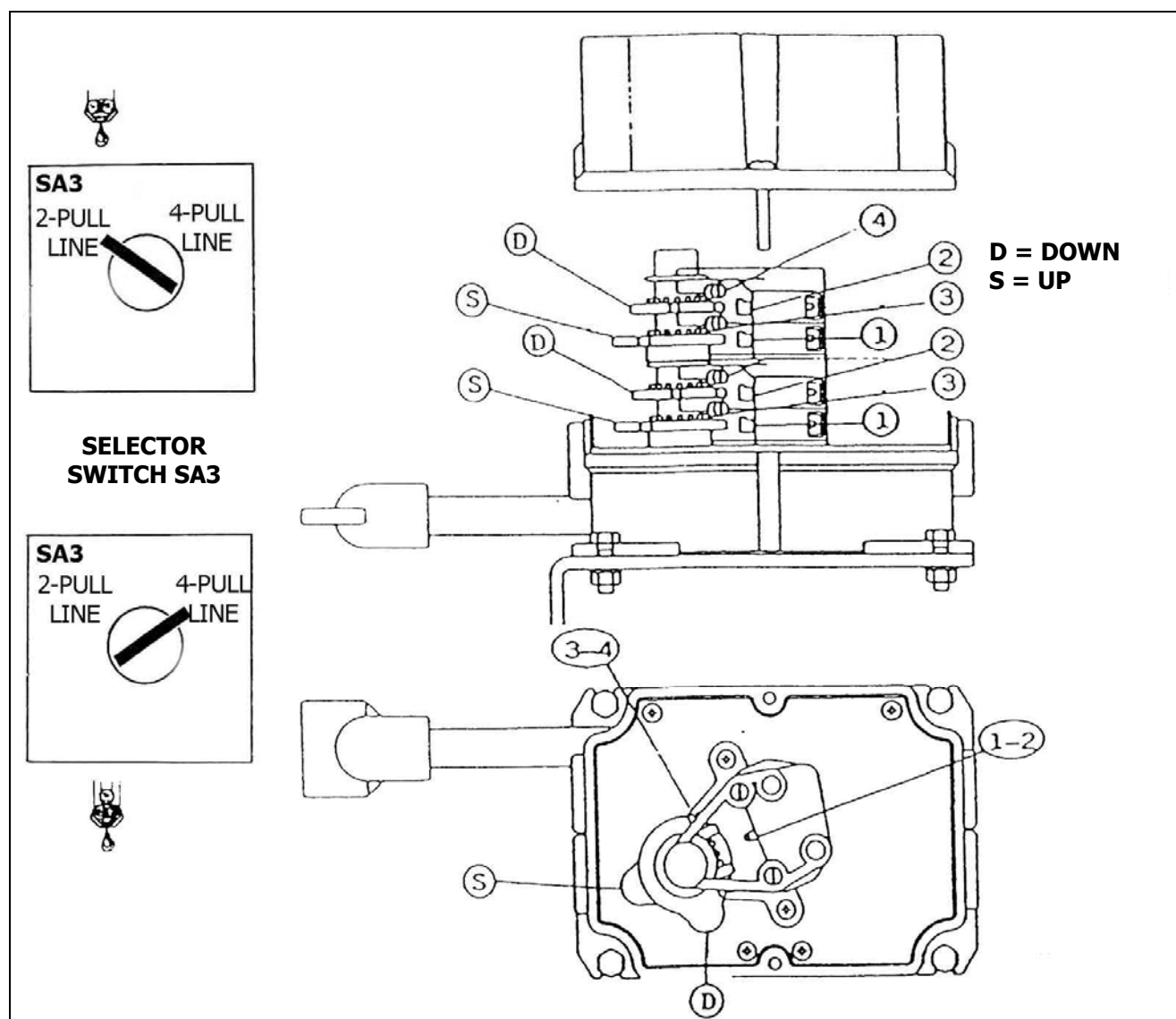
FUNCTION
It prevents the load in over-travel from crashing against the boom and the rope from slackening. The limit switch controls both the load slowing down and the load stop.
LOCATION
On the hoisting winch, at the end of the drum shaft.

	WARNING
➤	It shall be regulated both with 2-pull line and with 4-pull line.

- 2.1 The hoisting limit switch is equipped with 4 cams to control the load stroke, whether with 2-pull line or with 4-pull line, by means of the selector switch **SA3** situated inside the electrical cabinet.
- 2.2 Each cam controls both the stop limit switch (**2S1 – 2S1A – 2S2 – 2S2A**) and the slowing down limit switch (**2S12 – 2S12A – 2S13 – 2S13A**). The cams are arranged as follows.

2-PULL LINE		Cams for 2-pull line: adjust with the block in 2-pull line configuration and the selector SA3 in position "2-PULL LINE"
4-PULL LINE		Cams for 4-pull line: adjust with the block in 4-pull line configuration and the selector SA3 in position "4-PULL LINE"

	WARNING
➤	The limit switch is equipped with double contacts which combine the functions of slowing down and stop.



10.2.1. ADJUSTMENT OF THE LIMIT SWITCH WITH 2-PULL LINE



WARNING

- Block with 2-pull line (paragraph 08.7.1).
- **Selector switch SA3** in position "2-PULL LINE" (paragraph 03.5).

- 2.3 To adjust the UP limit switch with 2-pull line, proceed as it follows:
- o Move the trolley near to the tower.
 - o In this case the block for 4-pull line is connected with the trolley and the max. height the main block may be lifted to is **50-60 cm (19.7-23.6 in)** under the block for 4-pull line.
 - o Switch the power off.
 - o Remove the protection cover of the limit switch by loosening the two fixing screws.



- o Turn screw **3** to rotate the eccentric **S**. Turn the screw so that the eccentric is rotated until it depresses push-button **1** (contact open) of the micro switch so that push-button **1** is released (contact closed) as soon as the load block starts to lower and cam **S** starts to rotate.
- o Switch the power on.
- o Lower the load block almost onto the ground.
- o Switch the power off.
- o Turn the screw **4** so that the eccentric is rotated until it depresses push-button **2** (contact open) of the micro switch so that push-button **2** is released (contact closed) as soon as the load block starts to lift and cam **D** starts to rotate.
- o Replace the protection cover of the limit switch back into position, switch the power on and repeatedly move the load block up and down. If necessary, carry out a further setting of cams **D** and **S**.

10.2.2. ADJUSTMENT OF THE LIMIT SWITCH WITH 4-PULL LINE

	WARNING
➤ Block with 4-pull line (paragraph 08.7.2). ➤ Selector switch SA3 in position "4-PULL LINE" (paragraph 03.5).	

- 2.4 Repeat the adjustment procedure with the other two cams for 4-pull line; in this case the main block is connected with the block for 4-pull line and the max. height the block may be lifted to is **50-60 cm (19.7-23.6 in)** under the trolley.

10.2.3. CHECK OF THE LIMIT SWITCH ADJUSTMENT

- 2.5 The limit UP and DOWN positions are the following ones:
- o In the max. height position, being the trolley close to the tower, the main block shall remain **50-60 cm (19.7-23.6 in)** under the block for 4-pull line (2-pull line) or the block shall remain **50-60 cm (19.7-23.6 in)** under the trolley (4-pull line).
 - o In the min. height position, the hook shall not rest onto the ground and, being the slung load hooked, shall not make the hoisting rope slacken.
- 2.6 At each crane erection, check that the limit switch shaft is perfectly aligned with the one of the hoisting reduction gear. In case of displacements, due to eventual crashes during transporting or imprecise initial positioning, align the two axes after loosening the fastening screws of the limit switch support.

	WARNING
➤ The limit switch function at the height where the adjustment has been carried out only if the rope correctly winds up on the drum, in consecutive layers. Always check the correct winding of the rope on the drum. ➤ Failure in adjusting the UP limit switch causes the block to overtravel and to hit the trolley, with possible breakage of the hoisting rope and falling of the load.	



- Failure in adjusting the DOWN limit switch causes the block to rest onto the ground, with consequent slackening of the rope, wound up on the drum, and possible abnormal winding and damaging for the hoisting rope.
- **The hoisting limit switch is a safety device. As such, it shall function only in case of failure or wrong operation. In normal operation, the operator shall stop the movement before the safety device start functioning.**
- Failure in checking daily or at each new shift start the efficiency of the limit switch may cause the risk that it will not function in case of necessity.
- When switching from 2-pull line to 4-pulls line (or vice versa), turn the selector switch **SA3** into the correspondent position. Failure in carrying out this operation every time, the limit switch will not function.
- The hoisting limit switch may be equipped with a bypass selector switch, that shall be employed **according with the prescriptions of the paragraph 03.6 only.**



10.3. HOISTING SAFETY DETECTOR (SSS)

FUNCTION
It prevents the uncontrolled descent of the load, in case of malfunctioning of the hoisting variable speed drive.

LOCATION
It is in front of the external flange of the hoisting drum.

- 3.1 The hoisting safety detector doesn't need any adjustment, but it shall be always kept perfectly efficient and, because of its importance in order to obtain the correct functioning of the crane, it takes to check it frequently.

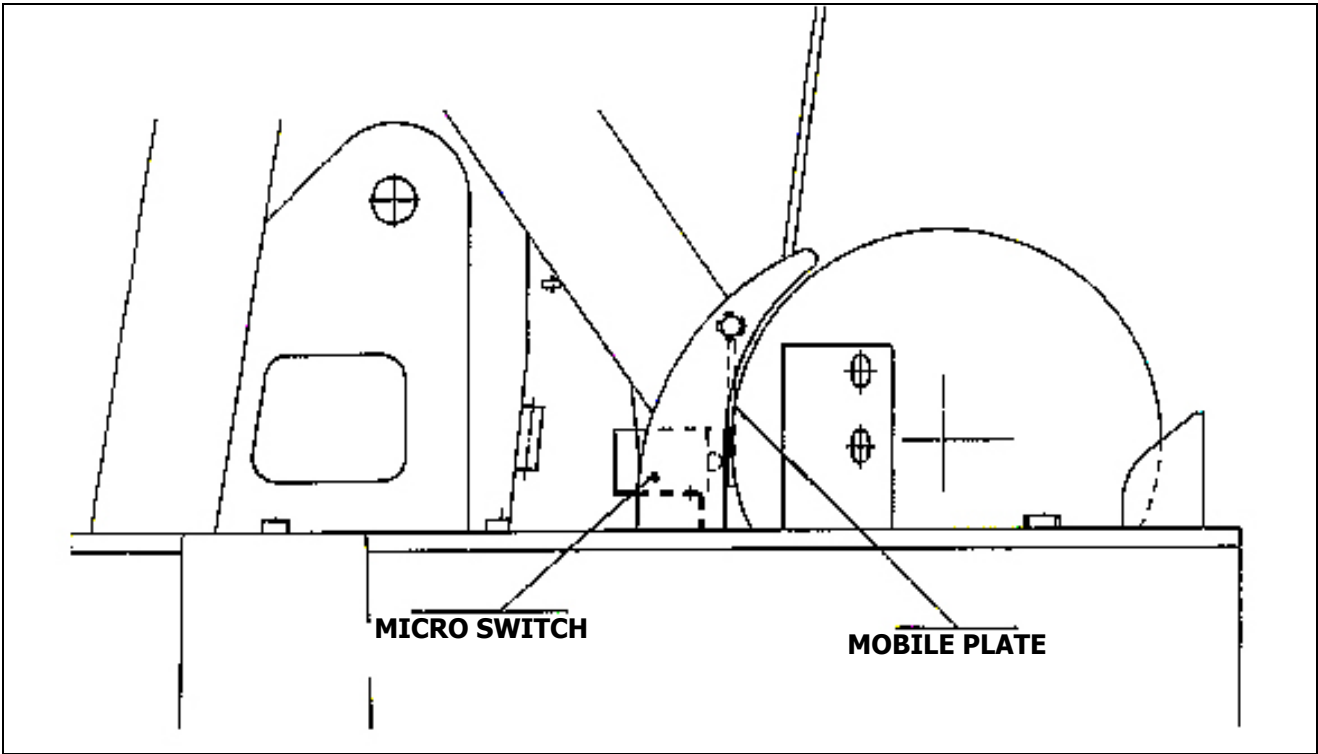
	WARNING
➤ If the hoisting safety detector doesn't work perfectly, there subsists the serious risk of falling of the load, with risk of crushing and shock for the exposed persons.	



10.4. HOISTING ROPE SAFETY DEVICE (SAS)

FUNCTION
It prevents the hoisting rope from passing on the drum side flanges in case of irregular rope winding.
LOCATION
It is positioned behind the hoisting rope drum.

- 4.1 It consists of a movable plate, hinged on apposite supports, oscillating on a horizontal axis. The relevant micro switch, fitted behind the plate, is equipped with an actuator.
- 4.2 Should the rope be irregularly wound on the drum in superimposed layers having a height higher than the side flanges, it would push the plate to actuate the micro- witch that controls rope winding stop.

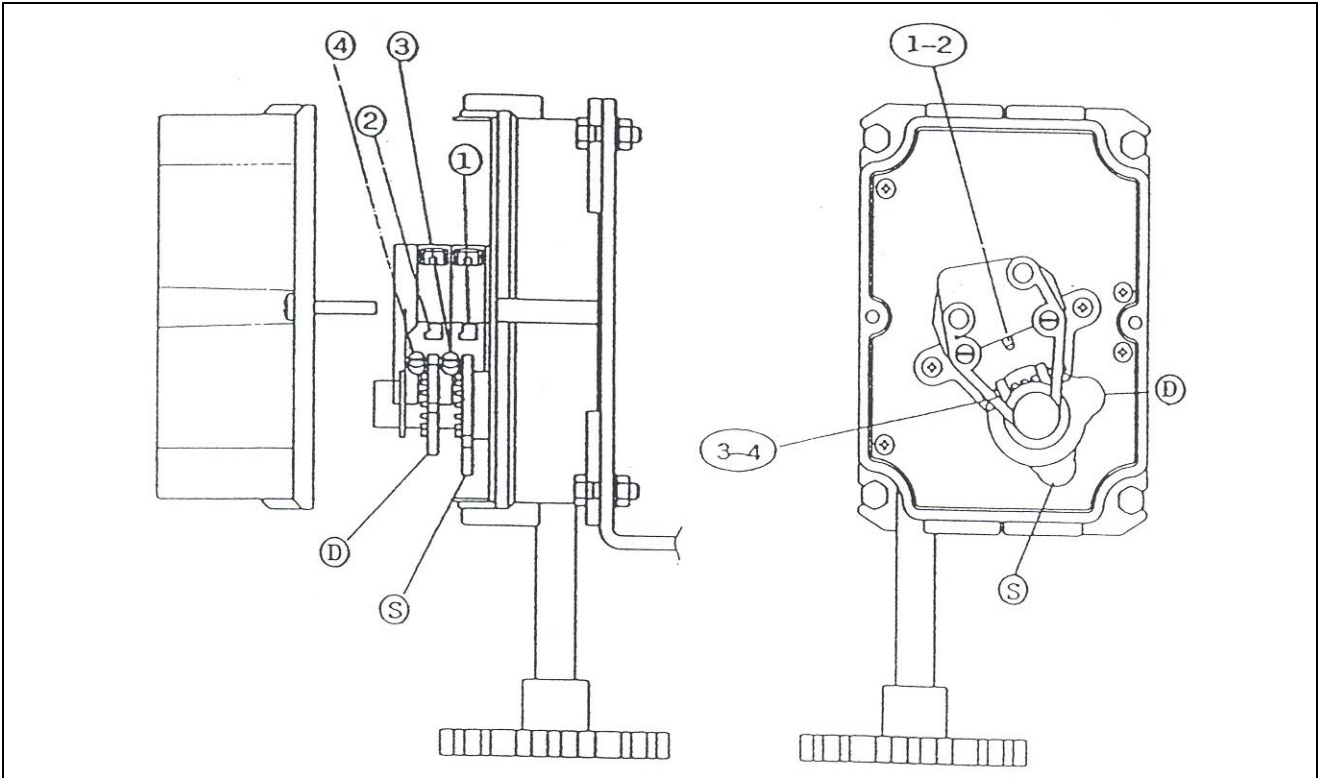


 WARNING
➤ Failure in regulating the hoisting rope safety device on the hoisting rope may cause rope fleeing from the drum, with rope possible breakage and consequent load falling. ➤ The hoisting rope safety device is a safety device and shall therefore perform its function only in case of failures or wrong operations. ➤ Failure in checking daily or at each new shift start the efficiency of the safety device may cause its non-intervention when required, with consequent serious injures and damages to persons and things.



10.5. ADJUSTMENT OF THE SWING LIMIT SWITCH (FCR)

FUNCTION
It prevents swing in one direction only, to the right or to the left, limiting the number of possible turns (1.5 max.) or the arc of swing whenever fixed obstacles are detected.
LOCATION
It is positioned on the upper base frame, near the swing motor.



- 5.1 Crane swing movement shall be limited to one and a half turns to the right or to the left with the purpose of avoiding damages to the electrical cables between the upper and lower base frame.
- 5.2 **TO LIMIT THE CRANE SWING LEFTWARDS.**
 - Remove the protection cover of the limit switch loosening the two fixing screws.
 - Switch off the power supply.
 - By means of a screwdriver, turn screw **3** to make eccentric **S** to rotate; turn the screw so that the eccentric is rotated so much to depress the micro switch push-button **2** (contact open) so that push-button **1** is released (contact closed) as soon as the crane starts to rotate to the right and the eccentric **S** to turn.
- 5.3 Switch on the power supply and swing the crane one and a half turns to the right, and then stop it.
- 5.4 **TO LIMIT THE CRANE SWING LEFTWARDS.**
 - Switch off the power supply.



- o By means of a screwdriver, turn screw **4** so that eccentric **D** rotates; turn the screw so that the eccentric is rotated so much to depress the micro switch push-button **2** (contact open) so that push-button **2** is released (contact closed) as soon as the crane starts to rotate to the left and the eccentric **D** to turn.
- 5.5 Fit the protection cover of the limit switch back in position, fixing it by the screws.
- 5.6 Switch the power on and repeatedly swing the crane checking that it swings for not more than one and half turns to the right and to the left. Carry out a further setting of cams **D** and **S** if necessary.
- 5.7 Check, at each crane erection, that the limit switch gear meshes perfectly with the teeth of the slewing ring. In case of any movements due to crashes during transport or to an incorrect starting positioning, regulate the limit switch so that it meshes perfectly by loosening the screws on the limit switch support.



WARNING

- Swing the crane for **more than one and a half turns** to the right or to the left **will damage the power supply cable and the control board cable.**
- Failure in regulating the swing limit switch will cause the continuous swing of the crane in both directions, with possible breakage of the electrical supply cables and the control board cables.
- **The swing limit switch is a safety device and shall perform its function only in case of faults or wrong operations. In normal operation conditions, it is care and responsibility of the operator to stop the movement before the intervention of the safety device.**
- Failure in checking daily or at each new shift start the efficiency of the limit switch may cause the risk that it will not function in case of necessity.
- Should maintenance interventions require the removal of the gear safety cover, do not forget to place it back when the intervention is over.

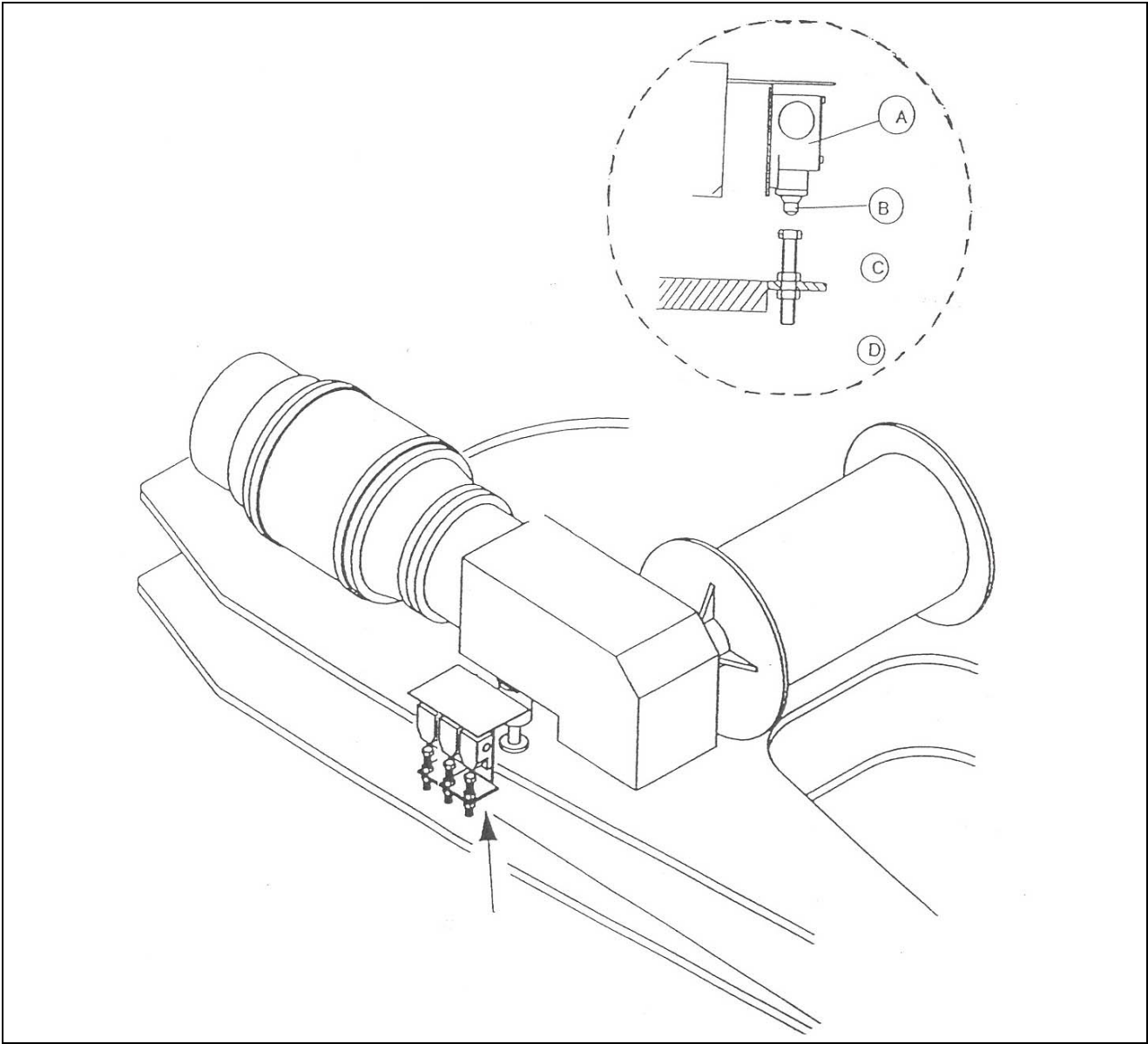


10.6. ADJUSTMENT OF THE RATED LOAD LIMITER (LCM)

FUNCTION
It prevents to lift at the micro and slow speeds load greater than the rated load of the crane: 2,000 kg (4,409 lbs) with 2-pull line, 4,000 kg (8,818 lbs) with 4-pull line.

LOCATION
On the rotary base frame under the hoisting winch (check the connections 1S2-terminals 24-26). Next to it there are the micro switches of the fast speed and middle speed limiters.

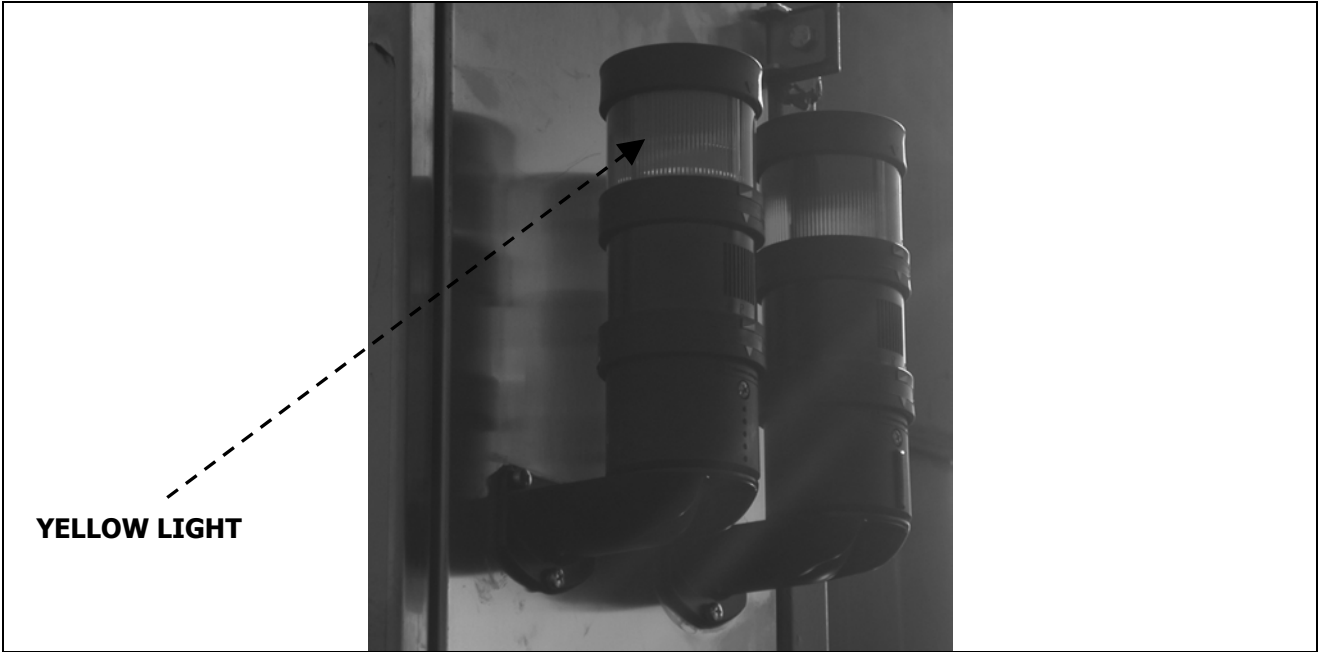
	WARNING
➤ The adjustment shall be carried out with 2-pull line.	



TEST LOAD	
2,000 kg + 100 kg = 2,100 kg 4,409 lbs + 220 lbs = 4,629 lbs	Load equal to the crane rated load with 2-pull line + overload



- 6.1 Move the trolley to less than **15 meters (49'-2")** from the crane axis of swing.
- 6.2 Remove the steel protection cover of the limiters. Lift up at slow speed the test load and regulate screw **C** so that it comes into contact with actuator **B** of micro switch **A**, stopping the load lifting.
- 6.3 Secure lock nuts **D**.
- 6.4 Lower the load to the ground. Remove the **100 kg (220 lbs)** overload and check that the crane easily lifts up the **2,000 kg (4,409 lbs)** scheduled as rated load for the crane with 2-pull line.
- 6.5 The rated load limiter is equipped with an alert (buzzer and yellow light placed on the side of the electric cabinet) indicating that the limit load is going to be attended.



WARNING

LOADS ALLOWED FOR THE FOUR HOISTING SPEEDS 2-PULL LINE	
Micro speed	2,000 kg (4,409 lbs)
Slow speed	2,000 kg (4,409 lbs)
Middle speed	1,400 kg (3,086 lbs)
Fast speed	800-1,000 kg (1,763-2,204 lbs)

➤

Operating the crane with 4-pull line, it is not necessary to repeat the adjustment of the rated load limiter. In this case, the hoisting speeds are halved as regards to the speeds used with 2-pull line.

LOADS ALLOWED FOR THE FOUR HOISTING SPEEDS 4-PULL LINE	
Micro speed	4,000 kg (8,818 lbs)
Slow speed	4,000 kg (8,818 lbs)
Middle speed	2,800 kg (6,172 lbs)
Fast speed	1,600-2,000 kg (3,527-4,409 lbs)

➤

Operating with **folded boom and 4-pull line**, adjust the rated load limiter to **3,000 kg (6,613 lbs)**

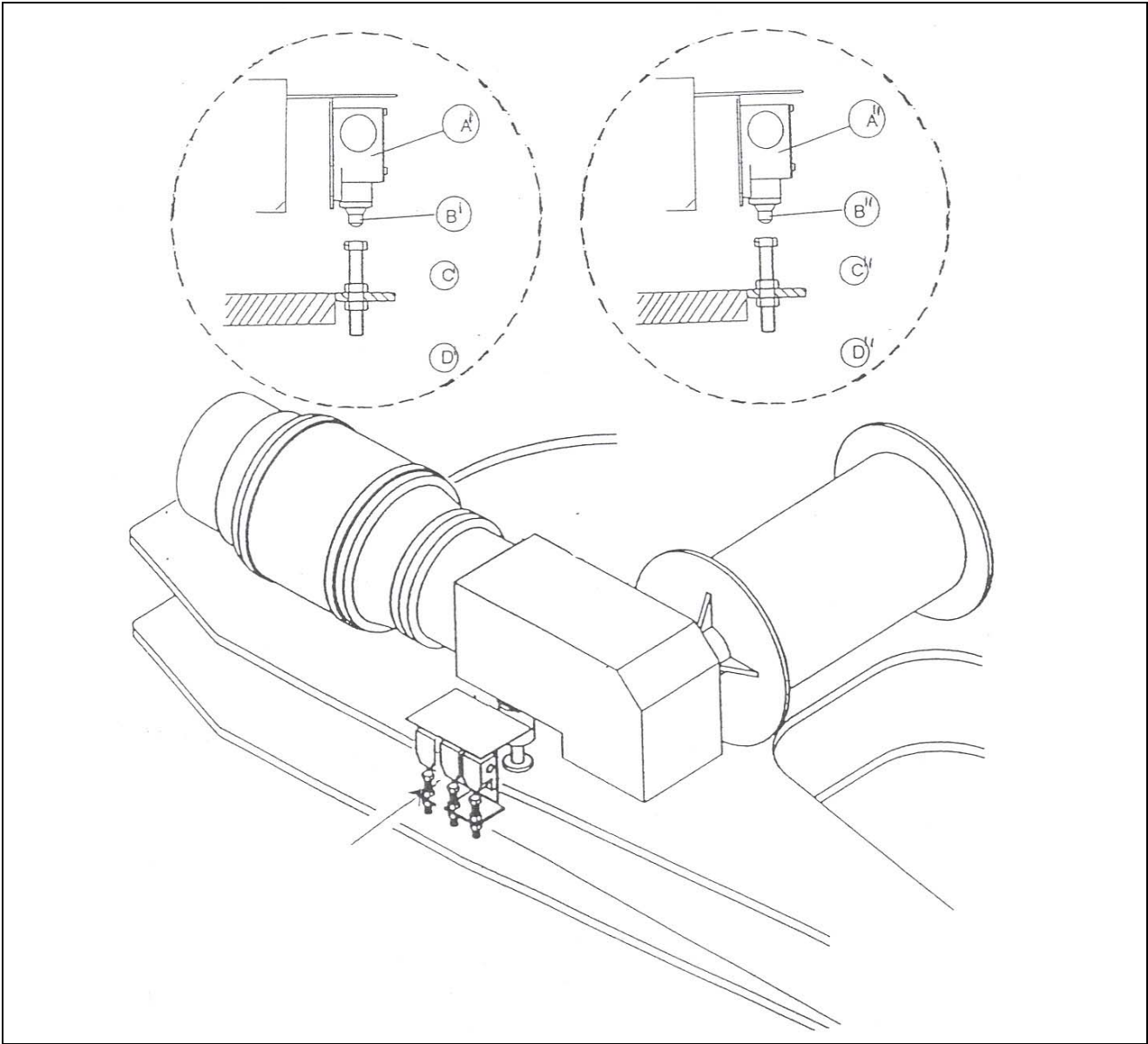


lbs), rated load allow for this configuration.

- If the crane is operated with **inclined boom**, the rated load is reduced to **1,000 kg (2,204 lbs)** constant all along the boom. It is necessary to re-adjust the limiter for the new load, both for 2-pull line and 4-pull line.
- The acoustic warning will automatically go and remain on for the whole time that the crane is in the overload condition; it will be automatically silenced when the overload is lowered to the ground or decreased to the permitted weight.
- Failure in adjusting the rated load limiter will, in case of overloads lifted by mistake, cause the crane rated load to be exceeded. Risk of damaging electrical and mechanical parts, or the machine structure. Risk of crane overturning with crushing and hitting hazards for all the exposed persons.
- **The rated load limiter is a safety device. Its intervention shall be limited to incorrect maneuvers. In normal operation conditions, it will be at the operator's care and responsibility to lift up only loads of known weight not exceeding 2,000 kg (4,409 lbs) with 2-pull line, 4,000 kg (8,818 lbs) with 4-pull line.**
- Failure in checking daily or at each new shift start the efficiency of the limit switch, may cause a failure in the intervention of the device in case of necessity.
- Should a load be lifted at speed higher than indicated, the hoisting variable speed drive will be immediately stopped. To restore the system, proceed as follows:
 - o depress emergency stop push-button;
 - o wait for minute at least, to let the capacitors discharge;
 - o switch the power on and operate the crane normally.
- The rated load limiter **LCM** and the fast speed (**LGV**) and middle speed (**LMV**) limiters are next. In case of any doubt in recognizing **LCM**, check the connections.



10.7. ADJUSTMENT OF THE SPEED LIMITERS



10.7.1. MIDDLE SPEED LIMITER (LMV)

FUNCTION	
It prevents to lift loads grater than the max. load allowed at the middle speed, about 1,400 kg (3,086 lbs) with 2-pull line, 2,800 kg (6,172 lbs) with 4-pull line , according with the load rate, i.e. the frequence of maneuvers per hour and the height the load shall be lifted to.	
LOCATION	
On the rotary base frame under the hoisting winch (check the connections 1S8 – terminals 72-74). Coupled with it there is the micro switch of the fast speed limiter. Next to them there is the micro switch of the rated load limiter.	
WARNING	
➤ The adjustment shall be carried out with 2-pull line.	



TEST LOAD	
1,400 kg + 50 kg = 1,450 kg 3,086 lbs + 110 lbs = 3,196 lbs	Load equal to the crane max. load at the middle speed with 2-pull line + overload

- 7.1 Remove the steel protection cover of the limiters. Lift up the test load at middle speed and regulate the screw **C'** so that it releases the push-button **B'** of the micro switch **A'**, stopping load hoisting.
- 7.2 Secure the lock nuts **D'**.
- 7.3 Lower the load onto the ground. Remove the **50 kg (110 lbs)** overload and check that the crane easily lifts the **1,400 kg (3,086 lbs)** scheduled as max. load at middle speed for the crane with 2-pull line.

10.7.2. FAST SPEED LIMITER (LGV)

FUNCTION
It prevents to lift loads grater than the max. load allowed at the fast speed, between 800 kg (1,763 lbs) and 1,000 kg (2,204 lbs) with 2-pull line, between 1,600 kg (3,527 lbs) and 2,000 kg (4,409 lbs) with 4-pull line , according with the load rate, i.e. the frequence of maneuvers per hour and the height the load shall be lifted to.

LOCATION
On the rotary base frame under the hoisting winch (check the connections 1S3 -terminals 82-84). Coupled with it there is the micro switch of the middle speed limiter. Next to them there is the micro switch of the rated load limiter.

**WARNING**

➤ **The adjustment shall be carried out with 2-pull line.**

TEST LOAD	
800 (1,000) kg + 50 kg = 850 (1,050) kg 1,763 (2,204) lbs + 110 lbs = 1,873 (2,314) lbs	Load equal to the crane max. load at the fast speed with 2-pull line + overload

- 7.4 Remove the steel protection cover of the limiters. Lift up the test load at fast speed and regulate the screw **C''** so that it releases the push-button **B''** of the micro switch **A''**, stopping load hoisting.
- 7.5 Secure the lock nuts **D''**.
- 7.6 Lower the load onto the ground. Remove the **50 kg (110 lbs)** overload and check that the crane easily lifts the **800-1000 kg (1,763-2,204 lbs)** scheduled as max. load at fast speed for the crane with 2-pull line.

**WARNING**

➤ Failure in adjusting the speed limiters may cause the crane max. load compatible with the max. middle or fast hoisting speed to be exceeded. Risk of damaging electrical and mechanical parts.

➤ **The speed limiters are safety devices. Their intervention shall be limited to failures or incorrect maneuvers. In normal operation conditions, it will be at the operator's care and responsibility to lift up at middle or fast speed only loads of known weight lower than 1,400 kg (3,086 lbs) with 2-pull line or 2,800 kg (6,172 lbs) with 4-pull line (at the middle speed) or 800–1,000 kg (1,763-2,204 lbs) with 2-pull line or 1,600-2,000 kg (3,527-4,409 lbs) with 4-pull line (at the fast speed).**

➤ Failure in checking daily or at each new shift start the efficiency of the limit switch, may cause a



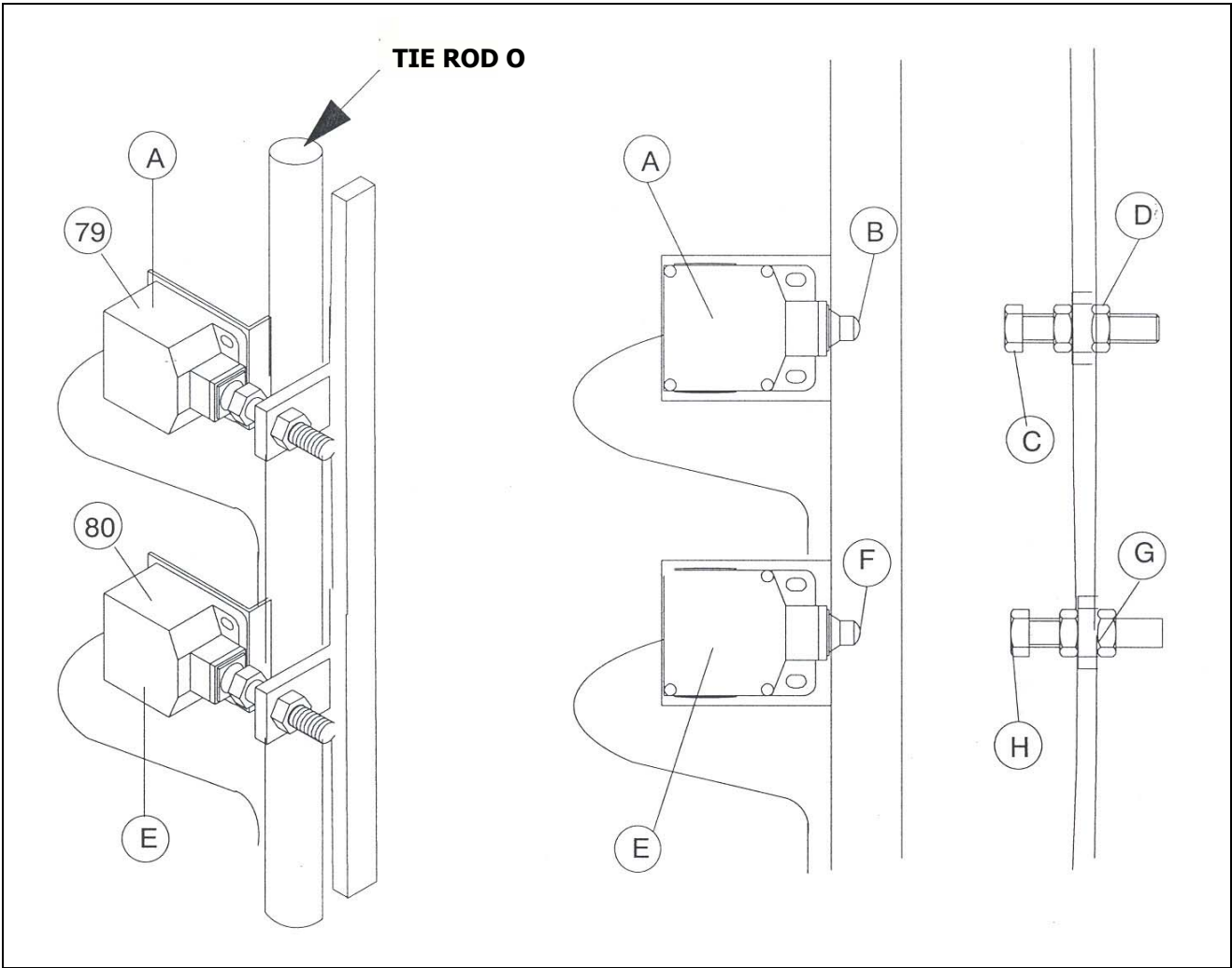
failure in the intervention of the device in case of necessity, causing the damaging of mechanical parts or motor overheating.

- Should a load be lifted at speed higher than indicated, the hoisting variable speed drive will be immediately stopped. To restore the system, proceed as follows:
 - o depress emergency stop push-button;
 - o wait for minute at least, to let the capacitors discharge;
 - o switch the power on and operate the crane normally.
- The rated load limiter **LCM** and the fast speed (**LGV**) and middle speed (**LMV**) limiters are next. In case of any doubt in recognizing **LCM**, check the connections.



10.8. ADJUSTMENT OF THE MAX. MOMENT LIMITERS

FUNCTION
They prevent the hoisting of loads over the permitted weights within the crane max. load at the boom tip and at the boom intermediate radii.



10.8.1. MAX. DYNAMIC MOMENT (LMMD)

LOCATION
Upper micro switch on the ballast tie rod O (check the connections 1S1 -terminals 2-24).

TEST LOAD		
Boom 41.7 m (136'-9")	1,000 kg + 50 kg = 1,050 kg 2,204 lbs + 110 lbs = 2,314 lbs	Load equal to the crane max. load at the boom tip + overload
Boom 30.85 m (101'-2") third boom section folded	1,400 + 50 kg = 1,450 kg 3,086 lbs + 110 lbs = 3,196 lbs	

- 8.1 Move the trolley to boom tip.
- 8.2 Attach the test load to the hoisting hook according with the max. radius of the crane.



- 8.3 Remove the steel protection cover of the limiters. Lift the test load from the ground and regulate screw **C** of the upper micro switch so that it depresses push-button **B** of micro switch **A**. This micro switch will stop the load lifting and the trolley forward displacement.
- 8.4 Secure nuts **D**.
- 8.5 Lower the load back onto the ground. Remove the **50 kg (110 lbs)** overload. Check that it is possible to lift the max. load allowed at the boom tip, according with the following table.

MAX. LOAD AT BOOM TIP	
Boom	Max. load at boom tip
41.7 m (136'-9")	1,000 kg (2,204 lbs)
30.85 m (101'-2") third boom section folded	1,400 kg (3,086 lbs)

10.8.2. MAX. STATIC MOMENT (LMMS)

LOCATION
Lower micro switch on the ballast tie rod O (check the connections 1S5 -terminals 24-28).

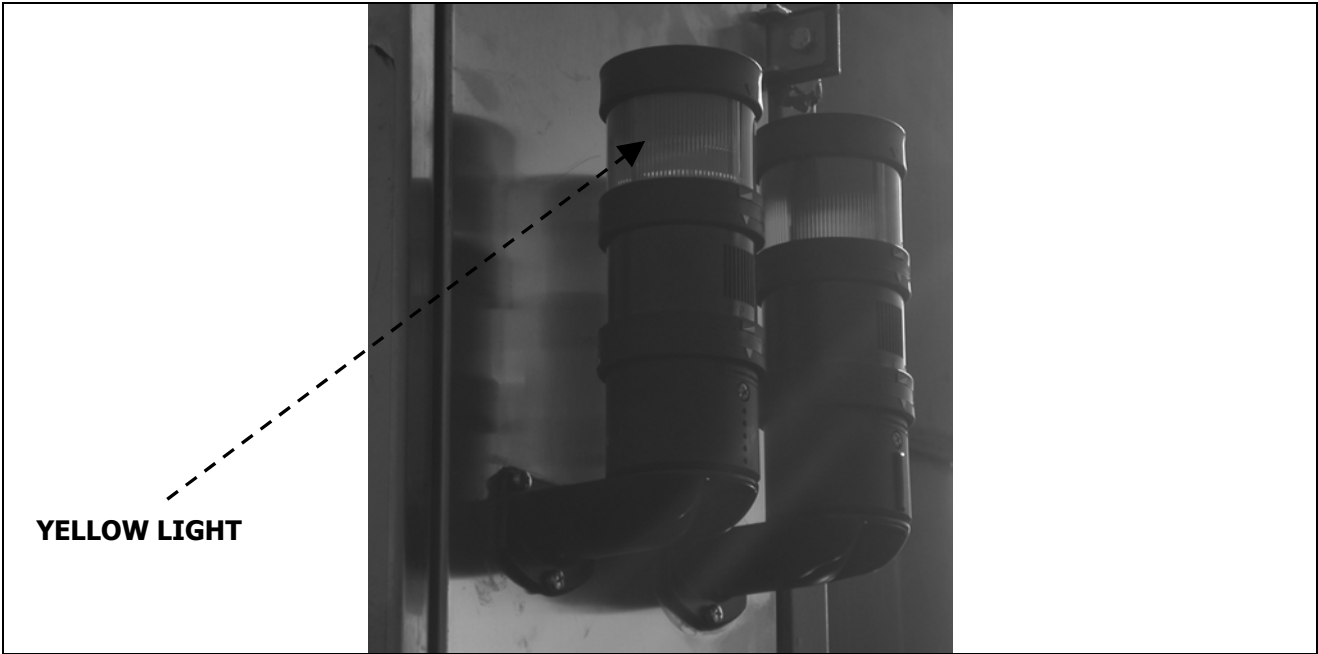
TEST LOAD		
Boom 41.7 m (136'-9")	1,000 kg + 50 kg = 1,050 kg 2,204 lbs + 110 lbs = 2,314 lbs	Load equal to the crane max. load at the boom tip + overload
Boom 30.85 m (101'-2") third boom section folded	1,400 + 50 kg = 1,450 kg 3,086 lbs + 110 lbs = 3,196 lbs	

- 8.6 Move the trolley backwards of about **2 m (6'-7")** from the boom tip.
- 8.7 Attach the test load to the hoisting hook according with the max. radius of the crane.
- 8.8 Remove the steel protection cover of the limiters. Lift the test load from the ground. Displace the trolley towards the boom tip, r regulate screw **H** of the lower micro switch, until it actuates push-button **F** of micro switch **E**. The micro switch will stop the trolley displacement forward.
- 8.9 Tighten nuts **G**.
- 8.10 Move the trolley backwards of about **2 m (6'-7")** from the boom tip. Check that, when moving the trolley towards the boom tip, micro switch **E** stops its displacement before it reaches the boom tip.
- 8.11 Lower the load back onto the ground. Remove the **50 kg (110 lbs)** overload. Move the trolley backwards of about **2 m (6'-7")** from the boom tip. Lift the max. load allowed with the trolley at the boom tjp, according with the following table. Check that, lifting this load, the trolley may get the boom tip and the micro switch doesn't stop its movement.

MAX. LOAD AT BOOM TIP	
Boom	Max. load at boom tip
41.7 m (136'-9")	1,000 kg (2,204 lbs)
30.85 m (101'-2") third boom section folded	1,400 kg (3,086 lbs)



8.12 The max. moment limiters are equipped with an alert (buzzer and yellow light placed on the side of the electric cabinet) indicating that the limit load is going to be attended.



WARNING

- The acoustic warning will automatically go and remain on for the whole time that the crane is in the overload condition; it will be automatically silenced when the overload is lowered to the ground or decreased to the permitted weight.
- Failure in setting the max. moment limiters may allow the hoisting of a load greater than allowed in the section between the boom tip and the point with rated load. Risks of seriously compromising the mechanical elements, damaging the machine structure, along with risk of crane overturning.
- **The limiter a safety device. Its intervention shall be limited to incorrect operations. In normal operation conditions, the operator will lift up only loads of known weight at the distance indicated on the load curves at paragraph 07.13.**
- Failure in checking daily or at each new shift start the efficiency of the limit switch, may cause a failure in the intervention of the device in case of necessity.
- The two max. moment limiters are in a line. In case of any doubt in recognizing the limiter to adjust, check the connections.



10.9. TROLLEY POSITIONING AND LIMIT SWITCHES

- 9.1 The trolley displacement limit switches normally don't require any adjustment.
- 9.2 Considering their importance in order to assure a correct crane functioning, it is necessary to check them, before starting crane erection.
- 9.3 When operating the crane with unfolded boom (**SA1** in position **1**, **SA2** in position **1**), the micro switches placed at the boom tip **4S5** and next to the tower **4S6** are actuated by the lower sliding block placed on the side of the trolley.
- 9.4 When operating the crane with boom third section folded (**SA1** in position **1**, **SA2** in position **2**), the limit switch at the boom second section end is the micro switch **4S12**, actuated by the upper sliding shoe of the trolley. The function of **4S6** remains unchanged.
- 9.5 When operating the crane with folded boom (**SA1** in position **1**, **SA2** in position **3**), the limit switch at the boom first section end is the micro switch **4S10**, actuated by the upper sliding shoe of the trolley. The function of **4S6** remains unchanged.

SUMMARY OF THE TROLLEY DISPLACEMENT LIMIT SWITCHES			
Operation configuration (Selector switch SA1 in position 1)	Position of the selector switch SA2	Trolley far limit switch	Trolley near limit switch
Unfolded boom	1	4S5	4S6
Partially folded boom (third boom section folded)	2	4S12	4S6
Folded boom	3	4S10	4S6

- 9.6 During crane erection (**SA1** in position **2** or **3**), the micro switch **5S1** (**4S10** and **5S1** are the same micro switch, with a double function) has the function of micro switch enabling the functioning of the hydraulic unit. If the trolley does not actuate the micro switch **5S1**, the hydraulic unit does not work (paragraph 07.5).
- 9.7 The positioning limit switches **FP1**, **FP2**, **FP3 "NO"** and **FP3 "NC"** have the function described at the paragraph 07.5 during the stages of folding and unfolding of the boom second section and of the boom third section. They are actuated by cams, sliding blocks or pushes and they shall be kept efficient.
- 9.8 During the procedures of crane erection and dismantling, the correct sequences shall be followed or the micro switches don't allow to go further, till it is carried out in the correct sequence (paragraph 07.5).

	WARNING
➤ All the micro switches S and FP shall always be kept efficient and correctly employed. Their cutting off may cause incorrect or uncontrolled operations, and this may cause the risk of damaging for the structures and the mechanisms. ➤ If the electrical limit switches are not efficient, the trolley may hit the bumpers, damaging the structural parts.	



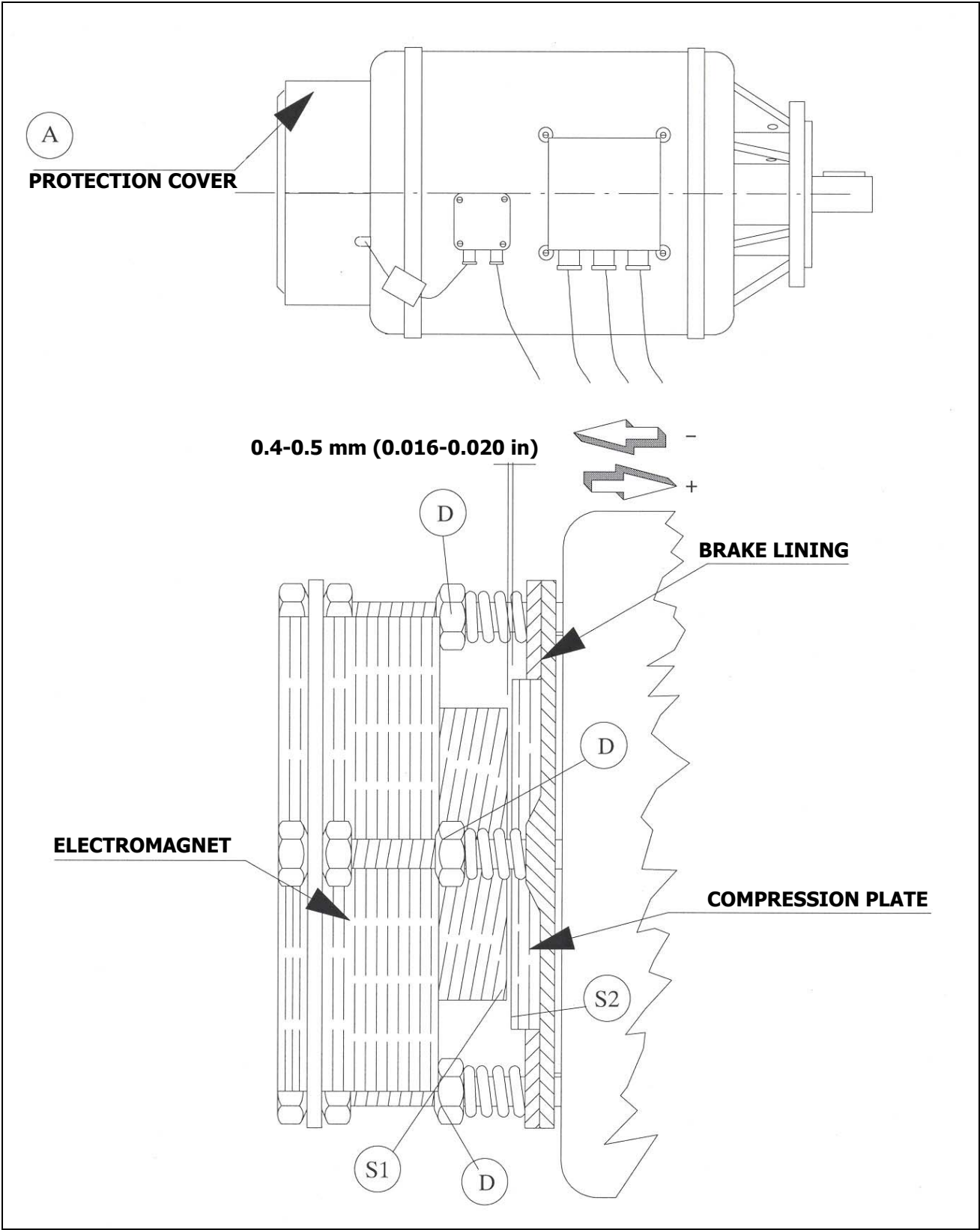
10.10. OTHER SAFETY DEVICES

- 10.1 The two following devices are very important in order to preserve the safety of all the people concerned with crane operation. Therefore, they shall be kept always efficient and functioning. Serious risks may occur in the event of faults of these devices.
- 10.2 The **EMERGENCY STOP** button is placed on the control board and it shall be actuate in any case of emergency: it stops the electrical feeding of the crane.
- 10.3 The **ACOUSTIC WARNING** is controlled by the control board and it shall be actuated in order to signal the beginning of each movement of the crane, and to advert the exposed people of the presence of suspended loads. The siren of the acoustic warning is placed on the lower part of the electric cabinet. Pay attention during crane displacements, to prevent damages to the siren.

	WARNING
➤ All the safety devices described above don't need any adjustment, but they shall be kept perfectly efficient and functioning. ➤ If the emergency stop button is not efficient, the emergency stop is not possible, and it is a very dangerous situation. ➤ If the alarm is not efficient, the movements of the crane cannot be signalled and there may be the danger of crushing and shock for the exposed people.	



10.11. ADJUSTMENT OF THE HOISTING MOTOR BRAKE (FMS)





FUNCTION
It prevents the free fall of the load in the following cases: - o stopping with suspended load; - o stopping of the lifting or lowering movement in case of power cut; - o stopping of the lifting or lowering movement in case of electric motor failure.

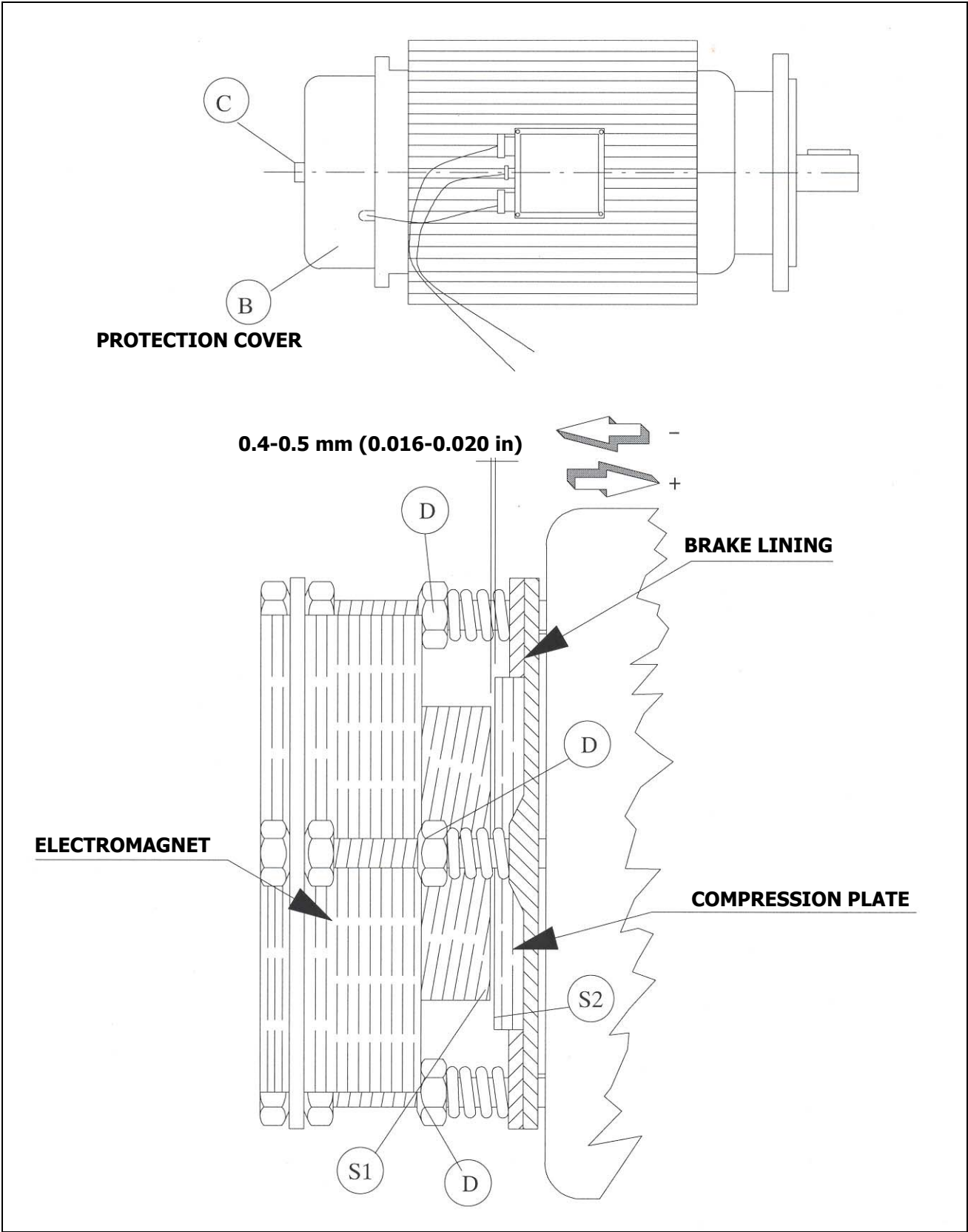
LOCATION
On the rear side of the hoisting motor.

- 11.1 Switch the power off.
- 11.2 Remove the protection cover **A**.
- 11.3 With a spanner turn the nuts **D** to the right (+ direction of the arrow) to increase braking torque or to the left (- direction of the arrow) to decrease braking torque.
- 11.4 It is important that the friction plate exerts its action on the whole surface of the brake lining disc; the plate and brake lining shall be set in a perfectly parallel position. To the purpose, employ a gauge or, even better, three reference blocks set at 120° angle to each other on the turned surfaces **S1** and **S2**. The gap between the surfaces shall be of **0.4-0.5 mm (0.016-0.020 in)**.
- 11.5 Fit the protection cover back into position and switch on the power supply.
- 11.6 Run braking tests by lifting or lowering the load for which brake requires setting (generally, the rated load of the crane); should the braking not be satisfactory, increase the braking torque.

 WARNING
➤ The brake reduces the load movement progressively. Braking effect shall not be too elevated, to prevent sudden stops and excessive stresses on the structural parts. ➤ Keep the contact surfaces of the braking system clean and free from traces of oil, humidity, rust, dust, etc. ➤ Failure in properly adjust the hoisting brake will cause, in case of stops with lifted load, its free fall, that may cause danger of crushing and shock for the exposed people. ➤ An incorrect adjustment of the brake may cause brake malfunctioning, with consequent damage or excessive wear of its mechanical and electrical components. Moreover, there subsists the risk of uncontrolled lowering of the suspended load, even in the absence of operated controls, with danger for the exposed persons. ➤ Failure in checking daily or at each new shift start the efficiency of the brake may cause the risk that it will not function in case of necessity. ➤ Failure in reassemble the protection cover of the brake may cause the risk of pulling and crushing for the exposed persons. ➤ The brake in use is DC fed and, as such, it requires a periodical check and a correct adjustment of the air gap. ➤ The adjustment of the springs of the hoisting brake shall ensure a holding power not lower than 125% of the torque exerted by the load hoisting.



10.12. ADJUSTMENT OF THE TROLLEY MOTOR BRAKE (FMC)

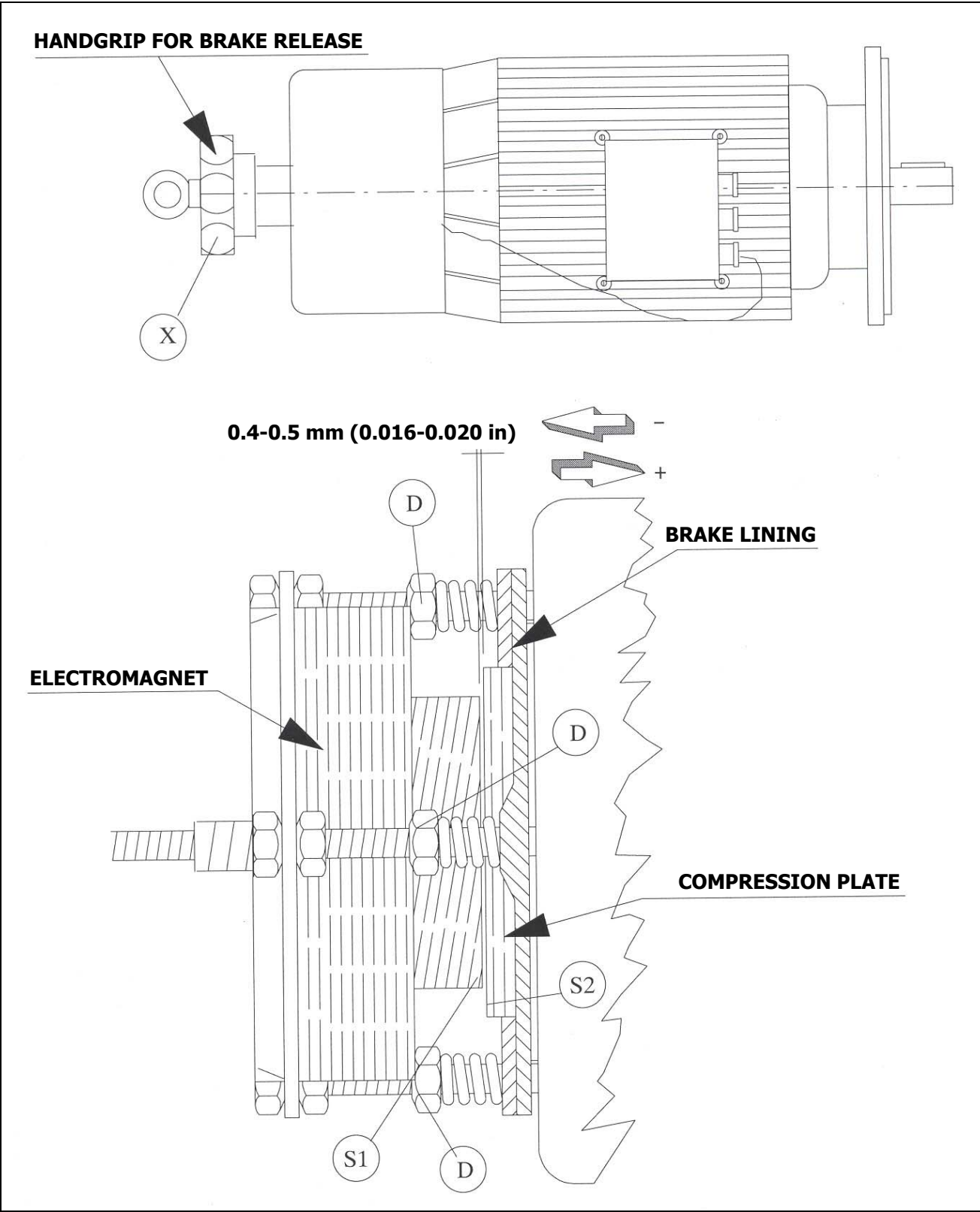




FUNCTION	
It prevents the uncontrolled movement of the trolley and ensures its stopping forwards or backwards in the following cases: - o power cut; - o motor failure. The brake shall function always and anyway after the slowing down stage of the load, controlled by the variable speed drive.	
LOCATION	
On the rear side of the trolley motor.	
	WARNING
➤ The adjustment shall be carried out being the crane dismantled and the boom unfolded. 12.1 Switch the power off. 12.2 Remove the protection case B, by loosening the middle screw C. 12.3 With a spanner turn the nuts D to the right (+ direction of the arrow) to increase braking torque or to the left (- direction of the arrow) to decrease braking torque.	
	WARNING
➤ The braking torque shall be considerably increased if the crane is operated with inclined boom. 12.4 It is important that the friction plate exerts its action on the whole surface of the brake lining disc; the plate and brake lining shall be set in a perfectly parallel position. To the purpose, employ a gauge or, even better, three reference blocks set at 120° angle to each other on the turned surfaces S1 and S2. The gap between the surfaces shall be of 0.4-0.5 mm (0.016-0.020 in). 12.5 Fit the protection cover back into position and switch on the power supply. 12.6 Erect the crane. 12.7 Carry out some tests of trolley stopping with a load suspended. The braking effect shall be slight and gradual.	
	WARNING
➤ The brake reduces the load movement progressively. Braking effect shall not be too elevated, to prevent sudden stops and excessive stresses on the structural parts. ➤ Keep the contact surfaces of the braking system clean and free from traces of oil, humidity, rust, dust, etc. ➤ Failure in properly adjusting the trolley brake will cause its uncontrolled displacement, that may cause the danger of crane overturning and crushing for the exposed people. ➤ An incorrect adjustment of the brake may cause brake malfunctioning, with consequent damage or excessive wear of its mechanical and electrical components. Moreover, there subsists the risk of uncontrolled lowering of the suspended load, even in the absence of operated controls, with danger for the exposed persons. ➤ Failure in checking daily or at each new shift start the efficiency of the brake may cause the risk that it will not function in case of necessity. ➤ Failure in reassemble the protection cover of the brake may cause the risk of pulling and crushing for the exposed persons.	



10.13. ADJUSTMENT OF THE SWING BRAKE (FMR)





FUNCTION
It prevents any uncontrolled swing of the crane. It has the function of stationary brake and its intervention is not applied in the braking stage.

LOCATION
Arranged in the upper part of the swing motor.

	WARNING
➤ Regulate the brake so that in case of sudden power failure and therefore in the absence of the motor braking effect, the brake does not act immediately, thus causing the swing to stop abruptly, but progressively slows down the swing movement instead.	

- 13.1 Switch the power off.
- 13.2 Remove the protection cover **A**.
- 13.3 With a spanner turn the nuts **D** to the right (+ direction of the arrow) to increase braking torque or to the left (- direction of the arrow) to decrease braking torque.
- 13.4 It is important that the friction plate exerts its action on the whole surface of the brake lining disc; the plate and brake lining shall be set in a perfectly parallel position. To the purpose, employ a gauge or, even better, three reference blocks set at 120° angle to each other on the turned surfaces **S1** and **S2**. The gap between the surfaces shall be of **0.4-0.5 mm (0.016-0.020 in)**.
- 13.5 Fit the protection cover back into position and switch on the power supply.
- 13.6 Test the crane swing braking. The timer controlling brake intervention closes the brake when swing has already been stopped by the relevant electrical equipment situated in the electric cabinet; the brake function is used as a "parking brake" with the crane stationary.

	WARNING
➤ With the crane out of service and at the end of the operation cycle, release swing brake by turning handgrip X clockwise, so that the crane is free to swing (CRANE FREE TO WEATHERVANE, paragraph 11.3.2). Prior to place the crane into service again, turn the handgrip X counter-clockwise to restore the swing brake.	

	WARNING
➤ The swing brake is a stationary brake employed only when the crane is at stand still. An incorrect setting of the electrical equipment arranged inside the electric cabinet can cause an early closing of the brake, when the crane is still moving, thus causing excessive wear of the braking elements. ➤ Keep the contact surfaces of the braking system clean and free from traces of oil, humidity, rust, dust, etc. ➤ Failure in adjusting the swing brake may cause uncontrolled crane swing due to side wind pressure, with possible risks of crane collision against fixed obstacles or hazards for exposed persons. ➤ An incorrect adjustment of the brake may cause brake malfunctioning, with consequent damage or excessive wear of its mechanical and electrical components and with risk of crushing, pulling, shock and shearing for the exposed persons. ➤ Failure in checking daily or at each new shift start the efficiency of the brake may cause the risk that	



it will not function in case of necessity.

- Failure in reassemble the protection cover of the brake may cause the risk of pulling and crushing for the exposed persons.



11. OPERATION RULES

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11.1. OPERATOR REQUISITES

1.1 Crane control and operation shall be entrusted to a **qualified, trained and informed operator**.

QUALIFIED
The operator shall posses the aptitude, physical and psychical requisites, needed for a correct crane operation.
TRAINED
The operator shall possess specific professional qualifications and shall have attended specialized training courses for lifting equipment operators.
INFORMED
The operator shall have received from the employer and user all the specific istructions concerning the crane he is in charge to and shall know all the contents of this instruction Manual.

- 1.2 The operator shall have the following physical and psychical characteristics:
- o he shall have visual and hearing acuity, according to clinical standards;
 - o he shall take neither alcohol nor drugs;
 - o he shall not suffer from vertigo and he shall not have motor deficiencis;
 - o he shall not be prone to fainting as a result of physical stress;
 - o he shall be psychically balanced;
 - o he shall have sense of responsibility.

	WARNING
➤	Crane control and operation shall not be entrusted to operators not corresponding to the above listed and described requirements. Any lack of attitude, awareness or knowledge may lead to danger situations for the exposed persons.



11.2. INSTRUCTIONS FOR THE USER

- 2.1 The user shall be responsible of selecting an installation **ground of suitable mechanical strength and resistance**. The ground strength shall be adequate to support both the max. lifted loads and the crane frame in every operation stege, and when out-of-service.
- 2.2 The user shall carefully check that **the crane is suitable for the operating requirements of the building site**, verifying for example the crane hoisting load in a certain radius depending on the intended necessity of lifting up loads of particular weight in a specific position.
- 2.3 The user shall check that the technical **specifications for correct crane operation** given in the present instruction Manual comply with the actual operating conditions of the working environment (i.e. wind, visibility, etc.).
- 2.4 The user shall provide for a **main power supply** of characteristics suitable for the crane safe and correct operation.
- 2.5 The user shall control that **no additional equipment or components have been fitted on the crane**, or, if any, that it has been previously checked for suitability to the intended use.
- 2.6 Before enabling putting into service of the crane, the user **shall check the crane correct erection and installation**, in compliance with the instructions given in the present Manual and with the laws in force.
- 2.7 The user shall be responsible of **selecting the operator in charge of crane control**, of **complying with the safety and operation standards** as well as of **carrying out the prescribed scheduled maintenance interventions** reported in this instruction Manuals.
- 2.8 The user shall be responsible of **training the operator in charge of crane control, giving him all the information** required for a safe and correct crane operation.
- 2.9 **Any crane use other than indicated at paragraph 01.3, of the present instruction Manual is strictly forbidden.**
- 2.10 In case of poor visibility, due to darkness or fog, the user shall provide the building site with a suitable **lighting system**, with the essential purpose to ensure to the operator and all the exposed persons a visibility suitable for any operation.
- 2.11 **Do not erect or operate the crane in explosive, corrosive or oxidative and fire-risk atmospheres or environments.**

	WARNING
➤ Extremely danger situations may derive from operating in disrespect of the above prescriptions.	



11.3. INSTRUCTIONS FOR THE OPERATOR

11.3.1. CRANE IN-SERVICE

- 3.1 At the start of a new shift, before proceeding with any hoisting operation, check for controls and safety devices correct functioning.
- 3.2 **If the crane is not in perfectly working order, it shall not be placed into service.**
- 3.3 Lift loads of known weight only at the indicated radii and speeds, as specified in the present instruction Manual or on the charts affixed to the crane electric cabinet (please refer to load curves, paragraph 07.13).
- 3.4 The hook shall always work vertically, without side pulls or swings and it shall not be used for dragging loads or for pulling any restrained object.
- 3.5 From the control station, the operator shall be able to clearly see: the building site area, the loading and unloading points, the aerial path of the load and the allowed load flags. Moreover, he shall be able to check that nobody is standing within the danger zone. In case of limited visibility, the presence of a signaller having a complete view of the working area and of the load path is strictly required (paragraph 11.4).
- 3.6 Before actuating a reverse movement, always wait for the previous one to stop. Avoid impulse controls, should they cause oscillations.
- 3.7 At starting or stopping stages of any movement, use slow speeds.
- 3.8 When operating more than one movement contemporaneously, carefully survey any possible drifting oscillation of the lifted load.
- 3.9 Limit switches and limiters shall be considered as safety devices. Under normal operation, be careful to stop any crane movement before their intervention.
- 3.10 Before starting any movement, always check for correct slinging, balance and stability of the lifted loads.
- 3.11 Actuate the emergency stop device (red push button on the cable or remote control board) only in case of need or danger.
- 3.12 When resting the load onto the ground, keep the rope tensioned by means of the weight of the block to prevent the abnormal winding of the hoisting rope on the drum.
- 3.13 Under any operation conditions three rope wraps are always to be left wound on the drums. Adjust the limiters accordingly, if required.
- 3.14 Do not walk under suspended loads and do not lift loads above any persons within the crane operating radius of action. Never leave the crane with a suspended load.
- 3.15 Hoisting and handling operations shall always be signalled by depressing the acoustic warning push-button fitted on the control board, so that all persons eventually exposed to the risk of load and structures falling will immediately move away from the danger zone.
- 3.16 The hydraulic devices shall be used only for erection and dismantling. **Never use the hydraulic erection devices when the crane has a load suspended to the hook.** Danger of great damages for the hydraulic devices.



- 3.17 It is forbidden to fold the boom with a load suspended to the hook. Anyway, it is forbidden to carry out operations of erection, dismantling or changing of the boom configuration with suspended loads, to prevent serious damages to the hydraulic devices.
- 3.18 Follow the maintenance instructions and carry out all interventions, even if not specified the present Manual, to ensure regular and safe crane operation.
- 3.19 Crane operation, erection and dismantling shall be carried out in the full respect of the laws in force and of all the imposed limitations concerning: crane installation, electrical connections, lifting hardware, personnel, load hoisting maneuvers, etc.
- 3.20 **The respect of these rules**, and of all the supplied instructions and of all the basic safety rules prescribed by the common sense, **is compulsory to keep the guarantee (granted by the Manufacturer for the cranes manufactured in its factory) valid. Any modification to structures or to operation rules is strictly forbidden.**
- 3.21 **The Manufacturer declines any responsibility for damages deriving from incorrect maneuvers carried out during erection, dismantling and operation of the crane, or for damages resulting from the use of worn-out cranes, from carelessness or disregard of the prescribed rules.**
- 3.22 **It is strictly forbidden to use the crane to lift up persons, or to hang on to loads during hoisting.**
- 3.23 **Any crane use other than indicated at paragraph 01.3, of the present instruction Manual is strictly forbidden.**
- 3.24 **Access to danger zone B is permitted only in case of need**, and after signalling it to the crane operator. **Access to the danger zone A within the ballast arc of rotation is strictly forbidden.** The zone shall be properly **enclosed** and marked.
- 3.25 **When lifting up loads, always act in strict respect of the load rates** indicated at paragraph 01.5. When carrying out a heavy-duty operation, always check for motor temperature, especially in presence of difficult factors (e.g. voltage drops, high frequency, ambient temperatures above average values, etc.).
- 3.26 **It is forbidden to use the crane to handle dangerous, harmful, inflammable or explosive materials.**
- 3.27 In case of limited visibility due to darkness or fog, activate the **lighting system**, to ensure to the operator and to all the exposed persons a suitable visibility for all the operations.
- 3.28 **Do not erect or operate the crane in explosive, corrosive or oxidative and fire-risk atmospheres or environments.**
- 3.29 **Never use the crane for heavy duties in temperatures below zero degrees centigrade (32°F).** In particular, carefully avoid any load and frames oscillation, sudden maneuvers, crashes, etc.
- 3.30 **In presence of wind**, act as it follows:
 - o **lift up loads of reduced wind exposed surface** as a function of the crane height and the wind force;
 - o **carefully check for the variable drifting effects** exerted by the wind on the boom frames in its different positions on its arc of swing **as well as for any "sailing" effect** of the suspended load;



- o As regards the **surfaces exposed to the wind**, to lift up loads operate in full respect of the indicative values given in the table below. Please remember that the values are indicative only, and may be subject to variations depending on the characteristics of the lifted load as well as of the wind strikes.

WIND SPEED	LOAD EXPOSED SURFACE
Lower than 10 km/h	No limitations
10-20 km/h	4 m² max.
20-35 km/h	2 m² max.
35-50 km/h	1 m² max.
Higher than 50 km/h	Smaller than 1 m²

WIND SPEED	LOAD EXPOSED SURFACE
Lower than 6.2 mph	No limitations
6.2-12.4 mph	43.0 ft² max.
12.4-21.7 mph	21.5 ft² max.
21.7-31.1 mph	10.7 ft² max.
Higher than 31.1 mph	Smaller than 10.7 ft²

- 3.31 Slings and lifting attachments are part of the load.
- 3.32 When the ambient temperature drops below **-20°C (-4°F)**, the crane shall be taken out of service.



WARNING

➤ Extremely danger situations may derive from operating in disrespect of the above prescriptions.



11.3.2. CRANE OUT-OF-SERVICE

- 3.33 At the end of every shift or in case of interruption in crane operation, carry out the following tasks:
- o **LIFT THE BLOCK** at the max. height almost;
 - o **PLACE THE TROLLEY** at the middle of the boom almost;
 - o **RELEASE THE SWING BRAKE** of the crane, to allow the boom to orientate according with the wind direction (**CRANE FREE TO WEATHERVANE** [paragraph 10.13](#));
 - o **STORE IN A SAFE PLACE** and not accessible to any not authorized person **THE CONTROL DEVICE**, wire control board or remote control board;
 - o **CUT OFF THE POWER SUPPLY** of the crane, opening the switches of the electric cabinet of the crane and of the electric cabinet of the building site;
 - o Carry out any other tasks considered necessary to take the crane out of service in **SAFETY CONDITIONS**.
- 3.34 Should the wind speed exceed **72 km/h (44.7 mph)**, stop crane operation and take the crane out of service, carrying out the tasks exposed in the previous point. Furthermore, check the stability of ballast, foundations and crane resting points.
- 3.35 For the crane out-of-service, it is possible to make the **BOOM ANCHORAGE**, that may be kept till a max. wind speed of **110 km/h (68.3 mph)**. Follow the instructions of the [paragraph 11.3.3](#).
- 3.36 Before leaving the working post, the operator shall make sure that not authorized persons may start the crane up.



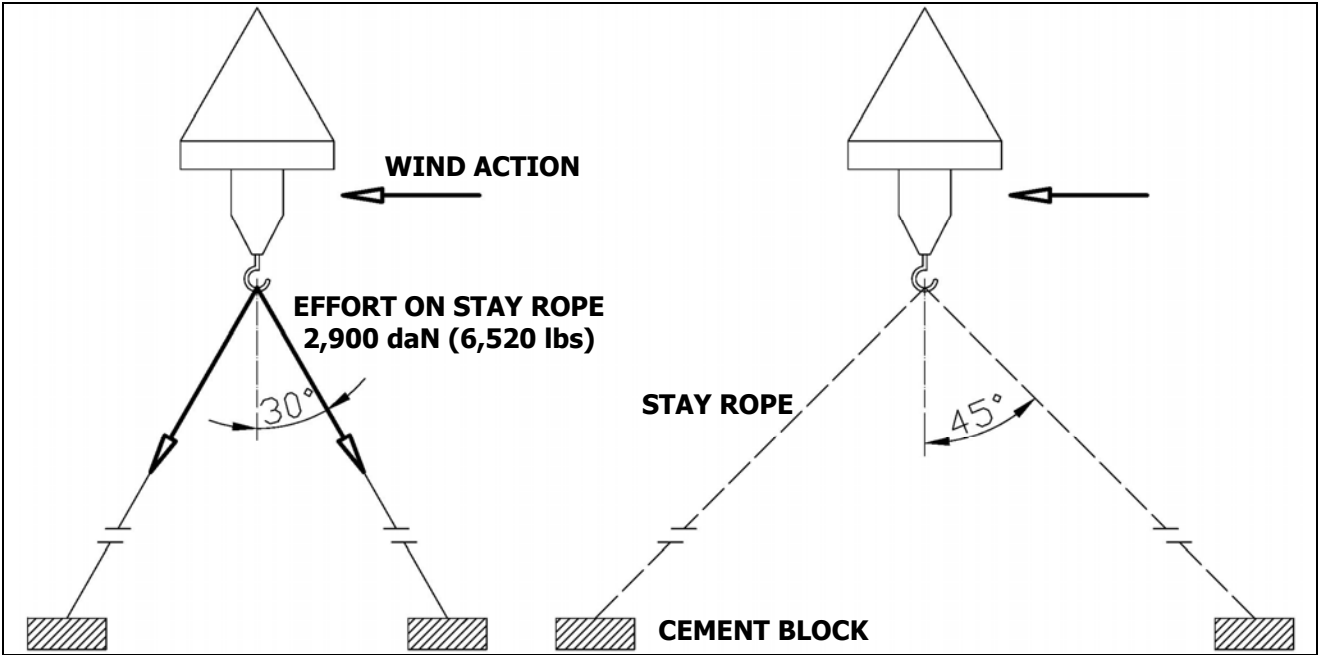
WARNING

- Extremely danger situations may derive from operating in disrespect of the above prescriptions.



11.3.3. BOOM ANCHORAGE

- 3.37 Being the crane out-of-service, it is possible to make a boom anchorage, that doesn't allow the crane swing. This anchorage shall be made according with the istructions of this paragraph.
- 3.38 The boom anchorage may be used till a **limit speed wind of 110 km/h (68.3 mph). Over this limit of wind speed, the anchorage shall be removed and the crane shall be free to swing, with the swing brake released (CRANE FREE TO WEATHERVANE, paragraph 10.13).**
- 3.39 The boom anchorage is made by two steel ropes with suitable length and strength, hooked to the block by means of eyelet and clips or by a grommet, and two reinforced concrete blocks with suitable size.
- 3.40 To realize the anchorage, lift the block till the max. height and place the two cement blocks in such a position that the stay ropes form, as regards to the vertical axis, an angle of **30°** or **45°**.
- 3.41 In the following picture two examples of anchorage are given, with the stay ropes placed at **30°** and **45°** as regards to the vertical axis. The instructions that follow refer to the heaviest case only (stay ropes with angle **30°** as regards to the vertical axis).



- 3.42 In the following table there are the min. breaking load of the ropes employed as stay ropes, as a function of different safety factors.

EFFORT ON STAT ROPE	SAFETY FACTOR	MIN. BREAKING LOAD OF STAY ROPE
2,900 daN (6,520 lbs)	3	8,700 daN (19,560 lbs)
2,900 daN (6,520 lbs)	4	11,600 daN (26,080 lbs)
2,900 daN (6,520 lbs)	5	14,500 daN (32,600 lbs)



3.43 The two stay ropes shall be fixed to two cement blocks, built as it follows:

FRICTION FACTOR GROUND – CEMENT BLOCK	UNIT WEIGHT OF THE REINFORCED CONCRETE BLOCK	UNIT VOLUME OF THE REINFORCED CONCRETE BLOCK
0.5	5,500 kg (12,126 lbs)	2.5 m ³ (88.1 ft ³)

	ATTENZIONE
➤ The boom anchorage may be used till a limit speed wind of 110 km/h (68.3 mph). Over this limit of wind speed, the anchorage shall be removed and the crane shall be free to swing: failure in following this prescriptions may engender the serious risk of crane overturning under the effect of the wind push. ➤ Failure in employing ropes having a suitable breaking load may engender the risk of breakage of stay ropes, with serious danger of crane overturning under the effect of the wind push. Min. safety factor for stay ropes = 3. ➤ Failure in suitably fixing the stay ropes to the hook of the crane block and to the reinforced concrete blocks may engender the risk of unhooking or unthreading of the stay ropes, with the serious danger of crane overturning under the effect of the wind push. ➤ Building reinforced concrete blocks having an inadequate mass, the blocks may move under the effect of stay rope pull, with serious danger for crane stability.	



11.4. HAND SIGNALS

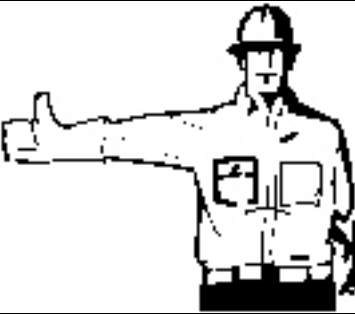
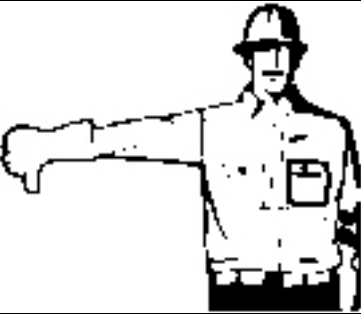
- 4.1 Should the operator have an incomplete visibility of the suspended load along its movement path, the intervention of a **signaller** is strictly required.
- 4.2 It may happen that, during crane erection, the person in charge of directing the operations performs the task of signaller, to indicate by hand signal to the crane operator the movements to be carried out.
- 4.3 Every hand signal shall be precise, simple, wide, easy to make and to understand, and different from any other one.
- 4.4 The signaller shall be able to constantly see all the maneuvers and the aerial path of the load, without being exposed to any risk.
- 4.5 The signaller shall pay his exclusive attention to the maneuver control, and to the safety of the persons exposed to eventual risks.
- 4.6 Should the operator not understand a signal, he shall immediately stop crane operation and ask for further instructions to the signaller.
- 4.7 With the purpose of enhancing the visibility of hand signals, the signaller shall wear or hold one or more suitable identification means, such as vests, sleeves, bracelets, signalling discs, etc..
- 4.8 The operator shall respond only to signals from the designated signaller, except for the STOP (EMERGENCY STOP). **A STOP (EMERGENCY STOP) signal from any person shall be immediately obeyed.**
- 4.9 The list of the conventional hand signals, suggested by the standard, is herewith indicated. It anyway does not prevent the possibility of employing other coding systems.

	WARNING
➤ Incomplete or incomprehensible signals may cause serious maneuver mistakes, with consequent dangers for all the exposed persons.	

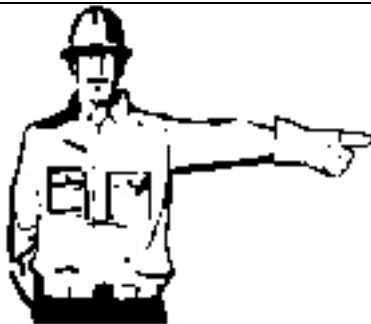
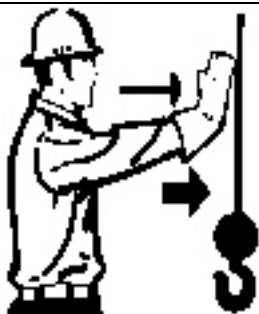


Arm extended, palm down, open hand. OPEN CLAM	Arm extended, palm down, close hand. CLOSE CLAM
Arm extended, palm down, move hand rightward and leftward. STOP. END OF THE MOVEMENT	Both arms outstretched at the sides horizontally, fingers outstretched. STOP (EMERGENCY STOP)
Clasp hands in front of the body. DOG EVERYTHING	
With arm extended downward, forefinger pointing down, move hand in small horizontal circles. LOWER LOAD	With forearm vertical, forefinger pointing up, move hand in small horizontal circles. RAISE LOAD



	
Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal (raise load shown as example).	Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal (lower load shown as example).
MOVE SLOWLY (RAISE LOAD)	MOVE SLOWLY (LOWER LOAD)
	
Arm extended, fingers closed, thumb pointing upward.	Arm extended, finger closed, thumb pointing downward.
BOOM UP OR TROLLEY IN	BOOM DOWN OR TROLLEY OUT
	
Arm extended, fingers closed, thumb pointing upward, other arm bent slightly with forefinger pointing down and rotate hand in horizontal circles.	Arm extended, fingers closed, thumb pointing downward, other arm with forearm vertical, forefinger pointing upward and rotate hand in horizontal circle.
BOOM UP, LOWER LOAD	BOOM DOWN, RAISE LOAD
	
Both fists in front of body with thumbs pointing outward	Both fists in front of body with thumbs pointing toward each other.
TROLLEY OUT	TROLLEY IN



	
Right arm extended, point with finger in direction of swing of boom.	Left arm extended, point with finger in direction of swing of boom.
SWING LEFT	SWING RIGHT
	
Use both fists in front of body, making a circular motion about each other, indicating direction of travel; forward or backward (for crawler cranes only).	Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.
TRAVEL IN DIRECTION INDICATED BY ROTATION OF HAND AND ARM MOVEMENT	RAIL OR BRIDGE TRAVEL IN DIRECTION INDICATED
	
Tap fist on head; the use regular signals.	Tap elbow with one hand; then use regular signals.
MAIN HOIST	WHIP LINE



11.5. CRANE SCRAPPING

- 5.1 Upon expiry of the crane standard operation life and upon completion of the operation cycles indicated by the designer to determine the fatigue of structural parts and mechanisms, the crane shall be scrapped
- 5.2 To scrap the crane, it's recommended to contact qualified companies, considering that the parts to be scrapped are basically formed by this materials:
 - o galvanized steel structural parts;
 - o painted steel structural parts;
 - o copper cables;
 - o components in plastic resin of various types;
 - o rubber accessories;
 - o cement blocks.
- 5.3 Special care shall be taken when scrapping the reduction units of winches and components of the hydraulic system. Avoid its dispersion in the environment. The drained oil shall be collected and disposed of carefully, in conformity with the laws in force.

	WARNING
➤	The crane as a whole and its components shall not be abandoned or dispersed in the environment.





12. MAINTENANCE

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12.1. ROPE MAINTENANCE

12.1.1. ROPE CHARACTERISTICS

HOISTING ROPE	
MATERIAL STRENGTH	2,160 N/mm ² (313,282 lb/in ²)
ROPE DIAMETER	9 mm (0.354 in)
ROPE CONSTRUCTION	NRHD ROTATION-RESISTANT 24x7 METAL CORE – ZN
LENGTH	175 m (574'-2")
BREAKING LOAD	6,863 daN – 6,996 kg (15,429 lbs)

TROLLEY ROPE	
MATERIAL STRENGTH	2,160 N/mm ² (313,282 lb/in ²)
ROPE DIAMETER	6 mm (0.236 in)
ROPE CONSTRUCTION	6x25 TEFLON CORE – ZN
LENGTH	51 + 72 m (160'-9" + 239'-6")
BREAKING LOAD	3,600 daN – 3,670 kg (8,093 lbs)

DERRICK ROPE	
MATERIAL STRENGTH	2,160 N/mm ² (313,282 lb/in ²)
ROPE DIAMETER	10 mm (0.236 in)
ROPE CONSTRUCTION	7x17 METAL CORE – ZN
LENGTH	37 m (121'-5")
BREAKING LOAD	7,800 daN – 7,951 kg (17,535 lbs)



TWO-ROPE TIE ROD (to lift the operation ballast blocks, supplied in the tool kit)	
MATERIAL STRENGTH	2,160 N/mm ² (313,282 lb/in ²)
ROPE DIAMETER	12 mm (0.472 in)
ROPE CONSTRUCTION	6x36 METAL CORE – ZN
LENGTH	2 m (6'-7")
BREAKING LOAD	8,500 daN – 8,665 kg (19,109 lbs)

BOOM STAY ROPE	
MATERIAL STRENGTH	2,160 N/mm ² (313,282 lb/in ²)
ROPE DIAMETER	26 mm (1.02 in)
ROPE CONSTRUCTION	8x36 METAL CORE – ZN
LENGTH	16.7 m (54'-10")
BREAKING LOAD	70,000 daN – 71,356 kg (157,366 lbs)

REAR STAY ROPE	
MATERIAL STRENGTH	2,160 N/mm ² (313,282 lb/in ²)
ROPE DIAMETER	38 mm (1.50 in)
ROPE CONSTRUCTION	8x19 METAL CORE – ZN
LENGTH	13.755 m (45'-2") (BUSH CENTER – BUSH CENTER)
BREAKING LOAD	140,000 daN – 142,711 kg (314,733 lbs)

TOWER RETURN STAY ROPE	
MATERIAL STRENGTH	2,160 N/mm ² (313,282 lb/in ²)
ROPE DIAMETER	20 mm (0.787 in)
ROPE CONSTRUCTION	6x31 METAL CORE – ZN
LENGTH	2.75 m (9'-0") (BUSH CENTER – BUSH CENTER)
BREAKING LOAD	36,000 daN – 36,697 kg (80,931 lbs)

DERRICK STAY ROPE	
MATERIAL STRENGTH	2,160 N/mm ² (313,282 lb/in ²)
ROPE DIAMETER	14 mm (0.551 in)
ROPE CONSTRUCTION	6x36 METAL CORE – ZN
LENGTH	4.27 m (14'-0")
BREAKING LOAD	16,569 daN – 16,889 kg (37,249 lbs)



12.1.2. CARRYING OUT THE ROPE MAINTENANCE AND INSPECTIONS

- 1.1 Carry out the procedure of **hoisting rope tensioning**, described at the paragraph 08.5, before putting the crane into service and repeat it frequently.
- 1.2 The ropes, the galvanized ones too, shall be carefully lubricated with greas or thick oil. Furthermore, the rope cleanliness shall be particularly cared; the ropes shall be free from sand deposits, cement encrustations, etc. If necessary, remove the ropes from the crane and wind them up on a winding reel.
- 1.3 Carry out a **daily inspection** of the ropes. The inspection shall be carried out by the **crane operator**.
- 1.4 The **daily inspection** scope is to detect all the possible danger situations that make necessary the immediate replacement of the rope. Among them: distortion of the rope, local decrease or increase in rope diameter, wear and corrosion, breakage of strands, presence of broken wires (paragraph 12.1.2), core protrusion, localized core deterioration in rotation-resistant ropes, damages due to heat or electring arcing.
- 1.5 During **the daily inspection**, a special care shall be paid checking the attachment points, the termination points and the connections. Check with special care the contact point of the rope with sheaves, drums, flanges and the zones where more layers of rape are in contact and the zones with crossover points.
- 1.6 The **daily inspection** of **rotation-resistant ropes** shall be particularly careful, because of their susceptibility to damage and to increase their deterioration.
- 1.7 The results of the **daily inspection** shall be recorded by the operator.
- 1.8 Carry out a **periodic inspection** of the ropes, according with factors such as the instructions of the manufacturer, the expected life, the load rates, the conditions of operation and maintenance. The inspection shall be carried out by a **qualified person**.
- 1.9 The **periodic inspection** shall be carried out at least once a month. It shall concern the entire length of the rope and its scope is to estimate if rope deteriorations may cause a decrease of original strength, and wheter further use of the rope constitutes a hazard.
- 1.10 The **periodic inspection** of the rope sections subject to rapid deterioration shall discover the damages, inspecting in particular the zones in contact with sheaves where rope travel is limited, the zones near ends where broken or corroded wires may protrude, the zones with reverse bends, the rope sections that are normally hidden during the daily inspections.
- 1.11 The **periodic inspection** scope is to detect all the possible deteriorations and damages described for the daily inspection, but even more carefully, especially for what concerns the alterations in rope diameter, the corrosion and the wear of wires in the end sections, the perfect condition of the ednd connections.
- 1.12 The results of the **periodic inspection** shall be recorded by the operator.
- 1.13 Ropes not in regular use **for more than a month**, due to crane shutdown or storage, shall be rigorously inspected, according with the prescriptions for periodic inspection.
- 1.14 In all cases when an accident or abnormal functioning has occurred that may have damaged the rope, its terminations or its connactions, the rope shall be inspected.
- 1.15 On every occasion when a rope has been brought back into operation after dismantling and reassembling, the rope shall be inspected.



- 1.16 Every three months, a qualified inspector shall carry out a very careful inspection of the ropes and the chains of the block, recording the result.
- 1.17 Rope replacement shall be done as regards to the location and the amount of broken wires, the level of wear and corrosion, and any other kind of alteration or deterioration (paragraph 12.1.3). Rope replacement shall be recorded.
- 1.18 In case of replacement of the rope, replace the end fixation clips too.
- 1.19 The replacement of ropes shall be carried out by qualified operators, trained and informed. Anyway, lay the ropes for all their length before winding them on the sheaves or drums. Check that the end clips to be tightened (paragraph 07.11).



12.1.3. ROPE REPLACEMENT

1.20 In this paragraph one can be found the instructions, according with the standard, to estimate if a rope requires replacement, when its deterioration condition prejudices its employ in safety conditions and performances.

A) BROKEN WIRES

1.21 The reported rules are taken from the rope manufacturer technical documentation. It takes to enumerate the broken wires, visible on the outer part of the crane, inspecting the most deteriorated section of the rope.

1.22 In the table it is reported the max. number of broken outer wires that can be accepted for a rope length equal to **6** and **30** times the diameter of the rope. The inspection shall be carried out on both the lengths and the rope shall be replaced if the breakage exceed the reported min. value even in one case only. The limit amount of broken wires is estimated considering that the standard prescribes a certain value for the ropes employed with steel sheaves, specifying that sheaves made of other materials may cause the breakage of inner wires.

TROLLEY ROPE Ø6 mm (0.236 in)		
LENGTH to inspect		LIMIT AMOUNT OF BROKEN OUTER WIRES
6xØ	36 mm (1.42 in)	5
30xØ	180 mm (7.09 in)	9

HOISTING ROPE Ø9 mm (0.354) ROTATION-RESISTANT		
LENGTH to inspect		LIMIT AMOUNT OF BROKEN OUTER WIRES
6xØ	54 mm (2.13 in)	2
30xØ	270 mm (10.7 in)	4

1.23 Consider that breakages are often difficult to detect, because the ends of the broken wire don't protrude from the rope surface.

1.24 It takes to be very careful, and it is proper to remove the grease covering the rope; scrub the rope with a soft wood stick and, if possible, bend the rope so that the broken wire ends are forced to raise up and become visible. In case of any doubt, replace the rope anyway.

1.25 It takes to consider the broken wire number increase, in the interval between two consecutive inspections. Even if the amount of broken wires remains below the limit value, an increase of their amount as regards to the previous inspection requires more frequent and careful inspections, because it necessarily brings to reach the limit values, that require the replacement of the rope.

B) OTHER CAUSES FOR ROPE REPLACEMENT

1.26 In addition to the broken wire limit amount rule, other kinds of distortion or deterioration make necessary the replacement of the rope.

1.27 **LOCAL GROUPING OF BROKEN WIRES.** When a rope has a local grouping of broken wires, it shall be immediately replaced. When the broken wires are in the same strand or when the broken wires are grouped in a section whose length is **less than 6** times the diameter, the rope shall be replaced even if the broken wire amount is less than the one indicated by the previous rule.

1.28 **BROKEN WIRES NEXT TO END CONNECTIONS.**When a rope has **more than 2 broken wires** beyond end connections, or **more than 1 broken wire** within one lay of an end connection, the end connection shall be remade shortening the rope, and in the respect of the connection characteristics, or the rope shall be replaced.



- 1.29 **BROKEN WIRE AT THE CONTACT POINT WITH THE CORE OF THE ROPE.** When an outer wire in contact with rope core is broken, and the core or loop of loose wires may protrude, the rope shall be replaced.
- 1.30 **WEAR.** If the wear of the rope causes the decrease of the diameter of outer wires of **one-third** of the original diameter or the decrease of the rope diameter is the **7%** of the nominal diameter, the rope shall be replaced. **WARNING:** to limit the wear the rope shall be correctly lubricated, according with the instructions of the paragraph 12.1.2.
- 1.31 **DISTORTIONS OF THE ROPE.** Waviness, strand or wire extrusion, kinks or tightened loops, crushing of one section, birdcaging, bends or any other damage resulting in distortion of the rope, require the immediate replacement of the rope.
- 1.32 **DAMAGES DUE TO HEAT.** The damaged caused to the rope by heat require the replacement of the rope.
- 1.33 **ELECTRIC ARCING.** The electric arcing through the rope requires the replacement of the rope.
- 1.34 **LOCAL REDUCTION IN ROPE DIAMETER.** A local reduction in rope diameter requires the replacement of the rope. In particular, for the **rotation-resistant** ropes, the reduction in diameter indicates a breakage of the core, and requires the immediate replacement of the rope.
- 1.35 **LOCALE INCREASE IN ROPE DIAMETER.** A local increase in rope diameter, concerning normally a very long section of rope, indicates a distortion of the core and, if marked, requires the replacement of the rope.
- 1.36 **BREAKAGE OF A STRAND.** The breakage of even one strand only requires the immediate replacement of the rope.
- 1.37 **DECREASE IN ELASTICITY.** The decrease in elasticity of the rope is normally connected with the conditions of the working environment. Signs of this defect may be: reduction of the rope diameter, rope lengthening, compression of wires and strands, presence of dark dust inside the strands. Even if no breakage is visible, the rope is more rigid and there is the risk of a fragile breakage and the rope shall be immediately replaced.
- 1.38 **CORROSION.** The corrosion is normally connected with the conditions of the working environment. The outer corrosion is detectable with a visual inspection. The inner corrosion is more difficult to detect, even if it shows signs very similar to wear or decrease in elasticity: the corrosion is connected with these phenomena, whose effects it heightens, quickening the rope deterioration and increasing the risk of breakage. If outer corrosion is detected or if inner corrosion is suspected, confirmed by a more careful inspection by a qualified person, the rope shall be immediately replaced.

	WARNING
➤ The replacement of ropes shall be carried out with material supplied by the crane Manufacturer only; the Manufacturer is the only that can supply ropes with suitable characteristics and breaking loads. When ordering a replacing rope, it takes to specify: - o function of the rope; - o diameter of the rope; - o length of the rope; - o causes of the breakage of the rope formerly in use. ➤ To operate the crane with damaged ropes may cause the breakage of the ropes with risk for the	

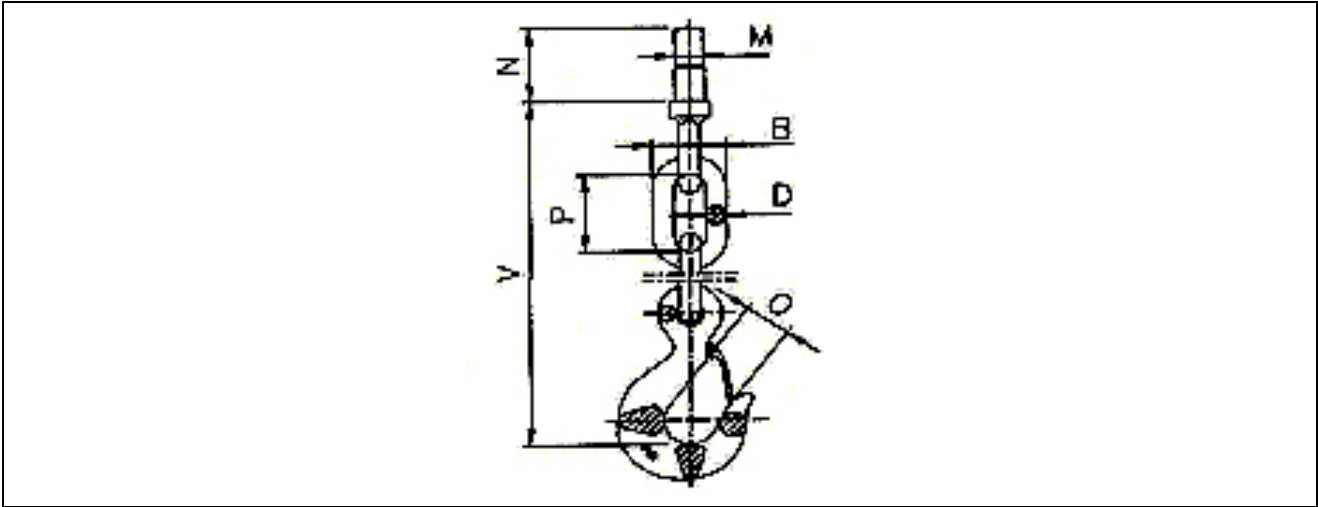


load to fall, for the trolley to move, for the structural parts to damage, for the crane to overturn.

- The replacement of the rope with not suitable material or by not qualified operators may cause serious dangers.
- Failure in correctly tighten the end clips may cause the rope to slide out and the load to fall.



12.1.4. HOISTING HOOK 4,000 KG (8,818 LBS)



Number of rings	Load [t]	Dimensions [mm]						
		B±2	D	M	N	O	P±5	V±5
1	4	90	26	M33x2	115	55	88	381

Number of rings	Load [lbs]	Dimensions [in]						
		B±2	D	M	N	O	P±5	V±5
1	8818	3.5	1.0	M33x2	4.5	2.2	3.5	15.0

HOISTING HOOK 4,000 kg (8,818 lbs)	
Hook material	ASTM A 105 NORMALIZED
Chain material	C 10 NORMALIZED
Hook load test	98 kN (22,031 lbs)
Hook min. opening load	196 kN (44,062 lbs)
Chain test load	100 kN (22,480 lbs)
Chain breaking load	250 kN (56,202 lbs)
Safety factor	5
Hook standard	ISO 4779

1.39 Every three months, a qualified inspector shall carry out a very careful inspection of the ropes and the chains of the block, recording the results.

WARNING

➤ The safety spring lock of the hoisting hook and of the derrick SHALL be kept always efficient.

➤ Should the chain of the hook be damaged that it cannot assure the safety factor guaranteed at first, it takes to replace it at the constructor factory. In any case, it is strictly forbidden to try to repair the chain by welding, binding or joint.



12.2. GENERAL MAINTENANCE

12.2.1. DAILY MAINTENANCE

- 2.1 Check for stabilizers and support beams, making sure that the crane frame and ground do not yield. Check that the crane is properly levelled and the ballast is stable.
- 2.2 Check the connections of the electrical equipment and the general conditions of the electrical cables, replacing them if required. Check for insulation of the electrical equipment. Check grounding connections and grounding plates; remove rust or concrete deposits from the clamps.
- 2.3 Check by view that there are any oil leakage in the reduction units and in the hydraulic installation and, if necessary, top up with oil of the recommended type (paragraph 12.5.7).
- 2.4 Check the ropes and their attachments, the hooks and the safety spring locks.
- 2.5 Check for perfect adjustment of self-braking motors under idle and max. load conditions.
- 2.6 Check the efficiency of the control devices, of the limiters, of the hoisting limit switch, of the swing limit switch, of the trolley limit switches and of all the safety devices.
- 2.7 Carry out any other operation required to ensure safety.

	WARNING
➤	After long period of shutdown, after an important repair or after an accidental overload and before bringing the crane into service again, the crane shall undergo drastic inspections of the structures and of all the electrical, mechanical, hydraulic components, etc.
➤	Failure in carrying out the scheduled maintenance interventions may lead to rapid deterioration of the mechanical, electrical and hydraulic components, to the damaging of structural components and to serious inefficiencies of the crane.
➤	Inside the speed drives there are capacitors having a time of discharge of fifteen minutes. In case of maintenance interventions requiring to remove the protection covers of the speed drives, wait at least fifteen minutes after switching the power off to the equipment before removing the covers and handle the inner components. Shouldn't this instruction be respected there is the danger of electric shock.
➤	Scraps of lubrication, replaced components, expendable materials, etc. that may represent a source of environment pollution shall be collected and disposed of according with the laws in force.



12.2.2. WEEKLY MAINTENANCE

- 2.8 Carry out all the tasks of the daily maintenance (paragraph 12.2.1).
- 2.9 Carry out the procedure of **hoisting rope tensioning**, described at the paragraph 08.5.
- 2.10 Check carefully the wear of the ropes and lubricate them; check the end terminations of the ropes.
- 2.11 Check the perfect tightening of all the fixing bolts (paragraph 12.2.4). For the check of the tightening of the slewing ring bolts, refer to paragraph 12.2.4.
- 2.12 Check the pins and their relevant cotter and hitch pins.
- 2.13 Check the tension of the trolley rope and check the efficiency of its tensioner. (Efficiency of the tensioner = number of wraps wound on the smaller drum).
- 2.14 Check the wear of the brake linings and, if necessary, replace them. Brake lining shall be replaced when the thickness of the friction material is reduced to **1 mm (0.039 in)**.
- 2.15 Check the perfect winding and unreeling of the ropes of the drums and the functioning of the winches.
- 2.16 Check carefully that all the sheaves can run freely and, if necessary, grease them. Check the efficiency of all the rope guards.
- 2.17 Check, by view, that the structure of the crane has not undergone deformations or abnormal yields.
- 2.18 Check the lifting hardware and the sling devices.
- 2.19 Every 80-100 hours of functioning, carefully lubricate the inner part of the slewing ring by means of its grease nipples, the outer teeth of the slewing ring and, in general, all the rotary parts of the crane.
- 2.20 Turn the selector switch **SA1** into position **2 ERECTION** and, pushing the "TOWER ERECTION – UP" button, slightly pressurize **100-150 bar (1,450-2,175 psi)** the tower erection cylinder, to check its perfect tightness and ensure the stability of the tower. The pressure shall never exceed **150 bar (2,175 psi)**.
- 2.21 Carry out any other operation required to ensure safety.



WARNING

- **After long period of shutdown, after an important repair or after an accidental overload and before bringing the crane into service again, the crane shall undergo drastic inspections of the structures and of all the electrical, mechanical, hydraulic components, etc.**
- Failure in carrying out the scheduled maintenance interventions may lead to rapid deterioration of the mechanical, electrical and hydraulic components, to the damaging of structural components and to serious inefficiencies of the crane.
- Inside the speed drives there are capacitors having a time of discharge of fifteen minutes. In case of maintenance interventions requiring to remove the protection covers of the speed drives, wait at least fifteen minutes after switching the power off to the equipment before removing the covers and handle the inner components. Shouldn't this instruction be respected there is the danger of electric shock.
- Scraps of lubrication, replaced components, expendable materials, etc. that may represent a source of environment pollution shall be collected and disposed of according with the laws in force.



12.2.3. MAINTENANCE AT EACH ERECTION OR YEARLY MAINTENANCE

- 2.22 Carry out all the tasks of the daily maintenance (paragraph 12.2.1) and the weekly one (paragraph 12.2.2).
- 2.23 Check carefully all the structural and mechanical components of the crane. After 1,600 hours of functioning, overhaul the gear units and, in general, all the bearings.
- 2.24 Carry out the procedure of **hoisting rope tensioning**, described at the paragraph 08.5.
- 2.25 Check carefully sheaves, ropes, end terminations of the ropes, block, chains, hook, lifting hardware.
- 2.26 Check the stay ropes.
- 2.27 Carry out a drastic test of all the controls of the crane.
- 2.28 Carry out the load tests according with the instructions of Chapter 09.
- 2.29 Check the hydraulic unit, the hydraulic cylinders, all the hoses and all the components of the hydraulic equipment.
- 2.30 After 3,200 hours of functioning, overhaul the hoisting winch and, in general, all the bearings.
- 2.31 The dismantled crane shall be duly protected from the atmospheric agents.
- 2.32 Carry out any other operation required to ensure safety.



WARNING

- **After long period of shutdown, after an important repair or after an accidental overload and before bringing the crane into service again, the crane shall undergo drastic inspections of the structures and of all the electrical, mechanical, hydraulic components, etc.**
- Failure in carrying out the scheduled maintenance interventions may lead to rapid deterioration of the mechanical, electrical and hydraulic components, to the damaging of structural components and to serious inefficiencies of the crane.
- Inside the speed drives there are capacitors having a time of discharge of fifteen minutes. In case of maintenance interventions requiring to remove the protection covers of the speed drives, wait at least fifteen minutes after switching the power off to the equipment before removing the covers and handle the inner components. Shouldn't this instruction be respected there is the danger of electric shock.
- Scraps of lubrication, replaced components, expendable materials, etc. that may represent a source of environment pollution shall be collected and disposed of according with the laws in force.



12.2.4. BOLT TIGHTENING

2.33 Bolt tightening shall be inspected and checked by qualified operators.

INSPECTION OF ALL THE BOLTS	
WEEKLY	Check the tightening of all the bolts.

2.34 The two protruding screws on the sides of the flange securing the **swing reduction unit** to the base frame are pullout screws and they shall be used only to disassemble the reduction unit. First loosen the fixing screws and then tighten the two pullout screws to move the reducer from its seat.

A) SLEWING RING BOLTS

2.35 The tightening of the bolts of the **slewing ring** shall be inspected and checked by qualified operators, according with the instructions of the manufacturer.

2.36 The first check of the bolt tightening shall be carried out **within the first 100 hours** of crane operation.

2.37 In case the first check has been positive, it is recommended to carry out the further check **after 3 months** of crane operation. In case this further test has been positive, it is recommended to carry out the further check **after 3 months (6 months in all)** of crane operation. In case this further test has been positive, it is recommended to carry out the further check **after 1 year** of crane operation. The further checks shall be carried out **at each crane dismantling, and at least once a year**.

2.38 During tightening check, the bolting shall be relieved from external force strains. Therefore, it takes to balance the boom, to relieve all the bolts.

INSPECTION OF THE BOLTS OF THE SLEWING RING		
SCREW DIAMETER	SCREW CLASS	TIGHTENING TORQUE
M20	10.9	558 Nm (411.6 lb·ft)

2.39 If one or more bolts has a tightening torque not corresponding to the value reported, bolts shall be replaced.

2.40 **Every 10 year**, all the bolts of the slewing ring shall be totally replaced.

	WARNING
➤ After long period of shutdown, after an important repair or after an accidental overload and before bringing the crane into service again, the crane shall undergo drastic inspections of the structures and of all the electrical, mechanical, hydraulic components, etc. ➤ Failure in carrying out the scheduled maintenance interventions may lead to rapid deterioration of the mechanical, electrical and hydraulic components, to the damaging of structural components and to serious inefficiencies of the crane. ➤ Inside the speed drives there are capacitors having a time of discharge of fifteen minutes. In case of maintenance interventions requiring to remove the protection covers of the speed drives, wait at least fifteen minutes after switching the power off to the equipment before removing the covers and handle the inner components. Shouldn't this instruction be respected there is the danger of electric shock. ➤ Scraps of lubrication, replaced components, expendable materials, etc. that may represent a source of environment pollution shall be collected and disposed of according with the laws in force.	



12.3. CARRYING OUT MAINTENANCE

- 3.1 Maintenance shall be carried out according with the exposed programme (paragraph 12.2):
 - o daily (paragraph 12.2.1);
 - o weekly (paragraph 12.2.2);
 - o at each erection or yearly (paragraph 12.2.3).
- 3.2 Maintenance shall be carried out rigorously, on all the parts of the crane, according with the scheduled procedures.
- 3.3 All the maintenance or component replacing interventions shall be carried out by qualified, trained and informed operators, knowing in any detail the crane they operate.
- 3.4 During maintenance, the swing brake shall be lock to prevent any uncontrolled movement of the crane. Anyway, pay attention to possible spontaneous swings under the effect of wind pushing.
- 3.5 Before starting maintenance, switch the power off to the electric cabinet of the building site and lock into position **OFF** the switch on the crane electric cabinet door. Disconnect the crane power supply from the building site electric cabinet.

	WARNING
➤ No maintenance or repair shall be carried out if even one of this conditions subsists: - o crane in-service; - o electric cabinet energized; - o swing brake unlocked.	

- 3.6 The replacement of any structural, mechanical, hydraulic or electrical component of the crane shall be carried out using only the original spares San Marco International.
- 3.7 No modification of any part of the crane shall be carried out under prior authorization of the Manufacturer.
- 3.8 Should be necessary, to carry out maintenance, remove protection covers, they shall be reassembled once the maintenance is finished.
- 3.9 Any repair shall be carried out by personnel authorized by San Marco International and under control of an engineer who shall take the full responsibility for it.
- 3.10 After the inspection, all the screws shall be tightened by means of dynamometric key (bolts of the slewing ring) and locked with the scheduled unscrewing-resistant washers or by means of loctite.
- 3.11 In case of replacement of electrical components, the access points to electrical cables shall be tightened by means of rubber or silicone gaskets.

	WARNING
➤ Maintenance have great importance for the regular and safe crane functioning. It shall be carried out punctually and by qualified, trained and informed operators, in the respect of the instructions reported in this Manual, of the safety rules and, in general, of all the devices suggested by common	



sense and caution, in order to prevent accident.

- In particular:
 - o carry out any check and inspection being the crane at standstill;
 - o carry out any intervention after switching the power off;
 - o use safety belts in perfect conditions;
 - o use the prescribed protection helmets and all the necessary personal protection equipments;
 - o reassemble the protection cover in case they have been disassemble;
 - o carry out any other operation required to ensure safety.
- Oil and lubricating scraps shall not be abandoned in the environment.
- **After long period of shutdown, after an important repair or after an accidental overload and before bringing the crane into service again, the crane shall undergo drastic inspections of the structures and of all the electrical, mechanical, hydraulic components, etc.**



12.4. AUTO-TUNING OF THE HOISTING MOTOR

4.1 In case of replacing or rewinding of the hoisting motor, the **AUTO-TUNING** of the motor shall be carried out, acting on the hoisting speed drive, before proceeding with crane operation.

PROCEDURE

- 1) Switch the power ON.
- 2) On the hoisting speed drive display you can read
rdy
- 3) Push the **ENT** button
- 4) On the hoisting speed drive display you can read
SEt -
- 5) Pushing the ▲ and ▼ buttons, display the function
drC -
- 6) Push the **ENT** button
- 7) Pushing the ▲ and ▼ buttons, display the function
tUn
- 8) Push the **ENT** button
- 9) On the hoisting speed drive display you can read
dOnE
- 10) Pushing the ▲ and ▼ buttons, display the function
YES
- 11) Push the **ENT** button
- 12) On the hoisting speed drive display you can read
dOnE
- 13) Push the **ESC** button several times, until on the hoisting speed drive display you can read
rdy

- 4.2 The **AUTO-TUNING** has been correctly carried out, and it is now possible to use the hoisting motor.
- 4.3 **ALTIVAR 71** variable speed drive may be equipped with graphifcs display. The tasks to carry out are the same, following the instructions of the display menus.



WARNING

- Failure in carrying out the **AUTO-TUNING**, after the replacing or rewinding of the hoisting motor, may cause the **serious** danger of free fall of the load.
- The **AUTO-TUNING shall not** be carried out for swing and trolley motors. It is not recommended, and it may even have negative consequences on the motors functioning.



12.5. LUBRICATION

12.5.1. HYDRAULIC UNIT

- 5.1 The hydraulic station tank has a capacity of **70 liters (18.5 gal)** of hydraulic oil **AVELOIL HYDROL 32** or equivalent.
- 5.2 When topping up oil, do not forget to filter the oil and bleed air from the system by slightly loosening the hose fittings on the cylinders until the oil comes out.

	WARNING
➤ Oil and lubricating scraps shall not be abandoned in the environment.	

12.5.2. CYLINDER RODS

- 5.3 When the crane is erected, the cylinder rods are extended.
- 5.4 In this condition and in oxidative environment (by the sea, near chimneys, in case of acid rain, etc.) it is recommended to periodically dismantle and then erect the crane again to lubricate the rods outer surfaces. In environments with higher oxidation, this operation shall be carried out more frequently.



12.5.3. OIL FOR GEAR REDUCTION UNITS

- 5.5 Periodically check the oil level using the apposite devices and top up as needed with oil of same brand and quality.

	WARNING
➤ Never mix oils of different brands.	

- 5.6 Fully replace the lubrication oil after the first **300-400 hours** of crane operation.
- 5.7 Afterwards, oil replacements shall be carried out every **1,600 service hours** for reduction units operating at a max. temperature of **40°C (104°F)**. At higher temperatures, the lubrication intervals are shortened.
- 5.8 **If the reduction unit is kept idle for longer than one month**, completely fill it up with oil to avoid condensate. Top up the oil level before servicing the reduction unit again.

	WARNING
➤ Oil and lubricating scraps shall not be abandoned in the environment.	

12.5.4. CLEANING AND INSPECTION OF GEAR REDUCTION UNITS

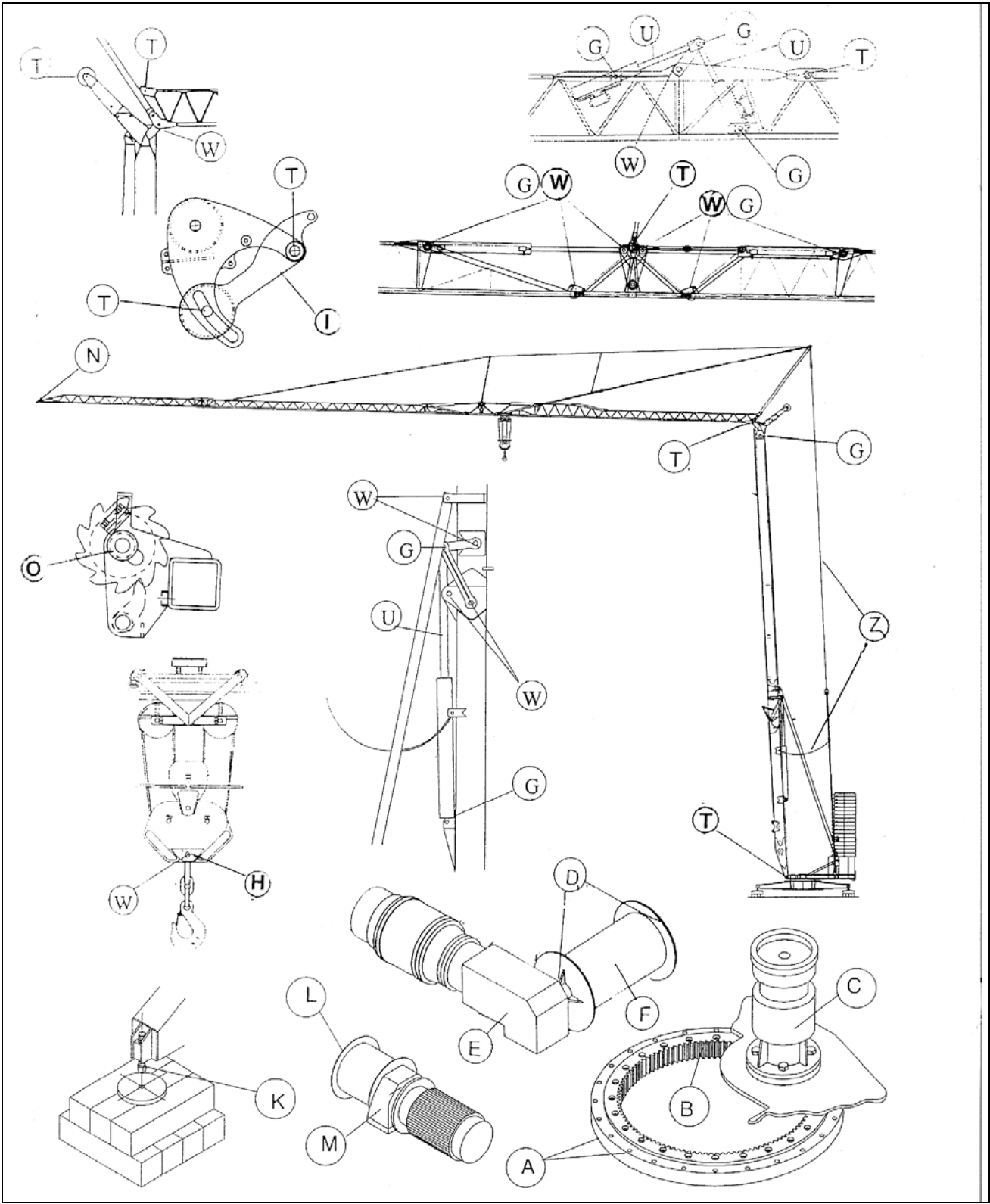
- 5.9 Once a year, carry out a careful cleaning of the gear reduction units, washing with petroleum or naphta the filter of the case and the gears.
- 5.10 In case of reduction units with forced lubrication, thoroughly clean the pipe filter as well. Repeat the operation at every oil replacing.
- 5.11 When cleaning the reduction unit, check gears and bearings; replace worn-out ones with new of the same size and quality.
- 5.12 It is recommended to check the shafts of the reduction units for alignment with the shafts of the cranes they are connected to.
- 5.13 Every time a reduction unit is opened and before closing it is necessary to clean the contact surfaces between case and cover. Apply a little rubber or dextrin paste layer, to obtain a perfect seal and prevent oil leakage. Carry out the same operation on closing surfaces between reduction unit body and base.

	WARNING
➤ Oil and lubricating scraps shall not be abandoned in the environment.	

- 5.14 noise levels or temperatures higher than normal are detected when operating the crane, stop the reduction unit immediately and search for possible causes.



12.5.5. LUBRICATION TABLE





12.5.6. PERIODICAL LUBRICATION SCHEDULE

DAILY	
F	Hosting rope.
WEEKLY	
A	Inner part of the slewing ring through the grease nipples.
B	Slewing ring gears.
C	Swing reduction unit through grease nipples.
D	Winch drum bearings through the grase nipple.
E	Hoisting reduction unit.
MONTHLY	
H	Trolley rope.
I	Trolley wheels.
L	Trolley drum support bearing.
M	Trolley reduction unit.
N	Sheaves and fixed hoisting rope end.
O	Sheaves and tensioner of the trolley rope.
U	Hydraulic cylinder rods.
AT EACH CRANE ERECTION OR DISMANTLING	
G	Erection cylinder pins.
P	Oil level of the hydraulic unit.
T	All the pins, the articulations and the operation screws.
Z	Stay ropes.
K	Stabilizers screws.
W	Main articulated joint pins through the grease nipples.
At each crane erection, apply a layer of grease on all the pins, the operation screws, the cotter and hitch pins and, in general, all the mechanical and structural parts requiring grasing.	

	WARNING
➤ Maintenance have great importance for the regular and safe crane functioning. It shall be carried out punctually and by qualified, trained and informed operators, in the respect of the instructions reported in this Manual, of the safety rules and, in general, of all the devices suggested by common sense and caution, in order to prevent accident. ➤ In particular: - o carry out any check and inspection being the crane at standstill; - o carry out any intervention after switching the power off; - o use safety belts in perfect conditions; - o use the prescribed protection helmets and all the necessary personal protection equipments; - o reassemble the protection cover in case they have been disassemble; - o carry out any other operation required to ensure safety. ➤ Oil and lubricating scraps shall not be abandoned in the environment. ➤ After long period of shutdown, after an important repair or after an accidental overload and before bringing the crane into service again, the crane shall undergo drastic inspections of the structures and of all the electrical, mechanical, hydraulic components, etc.	



12.5.7. RECOMMENDED OILS

HOISTING GEAR UNIT	ESSO – SPARTAN EP 220
SWING GEAR UNIT	ESSO – SPARTAN EP 220
TROLLEY GEAR UNIT	Lithium grease TAMOIL TAMLITH EPO
BEARINGS	ESSO – BEACON EP2
SLEWING RING – INTERNAL LUBRICATION OF BALLS	ESSO – BEACON EP2
SLEWING RING – EXTERNAL LUBRICATION OF TEETH	ESSO – CAZAR K2
ROPES	ESSO – BEACON EP2
THREADED PINS	ESSO – BEACON EP2
HYDRAULIC STATION	AVELOIL HYDROL 32

13. CRANE DISMANTLING

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13.1. DISMANTLING PREPARATION

	WARNING
➤ The following instructions concerns and shall be respected both when the whole dismantling procedure is carried out and when a partial dismantling is carried out, folding the boom; in this case, strictly respect all the instructions concerning this task. ➤ During all dismantling (even partial dismantling) operations, all exposed persons shall leave danger zones A, B and C, which shall be deserted. The operator shall remain as far from the crane as allowed from the control board connection cable; should it be necessary to approach the machine for any eventual inspection, it shall be done with the machine stopped and after making sure that all structures are stable. ➤ All dismantling (even partial dismantling) operations shall always be carried out by an expert, trained and skilled operator only, well aware of all the machine characteristics and familiar with the contents of the present instruction manual. The riggers can be supported by riggers' helpers, corresponding to the characteristics described at the <u>paragraph 02.4</u>.	

- 1.1 Swing the crane to the most suitable position for dismantling. The crane may be dismantled in any direction of swing (take care to align the tower with the lower base frame at the final lowering step) **but always and exclusively with folded boom**.
- 1.2 Crane dismantling or boom folding are allowed only in condition of no wind: aximum wind speed allowed **10 km/h (6.2 mph)**; avoid side winds, especially when folding the boom, which may damage the crane structural, mechanical and hydraulic parts.
- 1.3 To avoid damages to the mechanical parts, do not carry out any swing movement at the intermediate stages of boom folding.
- 1.4 Prior to crane dismantling check the hydraulic system devices for efficiency (oil level, solenoid valves, integrity of flexible pipes, hydraulic cylinders) and go through all the checks listed in the paragraph 04.8.3, to be carried out before and during the dismantling procedure. Failure in carefully carrying out these prior operations may lead to an abnormal functioning of devices, to the uncontrolled movement of structural parts and to risks of crushing and shock for the exposed persons.
- 1.5 Once started, crane dismantling shall be completed. Especially after unloading the ballast from the base frame, the crane cannot be left with the tower erected or only partially assembled because, if this were the case, an eventual wind gust may overturn it.
- 1.6 The hydraulic devices shall be used only for erection and dismantling. **Never use the hydraulic erection devices when the crane has a load suspended to the hook**. Danger of great damages for the hydraulic devices.
- 1.7 It is forbidden to fold the boom with a load suspended to the hook. Anyway, it is forbidden to carry out operations of erection, dismantling or changing of the boom configuration with suspended loads, to prevent serious damages to the hydraulic devices.



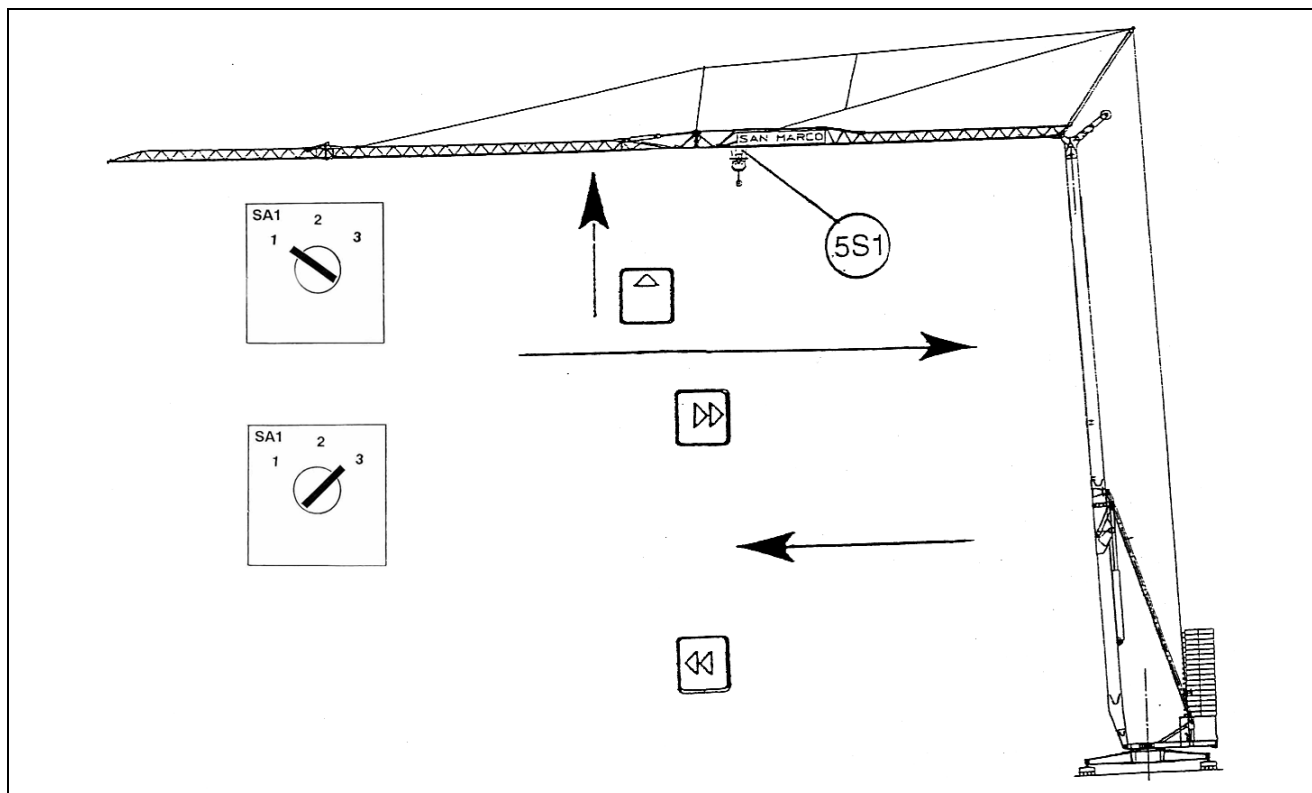
13.2. BOOM THIRD SECTION FOLDING



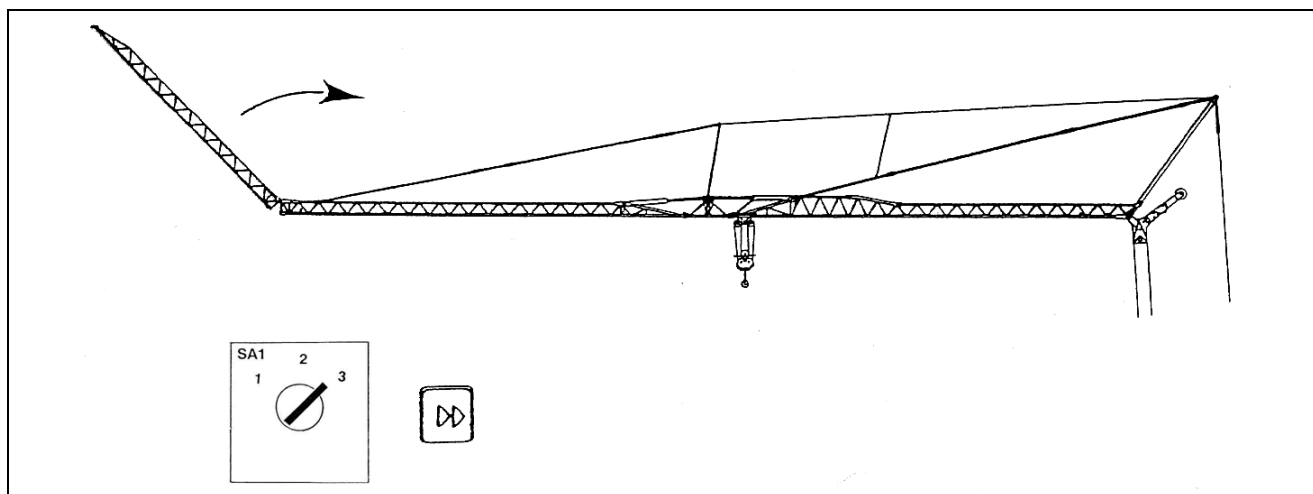
WARNING

- It is forbidden to fold the boom with a load suspended to the hook. Anyway, it is forbidden to carry out operations of erection, dismantling or changing of the boom configuration with suspended loads, to prevent serious damages to the hydraulic devices.

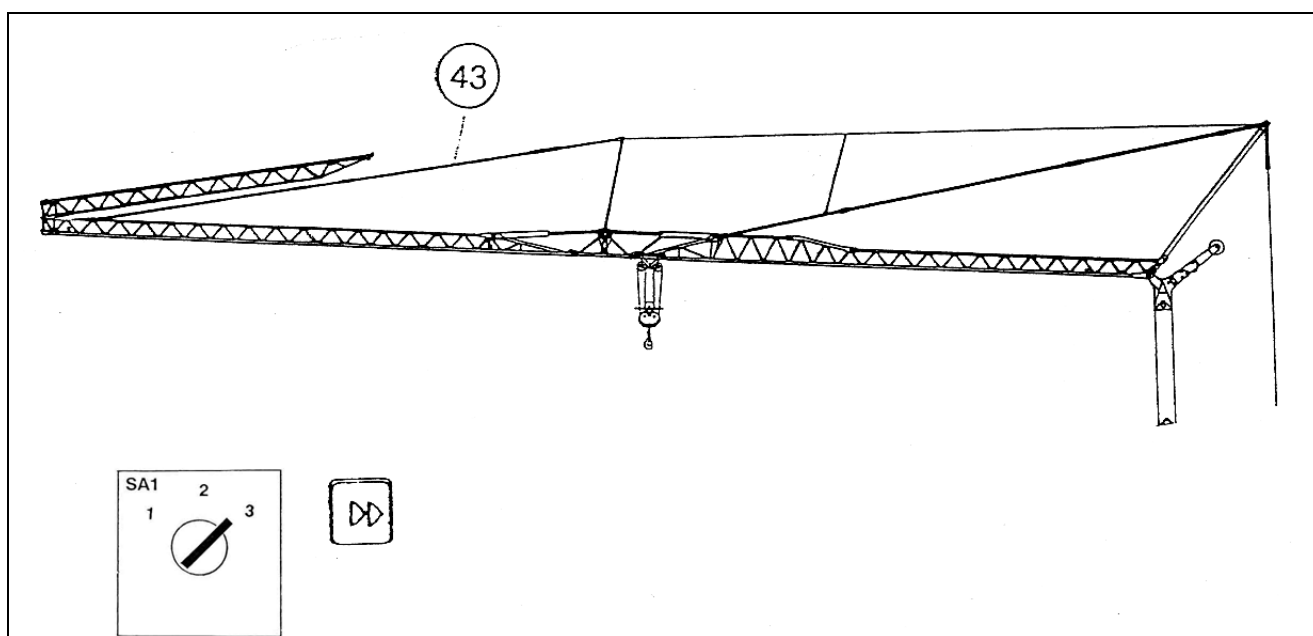
- 2.1 The first operation of the dismantling procedure consists in folding the boom third section; this operation shall be carried out prior to releasing and unloading the ballast.
- 2.2 **Boom third section folding may be carried out as a partial operation, intended to reduce the boom radius of the crane from 41.7 meters (136'-9") to 30.85 meters (101'-2").**
- 2.3 Turn the selector switch **SA1** into position **1 OPERATION**. Acting on the button "NEAR", move the trolley between the tower and the articulation between the first and the second section of the boom.
- 2.4 Acting on the button "UP" or "DOWN", lower the trolley (with 4-pull line connected) **two or three meters (6'-7" or 9'-10") under the trolley**.
- 2.5 Turn the selector switch **SA1** into position **3 ERECTION**. Acting on the button "FAR", move the trolley next to the articulation between the first and the second section of the boom, so that the sliding block of the trolley actuates the enabling micro switch **5S1** (paragraph 07.5). When the micro switch is actuated the trolley automatically stops.
- 2.6 Check the hydraulic equipment for efficiency (oil level, solenoid valves, integrity of flexible pipes, cylinders, etc.) and carry out all the checks listed in the paragraph 04.8.3.



- 2.7 By alternatively acting on "NEAR" and "FAR" push-buttons, slightly lift and lower the boom third section to make sure that the two cylinder chambers are filled with oil (paragraph 04.8.3).
- 2.8 Push the button "NEAR" to fold the boom third section.



- 2.9 Proceed until the boom third section rests on the tie rod **43**. Check that tie rods and ropes do not entangle and that all movements of the structural parts are carried out without any abnormal resistance or friction.



WARNING

- All the unfolding and folding movements of the third and the second boom sections are not equipped with electrical limit switches; during the final stages of any controlled movement check the mutual positions of the moving sections and stop the movements when needed. The third section of the boom shall slightly rest onto the tie rod **43**.

- 2.10 If it's meant to operate the crane with the boom third section folded, turn the selector **SA2** into position **2**, to enable the trolley far limit switch **4S12** at the end of the second boom section.



	WARNING
➤ Check that all movements are regular, that the ropes and tie rods do not entangle and that there are no anomalous frictions; inspect the reading of the pressure gauge on the hydraulic station. ➤ Should the selector switch SA1 not be correctly positioned during folding of the boom third section and boom second section, it will be impossible to carry out the above operations. ➤ When operating the crane with partially folded boom, if selector switch SA2 is not in the position corresponding to the actual configuration in use, the function of electric limit switch performed by the micro switches is not granted. This may cause the trolley to crash against the fixed stops. ➤ During the various boom folding stages, always check that the tie rods, ropes and structural elements move freely without entangling or crushing, in order to prevent damages to the structure. ➤ Carrying out swing movements with the boom second or third section in the intermediate folding position may cause damages to the structures and mechanisms. ➤ Folding the boom or its end section with side winds may seriously damage structures and mechanisms. Max. wind speed allowed 10 km/h (6.2 mph). ➤ Failure in carrying out the prior operations on the hydraulic station as indicated in <u>paragraph 04.8.3</u> may cause its anomalous operation, with consequent uncontrolled movements of the structures. ➤ All the boom third and second section folding operations shall be carried out with danger zones A, B and C completely free from personnel, due to the risk of crushing and shock for all exposed persons.	



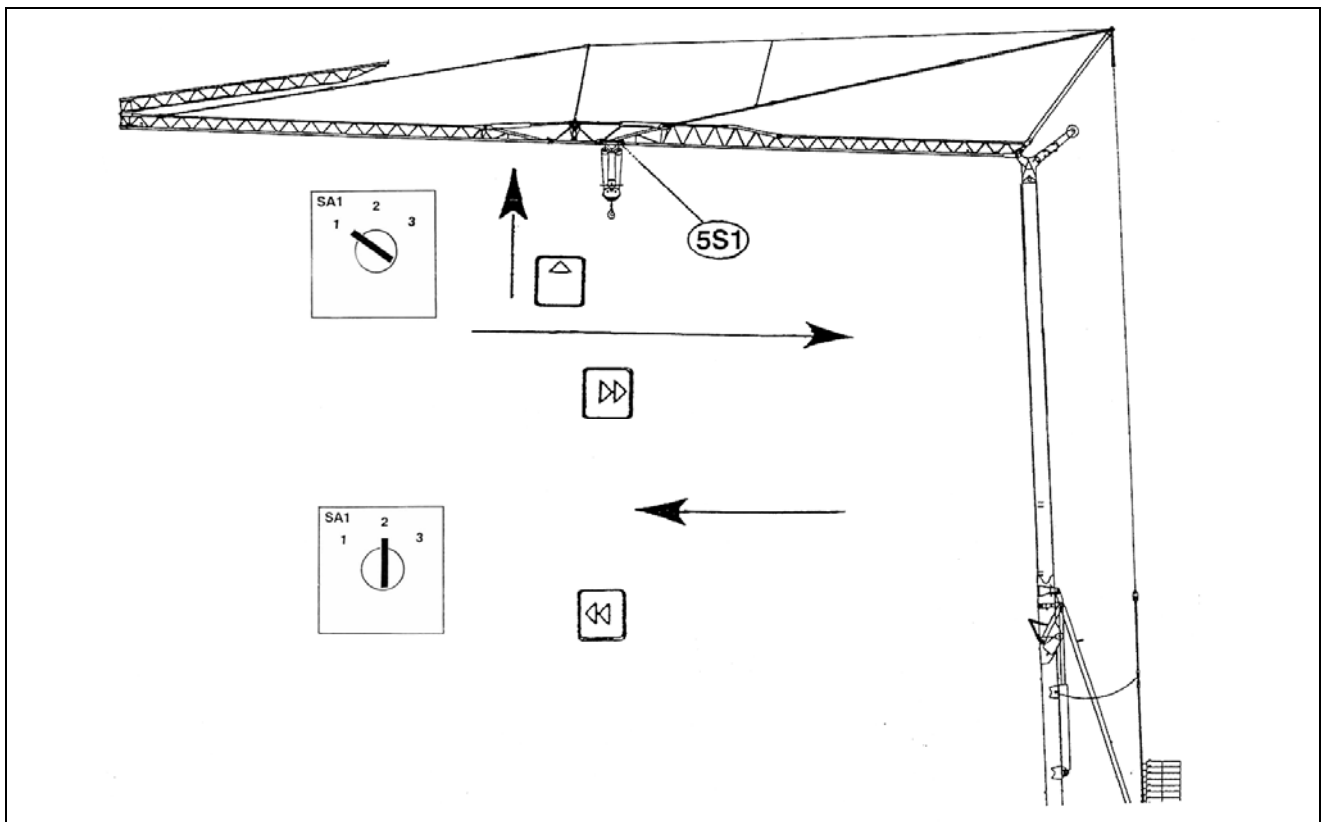
13.3. BOOM SECOND SECTION FOLDING



WARNING

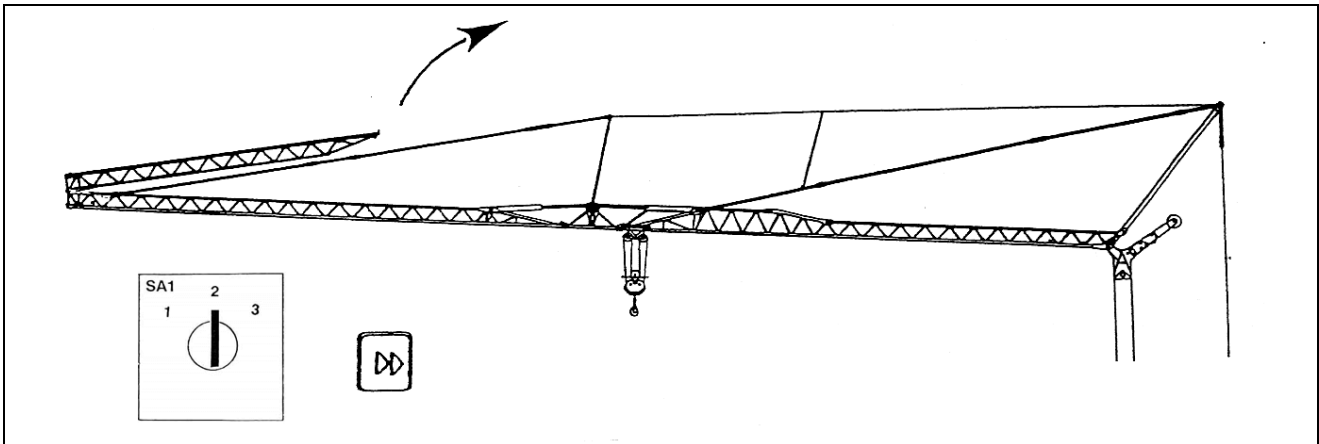
- It is forbidden to fold the boom with a load suspended to the hook. Anyway, it is forbidden to carry out operations of erection, dismantling or changing of the boom configuration with suspended loads, to prevent serious damages to the hydraulic devices.

- 3.1 Once the boom third section has been folded, fold the boom second section.
- 3.2 **Boom third section folding may be carried out as a partial operation, intended to fold the boom and to reduce the boom radius to 15.5 meters (50'-10").**
- 3.3 Folding the boom third section and folding the boom second section are operations that may be carried out even at different times, after operating the crane, for example, with folded third section for a certain period of time.
- 3.4 **TO BE CARRIED OUT ONLY IF THE CRANE HAS BEEN OPERATED WITH FOLDED BOOM THIRD SECTION.** Turn selector switch **SA1** into position **1**. Depressing the "NEAR" button, move the trolley between the tower and the articulation of the first an the second section of the boom. Depressing the "UP" or "DOWN" button place the block (with 4-pull line connected) **two or three meters (6'-7" or 9'-10") under the trolley**.
- 3.5 Check the hydraulic equipment for efficiency (oil level, solenoid valves, integrity of flexible pipes, cylinders, etc.) and carry out all the checks listed in paragraph 04.8.4.
- 3.6 **TO BE CARRIED OUT ONLY IF THE CRANE HAS BEEN OPERATED WITH FOLDED BOOM THIRD SECTION.** Turn selector switch **SA1** into position **2**. Ag Depressing the "FAR" button", move the trolley next to the articulation of the first an the second section of the boom, in such a position that trolley sliding block actuates the enabling micro switch **5S1** (paragraph 07.5). When the micro switch is actuated the trolley automatically stops.

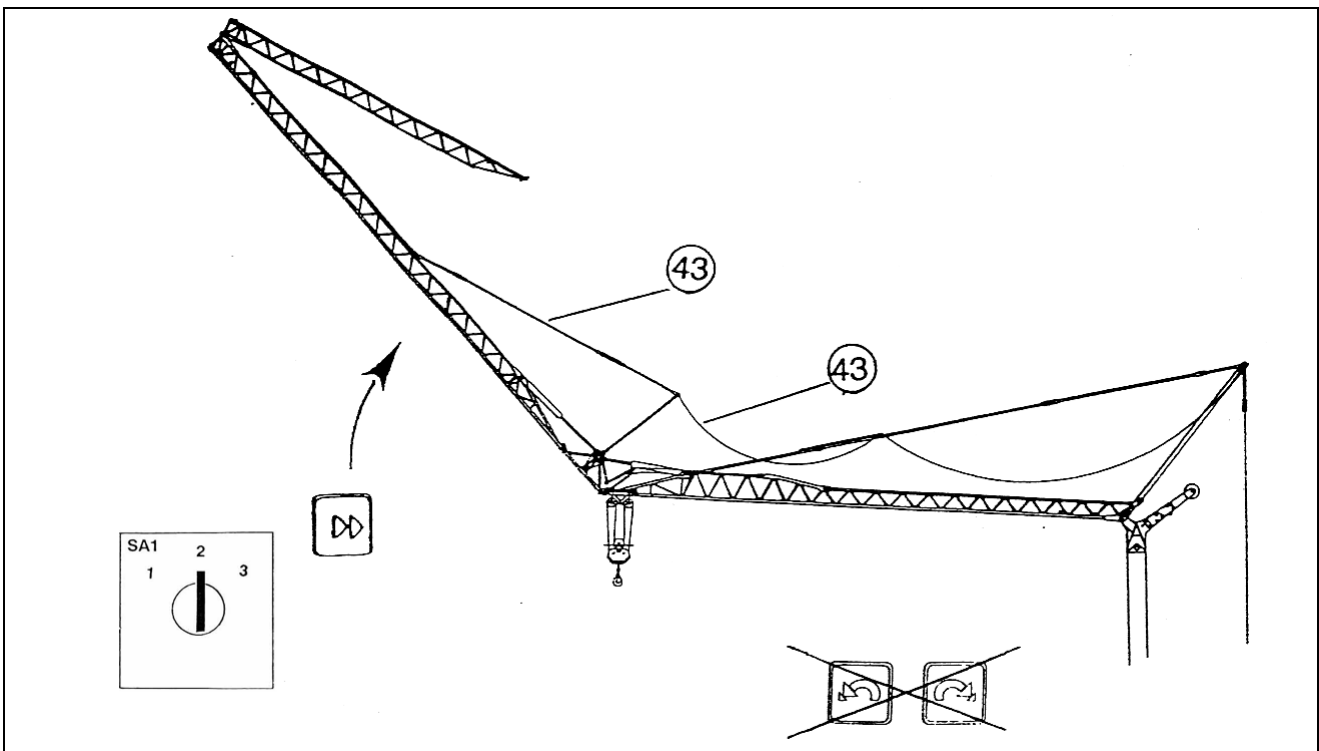




- 3.7 By alternatively depressing "NEAR" and "FAR", slightly raise and lower the boom second section, to make sure that the two cylinder chambers are fill with oil (paragraph 04.8.4).
- 3.8 Proceed with boom second section folding by depressing "NEAR" button.

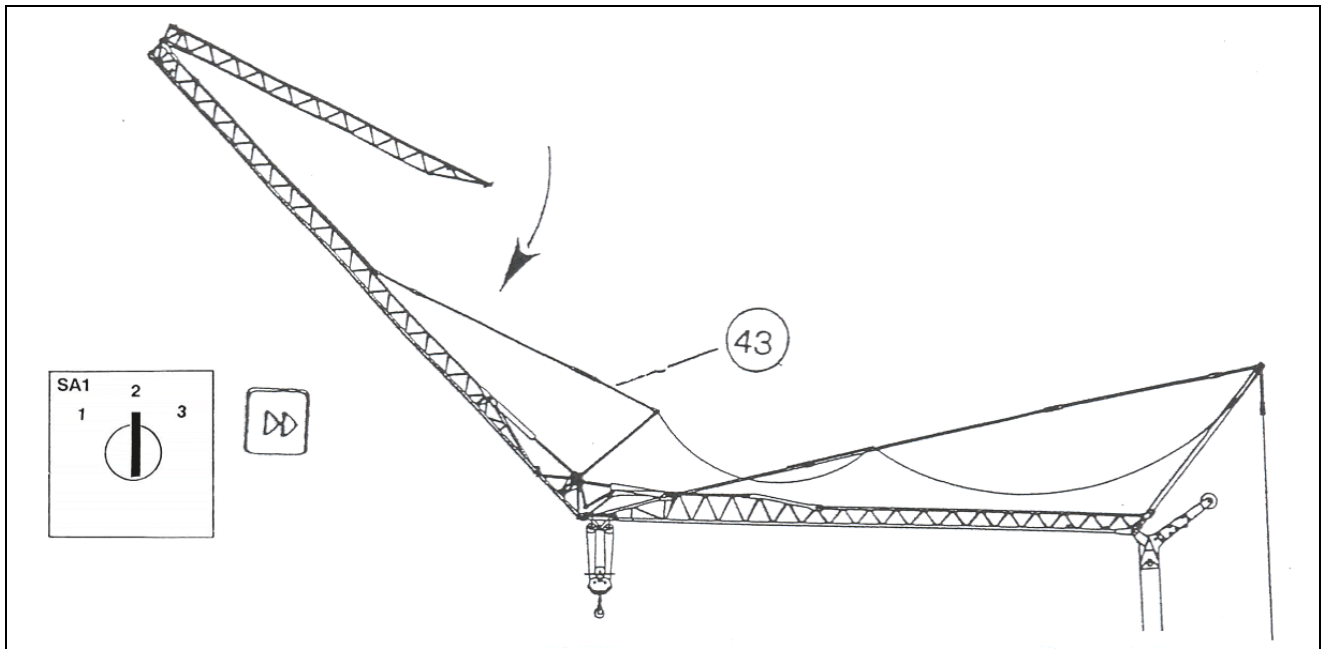


- 3.9 Turn selector switch **SA1** into position **3**. Depressing the "FAR" button, partially unfold the third boom section, to allow the tie rod **43** to slacken.
- 3.10 Turn selector switch **SA1** into position **2**. Depressing "NEAR", proceed with the folding of the second boom section till the position where the rod **43**, slackening, allows to completely fold the third boom section.

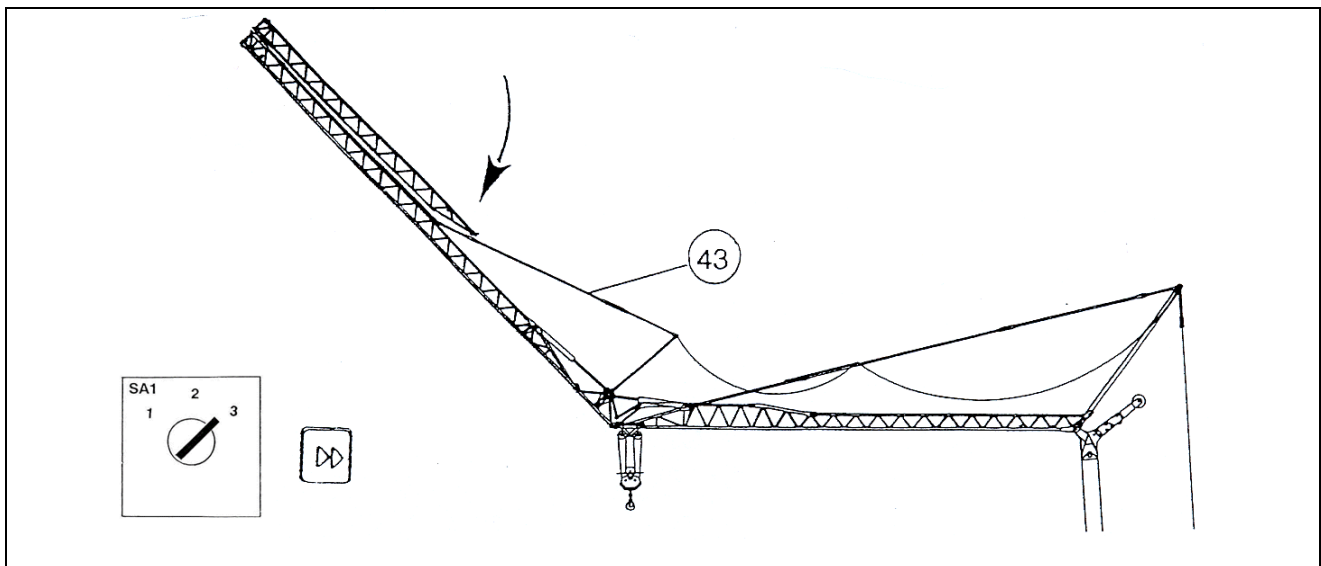


WARNING

- Check that all movements are regular, that the ropes and tie rods do not entangle and that there are no anomalous frictions; inspect the reading of the pressure gauge on the hydraulic station.



- 3.11 Slackening of the tie rod **43** allows the complete boom third section folding without any interference of structural parts. To proceed with this operation turn selector switch **SA1** into position **3**.
- 3.12 Depressing "NEAR" completely fold the third boom section till it rests onto the upper stringer of the boom second section and onto the slackened tie rod **43**.

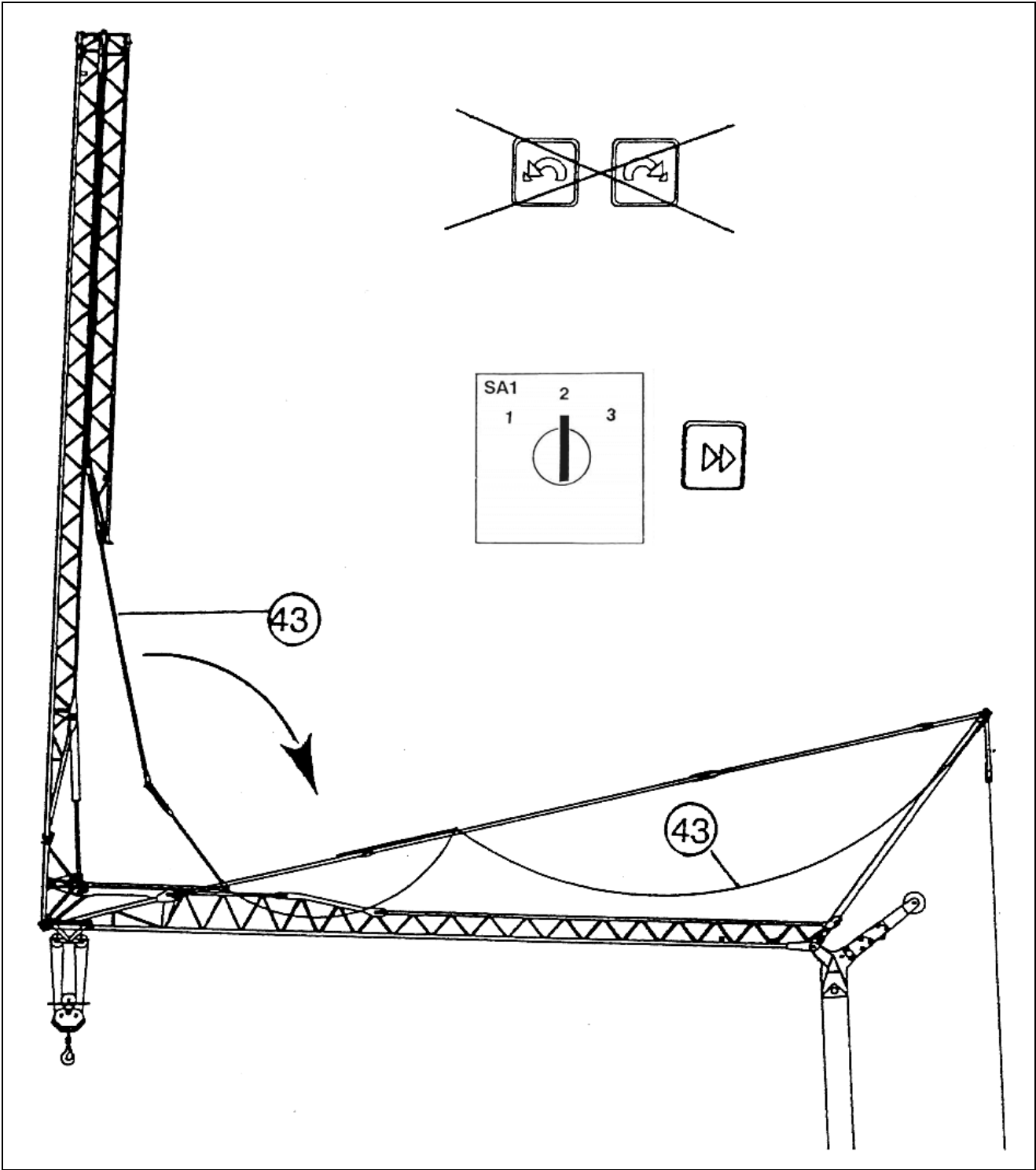


WARNING

- Check that all movements are regular, that the ropes and tie rods do not entangle and that there are no anomalous frictions; inspect the reading of the pressure gauge on the hydraulic station.
- All the unfolding and folding movement of the third and the second boom sections are not equipped with electrical limit switches; during the final stages of any controlled movement check the mutual positions of the moving sections and stop the movements when needed.



- 3.13 Being the third boom section completely folded it is possible to completely fold the second section without any interference of structural parts. To proceed with this operation turn selector switch **SA1** into position **2**.
- 3.14 Depressing "NEAR" proceed with the second boom section folding.



WARNING

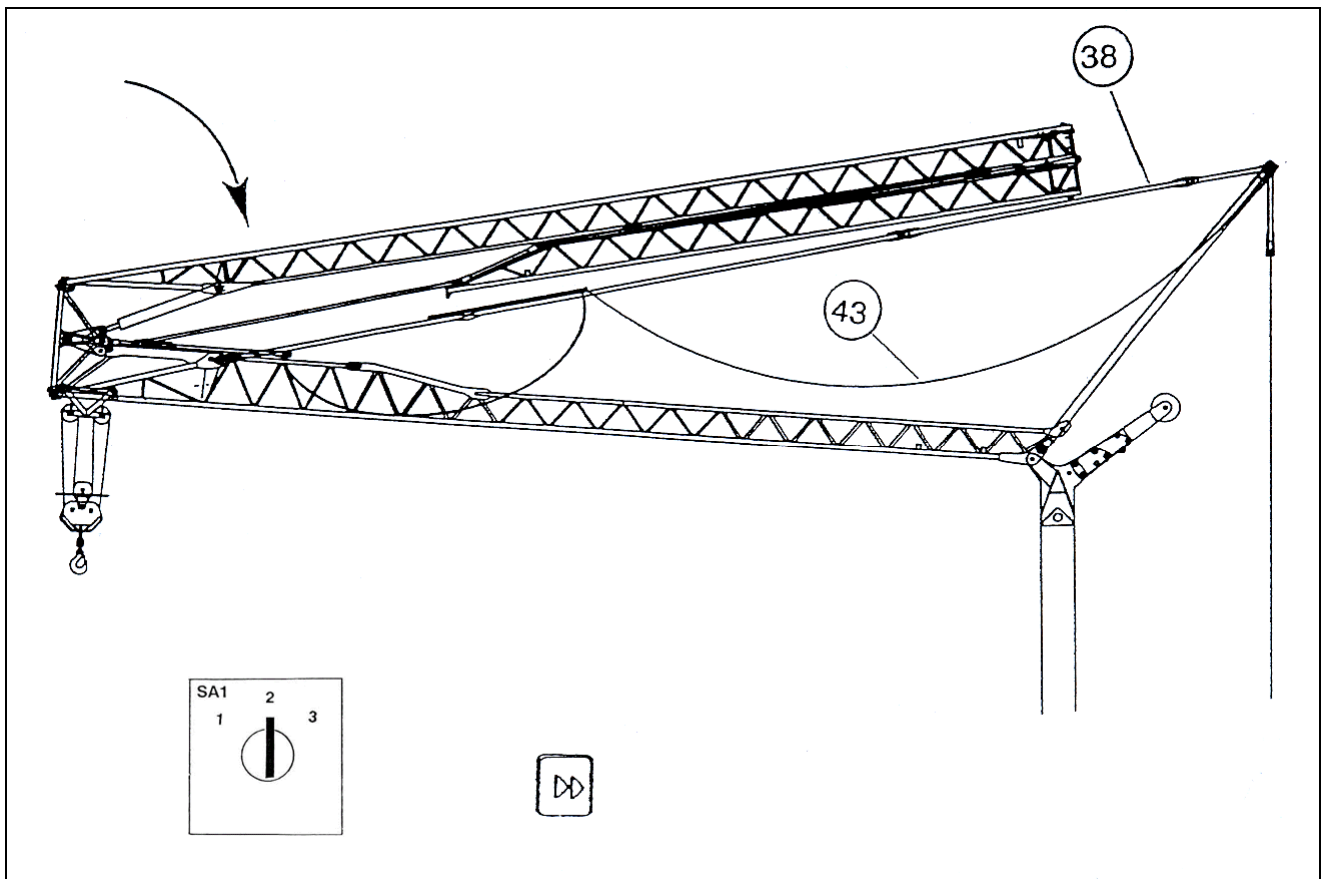
- Check that all movements are regular, that the ropes and tie rods do not entangle and that there



are no anomalous frictions; inspect the reading of the pressure gauge on the hydraulic station.

- In particular, check that the braces supporting the tie rod **43** and the tie rod **43** fold and slacken regularly without any crushing or interference.
- Folding the boom is possible only without wind: max. wind speed allowed **10 km/h (6.2mph)**; absolutely avoid side wind pushes that may cause the damaging of structural, mechanical or hydraulic parts.
- Carrying out swing movements with the boom in the intermediate folding position may cause damages to the structures and mechanisms.

3.15 Depressing "NEAR" completely fold the boom second section till it rests onto the tie rod **38**.

**WARNING**

- All the unfolding and folding movement of the third and the second boom sections are not equipped with electrical limit switches; during the final stages of any controlled movement check the mutual positions of the moving sections and stop the movements when needed. The boom second section shall slightly rest onto the tie rod **38**.

3.16 If it's meant to operate the crane with the folded boom and radius **15.5 meters (50'-10")**, turn selector switch **SA1** into position **1** and the selector switch **SA2** into position **3**, to enable the trolley far limit switch **4S10** at the ebd of the second section of the boom.

3.17 Otherwise, proceed with the dismantle procedure, as further indicated.



	WARNING
➤ Should the selector switch SA1 not be correctly positioned during folding of the boom third section and boom second section, it will be impossible to carry out the above operations. ➤ When operating the crane with folded boom, if selector switch SA2 is not in the position corresponding to the actual configuration in use, the function of electric limit switch performed by the micro switches is not granted. This may cause the trolley to crash against the fixed stops. ➤ During the various boom folding stages, always check that the tie rods, ropes and structural elements move freely without entangling or crushing, in order to prevent damages to the structure. ➤ Carrying out swing movements with the boom second or third section in the intermediate folding position may cause damages to the structures and mechanisms. ➤ Folding the boom or its end section with side winds may seriously damage structures and mechanisms. Max. wind speed allowed 10 km/h (6.2 mph). ➤ Failure in carrying out the prior operations on the hydraulic station as indicated in <u>paragraph 04.8.4</u>, may cause its anomalous operation, with consequent uncontrolled movements of the structures. ➤ All the boom third and second section folding operations shall be carried out with danger zones A, B and C completely free from personnel, due to the risk of crushing and shock for all exposed persons. ➤ After starting the load blocks unloading (<u>paragraph 13.4</u>), crane dismantling shall be completed in all its stages; it is not allowed to leave the crane without the ballast, whether fully or partially erected. ➤ Before starting to unload the ballast it takes to remove the protection enclosure of the danger zone A; in the further stages of crane dismantling the max. attention shall be paid to the possible movements, even the uncontrolled ones, of structures and mechanisms.	



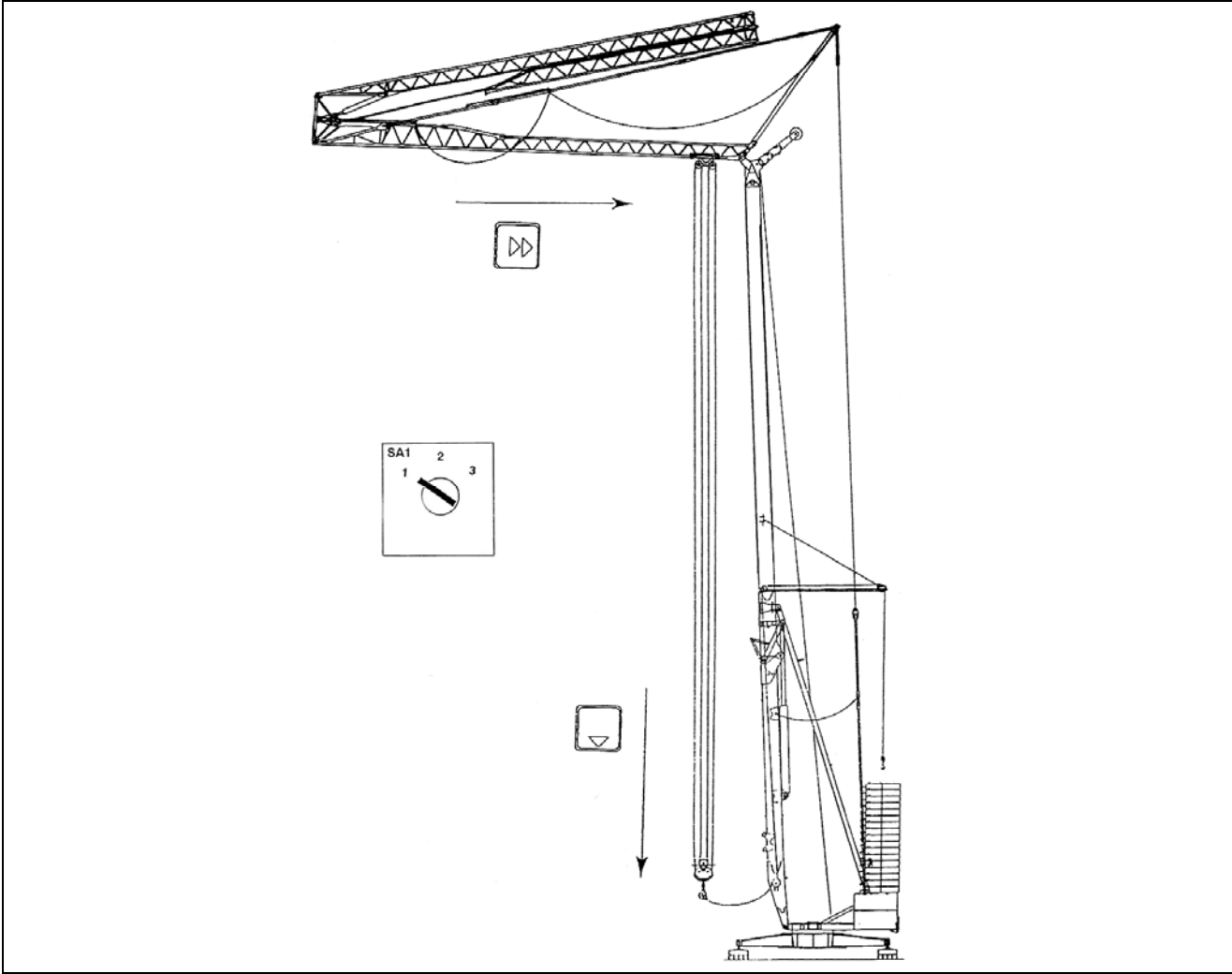
13.4. OPERATION BALLAST UNLOADING

- 4.1 The **19 blocks 400/3** shall be unloaded from the base frame. Remove the two fixing tie rods **M**, after loosening the nuts **O** (paragraph 05.1.3 and paragraph 08.3).

WARNING

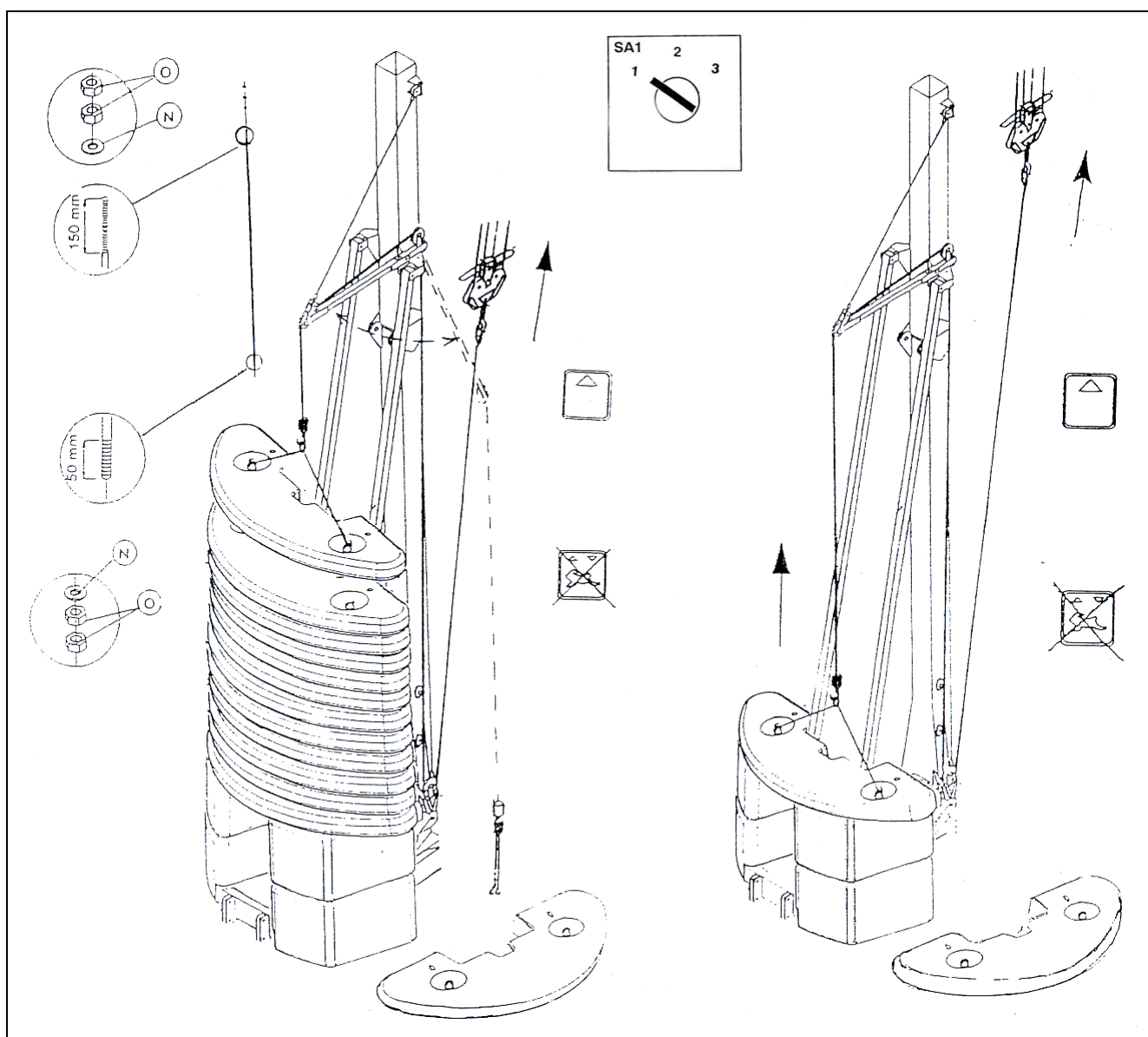
- During the ballast blocks movement, hook a nylon rope to the block lifted by the derrick, in order to pull it sideways and to manage it.
- To climb the blocks use the side ladders of the blocks; if it's needed to access to the upper parts of the crane or of the ballast at a height over **2 meters (6'-7")** from the ground, use a safety belt with double hook so that during climbing, climbing down and operating the operator is hooked with a hook at least all the time.
- Before starting operation ballast blocks unloading, it takes to dismantle the enclosure of the **danger zone A**. During the next stages of crane dismantling, it takes to pay the max. attention to possible uncontrolled movement of structures and mechanisms.

- 4.2 Turn the selector switch **SA1** into position **1 OPERATION**. Move the trolley back near to the tower and lower the block near the ground.
- 4.3 Unlock the derrick, unwind the derrick rope and lower the derrick hook so that the two-rope tie rods fixed to it may be hooked to the uppest block **400/3**.





- 4.4 Hook the uppest block **400/3**.
- 4.5 Hook the end grommet of the derrick rope to the block hook (paragraph 08.3).
- 4.6 Check:
 - o that the derrick is correctly assembled;
 - o that the derrick rope is correctly assembled;
 - o that the two-rope tie rod is correctly assembled;
 - o that the safety locks of all the hooks are integer.
- 4.7 Lift the first block **400/3** at the micro speed; turn the derrick and, acting on the "DOWN" push-button, put the block onto the ground, resing it inside the derrick rotation area, avoiding slantwise pulls.





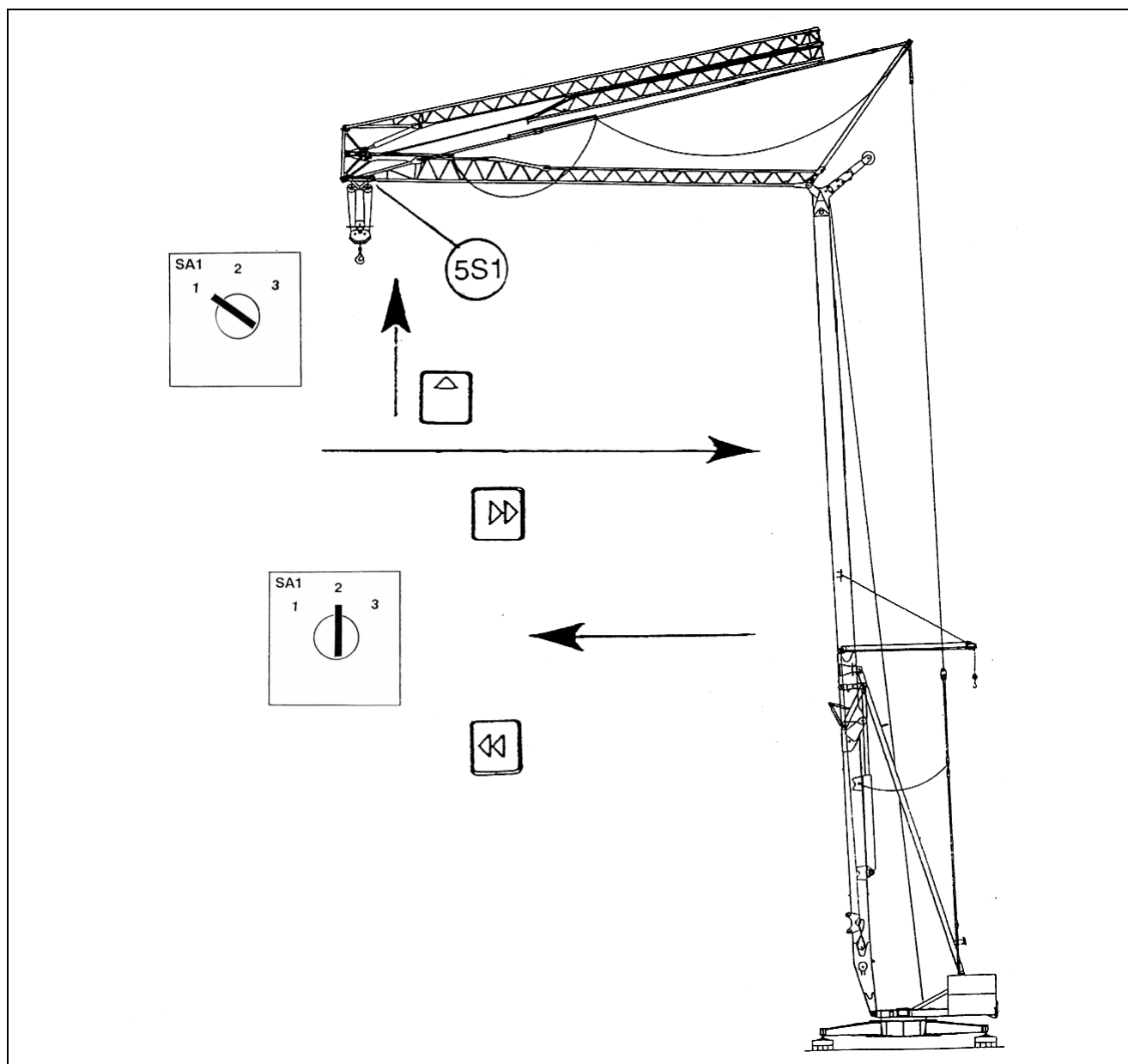
- 4.8 Proceed with unloading all the blocks type **400/3**; use only the micro speed and the slow speed for the returns without load.
- 4.9 Once unloaded all the blocks type **400/3**, remove them by a suitable lifting and transporting mean. Then unhook the grommet from the block and wind the derrick rope on the supports.

	WARNING
➤ The improper use of the derrick, against the prescriptions, may cause the risk of crushing and shock for the exposed persons. ➤ Lifting the blocks at fast speeds may cause deformations or breakages. ➤ The operator pushing or handling the block shall drive the block holding the provided handles and shall remain sideways displaced as regards to the block to prevent the risk of being involved in an unexpected block fall. ➤ The derrick shall only be employed to load and unload ballast blocks of 1,300 kg (2,866 lbs). max. from the ground onto the crane and vice versa. The blocks shall be unloaded by a different lifting mean beside the crane and within the operating range of the derrick; never pull ropes slantwise. ➤ Failure in moving back the trolley close to the tower to unload the ballast blocks may cause the risk of crane overturning. ➤ Never use the crane hoisting hook, even if the crane is partially ballasted, to move other ballast blocks inside the derrick rotation area; there subsists the risk of overturning. ➤ If it's needed to access to the upper parts of the crane or of the ballast at a height over 2 meters (6'-7") from the ground, use a safety belt with double hook so that during climbing and climbing down on hook at least is secured to the hooking points all the time. Failure in using the belt or in having at least one of the two hooks secured may cause the risk of falling. ➤ As an alternative, the ballast block may be unloaded by a lifting mean with suitable load. If the operation is carried out this way, don't damage the block. ➤ The erection ballast blocks 400/2 and 400/1 shall be unloaded from the machine base frame only after that all dismantling operations have been completed, with the tower resting on the base frame and with the crane resting on its rubberised axles by means of an auxiliary lifting means and not the derrick. Without the blocks 400/2 and 400/1 on board, the crane will overturn.	



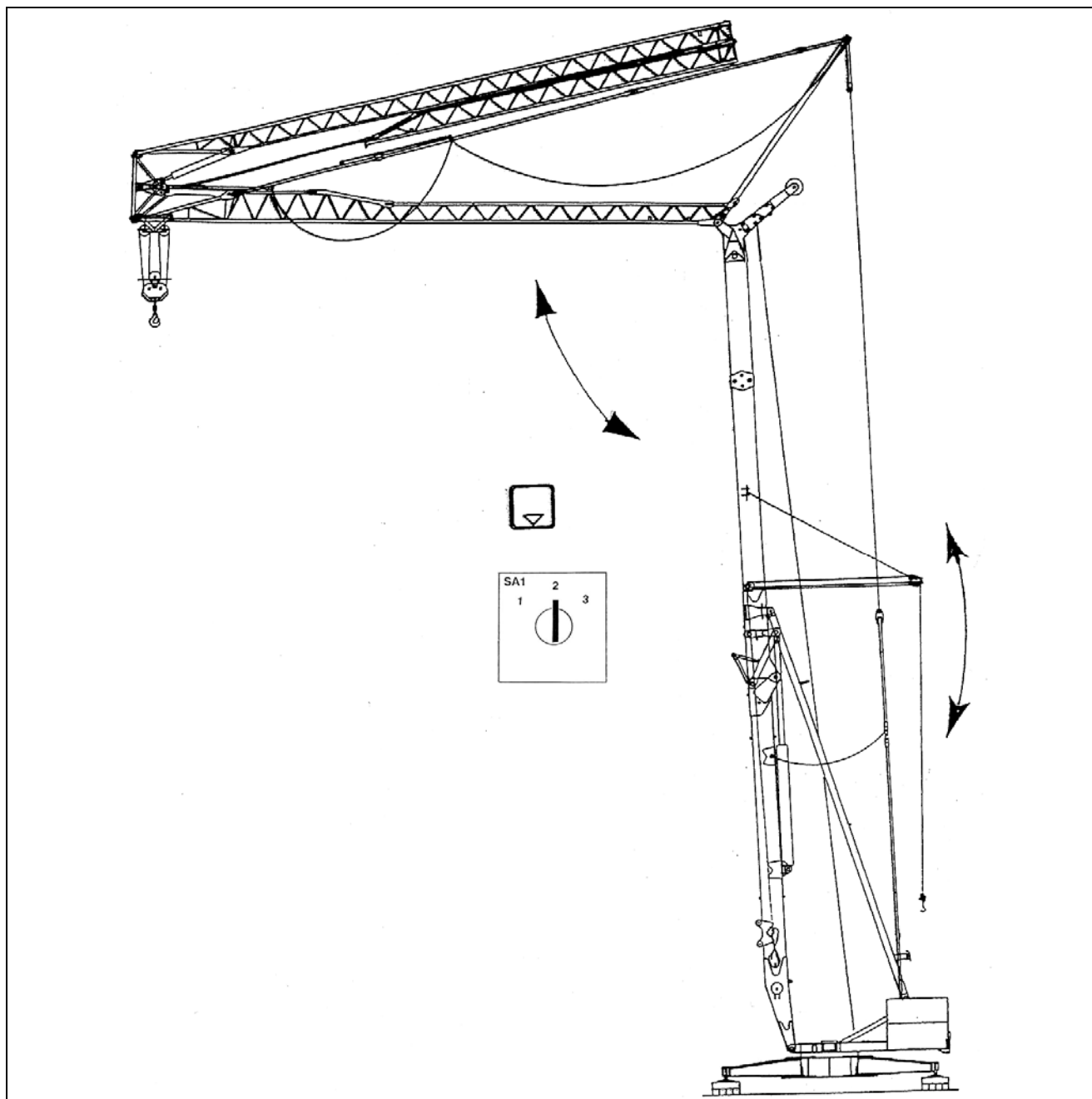
13.5. TOWER LOWERING

- 5.1 Swing the crane, to align the upper part of the base frame to the lower one, by the locking pin **x2.70.90.40** for crane transporting (paragraph 07.3). If necessary, crane dismantling may be carried out in any position along the swing circumference of the crane, and the alignment between the upper part of the base frame and the lower part may be carried out before crane transporting. But this way, it is not possible to use axles and stabilizer to remove the crane from its wooden resting plates.
- 5.2 Carry out all the checks of the hydraulic device described at the paragraph 04.8.4.
- 5.3 Turn selector switch **SA1** into position **1**. Depress "UP" or "DOWN" push-buttons to position the load block (with 4-pull line connected) **1 meter (3'-3")** under the trolley.
- 5.4 Turn selector switch **SA1** into position **2**. Depress "FAR" push-button to move the boom trolley near the articulation of the first and the second boom sections in such a position that the trolley sliding block actuates the enabling micro switch **5S1** (paragraph 07.5). Being the micro switch actuated, the trolley is automatically stopped.





- 5.5 Prior to start tower lowering, briefly depress "UP" or "DOWN" push-buttons alternatively to make sure the two chambers of the erection cylinder is filled with oil and pressurised (paragraph 04.8.4).
- 5.6 Depress "DOWN" push-button to start lowering the crane tower.
- 5.7 Proceed with tower lowering, checking that the movement is regular, that the derrick lowers in the correct position and that ropes and tie rods do not entangle.

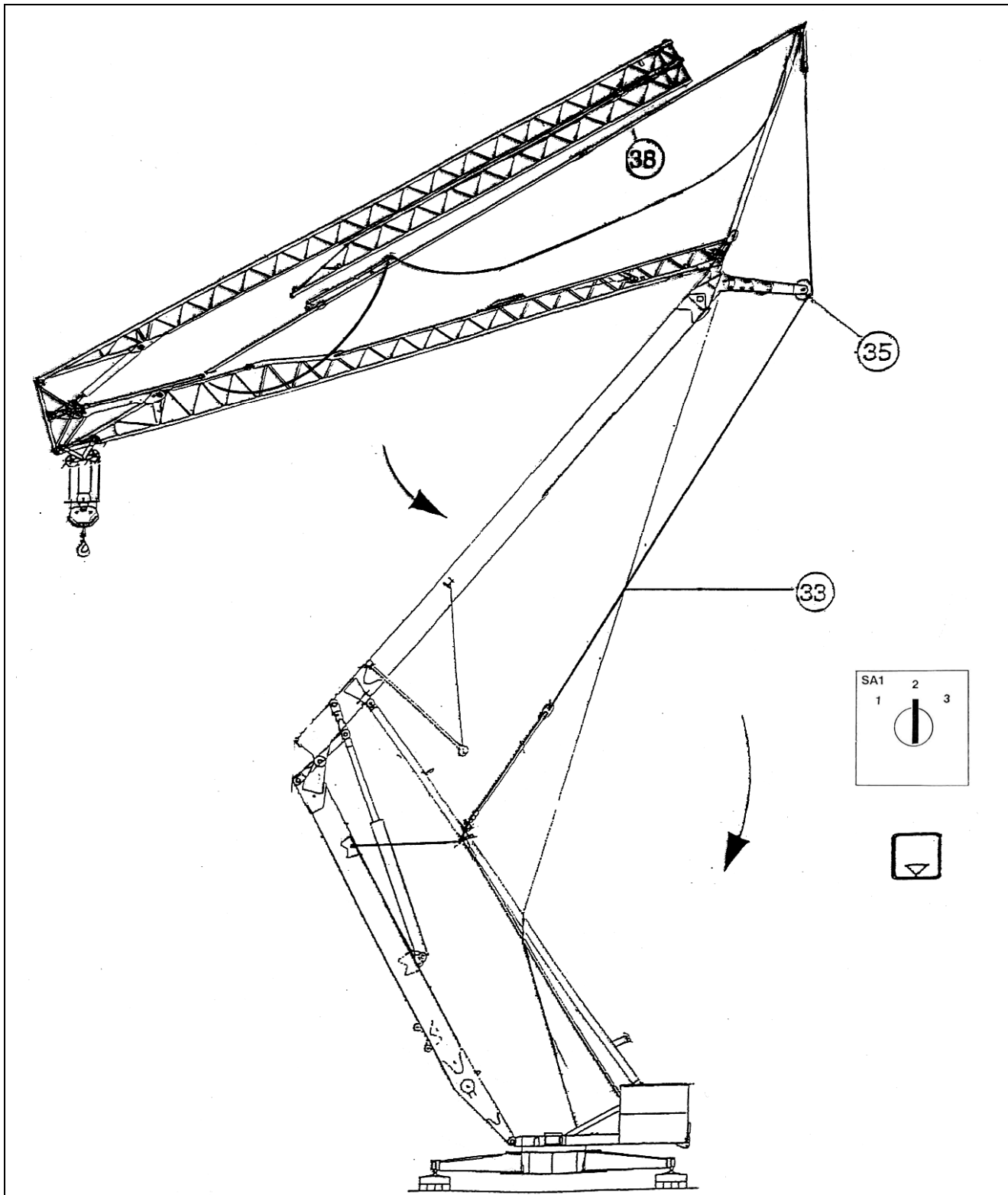


WARNING

- Keep **danger zones A B and C** completely free, remembering that **the danger zone A is not enclosed any more** (paragraph 07.1).

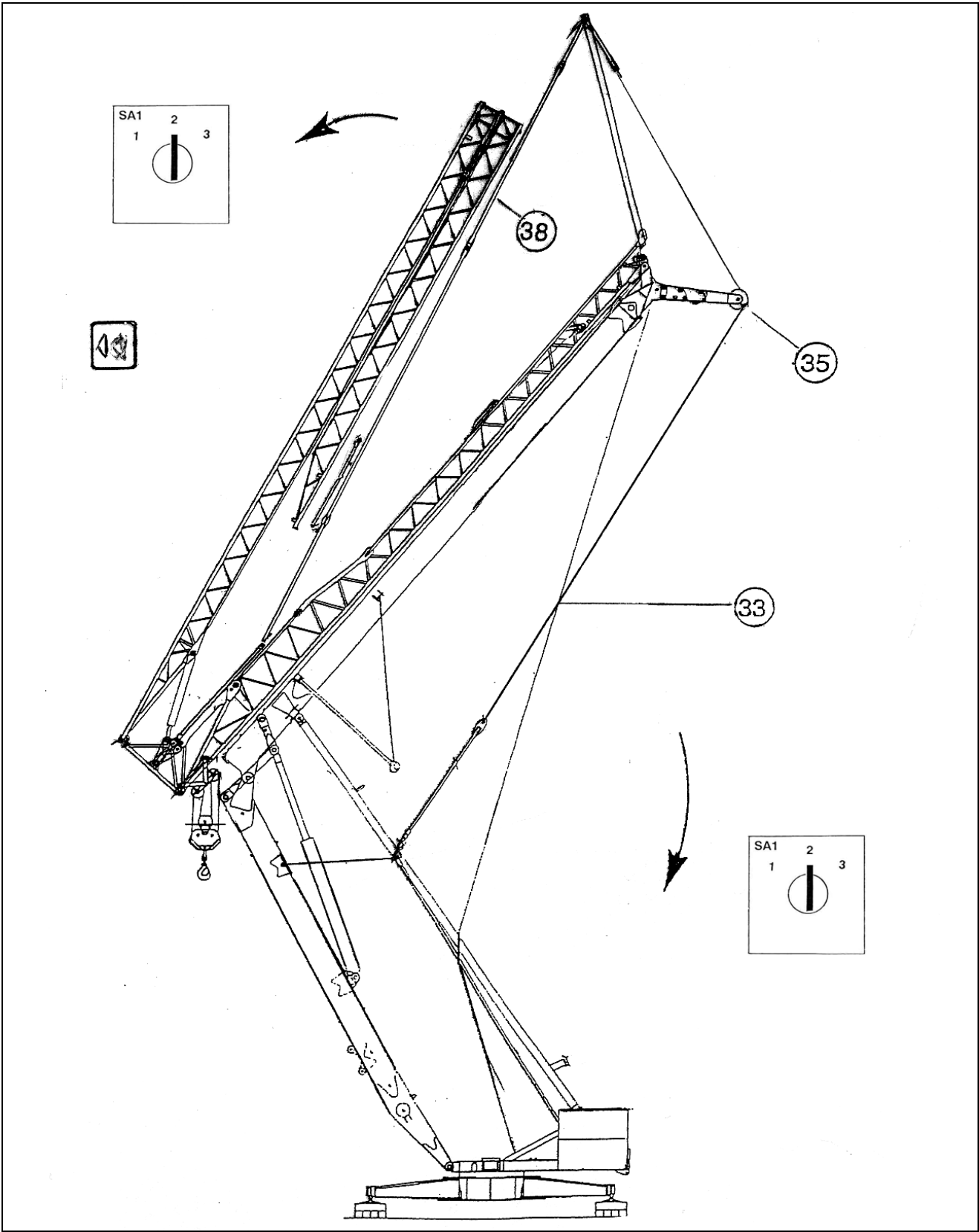


- 5.8 Frequently inspect readings on the station pressure gauge. Should it read a sudden pressure increase, stop the movement and check for the cause. Check that stay rope **33** rests on wheel **35**.



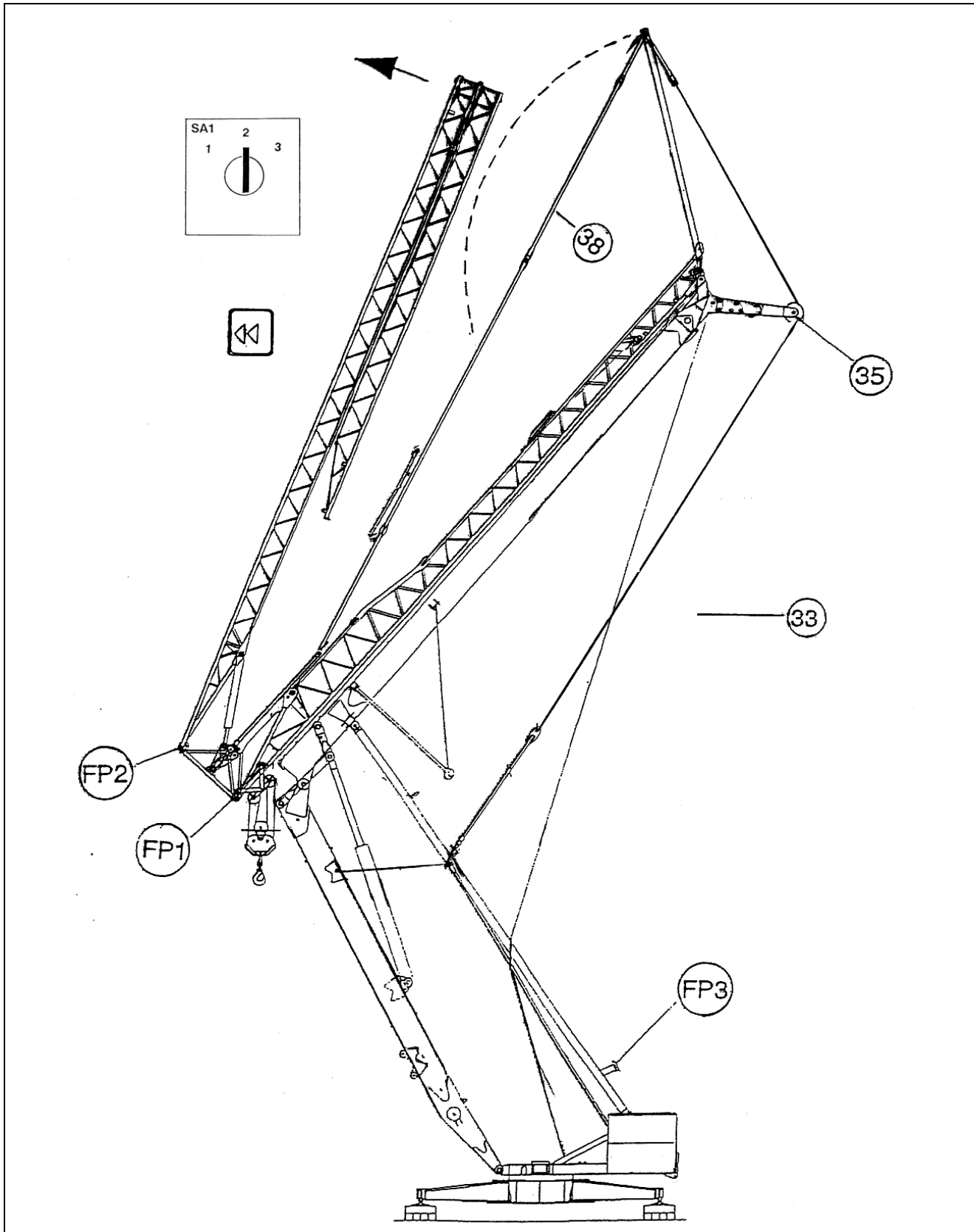


- 5.9 The lowering operation shall continue without any interruption or reverse movements, as these may exert abnormal stress on the crane structure. As soon as the boom rests onto the tower and before stay rope **33** slackens, stop the lowering movement. Depress "FAR" push-button to unfold the boom second section of such an angle to the boom first section so as to allow brace **39** to fold.





- 5.10 Proceed with boom second section unfolding by acting on "FAR" push-button. Limit switches **FP1**, **FP2** and **FP3** (paragraph 07.5) prevent to go over a certain boom second section unfolding position when the ballast on the base frame is not complete; in such a position the boom second section unfolding is automatically stopped.



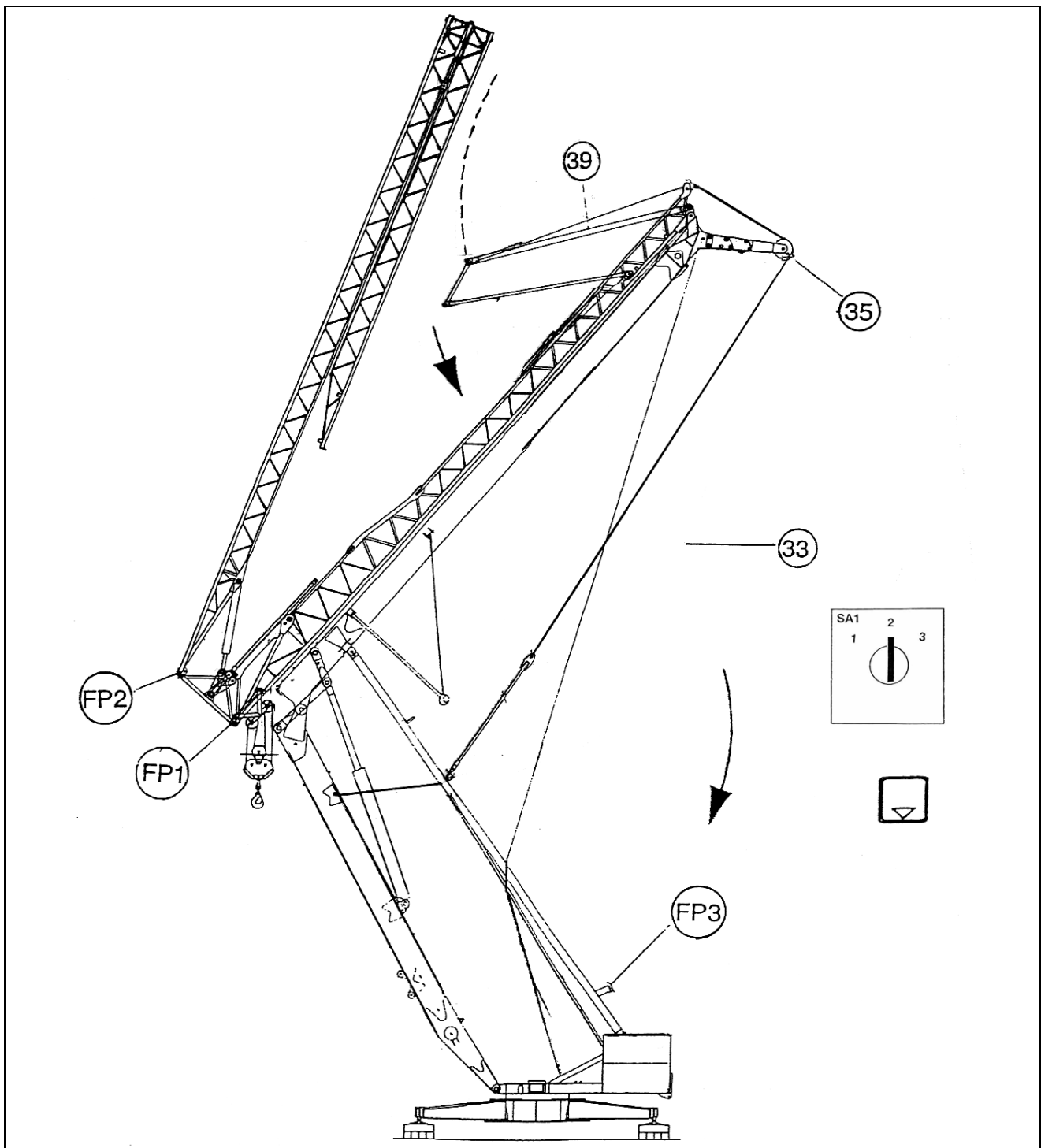


- 5.11 Proceed with tower lowering, making sure that brace **39** rotates forward.
- 5.12 Check that all movements are carried out correctly, that the ropes and tie rods **38** and **43** do not entangle and stay rope **33** rests onto the support roll **34**.



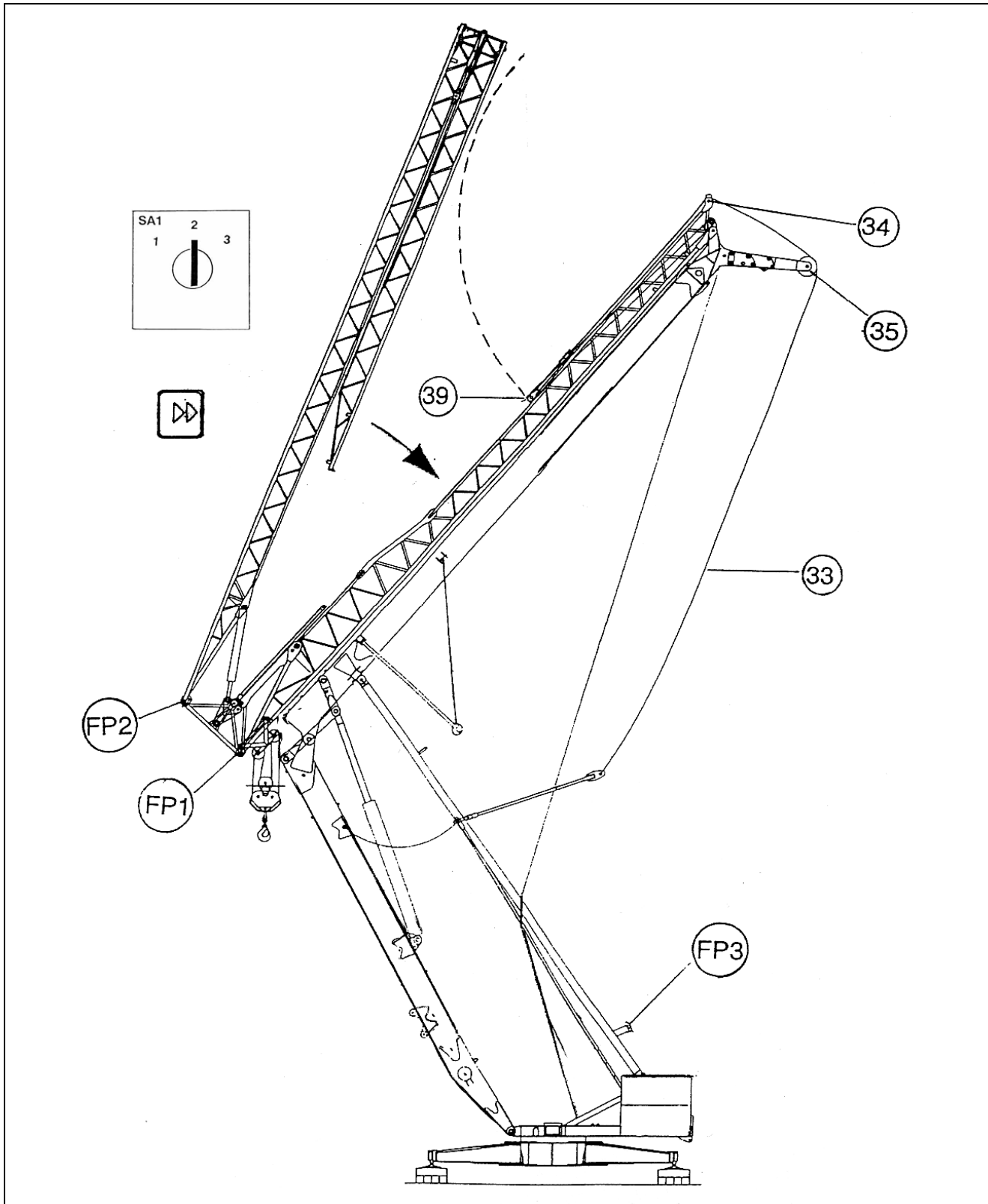
WARNING

- Failure in unfolding the boom second section before stay rope **33** slackens may cause serious damages to the crane structure.



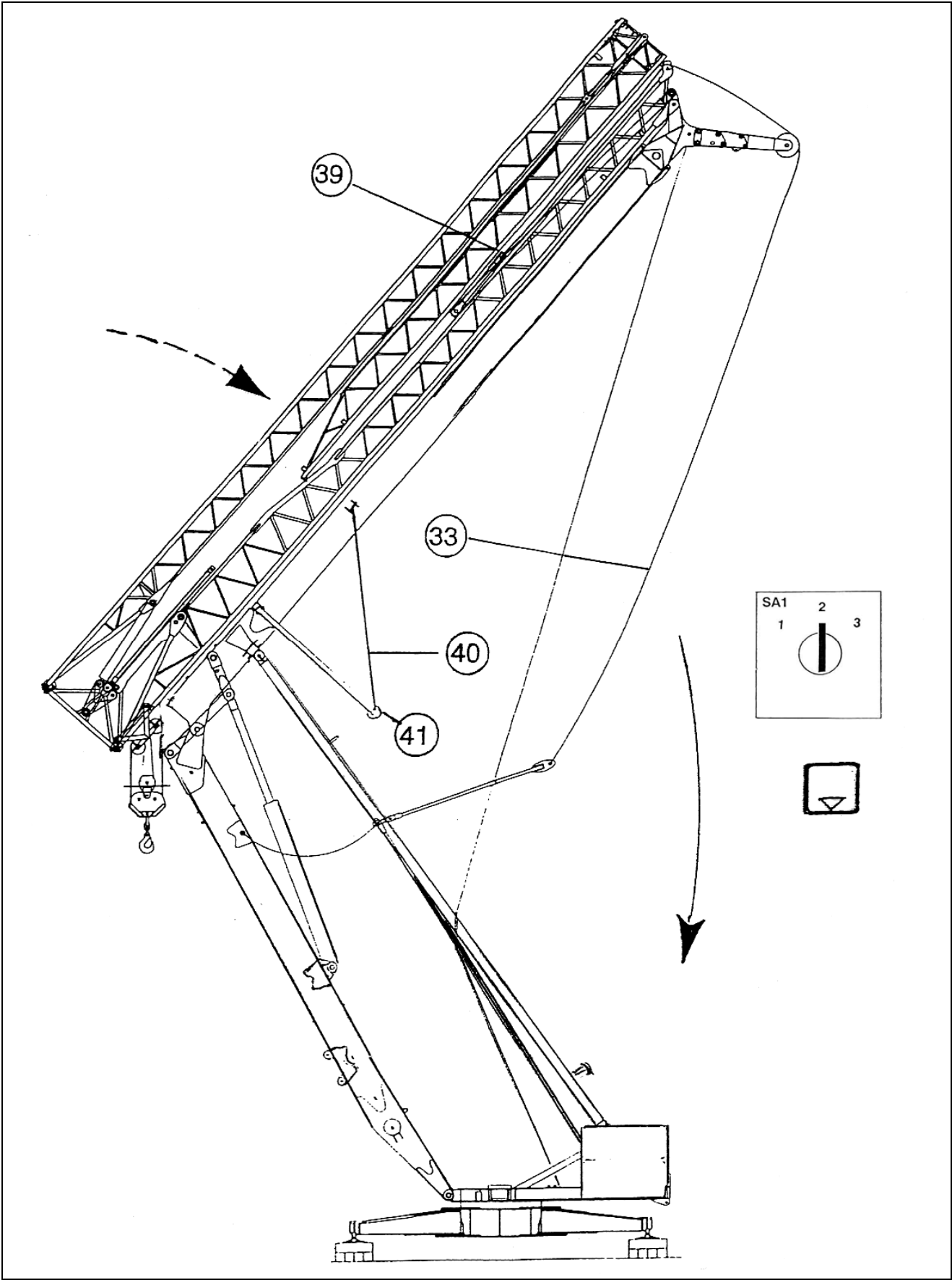


- 5.13 Proceed with tower lowering, checking that the tie rod **39** rotates forward till it rests on the upper stringer of the boom first section, and the rear stay rope **33** is slightly slackened.
- 5.14 Acting on "NEAR" push-button, fold the boom second section till it rests on the first section.



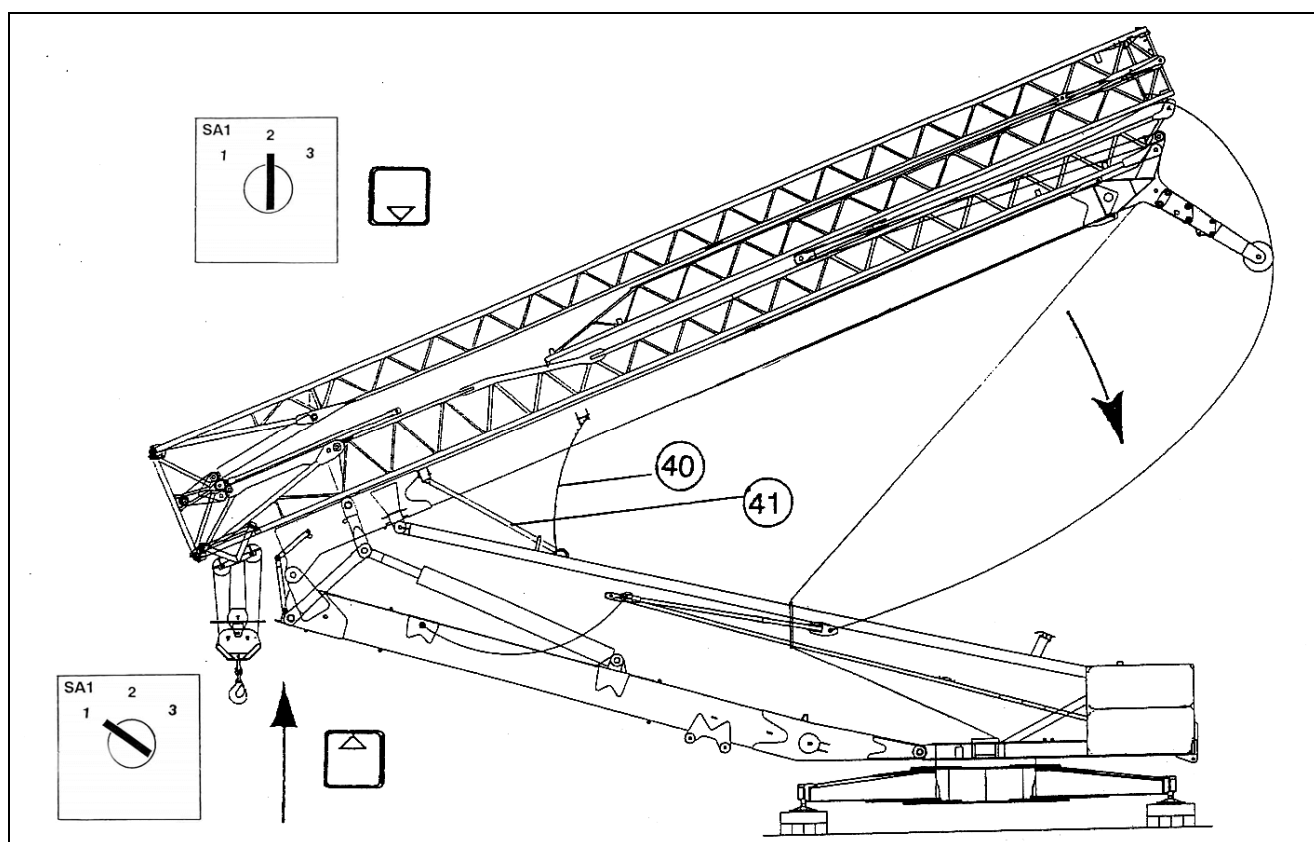


- 5.15 After completely folding the boom second section, acting on "DOWN" push-button start the lowering of the tower again.

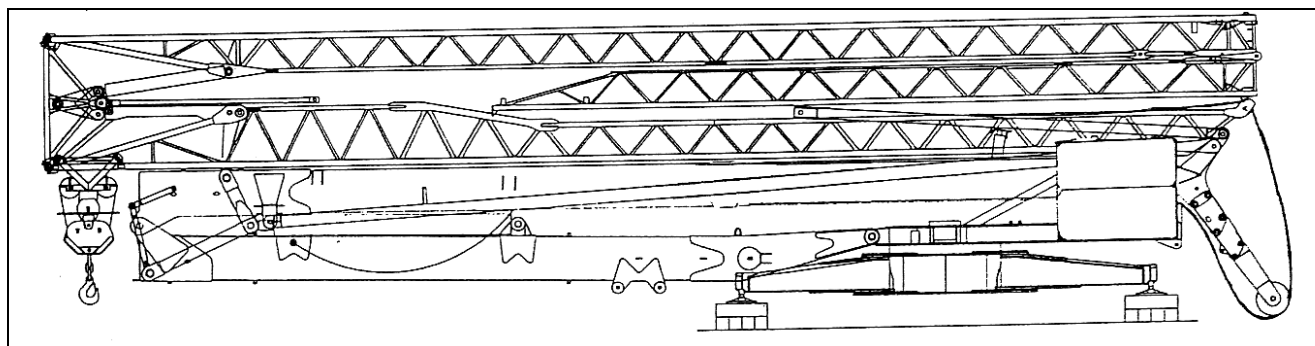




- 5.16 Proceed with tower lowering; check that the movement is regular and with no obstacle, that the structural parts mutually move with no interference or crushing, that the ropes and the tie rods don't entangle.
- 5.17 Folding the tower and slackening the derrick tie rod **40**, check that the derrick boom **41** rests onto the support of the brace in the correct position, not to undergo damages in the further stages of crane dismantling.
- 5.18 Owing to the tower lowering, the block tends to lower, moving away from the trolley. When needed, stop the tower lowering and, after turning the selector switch **SA1** into position **1**, acting on "UP" push-button lift the block next to the trolley.



- 5.19 Before that the tower fits between the ballast blocks **400/2**, switch the access ladders **A-B-C** into transporting position (paragraph 16.2).
- 5.20 Proceed with the tower folding, till it is in horizontal position and resting on the rear supports.





	WARNING
➤ Failure in inspecting the hydraulic equipment prior to tower lowering (paragraph 04.8.4) may lead to uncontrolled movements of the metal frame with consequent damages to the structural parts. ➤ To position the trolley on micro switch 5S1 enabling crane dismantling, always displace it from the tower towards the tip; by displacing it in the opposite direction, the micro switch will not enable the procedure next steps. ➤ Failure in resting the boom second section onto brace 39 and tie rod 38 will cause an abnormal stress to be exerted on the tower cylinder during lowering, with consequent danger of damaging the structures. ➤ Failure in opening the boom second section to allow the rotation of brace 39 when the boom first section is resting on the tower and before stay rope 33 slackens, may cause serious damages to the structure. ➤ Failure in recovering the hoisting rope when required and resting the load block onto the ground could slacken the rope on the drum with consequent possible damages. ➤ Failure in checking the correct positioning of derrick 41 on its apposite support during tower lowering may cause damages to the frame and ropes. ➤ Failure in checking the correct position of stay rope 33 when the tower is about to rest onto the base frame may cause damages to the stay rope. ➤ Failure in clearing danger zones A - B - C during crane dismantling may engender risks of crushing and collisions for all exposed persons. ➤ Dismantling the crane with wind speed higher than 10 km/h (6.2 mph) will seriously damage the structural parts. ➤ Failure in removing the enclosure around danger zone A before the final stage of tower lowering may result in damages to the structural parts. ➤ If the switches and selector switches are not set to their correct positions in the various dismantling stages, it will not be possible to carry out the dismantling procedure correctly. ➤ The erection ballast blocks 400/2 and 400/1 shall be unloaded from the machine base frame only after that all dismantling operations have been completed, with the tower resting on the base frame and with the crane resting on its rubberised axles by means of an auxiliary lifting means and not the derrick. Without the blocks 400/2 and 400/1 on board, the crane will overturn.	

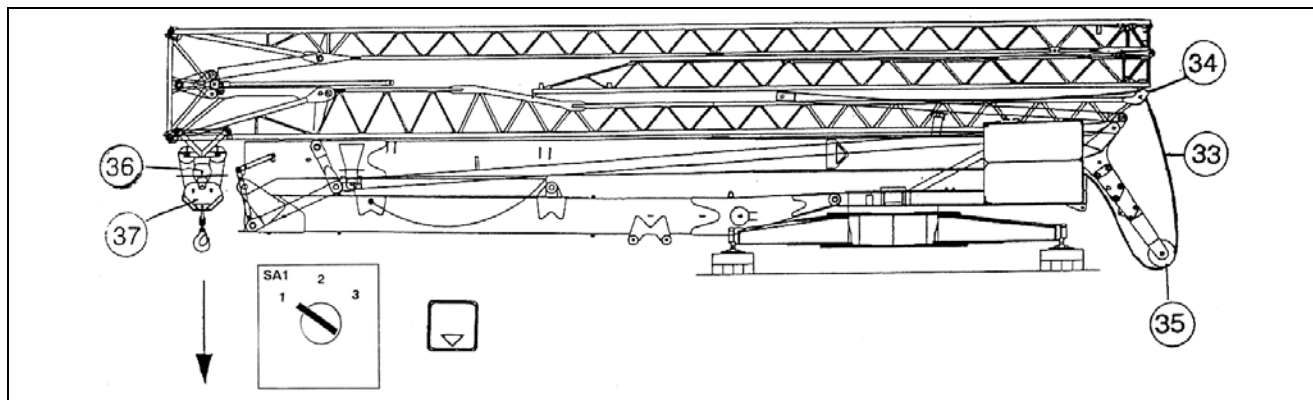


13.6. TRANSPORTING ARRANGEMENTS

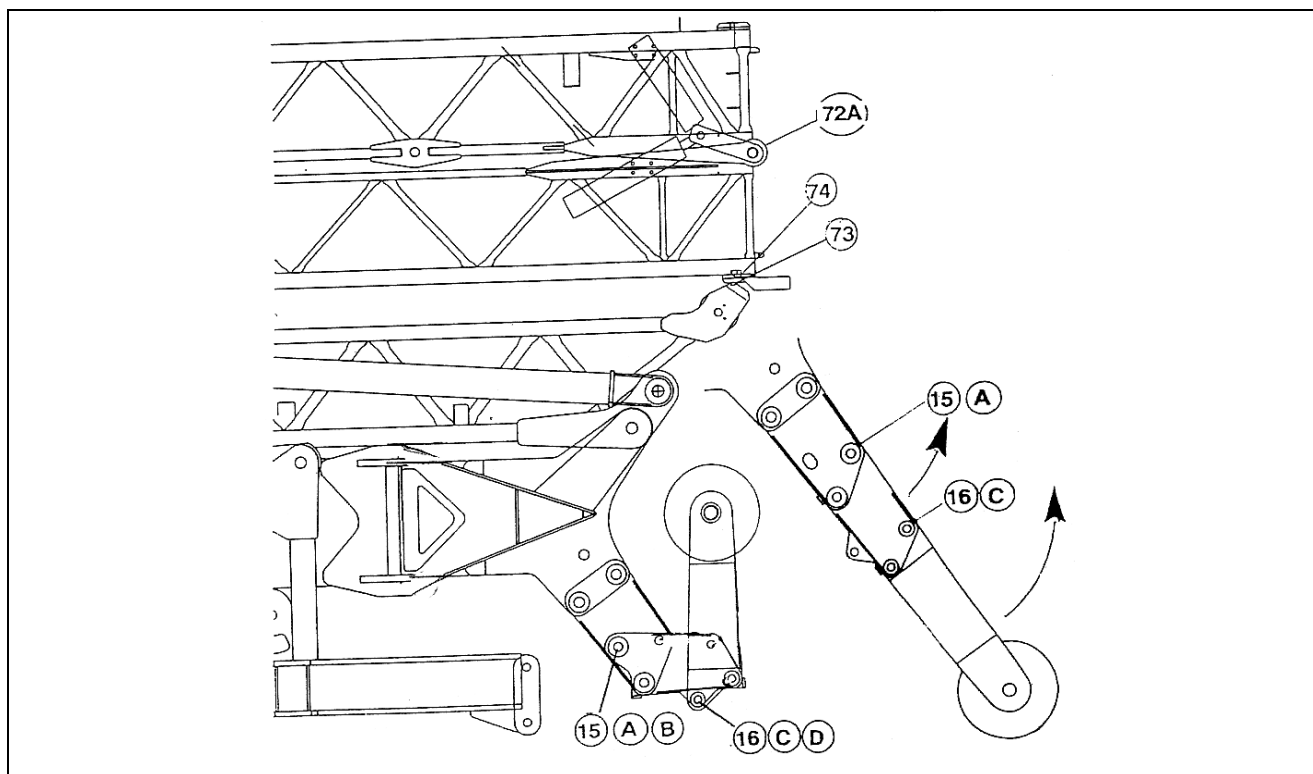


WARNING

- The erection ballast blocks 400/2 and 400/1 shall be unloaded from the machine base frame only after that all dismantling operations have been completed, with the tower resting on the base frame and with the crane resting on its rubberised axles by means of an auxiliary lifting means and not the derrick. Without the blocks 400/2 and 400/1 on board, the crane will overturn.

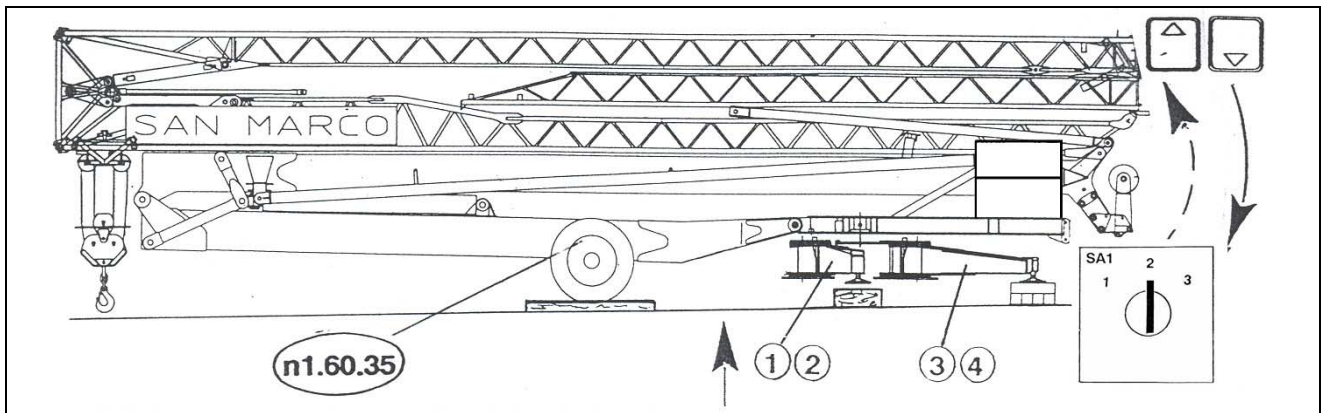


- 6.1 For the following operations of axle fitting operation, the rope between load block and trolley shall be **1-1.5 meters (3'-3" – 4'-11")** long. If necessary, lower the load block.
- 6.2 Fold upwards the two articulated sections of the rear cusp with wheel. Remove the pin **16 n1.410.40** from the holes **C** and rotate upwards the final part of the cusp until the holes **C** and the holes **D** of the intermediate part overlap; lock inserting the pin **n1.410.40** between the holes **C** of the final part and the holes **D** of the intermediate one.
- 6.3 Remove the pin **15 n1.480.40** from the holes **A** and rotate upwards the intermediate part of the cusp until the holes **B** and the holes **A** of the fixed part overlap; lock inserting the pin **n1.480.40** between the holes **4** of the fixed part and the holes **B** of the intermediate one.

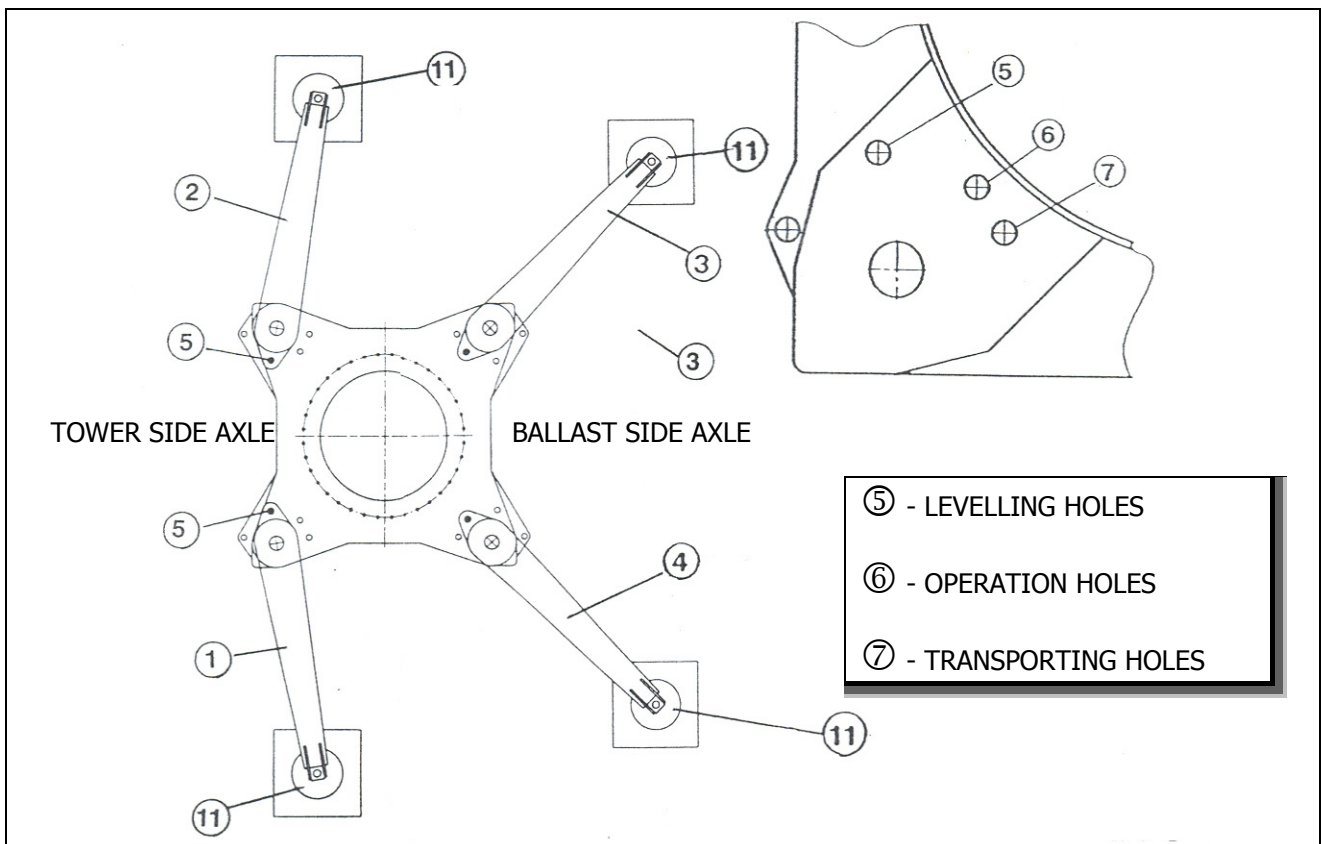




- 6.4 Secure the front section of the boom to the first one inserting and locking the vertical bolts **74** into the support **73**. Check that the upper base frame is aligned with the lower one, so that it is allowed to lock its rotation inserting the pin **x2.70.90.40** (paragraph 07.3). Lower the pin and lock it with the hitch pin.
- 6.5 Fit the rear axle locking it to the plates of the tower by means of the pins **n1.60.35**.

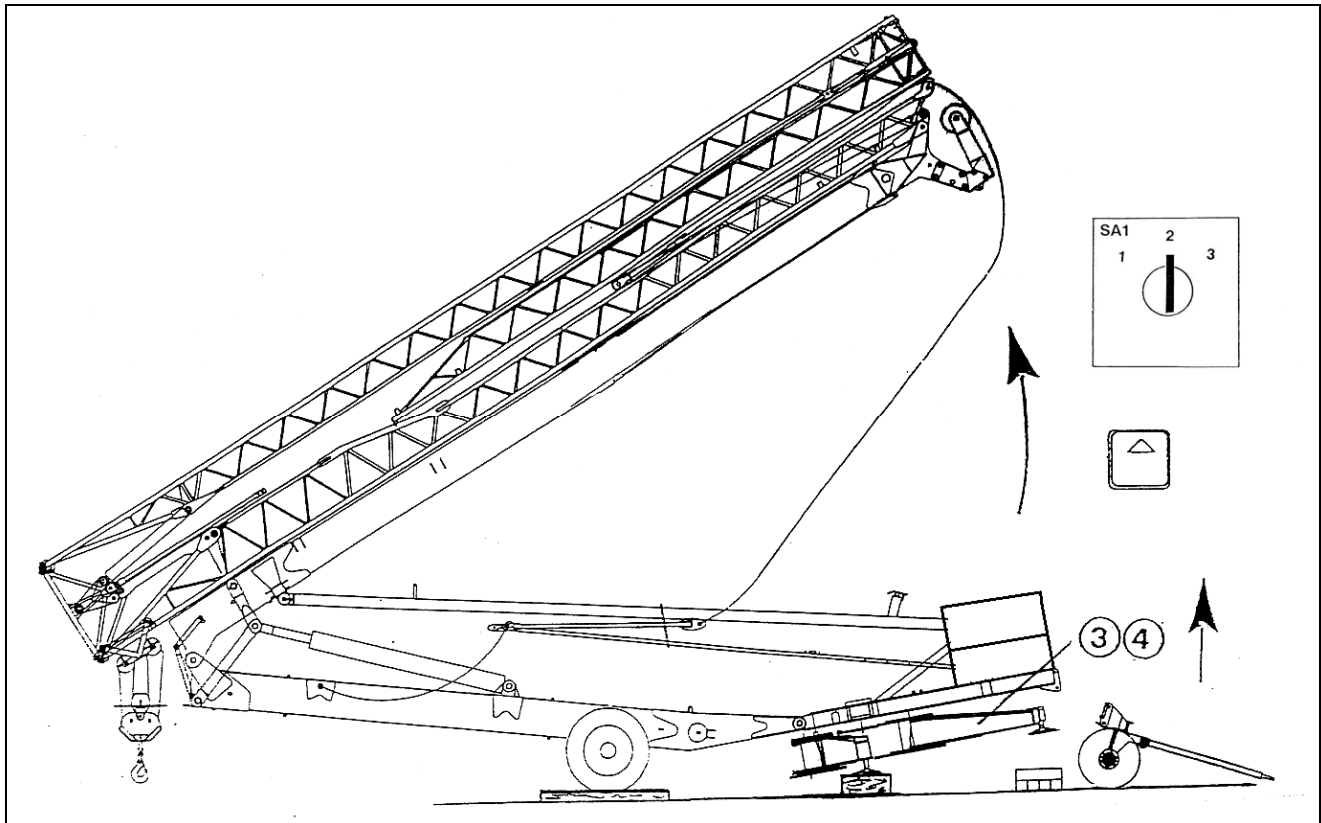


- 6.6 Depress "UP" push-button to lift the rear axle wheels of **20-25 cm (7.9-9.8 in)** from the ground to allow for the fitting of wooden boards underneath. Depress "DOWN" push-button to lower the wheels back onto the wooden boards and lift stabilizer arms **1** and **2** from their resting plates.
- 6.7 Release stabilizer arms **1** and **2** by extracting driving pins **r1.95.40** out of the operation holes **6**; rotate the two stabilizer arms towards the front of the crane so that pins **r1.95.40** can be inserted into levelling holes **5**. Fit two temporary wooden bases under the resting plates of stabilizer screws **1** and **2**.





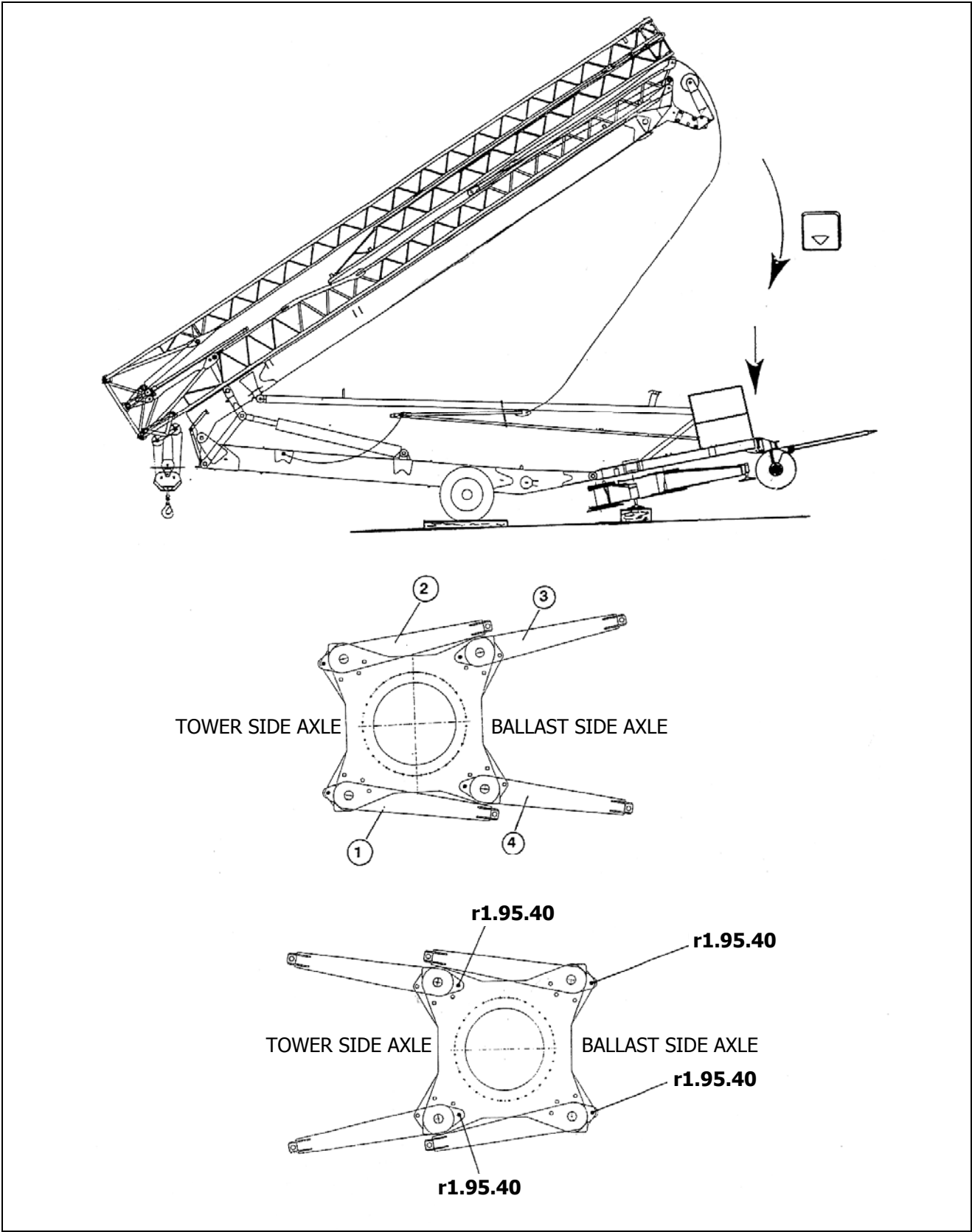
- 6.8 Place two temporary wooden bases and rest plates **11** under stabilizers **1** and **2**, depress "UP" push-button to lower the stabilizers **1** and **2** until they rest on their corresponding rest plates. Depress "UP" push-button once again to lower the crane on its rear side, thus lifting stabilizers **3** and **4** off their resting plates.



- 6.9 After making sure that front axle drawbar is locked by pins **n1.220.20** and **x1.135.20**, reassemble the axle securing it to the upper base frame plates with pins **n1.60.30** with relevant hitch pins.
- 6.10 Remove pins **r1.95.40** securing stabilizer arms **3** and **4** from holes **6** and fold the stabilizers back to their transportation position. Secure them by pins **r1.95.40** inserted into holes **7**.
- 6.11 Depress "DOWN" push button to lower the crane, when the front axle wheels touch the ground, the crane rests on both front and rear axles. Axle wheels are still raised above the wooden boards. In this way stabilizer arms **1** and **2** are raised from their rest plates and can be folded to the transportation position.
- 6.12 Secure all stabilizer arms in transporting position by pins **r1.95.40** inserted into holes **7**. Remove pins **n1.220.20** and **x1.135.20** locking the front axle drawbar.
- 6.13 Remove the electrical connections of the crane by disconnecting the cable from the terminals of dell'interruttore del basamento; disconnect the crane from the mains and from the grounding network.



- 6.14 Create a short descent ramp and tow the crane by a suitable means to lower the rear axle wheels off the wooden boards they were resting on.





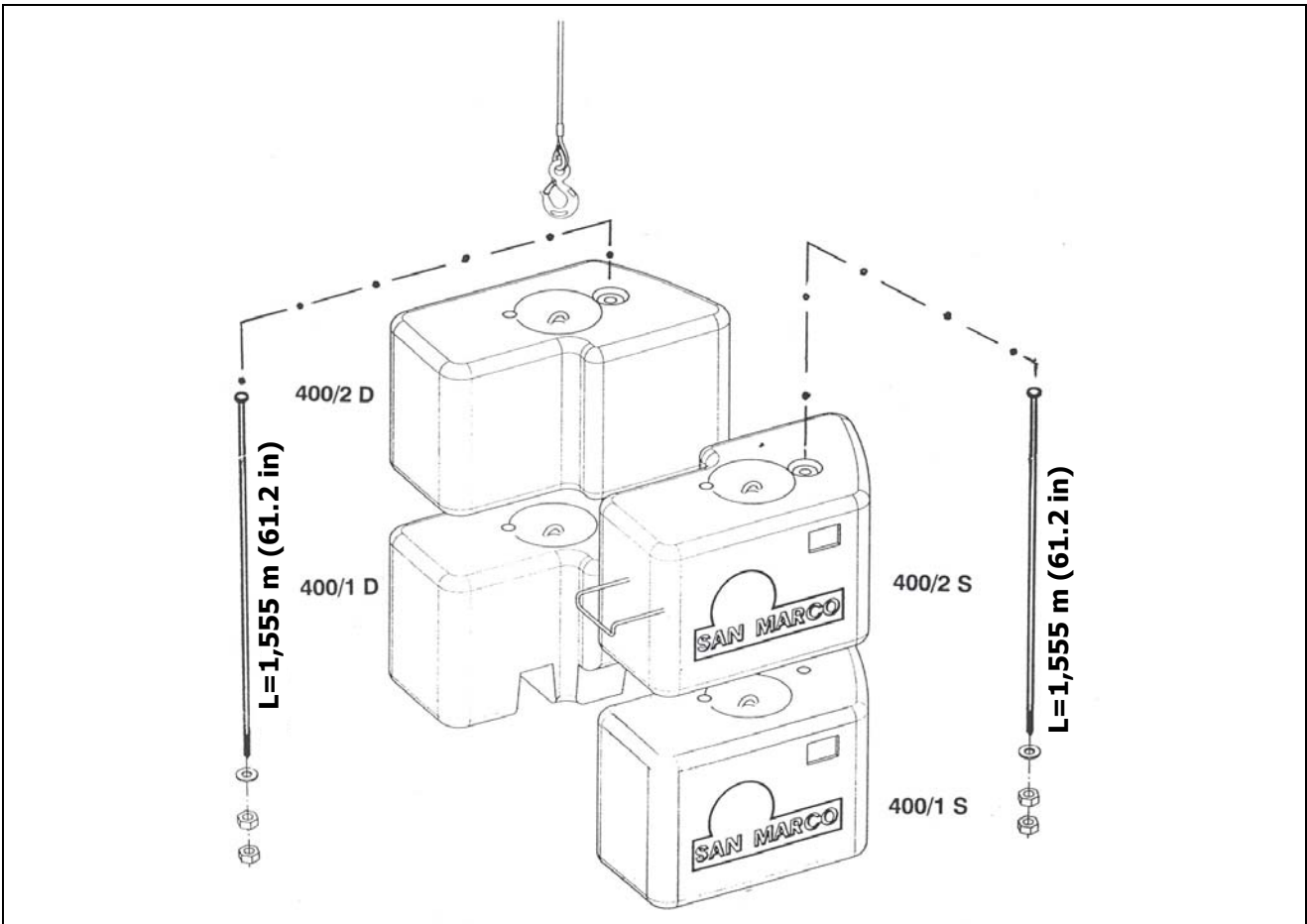
	WARNING
➤ Failure in wearing the prescribed double-lock safety belt to access any structural parts 2 metri (6'-7") above the ground might cause the risk of falling. ➤ When folding upward the rear cusp with wheel, there subsists the danger, in case the cusp is not properly supported, of uncontrolled movements with consequent risk of crushing or shearing for all exposed persons. ➤ Failure in locking the upper section of the base frame to the lower one by pin x2.70.90.40 may lead to the uncontrolled swing of the crane lower part, with consequent risks for all the exposed persons during machine transporting or levelling. ➤ Do not disconnect the grounding system before disconnecting the power supply, to prevent the risk of electric shocks. ➤ Failure in locking the stabilizer arms with the relevant pins r1.95.40 might cause their uncontrolled rotation during transport, with consequent possible damages to the structures and serious risks for all exposed persons. ➤ Do not displace the crane without previously removing pins n1.220.20 and x1.135.20 locking the drawbar. Risk of seriously damaging the front axle. ➤ Should axles not be securely fixed to the crane, serious accidents may occur during machine transporting. ➤ During all the time while the transporting arrangements are carried out the zone around the crane shall be empty; get closer only when the structures are still and after making sure of their stability. Otherwise there subsists the risk of crushing.	

	WARNING
➤ The erection ballast blocks 400/2 and 400/1 shall be unloaded from the machine base frame only after that all dismantling operations have been completed, with the tower resting on the base frame and with the crane resting on its rubberised axles by means of an auxiliary lifting means and not the derrick. Without the blocks 400/2 and 400/1 on board, the crane will overturn.	



13.7. ERECTION BALLAST UNLOADING

- 7.1 Before proceeding with crane transporting, it takes to unload the blocks **400/2** and **400/1** weighing **2,000 kg (4,409 lbs)** and **1,850 kg (4,079 lbs)** each one, forming the erection ballast.
- 7.2 During crane transporting, no block may remain installed; the erection ballast shall be lifted and removed by a suitable lifting mean.
- 7.3 Remove the tie rods fixing the blocks **400/2** and **400/1** to the upper base frame of the crane, loosening and unscrewing the nuts and the lock nuts.
- 7.4 Hook and lift the blocks according with this sequence: **400/2D – 400/2S – 400/1S – 400/1D**.

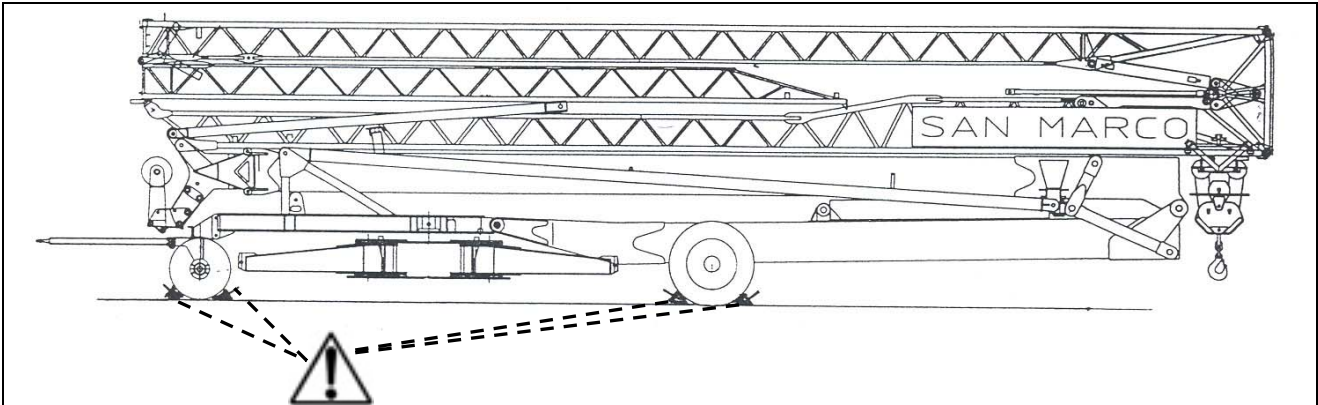


WARNING

- When the first of the two blocks **400/2** weighin **2,000 kg (4,409 lbs)** is removed from the base frame, the crane is unbalanced and tends to bend on the other side. It's recommended to do this operation on a plain and solid ground, keeping to a safety distance, consistent with the operation. The second erection block **400/2** weighing **2,000 kg (4,409 lbs)** shall be removed immediately after the first one, to re-equilibrate the crane. Then it takes to remove, with the same procedure, the two blocks **400/1** weighing **1,850 kg (4,079 lbs)**, first on one side and immediately after on the other side.
- Failure in employing a suitable lifting mean to remove the ballast blocks **400/2** and **400/1** there subsists the risk of falling of the block and danger of crushing for the exposed persons.



13.8. TRANSPORTING AND TOWING INSTRUCTIONS



- 8.1 Make sure that all movable parts of the crane are securely locked, in order not to create any problem during transporting. In particular, check that:
- o the upper part of the base frame is locked to the lower part;
 - o the second part of the boom is locked to the support;
 - o the stabilizers arms of the base frame are locked by means of the pins **r1.95.40** and their relevant hitch pins;
 - o the wheels are locked to the hubs and the axles are locked to the base frame;
 - o the drawbar is locked to the front axle.
- 8.2 Carry out any other operations of fixing or arrangement in order to ensure the safety to the exposed persons and to the crane.
- 8.3 For crane transporting, towing or lifting follow all the prescriptions reported at the paragraph 01.7 and at the paragraph 01.8.

	WARNING
➤ When the crane is parked or stationary, even on a level ground, the wheel of the crane shall be securely locked by means of break block to prevent any accidental crane rotations or displacement. ➤ When the crane is parked on transit areas, it takes to place suitable signs and signaling lights, to warn of the presence of the parked crane.	



14. RESIDUALS RISKS

14.1. RESIDUALS RISKS 14-1





14.1. RESIDUALS RISKS

- 1.1 Failure in strictly observing all the instructions given point by point in the present instruction manual will engender danger situations and consequent residual risks, as pointed out in each paragraph:



WARNING

- 1.2 The pointed risks may prejudice the crane integrity and as well as the safety of the operators and all exposed persons.
- 1.3 Several parts of the crane are located at **OVER 2 METERS (6'-7") ABOVE THE GROUND**. The surfaces of the structures are not protected by non-slip paint. There subsists the risk of falling, and the access is therefore strictly forbidden.
- o For the **dismantles crane** these parts are: boom sections; cusps; etc.
 - o For the **erected crane**: upper level of the ballast; etc.
- 1.4 It is compulsory both for the riggers and for the operator to wear all the time the **protection helmet**, the **gloves** and the **PERSONAL PROTECTION EQUIPMENT** prescribed by the laws relating to safety
- 1.5 Should the crane be operated at **wind speeds over 72 km/h (44.7 mph)**, there subsists a risk for its stability and for the integrity of its structures. When the wind reaches the limit speed of **72 km/h (44.7 mph)**, crane operation shall be stopped, the swing brake shall be released (**CRANE FREE TO WEATHERVANE**, paragraph 10.13) and the hook lifted till the max. height.
- 1.6 During load hoisting and trolleying, there subsists the residual risk of loads crashing against **SUDDEN OR UNEXPECTED OBSTACLES** met on their aerial path. It is therefore at the operator care and responsibility to continuously check that the aerial path of the hook is free from obstacles.
- 1.7 **LOADS INCORRECTLY SLUNG OR SECURED may fall**, totally or partially, thus prejudicing the health and safety of all exposed persons as well as the stability of the crane.
- 1.8 After any maintenance intervention or crane erection operations, make sure that **NO TOOLS AND WORKING EQUIPMENT ARE LEFT ON THE CRANE'S STRUCTURAL PARTS**. This may cause the residual risk of tools and equipment falling downward during or after crane erection, with subsequent danger for the operator and all exposed persons.
- 1.9 **IF MORE CRANES OPERATING ON THE SAME BUILDING SITE MAY INTERFERE** with one other, or should a crane interfere with fixed obstacles (buildings, trees, poles, material depots, etc.), although limit switches are adjusted to stop interference, there subsists the residual risk of crashes.
- 1.10 As far as cranes installed in special conditions (e.g. near to transmitters) are concerned, it may happen that the **ACCUMULATION OF STATIC ELECTRICITY IN THE CRANE METAL FRAME** is not discharged by the grounding system. This means there subsists the risk of electroshock for operators and exposed persons who, from the ground, may enter in contact with the structural parts of the crane, the load block, ropes or suspended loads. It is at the building site manager responsibility to warn all operators and exposed persons of the above risk, prescribing to wear insulated shoes and gloves and placing an insulating sling between the winch and the suspended loads.
- 1.11 When operating the crane for long periods at **HIGH AMBIENT TEMPERATURES**, it is possible that the external protections and or enclosures of the electrical equipment and motors reach rather high



temperatures. Do not touch these parts without making sure their temperature is such not to cause any burns.

- 1.12 The crane is equipped with all necessary devices to prevent the crane elements from overheating. **SHOULD ANY OF THE COMBUSTIBLE EQUIPMENT** (panel board, rubber cables, rubber oil pipes, etc.) **REACH ELEVATED TEMPERATURES**, there subsist the risk of fire. Suitable fire extinguishing means shall be kept at hand on the building site.
- 1.13 Under normal operation conditions, there is no risk of vibration, emission of radiation, dust and gas. However, the crane is not protected against external radiation and is not equipped with laser devices.
- 1.14 While operating the crane, operator shall be capable of directly inspecting from their work posts the entire building site, all loading and unloading points, the aerial path of the load, the charts indicating allowed loads as well as and the danger zone, to make sure that no exposed persons are present. Should, due to particular or exceptional conditions, it be impossible to meet even one of these prescriptions, the operator shall immediately call for the assistance of **SIGNALLER** who, with direct visibility of the area not directly controlled, provide instructions for the maneuvers with clear and easily understood hand signals.
- 1.15 Should the operator or the exposed persons be **DAILY EXPOSED TO A NOISE** airborne level higher than **80 dBA**, they shall wear appropriate ear protection equipment. The operator and all the exposed persons wearing earplugs or ear protection devices will be thus unable to hear the crane acoustic warnings of load hoisting and passage, as well as those signalling that the load and moment thresholds have been exceeded. If this is the case, a visual **flashing indicator light** shall be added to the acoustic warning, placed in such a position that all exposed persons who are not able to hear the acoustic warning signal may see it. Connect one or more **48 V** flashing lights to the terminals provided above the acoustic warning connecting terminals inside the electric cabinet.
- 1.16 **RISK OF CORROSION.** The crane non-galvanised elements are protected with a double layer of paint. Abrasions caused by erection, dismantling or transporting operations may damage the layer of paint, thus exposing surfaces to oxidation. To prevent corrosion from spreading and damaging the frame, restore the protection with a double layer of paint after each dismantling operation, taking care to thoroughly clean the surface before applying the paint.
- 1.17 **RISKS DUE TO FROST.** A number of holes are drilled in the tubular elements of the galvanised structural parts, in particular on the boom stringers, to allow the cast zinc to flow in and out of the tubular elements during the galvanisation process. If one of these holes, in the lower part of a tubular element, is obstructed during crane operation, water will collect inside the element and, at low temperature, ice will be formed with consequent damage to the frame. Each time the crane is dismantled, check the holes on the lower part of the tubular elements to make sure they are not obstructed and that rainwater and condensation can drain freely.
- 1.18 If the crane is erected in an area subject to frequent thunderstorms and therefore at elevated **RISKS OF LIGHTNING**, protect it by means of a suitable lightning protection follow the procedure indicated by the standard,
- 1.19 While there are no limits to the surface of hoisted loads in wind free conditions, an increase in wind speed with consequent pressure exerted on the suspended load reduces proportionally **THE SURFACE OF THE EXPOSED ACTUAL LOAD** (paragraph 11.3.1). Should the wind reach the max. crane operation wind speed of 70 72 km/h (44.7 mph), the suspended load surface shall be smaller than one square metre (10,7 ft²), with a wind of 35 km/h (21.7 mph), the surface shall be smaller than two square metres (21,5 ft²), and so on.
- 1.20 **THE MAXIMUM PERMITTED TOLERANCE for the crane SUPPLY VOLTAGE is ±5% of the rated value 480 V 60 Hz, whether with or without load.** Should a generator supply the power to the crane, make sure the generator is equipped with all the necessary devices to ensure the prescribed maximum voltage deviations at all crane operating stages.



- 1.21 The present operation and maintenance instruction Manual reflects the state-of-the-art at the time the crane is put on the market. The present instruction manual cannot be considered as inadequate only because manuals for the same type of crane, manufactured at a later date, are updated to take into account any technological progress. The manufacturer secures the right to update its production and the relevant instruction manuals, but is not obliged to update previous productions and previous instruction manuals. Therefore any lack in technical updating may be a source of residual risks for the user, due to the crane obsolescence.
- 1.22 **Capacitors arranged inside THE VARIABLE SPEED DRIVES have a discharge time of fifteen minutes.** Should it be necessary to carry out any maintenance intervention requiring the removal of the variable speed drive outer protections, wait at least fifteen minutes after the equipment has been switched off before removing the protections and handling internal components. Acting in disregard of these instructions may cause the risk of electroshock.
- 1.23 In order to assure a correct functioning in any condition of feeding with inverter for the hoisting winch, the power of the motor is superabundant as to the max. loads admitted according with lifting speeds. Under the best conditions of feeding, the installed power would allow to lift loads exceeding the max. loads admitted; in order to avoid risk of breaking or damaging for the hoisting devices and for the structural parts, it is compulsory to **lift loads according with the MAX. LOADS ADMITTED and indicated in the present Manual, and always to keep efficient the SPEED LIMITERS and the RATED LOAD LIMITER.**
- 1.24 **ALL LUBRICANTS**, especially the liquid ones, used in the reduction units or in the hydraulic system, that come into contact with the skin or eyes or if swallowed, may have serious consequences.
- 1.25 The hydraulic devices shall be used only for erection and dismantling. **NEVER USE THE HYDRAULIC ERECTION DEVICES WHEN THE CRANE HAS A LOAD SUSPENDED TO THE HOOK.** Danger of great damages for the hydraulic devices.
- 1.26 The occurrence of **ATMOSPHERIC DISCHARGES DUE TO STORMS** may cause overvoltages on the feeding line of the crane, that may cause damages to the electrical equipments of the machine; when the weather conditions may foster the forming of lightning, it is necessary **to place the crane out of service and to disconnect the feeding line to the crane electric cabinet**, opening the disconnecting switch or disconnecting the plug-socket connections. All the operators and the exposed persons shall immediately get away from the metal frame of the crane.



1.27 In accordance with the laws in force, San Marco cranes are designed, for what concerns the stability of the **crane out-of-service**, as a function of the following **MAX. WIND SPEEDS**:

HEIGHT OF THE STRUCTURAL PARTS	MAX. WIND SPEED
From 0 to 8 meters	100 km/h
From 8 to 20 meters	130 km/h
Over 20 meters	150 km/h

HEIGHT OF THE STRUCTURAL PARTS	MAX. WIND SPEED
From 0 to 26'-3"	62.1 mph
From 26'-3" to 65'-7"	80.7 mph
Over 65'-7"	93.2 mph

Should the weather forecast or the civil defence foresee hurricanes with wind speeds higher than those reported in the table, **the crane shall be immediately dismantled**.

1.28 The crane may be equipped with an **ACCESS LADDER** **OPTIONAL** (paragraph 16.1), to reach the upper part of the crane, in the event of a fault of the motor gear unit. **The use of the ladder is restricted only to riggers, equipped with safety belt with double hook**, fixed to the anti-fall device, inserted into the safety rope and assembled on the tower. **The lower section of the ladder shall be normally removed so that all the not-authorized people be prevented to climb to the upper part**. If the lower part of the ladder is left assembled, not-authorized and not-equipped people may reach the upper part of the crane, with the risk of fall.

15. REPAIRING THE MOST COMMON FAILURES

15.1. IRREGULARITIES DURING CRANE ERECTION AND DISMANTLING

15-1

15.2. IRREGULARITIES DUE TO ENVIRONMENTAL FACTORS.....

15-2

15.3. IRREGULARITIES DURING CRANE OPERATION

15-3

15.4. OPERATIONS IN AN EMERGENCY SITUATION

15-5





15.1. IRREGULARITIES DURING CRANE ERECTION AND DISMANTLING

IRREGULARITY
The crane does not work.
POSSIBLE CAUSE
The wires of the three-phase feeding cable R S T are not connected in the proper sequence.
INTERVENTION
Connect the wires R S T in the proper sequence.

IRREGULARITY
It's impossible to proceed with crane erection or dismantling.
POSSIBLE CAUSE
The boom trolley is not positioned on the relevant enabling micro switch arranged near the boom articulation.
INTERVENTION
Check for correct position of the trolley, whose sliding block shall actuate the lever of the enabling micro switch.

IRREGULARITY
It's impossible to proceed with crane erection or dismantling.
POSSIBLE CAUSE
The selector switches inside the electric cabinet are not placed in the position proper for the erection or dismantling stage that shall be carried out.
INTERVENTION
Check the correct position of the selector switches.

IRREGULARITY
At pickup stage, or when switching from one speed to another, the absorbed current reaches, for few instants, higher values than the measured ones while the crane is normally operated and running regularly to calculate the rated values.
WARNING
The indicated operating power values are rated ones.
INTERVENTION
Connection to the main power supply shall be equipped with delayed valves (not quick ones) to absorb the pickup currents.

	WARNING
➤ The most common failures may be inspected and repaired by qualified, trained and informed technicians from the building site, having all the required information to carry out the tasks. Should these technicians be unable to restore the crane operation, immediately contact the After-Sales Dept. of the Manufacturer's authorised dealer.	



15.2. IRREGULARITIES DUE TO ENVIRONMENTAL FACTORS

IRREGULARITY
The brake of one electric motor (or of more electric motors) remains locked.
POSSIBLE CAUSE
In presence of humidity, due to periods of rain or in the wintertime, the electric motors brakes may stick to the frame or the armature overnight or during long periods of inactivity. If this is the case, the traction of the magnet will not be sufficient to release the brake.
POSSIBLE RISKS
The brake may burn or the motor, running with the brake locked, may be damaged.
INTERVENTION
Manually release the brake by inserting the tip of a screwdriver, just once, between the brake and the magnet or between the brake and its frame to set the device free.

IRREGULARITY
One electric motor(or more electric motors) suddenly stops during operation.
POSSIBLE CAUSE
At high ambient temperatures the electric motors, when subjected to heavy load conditions, may increase in temperature so much to trip the motor thermal protections.
INTERVENTION
Immediately stop operation so that the motor can cool down and reset the protection device.

IRREGULARITY
At very low or very high temperatures, the oil density of the hydraulic system is significantly modified.
INTERVENTION
It takes to carry out a specific adjustment of the valves of the erection cylinders.

IRREGULARITY
Crane swing slows down when the crane swings into the wind, or tends to a longer stop when swinging windward.
POSSIBLE CAUSE
The adjustment of the swing variable speed drive has been carried out with wind blowing at slow speed.
INTERVENTION
Pay attention when operating in such conditions.

	WARNING
➤ The most common failures may be inspected and repaired by qualified, trained and informed technicians from the building site, having all the required information to carry out the tasks. Should these technicians be unable to restore the crane operation, immediately contact the After-Sales Dept. of the Manufacturer’s authorised dealer.	



15.3. IRREGULARITIES DURING CRANE OPERATION

IRREGULARITY
A movement is not executed after its control.
POSSIBLE CAUSE
It may be due to the intervention of a micro switch limiting the concerned movement, because of the overcoming of the limit controllet by the switch or because of a wrong adjustment of the device.
INTERVENTION
Control a movement in the opposite direction and check the adjustment of the limit switch involved.

IRREGULARITY
A movement is not executed after its control.
POSSIBLE CAUSE
The motors driving the operation movements of the crane are provided with magneto-thermal protections. In case of overload, one of these protections may trip, thus stopping the motor and preventing the execution of the requested movement.
INTERVENTION
Check inside the electric cabinet and eventually restore the magneto-thermal protection intervened.

IRREGULARITY
A movement is not executed after its control.
POSSIBLE CAUSE
Problem of the controlling device: a faulty control board connection; damages to the board connecting cable; improper plugging-in; etc.
INTERVENTION
Check all connections of the controlling device.

IRREGULARITY
The motor brakes can become jammed. Jamming may be ascertained detecting that the disc doesn't detach or in the absence of knock sign of the opening of the mobile armature.
POSSIBLE CAUSE
Different causes may lead to this irregularity: - o abnormal value of the gap size that shall be checked and corrected according with the value reported in the instruction Manual; - o sticking due to environmental conditions (frost, humidity, etc.); - o burnt-out brake coil, that shall be replaced; - o faulty coil, causing brake malfunctioning even after short periods of use; replace the coil.
INTERVENTION
If the gap size is abnormal: check the size and correct it to the value reported in the instruction Manual. If the coil is burnt-out, replace it. If the coil is faulty, replace it.



IRREGULARITY
The hoisting winch works in an abnormal way.
POSSIBLE CAUSE
The auto-tuning of the hoisting motor may not be carried out.
INTERVENTION
The aut-tuning shall always be carried out once, even in case of hoisting motor replacement.

	WARNING
➤ The most common failures may be inspected and repaired by qualified, trained and informed technicians from the building site, having all the required information to carry out the tasks. Should these technicians be unable to restore the crane operation, immediately contact the After-Sales Dept. of the Manufacturer's authorised dealer.	



15.4. OPERATIONS IN AN EMERGENCY SITUATION

	WARNING
➤ The following emergency operations may be carried out in case of power failure and in case of need to move the suspended load, blocked because of a power failure.	

A) TO LOWER THE SUSPENDED LOAD

- 4.1 Remove the protection cover from the hoisting motor brake (paragraph 10.11).
- 4.2 Insert a lever between the compression plate and brake lining.
- 4.3 Operate the lever to move the compression plate away from the brake lining as much as required to allow motor to turn.
- 4.4 Actuate the lever with short jog movements so that the load is lowered slowly.

B) TO SWING THE CRANE

- 4.5 Fully release brake handgrip as when the crane is out-of-service (paragraph 10.13).
- 4.6 Push the ballast on one side so that the crane is slowly swung.
- 4.7 Should the above operation not be possible, dismantle the swing motor and act directly on the bush on the gearbox IN side. By turning the bush with a proper tool, the crane is swung slowly.

C) SHOULD THE TROLLEY STOP DUE TO A FAILURE

- 4.8 It is necessary to use a movable platform, suitable for lifting up people, to gain safe access to the trolley or its gear-motor.
- 4.9 On cranes supplied complete with access ladders, it is possible to gain access to the machine upper section strictly complying with the safety procedures described at the paragraph 16.1.

	WARNING
➤ Never, under any circumstances, dismantle the crane with unfolded boom. Whenever necessary, use a truck crane and platform suitable for lifting up people to carry out the repairs required to fold the boom prior to crane dismantling. ➤ Only qualified, trained and informed riggers may carry out the above reported emergency operations.	





16. OPTIONAL

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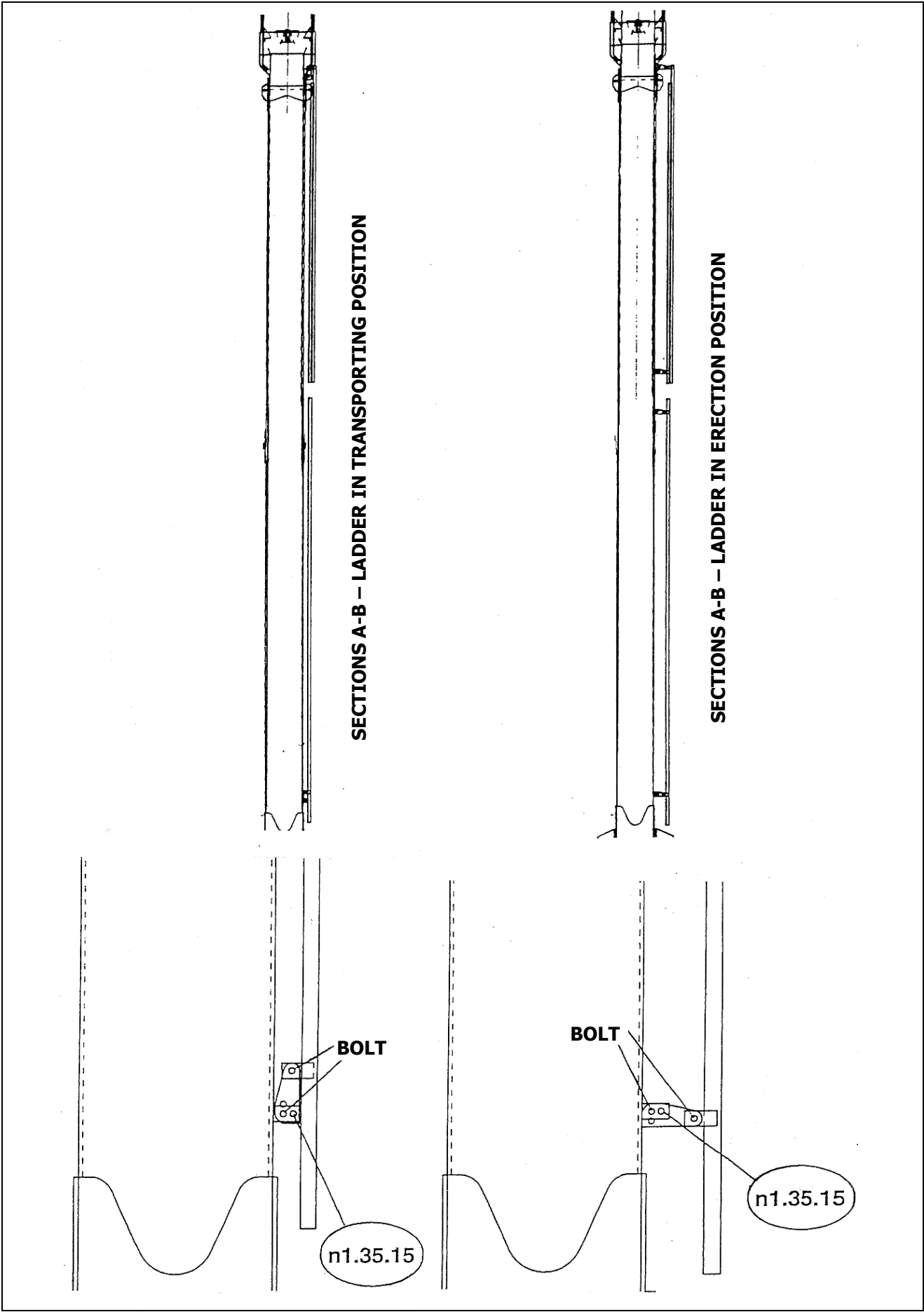


16.1. ACCESS LADDER

- 1.1 The crane can be fitted with an **OPTIONAL** metal ladder mounted on the tower to allow, if necessary, access to the upper parts of the crane for maintenance or repairing to the trolley gear reduction unit.
- 1.2 The use of the ladder as well as access to the crane upper parts **is restricted to expert and equipped riggers**; to climb on the crane it is compulsory to wear a safety belt with double hook, fixed to the anti-falling device inserted in the safety nylon rope supplied with the ladder, that shall be stretched on the tower during crane erection or fixed to the metal rope stretched on the boom and on the boom feet (near the cusp) to the gear motor for trolley displacement. **Access is strictly limited to the gear reduction unit and not over.**

16.1.1. ASSEMBLING THE LADDER

- 1.3 The ladder shall be assembled being the crane dismantled. The ladder is composed of six sections **A-B-C-D-E-F**, the upper ones **A** and **B** are permanently fixed to the tower with bolts and telescope one inside the other and, with the section **C** below, they are allowed to be folded against the tower when the crane is dismantled; the sections **D** and **E** are bolted to the lower tower while the lowest section **F**, just hooked, shall be placed into position by the rigger when he is going to climb the crane and removed once the task is complete, to prevent the not-qualified and not-equipped personnel to access the upper part of the crane.
- 1.4 Ladder assembling is carried out by the Manufacturer fixing the different sections and their relevant articulated plates with screws, nuts and lock nuts.
- 1.5 During crane erection in the building site and in the first steps of tower erection, as soon as the front part of the tower lifts over the ballast block **400/2** (paragraph 08.2), the ladder sections **A-B-C** shall be shifted into operation position turning the articulated plates that support them and moving them away from the tower; on the other hand, during crane dismantling in the building site and before the final steps of tower lowering (paragraph 13.5), when the front part of the tower has slightly gone down over the ballast blocks **400/2**, the ladder sections **A-B-C** shall be shifted into transporting position turning the articulated plates that support them and moving them closer to the tower. To shift the position of the ladder, refer to the following pictures. The eight pins **n1.35.15** shall be removed and re-inserted in the scheduled operating position, always locked by their relevant hitch pins.
- 1.6 **The lowest ladder section F shall be hooked to the lower part of section E only when necessary to access to the upper part of the crane; it shall normally be disassembled and kept in a safe place to prevent the not-authorized persons to use it.**





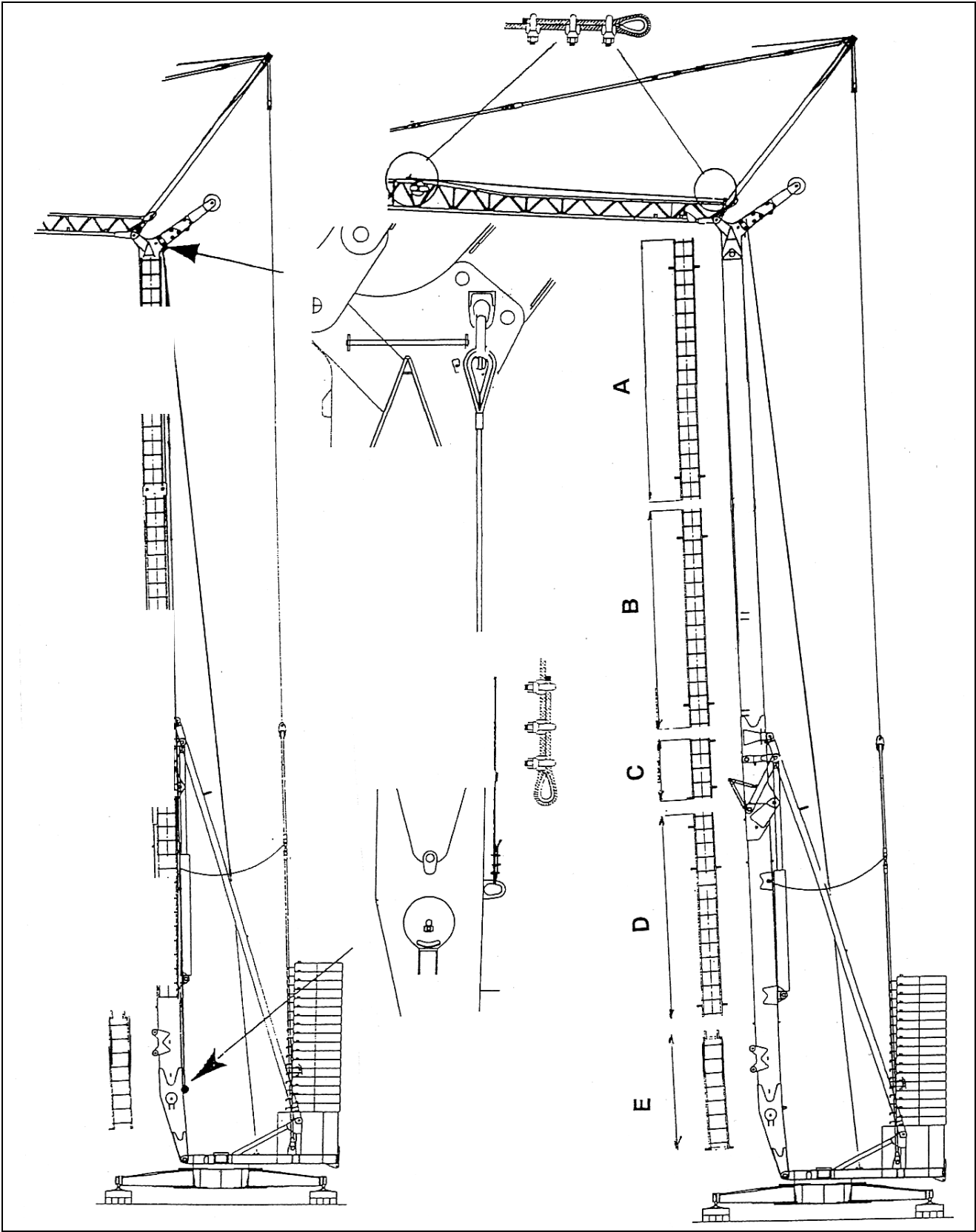
16.1.2. ASSEMBLING THE SAFETY ROPES

A) BOOM ROPE

- 1.7 It's a metal rope diameter **8 millimeters (0.315 in)** that shall be fixed by three metal clips at each end to the hook placed on the upper stringer of the boom, one close to the tower and the other one close to the trolley gear motor.
- 1.8 Before crane erection insert one end of the rope in one of the two hooks and fix it tightening the three metal clips; stretch the rope inserting the other end in the other hook and fix this end too with three metal clips. The rope shall be make run in the two intermediate hooks too to prevent it to entangle with the tie rods or the cusp during crane erection.

B) TOWER ROPE

- 1.9 Hook with a shackle or a carabiner the end thimble of the safety rope to the connection plate **1**, at the top of the tower; carefully tighten the shackle or carabiner.
- 1.10 Being the crane erected: insert into the rope the anti-falling device, insert the rope into the hook **2** at the base of the tower and tie the rope to the hook, slightly stretching it. The safety rope shall be detached from the hook **2** before crane dismantling.





16.2. LADDER EMPLOY

- 2.1 Use of the ladder is restricted to expert, qualified and equipped riggers; access to the crane upper parts by the ladder is allowed only in extra-ordinary situations and in case it is not possible to dismantle the crane as indicated in standard procedures, due to serious failures. Access is strictly limited to the trolley gear reduction unit.
- 2.2 To access the upper parts, the rigger shall wear the necessary personal protection equipment, in particular:
 - o **a double-lock safety belt**, so that one of the two hooks is always secured to the anti-falling device of the safety rope or to fixed structural parts of the crane in order to ensure, in any access position, the absence of risk of falling;
 - o **suitable shoes** providing a safe feet grip to eliminate the risks of slipping;
 - o **suitable gloves** for a safe grip of the hands, to eliminate the risks of slipping;
 - o **protection helmet** against falling objects;
 - o **suitable clothing** that allow free movement, not susceptible of being entangled in structural parts;
 - o the operator shall carry the small tools required for the repair in **a bag safely secured to the body**, so that it cannot accidentally fall.

	WARNING
➤ Accessing the upper part of the crane, wear a safety belt with double hook; to pass from the tower to the boom, before unhooking one of the two hooks from the anti-falling device of the tower rope, fix the other hook to the boom safety rope (REVERSE PROCEDURE PASSING FROM THE BOOM TO THE TOWER); one of the two hook of the bel at least shall always be fixed to the ropes. ➤ The access means allows to reach in safety conditions the trolley gear unit; FOR NO REASON THE RIGGER SHALL PROCEED TOWARD THE BOOM TIP. ➤ When climbing the crane the rigger shall not bring with him spare parts or heavy and bulky objects; such objects, if necessary, shall be lifted from the ground by means of a rope and a driving sheave, in case fixed to the upper part of the crane. ➤ The access to the upper part of the crane by means of the ladder is allowed to only one person at time; the structure of each ladder section is not designed to support the weight of two persons at the same time. ➤ While carrying out the above reported operations it takes to respect all the prescriptions of the laws in force concerning safety. ➤ The sixth ladder section shall be hooked to the crane only when it is going to be employed and shall be removed once completed the task; the safety rope shall be removed from the lower hook before the prospective crane dismantling. ➤ The access to the upper part of the crane of not-authorized, not-qualified and not-equipped personnel is strictly forbidden; failure in respecting this prescription cause the risk of falling from up above. To move along the boom hook the second hook to the metal safety rope stretched on the boom before unhooking the first hook from the anti-falling device slipping on the nylon tower rope.	



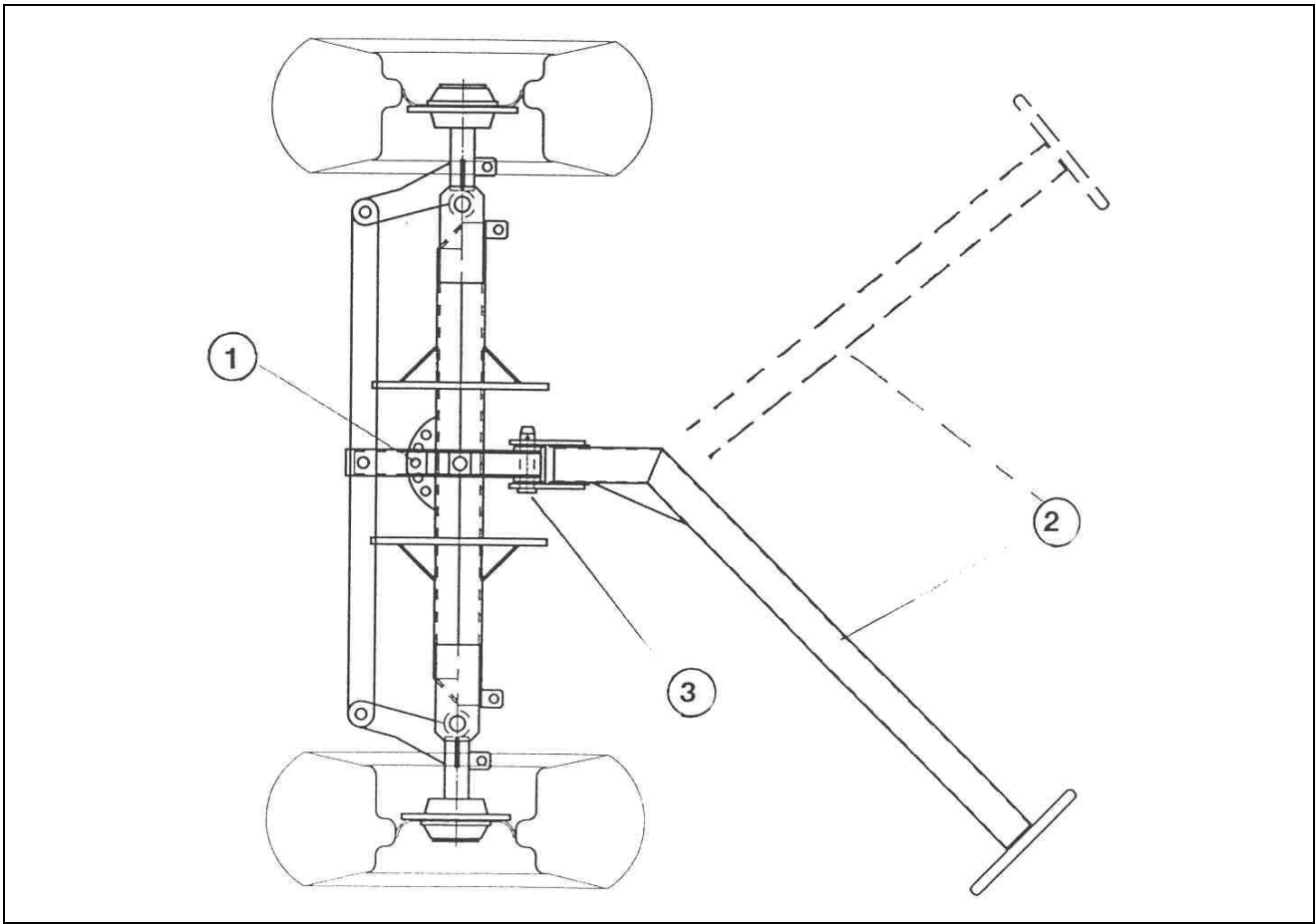
16.3. STEERING REAR AXLE

- 3.1 The crane may be supplied with a steering rear axle **OPTIONAL**, easing crane displacement during its positioning on the building site.
- 3.2 At the crane transporting stage, the hubs rotation is normally locked by pin **1** with the wheels parallel to the crane axis and drawbar **2** dismantled; when operating in the above conditions, the rear axle operates as a standard fixed axle.
- 3.3 To employ the steering axle: remove lock pin **1**, fit angle draw bar **2** and secure by means of pin **3**. The angle drawbar allows operating the crane both on its left and right side, depending on the installation of the draw bar.



WARNING

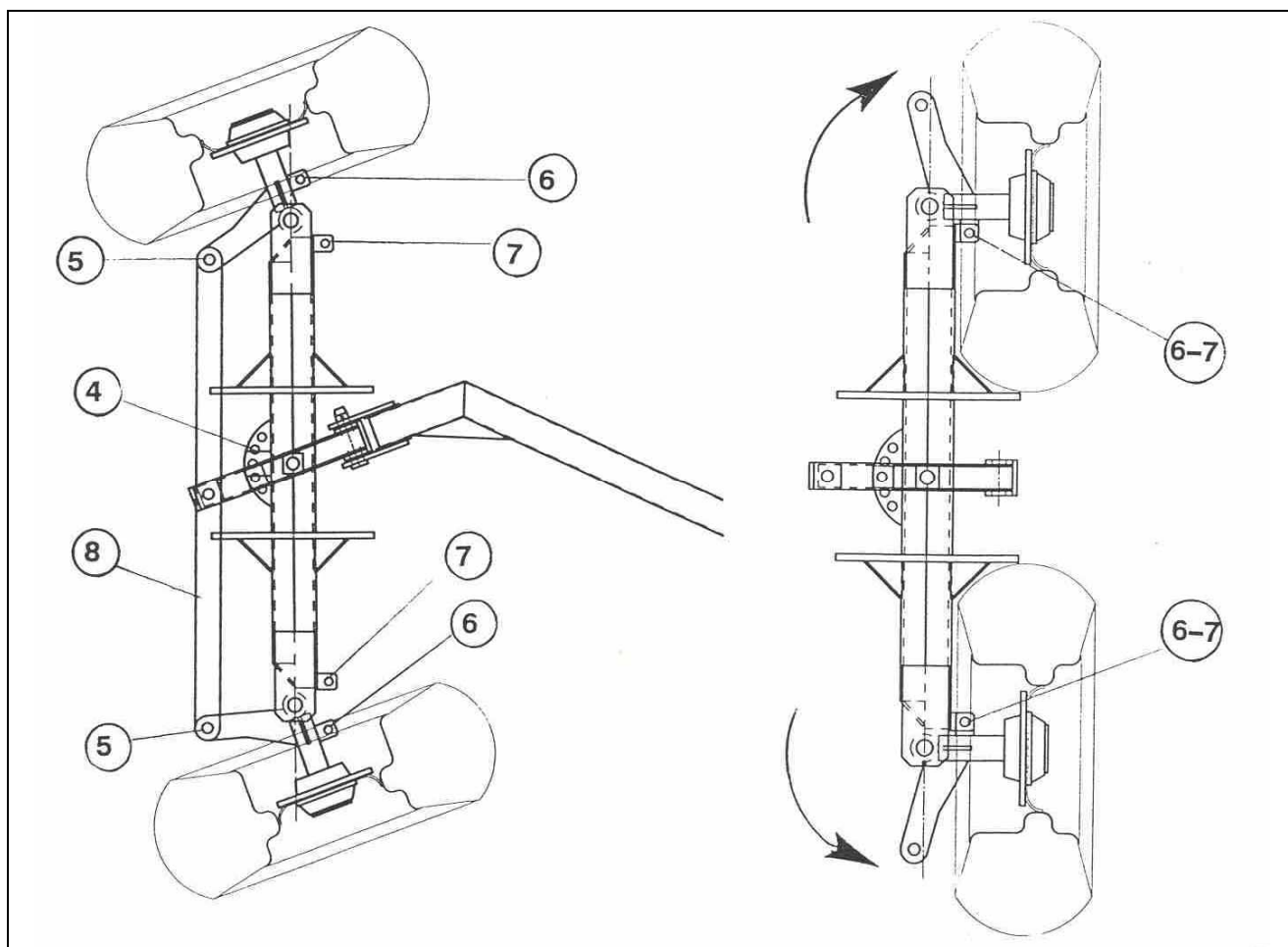
- Carry out all the above described operations only with the crane at stand still, stopped, and with the front wheels locked by wedges.
- Both the front and the rear axle drawbars shall be controlled with the crane towed, while it is displaced. Trying to control the draw bar with fixed crane will cause excessive stress to exerted on the crane, and will damage the wheels and the mechanisms.

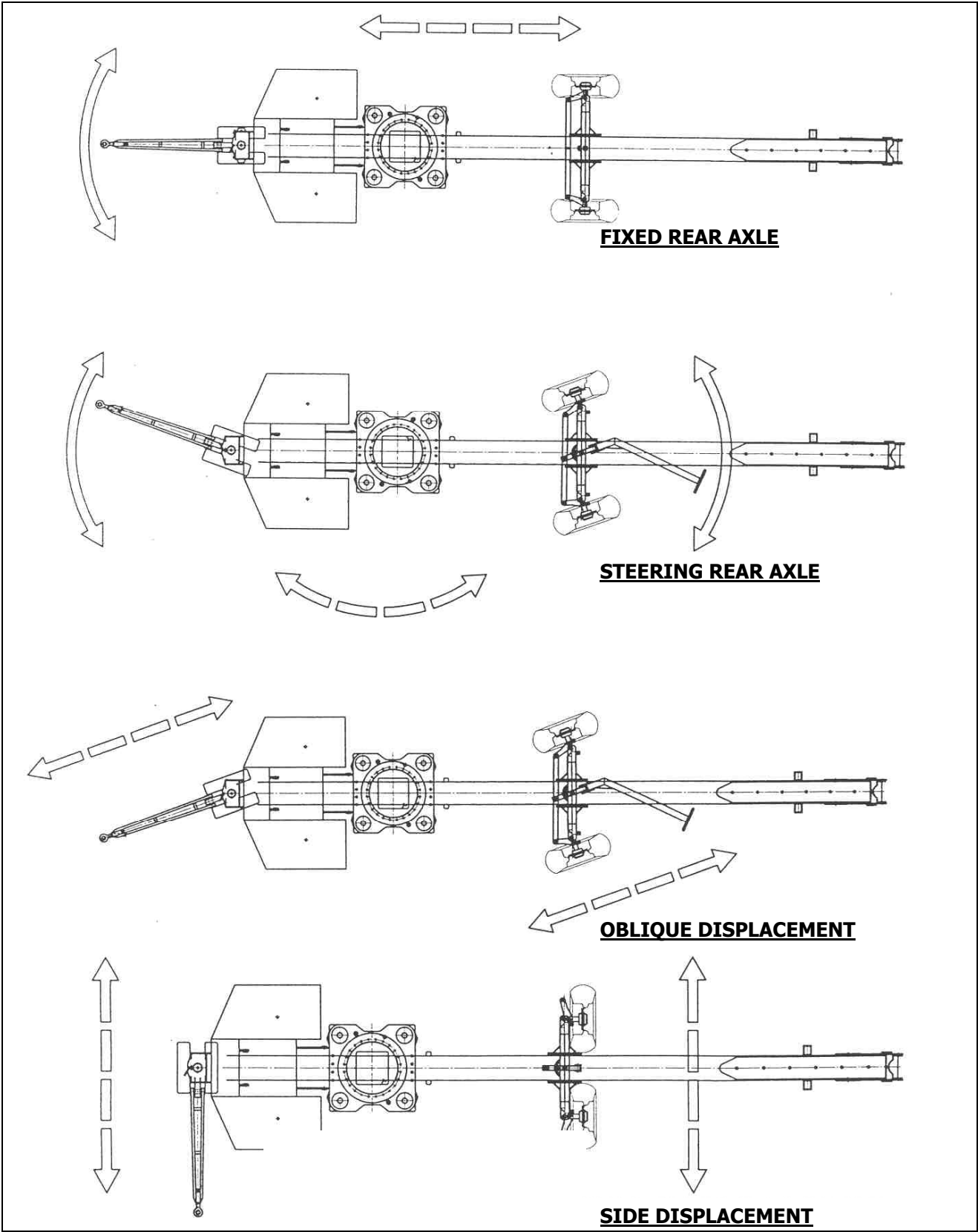


- 3.4 The multiple-hole rest plate **4** allows for axle locking in more different oblique positions, so that the crane can be towed in a direction different from its axis.



- 3.5 In addition, it is possible to control sideward displacement of the crane by turning the rear axle wheels by 90° to the crane axis. To the purpose, proceed as described:
- o remove pins **5** coupling the wheel hubs to the drawbar **8**;
 - o rotate the wheels in a perpendicular position to the crane axis so that the holes of plates **6** perfectly match those of plates **7**. To ease rotation, eventually lift the wheels up with a jack;
 - o secure wheels in that position by inserting lock pins into the holes of plates **6** and **7**;
 - o by acting on the front axle drawbar, rotate its wheels in perpendicular position, too;
 - o by pushing the crane sideward it is now possible to carry out short lateral displacing maneuvers. Side push shall be applied to the lower base frame; it shall be gradual in order not to prejudice crane stability.

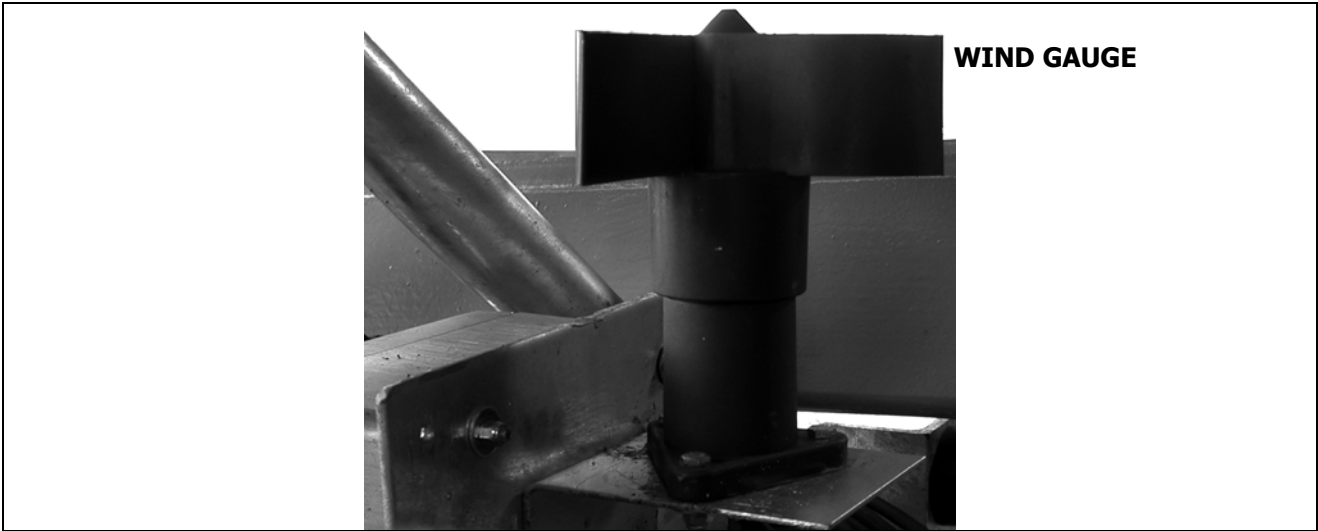




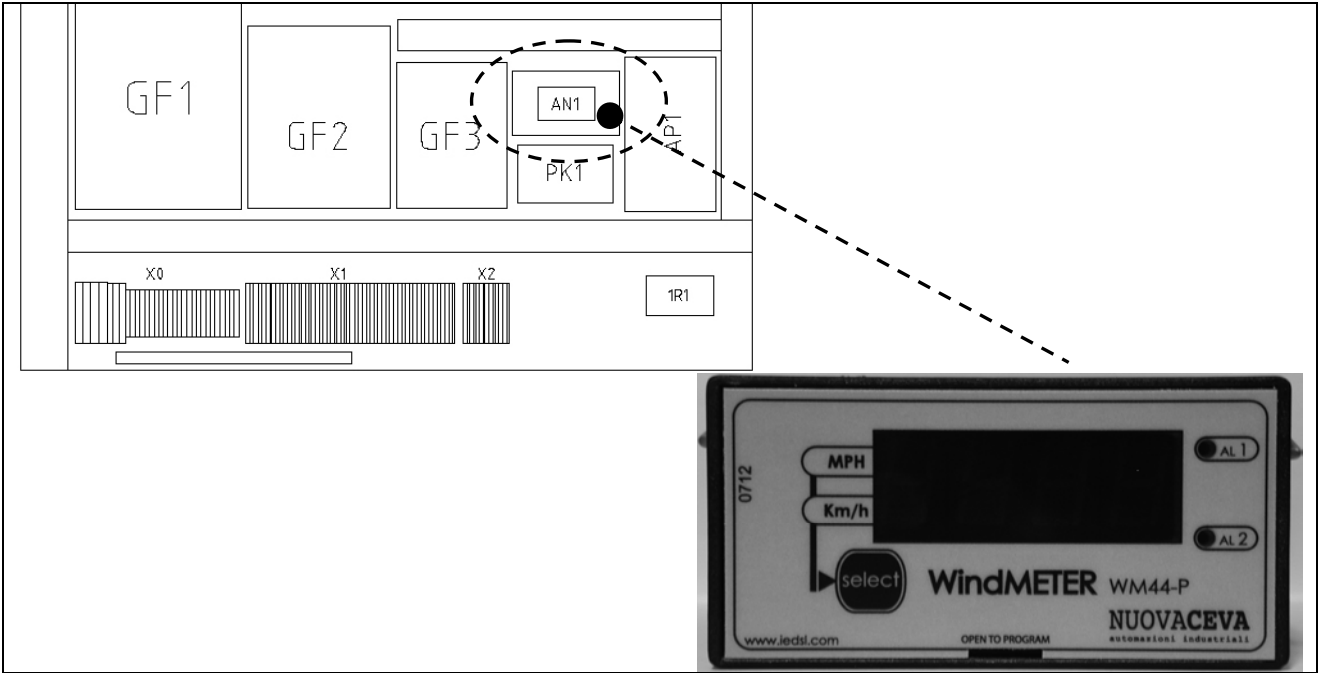


16.4. ANEMOMETER

- 4.1 The wind gauge of the anemometer is installed inside the crane boom, next to the articulation tower – boom.
- 4.2 Its protected location prevents damages to the device during crane transporting and erection.



- 4.3 On the electric cabinet door there is a display indicating the wind speed, measured by the gauge, with possibility to shift the displayed value from **km/h** to **mph** and vice-versa. The anemometer display is indicated as **AN1** in the wiring diagrams.

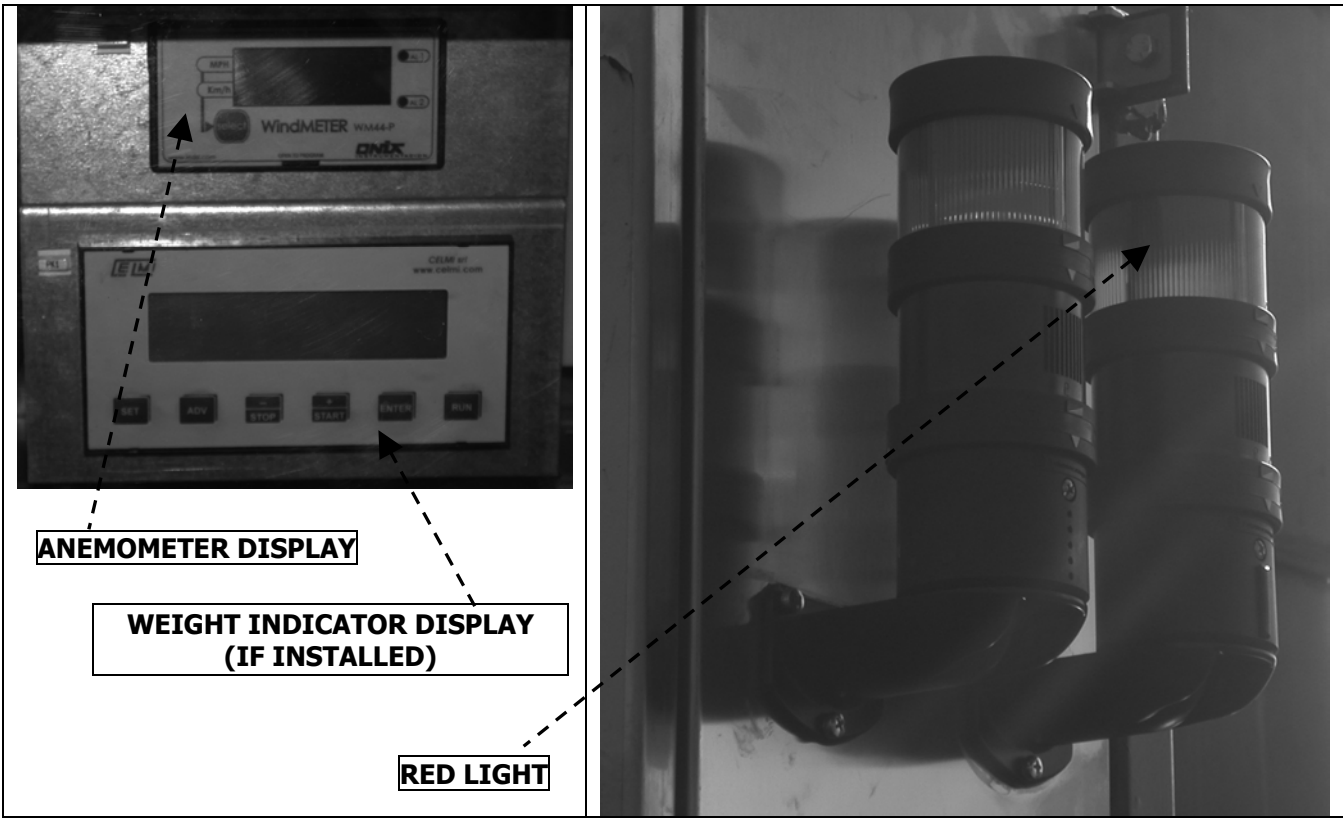


WARNING

- Don't mix the anemometer display with the weight indicator display (if installed, [paragraph 16.6.1](#)).



4.4 Next to the electric cabinet there is a column with the signaling red light.



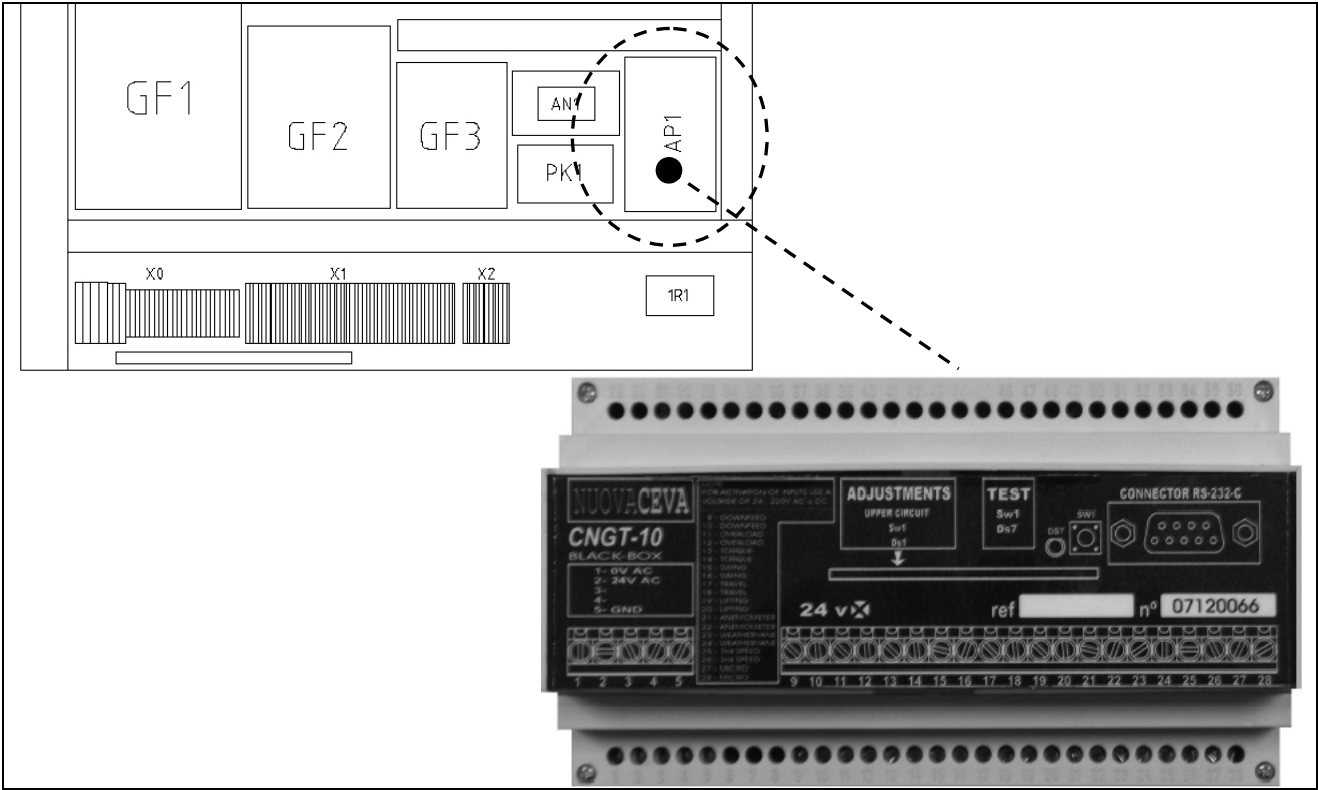
4.5 Connecting the electrical power of the crane, the gauging and the signaling system of the wind speed are enabled. No adjustment is required, because the device is set on the following parameters:

WIND SPEED	SIGNAL	MEANING
Over 50 km/h (34.2 mph)	Flashing red light and intermittent siren.	WARNING
Over 70 km/h (43.5 mph)	Fixed red light and continuous siren. The display indicating the wind speed flashes.	DANGER



16.5. BLACK BOX

- 5.1 The **BLACK BOX** is an optional component, indicated as **AP1** in the wiring diagrams. The crane may be equipped with the black box in order to record some data of the main crane functions and some incidents that may occur during crane operation. The data may be transferred to a PC where they are managed by a special exploitation software, supplied by San Marco International.



- 5.2 The device is equipped with a **TERMINAL BOARD** that may be connected both to the black box (after lifting the black box cover) and to the PC where the special exploitation software is installed. The connection is made by mean of a DB9 connector.





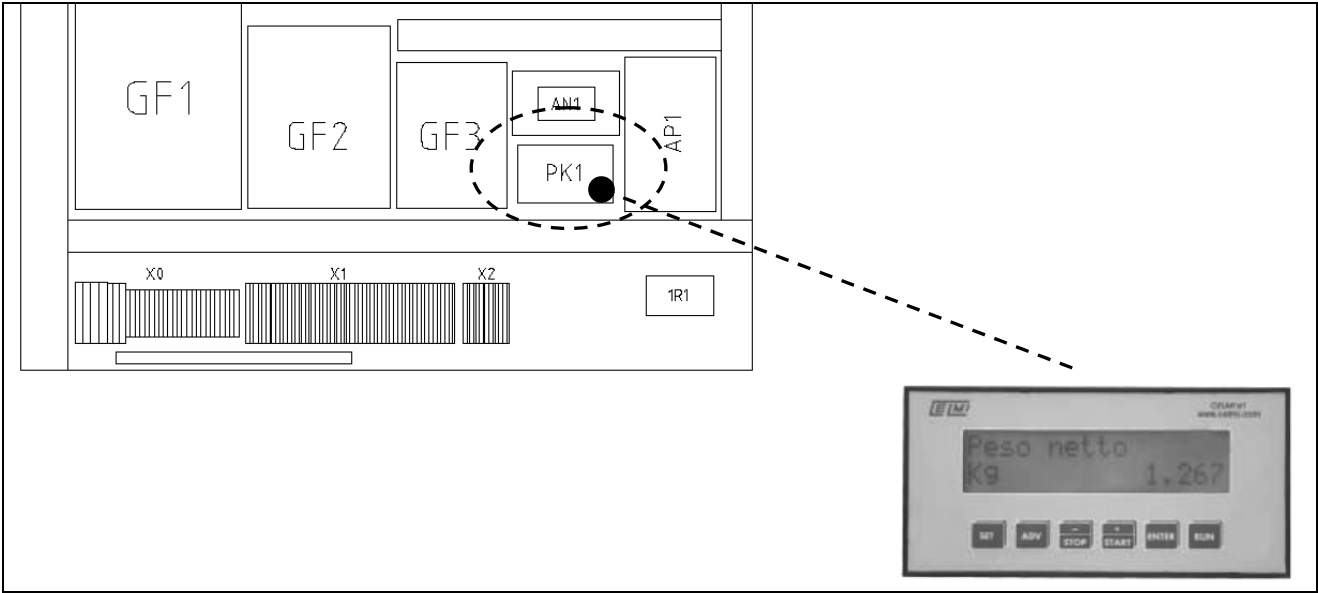
- 5.3 The exploitation software manages the data concerning:
- o overloads;
 - o overloads at the fast speed;
 - o exceeded max. moment;
 - o time of operation of crane swing motor;
 - o time of operation of crane trolley motor;
 - o time of operation of crane hoisting motor;
 - o exceeded max. wind speed of **70 km/h (43.5 mph)**;
 - o crane weathervane;
 - o voltage drops (when voltage decreases of 15% as regards the nominal voltage).
- 5.4 For the specific instructions of use of the black box, terminal board and exploitation software, refer to the special **Operation Manual "BLACK BOX CNGT-10/24"** supplied with the technical documentation of the crane.



16.6. WEIGHT INDICATOR

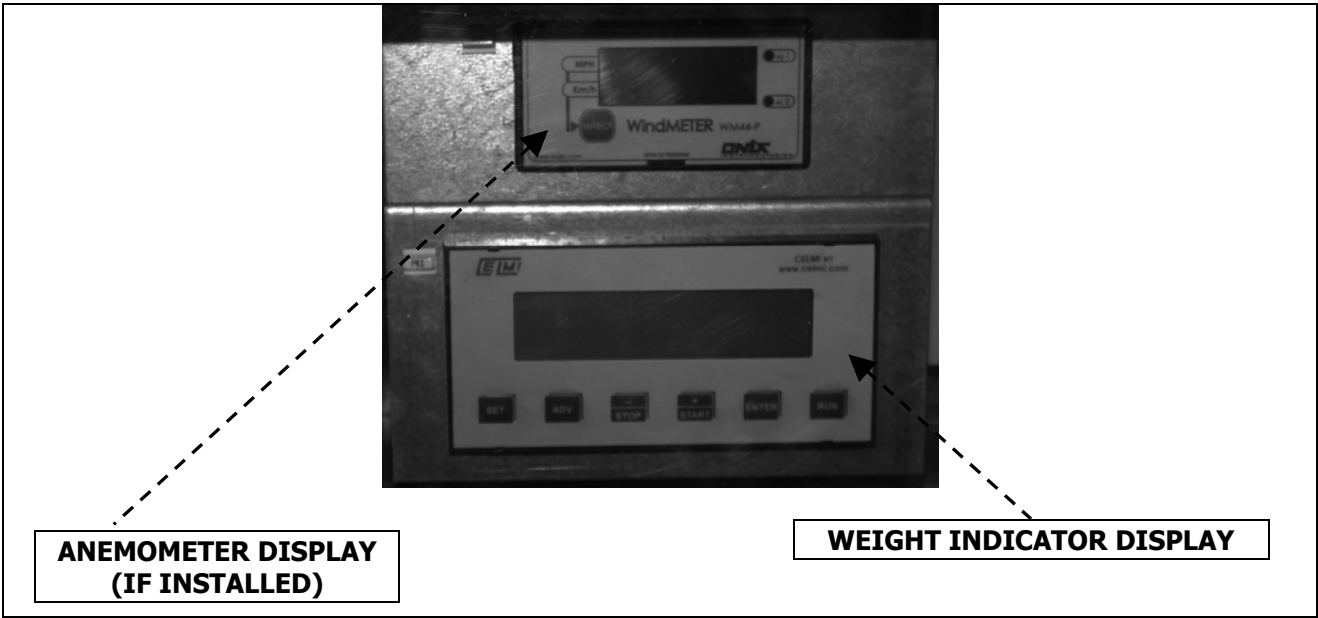
16.6.1. WEIGHT INDICATOR DISPLAY

6.1 The **WEIGHT INDICATOR** display is indicated as **PK1** in the wiring diagrams.



WARNING

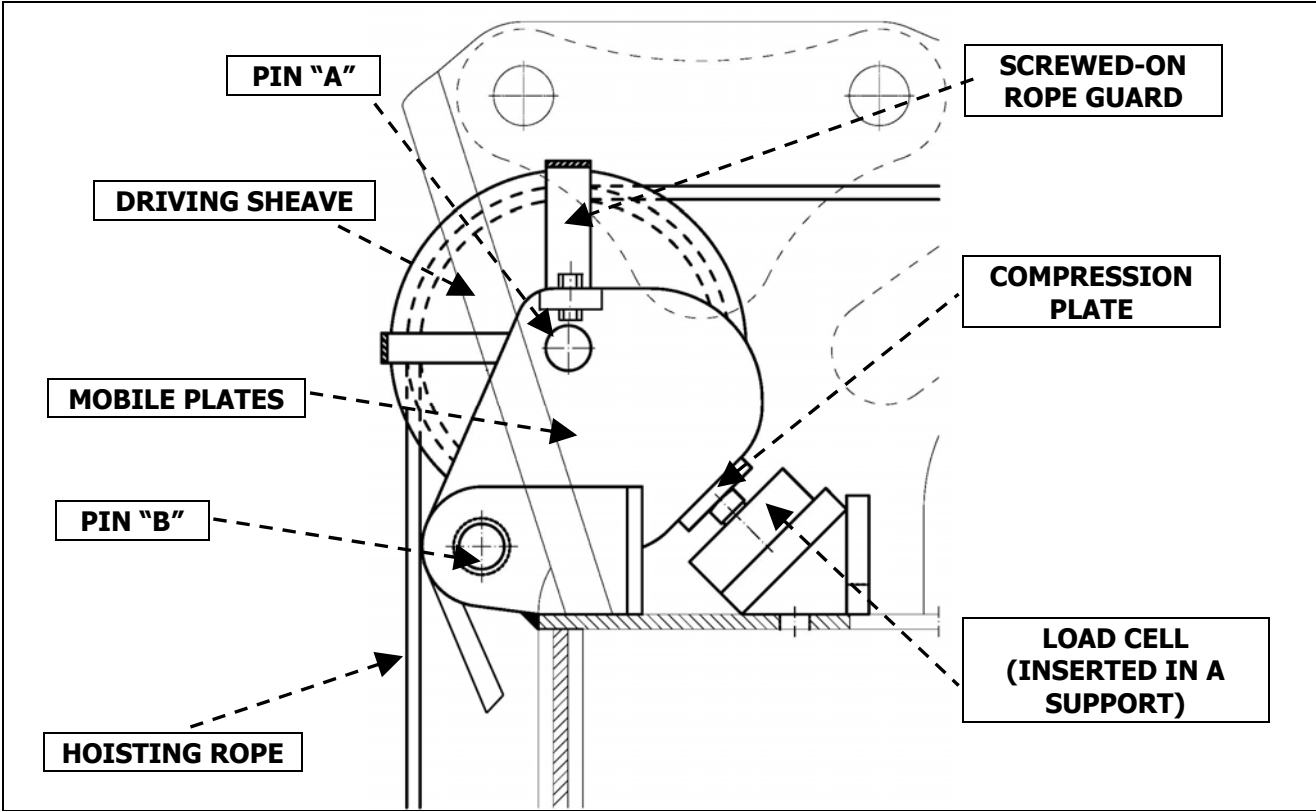
- Don't mix the weight indicator display with the anemometer indicator display (if installed, paragraph 16.4).



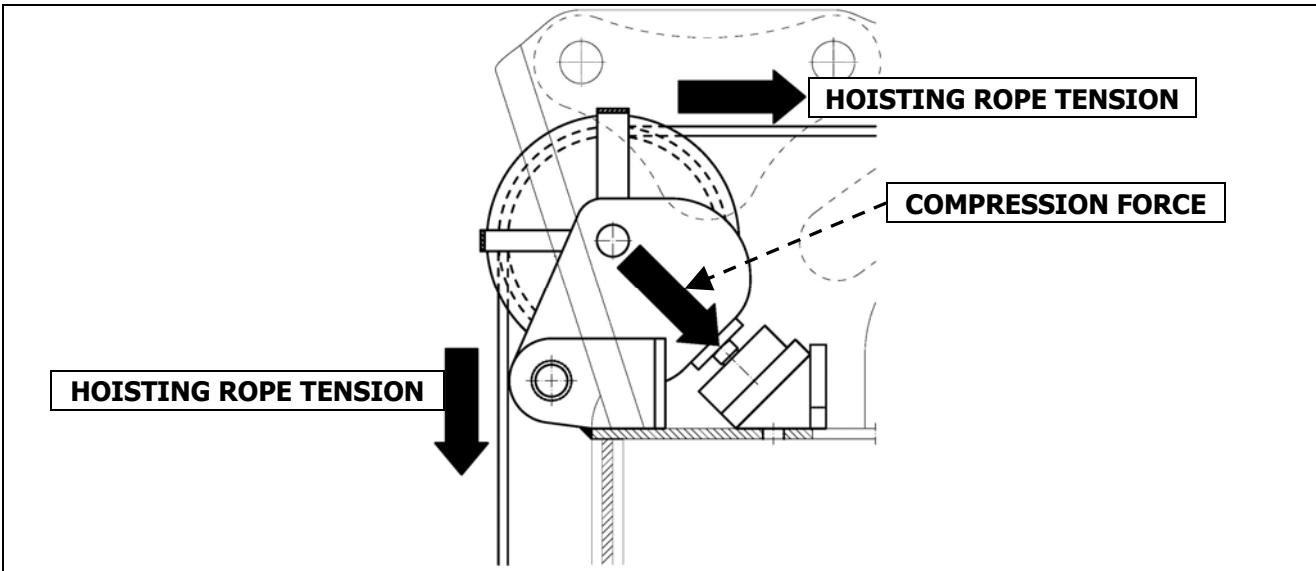


16.6.2. LOAD CELL

- 6.2 A compression **LOAD CELL** measures the weight indicated. The load cell is placed on the upper tower, below the driving sheave. The device is already assembled and ready-to-use when the crane is delivered.



- 6.3 The **driving sheave** is assembled between two plates (**mobile plates**). These plates can pivot around the **pin "B"** and they are connected by a third plate (**compression plate**), in their lower part.
- 6.4 When a load is lifted, the **hoisting rope** is stretched and it makes the sheave lower towards the tower. The compression plate below the sheave compresses the load cell. When the tension of the rope stops, the load cell is released.





	WARNING
➤ The load cell can support compression forces up to 3,000 kg (6,614 lbs). Over this limit the load cell has a permanent set, and it doesn't work any further. ➤ The device is conceived so that the compression force stressing the load cell is about 1,500 kg (3,307 lbs) when the crane lifts the max. allowed load, i.e. 4,000 kg (8,818 lbs) with 4-pull line, 2,000 kg (4,409 lbs) with 2-pull line. When the crane is correctly operated, the compression stress of the load cell doesn't exceed 3,000 kg (6,614 lbs). ➤ In any case, the compression force shall be less than the limit stress supported by the load cell.	

6.5 **In case of replacement of the driving pulley**, it just takes to remove the **pin "A"** and the **screwed-on rope guard**. Then, replace the pulley, insert the pin "A" and assemble the rope guard by means of its screws.



16.6.3. ADJUSTMENT OF THE WEIGHT INDICATOR

- 6.6 When the crane is delivered, the weight indicator has already been set to display the English language and the unit of weight used in the Country of delivery (**kg or lbs**).
- 6.7 **The first operation to carry out after putting the crane into service, consists in lifting a known load (whose weight is certain) to check that the displayed weight is consistent with the actual weight of the load, i.e. to check if the weight unit has been correctly set.**

	WARNING
➤ The displayed weight is not rigorous and it merely approximate. The fault in weighing may be 5-10% of the total weight.	

- 6.8 The weight indicator cannot be automatically swapped from **kg** to **lbs** or vice-versa. If it is necessary to change the weight unit, it takes to adjust the weight indicator to the new unit. The procedures to adjust **from kg to lbs** and **from lbs to kg** are the following ones.

	WARNING
➤ The adjustment operation shall be carried out by qualified, trained and informed operators. The following instructions are merely approximate. The operators shall always refer to the Operation Manual "WEIGHT INDICATOR Model LCD" supplied with the technical documentation of the crane.	

TO ADJUST FROM KG TO LBS
On the indicator display, push the SET button.
Push the ADV button to access the "Measuring unit" menu.
Push the ENTER button.
Push the + button few times till the "L" letter is displayed.
Push the ENTER button.
Push the - button few times till the "B" letter is displayed.
Push the ADV button to confirm.
Push the ADV button to access the "M.U. coefficient" menu.
Push the ENTER button few times to place the cursor on the units and decimals to enter the conversion ratio "2.205" by means of the + and - buttons.
Push the ADV button to confirm.
Push three times the ADV button to access the "Full scale" menu.
Enter the value "11023.000" .
Push the ADV button to confirm.
Push eight times the ADV button to access the "L.C. capacity" menu.
Enter the value "6614.000" .
Push the ADV button to confirm.



TO ADJUST FROM LBS TO KG
On the indicator display, push the SET button.
Push the ADV button to access the "Measuring unit" menu.
Push the ENTER button.
Push the + button few times till the "K" letter is displayed.
Push the ENTER button.
Push the - button few times till the "G" letter is displayed.
Push the ADV button to confirm.
Push the ADV button to access the "M.U. coefficient" menu.
Push the ENTER button few times to place the cursor on the units and decimals to enter the conversion ratio "1.000" by means of the + and - buttons.
Push the ADV button to confirm.
Push three times the ADV button to access the "Full scale" menu.
Enter the value "5000.000" .
Push the ADV button to confirm.
Push eight times the ADV button to access the "L.C. capacity" menu.
Enter the value "3000.000" .
Push the ADV button to confirm.

	WARNING
➤	The first operation to carry out after changing the adjustment of the weight indicator, consists in lifting a known load (whose weight is certain) to check that the displayed weight is consistent with the actual weight of the load, i.e. to check if the weight unit has been correctly set.

6.9 During the normal operation, the weight indicator is not supposed to need any further adjustment. Anyway, it takes to check it periodically the displayed weight, referring to loads whose weights are certain. If it should exceptionally be necessary to set the weight indicator, please refer to the **Operation Manual "WEIGHT INDICATOR Model LCD"** supplied with the technical documentation of the crane.



16.6.4. USE OF THE WEIGHT INDICATOR

- 6.10 To display the correct weight indications, the **SA3** selector switch shall be turned into the actual operation configuration (paragraph 03.5).
- o When operating the crane with the 2-pull line configuration, turn the selector switch into the **2-PULL LINE** position.
 - o When operating the crane with the 4-pull line configuration, turn the selector switch into the **4-PULL LINE** position.
 - o Remark that the **SA3** selector switch shall be correctly set in order to assure safety – controlling the intervention of the hoisting limit switch (paragraph 10.2).
- 6.11 If the **SA3** selector switch is turned into the correct operation position, the displayed weight is the actual weight, and no further calculation is required to the user.

	WARNING
➤ The displayed weight is not rigorous and it merely approximate. The fault in weighing may be 5-10% of the total weight. ➤ The displayed weight shall not be used for fiscal and business intents. The weight displayed shall not be use as a reference for the loads lifted by the crane: the operator shall lift known loads, inferior to the max. loads allowed for the different operation conditions. The rated load limiter, the speed limiters and the max. moment limiters shall function correctly. ➤ The SA3 selector switch shall always be turned into the correct operation configuration, in order to: - o make the hoisting limit switch correctly function (paragraph 10.2); - o display the actual weight on the weight indicator.	



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