

# MANUAL FOR USE OF THE HYDRAULIC DRILLING RIG AF120

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## **1. SAFETY MEASURES**

### **1.1 INTRODUCTION**

Dear Customer,

we wish to thank you for having chosen a drilling machine from IMT and are sure you will always be satisfied with your purchase.

This machine must be used according to the norms and instructions indicated in this manual to ensure the personal safety of the operator and jobsite workers; moreover, the following norms and regulations must be adhered to:

- staff safety 89/391/CEE (DL 626/94);
- jobsite safety 92/57/CEE (DL 494/96);
- highway code (during transport).

The machine can only be used by specialized and expert operators and skilled at driving special means of transport in jobsites, under the supervision of the Supervisor responsible for the jobsite safety.

The operator must read thoroughly and clearly understand all the procedures described in this manual and subsequently give the safety Supervisor a written and signed statement declaring that all the information contained in this instruction manual has been read, noted and clearly understood.

## 1.2 CERTIFICATE OF COMPLIANCE



### Certificate of compliance

according to the Machine directives 89/392 CEE and successive amendments in the Enclosed IIA

The undersigned:

**I.M.T. S.r.l.**

**Via d'Ancona 39**

**60027 Osimo (AN) Italy**

Declares on its own liability that the new machine stated here below:

**HYDRAULIC DRILLING RIG** Model **AF120**

Serial no.: **\*\*\*AF120\*\*\*** Year of Construction: **2002**  
Power **110 KW**

Is built in conformity to the legislative provisions that transpose the directive for Machines 89/392 EC and its successive amendments

----- Harmonized Norms -----	
<b>UNI EN 292/1</b>	(Machine Safety)
<b>UNI EN 292/2</b>	(Machine Safety)
<b>UNI EN 294</b>	(Safety, spaces to reach dangerous areas)
<b>UNI EN 418</b>	(Safety, emergency stop devices)
<b>UNI EN 7349</b>	(Safety, spaces to avoid crushing)
<b>EN 791 (01/96)</b>	(Safety of the drilling machine)
<b>UNI ISO 7000</b>	(Graphic symbols and signs)
<b>UNI EN 60204/1</b>	(Safety of the electrical equipment)
<b>CNR UNI 10011</b>	(Constructions in steel: calculus, execution, etc.)

Furthermore it declares as forseen in enclosed appendix V of the Directive for Machines 89/392 EC:

The marking of the symbol "EC" is affixed onto the machine.

The technical booklet is available at the Manufacturer's main office;  
EMC Technical file, in compliance to the 89/336, is available at the Manufacturer's main office.


## 1.3 IDENTIFICATION OF THE MACHINE


The machine is identified by its name plate which indicates the model, year of manufacture and serial number.

This is placed underneath the name plate of the machine base of the boom on the cabin side.

<b>Machine</b>	Weight without kelly	<b>54.000</b>	Kg
<b>Main Winch</b>	Hoisting capacity	<b>150</b>	KN
<b>Auxiliary Winch</b>	Hoisting capacity	<b>82</b>	KN
<b>Rotary</b>	Torque	<b>137</b>	KNm
<b>Engine</b>	Maximum Power	<b>110</b>	KW

## 1.4 GENERAL WARNINGS PULLBACK

	The present manual relative to the drilling equipment installed by IMT S.p.a. is integrated with original Caterpillar manuals, that are delivered together with the manual, and called: "Maintenance and Operation Manual" of the excavator CAT320B (SEBU 7021-01 Feb. 98)
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	The manuals are completely read and understood before attempting to operate the machine controls or carry out maintenance operations.
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In the pages that follow we will indicate CAT the Caterpillar manual of the hydraulic excavator 320B and Feb. 98 code SEBU 7021-01.

In the most important points where you should proceed to immediately read the Cat manual, page references are indicated for a fast and efficient search for relative information, therefore it should never be separated from the Caterpillar manual and in the case of purchase, must go together with the machine.

The manuals must be kept in the back seat pocket of the operator's seat.

All the safety measures, operation instructions, transport and maintenance are clearly indicated in the manual regarding the IMT AF120 drilling rig.

## 1.5 PLANNED USE OF THE RIG

The IMT AF120 drilling rig has been specifically designed to bore holes in every type of terrain to produce medium and large size diameter (500-2000 mm).

The rig operates the drilling technique by rotation of a tool (auger or bucket) connected to a telescopic kelly bar. The maximum depth depends on the length of the tool and kelly bar used.

The machine is equipped with two lifting winches which carry out the drilling operation and changing of tool.

It is strictly forbidden to use these winches for other lifting operations that are not directly related to the drilling operation itself.

IMT S.p.a. reserves the right to take legal action against the illegal and unauthorised use of the machine.

## 1.6 SAFETY WARNINGS

Most accidents that occur during the use and maintenance of the drilling machine are due to negligence of the most fundamental safety measures and risks of potentially dangerous situations inherent in many operations. Whoever places themselves at the

machine controls must have the skills and knowledge required for working in a jobsite, so as to not endanger their own life as well as that of other workers.

The use, lubrication, maintenance or repair of the machine carried out improperly can either lead to fatalities or cause serious harm to personnel.

Never operate the machine or carry out maintenance and repair operations without having first read and understood the procedures described in this manual.

Furthermore, the operator is the only one who can really be aware of the safety limits of the actual work he is carrying out.

In order to simplify matters, la IMT has tried to illustrate all the possibilities of dangerous situations that may arise when working in a jobsite in the best and most complete way.

The proper working and safety of the machine depend mostly on correct and regular maintenance of its parts. Therefore it is of utmost importance that the checking and specified operations in the manual are carried out carefully.

Always remember that the thorough knowledge of maintenance jobs and the care and precision they are carried out with are of fundamental importance in order to maintain machine safety standards as well as the efficiency and value of the rig in they years to come.

The indications for use describe the manoeuvres required in order to start up, turn off and use the machine in its various functions can be applied, after the operator has carefully studied and understood the manual.

Experience plays an essential role regarding safety, seeing that dangerous situations in the job site are not easily to illustrate in a manual and their true evaluation requires personnell that is professionally experienced.

Prudence is the best safeguard against accidents.

A copy of this manual is supplied with every machine and placed in the appropriate container behind the operator's seat. If on the point of beginning your work, you are without the manual, please request a copy immediately from IMT.

Some information in this manual show details and spare parts that may be different from those of the drilling rig, however the basic concepts remain the same.







Due to the constant product improvement that IMT carries out, some component parts of the machine may have a slightly different appearance from what is described in this manual. We remind you, however, that the procedure to be followed is what is described.





Characteristics, protection and accessories may vary in countries destined to receive the machine, and be in conformity to law requirements and regulations of that country, it being understood that the machine in your possession satisfies completely all the requirements stipulated by EC rules.



## 1.7 WARNING SIGNS

Some important signs regarding safety during working phases will be indicated as follows:

	Warning Danger !
	Danger High voltage-electrical parts !
	Danger of falling materials !
	Danger, use of naked flamme or smoking forbidden !
	Danger of explosions !
	Danger of corrosive material !

	wrong interpretation of these instructions may lead to accidents with serious repercussions to persons and property.
	Very important information
	Important information
	General information

Strictly adhere to safety measures indicated in the the “Operation and Maintenance Manual” of the crawler excavator CAT320B .

## 1.8 TRAINING REQUIRED OF OPERATORS

Before beginning to work in a jobsite, the operator must acquire the necessary knowledge regarding the machine so that all the required manoeuvres to activate the drilling rig can be carried out promptly and safely.


It is important for the operator to be aware of the methods and techniques used in foundations and jobsite works, seeing that he must coordinate his own work with that of the other machines and other auxiliary labour.

As well as being responsible for his work, the drilling rig operator is also responsible for the proper use of the machine and its safety with respect to other personal working in the zone.

The operator is obliged to inform the Safety Supervisor of any anomaly in the working of the machine for his own as well as others safety.

Even if the instructions for the operation of the rig and the description of working methods are limited to basic ideas they must be well understood and the manoeuvre must be exercised and repeated with accuracy and safety until promptness and confidence is gained, which is the basis of proper execution of work.

Only through repeated exercise can working techniques improve and the potentiality and efficiency of the machine can be fully exploited.

	<p>Always remember that the <b>operator is always the main person in charge of safety</b> as he is the one who must evaluate the risks linked to every manoeuvre of the machine and is the first one to detect an anomaly in the machines functions.</p>
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## 1.9 SAFETY AND CHECKING DEVICES

The machine is equipped with safety measures that are integrated into its structure:

- a) The hydraulic installation is equipped with a blocking lever positioned in the cabin; this blocking device must be engaged before the operator leaves his control position and then only disengaged after the operator has returned again to the sitting position inside the cabin.
- b) The hand levers are equipped with automatic returns in the neutral position (hold function)
- c) All the cylinders are supplied with valves to allow the immediate blocking of the piston in the case of the connecting tubes breaking.
- d) All the winches are equipped with a laminar brake that prevents the sliding of the cable ropes in the case of breakdown of the oleodynamic installation.
- e) The electronic depth counters in the cabin measure the drilling depth.
- f) The electronic inclinometer in the cabin checks the mast slant.
- g) Microswitch of mast end stroke controlled by the kelly bar guide
- h) Microswitch of auxiliary winch end stroke
- i) Microswitch of boom end stroke

- l) Limit microswitch for mast swing to the right and to the left
- m) Automatic verticalization system
- n) "0" point (Automatic return to working position)

## 1.10 GENERAL SAFETY RULES

With consideration to the type of machine used, the following rules must be applied:

- Read and observe all the danger warnings and safety rules regarding work issued by the Organisations existing in the countries you are working in.
- The operator must be taught and instructed on the operation of the rig before working autonomously.
- The operator must be experienced in jobsite work so that he can coordinate his own work with that of the other personnel.
- It is strictly forbidden to use the machine for other uses than its designed applications (see the machine general description).



If is forbidden too approach the working area (a radius of 15 metres from the machine).



During re-fuelling and the use of inflammable substances, smoking is strictly forbidden.

- During re-fuelling, checks and maintenance as well as in all the periods in which there may be oil or fuel leakages, any polluting of the ground environment must be avoided.
- Ensure that the windscreens of the cabin have perfect visibility.
- Approach the working area of the machine only for changing the tools; in this case, use only the directional controls of the kelly bar and rotation of the platform, taking care to ensure the stability of the machine (danger of overturning).
- Do not pass under the kelly bar or near the drilling hole.
- In the event of temporary stoppage, make sure that the hole is left well covered with sturdy material.
- Never operate the rig if you are not in the correct seating position in the cabin.
- If for some reason the machine controls must be abandoned, before doing this ensure that the hydraulic block is engaged.

### 1.10.1 Safety rules for loading and the transporting machine

- Do not attempt to lift the complete machine.
- Choose land that is flat and not prone to landslides.
- The loading and unloading of the machine to and from the articulated lorry without suitable loading/unloading ramps is forbidden.
- During transport, ensure that the drilling rig is firmly fixed using tie ropes on the crawler, blocks against translation, and ensure there are no parts or components of the drilling rig that are moving freely and are untied. The kelly bar must be firmly attached to the machine and the blocking pin against platform rotation must be inserted.
- Ensure that the outline of the dimensions is not greater than the highway code specifications and adopt all the necessary signs required for road circulation.

## 1.10.2 Safety rules during working phases




Avoid movement with the mast in the vertical position on ground that is uneven or gravelly. There is danger of overturning.

- Take great care of the positions of electrical wires and other possible obstructions when the mast is placed into the vertical position.
- Before beginning work, thoroughly inspect the terrain and evaluate every eventual risk and danger.;
- Respect the limits relative to the maximum working distance as specified in chapter 2 of this manual.;
- Maintain the safety distance from other machines working in the same jobsite;
- Be aware of the presence of soft ground in the vicinity of walls; be aware of soft ground near walls which have just been raised; the significant weight of the drilling rig could cause the wall to collapse;
- Avoid crossing or jumping over obstacles e.g. ground irregularities, heaps, tree trunks, steps, ditches, crags and tracks;
- During reverse gear, always look in the direction you are going;
- Ensure that you are aware of the load limits for ground, floor and access ramps;
- Stop work if anyone approaches the working radius of the rig;
- Do not supply voltage to cables that are twisted so as to avoid any abnormal strain that could lead to the breakage of the twisted part;
- Do not get into or out of the machine when it is moving;
- Always wear protective gloves when handling cables;
- Always wear clothes that will not get caught up in levers and moving parts;
- Stop the machine and disengage all the controls before abandoning the working position in the cabin or before leaving the machine unattended;
- When using the winches, never exceed the maximum limit described in the technical characteristics;
- The auxiliary winch must not be used to lift objects that are not aligned with the vertically of its cable rope;
- Maintain the control position free from any foreign obstacles;
- Do not transport people inside the machine;
- Adhere to the rest of the safety information stated in the CAT manual.



Before unloading the tool, ensure that nobody is in the vicinity.  
**Danger of falling objects from above !**

### 1.10.3 Work in proximity of electrical cables

	When working near suspended or underground electrical cables there is the danger of electrocution. Make sure that all the national and local safety norms have been carefully followed before beginning to work.
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Strictly adhere to the minimum recommended safety distances between the rig and the electrical cables indicated in table 1; in the event of dampness (humidity relative >70%) or rain, double the safety distances.

Table 1

Voltage cable [Volts]	Safety distance [Metres]
from 0 KV up to 1 KV	1.0 m
from 1 KV up to 110 KV	3.0 m
from 110 KV up to 220 KV	4.0 m
from 220 KV up to 380 KV	5.0 m


Remember that during working phases, the platform must be able to rotate freely without approaching any kind of electrical cable.

### 1.10.4 Noise emission

The operator's cabin has been designed in such a way as to maintain the sound pressure under 74 dB(A) (in the test conditions established by the Norm ISO 6394, 86/662/CEE and ISO/DIS 11201).

The external sound emissions at a distance of 4 mt. from the machine and at a height of 1.6mt. are always lower than 82 dB(A) (with the engine at the maximum rpm and without tools working).

In case of hard shocks due to the sudden Kelly bar spin inversion, the maximum peak noise is 112 dB. **(A proper use of the machine can avoid those shocks!).**

	In case of the user have to weigh up case by case the use of suitable protection for the personnel
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### 1.10.5 Vibration

The level of vibration for the operator who is situated in the cabin in test conditions established by the norm ISO 2631-1 and ISO5349, are:

1. Body, thighs, arms and head subject to an average level of vibration lower than 0.5 m/s<sup>2</sup>.
2. Feet and legs subject to an average level of vibration lower than 2.5 m/s<sup>2</sup>.

The vibrations felt by the operator during work phases may vary considerably according to the type of terrain that is being drilled and therefore, as stated by EN791, the user must weigh up case by case the use of suitable protection for personnel.

## 1.10.6 Seat

The machine is equipped with a anti-vibration seat with rubber damping in conformity to ISO 7096; it is essential to regulate the damping according to the operator's weight by turning the knob that is positioned at the front part of the seat, until it corresponds to the right weight. (see page 36 of the CATmanual)

## 1.10.7 Ground pressure

The rig in static conditions has a ground pressure lower than 1 Kg/cm<sup>2</sup>, and this can reach a value of 1.3 Kg/cm<sup>2</sup> during working phases (a value calculated in conformity to EN 791).

## 1.10.8 Wind force

The rig can be used as long as the wind speed measured on the ground does not 20m/s. Once this limit has been reached the work must be interrupted immediately.

The machine should not be parked on the yard with an upright mast if the wind speed exceeds 28 m/s (danger of overturning).

## 1.10.9 Fire extinguishers



The machine is equipped with a powder fire extinguisher situated in the bonnet behind the control cabin; it must be checked by expert personnel at least every six

A prompt intervention is essential for extinguishing the beginnings of a fire. For this reason, the personnell must be instructed on the correct procedure to be followed in order to stop the fire from spreading.

The safety Supervisor of the jobsite must instruct the personnell so that their actions can be coordinated and ensure that the fire is put out as quickly as possibly. With this in mind, it is better for the operator handling the extinguisher to be backed by all the personnel available.

Remember that extremely desperate situations or in absence of fire extinguishers, workers can throw earth onto the fire (for systematic organisation look at current legislation).


## 2. GENERAL INFORMATION

### 2.1 AIM OF GENERAL INFORMATION

This manual describes the use and maintenance of the IMT drilling apparatus mounted on the excavator base CAT320B and aims to give the operator a user's guide for the proper and safe use of the drilling rig and a comprehensive and logical maintenance.

Carefully read every section of the present manual before carrying out operation of the rig in order to avoid making mistakes in manoeuvres that could endanger your personal safety and damage the machine.

The correct procedures for carrying out manoeuvres are described in the manual, as well as operating and utilizing the machine.

	<p><b>The manufacturer declines responsibility or liability for damage caused to the machine due to its improper use.</b></p> <p>The manufacturer reserves the right to take legal action for any modification carried out to the machine of its production, without prior written authorization.</p>
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### 2.2 IDENTIFICATION DATA OF MACHINE MANUFACTURER

The drilling rigs of the AF SERIES and derived models are manufactured exclusively by:

**I.M.T. S.p.a.**

**Via d'Ancona 39, 60027 Osimo (AN) Italy**

Rag. Soc. 6346, C.C.I.A.A. 69429, C.E. 031153, C.F. e P.IVA 00194370425

Tel. +39-(0)71-723341 r.a., Telex 561349 IMT I, Telefax +39-(0)71-7133352

### 2.3 CONDITIONS TO MAINTAIN WARRANTY VALIDITY

The warranty issued for the drilling rig is subject and may be invalid in the event of non-observance of the Use and Maintenance instructions illustrated in this manual. It must be noted that the warranty does not cover the parts that are subject to wear and tear, filters, oil and other materials of consumption. IMT S.p.a. makes available its Technical After Sales Service at for all customers while Caterpillar handles all technical assistance and warranty for the machine base.

### 2.4 INFORMATION REGARDING CUSTOMER - IMT S.P.A. RELATIONS

#### 2.4.1 General information on technical assistance and spare parts

IMT S.p.a. puts its own Technical After Sales Service and Spare Parts Service at the customers' disposal.

These services allow the customer to promptly solve any eventual breakdown of the machine assuring against loss time and productivity.



## 2.4.2 Procedure for requesting Technical Assistance

In order to ensure the maximum promptness and efficiency of execution of technical assistance, the best procedure is to immediately call IMT S.p.a. or send a fax to the Technical After Sales Service describing the following:

1. the nature of the breakdown in detail, so that the technical personell can get ready the required spare parts or tools for the intervention;
2. the exact place where the machine is situated;
3. the personnel eventually available at the jobsite who can cooperate with the technical operators in the maintenance and repair operation.

Generally the technical assistance is available in very short period of time.

Always follow the instructions that will be provided so that any further damage will be avoided and the intervention time will be reduced to a minimum.

## 2.4.3 Procedure for spare parts request

Send via fax a copy of the following form duly filled in:

<b>Spare parts purchase order</b>		
Order details:		
Sent by:		
For the attention of:		IMT spa, Italy
Company name:		
<b>HYDRAULIC DRILLING RIG AF120</b>		
YEAR OR MANUFACTURE:		
SERIAL NO.:		
Qty	Code	Description
note:		
note:		
Type of delivery:	Urgent / Not urgent	Note:

## 2.4.4 Procedure for giving technical advice

Sometimes it may be possible to make improvements to a machine following advice from those who use these kinds of machines every day.

In the event of your having an idea about an improvement, please send a fax or make a call to IMT ; we will be glad to listen to your recommendations.

## 2.5 GENERAL DESCRIPTION

The drilling rig AF120 is expressly used for the realisation of water wells and bored piles of medium/large diameter (500 - 2000 mm).

The rotary has a hydraulic function and is composed of a transmission unit with power-shift gear to guarantee a high torque level during drilling and high rotations speed during unloading.

The rotary unit is pre-set for operations which require working with manoeuvring pipes (lining pipes).

The rotary runs vertically along the mast guide by means of a slider activated by a hydraulic cylinder for pull-down. The sliding guides are built of self-lubricating material in order to reduce wear and tear and have setting screws for regulating the play between the slider and mast.

The rig can be equipped with a telescopic kelly bar that is self-locking (internationally and nationally patented by IMT) realized with a series of telescopic elements equipped with teeth or keys that have the role of joining and locking together the various elements.

This system allows all the pulldown force and torque power generated to be transmitted to the tool.

This type of kelly bar also allows an extraction force that is the sum of the winch pull and pull back.

The stability of the AF120 is guaranteed by an undercarriage that is suitably dimensioned and by an auxiliary ballast applied to the machine.

The tool connected to the square joint of the last rod (the smallest one) is pulled up by the main winch by means of the special cable.

The winch cable is easily guided by the grooved drum and cable clip, and is perfectly visible to the operator in the operator's cab: this allows immediate checking of cable correct winding on to the drum.

A parallelogram articulation, consisting of a triangular element, boom and brace, allows hole axis displacement with respect to the machine axis. This displacement is controlled by the boom cylinders without affecting the mast uprightness.

The capacity of the mast to slant both forwards and laterally allows the operator to also work in terrain that is slightly sloped and by means of the articulation, it's possible to carry out drilling at variable distances from the machine without having to move the whole undercarriage into a different position.

At the minimum distance of the machine axis from the drilling axis, all the potentiality of the machine can be exploited (max. extraction force, max pulldown on the tool) while at the max. distance the max. extraction force must only be used with the mast foot rested on the ground

The drilling distance must always be reduced in terrains that do not guarantee ground solidarity to the stability of the machine, and must be evaluated case by case (see max. ground pressure).

## 2.5.1 Description of hydraulic installation

All the movements of the drilling rig are activated by hydraulic activators.

The suitable oil delivery is supplied by 3 pumps of the basic machine that feeds the control distributors:

2 main pumps for the power use;

1 auxiliary pump for the accessory operation.

The main pumps supply the following devices:

- Rotary *(Clockwise, anti-Clockwise, spin off)*
- Main Winch *(Up - down)*
- Auxiliary Winch *(Up - down)*
- *Casing*
- Left- Right Tracks *(forward, backward)*

Be aware that In **working** position the following manoeuvres as well are activated:

- Left track *(Extension/retraction);*
- Left track *(Extension/retraction);*
- Platform Rotation *(Clockwise, anti-Clockwise)*
- Pull-down *(cylinder)*
- Mast *(sideways movement)*
- Articulation *(Up-Down)*
- Mast *(Forward-backward)*
- Mast closing

The distributors are controlled hydraulically by hand levers.

## 2.5.2 Description of electrical installation

The electrical installation includes the ignition connectors of the diesel engine, activation of the electrovalves and general elements like pilot lights and control panels.

In the electrical installation, other important functions have evolved concerning safety i.e:

- Leveling (by means of electronic system with verticalità sensor);
- Main winch end of run with sensor activated by rod guide;
- Secondary winch end of run with sensor on the derrick;
- Mast right-hand and left-hand limit switch.

The electrical system is powered by two batteries 12 V 110 Ah with a series connection. The final voltage is 24 V c.c.

**3. TECHNICAL CHARACTERISTICS****3.1 DATA REGARDING THE BASIC MACHINE**

<b>MACCHINE BASED ON CATERPILLAR 320B</b>			
<b>HYDRAULIC SYSTEM</b>	open circuit	quantity	3
<b>DIESEL ENGINE</b>	Model	Type	Cat
	Power	KW	110
	Speed	rpm	2000
<b>UNDERCARRIAGE</b>	Max traction force	KN	220
	Speed	Km/h	1.76
<b>BASE MACHINE</b>	Weight	tons	42

## 3.2 DATA OF DRILLING RIG

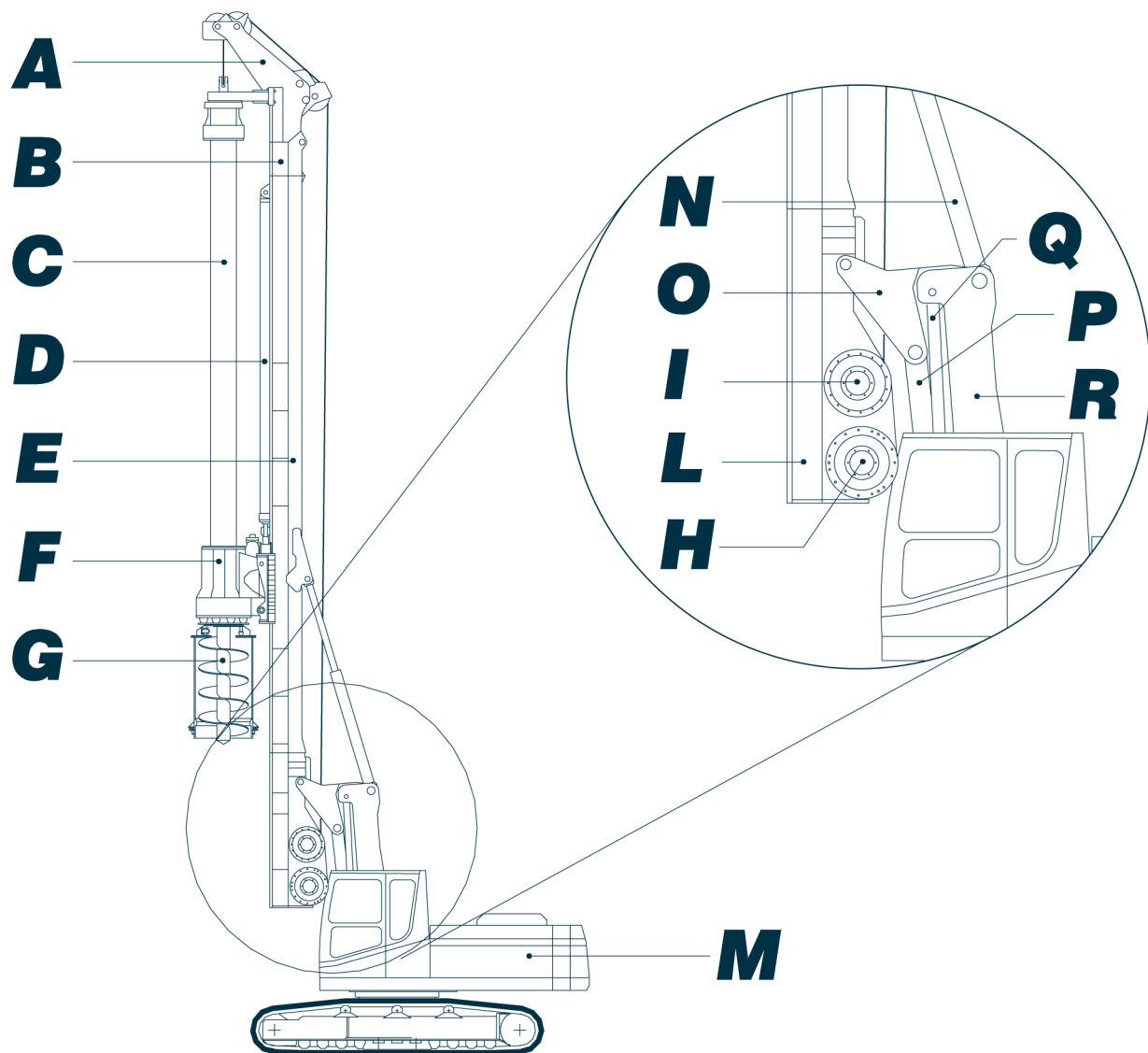


Figure 1

A	<b>Mast head</b>	I	<b>Main winch</b>
B	<b>Mast extension</b>	L	<b>Lower mast attachment</b>
C	<b>Kelly bar</b>	M	<b>Slewing upperstructure</b>
D	<b>Pull-Down cylinder</b>	N	<b>Mast cylinders</b>
E	<b>Mast</b>	O	<b>Triangle</b>
F	<b>Rotary</b>	P	<b>Brace</b>
G	<b>Tool</b>	Q	<b>Articulation cylinder</b>
H	<b>Auxiliary winch</b>	R	<b>Articulation: 1<sup>st</sup> Boom</b>

Figure 2

Figure 3

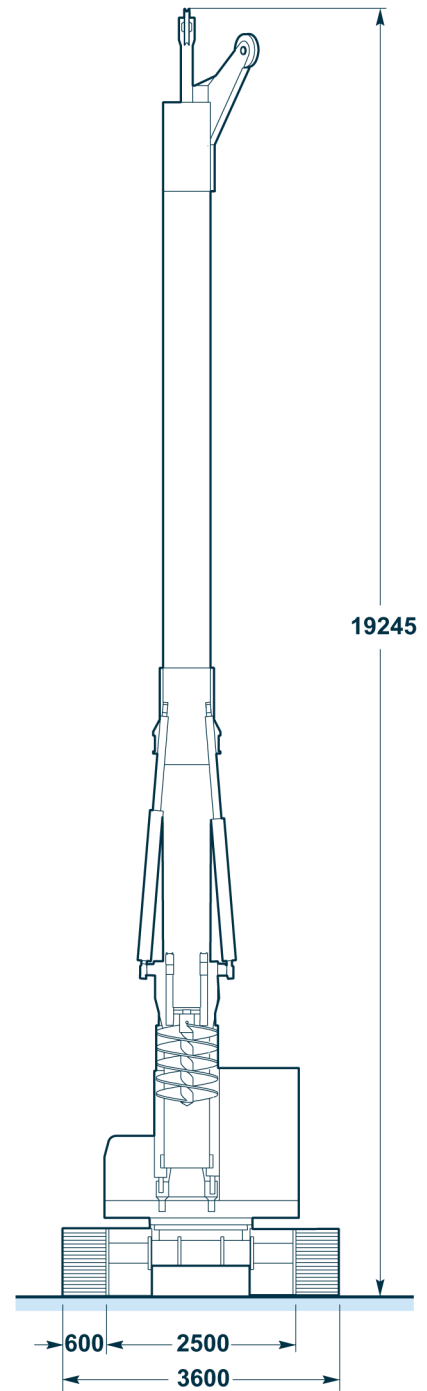
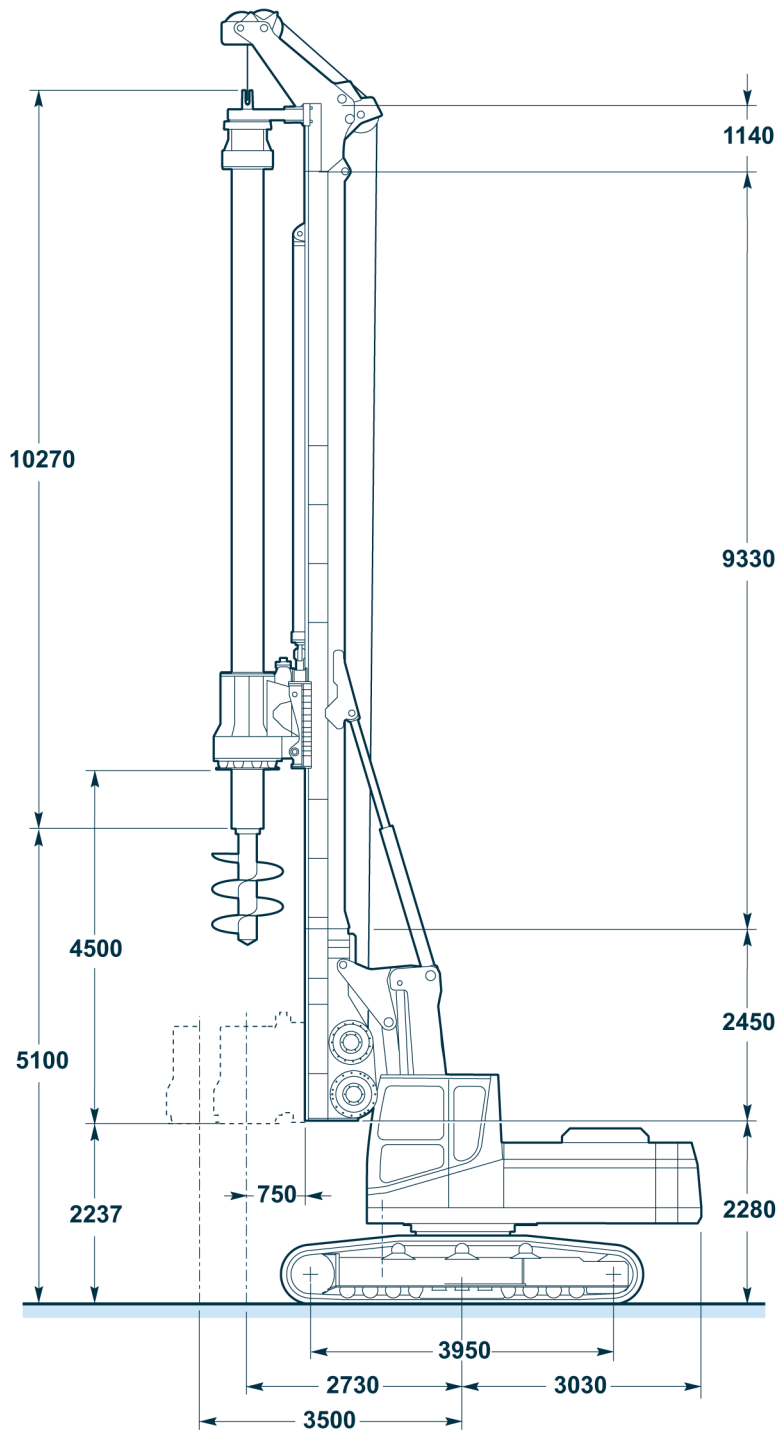


Figure 4

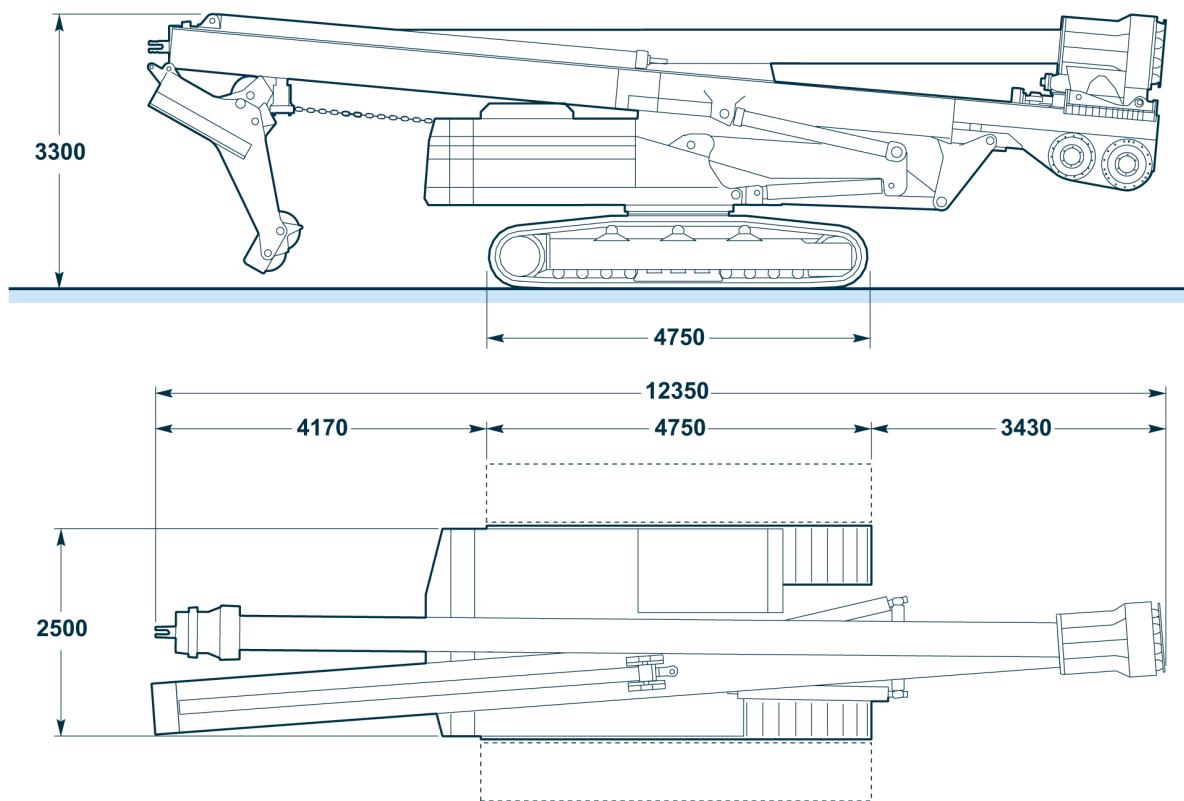


Figure 5

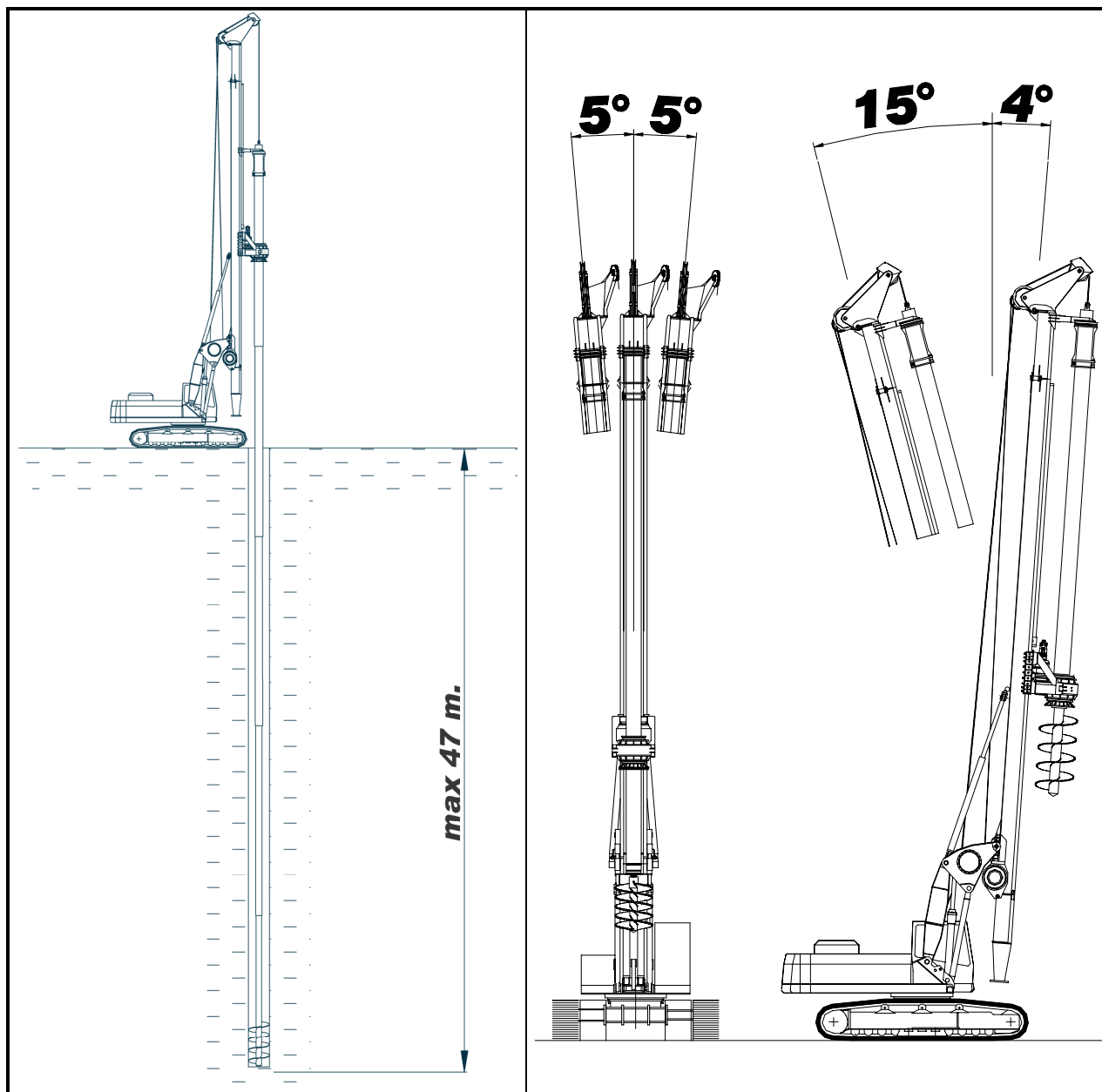


Figure 6

Figure 7



<b>IMT AF120 on CAT320 base</b>			
<b>HYDRAULIC ROTARY</b>	Max Torque	KNm	137
	Drilling speed	Rpm.	7-24
	Spin off speed	Rpm.	140
	Drilling width	mm	2.000
<b>PULL-DOWN</b>	Pull-down	KN	180
	Pull-back	KN	200
	Stroke	mm	4500
	Pulldown speed	mm/s	110
	Pullback speed	mm/s	225
<b>MAIN WINCH</b>	Pullback	KN	150
	Rope speed	m/min	80
	Rope Diam.	mm	22
	Rope length	m	65
<b>AUXILIARY WINCH</b>	Pullback	KN	82
	Rope speed	m/min	80
	Rope Diam.	Mm	18
	Rope length	m	65
<b>MASS</b>			
Rotary		Kg	4.500
Casing oscillator (*)	Type MG dia. 1300	Kg	8.000
Maximum drilling depth		m	47
Counterweight		Kg	8.300
Escavator base		Kg	38.000
Machine in order of work	with auger $\varnothing$ 1800 mm (*)	Kg	66.000
<b>DIMENSION</b>			
Track	Length	mm	5.470
	Length on the ground	mm	4.600
	Min. Width	mm	2.500
	Max. Width	mm	3.600
	Height	mm	1.095
	Track shoes	mm	600
	Minimum ground height	mm	380
	Machine (with erected mast)	Minimum Length	mm
Maximum Length		mm	8.375
Width		mm	4.500
Max Height		mm	16.400
Minimum drilling radius		mm	2.730
	Maximum drilling radius	mm	3.500

(\*) Note: accessories not included.

### 3.2.1 Maximum working slope

The maximum ground slope allowed for the drilling rig is 5° when the machine is working with the articulation completely raised (minimum range), otherwise working with maximum range (articulation lowered) the machine must work on flat ground.

### 3.2.2 Maximum slope for movement

The maximum slope allowed for the movement of a machine is 10° and is to be carried out with the mast reclined backwards by 10-15° and the kelly bar and tool near to the ground (20-30 cm).

Figure 8

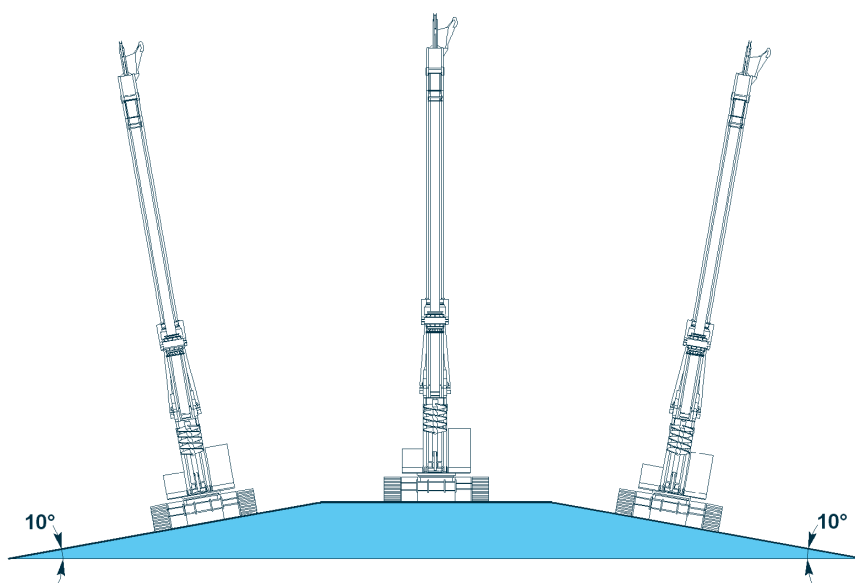
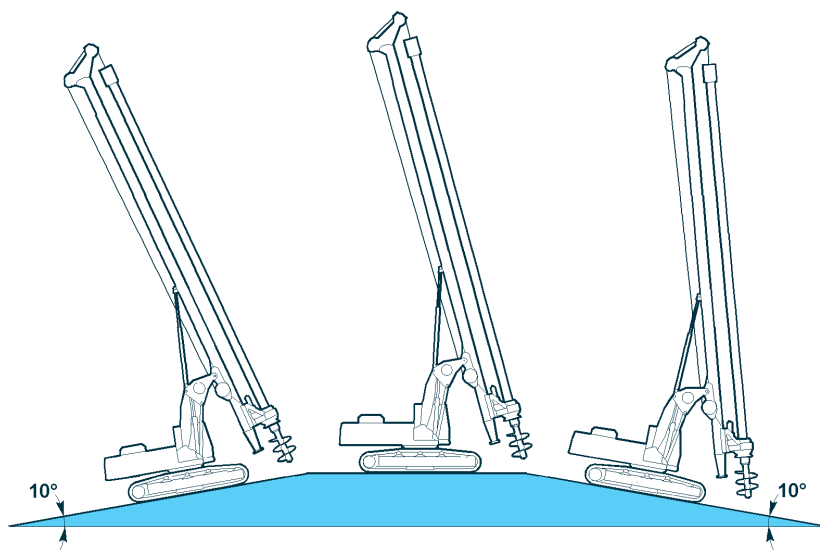


Figure 9

### 3.3 TECHNICAL DATA OF THE CASING OSCILLATOR

<b>CASING OSCILLATOR TYPE IMT MG 1300</b>			
<b>ROTATION</b>	Max Torque	KNm	1.540
	Oscillation Angle	°	26
	Max Diameter	mm	1.300
	Mix Diameter	mm	800
<b>EXTRACTION</b>	Lifting force	KN	1.600
	Clamping force	KN	1.110
	Lifting stroke	mm	500
<b>WEIGHT</b>	Casing oscillator without tilting device	Kg	8.000

(casing oscillator attachment)

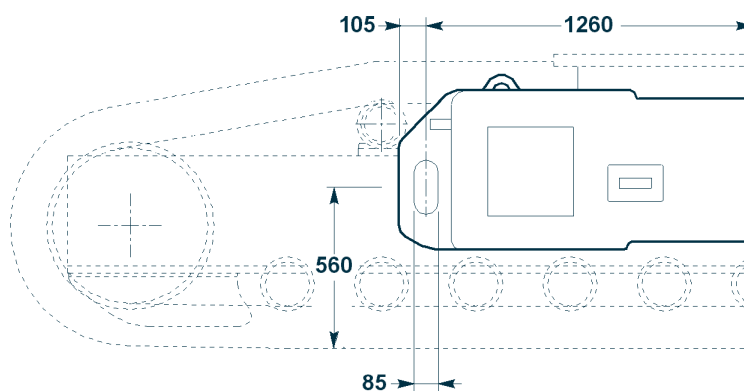


Figure 10

## 4. TRANSPORT

### 4.1 MACHINE CONFIGURATION FOR ROAD TRANSPORT

Road travelling must be in compliance with statutory traffic control regulations; a special trailer or another transportation vehicle with carrying capacity suitable for the drilling rig's weight should be used.

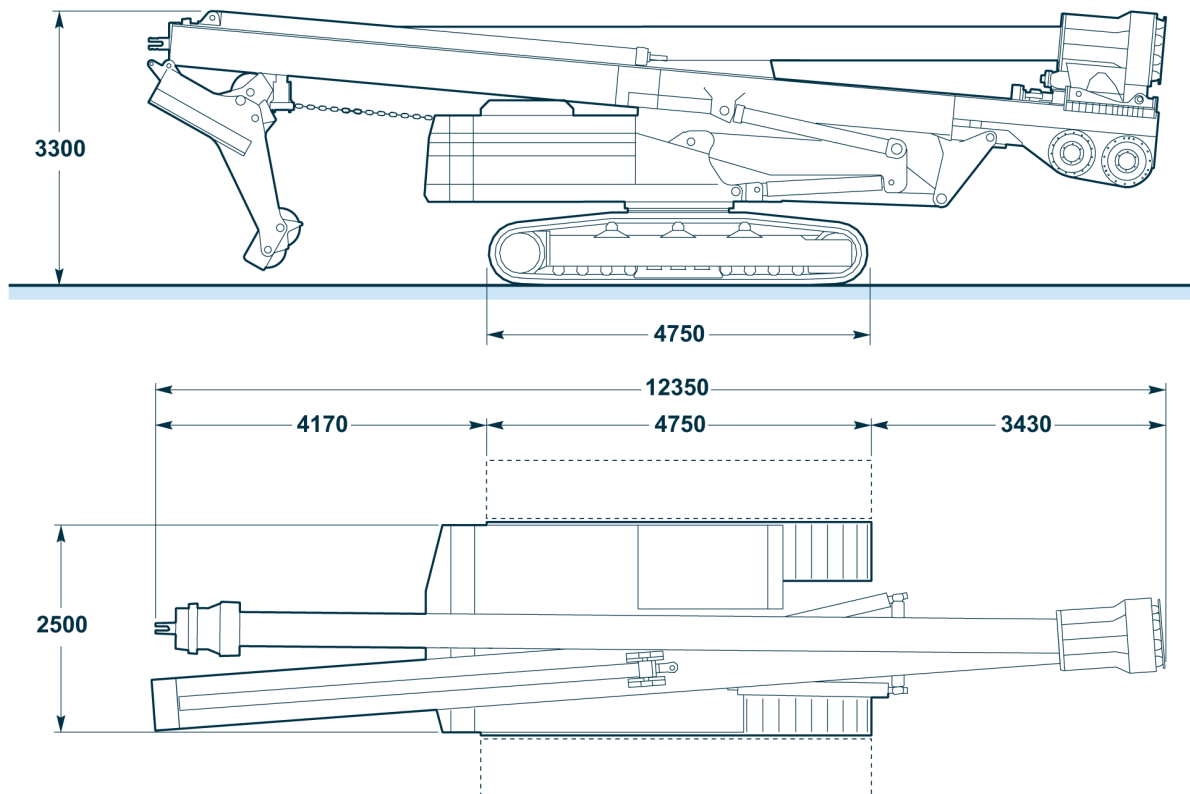


Figure 11

### 4.2 MACHINE LOADING AND UNLOADING

Loading and unloading must be carried out in compliance with the following instructions (see Figure 10 ):

- Select a flat area, making sure that the ground is not too soft;
- At least two workers are required (one to clearly signal the required manoeuvres);
- Make sure that there are no unauthorised persons in the area;
- Use ramps having suitable slopes and load-carrying capacities;
- Make sure that the load does not exceed the loading gauge and use the special warning signs prescribed by traffic control regulations;

For short-range travelling within the work area, follow these instructions:

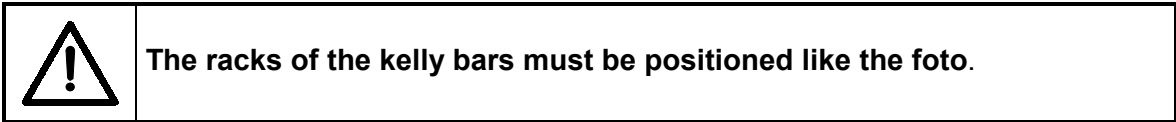
- Avoid manoeuvring with vertical mast;
- Bend the mast backwards by approximately 10-15°.

### 4.3 PREPARATION FOR TRANSPORT

1. Derrick open;
2. Rotary positioned about ½ meter from end of run (depending on the Kelly bar mountend);
3. Kelly bar slightly inserted in the rotary (square joint side) and restin on the stand (kelly bar guide side);

**NOTE**

- The Kelly bar must be blocked with chain (between kelly bar guide and counterweight).
4. Closed crawler tracks;



**Figure 12**



**Figure 13**



## 4.4 TRANSPORT ON SEMI-TRAILER

The following is the recommended machine configuration for transport on semi-trailer:

- mast unit all the way down and folded parallelogram articulation;
- folded mast attachment;
- tracks closed to their smallest overall dimensions;
- slewing upperstructure locked with an inserted locking pin;
- mast head folded to its smallest overall dimensions and locked with the special tie rod;
- doors and guards locked;
- machine fixed to the semi-trailer with steel ropes and tracks wedged to prevent shifting;

do not use too steep loading ramps!

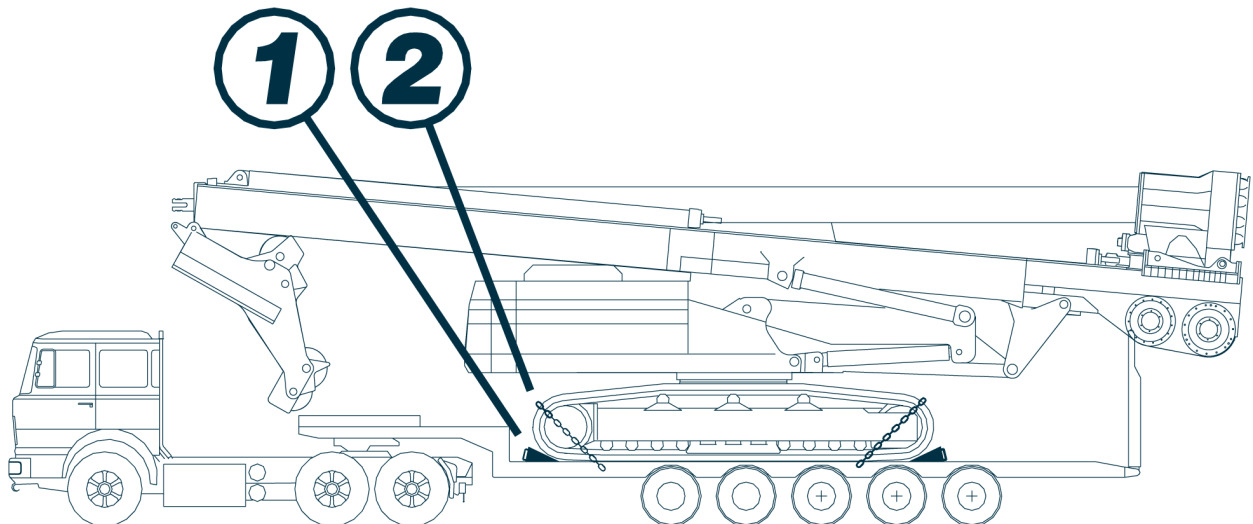


Figure 14

## 5. OPERATION INSTRUCTIONS

### 5.1 AIM OF OPERATION INSTRUCTIONS

In this section, the controls and operative procedures are illustrated for the correct and proper use of the AF120 drilling rig.

### 5.2 DRILLING

- Follow the safety instructions described in chapter 1.
- Choose the tool suitable for the type of terrain to be drilled.
- In order to attach the tool, raise the kelly bar to its vertical position over the tool, insert the square joint in the appropriate seating and block it with the pin and split pin (see chapter on assembly).
- Position the tool onto the ground at the point where you wish to begin drilling the hole and check mast verticality with the appropriate electrical levelling device.
- Lift the rotary to an appropriate height.
- Begin to drill by rotating the kelly bar in a clockwise direction; during the first few metres the weight of all the elements will guarantee enough force to push the tool forward and down while an excessive pulldown could deviate the hole verticality.
- When the first element of the kelly bar is completely out, the pulldown of the pulldown cylinder can be used to obtain a better penetration.
- When the tool is full, before carrying out the raising of the tool, always unlock the kelly bar elements by rotating the rotary in an anti-clockwise direction which is opposite to the drilling direction.
- Raise the kelly bar elements activating the main ; if this is not enough, then the pull-back cylinder should also be used.
- Lift the tool until it is at a useful height and avoid any obstacles; turn the platform up to the unloading point.
- If the tool is a bucket, it must be positioned in such a way as that the moving bottom does not hit the mast.
- Lift the kelly bar until the opening lever of the tool is opened by pulling it against the lower rotary flange.
- Once the unloading has occurred, close the tool by gently resting it on the ground and rotate simultaneously the platform in the direction that leads to the closing of the tool. Check that the kelly bar elements are unlocked and go back to the working position.
- If the tool is an auger, in order to unload it, it must be rotated in an anti-clockwise direction, increasing the rotary speed and if necessary prepare the fast rotary gear change with the proper button during the raising phase.
- Once the auger has had its rubble unloaded, rest it on the ground and rotate the kelly bar battery in an anti-clockwise direction in order to be certain that all the kelly bar elements are unlocked and then return to the working position



**The unloading of the tool must be carried out only with the rotation of the rotary**, the use of the main winch for the unloading of the tool may compromise the perfect functioning of the motor-reducer and the cable rope.

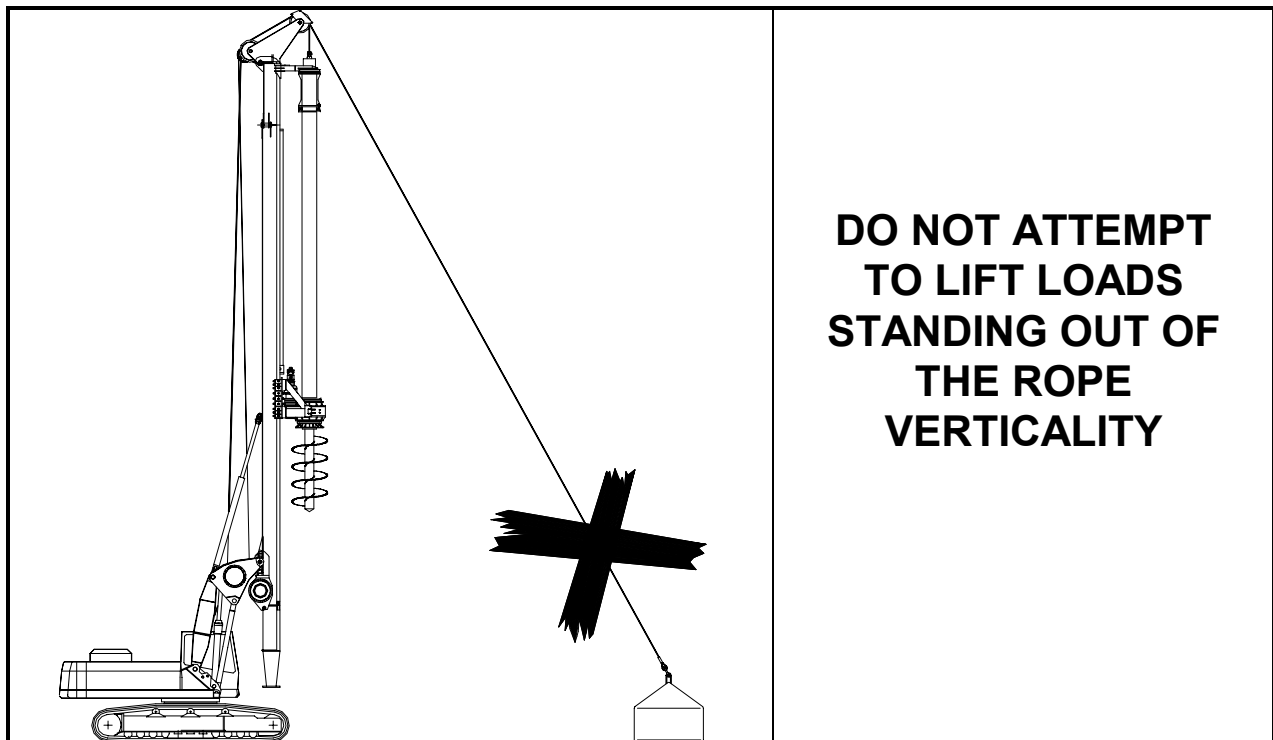


Figure 15

### 5.3 MOVING IN WORKING PHASES

- In order to avoid the presence of depressions influencing the machine stability, and leading to the possibility of overturning, it is best to partially recline the mast while moving about within the jobsite.
- Remember that the stability of the machine improves if the mast is lowered.

#### 5.3.1 Moving about on soft or damp terrain

Table 2 indicates the maximum ground pressure values in various configurations and the relative lift values on the ground. Before moving the machine, check that the terrain is not excessively soft, otherwise the machine could sink into the ground or overturn.

Table 2

Machine configuration	Maximum Ground pressure	Minimum Ground capacity
	[Kpa]	[KPa]
Mast horizontal	91.5	100
Pull sideways	186	200
Maximum during work with platform rotated at 30°	392	400

### 5.4 WARNING! AVOID THE FOLLOWING MANOEUVRES

- Do not move about with the mast in vertical position and the platform rotating when covering ground that is not perfectly flat and solid (stability).
- Do not give to much slack with the main winch and check the regular winding up of the rope.
- Do not drill with the pin and split pin which serve to block the tool in risky situations.
- Do not work with damaged cable ropes.
- Do not carry out any intervention or maintenance on the hydraulic installation with the engine running or without having already released the pressure from the oil tank, following the procedure indicated in the CAT manual.



- Do not work with a insufficient and low oil level.
- Do not carry out topping up with oil that is not in conformity with the recommended oils (see the recommended oils table).
- Do not carry out soldering on the machine or connected equipment without first having disconnected the electrical installation.
- Do not tamper without authorisation the hydraulic valves or any component of the hydraulic installation, as this may invalidate warranty claims.
- Do not work at maximum speed (1975 rpm) for the first 15 days of operation.
- Do not carry out brusque manoeuvres or kickbacks that could damage the rig or compromise its stability.
- Do not work with the crawler tracks overtight or too loose.
- Do not immediately activate or release the button for the rotary gear change.
- Do not leave rubble in the way of the tool while unloading.
- Do not exceed the maximum drilling distance or be at the hole's mouth in the event of slightly sloped terrain.
- Do not work on very sloped terrain (maximum slope 5%).

## **5.5 CONTROL SYSTEMS AND CABIN CHARACTERISTICS**

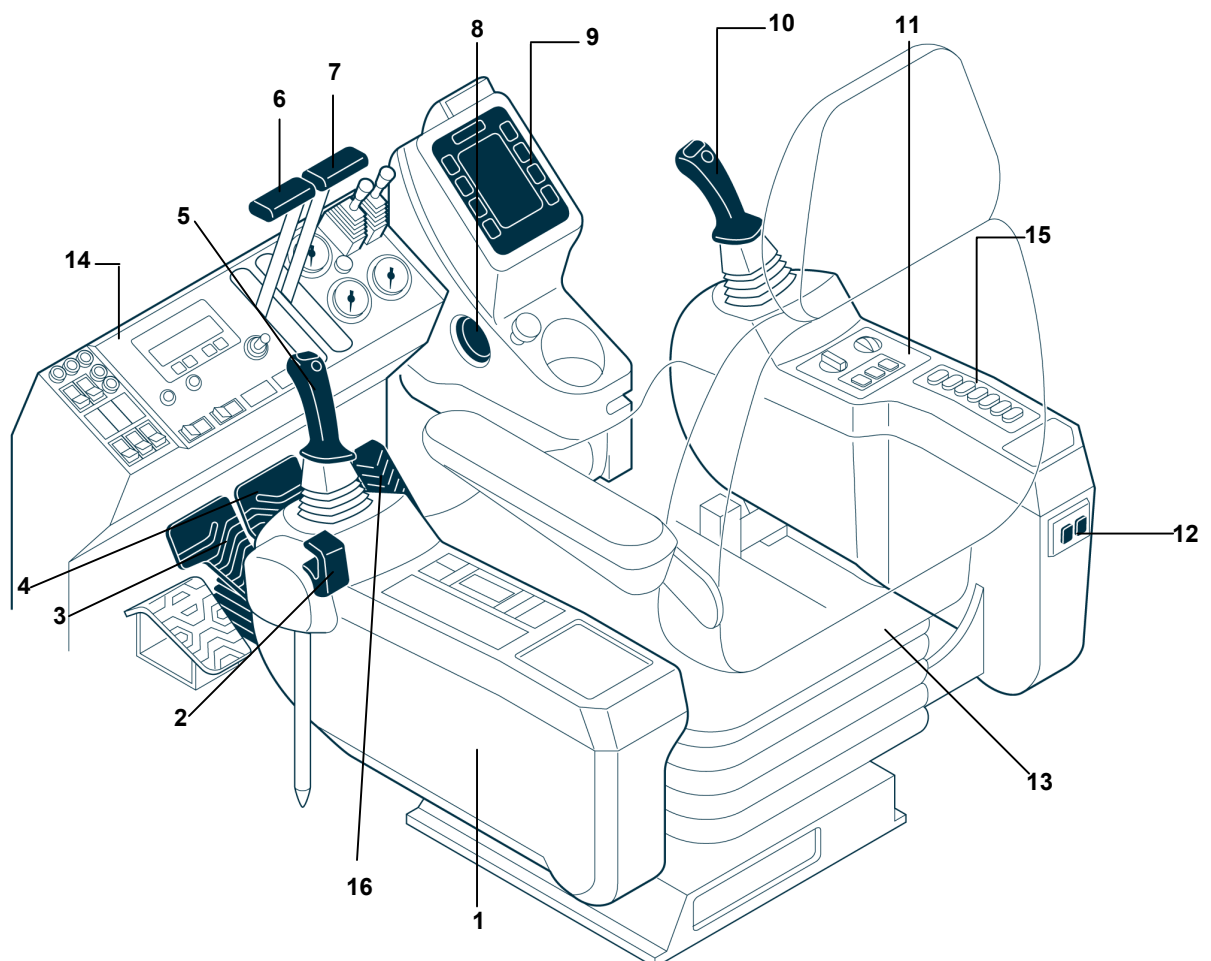
For this section, please see page 24-37 of the "Operation and Maintenance Manual" of the crawler tracked excavator CAT320B .

## 6.DRILLING EQUIPMENT CONTROLS

### 6.1 GENERAL MACHINE CONTROLS

- 1 Left-hand console (see caterpillar manual)
- 2 Hydraulic system enabling lever (see caterpillar manual)
- 3 Left-hand propel pedal (see caterpillar manual)
- 4 Right-hand propel pedal (see caterpillar manual)
- 5 Equipment control left-hand lever (see page 35)
- 6 Left-hand propel lever (see caterpillar manual)
- 7 Right-hand propel lever (see caterpillar manual)
- 8 Hour-meter (see caterpillar manual)
- 9 Electronic monitoring panel (see caterpillar manual)
- 10 Equipment control right-hand lever (see page 35)
- 11 Right-hand console (see caterpillar manual)
- 12 Electronic control system back-up switches (see caterpillar manual)
- 13 Operator's seat (see caterpillar manual)
- 14 Front dashboard (see page 36)
- 15 Lateral controls (see page 41)
- 16 Pedal for rod lifting (see page 44)

Figure 16



## 6.2 EQUIPMENT CONTROL LEFT-HAND LEVER.

- 1 Main winch rope lowering.
- 2 Main winch rope lifting.
- 3 Upperstructure clockwise slew.
- 4 Upperstructure counter-clockwise slew.
- 5 Mast foot lowering push-button (\*).
- 6 Mast foot lifting push-button (\*).
- 7 Upperstructure automatic return push-button: press shortly to control the upperstructure automatic return to the drilling position (the indicator light A starts flashing).

To store the upperstructure stop point, the tool should be positioned at the required point and the push-button should be held down for a few seconds, until the indicator A light becomes fixed.

(\* ) The foot mast is not found on all machines.

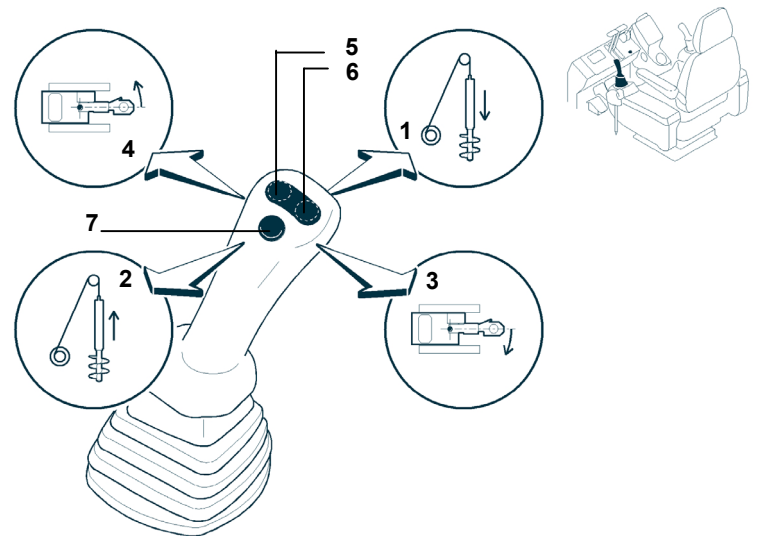


Figure 17

## 6.3 EQUIPMENT CONTROL RIGHT-HAND LEVER.

- 1 Rotary lowering
- 2 Rotary lifting
- 3 Rotary counter-clockwise rotation (drilling)
- 4 Rotary counter-clockwise rotation (tool discharging)
- 5 Fast speed change push-button: when pressed, it increases the rotary speed and enables to instantly shift gears up by three ratios.

### CAUTION

Only use this device during the earth discharge phase and not during drilling

- 6 Rotary sequential gear change push-button: when pressed, it shifts gears up by one ratio (from 1<sup>st</sup> to 6<sup>th</sup>)

The selected gear ratio is displayed.

- 7 Rotary sequential gear change push-button: when pressed, it shifts gears down by one ratio (from 6<sup>th</sup> to 1<sup>st</sup>)
- The selected gear ratio is displayed.

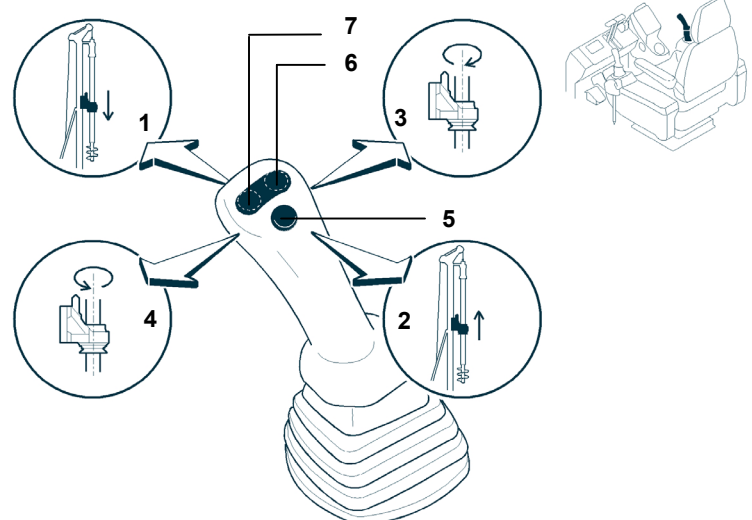


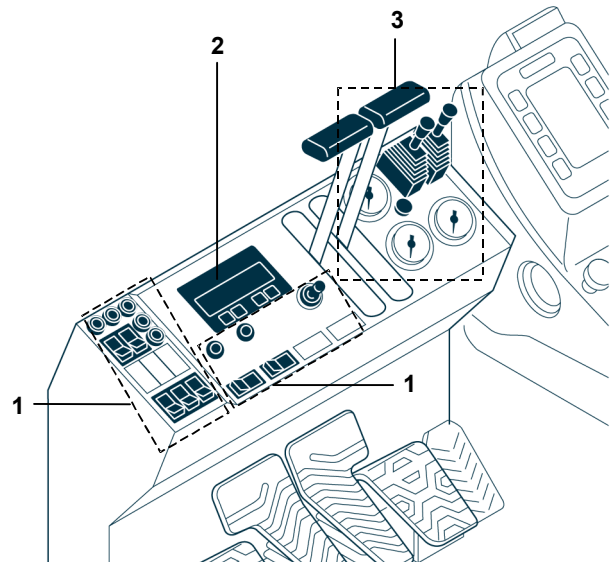
Figure 18

## 6.4 FRONT DASHBOARD

For a clearer arrangement of controls, the front dashboard is divided as follows:

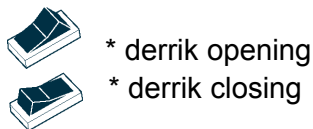
- 1 Front dashboard left side (see page 37)
- 2 Computer (see page 40)
- 3 Front dashboard right side (see page 38)

Figure 19



## 6.5 FRONT DASHBOARD LEFT SIDE

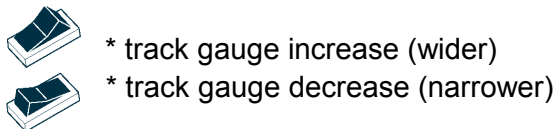
- 1 IMT oil filter warning light (red): it lights up to indicate that the filter needs servicing.
- 2 Maximum rotary distance during work indicator light (red): it lights up to indicate that the rotary has reached the maximum safety distance from the swivel ring axis.
- 3 Horn switch: it actuates the horn when pressed
- 4 Led indicating the good functioning of the pump motor for lubricating the rotary gear boxes (see figure 20). The red light indicates the pump malfunctioning.  
NOTE:At the moment of starting the led remains on for a few seconds.
- 5 Mast forward stroke limit-switch override control: when pressed, it enables to move the mast forwards, even if the limit-switch has tripped, exceeding the rotary maximum safety distance with respect to the swivel ring axis.
- 6 Auxiliary winch limit-switch override control: when pressed, it enables to operate the winch even if the limit switch has tripped. This control is especially useful during cable replacement.
- 7 Main winch limit-switch override control: when pressed, it enables to operate the winch even if the limit switch has tripped. This control is especially useful during cable replacement or to take down the rod pack.
- 8 Derrik opening and closing.



- 9 Track gauge adjustment switch: when pressed, it enables to increase or decrease the track gauge.

NOTE

Before operating these controls, make sure that the locking devices have been removed.



- 10 Available

- 11 Metre counter reset push-button: if pressed and held down for three seconds, with the tool resting on the ground, this control will reset the working depth metre counter.
- 12 Tilting cylinder control joystick (see page 39)
- 14 Hole bottom slop ovveside.
- 15 Automatic operation mode indicator light (red light): when this indicator is lit and flashing, the automatic operation mode (verticalization or upperstructure automatic return) is in progress.



Figure 20

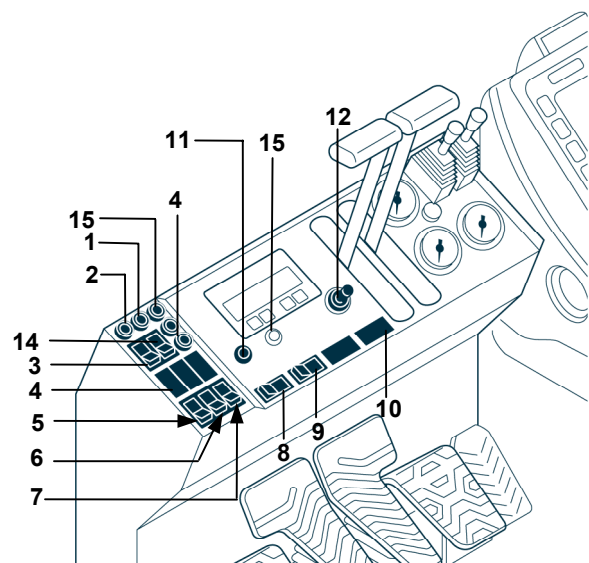


Figure 21

## 6.6 FRONT DASHBOARD RIGHT-HAND SIDE

**1** Manometer: it indicates the IMT distributor working pressure

**2** Manometer: it indicates the working pressure of the two caterpillar pumps.

**NOTE**

If the pump coupling has been disconnected by the special switch, the manometer will read the main winch working pressure.

**3** Manometer: it reads the working pressure of the two caterpillar pumps.

**NOTE**

If the pump coupling has been disconnected by the special switch, the manometer will read the rotary working pressure

**4** Boom control lever: it can be operated to control boom movements

Position A – it controls the mast forward or downward movement, according to its working position

Position B - it controls the mast backward or upward movement, according to its working position

**5** Auxiliary winch control lever: it can be operated to control the auxiliary winch

Position A – auxiliary winch rope lowering

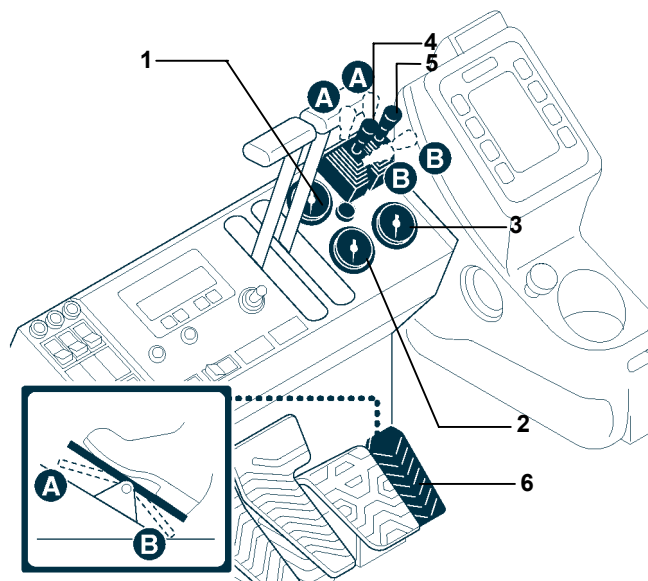
Position B – auxiliary winch rope lifting

**WARNING - DANGER**

Never use the auxiliary winch to pull in other directions than the vertical direction nor to pull objects located far from the machine, to prevent overturning risks.

**6** Pedal for rod loading (see page 44)

**Figure 22**



## 6.7 TILTING CYLINDER CONTROL JOYSTICK

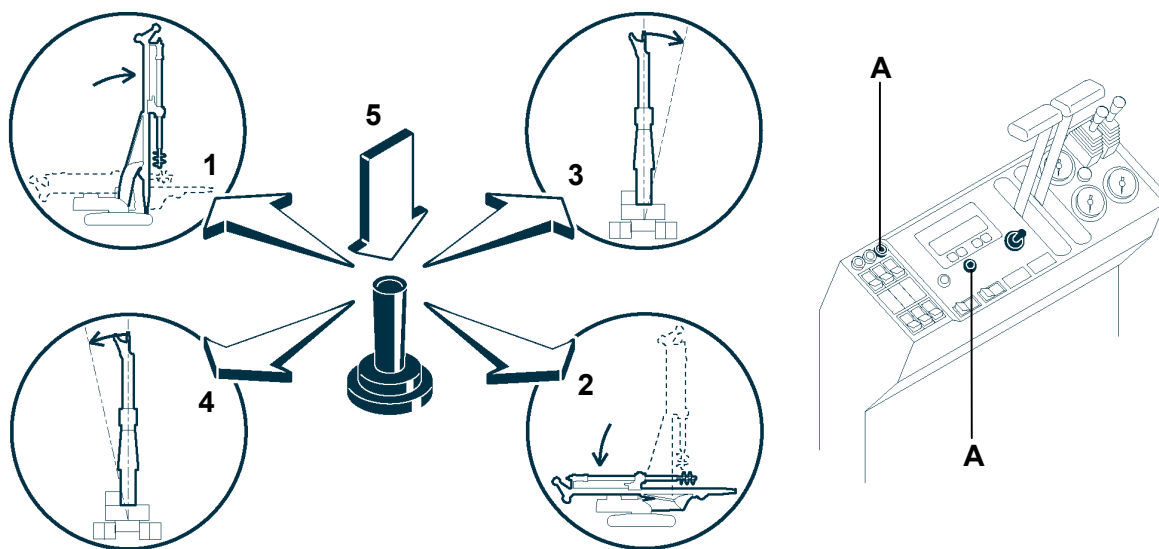
This joystick controls the mast tilting cylinders to enable mast opening and closing, as well as verticalization adjustment in the pre-drilling phase.

- 1 mast opening and front shifting
- 2 mast closing and rear shifting
- 3 mast right-hand sideways shifting
- 4 mast left-hand sideways shifting
- 5 mast automatic verticalization device actuation (the indicator A flashing light will go on)

**NOTE**

This function will only be actuated when the mast tilt angle with respect to the vertical line is  $9.9^\circ$ .

By pressing the joystick once again during automatic operation, the mast will stop in its current position.



**Figure 23**

## 6.8 COMPUTER

The computer display enables the operator to obtain all the real-time information listed below, useful for machine operation.

- 1 Mast tilt indicator (connected to the electronic level): it shows the mast front and lateral tilt up to a maximum angle of 9.9°, through the indicators 1a and 1b.
- 1a front tilt visual indicator
- 1b lateral tilt visual indicator
- 2 Mast lateral tilt digital indicator: the displayed value is referred to the vertical line up to a maximum angle of 9.9°
- 3 Mast front tilt digital indicator: the displayed value is referred to the vertical line up to a maximum angle of 9.9°
- 4 Rotary swing speed indicator
- 5 Rotary swing torque indicator
- 6 Drilling depth indicator
- 7 Rotary change gear ratio indicator
- 8 Base machine angle
- 9 Winch speed
- 10 Display brightness adjustment keys: press to adjust
- 11 Display contrast adjustment keys: press to adjust

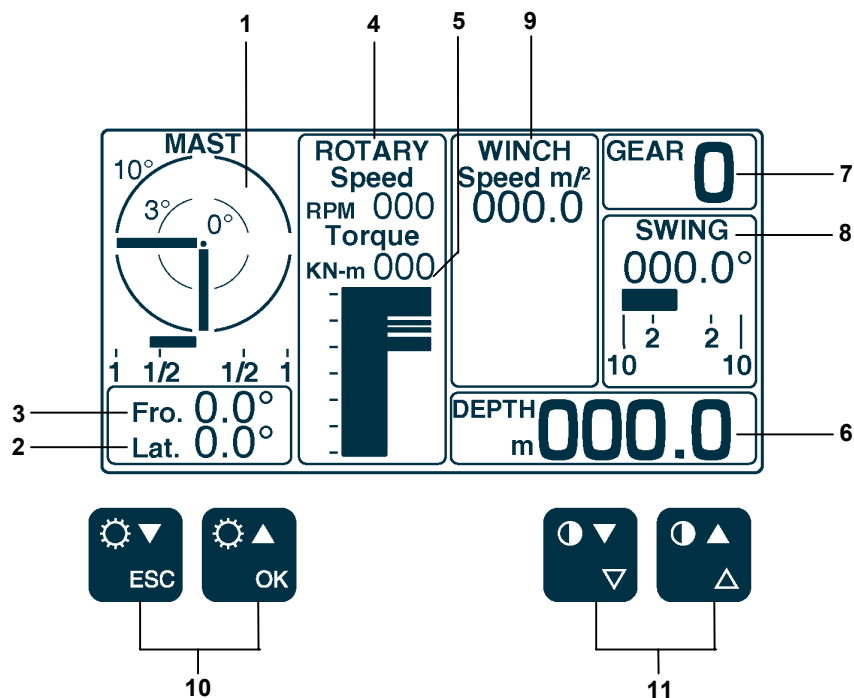


Figure 24



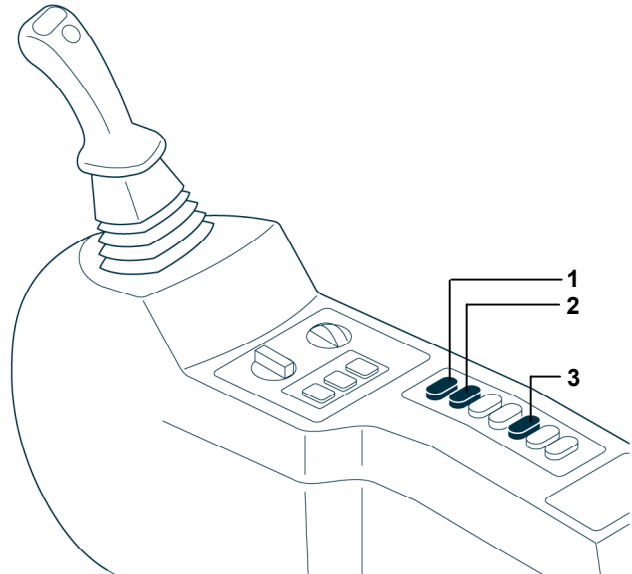
**6.9 LEFT-HAND LATERAL CONTROLS**

- 1** Accelerator reduction push-button (AEC): when pressed, it stores the current engine RPM and brings it down to idling; when pressed again, it brings the RPM up once again to the stored value.
- 2** Mast working headlights switch: when pressed, it switches the working headlights on or off.
- 3** Upperstructure swing brake release switch: this switch is located on the caterpillar; it enables a useful function for excavators, which is however not suitable for drilling rigs.

**NOTE**

Make sure that this switch is always turned to "0".

**Figure 25**



## 6.10 DIRECTIONS FOR USE

**CAUTION:** before starting to work with the machine, the operator should read and fully understand this manual, and carry out a few trial manoeuvres, to become familiar with the arrangement and functions of the machine controls.

Before starting to work, the machine should be prepared as explained below:

- start the engine (see section 7.1)
- increase the track gauge
- bring up the mast to its vertical position
- fit the rod pack and tool (see section 7.4)
- travel to the drilling area and position the machine.

### NOTE

If a rather long trip on bumpy ground is required to reach the drilling area, we recommend to lower the mast to improve machine stability

- level the mast using the special control
- lower the mast foot
- lower the tool to rest on the ground and store its position for automatic return with the special control.
- select the required rotary gear ratio.

### CAUTION

Make sure that the rod and tool are suitable for the torque applied to the rotary

- control the rotary swing and start drilling as indicated in section 5.2

### CAUTION

Never control any articulated joint movement or mast levelling when the rod has been lowered in the hole.

- when the tool is full, pull it back with the main winch and discharge it
- control the automatic return operation, rest the mast on the ground and lower the tool by the main winch.

The winch is equipped with a "hole bottom stop" device, which stops the winch going further down when the tool reaches the hole bottom.

### NOTE

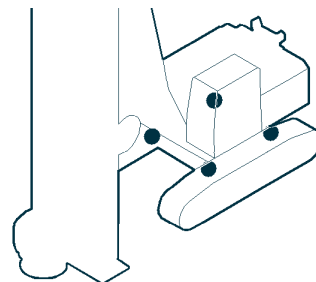
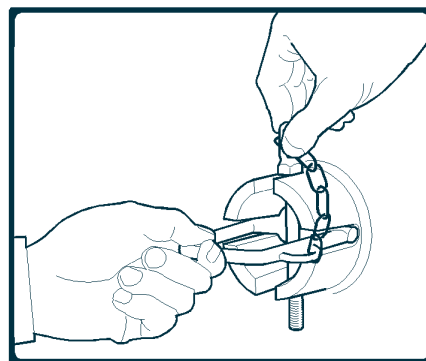
If the mast foot must be rested on the ground several times at the same point, we recommend placing metal sheets on the ground for the mast foot to rest on.

**6.11 CRAWLER TRACK TRAVEL**

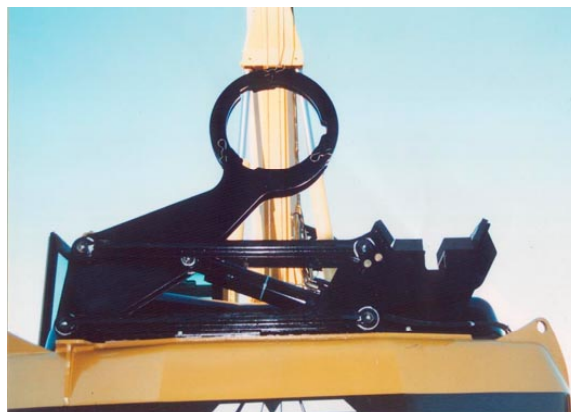
- take out the safety pins
- position the upperstructure longitudinally, then adjust the “track gauge increase” control.
- after increasing the track gauge, insert the safety pins

**NOTE**

Should it be hard to insert the pin, try slightly moving the track back and forth.

**Figure 26****6.12 ROD LIFTING GROUP**

- activate the pedal to lift rod

**Figure 27**

## 7. INSTRUCTIONS FOR USE

### 7.1 STARTING UP THE MACHINE

- Remove the blocking pin situated in the control cabin that locks the revolving platform.
- Check that the blocking lever on the left of the operator's seat for the hydraulic controls is engaged (in the raised position).



Keep the engine running for at least 5 minutes before beginning work in order to allow all the systems to reach the working temperature.

### 7.2 PROCEDURE FOR POSITIONING MAST

In order to lift the tool follow these instructions given here below:

- First activate the positioning piston in order to lift the mast.
- Act simultaneously on the articulation pistons and the positioner in order to lift the tool.
- With the tool completely raised, activate the tilting pistons for mast verticality.

### 7.3 POSITIONING OF THE RIG DURING WORK PHASES

Before beginning the work phases, carry out the following operations.

- Remove the pin that locks the kelly bar battery.
- Lift the mast to the vertical position and slide the kelly bar elements through the inside of the rotary so that the kelly bar guide is positioned on the trestle guides at the height of the mobile shoes.
- Re-lower the mast and fix the clamps of the kelly bar guide with pins.
- Remove the mobile shoes.
- Lift the mast and ensure that the kelly bar guide has been well attached.

## **8. MACHINE IN NON-WORKING PERIODS**

### **8.1 TEMPORARY STOPPAGES**

- Never leave loads hanging;
- Rest the tool on the ground;
- Shut down controls by engaging the block of hydraulic functions incorporated in the left seat arm rest of the control seat;
- Lock the control cabin and the bonnets to stop outsiders gaining access to the machine;
- Leave the machine in places that are off-limits to outsiders and on stable terrain. Check regularly the ground consistency after heavy rainfall;
- Take advantage and make good use of temporary stoppages to carry out all the routine checks of the rig and eventually any extra interventions.

### **8.2 DISPOSAL**

Since the rig disposal will happen a very long time after the first use of the rig, it's possible that during this time the legislation that governs these operations will have changed.

It is therefore necessary to find out this information and follow the latest procedures stated regarding the salvaging and disposal of the various parts.

All the materials must be salvaged and disposed of in conformity with the current laws ruling at the moment of disposing the rig.



The operations of disposal of the rig must be carried out only by authorised experts in this activity and who are aware of the current rules and regulations of such an operation.

In general, in order to dispose of a rig, the following must be carried out:

- Take the rig to a suitable place in order to disassemble the parts and be well equipped with containers to collect oil or fluids present within the machine;
- Empty the fuel tank and collect the contents without spilling anything and polluting the environment;
- Empty the oil tank and collect the contents without spilling anything and polluting the environment;
- Drain the oil and grease from the reducers;
- Proceed to disassemble the machine using the appropriate lifting devices;
- Separate the metal parts that can be recycled (e.g. undercarriage and drilling tools) and glass (e.g. cabin glass) from the plastic parts or plastic/metal parts (e.g. seals, flexible tubes, etc.).

IMT is at your service to provide detailed instructions regarding the operations to be carried out for disassembly of various machine parts and advice on the best techniques to be adopted according to the means at your disposal.

## 9. MAINTENANCE

The proper working and high performance in time depend on heeding to the information contained in this chapter, as well as the main essentials required to maintain the safety and efficiency of the machine.



**A careful and regular maintenance keeps the value of your investment**



**Neglecting the maintenance standards may eventually lead to hazards as the rig could end up in conditions different from what it has been designed for.**

### 9.1 GENERAL RULES

The information contained in this section are addressed to the person in charge of the machine and to all those people who will be employed in the works of repairs and maintenance, as well as the operator.

- Do not allow non-authorized people to repair or carry out interventions on the rig;
- Do not lubricate, repair, or set the machine with the diesel engine running unless absolutely required due to the nature of the intervention;
- Bring the rig to a standstill and rest the mast base on the ground, or if required by the nature of the intervention, completely lower the mast.
- **Avoid environmental pollution. Fluids, oils, and filtered elements (classed as harmful waste) must be disposed of according to the procedures dictated by Law (in Italy the collection of used oils is free at various collection centres located in the national territory).**
- Respect the procedures and information given regarding maintenance;
- Do not use the controls or flexible tubes as grips as these components are mobile and do not give firm holds;
- Do not carry out any maintenance on the rig with a person occupying the control cabin seat, unless they are specifically required to cooperate in the maintenance job;
- When maintenance has to be carried out inside open bonnets, remove the keys from the panel;
- Before starting up the rig or activating the tools, signal the move with an acoustic sound device. Lift and move the equipment slowly.
- The components must be handled with care avoiding catching hands or fingers in the cracks or moving parts;
- Never align holes or slots using your hands; always use the appropriate tools;
- Eliminate every trace of sharp edges and clippings from the replaced parts;
- When the maintenance operation requires access to drilling rig parts that are not able to be reached from the ground, use the appropriate equipment in conformity with safety regulations against personal injury;.
- When maintenance operations have to be carried out that are not indicated in this manual do not hesitate to contact the IMT Technical After Sales Service which will immediately give you helpful advice on the best methods to follow;
- Disconnect the batteries before any kind of intervention, or before carrying out electrical soldering on the machine structure;
- Do not check or fill up the fuel and hydraulic oil tanks or batteries, etc. while smoking or in the vicinity of a naked flame;

- Avoid the accumulation of dirt on the air grills and do not allow the accumulation of foreign bodies (leaves, paper, bags, etc.) on the machine (risk of fire);
- In case of need, use only auxiliary supply sources of electrical current that is earthed;
- If you have to lift or transport heavy parts, use hoists or similar devices of suitable capacity.
- Check that the harness is suitable for the load to be lifted and fitted correctly;
- During lifting, take care that of workers in the vicinity;
- When using compressed air for cleaning, use protective eye goggles with lateral guards  
Keep the pressure under 2 Bar (100 KPa);
- Do not carry out any modification unless authorized in writing by IMT to the tools or components of the drilling rig;
- In the event of repairs outside the warehouse, position the drilling rig on flat ground and block its movements. If the repairs have to be carried out on a slope, block all movements of the machine and its tools. Move it to flat ground as soon as possible;
- The place where the maintenance and repairs are carried out must be kept clean and dry. Do not accumulate dirty or greasy oil rags in the vicinity as they constitute a fire risk. Throw them into a closed metal container;
- Before beginning maintenance, bring the tool to rest on the ground and leave it securely positioned;
- The machine is activated by a high pressure hydraulic installation; oil leakages that come into contact with skin could penetrate skin layers and cause serious lesions (in the event of an accident, immediately request the aid of a doctor);
- Liquids are present on the machine (hydraulic fluid and cooling water) and main components (engine, exhaust, hydraulic pump, etc.) that can reach high temperature levels during operation; take great care while carrying out maintenance operations avoiding any direct contact (risk of burning);
- Take care of moving parts on the machine;
- Before checking the hydraulic installation release the pressure in the system and tank that are normally under pressure.

**(Rotary Oil level)**



**Figure 28**

**(Reduction gear oil)**



**Figure 29**

## 9.2 MAINTENANCE PROGRAM

For basic machine maintenance, follow the instructions given in the “Operation and Maintenance Manual” of the crawler excavator CAT320B (SEBU 7021-01 Feb. 98).

(Livello olio riduttori Rotary)

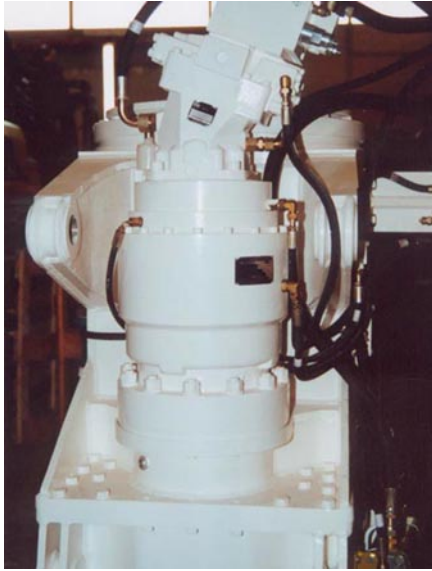


Figure 30

(Snodo girevole)

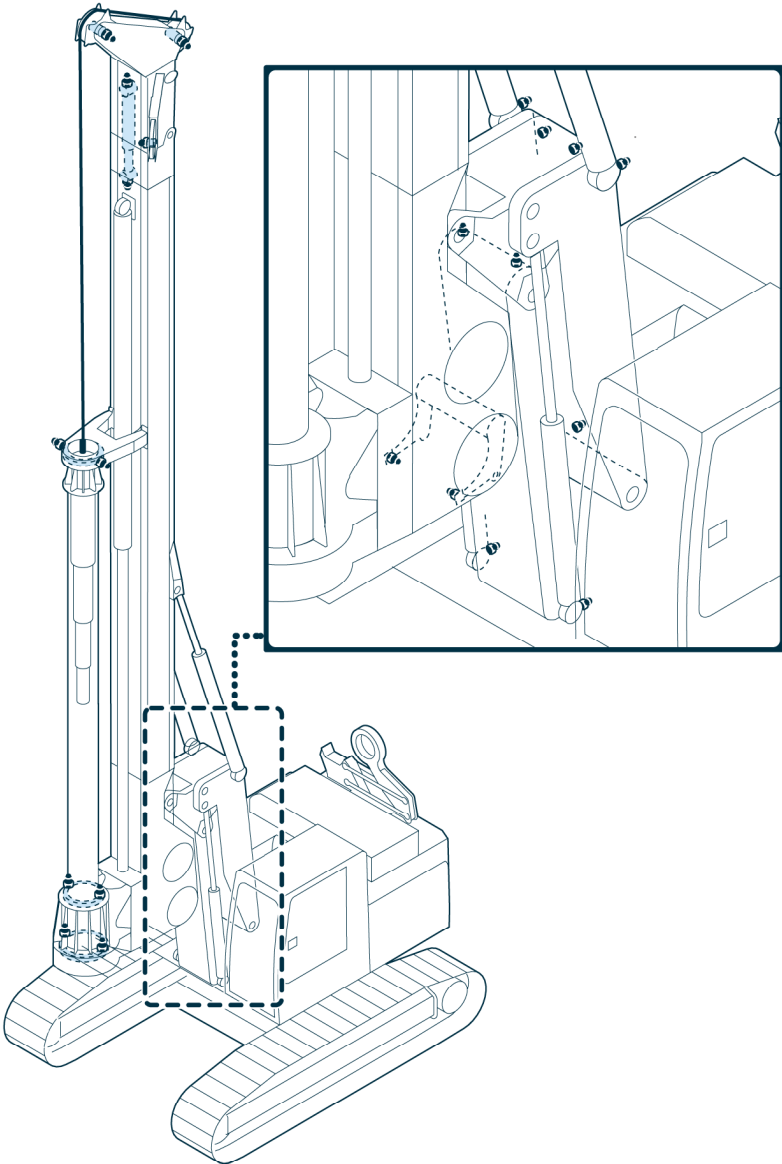


Figure 31



9.3 GREASING POINTS

Figure 32



## 9.5 LUBRICATION

POS.	LUBRICATION	SPECIFICATIONS	FIRST SUPPLY	CHECKING	REPL.
1	Hydraulic system	See manual Cat	SAE 10/20W AGIP		
2	Upper Rotary bearing	API GL-5 (MIL-L-21058)	SAE 90 AGIP ROTRAMP	50	2000
3	Rotary gears	API GL-5 (MIL-L-21058)	SAE 90 AGIP ROTRAMP	50	2000
4	Rotary gear box	API GL-5 (MIL-L-21058)	SAE 90 AGIP ROTRAMP	250	2000
5	Winch gear box	API GL-5 (MIL-L-21058)	SAE 90 AGIP ROTRAMP	500	2000
6	Upper Rotary bearing	DIN 5150 KPF 24-30	WHITESTAR "NILS"	50	
7	Kelly bar guide bearing	DIN 5150 KPF 24-30	WHITESTAR "NILS"	50	
8	Swivel joint	DIN 5150 KPF 24-30	WHITESTAR "NILS"	50	
9	Pins	DIN 5150 KPF 24-30	WHITESTAR "NILS"	50	
10	Mast guide	FETT	AGIP GR SM	50	
11	Main winch rope	26x90 DX $\sigma \geq 220$	DRL 508 AR	10	
12	Auxiliary winch rope	18x85 $\sigma \geq 140$	DRL 508	10	
13	Gear washing filter	$\geq 10$		50	


## 9.6 CABLE ROPE MAINTENANCE

The cable rope maintenance must be carried out with variable frequency according to the type of drilling the machine is carrying out, e.g. auger drilling, bucket drilling, continuous flight auger, etc. Indeed every working technique accompanies particular use of the cable rope that otherwise may lead to damage or fast wear and tear.

In the event of drilling with an auger: when operating the fast unloading of rubble, the piece of cable rope between the swivel joint of the kelly and the pulley is subject twisting; in order to avoid premature wear and tear, grease daily the 5 mt. piece of cable rope that leads out from the kelly attachment and often check the good working of the swivel joint.

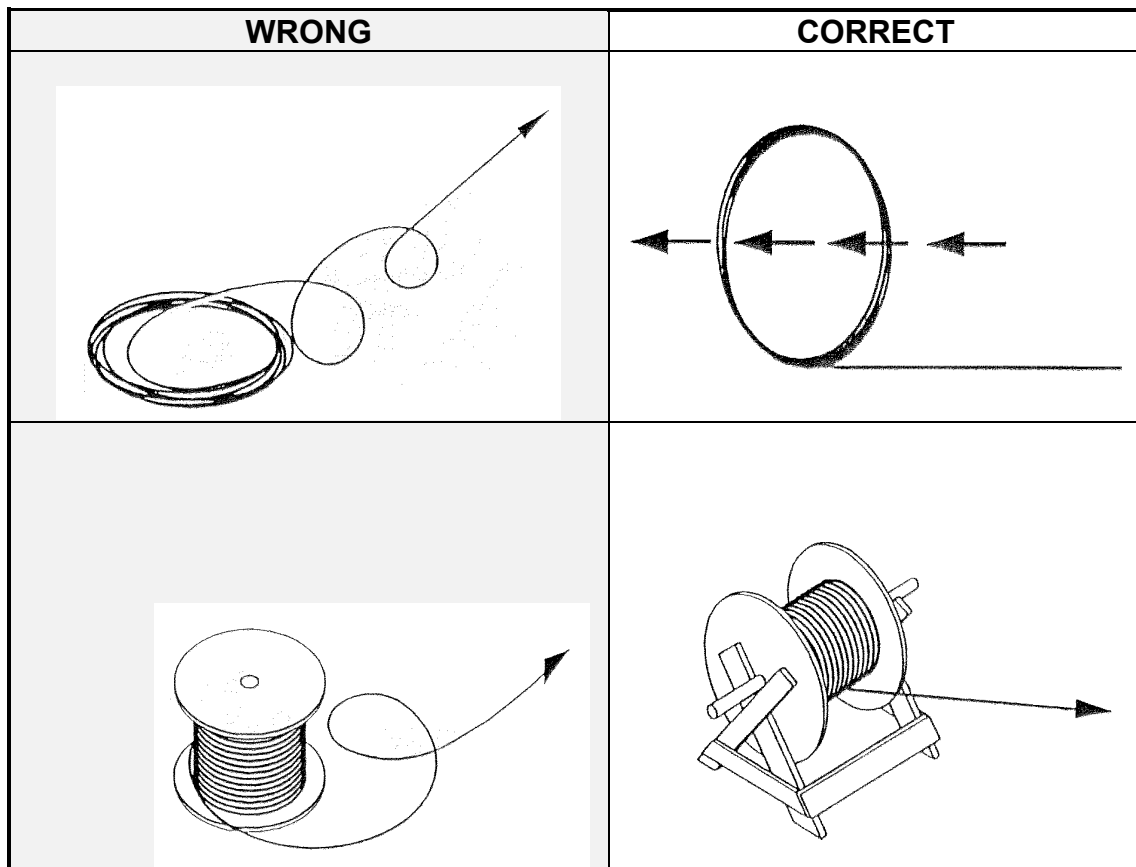
In the event of drilling with a bucket: when the opening of the bucket is carried out without due care and the an excessive pull is used to open the bucket, the strain is concentrated on a precise piece of the cable rope and therefore it is recommended that the 10 mt. of rope coming out of the kelly attachment are greased daily.

The lifespan of a cable rope can be shortened by improper or lack of maintenance, especially when working in corrosive environments.

	<p>During the checking and replacement of cable ropes always wear protective gloves</p>
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### 9.6.1 MOUNTING THE CABLE ROPES

When the cable rope is unwound from a roller and wound onto the winch drum, great care must be taken to avoid missing a turn, because this could lead to twisting, knotting and bending.



## 9.6.2 CABLE ROPE DAMAGE

Damage to the cable rope may happen in two ways:

- breaking of wires;
- deformations.

Both of these cases must be evaluated and checked according to the following instructions in order to establish whether the cable rope is still in safe conditions or whether it must be replaced.

### 9.6.2.1 *Criteria for substituting cable rope*

The operational safety of a cable rope is guaranteed by the proper evaluation of the following:

- Nature and number of wires broken;
- Breakage of metal wires near terminal ends;
- Localized grouping of thread breakage;
- Increased rhythm of wires broken;
- Strand breakage;
- Reduction of cable rope diameter;
- Reduction in elasticity;
- External and internal wear and tear;
- External and internal corrosion;
- Deformation;
- Deterioration due to heat or voltaic arc;
- Increased rhythm of permanent stretching.



Normally cable rope deterioration is due to a combination of more than one factor. It is essential that the examination of wear and tear is carried out by experts  
Do not hesitate to contact expert personnel in the event of serious doubts!

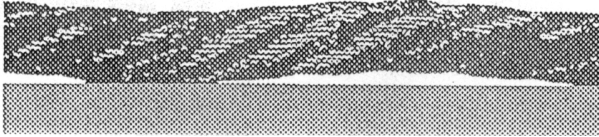
### 9.6.2.2 *Damage due to wires breaking*

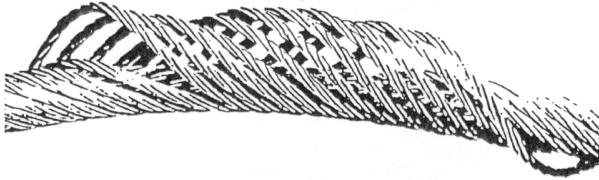
In the event of broken wires being visible on the rope surface, check the entire rope according to the following procedure:

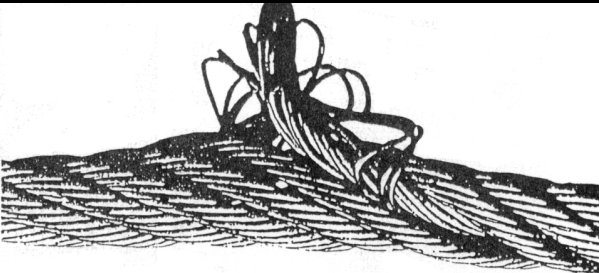
1. Take a piece of cable rope that is 6 times the diameter of the rope (e.g. cable rope with diameter 26 mm,  $6 \times 26 = 156$  mm).
2. Count the number of broken wires visible on the surface of the rope, taking every time a piece of rope that is 6 times the diameter;
3. If the number of broken wires is lower than the maximum recommended limit, the rope is alright;
4. If there is a piece of rope where the number of broken wires is greater than the maximum limit allowed then proceed to carry out the following test:
  - Take a test piece of cable rope 30 times the size of the diameter (e.g. of a cable rope of 26,  $30 \times 26 = 780$  mm)
  - Count the number of broken wires each time examining a length that is 30 times the diameter;
  - If the number of broken wires is lower than the maximum limit allowed, the rope is alright;
  - If there is a piece of the cable rope in which the number of broken threads is greater than what is recommended, then immediately replace the cable rope.

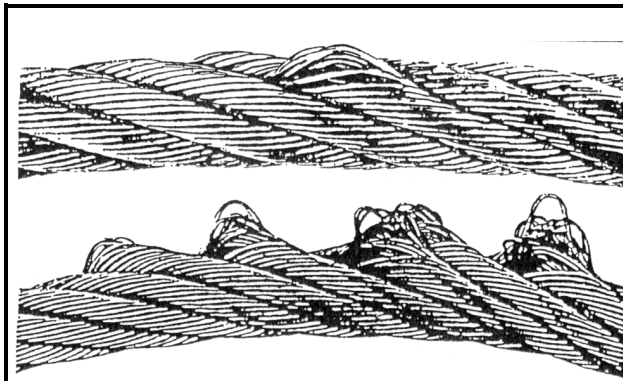
Number of wires N	Rope type	Maximum Broken wires in the cable part	Maximum Broken wires in the cable part
		6 d	30 d
da 141 a 160	crociata	6	13
da 161 a 180	crociata	7	14
da 181 a 200	crociata	8	16
da 201 a 220	crociata	8	18
da 221 a 240	crociata	10	19

### 9.6.2.3 *Damage due to deformation*

	<p><b>Rope with a spiral type deformation</b>                  This kind of deformation is when the longitudinal axis of the rope resembles a spiral. Even though this kind of deformation does not necessarily signify a lowering in the rope resistance, when the deformation reaches a certain body, it can transmit vibrations that may lead to an anomalous control of the rope, and in the long run may lead to wear and tear and damage to wires.  <u>Substitute when <math>d &gt; D/3</math></u></p>
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	<p><b>Rope with grommet deformation</b>                  This deformation happens when the wires of an external layer or strands are longer than the internal ones and poke out. This condition may happen after a sudden tear in the rope at rest.  <u>Immediately replace.</u></p>
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	<p><b>Strands sticking out</b>                  This kind of damage is generally associated with grommet deformation when the imbalance of the rope is shown by the core stramazione a canestro quando lo sticking out.  <u>Immediately replace.</u></p>
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**Espulsione dei fili**

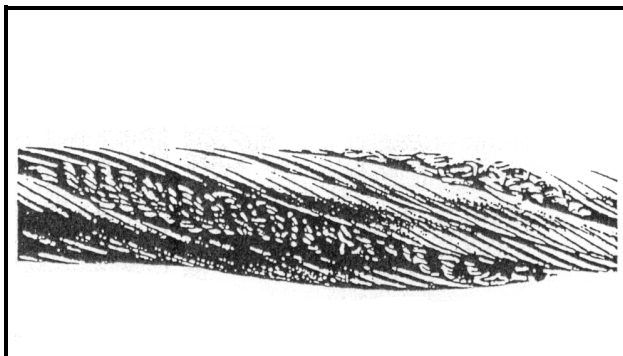
This damage is generally associated with the sudden application of a load on the rope.

Top Figure: Slight damage

keep the cable rope under tight control

Bottom Figure: serious damage

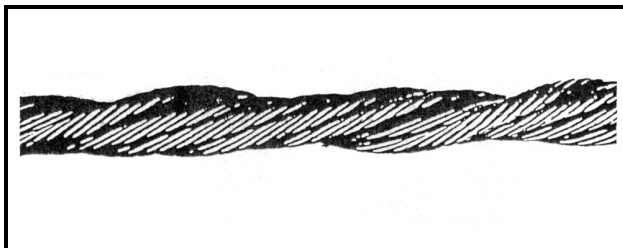
Immediately replace



**Localized increase of diameter**

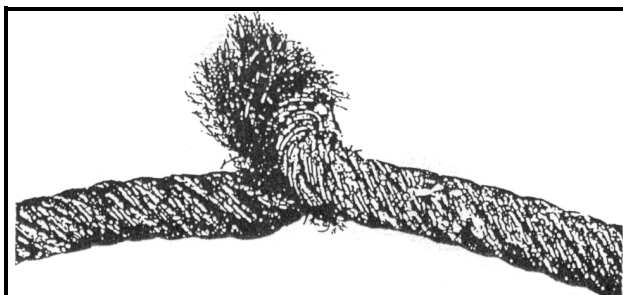
In particular conditions the core of the rope may swell up in localized or extensive areas. The result of this deformation is an imbalance in the external strands that take on an incorrect direction.

In the event of excessive swelling replace the cable rope.



**Localized reduction in the cable rope diameter**

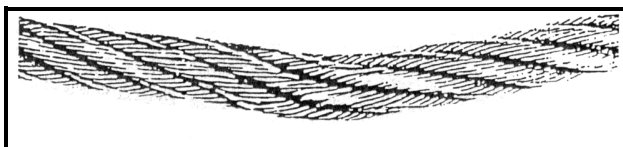
This deformation is associated with the breakage of the core centre. Immediately check the points nearest to the attachments and substitute in the event of serious deformation (see figure on left).



**Twisting and core strands on the surface**

This deformation happens when the rope remains tightened without the possibility of rotating.

Replace immediately



**Bends**

The bends are corner deviations of the rope caused by external actions.

Replace immediately

## 10. TESTS - INSPECTIONS - CHECKS

MAINTENANCE SUMMARY		
Frequency	Intervention	Description
At the beginning of every work shift	<b>Check</b>	that there are no oil leakages and always eliminate them before beginning work (this means you will avoid future and more serious damage).
	<b>Check</b>	that the screws and spacers that keep the cables on the mast head in their seating are properly positioned.
At the end of every shift	<b>Grease</b>	Swivel joint
Every day	<b>Check</b>	The state of pins and fixing devices and particularly the mobile ones
Every two days	<b>Grease</b>	the greasing points, including the rotary sliding guides, the kelly bar guides and all the slewing rings
Every week	<b>Check</b>	the state of the kelly bars, keeping them as clean as possible and oiling them internally to improve their sliding ease. (in the event of using bentonite mud, clean the kelly bar inside too, pouring water down from the top: this operation should be done at the end of the work shift).
	<b>Check</b>	Winch ropes and replace as soon as defects are spotted (wires sticking out, thinn wires, bends, etc.).
	<b>Check</b>	Pulleys (pins, bearings, grooves), replace if they are defective or worn (the pulleys must turn easily by hand any noises or vibrations during the rotation mean the bearings are damaged; the groove of the must not be assymetrical; a worn pulley considerably reduces the rope's lifespan therefore it is better to replace it as soon as possible).
	<b>Check</b>	all the oil levels of the following reducers: <ul style="list-style-type: none"> <li>• Rotary reducer;</li> <li>• Rotary box reducer (B);</li> </ul>

MAINTENANCE SUMMARY		
Frequency	Intervention	Description
		<ul style="list-style-type: none"> <li>• Main winch reducer;</li> <li>• Auxiliary winch reducer.</li> </ul>
Every week	<b>Check</b>	the play of the anti-friction shoes located on the rotary slider guides and kelly bar guides; if the play is greater than 2 mm, even if only on one side, regulate the play by regulating the regulatory screws and blocking bolts (C) (check that the operation carried out on the rotary slider is still aligned with the pull-down cylinder).
	<b>Check and grease</b>	Swivel joint of the kelly bar. The two ends must be able to rotate and must not have oil or grease leakages
	<b>Check</b>	Head flange of kelly bar (that, if broken at the welding point, are to be repaired immediately).
	<b>Check</b>	all the nuts and bolts of the rig especially if the rig is working in a corrosive environment (near the sea or salty water) or is subject to vibrations (core drilling or rock drilling)
	<b>Check</b>	Shock Absorbers
Every month	<b>Check</b>	Wear of kelly bar teeth



The frequency of checks mentioned above are calculated on the basis of one day shift of 8 hours work and in the event of a greater work load, increase proportionally the frequency of the interventions.



