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OPERATION & SAFETY RULES (Luffing/Jib Cranes)

- Every day before commencing work, all operations, braking functions, stop switches and other safety devices should be tested with care.
- The crane must be operated correctly to avoid damage or accident.
- If the crane for some unknown reason does not obey the controllers, operate the emergency stop button which will cut all power and activate the brakes.
- **NEVER** alter the setting of safety equipment.
- Faults in the electr. power or control systems must be corrected by professional personnel.
- The crane itself, wire slings and other lifting gear should be inspected frequently by the crane operator.
- Never allow anyone to climb up the mast when the crane is in service. Be sure that all personnel are clear of the crane and mast before starting work.
- Always know the weight of any load lifted. Do not use the load devices as "scales" or limit switches as stops. These device are safety devices only and not working parts of the crane mechanism. **THEY ONLY FUNCTION FOR POOR OPERATION.**
- Before lifting a load, be sure it is slung correctly and is not "stuck" to concrete, clay, ice, etc. Remove any obstacles before hoisting a load.
- The hook must not be lowered onto the ground, allowing the hoist rope to become slack. If this occurs, care must be taken that it is recoiled evenly and tautly on the drum.
- Always position the hook directly over the load to be lifted in order to avoid unequal stresses in the crane structure. Never pull loads up on the skew. Before lifting a load, tighten the hoist rope on min. speed.
- If the power supply is cut or the crane does not obey the controllers, a suspended load can be lowered (with care) by operating the brake manually.

OPERATION

- The operator shall always stop the luffing motion before it fouls the travel limit stops fitted at either end of the travel distance. Load swings are "caught" by operating the luffing motion in the same direction as the swing. When the load or moment devices are operated, the luffing-out motion is cut off. If a heavy load is lifted on a shot jib radius, the luffing-out motion will automatically be cut off in accordance with the load diagram on the specification sheet.
- If a collector ring is not fitted, the electr. cables between the stationary and moving structure can be twisted and damaged if the crane is slewed more than 3 or 4 turns in any one direction without reversing to "unwind" the twist in the cables.
- The crane must not be operated when wind velocity repeatedly exceeds 20 m/s, but irrespective of this max. limit, operation must be discontinued
 - if the load because of its shape or size cannot be landed safely, and
 - if it is difficult to slew the jib up against the prevailing wind (risk of overloading the slewing motor).
- When the crane is left unattended, lock the master switch and remove the key.
- When the crane is out of service, the brake on the slewing machinery must be released to allow the jib to weather-vane. The hook must be hoisted to its top position and the jib luffed into its recommended parking position (see separate instruction).
- When a rail-mounted crane is left unattended, it must be secured to the track by rail clamps to prevent drifting.

These rules are designed to promote safety, and do not purport to be all-inclusive or to supplant or replace other additional Safety Rules or precautionary measures. They are not intended to conflict with or supersede any requirements of law or of governmental regulations, codes and ordinances; reference to such specific provisions must be made by the user.

GENERAL - (Luffing/Jib Cranes)

BEFORE STARTING WORK

- Adjust seat to comfortable operating position.
- Adjust controllers to comfortable position.
- Adjust heating/ventilation.
- Check window wipers, lights, etc.
- Windows should be clean.
- Check communication to ground.
- Report any defects which may impair good operation.

SHUTDOWN

In the operation-shutdown position:

- The jib is at the inner parking position.
- The hook is at max. height position.
- The slewing brake is released.
- The machinery is switched off and the key removed.

All operating instructions begin from

OPERATION SHUTDOWN

The crane should always be left as shown at the end of a work shift, if there is no immediate shift change-over.

NOTE!

RAIL-MOUNTED CRANES

Rail-mounted cranes should always be left at determined parking positions with ground anchors (shoot bolts or shackles, etc.).

Before starting work the ground anchors should be released.

Shutdown - When the crane is left the ground anchors should be re-engaged.

CONTROL SYSTEM

PRINCIPLE OF OPERATION

JOYSTICK CONTROLLERS

Move the joystick controllers smoothly. On release they will return to the neutral position.

The control system for hoist/trolley/slewing motions is stepless. The electronic circuits will adjust the speed range in accordance with the position of the joysticks.

The trolley/slewing joysticks may be moved into an angular position, enabling both motions to be carried out at the same time.

RED EMERGENCY BUTTON (7)

On depressing, all motions will stop and the brakes will be applied. **THIS IS NOT A PANIC BUTTON - THINK FIRST AND FAST!** If the load is lowering at creeping speed and the icon for the hoist brake is lit green **DO NOT PRESS THE EMERGENCY STOP BUTTON!** (This is happening because the brake is slipping. **UNLOAD HOOK IMMEDIATELY!** see the section "Prevention of free fall due to hoist brake failure").

CONTROL RESTRICTIONS

When the joystick controllers are moved, the following restrictions under normal operation will be noted:

JOYSTICK CONTROLLER (1-2 & 3-4)

Hoist motion (1-2): Automatic reduction of speed, height and depth stop.

- * Load cannot be lifted with overload.
- * Load cannot be lifted with 100% moment.

Travel motion (3-4): Automatic stop each end.

JOYSTICK CONTROLLER (A-B & C-D)

Trolley motion (A-B): Automatic reduction of speed and stop each end.

Trolley motion out is stopped with 100% moment.

Max. trolley speed out is reduced to 10% with 90% moment.

Slewing motion (C-D): There are no restrictions on the slewing motion.

NOTE: A number of other restrictions are also applicable, see the Event Indication List.

RIGHT-HAND CONTROLLER

JOYSTICK CONTROLLER (1-2 & 3-4) : - Control of hoist winch and crane travel motion.

Movement forwards : - Hook block will lower (1)

Movement backwards : - Hook block will rise (2)

Movement to direction 1 : - Crane will travel to direction 1 (3))*

Movement to direction 2 : - Crane will travel to direction 2 (4))*

* Only applicable to rail mounted cranes.

PUSH BUTTON (5) : - Press: warning horn is activated.

KEY SWITCH (6) : - ON/OFF-switch for the crane electr. circuits. Turn to energize the motion circuits for hoist, slewing, trolley and bogies.

EMERGENCY BUTTON (7) : - Emergency stop switch. All motions will stop and the brakes will automatically be applied.

ENGAGE BUTTON (8) : - Push button for engagement of main relays and the green start lamp in the operator display. If all winches work properly the lamp is on constantly. If one of the winches is not in operation the lamp is flashing.

LEFT-HAND CONTROLLER

JOYSTICK CONTROLLER (A-B & C-D) : - Control of trolley winch and slewing motion.

Movement forwards : - Trolley travels out (B)

Movement backwards : - Trolley travels in (A)

Movement to the left : - Slewing counter-clockwise (C)

Movement to the right : - Slewing clockwise (D)

PUSH BUTTON (E) : - Press: slewing brakes will be applied if speed is close to zero.

MOTION-FITTED LIMIT SWITCHES
HOISTING & TROLLEY MOTIONS
Illustration
HOISTING
TROLLEYING

- stop	- stop
- max 10% speed	- max 10% speed
	- max 10% speed
- stop	- stop

CRANE TRAVEL (if applicable)
Illustration

- stop with deceleration time
- stop with deceleration time

DESCRIPTION OF CONTROL SYSTEM

HOIST WINCH - R.H. controller (1-2)

Hoist: - Movement is centre backwards (1)

Lower: - Movement is centre forwards (2)

TRAVEL MACHINERY - R.H. controller (only rail mounted cranes)

Travel to direction 1: - Movement is centre to position "Direction 1" (3)

Travel to direction 2: - Movement is centre to position "Direction 2" (4)

TROLLEY WINCH - L.H. controller (A-B)

Out: - Movement is centre forwards (B)

In: - Movement is centre backwards (A)

SLEWING MACHINERY - L.H. controller (C-D)

Slewing clockwise: - Movement is centre to right (D)

Slewing counter-clockwise: - Movement is centre to left (C)

THE JOYSTICK CONTROLLERS ARE SPRING LOADED AND WILL RETURN TO THE NEUTRAL POSITION ON RELEASE.

THE RED EMERGENCY STOP BUTTON IS POSITIONED ON THE R.H. CONTROLLER.

* Depressing this button will immediately apply the brakes to all operations

USE ONLY IN AN ABSOLUTE EMERGENCY!

* After use the hoist brake and all the control operations of the crane must be checked before resuming normal work.

IF ANY FORM OF SHOCK-LOADING HAS TAKEN PLACE, THE CRANE MUST BE CHECK-TEST LOADED.

TO START

- * Lift the red emergency stop button (if depressed).
- * Insert the key (R.H. control - pos. 6) and turn it clockwise)
- * Press the engage button (R.H. control - pos. 8). The green start lamp in the monitor display will be ON constantly if all drives are started up. If one or more drive does not start up the lamp will flash.

THE CRANE IS NOW READY FOR USE. ALL MOVEMENTS OF THE JOYSTICKS SHOULD BE MADE AS STEADY AND PRECISE OPERATIONS.

HOIST WINCH OPERATION

The speed range of the winch is stepless in that the electronic circuits will adjust the speed according to the position of the joystick.

- * When the joystick is moved out from the neutral position, the brake is freed and the hoist winch is in operation. The lamp for "Hoist brake free" on the monitor display panel will be on.
- * Return to the neutral position will stop the winch and apply the brake. The brake lamp will come off.

COUPLED SAFETY DEVICES TO HOIST WINCH

Emergency Stop Button - as described.

Depth Stop

The depth stop is fitted with 1 contact.

- * One contact is set so that - when activated - the winch will stop with the brake on and a min. of 3 turns of the hoist rope remaining on the drum.

Height Stop

The height stop is fitted with 2 contacts:

- * One contact is set so that - when activated - at a determined height the hoisting speed in use is reduced to max. 10% for the remaining distance.
- * One contact is set so that - when activated - at a determined distance between trolley and hook block the brake is applied and the winch stopped.

By pressing the hoist override push button (14) in the operator display the hook block may be moved past the height limit for changing over wire parts, see page 1.7.

Overspeed surveillance

The overspeed supervision is totally independent of the DC-thyristor converter. The overspeed supervision consists of a counter on the hoist drum. The counter is connected to a counter relay in the electrical panel. If the drum speed exceeds 110% of maximum speed, the counter relay will cut out the main contactor of the winch and thereby immediately apply the brakes.

Prevention of free fall due to hoist brake failure.

The hoist speed is continuously monitored via the encoder. So if the hoist brake should slip (i.e. bad maintenance of brake and brake lining) the DC converter will start up automatically and catch, then slowly lower the load until the crane driver takes control of the hoist via the joystick and puts the load on the ground. This function will prevent a load from free falling to the ground and most importantly prevent a person on the ground from being injured or even killed.

There is no alarm for this in the display so if the crane driver is not operating the hoist joystick, the load is lowering at creeping speed and the icon for the hoist brake is lit green (screen pos. 13) then the brake cannot hold the load on the hook. **IMPORTANT: DO NOT PRESS THE EMERGENCY STOP BUTTON OR THE HOOK WILL FALL TO THE GROUND!!** Instead the crane driver must take over the control of the winch via the joystick and lower the load to the ground and inspect the hoist brake immediately.

NOTE: This function is only functional when the crane is started up via the key switch, the engage button has been pressed and the main contactor and circuits for the hoist are engaged and operational.

Moment Device

- * A yellow warning lamp in the monitor display indicates that the winch is lifting 90% of the allowed load.
- * A red warning lamp in the monitor display indicates that the winch is lifting 100% of the allowed load.
- * The winch will stop and the brake be applied on 100% allowed load. The hoisting and trolley-out motions are stopped.

Overload Device

- * A yellow warning lamp in the monitor display indicates that the winch is lifting 90% of the max. load.
- * A red warning lamp in the monitor display indicates that the winch is lifting 100% of the max. load.
- * The hoist winch will stop and the brake be applied on 100% max. load. The hoisting motion is stopped.

TRAVEL OPERATION

The speed range of the drive is stepless the electronic circuit will adjust the speed according to the position of the joystick.

- * When the joystick is moved out from the neutral position, the brakes are freed and the travel machinery is in operation.
- * Return to the neutral position will stop the travel machinery and apply the brakes.

COUPLED SAFETY DEVICES TO TRAVEL MACHINERY

Travel Limit Switches

One of the bogies are fitted with a switch which operates as follows:

- * At a determined distance from the rail buffers the travel movement is automatically decelerated to stand still and the travel machinery is stopped.
- * A bell will ring constantly when the crane is travelling.

TROLLEY OPERATION

The speed range of the trolley winch is stepless, i.e. the speed will be adjusted according to the position of the joystick controller.

- * When the joystick is moved out from the neutral position, the brake is freed. The lamp for "trolley brake free" on the monitor display panel will be on.
- * Return to the neutral position will stop the trolley winch and apply the brake. The lamp for "trolley brake free" will come off.

COUPLED SAFETY DEVICES TO TROLLEY WINCH

End Stops

The trolley winch is fitted with a switch which operates as follows:

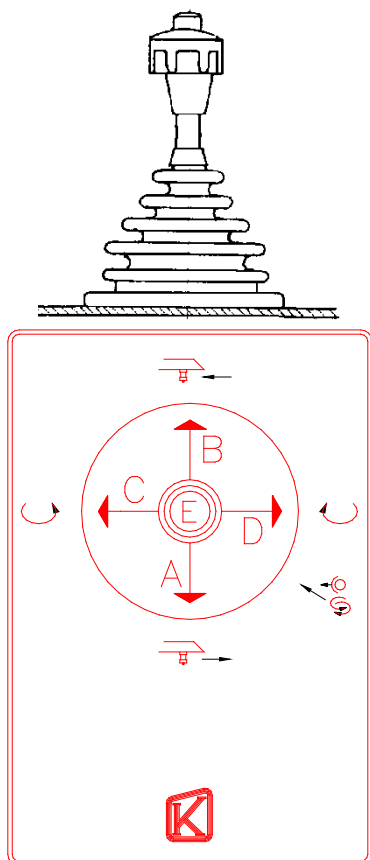
- * At a determined distance from either end of the trolley rail the trolley movement is first automatically reduced to max. 10% and then the trolley winch is stopped.

NOTE: - The trolley-out movement will also be stopped by the moment devices!

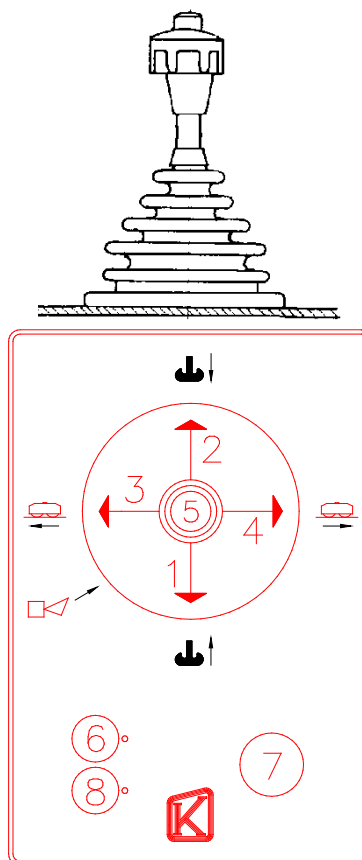
SLEWING OPERATION

The speed range of the slewing machinery is stepless, i.e. the speed will be adjusted to the position of the joystick controller. The operator should "feel" the joystick controller position in relation to the slewing motion.

- * When the joystick is moved out from the neutral position, the slewing brakes are freed and the jib can be slewed. The slewing brake free lamp on the operator display panel will be on.
- * Return to the neutral position will stop the slewing machinery. When the slewing speed is close to zero the brakes can be applied by pressing the joystick push-button (E). If this button is not pressed the brakes will be applied approx. 5 secs. after the slewing machinery has stopped. The slewing brake lamp will come off when the brakes are applied.

CONTROLLER LAYOUT

L.H. CONTROLLER

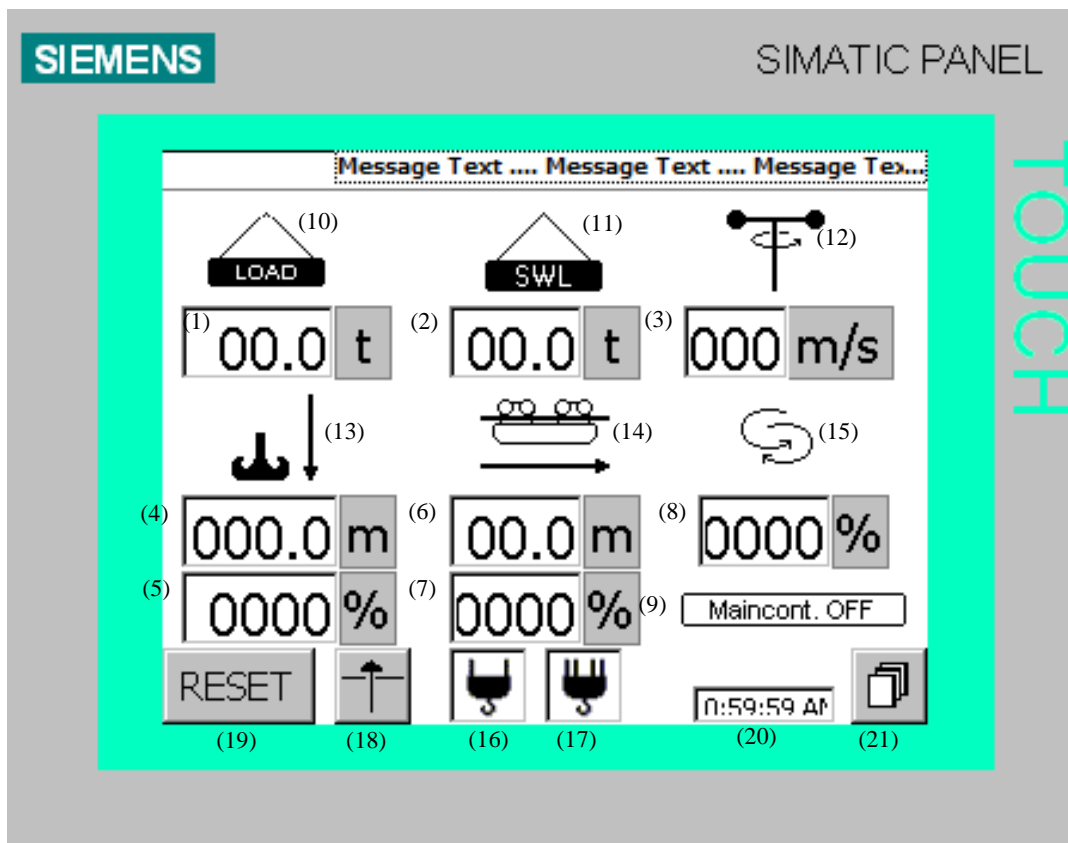
- A-B Joystick
TROLLEY IN/OUT**
- C-D Joystick
SLEWING RIGHT/LEFT**
- E Push button
SLEWING BRAKES**


R.H. CONTROLLER

- 1-2 Joystick
HOISTING/LOWERING**
- 3-4 Joystick *)
TRAVEL DIRECTION I & II**
- 5 Push button
HORN**
- 6 Key switch
ON/OFF**
- 7 EMERGENCY STOP BUTTON**
- 8 Push button
MAIN RELAYS ENGAGE**

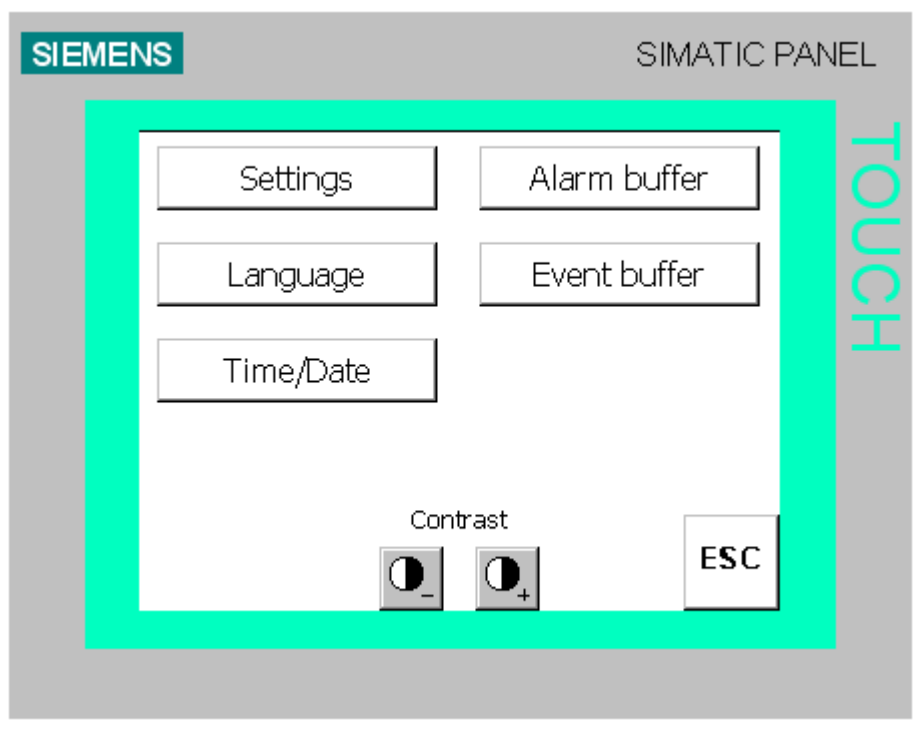
*) Only applicable to travelling cranes

OPERATOR SCREENS



Status screen

- (1) Indication of hook load [tons]
 - (2) Indication of Safe Working Load [tons]
 - (3) Indication of wind speed [m/sec]
 - (4) Indication of hook height [m] (can be zero adjusted at any position)
 - (5) Indication of hook speed [%]
 - (6) Indication of hook radius [m]
 - (7) Indication of trolley speed [%]
 - (8) Indication of slew speed [%]
 - (9) Main contactor ON/OFF, Green lamp
 - (10)+(11) Load alarm lamp
 - 90% load/SWL, Yellow lamp
 - 103% load/SWL, Red lamp
 - (12) Wind speed alarm
 - 15 m/s, Red lamp
 - (13) Hoist brake open, Green lamp
 - (14) Trolley brake open, Green lamp
 - (15) Slew brake open, Green lamp
 - (16) 2-fall selected, Green lamp
 - (17) 4-fall selected, Green lamp
 - (18) Override button
 - (19) RESET push button
 - (20) Clock
 - (21) Change page push button, to Select screen
- (Message text): E.g. height limit active, 90% load etc



- Settings:** To Settings screen, Password protected
- Time/Date:** To Time/Date screen for time and date setting
- Language:** For selection of language if more than one language is downloaded
- Alarm buffer:** To alarm buffer screen, data logging of alarms
- Event buffer:** To event buffer screen, date logging of messages from Status screen
- Contrast:** Contrast setting of display
- ESC:** Escape push button, back to Status screen

OPERATOR CABIN

Safety regulation.

- It is the duty of the operator to ensure that the cabin is kept clean and that all fittings (light, fire extinguisher) are in working order.
- A crane log book should be kept recording work hours, maintenance, stoppages, lubrication checks carried out, **AND DEFECTS REPORTED** and the person or department they were reported to.

ELECTRICAL PANEL ROOM

- The electrical control panels and electronic equipment are built into insulated rooms (cabin). They are fitted with a heater, air-condition and thermostats.
- These rooms are not storage areas for spare parts, bolts, oil, grease etc. There is no necessity for any personnel having access to these rooms, except for electrical maintenance staff. They must be kept locked.

BRAKES, PHASE FALL-OUT AND INDICATORS

Brakes: Hoist, slew, trolley, travel motions.

All brakes are applied by springs and opened by hydraulic pressure or electro-magnets. In the event of any power loss, the brakes will applied.

Phase fall-out relays:

Phase fall-out relays are fitted and in the event of a fall-out of 1, 2 or 3 phases, the control system reacts in the same way as when the emergency stop button is pressed.

The system is fail safe, motor drive to all motions will stop and the brakes be immediately applied.

After the phase failure has been corrected, the green button must be activated before the crane can be operated.

Indicators:

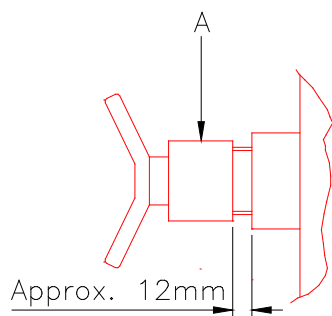
Indicators may be damaged through chocks. **Refrain from banging of any of the instruments or indicators.**

INFORM SERVICE IF ANY INDICATORS SHOWS A “SUSPECT“ READING.

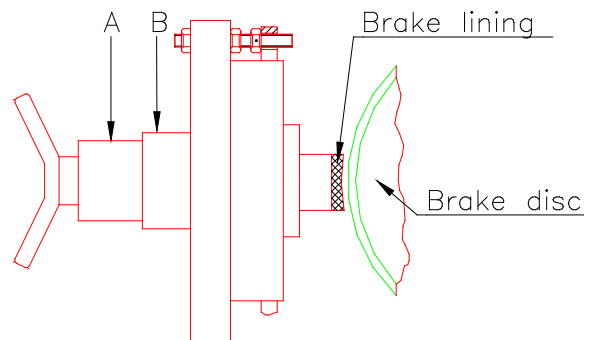
SLEWING BRAKE(S)

The slewing brake(s) is (are) used for holding the jib in position. When the crane is out of operation the slewing brake(s) must be released by screwing out the brake nut (A) to allow the jib to weathervane in the prevailing wind.

Before recommencing operation, the slewing brake(s) must be put back in the operational position by screwing the brake nut (A) in to the nuts (B).



Brake released.
Brake nut (A) screwed
out approx. 12 mm.



Brake operational.
(A) screwed in to (B).

WIND SPEED INDICATOR

The wind speed indicator is positioned on the operator's display.

**THE MAX. OPERATING WIND SPEED FOR THE CRANES IS 20 m/sec.
(= 45 mph - 39 knots).**

The indicator reads in metres per sec. (m/sec.). A damping device is fitted for gusting wind.

An event message will appear in the display at 15 m/sec.

When 18 m/sec. is reached the crane supervisor should be informed.

The crane will operate up to 20 m/sec., but for loads with a large surface area the speed should be reduced.

CHANGE-OVER OF HOIST ROPE REEVING

DESCRIPTION

The change-over system consist of a grip-arm (A) fitted on the intermediate block and a release bolt (B) fitted in the centre of the trolley. On the release bolt is fitted a secure pin which serves two purposes:

When it is placed in hole (b) the system is reeved in four parts and when placed in (a) the system is reeved in two parts and the intermediate block is parked in the hook block.

The manual change-over is carried out in the following manner:

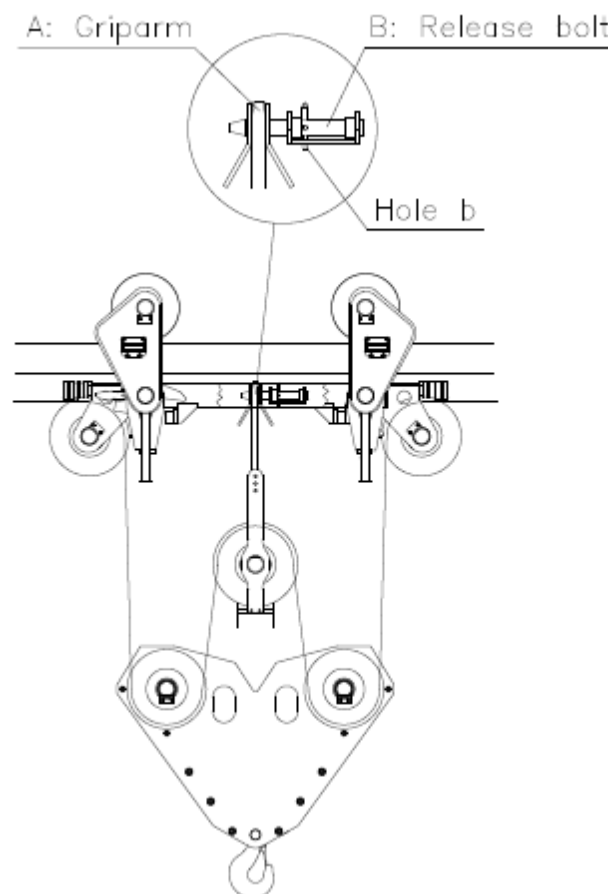
Position the trolley under the access hole in the inner jib section platform. Before the hook block by hoisting reaches the trolley the height stop will be operated and the hoist motion stopped. By pressing the hoist override push button in the operator display the hook block may then be to change-over position on min. speed. The push button should be kept pressed during this operation. When the manual change-over has taken place the hook block should be lowered until it is past the normal hoist limit point. Release push button.

Safety precautions:

- No load in the hook on change-over.
- No rotational swing of the hook assembly prior to engagement into the trolley.
- Be sure that the secure pin lock the release bolt in position (a) or (b) when change-over are finalized.

Change-over from 2 to 4 part line

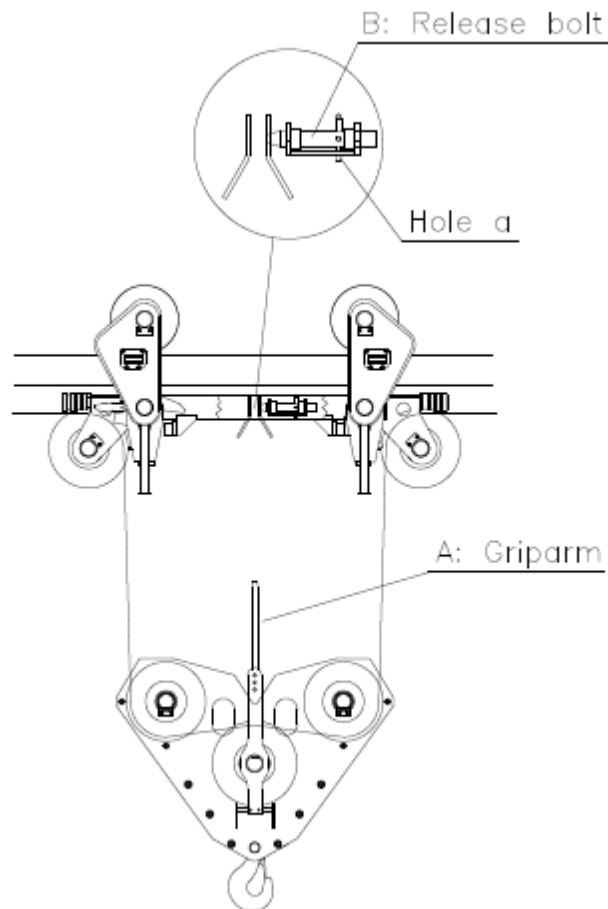
With the intermediate block parked in the hook assembly (2 part reeving) and the release bolt locked in position (b) hoist the hook block as described until the grip-arm has contact with its seat in the trolley. Push the release bolt into the grip-arm and lock the bolt with the secure pin in position a), the hook block can now be lowered in 4 part reeving. For correct load and hook height indication press the 4 part button in the operator display. The 4 part line button will light up.



Change-over from 4 to 2 part line

With the intermediate block in the trolley (4 part reeving) change over from 4 to 2 part reeving. Hoist the hook block until contact with trolley are reached. Disengage the release bolt from the grip-arm and lock it into pos. b). The hook and intermediate block can now be lowered in 2 part reeving.

For correct load and hook height indication press the 2 part button in the operator display. The 2 part line button will light up.



SLINGS

The hoist rope and its fittings are an important part of the crane equipment.

THE SLINGS BETWEEN HOOK AND LOAD ARE JUST AS IMPORTANT!

The crane operator can have from his position a better overall view of the load than ground staff have.

Inform the ground staff if slinging does not seem satisfactory before lifting a load.

All slings used should be subjected to test and inspection at set intervals.



TEST LOADING - GENERAL

(Not valid for K10.000)

Introduction

This instruction contains the recommendations of Krøll Cranes A/S.

It is the responsibility of the owner / user of the crane to comply with local laws and regulations, which may call for i.e. different periods between, or purposes for testloads.

When to test load

- When the crane is erected, and before it is put into service.
- If the crane has been subjected to any form of shock loading, i.e. a load drop due to a faulty sling, or the emergency stop have been used.
- After major repairs.
- Within one year from the last recorded test load.

Test load weights

A set of test loads should be kept on the site. These should consist of concrete blocks and steel blocks, which have been dynamometer-tested with the checked weight marked on them and the weight percentage for max. and jib tip load.

In order to cover all test loadings recommended by Krøll, the following weights should be available:

A combination to reach 110%. Supplement to reach 125%. This is for **both** maximum load **and** jib tip load.



Precautions



- Windspeed during test loading max. 8 m/sec.
- All operations during test, are to be carried out slowly and carefully, one at the time.
- Test loading should always be carried out under the direction of the crane supervisor.

Test loading

Dynamic test

110% of the nominal load is lifted 10 - 20 cm of the ground. Actuate only 1 operation at the time.

Static test

Supplement weight up to 125% of the nominal weight, is **carefully** placed on top of the load. Keep the load suspended for min. 5 minutes.

Records

Record all details of the test in the crane log book.

Always immediately inform the supervisor, and record any shock loading in the crane log book.

SHOCK LOADING

If the crane at any time is subjected to a shock load it must be inspected for damage and afterwards test loaded before putting it back into normal operation.

A shock load can be defined as a condition which has caused vibrations through the structure. This can be from an emergency stop when slewing with a heavy load, or trolleying with a load from which excessive load swing is caused. It can be a dropped load through poor slinging, or it may be that as the load is about to be lifted and there is tension on the hoist rope the sling(s) breaks (break). These are some of the possibilities.

Switch off the motions with the key - report immediately to the supervisor. Note all details in the crane log book, include the sequence of operation leading up to the point when the shock load occurred.

A shock loading condition can be said to have taken place if the
EMERGENCY STOP BUTTON HAS BEEN USED FOR AN EMERGENCY STOP!

WIND DEFLECTORS

If a tower crane is fitted with wind deflectors in the form of name plates and sign boards fixed to the counter jib, the total resisting moment of the counter jib may increase to the extent whereby the crane - when out of service - cannot slew the jib with the wind under high wind conditions.

THIS MAY HAVE SERIOUS CONSEQUENCES!

When wind conditions are approx. 3-5 m/sec., all cranes **MUST** be checked in the following manner:

- Slew the jib, side on to the wind.
- The slewing brake(s) should be in the disengaged position.

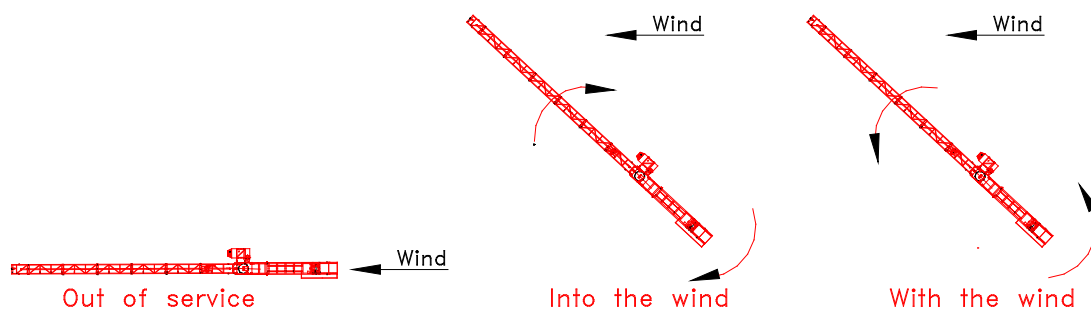
If the area of wind deflectors is correct, the jib should now slew with the wind. If the jib remains in position:

- Reduce the area of deflectors on the counter jib.

For cranes of short jib lengths - under 25 m (82 ft) approx. - it may be necessary to remove not only the deflectors from the counter jib, but also to fix deflectors to the tip section of the jib.

The test should be repeated several times, as a sudden gust of wind can slew even an exactly balanced jib. A single test could thus give an incorrect result.

ILLUSTRATION





OPERATIONAL CRANE

When the crane is constantly in use within its normal operational area the reduced speed or restricted areas of operation should be used to check stop operations and conductors at least once a month.

STANDING CRANE

If the crane is not to be used for a period of time, the hoist, trolley/luffing, slewing and travel motions should be run over their operation distance at least once every 2 weeks.

PERFORMING 360 DEGREES SLEWINGS

The crane should at least every 3 hours be slewed fully 360 degrees. This is to ensure that the rollers in the slewing ring don't pack up due to operation in a limited 90 degrees area.

PARKING

The Operator (in cabin)

- Carries out the procedure of raising the hook to max. high and bringing the trolley in to min. reach.
- Travels the crane until in the parking position.
- Slew the crane until the counterweight is into the direction approx. from which the wind is coming.
- Release the slewing brake, see info 2067, to allow the crane “free-to-weathervane”. The crane key turned off and removed.
- Ground staffs to position the crane by using the ground controller then insert and lock the shoot bolts.

NOTE: All shoot bolts and anchoring brackets should be removed before the crane is put into operation.