

Designation	Identification	No. of pages
Operation and safety rules	2184-01	2
General	2425-00	1
Control system	5734-00	9
Operator cabin	2998-00	1
Electrical panel room	2999-00	1
Brakes, phase fall-out and indicators	2991-00	1
Slewing brakes	2067-00	1
Wind speed indicator	2347-01	1
Change-over of hoist reeving	-	1
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- 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.
- 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.

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.

PRINCIPLE OF OPERATION

JOYSTICK CONTROLLERS

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

The control system for all function motions are stepless. The electronic circuits will adjust the speed range in accordance with the position of the joysticks.

The 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 due to slip through the brake **DO NOT PRESS THE EMERGENCY STOP BUTTON!** UNLOAD HOOK IMMEDIATELY VIA JOYSTICK!

CONTROL RESTRICTIONS

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

R.H. JOYSTICK CONTROLLER (1-2 & 3-4)

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

* Hoist up is stopped at 103% SWL.

Gantry motion (3-4): Automatic reduction of speed and stop at each rail end.

L.H. JOYSTICK CONTROLLER (A-B & C-D)

Slewing motion (A-B): No restrictions on the slewing motion.

Trolley motion (C-D): Automatic reduction of speed and stop at each jib end.

* Trolley motion out is stopped at 103% SWL.

* Trolley speed out is reduced to 10% with 90% SWL.

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

RIGHT-HAND CONTROLLER

- JOYSTICK CONTROLLER** (1-2 & 3-4) : - Control of hoist and gantry winch.
- Movement backwards : - Hook block will rise (1)
- Movement forwards : - Hook block will lower (2)
- Movement left : - Travel movement in dir.I (3)
- Movement right : - Travel movement in dir.II (4)
- PUSH BUTTON** (5) : - Press: Warning horn is activated.
- KEY SWITCH TOP CRANE** (6) : - ON/OFF-switch for the top crane electr. circuits. Turn to energize the motion circuits for hoist, slewing, trolley and gantry.
- EMERGENCY BUTTON** (7) : - Emergency stop switch. All motions will stop and the brakes will automatically be applied.
- ENGAGE BUTTON TOP CRANE** (8) : - Push button for engagement of main relay. The green start lamp in the operator display will light constantly if main contactor is engaged.

LEFT-HAND CONTROLLER

- JOYSTICK CONTROLLER** (A-B & C-D) : - Control of trolley and slewing motion.
- Movement backwards : - Trolley will move in (A)
- Movement forwards : - Trolley will move out (B)
- Movement to the left : - Slewing counter-clockwise (C)
- Movement to the right : - Slewing clockwise (D)
- PUSH BUTTON** (E) : - Press: Slew brakes will be applied if speed is close to zero.

MOTION-FITTED LIMIT SWITCHES**HOISTING & SLEW MOTIONS****Illustration****HOISTING**

| - stop
| - reduced speed
|
|
|
|
|
|
| - stop

TRAVEL

| - stop
| - reduced speed
|
|
|
|
| - reduced speed
| - stop

TROLLEY & SLEW MOTIONS**Illustration****SLEWING**

| - stop
| - reduced speed
|
|
|
|
| - reduced speed
| - stop

CRANE TRAVEL

| - stop
| - reduced speed
|
|
|
| - reduced speed
| - stop

DESCRIPTION OF CONTROL SYSTEM**HOIST WINCH** - R.H. controller (1-2)

- Lower: - Movement is centre forwards (1)
Hoist: - Movement is centre backwards (2)

TRAVEL MACHINERY - R.H. controller (3-4)

- Travel dir.I : - Movement is centre left (3)
Travel dir.II : - Movement is centre right (4)

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

- Trolley in : - Movement is centre backwards (A)
Trolley out : - Movement is centre forwards (B)

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

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

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 ENGAGE THE CRANE

- * Lift the red emergency stop button (if depressed).
- * Insert the key (R.H. control - pos. 7) and turn it clockwise)
- * Press the engage button (R.H. control - pos. 8). The green start lamp in the display will turn ON constantly (operator's display pos. 16), if all the main contactor is engaged

THE CRANE IS NOW READY FOR USE. ALL MOVEMENTS OF THE JOYSTICKS SHOULD BE MADE AS STEADY AND PRECISE OPERATIONS WITHOUT JERKING MOVEMENTS.

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 opened and the hoist winch is in operation. The brake lamp in the display panel will turn ON.
- * Returning the joystick to neutral position will stop the hoist winch and apply the brake. The brake lamp will turn OFF.

COUPLED SAFETY DEVICES TO HOIST WINCH

Emergency Stop Button - as described.

Depth Stop

One cam depth stop is adjusted after final software depth stop (Ultimate depth stop):

- * Software stop is set so that the winch will ramp down, stop and apply the brake with a min. of 3 turns hoist rope remaining on the drum.

Height Stop

One cam height stop is adjusted after final software height stop (Ultimate height stop):

- * Software stop is set at a determined distance between trolley and hook block. At this point the brake is applied and the winch stopped.
- * The software reduction speed stop, before final stop, is automatically set

By pressing the override push button in the operator display the hook block may be moved past the height limit for changing over wire parts. The erection key inside the control panel has to be set to erection position to manually override the Ultimate stop.

Overspeed surveillance

The overspeed supervision is totally independent system for the hoist. 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 hoist drum speed exceeds 110% of maximum speed, the counter relay will cut out the main safety relay and thereby immediately apply the brakes on all functions.

Overload Device

- * The load chart for the crane is entered into the PLC. The display will show Safe Working Load (SWL) compared to the trolley radius.
- * A yellow warning lamp in the monitor display indicates that the winch is lifting 90% of SWL.
- * A red warning lamp in the monitor display indicates that the winch is lifting 100% of SWL.
- * Hoisting and trolley-out motions will be stopped and brakes applied at 103% of SWL.

Automatic high speed control

The automatic hoist speed control, speed compared to the hook load, is disabled when the crane is put into erection condition. The hoist motors will run up to rated speed when in erection condition.

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. Be patient regarding reaction times do not try and force the slew movements, think ahead and start to slow down some distance before the drop point. Using creeping speed just before the drop point will prevent having to counter slew and will save time.

NOTE: - Never counter slew by jerking the joystick in the opposite slew direction. This does not work on a stepless control system.

- * When the joystick is moved out from the neutral position, the slewing brakes are opened and the jib can be slewed. The slewing brake indication in the display panel will turn ON.
- * Returning the joystick to 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. 15 secs. after the slewing has stopped. The slewing brake indication in the display will turn OFF.

COUPLED SAFETY DEVICES TO SLEW DRIVE

Emergency Stop Button - as described.

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 a joystick is moved out from the neutral position, the brake is opened. The trolley brake lamp in the display panel will turn ON.
- * Returning the joystick to neutral position will stop the trolley and apply the brake. The trolley brake lamp will turn OFF.

COUPLED SAFETY DEVICES TO TROLLEY WINCH

Emergency Stop Button - as described.

Outer Limits

- * Software stop is set at a determined distance between mechanical trolley stop out and trolley buffer. At this point the brake is applied and the winch stopped.
- * The software reduction speed stop, before final stop, is automatically set

Inner Limits

- * Software stop in is set at a determined distance between mechanical trolley stop in and trolley buffer. At this point the brake is applied and the winch stopped.
- * The software reduction speed stop, before final stop, is automatically set

By pressing the override push button in the operator display the trolley may be moved past the outer/inner limits for fine adjustment of radius.

NOTE: - The trolley out movement will be reduced to 10% out at 90% SWL!

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 opened and the travel machinery is in operation.
- * Returning the joystick to neutral position the undercarriage will ramp down, stop and apply the brakes.

COUPLED SAFETY DEVICES TO TRAVEL MACHINERY

Travel Limit Switches

One of the bogie sections is fitted with two switches, which operate as follows:

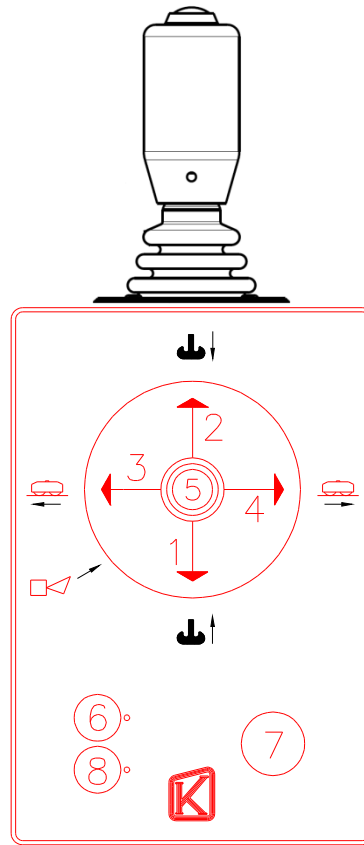
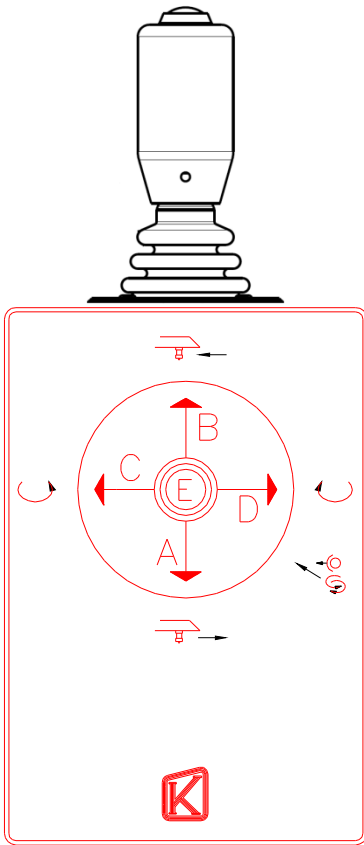
Dir. I Limits

- * One switch is set so that - when activated - at a determined distance from one end of the rail the gantry speed in is reduced to max. 10% for the remaining distance.
- * One switch is set so that - when activated - at a determined distance from one end of the rail the gantry is stopped and brakes applied.

Dir. II Limits

- * One switch is set so that - when activated - at a determined distance from one end of the rail the gantry speed in is reduced to max. 10% for the remaining distance.
- * One switch is set so that - when activated - at a determined distance from one end of the rail the gantry is stopped and brakes applied.

NOTE: - A siren will sound constantly and flashing lights at all four corners when the crane is travelling.

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

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.

- 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: 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.

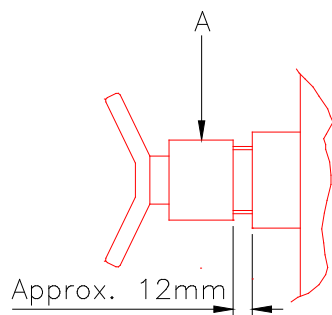
Indicators:

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

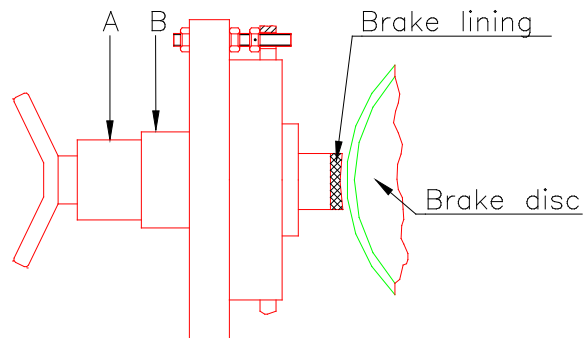
INFORM SERVICE IF ANY INDICATORS SHOWS A “SUSPECT“ READING.

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).

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.

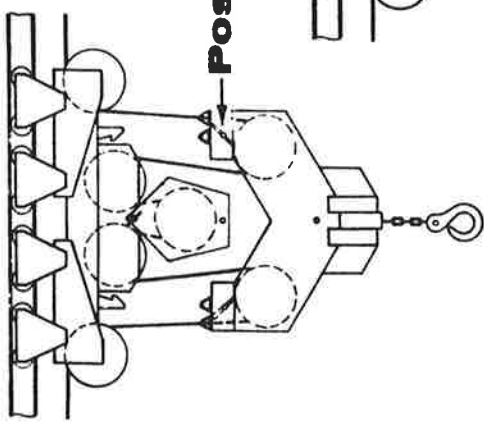
An event message will appear in the display at 15 m/sec.

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

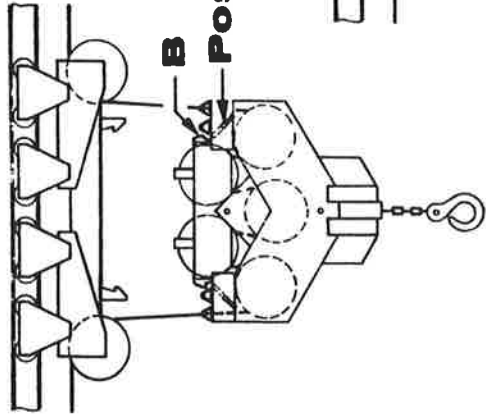
The crane will operate up to 20 m/sec., but for loads with a large surface area the speed should be reduced.

4-8-12 t Hook Assy

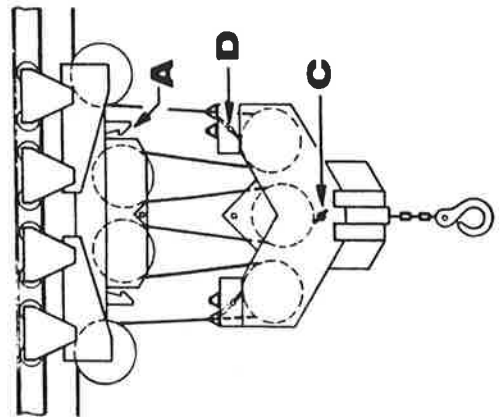
2 - 4 - 6 PART, Ø 15 HOIST ROPE REEVING



Pos. 1



Pos. 2



SEMI AUTO CHANGE OVER

The trolley is fitted with 2 spring-loaded claws (A). The top snatch block is fitted with suspension hooks (B).

The lower snatch block is fitted with connecting pin to the upper snatch block or the hook (C).

The hook assembly has a claw-operating plate (D).

Before the hook assembly reaches the trolley, the hoist limit switch will be operated and the hoist winch will stop. By the use of a master key switch on the driver's control box, the hook assembly may then be hoisted to change-over position on min. speed.

CHANGE-OVER WILL TAKE PLACE ACCORDING TO THE POSITION OF PIN (C) AND PLATE (D).

With both snatch blocks in the hook assembly (2-part reeve) and the plates (D) down in pos. (1), the snatch blocks will be held in the claws (A) (lower snatch block fitted to upper snatch block with pin connection), giving 4-part reeving on lowering the hook assembly.

With both snatch blocks in the trolley (4-part reeve) and plates (C) up in pos. (2), the snatch block will be released from the claws (A) - the hoist rope will retain the snatch block in the hook assembly giving 2-part reeving on lowering the hook assembly.

With the lower snatch block fixed to the hook with the connecting pin (C) and plates in pos. (1), only the upper snatch block will be held in claws (A) giving 6-part reeving on lowering the hook assembly. By moving claws (A) to pos. (2) change-over can be made to 2-part reeving.

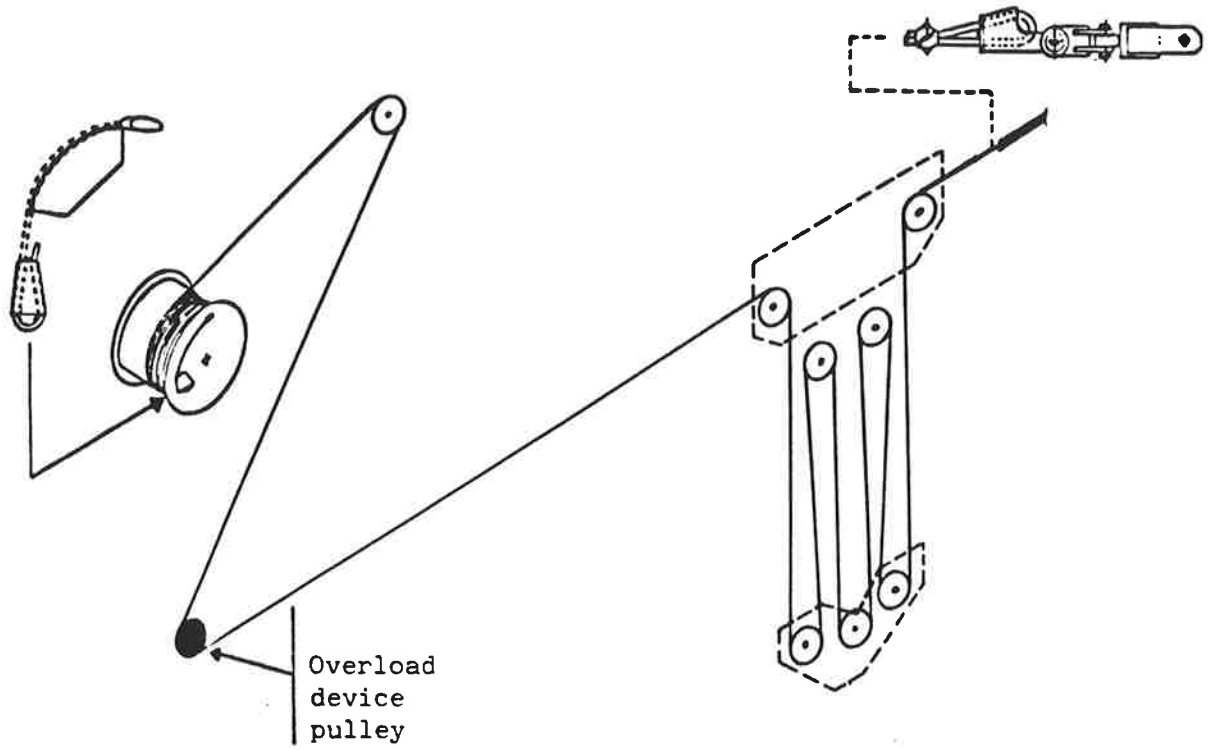
SAFETY PRECAUTIONS

NO LOAD IN THE HOOK ON CHANGE-OVER.

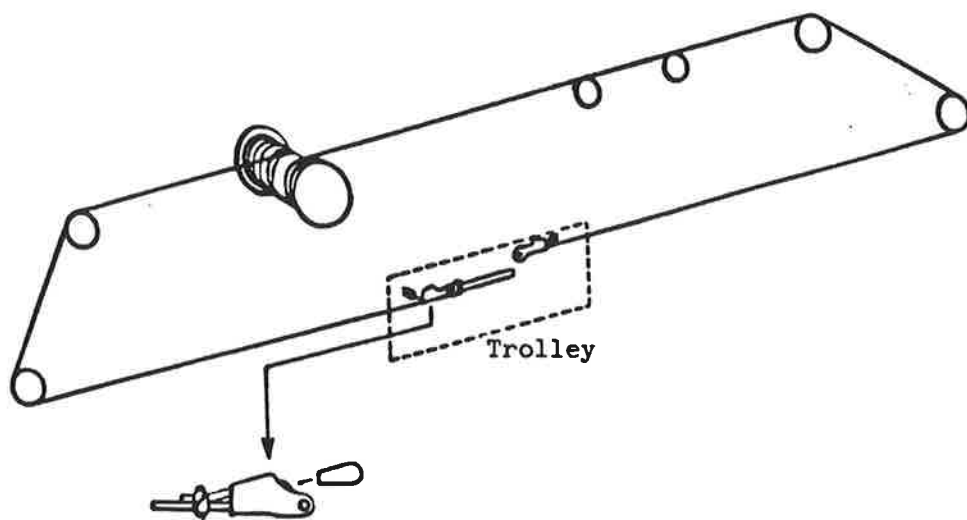
NO ROTATIONAL SWING OF THE HOOK ASSEMBLY PRIOR TO ENGAGEMENT OF THE CLAWS.

2 flags give indication of the claw movement.

• **HOIST ROPE RUN**



TROLLEY ROPE RUN



Everybody is aware the the main hoist rope, the luffing rope, the hook and all related hardware and fittings are an important part of the crane equipment.



All lifting equipment between the hook and the load is equally important!!

All lifting equipment must be fit for purpose, in serviceable condition and inspected regularly as per local regulations and standards.

The crane operator sometimes has from his position in the cabin a good view on the rigging of the load. In case he observes anything which doesn't look correct he need to communicate with the rigging crew before any lifting take place.

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.

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!**

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.

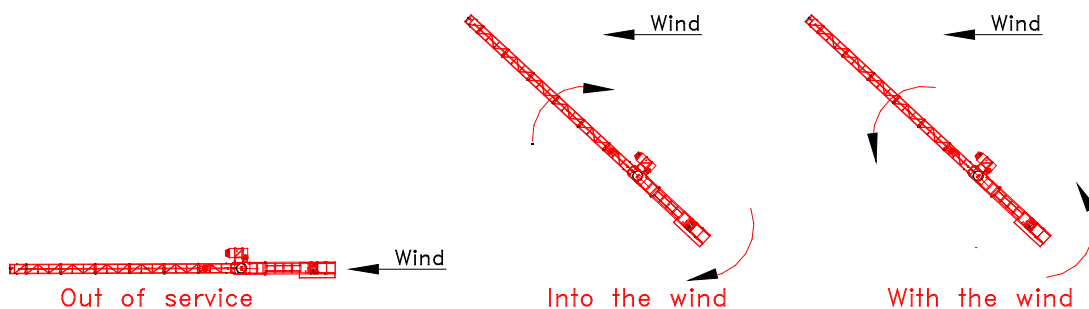
If the area of wind deflectors is correct, the jib should now slew with the wind. If the jib remains in position:

- 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.