LIFTING MACHINERY
Decree of 23 August 1947

Extracts

INSTALLATION OF MACHINES AND TRACKS

SECURITY DEVICES

Art. 22 - All lifting machinery shall be fitted with all the necessary safety devices, such as limit switch devices, luffing limit switch devices and, possibly, slewing limit devices.

These devices shall be of robust construction and, if applicable, re-armable from the operating cabin or station.

Circular of 9 July 1987

MINISTRY OF SOCIAL AFFAIRS AND EMPLOYMENT

TOWER CRANES WITH INTERFERING ZONES OF ACTION

Application of special security measures in the case of installation of tower cranes with interfering zones of action: application of the modified article 22 of decree No. 47-1592 of 23 August 1947.

MINISTRY OF SOCIAL AFFAIRS AND EMPLOYMENT
to
Regional Work and Employment directors,
Provincial Work and Employment directors,
Employment inspectors,

The attention of the minister of Social Affairs and Employment has been drawn to the risks incurred by Construction and Public Works employees in the operation of tower cranes with interfering zones of action.

The risk to be considered mainly concerns the fact that the crane operator must manoeuvre a load whilst avoiding collisions between the jibs and counter-jibs of cranes located below his own and/or the lifting cable and the load of cranes located above.

The crane operator must take various factors into consideration whilst retaining the capacity to decide rapidly in a working environment which can sometimes be very restrictive.

Although this problem is already an old one, it has become increasingly acute, due mainly to the increasing number of sites with high concentrations of tower cranes, and also to the recent development of technology, which enables the generalisation of appropriate devices, as defined by article 22 of the decree of 23 August 1947 relating to lifting machines other than lifts and material lifts.

This article prescribes that all lifting machines be fitted with devices required to ensure safety at work.

These devices come within the scope of application of these provisions for the prevention of risk by material means.

Moreover, it is noted that the Employment Inspectorate and prevention organisations may undertake actions which are insufficiently harmonised as long as they respect the prescriptions of the regulations.

The purpose of the present instruction is to indicate the conditions under which the use of such devices is desirable for satisfactory application of the abovementioned article 22.

This instruction is also an opportunity to consider the conditions, for reasons relating to safety at work, in which the zones of actions of cranes interfere with prohibited overfly zones.

1 - Gradual implementation of the measures

The relative newness of these measures and the time required for their generalisation may mean that their application may be gradual from the moment they concern the entire national territory.

The cost of the equipment, the necessary equality of companies with respect to the regulation, and the consequences of the current operating conditions of sites orientate the actions of the Employment Inspectorate towards the monitoring of new sites: ie those opened from 1 January 1998 onwards.

A certain period of adaptation may be required to determine the eventual consequences of the application of these measures concerning the operation of cranes, relations between crane operators, and between the latter and the banksmen.

This progressive application must take account of the time required to reach the objectives that have been fixed and of the variety of situations that may be encountered.

It is also essential that all those who participate in the act of construction (developers, research and design offices, contractors, etc.) are able to make their choices with complete possession of the facts, and to allow for them when choosing their equipment. From this point of view, the invitation to tender is highly important.

I therefore invite you, except for specific cases, to include the preventative actions that you judge necessary within the framework presented in annex 1 of the present instruction.

2 - Measures

The establishment head will be less subject to regulatory constraints if the organisation of site avoids the creation of supervised zones, or, failing this, confines them to that which is strictly indispensable for the execution of the works.

Solutions for risk prevention will thus be sought initially through better machine implantation and circulation of products, preventing the creation of volumes of interferences, whether or not these volumes are used.

If the interferences are not eliminated (whether or not these are working zones), appropriate devices must be installed.

Annex 1 distinguishes, case-by-case, the minimum measures that must be implemented, and makes the following comments.

Case 1. Risks due to the overflying of prohibited zones

By definition, these are zones where no charge nor, if applicable, any element of the machine can be introduced by a handling movement.

In the event of fault by the crane operator, the device must be able to prevent intrusion into the prohibited zone.

Case 2. Risks due to collision between the cable and counter-jib.

- The constraint is the same as in case 1 due to the specifications of norm NF E 52-082 (October 1982) made obligatory by a decree of the minister in charge of industry - and to the fact that the crane operator of the lower crane may not be able to contribute to the prevention of risk in a satisfactory manner.

Experience shows that a careful positioning of the cranes can eliminate the jib/ counter-jib risk, and consequently avoids the use of the measures cited.

Case 3. Risks due to collision between the cable and jib.

The diversity of means which may be proposed results from a differentiation of risk situations and the need for a measure, inevitably gradual in its application, due to the constraints relating to the availability of devices, and to the adaptation of personnel that may be required.

If applicable, and using experience that is acquired, certain choices could be reviewed.

3 – Conditions of implementation

There is no intention of defining the schedule of specifications of the most appropriate devices. Only the essential functions required for the correct application of the texts are defined.

In addition, a few principles must be respected:

1. When the device has an action on the crane mechanism, there must be no opposition to any movements contributing to the reduction of the risk.

2. Crane operators, banksmen and other operators concerned must receive - notably under the terms of articles R.231-38 of the Employment Code, 32 of decree No. 47-1592 of 23 August 1947, and 42 of the decree of 8 January 1965 - appropriate training relative to the crane that has been equipped, allowing them to understand the operation of the devices and the conditions of their implementation.

3. In the event that an action on the crane mechanisms substitutes the crane operator in the case of failure, the crane operator must be informed any modification in the operation of the mechanisms beforehand.

   Operators may therefore predict the action of the devices and have appropriate reactions.

4. Phonic communication between the crane operators, and between the latter and the banksmen, must be satisfactory.

5. The site must be prepared for installation of devices when they require the laying of connection cables between machines and between crane operators. (e.g. the laying of sheaths in the foundation).

6. The device and its adaptation on the lifting machine must not be a source of risk for the operators and workers on site. Its adaptation to situations encountered must be satisfactory.

7. The controls and verifications laid down in article 31 a of decree No. 47-1592 of 23 August 1947 also apply to the devices mentioned in the present instruction.

8. Operators, concerned by this text, located outside the tower crane operating cabin must, through appropriate signalling, be informed as to the operating condition of the control system.

9. Free-slewing operation must remain possible. It must occur only under conditions such as to prevent collision with the overflying crane.

In an additional despatch you will receive a study by I.N.R.S. entitled "Study of safety devices for tower cranes with interfering movements" which will provide you with the technical data, valuable for a better understanding of the problem, and the solutions which, with the current level of the technology, are available to company managers.

For the minister of Social Affairs and Employment,
By delegation:
The Director of Employment Relations,

M. AUBRY

ANNEX I

IMPLEMENTATION PROGRAMME

Case 1. Risks of overflying of prohibited zones.
Position information + action on mechanisms.
Action on mechanisms results in the impossibility to continue the dangerous movements.

Case 2. Risks due to cable/counter-jib collision
Position information + action on mechanisms.
Action on mechanisms results in the impossibility to continue the dangerous movements.

Case 3. Risks due to cable/jib collision.

Case 4. Risks due to interferences in the event of travelling of cranes.
The measures stipulated in cases 1, 2 and 3 are applicable.

ANNEX 2

DEFINITIONS

Automatic stoppage: Action of the device on the crane mechanism such that, despite the absence of an appropriate reaction from the crane operator, the dangerous movement or movements may be stopped before a collision occurs.

Prohibited zone: Zone in which the handling of a load, and if applicable the presence of an element of the machine, is prohibited due to statutory provisions or for any other reason.

Approach zone: A zone swept by the load and/or the machine before entering the risk zone (essentially prohibited zone or interferences zone). This zone is such that it enables the crane mechanism to change to a state allowing it to stop before any collision or the attainment of slow speed before penetration into the prohibited zone or those of the interferences.

Interference zone: A zone which may be swept by the load and/or the machine, and common to at least two machines.

Supervised zone: Consists of the approach zone and the prohibited zone and/or the interference zone.

Reduced speed: Its value is such that stoppage of the slewing movement of the crane may be undertaken under conditions compatible with the resistance of the mechanisms and its structures. It allows work in the interference zone to be continued provisionally. This value is defined by the crane manufacturer.
N.B. : This expression is here understood in the common sense.

Double interferences: Two interfering cranes. Several two-by-two interfering cranes.

Triple or higher interferences: Three or more interfering cranes. Several three-by-three, or more, interfering cranes.

	PERIODS	DOUBLE INTERFERENCES	TRIPLE OR MORE INTERFERENCES	
			GROUND SUPPLY ZONE	OTHER WORKING ZONES
	1	2	3	4
a	Up to 31.12.1989	Position information + Action on mechanisms: Automatic reduced speed	Position information + Action on mechanisms: Automatic reduced speed (2 hooks maximum in the interferences zone)	Position information + Action on mechanisms: Automatic stop
b	From 1.1.1990	Position information + Action on mechanisms: Automatic stop	Position information + Action on mechanisms: Automatic stop	Position information + Action on mechanisms: Automatic stop

N.B. : The action on the mechanisms is automatic, it concerns dangerous movements.
Case a3 (case 3) implies the automatic stoppage of the other hooks.

Technical note of 6 March 1991 relative to the application of the circular of 9 July 1987 concerning individual safety measures in the case of tower crane installations with interfering zones of action.

The circular of 9 July 1987 is included in article 22 of decree No. 47-1592 of 23 August 1947, under the terms of which the agents of the Employment Inspectorate may, in the form of a notice, require that the lifting machines used in an establishment or on a site are fitted with the necessary safety devices. In this instance, these are anti-collision safety devices.

The multiplication of sites where tower cranes are concentrated in a small area, such as sites for nuclear power stations or in densely populated areas, and the development of new techniques for assisting operators (warning in the event of danger), and also for operating aids (action on

mechanisms) have led to the definition of conditions for use of such devices for the satisfactory application of the abovementioned article 22.

The present technical note, which takes account of the variety of operating conditions of sites and of the various existing anti-collision safety devices on the market, provides the technical clarifications resulting from experience of application of the circular of 9 July 1987.

1. Site organisation

The first fundamental idea expressed in the circular of 9 July 1987 recalls that the establishment head will be less subject to the constraints likely to result from implementation of the anti-collision safety devices if the site organisation eliminates as many interference zones as possible.

Such site organisation is, in any event, the best means of preventing risks related to the existence of interference zones between tower cranes. This must always be implemented whenever possible, and the establishment heads must be convinced that this measure is good management in terms of safety and of site operation.

Although the existence of interference zones is inevitable, and calls for use of the devices required by the circular of 9 July 1987, responsibility for their implementation lies with the establishment head. The supervisory agents responsible for day-to-day management of the site must have the instructions, training, and the resources required for effective use of these devices.

Apart from the availability and the maintenance in operational condition of the crane operator aid devices required since 1 January 1990, measures are necessary in order to guarantee the coordination between the crane operators and banksmen on the basis of clear, reciprocal information delivered in real time, with the use of phonic means of communication recommended by section 3.4 of the circular of 9 July 1987.

Apart from organisational measures and resources, correct application of the circular of 9 July 1987 is reliant on appropriate training of all the agents concerned, including the supervisory personnel.

This training must, notably, avoid the abusive use of the devices, which must be considered to be safety auxiliaries and not automata, leading to deterioration of the equipment and to poor site operating conditions.

2. The principal devices

Depending on the site organisation and the handling plan chosen by the company, several types of equipment may be used. These are, notably:

- electromechanical limit switches leading to automatic stoppage at the entrance to a supervised zone;
- so-called "sequential type" devices allowing alternating access to an interference zone, which allow access to the interference zone, only to a single hook;
- tracking devices, which have major advantages for site operation. These devices allow the data given by the sensors to be managed in real time, either on a two-crane basis, or in a centralised fashion.

3. Reminder of the provisions of the circular of 9 July 1987

a) Section 2 - Case 2 of the circular of 9 July 1987 does not aim to revise the provisions made obligatory by norm NF E 52-082, which exclude any possibility of a collision between the cable and the counter-jib. However, marketing of the tracking devices mentioned in point 2 takes into account, in real time, of the positions and movements of facing obstacles, and permits, after warning, operators, to slow and eventually stop the dangerous movements before any collision. With this sole hypothesis, and provided that the anti-collision safety device is not neutralised in normal operation by the crane operator, it is accepted that the hook of the highest crane may enter

into the envelope volume of the positions in the time of the counter-jib of the lowest crane, without penetrating the volume swept by the jib before complete stoppage of the machines.

This improvement provided by the development of technology must also be taken into account by the site hierarchy, which must allow for the possible presence of the hook of the highest crane in the entire volume swept by the counter-jib of the lowest crane in order to organise its handling operations. In order to improve the ease of operation of the machines thus equipped, it is probably necessary that indicators, showing the position of the hook of the highest crane, be installed in the operating station of the lowest crane.

b) Section 3.9 of the circular of 9 July 1987 specifies that free-slewing operation, which must remain possible, must not create a situation leading to collision between the jib with the cable of the overflying crane. Consequently, the entire volume swept by the jib of an overflown crane in free-slewing operation must be considered to be a prohibited zone.

c) Annex I, which defines the conditions for action on the crane mechanisms, does not deliberately make a distinction between an overflying crane and an overflown crane. Although the visibility of an overflying crane is, in principle, better, to generalise the principle that an overflying crane is only subject to a signalling device would present risks, and operating difficulties. The following points must be taken into account:

- the tasks undertaken, since the operator does not have a precise view of the relative position of the overflown crane, particularly when the hook heights are very close or very far.
- additional information which would need to be given to the operators,
- the complication of the perception and reaction to such situations, firstly for the operator of a crane both overflying and overflown, confronted with a situation extremely difficult to manage, and dangerous, and also for the sling operators and the banksmen.

d) Sections 3.4 and 3.8 of the circular of 9 July 1987 define the measures to be taken depending on the state of operation or non-operation of the anti-collision safety device.

The information, according to which a crane stoppage consecutive to an action by the anti-collision safety device following a manoeuvre attempting to exceed the limits authorised by the latter, must normally be given to the banksmen through the phonic communication recommended by point 3.4 of the circular of 9 July 1987.

The signalling recommended in point 3.8 of the circular of 9 July 1987, which must be distinct from any other signalling. Its purpose is to inform ground personnel and site supervisory personnel, unambiguously, that the anti-collision safety device is out of service or that one or more movement controls have been neutralised by a decision of the supervisory personnel under the conditions specified in section 4.1. below.

If a signalling device, complementary to the phonic link recommended in 3.4 of the circular of 9 July 1987 proves necessary, it must be clearly distinct from the signalling mentioned in the above section, without any risk of confusion. Use of a same light, constant or flashing depending on the situation, is ruled out in relation hereto.

e) Installation in the crane operator's operating station of a push button, also called an override button, allowing him, following a stoppage triggered by the anti-collision safety device, to release this device in order to continue without hindrance the interrupted dangerous movement is neither in conformity with the circular of 9 July 1987, nor necessary.

Use, without instructions from the site manager, of a system to release the anti-collision safety device, would still make possible, and unexpectedly, execution of the dangerous manoeuvres. The supervisory personnel, the other crane operators and the ground personnel may not be warned in time. This possibility would inevitably encourage abusive use of the device which, we should recall, is a safety auxiliary leaving unaffected the professional liability of the crane operator, who must undertake in time the necessary manoeuvres, and not an automaton.

Furthermore, in accordance with point 3.1 of the circular of 9 July 1987, nothing must oppose the authorisation of movements which reduce the risk, when the anti-collision safety device acts on the crane mechanism.

4. Consideration of certain hazards

The anti-collision safety devices must correspond as far as possible the hazards resulting from the conduct of work on the sites.

These safety auxiliaries enable the site supervisory personnel to ensure the respect of instructions established to accomplish manoeuvres defined by the organisation plan. It is thus important that the supervisory personnel, as well as the crane operator, should be informed when the device is non-functioning.

Failure of a component in the system must not lead to any new risks, as is stipulated by point 3.6 of the circular of 9 July 1987.

In the absence of data indicating the position of cranes whose manoeuvres are managed by the device, the device must considered the volume swept by the crane, in question, to be prohibited.

Depending on the malfunction detected by the device, the automatic stop is desirable and may concern:

- two cranes, in the event of failure of the system of management of cranes in pairs;
- several cranes, or possibly the entire site, in the event of failure of a centralised management system.

As these are, above all, safety auxiliaries intended to facilitate the crane operator's conduct without replacing him, an automatic stop may in certain cases appear premature, given for example:

- the non-possibility of detecting all the possible failures of certain devices, notably inside the electronic comparators,
- the state of the mechanisms of certain old cranes.

Moreover, simultaneous and unexpected stoppage of all the cranes on the site may ultimately introduce other risks if, for example, sudden wind conditions changes at the time of the incident: it is possible that the brakes of the machines may not maintain the jib in position, without permitting the crane operator to take action instantaneously.

Therefore it seems useful to recommend, depending on the mechanical state of the cranes and the device management system, either of the following two solutions:

1. The failure of the device leads to the unexpected stoppage of the cranes, whose action it controls; as soon as this action occurs a fault signal is given. Faced with the partial or total stoppage of the site, the supervisory personnel decide to use the equipment for neutralising the device which is

located outside the crane cabin. They undertake the steps required to enter the device back into operation, and, in the mean time, with the signalling for use by the site still in action, the work may resume until intervention by the fault repair team. It is evident that the necessary organisational measures must be taken, under the responsibility of the establishment head, for the supervisory personnel to be able to intervene whenever necessary, in order to prevent use of the neutralisation device being, depending on the situation, either impossible or left to the free initiative of any agent.

2. In order to take account of the difficulties in modifying existing systems that do not correspond to the above instruction, it may be provisionally accepted that the crane or cranes in question are not immobilised provided a double fault signalling system, both visual and acoustic, informs the operators and the supervisory personnel of the site of the failure of the system. However this tolerance will not be maintained indefinitely. It is appropriate with this regard to bear in mind the essential requirement 4.1.2.6 a) laid down by the directive modifying European directive 89/392/EEC relative to machines, concerning the mobility and lifting risks, which provides notably that: "machines must be designed or equipped with devices which maintain the amplitude of the movements of their elements within the stipulated limits."

In all cases, the establishment head must draw up precise instructions for the site supervisory personnel. In the first case, agents with responsibility for implementing the neutralisation device must be authorised to do so in writing, after having received the necessary training and instructions to take initiatives leading to a rapid resumption of operation of the anti-collision device. This authorisation does not constitute a delegation of power and does not thus protect the establishment head from possible prosecution in the event of accident or abusive neutralisation.

The neutralisation equipment must, in no case, be accessible from the crane operators' cabins.

5. Cases in which the location of the site or age of the equipment is not compatible with strict application of the circular of 9 July 1987 and the present technical note.

The circular of 9 July 1987 and the present technical note emphasise the importance of an implantation of the cranes which avoids interferences as far as possible. The attention of the developer, the general contractors and the establishment heads must be drawn to this requirement as early as possible.

The possibility of an incompatibility between strict application of the circular of 9 July 1987 and the implantation of the site should thus be presented largely as a textbook case, or at least as an exceptional circumstance leading to interrogations on the site conception.

Since use of old cranes does not allow the implementation of anti-collision safety devices, this too should be exceptional.

These special circumstances must be treated on a case-by-case basis by the agents of the Employment Inspectorate who, I recall, are always, according to actual situations encountered, able to judge the appropriateness of using or not using the notice procedure and determining the content of the said notice. The present technical note defines a number of alternative solutions enabling a response to be found to most of the situations encountered on the sites. If they decide to accept a relaxation, the Employment Inspectorate agents faced with the special circumstances mentioned above must require all guarantees that this tolerance does not constitute in any sense an encouragement to poor design of sites, perpetuation of a risk situation or maintenance in service of obsolete machines or devices which are clearly no longer at the safety level that may legitimately be demanded, generally, by the current state of technology.