COMMISSION OF THE EUROPEAN COMMUNITIES

COM (78) 677 final

Brussels, 6 December 1978

Proposal for a

Council Directive (EEC)

on the approximation of the Laws of the Member States relating to safety requirements for tower cranes for building work

(Submitted to the Council by the Commission)

COM (78) 677 final

EXPLANATORY MEMORANDUM

I. INTRODUCTION

The Community market in tower cranes for building work, lifting appliances which are in general use in the construction field, is quite considerable. Production of tower cranes for building work for the year 1977 amounted to 9,000 units worth 400 million EUA. The Community is by far the biggest world producer representing 60% of the total production.

This sector involves 70 Community producers presently employing about 12,000 people . On average, 3 cranes in 10 are for the purposes of intra-Community trade and 3 cranes in 10 are now exported by the Community. In fact, in 1977, 2,600 units worth 120 million EUA were exported. The principal countries of destination are the Near East, Latin America, E.F.T.A. and the countries of Eastern Europe.

In the same year 1977 imports from third countries amounted only to 200 units worth 9 million EUA.

This sector therefore comprises an area in which the commercial balance is very definitely positive and in which competition in the European industry has increased to a very great extent. Consequently, the situation from the point of view of intra-Community trade is tending to deteriorate. In fact, according to information received, the recent modification to the legislation of one of the Member States involves additional charges for inspection and testing of approximately 14% of the value of a new crane. This does not take into consideration the cost of modifications which might also be necessary to the design of the crane.

II. GENERAL

1. A comparative examination of the laws, regulations and administrative provisions in force in the Member States in the sector of dismountable tower cranes for building work, particularly in regard to safety provisions for these lifting appliances, shows important differences not only betweeen the technical requirements but also between the administrative procedures before placing them on the market.

2. This situation compels manufacturers of tower cranes to adapt their production and stocks of spares to the varying technical requirements laid down by the laws of the Member States for which these appliances are intended. Furthermore, it appears that certain Member States are preparing changes in their laws in this field which could create new technical barriers.

3. Manufacturers are obliged to comply with different administrative procedures for the placing on the market of dismountable tower cranes for building work such as type-approval, type-examination or separate approval. Furthermore, the methods of examination and testing are often different.

4. National laws are, however, justified in that Member States are responsible for protecting users of tower cranes, in particular workers, and third parties. Consequently, approximation of the laws appears to be the most suitable means of eliminating the harmful effects resulting from the differences noted.

5. The sector of dismountable tower cranes for building work comes within the scope of the proposal for a directive presented to the Council on 16 July 1975 [1] on the approximation of the laws of the Member States relating to common provisions for lifting and mechanical handling appliances. On 30 December 1975, the Commission submitted a proposal for a directive on the approximation of the laws of the Member States relating to the permissible sound-emission level for tower cranes.[2]

6. The purpose of this Directive is therefore to remove the technical barriers to trade by approximation of the relevant laws. The legal basis is Article 100 of the Treaty.

7. The Commission has set up a Working Party of governmental experts, representatives of industrial associations and European inspection bodies in order to obtain technical advice. It has also made the necessary contacts with the Advisory Committee on Safety, Hygiene and Health Protection at Work.

III. HARMONIZATION METHOD

The harmonization method proposed in this Directive is the "optional" method.

IV. COMMENTS ON THE PROPOSAL FOR A DIRECTIVE

The proposal for a directive, as the first stage in the approximation of the laws for tower cranes, relates only to the technical safety requirements for dismountable tower cranes for building work. Approximation of the laws relating to rules for design is deferred to a later proposal as are the requirements for mobile cranes.

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1 OJ C 222 of 29 September 1975

2 OJ C 54 of 8 March 1976

As regards the choice of Community procedure for the placing on the market and the entry into service of dismountable tower cranes for building work, the Commission staff felt it advisable to abide by the opinion of the majority of the experts consulted and to propose EEC type-examination and EEC inspection.

The technical annex to the Directive consists of 16 chapters. In the event of the experts consulted coming to an agreement on a draft on safety requirements for hydraulic equipment before this Directive is adopted, the Commission will put forward these requirements as an additional chapter in the annex. In this context, however, it must be pointed out that according to the information available to the Commission staff hydraulic cranes for building work do not, up to the present, fall within the category of mass-produced lifting appliances.

V. CONSULTATION OF THE EUROPEAN PARLIAMENT AND THE ECONOMIC AND SOCIAL COMMITTEE

Pursuant to the second paragraph of Article 100 of the Treaty, the opinions of these two bodies are required because the implementation of the provisions in this Directive will, in all Member States, involve the amendment of legislation.

PROPOSAL FOR A COUNCIL DIRECTIVE (EEC)

on the approximation of the laws of the Member States relating to safety requirements for tower cranes for building work.

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 100 thereof,

Having regard to the proposal from the Commission,

Having regard to the Opinion of the European Parliament,

Having regard to the Opinion of the Economic and Social Committee,

Whereas in each Member State the design and construction of tower cranes for building work are subject to safety provisions which differ from one Member State to another and consequently hinder trade in these lifting appliances; whereas it is therefore necessary to approximate these provisions;

Whereas Council Directive 78/ /EEC of ..... on the approximation of the laws of the Member States relating to common provisions for lifting and mechanical handling appliances laid down a series of common procedures such as EEC type-approval, EEC type-examination and EEC independent certification, for the placing on the market of these lifting and mechanical handling appliances; whereas in the case of dismountable tower cranes for building work EEC type-examination and EEC inspection should be provided for;

Whereas this Directive, like Council Directive 78/ /EEC of ..... on the approximation of the laws of the Member States relating to the permissible sound emission level for tower cranes, is a separate directive within the meaning of Council Directive 78/ /EEC of ..... ,

Whereas technical progress requires rapid adaptation of the technical requirements; whereas the procedure laid down in Article 22 of Council Directive 78/ /EEC of ..... should therefore be adopted for amendments and adaptations to this Directive,

HAS ADOPTED THIS DIRECTIVE:

Article 1

1. This Directive applies to power-driven dismountable tower cranes for building work.

2. For the purposes of this Directive "tower crane" means a power-driven lifting appliance consisting of a vertical tower with a jib fitted to the upper part.
   The appliance shall be equipped with means for raising and lowering suspended loads and for horizontal movement of such loads by variation of load lifting radius, slewing and travelling of the complete appliance.
   The appliance may be installed in a fixed position or equipped with means for travel.

3. An EEC-tower crane means any tower crane for building work which satisfies the requirements of this Directive.

4. For the purposes of this Directive "building work" means work on building and public works sites where the crane is dismantled on completion of the work.

5. This Directive does not apply to:

   - permanently erected tower cranes;
   - power-driven mobile jib cranes which may be fitted with a tower attachment;
   - dockside and shipbuilders' tower cranes;
   - erection masts, with or without jibs.

Article 2

EEC-tower cranes shall undergo EEC type-examination and EEC inspection in accordance with the provisions of Article 2 of the Council Directive 78/ /EEC of .....

Article 3

1. Member States shall ensure that the approved bodies, in accordance with the provisions of Articles 9 to 15 of Council Directive 78/ /EEC of ....., grant an EEC type-examination certificate only when the type of tower crane complies with the requirements laid down in the Annex to this Directive.

2. The approved bodies shall ensure that EEC inspection is carried out in accordance with the provisions of Articles 16 to 19 of Council Directive 78/ /EEC of .....

3. The approved bodies shall issue an EEC type-examination certificate, a model of which is shown in Annex III to Council Directive 78/ /EEC of ....., for each type of tower crane for building work which meets the requirements laid down in the Annex to this Directive.

4. The manufacturer or his authorized agent shall, in accordance with Article 20 of Council Directive 78/ /EEC of ....., issue a certificate of conformity, a model of which is shown in Annex IV to that Directive, for each type of tower crane for building work constructed in conformity with the type which has undergone EEC type-examination.

5. Furthermore, the manufacturer or his authorized agent shall affix beside or on the instruction plate of the crane an indelible and durable EEC conformity mark in accordance with Article 20 of Council Directive 78/ /EEC of ..... and Annex I to that Directive.

Article 4

No Member State may, on grounds relating to the requirements laid down in this Directive, refuse, prohibit or restrict the placing on the market and the entry into service of the tower cranes for building work referred to in Article 1 (2) and (3) where these are accompanied by a certificate of conformity and bear the conformity mark referred to in Article 3 of this Directive.

Article 5

Amendments necessary to adjust the Annex to this Directive to technical progress shall be adopted in accordance with the procedure laid down in Article 22 of Council Directive 78/ /EEC of .....

Article 6

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive within eighteen months of its notification and shall forthwith inform the Commission thereof.

2. Once this Directive has been notified, the Member States shall also ensure that the Commission is informed, in sufficient time for it to submit its comments, of any draft laws, regulations or administrative provisions which they propose to adopt in the field covered by this Directive.

Article 7

This Directive is addressed to the Member States.

ANNEX

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ANNEX

1. Cabins and entrances

1.1. For cranes with a horizontal jib having an effective working moment exceeding 600 kNm*) or with a jib which is positioned at a height of more than 25 m above foundation level a cabin rotating with the tower is obligatory if the crane is controlled from a position on the crane more than 2 m from the ground on which it is set up.

For cranes with a luffing jib having an effective working moment exceeding 600 kNm*) or with the heel of the jib on the tower positioned at a height of more than 20 m above foundation level a cabin rotating with the tower is obligatory if the crane is controlled from a position on the crane more than 2 m from the ground on which it is set up.

1.2. If the appliance is provided with a cabin it shall not be suspended from a jib. It may be attached to or positioned in the tower but in such a way that it cannot be crushed if the jib accidentally falls.

When the cabin is situated inside the tower the window sections may protrude through the mast structure.

1.3. The cabin shall be sufficiently large to allow safe operation of the crane and permit of proper visibility from the seat.

1.4. The usuable internal dimensions of the cabin shall not be less than:

- length : 0.80 m
- width : 0.80 m
- height : 2.00 m

1.5. The cabin ceiling shall be smooth and shall not have any kind of projection.

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*) As per definition of the nominal characteristics of tower cranes indicated in the addendum.

1.6. The cabin shall:

1.6.1. - be provided with a roof capable of supporting at any point a mass of 100 kg distributed over a surface of 30 cm x 30 cm;

1.6.2. - afford protection to the crane-driver in atmospheric conditions such as rain, or extremes of heat or cold;

1.6.3. - be provided with an efficient and intrinsically safe means of heating, which shall be fixed in a permanent position;

1.6.4. - be adequately ventilated;

1.6.5. - be provided with equipment to give adequate and efficient artificial lighting;

1.6.6. - have an integral cabin seat which is comfortable and adjustable;

1.6.7. - allow the window-panes to be cleaned without risk; the front window and if necessary the other windows shall have (a) windscreen wiper(s);

1.6.8. - be provided with windows which shall be of safety glass or of a synthetic material which resists ignition and does not lose transparency under the influence of natural light;

1.6.9. - have a fixed thermally insulated non-skid glass panel at the foot rest position;

1.6.10 - with the exception of the windows, be constructed of materials which resist ignition.

1.7. Internal combustion engines shall not be installed in the cabin. Exhaust pipes shall be so constructed and installed as to prevent the entry of exhaust gases into the cabin and to prevent the driver's visibility from becoming obscured.

1.8. Access to the cabin shall be provided by a door which opens outwards and which is fitted with a mechanical closing device. The door shall lead to landings or gangways.

1.9. It shall, however, be permissible to have access to the cabin by means of a trap-door in the floor or in the ceiling of the cabin when, from a construction viewpoint, it is not possible to have an access door (as provided for in 1.8.), on condition that when access is gained by way of a trap-door in the floor:

- when the trap-door is in the open position there remains a minimum floor surface of 0.80 x 0.50 m;

- the trap-door can only be opened towards the inside of the cabin;
- an emergency exit is provided by an emergency trap-door either in the ceiling or on the side of the cabin. This trap-door shall be reached by an emergency ladder.

The dimensions of these trap-doors shall be at least 0.50 x 0.60 m and they shall be provided with a locking device to maintain them in the open position. The trap-door in the ceiling shall only open upwards.

1.10. When some oblique or vertical walls have windows situated at a level lower than 1.00 m in relation to the floor, the glazed portions shall be protected to a height of 1.00 m by horizontal bars at 0.25 m, 0.50 m and 1.00 m from the floor or by vertical bars at 0.20 intervals or by a suitable arrangement which does not obstruct the driver's visibility.

Each bar shall be capable of withstanding a force of 1000 N without noticeable deformation.

1.11. When the floor is provided with windows including oblique elements these shall be protected in an identical manner to that described in 1.10 above.

1.12. When the control station is situated at the foot of the crane, it shall be protected by a roof which is capable of absorbing the energy of a steel sphere of mass 7 kg falling through a vertical distance of 2 metres.

2. Access

2.1.1. All control stations and all parts of the crane to which access is required for inspection or regular maintenance operations shall be provided with safe means of access.

2.1.2. The areas referred to in the preceding paragraph which are located more than 2 m above the ground, and also the jibs shall be accessible by means of stairs, landings, gangways or ladders.
Stairs shall have hand rails on both sides.

2.1.3. In order to carry out erection or dismantling operations, inspection, emergency repairs or maintenance of parts located more than 2 m above the ground the crane, including the jib, shall be provided with sufficient support equipment (e.g. hand-rails, hand-grips, platforms, safety equipment etc.) to ensure the safety of personnel and to allow them access to the places of work.

Pulleys and moving parts located along a jib shall be so constructed as to eliminate the necessity for greasing maintenance between the erection and dismantling of the crane . If this is not the case, means of access shall be provided in the jib.

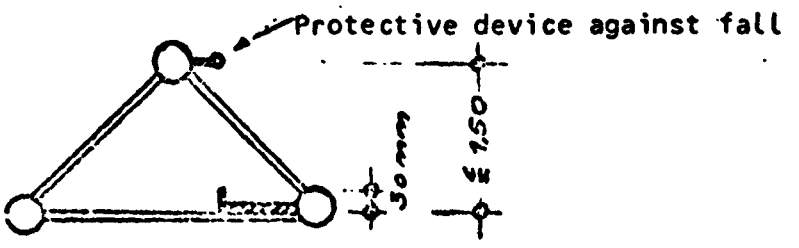

FIGURE 1

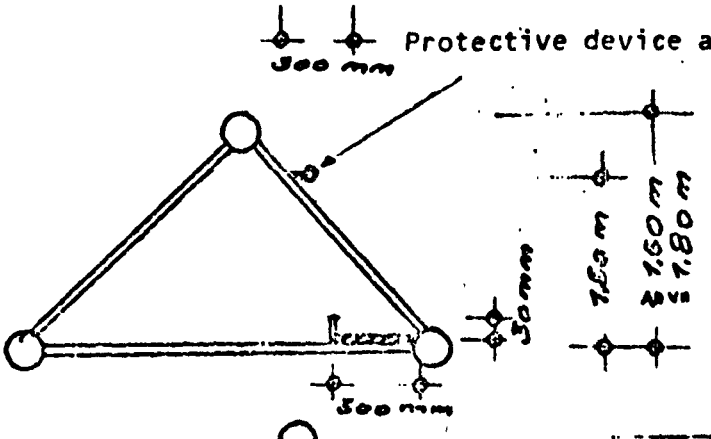

FIGURE 2

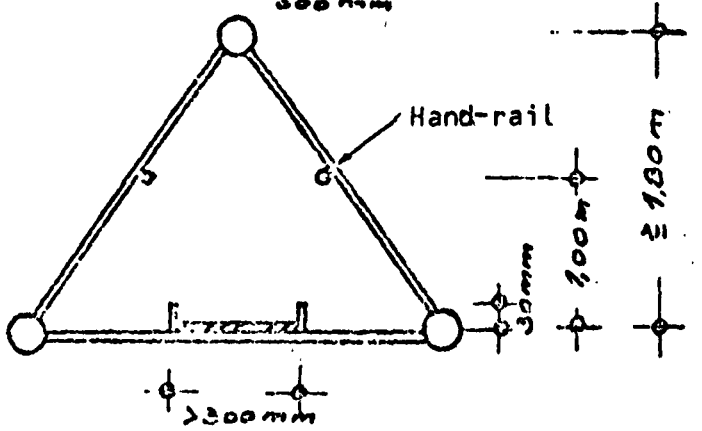

FIGURE 3

Figure 1: Where gangways are provided in jibs of a structural height of not more than 1.50 m, these gangways shall be fitted along the side of the jib. In this case, it is accepted that the diagonal bars have to be stepped over. As a protection against fall a handrail shall be fitted all the way along the longitudinal supports to which the worker's safety belt can be attached.

Figure 2: Where gangways are provided in jibs of a structural height of more than 1.50 m but not more than 1.80 m, these shall also be fitted along the side. The guide rail specified in Figure 1 acting as a protective device against fall shall be fitted 1.50 m above the gangway.

Figure 3: Where gangways are provided in jibs of a structural height greater than 1.80 m, the gangways shall be fitted to the centre of the longitudinal lower supports. At a height of 1 m above the floor of the gangway hand-rails shall be provided to act as protective devices against fall, at least on one side and possibly on both sides.

2.1.4. The above-mentioned means of access need not to be installed in the jibs where the latter can be lowered to enable a complete visual inspection to be carried out or where another appropriate means of carrying out a visual inspection is provided for in the construction.

2.2. Ladders and stairs

2.2.1. These are defined as follows:

2.2.1.1. - stairs : accesses forming an angle of not more than 65° to the horizontal plane.

2.2.1.2. - ladders : accesses forming an angle of not less than 75° but less than 90° to the horizontal plane.

2.2.1.3. Accesses forming an angle of more than 65° but less than 75° to the horizontal plane are forbidden.

2.2.2. Stairs

2.2.2.1. The stairs shall be provided with a handrail on both sides at a height of 1 m vertically above the edge of each step together with an intermediate rail located at half height.

2.2.2.2. The steps shall be of the non-skid type and shall be rounded off to protect the feet.

The rise between the steps shall not exceed 0.20 m and shall preferably comply with the following formula:

Twice the height of the step + one projection = 0.63 m;

The width of the steps shall be at least 0.60 m.
The distance between the steps shall be constant.

2.2.3. Ladders

Ladders shall have the following characteristics:

2.2.3.1. - the minimum width between uprights shall be 0.30 m;

2.2.3.2. - the rungs shall be spaced equally at intervals of between 0.25 m and 0.30 m inclusive;

2.2.3.3. - there shall be a free space behind the rungs of at least 0.16 m in depth and of a width at least equivalent to the width between the uprights;

2.2.3.4. - the minimum diameter of the rungs shall be 16 mm.

2.2.3.5. A rung shall be capable of supporting at its centre a force of 1200 N without becoming permanently bent.

2.2.3.6. Vertical or slightly inclined ladders which give access to a height of more than 5 m shall be fitted with hoop-guards from a point 2.50 m above their departure platform. The diameter of the hoops shall be between 0.70 and 0.80 m.

2.2.3.7. The distance between two hoops shall be at most 0.90 m.

The hoops shall be connected by at least three longitudinal bars spaced equally around the hoop.

In all cases a bar shall be fixed in a position diametrically opposite to the vertical line through the centre of the ladder.

2.2.3.8. The strength of the hoop-guards supported by the longitudinal bars shall permit the application, at any point on a hoop, of a force of 1000 N distributed over 10 cm without any visible deformation.

2.2.3.9. A hoop-guard is not required when the ladder is located inside a structure if this acts as a back guard and if the free passage between the ladder and the structure is between 0.70 m and 0.80 m inclusive. It is considered as ensuring equivalent protection if the characteristics of the structure are such that the vertical distance between the bars is always less than 0.75 m in the area where protection is necessary and that the diameter of the circle inscribed between the ladder and the bars is less than 0.75 m.

2.2.3.10. Ladders shall have rest platforms placed in such a way that the first flight does not exceed 10 m and that subsequent landings are provided every 6 m.

2.2.3.11. Flights of ladders shall be positively separated from one another where this is possible.

2.2.3.12. In the case of telescopic cranes the flight of 10 m may be exceeded on external masts depending on the type of the construction.

2.2.3.13. Emergency ladders

The emergency ladders specified in 1.9. shall comply with the requirements laid down in clauses 2.2.3.1. to 2.2.3.5. inclusive.

2.2.4. Floors and platforms

2.2.4.1. Any floor or platform more than 2 m above ground level shall be of all-metal construction and shall have a surface which minimizes the risk of slipping.

2.2.4.2. There shall be no possibility of water accumulation.

2.2.4.3. They shall be provided with guard rails consisting of:

- a handrail, 0.90 m to 1.00 m above the flooring;
- an intermediate rail at half height;
- a toe-guard 0.10 m in height;

or any other arrangement which gives at least equivalent protection.

2.2.4.4. In the case of perforated plates, gratings or any other items which do not form a continous surface, the perforations or apertures shall not admit a sphere 20 mm in diameter and in no case shall their area be greater than 400 mm^2.

3. Operator's position and control devices

3.1. The operator's position shall be so designed and installed as to ensure easy and safe control of the crane. In addition, the driver's view over the crane's field of action shall not be obstructed by any part of the crane irrespective of its position.

3.2. The force necessary to move a handle or control lever shall not exceed 100 N; that required to move a pedal shall not exceed 200 N.

3.3.1. The position and design of the control devices shall be such that they can be easily operated and that neither the crane nor the load can be set in motion by inadvertent action.

3.3.2. The motion shall stop automatically as soon as the control device is released.

3.4. Every device for controlling the crane or the load shall bear conspicuous markings to indicate the nature and direction of the movement it controls.

3.5.1. When control levers of the ball-and-socket or universal joint type are used the movements of the crane shall conform to the following lever movements:

movement of the crane	direction of lever movement
- hoisting, luffing in, inward movement of the crab or jib if the latter is capable of moving horizontally	- towards the operator (lever backwards)
- lowering of the load, lowering of the jib, outward movement of the crab or jib if the latter is capable of moving horizontally	- away from the operator (lever forwards)
- slewing to the right	- lever to the right
- slewing to the left	- lever to the left

3.5.2. For wheel control devices the movements of the crane shall conform to the following wheel movements:

movement of the crane	direction of wheel movement
- hoisting, luffing in, slewing right, inward movement of the crab or jib if the latter is capable of moving horizontally	- rotation clockwise
- lowering of the load, luffing out, slewing left, outward movement of the crab or jib if the latter is capable of moving horizontally	- rotation anti-clockwise

3.6. All essential and necessary information regarding the safe use of the crane in normal service and the precautions to be taken if there is a likelihood of high winds or storm conditions shall be displayed conspicuously, legibly and indelibly, in the national language or languages, at the operator's position and at other appropriate points on the crane.

3.7. A box shall be provided on every crane for the storage of documents relating to the safety of the crane.

4. Protection of transmission mechanisms

4.1. All transmission parts such as drives, projecting axle ends, wheels, belt-drives, chains and couplings which constitute a risk during normal operation, maintenance or adjustment shall be adequately protected.

4.2. Gearing which constitutes a hazard shall have a rigid protective guard.

4.3. Rail wheels which constitute a hazard shall be fitted with a protective device.

5. Locking devices for drives and couplings

Dog clutches and reverse gearings which are likely to constitute a hazard in the event of tripping, release or sudden reversing shall have an efficient locking device.

6. Protection against falling objects

6.1. Overhanging components (whether moving or not) or removable parts such as gears, pulleys, brake pulleys, brake counter-weights, covers, lids and boxes shall be assembled and fixed in such a way as to prevent their accidental displacement if such movement constitutes a hazard.

6.2. Lids and cupboard doors shall be fitted with hinges or other devices which prevent their accidental displacement and a locking device to maintain the lids and cupboards in the open position.

7. Transmission mechanisms and brakes

7.1. Every tower crane shall be equipped during all its operations with effective brakes (or any other equivalent device) which are appropriate for use and are capable of stopping and maintaining in the stopped position the movements of the crane and its heaviest loads, including test loads.

7.2. If the appliance is fitted with a mechanism for raising and lowering the hook, the operation of which allows passage through a neutral position, a device shall automatically immobilize the movement before reaching the neutral position and maintain it immobilized during the operation. Furthermore, the configuration of the kinematic chain shall be such that the continuity of the transmission between the immobilization device and the winding drum cannot be interrupted.

7.3 The hoist winches shall be so designed and constructed that during normal operation any uncontrolled descent of the load is **impossible.**

It shall not be possible, during any operation, to lower the load using the brake only.

7.4. Hoist winches shall be so designed that under the maximum permissible load the lowering speed specified by the manufacturer shall not be exceeded by more than 10%.

7.5. The release of the control device shall cause automatic application of the brakes or equivalent devices for hoisting, luffing, travelling or movement of the crab or jib. The brakes or equivalent devices shall remain locked on in the stopped position. Movements shall be stopped in such a way that the crane is not subjected to any dangerous stresses.

7.6. Brakes shall comply with the following requirements:

7.6.1. - Brakes which operate automatically shall be so designed and constructed that manual intervention from the operator's position is not possible during braking.

7.6.2. - be designed and constructed in such a manner as to ensure smooth application, without shock, jerking or excessive deceleration;

7.6.3. - be capable of adjustment;

7.6.4. - be adequately protected against bad weather, dust and ingress of water or oil;

7.6.5. - be so constructed that essential components for the correct functioning of the brakes, such as counterweights, drum winches or springs cannot be accidentally displaced or detached;

7.6.6. - where springs are used they shall function only in compression.

7.7. The correct functioning of the brakes or equivalent devices shall not be influenced by the failure of the power supply. Any failure shall bring about the application of the brake(s) and bring to a stop the related movement(s).

7.8. The provisions laid down in the foregoing points are not applicable to devices provided and designed to maintain the crane in a fixed position.

8. Wire-ropes and chains

This paragraph does not cover "Standing wire-ropes".

8.1. Wire-ropes for use with cranes shall be made of steel.

8.2. Steel wire-ropes which are wound on winding drums or pass over pulleys shall be made up of at least 114 wires. They shall not have more than one fibre core.

8.3. Each steel wire-rope shall be in a single length and shall not be spliced except at the end terminations. Eye splices shall be made with at least three tucks with a whole strand of the rope, and two tucks with one half of the wires cut out of each strand. This requirement shall not prevent the use of another type of manual or mechanical splice which can be shown to be of equal or greater efficiency.

8.4. Under static conditions, the load on the wire-rope shall not exceed one-fifth of the minimum breaking load as guaranteed by the manufacturer.

8.5. The crane manufacturer shall show, by calculation, that the ratio between the effective breaking load of the new rope and the maximum force induced in the rope, at the hoist winch position, is not less than 3.55.

8.6. The wire-ropes of trolley winches shall have a minimum breaking load guaranteed by the rope manufacturer, which shall be at least equal to 4.5 times the maximum force induced in the rope by the traction motion in the most unfavourable conditions (wind, starting, stopping, centrifugal force, etc....).

The nominal diameter shall not be less than 6 mm.

8.7. The length of wire-rope on a winding drum shall be such that in all possible working conditions at least two complete turns remain on the drum.

8.8. Chains, rings and accessories which constitute integral parts of the crane shall :

- be made of steel;
- not be subjected to a static load greater than one fifth of their breaking load when new.

9. Lifting hooks

9.1. Lifting hooks shall be made from a type of steel which does not deteriorate with age.

9.2. Lifting hooks under a test load equal to twice the maximum permissible load shall not show any sign of permanent deformation.

9.3. Lifting hooks shall be of a pattern or type which will not allow the accidental unhooking of the loads.

Their design shall be such that any accidental engagement with surrounding objects during lifting operations is avoided.

10. Winding drums and pulleys

10.1. Wire-rope drums of winches for lifting or luffing, for travelling of the trolley or the horizontal movement of the jib shall:

10.1.1. - be of the grooved type. The radius and the pitch of the grooves shall be suited to the diameter of the wire-rope so as to ensure correct winding of the wire-rope on the drum. The metal shall be of sufficient hardness to prevent indentation by the rope and the grooves shall have smooth machine surfaces;

10.1.2. - be fitted with a flange at each end unless other effective and permanent precautions are taken to prevent the rope inadvertently leaving the drum. The flanges shall project at least two rope diameters beyond the level of the last layer of wound rope;

10.1.3. - be fitted with a device to allow the wire-rope to be secured on the drum without damage. This device shall be easily accessible for inspection;

10.1.4. - be of a diameter measured at the bottom of the groove at least equal to twenty times the nominal diameter of the wire-rope.

10.2. The wire-rope shall wind on the drum in close and regular turns.

10.3. Each rope pulley shall:

10.3.1. - have a device which prevents the wire-rope becoming displaced from its groove;

10.3.2. - be of a nominal diameter measured at the bottom of the groove at least equal to twenty-two times the diameter of the wire-rope;

10.3.3. - have a groove which is suited to the diameter of the wire-rope.

10.4. Wire-rope winch drives employed for travelling the jib trolley or moving the jib horizontally shall not be dependent on friction traction with the exception of cranes of which the maximum permissible load does not exceed 10 kN, or when the crane can lift its maximum load at any radius.

11. Safety devices

11.1. Each mechanical motion of a tower crane shall be fitted with operational limiting devices.

11.2. These devices shall cause the mechanism to stop when the following extre permissible positions have been reached:

11.2.1. - the highest and lowest position of the lifting hook;

11.2.2. - the extreme permissible operating positions of the jib if a luffing movement is part of normal working operations;

11.2.3. - the positions at the end of the trolley track on the jib. For cranes having a trolley speed of not more than 25 m/min and a maximum load of less than 10 kN , no end of travel limiter for the trolley is required if friction drive is employed;

11.2.4. - the end positions of horizontally telescoping jibs;

11.2.5. - the positions at the ends of the tracks for rail-mounted travelling tower cranes.
(If a crane is equipped with a means for movement, end-of-travel devices shall be placed on the crane chassis.)

11.3. The functioning of the devices mentioned above shall not prevent movemen in the opposite direction after stopping and application of the brakes.

11.4. Cranes shall be provided with:

11.4.1. - a maximum rated load limiter regulated closely to the rated load.

11.4.2. - an overturning moment limiter when the rated load varies with the radius
This limiter shall be regulated closely to the rated load at the appropriate radii.

11.4.3. In every case the limiters shall act to prevent the lifting of a load which is at most equal to 1.10 times the rated load, the load being lifted under normal conditions of use.

11.4.4. The action of these devices shall cause braking and stopping of the following motions:

- lifting;
- increase in load radius tending to increase the load moment;
- slewing;
- travelling.

11.4.5. Movements of:

- lowering;
- decrease in load radius tending to reduce the load moment, shall be obtainable by using the normal control devices.

11.4.6. For slewing and travel movements the crane driver shall be in a position voluntarily to cancel, after the movement has stopped, the action of the devices which caused these movements to stop.

12. Indicators and instruction plates

12.1. When its radius multiplied by the maximum load is greater than 600 kNm, or the height under the hook is greater than 25 m, the crane shall have an instrument panel located in the cabin which indicates the following:

- moment;
- radius;
- load.

These indicators shall be such that they can be easily and simultaneously read by the operator and are within the operator's field of vision.

12.2. Other cranes which are not equipped with the above-mentioned indicators shall be equipped with radius markers (plates, range-poles etc.) with the indication of the corresponding maximum permissible load.
These indicators shall be clearly visible from any operating position.

12.3. The crane shall be fitted with sound signalling device(s) of a distinctive tone.
The sound of this/these device(s) shall be clearly audible within the working area of the crane.
The device(s) shall be actuated from the operator's position.

12.4. For cranes higher than 25 m, connections for an intercommunication system shall be provided in the cabin and in the lower part of the crane.

12.5. Wind loading device

12.5.1. The crane shall be fitted with a device for turning the jib in relation to the wind direction. The control system of this device shall be easily accessible and easily manageable from the operator's position.

12.5.2. The crane shall also be capable of being fitted with a device for turning the jib in relation to the wind direction that can be operated and managed from an easily accessible and clearly marked ground position. It shall not be possible, however, to use this device when the circuit which allows the crane movements to be controlled from the operator's position is open.

12.5.3. The operator shall be able at any time to take over control of the slewing motion from his position.

12.6. For cranes with a horizontal jib resilient buffer stops shall be provided at the trolley travel limit positions.

12.7. A crane with a crab or with a jib and counterweight travelling horizontally shall be equipped with a device to stop the crab or jib and counterweight in the event of breakage of a traversing cable.

12.8. In the vicinity of each wheel, or of each group of wheels of a rail-mounted crane, there shall be a rail guard to remove foreign objects from the rail, and a device which will prevent the crane from tipping should a wheel or an axle break. These two functions may be combined in one device.

The distance between the lowest part of each device and the top face of the track rail shall not exceed 20 mm.

12.9. Every crane travelling on tracks shall be equipped with devices designed to prevent displacement of the crane under maximum wind conditions as defined in the design rules. Furthermore, it shall be possible to equip the crane with devices to immobilize it in maximum wind conditions as defined in the design rules when it is not in service.

13. Electrical equipment

13.1. General provisions

The special provisions of this chapter relating to the installation and constituent parts of the electrical equipment equally apply to:

- the crane's flexible power supply cable;
- the cable-winding gear;
- the sectioning, isolating and cut-off control devices on the crane itself and any other devices downstream of the winding gear.

Items of electrical equipment shall:

(a) satisfy the requirements of the EEC Directive of 19 January 1973 (73/23/EEC) (low-voltage Directive)*;

(b) in the absence of harmonized standards, conform to the IEC or EEC (electricity) safety specifications published in the Official Journal of the European Communities pursuant to the low-voltage Directive*;

(c) in the absence of harmonized standards as indicated in (a) or where the safety requirements referred to in (b) have not been published, satisfy the safety requirements laid down under the national standards of the country where the crane is delivered.

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* Harmonized documents: see page 16

Harmonized CENELEC documents

HD 308 Identification and use of cables for voltages not exceeding the limit of LV 2 (1000 V ac, 1,500 V dc see HD 193)

Identification of the outer conductors of cables for voltages not exceeding the limit of LV 2 (1,000 V ac, 1,500 V dc see HD 193)

Identification and use of cables for voltages not exceeding the limit of LV 2.

HD 246-1 Diagrams, charts, tables - Part 1: definitions and classification

HD 246-2 Idem - Part 2: component identification

HD 365 Classification of the degree of protection given by the casings.

International Electrotechnical Commission publications (IEC)

IEC 364 (under consideration by CENELEC TC/64)
Current carrying capacities of conductors
Raceways overcurrent protection
Protective measures against direct contact
Protective measures against indirect contact

38 (1967) IEC normal voltages

117 Recommended descriptive symbols

144 Degree of protection for the casings of low voltage fittings

158 (1970) Low voltage control fittings for industrial use, Part 1: Contactors

255 Electrical relays

337 Auxiliary controls (low voltage control connecting devices for control and auxiliary circuits having auxiliary contactors)

408(1972) Outdoor low voltage switches, outdoor low voltage disconnecting switches incorporating low voltage fuses.

As regards the choice of lines supplying drive units, the main criteria to be taken into consideration are bad weather, dust and mechanical hazards.

The supply voltage value should correspond to one of the standard European values listed in IEC publication No 38.

The direct current mean value or the alternating current rms value of the voltage between conductors or between conductor and earth shall not exceed 250 volts in the case of safety, lighting, signalling and measuring control systems and circuits.

The use of movable metal control boxes for low voltage supply is permitted provided they conform to Class 2 as defined in Document IEC 529.

The insulation resistance between conductors and between conductor and earth shall exceed 1,000 ohms per volt and shall not be less than 500,000 ohms in the case of electric power circuits and the circuits of electrical appliances used for safety, control, lighting, signalling and measuring purposes. The above values do not apply to electronic circuits.

The neutral conductor and the protective conductor shall be kept separate at all times.

13.2. Lines - conductors - cables

Conductors and cables shall have the properties described in publications Nos HD 21, HD 22, HD 359 and HD 360.

13.2.1. Flexible connecting cables to the crane shall be of the series H 07 R N F Uo/U = 450/750

13.2.2. Flexible conductors placed on the crane shall be of the series H 07 V K Uo/U = 450/750.

13.2.3. Rigid conductors placed on the crane shall be chosen from the series H 07 VU - H 07 VR.

13.2.4. Bare wires and conductors shall be used only for wiring inside the boxes.

13.2.5. Only flexible conductors and cables shall be used outside the boxes.

13.2.6. Protection shall be provided for flexible conductors and cables secured to structural components, where there exists a risk of mechanical damage.

13.2.7. In the case of circuits supplied with a nominal voltage not exceeding 50 V between conductors or between conductor and earth, cables of nominal voltage Uo/U = 300/500 volts may be used.

13.2.8. Flexible cables on the crane shall not have PVC sheathing or insulation.

13.3. Method of installation - connection and distribution equipment

13.3.1. Low-voltage connection and distribution equipment shall, as a minimum, offer I.P.54 degrees of protection stipulated in HD 365.

13.3.2. The casing containing the starting resistors need not be of this type, but in that case shall be designed in such a way as to prevent the insertion of fingers and arranged so that as little dust and rain water as possible are allowed to accumulate (minimum degree of protection I.P.23 as defined in document HD 365).

13.3.3. The necessary instructions shall be supplied in respect of the electrical installations, so as to facilitate understanding of the system.

13.3.4. Steps shall be taken to ensure that staff carrying out normal maintenance have easy access to connection and distribution equipment. To this end, a minimum horizontal clearance of 0.60 m shall be provided between the front of the equipment and the nearest obstacle. The minimum vertical clearance shall be 2 m above the level of the platform.

13.3.5. Connections, connecting terminals and connectors shall be housed in cabinets or boxes.

13.3.6. Connecting terminals the accidental operation of which could cause operational hazards, shall be kept clearly apart, unless they are designed in such a way as to exclude this risk.

13.3.7. In order to ensure continued mechanical protection, the protective sheaths of the conductors and cables shall penetrate into the boxes housing the switches and equipment or the sheath shall terminate in a suitable gland.

13.3.8. Conductors relating to the control of different motions shall not be enclosed in a common conduit. On the other hand, cables relating to the control of different motions may be enclosed in a common conduit and may have a common entry into cases and boxes.

13.3.9. This provision does not apply to control, signalling and measuring conductors, irrespective of whether they are routed alongside the corresponding main conductors or not.

13.3.10. Where conductors with circuits of different voltages are routed along the same line or cable, all the conductors or cables shall be equipped with the insulation specified for the highest voltage.

13.3.11. Plug-in equipment and appliances shall be designed and constructed in such a way that, where tools are not required for the purposes of insertion and removal, it is impossible to reverse the connections.

13.4. Cross-section of the conductors

13.4.1. The cross-section shall be determined on the basis of Doc. IEC 364 (CENELEC HD8).

13.4.2. The minimum cross-section of the conductors shall be as follows:

- 1.00 mm^2 for flexible conduits, for control, signalling, telephone, (or intercommunication) and measuring conductors, excluding conductors used in electric safety circuits and any measuring conduits relating thereto.

- 1.50 mm^2 for control, signalling and measuring conductors in fixed conduits and for electrical safety or measuring equipment; when operating safety ispositive (operating at an inadequate or zero voltage) the cross-section may be reduced to 1 mm^2;

- 1.50 mm^2 for the conduits of electrical safety equipment including the measuring conduits;

- 1.50 mm^2 for conduits between parts of the fixed-installation lighting and the corresponding fuses;

- 1.50 mm^2 for conduits between fixed-installation motors and the corresponding fuses.

  - Account shall be taken of the possibility of using the different crane motors simultaneously. Furthermore, this cross-section shall be designed in such a way that intermittent and simultaneous operation of the different crane movements do not cause deterioration of the conductors.

- 1.50 mm^2 for all other conductors.

  - These requirements relating to the minimum diameter for conductors do not apply to conductors joining electronic components in the same circuit when these are located in the same box and are adequately protected against inclement weather and external mechanical hazards.

- 0.25 mm^2 for flexible conductors between electronic modules.

13.5. Isolators and circuit-breakers

13.5.1. The crane's electrical equipment shall include a device which acts as an isolator and a device which acts as a circuit-breaker or, alternatively, a single device performing both functions. These appliances, which shall be multipolar, shall be easily accessible.

13.5.2. Any device serving solely as an isolator shall not be capable of being operated except when the circuit-breaker is open. In addition, it shall be possible to lock the device mechanically in the open position. Mechanical locking, by means of keylocks or padlocks, of the equipment-box door will be regarded as meeting this requirement provided the isolator can be operated from inside the box only.

13.5.3. An actuator directly linked to the crane's general circuit-breaker shall be provided in the control cabin. It shall not be possible to put the crane back into service until this circuit-breaker has been unlocked and reset*. This re-setting may be carried out from the operator's seat.

13.5.4. All cabinets containing switchgear shall be fitted with a circuit-breaker capable of being locked by mechanical means in the open position, if it is not housed inside the cabinet, except in the case where each cabinet has a door switch which assures the opening of the circuit-breaking device. The door switch shall not be capable of re-setting the cut-out device.

13.5.5. The circuit-breaker shall have a cut-off capacity corresponding to category AC 2', as defined in IEC recommendation No 158.1.

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* In certain cases the manufacturer may specify in the service manual the checks and controls to be carried out before the crane is put back into service.

13.6. Contactors

13.6.1. The main and intermediate contactors shall belong to the following categories, as defined in IEC publication No 158.1:

- AC 2' in the case of a contactor for ac motors;
- DC 2 in the case of a dc contactor.

13.7. Protection systems for lines, equipment and current consumers

Provision shall be made to prevent the electrical equipment or parts of it from being damaged as a result of short-circuit, overloading or inadvertent earthing.

The following conditions, in particular, shall be complied with:

13.7.1. At the inlet of the supply system, a protection system with circuits which cut all the phase conductors*shall be provided against short circuits.

13.7.2. Each power circuit shall be protected on each phase conductor*against short circuits, particularly when the shunt circuit involves a change in wire cross-seciton. This protection may be dispensed with subject to the conditions stipulated in IEC publication 364 (harmonisation document 473).

13.7.3. Circuits supplying several motors relating to the same movement can have a common protection system against short-circuits. Sections of motor-connection conductors shall be of such dimensions that protection against short-circuits is assured.

13.7.4. Whether they involve circuit breakers with fuses, other circuit breakers or relays, the protection systems shall be such as to ensure cut-out of all the phase conductors* In the case of a fuse protective system, the cut-out shall be assured by means of a protective device which prevents monophased operation.

13.7.5. Infrequent stop-start motors with a power greater than 1 kW and frequent stop-start motors of a power greater than 15 kW shall be protected against overloading.

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* Cutting of phase conductors for alternating current and the cutting of positive and negative conductors for direct current respectively.

13.7.6. An overload detection system shall be provided on each phase conductor*. This detection system shall cause cutting of all phase conductors. (Doc. IEC 364).

13.7.7. For infrequent stop-start motors with a power not greater than 1 kW and frequent stop-start motors with a power not greater than 15 kW, protection against short-circuits may be provided.

13.7.8. For frequent stop-start motors with a power greater than 15 kW, protection against overload shall include an overcurrent detection system involving heat-sensitive devices incorporated in the windings of each motor. This detection system shall cut all phase conductors*.

13.7.9. After a protection device has functioned, it shall be re-set manually; this provision does not apply to the heat-sensitive devices.

13.7.10. The electro-magnets of the brakes and the brake motors shall have the same protection system against short circuits as the motors to which they belong functionally or shall be protected independently by a system providing equivalent safety.

13.7.11. It is not obligatory for the motors of the electrical cable reels to be individually protected when specially designed for this work.

13.7.12. Protective systems against short circuits as defined in paragraphs 13.7.10 and 13.7.11 may be used if the supply lines for the electro-magnets of the brakes, the brake motors and the winding drum motors are:

(a) less than 5 m long
(b) suitable for the normal load on the equipment and the motors.

13.7.13. Electrical equipment for the crane shall be so designed and constructed that its operational safety is not interrupted by a significant voltage drop or a no voltage situation arising in one or several active conductors of the electrical supply. In particular, the development of such incidents in the electrical supply shall in no case cause:

- the inadvertent start-up of any movement;
- any movement being obtained contrary to that which is desired;
- any movement at uncontrolled speed;
- uncontrolled descent of the load;
- the breakdown of a safety system.

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*Cutting of phase conductors for alternating current and the cutting of positive and negative conductors for direct current respectively.

13.8. Control and signalling circuits

The design and the execution of the control and signalling circuits shall be such as to ensure the safety of the staff in all circumstances, and protect the crane effectively against the results of equipment malfunctions. They shall, in particular, fulfil the requirements set out below.

13.8.1. All the control and signalling circuits shall be supplied by at least one transformer, which shall comprise separated windings and be connected upstream of the supply circuit breaker.

13.8.2. If the equipment comprises several control and signalling transformers functioning simultaneously, each of these transformers shall supply the control circuits corresponding to distinct mechanical components as far as possible.

13.8.3. The supply conductors for the control-circuit transformers shall be provided with a fused circuit breaker or by devices having an equivalent effect.

13.8.4. When the transformer supplying the control circuits is earthed at one end of its secondary circuit, the non-earthed conductor shall be protected against short circuits.

When the control circuits are supplied by means of a transformer none of whose secondary conductors is directly earthed, it is necessary to provide for protection against short circuits on each of the two secondary outlets.

13.8.5. The accidental earthing of one or more points in a control circuit shall cause neither inadvertent start-up nor abnormal operation and shall not prevent movements from being stopped.

13.8.6. Such defects shall not cause a dangerous increase in the potential of the earths.

13.8.7. The failure of a motor or any device shall automatically bring about the stopping of all the motors and auxiliary devices governing the same movements which could jeopardise safety were these to continue in operation.

13.8.8. All the contactors and relays controlling mechanically-connected, opposed components or counter-movements shall be protected against any faulty manoeuvre. The inverter switches that determine the direction of rotation of the motors shall be so interlocked that a short circuit cannot occur during a manoeuvre in normal operation.

13.8.9. Connection of coils and contacts

In control circuits with one side earthed, one end of the operating coils of the control device shall be connected directly to the earthed side of the control circuits and all control contacts shall be inserted between coils and the other side of the control circuit.

The following exception to this rule is allowed:

Contacts of protective relays (for example overload relays) may be connected between the earthed side and the coils provided that the conductors between such contacts and the coils of the control devices on which the relay contacts operate do not extend beyond a single control enclosure or compartment (Document HD 93.1.)

13.8.10. These requirements are not applicable to the electronic control circuits when these are so designed that the occurrence of a defect does not cause an inadvertent movement of the crane or the failure of a safety device.

13.8.11. No electrical circuit may be connected in parallel with the safety contacts with the exception of the circuits for:

- reversing a movement;
- exceeding the normal working travel during assembly or maintenance work on the condition that connections in parallel can only be carried out by means of a mechanical locking device in the open position during normal working;
- unlocking the direction control when the crane is not in operation;
- changing the pulley blocks.

13.8.12. In the protection systems, the safety contacts shall be of the mechanically forced type, and be actuated with as few intermediate components as possible. The gap shall be at least 3 mm.

13.8.13. The safety contacts shall be so installed that they retain their correct setting under any operational stress.

13.8.14. The electrical or electronic protection equipment shall be so designed and adapted that the occurrence of a defect cannot cause the operational breakdown of other safety systems.

Remark

If these requirements cannot be met, duplicating and cross-monitoring* of the circuits may be provided.

13.9. Protection against overspeed

13.9.1. A safety device to prevent overspeed when there is simultaneous two-phase operation in respect of lifting and luffing movements shall be installed.

13.9.2. If a vertical movement is obtained by means of a motor or a variable-torque transmission, it shall only be possible for the brake to be released when the field excitation of the motor is sufficient to ensure the proper operation of the motor or of the transmission.

13.9.3. With regard to the vertical and slewing movements:

(a) all movements actuated by a generator shall be provided with a device which actuates the brake in the event of the supply from the generator being cut off;

(b) all the main movements actuated by motors or transmissions having an electronically regulated supply shall be provided with a device which controls the speed and rotational direction and is capable of stopping, if need be, the movement in progress or selected.

13.10. Brake or stopping and immobilizing device

13.10.1. The isolation of a motor or a torque transmission shall cause the brake or equivalent device to be applied and shall ensure that movement ends and does not recommence.

13.10.2. For all movements under normal working conditions, the brake or equivalent device shall not be capable of being released until the relevant motor is receiving current. This does not apply to devices for rotating the crane.

13.10.3. In the case of motors supplied with variable current or by electronic devices, precautions shall be taken to prevent the torque developed by the motor from reaching a value sufficient to initiate movement before the brake is released.

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*Cross-monitoring means that if one circuit fails the second circuit prevents running of the motor before the fault has been eliminated.

13.11. Electric motors

Electric motors shall have at least IPX 4 degree of protection unless they are otherwise protected against water.

13.12. Lighting, heating and plug and socket equipment

13.12.1. The power supply to these items of equipment shall be connected upstream of the crane cut-out device (as defined in 13.5.1.).

13.12.2. A control device cutting all active conductors shall be placed at the power supply outlet.

13.12.3. Current circuits for lighting and heating shall be fed by separate transformers.

13.13. Electrical continuity between masses and metal components

13.13.1. The connection of the metallic masses of electrical components shall be assured by means of a protective conductor incorporated in the power supply cables.

13.13.2. The metallic masses and the structural components shall be interconnected in such a way that electrical continuity is ensured.

The electrical diagrams and plans shall be handed over to the user with the essential data; reference shall be made to IEC publications 117, 113.1 and 113.2.

The technical documents concerning the electrical equipment shall include the following items:

Equipment diagrams

Circuit diagrams

Diagrams or tables of the external connections

Operating instructions

Nomenclature of the electrical equipment

Maintenance instructions

List of the spare parts that should be kept in stock.

14. I.C. engine

14.1. General remarks

14.1.1. Failure of the I.C. engines shall not impair the operational safety of the crane.

14.1.2. In particular, the torque resulting from the lowering of a load or the braking of movements shall not give rise to an increase of more than 10% in the rotation speed of the I.C. engine.

14.1.3. I.C. engines and their accessories shall be so arranged that no risk is incurred (from burns, fumes, etc.) during maintenance operations or access as a result of their positioning within the structure of the crane.

14.1.4. All moving parts shall be protected by a casing or a robust cover.

14.1.5. Belts

1. The use of flat and round belting is prohibited.

2. (a) The use of V belts is not permitted for mechanisms which control hoisting, luffing or crab movements;

(b) The use of V-belts is permitted only for such purposes as slewing, crane travel and crab movements, pump and generator drives.

When V belts are used for these purposes the number of V belts shall be one more than the calculated number required for the transmission of the driving force. The belt tension shall be adjustable.

The operation of the brake shall not be effected by a failure of the belts. Furthermore, the functioning of the brake shall comply with the requirements in point 7.7.

14.1.6. The engine shall be mounted in such a way that no harmful vibrations are transmitted to the structure of the crane.

14.1.7. The I.C. engine shall be equipped with a speed governor, and any abnormality of operation shall be indicated in the control cabin.

14.1.8. The fuel tank, pipes and connections shall be protected from thermal or mechanical damage. The capacity shall be sufficient for 10 hours' operation.

14.1.9. Suppression of radio-interference of the engines shall be in conformity with the requirements of Council Directive No 72/245/EEC of 20 June 1972.

14.1.10. If more than one I.C. engine is used to drive the same machine, the controls of such engines shall be grouped and appropriately marked.

14.2. Drive motor : either an electric generator
or an hydraulic pump.

The equipment shall be designed in absolute conformity with Chapter 13 for electrical equipment.

14.3. Engine exerting direct mechanical action on the movements

- The same engine may drive a number of movements. Such movements may be produced simultaneously or separately; in all cases the control of movements shall be effective both in operation and at rest.
- During reversal of movements, there shall at no time be any interruption of control over the load and the movements of the crane.

15. Assembly

In addition to the rules given below on the assembly or dismantling of cranes, the safety instructions laid down by the manufacturer shall be observed.

15.1. These rules shall include all the necessary information relating to:

- the construction of tracks or supports;
- the making of ballast, if required;
- the electricity supply, if required;
- the exact procedure for the assembly of all components and the whole crane;
- the method of connecting the various components;
- the weight of each separate package;
- the characteristics of any auxiliary equipment required;
- the method of slinging the components, where appropriate;
- the weather conditions under which the crane may be assembled.

15.2. During all phases of assembly and dismantling, the stability of the equipment and the strength of the components shall be ensured in accordance with the design rules.

15.3. The following assembly operations may be distinguished:

- assembly of self-mounting cranes;
- assembly of conventional cranes by mounting each component separately with the aid of an auxiliary device.

In both cases, the assembly mechanisms - whether hand-operated, electric or hydraulic - shall be fitted with all the immobilization and safety devices necessary. Any mechanism equipped with an uncoupling device shall be provided with a safety arrangement to guard against the free fall of any component during assembly.

15.4. Wire-ropes, lifting hooks, winding drums and pulleys used only for assembly purposes and forming part of the crane shall comply with the requirements specified in chapters 8, 9 and 10. Points 8.4. and 8.5., however, need not be taken into account.

For application of point 10.1.4. the coefficient shall be 12.5 times the rope diameter instead of 20 times
and for point 10.3.2. the coefficient shall be 14 times the rope diameter instead of 22 times.

15.5. Instructions relating to assembly and maintenance

The manufacturer or the supplier shall supply with each crane instructions which can be understood by the user. These instructions shall set out all the characteristics of the crane, its mechanisms and its rail tracks. They shall provide all the information necessary for the use, maintenance, erection and dismantling of these items. They shall indicate the precautions to be taken in the event of high wind, storm and extreme cold.

16. Instructions to be fixed on the crane

The crane shall have a plate which is indelible and clearly visible giving the following information:

16.1. the name of the manufacturer or the production mark and if necessary the name of the supplier of the crane;

16.2. the manufacturing number;
the year of manufacture
and indication of the type;

16.3. the maximum permissible loads corresponding to the various operating radii;

16.4. for cranes with several lifting speeds, the maximum permissible lifting speeds with the corresponding maximum permissible loads;

16.5. mass of all ballast.

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Addendum to point 1.1.

Definition of the nominal characteristics of tower cranes

The nominal characteristics of a tower crane are defined as follows:

- Crane: Type M/P/N

for which

M = the torque value in relation to the rotating axis in 10 kNm at a span A = 20 log. M - 2.
If the crane can support jibs with a much greater or smaller span than A with different M values, the type will not change.

P = Maximum capacity in 10 kN of the crab equipment and pulley block with which the M value is obtained.

N = Capacity in kW of the driving engine of the hoisting mechanism.

No lower or upper limit is given for these values.

Examples:

1) - Type 40/3, 5/16
Crane of 1333 daN at 30 m with jib equal to or slightly greater than 30 m
35 kN maximum load
16 kW at the hoisting engine.

2) - Type 2000/92/125
Crane of 31 200 daN at 64 m with jib equal to or slightly greater than 64 m.
920 kN maximum load
125 kW at the hoising engine.

3) - Type 160/11/48
Crane of 3800 daN at 42 m with jib equal to or slightly greater than 42 m.
110 kN maximum load
48 kW at the hoisting engine.