BRITISH STANDARD

BS 357:1958

Incorporating Amendment Nos. 1, 2 and 3

Specification for

Power-driven travelling jib cranes (rail-mounted low carriage type)

UDC 621.874

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS

Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Co-operating organizations

The Mechanical Engineering Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Admiralty*
Air Ministry
Associated Offices' Technical Committee*
Association of Consulting Engineers (Incorporated)
British Chemical Plant Manufacturers' Association
British Compressed Air Society
British Electrical and Allied Manufacturers' Association*
British Engineers' Association*
British Internal Combustion Engine Manufacturers' Association
British Iron and Steel Federation*
British Railways, The British Transport Commission
Central Electricity Authority and Area Boards
Crown Agents for Oversea Governments and Administrations*
D.S.I.R. — Mechanical Engineering Research Laboratory*
Engineering Equipment Users' Association
Gas Council
High Commission of India*
Institute of Marine Engineers
Institute of Petroleum
Institution of Civil Engineers*
Institution of Gas Engineers
Institution of Heating and Ventilating Engineers
Institution of Mechanical Engineers*
Institution of Mechanical Engineers (Automobile Division)
Institution of Production Engineers*
Locomotive and Allied Manufacturers' Association of Great Britain
Machine Tool Trades Association
Ministry of Labour and National Service (Factory Inspectorate)*
Ministry of Power*
Ministry of Supply*
Ministry of Transport and Civil Aviation*
Ministry of Works
National Coal Board
National Physical Laboratory (D.S.I.R.)
Radio Industry Council
War Office*

The Government Departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the Committee entrusted with the preparation of this standard:

Aluminium Development Association
Aluminium Industry Council
Association of Cranemakers
British Constructional Steelwork Association
British Iron and Steel Research Association
Cable Makers Association
Contractors Plant Association
D.S.I.R. — Building Research Station
Dock and Harbour Authorities Association
Docks Division — The British Transport Commission
Excavator Makers Association
Federation of Civil Engineering Contractors
Institute of Quarrying
Institute of Welding
Institution of Engineering Inspection
Institution of Structural Engineers
London Master Builders Association
National Federation of Building Trades Employers

This British Standard, having been approved by the Mechanical Engineering Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on
28 February 1958

© BSI 01-2000

First published August 1930
First revision February 1958

The following BSI references relate to the work on this standard:
Committee references MEE/41, MEE/41/2
Draft for comment CW(MEE) 789

ISBN 0 580 35967 0

Amendments issued since publication

Amd. No.	Date of issue	Comments
3256	January 1959	
5469	February 1965	
5960	December 1966	Indicated by a sideline in the margin

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS

Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Contents

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

© BSI 01-2000

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS

Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Foreword

This standard makes reference to the British Standards listed in Appendix C.

This revised British Standard, published under the authority of the Mechanical Engineering Industry Standards Committee, forms one of a number of standards relating to cranes and excavators, others being:

BS 327-1, *Power-driven derrick cranes.*

BS 466, *Electric overhead travelling cranes.*

BS 1757, *Power-driven mobile cranes.*

BS 1761, *Single bucket excavators.*

BS 2452, *High pedestal or portal jib cranes.*

BS 2799, *Power-driven rail-mounted tower cranes.*

BS 3579, *Heavy duty electric overhead travelling cranes and special cranes for use in steel works.*

BS 2573, *Permissible stresses in cranes — Part 1: Structures.*

It indicates the minimum requirements for the types of crane described in Clause **2** but does not apply to railway breakdown cranes or other special rail-mounted cranes of similar type such as those used for bridge-building and track-laying.

As with all other British Standards for cranes, the object of the specification is to indicate the minimum requirements and to ensure reliability and safety, without placing restrictions on the general design of cranes or on the methods employed in their construction.

The standard makes reference to BS 2573, "*Permissible stresses in crane*", Part 1, "*Structures*" regarding the basic stresses and factors to be used in structural calculations; these are related to the classification of the crane and its expected duty.

It will be noted that the stability of a crane as dealt with under Clause **23** is different from Clause **10** of the 1930 specification. There is now only one set of coefficients to cover the various gauges.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 31 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

blank

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS

Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

1 Scope

This British Standard covers travelling jib cranes (power-driven, rail-wheel mounted, on low carriage) of the following types:

Type 1. Non-shunting type free on rail.

Type 2. Shunting type free on rail.

Type 3. Portable type.

Type 4. Any of the above types using outriggers.

Type 5. Any of the above types but with partial slewing.

Railway breakdown cranes and those of similar type are excluded.

Figure 1 shows an example of Type 1.

2 Description of types

Type 1. Cranes with carriages which are not suitable for shunting main line wagons and with a superstructure capable of slewing without limitation in either direction, and which are able to travel under their own power with loads Up to the maximum for which they have been designed suspended at any point in their full circle of slewing.

Type 2. Cranes similar to Type 1 primarily intended for crane duty but which have an extended carriage with headstocks suitable for shunting main line wagons and having travelling gear suitable for negotiating curves.

Type 3. Cranes similar to Type 1, but unable to travel under their own power.

Type 4. Cranes substantially conforming to any of the above types, but requiring the use of outriggers, jacks or blocks, as part of the crane to enable them to handle their designed maximum loads.

Type 5. Cranes having a limited arc of slewing.

3 Terminology

For the purposes of this standard the following definitions shall apply:

3.1
hoisting

lifting (or lowering) of the load in a vertical direction

3.2
slewing

the rotary motion of the crane jib or load about a vertical axis

3.3
derricking or luffing

the angular movement of the crane jib in a vertical plane

3.4
jib length

the shortest distance between the fulcrum of the jib and the centre of rotation of the jib head pulley

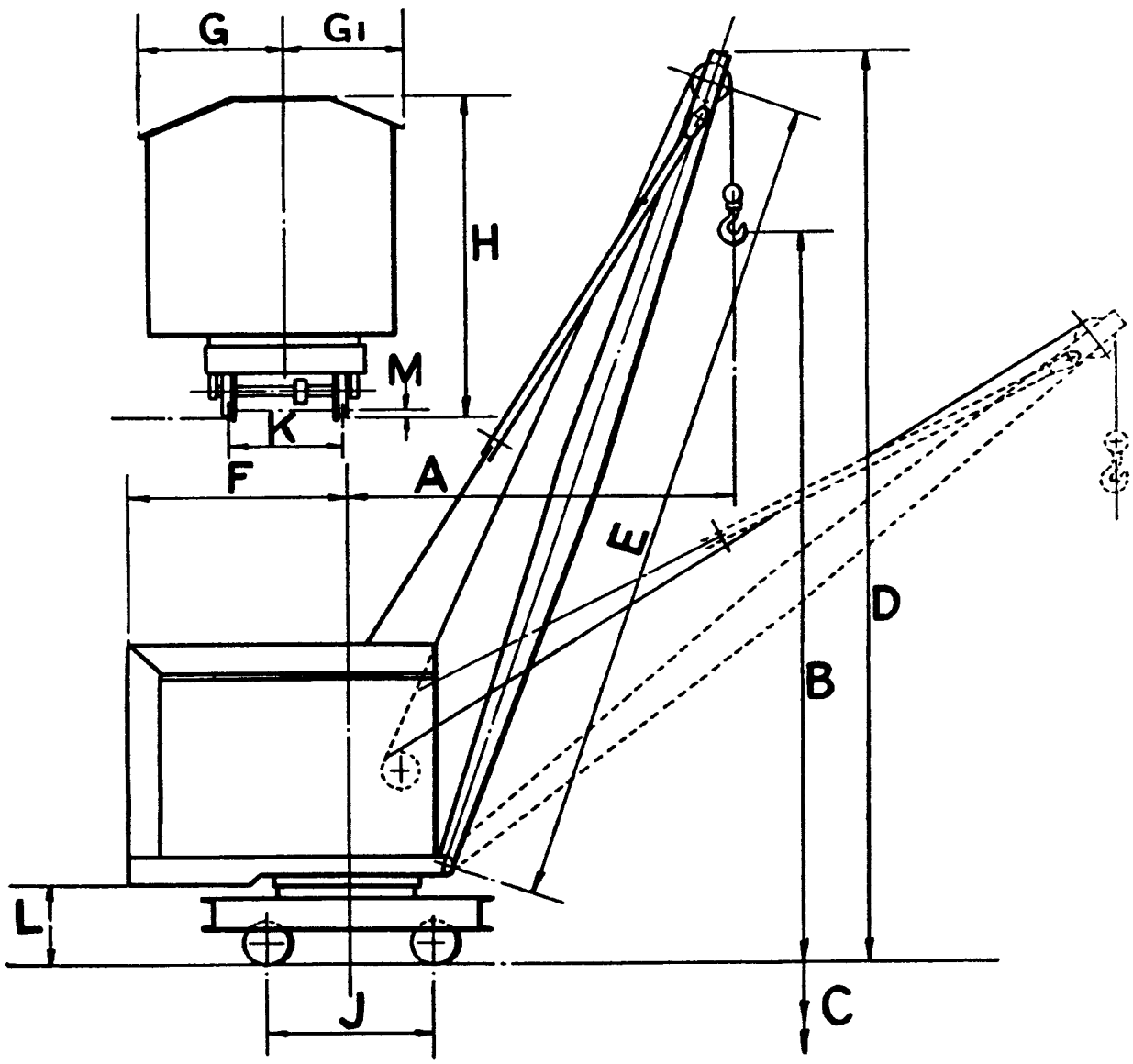
3.5
radius

the horizontal distance from the vertical centre line of the hook, when hanging vertically, to the slewing axis

3.6
margin of stability

when the crane is handling any safe working load at the appropriate operating radius the margin of stability is the additional load, expressed as a percentage of the safe working load, which is required to bring the crane to a condition of tipping with the jib adjusted if necessary to maintain the safe operating radius

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT



A. Radius.
B. Max. lift of hook above rail level with jib at radius A.
C. Max. reach of hook below rail level with jib at radius A.
D. Height of jib at radius A.
E. Length of jib between centres.
F. Max. permissible tail radius.
G & G1. Overall width of cabin.
H. Overall height of cabin above rail level.
J. Wheelbase.
K. Gauge.
L. Clearance under rotating superstructure to rail level.
M. Max. clearance above rail between wheels.

Figure 1 — Travelling jib crane

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

3.7
blocking-up base

the effective span of the supporting base when outriggers or other means are used to increase stability

3.8
tail radius

the maximum distance from the centre of rotation to the tail of the revolving superstructure

3.9
travelling

linear movement of the whole crane along a track

3.10
safe working load

the maximum load for which the crane may be used in compliance with the provisions specified in this British Standard

3.11
range of lift

the vertical distance between the highest and the lowest working positions of the hook

3.12
basic stresses

those given under the appropriate clauses and tables in BS 2573[1)]

3.13
wind load

the load produced by the wind pressure, which is a function of the wind velocity

3.14
fatigue failure

the tendency to fracture by means of a progressive crack under repeated alternating or cyclic stresses considerably below the tensile strength

3.15
tipping load

the load required to create the condition of tipping. A crane is deemed to be in the condition of tipping when it is supporting a load that cannot be increased by even a small amount without causing it to fall over

For explanations of the terms used to describe crane speeds, see Appendix F.

4 Information recommended to be supplied with enquiry or order

Information regarding the conditions under which the crane is to be used, together with particulars required by Appendix A, should be supplied with the enquiry or order.

5 Information to be supplied by manufacturer

The manufacturer shall supply with the tender the information required by Appendix B.

6 Service conditions

The crane shall be deemed to be under service conditions when it is on a level track and operating without load or with any load up to and including the safe working load. The loading shall include the load imposed by the wind pressure as specified in BS 2573, "*Permissible stresses in cranes*", Part 1, "*Structures*".

[1)] BS 2573, "*Report on permissible stresses in crane structures*".

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

7 Classification, duty and permissible stresses

a) *Classification and duty*. This British Standard covers the design and construction of Class 2 and 3 power-driven travelling jib cranes, these being the classifications adopted in BS 2573 as follows:

Class	Maximum number of hours in use per year (for design purposes)	Description of duty
2	2 000	Medium duty — general use
3	3 000	Heavy duty — intermittent grabbing and magnet work

NOTE Normally in the United Kingdom travelling jib cranes are designed to Class 2 requirements. If such cranes are derated to 80 per cent of the normal crane safe working load for grabbing and magnet duties, it may be assumed that they comply with Class 3 requirements.

b) *Permissible stresses*. The structure of the crane shall comply with BS 2573, "*Permissible stresses in cranes*", Part 1, "*Structures*".

For inertia forces set up in slewing, the design acceleration or retardation at the jib or cantilever head pulley shall be not less than 2 ft/s^2.

Permissible working stresses for parts other than those used in the crane structure shall be as specified in the following clauses of this standard:

Wire ropes: Clause **28**
Lifting hooks: Clause **29**
Gearing: Clause **34**
Brakes: Clause **38**.

8 Materials and equipment

The materials used in the load-bearing members of the structure of the crane shall comply with the British Standards set out in Appendix C. Other materials and equipment shall comply where applicable with British Standards as set out in Appendix C.

No timber shall be used for any load-bearing part of the crane structure.

Clause **9**. *Deleted in accordance with Amendment No. 2 issued February, 1965 (PD 5469).*

Clause **10**. *Deleted in accordance with Amendment No. 2 issued February, 1965 (PD 5469).*

Clause **11**. *Deleted in accordance with Amendment No. 2 issued February, 1965 (PD 5469).*

12 Steel plates and rolled sections shall be not less than $\frac{1}{4}$ in. thick.

The minimum thickness of tubular members with ends sealed shall be 10 S.W.G. (0.128 in.).

For corrosive conditions these minima shall be increased.

Clause **13**. *Deleted in accordance with Amendment No. 2 issued February, 1965 (PD 5469).*

14 Special requirements for frame structures including jibs

The slenderness ratio l/r shall not exceed the following values:

Struts entirely of lattice construction	120
Struts consisting of simple members	160
Bracing members	240

Struts consisting of two single or plated sections connected by latticing shall be considered as a single member strut in the unbraced plane with a limit of 160 in this plane, and with a limit of 120 in the latticed plane.

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

The latticing and plating of a strut member shall be proportioned to resist the maximum transverse shear at any cross section, such shear being assumed to be divided equally between the planes of bracing concerned, but the value allowed for transverse shear in the direction of the two axes of the strut as a whole shall in no case be less than the percentage of maximum axial load given in the table below, plus the shear at such planes of bracing due to simultaneous transverse loads in the member.

Additional shear force on struts				
Slenderness ratio of strut (l/r)	**Up to 80**	**120**	**160**	**240**
Transverse shear force as percentage of axial compressive load under service conditions	2.5	5.0	8.0	12.0

Intermediate values may be determined by linear interpolation.

15 Jibs

The jib feet and the members by which they are connected to the crane shall be of steel except that cast iron may be used for the sole purpose of increasing the pin bearing area.

Diaphragm braces shall be provided for stiffening purposes when the jib is of lattice construction.

16 Joints

a) *Strength of joints*. The calculated strength of riveted joints or joints made by friction grip bolts in structural members shall be not less than the calculated net strength of the member.

The calculated strength of other bolted joints in structural members shall be not less than the net strength of the member plus 25 per cent.

The calculated stress in rivets, bolts and welds shall not exceed the permissible stresses given in BS 2573-1.

Welded joints shall be designed in accordance with BS 2573-1.

b) *Rivet and bolt holes* (except those for friction grip bolts). All rivet and bolt holes shall be drilled accurately and all arrises and burrs shall be removed before assembly.

The diameter of holes for rivets shall not exceed the nominal rivet shank diameter by more than $^1/_{16}$ inch (1.6 mm).

The diameter of holes for precision bolts shall not exceed the nominal bolt shank diameter by more than $^1/_{64}$ inch (0.4 mm).

Where turned bolts are used in the structure the plain barrel part of the bolt shall be sufficiently long to ensure adequate bearing area for the load.

Where bolts are used in shear they shall be fitted into reamed holes. Black mild steel bolts shall not be used for joints in stress bearing members.

c) *Friction grip bolts*. Friction grip bolts shall comply with BS 3139 and shall be fitted in accordance with the recommendations of BS 3294.

d) *Rivet spacing*. The distance between the centres of rivets for stress-bearing parts shall be not less than $2^1/_2$ times the diameter of the rivet, and shall not exceed sixteen times the thickness of the thinnest outside plate or angle. Where two lines of staggered riveting are used in the same angle or flange, the maximum distance between the rivets on each line may be taken as 1.5 times those given above.

The distance between centres of rivets and the sheared or hand flame cut edge of a plate shall be not less than 1.75 times the diameter of the rivet, and between the centre of the rivet and a rolled, machined, or machine flame cut edge shall be not less than 1.5 times the diameter of the rivet.

e) *Welding*. All welding shall comply with BS 1856, BS 938, or BS 2642.

--`,,```,,,,````-`-`,,`,,`,`,,`---

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

17 Bolts other than those used in crane structure, and set screws (See Clause **16**)

Bolts and set screws shall comply with BS 1083. Bolts and set screws shall be locked or locking set screws used.

18 Supports for the rotating part of the crane

The rotating part of the crane shall be supported upon a centre post or pin, or a live ring of rollers or balls, or upon rollers on fixed axles, and provision shall be made to compensate for wear where necessary.

The load on the rollers shall not exceed the value obtained from the following formula:

$$L = 6B \times c \times d$$

where B = Lesser Brinell hardness number of the surfaces in contact

c = width of roller (inches)

d = mean diameter of roller (inches)

L = load (pounds)

19 speeds

The geared travelling and slewing speeds[2)] given in Table 1 are the maximum values for a crane handling the maximum load for which the crane has been designed.

These speeds are for normal crane duty and shall be reduced for cranes of gauges narrower than 4 ft 8½ in. For special duty cranes the speeds may be varied by agreement between the manufacturer and the purchaser.

Table 1 — Travelling and slewing speeds

Combined weigh of crane & max. hook load (tons)	Up to 20	21 to 30	31 to 40	41 to 50	Over 50
Max. travelling speed (ft per minute)	450	400	400	350	300
Max. rate of slewing	1 rev. in 20 sec.	1 rev. in 25 sec.	1 rev. in 30 sec.	1 rev. in 40 sec.	1 rev. in 60 sec.

Clause **20**. *Deleted in accordance with Amendment No. 2 issued February, 1965 (PD 5469).*

21 Identification

For the purposes of identification the crane shall bear the manufacturer's name, serial number and the year of manufacture.

If special materials, such as high-tensile steel or aluminium alloy, have been used in the structure, the crane shall bear a notice to this effect.

22 Track

Unless stated to the contrary, the track shall be assumed to be level and secured to foundations or sleepers of adequate strength and spacing to take the maximum applied wheel pressure and designed to suit the allowable bearing pressure on the ground.

The track is not the responsibility of the crane manufacturer unless agreed to the contrary.
See also Appendix E.

[2)] For explanations of the terms used to describe crane speeds, see Appendix F.

© BSI 01-2000

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS

Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

23 Stability

With the crane working on firm level track and with the jib at right angles to the larger side of the rectangle formed by the wheelbase and the gauge or blocking-up base, the load on the crane in the condition of tipping when handling any load at the appropriate radius shall not be less than the following:

i) for cranes on elevated structures or quay walls:

safe working load plus 50 per cent.

ii) for all other cranes:

Safe working load at appropriate radii	Tipping load
Up to and including 5 tons	Safe working load plus 50 per cent
Above 5 tons up to and including 7½ tons	Safe working load plus 2½ tons
Over 7½ tons	Safe working load plus 33⅓ per cent

In addition to the *minimum* requirements stated above the stability must be calculated in accordance with the following formula and the greater of the two values obtained shall be used:

$$\text{Required margin of stability} = \frac{F \times \text{Radius of crane}}{\text{Gauge (}or\text{ Blocking-up base)}}$$

where F is a coefficient (see Table 2) the numerical value of which depends on the gauge or blocking-up base.

The blocking-up base shall be measured between centres of supports and shall be used in determining the stability when outriggers, jacks or blocks are used.

Table 2 — Value of coefficient *F*

Gauge (*or* Blocking-up base)	Coefficient *F*
10 ft or more	7.6
9 ft	7.7
8 ft	7.9
7 ft	8.2
5 ft 6 in	8.9
4 ft 8½ in	9.4
3 ft 6 in	10.3
3 ft 3⅜ in (one metre) or less	10.5

The stability coefficient F applies to all cranes in which the maximum height of the jib head above the rail is 50 ft or less. When this dimension is exceeded, the coefficient shall be increased by 1 per cent for every additional 5 ft or part thereof.

For cranes designed as grabbing or magnet cranes the load on which the stability is calculated shall be the weight of grab and contents plus 25 per cent or magnet and load plus 25 per cent.

Cranes of 4 ft 8½ in gauge and over shall be stable backwards, when not blocked, with the jib removed, with the tail at right angles to the track, and both with and without a full complement (if any) of fuel and water. Cranes of less than 4 ft 8½ in gauge which are not stable under these conditions across track with the jib removed shall bear a clear, indelible inscription reading "This crane is unstable across track with jib removed".

24 Mechanical interlocks

Except when the mechanism driving the derricking drum is self-locking, or when the derricking drum is independently driven, an effective interlocking arrangement shall be provided between the derricking clutch and the brake or pawl sustaining the derricking drum. The arrangement shall ensure that the sustaining brake cannot be released until the clutch is effectively engaged, and that the clutch cannot be disengaged until the brake is effectively engaged, irrespective of the drum being under load or not.

If a sustaining pawl is used it shall not be possible to release it until the clutch is fully engaged, and it shall not be possible for the clutch to be disengaged until the pawl is fully engaged.

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

25 Guarding

a) *General.* Effective guards shall be provided for gear wheels, belt and chain drives, revolving shafts, flywheels, couplings, collars, projecting set screws, bolts or keys on any revolving shaft, wheel or pinion, unless those parts are made safe by design or by position or are effectively guarded by parts of the crane structure.

NOTE Appendix G gives legislation affecting cranes operated in the United Kingdom. Attention is drawn to Section 17 of the Factories Act, 1937, and Regulation 86 of the Building (Safety, Health and Welfare) Regulations, 1948, which relate to the construction and sale of new machinery.

The guard may be sheet metal, perforated or expanded metal, wire mesh, wood, pressed fibre or other material as may be deemed most suitable, and should completely encase the parts concerned. The guards shall be designed to allow for routine inspection and maintenance work.

The guards shall be substantially constructed to withstand the conditions in the situation in which they are to be used. They shall be sufficiently rigid to resist distortion and shall be securely attached to fixed supports.

b) *Thickness.* The thickness of metal guards shall be not less than 18 S.W.G. (0.048 in.).

c) *Size of opening and clearance.* The minimum clearance between the guard and the moving parts, and the size of opening in guards of perforated metal, woven wire, metal lattice or similar material shall be in accordance with the following requirements:

Table 3

Size of opening	Minimum clearance
in.	in.
Not exceeding $\frac{3}{8}$	$\frac{7}{8}$
Over $\frac{3}{8}$ up to and including $\frac{1}{2}$	2
Over $\frac{1}{2}$ up to and including $1\frac{1}{4}$	4
Over $1\frac{1}{4}$ up to and including $1\frac{1}{2}$	5

By size of opening is meant the greatest dimension of the opening except in the case of slotted material, when the length of the slot may be disregarded if the width of the slot does not exceed $\frac{1}{2}$ in.

26 Audible warning device

A device shall be fitted to enable the driver of a self-propelled crane to give audible warning of approach.

27 Load and radius indication

The crane shall bear a legible inscription stating the length or lengths of jib, the maximum safe working loads at the appropriate radius under all operating conditions.

When a crane is used for grabbing or magnet duties, it shall bear a legible description stating the maximum permissible weight of the grab or magnet, together with its contents or load, and the maximum radius at which the crane may be worked with the grab or magnet.

For cranes of variable radius, clear indication of the safe working loads at the appropriate radius shall be given by means of an indicator which is in full view of the driver. When different lengths of jib can be used, or when change-speed gear is fitted, or when outriggers or jacks and blocks are provided, or where alternative reeving can be used on the hoisting motion, the safe working loads for each condition shall be clearly indicated.

28 Wire ropes

a) *General.* Unless otherwise stated in Appendix A or Appendix B, ropes shall comply with BS 302, BS 621. Ropes of 6 × 61 construction shall not be used if less than $1\frac{1}{4}$ in (32 mm) diameter.

If a load is shared by two or more rope systems, means shall be provided for ensuring that it is shared in the design proportions. Arrangements entailing reverse bends shall be avoided as far as possible. A rope reeving diagram shall be provided.

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Derricking ropes shall be of sufficient length to permit the jib being raised from, or lowered to, the horizontal position during the erection or inspection of the crane.

Terminal fittings of ropes shall be capable of withstanding not less than 90 per cent of the nominal breaking load of the rope or ropes to which they are attached. Recommended methods of attaching terminal fittings are given in Appendices to the appropriate British Standard (e.g. BS 302, BS 621, Appendix A; BS 461, Appendix C; BS 463, Appendix B, etc.).

NOTE This requirement does not apply to the anchorage of a rope to a drum.

b) *Strength requirements*. The ratio between the nominal breaking load and the working load of a rope shall comply with the following requirements for service and erection conditions.

In determining the ratio, allowance shall be made for friction losses at the pulleys, the safe working load of the crane (including lifting attachments such as slings, lifting beams, etc.) and the hook block, but not the weight of the rope. For grabbing or magnet cranes the load shall be assumed to be the weight of the grab or magnet and its burden.

i) *Service conditions*. Under service conditions the ratio for running ropes and standing ropes which pass over pulleys shall be not less than 4.5 for Class 2 cranes and 5.5 for Class 3 cranes. For straight standing ropes the ratio shall be not less than 3.5 for Class 2 cranes and 4.0 for Class 3 cranes.

ii) *Erection conditions*. The ratio for running ropes and standing ropes which pass over pulleys shall be not less than 3.75. For straight standing ropes, the ratio shall be not less than 3.

NOTE For the purpose of calculating friction losses, the efficiency of pulleys is assumed to be 98 per cent when fitted with anti-friction bearings, and 96 per cent when fitted with plain bearings.

29 Lifting hooks

Lifting hooks shall comply with BS 482, BS 2903, BS 3017, BS 3033 or BS 3317 where applicable (see Appendix C).

NOTE For loads exceeding 40 tons (40 000 kg), hooks of the ramshorn type to BS 3017 or of the triangular type to BS 3317 are preferable.

Swivelling hooks shall be mounted on anti-friction bearings suitable for the purpose.

If required, a locking device shall be fitted to prevent rotation of the hook.

30 Rope drums

a) *General.*

i) The diameter of drums measured at the bottom of the groove, shall in no case be less than $14d$, where d is the diameter of the rope.

ii) Drums shall where possible accommodate in one layer the length of rope requisite for the range of lift. If the rope is wound on the drum in more than one layer the anchorage shall be located clear of the winding, preferably outside the flanges.

iii) Adequate means shall be provided to prevent the rope inadvertently leaving the drum. If solely for this purpose the drum is flanged at both ends, the flanges shall project a distance not less than two rope diameters beyond the rope.

NOTE A spur or other wheel secured to a drum can form one of the flanges provided it is adequately guarded.

iv) The inclination of the rope at the point of lead off from a drum shall not exceed 1 in 12 each side of a centre line which represents the true lead off.

b) *Drum grooves*. Grooving shall be smooth and free from surface defects liable to injure the rope. The edges shall be rounded.

If rope drums are helically grooved, the contour at the bottom of the grooves shall be circular over a minimum angle of 120° and the radius of the grooves shall exceed the radius of the ropes by not less than the values given in Table 4.

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Table 4 — Minimum groove radii

Diameter of rope d	Minimum amount by which groove radius shall exceed rope radius
Up to and including $^5/_8$ in (15.8 mm)	$^1/_{32}$ in (0.8 mm)
Over $^5/_8$ in but less than 1 in (25.4 mm)	$^3/_{64}$ in (1.2 mm)
1 in up to and including $1^1/_8$ in (28.6 mm)	$^1/_{16}$ in (1.6 mm)
Over $1^1/_8$ in	$^3/_{32}$ in (2.4 mm)

The grooves on the drum shall be pitched so that the clearance between adjacent turns of the rope is not less than the dimension given in Table 5.

Table 5 — Minimum rope clearances

Diameter of rope d	Minimum clearance between turns
Up to and including $^1/_2$ in (12.7 mm)	$^1/_{16}$ in (1.6 mm)
Over $^1/_2$ in up to and including $1^1/_8$ in (28.6 mm)	$^3/_{32}$ in (2.4 mm)
Over $1^1/_8$ in	$^1/_8$ in (3.2 mm)

NOTE If special types of grooving are employed the above dimensional requirements may be ignored.

c) *Rope anchorages*. Rope anchorages shall be protected by not less than two dead turns remaining on the drum when the rope is paid out to its maximum working length.

Rope anchorages shall be secure and readily accessible. If two or more ropes lead off a drum, provision shall be made for adjustment of the rope length at the anchored end.

31 Rope pulleys

a) *Diameter*. The diameter of pulleys, measured at the bottom of the groove, shall in no case be less than 17d, where d is the diameter of the rope.

b) *Grooves*. Rope pulleys shall be grooved to a depth not less than $1\frac{1}{2}$ times the diameter of the rope. The grooves shall be finished smoothly and be free from surface defects liable to injure the rope. The edges shall be rounded.

The contour at the bottom of the groove shall be circular over an angle of 120°. The radius of this part of the groove shall exceed the radius of the rope by the amount specified in Clause **30**, Table 4.

c) *Guarding*. Pulleys shall be guarded to retain the ropes in the grooves unless there is no likelihood of their becoming unloaded in service.

d) *Angle of lead* (*or fleet angle*). The angle between the rope and a plane perpendicular to the axis of the pulley shall not exceed 1 in 12.

e) *Supports*. If required, suitably designed supports shall be fitted on the jib and other parts of the structure to prevent chafing of the ropes.

32 Shackles

a) Shackles shall comply as regards strength and safety with BS 825 "*Mild steel shackles for lifting purposes*", or BS 3032, "*Higher tensile steel shackles*". When used for attaching the hook, shackles shall be provided with screwed pins.

b) When used eccentrically, shackles shall not be subjected to a load in excess of one-third of the normal proof load.

c) Each shackle shall be legibly stamped on a non-vital part with an identification number, and the pin of the shackle shall bear the same number.

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

33 Overhauling weight

When an overhauling weight is used on the rope it shall have a smooth bore and be bell-mouthed at the top and bottom unless the rope is efficiently served or otherwise protected, and provision shall be made for the examination of the part of the rope passing through the weight.

The overhauling weight shall be designed so as to avoid catching on obstructions.

34 Gearing

Gearing shall be designed for strength and for temperature rise in accordance with the following standards where applicable, using the correction factors given in Appendix D:

BS 436, *Machine cut gears. A. Helical and straight spur.*

BS 545, *Bevel gears (machine cut).*

BS 721, *Machine cut gears. C. Worm gearing.*

Machine-cut gearing is preferable.

Keys in gear trains shall be fitted and secured so that they cannot work loose (see Clause **36**).

Transmission chains and chain wheels shall be in accordance with BS 228, "*Steel roller chains and chain wheels*".

NOTE In determining the strength and wear factors from the appropriate charts of BS 436, it should be assumed, in the absence of known service conditions, that the equivalent running time per day is not less than 6 hours.

35 Bearings

All rotating shafts shall be mounted in ball or roller bearings or bearings lined with antifriction material. Ball and roller bearings shall be protected from water, dirt or other foreign matter. Pedestals for bearings shall be machined on the base and shall fit on a machined surface except when supported on three points. Bearings subject to load on the caps shall be designed to withstand such loading.

36 Rotating and fixed shafts and axles

Shafts and axles shall be designed to resist all stresses due to bending and torsion or a combination of both. Due allowance shall be made for stress reversal and for keyways and splines. Where a change in section is necessary allowance shall be made for stress concentration.

Shafts shall be machined true, finished smoothly where necessary, and provided with fillets of as large a radius as possible where any change in diameter occurs.

Keys and key-ways shall comply with BS 46-1, except where design considerations may necessitate departure therefrom.

Splines and serrations shall be of involute or straight-sided form, and shall comply with BS 2059 or BS 3550 as appropriate.

37 Pawls

Where pawls and ratchet wheels are used they shall be of steel of suitable quality for the duty.

38 Brakes

Each motion of the crane shall be controlled by a brake in accordance with the following, which are minimum requirements:

a) *General.* Springs for applying brakes shall be of the compression type and shall not be stressed in excess of 80 per cent of the torsional elastic limit of the material.

Brake blocks and linings shall be protected from water, grease or oil or other substances which have adverse effects.

Brake shoes shall remain securely fixed during the effective life of the lining.

Brakes shall be provided with a simple and easily accessible device to compensate for the wear of the linings. Brake weights, if fitted, shall be fixed securely to their levers.

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

The wearing surfaces of all brake drums or plates shall be machined smooth and shall be free from defects.

Where electro-mechanical brakes are fitted they shall apply the braking torque immediately the current is cut off through any cause, even after the linings and fittings have become worn.

With d.c. supply, arrangements shall be made to prevent the brake magnet from being energized by the back e.m.f. of the motor when the supply has been interrupted. This does not apply to any circuit arrangement in which the load is still under full control despite supply failure, as for example, the potentiometer system of control.

Where electric braking is adopted the conductors and contact surfaces of the motor and the control gear shall be proportioned so that the additional duty will not cause overheating.

The temperature of the friction surface of the hoisting brake shall not exceed the maximum temperature specified by the manufacturer of the brake linings, after the maximum safe working load has been raised, and lowered on the brake, five times through the specified height of lift.

Brakes applied by hand shall not require a force greater than 35 lb at the handle. If applied by foot they shall not require a force greater than 70 lb on the pedal to exert the restraining torque specified below. They shall be provided with a locking device which is applied automatically and which cannot be released accidentally. The locking gear must be capable of holding the restraining torque specified in the sub-paragraphs below.

b) *Hoisting motion brakes*. Hoisting motion brakes shall be designed to exert a restraining torque at least 25 per cent greater than the torque transmitted to the brake drum from the suspended load.

While the restraining torque is being exerted, the stresses in any part of the brake construction, excluding springs, shall not exceed one eighth of the minimum tensile strength of the material.

c) *Derricking motion brakes*. Derricking motion brakes shall be designed to exert a restraining torque at least 50 per cent greater than the maximum torque under service conditions, taking into account the effect of friction in the transmission components between the load and the brake.

While the restraining torque is being exerted, the stresses in any part of the brake construction, excluding springs, shall not exceed one eighth of minimum tensile strength of the material.

d) *Slewing brakes*. A slewing brake or other means of arresting the slewing motion shall be provided. The brake shall be capable of being secured in the holding position, or other means of locking the structure shall be provided.

e) *Travelling brakes*. Each crane shall be fitted with a parking brake or other device for preventing accidental movement of the crane.

Self-propelled cranes shall be fitted with a device for bringing the unloaded crane to rest, with a retardation not less than 1 ft/sec^2, when travelling on the level.

Cranes which are not self-propelled shall be fitted with a device, such as rail clips, for preventing accidental movement along the track.

39 Lubrication

Provision shall be made for lubrication of all bearings. All lubricating nipples shall be readily accessible. Ball and roller bearings which are to be lubricated by grease shall be packed with grease during initial assembly.

Where any bearings are provided with a reservoir for grease this reservoir shall be charged with grease on assembly. Where accessibility to a bearing for lubrication may be difficult, provision shall be made for remote lubrication or safe access to the lubricating point. A lubrication diagram shall be provided.

Suitable lubricating nipples are specified in BS 1486 Part 1, "*Lubricating nipples and adaptors*" and Part 2 "*Heavy duty lubricating nipples*".

40 Slewing

A slipping device shall be provided in the slewing mechanism, or other means adopted, in order to protect the structure and mechanism from shock and from a torque greater than that for which they have been designed.

This clause does not apply to cranes on which slewing motion is manually operated.

© BSI 01-2000

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS

Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

41 Electrical equipment

a) *General*. All electrical equipment not otherwise enclosed or protected shall be of weatherproof construction, and all rotating and live parts shall be adequately protected to prevent inadvertent or accidental contact.

Where it is necessary for any electrical equipment to be adjusted or inspected whilst "live", clearances as for switchboards shall be provided.

b) *Brake magnets*. The terminals of brake magnets shall be protected from accidental contact and the windings snail be effectively protected from mechanical damage. Where necessary they shall be provided with an efficient cushioning device.

Two duties are recognized for both a.c. and d.c., viz.:

1. Continuous or heavy duty.
2. Normal duty.

As with an alternating current brake magnet the current in the coil is greater for the open position than the closed, the ratings for a.c. are slightly different from d.c., and in accordance with Table 6.

Table 6 — Brake magnet ratings

Magnet duty	d.c. magnets	a.c. magnets
Heavy	Suitable for being in circuit continually where the brake coil operates infrequently OR 240 operations per hour where the time the brake coil is in circuit is not more than 7½ minutes out of every 15 minutes	Suitable for being in circuit continually where the brake coil operates infrequently OR Suitable for 240 operations per hour where the time the brake coil is in circuit is not more than 5 minutes out of every 15 minutes
Normal	Suitable for 240 operations per hour where the time that the brake coil is in circuit is not more than 5 minutes out of every 15 minutes	Suitable for 120 operations per hour where the time that the brake coil is in circuit is not more than 5 minutes out of every 15 minutes

The brake magnets shall operate for both duties, at the currents and voltages given in Table 7 below:

Table 7 — Brake magnet operating currents

Winding	d.c. magnets	a.c. magnets
Series		
For series — resistor control	Lift at 60 per cent full load current Hold at 15 per cent full load current	
Potentiometer control	Lift at 40 per cent full load current Hold at 15 per cent full load current	
Shunt	[a] Lift at 90 per cent normal voltage [a] Hold at 50 per cent normal voltage	[a] Lift at 90 per cent normal voltage [a] Hold at 50 per cent normal voltage

[a] This is intended to apply with hot coils corresponding to the duty cycle at normal volts. The temperature-rise of the brake magnet shall not exceed that allowed for the control equipment fitted (see BS 587, "*Motor starters and controllers*").

Motor magnets or electro-hydraulic brake releasing gear may be used in preference to brake magnets if desired.

42 Electric generators an motors

Electric motors and generators shall be of the protected, screen-protected, drip-proof, or totally enclosed type, except where other protection is required, and shall comply with the requirements of BS 2613.[3)]

NOTE For motors working under tropical conditions see BS 1156[4)] for guidance.

[3)] BS 2613, "*The electrical performance of rotating electrical machinery*".
[4)] BS 1156, "*A.c. and d.c. motors and generators, excluding shipborne and airborne machines*".

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

In addition to the requirements of BS 2613 the ratings of the motors shall be such that during the operation of the crane under service conditions the temperature rises do not exceed those permitted by BS 2613.

Generators and motors shall be located so that brush gear and terminals are readily accessible for inspection and maintenance.

All phase ends of the stator windings of a.c. motors shall be available at the motor terminal block.

Unless specially designed for higher speeds the motor shall be so arranged that its speed cannot exceed $2\frac{1}{2}$ times the rated speed.

43 Controllers and resistors

a) Controllers when in the off position shall open all supply lines for the respective motors unless otherwise agreed.

b) The controllers and resistors shall be adequately protected to prevent accidental contact with live parts, and shall be rated so that the temperature does not exceed the limit specified in BS 587[5)] during the operation of the crane under service conditions. For Class 1 and 2 cranes the rating shall be taken as five minutes.

NOTE It is recommended that the resistors should be enclosed in well ventilated housings, and, where necessary, with sheet metal covers, and that each resistor should be fitted with a terminal bar, unless all terminals are brought out on one side of the resistor. The terminal bar shall be fitted in any case where the current rating is above 100 amp.

44 Electrical protective gear

Ironclad protective gear shall be provided as follows:

a) A panel having, as minimum equipment, either an electromagnetically operated main contactor or manually operated circuit breaker, together with overload devices for each motor circuit.

The number of devices and their position shall normally be in accordance with one of the following arrangements as agreed between the manufacturer and purchaser but, if specified by the purchaser, other arrangements giving protection not less effective than any of these shall be considered as complying with this specification.

D.C. supply:

1) Where neither line is earthed.

i) One per motion and one in the common return line.

ii) Two per motion.

2) Where one line is earthed.

i) One per motion all connected in the non-earthed line.

ii) One per motion and one equivalent to that connected in the common return line, but all connected in the non-earthed line.

2 or 3-phase a.c. supply:

1) 3-wire supply.

i) Two per motion in separate phase wires.

ii) Two per motion in separate phase wires, and one common return relay in the third wire.

iii) Three per motion in separate lines.

2) 4-wire supply:

As for 3-wire supply ii) and iii).

A double-pole switch-and-fuse shall be connected in the operating coil circuit of the contactor when fitted. A push-button emergency stop or stops shall be placed so as to be readily available for use promptly by the operator in case of emergency. The push-button or buttons shall be connected in the operating coil circuit in the case of a contactor, and in the under-voltage release circuit in the case of a circuit breaker.

Electrical interlocking shall be provided to prevent the main contactor or circuit breaker from being closed unless all controllers are in the OFF position.

5) BS 587, "*Motor starters and controllers*".

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

A durable copy of the protective panel connection diagram shall be fixed inside the cover whenever practicable.

b) Providing the aggregate horsepower of the two largest motors does not exceed 40 or their aggregate current does not exceed 60 amperes, a manually operated easily accessible switch fuse panel may be used instead of the gear detailed in Section *a*. The minimum requirement shall then be a main switch in association with, for each motor, replaceable high breaking-capacity cartridge fuses.

The number and method of connection of the fuses shall be similar to the number and method of connection of the overload devices detailed in Section *a*.

A durable diagram of connections of the protective panel shall be fixed to the inside of the cover.

For electric cranes which are supplied from an engine-driven or motor-driven generator mounted on the crane, such protection shall be provided as agreed between the purchaser and the manufacturer.

45 Isolating switch

The isolating switch shall be mechanically interlocked with the door giving access to the protective panel, where possible. Where it is not possible, a red label plate shall be fixed on the door of the protective panel, marked "Isolate before opening cover". The switch shall comply with BS 862, "*Air-break circuit breakers (including totally-enclosed and flameproof types) for voltages not exceeding 660 volts*".

Facilities shall be provided for locking the isolating switch in the OFF position.

46 Limit switches

Where practicable, and if required by the purchaser, limit switches shall be provided on electric cranes to prevent one or more of the following:

a) over-hoisting,

b) over-lowering,

c) over-derricking in both directions,

d) over-travelling.

The contacts of limit switches shall be operated positively. Switches in which the contacts are operated by a spring or gravity, or both, on the withdrawal of a cam or similar device, shall not be used.

47 Electrical cables for power circuits

Unless otherwise agreed between purchaser and manufacturer, cables shall comply with BS 7, "*Rubber-insulated cables and flexible cords for electric power and lighting*", or BS 2004, "*Polyvinyl chloride insulated cables and flexible cords for electric power and lighting*", or BS 608, "*Varnished cambric insulated cables for electricity supply*", and conductors having a nominal area less than 0.0045 sq. in. shall not be used.

The loading in any cable under service conditions shall not exceed the rating specified in the I.E.E. Regulations[6)] for the Electrical Equipment of Buildings, for the type of cable and the conditions of installation.

All cables shall be adequately protected against mechanical damage, and metal trunking may be used if desired.

Where cables and wires are drawn into a metal conduit, the conduit shall be of heavy gauge, welded or solid-drawn metal tube and shall be screw jointed. The conduit shall be sealed to prevent ingress of air and water as far as practicable and shall be drained. Galvanized conduit shall be used when exposed to the wind or damp conditions.

For external wiring V.I.R. cables shall not be used unless enclosed throughout their entire length in conduit as above specified. Varnished cambric insulated, taped and braided cable shall not be used for external wiring.

Provision shall be made for the protection of all live conductors and terminals against accidental or inadvertent contact in accordance with statutory requirements.

[6)] Issued by the Institution of Electrical Engineers.

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

48 Main supply

For travelling cranes the main supply may be obtained from bare conductors, and collectors, or by flexible cable from plug boxes or other fixed supply points.

If the bare conductors are above ground they shall be strongly and effectively guarded so that they cannot be fouled by the load.

Where flexible cables in the way of traffic are liable to be run over, manually or automatically operated take-up gear shall be provided.

49 Lighting

Lighting shall be provided as required by the purchaser.

In the event of a hand lamp being provided it shall not be connected to a circuit exceeding 250 volts d.c. or 25 volts a.c.

50 Heating

Fixed electric heaters shall be provided when required by statute or by the purchaser. Where electric heaters are fitted they shall be of the non-luminous type and their voltage shall not exceed 250 volts. When arranged in series on any higher voltage double-pole switch-fuse protection shall be provided.

51 Earthing

The crane structure, motor frames and metal cases of all electrical equipment, including metal conduit or cable guards, shall be effectively earthed. For cranes fed from an external supply, an earthing collector ring shall be provided and earthing shall be independent of the contact between track wheels and rails.

52 Collector rings

For conveying current between the non-revolving and the revolving part of the crane a collector column shall be provided, preferably inside the machinery house and at the top of the centre pin. This shall not apply to Type 5 cranes (see Clause **2**).

The column shall consist of collector rings with contact fingers of ample capacity for the duty, and shall be completely protected against accidental contact. Rings and fingers shall be readily accessible for examination.

53 Boilers

Crane boilers shall comply with the requirements of BS 665, "*Vertical cross tube boilers*", or BS 761, "*Cylindrical vertical multi-tubular boilers*", and with any special requirements of the purchaser. Safety fittings shall comply with BS 759, "*Valves, gauges and other safety fittings for land boiler installations*".

Safety valves shall be of the direct spring-loaded type, provided with a testing lever, and shall be adjusted and ferruled or secured in such a position that the maximum permissible working pressure of the boiler cannot be exceeded. The safety valve shall be fitted in a position independent of the steam outlet to the engine, or of any other mounting.

The capacity of the boiler-feeding apparatus shall be not less than one-and-a-half times the maximum evaporative capacity of the boiler.

A second means of feeding shall be provided and each shall have a capacity not less than that specified, and shall be provided with an independent check valve.

Boiler pads, where use for mounting, shall comply with BS 10-2, "*Tables of pipe flanges (for land use) for working steam pressures up to 450 lb/sq. in.*", for diameter of pad, number and size of studs, and drilling centres.

The boiler mountings shall be in accordance with BS 759 where applicable.

The stop valve shall be connected directly to the boiler shell.

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

54 Steam engines

The torque exerted by the engine shall be such that, with the maximum rated load suspended and with a steam pressure equal to 80 per cent of the certified working pressure, hoisting can be effected from standstill with the cranks in any position.

55 Internal combustion engines

Internal combustion engines shall comply with BS 649, "*Reciprocating internal combustion engines for marine auxiliary and land service (excluding carburettor type)*" or with BS 765, "*Internal combustion engines, carburettor type, excluding aero engines*", rated on the one-hour basis, and a silencer shall be fitted to the exhaust. Fuel tank capacity shall be sufficient for at least 8 hours running on normal crane duty, and means shall be provided for ascertaining the amount of fuel contained in the tank.

Provision shall be made for draining the water circulating system during frosty weather, the drain cocks being fitted in accessible positions. The arrangement shall be such that it is not possible to leave pockets of water either in the system or the pump casing.

56 Air receivers

Where an air receiver is provided the receiver, together with its fittings, shall comply with the requirements of the appropriate British Standards.

57 Controls

Control levers and pedals shall be placed in positions which allow the driver, when in his normal position, ample room for operation and control, a view of the load unrestricted by the crane structure, and as clear a view as possible of the surroundings, including those forward and to each side of this position. The total maximum travel of the handle of control levers shall be not greater than 24 in. for a lever working in one direction, or 12 in. on either side of the neutral position for a two-way lever. The pedals shall have non-slip surfaces and their travel shall be not more than 10 in.

Each control shall, where practicable, be provided with a locking device to prevent accidental engagement of the control.

Every lever handle or wheel provided for controlling the operation of any part of the crane shall have upon it, or adjacent to it, clear markings to indicate its purpose and mode of operation.

58 Driver's cabin

Unless stated to the contrary by the purchaser, a cabin shall be supplied by the manufacturer. The cabin shall:

a) afford the driver adequate protection from the weather,

b) as far as is practicable afford the driver a clear and unrestricted view of the load and the jib in all normal working positions, and

c) be constructed so as to afford ready access to such parts of the machinery as are within the cabin.

d) a seat shall be provided for the driver and, where practicable, the controls shall be operable from a seated position.

59 Testing

a) An insulation test shall be made of the wiring of each motor circuit, and of the complete wiring of the crane. The insulation resistance of the wiring of any individual circuit shall be not less than two megohms, both between phases and to earth, but because of wide variations in circuit complexity no specific values of insulation resistance can be given for the wiring as a whole, or for the apparatus connected to the wiring.

b) Before any crane is put into service it shall be tested as shown in Table 8 and a certified record of the figures shall be supplied to purchaser.

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Table 8 — Testing

1	2	3	4	5	6	7
Type of crane	**Test No.**	**Hoisting**	**Derricking**	**Slewing**	**Travelling**	**Remarks**
All cranes except non-derricking.	1	Crane to lift loads 25 per cent in excess of safe working loads at various radii appropriate to those safe working loads and including the maximum and minimum radius.	Loads and radii as Col. 3 Test 1. For cranes designed to derrick with load, derricking motion to be tested between the limits of the radii.	Test loads and radii as Col. 3 Test 1. Slewing motion to be tested in both directions through the maximum angle for which crane has been designed.	The crane is not required to travel with test load.	During these tests the specified speeds need not be attained but the crane shall prove itself capable of dealing with the overload without difficulty. Not more than one cycle shall be performed with each overload, which need not be lifted to a height greater than that necessary to bring load on to all the teeth of the gears.
	2	Crane to lift the safe working loads at various radii appropriate to the safe working loads, and including the maximum and minimum radii.	Loads and radii as Col. 3 Test 2. For cranes designed to derrick with load, derricking motion to be tested between the limits of the radii.	Safe working loads and radii as Col. 3 Test 2. Slewing motion to be tested in both directions through the maximum angle for which crane has been designed.	Sate working loads and radii as Col. 3 Test 2. Travelling motion to be tested in both directions and when construction permits, with jib pointing fore and aft and at right angles to the direction of travel. *NOT* applicable to portable cranes unable to travel under their own power.	The speeds enumerated in Appendix B shall be substantially as specified.

© BSI 01-2000

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS

Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Table 8 — Testing

1	2	3	4	5	6	7
Type of crane	**Test No.**	**Hoisting**	**Derricking**	**Slewing**	**Travelling**	**Remarks**
Non-derricking cranes.	1	Crane to lift loads 25 per cent in excess of safe working load.	—	Tested in both directions through the maximum angle for which the crane has been designed to slew with the hook loaded to 25 per cent in excess of safe working load.	The crane is not required to travel with test load.	As Test 1 Col. 7.
	2	To lift the safe working load.	—	Tested in both directions through the maximum angle for which the crane has been designed to slew with the safe working load on the hook.	Travelling motion to be tested in both directions with the safe working load on the hook and when construction permits with jib pointing fore and aft and at right angles to the direction of travel. *NOT* applicable to portable cranes unable to travel under their own power.	As Test 2 Col. 7.

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

When testing the travelling motion of a crane designed for use when blocked, the load on the hook shall be that specified by the manufacturer, or for which the crane is designed to operate when free to travel on its wheels.

Tests 1 and 2 shall be carried out on a reasonably straight firm track, true to the specified levels and gauge.

c) When requested to do so, the crane maker shall demonstrate the stability of a crane to be in accordance with Clause **23** by the application of a static overload, provided that the load to be added to tip the crane does not exceed 66⅔ per cent of the safe working load appropriate to the radius at which it is being carried out.

The load on the hook or grab shall be suspended a few inches above the ground, and shall be built up gradually above the safe working load until the crane tips, or until the above maximum is reached. The jib shall be at right angles to the larger side of the rectangle formed by the wheelbase and the gauge or blocking-up base. It is understood that during the stability test, the load shall not be moved under power.

If loose ballast is required for the stability of the crane, the amount, type and location of the ballast shall be specified on the test certificate.

Where a safe load indicator is provided, its setting shall be verified during the tests.

The tests shall be carried out at the manufacturer's works, or at a place to be agreed between the purchaser and the manufacturer, and when conducting acceptance tests the manufacturer shall be entitled to employ his own crane driver.

The requirement that the contract speeds of electric cranes are to be attained are contingent on the electric supply to the motors being correctly maintained.

60 Painting

Prior to painting, metal work shall be thoroughly clean and dry and free from welding slag, rust, loose scale and grease.

Wood or metal surfaces bolted or riveted together shall be primed before assembly.

Paint need not be applied when other forms of corrosion preventive are used.

Where friction grip bolts are used the surfaces in contact shall not be painted.

61 Equipment

With each crane the following equipment shall be provided:

a) An instruction book or charts including:

i) An outline drawing of the crane showing leading dimensions and disposition and weight of any loose ballast.

ii) Rope reeving diagrams and particulars of ropes.

iii) A diagram showing the lubrication points and recommended grades of lubricants.

iv) A wiring diagram of the crane on which is given the rating of each of the motors, the cable sizes, and such other information as will tend to facilitate inspection and maintenance of the crane.

v) General maintenance and operating instructions.

b) A set of tools for the day-to-day maintenance and lubrication of the crane.

62 Loose ballast

Where loose ballast is required for the stability of the crane a plate shall be permanently fixed to the crane stating the weight of such ballast stowed in the tail and carriage compartments. The weight of ballast stowed shall be stated also on the test certificate.

© BSI 01-2000

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS

Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Appendix A Information desirable to be supplied with enquiry or order

The following particulars should enable the manufacturer to select the most suitable crane from his production range to suit customers' requirements or, alternatively, to suggest requirements, or a specially designed machine.

1. Duty for which crane is required.

a) *General merchandise*. State weight, size and kind of loads.

b) *Grabbing duty*.

State: i) Nature of material to be handled and weight in pounds per cubic foot.

ii) Type of grab, e.g. single rope with ring discharge, or single rope with dumping discharge, or double rope.

iii) If grab is not to be supplied by the crane maker, state the length of rope or chain withdrawn to close the grab.

iv) Output required in tons per hour. Give full particulars of operating cycle, e.g. Maximum grabbing radius, height of lift above and below rail, angle through which jib will be slewed, and if derricking or travelling motions will be involved. If grabbing from ships or barges it is important that the sizes of the hatchway openings should be given.

c) *Magnet duty*. State nature of material to be handled. If an existing magnet is to be used, the following particulars should be given: type, size, weight, voltage, current rating (cold) and gross working load.

d) *Shunting duties*. If crane is required for shunting duties, give particulars of type of buffer and draw-gear required.

e) If other duties are required particulars should be given.

2. Site conditions.

a) Will the crane travel on the ground level or on a gantry? State Whether or not the crane is on a waterside track.

b) Arctic, temperate or tropical climate.

c) Approximate altitude above sea level.

d) If possible a sketch should be given showing site conditions and minimum clearances.

e) Do atmospheric conditions necessitate special equipment or painting?

3. Capacity of crane. ..... **tons (max. load) at** .....**ft radius**

..... **tons at** .....**ft max. radius.**

(tons of 2 240 lb unless otherwise stated).

State if crane is to be capable of travelling with maximum load at its rated radius or if it can be blocked up for this duty.

4. Prime movers.

a) Steam engine: state kind of boiler fuel.

b) Internal combustion engine: state kind of fuel.

c) Compressed air motor: state pressure.

d) Electric motor: if d.c. give voltage,

if a.c. give voltage, number of phases and frequency.

State method of current collection to be used, i.e. trailing cable, live rail or trolley wire. If trailing cable, state if cable drum or link box is to be provided.

e) Diesel-electric or petrol-electric.

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

5. Track.

a) Gauge.

b) Weight and profile of rail.

c) Maximum permissible load per wheel. If any special conditions necessitate limitation of axle load give full particulars.

d) Minimum radius of the curve along which the crane will have to travel, and super-elevation of rails, if any.

e) Clearance between running rail and check rail.

f) Particulars of any gradient, i.e. maximum slope and length the crane will be required to travel, and whether loaded or unloaded. Also the frequency with which the gradient will be negotiated. Also state if gradient is on straight or curved track.

6. Range of lift of book.

From.....ft below rail level,
to .....ft above rail level at .....ft radius.

7. Maximum permissible tail radius. .....ft.

8. Speeds. Hoisting (maximum load).....ft per min.
Hoisting (light load) .....ft per min.
Slewing (maximum load) .....revs per min.
Derricking (maximum load).....ft per min.
Travelling (maximum load) .....ft per min.

9. Driver's cabin. State requirements.

10. Automatic safe-load indicator. State if this indicator is required, in addition to the usual load and radius indicator.

11. Particulars of any statutory requirements with which crane will have to comply.

For the United Kingdom, see Appendix G.

12. Particulars if any special circumstances necessitate limitation of weights or dimensions of pieces.

13. Particulars of any further requirements or special conditions not included in the foregoing, e.g. operation in flammable surroundings.

Appendix B Information to be supplied by manufacturer when tendering

1. Type of crane (See Clause **2**).

Diagram giving the following details:

a) Rating (loads and radii).

b) Grab particulars, type and size, if to be supplied.

c) Magnet and ancillary equipment particulars, type and size, if to be supplied.

d) Main dimensions and clearances (See Figure 1).

e) Height of lift above and below rail (See Figure 1).

2. Specification giving the following details:

a) Prime mover, state maker.

i) For steam cranes: Dimensions of engines.
Boiler description and dimensions.
Working pressure .....lb/sq. in.
Feed water tank capacity .....gallons.
Nature of boiler feed arrangement.

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

ii) For electric cranes: Motors: number, type and enclosure.
Rating: horsepower, and speed in rev/min.
iii) For internal combustion engines: B.H.P. and No. of cylinders.
Rated speed at full load, rev/min.
iv) For diesel-electric cranes: Diesel engine particulars as above.
Motor particulars as for electric cranes.
Generator: type and enclosure.
Output in kW at .....rev/min.
v) For compressed air drive: give particulars, e.g. .....lb/sq. in. pressure.

b) Control equipment. For electric and diesel-electric.
Type of controllers, rating of resistances, and particulars of electrical equipment.

c) Working speeds of motions.

d) Description of brakes.

e) Gearing: Material. Cast or machine-cut teeth.

f) Support of revolving superstructure, e.g. centre-post, live-ring or fixed-axle roller.

g) Rail wheel construction, e.g. steel tyres or solid rolled or cast wheels.

h) Ropes: Type, grade of steel, diameter and construction and number of falls of hoisting and derricking ropes.

i) Rope end fittings.

j) Driver's cabin, if to be supplied.

k) Safety devices and indicators, e.g. limit switches and load indicators.

l) Lighting, if to be supplied.

m) Loose ballast (if any) to be supplied by purchaser.

n) Weight of crane under service conditions without load on hook.

o) Wheel loading diagram.

p) Minimum radius of the curve along which the crane will travel.

q) Manufacturer's comments on any information provided under Sections 12 and 13 of Appendix A.

r) Other particulars not scheduled above.

3. Shipping specification.

Appendix C List of British Standards for materials and equipment to be used in the manufacture of cranes

Crane details	BS No. and title
1. Materials.	
Castings, iron	BS 1452, *Grey iron castings.*
	BS 310, *Blackheart malleable iron castings.*
	BS 309, *Whiteheart malleable iron castings.*
	BS 991, *Data on cast iron.*
Castings, steel	BS 592, *Carbon steel castings for general engineering purposes.*
Sections, steel	BS 4, *Part 1: Hot-rolled sections — Part 2: Hot-rolled hollow sections.*
Steel, structural	BS 15, *Structural steel.*
	BS 548, *High-tensile structural steel for bridges, etc., and general building construction.*
	BS 968, *High tensile (fusion welding quality) structural steel for bridges, etc., and general building construction.*

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Crane details	BS No. and title
1. Materials (contd.)	
Steel, wrought	BS 970, *Wrought steels (bars, billets and forgings).*
Tubes, steel	BS 1775, *Steel tubes for mechanical, structural and general engineering purposes.*
Rivet materials	BS 15, *Structural steel.*
	BS 548, *High tensile structural steel for bridges, etc., and general building construction.*
Steel bars for machine parts	BS 970, *Wrought steels (bars billets and forgings).*
Springs, coil and spiral	BS 24-3B, *Helical and volute springs and spring steels.*
	BS 1408, *Hard drawn steel wire for springs.*
	BS 1429, *Annealed steel wire for oil-hardened and tempered springs.*
Shafts, steel	BS 970, *Wrought steels.*
Axles	BS 24-1.4, *Carriage and Wagon Axles.*
Paint	BS 2521-24, *Ready mixed oil-based priming paints.*
	BS 2525-32, *Ready mixed oil-based undercoating and finishing paints (exterior quality).*
Permissible stresses	BS 2573, *Report on permissible stresses in crane structures.*
2. Structural details, etc.	
Permissible stress	BS 2573, *Permissible stresses in cranes — Part 1: Structures.*
Bolts, nuts and washers	BS 916, *Black bolts, screws and nuts.*
	BS 1083, *Precision hexagon bolts, screws, nuts and plain washers.*
	BS 1768, *Unified precision hexagon bolts, screws, nuts (UNC and UNF threads) and plain washers — normal series.*
	BS 1769, *Unified black hexagon bolts, screws and nuts and plain washers — heavy series.*
	BS 1981, *Unified machine screws and machine screw nuts.*
	BS 2708, *Unified black square and hexagon bolts, screws, nuts (UNC and UNF threads) and plain washers — normal series.*
	BS 3139, *High strength friction grip bolts for structural engineering.*
	BS 3294, *The use of high strength friction grip bolts in structural steelwork.*
Rivets (dimensions)	BS 275, *Dimensions of rivets ($\frac{1}{2}$ in. to $1\frac{3}{4}$ in. diameter).*
	BS 641, *Dimensions of small rivets for general purposes.*
Sections, steel	BS 4, *Dimensions and properties of channels and beams for structural purposes.*
	BS 4A, *Dimensions and properties of equal angles, unequal angles and T bars for structural purposes.*
	BS 6, *Dimensions and properties of bulb angles and bulb plates for structural purposes.*
Welding	BS 693, *Oxy-acetylene welding in mild steel.*
	BS 938, *General requirements for the metal-arc welding of weldable structural steel tubes.*
	BS 1856, *General requirements for the metal-arc welding of mild steel.*
	BS 2642, *General requirements for the metal-arc welding of medium tensile weldable structural steels to BS 968, Type a.*

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Crane details	BS No. and title
3. Machinery and machinery details.	
Bearings, ball and roller	BS 292, *Dimensions of ball bearings and parallel-roller bearings.*
oil retaining	BS 1131, *Plain bearings (metal).*
Chains and chain wheels	BS 228, *Steel roller chains and chain wheels.*
Engines	BS 649, *Reciprocating internal combustion engines for marine auxiliary and land service (excluding carburettor-type).*
	BS 765, *Internal combustion engines, carburettor-type, excluding aero-engines.*
Boilers	BS 665, *Vertical cross tube boilers of riveted construction.*
	BS 761, *Vertical multi-tubular boilers of riveted construction.*
	BS 759, *Valves, gauges and other safety fittings for application to land boiler and piping installations for and in connection with land boilers.*
Gearing: spur	BS 436, *Machine cut gears A. Helical and straight spur.*
Gearing: bevel	BS 545, *Bevel gears (machine cut).*
worm	BS 721, *Machine cut gears. C. Worm gearing.*
Keys and keyways	BS 46, *Part 1: Keys and keyways.*
Splines and serrations	BS 2059, *Straight-sided splines and serrations.*
	BS 3550, *Involute splines.*
Taper pins, solid and split	BS 46, *Part 3: Solid and split taper pins.*
Lubricating nipples and adaptors	BS 1486-1, *Lubricating nipples and adaptors.*
	BS 1486-2, *Heavy duty lubricating nipples.*
Screw threads	BS 84, *Parallel screw threads of Whithworth form.*
	BS 1580, *Unified screw threads (with metric equivalents).*
Air receivers	BS 428, *Forge welded air receivers.*
	BS 430, *Solid-drawn steel air receivers.*
	BS 487, *Fusion-welded steel air receivers.*
	BS 1099, *Small fusion-welded steel air receivers.*
	BS 1123, *Valves, gauges and other safety fittings for air receivers and compressed-air installations.*
4. Electrical machinery and equipment.	
Appliances and accessories	BS 816, *Requirements for electric appliances and accessories.*
Cables	BS 7, *Rubber-insulated cables and flexible cords for electric power and lighting.*
	BS 480, *Impregnated paper-insulated cables for electricity supply — Part 1: Lead or lead-alloy sheathed cables for working voltages up to and including 33 kV — Part 2: Aluminium sheathed cables for working voltages up to and including 22 kV.*
	BS 608, *Varnished cambric insulated cables for electricity supply.*
	BS 1116, *Flexible trailing cables for quarries and metalliferous mines.*
	BS 2004, *Polyvinyl chloride insulated cables and flexible cords for electric power and lighting (for working voltages up to 250 volts).*
Circuit-breakers	BS 862, *Air-break circuit-breakers (including totally-enclosed flameproof types) for voltages not exceeding 660 volts.*
	BS 936, *Oil circuit-breakers for alternating current circuits up to and including 660 volts.*

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Crane details	BS No. and title
4. Electrical machinery and equipment (contd.).	
Conduit	BS 31, *Steel conduits and fittings for electrical wiring.*
Contactors	BS 775, *Contactors, when supplied separately or in combination with other gear.*
Controllers and resistors	BS 587, *Motor starters and controllers.*
Climate proofing	BS 1156, *A.C. and d.c. motors and generators, excluding shipborne and airborne machines.*
Motors	BS 2613, *Electrical performance of rotating electrical machinery.*
Switches	BS 861, *Airbreak switches and isolators.*
5. Lifting equipment.	
Wire rope terminal attachments and wire rope slings	BS 461, *Bordeaux connections for wire rope and chain for general engineering purposes.*
	BS 462, *Bull dog grips for wire ropes for general engineering purposes.*
	BS 463, *Sockets for wire ropes for general engineering purposes.*
	BS 464, *Thimbles for wire rope for general engineering purposes.*
	BS 529, *Steel eyebolts.*
	BS 643, *Capping metal for steel wire ropes.*
	BS 716, *Mild steel rigging and stretching screws and turnbuckles, for use with wire ropes for general purposes.*
	BS 1290, *Wire rope slings and sling legs.*
Chains and chain slings	BS 394, *Short link wrought iron crane chain (excluding pitched or calibrated chain).*
	BS 465, *Pitched and calibrated wrought iron load chain.*
	BS 590, *Electrically welded mild steel chain.*
	BS 781, *Wrought iron chain slings and rings, links, alternative to rings, egg links and intermediate links.*
	BS 1663, *Electrically welded higher tensile steel chain (short link and pitched or calibrated) for lifting purposes.*
Hooks	BS 482, *Wrought iron and mild steel hooks for cranes, chains, slings, blocks and general engineering purposes (excluding building operations).*
	BS 591, *Wrought iron and mild steel hooks of the "C" or Liverpool type.*
	BS 2903, *Higher tensile steel hooks for chains, slings, blocks and general engineering purposes.*
	BS 3017, *Mild steel forged ramshorn hooks.*
	BS 3033, *Higher tensile steel hooks of the "C" or Liverpool type.*
	BS 3317, *Mild steel forged triangular lifting eyes for use on wire rope pulley blocks with a lifting capacity of 60 tons or more.*
Shackles	BS 825, *Mild steel shackles.*
	BS 3032, *Higher tensile steel shackles.*
Wire ropes	BS 302 & BS 621, *Steel wire ropes for cranes, excavators and general engineering purposes.*

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Appendix D Load capacity of gears

All gears should be designed on the basis of the load capacity formulae given in the appropriate British Standards quoted in Clause **34**.

It is recommended that, for the necessary calculations, the gears should be considered as carrying the following loads:

Motion	Designed tooth load
a) For strength: All motions	1.6 × full load
b) For wear:	
Hoisting	0.4 × full load
Slewing	0.4 × full load
Derricking	0.7 × full load
Travelling — Non-shunting	0.5 × full load
Travelling — Steam-driven shunting cranes	0.7 × full load
Travelling — Diesel or electric shunting cranes	0.9 × full load

The full load value of tooth load should be derived from the power needed to drive each motion and not from the power of the single prime mover in the case of steam, direct diesel, or single motor driven cranes.

Appendix E Notes on track (see Clause **22**)

The manufacturer of a crane to this standard is not to be responsible for the design or construction of the track upon which the crane is going to work, but will provide, if requested, the following information as a recommendation and guide to the user.

a) Weight and type of rail to be used.

b) Gauge.

c) Minimum radius of any curve which the crane will negotiate.

d) Increase in the gauge on curves.

e) Maximum pitch of the sleepers in relation to the bearing capacity of the ground.

f) Maximum load on any one wheel when the crane is handling its full working load.

Appendix F Notes on crane speeds (see Clause **19**)

The term "speed of a crane" is used generally to express a number of different conditions. To clarify the meaning, the various conditions are:

1. Geared speed. The speed of the hook or other motion which corresponds to revolutions per minute of the prime mover at full load; for example, in the case of an electric motor the full load revolutions per minute is the maker's name plate speed corresponding to the rated horse power of the motor.

2. Free speed. To obtain the acceleration required on a crane motion it is necessary that the prime mover should have power available in excess of that required to drive the motion at the geared speed. When cranes are driven by prime movers with torque characteristics similar to a steam engine, or a series-wound motor, the crane continues to increase speed beyond its geared speed until the prime mover reaches a stable condition. This is known as the free speed. In certain cases the free travelling speed of a crane may be as high as $2\frac{1}{2}$ times the geared speed.

3. Working speeds. The speeds which the maker specifies as the performance speeds of the crane.

It is not possible to forecast exact speeds, as considerable variations occur owing to variation of friction and tractive resistance, but, by custom, working speeds are understood to mean the following:

Hoisting speed. The speed at which the crane will lift full load. It is expected that the crane will attain this figure but it will not be rejected if it exceeds this figure.

Hoisting speed — slow. When a slow hoisting speed is specified it is expected that the crane with full load on the hook will hoist at this speed or less.

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Where light-hook speeds or speeds for loads less than full load are required they are usually listed separately.

Lowering speed. When lowering speeds are specified, a device is incorporated in the mechanism which governs the speed. In the case of maximum lowering speed this is the speed with full load on the hook which will not be exceeded, and a different speed is usually obtained for the light hook condition. When a crane has a free-barrel the lowering speeds obtained are at the discretion of the operator.

Travelling speed. The speed at which a crane can travel safely with full load on the hook. This speed may be considerably less than the maximum speed at which the crane may travel safely with empty hook. Unless otherwise specified travelling is assumed to be on a straight and level track.

Slewing speed. The maximum speed at which the crane will slew safely with full load on the hook. In practice, the slewing motion is engaged for less than a full revolution and rapid acceleration is required in preference to a high rate of rotation and in such cases the working speed is often less than the geared speed.

Derricking speed. The average speed measured horizontally from maximum to minimum radius.

The quoted derricking speeds may not be obtainable under all conditions of working due to the incidence of load swing.

Unless the speed of a crane is given on the basis of a time cycle the speed is always measured after the motion has accelerated to its working speed, with the exception of the derricking motion.

Appendix G Legislation affecting cranes in the United Kingdom

(This information is included for guidance only)

1. Factories Act, 1961.
2. The Chains, Ropes and Lifting Tackle (Register) Order, 1938, dated 16th June, 1938. S.R. & O. 1938. No. 599.
3. The Cranes and other Lifting Machines (Register of Examinations) Order, 1938, dated 16th June, 1938, S.R. & O. 1938. No. 600.
4. Certificate of Exemption No. 1. Annealing. Factory Form 661, dated 4th August, 1938.
5. Docks Regulations, 1925. S.R. & O. 1925. No. 231.
6. Docks Regulations, 1934. S.R. & O. 1934, No. 279. Regulations 3, 18–22, 25–29, 33–34, 49, 51 and the Schedule of manner of test and examination before taking lifting machinery and gear into use.
7. Docks Regulations, 1934. Certificate of Exemption No. 1. Annealing. Factory Form 1950, dated 1st June, 1934.
8. Ship building and Ship Repairing Regulations, 1960, S.I. 1960, No. 1932.
9. The Construction (Lifting Operations) Regulations 1961, S.I. 1961, No. 1581.
10. The Construction (Lifting Operations) Certificates Order, 1962, No. 227.
11. Electricity Regulations, 1908, S.R. & O. 1908. No. 1312.
12. Electricity (Factories Act) Special Regulations, 1944. S.R. & O. 1944. No. 739.
13. Memorandum on the Electricity Regulations. (Factory Form No. 928.)
14. Road Traffic Acts. 1962.

Cranes for use in coal and metalliferous mines and in quarries are subject to:

Mines and Quarries Act, 1954, Sections 81, 82, 83, 84, 85 and 87.
Coal and other mines (Electricity) Regulations, 1956, (Statutory Instrument. No. 1779, 1956).
Miscellaneous Mines (Electricity) Regulations, 1956, (Statutory Instrument, No. 1779, 1956).
Quarries (Electricity) Regulations, 1956, (Statutory Instrument, No. 1781, 1956).

Copies of the above may be obtained from:

H.M. Stationery Office,
York House,
Kingsway,
London, W.C.2.

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

References. The following table indicates which section of appropriate statutory regulations may apply to certain clauses in the specification. It should not be assumed that the list of references is complete.

Clause	Subject	Regulation
23	Stability	Regulation 19, Construction (Lifting Operations) Regulation 1961.
25	Guarding	Factories Act 1961, Part II Section 12–17 Regulations 42 and 43 of the Construction (General Provisions) Regulations 1961. Section 82 of the Mines and Quarries Act.
27	Load and radius indication	Section 27(4) of the Factories Act 1961. Regulations 29 and 30 of the Construction (Lifting Operations) Regulations 1961. Section 85 of the Mines and Quarries Act.
28	Wire ropes	Dock regulations regarding appropriate ratios.
29	Lifting hooks	Regulation 36, Construction (Lifting Operations) Regulations 1961.
44	Protective gear	Electricity (Factories Act) Special Regulations, 1908 and 1944, S.R. and O. No. 1312.
53	Boilers	Sections 32 to 34 of the Factories Act 1961. Section 84 of the Mines and Quarries Act.
56	Air receivers	Section 36 of the Factories Act 1961. Section 84 of the Mines and Quarries Act.
57	Control handles and levers	Regulation 16 of the Construction (Lifting Operations) Regulations 1961.
58	Crane cabin	Regulation 14 of the Construction (Lifting Operations) Regulations 1961.

Appendix H Maximum ratings for cables up to 0.06 in² for use in cranes under average conditions

Where cranes are equipped with one-hour rated motors, the stator or armature cables may be up-rated by a factor of 1.4 above the ratings for continuous duty given in the I.E.E. Regulations for the Electrical Equipment of Buildings, 13th Edition, 1955, Table 12, Col. 7. The I.E.E. ratings are given in the second column of Table 9 and those for one hour rated motors are listed in the column headed "Primary 1-hour". Similarly, for cranes equipped with ½-hour rated motors an up-rating factor of 1.7 may be used.

For rotor or armature resistors, it will be appreciated that the cables in these circuits carry current during accelerating periods only and may be still further up-rated. For 10 minute and 5 minute rated resistors the maximum current ratings are given in the appropriate columns of Table 9.

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

Table 9 — Rubber-insulated, PVC-insulated or varnished-cambric-insulated cables in trunking or conduit

Rating factor	I.E.E Rating 1	Primary 1-hour × 1.4	Resist 10 min × 1.5	Primary $^1/_2$-hour × 1.7	Resist 5 min × 2
Cable size	Maximum rating — amperes				
7/.029 0.004 5 in^2	15 (3 300)	21 (4 700)	22 (4 800)	25 (5 500)	30 (6 700)
7/.036 0.007 in^2	25 (3 600)	35 (5 000)	37 (5 300)	42 (6 000)	50 (7 100)
7/.044 0.01 in^2	32 (3 200)	45 (4 500)	48 (4 800)	55 (5 500)	65 (6 500)
7/.052 0.014 5 in^2	39 (2 700)	55 (3 800)	59 (4 000)	65 (4 500)	78 (5 400)
7/.064 0.022 5 in^2	48 (2 100)	67 (3 000)	72 (3 200)	80 (3 500)	96 (4 200)
19/.044 0.03 in^2	56 (1 850)	78 (2 600)	85 (2 800)	95 (3 200)	112 (3 700)
19/.052 0.04 in^2	67 (1 700)	95 (2 400)	100 (2 500)	115 (2 900)	134 (3 400)
19/.064 0.06 in^2	88 (1 450)	123 (2 000)	130 (2 200)	150 (2 500)	176 (2 900)

Figures in brackets define the current density in amp/in^2 at rated load.
NOTE The above figures have been taken from the curves shown in Figure 2.

It should be appreciated that the ratings given in the I.E.E. Regulations are only applicable under the particular conditions defined by the Regulations and the up-rating factors permitted by this Appendix are formulated on a similar basis.

Consideration should therefore be given to such factors as the ambient temperature, grouping and disposition of the cables, and to the limitation of voltage drop, which will influence selection of suitable cables. It should also be noted that these up-rating factors are only applicable to cable connections concerned with crane operation and not to general wiring or to wiring for other purposes.

© BSI 01-2000
Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

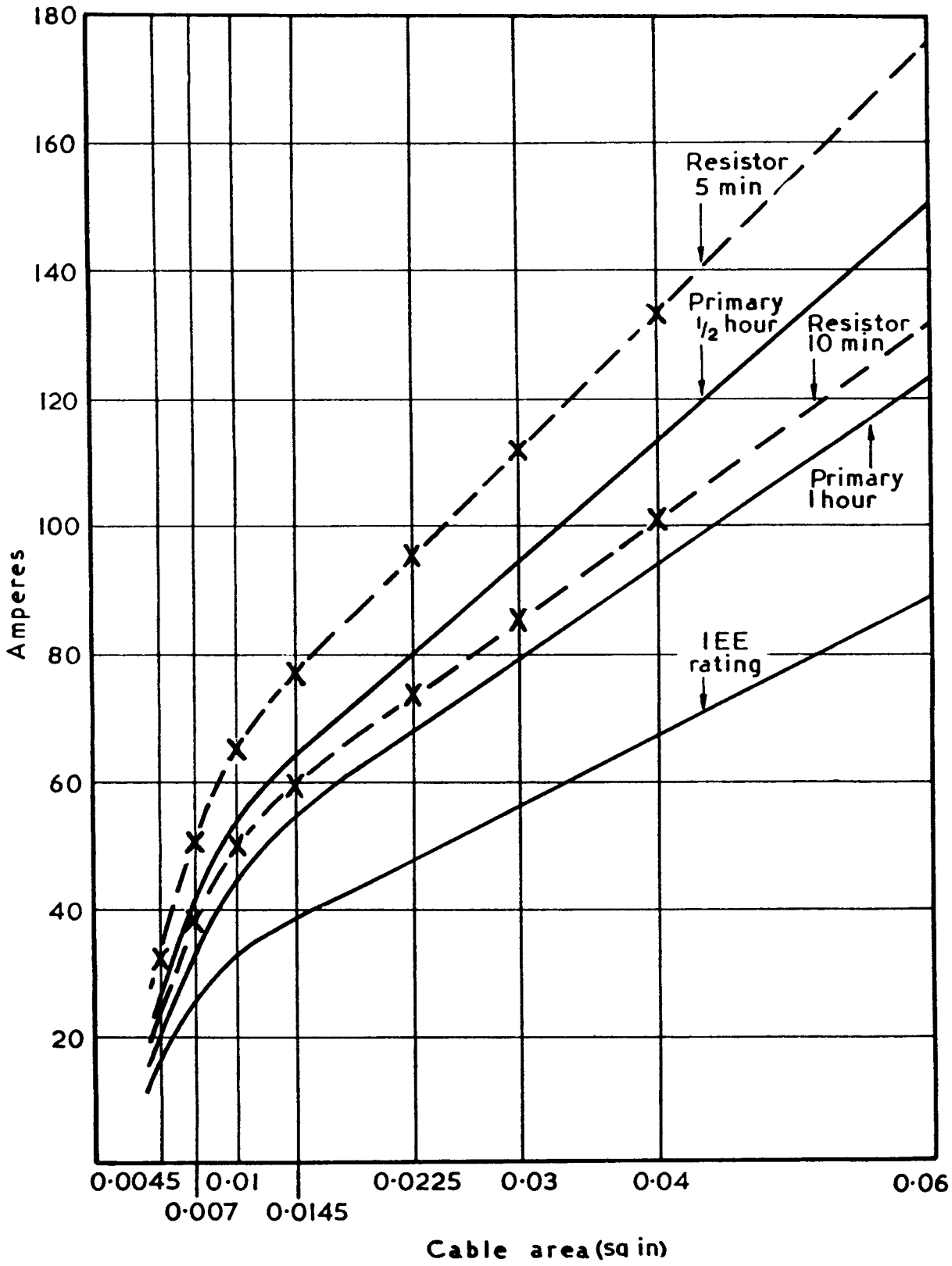


Figure 2 — Maximum ratings for cables up to 0.06 in² for average crane conditions, cranes with rubber-insulated, PVC-insulated, or varnished-cambric-insulated cables in trunking or conduit

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS
Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

If permission is granted, the terms may include royalty payments or a licensing agreement. Details and advice can be obtained from the Copyright Manager. Tel: 020 8996 7070.

BSI
389 Chiswick High Road
London
W4 4AL

Copyright British Standards Institution
Provided by IHS under license with BSI - Uncontrolled Copy
No reproduction or networking permitted without license from IHS

Licensee=BP International/5928366101
Not for Resale, 06/05/2010 04:05:21 MDT