

Specification for

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

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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.

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

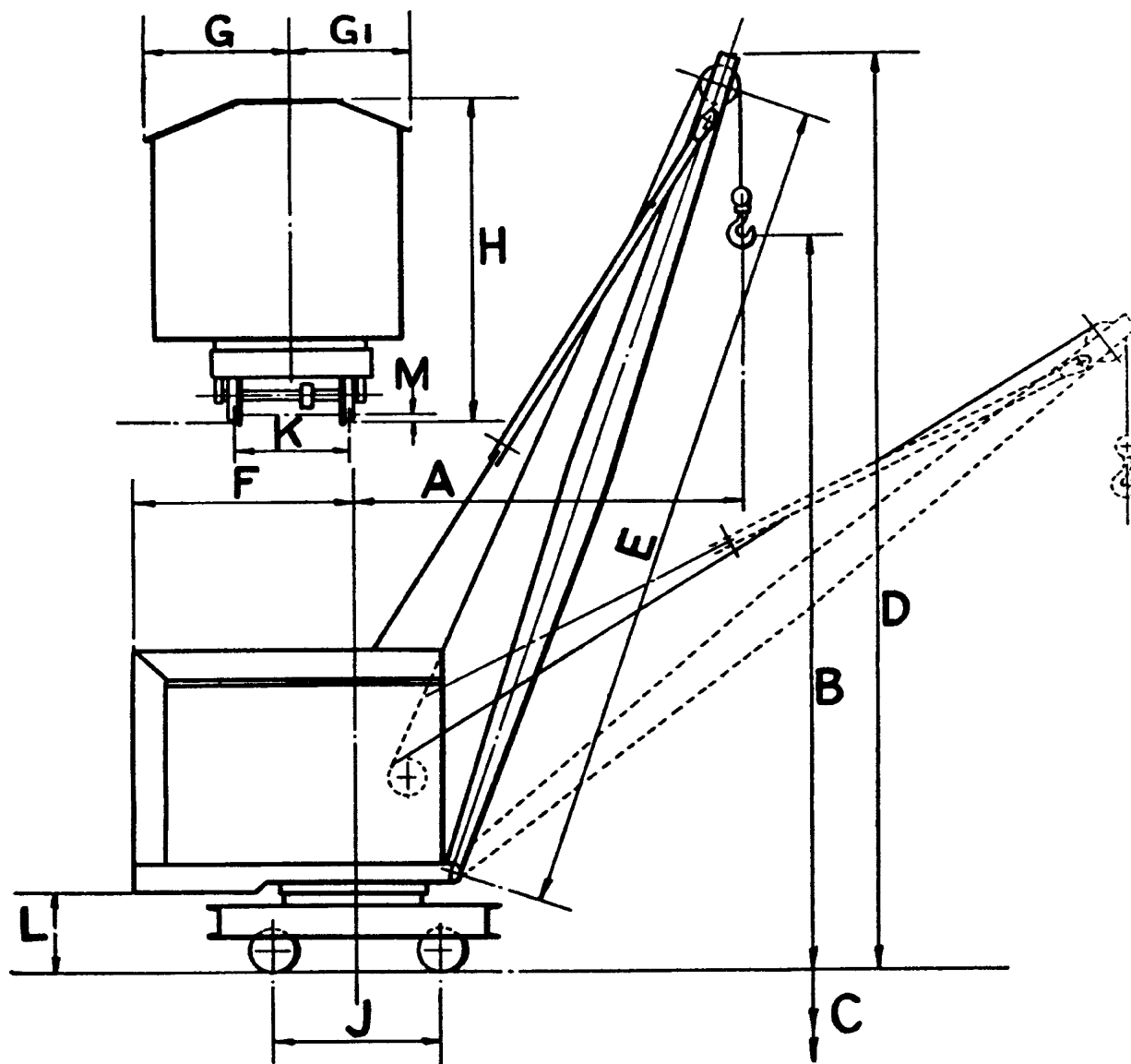
radius

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



- 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

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 2573¹⁾

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*".

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/s².

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.

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 $\frac{1}{16}$ inch (1.6 mm).

The diameter of holes for precision bolts shall not exceed the nominal bolt shank diameter by more than $\frac{1}{64}$ 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 $2\frac{1}{2}$ 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.

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 speeds²⁾ 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 weight 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.