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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Shipbuilding — Fixed jib cranes — Ship-mounted type for general cargo handling

*Construction navale — Grues à flèche fixe — Type de bord pour manutention de
marchandises diverses*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8431 was prepared by Technical Committee ISO/TC 8, *Shipbuilding and marine structures*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Shipbuilding — Fixed jib cranes — Ship-mounted type for general cargo handling

1 Scope and field of application

This International Standard specifies the requirements for permanently mounted fixed single jib cranes powered by electric or hydraulic systems, or reciprocating internal combustion (RIC) engines.

Jib cranes are capable of hoisting, lowering, level luffing or slewing general cargo. All functions may be performed separately or simultaneously, as agreed between the manufacturer and purchaser.

This International Standard does not include magnet and grabbing types, nor requirements for multicrane operation, nor details for the type of permanent mounting, e.g. on a strengthened deck, or pedestal or rotating pedestal, nor are requirements for multicrane, twin jib crane, telescopic and/or articulated jib crane or offshore operation included.

2 References

ISO 2374, *Lifting appliances — Range of maximum capacities for basic models*.

ISO 2408, *Steel wire rope for general purposes — Characteristics*.

ISO 3828, *Shipbuilding and marine structures — Deck machinery — Vocabulary*.

ISO 4301-1, *Cranes and lifting appliances — Classification — Part 1 : General*.

ISO 4306-1, *Lifting appliances — Vocabulary — Part 1 : General*.

ISO 4308-1, *Cranes and lifting appliances — Selection of wire ropes — Part 1 : General*.

ISO 4310, *Cranes — Test code and procedures*.

ISO 7363, *Cranes and lifting appliances — Technical characteristics and acceptance documents*.

ISO 7752-1, *Lifting appliances — Controls — Layout and characteristics — Part 1 : General principles*.

ISO 7824, *Shipbuilding and marine structures — Lubrication nipples — Cone and flat types*.

ISO 7825, *Shipbuilding — Deck machinery — General requirements*.

ISO 8686-1, *Cranes and lifting appliances — Design principles for loads and load combinations — Part 1 : General*.¹⁾

IEC Publication 92, *Electrical installations in ships*.

IEC Publication 529, *Classification of degrees of protection provided by enclosures*.

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 3828 and ISO 4306-1 apply, with the following additions.

3.1 luffing: Angular motion of the jib in a vertical plane. (Definition repeated from ISO 4306-1.)

3.2 nominal size: Figure corresponding to the safe working load (SWL) which a jib crane is rated to lift at the maximum operating radius at the hook, expressed in tonnes.

NOTE — It is common for this type of crane to have a constant SWL at all operating radii.

3.3 nominal hoisting speed: Average speed at which the safe working load (SWL) can be lifted using the hoist winch only.

3.4 nominal luffing time: Time taken to raise the jib with the safe working load (SWL) from the maximum operating radius to the minimum operating radius, by the use of the luffing device only.

3.5 nominal slewing speed: Speed which the jib crane can maintain when the jib with the safe working load (SWL) is revolved at maximum operating radius, under adverse conditions of 5° heel and 2° trim acting simultaneously.

1) At present at the stage of draft.

4 Design and construction

Cranes shall meet the general requirements for deck equipment in ISO 7825, and the specific requirements given in 4.1 to 4.8. For crane classification and utilization classes, see ISO 4301-1; for the selection of the wire ropes (4.3), and for further requirements, see ISO 4308-1.¹⁾

NOTE — Attention is drawn to the requirements of administrations and relevant Classification Societies.

4.1 General

4.1.1 For the design of structural parts of the jib crane, see ISO 8686-1. Marine applications are under consideration.

4.1.2 The crane shall be designed to work safely and efficiently at all angles of heel of the ship up to 5° and at all angles of trim up to 2° occurring simultaneously.

If greater angles of heel and trim are required, these shall be notified to the manufacturer by the purchaser at the time of enquiry.

4.1.3 The manufacturer shall indicate the limiting conditions for operation of the crane and shall ensure that adequate guidance is provided for stowage of the crane.

4.2 Design of hoist and luffing mechanisms

4.2.1 The diameter of the drums used in these mechanisms shall be not less than 18 times the diameter of the steel wire rope, measured at the bottom of the groove, if any. For standard sizes of steel wire rope, see ISO 2408.

4.2.2 The length of these drums shall be such that the rope can be fully accommodated in not more than three evenly wound layers. The arrangement shall be such that there will be not less than three turns of the rope on the drum at any position of the hook or jib.

4.2.3 The flange height shall be such that it will project not less than 2,5 times the rope diameter beyond the outermost layer, when the maximum working length of rope is fully and evenly wound on the drum, except when fitted with a special mechanical device preventing the wire jumping over the flange; in this case a lower value is allowed.

4.2.4 Hoisting and luffing mechanisms shall be provided both with a device to prevent slack rope developing and with a limit stop or switch.

4.3 Design ropes

Wire rope shall be suitable for the diameters of the sheaves and drums, and shall comply with galvanized steel wire rope in accordance with ISO 2408²⁾ or with an equivalent national standard, and have a minimum breaking load not less than the maximum tension in the rope multiplied by a factor obtained from table 1.

Table 1 — Safety factor of ropes*

Safe working load (SWL) t	Safety factor
SWL ≤ 10	5
10 < SWL ≤ 160	$\frac{10\,000}{(8,85 \text{ SWL}) + 1\,910}$
SWL > 160	3

* Proper allowance should be made for friction in the reeving system, particularly for lower values of the safety factor.

4.4 Brake system design

4.4.1 Automatic braking systems shall be provided for all motions. The automatic braking systems shall function when the operating devices return to stop or the braking position, and also when there is no power supply available to the crane.

4.4.2 The braking systems shall be capable of effectively arresting and holding a load equivalent to at least 1,5 times the safe working load when braking from the maximum design system speed or 1,25 times for slewing gears at the angles of heel and trim specified in 4.1.2.

4.4.3 Means shall be provided for controlled lowering of the load and for over-riding the brakes in the event of a power failure.

4.4.4 The braking systems shall not induce excessive shock loads, i.e. "excessive" meaning likely to cause damage to the crane structure, mechanism or ship's supporting structure.

4.4.5 Mechanical brakes shall be fitted with brake linings of incombustible material, which shall not be unduly affected by heat and moisture.

4.5 Control

For other requirements not covered by the specific following subclauses or by ISO 7825, see ISO 7752-1.

1) For the purposes of this International Standard, the empirical factor K' should be taken as 0,330.

2) This requirement does not preclude the use of non-galvanized steel wire rope, by agreement between the shipowner and Classification Society.

4.5.1 Methods of control

The primary controls of the jib crane shall be adjacent to each other, but remote control may be provided in addition, when specified by the purchaser. The controls for hoisting, lowering, luffing and slewing shall permit variable operating speeds.

Control arrangements shall be in accordance with ISO 7752-1.

4.5.2 Power sources

Jib cranes shall be designed for operation powered by either electric, hydraulic or RIC engines.

4.5.3 Operating devices

4.5.3.1 When the crane is fitted with a cabin, as is usual, the direction of motion of the gear for hoisting or luffing-in shall be obtained by movement of a hand-lever from the central stop position towards the operator. Movement away from the operator shall result in lowering or luffing-out.

When there is no cabin, the requirements of the Classification Societies shall be fulfilled.

To slew the crane, movement of the operating device to the left shall slew the jib crane to the left, and movement of the operating device to the right shall slew the jib crane right.

Levers having vertical movement shall cause the winch to lower or luff-out when the levers are depressed and to hoist or luff-in when the levers are raised.

4.5.3.2 Whatever the form of motive power, the operating device shall be arranged to return to the braking position automatically.

After a power failure or emergency stop, it shall be impossible to restart the crane until all operating devices have been returned to the stop or braking positions.

NOTE — Attention is also drawn to the International Labour Organisation (ILO) *Code of Practice on Safety and Health in Shipbuilding and Ship repairing* and the ILO *Code of Practice on Safety and Health in Dock Work*.

4.5.3.3 All control devices shall be clearly and permanently marked with their purpose and mode of operation.

4.5.4 Emergency stop

The jib crane shall be fitted with a quick-acting emergency stop mechanism, which when actuated by the operator removes motive power from the crane and applies the automatic control brake system. The emergency stop mechanism shall be located in a clearly marked and accessible position within easy reach of the operator and protected against unintended use.

The emergency stop should not be of the automatically resetting type.

4.5.5 Gear levers

Levers for gear change shall be positively locked in their respective positions; alternatively in the absence of an interlock a notice shall be fitted stating "Mechanical gears shall not be changed under load".

4.6 Level luffing

The design of jib and luffing gear shall ensure that the load moves in almost a horizontal direction.

As well as achieving practically horizontal movement of the load, the jib shall remain stable when at minimum radius and with the maximum SWL suspended at a reduced radius due to the hoisting cable(s) being inclined towards the crane at an angle of 8° to the axis of the crane.

NOTE — When in special cases (e.g. cranes on river traffic ships, etc.) there is no demand for level luffing arrangements, this should be agreed between the manufacturer and purchaser.

4.7 Limit switches

Limit switches or similar devices shall protect the jib crane from over-travel in any mode of operation. If agreed between the purchaser and manufacturer, it shall also be possible to reset the limit switches to restrict the movement of the jib crane for any temporary or permanent obstructions.

NOTE — A standard on limiting and indicating devices is in preparation by ISO/TC 96.

4.8 Construction

4.8.1 Access

Safe means of access and egress to the operator's cabin and control position shall be provided. Provision shall be made for the operator to escape in the case of emergency.

NOTE — Attention is drawn to the ILO *Code of Practice on Safety and Health in Dock Work*.

4.8.2 Lubrication

Jib cranes shall be designed to ensure that lubrication is efficient during operation and when inclined at up to 5° heel and 2° trim.

Lubrication nipples shall meet the requirements of ISO 7824.

4.8.3 Electrical equipment

The requirements of IEC Publication 92 shall be met.

The enclosures of electrical equipment mounted on exposed decks shall be watertight according to IEC Publication 529 with a degree of protection not less than IP 56. The enclosures of portable electrical equipment shall be weather-proof according to IEC Publication 529 with a degree of protection not less than IP 33.

5 Performance

Performance of jib cranes shall be within the limits given in table 2, the nominal sizes of which have been selected from ISO 2374. The exact figures shall be agreed between the manufacturer and purchaser.

6 Acceptance tests and rules concerning tests at manufacturer's works for acceptance of jib crane by purchaser

6.1 General

The tests shall normally be carried out at the manufacturer's works. Where this is not possible, the tests may be carried out at a place to be agreed between the manufacturer and purchaser.

The results of the tests carried out in accordance with the requirements of 6.2 and 6.3 shall be stated in the manufacturer's test certificate, prepared according to ISO 7363. The tests shall be carried out in the presence of the purchaser's representatives, and of the Classification Societies' representative if necessary.

Other tests can be agreed between the manufacturer and purchaser; in this case reference shall be made to ISO 4310.

6.2 Type testing

6.2.1 General

One jib crane from each batch of each nominal size shall be tested in accordance with 6.2.2, 6.2.3 and 6.2.4.

This test may be replaced by a prototype test certificate, if agreed between the manufacturer and purchaser at the time of enquiry.

Where tests are required in addition to the type test, these shall be agreed between the manufacturer and purchaser.

NOTE — Attention is drawn to the requirements of relevant Classification Societies.

6.2.2 No-load test (functional test)

The test shall be carried out at maximum speed on each motor, through the full working range, for a total of 15 min duration in each direction. When the motors are fitted with reduction gear, each gear shall be tested for an additional 5 min at maximum speed in each direction. During the test the following shall be checked and recorded:

- a) tightness against oil leakage;
- b) temperature of bearings;
- c) presence of abnormal noise;
- d) power input, except for internal combustion engines, or pressure in hydraulic systems;
- e) rotational speeds of motors;
- f) control and remote control operation;
- g) speed of hoisting and lowering of the hook, luffing and slewing;
- h) function of limit switch for hoisting, slewing, luffing and other safety devices.

At the end of the test, each motor shall be run through the full speed range to check for vibration.

6.2.3 Nominal load test

A 30 min continuous hoisting, slewing, level luffing and lowering cycling test shall be carried out under nominal load conditions, allowing a 20 s pause between consecutive cycles. Cranes fitted with remote control facilities shall be additionally load-tested for 5 min under similar cyclic conditions, as soon as possible after the 30 min test.

Table 2 — Performance data

Nominal size (see 3.2)	1,6	3	5	8	10	12	16	20	25	30	36	40
Nominal load SWL, t	1,6	3,2	5	8	10	12,5	16	20	25	30	36	40
Nominal hoisting speed, m/s	0,9	0,75	0,58	0,33	0,33	0,33	0,33	0,33	0,26	0,22	0,18	0,16
Nominal luffing time ¹⁾ , s	30	38	40	42	52	52	52	54	54	70	70	70
Nominal slewing speed, r/min	1,2	1,0	1,0	0,7	0,65	0,65	0,6	0,6	0,5	0,4	0,4	0,4
Light line speed (if any), m/s	1,8	1,5	1,17	0,67	0,67	0,67	0,67	0,67	0,52	0,44	0,36	0,32
Controlled speed for setting down nominal load, m/s	0,25	0,20	0,20	0,12	0,12	0,10	0,08	0,08	0,06	0,05	0,05	0,05

1) The maximum nominal time of luffing is based on a maximum operating radius of 25 m.

During the test, the following minimum information shall be recorded:

- a) speed of hoisting;
- b) slewing speed (see 3.5);
- c) time of luffing;
- d) speed of lowering;
- e) power input (except for internal combustion engine);
- f) pressure in the hydraulic systems, if any;
- g) temperature of bearings;
- h) the travel of the load on operation of the braking systems under normal power conditions;
- i) the operation of the automatic braking systems when power is switched off.

6.2.4 Overload test

The test load stated in table 3 shall be applied for one hoisting, slewing, level luffing and lowering test. Each braking system shall be operated at least three times under overload test conditions with maximum design lowering speed. During the overload test, all movements which may be used in service, such as hoisting, slewing, level luffing and lowering, shall be applied slowly over the allowable controlled movements of the jib crane.

Following the overload test, the jib crane shall be tested at each rated SWL and operating radius for two consecutive cycles in accordance with 6.2.2.

Where it is not practicable for the cranes to raise the full test load, as may be the case for hydraulic cranes, a reduced test load may be accepted; however in no case shall this be less than $1,1 \times \text{SWL}$.

Table 3 — Overload test

Safe working load (SWL)	Test load
SWL < 20	SWL + 25 %
20 < SWL < 50	SWL + 5 t
SWL > 50	SWL + 10 %

6.3 Individual test

Each jib crane shall be subjected to a no-load test as indicated in 6.2.2.

7 Marking

Jib cranes shall be permanently marked by means of a rating plate, prominently displayed or welded into the jib. The rating plate shall contain such information as is relevant to the crane, including the following minimum:

- a) manufacturer and serial number;
- b) safe working load (SWL), in tonnes;
- c) minimum and maximum operating radii.

8 Designation

Fixed jib cranes conforming to this International Standard shall be designated as follows:

- a) jib crane;
- b) the number of this International Standard;
- c) type of drive (E for electric, H for hydraulic and RIC for reciprocating internal combustion engine);
- d) nominal size (see table 2);
- e) hook travel at maximum luffing radius, in metres;
- f) minimum and maximum operating radii, in metres;
- g) operating slewing angle (only for the limited slewing cranes);
- h) the words "without cabin" if the crane is so designed.

Example:

An electric crane with fixed jib of nominal size 12, 30 m hook travel and maximum and minimum operating radii of 3 m and 20 m respectively, with slewing angle of 300° and with cabin is designated as follows:

Jib crane ISO 8431 — E 12/30/3 - 20/300

Annex

On-board acceptance tests and inspections

(This annex forms an integral part of the Standard.)

In addition to any statutory test of the jib crane and its foundations, it is recommended that the shipyard should arrange for the following inspections and tests to be carried out on-board ship to ensure that the jib crane is fully operable, prior to the overload test.

A.1 Preliminary inspections

- a) Inspection ports opened and interior of casings (if possible) checked for cleanliness, surface deterioration and foreign matter.
- b) If fitted, filters in hydraulic lines checked for cleanliness.
- c) Power supply adequate and power connections checked for tightness.
- d) Deck and casing connections checked for tightness.
- e) The supply of the correct grades of oil in sufficient volume checked for safe operation. Sumps and oil baths checked for correct volume of oil.
- f) Crane fully examined in accordance with the manufacturer's specifications, especially control and brake systems and any emergency gear.

A.2 Running tests

A.2.1 Test without load

The fully assembled jib crane shall be operated without load, to ensure that all controls and safety features operate in accordance with the manufacturer's instruction book and test certificate.

A.2.2 Nominal load test

The jib crane shall be operated for two consecutive cycles with the nominal load, complying with the requirements of 6.2.3.

A.2.3 Checks

During the tests specified in A.2.1 and A.2.2, the following additional operations shall be observed:

- a) operation of the braking system;
- b) demonstration of the variable operating speeds.

A.2.4 Overload test

This shall be carried out to the requirements of table 3 unless an equivalent statutory test has been made.