

JIS

JAPANESE INDUSTRIAL STANDARD

Standard for Construction and
Performance of Truck Cranes,
Wheel Cranes and Crawler Cranes

JIS D 6301 —1976

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Standard for Construction and Performance of
Truck Cranes, Wheel Cranes and Crawler Cranes

D 6301-1976

1. Scope

This Japanese Industrial Standard specifies the standard for construction and performance, classifying the mobile cranes into revolving super structures, base carriers and front attachments and also completed mobile cranes.

- Remarks 1. The mobile cranes, other than the provisions of this standard, also shall generally conform to the Law of Safety and Sanitary in Labour (Safety Regulations for Cranes and Others and Standards for Construction of Travelling Cranes), The Road Law (Vehicular Passage Restriction Order) and Road Vehicles Act (Safety Regulations for Road Vehicles).
2. Units and values denoted with { } in this standard are in accordance with the International System of Units (SI) and are given for reference.

2. Definitions

For the purposes of this standard the following definitions apply. The other definitions are given in JIS D 0101 and JIS D 0102.

- (1) Mobile Crane The mobile crane shall be provided with wheels or crawler belts, and shall be capable of self-propelling without rails.
- (2) Oil Hydraulic Mobile Crane The oil hydraulic mobile crane shall be that of which all or a greater part of crane operations are driven by oil hydraulic mechanisms.
- (3) Mechanical Mobile Crane The mechanical mobile crane shall be that of which all or a greater part of crane operations are driven mechanically.

Applicable Standards:

JIS D 0101-Glossary of Terms Relating to Automobiles (Part 1. Kinds of Automobiles)

JIS D 0102-Glossary of Terms Relating to Automobiles (Part 2. Dimensions, Weights and Performance of Automobiles)

JIS D 1002-Test Code of Air Cooled Gasoline Engines for Automobiles

JIS D 1003-Test Code of Water Cooled Gasoline Engines for Automobiles

JIS D 1004-Test Code of Diesel Engines for Automobiles

JIS D 1005-Testing Method of Diesel Engines for Construction Machinery

- (4) Revolving Super Structure The revolving super structure shall be a part which plays revolving motions in running operations, which is supported by a revolving suspension. However, those parts, which are to be replaced in exchanging of a front attachment, and which do not play revolving motion in a revolving circle and so on, shall be excluded.
- (5) A-Frame The A-frame shall be a mechanism involved in a revolving super structure, to which an apparatus to support a boom is attached. This may also called as a "gantry".
- (6) High A-Frame The high A-frame shall be an elevating type A-frame. This may also called as a "high gantry".
- (7) Revolving Suspension The revolving suspension shall be a part which is mounted on a base carrier and supports the revolving super structure.
- (8) Base Carrier The base carrier shall be a part, on which the revolving super structure is mounted, by which travelling ability of the mobile crane are imparted. There are three types of base carriers such as truck type, wheel type and crawler type.
- (9) Outrigger The outrigger shall be the stabilizing legs generally attached to a wheeled automobile in order to increase the stability in crane operations.
- (10) Crawler Crane The crawler crane shall be the mobile crane with a crawler typed base carrier.
- (11) Truck Crane The truck crane shall have the tyred base carrier which is supported by two axles or more of axles and is equipped with the revolving suspension, on which the revolving super structure is mounted and its base carrier is of truck type. The truck type mentioned here shall generally be equipped with a power unit and an operating seat respectively on the base carrier and the revolving super structure, the travelling operation of which shall be made from the operating seat on the base carrier.
- (12) Wheel Crane The wheel crane shall have the tyred base carrier which is supported by two or more of axles and is equipped with the revolving suspension, on which the revolving super structure is mounted. This is also called as the "mobile crane". The wheel type mentioned here shall generally be equipped with a power unit and operating seat on the revolving super structure, the travelling operation of which shall be made from the operating seat.
- (13) Front Attachment The front attachment shall be a necessary part to be mounted on the crane body proper when the mobile crane is used as a crane with hook, a crane with grab bucket and so on.
- (14) Boom The boom shall be a pillar structure, directly attached to the revolving super structure, by which a load shall be supported through a boom point sheave and a hoisting wire rope, hereinafter referred to as the "rope", and the operating radius may be adjusted by its lifting and lowering.

- (15) Basic Boom The basic boom shall be the minimum length of a boom, when all of the extension booms are removed, in the case the boom is variable in length by inserting the extension booms.

In the case of a telescopic boom the minimum length of contracted boom shall be regarded as the basic boom.

- (16) Extension Booms The extension booms shall be the ones which are inserted between the basic boom to extend its length.
- (17) Jib The jib shall be a part which is attached to the top of the boom in order to extend additionally its length.

3. Revolving Super Structure

3.1 Power Units Diesel engines, gasoline engines and so on are employed as the power units of the mobile cranes, and as starting systems electric motor types, pneumatic types, internal combustion types and so on are employed.

Furthermore, some mobile cranes are equipped with special equipments of electric generators, air compressors, oil pumps and engine preheaters, and also in some cases the other power units for lighting use and so on are mounted. The essential items of performances of power units and fuel capacities shall be as follows.

- (1) As to the one hour rated output, continuous rated output, maximum output in operation, maximum torque, fuel consumption ratio, rated speed of revolution and so on for the power units, measured values according to JIS D 1002, JIS D 1003, JIS D 1004 or JIS D 1005 shall be applied.
- (2) In the case when an independent power unit to operate the crane is equipped on the revolving super structure, the capacity of fuel of which shall be capable to continue not less than 15 h of continuous operation.

3.2 Power Transmission Mechanism The power transmission mechanism means the mechanism, through which the power is transmitted from the power unit to various parts of the revolving super structure, and generally consists of various shafts such as the prime mover shaft, counter shafts, hoisting drum shafts, reversing shaft, boom derricking drum shaft, revolving and travelling drive shafts etc., and various gears. However, in the case of an oil hydraulic type an oil pump, valves, oil motors, oil hydraulic cylinders, hydraulic oil pipings and so on shall be included in this mechanism.

The driving shaft is provided with a clutch and fluid coupling or a torque converter, gear reducer and so on, the motion of which shall be reduced by gears and chains and drives the above mentioned shaftings. (This part shall be called as the primary reduction gear.)

3.3 Hoisting Winch The hoisting winch shall be an apparatus, by which the loads are lifted and lowered, generally composed of one or two of hoisting drums and the working mechanisms.

The line pull, working load of rope, rope speed, diameter of drum and sheave, safety factor of rope, braking mechanism and so on shall be as follows.

- (1) The line pull, which is expressed by the maximum tension on the drum under the maximum torque of the power unit or oil motor, shall be the one on the first layer of the rope on the pitch circle diameter (This shall be the minimum pitch circle diameter for the drum of a differential diameter type. Hereinafter, it is referred to as same). However, in the case when this is indicated by a calculated value, the mechanical efficiency of the power unit or the oil pump under the rated speed of revolution shall be counted in and its value of efficiency shall also be listed.
- (2) The working load of rope shall be the quotient of the value of the rated load including the efficiency of sheaves, through which the rope is wound, divided by the number of turns of the rope of the slinging device.
- (3) The rope speed shall be that of the first layer of the rope on the pitch circle diameter of the drum revolving under the rated speed of revolution of the power unit or the oil hydraulic pump.
- (4) Magnification of the pitch circle diameters of the drum and sheave to the rope diameters shall be as follows. However, these shall be taken as ten times or more for a equalizer sheave and as five times or more for an over load cut-out device.

Composition of rope	Magnification
6 x 19	22 times min.
6 x 24	20 times min.
6 x 37	16.2 times min.
6 x Fi (25)	20 times min.
6 x Fi (29)	16.2 times min.

- (5) The safety factor of the wire rope, which are expressed by a value $\frac{\text{Breaking load of rope}}{\text{Maximum working load of rope}}$, shall be as follows. However, the working load shall include the efficiency of the sheave.
 - (a) Rope for hoisting of hook and rope for derricking of boom 5 min.
 - (b) Rope for telescoping of boom and rope for supporting of boom 4 min.
- (6) The capacity of the braking, mechanism shall be capable to support a static load equivalent to 150 % of the maximum rated load. Moreover, a locking device (including the oil hydraulic locking device), which has sufficient capacity to maintain the braking condition, shall be required.
- (7) When a torque converter is used, the rope speed and the line pull shall be determined on the basis of one point on the speed-torque curve of the torque converter.

3.4 Boom Derricking Device The boom derricking device shall be the mechanism to control the boom angle and divided into two types of mechanical- and oil hydraulic type. The boom is either lowered by friction brake or controlled by connecting it to the power transmission mechanism. The braking mechanism and locking device (or mechanisms providing equal performances to these) shall be provided without fail.

The working load of rope, rope speed, diameter of drum and sheave, safety factor of rope and the braking mechanism of the boom derricking device shall be as follows.

- (1) The working load of the rope shall be a value of load acting on the boom derricking rope, at a boom angle within the working range specified to the crane, under the rated load including the sheave efficiency, divided by the number of turns of the rope.
- (2) The rope speed shall be same as 3.3 (3).
- (3) The diameters of the drum and the sheave shall be as 3.3 (4).
- (4) The safety factor of the rope shall be same as 3.3 (5).

3.5 Swing Gear The swing gear shall be a device which makes the revolving super structure swing.

The swing lock on the brake shall be the device which holds the revolving super structure at any desired position. Moreover, the swing gear shall be provided at least with one mechanism among those such as the lock, brake or a mechanism having similar performance with the former.

The swinging speed shall be the speed of revolution of the revolving super structure at its rated speed of revolution of the power unit or the oil hydraulic pump. The rated swinging speed shall be the maximum speed of the swing gear capable to operate the swinging motion slinging the rated load (See 7.1.3).

3.6 Operating Apparatus Main levers, pedals and so on shall be located within an easily operatable range for operators. The operating systems are divided into such types as a manual-mechanical type, manual oil-hydraulic type, pneumatic type, power driven oil hydraulic type, electric control type and so on. The operating powers and the strokes for the levers and the pedals and the operating seat shall be as follows.

- (1) The operating forces and the strokes of the manually operated pedals and levers for main operations such as the hoisting, derricking of boom, swinging and telescoping operations shall be as follows.

	Operating force kgf {N}	Stroke cm
Pedals	30 max. { 300 max. }	30 max.
Levers	20 max. { 200 max. }	Forward & backward 60 max.

- (2) The operating seat, corresponding to the operator's physique, should preferably be made adjustable back- and forward and high and low. The position of the operating seat may be located at whichever place in the left, right or center of the crane.

Moreover, the levers and the pedals shall be marked with the necessary markings on the conspicuous places.

3.7 Frames The frames may be made adaptable types to mount various mechanisms of the revolving super structures. These generally consist of the revolving frame, A-frame and so on.

The revolving frames are constituted of the welded frame in a body or the detachable type bolted frame and so on.

The A-frame, a mechanism belongs to the revolving super structure, to which a device to support the boom is attached, may be designed into various heights and various forms according to the working conditions. In these cases, the working conditions shall be clearly indicated.

Furthermore, the A-frames are divided into a fixed type and a elevating type, and the latter shall be called as the high A-frame.

3.8 Crane Cab The crane cab shall be capable to protect the operator and the instruments from rain and snow, and shall be constructed so as to be easy in inspection and maintenance.

Moreover, if required for the convenience of transportation and so on, it shall be constructed capable to be assembled and disassembled in comparatively simple way.

The field of vision of the operating seat shall be constructed to provide a sufficient wide field of sight in operation in order to increase operational efficiency and to prevent the operation from accidents.

The front window and the overhead window shall be furnished with the safety glass or the high quality transparent plastics, and the door of the cab shall be a sliding type or a hinged type, to which a proper locking device shall be provided to prevent unexpected opening and closing of the door during travelling and operation. And it shall be securely locked with key. Proper handrails and steps for ascent and descent to and from the operating seat may be provided if required. The main walking floor shall be slip-proofed.

4. Revolving Suspension

The revolving suspensions shall be divided into the following types: Revolving circle only, sub-frame and revolving circle, sub-frame and revolving suspension frame, revolving suspension frame only and so on.

The revolving circles, which are mounted on the base carriers on the sub-frames and are supporting the revolving super structures, are divided into the types using conical rollers, cylindrical rollers, mix of the two or balls.

The sub-frames mentioned above, which are generally used as a reinforcement frames in converting general truck chassis, tractor chassis and so on into the mobile cranes, shall be mounted fixedly or detachably in the upper faces of the chassis frames. The upper faces of the sub-frames support the revolving super structures through the revolving circle or the revolving suspension frame.