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mixers and plants**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

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Safety requirements for concrete mixers and plants

Introduction

This Japanese Industrial Standard is type C standard (Detail machinery safety specification) described in the foreword of JIS B 9700-1.

1 Scope

This Standard specifies safety requirements for stationary and mobile mixers, plants and their components for use in the production of concrete and mortar.

In Annex A, typical plants, machinery and equipment covered in this Standard are shown for informative.

This Standard has taken into consideration all serious risk sources specific to concrete mixers and plants (see Annex B), which are directly associated with the mixers and plants used under the intended and expected conditions by their manufacturers, and shows specific measures to eliminate and reduce the risks that are likely to arise from these risk sources.

NOTE: This Standard intends to show the safety requirements for stationary and mobile mixers and plants, and their components for use in the production of concrete and mortar, and does not intend to perform conformity assessment in accordance with this Standard.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

- JIS A 8340-1 *Earth-moving machinery—Safety—Part 1: General requirements*
- JIS B 8361 *Hydraulic fluid power—General rules relating to systems*
- JIS B 8370 *Pneumatic fluid power—General rules relating to systems*
- JIS B 9700-1 *Safety of machinery—Basic concepts, general principles for design—Part 1: Basic terminology, methodology*
- JIS B 9700-2 *Safety of machinery—Basic concepts, general principles for design—Part 2: Technical principles*
- JIS B 9703 *Safety of machinery—Emergency stop—Principles for design*
- JIS B 9707 *Safety of machinery—Safety distances to prevent danger zones being reached by the upper limbs*
- JIS B 9960-1 *Safety of machinery—Electrical equipment of machines—Part 1: General requirements*
- JIS C 0664 *Insulation coordination for low-voltage equipment—Part 1: Principles, requirements and tests*

JIS C 0920 *Degrees of protection provided by enclosures*

JIS C 9335-1 *Household and similar electrical appliances—Safety—Part 1: General requirements*

ISO 9355-1 *Ergonomic requirements for the design of displays and control actuators—Part 1: Human interactions with displays and control actuators*

ISO 9355-2 *Ergonomic requirements for the design of displays and control actuators—Part 2: Displays*

ISO 9355-4 *Ergonomic requirements for the design of displays and control actuators—Part 4: Location and arrangement of displays and control actuators*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions are as follows:

3.1 concrete and mortar

homogenous mixture of cement, sieved aggregate, water, and, if necessary, admixture and/or chemical admixture

3.2 admixture and chemical admixture

3.2.1 admixture

materials added for the purpose of changing the characteristics of concrete or mortar (e.g. fly ash)

3.2.2 chemical admixture

chemicals added for the purpose of changing the characteristics of concrete or mortar (e.g. AE agents)

3.3 machinery and plants for use in the production of concrete and mortar

aggregation of storage equipment, carrier equipment (e.g. conveyors), measuring equipment, mixing equipment, supply equipment, wastewater treatment equipment, etc. (see Annex A)

3.4 batcher plant

plants consisting of measuring, mixing and supply equipment to prepare raw materials

3.5 storage equipment

equipment for temporal storage of raw materials (materials of a concrete such as aggregates, cement)

3.6 silo

facilities for storage of aggregates or fine particles, from the top of which aggregates or fine particles are supplied and from the bottom or the side of which delivered

3.7 receiving hopper for aggregate

hoppers installed in the basement or hoppers for use in receiving aggregates with a ramp through which the aggregates can be thrown in directly from dump trucks (see figure A.3)

The materials are taken out from the lower part of hoppers with conveyor and transferred to the next process.

3.8 conveyor

equipment (including a bucket lift) for transfer of materials from silos, storage areas or receiving hoppers, etc. to storage tanks or measuring tanks

3.9 measuring equipment

equipment for measurement of materials in accordance with mixing ratios by means of valves, gates, measuring instruments and volume measuring instruments, etc. (see figure A.5)

3.10 mixer

mixing machines for manufacture of concrete and mortar, which may operate intermittently or continuously

3.10.1 gravity mixer

mixers capable of mixing to discharge concrete by means of falling the materials by gravity after scooping them up with blades which are mounted on rotary blending tanks and driven by motors

3.10.1.1 tilting body type drum mixer

a type of gravity mixer capable of tilting the mixing tank to discharge concrete or mortar (see figure A.7)

Tilting body type drum mixer of 2.2 kw or less rated output capable of being carried by hand without aid of machines is referred to as small tilting body type drum mixer (see figure A.6).

3.10.1.2 chute discharging type drum mixer

a type of gravity mixer capable of discharging concrete or mortar with a chute without tilting the drum (see figure A.8)

3.10.1.3 reverse rotation discharging type drum mixer

a type of gravity mixer capable of discharging concrete or mortar by means of inverse rotation of spiral blades for mixing (see figure A.9)

3.10.2 forced kneading type mixer

mixers capable of mixing and discharging concrete forcibly by means of rotation of blades with motors

3.10.2.1 paddle type mixer

a type of forced mixing type mixer capable of feeding materials to the fixed tank through its upper inlet, mixing the materials with blades rotated at one or two axes inside the

tank, and discharging concrete from an outlet at the bottom by opening and closing it or by tilting the tank (see figure A.10 to figure A.12)

3.10.2.2 pan type mixer

a type of forced mixing type mixer capable of mixing materials in a stationary or rotational pan arranged in a longitudinal direction with rotational or stationary blades

The materials are fed to the pan from its upper inlet (see figure A.13 and figure A.14).

3.10.3 continuous type mixer

mixers with a drum installed inclined or horizontally in which screws or some individual blades to carry forward materials are provided (see figure A.15 to figure A.17)

3.10.4 stationary mixer

mixers fixed on a foundation or plant mounting frames

3.10.5 mobile mixer

mixers not fixed on a foundation or plant mounting frames, including mixers with wheels directly mounted on the mixer frames

3.11 wastewater treatment equipment

equipment to separate aggregate and cement from mixed water consisting of residual concrete and washing water, and to recover these materials for reuse as well as to make the treated water dischargeable into drainage (see figure A.18 to figure A.20)

4 List of significant hazards

The list of significant hazards shall be in accordance with Annex B.

5 Safety requirements and safety measures

5.1 General

Machinery and plants to manufacture concrete and mortar shall be in conformity with these safety requirements and safety measures. In addition, when new risk not listed in the serious risk sources in Annex B is found in machinery and plants as a result of risk assessment, the machinery and plants shall be designed in accordance with **JIS B 9700-1** and **JIS B 9700-2**.

NOTE: Serious risk sources are those that were identified as directly associated, when the designer and manufacturer of the machinery and plants had performed risk assessment (see **JIS B 9702**) and that require concrete actions to eliminate or reduce them.

5.2 Common requirements

5.2.1 Strength

Machinery and plants shall be designed to have sufficient strength to withstand expected load, using leading-edge technologies.

5.2.2 Hydraulic and pneumatic systems

Hydraulic and pneumatic systems shall be designed based on **JIS B 8361** and **JIS B 8370** respectively.

5.2.3 Controlling devices and instrumentation

5.2.3.1 General

Controlling devices and instrumentation shall be selected, designed, manufactured and arranged based on **ISO 9355-1**, **ISO 9355-2** and **ISO 9355-4**.

5.2.3.2 Switches

Complex concrete plants such as the following shall be provided with at least one main switch lockable with a lock or a key.

- a) When all dangerous places are not visible from location of operational panels.
- b) When plants are operable from several operational panels and/or hand carry operational boxes.

In addition, the following switches shall be provided.

- One switch for whole equipment (plant) on an operational panel
- One switch for a mixer in the mixer control room
- One switch for a turn head (distribution chute) in the distribution chute area
- One switch for other equipment on an operational panel

5.2.3.3 Prevention of simultaneous operation

In the case where there are two or more operational panels, each function (such as start, stop) shall be operable from one panel only. In other cases, the priority shall be able to switch manually or automatically over from one panel to others.

When one panel has trouble with, the functions have to be switched over to another panel manually or automatically.

5.2.3.4 Emergency stop device

- a) **Location to be installed** Emergency stop device shall be installed at a place clearly visible from each operational panel and working place and easily accessible.
- b) **Requirements** Emergency stop devices shall meet the following requirements:
 - Can stop all functions (including stoppage of engines or electric motors) in the shortest period of time.
 - Prevent machinery from restarting automatically. The restarting shall be performed by an operator.
 - Be in conformity with **JIS B 9703**.

5.2.3.5 Prevention of automatic restarting

When power supply returns on after interruption, the machinery shall not restart automatically. Restarting shall be initiated with manual operation.

5.2.4 Electric and electronic devices

All electrical equipment shall be connected through earth leakage breakers or systems with equivalent safety and output ratings (see 6.3 of JIS B 9960-1).

No electrical equipment shall be installed permanently inside mixer.

Mixers with an electrical motor of 0.9 kW or less rated output shall be provided with double insulation or shall be operated in low voltage system (see 5.5 and Annex C). For mobile machinery without double insulation or low voltage system, the following warning label shall be affixed.

“**Warning:** Dangerous area” or “Do not connect to any household outlet”

5.2.5 Protection

5.2.5.1 Prevention of access to dangerous areas

Access of persons to dangerous areas such as places to store aggregate and water shall be restricted.

5.2.5.2 Fixed guard

Around all driving equipment such as driving belts, cooling fan belts, driving chains, rotating fans, connection parts of driving pinions, sprockets and driving shafts shall be protected with fixed guard (see JIS B 9716).

5.2.5.3 Protection against heat and exhaust gas

High temperature parts of machinery and plants (e.g. internal combustion engines, exhaust pipes, etc.) shall be protected with guard and heat insulation materials.

Exhaust gas shall be discharged to a direction that gets away from operating positions of operators not to inhale the gas.

5.2.6 Fuel equipment

The materials and construction of fuel equipment shall be those to withstand extreme conditions for use such as high temperature and vibration.

In addition, warning labels to show risks of fire and explosion shall be affixed to the machinery.

5.2.7 Ergonomics

To avoid improper body positions of operators, control spaces and access equipment shall be designed in consideration of ergonomics, and user-friendly handling and lifting devices to minimize the excessive loads shall be provided.

5.2.8 Weather conditions

Plants and their use conditions shall be so designed for operators as not to be exposed to bad weather as far as possible.

5.2.9 Exhaust and ventilation equipment

Unless it is proved that operation of machinery will generate no dangerous amount of powder dust, efficient exhaust and ventilation equipment shall be provided locally at the areas and/or machinery.

5.2.10 Noise and vibration

Machinery and plants shall be designed and manufactured as lower noise and lower vibration as possible.

5.3 Requirements for home and industrial use small tilting type drum mixer

5.3.1 Stability

Small tilting body type drum mixers shall be designed to have 10° or more stable tilting angle at discharging position of concrete or mortar.

The machine shall be provided with an indicating device to show the tilting angle.

5.3.2 Drum

The surface of rotating drum shall be as smooth as possible.

5.3.3 Tilting mechanism

The gap between the frame for tilting drum and the supporting frame shall not be 2.5 cm or less (see **JIS B 9711**).

The tilting mechanism shall be manually operable with both hands.

The gap between the frame for tilting drum and the rotating drum shall not be less than 3.5 cm.

It is recommended that the gap between the support bosses and the frame for tilting drum is at least 2.5 cm. The bosses should have no projecting parts or if not possible, they shall be covered with a sleeve.

5.3.4 Cover

The covers and doors for electric motors shall be designed to stay at open positions and not to drop at opening, or to be vertical arrangement (open sideways) so that safety is secured.

5.4 Requirements for other type mixers

5.4.1 Mixing tank

5.4.1.1 Rotating mixing tank

Whole mixing tanks shall be enclosed with fence equipped with an interlocking (see **JIS B 9710**). When a gate (passage) is opened, the mixer shall be automatically stopped or the gap between the smooth surface of the mixer and fence shall be kept at the safety distance specified in **JIS B 9707**.

5.4.1.2 Rotating blades

When the blades are inserted or lowered by rotating into a mixing tank, it shall be designed that starting of operation of blades can activate only when comings and goings

or access of persons are not available.

The blades of mixers shall be protected against unintended starting of the machines except they are in the mixers. These protection devices shall be effective against rotation of mixers with inertia.

The spaces between a rotating drum and fixed parts of mixers shall be protected against the danger of being caught in.

5.4.1.3 Protection for openings of receiving and discharging

Openings for receiving and discharging of stationary mixers shall be safeguarded with supply hoppers and discharge hoppers installed close to them. The openings of hoppers shall keep the safety distance specified in table 4 of **JIS B 9707**. However, when the above safety distance cannot be kept due to the installation of working platform for maintenance, a warning sign shall be affixed on the machines.

When there is a doorway for the maintenance of a mixing tank, an interlocking mechanism shall be provided.

Discharge openings on mobile mixers except continuous type shall be safeguarded with hoppers or protective shield.

The discharge openings on continuous type mixers shall be safeguarded with hoppers of minimum height of 120 mm and minimum width of 85 mm.

5.4.1.4 Hopper

Openings to receive materials and discharge openings of mobile mixers shall be protected with grates in accordance with **JIS B 9707**. At the bottom of mobile mixers except continuous type, the following grates shall be provided:

- In the case of the maximum allowable mesh width of 70 mm, the minimum allowable distance between the cover and the compressed part shall be 150 mm
- In the case of the maximum allowable mesh width of 40 mm, the minimum allowable distance between the cover and the compressed part shall be 120 mm

The above requirements shall not apply to tilting body type mixers.

On mixing tanks, a warning sign for being caught in shall be affixed in a clearly recognizable and permanent manner.

5.4.1.5 Cover

The access hole on mixer shall be provided with a protective cover.

When the cover for an opening of a mixing tank and hoppers that can be opened without special tools is opened, the driving parts for the mixing tank and blades shall be automatically stopped (Driving power interlock devices).

For mobile mixers, it can be interlocks of operation.

When a cover to be opened with tools is frequently opened and closed, an interlocking device to automatically stop the driving power shall be installed.