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(JCMA/JSA)

**Earth-moving machinery — Safety —
Part 4: Requirements for hydraulic
excavators**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee as the result of proposal of revision of Japanese Industrial Standard submitted by Japan Construction Machinery and Construction Association (JCMA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS A 8340-4 : 2004** is replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Ministers and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

JIS A 8340 series consists of the following seven parts under the general title “*Earth-moving machinery—Safety*”:

Part 1: General requirements

Part 2: Requirements for bulldozers

Part 3: Requirements for loaders

Part 4: Requirements for hydraulic excavators

Part 5: Requirements for dumpers

Part 6: Requirements for cable excavators

Part 7: Requirements for graders

Earth-moving machinery — Safety — Part 4 : Requirements for hydraulic excavators

Introduction

This Japanese Industrial Standard is a type-C standard (machine safety standard) as stated in **JIS B 9700-1**.

When requirements of this type-C standard are different from those which are stated in type-A or -B standards, the requirements of this type-C standard take precedence over the requirements of other standards.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the scope of this Standard.

This Standard has been prepared based on the first edition of **ISO 20474-5** published in 2008 with some modifications of the technical contents. Also in this Standard, requirements applicable to Japan extracted from **ISO/TS 20474-14** which gives information on provisions that are mandatory in particular countries or regions, and related matters thereof as required are added.

The portions given dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications and their explanations is given in Annex JF.

1 Scope

This Standard gives the safety requirements specific to hydraulic excavators as defined in **JIS A 8308**.

NOTE 1 Representative types of excavators to which this Standard is applicable are illustrated in Annex JD.

This Standard is intended to be used in conjunction with **JIS A 8340-1 : 2011**, which specifies general safety requirements common to earth-moving machine families, but the specific requirements given in this Standard take precedence over the general requirements of **JIS A 8340-1 : 2011**.

This Standard deals with all significant hazards, hazardous situations and events relevant to the hydraulic excavators within its scope when used as intended or under conditions of misuse reasonably foreseeable by the manufacturer. It specifies the appropriate technical measures for eliminating or reducing risks arising from significant hazards, hazardous situations or events during commissioning, operation and maintenance.

NOTE 2 The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 20474-5 : 2008 *Earth-moving machinery — Safety — Part 5 : Re-*

quirements for hydraulic excavators (MOD)

The symbols which denote the degree of correspondence in the contents in the corresponding International Standard and **JIS** are IDT (identical), MOD (modified) and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards with the year indication, only the editions of the indicated year shall be applied and the revisions (including amendments) made thereafter shall not be applied. For those without the indication of the year, the most recent edition (including amendments) shall be applied.

JIS A 8308 *Earth-moving machinery — Basic types — Vocabulary*

JIS A 8317-2 *Earth-moving machinery — Determination of emission sound pressure level at operator's position — Dynamic test conditions*

JIS A 8319 *Earth-moving machinery — Determination of ground speed*

JIS A 8340-1 *Earth-moving machinery — Safety — Part 1 : General requirements*

NOTE : Corresponding International Standard : **ISO 20474-1** : 2008 *Earth-moving machinery — Safety — Part 1 : General requirements* (MOD)

JIS A 8403-1 *Earth-moving machinery — Hydraulic excavators — Part 1 : Terminology and commercial specifications*

NOTE : Corresponding International Standard : **ISO 7135** : 1993 *Earth-moving machinery — Hydraulic excavators — Terminology and commercial specifications* (MOD)

JIS A 8403-4 *Earth-moving machinery — Hydraulic excavators — Part 4 : Bucket volumetric ratings*

NOTE : Corresponding International Standard : **ISO 7451** : 1997 *Earth-moving machinery — Volumetric ratings for hydraulic excavator buckets and backhoe loader buckets* (IDT)

JIS A 8421-3 *Earth-moving machinery — Loaders — Part 3 : Bucket volumetric ratings*

NOTE : Corresponding International Standard : **ISO 7546** : 1983 *Earth-moving machinery — Loader and front loading excavator buckets — Volumetric ratings* (IDT)

JIS A 8921 *Earth-moving machinery — Tip-over protection structure (TOPS) for compact excavators — Laboratory tests and performance requirements*

NOTE : Corresponding International Standard : **ISO 12117** : 1997 *Earth-moving machinery — Tip-over protection structure (TOPS) for compact excavators — Laboratory tests and performance requirements* (IDT)

JIS A 8922 *Earth-moving machinery — Hydraulic excavators — Laboratory tests and performance requirements for operator protective guards*

NOTE : Corresponding International Standard : **ISO 10262** : 1998 *Earth-moving machinery — Hydraulic excavators — Laboratory tests and performance requirements for operator protective guards* (IDT)

JIS D 0006-1 *Earth-moving machinery — Engines — Part 1 : Test code for net power*

ISO 10567 : 2007 *Earth-moving machinery — Hydraulic excavators — Lift capacity*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS A 8340-1** and **JIS A 8403-1** and the following apply (see Annex JD).

3.1 hydraulic excavator

self-propelled machine on crawlers or wheels, having an upper structure normally capable of a 360° swing with mounted equipment, primarily designed for excavating, swinging and discharging earth and sand or other material with hydraulic boom, arm or bucket, without moving the undercarriage during the work cycle

NOTE : Hydraulic excavators may also be used for material handling and transportation.

3.1.1 minimal swing radius excavator

excavator for operation in confined space designed to have the rear end swinging radius and the front minimum swinging radius approximately equivalent (+ 20 % max.) to the width of the undercarriage

3.1.2 minimal rear swing radius excavator

excavator of which the rear end swinging radius of the upper structure is limited to 120 % of the undercarriage width, to ensure safety at the rear of the machine, but the front minimum swinging radius exceeds 120 % of that width

3.1.3 compact excavator

excavator with an operating mass (see **JIS A 8320**) of less than or equal to 6 000 kg

3.2 walking excavator

(The definition of this term given in the corresponding International Standard has been deleted in this Standard since the term regards a type of machine not available in Japan.)

3.3 excavator with super long reach work piece

excavator with a work piece with extra large operating radius such as super long reach equipment, slide arm, telescopic clamshell, demolition super long reach equipment, etc.

3.4 material handling

application of excavator using attachment as follows :

- a) operations where an excavator is equipped with two-point support attachment so as to be capable of free positioning, and lifts the objects by grappling or clamping

and transports them to a certain position and/or positions them

b) any of the gathering works using an attachment of one point support

3A List of significant hazards inherent in hydraulic excavators

All the hazards, hazardous situations and hazardous events that are identified as significant hazards inherent in hydraulic excavators by risk assessment, and that require measures to eliminate or reduce the risks generated therefrom are listed in Annex JA.

4 Safety requirements and/or protective measures

4.1 General

Hydraulic excavators shall conform to the safety requirements and protective measures specified in JIS A 8340-1, and the requirements specific to excavators given in this clause.

Requirements for excavators to be used for underground works in non-explosive ambience shall be as given in Annex JE.

4.2 Access

(This subclause specified in the corresponding International Standard has been deleted in this Standard since the specification in JIS A 8340-1, 4.2 is applied.)

4.3 Operator's station

4.3.1 Minimum space envelope

To minimum space envelope, JIS A 8340-1, 4.3.1.2 shall apply with the following additions :

- For an excavator of which the front window can be housed in the ceiling, the height of the space above SIP shall not be less than 920 mm with the front window being housed in the cab, regardless of the provision of JIS A 8340-1, 4.3.2.5.
- Not to apply to compact excavators of less than 1 500 kg in operating mass (see JIS A 8320).

4.3.2 Operator protective device

4.3.2.1 Operator protective guard

To operator protective guard, the following shall apply regardless of the provision in JIS A 8340-1, 4.3.3 :

Excavators shall be designed such that they can be fitted with the operator protective guard defined in JIS A 8922. The manufacturer shall inform the user that the protective guards are available as an option, and the user shall select one according to the risk relevant to the use.

In the case of excavators used for operations with a risk of scattering of broken pieces, such as operation of hydraulic breaker in demolition work, safety glass shall be

used for the front face of the operator's enclosure, and/or in the case of machines without a cab, other suitable protective device for preventing similar hazards shall be provided.

NOTE : Article No.153 of the Industrial Safety and Health Law provides for head guard of which the required energy is slightly greater than level I of operator protective guard specified in JIS A 8922.

4.3.2.2 Tip-over protective structure

To tip-over protective structure, the following shall apply regardless of the provision of JIS A 8340-1, 4.3.3 :

A minimal swing radius excavator or a compact excavator having operating mass equal to or less than 2 200 kg shall be provided with a tip-over protective structure (hereafter referred to as "TOPS") specified in JIS A 8921.

4.3.3 Operator's seat

4.3.3.1 Seat adjustment of compact excavator

The provision for compact earth-moving machinery in JIS A 8340-1, 4.4.1.3 shall apply only to compact excavators of operating mass (see JIS A 8320) exceeding 2 200 kg.

4.3.3.2 Restraint system (seat belt)

The requirement of JIS A 8340-1, 4.4.1.5 shall apply to compact excavators equipped with TOPS of operating mass exceeding 2 200 kg and excavators of operating mass exceeding 6 000 kg.

4.3.3.3 Vibration

JIS A 8340-1, 4.4.1.4 shall not apply to excavators.

4.3.4 Rear window

To rear window of excavators, the provision of defrosters given in JIS A 8340-1, 4.3.2.7 and that of window wipers and washers given in JIS A 8340-1, 4.3.2.9 shall not apply.

4.4 Controls

To controls of excavators, JIS A 8340-1, 4.5.1 shall apply together with the following :

a) The boom swing and/or offset operating pedal shall be located so as to be accessible to the operator's right foot, and as follows :

- For crosswise step type, downward motion of the right of the pedal shall effect clockwise swing of the boom and of the left of the pedal shall effect counterclockwise swing.
- For straight step type, where the pedal is located left of the boom foot middle, downward motion of the front of the pedal shall effect clockwise swing of the boom and of the rear of the pedal shall effect counterclockwise swing. Where the pedal is located right of the boom foot middle, the boom shall swing in the reverse directions respectively.

The position of the pedal shall not be such that incorrect operation can be easily induced, such as in the vicinity of the boom foot middle.

b) **JIS A 8340-1, 4.6.1** shall apply together with the following :

- The movements of the controls for driving and steering do not need to correspond to the intended direction of movement if the upper structure is not in the normal driving direction.
- No control parts of the driving device, work piece and brake shall obstruct the visibility necessary for the operation.

c) JIS A 8340-1, 4.6.2 shall only apply to excavators of which the ground speed measured in accordance with JIS A 8319 exceeds 30 km/h.

4.5 Swing brakes

Swing brakes shall conform to the requirements given in Annex JB.

4.6 Stability and safety devices

4.6.1 General

To stability and safety devices, **JIS A 8340-1, 4.11** shall apply together with **4.6.2** to **4.6.4** in this Standard.

All load ratings as defined hereafter are based on tests and/or calculations of machines on a level and firm supporting surface.

The mass of the load, its density and the location of its centre of gravity, as well as mass of the work piece and the quick release mechanism (if fitted) shall be included in the determination of the load rating and the size and/or capacity of the work piece.

In order to provide sufficient stability, the load rating in intended operations shall be determined as specified in **4.6.2**.

4.6.2 Bucket and shovel applications

The load rating of an excavator used in a bucket or shovel applications shall be as specified in either of the following, whichever is the lesser of the two :

- a) The rated tipping load in accordance with **ISO 10567 : 2007, 3.8**, in the most unfavourable position
- b) The hydraulic lift capacity in accordance with **ISO 10567 : 2007, 3.11**

The volumetric rating of the bucket or shovel shall be determined in accordance with **JIS A 8403-4** or **JIS A 8421-3**.

NOTE : The mass and volumetric rating of the bucket and the density of the material have to be taken into account when a bucket is selected for a specific application.

4.6.3 Log application

(This application specified in the corresponding International Standard has been deleted in this Standard since it involves specifications not available in Japan.)

4.6.4 Material handling applications

4.6.4.1 General

To the load rating and/or volumetric rating of material handling, 4.6.4.2 shall apply.

4.6.4.2 Load rating and/or volumetric rating

The load rating and/or volumetric rating of various uses in material handling shall be determined by the manufacturer based on the rated lift capacity as defined in ISO 10567 : 2007, 3.13, by taking into account the length, shape and specific gravity of the acceptable object, relating laws and regulations, etc.

4.6.4.3 Marking of load rating and/or volumetric rating

The load rating and/or volumetric rating according to various material handling uses shall be marked inside of the operator's enclosure.

4.6.4.4 Safety of grabbing attachment

The grabbing attachment shall satisfy the following conditions :

- It is capable of operating the open and close function from the operator's station and having a strength capable of holding the object in midair.
- The grabbing mechanism is designed to prevent unintended slackness.

4.6.4.4A Stability and safety device of excavator with super long reach work piece

Annex JC gives requirements for stability and necessary safety devices for excavators with super long reach equipment, slide arm, telescopic clamshell and demolition super long reach equipment.

4.6.4.5 Other applications

(Other applications specified in the corresponding International Standard are not adopted in this Standard since there are no other derivated machinery than described above that are available in Japan.)

4.6A Noise

4.6A.1 Exterior emission sound power level

To the sound power level emitted in the air, JIS A 8340-1, 4.13.2.1 shall apply together with the following :

For a low noise type excavators required by the working surroundings, the noise measured value shall not exceed the criteria given in table 0A.

Table 0A Criteria for low noise type excavator

Engine output (kW)	Sound power level [dB(A)]
$P < 55$	99
$55 \leq P < 103$	104
$103 \leq P < 203$	106
$203 \leq P$	106

The criteria (sound power level) for ultra low noise type excavator shall be more than 6 dB (A) lower than that for low noise excavator.

4.6A.2 Emission sound pressure level at operator's position

The emission sound pressure level at the operator's position shall be measured according to JIS A 8317-2.

4.7 Parking brake of crawler compact excavators

In addition to the regular parking brake, an attachment (e.g. bucket) or a special attachment (e.g. blade) may be used to prevent the machine from movement.

4.8 Specific requirements for walking excavators

(These requirements specified in the corresponding International Standard are not adopted in this Standard since they involve specifications not available in Japan.)

5 Verification of safety requirements and/or protective measures

(This clause specified in the corresponding International Standard has been deleted in this Standard since JIS A 8340-1 is applied.)

6 Information on use

6.1 Instruction handbook

To the instruction handbook, JIS A 8340-1, 6.2 shall apply together with the following :

- Description of the excavator configuration required for material handling (length of boom and arm, if required mass of additional counterweight, etc.)
- Parking procedure for compact crawler excavators
- A description of machine stability in different applications
- Safety instructions for selection and use of additional protective guards (for the case of e.g. demolition work) (see 4.3.2.1)
- An instruction that compact excavators (1 500 kg or under) not fitted with a protective guard shall not be used for applications where there is a risk of falling objects
- Warning to fasten the seat belt and wear a helmet without fail for operating a compact excavator with TOPS (see 4.3.3.2)

- Recommendation for fastening the seat belt and wearing a helmet to ensure safety during operation of excavator of operating mass exceeding 6 000 kg (see 4.3.3.2)
- Instruction on correct installation of the quick release mechanism and on confirmation that the mechanism has been suitably fitted.
- Notice that the operating direction of travelling and steering controls and the machine movement, where the upper structure is not in the normal travelling direction, do not coincide with the intended direction.
- Safety alert for machines equipped with a super long reach work piece.

Annex JA (informative)

List of significant hazards inherent in hydraulic excavators

In addition to the list of hazards given in JIS A 8340-1, Annex JA, the following list applies.

No. ¹⁾	Hazard	JIS B 9700-1	JIS B 9700-2	JIS A 8340-4
Hazards, hazardous situation and event				
1	Mechanical hazards which can be generated from :			
	— machine components or work piece e.g. — attachment, quick release mechanism and/or work piece — material and timber handling	4.2	4.2	4.6.2, 4.6.4 4.6.4
1.1	Crushing hazard	4.2.1	4.2.1	4.6.1, 4.6.4
4	Hazard generated by noise	4.5	4.2.2, 4.3 c), 4.4 c), 4.8.4, 5.4.2	4.6A
16	Lack of machine stability/overturning	4.2.2	4.6, 5.2.6	4.6.1, 4.6.4.4A
16.1	Overload operation on the bucket, fork, material handling, timber handling and other uses			4.6.2, 4.6.4 4.6.4.4A, Annex JC
Additional hazard, hazardous situation and event due to mobility				
18	Matters relating to travelling function			
18.4	Travelling function			4.4
18.6	Lack of capacity for deceleration, stopping and parking			4.7
19	Matters relating to working position (including operator's station) on the machine			
19.4	Mechanical hazards at operating/working position			
	a) Rolling-over		5.2	Annex JC
	b) Falling object, penetration of object		5.2	4.3.2.1
	c) Swing brake			4.5, Annex JB
	d) Protective guard		5.2	4.3.2.1
	e) Tip-over protective structure (TOPS)		5.2	4.3.2.2
19.7	Unsuitable seat			4.3.3
22.3	Hazards resulting from rescue or traction (of the machine)		5.5.5	
24	Incomplete guidance to the operator (instruction handbook, signs, warning and marking)			Clause 6
Additional hazard and hazardous situation and event due to lifting work				
25	Mechanical hazard and hazardous event			
25.1	Falling load, collision and overturning of machine resulting from the following :			
25.1.3	Unsuitable grabbing attachment/auxiliary device			4.6.4
Note ¹⁾ For numbers, see JIS A 8340-1, Annex JA.				

Annex JB (normative)

Requirements for swing brakes of hydraulic excavators

JB.1 Scope

This Annex specifies performance requirements and test methods for service swing brake, parking swing brake and swing lock of excavators defined in 3.1.

JB.2 Terms and definitions

For the purposes of this Annex, following terms and definitions apply.

JB.2.1 swing

rotation of the upper structure of excavator in relation to the undercarriage

JB.2.2 rated swing speed

number of swings per minute in a steady state

JB.2.3 swing deceleration angle

angle of swing decelerated from the rated swing speed to a complete stop

JB.2.4 swing torque

the moment to drive the upper structure in relation to the undercarriage, expressed in Nm

JB.2.5 service swing brake

hydraulic, frictional or other type of appliance or mechanism to stop the swing of upper structure in relation to the undercarriage

JB.2.6 parking swing brake

appliance or mechanism to keep the upper structure in a fixed state after stopping the swing

JB.2.7 swing lock

an engagement mechanism to lock the upper structure at a specified position in relation to the undercarriage

JB.3 Test conditions

The test shall be performed by fitting the standard work piece specified by the manufacturer. The outriggers or blade, if provided, shall be set on the ground in working state according to the designation by the manufacturer.

All the water and oils shall be at the levels prescribed by the manufacturer, and the fuel tank shall be filled to at least half the capacity. The hydraulic pressure of the swing device shall be the pressure specified by the manufacturer.

The excavator shall be placed on a flat ground with a maximum slope of $\pm 1\%$.

The rated swing speed shall be measured with the work piece extended into the state of maximum reach and the bucket in discharging state.

JB.4 Minimum performance and measurement

JB.4.1 Rated swing speed

The rated swing speed, by the result of the test measurement at the engine speed as stated in **JIS D 0006-1**, shall meet the following :

Rated swing speed $< 1.05 \times$ measured value

JB.4.2 Service swing brake

The service swing brake appliance and/or mechanism shall not be detachable.

JB.4.3 Parking swing brake

The parking swing brake shall be capable of keeping the upper structure in a fixed state, on a maximum slope on which working is also intended by the manufacturer, with the work piece stopped in the state of maximum reach at right angles to the direction of the slope. After the duration of 5 min, the drift from the initial stop position shall be less than 10° .

The parking swing brake shall be effected automatically or can be applied manually whether the engine is working or stopped, and shall remain effective even if the power supply has been disconnected.

The parking swing brake of an excavator with an operating mass of over 6 000 kg shall be completely of mechanical type, such as a spring loaded friction brake. For a compact excavator with an operating mass of 6 000 kg or less, the parking swing brake may be a hydraulic lock valve directly attached to the swing motor. In this case, another swing lock meeting **JB.4.4** shall be provided.

NOTE 1 The requirement for the parking swing brake to be “completely of mechanical type” is not intended to prevent the advancement of other techniques that can ensure equivalent safety.

NOTE 2 The parking swing brake shall function as an emergency brake in cases of hose breakage.

JB.4.4 Swing lock

The swing lock, when operated, shall be free from permanent deformation when the maximum torque of the swing motor is applied.

The swing lock, if the parking swing brake is provided with the function defined in **JB.2.7**, is not required.

Annex JC (normative)

Requirements for hydraulic excavators with super long reach work piece

JC.1 Scope

This Annex specifies the design basis, evaluation method, required safety devices, notices and so forth relating to hydraulic excavators with super long reach work pieces such as super long reach equipment, slide arm, telescopic clamshell and demolition super long reach equipment.

(These requirements can be changed as necessitated by advancement of technology — the manufacturers should always respond by applying the latest technology and strive to ensure more safety.)

All of the evaluations of the safety of excavators with super long reach work piece defined in this Annex shall be performed under the following conditions, and the relevant conditions given in the particular specification :

- The machine in the operating mass condition;
- On a level rigid ground;
- In the longitudinal or transverse direction of the crawler track, whichever is adverse to stability.

JC.2 Terms and definitions

For the purpose of this Annex, the following terms and definitions apply.

JC.2.1 operating mass condition

condition of a machine in which the fuel, lubricating oil, working fluid and cooling water is filled to the specified level, and the base machine mounted with a cab or canopy and operator protective guard (OPG), etc. specified by the manufacturer is fitted with a work piece, equipped with handy tools and ridden by an operator (75 kg)

JC.2.2 tipping line

a horizontal line connecting the points making a pivot of over-turn defined in ISO 10567 : 2007

JC.2.3 tipping condition

condition of a machine loaded with the rated tipping load defined in ISO 10567 : 2007, 3.8

JC.2.4 maximum loading mass

a loading mass under the state of maximum operating radius by which the machine can keep sufficient stability in any direction of 360° to the upper structure, which is