



JAPANESE  
INDUSTRIAL  
STANDARD

Translated and Published by  
Japanese Standards Association

---

JIS B 9702 : 2000

(ISO 14121 : 1999)

**Safety of machinery —  
Principles of risk assessment**

---

ICS 13.110

Reference number : JIS B 9702 : 2000 (E)

PROTECTED BY COPYRIGHT



**Documents**

Document Sharing Hub

## Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law:

Date of Establishment: 2000-11-20

Date of Public Notice in Official Gazette: 2000-11-20

Investigated by: Japanese Industrial Standards Committee  
Standards Board

Technical Committee on General Machinery

---

JIS B 9702 : 2000, First English edition published in 2004-11

Translated and published by: Japanese Standards Association  
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

---

In the event of any doubts arising as to the contents,  
the original JIS is to be the final authority.

© JSA 2004

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

## Contents

|                                                                                            | Page |
|--------------------------------------------------------------------------------------------|------|
| Introduction .....                                                                         | 1    |
| 1 Scope .....                                                                              | 1    |
| 2 Normative references .....                                                               | 2    |
| 3 Terms and definitions .....                                                              | 2    |
| 4 General principles .....                                                                 | 2    |
| 4.1 Basic concept .....                                                                    | 2    |
| 4.2 Information for risk assessment .....                                                  | 4    |
| 5 Determination of the limits of the machinery .....                                       | 5    |
| 6 Hazard identification .....                                                              | 5    |
| 7 Risk estimation .....                                                                    | 6    |
| 7.1 General .....                                                                          | 6    |
| 7.2 Elements of risk .....                                                                 | 6    |
| 7.3 Aspects to be considered when establishing elements of risk .....                      | 8    |
| 8 Risk evaluation .....                                                                    | 10   |
| 8.1 General .....                                                                          | 10   |
| 8.2 Achievement of risk reduction objectives .....                                         | 11   |
| 8.3 Comparison of risks .....                                                              | 11   |
| 9 Documentation .....                                                                      | 12   |
| Annex A (informative) Examples of hazards, hazardous situations and hazardous events ..... | 13   |
| Annex B (informative) Methods for analysing hazards and estimating risk .....              | 18   |
| Bibliography .....                                                                         | 20   |

## Safety of machinery—Principles of risk assessment

**Introduction** This Japanese Industrial Standard has been prepared based on the first edition of ISO 14121 *Safety of machinery—Principles of risk assessment* published in 1999 without modifying the technical contents.

The quotation of EN 292-2:1991/A1:1995 in annex A (informative) of the said standard left as it is in this Standard because the annex is only informative.

The description concerning “European equivalents to cited normative International Standard”, contained in the bibliography of the said standard, is not suitable for JIS and eliminated from this Standard.

The function of this Standard is to describe principles for a consistent systematic procedure for risk assessment as introduced in clause 5 of ISO/DIS 12100-1.

This Standard gives guidance for decisions during the design of machinery (see 3.11 of ISO/DIS 12100-1) and will assist in the preparation of consistent and appropriate Type B and Type C standards in order to comply with the essential safety and health requirements.

By itself this Standard will not provide presumption of conformity to the essential safety and health requirements (see annex A of ISO/DIS 12100-1).

**1 Scope** This Japanese Industrial Standard establishes general principles for the procedure known as risk assessment, by which the knowledge and experience of the design, use, incidents, accidents and harm related to machinery is brought together in order to assess the risks during all phases of the life of the machinery [see 3.11 a) of ISO/DIS 12100-1].

This Standard gives guidance on the information required to allow risk assessment to be carried out. Procedures are described for identifying hazards and estimating and evaluating risk. The purpose of the International Standard is to provide advice for decisions to be made on the safety of machinery and the type of documentation required to verify the risk assessment carried out.

This Standard is not intended to provide a detailed account of methods for analysing hazards and estimating risk, as this is dealt with elsewhere (e.g. text books and other reference documents). A summary of some of these methods is given for information only (see annex B).

**Note :** The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the content between the relevant International Standard and JIS are IDT (identical), MOD (modified), and NEQ (not equivalent) according to ISO/IEC Guide 21.

ISO 14121:1999 *Safety of machinery—Principles of risk assessment*  
(IDT)

**2 Normative references** The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of coming into effect is given to these referred standards, only the edition of indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative references without the indication of the year of publication apply only to the most recent editions (including the amendments).

JIS B 9960-1:1999 *Safety of machinery—Electrical equipment of machines—Part 1: General requirements*

Note : IEC 60204-1:1997 *Safety of machinery—Electrical equipment of machines—Part 1: General requirements* is equivalent to the said standard.

ISO/DIS 12100-1 *Safety of machinery—Basic concepts, general principles for design—Part 1: Basic terminology, methodology.*

ISO/DIS 12100-2 *Safety of machinery—Basic concepts, general principles for design—Part 2: Technical principles and specifications.*

**3 Terms and definitions** For the purposes of this Standard, the terms and definitions given in ISO/DIS 12100-1 and the following apply.

**3.1 harm** physical injury and/or damage to health or property

Note : In accordance with ISO/IEC Guide 51:1990, 3.4

**3.2 hazardous event** event that can cause harm

**3.3 safety measure** means that eliminates a hazard or reduces a risk

**3.4 residual risk** risk remaining after safety measures have been taken

#### **4 General principles**

**4.1 Basic concept** Risk assessment is a series of logical steps to enable, in a systematic way, the examination of the hazards associated with machinery. Risk assessment is followed, whenever necessary, by risk reduction as described in clause 5 of ISO/DIS 12100-1. When this process is repeated it gives the iterative process for eliminating hazards as far as possible and for implementing safety measures.

Risk assessment includes (see figure 1):

- risk analysis

- 1) determination of the limits of the machinery (see clause 5);
  - 2) hazard identification (see clause 6);
  - 3) risk estimation (see clause 7);
- risk evaluation (see clause 8).

Risk analysis provides the information required for the risk evaluation, which in turn allows judgements to be made on the safety of machinery.

Risk assessment relies on judgemental decisions. These decisions shall be supported by qualitative methods complemented, as far as possible, by quantitative methods. Quantitative methods are particularly appropriate when the foreseeable severity and extent of harm are high.

Quantitative methods are useful to assess alternative safety measures and to determine which gives better protection.

Note : The application of quantitative methods is restricted by the amount of useful data which is available, and in many applications only qualitative risk assessment will be possible.

The risk assessment shall be conducted so that it is possible to document the procedure which has been followed and the results which have been achieved (see clause 9).

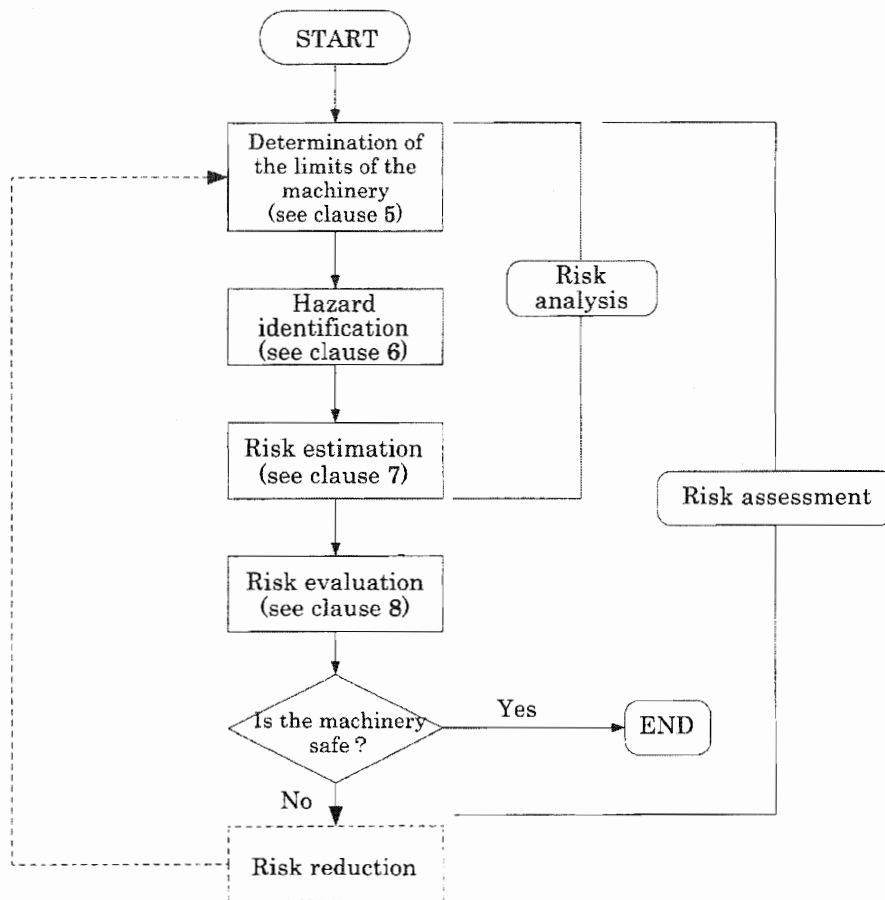


Figure 1 The iterative process to achieve safety

Note : Risk reduction and the selection of appropriate safety measures are not part of risk assessment. For further explanation, see clause 5 of ISO/DIS 12100-1 and ISO/DIS 12100-2.

**4.2 Information for risk assessment** The information for risk assessment and any qualitative and quantitative analysis shall include the following as appropriate:

- limits of the machinery (see clause 5);
- requirements for the life phases of the machinery [see 3.11 a) of ISO/DIS 12100-1];
- design drawings or other means of establishing the nature of the machinery;
- information concerning power supply;
- any accident and incident history;
- any information about damage to health.

The information shall be updated as the design develops and when modifications are required.

Comparisons between similar hazardous situations associated with different types of machinery are often possible, provided that sufficient information about hazards and accident circumstances in those situations is available.

The absence of an accident history, a small number of accidents or low severity of accidents shall not be taken as an automatic presumption of a low risk.

For quantitative analysis, data from databases, handbooks, laboratories and manufacturers' specifications may be used provided that there is confidence in the suitability of the data. Uncertainty associated with this data shall be indicated in the documentation (see clause 9).

Data based on the consensus of expert opinion derived from experience (e.g. DELPHI Technique—see annex B.8) can be used to supplement qualitative data.

## **5 Determination of the limits of the machinery** Risk assessment shall take into account:

- the phases of machinery life [see 3.11 a) of ISO/DIS 12100-1]
- the limits of machinery (see 5.1 of ISO/DIS 12100-1) including the intended use (both the correct use and operation of the machinery as well as the consequences of reasonably foreseeable misuse or malfunction) in accordance with 3.12 of ISO/DIS 12100-1;
- the full range of foreseeable uses of the machinery (e.g. industrial, non-industrial and domestic) by persons identified by sex, age, dominant-hand usage, or limiting physical abilities (e.g. visual or hearing impairment, size, strength);
- the anticipated level of training, experience or ability of the foreseeable users such as:
  - 1) operators (including maintenance personnel or technicians);
  - 2) trainees and juniors;
  - 3) general public;
- exposure of other persons to the hazards associated with the machinery, where it can be reasonably foreseen.

## **6 Hazard identification** All hazards, hazardous situations and hazardous events associated with the machinery shall be identified. Annex A gives examples to assist in this process (see clause 4 of ISO/DIS 12100-1, for further information on describing hazards generated by machinery).

Several methods are available for the systematic analysis of hazards. Examples are given in annex B.