IS 14475-1 (1997): Cranes - Condition monitoring, Part 1: General [MED 14: Cranes, Lifting Chains and Related Equipment]

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भारतीय मानक

क्रेन — स्थिति मानीटरिंग

भाग 1 सामान्य

Indian Standard

CRANES — CONDITION MONITORING

PART 1 GENERAL

ICS 53.020.20

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 1997

Price Group 4

NATIONAL FOREWORD

This Indian Standard which is identical with ISO 12482-1 : 1995 'Cranes — Condition monitoring — Part 1 : General', issued by International Organization for Standardization (ISO), was adopted by the Bureau of Indian Standards on the recommendations of the Cranes, Lifting Chains and Its Related Equipment Sectional Committee, and approval of the Heavy Mechanical Engineering Division Council.

The text of ISO standard has been approved for publication as Indian Standard without deviations. Certain terminology and conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a full stop (.) as a decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 4301-1 : 1986	IS 13834 (Part 1) : 1994 Cranes — Classification: Part 1 General	Identical
ISO 4306-1 : 1990	IS 13473 (Part 1) : 1992 Cranes — Vocabulary: Part 1 General	Identical
*ISO 4306-2 : 1994	IS 13473 (Part 2) : 1992 Vocabulary: Part 2 Mobile cranes	Technically Equivalent
ISO 4306-3 : 1991	IS 13473 (Part 3) : 1993 Cranes — Vocabulary: Part 3 Tower cranes	Identical
ISO 9927-1 : 1994	IS 14473 (Part 1) : 1997 Cranes — Inspections : Part 1 General	Identical

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

*ISO 4306-2 : 1985 was adopted as IS 13473 (Part 2) : 1992. Now, ISO 4306-2 has been revised in 1994. Hence the degree of equivalence for corresponding Indian Standard is shown as Technically Equivalent.

Indian Standard
CRANES — CONDITION MONITORING
PART 1 GENERAL

1 Scope

The purpose of this part of ISO 12482 is to:

— ensure that the design constraints of the intended use of a crane are clearly identified;

— define actions to be taken when the crane has been used over a period of time and has approached these constraints, to ensure a new safe working period.

A description is given of the special assessment required to monitor the condition of a crane.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 12482. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 12482 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4301-1:1986, *Cranes and lifting appliances — Classification — Part 1: General.*

ISO 4306-1:1990, *Cranes — Vocabulary — Part 1: General.*

ISO 4306-2:1994, *Cranes — Vocabulary — Part 2: Mobile cranes.*

ISO 4306-3:1991, *Cranes — Vocabulary — Part 3: Tower cranes.*

ISO 9927-1:1994, *Cranes — Inspections — Part 1: General.*

3 Definitions

For the purposes of this part of ISO 12482, the definitions of crane types given in ISO 4306-1, ISO 4306-2 and ISO 4306-3, together with the following definitions, apply.

3.1 constraint: Boundary parameter used for assessment and identified in accordance with ISO 4301 for the usage intended.

3.2 special assessment (SA): Thorough examination and evaluation of the crane, to be made when the crane approaches the design constraints.

3.3 general overhaul (GO): All actions required after a special assessment, according to the assessment report recommendations, before further use of the crane.

3.4 safe working period (SWP): Period of time between two successive general overhauls.

3.5 serial hoist: Hoist, in accordance with ISO 4306-1:1990, subclause 4.7, which is designed and produced independently of a specific crane or application.

4 Special assessment

Cranes are inspected at intervals in accordance with ISO 9927-1. However when the crane approaches the

design constraints, a special assessment shall be made to monitor the condition of the crane.

The supplier of the crane shall ensure that criteria for when and how such an assessment shall be carried out (e.g. number of crane cycles, load spectrum, etc.) are provided to the user/owner.

The special assessment shall cover all parts of the crane in which deterioration may affect safe use, and should include the following main groups of parts:

— load-carrying structures;

— mechanical systems;

— hydraulic systems;

— pneumatic systems;

— electrical systems;

— safety systems.

The user/owner shall ensure that adequate records are maintained (see clause 8) to enable determination of the approach to the design constraints. During the regular inspections (see ISO 9927-1) these records shall be inspected to ensure that the special assessment is carried out at the appropriate time.

NOTE 1 It should be recognized that different parts of the crane may approach the design constraints at different times (e.g. the hoist mechanism before the travel motion system).

5 Responsibility for special assessment

The special assessment procedure, based upon the information provided by the supplier (see clause 7), shall be carried out under the supervision of the expert engineer (see ISO 9927-1). The expert engineer may seek the assistance of specialists in particular types of examination whenever necessary.

The results of the special assessment, together with any conclusions, requirements or recommendations, shall be contained in a report (see clause 9) to be given to the user/owner of the crane.

6 Responsibility of the user/owner

6.1 Duties of the user/owner

The user/owner shall ensure that:

a) records are kept of the crane use, inspections and maintenance;

b) the special assessment is carried out at the appropriate time;

c) any general overhaul requirements given in the special assessment report are carried out before further use of the crane.

6.2 If criteria are not available

Where the user/owner does not have assessment criteria for a crane, the following shall be used to indicate when a special assessment shall be carried out:

a) any increase in the frequency of reported defects;

b) when the regular inspection (see ISO 9927-1) reveals a significant deterioration in the condition of the crane.

In no circumstances shall the special assessment be carried out later than the following number of years after manufacture for:

— tower cranes, loader cranes, mobile cranes: 10 years;

— all other cranes: 20 years.

7 Criteria for special assessment

The supplier shall ensure that, when providing criteria for special assessment of the crane, the following are included:

a) number of load cycles or number of operating hours, as appropriate;

b) distance travelled;

c) load spectrum;

d) exceptional circumstances to which the crane has been subjected (e.g. environmental, climatic or accident);

e) list of parts and areas to be critically assessed;

f) methods of assessment (measurement, nondestructive testing, acoustic emission, etc.);

g) acceptance criteria.

The criteria shall take into account crane usage. Suppliers therefore should not give criteria based purely on time elapsed.

Provisions for determining and assessing design constraints for serial hoists are given in annex A.

8 User/owner records

8.1 Contents of records

The crane user/owner shall keep records of the crane usage adequate to identify the criteria given by the crane supplier. Records shall also be kept of maintenance, inspections and unusual occurrences (e.g. unexpected loads from operational error, extreme climatic conditions, etc.), breakdowns, repairs and modifications.

8.2 If records are not available

Where complete records are not available for the history of the crane, it shall be inspected in accordance with annex A of ISO 9927-1:1994 and any requirements as a result of that inspection shall be carried out before further use of the crane.

A special assessment shall be carried out within 12 months of the date of that inspection, or of an earlier date if specified by the person carrying out the inspection.

9 Special assessment report

A report, containing the following, shall be prepared by the expert engineer carrying out the special assessment of the crane:

a) names and qualification of all persons participating in the assessment;

b) identification of the criteria used for the assessment;

c) results of the special assessment;

d) requirements for any action (GO) to be taken before further use of the crane;

e) recommendations for actions to be carried out within a given time period;

f) criteria for next assessment.

NOTE 2 Items d) and e) should comply with the manufacturer's recommendations.

Annex A
(normative)

Provisions for assessing serial hoists

Many elements in a serial hoist are not accessible at the prescribed inspections. Therefore this annex makes provisions for the assessment of serial hoists.

A.1 Classification for design constraints

In order to match serial hoists as far as possible to the actual working conditions, they are classified into groups of mechanisms as a whole, in accordance with ISO 4301-1.

Assuming given load cycles (with given relationships of distance of travel, positioning, hoisting grounded load, etc.) according to ISO 4301-1 and load spectrum, the classification results in the design constraints, D, given in table A.1.

The design constraints are expressed as hours that the serial hoist is in motion.

Figure A.1 illustrates the operation of a serial hoist in accordance with this part of ISO 12482.

A.2 Design constraints

Anyone offering a serial hoist for use (manufacturer, supplier, importer, etc.) shall document the design constraints D, in hours, in the operating instructions and also the working conditions on which these are based. The working conditions can be stated by specifying the group classification of the mechanism (ISO 4301-1) or by specifying the load spectrum factor, K_m, of the load spectrum.

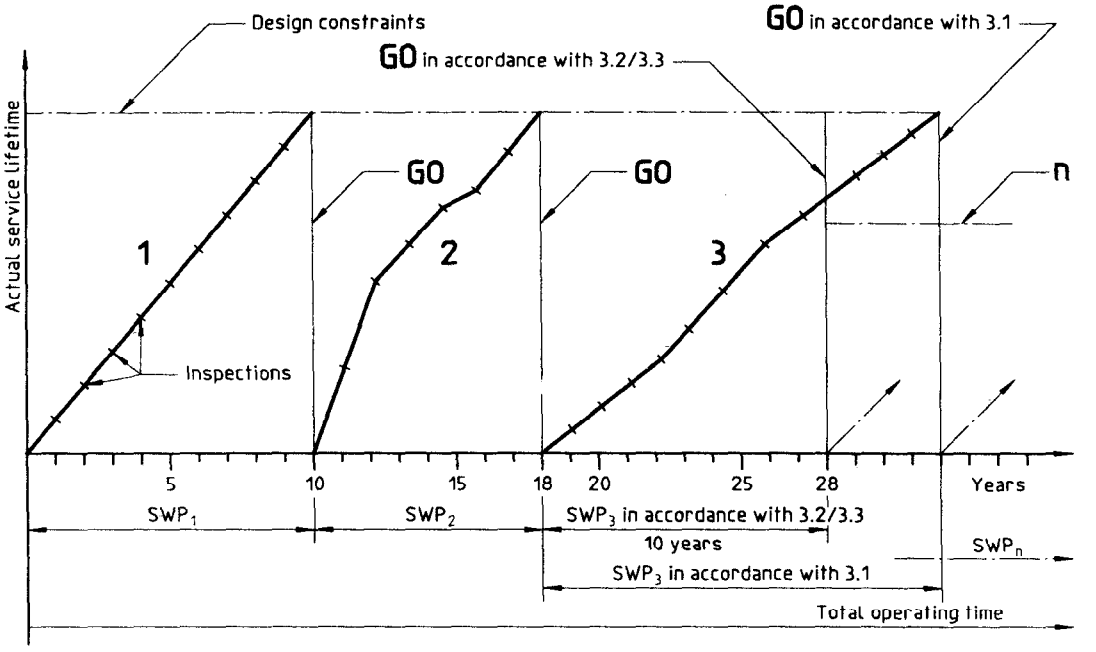
The calculations given in A.4.2 and A.4.3 are based on a comparison of the actual service lifetime and the design constraints D for state of loading 4, "very heavy" ($K_m = 1$) according to table A.1.

A.3 Recording working conditions

The working conditions shall be recorded in one (or more) of three ways (see A.3.1 to A.3.3). The user/owner is responsible for the correctness of recording and documentation in the log-book. Documentation shall be carried out at least once a year during the regular inspections (see ISO 9927-1).

Table A.1 — Design constraints for serial hoists

State of loading	Load spectrum factor, K_m	Design constraint, D h							
		Group classification of mechanism as a whole (ISO 4301-1)							
		M1	M2	M3	M4	M5	M6	M7	M8
1 — Light	$< 0,125$	800	1 600	3 200	6 300	12 500	25 000	50 000	100 000
2 — Moderate	$0,125 < K_m \leq 0,25$	400	800	1 600	3 200	6 300	12 500	25 000	50 000
3 — Heavy	$0,25 < K_m \leq 0,5$	200	400	800	1 600	3 200	6 300	12 500	25 000
4 — Very heavy	$0,5 < K_m \leq 1$	100	200	400	800	1 600	3 200	6 300	12 500



Key

GO General overhaul

1 Period of operation according to classification

2 Period of variable operation (heavier load)

3 Period of variable operation (lighter load)

n New design constraints (after GO), which may be lower than the previous ones and shall be specified by the manufacturer

Figure A.1 — Design constraints and safe working periods (SWPs)

A.3.1 Instrument recording

The working conditions and working hours are recorded by special instruments. The actual service lifetime is obtained by evaluating the data collected.

A.3.2 Log-book documentation together with suitable counters

The actual load spectrum factor K_m and the effective operating hours t_i are documented by the user/owner of the serial hoist. The serial hoist is equipped with a suitable counter (for time or distance) which allows the effective operating hours t_i to be calculated. The serial hoist shall also be equipped with a rated capacity limiter.

A.3.3 Log-book documentation without counters

The actual load spectrum factor K_m and the effective operating hours t_i are documented by the user/owner of the serial hoist.

A.4 Reaching design constraints

At each inspection, the competent person responsible for carrying out inspection shall check whether the design constraints have been reached. Depending on the method of recording, the design constraints are considered to have been reached as follows.

A.4.1 When recording by instrument

When the recording instrument indicates that the design constraints have been reached.

A.4.2 When recording by documentation (with counters)

In each documented period of time i, a portion ΔD_i of the design constraints D is used up.

ΔD_i shall be multiplied by an empirical factor $F_1 = 1,2$.

The design constraints of the serial hoist have been reached at the inspection at which

$$\sum_i (1,2\Delta D_i) \geq D$$

where

$$\Delta D_i = K_{mi} \cdot t_i$$

ΔD_i is the expended portion of service lifetime per inspection interval i;

t_i is the effective number of operating hours per inspection interval i;

K_{mi} is the documented actual load spectrum factor per inspection interval i;

D is the design constraint for state of loading 4, "very heavy", according to table A.1.

A.4.3 When recording by documentation (without counters)

Since time overruns are unlimited and are not recorded, the expended portion of the service lifetime ΔD_i must be increased by an empirical factor of $F_2 = 1,4$. The design constraints for the serial hoist have been reached at the inspection at which

$$\sum_i (1,4\Delta D_i) \geq D$$

where

$$\Delta D_i = K_{mi} \cdot t_i$$

ΔD_i is the expended portion of service lifetime per inspection interval i;

t_i is the effective number of operating hours per inspection interval i;

K_{mi} is the documented actual load spectrum factor per inspection interval i;

D is the design constraint for state of loading 4, "very heavy", according to table A.1.

A.5 Special assessment and general overhaul on reaching the design constraints

On reaching the design constraints, a special assessment of the serial hoist shall be carried out. When the working conditions are recorded by documentation (with or without counters), the assessment shall be performed not later than 10 years after commissioning of the hoist. The assessment shall be initiated by the user/owner and be performed by the manufacturer or an expert engineer. The manufacturer may also authorize other persons to perform the assessment. The serial hoist assessment shall be documented in the assessment report (see clause 9). The general overhaul (GO) shall be carried out by the manufacturer or a person authorized by the manufacturer or by an expert engineer before further use of the serial hoist.

The manufacturer or an expert engineer shall specify the following for the GO:

— which parts, components or devices shall definitely be replaced (even if no damage is evident);

— which parts, components or devices shall be checked by which methods, and as from which finding these shall be replaced;

— which new design constraints are applicable;

— when the next assessment and GO shall be carried out.

A.6 Interim criteria for serial hoists in prior use

Criteria for serial hoists in use prior to publication of this part of ISO 12482 are given in A.6.1 to A.6.3.

A.6.1 Design constraints

The value given at a later date by the manufacturer, supplier, importer etc. shall be used as the design constraint D. If no information has been provided and if no conclusions can be reached by comparing with current standardization and thus design values, a design constraint D of 50 h shall be applied and a special assessment shall be carried out within 12 months.

A.6.2 User/owner records

In accordance with A.3, the working conditions shall be documented for the entire duration of operation. The complete time can be divided into periods of dif-

ferent working conditions (and preferably into periods where these conditions are either known or not known). The expended portion of the design constraints shall be determined from this in accordance with A.4 and entered in the log-book at the first inspection after this part of ISO 12482 comes into force.

A.6.2.1 For periods where previous operating conditions are not known

For serial hoists in use prior to publication of this part of ISO 12482, the following assumptions are made for the purposes of determining design constraints when previous operating conditions have not been recorded:

— the working conditions are assumed to have load spectrum factor $K_m = 0,25$;

— $F = 1,5$ (empirical factor);

— 1 year equals 250 working days;

— the daily operating time is assumed to be 1 h.

Thus the design constraints of the serial hoist are considered to have been reached when

$$\sum_i (1,5\Delta D_i) \geqslant D$$

where $\Delta D_i = 0,25 \times 1 \times 250 \times$ No. of years.

For example, on the basis of this assumption, for hoists classified as M4, an assessment shall be planned at the latest 8,5 years after commissioning of the serial hoist.

A.6.2.2 For periods when the serial hoist is out of use

For periods when the records show the serial hoist is out of use, a load spectrum factor of $K_m = 0,125$ is assumed for a theoretical mean operating time of 0,5 h per day and an empirical factor $F = 1,5$.

Thus the design constraints of the serial hoist are considered to have been reached when:

$$\sum_i (1,5\Delta D_i) = D$$

where $\Delta D_i = 0,125 \times 0,5 \times 250 \times$ No. of years.

For example, on the basis of this assumption, for hoists classified as M3 an assessment shall be carried out at the latest 17 years after manufacture in the case of an unused serial hoist.

A.6.3 Initiation of special assessment

A special assessment as described in A.5 shall be carried out when:

— any increase in the frequency of defects is reported;

— a regular inspection (see ISO 9927-1) reveals a deterioration of the condition of the serial hoist;

— the design constraints D have been reached in accordance with A.4, A.6.2.1 or A.6.2.2.

If no information regarding assessment is available from the manufacturer, the serial hoist shall not be operated further after the design constraints D have been reached/exceeded.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act,* 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards : Monthly Additions'.

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