SINGAPORE STANDARD

SS 497 : 2002

(ICS 53.020)

SPECIFICATION FOR

Design, safe use and maintenance of overhead travelling cranes

Published by
SPRING Singapore
2 Bukit Merah Central
Singapore 159835
SPRING Singapore Website: www.spring.gov.sg
Standards Website: www.standards.org

SPRING singapore

SINGAPORE STANDARD

SS 497 : 2002

(ICS 53.020)

SPECIFICATION FOR

Design, safe use and maintenance of overhead travelling cranes

Programme Director
Standardisation Department
SPRING Singapore
2 Bukit Merah Central
Singapore 159835
Telephone: 62786666 Telefax: 62786667
Email: stn@spring.gov.sg

ISBN 9971-67-894-2

Contents

Page

Foreword 7

SPECIFICATION

Section One – General

1 Scope 9
2 Definitions 9
3 Legislation relevant to this standard 11
4 Responsibilities 12

Section Two – Design considerations

5 Group classification of cranes 12
6 Loads and load combinations 15
7 Design of crane structures 28
8 Crane mechanisms 30
9 Electrical equipment and controls 40
10 Manufacture and construction 45

Section Three – Operation and maintenance

11 Safe use and operation of cranes 48
12 Inspection and testing 51

ANNEXES

A Application of the allowable stress method of design 54
B Application of the limit state method of design 56
C Guidance on classification of overhead travelling cranes and their mechanisms in relation to usage 58
D Information to be provided when ordering an overhead travelling crane 59
E Selection of wire ropes 60

TABLES

1 Group classification of cranes according to utilisation 13
2 Classes of utilisation of cranes 13
3 Nominal load spectrum factor and state of loading for cranes 14
4 Categories of loads and load combination table 17
5 Application table for dynamic multiplier (ϕ_1) 19

		Page
6	Hoisting classes of cranes	19
7	Factors β_2, $\phi_{2\ min}$ and $\phi_{2\ max}$	20
8	Lateral loads due to acceleration from traverse (cross-travel) drives	22
9	Lateral loads due to acceleration from travel (long-travel) drives	23
10	In-service wind data	24
11	Classes of utilisation of mechanisms	31
12	Nominal load spectrum factor and state of loading for crane mechanisms	32
13	Group classification of crane mechanisms	32
14	Permissible stress (P_c) for mechanism components	35
15	Mechanical duty factor, G	35
16	Minimum drum-to-rope and sheave-to-rope diameter ratios	39
17	Duty type factors	43
18	Values of coefficients γ_f , γ_m and γ_p	56
19	Zp values	60
20	Minimum breaking load factor, K'	61

FIGURES

1	Illustration of typical lifting attachments in relation to safe working load	11
2	Typical load spectra	14
3	Acceleration loads due to traverse (cross-travel) drives	22
4	Acceleration loads due to travel (long-travel) drives	23
5	Distribution of horizontal forces	24
6	Skew load coefficients	25
7	Dynamic multiplier (ϕ_5) for buffers	27
8	Headroom above platforms and walkways on crane	46
9	Clearances for access landings – Shearing and crushing conditions	47
10	Typical flow chart of the allowable stress method of design	54
11	Typical flow chart of the limit state method of design	57

Foreword

This Singapore Standard was prepared by the Technical Committee on Lifting and Hoisting Systems under the direction of the General Engineering and Safety Standards Committee.

This standard replaces SS 120 : 1975 which was only applicable to electric overhead travelling cranes. SS 120 was reviewed in 2002 to keep up with the technological developments in modern overhead travelling cranes (OTC). The new standard is aligned with current industrial practices on the safe use, maintenance and testing of OTC. The salient points are as follows:

(a) The responsibilities of the relevant parties who are involved in the design, use, maintenance, testing and inspection of OTC are delineated.

(b) The requirements under each clause are elaborated to provide a common understanding amongst the various interested parties.

(c) The in-service wind speeds in Table 10 are based on the data obtained from the Singapore Meteorological Service for the period between 1983 and 1994.

(d) Section Two covers the basic design considerations for the crane. Where the design and calculations are based on an overseas / established crane standard, there shall be no mix-and-match of the data quoted in this Singapore Standard and the aforesaid crane standard (e.g. the load factors, coefficients, etc).

(e) The minimum drum-to-rope and sheave-to-rope ratios to be used on the crane depend on classification of the crane mechanism.

(f) Anti-collision devices have been introduced as part of the crane mechanism when two or more cranes / trolleys operate on a common runway / bridge structure.

(g) It is now compulsory to install an emergency stop button.

(h) When tested with the SWL, the maximum deflection at the centre of the bridge shall not exceed 1/750 of the span.

In preparing this standard, reference was made to the following standards:

(a)	AS 1418	Cranes (including hoists and winches)
		Part 1 : 1994 General requirements
		Part 3 : 1997 Bridge, gantry and portal cranes (including container cranes)
(b)	BS 2573	Rules for the design of cranes
		Part 1 : 1983 Classification, stress calculations and design criteria for structures
		Part 2 : 1980 Classification, stress calculations and design criteria of mechanisms
(c)	DIN 10518	Cranes – Steel structures
		Part 1 : 1994 Verification and analyses

(d)	IEC 60204	Safety of machinery – Electrical equipment of machines
		Part 32 : 1998 Requirements for hoisting machines
(e)	ISO 2408 : 1985	Steel wire ropes for general purposes - Characteristics
(f)	ISO 4301	Cranes – Classification
		Part 1 : 1986 – General
		Part 5 : 1991 – Overhead travelling and portal bridge cranes
(g)	ISO 4308	Cranes and lifting appliances – Selection of wire ropes
		Part 1 : 1986 – General
(h)	ISO 4310 : 1981	Cranes – Test code and procedures
(i)	ISO 8686	Cranes – Design principles for loads and load combinations
		Part 1 : 1989 General
		Part 5 : 1992 Overhead travelling and portal bridge cranes
(j)	ISO 9927	Cranes – Inspections
		Part 1 : 1994 General
(k)	ISO 10245	Cranes – Limiting and indicating devices
		Part 1 : 1994 General
		Part 5 : 1995 Overhead travelling and portal bridge cranes
(l)	ISO 10972	Cranes – Requirements for mechanisms
		Part 1 : 1998 General
(m)	ISO 11660	Cranes – Access, guards and restraints
		Part 5 : 2001 Bridge and gantry cranes

Acknowledgement is made for the use of information from the above standards.

NOTE

1. *Singapore Standards are subject to periodic review to keep abreast of technological changes and new technical developments. The revisions of Singapore Standards are announced through the issue of either amendment slips or revised editions.*

2. *Compliance with a Singapore Standard does not exempt users from legal obligations.*

Specification for design, safe use and maintenance of overhead travelling cranes

Section One – General

1 Scope

This standard applies to all types of overhead travelling cranes as defined in 2.18. It specifies the basic requirements of overhead travelling cranes (hereinafter called 'cranes') and lays down the responsibilities of the various parties involved.

This standard does not apply to jib cranes, gantry cranes and monorail hoists.

NOTE 1 – The titles of the publications referred to in this standard are listed at the end of the standard.

NOTE 2 – Annex D is informative and could be used as a reference when ordering an overhead travelling crane.

2 Definitions

For the purpose of this Singapore Standard, the definitions used in ISO 4306-1 : 1990 and those listed below shall apply:

2.1 Altered

It means either the modification of the structure, intended usage, electrical circuitry or the instrumentation of the crane.

2.2 Approved person

A person who is appointed by the Chief Inspector of Factories to conduct inspection and testing of overhead travelling cranes.

2.3 Bridge

The structural member(s) on which the crab(s) is / are supported.

2.4 Certified

It means certified according to relevant industrial or national standards that are recognised by the relevant authority.

2.5 Compatible

As recognised and accepted by the relevant authority.

2.6 Competent person

A person, who by way of his vocational background and experience, has good knowledge in overhead travelling cranes.