

X

इंटरनेट

## Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार" Mazdoor Kisan Shakti Sangathan "The Right to Information, The Right to Live"

Gates and Valves]

"पुराने को छोड नये के तरफ" Jawaharlal Nehru "Step Out From the Old to the New"

मानक

IS 6938 (2005): Design of rope drum and chain hoists for

hydraulic gates - Code of practice [WRD 12: Hydraulic

611111111

Made Available By Public.Resource.Org

"ज्ञान से एक नये भारत का निर्माण″ Satyanarayan Gangaram Pitroda "Invent a New India Using Knowledge"

RIGHT TO INFORMATION "ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता Bhartrhari-Nītiśatakam "Knowledge is such a treasure which cannot be stolen"





# BLANK PAGE



PROTECTED BY COPYRIGHT

# भारतीय मानक द्रवचालित दरवाजों के लिए रस्सा ड्रम और चेन शृंखला दाइस्टों के डिजाइन — रीति संहिता (दूसरा पुनरीक्षण)

Indian Standard

## DESIGN OF ROPE DRUM AND CHAIN HOISTS FOR HYDRAULIC GATES — CODE OF PRACTICE

(Second Revision)

ICS 93.160

© BIS 2005

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

Price Group 7

#### FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Hydraulic Gates and Valves Sectional Committee had been approved by the Water Resources Division Council.

Controlled release of water from reservoirs is made by the use of spillway gates provided on crests, control gates in conduits or in the body of the dam and tunnels. For the operation of these gates, various types of mechanisms are provided. The rope drum and chain hoists are used for gates which close by their own weight and where no positive thrust is required to close them.

In the formulation of this standard, due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

This standard was first published in 1973 and subsequently revised in 1989. In this revision the requirements of motors, hoist limit switch, control panel and figures have been modified in the light of experience gained over the years.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with 1S 2: 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## Indian Standard

## DESIGN OF ROPE DRUM AND CHAIN HOISTS FOR HYDRAULIC GATES — CODE OF PRACTICE

## (Second Revision)

#### **1 SCOPE**

This standard lays down guiding principles for design of rope drum and chain hoists used for the operation of hydraulic gates.

#### **2 REFERENCES**

The standards listed in Annex A contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

#### **3 GENERAL**

#### 3.1 Hoist Capacity

**3.1.1** The hoist capacity shall be determined by taking into consideration the following forces which might be required to overcome:

- a) Weight of the gate along with all its components including the weight of wire rope and its attachments and ballast, if any;
- b) All frictional forces comprising of:
  - 1) Wheel friction,
  - 2) Guide friction, and
  - 3) Seal friction including friction due to initial interference;
- c) Any hydrodynamic load, like downpull/uplift force, etc;
- d) Silt and ice load wherever encountered;
- e) Weight of lifting beam, if used; and
- f) Any other consideration specific to a particular site.

**3.1.2** The worst combination of the above forces, during either lowering cycle or raising cycle, shall be considered.

**3.1.3** The hoist capacity thus arrived at shall be increased by 20 percent to cater for the reserve hoist capacity unless otherwise specified by the purchaser.

3.1.4 The gate shall be designed for closing under its self weight ( without any positive thrust to the same ) and the downward forces closing the gate while lowering shall be at least 20 percent higher than the frictional and other forces opposing the downward motion. The necessary closing/seating load shall be calculated considering the net crosssectional area of the bottom seal and maximum water pressure acting on it such that the lowering force is more than the seating load. However, the values of closing/seating load shall be greater than those given below:

Type of Gate	Minimum Seating Load
Low head gates	2.5 kN/m length of gate
Medium head gates	5.0 kN/m length of gate
High head gates	10.0 kN/m length of gate

**3.1.5** The usual operating speed for such hoist shall be 300 to 700 mm/min. However, higher values may be adopted depending upon the requirements.

Typical hoisting arrangements for operation of various gates are shown in Fig. 1 and Fig. 2.

#### **4 DESIGN OF MECHANICAL PARTS**

#### 4.1 General Requirements

**4.1.1** The various components of hoist mechanism shall be so proportioned as to take the worst load coming on individual component.

**4.1.2** The stress in various components of hoist shall be checked for maximum power transmission in these components, taking into account the permissible stresses as given in relevant clauses. Various structural and mechanical components of hoist shall also be checked for breakdown torque of the motor.

**4.1.3** All the hoisting machinery parts shall be checked for static as well as dynamic loads.

**4.1.4** The combined stress in each component shall be found by the following formula:

$$\sigma_{\rm c} = \sqrt{\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2 + 3\tau^2}$$

where

τ

 $\sigma_c = \text{combined stress, in N/mm}^2$ ;

 $\sigma_1 \sigma_2$  = tensile/compressive stresses, in N/m<sup>2</sup>; and

= torsional shear stress, in  $N/mm^2$ .



# 1A Rope Drum Hoist ( Plan)





**SECTION A-A** 

**SECTION B-B** 

1B Machine Assembly



1C Gate Attachment with Balancing Sheave Assembly

FIG. 1 TYPICAL HOISTING ARRANGEMENTS OF GATES

4

IS 6938 : 2005



IS 6938 : 2005

S

#### IS 6938 : 2005

#### 4.2 Wire Ropes

#### **4.2.1** General

The wire rope shall be made from improved plough steel, galvanized (if required), Lang's lay and fibre core or normally of  $6 \times 36$  or  $6 \times 37$  construction and shall conform to IS 2266.

**4.2.1.1** For calculating the rope tension pulley efficiency should be taken into account.

**4.2.1.2** In case of multiple falls, the wire rope shall be provided with a device that takes care of unequal stretch of rope.

#### 4.2.2 Breaking Strength

The breaking strength of wire rope, if not given by the manufacturer of rope, shall be calculated on the basis of IS 2266.

#### 4.2.3 Factor of Safety

The minimum factor of safety based on minimum breaking strength and safe working load of the wire rope shall be as given in Table 1.

Table 1 Minimum Factor of Safety for Wire Ropes

SI No.	Operating Condition	Minimum Factor of Safety
(1)	(2)	(3)
·i)	Normal operation condition	6
ii)	Breakdown torque condition	3
iii)	For counterweight suspension	5

**4.2.4** Wire ropes shall be guided over as few pulleys as possible. Reverse 'S' shaped bends shall be avoided as far as possible.

**4.2.5** The strength of the socket end of wire rope shall be approximately equal to that of the rope itself. The ends of wire ropes shall also be secured against twisting. The material for wire rope socket shall conform to IS 2485.

#### 4.3 Drums

#### 4.3.1 General

**4.3.1.1** The grooved drum shall be of such a size that normally there will not be more than one layer of rope on the drum when the rope is in its fully wound position unless specified.

**4.3.1.2** The length of the drum shall be such that each lead off rope has minimum two full turns on the drum when the gate is at its lowest position, and one spare groove for each lead off the drum when the gate is at its highest position.

**4.3.1.3** The drum may be flanged at ends. The flanges shall project to a height of not less than two rope diameters above the rope. A spur gear secured to the drum may be regarded as forming one of the flanges.

**4.3.1.4** The lead angle (fleet angle) of the rope shall not exceed  $5^{\circ}$  or 1 in 12 on either side of helix angle of groove in the drum.

#### 4.3.2 Material for Drums

The drums shall be made from one of the following materials:

- a) Cast iron conforming to IS 210,
- b) Cast steel conforming to IS 1030, and
- Mild steel plates conforming to IS 2062.
  NOTE Use of cast iron shall be limited to small capacity hoists only.

#### 4.3.3 Strength of Drum

The drum shall be strong enough to withstand the crushing as well as the bending. The crushing strength of drum shall be calculated by the following formula:

$$C_t = \frac{K \times T}{p \times t}$$

where

- $C_1 = \text{compressive stress, in N/mm}^2$ ;
- K = coefficient which depends upon the number of layers of rope over the drum and may be taken from Table 2;
- T = tension on one wire rope in N;
- p = pitch of scoring or centre to centre distance between adjoining grooves, in mm; and
- t = thickness of drum at the bottom of groove, in mm.

NOTE — The minimum thickness of drum shall not be less than 16 mm in case of cast steel and 20 mm in case of cast iron.

Table 2 Value of K

SI No.	Number of Layers of Rope Over the Drum	Value of K
(1)	(2)	(3)
i)	1	1
ii)	2	1.75
iii)	3	2.0
iv)	4	2.25

4.3.3.1 The permissible compressive stresses for the various materials from which drum is made shall be taken as follows:

Material	Indian Standard	Normal Torque Cohditions	Breakdown Conditions
(1)	(2)	(3)	(4)
Cast iron	IS 210	0.2 UTS	0.4 UTS
Cast stee	I IS 1030	0.2 UTS	80 percent of YP
Mild stee	IS 2062	0.17 UTS	80 percent of YP

#### 4.3.4 Grooves on Drum

4.3.4.1 The rope drum shall be machine-grooved and contour at the bottom of grooves shall be circular over an angle of at least  $120^\circ$ . The radius of groove shall be 0.53 times the diameter of rope rounded off to next full millimeter. The depth of groove shall not be less than 0.35 times the diameter of the rope.

4.3.4.2 The grooves of the drum shall be so pitched that there is a clearance of not less than the following values between adjacent turns of rope:

- a) 1.5 mm for ropes up to and including 12 mm diameter,
- b) 2.5 mm for ropes over 12 mm and including 30 mm diameter, and
- c) 3.0 mm for ropes over 30 mm diameter.

4.3.4.3 • Grooving shall be finished smooth and the edges between the grooves shall be rounded.

#### 4.3.5 Diameter of Drums

The minimum pitch diameter of the drum shall be 20 times the diameter of rope of 6/36 or 6/37 construction.

4.3.6 In case of fabricated drums, the number of segments shall not exceed two.

#### 4.3.7 Fixing of Rope

The ends of the rope shall be fixed at minimum two points on the drum in such a way that the fixing device is easily accessible and the rope is not subjected to undue twists and turns. Each rope shall have not less than two full turns on the drum before it is fixed.

#### 4.4 Sheaves or Pulleys

#### 4.4.1 Diameter of Pulleys/Sheaves

The minimum pitch diameter of pulleys/sheaves shall not be less than that shown in Table 3.

# Table 3 Minimum Value of D/d Ratio for<br/>Pulleys/Sheaves

(Clause 4.4.1)	(	Clause	4.4.1	)
----------------	---	--------	-------	---

SI No.	Type of Pulley/ Sheave	D/d Ratio (Minimum Value for 6/36 or 6/37 Ropes)
i)	For idler pulleys or balancing pulleys	12
ii)	All pulleys/sheaves other than idler or balancing pulleys	a 20
	NOTE	
	D = pitch diameter of	pulley, in mm; and
	d = diameter of wire r	ope, in mm.

**4.4.2** The diameter at the bottom of the grooves of the equivalizing sheaves shall be not less than 62 percent of the minimum pulley diameter.

#### 4.4.3 Grooves

Sheaves or pulleys shall be machine-grooved to a depth of not less than 1.5 times the diameter of the rope. Grooves shall be finished smooth and shall be free from surface defects likely to injure rope. The contour at the bottom of the grooves shall be circular over an angle of approximately  $130^\circ \pm 5^\circ$ . The radius of the groove shall be 0.53 times the diameter of a rope. The included angle which is the angle between the straight slopes at the sides of the grooves shall be approximately  $52^\circ$ .

#### 4.4.4 Sheave Guards

Sheave/pulley shall be provided with guards to retain the ropes in the groove, if necessary.

#### 4.4.5 Material for Sheaves/Pulleys

Sheaves/pulleys shall be made from any suitable material as specified for drums.

#### 4.5 Gearing

**4.5.1** The gear shall be machine-cut with smooth finish. Following spur gear tooth forms may be used in the reduction units of these hoists:

- a) 20° stub tooth system, and
- b) 20° full depth involute system.

Face width of spur gear shall not be less than 8 and more than 12 modules.

The q value for stub tooth system and full depth involute system is given in Table 4.

#### 4.5.2 Design

Unless more accurate methods are applied and called for the spur gears shall be designed according

Table 4 q Value for Calculation of Stress in Toothat Root ( External Tooth ) for 20° Full DepthInvolute System and 20° Stub Tooth Systems

SI No.	Number of Teeth on Gear/Pinion	q Value for 20°	q Value for 20° Stub Tooth
(1)	(2)	(3)	(4)
i)	12	4.60	3.215
ii)	13	4.35	3.086
iii)	14	4.10	2.941
iv)	15	3.90	2.865
v)	16	3.75	2.770
vi)	17	3.60	2.717
vii)	18	3.50	2.652
viii)	21	3.30	2.506
ix)	24	3.20	2.424
x)	28	3.10	2.325
xi)	34	3.00	2.242
xii)	40	2.90	2.179
xiii)	50	2.80	2.110
xiv)	65	2.70	2.040
xv)	80	2.60	2.008
xvi)	100	2.50	1.976
xvii)	Above 100	2.50	1.976
NO	TE Intermediate		intonnalatad

NOTE — Intermediate values may be interpolated.

to the formula given below:

$$\sigma_{\rm root} = \frac{P \times q}{F \times m}$$

where

 $\sigma_{root}$  = stress in N/mm<sup>2</sup> at root of gear;

P = tooth load, in N;

q =strength factor indicated in Table 4;

F = face width, in mm; and

m = module in mm.

#### 4.5.3 Allowable Stress

**4.5.3.1** The allowable stress shall be taken as 20 percent of the ultimate tensile strength of material used for the manufacture of the gear for the normal operating condition.

**4.5.3.2** For breakdown torque condition, the allowable stress shall be taken as 80 percent of the yield point stress of the material.

#### 4.5.4 Material

All spur gear shall be of cast steel, forged steel, carbon steel surface hardened steel or fabricated mild steel. The choice of material shall be judicious. The gears and pinions shall be made from two different grades of materials, higher strength grade shall be used for pinion and lower strength grade for spur gear.

4.5.5 Keys in gear trains shall be so fitted and secured that they should not become loose when in service.

#### 4.5.6 Speed Reducers

**4.5.6.1** Standard worm or helical reducers, if used, for the first stage heavy reduction at the central drive unit, shall be high grade reduction unit suitable for the service intended. The proportions of all the parts, therein, shall be in accordance with the best engineering practices.

**4.5.6.2** Rating and efficiency of the reducers used in calculations shall be according to the manufacturer recommendation.

**4.5.6.3** Speed reducers shall be filled with lubricants as per recommendations of the manufacturer.

#### 4.6 Chain

The roller chain is usually made from straps and pins. All straps should bear evenly. Subject to this condition, the safe bearing pressure between the straps and the pins shall be as follows:

- a) Chain for crest gates : 90 N/mm<sup>2</sup>, and
- b) Chain for sluice gates : 70 N/mm<sup>2</sup>.

**4.6.1** The minimum breaking strength shall amount to:

- a) 500 N/mm<sup>2</sup> in case of straps, and
- b)  $600 \text{ N/mm}^2$  in case of pins.

**4.6.2** Maintenance shall also be given due consideration in arriving at the selection of the size of the chains. Materials for various parts of the chain shall be as follows:

- a) Straps : High carbon steel (Temper 1/4 H of IS 513),
- b) Bushings : Steel (Grade 280-520 W for welding and Grade 280-520 N for without welding of IS 1030 ),
- c) Rollers : Steel (with hardened tread and tough centres) (Grade 55 C8 of IS 3445), and
- d) Pins : High carbon heat treated steel or chromium plated alloy steel (Class 4 of IS 2004).

#### 4.7 Shafts

#### 4.7.1 General

The shafts shall be designed for appropriate load/ torque, that is, being transmitted. Shafts shall have ample strength and rigidity and adequate bearing surfaces. They shall be finished smoothly and, if shouldered, shall be provided with fillets of large radius.

#### 4.7.2 Dimensioning of Shafts

In dimensioning the shaft with ratio ( length/ diameter )  $\geq$  50, the angle of twist and the revolutions/minute shall be taken into account, in addition to simple bending, pure torsion, or the combined effect of bending and torsion. The twist that shall be permitted is 1/4° to 1/3° per m. Linear deflection in the shaft shall not exceed 1 mm/m of length.

#### 4.7.3 Material

All shafts shall be of forged/rolled steel.

#### 4.7.4 Allowable Stress

The allowable stress for solid shaft shall be as follows:

- a) Maximum allowable bending stress, ( $\sigma_b$ ) either in tension or compression only
  - $\sigma_b = 0.5$  yield point or 20 percent of ultimate strength whichever is less.
- b) Maximum allowable torsional shear stress (τ)
  - $\tau$  = 30 percent of the yield point stress.
- c) Combined stress shall be calculated with the following formula and shall not be greater than that at (a) above

$$\sigma_{\rm c} = \sqrt{\sigma_{\rm b}^2 + 3\tau^2}$$

where

- $\sigma_c$  = combined stress, in N/mm<sup>2</sup> and shall not exceed 0.24 UTS or 0.60 YP, whichever is less;
- $\sigma_{\rm b}$  = tensile/compressive stress, in N/mm<sup>2</sup>; and
- $\tau$  = shear stress, in N/mm<sup>2</sup>.

The allowable stress for shafts with keys shall be 75 percent of the above value.

The shaft shall also be designed for combined bending and twisting by making use of the following formulae and shall be checked for breakdown torque condition. For breakdown torque condition, the allowable stress shall be taken as 80 percent of the yield point stress of the material except for shear for which value shall be limited in the ratio of permissible stress under normal conditions. The equivalent bending and twisting stress shall not exceed 1.2 times the maximum allowable stress as at 4.7.4 (a) and 4.7.4 (b) separately.

1) Bending:

$$M_{\rm e} = 0.5 (M + \sqrt{M^2 + T^2})$$

2) Twisting:

where

 $M_e$  = equivalent bending moment, in Nm;

 $T_{\rm e} = \sqrt{T^2 + M^2}$ 

- M = bending moment, in Nm;
- T = twisting moment, in Nm; and
- $T_e$  = equivalent twisting moment, in Nm.

#### 4.8 Bearings

#### 4.8.1 Types of Bearing

All the running shafts shall be provided with ball, roller or bush bearings. Selection of bearings shall be done on consideration of duty, load and speed of the shaft.

**4.8.1.1** Life of ball and roller bearings shall be calculated in accordance with the maufacturer's recommendations.

**4.8.1.2** Bearings shall be easily accessible for lubrication and/or replacement. If there is more than one bearing on one shaft, every bearing shall be provided with individual lubrication arrangement.

**4.8.1.3** The minimum thickness of bronze bush shall be calculated by the following formula:

$$t = 0.08 d + 3 mm$$

where

d = diameter of the shaft, in mm; and

t = thickness of bush, in mm.

NOTE — Allowable bearing stress in case of bronze bush shall be as per Annex B of IS 4622. However, in case of breakdown torque condition it may be increased by 33 1/3 percent.

#### 4.9 Couplings

#### 4.9.1 Material

All couplings shall be of forged steel or cast steel and shall be designed to transmit the maximum torque that may be developed.

**4.9.2** Solid couplings shall be aligned in such a way that they meet accurately. Flexible couplings shall be initially aligned with the same accuracy as solid couplings.

**4.9.3** Flexible couplings shall be fitted between motor shafts and extension shafts.

#### 4.10 Gear Boxes

4.10.1 Gear boxes shall be of rigid construction fitted with inspection covers and lifting handles where necessary. The gear boxes shall be so designed that the gears can be easily removed or replaced and shall be such that the gears are suitably lubricated. Facilities for oil filling and draining, connection for oil level indication and adequate breathing shall be provided where necessary. The boxes shall be mounted on a level surface.

**4.10.2** Material for the gear box shall be cast iron, cast steel or fabricated from mild steel conforming to relevant Indian Standards.

#### 4.11 Hoist Supporting Structure

Allowable stresses for hoist supporting structure shall be in accordance with 1S 800 and an impact factor of 1.1 shall be considered. For breakdown torque condition, the allowable stress shall be taken as 80 percent of the yield point stress of the material.

**4.11.1** The deflection of hoist bridge shall be limited to 1/800 for spans up to 12 m and 1/1 000 for spans above 12 m.

NOTE — Impact factor should not be taken for breakdown torque condition.

#### **5 ELECTRICAL EQUIPMENT**

#### 5.1 Efficiency of System

5.1.1 The usual values of efficiencies adopted for the various elements of hoisting mechanism shall be taken from Table 5. The overall efficiency of the system which is the product of individual efficiency of elements, shall then be worked out. This overall efficiency of the system shall be used in calculating the capacity of the electric motor.

5.1.2 The ratio of overall running efficiency to the overall starting efficiency shall be less than the ratio of starting torque to running torque of the motor.

#### 5.2 Motors

5.2.1 The motor shall be totally enclosed fancooled, high starting torque, squirrel cage, three phase induction motor of rated capacity conforming to

IS 325. Unless otherwise specified the motor rating shall be 40 percent cyclic duration factor, rated S 3 duty ( with six starts per hour ).

**5.2.2** The motor shall be suitable for outdoor type duty. The motor shall be suitable for reversing frequent acceleration and mechanical braking.

5.2.3 The breakdown torque of the motor at rated voltage shall be not less than 2 times ( that is, 200 percent ) of the rated torque. During this condition, for checking the hoist components and hoist supporting structure, the starting efficiency of the system shall be considered.

**5.2.4** Motors shall be so located that the bush gear and terminals are readily accessible for inspection and maintenance and normal ventilation is not restricted.

5.2.5 Motor shall be provided with strip type anti condensation heater.

#### 5.3 Electro-magnetic Brake

5.3.1 The electro-magnetic brake shall be of spring set, shoe type. It shall be solenoid operated and continuously rated. The brake shall be effective in both directions of travel and shall be capable of overcoming at least 150 percent of the full load torque exerted by the motor.

5.3.2 The brake shall set automatically when the current is cut off from the motor and it shall be electrically released when the current is applied to the motor. The brake shall be equipped with a hand-operated release lever. A weather-proof cover complete with heaters, if required, shall be provided to prevent condensation on moving parts.

5.3.3 In addition to electro-magnetic brake, additional brakes shall also be provided, in such case where undesirable gravity fall of gate is to be arrested or where frequent intermediate stopping of gate is required during lowering cycle or where the selected

SI No.	Particular of Elements	Starting Efficiency Percent	Running Efficiency Percent
(1)	(2)	(3)	(4)
i)	Drum/sheave/pulley:		
	a) Bronze bushing	93	95
	b) Anti-friction bearing	95	98
ii)	Each set of spur gears	93	95
iii)	Each set of helical gears	95	98
iv)	Standard drives, such as, worm reducer, helical gear reducer, etc	As per manufacturer's recommendations	As per manufacturer's recommendations
V)	Electrical motor	do	do

Table 5 Efficiencies of Various Components of Hoisting Mechanism (*Clause* 5.1.1)

gear box is not of self locking type.

#### 5.4 Limit Switches

#### 5.4.1 General

The limit switches, after being tripped, shall automatically reset themselves within a reasonable distance travelled in opposite direction. This does not prevent the use of changeover type limit switches where resetting is achieved by striker when moving in opposite direction. They may be mechanically driven from the shaft.

#### 5.4.2 Hoist Limit Switch

**5.4.2.1** It is a device provided to cut off the current, stop the motion of hoist mechanism and to apply the brake when the gate has reached a predetermined level. Rotary type double acting limit switch shall be provided.

**5.4.2.2** Limit switches for intermediate positions of travel, if required, shall also be provided.

**5.4.3** Limit switches shall be weather-proof type. Adequate adjustment shall also be provided to compensate for rope elongation.

#### **6 GATE POSITION INDICATOR**

6.1 The gate position indicators shall invariably be provided with each hoist unless otherwise specified by the purchaser.

6.2 The indicator dial shall be made from nonrusting metal or enamelled plate or thick plastic sheet. It shall generally be of circular shape. If agreed to, other shapes may also be adopted.

6.3 The markings on dial in the operating range may preferably be kept at reading of 1/20th of metre. The metre markings shall be very bold. The words 'closed', 'open' or 'fully raised' shall also be engraved or permanently marked.

**6.4** The dial shall be located at a convenient place from where it may be easily seen by the gate operator.

6.5 The indicator point shall be made of non-rusting metal. Electroplated indicator pointer can also be provided, if mutually agreed to. Digital type indicator may also be used.

#### 6.6 Control Equipment

6.6.1 The hoist mechanism shall be complete with one local control panel with push buttons. The control panel shall be totally enclosed with IP 54 protection. The push buttons shall be suitably labelled as 'Raise', 'Stop' and 'Lower'.

6.6.2 Lamps to indicate the condition of the control

circuits and direction of motion may be provided.

6.6.3 For emergency gate hoist requiring crack opening, one additional push button of momentary contact type, labelled 'Crack' shall be provided along with the indicating lamp showing 'Gate cracked open'.

**6.6.3.1** Crack operation push button shall have suitable limit switch/timer control to limit the initial operation time of motor crack opening as per recommendations of the manufacturer of the motor for utilizing torque higher than that referred for normal operation.

6.6.4 The hoist shall be provided with all the necessary relays, starter, heaters, if required, fuses, limit switches and indicating lights complete with suitable wiring so that all the functions are carried out smoothly.

6.6.5 Remote control equipment, if required, shall be provided to enable the operation of gates from regulation room. Gate position indicator, alarms, suitable interlocks with local control panel, shall be provided in regulation room, if required. Fibre optical/ conventional cables may be used for communication link.

**6.6.6** All the controls shall be so interlocked that the proper functioning of individual parts for the purpose is ensured.

6.6.7 Alternative source of electrical supply may be provided by the purchaser for important projects, if considered necessary.

**6.6.8** Protection for rope overload and slack rope may be provided at the discretion of the designer.

#### 6.7 Manual Operation for Electrically Operated Hoists

**6.7.1** The manual operation shall be provided, if required for emergency operation in the event of electric supply failure.

**6.7.2** Electrical interlocks shall be provided to prevent operation by electrical power when the manual drive is engaged.

6.7.3 The manual operation should be designed in such a manner that the continuous effort per man does not exceed a crank force of 100 N with 400 mm of crank radius at a continuous rating of 24 rev/min. The maximum number of persons may be restricted to 4.

6.7.4 Manual operation shall be provided with ratchet and pawl arrangement so that the gates do not fall of their own weight during manual operation.

6.8 If desired by the purchaser, only manual operation may be provided for small capacity hoists.

## ANNEX A

## (Clause 2)

## LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title	
210:1993	Grey iron casting — Specification (fourth revision)	2062 : 1999	Steel for general structural purposes — Specification ( <i>fifth</i>	
325 : 1996	Three-phase induction motors —		revision)	
	Specification ( <i>fifth revision</i> )	2266 : 2002	Steel wire ropes for general	
513 : 1994	Cold rolled low carbon steel sheets and strips ( <i>fourth revision</i> )		engineering purposes - Specification ( <i>fourth revision</i> )	
800 : 1984	Code of practice for general construction in steel ( second revision )	2485 : 1979	Specification for drop forged sockets for wire ropes for general engineering purposes ( first	
1030 : 1 <b>998</b>	Carbon steel castings for general		revision)	
	engineering purposes ( <i>fifth</i> <i>revision</i> )	3445 : 1992	Forged steel rolls (first revision)	
2004 : 1991	Carbon steel forgings for general engineering purposes ( third revision )	4622 : 2003	Recommendations for structural design of fixed — Wheel gates ( <i>third revision</i> )	

.

## ANNEX B

## (Foreword)

### COMMITTEE COMPOSITION

## Hydraulic Gates and Valves Sectional Committee, WRD 12

Organization	Representative(s)
In Personal Capacity ( 2047, Pocket 2, Sector D, Vasant Kunj, New Delhi 110 070 )	Shri N. Vishwanathan ( <i>Chairman</i> )
Bhakra Beas Management Board, Punjab	Deputy Chiefe Engineer Executive Engineer ( <i>Alternate</i> )
Bharat Heavy Electricals Ltd, Bhopal	DGM ( HTE )
Central Electricity Authority, New Delhi	Shri R. K. Rustagi
Central Water and Power Research Station, Pune	Shri R. M. Sinnarkar Shri S. L. Patil ( <i>Alternate</i> )
Central Water Commission, New Delhi	Director Gates ( E & NE ) Director ( Gates-NW & S ) ( <i>Aliernale</i> )
Himachal Pradesh State Electricity Board, Sunder Nagar, Himachal Pradesh	Chief Engineer ( Design ) Shri K. D. Sharma ( <i>Alternate</i> )
Irrigation Department, Government of Maharashtra, Nasik	Superintending Engineer ( Gates ) Executive Engineer ( <i>Alternate</i> )
Irrigation Research Institute, Roorkee	Chief Engineer ( Design ) Superintending Engineer ( <i>Alternate</i> )
National Hydroelectric Power Corporation Ltd, Faridabad	Shri G. S. Sharma Shri A. K. Roy ( <i>Alternate</i> )
Orissa Construction Corporation Ltd, Bhubaneshwar	Director ( Mechanical ) Senior Manager ( Design ) ( <i>Alternate</i> )
Texmaco Ltd, Kolkatta	-Shri S. R. Sinha Shri Udayan Banerejee ( <i>Alternate</i> )
Triveni Structurals Ltd, Allahabad	Shri J. P. Mishra Shri B. P. Singh ( <i>Alternate</i> )
Tungabhadra Steel Products Ltd, Karnataka	Shri Hussain Bin Ali Shri Y. S. Chandrashekaraiah ( <i>Alternate</i> )
Water Resources Development Training Centre, Roorkee	Prof Gopal Chauhan
BIS Directorate General	Director and Head ( WRD ) [ Representing Director General ( <i>Ex-officio Member</i> ) ]
Member	Secretary
SHRIMATI R	OSY DHAWAN

#### **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.

#### Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

#### **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 Catalogue' and 'Standards : Monthly Additions'.

**Amendments Issued Since Publication** 

This Indian Standard has been developed from Doc : No WRD 12 (339).

Amend No.	Date of Issue	Text Affected
· · · · · · · · · · · · · · · · · · ·		
	······································	
		· · · · · · · · · · · · · · · · · · ·
	BUREAU OF INDIAN STANDARD	S
Headquarters:		
Manak Bhavan, 9 Bahadur Telephones : 2323 0131, 23	Shah Zafar Marg, New Delhi 110 002 23 3375, 2323 9402 <i>Website :</i> www.bis.org.in	
<b>Regional Offices :</b>		Telephones
Central : Manak Bhavan NEW DELHI 11	9 Bahadur Shah Zafar Marg 0 002	{23237617 23233841
Eastern : 1/14 C. I. T. Sch KOLKATA 700	eme VII M, V. I. P. Road, Kankurgachi 054	{23378499,23378561 23378626,23379120
Northern: SCO335-336, S	ector 34-A, CHANDIGARH 160 022	{260 3843 260 9285
Southern: C. I. T. Campus	IV Cross Road, CHENNAI 600 113	{2254 1216,2254 1442 2254 2519,2254 2315
Western : Manakalaya, E9 MUMBAI 400 0	9 MIDC, Marol, Andheri (East) 193	2832 9295, 2832 7858        2832 7891, 2832 7892
Branches : AHMEDABAJ FARIDABAD LUCKNOW. N VISAKHAPAJ	D. BANGALORE. BHOPAL. BHUBANE GHAZIABAD. GUWAHATI. HYDERAB AGPUR. NALAGARH. PATNA. PUNE. RAJKOT. NAM.	SHWAR. COIMBATORE. BAD. JAIPUR. KANPUR. THIRUVANANTHAPURAM.

#### Printed at New India Printing Press, Khurja, India