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मानक

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“The Right to Information, The Right to Live”

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Jawaharlal Nehru

“Step Out From the Old to the New”

IS 13349 (1992): Cast iron single faced thimble mounted sluice gates [CED 3: Sanitary Appliances and Water Fittings]



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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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IS 13349 : 1992  
Reaffirmed 2007

भारतीय मानक

ढलवां लोहे के फलक वाले थिम्बल आरोपित  
जलकपाट - विशिष्ट

*Indian Standard*

CAST IRON SINGLE FACED THIMBLE  
MOUNTED SLUICE GATES — SPECIFICATION

UDC 621.646.5 [669.13] : 628.146.5

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

April 1992

Price Group 6

**AMENDMENT NO. 1      JANUARY 1995**  
**TO**  
**IS 13349 : 1992 CAST IRON SINGLE FACED**  
**THIMBLE MOUNTED SLUICE**  
**GATES — SPECIFICATION**

( *Second cover page, Foreword, second para, fourth line* ) — Substitute '1 200' for '12'.

[ *Second cover page, Foreword, fourth para, (b), first line* ] — Delete the word 'gate' between 'back' and 'frame'.

( *Second cover page, Foreword, fifth para, fourth line* ) — Substitute 'used' for 'use'.

( *Second cover page, Foreword, eighth para, fourth line* ) — Substitute the words 'relating to' after the words 'the practices'.

( *Page 2, Table 3* ) — Substitute the following for the existing:

**Table 3 Materials**  
( *Clause 6.1* )

Sl No.	Item	Material	Conforming to IS	Grade/Designation
(1)	(2)	(3)	(4)	(5)
1.	Thimble, frame, guide, extension guide, slide (shutter), gear box, pedestal, stem guide, bracket, wedging devices, flush bottom seal support bgr	Cast Iron	210 : 1993	FG 200 or higher
2	Yoke ( Bridge )	Cast Iron Structural Steel	210 : 1993 2062 1992	FG 200 or higher Grade A
3	a) Wedges	Cast Iron Naval Brass Phosphor Bronze Leaded Tin Bronze Stainless Steel	210 . 1993 291 : 1989 28 1985 318 . 1981 3444 . 1987	FG 200 or higher Grade 1 or Grade 2 Grade 1 or Grade 2 LTB 1 or LTB 2 Grade 2
	b) Wedge facings	Naval Brass Phosphor Bronze	291 : 1989 7814 1985	Grade 1 or Grade 2 HB, Grade 2 or HB, Grade 3

**Price Group 1**

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**Table 3 Materials ( Continued )**

Sl No.	Item	Material	Conforming to IS	Grade/Designation
(1)	(2)	(3)	(4)	(5)
		Leaded Tin Bronze	318 : 1981	LTB 1 or LTB 2
		Stainless Steel	6911 : 1992	04Cr1Ni or 04Cr17Ni12Mo2Ti or 12Cr12 or 15Cr16Ni2
4	Operating nut and Guide Bush	Leaded Tin Bronze	318 : 1981	LTB 1 or LTB 2
5	Connecting block	Cast Iron	210 : 1993	FG 200 or higher
		Tin Bronze	306 : 1983	Sand Cast
		Leaded Tin Bronze	318 : 1981	LTB 1 or LTB 2
6	Seating faces	Naval Brass	291 : 1989	Grade 1 or Grade 2
		Phosphor Bronze	7814 : 1985	HB, Grade 2 or HB, Grade 3
		Tin Bronze	306 : 1983	Sand Cast
		Leaded Tin Bronze	318 : 1981	LTB 1 or LTB 1
		Stainless Steel	6911 : 1992	04Cr1, Nine or 04Cr17Ni12Mo2Ti or 12Cr12 or 15Cr16Ni2
7	Stem extension rod	Mild Steel	2062 : 1992	Grade A
		Stainless Steel	6603 : 1972	04Cr18Ni10 or 04Cr17Ni12Mo2Ti20 or 12Cr13 or 15Cr16Ni2
8	Flush bottom resilient seal	Natural or Synthetic Rubber	11855 : 1986	
9	Coupling	Cast Iron	210 : 1993	FG 200 or higher
		Mild Steel	2062 : 1992	Grade A
		Stainless Steel	6603 : 1972	04Cr18Ni10 or 04Cr17Ni12Mo2Ti20 or 12Cr13 or 15Cr16Ni2
10	Flush bottom seal retainer bar	Cast Iron	210 : 1993	FG 200 or higher
		Phosphor Bronze	7814 : 1985	HB, Grade 2 or HB, Grade 3
		Stainless Steel	6603 : 1972	04Cr18Ni10 or 04Cr17Ni12Mo2Ti20 or 12Cr13 or 15Cr16Ni2

**Table 3 Materials ( Concluded )**

Sl No.	Item	Material	Conforming to IS	Grade/Designation
(1)	(2)	(3)	(4)	(5)
11	Anchor bolts	Mild Steel	2062 . 1992	Grade A
		Stainless Steel	6603 . 1972	04Cr18Ni10 or 04Cr17Ni12Mo2Ti20 or 12Cr13 or 15Cr16Ni2
12	Fasteners like assembly bolts, studs, nuts, etc.			
	a) For wall thimbles	Stainless Steel	6603 1972	04Cr18Ni10 or 04Cr17Ni12Mo2Ti20
	b) For gate assembly, stem guides and lifting devices	Mild Steel	1363 (Part 1) 1992 and 1363 (Part 3) 1993 6603 1972	04Cr 18Ni10 or 04Cr17Ni12Mo2Ti20

**NOTES**

1 In case of brass, bronze or stainless steel used for various components, only the chemical composition as specified in the relevant Indian Standard shall be complied with

2 When copper zinc alloy comes in contact with water containing acid or alkali, zinc from the alloy dissolves leaving the alloy metal porous and weak. This loss of zinc from the copper zinc alloy results in type of corrosion called dezincification. Low zinc content may resist dezincification.

3 Use of stainless steel for the seating faces and wedges should be avoided wherever possible, because stainless steel machined surfaces rubbing against each other under high pressure have a tendency to gall which may result in severe damage to the sliding surfaces.

The use of brass should be avoided where dezincification can occur. Bronze having less than 2 percent aluminium and 5 percent zinc should be used where dezincification of bronze can occur. If dezincification of the bronze is a problem, slide gate seat facings and bronze castings should be phosphor or silicone bronze both of which meeting the low zinc requirement.

( Page 4, clause 7.5.2.4 ) — Delete.

( Page 4, clause 7.8.1, ninth line ) — Delete the word 'to'.

( Page 5, clause 7.11.3, first line ) -- Substitute the word 'furnished' for 'furnishes'.

( Page 5, clause 7.12.1, fourth line ) — Substitute the word 'hold' for 'held'.

( Page 5, clause 7.12.2, eleventh line ) — Substitute the word 'with' for 'be'.

( Page 5, clause 8.1, eighth line ) — Substitute the word ‘use’ for ‘used’.	30
( Page 5, clause 9.1, seventh line ) — Substitute the word ‘mechanism’ for ‘machanism’.	31
( Page 5, clause 9.2, fifth line ) — Substitute the word ‘bearing’ for ‘hearing’ and ‘enclosed’ for ‘erclosed’.	206
( Page 6, clause 9.3, tenth line ) — Substitute the words ‘on which’ for ‘or which’.	344
( Page 6, clause 9.3.2, second line ) — Substitute the word ‘manner’ for ‘marner’.	660
( Page 6, clause 9.4, third line ) — Substitute the word ‘crank’ for ‘crark’.	691
( Page 7, clause 12.1, second para, sixth line ) — Add the word ‘of’ between the words ‘warping’ and ‘the gate’.	781
( Page 7, clause 13.3.2, second line ) — Add the word ‘for’ between ‘leakage’ and ‘class 1’.	1122
( Page 8, clause A-1, third line ) — Substitute ‘data’ for ‘date’.	1185
( Page 8, clause A-1, Sl No. 12 ) — Add the word ‘Field’ before ‘Leakage’.	
( Page 8, clause A-1, Sl No. 14 ) — Substitute the following for the existing:	‘life’
‘14. Wedges : Whether the wedging devices should have cast iron, bronze or stainless steel wedges. If wedges are of cast iron, whether they should have cast iron contacting faces or should have brass or bronze or stainless steel facings.’	
( Page 9, Annex B ) — Substitute the following for the existing:	

## ‘ANNEX B

( Clause 2.1 )

### LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>
28 : 1985	Specification for phosphor bronze ingots and castings ( <i>second revision</i> )
210 : 1993	Specification for grey iron castings ( <i>fourth revision</i> )
291 : 1989	Specification for naval brass rods and sections ( suitable for machining and forging ) ( <i>second revision</i> )

( C



e' for	306	1983	Specification for tin bronze ingots and castings ( <i>third revision</i> )
necha-	318	: 1981	Specification for leaded tin bronze ingots and castings ( <i>second revision</i> )
earing'	2062	1992	Specification for steel for general structural purposes ( <i>fourth revision</i> )
which'	3444	· 1987	Specification for corrosion resistant high alloy steel and nickle base castings for general applications ( <i>second revision</i> )
anner'	6603	: 1972	Specification for stainless steel bars and flats
nk' for	6911	1992	Specification for stainless steel plate, sheet and strip ( <i>first revision</i> )
rd 'of'	7814	: 1985	Specification for phosphor bronze sheet and strip ( <i>first revision</i> )
etween	11228	· 1985	Recommendations for design of screw hoists
e'.	11855	: 1986	General requirements for rubber seals for hydraulic gates'
before	( <i>Page 9, clause C-3, second line</i> ) — Substitute the word 'lft' for 'life'.		
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( CED 3 )

## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Sanitary Appliances and Water Fittings Sectional Committee had been approved by the Civil Engineering Division Council.

Single faced cast iron sluice gates are extensively used in water supply and drainage works for controlling the flow. These are of two types one where the gate with spigot back frame is directly mounted on the wall and the other where mounting on the wall is through wall thimble. The first type is covered by IS 3042 : 1965 'Specification for single faced sluice gates ( 200 to 12 mm size )' ( *under revision* ).

This standard covers sluice gates of second type meant for mounting on the face of wall through a cast iron wall thimble an accessory which is first embedded in the wall and its front flange being flush with the face of wall. The gate frame having machined back flange is mounted on thimble flange, with a gasket in between the flanges, and is fastened to it with the help of studs.

Thimble mounted sluice gates have following advantages:

- a) It remains clear off the wall even after its installation and hence it can be easily removed from the face of wall whenever required either for repairs, maintenance or relocation.
- b) Mounting of flange back gate frame gate on wall thimble eliminates the necessity of using anchor bolts, and providing recesses in the wall.
- c) The construction makes the gate rigid and suitable for unseating head applications.
- d) Flange back construction makes it possible to test the gate at manufacturers works for its leakage performance making it possible to specify permissible leakage limits.

These gates are primarily meant for use in water supply and waste water applications such as water filtration and purification works, intake wells, pumping stations, drainage and irrigation canals, water and sewage treatment plants, flood control, thermal power stations and water cooling plants, etc, requiring flow control or shut off. These gates may also be use for industrial waste water and with other fluids provided the suitability of materials used for the seating faces, wedge facing, stem guide lining, stem nut, guide bush, resilient seat, etc, is first ascertained for their compatability with the end use.

The information to be supplied with enquiry and order by the purchaser is given in Annex A.

As sluice gate is a custom equipment it is not practical to specify single type of material, or method of construction of fabrication. Various possible alternatives vary with the site conditions and requirements of the users. Such alternatives are dealt with separately at appropriate places in this standard.

While formulating this standard an attempt has been made of making this standard in line with other internationally accepted standard available on the subject. Guidance has been taken from ANSI AWWA C-501-87 AWWA Standard for Cast Iron for Sluice Gates, issued by the American Water Works Association. At the same time relating to the practices in this field in the country have been kept in view.

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, shall be rounded off in accordance with IS 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

# CAST IRON SINGLE FACED THIMBLE MOUNTED SLUICE GATES — SPECIFICATION

### 1 SCOPE

**1.1** This standard covers single faced vertically sliding type cast iron sluice gates of nominal sizes from 300 to 2 500 mm, suitable for mounting on the flange of cast iron wall thimble. These sluice gates are meant for use for water supply and waste water application.

**1.1.1** These sluice gates are designed for either seating head or unseating head, or both.

**NOTE** — Gates designed for unseating head shall quality in all respects the requirements specified for seating head.

**1.2** Sluice Gates as per this standard in addition to manual may be adapted to electric hydraulic or pneumatic power operation. Requirements for actuating gear except in case of manual operation is left to the mutual agreement between the purchaser and the manufacturer.

**1.3** Sluice gates as per this standard may be of the conventional-closure or of flush-bottom closure type.

### 2 REFERENCES

**2.1** Indian Standards listed in Annex B are the necessary adjuncts to this standard.

### 3 CLASSIFICATION

**3.1** Based on maximum unbalanced (seating or unseating) water heads, sluice gates shall be classified as

- a) Class 1 — Suitable for maximum sluice gates unbalanced head up to and including 5 metres of water,
- b) Class 2 — Suitable for maximum sluice gates unbalanced head above 5 metres and up to and including 10 metres of water, and
- c) Class 3 — Suitable for maximum sluice gates unbalanced head above 10 metres and up to and including 15 metres of water.

### 4 SHAPES AND TYPES

#### 4.1 Shapes

**4.1.1** The opening of the sluice gates and the wall thimble may be either circular, square or rectangular.

**NOTE** — In case of circular openings a gate with square opening may be adopted provided that wall thimble has a circular opening to suit the water way opening and a square flange to suit the square flange of the gate frame.

#### 4.2 Types

**4.2.1** Sluice gates may be manufactured either with rising stem or non-rising stem (*see* Annex C).

**NOTE** — Non-rising stem type sluice gates are generally not recommended.

**4.2.2** Sluice gates may be either of conventional bottom closure or flush bottom closure (*see* Annex D).

**4.2.3** Sluice gates may be for either upward opening or downward opening.

**4.2.4** Sluice gates may have operating headstock either mounted on platform or directly mounted on yoke.

**NOTE** — Sluice gates with headstock mounted on the yoke of frame are called self-contained type.

### 5 NOMINAL SIZES

**5.1** Nominal sizes of square (or round) and rectangular sluice gates shall be as given in Table 1 and Table 2 respectively.

#### NOTES

**1** Nominal size of a sluice gate shall be reckoned by the clear opening of gate frame. In case of rectangular opening the size shall be specified as Width × Height of opening. The first of the two dimensions shall mean the width of opening.

**2** Sizes indicated in Table 1 and Table 2 are preferred sizes. Other sizes as agreed to between the manufacturers and purchasers are permissible.

**Table 1** Nominal Size of Square (or Round) Sluice Gates in mm

( Clause 5.1 )			
300	750	1 200	1 800
400	900	1 400	2 000
500	1 000	1 500	2 250
600	1 100	1 600	2 500

### 6 MATERIALS

**6.1** Materials used in the manufacture of various components of sluice gates shall conform to the Indian Standards given in Table 3.

**6.1.1** Components other than mentioned in Table 3 shall conform to the appropriate Indian standard, where one exists.

**Table 2 Nominal size of Rectangular Sluice Gates, in mm**  
( Clause 5.1 )

Width × Height	Width × Height	Width × Height
300 × 400	1 000 × 750	1 500 × 1 800
400 × 300	1 000 × 1 200	1 500 × 2 000
500 × 400	1 000 × 1 500	1 600 × 1 200
500 × 750	1 100 × 900	1 600 × 2 000
600 × 400	1 100 × 1 500	1 800 × 1 200
600 × 750	1 200 × 900	1 800 × 1 500
750 × 500	1 200 × 1 500	1 800 × 2 500
750 × 600	1 200 × 1 800	2 000 × 1 500
750 × 900	1 400 × 1 000	2 000 × 2 500
750 × 1 100	1 400 × 1 800	2 250 × 1 500
900 × 600	1 500 × 1 000	2 250 × 2 500
900 × 1 200	1 500 × 1 200	2 500 × 1 600
		2 500 × 2 000

## 7 GENERAL DESIGN AND CONSTRUCTION REQUIREMENTS

### 7.1 Frames

#### 7.1.1 Design

The frame shall be designed for maximum head indicated in 3.1 for the appropriate class with a minimum safety factor of five with regard to tensile, compressive and shear strengths.

#### 7.1.2 Construction

The frame shall surround the periphery of waterway opening and shall be of unit construction without any joint, cast in one piece.

The frame shall be machined on the rear face for bolting directly to the machined face of wall

**Table 3 Materials**  
( Clause 6.1 )

Sl No. (1)	Item (2)	Material (3)	Conforming to IS No. (4)
1.	Thimble, frame, guide, extension guide slide ( shutter ), gear box pedestal, stem guide, bracket, wedges, flush-bottom seal support bar	Cast Iron	210 : 1978
2.	Yoke ( Bridge )	Cast Iron Structural Steel	210 : 1978 226 : 1975
3.	Wedges, Wedge facings	Naval Brass Phosphor Bronze Leaded Tin Bronze Stainless Steel	291 : 1989 7814 : 1985 318 : 1981 6911 : 1972
4.	Operating nut and guide bush	Leaded Tin Bronze	318 : 1981
5.	Connecting block	Cast Iron Tin Bronze Leaded Tin Bronze	210 : 1978 306 : 1983 318 : 1981
6.	Seating faces	Naval Brass Phosphor Bronze Tin Bronze Leaded Tin Bronze Stainless Steel	291 : 1989 7814 : 1985 306 : 1983 318 : 1981 6911 : 1972
7.	Stem Extension Rod	Mild Steel Stainless Steel	226 : 1975 6603 : 1972
8.	Flush Bottom resilient seal	Natural or Synthetic Rubber	11855 : 1986
9.	Coupling	Cast Iron Mild Steel Stainless Steel	210 : 1978 226 : 1975 6603 : 1972
10.	Flush bottom seal retainer bar	Cast Iron Phosphor Bronze Stainless Steel	210 : 1978 7814 : 1985 6603 : 1972
11.	Anchor bolts	Mild Steel Stainless Steel	226 : 1975 6603 : 1972

#### NOTES

1 Minimum grade of cast iron used shall not be lower than FG 200.

2 In the case of brass, bronze or stainless steel used for various components, only the chemical composition, as specified in the relevant Indian Standard shall be complied with.

3 When copper zinc alloy comes in contact with water containing acid or alkali, zinc from the alloy dissolves leaving the alloy metal porous and weak. This loss of zinc from the copper zinc alloy results in a type of corrosion called dezincification. Low zinc content may resist dezincification.

The use of brass should be avoided where dezincification can occur. Bronze having less than 2 percent aluminium and 5 percent zinc should be used where dezincification of bronze can occur. If dezincification of the bronze is a problem, sluice gate seat facings and bronze castings should be phosphor or silicon bronze both of which meet the low zinc requirement.

4 Use of stainless steel for the seating faces and wedges should be avoided wherever possible, because stainless steel machined surfaces rubbing against each other under high pressure have a tendency to gall which may result in severe damage to the sliding surfaces.

thimble. All other surface forming joints or bearings shall be machined

## 7.2 Slide ( Shutter )

### 7.2.1 Design

The slide made of cast iron with strengthening ribs where required and a reinforced section at the edges to receive the seating faces shall be designed for the maximum head indicated in 3.1 for the appropriate class with a minimum safety factor of five with regard to tensile, compressive and shear strengths

### 7.2.2 Construction

The slide shall have tongues on each side extending the full length. The tongues shall be machined accurately on contact surfaces. Surfaces of the slide that come into contact with the seat facings and wedges shall be machined accurately. The maximum allowable clearance between the slide and the slide guides shall be 1.5 mm

### 7.2.3 Provision for Connecting Slide with Stem

The slide shall be provided with an integrally cast pocket above the horizontal centre line of the slide, reinforced by ribs, to house the connecting block in case of rising stem or an operating nut in case of non-rising stem. The operating nut pocket shall be drained

## 7.3 Seating Faces

### 7.3.1 Design

The seating faces made of strips of either naval brass or bronze or stainless steel depending upon the quality of fluid to be handled shall be secured firmly in machined grooves of either rectangular or dovetail cross section in the frame and slide faces in such a way that they will remain in place, free from distortion and loosening during the life of sluice gate

In case of class 1 duty gates the seating faces may be attached to the machined flat faces of frame and slide with the help of either brass rivet pins or counter sunk head machine screws of the same material

### 7.3.2 Clearance

The face shall be so finished that the maximum clearance between the seating surfaces, with the slide in the closed position, shall be 0.10 mm.

## 7.4 Seals for Flush Bottom Gates

### 7.4.1 General

Resilient seals for flush bottom gates shall be of natural or synthetic rubber. Reclaimed rubber shall not be used. Rubber seals shall be resistant to microbiological attack, copper

poisoning and ozone attack. Rubber compounds shall contain no more than 1.5 parts of wax per 100 parts of rubber hydrocarbon and shall be free of vegetable oils, vegetable oil derivatives, animal fats and animal oils

### 7.4.2 Design

The design of the seal shall be such as to provide for the minimum leakage requirements specified in 11.4 and 13.3.

### 7.4.3 Construction

The rubber seal shall be mounted on the slide or the frame and shall be held securely in place with a retainer bar bolted to the frame or slide leaving an unobstructed flush invert

## 7.5 Guides

### 7.5.1 Design

Guides made of cast iron shall be designed for the maximum head indicated ( see 3.1 ) with a safety factor of 5 for shear, compression and tension. They shall be capable of taking the entire thrust produced by water pressure and wedging action with a safety factor of 5. The guides shall be of such length that they extend above waterway opening atleast by  $( 0.5 \times H + 250 )$  mm, where 'H' is the height of waterway opening in millimetres

### 7.5.2 Construction

Guides may be either integrally cast with the frame or may be formed by bolting suitable guide strips or guide bars with grooves to the frame. Provision shall be made to prevent lateral movement of bolted on guides. Wedges or wedge facings shall be attached securely to the guides at points where, in the closed position, they will make full contact with wedging surfaces on the slide

**7.5.2.1** Guide extensions, that is portion of guides extending vertically upwards of the frame may either be integral with the frame casting or integral with the guide bars. Alternatively, guide extensions may be in split construction and may be bolted either to the top of frame or to the top of guide bars

**7.5.2.2** Split guide extensions shall be firmly secured at their joints with the help of dowel pins or slot and tennon arrangement to ensure proper alignment of guide grooves

**7.5.2.3** Guides including their extensions upwards of the frame shall be machined on all bearing and contact faces. Faces of extension guide coming in contact with the seating faces of the slide while opening the gate shall be fitted with seating faces of the same material as that on the slide. The maximum allowable clearance between the slide and the slide guide shall be 1.5 mm.

roller bearing of appropriate size. All gears and bearing shall be enclosed in a housing. Suitable provisions shall be made for lubrication

### **9.3 Lift Mechanism**

The lift mechanism shall be supplied with a pedestal machined and drilled to receive the gear housing and drilled for bolting to the operating floor. The height of the pedestal shall be sufficient to provide the horizontal handwheel in case of ungeared lifts or the horizontal axis of the driving shaft for crank in case of geared lifts at a convenient working height of approximately 500 mm from the base of the pedestal or the operating floor or which the operator has to stand. The pedestal shall be provided with a suitable covered window to enable easy cleaning and greasing of the stem threads

**9.3.1** Manual lifting mechanism to be mounted directly on the yoke of self contained gate may be provided with or without pedestal, as required

**9.3.2** The lift mechanism shall be designed in such a manner as to permit the gate operating under the operating head specified, with an effort not more than 70 Newton meter on lifting device after the sluice ( that is slide/shutter ) is unseated from its wedges

**9.3.3** Guidance as necessary may be obtained from IS 11228 : 1985 while designing the lift mechanism of a gate.

### **9.4 Handwheel/Crank**

The maximum handwheel diameter shall be 800 mm and the maximum crank radius shall be 400 mm. The crank shall be removable and fitted with a corrosion resistant sleeve type handle. The wheel or crank shall rotate either in horizontal or vertical plane.

### **9.5 Opening Direction**

The direction of wheel or crank rotation to open the gate shall be counter clockwise and shall be indicated on the lift mechanism

### **9.6 Stem Cover**

Each rising stem unit shall be provided with a suitable stem cover. The cover shall be made of a galvanized pipe

### **9.7 Gate Travel Indicator**

Gate travel indicator shall be provided to indicate the position of the gate

**NOTE** — All gates having width of opening equal to or greater than two times the height of opening shall be provided with two lifting devices connected by a tandem shaft for simultaneous operation.

### **9.8 Surface Preparation**

All exposed surfaces of the head stock mechanism shall have protective coating applied in accordance with 8

## **10 FABRICATION AND WORKMANSHIP**

**10.1** All parts of the sluice gate and accessories shall be machined accurately on mating and bearing surfaces. All like parts, except for the seating sealing surfaces, shall be interchangeable so that replacement parts can be furnished at any time and attached in the field with a minimum of fitting, chipping or remachining. All parts shall conform to designed dimensions and shall be free from defects of material and workmanship. All attaching bolt holes shall be drilled accurately to layout indicated on the drawings

**10.1.1** All castings shall be clean and sound without defects that could impair their function.

**10.1.2** The seating faces shall have smooth machined or hand scraped surface finish. All surfaces, such as guides-to-frame and frame-to-wall thimble shall be machined flat.

## **11 SHOP TESTING**

**11.1** All sluice gates shall be subjected to the tests specified in **11.2**, **11.3**, **11.4** and **11.5** for their conformity to the specified requirements

### **11.2 Seat Clearance Check**

Before final assembly, all seating and wedging surfaces shall be cleaned thoroughly of all foreign materials and final adjustments made. With the gate fully closed, the clearance between seating faces shall be checked with a 0.10 mm thick feeler gauge. If 0.1 mm thick feeler gauge can be inserted between seating sealing faces, then wedging devices must be readjusted or the gate slide or gate frame or both refinished until insertion is no longer possible.

### **11.3 Smooth Movement Test**

After completion, all seating and wedging surfaces shall be cleaned thoroughly of all foreign materials and final adjustments made. The sluice gate shall then be shop operated from the fully closed to the fully open position to verify that the assembly is workable

### **11.4 Shop Leakage Test by Applying Unseating Hydraulic Pressure**

A shop leakage test by applying the specified maximum unseating hydraulic head shall be conducted at the manufacturer's workshop. The test shall not show leakage in excess of 2.5, 3.5 and 4.5 litres per minute per meter of seating perimeter for class 1, class 2 and class 3 sluice gates respectively. For gates designed for seating head only an equivalent unseating head shall

be used. For this test clamps may be used in place of top and bottom wedges ( *see* 7.8.2 ).

### 11.5 Hydrostatic Test

**11.5.1** Hydrostatic test shall be carried out on the gate assembly at manufacturer's workshop as given in 11.5.2.

**11.5.2** Water pressure of 1.5 times the unbalanced specified maximum operating head shall be applied to the sluice gates in closed position for a period of 5 minutes. Under this test there shall be no leakage through the metal nor shall any part be permanently deformed.

## 12 INSTALLATION

### 12.1 General

The purchaser should follow the manufacturer's guidelines about the minimum clearance for installation, storing and handling for the gates under supply in addition to those covered in 12.2 to 12.5.

It shall be the purchaser's responsibility to handle, store and install the wall thimble, gate, operating mechanism, stem, stem guides and accessories in accordance with the manufacturer's drawings and recommendations. Care shall be taken to avoid warping the gate frame and to maintain tolerances between seating faces. All gates, thimbles, stems and operators shall be plumbed, shimmed and aligned accurately.

### 12.2 Hole Protection

Tapped holes in thimbles shall be plugged for protection during concrete pouring and setting.

### 12.3 Surface Protection

During erection, the surfaces of the thimble and gate shall be covered or otherwise protected from concrete spillage, paint, oil and debris. Any damage that occurs to the thimble or gate in storage or handling shall be set right prior to installation of the gate or testing and operation of the gate.

### 12.4 Thimble

Thimbles shall be positioned accurately and supported to prevent shifting during the pouring of the surrounding concrete. Thimbles shall be carefully braced both horizontally and vertically to prevent distortion. Concrete shall be poured carefully to provide a good bond to the thimble without voids. Grout shall be forced into the air vent holes.

### 12.5 Slide

After the entire assembly of manually operated gates has been installed, adjusted, and properly

lubricated, each slide shall be operated for one complete cycle, open-close-open or close-open-close.

## 13 INSPECTION, SHIPMENT AND FIELD TESTING

### 13.1 Inspection

All work performed under this standard shall be subject to inspection and approval by the purchaser or his agent who shall have access to all places of manufacture where materials are being produced or fabricated, or where tests are being conducted and shall be accorded full facilities for inspection and observation. All sluice gate or part that does not conform to the requirements of this standard shall be made satisfactory or shall be rejected and replaced.

### 13.2 Shipment

Sluice Gates shall be complete when shipped and the manufacturer shall use all due and customary care in preparing them for shipment to avoid damage in handling or in transit. Particular care shall be taken to see that the parts are completely closed and locked in position before shipment. Parts that are to be embedded in concrete may be shipped separately, if requested by the purchaser. Sluice Gates of 600 mm and larger shall be bolted securely or otherwise fastened to skids in such a manner that they may be safely handled.

### 13.3 Field Leakage Test

A field leakage test may be performed by the purchaser after installation of the sluice gate. The manufacturer shall be notified of the test in sufficient time to enable him to have his representative present at the test site. After all adjustments have been made and the mechanism properly lubricated, each gate slide shall be operated through one complete cycle as a final check on proper operation before starting the leakage test. Seating and unseating heads shall be measured from the top surface of the water to the centre of the gate.

#### 13.3.1 Seating Head

Under the maximum specified seating head, the leakage shall not exceed 1.25 lpm ( litres per minute ) per metre of seating perimeter.

#### 13.3.2 Unseating Head

Under the maximum specified unseating head, the leakage class 1, class 2 and class 3 sluice gates shall not exceed 2.5, 3.5 and 4.5 lpm ( litres per minute ) per meter of seating perimeter, respectively.

14 MARKING

14.1 Following information shall be embossed on the slide of each sluice gate:

- a) Indication of the source of manufacture,
- b) Size class and type of sluice gate,
- c) '+' for seating and '-' for unseating head, and

d) Year of manufacture.

14.2 Any additional marking required may be agreed to between the purchaser and the manufacturer.

14.3 Each sluice gate may also be marked with the Standard Mark.

ANNEX A  
( Foreword )

INFORMATION TO BE SUPPLIED WITH ENQUIRY AND ORDER

A-1 When placing orders for sluice gates to be manufactured according to this standard the purchaser should include the following date in his enquiry/order:

- 1 Number and title of this Indian Standard.
- 2 Shape of waterway; round, square or rectangular
- 3 Size: If rectangular, width × height
- 4 Design head from surface of water to centre line of gate, in metres.
  - a) Seating head,
  - b) Unseating head,
  - c) Both seating head and unseating head.
- 5 Operating head: from surface of water to centre line of gate, in metres
- 6 Distance between centre line of waterway to base of operating platform, in metres
- 7 Method of operation: Manual/electrical/hydraulic or pneumatic, if one or the other of the last three particulars of supplies, motive water/air pressures available.
- 8 Length and shape of wall thimble ( see 7.10.2 )
- 9 Rising stem or non-rising stem ( see Annex C ).
- 10 Type of closure: Conventional or Flush Bottom ( see Annex B ).
- 11 Type of fitment of sealing faces for class 1 duty gates:
  - a) On machined flat surface, or

b) in machined grooves.

- 12. Leakage test, whether required
- 13. Type of fluid to be handled: whether fresh or raw water or sewage, etc.
- 14. Wedges: Whether to be lined with brass, bronze or stainless steel on their mating tapered faces or to have cast iron contacting faces.
- 15. Acceptable materials:

NOTE — In the absence of any specific provision by the purchaser, any listed material shall be acceptable. It is recommended, however, that unless experience has shown that dezincification or dealuminization has not been a problem, the purchaser should prohibit the use of materials likely to be subject to dezincification or dealuminization.

- 16 Inspection by purchaser, if any.
- 17. Any special design and construction required for conditions beyond the scope of this standard, should be defined, including intended operation frequency and duration.
- 18. An installation requirement drawing should be furnished by the purchaser showing clearances, wall thickness, details of wall pipe and thimble installation, location of lift mechanism, that is, whether on yoke or on platform and whether the gate is to be upwards opening or down-wards opening
- 19. Number of units required for each similar size and type of gate.



## ANNEX B

( Clause 2.1 )

### LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
210 : 1978	Specification for grey iron castings ( <i>third revision</i> )	318 : 1981	Specification for leaded in bronze ingots and castings ( <i>second revision</i> )
226 : 1975	Specification for structural steel ( standard quality ) ( <i>fifth revision</i> )	6603 : 1972	Specification for stainless steel bars and flats
291 : 1989	Specification for naval brass rods and sections ( suitable for machining and forging ) ( <i>second revision</i> )	6911 : 1972	Specification for stainless steel plate, sheet and strip
		7814 : 1985	Specification for phosphor bronze sheet and strip ( <i>first revision</i> )
306 : 1983	Specification for tin bronze ingots and castings ( <i>third revision</i> )	11228 : 1985	Recommendations for design of screw hoists
		11855 : 1986	General requirements for rubber seals for hydraulic gates

## ANNEX C

( Clauses 4.2.1 and A-1 (9) )

### RISING OR NON-RISING STEM GATES

**C-1** Rising stem gates have non-rotating stems and rotating lift-nuts. The lift nut is housed in lift mechanism which remains safely above gate well water level.

**C-2** Non-rising stem gates have rotating stems and non-rotating lift nuts. The lift nut is housed in a pocket provided at the top of slide.

**C-3** The big disadvantage of the non-rising stem gates is that the threaded operating life nut and stem remain in the exposed position in the gate well and hence the threads remain exposed to damage and corrosion. Further, since the

threaded part of the stem remains normally submerged it is impossible to regularly clean and lubricate it. Any debris or rubbish jamming in the threads create wear of the stem and the operating nut and make the gate very difficult to operate. Operating problems with such gates increase with the gate size.

**C-4** Wherever possible the use of non-rising stem gates should be avoided. Such gates should be used only in those locations where there is limited head room or where the rising stem is likely to interfere with some other part of the installation over the top of operating headstocks or lift mechanisms.

## ANNEX D

( Clauses 4.2.2 and A-1 (10) )

### TYPE OF BOTTOM CLOSURE

#### **D-1 CONVENTIONAL OR FLUSH BOTTOM**

**D-1.1** The conventional closure involves two corrosion resistant seating faces mating against each other, when the gate is fully closed. One such face is provided across the bottom of the slide and the other corresponding horizontal face is provided across the bottom of the frame. The bottom edge of the slide has to travel beyond the invert of the gate to cause this type of closure to be made. Hence gates with conventional bottom closure are recommended for only those installations, where there is an ample

vertical clearance between the bottom of the opening, that is, invert of the gate and the invert of the chamber or channel structure.

**D-1.2** If the gate with conventional closure is installed at a situation, where the bottom of the gate opening is to be at the same elevation as the invert of the chamber or channel structure, then a recess or a cut-out is formed at the invert, where debris, silt and foreign material may collect. These interfere with the proper closing of gate. Gates with flush bottom closure avoid such recess or cut out at the invert and hence

such gates are recommended for such situations where the bottom of the gate opening, as well as the chamber or channel floor are to be at the same elevation or level.

In case of flush-bottom closure, the bottom corrosion resistant seating face is omitted from the slide as well as the frame. A resilient rubber seating face is substituted either along the bottom of slide or along the bottom of the frame. If the rubber seating face is provided along the bottom of slide, it closes against a machined cast iron bar fitted at the bottom of frame with its machined face flush with the gate invert. If the rubber seating face is provided along the bottom of frame, top of the rubber seal is kept flush with gate invert. In this case the slide closes against the resilient rubber seal in the invert.

**D-1.3** Gates with flush bottom closure are also recommended when complete flushing of the

chamber is needed or when the deflection of the bottom edge of the slide under high seating pressure, in case of wider gate, is likely to create problems of interference between the seat facings on the frame and the slide at the time of closing the gate.

**D-1.4** Flush-Bottom Sluice Gates are installed in the same manner as conventional gates. A recess or cut-out is provided in the floor along the width of waterway opening for accommodating the bottom member of frame. After putting the gate in position, the recess can be filled with asphalt surfacing material or concrete containing saw dust. The recess should be filled level with the floor of the chamber and the invert of the gate.

Purchasers should consult the manufacturer regarding the dimensions of the recess or cut out to be provided in the floor.

## ANNEX E ( Clause 7.11.1.3 )

### FORCE REQUIRED TO ACTIVATE SLUICE GATE

**E-1** The maximum force required to activate a sluice gate occurs during the unseating and raising the weight of the slide. In the closing, or normally the downward motion of the gate, the weight of the stem and slide acts in the direction of motion and reduces the force required.

**E-2** The force required to activate the slide is, in part empirically determined. The weight of the slide and stem, the head of water on the gate at the centre line of the opening, and the friction of the slide against the seats and wedges are required to calculate the force to open the gate. These factors are normally presented in the following manner

$$F = 10\,000 \times f \times A \times H + 1.5 \times P_1 + P_2 \quad \text{Eq (1)}$$

where

$F$  = Total maximum force required to open slide, in Newtons;

$f$  = Friction factor of slide against seat;

$A$  = Area of gate opening, in square metres,

$H$  = Head of water at gate centre line, in metres,

$P_1$  = Weight of slide, in Newtons, and

$P_2$  = Weight of stem, in Newtons.

The friction factor ' $f$ ' between the slide and the seats may be taken as 0.35. The weight of the stem and slide should be obtained from the manufacturer of the gate. It has not been general practice to reduce the weight of the slide or stem because of the buoyant effect of the water. The force required to overcome the frictional effect of the wedges is accounted for by empirically assigning one half the weight of the slide. The force, thus determined, is associated with 200 Newtons effort on the activator. Once released from the wedges the force in Newtons becomes:

$$F = 10\,000 \times f \times A \times H + P_1 + P_2 \quad \text{Eq (2)}$$

The force determined by Eq 2 will be less than the unseating force and is the force required for sustained effort on the activator.

**ANNEX F**  
( Clause 7.11.1.4 )

**RECOMMENDED NOMINAL DIAMETER OF STEEL STEMS**

Table 4 ( Concluded )

Sl No	Gate Size in mm		Stem Diameters in mm for Gate of		
	Width × Height		Class 1	Class 2	Class 3
	(1)	(2)	(4)	(5)	(6)
11	750	× 500	30	30	30
12	750	× 600	30	30	30
13	750	× 750	35	35	35
14	750	× 900	40	40	40
15	750	× 1 100	40	40	40
16	900	× 600	30	30	35
17	900	× 900	40	40	40
18	900	× 1 200	45	45	45
19	1 000	× 750	35	35	40
20	1 000	× 1 000	40	40	45
21	1 000	× 1 200	45	45	45
22	1 000	× 1 500	50	50	50
23	1 100	× 900	40	40	45
24	1 100	× 1 100	40	40	45
25	1 100	× 1 500	50	50	50
26	1 200	× 900	40	40	45
27	1 200	× 1 200	45	45	45
28	1 200	× 1 500	50	50	50
29	1 200	× 1 800	55	55	55
30	1 400	× 1 000	40	40	45
31	1 400	× 1 400	45	45	50
32	1 400	× 1 800	55	55	55
33	1 500	× 1 000	40	40	45
34	1 500	× 1 200	45	45	50
35	1 500	× 1 500	50	50	55
36	1 500	× 1 800	55	55	60
37	1 500	× 2 000	60	60	65
38	1 600	× 1 200	45	45	50
39	1 600	× 1 600	50	50	55
40	1 600	× 2 000	60	60	70
41	1 800	× 1 200	45	45	55
42	1 800	× 1 500	50	50	60
43	1 800	× 1 800	55	60	70
44	1 800	× 2 500	70	70	80
45	2 000	× 1 500	50	50	65
46	2 000	× 2 000	60	65	75
47	2 000	× 2 500	70	70	85
48	2 250	× 1 500	60	65	75
49	2 250	× 2 250	65	70	85
50	2 250	× 2 500	70	70	85
51	2 500	× 1 600	60	65	75
52	2 500	× 2 000	65	70	85
53	2 500	× 2 500	70	75	90

  

Sl No	Gate Size in mm		Stem Diameters in mm for Gates of		
	Width × Height		Class 1	Class 2	Class 3
	(1)	(2)	(4)	(5)	(6)
1.	300	× 300	30	30	30
2	300	× 400	30	30	30
3	400	× 300	30	30	30
4	400	× 400	30	30	30
5	500	× 400	30	30	30
6	500	× 500	30	30	30
7	500	× 750	30	30	30
8	600	× 400	30	30	30
9	600	× 600	30	30	30
10	600	× 750	35	35	35

**F-1** Nominal diameters of mild steel or stainless stems recommended for various sizes and three classes of gates calculated on the basis of Euler's Column Formula ( see 7.11.1 ) and assuming maximum slenderness ratio of 200 ( see 7.12.2 ), are given in Table 4

**F-2** Threads on the stem are assumed to be single start square threads with pitches considered as under

Stem Dia mm	Pitch mm
30 to 45	6
50 to 75	10
80 to 90	12

**F-3** Stem diameters as mentioned in Table 4 are checked for interference free travel of stem coupling, if any, between the stem guides

**F-4** Diameters stated in Table 4 are recommended for guidance. The diameter of stem to be finally decided for a particular gate should be checked for being safe in critical buckling as per 7.11.1 for the output of the operating/lift mechanism ( operating headstock ) to be adopted by the manufacturer

**Table 4 Recommended Nominal Diameters of Mild Steel or Stainless Steel Stems for Various Classes of Gates**

**Standard Mark**

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