

CLIENT Bangalore Water Supply and Sewerage Board	CONTRACTOR: Larsen & Toubro Limited	CONSULTANT: ONTB Project Management Consultants
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PROJECT

Bengaluru Water Supply and Sewerage Project (Phase 3) – City Trunk Main Along Eastern Route CP-09 under JICA loan Id P266

Doc No: QAP No: 03.QAP .3104 Rev: 04 Date: 03.12.2020
QAP No: 01.QAP.3106 Rev: 03 Date: 03.12.2020
QAP No: 02 QAP.3107 Rev: 02 Date: 03.12.2020

Doc Name: QAP and GAD for Butterfly valve, Air Valve and Sluice/Scour Valve-VAG Make
DRAFTING /DOCUMENT REVIEW STATUS

Date of Receipt:

- A. Approved, manufacture /construction may commence
- B. Acceptable subject to changes indicated. Resubmit for approval but manufacture / construction may commence.
- C. Amend as per the comments indicated and resubmit for approval.
- D. Comments noted in letter /memo attached to forwarding transmittal No.....
- E. Amend as comments indicated resubmit for record
- F. Comments noted in letter /memo attached to forwarding transmit No.
Dated..... amend as comments indicated resubmit for record.
- G. Drawing of this category is for information and hence not required to be approved.
- H. Returned without review.

Approval of drawing / document does not absolve contractor /vendor from any responsibilities for their accuracy or for the design performance and safety of the plant / works or any other obligations under the contract and Indian statutory laws nor does it limit the Employer's rights under the contract.

For ONTB

Verified by Date..... 07/12/2020



For BWSSB

Checked by Date..... 09/12/2020

Reviewed by Date..... 09/12/2020

Total Pages:.....

Approved by
Chief Engineer(K) Date





Quality Assurance Plan

Project : CP-09

Contractor : Larsen & Toubro Limited

Client : Bangalore Water Supply & Sewage Board

VAG Valves (India) Pvt Ltd,
Plot No.57 & S6, Phase- III,
TSIIC Pashamylaram,
Pattancheru, Medak Dist 502307
Telangana

Item: EKN Butterfly Valve. (Body and Disc of GGG-40)									QAP No: 03.QAP.3104
Manufacturer Name: Vag Valves India Pvt Ltd.									Rev No: 04
Size	DN800	DN1000	DN1600	DN1300	DN2200				Date: 03.12.2020
PN in bar	PN16	PN16	PN16	PN16	PN16				

Inspection Conditions:

After completion of 100% Internal testing, Valves will be offered for TPI/Client Inspection.
TPI/Client can select 100% of the total lot of each valve size for witness purpose.

S.No	Examination / Process	Test Procedure/ Standard	M	L&T	TPI/Client
1	Tests to be Conducted on Final Assembled Valve.				
1.1	Strength test of the body with water (1.5 X nominal pressure).	IS 13095:1991	W	W	W
1.2	Leakage test from inside to outside with water (1.5 X nominal Pressure) for Assembled Parts.	IS 13095:1991	W	W	W
1.3	Leakage test on the seat in both sides (1.1 X nominal pressure).	IS 13095:1991	W	W	W
1.4	Functional Test of the Valve without pressure. (Fully open to close & vice-versa).	IS 13095:1991	W	W	W
2	Final Inspection				
2.1	Inspection of the main- and Installation Dimensions & Visual Inspection	As Per Approved Drawing	W	W (Visual 100%)	W
2.2	Material certificate for following components: Body & Disc- Mechanical Properties. Shaft-Mechanical & Chemical Properties. Seal Ring of EPDM -WRAS Mechanical Properties,	As Per Approved Drawing	W	R	R
2.3	Visual Inspection, color shade of the coating - DFT Measurement: Coating thickness reports. (Internal and External With Epoxy Powder Coating)	As Per Approved Drawing / DFT >250μ	W	W	W
2.4	Inspection of the valve marking	EN 13095 / Approved Drawings	W	W	W
2.5	Inspection of Cleanliness before Shipment.		W	N.A	X
2.6	Packing inspection.		W	N.A	X
2.7	Preparation of documentation.		W	N.A	X

M= Manufacturer ; TPI= Third party Inspection; D= Document/Report; W- Witness; R=Review

N.A= Not Applicable.

Note: Wherever applicable, Gear Box TC & Actuator TC to be submitted for review.

Prepared By:	Department	Approved By:	Department	Sign & Seal
P. Shubhasis	Quality Control	G. Satyanarayana	Quality Control	Date 03.12.2020



(03-12-2020)
P. Shubhasis

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BSI:14

A A A S.No. Description Material

01	Body	Ductile Iron. (GGG-40)
2.1	Disc	Ductile Iron. (GGG-40)
2.2	Retaining Ring	Stainless Steel (ASTM A240 Type 304)
2.3	Profile Seal Ring	EPDM Rubber (Food Grade)
2.4	Body Seat	Ni-Cr Weld Overlay, Micro-Finished
Q3	Shaft	Stainless Steel (ASTM A276 Gr. 420)
04	Bearing Bush	Bronze (CuSn12-C)
05	Gear box	Emerson
-	Internal Fasteners	Stainless Steel AISI316
-	Gear box housing	Cast Iron IS: 210 FG200
-	Handwheel	MS Fabricated/CS

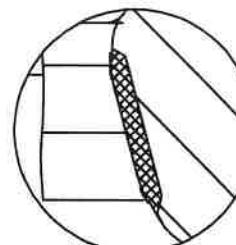
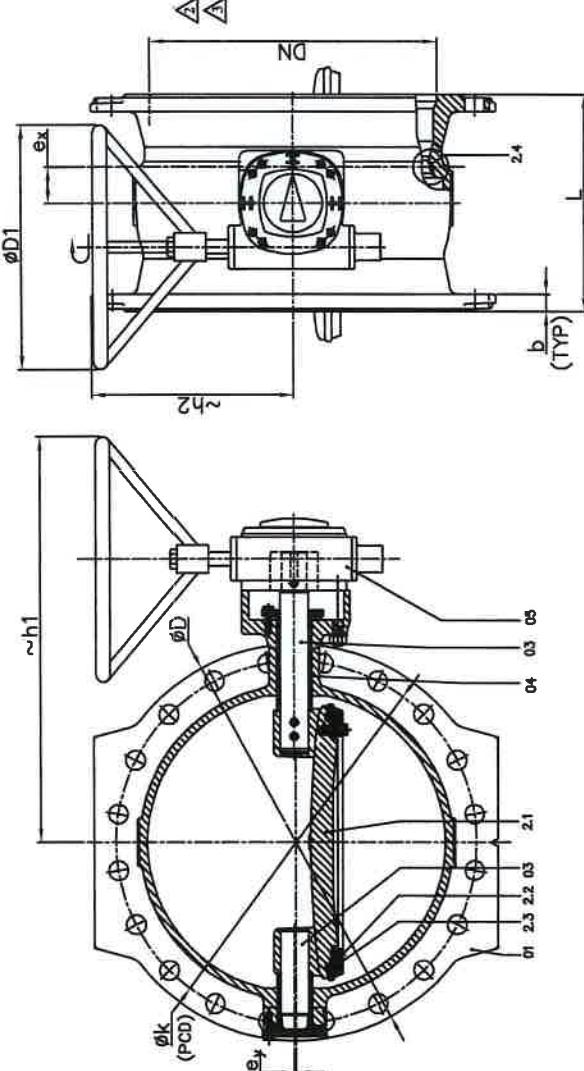
Note:-

- All dimensions are in mm.
- Valve is Epoxy Coated in Blue color, RAL 5005 Both inside & outside with minimum 250 Microns Thick.
- Governing Std. : EN 593.
- Face to Face Dimension as per. : IS 13095.
- Flange Drilling as per. : IS 9523.
- Hydro Testing as per. : IS 13095.
- Body test pressure: 1.5 times to rated pressure for 5 minutes.
- Seat test pressure : 1.1 times to rated pressure for 2 minutes.
- Application. : Water.
- For flange hole diameter (Ød), tolerance will measure ± 1.5 mm due to the coating but it will be suitable for bolt insertion.
- Gear box Model: DN800: AT-150; DN1000: AT-300.
- Dimension with '-' symbol may vary ± 50 mm.
- Weight of the valve- DN800: -880 Kg; DN1000: -1500 Kg
- No. of turn required to close/open the valve-DN800: 113; DN1000: 226
- Type of Flange: Raised face.

CUSTOMER APPROVAL

F G H

Client :	Bangalore Water Supply & Sewage Board												
Contractor :	Larsen & Toubro Limited												
Project :	CP-09												
VAG		Title: G.A. Drawing Of EKN Butterfly Valve with Gear Box											
VAG-Valves (India) Pvt. Ltd. Hyderabad, Telangana.		Name: Sign Date Scale NTS GVS BNR GVS BNR 07-10-20 Projection											
Seat		Name: Sign Date Scale NTS GVS BNR GVS BNR 07-10-20 Projection											
A A A		Name: Sign Date Scale NTS GVS BNR GVS BNR 07-10-20 Projection											
DN	PN	L± $\frac{1}{2}$	D± $\frac{1}{2}$	No. of Holes	d	b± $\frac{1}{2}$	~h1	~h2	ØD1	03 Details Updated 03-12-20	GVS BNR Drawn		
H 800	16	470	1025	950	24	41	43	1159	512	02 Details Updated 05-11-20	GVS BNR Checked		
1000	16	550	1255	1170	28	44	50	1440	627	01 Details Updated 26-10-20	GVS BNR Approved		
									750	Rev. No.	Drg. No. 03-800-16-4568	A3 Rev. 03	
										6	5	1	
										6	7	12	
										8	9	11	
										10			



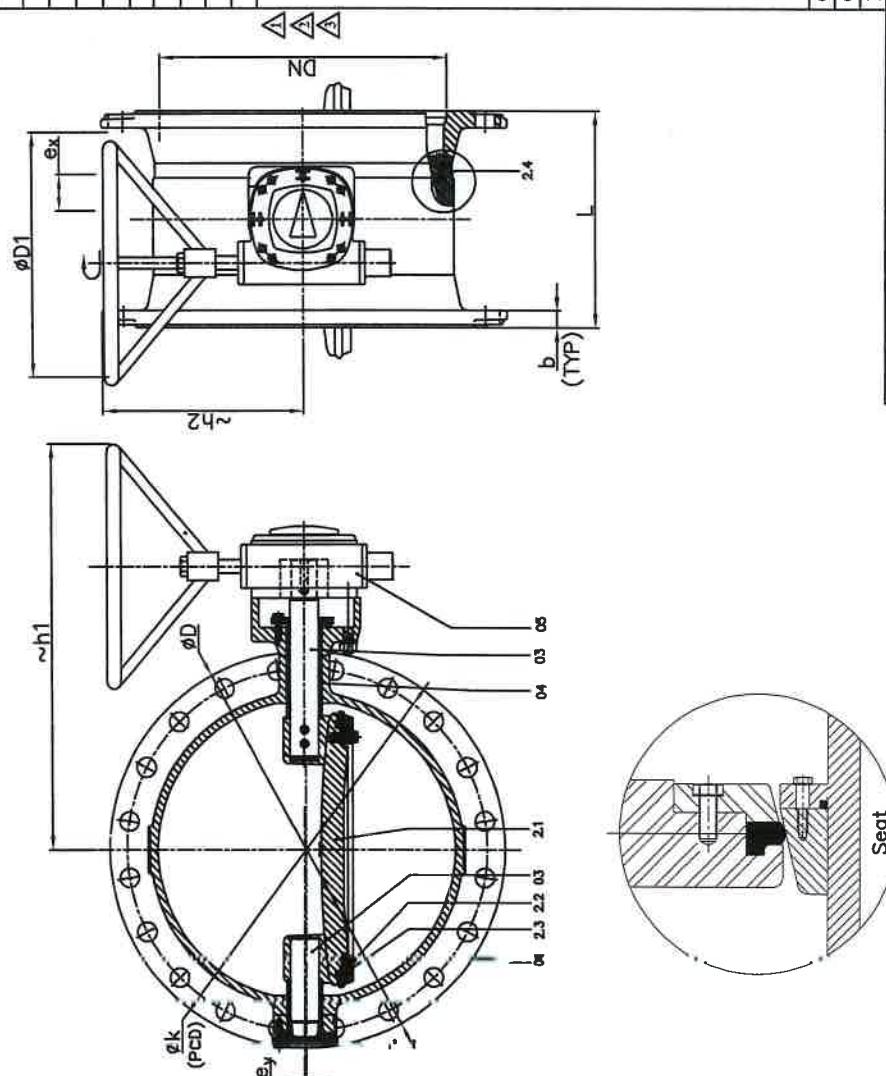
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Note:-

1. All dimensions are in mm.
 2. all external surfaces of valve shall be painted with food grade epoxy enamel blue RAL 5005, min. DFT>250.
 3. Face to Face Dimension as per : IS 13095.
 4. Flange Drilling as per : EN 1092.
 5. Hydro Testing as per : IS 13095.
 Body test pressure: 1.5 times to rated pressure for 5 minutes.
 Seat test pressure : 1.1 times to rated pressure for 2 minutes.
 6. Application. : Water.
 7. For flange hole diameter (ϕD), tolerance will measure ± 1.5 mm due to the coating but it will be suitable for bolt insertion.
 8. Gear box Model: AT 750.
 9. Dimension with \sim symbol may vary ± 1.5 mm.
 10. Weight of the valve: ~3000 Kg
 11. No. of turn required to close/open the valve-DN1300: 447
 12. Type of Flange: Raised face.

CUSTOMER APPROVAL

Client :	Bangalore Water Supply & Sewage Board		
Contractor :	Larsen & Toubro Limited		
Project :	CP-09		
VAG			
VAG-Valves (India) Pvt. Ltd. Hyderabad, Telangana.			
G.A. Drawing Of Butterfly Valve with Gear Box			
Drg. No.	03-1300-16-4575		
Rev.	03		



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A

S.No.	Description	Material
01	Body	Ductile Iron. (GGG-40)
2.1	Disc	Ductile Iron. (GGG-40)
2.2	Retaining Ring	Stainless Steel (ASTM A240 Type 304)
2.3	Profile Seal Ring	EPDM Rubber (Food Grade)
2.4	Body Seat	Ni-Or. Weld Overlay. Micro-Finished
03	Shaft	Stainless Steel (ASTM A276 Gr. 420)
04	Bearing Bush	Bronze (CuSn12-C)
05	Gear box	Emerson
-	Internal Fasteners	Stainless Steel AISI316
-	Gear box housing	Cast Iron IS: 210 FG200
-	Handwheel	MS Fabricated/C/S

B

C

D

E

F

G

H

Note:-

- All dimensions are in mm.
- Valve is Epoxy Coated in Blue color, RAL 5005 Both inside & outside with minimum 150 microns.
- Governing Std. : EN 593.
- Face to Face Dimension as per. : IS 13095.
- Flange Drilling as per. : EN 1092.
- Hydro Testing as per. : IS 1395.
- Body test pressure: 1.5 times to rated pressure for 5 minutes.
- Seat test pressure : 1.1 times to rated pressure for 2 minutes.
- Application. : Water.
- For flange hole diameter "Ød1" tolerance will measure ± 1.5 mm due to the coating but it will be suitable for bolt insertion.
- Gear box Model: DN1600: AT1000; DN2200: AT2500.
- Dimension with ' \sim ' symbol may vary ± 50 mm.
- Weight of the valve- DN1600: ~5080 Kg; DN2200: ~14000 Kg.
- No. of turn required to close/open the valve-DN1600: 656; DN2200: 1860
- Type of Flange: Raised face.

CUSTOMER APPROVAL

Client :	Bangalore Water Supply & Sewage Board
Contractor :	Larsen & Toubro Limited
Project :	CP-09

VAG

VAG-Valves (India) Pvt. Ltd.
Hyderabad, Telangana.

Seat

**G.A. Drawing Of
EKN Butterfly Valve
with Gear Box**

DN	PN	L \pm g	D \pm g	K	No.of Holes	d	b \pm g	~h1	~h2	ØD1	03 Details Updated	03-12-20 GVS Drawn	BNR	GVS	Date	Scale	NTS	Projection
1600	16	790	1930	1820	40	57	70	1884	965	750	02 Details Updated	03-11-20 GVS Checked	BNR	BNR	07-10-20			H
2200	16	1030	2550	2440	52	62	85	2703	1323	900	01 Details Updated	26-10-20 GVS Approved	BNR	BNR	07-10-20			

Drg. No. 03-1300-16-4569

A3 Rev. 03



VAG Valves (India) Pvt Ltd,
Plot No.57 & 56, Phase- III,
TSIIC Pashamylaram,
Pattancheru, Medak Dist 502307
Telangana

Quality Assurance Plan

Project : CP-09

Contractor : Larsen & Toubro Limited

Client : Bangalore Water Supply & Sewage Board

Item: EKO-Plus Resilient Seated Gate /Sluice Valve/Scour Valve- (Body and Bonnet of GGG-40)								QAP No: 01.QAP.3106
Manufacturer Name: Vag Valves India Pvt Ltd.								Rev No: 03 Date: 03.12.2020
Size	DN200	DN300	DN400	DN150	DN250	DN100	DN80	
PN in bar	PN16	PN16	PN16	PN16	PN16	PN16	PN16	
Inspection Conditions: 100% of the total lot of each valve size/type will be offered for inspection after completion of 100% Internal testing. L&T/TPI/Client has to select 100% for DN400 & 30% for rest of the sizes from the total lot of each valve Size/type randomly.								
S.No	Examination / Process				Test Procedure/ Standard	M	L&T	TPI/Client
1	Tests to be Conducted on Final Assembled Valve.							
1.1	Strength test of the body with water (1.5 X nominal pressure).				IS 14846:2000	W	RW	RW
1.2	Leakage test from inside to outside with water (1.5 X nominal Pressure) for Assembled Parts.				IS 14846:2000	W	RW	RW
1.3	Leakage test on the seat in both sides (1.1 X nominal pressure).				IS 14846:2000	W	RW	RW
1.4	Functional Test of the Valve without pressure.				Smooth Operation	W	RW	RW
2	Final Inspection							
2.1	Inspection of the main- and Installation Dimensions & Visual Inspection				As Per Approved Drawing	W	W Visual-100%	W
2.2	Material certificate for following components: Body, Bonnet & Wedge Core - Mechanical & Chemical Properties. Stem- Chemical Properties & Mechanical Properties, Lining-EPDM -WRAS Mechanical Properties,				As Per Approved Drawing	W	R	R
2.3	Visual Inspection, color shade of the coating - DFT Measurement: Coating thickness reports. (Internal and External With Epoxy Powder Coating)				As Per Approved Drawing / DFT >250	W	W	W
2.4	Inspection of the valve marking				IS 14846:2000	W	W	W
2.5	Inspection of Cleanliness before Shipment.					W	N.A	X
2.6	Packing inspection.					W	N.A	X
2.7	Preparation of documentation.					W	N.A	X

Note:

M= Manufacturer ; TPI= Third party Inspection; D= Document/Report; W- Witness; R=Review; RW-Random Witness
N.A= Not Applicable. Note: Wherever applicable, Gear Box TC & Actuator TC to be submitted for review.

Prepared By:	Department	Approved By:	QC	Department	Sign & Seal
P.Shubhasis	Quality Control	G.Satyanarayana		Quality Control	Date 03.12.2020

(03-12-2020)



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Note:-

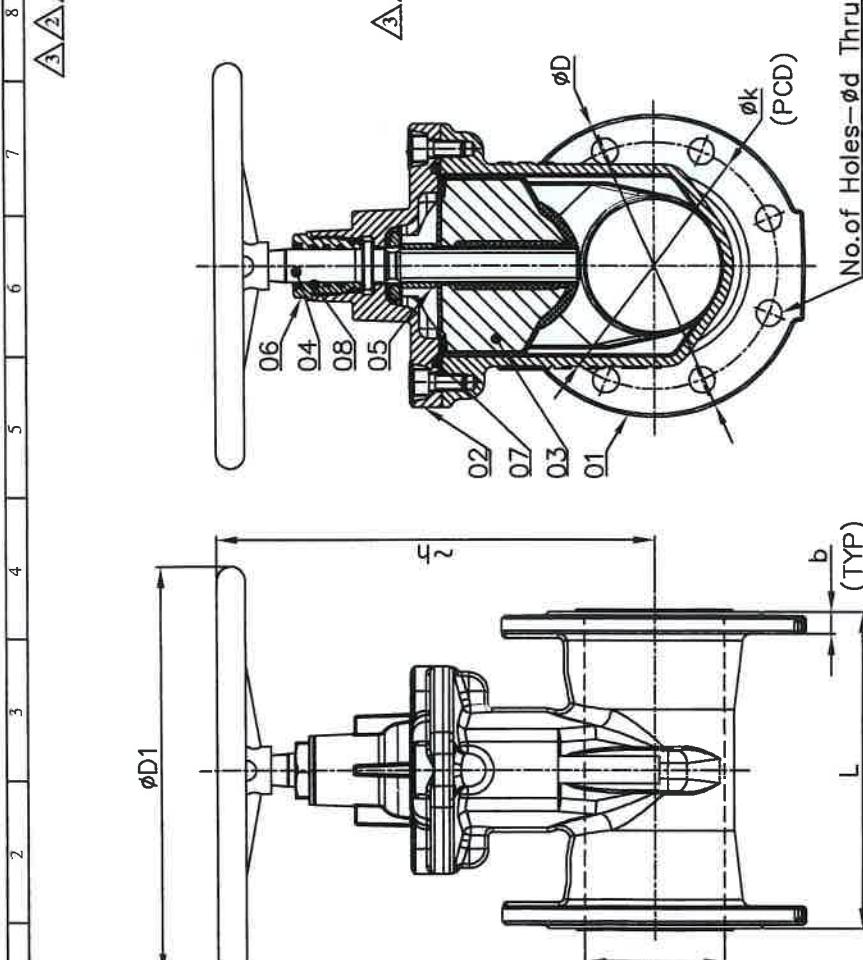
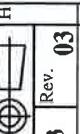
- All dimensions are in mm.
2. Valve is Epoxy Coated in Blue color, RAL 5005 Both inside & outside with minimum 250 Microns Thick.
3. Face to Face Dimension as per. : IS 14846.
5. Flange Drilling as per. : IS 14846.
6. Hydro Testing As per. : IS 14846.
- Body test pressure: 1.5 times to rated pressure for 5 minutes.
- Seat test pressure: 1.1 times to rated pressure for 2 minutes.
7. Application. : Water.
8. For flange hole diameter (φd), tolerance will measure ±1.5 mm due to the coating but it will be suitable for bolt insertion.
9. Weight of the valve- DN80: -15 Kg; DN100: -20 Kg; DN150: 35 Kg
10. Dimension with '-' symbol may vary ±15mm.
11. Type: Non-Rising spindle.
12. No. of turn required to close/open the valve-DN80: 20.5; DN100: 20.5; DN150: 30.5
13. Type of Flange: Raised face.

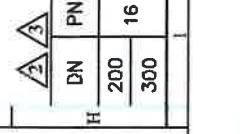
CUSTOMER APPROVAL

Client :	Bangalore Water Supply & Sewage Board																			
Contractor :	Larsen & Toubro Limited																			
Project :	CP-09																			
VAG																				
VAG-Valves (India) Pvt. Ltd Hyderabad, Telangana.																				
Title: G.A. Drawing Of EKOpus Gate Valve																				
G	H																			
DN	PN	L±4	D±2	k	No.of Holes	d	b±2	~h	φD1	03	Details Updated	03-12-20	GVS	BNR	Drawn	Name	Sign	Date	Scale	NTS
H 080	203	200	160	08	19	285	250	02	03	Details Updated	05-11-20	GVS	BNR	Checked	BNR	GVS	07-10-20	Projection	H	
100	16	229	220	180	08	19	315	300	01	Details Updated	26-10-20	GVS	BNR	Approved	BNR	BNR	07-10-20			
150	267	285	240	08	23	395	300	00	Rev. No.	Description	Date	Drawn	CKD	Drg. No.	01-080-16-4574	A3	Rev. 03			
1	2	3	4	5	6	7	8	9	10	11	12									

3 3 3

188-FCI

S.No.												Description		Material		
A	01	Body	Ductile Iron. (GGG-40)													
	02	Bonnet	Ductile Iron. (GGG-40)													
	03	Wedge	Ductile Iron. (GGG-40) with EPDM Lining (Food Grade)													
	04	Stem	Stainless Steel (ASTM A276 Gr.420)													
B	05	Stem Nut	Brass (CuZn40Pb2)													
	06	Stem Bearing	Brass (CuZn40Pb2)													
	07	Seal Ring	EPDM (Food Grade)													
	08	O-Ring	NBR													
	-	Internal Fasteners	Stainless Steel AISI316													
	-	Handwheel	MS Fabricated													
C	Note:-															
	1. All dimensions are in mm. 2. Valve is Epoxy Coated in Blue color, RAL 5005 Both inside & outside with minimum 250 Microns Thick. 3. Face to Face Dimension as per. : IS 14846. 4. Flange Drilling as per. : IS 923. 5. Hydro Testing As per. : IS 14846. Body test pressure: 1.5 times to rated pressure for 5 minutes. Seat test pressure : 1.1 times to rated pressure for 2 minutes. 6. Application. : Water. 7. For flange hole diameter ($\varnothing D$), tolerance will measure ± 1.5 mm due to the coating but it will be suitable for bolt insertion. 8. Weight of the valve- DN200: ~57 Kg; DN300: ~125 Kg. 9. Dimension with \sim symbol may vary ± 1.5 mm. 10. Type: Non-Rising spindle. 11. No. of turn required to close/open the valve-DN200: 34; DN300: 51 12. Type of Flange: Raised face.															
																
F	CUSTOMER APPROVAL															
G	 VAG VAG Valves (India) Pvt. Ltd. Hyderabad, Telangana.												Title: G.A. Drawing Of EKOplus Gate Valve			
H	DN	PN	$L \pm \frac{1}{2}$	$D \pm \frac{1}{2}$	K	No. of Holes	d	$b \pm \frac{1}{2}$	h	$\varnothing D_1$	03 Details Updated	03-12-20	GVS	BNR	Drawn	Name
	200	16	292	340	295	12	23	20	500	400	02 Details Updated	05-11-20	GVS	BNR	Checked	GVS
	300	16	356	460	410	12	28	24.5	680	500	01 Details Updated	26-10-20	GVS	BNR	Approved	BNR
											Rev. No.	Description	Date	Drawn	CKD	
											Drg. No.	01-200-16-4570		A3	Rev. 03	
															Projection	
																



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3/2 A

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3/2 H

S.No.

Description

Material

A

01 Body Ductile Iron. (GGG-40)

02 Bonnet Ductile Iron. (GGG-40) with EPDM Lining (Food Grade)

03 Wedge Ductile Iron. (GGG-40) with EPDM Lining (Food Grade)

04 Stem Stainless Steel (ASTM A276 Gr.420)

05 Stem Nut Brass (CuZn40Pb2)

06 Stem Bearing Brass (CuZn40Pb2)

07 Seal Ring EPDM (Food Grade)

08 O-Ring NBR

- Internal Fasteners Stainless Steel AISI316

- Handwheel MS Fabricated

B

C

D

E

F

G

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Note:-

1. All dimensions are in mm.
 2. Valve is Epoxy Coated in Blue color, RAL 5005 Both inside & outside with minimum 250 Microns Thick.
 3. Face to Face Dimension as per : IS 4846.
 4. Flange Drilling as per : IS 9523.
 5. Hydro Testing As per : IS 104846.
 6. Body test pressure: 1.5 times to rated pressure for 5 minutes.
 7. Seat test pressure : 1.1 times to rated pressure for 2 minutes.
 8. Application: Water.
 9. For flange hole diameter (ϕD), tolerance will measure ± 1.5 mm due to the coating but it will be suitable for bolt insertion.
 10. Weight of the valve- DN200: ~57 Kg; DN350: ~98 Kg.
 11. Dimension with \sim symbol may vary ± 1.5 mm.
 12. Type of Flange: Raised face.

CUSTOMER APPROVAL

Client : Bangalore Water Supply & Sewage Board
 Contractor : Larsen & Toubro Limited
 Project : CP/09

Title: G.A. Drawing Of EKOpus Gate Valve

VAG Valves (India) Pvt. Ltd.
 Hyderabad, Telangana.

No. of Holes- ϕd Thru

ϕD

ϕk (PCD)

b (TYP)

L

DN

$b \pm \frac{1}{2}$

ϕD

$\sim h$

ϕD_1

03 Details Updated 03-12-20 GVS BNR Drawn GVS 07-10-20 Projection

02 Details Updated 05-11-20 GVS BNR Checked BNR 07-10-20

01 Details Updated 26-10-20 GVS BNR Approved BNR 07-10-20

Rev. No. Description Date Drawn CKD

01-200-16-4573 A3 Rev. 03

1 2 3 4 5 6 7 8 9 10 11 12

A	1	2	3	4	5	6	7	8	9	10	11	12
B	1	2	3	4	5	6	7	8	9	10	11	12
C	1	2	3	4	5	6	7	8	9	10	11	12
D	1	2	3	4	5	6	7	8	9	10	11	12
E	1	2	3	4	5	6	7	8	9	10	11	12
F	1	2	3	4	5	6	7	8	9	10	11	12
G	1	2	3	4	5	6	7	8	9	10	11	12
H	1	2	3	4	5	6	7	8	9	10	11	12

1. Body

2. Bonnet

3. Wedge

4. Stem

5. Stem Nut

6. Stem Bearing

7. Seal Ring

8. Gear Box

9. O-Ring

10. Internal Fasteners

11. Gearbox housing

12. Handwheel

13. NBR

14. Brass (CuZn40Pb2)

15. Brass (CuZn40Pb2)

16. EPDM (Food Grade)

17. Stainless Steel (ASTM A276 Gr.420)

18. Ductile Iron (GGG-40)

19. Ductile Iron (GGG-40)

20. Ductile Iron (GGG-40) with EPDM (Food Grade) Lining

21. Stainless Steel (ASTM A276 Gr.420)

22. AISI316

23. SG 400 / 15

24. MS Fabricated/CS

Note:-

1. All dimensions are in mm.
2. Valve is Epoxy Coated in Blue color, RAL 5005 Both inside & outside with minimum 250 Microns Thick.
3. Face to Face Dimension as per : IS 14846.
4. Flange Drilling as per : IS 9523.
5. Hydro Testing As per : IS14846.
6. Application: Body test pressure: 1.5 times to rated pressure for 5 minutes. Seat test pressure : 1.1 times to rated pressure for 2 minutes.
7. For flange hole diameter (ϕd) tolerance will measure ± 1.5 mm due to the coupling but it will be suitable for bolt insertion.
8. VAG Gate valves can't be recommend for throttling application and shall only be used for ON-OFF duty. Customer using these valves for throttling shall void of warranty.
9. Weight of the valve: ~ 235 Kg
10. Type: Non-Rising spindle.
11. Gearbox Model: ATB 06
12. No. of turn required to close/open the valve-DN400: 113
13. Type of Flange: Raised face.

CUSTOMER APPROVAL

Client :	Bangalore Water Supply & Sewage Board		
Contractor :	Larsen & Toubro Limited		
Project :	CP-09		
VAG			
VAG-Valves (India) Pvt. Ltd. Hyderabad, Telangana.			
Title: G.A. Drawing Of Gate Valve with Gear Box			
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21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
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Quality Assurance Plan

Project : CP-09

Contractor : Larsen & Toubro Limited

Client : Bangalore Water Supply & Sewage Board

VAG Valves (India) Pvt Ltd,
Plot No.57 & 56, Phase- III,
TSIIC Pashamylaram,
Pattancheru, Medak Dist 502307
Telangana

Item: DUOJET Tamper Proof Air Valve. (Body and Bonnet of GGG-40)								QAP No: 02.QAP.3 07
Manufacturer Name: Vag Valves India Pvt Ltd.								Rev No: 2 Date: 03.12.20
Size	DN150	DN200						
PN in bar	PN16	PN16						
Inspection Conditions: 100% of the total lot of each valve size/type will be offered for inspection after completion of 100% Internal testing. L&T/TPI/Client has to select 30% from the total lot of each valve Size/type randomly.								
S.No	Examination / Process				<i>Test Procedure/ Standard</i>	M	L&T	TPI/Client
1	Tests to be Conducted on Final Assembled Valve.							
1.1	Strength test of the body with water (1.5 X nominal pressure).				IS 14845:2000	W	RW	RW
1.2	Leakage test from inside to outside with water (1.5 X nominal Pressure) for Assembled Parts.				IS 14845:2000	W	RW	RW
1.3	Leakage test on the seat (1.1 X nominal pressure).				IS 14845:2000	W	RW	RW
1.4	Functional Test of the Valve without pressure.				Air passage & the function of ball floats in a valve shall be satisfactory, and the valve shall work smoothly.	W	RW	RW
2	Final Inspection							
2.1	Inspection of the main- and Installation Dimensions & Visual Inspection				As Per Approved Drawing	W	W Visual -100%	W
2.2	Material certificate for following components: Body & Bonnet - Chemical & Mechanical Properties Float- Chemical & Mechanical Properties EPDM -WRAS Mechanical Properties,				As Per Approved Drawing	W	R	R
2.3	Visual Inspection of the coating - DFT Measurement: Batch Certificate and Painting Compliance Report. (Internal and External With Epoxy Powder Coating)				As Per Approved Drawing / DFT >250	W	W	W
2.4	Inspection of the valve marking				EN 12266-1	W	W	W
2.5	Inspection of Cleanliness before Shipment.					W	N.A	X
2.6	Packing inspection.					W	N.A	X
2.7	Preparation of documentation.					W	N.A	X

Note:

M= Manufacturer ; TPI= Third party inspection; D= Document/Report; W= Witness; R=Review; RW= Random Witness.
N.A= Not Applicable.



Prepared By:	Department	Approved By:	Department	Sign & Seal
P.Shubhasis	Quality Control	G.Satyanarayana	Quality Control	Date 3.12.20



BS : 03

	1	2	3	4	5	6	7	8	9	10	11	12
AAA	Sl.No.	Description	Material									
01	Body	Ductile Iron (GGG-40)	A									
02	Bonnet	Ductile Iron (GGG-40)	A									
03	Wedge	Ductile Iron (GGG-40) with EPDM (Food Grade) Lining	A									
04	Stem	Stainless Steel (ASTM A276 Gr.420)	B									
05	Stem Nut	Brass (CuZn40Pb2)	B									
06	Seal Ring	EPDM (Food Grade)	B									
07	Body	Ductile Iron (GGG-40)	B									
08	Bonnet Assembly	Ductile Iron (GGG-40)	B									
09	Float	Stainless Steel (AISI 316Ti)	C									
10	Main Gasket	EPDM (Food Grade)	C									
11	O-Ring	NBR	C									
-	Internal Fasteners	Stainless Steel AISI316	C									
-	Handwheel	MS Fabricated	C									

Note:-

- All dimensions are in mm.
- Valve is Epoxy Coated in Blue color, RAL 5005 Both inside & outside with minimum 250 Microns Thick.
- Face to Face Standard : IS 14846.
- Flange Drilling As per : IS 9523.
- Hydro Testing As per : IS 14846.
- Body test pressure: 1.5 times to rated pressure for 5 minutes.
- Seat test pressure: 1.1 times to rated pressure for 2 minutes.
- Connecting hardware's and gasket for Gate valve and Air valve are not in VAG scope of supply.
- For flange hole diameter (ϕD_1), tolerance will measure ± 1.5 mm due to the coating but it will be suitable for bolt insertion.
- Dimension with \sim symbol may vary ± 1.5 mm.
- Weight of the valve-DN150: ~ 90 Kg; DN200: 115 Kg
- Type: Non-Rising spindle.
- No. of turn required to close/open the valve-DN150: 30.5 ;DN200: 34
- Type of Flange: Raised face.

CUSTOMER APPROVAL

Client :	Bangalore Water Supply & Sewage Board
Contractor :	Larsen & Toubro Limited
Project :	CP-09

VAG G.A. Drawing Of
VAG-Valves (India) Pvt. Ltd. DUOJET (Air Valve) with
Hyderabad, Telangana. Isolation Gate Valve

G

Name	Sign	Date	Scale	NTS
Drawn	GVS	07-10-20	Projection	
Checked	BNR	07-10-20		H
Approved	BNR	07-10-20		
Rev. No.	Description	Date	Drawn CKD	A3 Rev. 03

ONTB Comments

ONTB Comments				
Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
Sr. No	ONTB Comments(Design)			
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Butterfly Valves for CP-09	03-1300-16-4575/03-800-16-4568/03-1300-16-4569		
1	As per Cl.no.5.8.2 (a) The Butterfly Valves shall be double flanged long body, double eccentric type conforming to IS 13095/ BS EN 593. Mark the double eccentric/ offset dimensions in the drawing.	We confirm that offered valves are The Butterfly Valves shall be double flanged long body, double eccentric type conforming to BS EN 593. Face to face dimension as per IS13095. Refer GAD for eccentric dimension.	Face to face dimension as per IS 13095.	
2	As per Cl.no.5.8.2 (a) The Butterfly Valves shall be double flanged long body, double eccentric type conforming to IS 13095/BS EN 593. To check the Face to face dimension attach the relevant pages of the standard to check long body dimension.			
3	As per Cl.no.5.8.2 (c) All fasteners shall be set flush so as to offer the least resistance possible to the flow through the valve. Confirm whether same is adopted in your design.	Yes, Complies. Retaining Ring profile assist flow over fastener to achieve least resistance over the disc.		
4	As per Cl.no.5.8.2 (f) "Valve of diameter 450 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400 N." Provide confirmation about this clause and gear box details for	Yes, We confirm that the butterfly valves can be operated by one man against head of 15% in excess.		



Project	Description	Doc./Dwg. No.	Status/Action	Compliance
Citr Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Butterfly Valves for CP-09	03-1300-16-4575/03-800-16-4568/03-1300-16-4569		
Sr. No	ONTB Comments(Design)			
	review and approval.			
f	As per Cl.no.5.8.2 (f) The time from fully open to fully closed position and vice versa shall be limited to about 5 minutes. The valve shall be suitable for controlling flows by throttling. Mention the duration of opening and closing in the drawing.		Limited to 5 minutes.	
g	As per Cl.no.5.8.2 (g) All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels. Mention the Hand wheel diameter in all the drawing and provide the basis for the selected diameter and mention the no. of turns required from fully open to fully close condition. Mention the material of construction of the hand wheel.		Yes, Complies. Marking available on handwheel washer.	
h	As per Cl.no.5.8.2 (g) Hand wheels shall be provided with an integral locking device to prevent operation by unauthorized persons. Revise the drawing show hand wheel with interlocking device.		Chain and lock shall be provided.	
i	As per Cl.no.5.8.2 (h) The contractor shall submit gear box & electrical actuator sizing calculation along with datasheet, QAP and drawings approval. Submit the gear box sizing calculation for approval.		Sizing calculations, datasheet provided.	
j	All the butterfly valve shall comply to the same material of construction with their grades as mentioned in the contract document cl. no.5.8.2. Material of construction of valves shall comply with following requirement:			



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Butterfly Valves for CP-09	03-1300-16-4575/03-800-16-4568/03-1300-16-4569		
Sr. No	ONTB Comments(Design)			
Sr. No.	Component	Material	Component	Material
(a)	Body	SG Iron IS 1865 Gr. 500/7/GGG50 or 400/15/GGG40	Body	SG Iron IS 1865 Gr. 400/15/GGG40
(b)	Disc	SG Iron IS 1865 Gr. 500/7/GGG50 or 400/15/GGG40	Disc	SG Iron IS 1865 Gr. 400/15/GGG40
(c)	Shaft	Stainless Steel; ASTM A 276 Gr. 431/420	Shaft	Stainless Steel; ASTM A 276 Gr. 420
(d)	Seal retaining ring	Stainless Steel; ASTM A 743 CF8	Seal retaining ring	Stainless Steel ASTM A 743 CF8
(e)	Bearing	Stainless Steel backed Teflon	Bearing	Bronze (CuSn12-C)
(f)	Disc seal	Food Grade EPDM	Disc seal	Food Grade EPDM
(g)	Body seat	Stainless Steel; ASTM A 743 CF8 / Nickel-chromium overlay welding and micro finished	Body seat	Stainless Steel; ASTM A 743 CF8 / Integral Nickel-chromium overlay welding and micro finished
(h)	Internal Fasteners	SS 316	Internal Fasteners	SS 316
(i)	External Fasteners	SS316	External Fasteners	Not in VAG Scope.
(k)	Gear, Gear housing	Cast Steel ASTM A 216 Gr.WCB	Gear, Gear housing	Cast Iron FG200, as gearbox manufacturer's confirmed MOC Cast Steel can't be in manufacturing range.



Project	Description	Doc./Dwg's. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Butterfly Valves for CP-09	03-1300-16-4575/03-800-16-4568/03-1300-16-4569		
Sr. No	ONTB Comments(Design)			
10	In drawing in testing standard is mentioned as EN 12266-1, mention only one standard i.e, IS 13095 and consider as per cl.no.5.8.10.2, (b) Butterfly Valves: The following test shall be carried out for butterfly valves as per test procedure briefed in IS 13095: (i) Seat leakage test at 1.1 times the rated pressure (ii) Body hydrostatic test at 1.5 times the rated pressure (iii) Disc strength test at body test pressure one per size (iv) Valve operation with and without actuator Mention the same in QAP and drawings.		Yes, Complies	
11	As per Cl 5.8.10.2 The material certificates, physical properties, heat treatments and shop test certificates of valve body, disc, wedge and shaft shall be duly approved and certified by the manufacturer and these shall be subject to review & approval by Engineer. Notwithstanding the above requirement for inspection and quality control, the following inspection and quality control measures shall be carried out by manufacturer: (i) Magnetic particle tests on body and disc/door. (ii) Dye penetration tests on metal seats. (iii) Ultrasonic tests on shafts. (iv) Overload Torque Test shall be carried out on the gear boxes of the valves. The test shall be carried out by applying 1.5 times the rated torque.		As per specification, We notwithstanding to all required Certificates.	

Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Butterfly Valves for CP-09	03-1300-16-4575/03-800-16-4568/03-1300-16-4569		
Sr. No	ONTB Comments(Design)			
	Provide a detail QAP for review considering all the contract requirements.			
12	Confirm the testing duration as 5 minutes for Body and Disc strength test and 2 minutes for seat in QAP and testing procedure.		Yes, Complies.	
13	All the Butterfly valves are installed in the Valve chamber, provide detail dimensional drawing to adopt proper clearance while preparing the construction drawing of the valve chamber.		Required dimensions mentioned in GAD. Refer revised GAD	
14	As all the Butterfly valve are installed in Valve chamber and it will be resting on the flat pedestal, provide footing arrangement either integral casted or external attached, to install the Valve easily in the Valve Chamber.		Footing arrangement integrated with body.	
15	Mention the total weight of the Butterfly Valve, which is required for the designing of the valve chamber pedestals.		Provided. Refer revised GAD.	
16	Mention the total valve length from center line of the valve to end cover plate and Bypass valve with piping. This dimension is very important as Consultant needs to release the Valve Chamber drawing for the construction works.		total valve length from center line of the valve to end cover plate is the radius of the valve body.	
17	As per cl.no.5.8.1 (d) Valve of diameter 300 mm and above shall be provided with lifting eyes, and shall have detachable bolted covers for inspection, cleaning and servicing.		Lifting holes are available for valve body and shown in drawing.	



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Butterfly Valves for CP-09	03-1300-16-4575/03-800-16-4568/03-1300-16-4569		
Sr. No	ONTB Comments(Design)			
	Provide Lifting Eye arrangement either integrally casted or externally in the valve. Revise the drawing.			
18	In drawing mention the flange type as Flat Face or Raised Face.	Raised Face.		
19	As per Cl.no.5.8.2 (j) All bypass piping shall be provided with MS pipe of minimum 8 mm thick and reinforcement pad at the weld joint of pipe. Bypass joints bolts & Nuts shall be of SS304 material only. Confirm the Bypass pipe thickness as minimum 8 mm and Bypass joints bolts & Nuts shall be of SS304 material only in the drawing it may not be VAG scope of supply.	Bypass valve piping in L&T scope. VAG support to L&T to prepare drawing.		
20	Show the zoom view of Valve seating arrangement in the drawing.	Yes, Complies.		
21	Show the Name plate details in the drawing.	Provided sample name plate drawing.		
22	Mention only one gear box make in the drawing and model selected in Butterfly valve drawing.	Provided. Refer revised GAD.		
23	In QAP mention all the parts of the butterfly valve for which Physical & Chemical Properties which will be given for review. And Heat no. details should be presented for all the casted parts.	Refer revised QAP.		
24	As per contract document 100% witness is required, but provided for client/TPI is only 100% which is not acceptable. Kindly revise it as 100% inspection witness.	100% quantity shall be witnessed.		



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Butterfly Valves for CP-09	03-1300-16-4575/03-800-16-4568/03-1300-16-4569		
Sr. No	ONTB Comments(Design)			
25	Provide the flange dimension with tolerance details in the drawings which will be easy to understand, and easy to inspect at the time of inspection at factory premises. There should not be any negative tolerance.		As agreed, GAD revised. Refer revised GAD.	
26	In drawing mention the bolt size required as per IS standard, in bigger size valves.		Hole Dia. mentioned in GAD. Fasteners length shall be confirmed by L&T. VAG supports L&T team.	
27	Butterfly Valve gearbox shall be provided with position indicator to show the position of the disc, mounted on the drive shaft end. Rigid adjustable stop mechanism shall be provided within the gear box or elsewhere on the valve to prevent movement of the disc beyond the fully open or closed position (i.e. set points).		Yes, Complies.	
28	Provide fabrication drawing of Companion flange to understand whether all the sizes starting from 800 mm dia. to 2200 mm dia. is manufactured by a single piece plate or multiple pieces welded to form one full flange. Provide a Separate QAP for Companion flange for review and approval.		Companion flanges are not in VAG scope. Shall be provided by L&T separately along with flanges QAP.	
29	Provide Bypass Sluice Valve drawing and QAP for approval which is missing in the submission.		Already provided. Refer GAD: 01-200-16-4573 & 01-080-16-4574.	
30	In QAP of 1300 mm & 2200 mm Butterfly Valve mention Witness for hydro testing for L&T and TPI/Client.		As agreed, valves shall be witnessed.	
31	As per contract document Page no. 038, Addendum no.2, Sl.no:10, Inspection and Tests-Mechanical 5.8.10.2 (g) Before installing Butterfly and Sluice Valves at the site		In L&T scope. Anyhow, VAG support for installation of valves as per agreed terms.	



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Butterfly Valves for CP-09	03-1300-16-4575/03-800-16-4568/03-1300-16-4569		
Sr. No	ONTB Comments(Design)			
	contractor is required to carry out hydro test as directed by the Engineer. Contractor has to establish test set up at work site to test the Butterfly & Sluice valves along with their mating flanges bolted and spool pieces after welding to check the water tightness of the joints (no leakages in joints) and hydro test pressure shall be same as line pressure at site after hydro testing the whole valve assembly along with spools shall be lowered in the valve chamber and same shall be welded along the pipeline. Confirm.			
32	The Valve rating and quantity shall be procured as per actual L-sectional drawing released.		Shall be confirm by L&T.	
33	In Butterfly Valve drawing note no.8 “VAG Butterfly valve can’t be recommend for throttling application and shall only be used for On-Off duty. Customer using these valves for throttling shall void of warranty.” Delete this statement as this valves are used in Rising main & Gravity feeder main, throttling situation may not arise it will be mainly for on-off condition only.		Agreed.	

ONTB Comments

Project	Description	Doc./Dwg's. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Sluice Valve (Scour Purpose) for CP-09			
Sr. No	ONTB Comments(Design)			
1	Sluice valves dimensions should comply to IS 14846 as per cl.no.5.8.3 (a) Face to Face dimension shall be as per IS 14846-2000 only. Mention the same in the drawing IS code in the drawing and same should be followed.			Face to face dimensions are as per IS 14846.
2	In drawing Governing Standard is mentioned as EN 1074, as per contract document cl. no.5.8.3 (a) All the Sluice valve shall be of resilient seated, glandless design & metal seated generally confirm to BS 5163 -89/ IS 14846 -2000. Specify only one among the two which is specified in the contract document.			We confirm that offered valves are resilient seated, glandless design and confirm to BS 5163 -89.
3	As per cl.no. 5.8.3, (c) "Sluice valves shall be of non-rising spindle type." Confirm in all the drawings mention it as Non-rising Spindle only.			We confirm that offered valves are non-rising spindle type.
4	As per cl.no. 5.8.3, (d) Valve of 400 mm and above shall be provided with thrust bearing arrangement for ease of operation. Provide Thrust Bearing arrangement for valves 400 mm and above in the drawing.			Thrust bearing arrangement not applicable for DN400 shall applicable for sizes above DN500.
5	The total height of the valve from center line of valve to top edge of the hand wheel it should be as per IS standard.			We maintain valve height less than IS standard for easy installation connecting underground pipe.
6	As per cl.no.5.8.3 (f) Valve shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position. Provide confirmation regarding this clause of the contract document.			Yes, Complies
7	Provide Painting Procedure for better understanding and matching the contract cl.no.5.8.3			Refer attachment painting procedure.



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Sluice Valve (Scour Purpose) for CP-09			
Sr. No	ONTB Comments(Design)			
	(k) The Valves shall be painted with Electro static epoxy powder coating both inside and outside with pocket less body passage for a minimum DFT of 250 Microns.			
8	Mentioned hand wheel diameter in the drawing. Manufacturer is required to give justification with calculation that proposed valve is Operate able with the effort parameters specified and no. of turns to ensure the time required to operate the valve from full open to full close is within reasonable limits. Mentioned Hand wheel diameter in all the drawing and provide the basis for the selected diameter and mention the no. of turns required from fully open to fully close condition.		Refer revised GAD	
9	As per cl.no.5.8.3 (g) All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels. Show the same in the drawing.		Yes, Complies. Marking available on handwheel washer.	
10	Provide fabrication drawing of Companion flange to understand whether all the sizes starting from 100 mm dia. to 400 mm dia. is manufactured by a single piece plate or multiple pieces welded to form one full flange.		Companion flange drawing provided for nonstandard sizes like DN1300 & 2200.	
11	Provide Gear box sizing (Torque rating) sizing calculation for review and approval.		Provided.	
12	Confirm the testing duration as 5 minutes for Body test and 2 minutes for seat in QAP and testing procedure.		Yes, Complies	
13	As per Cl.5.8.10.2 The material certificates, physical properties, heat treatments and shop test certificates of valve body, disc, wedge and shaft shall be duly approved and certified by the manufacturer and these shall be subject to review & approval by Engineer. Notwithstanding the above requirement for inspection and quality control, the following		As per specification, we withstand to all required Certificates.	



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Sluice Valve (Scour Purpose) for CP-09			
Sr. No	ONTB Comments(Design)			
	inspection and quality control measures shall be carried out by manufacturer:			
	(i) Magnetic particle tests on body and disc/door.			
	(ii) Dye penetration tests on metal seats.			
	(iii) Ultrasonic tests on shafts.			
	(iv) Overload Torque Test shall be carried out on the gear boxes of the valves. The test shall be carried out by applying 1.5 times the rated torque.			
	Provide a detail QAP for review considering all the contract requirements.			
14	As per Cl. no. 5.8.10.2 Sluice Valves: The following test shall be carried out for sluice valves as per test procedure briefed in IS 14846: Seat leakage test at rated pressure Body hydrostatic test at 1.5 times the rated pressure Valve operation with and without actuator		Yes, Complies.	
15	In drawing mention the flange type as Flat Face or Raised Face.		Yes, Complies. Raised Face.	
16	Mention the material of construction of sluice valve as provided in the 5.8.3 with their grades. MOC applicable as commented below;		Updated. Refer revised GAD.	
17	To check the flange dimension with tolerance details attach the standard pages, which will be easy to understand, and easy to inspect at the time of inspection at factory premises.		Yes, Complies.	Hole Dia. mentioned in GAD. Fasteners length shall be confirmed by L&T. VAG supports L&T team.
18	In drawing mention the bolt size required as per IS standard.			
19	As per contract document 100% witness is required, but provided for client/TPI is only 10% which is not acceptable. Kindly revise it as 100% inspection witness.		Yes, Complies. Refer revised QAP.	



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
Sr. No	ONTB Comments(Design)			
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Sluice Valve (Scour Purpose) for CP-09			
20	Mention the total weight of the Sluice valve with its gear box in the drawing.		Refer updated GAD.	
21	Show the Name plate details in the drawing.		Provided sample name plate drawing.	
22	Mention the gear box in the drawing and model selected in Sluice valve drawing of 400 mm dia.		Provided in GAD.	
23	In QAP mention all the parts of the Sluice valve for which Physical & Chemical Properties which will be given for review. And Heat no. details should be presented for all the casted parts.		Refer updated QAP.	
24	Mention Valve Seats as NBR material only.		O-Rings are of NBR material.	
25	In the drawing of 300 mm & 400 mm dia. Sluice valve there is no lifting eye bolt arrangement, as per cl.no.5.8.1 (d) Valve of diameter 300 mm and above shall be provided with lifting eyes and shall have detachable bolted covers for inspection, cleaning and servicing.		Integrated lifting lugs provided for DN 400. Flange holes can be used for lifting for smaller sizes below DN300.	
26	As per contract document Page no. 038, Addendum no 2, Sl.no:10, Inspection and Tests- Mechanical 5.8.10.2 (g) Before installing Butterfly and Sluice Valves at the site contractor is required to carry out hydro test as directed by the Engineer. Contractor has to establish test set up at work site to test the Butterfly & Sluice valves along with their mating flanges bolted and spool pieces after welding to check the water tightness of the joints (no leakages in joints) and hydro test pressure shall be same as line pressure at site after hydro testing the whole valve assembly along with spools shall be lowered in the valve chamber and same shall be welded along the pipeline. Confirm.		In L&T scope. Anyhow, VAG support for installation of valves as per agreed terms.	



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Sluice Valve (Scour Purpose) for CP-09			
Sr. No	ONTB Comments(Design)			
27	The Valve Rating and quantity shall be procured as per actual L-sectional drawing released.		Shall be confirm by Contractor.	
28	In Sluice Valve drawing note no.8 "VAG Shuice valve can't be recommend for throttling application and shall only be used for On-Off duty. Customer using these valves for throttling shall void of warranty." Delete this statement as this valves are used in Rising main & Gravity feeder main, for Scour purpose this may not arise it will be mainly for on-off condition only. Confirm whether these valves are design for off condition for a longer duration of atleast 4 – 5 years, as it will be opened during scouring only.		Deleted in drawing.	



ONTB Comments

Project	Description	Doc./Dwg. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Air Release Valve with isolating Sluice Valve for CP-09			
Sr. No	ONTB Comments(Design)			
	Isolating Sluice Valve Comments			
1	Sluice valves dimensions should comply to IS 14846 as per cl.no.5.8.3 (a) Face to Face dimension shall be as per IS 14846-2000 only. Mention the same in the drawing IS code in the drawing and same should be followed.		Face to face dimensions are as per IS 14846.	
2	In drawing Governing Standard is mentioned as EN 1074, as per contract document cl. no.5.8.3 (a) All the Sluice valve shall be of resilient seated, glandless design & metal seated generally confirm to BS 5163 -89/ IS 14846 -2000. Specify only one among the two which is specified in the contract document.		We confirm that offered valves are resilient seated, glandless design and confirm to BS 5163 -89.	
3	As per cl.no. 5.8.3, (c) "Sluice valves shall be of non-rising spindle type." Confirm in all the drawings mention it as Non-rising Spindle only.		We confirm that offered valves are non-rising spindle type.	
4	As per cl.no. 5.8.3, (d) Valve of 400 mm and above shall be provided with thrust bearing arrangement for ease of operation. Provide Thrust Bearing arrangement for valves 400 mm and above in the drawing.		Thrust bearing arrangement not applicable for DN400 shall applicable for sizes above DN500.	
5	The total height of the valve from center line of valve to top edge of the hand wheel it should be as per IS standard.		We maintain valve height less than IS standard for easy installation connecting underground pipe.	
6	As per cl.no.5.8.3 (f) Valve shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position. Provide confirmation regarding this clause of the contract document.		Yes, Complies	
7	Provide Painting Procedure for better understanding and matching the contract cl.no.5.8.3.		Refer attachment painting procedure.	



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Air Release Valve with isolating Sluice Valve for CP-09			
Sr. No	ONTB Comments(Design)			
	(k) The Valves shall be painted with Electro static epoxy powder coating both inside and outside with pocket less body passage for a minimum DFT of 250 Microns.			
8	Mentioned hand wheel diameter in the drawing. Manufacturer is required to give justification with calculation that proposed valve is Operate able with the effort parameters specified and no. of turns to ensure the time required to operate the valve from full open to full close is within reasonable limits. Mentioned Hand wheel diameter in all the drawing and provide the basis for the selected diameter and mention the no. of turns required from fully open to fully close condition.		Refer revised GAD	
9	As per cl.no.5.8.3 (g) All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels. Show the same in the drawing.		Yes, Complies. Marking available on handwheel washer	
10	Provide fabrication drawing of Companion flange to understand whether all the sizes starting from 100 mm dia. to 400 mm dia. is manufactured by a single piece plate or multiple pieces welded to form one full flange.		Companion flange drawing provided for nonstandard sizes like DN1300 & 2200.	
11	Provide Gear box sizing (Torque rating) sizing calculation for review and approval.		Provided.	
12	Confirm the testing duration as 5 minutes for Body test and 2 minutes for seat in QAP and testing procedure.		Yes, Complies	
13	As per Cl.5.8.10.2 The material certificates, physical properties, heat treatments and shop test certificates of valve body, disc, wedge and shaft shall be duly approved and certified by the manufacturer and these shall be subject to review & approval by Engineer. Notwithstanding the above requirement for inspection and quality control, the following		As per specification, We withstand to all required Certificates.	



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Air Release Valve with isolating Sluice Valve for CP-09			
Sr. No	ONTB Comments(Design)			
	inspection and quality control measures shall be carried out by manufacturer:			
	(i) Magnetic particle tests_on body and disc/door. (ii) Dye penetration tests_on metal seats. (iii) Ultrasonic tests on shafts. (iv) Overload Torque Test shall be carried out on the gear boxes of the valves. The test shall be carried out by applying 1.5 times the rated torque.			
14	Provide a detail QAP for review considering all the contract requirements.			
	As per Cl. no. 5.8.10.2 Sluice Valves: The following test shall be carried out for sluice valves as per test procedure briefed in IS 14846: Seat leakage test at rated pressure Body hydrostatic test at 1.5 times the rated pressure Valve operation with and without actuator		Yes, Complies	
15	In drawing mention the flange type as Flat Face or Raised Face.			Yes, Complies. Raised Face.
16	Mention the material of construction of sluice valve as provided in the 5.8.3 with their grades. MOC applicable as commented below;			Updated. Refer revised GAD.
17	To check the flange dimension with tolerance details attach the standard pages, which will be easy to understand, and easy to inspect at the time of inspection at factory premises.		Yes, Complies.	
18	In drawing mention the bolt size required as per IS standard.			Hole Dia. mentioned in GAD. Fasteners length shall be confirmed by L&T. VAG supports L&T team.
19	As per contract document 100% witness is required, but provided for client/TPI is only 10% which is not acceptable. Kindly revise it as 100% inspection witness.			Yes, Complies. Refer revised QAP.



Project	Description	Doc./Dwgs. No.	Status/Action	Compliance
Sr. No	ONTB Comments(Design)			
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Air Release Valve with isolating Sluice Valve for CP-09			
20	Mention the total weight of the Sluice valve with its gear box in the drawing.		Refer updated GAD.	
21	Show the Name plate details in the drawing.		Provided sample name plate drawing.	
22	Mention the gear box in the drawing and model selected in Sluice valve drawing of 400 mm dia.		Provided in GAD.	
23	In QAP mention all the parts of the Sluice valve for which Physical & Chemical Properties which will be given for review. And Heat no. details should be presented for all the casted parts.		Refer updated QAP.	
24	Mention Valve Seals as NBR material only.		O-Rings are of NBR material.	
1	Attach the functional Procedure literature of this Air Valve and it should be same as specified in Cl.no.5.8.6 (b).		Provided.	
2	As per cl. no. 5.8.6 (h), All Stub piping and cluster piping shall be provided with MS pipe of minimum 10 mm thick and reinforcement pad at the weld joint of pipe. All flange joints bolts & Nuts shall be of SS304 material only. Mention the same in the drawing. Fasteners and Stub piping may be in the scope of M/s. L&T, but mention the details in the drawing.		Separate drawing shall be provided by L&T.	
4	As per cl. no. 5.8.6 (j), The contractor shall provide test certificates for materials and properties shall be in accordance with relevant standards.		Yes, Complies.	
5	Provide Painting Procedure for better understanding and matching the contract cl.no.5.8.6. (g)The Valves shall be painted with Electro static epoxy powder coating both inside and outside with pocket less body passage for a minimum DFT of 250 Microns.		Provided.	
6	In QAP and Drawing mention the testing duration as 5 min for Body test and minimum 2 min for seat test.		Refer updated QAP.	



Project	Description	Doc./Dwg. No.	Status/Action	Compliance
City Trunk Main along Eastern Route CP-09	Mechanical data sheet, GA and QAP for Air Release Valve with isolating Sluice Valve for CP-09			
Sr. No	ONTB Comments(Design)			
7	As per cl.no. 5.8.6 (k) Before carrying out pipeline pressure testing the Contractor shall verify with the supplier of the air valves that the valves have the capacity to sustain the pipeline test pressures. In the event that they do not sustain the pressure the valves shall be removed and the stubs off the pipeline shall be blanked off before pressure testing the pipeline. Provide Confirmation for this clause during hydro testing at the commissioning Valve should not fail at site.		In L&T scope. Anyhow, VAG support for installation of valves as per agreed terms.	
8	As per cl. no. 5.8.6 Material of construction is defined, kindly follow the same.		Body/Top Cover SG Iron IS 1865 400/15/GGG40 Small orifice: Shutoff device: Stainless Steel AISI 321 AISI 321 having better weldability properties compare to SS316. Seat Ring: EPDM food grade Cover Bolts: SS304 Internal Gaskets & Seals: Food Grade EPDM	
	Sr. No. Component Material			
(a)	Body/Top Cover SG Iron IS 1865 Gr. 500/7/GGG50 or 400/15/GGG40			
(b)	Small orifice Plug Leaded Tin Bronze IS 318 Gr. LTB 2/SS 316			
(c)	Leaded Tin Bronze IS 318 Gr. LTB 2/ SS 316			
(d)	Float/Balls SS AISI 304			
(e)	Cover Bolts Austenitic alloy steel/SS 304			
(f)	Gaskets & Seals Food Grade EPDM			



Final product Tests:**1. Hydro test Procedure:****a. Shell test as per EN - 12266 & IS**

Shell and Strength test of the body with water (1.5x Nominal Pressure)

1. Make sure that valves are clamped on the test bench and Fill with water completely while Gate/Disc in semi open condition.
2. Ensure that there will be no leakage during filling of the water due to incomplete clamping.
3. Ensure that water is filled completely.
4. Pressurize the filled water up to 1.5 times of the nominal pressure and maintain the holding period as per the standard.
5. There should be no leakage during the holding period.

b. Seat test as per EN- 12266 & IS wherever applicable.

Leak test on the Seat in both directions with water (1.1x Nominal Pressure)

1. Make sure that valves are clamped on the test bench and Fill with water completely while Gate/Disc in fully closed condition.
2. Ensure that there will be no leakage during filling of the water due to incomplete clamping.
3. Ensure that water is filled completely.
4. Pressurize the filled water up to 1.1 times of the nominal pressure and maintain the holding period as per the standard.
5. There should be no leakage during the holding period from one side to another side.

2. Function test (opening & closing of valve).

3. Dimensional & Visual inspection (As per drawing).

4. Coating inspection.



PROCESS FLOW CHART FOR POWDER COATING



PRODUCTION

Shot blasted component

COATING PROCESS

Furnace

Hanging of the components
Reach oven temp. to be 240 °C
Heat the component to 210 ± 10 °C for Spraying 'or' 200 ± 10 °C for Dipping

Coating area

Immediately Powder Coating

Cooling Process

QUALITY ASSURANCE

Checking coating thickness
 $> 250 \mu\text{m}$
Results should be recorded

Visual Inspection

Noncompliance to be addressed

NO

YES

STORE

ADDITIONAL QUALITY INSPECTIONS

Components ready for assembly& testing

If found ok, Reday for Despacth



PROCESS FLOW CHART FOR SHOT BLASTING



PRODUCTION

Machined components

SHOT BLASTING PROCESS

- Plugging the threaded region
- Hanging the components on to the hanger
- Shot blast the components for required duration
- Surface Quality : SA 2 ½ Free from dust, rust & grease
- Cleaning with air

QUALITY ASSURANCE

- Visual Inspection
- Checking shot blasted component to meet surface quality : SA 2 ½.
- Goods O.K?
- NO → Noncompliance to be addressed
- YES → component is ready for powder coating

STORES

ADDITIONAL QUALITY INSPECTIONS

- Checking the quality of the grid material periodically
- * Manually rubbing with hand
- By swiveling method

VAG-Valves India Pvt. Ltd.

Product: _____ **DN:** _____ **PN:** _____
Year of Mfg: _____ **Client:** _____ **Contractor:** _____
Project: _____ **Sr. No:** _____

Part number:		Technical Drawing		Inspection Description	
Weight (kg)	Material	SS 304	General Cast part Rubber part Tolerance of welding part	Code/no.	State
-	Date	Name	Name Plate reference drawing 32x20x1	NTS	
Prepared	18-10-11	1000			
Received and Approved	18-10-11	ASR			
Reviewed	01-11-11	SVS			
Rev Received / Approved	02-11-11	DRR			
Drawing number:		Bathnum	Page	Format	Language
VAG		10-32-28-0011	1	A3	
4	3	2			





Bronze (CuZn12-C) Vs Stainless Steel backed PTFE

Austenitic group Stainless steel has good corrosion resistance, usually good formability and an increase in strength as a result of cold work and PTFE is a polymeric material has low material properties and poor performance.

Bronze (CuZn12-C) is a Copper-Tin alloy has good machining properties, high strength and good corrosion resistance making it suitable for pump and valve components.

Bronze is suitable for bearing bushes having medium to high loads and speeds and has good resistance to impact loading or pounding and are of self-lubricating.

Conclusion: In view of above Bronze is superior and recommended as MOC of Bearing Bush.

For VAG valves (INDIA) Pvt. Ltd.



VAG-Valves (India) Private Limited
Plot Nos. 57&56, Phase III, TSIIC
Pashamylaram, Patancheru Mandal
Sangareddy District – 502 307, Telangana
Phone: +91 -08455-224884
Web: www.vag-india.com

CIN No: U29299TG2004PTC044187



Comparison of Brass (CuZn40Pb-2) Vs LTB-2

Brass is an alloy made of copper and zinc, the proportions of zinc and copper can vary to create a range of brasses with varying properties. Has a higher malleability due to which it can be forged to various shapes. And can be used in low friction applications due to self-lubricating properties.

Leaded Tin Bronze grade 1&2 are meant for general castings and have a fair strength and good machining properties they are used in valve fittings but not suitable for high pressure high speed bearings.

Technical Parameters and Use	Brass (CuZn40Pb-2)	LTB-2
Tensile strength(MPa)	430-480	200-300
Yield Strength(MPa)	160-250	100-140
Minimum elongation	10-20	24-30

In view of the above technical parameters, Brass has advantage of higher strength & moderate in elongation due to which these can be used in high pressure application. Both the materials showing self-lubrication property which eases the use of the material as wedge nut & Stem Bearing for our application.

Conclusion: Brass with Higher strength is better suitable for this application.



For VAG Valves (INDIA) Pvt. Ltd.





Stainless Steel AISI 321 vs Stainless Steel (AISI316)

Stainless Steel grade 316 is Austenitic group Stainless steel contains 10-14% Ni giving it better resistance to corrosion.

Stainless steel grade 321 contains titanium maximum of 0.7%. The titanium atoms stabilize the structure of the 304 at temperatures over 800°C. This prevents carbide precipitation at the grain boundaries and protects the metal from corrosion.

Mechanical properties	Stainless Steel AISI 316	Stainless Steel AISI 321
Tensile strength (MPa)	515	500-700
Hardness (Brinell)	205	217
Minimum elongation (% in 2")	40%	40%
Chemical Composition		
% C (Increase the Hardness & Strength)	0.08	0.08
%Si (It is a common deoxidizer, Improves resistance to high temperature scaling)	0.75	1.0
% Mn (Increases strength and responsiveness to heat treatment)	2.0	2.0
%P (Usually added with S to improve machinability and increases strength)	0.045	0.045
%S (Increases machinability)	0.030	0.030
%Cr (Increases resistance to oxidation)	16-18	17 - 19
%Ni (Increases ductility, toughness and corrosion resistance)	10-14	9 – 12
%Ti (Good Weldability)	-	0.70

In view of the above technical parameters the SS 321 material has advantage of higher strength and good weldability due to which this can be used in high pressure application and same corrosion resistance helps in usage for applications where there is continuous contact with water.

Conclusion: The higher the strength and better weldability property is the applicability.

For VAG Valves (INDIA) Pvt. Ltd.

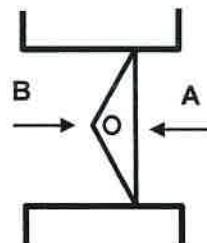


VAG VALVES (INDIA) PVT. LTD		
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN800 PN16	Page 1 of 3	



Valve Torque Calculation

Nominal Size	DN	800
Nominal Pressure	PN	16
Density of Fluid	Kg/m3	1000
Width of profile rubber contact	S in mm	5
Eccentricity of valve (2nd)	E_x in mm	2.5
Sealing diameter	dD in mm	737.9
Zeta value Valve open	Zeta	0.38
Friction factor shaft / bush	müL	0.13
Friction factor seal / valve seat	müDi	0.3
Diameter of the shaft	dL in mm	100
Flow Discharge	m3/hr	5600
Flow Velocity	m/s	3.10
Head loss	Bar	0.1859
Face to Face	Mm	470

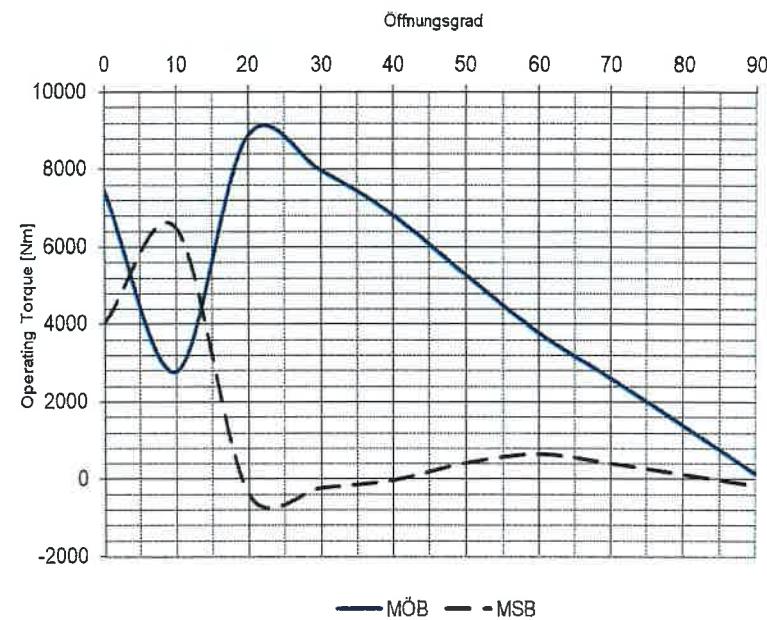


	CLOSED	0	10	20	30	40	50	60	70	80	90	OPEN
opening degree	0	400	100	37	14	6	2.3	1.2	0.6	0.38		
zeta variation valve	u											
velocity	0	2.1	2.7	2.9	3.0	3.1	3.1	3.1	3.1	3.1	3.1	
cmA	0	-0.005	-0.018	-0.025	-0.045	-0.06	-0.115	-0.158	-0.105	0.29		
cmB	0	0.01	-0.02	-0.04	-0.08	-0.115	-0.155	-0.218	-0.275	-0.21		
friction torque bearings	Mreib	4448	4380	4179	3852	3407	2859	2224	1521	772	0	
eccentr. Torque	Mexz	1711	1685	1607	1481	1310	1100	855	585	297	0	
sealing torque	Mdicht	1307	261	65	33	0	0	0	0	0	0	
hydraulic torque from side A	MHA	0	-1769	-2712	-1635	-1189	-696	-527	-378	-131	217	
hydraulic torque from side B	MHB	0	3539	-3013	-2616	-2114	-1333	-710	-521	-342	-157	
MÖB=MHB+MR+MDi+Mex	MÖB	7465	2787	8866	7982	6831	5292	3789	2627	1412	157	
MSB=MHB+MR+MDi-Mex	MSB	4044	6495	-376	-213	-17	426	658	415	133	-157	
MÖA=MHA+MR+MDi-Mex	MÖA	4044	4726	5349	4038	3285	2455	1895	1314	606	-217	
MSA=-MHA+MR+MDi+Mex	MSA	7465	4557	3140	3731	3529	3263	2552	1729	939	217	

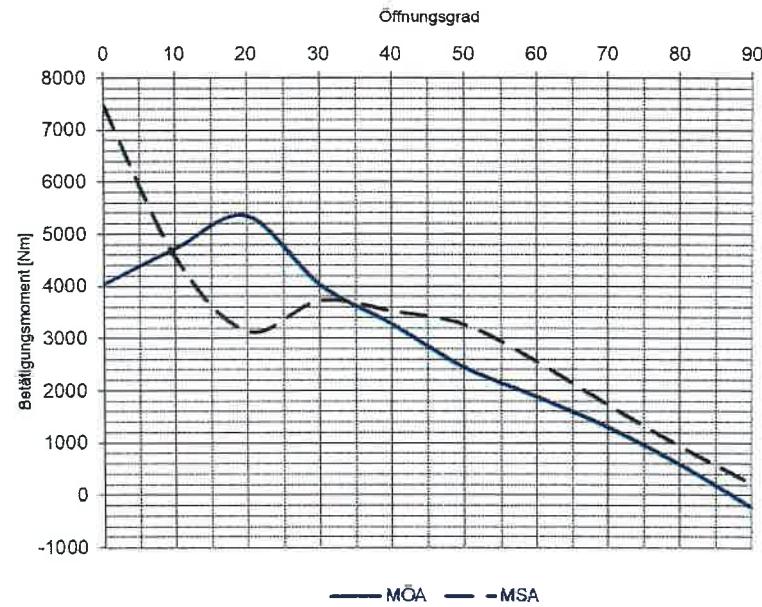
VAG VALVES (INDIA) PVT. LTD		
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN800 PN16	Page 2 of 3	



torque characteristic flow from
side "B"



torque characteristic flow from side "A"



VAG VALVES (INDIA) PVT. LTD		 VAG
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN800 PN16	Page 3 of 3	

Maximum torque @ 22deg opening = 9000 Nm (where discharge 5600 m³/hr & velocity 3.10m/s considered)

Gear Box Sizing Calculation:

Total Valve Torque = 9000 Nm

Factor = 1.25

$$\begin{aligned}\text{Sizing Torque} &= \text{Total Valve Torque} \times \text{factor} \\ &= 9000 \times 1.25 \\ &= 11250 \text{ Nm}\end{aligned}$$

Gear Box (Worm type) selected: AT150

Gear Ratio = 450:1

Gear Box rated torque = 15000 Nm

Mechanical Advantage of Gear Box AT150 = 100

$$\begin{aligned}\text{Input torque to the gear box} &= \text{Torque required by the actuator} \\ &= \text{Sizing torque/Mechanical Advantage} \\ &= 11250/100 \\ &= 112.5 \text{ Nm}\end{aligned}$$

Selected Gear Box satisfies the requirement.

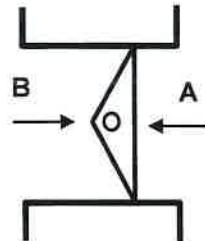


VAG VALVES (INDIA) PVT. LTD		
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN1000 PN16	Page 1 of 3	



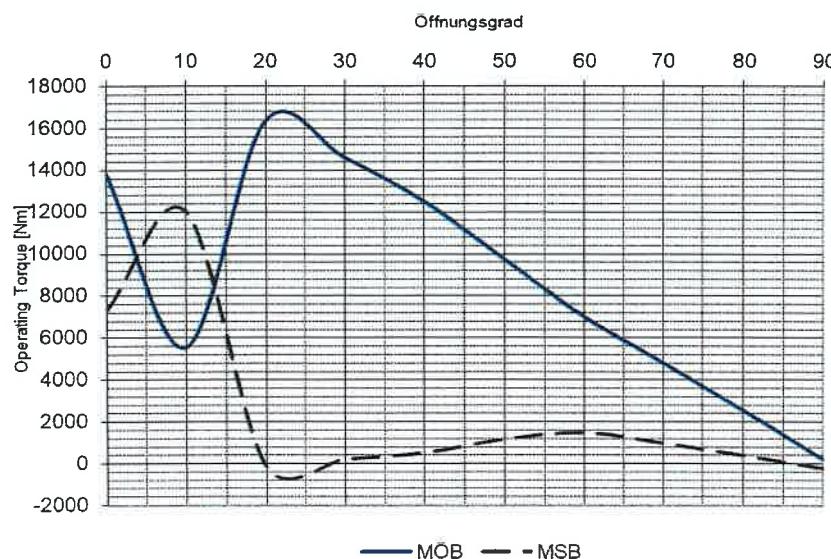
Valve Torque Calculation

Nominal Size	DN	1000
Nominal Pressure	PN	16
Density of Fluid	Kg/m3	1000
Width of profile rubber contact	S in mm	5
Eccentricity of valve (2nd)	E_x in mm	3
Sealing diameter	dD in mm	932
Zeta value Valve open	Zeta	0.34
Friction factor shaft / bush	μL	0.13
Friction factor seal / valve seat	μDi	0.3
Diameter of the shaft	dL in mm	120
Flow Discharge	m3/hr	7900
Flow Velocity	m/s	2.8
Head loss	Bar	0.1355
Face to Face	Mm	550

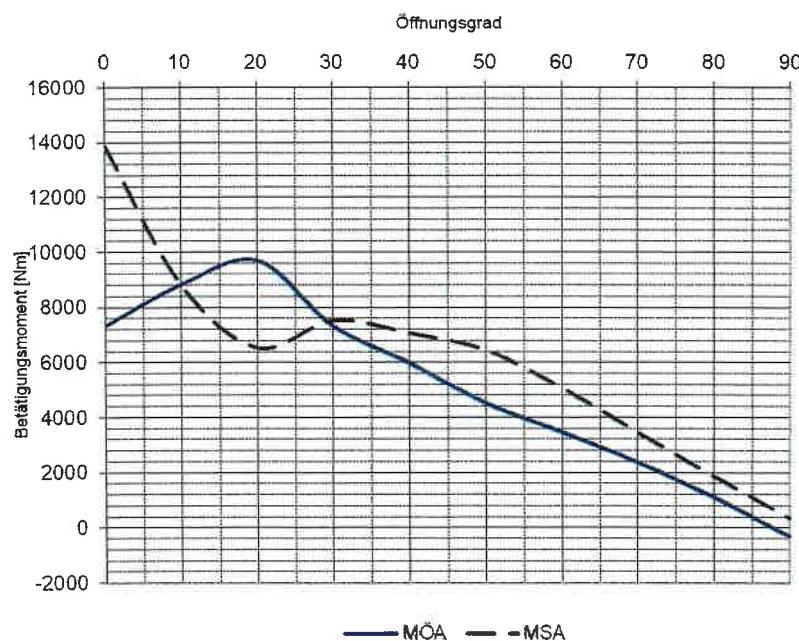


	CLOSED	0	10	20	30	40	50	60	70	80	OPEN
opening degree		0									
zeta variation valve	u	400	100	37	14	6	2.3	1.2	0.6	0.34	
velocity		0	2.0	2.5	2.7	2.8	2.8	2.8	2.8	2.8	2.8
cmA		0	-0.005	-0.018	-0.025	-0.045	-0.06	-0.115	-0.158	-0.105	0.29
cmB		0	0.01	-0.02	-0.04	-0.08	-0.115	-0.155	-0.218	-0.275	-0.21
friction torque bearings	Mreib	8514	8385	8001	7373	6522	5473	4257	2912	1478	0
eccentr. Torque	Mexz	3275	3225	3077	2836	2509	2105	1637	1120	569	0
sealing torque	Mdicht	2085	417	104	52	0	0	0	0	0	0
hydraulic torque from side A	MHA	0	-3235	-4655	-2736	-1967	-1146	-843	-587	-198	318
hydraulic torque from side B	MHB	0	6470	-5172	-4378	-3497	-2197	-1136	-810	-517	-231
MÖB=MHB+MR+MDi+Mex	MÖB	13873	5557	16354	14640	12528	9774	7030	4842	2565	231
MSB=MHB+MR+MDi-Mex	MSB	7324	12046	-145	211	517	1171	1484	982	392	-231
MÖA=MHA+MR+MDi-Mex	MÖA	7324	8812	9683	7326	5981	4514	3462	2379	11107	318
MSA= MHA+MR+MDi+Mex	MSA	13873	8792	6527	7525	7064	6432	5052	3445	1850	318

**torque characteristic flow from
side "B"**



torque characteristic flow from side "A"



VAG VALVES (INDIA) PVT. LTD		
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN1000 PN16	Page 3 of 3	



Maximum torque @ 23deg opening = 17150 Nm (where discharge 7900 m3/hr & velocity 2.79m/s considered)

Gear Box Sizing Calculation:

Total Valve Torque = 17150 Nm

Factor = 1.25

$$\begin{aligned}\text{Sizing Torque} &= \text{Total Valve Torque} \times \text{factor} \\ &= 17150 \times 1.25 \\ &= 21437.5 \text{ Nm}\end{aligned}$$

Gear Box (Worm type) selected: AT300

Gear Ratio = 902:1

Gear Box rated torque = 28000 Nm

Mechanical Advantage of Gear Box AT300 = 210

$$\begin{aligned}\text{Input torque to the gear box} &= \text{Torque required by the actuator} \\ &= \text{Sizing torque/Mechanical Advantage} \\ &= 21437.5/210 \\ &= 102 \text{ Nm}\end{aligned}$$

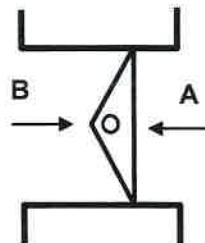
Selected Gear Box satisfies the requirement.



VAG VALVES (INDIA) PVT. LTD			 VAG
EKN Butterfly Valve Calculation		Revision No.	
Design Calculation for EKN DN1200 PN16		Page 1 of 3	

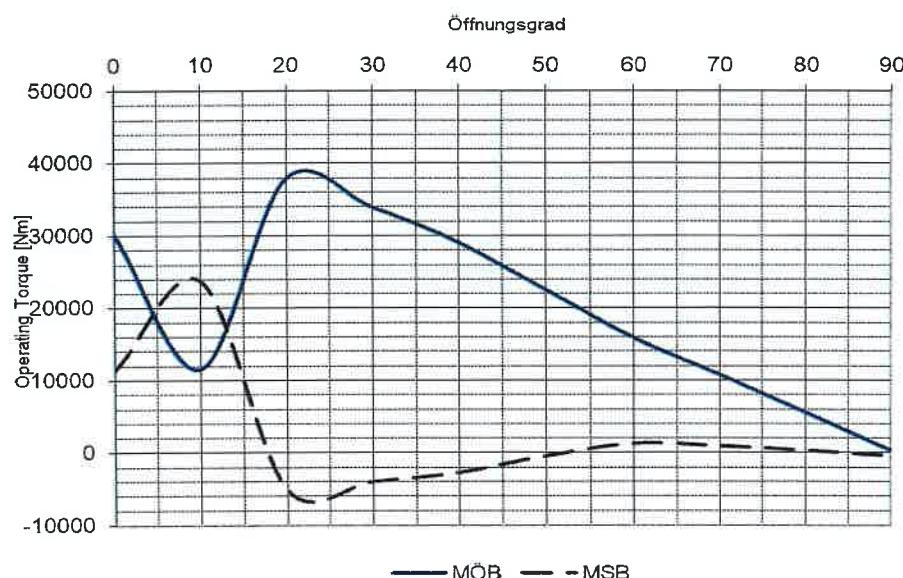
Valve Torque Calculation

Nominal Size	DN	1300
Nominal Pressure	PN	16
Density of Fluid	Kg/m3	1000
Width of profile rubber contact	S in mm	5
Eccentricity of valve (2nd)	E_x in mm	5
Sealing diameter	dD in mm	1227.7
Zeta value Valve open	Zeta	0.25
Friction factor shaft / bush	m _ü L	0.13
Friction factor seal / valve seat	m _ü Di	0.3
Diameter of the shaft	dL in mm	140
Flow Discharge	m ³ /hr	11600
Flow Velocity	m/s	2.91
Head loss	Bar	0.1080
Face to Face	Mm	470

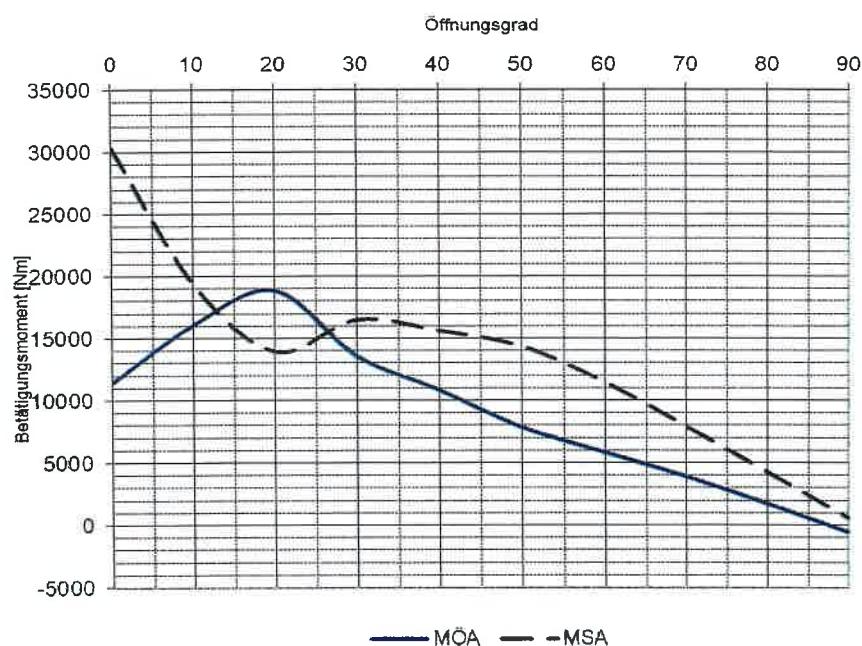


	CLOSED	0	10	20	30	40	50	60	70	80	OPEN 90
opening degree	0	0	10	20	30	40	50	60	70	80	90
zeta variation valve	u	400	100	37	14	6	2.1	1.0	0.5	0.25	
velocity		0	2.0	2.6	2.8	2.9	2.9	2.9	2.9	2.9	2.9
cmA		0	-0.005	-0.018	-0.025	-0.045	-0.06	-0.115	-0.158	-0.105	0.29
cmB		0	0.01	-0.02	-0.04	-0.08	-0.115	-0.155	-0.218	-0.275	-0.21
friction torque bearings	Mreib	17238	16976	16198	14928	13205	11080	8619	5896	2993	0
eccentr. Torque	Mexz	9471	9327	8900	8202	7255	6088	4736	3239	1645	0
sealing torque	Mdicht	3618	724	181	90	0	0	0	0	0	0
hydraulic torque from side A	MHA	0	-7693	-11343	-6732	-4860	-2836	-1934	-1248	-389	580
hydraulic torque from side B	MHB	0	15385	-12604	-10771	-8639	-5436	-2607	-1722	-1019	-420
MÖB=MHB+MR+MDi+Mex	MÖB	30327	11642	37883	33992	29100	22604	15961	10857	5657	420
MSB=MHB+MR+MDi-Mex	MSB	11384	23757	-5125	-3955	-2690	-444	1276	934	330	420
MÖA=MHA+MR+MDi-Mex	MÖA	11384	16064	18822	13548	10809	7828	5817	3905	1738	-580
MSA= MHA+MR+MDi+Mex	MSA	30327	19334	13936	16489	15601	14332	11420	7887	4249	580

**torque characteristic flow from
side "B"**



torque characteristic flow from side "A"



VAG VALVES (INDIA) PVT. LTD		
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN1200 PN16	Page 3 of 3	



Maximum torque @ 22deg opening = 39400 Nm (where discharge 13900 m³/hr & velocity 2.91m/s considered)

Gear Box Sizing Calculation:

Total Valve Torque = 39400 Nm

Factor = 1.25

$$\begin{aligned}\text{Sizing Torque} &= \text{Total Valve Torque} \times \text{factor} \\ &= 39400 \times 1.25 \\ &= 49250 \text{ Nm}\end{aligned}$$

Gear Box (Worm type) selected: AT750

Gear Ratio = 1826:1

Gear Box rated torque = 75000 Nm

Mechanical Advantage of Gear Box AT750 = 400

$$\begin{aligned}\text{Input torque to the gear box} &= \text{Torque required by the actuator} \\ &= \text{Sizing torque/Mechanical Advantage} \\ &= 49250/400 \\ &= 123 \text{ Nm}\end{aligned}$$

Selected Gear Box satisfies the requirement.

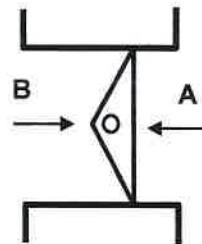


VAG VALVES (INDIA) PVT. LTD		
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN1600 PN16	Page 1 of 3	



Valve Torque Calculation

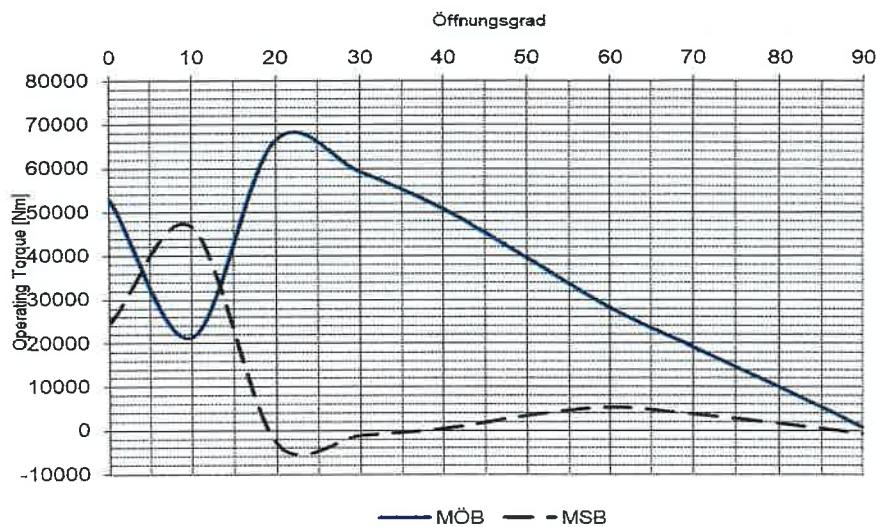
Nominal Size	DN	1600
Nominal Pressure	PN	16
Density of Fluid	Kg/m3	1000
Width of profile rubber contact	S in mm	5
Eccentricity of valve (2nd)	E_x in mm	5
Sealing diameter	dD in mm	1580.3
Zeta value Valve open	Zeta	0.25
Friction factor shaft / bush	m _ü L	0.13
Friction factor seal / valve seat	m _ü Di	0.3
Diameter of the shaft	dL in mm	180
Flow Discharge	m ³ /hr	19800
Flow Velocity	m/s	2.73
Head loss	Bar	0.0955
Face to Face	Mm	790



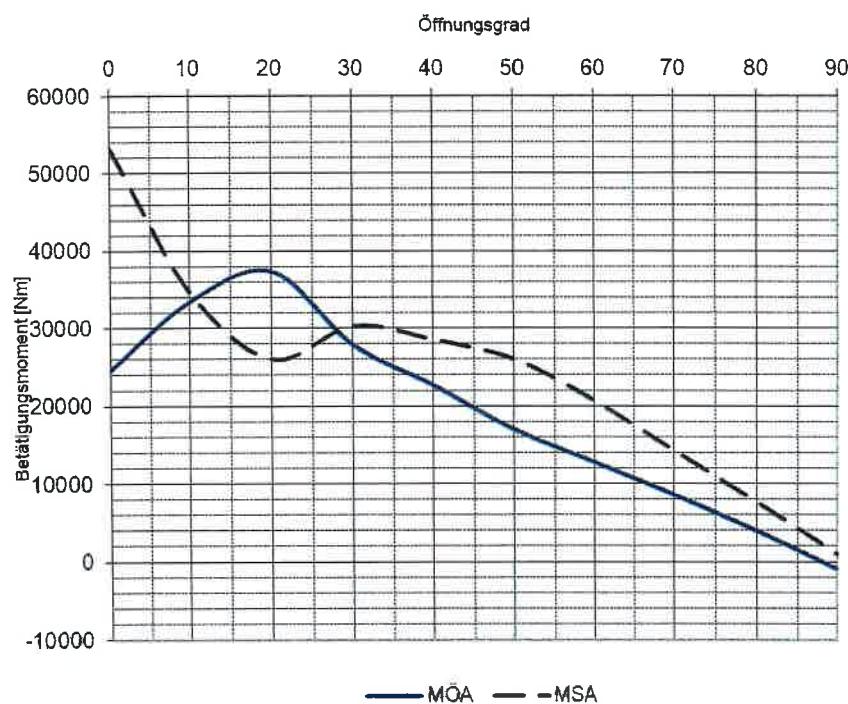
		CLOSED									OPEN
opening degree		0	10	20	30	40	50	60	70	80	90
zeta variation valve		u	400	100	37	14	6	2.1	1.0	0.5	0.25
velocity		0	2.0	2.5	2.6	2.7	2.7	2.7	2.7	2.7	2.7
cmA		0	-0.005	-0.018	-0.025	-0.045	-0.06	-0.115	-0.158	-0.105	0.29
cmB		0	0.01	-0.02	-0.04	-0.08	-0.115	-0.155	-0.218	-0.275	-0.21
friction torque bearings	Mreib	33448	32940	31431	28967	25623	21500	16724	11440	5808	0
eccentr. Torque	Mexz	14294	14077	13432	12379	10950	9188	7147	4889	2482	0
sealing torque	Mdicht	5460	1092	273	136	0	0	0	0	0	0
hydraulic torque from side A	MHA	0	-13418	-19066	-11154	-8001	-4658	-3173	-2047	-638	951
hydraulic torque from side B	MHB	0	26836	-21185	-17846	-14223	-8928	-4277	-2824	-1671	-689
MÖB=MHB+MR+MDi+Mex	MÖB	53202	21272	66321	59328	50796	39616	28148	19153	9961	689
MSB=MHB+MR+MDi-Mex	MSB	24614	46791	-2913	-1121	449	3384	5300	3727	1655	-689
MÖA=MHA+MR+MDi-Mex	MÖA	24614	33373	37338	27878	22674	16970	12750	8598	3964	-951
MSA= MHA+MR+MDi+Mex	MSA	53202	34691	26070	30329	28572	26030	20698	14282	7652	951

VAG VALVES (INDIA) PVT. LTD			
EKN Butterfly Valve Calculation	Revision No.	00	 VAG
Design Calculation for EKN DN1600 PN16		Page 2 of 3	

torque characteristic flow from side "B"



torque characteristic flow from side "A"



VAG VALVES (INDIA) PVT. LTD		
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN1600 PN16	Page 3 of 3	



Maximum torque @ 20deg opening = 68350 Nm (where discharge 19800 m³/hr & velocity 2.73m/s considered)

Gear Box Sizing Calculation:

Total Valve Torque = 68350 Nm

Factor = 1.25

$$\begin{aligned}\text{Sizing Torque} &= \text{Total Valve Torque} \times \text{factor} \\ &= 68350 \times 1.25 \\ &= 85437.5 \text{ Nm}\end{aligned}$$

Gear Box (Worm type) selected: AT1000

Gear Ratio = 2635:1

Gear Box rated torque = 100000 Nm

Mechanical Advantage of Gear Box GS 315 = 600

$$\begin{aligned}\text{Input torque to the gear box} &= \text{Torque required by the actuator} \\ &= \text{Sizing torque}/\text{Mechanical Advantage} \\ &= 85437.5/600 \\ &= 142.4 \text{ Nm}\end{aligned}$$

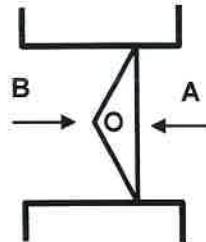
Selected Gear Box satisfies the requirement.



VAG VALVES (INDIA) PVT. LTD		
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN2200 PN16	Page 1 of 3	

Valve Torque Calculation

Nominal Size	DN	2200
Nominal Pressure	PN	16
Density of Fluid	Kg/m3	1000
Width of profile rubber contact	S in mm	5
Eccentricity of valve (2nd)	E_x in mm	6
Sealing diameter	dD in mm	2107
Zeta value Valve open	Zeta	0.3
Friction factor shaft / bush	m _ü L	0.13
Friction factor seal / valve seat	m _ü Di	0.3
Diameter of the shaft	dL in mm	250
Flow Discharge	m ³ /hr	37400
Flow Velocity	m/s	2.74
Head loss	Bar	0.1145
Face to Face	Mm	1030

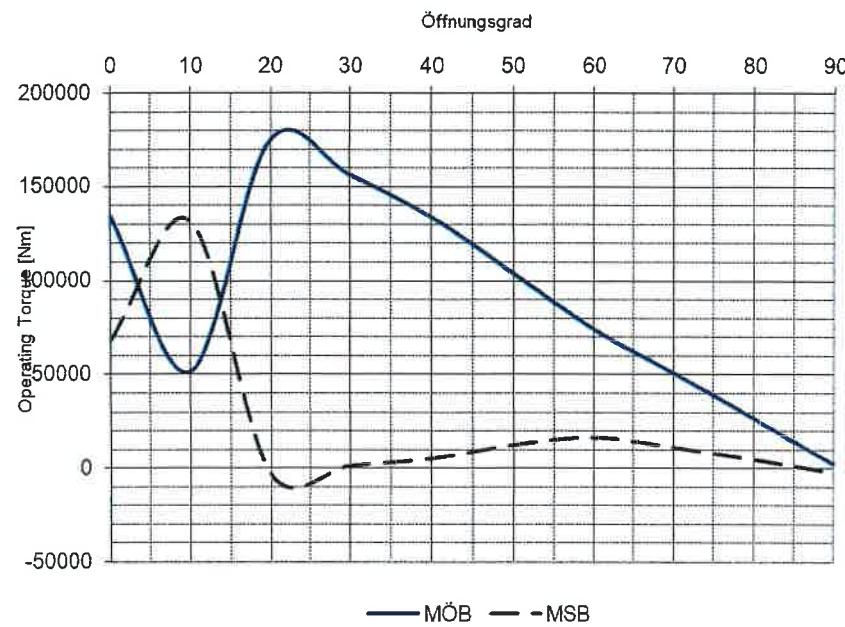


	CLOSED	0	10	20	30	40	50	60	70	80	90
opening degree	0										
zeta variation valve	u	400	100	37	14	6	2.2	1.1	0.5	0.3	
velocity	0	2.0	2.5	2.6	2.7	2.7	2.7	2.7	2.7	2.7	2.7
cmA	0	-0.005	-0.018	-0.025	-0.045	-0.06	-0.115	-0.158	0.105	0.29	
cmB	0	0.01	-0.02	-0.04	-0.08	-0.115	-0.155	-0.218	0.275	-0.21	
friction torque bearings	Mreib	90655	89278	85188	78510	69446	58272	45328	31006	15742	0
eccentr. Torque	Mexz	33473	32964	31454	28988	25642	21516	16736	11448	5812	0
sealing torque	Mdicht	10655	2131	533	266	0	0	0	0	0	0
hydraulic torque from side A	MHA	0	-36546	-51903	-30357	-21774	-12676	-9033	-6099	-1989	3105
hydraulic torque from side B	MHB	0	73093	-57670	-48571	-38709	-24296	-12175	-8415	-5209	-2249
MÖB=MHB+MR+MDi+Mex	MÖB	134782	51280	174845	156336	133796	104084	74239	50869	26764	-2249
MSB=MHB+MR+MDi-Mex	MSB	67837	131537	-3403	1216	5095	12460	16417	11143	4720	-2249
MÖA=MHA+MR+MDi-Mex	MÖA	67837	94991	106170	80145	65578	49433	37624	25656	11919	-3105
MSA=-MHA+MR+MDi+Mex	MSA	134782	87827	65272	77407	73314	67111	53031	36356	19566	3105

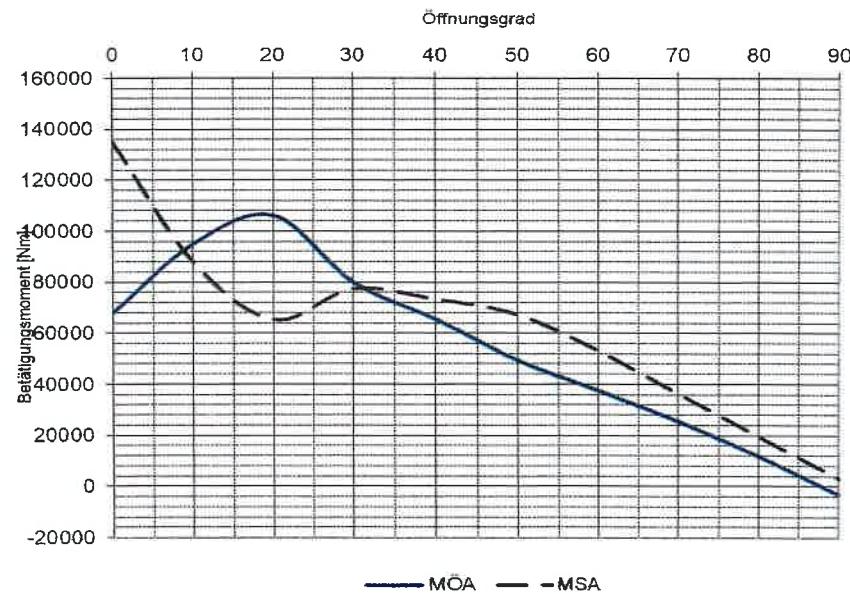
VAG VALVES (INDIA) PVT. LTD		
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN2200 PN16	Page 2 of 3	



torque characteristic flow from
side "B"



torque characteristic flow from side "A"



VAG VALVES (INDIA) PVT. LTD		
EKN Butterfly Valve Calculation	Revision No.	00
Design Calculation for EKN DN2200 PN16	Page 3 of 3	



Maximum torque @ 20deg opening = 179500 Nm (where discharge 37400 m³/hr & velocity 2.74m/s considered)

Gear Box Sizing Calculation:

Total Valve Torque = 179500 Nm

Factor = 1.25

$$\begin{aligned}\text{Sizing Torque} &= \text{Total Valve Torque} \times \text{factor} \\ &= 179500 \times 1.25 \\ &= 224375 \text{ Nm}\end{aligned}$$

Gear Box (Worm type) selected: AT2500

Gear Ratio = 7440:1

Gear Box rated torque = 250000 Nm

Mechanical Advantage of Gear Box AT2500 = 1630

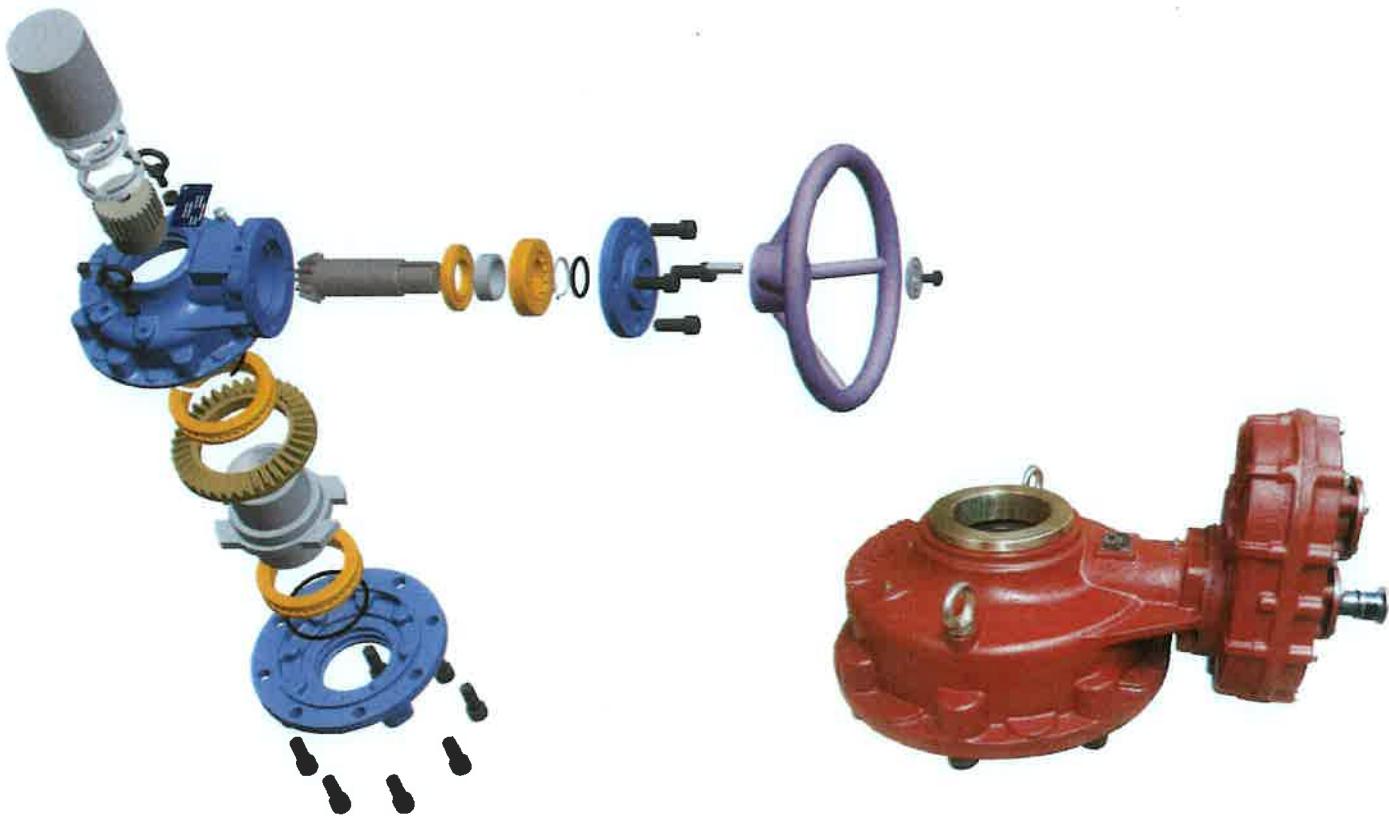
$$\begin{aligned}\text{Input torque to the gear box} &= \text{Torque required by the actuator} \\ &= \text{Sizing torque}/\text{Mechanical Advantage} \\ &= 224375/1630 \\ &= 137.6 \text{ Nm}\end{aligned}$$

Selected Gear Box satisfies the requirement.



Multi-turn Bevel Gear Operators for Manual Operation and Electrical Actuation

ATB Series (B-Type, Non Thrust)



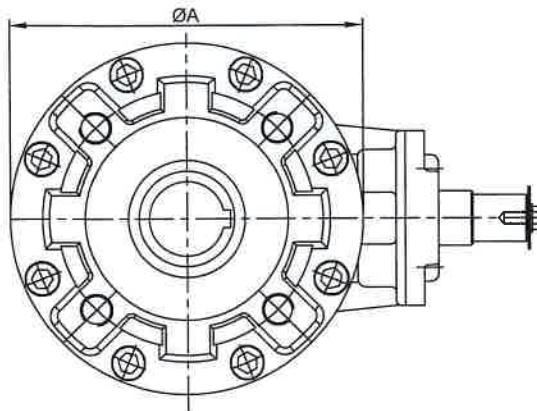
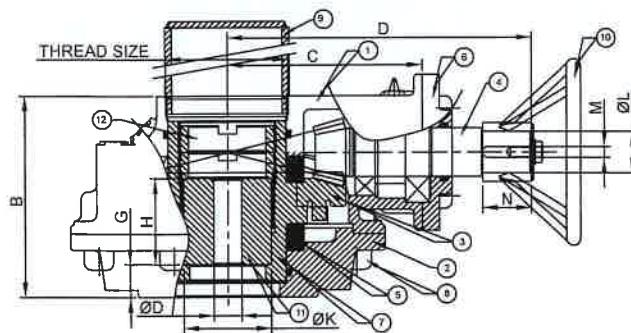
Description

- Robust and compact design with aesthetically pleasing look
- Widely used on valves for oil and gas, chemical, power, waterworks, sewage, etc.
- 12 models up to a torque of 18,000 Nm and F-48 mounting base
- Grease filled for life
- Unique top entry replaceable stem nut in aluminum bronze material for corrosion and wear resistance
- Fully sealed gearbox and completely enclosed gearing
- IP-67 standard enclosure
- Ductile iron casing for higher strength and alloy steel pinions
- High performance roller bearings at input and thrust bearings on output
- Epoxy primer coating is standard
- Powder coated handwheels for smooth and easy operation
- Removable adapter option available for easy slacking of gears
- Additional spur and bevel configurations available to reduce rim pull / input effort and also for 'top operating' requirement

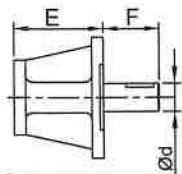
Features

- Housing material options (carbon steel / stainless steel)
- Pinions, fasteners and hand wheel material option available in stainless steel
- Bevel gear material option available in aluminum bronze
- High temperature variant up to +200°C (+392°F) & low temperature variant up to -52°C (-61.6°F) available
- Marine application (all exposed shafts and fasteners in stainless steel)
- Finish painting available on request
- Padlock arrangement option available
- Input flange with various mountings as per ISO 5211 available for electric actuation
- Extension shaft for buried service available
- Auxiliary spur / bevel input reducers available in single reduction / double reduction options
- Twin shaft versions available on bevel gearboxes with single reduction and double reduction auxiliary spur reducers
- Dual Input (90°) / multiple input option available on all models
- Chain wheel operation
- Top operating option available
- Lost motion option available (hammer blow)

Multi-turn Bevel Gear Operators for Manual Operation and Electrical Actuation



Electrical Actuation Flange Mounting For All Models



Actuator Mounting ISO 5211	Od
F10	25
F14	30
F16	35

Flange Drill As Per ISO 5211 Keyway As Per IS 2048

Sr No.	Description	Material	US Standard	IS Standard
1	Housing	Ductile Iron	ASTM A536 65-45-12	SGI 400/12
2	Base Plate	Ductile Iron	ASTM A536 65-45-12	SGI 400/12
3	Bevel Gear	Carbon Steel	ASTM A322 4140	40CrMo3
4	Bevel Pinion	Carbon Steel	ASTM A322 4140	40CrMo3
5	Spacer	Carbon Steel	ASTM A576 1045	45C8
6	Flange Cap	Ductile Iron	ASTM A536 65-45-12	SGI 400/12
7	Adaptor Sleeve	Ductile Iron	ASTM A536 70-50-05	SGI 500/7
8	Hardware	Carbon Steel	-	10.9 Gr or Equivalent
9	Stem Protector	Carbon Steel	ASTM A53	IS 2062 Gr B
10	Handwheel (Pipe)	Carbon Steel	ASTM A53	IS 2062 Gr B
11	Adaptor	Bronze	B148 C95800	-
12	Lock Nut	Carbon Steel	ASTM A576 1045	45C8

Model	Ratio	Rated Output Torque (Nm)	Mech. Advant.	Input Torque (Nm)	Valve Mtg-Flange ISO 5211	Opt. Mtg-Flange ISO	Max. Stem (OI)	A	B	C	D	E	F	G	H	OK	OL	M	N	Recom. Hand-wheel	App. Wgt. (Kg)	Thread Size
ATB-01B	1:1	150	0.9	166	F07/F10	-	20	135	105	88	172	66	58	9	40	33	Ø25	8	35	Ø300	10	13/4X11TPI BSP
ATB-02B	2.5:1	250	2.25	111	F10/F12	--	25	150	110	100	185	66	58	17.5	43	37.5	Ø25	8	35	Ø300	12	2X11TPI BSP
ATB-03B	3:1	400	2.7	148	F10/F12	F14	30	169	113	110	201	66	58	16.5	48	45.5	Ø30	8	35	Ø400	13	2X11TPI BSP
ATB-06B	3.25:1	600	2.92	205	F12/F14	F16	35	193	122	108	187	66	58	16.5	56	53	Ø30	8	35	Ø500	15	2.5X11TPI BSP
ATB-11B	4:1	1100	3.6	305	F14/F16	-	42	228	145	141	217	66	58	23.5	62	63	Ø30	8	35	Ø600	24	3X11TPI BSP
ATB-16B	4.5:1	1600	4.05	395	F16/F20	F25	60	275	168	166	254	66	58	29	77.5	87.5	Ø30	8	35	Ø600	34	3.5X11TPI BSP
ATB-23B	5:1	2500	4.5	556	F20/F25	F30	70	335	174	193	281	66	58	26	83.5	93.5	Ø30	8	35	Ø600	50	4X11TPI BSP
ATB-38B	5.5:1	3800	4.95	768	F25/F30	F35	75	376	202	220	323	66	58	35.5	100	101	Ø38	10	35	Ø600	84	5X11TPI BSP
ATB-55B	6:1	5500	5.4	1018	F30/F35	F40	110	432	235	246	352	70	60	48.5	105	125	Ø38	10	35	Ø750	155	5X11TPI BSP
ATB-85B	6.5:1	8500	5.85	1452	F35/F40	--	120	490	259	267	372	70	60	55.5	110	141	Ø38	10	35	Ø750	185	6X11TPI BSP
ATB-130B	7:1	13000	6.3	2063	F35/F40	--	130	590	290	340	468	70	60	47.5	141.5	177.5	Ø50	14	50	Ø750	280	M218X3P
ATB-180B	8:1	18000	7.2	2500	F40	F48	145	680	323	390	512	70	60	49.5	150	197.5	Ø50	14	50	Ø750	360	M218X3P

Contact us at Gears@Emerson.com



VAG EKN® Butterfly Valve

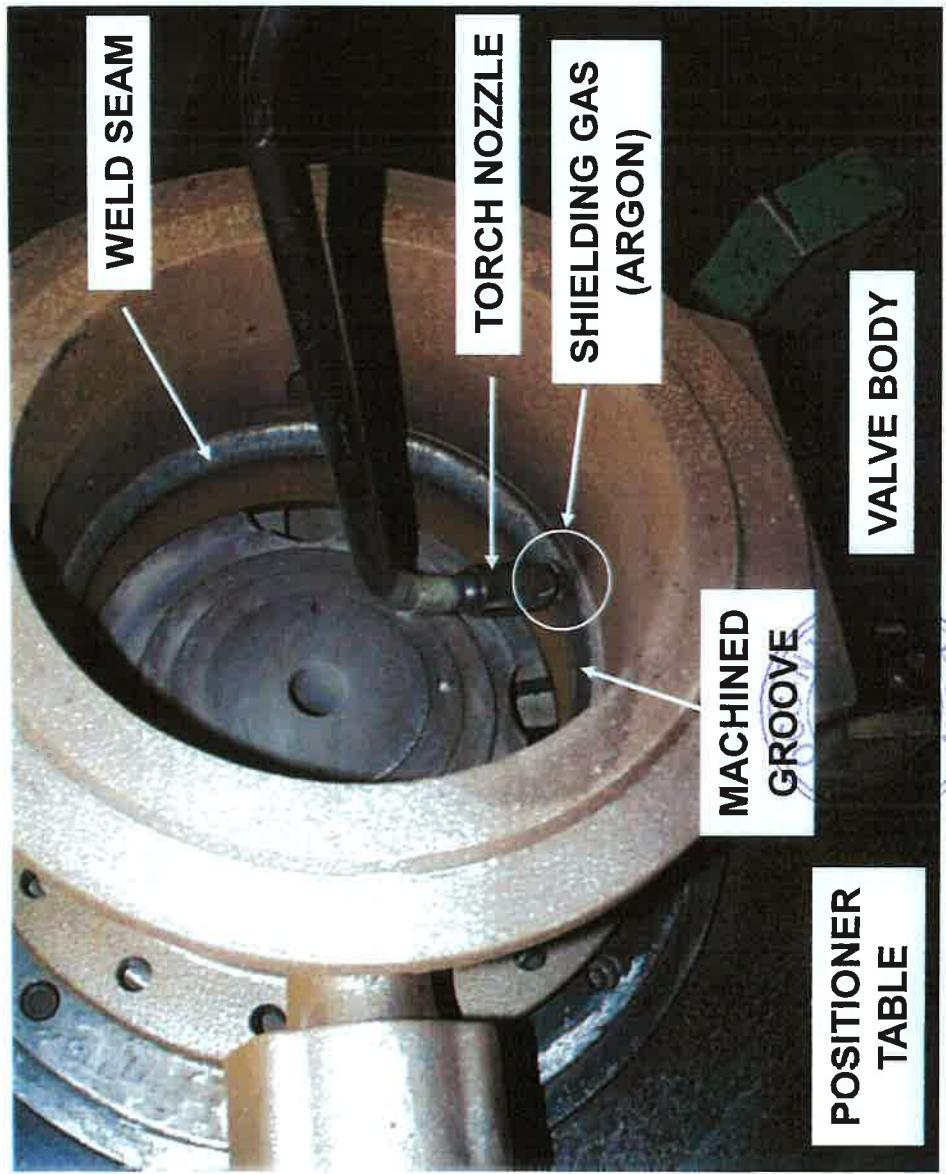
Welding information





VAG EKN® Butterfly Valve

FUSION BONDED SEAT FACE OF VALVES
BY BACK-UP WELDING OF NICKEL (MIG)

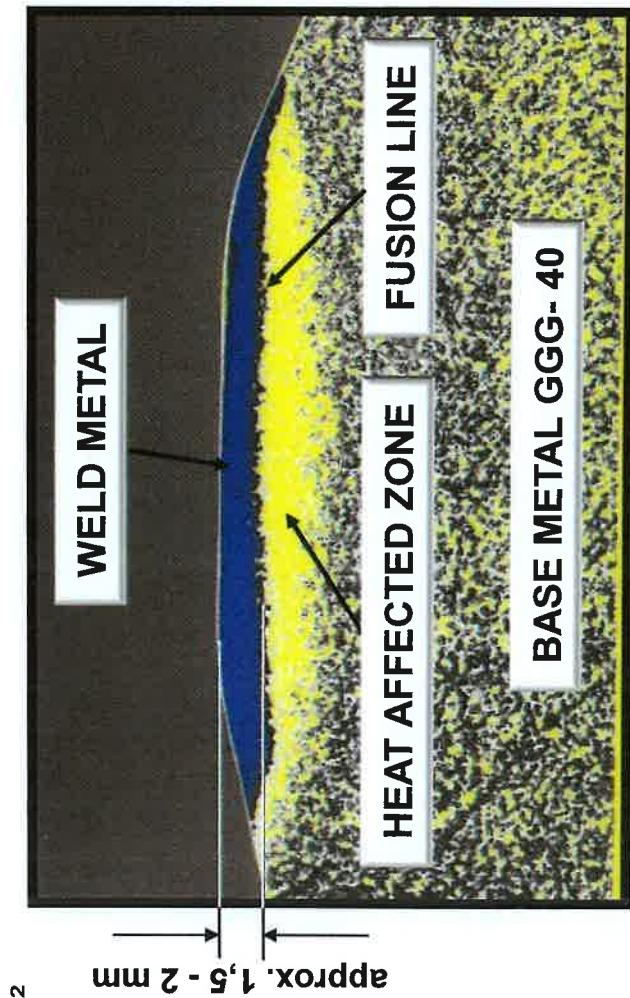


VAG EKN® Butterfly Valve

Attributes of the welding material

- Welding process : MIG
- Protective gas : Argon
- Welding wire : NiCr 20 Nb acc. to DIN 1736
- Material number : 2.4806
- Composition : Ni > 67%, Cr = 18 - 22%, Mn = 2,5 - 3,5%
- Mech. attributes : $R_m = 600 \text{ N/mm}^2$, $R_{p0,2} = 380 \text{ N/mm}^2$
- : Ultimate strain 25%

- Hardness : Basic material = 150 HV
- Transition zone = 330 HV
- Filler metal = 250 HV



HV is the unit for the hardness of the material

Welded seat steps

Pre-machined seat area **Finished welding process on seat area**

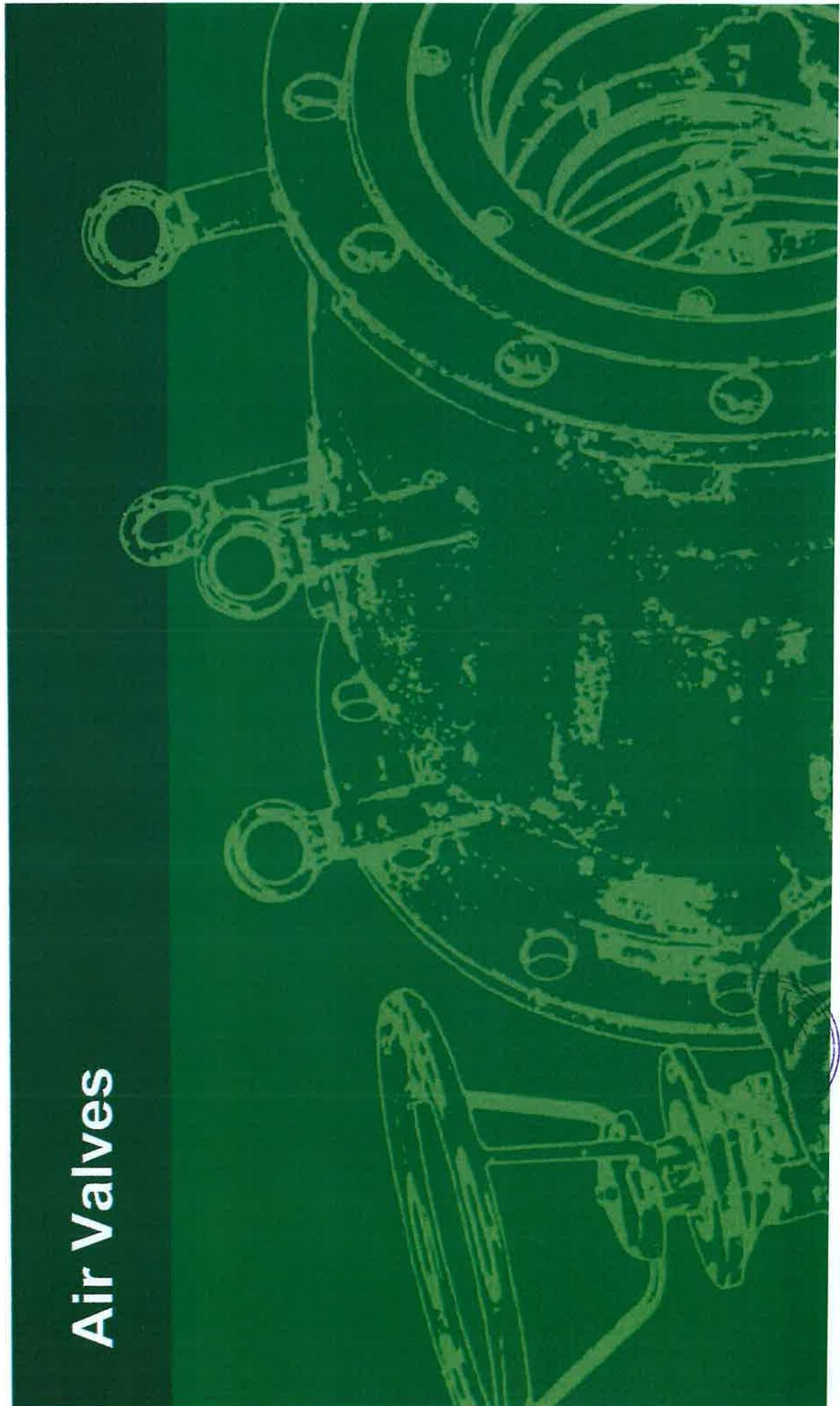


Finished welded seat after machining





Air Valves



Air Valves

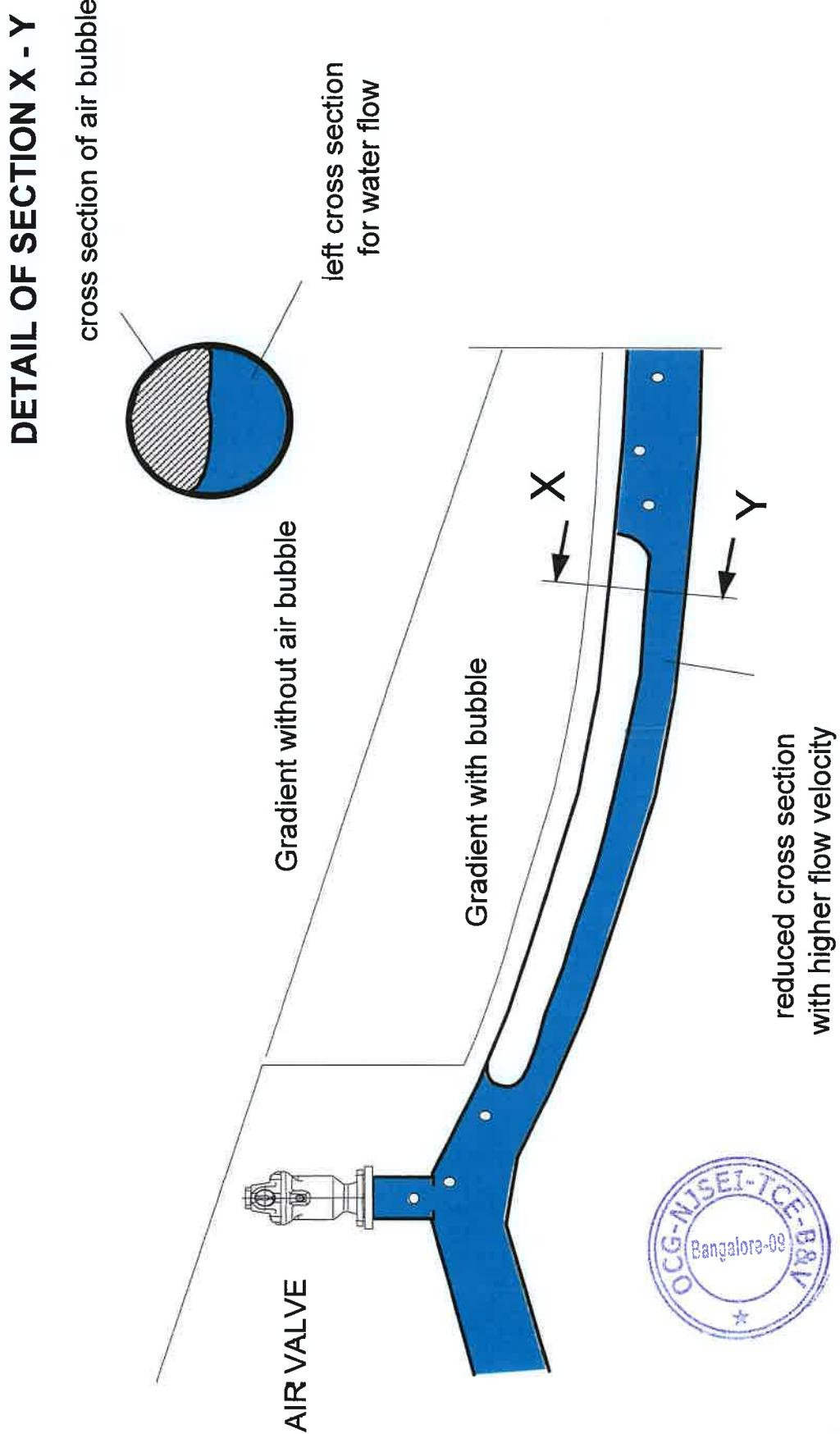
Definition:

**Automatic admission and venting of air in pipelines
of water supply systems**



Air bubble in pipeline

Influence of an air bubble within the pipeline



Purpose of Air Valves

Unexplainable operating faults in the pipeline, like

- Sudden flow rate and pressure changes
- pressure surge (water hammer)
- fluctuating flow rates when pump characteristic curves are flat
- reduced flow rates

may be caused by air pockets !!

Hence pipes must be vented continuously to keep them as air free as possible.

In certain circumstances air must also be admitted into pipelines

Whenever a pipe is drained, in particular during operating faults, pump failures or pipe ruptures, quick air admission is required



Functions of Air Valves

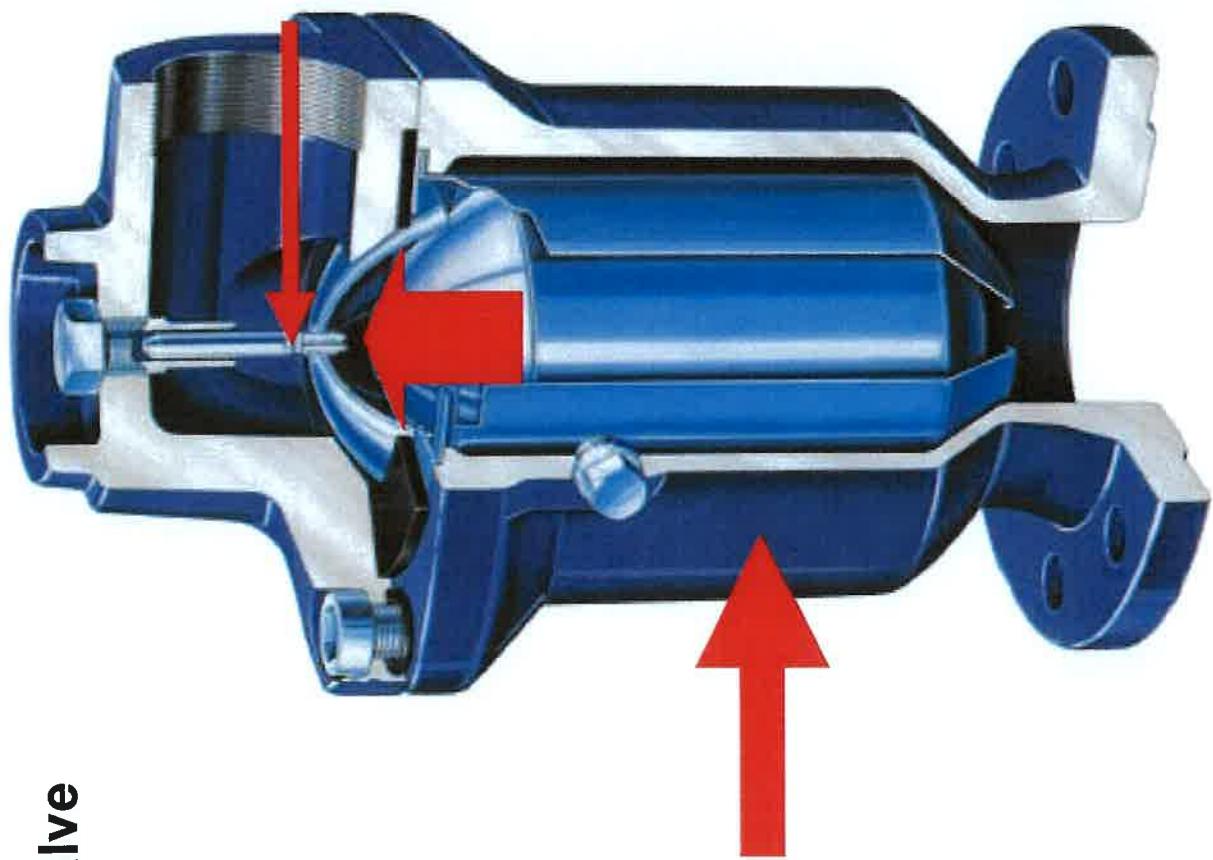
AIR VALVES should be able to:

- Vent air when filling pipelines
- Admit air when draining pipelines
- Continuous venting of pipeline to release small quantities of air carried and released by the medium (water)



Single chamber

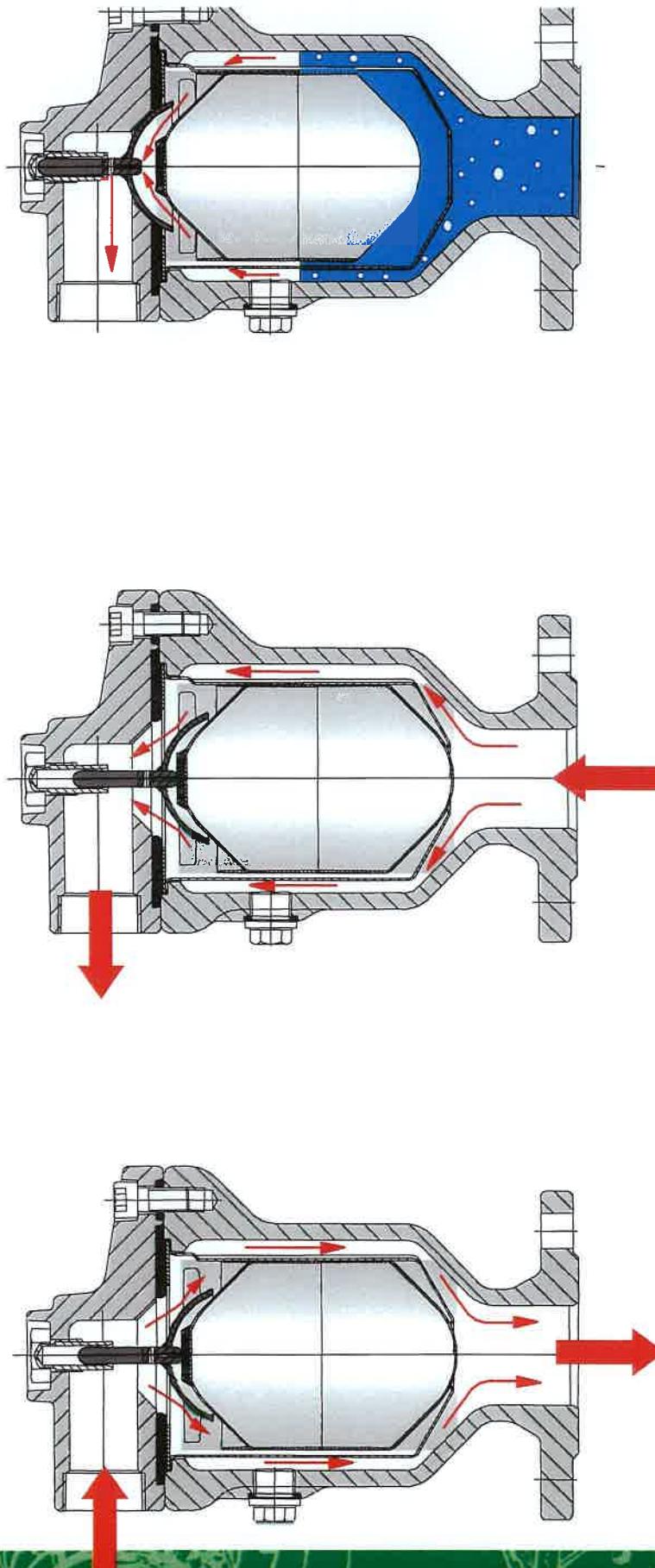
VAG DUOJET® Automatic Air Valve



- Single chamber
- Two orifices
 1. Big venting orifice
 2. Small venting orifice
- Three functions
 1. Admission
 2. Venting
 3. Venting during operation



Single chamber: three functions



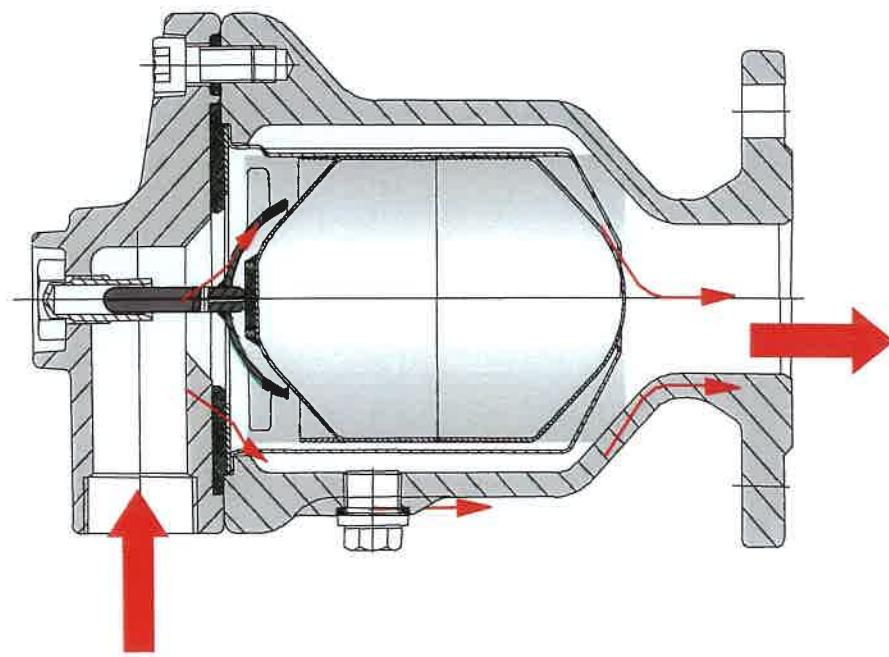
1. Admission during
draining

2. Venting during filling

3. Venting during
operation



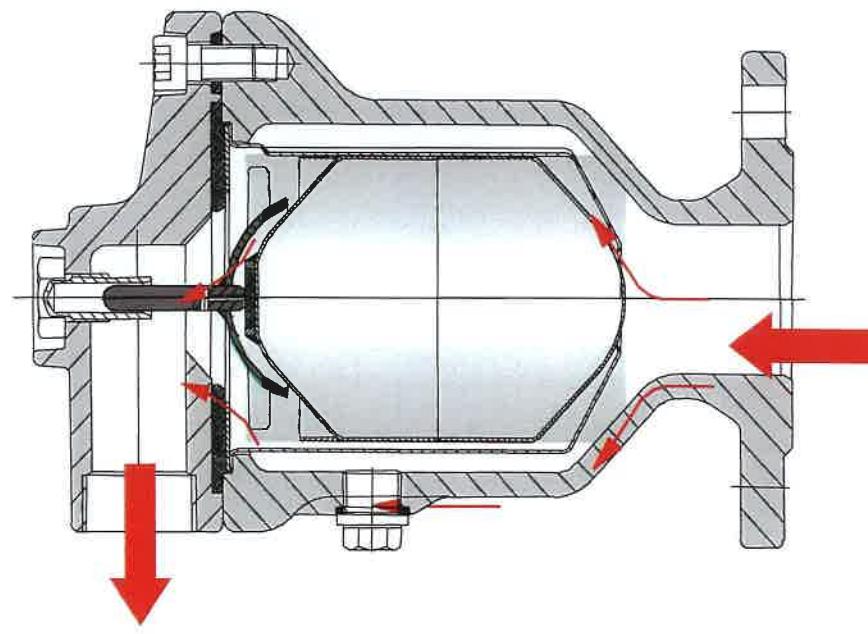
1. Admission



Admission during draining of pipelines



2. Venting



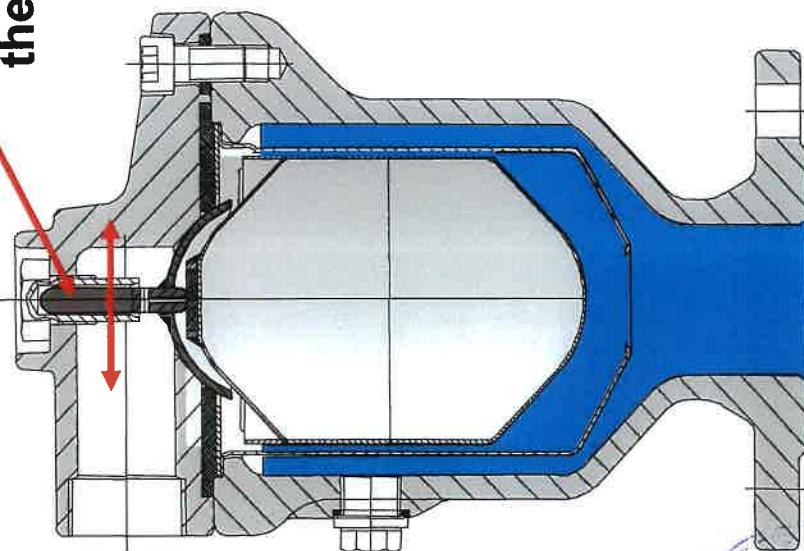
Venting during filling pipelines



3. Venting during operation

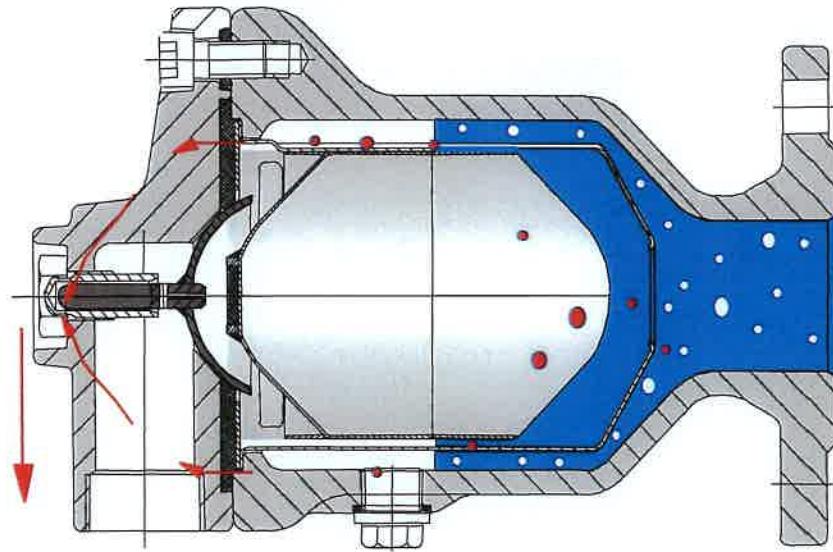
Shut off dome closes the big orifice

The float closes
the small venting
orifice

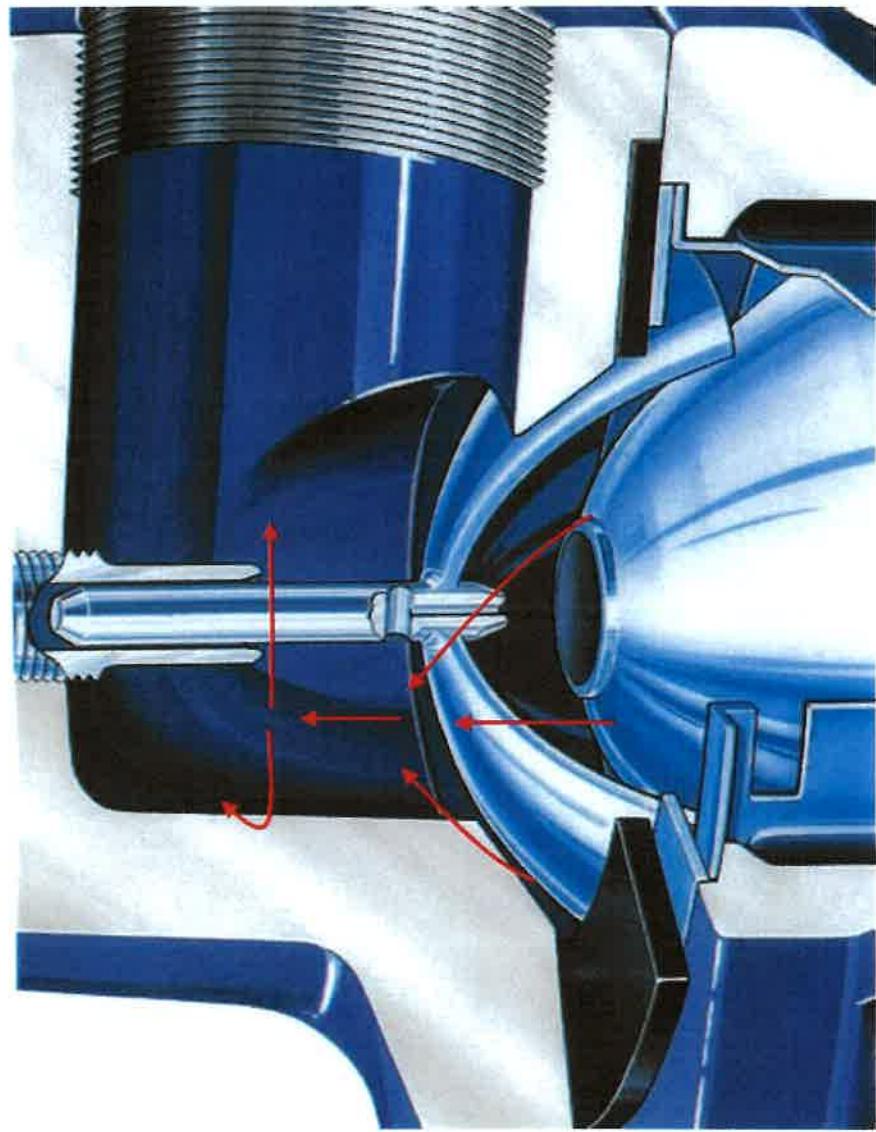


VAG DUOJET®
closed after venting

Venting during operation



3. Venting during operation



Venting during operation



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BRITISH STANDARD

BS EN
593:2004

Industrial valves

Metallic butterfly

valves

The European Standard EN 593:2004 has the status of a
British Standard

ICS 23.060.30



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BS EN 593:2004

National foreword

This British Standard is the official English language version of EN 593:2004. It supersedes BS EN 593:1998 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PSE/7, Industrial valves, to Subcommittee PSE/7/4, Butterfly valves, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of *British Standards Online*.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 22, an inside back cover and a back cover.

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Amendments issued since publication

Amd. No.	Date	Comments

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EUROPEAN STANDARD

EN 593

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2004

ICS 23.060.30

Supersedes EN 593:1998

English version

Industrial valves - Metallic butterfly valves

Robinetterie industrielle - Robinets métalliques à papillon

Industriearmaturen - Metallische Klappen

This European Standard was approved by CEN on 24 December 2003.

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EN 593:2004 (E)

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EN 593:2004 (E)

Foreword

This document (EN 593:2004) has been prepared by Technical Committee CEN/TC 69 "Industrial valves", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2004 and conflicting national standards shall be withdrawn at the latest by August 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

This document supersedes EN 593:1998.

The informative annexes A, B and C can be used for practical application of this product standard.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.



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EN 593:2004 (E)

1 Scope

This standard specifies requirements for butterfly valves having metallic bodies for use in flanged or butt welding piping systems and used for isolating, regulating or control applications.

The PN and Class ranges are :

- PN 2,5 ; PN 6 ; PN 10 ; PN 16 ; PN 25 ; PN 40 ; Class 150 ; Class 300.

The DN range is :

- DN 20 ; DN 25 ; DN 32 ; DN 40 ; DN 50 ; DN 65 ; DN 80 ; DN 100 ; DN 125 ; DN 150 ; DN 200 ; DN 250 ; DN 300 ; DN 350 ; DN 400 ; DN 450 ; DN 500 ; DN 600 ; DN 700 ; DN 750 ; DN 800 ; DN 900 ; DN 1000 ; DN 1200 ; DN 1400 ; DN 1600 ; DN 1800 ; DN 2000 ; DN 2200 ; DN 2400.

DN 750 is used only for Class 150 and Class 300.

For special application as industrial process control valves, see EN 1349 and EN 60534-2-1.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 19:2002, *Industrial valves – Marking of metallic valves*.

EN 287-1, *Approval testing of welders – Fusion welding – Part 1 : Steels*.

EN ISO 15607, *Specification and qualification of welding procedures for metallic materials - Part 1: General rules (ISO 15607:2003)*

EN 558-1, *Industrial valves – Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems – Part 1 : PN-designated valves*.

EN 558-2, *Industrial valves – Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems – Part 2 : Class-designated valves*.

EN 736-1, *Valves – Terminology – Part 1 : Definition of types of valves*.

EN 736-2, *Valves – Terminology – Part 2 : Definition of components of valves*.

EN 736-3:1999, *Valves – Terminology – Part 3 : Definition of terms*.

EN 1092-1, *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1 : Steel flanges*.

EN 1092-2, *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 2 : Cast iron flanges*.

EN 1092-3, *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 3 : Copper alloy flanges*.



VAG VALVES (INDIA) PVT. LTD		
Gate Valve Calculation	Revision No.	00
Design Calculation for GV DN400 PN16	Page 1 of 1	



Gear Box Sizing Calculation:

Total Valve Torque = 270 Nm

Factor = 1.5

$$\begin{aligned}\text{Sizing Torque} &= \text{Total Valve Torque} \times \text{Factor} \\ &= 270 \times 1.5 \\ &= 405 \text{ Nm}\end{aligned}$$

Gear Box Selected: ATB-06B

Gear Ratio = 3.25:1

Gear Box rated torque = 600 Nm

Gear box selected torque is higher than sizing torque.

Hence Safe.



Quarter-turn Worm Gear Operators for Manual Operation

AT Series



Description

- Lean design whilst optimizing robustness and strength
- Used for less critical applications
- 27 models up to a torque of 350,000 Nm and F-60 mounting base
- Grease filled for life
- Fully sealed gearbox and completely enclosed gearing
- Cast iron casing and ductile iron quadrant
- Stroke 0-90° (+5° adjustable)
- Zinc plated fasteners
- High performance axial bearings
- Epoxy primer coating is standard for gearbox
- Powder coated handwheels for smooth and easy operation

Features

- Housing material options (ductile iron / stainless steel)
- Worm shaft, fasteners and hand wheel material option available in stainless steel
- Worm wheel material option available in aluminum bronze
- High temperature variant up to +200°C (+392°F) & low temperature variant up to -52°C (-61.6°F) available
- Marine application (all exposed shafts and fasteners in stainless steel)
- Finish painting is available on request
- IP-67 standard enclosure
- Padlock arrangement option available
- Namur mounting option available for limit switch box fitment
- Extension shaft for buried service available



Options

- Top mounted / top operated version ("handwheel, chainwheel or electric actuator" to be mounted / operated from the top of the gearbox and not from the side)
- Twin-shaft version available for some models of AT and AT-IS series to reduce no. of turns to close for manual operation (for models above AT-300/2/S3 and AT-300/1/S3-IS)
- Stainless steel version of gearboxes available for applications in highly corrosive environments as well as food and beverage, pharmaceutical and sanitary facilities. Option available for all models of AT, AT-IS, IS-EA and CW series
- Gearbox options as per API 6D specifications available for torques up to 3500 Nm
- Part turn 180° operated gearbox option available up to 15000 Nm

Quarter-turn Worm Gear Operators for Manual Operation

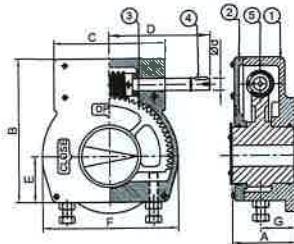


Figure 1

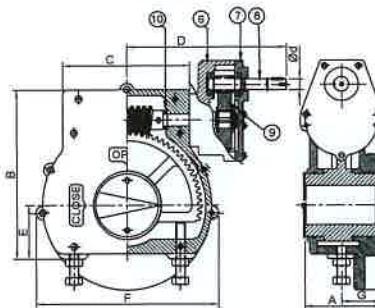
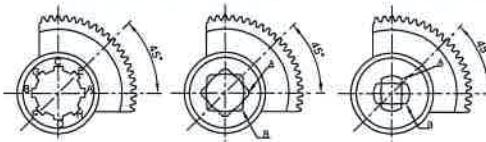


Figure 2



View From Top At Close Position

Note:

Refer to Figure (1) for Models up to "AT-90"

Refer to Figure (2) for Models above "AT-90"

Sc. No.	Description	Material	US Standard	IS Standard
1	Housing	Cast Iron	ASTM A48-83 30A	IS 210 FG 200
2	Top Cover	Cast Iron	ASTM A48-83 30A	IS 210 FG 200
3	Worm Wheel	Ductile Iron	ASTM A70-50-05	SGI 500/7
4	Input Shaft	Carbon Steel	A576-1045	45C8
5	Worm	Carbon Steel	A576-1045	45C8
6	Spur Housing	Cast Iron	ASTM A48-83 30A	IS 210 FG 200
7	Spur Cover	Cast Iron	ASTM A48-83 30A	IS 210 FG 200
8	Spur Pinion	Carbon Steel	A322-4140	40CrMo3
9	Spur Gear	Ductile Iron	ASTM A70-50-05	SGI 500/7
10	Thrust Bearing	Special Steel	ASTM A295 52100	-

Model	Output Torque (Nm)	Mech. Advantage +10%	Ratio	Turns To Close	ISO 5211 Mounting	Max Drive Bore	Approx. Unit Weight (Kg)	Recommended Handwheel (mm)	Handwheel Dimensions (mm)							
									A	B	C	D	E	F	G	Hd
AT 20	250	8	33:1	8.25	F05, F07	20	2.2	Ø175	49.5	110	78	161	36	90	23	12
AT 25	500	10	40:1	10	F07, F10	30	5	Ø250	63	136	98	175	54	108	35	15
AT 30	700	10	40:1	10	F07, F10, F12	32	6	Ø350	74	143	95	201	45	128	39	20
AT 40	1000	11	44:1	11	F10, F12, F14	45	10.5	Ø350	86	176	116	210	70	140	47	20
AT 50	1500	12.5	48:1	12	F10, F12, F14, F16	50	11.5	Ø500	82	198	137	226	81	168	44.5	20
AT 60	2000	15	60:1	15	F10, F12, F14, F16	50	15	Ø500	86	214	156	242	83	176	46	20
AT 70	3500	18	73:1	18.25	F14, F16	80	36	Ø600	113	265	206	250	85	250	52	20
					F25		36.5									
AT 80	3000	22	80:1	20	F12, F14, F16	60	32	Ø500	122.5	245	232	253	84	244	64	20
					F25	80	35		119.5					300		
AT 90	4000	22.5	90:1	22.5	F16, F25	90	62	Ø600	133	305	268	249	100	350	78	20
AT 80/1/S1	4500	50	264:1	66	F12, F14, F16	60	36	Ø500	122.5	245	232	325	84	244	290	20
					F25	80	40		119.5							
AT 70/3/S1	6500	65	292:1	73	F14, F16	80	39	Ø600	113	265	206	324	85	250	302	20
					F25	80	49									
AT 90/1/S1	8000	70	300:1	75	F16, F25	90	68	Ø600	133	305	268	355	100	350	78	20
AT 100/1/S1	10000	75	300:1	75	F25, F30	100	71	Ø600	151	338	263	352	110	377	76	20
AT 150/1/S2	15000	100	450:1	112.5	F25, F30	100	85	Ø600	151	338	263	396	110	377	76	20
AT 250/2/S2	22500	120	456:1	114	F25, F30, F35	110	140	Ø600	157	424	334	430	133	469	88	20
AT 300/2/S3	28000	210	902:1	225.5	F25, F30, F35	150	140	Ø750	157	424	334	471	133	469	88	20
AT 350/2/S3	35000	253	1114:1	287.5	F25, F30, F35	150	160	Ø750	157	424	334	471	133	469	88	20
AT 450/1/S3	45000	270	1175:1	293.75	F30, F35, F40	150	292	Ø750	200	533	425	515	162	592	100	20
AT 500/1/S3	50000	287	1261:1	325.5	F30, F35, F40	150	380	Ø750	203	650	595	599	199	710	105	20
AT 600/1/S3.5	60000	340	1545:1	386.25	F30, F35, F40	150	425	Ø750	203	650	595	654	199	710	105	25
AT 750/1/S4	75000	400	1826:1	447	F40, F48	200	430	Ø750	203	650	595	658	199	710	105	25
AT 1000/1/S4	100000	600	2635:1	656	F40, F48	200	450	Ø750	203	650	595	658	199	710	103	25
AT 1500/1/S5	150000	860	4224:1	1056	F40, F48	250	1000	Ø900	313	890	729	789	276	960	170	30
AT 2000/1/S5	200000	1210	5498:1	1374.5	F40, F48	250	1200	Ø900	313	890	729	789	276	960	170	30
AT 2500/1/S6	250000	1630	7440:1	1860	F48, F60	260	1800	Ø900	385	1154	1006	963	350	1292	175	30
AT 3000/1/S6	300000	2045	9300:1	2325	F48, F60	260	2000	Ø900	385	1154	1006	963	350	1292	175	25
AT 3500/1/S6	350000	2482	11284:1	2821	F48, F60	260	2200	Ø1000	385	1154	1006	963	350	1292	175	35

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Valves for waterworks purposes —

**Part 1: Predominantly key-operated
cast iron gate valves — Code of practice**

ICS 23.060.30



Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee PSE/7, Industrial valves, to Subcommittee PSE/7/3, Cast iron isolating, check and hydrant valves for industrial use and valves for water industry applications, upon which the following bodies were represented:

British Chemical Engineering Contractors Association
BVAA — British Valve and Actuator Association
CMF — Cast Metals Federation
Ductile Iron Producers Association
Energy Industries Council
Institution of Mechanical Engineers
Pipeline Industries Guild
Society of British Water Industries
Water UK

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Foreword

This part of BS 5163 has been prepared under the direction of PSE/7 to facilitate the application of BS EN 1074-1:2000 and BS EN 1074-2:2000. Along with BS 5163-2:2004, BS EN 1074-1:2000 and BS EN 1074-2:2000, this part of BS 5163 supersedes BS 5163:1986, which is withdrawn.

This standard provides guidance on certain aspects of valve selection and operation that will permit the integration of new gate valve products into water distribution networks within the UK with the minimum of physical impact and operating costs. A number of aspects of valve construction considered essential for consistency of operation are provided in this code of practice that are not detailed within BS EN 1074-1:2000 or BS EN 1074-2:2000. Guidance is also provided in this code of practice as to those aspects that might affect operating costs and thus have an impact on selection of appropriate gate valves for UK distribution networks.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.



Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 9 and a back cover.

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1 Scope

This part of BS 5163 gives guidance on selection, including reference to preferred features and operation, of cast iron gate valves, complying with BS EN 1074-1 and BS EN 1074-2, with flanged ends, that are ring key and bar operated. These valves are primarily for underground use for waterworks purposes and primarily for use with water intended for human consumption in the United Kingdom.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 5163-2, *Gate valves for waterworks purposes — Part 2: Stem caps for use on isolating valves and hydrants in pipelines carrying water for human consumption — Specification*.

BS 6920-1, *Suitability of non-metallic products for use in constant contact with water intended for human consumption with regard to their effect on the quality of water — Part 1: Specification*.

BS EN 558-1:1996, *Industrial valves — Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems — Part 1: PN-designated valves*.

BS EN 681-1:1996, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*.

BS EN 736-2, *Valves — Terminology — Part 2: Definition of components of valves*.

BS EN 736-3, *Valves — Terminology — Part 3: Definition of terms*.

BS EN 1074-1, *Valves for water supply — Fitness for purpose requirements and appropriate verification tests — Part 1: General requirements*.

BS EN 1074-2, *Valves for water supply — Fitness for purpose requirements and appropriate verification tests — Part 2: Isolating valves*.

BS EN 1092-2, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 2: Cast iron flanges*.

BS EN 1503-3, *Valves — Materials for bodies, bonnets and covers — Part 3: Cast irons specified in European Standards*.

BS EN 1982:1999, *Copper and copper alloys — Ingots and castings*.

BS EN ISO 5210, *Industrial valves — Multi-turn valve actuator attachments*.

WRc. WIS-4-52-01, *Polymeric anti-corrosion (barrier) coatings. 1992. (www.webookshop.com)*

GREAT BRITAIN. Water Supply (Water Quality) Regulations 2000. London: The Stationery Office.

GREAT BRITAIN. Water Supply (Water Quality) (Scotland) Regulations 2001. London: The Stationery Office.

NOTE In the event of the regulations being revised, the latest version should apply, but care is advised as regulation numbering might change.



3 Terms and definitions

For the purposes of this part of BS 5163, the following terms and definitions apply.

3.1

stem cap

device to enable valves of different sizes and stem configurations to be operated by standard operating keys

NOTE 1 A stem cap is an operating element. See also BS EN 736-2.

NOTE 2 The socket end of operating keys should be dimensionally in accordance with BS 336 up to DN 300.

3.2

ring key and bar

operating key with a socket at its lower end, which engages with the stem cap on the valve or hydrant, and a ring at the upper end to enable a bar to be inserted, which can then be used manually to turn the valve stem

NOTE A ring key and bar is illustrated in Figure 1.

3.3

T key

operating key similar to a ring key and bar but having a fixed short-length upper bar attached centrally at right angles to the shaft

NOTE A T key is illustrated in Figure 2.

3.4

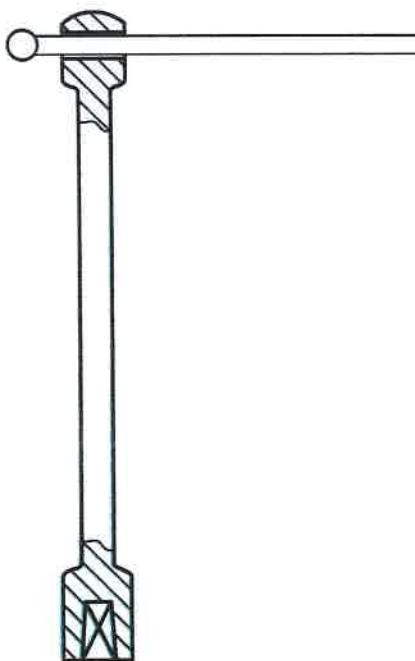
mST

minimum strength torque as specified in BS EN 1074-1

4 Preferred features

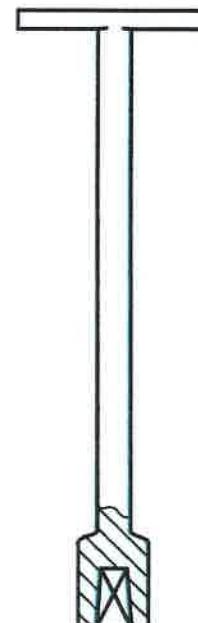
4.1 Type of valves

Gate valves complying with BS EN 1074-2 can be operated by various means, e.g. T key, handwheel or actuator, through a gearbox, or by ring key and bar. See Figure 1 and Figure 2 for examples. For UK purposes it is usual practice to use valves delivered with a stem cap suitable for use with a ring key and bar.



NOTE This sketch is diagrammatic only.

Figure 1 — Typical operator — Ring key and bar



NOTE This sketch is diagrammatic only.

Figure 2 — Typical operator — T key

4.2 Dimensions and tolerances

4.2.1 Face-to-face dimensions and tolerances

Where valves rated PFA 10 and PFA 16 are used, then the face-to-face dimensions and tolerances should be as specified in Table 3, Basic Series 3 in BS EN 558-1:1996.

Where valves rated PFA 25 are used, the face-to-face dimensions and tolerances should be as specified in Table 3, Basic Series 19 in BS EN 558-1:1996.

For valve sizes above DN 1000, the face-to-face dimensions should be by agreement between purchaser and manufacturer.

4.2.2 Body flange dimensions

Valves should comply with BS EN 1092-2, as is required by BS EN 1074-1.

However, where valves are required to be installed in existing pipework installations, then the body flange details may be by agreement between purchaser and manufacturer.

4.2.3 Maximum height dimensions

In order to accommodate the typical depths of burial of pipelines in the UK, valves should be selected with consideration of a maximum overall height dimension as given in Table 1 and illustrated in Figure 3.

4.3 Operational features

4.3.1 Features

It is recommended that only valves with the following features should be used:

- inside screw stem (non-rising) with a stem thread lead of 12 mm;
- wedge type obturator;
- clearway bores as defined in BS EN 736-3.

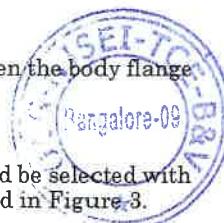
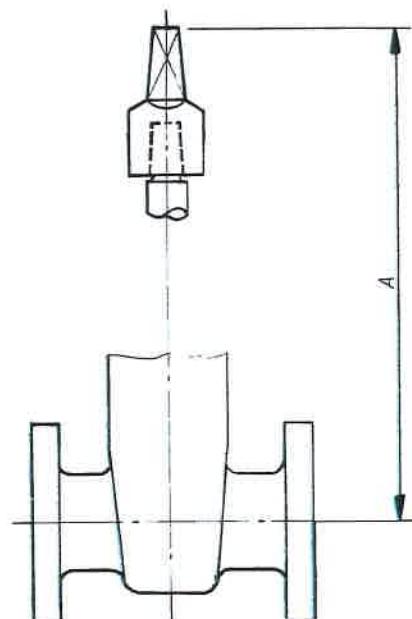


Table 1 — Maximum overall heights (see Figure 3)

Nominal size DN	Centre of waterway to top of stem cap (max), A mm
50	460
65	485
80	530
100	590
125	640
150	695
200	830
250	940
300	1 030
350	1 210
400	1 290
450	1 390
500	1 470
600	1 710

For sizes of valves greater than DN 600 overall heights should be agreed between purchaser and manufacturer.

NOTE The heights stated do not take into account any additional height caused by the fitting of a gearbox, handwheel or actuator.

**Key**

A Maximum overall height (see Table 1)

Figure 3 — Maximum overall height

4.3.2 Stem sealing

When the seal is a toroidal sealing ring or a lip seal device, it is recommended that:

- a) the user selects valves where at least two such seals are used;
- b) in all designs of seals, except stuffing boxes and glands, an additional device should be positioned above the seals to prevent the ingress of foreign matter;
- c) stem seals should be capable of being replaced, with the valve under pressure and in the fully open position.

NOTE The user is warned that there might be some leakage to atmosphere during this operation.

4.3.3 Stem caps

Unless otherwise specified, valves should be selected with stem caps conforming to BS 5163-2.

4.3.4 Actuator operations

For valves operated by electric actuator or gearbox, users should ensure that the dimensions of valve mating details comply with BS EN ISO 5210.

When gearboxes or powered actuators are fitted to valves, it is essential that care be taken in design and operation to ensure the torque input to the valve stem cannot exceed the mST of the valve.

4.4 Coatings

Users should select valves in which all cast iron components exposed to the external environment or to the water contained in the valve are fully coated to provide protection against corrosion. The user should ensure that where polymeric barrier coatings are used they are in accordance with WIS 4-52-01/02.

Vulcanized or bonded elastomer acting as a seating medium should provide an equivalent level of protection against corrosion. Such elastomers should comply with BS EN 681-1:1996 Type WA.

The user should also ensure that where areas of cast iron are threaded and not corrosion protected as a consequence, then that surface area has either been isolated from the atmosphere and the water in the valve by seals or suitable sealing compounds, or a suitable corrosion protection has been applied to the surface of the iron.

Areas of cast iron behind metal trim valve seats should also be similarly protected.

4.5 Materials

In support of the requirements for the materials for manufacture of valves (see BS EN 1074-1), it is recommended that users should select valves whose materials comply with the following.

- a) Cast irons: BS EN 1503-3.
- b) Stainless steel: used for manufacturing valve components, should have a minimum 13 % chrome content.
- c) Copper alloys:

- 1) If ingots or castings are used, BS EN 1982:1999.

NOTE The following grades and their equivalents have traditionally been used for a considerable time. Other alloys may be used with agreement between manufacturer and purchaser.

Leaded Gunmetal to BS EN 1982:1999 grade CC491K, CuSn5Zn5Pb5-C (equivalent to BS 1400:1985, LG2).¹⁾

Leaded Gunmetal to BS EN 1982:1999 grade CC492K, CuSn7Zn2Pb3-C (equivalent to BS 1400:1985, LG4).¹⁾

Aluminium Bronze to BS EN 1982:1999 grade CC331G, CuAl10Fe2-C (equivalent to BS 1400:1985, AB1).¹⁾

Aluminium Bronze to BS EN 1982:1999 grade CC333G, CuAl10Fe5Ni5-C (equivalent to BS 1400:1985, AB2).¹⁾

- 2) If rod or bar is used, BS EN 12163.

- 3) If forging stock is used, BS EN 12165.

- d) Resilient materials: BS EN 681-1:1996 Type WA.

- e) Lubricants should be non-detrimental to other materials with which they might come into contact.

¹⁾ BS 1400:1985 has been withdrawn, superseded by BS EN 1982:1999.

5 Valves for water intended for human consumption — Effect of materials on water quality

When used under the conditions for which they are intended, all materials in contact with or likely to come into contact with water for public supply should be introduced in accordance with the requirements of Regulation 31 of the Water Supply (Water Quality) Regulations 2000 or Regulation 27 of the Water Supply (Water Quality) (Scotland) Regulations 2001.

NOTE This applies pending the introduction of a European Acceptance Scheme (EAS).

All materials that are likely to come into contact with water intended for human consumption in the UK should comply with BS EN 1074-1 and, for non-metallic materials including lubricants, the requirements of BS 6920-1.

6 Marking

To ensure that a valve is suitable for use with ring key and bar operation it is important that valves are clearly differentiated. Users should therefore select cast-iron valves that have been marked, not only with the marking specified by BS EN 1074-1 but also with the number of this code of practice (i.e. BS 5163-1) to indicate their suitability for use with ring key and bar operation. Similarly users should also ensure that seat trim is indicated on the valves, e.g. RES for resilient seated valves and CF for copper alloy seated valves.

7 Preparation for storage and transport

7.1 If packaging arrangements are to be agreed between manufacturer and purchaser as permitted by BS EN 1074-1, the recommendations in Clause 6 should be taken into account.

7.2 After testing, each valve should be drained of the test fluid, cleared of any extraneous matter and suitably protected in preparation for storage and transport.

7.3 Valve obturators, except in resilient seated designs, should be in the closed position when despatched to protect the obturator from transport damage.

The obturator in resilient seated valves should be protected from direct ultra-violet light by being fully opened or by the use of protective packaging or end caps.

NOTE BS EN 12351 covers end caps.



Annex A (normative)

Information to be supplied by the purchaser

The following information should be agreed between the purchaser and supplier:

- a) number and year of this British Standard (i.e. BS 5163-1:2004);
- b) number and year of BS EN 1074-1;
- c) nominal size (DN);
- d) nominal pressure (PFA);
- e) whether a resilient seated or metal seated valve is required;
- f) trim materials required;
- g) form of stem sealing required;
- h) fluid to pass through valve if other than potable water;
- i) maximum differential pressure in operation;
- j) whether a handwheel is required;
- k) direction of closure;
- l) if actuator operation is required, details of the power supply and service conditions;
- m) whether a test certificate is required;
- n) requirements for any special marking;
- o) special requirements for despatch;
- p) whether the valve will be used in a closed end or open end application;
- q) orientation of the valve stem and seats when the valve is installed;
- r) for valves above DN 600, the size of stem cap and overall height requirements;
- s) if by-pass valves are required, any variation of face-to-face dimension;
- t) any special gearing requirements;
- u) for valves above DN 1 000, the face-to-face dimension required;
- v) for existing pipework, details of any special body flange requirements.





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Bibliography

Standards publications

BS 336, *Specification for fire hose couplings and ancillary equipment.*

BS 1400:1985, *Specification for copper alloy ingots and copper alloy and high conductivity castings.²⁾*

BS EN 12351, *Industrial valves — Protective caps for valves with flanged connections.*



²⁾ BS 1400:1985 has been withdrawn, superseded by BS EN 1982:1999.

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Table 2 — Dimensions of basic series

Dimensions in millimetres

DN	Basic series														DN	
	1	2	3	4	5	7	8 ^a	9 ^a	10	11 ^a	12	13	14	15		
10	130	210	102	—	—	108	90	105	—	—	130	—	115	—	—	—
15	130	210	108	140	165	108	90	105	57	130	—	115	—	80	140	
20	150	230	117	152	190	117	95	115	64	130	—	120	—	90	152	
25	160	230	127	165	216	127	100	115	127	70	140	—	125	120	165	
32	180	260	140	178	229	146	105	130	140	76	165	—	130	140	178	
40	200	260	165	190	241	159	115	130	165	83	165	106	140	240	33	
50	230	300	178	216	292	190	125	150	203	102	203	108	150	250	43	
65	290	340	190	241	330	216	145	170	216	108	222	112	170	270	46	
80	310	380	203	283	356	254	155	190	241	121	241	114	180	280	64	
100	350	430	229	305	432	305	175	215	292	146	305	127	190	300	64	
125	400	500	254	381	508	356	200	250	330	178	356	140	200	325	70	
150	480	550	267	403	559	406	225	275	356	203	394	140	210	350	76	
200	600	650	292	419	660	521	275	325	495	248	457	152	230	400	89	
250	730	775	330	457	787	635	325	390	622	311	533	165	250	450	114	
300	850	900	356	502	838	749	375	450	698	349	610	178	270	500	114	
350	980	1 025	381	762	889	—	425	515	787	394	686	190	290	550	127	
400	1 100	1 150	406	838	991	—	475	575	914	457	762	216	310	600	140	
450	1 200	1 275	432	914	1 092	—	500	—	978	483	864	222	330	650	152	
500	1 250	1 400	457	991	1 194	—	—	700	978	—	914	229	350	700	152	
600	1 450	1 600	508	1 143	1 397	—	—	—	1 295	—	1 067	267	390	800	178	
700	1 650	—	610	—	1 549	—	—	—	1 448	—	—	292	430	900	229	
750	—	—	610	1 397	1 651	—	—	—	1 524	—	—	—	—	—	—	
800	1 850	—	660	—	1 651	—	—	—	1 676	—	—	318	470	1 000	241	
900	2 050	—	711	—	2 083	—	—	—	1 956	—	—	330	510	1 100	241	
1 000	2 250	—	813	—	—	—	—	—	—	—	—	410	550	1 200	300	
1 200	—	—	—	—	—	—	—	—	—	—	—	470	630	—	350	
1 400	—	—	—	—	—	—	—	—	—	—	—	530	710	—	390	
1 600	—	—	—	—	—	—	—	—	—	—	—	600	790	—	440	
1 800	—	—	—	—	—	—	—	—	—	—	—	670	870	—	490	
2 000	—	—	—	—	—	—	—	—	—	—	—	760	950	—	540	

^a CTF dimensions for angle pattern valves.



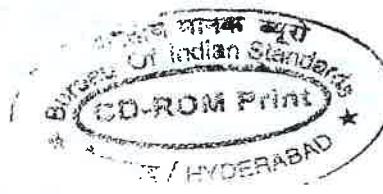
भारतीय मानक

जलकल के लिए स्लूस वाल्व (50 से 1 200 मिमी
साइज के) — विशिष्टि

Indian Standard

**SLUICE VALVE FOR WATER WORKS PURPOSES
(50 TO 1 200 mm SIZE) — SPECIFICATION**

ICS 23.060.30



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Indian Standard

SLUICE VALVE FOR WATER WORKS PURPOSES (50 TO 1 200 mm SIZE) — SPECIFICATION

1 SCOPE

This standard covers requirements for non-rising stem type sluice valves from 50 to 1 200 mm sizes used for water supply up to 45°C and having double flanged ends for connections.

2 REFERENCES

The Indian Standards given in Annex E contain provisions, which through reference in this text, constitute provision 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 E.

3 TERMINOLOGY

For the purpose of this standard, the definitions, covered in IS 4854 (Part 1) shall apply.

4 NOMINAL PRESSURES

Sluice valves shall be designated by nominal pressure (PN) defined as the maximum permissible gauge working pressure in MPa for the sizes indicated as follows:

Nominal Pressure (PN)	Nominal Sizes
MPa	mm
PN 1.0	50 to 1 200
PN 1.6	50 to 600

5 NOMINAL SIZES

5.1 Sluice valves shall be of the following sizes:

50, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 750, 800, 900, 1 000, 1 100 and 1 200 mm.

5.1.1 The nominal size shall refer to the nominal bore of the waterway. The actual bore at any point shall not be less than the nominal size given in 5.1.

6 MATERIAL

The material for different component parts of sluice valves shall conform to requirements given in Table 1. Where alternative materials are specified in Table 1, these may be used with the agreement of purchaser

except the combination of stem and nut for wedge (see 7.7).

7 MANUFACTURE

7.1 A typical illustration of a sluice valve is given in Fig. 1A, 1B and 1C.

7.2 Bodies and Bonnets

7.2.1 Bodies and bonnets shall be so designed as to withstand the test pressure specified in 10.1.1. The bodies of the valves shall be fitted with seat rings securely fixed in machined recesses.

7.2.2 The manufacturer shall provide a reasonable clearance behind the rear face of the flange on body and bonnet to provide free access to use spanners for assembling and dismantling.

7.2.3 The portions of bonnet (gland and stuffing box) which come in contact with spindle shall be provided whenever required by the customer with bushings of minimum 3 mm thickness and of material as specified in Table 1 as anti-frictional devices.

7.2.4 The dimensions of sluice valve assemblies are given in Tables 2 and 3 read in conjunction with Fig. 1A, 1B and 1C.

7.3 Flanges

The Flanges and their dimensions of drilling shall be in accordance with the requirements given in IS 1538 unless otherwise specified by the purchaser in the contract. The requirements for valve sizes 50 mm and 65 mm are given in Table 3A.

7.4 Wedges

7.4.1 Valves shall be fitted with double faced cast iron wedge made in one piece and having two machined facing rings securely fixed into machined recesses in the wedge. When shut, the wedge-facing ring shall ride high on the body seat ring to allow for wear. The minimum wear travel shall be 25 percent of the face width (B) of the seat ring as given in Table 4 and read in conjunction with Fig. 2A and 2B.

7.4.2 The wedge faces shall be smooth finished and shall have an equal inclination of not less than 4° up to 600 mm size and not less than 2° in sizes 700 mm and above on each side of the face of the wedge.

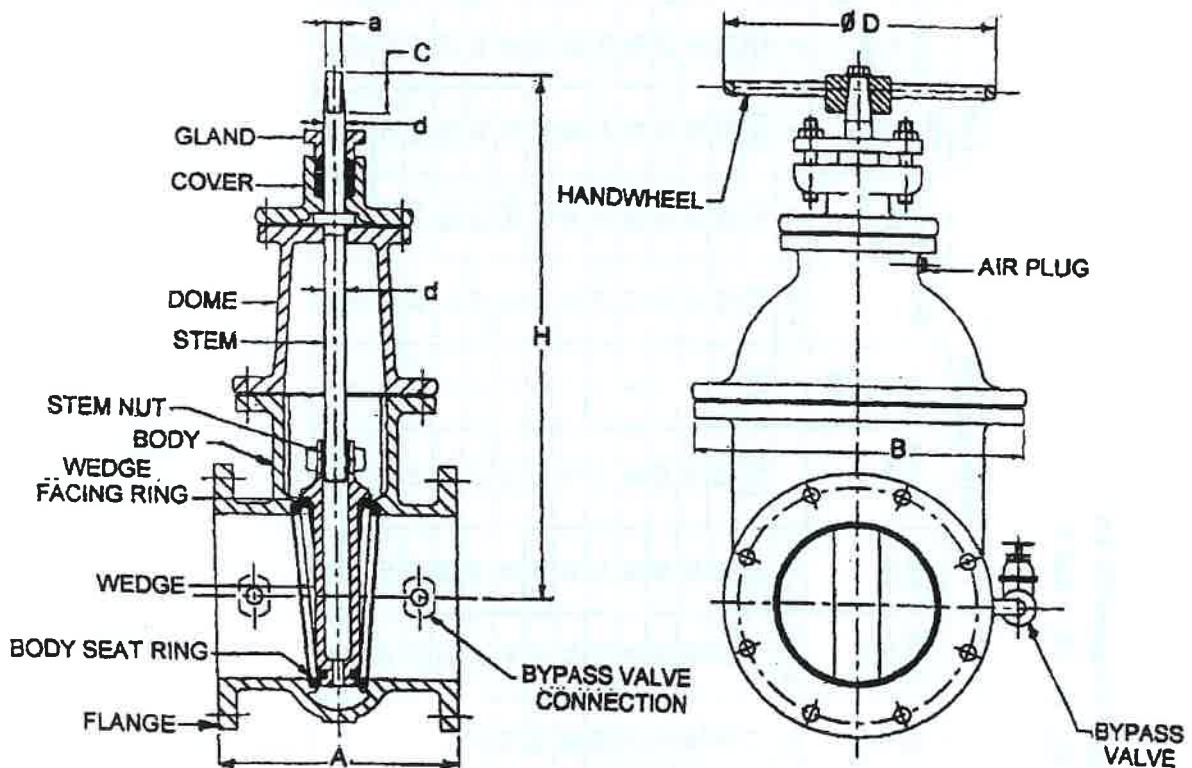


FIG. 1B TYPICAL SKETCH OF A SLUICE VALVE FOR SIZE 200 mm ϕ AND ABOVE

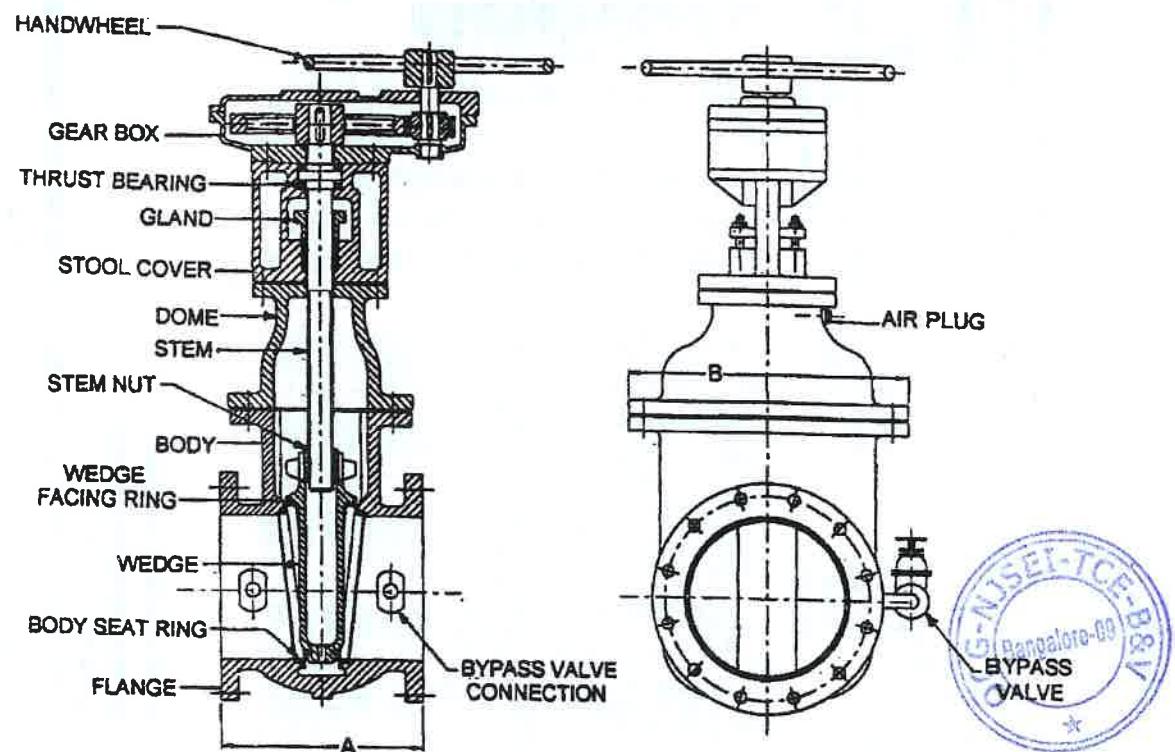


FIG. 1C TYPICAL SKETCH OF A SLUICE VALVE WITH BALL THRUST BEARING AND SPUR GEAR ARRANGEMENT

Table 3 Dimensions of Sluice Valves for Nominal Pressure PN 1.6
 (Clause 7.2.4, 7.7.1, 7.9, 7.11, 7.12, 7.13 and Fig. 1A, 1B, 4 and 5)

All dimensions in millimetres.



Sl No.	No. nominal Size	BODY				STEM				STUFFING BOX				CAP			
		Length Over Flanges	Width	Overall Height	Square	Length of Square	Dia of Stem	Length from Collar	Collar Thickness	Dia of Collar	Depth of Nut	Inside Dia	Packing Size	No. of Packing	Size of Hand Wheel	Size of Bottom Square	Length of Square
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
i)	050	178	250	215	160	365	15	30	22	225	180	08	50	30	42	10	4
ii)	065	190	270	230	215	380	15	30	22	225	180	08	50	30	42	10	4
iii)	080	203	280	230	220	425	15	30	22	240	190	08	50	30	42	10	4
iv)	100	229	300	255	250	470	18	36	27	240	190	08	53	35	47	10	4
v)	125	254	325	266	310	485	18	36	27	250	200	10	55	35	47	10	5
vi)	150	267	350	280	330	595	18	36	27	250	200	10	55	35	47	10	5
vii)	200	292	400	318	460	725	22	42	32	340	280	10	65	45	56	12	5
viii)	250	330	450	355	495	835	25	48	36	450	280	10	65	50	60	12	5
ix)	300	356	500	380	585	910	25	48	36	465	240	15	70	50	60	12	5
x)	350	381	550	690	730	10300	30	55	42								
xi)	406	406	600	750	800	11000	35	60	47								
xii)	450	432	650	820	850	12100	37	65	52								
xiii)	500	457	700	880	930	13400	37	65	52								
xiv)	600	508	800	10000	10500	15000	42	70	57								

NOTES

- 1 - PD Preferred dimensions (short body).
- 2 - ALT I Alternate I dimensions (long body).
- 3 - ALT II Alternate II dimensions.
- 4 - \$ Dimensions given under Alternate II will stand deleted with effect from 01 April 2005.

Tolerances on Length L

- Up to and including 300 mm ± 2 mm
- Above 300 and including 600 mm ± 3 mm

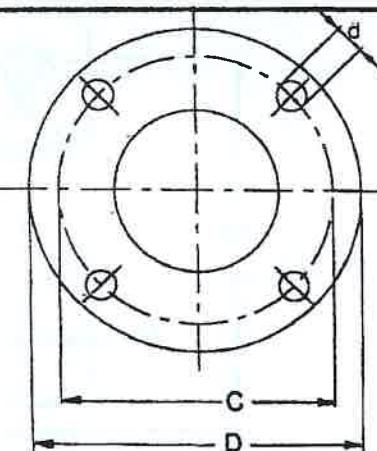
Other Tolerances

- Tolerances on Square, a and X ± 0.5 mm
- Tolerances on Length of Square, C ± 1.0 mm
- Tolerances on Size of Hand wheel, D ± 5.0 mm
- Tolerances on Length between Squares ± 0.5 mm

Table 3A Flanges of Sluice Valves

(Clause 7.3)

All dimensions in millimetres.



Sl No.	Particulars	Dimensions for Nominal Size	
		50	65
1.	Outside diameter (D)	165 $+1.5$ -1.0	185 $+1.5$ -1.0
2.	Thickness of flange	165 $+2.0$ -0.0	16 $+2.0$ -0.0
3.	Diameter of bolt circle (C)	125 ± 1.0	145 ± 1.0
4.	Number of bolts (Equally spaced off centre)	4	4
5.	Diameter of bolt holes (d)	19	19
6.	Diameter of bolts	16	16

Table 4 Dimensions of Body, Seat and Wedge Facing Rings

(Clause 7.4)

All dimensions in millimetres.

Valve Size	A	B	C	D
50	7	10	3	5
65	8	11	3	6
80	8	12	3	6
100	9	13	3	7
125	9	14	4	7
150	9	14	4	7
200	11	16	4	8
250	11	17	4	9
300	13	19	5	10
350	13	19	5	10
400	13	19	5	10
450	13	19	5	10
500	15	22	6	11
600	16	24	6	12
700	19	28	7	14
750	19	28	7	14
800	22	32	8	16
900	24	36	9	18
1000	27	40	10	20
1100	30	44	11	22
1200	30	44	11	22

7.5 Guides and Lugs

The guides and the lugs shall be provided to guide the wedge through its full travel. It shall be optional for the manufacturer to provide guides on the wedge and lugs on the body or vice-versa. Where sluice valves are intended to be used in a horizontal position and where so desired by the purchaser the lugs and guides shall be provided with channel and shoe arrangement as per material specification in Table 1. Wherever the channel and shoe arrangement is provided on guides and lugs, the same shall be secured by non-protruding rigid rivets of non-ferrous metals. The thickness of the channel and shoe liner shall be minimum 5 mm for sizes of valves 450 mm and above. The maximum clearance between the guides and lugs with or without channel and shoe arrangement shall be as given in 7.5.1.

7.5.1 The clearance between lugs and guides for different sizes of sluice valves shall be as given below:

Valve Size (mm)	Maximum Total Clearance (mm)
50 to 300	3
350 to 450	4
500 to 600	5
700 to 1200	6

7.6 Facing or Seat Rings

The dimensions of the wedge facing rings and body seat rings shall be as specified in Table 4 read in conjunction with Fig. 2B.

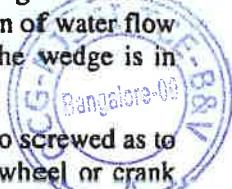
7.7 Stems and Wedge Nuts

7.7.1 The major dimensions of stems and wedge nuts shall be in accordance with Tables 2, 3 and 4 and read in conjunction with Fig. 1A, 1B, 1C, 2A, 2B, 3A, 3B, 4, 5 and 6.

7.7.2 Stems shall have machine-cut single start square or trapezoidal threads of such lengths that the wedges can be raised to a position so as to ensure full flow passage through the valve.

7.7.3 The clearance between the wedge net housing lugs on the wedge and the inside surface of the valve body shall be adequate to insert the wedge net into the wedge lug recess either in the direction of water flow or in perpendicular direction when the wedge is in closed position.

7.7.4 The stem of all valves shall be so screwed as to close the valve when the cap, hand wheel or crank handle is rotated in clockwise direction (However, counter clockwise rotation of stem for valve closure is permitted subject to agreement between the purchaser and the manufacturer). Stems required for hand wheel mounting shall be tapped on top to suit setscrew.



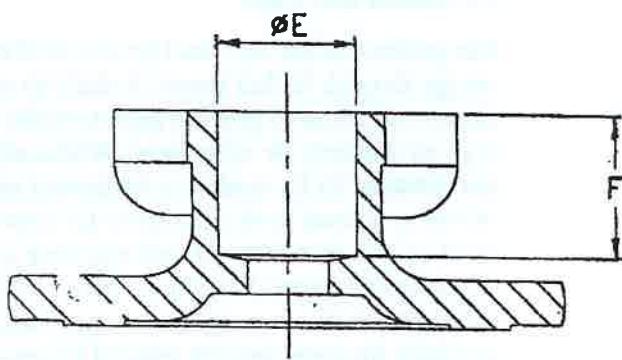


FIG. 5 STUFFING BOX

minimum size of bypass arrangements as required by a purchaser shall be as given below:

Nominal size of Sluice Valve (mm)	Size of By Pass Arrangement (mm)
250	25
300	25
350	40
400	40
450	50
500	50
600	65
700	80
750	80
800	80
900	100
1 000	100
1 100	125
1 200	125

8 ACCESSORIES OR OPTIONAL FEATURES

Some of the accessories or optional features used with large sluice valves are given in Annex A for information.

9 COATING

9.1 All coatings shall be carried out after satisfactory testing of the valves prior to despatch. All the unmachined ferrous surfaces of the valve (both inside and outside) shall be thoroughly clean, dry and shall be free from rust and grease before painting. All exposed machined ferrous surfaces shall be painted with one coat of aluminium red oxide primer conforming to IS 5660.

9.2 Two coats of black japan conforming to Type B of IS 341 or paint conforming to IS 9862 or IS 2932 shall be applied by brush or spray for exterior application in colour as approved by the purchaser.

NOTE — A valve may be assembled without coating if a purchaser specifically desires to inspect the assembled valve without any coating.

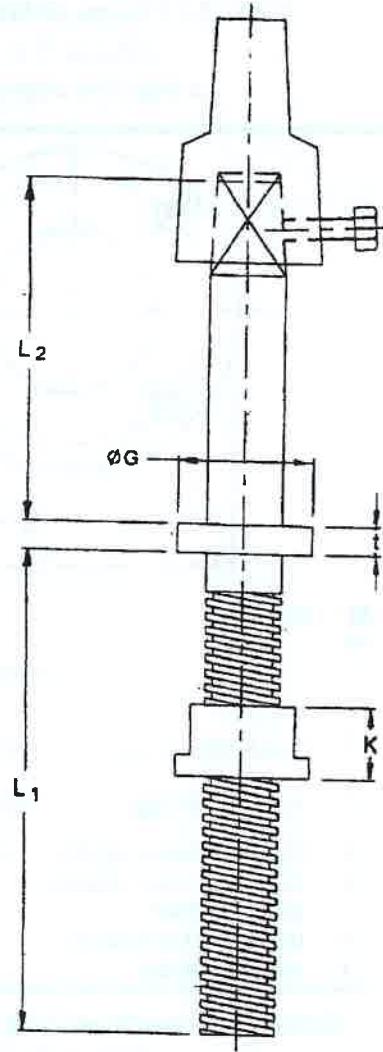


FIG. 6 STEM WITH CAP

10 TESTING

10.1 Hydrostatic Test

10.1.1 Each valve shall be subjected to hydrostatic tests as described in Annex B to the test pressures and test duration specified in Table 5 and Table 6 respectively. The valves during the test shall not show any sign of leakage.

Table 5 Test Pressure for Sluice Valves

PN Rating	Test for Body/Seat	Test Pressure MPa (Gauge)
PN 1.0	Body	1.5
	Seat	1.0
PN 1.6	Body	2.4
	Seat	1.6

10.1.2 Valves intended, when in use, to be rigidly held at both ends in a pipeline either above or below ground, shall be subjected to 'closed-end' test (see B-1).

ANNEX A

(Clause 8)

ACCESSORIES OR OPTIONAL FEATURES FOR SLUICE VALVES**A-1 ACCESSORIES OR OPTIONAL FEATURES**

A-1.1 Accessories used, where required, with large sluice valves are given in **A-1.1.1** to **A-1.1.15** and details of these should be furnished by the manufacturer where so desired by the purchaser.

A-1.1.1 Locking Arrangement for Hand Wheel**A-1.1.2 Valve Gate Position Indicator**

They shall have two positions marked at the shut end of the scale, first one corresponding to the position of the gate tangential to the bore of the seating and the second position below the first, corresponding to the position of the gate as it sits on the seating after moving a further distance equal to the depth of the seating.

A-1.1.3 Anti-Friction Devices

Thrust bearing of ball or similar type for stem collars.

A-1.1.4 Valve Headstock for Manual Operation

Through extended Stem with a view to facilitate operation or when operation point is exactly over the extended Stem.

A-1.1.5 Gunmetal scour or cast iron cleaning door at

the bottom of the sluice valve body.

A-1.1.6 By-Pass Arrangement Valve

Full way gate valve may conform to IS 778 and sluice valve where used, may conform to this standard.

A-1.1.7 Power Drive

Hydraulic, pneumatic or electric

A-1.1.8 Easing Screw**A-1.1.9 Air**

Release plug

A-1.1.10 Drain Plug**A-1.1.11 Channel and Shoe Arrangement****A-1.1.12 Gearing Arrangement**

Spur, worm or bevel

A-1.1.13 Chain and Wheel Arrangement**A-1.1.14 Riveted Seat Rings in the Body**

A-1.1.15 Pipe flanges drilling and dimensions other than IS 1538.

ANNEX B

(Clause 10.1.1)

TESTING OF SLUICE VALVES**B-1 CLOSED-END TEST**

B-1.1 Each valve shall be tested with the spindle in vertical position, unless otherwise specified by the purchaser. The testing machine, which may be either of hydraulic or mechanical type, shall exert adequate force to compress the flexible material on either side without exerting an undue load on the valve body.

B-1.2 Each valve held in vertical position shall be subjected to three hydrostatic tests. The first test shall be made with the wedge open and the pressure applied for a period of minimum 5 minutes to the whole body of the valve after releasing air through the gland. The second and third tests shall be made to determine the water tightness of the faces with the wedge closed. After the first test, the body pressure shall be reduced to working pressure and

the wedge shall be closed so that the bonnet remains filled with water. The second test shall be conducted with the pressure (see 10.1.1) applied to the one face and the third test with the pressure applied to the other face of the wedge. Under this condition, the valve seating on the down-stream side shall be watertight for a period of 2 minutes. During the period of above test, the pressure gauge reading shall not fall below the test pressure.

B-1.3 A typical arrangement for closed-end test for sluice valves is shown in Fig. 7. The first test is done with the wedge open and the pressure applied to the whole body of the valve. The second test is made as shown by applying pressure from side Y hydraulically, the third test is done applying pressure from the side X.

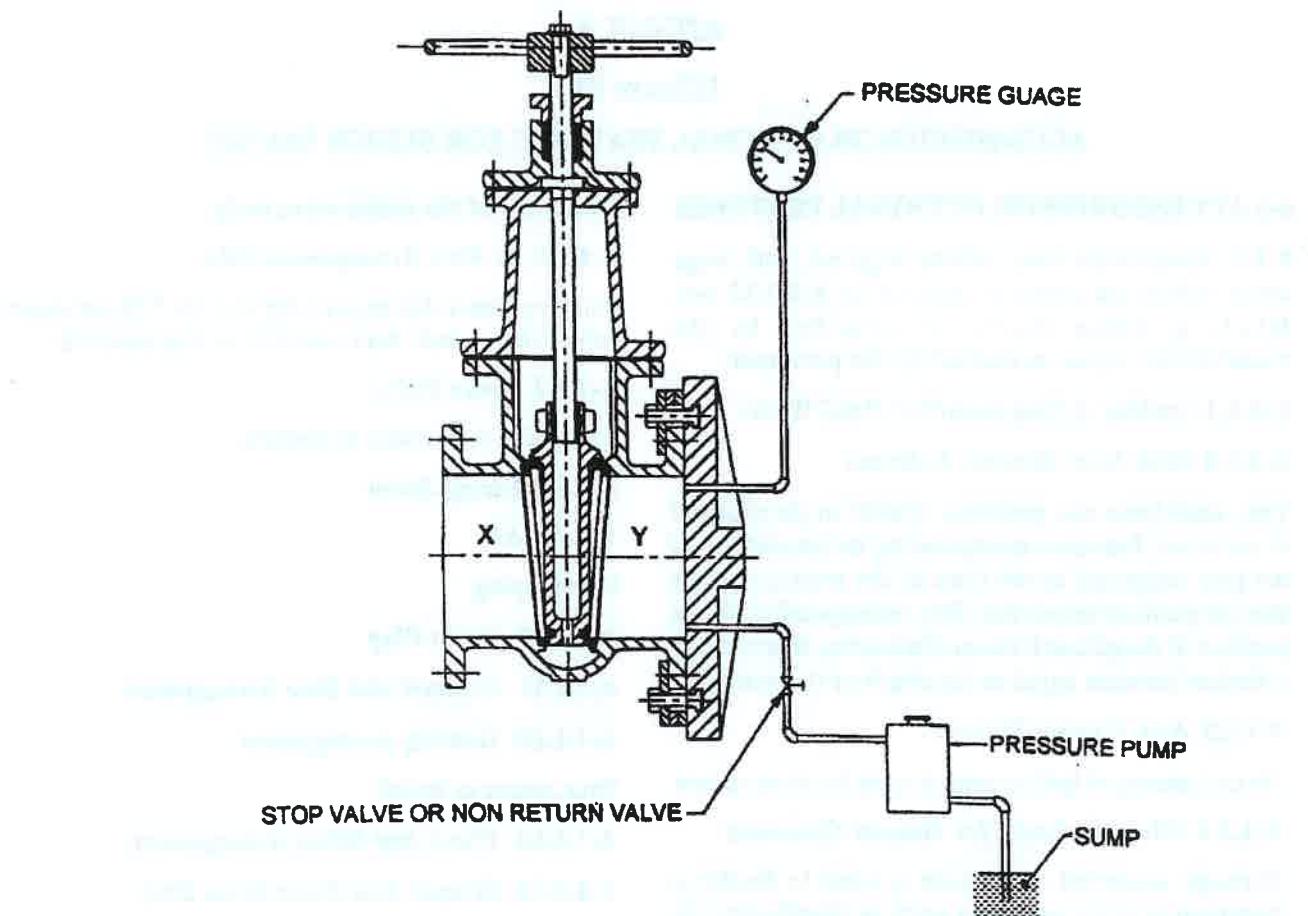


FIG. 8 TYPICAL VALVE TESTING ARRANGEMENT FOR OPEN-END TEST



ANNEX C

(Clause 10.2.1)

SAMPLING OF FORGED STEMS FOR FLAW DETECTION TEST

C-1 LOT

C-1.1 All the forged stems of same size from the same manufacturer, produced from the same batch of brass or stainless steel, shall be grouped together to constitute a lot.

C-1.2 Each lot as defined in **C-1.1**, shall be taken separately for sampling and testing before it is accepted for utilization in producing of valves. For this purpose, the number of samples depending on the size of the lot shall be drawn from the lot strictly at random. The number of samples from a lot shall be as given in **C-2**. For ensuring the randomness of sampling, guidance may be taken from IS 4905.

C-2 SCALE OF SAMPLING

The number of sample stems to be selected from a lot shall be as given below:

No. of Stems in the Lot	No. of Stems in the Sample
Up to 8	All
9 to 25	8
26 to 50	13
51 to 100	20
101 to 300	32
301 and over	50

C-3 CRITERIA FOR CONFORMITY

C-3.1 All the sample stems selected from the lot in accordance with **C-1.2**, shall be subjected to the flaw detection test. The lot shall be accepted only when all the sample stems are found to pass in the flaw detection test.

C-3.2 In case, if any one or more of the sample stems failing in the flaw detection test, all the stems in the lot shall be subjected to flaw detection test before acceptance and only those which are found to be satisfactory, shall be used in the production of valves.

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
3444 : 1987	Corrosion resistant alloy steel and nickel base castings for general application (<i>second revision</i>)	5660 : 1970	Ready mixed paint, brushing, aluminium — Red oxide primer
3658 : 1981	Code of practice for liquid penetrant flaw detection (<i>first revision</i>)	6603 : 2000	Stainless steels bars and flats (<i>first revision</i>)
4218 (Part 5) : 1979	ISO Metric screw threads: Part 5 Tolerances (<i>first revision</i>)	6912 : 1985	Copper and copper alloy forging stock and forgings (<i>first revision</i>)
4687 : 1995	Gasket and packing — Gland packing asbestos (<i>second revision</i>)	7008 (Part 3) : 1988	ISO Metric trapezoidal screw threads : Part 3 Basic dimensions (<i>first revision</i>)
4854 (Part 1) : 1969	Glossary of terms for valves and their parts : Part 1 Screw down stop check and gate valve and their parts	7008 (Part 4) : 1988	ISO Metric trapezoidal screw threads : Part 4 Tolerances (<i>first revision</i>)
4905 : 1968	Methods for random sampling	9862 : 1981	Ready mixed paint, brushing, bituminous, black, lead-free, acid, alkali, water and chlorine resisting
5414 : 1995	Gasket and packing — Gland packing, jute and hemp (<i>first revision</i>)		



(Continued from page 16)

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U.P. Jal Nigam, Lucknow

In personal capacity (B-58 A, Gangotri Enclave, Alaknanda, New Delhi 110019)



TO

**IS 14846 : 2000 SLUICE VALVE FOR WATER WORKS PURPOSES
(50 TO 1200 mm SIZE) — SPECIFICATION**

[Page 2, Table 1, Sl No. (i), col 8] — Substitute '500/7' for '260-300/12 or 500/2' against IS 1865 and add '230-450W' against IS 1030.

[Page 2, Table 1, Sl No. (iii), col 5] — Substitute the existing by '12Cr13/04Cr18Ni10/04Cr17Ni12Mo2'.

(Page 4, Table 2) — Substitute the existing Table 2 with the Table 2 appearing on page 2.

(Page 5, Table 3) — Substitute the existing Table 3 with the Table 3 appearing on page 3.

(Page 7, Clause 7.7.3, line 1 and 3) — Substitute 'nut' for 'net'.

(Page 7, Table 3A, Sl No. 2, col 3) — Substitute '16 $\frac{+2.0}{-0.0}$ ' for '165 $\frac{+2.0}{-0.0}$ '.

(Page 7, Table 4) — Add 'Min' below A, B, C and D.

(Page 8, Fig. 4) — Substitute the existing Fig. 4 by the following:

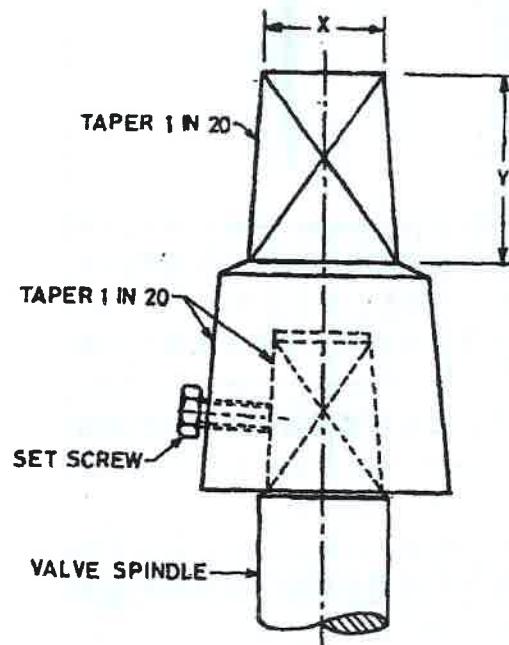


FIG 4 VALVE CAP

(Page 8, clause 7.14) — Insert the following at the end of the clause:

<i>' Nominal Size of Sluice Valve (mm)</i>	<i>Size of By Pass Arrangement (mm)</i>
200	25

(Page 9, clause 9.1, lines 3 and 4) — Delete '(both inside and outside)'.





Table 3 Dimensions of Sluice Valves for Nominal Pressure PN 1.6
 (Clauses 7.2.4, 7.7.1, 7.9, 7.11, 7.12, 7.13 and Fig. 1A, 1B, 4 and 5)
 All dimensions in millimetres.

S No. N. m in. Size	BODY			STEM						STUFFING BOX				CAP							
	PD	ALT-I	ALT-II	B Max	H Max	a	C	Min	L1	L2	t	G	K Min	E	Min	F	D	X	Y		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
i)	50	178	259	215	160	365	15	30	22				30	42	10	4	45	280	35	60	
ii)	65	190	270	230	215	380	15	30	22				30	42	10	4	45	280	35	60	
iii)	80	203	280	230	220	425	15	30	22				30	42	10	4	45	280	35	60	
iv)	100	229	300	255	250	470	18	36	27				35	47	10	4	45	360	35	60	
v)	125	254	325	266	310	485	18	36	27				35	47	10	5	55	360	35	60	
vi)	150	267	350	280	330	595	18	36	27				35	47	10	5	55	360	35	60	
vii)	200	292	400	318	460	725	22	42	32				45	56	12	5	65	450	35	60	
viii)	250	330	450	355	495	835	25	48	36				50	60	12	5	65	640	35	60	
ix)	300	356	500	380	585	910	25	48	36				50	60	12	5	65	640	35	60	
x)	350	381	550	690	730	1030	30	55	42				55	66	12	6	77	640	48	75	
xii)	400	406	600	750	800	1110	35	60	47				55	75	14	6	90	730	48	75	
xiii)	450	432	650	820	850	1210	37	65	52				60	80	14	6	90	800	48	75	
xiv)	500	457	700	880	930	1340	37	65	52				60	80	14	6	90	800	48	75	
xv)	600	508	800	1000	1050	1500	42	70	57				60	89	16	6	102	800	48	75	

NOTES

1—PD Preferred dimensions (short body).
 2—ALT I Alternate I dimensions (long body).
 3—ALT II Alternate II dimensions.

4—S Dimensions given under Alternate II will stand deleted with effect from 01 April 2005.
 5—* Packing size represents diameter in case of round and side in case of square shaped packings.

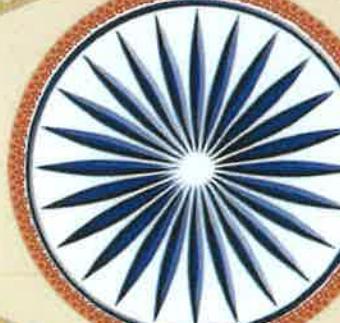
Tolerances on Length 'A'
 Up to and including 300 mm ± 2 mm
 Above 300 and including 600 mm ± 3 mm
 Above 600 and including 800 mm ± 4 mm
 Above 800 and including 1000 mm ± 5 mm
 Above 1000 mm ± 6 mm

Other Tolerances
 Tolerances on square, 'a' and X ± 0.5 mm
 Tolerances on length of square, C ± 1.0 mm
 Tolerances on size of hand wheel, D ± 5.0 mm
 Tolerances on length of square 'Y' ± 0.5 mm



इंटरनेट

मानक



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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

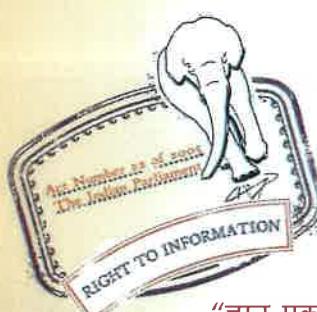
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Jawaharlal Nehru

“Step Out From the Old to the New”

IS 9523 (2000) : Ductile Iron Fittings for Pressure Pipes
for Water, Gas and Sewage [MTD 6: Pig iron and Cast Iron]



“ज्ञान से एक नये भारत का निर्माण”

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

Bhartṛhari—Nītiśākām

“Knowledge is such a treasure which cannot be stolen”



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भारतीय मानक

पानी, गैस एवं मल जल के लिए दाब पाइप हेतु तन्द्रा
लोहे की फिटिंगें — विशिष्टि
(पहला पुनरीक्षण)

Indian Standard

DUCTILE IRON FITTINGS FOR PRESSURE PIPES FOR
WATER, GAS AND SEWAGE — SPECIFICATION

(First Revision)

First Reprint AUGUST 2000

ICS 23:040.10; 23.040.40

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



FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Pig Iron and Cast Iron Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This Indian Standard was first published in 1980. While reviewing this standard, in light of the experience gained during these years, it was decided by the Sectional Committee to revise the standard with the following main modifications:

- i) Nominal diameters range has been increased to include up to 2 000 mm size and sizes which are commonly used in India have been included.
- ii) The use of mechanical and push-on flexible joints have been recommended and lead joint fittings have been discontinued.
- iii) Requirements for coating have been modified incorporating the optional requirement for cement mortar lining.
- iv) The standard has been generally updated taking into account the modern trend in this respect in other international specifications particularly the current changes made in EN 545:1994 and ISO 2531:1998.
- v) The weight of castings depends mainly on the weight of socket which again depend on the type of joints. Hence as per current international practice all weights are being withdrawn from the standard.

In order to have co-ordination and interchangeability with other International Standards, assistance has been derived from the following publications:

ISO 2531: 1998	Ductile iron pipes, fittings and accessories and their joints for water or gas application, issued by the International Organization for Standardization (ISO)
ISO 4179 : 1985	Ductile iron pipes for pressure and non-pressure pipelines — Centrifugal cement mortar lining general requirements
ISO 7186 : 1996	Ductile iron products for sewage applications
ISO 8179-1 : 1995	Ductile iron pipes — External coating — Part 1 : Metallic zinc with finishing layer
ISO 8179-2 : 1995	Ductile iron pipes — External coating — Part 2 : Zinc rich paint with finishing layer
ISO 8180 : 1985	Ductile iron pipes — Polyethylene sleeving
ISO 10804-1 : 1996	Restrained joint system for ductile iron pipelines — Part 1 : Design rule and type testing
EN 545 : 1994	Ductile iron pipes, fittings accessories and their joints for water pipelines
EN 598 : 1995	Ductile iron pipes, fittings, accessories and their joints for sewerage applications
EN 969 : 1996	Ductile iron pipes, fittings, accessories and their joints for gas pipeline
JIS 5527 : 1989	Ductile iron fittings for pressure pipes

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.



AMENDMENT NO. 3 SEPTEMBER 2012
TO

**IS 9523 : 2000 DUCTILE IRON FITTINGS FOR PRESSURE
PIPES FOR WATER, GAS AND SEWAGE —
SPECIFICATION**

(First Revision)

(Page 5, Table 4, Nominal Diameter DN 1100, Number of holes) —
Substitute '32' for '28'.

(Page 20, Table 28, Fig, dimension 'd') — Substitute ' $\square d$ ' for ' $\emptyset d$ '.

(MTD 6)

Reprography Unit, BIS, New Delhi, India





Our Ref: CMD III/16:9523

Date : 11/10/2010

Subject: Implementation of Amendment No.2 issued to IS 9523: 2000 – Ductile Iron Fittings for Pressure Pipes for Water, Gas & Sewage

Amendment No. 2 October 2010 to IS 9523: 2000 has been published (copy enclosed). This amendment does not require any change in the existing STI (Doc:STI/9523/1 September 2000).

It has been decided to implement this amendment with immediate effect. ROs/BOs are requested to inform the licensees under their jurisdiction about implementation of the amendment and ensure compliance.

Encl: as above

(Ashok Narula)

Director & Scientist -E (CMD 3)

Scientist-F & HEAD(CMD3) 11/10/11

All ROs/BOs/CMD-1/ BIS labs

Copy to: ITS – for putting the circular on INTRANET immediately.

MTD – for arranging necessary Gazette Notification

CMD III



**AMENDMENT NO. 2 OCTOBER 2010
TO**

**IS 9523 : 2000 DUCTILE IRON FITTINGS FOR PRESSURE
PIPES FOR WATER, GAS AND SEWAGE —
SPECIFICATION**

(First Revision)

(Page 4, clause 11.2) — Add the following new clause after 11.2:

'11.3 When, by agreement between the manufacturer and the purchaser, fittings with different shapes, lengths and combinations of diameters than those given in Tables 15 to 31 are supplied according to this standard, they shall comply with thicknesses, nominal sizes, external diameters and flange dimension as specified in 5, 11 and Tables 3 to 7 and all other requirements of this standard.'

(MTD 6)

H(CMD-B)
A/S
S-110
B-110
m/s/yd

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 1 JUNE 2010

TO

**IS 9523 : 2000 DUCTILE IRON FITTINGS FOR
PRESSURE PIPES FOR WATER, GAS AND SEWAGE
— SPECIFICATION**

(First Revision)

(Page 2, clause 4.1, last sentence) — Substitute the following for the existing:

'It shall be manufactured by any method at the discretion of the manufacturer provided that the requirements defined in this standard are complied with.'

(MTD 6)

Reprography Unit, BIS, New Delhi, India



Indian Standard

DUCTILE IRON FITTINGS FOR PRESSURE PIPES FOR WATER, GAS AND SEWAGE — SPECIFICATION (First Revision)

1 SCOPE

1.1 This standard covers requirements for ductile iron fittings (special castings) to be used with pressure pipes for carrying water, gas and sewage for sizes from 80 to 2 000 mm nominal diameter.

1.2 This standard is applicable to fittings meant for mechanical joints (bolted gland), push-on-joints and flanged joints for jointing by means of various types of gaskets. The design of the socket and the gasket are not within the scope of this standard. If required, fittings fabricated from spun pipes and plain ended fittings can also be used.

1.3 This standard does not restrict the use and development of other types of joints as long as they maintain the overall dimensions for reasons of safety and interchangeability.

1.4 The fittings covered by this standard are normally supplied with externally and internally coated to protect against corrosion.

1.5 The fittings are suitable for fluid temperatures between 0°C and 50°C excluding frost.

NOTE — The terms 'special castings' and 'push-on-flexible joints' have been referred as 'castings' and 'Push-on-joints' respectively henceforth in this standard.

2 REFERENCES

The following Indian Standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of the 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 below:

IS No.	Title
269 : 1989	33 grade ordinary portland cement (<i>fourth revision</i>)
455 : 1989	Portland slag cement (<i>fourth revision</i>)
1387 : 1993	General requirements for supply of metallurgical materials (<i>second revision</i>)
1500 : 1983	Methods for Brinell hardness test for metallic materials (<i>second revision</i>)

1608 : 1995	Mechanical testing of metals — Tensile testing (<i>second revision</i>)
1865 : 1991	Iron castings with spheroidal or nodular graphite (<i>third revision</i>)
5382 : 1985	Rubber sealing ring for gas mains, water mains and sewers (<i>first revision</i>)
6452 : 1989	Specification for high alumina cement for structural use
6909 : 1990	Specification for supersulphated cement
8329 : 1994	Centrifugally cast (spun) ductile iron pressure pipes for water, gas and sewage (<i>second revision</i>)
8350 : 1977	Deviations for untoleranced dimensions of SG iron castings
12330 : 1988	Sulphate resisting portland cement

3 TERMINOLOGY

For the purposes of this standard, the following definitions shall apply.

3.1 Ductile Iron — Type of iron used for pipes, fittings and accessories in which graphite is present primarily in spheroidal form.

3.2 Pipe — Casting of uniform bore, straight in axis, having either socket, spigot or flanged ends, except for flanged sockets, flanged spigots and collars which are classified as fittings.

3.3 Fitting — Casting other than a pipe, which allows pipeline deviation, change of direction or bore. In addition flanged-sOCKETS, flanged-spigots and collars are also classified as fittings.

3.4 Accessory — Any item other than a pipe or fitting which is used in a pipeline, such as:

- glands and bolts for mechanical flexible joints;
- glands, bolts and locking rings or segments for restrained joints.

NOTE — Valves and hydrants of all types are not covered by the term accessory.

3.5 Flange — Flat circular end of fittings, extending perpendicular to its axis, with bolt holes equally spaced on a circle.

NOTE — A flange may be fixed (for example, integrally cast,

threaded-on or welded-on) or adjustable; an adjustable flange comprises of a ring, in one or several parts bolted together, which bears on an end joint hub and can be freely rotated around the fittings axis before jointing.

3.6 Collar, Coupling — Connecting piece used to join together the spigots of mat pipes or fittings.

3.7 Spigot — Male end of fittings.

3.8 Socket — Female end of fittings to make the joint with the spigot of an adjacent component.

3.9 Gasket — Sealing component of a joint.

3.10 Joint — Connection between the ends of fittings in which a gasket is used to effect a seal.

3.11 Flexible Joint — Joint which provides significant angular deflection and movement parallel and/or perpendicular to the fittings axis.

3.12 Push-on Flexible Joint — A flexible joint in which an elastomeric gasket is located in the socket and the joint assembly is effected by entering the spigot through the gasket into the socket.

3.13 Mechanical Flexible Joint — Flexible joint in which sealing is obtained by applying pressure to the gasket by mechanical means, for example, a gland.

3.14 Restrained Joint — Joint wherein a device is provided to prevent separation of the assembled joint.

3.15 Flanged Joint — Joint between two flanged ends.

3.16 Nominal Size (DN) — Numerical designation of size which is common to all components in a piping system. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.

3.17 Nominal Pressure (PN) — A numerical designation expressed by a number which is used for reference purposes. All components of the same nominal size *DN* designated by the same *PN* number have compatible mating dimensions.

3.18 Batch — Quantity of castings from which a certain number of samples may be taken for testing purposes during manufacture.

3.19 Length — Effective length of a fitting, as shown on the drawings of 11.2.

NOTE — For flanged fittings the effective length is equal to the overall length and is noted *L* (*H* for branches). For socketted fittings, the effective length is equal to the overall length minus the spigot insertion depth.

3.20 Ovality — Out of roundness of a fittings section; it is equal to $100\{(A_1 - A_2)/(A_1 + A_2)\}$, where A_1 is the maximum axis and A_2 the minimum axis of the fittings cross section.

3.21 Deviation in Length — Amount by which the design length may differ from the standardized length of a fitting.

NOTE — Fittings are designed to a length taking into account standard length plus or minus the deviation; they are manufactured to this length plus or minus the tolerance given in Table 14.

SECTION 1 GENERAL REQUIREMENTS

4 MANUFACTURE AND REPAIR

4.1 The metal used for the manufacture of casting shall conform to the appropriate grade as specified in IS 1865, in commensurate with the requirements as laid down in this standard. It shall be prepared at the discretion of the manufacturer in a cupola, or an active mixer or other suitable furnace.

4.2 The castings shall be stripped with all precautions necessary to avoid warping or shrinkage defects, detrimental to their good quality. The castings shall be sound and free from surface or other defects.

4.3 Casting showing small imperfections which result from the method of manufacture and which do not affect its final use shall not be rejected on that account alone.

4.4 Minor defects may be rectified with the approval of the purchaser. Repairing of defects by welding, plugging off leaks by caulking or by application of epoxy putty may not be done without previously securing the approval of the purchaser. Repairs are to be carried out according to a written procedure included in the manufacturer's quality assurance system. Any dressing to remove imperfections, shall not reduce the thickness of the casting below the specified thickness.

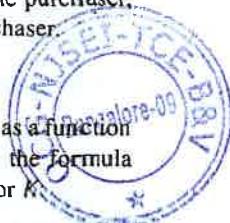
4.5 The castings shall be such that they could be cut, drilled or machined. In case of dispute the castings may be accepted provided that the hardness measured on the external un-machined surface does not exceed 250 HBS.

4.6 Where castings are required to withstand pressure higher than those specified in this standard, the casting may be strengthened by means of increased wall thickness, if necessary, at the expense of the internal diameter or by suitable ribbing or as may be mutually agreed between the manufacturer and the purchaser, to suit the pressure specified by the purchaser.

5 THICKNESS

The thickness '*e*' of fittings is calculated as a function of the nominal diameter '*DN*' by using the formula given below with the following values for *K*:

$$e = K (0.5 + 0.001 DN)$$



where $K = 14$

$$e = 7 + 0.014 DN$$

where $K = 12$

$$e = 6 + 0.012 DN$$

For 'DN 80' the thickness of the fitting has been limited to minimum of 7 mm, so that, taking the tolerances into account, the thickness of the fittings is always at least equal to that of the pipes of the same nominal diameter.

6 JOINTS

6.1 In the case of push-on-joints for sizes 'DN 600' and above the sockets may be with or without centering rings.

6.2 Design of the socket and rubber gaskets are not within the scope of this standard.

6.3 If agreed between the manufacturer and the purchaser, the fittings can be made with plain end also, for jointing with the help of a collar/coupling provided that the overall length of the fitting remains the same. The length of the spigot necessary for jointing shall not be less than the length of the socket of the jointing pipe.

6.4 In case of push-on-joints the spigot end of fitting, if any, shall be suitably chamfered to facilitate smooth entry of spigot in the socket of the pipes or fittings fitted with rubber gasket.

6.5 In case of flange and mechanical joint casting, the flange shall be at right angle to the axis of the joint. The bolt holes shall be either cored or drilled.

6.6 The centre of bolt holes circle shall be concentric with the bore circle and shall be located off the centre line, unless otherwise specified by the purchaser. Where there are two or more flanges, the bolt holes shall be correctly aligned between them.

6.7 The flanges shall be plain faced or with raised boss as given in Tables 4, 5, 6 and 7 over the contact surface with a tool mark finishing having a pitch of 1 ± 0.3 mm, serrations may be spiral or concentric.

* **6.8** For high pressure mains, requiring working pressure greater than 2.4 MPa, suitable flexible joint may be preferred where the joint is restrained against axial movement.

6.9 Push-on-joint fittings are normally not used for sizes above DN 1 600.

7 RUBBER GASKETS

The material of rubber gaskets for use with mechanical joints and push-on-joints shall conform to IS 5382. Unless otherwise agreed between the manufacturer and the purchaser, dimensions of the rubber gasket shall

be as per manufacturer's own design.

8 SAMPLING

Sampling criteria for checking the conformity of the castings, other than the requirements specified in this standard, shall be as laid down in IS 11606. The frequency of testing is related to the system of production and quality control used by the manufacturer. The maximum batch size shall be 4 MT of crude castings, excluding the risers.

9 MECHANICAL TEST

Mechanical tests shall be carried out during manufacture by batch sampling system. Samples shall be taken, at the manufacturer's option, from an integrally cast sample, either from a sample attached to the casting or from a sample cast separately. In the latter case, it shall be cast from the same metal as that used for the casting. If the casting is subjected to heat treatment the sample shall be subjected to same heat treatment as that of castings. The samples, being representative of finished product, are tested for tensile strength, elongation and hardness to verify mechanical requirements. One test for castings produced during 24 hours shall be adequate. The results obtained shall be taken as to represent all the fittings of all sizes made during that period.

9.1 Tensile Test

One tensile test shall be made on bar cast from the same metal in accordance with the methods specified in IS 1608. The result of the test shall conform to the mechanical properties given in Table 1.

Table 1 Mechanical Properties of Fittings

Nominal Diameter (mm) (1)	Type of Castings (2)	Tensile Strength (Min), (MPa) (3)	Elongation at Break Percent (Min) (4)
All sizes	Fittings	420	5

9.2 Hardness Test

For checking Brinell hardness specified in 4.5 test may be carried out on the test bar used for the test in 9.1. Test shall be carried out in accordance with the procedures laid down in IS 1500.

9.3 Heat Treatment

Fittings shall be supplied in either 'as cast' condition or 'heat treated' condition. In either case, the fittings shall comply with the mechanical properties specified in 9.1 and 9.2. In the case of heat treated fittings the test samples shall be subjected to the same heat treatment process as that of fittings to which they are representative.

9.4 Retests

If the piece representing the lot fails to pass tests specified in 9.1 and 9.2 in the first instance, two additional tests shall be made on test pieces made from the same metal used for that lot. Should either of these additional test pieces fail to pass the test the lot shall be considered as not complying with this standard.

10 HYDROSTATIC TEST

For hydrostatic test, the fittings shall be kept under pressure for 10 seconds. They shall withstand the pressure test without showing any sign of leakage, sweating or other defect of any kind. The test shall be conducted before the application of surface coating.

10.1 The fittings shall withstand the hydrostatic pressure given in Table 2.

Table 2 Hydrostatic Test Pressure for Castings

Nominal Diameter <i>DN</i> (mm) (1)	Hydrostatic Test Pressure at Works, MPa (2)
Up to and including 300	2.5
Over 300 and up to and including 600	1.6
Over 600 and up to and including 2 000	1.0

NOTE — The work hydrostatic test pressure is less for fittings than for pipes specified in the relevant Indian Standard for pipes because the shape of the fittings makes it difficult to provide sufficient restraint to high internal pressure during the test.

10.2 When fittings are required for higher test pressures, the test pressures are subject to agreement between the purchaser and the manufacturer (see 4.6).

11 SIZES

The standard nominal sizes 'DN' of the fittings covered in this standard are as follows:

80, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 750, 800, 900, 1 000, 1 100, 1 200, 1 400, 1 600, 1 800 and 2 000 mm.

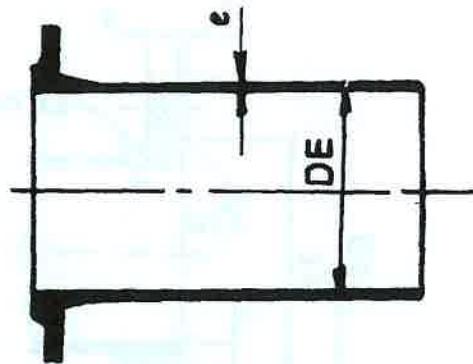
NOTE — Nominal size is a number used to classify fittings/joints/castings and corresponds approximately to their internal diameter.

11.1 Dimensional and other requirements for socket/spigot of push-on-joints, mechanical joints and flanges shall conform to the requirements specified in Tables 3, 4, 5, 6 and 7 under Section 2 as relevant.

11.2 Dimensional and other requirements for fittings for specified *DN* shall conform to the values as given in the Tables 15 to 31 under Section 3.

SECTION 2 DIMENSIONS AND OTHER REQUIREMENTS

Table 3 Dimensions of Fittings for Push-on-Joint and Mechanical Joint
(Clause 11.1)



Nominal Diameter <i>DN</i>	External Diameter <i>DE</i>			Wall Thickness, <i>e</i> mm		
	Nominal (1)	Tolerance (2)	<i>K12</i> (4)	<i>K14</i> (5)	Tolerance (6)	
80	98	+1/-2.7	7.0	8.1	-2.38	
100	118	+1/-2.8	7.2	8.4	-2.40	
125	144	+1/-2.8	7.5	8.7	-2.42	
150	170	+1/-2.9	7.8	9.1	-2.45	
200	222	+1/-3.0	8.4	9.5	-2.50	
250	274	+1/-3.1	9.0	10.5	-2.55	
300	326	+1/-3.3	9.6	11.2	-2.60	
350	378	+1/-3.4	10.2	11.9	-2.65	
400	429	+1/-3.5	10.8	12.6	-2.70	
450	480	+1/-3.6	11.4	13.3	-2.75	
500	532	+1/-3.8	12.0	14.0	-2.80	
600	635	+1/-4.0	13.2	15.4	-2.90	
700	738	+1/-4.3	14.4	16.8	-3.0	
750	790	+1/-4.4	15.0	17.5	-3.05	
800	842	+1/-4.5	15.6	18.2	-3.10	
900	945	+1/-4.8	16.8	19.6	-3.20	
1 000	1 048	+1/-5.0	18.0	21.0	-3.30	
1 100	1 152	+1/-5.4	19.2	21.4	-3.40	
1 200	1 255	+1/-5.8	20.4	23.8	-3.50	
1 400	1 462	+1/-6.6	22.8	26.6	-3.70	
1 500	1 565	+1/-7.0	24.0	28.0	-3.80	
1 600	1 668	+1/-7.4	25.2	29.0	-3.90	
1 800	1 875	+1/-8.2	27.6	32.2	-4.10	
2 000	2 082	+1/-9.0	30.0	35.0	-4.30	

12 TOLERANCES

12.1 The tolerance on dimensions of barrel and socket for push-on-joints fittings shall be as given in Table 3.

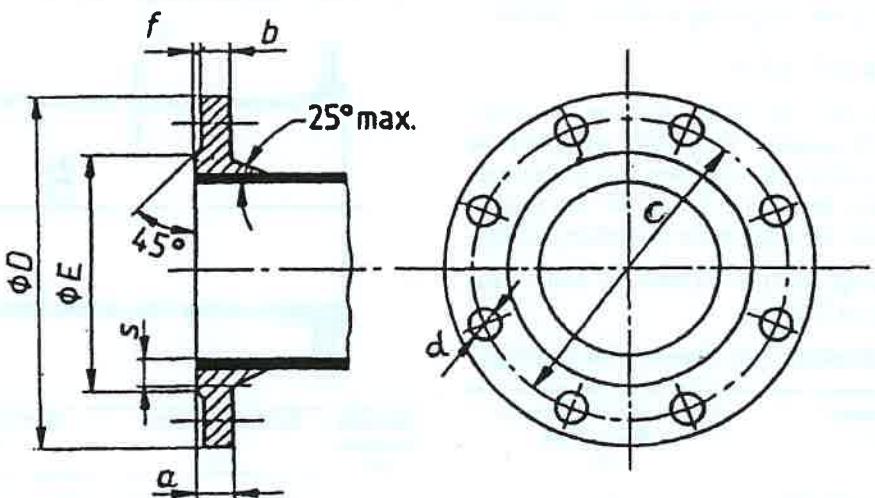
12.2 Tolerances for the various dimensions of flanges shall be as given in Tables 8, 9, 10 and 11.



Table 4 Dimensions of Standard Flange Drilling for Flange Fittings PN 10

(Clause 11.1)

All dimensions in millimetres.



Nominal Diameter	Dimensions								Holes		Bolt Size, Metric
	DN	D	E	C	b	f	a	s	No.	Dia (d)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(9)	(10)	(11)
80	200	132	160	16	3	19	15		4	19	M16
100	220	156	180	16	3	19	15		8	19	M16
125	250	184	210	16	3	19	15		8	19	M16
150	285	211	240	16	3	19	15		8	23	M20
200	340	266	295	17	3	20	15		8	23	M20
250	395	319	350	19	3	22	16		12	23	M20
300	445	370	400	20.5	4	24.5	17.5		12	23	M20
350	505	429	460	20.5	4	24.5	19.5		16	23	M20
400	565	480	515	20.5	4	24.5	19.5		16	28	M24
450	615	530	565	21	4	25.5	20		20	28	M24
500	670	582	620	22.5	4	26.5	21		20	28	M24
600	780	682	725	25	5	30	24		20	31	M27
700	895	794	840	27.5	5	32.5	24		24	31	M27
750	960	857	900	29	5	34	24		24	31	M27
800	1 015	901	950	30	5	35	24.5		24	34	M30
900	1 115	1 001	1 050	32.5	5	37.5	26.5		28	34	M30
1 000	1 230	1 112	1 160	35	5	40	28		28	37	M33
1 100	1 340	1 231	1 270	38	5	43	30		28	37	M33
1 200	1 455	1 328	1 380	40	5	45	31.5		32	40	M36
1 400	1 675	1 530	1 590	41	5	46	32		36	43	M39
1 600	1 915	1 750	1 820	44	5	49	34.5		40	49	M45
1 800	2 115	1 950	2 020	47	5	52	36.5		44	49	M45
2 000	2 325	2 150	2 230	50	5	55	38.5		48	49	M45

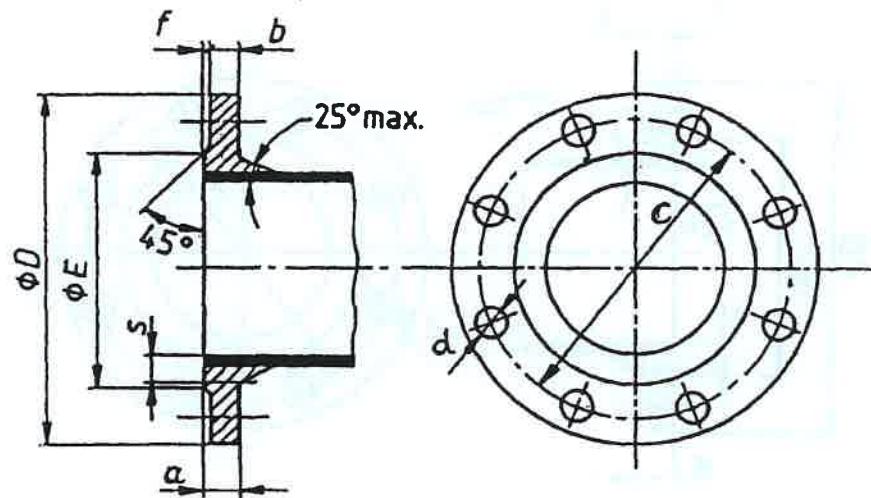
NOTES

1 Flanges shall be fixed.

2 Dimensions 'a' and 's' are for guidance only.

Table 5 Dimensions of Standard Flange Drilling for Flange Fittings PN 16
(Clause 11.1)

All dimensions in millimetres.



Nominal Diameter <i>DN</i>	Dimensions							Holes		Bolt Size Metric (11)
	<i>D</i> (2)	<i>E</i> (3)	<i>C</i> (4)	<i>b</i> (5)	<i>f</i> (6)	<i>a</i> (7)	<i>s</i> (8)	No. (9)	Dia (<i>d</i>) (10)	
80	200	132	160	16	3	19	15	8	19	M16
100	220	156	180	16	3	19	15	8	19	M16
125	250	184	210	16	3	19	15	8	19	M16
150	285	211	240	16	3	19	15	8	23	M20
200	340	266	295	17	3	20	16	12	23	M20
250	400	319	355	19	3	22	17.5	12	28	M24
300	455	370	410	20.5	4	24.5	19.5	12	28	M24
350	520	429	470	22.5	4	26.5	21	16	28	M24
400	580	480	525	24	4	28	22.5	16	31	M27
450	640	548	585	26	4	30	24	20	31	M27
500	715	609	650	27.5	4	31.5	25	20	34	M30
600	840	720	770	31	5	36	27	20	37	M33
700	910	794	840	34.5	5	39.5	27.5	24	37	M33
750	970	857	900	36	5	41	28	24	37	M33
800	1 025	901	950	38	5	43	30	24	40	M36
900	1 125	1 001	1 050	41	5	46	32.5	28	40	M36
1 000	1 255	1 112	1 170	45	5	50	35	28	43	M39
1 100	1 355	1 218	1 270	48.5	5	53.5	37.5	32	43	M39
1 200	1 485	1 328	1 390	52	5	57	40	32	49	M45
1 400	1 685	1 530	1 590	55	5	60	42	36	49	M45
1 600	1 930	1 750	1 620	60	5	65	45.5	40	56	M52
1 800	2 130	1 950	2 020	65	5	70	49	44	56	M52
2 000	2 345	2 150	2 230	70	5	75	52.5	48	62	M56

NOTES

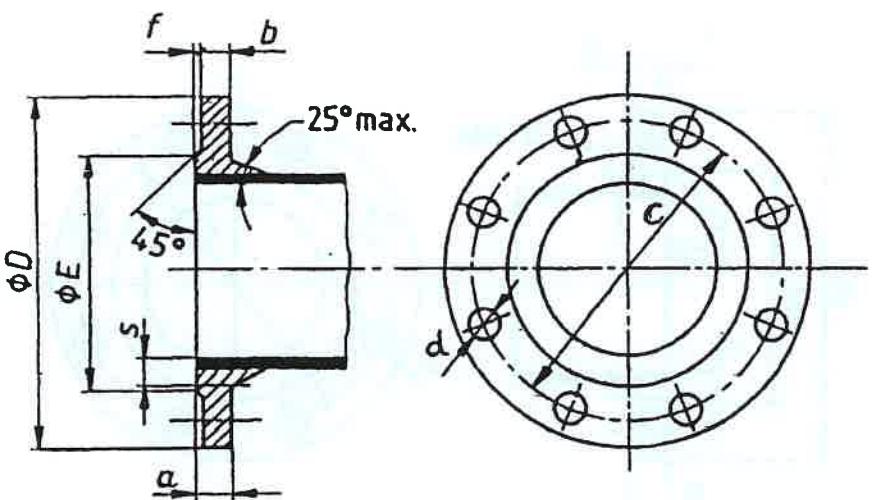
1 Flanges shall be fixed.

2 Dimensions 'a' and 's' are for guidance only.



Table 6 Dimensions of Standard Flange Drilling for Flange Fittings PN 25
(Clause 11.1)

All dimensions in millimetres.



Nominal Diameter <i>DN</i>	Dimensions							Holes		Bolt Size Metric (11)
	<i>D</i>	<i>E</i>	<i>C</i>	<i>b</i>	<i>f</i>	<i>a</i>	<i>s</i>	No.	Dia (<i>d</i>)	
(1) 80	200	132	160	16	3	19	15	8	19	M16
100	235	156	190	16	3	19	15	8	23	M20
125	270	184	220	16	3	19	15	8	28	M24
150	300	211	250	17	3	20	16	8	28	M24
200	360	274	310	19	3	22	17.5	12	28	M24
250	425	330	370	21.5	3	24.5	19.5	12	31	M27
300	485	389	430	23.5	4	27.5	22	16	31	M27
350	555	448	490	26	4	30	24	16	34	M30
400	620	503	550	28	4	32	25.5	16	37	M33
450	670	548	600	30.5	4	34.5	27.5	20	37	M33
500	730	609	660	32.5	4	36.5	29	20	37	M33
600	845	720	770	37	5	42	33.5	20	40	M36
700	960	820	875	41.5	5	36.5	33.5	24	43	M39
750	1 020	883	940	45	5	50	34	24	43	M39
800	1 085	928	990	46	5	51	35.5	24	49	M45
900	1 185	1 028	1 090	50.5	5	55.5	39	28	49	M45
1 000	1 320	1 140	1 210	55	5	60	42	28	56	M52
1 100	1 420	1 240	1 310	60.5	5	65.5	45	32	56	M52
1 200	1 530	1 350	1 420	64	5	69	48.5	32	56	M52
1 400	1 755	1 560	1 640	69	5	74	52	36	62	M56
1 600	1 975	1 780	1 860	76	5	81	56.5	40	62	M56
1 800	2 195	1 980	2 070	83	5	88	61.5	44	70	M64
2 000	2 425	2 210	2 300	90	5	95	66.5	48	70	M64

NOTES

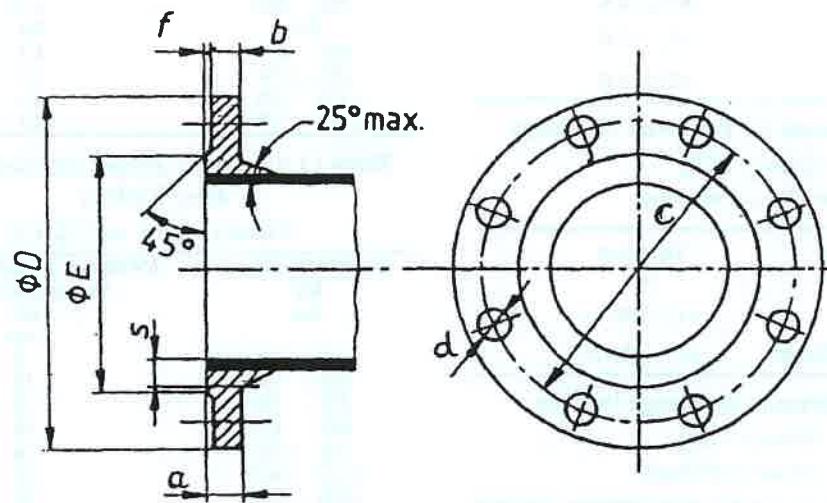
1 Flanges shall be fixed.

2 Dimensions 'a' and 's' are for guidance only.

Table 7 Dimensions of Standard Flange Drilling for Flange Fittings PN 40

(Clause 11.1)

All dimensions in millimetres.



Nominal Diameter <i>DN</i>	Dimensions							Holes		Bolt Size Metric (11)
	<i>D</i> (2)	<i>E</i> (3)	<i>C</i> (4)	<i>b</i> (5)	<i>f</i> (6)	<i>a</i> (7)	<i>s</i> (8)	No. (9)	Dia (<i>d</i>) (10)	
80	200	132	160	16	3	19	15	8	19	M16
100	235	166	190	16	3	19	15	8	23	M20
125	270	184	220	20.5	3	23.5	16.5	8	28	M24
150	300	211	250	23	3	26	18	8	28	M24
200	375	284	320	27	3	30	21	12	31	M27
250	450	345	385	31.5	3	34.5	24	12	34	M30
300	515	409	450	35.5	4	39.5	27.5	16	34	M30
350	580	465	510	40	4	44	31	16	37	M33
400	660	535	585	44	4	48	33.5	16	40	M36
450	685	560	610	46	4	50	35	20	40	M36
500	755	615	670	48	4	52	36.5	20	43	M39
600	890	735	795	53	5	58	40.5	20	49	M45

NOTES

1 Flanges shall be fixed.

2 Dimensions 'a' and 's' are for guidance only.

Table 8 Tolerances on the External Diameter *D* and *E*

(Clause 12.2)

All dimensions in millimetres.

<i>DN</i>	80	100	125	150	200	250	300	350	400	450	500	600
Tolerance on <i>D</i>	± 4.5			$+5.5, -2.5$			$+6.5, -3.5$					
Tolerance on <i>E</i>	± 4.0			± 4.5			± 5.0					
<i>DN</i>	700	750	800	900	1 000	1 100	1 200	1 400	1 600	1 800	2 000	
Tolerance on <i>D</i>	$+7.5, -4$			$+8.5, -4$			$+10, -5$			$+12, -6$		
Tolerance on <i>E</i>	± 5.5			± 5.5			± 6.0			± 6.0		



Table 9 Tolerances on Raised Face Height (f)

(Clause 12.2)

All dimensions in millimetres.

Height of Raised Face (f) (1)	Tolerance (2)
3	+1.5, -2.0
4	+2, -3.0
5	+2.5, -4.0

Table 10 Tolerances on Thickness of Flange

(Clause 12.2)

All dimensions in millimetres.

Type of Flange (1)	Tolerance (2)
Integrally cast flanges	$\pm (3 + 0.05 b)$
Welded and screwed on flanges	$\pm (2 + 0.05 b)$

Table 11 Tolerances on Flange Drilling

(Clause 12.2)

All dimensions in millimetres.

Dimension (1)	Bolt Hole Diameter		
	Dia 19 to dia 28 (2)	Dia 31 to dia .56 (3)	Above dia 62 (4)
Bolt hole diameter, d	+ 2, - 0	+ 3, - 0	+ 4, - 0
Pitch circle diameter, C	± 2	± 2.8	± 4.8
Centre-to-centre of adjacent bolt holes	± 2	± 2.8	± 4.8

12.3 Tolerance on Ovality

12.3.1 Fittings shall be as far as possible circular internally and externally. The tolerance for out of roundness of the socket and spigot ends in the jointing zone for push-on-joint as given in Table 12 and for mechanical joint as given in Table 13.

12.3.2 In case of oval spigot ends for push-on-joints (DE), the minor axis is permitted to be less than the minimum allowable diameter by the value given below provided the mean diameter DE measured by circumferential tape, comes within the minimum allowable dimensions of DE (see Table 3) after applying the tolerance.

The polyethylene sleeves may be supplied, for encasement of the fittings at site, along with the fittings if ordered by the purchaser. This encasement shall prevent contact between fittings and the surrounding backfill and bedding material. Details are given in Annex D.

NOTE — Unless otherwise agreed between the purchaser and the manufacturer the requirement of sleeving shall comply with the requirements as contained in Annex D.

Table 12 Allowable Ovality for Push-on-Joint Fittings

(Clause 12.3.1)

Nominal Diameter <i>DN</i> (mm)	Allowable Difference Between Minor Axis and DE , Min (mm)
80 - 300	1.0
350 - 600	1.75
700	2.0
750 - 800	2.4
900 - 1 000	3.5
1 100 - 1 200	4.0
1 400 - 1 600	4.5

Table 13 Allowable Ovality for Mechanical Joint Fittings

(Clauses 12.3.1 and 12.4.3)

Nominal Diameters <i>DN</i> mm	Maximum Ovality of Spigot of External Diameters DE mm
80 - 150	5
200 - 350	10
400 - 500	20
600 - 800	30
900 - 1 000	40
1 100 - 1 400	50
1 600 - 2 000	60

12.3.3 Mechanical joint will accept some degree of spigot ovality but the measured difference between the maximum and minimum axis of individual spigots shall not exceed the values given in Table 13.

12.4 The tolerance on the wall thickness of fittings shall be as follows:

Type of Casting	Wall Thickness (mm)	Tolerance (mm)
Fittings	7, Greater than 7	-2.3, -(2.3+0.001 <i>DN</i>)

12.5 Lengths of Fittings

The permissible deviations on the lengths of fittings shall be as given in Table 14.

Table 14 Deviation on Lengths of Fittings

(Clauses 3.2.1 and 12.5)

Types of Fittings	Nominal Diameter <i>DN</i> mm	Deviation in L and H mm
Flanged sockets	80 to 1 200	± 25
Flanged spigots	1 400 to 2 000	± 35
Collars, tapers		
Tees	80 to 1 200 1 400 to 2 000	+50/-25 +75/-35
Bends 90° (1/4)	80 to 2 000	$\pm (15 + 0.03 DN)$
Bends 45° (1/8)	80 to 2 000	$\pm (10 + 0.025 DN)$
Bends 22° 30' and 11° 15' (1/16 and 1/32)	80 to 1 200 1 400 to 2 000	$\pm (10 + 0.02 DN)$ $\pm (10 + 0.025 DN)$

13 COATING

13.1 Fittings and accessories shall be normally delivered internally and externally coated.

13.1.1 External Coatings

By agreement between the manufacturer and the purchaser, any one of the following coatings may be applied depending upon the external condition of use:

Metallic zinc with finishing layer as included in Annex A;

Zinc rich paint with finishing layer, as included in Annex A;

Bituminous paint : as included in Annex C; and
External sleeving : Annex D.

13.1.2 Internal Linings

By agreement between the manufacturer and the purchaser, the following lining may be applied depending on the internal conditions of use:

Portland cement (with or without additives) mortar, as included in Annex B;

Blast furnace slag cement mortar as included in Annex B;

High alumina (calcium aluminate) cement mortar as included in Annex B;

Cement mortar with seal-coat: as included in Annex B; and

Bituminous paint as included in Annex C.

13.2 Unless otherwise between the purchaser and the manufacturer, the external coating and the internal lining when applied shall conform to the requirements specified in this standard (including Annex). Additional requirements other than those specified may be agreed between the purchaser and the manufacturer.

14 QUALITY ASSURANCE

14.1 General

The manufacturer shall be able to demonstrate the conformity of the product to the requirements contained in this standard by controlling the manufacturing process and carrying out the various tests as specified in this standard.

14.2 Quality Assurance System

The manufacturer shall control the quality of the product during manufacturing process by a system of process control in order to comply with the technical requirements contained in this standard wherever possible statistical sampling techniques should be used to control the process so that the product is produced within the specified limits.

15 MARKING

15.1 Each fittings shall have as cast, stamped or indelibly painted on it, the following appropriate marks.

- Indication of the source of manufacture,
- The nominal diameter,
- The last two digits of the year of manufacture,
- PN rating of flanges when applicable, and
- Any other mark required by the purchaser.

15.1.1 Marking may be done on the barre! of castings or on the outside of the sockets.

15.2 BIS Certification Marking

The fittings may also be marked with the Standard Mark.

15.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

SECTION 3 SPECIAL CASTINGS

16 SPECIAL CASTING

Special castings of the following types with their ends either socketed (for mechanical joints or push-on-joints) or flanged shall conform to the dimensions, as relevant, to those given in tables mentioned below for each type. Tolerances shall be as per Tables 12, 13 and 14.

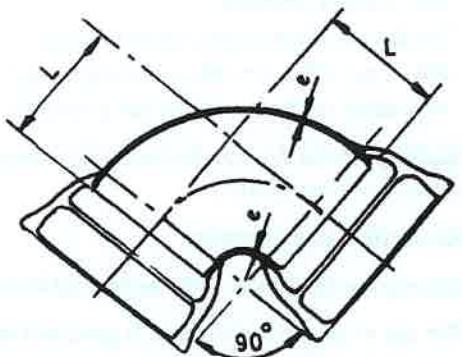
Double Socket 90° Bend	Table 15
Double Socket 45° Bend	Table 16
Double Socket 22½° Bend	Table 17
Double Socket 11¼° Bend	Table 18
Double Socket 90° Duckfoot Bend	Table 19
Double Socket Tapers	Table 20
All Socket, Flanged on Double Socket Tees	Table 21
Collars	Table 22
Flanged Socket	Table 23
Flanged Spigot	Table 24
Blank Flanges	Table 25
90° Double Flanged Bend	Table 26
45° Double Flanged Bend	Table 27
90° Duckfoot Double Flanged Bend	Table 28
All Flange Tee	Table 29
Double Flanged Tapers	Table 30
Reducing Flange	Table 31



Table 15 Double Socket 90° Bend

(Clauses 11.2 and 16)

All dimensions in millimetres.

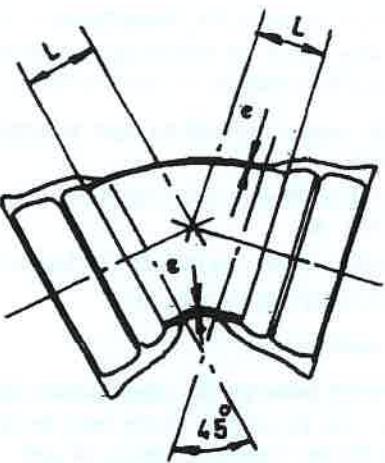


Nominal Size	<i>e</i>	L
80	7.0	100
100	7.2	120
125	7.5	145
150	7.8	170
200	8.4	220
250	9.0	270
300	9.6	320
350	10.2	370
400	10.8	420
450	11.4	470
500	12.0	520
600	13.2	620
700	14.4	720
750	15.0	770
800	15.6	820
900	16.8	920
1 000	18.0	1 020
1 100	19.2	1 130
1 200	20.4	1 230
1 400	22.8	1 430
1 600	25.2	1 630

Table 16 Double Socket 45° Bend

(Clauses 11.2 and 16)

All dimensions in millimetres.



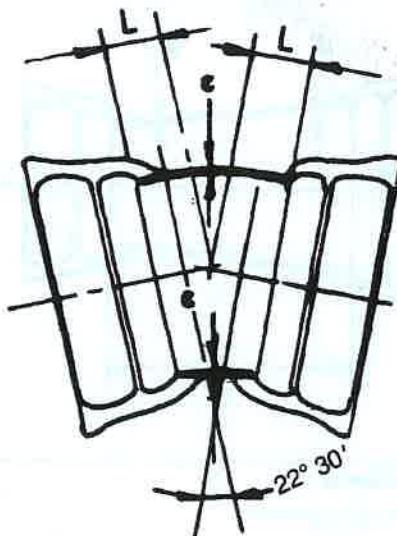
Nominal Size	<i>e</i>	L
80	7.0	55
100	7.2	65
125	7.5	75
150	7.8	85
200	8.4	110
250	9.0	130
300	9.6	150
350	10.2	175
400	10.8	195
450	11.4	220
500	12.0	240
600	13.2	285
700	14.4	330
750	15.0	350
800	15.6	370
900	16.8	415
1 000	18.0	460
1 100	19.2	505
1 200	20.4	550
1 400	22.8	515
1 600	25.2	565
1 800	27.6	610
2 000	30.0	660



Table 17 Double Socket $22\frac{1}{2}^\circ$ Bend

(Clauses 11.2 and 16)

All dimensions in millimetres.

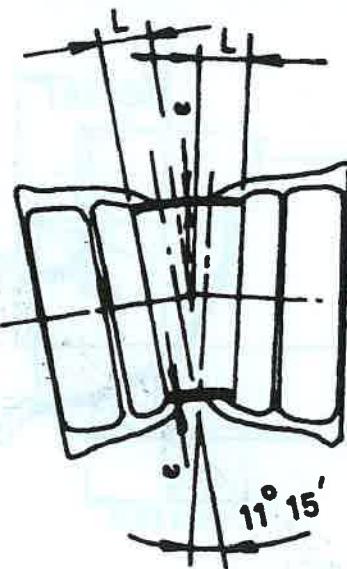


Nominal Size	<i>e</i>	<i>L</i>
80	7.0	40
100	7.2	40
125	7.5	50
150	7.8	55
200	8.4	65
250	9.0	75
300	9.6	85
350	10.2	95
400	10.8	110
450	11.4	120
500	12.0	130
600	13.2	150
700	14.4	175
750	15.0	185
800	15.6	195
900	16.8	205
1 000	18.0	210
1 100	19.2	220
1 200	20.4	240
1 400	22.8	260
1 600	25.2	280
1 800	27.6	305
2 000	30.0	330

Table 18 Double Socket $11\frac{1}{4}^\circ$ Bend

(Clauses 11.2 and 16)

All dimensions in millimetres.



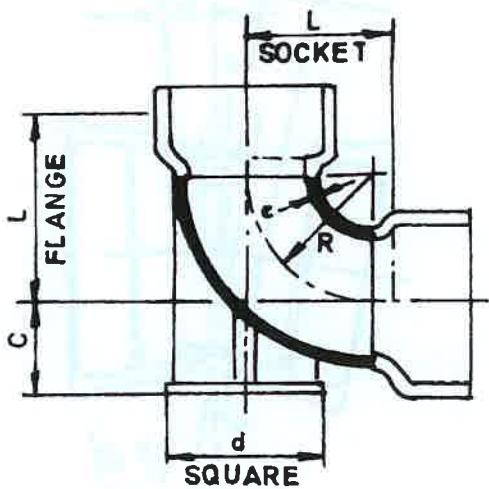
Nominal Size	<i>e</i>	<i>L</i>
80	7.0	30
100	7.2	30
125	7.5	35
150	7.8	35
200	8.4	40
250	9.0	50
300	9.6	55
350	10.2	60
400	10.8	65
450	11.4	70
500	12.0	75
600	13.2	85
700	14.4	95
750	15.0	100
800	15.6	110
900	16.8	115
1 000	18.0	120
1 100	19.2	120
1 200	20.4	130
1 400	22.8	130
1 600	25.2	140
1 800	27.6	155
2 000	30.0	165



Table 19 Duckfoot Double Socket 90° Bend

(Clauses 11.2 and 16)

All dimensions in millimetres.

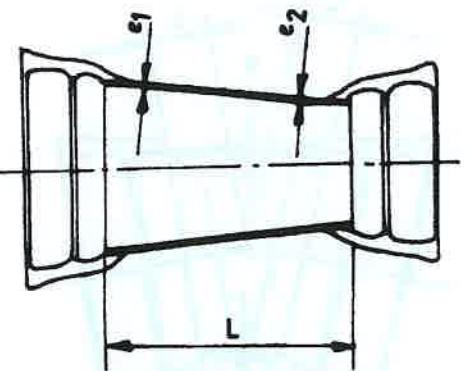


Nominal Size	e	L	c	d
80	7.0	110	110	180
100	7.2	130	125	200
125	7.5	155	140	225
150	7.8	180	160	250
200	8.4	230	190	300
250	9.0	280	225	350
300	9.6	325	255	400
350	10.2	380	290	450
400	10.8	430	320	500
450	11.4	480	355	550
500	12.0	530	385	600
600	13.2	630	450	700
700	14.4	735	515	800
750	15.0	790	545	850
800	15.6	830	580	900
900	16.8	930	645	1000
1000	18.0	1035	710	1100
1100	19.2	1130	775	1200
1200	20.4	1230	840	1300
1400	22.8	1430	970	1500
1600	25.2	1630	1100	1700

**Table 20 Double Socket Concentric Tapers**

(Clause 11.2 and 16)

All dimensions in millimetres.

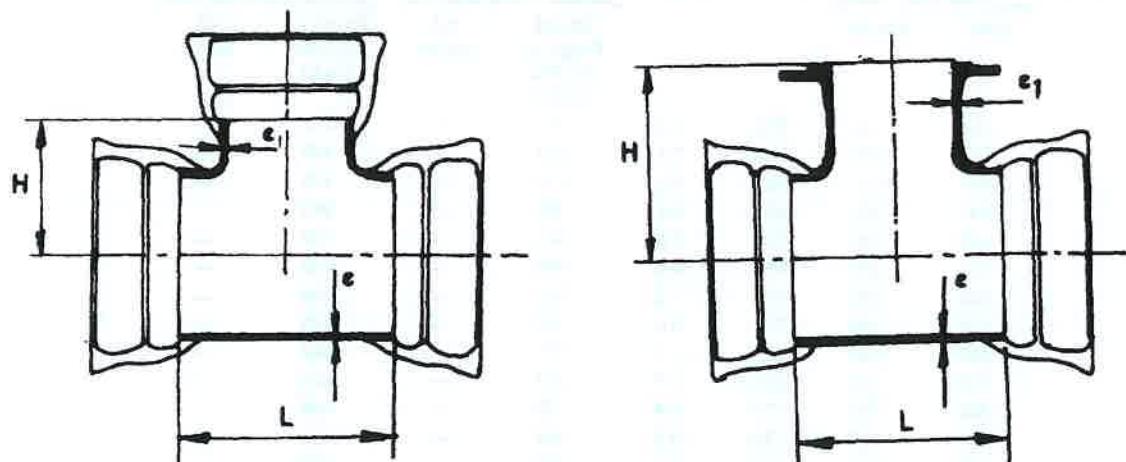


Nominal Diameter (DN)		e_1	e_2	L
Larger End	Smaller End			
100	80	7.2	7.0	90
125	80	7.5	7.0	140
150	80	7.8	7.0	190
150	100	7.8	7.2	150
200	100	8.4	7.2	250
200	150	8.4	7.8	150
250	150	9.0	7.8	250
250	200	9.0	8.4	150
300	150	9.6	7.8	350
300	200	9.6	8.4	250
300	250	9.6	9.0	150
350	200	10.2	8.4	360
350	250	10.2	9.0	260
350	300	10.2	9.6	160
400	250	10.8	9.0	360
400	300	10.8	9.6	260
400	350	10.8	10.2	160
450	350	11.4	10.2	260
450	400	11.4	10.8	160
450	500	12.0	10.2	360
500	400	12.0	10.8	260
500	500	12.0	10.8	460
600	400	13.2	10.8	260
600	500	13.2	12.0	260
700	500	14.4	12.0	480
700	600	14.4	13.2	280
750	500	15.0	12.0	480
750	600	15.0	13.2	280
800	600	15.6	13.2	480
800	700	15.6	14.4	280
900	700	16.8	14.4	480
900	800	16.8	15.6	280
1000	800	18.0	15.6	480
1000	900	18.0	16.8	280
1100	1000	19.2	18.0	280
1200	1000	20.4	18.0	480
1400	1200	22.8	20.4	360
1600	1400	25.2	22.8	360

Table 21 All Socket, Flange on Double Socket Tees

(Clauses 11.2 and 16)

All dimensions in millimetres.



Nominal Dia (DN)		e	e_1	L		H	
Body	Branch			Branch Flange on Double Socket	All Socket	Flange on Double Socket	All Socket
80	80	7	7	170	170	165	85
100	80	7.2	7	170	170	175	95
100	100	7.2	7.2	190	190	180	95
125	80	7.5	7	170	170	190	105
125	100	7.5	7.2	195	195	195	100
125	125	7.5	7.5	225	225	200	110
150	80	7.8	7	170	170	205	120
150	100	7.8	7.2	195	195	210	120
150	150	7.8	7.8	255	255	220	125
200	80	8.4	7	175	175	235	145
200	100	8.4	7.2	200	200	240	145
200	150	8.4	7.8	255	255	250	150
200	200	8.4	8.4	315	315	260	155
250	80	9	7	180	180	265	170
250	100	9	7.2	200	200	270	170
250	150	9	7.8	260	260	280	175
250	200	9	8.4	315	315	290	180
250	250	9	9	375	375	300	190
300	100	9.6	7.2	210	210	300	220
300	200	9.6	8.4	325	325	320	220
300	300	9.6	9.6	440	440	340	220
350	100	10.2	7.2	205	—	330	—
350	200	10.2	8.4	325	—	350	—
350	350	10.2	10.2	495	—	380	—

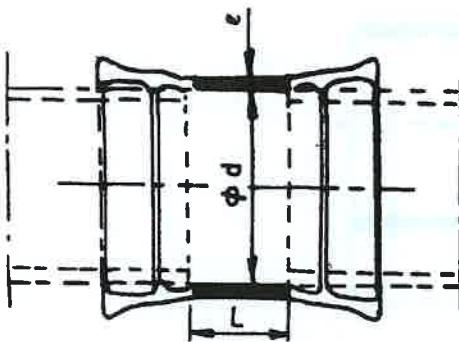


Table 21 (Concluded)

Nominal Dia (DN)	e	e_1	L		H	
			Branch Flange on Double Socket	All Socket	Flange on Double Socket	All Socket
Body	Branch					
400	80	10.8	7.0	185	—	355
400	100	10.8	7.2	210	—	360
400	150	10.8	7.8	270	—	370
400	200	10.8	8.4	325	—	380
400	300	10.8	9.6	440	—	400
400	400	10.8	10.8	560	—	420
450	100	11.4	7.2	215	—	390
450	250	11.4	9.0	390	—	420
450	450	11.4	11.4	620	—	460
500	100	12.0	7.2	215	—	420
500	200	12.0	8.4	330	—	440
500	400	12.0	10.8	565	—	480
500	500	12.0	12.0	680	—	500
600	200	13.2	8.4	340	—	500
600	400	13.2	10.8	570	—	540
600	600	13.2	13.2	800	—	580
700	200	14.4	8.4	345	—	525
700	400	14.4	10.8	575	—	555
700	700	14.4	14.4	925	—	600
750	400	15.0	10.8	575	—	585
750	750	15.0	15.0	985	—	635
800	200	15.6	8.4	350	—	585
800	400	15.6	10.8	580	—	615
800	600	15.6	13.2	1045	—	645
800	800	15.6	15.6	1045	—	675
900	200	16.8	8.4	355	—	645
900	400	16.8	10.8	590	—	675
900	600	16.8	13.2	1170	—	705
900	900	16.8	16.8	1170	—	750
1000	200	18.0	8.4	360	—	705
1000	400	18.0	10.8	595	—	735
1000	600	18.0	13.2	1290	—	765
1000	1000	18.0	18.0	1290	—	825
1100	400	19.2	10.8	600	—	795
1100	600	19.2	13.2	830	—	825
1200	600	20.4	13.2	840	—	885
1200	800	20.4	15.6	1070	—	915
1200	1000	20.4	18.0	1300	—	945
1400	600	22.8	13.2	1030	—	980
1400	800	22.8	15.6	1260	—	1010
1400	1000	22.8	18.0	1495	—	1040
1600	600	25.2	13.2	1040	—	1090
1600	800	25.2	15.6	1275	—	1120
1600	1000	25.2	18.0	1505	—	1150
1600	1200	25.2	20.4	1740	—	1180

NOTE — PN 16 is the preferred flange. PN 25 and PN 40 flanges are supplied when ordered.

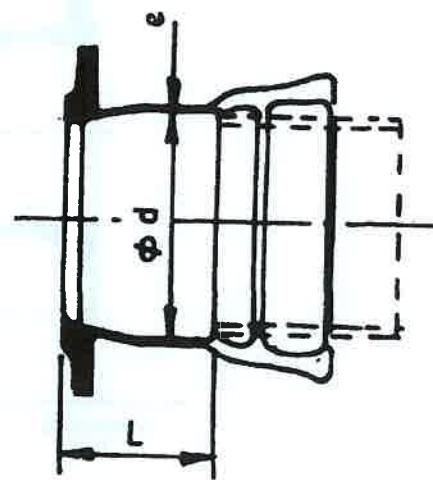
Table 22 Collars
(Clauses 11.2 and 16)
 All dimensions in millimetres.



Nominal Dia (DN)	e	L	d
80	7.0	160	109
100	7.2	160	130
125	7.5	165	156
150	7.8	165	183
200	8.4	170	235
250	9.0	175	288
300	9.6	180	340
350	10.2	185	393
400	10.8	190	445
450	11.4	195	498
500	12.0	200	550
600	13.2	210	655
700	14.4	220	760
750	15.0	225	810
800	15.6	230	865
900	16.8	240	970
1 000	18.0	250	1 075
1 100	19.2	260	1 180
1 200	20.4	270	1 285
1 400	22.8	340	1 477
1 600	25.2	360	1 683

NOTE — For operational convenience collars are with mechanical joints only.

Table 23 Flanged Socket
(Clauses 11.2 and 16)
 All dimensions in millimetres.



Nominal Dia (DN)	e	L	d
80	7.0	130	109
100	7.2	130	130
125	7.5	135	156
150	7.8	135	183
200	8.4	140	235
250	9.0	145	288
300	9.6	150	340
350	10.2	155	393
400	10.8	160	445
450	11.4	165	498
500	12.0	170	550
600	13.2	180	655
700	14.4	190	760
750	15.0	195	810
800	15.6	200	865
900	16.8	210	970
1 000	18.0	220	1 075
1 100	19.2	230	1 180
1 200	20.4	240	1 285
1 400	22.8	310	1 477
1 600	25.2	330	1 683

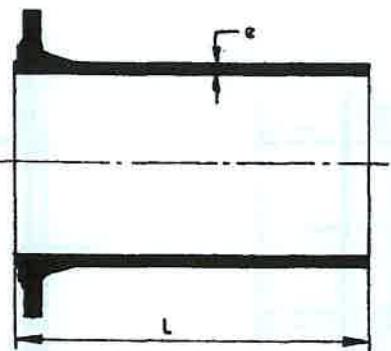
NOTE — PN 16 is the preferred flange. PN 25 and PN 40 flanges are supplied when ordered.



Table 24 Flanged Spigot

(Clauses 11.2 and 16)

All dimensions in millimetres.



Nominal Dia (DN)	<i>D_E</i>	<i>e</i>	<i>L</i>
80	98	7.0	350
100	118	7.2	360
125	144	7.5	370
150	170	7.8	380
200	222	8.4	400
250	274	9.0	420
300	326	9.6	440
350	378	10.2	460
400	429	10.8	480
450	480	11.4	500
500	532	12.0	520
600	635	13.2	560
700	738	14.4	600
750	790	15.0	600
800	842	15.6	600
900	945	16.8	600
1 000	1 048	18.0	600
1 100	1 152	19.2	600
1 200	1 255	20.4	600
1 400	1 462	22.8	710
1 600	1 668	25.2	780
1 800	1 875	27.6	850
2 000	2 082	30.0	920

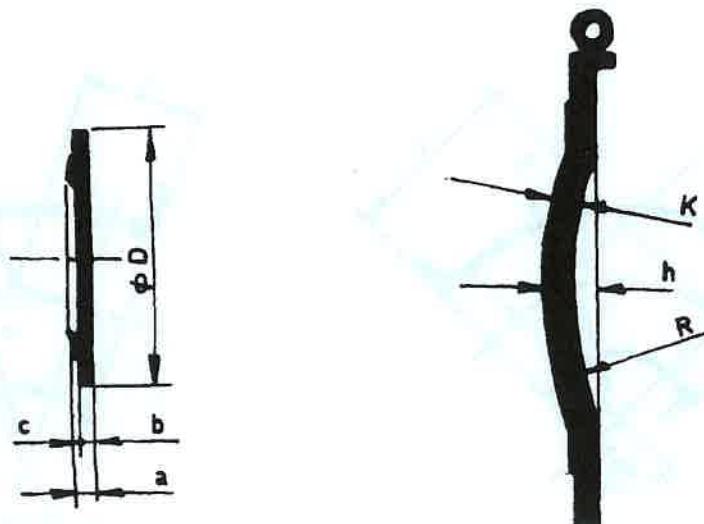
NOTE — PN 16 is the preferred flange. PN 25 and PN 40 flanges are supplied when ordered.



Table 25 Blank Flanges, Type PN 16

(Clauses 11.2 and 16)

All dimensions in millimetres.



Nominal Dia (DN)	<i>a</i>	<i>b</i>	<i>K</i> and <i>R</i>	<i>h</i>	<i>D</i>
80	19.0	16.0	—	—	200
100	19.0	16.0	—	—	220
125	19.0	16.0	—	—	250
150	19.0	16.0	—	—	285
200	20.0	17.0	—	—	340
250	22.0	19.0	—	—	400
300	24.5	20.5	—	—	455
350	26.5	22.5	325	71	520
400	28.0	24.0	375	80	580
450	30.0	26.0	425	88	640
500	31.5	27.5	475	97	715
600	36.0	31.0	575	114	840
700	39.5	34.5	675	131	910
750	41.0	36.0	625	139	970
800	43.0	38.0	775	148	1025
900	46.5	41.5	875	165	1125
1000	50.0	45.0	975	182	1255
1100	53.5	48.5	1075	199	1355
1200	57.0	52.0	1175	216	1455
1400	60.0	55.0	1375	244	1685
1600	65.0	60.0	1575	276	1930

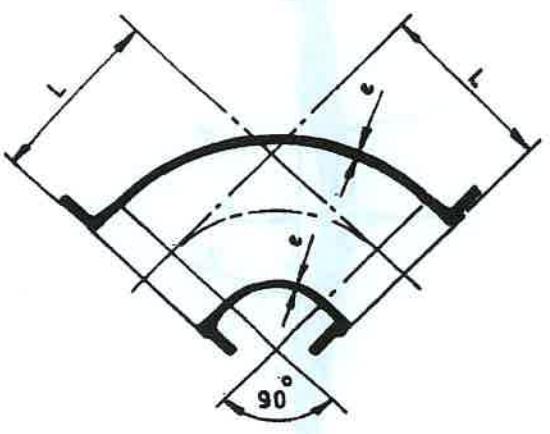
NOTE — PN 16 is the preferred flange. PN 25 and PN 40 flanges are supplied when ordered.



Table 26 Double Flanged 90° Bend

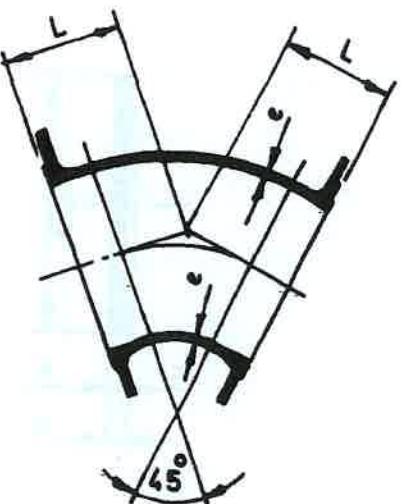
(Clauses 11.2 and 16)

All dimensions in millimetres.

**Table 27 Double Flanged 45° Bend**

(Clauses 11.2 and 16)

All dimensions in millimetres.



Nominal Size (DN)	ϵ	L
80	7.0	165
100	7.2	180
125	7.5	200
150	7.8	220
200	8.4	260
250	9.0	350
300	9.6	400
350	10.2	450
400	10.8	500
450	11.4	550
500	12.0	600
600	13.2	700
700	14.4	800
750	15.0	850
800	15.6	900
900	16.8	1 000
1 000	18.0	1 100
1 100	19.2	1 235
1 200	20.4	1 340
1 400	22.8	1 550
1 600	25.2	1 765

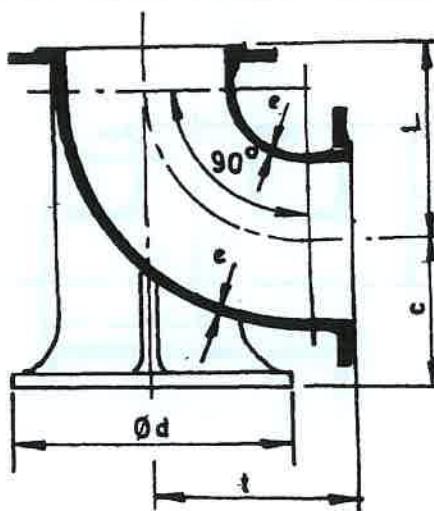
Nominal Size (DN)	ϵ	L
80	7.0	130
100	7.2	140
125	7.5	150
150	7.8	160
200	8.4	180
250	9.0	350
300	9.6	400
350	10.2	298
400	10.8	324
450	11.4	350
500	12.0	375
600	13.2	426
700	14.4	478
750	15.0	504
800	15.6	529
900	16.8	581
1 000	18.0	632
1 100	19.2	694
1 200	20.4	750
1 400	22.8	775
1 600	25.2	845
1 800	27.6	910
2 000	30.0	980



Table 28 Duckfoot Double Flanged 90° Bend

(Clauses 11.2 and 16)

All dimensions in millimetres.



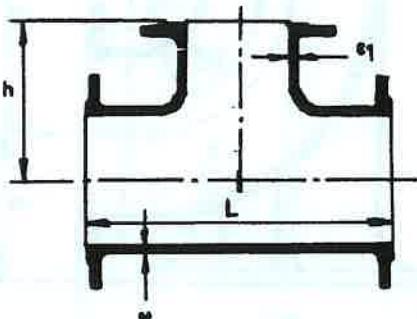
Nominal Size (DN)	<i>e</i>	<i>L</i>	<i>c</i>	<i>d</i>
80	7.0	155	110	180
100	7.2	175	125	200
125	7.5	200	140	225
150	7.8	230	160	250
200	8.4	280	190	300
250	9.0	335	225	350
300	9.6	385	255	400
350	10.2	440	290	450
400	10.8	495	320	500
450	11.4	545	355	550
500	12.0	600	385	600
600	13.2	705	450	700
700	14.4	810	515	800
750	15.0	860	550	850
800	15.6	915	580	900
900	16.8	1 020	645	1 000
1 000	18.0	1 130	710	1 100
1 100	19.2	1 235	775	1 200
1 200	20.4	1 340	840	1 300
1 400	22.8	1 550	970	1 500
1 600	25.2	1 765	1 100	1 700



Table 29 All Flanged Tees

(Clauses 11.2 and 16)

All dimensions in millimetres.



Nominal Diameter (DN)		e	e_1	L	h
Body	Branch				
80	80	7.0	7.0	330	165
100	80	7.2	7.0	360	175
100	100	7.2	7.2	360	180
125	80	7.5	7.0	400	190
125	100	7.5	7.2	400	195
125	125	7.5	7.5	400	200
150	80	7.8	7.0	440	205
150	100	7.8	7.2	440	210
150	125	7.8	7.5	440	215
150	150	7.8	7.8	440	220
200	80	8.4	7.0	520	235
200	100	8.4	7.2	520	240
200	150	8.4	7.8	520	250
200	200	8.4	8.4	520	260
250	100	9.0	7.2	700	275
250	200	9.0	8.4	700	325
250	250	9.0	9.0	700	350
300	100	9.6	7.2	800	300
300	200	9.6	8.4	800	350
300	300	9.6	9.6	800	400
350	100	10.2	7.2	850	325
350	200	10.2	8.4	850	325
350	350	10.2	10.2	850	425
400	100	10.8	7.2	900	350
400	200	10.8	8.4	900	350
400	400	10.8	10.8	900	450



Table 29 (Concluded)

Nominal Diameter (DN)		e	e_1	L	h
Body	Branch				
450	100	11.4	7.2	950	375
450	200	11.4	8.4	950	375
450	450	11.4	11.4	950	475
500	100	12.0	7.2	1 000	400
500	200	12.0	8.4	1 000	400
500	400	12.0	10.8	1 000	500
500	500	12.0	12.0	1 000	500
600	200	13.2	8.4	1 100	450
600	400	13.2	10.8	1 100	550
600	600	13.2	13.2	1 100	550
700	200	14.4	8.4	650	525
700	400	14.4	10.4	870	555
700	700	14.4	14.4	1 200	600
750	200	15	8.4	670	555
750	400	15	10.8	890	585
750	750	15	15.0	1 275	640
800	200	15.6	8.4	690	585
800	400	15.6	10.8	910	615
800	600	15.6	13.2	1 350	645
800	800	15.6	15.6	1 350	675
900	200	16.8	8.4	730	645
900	400	16.8	10.8	950	675
900	600	16.8	13.2	1 500	705
900	900	16.8	16.8	1 500	750
1 000	200	18.0	8.4	770	705
1 000	400	18.0	10.8	990	735
1 000	600	18.0	13.2	1 650	765
1 000	1 000	18.0	18.0	1 650	825
1 100	400	19.2	10.8	980	795
1 100	600	19.2	13.2	1 210	825
1 200	600	20.4	13.2	1 240	885
1 200	800	20.4	15.6	1 470	915
1 200	1 000	20.4	18.0	1 700	945
1 400	600	22.8	13.2	1 550	980
1 400	800	22.8	15.6	1 760	1 010
1 400	1 000	22.8	18.0	2 015	1 040
1 600	600	25.2	13.2	1 600	1 090
1 600	800	25.2	15.6	1 835	1 120
1 600	1 000	25.2	18.0	2 065	1 150
1 600	1 200	25.2	20.4	2 300	1 180

NOTES

1 No value is specified for radius R but internal and external radius are equal.

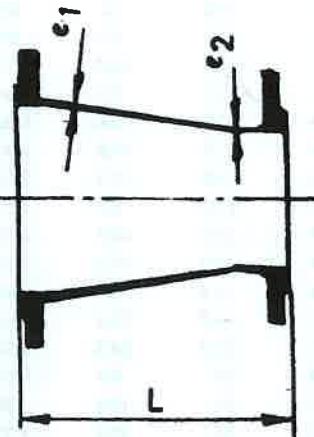
2 PN 16 is the preferred flange. PN 25 and PN 40 flanges are supplied when ordered.



Table 30 Double Flanged Concentric Tapers

(Clauses 11.2 and 16)

All dimensions in millimetres.



Nominal Diameter (DN)		e_1	e_2	L
Larger End (Body)	Smaller End (Branch)			
100	80	7.2	7.0	200
125	100	7.5	7.2	200
150	125	7.8	7.5	200
200	150	8.4	7.8	300
250	200	9.0	8.4	300
300	250	9.6	9.0	300
350	300	10.2	9.6	300
400	350	10.8	10.2	300
450	400	11.4	10.8	300
500	400	12.0	10.8	600
600	500	13.2	12.0	600
700	600	14.4	13.2	600
750	600	15.0	13.2	600
800	700	15.6	14.4	600
900	800	16.8	15.6	600
1 000	900	18.0	16.8	600
1 100	1 000	19.2	18.0	600
1 200	1 000	20.4	18.0	790
1 400	1 200	22.8	20.4	850
1 600	1 400	25.2	22.8	910

NOTE — PN 16 is the preferred flange. PN 25 and PN 40 flanges are supplied when ordered.

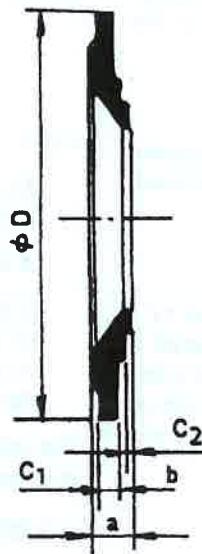


Table 31 Reducing Flange PN 16

(Claus 11.2 and 16)

All dimensions in millimetres.

$$b = 10 + 0.035 DN \text{ with a minimum value of } 16$$



Larger End			Smaller End		
Nominal Dia <i>DN</i>	<i>D</i>	<i>b</i>	<i>c₁</i>	Nominal Dia <i>DN</i>	<i>c₂</i>
200	340	17	3	80	3
	340	17	3	100	3
	340	17	3	125	3
350	520	22.5	4	250	3
400	580	24	4	250	3
	580	24	4	300	4
700	910	34.5	5	500	4
900	1125	41.5	5	700	5
1 000	1255	45	5	700	5
	1255	45	5	800	77



ANNEX A

(Clause 13.1.1)

ZINC COATING

A-1 SURFACE CONDITION

The fittings surface shall be dry and free from rust or any non-adhering particles or foreign matter such as oil or grease. Zinc rich paint or metallic zinc shall be applied on to the oxide external surface of the fittings or to a blast cleaned or ground surface, at the manufacturer's option.

A-2 MATERIALS

The coating materials are metallic zinc with content of at least 99 percent by mass or Zinc rich paint which contains 85 percent Zinc in Dry film.

A-3 METHOD OF APPLICATION

The metallic zinc coating shall be applied by a spraying process in which metallic zinc material is heated to a molten-state and projected in small droplets by spray guns onto surface. The zinc rich paint coating shall be applied by a spraying or a brush process onto the fittings surface.

A-4 COATING CHARACTERISTICS

A-4.1 The metallic zinc coating or zinc rich paint shall cover the outside diameter of the fittings and shall be free from such defects as bare patches or lack of adhesion.

A-4.2 Damaged areas of zinc coating or zinc rich paint coating caused by handling are acceptable providing the damage is less than 5 cm² per square metre of coated surface and the minor dimensions of the damaged area does not exceed 5 mm.

A-5 ZINC COATING MASS

The mean mass of zinc coating measured shall be not less than 130 g/m² with a local minimum of 110 g/m². In case of zinc rich paint the mean mass is 150 g/m² and the local minimum value is 130 g/m².

A-6 DETERMINATION OF ZINC COATING OR ZINC RICH PAINT COATING

A rectangular token is attached along the fittings axis before passing it through the zinc coating equipment. After coating and trimming the minimum token sizes shall be either.

- a) 250 mm × 100 mm, or

- b) 500 mm × 50 mm.

The mean mass of zinc coating M expressed in Grams per square metre, is calculated mass difference of the token before and after zinc coating from the following formula:

$$M = \frac{C(M_2 - M_1)}{A}$$

where

M_1 and M_2 are masses in grams before and after zinc coating measured to an accuracy of 0.1 g,

A is the area of the token in square metre, and

C is a correction factor depending on the material of the token taking into account difference in surface roughness between the token and the fittings surface.

The value of C shall be determined by the manufacturer and specified when required in test documents.

A-7 REPAIRS OF THE ZINC COATING

Areas left uncoated, for example, under the test token and coating damaged in excess of 5 cm² per square metre of coating shall be repaired by either:

- a) a metallic zinc spray, or
- b) by application of zinc rich paint containing more than 85 percent zinc by mass in the dried film: mean mass of the applied paint shall not be less than 150 g/m².

A-8 FINISHING LAYER

After metallic zinc coating or zinc rich paint coating the fittings shall be given a finishing layer of bituminous paint or synthetic resin compatible with the zinc coating.

Application of this finishing layer may be done by any proven process such as spraying or brush coating at the manufacturer's choice. It shall uniformly cover the zinc coating and be free from bare patches or lack of adhesion.

The mean dry film thickness of the finishing layer shall be less than 70 µm with a less minimum thickness of 50 µm.

ANNEX B

(Clause 13.1.2)

CEMENT MORTAR LINING

B-1 MATERIALS**B-1.1 Cement**

The cement used for the lining shall conform to the existing standards on cement.

The type of cement to be used is to be mutually decided between the purchaser and the manufacturer. Normal recommendation are:

- (i) Portland cement (as per IS 269 or IS 455) mortar lining perform rather well and have an expected life of approximately 50 years in soft water with moderate amount of aggressive CO_2 and when pH is within 6 to 9. Longer service life can be obtained by increasing the mortar lining thickness.
- (ii) Where cement mortar lining may be exposed to sulphate attack, ordinary Portland cement should be replaced by sulphate resisting Portland cement (as per IS 12330 or IS 6909). The sulphate concentration limit for sulphate resisting Portland cement is approximately 3 000 mg/l, the same as blast furnace slag cement which naturally possess a good resistance to sulphate attack. For sea water transmission blast furnace slag cement which has C_3A content below 3 percent can be used.
- (iii) High Alumina cement (as per IS 6452) mortar lining is suitable for continuous use of pH between 4 and 12 and no severe damage occur after occasional exposure to pH 3 to 4 and 12 to 13.
- (iv) The recommended types of cements used for lining are as given in Table 32.

Table 32 Recommended Types of Cements Used for Lining

Water Characteristics (1)	Portland Cement (2)	Sulphate Resisting Cements (Including Blast Furnace Slag Cements) (3)	High Alumina Cement (4)
Minimum value of pH	6	5.5	4
Maximum content (mg/l) of:			
Aggressive CO_2	7	15	no limit
Sulphates (SO_4^{2-})	400	3 000	no limit
Magnesium (Mg^{++})	100	500	no limit
Ammonium (NH_4^+)	30	30	no limit

B-1.2 Sand

The sand used shall have a controlled granulometric distribution from fine to coarser elements; it shall be clean and shall be composed of inert, hard, strong and stable granular particles.

The fine fraction comprising particles passing through a sieve of aperture size 0, 125 mm shall not be more than 10 percent by mass.

The fraction comprising grains up to a maximum diameter equal to one-third of the normal thickness of the mortar lining shall not be less than 50 percent by mass.

The coarsest fraction (comprising particles which do not pass through a sieve of the aperture size closest to half the normal thickness of the mortar lining) shall not exceed 5 percent by mass.

B-1.3 Water

The water used for the preparation of the mortar shall not contain substances deleterious to the mortar nor to the water it is eventually intended to transport in the pipeline. The presence of solid mineral particles is, however, admissible provided that these requirements are still fulfilled.

B-1.4 Mortar

The mortar of the lining shall be composed of cement, sand and water.

Additives, which shall be specified, may be used, provided that they do not prejudice the quality of the coating and that of the transported water.

The mortar shall be thoroughly mixed and shall have a consistency which results in a dense and homogeneous lining.

The mortar shall contain by mass at least one part of cement to 3.5 parts of sand.

B-2 CONDITION OF THE INTERIOR SURFACE OF THE FITTINGS BEFORE APPLICATION OF THE LINING

All foreign bodies, loose scale or any other material which could be detrimental to good contract between the metal and the lining shall be removed from the surface to which the lining is to be applied.

The inner surface of fittings shall also be free of any metal projections likely to protrude beyond 50 percent the thickness of the lining.



B-3 APPLICATION OF THE LINING

The mortar will be works applied by a suitable process. Smoothing with a trowel is permitted. The layer of mortar should be free of any cavity or visible air bubbles and care shall be taken to ensure maximum density at all points.

After the lining is applied it shall be cured at temperatures greater than 4°C. Any loss of water from the mortar by evaporation shall be sufficiently slow so that hardening is not impeded.

B-4 REPAIR OF LINING

Repairs to damaged or defective areas are allowable. The damaged mortar shall first be removed from these areas. Then the defective part shall be repaired by using, for example, a trowel with fresh mortar so that a continuous lining having a constant thickness is again obtained.

For the repair operation, the mortar shall have a suitable consistency, if necessary, additives may be included to obtain good adhesion against the side of the existing undamaged mortar.

B-5 THICKNESS OF THE LINING

The nominal thickness of the lining and its negative tolerance and maximum crack width/radial displacement are given in Table 33.

At the fittings ends, the lining may be reduced to values below the minimum thickness. The length of the chamfer shall be as small as possible but, in any case, shall be less than 50 mm.

B-6 DETERMINATION OF LINING THICKNESS

The thickness of the lining is checked on the freshly centrifuged mortar by the insertion of a steel pin, or on the hardened mortar by means of a non-destructive method of measurement.

The thickness of the lining shall be measured at both ends of the fittings in at least one section perpendicular to the fittings axis.

B-7 SURFACE CONDITION OF THE HARDENED LINING

The surface of the cement mortar lining shall be uniformly smooth. Only isolated grains of sand are allowed to appear on the surface of the lining.

The lining shall be such that it cannot be dislodged with pressure of hand and shall be free from corrugations or ridges that could reduce the thickness of the lining to less than the minimum value at one point, as specified in the Table 33.

Table 33 Thickness of Lining

(Clauses B-5 and B-7)

All dimensions in millimetres.

DN	Thickness		Maximum Crack Width and Radial Displacement	
	Nominal Value	Tolerance		
080 to 300	3.0	-1.5	0.8	
350 to 600	5.0	-2.0	1.0	
700 to 1 200	6.0	-2.5	1.2	
1 400 to 2 000	9.0	-3.0	1.5	

NOTE — Fittings ends may have a chamfer of maximum length 50 mm.

On contraction of the lining, the formation of cracks cannot be avoided. These cracks, together with other isolated cracks which may result from manufacture or may develop during transportation, are acceptable up to a width given in the above.

B-8 SEAL COAT

B-8.1 General

When specified the cement lining shall be given a seal coat of bituminous material or any other epoxy based material compatible with Cement Mortar Lining. Other seal-coat materials may be used, but they shall be agreed on at the time of purchase and shall be specified on the purchase order.

The purpose of seal coat is to minimize lime leaching of the cement mortar as well as to restrict the unwanted rise in pH value of the transmitted water.

When the pipes are to be used for conveying potable water the inside coating shall not contain any constituent soluble in such water or any ingredient which could impart any taste or whatsoever to the potable water after sterilization and suitable washing of the mains.

ANNEX C

(Clauses 13.1.1 and 13.1.2)

BITUMINOUS COATING

C-1 GENERAL

Unless otherwise agreed between the purchaser and the manufacturer, fittings shall be coated externally and internally with the same material. (Bituminous coatings are either hot applied or cold applied).

C-2 GENERAL CHARACTERISTICS

C-2.1 Coating shall not be applied to any fittings unless its surfaces are clean, dry and free from rust.

C-2.2 Unless otherwise agreed between the purchaser and the manufacturer all fittings shall be coated externally and internally with the same material. The method of coating shall be as per usual practice of the manufacturers. The coating material shall set rapidly with good adherence and shall not scale off. The mean thickness of the coating shall be not less than 70 µm and the local

minimum thickness shall be not less than 50 µm.

C-2.3 Where the coating material has a tar or similar base, it shall be smooth and tenacious and hard enough not to flow when exposed to a temperature of 65°C but not so brittle at a temperature of 0°C as to chip off when scribed with a penknife.

C-2.4 When the pipes are to be used for conveying potable water the inside coating shall not contain any constituent soluble in such water or any ingredient which could impart any taste or whatsoever to the potable water after sterilization and suitable washing of the mains.

C-2.5 Pipes with or without sockets and flanges which are imperfectly coated or where the coating does not set or conform to the required quality, the coating shall be removed and the pipes/flanges recoated.

ANNEX D

(Clause 13.1.1)

POLYETHYLENE SLEEVING

D-1 MATERIAL

D-1.1 Characteristics

The material used for making the film is polyethylene or a mixture of polyethylenes and/or ethylene and olefin copolymers.

Its density shall be between 910 and 930 kg/m³.

D-1.2 Additives and Impurities

If protection against ultra-violet rays is required, the material shall be stabilized by the addition of an appropriate product: if carbon black is used for this purpose the addition shall be in the range of 2 to 3 percent by mass.

D-2 DIMENSION

D-2.1 Width

The nominal flat width of the tube or flat or flat sheet is specified in Table 34.

D-2.2 Thickness

The nominal thickness of the sleeving shall be not less than 200 µm and not more than 250 µm unless otherwise agreed.

Table 34 Layflat Width of Tubular Polyethylene Film for Various Sizes of Iron Fittings

Layflat Width of Tubular Polyethylene Film	
Nominal Internal Diameter of Fittings in mm	For Use with Fittings Line Incorporating Flexible Joints
80	350
100	350
150	450
200	550
250	650
300	700
350	800
400	1 100
450	1 100
500	1 350
600	1 350
700	1 750
800	1 750
900	2 000
1 000	2 000
1 100	2 500
1 200	2 500
1 400	2 750
1 500	2 750
1 600	3 100
1 800	3 600
2 000	4 000

NOTE — Actual Layflat width of the tubular film shall not differ* from the nominal by more than ±2.5 percent



The negative tolerance on the nominal thickness shall not exceed 10 percent.

If necessary, it is permitted to use thicker sleeving or double sleeving.

D-3 MECHANICAL PROPERTIES

Tensile strength of the film in the longitudinal and transverse direction shall be not less than 8.3 MPa.

D-4 ELONGATION

The elongation at fracture of the film in the longitudinal and transverse directions shall be not less than 300 percent.

D-5 DIELECTRIC STRENGTH

The Dielectric Strength of the film should be $31.5\text{V}/\mu\text{m}$ minimum.



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