



# CORPORATE STANDARD

AA7501408

Rev. No. 01

PAGE 1 of 3

## GLOBE VALVE, CARBON STEEL, PRESSURE CLASS 150

### 1.0 GENERAL

#### 1.1 SCOPE

This standard specifies the requirements of globe valves hand operated, outside screw and yoke type, carbon steel body material, pressure class ASME 150 with flanged and butt welded end connections in size range 50 mm to 400 mm.

1.2 This standard shall be supplemented by AA0851403 for Technical delivery conditions.

#### 1.3 APPLICATION

Suitable for use in fluids like steam, air, oil, water and other process gases like H<sub>2</sub>, N<sub>2</sub>, Syngas etc\*.

### 2.0 DESIGNATION

eg: GLOBE VLV CS NB100 CL150 RF

### 3.0 TECHNICAL REQUIREMENTS

CL	REQUIREMENTS	COMPLIANCE
3.1	Pressure temperature ratings	ASME B16.34
3.2	Materials	As specified in Table-1
3.3	Construction	Generally in line with BS 1873
3.4	End Connections:	
3.4.1	Flanged	ASME B16.5
3.4.2	Butt welded	ASME B16.25
3.5	Face to face and end to end dimensions	ASME B16.10 (Reproduced in Table-2)
3.6	Hydraulic test pressures:	
3.6.1	Body	32 kg/cm <sup>2</sup>
3.6.2	Seat	23 kg/cm <sup>2</sup>
3.6.3	Back Seat	23 kg/cm <sup>2</sup>
3.6.4	Air leak test	6 kg/cm <sup>2</sup>
3.6.5	Additional Testing requirement for H <sub>2</sub> , N <sub>2</sub> and other gas services	Test to be done as per mutual agreed procedure.

Revisions: As per clause 22.5 of MOM of MRC-Valves

**APPROVED:**  
INTERPLANT MATERIAL RATIONALISATION  
COMMITTEE – MRC (V)

Rev. No. 01	Amd. No.	Reaffirmed	Prepared	Issued	Dt. of 1 <sup>st</sup> Issue
Dt:	Dt:	Year:	HPEP, Hyderabad	Corp. R&D	01-10-1985

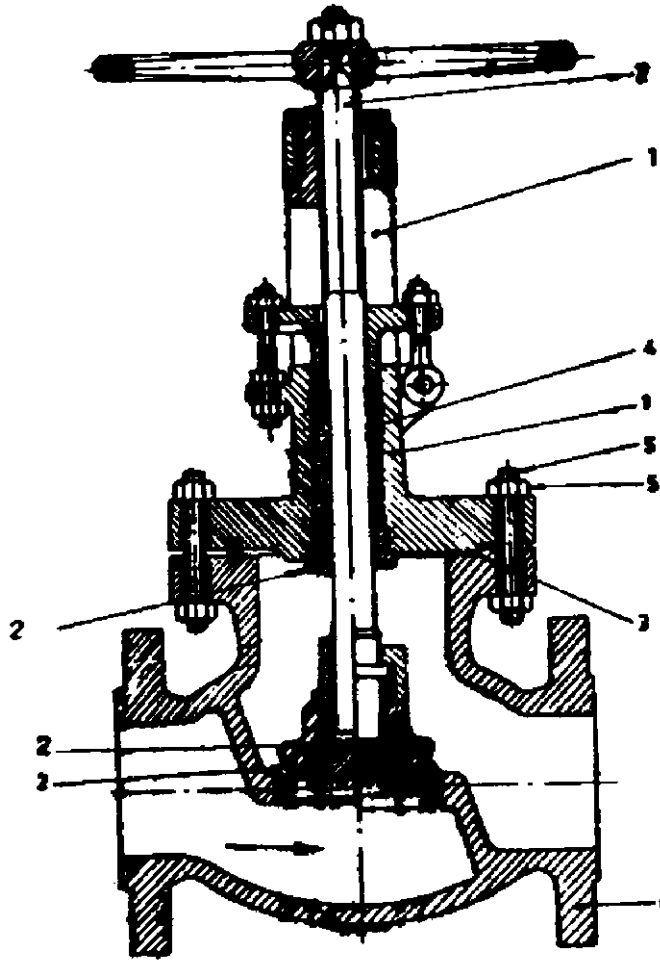


TABLE-1

Sl. No.	Part	Material
1	Valve body, bonnet / yoke	ASTM A216 WCB
2	Trim (Stem, body seat ring, disc, thrust plate, back seat bushing)	SS: 13% Cr
3	Gasket	Spiral wound Stainless Steel with GRAFOIL filler
4	Gland Packing	Grafoil
5	Bolts, nuts for body & bonnet	ASTM A193, B7/ ASTM A194, Gr 2H
6	Other Parts	As per relevant standards

Note: For gas service wherever specified in enquiry Cu & Cu alloys shall not be used for any component.

## GLOBE VALVE, CARBON STEEL, PRESSURE CLASS 150

TABLE – 2

NOMINAL SIZE (NB)		FACE TO FACE AND END TO END DISTANCE (L)	WEIGHT PER PIECE (kg) APPROX		END CONNECTIONS		
					FLANGED	BUTT WELDED	
mm	inch	RF & BW	FL	BW	RF SUB CODE	PIPE OD x t*	SUB CODE
50	2	203	24	18	068	60.3 x	--
(65)	(2 1/2)	216	30	27	-	73.0 x	--
80	3	241	37	34	084	88.9 x	--
100	4	292	61	51	106	114.3 x	--
(125)	(5)	356	94	78	-	-	--
150	6	406	110	88	122	168.3 x	--
200	8	495	168	146	130	219.1 x	--
250	10	622	238	215	149	273.1 x	--
300	12	698	410	370	-	323.9 x	--
350	14	787	450	400	-	355.6 x	--
400	16	914	636	550	-	406.4 x	--

FL Flanged, BW Butt Welded, RF Raised Face, RJ Ring Joint

### NOTE

- 1) 12 Digit Material Code shall be obtained by Suffixing Sub Code to the Standard No.
- 2) Specific requirements of the Plants shall be covered by Plant Annexure to this Standard.
- 3) Sizes given in brackets are non-preferred.
- 4) All Dimensions are in mm unless otherwise specified.
- 5) \* Thickness of pipe varies according to the actual working pressure. Figs given are for general information only. User units to choose pipe thickness according to working pressure.



# CORPORATE STANDARD

AA7501468

Rev. No. 01

PAGE 1 of 3

## GLOBE VALVE, CARBON STEEL, PRESSURE CLASS 800

### 1 GENERAL

#### 1.1 SCOPE

This standard specifies the requirements of globe valves, hand operated, outside screw and yoke type, forged carbon steel body material, pressure class 800 with screwed and socket welded end connections for size ranges 8 mm to 50 mm.

1.2 This standard shall be supplemented by AA0851403 for Technical delivery conditions.

#### 1.3 APPLICATION

These valves suitable for fluids like steam, air, oil, water.

### 2 DESIGNATION

e.g.: GLOBE VLV CS NB25 CL800 SW

### 3 TECHNICAL REQUIREMENTS

CL	REQUIREMENTS	COMPLIANCE
3.1	Pressure temperature ratings	ISO 15761
3.2	Materials	As specified in table 1
3.3	Construction	Generally in line with ISO 15761
3.4	End Connections	
3.4.1	Screwed	NPT Female parallel threads as per ASME B 1.20.1
3.4.2	Socket welded	ASME B16.11
3.5	End to end dimensions	As given in Table 2
3.6	Hydraulic test pressures	
3.6.1	Body	210 kg/cm <sup>2</sup>
3.6.2	Seat	153 kg/cm <sup>2</sup>
3.6.3	Back Seat	153 kg/cm <sup>2</sup>
3.6.4	Air leak test	6 kg/cm <sup>2</sup>

COPYRIGHT AND CONFIDENTIAL  
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.  
It must not be used directly or indirectly in any way detrimental to the interest of the company.

Revisions:  
As per clause 22.7 of MOM of MRC-Valves

**APPROVED:**  
INTERPLANT MATERIAL RATIONALISATION  
COMMITTEE – MRC (V)

Rev. No. 01	Amd. No.	Reaffirmed	Prepared	Issued	Dt. of 1 <sup>st</sup> Issue
Dt: 28-09-2015	Dt:	Year:	HPEP, Hyderabad	Corp. R&D	01-10-1985

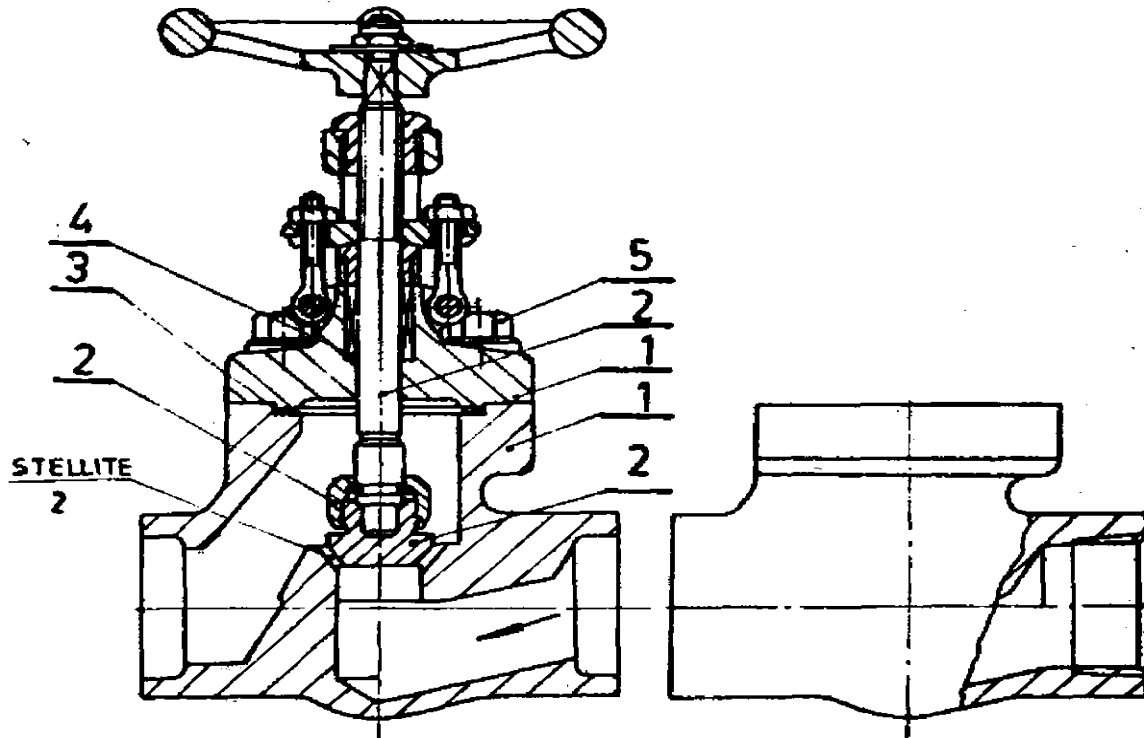


Table 1

Sl. No.	Material	Part
1	Valve body & yoke	ASTM A105
2	Trim, (stem, body seat ring, disc seat, disc nut)	SS 13 % Cr with renewable seat ring
3	Gasket	Spiral wound stainless steel with grafoil filler
4	Gland Packing	Grafoil
5	Bolts, nuts for body & bonnet	ASTM A193 B7 ASTM A194 2H
6	Other parts	As per relevant standards



# CORPORATE STANDARD

AA7501468

Rev. No. 01

PAGE 3 of 3

## GLOBE VALVE, CARBON STEEL, PRESSURE CLASS 800

**Table 2**

Nominal Size (NB)		End to End Distance L	Weight per piece (kg) Approx.	End Connections				
				Socket Welded			Screwed	
mm	inch			Socket Dia. (min.)	Pipe OD	Sub Code	Size of Screwed end	Sub Code
8	¼	84.1	1.6	14.1	13.7	-	¼" NPT	-
10	⅜	84.1	1.6	17.5	17.1	575	⅜" NPT	-
15	½	84.1	1.6	21.7	21.3	583	½" NPT	893
20	¾	90.5	1.8	27.1	26.7	591	¾" NPT	907
25	1	111.1	3.4	33.8	33.4	605	1" NPT	915
(32)	(1 ¼)	165.1	5.2	42.5	42.2	-	-	-
40	1 ½	165.1	6.5	48.6	48.3	621	1 ½" NPT	-
50	2	177.8	11.1	61.11	60.3	630	2" NPT	940

FL Flanged BW Butt Welded RF Raised Face RJ Ring Joint SC Screwed SW Socket Welded.

**NOTE**

- 1) 12 Digit Material Code shall be obtained by Suffixing Sub-Code to the Standard No.
- 2) Specific requirements of the Plants shall be covered by Plant Annexure to this Standard.
- 3) Sizes given in brackets are non- preferred.
- 4) All Dimensions are in mm unless otherwise specified.



# CORPORATE STANDARD

AA7501508

Rev. No. 02

PAGE 1 of 3

## GLOBE VALVE, CARBON STEEL, PRESSURE CLASS 1500

### 1.0 GENERAL

#### 1.1 SCOPE

This standard specifies the requirements of globe valve, hand operated, outside screw and yoke type, carbon steel body material, pressure class ASME 1500 with flanged, screwed, butt welded and socket welded end connections in size ranges from 8 to 400 mm.

1.2 This standard shall be supplemented by AA0851403 for Technical delivery conditions.

#### 1.3 APPLICATION

These valves are suitable for fluids like steam. Air, oil, water, N<sub>2</sub>, CO<sub>2</sub>, Syngas etc.

### 2.0 DESIGNATION

eg: GLOBE VLV CS NB100 CL1500 RJ

### 3.0 TECHNICAL REQUIREMENTS

CL	REQUIREMENTS	COMPLIANCE
3.1	Pressure temperature ratings	ASME B16. 34
3.2	Materials	As specified in table 1
3.3	Construction	Generally in line with ISO 15761 for forged steel valves
3.4	End Connections	
3.4.1	Flanged	ASME B16.5
3.4.2	Socket welded	ASME B16.11
3.4.3	Butt welded	ASME B16.25
3.4.4	Screwed	ASME B 1.20.1
3.5	End to end dimensions	
3.5.1	Face to face dimensions End to End Dimensions for Flanged and Butt welded	ASME B16.10 (As per table 2)
3.5.2	-do- Screwed and Socket welded	-do-
3.6	Hydraulic test pressures	
3.6.1	Body	396 kg/cm <sup>2</sup> (5650 psig)
3.6.2	Seat	291 kg/cm <sup>2</sup> (4150 psig)
3.6.3	Back Seat	291 kg/cm <sup>2</sup> (4150 psig)
3.6.4	Air leak test	6 kg/cm <sup>2</sup> (85 psig)
3.6.5	Additional Testing requirement for N <sub>2</sub> and other gas services	Test to be done as per mutual agreed procedure

Revisions: As per clause 22.5 of MOM of MRC-Valves

**APPROVED:**  
INTERPLANT MATERIAL RATIONALISATION  
COMMITTEE – MRC (V)

Rev. No. 02

Amd. No.

Reaffirmed

Prepared

Issued

Dt. of 1<sup>st</sup> Issue

Dt:

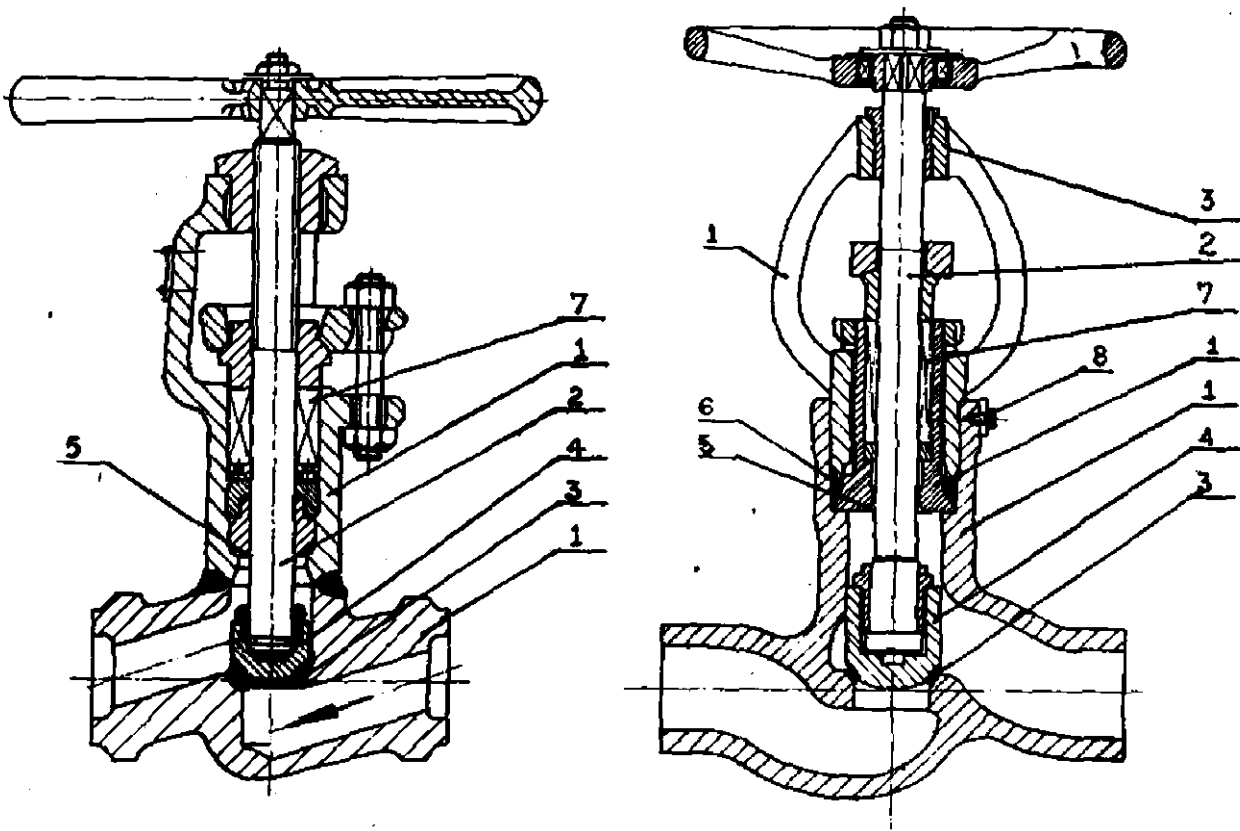
Dt:

Year:

HPEP, Hyderabad

Corp. R&amp;D

01-10-1990



For Sizes up to 2"

For Sizes 2½" and above

TABLE - 1

Sl. No.	Part	Material	
		For 2" and below	for 2½" and above
1	Valve Body, Bonnet & Yoke	ASTM A105	ASTM A216 WCC
2	Stem, Thrust plate	SS 13% Cr	SS 13% Cr
3	Body Seating	Stellite	Stellite
4	Disc	13% Cr SS+Stellite	CS+Stellite
5	Back Seat	SS 13% Cr	Stellite
6	Gasket	-	Soft Iron/Grafoil
7	Gland Packing	Grafoil	Grafoil
8	Body/Bonnet Bolt & Nuts	ASTM A193-B7, ASTM A194-2H	
9	Other Parts	As per relevant Standards	



# CORPORATE STANDARD

AA7501508

Rev. No. 02

PAGE 3 of 3

## GLOBE VALVE, CARBON STEEL, PRESSURE CLASS 1500

TABLE - 2

Nominal Size (NB)		Face to Face & End to End Distance 'L'			Weight per piece (kg) Approx.			Flange Sub code	Socket Welded			Butt Welded		Screwed (NPT)	
mm	inch	BW	RJ	SW & NPT	BW	RJ	SW & NPT	RJ	Socket ID	Pipe OD	Sub Code	Pipe OD x t*	Sub Code	Screw Size	Sub-Code
8	¾	-	-	127	-	-	5	-	14.1	13.7	569	-	-	¼" NPT	879
10	¾	-	-	127	-	-	5	-	17.5	17.1	577	-	-	¾" NPT	887
15	½	-	216	127	-	12	5	283	21.7	21.3	585	-	-	½" NPT	895
20	¾	-	229	127	-	16	8.4	291	27.05	26.7	593	-	-	¾" NPT	909
25	1	-	254	127	-	20.5	8.4	305	33.8	33.4	607	-	-	1" NPT	917
(32)	(1 ¼)	-	279	215.9	-	38	23.6	-	-	-	-	-	-	-	-
40	1 ½	-	305	215.9	-	43.6	23.6	321	48.65	48.3	623	-	-	1 ½" NPT	933
50	2	368	371	215.9	-	75	23.6	330	61.1	60.3	631	60.3 x	640	2" NPT	941
(65)	(2 ½)	340	422	-	56	105	-	348	-	-	-	73.0 x	658	-	-
80	3	390	473	-	65	120	-	356	-	-	-	86.9 x	666	-	-
100	4	480	549	-	111	180	-	372	-	-	-	114.3 x	682	-	-
(125)	(5)	580	676	-	140	250	-	-	-	-	-	-	-	-	-
150	6	630	711	-	165	300	-	399	-	-	-	168.3 x	704	-	-
200	8	770	841	-	350	550	-	402	-	-	-	219.1 x	712	-	-
250	10	930	1000	-	700	1150	-	410	-	-	-	273.1 x	720	-	-
300	12	1130	1146	-	1000	1750	-	429	-	-	-	323.9 x	739	-	-
350	14	1257	1276	-	1380	2300	-	437	-	-	-	355.6 x	747	-	-
400	16	1384	1406	-	2000	3300	-	445	-	-	-	406.4 x	755	-	-

### NOTE:

- 1) 12 digit material code shall be obtained by suffixing sub-code to the Standard No.
- 2) Specific requirements of the plant shall be covered by plant annexure to this standard.
- 3) Sizes given in brackets are non-preferred.
- 4) All dimensions are in mm unless otherwise specified.
- 5) \* Thickness of pipe varies according to the actual working pressure. Figs given are for general information only. User units to choose pipe thickness according to working pressure.



# CORPORATE STANDARD

AA7541508

Rev. No. 01

PAGE 1 of 3

## SWING CHECK NON RETURN VALVE, CARBON STEEL PRESSURE CLASS 1500

### 1.0 GENERAL

#### 1.1 Scope

This standard specifies the requirements of swing check non return valves, carbon steel body material, pressure class 1500, with flanged and butt welded and connections for size range from 65 mm to 400 mm.

1.2 This standard is supplemented by AA0851403 - TDC for valves.

#### 1.3 Applications

These valves are used for fluids like steam, air, oil, water and other process gases like H<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, syngas etc.

### 2.0 DESIGNATION

eg. SCNRV CS NB 100 CL 1500 BW

### 3.0 TECHNICAL REQUIREMENTS

CL	REQUIREMENTS	COMPLIANCE
3.1	Pressure temperature ratings	ASME B16.34
3.2	Materials	As specified in Table 1
3.3	Construction	Generally in line with BS 1868
3.4	End Connections	
3.4.1	Flanged ends	ASME B16.5
3.4.2	Butt Welded ends	ASME B16.25
3.5	Face to face and end to end distance	ASME B16.10 (Reproduced in Table 2)
3.6	Hydraulic Test pressures	
3.6.1	Body	396 kg/cm <sup>2</sup>
3.6.2	Seat	291 kg/cm <sup>2</sup>
3.6.3	Additional Testing requirement for H <sub>2</sub> , N <sub>2</sub> and other gas services	Test to be done as per mutual agreed procedure

Revisions: As per clause 22.5 of MOM of MRC-Valves

**APPROVED:**  
INTERPLANT MATERIAL RATIONALISATION  
COMMITTEE – MRC (V)

Rev. No. 01

Amd. No.

Reaffirmed

Prepared

Issued

Dt. of 1<sup>st</sup> Issue

Dt:

Dt:

Year:

HPEP, Hyderabad

Corp. R&D

01-10-1986

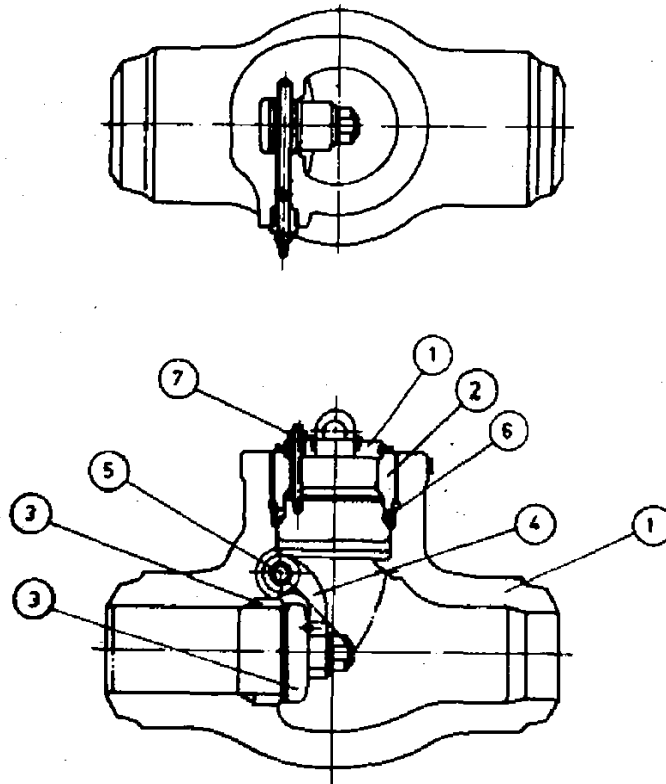


TABLE - 1

Sl. No.	Part	Material
1	Valve body & cover	ASTM A216 WCC
2	Bonnet	ASTM A105
3	Seat & Disc	Stellite on Carbon Steel
4	Arm	Carbon Steel
5	Hinge pin	13% Cr SS
6	Gasket	Soft iron/ Grafoil
7	Bolts, nuts for body & cover	ASTM A193 B7 ASTM A194 Gr. 2H

Note: For gas service, wherever specified in enquiry copper & copper alloys shall not be used for any component.

## SWING CHECK NON RETURN VALVE, CARBON STEEL PRESSURE CLASS 1500


### TABLE - 2

NOMINAL SIZE (NB)		FACE to FACE & END to END DISTANCE 'L'		WEIGHT PER PIECE (kg) APPROX		END CONNECTIONS		
						FLANGED	BUTT WELDED	
mm	INCH	BW	RJ	FL/RJ	BW	RJ SUB CODE	PIPE OD X t*	SUB CODE
(65)	(2 ½)	254	422	50	32	349	73.0 X	659
80	3	305	473	80	55	357	88.9 X	667
100	4	406	549	130	85	373	114.3 X	683
(125)	(5)	483	676	250	135	--	---	-
150	6	559	711	305	160	390	168.3 X	705
200	8	711	841	520	270	403	219.1 X	713
250	10	864	1000	700	420	411	273.1 X	721
300	12	991	1146	1100	680	420	323.9 X	730
350	14	1067	1276	1700	1000	438	355.6 X	748
400	16	1194	1407	2500	1665	446	406.4 X	757

BW – Butt Welded; RJ – Ring Joint; FL – Flanged; RF – Raised Face;

**NOTE:**

- 1) 12 digit material code shall be obtained by suffixing sub-code to the Standard No.
- 2) Specific requirements of the plants shall be covered by plant annexure to this Standard No.
- 3) Sizes given in brackets are non-preferred.
- 4) All dimensions are in mm unless otherwise specified.
- 5) \* Thickness of pipe varies according to the actual working pressure figs given are for general information only. User units to choose pipe thickness to working pressure.

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
		<b>PURCHASE SPECIFICATION</b>	Rev. No. 01
		<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>	Page 1 of 13

COPYRIGHT AND CONFIDENTIAL  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,  
 It must not be used directly or indirectly in any way detrimental to the interest of the company.

**1.0 GENERAL:**

The actuators are intended for operation of valves used in power stations, fertilizer plants, petro-chemical plants & refineries. These will generally be located outdoor where it will be exposed to atmosphere laden with fine coal dust, ammonia vapour, hydro carbon vapour. The actuators proposed shall be suitable for operation under aforesaid atmospheric condition. Copper and copper alloys shall not be used.

**2.0 SCOPE:**

This specification covers the design, manufacture, testing and delivery of electric actuators for open/close & regulating duty. The actuator assembly shall be complete with drive motors, gears, hand wheel, signalling and switching units associated control and terminal boxes, internal wiring, earthing terminal and other accessories as required.


**3.0 STANDARDS:**

The actuator shall comply with the requirements of latest issue of relevant IEC/Indian standard **IS 325**. In case of any conflict between this specification and the above standards, this standard shall prevail. The mounting dimensions shall be as per DIN 3210.

Valve design shall be as per the specifications indicated in table below (Types of valves-as applicable & as per requirement mentioned in Variant Table)

Sl. No.	VALVE TYPE	MATERIAL	ANSI Pr.CLASS	BHEL CORP. STD.
3.1	GATE VALVE	CARBON STEEL	150	AA7521418
3.2	GATE VALVE	CARBON STEEL	300	AA7521428
3.3	GATE VALVE	CARBON STEEL	600	AA7521448
3.4	GATE VALVE	CARBON STEEL	1500	AA7521508
3.5	GATE VALVE	CARBON STEEL	2500	AA7521528
3.6	GATE VALVE	1-1/4CR-1/2MO	600	AA7521451
3.7	GATE VALVE	1-1/4CR-1/2MO	1500	AA7521511
3.8	GATE VALVE	2-1/4CR-1MO	300	AA7521434
3.9	GATE VALVE	2-1/4CR-1MO	600	AA7521454
3.10	GATE VALVE	2-1/4CR-1MO	1500	AA7521514
3.11	GATE VALVE	2-1/4CR-1MO	2500	AA7521534
3.12	GATE VALVE+GL.SEALING	CARBON STEEL	150	AA7526408
3.13	GATE VALVE+GL.SEALING	CARBON STEEL	300	AA7526428
3.14	GLOBE VALVE	CARBON STEEL	150	AA7501408
3.15	GLOBE VALVE	CARBON STEEL	300	AA7501428
3.16	GLOBE VALVE	CARBON STEEL	600	AA7501448
3.17	GLOBE VALVE	1-1/4CR-1/2MO	600	AA7501451
3.18	GLOBE VALVE	1-1/4CR-1/2MO	1500	AA7501511
3.19	GLOBE VALVE	1-1/4CR-1/2MO	2500	AA7501531
3.20	GLOBE VALVE	2-1/4CR-1MO	600	AA7501454
3.21	GLOBE VALVE	2-1/4CR-1MO	1500	AA7501514
3.22	GLOBE VALVE	2-1/4CR-1MO	2500	AA7501534
3.23	GLOBE VALVE+GL.SEALING	CARBON STEEL	150	AA7506408

Refer Doc	LAYOUTS & PIPING ENGINEERING	PREPARED	CHECKED	APPROVED	DATE
	PROJECT ENGINEERING & SYSTEMS DIVISION	RAGHAVENDRA SVN	G SRIKANTH	VVSS SUNDAR	04.10.14

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
	<b>PURCHASE SPECIFICATION</b>		Rev. No. 01
	<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>		Page 2 of 13

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

3.24	GLOBE VALVE+GL.SEALING	CARBON STEEL	300	AA7506428
3.25	GLOBE VALVE WITH REG. DISC	CARBON STEEL	800	HY7511943
3.26	GATE VALVE	STAINLESS STEEL	150	AA7521418
3.27	GLOBE VALVE	STAINLESS STEEL	150	AA7501418
3.28	GLOBE VALVE	CARBON STEEL	1500	AA7501508
3.29	GATE VALVE	CARBON STEEL	150	AA7521408
3.30	GLOBE VALVE WITH REG. DISC	2-1/4CR-1MO	1500	HY7511514
3.31	GLOBE VALVE WITH REG. DISC	CARBON STEEL	150	AA7511408
3.32	GLOBE VALVE WITH REG. DISC	CARBON STEEL	300	AA7511428

Sl. No.	VALVE TYPE	MATERIAL	Pr.CLASS	PLANT SPEC.
3.33	GATE VALVE (SIZE >24")	CARBON STEEL	ANSI 300	PY52049
3.34	REG.GLOBE VALVE 6" FL	CARBON STEEL	ANSI 600	PY52121
3.35	GATE VALVE	CAST IRON	PN 1.6	PY52127

**4.0 AMBIENT CONDITION:**

The actuators shall be suitable for operation in an ambient temperature of 50°C, -15°C min.and max. relative humidity of 100% unless otherwise specified.

**5.0 POWER SUPPLY**

5.1 The actuator motor shall be of squirrel cage Induction type and suitable for operation on power supply of 415V, 3 Phase 50Hz AC unless otherwise specified. Only one feeder of 415V, 3 Ph, 50 Hz AC will be provided. Any other power supplies required for control circuit operation shall be derived from 415V, 3 Ph, 50 Hz AC only.

5.2 For isolating service the actuator shall be rated for minimum of fifteen minutes continuous operation or three successive open close operations of the valve whichever is longer.

5.3 For regulating service, the actuator shall be suitably time rated for the duty cycle with not less than 150 starts per hour.

5.4 The motor shall operate without any practical difficulty for any of the following conditions:


- a) Voltage variation : ± 10%
- b) Frequency variation : ±5%
- c) Combined variation : ±10%

**6.0 PERFORMANCE:**

6.1 Motor shall be suitable for direct on line starting.

6.2 Starting current shall not exceed six times full load current.

6.3 Motors shall meet the requirements of current, torque, axial thrust, acceleration & stall time as imposed by driven equipment. Thermal torque rating of each drive unit shall have adequate margin and at least equal to theoretical brake torque required to drive the equipment under full load, including all losses in speed reducers and power transmission.

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
		<b>PURCHASE SPECIFICATION</b>	Rev. No. 01
		<b>VALVE WITH ELECTRICAL ACTUATOR</b> <b>&amp; INTEGRAL STARTER</b>	Page 3 of 13

**COPYRIGHT AND CONFIDENTIAL**  
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

6.4 The motors shall be capable of withstanding the torque and voltage stresses resulting from an out of phase condition between motor residual voltage and incoming source voltage equal to 150% of rated voltage during transfer of supply.

6.5 The motor temperature rise shall be limited to class 'B' values.

6.6 The motor shall be capable of running at 75% of rated voltage for a period of 5 minutes. The motor shall also be capable of starting and accelerating to full speed along with the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of its rated value.

6.7 Margin of 20% shall be provided in motor rating over and above the continuous maximum demand of the driven equipment.

#### 7.0 CONSTRUCTION

7.1 Motors shall be totally enclosed to minimum protection class of IP67 as per IEC 345. The enclosure shall be suitable to protect the motor from leakage steam, water, gas or oil from valve joints and glands.

7.2 Cooling fans where ever provided shall be suitable for both directions of rotation.

7.3 Actuator Make: Only reputed & proven designs are acceptable. Unless noted otherwise it shall be of ROTORK / AUMA / LIMITORQUE/ ANTRIEB make.

#### 8.0 INSULATION:

Motors shall have class 'F' non-hygroscopic insulation.

#### 9.0 LUBRICATION:

The actuators shall be provided with double shielded, Grease prelubricated regressive, antifriction bearings having a minimum life rating of 1,00,000 hours.

#### 10.0 TORQUE SWITCHES :

10.1 Each actuator shall be provided with atleast one open and one close torque switches. All torque switches shall be with 2 NO + 2 NC contacts.

10.2 The torque switches shall have an accuracy  $\pm 3\%$  of set value. The exact value shall be furnished in the offer.

10.3 The torque switches shall be provided with calibrated knobs for setting desired torque. Separate knobs shall be provided for close and open torque switches.

10.4 The torque switches shall be provided with mechanical latching device to prevent operations when unsealing a jammed valve in closed position. Similarly close torque switch shall not act while unsealing from jammed open position. The latching device shall unlatch as soon as the valve leaves the end position. If such provision is not possible, the torque

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
	<b>PURCHASE SPECIFICATION</b>		Rev. No. 01
	<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>		Page 4 of 13

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

switches shall be bypassed by end position limit switches which opens on valve leaving end position. These limit switches additional to the number of limit switches specified elsewhere.

**11.0 LIMIT SWITCHES:**

11.1 One open and one close limit switches shall be provided. The type of limit switches shall be gear driven cam type or proximity type as given in the data sheet.

11.2 Two intermediate position limit switches each independently adjustable for entire travel shall be provided. All limit switches shall be with 2NO + 2NC contacts and shall be of rotary coil type.

11.3 Actuator running in open and actuator running in close direction contacts shall be provided. The same shall be with 2 NO + 2 NC contacts.

**12.0 CONTACTS:**

12.1 The contacts of limit and torque switches shall be snap acting, self cleaning type. The contacts shall be Capable of making and breaking inductive current of 5A at 240V AC/0.25 A at 220V DC.

12.2 The actuator motor shall be provided with winding temperature protection by thermostat embedded in the hot spot of the motor windings directly sensing the winding temperature and giving tripping command to trip motor for overload.

**13.0 ENCLOSURE:**

13.1 The torque and limit switches shall preferably be housed in a separate enclosure with protection class IP67 of IEC 144.

**14.0 HAND WHEEL :**

14.1 The actuator shall be provided with a hand-wheel for manual operation. The size of hand wheel shall be sufficiently big for easy operation. A lever shall be provided to engage the hand wheel but shall disengage automatically on energising the motor.


14.2 The hand wheel shall be so arranged that when looking from hand wheel the valve is closed by rotating the hand wheel in clock wise direction.

14.3 The hand wheel shall have plain polished rim.

**15.0 SPACE HEATER:**

Space Heater shall be provided for actuators rated above 5 kw or if the ambient temperature is below **5 Deg C.**

Where applicable, space heater shall be provided in limit switch and starter compartments to prevent condensation. The Power supply requirements of space heater shall be derived within the actuator compartment from 415V AC 3 phase supply.

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
	<b>PURCHASE SPECIFICATION</b>		Rev. No. 01
	<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>		Page 5 of 13

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

**16.0 LOCAL POSITION INDICATOR**

16.1 Each actuator shall be provided with a mechanical position indicator to indicate valve position with sufficient accuracy.

16.2 The local position indicator should be factory calibrated so that it reads accurately the valve/ damper position when the actuator is mounted at purchaser's works or at site. It shall preferably be adjustable.

**17.0 REMOTE POSITION TRANSMITTERS**

Each actuator shall be provided with 4-20mA, 2wire 24V DC potentiometric type electronic position transmitter or with proximity type position transmitter or LVDT type position transmitter as indicated in the data sheet.

**18.0 INTEGRAL STARTER:**

18.1 Integral Starter shall be provided in a water tight enclosure with protection class 67 as per IEC 144.

18.2 The integral starter shall consist of the following equipment.

- a) Mechanically and electrically interlocked reversing contactors.
- b) Thermal overload relay.
- c) Step down control transformer.
- d) Interposing relays.
- e) Monitoring relay.
- f) Fuses on primary and secondary side of control transformer.

18.3 The control transformer shall be provided with earther screen between primary and secondary winding.

18.4 One line of secondary of control transformer shall be earthed through a disconnecting link.


18.5 The control transformer shall be sized to feed an external load of at least 15 VA in addition to internal load.

**19.0 LOCAL CONTROLS:**

19.1 Local open-stop push buttons shall be provided on the actuator. The stop push button shall stay put on depressing and require a key to reset. In addition to the push buttons, a two position key operated selector switch shall be provided for local remote operation mode selection. Contacts with 2 NO + 2 NC shall be provided for actuator in remote mode and actuator in local mode.

**20.0 WIRING:**

20.1 The internal wiring shall be of minimum 1.5 sq.mm stranded PVC insulated copper conductor.

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
	<b>PURCHASE SPECIFICATION</b>		Rev. No. 01
	<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>		Page 6 of 13

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

20.2 The wiring shall be identified by means of numbered ferrules on both ends of all wires.

**21.0 Terminal & Terminal Boxes :**

**21.1 Motor Terminal Box :**

21.1.1 The terminals, terminal boards, terminal boxes, winding details and associated equipment shall be suitable for connection to supply system having short circuit capacity 40 KA for 1 sec.

21.1.2 The terminals shall be stud type insulated from the frame. The insulation shall not be porcelain. The minimum size of studs shall be 6mm brass or 4 mm stainless steel or phosphor bronze.

21.1.3 The terminal boxes shall be totally enclosed to protection class IP 67 of IEC 144.

21.1.4 Terminal box shall be capable of being turned through 360° in steps of 90° to facilitate cable entry from any direction.

21.1.5 Terminal box shall have sufficient space to connect one no. of 3Cx2.5 sq.mm copper conductor, PVC insulated armoured cable.

**21.2.0 Actuator Terminal Box :**

21.2.1 All terminals of limit and torque switches, space heater, position transmitters shall be brought to a common terminal box. The enclosure shall be to protection class IP 67 of IEC 144.

21.2.2 The terminal shall be screw type with sufficient insulation between two adjacent terminals.

21.2.3 There shall be at least five terminals spare to terminate spare cores of cable.

21.2.4 The actuator terminal box shall be suitable for receiving the following cables.

- a) one no. 19C X 2.5 sq.mm control cable.
- b) one no. 10C X 2.5 sq.mm control cable.
- c) one no. DAS cable of OD 8.0 mm (approx.)


**22.0 Cable Glands:**

22.1 The motor terminal box and actuator terminal box shall be provided with double compression nickel plated brass cable glands to suit cable type and size specified in data sheet.

**23.0 Name Plate:**

23.1 Name plate with inscription shall be provided for push buttons and selector switch.

23.2 Motor shall be provided with name plate as per IEC/IS standard.

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
	<b>PURCHASE SPECIFICATION</b>		Rev. No. 01
	<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>		Page 7 of 13

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

23.3 Wiring diagram of actuator shall be fixed inside the actuator terminal box cover plate.

23.4 A name plate on the actuator shall be provided with the following minimum data.

- (a) Tag No (purchaser's Tag no of associated valve/damper)
- (b) Torque rating
- (c) Full travel time

**24.0 EARTHING TERMINAL :**

Two earthing terminals with earth symbol shall be provided on either side of motor and also an actuator terminal box. The earth terminal shall be 4 mm brass stud.

**25.0 PAINTING :**

The motor external parts shall be furnished and painted to produce a neat and durable surface which would prevent rusting and corrosion. The equipment shall be thoroughly degreased. All rust, sharp edges and scale removed and treated with one coat of primer and finished with two coats of grey enamel paint. Motor fans (if any) shall also be painted to withstand corrosion.

**26.0 TESTS :**


26.1 **Type Tests :** 5 copies of type test certificates shall be furnished for perusal. The type test should have been carried out as per IEC/IS 325 specification. But the following minimum check should have been carried out.

- a) Working check for all accessories.
- b) Pressurisation : the actual gear box shall be fitted with oil and pressurised at 1 bar for a period of not less than 15 minutes. No seepage or leakage shall be allowed.
- c) IR (Insulation Resistance) test.
- d) Torque characteristics : The manufacturer shall supply a set of curves showing maximum operating duration of actuator for various torque values corresponding to motor temperature rise.
- e) Supply variation
- f) Torque switch setting
- g) Consecutive starts of 60 starts
- h) Overheating test.
- i) Degree of protection test.
- j) Humidity cycling
- k) Endurance test.

**26.2 Routine Test :**

The following routine tests shall be carried out on each actuator.

- a) IR test and Impulse test.
- b) Wiring continuity test.
- c) Operational test for proper functioning of the valve along with actuator.
- d) Motor locked rotor test and check current at stand still.
- e) Load actuator to maximum rated torque and measure load current.

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
		<b>PURCHASE SPECIFICATION</b>	Rev. No. 01
		<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>	Page 8 of 13

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

f) Over voltage test.

**27.0 SPARES:**

A list of recommended spares with unit price shall be furnished for three years of trouble free operation.

**28.0 DOCUMENTS :**

28.1 Any deviation in the offered product from any clause / sub clause above must be clearly mentioned by the bidder in the offer.

28.2 Three copies of complete technical literature, wiring diagram and dimensional drawings shall be furnished along with the offer.

28.3 Three copies of technical datasheet of the actuator shall be furnished along with the offer.


28.4 Ten copies each of the following documents/drawings shall be furnished within 2months after placement of order:

- a) Final control circuit and wiring diagram showing external wiring.
- b) Final overall assembly drawing of valve + actuator assembly
- c) O & M Manuals.

28.5 Six copies of all 'type and routine test certification' shall be despatched separately.

**DATA SHEET :**

SLNO	PARAMETERS	
1	Tag No.	
2	Service	
3	Project	
4	Power supply	Motor –415V, 3 phase AC, 50 Hz Space Heater (Where Applicable) –Power supply internally fed
5	Electronic position transmitter (EPT)	4-20mA, 2 wire 24V DC potentiometric type.
6	Integral starter	YES/ <del>NO</del>
7	Local push buttons	YES/ <del>NO</del>
8	Local / Remote selector switch	YES/ <del>NO</del>
9	Enclosure	Weather proof IP67
10	Power cable size	a) 4 core x 2.5 mm sq. Copper conductor PVC insulated upto 3.7 KW motor. b) 4 core x 6.0 mm sq. Aluminium conductor PVC insulated and steel armoured for 3.8 to 5.0 KW motor. c) 3 core x 16 sq. mm Aluminium conductor PVC insulated and steel armoured.

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
	<b>PURCHASE SPECIFICATION</b>		Rev. No. 01
	<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>		Page 9 of 13

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

11	Control cable size	2 nos. multi core 2.55 sq.mm copper conductor PVC insulated & armoured Cable.
12	Painting	Epoxy based shade 631 of IS-5
13	Fault withstand capacity of motor terminal box	45 KA for 0.2 Seconds

**29.0 PERFORMANCE GUARANTEE:**

Actuators shall be guaranteed for satisfactory performance under the specified conditions for a period of 24 Months.

**30.0 PACKING :**

Actuators shall be seaworthy for transport by rail, road or sea as applicable.

31.0 Where ever the integral bypass valve is provided the bypass valve also shall be fitted with

electric actuator with similar technical features as of main actuator.

32.0 Extension spindle general arrangements Drg No. (vendor shall enclose the drgs. wherever applicable)

**NOTE :-** Wherever valves are required with extension spindle arrangement vendor shall supply the extension spindle arrangement with floor pedestal (pedestal shall have 4 x dia 18 holes on pcd 260 to fix the pedestal on floor) and with 2 universal joints and one expansion piece to accommodate the piping expansion/ movement for both main valve and bypass valve (where ever applicable).


**31.0 INSPECTION AND TESTING:**

Bidder to furnish Quality Plan to BHEL/Customer/Consultant for approval after award of contract. Quality plan will be reviewed during detailed Engineering stage with respect to Inspection, standard Engineering practices & Specification Requirements and various tests and stages of inspection. Bidder to abide by the same.

QAP guidelines and format is attached.

Inspection agency:

BHEL/Third Party appointed by BHEL/Customer/Consultant. The various review/witness/observation stages by Individual agencies (or) Group of Agencies as above will be in line with approved quality plan

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
		<b>PURCHASE SPECIFICATION</b>	Rev. No. 01
		<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>	Page 10 of 13


ANNEXURE-A – DATA SHEET

Information To Be Furnished By Vendor Along With Offer

(Vendor to fill-up this data sheet and furnish along with offer. REVISIONS carried out if any, at any time later must be submitted to BHEL PE&SD Hyd.)

Sl. No	PARAMETERS	VENDOR'S RESPONSE	REMARKS
1.	Valve tag No(s).		
2.	Quantity		
3.	Description(Type/Matl./End Details)		
4.	Valve size/ANSI Pressure Class		
5.	Actuator(Motor)rating (kW)		
6.	Make of actuator & Model No.		
7.	Type of motor (Sq.cage/Induction)		
8.	Supply voltage / Frequency.	415V +/-5% /50Hz +/-5%	
9.	Suitable for short time duty.	15 min	
10.	Suitable for minimum no. of starts.	150	
11.	Enclosure protection class for complete actuator unit	IP 67	
12.	Hazardous Area Classification	Safe Area	
13.	Motor insulation		
14.	Design ambient Temp.	80%	
15.	Minimum starting voltage	75%	
16.	Min. voltage during running for 5 min.		
17.	Motor full load current		
18.	Motor starting current.		
19.	Type of bearings (Sealed for life-Type) min. Life	100,000hrs	
20.	Torque (Nm)		
21.	Output speed (rpm)		
22.	End of travel limit switch		
23.	Intermediate adjustable position limit switches		
24.	Built-in local position indicator	One	
25.	Built-in electronic positioner with power supply unit		
26.	In built electric positioner unit with position transmitter for remote indication-for regulating type of valves.	4 -20 mA isolated output	
27.	Integral stator (Clause 18)		
28.	Local push button for local/remote/stop facility		
29.	Local remote selectors switch		
30.	Torque limit switches-1 one for each direction		
31.	Contact ratings	5 Amps at 240V AC 0.5 Amps at 110V DC	


**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
	<b>PURCHASE SPECIFICATION</b>		Rev. No. 01
	<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>		Page 11 of 13

**COPYRIGHT AND CONFIDENTIAL**

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,  
It must not be used directly or indirectly in any way detrimental to the interest of the company.

32.	Space heater in terminal box		
33.	Hand wheel (with declutching lever)	1 No.	
34.	Name plate SS316 material (Clause 7.1.2)		
35.	Paint-epoxy based (shade 631 Grey-IS-5)		
36.	Cable glands (explosion proof design, if applicable)		
37.	Dimensional G.A drawing	Drg. No.	
38.	Control wiring drawing	Drg. No.	
39.	Action of loss of signal	Stay put	
40.	Motion inhibit feature between actuator movements		
41.	Protection system provided (against single phasing, incorrect phase rotation, thermostat)		
42.	Type of service-Isolating/Regulating		
43.	Valve & Actuator assembly GA drawing (enclosed)		

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
	<b>PURCHASE SPECIFICATION</b>		Rev. No. 01
	<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>		Page 12 of 13

**VARIANT TABLE:**

Var No	Size	End conn	Item Description	Applicable Valve Spec	Material Code
01	32"	BW	MO GTV CS (WCB) 32" CL 300 BW	PY52049	PY9752034012
02	12"	BW	MO GTV AS (WC9) 12" CL 1500 BW	AA7521514	PY9752034020
03	--	--	ACTUATOR FOR 14" GTV CS GO VALVE	--	PY9752034039
04	6"	FLRF	MO REG.GLV CS (WCB) 6" CL 600 FLRF	PY52121	PY9752034047
05	16"	FLFF	MO GTV CAST IRON 16" CL PN1.6 FF	PY52127	PY9752034055
06	10"	FLFF	MO GTV CAST IRON 10" CL PN1.6 FF	PY52127	PY9752034063
07	12"	FLFF	MO GTV CAST IRON 12" CL PN1.6 FF	PY52127	PY9752034071
08	14"	FLFF	MO GTV CAST IRON 14" CL PN1.6 FF	PY52127	PY9752034080

**COPYRIGHT AND CONFIDENTIAL**


The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,  
It must not be used directly or indirectly in any way detrimental to the interest of the company.

Form No:	 PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52034</b>
		<b>PURCHASE SPECIFICATION</b>	Rev. No. 01
		<b>VALVE WITH ELECTRICAL ACTUATOR &amp; INTEGRAL STARTER</b>	Page 13 of 13

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,  
 It must not be used directly or indirectly in any way detrimental to the interest of the company.

**RECORD OF REVISIONS:**

Rev No	Date	Revision Detail	Prepared	Reviewed	Approved
00	04.10.14	FIRST ISSUE	SVN R	GS	VVSS S
01	22.09.22	Inspection and testing notes are added	SVN R	GS	VVSS S

Form No:	 <b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52 151</b>
		<b>TECHNICAL SPECIFICATION</b>
		<b>GATE VALVE, CARBON STEEL, PRESSURE CLASS 800</b>
		Rev. No. 01
		Page 1 of 3

**GATE VALVE, CARBON STEEL,  
PRESSURE CLASS 800**

**1.0 GENERAL**

**1.1 SCOPE**

This standard specifies the requirements of solid wedge gate valves, compact design, hand operated, outside screw and yoke type, carbon steel body material, pressure class 800 with screwed and socket welded end connections for size ranges 8 mm to 50 mm.

1.2 This standard shall be supplemented by AA0851403 for Technical delivery conditions.

**1.3 APPLICATION**

These valves are suitable for fluids like steam, air, oil, water and other process gases line N<sub>2</sub>, H<sub>2</sub>, CO<sub>2</sub>, syngas etc.

**2.0 DESIGNATION**

e.g.: GATE VALVE CS 1" CL800 SW

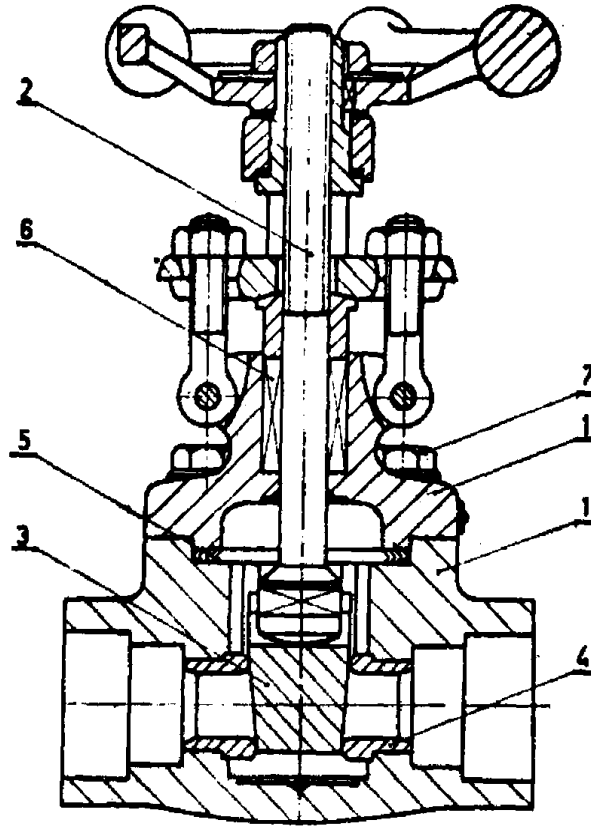
**3.0 TECHNICAL REQUIREMENTS**

CL	REQUIREMENTS	COMPLIANCE
3.1	Pressure temperature ratings	ASME B 16.34
3.2	Materials	As specified in Table 1
3.3	Construction	Generally in line with ISO 15761
3.4	End Connections	
3.4.1	Screwed	NPT Female parallel threads as per ASME B 1.20.1
3.4.2	Socket welded	ASME B16.11
3.5	Face to face and End to end dimensions	As given in Table 2
3.6	Hydraulic test pressures	
3.6.1	Body	210 kg/cm <sup>2</sup>
3.6.2	Seat	153 kg/cm <sup>2</sup>
3.6.3	Back Seat	153 kg/cm <sup>2</sup>
3.6.4	Air leak test	6 kg/cm <sup>2</sup>
3.6.5	Additional Testing requirement for H <sub>2</sub> , N <sub>2</sub> and other gas services	Test to be done as per mutual agreed procedure

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

Refer Doc	<b>LAYOUTS &amp; PIPING ENGINEERING</b>	PREPARED	CHECKED	APPROVED	DATE
	<b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<i>Imran</i> IMRAN AHMAD	<i>DS</i> DS BARAIK	<i>Srikanth</i> SRIKANTH G	02.05.16

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,  
 It must not be used directly or indirectly in any way detrimental to the interest of the company.



**TABLE - 1**

Sl. No.	Part	Material
1	Valve body, bonnet and yoke	ASTM A105
2	Spindle	13% Cr SS
3	Wedge	13% Cr SS
4	Body Seating	13% Cr SS
5	Gasket	Spiral wound stainless steel with Grafoil filler
6	Gland Packing	Grafoil with deep stuffing box
7	Bolts, nuts for body and bonnet	ASTM A193 B7, ASTM A194 2H
8	Other Parts	As per relevant standards.

Note: For gas service, wherever specified in the enquiry, Cu & Cu alloys shall not be used for any component.



**TABLE - 2**

Nominal size (NB)		End to End Distance 'L'	Weight per piece(Kg) Approx.
mm	inch	mm	kg
8	1/4	84.1	1.81
10	3/8	84.1	1.81
15	1/2	84.1	1.81
20	3/4	90.5	2.04
25	1	114.3	3.65
40	1 1/2	120.7	6.47
50	2	130.2	8.40

**4.0 DOCUMENTATION:**

**4.1 Along with the offer:**

One copy of each of the following documents shall be submitted along with the offer:

- i) G.A. drawings/ leaflets/ catalogues for the item with binding dimensions, material specification details, weight etc.
- ii) Signed and stamped copy of this specification accepting the scope of supply as indicated in the specification.

**4.2 After PO Placement:**

Four copies each of the following documents shall be submitted for approval.

G.A. Drawings for the offered item with binding dimensions, material specification details, tests to be conducted, weight etc.

Schedule for document submissions:

S.no	Description	Schedule
1	Submission of GA drawing by vendor	7 days from the date of P.O.
2	Approval GA drawing by BHEL	14 days from drawing submission *


\* The GA drawing submitted by vendor shall be strictly in compliance to all applicable standards and specification. The approval of GA drawing in no way absolves the supplier from meeting this specification requirement

++++

**COPYRIGHT AND CONFIDENTIAL**  
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

**RECORD OF REVISIONS:**

Rev No	Date	Revision Detail	Revised by	Approved by
00	12.01.2016	First Issue	CHM	SRIKANTH G
01	02.05.2016	Variance table excluded & Generally revised	<i>Yug</i> DS BARAIK	<i>Srikanth</i> SRIKANTH G

Form No:	 <b>BHEL</b> PE&SD	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52 167</b>
	<b>TECHNICAL SPECIFICATION</b>		Rev. No. 00
	<b>GATE VALVE, ALLOY STEEL(2 1/4 Cr 1Mo)</b> <b>PRESSURE CLASS 2500</b>		Page 1 of 3

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

**GATE VALVE, ALLOY STEEL (2 1/4 Cr 1Mo)**  
**PRESSURE CLASS 2500**

**1.0 GENERAL**

**1.1 SCOPE**

This standard specifies the requirements of flexible wedge gate valves, hand operated, outside screw and yoke type, alloy steel ( 2 ¼ Cr 1 Mo) body material, pressure class ASME 2500, with flanged and butt welded end connections for size ranges 15 mm to 500 mm.

1.2 This standard shall be supplemented by AA0851403 for technical delivery conditions.

**1.3 Applications**




These valves are suitable for fluids like steam, air, oil, water.

**2.0 DESIGNATION**

e.g.: GATE VLV WC9 4" CL2500 BW

**3.0 TECHNICAL REQUIREMENTS**

CL	REQUIREMENTS	COMPLIANCE
3.1	Pressure temperature ratings	As per ASME B16.34
3.2	Materials	As specified in Table 1
3.3	Construction	Generally in line with ASME B16.34
3.4	End Connections	
3.4.1	Flanged	ASME B16.5
3.4.2	Butt welded	ASME B 16.25 & to suit matching pipe
3.5	Face to face and End to end dimensions	ASME B16.10
3.6	Hydraulic test pressures	
3.6.1	Body	660 kg/cm <sup>2</sup>
3.6.2	Seat	484 kg/cm <sup>2</sup>
3.6.3	Back Seat	484kg/cm <sup>2</sup>
3.6.4	Air leak test	6 kg/cm <sup>2</sup>

Refer Doc	<b>LAYOUTS &amp; PIPING ENGINEERING</b>	PREPARED	CHECKED	APPROVED	DATE
	<b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	 IMRAN AHMAD	 DS BARAIK	 SRIKANTH G	02.05.16



Form No:

PE&SD

**BHARAT HEAVY ELECTRICALS LIMITED  
PROJECT ENGINEERING & SYSTEMS DIVISION**

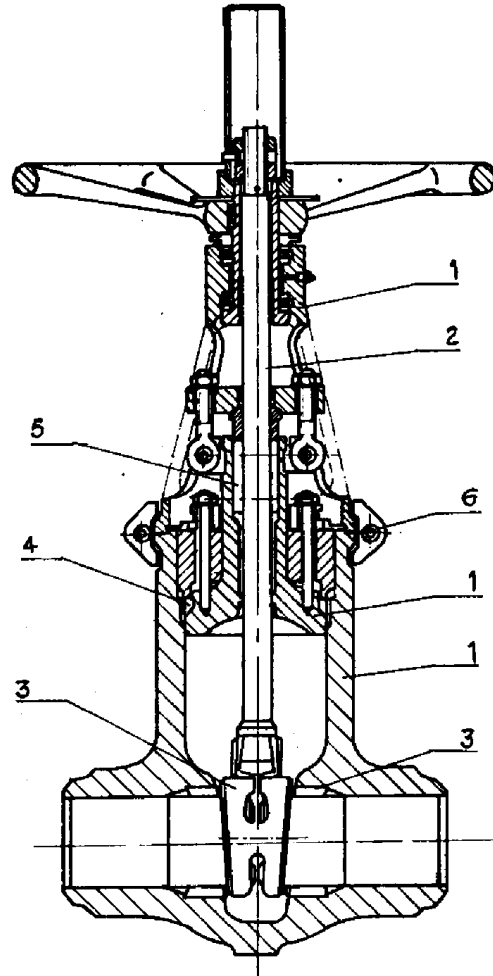
**TECHNICAL SPECIFICATION**

**GATE VALVE, ALLOY STEEL(2 1/4 Cr 1Mo)  
PRESSURE CLASS 2500**

**PY 52 167**

Rev. No. 00

Page 2 of 3



**Table-1**

Sl. No.	Part	Material	
		For 2" and below	for 2 1/2" and above
1	Valve Body, Bonnet & Yoke	ASTM A182-F22	ASTM A217-WC9
2	Spindle & back seat	13% Cr SS	15-17% Cr SS
3	Wedge body seating	Stellite on F22	Stellite on WC9
4	Gasket	-	Soft Iron/Grafoil
5	Gland packing	Grafoil	
6	Bolts & nuts for Body/bonnet	ASTM A193 B16	ASTM A193 B16
		ASTM A194 Gr.4	ASTM A194 Gr.4
7	Other parts	As per relevant standards	

**COPYRIGHT AND CONFIDENTIAL**  
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.



Form No:

**BHARAT HEAVY ELECTRICALS LIMITED  
PROJECT ENGINEERING & SYSTEMS DIVISION****PY 52 167****TECHNICAL SPECIFICATION**

Rev. No. 00

**GATE VALVE, ALLOY STEEL(2 1/4 Cr 1Mo)  
PRESSURE CLASS 2500**

Page 3 of 3

**COPYRIGHT AND CONFIDENTIAL**  
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,  
It must not be used directly or indirectly in any way detrimental to the interest of the company.

**4.0 DOCUMENTATION:****4.1 Along with the offer:**

One copy of each of the following documents shall be submitted along with the offer:

- i) G.A. drawings/ leaflets/ catalogues for the item with binding dimensions, material specification details, weight etc.
- ii) Signed and stamped copy of this specification accepting the scope of supply as indicated in the specification.

**4.2 After PO Placement:**

Four copies each of the following documents shall be submitted for approval.

G.A. Drawings for the offered item with binding dimensions, material specification details, tests to be conducted, weight etc.

Schedule for document submissions:


S.no	Description	Schedule
1	Submission of GA drawing by vendor	7 days from the date of P.O.
2	Approval GA drawing by BHEL	14 days from drawing submission *

\* The GA drawing submitted by vendor shall be strictly in compliance to all applicable standards and specification. The approval of GA drawing in no way absolves the supplier from meeting this specification requirement

+++

**RECORD OF REVISIONS:**

Rev No	Date	Revision Detail	Revised by	Approved by
00	02.05.2016	FIRST ISSUE	 DS BARAIK	 SRIKANTH G

Form No:	 <b>PE&amp;SD</b>	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 52 184</b>
		<b>TECHNICAL SPECIFICATION</b>	Rev. No. 01
		<b>REGULATING TYPE GLOBE VALVE, ALLOY STEEL</b> <b>(2 ¼ Cr-1 Mo) PRESSURE CLASS 2500</b>	Page 1 of 3

**COPYRIGHT AND CONFIDENTIAL**  
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

**REGULATING TYPE GLOBE VALVE, ALLOY STEEL (2 ¼ Cr-1 Mo)  
PRESSURE CLASS 2500**

**1.0 GENERAL**

**1.1 SCOPE**

This standard specifies the requirements of flexible wedge gate valves, hand operated, outside screw and yoke type, carbon steel body material, pressure class ASME 600, with flanged and butt welded end connections for size range 50 mm to 600 mm.

**1.2** This standard shall be supplemented by AA0851403 for Technical delivery conditions.

**1.3 APPLICATION**




These valves are suitable for fluids like steam, air, oil, water and other process gases like H<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, Syngas etc.

**2.0 DESIGNATION**

e.g.: GLOBE VLV RD WC9 2" CL 2500 BW

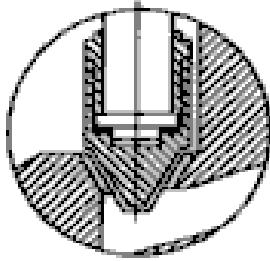
**3.0 TECHNICAL REQUIREMENTS**

CL	REQUIREMENTS	COMPLIANCE
3.1	Pressure temperature ratings	ANSI B 16.34
3.2	Materials	As specified in Table 1
3.3	Construction	Generally in line with BS 1873
3.4	Regulating Disc	The disc shall be of tapered plug type or parabolic type suitable for regulation of flow quantity.
3.5	End Connections:	
3.5.1	Flanged	ANSI B 16.5
3.5.2	Butt welded	ANSI B 16.25 and to suite matching pipe as mentioned in Variant Table
3.5.3	Socket Welded	
3.6	Face to face and End to end dimensions	ANSI B16.10
3.7	Hydraulic test pressures	
3.7.1	Body	621 kg/cm <sup>2</sup>
3.7.2	Seat	456 kg/cm <sup>2</sup>
3.7.3	Back Seat	456 kg/cm <sup>2</sup>
3.7.4	Air leak test	7 kg/cm <sup>2</sup>

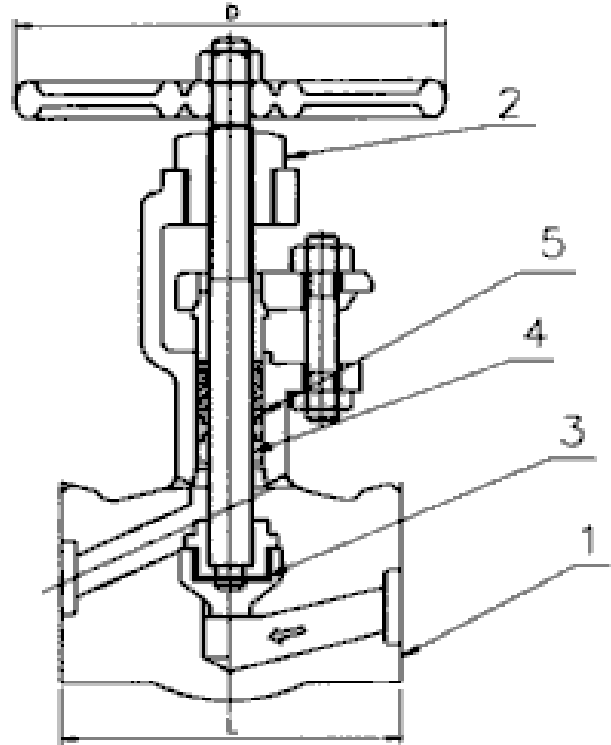
Refer Doc	<b>LAYOUTS &amp; PIPING ENGINEERING</b>	PREPARED	CHECKED	APPROVED	DATE
	<b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	 IMRAN AHMAD	 DS BARAIK	 SRIKANTH G	02.05.16



**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,  
 It must not be used directly or indirectly in any way detrimental to the interest of the company.



**REGULATING DISC**



**TABLE-1**

S.No.	PART	MATERIAL
1.	Valve body, bonnet / yoke	ASTM A182 GrF22 for size up to 1 1/2" NB & ASTM A216 WC9 for size 2" NB & above.
2.	Seat & Disc	13% Cr. S.S for size up to 60 NB 15-17% Cr. Facing for sizes 65 NB & above Stellite facing to be provided
3.	Spindle Backseat Bush Thrust Plate	ASTM A 182 Gr. F 6a
4.	Gasket	Soft Iron/Grafoil
5.	Gland packing	Grafoil
6.	Bolts, nuts for body & bonnet.	ASTM A193 B16/ ASTM A194 Gr.4
7.	Other Parts	As per relevant Std.



Form No:

**BHARAT HEAVY ELECTRICALS LIMITED  
PROJECT ENGINEERING & SYSTEMS DIVISION****PY 52 184****TECHNICAL SPECIFICATION**

Rev. No. 01

**REGULATING TYPE GLOBE VALVE, ALLOY STEEL  
(2 ¼ Cr-1 Mo) PRESSURE CLASS 2500**

Page 3 of 3

**COPYRIGHT AND CONFIDENTIAL**  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,  
 It must not be used directly or indirectly in any way detrimental to the interest of the company.

**4.0 DOCUMENTATION:****4.1 Along with the offer:**

One copy of each of the following documents shall be submitted along with the offer:

- i) G.A. drawings/ leaflets/ catalogues for the item with binding dimensions, material specification details, weight etc.
- ii) Signed and stamped copy of this specification accepting the scope of supply as indicated in the specification.

**4.2 After PO Placement:**

Four copies each of the following documents shall be submitted for approval.

G.A. Drawings for the offered item with binding dimensions, material specification details, tests to be conducted, weight etc.

Schedule for document submissions:

S.no	Description	Schedule
1	Submission of GA drawing by vendor	7 days from the date of P.O.
2	Approval GA drawing by BHEL	14 days from drawing submission *

\* The GA drawing submitted by vendor shall be strictly in compliance to all applicable standards and specification. The approval of GA drawing in no way absolves the supplier from meeting this specification requirement

++++

**RECORD OF REVISIONS:**

Rev No	Date	Revision Detail	Revised by	Approved by
00	27.04.2016	FIRST ISSUE	 DS BARAIK	 SRIKANTH G
01	02.05.2016	VARIANT TABLE EXCLUDED	 DS BARAIK	 SRIKANTH G

**PRODUCT STANDARD****PROJECT ENGINEERING & SYSTEMS DIVISION****PY52277**

Rev No. 00

Page 1 of 3

**TECHNICAL SPECIFICATION FOR GATE VALVE, CARBON STEEL, PRESSURE CLASS 1500****1.0 GENERAL****1.1 Scope**

This standard specifies the requirements of flexible wedge gate valves, hand operated, outside screw and yoke type, carbon steel body material, pressure class ASME 1500 with flanged, socket/butt welded end connections for size ranges from 0.5" to 20"

1.2 This standard shall be supplemented by AA0851403 for Technical delivery conditions.

**1.3 Applications**

These valves are suitable for fluids like steam, air, oil, water and other process gases like H<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, syngas etc.

**2.0 DESIGNATION**

e.g. GATE VLV CS(A105) 1" CL1500 BW

**3.0 TECHNICAL REQUIREMENTS**

CL	REQUIREMENTS	COMPLIANCE
3.1	Pressure temperature ratings	ASME B 16.34
3.2	Materials	As specified in Table - 1
3.3	Construction	Generally in line with ASME B16.34
3.4	End Connections	
3.4.1	Flanged	ASME B 16.5
3.4.2	Butt welded	ASME B 16.25
3.4.3	Socket welded	ASME B 16.11
3.5	Hydraulic Test Pressures	
3.5.1	Body	396 kg/cm <sup>2</sup>
3.5.2	Seat	291 kg/cm <sup>2</sup>
3.5.3	Back seat	291 kg/cm <sup>2</sup>
3.5.4	Air leak	6 kg/cm <sup>2</sup>
3.6	Additional Testing requirement for H <sub>2</sub> , N <sub>2</sub> and other gas services	Test to be done as per mutual agreed procedure

**COPYRIGHT AND CONFIDENTIAL**

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.

Ref. Doc

**Revisions :**

**Refer to record of revisions :**

**Prepared :**

*U. Pradeep*  
**U. Pradeep**

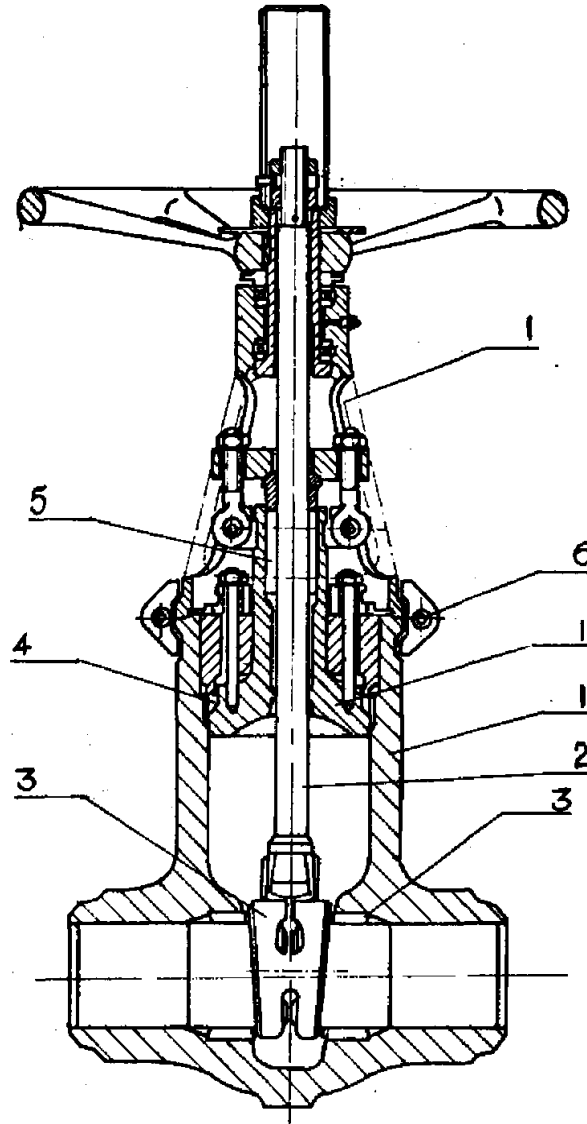
**Checked / Approved:**

*G. Kalyan Srikant*  
**G Kalyan/ G.Srikanth**

**Date :****03.05.19**


**COPYRIGHT AND CONFIDENTIAL**

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .  
It must not be used directly or indirectly in any way detrimental to the interest of the company.

**TABLE - 1**

Sl. No.	Part	Material	
		For 2" and below	For 2 1/2" and above
1	Valve Body, bonnet/yoke	ASTM A105	ASTM A216 WCC
2	Stem	SS 13% Cr	SS 13% Cr
3	Body Seating Ring, Wedge seating	CS + Stellite	CS + Stellite
4	Gasket	—	Soft iron / Grafoil
5	Gland packing	Grafoil	
6	Body/Bonnet Bolts & nuts	ASTM A193 B7, ASTM A194 2H	ASTM A193 B7, ASTM A194 2H
7	Backseat	A105 + Stellite	A105 + Stellite
8	Other parts	As per relevant standards	

Note: For gas service, wherever specified in enquiry, copper & copper alloys shall not be used for any component.

TD-106-3	Rev.No. 5		<b>PRODUCT STANDARD</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>		<b>PY52277</b>	
Form No.					Rev No. 00	
					Page 03 of 03	
<b>RECORD OF REVISIONS</b>						
<b>COPYRIGHT AND CONFIDENTIAL</b> The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.						
Ref. Doc.						
Rev. No.	Date	Revision Details	Revised	Checked /Approved		
00	03.05.19	First Issue	UP	GKC/GS		



# CORPORATE STANDARD

AA 085 14 03

Rev. No. 02

PAGE 1 OF 10

## TECHNICAL DELIVERY CONDITIONS FOR VALVES

### 1.0 SCOPE

- 1.1 This Standard stipulates the Technical Delivery Conditions for Industrial Valves to DIN/ANSI/IS/BS Standards, covering the requirements of constructional features, Accessories, Inspection, Tests, Test Certificates, Documentation, Preservation, Packing and Marking.
- 1.2 This Standard supplements the individual BHEL Valve Standards and forms a part of the Purchasing Conditions.
- 1.3 In addition to the general requirements stipulated in this Standard, any special requirements specified on the Enquiry /Purchase Order/Quality plan shall also be complied with.
- 1.4 The suppliers shall strictly comply with this standard in all respects. No deviations shall be allowed, unless written permission of BHEL is obtained before finalization of the Order.

### 2.0 CONSTRUCTIONAL FEATURES

Provision of the constructional features given in Table-1 shall be ensured for different types of Valves.

### 3.0 ACCESSORIES

The accessories mentioned in Table - 2 shall be provided for different types of Valves.

### 4.0 INSPECTION

#### 4.1 INSPECTION AGENCY

Inspection agency for different categories of valves shall be as follows:

##### 4.1.1 ATTESTED VALVES

For carbon and alloy steel attested valves coming under the purview of IBR (Indian Boiler Regulations), the inspection agency shall be as follows

a) Indigenous Valves: Authorized Inspector of CIB (Chief Inspector of Boilers).

In addition, BHEL representative shall witness the Inspection/Testing at supplier's works (other than BHEL, Tiruchy) for the following categories of valves,

- i) All Valves of Class 600 and above
- ii) All Valves of size 350 NB and above of all pressure ratings.
- iii) All Motor / Gear operated valves,
- iv) All valves with BW ends.
- v) All valves with any special features like sealed gland, regulating disc etc.

#### Revisions:

Cl. 19.07 of MOM of WG - VALVES

APPROVED :  
INTERPLANT STANDARDIZATION COMMITTEE  
WG - VALVES

Rev. No. 02

Amd . No.

Reaffirmed

Prepared  
Corp. R&D

Issued  
Corp. R&D

Dt. of 1st Issue  
OCTOBER, 1985

Dt: 31.07.2012

Dt :

Year:



b) Imported Valves: M/s Lloyds/TUV or any other inspection agency approved by IBR.

#### **4.1.2 NON-ATTESTED (CERTIFIED) VALVES**

- a) For Cast Iron, Gun Metal and other general purpose Valves (other than Stainless Steel Valves), not coming under the preview of IBR, the supplier's Inspection. Department shall undertake testing/inspection in presence of BHEL representative. However, witnessing of testing/inspection by BHEL representative may be waived off for Cast Iron and gun metal Valves on case to case basis.
- b) In case of all Stainless Steel Valves, the inspection agency shall be M/s Lloyds/BHEL Inspectors, unless otherwise specified in the Enquiry / Purchase Order.

#### **4.2 SCOPE OF INSPECTION**

The scope of inspection shall be as follows:

- (a) All tests listed in Cl.5
- (b) Any other tests specified in the Enquiry / Purchase Order / Quality Plan
- (c) Stamping of all accepted Valves and issue of Inspection reports and certificates.

#### **5.0 TEST & TEST CERTIFICATES**

The tests specified in Table-3 shall be conducted and 5 copies of the relevant test certificates shall be furnished to BHEL along with each consignment. The following abbreviations are used in the table. AI - Authorized Inspector; CS - Carbon Steel; AS - Alloy Steel; SS - Stainless Steel.

#### **6.0 GUARANTEE CERTIFICATE**

2 copies of the guarantee certificate shall be submitted before dispatch of valves. All the valves shall be guaranteed for trouble free operation for a period of 12 months from the date of commissioning or 24 months from the date of dispatch. The valves found defective due to design deficiency, Manufacturing defects etc., during the guarantee period shall be replaced by the supplier at no extra charge to BHEL.

#### **7.0 DOCUMENTS**

##### **7.1 ALONG WITH THE OFFER**

4 copies each of the following documents shall be submitted along with the quotation.

- i) Drawing/leaflet/catalogue for the offered item indicating complete cross sectional arrangement, standards governing the valves and valve rating, indicating direction of flow by an arrow marked on the body, binding dimensions, bill of materials with material specification details, hydraulic/air test pressure for body/seat/ back seat, overall height, dismantling clearances, weight and special features, if any, as specified in the main specification of the valves.



# CORPORATE STANDARD

AA 085 14 03

Rev. No. 02

PAGE 3 OF 10

- ii) Quality plan adopted by the supplier during manufacture and inspection / testing of valves.
- iii) List of recommended spares for 3 years trouble free operation of valves.
- iv) Any deviations to this standard / individual specification proposed by the supplier.
- v) Actuator technical data sheet, wiring diagram, limit Switch development diagram.
- vi) Regulation characteristics for Regulating globe valve.

The offer submitted without the above mentioned documents shall be considered as incomplete and therefore the offer shall be ignored for the purpose of technical/commercial evaluation.

## 7.2 AFTER PLACEMENT OF ORDER

7.2.1 Immediately after placement of order as per purchase order the following documents shall be furnished,

- i) Certified contract drawings for approval. After approval of the same RTF shall be furnished
- ii) Standard Quality plan duly countersigned by the supplier.
- iii) Operation and maintenance instructions.
- iv) Lubricant recommendation covering the following details:
  - a) Item to be lubricated.
  - b) Method of lubrication.
  - c) Type of lubricant and source of supply.
  - d) Frequency of lubrication.
- v) Storage instructions.

## 8.0 CLEANING

Particular care shall be taken to ensure that all foundry sand and loose material is properly removed by fettling/shot blasting.

## 9.0 PAINTING

Valves shall be painted externally after the hydraulic testing has been carried out. Just before the painting, valve bodies and other items shall be thoroughly cleaned. The valves shall be first painted with red oxide primer followed by 2 coats of spray painting with enamel paint. The colour of the paint shall be Blue for Carbon Steel Valves and Aluminum heat resisting for alloy steel valves. In case of forged steel valves up to 2" phosphating may be done instead of painting. For alloy steel forged valves a yellow band may be painted on the body after phosphating.

**10.0 MARKING ON VALVES****10.1 BODY**

The body of the valve shall have the following markings:

- a) Nominal size.
- b) Pressure rating.
- c) Material grade of body.
- d) Supplier's Trade Mark.
- e) Arrow showing direction of flow (for globe and check valves).
- f) Inspector's' identification mark.

**10.2 NAME PLATE**

**10.2.1** The nameplate shall be fitted below the hand wheel nut for globe/gate valve and on the body/cover for Non-return valves covering the following details.

- a) Manufacturer's name.
- b) Nominal size,
- c) Pressure rating.
- d) Material grades of body, bonnet and trim.
- e) Manufacturer's identification/serial No.,
- f) Year of manufacture.
- g) BHEL material code number/Tag No. From Purchase Order.

**10.2.2 ACTUATOR**

A name plate covering the following details shall be fitted to the actuator.

- a) Make.
- b) Model No.
- c) Output shaft r.p.m.
- d) K.W. rating

**10.3 HAND WHEEL**

Hand wheel shall have the working "open" and "shut" - duly cast alongwith the arrow to show direction of closing the valve.

**11.0 PRESERVATION**

Suitable temporary rust preventive with minimum life of one year shall be applied inside the valve body in order to prevent corrosion.

**12.0 END PROTECTION****12.1 FLANGED VALVES**

A circular blanking plate made of thin steel sheet, with diameter 6mm less than the bolt holes inner PCD, shall be firmly fixed to the flange faces by the application of adhesive, after ensuring that the flange faces have been thoroughly degreased. A thin coat of adhesive shall be applied to the flange face and the blanking plate and then allowed to dry for 15 to 20 minutes. The coated face of the blanking plate should then be joined to the face of the flange taking care that the plate is concentric with the flange. Firm pressure shall be applied to ensure intimate contact between the plate and flange.

A wooden blank should then be bolted to the flange using a minimum of four bolts.



## CORPORATE STANDARD

AA 085 14 03

Rev. No. 02

PAGE 5 OF 10

### **12.2 SCREWED, SOCKET & BUTT WELDED VALVES**

Valve ends shall be protected from external damage and sealed against the ingress of dirt by means of plastic/ Steel end covers firmly secured.

12.3 Any improved method of end protection can however be considered and the suppliers shall furnish complete details at offer stage.

### **13.0 PACKING**

13.1 All the valves shall be packed suitably in closed wooden cases in order to avoid damage during transit and storage at BHEL. Suitable supports shall be provided inside the cases in order to avoid internal movement. In case of imported consignments the packing shall be seaworthy.

13.2 Each valve after end protection should be wrapped in polythene sheet before packing in the cases.

13.3 Valves of sizes upto Nb 50mm (2") could be packed in one packing case taking care that they do not strike with each other. Enough packing material shall be kept inside the case to avoid damage.

13.4 Valves of size above 50mm (2") shall be packed separately in each case. In case, the handwheel, extension spindle or any other accessory of a valve is removed at the time of packing, the same must be kept in the same case and not separately.

13.5 Each packing case must contain 2 copies of the shipping list giving details of all the contents of the case.

### **14.0 MARKING**

The following marking shall be done on each packing case minimum on two sides and also at the top.

- a) Complete address of the consignee and destination as per BHEL Purchase Order.
- b) BHEL Purchase Order Number.
- c) BHEL Valve Standard Number(s).
- d) Number of pieces in each packing case.
- e) Net weight.
- f) Gross weight.
- g) Packing case numbers and total number of packings.
- h) Arrow indicating top of the packing case.



TABLE I – CONSTRUCTIONAL FEATURES

CL NO	FEATURE	VALVE TYPE	PRESSURE CLASS ANSI/DIN					
			CL 150 NP 10&16	CL 300 NP 25&40	CL 600 NP 64&100	CL 900 NP 160	CL 1500 NP 250	CL 2500 NP 320&400
2.1	SPINDLE	GLOBE GATE	Outside screw & Yoke type with rising Spindle					
2.2	BONNET/ COVER	GLOBE GATE CHECK	Bolted to the Body for all sizes			Seal welded for NB50 and below. Pressure sealed for NB65 and above.		
2.3	BORE	GLOBE GATE CHECK	Full bore ANSI rating. For DIN rating			Shall not be less than 80% of the Full Venture Bore area.		
2.4	DISC	GLOBE	Radii used/ Spherical Seating Disc. For NB65 and above, the Disc shall be free to Revolve on the spindle for valves upto C1.900.					
		REGU LATING GLOBE	Taper Plug type Disc/Parabolic type Disc. For NB65 and above the disc shall be free to revolve on the spindle					
		SWING CHECK N.R.V	The Body Seat shall be inclined at such an angle from the vertical, to facilitate positive closing and to prevent valve clatter. The friction between hinge pin and bush shall be as minimum as possibilities so as to ensure that The check valve closes when the return of flow is even at a pressure of 1 ata.					
		PISTON LIFT N.R.V	Shall be provided with guided Disc, which enables the back pressure to be utilized fully for positive disc closing. The fluid collected in the space between disc, body and Cover should act as a damper.					
2.5	WEDGE	GATE	Solid Wedge for upto NB80, Flexible Wedge for NB 100 & above.					
2.6	TRI M	GLOBE GATE N.R.V	Minimum Hardness Values for various trim materials shall be as follows and the seating surface of stainless steel shall have a minimum differential Hardness of 50 BHN					



# CORPORATE STANDARD

AA 085 14 03

Rev. No. 02

PAGE 7 OF 10

TABLE I – CONSTRUCTIONAL FEATURES

CL NO	FEATURE	VALVE TYPE	PRESSURE CLASS ANSI/DIN					
			CL 150 NP 10&16	CL 300 NP 25&40	CL 600 NP 64&100	CL 900 NP 160	CL 1500 NP 250	CL 2500 NP 320&400
2.6	TRIM (Contd.)		Part			Hardness, BHN		
			Stem/Hingepin			200-220		
			Body Seat			250-270		
			Wedge/Disc Seating			300-320		
			Back Seat bush			250-270		
			Thrust Plate (for gate Valves)/			350-370		
2.7	BACK SEAT	GLOBE GATE	Shall be provided for all sizes. For NB65 and above back seat bush will be Provided.					
2.8	DIRECTION OF FLOW	GLOBE	The direction of Flow shall be preferably from bottom to top and the Arrow showing the direction shall be cast on the body.					
2.9	OPENING/ CLOSING	GLOBE GATE	The valves shall close by rotating the Hand Wheel in clockwise Arrow showing the direction shall be cast on the body.					

TABLE – 2 ACCESSORIES

CL NO	FEATURE	VALVE TYPE	PRESSURE CLASS ANSI/DIN					
			CL 150 NP 10&16	CL 300 NP 25&40	CL 600 NP 64&100	CL 900 NP 160	CL 1500 NP 250	CL 2500 NP 320&400
3.1	Position Indicator	GLOBE GATE REGULATING GLOBE	Shall be provided for all regulating globe valve and other valves of non-rising spindle type.					
3.2	Impact Hand Wheel	GLOBE	Shall be provided wherever necessary.					
3.3	Ball Bearing	GLOBE GATE	Shall be provided wherever necessary for smooth operation.					
3.4	Gear Operation	GATE	Shall be provided for the following sizes for different pressure classes.					
			NB 350& above	NB 300& above	NB 250& above	NB 200& above	NB 150& above	NB 150 above



TABLE – 2 ACCESSORIES (Contd.)

CL NO	REQUIREMENT	VALVE TYPE	PRESSURE CLASS ANSI/DIN					
			CL150 NP10&16	CL300 NP25&40	CL600 NP64&100	CL900 NP160	CL1 500 NP 250	CL2 2500 NP320&400
3.5	Integral Bypass	GATE	NB 250 & above			NB 200 & above		
*NOTE: Integral Bypass shall be provided as per MSS:SP-45. The Bypass Pipe shall be seamless, Schedule 80 minimum and of the same material As that of Valve body.								
3.6	EyeBolts	All valves	Suitable eyebolts shall be provided for heavy valves.					

TABLE – 3 TESTS

CL. NO.	TEST	APPLICABLE STANDARD	APPLICABLE COMPONENTS	EXTENT OF TESTING	CERTIFICATES REQUIRED
5.1	Visual Inspection	MSS-SP55 IS:210 IS:318	Steel Castings CI Castings Gunmetal Castings	100 %	Inspection by 'AI' and then attestation of Manufacturer's certificate by 'AI'
		Manufac-turer's Standard	Forgings and other components	100 %	Verification of Manufac-turer's certificate by 'AI'
5.2	Dimensional Check	Relevant BHEL Standards	Overall dimensions and end connections	100%	IBR, Form IIIc Inspection report by 'AI'
5.3	Material Tests:				
5.3.1	Chemical Analysis	Relevant material Standard	Body, bonnet, Yoke	Each heat/melt	Material test certificate attested by 'AI'; Body bonnet & yoke shall have identification
5.3.2	Mechanical Tests	-do-	-do-	-do-	-do-



# CORPORATE STANDARD

AA 085 14 03

Rev. No. 02

PAGE 9 OF 10

TABLE -3 TESTS

CL.NO	TEST APPLICABLE STANDARD	APPLICABLE COMPONENTS	EXTENT OF TESTING	CERTIFICATES REQUIRED
5.3.3	Heat Treatment -do-	Body, Bonnet, Yoke	100%	Inspection Report Test Certificate
5.3.4	Hardness Tests -do-	Trim	100%	
5.4	Non-destructive tests:			
5.4.1	Radio-graphy ASTM:E94&E142  CL90050 %	Body& Bonnet Castings	AS:100% CS&SS upto CL 300-10% CL600 to  CL 1500 & above -100% 100%	Manufacturer's Certificates with the stamp of 'AI'     -do-
5.4.2	Ultrasonic Test ASTM : 388	Body/Cover Forging	100%	-do-
5.4.3	Magnetic Particle Inspection (MPT) ASTM: E138/ E709	Trim	100%	-do-
5.4.4	Liquid Penetrant Inspection ASTM:E165 Dye Penetrant Inspection (LPI/DPI)	Seating Surfaces, Spindle Butt Welding ends of valves	100%	-do-
*5.5	Hydraulic Test API:598	a) Body & Seat b)Back Seat	100% 100%	IBR-Forth IIIC-b/AI Authorised inspector's certificate
*5.6	Air Leak Test API:598	Seat	100%	-do-



TABLE – 3 TESTS

CL. NO	TEST	APPLICABLE STANDARD	APPLICABLE COMPONENTS	EXTENT OF TESTING	CERTIFICATES REQUIRED
5.7	Functional test on Assembled valves with actuators / gears (with hand wheel on actuator and with electrical actuator)	--	Motor / Gear operated Valves	100%	Authorised Inspector certificates

**\*Note: Test pressure shall be as given in individual BHEL standards and no leakage shall be allowed during hydraulic/air test. The test duration shall be as follows:**

	Nominal Size 'mm'	Minimum Test Duration in seconds		
		Body	Seat	Back Seat
Test Duration	Upto and including 50	15	15	15
	65 upto and including 150	60	60	15
	200 upto and including 300	120	120	15
	350 and above	300	120	15

TABLE 4 – Duration of Required Test Pressure

Valve Size (NPS)	Minimum Test Duration (Seconds) <sup>a</sup>				
	Shall		Back Seat	Closure	
	Check Valves (API Std 594)	Other Valves	All Valves with Backseat Feature	Check Valves (API Std 594)	Other Valves
=2	60	15	15	60	15
2½ -6	60	60	60	60	60
8-12	60	120	60	60	120
=14	120	300	60	120	120

**Note: <sup>a</sup>The test duration is the period of inspection after the valves is fully prepared and is under full pressure.**

TABLE 1 : Painting scheme for Piping Items						
Sl.No.	Description	Surface Preparation & Surface Profile (At Shop)	Initial Coat-Primer (At Shop)	Finish Coat	Total DFT (microns)	Remarks
1	CS, LTCS and AS -Thermally Insulated Piping Components Design temp Above 200° C (Pipes, Pipe fittings, Flanges, Valves, Specialities like strainer, steam traps)	SA 2 1/2	1 coat of Zinc silicate primer, DFT- 75 microns	1 coat of Heat resistant Silicone Aluminium @ 25 µ DFT/coat	100 µ	

**NOTES:**

- 1) Method of Surface preparation: Blast cleaning (Grit Blasting), no Sand blasting is permitted.
- 2) HR Silicone Aluminium paints are available for different temperature ranges and hence should be selected for appropriate temperature zone

**SPECIFICATION NO. M-19**

**FOR**

**PAINTING**

**SPECIFICATION NO. M-19  
FOR  
PAINTING**

**C O N T E N T S**

<b>CLAUSE NO.</b>	<b>DESCRIPTION</b>	<b>PAGE NO.</b>
1.00.00	INTENT OF SPECIFICATION .....	1
2.00.00	GENERAL INFORMATION .....	1
3.00.00	PAINT.....	2
4.00.00	SURFACE PREPARATION .....	3
5.00.00	PAINTING.....	4
6.00.00	INSPECTION.....	6
7.00.00	GALVANISING.....	6
8.00.00	SCHEDULE OF FINISHES .....	7

**SPECIFICATION NO. M-19  
FOR  
PAINTING**

**1.00.00 INTENT OF SPECIFICATION**

1.01.00 The intent of this Specification is to cover the requirements for the supply and application of protective finishes. The work includes for the supply of all consumable materials, tools and equipment to complete the work.

1.02.00 Where paint systems are applied in the manufacturers works, the Contractor may offer the manufacturer's standard paint finish suitable for the operating and ambient conditions, subject to the approval of the Engineer. However, regardless of the manufacturer, the colour finish of all equipment shall produce a coordinated appearance. All electrical panels in the same area shall have the same shade of colour and equipment installed into the same system shall have the same finish colour, regardless of manufacturer.

**2.00.00 GENERAL INFORMATION**

2.01.00 All work shall be carried out in strict compliance with any safety regulations for the site and any relevant requirements of national or local law. In particular, when working in restrictive areas, the Contractor shall ensure that all plant, equipment and tools meet the appropriate regulations controlling work in such areas and are approved by the Engineer.

2.02.00 Blast cleaning and spray painting equipment, working in locations where an explosive atmosphere may be present at any time, shall be continuously bonded from the nozzle to the surface being painted and backwards from the nozzle to the compressor, which shall be earthed.

2.03.00 Compressors and any associated pressure vessels shall be protected against over pressure.

2.04.00 The Contractor shall provide and maintain in good condition all plant, equipment and tools necessary to carry out the work in an efficient manner and provide lubricating oils, greases, consumable materials and parts as necessary to maintain the plant, equipment and tools in good working order.

2.05.00 Prior to the commencement of the work the Contractor shall submit, for approval, detailed proposals as to how he intends to carry out the work within the framework of this Standard. The Contractor shall provide full details regarding the use of subcontractors, location of work and choice of materials.

2.06.00 The Contractor shall provide all paints, thinners, abrasives, scaffolding, lighting and all other materials necessary to complete the work.

2.07.00 Unless otherwise instructed, stainless steel and nonferrous alloys shall not be painted.

- 2.08.00 The Contractor shall, prior to painting, protect nameplates, lettering, gauges, sight glasses, light fittings and similar such items, to ensure that these are in no way defaced or damaged during the work.
- 3.00.00 **PAINT**
- 3.01.00 **General**
- 3.01.01 Red lead primers shall be equivalent to BS 2523 Type B but based on quicker drying media in order to ensure overnight drying.
- 3.01.02 Zinc phosphate primer shall be based on suitable oleoresinous media and shall contain a minimum of 30% zinc phosphate pigment by weight in the dry film. Where zinc phosphate primer is offered as an alternative to red lead primer the manufacturer shall produce evidence of comparative performance.
- 3.01.03 Zinc silicate primer shall be based on inorganic or ethyl silicate media and shall contain not less than 85% metallic zinc by weight in the dry film.
- 3.01.04 Zinc rich primers shall be based on two pack epoxy media and shall contain a minimum of 90% metallic zinc by weight in the dry film.
- 3.01.05 Zinc phosphate chlorinated rubber primer shall be based on suitably plasticised chlorinated rubber media and shall contain a minimum of 20% zinc phosphated by weight in the dry film.
- 3.01.06 Zinc phosphate two pack epoxy primer shall be based on polyamide cured two pack epoxy media and shall contain a minimum of 20% zinc phosphate by weight in the dry film.
- 3.01.07 Mordant solution (T-Wash) shall comprise a phosphoric acid solution incorporating copper salts in a solvent/water solution.
- 3.01.08 Micaceous iron oxide paint shall be based on a phenolic linseed tung oil media or equivalent and shall contain a minimum of 50% micaceous iron oxide by weight in the dry film.
- 3.01.09 Where colour finishes other than micaceous iron oxide are required these shall be based on titanium dioxide and/or light fast coloured pigments dispersed in alkyd media. A full gloss finish is required. Such paints should be used in conjunction with their appropriate undercoating.
- 3.01.10 Two-pack epoxy finishing paints shall be based on a polyamide or amine adduct cured two-pack epoxy media and shall be pigmented with titanium dioxide and/or light fast coloured pigments to provide the necessary opacity, film building and weather resistance. A semi-gloss finish is required.
- 3.01.11 Vinyl finishing paints shall be based on a vinyl copolymer media and shall be pigmented with titanium dioxide and/or light fast coloured pigments to provide the necessary opacity, film build and weather resistance. A semi-gloss finish is required.

- 3.01.12 Chlorinated rubber finishing paints shall be based on suitably plasticised chlorinated rubber media and shall be pigmented with titanium dioxide and/or light fast coloured pigments to provide the necessary opacity, film build and weather resistance. A semi-gloss finish is required.
- 3.01.13 Epoxy coal tar shall be based on a two-pack formulation incorporating epoxy resin and suitable pigments in one pack and a polyamide curing agent and coal tar in the second. The epoxy resin shall comprise 35-45% by weight of the resin coal tar blend. The finishing colour shall be black. Aluminium or red oxide pigmentations shall be allowed for contrasting of intermediate coats. Alternative curing agents shall be allowed where necessary to provide low temperature cure.
- 3.01.14 Aluminium silicone paint shall be based on a one-pack formulation comprising leafing aluminium pigment dispersed in silicone or modified silicone media. The paint shall be capable of withstanding continuous exposure to temperatures between 120°C and 500°C.
- 3.01.15 Aluminium in the form of paint or metal spray shall not be used on any steel surface which may operate above 120°C located where an explosive atmosphere may be present at any time (Zone 1 Areas).
- 3.01.16 Urethane paints shall be of isocyanate reactive types which are made by reacting excess TDI (Toluene di isocyanate) with a hydroxyl (OH) bearing substance to form a prepolymer, which then reacts further with hydroxyl groups of polyol or with moisture to form the film.
- 4.00.00 **SURFACE PREPARATION**
- 4.01.00 **Preparation Requirements**
- 4.01.01 Surface preparation shall not take place at temperatures below 5°C, when the relative humidity is greater than 85% or when the metal surface temperature is less than 3°C above the ambient dew point or outside daylight hours on exterior locations.
- 4.01.02 Surface preparation may also be suspended at the direction of the Engineer when adverse weather conditions are likely to develop before painting could be carried out.
- 4.01.03 Surface preparation of new steel surfaces shall remove all surface irregularities and mill scale together with all rust and surface contaminants, such as grease, dirt and solid pollution.
- 4.01.04 Surface irregularities including weld spatter, rough capping, undercut and slag together with sharp or rough edges and burrs, surface laminations and laps shall be removed or made smooth prior to commencement of surface preparation. Such irregularities which become apparent after surface preparation by blast cleaning or hot acid pickling shall be similarly treated.
- 4.01.05 Grease or oil contamination shall be removed by either wiping or scrubbing the surface with rags or brushes wetted with white spirit and then wiping down with clean dry cloths. Alternatively proprietary emulsifying agents may be used

for this purpose and the surface then washed down with clean water. The surface shall be allowed to dry out before proceeding with further preparation and painting.

- 4.01.06 Steel surfaces shall be prepared by blast cleaning to BS 4232 to the appropriate quality specified. Reference shall be made to Swedish Std. SIS 05 59 00- 1967 for photographic illustrations of equivalents to these qualities.
- 4.01.07 Selection of abrasives for blast cleaning shall be in accordance with Table 2 in BS 4232 and shall give surface profile or anchor pattern generally within the range 50-75 microns with rogue peaks of maximum amplitude 100 microns. Spent abrasives shall be completely removed from the prepared surface by either vacuum cleaning or stiff brushing.
- 4.01.08 The pressure and volume of the compressed air supply for blast cleaning shall meet the work requirement and shall be sufficiently free from all water contamination to ensure that the cleaning process is not impaired. Traps, separators and filters shall be emptied and cleaned regularly.
- 4.01.09 Acid descaling and derusting followed by hot passivation by the Jenolising process or as described in SSPC SP 8 will be accepted as a substitute for blast cleaning provided this method of preparation is complete with the specified paint system.
- 4.01.10 Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill scale and shall only be used where blast cleaning is impractical and with the approval of the Engineer. Such preparation shall be in accordance with the photographic illustrations in SIS 05 59 00- 1967 Grade C ST 2 or 3 as specified.
- 4.01.11 New galvanised surfaces shall be thoroughly degreased with white spirit or emulsifying agents and chemically etched either by a proprietary pretreatment solution, or by using a two-pack etching primer in the painting process. Weather galvanised surfaces shall be prepared by steel wire brushing to remove all corrosion products and followed by digressing with white spirit.
- 4.01.12 Surface preparation by wet blasting may be used in certain environments at the discretion of the Engineer, in order to provide increased safety against sparking, to minimise atmospheric and surface pollution, or to prepare surfaces which are salt contaminated and spend much of their time in wet conditions.

## 5.00.00 **PAINTING**

- 5.01.00 All painting shall be carried out in conformity both with this Standard and with the paint manufacturer's recommendation. All paints in any one particular system, whether shop or site applied, shall originate from one paint manufacturer.
- 5.02.00 Particular attention shall be paid to the manufacturer's instructions on storage, mixing, thinning and pot life. The paint shall only be applied in the manner detailed by the manufacturer e.g. brush, roller, conventional or airless spray and shall be applied under the manufacturer's recommended condition. Minimum and maximum time intervals between coats shall be closely followed.

- 5.03.00 Hand mixing of paints shall only be permitted for containers up to 5 litres. All larger containers shall be mixed by mechanical agitators and brought to a uniform consistency. Where pigment separation readily occurs, provision shall be made for continuous mixing during application.
- 5.04.00 Two-pack paints shall be mixed in strict accordance with manufacturer's instructions. The pot life of such paints shall be specifically noted and any mixed paint which has exceeded its pot life shall be discarded irrespective of its apparent condition.
- 5.05.00 The Contractor shall avoid contamination of any adjacent items of plant and equipment or property by paint overspray, drips or spillage, providing appropriate protection where necessary. If any such contamination does occur the Contractor shall remove it.
- 5.06.00 Painting shall not take place under adverse weather conditions, in particular rain, fog, snow, sandstorm or when such conditions are likely to occur before the paint has become dry. Painting shall not take place at temperatures below 5°C when the relative humidity is greater than 85%, or when the metal surface temperature is less than 3°C above the ambient dew point. Painting shall not take place outside daylight hours on exterior locations. Painting may also be suspended due to wind speed.
- 5.07.00 All prepared steel surfaces should be primed before visible re-rusting occurs or within 4 hours, whichever is sooner.
- Acid-descaled steel surfaces shall be primed as soon as the surface is dry and while the surface is still warm.
- 5.08.00 Where further painting is to be carried out, zinc silicate primers shall be sealed with a tie coat as soon as practical after complete curing has taken place, to avoid salt or chemical contamination of the porous zinc silicate primer. The tie coat shall be selected to ensure sound adhesion to the zinc silicate primer and be compatible with the finishing coat process. When over coating with aluminium silicone paint, a tie coat is not necessary.
- Where the quality of film is impaired by excess film thickness, (wrinkling, mud cracking or general softness) the Contractor shall remove the unsatisfactory paint coating and apply another. As a general rule, dry film thickness should not exceed the specified minimum dry film thickness by more than 25%. In all instances where two or more coats of the same paint are specified, such coatings shall be of contrasting colours so that each stage of the work can be readily identified and film thicknesses determined accordingly.
- Intervals between coats shall comply with manufacturer's recommendations and should generally be kept to the absolute minimum in order to prevent contamination between coats. Where contamination occurs between coats, this shall be completely removed, generally by washing with 1% By-Prox detergent solution of equivalent, and rinsing with clean fresh water.

5.09.00 All points of damage of paintwork incurred at any stage of the work, including site welding operations, shall be re-prepared by blast cleaning to the original standard and recoating with the specified priming coat and finish coat to restore the film thickness. In all such instances preparation shall extend 25mm of sound paintwork shall be lightly blasted to etch the surface.

6.00.00 **INSPECTION**

6.01.00 The Contractor shall inform the Engineer before the start of work. The Engineer or the Engineer's representative shall have free access to the fabrication and/or the field painting shop during the course of the work to inspect the following:-

- visual inspection of surface preparation; comparison basis : photo index given in the Swedish Standard SIS 055900.
- consecutive inspection of workmanship and conformity of specification.
- post-inspection of painted surfaces and surface preparation by local removal of the coat(s).

All test areas for destructive tests (e.g. removal of paint, cutting tests, etc.) shall be correctly repaired by the Contractor.

To ensure conformity with the Specification with regard to dry film thickness the Contractor himself shall carry out a sufficient number of tests. The dry films thickness will be measured by the Engineer. The tolerances of dry film thickness of all inspected parts shall be as follows:

- not less than 90% of all measurements may only have 90 - 100% of the specified thickness
- all areas having less than 90% of the specified dry film thickness shall be repaired at the Contractor's expenses.

7.00.00 **GALVANISING**

7.01.00 All galvanising shall be carried out by the hot dip process (and unless otherwise specified shall conform in all respects with BS 729 and BS 2989 as applicable).

7.02.00 Attention shall be paid to the detail design of members (in accordance with BS 4479). Adequate provision for filling, venting and draining shall be made for assemblies fabricated from hollow sections. Vent holes shall be suitably plugged after galvanising.

7.03.00 All surface defects in the steel including cracks, surface laminations, laps and folds shall be removed (in accordance with BS 4360). All drilling, cutting, welding, forming and final fabrications of unit members and assemblies shall be completed before the structures are galvanised. The surface of the steelwork to be galvanised shall be free from welding slag, paint, oil grease and similar contaminants.

- 7.04.00 The minimum average coating weight shall be as specified in Table 1 of BS 729. Structural steel items shall be initially grit blasted to BS 4232, second quality (SA2 1/2), and the minimum average coating weight on steel sections 5mm thick and over shall be 915 g/m<sup>2</sup>.
- 7.05.00 On removal from the galvanising both the resultant coating shall be smooth, continuous, free from gross surface imperfections such as bare spots, lamps, blisters and inclusions of flux, ash or dross.
- 7.06.00 Galvanised contact surfaces to be joined by high strength friction grip bolts shall be roughened before assembly so that the required slip factor (defined in BS 3294, Part 1 and BS 4604 Part 1) is achieved. Care shall be taken to ensure that roughening is confined to the net area of the mating surfaces.
- 7.07.00 Bolts, nuts and washers, excluding general grade high strength friction grip bolts (referred to in BS 3139 Part 1 and BS 4395 part 1) shall be hot dip galvanised and subsequently centrifuged (according to BS 729). Nuts shall be retapped after galvanised and the threads oiled to permit the nuts to be finger turned on the bolt for the full depth of the nut. No lubricants, applied to the projecting threads of a galvanised high strength friction-grip bolt after the bolt has been inserted through the steelwork, shall be allowed to come into contact with the mating surfaces.

During off loading and erection nylon slings shall be used. Galvanised work which is to be stored in works or on site shall be stacked so as to provide adequate ventilation to all surfaces to avoid wet storage staining (white rust).

Small areas of the galvanised coating damaged in any way shall be restored by cleaning the area of any weld slag and thoroughly wire brushing to give a clean surface followed by the application of two coats of zinc rich-paint, or the application of a low melting point zinc alloy repair rod or powder to the damaged area, which is heated to 300°C.

After fixing, bolt heads, washers and nuts shall receive two coats of zinc rich paint.

Connections between galvanised surfaces and copper, copper alloy or aluminium surfaces shall be protected by suitable inert tape wrapping to the Engineer's approval.

8.00.00 **SCHEDULE OF FINISHES**

8.01.00 **Structural and Supporting Steelwork, Shell Plates**

8.01.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2½).

8.01.02 **Priming**

Zinc chrome primer, dft 40 microns per coat (2 coats).

8.01.03 **Intermediate Coat**

Micaceous iron oxide paint, dft 60 microns per coat (1 coat).

8.01.04 **Finish**

Polyurethane paint, dft 50 microns per coat (1 coat).

8.01.05 **Total Dry Film Thickness**

190 microns.

8.02.00 **Steel Surfaces Exposed to Solvent/Chemical attack**

8.02.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2 1/2)

8.02.02 **Priming**

Zinc Phosphate 2 pack epoxy primer, dft 50 microns per coat (2 coats).

8.02.03 **Finish**

Two pack epoxy finish dft 75 microns per coat (2 coats).

8.02.04 **Total Dry Film Thickness**

250 microns

8.03.00 **Steel Surfaces exposed to Salt Contamination**

8.03.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2½).

8.03.02 **Priming**

Zinc Chrome Primer, dft 40 microns per coat (2 coats).

8.03.03 **Intermediate Coat**

Micaceous Iron Oxide Paint, dft 60 microns per coat (2 coats).

8.03.04 **Finish**

Polyurethane paint, dft 25 microns per coat (1 coat).

8.03.05 **Total Dry Film Thickness**

250 microns.

8.04.00 **Steel Surfaces exposed to Continuous condensation**

8.04.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2 1/2).

8.04.02 **Priming**

Zinc Phosphate 2 peak chlorinated rubber primer, dft 50 microns per coat (2 coats).

8.04.03 **Finish**

Micaceous iron oxide chlorinated rubber, dft 75 microns per coat (2 coats).

8.04.04 **Total Dry Film Thickness**

250 microns.

8.05.00 **Steel Surface Operating at Elevated Temperatures Uninsulated**

8.05.01 **Preparation**

80 - 350 degree C Blast clean to BS 4232 2nd Quality

80 - 550 degree C Blast clean to BS 4232 1st Quality

8.05.02 **Priming**

80 - 350 degree C Zinc silicate primer, dft 75 microns

80 - 550 degree C Aluminium spray, dft 125 microns.

8.05.03 **Finish**

Aluminium Silicone paint, dft 25 microns.

8.05.04 **Total dry film thickness**

80 - 350° 100 microns

80 - 550° 150 microns

8.06.00 **Steel Surface Operating at Elevated Temperature Insulated**

8.06.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2 1/2)

8.06.02 **Priming**

1 coat of zinc silicate primer, dft 75 microns.

- 8.06.03      **Finish**  
None or 1 coat of aluminium silicone paint, dft 25 microns.
- 8.06.04      **Total Dry Film Thickness**  
75 or 100 microns
- 8.07.00      **Steelwork encased in concrete, brickwork or fire proofing.**
- 8.07.01      **Preparation**  
Blast clean to BS 4232 3rd quality (SA 2).
- 8.07.02      **Priming**  
2 coats bituminous paint to BS 3416 type 1, dft 40 microns per coat.
- 8.07.03      **Finish**  
None
- 8.07.04      **Total Dry Film Thickness**  
80 microns.
- 8.08.00      **General Requirements for Painting Completed Off site**
- 8.08.01      **Preparation**  
Blast clean to BS 4232 2nd Quality (SA 2½)
- 8.08.02      **Priming**  
1 coats zinc rich 2 pack epoxy primer, dft 35 microns.
- 8.08.03      **Finishing**  
2 coats 2 - pack epoxy undercoat, dft 75 microns per coat.  
1 coats 2 - peak epoxy finish, dft 50 microns.
- 8.08.04      **Total Dry Film Thickness**  
235 microns.
- 8.08.05      Manufacturers may offer their standard paint procedure subject to the approval of the Engineer.

8.09.00 **Internal Surfaces of Storage Tanks**

8.09.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2 1/2).

8.09.02 **Priming**

1 coat zinc phosphate, dft 25 microns.

or

1 coat red oxide 2 pack epoxy primer, dft 25 microns.

or

1 coat zinc rich 2 - pack epoxy primer, dft 35 microns.

8.09.03 **Finish**

3 coats epoxy coal tar, dft 125 microns per coat.

or

3 coats non-staining bituminous paint, dft 50 microns per coat.

8.09.04 Paint system and total dry film thickness to be selected on contents of storage vessel and operating temperature and conditions.

8.10.00 **Galvanised Surfaces**

8.10.01 **Preparation**

Remove all corrosion by wire brushing by hand, degrease and chemically etch the cleaned zinc surface. Rinse with clean water.

8.10.02 **Priming**

1 coat zinc phosphate primer in oleoresinous, vinyl epoxy or chlorinated rubber media to suit finish paint system, dft 30 microns.

8.10.03 **Finish**

2 coats finish paint in oleoresinous, vinyl epoxy, or chlorinated rubber media, dft 50 microns per coat.

8.10.04 **Total Dry Films Thickness**

205 microns, including 75 microns of galvanising.

All underground pipework shall be coated and wrapped as per AWWA C-203.