GLOBE VALVE, CARBON STEEL, PRESSURE CLASS 150

1 GENERAL

1.1 SCOPE

This standard specifies the requirements of globe valves hand operated, outside screw and yoke type, CARBON STEEL body material, ASME PRESSURE CLASS 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_2, N_2, Syngas etc.

2 DESIGNATION

e.g.: GLOBE VLV CS NB100 CL150 RF

3 TECHNICAL REQUIREMENTS

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	As specified in Table-2
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	30 kg/cm²
3.6.2 Seat	22 kg/cm²
3.6.3 Back Seat	22 kg/cm²
3.6.4 Air leak test	6 kg/cm²
3.6.5 Additional Testing requirement for H_2, N_2 and other gas services	Test to be done as per mutual agreed procedure

CORPORATE STANDARD

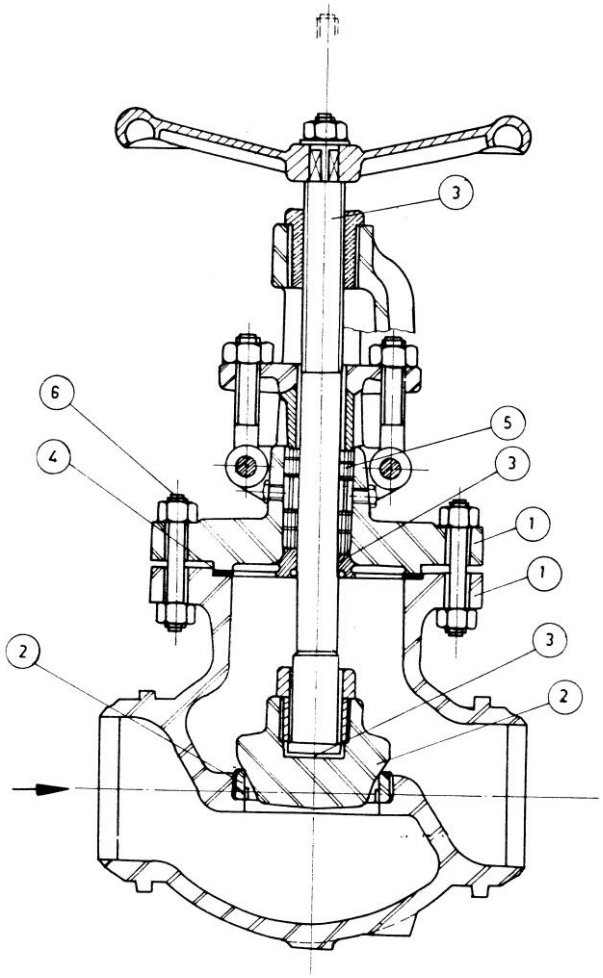

Table 1

Sl. No	Part	Material
1	Valve body, bonnet / yoke	ASTM A216 Gr.WCB
2	Seat/Disc	13% Cr.S.S. upto 100 NB. 13% Cr. Facing on WCB for the rest
3	Spindle, Back seat bush, Thrust plate	ASTM A182 Gr.F6a
4	Gasket	Spiral wound Stainless Steel with GRAFOIL filler
5	Gland Packing	Grafoil
6	Bolts, nuts for body & bonnet	ASTM A193 Gr. B7, ASTM A194 Gr. 2H
7	Other Parts	As per relevant standards

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

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 ½)	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.

4 REFRRED STANDARDS (Latest Publications Including Amendments)

1) AA0851403
2) ASME B16.10
3) ASME B16.25
4) ASME B16.34
5) ASME B16.5
6) ASTM A182
7) ASTM A193
8) ASTM A194
9) ASTM A216
10) BS 1873

SPECIFICATION FOR GATE VALVE

1.0. General:

1.1 These valves shall confirm to latest version of applicable standards as specified in specification

2.0. Application:

2.1) These valves are intended to use in Lube oil system.
2.2) The supplier shall strictly comply with this standard in all respects. No deviation shall be allowed, unless written permission of BHEL is obtained before finalization of order.

3.0 Applicable standards:

The following standards shall be complied
3.1) For Material:
3.1.1) SS gate Valve #800 SW ends up to 1.5" ends Annexure-2
3.1.2) SS gate Valve #150 RF from 2" and above ends Annexure-3
3.1.3) SS gate Valve #300 RF from 2" and above ends Annexure-4

3.2) Other Technical requirements shall be as per Annexure-1

4.0 Technical delivery conditions:

4.1) As per corporate standard AA0851403 (a copy to be enclosed) except IBR. IBR is not required for these items.

Ref.Doc.
None

Variant Table

Variant No.	Description	Nominal Bore	Pressure class	End Conn.	Material
1	Gate Valve	½”	800	SW	ASTM A182 GR F316
2	Gate Valve	¾”	800	SW	ASTM A182 GR F316
3	Gate Valve	1”	800	SW	ASTM A182 GR F316
4	Gate Valve	1 1/2”	800	SW	ASTM A182 GR F316
5	Gate Valve	2”	150	RF	ASTM A351 GR CF8M
6	Gate Valve	3”	150	RF	ASTM A351 GR CF8M
7	Gate Valve	4”	150	RF	ASTM A351 GR CF8M
8	Gate Valve	6”	150	RF	ASTM A351 GR CF8M
9	Gate Valve	8”	150	RF	ASTM A351 GR CF8M
10	Gate Valve	2”	300	RF	ASTM A351 GR CF8M
11	Gate Valve	3”	300	RF	ASTM A351 GR CF8M
12	Gate Valve	4”	300	RF	ASTM A351 GR CF8M
13	Gate Valve	6”	300	RF	ASTM A351 GR CF8M
14	Gate Valve	8”	300	RF	ASTM A351 GR CF8M

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PRODUCT STANDARD

HYDERABAD

Record of Revisions

Rev No	Revision Details	Revised By	Approved By
00	First Issue	DMK	M.A.Haseeb

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 wit any special features like sealed gland, regulating disc etc.

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 indictating 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.

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" phospating 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.

10.2.2ACTUATOR

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 s heet, 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 flang e 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.

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.

CORPORATE STANDARD

TABLE I – CONSTRUCTIONAL FEATURES

CL NO	FEATURE	VALVE TYPE	PRESSURE CLASS ANSI/DIN					
			CL 150	CL 300	CL 600	CL 900	CL 1500	CL 2500
			NP 10&16	NP 25&40	NP 64&100	NP 160	NP 250	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 1 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 postitive 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					

TABLE I – CONSTRUCTIONAL FEATURES

CL NO	FEATURE	VALVE TYPE	PRESSURE CLASS ANSI/DIN					
			CL 150	CL 300	CL 600	CL 900	CL 1500	CL 2500
			NP 10&16	NP 25&40	NP 64&100	NP 160	NP 250	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	CL 300	CL 600	CL 900	CL 1500	CL 2500
			NP 10&16	NP 25&40	NP 64&100	NP 160	NP 250	NP 320&400
3.1	Position Indicator	GLOBE GATE REGU LATING 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

CORPORATE STANDARD

TABLE – 2 ACCESSORIES (Contd.)

CL NO	REQUIREMENT	VALVE TYPE	PRESSURE CLASS ANSI/DIN					
			CL150	CL300	CL600	CL900	CL1 500	CL2 2500
			NP10&16	NP25&40	NP64&100	NP160	NP 250	NP320&400
3.5	Integral Bypass	GATE	NB 250 & above			NB 200 & above		
			*NOTE: Integral Bypass hall 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	CERTICATES REQUIRED
5.1	Visual Inspection	MSS-SP55 IS:210 IS:318	Steel Castings Cl 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	Overal 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-

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-dest-tructive 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%	Manufacturer's Certificates with the stamp of 'AI[1]
		Any butt Welded Joints	100%	-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 Dye Pene-trant Ins-pection (LPI/DPI) ASTM:E165	Seating Surfaces, Spindle Butt Weld-ing 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-

CORPORATE STANDARD

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)[a]				
	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: [a]The test duration is the period of inspection after the valves is fully prepared and is under full pressure.

ANNEXURE-1

वाल्वों के लिए तकनीकी टिप्पणियाँ

TECHNICAL NOTES FOR VALVES

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
7	13.07.17	REVISED AND ISSUED AS STANDARD SPECIFICATION	PK	SH	MI	RN
6	04.08.10	REVISED AND ISSUED AS STANDARD SPECIFICATION	RN	ATD	SC DM	ND
5	04.07.08	REVISED AND ISSUED AS STANDARD SPECIFICATION	RN	SC	DM	VC
4	15.11.00	REVISED AND ISSUED AS STANDARD SPECIFICATION	RN	BRB	NS	MI
3	04.04.94	ISSUED IN LINE WITH GENERAL REVISION	AKG	NS	GRR	AS

Abbreviations:

AARH	:	Arithmetic Average Roughness Height
ANSI	:	American National Standards Institute
API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing & Materials
BGO	:	Bevel Gear Operator
BHN	:	Brinnel Hardness Number
BIS	:	Bureau of Indian Standards
BS	:	British Standard
BVIS	:	Bureau Veritas Industrial Services
BW	:	Butt Weld
CAT	:	Category
CEIL	:	Certification Engineers International Limited
CS	:	Carbon Steel
DFT	:	Dry Film Thickness
DNV	:	Det Norske Veritas
DP	:	Dye-Penetrant
eDMS	:	Electronic Document Management System
IBR	:	Indian Boiler Regulations
IGC	:	Inter Granular Corrosion
IS	:	Indian Standard
LT	:	Low Temperature
LTCS	:	Low Temperature Carbon Steel
MOV	:	Motor Operated Valve
MP	:	Magnetic Particle
MR	:	Material Requisition
NDT	:	Non Destructive Testing
PMI	:	Positive Material Identification
PO	:	Purchase Order
PR	:	Purchase Requisition
RFQ	:	Request for Quotation
SCRD	:	Screwed
SS	:	Stainless Steel
SW	:	Socket Weld

Piping Standards Committee

Convenor : Mr M. Ismaeel

Members :
Mr. Amrendra Kumar
Mr. G. Balaji
Mr. Udayan Chakravarty
Mr. K.J. Harinarayanan (S&ME)
Mr. S. Ghoshal (Process-2)
Mr. G.K. Iyer (Projects)
Mr. Pankaj Kumar Rai (Construction)

CONTENTS

1.0 GENERAL

1.1 Vendor shall supply valves in accordance with the valve specification sheets along with auxiliaries, if any, such as gear operator, bypasses, drains, locking arrangements etc. wherever specified in the specification sheets, subject notes and other enclosures to the material requisition (MR).

1.2 Vendor shall quote in strict accordance with the valve data / specification sheets, subject technical notes and all other enclosures to the MR. For 'Cat-I valves', no deviations whatsoever shall be accepted. Post Order Waiver/ Deviation format 5-0000-0180-F1 as mentioned in Cl. 5.17 of specification for Quality Management System Requirements from Bidder (6-78-0001) is not applicable for Cat-I valves. For Cat-II Valves, if exceptions/ deviations become absolutely must, the same shall be requested as explained in clause 2.3.6 giving reasons for seeking such exceptions/ deviations.

1.3 All codes and standards for manufacture, testing, inspection etc. shall be of latest editions as on issue date of RFQ.

2.0 DOCUMENTATION

2.1 All document submissions to EIL shall be through EIL eDMS.

2.2 For 'Cat-I' valves, no documents shall be submitted with the offer.

2.3 For 'Cat-II' valves, vendor shall submit the following documents with the offer:

2.3.1 Manufacturer's complete descriptive and illustrative catalogue / literature.

2.3.2 Detailed dimensioned cross section drawing with parts / material lists, weight etc.

2.3.3 Drawings for valves with accessories like gear operator, hydraulic / pneumatic operator, motor, extension bonnet, extended stems with stands, bypass etc. giving major salient dimensions.

2.3.4 One copy of the valve specification sheets signed as "Accepted" by the manufacturer. Deviations, if any shall be marked as applicable on the valve specification sheet.

2.3.5 If the valve is regretted or has no deviation, the manufacturer shall write clearly on valve specification sheets as "Regret" or "No Deviation".

2.3.6 For 'CAT-II' valves, if there is any deviation, the same shall be listed clausewise.

2.3.7 On failure to submit documents as specified in clauses 2.1.1 to 2.1.6 above, the offer is likely to be rejected.

2.4 The following documents shall be submitted through eDMS of EIL after placement of the order:

2.4.1 For Cat-I valves to manufacturers' standard specified in MR/valve specification sheet, detailed dimensioned cross section drawing with parts, materials, weight, etc. shall be submitted for records/information.

2.4.2 For 'Cat-II' valves, Vendor shall submit for review drawings mentioned in clauses 2.1.2 & 2.1.3 before start of manufacture. No other drawings shall be submitted for review.

2.4.3 Test report shall be supplied for all mandatory tests as per the applicable code. Test reports shall also be furnished for any supplementary tests as specified in clauses 3.13, 3.14 & 3.15.

2.4.4 Material test certificates (physical properties, chemical composition & heat treatment report) of the pressure containing parts shall be furnished for the valves supplied. Material test certificates for the other parts shall also be furnished for verification during inspection.

2.5 In addition to submissions through EIL eDMS, Catalogues/Drawings shall be in submitted in hard copies (6 sets) and soft copies (2 CDs/DVDs) along with delivery for Purchaser's record for all categories/types of valves.

3.0 DESIGN AND CONSTRUCTION

3.1 Valve shall be designed, manufactured, tested, inspected and marked as per the manufacturing standards, design codes and standards indicated in the respective valve specification sheets. Any conflict between the requisition, enclosures, specification sheets and referred standards/ codes shall be brought to the notice of the purchaser for clarifications and resolution, before proceeding with the manufacture. The purchaser's decision shall be final and binding to the vendor. The drawings submitted for review shall not include any deviations except as communicated in writing in Deviation permits. The Drawings shall be reviewed only for design and construction features.

3.2 All flanged valves shall have flanges integral (except forged valves) with the valve body. Flange face finish shall be normally specified in the valve specification sheet as 125 AARH etc. The interpretation for range of face finish shall be as follows:

Stock Finish	:	1000 μ in AARH max.
125 AARH	:	Serrations with 125 to 250 μ in AARH
63 AARH	:	32 to 63 μ in AARH

3.3 For all weld end valves with bevel end as per ASME B16.25, the contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Upto 10 mm	Figure 4
	> 10 mm & Upto 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

Valve ends shall match thickness of the connecting pipe. Sloping of inside contour of valves shall be done wherever necessary to achieve this.

3.4 For flanged valves with ring joint flanges the hardness shall be as follows:

Flange Material	Min. Hardness of Groove (BHN)
Carbon Steel	140
1% Cr to 5% Cr, 9% Cr	150
Type 304, 316, 321, 347	160
Type 304L, 316L	140

3.5 Following requirements for check valves shall be met over and above the valve specification sheet requirements:

3.5.1 Unless specified otherwise in the data sheet all check valves 3" & above (except in 900#, 1500# & 2500# rating) shall have a drain boss at location "G" (Refer Fig.No.1 of ASME B16.34) where pocket is formed in valve body. A tapped drain hole with plug shall be provided as per ASME B16.34. Threads shall be as per ASME B1.20.1 (Taper) NPT.

3.5.2 For heavy check valves, provisions shall be available for lifting by way of lugs, eye bolts and other such standard devices.

3.6 If an overlay weld-deposit is used for the body seat ring seating surface, the corrosion resistance of the seat ring base material shall be at least equal to the corrosion resistance of the material of the shell.

3.7 Following valve bypass requirements shall be met:

3.7.1 By-pass requirement for Gate valves shall be as follows unless otherwise mentioned.

ASME 150 Class	On sizes 26" and above
ASME 300 Class	On sizes 16" and above
ASME 600 Class	On sizes 6" and above
ASME 900 Class	On sizes 4" and above
ASME 1500 Class	On sizes 4" and above
ASME 2500 Class	On sizes 3" and above

3.7.2 The by-pass piping arrangement shall be such that clearance between main valve body and by-pass assembly shall be the minimum possible for layout reasons. Vendor shall follow the sketch enclosed in Specification No. 6-44-0052-A1.

3.7.3 By-pass valve shall be a globe valve. The sizes shall be as under:

On main valve ≤ 4"	:	1/2"
On main valve 6" to 8"	:	3/4"
On main valve 10" & above	:	1"

By-pass piping shall be of same metallurgy as main valve. The by-pass piping, fittings and valve tag numbers shall be as specified in Specification No. 6-44-0052-A2. In case details of by-pass arrangement for any Valve tag number is missing, Vendor shall bring the same to notice of EIL and provide by-pass as per details specified.

3.7.4 Vendor shall supply the by-pass valve duly tested and fitted to the main valve. Valves with by-pass shall have the direction of flow marked on the main valve. By-pass attachment to the

main valve body shall not be screwed. All fillet welds for by-pass installation shall be 100% examined by DP/MP test and Butt-weld joints shall be 100% examined by radiography.

3.8 Valve body / bonnet shall be forged / cast as specified. Forgings are acceptable in place of casting but not vice-versa.

3.9 Stem shall be forged or machined from forged / rolled bar. No casting is permitted. However, integral stem of cast material is acceptable for Plug valves.

3.10 Stelliting / hardfacing by deposition, shall be minimum 1.6 mm.

3.11 Renewable seat rings shall be seal welded for valves of size 3" and above to prevent loosening in service.

3.12 For Low Temperature & Cryogenic valve requirements, refer Specification.No.6-44-0052-A3 unless otherwise specified.

3.13 For Hydrogen service valve requirements, refer Specification.No.6-44-0052-A4 unless otherwise specified.

3.14 Valves under 'NACE' category shall meet the requirements specified in MR-0103 unless otherwise specified.

3.15 For all austenitic stainless steel valves Inter Granular Corrosion (IGC) test shall be conducted as per the following:

3.15.1 ASTM A262 Practice 'B' with acceptance criteria of '60 mils/year (max.)' for all materials - forged, rolled, wrought and casting.

Or

ASTM A262 Practice 'E' with acceptance criteria of 'No cracks as observed from 20X magnification' for all materials other than castings. 'Microscopic structure to be observed from 250X magnification' in addition.

3.15.2 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc.) ASTM A262 Practice 'C' with acceptance criteria of '15 mils/year (max.)' shall be conducted.

3.15.3 For the IGC test as described in Clauses 3.15.1 & 3.15.2, two sets of samples shall be drawn from each solution annealing lot. One set shall correspond to the highest Carbon content and the other to the highest pressure rating. When testing is conducted as per practice 'E', photograph of the microscopic structure shall be submitted for record.

3.16 All types of 321 or 347 stainless steel valves shall be in a stabilised heat treated condition. Stabilising heat treatment shall be carried out subsequent to the normal solution annealing. Soaking temperature and holding time for stabilising heat treatment shall be 900°C and 4 hours respectively.

3.17 Spiral wound bonnet gaskets are to be provided with inner/outer ring except when encapsulated gaskets type body-bonnet joints are employed. Outer ring may be avoided in case of non-circular spiral wound gasket used in 150# valve provided the outermost layer of spiral touches the bolts ascertaining the centering.

3.18 All Stainless Steel Castings shall be solution heat treated.

3.19 Only normalized and tempered material shall be used in the following specifications :

Castings : A217 Gr.WC1, A217 Gr.WC4, A217 Gr.WC5, A217 Gr.WC6, A217 Gr.WC9, A217 Gr.C5, A217 Gr.C12

Forgings : A182 Gr.F11 Cl.2, A182 Gr.F12 Cl.2

3.20 Ball / Plug / Butterfly Valves

3.20.1 As a prequalification, fire safe test as per API 607 / API 6FA / BS EN ISO 10497 (Supersedes BS 6755 Part II) shall be carried out on soft seated ball, plug & butterfly valves and also on lubricated plug valves The test shall be witnessed and certified by a third party inspection agency like Lloyds, BVIS, DNV or EIL/ CEIL unless otherwise specified. The vendor has to submit test certificate for the particular design of the valve offered, if fire safe design is required as per the Valve Material Specification sheet..

3.20.2 Each valve shall be supplied with a lever / wrench except for gear operated / motor operated valves.

3.20.3 Soft-seated ball, plug & butterfly valves shall be supplied with antistatic devices.

3.20.4 BW / SW end ball valves shall have a 100 mm long seamless pipe nipple welded to each end of the valve. Nipples are to be welded prior to assembling Teflon seats / seals. Specifications of the nipples shall be as indicated in the MR.

3.20.5 The face-to-face dimensions of all ball valves shall be same as those of gate valves of the corresponding ANSI class (except 10" onwards in Class 150 where the face-to-face dimensions shall be as per API 6D long pattern).

3.20.6 The ball of ball valve shall not protrude outside the end flanges of valve.

3.20.7 Ball valves shall be of floating ball/trunnion mounted type as per following:

150#	8" & below	Floating ball
	10" & above	Trunnion mounted
300#	4" & below	Floating ball
	6" & above	Trunnion mounted
600# & above	1.5" & below	Floating ball
	2" & above	Trunnion mounted

3.20.8 Unless otherwise specified in the data sheets, bore of all reduced bore ball valves shall be limited to one size lower than the nominal bore.

3.21 The MOVs are to be installed in an open area and the actuators shall be suitable for all weather conditions. The testing of complete assemblies of MOVs along with the actuators shall be done by the supplier at his works.

3.22 Ends of flanged valves of 22" size shall match corresponding flanges to MSS-SP44 unless otherwise specified.

3.23 Yoke material shall be same as bonnet material where maximum temperature specified is more than 427°C.

4.0 OPERATION

4.1 Gear operation shall be provided as under:

Valve Type	Class	Size Requiring Gear-Operator
Gate Valve, Globe Valve & Diaphragm Valve	150 Class	12" and larger
	300 Class	12" and larger
	600 Class	10" and larger
	900 Class	6" and larger
	1500 Class	3" and larger
	2500 Class	3" and larger
Ball Valve / Plug Valve (Other than pressure balance plug valves)	150 Class	6" and larger
	300 Class	6" and larger
	600 Class	4" and larger
	900 Class	3" and larger
	1500 Class	3" and larger
Butterfly Valve	150, 300 Class	6" and larger

For sizes lower than these ranges, hand wheel / lever / wrench shall be provided. For pressure balance plug valves manufacturer's recommendation shall be acceptable provided the requirements specified in clause 4.6 are met.

4.2 Gear operator shall be provided, with position indicators for open / close positions and with limit stops. (Limit stops are not applicable for gate and globe valves).

4.3 Where gear operator is not called for as per Clause 4.1 but vendor recommends a gear operator, the same shall be highlighted.

4.4 Gear operator shall be so designed as to operate effectively with the differential pressure across the closed valve equal to the cold non-shock pressure rating.

4.5 Ball, plug and butterfly valves, shall have "Open" position indicators with limit stops.

4.6 Hand wheel diameter shall not exceed 750mm and lever length shall not exceed 500mm on either side. Effort to operate shall not exceed 35 Kg at handwheel periphery. However, failing to meet the above requirements, vendor shall offer gear operated valve and quote as per clause 4.3.

5.0 INSPECTION AND TESTING

5.1 Every valve shall be subjected to all the mandatory tests and checks called in the respective codes / data sheet by EIL inspection or any third party as approved by the purchaser. For IBR valves refer clause 7.0.

5.2 Every valve, its components and auxiliaries must be subjected to all the mandatory tests and checks called for in the respective codes, data sheets etc. by the manufacturer.

5.3 Though the extent of inspection shall be as under, exact extent with hold points shall be decided by EIL regional inspection office and recorded in the form of inspection plan. In case of third party inspection, the inspection plan shall be approved by the purchaser.

Forged Valves:

1. Visual and dimensional inspection.
2. Review of material test certificates.
3. Any mandatory or supplementary test.
4. Hydrostatic test on 10% valves selected on random basis.
5. Strip check is required for 1% of total ordered quantity of Gate & Globe valves (min. 1 No.) for each Valve sheet no., however, strip check is not required for CS/ Brass/ Bronze material valves with 13% Cr/ Brass/ Bronze trims.

Cast Steel Valves:

1. Visual and dimensional inspection.
2. Review of material test certificates.
3. Review of radiographs/radiographic reports or any other NDT tests wherever applicable as per data sheet.
4. Any mandatory or supplementary test.
5. Hydrostatic test 100% for body, 10% other test.
6. Strip check is required for 1% of total ordered quantity of Gate & Globe valves (min. 1 No.) for each Valve sheet no., however, strip check is not required for CS/ Brass/ Bronze material valves with 13% Cr/ Brass/ Bronze trims.

   Samples for strip check shall be selected at random and shall generally be in the highest size in the lot.

5.4 In case of motor operated or actuator operated valves, functional / operational checks as per the requirements of the specifications shall be made on each valve.

6.0 RADIOGRAPHY OF CAST VALVES

6.1 Valve castings shall undergo radiographic examination as specified below.

Material	Rating	Size Range	Radiography
All	150#	24" and below	NIL**
		26" and above*	100%
	300#	16" and below	NIL**
		18" and above	100%
	600# & above	All sizes	100%

* No radiography is required for valves of size 26" and above in cooling water service.

**For sizes 24" & below in 150# and 16" & below in 300#, radiography percentage if specifically mentioned in individual valve material spec sheet shall govern.

Radiography specified as random 10% or 20% etc. in the respective valve data sheet implies 10% or 20% etc. of number of valves ordered against each item number with a minimum of one valve against each item.

6.2 Radiography procedure, areas of casting to be radiographed shall be as per ASME B16.34 and acceptance criteria shall be as per ASME B16.34 Annexure-B. However for areas of casting to be radiographed for types of valves not covered in ASME B16.34, vendor shall radiograph castings in line with ASME B16.34.

6.3 For random radiography wherever specified in individual data sheets, the sampling shall be per size of the quantity ordered for each foundry.

6.4 Radiography wherever specified in the data sheets or as per clause 6.1 shall be done by X-ray / γ-ray to get the required sensitivity.

7.0 IBR CERTIFICATION

7.1 For valves described "IBR", valves shall be in accordance with the latest IBR (Indian Boiler Regulation) including the requirements specified in the specification.

7.2 For SW / BW end carbon steel valves under IBR, the chemical composition shall conform to the following:

Carbon (Max)	:	0.25%
Others (S, P, Mn)	:	As per IBR

7.3 Valves coming under the purview of "IBR"(Indian Boiler Regulations) shall each be individually accompanied by IBR certificate original in Form III-C duly approved by IBR authority / local authority empowered by the Central Boiler Board of India. Photocopy of original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance.

7.4 All "IBR" valves shall be painted red in body-bonnet / body-cover joint.

8.0 MARKING

8.1 Valve markings, symbols, abbreviations etc. shall be in accordance with MSS-SP-25 or the standard referred in specification sheet as applicable. Vendor's name, valve rating, material designation, nominal size, direction of flow (if any) etc. shall be integral on the body.

8.2 Each valve shall have a corrosion resistant tag giving size, valve tag / code no., securely attached to the valve body.

8.3 Paint or ink for marking shall not contain any harmful metal or metal salts such as zinc, lead or copper which cause corrosive attack on heating.

8.4 Carbon Steel / Alloy Steel valves shall be painted with one coat of inorganic zinc silicate (minimum DFT 65 to 75 microns).

9.0 DESPATCH

9.1 Valve shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.

9.2 Valves shall be protected from rust, corrosion and any mechanical damage during transportation, shipment and storage.

9.3 Rust preventive on machined surfaces to be welded shall be easily removable with a petroleum solvent or shall not be harmful to welding.

9.4 Each end of valve shall be protected with the following materials:

Flange Face	:	Wood or Plastic Cover
Bevelled End	:	Wood or Plastic Cover
SW & SCRD. End	:	Plastic Cap

9.5 End protectors of wood / plastic to be used on flange faces shall be attached by at least three bolts and shall not be smaller than the outside diameter of the flange. However, plastic caps for SW & SCRD end valves shall be press fit type.

9.6 End protectors to be used on bevelled end shall be securely and tightly attached.

9.7 For special service valves additional requirement for despatch shall be as prescribed in data sheet.

10.0 ATTACHMENTS

6-44-0052-A1	:	Bypass Piping Arrangement
6-44-0052-A2	:	Specifications for Bypass Piping, Fittings and Valves
6-44-0052-A3	:	Special Requirements for Low Temperature and Cryogenic Valves
6-44-0052-A4	:	Special Requirements for Hydrogen Service Valves

11.0 REFERENCES

6-78-0001	:	Specification for Quality management system requirements from bidders
6-78-0003	:	Specification for documentation requirements from suppliers
6-81-0001	:	Specification for Positive Material Identification (PMI) at Supplier's Works
6-81-0004	:	Inspection and Test plan for Valves

ANNEXURE -2

VALVE MATERIAL SPECIFICATION

GATE VALVE SPECIFICATION			MANUF'S OFFER	
TAG NO• : 51045 RATING : 800 SIZE RANGE : 0.5" TO 1.5'		PIPING CLASS :AIK, A3K, A47K, A48K, BIK, DIK, D82K, STANDARD : API 602/ ISO 15761 ENDS : SW 3000 TO B-16.11	STANDARD: MFGRS CAT/FIG: RATING: ENDS:	
DESCRIPTION	CONSTRUCTION	MATERIAL	CONSTRUCTION	MATERIAL
BODY	FORGED	ASTM A 182 GR.F316		
BONNET	BOLTED	ASTM A 182 GR.F316		
STEM	RISING	SS 316; (NO CASTING)		
WEDGE DISC	SOLID	STELLITED		
BODY SEAT RING	RENEWABLE	STELLITED		
STEM PACKING	RENEWABLE WITH VALVE OPEN ON STREAM	CORROSION INHIBITED DIE FORMED FLEXIBLE GRAPHITE WITH BRAIDED ANTI EXTRUSION RINGS		
HAND WHEEL	NON RISING	MALLEABLE IRON/CAST ST/FAB.ST/DUCT. IRON		
BONNET BOLTS		ASTM A193 GR B8		
BONNET NUTS		ASTM A194 GR.8		
BONNET GASKET		SP WND SS316-GRAFOIL FILLER		
SPECIAL SERVICE CONDITIONS		MAX TEMP 454 DEG.C.		
BACK SEAT & SHOULDER	INTEGRAL			
OTHERS	O.S & Y.			
HYDROSTATIC TEST PRESSURE	BODY : 2900 PSIG	SEAT : 2125 PSIG		
TEST PRESSURE WITH AIR	80 PSIG			

NOTES

1 THIS VALVE SPEC SHEET SHALL BE READ IN CONJUNCTION WITH TECHNICAL NOTES FOR VALVES.

2 ONLY IN THE CASE OF CATEGORY - 11 MRs,BIDDER SHALL CLEARLY WRITE ALL/ ANY DEVIATION AGAINST EACH PART/ MATERIAL OF VALVE IN THE SPACE PROVIDED FOR AND WHEREVER BIDDER AGREES WITH EIL'S SPEC BIDDER SHALL INDICATE "AGREED".

3 NO CUTTING/ OVERWRITING BY BIDDER ON Ella'S SPEC IS ALLOWED.

4 VALVES AS PER API-602 AND TESTING AS PER API-598 ARE ALSO ACCEPTABLE.

ANNEXURE -3

VALVE MATERIAL SPECIFICATION

GATE VALVE SPECIFICATION			MANUF'S OFFER	
TAG NO• : 51345 PIPING CLASS : AIK, A3K, RATING : 150 STANDARD : API 600/ ISO 10434 SIZE RANGE : 2.0" TO 24.0" ENDS : FLGD TO B-16.5 RF/125AARH			STANDARD: MFGRS CAT/FIG: RATING: ENDS:	
DESCRIPTION	CONSTRUCTION	MATERIAL	CONSTRUCTION	MATERIAL
BODY	CAST	ASTM A 351 GR CF8M		
BONNET	BOLTED	ASTM A 351 GR.CF8M		
STEM	RISING	SS 316; (NO CASTING)		
WEDGE DISC	SOLID/FLEXIBLE	SS 316		
BODY SEAT RING	RENEWABLE/NONRENEWABLE	SS 316		
STEM PACKING	RENEWABLE WITH VALVE OPEN ON STREAM	CORROSION INHIBITED DIE FORMED FLEXIBLE GRAPHITE WITH BRAIDED ANTI EXTRUSION RINGS		
HAND WHEEL	NON RISING	MALLEABLE IRON/CAST ST/FAB.ST|DUCT. IRON		
BONNET BOLTS		ASTM A193 GR B8		
BONNET NUTS		ASTM A194 GR 8		
BONNET GASKET		SP WND SS316-GRAF01L FILLER/CORRUGATED SS316		
REQUIREMENT OF GEAR OPERATOR		REFER TECHNICAL NOTES FOR PURCHASE OF VALVES.		
REQUIREMENT OF RADIOGRAPHY		REFER TECHNICAL NOTES FOR PURCHASE OF VALVES.		
SPECIAL SERVICE CONDITIONS		MAX TEMP 371 DEG.C.		
BACK SEAT & SHOULDER		SS 316		
OTHERS				
HYDROSTATIC TEST PRESSURE	BODY : 425 PSIG	SEAT : 325 PSIG		
TEST PRESSURE WITH AIR	80 PSIG			

NOTES

1 THIS VALVE SPEC SHEET SHALL BE READ IN CONJUNCTION WITH TECHNICAL NOTES FOR VALVES.
2 ONLY IN THE CASE OF CATEGORY - 11 MRs,BIDDER SHALL CLEARLY WRITE ALL/ ANY DEVIATION AGAINST EACH PART/ MATERIAL OF VALVE IN THE SPACE PROVIDED FOR AND WHEREVER BIDDER AGREES WITH EIL'S SPEC BIDDER SHALL INDICATE "AGREED".
3 NO CUTTING/ OVERWRITING BY BIDDER ON EIL'S SPEC IS ALLOWED.
4 10 VALVE CASTINGS SHALL UNDERGO RADIOGRAPHIC EXAMINATION.
5 ALL CASTINGS SHALL BE SOLUTION HEAT TREATED.
6 WELD REPAIRS, IF ANY, SHALL BE CARRIED OUT BEFORE SOLUTION HEAT TREATMENT. 7 VALVES AS PER API-600 AND TESTING AS PER API-598 ARE ALSO ACCEPTABLE.

ANNEXURE- 4

VALVE MATERIAL SPECIFICATION

GATE VALVE SPECIFICATION			MANUF'S OFFER	
RATING : 300 **STANDARD** : BS-1873 **SIZE RANGE :** 2.0" TO 16.0" **ENDS** : FLGD TO B-16.5 RF/125AARH			**STANDARD:** **MFGRS CAT/FIG:** **RATING:** **ENDS:**	
DESCRIPTION	**CONSTRUCTION**	**MATERIAL**	**CONSTRUCTION**	**MATERIAL**
BODY	CAST	ASTM A 351 GR CF8M		
BONNET	BOLTED	ASTM A 351 GR.CF8M		
STEM	RISING	SS 316 (NO CASTING)		
DISC	LOOSE PLUG TYPE/BALL TYP	SS 316		
BODY SEAT RING	RENEWABLE/NON RENEWABLE	SS 316		
STEM PACKING	RENEWABLE WITH VALVE OPEN ON STREAM	CORROSION INHIBITED DIE FORMED FLEXIBLE GRAPHITE WITH BRAIDED ANTI EXTRUSION RINGS		
HAND WHEEL	RISING	MALLEABLE IRON/CAST ST/FAB.ST/DUCT. IRON		
BONNET BOLTS		ASTM A193 GR B8		
BONNET NUTS		ASTM A194 GR 8		
BONNET GASKET		SP WND SS316 WITH GRAFOIL FILLER/CORRUGATED SS316		
REQUIREMENT OF GEAR OPERATOR		REFER TECHNICAL NOTES FOR PURCHASE OF VALVES.		
REQUIREMENT OF RADIOGRAPHY		REFER TECHNICAL NOTES FOR PURCHASE OF VALVES.		
OTHERS	O S & Y			
SPECIAL SERVICE CONDITION		MAX TEMP 427 DEG. C.		

BACK SEAT & SHOULDER		SS 316		
HYDROSTATIC TEST PRESSURE	BODY : 1125 PSIG	SEAT : 825 PSIG		
TEST PRESSURE WITH AIR	80 PSIG			

NOTES

1 THIS VALVE SPEC SHEET SHALL BE READ IN CONJUNCTION WITH TECHNICAL NOTES FOR VALVES.

2 ONLY IN THE CASE OF CATEGORY - II MRs,BIDDER SHALL CLEARLY WRITE ALL/ ANY DEVIATION AGAINST EACH PART/ MATERIAL OF VALVE IN THE SPACE PROVIDED FOR AND WHEREVER BIDDER AGREES WITH EIL'S SPEC BIDDER SHALL **INDICATE "AGREED".**

3 **NO CUTTING/ OVERWRITING BY BIDDER ON SPEC IS ALLOWED.**

4 **TESTING SHALL BE AS PER BS EN 12266-1.**

5 **10% VALVE CASTINGS SHALL UNDERGO RADIOGRAPHIC EXAMINATION.**

6 **ALL CASTINGS SHALL BE SOLUTION HEAT TREATED.**

7 **WELD REPAIRS, IF ANY, SHALL BE CARRIED OUT BEFORE SOLUTION HEAT TREATMENT.**

SPECIFICATION FOR GATE VALVE (NACE+H2 SERVICE)

1.0. General:

1.1 These valves shall confirm to latest version of applicable standards as specified in specification

2.0. Application:

2.1) These valves are intended to use in Hydrogen sulphide (H_2S) bearing fuel Gas service. These valves should provide resistance to sulphide stress cracking (SSC) and for stress corrosion cracking in sour environments.

2.2) The supplier shall strictly comply with this standard in all respects. No deviation shall be allowed, unless written permission of BHEL is obtained before finalization of order.

3.0 Applicable standards:

The following standards shall be complied

3.1) For Material:

3.1.1) SS gate Valve #800 SW ends up to 1.5" ends Annexure-3

3.1.2) SS gate Valve #1500 BW ends up to 1.5" Annexure-4

3.1.3) SS gate Valve #150 RF from 2" and above ends Annexure-5

3.2) Hydrogen service requirement as per Annexure-2

3.3) NACE MR0175

3.4) Other Technical requirements shall be as per Annexure-1

Variant Table

Variant No.	Description	Nominal Bore	Pressure class	End Conn.	Material
1	Gate Valve	¾”	800	3000SW	SS316
2	Gate valve	¾”	1500	BW	SS316
3	Gate Valve	2”	150	RF	ASTM A351 GR CF8M
4	Gate Valve	1 ½”	800	3000SW	SS316
5	Gate Valve	2”	600	RJ	ASTM A351 GR CF8M
6	Gate Valve	2”	1500	RJ	ASTM A351 GR CF8M
7	Gate Valve	3/4”	1500	SW	SS316
8	Gate Valve	2”	600	RF	ASTM A351 GR CF8M
9	Gate Valve	1”	800	3000SW	SS316

PRODUCT STANDARD

HYDERABAD

Record of Revisions

Rev No	Revision Details	Revised By	Approoved By
00	First Issue	Chandu	Haseeb

ANNEXURE-I

वाल्वों के लिए तकनीकी टिप्पणियाँ

TECHNICAL NOTES FOR VALVES

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
7	13.07.17	REVISED AND ISSUED AS STANDARD SPECIFICATION	PK	SH	MI	RN
6	04.08.10	REVISED AND ISSUED AS STANDARD SPECIFICATION	RN	ATD	SC DM	ND
5	04.07.08	REVISED AND ISSUED AS STANDARD SPECIFICATION	RN	SC	DM	VC
4	15.11.00	REVISED AND ISSUED AS STANDARD SPECIFICATION	RN	BRB	NS	MI
3	04.04.94	ISSUED IN LINE WITH GENERAL REVISION	AKG	NS	GRR	AS

Abbreviations:

AARH	:	Arithmetic Average Roughness Height
ANSI	:	American National Standards Institute
API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing & Materials
BGO	:	Bevel Gear Operator
BHN	:	Brinnel Hardness Number
BIS	:	Bureau of Indian Standards
BS	:	British Standard
BVIS	:	Bureau Veritas Industrial Services
BW	:	Butt Weld
CAT	:	Category
CEIL	:	Certification Engineers International Limited
CS	:	Carbon Steel
DFT	:	Dry Film Thickness
DNV	:	Det Norske Veritas
DP	:	Dye-Penetrant
eDMS	:	Electronic Document Management System
IBR	:	Indian Boiler Regulations
IGC	:	Inter Granular Corrosion
IS	:	Indian Standard
LT	:	Low Temperature
LTCS	:	Low Temperature Carbon Steel
MOV	:	Motor Operated Valve
MP	:	Magnetic Particle
MR	:	Material Requisition
NDT	:	Non Destructive Testing
PMI	:	Positive Material Identification
PO	:	Purchase Order
PR	:	Purchase Requisition
RFQ	:	Request for Quotation
SCRD	:	Screwed
SS	:	Stainless Steel
SW	:	Socket Weld

Piping Standards Committee

Convenor : Mr M. Ismaeel

Members :
Mr. Amrendra Kumar
Mr. G. Balaji
Mr. Udayan Chakravarty
Mr. K.J. Harinarayanan (S&ME)
Mr. S. Ghoshal (Process-2)
Mr. G.K. Iyer (Projects)
Mr. Pankaj Kumar Rai (Construction)

CONTENTS

1.0 GENERAL

1.1 Vendor shall supply valves in accordance with the valve specification sheets along with auxiliaries, if any, such as gear operator, bypasses, drains, locking arrangements etc. wherever specified in the specification sheets, subject notes and other enclosures to the material requisition (MR).

1.2 Vendor shall quote in strict accordance with the valve data / specification sheets, subject technical notes and all other enclosures to the MR. For 'Cat-I valves', no deviations whatsoever shall be accepted. Post Order Waiver/ Deviation format 5-0000-0180-F1 as mentioned in Cl. 5.17 of specification for Quality Management System Requirements from Bidder (6-78-0001) is not applicable for Cat-I valves. For Cat-II Valves, if exceptions/ deviations become absolutely must, the same shall be requested as explained in clause 2.3.6 giving reasons for seeking such exceptions/ deviations.

1.3 All codes and standards for manufacture, testing, inspection etc. shall be of latest editions as on issue date of RFQ.

2.0 DOCUMENTATION

2.1 All document submissions to EIL shall be through EIL eDMS.

2.2 For 'Cat-I' valves, no documents shall be submitted with the offer.

2.3 For 'Cat-II' valves, vendor shall submit the following documents with the offer:

2.3.1 Manufacturer's complete descriptive and illustrative catalogue / literature.

2.3.2 Detailed dimensioned cross section drawing with parts / material lists, weight etc.

2.3.3 Drawings for valves with accessories like gear operator, hydraulic / pneumatic operator, motor, extension bonnet, extended stems with stands, bypass etc. giving major salient dimensions.

2.3.4 One copy of the valve specification sheets signed as "Accepted" by the manufacturer. Deviations, if any shall be marked as applicable on the valve specification sheet.

2.3.5 If the valve is regretted or has no deviation, the manufacturer shall write clearly on valve specification sheets as "Regret" or "No Deviation".

2.3.6 For 'CAT-II' valves, if there is any deviation, the same shall be listed clausewise.

2.3.7 On failure to submit documents as specified in clauses 2.1.1 to 2.1.6 above, the offer is likely to be rejected.

2.4 The following documents shall be submitted through eDMS of EIL after placement of the order:

2.4.1 For Cat-I valves to manufacturers' standard specified in MR/valve specification sheet, detailed dimensioned cross section drawing with parts, materials, weight, etc. shall be submitted for records/information.

2.4.2 For 'Cat-II' valves, Vendor shall submit for review drawings mentioned in clauses 2.1.2 & 2.1.3 before start of manufacture. No other drawings shall be submitted for review.

2.4.3 Test report shall be supplied for all mandatory tests as per the applicable code. Test reports shall also be furnished for any supplementary tests as specified in clauses 3.13, 3.14 & 3.15.

2.4.4 Material test certificates (physical properties, chemical composition & heat treatment report) of the pressure containing parts shall be furnished for the valves supplied. Material test certificates for the other parts shall also be furnished for verification during inspection.

2.5 In addition to submissions through EIL eDMS, Catalogues/Drawings shall be in submitted in hard copies (6 sets) and soft copies (2 CDs/DVDs) along with delivery for Purchaser's record for all categories/types of valves.

3.0 DESIGN AND CONSTRUCTION

3.1 Valve shall be designed, manufactured, tested, inspected and marked as per the manufacturing standards, design codes and standards indicated in the respective valve specification sheets. Any conflict between the requisition, enclosures, specification sheets and referred standards/ codes shall be brought to the notice of the purchaser for clarifications and resolution, before proceeding with the manufacture. The purchaser's decision shall be final and binding to the vendor. The drawings submitted for review shall not include any deviations except as communicated in writing in Deviation permits. The Drawings shall be reviewed only for design and construction features.

3.2 All flanged valves shall have flanges integral (except forged valves) with the valve body. Flange face finish shall be normally specified in the valve specification sheet as 125 AARH etc. The interpretation for range of face finish shall be as follows:

Stock Finish	:	1000 μ in AARH max.
125 AARH	:	Serrations with 125 to 250 μ in AARH
63 AARH	:	32 to 63 μ in AARH

3.3 For all weld end valves with bevel end as per ASME B16.25, the contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Upto 10 mm	Figure 4
	> 10 mm & Upto 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

Valve ends shall match thickness of the connecting pipe. Sloping of inside contour of valves shall be done wherever necessary to achieve this.

3.4 For flanged valves with ring joint flanges the hardness shall be as follows:

Flange Material	Min. Hardness of Groove (BHN)
Carbon Steel	140
1% Cr to 5% Cr, 9% Cr	150
Type 304, 316, 321, 347	160
Type 304L, 316L	140

3.5 Following requirements for check valves shall be met over and above the valve specification sheet requirements:

3.5.1 Unless specified otherwise in the data sheet all check valves 3" & above (except in 900#, 1500# & 2500# rating) shall have a drain boss at location "G" (Refer Fig.No.1 of ASME B16.34) where pocket is formed in valve body. A tapped drain hole with plug shall be provided as per ASME B16.34. Threads shall be as per ASME B1.20.1 (Taper) NPT.

3.5.2 For heavy check valves, provisions shall be available for lifting by way of lugs, eye bolts and other such standard devices.

3.6 If an overlay weld-deposit is used for the body seat ring seating surface, the corrosion resistance of the seat ring base material shall be at least equal to the corrosion resistance of the material of the shell.

3.7 Following valve bypass requirements shall be met:

3.7.1 By-pass requirement for Gate valves shall be as follows unless otherwise mentioned.

ASME 150 Class	On sizes 26" and above
ASME 300 Class	On sizes 16" and above
ASME 600 Class	On sizes 6" and above
ASME 900 Class	On sizes 4" and above
ASME 1500 Class	On sizes 4" and above
ASME 2500 Class	On sizes 3" and above

3.7.2 The by-pass piping arrangement shall be such that clearance between main valve body and by-pass assembly shall be the minimum possible for layout reasons. Vendor shall follow the sketch enclosed in Specification No. 6-44-0052-A1.

3.7.3 By-pass valve shall be a globe valve. The sizes shall be as under:

On main valve ≤ 4"	:	1/2"
On main valve 6" to 8"	:	3/4"
On main valve 10" & above	:	1"

By-pass piping shall be of same metallurgy as main valve. The by-pass piping, fittings and valve tag numbers shall be as specified in Specification No. 6-44-0052-A2. In case details of by-pass arrangement for any Valve tag number is missing, Vendor shall bring the same to notice of EIL and provide by-pass as per details specified.

3.7.4 Vendor shall supply the by-pass valve duly tested and fitted to the main valve. Valves with by-pass shall have the direction of flow marked on the main valve. By-pass attachment to the

main valve body shall not be screwed. All fillet welds for by-pass installation shall be 100% examined by DP/MP test and Butt-weld joints shall be 100% examined by radiography.

3.8 Valve body / bonnet shall be forged / cast as specified. Forgings are acceptable in place of casting but not vice-versa.

3.9 Stem shall be forged or machined from forged / rolled bar. No casting is permitted. However, integral stem of cast material is acceptable for Plug valves.

3.10 Stelliting / hardfacing by deposition, shall be minimum 1.6 mm.

3.11 Renewable seat rings shall be seal welded for valves of size 3" and above to prevent loosening in service.

3.12 For Low Temperature & Cryogenic valve requirements, refer Specification.No.6-44-0052-A3 unless otherwise specified.

3.13 For Hydrogen service valve requirements, refer Specification.No.6-44-0052-A4 unless otherwise specified.

3.14 Valves under 'NACE' category shall meet the requirements specified in MR-0103 unless otherwise specified.

3.15 For all austenitic stainless steel valves Inter Granular Corrosion (IGC) test shall be conducted as per the following:

3.15.1 ASTM A262 Practice 'B' with acceptance criteria of '60 mils/year (max.)' for all materials - forged, rolled, wrought and casting.

Or

ASTM A262 Practice 'E' with acceptance criteria of 'No cracks as observed from 20X magnification' for all materials other than castings. 'Microscopic structure to be observed from 250X magnification' in addition.

3.15.2 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc.) ASTM A262 Practice 'C' with acceptance criteria of '15 mils/year (max.)' shall be conducted.

3.15.3 For the IGC test as described in Clauses 3.15.1 & 3.15.2, two sets of samples shall be drawn from each solution annealing lot. One set shall correspond to the highest Carbon content and the other to the highest pressure rating. When testing is conducted as per practice 'E', photograph of the microscopic structure shall be submitted for record.

3.16 All types of 321 or 347 stainless steel valves shall be in a stabilised heat treated condition. Stabilising heat treatment shall be carried out subsequent to the normal solution annealing. Soaking temperature and holding time for stabilising heat treatment shall be 900°C and 4 hours respectively.

3.17 Spiral wound bonnet gaskets are to be provided with inner/outer ring except when encapsulated gaskets type body-bonnet joints are employed. Outer ring may be avoided in case of non-circular spiral wound gasket used in 150# valve provided the outermost layer of spiral touches the bolts ascertaining the centering.

3.18 All Stainless Steel Castings shall be solution heat treated.

3.19 Only normalized and tempered material shall be used in the following specifications :

Castings : A217 Gr.WC1, A217 Gr.WC4, A217 Gr.WC5, A217 Gr.WC6, A217 Gr.WC9, A217 Gr.C5, A217 Gr.C12

Forgings : A182 Gr.F11 Cl.2, A182 Gr.F12 Cl.2

3.20 Ball / Plug / Butterfly Valves

3.20.1 As a prequalification, fire safe test as per API 607 / API 6FA / BS EN ISO 10497 (Supersedes BS 6755 Part II) shall be carried out on soft seated ball, plug & butterfly valves and also on lubricated plug valves The test shall be witnessed and certified by a third party inspection agency like Lloyds, BVIS, DNV or EIL/ CEIL unless otherwise specified. The vendor has to submit test certificate for the particular design of the valve offered, if fire safe design is required as per the Valve Material Specification sheet..

3.20.2 Each valve shall be supplied with a lever / wrench except for gear operated / motor operated valves.

3.20.3 Soft-seated ball, plug & butterfly valves shall be supplied with antistatic devices.

3.20.4 BW / SW end ball valves shall have a 100 mm long seamless pipe nipple welded to each end of the valve. Nipples are to be welded prior to assembling Teflon seats / seals. Specifications of the nipples shall be as indicated in the MR.

3.20.5 The face-to-face dimensions of all ball valves shall be same as those of gate valves of the corresponding ANSI class (except 10" onwards in Class 150 where the face-to-face dimensions shall be as per API 6D long pattern).

3.20.6 The ball of ball valve shall not protrude outside the end flanges of valve.

3.20.7 Ball valves shall be of floating ball/trunnion mounted type as per following:

150#	8" & below	Floating ball
	10" & above	Trunnion mounted
300#	4" & below	Floating ball
	6" & above	Trunnion mounted
600# & above	1.5" & below	Floating ball
	2" & above	Trunnion mounted

3.20.8 Unless otherwise specified in the data sheets, bore of all reduced bore ball valves shall be limited to one size lower than the nominal bore.

3.21 The MOVs are to be installed in an open area and the actuators shall be suitable for all weather conditions. The testing of complete assemblies of MOVs along with the actuators shall be done by the supplier at his works.

3.22 Ends of flanged valves of 22" size shall match corresponding flanges to MSS-SP44 unless otherwise specified.

3.23 Yoke material shall be same as bonnet material where maximum temperature specified is more than 427°C.

4.0 OPERATION

4.1 Gear operation shall be provided as under:

Valve Type	Class	Size Requiring Gear-Operator
Gate Valve, Globe Valve & Diaphragm Valve	150 Class	12" and larger
	300 Class	12" and larger
	600 Class	10" and larger
	900 Class	6" and larger
	1500 Class	3" and larger
	2500 Class	3" and larger
Ball Valve / Plug Valve (Other than pressure balance plug valves)	150 Class	6" and larger
	300 Class	6" and larger
	600 Class	4" and larger
	900 Class	3" and larger
	1500 Class	3" and larger
Butterfly Valve	150, 300 Class	6" and larger

For sizes lower than these ranges, hand wheel / lever / wrench shall be provided. For pressure balance plug valves manufacturer's recommendation shall be acceptable provided the requirements specified in clause 4.6 are met.

4.2 Gear operator shall be provided, with position indicators for open / close positions and with limit stops. (Limit stops are not applicable for gate and globe valves).

4.3 Where gear operator is not called for as per Clause 4.1 but vendor recommends a gear operator, the same shall be highlighted.

4.4 Gear operator shall be so designed as to operate effectively with the differential pressure across the closed valve equal to the cold non-shock pressure rating.

4.5 Ball, plug and butterfly valves, shall have "Open" position indicators with limit stops.

4.6 Hand wheel diameter shall not exceed 750mm and lever length shall not exceed 500mm on either side. Effort to operate shall not exceed 35 Kg at handwheel periphery. However, failing to meet the above requirements, vendor shall offer gear operated valve and quote as per clause 4.3.

5.0 INSPECTION AND TESTING

5.1 Every valve shall be subjected to all the mandatory tests and checks called in the respective codes / data sheet by EIL inspection or any third party as approved by the purchaser. For IBR valves refer clause 7.0.

5.2 Every valve, its components and auxiliaries must be subjected to all the mandatory tests and checks called for in the respective codes, data sheets etc. by the manufacturer.

5.3 Though the extent of inspection shall be as under, exact extent with hold points shall be decided by EIL regional inspection office and recorded in the form of inspection plan. In case of third party inspection, the inspection plan shall be approved by the purchaser.

Forged Valves:

1. Visual and dimensional inspection.
2. Review of material test certificates.
3. Any mandatory or supplementary test.
4. Hydrostatic test on 10% valves selected on random basis.
5. Strip check is required for 1% of total ordered quantity of Gate & Globe valves (min. 1 No.) for each Valve sheet no., however, strip check is not required for CS/ Brass/ Bronze material valves with 13% Cr/ Brass/ Bronze trims.

Cast Steel Valves:

1. Visual and dimensional inspection.
2. Review of material test certificates.
3. Review of radiographs/radiographic reports or any other NDT tests wherever applicable as per data sheet.
4. Any mandatory or supplementary test.
5. Hydrostatic test 100% for body, 10% other test.
6. Strip check is required for 1% of total ordered quantity of Gate & Globe valves (min. 1 No.) for each Valve sheet no., however, strip check is not required for CS/ Brass/ Bronze material valves with 13% Cr/ Brass/ Bronze trims.

   Samples for strip check shall be selected at random and shall generally be in the highest size in the lot.

5.4 In case of motor operated or actuator operated valves, functional / operational checks as per the requirements of the specifications shall be made on each valve.

6.0 RADIOGRAPHY OF CAST VALVES

6.1 Valve castings shall undergo radiographic examination as specified below.

Material	Rating	Size Range	Radiography
All	150#	24" and below	NIL**
		26" and above*	100%
	300#	16" and below	NIL**
		18" and above	100%
	600# & above	All sizes	100%

* No radiography is required for valves of size 26" and above in cooling water service.

**For sizes 24" & below in 150# and 16" & below in 300#, radiography percentage if specifically mentioned in individual valve material spec sheet shall govern.

Radiography specified as random 10% or 20% etc. in the respective valve data sheet implies 10% or 20% etc. of number of valves ordered against each item number with a minimum of one valve against each item.

6.2 Radiography procedure, areas of casting to be radiographed shall be as per ASME B16.34 and acceptance criteria shall be as per ASME B16.34 Annexure-B. However for areas of casting to be radiographed for types of valves not covered in ASME B16.34, vendor shall radiograph castings in line with ASME B16.34.

6.3 For random radiography wherever specified in individual data sheets, the sampling shall be per size of the quantity ordered for each foundry.

6.4 Radiography wherever specified in the data sheets or as per clause 6.1 shall be done by X-ray / γ-ray to get the required sensitivity.

7.0 IBR CERTIFICATION

7.1 For valves described "IBR", valves shall be in accordance with the latest IBR (Indian Boiler Regulation) including the requirements specified in the specification.

7.2 For SW / BW end carbon steel valves under IBR, the chemical composition shall conform to the following:

Carbon (Max)	:	0.25%
Others (S, P, Mn)	:	As per IBR

7.3 Valves coming under the purview of "IBR"(Indian Boiler Regulations) shall each be individually accompanied by IBR certificate original in Form III-C duly approved by IBR authority / local authority empowered by the Central Boiler Board of India. Photocopy of original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance.

7.4 All "IBR" valves shall be painted red in body-bonnet / body-cover joint.

8.0 MARKING

8.1 Valve markings, symbols, abbreviations etc. shall be in accordance with MSS-SP-25 or the standard referred in specification sheet as applicable. Vendor's name, valve rating, material designation, nominal size, direction of flow (if any) etc. shall be integral on the body.

8.2 Each valve shall have a corrosion resistant tag giving size, valve tag / code no., securely attached to the valve body.

8.3 Paint or ink for marking shall not contain any harmful metal or metal salts such as zinc, lead or copper which cause corrosive attack on heating.

8.4 Carbon Steel / Alloy Steel valves shall be painted with one coat of inorganic zinc silicate (minimum DFT 65 to 75 microns).

9.0 DESPATCH

9.1 Valve shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.

9.2 Valves shall be protected from rust, corrosion and any mechanical damage during transportation, shipment and storage.

9.3 Rust preventive on machined surfaces to be welded shall be easily removable with a petroleum solvent or shall not be harmful to welding.

9.4 Each end of valve shall be protected with the following materials:

Flange Face	:	Wood or Plastic Cover
Bevelled End	:	Wood or Plastic Cover
SW & SCRD. End	:	Plastic Cap

9.5 End protectors of wood / plastic to be used on flange faces shall be attached by at least three bolts and shall not be smaller than the outside diameter of the flange. However, plastic caps for SW & SCRD end valves shall be press fit type.

9.6 End protectors to be used on bevelled end shall be securely and tightly attached.

9.7 For special service valves additional requirement for despatch shall be as prescribed in data sheet.

10.0 ATTACHMENTS

6-44-0052-A1	:	Bypass Piping Arrangement
6-44-0052-A2	:	Specifications for Bypass Piping, Fittings and Valves
6-44-0052-A3	:	Special Requirements for Low Temperature and Cryogenic Valves
6-44-0052-A4	:	Special Requirements for Hydrogen Service Valves

11.0 REFERENCES

6-78-0001	:	Specification for Quality management system requirements from bidders
6-78-0003	:	Specification for documentation requirements from suppliers
6-81-0001	:	Specification for Positive Material Identification (PMI) at Supplier's Works
6-81-0004	:	Inspection and Test plan for Valves

ANNEXURE-II

REQUIREMENTS FOR WET H2S/HIC SERVICES (AXN-1, AXN-2, AXN-3 & AXN-4) APPLICABLE TO CARBON STEELS

PROJECT : RAJASTHAN REFINERY

OWNER : HRRL

JOB NO. : B224

LOCATION : PACHPADRA, RAJASTHAN

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
A	29.03.2019	ISSUED AS JOB SPECIFICATION	MKS	PPSW	MK

1.0 General

This document defines job specific requirements for WETH2S/HIC items under AXN1, AXN2, AXN3 & AXN4 for Carbon Steels.

2.0 Requirements of 'AXN-1', 'AXN-2', 'AXN-3' AND 'AXN-4' items applicable to carbon steels

2.1 All 'AXN-1' Carbon steel items shall meet the following requirements:

a) Requirements as per NACE MR0103
b) Requirements for 'Wet H2S Resistant Materials' as elaborated in this document.

2.2 All 'AXN-2' Carbon steel items shall meet the following requirements:

a) Requirements as per NACE MR0103
b) Requirements for 'Wet H2S Resistant Materials' as elaborated in this document.
c) Special requirements for Hydrogen service as given in Technical Notes for the item or as given in Job Spec B224-6-44-0082 for the item.

2.3 All 'AXN-3' Carbon steel items shall meet the following requirements:

a) Requirements as per NACE MR0103
b) Requirements of 'HIC Resistant Materials' as elaborated in this document.

2.4 All 'AXN-4' Carbon steel items shall meet the following requirements:

a) Requirements as per NACE MR0103
b) Requirements of 'HIC Resistant Materials' as elaborated in this document.
c) Special requirements for Hydrogen service as given in Technical Notes for the item or as given in Job Spec B224-6-44-0082 for the item.

3.0 Welding in wet H2S service

Filler metal and weld deposit shall have diffusible hydrogen content typically below 5mL/100g. Nickel content of filler metal also shall remain below 1 and Manganese content below 1.5 .

Welding Procedure Specification WPS for CS material in wet H2S service shall include PWHT regardless of construction code requirement. PWHT temperature shall not be less than 620 C (1150 F) and minimum 93 C (200 F) preheat temperature should be used for all welding. A hardness survey on preproduction welded coupons to be conducted. Test indentations should be taken on the weld deposit, Heat Affected Zone (HAZ) and base metal, in the cap and root of the weld. Welding Procedure Qualification Record (PQR) shall be documented with hardness survey.

Hardness should be limited to the following after PWHT:

- Base metal: 237HBW (22HRC)
- Weld deposit: 200HBW
- Heat Affected Zone: 237HBW (22HRC)

PWHT shall be applied to welded assemblies for corrosion reasons, and production welds shall be 100 UT tested. Hardness verification of production welds is required. More information on welding practice of CS material in wet H2S service can be found in document NACE SP0472.

4.0 Wet H2S resistant materials

4.1 General requirement for CS materials in wet H2S service

This section applies to 'Wet H2S resistant materials'. In addition to PWHT requirements and hardness limitations of welded assemblies described in clause 3.0, CS supplied under this specification shall comply with the following:

- CS must be fully killed,
- CS products shall be supplied in the Normalized or Quench and Tempered condition regardless of thickness,
- Hardness of CS products (base metal before PWHT) shall be limited below 22HRC (or 237HBW),
- Ni content shall be limited below 1 w,
- Carbon content shall be limited below 0.20 w,
- Carbon Equivalent CE C Mn/6 (Cr Mo V)/5 (Ni Cu)/15 should be limited:
  - Below 0.42% for thickness below 2"
  - Below 0.45% for thickness above 2"

Thermal stress relieving is required for cold worked and cold forged zones, even if not required by the construction code. Cold deformation above 5 may require recovery annealing to restore properties of steels.

In addition to the above points, 'Wet H2S materials' shall have Phosphorous and Sulfur content limited as described in following sections dedicated to different CS product forms.

4.2 Plates, Welded pipes and other products originated from plates

All the specifications given in clause 3.0 and 4.1 are applicable and Impurity level in carbon steel products originated from plates shall be controlled in order to avoid the occurrence of brittle phases during welding:

- Maximum allowable Phosphorus content **0.020 w**
- Maximum allowable Sulfur content **0.015 w**

4.3 Seamless Pipes

Small and medium size process piping shall be of seamless type whenever possible.

All the specifications given in clause 3.0 and 4.1 are applicable and Impurity level in seamless carbon steel pipes shall be controlled in order to avoid the occurrence of brittle phases during welding:

- Maximum allowable Phosphorus content **0.030 w**
- Maximum allowable Sulfur content **0.010 w**

4.5 Forgings, Castings, Fittings and Accessories

All the specifications given in clause 3.0 and 4.1 are applicable and Impurity level in carbon steel forgings, castings and fittings not originated from plates shall be controlled in order to avoid the occurrence of brittle phases during welding:

- Maximum allowable Phosphorus content **0.025 w**
- Maximum allowable Sulfur content **0.020 w**

Valves internals made from carbon steel shall have hardness limited below 22HRC before PWHT. Other elements not made from carbon steel shall comply with dedicated section of NACE MR0103 if applicable.

5.0 HIC resistant materials

5.1 Plates, welded pipes and other products originated from plates

In addition to all the requirements listed in clause 3.0 (Welding in wet H2S service) and clause 4.0 (Wet H2S resistant materials), HIC resistant material products originated from plates shall comply with the following:

Killed carbon steel plates shall be obtained by vacuum degassing process. Inclusion shape control by calcium treatment (or equivalent process) is also required, and impurity level shall be controlled in order to limit the level of inclusions:

- maximum allowable Phosphorus content **0.010 w**
- maximum allowable Sulfur content **0.002 w**
- maximum allowable Oxygen content **0.0025 w (target 0.0020 w)**

Plates, welded pipes and other products originated from plates shall pass HIC test as per NACE TM0284. Mill test reports shall include the values for the Crack Length Ratio (CLR), Crack Sensitivity Ratio (CSR) and Crack Thickness Ratio (CTR).

HIC test results requirements:
- Average CLR ≤ 5% with CLR □ 7 for each individual section
- Average CTR □ 1.5 with CTR □ 2 for each individual section
- Average CSR □ 0.5 with CTR □ 0.7 for each individual section

The average is the sum of the values obtained on each section divided by the total number of sections examined (arithmetic mean).

5.2 Other product forms not originated from plates

Products that are not originated from plates shall meet the requirements listed in clause 3.0 (Welding in wet H2S service) and clause 4.0 (Wet H2S resistant materials) for the achievement of resistance to HIC related damage mechanisms.

SPECIAL REQUIREMENTS FOR HYDROGEN SERVICE FOR PIPING MATERIALS

PROJECT : RAJASTHAN REFINERY

OWNER : HPCL RAJASTHAN REFINERY LIMITED

JOB NO. : B224

LOCATION : PACHPADRA ,RAJASTHAN

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
A	29.03.2019	ISSUED AS JOB SPECIFICATION	MKS	PPSW	MK

SPECIAL REQUIREMENTS FOR HYDROGEN SERVICE

1.0 GENERAL

These requirements are applicable in addition to the requirements specified in the Piping Material Specifications.

2.0 PIPES, FLANGES AND FITTINGS

2.1 Method of Manufacture

All carbon steel pipes, fittings and flanges having wall thickness 9.53 mm and above shall be normalised. Cold drawn pipes and fittings shall be normalised after the final cold draw pass for all thicknesses. In addition, fittings made from forgings shall have Carbon - 0.35% max. and Silicon - 0.35% max. The normalising heat treatment shall be a separate heating operation and not a part of the hot forming operation.

All alloy steel (Cr-Mo) pipes, forgings and fittings shall be normalised and tempered. The normalising and tempering shall be a separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 psi.

2.2 Impact Test

For all carbon steels and alloy steels pipes, flanges and fittings with thickness over 20 mm, Charpy-V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and in accordance with ASTM A370. Impact energies at 0 C shall average greater than 27J (20 ft-lb) per set of 3 specimens, with a minimum of 19J (15 ft-lb).

If welding is used in manufacture, impact test of Heat Affected Zone (HAZ) and weld metal shall also be carried out.

2.3 Hardness

For carbon steel pipes and fittings, hardness of weld and HAZ shall be limited to 200 BHN (max.).
For alloy steel pipes and fittings, hardness of weld and HAZ shall be limited to 225 BHN (max.).

3.0 VALVES

3.1 All valve castings shall be of radiographic quality.

3.2 All cast valve flanges & bodies with flange rating of Class 900 or greater shall be examined in accordance with paragraphs 7.2 through 7.5 of Appendix-VII of ASME SEC-VIII, DIV.1, regardless of casting quality factor.

3.3 Only Normalized and Tempered material shall be used in the following specifications:

Castings: A217 Gr.WC1, A217 Gr.WC4, A217 Gr.WC5, A217 Gr.WC6, A217 Gr.WC9, A217 Gr.C5, A217 Gr.C12

Forgings: A182 Gr.F11 Cl.2

3.4 Body / bonnet / cover joints & stuffing box of valves shall have low emission. One valve per metallurgy, per rating, per size shall be helium leak tested as per ASME Sec.V, Subsection A, Article 10 (Detector Probe Technique), Appendix IV at a minimum of 25% of the allowable (rated) cold working pressure. Selection of valves for helium leak test shall be at random. Test duration shall be as follows:

Test Duration in Minutes					
Nominal Size	Pressure Class				
	Upto 300	600	800 & 900	1500	2500
Upto 2"	3	6	9	12	12
3" to 6"	6	9	12	15	18
8" to 16"	9	9	12	15	18
18" to 24"	9	12	15	18	21

The valve shall show no leakage. No leakage is defined as a total leakage rate of less than 0.0001 ml/s of helium.

3.5 CS & AS Valves :

Bend test and Magnetic Particle inspection of the entire surface of body and bonnet casting shall be in accordance with ASTM A217. Supplementary requirement S3 & S4 evaluation of magnetic particle, inspection shall be in accordance with MSS-SP-53 except that no linear discontinuities shall be allowed.

The Brinell hardness of heat treated casting shall not exceed 200 BHN for carbon steel & 225 for alloy steel.

Repair of defective casting shall be outlined in writing to the purchaser before repair starts. Repair method to be approved prior to welding.

Casting shall be preheated to a minimum of 400ºF prior to welding and all Chromium-Molybdenum alloys shall be postweld heat treated after welding is complete. Stress relieving is essential for welds.

Carbon steel shall be normalised and alloy steels shall be normalised & tempered.

Dye Penetrant test of welds shall be in accordance with ASTM B165 Procedure B-2. Interpretation as per Appendix-8 of ASME-VIII Div.1.

The tensile stress for AS shall be less than 100,000 psi.

Charpy V-notch impact testing is to be done for valve material (average 20 ft-lb for set of 3 [minimum value 15 ft-lb] at 30 F).

For radiography and acceptance criteria for valve castings, refer para 2 of clause3.6.

3.6 SS Valves :

Casting and test bar shall be heat treated together. Valve casting shall be in solution heat treated and pickled condition.

Critical body and bonnet casing section typically defined by ASME B16.34 shall be radiographed and shall meet ASTM E446 (upto 2" thick) Category A,B & CA Level 2, Category CB, OC & CD Level 3, Category D,B & F Level 0. For wall thickness 2" to 4.5" comparable plates of ASTM E186 shall be used. ASTM E94 and ASTM E142 shall be used for recommended practice & controlling quality of radiography as guide.The entire surface of all castings shall be dye-penetrant inspected after pickling.

Repair welds shall be 100% radiographed and evaluated in accordance with paragraph 344.5 of ASME B31.3 with a minimum casting quality factor of 0.95. Dye Penetration test shall be as per ASTM E165 Procedure B-2, Interpretation as per Appendix-8 of ASME-VIII Div.1.

ANNEXURE-III

VALVE MATERIAL SPECIFICATION

Tag No: **Sheet No. 1 of 1**

GATE VALVE SPECIFICATION			MANUF'S OFFER	
TAG NO. : **PIPING CLASS :**			**STANDARD:**	
RATING : 800	**STANDARD** : API 602/ ISO 15761		**MFGRS CAT/FIG:**	
SIZE RANGE : 0.5" TO 1.5"	**ENDS** : SW 3000 TO B-16.11		**RATING:** **ENDS:**	
DESCRIPTION	**CONSTRUCTION**	**MATERIAL**	**CONSTRUCTION**	**MATERIAL**
BODY	FORGED	ASTM A 182 GR.F316		
BONNET	BOLTED	ASTM A 182 GR.F316		
STEM	RISING	SS 316 (NO CASTING)		
WEDGE DISC	SOLID	STELLITED		
BODY SEAT RING	RENEWABLE	STELLITED		
STEM PACKING	RENEWABLE WITH VALVE OPEN ON STREAM	CORROSION INHIBITED DIE FORMED FLEXIBLE GRAPHITE WITH BRAIDED ANTI EXTRUSION RINGS		
HAND WHEEL	NON RISING	MALLEABLE IRON/CAST ST/FAB.ST/DUCT. IRON		
BONNET BOLTS		ASTM A453GR660CLA		
BONNET NUTS		ASTM A453GR660CLA		
BONNET GASKET		SP WND SS316+GRAFOIL FILLER		
SPECIAL SERVICE CONDITIONS		MAX TEMP 538 DEG.C.		
BACK SEAT & SHOULDER	INTEGRAL			
OTHERS	O.S & Y.			
HYDROSTATIC TEST PRESSURE	BODY : 2900 PSIG	SEAT : 2125 PSIG		
TEST PRESSURE WITH AIR	80 PSIG			

NOTES

1 THIS VALVE SPEC SHEET SHALL BE READ IN CONJUNCTION WITH TECHNICAL NOTES FOR VALVES.
2 ONLY IN THE CASE OF CATEGORY - II MRs,BIDDER SHALL CLEARLY WRITE ALL/ ANY DEVIATION AGAINST EACH PART/ MATERIAL OF VALVE IN THE SPACE PROVIDED FOR AND WHEREVER BIDDER AGREES WITH EIL'S SPEC BIDDER SHALL INDICATE "AGREED".
3 NO CUTTING/ OVERWRITING BY BIDDER ON EIL'S SPEC IS ALLOWED.
4 STRESS RUPTURE TEST AS DETAILED IN ASTM A453 SHALL BE CARRIED OUT FOR ALL ASTM A453 BOLTING MATERIAL IRRESPECTIVE OF TEMPERATURE.
5 VALVES AS PER API-602 AND TESTING AS PER API-598 ARE ALSO ACCEPTABLE.

SIGNATURE & SEAL OF MANUFACTURER

ANNEXURE-IV

VALVE MATERIAL SPECIFICATION

Tag No: **Sheet No. 1 of 1**

GATE VALVE SPECIFICATION			MANUF'S OFFER	
TAG NO. : **PIPING CLASS :**			**STANDARD:**	
RATING : 1500		**STANDARD** : API 602/ ISO 15761	**MFGRS CAT/FIG:**	
SIZE RANGE : 0.5" TO 1.5"		**ENDS** : BW TO B-16.25	**RATING:**	**ENDS:**
DESCRIPTION	**CONSTRUCTION**	**MATERIAL**	**CONSTRUCTION**	**MATERIAL**
BODY	FORGED	ASTM A 182 GR.F316		
BONNET	WELDED/THD & SEAL WELDED	ASTM A 182 GR.F316		
STEM	RISING	SS 316(NO CASTING)		
WEDGE DISC	SOLID	STELLITED		
BODY SEAT RING	NON-RENEWABLE/RENEWABLE	STELLITED		
STEM PACKING	RENEWABLE WITH VALVE OPEN ON STREAM	CORROSION INHIBITED DIE FORMED FLEXIBLE GRAPHITE WITH BRAIDED ANTI EXTRUSION RINGS		
HAND WHEEL	NON RISING	MALLEABLE IRON/CAST ST/FAB.ST/DUCT. IRON		
BOLTS		ASTM A453 GR.660 CL.A		
NUTS		ASTM A453 GR.660 CL.A		
SPECIAL SERVICE CONDITIONS		MAX TEMP 482 DEG.CENT. (H2 SERVICE)		
BACK SEAT & SHOULDER	INTEGRAL	STELLITED		
OTHERS	O.S & Y.			
HYDROSTATIC TEST PRESSURE	BODY : 5400 PSIG	SEAT : 3975 PSIG		
TEST PRESSURE WITH AIR	80 PSIG			

NOTES

1. THIS VALVE SPEC SHEET SHALL BE READ IN CONJUNCTION WITH TECHNICAL NOTES FOR VALVES.
2. ONLY IN THE CASE OF CATEGORY - II MRs,BIDDER SHALL CLEARLY WRITE ALL/ ANY DEVIATION AGAINST EACH PART/ MATERIAL OF VALVE IN THE SPACE PROVIDED FOR AND WHEREVER BIDDER AGREES WITH EIL'S SPEC BIDDER SHALL INDICATE "AGREED".
3. NO CUTTING/ OVERWRITING BY BIDDER ON EIL'S SPEC IS ALLOWED.
4. VALVES AS PER API-602 AND TESTING AS PER API-598 ARE ALSO ACCEPTABLE.
5. VALVE ENDS SHALL MATCH THICKNESSES OF CONNECTING PIPES WHICH ARE AS FOLLOWS: PIPE SIZE 0.5" TO 1.0"- SCH '80S', 1.5" TO 1.5" - SCH160.
6. VALVES SHALL MEET THE REQUIREMENTS FOR HYDROGEN SERVICE AS SPECIFIED IN TECHNICAL NOTES.
7. STRESS RUPTURE TEST AS DETAILED IN ASTM A453 SHALL BE CARRIED OUT FOR ALL ASTM A453 BOLTING MATERIAL IRRESPECTIVE OF TEMPERATURE.

SIGNATURE & SEAL OF MANUFACTURER

ANNEXURE-V

VALVE MATERIAL SPECIFICATION

Tag No: **Sheet No. 1 of 1**

GATE VALVE SPECIFICATION			MANUF'S OFFER	
TAG NO. : **PIPING CLASS :**			**STANDARD:**	
RATING : 600/300/150	**STANDARD**	: API-600	**MFGRS CAT/FIG:**	
SIZE RANGE : 2.0" TO 24.0"	**ENDS**	: AS PER THE ENQUIRY	**RATING:**	**ENDS:**
DESCRIPTION	**CONSTRUCTION**	**MATERIAL**	**CONSTRUCTION**	**MATERIAL**
BODY	CAST	SS316		
BONNET	BOLTED	SS316		
STEM	RISING	SS 316 (NO CASTING), 32 RMS FINISH		
WEDGE DISC	FLEXIBLE	STELLITED		
BODY SEAT RING	RENEWABLE/NON-RENEWABLE	STELLITED		
STEM PACKING		GRAFOIL DIE MOULDED RINGS WITH SACRIFICIAL CORROSION INHIBITOR		
HAND WHEEL	NON RISING	MALLEABLE IRON/CAST ST/FAB.ST/DUCT. IRON		
BONNET BOLTS		A453 GR.660CL.A		
BONNET NUTS		A453 GR.660CL.A		
BONNET GASKET		SP WND SS316-GRAFOIL FILLER		
REQUIREMENT OF GEAR OPERATOR		REFER TECHNICAL NOTES FOR PURCHASE OF VALVES.		
REQUIREMENT OF RADIOGRAPHY		REFER TECHNICAL NOTES FOR PURCHASE OF VALVES.		
SPECIAL SERVICE CONDITIONS		MAX TEMP 538 DEG.C.		
BACK SEAT & SHOULDER		SS316		
OTHERS	O.S & Y.			
HYDROSTATIC TEST PRESSURE	BODY : 2175 PSIG	SEAT : 1600 PSIG		
TEST PRESSURE WITH AIR	80 PSIG			

NOTES

1 THIS VALVE SPEC SHEET SHALL BE READ IN CONJUNCTION WITH TECHNICAL NOTES FOR VALVES.
2 ONLY IN THE CASE OF CATEGORY - II MRs,BIDDER SHALL CLEARLY WRITE ALL/ ANY DEVIATION AGAINST EACH PART/ MATERIAL OF VALVE IN THE SPACE PROVIDED FOR AND WHEREVER BIDDER AGREES WITH EIL'S SPEC BIDDER SHALL INDICATE "AGREED".
3 NO CUTTING/ OVERWRITING BY BIDDER ON EIL'S SPEC IS ALLOWED.
4 TESTING SHALL BE AS PER API 598.
5 100% VALVE CASTINGS SHALL UNDERGO RADIOGRAPHIC EXAMINATION.
6 ALL CASTINGS SHALL BE SOLUTION HEAT TREATED.
7 WELD REPAIRS, IF ANY, SHALL BE CARRIED OUT BEFORE SOLUTION HEAT TREATMENT.
8 STRESS RUPTURE TEST AS DETAILED IN ASTM A453 SHALL BE CARRIED OUT FOR ALL ASTM A453 BOLTING MATERIAL IRRESPECTIVE OF TEMPERATURE.

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INSPECTION AND TEST PLAN
FOR
VALVES

Rev No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
6	14 11 2018	REVISED AND RE-ISSUED	KC	NM	RKS	RKT
5	17 06 2013	REVISED AND RE-ISSUED	TKK	RKS	SCG	DM
4	15 07 2011	REVISED AND RE-ISSUED	TKK	SCG	AKC	DM
3	30 06 2010	REVISED AND RE-ISSUED	RKB	VKJ	SKP	ND
2	31 01 2008	REVISED AND RE-ISSUED	CS	SS	MVKK	VC

Abbreviations:

CEIL	:	Certification Engineers International Limited	MRT	:	Mechanical Run Test
CIMFR	:	Central Institute of Mining & Fuel Research	NDT	:	Non Destructive Testing
CE	:	Carbon Equivalent	NPSH		Net Positive Suction Head
DFT	:	Dry Film Thickness	PO	:	Purchase Order
DPT	:	Dye Penetrant Testing	PESO	:	Petroleum Explosive Safety Organization
DHT	:	De-hydrogen Heat Treatment	PQR	:	Procedure Qualification Record
ERTL	:	Electronics Regional Test Laboratory	PR	:	Purchase Requisition
FCRI	:	Fluid Control Research Institute	PMI	:	Positive Material Identification
HT	:	Heat Treatment	RT	:	Radiography Testing
HIC	:	Hydrogen Induced Cracking	SSCC	:	Sulphide Stress Corrosion Cracking
ITP	:	Inspection and Test Plan	TC	:	Test Certificate
IP	:	Ingress Protection	TPI or TPIA	:	Third Party Inspection Agency
IHT	:	Intermediate Heat Treatment	UT	:	Ultrasonic Testing
IC	:	Inspection Certificate	VDR	:	Vendor Data Requirement
IGC	:	Inter Granular Corrosion	WPS	:	Welding Procedure Specification
MPT/MT	:	Magnetic Particle Testing	WPQ	:	Welders Performance Qualification
MTC	:	Material Test Certificate			

Inspection Standards Committee

Convenor : Mr. R K. Singh

Members:

Mr. Rajeev Kumar	Mr. Neeraj Mathur	Mr. Himangshu Pal	Mr R Muthu Ramalingam (RPO Rep.)
Mr. T Kamalakannan	Mr. Mahendra Mittal	Mr Deepak Gupta (Projects)	

1.0 SCOPE

This Inspection and Test Plan covers the minimum testing requirements of Valves.

2.0 REFERENCE DOCUMENTS

PO/PR/Standards referred therein/ Job specifications /Approved documents.

3.0 INSPECTION AND TEST REQUIREMENTS

SL NO	STAGE / ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
1.0	**Procedure**						
1.1	Hydrostatic Test, Heat Treatment, NDT, Helium Leak Test and Other Procedures	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS, PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	-	H	W- New R- Existing
1.3	Pre-Qualification Tests	Fire safe, Cryogenic & Other Test as applicable	As per PR / Purchase Specification	Acceptance Report	-	H	H (If new)

SL NO	STAGE / ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
2.0	**Material Inspection**						
2.1	Castings & Forgings (Body, Bonnet, Disc, Stem, Body ring)	Chemical, Mechanical, Heat Treatment, NDT, IGC & Other Properties as applicable	100%	Test Certificates	H	R	R
2.2	Castings & Forgings (Body, Bonnet, Disc, Stem, Body ring)	Visual & Dimension	100%	Inspection Report	H	H	-
2.3	Body and Bonnet Castings	Radiography Examination	As per PR / Purchase Specification	Films and report	H	R	R
2.4	Bars for Trim material	Chemical Analysis	Each Heat	Test Certificates & Lab Report	H	R	-
2.5	Gaskets, Gear units, Fasteners, Gland, Packings, etc.	Physical / Chemical Properties	100%	Test Certificates & Lab Report	H	R	-
2.6	Actuators as applicable	Performance, Statutory Certificates as applicable	100%	Test Certificates, Inspection report	H	H	R

SL NO	STAGE / ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
3.0	**In Process Inspection**						
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection Reports	-	H	-
3.2	Machining of components	Visual / Dimension	100%	Inspection Reports	-	H	-
4.0	**Final Inspection**						
4.1	Hydrostatic / Pneumatic Test and Helium Leak test as applicable	Leak Check	As per PR / Purchase Specification	Test Report	-	H	RW (Note 1)
4.2	Visual / Dimension	Surface & Dimension Check	100%	Test Report	-	H	RW (Note 1)
4.3	Functional Test for Actuator Operated Valves	Satisfactory Performance	100%	Test Report	-	H	RW

SL NO	STAGE / ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
4.4	PMI Check	Chemical	As per EIL Spec. 6-81-0001	Inspection Report	-	H	RW
4.5	Strip Check (As applicable)	Verify Components & Differential hardness if applicable	As per PR / Purchase Specification	Inspection Report	-	H	RW (Note-1)
4.6	Final Stamping	Stamping of Accepted Valves	Stamping of Valves which are witnessed by EIL/TPIA.	Inspection Report	-	H	H (Note-1)
5.0	**Painting**						
5.1	Painting and Color coding as applicable	Visual / DFT Check	100%	Inspection Report	-	H	-
6.0	**Documentation & IC**						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Supplier TC & IC	-	H	H

Legend: H- Hold (Do not proceed without approval), P-Perform, RW - Random Witness (As specified or 10% (min.1 no. of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable):

1. Non NACE & Non Hydrogen service Carbon Steel Cast Valves up to size 12"-300ANSI Class and Carbon Steel Forged Valves up to size 1.5"- 800 ANSI Class will be accepted on review of Supplier Test Certificates. Supplier Test Certificate along with back up reports to be reviewed by EIL/TPIA
2. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable. (Unless otherwise agreed upon)
3. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred therein /Job Specification /Approved Documents.