Gas Industry Standard

GIS/V6:2019

Specification for

STEEL VALVES FOR USE WITH NATURAL GAS AT NORMAL OPERATING PRESSURES ABOVE 7 BAR AND SIZES ABOVE DN15

(SUPPLEMENTARY TO EN13942:2009)

Contents

Foreword

Gas Industry Standards (GIS) are revised, when necessary, by the issue of new editions. Users should ensure that they are in possession of the latest edition. Contractors and other users external to Gas Transporters should direct their requests for copies of a GIS to the department or group responsible for the initial issue of their contract documentation.

Comments and queries regarding the technical content of this document should be directed in the first instance to the contract department of the Gas Transporter responsible for the initial issue of their contract documentation.

This standard calls for the use of procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Compliance with this engineering document does not confer immunity from prosecution for breach of statutory or other legal obligations.

Mandatory and non-mandatory requirements

For the purposes of a GIS the following auxiliary verbs have the meanings indicated:

can indicates a physical possibility;

may indicates an option that is not mandatory;

shall indicates a GIS requirement;

should indicates best practice and is the preferred option. If an alternative method is used then a suitable and sufficient risk assessment needs to be completed to show that the alternative method delivers the same, or better, level of protection.

Disclaimer

This engineering document is provided for use by Gas Transporters and such of their contractors as are obliged by the terms of their contracts to comply with this engineering document. Where this engineering document is used by any other party, it is the responsibility of that party to ensure that the engineering document is correctly applied.

Brief history

First published as National Grid Gas V6 Steel valves for use with natural gas at normal operating pressures above 7 bar. Part 1 - 100 mm nominal size and above Part 2 - 80 mm nominal size and below	February 1994
Supplement to V/6 part 1	September 2005
Revised and re-issued as T/SP/V/6 supplementary to EN13942:2009	June 2014
Re-issued to correct error in Section 8.	August 2014
Additional statements to include compressor valves and clear up references in Annex D	March 2015
Additional fire type-testing clause added in Section 7, additional requirement for gearbox G.A. and amendment to fire safe certificate in Section 15, minor amendment to Appendix F and error in Appendix J corrected.	August 2016
Minor Amendment to existing version, adding reference to T/PM/P/24	May 2018
Reviewed, updated and published as a Gas Industry Standard	April 2019

1. Scope

This standard supplements and amends the requirements for pipeline valves produced in accordance with EN13942:2009. The requirements of EN13942:2009 shall apply except where modified by this standard.

This standard applies to ball, plug, check and gate valves, equal to or greater than 15 mm nominal diameter (DN), for use in pipeline systems and associated installations which comply with IGEM/TD/1 and IGEM/TD/13, or BS EN 1594 and BS EN 12186, supplying natural gas and operating at pressures above 7 bar.

The requirements of this standard shall apply, as far as is physically practicable, to other types of isolation valve that may be used by a Gas Transporter.

Control valves, pressure regulators, slam-shut and pressure relief valves are not covered by this standard. Valves of 25 mm DN and smaller for instrumentation and control purposes are covered by a Gas Transporter specification GIS/V8.

Unless otherwise specified by the BUYER the design temperature is between –20°C and +60°C. Special attention shall be given to the temperatures experienced by valves on the outlet and adjacent to compressor units as they could see above +60°C in normal and abnormal circumstances.

2. Normative references

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

2.1 British and European standards

BS EN 10226-2, *Pipe threads where pressure tight joints are made on the threads. Taper external threads and taper internal threads. Dimensions, tolerances and designation*

BS EN ISO 148-1, *Metallic materials. Charpy pendulum impact test. Test method*

BS 1486-4, *Lubricating nipples. Specification for hydraulic grease nipples*

BS EN 1594, *Gas supply systems – Pipelines for maximum operating pressure over 16 bar – Functional requirements.*

BS EN ISO 2566, *Steel - conversion of elongation values. Part 1. Carbon and low alloy steels.*

BS EN ISO 3183, *Petroleum and natural gas industries. Steel pipe for pipeline transportation systems.*

BS 3799, *Specification for steel pipe fittings, screwed and socket welding for the petroleum industry*

PD 5500, *Unfired pressure vessels*

BS 6755-2, *Testing of valves. Specification for fire type-testing requirements*

BS EN ISO 8501, *Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

BS EN ISO 9606-1*, Qualification testing of welders. Fusion welding. Steels*

BS EN ISO 10497:2004, *Testing of valves. Specification for fire type-testing requirements*

BS EN 10204, *Metallic products. Types of inspection documents*

BS EN 12186, *Gas supply systems – Gas pressure regulating stations for transmission and distribution – Functional requirements*

BS EN 12266-1, *Industrial valves — Testing of valves —*

Part 1: Pressure tests, test procedures and acceptance criteria — Mandatory requirements

BS EN 12266-2, *Industrial valves — Testing of valves —*

Part 2: Tests, test procedures and acceptance criteria — Supplementary requirements

BS EN 12627, *Industrial valves – Butt welding ends for steel valves.*

BS EN 13445, *Unfired pressure vessels.*

BS EN 13942:2009, *Petroleum and Natural Gas Industries – Pipeline transportation systems – Pipeline valves (ISO 14313 modified)*

BS EN ISO 15614-3, *Specification and qualification of welding procedures for metallic materials. Welding procedure test. Fusion welding of non-alloyed and low-alloyed cast irons*

BS EN ISO 80079-36, *Explosive atmospheres. Non-electrical equipment for explosive atmospheres. Basic method and requirements*

BS EN ISO 80079-37, *Explosive atmospheres. Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"*

2.2 Institution of Gas Engineers and Managers Standards

IGEM/TD/1 - *Steel pipelines and associated installations for high pressure gas transmission.*

IGEM/TD/1 - *Supplement 1 – Handling, transport and storage of steel pipe, bends and fittings*

IGEM/TD/13 - *Pressure regulating installations for transmission and distribution.*

2.3 American Petroleum Institute (API) Standard

API 594, *Check valves: flanged, lug, wafer, and butt-welding*

API 598, *Valve inspection and testing*

API Spec 6FA, *Specification for fire text for valves*

API Spec 6FC, *Specification for fire test for valves with selective backseats first edition*

API Spec 6FD, *Specification for Fire Test for Check Valves*

API Std 607, *Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats*

2.4 The American Society of Mechanical Engineers

ASME B16.25, *Buttwelding Ends*

ASME B16.34, *Valves Flanged, Threaded and Welding End*

ASME IX, *An introduction to Welding Qualification*

2.5 American Society for Testing and Materials

ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM G14, *Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)*

2.6 Gas Industry Standards

GIS/DAT6 *Standard sizes of carbon and carbon manganese steel pipe for operating pressures greater that 7 Bar*

GIS/F6 *Carbon and carbon manganese steel pipe pups fot operating pressures greater than 7 bar*

GIS/VA1 *Fluid powered actuators for two position (open/closed) quarter turn valves*

GIS/VA2 *Electric powered actuators for two position (open/closed) quarter turn valves*

GIS/V/8 *Valves (25mm nominal size and below) for instrumentation and control purposes*

2.7 Gas Transporter Specifications

*/SP/C/9 *Carbon steel castings for pressure purposes above 7 Bar.*

*/SP/PA/9 *Paint Systems – properties and performance requirements*

*/SP/CW/5 *Field applied external coatings for buried pipework and systems*

*/SP/CW/6 *The external protection of steel line pipe and fittings using fusion bonded powder and other coating systems*

*/SP/PA/10 *New and Maintenance painting at works and site for above ground pipeline and plant installations*

NOTE

EN standards are adopted in the UK as BS EN

International, European and National standards, but not Gas Transporter specifications, cited by

EN13942:2009 and this standard, may be replaced, by agreement, by other recognised and equivalent International, European, National or industry standards.

Where no date is shown, the latest edition of each standard and specification shall apply.

- Gas Transporters will each have their own specifications normally in the referenced format */SP/XX/No, where * is replaced by the Gas Transporters reference e.g. T for National Grid, or SGN, WWU etc. followed by the specification initials and number reference.

3. Terms and Definitions

For the purposes of this document, the following definitions apply.

3.1 Bi-directional valve

Bi-directional ball valves are normally trunnion mounted with seats that move to form a seal on the ball, which rotates on a fixed axis.

3.2 Double-block-and-bleed valve (DBB)

Double-block-and-bleed (DBB) refers to a method of isolation by shutting off two parts of one valve, with a bleed to atmosphere between the two shut-offs or ‘blocks’.

The pressure is blocked off at one end of the arrangement which enables work to be carried out in air at atmospheric pressure at the other end. The bleed is used to prove that the isolation is satisfactory and can be checked regularly as work proceeds.

Double block and bleed valve configurations include bi-directional ball valves with fixed (trunnion mounted) obturators and bi directional (double piston action) or uni-directional (single piston, self-relieving action) seats. Positive double isolation is only provided when both sides of the valve are under pressure. Uni-directional seats rely on spring pressure on the downstream side to overcome cavity pressure; bi-directional seats ‘lock on’ under cavity pressure but may cause line pressure to be retained in the cavity even after the pipeline on both sides has been depressurised. See 3.5 Seating surfaces.

3.3 Double-isolation-and-bleed valve (DIB)

Double-isolation-and-bleed (DIB) provides positive double isolation with either side of the valve (or both) under pressure.

DIB valve configurations include double isolation (tandem) ball or plug valves, with two obturators and a vent point between them, in one valve assembly.

3.4 Maximum pressure differential (MPD)

The valve shall operate as normal when the maximum pressure differential, according to the class of the valve, is applied across the valve, i.e. from one end of the valve to the other.

3.5 Seating surfaces

A valve that can only provide one sealing surface at a time is a single seated valve. Single plug valves and single floating ball valves (where the ball moves onto one seat or the other) are therefore single seated. Trunnion mounted ball valves (where each seat moves onto the fixed ball) are twin seated.

Twin seated ball valves include the following variants.

Twin-seat valve, both seats uni-directional (single piston, self-relieving action): Valve with two seats, sealing in opposite directions, each sealing in one direction only. The seats are generally designed so that they relieve pressure from the valve cavity when differential the pressure between the cavity and the bore of the valve exceeds the spring loading.

Twin-seat valve, both seats bi-directional (double piston action): Valve with two seats, each sealing in both directions, so that they engage under cavity as well as line pressure.

Twin-seat valve, one seat uni-directional and one seat bi-directional: Valve with two seats, one sealing in one direction and one in either direction. Such valves are generally installed to self-relieve in the prevailing upstream direction.

3.6 Balanced plug valve

Plug valve that is protected against seizure due to taper locking, by means other than plug sealant pressure alone, e.g. by product fluid pressure distribution and / or spring loading.

3.7 Golden weld

A field weld that is not subjected to pressure testing but subjected to additional control and inspection.

3.8 Pipe pup

Length of pipe used as a transition piece between the pipeline and the body of the valve.

3.9 Secondary seat sealing

Facility for injection of sealant into the seat ring cavity to improve the gas tightness of the valve in the closed position during routine maintenance or in an emergency.

3.10 Secondary stem sealing

Stem configuration to facilitate the injection of sealant into the stem area to improve the gas tightness of the stem seal(s) during routine maintenance or in an emergency.

3.11 Manufacturer

The manufacturer of the valve.

3.12 Buyer

The purchaser of the valve, who may be a Gas Transporter or its nominated agent.

4. Conformance

4.1 Conformance

Prior to tendering, the Buyer may require Manufacturing Procedure Qualification to be carried out.

4.2 Units of measurement

In this standard, for data expressed in both SI and USC units, a dot (on the line) is used as the decimal separator, and no comma or space is used as the thousands separator, in order to be consistent with other Gas Transporter specifications.

5. Valve Types and Configurations

5.1 Valve Types

5.1.1 Gate valves

The BUYER shall specify on the Data Sheet the type of gate valve (e.g. expanding gate, slab gate) that is required.

5.1.2 Lubricated and non-lubricated plug valves

Unless otherwise specified by the BUYER on the Data Sheet, plug valves shall be of the balanced type, regular pattern and with lubrication. This includes double isolation and bleed valves

5.1.3 Ball valves

Unless otherwise specified by the BUYER on the Data Sheet all ball valves shall be full bore opening and be capable of double block and bleed (DBB) or double isolation and bleed (DIB).

The BUYER shall specify, and the Gas Transporter shall agree, the degree of isolation (DIB or DBB) and the valve seat action (uni- or bi-directional) that is required for the specific application.(see 3.2, 3.3 and 3.5).

5.1.4 Check valves (Non-Return Valves)

The BUYER shall specify on the Data Sheet the type of check valve that is required e.g. swing, single or dual wafer, axial flow or piston (lift),and where applicable, whether it is to be full or reduced opening and long or short pattern. Check valves shall meet the requirements of EN13942:2009 and additionally API 594. They shall be tested in accordance with EN13942:2009 and additionally API 598

5.1.5 Other types of isolation valve

Other types of valve to be used on pipelines and installations for isolation purposes (e.g. globe, butterfly) shall conform to the relevant European or British standard and shall comply with this standard as far as is relevant and physically practicable.

5.2 Valve configurations

5.2.1 Full-opening valves

Unless otherwise specified by the BUYER on the Data Sheet, full-opening flanged-end and welding-end valves of all types shall be unobstructed in the fully opened position, shall have an internal bore as specified in Table 1 of EN13942:2009 and shall be capable of being pigged. Where a full opening valve is required for hot tapping or stopples the minimum bore required shall be stated in line 46 (special requirements) of Annex I (data sheet).

Important: For some valve sizes this minimum bore is larger than standard in order to accommodate Lock-O Ring flanges/plugs/bar plugs and completion plugs. These requirements must be stated by the Buyer or Gas Transporter.

6. Design

6.1 Design standards and calculations

At the time of tendering the valve manufacturer shall supply two sets of the following:

a) General arrangement drawings showing relative positions and sizes of vents, drains, gearboxes, stem extension columns and other external parts, together with overall dimensions.
b) Completed data sheet (see Annex D).
c) Details of performance characteristics for full bore or reduced bore as applicable.
d) Care shall be taken to ensure that the valve assembly, including any actuation, is suitable for the hazardous area zone it is to be installed. Each Gas Transporter must state its specific requirements for the valve location.

NOTE: PD 5500 is also a recognised design code.

6.2 Face-to-face and end-to-end dimensions

Variations from the requirements of EN13942:2009 shall be agreed with the BUYER at the time of qualification of the manufacturer’s product.

Note: Face-to-face and end-to-end dimensions in BS EN13942:2009 apply to unpupped valve bodies only.

6.3 Valve operation

Valves shall be capable of both opening and closing operations at the ASME Class or PN maximum pressure differential (MPD)

6.4 Pigging

Unless otherwise specified by the BUYER on the data sheet, all full-opening valves of all sizes shall be piggable.

6.5 Valve ends

6.5.1 Flanged ends

6.5.1.1 General

Flanged valves may have flanges in accordance with EN 1759 and BS 3293.
Flanges shall be integral with the body or butt welded to it.
End flanges of flanged valves shall be square with the axis of the valve to ±0.5 0^{O}

6.5.2 Welding ends

Unless otherwise specified by the BUYER the end profile shall be tapered, in accordance with EN 12627 or, by agreement, ASME B16.25.

The wall thickness at the weld end shall be equal to or greater than the wall thickness of the mating pipe.

If the welding end connection has a yield strength (SMYS) of less than that of the mating pipe then the wall thickness at the weld end shall be increased in inverse proportion to the yield strengths. The wall thickness at the weld end shall not be greater than 1.5 times the wall thickness of the mating pipe.

NOTE: This means that the SMYS of the valve weld connection shall not be less than 2/3 of the SMYS of the mating pipe or pup.

The inside diameter of the welding end connection shall not be less than that of the mating pipe. Out of roundness on welding ends shall not exceed 0.5 %.

If a manufacturer elects to use extension rings, these shall be deemed to be an integral part of the valve and shall be included in the end to end dimensions and in the valve pressure testing.

Where specified by the purchaser, pipe pups shall be supplied in accordance with GIS/F6 and page 1 of the Data Sheet. The total length of pipe required to manufacture pups to conform to Tables 1a and 1b of this standard shall be stated by the manufacturer on Page 2 of the Data Sheet in Annex D of this standard.

Pups on ball valves should be of such length as to give the overall length of valve assembly as shown in Tables 1a and 1b of this standard unless otherwise specified by the BUYER on the Data Sheet (Annex D).

The tabulated overall lengths are specified in order to provide a standard overall length for each valve size, to allow valves to be supported at the pipe pups and to facilitate on-site welding and inspection.

By agreement with the Gas Transporter, the BUYER, manufacturer or welding contractor may propose overall lengths of valve assemblies that differ from those shown, for consideration by the Gas Transporter, provided that due consideration is given to the above factors.

Any additional dimensional requirements and constraints shall be provided by the BUYER on the Data sheet.

ADDITIONAL TABLE 1a - Overall length of ball valve assembly with two pipe pups

Bare valve		Overall length			Pup length	
Size	Length	of valve and pup assembly A (mm)			minimum	
DN (mm)	Standard maximum[1] (mm)	Valve supported at pups[2,7]	Valve supported at body[3]	Tolerance on A	Valve supported at pups[4]	Valve supported at body[5]
15	-	**400**	400	+10 -5	100	
25	-	**450**	450			
40	-	**550**	550			
50	292	**700**	700		200	
80	356	**760**	760			
100	432	**1040**	1040		300	250
150	559	**1170**	1170			
200	660	**1880**	1880	+15 -5	400	
250	787	**2005**	2005		500	
300	838	**2055**	2055			
400	991	**2165**	2165		585	
450	1092	**2265**	2265			
600	1397	**2750**[7]	2300		675	
750	1651	**3225**[7]	2500		785	
900	2083	**3605**[7]	3085			
	≤ *2000*[6]	**-**	*2500*			
1050	2235	**3750**[7]	3235			
	≤ *2000*[6]	**-**	*2500*			
1200	2489	**4060**[7]	3490			
	≤ *2000*[6]	**-**	*2500*			

Notes to Table 1a

1 Standard welding end to end length of valve to BS EN13942:2009 on which overall length of valve and pup assembly is based

2 Standard overall assembly length for each valve size, to allow valve to be supported on pups above or below ground

3 Alternative overall assembly length, where valve is supported at valve body, by agreement with BUYER

4 Minimum length of pup, supporting valve, on standard or shorter valve length, by agreement with BUYER

5 Minimum length of pup, not supporting valve, on standard or shorter valve length, by agreement with BUYER.

6 *Maximum valve end to end length to allow shorter assembly length, with shortest non-supporting pups by agreement with BUYER and the Gas Transporter in advance*

7 On valves greater than DN 450, the provision of valves to be supported at pups shall be subject to verification of stresses at valve weld end and the agreement of the BUYER.

ADDITIONAL TABLE 1b – Overall length of ball valve assembly with one flange and one pipe pup

<table>
<tr><th colspan="2">Bare valve</th><th colspan="3">Overall length</th><th colspan="2">Pup length</th></tr>
<tr><th>Size</th><th>Length</th><th colspan="3">of valve and pup assembly A (mm)</th><th colspan="2">minimum</th></tr>
<tr><th>DN (mm)</th><th>Standard maximum[1] (mm)</th><th>Valve supported at pup[2]</th><th>Valve supported at body[3]</th><th>Tolerance on A</th><th>Valve supported at pups[4]</th><th>Valve supported at body[5]</th></tr>
<tr><td>15</td><td>-</td><td colspan="2">-</td><td rowspan="8">+10
-5</td><td colspan="2" rowspan="3">100</td></tr>
<tr><td>25</td><td>-</td><td colspan="2">-</td></tr>
<tr><td>40</td><td>-</td><td colspan="2">-</td></tr>
<tr><td>50</td><td>295</td><td colspan="2">395</td><td colspan="2" rowspan="2">200</td></tr>
<tr><td>80</td><td>359</td><td colspan="2">560</td></tr>
<tr><td>100</td><td>435</td><td colspan="2">735</td><td rowspan="2">300</td><td rowspan="13">250</td></tr>
<tr><td>150</td><td>562</td><td colspan="2">865</td></tr>
<tr><td>200</td><td>664</td><td colspan="2">1270</td><td rowspan="13">+15
-5</td><td>400</td></tr>
<tr><td>250</td><td>791</td><td colspan="2">1395</td><td rowspan="2">500</td></tr>
<tr><td>300</td><td>841</td><td colspan="2">1450</td></tr>
<tr><td>400</td><td>994</td><td colspan="2">1580</td><td rowspan="2">585</td></tr>
<tr><td>450</td><td>1095</td><td colspan="2">1680</td></tr>
<tr><td>600</td><td>1407</td><td>2290</td><td>1860</td><td>675</td></tr>
<tr><td>750</td><td>1664</td><td>2450</td><td>2115</td><td rowspan="5">785</td></tr>
<tr><td rowspan="2">900</td><td>2099</td><td>2885</td><td>2600</td></tr>
<tr><td>≤ 2000[6]</td><td>-</td><td>2500</td></tr>
<tr><td rowspan="2">1050</td><td>2235</td><td>3020</td><td>2735</td></tr>
<tr><td>≤ 2000[6]</td><td>-</td><td>2500</td></tr>
<tr><td rowspan="2">1200</td><td>2489</td><td>3275</td><td>2990</td></tr>
<tr><td>≤ 2000[6]</td><td>-</td><td>2500</td></tr>
</table>

Notes to Table 1b

1 Standard RJ flanged end to end length of Class 600 ball valve to BS EN13942:2009 on which overall length of valve and pup assembly is based.

2 Standard overall assembly length for each valve size, to allow valve to be supported on pup at one end above or below ground.

3 Alternative overall assembly length, where valve is supported at valve body, by agreement.

4 Minimum length of pup, supporting valve, on standard or shorter valve length, by agreement.

5 Minimum length of pup, not supporting valve, on standard or shorter valve length, by agreement.

6 Maximum valve end to end length to allow shorter assembly length, with shortest non-supporting pups by agreement in advance

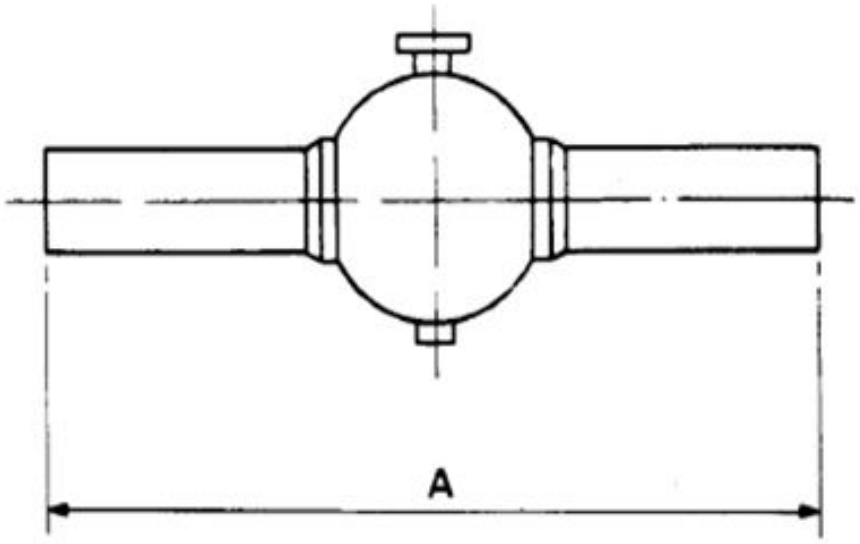


Figure to table 1a

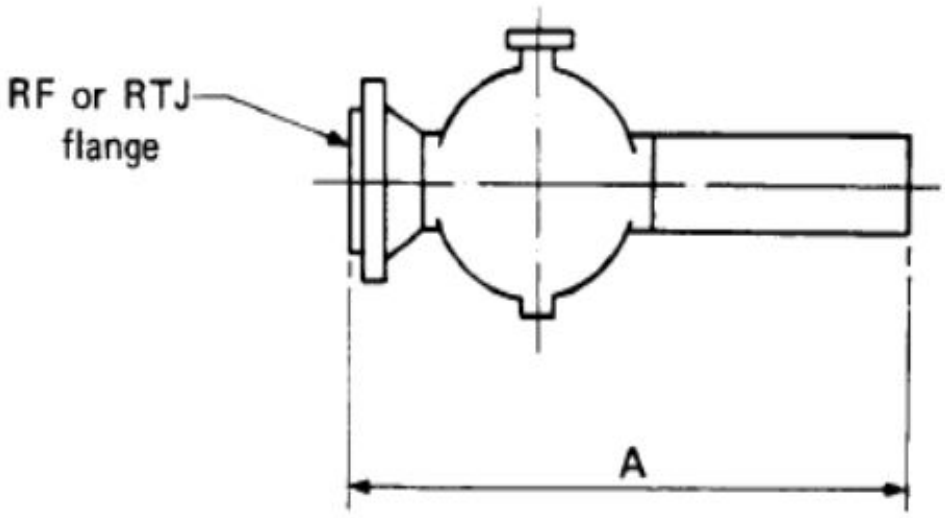


Figure to table 1b

6.6 Pressure relief

A separate pressure relief device for the valve body cavity shall not be provided unless specified by the BUYER in the Data Sheet, Section 1, line 46 (See Annex D) and agreed by the Gas Transporter.

6.7 Bypasses, drains and vents

Drain and vent connection details are covered in Annex A of this standard.

6.8 Injection points

Unless otherwise specified in the data sheet (Annex D line 34) seat and stem sealant injection shall be provided on all valves equal to or greater than DN 100.

Sealant injection details are covered in Annex C of this standard.

6.9 Drain, vent and sealant lines

When stem extensions, together with extended vent and sealant lines are required, consideration should be given to the design of the larger valve assemblies to make them easier to transport by road. By prior agreement with the Gas Transporter, valves with stem extensions and associated pipework may be finally assembled at site.

Stem extensions for drain, vent and sealant lines are covered in Annexes A & C of this supplement.

6.10 Drain, vent and sealant valves

Valve vent and drain connection details are covered in Annexes A & C of this standard.

6.11 Hand-wheels and wrenches - Levers

Any limiting dimensions that affect the design of the hand wheel or wrench shall be specified on the Data sheet.

The direction of closing of the hand wheel or lever shall be clearly marked.

Hand wheels and levers shall be fitted in such a way that they can be removed and replaced securely when necessary.

6.12 Locking devices

Additional requirements are as specified on the Data Sheet (Annex D line 46).

6.13 Position indicators

Every valve assembly shall be fitted with a visible indicator to show the position of the obturator throughout its travel. The valve stem itself shall show clear identification of the position of the valve port to enable correct connection of an actuator, gearbox or stem extension.

6.14 Travel stops

All valves without actuators or gearboxes, i.e. lever operated, shall be fitted with travel stops.

All actuators and gearboxes shall be fitted with travel stops unless the valve itself is fitted with travel stops.

6.15 Actuator, operators and stem extensions

6.15.1 General

Actuators shall conform to GIS/VA1 or GIS/VA2

The valve manufacturer shall ensure and verify that the time required to open and close the actuated valve assembly is in accordance with the BUYER's Actuator Specification Data Sheet as defined in the relevant GIS/VA1 or GIS/VA2 specifications.

The manufacturer shall also provide a valve and actuator with due consideration for access to all controls, hand wheels and maintenance

Means shall be provided to periodically lubricate gearboxes.

6.16 Lifting and support

Lifting lugs shall be sufficient to lift and install the valve in the orientation specified in the Data Sheet. Each lug shall be designed to take the full weight of the valve, pups and stem extension combined. The total weight of the valve assembly shall be stated on the valve body. Tapped holes and eye bolts shall not be used for lifting lugs.

If required, the BUYER may specify support legs to the valve body (refer to Annex D line 46 “special requirements”). The spacing of supporting legs and dimensions of supporting feet shall be agreed with the BUYER. On valves of size greater than DN 450, where welding end or flanged valves are ordered without support legs to the valve body, the BUYER should verify that the bending and shear stress at the welded or flanged and bolted ends are not excessive when the valve is supported solely at the pups.

6.17 Drive trains

6.17.1 Design thrust or torque

The valve manufacturer shall specify the maximum torque required for valve operation, at maximum pressure differential, and also the maximum torque that can be exerted on the valve stem or drive train without damage.

6.18 Fire type-testing

The fire resistance design of valves shall be qualified by fire testing in accordance with BS EN ISO 10497.

Fire resistance designs already qualified to BS 6755-2, API Spec 6FA, API Spec 6FC, API Spec 6FD or API Std 607, third edition, are also acceptable.

6.19 Design documents

The manufacturer shall prepare and retain design documentation for the predicted life of the valves supplied.

Specific design information required for each order shall be provided as specified in the Data Sheets in Annex D of this standard.

The manufacturer shall specify the periodic maintenance that is required to enable the valve to function satisfactorily throughout its design life.

6.20 Design safeguards

Where any pressure retaining parts or assemblies of the valve are held together by means of screwed components, the valve shall be designed to prevent accidental dismantling under pressure.

Where bolted glands are used, gland bolts shall pass through holes in the gland flange. Open slots are not permitted.

In order to prevent leakage or binding of the valve, plug valve bodies and plugs should be matched by grinding and lapping and a suitable anti-friction coating applied to the plug.

The valve operating mechanism shall be designed in such a way that, with the valve under pressure and in any position from fully closed to fully open, any part that has failed should be capable of being repaired or replaced without depressurising the valve. If a weak link in the mechanism is used to meet this requirement (e.g. a shear pin or slipping clutch), the design shall be such that the weak link should be capable of being replaced easily on site without the need to dismantle other parts and without special tools. It shall also be possible for the drive key to be removed and replaced on site without depressurising the valve.

6.21 Non-electrical equipment for explosive atmospheres

All equipment supplied shall be certified in accordance BS EN ISO 80079 Parts 36 and 37 for Group IIA gases in Zone 1 hazardous area. The purchaser will specify whether they will accept self-certification or require independent certification.

7. Materials

7.1 Material specification.

Mechanical testing shall be performed in accordance with BS EN ISO 6892-1 and BS EN ISO 148-1. The elongation shall be proportional: L = 5.65 √S0.

Mechanical testing performed in accordance with ASTM standards is acceptable subject to:

- Elongation values being converted in accordance with EN ISO 2566-1.

- Results being converted to SI units.

Metallic pressure containing parts (except stems and gaskets) shall be made of suitable materials listed in BS EN 13445 or ASME B16.34 or an agreed equivalent standard.

Material for pressure containing parts (bodies, end flanges, bonnets and covers) shall conform to the following:

- Be delivered with certificates to BS EN 10204 3.1 (as a minimum), guaranteeing the quality and the mechanical properties required by this standard (yield strength, tensile strength, percent elongation, impact test values at -20°C (see section 7.3), the chemical analysis, the manufacturing process and the marking (e.g. the cast/heat number) of the steel. In addition to the actual results, the certificates shall also contain the minimum requirements allowed by this standard. For valves with butt welding ends for connection to the pipeline, supplementary requirements in section 7.3 are mandatory.

- The minimum percent elongation shall be in accordance with Table 1A below.

Table 1A – Mechanical Test Requirements

Grade		Sample		Yield Strength		Tensile strength		Elongation
EN	ISO API	Location	Direction [b]	$R_{t0.5}$ (N/mm^2)		Rm(N/mm^2)		A(%)
			On body samples	min	max	min	max	min
245	B	Body	L for DN <200 T for DN ≥200	245	440	415	530	22
		Weld			690		760	
290	X42	Body		290	440	415	540	21
		Weld			690		760	
360	X52	Body		360	510	460	630	20
		Weld			690		760	
415	X60	Body		415	565	520	680	18
		Weld			690		760	
450	X65	Body		450	570	535	700	
		Weld			690		825	
485	X70	Body		485	605	570	760	
		Weld			750		915	
555	X80	Body		555	675	625	825	

		Weld			750		990	

The ratio between the yield strength and the tensile strength shall not exceed 0.90.

7.2 Forged and cast parts.

No repairs shall be permitted on forgings or plate.

Valve body/bonnet or shell castings shall conform to the requirements of */SP/C/9 and shall be obtained from foundries qualified to */SP/C/9 by a Gas Transporter or its nominated agent

Castings may only be repaired by prior agreement with the Gas Transporter and fully in accordance with */SP/C/9.

7.3 Toughness test requirements

Mechanical testing shall be made at the frequency specified by the relevant material standard, and shall be on a minimum of each heat of the material, in the final heat treated condition.

Notch toughness testing (Charpy V) shall be in accordance with BS EN ISO 148-1 or, by agreement, to BS EN ISO 148-1 or ASTM A370.

The standard impact test temperature shall be -20°C. For full-size test specimens, the values shall be as per the following Table 1B. Where full-size specimens cannot be obtained, sub-size specimens with a minimum thickness of 5 mm without flattening shall be used and the required impact values shall be adapted in accordance with the formula of section 8.1.4.1 of BS EN 1594. If test certificates confirm notch toughness properties at a lower temperature than -20°C, the minimum values shall be as specified in the Table 1B below, which replaces that in EN13942:2009.

Pressure containing parts for all valves shall be impact tested.

Table 1B – Impact Test Requirements at Minus 20^{O}C

Yield Strength	Minimum average	Minimum individual
(N/mm2)	(J)	(J)
≤360	27	20
>360	40	30

7.4 Bolting

Bolting shall be provided with an EN 10204-3.1 certificate (as a minimum) and with the same guarantees for elongation and Charpy toughness as for the other pressure containing parts.

8. Welding

8.1 Qualifications

Valve to pipe pup welding shall be carried out using a qualified procedure approved by the Gas Transporter.

The use of ASME IX for weld procedure and welder qualification shall be acceptable only if the validity ranges in BS EN ISO 15614-3 and BS EN ISO 9606-1 are used.

8.2 Impact testing

Impact testing shall be carried out for qualification of procedures for welding on all valves.

Impact testing shall be performed in accordance with BS EN ISO 148-1 or, by agreement, to BS EN ISO 148-1 or ASTM A370.

9. Quality Control

9.1 NDE Requirements.

9.1.1 The Contractor shall submit procedures for all proposed NDE techniques before production commences.

All operators of NDE equipment shall have a thorough knowledge of the operation of the equipment, its capabilities and the test procedures to be used. All operators who will carry out the specified NDE shall hold a current CSWIP* approval certificate in the appropriate grade. Other approval certificates may be proposed by the Contractor as a variant for consideration by the Purchaser. The operator will also be required to demonstrate his ability to carry out the procedure methods.

* Certification Scheme for Weldment Inspection Personnel.

9.1.2 The Contractor shall carry out inspection and testing of each valve to the procedure and shall supply a certificate covering the following tests:

a) Valve castings shall be subjected to NDE in accordance with, */SP/C/9.
b) All welds joining pressure containing parts, including the attachment of pups, shall be subjected to NDE using either X-radiography or ultrasonic techniques. Where seat rings are specified, all seat ring areas shall be subjected to NDE.
c) Welds joining all non-pressure containing parts of valves and gearboxes shall be subject to random 10% magnetic particle inspection (MPI) crack detection.

Lifting lugs or brackets welded to valve bodies shall be subjected to 100% MPI.

9.1.3 Prior to production testing, the Contractor shall perform calibration tests to verify proper functioning of ultrasonic test equipment and the ability of the operator to detect defects.

9.1.4 All weld repairs shall undergo NDE in accordance with the procedure used initially in testing the weld.

9.1.5 Inspection frequencies and acceptance standards for castings shall be agreed between Purchaser and Contractor.

9.1.6 The main fabrication welds shall meet the acceptance standards of PD 5500.

10.Pressure Testing

10.1 General

Each valve produced shall be tested in order to ensure pressure integrity, valve closure and sealing as follows:

After hydrostatic testing, low pressure pneumatic seat testing shall be carried out in accordance with EN13942:2009 Annex B.3.2 type I (1 bar) then, B.3.3 Type II (6 bar)

Valves may only be tested with pipe pups attached by agreement with the BUYER. In this case the Manufacturer shall verify that hoop stress in the pipe pups at Class shell test pressure does not exceed a limit specified by the BUYER, normally 0.90 SMYS.

Torque / thrust testing (Annex B.6) shall be carried out on all actuated valves, but on manual operated valves is only required at the special request of the BUYER.

After hydrostatic testing and before pneumatic testing, a closed to open torque test shall be carried out at maximum Class differential pressure on each seat according to EN13942:2009. Annex B.6 parts c) and d). The measured torque shall not exceed the breakaway torque specified by the

manufacturer.

Extended vent and drain lines and relevant attached valves shall be either included in the hydrostatic shell test, or be tested separately to the same test pressures.

Extended Sealant lines should be tested separately.

10.2 Hydrostatic shell test

Testing shall be carried out in such a way that any voids or cavities in the valve are exposed to the full hydrostatic test pressure.

10.3 Type testing

Type testing shall be carried out in accordance with Annex F of this standard whenever there is a new, or change in, valve manufacturer, product, manufacturing process or location.

11. Coating

All valves shall be corrosion protected using coating or painting systems as detailed in */SP/PA/9, and applied in accordance with specifications stated in table 1 of this standard. Machined flanged faces shall receive corrosion protection from a rust preventative coating or a corrosion inhibitor before dispatch from the manufacturer, either of which can be readily removed on site.

Table 2 – Summary of Valve Coating and Painting Requirements

Factory Coating / Painting		
Valve Location	**Coating / Painting**	**Specification**
Totally above ground	Painting	*/SP/PA/10 – SPA1
Partially or completely buried	Coating	Annex E
Where valve is to be coated or painted at site then the valve shall be painted with an easily removable holding primer.		
Site Coating /Painting		
Valve Location	**Coating / Painting**	**Specification**
Totally above ground	Painting	*/SP/PA/10 – SPA1
Partially or completely buried	Coating	*/SP/CW/5
N.B. Remove factory applied holding primer prior to coating/painting		

Above Ground Valves

For valves due to be located totally above ground, after the completion of all pressure testing, and the attachment of pups when required, all external surfaces, pups and gearboxes should be painted, as stated in the data sheet, and in accordance with */SP/PA/10. Alternatively, if agreed by the Gas Transporter, the components may be painted with a holding primer, which can be easily removed on site, to allow the component to be painted to */SP/PA/10 in-situ.

Buried or Partially Buried Valves

For valves due to be partially or completely buried, valves shall be factory coated in accordance with Annex E of this standard. Alternatively, if agreed by the Gas transporter, the components may be painted with a holding primer, which can be easily removed on site, to allow the component to be coated with a multi-component liquid system to */SP/CW/5 in-situ. If required valve sections more than 500mm above ground level may be over-painted in accordance with */SP/PA/10 to match the AGI colour scheme.

For painting/coating of all valves, attention shall be taken to ensure the detail of coating/painting, such as the application of coating/painting behind items such as clips and that identification plates are not obscured. On stem extensions, all pipework should be coated before and after assembly.

Where valves are fitted with a stem extension, the coating shall be terminated approx. 50mm below the pipe fittings and clips/brackets on the extended vent, drain and sealant lines. Above this point painting to */SP/PA/10 should be carried out.

Fixing clips should be correctly sized to avoid damage to applied coating or paintwork and should be of steel or non-metallic material.

12. Marking

Also required are:

BUYER / The Gas Transporter Gas order number

The Gas Industry Standard reference, GIS/V6:2019.

Gross weight of the assembly and any specific requirements stated on the Valve Data Sheet Page 1 in Annex I of this standard.

CE Marking affixed in a visible, easily legible and indelible fashion to declare conformity to the provisions of the Pressure Equipment Directive.

ATEX equipment category where applicable.

For valves too small to include all of this information an agreed summary of essential information shall include the serial number and the BUYER/Gas Transporter order number. If parts of the valve assembly are packed separately they shall be permanently marked for identification.

For underground valves a second name plate shall be located at the upper end of the stem extension in addition to the valve body identification plate and shall be fitted using a suitable adhesive after all corrosion protection has been carried out.

13. Preparation for Shipment

At all stages of manufacture, precautions shall be taken to avoid contamination of seats, etc. and to prevent damage to the seating components.

During transit, valves shall be adequately supported. Where chains or wire ropes are used to secure the valves, they shall not come into direct contact with the valves or pups. Damage to valves by the incorrect use of slings, chains or wire ropes, etc., will be cause for rejection.

Valves 200 mm nominal size and larger shall be adequately supported on pallets.

Smaller valves shall be packed together in wooden crates. In all instances, valves shall be prepared for transit so that they are not in direct contact with one another.

Ends of valves shall be protected to prevent mechanical damage during loading, transit and unloading. The ends shall be sealed to prevent the ingress of dirt or moisture.

Ball and plug valves shall be transported in the open position: all other types of valves shall be transported in the closed position.

14. Documentation

A manufacturing data book shall be provided for each valve supplied and shall contain the documentation listed below, as a minimum:

- Index
- Register and copies of material certification for pressure containing parts per EN 10204.3.1 (original copies) including pipe pups where applicable
- As built drawings (certified as built GA drawings)
- NDE certificates
- Pressure test certificates
- Operating and Maintenance manual (1 manual per sales order)
- Fire-safe certificate
- Painting/Coating inspection report

And as applicable:

- Welding traceability of subcontracted pipe pup welding.
- Weld map
- Actuator functional tests reports.
- Pressure test reports including vent, drain & sealant lines.
- NACE certificate.
- BASEEFA/ATEX certificates.
- Vent and drain valves, (plug/ball) and needle/ball valves on sealant lines:
  - Material certificates on pressure containing parts per EN10204.3.1.B
  - Pressure tests certificates (from manufacturer)
  - Certificate of conformity
- Pipe pups (if applicable) :
  - Material certificates
  - NDE certificates (MT+ UT)
- Actuator documentation
- A Gearbox Certificate of Conformity and general assembly drawing(s) are required from the manufacturer.

Annex - A Valve Vent and Drain Connection Details

A.1 General

Provision shall be made for ball valves ≥ DN 100 to be fitted with separate vent and drain connections or where valve physical dimensions do not permit separate connections, a combined vent/drain connection (with respect to the specified installed orientation).

All double block and bleed valves shall be provided with a vent valve.

Drain or vent connections are not required on single plug valves unless specified by the BUYER. The requirement for vents and drains for valves other than ball and plug types shall be specified by the BUYER.

All vent and drain connections should be fitted with a valve that should conform to this standard and shall be capable of being used partially open without damage to its sealing surfaces. Vent valves shall be fitted with stainless steel captive vent bleed plugs, solid plugs shall not be used.

All tapped holes shall be spot faced before drilling. Any screwed connections provided shall not be seal welded.

There should be no unused connections into the valve body. However if any unused connections exist, for instance due to a change in the specified installed orientation, they shall be threaded and plugged with a suitable hexagon or square-headed threaded vented plug. Tapping threads shall be BS EN 10226-2 unless otherwise specified for specific applications. The minimum effective threaded engagement of the plug shall be at least equal to the nominal thread diameter.

Note that references to vents are deemed to include bleeds throughout the text.

A.2 Vent and drain tapping points on main valve body

Sizes for vents and drains should conform to Table A.1. Vent and drain tapping points should be fitted with valves complying with this Gas Industry Standard.

For valves of size DN 450 or larger, and all below ground valves, connections into the valve should be socket welded. Socket weld fittings shall be to BS 3799. Fittings for vent and drain lines shall be 3000 lb minimum as specified in BS 3799).If screwed connections are to be used on above ground valves <DN 450 the Seller shall provide proof of their integrity taking into account the valve size, maximum permitted operating pressure and location. Tapping threads shall be BS EN 10226-2 unless otherwise specified for specific applications.

Weld connections into the valve shall be made by means of a purpose made socket weld fitting, complying with BS 3799 unless otherwise specified.

Full details of size and position of all body tappings shall be specified on the general arrangement drawing in accordance with the Data Sheet (Annex D) and Section 6.18 of this standard.

A.3 Vent and drain extensions

The supply of any stem extension assembly shall include separate extensions to each vent and drain connection.

Vent and drain lines shall be of either butt welded or socket welded construction, unless otherwise specified. Socket weld fittings shall be to BS 3799. Fittings for vent and drain lines shall be 3000 lb minimum (as specified in BS 3799). The pipe used shall conform to Grade L245 of BS EN ISO 3183, and be sized not less than the connection size in the main valve body.

Vent and drain lines extensions shall be fitted with valves of nominal size equal to the connection size from the main valve.

Each vent and drain line shall be provided with a valve complying with this standard immediately adjacent to the upper flange of the stem extension for normal operation and fitted with a suitably sized vented plug. Each vent and drain line shall additionally be provided with a means to isolate the vent or drain line for maintenance. This shall be immediately adjacent to the main valve body

and should be a valve also complying with this standard.

The top of the vent and drain lines shall be clearly marked to indicate which is the vent and which is the drain.

Vent and drain assemblies shall be hydrostatically pressure tested. Testing may be carried out by means of a shop test on sub-assemblies. The test pressure for vent and drain assemblies shall be equal to that for the main valve body.

If the BUYER specifies that extension assemblies are required to be dismantled for transport to site, the vent and drain lines shall be welded together on site using ‘golden welds’ (see 3.7) to weld procedures approved by the Gas Transporter.

Vent and drain extension lines shall be adequately protected against the possibility of in-service corrosion, especially under securing clips etc. See Section 11 and Annex E.

TABLE A.1 – Vent and Drain Port Sizes

Valve nominal size **DN**	**Valve nominal size** **NPS**	**Vent or drain port minimum nominal size** **inch**	**Vent or drain port minimum nominal size** **mm**
25 to 100	1-4	0.5	15
150 – 200	6 – 8	0.75	20
250 – 400	10 – 16	1.0	25
450 - 1200	18 - 48	1.5	40

Note: Valve sizes not shown have drain holes sized to the next larger valve nominal size

Annex - B Additional Details Relating to Operators and Stem Extensions

B.1 General

Where provision is made for mounting a stem extension assembly, the design shall be such that the complete assembly shall form a rigid unit giving a positive drive under all conditions with no possibility of free movement between the valve body, stem extension or its operator.

B.2 Drive stem

The inner drive stem extension shall be so designed as to ensure that full engagement with the valve stem is maintained in all attitudes of the valve and stem extension assembly. The drive stem and extension casing shall be adequately protected to prevent internal and/or external in-service corrosion (refer to B.9), in order to prevent the risk of corrosion products becoming dislodged and obstructing full valve travel.

B.3 Hollow extension

Where a hollow valve stem extension (i.e. inner drive stem extension) is used, provision shall be made to equalise the pressure between the bore of the stem extension and the annulus.

To prevent ingress of water, the necessary vent hole shall be drilled above the level of any vent in the outer tube.

B.4 Vent to atmosphere

The outer housing shall be fitted with a vent to atmosphere, which shall be designed to prevent the ingress of debris and insects.

B.5 Gaskets

The supply of a stem extension assembly shall include gaskets for both upper and lower mating flanges, to prevent the ingress of water.

B.6 Length

The length of the stem extension (i.e. the dimensions, either A or B as shown in Figure B.1) shall be specified in the Data sheet.

B.7 Manufacturer's supply

Gearboxes, vent, drain and sealant valves and all extensions, shall be supplied by the valve manufacturer unless otherwise specified in the data sheet.

Where the stem extension is supplied separately from the valve, the vent, drain and sealant lines shall be trial assembled and provision shall be made for adjustment during site assembly. All items / assemblies shall be clearly and individually identified as to duty and position. Stem extension pipe work shall be match marked prior to dispatch.

NOTE. When stem extensions together with extended vent and sealant lines are required, consideration should be given to the design of the larger valve assemblies to make them easier to transport by road. It may be advantageous for the valve assemblies to be finally assembled at site after the components have been transported there on trailers of standard width. Any requirements for site assembly of stem extensions, vent, drain and sealant lines should be noted in the valve Data Sheet section 1, line 46

B.8 Extension Line supports

The vent, drain and sealant lines shall be adequately supported from the outer extension tube and protected against the possibility of in-service corrosion, especially under securing clips etc. Also refer to Section 11 and Annex E. The tube shall not be drilled to provide such support.

The design of the supports shall be such that operation of the valve or discharge of gas will not impose excessive forces on the pipe work.

B.9 Painting and Protection

B.9.1 Internal surface preparation

Internal surface preparation shall be as detailed below.

No surface preparation, or painting, shall be carried out when the relative humidity is greater than 90%, when the metal temperature is less than 3°C above the dew point, or when the metal temperature is below 10°C. All grease and dirt shall be removed using solvent.

The surfaces to be painted shall be blast cleaned to a standard equivalent to BS 7079 Sa 3 quality. The surface profile shall average 100µm peak-to-trough with maximum 150 µm.

Pickling and phosphating may be proposed by the Contractor as a variant for consideration by

The Gas Transporter as an alternative method of preparation only when blast cleaning is not possible.

Application of paint shall be within 4 h of commencement of blast cleaning, or within 4 h of completion of the cleaning process where a pickling and phosphating process is to be used. When this period is exceeded, or if rust blooming or contamination occurs, the cleaning process shall be repeated.

B.9.2 External surface preparation

External surface preparation shall be in either in accordance with */SP/PA10 or Annex E as specified in the data sheet (see Annex D, line 44).

B.9.3 Internal surface painting

Internal surfaces of the stem extension shall be painted in accordance with B.9.1.

The paint to be applied shall be a two-pack epoxy pitch. Where specified by the paint manufacturer, a wash primer or etch primer shall be applied to ensure an adequate key.

Two-pack paints shall be mixed strictly in accordance with the manufacturer's instructions.

Partly filled containers shall not be used. In general, an induction period of about 30 min shall be allowed after mixing and prior to use. It should also be noted that two-pack materials have a limited pot-life which is to some extent dependent on ambient conditions and which shall not be exceeded.

Thinners may only be used in accordance with the manufacturer's instructions. Only thinners recommended by the paint manufacturers should be used. The same material should be used for cleaning out any equipment used in the application of paint.

The first coat of epoxy pitch shall be applied according to the instructions and within the period specified by the manufacturer.

Subsequent coats shall be applied according to the manufacturer's instructions to give a total dry film thickness of a minimum of 375µm and a maximum of 500µm. No individual coat shall exceed a dry film thickness of 200µm.

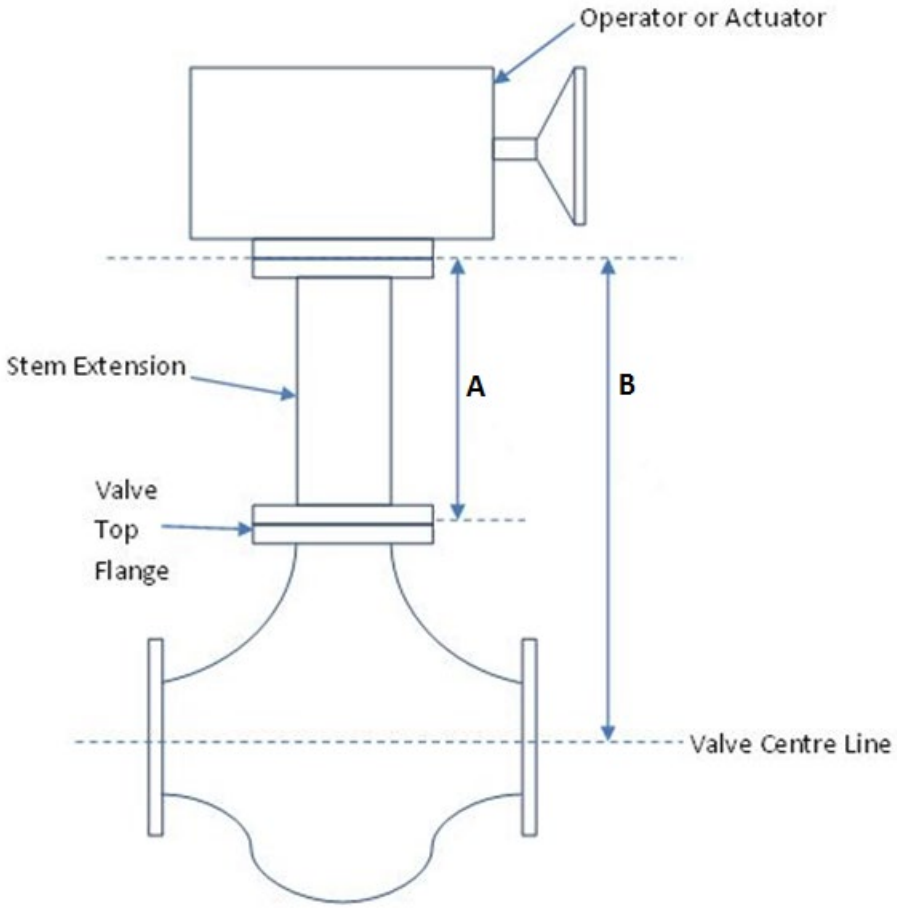


Figure B.1 - Dimensions for stem extension length

Annex - C Details relating to Sealant Injection

C.1 Sealant or lubrication injection facilities

Wherever facilities for sealant or lubricant injection on ball valves are required, all injection points shall incorporate a separate non-return valve in the valve body or stem housing followed by an isolating valve and a giant button head nipple in accordance with BS1486 or equivalent, complete with vented cap, of sufficient capacity. The isolating valve should conform to the Gas Transporter's Specification */SP/V/8.

C.2 Sealant or lubricant injection extension lines

The supply of any stem extension assembly shall include extensions to the sealant connections. Separate extension lines shall be provided for each sealant injection point.

The pipe used shall conform to Grade L245 of BS EN ISO 3183, and be sized not less than the connection size in the main valve body.

Sealant pipe connections into valves may be socket welded or screwed. Socket weld fittings shall be to BS 3799. Sealant line fittings shall meet the requirements of C.3.

Screwed connections shall not be seal welded. Tapping threads shall be BS EN 10226-2 unless otherwise specified for specific applications

Sealant lines shall be of either butt welded or socket welded construction. A breakaway coupling, conforming to BS 3799, should only be incorporated where necessary for assembly purposes. Threaded connections shall only be used for sealant valves. If a socket connection to the valve is offered the conditions as above for vent and drain lines apply.

Each sealant line extension shall be fitted with valves of nominal size equal to the connection size in the main valve.

Each sealant line shall be provided with a valve, immediately adjacent to the upper flange, or as close as is reasonably practicable, of the stem extension, for normal operation. Each sealant line shall additionally be provided with a means to isolate the sealant line for maintenance. The separate check valve in the valve body shall not be relied on to provide an effective isolation for maintenance.

All sealant line valves shall conform to the Gas Transporter's Specification */SP/V/8 and be of 10,000lb rating as a minimum and may be of either ball or needle type.

Sealant lines shall be adequately protected against the potential for in-service corrosion under securing clips etc.

Sealant line assemblies shall be hydrostatically pressure tested. Testing by means of a shop test shall only be carried out on sub-assemblies. The sealant line test pressure shall not be less than 1.25 times the maximum pressure developed by the sealant gun specified by the Gas Transporter in C.3 below.

C.3 Sealant gun

The Sealant gun used by Gas Transporters Grid operates at a maximum 690 Bar/10,000 psi under normal conditions. The manufacturer shall confirm that the sealant injection system provided is suitable to withstand this stated maximum pressure. This information shall be included in the valve instruction and operating Manual.

The manufacturer shall ensure that the valve operator does not impede access for the use of the sealant injection gun.

Annex - D Valve Data Sheet

VALVE DATA SHEET SECTION 1 BUYER VALVE DATA									
ENQUIRY	1					Ref:			
ORDER	2					Date:			
VALVE TYPE (Please Specify as per section 5.1)	3								
SIZE	4		DN		mm				
PRESSURE RATING	5	PN			Class:				
SERVICE	6	Above Ground:			Below Ground				
	7	Max / Min Temperature:			-20 C / +60 C				
	8	Max Differential pressure (bar g):			Max Class Pressure				
	9	Max. Flow rate (scmh)							
END CONNECTIONS	10	Flanged			Flanged & Butt welded				
	11	Pupped			Flanged & Pupped				
	12	Butt welded							
	13	Overall valve Length:			mm				
	14	Pipe pups to be provided by BUYER:			Yes			No	
	15	Flange facing : Raised Face:			Ring joint				
CONNECTING PIPE	16	Grade:							
	17	Outside Diameter:			mm				
	18	Wall Thickness			mm				
DESIGN	19	Bore (normally Full for ball valve, Reduced for plug valve)l			Full			Reduced	
	20	Valve sealing action	Double block and bleed (see 4.7)		Yes		No		
			Double Isolation and Bleed (see 4.8)		Yes		No		
	21	Ball valve: seat action (see 3.5)	No preference		Yes		No		
			Both Uni Directional		Yes		No		
			Both Bi Directional		Yes		No		
			One Uni and One Bi Directional		Yes		No		
	22	Plug valve: pattern Regular (normally Regular)	Regular	Venturi			Short		
	23	Check valve: design configuration (see 6.1.4)	Type						
			Pattern						
	24a	Fire safe (normally Yes)	Yes	No					
	24b	Hazardous Area Zone (see 6.1)	Zone						
ADDITIONAL DETAILS	25	Handing of valve			Right Hand		Left Hand		
	26	Ref for handing i.e. when view from			Flanged End		Upstream End		
	27	Valve Stem Orientation			Horizontal		Vertical		
	28	Valve Bore Orientation			Horizontal		Vertical		
	29	Stem Extension			Required		Not required		
	30	Length of Stem Extension (see Fig B.1)			mm				
	31	Vent Extension			Required		Not Required		
	32	Drain Extension			Required		Not Required		
	33	Sealant Injection (≥ DN 100)			Required		Not Required		
	34	Sealant Extension			Required		Not Required		
	35	Type of Welding / Vent, Drain & Sealant Extensions							
					Screwed		Socket Weld		
	36	Connection into Valve			Threaded (BSPT)		Socket Weld		
	37	Vent and Drain Valves supplied by			BUYER		Manufacturer		
	38	Sealant Valves Supplied by			BUYER		Manufacturer		
	39	Gearbox Manual Operation			Required		Not Required		
	40	Provision / Gearbox for power operation Refer to actr data sheet ref……			Required Data sheet ref……		Not Required		
	41	Direct Mounted Power Actuator			Required		Not Required		
	42	Flange Protection			Required		Not Required		
	43	Locking Device			Required		Not Required		
CORROSION PROTECTION	44	Type			Painting – */SP/PA/10:		Coating – Annex E:		
SPECIAL REQUIREMENTS	45								

ISSUE	BY	DATED

Annex D (Continued)

VALVE DATA SHEET MANUFACTURER VALVE DATA							SECTION 2
SPECIFICATION	**46**						
MANUFACTURER'S DESIGNATION	**47**						
VALVE DESIGN / MODEL	**48**						
ATEX EQUIPMENT CATEGORY (see 13)	**59**						
TECHNICAL DESCRIPTION	**50**	Ball Support	Trunnion		Floating Ball		
	51	Sealing Action					
	52	Body Construction	Fully Welded		Bolted		
			Cast		Forged		
ACTUATOR	**53**	Manufacturer					
	54	Type					
END CONNECTIONS: PUPS	**55**	If finished pups are supplied free-issue	Length of pup required			mm	
			Type of weld end preparation required on valve end of pipe ups				
	56	If pipe is supplied free-issue	Length of pipe required for pup			mm	
VALVE CHARACTERISTICS	**57**	End to End dimension		mm			
	58	Weight		Kg			
	59	Maximum Sealant Gun Injection Pressure		bar			
SPECIAL REQUIREMENTS	**60**						
REMARKS	Section 1 BUYER Data to be completed where blank, or altered by Manufacturer according to proposed valve details						
	Section 2 Manufacturer Valve Data to be completed by the Manufacturer						
	All items to be completed (put --, none, or n/a where appropriate).						
	Both BUYER and Manufacturer to sign and date relevant section and update Datasheet issue number						

ISSUE	BY	DATED

Annex - E Multi Component Liquid Coating of Valves for Buried Service

NOTE: The requirements of this Annex are taken from */SP/CW/6 parts 1 & 2

E.1 Coating procedure qualification

E.1.1 General

All Coating applicators shall be qualified in accordance with this Annex by the Gas Transporter before any coating operations commence.

A detailed sequence of operations to be followed for the coating of valves shall be demonstrated. Any proposed changes in coating materials, coating process, plant, or quality history shall be formally notified in writing to the appropriate Gas Transporter and this shall necessitate a new coating procedure qualification.

E.1.2 Coating procedure specification

A coating procedure shall be submitted by the coating applicator to the Gas Transporter for review and acceptance prior to commencement of qualification testing.

The coating procedure specification shall incorporate full details of the following:

a) Quality plan.
b) Coating materials to be used shall be selected from the Gas Transporter's Register of Qualified Coatings. The appropriate data sheets shall be made available for review.
c) Valve dimensions.
d) Process temperature profile.
e) Valve cleaning.
f) Blast cleaning medium and technique.
g) Blast cleaning finish, surface profile, surface cleaning and metal defect removal.
h) Dust removal.
i) Provision of coating cut-back.
j) Preheat method time and temperature of coating constituents (if specified).
k) Residual surface contamination.
l) Multi-component liquid and primer (if used) mixing and application.
m) Curing regime.
n) Repair technique.
o) Coating stripping technique.
p) Handling procedures.
q) Operator details

E.1.3 Coating procedure approval tests

E.1.3.1 Test pieces

Two test pieces (pipes, each approx. 1m long and as close as possible to the maximum size of valves to be supplied) for the coating procedure approval tests shall be selected and agreed by the Gas Transporter. Test pieces shall be subjected to the complete set of tests specified in E.1.3.2 to E.1.3.9 inclusive after curing in accordance with the Manufacturer's recommendations. Coating of the test pieces shall be witnessed by the Gas Transporter or its appointed agent and a full set of test results recorded. In addition, the Contractor shall ensure that the tests specified in E.1.3.2 to E.1.3.9 inclusive are carried out by an independent test house or witnessed by the Gas Transporter or its appointed agent and the results are included in a qualification test report submitted to the Gas Transporter for review and acceptance.

Coated valves shall not be dispatched until the coating procedure has been approved by the Gas Transporter.

E.1.3.2 Thickness test

The coated test pieces shall be subjected to a thickness test. The cured coating thickness shall be not less than 1.5 mm and uniform for all tests.

E.1.3.3 Holiday detection test

The coated test pieces shall be subjected to a holiday detection test over 100% of the coated surface as detailed below. All defects shall be repaired in accordance with the manufacturer's instructions.

Equipment

Holiday detection should be carried out using dc, non-pulsing holiday detection equipment on surfaces at temperatures below 90 °C and free from moisture.

Operating Voltage

The operating voltage should be 125 V per 25 µm of coating thickness.

The rate of travel of the probe over the surface should not exceed 300 mm/s.

Electrode type

For all coating systems the wire brush type of electrode should be used, suitably curved to conform to the contour of the coated surface of the valve.

The brush should be maintained in such a condition that a full contact is assured over the full length of the brush.

Identification Method

All holidays should be identified with a waterproof marker.

Equipment Calibration

All holiday detectors should be calibrated at the beginning of every working day and, additionally, when requested by the Gas Transporter.

E.1.3.4 Hardness and cure test

The hardness and cure of the coating on every test piece shall be determined. The value of the hardness obtained shall be within the range specified by the Manufacturer of the material to indicate the correct degree of cure of the coating.

E.1.3.5 Impact resistance test

In order to assess the comparative resistance of coatings to impact damage, the coated test pieces shall be subjected to an impact resistance test at ambient temperature using the method as detailed below. The cured coating shall withstand an impact of 5 J without a holiday being caused.

Test equipment

The following test equipment is required:

a) A variable impact tester (ASTM G14, paragraph 4.2 or equivalent) with punch hammer type indentor modified as shown in Figure E.1 to accommodate a 14.3 mm diameter ball bearing and equipped with a minimum impact mass of 1 kg.
b) A sufficient supply of 14.3 mm diameter ball bearings manufactured from EN31 steel with Vickers hardness of 800 to 930.
c) A holiday detector (see E.1.3.3).
d) A thickness gauge.
e) Repair materials.

Test procedure on components

a) Check the test site to ensure that it is free from holidays with the holiday detector set at the required voltage for the particular coating thickness (see E.1.3.3).
b) Position the impact tester on a holiday free site 300 ± 50 mm from one end of the component.
c) Drop the impact weight from a height calculated to impart the specified impact energy to the coating. The impact height may be calculated using the formula H = J 9.81W where :

H = impactor height, in m

W = impactor mass, in kg.

J = impact energy, in Joules.

d) Retest the impact area for holidays using the detector set at the required operating voltage.
e) Repeat b) c) & d) at four more locations evenly spaced over the surface of the component.
f) Rotate the ball bearing after each impact.
g) After every 20 impacts fit a new ball bearing.
h) If a holiday is caused by the impact test, check the coating thickness in the test area using a thickness gauge.
i) Repair any holiday caused by impact testing using repair materials.

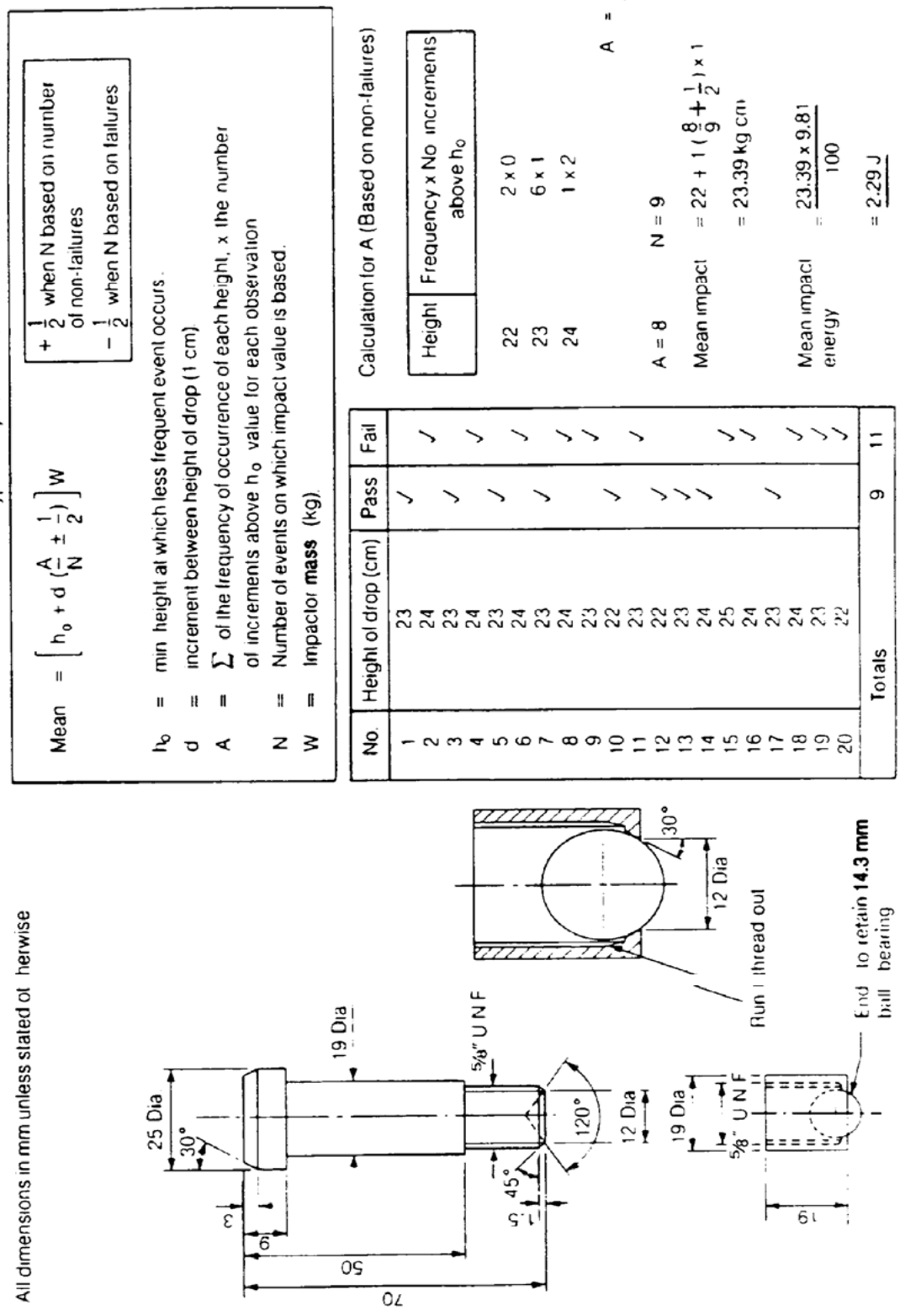
Test procedure on panels

a) Test sample panels (300 mm x 50 mm x 6 mm) and test panels (300 mm x 50 mm) cold cut from pipe sections in the longitudinal direction should be tested according to the procedure detailed in ASTM G14, paragraphs 6 to 9, using the apparatus detailed above.
   The additional modifications to the ASTM procedure specified above inclusive should apply. Test impact areas for failure using the holiday detector set at a voltage of 125 V per 25µm of coating thickness (this relates to coating thickness before impact damage).
   The minimum spacing between impacts along the centre line of the specimen should be 25 mm.
b) Rotate the ball bearing after each impact.
c) After every 20 impacts fit a new ball bearing.
d) Increase the height by an increment of 10 mm between impacts.
e) There shall be no disbonding at the minimum impact energy. Verify this by testing in accordance with clause 1.2.5.

Reporting results

a) If the coating withstands the specified impact energy without forming a holiday, the test should be recorded as a 'Pass'. If a holiday is formed at the specified impact energy, the test should be reported as 'Fail at thickness of...' and the measured coating thickness should be recorded.
b) The impact strength should be converted to impact energy in Joules and this value should be reported.

FIGURE E.1 - Impactor and typical calculation



E.1.3.6 Adhesion test

Procedure

a) Using a small hacksaw blade (e.g. 'Junior' type or similar) make two incisions through to the metal surface to form an X with an angle of approximately 30° at the point of intersection.
b) Draw a sharp knife along the cut lines to ensure that the hacksaw blade has reached the metal surface.
c) Starting at the point of intersection, force the coating from the steel substrate using the sharp pointed knife. Take care to protect the eyes and hands when carrying out this operation.

Reporting results

Refusal of the coating to peel or a cohesive failure within the coating should be recorded as a 'Pass'.

Cohesive failure, caused by voids leaving a honeycomb structure on the specimen surface, should constitute a failure.

For the purpose of this test, cohesive failure will be recorded where some coating material remains on the metal surface and where difficulty in coating removal has been experienced.

The extent of the adhesive failure between the coating and the metal substrate should be recorded. Adhesive loss greater than 3 mm shall be recorded as a 'Failure'.

E.1.3.7 Heat blister test

After initial cure, a test plate of representative wall thickness, coated at the same time as the batch of valve with multi-component liquid systems, shall be subjected to a heat blister test by heating the steel to a temperature in the range 50°C to 60°C and holding the temperature within that range for one hour. After heating, the test plate shall be inspected for blisters. In the event of blistering being observed, an investigation into the cause of the defect shall be immediately undertaken. Samples of coating may have to be removed for nitrogen analysis or other appropriate tests and the coating operations may have to cease during the period of the investigation. When the cause of the defect has been established, components in the coating sequence during which the plate has been coated, shall be tested until an acceptable coating is identified.

E.1.3.8 Cathodic disbonding test

The coated test pieces shall be subjected to a cathodic disbonding test as detailed below to assess the comparative resistance of damaged pipe coatings to disbonding when exposed to cathodic protection in potentially corrosive soils.

The disbondment shall not extend more than 5 mm radially from the edge of the damaged coating after the test period of 28 days.

Test requirement

Apparatus

The following apparatus will be required:

a) A stabilized dc power unit having a voltage output of 12 V and a capability to supply 20 mA simultaneously to each test area in circuit. A suitable circuit is shown in Figure C.1 a).
b) Digital voltmeter, range 1.999 V (3.5 digit), input impedance 10^3 M Ω. Accuracy of 0.1% ±1 digit at 20 ±1°C.
c) Variable resistor, range 1 kΩ ±10%, 1 W (one required for each specimen).
d) 75 mm length of 0.8 mm diameter platinum wire, or similar length of 6 mm wide, 1.5 mm thick platinised titanium strip (one required for each test area).
e) Holiday detection equipment.
f) Reference electrode of the saturated calomel type, constructed from glass or plastics

with porous plug. The diameter should be not greater than 10 mm.

g) A 6 mm diameter twist drill with included cutting angle of 160°.
h) Equipment for maintaining the temperature of the specimens and test area at 20 ±2 °C.
i) A length of rigid plastic pipe per test area to be used as a solution container (approximate dimensions 60 mm long x 50 mm nominal bore).
j) Elastomeric adhesive for fixing the plastic pipe to the test surface, e.g. a silastic silicone rubber grade RTV 738 or RTV 732 or equivalent material.
k) Fixed resistor, 1 Ω ±2%, 1 W (one required for each test area).

Reagent

An electrolyte, comprising a sodium chloride (NaCl) solution (3% W/V). 30 g of NaCl should be dissolved in distilled water and made up to 1 litre.

Preparation of test panels

a) Laboratory prepared specimens
Sample panels 300 mm x 50 mm x 6 mm should be prepared simulating the conditions of application for a factory coated pipe.
b) Specimens taken from components
Test panels 300 mm x 50 mm should be cut from a sample production coated pipe.

Preparation of test areas

a) Test the prepared panels for holidays with the holiday detector set at the required voltage (see clause E.1.3.3).
b) Fix two lengths of rigid plastic tube perpendicular to the coated surface using a suitable elastomeric adhesive (see Figure E.2). Place them with their centres on the centre line of the panel width and equidistant from the panel ends and each other and leave for a period of 12 h to allow the adhesive to fully cure.
c) Drill a 6 mm diameter hole through the coating to the metal surface in the centre of each test area using the drill specified in E.1.3.8 g.

Initial test procedure

a) Fill each plastic tube with NaCl electrolyte to a depth of approximately 50 mm (see E.1.3.8 k) with the apparatus set up as shown in Figure E.2 a). Bring the temperature of the specimens and test area to 20 ±2 °C Maintain this temperature throughout the test period.
b) Connect a voltmeter and reference electrode to each test rig in turn as shown in Figure E.2 b)
With the tip of the calomel reference electrode positioned approximately 10 mm from the centre of the hole, adjust the voltmeter reading to read a negative voltage of 1500 mV with respect to the calomel electrode. Carry this out using the variable resistance shown in Figure E.1 a).
c) Record, at intervals of 24 h, the voltmeter indication for each test area and adjust the variable resistor to correct any drift from the negative voltage setting of 1500 mV. Also record, every 24h, the current flow by measuring the voltage drop across the 1 Ω fixed resistor.
d) Every 24 h check the plastic tube for loss of electrolyte and restore the level with distilled water as necessary.

Investigation procedure

a) After seven days, remove the electrolyte and plastic tube from one test site and remove any excess moisture.
b) For all coatings in excess of 600µm thickness use the following method:

I. Using a small hacksaw blade (e.g. 'junior' type or similar), make two cuts across the 6 mm hole at an angle of approximately 30° to each other to form a truncated 'X'. Make the cuts through to the metal surface and to extend radially from the 6 mm hole.

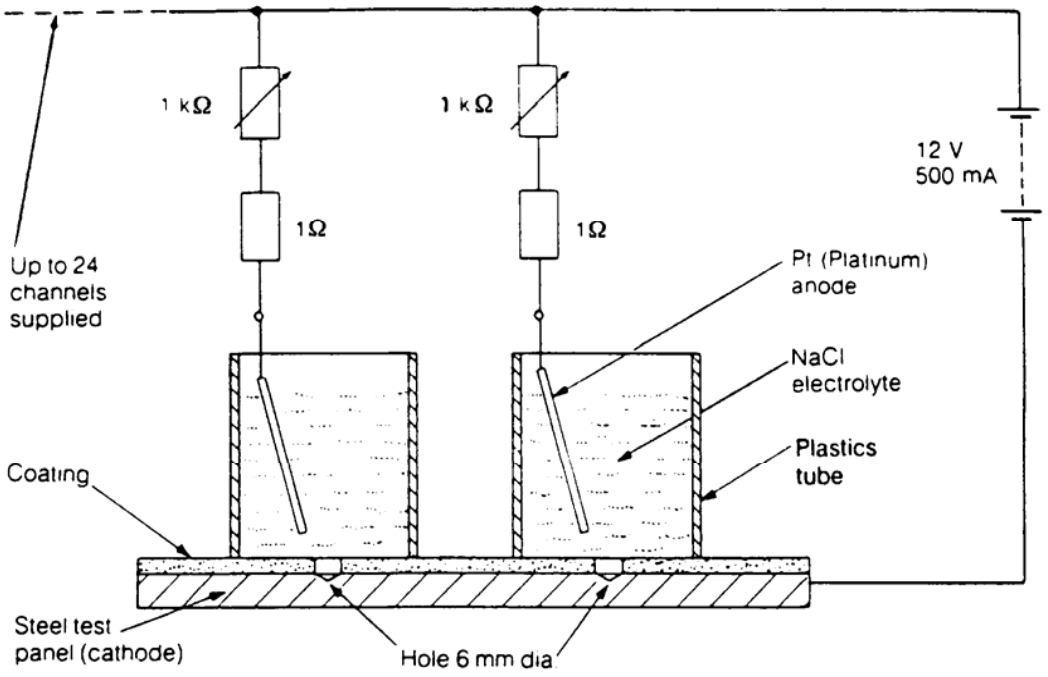
II. To ensure that the hacksaw blade has reached the metal surface, draw the point of the sharp knife along the cut lines.

III. Starting at the base of the truncated V, force the coating from the steel substrate using the sharp pointed knife. Take care to protect the eyes and hands when carrying out this operation.

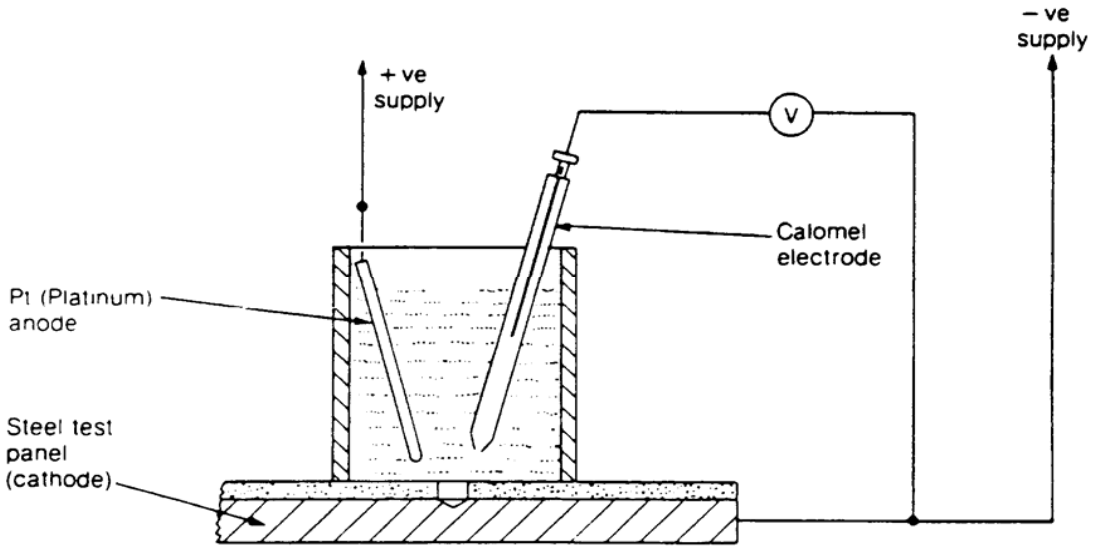
c) Repeat the investigation procedure at the second test site after 28 days.

Reporting results

The amount of disbonding should be quoted as the radial distance (from the edge of the pre-damage) over which the coating peels easily from the metal surface.



a) Cathodic disbonding test rig



b) Voltage adjustment circuit

FIGURE E.2 - Cathodic disbonding test apparatus

E.1.3.9Water immersion test

The coated test pieces shall be prepared and subjected to a water immersion test as detailed below. The coating shall show no loss of adhesion greater than 3 mm after 28 days.

The equipment and procedure detailed below inclusive should be used to assess the comparative resistance of coatings applied to components (free of holidays) to loss of adhesion due to water absorption.

Equipment

The following equipment will be required:

a) A water bath which should be maintained at a temperature of 50 ±2 °C.
b) A holiday detector.
c) A 6 mm diameter twist drill.
d) A pointed sharp knife, e.g. Stanley type or similar.
e) A 5 mm diameter steel rod 450 mm long.
   Elastomeric adhesive for repairing test areas, e.g. Silastic silicone-rubber, grades RTV 738 or RTV 732 or equivalent.

Sample preparation

a) Laboratory prepared specimens
   Prepare 300 mm x 50 mm x 6 mm panels under conditions of application and cure similar to those for a coated component.
b) Specimens taken from components
   Cold cut 300 mm x 50 mm specimens from a sample pipe or, in the case of a fitting, from the pipe pup which has been coated as a test piece.

Preparation of test area

a) To ensure freedom from holidays, test the prepared panels for holidays with the holiday detector set at the required voltage (see clause E.1.3.3).
b) Drill a 6 mm diameter hole through the test panel within 25 mm of one end.
c) Protect the bare metal of the panel with internal coating material (Internal pipe coating material (complying with */SP/CM2).

Initial test procedure

a) Carry out an initial adhesion test as described in clause E.1.3.6.
b) Using the steel rod fitted through the 6 mm diameter hole, suspend the specimen panel in the water bath immersing all but the top 50 mm of the panel.
c) After 7 days, remove the panel from the water bath and allow it to cool to ambient temperature.
   No longer than 30 minutes should be allowed between removing the test panel from the bath and performing the adhesion test.
d) Test the coating adhesion as specified in the investigation procedure below.
e) Repair the test area using elastomeric adhesive.
f) Return the panel to the water bath immediately.
g) If, after seven days immersion, the coating is retested and is found to be satisfactory, return the panel to the water bath and repeat the adhesion test at intervals of seven days up to a total immersion time of 28 days. If the coating fails the requirements of this standard at any test interval within the 28 days, it should be removed from test.

Investigation procedure

For laboratory panels with coatings greater than 600µm thickness use the following procedure:

a) Using a small hacksaw blade (e.g. 'junior' type or similar) make two incisions through to the metal surface to form an X with an angle of approximately 30° at the point of intersection.
b) Draw a sharp knife along the cut lines to ensure that the hacksaw blade has reached the metal surface.
c) Starting at the point of intersection, force the coating from the steel substrate using the sharp pointed knife. Take care to protect the eyes and hands when carrying out this operation.

Reporting results

Refusal of the coating to peel or a cohesive failure within the coating should be recorded as a 'Pass'.

Cohesive failure, caused by voids leaving a honeycomb structure on the specimen surface, should constitute a failure.

For the purpose of this test, cohesive failure will be recorded where some coating material remains on the metal surface and where difficulty in coating removal has been experienced.

The extent of the adhesive failure between the coating and the metal substrate should be recorded.

Adhesive loss greater than 3 mm shall be recorded as a 'Failure'.

E.2 Production coating procedure to */SP/CW/6 part 2

E.2.1 Protection of weld end preparations

Weld end preparations shall be protected from mechanical damage during handling and storage. The weld end preparations should also be protected during blast cleaning and coating operations. The methods used should also ensure that no damage occurs to the internal surface of the components.

Protection during handling and storage should be in accordance with IGEM/TD/1 Supplement 1. Weld end preparations shall be protected from coating during the process by a method, which should not be detrimental to the coating process and the subsequent coating performance. The coating should not be applied within 150 ±15 mm in the case of multi-component liquid coatings or where automatic ultrasonic testing is to be used for non-destructive testing of circumferential welds.

E.2.2 Surface preparation

E.2.2.1 General

The surface of the valve to be coated shall be prepared as detailed in E.2.2.2 to 2.2.6 below. Components shall be blast cleaned to a minimum standard BS EN ISO 8501 Sa 2½ using 100% grit in the final stage of blast cleaning. The surface profile should be within the range 75 µm to 100 µm peak to trough height and angular in nature.

E.2.2.2 Contaminant removal

Where oil, grease or other contaminants are present, they shall be removed, without spreading them over the surface, with a suitable solvent. For components which have been subjected to contamination, the contaminant shall be removed by washing either with potable water or a chemical cleaner. If a chemical cleaner is used, subsequent washing with potable water will be necessary. The component shall be dried before blast cleaning.

E.2.2.3 Surface inspection

The metal surface shall be inspected immediately after blast cleaning and all slivers, scabs, etc., made visible by blast cleaning and detrimental to the coating process shall be removed by grinding. After the removal of defects, the remaining wall thickness should comply with the relevant component specification. Any rectified areas shall be blast cleaned to meet the requirements of E.2.2.1.

E.2.2.4 Defects

Any component found to have defects which exceed the levels permitted in the relevant component specification shall be set aside for examination.

E.2.2.5 Pre-coating cleaning

Directly before coating, any dust, grit or other contaminants shall be removed from the component surface by a method established as acceptable by the relevant coating procedure trial and recorded in the relevant coating procedure.

The pipe should not come in contact with materials likely to contaminate the pipe surface, in particular adhesives and rubbers which may lead to blistering of the factory coating during the girth weld coating process.

E.2.2.6 Rust blooming or further surface contamination

Where rust blooming or further surface contamination (see E.2.1.2) has occurred, the component shall be cleaned again in accordance with E.2.2.2 if applicable and again blast cleaned in accordance with E.2.2.1.

Coating should take place before any contamination or rust blooming occurs (typically within 4 hours).

E.2.3 Coating process

E.2.3.1 General

The production coating process shall be carried out using a procedure approved in the qualification procedure. This shall normally be a by spray application coating process, but brush application may be used on small areas.

The thickness of the coating shall be not less than 1.5 mm.

E.2.3.2 Pre-mix agitation

Each coating component shall, when necessary, be mixed to a homogeneous state before any part of the component is withdrawn from its container.

E.2.3.3 Mixing for use

The components (e.g. base and curing agent) of a coating material are normally supplied separately packed.

They shall be mixed in accordance with the Manufacturer's instructions.

If preheating of one or more of the coating material components is required prior to mixing and application, the procedure shall be monitored and controlled to avoid excessive heating which might affect application or the integrity of the coating.

Material cure time is dependent on ambient temperature. Should it be necessary to shorten the cure time, this may be achieved by the application of heat to the prepared surface before coating commences.

Thinners shall not be used unless recommended by the Manufacturer.

E.2.3.4 Spraying equipment

The spraying equipment shall be adequate for applying the application of the coating in accordance with the coating material, the Manufacturer’s instructions and the qualified coating qualification procedure.

The equipment shall be maintained in good order by the Contractor and/or the equipment supplier. All air lines shall be provided with filters and vapour traps to ensure that the air is free from oil and moisture. All critical parameters shall be monitored.

Tools and equipment shall be cleaned using only such solvents as are recommended by the coating material manufacturer.

E.2.3.5 Operator qualifications

Individual operators shall be experienced in the use of multi component liquid spraying equipment and shall be suitably qualified. The Coating applicator shall maintain a register of qualified operators together with a record of their qualification tests.

Required qualification tests are as detailed in Clauses E.1.3.1 to E.1.3.9.

This register shall me made available for review by the Gas Transporter as required.

E.2.3.6 Spraying procedure

E.2.3.6.1. The spraying procedure shall be in accordance with the qualified coating qualification procedure which and shall include a total time allowed for coating.

E.2.3.6.2. Solvent flushing of spray equipment used for rapid cure materials is normally employed to prevent coating material gelling in the gun when spray operations cease for significant periods of time. It is essential that, on recommencement of spraying, the operator ensures that solvent-free material only is applied to the work to avoid ensuing problems caused by solvent blistering of the coating. Additionally, all solvent flushing operations shall be carried out by discharging the solvent into a suitable container. Solvent shall not be discharged at random on to the surrounding work area.

E.2.3.6.3. Coating material filters shall be installed as part of the spray equipment to ensure that particles which would be detrimental to the coating application are not deposited on to the surfaces being coated. Regular inspection and maintenance of the filters is recommended.

E.2.3.6.4. The coating component feed lines to the spray-gun shall be equipped with a pressure gauge fitted with a pulsation damper, to facilitate pressure readings. The location of this gauge shall be downstream of all pressure drop devices and as near to the gun tip as is reasonably practicable.

E.2.3.6.5. The coating contractor shall monitor and record all relevant ambient conditions during application and cure.

E.2.3.6.6. The temperature of the metal surface at the time of application shall be not lower than 10ºC. Ideally, for optimum results, the metal surface temperature should be between 25ºC and 35ºC, but, it is essential that care be taken to avoid contaminating the surface. The relative humidity shall be 80% or less during application and the ensuing first hour of cure time.

E.2.3.6.7. Coating operations shall be stopped when the conditions are such that an inferior coating will result. Such conditions include inadequate surface preparation, unsatisfactory application procedure, poor coating material performance and when the steel temperature at any stage of the process falls to within 3oC of the dew point measured in the work area.

E.3 Visual inspection

The coating colour and appearance shall be uniform and free from runs, sags, blistering, roughness, foaming and general film defects.

E.4 Testing of cured coatings

Cured coatings on valves shall comply with the requirements of E.1.3.2 to E.1.3.6 inclusive. In addition, a heat blister test shall be carried out once per shift.

The Contractor shall ensure that the tests are carried out and a coating report is included in the valve data books.

E.5 Repair of defects

All repairs to holidays and other coating defects shall be with multi-component liquid materials to ensure compatibility with the applied coating. Repair methods shall include adequate surface preparation techniques, agreed overlaps, coating thicknesses and a demonstration of satisfactory adhesion and cure. All repairs shall be retested for holidays as detailed in E.1.3.2.

The area to be overlapped shall extend to at least 75 mm from the periphery of the defect. The repair material shall be applied to the prepared surfaces using a scraper, palette knife or paint brush.

Care shall be taken to ensure that the thickness over the repair area is not less than 1.5 mm when cured.

E.6 Handling of coated valves

All coated valves shall be handled and stored to prevent damage to the component and coating. The weld end preparations may be required to be protected from damage and corrosion. The type of protection and the method of application shall be specified by the Gas Transporter.

E.7 Stripping of coating

Rejected coatings shall be removed by a procedure which shall not cause mechanical damage to the valve.

E.8 Identification

The Contractor shall be responsible for ensuring that all internal and external identification markings are noted before the surface preparation begins, and are replaced after the coating process.

Annex - F Type Testing

F.1 Scope of tests

The type tests are intended to verify functional performance – whether the valve will close and seal reliably in service. They are non-destructive so they may be carried out on a production valve, produced for the Gas Transporter or another client, at the manufacturer's premises and with its standard test equipment. All the tests are specified in EN13942:2009.

The test schedule shall be agreed in advance with the Gas Transporter. Tests shall be witnessed by the Gas Transporter or its nominated representative, who may be a third party inspection agency or an independent consultant.

Recommended test schedules, adopted by Gas Transporters, are shown in Tables F3 to F5.

The test schedule shall include for all type of valve:

- Shell test: hydrostatic, for pressure integrity
- Seat tests: hydrostatic and pneumatic, for leakage
- Torque tests: break-out at maximum differential pressure (Class MPD) and extended cycling at zero differential pressure, to verify closure and assess wear

The number and sequence of tests may be varied, by agreement with the Gas Transporter, for other types or configurations of valve or in order to expedite tests.

One set of tests qualifies the following range of valves

- One design e.g. side entry ball valve, trunnion mounted, same basic design, same basic construction
- One pressure class (e.g. Class 600, equivalent to PN 100 for test purposes)
- Tests on the largest and smallest valves in the range will qualify all sizes in-between. Otherwise one valve qualifies that size plus the next one larger and next two smaller sizes.

For valve types other than ball or plug (e.g. check (non-return) valves) relevant tests shall be agreed between the manufacturer and BUYER by reference to API 598.

F.2 Test equipment

The manufacturer shall provide

- Two rigs with dedicated operators, in order to expedite tests without delays.
- Valve actuators of sufficient capacity to carry out break-out at full MPD and the full numbers of cycles within reasonable time
- Direct readings of pressure and torque are essential. Additional recording facilities are preferable.
- Hydrostatic testing to be accurate and sensitive to 1 bar by means of calibrated gauge and/or transducer plus manometer tube
- Pneumatic leak testing by soap bubble or water bubble with minimum (< = 5 mm) immersion.
- Torque measurements by calibrated wrench or transducer. Gearbox mechanical advantage shall be calibrated.

F.3 Test conditions

All valves shall be tested 'dry' without sealant injection. However, where plug valves rely on a sealing compound to effect a seal, it is possible to charge with sealing compound prior to testing.(refer to BS EN 12266-1 table A.3 note 5 BS EN12266-2 table A.2 note 4)

Test pressures and durations shall be not less than shown in Tables F1 and F2

TABLE F.1 – Test Pressures

Class		Test pressure – bar				
ASME	Equivalent PN	Hydrostatic			Pneumatic	
		Breakout Torque	Shell	Seat		
300	50	50	76	55	6	1
400	68	68	100	73	6	1
600	100	100	150	110	6	1
900	150	150	224	166	6	1

TABLE F.2 – Test Durations (Holding Times)

Size		Test Duration – min			
NPS	DN	Hydrostatic		Pneumatic	
		Shell	Seat		
<= 4	<= 100	2	2	2	2
6 – 10	150 –250	5	5	5	5
12 – 18	300 – 450	15	5	5	5
>= 20	>= 500	30	5	5	5

F.4 Test sequence

Standard test sequences for ball and plug valves shown in Tables F.3, 4 and 5. They may be varied by agreement, noting that

- The standard sequences are designed to detect faults early and to re-verify sealing at the end of the tests
- Pneumatic testing at 7 then 1 bar is designed to verify re-sealing after exercising the valve
- Break-out torques include one 12 hour hold in order to simulate the effect seat settlement in service
- The number of torque cycles at 0 bar differential pressure is intended to simulate the effects of valve wear in service.

F.5 Acceptance criteria and levels

Any visible seat leakage is unacceptable.

Torque values shall be within calculated design values

Any failure requires an investigation into the cause of failure and a full retest of a valve of the same size.

TABLE F.3 – Standard Type Test Schedule and Sequence for a Class 600 (PN100) Ball Valve

Test Step	Test	Test pressure (bar)	Description	Comment
1	Hydrostatic shell test	150	Check integrity of valve body.	Always carry out as first test.
2	Hydrostatic seat test 1	110	Both seats tested separately, pressurised from ends of valve.	First high pressure test of valve seats.
3	Double block & bleed test – valve closed	110	Hydrostatic pressure applied at both valve ends. Leakage detection at drain or vent valve outlet.	Carried out after individual seat hydrostatic test.
4	Ball Valves, Valve Seat Test – open	110	Hydrostatic pressure applied to bore of valve in fully open position.	Test not possible if valve designed so that cavity is pressurised when ball is in open position.
5a	Double piston test	110	Hydrostatic pressure applied to cavity. Leakage detection from bore of valve.	Valve must have two double piston seats for this test. Alternatively use 5b.
5b	Seat self-relieving test	As result.	Hydrostatic pressure gradually applied to cavity, bore at atmospheric pressure. Seat seal relief pressure recorded.	Only possible on valves with self-relieving seals on seats, Alternatively use 5a.
6	Breakout torque test 1	100	Torque measured to partly open valve from fully closed position with hydrostatic pressure at one end of valve at a time.	Three tests per seat. Total six tests.
7	Pneumatic seat test 1	1 and 6	Tests carried out at 1 bar and 6 bar on both seats, pressurised from ends of valve, with valve in closed position. It is important that 1 bar test is done first on each seat.	Ensures integrity of valve after first breakout tests so that tests should continue. Four tests required in total. Example of order of testing: Seat A: 1 bar, 6 bar; Seat B: 1 bar, 6 bar
8	Cycling Test 1	0	Atmospheric pressure. Maximum torque measured for first cycle and thereafter every tenth cycle. Total 25 cycles.	May be curtailed on larger valves with agreement of the Gas Transporter if large proportion of this test is complete and torques are consistently within design values. Test 11 will still be required. (See below.)
9	Breakout torque test 2	100	Torque measured to partly open valve from fully closed position with hydrostatic pressure at one end of valve each time.	Three tests per seat. Total six tests.
10	Hydrostatic seat test 2	110	Both seats tested separately, pressurised from ends of valve.	Second high pressure test of valve seats. (See Test 2)
11	Cycling Test 2	0	Atmospheric pressure. Maximum torque measured for first cycle and thereafter every tenth cycle. Total 25 cycles.	May be curtailed on larger valves with agreement of the Gas transporter if large proportion of this test is complete and torques are consistently within design values. Second of two tests.
12	Pneumatic seat test 2	1 and 6	Tests carried out at 1 bar and 6 bar on both seats, pressurised from ends of valve, with valve in closed position. It is important that 1 bar test is done first on each seat.	Ensures final integrity of valve after all other tests have been completed. Four tests required. Example of order of testing: Seat A: 1 bar, 6 bar; Seat B: 1 bar, 6 bar
13	Examination	-	Valve dismantled for examination of working surfaces and to provide a photographic record.	May be waived for valves 400 mm or larger if valve has satisfied test procedure satisfactorily.

TABLE F.4 – Standard Type Test Schedule and Sequence for a Class 600 (PN 100) Single Plug Valve

Test Step	Test	Test pressure (bar)	Description	Comment
1	Hydrostatic shell test	150	Check integrity of valve body.	Carry out as first test without exception.
2	Hydrostatic seat test 1	110	Both seats tested separately, pressurised from ends of valve.	First high pressure test of valve seats.
3-5b	N/A			
6	Breakout torque test 1	100	Torque measured to partly open valve from fully closed position with hydrostatic pressure at one end of valve at a time.	Three tests per seat. Total six tests.
7	Pneumatic seat test 1	1 and 6	Tests carried out at 1 bar and 6 bar on both seats, pressurised from ends of valve, with valve in closed position. It is important that 1 bar test is done first on each seat.	Ensures integrity of valve after first breakout tests so that tests should continue. Four tests required in total. Example of order of testing: Seat A: 1 bar, 6 bar; Seat B: 1 bar, 6 bar
8	Cycling Test 1	0	Atmospheric pressure. Maximum torque measured for first cycle and thereafter every tenth cycle. Total 120 cycles.	May be curtailed on larger valves with agreement of the Gas Transporter if large proportion of test complete and torques consistently within design values. Test 11 will still be required. (See below.)
9	Breakout torque test 2	100	Torque measured to partly open valve from fully closed position with hydrostatic pressure at one end of valve at a time.	Three tests per seat. Total six tests.
10	Hydrostatic seat test 2	110	Both seats tested separately, pressurised from ends of valve.	Second high pressure test of valve seats. (See Test 2)
11	Cycling Test 2	0	Atmospheric pressure. Maximum torque measured for first cycle and thereafter every tenth cycle. Total 120 cycles.	May be curtailed on larger valves with agreement of the Gas transporter if large proportion of this test is complete and torques are consistently within design values. Second of two tests.
12	Pneumatic seat test 2	1 and 6	Tests carried out at 1 bar and 6 bar on both seats, pressurised from ends of valve, with valve in closed position. It is important that 1 bar test is done first on each seat.	Ensures final integrity of valve after all other tests have been completed. Four tests required in total. Example of order of testing: Seat A: 1 bar, 6 bar; Seat B: 1 bar, 6 bar
13	Examination	-	Valve dismantled for examination of working surfaces and photographic record of test.	May be waived for valves 400 mm or larger if valve has satisfied test procedure satisfactorily.

Table F.5 - Standard Type Test Schedule and Sequence for a Class 600 (PN 100) Double Isolation Plug Valve

Test Step	Test	Test pressure (bar)	Description	Comment
1	Hydrostatic shell test	150	Check integrity of valve body.	Carry out as first test without exception.
2	Hydrostatic seat test 1	110	All four seats tested separately, pressurised from appropriate end of valve with one plug in closed position and one open.	First high pressure test of valve seats. Total four tests.
3	Double block & bleed test – closed	110	Hydrostatic pressure applied at both valve ends. Leakage detection at bleed valve outlet.	Carried out after individual seat hydrostatic test.
4-5b	N/A			
6	Breakout torque test 1	100	Torque measured to partly open one plug from fully closed position. Hydrostatic pressure at one end of valve at a time.	Three tests per seat. Total twelve tests.
7	Pneumatic seat test 1	1 and 6	Tests carried out at 1 bar and 6 bar on both seats, pressurised from ends of valve, with valve in closed position. It is important that 1 bar test is done first on each seat.	Ensures integrity of valve after first breakout tests so that tests should continue. Four tests required in total. Example of order of testing: Seat A: 1 bar, 6 bar; Seat B: 1 bar, 6 bar
8	Cycling Test 1	0	Atmospheric pressure. Maximum torque measured for first cycle and thereafter every tenth cycle. 120 cycles per plug. Total 240 cycles. Carried out separately on both plugs, although plugs may be cycled at same time.	May be curtailed on larger valves with agreement of National Grid if large proportion of test complete and torques consistently within design values. Test 11 will still be required. (See below.)
9	Breakout torque test 2	100	Torque measured to partly open one plug from fully closed position. Hydrostatic pressure at one end of valve at a time.	Three tests per seat. Total twelve tests.
10	Hydrostatic seat test 2	110	All four seats tested separately, pressurised from appropriate end of valve with one plug in closed position and one open.	Second high pressure test of valve seats. Total four tests. (See Test 2)
11	Cycling Test 2	0	Atmospheric pressure. Maximum torque measured for first cycle and thereafter every tenth cycle. 120 cycles per plug. Total 240 cycles. Carried out separately on both plugs, although plugs may be cycled at same time.	May be curtailed on larger valves with agreement of the Gas transporter if large proportion of this test is complete and torques are consistently within design values. Second of two tests. (See Test 8)
12	Pneumatic seat test 2	1 and 6	Tests carried out at 1 bar and 6 bar on both seats, pressurised from ends of valve, with valve in closed position. It is important that 1 bar test is done first on each seat.	Ensures final integrity of valve after all other tests have been completed. Eight tests required in total. Example of order of testing: Plug A Seat 1: 1 bar, 6 bar; Plug A Seat 2: 1 bar, 6 bar etc.
13	Examination	-	Valve dismantled for examination of working surfaces and photographic record of test.	May be waived for valves 400 mm or larger if valve has satisfied test procedure satisfactorily.