



CPC ENGINEERING SPECIFICATION	
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## SCOPE

This procedure covers the "in-plant" engineering test requirements per API 6A, 19th Edition, for new CPC Gate Valves - Type "B", "DB", and "HB." All the API 6A test requirements, quality control, and general performance for valve assemblies are included.

## QUALITY CONTROL TEST REQUIREMENTS

### Note on Pressure Stabilization:

Pressure shall be considered stabilized when the change rate is no more than 5% of the testing pressure per hour or 500 psi/hour (3.5 MPa/hour), whichever is less. (See Table 6 for shorter holding period).

## 1.0 HYDROSTATIC PRESSURE TEST

**NOTE:** If the valve is hydraulically operated, go to Section 8.0 to complete the hydraulic actuator hydrostatic test, first.

### 1.1 Hydrostatic Test Pressures

- 1.1.1 The hydrostatic test pressure shall be determined by the rated working pressure of the valve assembly (see Table 1).
- 1.1.2 For a member with end or outlet connections having different working pressures, the lowest working pressure rating shall be used to determine the hydrostatic body test pressure.
- 1.1.3 The test pressure shall not be applied as a differential pressure across the gate.

- 1.2 Hydrostatic testing shall be completed prior to painting; however, pressure containing parts have been made of wrought material may be painted prior to hydrostatic testing. After hydrostatic testing, the valve may be disassembled in order to complete the painting of any remaining components prior to seat testing of the fully assembled valve. Also, painted valve assemblies from stock may be retested without removing the paint.
- 1.3 Pressure holding periods shall not start until the test pressure has been reached and allowed to stabilize. External surfaces shall be dried thoroughly before testing.

### 1.4 Hydrostatic Body Test Procedure

- 1.4.1 Assemble valve sufficiently to completely seal pressure containing components. For hydrostatic testing purposes only, non-pressure containing components may be omitted or substituted as necessary to ensure a complete pressure seal. Tighten the bonnet bolts fully according to torque recommendations in Table 7.



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**1.4.2** Flange up all connections and assemble to test stump utilizing appropriate size ring joint gaskets. Refer to Tables 2 and 3 for ring gasket size and/or CPC part numbers.

**NOTE:** Rubber coated API ring joint gaskets are **NOT** permitted.

**1.4.3** The valve and test stump are to be connected with another test apparatus as shown in Figure 1.

**1.4.4** Open valve and set the gate in the one-half open position (if applicable).

**1.4.5** Tap water or water with additives shall be used as the testing fluid.

**1.4.6** Fill valve body with the testing fluid. Make sure all air is expelled from the body. Cycle the valve several times during fill to insure all air is displaced with water.

**1.4.7** For PSL 3 and 4, place chart, identified with serial number and/or factory order number, on recorder.

**1.4.8** Place safety test bell, or another protective device, over the valve.

**1.4.9** Pressurize to shell test pressure as determined by valve assembly working pressure and end connections per Section 1.1. Hold pressure for a minimum period of three (3) minutes. Check for leaks. Bleed to zero pressure.

**1.4.10** Re-pressurize to shell test pressure as in Section 1.4.9. For PSL 1 and 2, hold for a minimum period of three (3) minutes. For PSL 3 and 4, hold for a minimum of fifteen (15) minutes. Check for leaks. Bleed to zero pressure.

**1.5** For PSL 4, continue to Section 4.0, "Gas Body Test."

## **2.0 HYDROSTATIC SEAT TEST, BOTTOM SEAT**

**2.1** Fill body with testing fluid. Make sure all air is expelled. Cycle the valve several times during fill to insure all air is displaced with water.

**2.2** For PSL 3 and 4, place chart, identified with serial number and/or factory order number, on recorder (can be same chart as in 1.4.7).

## **2.3 PSL 1**

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**2.3.1** Set the gate in the closed position and open drain line on bottom side of gate to atmosphere.

**2.3.2** Apply rated working pressure of valve (see Table 1) to top side of gate. Hold for a minimum period of three (3) minutes. Check for leaks. Bleed to zero pressure.

**2.3.3** Repeat step 2.3.2.

#### **2.4 PSL 2**

**2.4.1** Set the gate in the closed position and open drain line on bottom side of gate to atmosphere.

**2.4.2** Apply rated working pressure of valve to top side of gate. Hold for a minimum period of three (3) minutes. Check for leaks. While under full differential pressure across the gate, open valve and bleed to zero pressure.

**2.4.3** Close valve and repeat step 2.4.2.

**2.4.4** Close valve and apply rated working pressure of valve (see Table 1) to top side of gate. Hold for a minimum period of three (3) minutes. Check for leaks. Bleed to zero pressure.

#### **2.5 PSL 3-4**

**2.5.1** Set the gate in the closed position and open drain line on bottom side of gate to atmosphere.

**2.5.2** Apply rated working pressure of valve to top side of gate. Hold for a minimum period of three (3) minutes. Check for leaks. While under full differential pressure across the gate, open valve and bleed to zero pressure.

**2.5.3** Close valve and repeat step 2.5.2 but the holding period shall be extended to a minimum of fifteen (15) minutes.

**2.5.4** Apply rated working pressure of valve (see Table 1) to top side of gate. Hold for a minimum period of fifteen (15) minutes. Check for leaks. Bleed to zero pressure.

#### **2.6 Additional Low-Pressure Test for UK-DEN Requirements Only**

**2.6.1** Cycle valve several times to insure no pressure is trapped inside.

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**2.6.2** Apply 300 psi (2.1 MPa) - 350 psi (2.4 MPa) to bottom side of seat. Hold for a minimum of three (3) minutes. Check for leaks. Bleed pressure to zero.

**2.7** The assembly is acceptable if there is no visible evidence of leakage during each holding period. Continue to Section 3.0, "Hydrostatic Top Seat Test."

### **3.0 HYDROSTATIC SEAT TEST, TOP SEAT**

#### **3.1 PSL 1**

**3.1.1** Set the gate in the closed position and open drain line on top side of gate to atmosphere.

**3.1.2** Apply rated working pressure of valve to bottom side of gate. Hold for a minimum period of three (3) minutes. Check for leaks. Bleed to zero pressure.

**3.1.3** Repeat step 3.1.2.

#### **3.2 PSL 2**

**3.2.1** Set the gate in the closed position and open drain line on top side of gate to atmosphere.

**3.2.2** Apply rated working pressure of valve to bottom side of gate. Hold for a minimum period of three (3) minutes. Check for leaks. While under full differential pressure across the gate, open valve and bleed to zero pressure.

**3.2.3** Close valve and repeat step 3.2.2.

**3.2.4** Close valve and apply rated working pressure of valve to bottom side of gate. Hold for a minimum period of three (3) minutes. Check for leaks. Bleed to zero pressure.

#### **3.3 PSL 3-4**

**3.3.1** Set the gate in the closed position and open drain line on top side of gate to atmosphere.

**3.3.2** Apply rated working pressure of valve to bottom side of gate. Hold for a minimum period of three (3) minutes. Check for leaks. While under full differential pressure across the gate, open valve and bleed to zero pressure.



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- 3.3.3 Close valve and repeat step 3.3.2 but the holding period shall be extended to a minimum of fifteen (15) minutes.
- 3.3.4 Apply rated working pressure of valve to bottom side of gate. Hold for a minimum period of fifteen (15) minutes. Check for leaks. Bleed to zero pressure.

#### **3.4 Additional Low-Pressure Test for UK-DEN Requirements Only**

- 3.4.1 Cycle valve several times to insure no pressure is trapped inside.
- 3.4.2 Apply 300 psi (2.1 MPa) - 350 psi (2.4 MPa) to top side of seat. Hold for a minimum of three (3) minutes. Check for leaks. Bleed pressure to zero.
- 3.5 The assembly is acceptable if there is no visible evidence of leakage during each holding period.
- 3.6 For PSL 4, continue to Section 5.0, "Seat Gas Test."

### **4.0 GAS BODY TEST (PSL 4)**

#### **4.1 Test Pressures**

- 4.1.1 The test pressure shall be the rated working pressure for the assembly (see Table 1).
- 4.1.2 For a member with end or outlet connections having different working pressures, the lowest pressure rating shall be used to determine the test pressure.
- 4.2 The pressure holding period shall not start until the test pressure has been reached and allowed to stabilize.
- 4.3 The test shall be conducted at ambient temperature.
- 4.4 The test medium shall be nitrogen.
- 4.5 The test shall be conducted with the assembly completely submerged in a water bath.

#### **4.6 Test Procedure**



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- 4.6.1** The valve and test stump are to be connected with another test apparatus as shown in Figure 1.
- 4.6.2** Blind flanges or other suitable end closures are to be used with the valve end or outlet connections.
- 4.6.3** Open valve and set the gate in the one-half open position.
- 4.6.4** Place chart, identified with serial number and/or factory order number, on recorder (can be same chart as in 1.4.7).
- 4.6.5** Place safety test bell, or another protective device, over component.
- 4.6.6** Pressurize to test pressure as determined by the working pressure and end connection per Section 4.1. Hold for a minimum period of fifteen (15) minutes. Check for leaks. Bleed to zero.
- 4.6.7** The assembly is acceptable if there are no visible bubbles in the water bath during the holding period.

## **5.0 GAS SEAT TEST (PSL 4), BOTTOM SEAT**

- 5.1** The test pressure shall be the rated working pressure for the assembly (see Tables 1 and 4).
- 5.2** The pressure holding period shall not start until the test pressure has been reached and allowed to stabilize.
- 5.3** The test shall be conducted at ambient temperature.
- 5.4** The test medium shall be nitrogen.
- 5.5** The test shall be conducted with the assembly completely submerged in a water bath.

## **5.6 Test Procedure**

- 5.6.1** The valve and test stump are to be connected with other test apparatus as shown in Figure 1.
- 5.6.2** Blind flanges or other suitable end closures are to be used with the valve end or outlet connections.
- 5.6.3** Place chart, identified with serial number and/or factory order number, on recorder (can be same chart as in 1.4.7).



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- 5.6.4 Set the gate in the closed position and open drain line on bottom side of gate to atmosphere.
- 5.6.5 Apply rated working pressure of valve (see Table 1) to top side of gate. Hold for a minimum period of sixty (60) minutes. Check for leaks. While under full differential pressure across the gate, open valve and bleed to zero pressure.
- 5.6.6 Close valve and apply between 5% and 10% of the rated working pressure (see Table 4). Hold for a minimum period of sixty (60) minutes. Check for leaks. While under full differential pressure across the gate, open valve and bleed to zero pressure.
- 5.6.7 The assembly is acceptable if there are no visible bubbles in the water bath during the holding period so continue to Section 6.0, "Gas Top Seat Test."

## 6.0 GAS SEAT TEST (PSL 4), TOP SEAT

### 6.1 Test Procedure

- 6.1.1 Set the gate in the closed position and open drain line on top side of gate to atmosphere.
- 6.1.2 Apply rated working pressure of valve (see Table 1) to bottom of gate. Hold for sixty (60) minutes. Check for leaks. While under full differential pressure across the gate, open valve and bleed to zero pressure.
- 6.1.3 Close valve and apply between 5% and 10% of the rated working pressure (see Table 4). Hold for a minimum period of sixty (60) minutes. Check for leaks. While under full differential pressure across the gate, open valve and bleed to zero pressure.
- 6.1.4 The assembly is acceptable if there are no visible bubbles in the holding periods. Continue to Section 7.0, "Gas Back Seat Test."

## 7.0 GAS BACK SEAT TEST (PSL 4)

- 7.1 The test pressure shall be the rated working pressure for the assembly (see Tables 1 and 4).
- 7.2 The pressure holding period shall not start until the test pressure has been reached and allowed to stabilize.
- 7.3 The test shall be conducted at ambient temperature.

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**7.4** The test medium shall be nitrogen.

**7.5** The test shall be conducted with the assembly completely submerged in a water bath.

#### **7.6 Test Procedure**

**7.6.1** Remove the back-seat screw test.

**7.6.2** The valve and test stump are to be connected with another test apparatus as shown in Figure 1.

**7.6.3** Blind flanges or other suitable end closures are to be used with the valve end or outlet connections.

**7.6.4** Back seat the stem against the bonnet shoulder.

**7.6.5** Place chart, identified with serial number and/or factory order number, on recorder (can be same chart as in 1.4.7).

**7.6.6** Place safety test bell, or another protective device, over component.

**7.6.7** Apply rated working pressure of valve (see Table 1). Hold for a minimum period of sixty (60) minutes. Check for leaks. Bleed to zero pressure.

**7.6.8** Cycle the valve.

**7.6.9** Back seat the stem against the bonnet shoulder.

**7.6.10** Apply between 5% and 10% of the rated working pressure (see Table 4). Hold for a minimum period of sixty (60) minutes. Check for leaks. Bleed to zero pressure.

**7.6.11** The assembly is acceptable if there are no visible bubbles in the water bath during the holding periods.

#### **8.0 HYDRAULIC ACTUATOR HYDROSTATIC TEST**

**8.1** Pressure holding periods shall not start until test pressure has been reached and allowed to stabilize. External surfaces shall be dried thoroughly before testing.

**8.2** The hydraulic test pressure shall be a minimum of 1.5 times the actuator's maximum operating hydraulic pressure (the maximum operating hydraulic pressure for CPC actuator is 3000 psi (20.7 MPa)).



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**8.3** Tap water with or without additives or hydraulic fluid shall be used as the testing fluid.

**8.4 Test Procedure**

**8.4.1** Vent “close port” to atmosphere.

**8.4.2** Pressurize the chamber through the “open port” to 4500 psi (31.0 MPa). Hold for a minimum of three (3) minutes. Check for leaks. Bleed to zero pressure.

**8.4.3** Repeat step 8.4.2.

**8.4.4** Vent “open port” to atmosphere.

**8.4.5** Pressurize the chamber through the “close port” to 4500 psi (31.0 MPa). Hold for a minimum of three (3) minutes. Check for leaks. Bleed to zero pressure.

**8.4.6** Repeat step 8.4.5.

**8.4.7** The assembly is acceptable if there is no visible evidence of leakage during each holding period.

**9.0 ACTUATOR FUNCTIONAL TESTS**

Actuator seal and operational tests are concurrent with the valve seat test and are not repeated as independent tests.

**10.0 VALVE ASSEMBLY DRIFT TEST**

**10.1** The diameter and gauge length of the mandrel shall be in accordance with Table 5.

**10.2** The assembly shall be drift tested after it has been operated and pressure tested.

**10.3** With the assembly positioned horizontally, pass the drift mandrel through the bore.

**10.4** The valve assembly is acceptable if the mandrel passes through without being forced.

**10.5** Record the results of the test.

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**TABLE NO. 1**  
**PRESSURE TABLE FOR FLANGE OR**  
**HUB CONNECTIONS**

WORKING PRESSURE (+5%, -0%) PSI (MPa)		SHELL TEST PRESSURE (+5%, -0%) PSI (MPa)	
1,000 (6.9)	+50 (0.3), -0	2,000 (13.8)	+100 (0.7), -0
2,000 (13.8)	+100 (0.7), -0	4,000 (27.6)	+200 (1.4), -0
3,000 (20.7)	+150 (1.0), -0	6,000 (41.4)	+300 (2.1), -0
5,000 (34.5)	+250 (1.7), -0	7,500 (51.7)	+375 (2.6), -0
10,000 (69.0)	+500 (3.5), -0	15,000 (103.4)	+750 (5.2), -0
15,000 (103.4)	+750 (5.2), -0	22,500 (155.0)	+1125 (7.8), -0

**TABLE NO. 2**  
**R & RX RING JOINT GASKETS FOR TESTING**

Flange	Nominal Size in. (mm)	R Low Carbon Steel Cadmium Plated			RX Low Carbon Steel Cadmium
		R or RX Number	Oval	Octagon	
2000 (13.8)	2-1/16 (52)	23	050192	050164	050376
3000 (20.7), 5000 (34.5)	2-1/16 (52)	24	050193	050165	050380
2000 (13.8)	2-9/16 (65)	26	050194	050166	050381
3000 (20.7), 5000 (34.5)	2-9/16 (65)	27	050195	050167	050382
2000 (13.8), 3000 (20.7)	3-1/8 (79)	31	050196	050168	050383
5000 (34.5)	3-1/8 (79)	35	050197	050169	050384
2000 (13.8), 3000 (20.7)	4-1/16 (103)	37	050198	050170	050385
5000 (34.5)	4-1/16 (103)	39	050199	050171	050386
3000 (20.7)	5-1/8 (130)	41	050200	050172	050387
5000 (34.5)	5-1/8 (130)	44	--	--	050388
2000 (13.8), 3000 (20.7)	7-1/16 (179)	45	050201	050173	050373
5000 (34.5)	7-1/16 (179)	46	050202	050174	050389



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**TABLE NO. 3**  
**BX RING JOINT GASKETS FOR TESTING**

Flange		BX Number	Low Carbon Steel Cadmium Plated
Working Pressure Psi (MPa)	Nominal Size in. (mm)		
10,000 (69.0), 15,000 (103.4)	1-13/16 (46)	151	050352
20,000 (138.0)	2-1/16 (52)	152	050353
	2-9/16 (65)	153	050354
	3-1/16 (78)	154	050355
	4-1/16 (103)	155	050366
	7-1/16 (179)	156	050356

**TABLE NO. 4**  
**PRESSURE TABLE FOR LOW PRESSURE SEAT TEST**

Working Pressure Rating Psi (MPa)	Test Pressure Range Psi (MPa)
1,000 (6.9)	100-200 (0.7-1.4)
2,000 (13.8)	200-400 (1.4-2.8)
3,000 (20.7)	300-600 (2.1-4.1)
5,000 (34.5)	500-1000 (3.5-6.9)
10,000 (69.0)	750-1500 (5.2-10.3)
15,000 (103.4)	1125-2250 (7.8-15.5)



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**TABLE NO. 5**  
**DRIFT TEST MANDRELS**

Valve Bore Diameter in. (mm)	Mandrel Diameter in. (mm)	Minimum Mandrel Length in. (mm)
1-13/16 (46)	1.78 (45.20)	3.00 (76)
2-1/16 (52)	2.03 (51.60)	3.00 (76)
2-9/16 (65)	2.53 (64.30)	3.00 (76)
3-1/16 (78)	3.03 (77.00)	3.06 (78)
4-1/16 (103)	4.03 (102.40)	4.06 (103)
5-1/8 (130)	5.09 (129.40)	5.12 (130)
7-1/16 (179)	7.03 (178.60)	7.06 (179)

**TABLE 6**  
**ALLOWABLE CHANGE RATE FOR PRESSURE STABILIZATION**

TESTING PRESSURE PSI (MPa)	ALLOWABLE CHANGE RATE (5% of Testing Pressure per Hour or 500 psi (3.5 MPa) per Hour)			
	PER HOUR Psi (MPa)	5 MIN. psi (MPa)	10 MIN. psi (MPa)	15 MIN. psi (MPa)
1,000 (6.9)	-50 (-0.3)	-5 (-0.03)	-9 (-0.06)	-13 (-0.09)
2,000 (13.8)	-100 (-0.7)	-9 (-0.06)	-17 (-0.12)	-25 (-0.17)
3,000 (20.7)	-150 (-1.0)	-13 (-0.09)	-25 (-0.17)	-38 (-0.26)
4,000 (27.6)	-200 (-1.4)	-17 (-0.12)	-34 (-0.23)	-50 (-0.34)
5,000 (34.5)	-250 (-1.7)	-21 (-0.14)	-42 (-0.29)	-63 (-0.43)
6,000 (41.4)	-300 (-2.1)	-25 (-0.17)	-50 (-0.34)	-75 (-0.52)
10,000 (69.0)	-500 (-3.5)	-42 (-0.29)	-83 (-0.57)	-125 (-0.86)
15,000 (103.4)	-500 (-3.5)	-42 (-0.29)	-83 (-0.57)	-125 (-0.86)
22,500 (155.0)	-500 (-3.5)	-42 (-0.29)	-83 (-0.57)	-125 (-0.86)

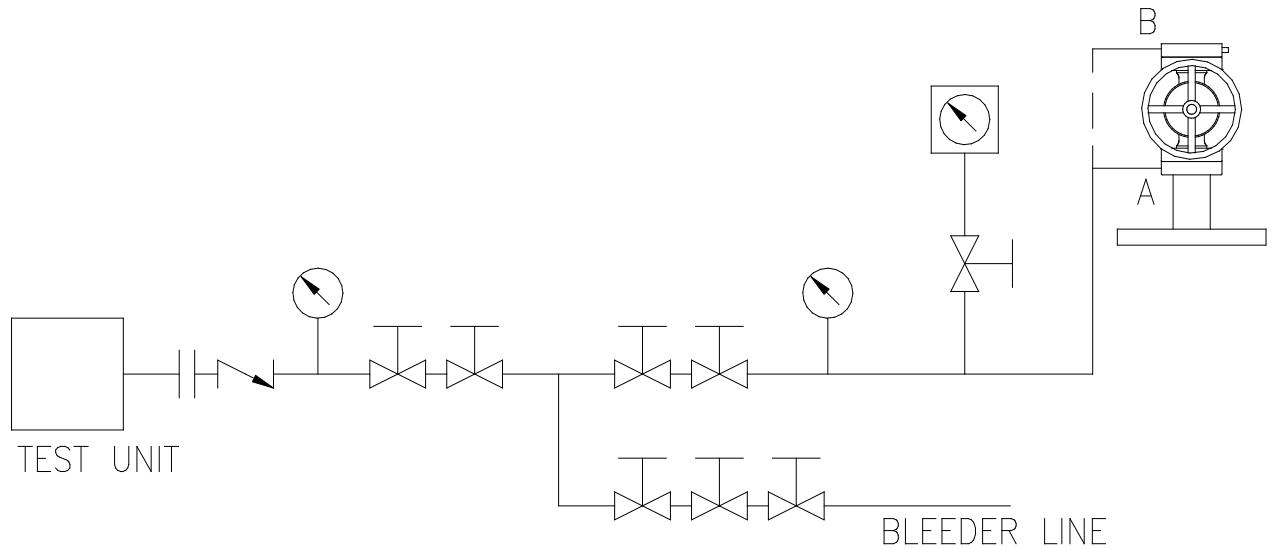


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**TABLE NO. 7**  
**RECOMMENDED TORQUE FOR BONNET BOLTS**  
**USING MOLYPASTE (0.067) LUBRICANT**

Bolt Size	Torque ft-lb (N-m)
7/8 – 9 UNC	325 (440.6)
1 – 8 UNC	475 (644.0)
1-1/4 – 8 UN	850 (1152.5)
1-1/2 – 8 UN	1400 (1898.2)
1-3/4 – 8 UN	2040 (2765.9)

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**FIGURE NO. 1**  
**VALVE AND TEST STOOL CONNECTIONS WITH OTHER APPARATUS**



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## ACCEPTANCE STATEMENT FOR CPC GATE VALVES

Serial Number and/or Factory Order Number: \_\_\_\_\_

1. COMPONENT HYDROSTATIC SHELL TEST P/N:

DESCRIPTION:

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Acceptance Criteria: No visible leakage under the test pressure.

CPC Representative  
Date: \_\_\_\_\_

Third Party Witness  
Date: \_\_\_\_\_

Serial	Number	and/or	Factory	Order	Number:

2. COMPONENT HYDROSTATIC SHELL TEST P/N:

DESCRIPTION:

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Acceptance Criteria: No visible leakage under the test pressure.

CPC Representative  
Date: \_\_\_\_\_

Third Party Witness  
Date: \_\_\_\_\_

Serial	Number	and/or	Factory	Order	Number:

3. COMPONENT HYDROSTATIC SHELL TEST P/N:

DESCRIPTION:

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Acceptance Criteria: No visible leakage under the test pressure.

CPC Representative

Third Party Witness



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Date: \_\_\_\_\_

## ACCEPTANCE STATEMENT FOR CPC GATE VALVES

Serial Number and/or Factory Order Number: \_\_\_\_\_

1. ASSEMBLY WORKING PRESSURE TEST

Acceptance Criteria: No visible leakage under the test pressure.

CPC Representative \_\_\_\_\_  
Date: \_\_\_\_\_

Third Party Witness \_\_\_\_\_  
Date: \_\_\_\_\_

2. GAS BODY TEST

Acceptance Criteria: No visible bubbles under the test pressure while completely submerged in a water bath.

CPC Representative \_\_\_\_\_  
Date: \_\_\_\_\_

Third Party Witness \_\_\_\_\_  
Date: \_\_\_\_\_

3. ASSEMBLY DRIFT TEST

Acceptance Criteria: The drift mandrel shall completely pass through the bore of the assembled valve.

CPC Representative \_\_\_\_\_  
Date: \_\_\_\_\_

Third Party Witness \_\_\_\_\_  
Date: \_\_\_\_\_