



API 682 Seal Qualification Test Certificate

Seal Tested:	CAPI Type A Single		
Nominal Sizes Tested:	50mm (2"), 100mm (4")		
Seal Materials Tested:	Premium Grade Blister Resistant Carbon Graphite Reaction Bonded Silicon Carbide		
API Seal Type:	Type A		
API Seal Configuration(s):	1CW-FL		
API Seal Category:	2, 3		
API Flush Plan(s):	11 & 62		
Test Fluid:	Flashing Hydrocarbon (Propane)	Non-Flashing Hydrocarbon	Non-Flashing Hydrocarbon
Base Pressure:	17 barg (250 psig)	7 barg (100 psig)	7 barg (100 psig)
Base Temperature:	30°C (90°F)	20°C (70°F)	260°C (500°F)
Speed:	3600 rpm	3600 rpm	3600 rpm

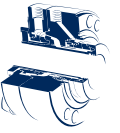
This is to certify that the above seals have been tested in accordance with API 682 requirements.

Stephen Shaw CEng FIMechE CMIOSH BEng (Hons) MBA
Group Engineering Director



ENVIRONMENTAL TECHNOLOGY

Mechanical Seal Qualification Test Form



1CW, 2CW-CW, 3CW-FB, 3CW-FF, 3CW-BB

Test Ref: T2/1/PT00801_3 Revision: 06/23

Manufacturer: AESSEAL plc Seal Type / Model: CAPI Type A Single

Seal Type: A B C ES

Materials of Construction: Primary Seal Faces: Antimony Carbon FH82A/SC2 Reaction Bonded Silicon Carbide Secondary Seal Faces*: N/A

Secondary Seals: Fluoroelastomer Metal Hardware: 316 SS

Seal Size: 50mm Seal Code: 1CW-FL Piping Plan: _____ Shaft Speed: 3600rpm

Pumped Fluid (Table I.2): Nonhydrocarbon (water, caustic acid) Nonflashing Hydrocarbon Flashing Hydrocarbon

Shaft Runout (Figure 19): <0.1mm Sleeve Runout (Figure 19): _____ Chamber Concentricity (Figure 12): <0.1mm Seal Chamber Face Runout (Figure 14): _____

Test Fluid: Propane °C (°F): 30 / (86) Base-point Pressure MPa (bar) (psi): 1.7 / (17) / (247)

Relative Density (SG): _____ Vapor Pressure: _____ Solids: None Particle Size: N/A *Dual Seals

DYNAMIC TEST 100 h minimum			Pressure barg (psig)	Process Temp. °C (°F)	Flush Temp. IN °C (°F)	Flush Temp. OUT °C (°F)	Flush Flow Rate m ³ /h (U.S. gal/min)	Seal Chamber Temp. °C (°F)	Barrier Fluid Pressure barg (psig)	Barrier Fluid Temp. IN °C (°F)	Barrier Fluid Temp. OUT °C (°F)	Power Consumption kW (hp)	Hydrocarbon Leakage g/day (ppm)	Nonhydrocarbon Leakage cm ³ /min	Circulating Device m ³ /h (U.S. gal/min)
Date	Time														
	Start	Stop													
10-03-2006	15:21		16.99 (246)	30 (86)				30.5 (87)				0.28 (0.38)	3.84 (11)	N/A	
15-03-2006		09:32	16.78 (243)	30 (86)				30.34 (87)				0.28 (0.38)	6.96 (25)	N/A	
STATIC TEST 4 h minimum															
15-03-2006	09:38		16.58 (240)	24 (75)				24.4 (76)				0	24.48 (136)	N/A	
15-03-2006		13:59	16.60 (241)	16 (60)				16.62 (62)				0	29.04 (172)	N/A	
CYCLE TEST 5 cycles minimum															
15-03-2006	14:12		17.46 (253)	30 (86)				29.7 (85)				0.29 (0.39)	6 (20)	N/A	
15-03-2006			17.08 (248)	30 (86)				19.52 (67)				0.28 (0.38)	6.72 (24)	N/A	
15-03-2006		16:44	17.05 (247)	19 (66)				19.46 (67)				0	27.36 (158)	N/A	

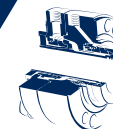
This is to certify that the seal noted above has been tested in accordance with the API 682 requirements.

Notes:

1. Conducted to latest version of API 682 at time of test; 3rd edition.
2. API 682 specifies pass rate for liquid leakage as <5.6 g/h which equates to 134.4 g/day or 1000ppm for gas and vapour.
3. kW / HP are calculated theoretical values.

Authorised By:
Stephen Shaw
Group Engineering Director

Mechanical Seal Qualification Test Form



1CW, 2CW-CW, 3CW-FB, 3CW-FF, 3CW-BB

Test Ref: T2/7/PT00801_17 Revision: 06/23

Manufacturer: AESSEAL plc Seal Type / Model: CAPI Type A Single

Seal Type: A B C ES

Materials of Construction: Primary Seal Faces: Antimony Carbon FH82A/SC2 Reaction Bonded Silicon Carbide Secondary Seal Faces*: N/A

Secondary Seals: Fluoroelastomer Metal Hardware: 316 SS

Seal Size: 100mm Seal Code: 1CW-FL Piping Plan: 11 Shaft Speed: 3600rpm

Pumped Fluid (Table I.2): Nonhydrocarbon (water, caustic acid) Nonflashing Hydrocarbon Flashing Hydrocarbon

Shaft Runout (Figure 19): <0.1mm Sleeve Runout (Figure 19): _____ Chamber Concentricity (Figure 12): <0.1mm Seal Chamber Face Runout (Figure 14): _____

Test Fluid: Propane Base-point Temperature °C (°F): 30 / (86) Base-point Pressure MPa (bar) (psi): 1.7 / (17) / (247)

Relative Density (SG): _____ Vapor Pressure: _____ Solids: None Particle Size: N/A *Dual Seals

DYNAMIC TEST 100 h minimum			Pressure barg (psig)	Process Temp. °C (°F)	Flush Temp. IN °C (°F)	Flush Temp. OUT °C (°F)	Flush Flow Rate m ³ /h (U.S. gal/min)	Seal Chamber Temp. °C (°F)	Barrier Fluid Pressure barg (psig)	Barrier Fluid Temp. IN °C (°F)	Barrier Fluid Temp. OUT °C (°F)	Power Consumption kW (hp)	Hydrocarbon Leakage g/day (ppm)	Nonhydrocarbon Leakage cm ³ /min	Circulating Device m ³ /h (U.S. gal/min)
Date	Time														
	Start	Stop													
05-10-2006	14:55		16.81 (244)	28.03 (82)	28.03 (82)	37.21 (99)	0.45 (1.98)	37.21 (99)				0.75 (1)	0.83 (2.5)	N/A	
10-10-2006		14:00	16.96 (246)	28.6 (83)	28.6 (83)	35.88 (97)	0.46 (2.03)	35.88 (97)				0.75 (1)	0.34 (1)	N/A	
STATIC TEST 4 h minimum															
10-10-2006	14:01		16.92 (245)	29.6 (85)	29.6 (85)	29.86 (86)	0	29.86 (86)				0	<0.34 (1)	N/A	
11-10-2006		09:30	16.93 (246)	28.9 (84)	28.9 (84)	28.83 (84)	0	28.33 (83)				0	<0.34 (1)	N/A	
CYCLE TEST 5 cycles minimum															
11-10-2006	09:37		16.85 (244)	31.05 (88)	31.05 (88)	36.81 (98)	0.46 (2.03)	36.81 (98)				0.75 (1)	<0.34 (1)	N/A	
11-10-2006			16.84 (244)	31.33 (88)	31.33 (88)	37.66 (100)	0.46 (2.03)	37.66 (100)				0.75 (1)	<0.34 (1)	N/A	
11-10-2006		12:28	17.23 (250)	24.65 (76)	24.65 (76)	26.09 (79)	0.45 (1.98)	26.09 (79)				0	0	N/A	

This is to certify that the seal noted above has been tested in accordance with the API 682 requirements.

Notes:

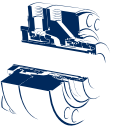
1. Conducted to latest version of API 682 at time of test; 3rd edition.
2. API 682 specifies pass rate for liquid leakage as <5.6 g/h which equates to 134.4 g/day or 1000ppm for gas and vapour.
3. kW / HP are calculated theoretical values.
4. Immeasurable face wear observed.
5. Average hydrocarbon leakage observed - 1.25ppm.

Authorised By:
Stephen Shaw
Group Engineering Director



ENVIRONMENTAL TECHNOLOGY

Mechanical Seal Qualification Test Form



1CW, 2CW-CW, 3CW-FB, 3CW-FF, 3CW-BB

Test Ref: T4/1/PT00API_2 Revision: 06/23

Manufacturer: AESSEAL plc Seal Type / Model: CAPI Type A Single

Seal Type: A B C ES

Materials of Construction: Primary Seal Faces: Antimony Carbon FH82A/SC2 Reaction Bonded Silicon Carbide Secondary Seal Faces*: N/A

Secondary Seals: Fluoroelastomer Metal Hardware: 316 SS

Seal Size: 50mm Seal Code: 1CW-FL Piping Plan: 11 Shaft Speed: 3600rpm

Pumped Fluid (Table I.2): Nonhydrocarbon (water, caustic acid) Nonflashing Hydrocarbon Flashing Hydrocarbon

Shaft Runout (Figure 19): _____ Sleeve Runout (Figure 19): _____ Chamber Concentricity (Figure 12): 0.1mm Seal Chamber Face Runout (Figure 14): <0.1mm

Test Fluid: Mineral Oil Base-point Temperature °C (°F): 20 (68) Base-point Pressure MPa (bar) (psi): 0.7 / (7) / (102)

Relative Density (SG): 0.873 Vapor Pressure: N/A Solids: None Particle Size: N/A *Dual Seals

DYNAMIC TEST 100 h minimum			Pressure barg (psig)	Process Temp. °C (°F)	Flush Temp. IN °C (°F)	Flush Temp. OUT °C (°F)	Flush Flow Rate m ³ /h (U.S. gal/min)	Seal Chamber Temp. °C (°F)	Barrier Fluid Pressure barg (psig)	Barrier Fluid Temp. IN °C (°F)	Barrier Fluid Temp. OUT °C (°F)	Power Consumption kW (hp)	Hydrocarbon Leakage g/day (ppm)	Nonhydrocarbon Leakage cm ³ /min	Circulating Device m ³ /h (U.S. gal/min)
Date	Time														
	Start	Stop													
04-04-2002	16:52		7.14 (104)	19.97 (68)	22.97 (73)	22.48 (72)	0.4 (1.76)	19.97 (68)				0.15 (0.2)	85 (900)	N/A	
10-04-2002		09:41	7.03 (102)	20.12 (68)	17.64 (64)	22.42 (72)	0.2 (0.88)	20.19 (68)				0.15 (0.2)	48 (388)	N/A	
STATIC TEST 4 h minimum															
10-04-2002	10:03		7.04 (102)	19.43 (67)	18.33 (65)	21.52 (71)	0.22 (0.97)	19.43 (67)				0	0	N/A	
10-04-2002		14:04	6.98 (101)	19.77 (68)	18.25 (65)	21.28 (70)	0.23 (1.01)	19.92 (68)				0	0.52 (1.54)	N/A	
CYCLE TEST 5 cycles minimum															
10-04-2002	14:08		6.86 (100)	19.65 (67)	17.47 (63)	22.18 (72)	0.37 (1.63)	19.65 (67)				0.16 (0.2)	0	N/A	
12-04-2002			7.29 (106)	19.97 (68)	21.01 (70)	22.27 (72)	0.4 (1.76)	19.97 (68)				0.15 (0.2)	0	N/A	
12-04-2002		12:20	7.18 (104)	19.16 (66)	19.45 (67)	20.24 (68)	0.22 (0.97)	19.16 (66)				0	25 (140)	N/A	

This is to certify that the seal noted above has been tested in accordance with the API 682 requirements.

Notes:

1. Conducted to latest version of API 682 at time of test; 1st edition.
2. API 682 specifies pass rate for liquid leakage as <5.6 g/h which equates to 134.4 g/day or 1000ppm for gas and vapour.
3. kW / HP are calculated theoretical values.

Authorised By:
Stephen Shaw
Group Engineering Director

Mechanical Seal Qualification Test Form



1CW, 2CW-CW, 3CW-FB, 3CW-FF, 3CW-BB

Test Ref: T4/7/PT00API_1 Revision: 06/23

Manufacturer: AESSEAL plc Seal Type / Model: CAPI Type A Single

Seal Type: A B C ES

Materials of Construction: Primary Seal Faces: Antimony Carbon FH82A/SC2 Reaction Bonded Silicon Carbide Secondary Seal Faces*: N/A

Secondary Seals: Fluoroelastomer Metal Hardware: 316 SS

Seal Size: 100mm Seal Code: 1CW-FL Piping Plan: 11 Shaft Speed: 3600rpm

Pumped Fluid (Table I.2): Nonhydrocarbon (water, caustic acid) Nonflashing Hydrocarbon Flashing Hydrocarbon

Shaft Runout (Figure 19): 0.2mm Sleeve Runout (Figure 19): _____ Chamber Concentricity (Figure 12): <0.1mm Seal Chamber Face Runout (Figure 14): 0.01mm

Test Fluid: Mineral Oil °C (°F): 20 / (68) Base-point Pressure MPa (bar) (psi): 0.7 / (7) / (102)

Relative Density (SG): 0.873 Vapor Pressure: N/A Solids: None Particle Size: N/A *Dual Seals

DYNAMIC TEST 100 h minimum			Pressure barg (psig)	Process Temp. °C (°F)	Flush Temp. IN °C (°F)	Flush Temp. OUT °C (°F)	Flush Flow Rate m ³ /h (U.S. gal/min)	Seal Chamber Temp. °C (°F)	Barrier Fluid Pressure barg (psig)	Barrier Fluid Temp. IN °C (°F)	Barrier Fluid Temp. OUT °C (°F)	Power Consumption kW (hp)	Hydrocarbon Leakage g/day	Nonhydrocarbon Leakage cm ³ /min	Circulating Device m ³ /h (U.S. gal/min)
Date	Time														
	Start	Stop													
22-08-2003	17:00		6.90 (100)	20.55 (69)	22.48 (72)	34.76 (95)	0.14 (0.6)	30.45 (87)				0.99 (1.3)	0	N/A	
27-08-2003		09:52	6.96 (101)	22.26 (72)	24.45 (72)	38.22 (101)	0.15 (0.7)	32.28 (90)				0.80 (1.1)	50.4	N/A	
STATIC TEST 4 h minimum															
27-08-2003	09:55		7.22 (105)	22.10 (72)	24.13 (75)	37.55 (100)	0.27 (1.2)	28.09 (83)				0	<2.1	N/A	
27-08-2003		13:55	6.91 (100)	19.99 (68)	20.55 (69)	22.53 (73)	0.29 (1.3)	23.02 (73)				0	<2.1	N/A	
CYCLE TEST 5 cycles minimum															
27-08-2003	14:15		6.78 (98)	19.80 (68)	21.65 (71)	33.42 (92)	0.14 (0.6)	28.29 (83)				0.98 (1.3)	25.2	N/A	
28-08-2003			7.25 (105)	20.05 (68)	22.91 (73)	35.10 (95)	0.14 (0.6)	27.87 (82)				0.83 (1.1)	<2.1	N/A	
29-08-2003		14:14	7.1 (103)	20.20 (68)	21.15 (70)	32.26 (90)	0.29 (1.3)	24.68 (76)				0	<2.1	N/A	

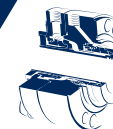
This is to certify that the seal noted above has been tested in accordance with the API 682 requirements.

Notes:

1. Conducted to latest version of API 682 at time of test; 2nd edition.
2. API 682 specifies pass rate for liquid leakage as <5.6 g/h which equates to 134.4 g/day or 1000ppm for gas and vapour.
3. kW / HP are calculated theoretical values.

Authorised By:
Stephen Shaw
Group Engineering Director

Mechanical Seal Qualification Test Form



1CW, 2CW-CW, 3CW-FB, 3CW-FF, 3CW-BB

Test Ref: T5/2/PT00API_9 Revision: 06/23

Manufacturer: AESSEAL plc Seal Type / Model: CAPI Type A Single

Seal Type: A B C ES

Materials of Construction: Primary Seal Faces: Antimony Carbon FH82A/SC2 Reaction Bonded Silicon Carbide Secondary Seal Faces*: N/A

Secondary Seals: Fluoroelastomer Metal Hardware: 316 SS

Seal Size: 50mm Seal Code: 1CW-FL Piping Plan: 11 & 62 Shaft Speed: 3600rpm

Pumped Fluid (Table I.2): Nonhydrocarbon (water, caustic acid) Nonflashing Hydrocarbon Flashing Hydrocarbon

Shaft Runout (Figure 19): 0.025mm Sleeve Runout (Figure 19): _____ Chamber Concentricity (Figure 12): 0.1mm Seal Chamber Face Runout (Figure 14): <0.1mm

Test Fluid: Mineral Oil Base-point Temperature °C (°F): 260 (500) Base-point Pressure MPa (bar) (psi): 0.7 / (7) / (102)

Relative Density (SG): 0.873 Vapor Pressure: N/A Solids: None Particle Size: N/A *Dual Seals

DYNAMIC TEST 100 h minimum			Pressure barg (psig)	Process Temp. °C (°F)	Flush Temp. IN °C (°F)	Flush Temp. OUT °C (°F)	Flush Flow Rate m ³ /h (U.S. gal/min)	Seal Chamber Temp. °C (°F)	Barrier Fluid Pressure barg (psig)	Barrier Fluid Temp. IN °C (°F)	Barrier Fluid Temp. OUT °C (°F)	Power Consumption kW (hp)	Hydrocarbon Leakage g/day	Nonhydrocarbon Leakage cm ³ /min	Circulating Device m ³ /h (U.S. gal/min)
Date	Time														
	Start	Stop													
12-06-2002	11:20		6.90 (100)	258 (496)	237 (459)	258 (496)	0.44 (1.9)	258 (496)				0.21 (0.3)	0	N/A	
17-06-2002		15:21	6.92 (100)	260 (502)	240 (464)	261 (502)	0.48 (2.1)	261 (502)				0.21 (0.3)	0	N/A	
STATIC TEST 4 h minimum															
17-06-2002	15:21		7.03 (102)	260 (500)	240 (464)	261 (502)	0.49 (2.1)	261 (502)				0	0	N/A	
18-06-2002		09:43	6.86 (100)	261 (502)	240 (464)	261 (502)	0.49 (2.1)	262 (504)				0	0	N/A	
CYCLE TEST 5 cycles minimum															
18-06-2002	10:45		6.64 (96)	260 (500)	239 (462)	260 (500)	0.48 (2.1)	260 (500)				0.26 (0.4)	0	N/A	
19-06-2002			7.16 (104)	261 (502)	208 (406)	260 (500)	0.54 (2.4)	257 (495)				0.21 (0.3)	0	N/A	
20-06-2002		16:13	7.37 (107)	261 (502)	243 (469)	262 (504)	0.56 (2.5)	262 (504)				0	0	N/A	

This is to certify that the seal noted above has been tested in accordance with the API 682 requirements.

Notes:

1. Conducted to latest version of API 682 at time of test; 1st edition.
2. API 682 specifies pass rate for liquid leakage as <5.6 g/h which equates to 134.4 g/day or 1000ppm for gas and vapour.
3. kW / HP are calculated theoretical values.

Authorised By:
Stephen Shaw
Group Engineering Director