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TYPE APPROVAL CERTIFICATE

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Certificate No.	**35 658 - 84 HH**
Company	**BAC Valves S.A.** **Tapis, 126** **17600 Figueres, SPAIN**
Product Description	**Cryogenic Ball Valves**
Type	**NP, FB, FBL, FBM, FR, PQR-i, TEV-f**
Environmental Category	**None**
Technical Data / Range of Application	**TECHNICAL DATA** **Split body, full bore free-floating or trunnion mounted ball.** **Flanged or threaded end connections** **RANGE OF APPLICATION** **The above mentioned types of ball valves are type approved for the use in process and cargo systems on liquefied gas tankers and fresh water, sea water, ballast water, bilge, sanitary, compressed air, steam, fuel oil, lubrication oil, cargo oil, N2 and chemicals (refer to following pages)** **Temperature range: -196 to 250°C (refer to page 3)** **Pressure rating and Size range: Refer to following pages** **For service temperatures above 50°C (stainless steel) and 120°C (carbon steel) the pressure reduction factors of manufacturer to be observed.**
Test Standard	**VI-7-8 Guidelines for the Performance of Type Approvals for Components and Systems of Mechanical Engineering: 2008. BS 6364:1984.**
Documents	**Refer to following pages**
Remarks	**GL Approval Ref.No.: 14-098452**

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Material combinations:

Type	Body	Ball / Stem	Seals	Seat
NP (SS)	SS, ASTM A-351 CF8M		PTFE, Reinforced PTFE and Graphite	Mod. PTFE
FBM	SS, ASTM A-351 CF8M	SS, ASTM A-351 CF8M PTFE / 904L / AISI 316 SS, DIN EN10213-4 WNo 1.4308 / AISI 304		
FB, FB-L (CS)	CS, DIN EN10213-2 WNo 1.0619 / ASTM A105 N / WCC	SS WNo 1.4408 / AISI 316 / CF8M		
FB, FB-L (SS)	SS, DIN EN10213-4 WNo 1.4408 / CF8M / SS316	SS ASTM A-351 CF8M / AISI 316		
PQR-i CS,	CS, ASTM A-216 WCC / A 105 SS, ASTM A-351 CF8M / SS316	SS ASTM A-351 CF8M / AISI 316		
TEV-f Floating Ball Valves	ASTM A-479 316	ASTM A-479 316	Graphite+316	PTFE

SS316 and AISI 316 are not recommended for use in sea water systems.

Application/Limitation
Cryogenic application
The valve types and sizes listed in the below table have been subjected to a cryogenic test at minimum design temperature and can be used in systems with design temperatures as follows:

Type	Pressure rating/Sizes	Minimum design temperature
FB	PN 50/ DN15, DN20, DN25, DN40, DN50, DN80, DN100, DN150	-196 °C
PQR-i.	PN50/ 1/2", ¾",1", 11/2", 2", 3", 4"	-196 °C
TEV-f	Class 300: DN50, DN80, DN100	-196 °C
	Class 600: DN15	-196°C
	Class 1500: DN25	-196°C

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Non-cryogenic application
Valves not subjected to a cryogenic test can be used in systems with design temperatures down to -55 or -40 °C, depending on the body material.
Size ranges:
NP DN250, 300, 350 and 400 (10", 12", 14" and 16")
FB DN15, 20, 25, 40, 50, 80, 100, 150 and 200
FBL DN15, 20, 25, 32, 40, 50, 65, 80, 100, 125, 150 and 200
FBM DN15, 20, 25, 32, 40 and 50
FR DN15, 20, 25, 32, 40 and 50
PQR-i ½ ", ¾" 1", 11/2", 2", 3", 4", 6", 8", 10" and 12"

Flange rating:
- DIN 3357 PN 16, 25, 40
- ANSI Class 150 and 300

Maximum working temperatures for valves with the following body materials
Carbon Steels -40 to 250 °C
Stainless Steels -196 to 250 °C

Materials in body and bonnet shall be charpy tested when the thickness exceeds 6 mm.
Acceptance criteria according to GL Rules for Materials and Welding II-1, Chapter 2; Sec: 3- E.

In addition to the systems mentioned on the front-page, the valves may be used in the following chemicals:

- Ammonium Nitrate Solution, 93% or less 1)
- Carbon disulphide
- Hydrogen peroxide Solutions of 60% but not over 70% 1)
- Diethyl Ether 1)
- Phosphorus, yellow or white 1)
- Propylene oxide and mixtures of ethylene oxide/propylene oxide 1, 2)
- Sulphuric acid 1)
- Sulphur liquid

Notes:
1) - only valves of stainless steel may be used.
2) - FBM type valves may not be used in Propylene oxide.

Valve type FBL, FBM and FR are not approved for application at fire zone bulkheads and decks where destruction of the soft seal may cause flooding of adjacent compartments.
The valves are further not approved as quick closing valve at fuel and lubricating oil tanks or fuel and lubricating oil piping systems.

For application of ball valves with threaded end connections the application limitation specified in GL Rules I-1-2 Machinery Installation, Section 11 is to be observed.

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Documents
Basic drawings FB valve type:
FB-PN16, 40-RH -110°C, FB-#150/300-RH-110°C, PQR-i-#150/300-RH, dated 13.09.2002
Overview basic drawings and TA Luft drawings

Valve Type	Standard Drawing	TA Luft Drawing
FB ANSI	FB-#150/300-RH	05-02-020-0300-000_00
	FBC ANSI EB200	05-02-020-0300-050_00
		05-02-020-0300-100_00
		05-02-020-0300-200_00
		05-02-040-0300-000_00
		05-02-040-0300-050_00
		05-02-040-0300-100_00
		05-02-040-0300-200_00
		05-02-200-0300-000_00
		05-02-200-0300-050_00
		05-02-200-0300-100_00
		05-02-200-0300-200_00
FB DIN	FB-PN16&40-RH	05-02-020-0040-000_00
	FBC DIN EB200	05-02-020-0040-050_00
		05-02-020-0040-100_00
		05-02-020-0040-200_00
		05-02-040-0040-000_00
		05-02-040-0040-050_00
		05-02-040-0040-100_00
		05-02-040-0040-200_00
		05-02-200-0040-000_00
		05-02-200-0040-050_00
		05-02-200-0040-100_00
		05-02-200-0040-200_00
		05-02-020-0040-L00_00
		05-02-040-0040-L00_00
		05-02-100-0040-L00_00

New extended bonnet seal drawing
- DT-GAD-FB-DIN-SS-OR-CRY196-H95
- DT-GAD-FB-ANSI-SS-OR-CRY196-H95
- DT-GAD-FR-DIN-SS-OR-OR-CRY196-BSP-H95

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Overview basic drawings and TA Luft drawings PQRi valve type

Valve Type	Standard drawing	TA Luft drawing
PQRi ANSI	PQRi#150/300-RH	11-02-025-0300-000_00
		11-02-025-0300-050_00
		11-02-025-0300-100_00
		11-02-025-0300-200_00
		11-02-050-0300-000_00
		11-02-050-0300-050_00
		11-02-050-0300-100_00
		11-02-050-0300-200_00
		11-02-300-0300-000_00
		11-02-300-0300-050_00
		11-02-300-0300-100_00
		11-02-300-0300-200_00

Overview basic drawings valve type TEV-f

DW-TEV-f-CRIO-196-ANSI-3_6-000- General Drawing "BAC" Ball valve Top Entry Type Cryogenic
DW-TEV-f-CRIO-196-ANSI-0.5_2-1500- General Drawing "BAC" Ball valve Top Entry Type Cryogenic
DW-TEV-f-CRIO-196-ANSI-0.5_2-600- General Drawing "BAC" Ball valve Top Entry Type Cryogenic
DW-TEV-f-ANSI-3_6-000- General Drawing "BAC" Ball valve Top Entry Type
DW-TEV-f-ANSI-0.5_2-1500- General Drawing "BAC" Ball valve Top Entry Type
DW-TEV-f-ANSI-0.5_2-600- General Drawing "BAC" Ball valve Top Entry Type
V-050-40-300-CRY-BAR- Ball Valve Cover Top Entry Type - NPS 2" #300 Cryogenic
V-50-20 - Ball DN50 #300
V-050-16-300-196- Ball Valve Extended Bonnet Top Entry Type – NPS 2" #150-#600 Cryo -196°C
V-050-10-40-CRY-BW-BAR- Ball Valve Top Entry Type – DN50 PN40 – Butt Weld Ends Sch.40 cryogenic service
V-080-40-300-CRY-BAR- TEV-f NPS 3" #300 Bonnet
V-080-20 - TEV-f NPS 3" Ball
V-080-16-300-196- Ball Valve Body Extended Bonnet Top Entry Type NPS 3" (-196°C)
V-080-10-300-CRY-BW-BAR- Ball Valve Body Top Entry Type 3" #300 Buttweld Ends Sch.40 Cryogenic
V-100-40-300-CRY-BAR- TEV-f NPS 4" #300 Bonnet
V-100-20 - TEV-f NPS 4" Ball
V100-16-300-196- Ball Valve Body Extended Bonnet Top Entry Type NPS 4" (-196°C)
V-100-10-300-BAR- Ball Valve Top Entry Type 4" #300 Flanged RF
V-015-40-1500-196-BAR- Ball Valve Extended Bonnet Top Entry Type NPS 1/2" #1500 Cryo -196°C
V-015-40-600-CRY-BAR A TEV-f NPS ½" Class 600 cryogenic
V-015-20 B Ball Valve Top Entry Type NPS ½" Approved
V-015-16-600-196- Ball Valve Extended Bonnet Top Entry Type NPS ½" #150-#600 Cryo -196°C ISO F03
V-015-10-1500-BAR- Ball Valve Body Top Entry Type ½" #1500 Flanged RF
V-015-10-600-CRY-BW-BAR- Ball Valve Body Top Entry Type ½" #600 Buttweld Ends Sch.80 Cryogenic
V-025-40-1500-196-BAR- Ball Valve Extended Bonnet NPS 1" #1500
V-025-40-600-CRY-BAR A TEV-f NPS 1" Class 600 Cryogenic
V-25-20 A TEV-f NPS 1" Ball
V-025-16-600-196- Ball Valve Extended Bonnet Top Entry Type NPS 1"#150-#600 Cryo -196°C
V-025-10-1500-LS-CRY-BAR B Ball Valve Body Top Entry Type 1" #1500 Lip seal Cryogenic Flanged RF

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Installation and Maintenance Instruction
- FB/FBM/FBL/FR: IM-FB-SS-OR-CRY-H95-01-EN / IM-FB-SS-OR-STD-H95-01-EN
- PQR_i: IM-PQR_i-SS-OR-CRY-EB-H95-02-EN / IM-PQR_i-SS-OR-STD-H95-01-EN

Type tests carried out
Fire test (for NP, FB and PQR-i), hydrostatic pressure test, seat leakage test and cryogenic testing (for FB, PQR-I, TEV-f acc. to BS 6364)

Test reports
- Test report No. 0045/84/30204 BAC, dated 06.09.1984
- B-Test report no.:65 dated 12-11-2008
- B.V. Ref.: 11/EK2/08/0026/01
- B.V. Ref.: 1/EK2/08/0043/01

Leakage test reports:
7.907, 7.908, 7.909 dated 25.06.98, 1 112742 dated 11.05.95, 7.910, 7.911, 7.912 dated 25.06.98, BCL 600705/1 dated 18.07.96, BRC/12/210/0074/96-A dated 13.07.96, 1-25593, 2-25593 and 3-25593 dated 05.03.05

Fire test reports:
BCL200663/1 dated 11.2.93, BCL400651/1 dated 20.06.94, BCL200339/1 dated 21.12.92, BCL1004227/9 dated 12.06.91, and BCL200390/1 dated 11.2.93

DNV's test report No.: 44001171 dated 2007-07-11
DNV's retention survey report dated 2007-08-10
DH-DNV-FB_PQRI-P-13148_01 dated 2009-05-18
BV Fire test report with ref. 11/EK2/08/0043/01
Retention survey report dated 2011-05-27

Differences in design seals body – FB
Cryogenic test report FB #300 316 PTFR DN15 NPS 1/2"
Cryogenic test report FB #300 316 PTFR DN20 NPS 3/4"
Cryogenic test report FB #300 316 PTFR DN25 NPS 1"
Cryogenic test report FB #300 316 PTFR DN40 NPS 1 1/2"
Cryogenic test report FB #300 316 PTFR DN50 NPS 2"
Cryogenic test report FB #300 316 PTFR DN80 NPS 3"
Cryogenic test report FB #300 316 PTFR DN100 NPS 4"
Cryogenic test report FB #300 316 PTFR DN150 NPS 6"

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TEV- f
FQ-07 1 TEV-f DN80 Class 300
Production/Prototype Cryogenic Test Report according to BS 6364:1984, dated 2014-04-02.
FQ-07 1 TEV-f DN50 Class 300
Production/Prototype Cryogenic Test Report according to BS 6364:1984, dated 2014-04-02.
FQ-07 1 TEV-f DN15 Class 600
Production/Prototype Cryogenic Test Report according to BS 6364:1984, dated 2014-04-02.
FQ-07 1 TEV-f DN100 Class 300
Production/Prototype Cryogenic Test Report according to BS 6364:1984, dated 2014-02-28.
FQ-07 1 TEV-f DN25 Class 1500
Production/Prototype Cryogenic Test Report according to BS 6364:1984, dated 2014-02-28.

New extended bonnet seal
Test report form FQ-07 rev.1 of tests carried out on:
- ¾" and 1" dated 2014-06-10
- DN 15, DN 40 dated 2014-06-11
- DN 50, DN 80, DN100, DN150 dated 2014-06-12

Production test scope
Valves included in pipe class I and II are subject to pressure test at room temperature at manufacturer work shop in the presence of a DNVGL surveyor.
In case of application at service temperatures below -55°C in addition 10% of each type and size of valve is subject to cryogenic tightness testing.
BAC production test procedure applicable: PQ-25

Material certificates
For purchasing of valve bodies and other pressurized parts of the valves the requirements specified in GL Rules I-1-2 Machinery Installation, Section 11-B-3 Testing of materials are to be observed.

Marking of product
For traceability to this type approval certificate each valve shall be provided with a name plate specifying at least the following data:
- Manufacturer's name or trade mark
- Valve type designation
- Size
- Nominal pressure, Pressure class
- Service pressure (if different to nominal pressure or pressure class)

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