SAFETY MANUAL

SH 28t

Translation of original instructions

BR 28t Piggable 3-Way Ball Valve

Edition February 2024

PFEIFFER Chemie-Armaturenbau GmbH · Hooghe Weg 41 · 47906 Kempen · Germany
Phone: +49 2152 2005-0 · Fax: +49 2152 1580
E-Mail: sales-pfeiffer-de@samsongroup.com · Internet: www.pfeiffer-armaturen.com

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1. GENERAL

1.1 Definition of signal words

	**DANGER**	*Hazardous situations which, if not avoided, will result in death or serious injury*
	**WARNING**	*Hazardous situations which, if not avoided, could result in death or serious injury*
	***NOTICE***	*Property damage message or malfunction*
	***Note***	*Additional information*
	***Tip***	*Recommended action*

1.2 Purpose of this manual

The Safety Manual **SH 28t** contains information relevant for the use of the **BR 28t** 3-way ball valve in safety-instrumented systems according to IEC 61508 and IEC 61511.

The safety manual is intended for planners, constructors, and operators of safety-instrumented systems.

 ***NOTICE***	*Risk of malfunction due to incorrect installation or start-up of the device.* Refer to the mounting and operating instructions ▶ **EB 28t** on how to install and start-up the device. Observe the warnings and safety instructions written in the mounting and operating instructions.

1.3 Further documentation

The documents listed below contain descriptions of the start-up, functioning and operation of the 3-way ball valve. You can download these documents from the PFEIFFER website.

- Data sheet BR 28t ▶ **TB 28t**
- Mounting and operating instructions BR 28t ▶ **EB 28t**
- Functional safety of globe valves, rotary plug valves, ball valves and butterfly valves ▶ **WA 236**

 ***NOTICE***	In addition to the ball valve documentation, observe the documentation for the actuator and valve accessories.

2. SCOPE

2.1 General

The **BR 28t** piggable 3-way ball valve in combination with an actuator, e.g. the pneumatic quarter-turn actuator **BR 31a**, is designed primarily for controlling the flow rate, pressure and temperature of liquid media in a piggable pipe system.

2.2 Use in safety-instrumented systems

The 3-way ball valve can be used in safety-instrumented systems according to IEC 61508 and IEC 61511.
The 3-way ball valve can be used in safety-instrumented systems up to SIL 2 (single device) and SIL 3 (redundant configuration) on observing the requirements of IEC 61508.

The safety-instrumented function of the 3-way ball valve is to be regarded as a Type A element in accordance with IEC 61508-2.

Note	The architecture and the interval between proof tests must be considered concerning the safety integrity level.
Tip	Through the use of a positioner with diagnostic features on the control valve, the diagnostic coverage can be increased, and, as a result, the probability of failure on demand reduced.

2.3 Versions and ordering data

Piggable 3-way ball valve combined with actuators with travel stop and/or handwheel as well as manual override are not suitable for use in safety-instrumented systems.
All other versions are suitable for use in safety-instrumented systems.

Actuators with adjustable limit stops are adjusted after adjustment against subsequent adjustment, e.g. with sealing wax, secured.

2.4 Mounting

The 3-way ball valve and actuator are normally delivered already assembled by PFEIFFER.

3. TECHNICAL DATA

Table 1: *DIN version*

Type	**28t**	
	DIN	**ANSI**
Nominal size	DN 50 ... 200	NPS2 ... 8
Nominal pressure	PN 10 ... 40	cl150 ... 300
Material [1)]	1.4571 / 1.4408	A182 F316 / A351 CF8M
Face to face	DIN EN 558, row 1	
Type of connection	DIN 2430-2 (VS) / DIN EN 1092-1	DIN 2430 / ASME B16.5
Seat-ball seal	soft seal	
Heating jacket	On request	
Compliance	CE, EAC	
Temperature ranges Permissible operating pressures acc. to pressure-temperature diagrams, see Data sheet ▶ TB 28t,		
Body	-10 °C ... +200 °C (14 °F ... 392 °F)	
Leakage class acc. to DIN EN 12266-1, Test P12		
Metal seal	-	
Soft seal	A	

[1)] Other materials optionally available

4. SAFETY-RELATED FUNCTIONS

4.1 Safety-related fail-safe action

The 3-way ball valve, in combination with a pneumatic rotary actuator, controls the process medium flowing through it.

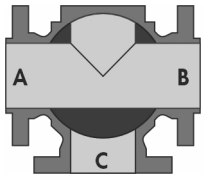
4.2 Fail-safe action

Depending on how the pneumatic actuator is mounted to the 3-way ball valve, the ball valve has two fail-safe positions which become effective when the air pressure in the actuator is relieved or when the supply air fails. **The position of the ball is to be determined accordingly.**

4.3 Flow patterns

The layout and the switching functions of the actuator are variable. The 3-way valves are designed and equipped according to specific customer requirements.

Flow patterns for BR 28t piggable 3-way ball valve



Design: ***BR 28t horizontal, 3-way with T-ball***

Fig. 1: *Possible initial position of the 3-way ball valve*

4.4 Protection against unauthorized changes to the configuration

The 3-way ball valve's fail-safe position depends on the mounted actuator's direction of action. The actuator's direction of action can be reversed. However, this is not possible while the process is running.

5 INSTALLATION AND START-UP

The 3-way ball valve is delivered ready to install and can be installed into the pipeline without the need for any additional installation work.

Refer to the valve documentation on how to install and start-up the 3-way ball valve.

Tip	PFEIFFER recommend checking the installation and start-up using a checklist. Examples of such checklists are included in VDI 2180-5 and the SAMSON brochure WA 236 (Functional safety of globe valves, rotary plug valves, ball valves and butterfly valves).

6. REQUIRED CONDITIONS

WARNING	*Risk of malfunction due to incorrect selection or wrong installation and operating conditions.* Only use 3-way ball valves in safety-instrumented systems after the necessary conditions in the plant have been fulfilled.
Tip	PFEIFFER recommend checking the necessary conditions using a checklist. Examples of such checklists are included in VDI 2180-5 and the SAMSON brochure WA 236 (Functional safety of globe valves, rotary plug valves, ball valves and butterfly valves).

6.1 Selection

⇨ The suitability of the entire ball valve assembly (3-way ball valve, actuator, valve accessories) for the intended use (pressure, temperature) has been checked.

⇨ The 3-way ball valve materials are suitable for the process medium.

⇨ The design of the 3-way-ball valve is suitable for the required leak rate and for the indicated switching cycles.

⇨ The actuator is correctly sized based on the required transit time and thrust.

⇨ For the actuator design, the longest period of the non-operation must be specified and taken into account.

6.2 Mechanical and pneumatic installation

⇨ The piggable 3-way ball valve is installed properly into the pipeline as described in the mounting and operating instructions and the actuator mounted on it. Valve accessories are mounted correctly.

⇨ The prescribed direction of flow is observed. The arrow on the valve indicates the direction of flow.

⇨ The 3-way ball valve ports designated A, B and C must be connected in accordance with the intended switching positions in the pipeline.

⇨ Tightening torques (e.g. for flange connections) are listed in the manual and operating instructions ▶ **EB 28t** and are observed.

⇨ The end connection of the pipeline is aligned with the 3-way ball valve´s end connections and their ends have parallel planes. Connection flanges that are not parallel can damage the ball valve and lead to increased operating torques!

6.3 Operation

⇨ The control shaft is not blocked.

⇨ The medium flow through the 3-way ball valve is not blocked.

⇨ The 3-way ball valve is only used in applications that meet the specifications used for sizing at the ordering stage.

6.4 Maintenance

⇨ Maintenance is only performed by fully trained, qualified operating personnel.

⇨ Only original parts are used for spare parts.

⇨ Maintenance is performed as described in the section on servicing or maintenance in the associated valve documentation.

 *Tip*	Contact PFEIFFER concerning any work not described in the section on servicing or maintenance in the associated valve documentation.

7. PROOF TESTING

The proof test interval and the extent of testing lie within the operator's responsibility. The operator must draw up a test plan, in which the proof tests and the interval between them are specified. We recommend summarizing the requirements of the proof test in a checklist.

 **WARNING**	*Risk of dangerous failure due to malfunction in the event of emergency (ball valve does not move to the fail-safe position).* Only use devices in safety-instrumented systems that have passed the proof test according to the test plan drawn up by the operator.
 ***NOTICE***	*Malfunction due to a non-observance of the required inspection requirements.* To test the fail-safe action properly, the following requirements must be met: – Multi-port ball valve and actuator are assembled together properly. – The Multi-port ball valve is installed properly into the plant.

Regularly check the safety-instrumented function of the entire SIS loop. The test intervals are determined, for example on calculating each single SIS loop in a plant (PFD_{avg}).

 *Tip*	PFEIFFER recommend performing the proof tests based on a checklist. An example of such a checklist is included in the SAMSON brochure WA 236 (Functional safety of globe valves, rotary plug valves, ball valves and butterfly valves).

8. VISUAL INSPECTION TO AVOID SYSTEMATIC FAILURE

To avoid systematic failure, inspect the 3-way ball valve regularly. The frequency and the scope of the inspection lie within the operator's responsibility. Take application-specific influences into account, such as:

- ⇨ Blockage of control shaft
- ⇨ Corrosion (destruction primarily of metals due to chemical and physical processes)
- ⇨ Material fatigue
- ⇨ Wear induced by the process medium
- ⇨ Abrasion (material removed by solids contained in the process medium)
- ⇨ Medium deposits
- ⇨ Aging (damage caused to organic materials, e.g. plastics or elastomer, by exposure to light and heat)
- ⇨ Chemical attack (organic materials, e.g. plastics or elastomer, which swell, leach out or decompose due to exposure to chemicals)

 *NOTICE*	*Risk of malfunction due to the use of unauthorized parts.* Only use original parts to replace worn parts.

9. FUNCTION TESTING

Regularly check the safety function according to the test plan drawn up by the operator.

 *Info*	Record any faults in the 3-way ball valve and inform PFEIFFER of them in writing.

9.1 Safety-related fail-safe action

1. Supply the actuator with the signal pressure to allow the 3-way ball valve to move to the end position (Note switch positions).
2. Disconnect the signal pressure. This must cause the 3-way ball valve to move to the opposite end position. When using drives with a centred centre position, an fail safe position may not be reached
3. Check whether the 3-way ball valve reaches the end position within the required time.
4. Check whether the maximum permissible leakage is observed.

9.2 Safety-instrumented function of valve accessories

- ⇨ Check the safety-instrumented function of valve accessories. Refer to the associated safety manuals.

10. REPAIRS

Only perform the work on the 3-way ball valve described in the ball valve documentation.

 **NOTICE**	*Fail-safe action impaired due to incorrect repair.* Service and repair work must only be performed by trained staff.

11. CUSTOMER REQUEST FORM FOR SIL APPLICATIONS

 **Tip**	The following form helps to collect relevant information for SIL applications.

KUNDENABFRAGE
DOKUMENTATIONSAUFTRAG FÜR SIL

CUSTOMER REQUEST
DOCUMENTATION FOR SIL

PFEIFFER Chemie-Armaturenbau GmbH
Classification: Public

Kunde */ customer:* _____ Datum */ date:* 27. February 2024

Auftrags-Nr. / Anfrage: _____
Order no. / request

Armatur */ valve:* BR */ BR* _____ DN / NPS _____ PN / cl _____

Bitte stellen Sie uns für die Erstellung der SIL-Herstellererklärung folgende zusätzliche Informationen für jede Armatur zur Verfügung */ For SIL - manufacturer declaration we ask for providing us following additional information for each valve:*

- Medium: _____
  Medium
- Eigenschaft des Mediums: schmierend / *greasing* ☐ nicht schmierend / *sticking* ☐ trocken / *dry* ☐ korrosiv / *corrosive* ☐
  Property of medium abrasiv / *abrasive* ☐ auskristallisierend / *crystallizing* ☐ polymerisierend / *polymerizing* ☐
  feststoffhaltig / *solids* ☐ (hart / *hard* ☐ weich / *soft* ☐ schlammig / *slurry* ☐ faserig / *fibrous* ☐)
- Druck: _____ [bar]
  Inlet and outlet pressure
- Temperatur: _____ [°C]
  Medium temperature
- Dichtigkeitsklasse: _____
  Tighten class
- Längste Dauer der Nichtbetätigung (betriebliche Anforderung) _____ (Schaltzyklen pro Jahr) _____
  Longest period of non-operation (operation mode) *(quantity of cycles/year)*
- Schaltzeit (wenn erforderlich): AUF _____ [sec.] ZU _____ [sec.]
  Cycle time (if required) *OPEN* *CLOSE*
- Einbauort: _____
  Location for installing (inside or outside)
- Einbaulage: _____
  Installing orientation (horizontal or vertical)
- Betriebsart: kontinuierliche Fahrweise ☐ Batchfahrweise ☐
  Mode of operation *continuous operating conditions* *changing operating*
- Funktion des Stellgliedes: _____ AUF/ZU ☐ Regel ☐ Sonstiges _____
  Function of the valve *ON/OFF* *Control* *Other*
- Armaturen Isolierung: ja */ yes* ☐ / nein */ no* ☐ Isolierstärke in mm _____
  Valve heat insulation *insulation thickness*
- Für die Antriebsauslegung benötigen wir den Zuluftdruck: min. _____ [bar] max. _____ [bar]
  For the actuator design we need the air supply

Datum, Name und Unterschrift des Kunden _____
Date, name and sign of customer