SAFETY MANUAL

SH 8393 EN

Translation of original instructions

Type 3755 (stainless steel body)

Type 3755-2: flanged-on threaded exhaust port

Type 3755 Pneumatic Volume Booster

Edition June 2024

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

Purpose of this manual

The Safety Manual SH 8393 contains information relevant to the use of the Type 3755 Pneumatic Volume Booster 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 mounting, connection or start-up of the device.
Refer to Mounting and Operating Instructions ▶ EB 8393 for details on how to mount the device, perform the pneumatic connections as well as start up the device.
Observe the warnings and safety instructions written in the Mounting and Operating Instructions EB 8393.

Further documentation

The documents listed below contain descriptions of the start-up, functioning and operation of the pneumatic volume booster. You can download these documents from the SAMSON website.

- ▶ T 8393: Data sheet
- ▶ EB 8393: Mounting and operating instructions

Note

In addition to the volume booster documentation, observe the technical documentation for the pneumatic actuator, control valve and other valve accessories.

Contents

1 Scope

General

The Type 3755 Pneumatic Volume Booster is used together with positioners to increase the positioning speed of pneumatic actuators with an area ≥ 1000 cm² or a travel volume ≥ 6 l.

Use in safety-instrumented systems

The Type 3755 Pneumatic Volume Booster is suitable for use in safety-instrumented systems according to IEC 61508 and IEC 61511 as follows:

– Up to SIL 2 (single device)
– Up to SIL 3 according to IEC 61508 (redundant configuration of valves)

i ***Note***

– This manufacturer's declaration is based on a development process complying with IEC 61508 as well as on the evaluation of results from devices used in the field.
– The safety function of the pneumatic volume booster is to be regarded as a Type A element in accordance with IEC 61508-2.
– The architecture and the interval between proof tests must be changed accordingly for a higher safety integrity level.
– The manufacturer's declaration at the back of the safety manual contains further details for the use in safety-instrumented systems.

Versions and ordering data

The Type 3755 Pneumatic Volume Booster is available with aluminum or stainless steel body in standard or low-temperature version. These versions can be configured in the table below to generate the corresponding article code:

Pneumatic Volume Booster Type 3755-	**x**	**x**	**x**	**0**	**0**	**x**	**x**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Body material														
Aluminum					0									
Stainless steel					1									
Temperature range														
Standard, –40 to +80 °C										0				

Hook-up examples

The pneumatic volume booster is mounted between the positioner and actuator.

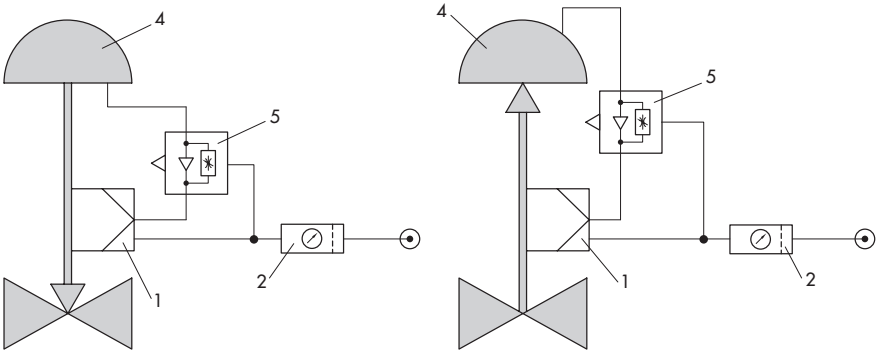

Fig. 1: *Standard connection of the pneumatic volume booster for both fail-safe positions*

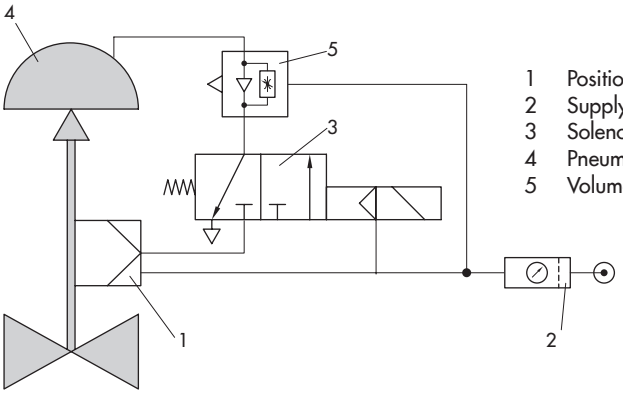

Fig. 2: *Installation of the pneumatic volume booster with an additional solenoid valve*

2 Technical data

Pneumatic volume booster	Type 3755-1	Type 3755-2	Type 3755-2
	Aluminum body		Stainless steel body
Flow coefficients			
K_{VS} Supply	2.5 m³/h		
K_{VS} Exhaust	2.5 m³/h		
K_{VS} Bypass	0.3 m³/h		
Closed loop control			
Pressure ratio: Signal to output	1:1		
Response pressure	Standard temperature range: 80 mbar Low temperature range: 100 mbar		
Pressure			
Supply	Max. 10 bar · Max 145 psi		
Actuator	Max. 7 bar · Max 101.5 psi		
Signal	Max. 7 bar · Max 101.5 psi		
Air quality acc. to ISO 8573-1	Maximum particle size and density: Class 4, Oil content: Class 3, Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected		
Connecting thread			
Supply (SUP)	G ¾ (optionally ¾ NPT)		
Actuator/output (OUT)	G ¾ (optionally ¾ NPT)		
Signal (SIG)	G ¼ (optionally ¼ NPT)		
Exhaust (EXH)	–	G 1 (optionally 1 NPT)	
Safety integrity level			
Use in safety-instrumented systems acc. to IEC 61508/ IEC 61511 [1)]	**Suitable for use in safety-instrumented systems up to SIL 2:** applies to a single device **Suitable for use in safety-instrumented systems up to SIL 3:** applies to redundant configuration of valves according to IEC 61508		

Pneumatic volume booster	Type 3755-1	Type 3755-2	Type 3755-2
	Aluminum body		Stainless steel body
Degree of protection			
Degree of protection provided by enclosure according to EN 60529	IP44 [2]	IP66 [3]	
Conformity	EAC		
Other operating parameters			
Permissible ambient temperature	Standard temperature range: −40 to +80 °C Low temperature range: −55 to +60 °C		
Service life	≥1x10^7 full travel cycles		
Weight	2.1 kg	2.4 kg	5.2 kg
Materials			
Body	Cast aluminum, powder coating (RAL 1019) EN AC-43000KF according to DIN EN 1706	EN AC-43000KF according to DIN 1706 and EN AW-5083-H112 according to DIN EN 755-3	1.4404 and 1.4571
Exhaust side	Silencer with sintered polyethylene filter disk and stainless steel retaining plate	Flanged-on threaded port made of aluminum, powder coated (RAL 1019)	Threaded port made of stainless steel
Diaphragm	Standard temperature range: VMQ Low temperature range: PVMQ		
Seat-plug seal	VMQ		
Other seals	NBR		
Other external parts	1.4404		

1) Only suitable for the standard temperature range and with the aluminum body
2) Exhaust side facing downward or to the side
3) The following applies for Type 3755-2: body IP66; the IP rating depends on how the venting is implemented (pipe, silencer etc.).

3 Safety-related functions

The safety function of the Type 3755 Pneumatic Volume Booster is the emergency venting on demand.

4 Mounting, connection and start-up

Refer to Mounting and Operating Instructions ▶ EB 8393 for details on how to mount, perform the pneumatic connections as well as start up the device.
Only use the specified original mounting parts and accessories.

5 Required conditions

⚠ WARNING

Risk of malfunction due to incorrect selection or wrong installation and operating conditions. Only use control valves in safety-instrumented systems if the necessary conditions in the plant are fulfilled. The same applies to the mounted pneumatic volume booster.

Selection

➔ The volume booster's required degree of protection is observed.

Versions	Degree of protection
Type 3755-1	IP 44 (exhaust side facing downward or to the side)
Type 3755-2	IP 66

➔ The permissible ambient temperature from –40 to +80 °C has been observed.

Mechanical and pneumatic installation

➔ The pneumatic volume booster is mounted properly as described in the mounting and operating instructions and connected to the air supply.

➔ The maximum supply pressure does not exceed 10 bar.

➔ The pneumatic air supply meets the instrument air specifications.

Particle size and quantity	Oil content	Pressure dew point
Class 4	Class 3	Class 3
≤5 µm and 1000/m³	≤ 1 mg/m³	–20 °C or at least 10 K below the lowest ambient temperature to be expected

Tip

SAMSON recommends installing a supply pressure regulator/filter upstream of the positioner. For example, the SAMSON Type 4708 Supply Pressure Regulator with 5 µm filter cartridge can be used.

- ➔ The piping and screw fittings have sufficiently sized cross-sections.
- ➔ The pneumatic volume booster is mounted as prescribed.
- ➔ The exhaust port (EXH) is not blocked or restricted. Under exceptional circumstances, this may be permitted to extend the exhaust time. In such cases, the engineering must be performed only by trained and experienced personnel.

Operation

- ➔ The adjusted bypass restriction is lead sealed and protected against subsequent adjustment.
- ➔ The exhaust port (EXH) is protected against icing up or dirt entering it.
- ➔ The supply pressure is greater than the maximum signal pressure to be expected, but does not exceed 10 bar.

Tip

The pneumatic volume booster does not have its own diagnostic capabilities. However, the diagnostic data of a connected SAMSON Series 3730 or 3731 Positioner can be used to assess the performance of the volume booster.

6 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 check-list.

⚠ WARNING

Risk of dangerous failure due to malfunction in the event of emergency (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.

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}).

Function testing

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

i ***Note***

Record any faults in the pneumatic volume booster and inform SAMSON of them in writing.

1. Move the valve clearly away from the fail-safe position (e.g. set point at 50 % in control valves or to the operating position of on/off valves).
2. De-energize (e.g. 0 mA signal) the inputs at the connected devices (positioner, solenoid valve etc.).
3. Check the effect:
   Does the valve move to the fail-safe position within the required time?

Visual inspection to avoid systematic failure

To avoid systematic failure, visible inspections of the pneumatic volume booster on a regular basis must be performed. The frequency and the scope of the inspection lie within the operator's responsibility. Take application-specific influences into account, such as:

– Corrosion (destruction primarily of metals due to chemical and physical processes)
– Aging (damage caused to organic materials, e.g. plastics or elastomers, 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.

7 Repairs

Only perform the work on the pneumatic volume booster described in ▶ EB 8393.

NOTICE

Safety-instrumented function will be impaired if repair work is performed incorrectly.
Only allow trained staff to perform service and repair work.

8 Safety-related data

The Type 3755 Pneumatic Volume Booster is suitable for use in safety-instrumented systems according to IEC 61508 and IEC 61511. It is suitable for use in safety-instrumented systems up to SIL 2 (single device) and SIL 3 (redundant configuration) according to IEC 61508. The evidence is based on proven-in-use data combined with an FMEA.

Safety-related data

$\lambda_{safe,\ undetected}$	1380 FIT
$\lambda_{safe,\ detected}$	0 FIT
$\lambda_{dangerous,\ undetected}$	120 FIT
$\lambda_{dangerous,\ detected}$	0 FIT
$PFD_{avg.}$ with annual test	5.26×10^{-4}
HFT (Hardware Fault Tolerance)	0
DC (Diagnostic Coverage)	0
Device type	A
Safe failure fraction (SFF)	92 %
MTBFtotal	76 years
$MTBF_{dangerous,\ undetected}$	950 years

1 FIT = 1 failure per 10^9 hours

Useful lifetime

According to IEC 61508-2, section 7.4.9.5, a useful lifetime of eight to twelve years can be assumed. Other values can be used based on the user's previous experience (proven in use).

Intended use

– Refer to the mounting and operating instructions of the pneumatic volume booster:

  ▶ EB 8393: Mounting and operating instructions

– Quality requirements for instrument air: see Chapter 5.

Safety-related assumptions

In case of fault, the actuator is vented, causing the valve to move to its fail-safe position.

Requirements

– Short mean time to repair compared to the average rate of demand.
– Normal exposure to industrial environment and fluids.
– The user is responsible for ensuring that the device is used as intended.

SH 8393 EN

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2024-06-18 · English