

Series 3755
Type 3755
Pneumatic Volume Booster



Type 3755-1: low-noise venting over a sintered polyethylene filter disk



Type 3755-2: flanged-on threaded exhaust port

Safety Manual

SH 8393 EN

Edition January 2018

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 for 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 the Mounting and Operating Instructions ► EB 8393 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. The documents marked with an asterisk (*) are supplied with the pneumatic volume booster either in printed or electronic form.

- T 8393: Data Sheet
- EB 8393*: Mounting and Operating Instructions

Note

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

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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 $\geq 1000 \text{ cm}^2$ or a travel volume $\geq 6 \text{ l}$.

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.*

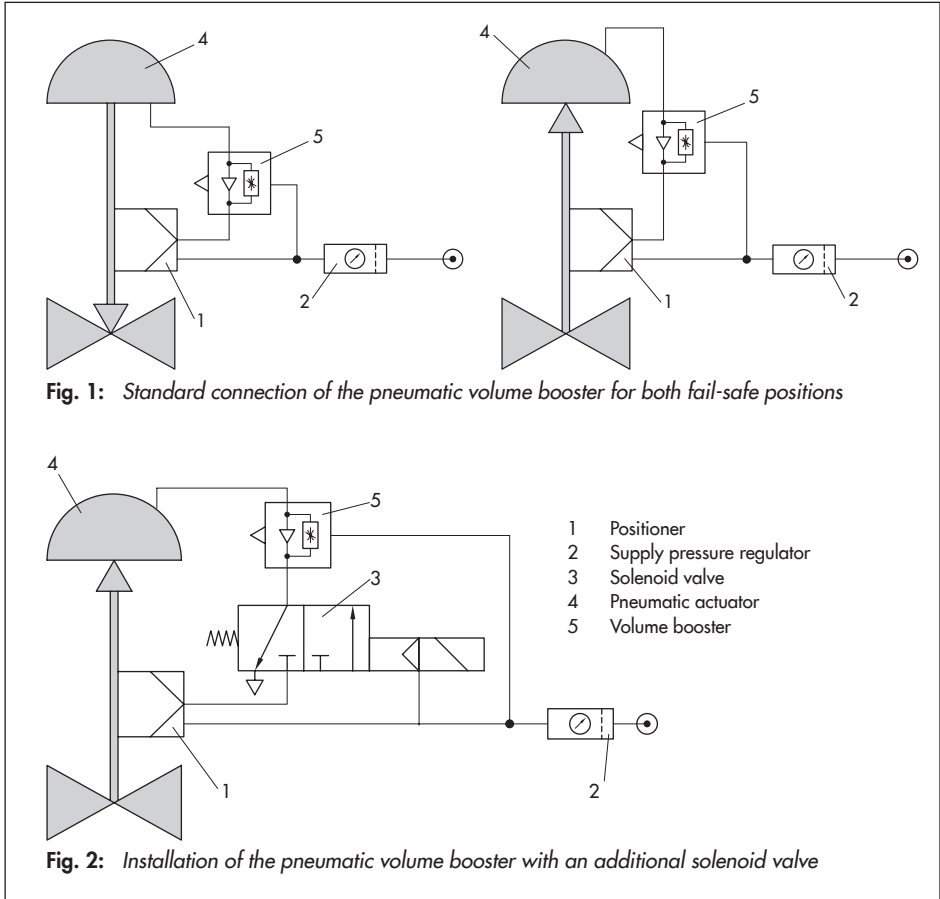
Versions and ordering data

The Type 3755 Pneumatic Volume Booster is available with aluminum or stainless steel body in standard or low-temperature version. Only the **aluminum body version** with **standard temperature range** is suitable for use in safety-instrumented systems. This version has the following 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									
Temperature range														
Standard, -40 to +80 °C													0	

Example hook-ups

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



2 Technical data

Pneumatic volume booster	Type 3755-1	Type 3755-2
	Aluminum body	
Flow coefficients		
K _{VS} Supply	2.5 m ³ /h	
K _{VS} Exhaust	2.5 m ³ /h	
K _{VS} Bypass	0.3 m ³ /h	
Closed loop control		
Pressure ratio: Signal to output	1:1	
Response pressure	Standard temperature range: 80 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 port (EXH)	–	G 1 (optionally 1 NPT)
Safety integrity level		
Use in safety-instrumented systems according to IEC 61508/IEC 61511	<p>Suitable for use in safety-instrumented systems up to SIL 2: applies to a single device</p> <p>Suitable for use in safety-instrumented systems up to SIL 3: applies to redundant configuration of valves according to IEC 61508</p> <p>➔ See manufacturer's declaration at the back of this safety manual.</p>	

Safety-related functions

Pneumatic volume booster	Type 3755-1	Type 3755-2
	Aluminum body	
Degree of protection		
Degree of protection provided by enclosure according to EN 60529	IP 44 ¹⁾	IP 66
Compliance	CE	
Other operating parameters		
Permissible ambient temperature	Standard temperature range: -40 to +80 °C	
Service life	≥1 x 10 ⁷ full strokes	
Weight	2.1 kg	2.4 kg
Materials		
Body	Cast aluminum, powder paint coated (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
Exhaust side	Silencer with sintered polyethylene filter disk and stainless steel retaining plate	Flanged-on threaded port made of aluminum, powder coated (RAL 1019)
Diaphragm	Standard temperature range: VMQ	
Seat-plug seal	VMQ	
Other seals	NBR	
Other external parts	1.4404	

¹⁾ Exhaust side facing downward or to the side

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 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 after the necessary conditions in the plant have been 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
$\leq 5 \mu\text{m}$ and $1000/\text{m}^3$	$\leq 1 \text{ mg}/\text{m}^3$	-20 °C or at least 10 K below the lowest ambient temperature to be expected

Tip

We recommend 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 opening (EXH) remains open when the booster is installed on site.

Operation

- The adjusted bypass restriction is lead sealed and protected against subsequent adjustment.
 - The exhaust opening (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 checklist.

⚠ 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 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

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

HERSTELLERERKLÄRUNG

Für folgende Produkte

Pneumatischer Volumenstromverstärker Typ 3755-xxx000x000...

Hiermit wird bestätigt, dass der pneumatische Volumenstromverstärker gemäß IEC 61508 für den Einsatz in sicherheitsgerichteten Kreisen geeignet ist. Basis dieser Erklärung ist ein mit IEC 61508 konformer Entwicklungsprozess sowie die Auswertung der Ergebnisse aus dem Feldeinsatz des Gerätes.

Der pneumatische Volumenstromverstärker hat eine HFT von 0 und kann nach IEC 61511 bis SIL 2 (einzelnes Gerät, HFT = 0) und SIL 3 (Einsatz an redundant verschalteten Ventilen, HFT = 1) eingesetzt werden. Das Gerät ist nach Typ A eingestuft.

Geltungsbereich

Diese Erklärung gilt nur für Geräte in den Ausführungen mit Standard-Temperaturbereich, Gehäusewerkstoff Aluminium und mit Standard-Dynamikverhalten, Typ 3755-xxx000x000....

Sicherheitstechnische Annahmen

Der pneumatische Volumenstromverstärker entlüftet den Antrieb in Abhängigkeit des zwischen Steuereingang und Ausgang anliegenden Differenzdrucks. Die Luftleistung ist abhängig vom anliegenden Differenzdruck, der maximale Kvs Wert beträgt 2,5.

Sicherheitstechnische Kenndaten

$\lambda_{\text{safe, undetected}}$	270 FIT
$\lambda_{\text{safe, detected}}$	0
$\lambda_{\text{dangerous, undetected}}$	26 FIT
$\lambda_{\text{dangerous, detected}}$	0
PFD _{avg} bei jährlicher Prüfung	0,0001
HFT (Hardware Fault Tolerance)	0
DC (Diagnostic Coverage)	siehe Diagnose
Gerätetyp	A
SFF (Safe Failure Fraction)	>90 %
MTBF gesamt	385 Jahre
MTBF _{dangerous, undetected}	4390 Jahre

MANUFACTURER'S DECLARATION

For the following products

Type 3755-xxx000x000... Pneumatic Volume Booster

We hereby certify that the pneumatic volume booster is suitable for use in safety-instrumented systems according to IEC 61508. 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 pneumatic volume booster has an HFT of 0 and can be used up to SIL 2 (single device, HFT = 0) and SIL 3 (use on redundant configuration of valves, HFT = 1) according to IEC 61511. The device is classified as type A.

Scope

This declaration only applies to device versions with the standard temperature range, aluminum body and standard dynamic response, Type 3755-xxx000x000....

Safety-related assumptions

The pneumatic volume booster vents the actuator depending on the pressure difference between control input and output. The air capacity depends on the differential pressure in the device. The maximum Kvs coefficient is 2.5.

Safety-related data

$\lambda_{\text{safe, undetected}}$	270 FIT
$\lambda_{\text{safe, detected}}$	0
$\lambda_{\text{dangerous, undetected}}$	26 FIT
$\lambda_{\text{dangerous, detected}}$	0
PFD _{avg} with annual test	0.0001
HFT (hardware fault tolerance)	0
DC (diagnostic coverage)	See Diagnostics
Device type	A
Safe failure fraction (SFF)	>90 %
MTBF _{total}	385 years
MTBF _{dangerous, undetected}	4390 years

Nutzbare Gebrauchsdauer

- Das Gerät enthält keine alterungskritischen Bauteile
- Gerätespezifische Instandhaltungsempfehlungen liegen vor

Nach IEC 61508-2 (2010) Abschnitt 7.4.9.5 können 8 – 12 Jahre angenommen werden oder ein Wert benutzt werden, der sich durch Betriebsbewährung oder anhand von Maßnahmen des Betreibers entsprechend Fußnote IEC 61508-2 (2010) Abschnitt 7.4.9.5 N3 ergibt.

Bestimmungsgemäße Verwendung

- Bedienungsanleitung EB 8393
- Sicherheitshandbuch SH 8393
- Anforderung an Instrumentenluft-Qualität

Betriebsbewährtheit

- Die Anforderungen IEC 61511-1 Abschnitt 11.5.3 „Anforderungen an die Auswahl von Komponenten und Teilsystemen auf Basis einer früheren Verwendung“ sind erfüllt.
- Der Nachweis der Leistungsfähigkeit des Gerätes ist durch die bei der Firma SAMSON dokumentierte Felderfahrung erbracht.
- Die Verantwortung für den Einsatz in spezifischen Umgebungsbedingungen liegt beim Anwender.

Diagnose

Das Gerät enthält keine eigenen Vorrichtungen zur Diagnose. Die Diagnosedaten eines vorgeschalteten Stellungsreglers können jedoch zur Beurteilung der Leistungsfähigkeit des Gerätes herangezogen werden, typische Parameter sind zum Beispiel „Laufzeit“, „Totzeit“, „bleibende Regelabweichung“ des angeschlossenen Ventils. Applikationsabhängig können auch andere Parameter verwendet werden.

Useful lifetime

- The device does not contain any components that are critical concerning aging.
- Device-specific maintenance recommendations exist.

According to IEC 61508-2 (2010), section 7.4.9.5, a useful lifetime of eight to twelve years can be assumed. Other values can be used based on the previous experience (proven-in-use) or based on the measures taken by the operator as described in NOTE 3 of IEC 61508-2 (2010), section 7.4.9.5.

Intended use

- Mounting and Operating Instructions EB 8393
- Safety Manual SH 8393
- Quality requirements for instrument air

Proven in use

- The requirements stipulated in section 11.5.3 in IEC 61511-1 (Requirements for the selection of components and sub-systems based on prior use) are met.
- The evidence of the device's performance is supplied by the documented field experience gained by SAMSON.
- The user is responsible for the use in specific ambient conditions.

Diagnostics

The device does not have its own diagnostic capabilities. However, the diagnostic data of a connected positioner can be used to assess the performance of the device. Typical parameters include the transit time, dead time and set point deviation of the connected valve. Other application-related parameters can also be used.



Voraussetzungen

Die Reparaturzeit ist klein gegenüber dem mittleren Zeitintervall zwischen zwei Anforderungen. Durchschnittliche Beanspruchung in industrieller Umgebung durch Medien und Umgebungsbedingungen. Der Anwender ist für bestimmungsgemäßen Gebrauch verantwortlich.

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.

SAMSON AG

A blue ink signature of Michael Kiener, written in a cursive style, positioned above a horizontal line.

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