

LEWIS
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BULLETIN 510



**The Guiding Light to
Pneumatic Machine
Safeguarding.**



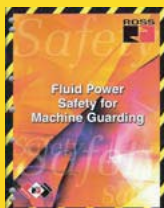
**Complete Your System
with ROSS CONTROLS®
Safety-Related Products.**

Where Does Your Safety System End?

A Complete Safety System should always include all of the components (both electrical and mechanical) – not just the electrical.

SAFETY INFORMATION AND TRAINING

Fluid Power Safety for Machine Guarding Book (order A10264)



- Over 50 pages of information providing an overview of topics related to the safe application of fluid power in industrial applications.
- Topics include Control Integrity, Control Categories, LOTO, Alternative LOTO, Risk Assessment, Risk Assessment as Related to Fluid Power, Clutch/Brake Controls for Mechanical Stamping Presses, Understanding the Function of Counterbalance on Mechanical Stamping Presses, and FAQ's.

+Fluid Power Safety Risk Locator Program (order A10264CD for book+Risk Locator)

- Simply answer questions about your machine and the interactive CD program provides guidance to areas of possible safety concerns for closer examination.

Machine Guarding Safety Course

- A one day class.
- Topics include:
 - Safety System Integrity, Basics of Fluid Power for the System Designer, Basics of Machine Guarding, Recent Developments in Safety Standards, Safety Signage, Canada's Special Requirements, Fluid Power Safety, Energy Isolation (LOTO) – Lockout and Tagout, Risk Assessment, OSHA vs. ANSI, and Initial Accident Scene.
- Contact ROSS or your local ROSS distributor.

This bulletin is dedicated to the memory of our dear friend and colleague, Dick Schnell, our guide into the business of Machine fluid power Safety.

Dr. Richard Schnell
1947 - 2006

COVER CREDITS: Lighthouse Concept - Dick Schnell, GIM Safety ; Photo - Steve Phillips, Distributor Sales Manager.

CONTENTS

Air Dump / Release (3-way)	3, 4
Electrical & Pneumatic Energy Isolation for LOTO	4
Cylinder Return to Home Position	5
Load Holding	5-6
Cylinder Position Holding	5
Pneumatic Energy Isolation for LOTO (L-O-X®)	7
Combined Pneumatic Energy Isolation for LOTO and Soft Start (L-O-X®/EEZ-ON®)	8
Soft Start (EEZ-ON®)	9
Broken Hose or Plastic Tubing Protection	10
Pressure Verification	10
Exhaust Conditioning	11
Exhaust Noise Reduction (Silencers)	11
Standard Specifications	12
Global Fluid Power Safety Reference	14
Product Approvals and Standards Conformity	14



3-Way Sensing Valve (Non-Critical)

Functions as a 3-Way 2-Position, Normally Closed Valve – Air Pilot or Solenoid-Operated

- For Category 2 applications.
- Air pilot and solenoid versions available.
- Poppet construction for near zero leakage.
- Directly operated safety-rated force-guided positive-break status switch (DPST).
- Applications include Air Dump and Trapped-Pressure Release.

Air Dump / Release



Solenoid-operated Model Number*	Air Pilot-operated Model Number*	Port Size		C _v	
		In-Out	Exhaust	1 to 2	2 to 3
SV27NC305407PSAA1A**	SV27NC305405ASAA	1/2 ***	1	6.3	9.2
SV27NC305507PSAA1A**	SV27NC305505ASAA	3/4 ***	1	7.7	11
SV27NC305607PSAA1A**	SV27NC305605ASAA	1 ***	1	8.0	12
SV27NC307607PSAA1A**	SV27NC307605ASAA	1	1-1/2	23	34
SV27NC307707PSAA1A**	SV27NC307705ASAA	1-1/4	1-1/2	30	32
SV27NC307807PSAA1A**	SV27NC307805ASAA	1-1/2	1-1/2	30	32
SV27NC309807PSAA1A**	SV27NC309805ASAA	1-1/2	2-1/2	68	70
SV27NC309907PSAA1A**	SV27NC309905ASAA	2	2-1/2	70	70
SV27NC309957PSAA1A**	SV27NC309955ASAA	2-1/2	2-1/2	70	71

* NPT port threads. For BSPP threads, replace “N” in the model number with a “D”.

** “1A”=120V/60Hz solenoids. For 240V/60, change “1A” to “2A”; for 24V/60, “3A”; for 24 VDC, “1D”.

***EN 954-1, ISO 13849-1, & AS4024-1 (3/4 bodies only)



Control Reliable Pneumatic Energy Isolation

Series **DM²**C Solenoid-Operated 3-Way 2-Position, Normally Closed Valve



Air Dump / Release

- For Category 4 applications (Control reliable).
- 100% dynamic onboard self-contained monitoring system, requiring no further valve monitoring controls.
- Completely dynamic fault memory to prevent accidental reset – cannot be reset by removing air pressure or electrical power.
- Base mounted for easy change out.
- Highly contaminant tolerant poppet construction.
- All necessary features for safety applications are included:
 - a) Electrical reset valve
 - b) Status Indicator switch for valve condition (ready to run) feedback.

Model Number*	Port Size		C _v 1 to 2
	Inlet	Outlet	
DM2CNA42**21	1/2	1/2	3
DM2CNA54**21	3/4	3/4	4.4
DM2CNA55**21	3/4	1	4.4
DM2CNA66**21	1	1	8.5
DM2CNA88**21	1 1/2	2	22

* NPT port threads. For BSPP threads, replace “N” in the model number with a “D”.

** Insert voltage code: “A” = 24 VDC, “B” = 110 VAC.

This valve is expressly not intended for use in press clutch/brake applications.

- ▶ Air Dump / Release
- ▶ Electrical / Pneumatic Energy Isolation (LOTO)



3-Way Sensing Valve (Non-Critical) & Air Entry



Functions as an Air Entry Package with 3-Way 2-Position, Normally Closed Solenoid-Operated Valve

- For Category 2 applications.
- Pre-engineered panel-mounted design includes filter and regulator (FR), or filter, regulator, and lubricator (FRL).
- Poppet construction for near zero leakage.
- Directly operated safety-rated force-guided positive-break status switch (DPST).
- Applications include Air Dump and Trapped-Pressure Release.



Model Number*	Air Entry Type	Port Size		C _v	
		Inlet	Outlet	1 to 2	2 to 3
RC208-06	FR	1/2	1	6.3	9.2
RC212-06	FR	3/4	1	7.7	11
RC216-06	FR	1	1	8.0	12
RC208L-06	FRL	1/2	1	6.3	9.2
RC212L-06	FRL	3/4	1	7.7	11
RC216L-06	FRL	1	1	8.0	12

* NPT port threads. Specify voltage and hertz when ordering.

Control Reliable Energy Isolation & Air Entry



Air Preparation with Series **DM²**®C Solenoid-Operated 3-Way Valve

- For Category 4 applications (Control reliable).
- Pre-engineered panel-mounted design includes filter and regulator (FR), or filter, regulator and lubricator (FRL).
- 100% dynamic onboard self-contained monitoring system, requiring no further valve monitoring controls.
- Completely dynamic fault memory to prevent accidental reset – cannot be reset by removing air pressure or electrical power.
- All necessary features for safety applications are included:
 - a) Electrical reset valve
 - b) Status indicator switch for valve condition (ready to run) feedback.



This valve is expressly not intended for use in press clutch/brake applications.

Model Number*	Air Entry Type	Port Size		C _v 1 to 2
		In-Out	Exhaust	
RC408-06	FR	1/2	1	3
RC412-06	FR	3/4	1	4.4
RC416-06	FR	1	1	4.4
RC408L-06	FRL	1/2	1	3
RC412L-06	FRL	3/4	1	4.4
RC416L-06	FRL	1	1	4.4
RC408-06 ^{EB}	FR	1/2	1	3
RC412-06 ^{EB}	FR	3/4	1	4.4
RC416-06 ^{EB}	FR	1	1	4.4
RC408L-06 ^{EB}	FRL	1/2	1	3
RC412L-06 ^{EB}	FRL	3/4	1	4.4
RC416L-06 ^{EB}	FRL	1	1	4.4

* NPT port threads. Specify voltage and hertz when ordering.



- Cylinder Return to Home Position ◀
- Load Holding ◀
- Cylinder Position Holding ◀



Control Reliable 4-Way Valve - Series 77 CROSSMIRROR®

Functions as a Single Solenoid-Operated 4-Way 2-Position Valve (5/2)
Returns Cylinder to Home Position

- For Category 4 applications (Control reliable).
- Base mounted for easy change out.
- Stainless steel spool valve construction.
- Status indication switch (ready-to-run) to inform machine controller of valve condition; must be interfaced to machine controls in order to prevent run signal until fault is reset in machine logic.
- Applications include small size pneumatic cylinder-operated presses, valve operators, and safety latches.

This valve is expressly not intended for use in press clutch/brake applications.

Model Number*	Port Size		C _v			
	Inlet	Outlet	1 to 2	1 to 4	2 to 3	4 to 5
7776A3411	1/2	3/8	2.0	1.6	1.6	2.8
7776A4421	3/4	1/2	3.2	3.4	2.7	7.2
7776A5411	3/4	3/4	3.2	3.4	2.7	7.2

* NPT port threaded base. For BSPP threads, order valve assembly with a "D" prefix.
Specify voltage when ordering: 24 VDC, 110 VAC, 220 VAC.

Cylinder Return to Home Position



BG Approved



PO Check Valves (Non-Critical)

For Cylinder Position Holding And Load Holding with Trapped Pressure Release



Load Holding



Cylinder Position Holding

Single PO Check Model Number*	Port Size	C _v 1 to 2
2751A3922	3/8	2.6
2751A4922	1/2	2.8
2751A5917	3/4	9.2

* NPT port threads. For BSPP threads, add a "D" prefix to the model number.

- For Category 1 applications.
- Automatic trapped pressure release when pressure is removed from the Blowdown Signal Port (BP).
- Poppet construction for near zero leakage.
- Applications include Air Holding and Cylinder Load Holding.

Dual PO Check Model Number*	Port Size	C _v 1 to 2
2768C3901	3/8	2.9
2768C4901	1/2	3.2
2768C5901	3/4	8.5
2768A6901	1	8.5

* NPT port threads. For BSPP threads, add a "D" prefix to the model number.

PO Check with Sensing

Functions as a 2-Way 2-Position Air Pilot- or Solenoid-Operated Check Valve



- For Category 2 applications.
- Air pilot- and solenoid-operated versions.
- Poppet construction for near zero leakage.
- Directly operated safety-rated force-guided positive-break status switch (DPST).
- Holds a vertical load in the event of loss of air pressure (and loss of electrical power with solenoid operated).



Solenoid-operated Model Number*	Air Pilot-operated Model Number*	Port Size*	C _v 1 to 2
SV27NC115408CSAA1A**	SV27NC115405ASAA	1/2 ***	4.5
SV27NC115508CSAA1A**	SV27NC115505ASAA	3/4 ***	8.3
SV27NC115608CSAA1A**	SV27NC115605ASAA	1 ***	10.3
SV27NC117608CSAA1A**	SV27NC117605ASAA	1	20.2
SV27NC117708CSAA1A**	SV27NC117705ASAA	1-1/4	29.1
SV27NC117808CSAA1A**	SV27NC117805ASAA	1-1/2	31.4



***EN 954-1, ISO 13849-1, & AS4024-1 (3/4 bodies only)

* NPT port threads. For BSP threads, replace "N" in the model number with a "D".
 ** "1A"=120V/60Hz solenoids. For 240V/60, change "1A" to "2A"; for 24V/60, "3A"; for 24 VDC, "1D".

Redundant PO Check with Sensing

Functions as a 2-Way 2-Position Air Pilot- or Solenoid-Operated Check Valve



- For Category 3 applications.
- Air pilot- and solenoid-operated versions.
- Poppet construction for near zero leakage.
- Directly operated safety-rated force-guided positive-break status switch (DPST).
- Holds a vertical load in the event of loss of air pressure (and electrical power with solenoid operated models).

Solenoid-operated Model Number*	Air Pilot-operated Model Number*	Port Size*	C _v 1 to 2
SV27NC555408CSAA1A**	SV27NC555405ASAA	1/2 ***	4.5
SV27NC555508CSAA1A**	SV27NC555505ASAA	3/4 ***	8.3
SV27NC555608CSAA1A**	SV27NC555605ASAA	1 ***	10.3
SV27NC557608CSAA1A**	SV27BC555405ASAA	1	12.1
SV27NC557708CSAA1A**	SV27BC555505ASAA	1-1/4	18.7
SV27NC557808CSAA1A**	SV27BC555605ASAA	1-1/2	22.3



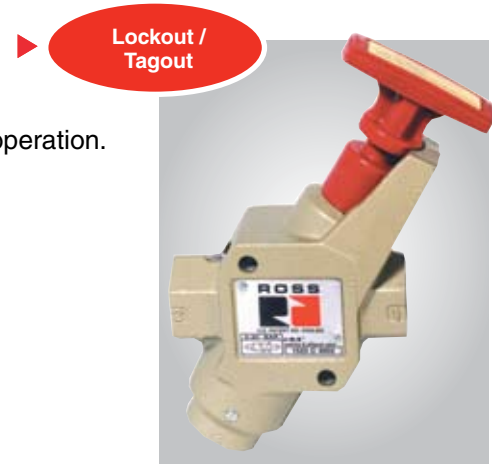
***EN 954-1, ISO 13849-1, & AS4024-1 (3/4 bodies only)

* NPT port threads. For BSP threads, replace "N" in the model number with a "D".
 ** "1A"=120V/60Hz solenoids. For 240V/60, change "1A" to "2A"; for 24V/60, "3A"; for 24 VDC, "1D".

Pneumatic Energy Isolation for LOTO

L-O-X[®] Valves (Lockout & eXhaust)

- Easily identified by unique shape.
- Lockable only in the OFF position.
- Large exhaust port exceeds inlet size for rapid release of pressure.
- Positive action (2 positions only).
- Simple push/pull of the large red handle provides positive direct manual operation.
- Pressure sensing port allows installation of either the Pop-Up Indicator or Pressure Switch option to verify pressure is released. See Page 10 for accessories.



Model Number*	Port Size		C _v	
	In-Out	Exhaust	1 to 2	2 to 3
1523C3002	3/8	3/4	6.0	8.0
1523C4002	1/2	3/4	7.1	8.3
1523C5012	3/4	3/4	8.6	9.5
1523C5002	3/4	1-1/4	13	12
1523C6002	1	1-1/4	13	14
1523C7012	1-1/4	1-1/4	20	14

* NPT port threads. For BSPP threads, add a "D" prefix to the model number, e.g. D1523B3002.

Pneumatic Energy Isolation for LOTO

L-O-X[®] Function (Lockout & eXhaust) with Manual or Combination Manual/Solenoid Operation



- Easily identified by unique shape.
- Lockable only in the OFF position.
- Large exhaust port exceeds inlet size for rapid release of pressure.
- Simple push/pull of the large red handle accommodates reduced manual actuation forces, allowing easy operation.
- Pressure sensing port allows installation of either the Pop-Up Indicator or Pressure Switch option to verify pressure is released. See Page 10 for energy release verification accessories.
- Solenoid-operated models for air dump function (category 1).

Manual Models				Combination Solenoid / Manual Models			
Model Number*	Port Size	C _v 1 to 2	C _v 2 to 3	Model Number*	Port Size	C _v 1 to 2	C _v 2 to 3
2783A6006	1	6.0	8.0	2773A2072**	1/4	2.5	3.1
2783A7006	1-1/4	7.1	8.3	2773A3072**	3/8	3.6	5.3
2783A8016	1-1/2	8.6	9.5	2773A4082**	1/2	3.3	5.3
2783A8006	1-1/2	13	12	2773A4072**	1/2	6.3	9.2
2783A9006	2	13	14	2773A5072**	3/4	7.7	11
2783A9016	2-1/2	20	14	2773A6082**	1	8.0	12
				2773A6072**	1	23	34
				2773A7072**	1-1/4	30	32
				2773A8082**	1-1/2	30	30

* NPT port threads. For BSPP threads, add a "D" prefix to the model number, e.g. D2773A2072.

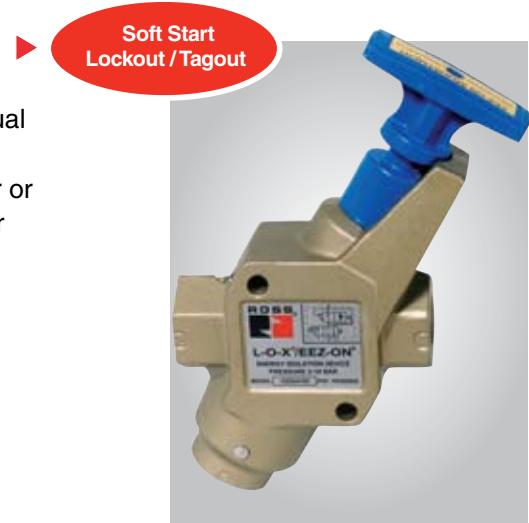
** Specify voltage and hertz when ordering.

► Soft Start Lockout / Tagout

Pneumatic Energy Isolation with Soft Start for LOTO

Combination L-O-X® (Lockout & eXhaust) and EEZ-ON® Valves (Soft Start)

- Gradual re-application of pneumatic pressure prevents rapid equipment movement at startup.
- Lockable only in the OFF position.
- Large exhaust port exceeds inlet size for rapid release of pressure.
- Positive action (2 positions only).
- Simple push/pull of the large blue handle provides positive direct manual operation.
- Pressure sensing port allows installation of either the Pop-Up Indicator or Pressure Switch option to verify pressure is released. See Page 10 for accessories.



Model Number*	Port Size		C _v	
	In-out	Exhaust	1 to 2	2 to 3
1523B3102	3/8	3/4	6.0	8.0
1523B4102	1/2	3/4	7.1	8.3
1523B5112	3/4	3/4	8.0	9.5
1523B5102	3/4	1-1/4	12.0	10.9
1523B6102	1	1-1/4	13.7	12.0
1523B7112	1-1/4	1-1/4	16.2	12.8

* NPT port threads. For BSPP threads, add a "D" prefix to the model number, e.g. D1523B3102.

Pneumatic Energy Isolation with Soft Start for LOTO

Combination L-O-X® (Lockout & eXhaust) and EEZ-ON® Valves (Soft Start) with Manual or Manual /Solenoid-Operated



- Gradual re-application of pneumatic pressure prevents rapid equipment movement at startup.
- Lockable only in the OFF position.
- Large exhaust port exceeds inlet size for rapid release of pressure.
- Simple push/pull of the large blue handle provides positive direct manual operation.
- Pressure sensing port allows installation of either the Pop-Up Indicator or Pressure Switch option to verify pressure is released. See Page 10 for accessories.

Manual Models		Combination Solenoid / Manual Models			
Model Number*	Port Size	Model Number*	Port Size	C _v 1 to 2	C _v 2 to 3
2783B2055	1/4	2773B2075**	1/4	2.5	3.1
2783B3055	3/8	2773B3075**	3/8	3.6	5.3
2783B4065	1/2	2773B4085**	1/2	3.3	5.3
2783B4055	1/2	2773B4075**	1/2	10.0	13.0
2783B5055	3/4	2773B5075**	3/4	12.0	15.0
2783B6065	1	2773B6085**	1	12.0	16.0
2783A6055	1	2773B6075**	1	23.0	34.0
2783A7055	1-1/4	2773B7075**	1-1/4	30.0	32.0
2783A8065	1-1/2	2773B8085**	1-1/2	30.0	31.0

* NPT port threads. For BSPP threads, add a "D" prefix to the model number, e.g. D2773B2075.

** Specify voltage and hertz when ordering.

EEZ-ON® Valves

3-Way Normally Closed EEZ-ON®

- Gradual re-application of pneumatic pressure prevents rapid equipment movement at startup.
- Large exhaust port exceeds inlet size for rapid release of pressure.
- Pressure sensing port allows installation of either the Pop-Up Indicator or Pressure Switch option to verify pressure is released. See Page 10 for accessories.

Manual Models		Combination Solenoid / Manual Models		C_v	
Model Number*	Port Size	Model Number*	Port Size	1 to 2	2 to 3
2783B2037	1/4	2773B2037**	1/4	2.5	3.1
2783B3037	3/8	2773B3037**	3/8	3.6	5.3
2783B4047	1/2	2773B4047**	1/2	3.3	5.3
2783B4037	1/2	2773B4037**	1/2	6.3	9.2
2783B5037	3/4	2773B5037**	3/4	7.7	11
2783B6047	1	2773B6047**	1	8.0	12

* NPT port threads. For BSPP threads, add a "D" prefix to the model number, e.g. D2773B2037.

** Specify voltage and hertz when ordering.



EEZ-ON® Valves – Port-Mounted

Right Angle Style 2-Way Normally Closed EEZ-ON®

Models with Threaded Banjo			
Model Number*	Port 1 (female)	Port 2 (male)	C_v 1 to 2
1969A1010	1/8	1/8	0.7
1969A2010	1/4	1/4	1.1
1969A3010	3/8	3/8	1.9
1969A4010	1/2	1/2	2.2

* NPT port threads. For BSPP threads, add a "D" prefix to the model number, e.g. D1969A1010.



- Gradual re-application of pneumatic pressure prevents rapid equipment movement at startup.
- Right angle style mounts directly in cylinder ports.
- Available with threaded ports or push-in-tubing ports.

Models with Push-to-Connect Fitting			
Model Number	Port 1 mm (inches)	Port 2 (male)	C_v 1 to 2
D1969A1020*	4.0 (5/32)	1/8	0.5
D1969A1030*	6.0 (1/4)	1/8	0.5
D1969A1040	8.0	1/8	0.5
D1969A2020*	6.0 (1/4)	1/4	0.6
D1969A2030*	8.0 (3/8)	1/4	0.6
D1969A2040	10.0	1/4	0.6
D1969A3020*	8.0 (3/8)	3/8	1.5
D1969A3030	10.0	3/8	1.5

* BSPP port threads. For NPT threads, delete the "D" prefix from the model number, e.g. 1969A1020.

- ▶ Prevent Hose Whip
- ▶ Pressure Release Verification



Broken Hose or Plastic Tubing Protection

HOZE-FUZE™

- Automatically reduces flow to a safer level upon sensing a broken hose in order to prevent dangerous “hose whip.”
- Simple installation.
- Comes with male threaded ports on inlet and female threaded outlet port. *(1/4” tube models have push-in-tube fitting outlet.)



Prevent Hose Whip

Model Number*	Port Size**
1969A2001	1/4 Male-Female
1969A3001	3/8 Male-Female
1969A4001	1/2 Male-Female
1969A5002	3/4 Female-Female
1969A6002	1 Female-Female
1969A2002	1/4 Female - 1/4 Tube*

* NPT port threads. For BSPP threads, add a “D” prefix to the model number, e.g. D1969A2001.

** HOZE-FUZE® size should match actual hose inside-diameter size.

Approximate Flow Before Shut-Off (Cfm)

	50 psi	75 psi	100 psi	125 psi	150 psi	180 psi
1/4	13	15	18	21	23	26
3/8	39	49	58	67	76	87
1/2	65	80	96	111	126	144
3/4	110	126	142	158	174	193
1	173	210	248	285	322	367

Pneumatic Energy Release Verification Options

Visual Pop-Up Indicator or Pressure Switch (electrical)

- Provides a means to verify the release of pressure in L-O-X® valve outlet.
- May be installed on all L-O-X® and L-O-X®/EEZ-ON® valves with pressure sensing port.

Model Number	Inlet Port Size*	Outlet Port Size
988A30	1/8	Pop-Up
586A86	1/8	Pressure Switch

* NPT port threads.



Pressure Release Verification

Silencer/Reclassifiers



Exhaust Conditioning ◀

- Captures 90% of exhausted lubricants.
- Use on air tools, valve & cylinder systems, and air motor applications, or any system that requires air line lubrication.
- Both a drain cock and a 1/8 tube fitting are supplied for the manual or constant draining of accumulated liquids.

Model Number*	Port Size	C _v 1 to 2
5055B4009	1/2	5.4
5055B5009	3/4	7.4
5055B6009	1	7.4

* NPT port threads. For BSPP threads, add a "C" prefix to the model number, e.g. C5055B4009.

Silencers

Male Ported Models

Model Number*	Port Size	C _v 1 to 2
5500A1003	1/8	2.0
5500A2003	1/4	2.0
5500A3013	3/8	2.0
5500A3003	3/8	5.7
5500A4003	1/2	7.0
5500A5013	3/4	7.0
5500A5003	3/4	15
5500A6003	1	18
5500A7013	1-1/4	18

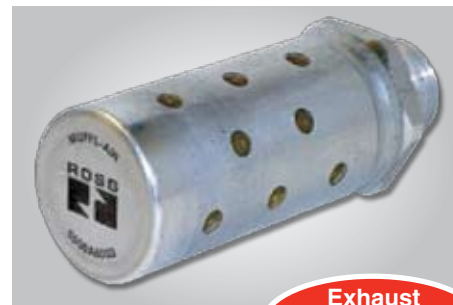
* NPT port threads. For BSPT threads, add a "D" prefix to the model number, e.g. D5500A1003.

Female Ported Models

Model Number*	Port Size	C _v 1 to 2
5500A7001	1-1/4	37
5500A8001	1-1/2	38
5500B9001	2	50
5500A9002	2-1/2	62

* NPT port threads. For BSPT threads, add a "D" prefix to the model number, e.g. D5500A7001.

- Reduces exhaust noise.
- Diffuses exhausting air.



Exhaust Noise Reduction ◀



TECHNICAL SPECIFICATIONS

****General specifications provided above. Please consult ROSS for additional information regarding specific and detailed operating specifications for any of the products shown in this brochure.**

Pilot solenoids: Rated for continuous duty.

Standard voltages: 24 VDC, 110 VAC (50/60 Hz), 220 VAC (50/60 Hz).
For other voltages consult ROSS. Specify voltage and frequency on order.

Inlet Pressure: 15 to 150 psig (1 to 10 bar).

Except:

L-O-X® (Series 15), L-O-X®/EEZ-ON® (Series 15 & 27): 30 to 150 psig (2 to 10 bar)

DM²C valves: 30 to 120 psig (2 to 8 bar)

CROSSMIRROR® & SV27 valves: 40 to 120 psig (2.8 to 10 bar)

HOZE-FUZE™: 0 to 260 psig (0 to 17 bar)

Port-mounted 2/2 EEZ-ON® valves: 45 to 150 psig (3 to 10 bar)

Silencer/Reclassifiers: 5 to 150 psig (0.3 to 10 bar)

Flow Media: Compressed air, filtered (5µm recommended).

Temperature Range: Ambient: 40° to 120° F (4 to 50 C)

Media: 40° to 175° F (4 to 80 C)

Except:

L-O-X® and L-O-X®/EEZ-ON® (series 15), Single & Dual PO Checks, Manual 3/2 EEZ-ON® (Series 27) and Silencer/Reclassifiers: Ambient/Media 40° to 175° F (4 to 80 C)

DM²C: Ambient 15° to 122° F (-10 to 150 C); Media 40° to 175° F (4 to 80 C)

HOZE-FUZE™: Ambient/Media -4° to 275° F (-20 to 135 C)

Port-mounted EEZ-ON®: Ambient/Media 15° to 160° F (-10 to 70 C)



NOTES

World's Best Practice for machinery safety is constantly evolving. As technology improves and lessons are learnt, safer designs and better methods become the norm.

Internationally, there are various Standards which document procedures and requirements to assist in achieving satisfactory levels of safety. These are constantly being rewritten and reviewed to keep them up to date. There is also a movement towards "global harmonization" of Standards to bring them into line throughout the world.

Australian Safety Standards draw on the best overseas information from the USA, Canada, the European Union and elsewhere. Common threads in the approach to safety include the requirement of risk assessment, and the application of safety integrity levels (SIL) or "categories". The concepts of energy isolation, redundancy, monitoring, and prevention of unexpected start-up are universal. Australian Standard 4024.1 (2006) notates the correct procedures to achieve machinery safety in Australia. Other standards also apply.

Workplace laws now require safety be addressed at every stage of a machine's life cycle from design through building and operating to de-commissioning & disposal.

The responsibility for safety is legally applied to all stakeholders in Australian work environments –from owners/managers to supervisors, operators, maintenance & cleaning personnel.

The Ross products in this catalogue are specifically designed and manufactured to assist in achieving World's Best Practice in Machinery Safety.

For further info on pneumatic safety, or any of these products, please feel free to contact Lewis Automation.



A Global Snapshot of Fluid Power and Safety

Safety

Safety is part of a loss prevention program that attempts to eliminate or mitigate injury to all persons, including machine operators and maintenance personnel (highest historical injury rate), as well as damage to the machine, damage to other company assets, and harm to the environment. Current standards now acknowledge that there is no such thing as zero risk, thus it is vitally important to protect personnel and property.

Control Integrity

The important aspect in a control system's design is that the integrity of the entire system must be considered, not just the electrical control portion. Today, designers are required to consider all of the SRC/CS (safety related components of the control system), which includes everything in the system – even the wiring, hoses and installation hardware. The system's integrity is based on the weakest link in the system chain.

The function of a control valve is equivalent to the function of an electrical control relay, and therefore, is subject to the same rules for selection of safety-integrity category. If the controls are designed to category 4, the valve must also meet the requirements of category 4 (commonly referred to as control reliable). To be control reliable, a valve, relay or system must be:

- Redundant in function
- Monitored for a fault (and, therefore, the loss of redundancy)
- Designed to fail-to-safe (single failure does not inhibit the safety stopping function)
- Able to lock and inhibit further operation upon detection of a fault until corrected
- Be designed and manufactured specifically for safety
- Designed such that, where stopping performance is involved, the valve must also be monitored for diminished performance (sluggish behavior) so as to not increase the stopping time
- Be verified by an independent testing lab such as the B-G, TUV, CSA, or UL.

Control reliable valves must be factory designed and engineered to ensure their internal design integrity. Many attempts at self-designed valving appear to be safe but contain unrecognized internal potential problems, which can lead to a momentary unsafe condition. Since these problems are unknown, unseen, and unexpected, they are often excluded from design and safety reviews. A good example is the spool cross-over conditions or ghost positions of a valve, which are usually not shown on schematics. These unknown conditions can present a breach in the integrity of the circuit. Incorporating a control reliable self-monitored valve into your system eliminates all of these concerns. The valve and the monitoring system have undergone integrity testing, and have been designed to meet the safety standards by the manufacturer.

LOTO - Lockout/Tagout Energy Isolation

After performing LOTO and before a worker can enter a protected area of a machine, all energy must be dissipated and verified. De-energized is defined by the standards as being disconnected from all energy sources and not containing residual stored energy. This must be accomplished, for fluid power, with the use of a manually operated valve that meets certain standards or best safety practices. To meet various standards throughout the world an energy isolation valve must:

- Have a secure and tamper resistant method of lock attachment,
- Be located outside the protected area in an easily accessible location,
- Must be provided, either the valve or system, with a method for the employee to verify the dissipation of the energy prior to entering the protected area,
- Not be used for any other function except LOTO,
- Have a full-size exhaust port,
- Be positive acting (only has 2 positions),
- Be easily identifiable,
- Only be lockable in the off position.

Alternative Lockout

New standards address non-standard lockout techniques, called Alternative LOTO. These systems can offer several advantages resulting in cost savings and machine up-time. Before Alternative LOTO can be used, you must determine whether the task qualifies for Alternative LOTO. This requires that the task to be performed must pass the litmus test of being a routine, repetitive task that is integral to the production process. Once this is established, an alternative system can be evaluated, starting with a risk assessment to establish the necessary protection level for the controls. The machine must still be provided with a standard lockout system for repair and other tasks that do not pass the litmus test.

Using Alternative LOTO has allowed many companies to incorporate two advantages into their LOTO program. The first is by using a single lock-point system (also referred to as a remote, low-voltage system), the time to perform the lockout function is reduced since only placement of one lock is required. The second advantage is enhanced safety by reducing

the number of lockout points to one, thus avoiding the chance of one point being missed. These systems place electrical lockout switches on the machine at the points where access to the machine is required. The switches are connected to an appropriate control system (Category 3 or 4), which incorporates valves of a correspondingly appropriate safety control category. The operator can immediately perform lockout at the point nearest the task to be performed without need to travel all around the machine to access all of the lockout points. After the task is completed, the operator can immediately unlock that single lockout point, and then only needs to travel to the operator's station to restart the machine.

Risk Assessment/Reduction

Risk assessment can be used to determine what minimum level of safety products must be used for a specific application. It weighs the degree of harm (injury to personnel, damage to property, or harm to the environment) that may result from an accident and then prompts steps to be taken to determine if it is feasible to reduce these risks to a tolerable level. Risk assessment involves more than just an analysis of the machine. Risk exposure changes with different tasks, so the assessment program is task based. In order to ensure that all tasks are examined and that the operations that are performed during each task are evaluated, the best approach to risk assessment is to form a team that will create a cross-section of knowledge that properly captures all tasks and operations. It may be necessary to obtain professional assistance to achieve this goal.

Once a risk is located there is a pre-determined hierarchy for reducing that risk, which **MUST** be followed:

- First, attempt to engineer the risk out of the machine (such as eliminating an exposed gear drive)
- Second, guard the risk out (includes light curtains and safety circuits)
- Third, incorporate the use of devices (parts handling tongs as an example)
- Fourth, make the worker aware (warning signs).

A concern for risk assessment is that, in the past, many risks have gone unacknowledged because they were not recognized. In order to perform a true risk assessment, additional knowledge or new input is more than likely required. Do not be afraid to involve knowledgeable persons to help your assessment team detect these hazards. A company knowledgeable in fluid power safety can help discover equipment hazards, and can offer safe and cost-justified solutions. Fluid power safety valves are available for every control category in which electrical control devices are available.

Listed below are a few potential areas of concern for safety and risk reduction in fluid power:

- A) Hydraulic accumulator dump valves, which must be monitored or manually operated,
- B) Pilot-operated check valves (PO checks), which are designed to hold a load in place, and inherently trap pressure (which must be released during lockout procedures),
- C) Use of 3-position all ports blocked valves, which also trap pressure,
- D) Hazard created when a hose- or plastic tube-fitting blows off,
- E) The sudden surge of pressure associated with compressed air being reapplied after LOTO, thus causing cylinders to move quickly, subjecting the machine to shock,
- F) Overall circuit analysis, including all electrical and fluid power elements, to uncover potential hazards, even if there have not been any unsafe conditions created in the past. The standards say that if it can happen, it must be considered.

For further information on these and other fluid power safety subjects we suggest that you refer to ROSS CONTROLS® technical reference book "Fluid Power Safety for Machine Guarding." ROSS CONTROLS® also offers a "Risk Locator for Machinery with Pneumatic Power" CD ROM, as well as courses in Fluid Power Safety.

ROSS CONTROLS® manufactures a complete line of pneumatic safety valves in order to meet the needs of any safety application. With over 55 years of experience developing the highest state-of-the-art safety valving, you can be assured that a ROSS valve will provide the highest quality and protection available on the market, meeting or exceeding applicable standards. In addition, ROSS CONTROLS®, the leader in Fluid Power Safety equipment, is completely dedicated to assisting its customers to enhance worker safety. For answers to specific questions please e-mail: sales.info@rosscontrols.com.

Design Standards and Certifications

ROSS valves for Safety-related applications are designed to meet many Global standards including the following:

CSA, Australian AS, EN, ISO, OSHA, ANSI, & CE

When required, ROSS products can be tested and certified by the following authorities:

UL, CSA, TUV, BG

Please visit www.rosscontrols.com for detailed technical information about any product contained in this brochure. Products containing the ROSS CONTROLS® safety logo are certified by ROSS to be engineered and designed for safety-related applications.





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BULLETIN 510

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