

# INSTALLATION, OPERATION & MAINTENANCE MANUAL

for the 1 & 2 Cubic Foot Abrasive Blasting Machines



## MANUAL CONTENTS



03	Catati	Warnings
11.5	SAIRIA	vvarnings

- 05 Description
- 07 System Set Up
- 09 Operation
- 11 Fault Finding

#### **DIAGRAMS**

- 13 RMS Exhaust Valve
- 14 Micro-Valve 1
- 15 Micro-Valve 2
- 16. Deadman Handle
- 17. Auto Air Valve
- 18 Spare Parts & Accessories
- 21. Maintenance

Fill in your model and serial number in the blank spaces below. These can be used for reference whenever service or maintenance is required.

Unit Serial Number	
Date Of Issue	

### SAFETY WARNINGS

# **△ WARNING △**

Read all recommended safe procedures before attempting to use this equipment.

- Depressurise unit before loading media or before any maintenance is performed.
- Do not use abrasives containing silica, lead, arsenic, copper, zinc or sharp glass particles use of abrasives containing these elements could result in serious injury or death.
- Furnish all personnel in the work area with hearing protection and approved respiratory equipment.
- Do not modify or alter any equipment or controls without written consent from Blast-One.
- Wear suitable eye protection when filling unit. There is a possibility that some abrasive may be blown back as the pop-up valve seats.
- Always keep fingers well clear of the working area of the pop-up valve.
- Periodically check all hoses to see that they are in good condition. Repair any valves or hoses that show any signs of wear or leakage.
- All blast operators must use approved respiratory protective equipment.
- The interior condition of the vessel should be inspected regularly for corrosion.
- All blast hose couplings and air hose couplings are provided with holes which must be safety pinned or wired to prevent accidental disconnections.
- Any blast equipment without remote controls must have remote controls installed before
  operating. Failure to do so is a violation of safety regulations and can cause serious injury
  or death to personnel in the blasting area. The use of A-BEC, Clemco or a similar bleeder
  type deadman can cause unintentional start-up without warning, which can result in serious
  personal injury.
- Unrestricted air flow through a compressed air hose end will result in a whipping action which can cause severe injury or death. Always attach a ball valve to each hose "at the source of supply or branch line". Whip check hose restraints should be installed.
- Before operating any abrasive blasting equipment, READ ALL operating and maintenance instructions. Personal protective equipment is REQUIRED when using this type of equipment. Blasters MUST be equipped with heavy canvas or leather gloves, and blast overalls. Safety shoes and hearing protection MUST be worn when required.
- Many coatings contain lead and other heavy metals that are toxic to humans and other life forms. It is imperative when removing lead based coatings, that the operator be aware of the standard industrial hygiene program as referenced in Australian Standard 4361.1. A thorough understanding of all applicable regulations are necessary before operating this equipment.

# **△ WARNING △**

When the unit is operating, DO NOT:

- Attempt to perform maintenance while the unit is under pressure or is even capable of being pressurised. This means at a minimum the inlet valve should be closed and ideally the air source be shut off or disconnected. Anytime the manual blow-down valve (if fitted) is closed it should be assumed the unit is under pressure.
- Aim the blast nozzle at any person or object indiscriminately;
- Remove, repair, or replace any parts while equipment is operating;
- Use worn or inferior quality hoses;
- OVERFILL THE UNIT:
- Operate this machine without thorough knowledge of the machines' operation;
- Exceed the recommended air pressure;
- Operate without safety locking clips on the air hoses.

### **△** CAUTION **△**

The products described and illustrated in this manual are intended for experienced and knowledgeable users of similar equipment used in the blasting industry. The important safety instructions appearing in this manual cover normal conditions and situations. Unusual, unforeseeable use may occur and in these situations it must be understood that common sense, caution and care are to be followed. These factors are not built into the machine, but are supplied by the person(s) maintaining and operating it.

No representations are made or intended as to the useful life, maintenance cycles, efficiency or performance of this product or combination of products. It is the responsibility of the user to ensure that proper and comprehensive training of operators has been performed and all environmental and safety precautions observed.

### **DESCRIPTION**

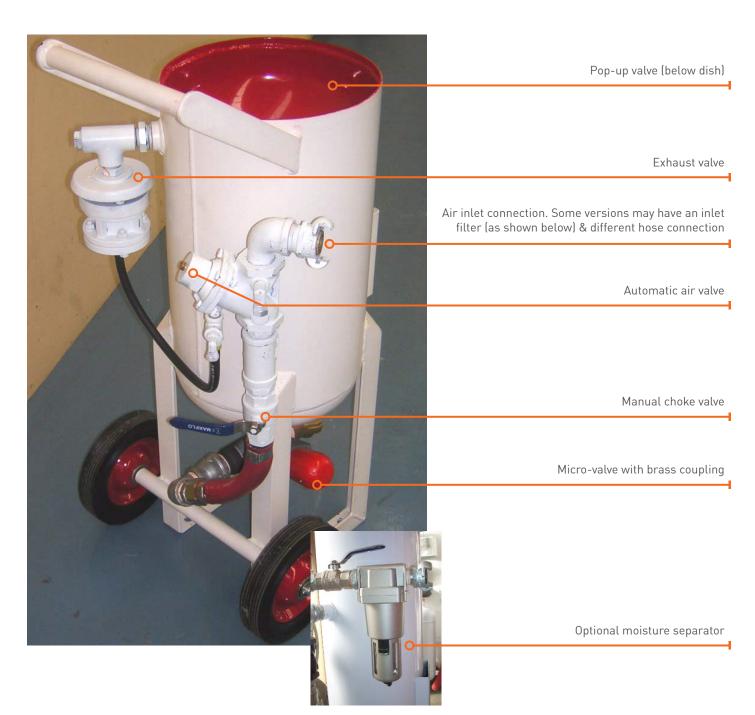
The unit comprises a certified pressure vessel with internal pop-up valve, external pilot operated automatic air valve, "Micro-valve" abrasive metering valve, pilot operated exhaust valve, manually operated "choke" ball valve and associated pipe work.

All parts are replaceable. Spare parts illustrations and part numbers are provided at the end of this manual.

Connections are provided for the remote "dead-man" control handle and blasting hose. Some units may have an optional moisture separator fitted. These are not described in this manual.

The air inlet, as standard, is an "A" Type coupling.

Both the one cubic foot and two cubic foot models are identical except for capacity, axles and wheels, due to the additional weight.



### **HOW THE SYSTEM WORKS**

When the deadman is depressed air pressure passes from the supply hose to the green control hose. The green control hose is connected to the automatic air valve which will open, allowing air to pass into the pot, forcing up the pop-up valve and pressurising the pot.

At the same time, air from the deadman passes to the exhaust valve, closing it off and preventing air from within the pot escaping.

Air also passes down through the choke valve to the Micro-valve, and through the blast hose to the nozzle.

The abrasive flow is adjusted with the knob on the Micro Valve, which enters the air stream to the blast nozzle.

When the deadman is released, the air pressure in the green hose is disconnected and vented. This de-energises the auto air valve, closing off the air to the blast nozzle. At the same time, the exhaust air valve is de-energised, releasing the pressure in the blast pot. When the air is released, the popup valve will drop, allowing abrasive to be added if required.

Depressurisation is a noisy operation, so hearing protection for operators and persons in the vicinity is mandatory.

# **△ WARNING △**

Noise levels are extremely high when the vessel is de-pressurised. Ear protection MUST BE WORN.

Advise other personnel in the vicinity when intending to de-pressurise a vessel.

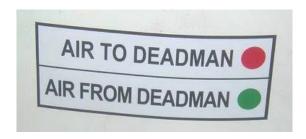
# SYSTEM SET UP

### **CONNECTING HOSES:**



Connect the twin-line deadman hoses to the 1/8" BSP (green hose to green elbow) and 1/4 BSP (red hose to red elbow) swivel connections on the control valve.

A decal is applied to the pot to indicate the hoses & fittings color



# **CONNECTING HOSES: (CONTD.)**



Connect the supply air hose to the inlet connection. Some versions may have an inlet moisture filter

DO NOT TURN THE AIR ON YET!



Connect the blasting hose to the outlet coupling on the Micro-valve

### TO FILL:

In instances where the operator and deadman are not readily visible, or as an added safety precaution, it is recommended that the inlet air supply be turned off prior to filling. This will prevent the operator from turning the unit on while it is being filled.

Dump abrasive into the top head dish, being careful not to get pieces of the bag, etc. into the pot. The abrasive will flow into the pot until full. An excessive amount of material piled on top of the pop-up valve after the unit is full may prevent the pop-up valve from closing properly.

# **⚠ WARNING ⚠**



Keep fingers away from the pop up valve. Whenever compressed air is applied to the unit, there is the possibility that the valve may energise. Severe personal injury can result

### **OPERATION**

### **CHECK LIST:**

- 1. The deadman twin-line hoses are connected and tightened;
- 2. The blast hose is connected to the Micro valve AND has a safety locking pin inserted;
- 3. The supply air hose is connected to the inlet fitting AND has a safety locking pin inserted;
- 4. Abrasive has been added to the pot.
- 5. The air supply is "ON";
- 6. Abrasive has been added to the pot.
- 7. OPEN the supply air ball valve. Listen for any leaks on connections and fittings.

# **△** WARNING **△**

Failure to install safety pins on all blast hose couplings could result in serious injury or death.

### **BLASTING PROCEDURE:**

With the nozzle pointed at the work, push in the safety button and depress the handle on the deadman. Air and abrasive will flow into the blast hose, and blasting will commence.

The abrasive flow can be adjusted with the control job on the abrasive metering valve. Turn clockwise for less abrasive and counter clockwise for more abrasive. Due to the length of the blast hose there will be a slight delay in control of the abrasive at the nozzle so allow a few seconds before adjusting further.

### STOPPING THE BLASTING & DEPRESSURISING THE POT

To stop blasting, release the deadman handle. The auto air valve and exhaust valve will deenergise, simultaneously stopping the blasting the process and exhausting the pressure in the blast pot. When the air is released, the pop-up valve will drop, allowing abrasive to be added if required.

# **⚠ WARNING ⚠**

Airborne particles and loud noise hazard from exhaust air can cause serious injury and loss of hearing. Stay clear of the blow down path. DO NOT place hands or other body parts in the blow down air path. Make sure no personnel are in the blow down air path. Wear approved eye and ear protection.

# Air Consumption (c.f.m.) Per Blast Nozzle

NOZZLE SIZE		60 P.S.I.	70 P.S.I.	80 P.S.I.	90 P.S.I.	100 P.S.I	120 P.S.I.
No. 2	1/8"	17	19	21	24	26	30
No. 3	3/16"	37	42	47	52	57	67
No. 4	1/4"	66	75	84	93	103	119
No. 5	5/16"	103	117	131	145	158	186
No. 6	3/8"	149	169	189	209	229	269
No. 7	7/16"	203	230	258	285	312	367
No. 8	1/2"	265	300	336	371	407	478
No. 10	5/8"	412	468	524	580	632	744
No. 12	3/4"	596	676	756	836	916	1076
Efficiency		55%	64%	74%	86%	100%	130%

# Abrasive Consumption (lbs per hour) Per Blast Nozzle

NOZZLE SIZE		60 P.S.I.	70 P.S.I.	80 P.S.I.	90 P.S.I.	100 P.S.I	120 P.S.I.
No. 2	1/8"	90	105	115	130	140	165
No. 3	3/16"	205	230	260	290	320	375
No. 4	1/4"	365	420	460	500	560	660
No. 5	5/16"	575	650	725	825	900	1050
No. 6	3/8"	840	945	1050	1155	1260	1475
No. 7	7/16"	1150	1300	1450	1600	1750	2050
No. 8	1/2"	1460	1660	1850	2000	2250	2650
No. 10	5/8"	2290	2600	2900	3125	3520	4100
No. 12	3/4"	3300	3750	4180	4500	5060	5950

# **FAULT FINDING**

SYMPTOM	POSSIBLE PROBLEM	REMEDY		
	The pot is empty.	Refill		
Air Blast but No	The abrasive in the pot is wet (Moisture can enter in vapour form with the compressed air - this is not uncommon depending on air quality) *	Try closing the choke valve until some abrasive is pumped out. Operating the unit in the "choked" condition will allow the use of media that is too damp to flow properly, but it greatly accelerates wear in the metering valve. Continuous running in the "choked" position also reduces productivity & therefore should be avoided.		
Abrasive	Foreign matter is plugging the abrasive metering valve.	Try closing the choke valve & opening the abrasive metering valve momentarily to see if that will blow the obstruction out. If this does not work then it will be necessary to depressurise the pot & remove the obstruction by hand.		
	Pop up valve leak - worn or out of alignment with seal	Check and rectify		
	Exhaust valve leak	Check diaphragm. Repair as necessary		
	Insufficient air compressor (see air requirements chart)	Use a larger compressor or a smaller nozzle		
Reduced Pressure at the Nozzle (with or	Air hose is too small.	The air hose diameter should be at least 3 times the nozzle diameter. (Air blows out the pop-up valve opening but the pot does not pressurise.)		
without abrasive flow).	Abrasive adjustment open too far	Start off with no abrasive (fully closed) then open slowly until a slight colour change can be seen		
	Pop-up not seating properly	Check valve and "O"-ring seat		
	Choke valve partially closed	Open fully		
Unit is Slow to Turn On or Will Not Turn On	Air hose is too small	The air hose diameter should be at least 3 times the nozzle diameter. (Air blows out the pop-up valve opening but the pot does not pressurise.)		
	Insufficiently sized air compressor.	See above		

 $<sup>\</sup>ensuremath{^*}$  Use dry air. Contact Blastech for an air dryer to suit your application.

### **FAULT FINDING**

	Control hoses are leaking. (The pot turns on slowly or does not turn on at all.)	Check and repair
Unit is slow to turn on or will not turn on	Defective diaphragm in automatic air valve or blow down valve	Repair as necessary
	Control hoses are plugged or kinked	Repair as necessary
Unit turns on	The lever on the deadman is worn out	Replace the lever.
accidentally	The safety button on the deadman is missing	Replace
Unit is slow to turn off	A bleeder type deadman has been installed. These are unsafe because a piece of dirt from the air hose can plug the hole in the deadman and cause the blast unit to turn on	Use correct deadman control handle
or will not turn off	The deadman is faulty	Repair or replace
	Deadman connected back to front	Change hoses around
	Auto air valve jammed open	Repair as necessary

#### **WORK UNDER PRESSURE**

#### Check nozzle pressure for productivity -

Use a hypodemic needle pressure gauge kit, and insert the needle into the blast hose slowly, a few inches back from the nozzle. Point the needle toward the nozzle, and at a slight angle. Insert slowly until you get a constant reading. Are you getting 100psl?

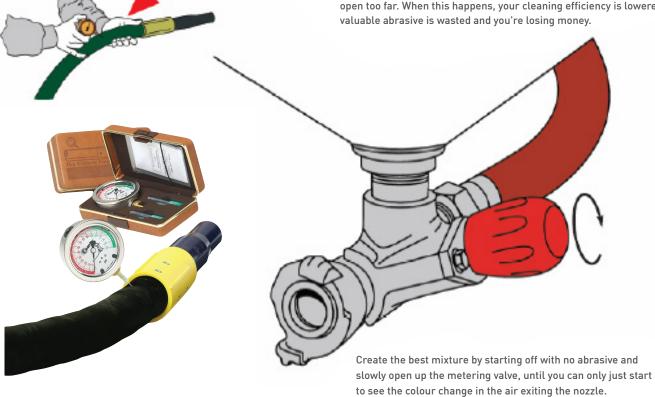
#### **ABRASIVE SETTINGS**

#### Don't lose valuable abrasive -

Make sure your abrasive metering valve is set properly. How can you tell? Look at the abrasive flow coming out of your nozzle. An efficient air/abrasive mixture will be only slightly visible, appearing as a coloured haze in the air system.

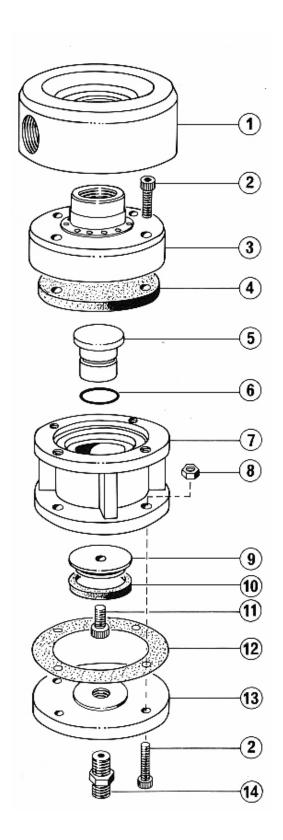
If you see a lot of colour in this flow, there's too much abrasive (and not enough air) in the mixture. Why? Your abrasive metering valve is open too far. When this happens, your cleaning efficiency is lowered, valuable abrasive is wasted and you're losing money.

That's all the abrasive you need for fast blasting.



# **DIAGRAMS**

# **RMS OUTLET VALVE**

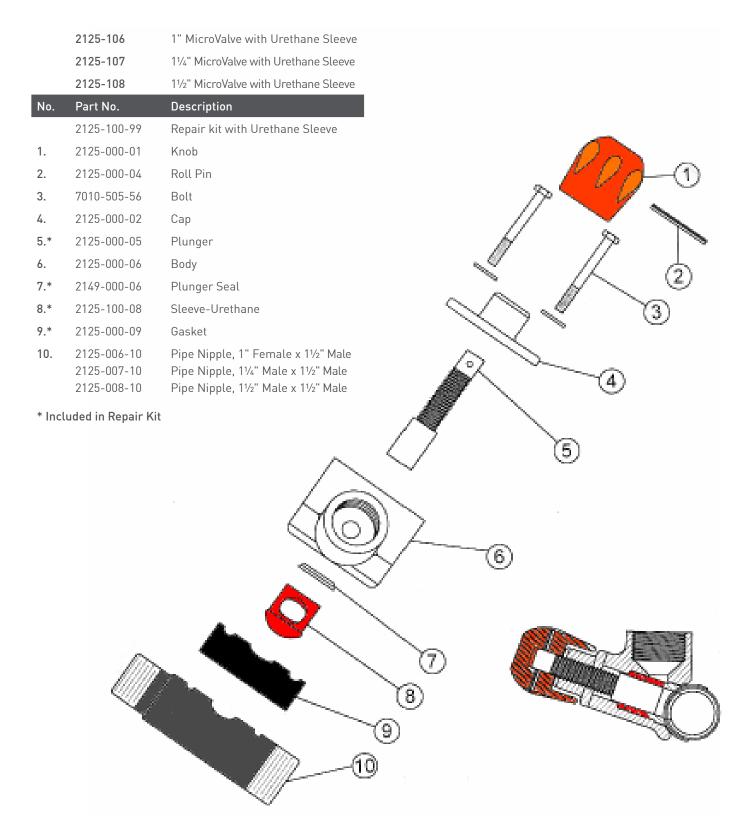


Item	Description	Code No.
-	Outlet Valve complete	RMS-2000
- +	Exhaust cover	RMS-2100
- +	Exhaust gasket	RMS-2101
1	Manifold	RMS-2001
2	Cap Screw	RMS-1012
3	Top Cover	RMS-2013
4 *	Diaphragm	RMS-2014
5	Main Piston	RMS-2015
6 *	'O' Ring	RMS-1023
7	Main Body	RMS-2017
8	Nul	RMS-2018
9	Seal Retainer	RMS-1017
10 *	'U' Seal	RMS-1016
11	Cap Screw	RMS-1015
12 *	Gasket	RMS-1014
13	Cover	RMS-1013
14	Nipple	FNIP-06

<sup>\*</sup> included in Service kit 1 (see page 14) + Service kit 2 includes Service kit 1 plus +

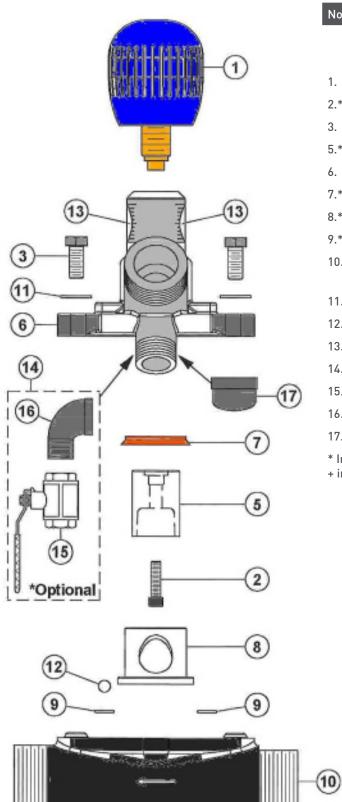
### MICRO VALVE

### MICRO VALVE 1 (Orange Knob)



# **DIAGRAMS**

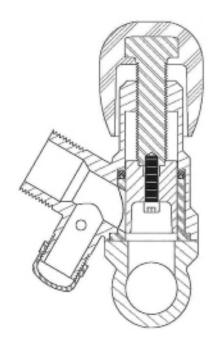
### MICRO VALVE 2 (Blue Knob)



2127-107	MV2 Valve Assembly, Urethane 1-1/4" & 1"
2127-108	MV2 Valve Assembly. Urethane 1-1/2"

	2127-100	MVZ valve Assembly, Oreliane 1-72				
No.	Part No.	Description				
	2127-100-98	Replacement Parts Kit, Seals Only				
	2127-100-99	Replacement Parts Kit				
1.	2127-000-01	Knob				
2.*	7011-005-060	Socket Head Cap Screw, 5/16"x1" Lg. Self Sealing				
3.	7010-507-06	Hex Bolt, 3/8"x1" Lg.				
5.*	2127-000-05	Plunger				
6.	2127-000-06	Body				
7.*+	2149-500-06	Plunger Seal				
8.*+	2127-100-08	Polyurethane Sleeve				
9.*+	2127-000-09	0-Ring				
10.	2127-007-10	Base, 11/4" [1-1/4"M x 1-1/2"M]				
	2127-008-10	Base, 1½" (1-½"M x 1-½"M)				
11.	7027-503-02	Flat Washer, 3/8"				
12.*+	2127-000-12	Ball				
13.	2127-000-13	Orifice Indicator Decal				
14.	2127-000-14	Cleanout Ball Valve Adder				
15.	2401-505	Ball Valve, 3/4" Full Port				
16.	3006-105	Street Elbow 90°, 3/4" Galv.				
17.	3037-105	Pipe Cap, 3/4" Galv.				
* Included in Replacement Parts Kit						

<sup>+</sup> included in Replacement Parts Kit, Seals Only

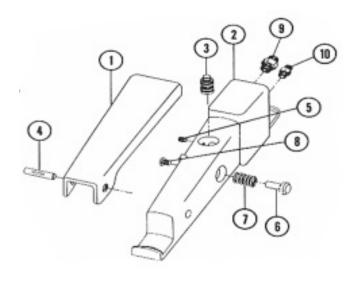


# "RESPONSE" DEADMAN HANDLE



No	o. Part No.	Description
	2263-002-99	Repair Kit
1.	2263-002-01	Lever
2.	2263-002-02	Body
3.	2263-002-03	Cartridge assembly
4.	2263-002-04	Hinge pin
5.	2263-002-05	Cartridge set screw
6.	2263-002-06	Button
7.	2263-002-07	Spring
8.	2263-002-08	Button screw
9.	FB-N-02	Hex nipple 1/8" x 1/8"
10	. FB-N-04	Hex nipple 1/4" x 1/4"

# "STX" DEADMAN HANDLE



No.	Part No.	Description
	2263-000-99	Repair Kit
1.	2263-000-01	Lever
2.	2263-000-02	Body
3.	2263-000-03	Cartridge assembly
4.	2263-000-04	Hinge pin
5.	2263-000-05	Cartridge set screw
6.	2263-000-06	Button
7.	2263-000-07	Spring
8.	2263-000-08	Button screw
9.	FB-N-02	Hex nipple 1/8" x 1/8"
10.	FB-N-04	Hex nipple 1/4" x 1/4"

25.

2014-300

\* Included in Repair Kit

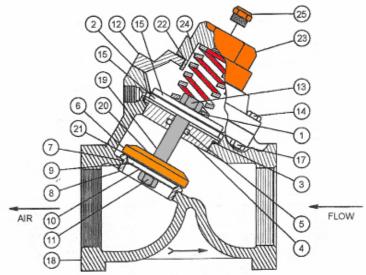
# **AUTOMATIC AIR VALVE (NORMALLY CLOSED)**

2123-107

1 1/4" Valve

	2123-106	1" Valve		2123-108	1 1/2" Valve		2123-109	2" Valve
No.	Part No.	Description	No.	Part No.	Description	No.	Part No.	Description
	2123-006-99	Repair Kit		2123-007-99	Repair Kit		2123-009-99	Repair Kit
1.*	2123-006-01	Gasket	1.*	2123-007-01	Gasket	1.*	2123-009-01	Gasket
2.*	2123-006-02	Diaphragm	2.*	2123-007-02	Diaphragm	2.*	2123-009-02	Diaphragm
3.*	2123-006-03	0-Ring	3.*	2123-007-03	O-Ring	3.*	2123-009-03	0-Ring
4.	2123-006-04	Retainer Bushing	4.	2123-007-04	Retainer Bushing	4.	2123-009-04	Retainer Bushing
5.*	2123-006-05	0-Ring	5.*	2123-007-05	O-Ring	5.*	2123-009-05	0-Ring
6.	2123-006-06	Disk Retainer	6.	2123-007-06	Disk Retainer	6.	2123-009-06	Disk Retainer
7.*	2123-006-07	0-Ring	7.*	2123-007-07	O-Ring	7.*	2123-009-07	0-Ring
8.	2123-006-08	Seat	8.	2123-007-08	Seat	8.	2123-009-08	Seat
9.	2123-006-08	Disc Plate	9.	2123-007-09	Disc Plate	9.	2123-009-09	Disc Plate
10.	"Deleted"	Lock Washer, Internal	10.	"Deleted"	Lock Washer, Internal	10.	"Deleted"	Lock Washer, Inter
11.*	2123-006-11	Lock Nut	11.*	2123-007-11	Lock Nut	11.*	2123-009-11	Lock Nut
12.	2123-106-12	Сар	12.	2123-107-12	Сар	12.	2123-109-12	Сар
13.*	2123-006-13	Hex Nut (w/Locktite)	13.*	2123-007-13	Hex Nut (w/Locktite)	13.*	2123-009-13	Hex Nut (w/Locktit
14.	2123-006-14	Cap Screw	14.	2123-007-14	Cap Screw	14.	2123-009-14	Cap Screw
15.	2123-006-15	Diaphragm Plate	15.	2123-007-15	Diaphragm Plate	15.	2123-009-15	Diaphragm Plate
17.	2123-006-17	Lock Nut	17.	2123-007-17	Lock Nut	17.	2123-009-17	Lock Nut
18.	2123-006-18	Body, 1"	18.	2123-007-18	Body, 1 1/4"	18.	2123-009-18	Body, 2"
19.	2123-006-19	Shaft		2123-008-18	Body, 1 1/2"	19.	2123-009-19	Shaft
20.*	2123-006-20	Gasket	19.	2123-007-19	Shaft	20.*	2123-009-20	Gasket
21.*	2123-006-21	Dick	20.*	2123-007-20	Gasket	21.*	2123-009-21	Dick
22.	2123-106-22	0-ring	21.*	2123-007-21	Dick	22.		Not Needed
23.	2123-106-23	Spring Retainer	22.	2123-107-22	O-ring	23.	2123-109-23	Spring Retainer
24.	2123-106-24	Spring	23.	2123-107-23	Spring Retainer	24.	2123-109-24	Spring
			2/	2122_107_2/	Spring			

<sup>0-</sup>Ring Disk Retainer 0-Ring Seat Disc Plate Lock Washer, Internal Lock Nut Сар Hex Nut (w/Locktite) Cap Screw Diaphragm Plate Lock Nut Body, 2" Shaft Gasket Dick Not Needed Spring Retainer Spring 2123-109-24 24. 2123-107-24 Spring Vent, 1/8" (not included) Vent, 1/8" (not included) 2014-300 25. 2014-300 Vent, 1/8" (not included) \* Included in Repair Kit \* Included in Repair Kit



NOTE: With spring closed valve air flow is in opposite direction from arrow on valve body.

# SPARE PARTS & ACCESSORIES





DM 2263-001

Deadman handle
RESPONSE version



DM 2263-002

Deadman twin line, fitted with connectors



AH RMS-4020

Micro-Valve 1



GV 2125-107

Micro-Valve 2



11/4 x 11/2 " GV 2127-107 11/2 x 11/2" GV 2127-108

Auto Air Valve



DM 2123-106

# SPARE PARTS & ACCESSORIES

RMS Exhaust valve		DM RMS-2000
Lid & Screen		BM 5012-010
Nozzle pressure test kit		BA HNG-KIT
Nut, tail & leather washer	0	FNTL-25 x 25
RMS valve cover & gasket	00	DM-RMS-2100 & DM-RMS-2101
Pop-up valve seat support		KL-012
Pop-up valve seating ring Pop-up valve seat support "0"-ring (not shown; KL-013)	0	BA PM-5

# SPARE PARTS & ACCESSORIES

Pop-up valve	BA-PM-2
Air inlet claw coupling	FM-AT25-TN (clips HF-CLP-2)
Brass blast hose coupling	HF BTC-2
Claw coupling	1-1/2" male FMSL38TM 1-1/2" female FMSL38TF 2" male FMSL50TM 2" female FMSL50TF
Micro-Valve 1 Service Kit	GV 2125-100-99
Micro-Valve 2 Service Kit - Complete	GV 2127-100-99
Micro-Valve 2 Service Kit - "O" rings only	GV 2127-100-98
Auto Air Valve Service Kit	DM 2123-006-99
Coupling gasket (pkt 10)	HF-GMRL-P
Coupling gasket (pkt 10) (high pressure)	HF-GMRH-P
Surelock gasket (pack 10)	FM SL-GSK-P
Ball valve	FV BL-25

# **MAINTENANCE**

# **INTERVAL SCHEDULE**

Applicable to the following equipment:-	Blast Pot		
INSPECTION	DAILY	WEEKLY	SIX MONTHLY
Drain air inlet moisture separator	Х		
Check condition of gaskets on hose connections	Χ		
Check deadman hoses for wear, damage, leaks	Χ		
Clean filling screen (if fitted)	Χ		
Ensure safety pins are fitted to all connections	Χ		
Check deadman operation	Χ		
Check for air leaks on any hose connection	Χ		
Check nozzle gasket		Х	
Check nozzle for wear		Х	
Check pop-up valve seals correctly		Х	
Check operation of exhaust valve		Х	
Inspect vessel for rust, dents, bulges etc		Х	
Remove Micro valve & inspect for wear, replace parts as required			X
Remove auto air valve & inspect for wear, replace parts as required			X
Remove exhaust valve & inspect for wear, replace parts as required			X

# **MAINTENANCE LOG**

DATE	REPORT	OPERATOR

# **REVISION STATUS**

REVISION NUMBER	DATE	REVISION AUTHOR
Original	January 2011	DBT
Α		
В		
С		



#### BLASTONE INTERNATIONAL (AUST) PTY LTD

57 Alexandra Place Murarrie Queensland 4172 Australia

PO Box 3385 Tingalpa DC Queensland 4172 Australia

Toll Free 1800 190 190 Tel (07) 3329 5000 Fax (07) 3329 5066 Email sales.au@blastone.com www.BlastOne.com

#### AUSTRALIAN OFFICES

Adelaide | Brisbane | Darwin | Mackay | Melbourne | Perth | Sydney

#### BLASTONE INTERNATIONAL

4510 Bridgeway Avenue Columbus Ohio 43219 USA

Toll Free 800 999 1881 Tel (614) 476 3000 Fax (614) 476 3002 Email sales@blastone.com www.BlastOne.com

#### NORTH AMERICAN OFFICES

Chicago | Columbus | Los Angeles | Minneapolis