



OPERATION, PREVENTIVE MAINTENANCE AND PARTS SUPPORT MANUAL

FOR

MAXIFORCE AIR LIFTING BAG SYSTEMS

1 FEBRUARY 2005

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7	17 JUN 03	Lift capacities, lift heights, and height vs. load capacity graph updated.	

FOREWORD

This technical manual conforms to Military Specifications MIL-M-38784 General Style and Format Requirements, MIL-M-7298 Commercial Equipment Technical Manual and MIL-M-15071 Equipment and Systems Content Requirements for Technical Manuals. The manual contains description, operating instructions, theory of operation, scheduled maintenance recommendations and parts lists for MAXIFORCE® Air Lifting Bag Systems manufactured by Paratech Incorporated, 1025 Lambrecht Road, Frankfort, Illinois 60423-7000.

All pertinent data relative to the MAXIFORCE® Air Lifting Bag Systems is contained herein without specific reference to other publications. Refer to the table of contents for the arrangement of the contents within this publication.

This manual consists of one volume arranged in four chapters as follows:

Chapter 1 - General Information and Safety Precautions

Chapter 2 - Operation

Chapter 3 - Scheduled Maintenance

Chapter 4 - Parts List

TABLE OF CONTENTS

Chapter/Para	Title	Page
1	GENERAL INFORMATION AND SAFETY	1-1
	FIRST PROCEDURES	
1-1	Safety Precautions	1-1
1-2	Scope of Manual	1-1
1-3	Arrangement	1-1
1-4	Equipment Function	1-1
1-5	Interrelationship of Components	1-1
1-6	Equipment Description	1-2
1-7	Reference Data	1-4
1-8	Equipment, Accessories and Documents	1-4
2.	OPERATION	2-1
2-1.	Introduction	2-1
2-2	Controls and Indicators	2-1
2-3	System Functional Operation	2-3
2-4	Component Interconnection Prior to Inflation	2-4
2-5	Normal Operating Procedure During Inflation	2-5
2-6	Changing Air Cylinders	2-7
2-7	Normal Operating Procedure During Deflation	2-7
2-8	Component Disconnection After Deflation	2-7
2-9	Applications	2-8
2-10	Lift Bag Chemical Compatibility	2-11
3.	MAINTENANCE AND STORAGE	3-1
3-1	General	3-1
3-2	Preventive Maintenance Plan	3-1
3-3	Post Operation Preventive Maintenance	3-1
3-4	Storage	3-3
4.	PARTS LIST	4-1
4-1	Introduction	4-1
4-2	List of Major Components	4-1
4-3	Parts List Tables	4-1
4-4	List of Manufacturers	4-1
4-5	Exploded Assemblies: Controllers and Regulators	4-10

LIST OF TABLES

Table	Title	Page
1-1	MAXIFORCE Air Lifting Bag Reference Data	1-4
4-1	List of Major Components	4-1
4-2	MAXIFORCE Air Lifting Bag System Components Parts List	4-2

LIST OF FIGURES

Figure	Title	Page
1-1	Typical MAXIFORCE Air Lifting Bag System	1-1
1-2	Typical MAXIFORCE Lift Bag	1-2
1-3	Piston Type High Pressure Regulator	1-2
1-4	Diaphragm Type Standard Regulator	1-2
1-5	Single Safety Relief and Control Valve	1-3
1-6	Dual Safety Relief and Control Valve	1-3
1-7	Single Push-button Safety Relief and Control Valve	1-3
1-8	Dual "Deadman" Safety Relief and Control Valve	1-3
1-9	Safety In-Line Relief Valve	1-4
2-1	Manual Compressor Controls and Indicators	2-1
2-2	Air Cylinder Controls and Indicators	2-1
2-3	Piston Type Pressure Regulator Controls and Indicators	2-2
2-4	Diaphragm Type Pressure Regulator Controls and Indicators	2-2
2-5	Single Safety Relief and Control Valve Controls and Indicators	2-2
2-6	Dual Safety Relief and Control Valve Controls and Indicators	2-2
2-7	Single Push-button Safety Relief and Control Valve Controls and Indicators	2-2
2-8	Dual "Deadman" Safety Relief and Control Valve Controls and Indicators	2-3
2-9	In-Line Relief Valve Controls and Indicators	2-3
2-10	Quick Connect Coupling Safety Locking Ring	2-4
2-11	Typical Applications	2-9
2-12	Correct Method of Safety Cribbing/Bracing	2-10
2-13	Lift Bag Stacking and Tandem Combinations	2-10
2-14	Correct Method for Inflating Stacked Lift Bags	2-11
2-15	Using Two Lift Bags to Lift Cylindrical Objects	2-11
3-1	Air Hose Nipple Replacement	3-2
3-2	Air Hose Quick Connect Coupling Replacement	3-2
4-1	Single Safety Relief and Control Valve	4-10
4-2	Dual Safety Relief and Control Valve	4-10
4-3	Single Push-button Safety Relief and Control Valve	4-11
4-4	Dual "Deadman" Safety Relief and Control Valve	4-12
4-5	Diaphragm Type Pressure Regulator	4-13
4-6	Piston Type Pressure Regulator	4-15

SAFETY FIRST

Personnel safety and the prevention of equipment damage were primary considerations during the design and expected utilization of MAXIFORCE® Air Lifting Bag Systems. When MAXIFORCE Air Lifting Bag Systems are properly used in combination with good common sense, an extremely safe method of applying force is realized.

Although the following safety first list is quite extensive, the majority of the precautions are just good common sense for any personnel qualified in the use of lift bags. However, some of the precautions are not obvious and Paratech strongly recommends that all operating/assisting/maintenance personnel read and understand the complete safety first procedures in order to ensure personnel and equipment safety.

Since there are four distinct operational phases of lift bag use: Prior to Inflation, During Inflation and While Inflated, During Deflation, and After Removal, the safety first list is charted to reflect these applications. As shown in the following table, during each operational phase, each safety procedure may be required Always (A), If Time Permits (ITP), or Depending Upon Application (DUA).

SAFETY FIRST PROCEDURE	PRIOR TO INFLATION	DURING INFLATION AND WHILE INFLATED	DURING DEFLATION	AFTER REMOVAL
Regardless of the condition for lift bag use, safety first is primary to prevent injury or death and/or equipment damage.	A	A	A	A
All personnel at the immediate lift bag site must be trained and qualified.		A	A	
All personnel at the immediate lift bag site must be properly suited up (protective clothing, helmet, eye protection, gloves, footwear, etc.) at all times.	ITP	A	A	
Never exceed the maximum inflation pressure marked on the lift bag. (Normally 118 psi / 8 bar)		A		
Do not handle hoses or lift bags while the system is pressurized.		A	A	
Do not connect or disconnect system components when the system is pressurized. The only exception is disconnection of a safety in-line relief valve from a controller. Refer to the technical manual for multiple lift bag use.		A	A	

Observance of the following safety first procedures will assure the safe and efficient utilization of the MAXIFORCE Air Lifting Bag System.

SAFETY FIRST PROCEDURE	PRIOR TO INFLATION	DURING INFLATION AND WHILE INFLATED	DURING DEFLATION	AFTER REMOVAL
Always be on the opposite side of any expected movement	A	DUA	A	
Always stand clear of a load that is only supported by lift bag(s). Never be below a lift bag supported load that has no blocking or cribbing for positive support	A	A	A	
Use blocking, shoring and cribbing where ever possible to support and sustain loads.	A	A	A	
Use locking rings on couplings to prevent release of air pressure due to accidental disengagement of system components	A	A	A	
Always center load on lift bag or it may be violently ejected from under load during pressurization	DUA	A	A	
Be extremely careful to stabilize, as much as possible, unstable (off-center) loads.	A	A	A	
Be careful that hoses are not kinked.	A	A	A	A
Check visually that equipment is not damaged (scuffs, kinks, tears, ply separation, etc) and audibly for the leakage of air.	ITP			A
Never stack more than two lift bags on each other during operation.	A			
If required to stack two lift bags for increased height, always place smaller bag centered on the top.	A			
Use proper sized lift bag(s) for the load conditions encountered.	A			
During transport of lift bags, carry in such a way so as to protect the inflation nipple. Use two men on large lift bags over 30 pounds (14 kg).	A			A

SAFETY FIRST PROCEDURE	PRIOR TO INFLATION	DURING INFLATION AND WHILE INFLATED	DURING DEFLATION	AFTER REMOVAL
Protect bag with thermal blanket, plywood, etc. whenever a lift bag will contact a surface in excess of 150°F (65°C).	ITP			A (storage)
Never use a lift bag where contact temperatures are in excess of 220°F (105°C).	A			A (storage)
Never work in the dark. Use flash lights or flood-lights to provide shadow-free illumination of work area	ITP	ITP	ITP	
Inflate only enough to achieve desired lift		A		
If force must be applied to a small diameter or small area object, always use plywood/dimension lumber or other larger area rigid material between the lift bag and the object to distribute the load more evenly over the lift bag surface. Otherwise safe maximum lifting force cannot be applied.	A			
Always evaluate the condition prior to execution in order to determine which size lift bag to use and where to apply it to achieve the desired result.	ITP			
Always inflate a lift bag slowly to prevent possible shifting of load. Stop if load begins to shift, stabilize and block load before continuing.		A		
Be sure all valves between air source and lift bag(s) are in a closed position before turning on air source to system. This will prevent an uncontrolled lift. Also open air supply source slowly to prevent damage to regulator.	A			
Never lift with a lift bag directly in contact with sharp or pointed objects that may puncture, abrade or otherwise damage the lift bag.	DUA			

SAFETY FIRST PROCEDURE	PRIOR TO INFLATION	DURING INFLATION AND WHILE INFLATED	DURING DEFLATION	AFTER REMOVAL
<p>Always have 3 points of contact to ensure a stable foundation when lifting unsecured loads.</p> <p>Undue haste could result in injury to personnel and damage/render the lift bag system useless.</p> <p>Keep as far away as possible from lift bag(s). Hose length governs this safety first procedure.</p> <p>Never inflate a lift bag over 30 psi (2 bar) when not under load.</p>	<p>DUA</p> <p>A</p>	<p>A</p> <p>A</p>	<p>A</p> <p>A</p>	<p>A (maintenance)</p>

CHAPTER 1 GENERAL INFORMATION

1-1 SAFETY PRECAUTIONS.

Refer to the Safety First procedures preceding Chapter 1, General Information and Safety Precautions for the procedures to be observed to assure safe and efficient utilization of MAXIFORCE® Air Lifting Bag Systems.

1-2 SCOPE OF MANUAL.

This technical manual provides instructions for the operation, preventive maintenance and parts support for MAXIFORCE Air Lifting Bag Systems manufactured by Paratech Incorporated, 1025 Lambrecht Road, Frankfort, Illinois 60423-7000.

1-3 ARRANGEMENT.

Refer to the Table of Contents for arrangement of the subject matter in this manual.

1-4 EQUIPMENT FUNCTION .

1-4.1. MAXIFORCE Air Lifting Bag Systems are multi-application, portable inflation systems used for lift and displacement of heavy rigid objects, up to 146,000 pounds (66,637 kilograms), while requiring less than 1 inch (2.5 centimeters) of bag insertion clearance. Total capable lift (utilizing two stacked lift bags) is 40 inches (100 centimeters). Inflation may be obtained from any air source (self-contained compressed air cylinder, air compressor, truck air brake system, building compressed air system, foot pump, etc.) capable of supplying 118 psi (8.1 Bar) pressure.

1-4.2 MAXIFORCE Air Lifting Bag Systems are designed for use in emergency situations such as building collapse, structural containment, vehicular extrications, industrial entrapment, and excavation collapse and containment.

1-4.3 In addition to use during emergency situations, MAXIFORCE Air Lifting Bag Systems are also effectively used for:

a. Preventive and/or corrective maintenance procedures where positioning and aligning heavy equipment and machinery in mills, manufacturing facilities and maintenance shops is required such as removing wheels, pulleys and gears from large machinery.

b. Lifting or shifting pipelines requiring welding and maintenance.

c. Breaking out granite and marble blocks and slabs in quarrying operations.

d. Re-railing railroad and mining cars, pre-stressing support columns, general maintenance requiring lifting in rail, mining, underground and subway work.

e. Lifting operations underwater or on unstable, soft ground (mud, sand, snow, strewn debris, etc.) where conventional jacking equipment tends to sink.

f. Since the lift bags contain no spark producing parts, they may also be used safely in explosive environments.

1-5 INTERRELATIONSHIP OF COMPONENTS.

Refer to figure 1-1 for the interrelationship of the six basic components (air source, pressure regulator, controller, safety in-line relief valve, interconnecting hose, and lift bag) comprising MAXIFORCE Air Lifting Bag Systems and their relative sizes.

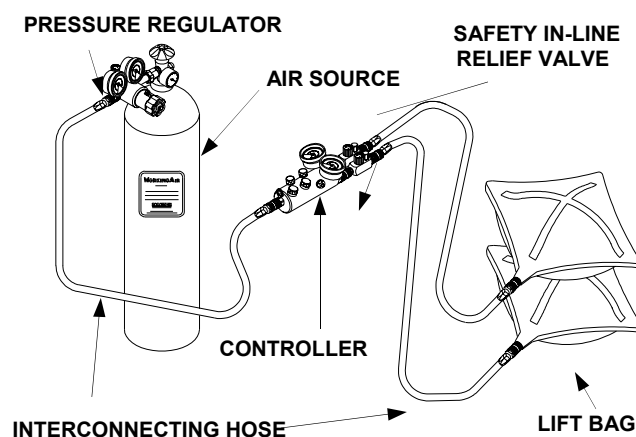


Figure 1-1. Typical MAXIFORCE Air Lifting Bag System

1-6 EQUIPMENT DESCRIPTION.

1-6.1 LIFT BAGS. MAXIFORCE Lift Bags (figure 1-2) are composite items fabricated from neoprene, reinforced with six layers (three per side) of Kevlar reinforced fabric for strength and rigidity even at full inflation pressure of 118 psi (8.1 Bar). All Lift Bags incorporate non-slip molded surfaces designed for maximum friction and holding capability. A bright yellow "X" is molded into each side to provide high visibility during pre-inflation centering. Each Lift Bag is proof tested at twice the operating (full inflation) pressure and has a minimum burst pressure of four times the operating (118 psi (8.1 Bar) pressure. Refer to Table 1-1 for a summary of the technical data for each MAXIFORCE Lift Bag.

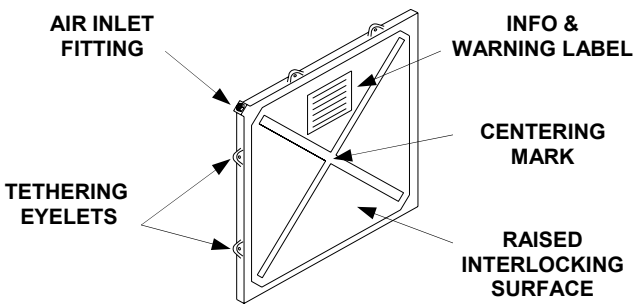


Figure 1-2. Typical MAXIFORCE Lift Bag

1-6.2 PRESSURE REGULATORS. Two pressure regulators are available for use with MAXIFORCE Air Lifting Bag Systems.

a. A piston type high pressure regulator (figure 1-3) that reduces inlet pressure of up to 6,000 psi (414 Bar) to 135 psi (9.3 Bar). The pressure regulator is designed to mate with a CGA-346/347 adapter fitting.

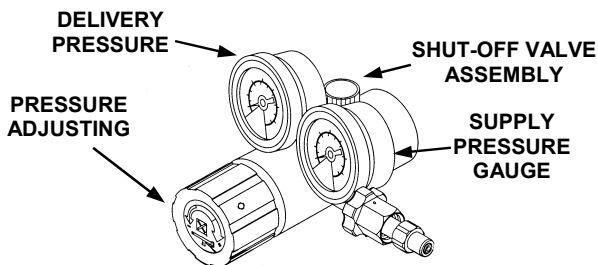


Figure 1-3. Piston Type High Pressure Regulator

b. A diaphragm type standard pressure regulator (figure 1-4) that reduces inlet pressure of up to 3,000 psi (206.8 Bar) to 135 psi (9.3 Bar). The pressure regulator is designed to mate with a CGA-346 adapter fitting.

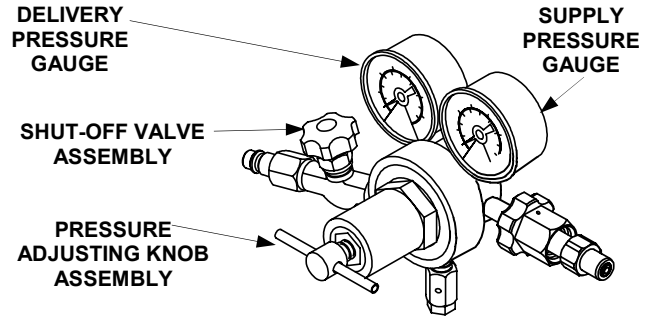


Figure 1-4 Diaphragm Type Pressure Regulator

Each pressure regulator is a self-contained, direct-acting, pressure-reducing type utilizing spring-loading to balance the outlet pressure and thereby reduce the effect of decaying or variations in the inlet pressure. The regulators are designed primarily for use with a SCBA (self-contained breathing apparatus) air cylinder or a SCUBA (self-contained underwater breathing apparatus; adapter required) air cylinder. However, a CGA-580 nitrogen cylinder adapter is available as optional equipment. The standard nipple and knob assembly may also be replaced to permit an optional DIN nipple and nut assembly or a British nipple and knob assembly to be installed in order to interface the pressure regulators with alternate breathing air cylinders.

Each pressure regulator incorporates a piston or diaphragm sensor and soft seated main valve to provide bubble tight service. The adjusting mechanism on the piston regulator, activated by a pressure adjusting knob, incorporates a high load thrust bearing to provide the desired setting sensitivity while maintaining a low operating torque.

The pressure regulators will operate with any breathing air. When using any gaseous media, it is necessary to remove moisture to prevent "icing"; a condition that occurs at high expansion ratios during regulator operation. A 10 micron internal filter is incorporated in the pressure regulator. However, if excessive contamination is a problem, a slightly coarser filter with increased capacity may be installed on the supply side of the pressure regulator.

1-6.3 CONTROLLERS (SAFETY RELIEF AND CONTROL VALVE). Four controllers are available for use with MAXIFORCE Air Lifting Bag Systems.

a. The single safety relief and control valve (figure 1-5) is a single input/single output controller incorporating quick disconnect hose fittings and single knob controls to apply and release air pressure to one lift bag. A gauge is provided to monitor the air pressure applied to the lift bag and a 118 psi (8.1 Bar) relief valve is incorporated to limit the applied air pressure. Inflation and deflation is accomplished by turning the associated valve knob.

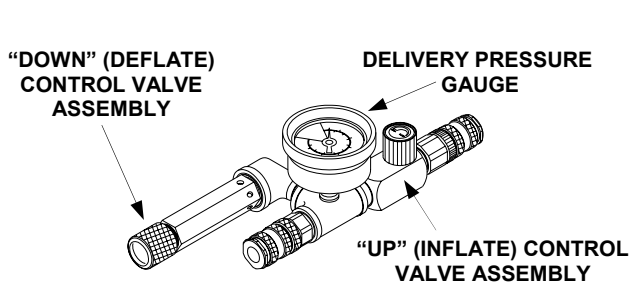


Figure 1-5. Single Safety Relief and Control Valve

b. The dual safety relief and control valve (figure 1-6) is a single input/dual output controller incorporating quick disconnect hose fittings and dual knob controls to apply and release air pressure to either one or two lift bags. Two gauges are provided to monitor the air pressure applied to either one or two bag(s) and a 118 psi (8.1 Bar) relief valve is incorporated to limit the applied air pressure. Inflation and deflation is accomplished by turning the associated valve knob.

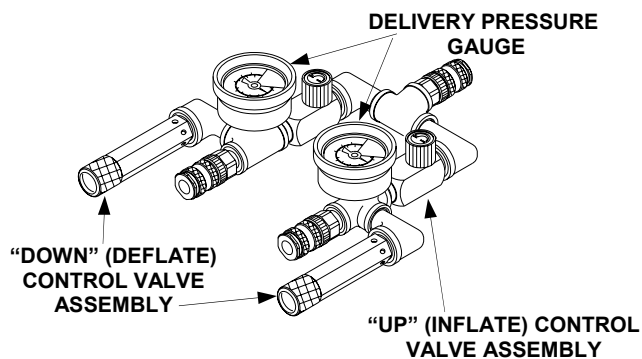


Figure 1-6. Dual Safety Relief and Control Valve

c. The single safety relief and control valve with bypass (figure 1-7) is a single input/single output controller incorporating quick disconnect hose fittings and single push-button controls to apply and release air pressure to a single lift bag. One gauge is provided to monitor the air pressure applied to the lift bag(s) and a 118 psi (8.1 Bar) relief valve is incorporated to limit the applied air pressure. Inflation and deflation is accomplished by depressing the associated valve spring loaded push-button. The bypass, located between the inflation and deflation valves, is used to “bypass” the inflation valve. This allows a continuous flow of air supply to a lift bag without having the operator manually keep the inflation valve open by constantly depressing the inflation valve. The use of the bypass compensates for any pressure drop inside of the lift bag that can be caused by a shifting load, undetected air leaks, etc... It is activated by turning the bypass knob counter-clockwise.

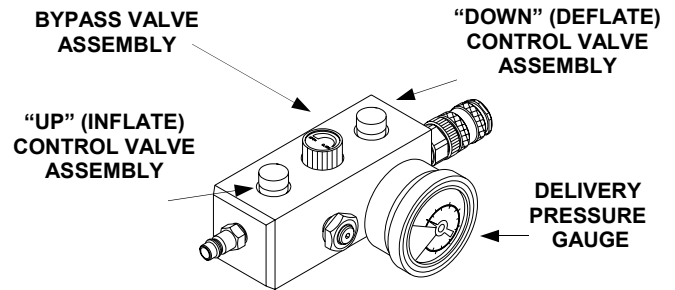


Figure 1-7. Single Push-button Safety Relief and Control Valve with Bypass

d. The dual "deadman" safety relief and control valve (figure 1-8) is a single input/dual output controller incorporating quick disconnect hose fittings and dual push-button controls to apply and release air pressure to either one or two lift bags. Two gauges are provided to monitor the air pressure applied to either one or two bag(s) and a 118 psi (8.1 Bar) relief valve is incorporated to limit the applied air pressure. Inflation and deflation is accomplished by depressing the associated valve spring loaded push-button.

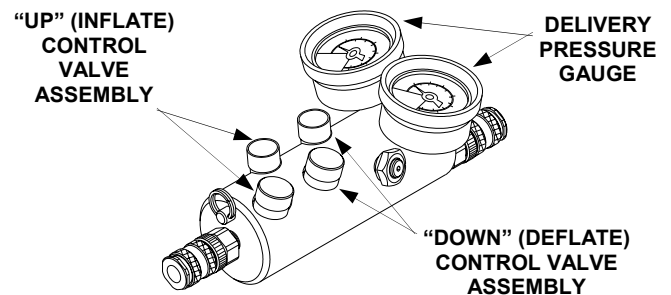


Figure 1-8. Dual “Deadman” Safety Relief and Control Valve

1-6.4 HOSES. Hoses are used to convey air from the air supply source to the lift bag(s). All hoses are equipped with dual locking quick disconnect fittings to prevent their accidental disconnection. All hoses are general purpose 3/8 inch inside diameter, pvc (vinyl) core, single spiral poly yarn braid reinforced and a pvc abrasion resistant cover. The service temperature range is -15°F to +150°F (-25°C to +65°C). All hoses have a working pressure of 300 psi (20.7 bar) with a 4 : 1 safety factor. Available hose lengths are 16 foot (5 meter), 32 foot (10 meter) and 50 foot (15 meter). Available colors in all lengths are red, yellow, blue, green, gray and black .

1-6.5 SAFETY IN-LINE RELIEF VALVE. The safety in-line relief valve (figure 1-9) is designed to keep MAXIFORCE lift bags fully and properly inflated when the lift bag(s) are; 1. Disconnected from the controller (safety relief and control valve) and 2. When excess pressure must be automatically relieved due to shifting

loads and/or temperature changes. The safety in-line relief valve consists essentially of an air inlet and air outlet (with safety locking ring) quick disconnect fitting, a shut-off valve to isolate the associated lift bag and an internal, non-adjustable spring loaded mechanism designed to relieve lift bag pressures in excess of 135 psi.

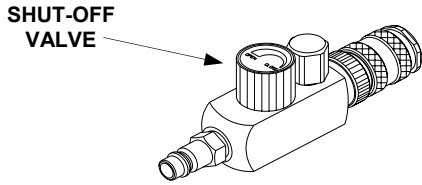


Figure 1-9. Safety In-Line Relief Valve

1-6.6 **FITTINGS.** A variety of adapters, couplings and air fittings are available to permit alternate air sources to inflate the MAXIFORCE lift bag(s) or enable various air-powered tools and accessories to be equipped with the same fittings permitting convenience of operation and/or combining equipment resources such as hoses, regulators, self-contained compressed air cylinders, etc.

1-7 **REFERENCE DATA.** Reference data pertaining to MAXIFORCE Lift bags and Lift bag System Components are summarized for quick reference in Tables 1-1 and 1.2.

1-8 **EQUIPMENT, ACCESSORIES AND DOCUMENTS**

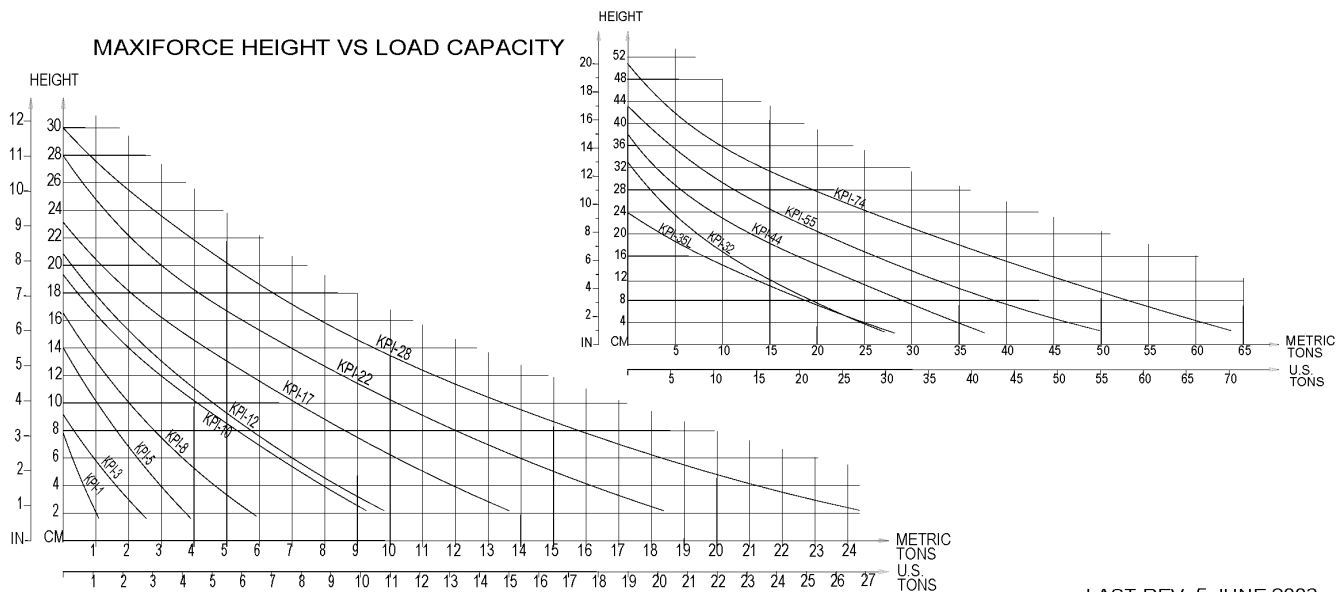
1-8.1 **EQUIPMENT SUPPLIED.** Data pertaining to the dimensions and weight of MAXIFORCE Lift Bags are presented in Table 1-2.

1-8.2 **ACCESSORIES.** Accessories used in conjunction with MAXIFORCE Lift Bag Systems are listed with sufficient descriptive information regarding their use and application in Chapter 4, Parts List.

1-8.3 **DOCUMENTS.** No documents other than this publication are required as supporting literature for MAXIFORCE Lift Bag Systems.

Table 1-1. MAXIFORCE Lift Bag Reference Data
LIFT BAG CONSTANTS:

Base Material	Neoprene
Reinforcing Material	Kevlar
Number of Reinforcing Layers (Each Side).....	3
Surface Type	Molded Non-Slip
Short Term Temperature Range °F (°C).....	-75 (-60) to +220 (+105)
Continuous Duty Temperature Range °F (°C).....	-40 (-40) to +150 (+65)
Maximum Working Pressure PSI (Bar).....	118 (8.1)
Test Pressure PSI(Bar)	236 (16.2)



LAST REV. 5 JUNE 2003

TECHNICAL DATA
MAXIFORCE LIFTING BAG SPECIFICATIONS

KEVLAR REINFORCED TYPE	PART	MAX. LIFTING CAPACITY AT 118 PSI (8.1Bar) U.S. Tons (Metric Tons)	SIZE* LG inches (mm) WIDE inches(mm) THICK inches (mm)	LIFTING HEIGHT inches (mm)	MAX WRKG PRESSURE PSI (Bar)	TEST PRESSURE PSI (Bar)	BURSTING PRESSURE MINIMUM PSI (Bar)	AIR REQUIREMENT AT 118 PSI (8.1) Bar Cu. Ft. (Litres)	INFLATION TIME Seconds	WEIGHT (approx) Lb. (Kg)
KPI-1	22-888110	1.2 (1.1)	7.25 (184) 7.25 (184) .6(15)	3.0(76)	118(8.1)	200(13.8)	700(48)	.14(4)	1	1.1(.5)
KPI-3	22-888120	2.8 (2.5)	7(178) 13(330) .6(15)	3.5(90)	118(8.1)	200(13.8)	700(48)	.35(10)	1	2.2(1)
KPI-5	22-888130	4.3 (3.9)	11.25(286) 11.25(286) .6(15)	5.4(74)	118(8.1)	200(13.8)	700(48)	.77(22)	2	3.1(1.4)
KPI-8	22-888135	6.5 (5.9)	13.25(337) 13.25(337) .8(15)	6.4(163)	118(8.1)	200(13.8)	700(48)	1.8(51)	2	6(2.8)
KPI-10	22-888138	10.2 (9.3)	19.5(496) 13.25(337) .8(20)	7.5(190)	118(8.1)	200(13.8)	700(48)	2.8(79)	3	9(4.1)
KPI-12	22-888140	10.8 (9.8)	16.5(420) 16.5(420) .8(20)	8.2(208)	118(8.1)	200(13.8)	700(48)	3.0(84)	3	8(3.6)
KPI-17	22-888150	15.0 (13.6)	22.25(540) 16(407) .8(20)	9(230)	118(8.1)	200(13.8)	700(48)	4.9(138)	4	11(5)
KPI-22	22-888160	20.2 (18.3)	21.25(540) 21.25(540) .8(20)	11(280)	118(8.1)	200(13.8)	700(48)	7.3(208)	7	15(6.8)
KPI-28	22-888165	26.8 (24.3)	21(534) 27(686) .8(20)	11.7(297)	118(8.1)	200(13.8)	600(41)	11(311)	10	19(8.6)
KPI-32	22-888170	29.9 (27.1)	25(635) 25(635) .8(20)	13(330)	118(8.1)	200(13.8)	600(41)	13.8(390)	11	21(9.5)
KPI-35L	22-888180	31.1 (28.2)	43(1093) 16(407) .8(20)	9.3(236)	118(8.1)	200(13.8)	600(41)	11.7(332)	12	22(10)
KPI-44	22-888190	41.5 (37.6)	28(711) 28(711) .8(20)	15(381)	118(8.1)	200(13.8)	475(32)	21.6(613)	20	29(13)
KPI-55	22-888195	54.9 (49.8)	34.5(877) 33.25(845) 1(20)	17(432)	118(8.1)	200(13.8)	475(32)	34(969)	35	40(18)
KPI-74	22-888200	70.2 (63.7)	39.75(1010) 38(966) 1(25)	20(508)	118(8.1)	200(13.8)	475(32)	47(1329)	53	60(27)

* ALL SIZES INCLUDE NIPPLE & TETHERING EYELETS

CHAPTER 2 OPERATION

2-1 INTRODUCTION.

2-1.1 MAXIFORCE Lifting Bag Systems are multi-application, portable inflation systems used for lift and displacement of heavy rigid objects, up to 146,000 pounds (66,225 kilograms), while requiring less than 1 inch (2.5 centimeters) of bag insertion clearance. Total capable lift (utilizing two stacked lift bags) is 40 inches (100 centimeters). Inflation may be obtained from any air source (self-contained compressed air cylinder, air compressor, truck air brake system, building compressed air system, foot pump, etc.) capable of supplying 118 psi (8.1 Bar) pressure.

2-1.2 MAXIFORCE Lifting Bag Systems are designed for use in emergency situations such as building collapse, structural containment, vehicular extrications, industrial entrapment, and excavation collapse and containment. The specific situation requiring the use of a MAXIFORCE Lifting Bag System will generally determine the size and quantity of lift bag(s) to be utilized in combination with each other. In addition to use during emergency situations, MAXIFORCE Air Lifting Bag Systems are also effectively used for:

a. Preventive and/or corrective maintenance procedures where positioning and aligning heavy equipment and machinery in mills, manufacturing facilities and maintenance shops is required such as removing wheels, pulleys and gears from large machinery.

b. Lifting or shifting pipelines requiring welding and maintenance.

c. Breaking out blocks and slabs in quarrying operations.

d. Re-railing railroad and mining cars, pre-stressing support columns, general maintenance requiring lifting in rail, mining, underground and subway work.

e. Lifting operations underwater or on unstable, soft ground (mud, sand, snow, strewn debris, etc.) where conventional jacking equipment tends to sink.

f. Since the lift bags contain no spark producing parts, they may be used safely in explosive environments.

2-2 CONTROLS AND INDICATORS.

2-2.1 **CONTROLS.** No controls are used on a lift bag. However, the standard components required for use in conjunction with a lift bag do contain the following operational controls indicated:

- a. **Manual Compressor.** The only controls on a manual compressor (figure 2-1) are the foot lever used to deliver pressure and a sliding valve collar that permits isolating one of the two cylinders thereby increasing the delivered pressure and decreasing the delivered volume by a factor of 2.

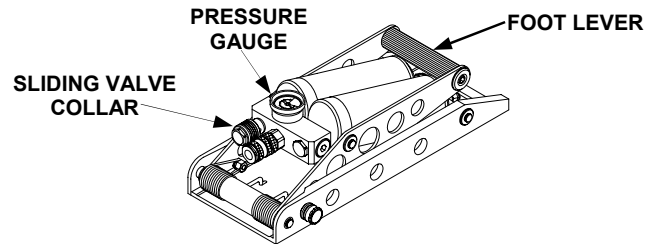


Figure 2-1. Manual Compressor Controls and Indicators

- b. **Air Cylinder.** The only control on an air cylinder (figure 2-2) is the shut-off valve that permits or prevents the flow of compressed air.

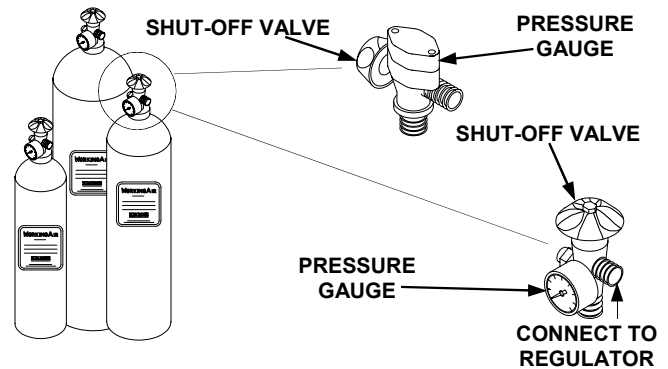


Figure 2-2. Air Cylinder Controls and Gauges

- c. **Piston and Diaphragm Type Pressure Regulators.** The only controls on either a piston type pressure regulator (figure 2-3) or a diaphragm type pressure regulator (figure 2-4) are the shut-off valve assembly and the pressure adjusting knob assembly. The shut-off valve assembly is either opened to permit regulated delivery air to pressurize the lift bag system or closed to prevent (seal off) regulated delivery air from pressurizing the lift bag system. The pressure adjustment knob is turned to control the delivery pressure up to 135 psi (9.3 bar) maximum.

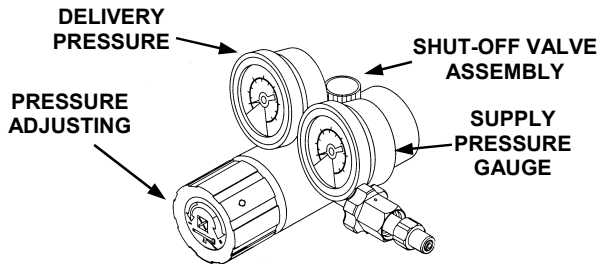


Figure 2-3. Piston Type Pressure Regulator Controls and Gauges

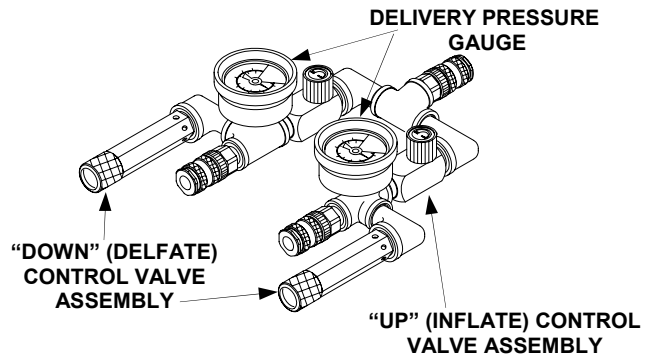


Figure 2-6. Dual Safety Relief and Control Valve Controls and Gauges

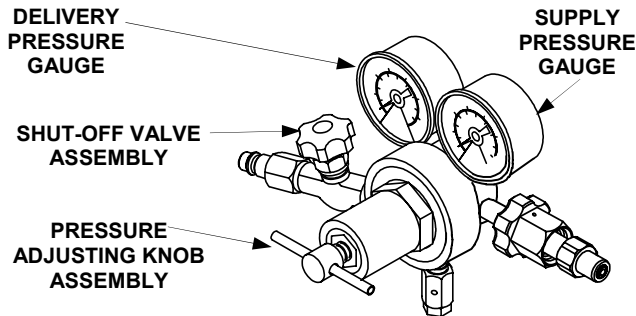


Figure 2-4. Diaphragm Type Pressure Regulator Controls and Gauges

e. **Single Push-button Safety Relief and Control Valve with Bypass.**

The only controls on the single push-button safety relief and control valve with bypass (figure 2-7) are the “UP” (inflate) and “DOWN”(deflate) control valve assemblies, and the bypass control valve assembly. The “UP” and “DOWN”control valve assemblies are either independently opened (“UP”) to permit regulated air to inflate the lift bag or closed(“DOWN”) to relieve system air to deflate the lift bag and prevent regulated air from pressurizing the system. The bypass is independently opened to permit continuous regulated air to inflate the lift bag or closed to allow the relief of system air to deflate the lift bag and prevent regulated air from pressurizing the system.

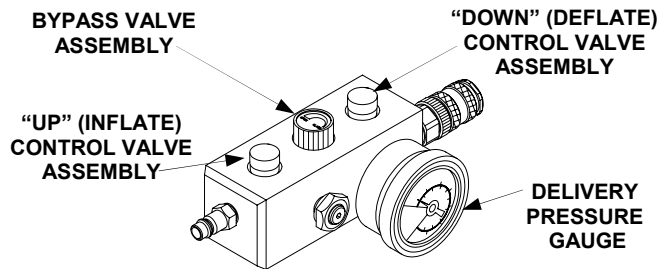


Figure 2-7. Single Push-button Safety Relief and Control valve with Bypass Controls and Gauges

d. **Single and Dual Safety Relief and Control Valve.**

The only controls on a single or dual safety relief control valve (figures 2-5 and 2-6 respectively) are the “UP” (inflate) and “DOWN”(deflate) control valve assemblies. The control valve assemblies are either independently opened (“UP”) to permit regulated air to inflate the lift bag(s) or closed (“DOWN”) to relieve system air to deflate the lift bag(s) and prevent regulated air from pressurizing the system. Each of the “UP” and “DOWN” control valve assemblies on the dual safety relief and control valve operate independent of the other thereby permitting the application and release of air pressure to and from the lift bag(s)

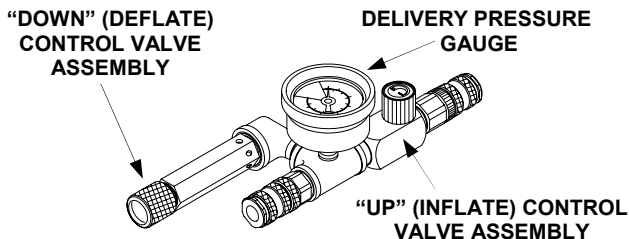


Figure 2-5. Single Safety Relief and Control Valve Controls and Gauges

f. **Dual “Deadman” Safety Relief and Control Valve**

The only controls on the dual “deadman” safety relief and control valve (figure 2-8) are the “UP” (inflate) and “DOWN”(deflate) control valve assemblies. The control valve assemblies are either independently opened (“UP”) to permit regulated air to inflate the lift bag(s) or closed(“DOWN”) to relieve system air to deflate the lift bag(s) and prevent regulated air from pressurizing the system. Each of the “UP” and “DOWN” control valve assemblies on the dual “deadman” safety relief and control valve operate independent of the other thereby permitting the application and release of air pressure to and from the lift bag(s).

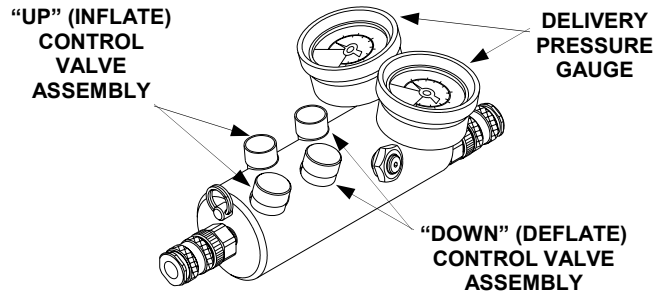


Figure 2-8. Dual “Deadman” Safety Relief and Control Valve Controls and Gauges

- g. **In-Line Relief Valve.** The only control on an in-line relief valve (figure 2-9) is the shut-off valve that maintains pressure to the lift bag(s) when the dual safety relief or dual “deadman” safety relief and control valve must be disconnected during an operation requiring the use of multiple lift bags.

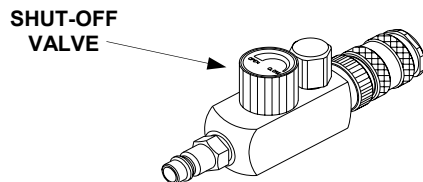


Figure 2-9. In-Line Relief Valve Controls

2-2.2 **INDICATORS.** No gauges are used on a lift bag. However, the standard components required for use in conjunction with a lift bag do contain the following operational controls indicated:

- a. **Manual Compressor (Figure 2-1).** A delivery pressure gauge is provided on the manual compressor. The gauge is marked in 20 psi increments from 0 psi to 200 psi and is scribed each 2 psi. The pressure gauge is also marked each 200 kPa from 0 to 1400 kPa and is scribed each 20 kPa.
- b. **Air Cylinder (Figure 2-2).** A supply pressure gauge is provided on the air cylinder. The gauge is marked in 1000 psi increments from 1000 psi to 4000 psi and is scribed each 200 psi.
- c. **Piston and Diaphragm Type Pressure Regulators (Figures 2-3 and 2-4 Respectively).** Two pressure gauges are provided; the supply pressure gauge and the delivery pressure gauge. The supply pressure gauge is marked in 1000 psi increments from 1000 psi to 6000 psi (890401) and is scribed each 200 psi. The supply pressure gauge is also marked each

10,000 kPa from 10,000 kPa to 40,000 kPa and is scribed each 1000 kPa. The delivery pressure gauge is marked in 50 psi increments from 50 psi to 400 psi and is scribed each 10 psi.

- d. **Single and Dual Safety Relief and Control Valves (Figures 2-5 and 2-6 Respectively).** A delivery pressure gauge is provided for each of the "UP"/"DOWN" control valve assembly(s), respective to the controller (single or dual safety relief and control valve). The gauge is marked in 20 psi increments from 0 psi to 200 psi and is scribed each 2 psi. The pressure gauge is also marked each 200 kPa from 0 to 1400 kPa and is scribed each 20 kPa.
- e. **Single Push-button and Dual "Deadman" Safety Relief Control Valves (Figure 2-7 and 2-8 Respectively).** A delivery pressure gauge is provided for each of the "UP"/"DOWN" control valve assembly(s), respective to the controller (single push-button or dual “deadman” safety relief and control valve); one therefore per each lift bag. Each gauge is marked in 20 psi increments from 0 psi to 200 psi and is scribed each 2 psi. The pressure gauge is also marked each 200 kPa from 0 to 1400 kPa and is scribed each 20 kPa.

2-3 SYSTEM FUNCTIONAL OPERATION.

Functionally, an interconnected MAXIFORCE® Lift bag System operates as follows:

- a. A self-contained air cylinder, air compressor, foot pump or alternate air supply provides the necessary volume and pressure to pressurize the system and ultimately inflate the lift bag.
- b. After a lift bag(s) is properly positioned for a lift/displacement, the air supply is "turned on". High pressure air is reduced by an in-line pressure regulator to a usable 135 psi (9.3 Bar).
- c. The reduced air pressure is supplied via an air hose to a controller (safety relief and control valve). The controller permits air to flow via air hose(s) to either one or two lift bags permitting a controlled lift/displacement. In the line between the controller and the lift bag(s) are in-line relief valve(s) to maintain proper pressure in the lift bags while disconnected from the controller.
- d. As air flows into the lift bag, it increases in height resulting in a corresponding lift/displacement. Maximum lift/displacement force occurs at

approximately one inch of inflation height (minimum reduction of the lift bag cross section). As additional air flows into the lift bag, the cross section reduces as the height increases resulting in a corresponding reduction in lift/displacement capacity .

- e. When the lift bag(s) are to be partially or fully deflated, control(s) on the controller are operated to perform this function as well as prevent any further inlet air pressure from flowing beyond the controller.
- f. At the conclusion of operation, the air supply is "turned-off", any residual system air pressure is relieved ("bled-off") through the controller, the system components are disconnected, inspected and stored for future use.

2-4 COMPONENT INTERCONNECTION PRIOR TO INFLATION.

WARNING

Refer to the SAFETY FIRST instructions preceding chapter 1 for those safety first procedures to be followed for each specific operational phase of the application at hand. Regardless of the lift bag application and/or environmental conditions, strict adherence to SAFETY FIRST is essential to prevent personnel injury/death and/or equipment damage. It may make the difference between saving a life or endangering/sacrificing another life.

2-4.1 The following procedures describe in detail a typical interconnection of the previously described components comprising a MAXIFORCE Air Lifting Bag System. This procedure can be accomplished by trained personnel in less than one minute. If the specific application does not require the use of all of the referenced components or some of the components are not available, eliminate the non-applicable steps and proceed with the interconnection. Any adapters, couplings and/or air fittings required in conjunction with the components are addressed generally but not specifically during the interconnection. It is assumed these parts are available and will be installed where required in the system.

2-4.2 Refer to Table 1-1 to determine the required lift bag (s) for the load/displacement and full inflation height demands for the application at hand. Once the proper lift/displacement and height configuration is determined and the individual components selected, it is only necessary to clean, where required, the individual components sufficiently to clear them of any contaminants that would prevent their full engagement and proper locking to each other and to interconnect the components.

WARNING

Refer to the SAFETY FIRST instructions preceding chapter 1 and adhere to the applicable "prior to inflation" procedures.

- a. Remove all dust, dirt, oil or grease from the MAXIFORCE Air Lifting Bag System components. Do not use any system components without first cleaning off any contaminants.
- b. Inspect all inlet and outlet fittings for any damage that will permit air leakage. Do not use any component if an air leakage condition is suspected or exists.
- c. Attach the air inlet connector on a pressure regulator (diaphragm or piston type) to an air supply using the appropriate interconnecting fittings as required. Be certain to turn the safety locking ring on any quick connect coupling to the locked position as shown in figure 2-10. Tighten all connections just enough to prevent air leakage. Do not overtighten.
- d. Check that the pressure regulator shut-off valve is closed (full clockwise). Check that the pressure regulator pressure adjusting knob is full counterclockwise to close the internal needle valve (no flow through the pressure regulator).
- e. Attach an air hose quick connect coupling to the pressure regulator outlet port using the appropriate interconnecting fittings as required. Check that the quick connect coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10.

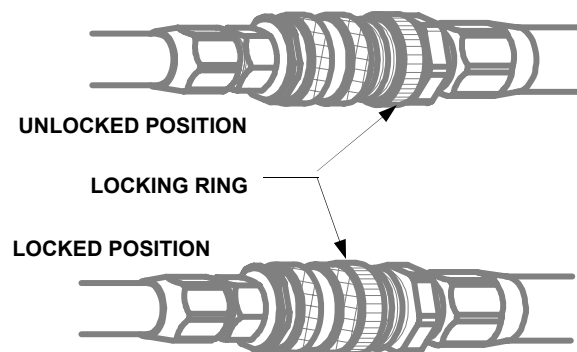


Figure 2-10. Quick Connect Coupling Safety Locking Ring

- f. Attach the inlet port quick connect coupling on a controller (single, dual, single push-button, or dual "deadman" safety and relief valve) to the air hose quick connect nipple. Check that the quick connect

coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10.

- g. Attach the inlet port quick connect nipple on a safety in-line relief valve to the outlet port quick connect coupling on a controller (single, dual, single push-button, or dual "deadman" safety and relief valve). Check that the quick connect coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10. Check that the safety in-line relief valve shut-off valve is closed (full clockwise).
- h. If using a dual or dual "deadman" safety and relief valve, attach the inlet port quick connect nipple on a second safety in-line relief valve to the second outlet port quick connect coupling on the dual or dual "deadman" safety and relief valve. Check that the quick connect coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10. Check that the safety in-line relief valve shut-off valve is closed (full clockwise).
- i. Attach an air hose quick connect nipple to the safety in-line relief valve outlet port coupling using the appropriate interconnecting fittings as required. Check that the quick connect coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10. Connect additional lengths of air hose of the same color as required.
- j. If a second safety in-line relief valve is used, attach an air hose quick connect nipple to the second safety in-line relief valve outlet port coupling using the appropriate interconnecting fittings as required. A different colored air hose should be used to permit the rapid and positive identification of the lift bag connected to each side of the controller. Check that the quick connect coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10. Connect additional lengths of air hose of the same color as required.
- k. Attach a lift bag nipple to the air hose quick connect

coupling. Check that the quick connect coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10.

- l. If a second lift bag is being used, attach the second lift bag nipple to the other air hose quick connect coupling. Check that the quick connect coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10.
- m. The MAXIFORCE Air Lifting Bag System is now fully interconnected and can be positioned with any required shoring and/or cribbing, and inflated for a lift/displacement.

2-5 NORMAL OPERATING PROCEDURE DURING INFLATION.

Proceed as follows to inflate the lift bag(s) after the individual components are interconnected, the lift bag(s) are positioned and the necessary shoring and/or cribbing is in position.

WARNING

Refer to the SAFETY FIRST instructions preceding chapter 1 and adhere to the applicable "during and while inflated" procedures.

WARNING

Be sure **all** shut-off valves are in a closed position prior to opening the air supply to the system; this will prevent an uncontrolled lift/displacement.

- a. **Slowly** open (turn counter clockwise) the air supply to the pressure regulator. The supply pressure will be indicated on the air supply pressure gauge as well as on the pressure regulator supply pressure gauge. The delivery pressure gauge on the pressure regulator should indicate 0 psi.

WARNING

Do not adjust the pressure regulator to exceed the maximum pressure rating of any component in the system apparatus or 135 psi (9.3 Bar) which ever is less.

- b. Adjust the pressure regulator pressure adjusting knob (turn clockwise) to increase the delivery pressure from 0 psi to 135 psi (9.3 Bar).
- c. **Slowly** open (turn counterclockwise) the pressure regulator shut-off valve. The delivery pressure should remain at 135 psi (9.3 Bar).
- d. Open the shut-off valve on the safety in-line relief valve(s).

NOTE:

When operating the lift bag, always inflate slowly and only lift or move the amount necessary.

- e. Press and release the single push-button or dual "deadman" controller inflation valve(s), or open (turn counter clockwise) and close (turn clockwise) the single/dual controller inflation valve repeatedly to **slowly** inflate the lift bag to the required height or 118 psi (8.1 Bar). Inflating the lift bag(s) slowly will minimize the possibility of shifting. If a second lift bag is interconnected to the controller, operate the associated inflation valve to **slowly** inflate the second lift bag. The lift bags may be inflated simultaneously or alternately as desired by the operator.
- f. With the lift bag inflated to the desired height/pressure close (turn clockwise) the shut-off valve on the safety in-line relief valve(s).
- g. If additional lift bags are required for the application, proceed as follows:
 1. Determine the lift bag to remain inflated and in position. Be sure the shut-off valve on the associated safety in-line relief valve is closed.
 2. Release the safety locking ring on the quick connect coupling between the controller and the safety in-line relief valve. Disengage the coupling lock ring to release the safety in-line relief valve from the controller.
 3. Attach the inlet port quick connect nipple on a

safety in-line relief valve to the outlet port quick connect coupling on the controller. Check that the quick connect coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10. Check that the safety in-line relief valve shut-off valve is closed (full clockwise). Do not overtighten.

4. Attach an air hose quick connect nipple to the safety in-line relief valve outlet port coupling using the appropriate interconnecting fittings as required. Check that the quick connect coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10. Connect additional lengths of air hose as required.
5. Attach a lift bag nipple to the air hose quick connect coupling. Check that the quick connect coupling is fully engaged and locked in position to assure a leak-free connection. Be certain to turn the safety locking ring on the quick connect coupling to the fully locked position as shown in figure 2-10.
6. Press and release the single push-button or dual "deadman" controller inflation valve(s), or open (turn counterclockwise) and close (turn clockwise) the single/dual controller inflation valve repeatedly to **slowly** inflate the lift bag to the required height or 118 psi (8.1 Bar). Inflating the lift bag(s) slowly will minimize the possibility of shifting.
7. Adhere to procedural steps 1 through 6 to add any additional quantity of lift bags required for the application.

2-6 CHANGING AIR CYLINDERS.

NOTE

If the air source for a given application requires the use of air cylinder, it should be changed during inflation whenever the air cylinder pressure falls below 200 psi (13.8 Bar).

- a. Close (turn clockwise) the air cylinder and the pressure regulator shut-off valves. The supply pressure gauge on the pressure regulator should indicate 0 psi. The delivery pressure gauge will indicate the regulated pressure until the internal

pressure is relieved, any residual system air pressure will be relieved through the controller.

- b. Turn the pressure regulator pressure adjusting knob full counter clockwise to close the internal needle valve (no flow through the pressure regulator).
- c. As required, turn the nut on the pressure regulator air inlet connector or interconnecting air cylinder to pressure regulator fitting to the unlocked position. Disengage the inlet nipple to release the air cylinder from the pressure regulator.
- d. Attach the air inlet connector on the pressure regulator to a full air cylinder using the appropriate interconnecting fittings as required. Tighten all connections just enough to prevent air leakage. Do not overtighten.
- e. **Slowly** open (turn counter clockwise) the air supply to the pressure regulator. The supply pressure will be indicated on the air supply pressure gauge as well as on the pressure regulator supply pressure gauge. The delivery pressure gauge on the pressure regulator should indicate 0 psi.
- f. Adjust the pressure regulator pressure adjusting knob (turn clockwise) to increase the delivery pressure from 0 psi to 135 psi (9.3 Bar).
- g. **Slowly** open (turn counter clockwise) the pressure regulator shut-off valve. The delivery pressure should remain at 135 psi (9.3 Bar).

2-7 NORMAL OPERATING PROCEDURE DURING DEFLATION.

NOTE

If a lift bag(s) is to be removed after it is deflated, shoring or cribbing must be in position, as required, to restrain the load permitting the removal of the lift bag(s).

- a. To either partially or fully deflate an inflated lift bag(s) **disconnected** from a controller, open and close as required the shut-off valve on the safety in-line relief valve to slowly achieve the desired deflation. The lift bag design prevents it from deflating rapidly. Alternately opening and closing the shut-off valve will permit a more slowly controlled deflation. This prevents any quick load movements that may cause damage or personnel injury. Repeat for any additional lift bag(s) disconnected from the controller that can be partially

or fully deflated.

- b. To either partially or fully deflate an inflated lift bag (s) **connected** to a controller, press and release the single push-button or "deadman" dual controller deflation valve(s), or open (turn counterclockwise) and close (turn clockwise) the single/dual controller deflation valve repeatedly to **slowly** deflate the lift bag. Repeat for an additional lift bag connected to the controller if it can be partially or fully deflated.
- c. Gather the system components together in preparation for movement to another work area or for disconnection, post inspection and storage.

2-8 COMPONENT DISCONNECTION AFTER DEFLATION.

The following procedures describe in detail a typical disconnection of the previously described components comprising a MAXIFORCE Air Lifting Bag System. This procedure can be accomplished by trained personnel in less than one minute. If the specific application did not require the use of all of the referenced components or some of the components are not available, eliminate the non-applicable steps and proceed with the disconnection. Any adapters, couplings and/or air fittings used in conjunction with the components are not addressed during the disconnection.

- a. After the lift bag(s) has been removed from its lift/displacement position and the interconnected system components are gathered together, check that the supply pressure gauge and delivery pressure gauge on the pressure regulator indicate 0 psi.
 1. If the supply pressure gauge indicates a pressure other than 0 psi turn off the air supply. Any residual system air pressure will be relieved through the controller. If a significant pressure is still indicated, the air supply shut-off valve is probably defective and air leakage should be anticipated when the air supply is disconnected from the pressure regulator.
 2. If the delivery pressure gauge on the pressure regulator indicates a pressure other than 0 psi, be sure the air supply is turned off and press the single push-button or "deadman" dual controller deflation valve(s), or open (turn counterclockwise) the single/dual controller deflation valve to exhaust air from the system.
- b. Turn the safety locking ring on the air hose quick connect coupling, interconnecting the lift bag, to the unlocked position. Disengage the coupling lock ring

to release the lift bag from the air hose.

- c. Turn the safety locking ring on the safety in-line relief valve quick connect coupling, interconnecting the air hose, to the unlocked position. Disengage the coupling lock ring to release the air hose from the safety in-line relief valve.
- d. Turn the safety locking ring on the single push-button or dual "deadman" or single/dual safety and relief valve quick connect coupling, interconnecting the safety in-line relief valve, to the unlocked position. Disengage the coupling lock ring to release the safety in-line relief valve from the dual "deadman" or single/dual safety and relief valve.
- e. If a dual "deadman" or dual safety and relief valve is used with two safety in-line relief valves and associated lift bags, repeat preceding steps b through d.
- f. Turn the safety locking ring on the single push-button or dual "deadman" or single/dual safety and relief valve quick connect coupling, interconnecting the air hose, to the unlocked position. Disengage the coupling lock ring to release the single push-button or dual "deadman" or single/dual safety and relief valve from the air hose.
- g. Turn the safety locking ring on the air hose quick connect coupling, interconnecting the pressure regulator (diaphragm or piston type), to the unlocked position. Disengage the coupling lock ring to release the air hose from the pressure regulator (diaphragm or piston type).
- h. As required, turn the safety locking ring on the air source fitting quick connect coupling, interconnecting the pressure regulator (diaphragm or piston type), to the unlocked position. Disengage the coupling lock ring or other fitting to release the pressure regulator (diaphragm or piston type) from the air source.
- i. If the components are not to be immediately reused, perform the post operation inspection and storage in accordance with Chapter 3.

2-9 APPLICATIONS.

2-9.1 MAXIFORCE Air Lifting Bag Systems are multi-application, portable inflation systems used for lift and displacement of heavy rigid objects, up to 146,000 pounds (66,637 kilograms), while requiring less than 1 inch (2.5 centimeters) of bag insertion clearance. Total capable lift (utilizing two stacked lift bags) is 40 inches (100 centimeters).

2-9.2 As shown in figure 2-11, MAXIFORCE Air Lifting Bag Systems are designed for use in emergency situations such as building collapse, structural containment,

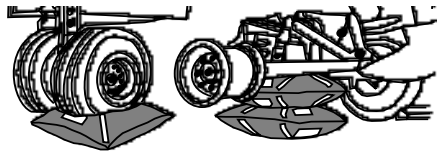
vehicular extrications, industrial entrapment, and excavation collapse and containment.

2-9.3 In addition to use during emergency situations, MAXIFORCE Air Lifting Bag Systems are also effectively used for:

- a. Preventive and/or corrective maintenance procedures where positioning and aligning heavy equipment and machinery in mills, manufacturing facilities and maintenance shops is required such as removing wheels, pulleys and gears from large machinery.
- b. Lifting or shifting pipelines requiring welding and maintenance.
- c. Breaking out granite and marble blocks and slabs in quarrying operations.
- d. Re-railing railroad and mining cars, pre-stressing support columns, general maintenance requiring lifting in rail, mining, underground and subway work.
- e. Lifting operations underwater or on unstable, soft ground (mud, sand, snow, strewn debris, etc.) where conventional jacking equipment tends to sink.
- f. Since the lift bags contain no spark producing parts, they may also be used safely in explosive environments.

2-9.4 In addition to the Safety First Procedures in the front of this publication, the following general application notes and procedures should be followed whenever a MAXIFORCE Air Lifting Bag System is to be employed.

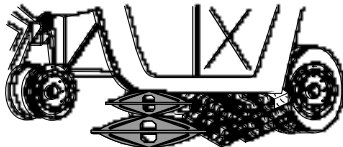
- a. All procedures should be used as guidelines, not absolute dictates. Any previous application may, as a result of a seemingly inconsequential change, require modification or possibly completely new procedures to achieve the same result.
- b. Lift bags are relatively lightweight. The maximum weight is 60 pounds (27.2 kg). All lift bags over 9 pounds incorporate at least two lifting eyelets.
- c. If a lift bag is being used to lift or displace a thin surface or material, use plywood between the lift bag and the surface to more evenly distribute the applied force.
- d. If a lift bag will be used on an icy, greasy or otherwise slick surface, use a granular material between the lift bag and the surface to increase the coefficient of friction, thereby preventing the lift bag from slipping.
- e. Build support cribbing/bracing height to a point that just allows the lift bag(s) to be inserted. Safety cribbing/bracing may also be installed as the load is being lifted, but care must be exercised to avoid



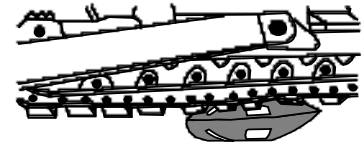
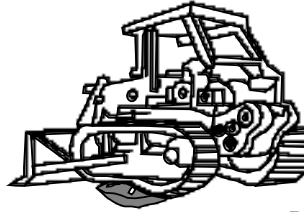
**AIRCRAFT FLAT TIRE
SUPPORT & REPAIR**



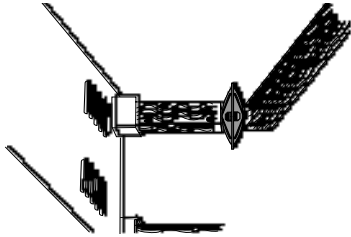
HALF-TRAK TIRE REPAIR



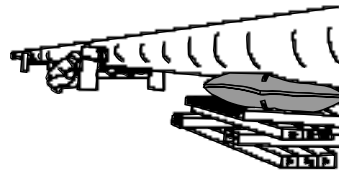
VEHICLE JACKING OPERATION



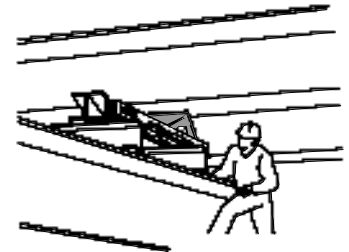
**RAISING EARTH MOVER
MIRED IN MUD**



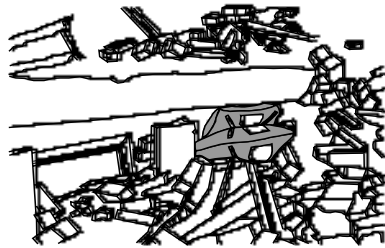
POSITIONING OF HEAVY MACHINERY



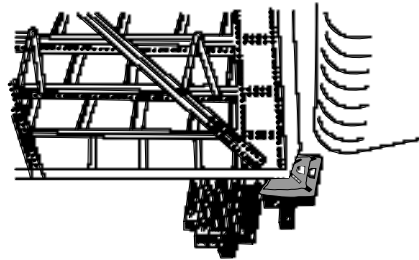
RAISING PIPELINE FOR INSPECTION



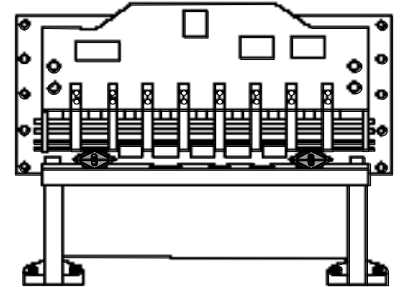
**LIFTING SECTION OF COLLAPSED
HIGHWAY OVERPASS**



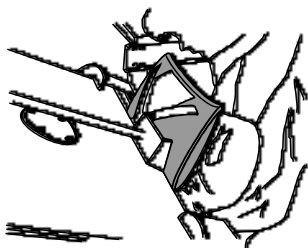
**RAISING SECTION OF COLLAPSED
BUILDING TO ALLOW RESCUE ACCESS**



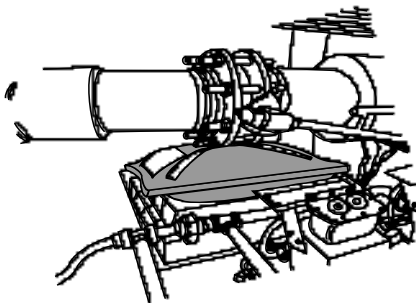
**JACKING UP CANAL LOCK GATE
DURING MAINTENANCE**



LIFTING AND STABILIZING CUTTER



**OPENING DOOR OF GRINDING
MACHINE TO FREE VICTIM'S ARM**



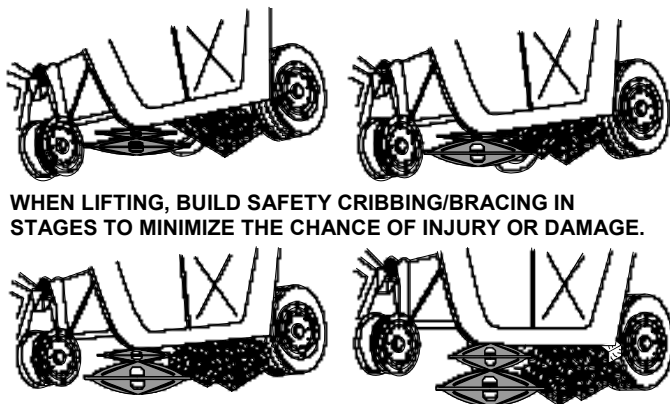
**ALIGNING AND STABILIZING
PIELINE SECTIONS**



**PRYING OPEN FENCE TO RESCUE
TRAPPED ANIMAL**

Figure 2-11. Typical Applications

injury and damage in the event of a drop and/or load shift (Figure 2-12). The top support cribbing/bracing layer must be sufficiently solid to prevent a cribbing/bracing shift and collapse during inflation when the lift bag(s) take on the characteristic double dome shape. Build safety cribbing/bracing after the desired lift to minimize the drop distance in the event of air loss after inflation. A generally applied safety rule is: lift between one and two inches (three and six cm.), then safety crib/brace between one and two inches (three and six cm.). After full safety cribbing/bracing is in place, the lift bag may be slowly deflated and removed, and the support cribbing/bracing removed, allowing the load to rest fully on the safety cribbing/bracing.



WHEN LIFTING, BUILD SAFETY CRIBBING/BRACING IN STAGES TO MINIMIZE THE CHANCE OF INJURY OR DAMAGE.

IF THE LOAD SHIFTS, THE SAFETY CRIBBING/BRACING WILL PREVENT IT FROM DROPPING TOO FAR.

Figure 2-12. Correct Method of Safety Cribbing/Bracing

f. Lifting capacity does not increase by stacking two lift bags one on top of the other; only lifting height increases. Lifting capacity is controlled by the smaller bag capacity. Use lift bags, side-by-side, to additively increase capacity by inflating the lift bags simultaneously. (Figure 2-13)

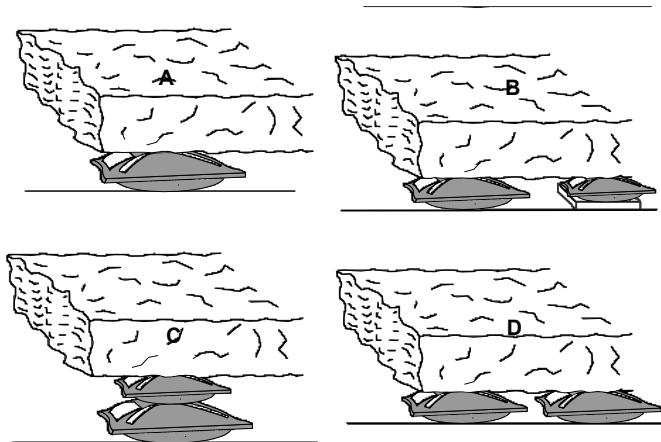


Figure 2-13. Lift bag Stacking and Tandem Combinations

g. If the lift height requirement demands the use of two stacked lift bags, (Figure 2-14) the smaller lift bag shall be on the top (A) and the bottom lift bag inflated first until the top lift bag contacts the load (B). The top lift bag is then inflated to achieve the desired lift (C). If additional lift is required at full inflation of the top lift bag, the bottom lift bag is further inflated (D).

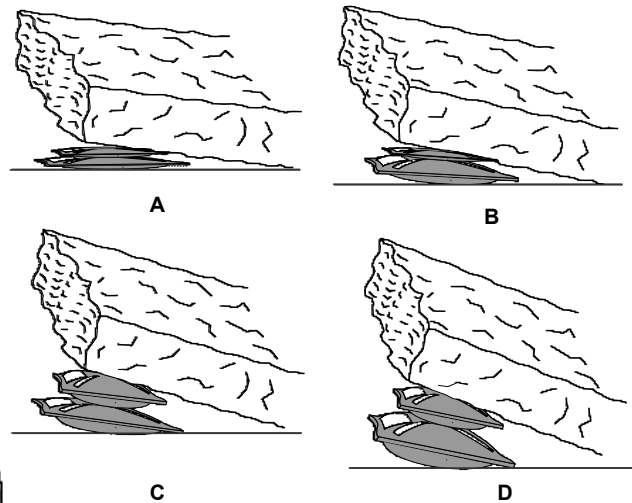


Figure 2-14. Correct Method for Inflating Stacked Lift Bags

h. When lifting large cylindrical objects (Figure 2-15), use a lift bag on both sides of the cylinder and wedges to provide an even lift.

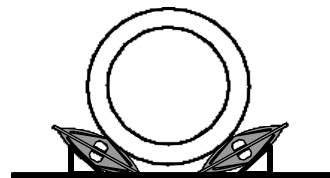


Figure 2-15. Using Two Lift Bags to Lift Cylindrical Objects

2-10 LIFT BAG CHEMICAL COMPATIBILITY.

Use the following chemical compatibility table only as a guide in determining the MAXIFORCE Lift Bag resistance to solvents, acids, salts and other chemical solutions. Each commodity is assigned an alpha character to denote its expected effect upon the lift bag. The specific ratings in this table are based upon published literature from various polymer suppliers and manufacturers and “Chemical Resistance Guide For Elastomers II” published by Compass Publications, copyright 1994. Paratech is unable to guarantee their accuracy and therefore assumes no liability for the use thereof.

A. - EXCELLENT SERVICE

Long service may be expected with little reduction in properties due to the exposure. Suitable for continuous service.

B. - GOOD SERVICE

Good service may be expected, but properties will be affected by the exposure. Usually suitable for continuous and intermittent service.

C. - FAIR SERVICE

Fair service may be expected if exposure is limited or infrequent. Not recommended for continuous use but may give some service if it is the only option available.

U. - NOT RECOMMENDED FOR CONTINUOUS USE

BLANK - INSUFFICIENT INFORMATION

The table positions which are not rated indicate insufficient information at the time of publication to determine an accurate rating.

	A
Acetaldehyde	U
Acetamide	B
Acetic Acid 5%	A
Acetic Acid 30%	A
Acetic Acid, Hot High Press	C
Acetic Acid, Glacial	U
Acetic Anhydride	A
Acetone	C
Acetophenone	U
Acetyl Acetone	U
Acetyl Chloride	U
Acetylene	B
Acetylene Tetrabomide	B
Acrylonitrile	C
Adipic Acid	A
Aero Lubriplate	A
Aero Safe 2300	U
Aero 2300W	U
Aero Shell IAC	B
Acero Shell 7A Grease	B
Aero Shell 17 Grease	B
Aero Shell 750	U
Aerozene 50 (50% Hydrazine 50%UDMH)	U
Air- Below 300F (148.9 C)	A
Air Above 300F (148.9 C)	U
Alkazene	U
Alum-N3Cr-K	A
Aluminum Acetate	B
Aluminum Bromide	A
Aluminum Chloride	A
Aluminum Fluoride	A
Aluminum Nitrate	A
Aluminum Phosphate	A
Aluminum Salts	A
Aluminum Sulfate	A
Ambrex 33 Mobil	B
Amines, Mixed	B
Ammonia Anhydrous (Liquid)	A
Ammonia Gas, Cold	A
Ammonia Gas, Hot	B
Ammonia & Lithium Metal Solution	U
Ammonium Carbonate	A
Ammonium Chloride	A
Ammonium Hydroxide (Concentrate)	A
Ammonium Nitrate	A
Ammonium Nitrite	A
Ammonium Persulfate Solution	A
Ammonium Persulfate 10%	A
Ammonium Phosphate	A

Ammonium Phosphate, Mono-Basic	A
Ammonium Phosphate, Dibasic	A
Ammonium Phosphate, Tribasic	A
Ammonium Salts	A
Ammonium Sulfate	A
Ammonium Sulfide	U
Amyl Acetate	U
Amyl Alcohol	A
Amyl Borate	A
Amyl Chloride	U
Amyl Chloranaphthalene	U
Amyl Naphthalene	U
Anderol L-774 (diester)	U
Anderol L-826 (diester)	U
Anderol L-829 (diester)	U
Ang-25 (Glycerol Ester)	B
Ang-25 (di-ester Base) (TG749)	U
Anhydrous Ammonia	A
Anhydrous Hydrazine	B
Anhydrous Hydrogen Fluoride	U
Aniline	U
Aniline Dyes	B
Aniline Hydrchloride	U
Aniline Oils	U
Animal Fats	B
Animal Fats (Lard Oil)	B
AN-O-3 Grade M	B
An-O-6	B
AN-O-366	B
AN-VV-O-366b Hydr. Fluid	B
Ansul Ether	U
Aqua Regia	U
Argon	U
Aroclor 1248	U
Aroclur 1254	U
Aroclur 1260	A
Aromatic Fuel 50%	U
Arsenic Acid	A
Arsenic Trichloride	A
Askarel	U
Asphalt Emulsion	U
Asphalt Topping	B
ASTM Oil #1	A
ASTM Oil #2	B
ASTM Oil #3	B
ASTM Oil #4	U
ASTM Reference Fuel A	B
ASTM Reference Fuel B	U
ASTM Reference Fuel C	U
ATL-857	U
Atlantic Dominion F	B
Aurex 903R Mobil	B
Automatic Transmission Fluid	B
Automotive Brake Fluid	B

	B
Bardol B	U
Barium Chloride	A
Barium Hydroxide	A
Barium Salts	A
Barium Sulfate	A
Barium Sulfide	A
Bayol D	B
Beer	A
Beet Sugar Liquors	A
Benzaldehyde	U
Benzene	U
Benzenesulfonic Acid	A
Benzine	B
Benzochloride	U
Benzoic Acid	A
Benzophenol	U
Benzyl Alcohol	B
Benzyl Benzoate	U
Benzyl Chloride	U
Black Point 77	C
Black Suphate Liquors	A
Blast Furnace Gas	U
Bleach Solutions	U
Borax	A
Bordeaux Mixture	B
Boric Acid	A
Boron Fluids (HEF)	U

Brake Fluid (Non-Petroleum).....	B
Bray GG-130.....	U
Brayco 719-R (WH-910).....	B
Brayco 885 (MIL-L-6085A).....	U
Brayco 910.....	B
Bret 710.....	B
Brine.....	A
Brom-113.....	U
Brom-114.....	B
Bromine.....	U
Bromine Anhydrous.....	U
Bromine Pentafluoride.....	U
Bromine Trifluoride.....	U
Bromine Water.....	B
Bromobenzene.....	U
Bromochloro Trifluoroethane.....	U
Bunker Oil.....	B
Butadiene.....	B
Butane.....	A
Butane 2, 2-Dimethyl.....	B
Butane 2, 3-Dimethyl.....	B
Butanol (Butyl Alcohol).....	A
1-Butene, 2-Ethyl.....	U
Butter.....	B
Butyl Acetate.....	U
Butyl Acetate Ricinoleate.....	U
Butyl Acrylate.....	U
Butyl Alcohol.....	A
Butyl Amine.....	U
Butyl Benzoate.....	U
Butyl Butyrate.....	U
Butyl Carbitol.....	C
Butyl Cellosolve.....	U
Butyl Cellosolve Adipate.....	U
Buty Ether.....	U
Butyl Oleate.....	U
Butyl Stearate.....	U
Butylene.....	C
Butyraldehyde.....	U
Butyric Acid.....	U

C

Carbon Tetrachloride.....	U
Carbonic Acid.....	A
Castor Oil.....	A
Cellosolve.....	U
Cellosolve Acetate.....	U
Cellosolve Butyl.....	U
Celloguard.....	A
Cellulube A60 (Now Fyrquel).....	U
Cellolube 90, 100, 150, 220, 300, 500.....	U
Cellutherm 2505A.....	U
Cetane (Hexadecane).....	B
China Wood Oil (Tung Oil).....	A
Chloracetic Acid.....	A
Chlorodane.....	C
Chlorextol.....	B
Chlorinated Salt Brine.....	U
Chlorinated Solvents, Dry.....	U
Chlorinated Solvents, Wet.....	U
Chlorine, Dry.....	C
Chlorine, Wet.....	C
Chlorine Dioxide.....	U
Chlorine Dioxide (8% Cl as NAClO2 in solution).....	U
Chlorine Trifluoride.....	U
Chloroacetone.....	C
Chloroacetic Acid.....	U
Chlorobenzene.....	U
Chlorobenzene, (Mono).....	U
Chlorobromo Methane.....	U
Chlorobutadiene.....	U
Chlorododecane.....	U
Chloroform.....	U
O-Chloronaphthalene.....	U
1-Chloro 1-Nitro Ethane.....	U
Chlorosulfonic Acid.....	U
Chlorotoluene.....	U
Chlorox.....	B
O-Chlorphenol.....	U
Chrome Alum.....	A

Chrome Plating Solutions.....	U
Chromic Acid.....	U
Chromic Oxides 88 Wt % Aqueous Solution.....	U
Circo Light Process Oil.....	B
Citric Acid.....	A
City Service Koolmotor - AP Gear Oil 140-E.P. Lube.....	B
City Service #65, #120, #250.....	B
Cobalt Chloride.....	A
Cobalt Chloride, 2N.....	A
Cocanut Oil.....	A
Cod Liver Oil.....	B
Coffee.....	A
Coke Oven Gas.....	U
Coliche Liquors.....	A
Convelex 10.....	U
Coolanol (Monsanto).....	A
Copper Acetate.....	B
Copper Chloride.....	A
Copper Cyanide.....	A
Copper Salts.....	A
Copper Sulfate.....	A
Copper Sulfate 10%.....	A
Copper Sulfate 50%.....	A
Corn Oil.....	A
Cottonseed Oil.....	A
Creosols.....	U
Creosote.....	C
Creosote, Coal Tar.....	B
Creosote, Wood Tar.....	B
Creosylic Acid.....	U
Crude Oil.....	U
Cumene.....	U
Cutting Oil.....	B
Cyclohexane.....	U
Cyclohexanol.....	B
P-Cymene.....	U

D

Decalin.....	U
Decane.....	U
Delco Brake Fluid.....	B
Denatured Alcohol.....	A
Detergent Solutions.....	B
Developing Fluids (Photo).....	A
Dextron.....	B
Diacetone.....	U
Diacetone Alcohol.....	U
Diazon.....	C
Dibenzyl Ether.....	U
Dibenzyl Sebacate.....	U
Dibromoethyl Benzene.....	U
Dibutylamine.....	U
Dibutyl Ether.....	U
Dibromoethyl Benzene.....	U
Dibutylamine.....	U
Dibutyl Ether.....	U
Dibutyl Phthalate.....	U
Dibutyl Sebacate.....	U
O-Dichlorobenzene.....	U
P-Dichlorobenzene.....	U
Dichloro-Butane.....	U
Dichloro-Isopropyl Ether.....	U
Dicyclohexylamine.....	U
Diesel Oil.....	B
Di-Ester Lubricant MIL-L7808.....	U
Di-Ester Synthetic Lubricant.....	U
Diethylamine.....	B
Diethyl Benzene.....	U
Diethyl Ether.....	U
Diethyl Sebacate.....	U
Diethylene Glycol.....	A
Diiododibromomethane.....	U
Disobutylene.....	U
Disocetyl Sebacate.....	U
Disopropyl Benzene.....	U
Disopropyl Ketone.....	U
Dimethyl Aniline.....	U
Dimethyl Formamide.....	U
Dimethyl Phthalate.....	U
Dinitro Toluene.....	U
Diocetyl Phthalate.....	U
Diocetyl Sebacate.....	U
Dioxane.....	U

Diozolane	U
Dipentene	U
Diphenyl	U
Diphenyl Oxides.....	U
Dow Chemical 50-4	B
Dow Chemical ET378	U
Dow Chemical ET588	B
Dow Corning-3	A
Dow Corning-4	A
Dow Corning-5	A
Dow Corning-11	A
Dow Corning-33	A
Dow Corning-44	A
Dow Corning-55	A
Dow Corning-200	A
Dow Corning-220	A
Dow Corning 510	A
Dow Corning-550	A
Dow Corning-705	A
Dow Corning-710	A
Dow Corning-1208	A
Dow Corning-4050	A
Dow Corning-6620	A
Dow Corning-F60	A
Dow Corning-F61	A
Dow Corning-XF60	A
Dow Guard	A
Dowtherm Oil	U
Dowtherm A or E	U
Dowtherm 209, 50% Solution	B
Drinking Water	B
Dry Cleaning Fluids	U
DTE Light Oil	B

E

Elco 28-EP Lubricant	C
Epichlorohydrin	U
Epoxy Resins	A
Esam-6 Fluid	B
Esso Fuel 208	B
Esso Golden Gasoline	U
Esso Motor Oil	C
Esso Transmission Fluid (Type A)	B
Esso WS3812 (MIL-L-7808A)	U
Esstic 42, 43	B
Ethane	B
Ethanol	A
Ethanol Amine	B
Ethers	U
Ethyl Acetate-Organic Ester	U
Ethyl Acetoacetate	U
Ethyl Acrylate	U
Ethyl Acrylic Acid	B
Ethyl Alcohol	A
Ethyl Benzene	U
Ethyl Benzoate	U
Ethyl Bromide	U
Ethyl Cellosolve	U
Ethyl Cellulose	B
Ethyl Chlorocarbonate	U
Ethyl Chloroformate	U
Ethyl Cyclopentane	C
Ethyl Ether	U
Ethyl Formate	B
Ethyl Hexanol	A
Ethyl Mercaptan	C
Ethyl Oxalate	U
Ethyl Pentachlorobenzene	U
Ethyl Silicate	A
Ethylene	A
Ethylene Chloride	U
Ethylene Chlorohydrin	B
Ethylene Diamine	A
Ethylene Dibromide	U
Ethylene Dichloride	U
Ethylene Glycol	A
Ethylene Oxide	U
Ethylene Trichloride	U
Ethylmorpholene Stannous Octoate (50/50 Mixture)	U

F

F-60 Fluid (Dow Corning)	A
F-61 Fluid (Dow Corning)	A
Fatty Acids	B
FC-43 Heptacosofluorotributylamine	A
FC75 Fluorocarbon	A
Ferric Chloride	A
Ferric Nitrate	A
Ferric Sulfate	A
Fish Oil	A
Fluoroboric Acid	A
Fluorine (Liquid)	C
Fluorobenzene	U
Fluorocarbon Oils	A
Fluorolube	A
Fluorinated Cyclic Esters	U
Fluosilicic Acid	A
Formaldehyde	C
Formic Acid	A
Freon, 11	U
Freon, 12	A
Freon, 12 and ASTM Oil #2 (50/50 Mixture)	B
Freon, 12 ans Suniso 4G - (50/50 Mixture)	B
Freon, 13	A
Freon 13B1	A
Freon, 14	A
Freon, 21	B
Freon, 22	A
Freon, 22 and ASTM Oil (50/50 Mixture)	B
Freon, 31	A
Freon, 32	A
Freon, 112	B
Freon, 113	A
Freon, 114	A
Freon, 114B2	A
Freon, 115	A
Freon, 142b	A
Freon, 152a	A
Freon, 218	A
Freon, C316	A
Freon, C318	A
Freon, 502	A
Freon, 502	A
Freon, BF	B
Freon, MF	U
Freon, TF	A
Freon, TA	A
Freon, TC	A
Freon, TMC	B
Freon, T-P35	A
Freon, T-WD602	B
Freon, PCA	A
Fuel Oil	B
Fuel Oil, Acidic	B
Fuel Oil, #6	U
Fumaric Acid	B
Fuming Sulpharic Acid - (20/25% Oleum)	U
Furan (Furfuran)	U
Furfural	B
Furfuraldehyde	B
Furfaryl Alcohol	U
Furyl Carbinol	U
Fryquel A60	U
Fryquel 90,100,150,220,300,500	U

G

Gallic Acid	B
Gasoline	B
Gelatin	A
Girling Brake Fluid	B
Glacial Acetic Acid	U
Glauber's Salt	A
Glucose	A
Glue (Depending on Type)	A
Glycerine-Glycerol	A
Glycols	A
Green Suphate Liquor	B
Gulferown Grease	B
Gulf Endurance Oils	B

Gulf FR Fluids (Emulsion).....	B
Gulf FRG-Fluids.....	A
Gulf FRP-Fluids.....	U
Gulf Harmony Oils.....	B
Gulf High Temperature Grease.....	B
Gulf Legion Oils.....	B
Gulf Paramount Oils.....	B
Gulf Scurity Oils.....	B

H

Halothane.....	U
Hannifin Lube A.....	A
Heavy Water.....	B
HEF-2 (High Energy Fuel).....	U
Helium.....	A
N-Heptane.....	B
N-Hexaldehyde.....	A
Hexane.....	B
N-Hexane-1.....	B
Hexyl Alcohol.....	B
High Viscosity Lubricant, U4.....	B
High Viscosity lubricant, H2.....	B
Hilo MS #1.....	U
Houghto-Safe 271 (Water and Glycol Base).....	B
Houghto-Safe 620 (Water/Glycol).....	B
Houghto-Safe 1010, Phosphate Ester.....	U
Houghto-Safe 1120, Phosphate Ester.....	U
Houghto-Safe 5040 (Water/Oil Emulsion).....	B
Hydraulic Oil (Petroleum Base).....	B
Hydrazine.....	B
Hydrobromic Acid.....	U
Hydrobromic Acid 40%.....	B
Hydrocarbons (Saturated).....	B
Hydrochloric Acid Hot 37%.....	U
Hydrochloric Acid Cold 37%.....	B
Hydrochloric Acid 3 Molar.....	C
Hydrochloric Acid Concentrated.....	U
Hydrocyanic Acid.....	B
Hydro-Drive, MIH-50 (Petroleum Base).....	B
Hydro-Drive, MIH-10 (Petroleum Base).....	B
Hydrofluoric Acid, 65% Max. Cold.....	A
Hydrofluoric Acid, 65% Min. Cold.....	U
Hydrofluoric Acid, 65% Max. Hot.....	C
Hydrofluoric Acid, 65% Min. Hot.....	U
Hydrofluosilicic Acid.....	B
Hydrogen Gas, Cold.....	A
Hydrogen Gas, Hot.....	A
Hydrogen Peroxide (1).....	B
Hydrogen Peroxide 90% (1).....	U
Hydrogen Sulfide Dry, Cold.....	A
Hydrogen Sulfide Dry, Hot.....	B
Hydrogen Sulfide Wet, Cold.....	A
Hydrogen Sulfide Wet, Hot.....	B
Hydrolube-Water/Ethylene Glycol.....	B
Hydroquinone.....	U
Hydne.....	B
Hyjet.....	U
Hyjet III.....	U
Hyjet S.....	U
Hyjet W.....	U
Hypochlorous Acid.....	U

I

Industron FF44.....	B
Industron FF48.....	B
Industron FF53.....	B
Industron FF80.....	B
Iodine.....	U
Iodine Pentafluoride.....	U
Isobutyl Alcohol.....	A
Iso-Butyl N-Butyrate.....	U
Isododecane.....	B
Iso-Octane.....	B
Isophorone (Ketone).....	U
Isopropanol.....	A
Isopropyl Acetate.....	U
Isopropyl Alcohol.....	A
Isopropyl Chloride.....	U
Isopropyl Ether.....	U

J

JP 3 (MIL-J-5624).....	U
JP 4 (MIL-J-5624).....	U
JP 5 (MIL-J-5624.....	U
JP-6(MIL-J-25656).....	U
JP X (MIL-F-25604).....	B

K

Kel F Liquids.....	
Kerosene.....	C
Keystone #87HX-Grease.....	U

L

Lactams-Amino Acids.....	B
Lactic Acid, Cold.....	A
Lactic Acid, Hot.....	U
Lacquers.....	U
Lacquer Solvents.....	U
Lactic Acids.....	A
Lard, Animal Fats.....	B
Lavender Oil.....	U
Lead Acetate.....	B
Lead Nitrate.....	A
Lead Sulfamate.....	A
Lehigh X1169.....	B
Lehigh X1170.....	U
Light Grease.....	B
Ligroin (Petroleum Ether or Benzine).....	B
Lime Bleach.....	B
Lime Sulphur.....	A
Lindol, Hydraulic Fluid (Phosphate Ester Type).....	U
Linoleic Acid.....	U
Linseed Oil.....	A
Liquid Oxygen.....	U
Liquid Petroleum Gas (LPG).....	B
Liquimoly.....	B
Lubricating Oils, Diester.....	C
Lubricating Oils, Petroleum Base.....	B
Lubricating Oils, SAE 10, 20, 30, 40, 50.....	B
Lye Solutions.....	A

M

Magnesium Chloride.....	A
Magnesium Hydroxide.....	B
Magnesium Sulfate.....	A
Magnesium Sulfite.....	A
Magnesium Salts.....	A
Malathion.....	
Maleic Acid.....	U
MCS 312.....	U
MCS 352.....	U
MCS 463.....	U
Mercuric Chloride.....	A
Mercury.....	A
Mercury Vapors.....	A
Mesityl Oxide (Ketone).....	U
Methane.....	B
Methanol.....	A
Methyl Acetate.....	B
Methyl Acetoacetate.....	U
Methyl Acrylic Acid.....	B
Methyl Alcohol.....	A
Methyl Benzoate.....	U
Methyl Bromide.....	U
Methyl Butyl Ketone.....	U
Methyl Carbonate.....	U
Methyl Cellosolve.....	B
Methyl Chloride.....	U
Methyl Chloroformate.....	U
Methyl D-Bromide.....	U
Methyl Cyclopentane.....	U
Methylene Chloride.....	U
Methyl Dichloride.....	U
Methyl Ether.....	C
Methyl Ethyl Keton (MEK).....	U
Methyl Ethyl Ketone Peroxide.....	U
Methyl Formate.....	B
Methyl Isobutyl Ketone (MIBK).....	U
Methyl Isopropyl Ketone.....	U
Methyl Methacrylate.....	U

Nitrobenzene	U
Nitrobenzene	U
Nitroethane	C
Nitrogen	A
Nitrogen(Tetroxide(N2O4)(1))	U
Nitromethane	C
Nitropropane	U

O

O-A-548A	B
O-T-6324b	U
Octachloro toluene	U
Octadecane	B
N-Octane	U
Octyl Alcohol	B
Oleic Acid	C
Oleum (Fuming Sulfuric Acid)	U
Oleum Spirits	C
Olive oil	B
Oronite 8200	A
Oronite 8515	A
Orthochloro Ethyl Benzene	U
Ortho-Dichlorobenzene	U
OS 45 Type III (OS45)	A
OS 45 Type IV (OS45-1)	A
OS70	A
Oxalic Acid	B
Oxygen, Cold	U
Oxygen, Cold 200-400°F	A
Ozone	C

P

P-S-66lb	C
P-D-680	C
Paint Thinner, Duco	U
Palmitic Acid	B
Para-dichlorobenzene	U
Par-al-Ketone	U
Parker O Lube	A
Peanut Oil	B
Pentane, 2 Methyl	B
Pentane, 2-4 Dimethyl	B
Pentane, 3 Methyl	B
N-Pentane	A
Perchloric Acid	B
Perchloroethylene	U
Petroleum Oil, Crude	B
Petroleum Oil, Below 250° F(121.1° C)	B
Petroleum Oil, Above 250° F(121.1° C)	U
Phenol	U
Phenol, 70%/30% H2O	U
Phenol, 85%/15% H2O	U
Phenylbenzene	U
Phenyl Ethyl Ether	U
Phenyl Hydrazine	U
Phorone	U
Phosphoric Acid 20%	B
Phosphoric Acid 45%	B
Phosphoric Acid, 3 Molar	C
Phosphoric Acid, Concentrated	U
Phosphorous Trichloride Acid	U
Pickling Solution	U
Picric Acid, H2O Solution	B
Picric Acid, Molten	U
Pinene	C
Pine Oil	U
Piperidine	U
Plating Solutions, Chrome	U
Plating Solutions, Others	U
Pneumatic Service	A
Polyvinyl Acetate Amulsion	B
Potassium Acetate	B
Potassium Chloride	A
Potassium Cupro Cyanide	A
Potassium Cyanide	A
Potassium Dichromate	A
Potassium Hydroxide	A
Potassium Nitrate	A
Potassium Salts	A
Potassium Sulfate	A

Potassium Sulfite	A
Prestone Antifreeze	A
PRL-High Temp. Hydr. Oil	B
Producer Gas	B
Propane	B
Propane Propionitrile	B
Propyl Acetate	U
N-Propyl Acetone	U
Propyl Alcohol	A
Propyl Nitrate	U
Propylene Oxide	U
Pyranol, Transformer Oil	B
Pyranol	U
Pydraul, 10E, 29ELT	U
Pydraul, 30E, 50E, 65E, 90E	U
Pydraul, 115E	U
Pydraul, 230E, 312C, 540C	U
Pyridine Oil	U
Pyrogard 42, 43, 53, 55 (Phosphate Ester)	U
Pyrogard, C, D	B
Pyrolingneous Acid	U
Pyrolube	U
Pyrrole	U

R

Radiation	C
Rapeseed Oil	B
Red Oil (MIL-H-5606)	B
Red Line 100 Oil	B
RJ-1 (MIL-F-25558)	B
RP-1 (MIL-R-25576)	B

S

Sal Ammoniac	A
Salicylic Acid	C
Salt Water	A
Santo Safe 300	U
Sewage	B
Shell Alvania Grease #2	B
Shell Carnea 19 and 29	U
Shell Dials	B
Shell Iris 905	A
Shell Iris 3XF Mine Fluid (Fire Resist. Hydr.)	B
Shell Iris Tellus #27, Pet. Base	B
Shell Iris Tellus #33	B
Shell Iris UMF (5% Aromatic)	B
Shell Lo Hydrax 27 and 29	B
Shell Macoma 72	B
Silicate Esters	A
Silicone Greases	A
Silicone Oils	A
Silver Nitrate	A
Sinc;air Opaline CS-EP Lube	U
Skelly, Solvent B, C, E	B
Skydrol 500	U
Skydrol 7000	U
Soap Solutions	A
Socony Vacuum AMV AC781 (Grease)	B
Socony Vacuum PD959B	B
Soda Ash	A
Sodium Acetate	B
Sodium Bicarbonate (Baking Soda)	A
Sodium Bisulfite	A
Sodium Borate	A
Sodium Carbonate (Soda Ash)	A
Sodium Chloride	A
Sodium Cyanide	A
Sodium Hydroxide	B
Sodium Hypochlorite	B
Sodium Metaphosphate	B
Sodium Nitrate	B
Sodium Perborate	B
Sodium Peroxide	B
Sodium Phosphate (Mono)	B
Sodium Phosphate (Dibasic)	A
Sodium Phosphate (Tribasic)	B
Sodium Salts	B
Sodium Silicate	A
Sodium Sulfate	A
Sodium Sulfide	A

Sodium Sulfite.....	A
Sodium Thiosulfate.....	A
Sovasol #1, 2 and 3.....	B
Sovasol #73 and 74.....	B
Soybean Oil.....	A
Spry.....	B
SR-6 Fuel.....	U
SR-10 Fuel.....	U
Standard Oil Mobilube GX90-EP Lube.....	B
Stannic Chloride.....	B
Stannic Chloride 50%.....	U
Stannous Chloride.....	A
Staulfer 7700.....	U
Steam, Below 350° F (176.7° C).....	U
Steam, Above 350° F (176.7° C).....	U
Stearic Acid.....	B
Stoddard Solvent.....	C
Styrene.....	U
Styrene (Monomer).....	U
Sucrose Solutions.....	A
Sulfite Liquors.....	B
Sulfur.....	A
Sulfur Chloride.....	U
Sulfur Dioxide, Wet.....	B
Sulfur Dioxide, Dry.....	U
Sulfur Dioxide, Liquofied under pressure.....	U
Sulfur Hexafluoride.....	A
Sulfur Liquors.....	B
Sulfur Molten.....	C
Sulfur Trioxide.....	U
Sulfuric Acid Dilute.....	B
Sulfuric Acid Concentrated.....	U
Sulfuric Acid 20% Oleum.....	U
Sulfuric Acid 3 Molar.....	C
Sulfurous Acid.....	B
Sunoco SAE 10.....	B
Sunoco #3661.....	B
Sunoco All Purpose Grease.....	B
Sunsafe(Fire Resist Hydr.Fluid).....	B
Super Shell Gas.....	U
Swan Finch EP Lube.....	B
Swan Finch Hypoid-90.....	B

T

TT-N-95a.....	C
TT-N-97B.....	C
TT-I-735b.....	B
TT-S-735, Type I.....	B
TT-S-735, Type II.....	C
TT-S-735, Type III.....	C
TT-S-735, Type IV.....	A
TT-S-735, Type V.....	B
TT-S-735, Type VI.....	U
TTT-656b.....	B
Tannic Acid.....	B
Tannic Acid, 10%.....	A
Tar Bituminous.....	C
Tartaric Acid.....	A
Terpineol.....	U
Tertiary Butyl Alcohol.....	B
Tertiary Butyl Catechol.....	B
Tertiary Butyl Mercaptan.....	U
Tetrabromomethane.....	U
Tetrabutyl Titanate.....	B
Tetrachloroethylene.....	U
Tetraethyl Lead.....	C
Tetraethyl Lead "Blend".....	U
Tetrahydrofuran.....	U
Tetralin.....	U
Texaco 3450 Gear Oil.....	U
Texaco Capella A and AA.....	B
Texaco Meropa #3.....	B
Texaco Regal B.....	U
Texaco Uni-Temp. Grease.....	B
Texamatic "A" Transmission Oil.....	B
Texamatic 1581 Fluid.....	B
Texamatic 3401 Fluid.....	B
Texamatic 3525 Fluid.....	B
Texamatic 3528 Fluid.....	B
Texas 1500 Oil.....	B

Thiokol TP-908.....	B
Thiokol TP-95.....	B
Thionyl Chloride.....	U
Tidewater Oil-Beedol.....	B
Tidewater Oil-Multigear 140, EP Lube.....	B
Titanium Tetrachloride.....	U
Toluene.....	U
Toluene Diisocyanate.....	U
Transformer Oil.....	B
Transmission Fluid Type A.....	B
Triacetin.....	B
Triaryl Phosphate.....	U
Tributoxyethyl Phosphate.....	U
Tributyl Mercaptan.....	U
Tributyl Phosphate.....	U
Trichloroacetic Acid.....	U
Trichloroethane.....	U
Trichloroethylene.....	U
Tricresyl Phosphate.....	B
Triethanol Amine.....	U
Triethyl Aluminum.....	U
Triethyl Borane.....	U
Trifluoroethane.....	U
Trinitrotoluene.....	A
Trioctyl Phosphate.....	U
Tripoly Phosphate.....	B
Tung Oil (China Wood Oil).....	B
Turbine Oil.....	U
Turbine Oil #15 (MIL-L-7808A).....	U
Turbine Oil #35.....	B
Turpentine.....	U
Type I, Fuel (MIL-S-3136).....	U
Type II Fuel (MIL-S-3136).....	B
Type III Fuel (MIL-S-3136).....	U

U

Ucon Hydrolube J-4.....	B
Ucon Lubricant LB-65.....	A
Ucon Lubricant LB-135.....	A
Ucon Lubricant LB-285.....	A
Ucon Lubricant LB-300.....	A
Ucon Lubricant LB-625.....	A
Ucon Lubricant LB-1145.....	A
Ucon-Lubricant 50-HB55.....	A
Ucon-Lubricant 50-HB100.....	A
Ucon Lubricant 50-HB260.....	A
Ucon Lubricant 50-HB660.....	A
Ucon Lubricant 50-HB5100.....	A
Ucon Oil LB-385.....	A
Ucon Oil LB-400X.....	A
Ucon 50-HB-280X (Polyacrylon Glycol Deriv.).....	A
Univis 40 (Hydr. Fluid).....	B
Univolt #35 (Mineral Oil).....	B
Unsymmetrical Dimethyl Hydrazine (UDMH).....	B

V

VV-B-680.....	B
VV-G-632.....	A
VV-G-671c.....	A
VV-H-910.....	B
VV-I-530a.....	B
VV-K-211d.....	C
VV-K-220a.....	B
VV-L-751b.....	B
VV-L-800.....	B
VV-L-820b.....	B
VV-L-825a, Type I.....	A
VV-L-825a, Type II.....	A
VV-L-825a, Type III.....	B
VV-O-526.....	A
VV-P-216a.....	B
VV-P-236.....	B
Varnish.....	U
Vegetable Oil.....	C
Versilube.....	A
Vinegar.....	B
Vinyl Chloride.....	U

W

Wagner 21B Brake Fluid.....	B
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Water	A
Wemco C	B
Whiskey and Wines	A
White Pine Tar	U
White Oil	B
Wolmar Salt	B
Wood Alcohol	A
Wood Oil	B

X

Xylene	U
Xylidenes-Mixed-Aromatic Amines	U
Xylol	U
Xenon	A

Z

Zeolites	A
Zinc Acetate	B
Zinc Chloride	A
Zinc Salts	A
Zinc Sulfate	A

CHAPTER 3 MAINTENANCE AND STORAGE

3-1 GENERAL.

The major components and accessories of a MAXIFORCE Air Lifting Bag System require little maintenance to ensure optimum performance. However, this maintenance must be performed to ensure personnel and equipment safety, and the assurance that when the system is to be utilized, it will function as designed and intended. This chapter provides preventive and corrective maintenance procedures that are necessary to verify that the MAXIFORCE Air Lifting Bag System will operate satisfactorily.



Do not drag or drop the bag on the nipple, as this can cause breakage of the brass inflation fitting and render the bag useless. ***BREAKAGE OF THE BRASS INFLATION FITTING IS NOT COVERED UNDER WARRANTY.***

3-2 PREVENTIVE MAINTENANCE PLAN.

Preventive maintenance of the MAXIFORCE Air Lifting Bag System is accomplished in accordance with paragraphs 3-3 and 3-4.

3-3 POST OPERATION PREVENTIVE MAINTENANCE.

Because of the contaminants present where a MAXIFORCE Air Lifting Bag System is generally used (maintenance sites, construction sites, accident sites, etc.), it is important that the system components be thoroughly cleaned, inspected and prepared for their next use before being placed in storage.

3-3.1 CLEANING.



Do not use any petroleum base product to clean components of the MAXIFORCE Air Lifting Bag System. Petroleum base products could adversely react with the non-metallic parts of the system components and may result in a component failure when none should be expected or tolerated.

- a. Keep the exterior of all components clean of all dirt, grit, oil and grease accumulations. Except for the lift bag(s), wipe exterior surfaces with a lint-free cotton machinery wiping towel **LIGHTLY** dampened with a soap and warm water solution. Be particularly

careful to remove all dirt, sand, grit, etc. from quick connect couplings and nipples. Swirl in a bucket with the soap and water solution until clean. Rinse with a wiping towel **LIGHTLY** dampened with clean water. Then dry the surfaces thoroughly with a clean, dry wiping towel or low pressure compressed air. Also clean the lift bag with a soap and warm water solution, but scrub the lift bag with a stiff bristle broom or brush and rinse by spraying with cold water. If the cleaning solution or rinse water gets into the lift bag through the nipple, allow the lift bag to dry thoroughly before its next use.

3-3.2 INSPECTION.

- a. While the lift bag is still wet with the cleaning solution, inflate to 30 psi and check for air bubbles denoting a leak(s). Except for air leakage from between the air inlet fitting and the male nipple, replace rather than attempt to repair a leaking lift bag. If air leakage is detected from around the male nipple threads, proceed as follows:

1. Deflate the lift bag.
2. Disconnect the quick connect coupling from the lift bag male nipple.

WARNING

When removing/installing a replaceable male nipple from/into a lift bag inlet fitting, be sure to hold the inlet fitting stationary while turning the male nipple. Turning the inlet fitting, or allowing it to turn, will loosen its bond with the lift bag. During operation, this will result in air leakage or possibly the ejection of the fitting, resulting in a hazardous condition and rendering the lift bag useless.

3. Unscrew the lift bag male nipple while holding the inlet fitting stationary.
4. Clean the interfacing threads and inspect the male nipple for visual damage. If damaged, discard. If not damaged, wrap teflon tape (two wraps) around the male nipple threads and tighten back into the inlet fitting.
5. Reconnect the lift bag to an air source, reinflate to 30 psi and recheck for air leaks. If none are found, deflate the lift bag, disconnect the quick connect coupling and install a protective cap (optional part) over the male nipple in preparation for storage.

- b. After a lift bag is clean and dry, all surfaces should be thoroughly inspected for cuts, abrasion, air bubbles and bulges (ply separation), and other similar damage. Remove all debris from the surface. Minor surface cuts and abrasion can be repaired with rubber cement and should not be considered a problem unless they are deep enough to expose the kevlar reinforcement layer.
- c. Inspect hose assemblies for cuts, cracks, crimps and brittleness. Inspect the hose quick connect coupling and nipple for secureness of attachment and burrs, nicks, corrosion or other similar damage that would prevent a leak proof interconnection.
- d. Refer to the separate instruction manuals provided with the pressure regulator and controller (safety relief and control valve) to inspect these components.
- e. If during the last three (3) months the MAXIFORCE Air Lifting Bag System and accessories have not been used for training or actual operational functions, they should be field tested to ensure they do not leak and are fully operational in preparation for their next use.

3-3.3. REPAIR.

The only repairs authorized on the MAXIFORCE Air Lifting Bag System components are those designated in the separate instruction manuals provided with the pressure regulator and controller (safety relief and control valve) and the following procedures detailing replacement of the quick connect couplings and nipples.

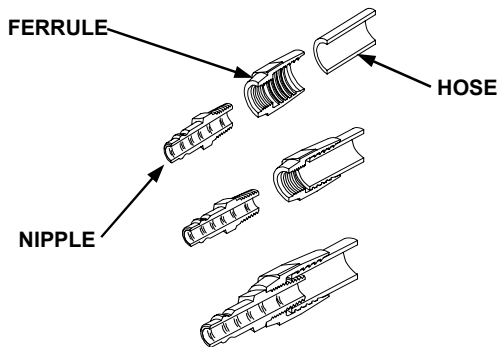


Figure 3-1. Air Hose Nipple Replacement

- a. **AIR HOSE NIPPLE REPLACEMENT.** Refer to figure 3-1 and replace a worn or otherwise damaged air hose nipple in accordance with the following procedure.
 1. Square cut the air hose just behind the ferrule to

release the nipple. Discard the nipple and ferrule.

2. Screw a new ferrule counterclockwise fully onto the hose and back the ferrule out 1/2 turn. There should be approximately 1/16 inch clearance between the ferrule inside shoulder and the end of the hose.
3. Hold the ferrule stationary and turn the nipple clockwise into the ferrule until it is fully seated (not required for emergency or field replacement).

- b. **AIR HOSE QUICK CONNECT COUPLING REPLACEMENT.** Refer to figure 3-2 and replace a worn or otherwise damaged air hose quick connect coupling in accordance with the following procedure.

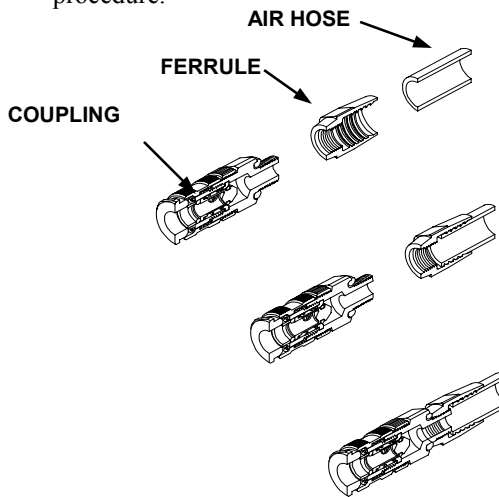


Figure 3-2. Air Hose Quick Connect Coupling Replacement

1. Square cut the air hose just behind the ferrule to release the quick connect coupling stem and the assembled ferrule (quick connect coupling). Discard the quick connect coupling.
2. Unscrew the new ferrule from the quick connect coupling stem. Screw the new ferrule counterclockwise fully onto the hose and back the ferrule out 1/2 turn. There should be approximately 1/16 inch clearance between the ferrule inside shoulder and the end of the hose.
3. Hold the ferrule stationary and turn the quick connect coupling stem clockwise into the ferrule until it is fully seated (not required for emergency or field replacement).

- c. COMPONENT QUICK CONNECT COUPLING AND NIPPLE REPLACEMENT. The quick connect couplings and nipples assembled into the pressure regulator, controller (safety relief and control valve) and the safety in-line relief valve are screw-type fittings. When their replacement is required, it is only necessary to unscrew the damaged part (quick connect coupling and/or nipple), remove and discard the "O" ring and screw in a replacement part using a new "O" ring. If an "O" ring is not used, be sure to wrap the male threads with two turns of teflon tape to assure a leak free connection.

3-4 **STORAGE.**

3-4.1 Storage of the MAXIFORCE Air Lifting Bag System components at a stationary facility requires the following:

- a. The short term (1 hour or less) temperature range must be within the limits of -75°F (-60°C) to +220°F (+105°C). The continuous temperature range must be within the limits of -40°F (-40°C) to +150°F (+65°C).
- b. The components must be protected from any extreme environmental conditions where blowing dust, sand, grit and other similar materials could cause damage. If these environmental conditions are likely to be encountered, plastic wrap all components for protection.
- c. Regardless of whether the lift bag(s) are to be stored flat or upright, the inlet nipple shall be covered with a protective cap over the inlet nipple. If stored upright, be sure the inlet nipple is upright where it will not rub the floor or sides of its storage container.

3-4.2 Storage of the MAXIFORCE Air Lifting Bag System components in a truck or at a movable facility requires the following:

- a. System components (pressure regulator, controller, safety in-line relief valve and other metallic items) that are stored in a truck compartment where they are subjected during transport to constant bumping will eventually be damaged. It is strongly recommended that these components be stored in their own cushioned cartons. It is further recommended that all components be strapped down, braced or otherwise secured within the compartment during transport.
- b. The short term (1 hour or less) temperature range must be within the limits of -75°F (-60°C) to +220°F (+105°C). The continuous temperature range must be within the limits of -40°F (-40°C) to +150°F (+65°C).
- c. The components must be protected from any extreme environmental conditions where blowing dust, sand, grit and other similar materials could cause damage. If these environmental conditions are likely to be encountered, plastic wrap all components for protection.
- d. Regardless of whether the lift bag(s) are to be stored flat or upright, the inlet nipple shall be covered with a protective cap over the inlet nipple. If stored upright, be sure the inlet nipple is upright where it will not rub the floor or sides of its storage container.

CHAPTER 4
PARTS LIST

4-1 INTRODUCTION.

This chapter lists available standard and optional parts for the MAXIFORCE Air Lifting Bag System. The parts list is used to identify and locate all repair parts, including all attaching hardware supplied. The parts should be ordered by part number when ordered from Paratech Incorporated, 1025 Lambrecht Road, Frankfort, Illinois 60423-7000.

4-2 LIST OF MAJOR COMPONENTS.

The MAXIFORCE Air Lifting Bag System is comprised of the user selected major components denoted in table 4-1.

Figure 4-2 Index Number	Qty	Component Name	Page No.
1-2	1	Air Source	4-2
3-7	1	Pressure Regulator	4-2
8-11	1	Controller	4-2
12	1	Air Hose	4-3
13-26	1	Lift Bag	4-4
27	1	Safety In-Line Relief Valve	4-4
28-59	1	Adapters and Fittings	4-6
60-61	1	Ratchet and Belt, and Lift Slings	4-7
62-72	1	Miscellaneous	4-8

Table 4-1. List of Major Components

4-3 PARTS LIST TABLES.

The MAXIFORCE Air Lifting Bag System parts are listed in table 4-2. The table contains five columns which are described below:

4-3.1 FIGURE AND INDEX NUMBER COLUMN.

This column shows the figure and index number of each part listed. Table 4-2 relates to illustrations contained in chapter 4. The index numbers which identify the individual parts are separated from the figure number by a hyphen. Index numbers run consecutively.

4-3.2 DESCRIPTION COLUMN.

The DESCRIPTION column describes each part (by noun name and modifiers) in sufficient detail for clarity. Descriptions are successively indented to the right to show assembly and part relationship.

4-3.3 QUANTITY COLUMN.

Quantities specified in the QUANTITY column are the total number of each part required per assembly.

4-3.4 CAGE COLUMN.

The assembly and parts are identified by the five digit code 30978. The code number, in accordance with Federal Supply Cataloging Handbook H-4-1, identifies Paratech Incorporated, 1025 Lambrecht Road, Frankfort, IL 60423-7000 as the manufacturer of all parts.

4-3.5 PART NUMBER COLUMN.

The part number column contains an identifying number for each part listed. Vendor numbers are shown where applicable.

4-4 LIST OF MANUFACTURERS.

Manufacturer's (vendor's) code number (30978) used in the parts list tables is in accordance with Federal Supply Cataloging Handbook H-4-1 and identifies Paratech Incorporated, 1025 Lambrecht Road, Frankfort, IL 60423-7000 as the manufacturer of all parts.

Table 4-2. MAXIFORCE Lifting Bag System Components Parts List

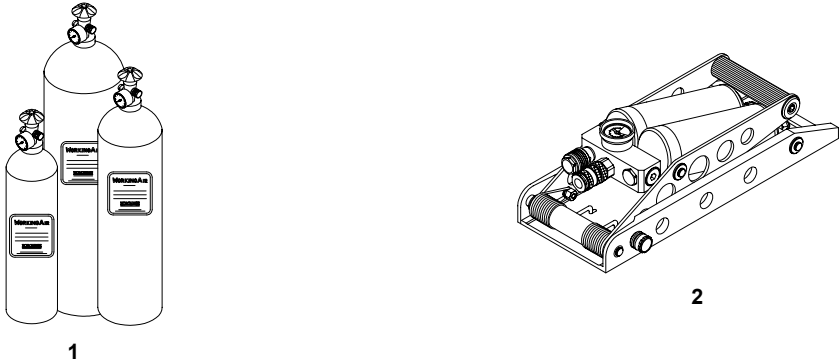
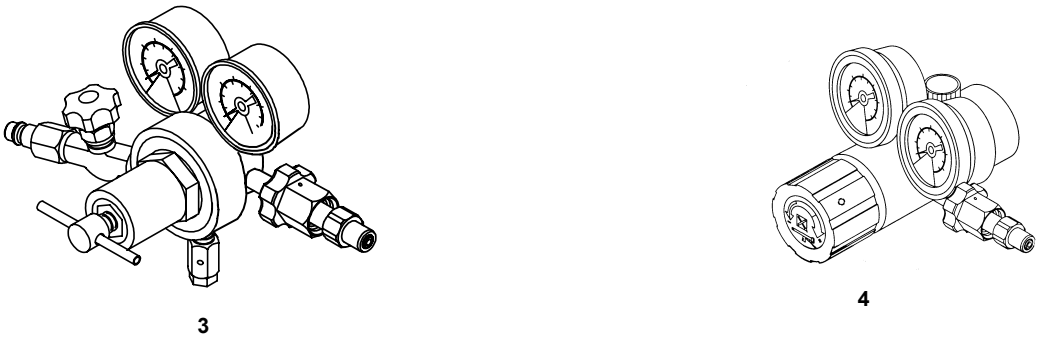
Figure and Index Number	Description	Quantity	CAGE	Part Number
AIR SOURCE				
4-2-1	AIR CYLINDER, With valve and gauge, 13 cu ft (368 litres)	1	30978	800013
-1	AIR CYLINDER, With valve and gauge, 50 cu ft (1,416 litres) .	1	30978	800050
-1	AIR CYLINDER, With valve and gauge, 80 cu ft (2,265 litres) .	1	30978	800080
-2	MANUAL AIR COMPRESSOR (hand/foot pump).....	1	30978	800400
				
PRESSURE REGULATORS				
4-2-3	PRESSURE REGULATOR, Diaphragm type, 3000 to 135 psi.... (206.8 to 9.3 Bar), CGA 346 inlet	1	30978	890500
-4	PRESSURE REGULATOR, Piston type, 6000 to 135 psi (414 to 9.3 Bar), CGA 347 inlet	1	30978	890401
				

Table 4-2. MAXIFORCE Lift Bag System Components Parts List (Continued)

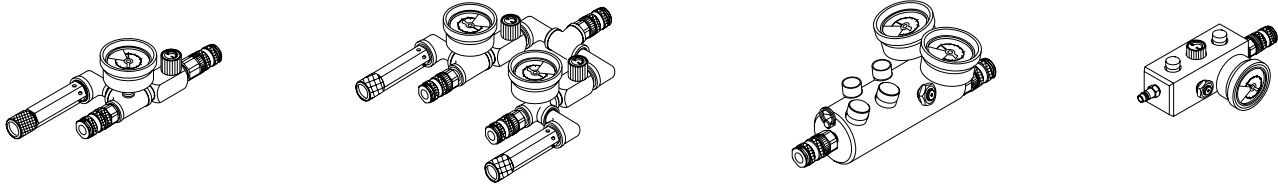
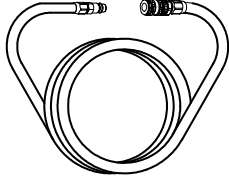
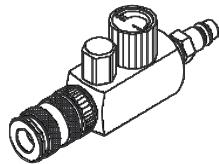
Figure and Index Number	Description	Quantity	CAGE	Part Number
CONTROLLERS (Safety Relief and Control Valve)				
4-2-5	SAFETY RELIEF AND CONTROL VALVE, Single	1	30978	890506
-6	SAFETY RELIEF AND CONTROL VALVE, Dual	1	30978	890507
-7	SAFETY RELIEF AND CONTROL VALVE, Dual "deadman" .	1	30978	890900
-8	SAFETY RELIEF AND CONTROL VALVE, Single with bypass, coupling and nipple inlet (for industrial use)	1	30978	889500
				
AIR HOSE				
4-2-9	AIR HOSE, Black, 3/8 inch (9.5 mm) dia. x 16 ft (4.9 m) long....	1	30978	890513
-9	AIR HOSE, Blue, 3/8 inch (9.5 mm) dia. x 16 ft (4.9 m) long	1	30978	890514
-9	AIR HOSE, Yellow, 3/8 inch (9.5 mm) dia. x 16 ft (4.9 m) long .	1	30978	890515
-9	AIR HOSE, Red, 3/8 inch (9.5 mm) dia. x 16 ft (4.9 m) long	1	30978	890516
-9	AIR HOSE, Green, 3/8 inch (9.5 mm) dia. x 16 ft (4.9 m) long ...	1	30978	890517
-9	AIR HOSE, Grey, 3/8 inch (9.5 mm) dia. x 16 ft (4.9 m) long.....	1	30978	890518
-9	AIR HOSE, Black, 3/8 inch (9.5 mm) dia. x 32 ft (9.8 m) long....	1	30978	890522
-9	AIR HOSE, Blue, 3/8 inch (9.5 mm) dia. x 32 ft (9.8 m) long	1	30978	890523
-9	AIR HOSE, Yellow, 3/8 inch (9.5 mm) dia. x 32 ft (9.8 m) long .	1	30978	890520
-9	AIR HOSE, Red, 3/8 inch (9.5 mm) dia. x 32 ft (9.8 m) long	1	30978	890521
-9	AIR HOSE, Green, 3/8 inch (9.5 mm) dia. x 32 ft (9.8 m) long ...	1	30978	890524
-9	AIR HOSE, Grey, 3/8 inch (9.5 mm) dia. x 32 ft (9.8 m) long.....	1	30978	890525
-9	AIR HOSE, Black, 3/8 inch (9.5 mm) dia. x 50 ft (15.2 m) long..	1	30978	890546
-9	AIR HOSE, Blue, 3/8 inch (9.5 mm) dia. x 50 ft (15.2 m) long ...	1	30978	890543
-9	AIR HOSE, Yellow, 3/8 inch (9.5 mm) dia. x 50 ft (15.2 m) long	1	30978	890542
-9	AIR HOSE, Red, 3/8 inch (9.5 mm) dia. x 50 ft (15.2 m) long	1	30978	890541
-9	AIR HOSE, Green, 3/8 inch (9.5 mm) dia. x 50 ft (15.2 m) long .	1	30978	890544
-9	AIR HOSE, Grey, 3/8 inch (9.5 mm) dia. x 50 ft (15.2 m) long...	1	30978	890545
				

Table 4-2. MAXIFORCE Air Lifting Bag System Components Parts List (Continued)

Figure and Index Number	Description	Quantity	CAGE	Part Number
LIFT BAGS (See Table 1-1 For Physical Characteristics)				
4-2-10	LIFT BAG, Model KPI-1, 1.5 ton (1,340 kg) capacity.....	1	30978	888110
-11	LIFT BAG, Model KPI-3, 3.2 ton (2,903 kg) capacity.....	1	30978	888120
-12	LIFT BAG, Model KPI-5, 4.8 ton (4,354 kg) capacity.....	1	30978	888130
-13	LIFT BAG, Model KPI-8, 7.6 ton (6,895 kg) capacity.....	1	30978	888135
-14	LIFT BAG, Model KPI-10, 11.4 ton (10,342 kg) capacity.....	1	30978	888138
-15	LIFT BAG, Model KPI-12, 12.0 ton (10,886 kg) capacity.....	1	30978	888140
-16	LIFT BAG, Model KPI-17, 17.0 ton (15,422 kg) capacity.....	1	30978	888150
-17	LIFT BAG, Model KPI-22, 21.8 ton (19,777 kg) capacity.....	1	30978	888160
-18	LIFT BAG, Model KPI-28, 27.6 ton (25,038 kg) capacity.....	1	30978	888165
-19	LIFT BAG, Model KPI-32, 31.8 ton (28,848 kg) capacity.....	1	30978	888170
-20	LIFT BAG, Model KPI-35L, 34.7 ton (31,479 kg) capacity.....	1	30978	888180
-21	LIFT BAG, Model KPI-44, 43.8 ton (39,734 kg) capacity.....	1	30978	888190
-22	LIFT BAG, Model KPI-55, 55.0 ton (49,895 kg) capacity.....	1	30978	888195
-23	LIFT BAG, Model KPI-74, 72.3 ton (65,589 kg) capacity.....	1	30978	888200
LIFT BAG SETS				
	LIFT BAG SET, 14 Bag, 346 ton (313.9 M ton) (consists of 1 each of index numbers: 10, 11, 12, 13, 14, 15, 16,17, 18, 19, 20, 21, 22, 23)	1	30978	889346
	LIFT BAG SET, 6 Bag, 255 ton (231.3 M ton) (consists of 1 each of index numbers: 17, 18, 19, 21, 22, 23)	1	30978	889255
	LIFT BAG SET, 10 Bag, 245 ton (222.3 M ton) (consists of 1 each of index numbers: 10, 11, 12, 15, 16, 17, 19, 20, 21, 23)	1	30978	889245
	LIFT BAG SET, 4 Bag, 236 ton (214.1 M ton) (consists of 2 each of index numbers: 21, 23)	1	30978	889236
	LIFT BAG SET, 7 Bag, 234 ton (212.3 M ton) (consists of 1 each of index numbers: 15, 16, 17, 19, 20, 21, 23) (NSN 5120-01-310-3770)	1	30978	889234

Table 4-2. MAXIFORCE Air Lifting Bag System Components Parts List (Continued)

Figure and Index Number	Description	Quantity	CAGE	Part Number
LIFT BAG SETS (Continued)				
	LIFT BAG SET, 4 Bag, 174 ton (157.9 M ton) (consists of 2 each of index numbers: 19, 22)	1	30978	889174
	LIFT BAG SET, 8 Bag, 136 ton (123.4 M ton) (consists of 1 each of index numbers: 10, 11, 12 13, 15, 16, 17, 19, 21)	1	30978	889136
	LIFT BAG SET, 5 Bag, 131 ton (118.8 M ton) (consists of 1 each of index numbers: 11, 16, 19, 20, 21)	1	30978	889131
	LIFT BAG SET, 5 Bag, 117 ton (106.1 M ton) (consists of 1 each of index numbers: 15, 16, 17, 19, 20)	1	30978	889117
	LIFT BAG SET, 4 Bag, 101 ton (91.6 M ton) (consists of 1 each of index numbers: 13, 14, 18, 22)	1	30978	889100
	LIFT BAG SET, 6 Bag, 97 ton (88 M ton) (consists of 1 each of index numbers: 13, 14, 15, 16, 17, 18)	1	30978	889097
	LIFT BAG SET, 7 Bag, 92 ton (83.5 M ton) (consists of 1 each of index numbers: 10, 11, 12, 15, 16 17, 19)	1	30978	889092
	LIFT BAG SET, 3 Bag, 52 ton (47.2 M ton) (consists of 1 each of index numbers: 11, 16, 19)	1	30978	889052
	LIFT BAG SET, 3 Bag, 50 ton (45.4 M ton) (consists of 1 each of index numbers: 15, 16, 17)	1	30978	889050
	LIFT BAG SET, 2 Bag, 48 ton (43.5 M ton) (consists of 1 each of index numbers: 16, 19)	1	30978	889048
	LIFT BAG SET, 6 Bag, 39 ton (35.4 M ton) (consists of 1 each of index numbers: 10, 11, 12, 13, 14, 15)	1	30978	889039
	LIFT BAG SET, 3 Bag, 9 ton (8.2 M ton) (consists of 1 each of index numbers: 10, 11, 12)	1	30978	889101
SAFETY IN-LINE RELIEF VALVE				
4-2-24	RELIEF VALVE, Safety in-line, 135 psi (9.3 Bar)	1	30978	890490



24

Table 4-2. MAXIFORCE Air Lifting Bag System Components Parts List (Continued)

Figure and Index Number	Description	Quantity	CAGE	Part Number
ADAPTERS AND AIR FITTINGS				
4-2-25	NIPPLE, 1/4 inch NPTM (fits MAXIFORCE and Vetter)	1	30978	890667
-26	NIPPLE, 1/8 inch NPTM (fits MAXIFORCE and Vetter)	1	30978	890668
-27	NIPPLE, 1/4 inch NPTM	1	30978	890681
-28	NIPPLE, 1/4 inch NPTF	1	30978	890682
-29	NIPPLE, 1/8 inch NPTM	1	30978	890683
-30	NIPPLE, 1/2 inch NPTM	1	30978	890684
-31	NIPPLE, 1/2 inch NPTF	1	30978	890685
-32	NIPPLE, 3/8 inch hose stem with ferrule	1	30978	890691 & 90624
-33	PROTECTOR, Nipple	1	30978	890695
-34	COUPLING, 3/8 inch hose stem with ferrule	1	30978	890700 & 90624
-35	COUPLING, 1/2 inch NPTM	1	30978	890710
-36	COUPLING, 1/4 inch NPTF	1	30978	890711
-37	COUPLING, 1/2 inch NPTF	1	30978	890720
-38	COUPLING, 1/4 inch NPSM with O-ring	1	30978	890721
-39	NIPPLE, Double male	1	30978	890730
-40	NIPPLE, Male and locking tire chuck	1	30978	890731
-41	NIPPLE, Industrial double male with valve	1	30978	890732
-42	NIPPLE AND GLAD HAND	1	30978	890734
-43	Y, With two 1/4 inch NPTM couplings	1	30978	890735
-44	Y, With two 1/4 inch NPTM couplings and MAXIFORCE nipple	1	30978	890736
-45	NIPPLE, Male and tire valve inflator	1	30978	890737
-46	NIPPLE, Male with 12 inch (30.5 cm) hose and clamp	1	30978	890738
-47	Y, With three couplings	1	30978	890740
-48	NIPPLE, With industrial twist lock and valve	1	30978	890749
-49	COUPLING, Industrial, 1/4 inch NPTF	1	30978	890751
-50	COUPLING, Industrial, 1/4 inch NPTM	1	30978	890752
-51	NIPPLE, Industrial, 1/8 inch NPTM	1	30978	890760
-52	NIPPLE, Industrial, 1/4 inch NPTM	1	30978	890761
-53	NIPPLE, Industrial, 3/8 inch NPTM	1	30978	890762
-54	NIPPLE, Industrial, 1/4 inch NPTF	1	30978	890763
-55	ADAPTER, CGA-346 high pressure air and CGA-580 nitrogen..	1	30978	895380

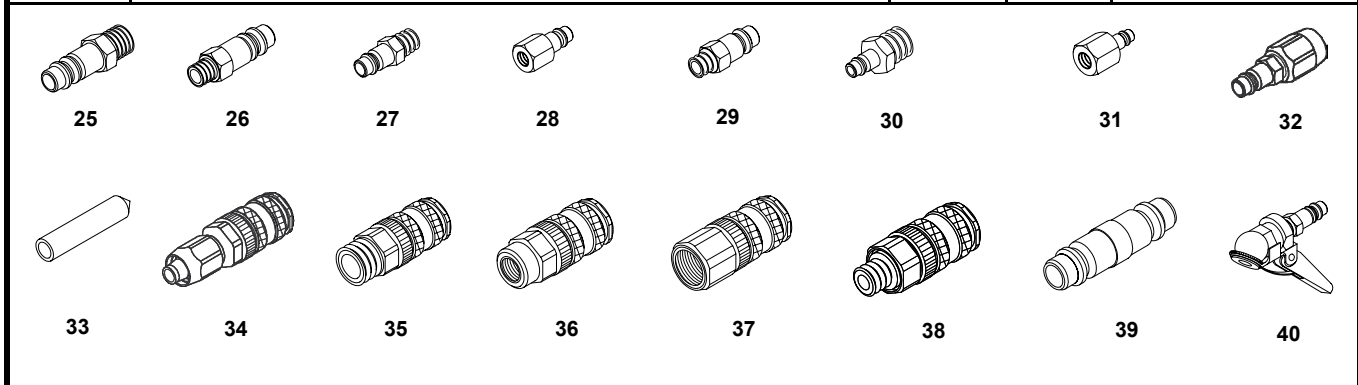


Table 4-2. MAXIFORCE Air Lifting Bag System Components (Continued)


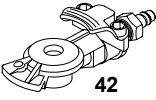





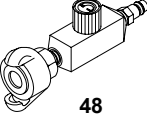







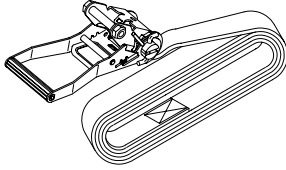
Figure and Index	Description	Quantity	CAGE	Part Number			
 <p>41</p>	 <p>42</p>	 <p>43</p>	 <p>44</p>	 <p>45</p>	 <p>46</p>	 <p>47</p>	
 <p>48</p>	 <p>49</p>	 <p>50</p>	 <p>51</p>	 <p>52</p>	 <p>53</p>	 <p>54</p>	 <p>55</p>
RATCHET AND BELT, AND LIFT SLINGS							
4-2-56	RATCHET AND BELT, 5000 lb (2268 kg), 30 foot (9.1 m)	1	30978	890805			
-56	RATCHET AND BELT, 5000 lb (2268 kg), 30 foot (9.1 m)	1	30978	890810			
-56	RATCHET AND BELT, 5000 lb (2268 kg), 25 foot (7.6 m)	1	30978	890554			
-57	LIFT SLING, 15 in. (38.1 cm) x 15 in. (38.1 cm)	1	30978	890580			
-57	LIFT SLING, 15 in. (38.1 cm) x 21 in. (53.3 cm)	1	30978	890581			
-57	LIFT SLING, 20 in. (50.8 cm) x 20 in. (50.8 cm)	1	30978	890582			
-57	LIFT SLING, 24 in. (61 cm) x 24 in. (61 cm)	1	30978	890583			
-57	LIFT SLING, 15 in. (38.1 cm) x 42 in. (106.7 cm)	1	30978	890584			
-57	LIFT SLING, 28 in. (71.1 cm) x 28 in. (71.1 cm)	1	30978	890585			
-57	LIFT SLING, 36 in. (91.4 cm) x 36 in. (91.4 cm)	1	30978	890586			
-58	EXTENSION BELT, 20 ft (6.1 m), orange	1	30978	890806			
-58	(for 890805 ratchet and belt)						
-58	WEBBING, 5000 lb (2268 kg), orange (specify length)	1	30978	890845			
-58	(for 890805 ratchet and belt)						
-58	EXTENSION BELT, 20 ft (6.1 m), yellow	1	30978	890811			
-58	(for 890810 ratchet and belt)						
-58	WEBBING, 5000 lb (2268 kg), yellow (specify length)	1	30978	890840			
-58	(for 890810 ratchet and belt)						
-58	EXTENSION BELT, 25 ft (7.6 m),	1	30978	890845			
-58	(for 890554 ratchet and belt)						
-58	LIFT SLING EXTENSION, 18 ft (5.5 m).....	1	30978	890556			
 <p>56</p>							

Table 4-2. MAXIFORCE Air Lifting Bag System Components Parts List (Continued)

Figure and Index Number	Description	Quantity	CAGE	Part Number
MISCELLANEOUS				
4-2-59	SHEET, Neoprene, 20 in. (50.8 cm) x 20 in. (50.8 cm)..... x 1/8 in. (0.32 cm)	1	30978	890466
-60	FITTING, 3/8 in. (9.5 mm) hose x 3/8 in. (9.5 mm) hose splice...	1	30978	890673
-61	FITTING, 3/8 in. (9.5 mm) hose x 1/4 in NPTM.....	1	30978	890674
-62	FITTING, 3/8 in. (9.5 mm) hose x 1/4 in. NPTF.....	1	30978	890744
-63	STORAGE CASE - 13 x 6 x 4.75 in (33 x 15.2 x 12.1 cm).....	1	30978	000905
-64	TIRE CHUCK, Locking, 1/4 in. NPTF.....	1	30978	890750
-65	CONNECTOR, Dual tank, with check valves, CGA-346/347.....	1	30978	800130
-66	CONNECTOR, Dual tank, with check valves, DIN fittings.....	1	30978	800135
-67	STORAGE CASE, Custom, master control package.....	1	30978	890325
-68	21 x 17.5 x 9 in (53.3 x 44.5 x 22.9 cm)			
-68	VHS VIDEO, MAXIFORCE training, 30 minutes.....	1	30978	890000
-68	PAL VIDEO, MAXIFORCE training, 30 minutes.....	1	30978	890002
CONTROL PACKAGES				
	CONTROL PACKAGE, Master (consists of 1 each of index numbers: 4, 7, 9 [16 ft black], 9 [16 ft blue], 9 [16 ft yellow], 9 [16 ft red], 9 [16 ft green], 40, 41, 48, 67; 2 each of index numbers: 27, 28, 29, 44; 4 each of index number: 24)	1	30978	890300
	CONTROL PACKAGE (consists of 1 each of index numbers: 3, 7, 9 [16 ft yellow], 9 [16 ft red])	1	30978	890350
	CONTROL PACKAGE (consists of 1 each of index numbers: 4, 7, 9 [16 ft yellow], 9 [16 ft red])	1	30978	890351

Table 4-2. MAXIFORCE Air Lifting Bag System Components Parts List (Continued)

Figure and Index Number	Description	Quantity	CAGE	Part Number
CONTROL PACKAGES (Continued)				
	CONTROL PACKAGE (consists of 1 each of index numbers: 3, 6, 9 [16 ft yellow], 9 [16 ft red])	1	30978	890355
	CONTROL PACKAGE (consists of 1 each of index numbers: 4, 6, 9 [16 ft yellow], 9 [16 ft red])	1	30978	890356
PNEUMATIC COMPONENTS AND ADAPTER KIT				
	PNEUMATIC COMPONENTS AND ADAPTER KIT (consists of 1 each of index numbers: 27, 28, 29, 30, 31,32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 63)	1	30978	890729
	PNEUMATIC COMPONENTS AND ADAPTER KIT (consists of 1 each of index numbers: 27, 32, 39, 40, 41, 42, 44, 45, 46, 48, 63)	1	30978	890733
LIFT BAG SET AND CONTROL PACKAGE				
	LIFT BAG SET AND CONTROL PACKAGE (consists of 1 each of lift bag set 889234 and 890350 control package)	1	30978	889122
	LIFT BAG SET AND CONTROL PACKAGE (consists of 1 each of lift bag set 889117 and 890350 control package)	1	30978	889112

4-5. **EXPLODED ASSEMBLIES.**

The following figures illustrate the various components of the four safety relief and control valves and the two pressure regulators used with the MAXIFORCE Air Lifting Bag System. They are accompanied by their parts lists for easy identification of individual components.

Any repairs of the safety relief and control valves or the pressure regulators should be performed according to the specifications documented in their own Operation and Maintenance Manuals obtained from Paratech Incorporated, 1025 Lambrecht Road, Frankfort, Illinois, 60423-7000 U.S.A.

Item Number	Description	Quantity	CAGE	Part Number
FIGURE 4-1. SINGLE SAFETY RELIEF AND CONTROL VALVE; PART NO. 890506				
1	Relief Valve	1	30978	890950
2	1/2" St. Elbow	1	30978	890656
3	Pressure Gauge Cover	1	30978	890697
4	Pressure Gauge	1	30978	890604
5	Coupling; 1/2" Male	1	30978	890710
6	1/2" Tee	1	30978	890657
7	Double 1/2" Male Valve	1	30978	890450
8	Knob Assembly w/ Retaining Ring	1	30978	890486 & 890487
9	Coupling; 1/2" Female	1	30978	890720
FIGURE 4-2. DUAL SAFETY RELIEF AND CONTROL VALVE; PART NO. 890507				
1	Relief Valve	1	30978	890950
2	Coupling; 1/2" Male	3	30978	890710
3	1/2" St. Elbow	4	30978	890656
4	1/2" X 1/2" X 1/2" Tee, Gauge	2	30978	890657
5	1/2" X 1/2" X 1/2" Tee	1	30978	890655
6	Pressure Gauge	2	30978	890604
7	Pressure Gauge Cover	2	30978	890697
8	Knob Assembly w/ Retaining Ring	2	30978	890486 & 890487
9	Double 1/2: Male Valve	2	30978	890450

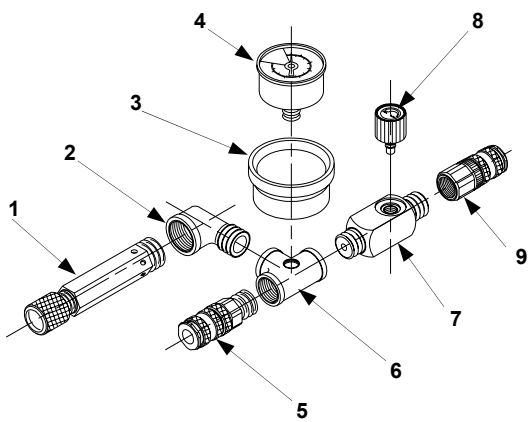


Figure 4-1. Single Safety Relief and Control Valve

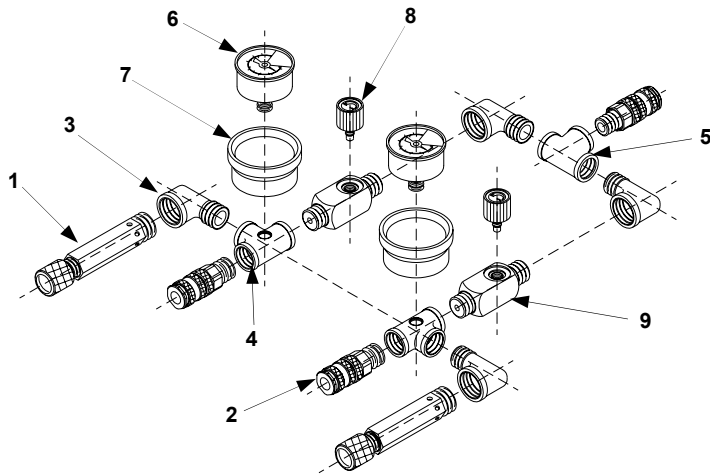


Figure 4-2. Dual Safety Relief and Control Valve

Item Number	Description	Quantity	CAGE	Part Number
FIGURE 4-3. SINGLE PUSH-BUTTON SAFETY RELIEF AND CONTROL VALVE WITH BYPASS; PART NO. 889500 (889510 with 2 Couplings)				
1	Screw; 6-32 Flat Head, S.S.....	2	30978	890930
2	Push Button.....	2	30978	890910
3	Spring.....	2	30978	890925
4	Stem Body; Long.....	1	30978	890918
5	“O” Ring; AS-011, 5/16” X .070”.....	2	30978	550170
6	Label.....	1	30978	890472L
7	Valve Knob Assembly.....	1	30978	890477
8	Bonnet.....	1	30978	890473
9	“O” Ring; AS-013, 7/16” X .070”.....	1	30978	550174
10	Stem Body; Short.....	1	30978	890917
11	Controller Body.....	1	30978	796106
12	Nipple; 1/4” NPS Male (on 889500 only).....	1	30978	890681
12a	Coupling: 1/4” Male (on 889510 only).....	1	30978	890721
12b	“O” Ring; AS-112, 1/2” X .103” (on 889510 only).....	1	30978	891153
13	Tetraseal; .310” X .066” X .13 4” Lg.....	2	30978	890940
14	Stem Valve.....	2	30978	890919
15	“O” Ring; AS-016, 5/8” X .070”.....	1	30978	890946
16	Plug.....	1	30978	890945
17	Coupling: 1/4” Male.....	1	30978	890721
18	“O” Ring; AS-112, 1/2” X .103”.....	1	30978	891153
19	Lock Nut; 6-32 with Nylon Insert.....	1	30978	550084
20	Relief Spring.....	1	30978	891216
21	“O” Ring; AS-015, 9/16” X .070”.....	1	30978	895252
22	Relief Stem Housing.....	1	30978	890484
23	Tetraseal; 1/4” X 1/16” Sq.....	1	30978	891207
24	Relief Stem.....	1	30978	890476
25	Pressure Gauge Cover.....	1	30978	890697
26	Pressure Gauge.....	1	30978	890604
27	Washer Plain #6.....	1	30978	890475

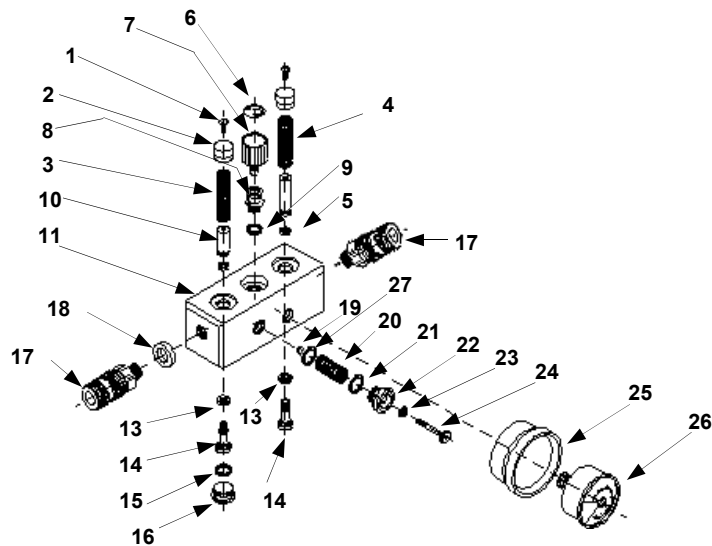


Figure 4-3. Single Pushbutton Safety Relief and Control Valve

Item Number	Description	Quantity	CAGE	Part Number
FIGURE 4-4. DUAL "DEADMAN" SAFETY RELIEF AND CONTROL VALVE; PART NO. 890900				
1	Controller Body.....	1	30978	890905A
2	Coupling; 1/4" Male.....	3	30978	890721
3	"O" Ring; AS-112, 1/2" X .103".....	3	30978	891153
4	Label; MAXIFORCE (not Shown).....	1	30978	890933
5	Eye Bolt.....	2	30978	890932
6	Split Ring.....	2	30978	020199
7	Pressure Gauge.....	2	30978	890604
8	Pressure Gauge Cover.....	2	30978	890697
9	"O" Ring; AS-011, 5/16" X .070".....	4	30978	550170
10	Stem Body; Short.....	1	30978	890917
11	Stem Body; Long.....	1	30978	890918
12	Spring.....	4	30978	890925
13	Push Button.....	4	30978	890910
14	Screw; 6-32, Flat Head, S.S.....	4	30978	890930
15	Tetraseal; .310" X .66" X .134" Lg.....	4	30978	890940
16	Stem Valve.....	4	30978	890919
17	"O" Ring; AS-016, 5/8" X .070".....	2	30978	890946
18	Plug.....	2	30978	890945
19	Relief Stem.....	2	30978	890920
20	Relief Spring.....	2	30978	890926
21	Relief Adjusting Screw.....	2	30978	890921
22	Labels; "UP" and "DOWN", Set (not shown).....	2	30978	890934
23	Carrying Strap (not shown).....	1	30978	890920
24	Protector for Coupling (not shown).....	3	30978	890726
25	"O" Ring 5/16 X 0.070.....	2	30978	890489

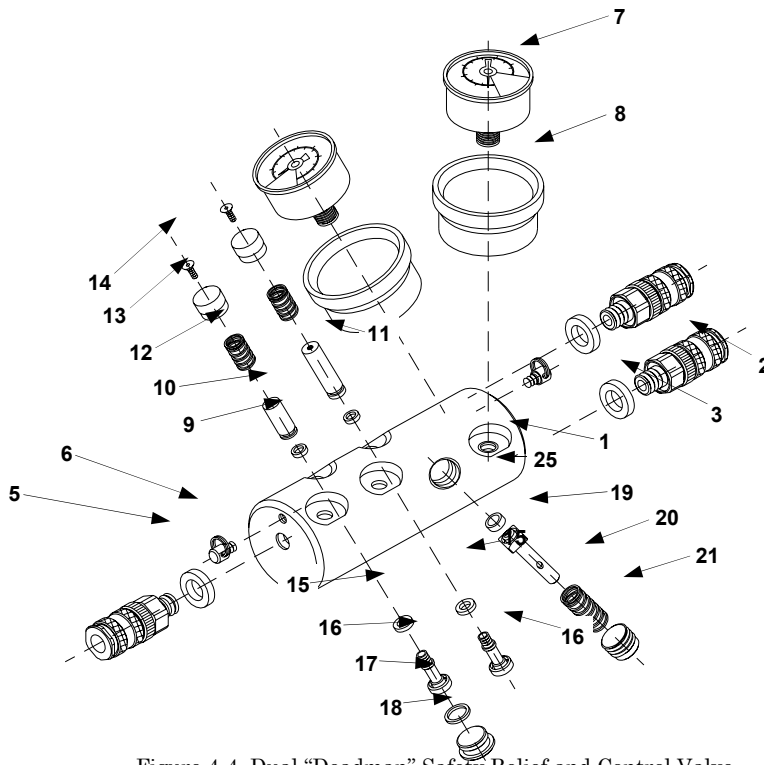


Figure 4-4. Dual "Deadman" Safety Relief and Control Valve

Item Number	Description	Quantity	CAGE	Part Number
FIGURE 4-5. DIAPHRAGM PRESSURE REGULATOR 3,000 - 135 PSI (206.8 - 9.3 BAR); PART NO. 890500				
1	Nipple; 1/4" NPTF, Outlet	1	30978	890682
2	Outlet Valve; 1/4"	1	30978	890639
3	Outlet Pressure Gauge	1	30978	890617
4	Inlet Pressure Gauge	1	30978	890612
5	Retaining Ring; 1000-50	1	30978	015778
6	Hand Tightening Knob	1	30978	895356
7	Nipple	1	30978	895351
8	Replacement Tip 614 KPT	1	30978	050075
9	Bonnet Bushing	1	30978	890637
10	Bonnet Bushing Retainer	1	30978	890638

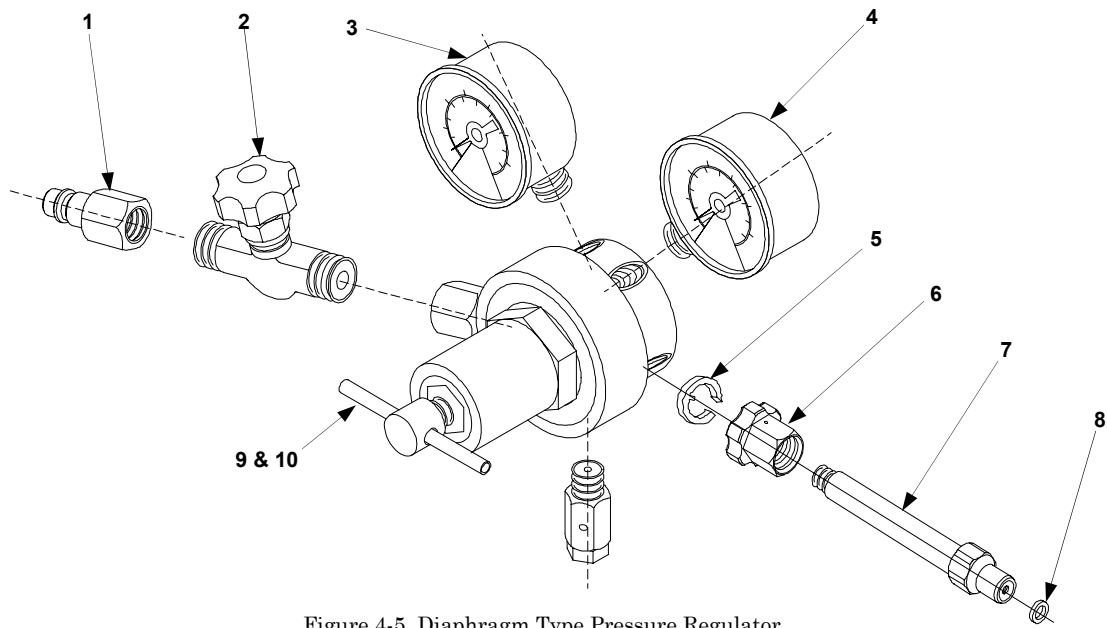


Figure 4-5. Diaphragm Type Pressure Regulator

Item Number	Description	Quantity	CAGE	Part Number
FIGURE 4-6. PISTON PRESSURE REGULATOR 6000 - 135 PSI (414 - 9.3 BAR); PART NO. 895401				
1	Cover, Gauge*	2	30978	890697
2	Gauge, Pressure, 0-400 psi *	1	30978	890617
3	Gauge, Pressure, 0-6000 psi *	1	30978	890612
4	Setscrew *	1	30978	895291
5	Knob Label.....	1	30978	895311
6	Knob, Adjusting *	1	30978	895345
7	Screw, Pressure Adjusting.....	1	30978	895326
8	Cap, Rear.....	1	30978	895344
9	Pin, Disc Guide	1	30978	895322
10	Spring, Disc.....	17	30978	895272
11	Piston	1	30978	895417
12	Seal, O-Ring AS-121.....	1	30978	895247
13	Seal, O-Ring AS-010 *.....	1	30978	895513
14	Seat, Vent *	1	30978	895418
15	Cartridge Assembly.....	1	30978	895408
16	Seal, O-Ring AS-015.....	1	30978	890252
17	End Cap.....	1	30978	895416
18	Spring.....	1	30978	895222
19	Filter.....	1	30978	895415
20	Needle Valve.....	1	30978	895411
21	Spacer.....	1	30978	895414
22	Seat, Main	1	30978	895412
23	Seal, O-Ring 90 DURO.....	1	30978	895513
24	Housing.....	1	30978	895413
25	Ring, Retaining	1	30978	890487
26	Valve, Shut-Off.....	1	30978	890333
27	Seal, O-Ring 7/16 x .070	2	30978	550174
28	Seal, O-Ring 90 POLYUR	3	30978	890489
29	Pin, Spring, Valve Stop.....	1	30978	890935
30	Label, Round p/n	1	30978	895401L
31	Setscrew.....	1	30978	550091
32	Screw, Adjusting.....	1	30978	890921
33	Stem	1	30978	890920
34	Spring, Stem.....	1	30978	890927
36	Nipple (22-895401).....	1	30978	890681
38	Retaining Ring	1	30978	015779
39	Seal, O-Ring CAST URETH.....	1	30978	550195
40	Nipple.....	1	30978	885351
41	Knob, Hand Tightening.....	1	30978	895356
42	Housing, Main.....	1	30978	895407
	* Not Shown			

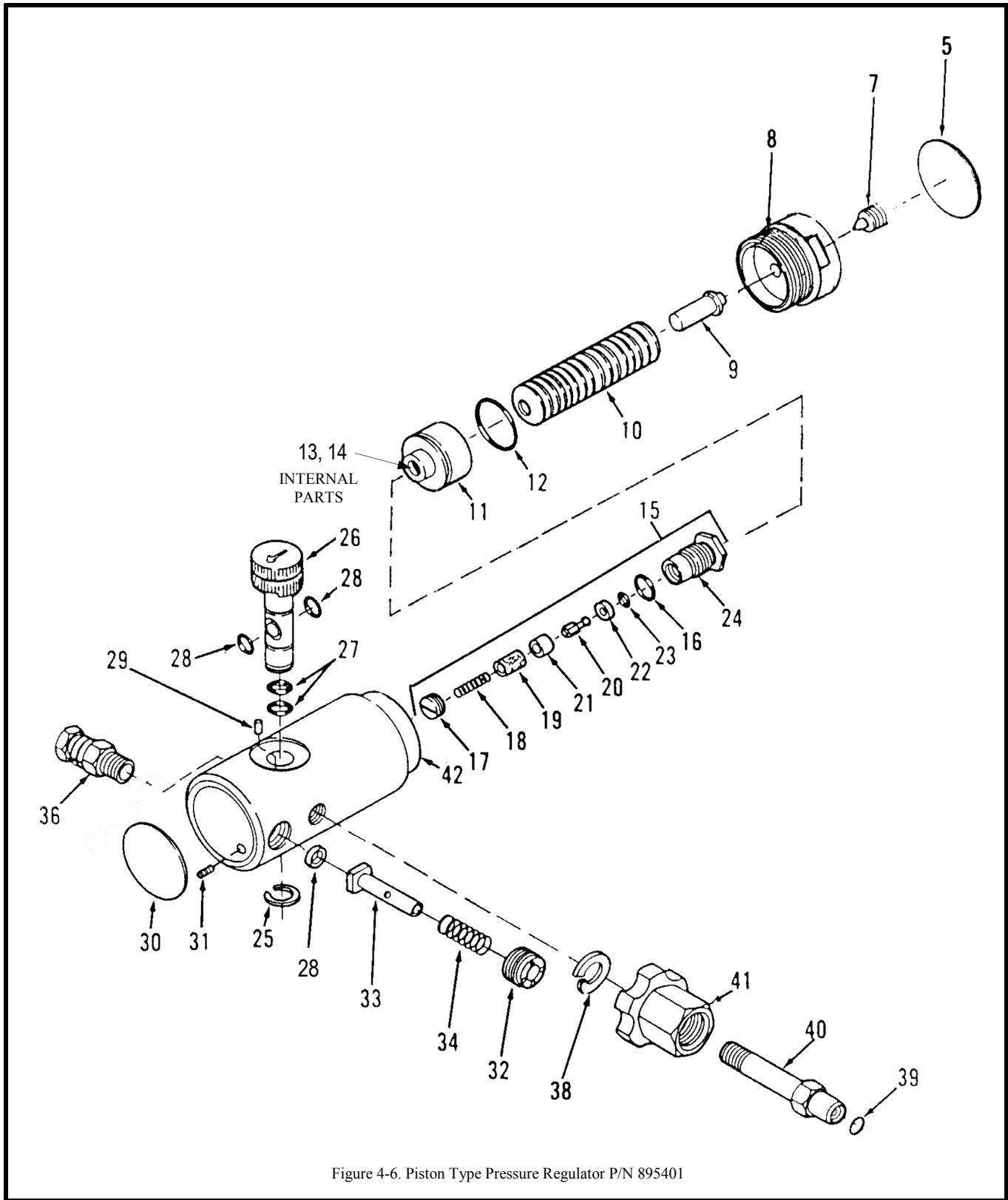


Figure 4-6. Piston Type Pressure Regulator P/N 895401

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Each **MAXIFORCE** lift bag or component thereof, manufactured by Paratech Incorporated, has been thoroughly inspected and properly adjusted before shipment to insure the highest quality and the greatest possible reliability.

Paratech Incorporated (hereinafter referred to as "Seller") hereby warrants the **MAXIFORCE** lift bag or component thereof to the original retail buyer only against defects in material and workmanship under normal use and service for a period of 3 years from the date of purchase. This warranty shall constitute the sole warranty of the Seller with respect to the **MAXIFORCE** lift bag or component thereof. **THE SELLER HEREBY DISCLAIMS AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** The Seller neither assumes nor authorizes any other person to assume for it any other obligations or liabilities in connection with the sale or use of this product.

Should there be any defects in the material or workmanship of the **MAXIFORCE** lift bag, buyer should return the defective product to the factory for inspection with shipping prepaid within 3 years from the date of purchase. If inspection shows that the **MAXIFORCE** lift bag or a component thereof is defective and that such defects were not caused by negligence, misuse, accident or unauthorized service, the product sold hereunder will be repaired or replaced at the option of the Seller, without charge, FOB at the factory, Frankfort, Illinois.

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