MAXI-FORCE AIR BAGS

1. INTRODUCTION

1.1 The Maxiforce air bag system is a valuable tool in rescue and extrication operations. When inflated with air, they are designed to lift and move heavy loads. They are relatively simple to assemble and operate, requiring only an inch of space for insertion.

1.2 The Maxiforce air bags can be used in a variety of ways. They are excellent for moving and lifting cylindrical and odd shaped objects. They can be used to lift collapsed floors, beams, and fallen trees and poles. With vehicles, they can be used in lifting the steering columns, doors, a door post, pedals, the dashboard, or for removing or prying open a windshield or a rear window. They can be used on elevator doors, subway trains and iron bars. The air bags work well with other extrication tools such as the Hurst tool, power saw, cutting torch or air chisel.

1.3 The Maxiforce air bags work on a simple proven law of physics. For each pound per square inch (psi) of air pumped into an air bag, the force is multiplied over the bag's entire surface, creating lifting force.

2. COMPONENTS

2.1 BAGS (See Fig. 1.)

2.1.1 There are 7 bags in the system, ranging from a 12-ton bag (the smallest) to a 74-ton bag (the largest). Lifting height runs from 8" (the smallest) to 20 inches (the largest). The bag's rated tonnage is based on its capacity to lift that tonnage one (1) inch. For example: 12 ton bag will lift 12 tons 1"; 74 ton bag will lift 74 tons 1".

Figure 1
2.1.2 The air bags are constructed of neoprene rubber reinforced with steel. They are similar to a steel belted radial tire.

2.1.3 The surface design is of a non-slip type and provides abrasion protection.

2.1.4 A light reflective label on one side of the bag shows its maximum tonnage and lifting height. Units should paint the lift capacity and lift height on the bags in addition to the label. After a period of time the label wears off. (See Fig. 2)

**Figure 2**

![Figure 2](image)

2.1.5 The bright yellow "X" is used for positioning the center of the bag under a load for maximum stability and lifting height.

2.2 PRESSURE REGULATOR (see Fig. 3)

2.2.1 The pressure regulator must be used whenever a high pressure air source is used.

2.2.2 The parts of the regulator are:

A. High Pressure Air Inlet.
B. High Pressure Gauge.
C. Pressure Gauge.
D. Pressure Regulator Knob.
E. Knurled Knob-Controlling Air Supply Connection.
F. Air Supply Nipple Connection.
2.3 DUAL COMBINATION CONTROL VALVE & SAFETY RELIEF (CVSR) (See Fig.4.)

2.3.1 The parts of the CVSR are:

A. Air Inlet.
B. Control Valve Lever.
C. Operating Gauge.
D. Safety Relief Assemblies.
E. Safety Relief Control Knobs.

Figure 4

A. Air Inlet
B. Control Valve Lever
C. Operating Gauge
D. Safety Relief Assembly
E. Safety Relief Control Knobs

Air Outlets
2.4 AIR SUPPLY HOSES

2.4.1 Two (2) Red Air Supply Hoses 16 feet in length.
2.4.2 One (1) Yellow Air Supply Hose 16 feet in length.
2.4.3 Additional lengths of hose can be used to allow safe remote operation of the air bags. All bags, air supply hoses, and regulators are equipped with heavy duty quick connectors of a special size to prevent improper connection. (See Fig. 5.)

Figure 5

2.5 SCBA CYLINDERS

2.5.1 Steel SCBA cylinders are used to operate the air bags.

**Note:** Figures 6-10 depict the Pressure Regulator attached to an aluminum SCBA cylinder. In actual practice, only the steel SCBA cylinder may be used.
3. **ASSEMBLY**

3.1 **TO SET THE PRESSURE REGULATOR**

3.1.1 Close regulator air supply by turning the small knurled black knob clockwise. (See Fig. 6)

![Figure 6](image1)

3.1.2 Connect regulator to a high pressure air source. (See Fig. 7)

![Figure 7](image2)
3.1.3 Open air source slowly and watch the gauge. The high pressure gauge should reflect the air source pressure. (See Fig. 8)

![Figure 8](image)

3.1.4 Set the low pressure gauge to 135 psi by turning the pressure regulator knob clockwise. (See Fig. 9)

![Figure 9](image)

NOTE: When the high pressure gauge falls below 200 psi, change the air cylinder.

NOTE: Always open the high pressure air source slowly. Failure to do so may damage the regulator diaphragm. Make sure all valves are in the closed position before you turn on your air source. This will reduce the risk of any uncontrolled lift.
3.2 DUAL COMBINATION CONTROL VALVE AND SAFETY RELIEF (CVSR)

3.2.1 The control valves are quarter turn ball valves which work independently.

3.2.2 Check both control levers to make sure they are in the closed position (perpendicular to air supply line.) Connect one of the red air supply hoses to the pressure regulator and to the control valve and safety relief inlet. The other red air supply hose is connected to one of the air outlets. (See Fig. 10)

![Figure 10](image)

3.2.3 Return to the regulator and fully open the knurled knob air outlet valve, counterclockwise. This will bring the air up to the control valve safety relief.
3.2.4 Select a bag size capable of lifting the load and connect an air supply hose to the inlet nipple protruding from the corner of the bag. (See Fig. 11.)

![Figure 11]

3.2.5 Connect the air supply hose to the outlet connection on the dual CVSR. Both safety relief valves must be closed. (See Fig. 12)

3.2.6 Be sure to engage the dual locking mechanism located on the female connections and CVSR. Simply insert the male into the female and then rotate the serrated knob at the base of the female connection (clockwise) until it is snug. Give both hoses a "tug", to make sure they are securely joined.

3.2.7 Place the bag under the load with the air inlet nipple pointing out. Place the bag as close to the load as possible to maximize the contact area between the bag and the load.

**Note:** Always have the bag connected prior to placing it under or between a load to minimize the operator's exposure to the load area and to eliminate the possibility of the operator placing the bag with the air inlet under the load.
4. INFLATION AND DEFLATION OF THE BAGS

4.1 Open the control valve lever by slowly moving it parallel to the air line. The bag will gradually inflate. The speed of inflation is controlled by this lever.

NOTE: Inflate the bags slowly to minimize the chance of the load shifting.

4.2 As the bag is being inflated, note the gauge reading on the control valve safety relief. The gauges read the internal air pressure of the connected bag. Maximum internal air pressure for the bag when used for lifting purposes is 118 psi. The safety relief valve will prevent over-inflation. Air pressure in excess of the 118 psi limit will be expelled from the opening at the base of the control valve safety relief. Normally, inflation should be just enough to lift the load as far as needed.

4.3 When the gauge reading reaches the vicinity of the red mark, the safety relief will open (at 118 psi) and start venting. At this time, close the control lever to conserve the air supply. If the desired lift is reached before the bags reaches maximum pressure, simply close the control lever.

NOTE: Stabilize and shore a load before placing bags into position. Build shoring in stages as load is being lifted. Always exercise care to avoid injury in the event of a drop or load shift.
4.4 To deflate the bag with the control valve safety relief, close the control levers. Then, slowly turn the knurled knob on the top of the safety relief counter-clockwise. The lowering speed must be adjusted by the operator. (See Fig. 13.)

**Figure 13**

NOTE: The bags are designed to inflate and deflate slowly to prevent the load from being thrown off-center.

4.5 Two separate shut-off control devices are provided to be used where it may be necessary to inflate several bags. (See Fig. 14.) The shut-off device is placed on the nipple of the lifting bag. As soon as the bag is inflated to the required height, the knurled knob can be turned clockwise closing off the flow of air to the bag. That bag will now remain inflated. The air hose can be disconnected and attached to another bag.
5. **CHANGING AIR CYLINDERS**

5.1 Air cylinders can be changed during operation or when pressure falls below 200 psi.

5.2 To change cylinder:

5.2.1 Stop operation.

5.2.2 Block or shore the lift.

5.2.3 Make sure all air inlet and outlet valves on cylinder, pressure regulator, and control valve and safety relief are in the fully closed position. This will isolate the bag from the air supply and will prevent bags from deflating.

5.2.4 Disconnect the air outlet hose from the pressure regulator.

5.2.5 Bleed the regulator using the knurled knob.

5.2.6 Disconnect the regulator from the air cylinder.

5.2.7 Connect the pressure regulator to a new cylinder.

5.2.8 Re-connect the air outlet hose to the pressure regulator.

5.2.9 Resume operations.
6. OPERATIONAL GUIDELINES

6.1 Personnel should wear protective clothing.

6.2 Only trained members should be allowed to operate the system.

6.3 Before raising an object, determine the desired height or load movement and obtain blocks or shoring before the bags are inflated.

6.4 When using an air bag, inflate at a slow rate and maximize the surface contact area of the bag. This may require either blocking up the bag before inflating or using two bags, one on top of the other. If necessary to block up a bag, 3/4" plywood, 3 layers thick, glued and nailed or screwed together is recommended. Plywood will not split or crack under loads as it has elasticity.

6.5 The bags should only be inflated half to three quarters of their rated height capacity. The "pillowing effect" should be avoided. This can cause the load to shift with possible dangerous results.

6.6 During inflation, stand to one side and clear all personnel from the vicinity. Do not stand in front of the opening where the bag has been placed, there is a possibility of the bag being pushed out by the load shifting.

6.7 Never work under a load unless it is blocked or shored. As the load is being moved or lifted, always block or shore the load. Remember that although a bag does not need a smooth surface, blocks and shoring do.

6.8 Avoid inflating bags against sharp objects or on a surface heated to over 220 F. If necessary, insert a flexible insulated pad (heavy canvas, leather, rubber) or 3/4" plywood between the hot or sharp surface and the bag, in order to protect the bag.

6.9 Two bags may be used safely from one control valve safety relief device.

6.9.1 This allows for a greater lift height.

6.9.2 It allows lifting the same load at two separate points to maximize surface contact.

6.9.3 Never stack more than two bags on top of each other and always place the smaller bag on top of the larger one.

6.9.4 When stacking bags, generally inflate the bottom bag first.

6.9.5 Remember that when stacking you cannot add together the tonnage of the two bags to get the total lifting weight. The tonnage of the smaller bag is the maximum that can be lifted.
6.9.6 The lifting capability is reduced by 50% to obtain maximum lifting height. Example: a 30 ton bag with a maximum lifting height of 10 inches will lift 30 tons 1 inch, but will lift 15 tons to a height of 10 inches.

6.9.7 Do not operate bags, hoses, valves or regulators that are damaged or improperly assembled.

6.9.8 It is recommended that the bags be stored in a horizontal position to reduce stress.

6.9.9 It is important to center the bags on top of each other when stacking them. (See Fig. 15) Blocking or shoring should be centered as much as possible. Do not place wood between the bags.

![Figure 15](image)

6.9.10 To insure proper inflation of the correct bag (when two bags are stacked) always refer to the bag by the color of the supply hose; e.g. when you want the bottom bag inflated, say "raise the yellow bag" when the yellow supply hose is connected to the bottom bag. This is extremely important when the operator of the control valve and safety relief cannot see the bags or cannot distinguish which line is connected to what bag.

6.9.11 Have one firefighter on the far side of the lift to observe any shift or reaction. The firefighter should be equipped with a handi-talkie.
7. **LEAK SEALING FIELD KIT**

7.1 In addition to being used to lift heavy loads, air bags can also be used to seal leaks in tank trucks or containers used to store chemical or fuels.

7.2 The leak sealing field kit consist of: (See Fig. 16.)

7.2.1 Four (4) brass clamps, non-sparking.

7.2.2 Two (2) nylon ratchet belts, 30 feet long.

7.2.3 Two (2) nylon extension belts, 20 feet long.

7.2.4 One (1) air hose, orange in color, with a built-in 22 psi safety relief valve. This air hose should only be used for leak sealing. The 22 psi safety relief valve is designed to limit the internal air pressure in the bag to 22 psi. This will reduce the possibility of tank or cylinder rupturing because of too much external pressure.

7.2.5 One (1) sheet of Neoprene (used for added bag protection), size 20"x20".

![Figure 16](image)

NOTE: This kit is not recommended for use with air bags of any other manufacturer.

7.3 **TO ASSEMBLE**

7.3.1 Attach the four clamps tightly to the corners of the chosen bag. Do not be concerned if the teeth of the clamps appear to be "biting" into the bag. This is necessary for proper holding and prevents the clamps from being pulled off when the bags are inflated. (See Fig. 17)
7.3.2 Attach the ratchet belts, and, if necessary the extension belts. Take up the slack. Place the air bag against the leak, using the rubber gasket, and tighten belts until snug. Connect the orange hose to the control valve and safety relief and to the air bag.

7.3.3 Slowly inflate the bag. Stop as soon as the leak is stopped, or when the 22 psi in-line safety relief valve opens and begins venting. Do not attempt to override this device or to inflate the air bags past 22 psi when using for leak-sealing purposes. Too much pressure can cause a rupture or collapse of weakened shell structure. (See Fig. 18)
7.3.4 On many damaged cylinders or tanks the air bags will not conform to the indentation or shape of the damaged area. In these cases, use something soft (such as a rolled blanket) to shove or wedge into the indentation, then put the air bag over that area and inflate. As in many cases of temporary, emergency leak-sealing, it may not be able to completely stop the leak, but control it until a permanent solution is effected.

8. MAINTENANCE

8.1 LIFTING BAGS

8.1.1 Prior to each use, check the lifting bag, nipple, couplings, and controller components for signs of damage.

8.1.2 When necessary, wash bags with soap and water. Avoid getting water in the bags. If water does get in, allow the bags to thoroughly dry before the next use.

8.1.3 Never drag the lifting bag by the control hoses. This could cause nipple damage or failure. Inspect after each use.

8.2 HOSES

8.2.1 Keep couplings clean and dry.

8.2.2 Inspect for any cracks or nicks.

8.3 CONTROL VALVE AND SAFETY RELIEF

8.3.1 Keep couplings clean and dry.

8.3.2 Replace broken gauges when necessary.

8.4 PRESSURE REGULATOR

8.4.1 Keep clean and dry.

8.4.2 Do not lubricate.

8.4.3 Limit repairs to lens replacement only.

Note: The average life span of the Maxiforce air bags is 10 years. Life expectancy is based on air pollutants, not usage. Bags used in a heavily industrialized area will not last as long as bags in a rural area.