MASTER-LEE ENGINEERED PRODUCTS
AIRGRIPS™ MAINTENANCE MANUAL

OI-AG-001
(Operating Instruction for AirGrips™)

The Master-Lee Engineered *Products* AirGrips™ air operated grippers are available in two package arrangements, Deluxe AirGrips™ and Econo-AirGrips™, and two mast styles, Ball-Lock and J-Lock.

The Deluxe AirGrips™ package consists of the following:

3 - Large Air Cylinders
2 - Valves with Gauges and Regulators
2 - 1/4 inch air hoses 100 feet long each with fittings
4 - Male Air Fittings
1 - Three-Finger Gripper
1 - Small Plier Head
1 - Large Plier Head
1 - Wide Jaw Head
1 - C-Clamp Head
1 - Needle Nose Head
1 - Clamshell Head
8 - 10 foot Center Mast Sections
2 - 5 foot mast section with lifting bail
2 - 10 foot Bottom Mast sections [Ball-Lock]
2 - 6” Bottom Mast Adapters [J-Lock]

The Econo-AirGrips™ package consists of the following:

2 - Large Air Cylinders
1 - Valve with Gauge and Regulator
1 - 1/4 inch air hose 100 feet long
2 - Male Air Fittings
1 - Three-Finger Gripper
1 - Needle Nose Head
1 - Large Plier Head
4 - 10 foot Center Mast Sections
1 - 5 foot mast section with lifting bail
1 - 10 foot Bottom Mast Section [Ball-Lock]
1 - 6” Bottom Mast Adapter [J-Lock]

BASIC CONCEPT

The basic concept behind AirGrips™ is very simple: operation of a gripper head by actuation of a pneumatic cylinder. Air is supplied through the customer provided fitting to the regulator. The air then flows through the manual self-bleeding valve, through the air line which is routed to the bottom section of the handling mast, and finally through a quick disconnect into the back of the air cylinder. When air pressure is applied to the back of the cylinder the cylinder rod moves forward and pushes against the gripper anvil which actuates the jaws or fingers of the gripper head.

Several interchangeable gripper heads are provided (the quantity and variety depends on whether the Deluxe AirGrips™ or Econo-AirGrips™ were purchased). Each of the gripper heads can be used for a multitude of operations and will be discussed in detail later. Each gripper head is closed using air pressure and opened by releasing air pressure and allowing the internal spring to return the cylinder piston and the gripper head to the open position. The exception to this is the Three-Finger Gripper. This gripper is normally closed and opened when air pressure is applied to the cylinder.

The handling masts are assembled end to end in different fashions depending on which style is used. This will be explained in detail in the next section. Attaching the various cylinders and gripper heads to the masts is accomplished using quick disconnects and is also explained in detail in the next section.

ASSEMBLY

Prior to assembling the gripper package, determine the approximate length of handling mast required to reach to the area of operation.

One option is to lay out the handling masts beside the pool with the first mast section containing the cylinder quick disconnect adaptor. Connect the gripper, cylinder, and masts together then move the entire assembly to the work location.

NOTE: For safety reasons, do not attempt to lift an assembled mast longer than 20 feet from a horizontal position.

If the assembled masts are to be longer than 40 feet or an object weighing more than 20 pounds is to be lifted, the top lifting bail section should be used. The bail section attaches to the rest of the masts in the same manner the other mast sections are connected together. The crane hook or other lifting devices attach onto the bail end. All mast sections have a Working Load Limit (WLL) of 1000 pounds.

Most often the assembly process begins with the Bottom Mast Section or Bottom Mast Adapter. The cylinder, airline and gripper head are attached, then the assembly is raised to a vertical position. As the assembly is lowered into the water, more mast sections are added as necessary. Finally, the bail section is added last. The Air Cylinder should be tested in air before being lowered into the water.

For the Ball-Lock style masts, there are two alternatives to routing the airline. One method is to route the airline out through the slot near the top of the Bottom Mast section (p/n D1478). This makes it easier to assemble and disassemble the handling masts. However, this method does expose the airline to bumps and scrapes that may occur during normal operation. The other method is to route the airline through the center of the handling masts all of the way to the top of the assembled masts. This protects the airline from bumps and scrapes but hinders assembly and

disassembly of the mast sections. This method is not recommended. For the J-Lock style masts, the airline must exit through the slot in the Bottom Mast Adapter (p/n D0082). See Figure 1.

Figure 1 shows how the Male Air Fitting (p/n D0010H23) is attached to the airline. The airline must be fed through the Swagelok Fitting before the air fitting is attached. After the air fitting is attached, the tubing and air fitting are pulled back until the air fitting seats in the Swagelok Fitting. Be careful not to kink the airline during this process.

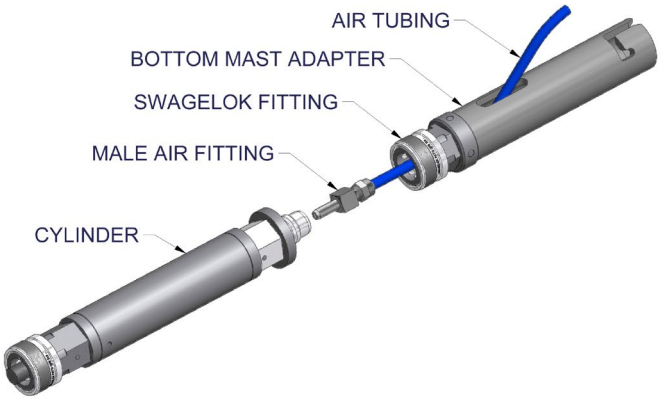

Figure 1 – J-Lock Bottom Mast Adapter Airline Attachment

Ball-Lock Mast Sections are connected together using slip joints and a locking pin. Slip the lower end of one section into the expanded, top end of the first mast section. Then align the holes in the mast sections and insert the ball lock pin. The button on the back of the pin allows the pin to be inserted and retracted. Ensure that the pin has been inserted all the way through the mast sections and that the small locking balls protrude all the way through the outer mast section preventing removal of the pin. See Figure 2.

Figure 2 – Ball-Lock Mast Section Joint

For the J-Lock masts, insert the male end of one mast into the female end of another mast. Align

the pins in the male end with the J-Slot. Guide the pins down the J-Slot, rotate the pole approximately ¼ turn, then pull the masts apart so the pin is fully seated in the J-Slot. When the pin is fully seated, rotate the first locking nut until it is snug against the top of the other mast. Then, rotate the second locking nut until it is snug against the first locking nut. See Figure 3.

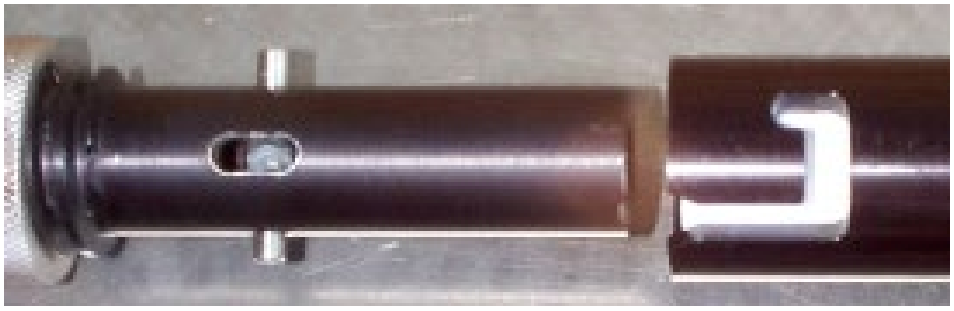

Figure 3 – J-Lock Mast Section Joint

The cylinder attaches to the Bottom Mast or Mast Adapter with the male Swagelok fitting on the back of the cylinder. Note that inside of this cylinder quick disconnect there is an airline quick disconnect. This is where the male fitting on the airline is inserted. To assemble the cylinder to the Bottom Mast or Mast Adapter, line up the key on the cylinder with the keyway on the female Swagelok Fitting on the mast or adapter. Pull back the ring on the Swagelok fitting and slip the cylinder into the fitting. The airline connection will be made automatically. Push the cylinder all the way into the fitting until it stops and the key and keyway are engaged. The ring on the Swagelok fitting is released it should fit flush with the back of the cylinder assembly and the retaining balls should not show. The cylinder should not be able to be pulled out of the fitting now.

Attach the gripper head to the front of the cylinder in the same manner the cylinder was attached to the mast.

Finally, attach free end of the airline to the fitting on the Valve/Regulator/Gauge Assembly (p/n D0010-G06SA). When using a double-acting cylinder/gripper, the airline routing may be different than described above. Also a double-acting Valve/Regulator/Gauge (p/n D0010-G06DA) must be used.

Because there are a wide variety of fittings used in plants the customer must provide the fitting from supply airline to the regulator of the AirGrip tooling. The fitting required for the regulator is 1/4" O.D. tube or 1/8 inch female pipe thread (NPT) if the tube fitting is removed.

OPERATION

The weight of the assembled gripper will vary with the length of the handling mast but will weigh about 25 lb with a mast length of 40 feet and the large cylinder and large gripper head attached. Prior to inserting the gripper assembly in the water, test the gripper several times to ensure smooth operation.

Minimum pressure required for the operation of the large gripper heads is 10 psi with the maximum being 120 psi. Set the regulator to the desired pressure and actuate the gripper by sliding the valve handle. This will supply air to the cylinder and cause the gripper head to close. Sliding the valve handle in the opposite direction will open the gripper head and a small amount

of air will escape from the valve. This air is clean plant air and does not present any airborne contamination problems.

Air will escape out of the weep hole in the cylinder during the first few underwater actuations of the grippers. This is due to the entrapped air in the front of the cylinder. **A small amount of water will get entrapped in the front of the cylinder during operation under water. Therefore, operate the cylinder several times immediately after removal from the water and prior to moving to a dry area.** The entrapped water will jet from the weep hole in the front of the cylinder. This water may be contaminated, so use caution to ensure that the water is sprayed back into the pool or contained in a bag.

To pick up an object underwater lower the AirGrip assembly, gripper head down, into the pool. Place the gripper head around the object to be grasped and slide the air valve handle to close the gripper on the object. To release the object, simply slide the air valve handle in the opposite direction to release the air pressure. The jaws will open on the gripper and the object will be released. The grip and release operation is the opposite for the Three-Finger Gripper. When air is supplied to the Three-Finger Gripper, the fingers are opened. When the air pressure is released, the internal spring in the gripper caused the finger to close.

CAUTION: IF AIR PRESSURE IS LOST THE GRIPPERS WILL OPEN. ENSURE THAT THE GRIPPER IS NOT BEING USED PRIOR TO DISCONNECTING THE AIR SUPPLY.

Different gripping forces can be attained with the AIRGRIP heads by regulating the amount of pressure with the air regulator. The following table shows the gripping force of the various grippers at 90 psi supply air pressure.

GRIPPER HEAD	GRIPPER FORCE @ 90 PSI
Large Plier	140 lb
Clamshell Plier	130 lb
Wide Jaw Plier	90 lb
C-Clamp Plier	90 lb
Needle-Nose Plier	30 lb
Small Plier	100 lb

The Three-Finger Gripper comes with its own cylinder therefore it can be attached directly to the handling mast without a separate air cylinder. The fingers on the gripper are opened with air pressure and will close when the air pressure is released. The gripping force on the Three-Finger Gripper is controlled by the internal spring and is approximately 20 lb. Therefore, if air pressure is lost the gripper will not release.

If a delicate or small object is to be retrieved, the gripping force of the Three-Finger Gripper can be adjusted using the regulator. First, open the gripper by actuating the valve. Position the gripper over the object to be grasped. Begin to turn the air regulator to reduce the pressure. The gripper will slowly close. The lower the air pressure, the harder the gripper holds the object.

MAINTENANCE

Inspect the air regulator for damage prior to every use. A damaged regulator can leak excessively and be a source of loose parts. Replace if necessary. Inspect the air valve for smooth operation or damage prior to every use. Lubricate it with WD-40 or LPS-l if it leaks or is hard to turn. Inspect the air line for kinks, holes, or breaks. Incomplete breaks in the airline can be detected by looking for a white ring around the area affected by the break. Holes and kinks

will also leave a white mark around the affected area. If a kink, break, or hole is detected the airline should be replaced.

After each use the cylinders should be lubricated using WD-40 or LPS-l or any other approved light lubricant. To lubricate the cylinders spray or drop the lubricant into the small weep hole on the wall of the cylinder and the air fitting at the rear of the cylinder. Operate the cylinder several strokes to distribute the lubricant. Pull on the cylinder rod by hand to ensure that no dragging occurs. Some resistance will be felt because of the internal spring, but the operation should be smooth.

NOTE: FAILURE TO LUBRICATE THE CYLINDERS PRIOR TO STORAGE WILL SEVERELY DEGRADE THEIR PERFORMANCE.

Before each use, inspect the mast sections for smooth assembly to each other. The ball lock style sections should be inspected for ball lock pin insertion. The pin should easily slide through both holes and lock on the outside tube only. The balls of the pin should protrude enough to prevent pin removal. Look for missing or worn balls. Inspect the holes for signs of elongation. This is an indication of overloading the masts and can prevent the pin from locking in place. If the ball lock pin can be removed without pressing the release button the following options are available: use a ¼" diameter bolt and lock nut; drill out the holes in both masts to accept the next larger size pin; drill a new ¼" diameter hole 90° from the existing hole. Remember, if a larger or new hole is drilled then the mast section may not fit any other mast section than the one with which it was drilled. If there is excessive damage to the mast, do not use it.

The J-Lock style mast sections should be inspected for smooth assembly to each other as well. Before each use, inspect the locking pin, the J-Slot, the locking threads and the locking nut. Make sure the locking nut spins smoothly with no obstructions. If there are any obstructions with the locking nut and threads or there is any indication of physical damage to the locking nut, locking threads, locking pin or the J-Slot, it is recommended that the mast or masts be replaced.

PRECAUTIONS

THE FORCE OF THE AIRGRIPS™ DURING OPERATION IS GREATER THAN 100 POUNDS AND CAN CRUSH FINGERS AND CAUSE SEVERE INJURY. BE CAREFUL NOT TO ACTUATE THE GRIPPERS WHILE A PERSON'S HANDS OR FINGERS ARE NEAR THE GRIPPER HEAD.

DISCONNECT THE AIRLINE FROM THE GRIPPER ASSEMBLY DURING MAINTENANCE TO PREVENT ACTUATION.

DO NOT USE AN AIRLINE THAT IS PUNCTURED, KINKED, CRUSHED, OR DAMAGED IN ANY WAY.

ENSURE THAT THE GRIPPER HEADS AND CYLINDERS ARE FIRMLY ATTACHED TO THE HANDLING MAST PRIOR PLACING IN SERVICE.

DO NOT PUT YOUR FACE NEXT TO THE AIR VALVE DURING OPERATION. AIR RUSHES FROM THE VALVE AT HIGH VELOCITY WHEN THE AIR PRESSURE IS RELEASED.

ENSURE THAT THE BALL LOCK PINS THAT HOLD THE MAST SECTIONS TOGETHER ARE FULLY ENGAGED AND CANNOT BE PULLED OUT WITHOUT FIRST PRESSING THE RELEASE BUTTON.

ENSURE THAT THE J-LOCK PINS ARE FULLY ENGAGED IN THE J-SLOT WITH THE LOCKING NUT FULLY SEATED.

WHEN ASSEMBLING THE CYLINDERS AND GRIPPER HEADS ENSURE THAT THE QUICK CONNECT FEATURE IS FULLY ENGAGED AND THAT THE CYLINDER AND GRIPPER HEAD CANNOT BE REMOVED WITHOUT PULLING ON THE RETAINING RING.

WATER WILL BE ENTRAPPED IN THE FRONT OF THE CYLINDER AFTER UNDERWATER USE. THEREFORE, OPERATE THE CYLINDER SEVERAL TIMES OVER THE POOL, OUT OF THE WATER, TO REMOVE THE ENTRAPPED WATER.

THE ENTRAPPED WATER FROM THE CYLINDER MAY BE CONTAMINATED. THEREFORE, DIRECT THE SPRAY AWAY FROM PERSONNEL AND EQUIPMENT.

ARTICULATING WRIST

Several articulating wrists are available for use with the AirGrip tools. The optional articulating wrists attaches to the mast and cylinders using the same mechanical quick disconnect that used with the AirGrip grippers and cylinders. The wrist fits between the end of the bottom mast and the back of the air cylinder.

The Cable AirGrips™ Wrist can be remotely actuated using the cable that is attached to the wrist. To change the position of the wrist pull on the actuating cable to retract the spring-loaded locking pin from the locating slots in the wrist. The operator can now bump the gripper into a new position and release the actuating cable to lock the wrist into the new position.

The Manual AirGrips™ Wrist must be set and locked in position before placing into service. To change the position of the Manual Wrist, turn the locking collar counter-clockwise to retract the locking pin from the locating slots. Move the wrist to the desired position. Turn the locking collar clockwise to insert the locking pin into the locating slots. Make sure the locking collar is snug tight before putting into service.

The Cable Wrist and Manual Wrist have several locking positions between 0° (straight) and 90°(right angle to the mast).

The Air Articulating Wrist can swing from 0° to 90° by actuating the included double-acting air cylinder. This wrist requires its own air lines (twin line) and double-acting valve.

Each of the wrist assemblies are attached to the Swagelok fitting of the bottom mast section. The airline is then routed through the wrist in the same manner it was routed through the bottom mast section. See Figure 4.

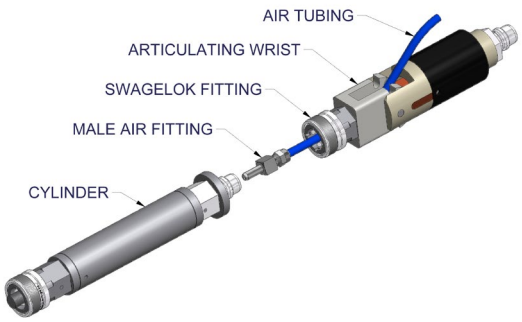

Figure 4 – AirGrip Wrist Attachment

CAUTION: DO NOT ATTEMPT TO LIFT MORE THAN 10 POUNDS WITH THE GRIPPER WITH THE WRIST IN ANY POSITION OTHER THAN STRAIGHT.

WRIST MAINTENANCE

Inspect the wrist for excessive wear on the locking pin and the locating slots prior to each use. No lubrication is required or recommended. Inspect the actuating cable for fraying and breaks. Replace if necessary. Inspect the attachment point of the cable to the locking pin for screw security prior to each use. Secure the cable attachment screw using LOCTITE 242 (blue Loctite) or an equivalent thread-locking compound. Also inspect the locating pin for free movement and spring return. Ensure the locking collar of the Manual Wrist spins freely. Inspect the cylinder of the Air Articulating Wrist for signs of damage.