



ADVANCED CIRCULATORY SYSTEMS, INC.

# Instructions For Use

# ResQ Pump<sup>®</sup>

**CAUTION – INVESTIGATIONAL DEVICE**  
Limited by Federal (US) Law to  
Investigational Use Only

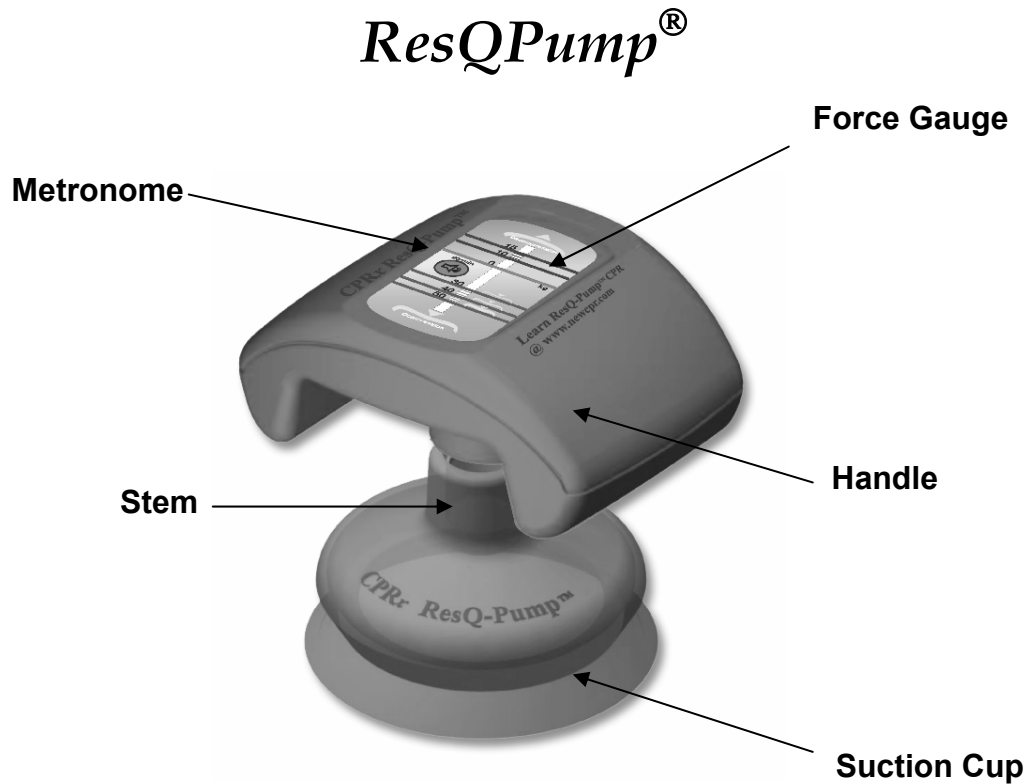
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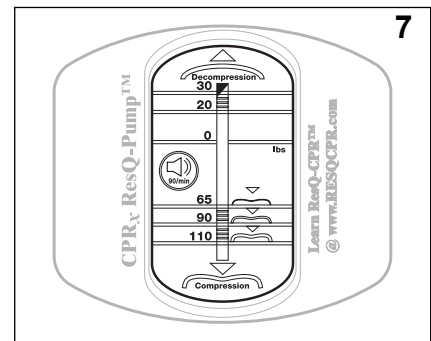
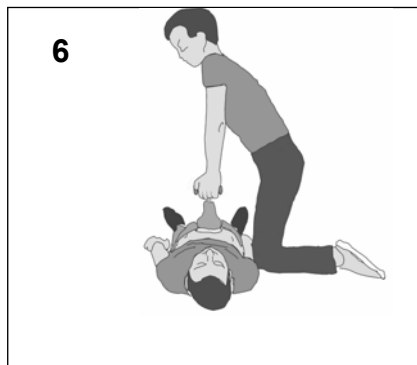
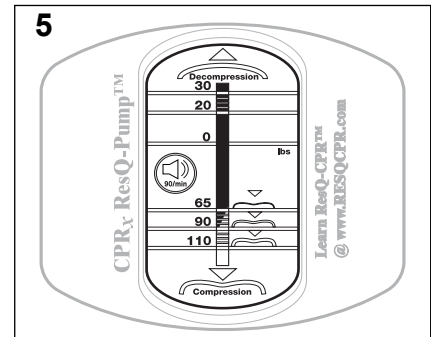
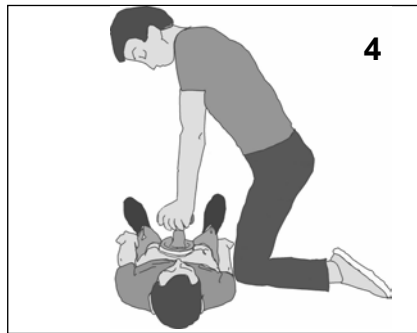
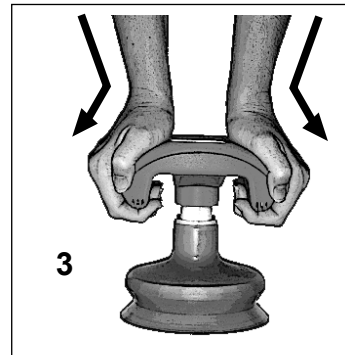
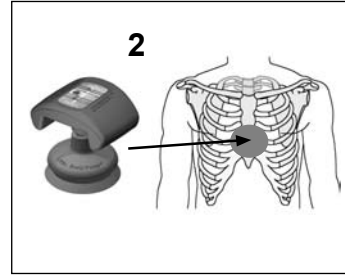
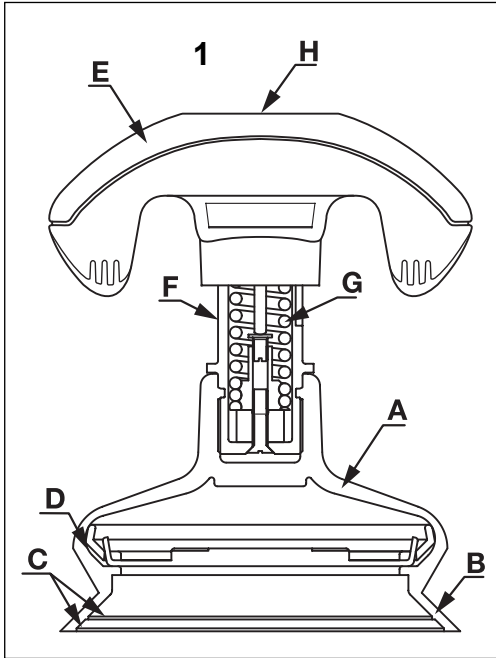
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# Device Figures



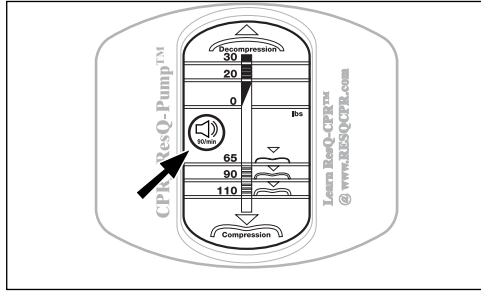


Figure 8

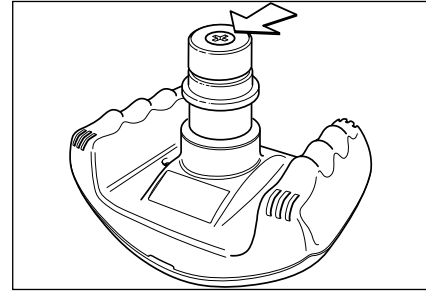


Figure 9

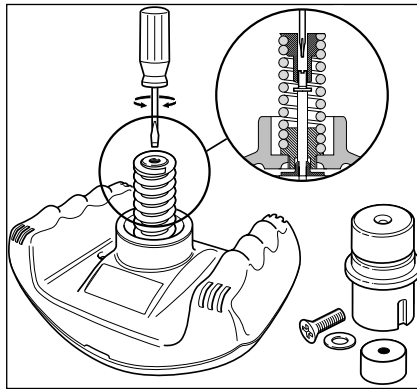


Figure 10

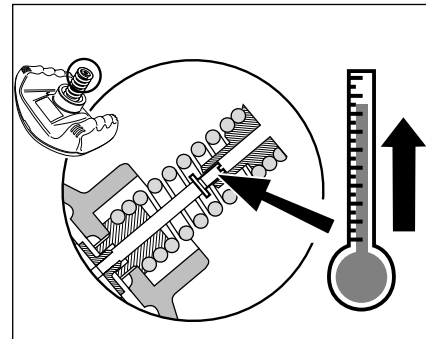


Figure 11

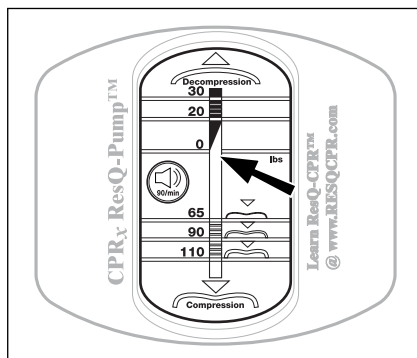


Figure 12

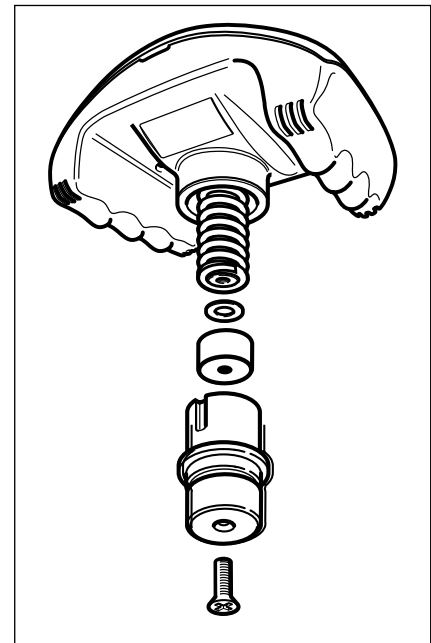


Figure 13

## Indications

The ResQPump is intended to assist rescuers in performing active compression decompression (ACD) cardiopulmonary resuscitation (CPR) on adult patients in cardiac arrest as defined by a lack of signs of circulation.

## Contraindications

1. This device is contraindicated in situations where CPR is not indicated.
2. Never use the ResQPump on patients with a pulse or signs of circulation.

## Precautions

1. Federal law restricts this device to investigational use only.
2. This manual contains basic information about using the ResQPump. It is not a substitute for training in ACD-CPR by a qualified instructor. Comprehensive instruction is required for proper use and includes monitored practice using the device on ACD-capable manikins.
3. Before beginning ACD-CPR, always check for signs of circulation.
4. Never use the ResQPump on conscious people for demonstration or training purposes.
5. Inadequate compression depth, decompression lift and rate may occur when rescuers become fatigued. Multiple rescuers should take turns performing the compression/decompressions, changing duties every few minutes.
6. Dry the chest (if necessary) to avoid unwanted device movement.
7. Always check for correct function, visible damage and force gauge calibration (set at zero) before placing the device into use.

This device does not contain latex.

## Introduction

The ResQPump enables the rescuer to perform ACD-CPR, which differs from standard CPR in that it actively re-expands (decompresses) the chest after each compression.

The design of the device allows the operator to use the same body position and compression technique as in standard CPR. Active chest decompression is achieved when the rescuer maintains a firm grip on the ResQPump and swings his or her body weight upwards after compression. The suction cup sticks to the chest and transfers the lifting force to the lower part of the ribcage. Compression force is transferred to the chest as in standard CPR via the device's piston. A force gauge in the handle assists the rescuer in applying the force needed to achieve 1<sup>1</sup>/<sub>2</sub> to 2 inches of compression, and the lift necessary for adequate decompression. A metronome guides the rescuer to compress and decompress at the appropriate rate and duty cycle.

## Device Description

**Figure 1** shows the ResQPump components. The silicone rubber suction cup (A) has a lip seal (B) that adapts to the curved shape of the chest. The lower lip surface has narrow sealing ridges (C) designed to optimize suction when chest hair is present.

Above the lip seal, the periphery is supported on the inside by a support ring that has a silicone rubber cushion pad (D) suspended in the center. The support ring ensures that skin in contact with the lip seal cannot be pulled inwards by the suction cup during decompression and distort the seal. The cushion pad reduces friction with the skin during compression.

When the ResQPump is compressed, the suction cup's cushion pad comes in contact with the chest. The involuted shape allows the cup's periphery to lift easily and vent excess air during compression. The repeated renewal of suction with each compression, combined with the self-reinforcing characteristics of the lip seal, ensures a very reliable grip on a variety of chest shapes.

The suction cup is connected to the handle (E) via a connection stem (F), which contains a strong compression/extension spring (G). Compression and extension of the spring is proportional to the force applied to the handle. Spring movement is transferred to the force gauge (H) located in the middle of the handle.

The handle is designed to provide a convenient grip that transfers compression via the heels of the hand and lift via the fingers. No change of grip is required between compression and decompression.

The device has a metronome integrated into the handle to guide the rescuer in the appropriate compression/decompression rate. The metronome emits two-tone signals of the same duration, a low pitch tone (768 Hz) and a high pitch tone (3070 Hz). The signal (set at 80/minute) guides the rescuer to compress and decompress at the appropriate rate and for equal amounts of time (50% duty cycle).

## Operating Instructions

### Assessment

Before beginning CPR, always assess the patient according to local standards to assure there are no signs of circulation (e.g. consciousness, breathing, coughing, movement or pulse).

### Device Position

The ResQPump's compression point is the same as for manual CPR. Slide your finger up the lower edge of the rib cage until you reach the notch at the bottom of the sternum. Place the ResQPump on the sternum so that the suction cup edge touches your finger (**Figure 2**). The distance between the edge of the suction cup and the compression point corresponds to the distance of the two fingers that you use to position the heel of your hand to perform manual CPR. An alternative method is to place the device in the middle of the sternum at the mid-nipple line.

### Rescuer Position

Kneel close to the patient's side. For optimal position, shorter rescuers may find it beneficial to elevate themselves slightly by kneeling on padding. If the patient is in bed (with hard surface under torso), it will be necessary to kneel next to the patient or stand on a platform of sufficient height. Grab the ResQPump's handle with both hands, placing the heels of your hands near the gauge with wrists bent (**Figure 3**). Compress and decompress with your shoulders directly over the sternum with arms outstretched and elbows locked (**Figure 4**). Use the large muscles in your thighs to lift and compress, bending at the waist.

## Compression

Compress the chest 1½ to 2 inches (**Figure 4**) and then note on the force gauge how much force that depth translates to. The red arrow tip indicates the force being applied (**Figure 5**). The approximate amount of force required will be: 65 lbs - soft/supple chest, 90 lbs - chest of average compliance (**Figure 5**), 110 lbs - stiff/rigid chest. Once you have determined how much force is required to compress the chest 1½ to 2", use that amount of force as your guide going forward.

## Decompression

Decompress (lift) the chest (**Figure 6**) until the tip of the red arrow on the force gauge registers between – 20 to – 30 lbs of force (**Figure 7**). You must exert this amount of upward force to fully achieve the benefits of active decompression. Closely monitor the force gauge and suction cup seal during use. If the suction cup dislodges, reposition it with the next compression. Use a 50% duty cycle, spending equal time compressing and decompressing.

## Consistent Performance/Metronome

Check the force gauge at regular intervals to ensure that you are delivering the appropriate forces necessary to compress and decompress. Use the metronome as a guide for compressing and decompressing at the rate of 80/min. This is slightly slower than the rate recommended for standard CPR to allow sufficient time for blood return to the chest. Start and stop the metronome by pressing the red button on the force gauge (**Figure 8**). Perform compression on one tone and decompression on the other. To avoid fatigue, rescuers should take turns performing the compression/decompressions, changing every 3 to 5 minutes.

## Troubleshooting

If suction difficulties occur, try adjusting the angle of the ResQPump on the chest to obtain an adequate seal. Occasionally, it may be necessary to shave hair from the middle of the chest to achieve good suction. If suction difficulties persist, you can still use the device for compression without causing additional harm to the patient. If there is question as to whether the device is functioning properly, discontinue its use and perform manual CPR instead.

Minor bruising or redness may occur in some patients. This is not a significant side effect and should not be considered a reason to discontinue its use. Rib fractures are a possible complication of any form of CPR. Proper positioning and compression depth will minimize the risk of causing such injuries.

## Cleaning

The ResQPump should be cleaned after every use. The silicone rubber suction cup attracts dust. Suction may become difficult if it gets too dusty. Store the ResQPump in a case to keep it clean.

To clean the handle, wipe it with a damp cloth and mild detergent. Never immerse the handle in water or autoclave to clean.

To clean the suction cup. Wash the suction cup with a mild detergent and rinse with tap water.

## Chemical Disinfection

If desired, the handle and cup may be chemically disinfected after washing. Wipe the cup and handle with a bleach solution (1 part 5% liquid household bleach and 9 parts water) or

Cavicide® (follow manufacturer's instructions for wetting times). Wipe the handle with a dampened cloth (do not immerse or rinse) to remove chemical residue. The cup may be rinsed with water. Wipe with a clean dry cloth and allow to air dry.

## Function Testing

Before placing the ResQPump into service and following each use, perform the following simple checks:

1. Inspect the handle and cup for visible damage. Replacement suction cups are available from the research team.
2. Compress the device against a smooth hard surface with approximately 110 lbs of force. Observe for an increasing gauge reading. Pull up on the handle with approximately – 30 lbs of force. Observe for a decreasing gauge reading and check for proper suction. The gauge should move smoothly within the compression and decompression ranges.
3. Check to make sure the force gauge reads zero (**Figure 8**) when no force is applied. If it does not, see instructions for gauge calibration.

## Force Gauge Calibration

In case the zero reading of the force gauge has drifted away from the zero line, the gauge needs to be readjusted as follows:

1. Remove the suction cup by pulling it from the stem of the handle.
2. Use a Torx™ tool (size T20) to loosen the screw at the top of the connection stem with a firm turn (**Figure 9**). Remove the nylon stem and the nylon spacer and washer located inside the stem (**Figure 10**).
3. Insert a straight blade 4 mm (or  $\frac{1}{8}$  inch) wide screwdriver in the threaded hole at the end of the spring/plunger assembly and catch the slot of the adjustment screw that is seated about  $\frac{5}{8}$  inch (1.5 cm) down inside the brass plunger (**Figure 10**).
4. Try to loosen the screw. If you feel excessive resistance, heat the screw slightly (heat-gun or hairdryer) to soften the locking resin (**Figure 11**).
5. Loosen the screw and adjust it until the gauge is on the zero line (**Figure 12**). Compress the spring a few times and check that the zero reading remains correct. Fine readjustment may be needed. If the screw was heated, wait until it cools to room temperature before proceeding to the next step.
6. Lock the screw by applying a drop of Three-Bond 1401C locking fluid (or equivalent) on top of the screw. Use a match or toothpick to ensure that the fluid is applied directly to the top of the screw. Wait ten minutes for the locking fluid to set.
7. Reassemble in reverse order. Place the nylon spacer and washer into the nylon stem as shown in **Figure 13**. Apply a drop of locking fluid to the tip and the thread near the end of the screw. Push the screw up through the end of the stem and through spacer and washer.
8. Finally, slip the spring/plunger on the handle down into the stem. Rotate the stem until it lines up with the handle and slips all the way into the handle, then tighten the screw.
9. Wait 24 hours before using the device to ensure that the locking resin obtains full strength. During this time the pump should be slung by the strap or left resting on the handle with the stem pointing up.