**PERFORMANCE OBJECTIVES**  
Demonstrate proficiency in ventilating a simulated patient utilizing a bag-valve-mask device.

**CONDITION**  
Ventilate a simulated adult, child, or infant in respiratory arrest (with an unprotected airway) for a minimum of 1 minute using the two and/or one rescuer technique. Necessary equipment will be adjacent to the patient or brought to the field setting.

**EQUIPMENT**  
Adult, child or infant manikin, adult and pediatric bag-valve-mask (BVM) device, O₂ connecting tubing, oxygen source with flow regulator, oropharyngeal and nasopharyngeal airways appropriate for manikin, silicone spray, water-soluble lubricant, 10cc syringe, pediatric resuscitation tape, goggles, masks, gown, gloves, timing device.

**PERFORMANCE CRITERIA**  
- Items designated by a diamond (🔹) must be performed successfully to demonstrate skill competency.
- Items identified by double asterisks (**) indicate actions that are required if indicated.
- Items identified by ($) are not skill component items, but should be practiced.
- Ventilation must be at least at the minimum rate required for the situation given.

### PREPARATION

<table>
<thead>
<tr>
<th>Skill Component</th>
<th>Key Concepts</th>
</tr>
</thead>
</table>
| Take body substance isolation precautions | 🔄 Mandatory personal protective equipment – gloves at all times  
🔹 Situational - long sleeves, goggles, masks, gown as needed  
🔹 Assess breathing |
| Select appropriate size mask and bag | 🔹 Ideally rescuers should use the appropriate size bag and mask. However, the size of the bag is not as important as the size of the mask.  
🔹 Note: If an adult bag is used on a pediatric patient, the tidal volume delivered should not exceed the chest rise of normal inspiration. |
| Assemble the bag-valve-mask device | 🔹 Pulse oximetry measures the oxygen saturation (SpO₂) of the patient’s arterial blood (delayed picture of ventilation)  
🔹 Waveform capnography measures the carbon dioxide (CO₂) in a patient’s exhaled breath (immediate graphic depiction of ventilation). It also (indirectly) measures metabolism and circulation.  
🔹 End-tidal carbon dioxide (EtCO₂) measures the CO₂ in an expired breath.  
🔹 Since waveform capnography is a measure of ventilation and pulse oximetry is a measure of oxygenation, ALS providers should use both devices to assess the patient’s respiratory status.  
🔹 Do not delay ventilation to place a pulse oximetry device on patient’s finger; may be done after ventilations have started. |
| BLS providers - Place a pulse oximetry device on patient’s finger - if available | 🔹 Connect BVM device to oxygen source  
🔹 Turn oxygen regulator to deliver 15L/min  
🔹 Do not delay ventilation to place a pulse oximetry device on patient’s finger; may be done after ventilations have started. |
| ALS providers - Place continuous waveform capnography sensor between the bag and mask - if available AND | 🔹 Place a pulse oximetry device on patient’s finger - if available |
| ** Place a pulse oximetry device on patient’s finger - if available | 🔹 Note: If an adult bag is used on a pediatric patient, the tidal volume delivered should not exceed the chest rise of normal inspiration. |

### TWO-RESCUER BAG-MASK VENTILATION PROCEDURE

<table>
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| Instruct 2nd rescuer to open the airway:  
🔹 Medical - head-tilt/chin-lift  
🔹 Trauma - jaw-thrust | 🔹 Move the patient no more than necessary to ensure an open airway.  
🔹 The 2nd rescuer is needed to maintain and ensure airway remains open. |

(Continued)
### Skill Component

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Note:</strong> If spinal immobilization is needed the 2nd rescuer will provide in-line axial stabilization</td>
</tr>
<tr>
<td>- It is important to maintain a neutral position in pediatric patients to prevent hyperflexion of the neck which may inhibit ventilations or occlude the airway (head is relatively large for size of the body).</td>
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<tr>
<td><strong>Note:</strong> Place approx. 2” of padding under the shoulders or entire torso to achieve appropriate airway alignment.</td>
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</tbody>
</table>

**Remove visible obstruction or suction – if indicated**

**Insert oropharyngeal/nasopharyngeal airway**

- NPAs are contraindicated in infants (less than 12 months) due to the small diameter of the nostril and presence of adenoidal tissue.
- If the NPA airway extends past the nostrils, this may result in the inability to maintain a tight seal and inhibits the function of the NPA when the mask is in place.

**Place mask over mouth and nose, instructing 2nd rescuer to maintain a tight seal and patent airway using one of the following two-handed techniques:**

- **Double C-E clamp technique**
- **Thenar eminences (TE) technique**

- The jaw-lift maneuver should be used when performing two-rescuer bag-mask ventilations.
- Avoid pushing mask down on the face. Pressure on the eyeballs results in vagal stimulation – especially in pediatric patients.
- The top of the mask is over the bridge of the nose and the bottom is in the groove between the lower lip and the chin.
- Avoid pressure on soft tissue under the chin which may result in airway obstruction.
- The thenar eminences allow the rescuer to do a good jaw-lift and create a more reliable seal while using the strongest muscles of the hands.

*Also called the two-thumbs down technique*

**Ventilating patient with appropriate tidal volume:**

- **Observe for effective rise and fall of chest**
- **Allow for adequate exhalation between ventilations**

- Use only enough force to allow for good chest rise. Over-inflation causes gastric distention which will decrease tidal volume by elevating the diaphragm.
- Exhalation requires more time than inspiration.
- The bag is refilled with oxygen when it expands during the time the patient exhales.

**Ventilating patient at approximate rate of:**

- **Adult - 10-12/minute**
- **Child - 12-20/minute**
- **Infant - 20-30/minute**
- **Neonate - 30-60/minute**

Reassess patient every 60 seconds after return of spontaneous circulation (ROSC):

- The ventilation range for pediatric patients varies due to the large age span. Example - the ventilation rate for a toddler to 8 years-of-age is 20/minute while a 14 year-old is ventilated at the adult rate.
- If a pulse oximetry or capnography wave form measuring device is used, the appropriate ventilation rate is the least number of ventilations per minute and end-tidal carbon dioxide (EtCO₂) within the normal range.

*Note:* Hyperventilation does not improve oxygenation, but may lead to hypocapnia and eventually respiratory alkalosis.

**Reassess:**

- **Lung compliance**
- **Airway patency**
- **Skin color**
- **Heart rate**

**Suction - if indicated**

- Continually assess respiratory status with each ventilation.
- Lung compliance provides information of successful inspiration or if there is interference with air delivery due to inadequate mask seal and airway or thoracic problems.
- In pediatric patients the resistance felt will generally be greater than in an adult due to the smaller size of the bronchi and bronchioles.
- In pediatric patients, hypoxia results in bradycardia which may lead to asystole. Reassess heart rate in neonates every 30-60 seconds and in infants and children every 1-2 minutes without stopping ventilations.
<table>
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<tr>
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</table>
| ♦ Open the airway: | ♦ Move the patient no more than necessary to ensure an open airway.  
♦ Medical - head-tilt/chin-lift  
♦ Trauma - jaw-thrust  
| | ♦ A 2nd rescuer is needed to maintain in-line axial stabilization if spinal immobilization is required.  
If only one rescuer is available to maintain spinal immobilization and ventilate with a BVM, the EMT may use his/her knees to stabilize the head.  
| | ♦ It is important to maintain a neutral position in pediatric patients to prevent hyperflexion of the neck which may inhibit ventilations or occlude the airway (head is relatively large for size of the body).  
Place approx. 2” of padding under the shoulders or entire torso to achieve appropriate airway alignment.  
| ♦ Insert oropharyngeal/nasopharyngeal airway | ♦ NPAs are contraindicated in infants (less than 12 months) due to the small diameter of the nostril and presence of adenoidal tissue.  
** Remove visible obstruction or suction - if indicated  
| | ♦ Some NPA airways may extend past the nostrils. This results in inability to maintain a tight seal and inhibits the function of the NPA when the mask is in place.  
| ♦ Place mask over mouth and nose, maintaining a tight seal and patent airway by using the C-E technique | ♦ Avoid pushing mask down on the face. Pressure on the eyeballs results in vagal stimulation – especially in pediatric patients.  
The top of the mask is over the bridge of the nose and the bottom is in the groove between the lower lip and the chin.  
| | ♦ Avoid pressure on soft tissue under the chin which may result in airway obstruction.  
| ♦ Ventilate patient with appropriate tidal volume:  
♦ Observe for effective rise and fall of chest  
♦ Allow for adequate exhalation between ventilations | ♦ Use only enough force to allow for good chest rise. Over-inflation causes gastric distention which will decrease tidal volume by elevating the diaphragm.  
| | ♦ Exhalation requires more time than inspiration.  
| | ♦ The bag is refilled with oxygen when it expands during the time the patient exhales.  
| ♦ Ventilate patient at approximate rate of:  
♦ Adult - 10-12/minute  
♦ Child - 12-20/minute  
♦ Infant - 20-30/minute  
♦ Neonate - 30-60/minute | ♦ The ventilation range for pediatric patients varies due to the large age span. The ventilation rate for a toddler to 8 years-of-age is 20/minute while a 14 year-old is ventilated at the adult rate.  
| ♦ Reassess:  
♦ Lung compliance  
♦ Airway patency  
♦ Skin color  
♦ Heart rate | ♦ Continually assess respiratory status with each ventilation.  
**Suction - if indicated  
| | ♦ Lung compliance provides information of successful inspiration or if there is interference with air delivery due to inadequate mask seal and airway or thoracic problems.  
| | ♦ In pediatric patients the resistance felt will generally be greater than in an adult due to the smaller size of the bronchi and bronchioles.  
| | ♦ In pediatric patients, hypoxia results in bradycardia which may lead to asystole. Reassess heart rate in neonates every 30-60 seconds and in infants and children every 1-2 minutes without stopping ventilations.  

### REASSESSMENT
(Ongoing Assessment)

<table>
<thead>
<tr>
<th>Skill Component</th>
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</tr>
</thead>
<tbody>
<tr>
<td>♦ Reassess the patient every 5 minutes or sooner.</td>
<td>• This is a priority patient who must be re-evaluated at least every 5 minutes.</td>
</tr>
<tr>
<td>• Primary assessment</td>
<td></td>
</tr>
<tr>
<td>• Relevant portion of the secondary assessment</td>
<td></td>
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<tr>
<td>• Vital signs</td>
<td></td>
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<tr>
<td>♦ Evaluate response to treatment</td>
<td>• Evaluate changes after any treatment is initiated, medication administered, or condition changes.</td>
</tr>
<tr>
<td>♦ Evaluate reassessment results and note any changes in patient’s condition and vital signs</td>
<td>• Comparing results assists in recognizing if the patient is improving, responding to treatment or condition is deteriorating.</td>
</tr>
</tbody>
</table>

**“Manage patient condition as indicated.”**

### PATIENT REPORT AND DOCUMENTATION

<table>
<thead>
<tr>
<th>Skill Component</th>
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<tbody>
<tr>
<td>§ Verbalize/Document:</td>
<td>• Documentation must be on either the Los Angeles County EMS Report form or Provider Patient Care Record.</td>
</tr>
<tr>
<td>• Percent of oxygen/Liter flow</td>
<td></td>
</tr>
<tr>
<td>• Ventilation rate</td>
<td></td>
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<tr>
<td>• Size of nasopharyngeal or oropharyngeal adjunct</td>
<td></td>
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<tr>
<td>• Resistance encountered (lung compliance)</td>
<td></td>
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<tr>
<td>• Gastric distention - if developed</td>
<td></td>
</tr>
<tr>
<td>• Dentures and location - if removed</td>
<td></td>
</tr>
<tr>
<td>• Response to ventilation</td>
<td>• Documenting reassessment information provides a comprehensive picture of patient’s response to treatment.</td>
</tr>
<tr>
<td>‐ chest rise and fall</td>
<td>• Last reassessment information (before patient care is transferred) should be documented in the section of the EMS form that is called “Reassessment after Therapies and/or Condition on Transfer”.</td>
</tr>
<tr>
<td>‐ color</td>
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<tr>
<td>‐ level of consciousness</td>
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### CARE of EQUIPMENT

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>♦ Dispose of contaminated equipment using approved technique.</td>
<td>• Place contaminated equipment in plastic bag, seal, and dispose at designated sites.</td>
</tr>
</tbody>
</table>

*Note: When releasing patient to higher level of care personnel, leave equipment to continue patient management.*

Developed 11/00     Revised 12/01, 1/03, 6/06, 6/10, 1/13, 1/14
BREATHING EMERGENCY / AIRWAY MANAGEMENT

BAG-MASK VENTILATION

UNPROTECTED AIRWAY

Supplemental Information

INDICATIONS:
- Respiratory arrest
- Respiratory compromise (hypoxia)

COMPLICATIONS:
- Gastric distention
- Vomiting

DEFINITIONS:
- **Capnography wave form** – graphic depiction of the partial pressure of carbon dioxide exhaled with each breath. It provides an immediate picture of ventilation and indirectly measures metabolism and circulation.
- **End-tidal carbon dioxide (EtCO₂)** – measures the carbon dioxide (CO₂) concentration of exhaled gas – normal value 35-45mmHg
- **Hypocapnia** – too little carbon dioxide in the blood stream.
- **Lung compliance (resistance)** -- measure of how easy it is to inflate the lungs. If compliance is high, the lungs are easy to inflate. If compliance is low the lungs are hard to inflate (stiffer lungs).
- **Pulse oximetry** – measures the oxygen saturation in arterial blood (SPO₂) -- normal values are 94-98% and 88-92% in COPD patients
- **Respiratory alkalosis** – rise in blood pH and may cause dizziness, tingling of the lips, hands or feet, headache, weakness, fainting and seizures and in extreme cases it can cause carpopedal spasms (contraction of the hands and feet).

INDICATIONS OF ETCO2 VALUES:
- The goal for most patients is to ventilate the patient such that the value is between 35-45mmHg
- In a spontaneously breathing patient the relationship between the measure EtCO₂ value and respiratory status is more complex. Both abnormally high and abnormally low values of EtCO₂ can indicate respiratory failure. In addition to primary respiratory processes, abnormal levels my represent compensatory mechanisms for a metabolic process, in particular low EtCO₂ can also represent compensatory hyperventilation in metabolic acidosis.
- In a patient receiving positive pressure ventilation but **not in cardiac arrest**:
  - If reading is greater than 45mmHg – CO₂ is high and indicative of hypoventilation and respiratory acidosis.
  - If reading is below 35mmHg – CO₂ is low and indicative of hyperventilation and respiratory alkalosis.
- In a patient in cardiac arrest:
  - A reading above 10mmHg indicates quality CPR
  - A reading below 10mmHg signifies a bad prognosis
  - A sudden increase above 35mmHg indicates ROSC

VENTILATION TECHNIQUES:
- **Double C-E clamp technique** -- use the thumb and index fingers of both hands to encircle the top of the mask. Use the third, fourth, and fifth fingers of each hand to lift both sides of the mandible to meet the mask.
- **Thenar eminences (TE) technique (two-thumbs down technique)** -- use the thenar eminences of both hands to apply pressure along the long axis of both sides of the mask. Use the second, third, fourth, and fifth fingers of each hand to lift both sides of the mandible to meet the mask.

NOTES:
- The BVM device should have either no pressure-relief (pop-off) valve or a valve with an override feature to permit use of high pressures which may be necessary to achieve visible chest rise and effective ventilation.
- Using a bag-valve-mask device with an oxygen reservoir attached to an oxygen source that delivers 15L/minute can provide a 90% or greater concentration of inspired oxygen. However, the effectiveness of the BVM device depends on the volume of gas that is squeezed out of the bag and if a proper seal is maintained.
- Squeezing the bag too forcefully will result in gastric distention and vomiting. Use only enough force and tidal volume needed to achieve visible chest rise.
- In cases of gastric distension, continue ventilations using appropriate airway maneuvers.
- In pediatric patients, hypoxia results in bradycardia which may lead to asystole. Reassess heart rate in neonates every 30-60 seconds and in infants and children every 1-2 minutes without stopping ventilations.
- It is important to maintain a neutral position in pediatric patients to prevent hyperflexion of the neck which may inhibit ventilations or occlude the airway (head is relatively large for size of the body). Appropriate airway alignment is achieved by placing approximately 2” of padding under the shoulders or entire torso if necessary.