RIVERSIDE COUNTY EMS AGENCY	Performance Standard	7303
	Effective **April 1, 2018**	Expires **March 31, 2019**
Category I Skill – Low Frequency/High Risk: **Positive Pressure Ventilation**	Approval: Medical Director **Reza Vaezazizi, MD**	Signed
Applies To: **PSP, EMT, AEMT, PM, MICN, BHP, EMS System**	Approval: REMSA Director **Bruce Barton**	Signed

Terminal Performance Objective

To establish and maintain adequate airflow (oxygenation and ventilation) to support gas exchange at the cellular level and prevent or reverse tissue hypoxia.

Before performing positive pressure ventilation, the PSP, EMT, AEMT, or paramedic must:

1. Methodically complete an assessment of the airway and breathing within 30 seconds.
2. Identify inadequate ventilations (minute volume) and/or signs of hypoxia within the first 30 seconds.
3. Apply appropriate, clinically-required technique to manually position the head and mandible of the unconscious patient to open the upper airway.
    a. Medical – Head tilt/chin lift
    b. Trauma – Jaw thrust or modified chin lift.
4. Clear secretions or other obstructions using appropriate method (manually, log rolling, suctioning, etc.) maintaining C-spine controls as patient's condition indicates.
5. Utilize the appropriate technique per American Heart Association Standards to insert the appropriate BLS airway within 10 seconds.
    a. NPA is the preferred BLS airway
6. Where equipped waveform capnography MUST be attached to the BVM.

While performing positive pressure ventilation, the PSP, EMT, AEMT, or paramedic must:

1. Employ the correct technique to achieve a tight mask seal while maintaining position of the head and mandible to maximize airflow to the lower airway.
2. Initiate ventilatory support using an appropriately-sized BVM with supplemental oxygen at 10 – 15 LPM.
3. Provide the clinically-required ventilatory (minute volume) support for the patient demonstrating the ability to modify tidal volume and/or ventilation rate to achieve chest/diaphragm expansion and full exhalation with each ventilatory cycle.
4. Ventilate patients with spontaneous circulation (Rescue Breathing) as clinically required :
    a. Ventilate the adult patient once every 5 to 6 seconds (10 – 12 times per minute) with tidal volume (TV) sufficient to produce visible chest rise and fall. [1] [2]
    b. Ventilate the pediatric patient once every 3 to 5 seconds (12 – 20 times per minute) with tidal volume sufficient to produce visible chest rise and fall [3] without hyperinflation or gastric insufflation.
    c. Ventilate neonatal patients 40-60 times per minute to maintain a heart rate greater than 100. [4]
5. Ventilate cardiac arrest patients during CPR as clinically required:
    a. Ventilate the adult patient without an advanced airway – synchronize 2 ventilations with 30 chest compressions. Provide ventilations with enough tidal volume to produce visible chest rise and fall during pauses in compression cycles (Class IIa).

[1] 2015 AHA Guidelines for CPR and ECC, Part 5 Adult Basic Life Support, pp S692-S693.
[2] PHTLS, Seventh Edition, Chapter 7 Airway and Ventilation p 164.
[3] 2015 AHA Guidelines for CPR and ECC, Part 13, Pediatric Basic Life Support, p S868.
[4] 2015 AHA Guidelines for CPR and ECC, Part 15, Neonatal Resuscitation, p S912.

    b. Ventilate the adult patient with an advanced airway in place – Provide 8-10 unsynchronized ventilations per minute with enough tidal volume to produce visible chest rise and fall during pauses in compression cycles (Class IIa).
6. Deliver positive pressure ventilations over a minimum of 1 second to avoid hyperinflation and minimize gastric insufflation, high (peak) airway pressures, pulmonary barotrauma and compromise of venous return to the heart (Class IIa).
7. Avoid hyperventilation to minimize high airway pressures, hypocarbia and cerebral vasoconstriction. [5] [6]
    a. Monitor ETCO2 for appropriate waveform morphology and CO2 levels in the non-intubated, intubated patient/patient with a Rescue Airway:
        i. The target range for ETCO2 level is between 30 – 45 mmHg if spontaneous circulation is present.
        ii. In cardiac arrest, metabolic derangements will significantly alter ETCO2 values and waveform morphology. Target range for ETCO2 levels is between 15 mmHg – 45 mmHg during CPR.
        iii. Recognize that in a patient with traumatic brain injury, ETCO2 less than 35 mmHg due to hyperventilation may actually cause harm. Minute volume should be adjusted accordingly while maintaining optimal oxygenation, reserving hyperventilation for those patients showing signs of cerebral herniation only. [7]
        iv. If the waveform capnography monitor malfunctions, a colorimetric end tidal CO2 detector shall be used, and the malfunction reported to the organization's QI Coordinator.
8. Differentiate respiratory pathophysiology and modify BVM technique based upon changes in lung compliance and/or airway resistance to maintain therapeutic airway pressure while minimizing gastric insufflations. [8]
    a. Ensure changes in inspiratory and expiratory time ratio (I:E Ratio) is factored into ventilatory cycles allowing for exhalation of each breath prior to delivery of the next breath.
9. Efficiently employ diagnostic tools such as pulse oximetry (target SpO2 is greater than 95% when spontaneous circulation is present) and auscultation of lung fields to thoroughly assess overall effectiveness of ventilatory support.
    a. In patients with COPD/pulmonary disease, it may not be possible or desirable to attain a SpO2 of 95%.
10. Immediately identify malfunctioning equipment or ineffective techniques and employ alternative measures to achieve effective ventilations.
11. Maintain effective ventilation and oxygenation throughout the entire prehospital period of treatment.
12. Maintain calm and effectively lead a team-based approach to resuscitation.
13. Rapidly determine the need for Advanced Life Support (ALS) airway adjuncts and/or medications when airway patency or ventilations cannot be effectively supported by BLS means.
14. Document all procedures and patient response to therapy on the PCR.

Critical Success Targets for PPV

1. Tight mask seal
2. Chest rise and fall with each ventilation cycle
3. SpO2 of greater than 95% in patients with spontaneous circulation.
4. Management of secretions and other airway obstructions
5. Minimal gastric distension
6. Evaluation and Documentation of ETCO2 morphology and values

System Benchmark

Number of patients PPV with chest rise and fall, patent airway, signs of adequate oxygenation.
Patient arrival at hospital with spontaneous circulation.

Applicable Protocols

[5] PHTLS , Seventh Edition, Chapter 7 Airway and Ventilation p 164.
[6] 2010 AHA Guidelines for CPR and ECC, Part 9 Post–Cardiac Arrest Care, p S773.
[7] The Brain Trauma Foundation's Guidelines for Prehospital Management of Severe Traumatic Brain Injury, Second Edition, Sections IV and VI
[8] 2010 AHA Guidelines for CPR and ECC, Part 13, Pediatric Basic Life Support, p S868.

All treatment protocols and performance standards that delineate positive pressure ventilation under optional or required treatment.

Core Competency Requirements to be covered during education/training on PPV

1. Respiratory A&P and Pathophysiology
2. Assessment of airway and breathing
3. Differentiation between adequate and inadequate respiration
4. Airway Positioning
5. Suctioning
6. Removal of foreign body obstructions
7. Oropharyngeal Airway selection and insertion
8. Nasopharyngeal Airway selection and insertion
9. BVM selection
10. Induction of supplemental oxygen
11. Hand ventilation with a BVM
12. Assessment of PPV adequacy and efficacy
13. Application and use of waveform capnography with PPV procedure
14. Airway pressure secondary to PPV – mean versus peak
15. Possible complications of PPV – gastric, pulmonary, cerebral, and cardiovascular complications of over-inflation and over-ventilation
16. Auscultation and diagnostic differentiation of lung sounds
17. Team Leadership and Patient Safety
18. Use of diagnostic tools

Adjunctive Performance Standards

1. Laryngoscopy with FBAO Removal/Magill Forceps (ALS personnel)
2. BLS Airway Adjuncts
3. ALS Airways

Equipment Requirements

1. Mannequin
2. NP Airway
3. OP airway
4. Advanced Airways
5. BVM with manometer
6. Stethoscope
7. Supplemental oxygen
8. Magill forceps
9. Laryngoscope
10. Pulse oximeter
11. Waveform capnography (required for ALS units and CCT units only)
12. Suction device (both hard and flexible)

Instructor Resource Materials

1. Prehospital Trauma Life Support
2. AHA CPR and BLS Provider Manual
3. AHA ACLS Provider Manual
4. AHA PALS Provider Manual
5. Current AHA Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care
6. NHTSA EMS Educational Instructor Guidelines for EMT and Paramedic

Positive Pressure Ventilation Validation

PERFORMANCE CRITERIA: 100% accuracy required on all items with an *

Before performing positive pressure ventilation, the FR, EMT, AEMT, and paramedic must:

Points	Score	Performance Steps	Additional Information
1		Take or verbalize body substance isolation.	Selection: gloves, goggles, mask, gown, booties, N95 PRN
1		Methodically complete an assessment of the airway and breathing within 30 seconds. *	Follow respiratory assessment sequence.
1		Identify inadequate ventilations and/or signs of hypoxia within the first 30 seconds. *	Pale/cyanotic, altered level of consciousness, diaphoresis, increased work of breathing or apnea, poor chest rise and fall
1		Apply the appropriate, clinically required technique to manually position the head and mandible of the unconscious patient to open the upper airway. *	• Medical – Head tilt/chin lift • Trauma – Jaw trust or modified chin lift
1		Manually clear blood, vomit, and foreign bodies when present. *	• Clear secretions or other obstruction using appropriate method (manually, log rolling, suctioning, etc.) maintaining C-spine control as patient condition indicates. • Use a rigid pharyngeal tip, if available, for suctioning oropharynx.
1		Utilize the appropriate technique per American Heart Association standards to insert the appropriate BLS airway within 10 seconds. *	NPA is the preferred BLS airway

While performing positive pressure ventilation, the FR, EMT, AEMT, and paramedic must:

1		Employ the correct technique to achieve a tight mask seal while maintaining position of the head and mandible to maximize airflow to the lower airway. *	• E –C Clamp technique (one rescuer) • Two rescuers is best for achieving a tight mask seal, with one rescuer holding the mask against the patient's face while maintaining head position, and the 2nd rescuer squeezing the bag.
1		Initiate ventilatory support using an appropriately sized BVM with supplemental oxygen at 10 – 15 LPM. *	
1		Provide the clinically required ventilatory (minute volume) support for the patient demonstrating the ability to modify tidal volume and/or ventilation rate to achieve chest/diaphragm expansion and full exhalation with each ventilation cycle. *	• Give sufficient volume to cause chest rise.

1		Ventilate patients with spontaneous circulation (Rescue Breathing) as clinically required. *	• Ventilate the adult patient once every 5 to 6 seconds (10 - 12 times per minute) with tidal volume (TV) sufficient to produce visible chest rise and fall. • Ventilate the pediatric patient once every 3 to 5 seconds (12 – 20 times per minute) with tidal volume sufficient to produce visible chest rise and fall without hyperinflation or gastric insufflations. • Ventilate neonatal patients 40 – 60 times per minute to maintain a heart rate greater than 100.
1		Ventilate cardiac arrest patients during CPR as clinically required. *	• Ventilate the adult patient without an advanced airway-synchronize 2 ventilations with 30 chest compressions. Provide ventilations with enough tidal volume to produce visible chest rise and fall during pauses in compression cycles (Class IIa). • Ventilate the adult patient with an advanced airway in place-provide 8 – 10 unsynchronized ventilations per minute with tidal volume sufficient to achieve rise and fall of the chest (Class IIa).
1		Deliver positive pressure ventilations over a minimum of 1 second. *	This is to avoid hyperinflation and minimize gastric insufflations, high (peak) airway pressures, pulmonary barotraumas and compromise of venous return to the heart (Class IIa).
1		Avoid hyperventilation to minimize high airway pressures, hypocarbia, and cerebral vasoconstriction. *	Monitor ETCO2 for appropriate waveform morphology and target CO2 levels in the intubated patient/patient with a Rescue Airway: • The target range for ETCO2 level is between 30 – 45 mmHg if spontaneous circulation is present. • In cardiac arrest, metabolic derangement will significantly alter ETCO2 values and waveform morphology. Target ranges for ETCO2 levels are between 15 mmHg – 45 mmHg during CPR. • Recognize that in a patient with traumatic brain injury, ETCO2 less than 35 mmHg due to hyperventilation may actually cause harm. Minute volume should be adjusted accordingly while maintaining optimal oxygenation, reserving hyperventilation for those patients showing signs of cerebral herniation only. • If the waveform capnography monitor malfunctions, a colorimetric end tidal CO2 detector shall be used, and the malfunction reported to the organization's QI Coordinator.
1		Differentiate respiratory pathophysiology and modify BVM technique based upon changes in lung compliance and/or airway resistance to maintain therapeutic airway pressure while minimizing gastric insufflation. *	Ensure changes in inspiratory and expiratory time ratio (I: E ratio) is factored into ventilatory cycles allowing for exhalation of each breath prior to delivery of the next breath.
1		Efficiently employ diagnostic tools such as pulse oximetry and auscultation of appropriate lung fields to thoroughly assess overall effectiveness of ventilatory support. *	SpO2 target is greater than 95% when spontaneous circulation is present. • In patients with COPD/pulmonary disease, it may not be possible or desirable to attain a SpO2 of 95%.

1		Immediately identify malfunctioning equipment or ineffective techniques and employ alternative measures to achieve effective ventilations. *	
1		Maintain effective ventilation and oxygenation throughout the entire pre-hospital period of treatment. *	
1		Maintain calm and effectively lead a team based approach to resuscitation. *	
1		Rapidly determine the need for Advanced Life Support (ALS) airway adjuncts and/or medications when airway patency or ventilations cannot be effectively supported by BLS means.*	
1		Document all procedures and patient response to therapy on Patient Care Report (PCR).	

Critical Failure Criteria

____Failure to take or verbalize BSI appropriate to the skill prior to performing the skill
____Failure to achieve and maintain a tight mask seal
____Failure to properly identify ineffective ventilations
____Any procedure that would have harmed the patient