Puritan Bennett™
Tube Compensation
Improving Spontaneous Breathing
OVERRIDE THE IMPOSED WORK OF BREATHING THROUGH AN ARTIFICIAL AIRWAY

**TUBE COMPENSATION**

In the mechanically ventilated patient, it has long been recognized that the single greatest cause of imposed work of breathing (WOB) is the resistance caused by the endotracheal (ET) tube.\(^1,2\) Tube Compensation (TC) is a spontaneous breath type that accurately overcomes the imposed WOB for the artificial airway. To bring you up to date on TC, we have compiled this booklet to explain how TC works, its advantages and how you can determine the percent support range necessary for your patients.

At Covidien, our reputation is based on three critical aspects of healthcare: ensuring patient safety, allowing clinicians to easily monitor data and optimizing institutional efficiency. Our innovative solutions for ventilation, airway management and patient monitoring ensure that you have clear and easy access to patient statistics at all times. Innovative developments such as trending software and Proportional Assist™ ventilation can reduce patient stay and related hospital expenditures.
PRESSURE SUPPORT AND ITS LIMITATIONS

The pressure generated in the patient lung can be significantly lower during inspiration than circuit pressure when flow is present. Pressure Support (PS) is frequently used clinically to overcome the imposed WOB attributable to artificial airways. When used in this manner, PS has several shortcomings. First, the PS level may not accurately match the pressure drop across the endotracheal tube.

It is difficult for PS with its fixed applied pressure to accurately compensate for the artificial airway due to varying inspiratory flow rates and because the pressure drop across an artificial airway is flow dependent.1-4 For any given breath, PS may under-correct for the WOB early in the inspiratory phase when flows are high and over-correct in the latter part of the inspiratory phase during low flow.3,4 Second, setting adequate PS may not be as easy or accurate as one might think. The inspiratory trigger, aggressiveness of rise to pressure, and the inspiratory termination criterion can affect synchrony.4 All these factors attempt to match the PS breath to the patient’s varying breathing pattern. Last, the user-selected level of PS is often not changed from patient to patient with varying ET tube size or when high or lower flows are present, likely resulting in inadequate or excessive support.

WHAT IS TUBE COMPENSATION?

Tube Compensation (TC) is a spontaneous breath type that accurately overcomes the imposed WOB for the artificial airway.2 It’s a hybrid of pressure support that automatically compensates for the flow-dependent pressure drop across the ET or trach tube and controls the patient’s carinal pressure to a constant PEEP value.2-4

TC accomplishes this support by assisting the patient’s spontaneous breaths with positive pressure proportional to the inspired flow and the internal diameter of the artificial airway.

The result is that the patient does not experience the resistive work due to inspiring through an artificial airway. This is particularly important in individuals with poorly functioning respiratory systems, who must exert even greater muscular effort to overcome the increased resistance to flow through an artificial airway. TC may be very helpful in distinguishing between ventilatory failure caused by the artificial airway and actual ventilator dependence.5
**WHAT ARE THE POTENTIAL ADVANTAGES OF TC?**

**Ease of use:** Simply tell the ventilator what size ET tube or trach tube is in place and the ventilator automatically calculates the correct support.

**Lowest WOB:** Compared to CPAP or T-piece breathing, patients will experience the lowest work of breathing in TC (can be used for spontaneous breaths in the Bi-Level Interface as well).⁶,⁷

**Potential for improved patient comfort:** Patients breathing spontaneously through an ET tube show increased signs of comfort compared to CPAP or T-piece breathing.³ When the imposed WOB was avoided by using TC, patients did not need additional PS.⁴

**Ability to track patients with variable drive:** A patient’s ventilatory drive and resultant flow can change dramatically depending on whether patients are asleep or awake, calm or agitated. TC can vary pressure considerably to compensate for any flow demand.⁴

**WHAT PERCENT SUPPORT DO I SET DURING TC?**

TC allows for the clinician to set the percent support in a range from 10% to 100%. Should the clinician desire, percent support is easily adjusted to support something less than total compensation.

If you would like more information about TC, or have any questions about how our ventilators can help your patients breathe efficiently and safely, call your Covidien representative.

### PRODUCT ORDERING INFORMATION

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**References**


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