Puritan Bennett™ 980 ventilator system information guide and best practices for more effective training

This guide is provided as a convenience companion document to the Operator’s Manual. It is not intended to replace the Operator’s Manual, which should always be available while using the ventilator. It is important to familiarize yourself with all information in the Operator’s Manual relevant to your institution’s use of the ventilator, including on-screen help instructions, warnings, and cautions.
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INTRODUCTION
The Puritan Bennett™ 980 ventilator helps patients breathe more naturally† through some of the most innovative breath delivery technology available.

Our simple, smart, and safe design provides more natural ventilation that may help improve patient comfort.†

Simple
Our innovative user interface features a highly customizable display with intuitive screen navigation.

Smart
Advanced synchrony tools help clinicians set the ventilator to adapt to their patients’ unique needs and help provide the appropriate level of support throughout the breath.

Safe
The newly designed Puritan Bennett™ 980 ventilator provides a unique ventilator assurance* feature and an integrated expiratory filtration system.

† Compared to conventional mechanical ventilation (VC, VC+, PC, PS)
This Puritan Bennett™ 980 ventilator training program implementation guide is designed to help you provide the best possible evaluation, installation, and follow-up training on the Puritan Bennett™ 980 ventilator system. This guide contains best practices, tips, planning for training, basic and clinical applications lesson plans, skills checklists, and product information.

How to use this guide

**Step 1**  Read Training 101 and Best Practices. These sections provide information on effective training techniques.

**Step 2**  Use Identifying the Clinical Roles of Trainees to learn how the training needs of the three different clinical roles will differ. This information will be important when planning training sessions.

**Step 3**  Training content is customized to three primary clinical roles who commonly manage ventilated patients: monitor, programmer and prescriber. Answer all questions in the Planning for Training, checklist. The answers will guide equipment planning and indicate which basic lesson plan to use (monitor, programmer, or prescriber), how to choose additional clinical lesson plan components, and which trainee materials to hand out.

*Note: After steps 1 and 2 are mastered, proceed to step 3 when planning training events.*

**Step 4**  Arrange for your equipment.

Before training, you must ensure that the Puritan Bennett™ 980 ventilator has passed SST while equipped with the filters and breathing circuit that match the trainee’s typical patient type. For training it must be equipped with that same setup plus an appropriately sized test lung and at least one battery.

If you plan to project the Puritan Bennett™ 980 ventilator screen, make sure to obtain an appropriate length of HDMI cable for connecting the ventilator to the LCD projector.

**Step 5**  Assemble a customizable lesson plan that includes the basic lesson plan for the clinical role you are training as well as the lesson plans for any clinical applications identified during the planning for training exercise.

**Step 6**  Review the basic and additional clinical lesson plans with the person at the facility who is arranging the training.

**Step 7**  Deliver equipment and perform the training.
Monitors are clinicians who monitor patients on a ventilator but do not make significant changes to ventilator settings (e.g., nurses). Programmers are clinicians who set up and program settings for patients on a ventilator (e.g., nurses, respiratory therapists [RTs], and physicians). Prescribers are clinicians who prescribe which settings are appropriate for the patient (e.g., physicians, physician’s assistants, and nurse practitioners).

TRAINING ASSETS

The Puritan Bennett™ 980 ventilator training assets include tools for both training facilitators and trainees.

**Assets for training facilitators**
(contained in this guide)

- Training 101
- Best Practices
- Identifying the Roles of the Trainees
- Planning for Training
- Basic Lesson Plans for Monitors, Programmers, and Prescribers
- Clinical Application Lesson Plans
- Skills Checklists
- Important Terms

**Not contained in this guide:**

- Education presentations
- PowerPoint slides with the training content that follows the programmer basic lesson plan
- PowerPoint slides with the training content that follows the clinical application lesson plans
Designed to support the learner during training, the trainee assets are not contained in this guide. These assets come packaged in the training kit, as listed below, but can also be handed out individually or made available electronically.

<table>
<thead>
<tr>
<th>TRAINING KIT CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-training reading</strong></td>
</tr>
<tr>
<td>This booklet serves as an introduction to the Puritan Bennett™ 980 ventilator. It is given to trainees prior to a training session. It includes information on:</td>
</tr>
<tr>
<td>• Setting up the ventilator for a new patient</td>
</tr>
<tr>
<td>• Using the user interface</td>
</tr>
<tr>
<td>• Key modes and features</td>
</tr>
</tbody>
</table>

| **Touch screen handout** |
| This handout is intended for use during live training sessions to help trainees follow along with live demonstrations of ventilator functions and includes labeled pictures of the touch screen and a description of its features. |

| **Practice exercises** |
| These are provided as potential practice exercises for the training facilitator to help trainees practice what they have learned. The questions cover monitoring, programming, and prescribing functions. |

| **Quick reference guide** |
| This guide serves as a quick reference for onsite use of certain ventilator features. The quick reference guide contains information on subjects such as: |
| • Patient setup |
| • Using the touchscreen |
| • Using Puritan Bennett™ Leak Sync software |
| • Using PAV™*+ software |
| • Using Volume Control Plus (VC+) breath type and Volume Support (VS) |
| • Setting up BiLevel mode |
| • Data management |
| • Prox Flow software |

| **Training evaluation** |
| Ask trainees to fill out the training evaluation card and indicate where improvements could be made or if there is a need for additional training. The completed evaluations can be used to gauge the success of the training session and improve future training sessions. |

None of the above-noted materials, including this training program, are intended to supersede the operator’s manual. Please always read the operator’s manual before using the Puritan Bennett™ 980 ventilator.
**TRAINING 101**

**Behavior Modeling Training (BMT)**

The Puritan Bennett™ 980 ventilator training makes use of behavior modeling training (BMT) methods. BMT provides:

- A set of well-defined behaviors (skills) to be learned
- A model or models displaying the effective use of those behaviors
- Opportunities for trainees to practice those behaviors
- Feedback and social reinforcement to trainees after practice
- Steps to maximize the transfer of those behaviors to the job

This implementation guide will help you teach a well-defined set of skills and will provide trainees with a model for the effective use of those skills and opportunities for practice. It will also help you provide feedback and social reinforcement to help trainees understand how to put those new skills into practice on the job.

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**Low engagement**

Training that includes oral, written, or multimedia presentation of factual information by an expert source.

**Medium engagement**

Training that includes a stronger element of interactivity, with or without feedback.

**High engagement**

Training that involves application of the concepts from the training content in a real or simulated environment.

The goal is to provide high-engagement training to promote the highest level of knowledge retention and transfer of skills to the trainee’s clinical role.
Customize Your Training to the Need

Evaluation Training

Evaluation training occurs when a facility or patient care area is evaluating the Puritan Bennett™ 980 ventilator during patient use prior to making a purchase decision. The amount of information provided during evaluation training is often significantly less than what is provided during the installation training. During evaluation training, only the information needed to effectively manage ventilated patients in the same or similar way to how they are currently managed is needed. Trainees do not need to learn everything about the Puritan Bennett™ 980 ventilator at this stage unless they specifically request the information. Follow the basic lesson plan and add relevant information from the clinical lesson plans as needed.

You will likely have about one hour to complete this training for programmers and less than an hour to complete this training for monitors and prescribers. Your goal is to give the trainees the information they need to evaluate the Puritan Bennett™ 980 ventilator. Each clinical role has unique needs.

It is important to stay focused. Don’t waste time on subjects not relevant to the clinical role you are training. Make sure monitors understand where to find patient data, as well as how to respond to alarms, adjust O₂%, and manage the ventilator during suctioning. Programmers and prescribers need to feel confident using the Puritan Bennett™ 980 ventilator for all of the ventilation strategies they currently employ. In addition, if they are open to it and time permits, you may provide the basics for using Puritan Bennett™ 980 ventilator options they wish to implement as part of the evaluation.

Installation Training

Installation training occurs when the facility obtains one or more Puritan Bennett™ 980 ventilators. The goal is to ensure that trainees feel confident interacting with the ventilator in the manner required by their clinical roles. Do your best to arrange for at least 90 minutes of training for programmers and 30 to 45 minutes for monitors and prescribers. Start with reinforcing the basic lesson plan contents and add whichever clinical application lesson plan components that are needed. Be prepared to address any concerns trainees encountered during the evaluation period. Make sure programmers and prescribers feel confident using the Puritan Bennett™ 980 ventilator for all of the ventilation strategies they currently employ and are aware of Puritan Bennett™ 980 ventilator options they don’t currently use. Encourage frequent communication. Check in with all three clinical roles regularly, including the night shift. Schedule follow-up training sessions for ventilation strategies the staff is not currently using but would like to begin using.
Follow-up Training

Follow-up training is important to help users of the Puritan Bennett™ 980 ventilator get the most out of the functionality of the ventilator and can be conducted for a number of purposes. The amount of time you need to schedule for the follow-up training will depend on the purpose of the training. Three common reasons for follow-up training are to:

1. Reinforce relevant features and benefits pertaining to the trainees’ clinical role, applicable patient population, and modes and breath types of use. It is important to reinforce this information multiple times to improve learning retention. Schedule about 30 minutes for each session.
2. Answer questions about the trainees’ experiences and resolve any confusion. Schedule about 30 minutes.
3. Introduce new concepts or expand trainee knowledge level about features and functions available on the Puritan Bennett™ 980 ventilator. Some institutions prefer to have their trainees learn new features in installments and may schedule follow-up training multiple times. Schedule about 60 minutes per topic.

Training Tips Checklist

From your opening remarks to the evaluation, advance planning can help improve the effectiveness of the training.

Here is a checklist of items to keep in mind as you get ready for a training session:

- Keep a positive attitude.
- Have an opening and a closing.
- Make training objectives clear.
- Review and stick to the agenda (if applicable).
- Involve learners in the session.
- Encourage questions; never criticize trainees.
- Gear the session towards learners’ needs.
- Be honest about not knowing something. If you don’t know the answer to a question, admit it. Indicate you will get back to the questioner with an answer and make sure to follow through.
- Use visuals and a variety of learning techniques.
- Use transfer-of-training techniques (hands-on practice) that ensure trainees can apply what they have learned in the session in their work environment.
Familiarizing Trainees with Terms and Abbreviations

There are terms and abbreviations associated with the use of the Puritan Bennett™ 980 ventilator that might not be familiar to trainees. Keep an operator’s manual handy and review the terms, abbreviations, and symbols described in Section 2. Make sure to explain any uncommon term and relate it to something familiar to the trainees (e.g., Puritan Bennett™ 980 ventilator VC+ mode is similar to Maquet™ pressure regulated volume control [PRVC] or Dräger AutoFlow™).

BEST PRACTICES

The following reminders can help prevent common mistakes even the best trainers may make.

30 Minutes Before the Training

☐ Connect the Puritan Bennett™ 980 ventilator to AC power and connect/turn on the gas supplies.
☐ Attach the test lung and start ventilating using the mode and breath type most familiar to the trainees. Whenever possible, use the New Patient default settings. Verify no alarms are in violation and all latched alarms have been cleared.
☐ Make sure there are enough chairs for all attendees.
☐ Adjust lighting and chairs to ensure all attendees can see the Puritan Bennett™ 980 ventilator user interface and all visual aids.
☐ If using a projector, test it.
☐ Ask the facility’s training coordinator if there are any last-minute change requests.

Training Session

• Start on time! Your audience’s time is valuable and you want them to have a positive experience.
• Welcome trainees as they enter the room.
• Introduce yourself.
• Be enthusiastic, smile, and be approachable.
• Confirm who is attending the session. Are they monitors, programmers, or prescribers (covered in the Identifying Clinical Roles section that follows)?
• Confirm the patient population the trainees treat, their familiarity with Puritan Bennett™ ventilators, their experience with using different features and breath types, and their preferred mode and breath type.
• Make any necessary adjustments to the lesson plan.
• Ask if the trainees have any questions related to the pre-training reading.
• Ask if the trainees have specific learning goals for the training session. If they do, make note of them and make sure to cover them.
• Review the session agenda with the trainees.
• Hand out training materials.
• Instruct the trainees to use the touch screen handout during training.
• Proceed with the lesson plan designed to meet the needs of the group.
• Make sure to include time for trainees to have hands-on time with the Puritan Bennett™ 980 ventilator; have them practice setting different modes if time allows.
Wrapping Up the Training Session

- Ask the trainees what they found most useful about the training session.
- Ask the trainees if they have any questions.
- Thank trainees for their time.
- Make sure each trainee has the appropriate training materials.
- Hand out the evaluation form and have the trainees fill it out. Collect the forms.

Training for a Diverse Clinical Audience

Depending on the facility, you may be working with trainees from more than one clinical role. It is best to schedule different training sessions for each role that needs training. This will enable you to do a better job of meeting the unique needs of the trainees. If you must train individuals with different roles in the same session, programmers and prescribers may be trained together.
IDENTIFYING CLINICAL ROLES

Training Monitors (Nurses)

Monitors view patient data, suction patients, and respond to alarms. They are not likely to manage ventilator settings other than $O_2\%$. Monitor training should focus on helping monitors find the information they need for charting, helping them to know what steps to take to prepare the ventilator for suctioning a patient, and helping them understand the ventilator’s key alarm functions. The Basic Lesson Plan for Monitors covers all typical functions monitors perform. There is rarely a need to cover any of the Clinical Application Lesson Plans. Do so only if requested.

Training Programmers (Nurses, Respiratory Therapists [RTs] and Physicians)

Programmers manage daily patient care on the ventilator. This includes but is not limited to setup, adjustment, and reprocessing between patients. The Basic Lesson Plan for Programmers covers all of the typical functions programmers perform except reprocessing. Before your training, find out how the programmers currently manage ventilators and teach them how to do the same functions on the Puritan Bennett™ 980 ventilator. This will help ensure that using the Puritan Bennett™ 980 ventilator will not cause a disruption in workflow. You will also need to train programmers on relevant sections of the Clinical Applications Lesson Plan.

Training Prescribers (Physicians, Physician’s Assistants, and Nurse Practitioners)

Typically, prescribers are most interested in knowing what the ventilator will do for their patients and what kind of patient information they can view, review, and download. The Basic Lesson Plan for Prescribers covers functions that are typical for prescribers to perform. In addition, be sure to train them on applicable sections of the Clinical Applications Lesson Plan modules. Do not spend time on ventilator setup unless requested to do so (some prescribers are also programmers).

Summary of Clinical Roles and Responsibilities

This chart summarizes the basic ventilation-related responsibilities of the monitor, programmer, and prescriber. There are some responsibilities that are listed more than once. They are often shared responsibilities. In the table below, the plus (+) sign indicates which clinical role needs a deeper level of information on shared responsibilities. Lesson plan contents reflect the level of understanding needed.
<table>
<thead>
<tr>
<th>MONITORING DATA AND ALARMS</th>
<th>SETUP AND PROGRAMMING</th>
<th>PRESCRIBING</th>
</tr>
</thead>
<tbody>
<tr>
<td>May be done by nurses</td>
<td>May be done by nurses, respiratory therapists (RTs), or physicians; technicians may perform reprocessing aspects of setup</td>
<td>May be done by physicians, physician’s assistants, or nurse practitioners, where permitted by law</td>
</tr>
<tr>
<td>• Reading displays</td>
<td>• Setting up the ventilator for a new patient</td>
<td>• Diagnosing a patient’s respiratory condition</td>
</tr>
<tr>
<td>• Charting data</td>
<td>• Cleaning the ventilator</td>
<td>• Applying respiratory ventilation theory to prescribe proper ventilator protocols</td>
</tr>
<tr>
<td>• Responding to alarms</td>
<td>• Changing filters and batteries</td>
<td>• Entering and adjusting A patient settings on the touch screen</td>
</tr>
<tr>
<td>• Adjusting O₂%</td>
<td>• Applying respiratory ventilation theory to prescribe proper ventilator protocols</td>
<td>• Interpreting live data</td>
</tr>
<tr>
<td>• Verifying physician orders</td>
<td>• Entering and adjusting patient settings on the touch screen</td>
<td>• Reviewing logged data</td>
</tr>
<tr>
<td></td>
<td>• Interpreting live data</td>
<td>• Reading displays+</td>
</tr>
<tr>
<td></td>
<td>• Reviewing logged data</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>• Responding to alarms+</td>
<td></td>
</tr>
</tbody>
</table>
Planning for training is a useful preparation technique. This section includes a checklist as well as several examples of how to translate the checklist into a training lesson plan. Answer the questions in the planning for training checklist, review the examples that follow and then select the training assets and basic and clinical lesson plan components you will need for a particular group of trainees. In all cases, you will begin with the basic monitor, programmer, or prescriber lesson plan. Then you will add clinical application lesson plan components as needed, according to what you have discovered through use of the planning for training checklist.

Breath type/feature questions use Puritan Bennett™ ventilator product terminology but apply to comparable functions on other manufacturers’ products.
PLANNING FOR TRAINING

PLANNING FOR TRAINING CHECKLIST

**Type of training?**
- [ ] Evaluation training (trying the product)
- [ ] Installation training (own the product)
- [ ] Follow-up training (own the product)

**Who is the audience? (Insert number of all roles who will attend. When possible, do not mix monitors with programmers or prescribers.)**
- [ ] Monitors
- [ ] Programmers
- [ ] Prescribers
- [ ] Other (specify) __________

**What kinds of patients do they ventilate? (Check all that apply)**
- [ ] Neonatal
- [ ] Pediatric
- [ ] Adult

**Will you provide food and drink?**
- [ ] Yes. What kind?
  __________
- [ ] No

**Indicate if your audience has ever used any of these Puritan Bennett™ ventilators.**
- [ ] Puritan Bennett™ 7200 ventilator
- [ ] Puritan Bennett™ 840 ventilator
- [ ] Puritan Bennett™ 980 ventilator

Remember: Preparation is key.
Which breath types/features have the trainees used?

☐ VC+  ☐ VS  ☐ BiLevel Mode  ☐ TC  ☐ PAV™+ software  ☐ Leak Comp
☐ Respiratory mechanics  ☐ Trending  ☐ NeoMode 2.0 software  ☐ Proximal flow sensor

Which modes and breath types are these trainees typically using?
(Check all that apply)

☐ AC VC  ☐ AC PC  ☐ VC+
☐ SIMV VC  ☐ SIMV PC  ☐ BiLevel Mode  ☐ APRV
☐ VS  ☐ PS  ☐ TC  ☐ PAV™+ software  ☐ Nasal CPAP

Has the Puritan Bennett™ 980 ventilator passed SST while equipped with the filters and breathing circuit that match the trainee’s typical patient type? Is it now equipped with that same setup plus an appropriately sized test lung and at least one battery?

☐ Yes  ☐ No. If no, take action to address.

Are there air and oxygen gas supplies in the training area?

☐ Yes  ☐ No. If no, an external compressor is needed.

Is there power near the ventilator setup location?

☐ Yes  ☐ No. If no, a power strip and/or extension cord is needed.

Is AV equipment available?

☐ Yes  ☐ No  ☐ Not sure

Which assets do the trainees already have?

☐ Pre-training reading
☐ Quick reference guide
☐ Touch screen handout
☐ Training evaluation
☐ Practice exercises

Have any concerns been expressed that you need to address?

☐ No
☐ Yes. If yes, please describe the concerns.
PLANNING FOR TRAINING
Which aspects of the lesson plan should you cover?

**Basic Lesson Plan**
- Monitor (nurses)
- Programmer (respiratory therapists/nurses)
- Prescriber (physicians)

**Clinical Applications Lesson Plan**
- Leak Sync software
- NIV
- Volume Control Plus (VC+)
- Pressure Control (PC)
- BiLevel Mode
- Pressure Support (PS)
- PAV™++ software
- Tube Compensation (TC)
- Volume Support (VS)
- NeoMode 2.0 (included with all Puritan Bennett™ 980 neonatal ventilators)
- Proximal flow sensor

Which assets will you use during the meeting?
- Lesson plans
- Skills checklists
- Slide presentation
- Touch screen handout

Which assets will you leave with the trainees after the training?
- Entire training kit
  or
- Pre-training reading
- Touch screen handout
- Training evaluation
- Practice exercises
- Quick reference guide

*Training tip: If your trainees have never used the Puritan Bennett™ 980 ventilator, they may be accustomed to different ventilator terminology than what is used on Puritan Bennett™ products. Be sure to take the time to explain terms when describing key modes and features.*
Look for the icons listed in each lesson plan.

Helpful icons are used throughout the Sample Lesson Plans to show what is expected of you for each particular item listed.
LESSON PLANS

This section contains basic lesson plans that are individualized for monitors, programmers, and prescribers followed by universally applicable clinical application lesson plans that cover key ventilator features. Content supporting the lesson plans is contained within the PowerPoint slides.

At the onset of each training session, be sure to point out where important ventilator functions are located. This will orient the trainees to the layout of the user interface in preparation for learning how to use it. To help you explain how to use key features of the Puritan Bennett™ 980 ventilator, it is important to show how the ventilator works and give your trainees the opportunity to work with it. You will need to demonstrate the ventilator’s key features and allow trainees to practice various functions. Be sure you highlight the potential benefit of each feature.

WHAT THE ICONS MEAN

**POINT OUT ICON**
Indicates the need to point out something so trainees know where it is found on the ventilator. Do not go into details or demo the feature at this time.

**EXPLAIN ICON**
Indicates a need to explain in detail.

**DEMO ICON**
Indicates a need to demonstrate how to use something.

**PRACTICE ICON**
Indicates a need to have trainees practice something.

**BENEFIT ICON**
Indicates a potential benefit that should be highlighted.
Overview, Geography, and Navigation for Monitors

Briefly describe the use and application for the Puritan Bennett™ 980 ventilator

Start with the ventilator already powered on and ventilating a test lung

Point out the location of the different control and monitoring areas of the user interface

- Breath delivery unit
  - On/Off switch
  - Communication ports
  - Inspiratory and expiratory filters
  - Hot-swappable batteries
  - Fan
- User interface
  - Touch screen
    - Vital patient data banner on top
    - Additional patient data display
    - Large-font data display
    - Left Menu tab
    - Graphics
    - Ventilator setup along lower left
    - Constant access icons
  - Bezel control keys
  - Adjustment knob

Show how to navigate the touch screen

- “Touch, turn, accept” is used as mnemonic device for setting and alarm changes
- Tap or swipe a tab to view more information
- Double tap to open, close, and change displayed patient data parameter

Show how to reposition the user interface

- For easier viewing

The following basic lesson plan is intended for monitors (e.g., nurses). The typical duration of a training session for monitors is approximately 15 to 20 minutes.
Power and Batteries for Monitors

Point out On/Off switch and note the benefit of the switch cover and the reconfirmation needed for shutdown

Point out where to look and describe how to know if AC is connected

Demonstrate how to view the battery charge level when external power is lost

Test battery charge level before it is inserted into the ventilator

Alarms for Monitors

Demonstrate the three ways to access the alarm settings

Demonstrate and discuss the audible and visual annunciation of low-, medium-, and high-priority alarms
### Demonstrate how to:

- Check which alarm has been violated
- Verify the alarm type
- Check for recommended solutions
- Use the alarm hot link or alarm icon to see high and low settings as well as current patient value
- Silence an alarm
- Reset an alarm
- Review the previous alarms (alarm log)

### Point out and describe how the alarm color changes (green and yellow) on the top of touch screen when an alarm is resolved

- Shows the ventilator is operating normally but an alarm has been violated

### If time allows, have trainees practice silencing, resetting, and checking alarms

### Settings for Monitors

**Point out how to find the following ventilation settings buttons:**

- Mode of ventilation
- Breath types for mandatory and spontaneous breathing
- Rate
- Tidal volume or pressure
- Flow or inspiratory time, I:E ratio, and expiratory time
- Pressure support
- PEEP
- Trigger type
- O₂ %

**Show how to adjust O₂ %**

- Use both the set O₂ % control and the Elevate O₂ icon
Explain how to use stand-by state

- Touch **Menu** tab on the left side of the touch screen. The menu appears.
- Touch **Stand-By** button. A stand-by state pending dialog appears instructing the clinician to disconnect the patient circuit. A timer starts that allows 30 seconds to disconnect the patient.
- Disconnect the patient circuit and confirm the disconnection by touching **Confirm** button. A timer starts that allows 30 seconds for confirmation of disconnect.
- Don’t block the wye or the ventilator will exit stand-by.
- To exit stand-by, reconnect patient circuit to patient airway.

Point out what happens during stand-by state

- 10 L/min through patient circuit
- O₂, 100% for adult and pediatric circuit types
- O₂, 40% for neonatal circuit types

Patient Data Monitoring for Monitors

Point out how to find monitored values for:

- Peak pressure
- PEEP
- Tidal volume mandatory/spontaneous
- Respiratory rate (fTOT)
- O₂%
- Is the patient triggering?

Help for Monitors

Show how to use the help feature (ToolTips)

- Either touch and hold an item for 0.5 seconds or drag the question mark Help icon to the item
- A glowing blue outline indicates availability of ToolTips
- Touch **More** to see additional help

Describe use of the SolvIT Center Training Content at medtronic.com/covidien/support

- The SolvIT Center provides answers to frequently asked questions about the ventilator system and other Puritan Bennett™ ventilator products 24 hours a day, 7 days a week

Point out how to contact the local Medtronic sales representative or clinical specialist

- Contact your local sales representative or clinical specialist
**Benefits of the Puritan Bennett™ 980 Ventilator for Monitors**

### SAFETY

| Discuss the benefits of the ventilation assurance feature | • This is a safety net feature  
| | • Provides backup ventilation to ensure continued ventilation if the background diagnostics detect a problem with certain components in the gas mix or inspiratory or expiratory subsystem. |
| Discuss the benefits of the status display | • Always visible, even if the main touch screen is unavailable  
| | • Indicates the presence of backup ventilation or the safety valve open state with no ventilation  
| | • Shows visual indication of patient pressures, PEEP, and P_{PEAK} alarm setting  
| | • Shows alarm volume level  
| | • Shows battery charge status  
| | • Identifies power source  
| | • Shows gas connection status |
| Discuss the benefits of stand-by | • Confirm before planned disconnect  
| | • Stops fluid spray from circuit during disconnect  
| | • Shows confirmed *Stand-By State* on screen  
| | • Automatically resumes ventilation when patient is reconnected |
| Explain and discuss the benefits of the Puritan Bennett™ 980 ventilator filtration | • High filter ratings/heated expiratory filter  
| | • Helps provide protection from cross-contamination of pathogens |

### IMPROVING PATIENT COMFORT

| Explain and discuss some general benefits of Puritan Bennett™ 980 ventilation options | • Adjustments/mode selection may help clinicians address synchrony, improve patient comfort, reduce patient sedation  
| | • Adjustments/mode selection may help clinicians improve patient comfort  
| | • Adjustments/mode selection may help clinicians reduce sedation use |
| | These are all noted in the Clinical Application Lesson Plans |
Overview, Geography, and Navigation for Programmers

Briefly describe the use and application for the Puritan Bennett™ 980 ventilator

Start with the ventilator already powered on and ventilating a test lung. When appropriate, use the default settings for new patient in the patient category ventilated by trainees.

FINDING YOUR WAY AROUND

Point out the location of the different control and monitoring areas of the user interface

- Breath delivery unit
  - On/Off switch
  - Communication ports
  - Inspiratory and expiratory filters
  - Hot-swappable batteries
  - Fan
- User interface
  - Touch screen
    - Patient data banner on top
    - Additional patient data display
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    - Left Menu tab
    - Graphics
    - Ventilator setup along lower left
    - Constant access icons
- Bezel control keys
- Adjustment knob

Show how to reposition the user interface

- For easier viewing

The following basic lesson plan is intended for programmers (e.g., nurses and respiratory therapists). The typical duration of a training session for programmers is approximately 60 minutes.
## TOUCH SCREEN

**Show how to navigate the touch screen**
- “Touch, turn, accept” as mnemonic device for setting and alarm changes
- Navigational gestures

## Setting Up the Puritan Bennett™ 980 Ventilator Pre-Use for Programmers

### FILTERS/FILTRATION

**Demonstrate how to attach the filters and explain the purpose of filters**
- Inspiratory vs. expiratory filters: locations and differences
- Purpose of inspiratory filters: one inside, one outside
- Purpose of expiratory filter drain bag
- Disposable vs. reusable filters*
- Required filter and filter door setup for neonatal patients
- Show how to change filters

**Have trainees practice changing filters**

### HUMIDIFIER

**Describe how to attach/set up a humidifier**
- Accommodates Hudson RCI™* and Fisher & Paykel humidifiers
- Circuit type and chamber volume are set during SST
- The humidifier volume setting entered during SST should always be equal to the chamber’s empty compressible volume. Fisher & Paykel™* and Teleflex (Hudson RCI™* humidifier) chamber volumes are listed in the operator’s manual.

### BREATHING CIRCUIT

**Describe how to attach the patient breathing circuit**
- Circuit type and predicted body weight (PBW; displayed in lb or kg) provide the basis for new patient values and absolute limits on various ventilator settings such as tidal volume ($V_T$) and peak flow ($V_{MAX}$)
- Run SST in order to change the circuit type (circuit inner diameter)
- Describe PBW guidelines for circuit selection (from operating manual)
- Circuit type maximum peak flow ($V_{MAX}$)
  - Neonatal 30 L/min
  - Pediatric 60 L/min
  - Adult 150 L/min

* Only disposable inspiratory and expiratory filters may be used in the United States.
PROXIMAL FLOW SENSOR (REQUIRES PROXIMAL FLOW OPTION AND NEOMODE 2.0 OPTION)

Cover this only if the trainees ventilate neonates and have proximal flow and NeoMode 2.0 software option installed.

Demonstrate how and describe when to attach the proximal flow sensor

- The proximal flow sensor is installed at the patient circuit wye
- The other end of the sensor connects to a keyed pneumatic connector on the ventilator’s front panel behind a clear blue door
- Install during SST (according to prompts)
- Door helps protect connector from getting wet
- Measures flow, volume and pressure at the patient wye; does not control flow, volume or pressure
- Intended for neonatal invasive ventilation
- Details are covered in clinical applications

Demonstrate how monitored data changes when the proximal flow sensor is enabled/disabled

To disable or enable the proximal flow option:
1. In the constant access icons area, touch the configuration wrench icon
2. Touch Options tab
3. Touch Prox tab
4. Touch Enabled or Disabled button

When the Prox Flow option is enabled, the Puritan Bennett™ 980 ventilator displays the standard monitored volume values and also the values that are measured with the proximal flow sensor. You can tell the difference between the two sets of values because the values measured at the wye by the proximal flow sensor are indicated with a Y.

EXHALATION VALVE ASSEMBLY (EVQ)

Describe the EVQ and demonstrate how it is changed

- Contains the expiratory port, expiratory flow sensor, exhalation valve diaphragm, expiratory filter seal, and pressure sensor filter
- Disinfection is not required on a routine basis (In the U.S. the EVQ has to be cleaned in between patients.)
- Can be cleaned and disinfected if a high-risk communicable contamination occurs
- Expected service life is 100 disinfection cycles
Power On and Short Self Test (SST) for Programmers

Demonstrate and explain how to turn the ventilator on and off correctly
- Power the ventilator off and on
- During power up, no cap or test lung on the patient connection of the circuit

Demonstrate how and explain when to perform all SST tests or just an SST leak test
- SST is available at power on before selecting New or Same Patient and starting ventilation. SST impacts accuracy of breath delivery and spirometry.
- You must run all SST tests when setting up a new patient, changing patient circuit, circuit accessories, or size, or installing the proximal flow sensor (neonatal application with NeoMode 2.0 software installed).
- For optimal breath delivery, you should also run SST after changing humidification type/chamber volume.
- Humidification type/chamber volume can be adjusted after running SST. However, when this is done the ventilator makes estimations about (rather than measuring) circuit system resistance and compliance. These estimated values are used in breath delivery management.
- You may perform an SST leak test in place of all tests when in need of testing an existing circuit for a possible leak.
- When running all SST tests:
  - Ensure a patient is not connected to the ventilator.
  - Select patient circuit type and humidification.
  - Amber colored prompts instruct operator on the steps to run each test. Continue to follow the current prompt instruction until prompted otherwise. For example, after the message to block the wye is given, keep it occluded through the tests until the screen advises otherwise.
  - Repeat a test if there is a failure.
  - Evaluate and decide whether to override an alert and authorize ventilation. An alert indicates one or more noncritical faults have been detected.
  - If SST passes, touch Patient Setup button to exit SST.
  - Select New Patient or Same Patient.
  - After selecting or verifying settings, touch Quick Start, Accept All or Start to begin ventilation.
  - Touch Confirm.
  - Don’t connect patient before Puritan Bennett™ 980 ventilator is ready for the patient or safety PCV will start (this is not BUV).
Patient Setup for Programmers

Show how to set up a new patient

- Select the following:
  - Gender and height or PBW
  - Ventilation type (INV/NIV)
  - Mode
  - Mandatory type
  - Spontaneous type
  - Trigger type
  - Primary settings (describe hard and soft bounds while showing selection of settings)
    - For example:
      - f (frequency)
      - V\text{t} (tidal volume)
      - Pressure
      - O\text{2} %
      - PEEP
      - Adjunct settings (i.e., rise time %, etc.)
  - Select Start
  - Patient connect confirmation screen will appear
  - Select Confirm or connect the patient if prepared to continue

Explain Quick Start

- Enter height and gender or PBW; touch Quick Start
- Connect patient

Show how to set up same patient

- Ventilator automatically returns to settings in place at time of power down
Making Settings Changes after Initial Setup for Programmers

Show how to enable and disable the proximal flow sensor
- Enable and disable the proximal flow sensor in the Options tab
- Describe how the proximal flow sensor affects monitoring with Leak Sync enabled and disabled

Show how to make ventilation, alarm, and vent setup settings adjustments
- Show where settings changes can be made (Left Menu tab, Vent Setup key and parameters in the bottom margin of the touchscreen)
- Simple “touch, turn, accept”
- Demonstrate batch changes
- Correct an inaccurate height, weight, gender, or humidifier approach

If time allows, have trainees practice making initial and post-setup setup changes

Alarms for Programmers

Demonstrate where to find alarm settings
- Touch the alarm icon in the constant access icons area.
- Create an alarm condition*
- Touch the hot link on the alarm violation message banner
- Swipe the Menu tab and open the settings menu to access the alarm screen

Demonstrate and discuss how to use apnea interval/apnea ventilation
- Apnea timer resets with every breath
- Apnea alarm causes apnea backup
  - Current apnea ventilation settings are displayed
  - Non-apnea ventilation settings may be changed during apnea backup
  - Reset by touching alarm reset key or when the patient triggers two consecutive inspirations and the exhaled volume is equal to or greater than 50% of the delivered volume
  - Apnea ventilation setting for inspiratory pressure or tidal volume is also used for manual inflations; it is displayed in the Vent Setup button.

*Note: You will not get an alarm violation banner unless you create an alarm. You cannot demonstrate the hot link without the active alarm.
Demonstrate and discuss the audible and visual aspects of low-, medium-, and high-priority alarms

- In VC, turn down the tidal volume; in PC, turn down the inspiratory pressure (P_I) to violate the mandatory \( \pm V_{TE} \) alarm
- Demonstrate low-, medium-, and high-priority alarms (2 breaths [low priority], 4 breaths [medium priority], and 10 breaths [high-priority])
- Three tiers of priority/three sounds
- Alarm volume escalates to maximum value if high-priority alarm is not acknowledged within 60 seconds
- Visual indicators are in several places
  - On top of touch screen
  - On alarm banners
  - On alarm settings screen
  - On status display if applicable

Demonstrate how to:

- Check to see which alarm has been violated
- Verify the alarm type
- Check for recommended solutions
- Use the alarm hot link or alarm icon to see high and low settings as well as current patient value
- Silence an alarm
- Reset an alarm
- Review the previous alarms (alarm log)

Point out and describe how the alarm indicator color changes (green and yellow) on the top of the touch screen when an alarm is resolved

- Shows the ventilator is operating normally but an alarm has been violated

If time allows, have trainees practice silencing, resetting, and checking alarms
Patient Data and Data Monitoring for Programmers

Show how to view/customize data display
- Double tap a data cell to customize the data displayed
- Swipe to the left/right or tap left/right arrow to show the rest of the vital patient data
- Tap or swipe a tab down to view more data
- Tap or swipe second tab to see large-font display
- Use the waveform layout icon to access alternate screen configurations for:
  - Graphs
  - Patient data
  - Large font
- Find a historical record of patient data via the clipboard icon

If using the proximal flow sensor option, demonstrate how the monitored values change with it enabled and disabled if there is a leak and Leak Sync software is on
- To enable/disable the proximal flow option:
  1. In the constant access icons area, touch the configuration/wrench icon
  2. Touch Options tab
  3. Touch Prox tab
  4. Touch Enabled or Disabled button

Data values including the letter Y are measured with the proximal flow sensor
- Peak pressure
- PEEP
- Tidal volume mandatory/spontaneous
- Respiratory rate ($f_{TOT}$)
- $O_2$ %

Graphics for Programmers

Explain the color coding on the graphics
- Inspiratory portion of a mandatory breath is green
- Inspiratory portion of a spontaneous breath is orange
- Exhalation is always yellow
- Insp/exp pause events are white
- Proximal flow sensor purges and insp/exp pause events are white

Show how to adjust the scale of a graphic
- Use the touch screen to select and drag
- Select and turn the adjustment knob

Show how to change the graphic view
- Use waveform layout icon to:
  - Change what is being graphed
  - View multiple graphs at once
Show how to use pause icon to stop plotting
- Touch pause icon
- When paused, numerical data will continue to update

Show how to use cursor to identify relevant numeric values for the intersecting points of the cursor and waveform or loop
- Touch and sweep the graph to the left
- Select and turn the adjustment knob

Show how to go back in time by “grabbing” the graph
- Touch pause icon

Show how to resume plotting by selecting pause icon again
- Touch and sweep the graph to the left
- Select and turn the adjustment knob

Show how to maximize/reduce the viewable area of a waveform
- Use the double-tap gesture, touch arrow, or swipe upward/downward anywhere on the waveform

Discuss and demonstrate how to capture a screen and transfer to a USB drive
- Use camera icon
- Capturing an image during a pause will cause a graph and numerical patient data values to become nonaligned
- Go to Menu tab (left margin of screen) and touch Screen Capture for access to download through USB port
**Menu Tab for Programmers**

**Demonstrate how to access Menu tab selections**
- Access setup, respiratory mechanics, stand-by, and screen capture
- Touch **Setup** button to view the vent, apnea, alarms, and more settings tabs
- Another way to access mode changes

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**More Settings for Programmers**

**Demonstrate how to access More Settings and explain how to use them**
- Setup **More Settings**:
  - Leak Sync: enabled/disabled
  - O₂ sensor: enabled/disabled/calibrate
  - Humidification type: heated exp tube/non-heated exp tube/HME
- More vent settings
  - D<sub>sens</sub>

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**Stand-By for Programmers**

**Demonstrate and explain how to use stand-by state**
- Touch **Menu** tab on the left side of the touch screen; the menu appears
- Touch **Stand-by** button. A stand-by state pending dialog appears instructing the clinician to disconnect the patient circuit, and a timer starts that allows 30 seconds to disconnect the patient
- Disconnect the patient circuit and confirm the disconnection by touching **Confirm** button; a timer starts that allows 30 seconds for confirmation of disconnect
- Do not block the wye or the ventilator will exit stand-by
- To exit stand-by, reconnect patient circuit to patient airway

**Explain what happens during stand-by**
- 10 L/min through circuit
- O₂ 100% for adult and pediatric circuit types
- O₂ 40% for neonatal circuit type
Respiratory Mechanics for Programmers

Demonstrate how to perform these pulmonary mechanics functions

- Inspiratory pause
  - Menu tab: respiratory mechanics or bezel key; two ways to do it
  - Touch and hold to do it manually
  - Touch and release for automatic function

- Expiratory pause
  - Menu tab: respiratory mechanics or bezel key; two ways to do it
  - Touch and hold to do it manually
  - Touch and release for automatic function

- Vital capacity

- $P_{0.1}$ (occlusion pressure)
  - Menu tab: respiratory mechanics
  - Touch and release for automatic function

- NIF (negative inspiratory force)
  - Menu tab: respiratory mechanics
  - Touch and hold to do it manually (this may be a coached maneuver)
Additional Icons/Keys/Buttons for Programmers

Discuss the importance and applications of all icons, keys, and buttons not yet fully described

- Vent setup
  - Vent settings
- Yellow triangle
  - View unread items
- Configuration/wrench icon
  - SST results
  - Comm Setup
  - Date/Time Change
- View which options are installed
  - PAV™+ software
  - BiLevel 2.0 Mode
  - Leak Sync software
  - NeoMode 2.0 software
  - Proximal flow sensing option
- Note that respiratory mechanics and tube compensation are standard
- Clipboard/logs icon
  - View logs
    - Alarms, settings, patient data, EST/SST status, general event, and service
- Breath phase indicator
  - Type of breath (assist (A), control (C), or spontaneous (S)) currently being delivered to the patient
  - Whether the ventilator is in the inspiratory or expiratory phase
  - During inspiration, assist (A) and control (C) breath indicators glow green and spontaneous (S) breath indicators glow orange
- Patient circuit indicator
  - Adult, pediatric, or neonatal
  - Note this is selected during SST
- Screen opacity
  - Use adjustment knob to view graphs in background
- Push pin
  - Keeps the current window open
  - Unpin or touch home icon to reverse action

Have trainees point out how to identify whether or not a breath was patient triggered and whether it was a mandatory or spontaneous breath

- Breath type indicator
- Waveform colors
Bezel Keys for Programmers

Discuss the purpose and demonstrate use of the following keys:

- Screen brightness (also a configurable preset)
- Display lock
- Alarm volume (also a configurable preset)
- Manual inspiration
- Respiratory mechanics: inspiratory pause (see above)
- Respiratory mechanics: expiratory pause (see above)
- Alarm reset
- Alarm silence

Ventilation/Safety Assurance Systems for Programmers

Discuss the benefits of backup ventilation

- This is a safety net feature
- Provides continued ventilation if the background diagnostics detect a problem with certain components in the gas mix or inspiratory or expiratory subsystems

Discuss the benefits of the status display

- Shows:
  - Power source
  - Safety valve open/vent inop and other critical high-priority device and battery alarms
  - Battery information
  - Patient circuit type
  - Relative available battery charge level
  - Pressure graph, $P_{PEAK}$ alarm setting, and current $P_{PEAK}$ and PEEP values
  - Air/O$_2$ source information
  - Ventilator operational hours
  - Alarm volume setting
  - EST, SST, and POST results (prior to patient connection)
- Always visible, even if touch screen is unavailable
Discuss the benefits of stand-by

- Reconfirm for disconnect
- Screens show **Stand-By State Active** and also show the elapsed time for disconnect
- Stop spray from circuit during disconnect
- Ventilation resumes automatically when patient is reconnected

Explain and discuss the benefits of filtering

- Three filters (two inspiratory/one expiratory)
- High filter ratings/heated expiratory filtration system
- Protection from cross-contamination of pathogens
- Review Heated Expiratory Filtration: Lessons from the SARS Experience

Help for Programmers

Show how to use the help features (ToolTips)

- Either touch and hold an item for 0.5 seconds, or drag the question mark help icon to an item; a glowing blue outline indicates availability of ToolTips
- Touch More to see additional help

Describe use of the SolvIT Center Training Content at medtronic.com/covidien/support

- The SolvIT Center provides answers to frequently asked questions about the ventilator system and other Puritan Bennett™ products 24 hours a day, 7 days a week

Point out how to contact the local Medtronic sales representative or clinical specialist

- Contact your local sales representative or clinical specialist
Optional: NeoMode 2.0 software (included with all Puritan Bennett™ 980 neonatal ventilators and Puritan Bennett™ 980 universal ventilators, other ventilators require NeoMode 2.0 software)

- Describe and point out how to set up NeoMode 2.0 software
- Explain how the NeoMode 2.0 software works
- Describe the specific NeoMode 2.0 software alarm strategy
- Describe when NeoMode 2.0 software is to be applied as well as limitations and contraindications

Optional: Proximal flow sensor

- Describe the potential clinical benefits of using the proximal flow sensor
- Describe and point out how to set up proximal flow sensor with NeoMode 2.0 software
- Explain how the neonatal proximal flow sensor works
- Describe the specific proximal flow sensor alarm strategy
- Describe when the proximal flow sensor is to be applied as well as limitations and contraindications
BASIC LESSON PLAN FOR PRESCRIBERS

Short segment basic lesson plans for Prescribers (Physicians, Physician’s Assistants, and Nurse Practitioners)

Prescribers may not be available for 60-minute training sessions. It is often necessary to provide training in shorter segments. Ensure the training is specifically geared to their specialty of care.

Nearly all prescribers will benefit from short segment basic lesson plans that familiarize them with the user interface, monitored data, graphic data, and location/capabilities of respiratory mechanics maneuvers. This will help them understand the basic workings of the Puritan Bennett™ 980 ventilator and know where to find the data they need for making decisions about ventilation. These parts of the lesson plan are included in this section.

In addition, add appropriate selections from the clinical applications lesson plan modules, focusing on those that are most applicable to the prescriber’s specialty of care (neonates, pediatric, adults). The planning for training exercise will help you identify which sections of the clinical applications lesson plan you might want to focus on. In addition, add any content that is requested by prescribers.

Those who care for children and adults may benefit from learning about Leak Sync, NIV, and PAV™+ software. Those who care for neonates may benefit most from learning about Leak Sync software, NIV, and NeoMode 2.0 software and use of the proximal flow sensor option. Follow the examples in the planning for training section to help you choose the applicable clinical application lesson plans to cover.

These short segment basic lesson plans purposely omit setup and alarm information. There is no need to cover it unless the prescriber requests it.
## Overview, Geography, and Navigation for Prescribers

**Briefly describe the use and application for the ventilator**
Start with the ventilator already powered on and ventilating a test lung

### FINDING YOUR WAY AROUND

**Show how to access the different areas of the user interface**
- Breath delivery unit
  - On/Off switch
  - Communication ports
  - Inspiratory and expiratory filters
  - Hot-swappable batteries
  - Fan
- User interface
  - Touch screen
    - Patient data banner on top
    - Additional patient data display
    - Large-font data display
    - Left Menu tab
    - Graphics
    - Ventilator setup along lower left
    - Constant access icons
  - Bezel control keys
  - Adjustment knob

**Show how to reposition the user interface**
- For easier viewing

### Using the Touch Screen for Prescribers

**Show how to navigate the touch screen**
- “Touch, turn, accept” as mnemonic device for setting and alarm changes
- Swipe a tab to view more information
- Tap
- Double tap

**Point out and describe the constant access icons**
- Lower right-hand side of touch screen
- Available at all times
Point out and describe the purpose of the yellow triangle
- Indicates the need to view, adjust, or check something

Bezel Keys for Prescribers
Discuss the purpose and demonstrate use of the following keys:
- Manual inspiration
- Respiratory mechanics: inspiratory pause
- Respiratory mechanics: expiratory pause
- Alarm reset
- Alarm silence

Viewing Patient Data for Prescribers
Show how to view/customize data displays
- Double tap a data cell to customize the data displayed
- Swipe to the left/right or tap left/right arrow to show the rest of the vital patient data
- Tap or swipe a tab down to view more data
- Tap or swipe second tab to see large-font display
- Use waveform layout icon to access alternate screen configurations for:
  - Waveforms
  - Patient data
- Find a historical record of patient data via clipboard icon
### Using Graphics for Prescribers

<table>
<thead>
<tr>
<th>Task</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show how to change the graphic view</td>
<td>• Use waveform layout icon to:</td>
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<tr>
<td></td>
<td>– Change what is being graphed</td>
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<tr>
<td></td>
<td>– View multiple graphs at once</td>
</tr>
<tr>
<td>Show how to adjust the scale of a graphic</td>
<td>• Use the touch screen; touch and drag</td>
</tr>
<tr>
<td></td>
<td>• Select and turn the adjustment knob</td>
</tr>
<tr>
<td>Show how to use the pause icon to stop plotting</td>
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</tr>
<tr>
<td>Show how to go back in time by “grabbing” the graph</td>
<td>• Touch and drag to the left</td>
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<td>Show how to resume plotting by selecting the pause icon again</td>
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</tr>
<tr>
<td>Show how to maximize/reduce the viewable area of a waveform</td>
<td>• Use the double-tap gesture or touch arrow</td>
</tr>
<tr>
<td>Discuss and demonstrate how to capture a screen and transfer to a</td>
<td>• Use camera icon</td>
</tr>
<tr>
<td>USB drive</td>
<td>• Capturing an image during a pause will cause a graph and its numerical patient data values to become nonaligned</td>
</tr>
<tr>
<td></td>
<td>• Open Menu tab (left margin of screen) and touch Screen Capture for access to download through USB port</td>
</tr>
</tbody>
</table>
Describe the problems associated with leaks

Leaks come from:
• Patient interface
  – ETT (cuffed, deflated cuff, or cuffless)
  – Trach tube (cuffed, deflated cuff, or cuffless)
  – Mask or other external interface
• Breathing circuit system

Challenges related to leaks:
• Auto-triggering
• Late cycling-off of pressure support and volume support breaths
• Overestimation of delivered tidal volume/flow
• Possible need for frequent manual adjustments
• Inconsistent ventilatory delivery
• Unreliable lung function testing
• Inappropriate clinical assessment
• Increased work of breathing due to trigger asynchronies

Describe the solution: Leak Sync software

Puritan Bennett™ Leak Sync software may reduce leak-related ventilation and monitoring problems during both inspiration and exhalation:
• Inspiration — leak compensated volumes/flow measurements are used for breath management
• Exhalation — bias flow is adjusted to minimize a leak’s impact on triggering

The software:
• Reduces auto-triggering and delayed cycling
• Improves delivered tidal volume reliability
• Works in VC+ and VS

Describe Leak Sync software updates

• Name: “Leak Compensation” changed to “Leak Sync”
• VC+ and VS added
• Defaults to ON with NIV and neonatal
Describe potential benefits of Leak Sync software

- May reduce the need for manual adjustments of sensitivity settings
- Improves triggering and cycling
- Improves validity of patient data
- Allows for VC+ and VS
- Enables avoidance of nuisance alarms
- May provide reassurance of an appropriate level of ventilatory support

Describe and demonstrate how to set up Leak Sync software

- Menu tab/Setup/More Settings
- Enabled or disabled
  - Enabled by default with neonatal patient type and also when NIV is selected
- Set D\textsubscript{LS} in L/min

Describe and demonstrate display changes with Leak Sync software enabled

- LS on vent setup button
- D\textsubscript{LS} = L/min (not %)
- V\textsubscript{L} and V\textsubscript{T} = estimated patient values
- Graphic displays estimated lung flows
- Data displayed:
  - V\textsubscript{LEAK}
  - %LEAK
  - LEAK

Describe the performance achieved by Leak Sync software

Invasive ventilation:
- The Puritan Bennett™ 840 ventilator outperformed all other ventilators in a study by requiring fewer breaths to achieve synchronization during increasing and decreasing leaks.\textsuperscript{9}

Noninvasive ventilation:
- The study demonstrated wide variations between the ability of ventilators to compensate for an air leak during noninvasive ventilation.\textsuperscript{9}
- The Puritan Bennett™ 840 ventilator and the Philips Respironics V60™ ventilator were the only ventilators in this study that adapted well to increasing or decreasing leaks.\textsuperscript{9}

Explain and demonstrate how Leak Sync software works

- Defaults on: NIV or Neonatal
- Defaults off: INV/Pediatric or Adult
- Adjusts within ~3 breaths
- V\textsubscript{T} and V\textsubscript{L} compensated display
- Flow/volume graphics leak compensated
- Bias flow automatically adjusted
**Describe capabilities and limitations**

**Capabilities**
- Neonatal, pediatric, and adult invasive and noninvasive ventilation
- Dynamic compensation of leaks during invasive and noninvasive ventilation

**Limitations**
Not active with:
- Tube Compensation (TC)
- Proportional Assist™ ventilation plus (PAV™+ software)

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**Noninvasive Ventilation**

**Describe the problems associated with invasive/noninvasive approaches to ventilation**
- Invasive ventilation may lead to significant asynchrony
- Leaks may impact patient tolerance to NIV
- Leaks may result in monitoring errors, breath management issues, and trigger and cycle asynchrony

**Describe the solution: noninvasive ventilation with Leak Sync software**
- NIV ventilation selection
- Use with nonvented mask or other leak-prone patient interface
- Works with various modes/breath types
- Leak Sync software enabled

**Describe potential benefits of noninvasive ventilation with Leak Sync software**
- Help patients tolerate NIV so they can continue using NIV
- Help avoid complications associated with intubation/artificial airways

**Describe and demonstrate how to set up NIV**
- Menu tab/vent
- NIV
- Shows applicable setting
  - CPAP mode is available
  - Flow trigger
  - ŴTI S₉₀₀₉₀ limit
  - Dₙ₉₀₀ defaults to OFF

**Describe and demonstrate how NIV works**
- NIV-compatible selection of mode and breath types
- NEO CPAP is available
  - Volume alarms are disabled to reduce nuisance alarms
- Leak Sync software automatically enabled
### Describe capabilities and limitations

Only Flow Triggering is available.

**Capabilities**
- Stable respiratory drive
- Neonatal
- Pediatric
- Adult
- Nonvented mask; infant prongs; uncuffed/cuffless trach/ET

**Limitations**
Not available with:
- Tube Compensation (TC)
- BiLevel Mode
- VC+ and VS
- Proportional Assist™ ventilation plus (PAV™+ software) breath types

### Volume Control Plus Software

**Describe the problems associated with breath delivery with a fixed flow pattern (like volume control)**
- Discomfort and asynchrony

**Describe the solution: software**
- VC+ breaths deliver a patient-responsive, variable flow
- The ventilator manages inspiratory pressure to achieve the desired (leak compensated if Leak Sync software is enabled) tidal volume target

**Describe potential benefits of VC+**
- Unlike standard VC, VC+:
  - Provides variable flow delivery and volume
  - Uses the lowest pressure necessary for volume delivery
  - Escalates pressure if volume delivery decreases
  - Active valve accommodates breathing variations

**Describe and demonstrate how to set up VC+**
- Select:
  - Gender and height or predicted body weight (PBW)
  - Invasive vent type
  - AC or SIMV mode
  - VC+ mandatory breath type
  - Adjust all available settings
  - Set all appropriate alarms

**Explain and demonstrate how VC+ works (including the alarm strategy)**
- Variable flow with active exhalation valve
- Titration of pressure
- 1 to 3 cmH₂O/breath
- Alarm strategy
  - \( \overline{TPeak} \) limit (determines max target pressure)
  - \( \underline{TPeak} \) limit (alerts to decreases in pressure delivery below acceptable levels)
  - \( TV_{lim} \) limit
Explain and demonstrate inadequate V\textsubscript{T} delivery

- Check that T\textsubscript{I} is long enough (see inspiratory flow waveform)
- Check that Rise % is fast enough
- Check that the set tidal volume is not too high in comparison with the T\textsubscript{P\textsubscript{PEAK}} limit
  - Check for auto-PEEP causing \textsuperscript{†} volume delivery/ T\textsubscript{P\textsubscript{PEAK}} limit (see expiratory flow waveform) and resolve

Describe capabilities and limitations

**Capabilities**
- Neonatal, pediatric, and adult invasive ventilation
- Leak Sync software compatible (pressure is titrated based on patient volume (total delivered volume – leaked volume))

**Limitations**
- Invasive only
- High effort may result in regulating of pressure down to undesirable levels (see use of \textsuperscript{†}P\textsubscript{PEAK} alarm use above)
- VC+ with leaks/ without Leak Sync software enabled may result in regulating of pressure down to undesirable levels (see use of \textsuperscript{†}P\textsubscript{PEAK} alarm use above)

Pressure Control

Describe the problems associated with breath delivery with a fixed flow pattern (like volume control) or variable pressure (like VC+)

- Fixed flow patterns in VC may result in discomfort and asynchrony\textsuperscript{12}
- VC+ may deliver an inconsistent pressure

Describe the solution: pressure control software

- PC breaths deliver variable (patient responsive) flow and volume
- The inspiratory pressure target remains constant

Describe potential benefits of pressure control

- Unlike VC+:
  - Mean airway pressure may be more consistent
- Unlike volume control:
  - May allow more natural breathing with variable flow delivery
**Describe and demonstrate how to set up pressure control**

- Select:
  - Gender and height or predicted body weight (PBW)
  - Invasive vent type
  - AC or SIMV mode
  - PC mandatory breath type
- Adjust all available settings
- Set all appropriate alarms

**Describe and demonstrate how to use the timing padlocks**

- The user determines whether to set inspiratory time, I:E ratio, or expiratory time as the primary setting
- Changes in the preset rate will not alter the primary variable set in the timing padlocked area

**Explain and demonstrate how pressure control software works**

- Mandatory, assisted/controlled pressure (AC or SIMV) based breath
- INV or NIV
- The user sets inspiratory time, inspiratory pressure/PEEP, and pressure rise
- The ventilator manages flow to meet the patient’s needs and control pressure delivery

**Describe capabilities and limitations**

**Capabilities**
- Neonatal, pediatric, and adult invasive or noninvasive ventilation
- Leak Sync software compatible - \{monitoring of flow/volume = patient flow/volume (total delivered flow/volume – leaked flow/volume)\}

**Limitations**
- Tidal volume is variable

**Puritan Bennett™ BiLevel Software**

**Describe problems associated with volume control and pressure control breath delivery**

- The flow delivery and timing limitations of volume control may lead to additional sedation
- Inverse ratios and monitoring are limitations in traditional PCV

**Describe the solution: BiLevel software**

- Mandatory-assisted and spontaneous-assisted pressure based breath types
- Active valve
- Strategies for boosting mean airway pressure
- Normal I:E or extended inverse available (>4:1)
- Direct control of “release” time

**Describe Puritan Bennett™ BiLevel software updates**

- No “float” of T:E when I:E > 4:1
Describe potential benefits of BiLevel software

- Flow and volume variable
- Active valve
- Conventional or APRV style of breath timing
- Potential for improved oxygenation
- Potential for reduction in sedation

Describe and demonstrate how to set up BiLevel software

Select:
- Gender and height or predicted body weight (PBW)
- Invasive vent type
- BiLevel mode
- PC mandatory breath type

Adjust all available settings. Note:
- \( P_H \): Pressure during the \( T_H \) period; above ambient (not above PEEP); must be set at least 5 above \( P_L \)
- \( P_L \): Pressure during the \( T_L \) period; \( T_L \) (release time) no longer “floats”
- Spontaneous type: TC or PS
- Set all appropriate alarms

Describe and demonstrate how to set the timing padlocks to lock release time

User determines the primary setting. Options:
- \( T_H \) (Time High)
- \( T_H \) ratio to TL (Time High to Time Low ratio)
- \( T_L \) (Time Low)

Changes in set frequency will not alter the primary variable set in the timing padlocked area.

Explain and demonstrate how BiLevel software works

Similar to SIMV, BiLevel software combines mandatory-assisted and spontaneous-assisted breath types
- Conventional or APRV\(^{16}\) breath timing (not limited to 4:1)
- \( P_{HIGH} (P_H) \) is above ambient, not above PEEP
- Patient may breathe spontaneously at \( P_H \) and \( P_L \) receiving PS or TC
- Alarm strategy
- \( P_{PEAK} \) (peak pressure) may be 1 to 2 cmH\(_2\)O higher than set \( P_H \)

Explain and demonstrate BiLevel spontaneous support options

PS:
- Target pressure for all \( P_{SUPP} \) breaths = \( P_L + P_{SUPP} \), even during \( T_H \)
- PS is only delivered at \( P_H \), if \( P_L + P_{SUPP} > P_H \)
- \( P_{SUPP} \) may be set at 0
- Tube compensation
Describe capabilities and limitations

**Capabilities**
- Neonatal, pediatric, and adult invasive
- Conventional or APRV breath timing
- Support spontaneous breaths with PS or TC

**Limitations**
- Only invasive
- Limited respiratory mechanics

Puritan Bennett™ PAV™+ Software

**Describe the problems associated with ventilator controlled breath delivery**

- Atrophy of diaphragm fibers happens rapidly due to disuse.
  - A 53% to 57% decrease in fast-twitch and slow-twitch fibers respectively occurs in less than 3 days.\(^{17}\)
- Patient-ventilator asynchrony is prevalent.
  - 24% of mechanically ventilated patients exhibit patient-ventilator asynchrony in >10% of their respiratory efforts.\(^{18}\)
  - Asynchrony is associated with 18 extra days on the ventilator.\(^{19}\)
  - Asynchrony may lead to increased use of sedation.\(^{12}\)
  - Prolonged ventilation time may lead to muscle atrophy\(^{17}\) and VAP.\(^{19}\)
- Cost
  - The average cost per day in the ICU for a patient receiving mechanical ventilation is $4,000.\(^{20}\)

**Describe the solution: PAV™+ software**

- Monitors patient’s demand breath by breath
- Monitors compliance and resistance
- Allows variable volume, flow, inspiratory time, and pressure
- Promotes natural breathing

**Describe potential benefits of PAV™+ software**

- Encourages use of the diaphragm
- Increases support as the patient’s demand increases
- Improves patient-ventilator synchrony\(^{21}\)
- May help the clinician better manage a patient’s work of breathing

**Describe and demonstrate how to set up PAV™+ software**

- Select:
  - Gender and height or predicted body weight (PBW > 25 kg)
  - Invasive vent type
  - SPONT mode
  - PAV™+ software spontaneous breath type
  - % Support
  - Tube type
  - Tube ID (6-10 mm ID)
- Adjust the alarms
Describe and demonstrate key PAV™*+ alarms

- T\(^{PEAK}\)
- TV\(_{E}\) limit
- TV\(_{E}\) and TV\(_{F}\)
- TV\(_{IT}\) and TV\(_{IT}\)

Describe PAV™* to PAV+ software description
- Default support starts at 70% Support
- Three graphs and work of breathing (WOB) bar
- Enhanced calculation of compliance and resistance

Explain and demonstrate how PAV™*+ software works: measurements
- Measures values that create work
  - Assesses compliance and resistance (4 to 10 breaths with an automatic plateau)
  - Measures flow and volume every 5 ms
- Uses the “equation of motion”

Explain and demonstrate how PAV™*+ software works: settings and monitored parameters
- % Support
- Tube size and type
- Monitors:
  - Compliance, resistance, and PEEPi
  - Work of breathing bar
  - WOB\(_{TOT}\) and WOB\(_{PT}\)
  - Elastic and resistance work
  - Estimated lung pressure shadow trace
  - Flow and volume waveforms

Explain and demonstrate the PAV™*+ software alarm strategy
- High inspired tidal volume (TV\(_{E}\))
- High circuit pressure (T\(^{PEAK}\))
- PAV software startup too long
- PAV software R&C not assessed
- Set all other traditional alarms

Summarize and demonstrate how the PAV™*+ software works
- PAV™*+ software measures work variables.
- The primary setting is % Support.
- The software amplifies patient efforts to offset the total work of breathing.
- The software adjusts delivered pressure within the same breath.
- The breath stops when patient inspiratory flow ceases.
- Delivered pressure adjusts dynamically to patient effort.
Summarize and demonstrate how the PAV™+ software works

- PAV™+ software measures work variables.
- The primary setting is % Support.
- The software amplifies patient efforts to offset the total work of breathing.
- The software adjusts delivered pressure within the same breath.
- The breath stops when patient inspiratory flow ceases.
- Delivered pressure adjusts dynamically to patient effort.

Describe capabilities and limitations

**Capabilities**
- Intact respiratory drive
- Pediatric (≥25 kg [55 lb]) and adult invasive ventilation
- 6.0 ID tube or greater

**Limitations**
- Not useful with
  - Apnea
  - Oversedation
  - Abnormal respiratory drive
  - Leaks
  - <25 kg (55 lb)
  - Severe air trapping
  - Pneumatic nebulizer
- Not available with NIV

**Tube Compensation Software**

Describe the problems associated with tracheal and endotracheal tubes, pressure support, and T-piece trials

- An endotracheal or tracheostomy tube can impose an increased work of breathing.
- Pressure support limitations:
  - Fixed delivery pressure approach
  - May provide under- or over-support
- T-Piece trials reduce the monitoring capabilities.

Describe the solution: TC software

- Tube Compensation (TC) provides spontaneous breathing assistance to help overcome the flow resistance of the artificial airway.
- TC software supports spontaneous breaths.
  - Only to the point of overcoming the artificial airways
- TC may reduce the work of breathing.

Describe potential benefits of TC software

- Provides variable pressure with variable effort.
- Reduces the imposed work associated with artificial airways.
- Allows for enhanced monitoring (and alarms + apnea backup) compared to the T-Piece approach.
Describe and demonstrate how to set up TC software

- Select:
  - Gender and height or predicted body weight (PBW)
  - SPONT mode
  - TC spontaneous breath type.
    - % Support: 10% to 100%
    - Tube ID
    - Tube type
    - $\overline{P}_{PEAK}$
    - $\overline{V}_n$
  - Adjust the alarms

Explain and demonstrate how TC software works

- Supports spontaneous breathing in SPONT, BiLevel mode, and SIMV
- TC checks the flow rate every 5 ms
- TC uses flow, the % Support setting, and a look-up table to determine delivered pressure
- % Support settings are from 10% to 100% (in 5% increments)

Explain and demonstrate TC software alarm strategy

- $\overline{P}_{PEAK}$
- $\overline{V}$ Spontaneous inspired tidal volume
- All typical alarms

Describe capabilities and limitations

Capabilities
- Invasive ventilation
- Intact respiratory drive
- 7.0 kg (15.4 lb) or greater
- 4.5 ID tube or bigger

Limitations
- <7.0 kg (15.4 lb)
- <4.5 ID tube
- In SPONT mode be aware of
  - Oversedation
  - Apnea
**Volume Support**

**Describe the problems associated with Pressure Support (PS)**
- Variances in compliance, resistance, and strength of inspiratory effort will affect the delivered tidal volume.
- Does not provide a target tidal volume.
- Does not downregulate pressure automatically.

**Describe the solution: Volume Support software**
- Volume Support (VS) provides variable flow (like PS). Pressure support delivers a variable pressure in order to attain a clinician set tidal volume.
- Automated pressure delivery is based on inspired volume that may be leak compensated using Puritan Bennett™ Leak Sync software.
- Pressure delivery is escalated if the R, C, or effort worsens and reduced if R, C, or effort improves.

**Describe potential benefits of Volume Support software**
- Encourages the use of the diaphragm
- Automatically decreases support pressure if target tidal volume is exceeded (1 to 3 cmH₂O)
- Increases pressure if the patient’s ability to take an adequate breath is compromised (1 to 3 cmH₂O)

**Describe and demonstrate how to set up Volume Support**
- Select **SPONT** mode
- Select **VS** for spontaneous type
- Select:
  - \( V_{T\,SUPP} \)
  - Trigger setting
  - Oxygen %
  - Rise %
  - \( E_{SENS} \)
  - PEEP
  - \( T V_{T} \)

**Explain and demonstrate how Volume Support software works**
- VS varies the inspiratory pressure support level to deliver the operator-set target tidal volume.
- During VS, the inspiratory pressure target cannot be lower than PEEP + 1.5 cmH₂O, and cannot exceed the high \( P_{PEAK} \) - 3 cmH₂O.
- Pressure adjusts a max of +/- 3 cmH₂O/breath if needed.
- Test breath at startup. “VS startup” is displayed in the GUI’s prompt area.

**Explain and demonstrate Volume Support software alarm strategy**
- \( TP_{PEAK} \) limit (determines max target pressure)
- Volume not delivered
- \( T V_{T} \) limit
- \( TP_{PEAK} \) limit
Describe capabilities and limitations

**Capabilities**
- Neonatal to adult
- Spontaneous capable patients
- Invasive ventilation only
- SPONT mode only

**Limitations**
- High effort may result in regulating of pressure down to undesirable levels (use $V_{PEAK}$ limit)
- Leaks without Leak Sync software enabled may result in higher estimation of delivered volume that causes regulating of pressure down.
- Not appropriate with:
  - Oversedation
  - Apnea
- Not active with:
  - NIV

Optional: NeoMode 2.0 (included with all Puritan Bennett™ 980 neonatal ventilators and Puritan Bennett™ 980 universal ventilators; other ventilators require NeoMode 2.0 software)

Describe the potential clinical benefits of NeoMode 2.0 software
- Ventilate neonates down to 0.3 kg with or without the proximal flow sensor and using invasive or noninvasive ventilation interfaces

Describe and demonstrate how to set up NeoMode 2.0 software
- Connect a neonatal breathing circuit to the ventilator
- Install the neonatal adapter door and neonatal expiratory filter
- Select the neonatal breathing circuit type in short self-test (SST).
- Ensure Leak Sync is enabled (if installed) during use of NeoMode 2.0 software

Explain how NeoMode 2.0 software works
- When installed, it is automatically launched when:
  - PBW range for neonates is 0.3 kg to 7.0 kg (0.66 lb to 15 lb)
  - Circuit type = neonatal
  - Neonatal adapter door and neonatal expiratory filter = installed
- Includes all INV modes and breath types and NIV A/C VC or PC, SIMV VC or PC, SPONT PS or VS, and CPAP
- Neonatal-specific trending
- Configurable elevated O$_2$,
- $C_{O2}/C$
**Describe the specific NeoMode 2.0 software alarm strategy**
- When in NeoMode 2.0, NIV CPAP is used:
  - Exhaled minute volume (V\text{ETOT}), exhaled tidal volume (V\text{ET SPONT}) and inspired tidal volume (V\text{IT}) alarms are not available
  - V\text{E} and V\text{ET} displays are not available
- In CPAP, apnea time, TA can be adjusted, if desired; defaults to off to avoid inadvertent alarms

**Describe when NeoMode 2.0 software is to be applied**
- 0.3 kg (0.66 lb) and above
- V\text{T} 2 mL (when Mandatory type is VC+) and above
- Neonatal breathing circuit
- Neonatal adapter door and neonatal expiratory filter

**Limitations and contraindications**
- >7.0 kg (15 lb) PBW
- Pediatric or adult breathing circuit
- PAV™++ software or TC
- If mandatory type is VC, lowest V\text{T} setting is 3 mL

**Optional: Proximal Flow Sensor**

**Describe the potential clinical benefits of using the proximal flow sensor**
- BTPS and compliance compensated flow, volume and pressure monitoring for invasive neonatal ventilation
- Waveforms that reflect on-airway measurements

**Describe and demonstrate how to set up proximal flow sensor with NeoMode 2.0 software**
- Install during the SST (prompts are given)
  - The proximal flow sensor is installed at the patient circuit wye
  - The other end of the sensor tubing connects to a keyed pneumatic connector on the ventilator’s front panel behind a clear door. Position the sensor with the arrows facing up.
  - Door is designed to protect the connection point from exposure to spills or from sprayed liquids during cleaning and disinfection
- Neonatal invasive ventilation only
Explain how the neonatal proximal flow sensor works

- Used for measuring flows, pressures, and tidal volumes of invasively ventilated neonatal patients
- The NeoMode 2.0 software option must be installed on the ventilator
- Auto and manual purge and auto-zero
- Monitors:
  - $V_{\text{TI}}$ inspired tidal volume (mandatory or spontaneous at patient circuit wye)
  - $V_{\text{TE}}$ exhaled tidal volume (at patient circuit wye)
  - $V_{\text{TE SPONT}}$ exhaled spontaneous tidal volume (at patient circuit wye)
  - $V_{\text{TE MAND}}$ exhaled mandatory tidal volume (at patient circuit wye)
  - $V_{\text{ETOT}}$ exhaled total minute volume (at patient circuit wye)
  - $V'$ flow throughout the breath cycle (at patient circuit wye)
  - $V_{\text{TI}}$ tidal volume (at patient circuit wye)
  - $P_{\text{CIRC}}$ pressure throughout the breath cycle (at patient circuit wye)
- Sensor specifications:
  - Weight 6.6 g; dead space <1 mL; pressure drop 1.5 cmH₂O at 10 L/min
  - PBW of 0.3 kg (0.66 lb) to 7.0 kg (15.4 lb)
  - ET tube sizes from 2.5 mm to 4.0 mm

Describe the specific proximal flow sensor alarm strategy

- Alarms respond to values monitored with the flow sensor
- Breaths are servo-controlled from internal flow sensors, not the $V_{\text{TI}}$

Limitations and contraindications

- Noninvasive (NIV)
- Pediatric and adult
- ET > 4.0 mm
- PBW > 7.0 kg (15.4 lb)
- Nebulized medications

Limitations and contraindications

- > 7.0 kg (15 lb) PBW
- Pediatric or adult breathing circuit
- No PAV™+ software or TC
- If mandatory type is VC, lowest $V$, setting is 3 mL
PLANNING FOR TRAINING CHECKLIST

Type of training?
- Evaluation training (trying the product)
- Installation training (own the product)
- Follow-up training (own the product)

Who is the audience? (Insert number of all roles who will attend. When possible, do not mix monitors with programmers or prescribers.)
- Monitors
- Programmers
- Prescribers
- Other (specify)

What kinds of patients do they ventilate? (Check all that apply)
- Neonatal
- Pediatric
- Adult

Will you provide food and drink?
- Yes. What kind?
- No

Indicate if your audience has ever used any of these Puritan Bennett™ ventilators.
- Puritan Bennett™ 7200 ventilator
- Puritan Bennett™ 840 ventilator
- Puritan Bennett™ 980 ventilator
Which breath types/features have the trainees used?

- VC+
- VS
- BiLevel Mode
- TC
- PAV™+ software
- Leak comp
- Respiratory mechanics
- Trending
- NeoMode 2.0 software
- Proximal flow sensor

Which modes and breath types are these trainees typically using? (Check all that apply)

- AC VC
- AC PC
- VC+
- SIMV VC
- SIMV PC
- BiLevel Mode
- APRV
- VS
- PS
- TC
- PAV™+ software
- Nasal CPAP

Has the Puritan Bennett™ 980 ventilator passed SST while equipped with the filters and breathing circuit that match the trainee’s typical patient type? For training it must be equipped with that same setup plus an appropriately sized test lung and at least one battery.

- Yes
- No. If no, take action to address.

Are there air and oxygen gas supplies in the training area?

- Yes
- No. If no, an external compressor is needed.

Is there power near the ventilator setup location?

- Yes
- No. If no, a power strip is needed.

Is AV equipment available?

- Yes
- No
- Not sure

Which assets do the trainees already have?

- Pre-training reading
- Quick reference guide
- Touch screen handout
- Training evaluation
- Practice exercises

Have any concerns been expressed that you need to address?

- No
- Yes. If yes, please describe the concerns.
Which aspects of the lesson plan should you cover?

**Basic Lesson Plan**
- Monitor (Nurses)
- Programmer (Respiratory Therapists/Nurses)
- Prescriber (Physician)

**Clinical Applications Lesson Plan**
- Leak Sync software
- NIV
- Volume Control Plus (VC+)
- Pressure Control (PC)
- BiLevel mode
- Pressure Support (PS)
- PAV™ software
- Tube Compensation (TC)
- Volume Support (VS)
- NeoMode 2.0 (included with all Puritan Bennett™ 980 neonatal ventilators)
- Proximal Flow Sensor

Which assets will you use during the meeting?
- Lesson plans
- Skills checklists
- Slide presentation
- Touch screen handout

Which assets will you leave with the trainees after the training?
- Entire training kit
  - or
- Pre-training reading
- Touch screen handout
- Training evaluation
- Practice exercises
- Quick reference guide
## BASIC CHECKLIST FOR MONITORS (NURSES)

### Touch Screen

**Identify Location**
- Ventilator setup button
- Ventilation settings
- Vital patient data
- Additional patient data
- Large-font patient data
- Graphics
- Constant access icons
- Menu tab/menus left
- Waveform layout icon
- Alarm banner

**Demonstrate Use**
- ToolTips
- “Touch, turn, accept”
- Double tap
- Stand-by
- Home icon
- Elevate O₂% icon
- Alarm icon

### Alarms

**Identify Meaning and Location**
- Audible and visual alarms
- Low-, medium-, and high-priority
- Criteria, recommended solutions, and hot links

### Ventilation Settings

**Locate Set Values**
- Modes and breath types of ventilation
- Tidal volume/pressure
- Flow/inspiratory time
- PEEP
- O₂%

### Patient Data Monitoring

**Identify Location and Meaning**
- Peak pressure
- Respiratory rate (fTOT)
- Exhaled tidal volume
- Minute volume

### Describe Puritan Bennett™ 980 Ventilator Features/Benefits

- Ventilation assurance/backup ventilation strategy
- Stand-by
- Filtration
- Adjustments, mode selection may help clinicians improve patient comfort
- Adjustments, settings selection may help clinicians reduce sedation use

### Touch Screen Bezel Control Keys

**Identify Location and Function**
- Manual inspiration key
- Alarm silence key
- Alarm reset key

### Status Display

**Show How to:**
- Identify power source
- See battery status
- See alarm volume setting
- See patient pressure/PEEP

### NOTE:

This checklist is provided to the healthcare provider for use, if desired, in assessing training of personnel on use of the Puritan Bennett™ 980 ventilator. The hospital should make its own determination as to which portions of the checklist are relevant to its procedures and to the responsibilities of its personnel, and its own determination as to any additional competency elements to assess for its personnel.
BASIC CHECKLIST FOR PROGRAMMERS (RESPIRATORY THERAPISTS)

Touch Screen

Demonstrate Use (“touch, turn, accept,” double tap, swipe, etc)
- Ventilator setup button
- Ventilation settings
- Alarm settings/display
  - Audible and visual alarms
  - Low-, medium-, and high-priority
  - Criteria, recommended solutions, and hot links
- Waveform layout icon
- Graphics
  - Change scale
  - Make bigger or smaller
  - Pause
  - Identify measured values
  - Review previous
  - Store an image
- Constant access icons
- Menu tab (more settings)
- ToolTips
- Stand-by
- Elevate O₂% icon
- Home button

Demonstrate Access
- Patient data; choose what to display
- Additional patient data
- Large-font patient data
- Logs

Touch Screen Bezel Control Keys

Identify Location and Function
- Screen brightness
- Display lock
- Manual inspiration
- Respiratory mechanics: inspiratory pause
- Respiratory mechanics: expiratory pause

Status Display

Show How to Identify:
- Power source
- Patient pressures
- Battery status
- Patient circuit size and type cleared by SST
- Ventilator operational hours
- EST, SST, and POST results

General Features

Describe Puritan Bennett™ 980 Ventilator Feature Benefits
- Ventilation assurance/backup ventilation strategy
- Stand-by state
- Air filtration features
- Modes/breath type adjustments
- Hot-swappable batteries
- Configurable elevate O₂%
- Quick start
- Omni-directional visual alarm

Leak Sync Software

- List the potential clinical benefits of Leak Sync software
- Describe and point out how to set up Leak Sync software
- Explain how the Leak Sync software works
- List the limitations and contraindications of using Leak Sync software
Leak Sync Software
- List the potential clinical benefits of Leak Sync software
- Describe and point out how to set up Leak Sync software
- Explain how the Leak Sync software works
- List the limitations and contraindications of using Leak Sync software

NIV
- Describe the potential clinical benefits of NIV
- Describe/how to set up NIV
- Explain how the NIV software works
- List the limitations and contraindications of using NIV

Volume Control Plus (VC+)
- Describe the potential clinical benefits of VC+
- Explain why VC+ may provide better synchrony than standard volume control (VC)
- Describe and point out how to set up VC+
- Explain how the VC+ software works
- Explain the alarm strategy used with VC+
- Understand what can cause delivered \( V_t \) to be less than set value and how to resolve
- List the limitations or contraindications of VC+

Pressure Control (PC)
- Describe and point out how to set up PC
- Describe how to use the timing padlocks

BiLevel Mode
- Describe the potential clinical benefits of BiLevel mode
- Describe and point out how to set up BiLevel mode
- Describe how to use the timing padlock to lock “release time”
- Describe spontaneous support options
- List the limitations or contraindications of BiLevel mode
- Describe the changes that can potentially impact oxygenation and ventilation

PAV++ Software
- Describe the potential clinical benefits of PAV++ software
- Describe and point out how to set up PAV++ software
- Explain how the PAV++ software works
- Discuss use of WOB and % support
- Describe the specific PAV++ software alarm strategy
- Describe when PAV++ software is to be applied as well as limitations and contraindications

Tube Compensation (TC)
- Describe the potential clinical benefits of TC
- Describe and point out how to set up TC
- Explain how the TC software works
- Describe the specific TC alarm strategy
- Describe when TC is to be applied as well as its limitations and contraindications

Volume Support (VS)
- Describe the potential clinical benefits of VS
- Explain why VS may provide more consistent ventilation than standard PS
- Describe and point out how to set up VS
- Explain how the VS software works
- Describe the specific VS alarm strategy
- Describe when VS is to be applied as well as the limitations and contraindications

Volume Control Plus (VC+)
- Describe the potential clinical benefits of VC+
- Explain why VC+ may provide better synchrony than standard volume control (VC)
- Describe and point out how to set up VC+
- Explain how the VC+ software works
- Explain the alarm strategy used with VC+
- Understand what can cause delivered \( V_t \) to be less than set value and how to resolve
- List the limitations or contraindications of VC+

Pressure Control (PC)
- Describe and point out how to set up PC
- Describe how to use the timing padlocks

BiLevel Mode
- Describe the potential clinical benefits of BiLevel mode
- Describe and point out how to set up BiLevel mode

NOTE: This checklist is provided to the healthcare provider for use, if desired, in assessing training of personnel on use of the Puritan Bennett™ 980 ventilator. The hospital should make its own determination as to which portions of the checklist are relevant to its procedures and to the responsibilities of its personnel, and its own determination as to any additional competency elements to assess for its personnel.
BASIC CHECKLIST FOR PRESCRIBERS (PHYSICIANS)

**Touch Screen**

**Demonstrate Use (“touch, turn, accept,” double tap, swipe, etc.)**
- Ventilator setup button
- Ventilation settings
- Alarm settings/display
  - Audible and visual alarms
  - Low-, medium-, and high-priority
  - Criteria, recommended solutions and hot links
- Waveform layout icon
- Graphics
  - Change scale
  - Make bigger or smaller
  - Pause
  - Identify measured values
  - Review previous
  - Store an image
- Constant access icons
- Menu tab (more settings)
- ToolTips
- Stand-by
- Elevate O₂% icon
- Home button

**Demonstrate Access**
- Patient data; choose what to display
- Additional patient data
- Large-font patient data
- Logs

**Touch Screen Bezel Control Keys**

**Identify Location and Function**
- Screen brightness
- Display lock
- Manual inspiration
- Respiratory mechanics: inspiratory pause

**Status Display**

**Show How to Identify:**
- Power source
- Patient pressures
- Battery status
- Patient circuit size and type cleared by SST
- Ventilator operational hours
- EST, SST, and POST results

**General Features**

**Describe Puritan Bennett™ 980 Ventilator Feature Benefits**
- Ventilation assurance/backup ventilation strategy
- Stand-by state
- Air filtration features
- Modes/breath type adjustments
- Hot-swappable batteries
- Configurable elevate O₂%
- Quick start
- Omni-directional visual alarm

**Leak Sync Software**

- List the potential clinical benefits of Leak Sync software
- Describe and point out how to set up Leak Sync software
- Explain how the Leak Sync software works
- List the limitations and contraindications of using Leak Sync software
漏气对齐（TC）
- 描述潜在临床益处
- 描述并指出如何设置
- 解释TC软件的工作原理
- 描述具体的TC警报策略
- 描述何时应用TC及其限制和禁忌症

体积支持（VS）
- 描述潜在临床益处
- 解释为什么VS可能提供更一致的通气
- 描述并指出如何设置VS
- 解释VS软件的工作原理
- 描述具体的VS警报策略
- 描述何时应用VS及其限制和禁忌症

基本检查表（医生）（续）

- 描述如何使用定时锁扣来锁定“释放时间”
- 描述自发支持选项
- 列出BiLevel模式的限制或禁忌症
- 描述可能影响氧合和通气的变化

PAV™+软件
- 描述潜在临床益处
- 描述并指出如何设置
- 解释PAV™+软件的工作原理
- 描述具体的PAV™+软件警报策略
- 描述何时应用PAV™+软件及其限制和禁忌症

管补偿（TC）
- 描述潜在临床益处
- 描述并指出如何设置
- 解释TC软件的工作原理
- 描述具体的TC警报策略
- 描述何时应用TC及其限制和禁忌症

无创通气（NIV）
- 描述潜在临床益处
- 描述/指出如何设置
- 解释NIV软件的工作原理
- 列出使用NIV软件的限制和禁忌症

压力控制（PC）
- 描述并指出如何设置
- 解释PC软件的工作原理
- 描述压力控制（PC）的限制和禁忌症

BiLevel模式
- 描述潜在临床益处
- 描述并指出如何设置

NOTE: 本清单供医疗机构在使用Puritan Bennett™ 980呼吸机时参考。医院应根据其程序和人员职责的需要，自行决定清单中哪些部分适用，并自行决定是否增加其他评估技能的要素。
IMPORTANT TERMS
Spontaneous ventilation, or spontaneous breathing, is the normal movement of air into and out of the lungs in response to respiratory muscle contraction.

Ventilation refers to the exchange of O\textsubscript{2} and CO\textsubscript{2} between the patient and the environment.

Respiration refers to physiologic gas exchange.

For air to flow through a tube or an airway, a pressure gradient must exist. A pressure gradient exists when the pressure at one end of the tube or airway is higher than the pressure at the other end.

Resistance is a measure of the impedance to airflow. It is measured in cmH\textsubscript{2}O/L/s or hPa L/s.

Two parameters are often used to describe the elastic and frictional forces in the respiratory system:

- Compliance is the relative ease with which the lungs expand.
- Elastance is the tendency for the lungs to return to their original shape after having been acted on by an outside force such as mechanical ventilation.
KEY MODES, BREATHE TYPES, AND BREATHEING STRATEGIES

**Invasive (INV)**

This is the conventional application of mechanical ventilation in which endotracheal (ET) or tracheostomy (trach) tubes are used.

**Noninvasive (NIV)**

NIV is a mechanical ventilation application that uses nonvented full-face masks, nasal masks, infant nasal prongs, or uncuffed ET/tracheal tubes. NIV is used when the clinician determines a mask or another noninvasive patient interface, rather than an endotracheal or tracheal tube, would result in the desired patient outcome.

**Assist-Control (AC) Ventilation**

AC is a ventilation mode in which the clinician sets a respiratory rate as well as mandatory/assisted breath type. The only kind of breath the ventilator delivers is a mandatory breath type, whether the patient breathes or not. When the patient makes a breathing effort that triggers the ventilator, the patient's effort is assisted with the mandatory selected breath type. When the patient does not make breathing efforts that trigger the ventilator, the ventilator delivers the number of mandatory breaths set on the rate control.

Common mandatory breath types in AC mode include volume control, pressure control, or a volume-targeted variable pressure control breath type (e.g., volume control plus [VC+], pressure-regulated volume control [PRVC], or autoflow). Sometimes, the term assist control is used synonymously with volume control.

**Synchronized Intermittent Mandatory Ventilation (SIMV) Mode**

SIMV is a ventilation mode. The clinician sets a respiratory rate, a mandatory/assisted breath type and a spontaneous (assisted) breath type. The set rate determines the number of mandatory/assisted breaths that are delivered each minute, whether the patient initiates them by making an effort and triggering the ventilator or not. In between those mandatory/assisted breaths, the patient can also initiate (trigger) spontaneous breaths. Various combinations of mandatory/assisted and spontaneous breath types are possible. Typically, most if not all of the mandatory/assisted and spontaneous breath types a ventilator offers are available in combination with each other during SIMV. SIMV VC+ and pressure support (PS) is a commonly used combination for adult patients.

SIMV PC and pressure support (PS) is a commonly used combination for pediatric patients. On the Puritan Bennett™ 980 ventilator, PS is automatically selected for spontaneous breathing type if SIMV is selected as the mode. SIMV was developed before PS and was intended as a weaning mode. However, it has been replaced in many regions by the use of SPONT mode ventilation using spontaneous (assisted) breath types like pressure support, volume support, or PAV™+ software for weaning.
**Spontaneous (SPONT) Mode**

SPONT is a ventilation mode in which the clinician sets a spontaneous (assisted) breath type. Breaths are only delivered in response to patient efforts that trigger the ventilator. The clinician sets an apnea backup so the patient will be ventilated if he or she fails to initiate a spontaneous breath after a predetermined period of time. Operator-initiated mandatory (OIM) breaths are also allowed and are delivered with the currently specified mandatory breath parameters. The patient must be able to breathe independently and exert the effort to trigger ventilatory support. Common breath types in spontaneous ventilation include pressure support, volume support, continuous positive airway pressure (CPAP), tube compensation, and PAV”™ software.

Mechanical ventilation is an artificial or mechanical method of breathing assistance designed to mimic, augment, or replace the normal mechanisms of breathing.

**Pressure Control (PC)**

PC is a mandatory/assisted breath type that does not restrict flow during the inspiratory phase. The operator controls inspiratory time and pressure, and pressure rise time%. Flow delivery decelerates after the peak flow is achieved. The actual flow and delivered tidal volume vary according to patient effort and the patient’s time constant (resistance x compliance). PC is not just for “sicker” lungs. It is one of the most synchronous of the conventional breath types, making it well suited to less sedated patients for whom comfort is an issue.

**Volume Control (VC)**

Volume control is a mandatory/assisted breath type. The ventilator delivers an operator-set tidal volume, peak flow, and flow pattern. These settings as well as time constants (resistance x compliance) and patient effort will affect peak pressure. The patient has no control over flow or flow pattern.

**Volume Control Plus (VC+)**

VC+ is a mandatory/assisted pressure-controlled breath type that does not restrict flow during the inspiratory phase. The clinician controls target tidal volume, inspiratory time, maximum inspiratory pressure (TP_{PEAK} minus 3 cmH2O), and pressure rise time. Flow delivery decelerates after the peak flow is achieved. The actual flow and delivered tidal volume vary according to patient effort and the patient's time constant (resistance x compliance). The software automatically adjusts inspiratory target pressure from breath to breath in response to changes in the delivered tidal volume. If delivered tidal volume is lower than the set value, the software will increase the pressure target level for the subsequent breath. If delivered tidal volume is higher than the set value, the software will decrease the pressure target level for the subsequent breath. The pressure target will never be adjusted outside the limits of the settings, even if the volume target is not achieved.
**BiLevel Mode**

BiLevel mode is a mixed ventilation mode that combines mandatory/assisted and spontaneous assisted breath types. Breaths are delivered in a manner similar to SIMV mode with PC and PEEP selected except the operator selected upper pressure is called $P_{\text{HIGH}}$ and is the target pressure above ambient rather than above PEEP. The lower pressure level is called $P_{\text{LOW}}$ instead of PEEP. The patient is free to initiate spontaneous breaths at either pressure level during BiLevel mode. Timing for moving between pressures is set with the Rate and the $T_{\text{r}}$, $T_{\text{i}}$, or the ratio of $T_{\text{r}}$ to $T_{\text{i}}$ (selectable) settings. To select settings that would result in a $T_{\text{r}}$:$T_{\text{i}}$ ratio greater than 1:1 or 4:1, you must touch the continue button to confirm after reaching the 1:1 and 4:1 limits.

Spontaneous breaths in BiLevel mode can be assisted with pressure support according to these rules (reference OpMan x06 BiLevel mode with pressure support, page A-5):

- Pressure support ($P_{\text{SUPP}}$) can be used to assist spontaneous breaths at $P_{\text{i}}$ and $P_{\text{HI}}$. $P_{\text{SUPP}}$ is always set relative to $P_{\text{i}}$. Target pressure = $P_{\text{i}}$ + $P_{\text{SUPP}}$. Spontaneous patient efforts at $P_{\text{i}}$ are not pressure supported unless $P_{\text{SUPP}} > (P_{\text{HI}} - P_{\text{i}})$. All spontaneous breaths, whether or not they are pressure supported, are assisted by a pressure of 1.5 cmH$_2$O.
- If $P_{\text{SUPP}} + P_{\text{i}}$ is greater than $P_{\text{HI}} + 1.5$ cmH$_2$O, all spontaneous breaths at $P_{\text{i}}$ are assisted by the $P_{\text{SUPP}}$ setting and all spontaneous breaths at $P_{\text{HI}}$ are assisted by $P_{\text{SUPP}} - (P_{\text{HI}} - P_{\text{i}})$.
- All spontaneous breaths not supported by PS or TC (for example, a classic CPAP breath) are assisted with an inspiratory pressure of 1.5 cmH$_2$O.

**Pressure Support (PS)**

PS is a spontaneous assisted breath type that does not restrict flow during the inspiratory phase. Inspiratory pressure, pressure rise time, and one of the breath-cycling off mechanisms ($E_{\text{SENS}}$) are controlled by the operator. The ventilator controls pressure and time cycling off mechanisms. When the ventilator is triggered, it raises breathing circuit pressure to the operator-selected level above the PEEP level during the inspiratory phase of breathing. When the threshold for one of the three breath-cycling off mechanisms is reached, circuit pressure is allowed to return to the PEEP level while the patient exhales. If pressure support is set to 0 cmH$_2$O, there is always a target inspiratory pressure of 1.5 cmH$_2$O applied. It is available in SPONT, SIMV, and BiLevel modes. If SIMV is selected as the mode, PS is automatically selected for spontaneous type.
Volume Support (VS)

VS is a pressure-supported spontaneous breath type available in SPONT mode. The target support volume ($V_{TSUPP}$) is the target volume for pressure-supported breaths. Similar to what VC+ does with pressure control breaths, VS automatically adjusts inspiratory target pressure of pressure support from breath to breath in response to changes in the patient’s condition.

Proportional Assist™+ Ventilation Plus (PAV™+ software)

PAV™+ software is a spontaneous breath type that is available only when invasive ventilation is selected. Like the other spontaneous breath types, PAV™+ software assists patient efforts that trigger the ventilator. Unlike other spontaneous breath types, the operator does not set pressure or volume. The operator sets % Supp (5% to 95%), tube type, and tube size. PAV™+ software adjusts pressure delivery to offload the operator set % Supp(ort) of work. It provides ventilatory support proportional to the patient’s inspiratory effort, letting the patient determine the duration and depth of each breath. PAV™+ software begins to assist an inspiration when flow (generated by the patient’s inspiratory muscles) appears at the patient wye. If the patient ceases inspiration, the assist also ceases.
The product information, best practices, and training scenarios in this implementation guide can help you train your audience to get the most out of the Puritan Bennett™ 980 ventilator.

Training 101: Puritan Bennett™ 980 ventilator training sessions follow proven behavior modeling training (BMT) methods. These methods feature a high degree of engagement by delivering training content in a real or simulated environment through hands-on involvement.2

Best Practices: This simple list of dos and don’ts is worth reviewing before every training session. Details can make a big difference.

Training Assets: Take a look at the teaching tools for effective training. Choose the ones that best suit the needs of your audience.

Planning for Training: Because every audience and training environment will be different, it pays to know your audience and their training needs. Plan ahead and plan to succeed!
11. Puritan Bennett™ 880 ventilator operator’s manual

* Ventilation Assurance provides for continued ventilatory support using one of three backup ventilation (BUV) strategies, bypassing the fault to maintain the highest degree of ventilation that can be safely delivered.

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