The range, resolution, and accuracy of the pneumatic controls—and the characteristics of the various pneumatic connections are described in Chapter 3, Specifications. Chapter 5 provides a detailed description of the functions and use of each control.

Patient Circuit

WARNING
Do not attempt to substitute another circuit configuration as this could result in injury to the patient and/or the operator, or cause equipment malfunction. The Patient Circuit described in this manual is specifically designed for patient use with the Model 3100B HFOV.

The Patient Circuit combines the three elements necessary for ventilation of the patient using HFOV techniques: bias flow/ Mean pressure, pressure oscillations, and pressure limiting. The Patient Circuit is illustrated in Figure 4.1.

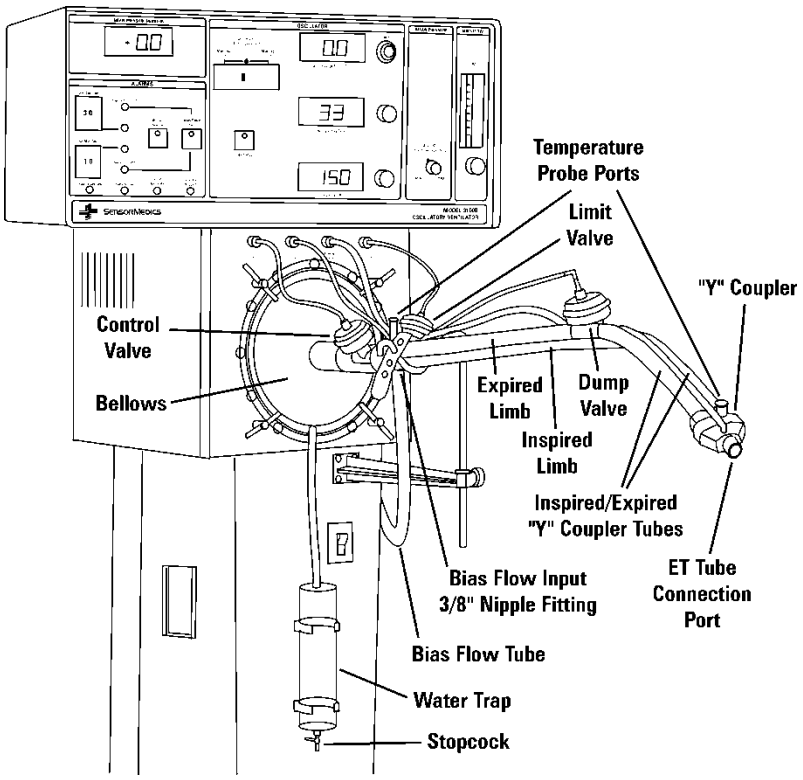

Figure 4.1. Details of Patient Circuit.

During normal operation, humidified, blended bias gas flows into the continuous flow line from the External Humidifier. This gas flows into and through the inspiratory limb of the Patient Circuit, through the "Y" coupler and then into the expiratory limb of the Patient Circuit. While passing through the "Y" coupler, the fresh gas exchanges oxygen and carbon dioxide at the ET tube/patient connection.

A proximal airway pressure sensing line made of 1/8" Tygon tubing runs from the "Y" coupler to the Airway Pressure Monitor via a white Luer bulkhead fitting near the Patient Circuit connection. The pressure signal is processed to determine various pressure measurements and alarm conditions. The Airway Pressure Monitor and tubing are discussed in a following section.

The expiratory limb carries the exchanged gas to the $P\overline{aw}$ Control Valve. This valve allows two expiratory flow paths. One path is a variable restriction controlled by the $P\overline{aw}$ Control Valve control line extending from the Pneumatic Logic and Control Subsystem via a green Luer bulkhead fitting near the Patient Circuit connection. The other flow path is a fixed orifice that requires a minimum bias flow be maintained through the Patient Circuit to ensure a flow of fresh Bias Gas regardless of the setting of the $P\overline{aw}$ Control Valve.

When the $P\overline{aw}$ Control Valve is changed, it adjusts the mean airway pressure at the ET tube/patient connection after about five system time constants have elapsed, but only if the set bias flow and oscillator characteristics remain unchanged for the same time period. Five time constants will vary from about one second to as long as 30 seconds. This time constant varies directly with $P\overline{aw}$ and inversely with bias flow.

The individual elastic and dimensional characteristics of the $P\overline{aw}$ Control Valve diaphragm interact with the valve control line pressure to determine the control dial maximum setting. The Patient Circuit Calibration control provides a screwdriver adjustment to set the maximum mean pressure that can be attained with a particular Patient Circuit under specified conditions. This control is used only when the Patient Circuit is replaced or the $P\overline{aw}$ control valve diaphragm of the existing Patient Circuit is changed. Refer to Chapter 7, Maintenance and Troubleshooting, for the complete setup procedure.

The Pressure Limit Valve limits the $P\overline{aw}$. When an abnormal condition exists or when the system mean pressure increases due to an inadvertent or deliberate control setting change, this valve acts to limit the mean proximal airway pressure.

Both the $P\overline{aw}$ Control Valve and the Pressure Limit Valve are mushroom valves that must be replaced periodically according to the procedures in Chapter 7, Maintenance and Troubleshooting.

The Dump Valve is activated by the Electronic and Pneumatic Control Subsystems only when the safety alarms are activated. The safety alarms are the following:

$P\overline{aw} > 60$ cmH_2O

$P\overline{aw} < 5$ cmH_2O

The Dump Valve, when activated, will open the entire Patient Circuit to ambient air. It allows the patient the opportunity to breathe spontaneously at normal atmospheric pressure when the safety alarms have been activated. In an emergency situation, the Dump Valve helps to prevent a decrease in cardiac output due to sustained elevated Patient Circuit pressure or atelectasis due to a negative Patient Circuit pressure.

The Dump Valve is a mushroom valve that must be replaced at intervals as described in Chapter 7.

Two ports are provided for inserting the temperature probe of the External Humidifier. One is near the patient “Y”; the other is near the Pressure Limit Valve.

The inspiratory limb acts as the propagation means for the pressure oscillations generated by the Oscillator Subsystem. A typical airway pressure oscillatory waveform is illustrated in Figure 3.2.