

## MEDICAL PRESSURE RELIEF VALVE FUNCTION TESTING

### PROBLEM:

The customer needed to verify the proper function of a pressure-relief valve installed within a drug delivery manifold. The pressure relief valve is designed to allow fluid to escape to a collection area when pressures in the normal fluid path exceeded a defined value. Tolerances for the pressure relief valve function were tight (+5% of the designed opening pressure) and the customer required 100% in-line testing.

### TEST REQUIREMENT:

Tolerances for the pressure relief valve function were tight (+5% of the designed opening pressure) and the customer required 100% in-line testing.

### CTS SOLUTION:

CTS developed their Sentinel Blackbelt leak test instrument to have an optional test type called Ramp-to-Event. This test type allows a compressed gas or air to be introduced into the part at a user-defined ramped-rate using an electronic pressure regulator. As pressure builds within the part, a precision pressure sensor tracks the actual pressure and continuously monitors the peak pressure. Once the pressure rises high enough to activate the relief valve, a sudden pressure loss event is detected by the sensor. The instrument immediately captures the peak pressure just prior to the relief-event occurring and stores this result and compares it with user-established min/max limits (+5% of the target opening level) programmed into the test. If the result is within the limits, the part is accepted and a second test automatically starts which performs a leak test on the part at a lower pressure (allowing the relief valve to re-close) using pressure decay technology. If outside the limits, the part is deemed a failure and the part rejected.



Side Note: Some check and pressure relief valves may not open suddenly as pressure ramps but instead may start opening/weeping slowly making detection of this event difficult. The opening condition may be so small that the pressure drop becomes insignificant compared to that rate of pressure increase thus, the instrument cannot see the weep occur. This application requires a modified circuit where a mass flow sensor is connected to the outlet of the part. The system functions exactly as described above except the event is triggered by the detection of flow through the part (downstream) that is monitored when the valve begins to open as opposed to a pressure drop on the inlet. This method is much more sensitive and is often desired for lab use or where a precise weeping value is required.

Poka-yoke: The instrument was installed with CTS Luer Connect to automatically seal the inlet port of the part and mate it to the test air port of the instrument. If the part passes both tests, the Connect automatically releases the part to the operator. If either test fails, the part is securely held in the Luer Connect and requires an authorized individual to reset the system and unlock the part. This action is used to prevent the inadvertent placement of the failed part into the passed-part area.