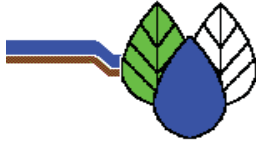




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Development of a Protocol to Determine the Cyclic Strength of PVC Pipe Fittings when Stressed to Failure

Major components built into the testing jig (see Figure 1) are described as follows:

1. **Nitrogen tank (yellow) equipped with a pressure regulator.** This arrangement is capable of supplying a controlled supply of gas at pressures to 3000 psi.
2. **Gas over water bladder tank (blue).** With a pressure-controlled gas inlet, the tank is capable of delivering a supply of water to the test jig at a specified pressure in a pulse-free manner. For these tests the water pressure was set at 250-260 psi. The supply pressure gauge is visible near the end of the tank.
3. **Three-way solenoid valve.** On signal from the timer circuit (see Figure 2), the solenoid valve alternately opens, thereby pressurizing the PVC tee, and closes thereby isolating the supply and depressurizing the PVC tee. For these tests, a 34-second cycle was used subjecting the tee to 17 seconds at 250 psi followed by 17 seconds at atmospheric pressure. The timer circuit also has a relay and an electrically-actuated cycle counter. The timer is a model H3C-R as manufactured by Anly Electronics Co, Ltd.
4. **A data logger** is required to record the maximum cycle pressure and document the time when the fitting failed. A model DLI2 by Dwyer Instruments was selected.

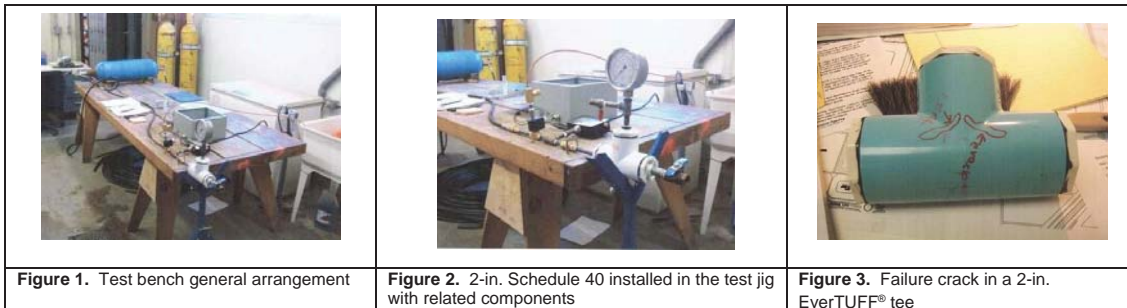


Figure 2 also shows a Schedule 40 PVC tee installed in the test jig. The tee sockets are fitted with Schedule 40 2-in. x 1/2-in. reducer bushings (SP x F). The solvent welding was accomplished using IPS P70 primer and IPS 711 solvent cement. A pressure gauge is fitted into the vertical connection. A ball valve is fitted into the downstream port and is used to vent the air in the system. During the test, the lab room temperature was kept between 60° and 65° F. The failure crack shown in Figure 3 is representative of the location noted in the test work.

Test results are as follows:

| Component Tested | Cycles to failure | | | | | Average |
|-------------------------|-------------------|---------|---------|---------|---------|----------|
| | Test #1 | Test #2 | Test #3 | Test #4 | Test #5 | |
| Spears® Schedule 40 tee | 8,580 | 10,694 | 7,822 | 7,653 | 11,302 | 9,201.2 |
| Spears® EverTUFF® tee | 12,809 | 13,483 | 12,942 | 16,239 | 15,693 | 14,234.4 |

Disclaimer

All tees were provided by Spears® Manufacturing Company. All other materials were purchased and assembled by the Center for Irrigation Technology (CIT), California State University, Fresno personnel. All tests were conducted by CIT, Fresno State personnel. Tests were conducted from June to November 2010. The cycle time and maximum pressure selected reflect an attempt to develop a protocol useful for comparative purposes. The results of this protocol must not be interpreted as applying to specific field situations.

CIT report dated November 15, 2010

