

SPECIFICATIONS**TB-S11**

April 2000

AWWA C900 and C905 Requirements for Bell Construction and Hydrostatic Proof Testing

The American Water Works Association (AWWA) specifications C900 and C905 have specific, detailed requirements for pipe bell construction and hydrostatic proof-testing. These are often misunderstood by those in the water works industry. This bulletin is intended to explain the details of the requirements and to provide a better understanding of their purpose and importance.

Dimension Ratio

First, it will be beneficial to better understand the concept of pipe Dimension Ratio (DR or SDR for Standard Dimension Ratio). The pipe DR is defined to be the ratio of the pipe outside diameter to the pipe minimum wall thickness. For example, a DR 18 C900 pipe would have an outside diameter equal to 18 times its wall thickness.

The significance of the DR for pressure pipes is that for a given DR, the pipe pressure capacity is the same regardless of the pipe diameter. For example, 4" DR 18 and 12" DR 18 have the same pressure class, 150 psi. This is because wall thickness increases proportionally with diameter for pipes of the same DR.

It is important to realize that the smaller the DR, the larger the pressure capacity of the pipe. This is why a DR 14 C900 pipe has a pressure class of 200 psi while a DR 18 C900 pipe has a pressure class of 150 psi.

Bell Construction

Bells are commonly formed on PVC pipes by reheating one end of the pipe and expanding it on a mandrel. Refer to Figure 1 for drawing of a typical bell cross-section. Two significant events happen during the process which affect the DR of the bell: 1) the diameter of the bell becomes larger than the diameter of the pipe body, and 2) the wall of the bell becomes thinner than it was before forming, because the plastic stretches when it is expanded on the forming mandrel. This means the DR of the bell is larger than it was before forming (meaning it has less pressure capacity) if the bell was formed from pipe of constant wall thickness.

In order for the bell to have the same pressure capacity as the rest of the pipe, AWWA C900 and C905 require that the bell be thickened. The socket portion of the bell must have a DR that is the same as that of the pipe body, because both pipe sections see the same pressure. The wall thickness in the gasket groove and the lip must meet the minimum wall requirements of the pipe body. The consequence of these requirements is that the wall of the pipe in the end that is to be formed into a bell must be significantly thickened during the extrusion process so that after the bell is formed, the wall thickness requirements are met. This ensures that the entire pipe, including the bell, will have the same pressure capacity.

It is important that these requirements be met. Thickening the bell is a costly procedure for manufacturers, but it ensures that the pipe will perform as expected. A manufacturer must meet the described bell construction requirements in order to rightfully print AWWA C900 or C905 on its pipe. Table 1 provides approximate wall thickness of PWPipe's C900 and C905 bells.

Hydrostatic Proof-Testing

Another requirement of AWWA C900 and C905 is that every pipe be individually hydrostatically pressure tested. Pipes made to C900 must be tested at a pressure equal to four times their pressure class. Pipes made to C905 must be tested at a pressure equal to two times their pressure rating. The test pressure is printed on the pipe for reference. For example, C900 pipe with a pressure class of 150 psi has "T600" printed on it for the 600 psi pressure test it has experienced. C905 pipe with a pressure rating of 235 psi has "T470" printed on it.

These tests add a measure of assurance of the quality of the pipe, and as with the bell construction requirements, a manufacturer must perform these pressure tests on each C900 and C905 pipe to rightfully print AWWA C900 and C905 on its pipe.

One result of the pressure testing of each C900 and C905 pipe is that the pipe may exhibit black rubber marks on the spigot end where the gasketed test cap was attached during the test. The existence of these marks is normal and is not evidence that the pipe has been "used" in any way.

FIGURE 1: TYPICAL C900/C905 BELL SECTION

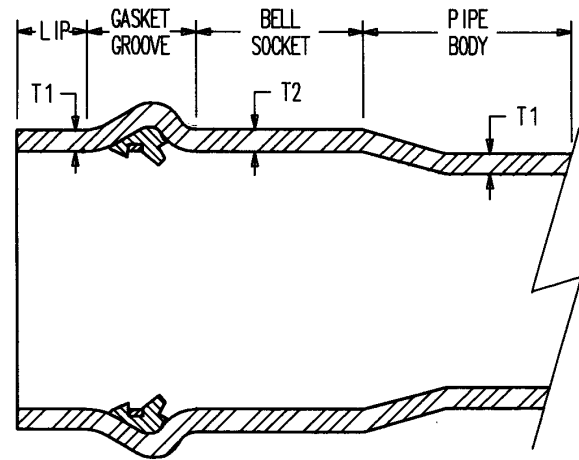


Table 1
Bell Wall Thickness Requirements

AWWA C900					AWWA C905				
Nominal Size (inches)	Dimension Ratio	Pressure Class (psi)	T1 (inches)	T2* (inches)	Nominal Size (inches)	Dimension Ratio	Pressure Rating (psi)	T1 (inches)	T2* (inches)
4	25	100	0.192	0.210	14	25	165	0.612	0.668
	18	150	0.267	0.303		18	235	0.850	0.960
	14	200	0.343	0.403					
6	25	100	0.276	0.302	16	25	165	0.696	0.760
	18	150	0.383	0.434		18	235	0.967	1.090
	14	200	0.493	0.579					
8	25	100	0.362	0.396	18	25	165	0.780	0.852
	18	150	0.503	0.569		18	235	1.083	1.225
	14	200	0.646	0.758					
10	25	100	0.444	0.486	20	25	165	0.864	0.944
	18	150	0.617	0.698		18	235	1.200	1.357
	14	200	0.793	0.930					
12	25	100	0.528	0.578	24	25	165	1.032	1.127
	18	150	0.733	0.830					
	14	200	0.943	1.110					

* This is PWPipe's minimum for our bell design. Other manufacturer's numbers may vary a few thousandths of an inch.