SIZING OF DEFLECTION MANDRELS FOR AWWA C905 PIPE

AWWA C905 pipes are not often used for gravity-sewer applications, since ASTM sewer pipes are commonly designed and installed at burial depths of more than 50 feet. However, when AWWA pipe is used in these installations, the question is how to size the "go/no-go" deflection mandrels that are used for testing non-pressure pipelines.

The procedure for sizing of deflection-test mandrels is found in appendices in ASTM PVC sewer pipe standards D3034 and F679. First, a "base inside diameter" (ID_{base}) is calculated by subtracting a statistical tolerance package from the pipe's average ID (ID_{avg}). The result is multiplied by (100% – allowable deflection %). The procedure is best shown through a design example:

DESIGN EXAMPLE: 18-INCH CIOD DR18 AWWA C905 PIPE

Given (per AWWA C905):

  Average outside diameter (OD_{avg}) = 19.500 inches
  Minimum wall thickness (t_{min}) = 1.083 inches
  OD tolerance = 0.020 inch

Deflection Mandrel

Procedure (from ASTM D3034 and F679 standards):

  $ID_{avg} = OD_{avg} - 2(1.06 \times t_{min}) = 19.500 - 2(1.06 \times 1.083) = 17.20$ inches

  Tolerance package = $\sqrt{(A^2 + 2B^2 + C^2)}$

    A = OD tolerance = .020 inch
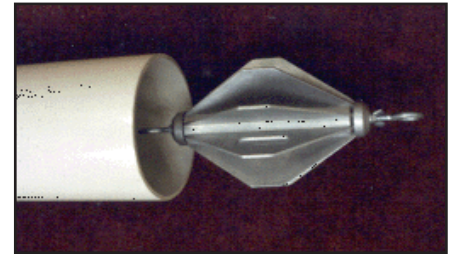   B = excess wall thickness tolerance = $0.06 t_{min}$ = 0.06 x 1.083 = 0.065 inch
    C = out-of-roundness tolerance = .614 inch (interpolated from Table X2.1 in the F679 standard)
  Tolerance package = $\sqrt{(0.020)^2 + (2)(0.065)^2 + (0.614)^2} = 0.62$ inch

  $ID_{base} = ID_{avg}$ – tolerance package = 17.20 – 0.62 = 16.58 inches
  Maximum allowable deflection is 7 ½%, so the mandrel size is $ID_{base} \times (1 - .075)$
  Mandrel size = 16.58 x .925 = 15.34 inches

Note: AWWA standards do not include mandrel information because gravity pipe is outside AWWA's scope. Values for out-of-roundness tolerance are therefore taken from the ASTM standards. For the tables below, out-of-roundness values are interpolated from ASTM sewer-pipe standards.

7 ½ % DEFLECTION MANDREL SIZES FOR AWWA C905 CIOD PIPE

DR	14-inch	16-inch	18-inch	20-inch	24-inch	30-inch	36-inch	42-inch	48-inch	DR
14	11.56	13.14	14.73	NA	NA	NA	NA	NA	NA	14
18	12.04	13.69	15.34	16.99	20.26	25.14	NA	NA	NA	18
21	12.28	13.96	15.64	17.32	20.67	25.64	30.67	NA	NA	21
25	12.51	14.22	15.94	17.65	21.05	26.12	31.25	36.29	41.41	25
32.5	12.79	14.54	16.29	18.04	21.52	26.71	31.94	37.10	42.33	32.5
41	12.98	14.76	16.54	18.31	21.84	27.11	32.42	37.65	42.97	41
51	NA	NA	16.72	18.51	22.09	27.41	32.78	38.07	43.45	51

NA = Product not included in C905 standard