



Measuring Head Selection

The 53-859 spherometer kit includes six measuring heads. Use the inner diameter value when measuring the curvature of convex surfaces and the outer diameter when measuring the curvature of concave surfaces. The values for these inner and outer diameters can be found in Table 1. For more curved surfaces, use a smaller head and for less curved surfaces, use a larger head.

Table 1 – Head Specifications

Head #	1	2	3	4	5	6
ID (mm)	4	8	12	16	20	24
OD (mm)	8	12	16	20	24	28



Measuring Head Configuration and Initial Calibration

Measuring heads are attached to the stem of the dial gauge and held in place with a thumb screw (Note: Given its small inner diameter, Head 1 requires the use of the needle tip that is included in this kit). Position the measuring head so the tip of the gauge protrudes just slightly beyond the head. Place the gauge on a flat surface and adjust the bezel on the gauge so the needle is set to the zero point.

Measurement

Place the gauge on the surface to be measured and push the gauge tip gently until it is in contact with the surface. The radius of curvature of the surface can be calculated using the following equation:

$$R = \frac{H^2 + \left(\frac{D}{2}\right)^2}{2H}$$

where R is the radius of curvature, D is the diameter of the head in Table 1 (ID for convex and OD for concave), and H is the distance the gauge tip moved from the zero point.

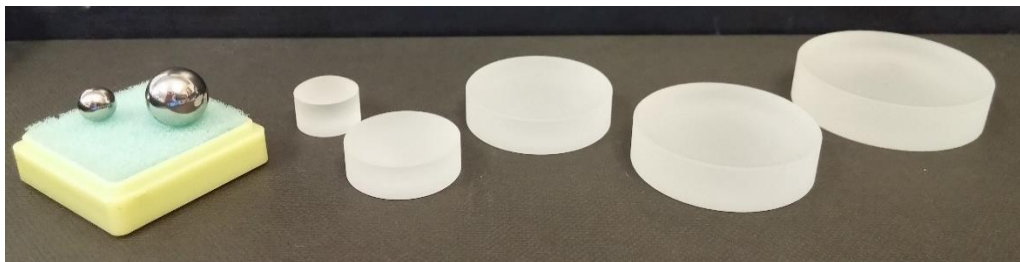
Rather than calculate this every time, reference values can be found for each measurement head in Tables 3-9 at the end of this manual.

Adjustment and Final Data

To account and adjust for any measurement error, seven standards have been included with a known radius (see Table 2). Measure the standard as instructed above in order to calculate the theoretical radius. Percent error can then be calculated using the actual values in Table 2.

Table 2 - Standard Specifications

Standard #	1	2	3	4	5	6	7
<i>Convex Radius (mm)</i>	3	5	10	20	50	100	Plano
<i>Concave Radius (mm)</i>	N/A	N/A	-10	-20	-50	-100	-200
<i>Shape</i>	Ball	Ball	Disc	Disc	Disc	Disc	Disc
<i>OD (mm)</i>	6	10	12	20	28	32	36



Gauge

To obtain the highest performance from the gauge, carefully read this section prior to use. It is recommended that receiving inspection be performed to confirm all performance requirements are satisfied.

- Operating Environments
 - Temperature: 0-40° C
 - Relative humidity: 30-70%
 - Use the gauge at sites with as little dust, oil, and oil mist as possible. Avoid direct sunlight.
- Precautions
 - Do not displace the spindle quickly. Do not apply force perpendicular to the spindle.
 - If any shock is exerted on the gauge due to a drop, etc., inspect the measuring accuracy before use.
 - Check the long hand, short hand, and the spindle for smooth movement.
 - Mount the gauge with the spindle oriented downwards.
 - Only mount by the lug or the stem. If mounting by the stem, take care so as not to exert excessive pressure on the stem as that can inhibit smooth spindle movement.
 - If using the gauge at a site with a significant temperature fluctuation, frequently adjust the zero point through calibration.
 - If the spindle stop is removed, the gears can become disengaged. Do not remove the spindle stop.
- Maintenance, Inspection, and Repair
 - Wipe stains from the spindle using a dry cloth or a cloth dampened with alcohol. Do not oil the spindle.
 - Wipe stains from the gauge face using a soft dry cloth or a cloth dampened with neutral detergent.
 - Disassembling the gauge will void the manufacturer's warranty.
- Limit Hand
 - Separate the limit hand before attaching it. Take care not to injure yourself when separating the limit hand or handling the separated parts (Fig. 1).
 - Attach and remove the limit hand as shown in Fig. 2 by attaching the limit hand to the bezel and pushing the hand until it clicks.
 - Remove the limit hand by pushing in the direction of the arrow seen in Fig. 3.
- Bezel Clamp
 - Attach and remove the bezel clamp as shown in Fig. 4 by inserting the clamp bracket (C) in the dovetail groove, holding in place with the clamping plate (B), and fixing with the clamp screw (A).

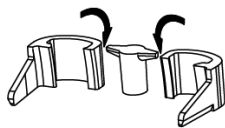


Fig. 1

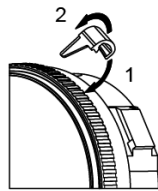


Fig. 2

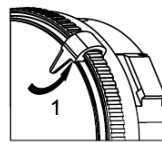


Fig. 3

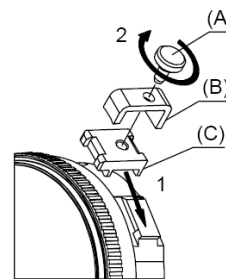
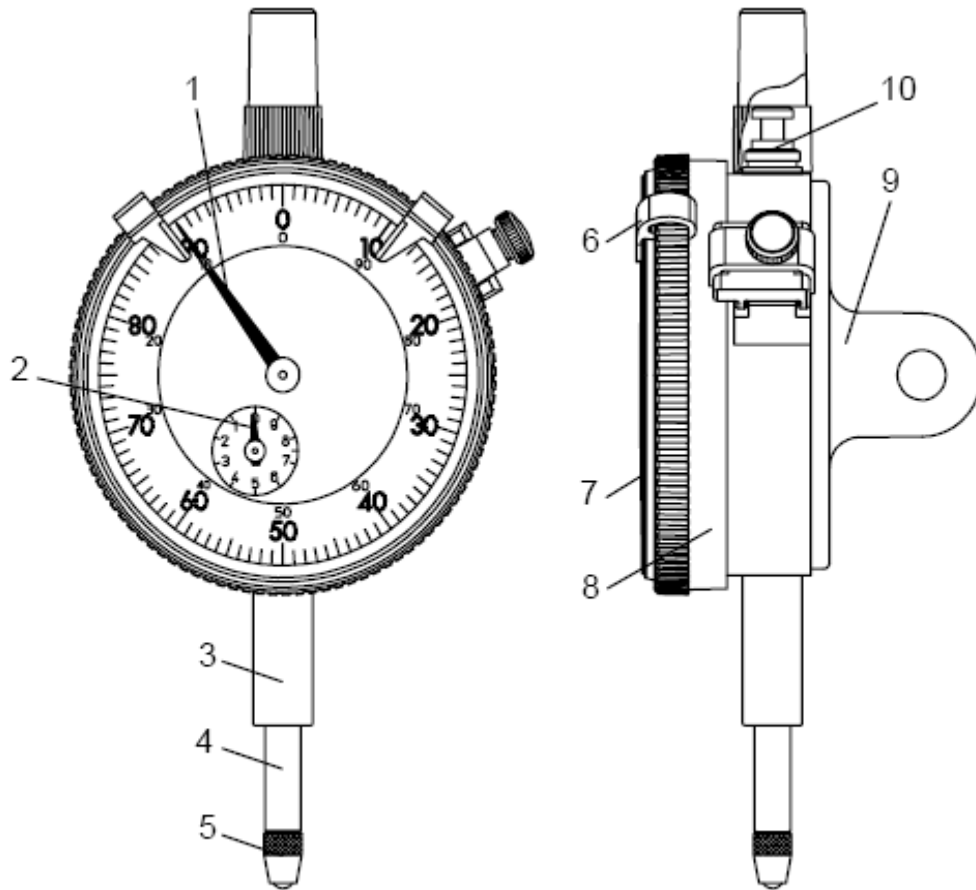


Fig. 4

- Gauge Parts
 1. Long Hand
 2. Short Hand
 3. Stem
 4. Spindle
 5. Contact Point
 6. Limit Hand
 7. Crystal Gauge Face
 8. Bezel
 9. Lug
 10. Spindle Stop



Mitutoyo

Table 3 - Radius Values (D = 4mm)

H	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	N/A	200	100	66.7	50	40	33.4	28.6	25	22.3
0.1	20.1	18.2	16.7	15.4	14.4	13.4	12.6	11.8	11.2	10.6
0.2	10.1	9.6	9.2	8.8	8.5	8.1	7.8	7.5	7.3	7
0.3	6.8	6.6	6.4	6.2	6.1	5.9	5.7	5.6	5.5	5.3
0.4	5.2	5.1	5	4.9	4.8	4.7	4.6	4.5	4.4	4.3
0.5	4.3	4.2	4.1	4	4	3.9	3.9	3.8	3.7	3.7
0.6	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.2
0.7	3.2	3.2	3.1	3.1	3.1	3	3	3	3	2.9
0.8	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.7	2.7	2.7
0.9	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5
1.0	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4
1.1	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3

Table 4 - Radius Values (D = 8mm)

H	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	N/A	800	400	266.7	200	160	133.4	114.3	100	88.9
0.1	80.1	72.8	66.7	61.6	57.2	53.4	50.1	47.1	44.5	42.2
0.2	40.1	38.2	36.5	34.9	33.5	32.1	30.9	29.8	28.7	27.7
0.3	26.8	26	25.2	24.4	23.7	23	22.4	21.8	21.2	20.7
0.4	20.2	19.7	19.3	18.8	18.4	18	17.6	17.3	16.9	16.6
0.5	16.3	15.9	15.6	15.4	15.1	14.8	14.6	14.3	14.1	13.9
0.6	13.6	13.4	13.2	13	12.8	12.6	12.5	12.3	12.1	11.9
0.7	11.8	11.6	11.5	11.3	11.2	11	10.9	10.8	10.6	10.5
0.8	10.4	10.3	10.2	10.1	9.9	9.8	9.7	9.6	9.5	9.4
0.9	9.3	9.2	9.2	9.1	9	8.9	8.8	8.7	8.7	8.6
1	8.5	8.4	8.4	8.3	8.2	8.1	8.1	8	7.9	7.9
1.1	7.8	7.8	7.7	7.6	7.6	7.5	7.5	7.4	7.4	7.3
1.2	7.3	7.2	7.2	7.1	7.1	7	7	6.9	6.9	6.8
1.3	6.8	6.8	6.7	6.7	6.6	6.6	6.6	6.5	6.5	6.5
1.4	6.4	6.4	6.3	6.3	6.3	6.2	6.2	6.2	6.1	6.1
1.5	6.1	6.1	6	6	6	5.9	5.9	5.9	5.9	5.8
1.6	5.8	5.8	5.7	5.7	5.7	5.7	5.6	5.6	5.6	5.6

Table 5 - Radius Values (D = 12mm)

H	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	N/A	1800.0	900.0	600.0	450.0	360.0	300.0	257.2	225.0	200.0
0.1	180.1	163.7	150.1	138.5	128.6	120.1	112.6	106.0	100.1	94.8
0.2	90.1	85.8	81.9	78.4	75.1	72.1	69.4	66.8	64.4	62.2
0.3	60.2	58.2	56.4	54.7	53.1	51.6	50.2	48.8	47.6	46.3
0.4	45.2	44.1	43.1	42.1	41.1	40.2	39.4	38.5	37.7	37.0
0.5	36.3	35.5	34.9	34.2	33.6	33.0	32.4	31.9	31.3	30.8
0.6	30.3	29.8	29.3	28.9	28.4	28.0	27.6	27.2	26.8	26.4
0.7	26.1	25.7	25.4	25.0	24.7	24.4	24.1	23.8	23.5	23.2
0.8	22.9	22.6	22.4	22.1	21.8	21.6	21.4	21.1	20.9	20.7
0.9	20.5	20.2	20.0	19.8	19.6	19.4	19.2	19.0	18.9	18.7
1	18.5	18.3	18.2	18.0	17.8	17.7	17.5	17.4	17.2	17.1
1.1	16.9	16.8	16.6	16.5	16.4	16.2	16.1	16.0	15.8	15.7
1.2	15.6	15.5	15.4	15.2	15.1	15.0	14.9	14.8	14.7	14.6
1.3	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6
1.4	13.6	13.5	13.4	13.3	13.2	13.1	13.1	13.0	12.9	12.8
1.5	12.8	12.7	12.6	12.5	12.5	12.4	12.3	12.2	12.2	12.1
1.6	12.1	12.0	11.9	11.9	11.8	11.7	11.7	11.6	11.6	11.5
1.7	11.4	11.4	11.3	11.3	11.2	11.2	11.1	11.1	11.0	11.0
1.8	10.9	10.8	10.8	10.8	10.7	10.7	10.6	10.6	10.5	10.5
1.9	10.4	10.4	10.3	10.3	10.2	10.2	10.2	10.1	10.1	10.0
2	10.0	10.0	9.9	9.9	9.8	9.8	9.8	9.7	9.7	9.7
2.1	9.6	9.6	9.6	9.5	9.5	9.4	9.4	9.4	9.3	9.3
2.2	9.3	9.2	9.2	9.2	9.2	9.1	9.1	9.1	9.0	9.0
2.3	9.0	8.9	8.9	8.9	8.9	8.8	8.8	8.8	8.8	8.7
2.4	8.7	8.7	8.6	8.6	8.6	8.6	8.5	8.5	8.5	8.5
2.5	8.5	8.4	8.4	8.4	8.4	8.3	8.3	8.3	8.3	8.2
2.6	8.2	8.2	8.2	8.2	8.1	8.1	8.1	8.1	8.1	8.0
2.7	8.0	8.0	8.0	8.0	7.9	7.9	7.9	7.9	7.9	7.8
2.8	7.8	7.8	7.8	7.8	7.8	7.7	7.7	7.7	7.7	7.7
2.9	7.7	7.6	7.6	7.6	7.6	7.6	7.6	7.5	7.5	7.5
3	7.5	7.5	7.5	7.5	7.4	7.4	7.4	7.4	7.4	7.4

Table 7 - Radius Values (D = 20mm)

H	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	N/A	5000.0	2500.0	1666.7	1250.0	1000.0	833.4	714.3	625.0	555.6
0.1	500.1	454.6	416.7	384.7	357.2	333.4	312.6	294.2	277.9	263.3
0.2	250.1	238.2	227.4	217.5	208.5	200.1	192.4	185.3	178.7	172.6
0.3	166.8	161.4	156.4	151.7	147.2	143.0	139.1	135.3	131.8	128.4
0.4	125.2	122.2	119.3	116.5	113.9	111.3	108.9	106.6	104.4	102.3
0.5	100.3	98.3	96.4	94.6	92.9	91.2	89.6	88.0	86.5	85.0
0.6	83.6	82.3	81.0	79.7	78.4	77.2	76.1	75.0	73.9	72.8
0.7	71.8	70.8	69.8	68.9	67.9	67.0	66.2	65.3	64.5	63.7
0.8	62.9	62.1	61.4	60.7	59.9	59.2	58.6	57.9	57.3	56.6
0.9	56.0	55.4	54.8	54.2	53.7	53.1	52.6	52.0	51.5	51.0
1	50.5	50.0	49.5	49.1	48.6	48.1	47.7	47.3	46.8	46.4
1.1	46.0	45.6	45.2	44.8	44.4	44.1	43.7	43.3	43.0	42.6
1.2	42.3	41.9	41.6	41.3	40.9	40.6	40.3	40.0	39.7	39.4
1.3	39.1	38.8	38.5	38.3	38.0	37.7	37.4	37.2	36.9	36.7
1.4	36.4	36.2	35.9	35.7	35.4	35.2	35.0	34.7	34.5	34.3
1.5	34.1	33.9	33.7	33.4	33.2	33.0	32.8	32.6	32.4	32.2
1.6	32.1	31.9	31.7	31.5	31.3	31.1	31.0	30.8	30.6	30.4
1.7	30.3	30.1	29.9	29.8	29.6	29.4	29.3	29.1	29.0	28.8
1.8	28.7	28.5	28.4	28.2	28.1	28.0	27.8	27.7	27.5	27.4
1.9	27.3	27.1	27.0	26.9	26.7	26.6	26.5	26.4	26.2	26.1
2	26.0	25.9	25.8	25.6	25.5	25.4	25.3	25.2	25.1	25.0
2.1	24.9	24.8	24.6	24.5	24.4	24.3	24.2	24.1	24.0	23.9
2.2	23.8	23.7	23.6	23.5	23.4	23.3	23.3	23.2	23.1	23.0
2.3	22.9	22.8	22.7	22.6	22.5	22.5	22.4	22.3	22.2	22.1
2.4	22.0	22.0	21.9	21.8	21.7	21.6	21.6	21.5	21.4	21.3
2.5	21.3	21.2	21.1	21.0	21.0	20.9	20.8	20.7	20.7	20.6
2.6	20.5	20.5	20.4	20.3	20.3	20.2	20.1	20.1	20.0	19.9
2.7	19.9	19.8	19.7	19.7	19.6	19.6	19.5	19.4	19.4	19.3
2.8	19.3	19.2	19.1	19.1	19.0	19.0	18.9	18.9	18.8	18.7
2.9	18.7	18.6	18.6	18.5	18.5	18.4	18.4	18.3	18.3	18.2
3	18.2	18.1	18.1	18.0	18.0	17.9	17.9	17.8	17.8	17.7
3.1	17.7	17.6	17.6	17.5	17.5	17.4	17.4	17.4	17.3	17.3
3.2	17.2	17.2	17.1	17.1	17.1	17.0	17.0	16.9	16.9	16.8
3.3	16.8	16.8	16.7	16.7	16.6	16.6	16.6	16.5	16.5	16.4
3.4	16.4	16.4	16.3	16.3	16.3	16.2	16.2	16.1	16.1	16.1
3.5	16.0	16.0	16.0	15.9	15.9	15.9	15.8	15.8	15.8	15.7
3.6	15.7	15.7	15.6	15.6	15.6	15.5	15.5	15.5	15.4	15.4
3.7	15.4	15.3	15.3	15.3	15.2	15.2	15.2	15.1	15.1	15.1
3.8	15.1	15.0	15.0	15.0	14.9	14.9	14.9	14.9	14.8	14.8
3.9	14.8	14.7	14.7	14.7	14.7	14.6	14.6	14.6	14.6	14.5
4	14.5	14.5	14.4	14.4	14.4	14.4	14.3	14.3	14.3	14.3
4.1	14.2	14.2	14.2	14.2	14.1	14.1	14.1	14.1	14.1	14.0
4.2	14.0	14.0	14.0	13.9	13.9	13.9	13.9	13.8	13.8	13.8
4.3	13.8	13.8	13.7	13.7	13.7	13.7	13.6	13.6	13.6	13.6
4.4	13.6	13.5	13.5	13.5	13.5	13.5	13.4	13.4	13.4	13.4
4.5	13.4	13.3	13.3	13.3	13.3	13.3	13.2	13.2	13.2	13.2
4.6	13.2	13.2	13.1	13.1	13.1	13.1	13.1	13.0	13.0	13.0
4.7	13.0	13.0	13.0	12.9	12.9	12.9	12.9	12.9	12.9	12.8
4.8	12.8	12.8	12.8	12.8	12.8	12.7	12.7	12.7	12.7	12.7
4.9	12.7	12.6	12.6	12.6	12.6	12.6	12.6	12.5	12.5	12.5
5	12.5	12.5	12.5	12.5	12.4	12.4	12.4	12.4	12.4	12.4

Table 8 - Radius Values (D = 24mm)

H	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	N/A	7200.0	3600.0	2400.0	1800.0	1440.0	1200.0	1028.6	900.0	800.0
0.1	720.1	654.6	600.1	553.9	514.4	480.1	450.1	423.6	400.1	379.0
0.2	360.1	343.0	327.4	313.2	300.1	288.1	277.1	266.8	257.3	248.4
0.3	240.2	232.4	225.2	218.3	211.9	205.9	200.2	194.8	189.7	184.8
0.4	180.2	175.8	171.6	167.7	163.9	160.2	156.8	153.4	150.2	147.2
0.5	144.3	141.4	138.7	136.1	133.6	131.2	128.9	126.6	124.4	122.3
0.6	120.3	118.3	116.4	114.6	112.8	111.1	109.4	107.8	106.2	104.7
0.7	103.2	101.8	100.4	99.0	97.7	96.4	95.1	93.9	92.7	91.5
0.8	90.4	89.3	88.2	87.2	86.1	85.1	84.2	83.2	82.3	81.3
0.9	80.5	79.6	78.7	77.9	77.1	76.3	75.5	74.7	74.0	73.2
1	72.5	71.8	71.1	70.4	69.8	69.1	68.5	67.8	67.2	66.6
1.1	66.0	65.4	64.8	64.3	63.7	63.2	62.6	62.1	61.6	61.1
1.2	60.6	60.1	59.6	59.2	58.7	58.2	57.8	57.3	56.9	56.5
1.3	56.0	55.6	55.2	54.8	54.4	54.0	53.6	53.2	52.9	52.5
1.4	52.1	51.8	51.4	51.1	50.7	50.4	50.0	49.7	49.4	49.1
1.5	48.8	48.4	48.1	47.8	47.5	47.2	46.9	46.6	46.4	46.1
1.6	45.8	45.5	45.3	45.0	44.7	44.5	44.2	43.9	43.7	43.4
1.7	43.2	43.0	42.7	42.5	42.2	42.0	41.8	41.6	41.3	41.1
1.8	40.9	40.7	40.5	40.3	40.1	39.8	39.6	39.4	39.2	39.0
1.9	38.8	38.7	38.5	38.3	38.1	37.9	37.7	37.5	37.4	37.2
2	37.0	36.8	36.7	36.5	36.3	36.1	36.0	35.8	35.7	35.5
2.1	35.3	35.2	35.0	34.9	34.7	34.6	34.4	34.3	34.1	34.0
2.2	33.8	33.7	33.5	33.4	33.3	33.1	33.0	32.9	32.7	32.6
2.3	32.5	32.3	32.2	32.1	31.9	31.8	31.7	31.6	31.4	31.3
2.4	31.2	31.1	31.0	30.8	30.7	30.6	30.5	30.4	30.3	30.2
2.5	30.1	29.9	29.8	29.7	29.6	29.5	29.4	29.3	29.2	29.1
2.6	29.0	28.9	28.8	28.7	28.6	28.5	28.4	28.3	28.2	28.1
2.7	28.0	27.9	27.8	27.7	27.6	27.6	27.5	27.4	27.3	27.2
2.8	27.1	27.0	26.9	26.9	26.8	26.7	26.6	26.5	26.4	26.4
2.9	26.3	26.2	26.1	26.0	26.0	25.9	25.8	25.7	25.7	25.6
3	25.5	25.4	25.4	25.3	25.2	25.1	25.1	25.0	24.9	24.8
3.1	24.8	24.7	24.6	24.6	24.5	24.4	24.4	24.3	24.2	24.2
3.2	24.1	24.0	24.0	23.9	23.8	23.8	23.7	23.7	23.6	23.5
3.3	23.5	23.4	23.3	23.3	23.2	23.2	23.1	23.0	23.0	22.9
3.4	22.9	22.8	22.8	22.7	22.7	22.6	22.5	22.5	22.4	22.4
3.5	22.3	22.3	22.2	22.2	22.1	22.1	22.0	22.0	21.9	21.9
3.6	21.8	21.7	21.7	21.6	21.6	21.6	21.5	21.5	21.4	21.4
3.7	21.3	21.3	21.2	21.2	21.1	21.1	21.0	21.0	20.9	20.9
3.8	20.8	20.8	20.8	20.7	20.7	20.6	20.6	20.5	20.5	20.5
3.9	20.4	20.4	20.3	20.3	20.2	20.2	20.2	20.1	20.1	20.0
4	20.0	20.0	19.9	19.9	19.8	19.8	19.8	19.7	19.7	19.6
4.1	19.6	19.6	19.5	19.5	19.5	19.4	19.4	19.4	19.3	19.3
4.2	19.2	19.2	19.2	19.1	19.1	19.1	19.0	19.0	19.0	18.9
4.3	18.9	18.9	18.8	18.8	18.8	18.7	18.7	18.7	18.6	18.6
4.4	18.6	18.5	18.5	18.5	18.4	18.4	18.4	18.3	18.3	18.3
4.5	18.3	18.2	18.2	18.2	18.1	18.1	18.1	18.0	18.0	18.0
4.6	18.0	17.9	17.9	17.9	17.8	17.8	17.8	17.8	17.7	17.7
4.7	17.7	17.6	17.6	17.6	17.6	17.5	17.5	17.5	17.5	17.4
4.8	17.4	17.4	17.3	17.3	17.3	17.3	17.2	17.2	17.2	17.2
4.9	17.1	17.1	17.1	17.1	17.0	17.0	17.0	17.0	16.9	16.9
5	16.9	16.9	16.9	16.8	16.8	16.8	16.8	16.7	16.7	16.7

Table 9 - Radius Values (D = 28mm)

H	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	N/A	9800.0	4900.0	3266.7	2450.0	1960.0	1633.4	1400.0	1225.0	1088.9
0.1	980.1	891.0	816.7	753.9	700.1	653.4	612.6	576.6	544.5	515.9
0.2	490.1	466.8	445.6	426.2	408.5	392.1	377.1	363.1	350.1	338.1
0.3	326.8	316.3	306.4	297.1	288.4	280.2	272.4	265.0	258.1	251.5
0.4	245.2	239.2	233.5	228.1	222.9	218.0	213.3	208.7	204.4	200.2
0.5	196.3	192.4	188.7	185.2	181.8	178.5	175.3	172.2	169.3	166.4
0.6	163.6	161.0	158.4	155.9	153.4	151.1	148.8	146.6	144.5	142.4
0.7	140.4	138.4	136.5	134.6	132.8	131.0	129.3	127.7	126.0	124.4
0.8	122.9	121.4	119.9	118.5	117.1	115.7	114.4	113.1	111.8	110.6
0.9	109.3	108.1	107.0	105.8	104.7	103.6	102.6	101.5	100.5	99.5
1	98.5	97.5	96.6	95.7	94.8	93.9	93.0	92.1	91.3	90.5
1.1	89.6	88.8	88.1	87.3	86.5	85.8	85.1	84.3	83.6	82.9
1.2	82.3	81.6	80.9	80.3	79.7	79.0	78.4	77.8	77.2	76.6
1.3	76.0	75.5	74.9	74.3	73.8	73.3	72.7	72.2	71.7	71.2
1.4	70.7	70.2	69.7	69.2	68.8	68.3	67.9	67.4	67.0	66.5
1.5	66.1	65.7	65.2	64.8	64.4	64.0	63.6	63.2	62.8	62.4
1.6	62.1	61.7	61.3	60.9	60.6	60.2	59.9	59.5	59.2	58.8
1.7	58.5	58.2	57.8	57.5	57.2	56.9	56.6	56.3	55.9	55.6
1.8	55.3	55.0	54.8	54.5	54.2	53.9	53.6	53.3	53.1	52.8
1.9	52.5	52.3	52.0	51.7	51.5	51.2	51.0	50.7	50.5	50.2
2	50.0	49.8	49.5	49.3	49.1	48.8	48.6	48.4	48.2	47.9
2.1	47.7	47.5	47.3	47.1	46.9	46.7	46.5	46.2	46.0	45.8
2.2	45.6	45.4	45.3	45.1	44.9	44.7	44.5	44.3	44.1	43.9
2.3	43.8	43.6	43.4	43.2	43.1	42.9	42.7	42.5	42.4	42.2
2.4	42.0	41.9	41.7	41.5	41.4	41.2	41.1	40.9	40.8	40.6
2.5	40.5	40.3	40.1	40.0	39.9	39.7	39.6	39.4	39.3	39.1
2.6	39.0	38.9	38.7	38.6	38.4	38.3	38.2	38.0	37.9	37.8
2.7	37.6	37.5	37.4	37.3	37.1	37.0	36.9	36.8	36.6	36.5
2.8	36.4	36.3	36.2	36.0	35.9	35.8	35.7	35.6	35.5	35.4
2.9	35.2	35.1	35.0	34.9	34.8	34.7	34.6	34.5	34.4	34.3
3	34.2	34.1	34.0	33.9	33.8	33.7	33.6	33.5	33.4	33.3
3.1	33.2	33.1	33.0	32.9	32.8	32.7	32.6	32.5	32.4	32.3
3.2	32.2	32.1	32.0	32.0	31.9	31.8	31.7	31.6	31.5	31.4
3.3	31.3	31.3	31.2	31.1	31.0	30.9	30.8	30.8	30.7	30.6
3.4	30.5	30.4	30.4	30.3	30.2	30.1	30.1	30.0	29.9	29.8
3.5	29.8	29.7	29.6	29.5	29.5	29.4	29.3	29.2	29.2	29.1
3.6	29.0	29.0	28.9	28.8	28.7	28.7	28.6	28.5	28.5	28.4
3.7	28.3	28.3	28.2	28.1	28.1	28.0	27.9	27.9	27.8	27.8
3.8	27.7	27.6	27.6	27.5	27.4	27.4	27.3	27.3	27.2	27.1
3.9	27.1	27.0	27.0	26.9	26.8	26.8	26.7	26.7	26.6	26.6
4	26.5	26.4	26.4	26.3	26.3	26.2	26.2	26.1	26.1	26.0
4.1	26.0	25.9	25.8	25.8	25.7	25.7	25.6	25.6	25.5	25.5
4.2	25.4	25.4	25.3	25.3	25.2	25.2	25.1	25.1	25.0	25.0
4.3	24.9	24.9	24.8	24.8	24.8	24.7	24.7	24.6	24.6	24.5
4.4	24.5	24.4	24.4	24.3	24.3	24.2	24.2	24.2	24.1	24.1
4.5	24.0	24.0	23.9	23.9	23.9	23.8	23.8	23.7	23.7	23.6
4.6	23.6	23.6	23.5	23.5	23.4	23.4	23.4	23.3	23.3	23.2
4.7	23.2	23.2	23.1	23.1	23.0	23.0	23.0	22.9	22.9	22.9
4.8	22.8	22.8	22.7	22.7	22.7	22.6	22.6	22.6	22.5	22.5
4.9	22.5	22.4	22.4	22.3	22.3	22.3	22.2	22.2	22.2	22.1
5	22.1	22.1	22.0	22.0	22.0	21.9	21.9	21.9	21.8	21.8