



# Knoxville Bolt and Screw, Inc.

[www.knoxvillebolt.com](http://www.knoxvillebolt.com)

614 Sevier Avenue  
P.O. Box 9149  
Knoxville, TN 37920-1738

FAX 865-573-8617

865-573-1991  
800-231-3309  
800-231-9566

## Washer Manufacturing

Stamped metal washers measure typically 0.005 to 0.250 in. thick, with outside diameters to 5 in. Metalforming companies stamp them on presses from 5 to 200 tons from sheetmetal blanks fed manually or automatically, or often from coil stock on progressive dies. Press lines may include automatic uncoiling, feeding and injection systems.

Washers can be stamped from any punchable materials, including spring steel, carbon steel, stainless steel, brass and aluminum alloys. Washer designs include wavy, bowed and slotted. Typical styles include fender washers (light, medium and heavy), high-strength structural washers, U-bolt washers, split-lock styles, dock washers and automotive body shims. Order quantities typically start at 100 pieces, although many suppliers will satisfy special requests for smaller quantities.

Value-added services offered by washer manufacturers include flat or tumble deburring, heattreating and plating (cadmium, phosphate, mechanical galvanizing and hot-dip galvanizing). Some washer manufacturers also offer fully-equipped A2LA laboratories and meet quality standards for nuclear construction, MIL-Spec work, and SAE and ANSI specs.

Two types of flat washers are defined for general use. Type A is a series of steel washers with broad tolerances, where design refinement is not important. They range from No. 6 to 3-in. hole size and from 3/16 to 5 1/2-in. OD. Type A washers are satisfactory for most assemblies. Type B washers are of higher quality and are specified in Narrow, Regular, and Wide diameters for each screw size from No. 0 to 3 in. However, many other standard sizes are available.

Series Designations -- N-Narrow, R-Regular, W-Wide



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| <b>American National Standard (ANSI)<br/>           Type B Plain Washers</b> |                     |        |                 |                  |           |
|--|---------------------|--------|-----------------|------------------|-----------|
| Nominal Size   | Decimal Equiv. Size | Series | Inside Diameter | Outside Diameter | Thickness |
| <b>No. 0</b>   | 0.060"              | N      | 0.0680          | 0.1250           | 0.0250    |
|  |                     | R      | 0.0680          | 0.1880           | 0.0250    |
|  |                     | W      | 0.0680          | 0.2500           | 0.0250    |
| <b>No. 1</b>   | 0.073"              | N      | 0.0840          | 0.1560           | 0.0250    |
|  |                     | R      | 0.0840          | 0.2190           | 0.0250    |
|  |                     | W      | 0.0840          | 0.2810           | 0.0320    |
| <b>No. 2</b>   | 0.086"              | N      | 0.0940          | 0.1880           | 0.0250    |
|  |                     | R      | 0.0940          | 0.2500           | 0.0320    |
|  |                     | W      | 0.0940          | 0.3440           | 0.0320    |
| <b>No. 3</b>   | 0.099"              | N      | 0.1090          | 0.2190           | 0.0250    |
|  |                     | R      | 0.1090          | 0.3120           | 0.0320    |
|  |                     | W      | 0.1090          | 0.4060           | 0.0400    |
| <b>No. 4</b>   | 0.112"              | N      | 0.1250          | 0.2500           | 0.0320    |
|  |                     | R      | 0.1250          | 0.3750           | 0.0400    |
|  |                     | W      | 0.1250          | 0.4380           | 0.0400    |
| <b>No. 5</b>   | 0.125"              | N      | 0.1410          | 0.2810           | 0.0320    |
|  |                     | R      | 0.1410          | 0.4060           | 0.0400    |
|  |                     | W      | 0.1410          | 0.5000           | 0.0400    |
| <b>No. 6</b>   | 0.138"              | N      | 0.1560          | 0.3120           | 0.0320    |
|  |                     | R      | 0.1560          | 0.4380           | 0.0400    |
|  |                     | W      | 0.1560          | 0.5620           | 0.0400    |



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| Nominal Size  | Decimal Equiv. Size | Series | Inside Diameter | Outside Diameter | Thickness |
|---------------|---------------------|--------|-----------------|------------------|-----------|
| <b>No. 8</b>  | 0.164"              | N      | 0.1880          | 0.3750           | 0.0400    |
|               |                     | R      | 0.1880          | 0.5000           | 0.0400    |
|               |                     | W      | 0.1880          | 0.6250           | 0.0630    |
| <b>No. 10</b> | 0.190"              | N      | 0.2030          | 0.4060           | 0.0400    |
|               |                     | R      | 0.2030          | 0.5620           | 0.0400    |
|               |                     | W      | 0.2030          | 0.7340           | 0.0630    |
| <b>No. 12</b> | 0.216"              | N      | 0.2340          | 0.4380           | 0.0400    |
|               |                     | R      | 0.2340          | 0.6250           | 0.0630    |
|               |                     | W      | 0.2340          | 0.8750           | 0.0630    |
| <b>.25</b>    | 0.25"               | N      | 0.2810          | 0.5000           | 0.0630    |
|               |                     | R      | 0.2810          | 0.7340           | 0.0630    |
|               |                     | W      | 0.2810          | 1.0000           | 0.0630    |
| <b>.3125</b>  | 0.312"              | N      | 0.3440          | 0.6250           | 0.0630    |
|               |                     | R      | 0.3440          | 0.8750           | 0.0630    |
|               |                     | W      | 0.3440          | 1.1250           | 0.0630    |
| <b>.375</b>   | 0.375"              | N      | 0.4060          | 0.7340           | 0.0630    |
|               |                     | R      | 0.4060          | 1.0000           | 0.0630    |
|               |                     | W      | 0.4060          | 1.2500           | 0.1000    |
| <b>.4375</b>  | 0.438"              | N      | 0.4690          | 0.8750           | 0.0630    |
|               |                     | R      | 0.4690          | 1.1250           | 0.0630    |
|               |                     | W      | 0.4690          | 1.4690           | 0.1000    |



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| Nominal Size | Decimal Equiv. Size | Series | Inside Diameter | Outside Diameter | Thickness |
|--------------|---------------------|--------|-----------------|------------------|-----------|
| <b>.5</b>    | 0.500"              | N      | 0.5310          | 1.0000           | 0.0630    |
|              |                     | R      | 0.5310          | 1.2500           | 0.1000    |
|              |                     | W      | 0.5310          | 1.7500           | 0.1000    |
| <b>.5625</b> | 0.562"              | N      | 0.5940          | 1.1250           | 0.0630    |
|              |                     | R      | 0.5940          | 1.4690           | 0.1000    |
|              |                     | W      | 0.5940          | 2.0000           | 0.1000    |
| <b>.625</b>  | 0.625"              | N      | 0.6560          | 1.2500           | 0.1000    |
|              |                     | R      | 0.6560          | 1.7500           | 0.1000    |
|              |                     | W      | 0.6560          | 2.2500           | 0.1600    |
| <b>.75</b>   | 0.750"              | N      | 0.8120          | 1.3750           | 0.1000    |
|              |                     | R      | 0.8120          | 2.0000           | 0.1000    |
|              |                     | W      | 0.8120          | 2.5000           | 0.1600    |
| <b>.875</b>  | 0.875"              | N      | 0.9380          | 1.4690           | 0.1000    |
|              |                     | R      | 0.9380          | 2.2500           | 0.1600    |
|              |                     | W      | 0.9380          | 2.7500           | 0.1600    |
| <b>1</b>     | 1.000"              | N      | 1.0620          | 1.7500           | 0.1000    |
|              |                     | R      | 1.0620          | 2.5000           | 0.1600    |
|              |                     | W      | 1.0620          | 3.0000           | 0.1600    |
| <b>1.125</b> | 1.125"              | N      | 1.1880          | 2.0000           | 0.1000    |
|              |                     | R      | 1.1880          | 2.7500           | 0.1600    |
|              |                     | W      | 1.1880          | 3.2500           | 0.1600    |



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| Nominal Size | Decimal Equiv. Size | Series | Inside Diameter | Outside Diameter | Thickness |
|--------------|---------------------|--------|-----------------|------------------|-----------|
| <b>1.25</b>  | 1.250"              | N      | 1.3120          | 2.2500           | 0.1600    |
|              |                     | R      | 1.3120          | 3.0000           | 0.1600    |
|              |                     | W      | 1.3120          | 3.5000           | 0.2500    |
| <b>1.375</b> | 1.375"              | N      | 1.4380          | 2.5000           | 0.1600    |
|              |                     | R      | 1.4380          | 3.2500           | 0.1600    |
|              |                     | W      | 1.4380          | 3.7500           | 0.2500    |
| <b>1.5</b>   | 1.500"              | N      | 1.5620          | 2.7500           | 0.1600    |
|              |                     | R      | 1.5620          | 3.5000           | 0.2500    |
|              |                     | W      | 1.5620          | 4.0000           | 0.2500    |
| <b>1.625</b> | 1.625"              | N      | 1.7500          | 3.0000           | 0.1600    |
|              |                     | R      | 1.7500          | 3.7500           | 0.2500    |
|              |                     | W      | 1.7500          | 4.2500           | 0.2500    |
| <b>1.75</b>  | 1.750"              | N      | 1.8750          | 3.2500           | 0.1600    |
|              |                     | R      | 1.8750          | 4.0000           | 0.2500    |
|              |                     | W      | 1.8750          | 4.5000           | 0.2500    |
| <b>1.875</b> | 1.875"              | N      | 2.0000          | 3.5000           | 0.2500    |
|              |                     | R      | 2.0000          | 4.2500           | 0.2500    |
|              |                     | W      | 2.0000          | 4.7500           | 0.2500    |
| <b>2</b>     | 2.000"              | N      | 2.1250          | 3.7500           | 0.2500    |
|              |                     | R      | 2.1250          | 4.5000           | 0.2500    |
|              |                     | W      | 2.1250          | 5.0000           | 0.2500    |



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| Nominal Size | Decimal Equiv. Size | Series | Inside Diameter | Outside Diameter | Thickness |
|--------------|---------------------|--------|-----------------|------------------|-----------|
| 2.25         | 2.250"              | N      | 2.3750          | 4.0000           | 0.2500    |
|              |                     | R      | 2.3750          | 5.0000           | 0.2500    |
|              |                     | W      | 2.3750          | 5.5000           | 0.3750    |
| 2.5          | 2.500"              | N      | 2.6250          | 4.5000           | 0.2500    |
|              |                     | R      | 2.6250          | 5.5000           | 0.3750    |
|              |                     | W      | 2.6250          | 6.0000           | 0.3750    |
| 2.75         | 2.750"              | N      | 2.8750          | 5.0000           | 0.2500    |
|              |                     | R      | 2.8750          | 6.0000           | 0.3750    |
|              |                     | W      | 2.8750          | 6.5000           | 0.3750    |
| 3            | 3.000"              | N      | 3.1250          | 5.5000           | 0.3750    |
|              |                     | R      | 3.1250          | 6.5000           | 0.3750    |
|              |                     | W      | 3.1250          | 7.0000           | 0.3750    |

N-Narrow, R-Regular, W-Wide