MEASUREMENT TECHNIQUES FOR THE INSPECTION OF COiled SPRING PINS
Diameter

Coiled pin design is such that, diameter will be within specification over a minimum of 270° of the circumference. This design characteristic ensures that diameter at the seam will remain equal to, or less than, that at any other point in the plane of rotation. This feature prevents the seam from damaging the host component.

Diameter is measured utilizing a micrometer. Micrometer measurements are taken at 0°, 45°, and 90° to the seam as depicted in the diagrams below. A micrometer with a reduced diameter anvil is used to measure very small pins. Regardless of anvil size, it is critical that the pin be centered between the upper and lower anvils. It is also critical that the micrometer not be tightened beyond the point at which it contacts the pin as excess compression may yield incorrect readings. Diameter is to be measured a minimum of one pin diameter in length from the end of the pin. This eliminates measurement error relating to the transition from chamfer to tenon diameter. For example, when measuring a Ø4.00mm coiled pin, diameter would be measured no closer than 4.00mm to the end of the pin.

Orientation at 0° to the seam

Orientation at 45° to the seam

Orientation at 90° to the seam
Length

The length of a coiled pin is easily measured utilizing a caliper or micrometer. It is critical that the pin be positioned squarely between the anvils of the measuring tool. See the photograph below:

Chamfer Diameter (‘B’ Max)

The chamfer diameter or ‘B’ maximum is designed to be smaller than the minimum recommended hole. This feature can be measured with a micrometer, caliper, or optical comparator. The easiest method by which to inspect is to open a micrometer to the specified ‘B’ max dimension, lock it, and ensure the pin ‘catches’ or fits between the upper and lower anvils. Please note the diagram, which demonstrates proper measurement technique utilizing a micrometer (most common method).
Hardness Inspection

Hardness is inspected utilizing either of two methods. The preferred method is a micro-harness test. The second method is superficial Rockwell testing.

Superficial Rockwell testing can provide valid results if employed correctly. The Rockwell testing scale is determined by the thickness of the strip being tested. See below:

**TABLE 1**

**HARDNESS TESTING SCALE BASED ON MATERIAL THICKNESS FOR FINISHED PRODUCTS**

<table>
<thead>
<tr>
<th>Thickness Range</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>.001 to .015</td>
<td>Vickers</td>
</tr>
<tr>
<td>.015 to .025</td>
<td>15N SCALE</td>
</tr>
<tr>
<td>.025 to .035</td>
<td>A-SCALE</td>
</tr>
<tr>
<td>.035 to .050</td>
<td>D-SCALE</td>
</tr>
<tr>
<td>.050 &amp; UP</td>
<td>C-SCALE</td>
</tr>
</tbody>
</table>

*As indicated, strip measuring .001 to .015" thick, must be measured using the Vickers scale however, the Vickers scale may be used to measure any strip thickness.

To employ the superficial Rockwell test method, a strip of the pin must be removed perpendicular to its axis. The strip must then be placed on the anvil in such a manner that it is fully supported. Because a coiled pin is round, care must be taken to ensure the strip radius does not contact the top anvil. See the following diagrams for proper sample preparation and strip orientation in reference to the test anvil:
Micro-hardness testing of a coiled pin is the preferred method. To test using this method, the pin is cross-sectioned and one of the resultant pieces mounted for test. The mount is then polished to remove cutting marks. It is critical to note that the cutting and polishing operations must be performed with proper coolants to prevent excessive heating of the sample.
Photograph of a mounted and polished coiled spring pin. This pin is now prepared for microhardness inspection.

Once the mount has been polished, the pins are tested in the middle of the center coil using the Vickers microhardness test method. Refer to the ‘X’ on the middle coil below.

Proper test location on a coiled spring pin

The Vickers diamond must be placed at least 1 diamond width from the edge of the material. When taking multiple hardness readings, each diamond must be placed so that the distance between any two diamonds is greater than twice the distance of any stress deformation that may occur when the indent is made. All hardness numbers are reported in HV (hardness Vickers).
SPIROL has developed a list of appropriate Vickers microhardness test loads to be used based on the raw material thickness being inspected. Refer to table 2.

**TABLE 2**

Strip Thickness vs. Microhardness Test Load

<table>
<thead>
<tr>
<th>Strip Thickness/ Inches</th>
<th>Load (Grams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.000 through .001</td>
<td>100</td>
</tr>
<tr>
<td>.002 through .004</td>
<td>200</td>
</tr>
<tr>
<td>.005 through .007</td>
<td>300</td>
</tr>
<tr>
<td>.008 and up</td>
<td>500</td>
</tr>
</tbody>
</table>

**Straightness Inspection**

Per ASME B18.8.2-2000 and ASME B18.8.100M-2000, the straightness of a coiled pin should be measured with a straightness gage as follows:

The straightness over the length of spring (coiled) pins shall be such that pins will pass freely through a ring gage of length as documented in Table 3 for the respective pin lengths. The maximum diameter of the ring gage hole must be equivalent to the maximum diameter of the pin free diameter plus the straightness diameter allowance documented in table 3.

**TABLE 3**

<table>
<thead>
<tr>
<th>Inch Coiled Pin Straightness Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal pin length</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Up to 1&quot; inclusive</td>
</tr>
<tr>
<td>1-2&quot; inclusive</td>
</tr>
<tr>
<td>Over 2&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metric Coiled Pin Straightness Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal pin length</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Up to 24mm inclusive</td>
</tr>
<tr>
<td>24-50mm inclusive</td>
</tr>
<tr>
<td>Over 50mm</td>
</tr>
</tbody>
</table>
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Please refer to [www.SPIROL.com](http://www.SPIROL.com) for current specifications and standard product offerings.

Reference Materials:
1. ASM Handbook Volume 8 – Mechanical Testing
2. ASME B18.8.2 2000
3. ASME B18.8.100M2000

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Americas
- SPIROL International Corporation
  - 30 Rock Avenue
  - Danielson, Connecticut 06239 U.S.A.
  - Tel. +1 860 774 8571
  - Fax. +1 860 774 2048
- SPIROL Shim Division
  - 321 Remington Road
  - Stow, Ohio 44224 U.S.A.
  - Tel. +1 330 920 3655
  - Fax. +1 330 920 3659
- SPIROL Canada
  - 3103 St. Etienne Boulevard
  - Windsor, Ontario N8W 5B1 Canada
  - Tel. +1 519 974 3334
  - Fax. +1 519 974 6550
- SPIROL Mexico
  - Carretera a Laredo KM 16.5 Interior E
  - Col. Moisés Saenz
  - Apodaca, N.L. 66613 Mexico
  - Tel. +52 81 8385 4390
  - Fax. +52 81 8385 4391
- SPIROL Brazil
  - Rua Mafalda Barnabé Soliane, 134
  - Comercial Vitória Martini, Distrito Industrial
  - CEP 13347-610, Indaiatuba, SP, Brazil
  - Tel. +55 19 3936 2701
  - Fax. +55 19 3936 7121
- SPIROL France
  - Cité de l'Automobile ZAC Croix Blandin
  - 18 Rue Léna Bernstein
  - 51100 Reims, France
  - Tel. +33 3 26 36 31 42
  - Fax. +33 3 26 09 19 76
- SPIROL United Kingdom
  - 17 Princenwood Road
  - Corby, Northants
  - NN17 4ET United Kingdom
  - Tel. +44 1536 444800
  - Fax. +44 1536 203415
- SPIROL Germany
  - Ottostr. 4
  - 80333 Munich, Germany
  - Tel. +49 89 4 111 905 71
  - Fax. +49 89 4 111 905 72
- SPIROL Spain
  - 08940 Cornellá de Llobregat
  - Barcelona, Spain
  - Tel. +34 93 193 05 32
  - Fax. +34 93 193 25 43
- SPIROL Czech Republic
  - Sokola Tůmy 743/16
  - Ostrava-Mariánské Hory 70900
  - Czech Republic
  - Tel/Fax: +420 417 537 979
- SPIROL Poland
  - ul. M. Skłodowskiej-Curie 7E / 2
  - 56-400, Oleśnica, Poland
  - Tel. +48 71 399 44 55

Europe
- SPIROL France
  - Cité de l'Automobile ZAC Croix Blandin
  - 18 Rue Léna Bernstein
  - 51100 Reims, France
  - Tel. +33 3 26 36 31 42
  - Fax. +33 3 26 09 19 76
- SPIROL United Kingdom
  - 17 Princenwood Road
  - Corby, Northants
  - NN17 4ET United Kingdom
  - Tel. +44 1536 444800
  - Fax. +44 1536 203415
- SPIROL Germany
  - Ottostr. 4
  - 80333 Munich, Germany
  - Tel. +49 89 4 111 905 71
  - Fax. +49 89 4 111 905 72
- SPIROL Spain
  - 08940 Cornellá de Llobregat
  - Barcelona, Spain
  - Tel. +34 93 193 05 32
  - Fax. +34 93 193 25 43
- SPIROL Czech Republic
  - Sokola Tůmy 743/16
  - Ostrava-Mariánské Hory 70900
  - Czech Republic
  - Tel/Fax: +420 417 537 979
- SPIROL Poland
  - ul. M. Skłodowskiej-Curie 7E / 2
  - 56-400, Oleśnica, Poland
  - Tel. +48 71 399 44 55

Asia
- SPIROL Asia Headquarters
  - 1st Floor, Building 22, Plot D9, District D
  - No. 122 HeDan Road
  - Wai Gao Qiao Free Trade Zone
  - Shanghai, China 200131
  - Tel. +86 21 5046 1451
  - Fax. +86 21 5046 1540

Pacific
- SPIROL Korea
  - 160-S Seokchon-Dong
  - Songpa-gu, Seoul, 138-844, Korea
  - Tel. +86 (0) 21 5046-1451
  - Fax. +86 (0) 21 5046-1540

e-mail: info@spirol.com

SPIROL.com