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A spokelength computer

The JavaScript routine behind the calculator at the bottom of this page determines spoke lengths for wheels of virtually any size and spoking pattern. I have gratefully nicked it from a Swiss site <http://www.tempo-sport.ch> and tweaked it just a little.

To obtain a more-or-less correct result it is essential that all input dimensions and measurements are as precise as reasonably possible. The final results may then be rounded to even millimeters. (Short quality spokes in any particular length are rarely easy to find, but that's a another story.)

DISCUSSION

1. All the input data need to be accurate, but some dimensions are obviously more critical than others to the quality of the output: Changes in the rim diameter [RID] parameter have a direct bearing on required spoke lengths, whereas the same amount of change applied to the hub flange diameter [P] has much less influence, at least in the case of a multi-crossed, tangential spoke lacing as opposed to a radial lace. The effect of flange width values [W] and [L] falls somewhere in between. Variations in spoke hole size (bore), finally, are so insignificant (less than 0.5 mm) that they may be ignored, as in the algorithms used for this calculator.

   By the term "spoke" we mean the traditional "elbowed" spokes, not straight-pull or other exotic types. The length of such a spoke is the distance from the inside of the elbow to the end of the threads.

   Please refer to the illustrations below for an explanation of the other required input dimensions and their abbrevations.

2. A 12 mm spoke nipple length [NL] is assumed by default. This is the "industry standard" DT brand's length, but be sure to substitute the appropriate value if you use a longer or shorter type.

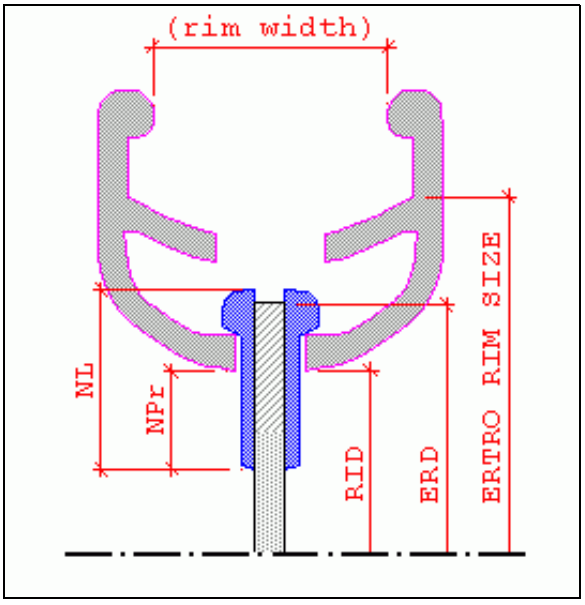
3. A typical difference between the Effective Rim Diameter [ERD] and the actual, average inside rim diameter [RID] of about 8 mm is also inferred. In reality, different rim models (especially with eyeletted holes) may vary from this, so a nipple-in-rim test measurement is always advisable. Anyway, the default "Nipple protrusion" [NP] value of 6.5 mm for the 12 mm nipple reflects a balance of 4 mm per spoke. Theoretically this lets the tensioned spoke's threaded end reach to where it is 1.5 - 2.0 mm (or 3 to 4 turns) from protruding out of the nipple head.

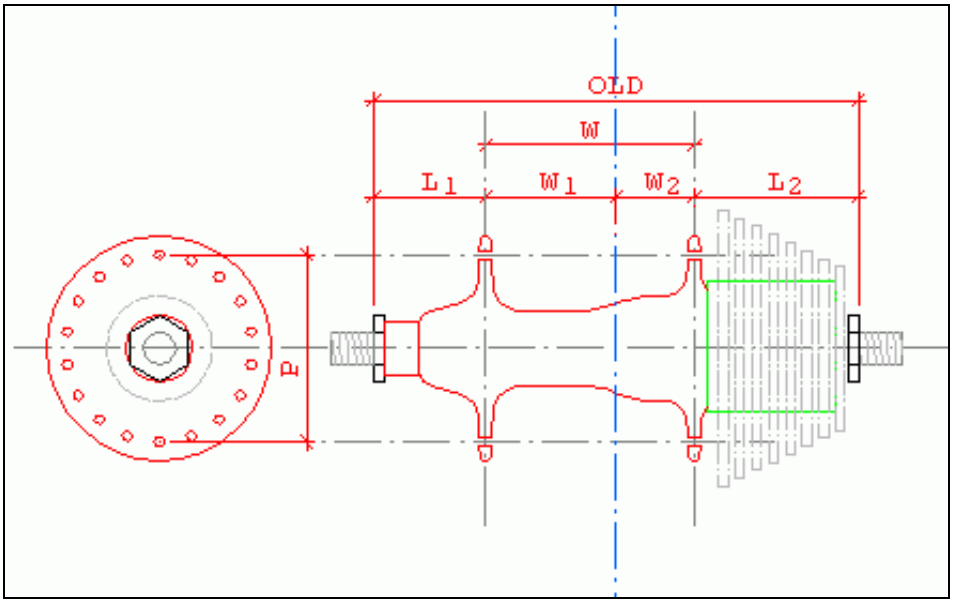
   For an explanation of the ERD dimension please see below.

4. Each side's spoke set is to be calculated separately. If you build a completely symmetrical wheel, like an unbraked front wheel, then you only have to do this once, of course. On the other hand, many types of hubs (apart from the conventional offset multi-sprocket hubs) like disc and drum-brakes

requires bilateral calculation due to the inherent unequal spoking.

5. Be aware that combining small diameter rims with large and/or wide flange hubs, perhaps using several spoke crosses, is asking for problems. The resultant unfavourable lateral and/or lengthwise spoking angles as the spokes enter the rim results in a wheel that is more difficult to build and true in the first place, and, more importanly, problematic to maintain fully tensioned in service. The constant bending motion on the nipples in such a wheel, combined with the smaller wheel's inherent greater number of stress cycles for a given distance travelled, may lead to creaking noises and ultimately premature spoke breakages (i.e at the nipple end, not the usual flange end).





ABBREVATIONS USED

ERD, the Effective Rim Diameter is the diameter on which the ends of the spokes should ideally lie in the finished wheel. Some rim manufacturers publish ERD figures, but it is not always clear exactly how these relate to the geometry of a particular rim's cross-section.
Conventionally the spoke-ends in an ideal, fully tensioned wheel are expected to stop flush with the nipple heads, but this is not an undisputable norm to strive for. For one thing, it means that there are then only a couple of turns "left" in the spoke before it will bottom out, so the "overshoot" tolerance is minimal. Furthermore, for single-bottom rim types, it is unavoidable that protruding spoke ends increase the risk of inner tube punctures. The length of the threaded part (and thus the maximum adjustable length) of a typical spoke is 9-10 mm/20-22 threads. When the spoke end is flush with the nipple head the maximum 8 mm/18 threads are engaged (= the entire threaded portion of the nipple). Using a corrected ERD definition of 2 mm/4 threads short of flush (2x2 mm diametrically) results in greater adjustment tolerance (+/-2 mm) without undue risk of thread-stripping in the worst "undershoot" case of only 4 mm/9 threads engaged in all.

P is the flange diameter, or more exactly, the diameter of the circle described by the spoke holes in the hub flange; sometimes (incorrectly?) called pitch. Since it is defined as the distance between centers of opposite holes it does NOT equal the outside diameter of the hub's flange. Left and right flange diameters are usually, but not always, the same.

RID is the rim's inner diameter. You can measure this directly across the rim (averaging several measurements) or, if the ERD is known, you can put a nipple of known length into a spoke hole in the rim, measure the part of the nipple that protrudes and do a little arithmetic: RID=ERD-2(NL-NPr).

OLD The Over Locknut Dimension is the outside distance from the locknut on one side to the other. Ideally the same as the distance between the frame's droputs. Note that axle length is inconsequential in this context.

L This is the distance from one side's locknut to the center plane of the nearest flange. This value may or may not be the same on both sides. $L_1=(OLD/2)-W_1$; $L_2=(OLD/2)-W_2$.

W The term Width refer the distance between (the centre planes of) the flanges. For the purpose of trigonometrical spoking analysis this parameter is often divided by the wheel's centreline into its bilateral sub-parts, here designated W_1 and W_2 respectively.
$W_1+W_2+L_1+L_2=OLD$.

NL Nipple length, i.e. overall length of the nippel used.

NPr Nipple Protrusion, i.e. length of the part of the nipple that can be seen outside the rim.

This calculator only works with Netscape Navigator 4.0
or Internet Explorer 4.0 or "better"

P	Spoke holes circle		[mm]
RID	Rim Inner Diameter		[mm]
OLD	Over-locknut-distance		[mm]
L	Locknut-to-Flange		[mm]
	Number of spokes this side	○ 9 ○ 12 ○ 14 ○ 16 ◉ 18 ○ 20	
	Number of crosses	○ 0 ○ 1 ○ 2 ◉ 3 ○ 4	
NL	Nipple length	12	[mm]
NPr	Nipple protrusion	6.5	[mm]
		Calculate!	
	Spoke length prescription:		[mm]