

So you need a new hydraulic flange for a port on an existing part – how do you get the right flange for the job?

A hydraulic flange provides a threadless, virtually leak-free connection to a port. When replacing a flange, the new flange needs to match the bolt pattern of the port on the connecting part. These bolt patterns are commonly drawn from standards, so determining the flanges needed is easy if the standard is known. The flange envelope dimensions are of secondary interest because they can vary depending on production methods. If the standard is not known, the bolt pattern is a major factor used to determine the correct new flange. This paper will discuss how to determine the bolt pattern of the standard and share an easy way to measure key dimensions. Remember that a few OEM's have designed special patterns that might not conform to any standards.

Determining the number and orientation of the bolt holes

The flange that is being replaced is a manufactured product and so will not exactly match the nominal bolt spacing dimension of any standard flange pattern but should be within tolerance. Flange standards always have rational nominal dimensions (2 5/8 inches, 98mm, etc.), but which bolt spacing dimension is the nominal one? Is the pattern rectangular, square, circular, or a double pattern? Are the basic dimensions inch or metric? All major national and international standards for hydraulic flange connections specify an even number of bolts (I will use the term bolts to match the phrases “bolt pattern” and “bolt circle” however normally a screw is used.) If there are eight boltholes that are not equally spaced, this might indicate two rectangular four-bolt patterns. If there are six or more boltholes, equally spaced, arranged in a circle, you should measure the bolt center to bolt center spacing on the diagonal (called a bolt circle).

Sometimes only adjacent bolts can be measured. The bolt circle measurement is given by dividing the center-to-center adjacent bolt measurement by the following factor:

Number of Bolts	Divisor
4	0.707
6	0.5
8	0.383
12	0.259

If four boltholes form a rectangle, the pattern probably conforms to SAE J518 and/or ISO 6162-1 or ISO 6162-2, and you should measure between the centers of adjacent boltholes.

If there are four boltholes equidistant from each other, you have either a circle pattern, which is measured on the diagonal (the nominal dimension is the diagonal), or a square pattern (the nominal dimension is between adjacent bolts), which is measured using

adjacent boltholes. Figure 1 illustrates the terms “bolt square” and “bolt circle” and how the different patterns are measured.

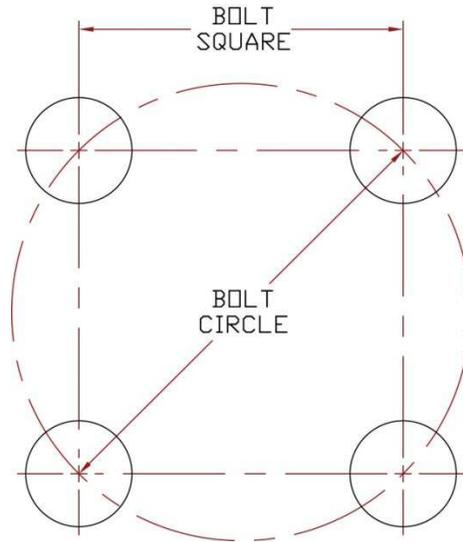


Figure 1 – Illustration of dimensions to measure on square vs. circle bolt patterns

In all cases, bolt hole patterns typically have a tolerance of +/- .010 inch (0.25 mm)

Measuring the distance between centerlines of boltholes

Here is an easy way to measure between the center of one bolt and the center of another bolt of equal size with the bolts installed. This procedure can be made while the flange is still in service. If the boltholes are accessible, use the ID measuring nibs (the short ones) to substitute the ID of the holes for the OD of the bolts in the procedure below.

- 1) Using a digital calipers, measure one of the bolt heads, then zero out the display. The measurement of the bolt head is normally about 1.5 times the bolt size. Figure 2 shows the calipers after measuring the bolt head and zeroing out the display.



Figure 2

- 2) Using the zeroed-out calipers, measure the bolt square or bolt circle to the outside of the bolt heads. Figure 3 shows how this is done. If you are not sure if the flange

pattern is inch or metric, measure in inches, and if the resulting measurement is more than a few thousandths of an inch from a simple rational number, the flange is possibly metric. To check, hit the in/mm button on the calipers or multiply the inch measurement by 25.4. If the number is close to a simple rational number, you can assume that the flange is metric.



Figure 3

Because the zeroing process in the first step accounts for the radii of both bolt heads and boltholes, the dimension on the calipers' display is the distance between the centerlines of the bolts. Use this dimension when ordering your replacement flange. Note that the calipers display a dimension of 2.754 inches. This would be the actual dimension measured ($\pm .002$ inches) but the nominal dimension for this standard is 2.750 ($\pm .010$) inches.

Examples

Figure 4 shows how many typical flange bolt hole patterns can be easily confused with each other, and how important it is to measure the correct dimension and measure it precisely. The values on the left are measurements made according to the bolt square convention between 2.728 and 2.828 inches; however, some of these bolt hole patterns are actually bolt circles, or metric, or both. The numbers in parentheses indicate the actual design. An additional point of differentiation is the bolt size.

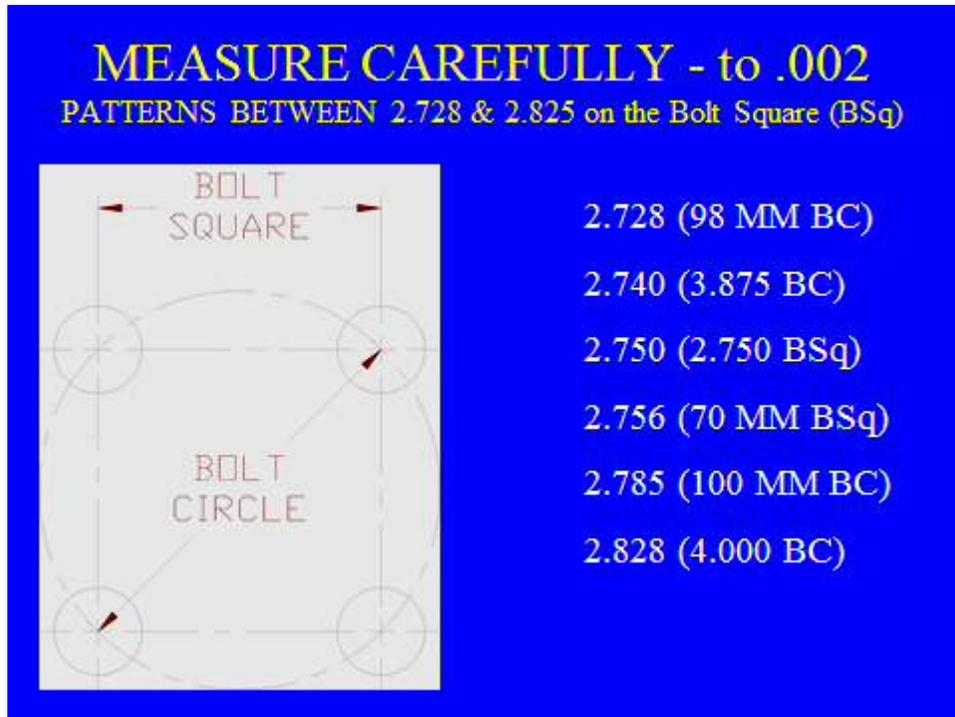


Figure 4

Summary

Careful, accurate measurement of flange bolt hole patterns will help ensure that you get the right flange for your application, and with the method described above, it can be relatively easy to do. Of course, your flange supplier will be happy to help you find the correct product.