



# Vickers

## Technical Reference

MCD manifold design guidelines, tooling, torque specifications, port and cavity dimensions



M

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Technical Reference

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# General Guidelines for Manifold Blocks Design



## WARNING

This information is designed to assist the engineering professional in the design of manifold blocks and related hydraulic systems. It is the designer's responsibility to verify the adequacy of the design through appropriate verifications, review and testing of the final design.

## Reviewing Circuit

All designs begin with a schematic circuit design inspired by the application. Before the planning stage, review the design utilizing the following steps:

- Match schematic symbols to model codes.
- Note size and cavity of each valve and write it on schematic.
- Note port numbers of the valves and write them on schematic.
- Note manifold port types and sizes specified by customer.
- Note pressure, flow and material of manifold block (steel or aluminum).

Circuit questions should be answered by the customer before beginning a design. It is also recommended that schematic hydraulic regions or networks be color coded using color pens. Regions or networks may be broken down in individual colors (pressure, tank, pilot, etc.) but it may be easier to design if regions are broken down into sub-regions such as pressure from port one of a solenoid valve to port two

of a relief valve. Colored layers may be assigned later to match schematic circuit coloring.

## Initial Design

Once the circuit is fully understood, it is advisable to lay the design out by hand first. Things to consider while planning the design are:

- Block size is often specified by customer.
- Specify an overall envelope size, in addition to the specified block size. Overall envelope size includes block size and any valves or fittings protruding from the manifold block.
- Restrictions specified for a mounting surface of the manifold block. Valves and ports may be restricted from a particular surface.
- Specify mounting holes, threaded holes and thru holes (if necessary).
- Arrange valves in a logical manner. Valves and ports in the same regions should be located in close proximity to each other.
- Eliminate as many turns in the regions as possible to reduce the number of cross drill holes or construction lines. This helps keep pressure drops ( $\Delta P$ ) and manufacturing costs down.

## Material Sizes

To obtain an optimal cost manifold it is desirable to

select a standard material size for the manifold, compare the block size with the standard material size table. See Standard Material Sizes (page M-5). If a standard size is not available, a cut plate may be used.

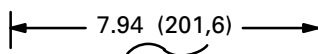
## Hydraulic Schematic

If a schematic is desired on the assembly, it may be created from existing symbols. As an alternative, the entire circuit may be created outside of an assembly and imported as a symbol (block). All of the Vickers screw-in cartridge valves have schematic symbols which can be found in the SICV Cartridge Valve Library of Symbols CD, used in conjunction with AutoCad software. Schematic symbols not found in the library may be created on an "as needed" basis.

## Accurate Design

All dimensions on CAD design must be accurate and to scale in order to be utilized by CAM software in conjunction with CNC machine tools. Manually or interactively modified dimension cannot be tolerated.

Example:



Note

Failure to ensure that CAD dimensions are accurate and to scale may result in improper machinery by CNC Machine Tools.

## Datum Point

The datum point or origin point (0,0,0) on machining drawings is the upper left corner when facing the front view.

## Assembly Dimensioning

Dimension all ports, mounting holes and overall envelope size.

## External Clearances

Allow enough room for clearance around solenoid coils, handknobs, levers and wrench clearance for fittings. If 90° elbow fittings are to be used, some may be required to swing a full 360 arc.

## Assembly Notes

Notes are added for standard or special assembly, handling, or shipping instructions, as well as special stampings.

## Port Table

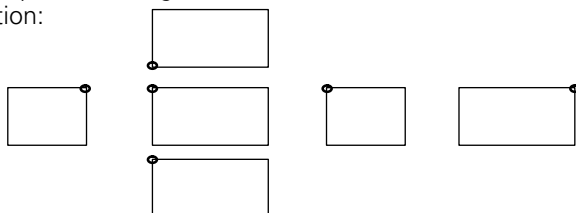
Include a port table with names and sizes of all ports.

## Standard Tooling

In order to obtain fast turnaround on designs, limit the tooling used to that listed in the standard tooling table. See Preferred Tooling for Machining Manifolds (page M-6).

# General Guidelines for Manifold Blocks Design

Datum Point Example in orthographic third angle projection:



## Squaring up the Block

Always "square up" the raw block before machining the cavities, ports and holes. This is to eliminate any potential "drill walk" which leads to scrapped manifolds. When squaring up a block, remove approximately 0.015" of material from each face for Aluminum blocks and 0.030" of material from each face for steel blocks. This is done to ensure that all six faces are parallel or perpendicular. Finished machining should reflect the squared up dimensions. See Standard Material Sizes (Table 1).

Example: 4.0" x 5.0" x 6.0" (101.6 mm x 127 mm x 152.4 mm) block will be dimensioned to 3.97" x 4.97" x 5.97" (100.8 mm x 126.2 mm x 151.6 mm)

## Creation of Machining Table

Create a machining operation table or bore chart. Machining depths are given from the surface of the block. List all drill depths, mills, taps and form tools in the machining table. Call out drill depths at the shoulder depth of the drill, not to the drill point depth.

## Machining Depths

All machining depths are to the corner of the full diameter as opposed to the drill point. All depths are measured from the face plane (surface) of a manifold block.

Avoid any drill depths greater than 25 diameters.

Additional line lengths may result in increasing pressure drops.

## Machining Notes

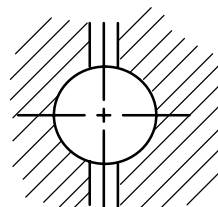
Machining notes are to be added for standard or special machining, handling and shipping instructions.

## Drillings

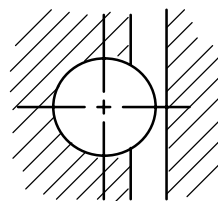
Drillings that go completely through a cavity port area should be on the center axis of the cavity wherever possible; see Figure (a). Otherwise it should intersect the cavity tangent to the outside diameter of the bore it connects with; see Figure (b).

Note

Breaking into a cavity at some point in between these recommended areas will lead to drill walk and can result in a high scrap rate, as well as premature drill breakage.



(a)



(b)

## Spotface Depths

All SAE ports and cavities have spotface depths of .031" (.8 mm) unless otherwise specified. BSPP ports have spotface depths of .060" (1.5 mm) unless otherwise specified.

## Counterbores

In counterbore cases, the actual cavity spotface is located at the depth of the counterbore. When counterbore depths are greater than 0.125", the following diameters should be used:

| VALVE SERIES | COUNTERBORE |             |
|--------------|-------------|-------------|
|              | Inch        | Metric (mm) |
| 8            | 1.38"       | 35,0        |
| 10           | 1.38"       | 35,0        |
| 12           | 1.75"       | 44,5        |
| 16           | 2.00"       | 50,8        |
| 20           | 2.56"       | 65,0        |

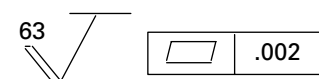
## Use of Expander Plugs and Zero Leak Gold SAE O-Ring Plugs

On small MCD packages, expander plugs can be used to block off construction

drilling at the surface of a face. Larger than a 12mm expander plug are not recommended in aluminum. Any construction drillings larger than 0.4" (10 mm) are plugged with zero leak gold SAE O-Ring plugs (internal hex type). The machining callout for these plugs can be either the industry standard SAE straight thread O-ring boss port configuration or the straight thread O-ring boss short port configuration. Refer to Port Dimensions (page M-9 and M-10).

## Surface Treatments

Any manifold face that calls for a surface mounted (gasket mounted) valve such as a DG4V type directional control valve, or a pump or motor interface, should have a minimum roughness callout of 63 microinches (.0016mm) and a flatness callout of .002" (.05mm). See examples below.



To prevent corrosion, steel manifolds are oil dipped or coated with rust protective fluid, unless otherwise specified. To prevent oxidation, aluminum manifold blocks are gold anodize, unless otherwise specified. Aluminum manifolds where the internally grounded coil is used should not be anodized. Prototypes are supplied without surface treatment.

# General Guidelines for Manifold Blocks Design/Standard material sizes

## Wall Thickness



### WARNING

Failure to follow the recommended wall thicknesses may lead to manifold failure. For pressures up to 3000 psi (210 bar), aluminum may be used, for pressures

above 3000 PSI (210 bar). Dura-Bar cast iron manifold material is recommended. Larger cavities or bores require a greater wall thickness. The table below shows recommended minimum wall thicknesses for Aluminum and Dura-Bar.

| DRILL SIZE/CAVITY BORE DIAMETER |                  | WALL THICKNESS |             |
|---------------------------------|------------------|----------------|-------------|
| Inch Ø                          | Metric (mm) Ø    | Inch           | Metric (mm) |
| .250"                           | 6,35             | .125"          | 3,18        |
| .250" up to .500"               | 6,35 up to 12,7  | .250"          | 6,35        |
| .500" up to .750"               | 12,7 up to 19,05 | .375"          | 9,53        |
| .750" up to 1.000"              | 19,05 up to 25,4 | .500"          | 12,7        |
| 1.000" up to 1.312"             | 25,4 up to 33,34 | .600"          | 15,24       |

**Table 1**  
**Standard Material Sizes**

| STANDARD 6061-T6 ALUMINUM BAR STOCK SIZES |           |           |
|-------------------------------------------|-----------|-----------|
| Size                                      | Size      | Size      |
| 2 x 2                                     | 3 x 3     | 4 x 5     |
| 2 x 3                                     | 3 x 3.5   | 4 x 6     |
| 2 x 4                                     | 3 x 4     | 4.5 x 4.5 |
| 2 x 5                                     | 3 x 4.5   | 5 x 5     |
| 2 x 6                                     | 3 x 5     | 5 x 6     |
| 2.5 x 2.5                                 | 3.5 x 3.5 | 5.5 x 5.5 |
| 2.5 x 3                                   | 3.5 x 4   | 6 x 6     |
| 2.5 x 3.5                                 | 3.5 x 4.5 |           |
| 2.5 x 4                                   | 4 x 4     |           |
| 2.5 x 4.5                                 | 4 x 4.5   |           |

## Creating Bill of Material – BOM

Develop a BOM that includes quantity, model codes, part numbers and descriptions of the MCD. Model codes of some valves require pressure settings. A machining operation table or bore chart should be created. All plugs, orifice plugs, disks, check valves, pistons, and any other part should be included in the BOM.



## Life Cycle of Manifold Blocks

Be aware that designing to these general guidelines will not guarantee the manifold will survive any finite number of cycles. The only way to properly assure a specified life is to run a thorough testing of both burst and endurance in the actual application circuit.

# Preferred Tooling for Machining of Custom Manifolds

## PREFERRED TOOLING FOR MACHINING MANIFOLDS

| Spot Drill<br>Size           | Jobber Length Drill<br>Size | Screw Machine Length Drill<br>Size | Size    |
|------------------------------|-----------------------------|------------------------------------|---------|
| 1" x 90                      | #38 (.1015)                 | 5/32"                              | 1/2"    |
| Dexport C-16 spot face       | #29 (.136)                  | 11/64"                             | 37/64"  |
| Dexport C-16 short spot face | D (.246)                    | 3/16"                              | 43/64"  |
| 1/4" spot drill              | R (.339)                    | #1 (.228)                          | 45/64"  |
|                              | R (.339)                    | F (.257)                           | 51/64"  |
|                              | U (.368)                    | 3/8"                               | 13/32"  |
|                              | 59/64"                      | 27/64"                             | 1-7/32" |
|                              |                             | 7/16"                              |         |

| Drill<br>Size inches           | Size Inches              | Size Inches                | Rougher |         |
|--------------------------------|--------------------------|----------------------------|---------|---------|
| 1/8" (3-1/2" flute length)     | 11/32" (6" flute length) | 11/16" (6" flute length)   | C-4-2   | C-12-3  |
| 1/8" (6" flute length)         | 3/8" (6" flute length)   | 3/4" (6" flute length)     | C-4-3   | C-12-3S |
| 3/16" (6" flute length)        | 3/8" (8" flute length)   | 51/64" (6" flute length)   | C-7-3   | C-12-4  |
| #7 (.201) (6" flute length)    | 13/32" (6" flute length) | 13/16" (6" flute length)   | C-8-2   | C-16-2  |
| 7/32" (6" flute length)        | 7/16" (6" flute length)  | 7/8" (6" flute length)     | C-8-3   | C-16-3  |
| 1/4" (3-1 / 2" flute length)   | 7/16" (8" flute length)  | 15/16" (6" flute length)   | C-8-4   | C-16-3S |
| 1/4" (6" flute length)         | 31/64" (6" flute length) | 31/32" (6" flute length)   | C1-8-2  | C-16-4  |
| 1/4" (8" flute length)         | 1/2" (6" flute length)   | 1" (6" flute length)       | C-10-2  | C-20-2  |
| 9/32" (3-1 / 2" flute length)  | 1/2" (8" flute length)   | 1-3/32" (6" flute length)  | C-10-3  | C-20-3  |
| 9/32" (6" flute length)        | 17/32" (6" flute length) | 1-1/8" (6" flute length)   | C-10-3S | C-20-3S |
| 5/16" (3-1 / 2" flute length)  | 9/16" (6" flute length)  | 1-1/4" (8" flute length)   | C-10-4  | C-20-4  |
| 5/16" (6" flute length)        | 39/64" (6" flute length) | 1-3/8" (6" flute length)   | C-12-2  |         |
| 5/16" (8" flute length)        | 5/8" (6" flute length)   | 1-13/32" (6" flute length) |         |         |
| 11/32" (3-1 / 2" flute length) | 43/64" (6" flute length) | 1-1/2" (6" flute length)   |         |         |

| Finish Tool         |                     | Flat Bottom Drill<br>Size Inches | Reamer<br>Size Inches | Slot Cutter          | End Mill |
|---------------------|---------------------|----------------------------------|-----------------------|----------------------|----------|
| C-4-2               | C-12-2              | 7/16"                            | .1285"                | #3 T                 | 1/2"     |
| C-4-3               | C-12-3              | 13/32"                           | .495"                 | #5 T                 | 3/8"     |
| C-7-3               | C-12-3S             | 1/2"                             | .562" (flat bottom)   | C-12-2UT             | 7/16"    |
| C-8-2               | C-12-4              | 17/32"                           | .6255" (flat bottom)  | #6 T                 | 13/32"   |
| C-8-3               | C-16-2              | 43/64"                           | 1.1255" (flat bottom) |                      | 13/16"   |
| C-8-4               | C-16-2 (undersized) | 39/64"                           | 1.437" (flat bottom)  | <b>Ball End Mill</b> | 7/8"     |
| C2-8-2              | C-16-3              | 1-3/32"                          | <b>Size mm</b>        | 9/32"                | 15/16"   |
| C-10-2              | C-16-3S             | 1-13/32"                         | 5mm                   | 11/32"               | 1"       |
| C-10-2 (undersized) | C-16-4              |                                  | 7mm                   |                      | 1-13/16" |
| C-10-3              | C-20-2              |                                  | 8mm                   |                      | 1-3/8"   |
| C-10-3S             | C-20-2 (undersized) |                                  | 9mm                   |                      | 1-1/2"   |
| C-10-4              | C-20-3              |                                  | 10mm                  |                      | 2"       |
|                     | C-20-3S             |                                  | 12mm                  |                      | 2.562"   |
|                     | C-20-4              |                                  | 14mm                  |                      |          |
|                     |                     |                                  | 16mm                  |                      |          |

# Preferred Tooling for Machining Custom Manifolds

## PREFERRED TOOLING FOR MACHINING MANIFOLDS CONTINUED

| Port Tool |             |              |       |              |               |
|-----------|-------------|--------------|-------|--------------|---------------|
| SAE #2    | Dexport #8  | Dexport #24  | SP-05 | SP-16        | BSPP-75-8225  |
| SAE #3    | Dexport #10 | Waukesha #20 | SP-06 | BSPP-13-8221 | BSPP-125-8227 |
| SAE #4    | Dexport #12 | SP-02        | SP-08 | BSPP-25-8222 |               |
| SAE #5    | Dexport #14 | SP-03        | SP-10 | BSPP-38-8223 |               |
| SAE #6    | Dexport #16 | SP-04        | SP-12 | BSPP-50-8224 |               |

| Sense Check Tool | Counter Sink | Drill     | Center Drill | Press Tap |
|------------------|--------------|-----------|--------------|-----------|
| SC-4-2-75        | 2" x 90      | 1/4" x 90 | #5           | #6-32 X   |
| SC-4-2-88        | 2" x 5"      |           |              | #10-24 X  |
|                  | 1/4" x 90    |           |              | 1/4"-20 X |

| Tap      |            |               |                   | Pulley Tap |
|----------|------------|---------------|-------------------|------------|
| 1/4"-20  | 5/8"-11    | 1/8"-28 BSPP  | 1/2"-14 NPTF      | 1/4"-20    |
| 5/16"-18 | 5/8"-18    | 1/4"-19 BSPP  | 3/4"-14 NPTF      | 5/16"-24   |
| 5/16"-24 | 3/4"-16    | 3/8"-19 BSPP  | 1"-11 1/2 NPTF    | 7/16"-20   |
| 3/8"-16  | 7/8"-14    | 1/2"-14 BSPP  | M10 x 1.5 Metric  | 9/16"-18   |
| 3/8"-24  | 1"-14      | 3/4"-14 BSPP  | M10 x 1.25 Metric | 3/4"-16    |
| 7/16"-14 | 1-1/16"-12 | 1"-11 BSPP    |                   |            |
| 7/16"-20 | 1-3/16"-12 | 1/16"-27 NPTF |                   |            |
| 1/2"-13  | 1-5/16"-12 | 1/8"-27 NPTF  |                   |            |
| 1/2"-20  | 1-5/8"-12  | 1/4"-18 NPTF  |                   |            |
| 9/16"-18 | 1-7/8"-12  | 3/8"-14 NPTF  |                   |            |

# Torque Specifications

For cartridge valves  
and fittings

## INSTALLATION TORQUE: CARTRIDGE INTO CAVITY

| Cartridge Size | For application pressure <210 Bar (3000 PSI) | For application pressure 210 Bar (3000 PSI) to 350 Bar |
|----------------|----------------------------------------------|--------------------------------------------------------|
|                | Aluminum cavity Nm (ft. lbs)                 | Steel cavity Nm (ft. lbs)                              |
| 4 Series       | 8.2 - 13.6 (6 - 10)                          | 8.2 - 13.6 (6 - 10)                                    |
| 8 Series       | 34.0 - 40.8 (25 - 30)                        | 34.0 - 40.8 (25 - 30)                                  |
| 10 Series      | 47.6 - 54.4 (35 - 40)                        | 68.0 - 75.0 (50 - 55)                                  |
| 12 Series      | 81.6 - 95.2 (60 - 70)                        | 102.0 - 115.0 (75 - 80)                                |
| 16 Series      | 108.8 - 122.4 (80 - 90)                      | 136.0 - 149.6 (100 - 110)                              |
| 20 Series      | 149.6 - 163.2 (110 - 120)                    | 163.0 - 183.0 (120 - 135)                              |

## INSTALLATION TORQUE: PLUGS AND FITTINGS INTO ALUMINUM OR STEEL MANIFOLDS

| Nominal Size       | Installation Torque<br>Nm (ft. lbs) |
|--------------------|-------------------------------------|
| SAE 2              | (3.4 - 4.1) 4.6 - 5.6               |
| SAE 3              | (5 - 7) 6.8 - 9.5                   |
| SAE 4 1/4" BSPP    | (6 - 10) 8.2 - 13.6                 |
| SAE 5              | (10 - 15) 13.6 - 20.4               |
| SAE 6 3/8" BSPP    | (15 - 20) 20.4 - 27.2               |
| SAE 8 1/2" BSPP    | (25 - 30) 34.0 - 40.8               |
| SAE 10 5/8" BSPP   | (35 - 40) 47.6 - 54.4               |
| SAE 12 3/4" BSPP   | (60 - 70) 81.6 - 95.2               |
| SAE 14             | (80 - 90) 108.8 - 122.4             |
| SAE 16 1" BSPP     | (100 - 110) 136.0 - 149.6           |
| SAE 20 1.1/4" BSPP | (110 - 120) 149.6 - 163.2           |

## INSTALLATION TORQUE: MISCELLANEOUS

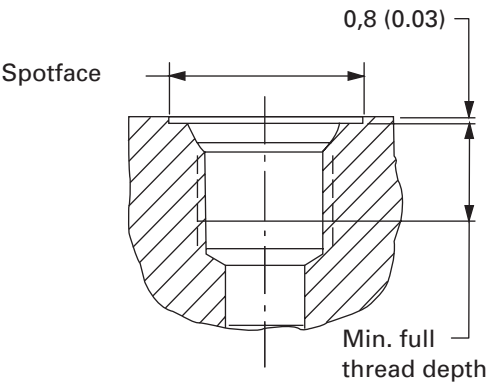
|                                                                       | Installation Torque<br>Nm (ft. lbs) |
|-----------------------------------------------------------------------|-------------------------------------|
| 1/2-20 Retaining nut, short or long, used on standard solenoid valves | 5.4 - 8.2 (4 - 6)                   |
| 1/2-20 Large retaining nut used on explosion proof solenoid coils     | 9.5 - 13.6 (7 - 10)                 |
| 1/2-20 Cap not used on RV, FC, ETC.                                   | 9.5 - 13.6 (7 - 10)                 |
| 10-24 Set screw used on Knobs                                         | 4.1 - 5.4 (3 - 4)                   |
| 7/8-24 Nut used on SV1-16-3-*.** solenoid valves                      | 13.6 - 20.4 (10 - 15)               |

# Port Information

SAE and BSPP Ports

## Port Dimensions

Key Dimensions in Standard  
Housings – mm (inch)



### SAE SIZES

| SAE size | Thread size      | Minimum spotface ø | Minimum full thread depth |
|----------|------------------|--------------------|---------------------------|
| 4        | 0.437"-20 UNF-2B | 21,1 (0.82)        | 11,5 (0.45)               |
| 6        | 0.563"-18 UNF-2B | 24,7 (0.96)        | 12,7 (0.50)               |
| 8        | 0.750"-16 UNF-2B | 30,2 (1.18)        | 14,2 (0.56)               |
| 10       | 0.875"-14 UNF-2B | 34,2 (1.34)        | 16,6 (0.65)               |
| 12       | 1.062"-12 UN-2B  | 41,3 (1.62)        | 19,0 (0.75)               |
| 16       | 1.312"-12 UN-2B  | 48,6 (1,91)        | 19,0 (0.75)               |

### BSPP SIZES

| BSPP thread size | Minimum spotface ø | Minimum full thread depth |
|------------------|--------------------|---------------------------|
| 1/4"             | 24 (0.94)          | 12,2 (0.48)               |
| 3/8"             | 27 (1.06)          | 12,2 (0.48)               |
| 1/2"             | 33 (1.29)          | 15,0 (0.59)               |
| 3/4"             | 42 (1.65)          | 16,3 (0.64)               |
| 1"               | 47 (1.85)          | 19,1 (0.75)               |

# Port Information

Short SAE ports

## Port Dimensions

Short Port – Straight Thread  
O-Ring Boss – SP-\*\*

Note

To be used for SAE plugged construction holes only. Not intended to be used for external porting with standard fittings.

**a** Diameter U shall be concentric with thread pitch diameter within 0.0005 in. (0.13mm) FIR, and shall be free from longitudinal and spiral tool marks. Annular tool marks up to 100 mu in. max. are allowed

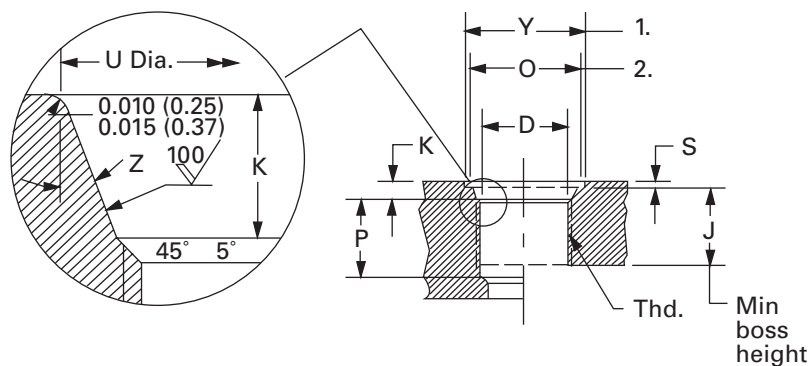
**b** If face of boss is on a machined surface, dim. Y and S need not apply

**c** Tap drill depths given require use of bottoming taps to produce the specified full thread lengths. Where standard taps are used, the tap drill depths must be increased accordingly.

**d** Nominal tubing O.D. is shown for the standard inch sizes and the conversion to equivalent to mm sizes. Figures are for reference only, as any boss can be used for a tubing size, depending upon other design criteria

| DASH NO. | NOMINAL TUBING    | MILLIMETER  | THREAD SIZE               | J FULL            | K                                         |
|----------|-------------------|-------------|---------------------------|-------------------|-------------------------------------------|
|          | O.D. <sup>d</sup> | mm (inch)   | SAE J475<br>ISO R725 inch | thd<br>Depth Min. | +0.4 (+0.015<br>-0.0 -0.000)<br>mm (inch) |
| 02       | 0.125"            | —           | 5 / 16 –24UNF–2B          | .31"              | 1.9 (0.07)                                |
| 03       | 0.1875"           | 4 (0.1575)  | 3 / 8 –24UNF–2B           | .31"              | 1.9 (0.074)                               |
| 04       | 0.250"            | 6 (0.235)   | 27 / 16 –20UNF–2B         | .35"              | 2.4 (0.093)                               |
| 05       | 0.3125"           | 8 (0.3150)  | 1 / 2 –20UNF–2B           | .36"              | 2.4 (0.093)                               |
| 06       | 0.375"            | 10 (0.3937) | 9 / 16 –18UNF–2B          | .38"              | 2.5 (0.097)                               |
| 08       | 0.500"            | 12 (0.4724) | 3 / 4 –16UNF–2B           | .45"              | 2.5 (0.100)                               |
| 10       | 0.625"            | 16 (0.6299) | 7 / 8 –14UNF–2B           | .50"              | 2.5 (0.100)                               |
| 12       | 0.750"            | —           | 1 1 / 16 –12UN–2B         | .59"              | 3.3 (0.130)                               |
| 16       | 1.000"            | 25 (0.9842) | 1 5 / 16 –12UN–2B         | .59"              | 3.3 (0.130)                               |

| DASH NO. | O          |              | P <sup>c</sup> | S <sup>b</sup> | U DIA. <sup>a</sup>      |                     | Y      | Z    |
|----------|------------|--------------|----------------|----------------|--------------------------|---------------------|--------|------|
|          | Min.<br>mm | Dia.<br>inch | Min.<br>inch   | Min.<br>inch   | +0.005<br>-0.000<br>inch | +0.13<br>-0.0<br>mm | inch   | ± 1° |
| 02       | 0.438      | 11           | 0.468"         | 0.0312"        | 0.358                    | 9.1                 | 0.439" | 12   |
| 03       | 0.500      | 13           | 0.468"         | 0.0312"        | 0.421                    | 10.7                | 0.531" | 12   |
| 04       | 0.563      | 15           | 0.438"         | 0.0312"        | 0.487                    | 12.4                | 0.594" | 12   |
| 05       | 0.625      | 16           | 0.438"         | 0.0312"        | 0.550                    | 13.9                | 0.656" | 12   |
| 06       | 0.688      | 18           | 0.515"         | 0.0312"        | 0.616                    | 15.6                | 0.719" | 12   |
| 08       | 0.875      | 22           | 0.563"         | 0.0312"        | 0.811                    | 20.6                | 0.906" | 15   |
| 10       | 1.000      | 26           | 0.625"         | 0.0312"        | 0.942                    | 23.9                | 1.031" | 15   |
| 12       | 1.250      | 32           | 0.719"         | 0.0312"        | 1.148                    | 29.2                | 1.281" | 15   |
| 16       | 1.500      | 38           | 0.906"         | 0.0312"        | 1.398                    | 35.5                | 1.562" | 15   |



# Cavity Tools

## Roughing Tools

Roughers are basically step drills which leave .030" per cutting diameter and .015" above all radii for the finishing reamer, with an additional .015" depth in the cavity bottom as clearance. The roughing tool is necessary to prepare the cavity for the finishing reamer, which has not been designed for the primary forming or bottom cutting.

| CAVITY             | FOR MATERIAL     | MODEL CODE       | PART NUMBER |
|--------------------|------------------|------------------|-------------|
| <b>2-Way</b>       |                  |                  |             |
| C-4-2              | Aluminum / Steel | RT-4-2-AS-8306   | 02-173997   |
| C-8-2              | Aluminum / Steel | RT1-8-2-AS-8028  | 02-165580   |
| C-10-2             | Aluminum         | RT-10-2-A-8030   | 889509      |
| C-10-2             | Steel            | RT-10-2-S-8035   | 889510      |
| C-12-2             | Aluminum / Steel | RT-12-2-AS-8213  | 02-160625   |
| C-16-2             | Aluminum         | RT-16-2-A-8031   | 889515      |
| C-16-2             | Steel            | RT-16-2-S-8036   | 889516      |
| C-20-2             | Aluminum         | RT-20-2-A-8032   | 565822      |
| C-20-2             | Steel            | RT-20-2-S-8037   | 889519      |
| <b>3-Way</b>       |                  |                  |             |
| C-4-3              | Aluminum / Steel | RT-4-3-AS-8304   | 02-173271   |
| C-8-3              | Aluminum / Steel | RT1-8-3-AS-8291  | 02-162384   |
| C-10-3             | Aluminum         | RT-10-3-A-8038   | 889511      |
| C-10-3             | Steel            | RT-10-3-S-8043   | 889512      |
| C-12-3             | Aluminum / Steel | RT-12-3-AS-8217  | 02-153261   |
| C-16-3             | Aluminum         | RT-16-3-A-8039   | 565825      |
| C-16-3             | Steel            | RT-16-3-S-8044   | 889517      |
| C-20-3             | Aluminum         | RT-20-3-A-8041   | 02-165581   |
| C-20-3             | Steel            | RT-20-3-S-8046   | 566706      |
| <b>3-Way Short</b> |                  |                  |             |
| C-10-3S            | Aluminum         | RT-10-3S-A-8099  | 565824      |
| C-10-3S            | Steel            | RT-10-3S-S-8209  | 566703      |
| C-12-3S            | Aluminum / Steel | RT-12-3S-AS-8220 | 02-113178   |
| C-16-3S            | Aluminum         | RT-16-3S-A-8040  | 02-165582   |
| C-16-3S            | Steel            | RT-16-3S-S-8045  | 566704      |
| C-20-3S            | Aluminum         | RT-20-3S-A-8042  | 889520      |
| C-20-3S            | Steel            | RT-20-3S-S-8047  | 566705      |
| <b>4-Way</b>       |                  |                  |             |
| C-8-4              | Aluminum / Steel | RT-8-4-AS-8292   | 02-172803   |
| C-10-4             | Aluminum         | RT-10-4-A-8072   | 889513      |
| C-10-4             | Steel            | RT-10-4-S-8073   | 889514      |
| C-16-4             | Aluminum         | RT-16-4-A-8074   | 889518      |
| C-16-4             | Steel            | RT-16-4-S-8075   | 565828      |
| C-20-4             | Aluminum         | RT-20-4-A-8076   | 565829      |
| C-20-4             | Steel            | RT-20-4-S-8077   | 566707      |
| <b>5-Way Short</b> |                  |                  |             |
| C-12-5S            | Aluminum         | RT-12-5-A-8350   | 02-187301   |
| C-12-5S            | Steel            | RT-12-5-S-8358   | 02-187309   |
| C-16-5S            | Aluminum         | RT-16-5-A-8352   | 02-187303   |
| C-16-5S            | Steel            | RT-16-5-S-8360   | 02-187311   |
| C-20-5S            | Aluminum         | RT-20-5-A-8354   | 02-187305   |
| C-20-5S            | Steel            | RT-20-5-S-8356   | 02-187307   |

# Cavity Tools

## Finishing Tools

These finishing tools have been designed as precision reamers for finishing operations only. They are not intended for primary forming or bottom cutting operations. Vickers recommends that a finishing tool only be used in a properly roughed hole. Failure to conform to this practice will produce unsatisfactory size and finishes and possibly break the tool.

| CAVITY             | FOR MATERIAL     | MODEL CODE       | PART NUMBER |
|--------------------|------------------|------------------|-------------|
| <b>2-Way</b>       |                  |                  |             |
| C-4-2              | Aluminum         | FT-4-2-A-8297    | 02-182339   |
| C-8-2              | Aluminum / Steel | FT1-8-2-AS-8070  | 02-112933   |
| C-10-2             | Aluminum / Steel | FT-10-2-AS-8048  | 566235      |
| C-12-2             | Aluminum / Steel | FT-12-2-AS-8214  | 02-162162   |
| C-16-2             | Aluminum / Steel | FT-16-2-AS-8078  | 565832      |
| C-20-2             | Aluminum / Steel | FT-20-2-AS-8079  | 565833      |
| <b>3-Way</b>       |                  |                  |             |
| C-4-3              | Aluminum         | FT-4-3-A-8275    | 02-172006   |
| C-8-3              | Aluminum / Steel | FT-8-3-AS-8295   | 02-171292   |
| C-10-3             | Aluminum / Steel | FT-10-3-AS-8050  | 565834      |
| C-12-3             | Aluminum / Steel | FT-12-3-AS-8244  | 02-163001   |
| C-16-3             | Aluminum / Steel | FT-16-3-AS-8080  | 565836      |
| C-20-3             | Aluminum / Steel | FT-20-3-AS-8082  | 889358      |
| <b>3-Way Short</b> |                  |                  |             |
| C-10-3S            | Aluminum / Steel | FT-10-3S-AS-8210 | 566708      |
| C-12-3S            | Aluminum / Steel | FT-12-3S-AS-8242 | 02-162998   |
| C-16-3S            | Aluminum / Steel | FT-16-3S-AS-8081 | 889356      |
| C-20-3S            | Aluminum / Steel | FT-20-3S-AS-8083 | 889359      |
| <b>4-Way</b>       |                  |                  |             |
| C-8-4              | Aluminum / Steel | FT-8-4-AS-8296   | 02-171291   |
| C-10-4             | Aluminum / Steel | FT-10-4-AS-8052  | 565838      |
| C-16-4             | Aluminum / Steel | FT-16-4-AS-8084  | 566571      |
| C-20-4             | Aluminum / Steel | FT-20-4-AS-8085  | 889360      |
| <b>5-Way Short</b> |                  |                  |             |
| C-12-5S            | Aluminum         | FT-12-5-A-8351   | 02-187302   |
| C-12-5S            | Steel            | FT-12-5-S-8359   | 02-187310   |
| C-16-5S            | Aluminum         | FT-16-5-A-8353   | 02-187304   |
| C-16-5S            | Steel            | FT-16-5-S-8361   | 02-187312   |
| C-20-5S            | Aluminum         | FT-20-5-A-8355   | 02-187306   |
| C-20-5S            | Steel            | FT-20-5-S-8357   | 02-187308   |

## Finishing Form Tools Speed & Feed for Aluminum 6061-T6 (T651)

This information is recommended as a good starting point. Speeds and/or feeds may be increased or decreased depending on actual machining conditions.

Note

Finish form tools may require 1/2 to 1 1/2 second dwell to obtain necessary finish.

| CNC MACHINE TOOL |     |     | BRIDGEPORT / LAGUN TYPE MACHINES |          |       |
|------------------|-----|-----|----------------------------------|----------|-------|
| Tool Size        | RPM | IPM | Tool Size                        | RPM      | IPM   |
| C-10-2           | 600 | 4   | C-10-2                           | 800-1000 | 5-6   |
| C-10-3           |     |     | C-10-3                           |          |       |
| C-10-4           |     |     | C-10-4                           |          |       |
| C-16-2           |     |     | C-16-2                           | 250      | 2 1/2 |
| C-16-3           |     |     | C-16-3                           |          |       |
| C-16-3S          |     |     | C-16-3S                          |          |       |
| C-16-4           | 500 | 3   | C-16-4                           |          |       |
| C-20-2           |     |     | C-20-2                           |          |       |
| C-20-3           |     |     | C-20-3                           |          |       |
| C-20-3S          |     |     | C-20-3S                          |          |       |
| C-20-4           |     |     | C-20-                            |          |       |

# C-\*\*-2 Cavity Dimensions

## Dimensions

mm (inch)



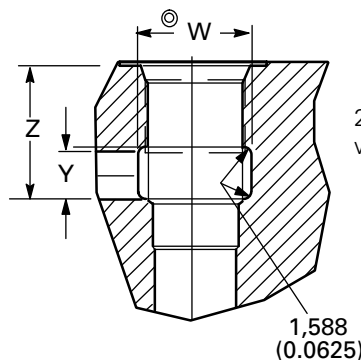
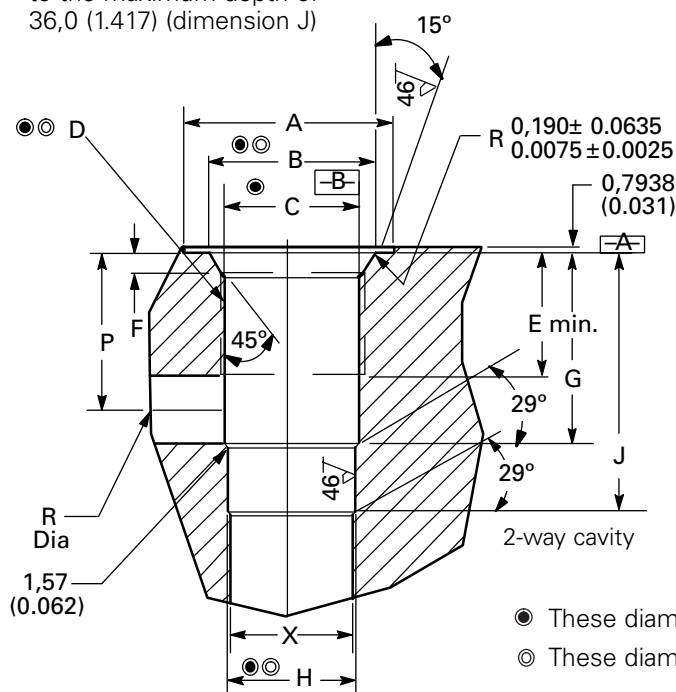
### WARNING

For EPV-10 & CV16-10, the cavity should be machined to the 14,29 (0.562) max diameter (dimension X) and to the maximum depth of 36,0 (1.417) (dimension J)

Cavity bores can be machined accurately in aluminum or steel. The necessary UNF, or UN threads may be machined using standard small tools, possibly already in your machine shop or from a local tool supplier.

Either you, our customer, or Vickers can design and manufacture customized manifolds or housings dedicated to individual applications. We call the resulting valve packages Modular Circuit Designs (MCDs). Cartridges selected for your

application can be accommodated in one or more MCDs, according to your requirements.



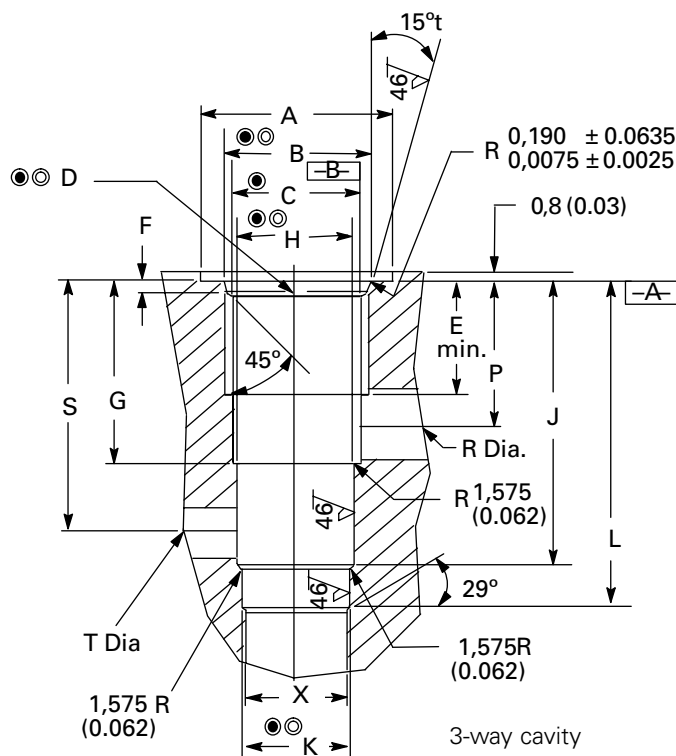
2-way cavity with undercut (U)

- ⊙ These diameters  $\frac{\text{mm}}{\text{inch}}$  0,051mm (.002 inch) B unless otherwise specified
- ⊙ These diameters  $\frac{\text{mm}}{\text{inch}}$  0,025mm (.001 inch) A unless otherwise specified

| CAVITY    | A                | B                    | C                    | D         | E                | F                          | G                | H                   | J                | P                | R                | X                |
|-----------|------------------|----------------------|----------------------|-----------|------------------|----------------------------|------------------|---------------------|------------------|------------------|------------------|------------------|
| mm (inch) | Spotface         | +0,0510<br>(+0.0020) | +0,0510<br>(+0.0020) | Thread    | Full<br>Thread   |                            |                  | ±0,0254<br>(±0.001) |                  |                  | Max.<br>Dia.     | Max.<br>Dia.     |
| C-4-2     | 21,03<br>(0.828) | 12,37<br>(0.487)     | 9,80<br>(0.386)      | .4375"—20 | 9,53<br>(0.375)  | 2,36-2,74<br>(0.093-0.108) | 15,49<br>(0.610) | 8,74<br>(0.344)     | 23,37<br>(0.920) | 9,93<br>(0.391)  | 6,35<br>(0.250)  | 6,35<br>(0.25)   |
| C-8-2     | 30,16<br>(1.188) | 20,65<br>(0.813)     | 17,47<br>(0.688)     | .750"—16  | 12,70<br>(0.500) | 2,54-2,92<br>(0.100-0.115) | 19,05<br>(0.750) | 12,72<br>(0.501)    | 30,17<br>(1.188) | 14,68<br>(0.578) | 8,74<br>(0.344)  | 11,11<br>(0.438) |
| C-10-2    | 30,16<br>(1.188) | 24,00<br>(0.945)     | 20,62<br>(0.812)     | .875"—14  | 15,88<br>(0.625) | 2,54-2,92<br>(0.100-0.115) | 23,81<br>(0.937) | 15,90<br>(0.626)    | 33,32<br>(1.312) | 18,23<br>(0.718) | 11,11<br>(0.437) | 14,29<br>(0.562) |
| C-12-2(U) | 38,10<br>(1.500) | 29,15<br>(1.148)     | 24,76<br>(0.975)     | 1.062"—12 | 22,22<br>(0.875) | 3,30/3,68<br>(0.130-0.145) | 34,92<br>(1.375) | 23,82<br>(0.938)    | 46,35<br>(1.825) | 27,94<br>(1.100) | 12,70<br>(0.500) | 22,22<br>(0.875) |
| C-16-2    | 44,45<br>(1.750) | 35,58<br>(1.401)     | 31,34<br>(1.234)     | 1.312"—12 | 22,22<br>(0.875) | 3,30/3,68<br>(0.130-0.145) | 34,14<br>(1.344) | 28,62<br>(1.127)    | 46,84<br>(1.844) | 24,60<br>(0.968) | 19,05<br>(0.750) | 19,05<br>(0.750) |
| C-20-2    | 57,66<br>(2.270) | 43,59<br>(1.716)     | 39,12<br>(1.540)     | 1.625"—12 | 20,64<br>(0.812) | 3,35/3,73<br>(0.132-0.147) | 44,45<br>(1.750) | 36,55<br>(1.439)    | 58,72<br>(2.312) | 30,96<br>(1.218) | 25,40<br>(1.000) | 30,16<br>(1.188) |

| CAVITY            | W                | Y                | Z                |
|-------------------|------------------|------------------|------------------|
| mm (inch)         |                  |                  |                  |
| C-12-2U<br>(only) | 30,82<br>(1.214) | 12,70<br>(0.500) | 34,29<br>(1.350) |

## C-\*\*-3 Cavity Dimensions



● These diameters  $\nabla$  0,051mm (.002 inch) B unless otherwise specified

◎ These diameters  $\perp$  0,025mm (.001 inch) A unless otherwise specified

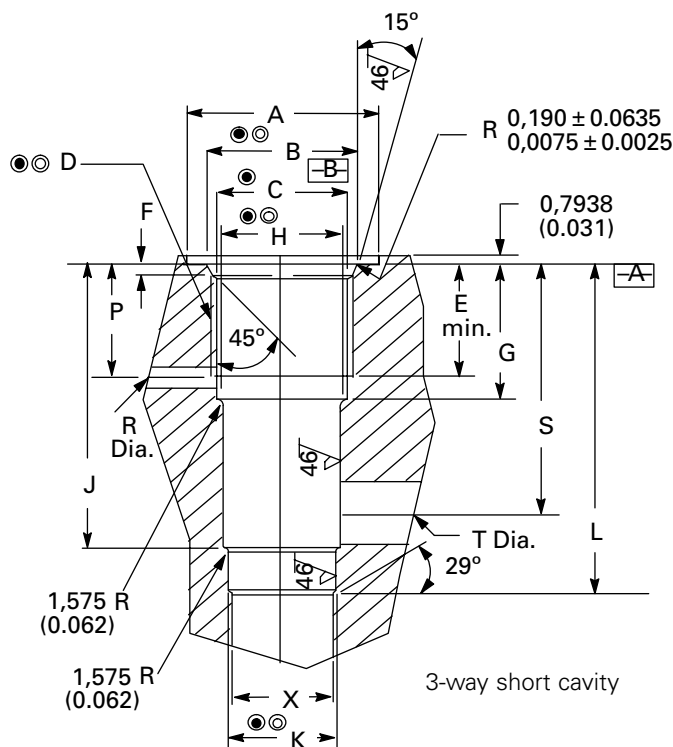
| CAVITY A           | B                     | C                    | D                | E              | F                | G                          | H                    | J                | K                    | L                |                   |
|--------------------|-----------------------|----------------------|------------------|----------------|------------------|----------------------------|----------------------|------------------|----------------------|------------------|-------------------|
| mm (inch) Spotface | +0,00510<br>(+0.0020) | +0,0510<br>(+0.0020) | Thread           | Full<br>Thread |                  |                            | ±0,0254<br>(±0.0001) |                  | ±0,0254<br>(±0.0001) |                  |                   |
| C-4-3              | 21,03<br>(0.828)      | 12,37<br>(0.487)     | 9,80<br>(0.386)  | .4375"—20      | 9,53<br>(0.375)  | 2,36-2,74<br>(0.093-0.108) | 15,49<br>(0.610)     | 8,74<br>(0.344)  | 30,05<br>(1.183)     | 7,95<br>(0.313)  | 38,10<br>(1.500)  |
| C-8-3              | 30,16<br>(1.188)      | 20,65<br>(0.813)     | 17,47<br>(0.688) | .750"—16       | 12,70<br>(0.500) | 2,54-2,92<br>(0.100-0.115) | 18,23<br>(0.718)     | 15,90<br>(0.626) | 33,25<br>(1.270)     | 14,30<br>(0.563) | 43,25<br>(1.703)  |
| C-10-3             | 30,16<br>(1.188)      | 24,00<br>(0.945)     | 20,62<br>(0.812) | .875"—14       | 15,87<br>(0.625) | 2,54-2,92<br>(0.100-0.115) | 21,59<br>(0.850)     | 17,50<br>(0.689) | 38,10<br>(1.500)     | 15,90<br>(0.626) | 47,62<br>(1.875)  |
| C-12-3             | 38,10<br>(1.500)      | 29,15<br>(1.148)     | 24,76<br>(0.975) | 1.062"—12      | 22,22<br>(0.875) | 3,30-3,68<br>(0.130-0.145) | 34,92<br>(1.375)     | 23,82<br>(0.938) | 57,78<br>(2.275)     | 22,25<br>(0.876) | 69,21<br>(2.725)  |
| C-16-3             | 44,45<br>(1.750)      | 35,58<br>(1.401)     | 31,34<br>(1.234) | 1.312"—12      | 22,22<br>(0.875) | 3,30-3,68<br>(0.130-0.145) | 34,13<br>(1.344)     | 28,62<br>(1.127) | 62,71<br>(2.469)     | 27,02<br>(1.064) | 75,39<br>(2.968)  |
| C-20-3             | 57,66<br>(2.270)      | 43,59<br>(1.716)     | 39,12<br>(1.540) | 1.625"—12      | 20,64<br>(0.812) | 3,35-3,73<br>(0.132-0.147) | 44,45<br>(1.750)     | 36,55<br>(1.439) | 85,72<br>(3.375)     | 33,38<br>(1.314) | 100,02<br>(3.938) |

| CAVITY    | P                | R                | S                | T                | X                |
|-----------|------------------|------------------|------------------|------------------|------------------|
| mm (inch) |                  | Max. Dia.        |                  | Max. Dia.        | Max. Dia.        |
| C-4-3     | 9,93<br>(0.391)  | 6,35<br>(0.25)   | 24,61<br>(0.969) | 6,35<br>(0.25)   |                  |
| C-8-3     | 14,68<br>(0.578) | 5,94<br>(0.234)  | 28,98<br>(1.141) | 5,94<br>(0.234)  | 12,70<br>(0.500) |
| C-10-3    | 18,26<br>(0.719) | 6,35<br>(0.250)  | 34,13<br>(1.344) | 6,35<br>(0.250)  | 14,27<br>(0.562) |
| C-12-3    | 27,94<br>(1.100) | 12,70<br>(0.500) | 50,80<br>(2.000) | 12,70<br>(0.500) | 20,62<br>(0.812) |
| C-16-3    | 24,60<br>(0.969) | 15,88<br>(0.625) | 53,18<br>(2.093) | 15,88<br>(0.625) | 19,05<br>(0.750) |
| C-20-3    | 30,96<br>(1.218) | 25,40<br>(1.00)  | 71,44<br>(2.812) | 25,40<br>(1.000) | 30,16<br>(1.188) |

# C-\*\*-3S Cavity Dimensions

## Dimensions

mm (inch)



● These diameters  $\sqrt{0,051\text{mm} (.002 \text{ inch})}$  B unless otherwise specified

○ These diameters  $\perp 0,025\text{mm} (.001 \text{ inch})$  A unless otherwise specified

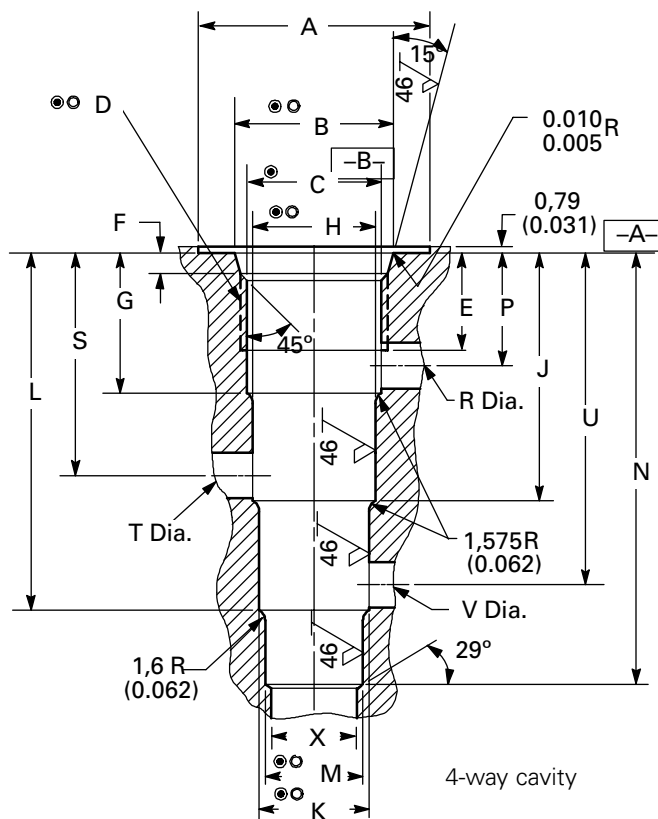
| CAVITY    | A                | B                     | C                    | D         | E                | F                          | G                | H                    | J                | K                    | L                |
|-----------|------------------|-----------------------|----------------------|-----------|------------------|----------------------------|------------------|----------------------|------------------|----------------------|------------------|
| mm (inch) | Spotface         | +0,00510<br>(+0.0020) | +0,0510<br>(+0.0020) | Thread    | Full<br>Thread   |                            |                  | ±0,0254<br>(±0.0001) |                  | ±0,0254<br>(±0.0001) |                  |
| C-10-3S   | 30,16<br>(1.188) | 24,00<br>(0.945)      | 20,62<br>(0.812)     | 0.875"—14 | 14,29<br>(0.562) | 2,54-2,92<br>(0.100-0.115) | 16,51<br>(0.650) | 19,08<br>(0.751)     | 38,48<br>(1.515) | 17,50<br>(0.689)     | 47,62<br>(1.875) |
| C-12-3S   | 38,10<br>(1.500) | 29,15<br>(1.148)      | 24,76<br>(0.975)     | 1.062"—12 | 22,22<br>(0.875) | 3,30-3,68<br>(0.130-0.145) | 25,40<br>(1.000) | 23,82<br>(0.938)     | 48,26<br>(1.900) | 22,25<br>(0.876)     | 59,69<br>(2.350) |
| C-16-3S   | 44,45<br>(1.750) | 35,58<br>(1.401)      | 31,34<br>(1.234)     | 1.312"—12 | 17,46<br>(0.687) | 3,30-3,68<br>(0.130-0.145) | 20,62<br>(0.812) | 28,62<br>(1.127)     | 46,02<br>(1.812) | 25,45<br>(1.002)     | 55,58<br>(2.188) |
| C-20-3S   | 57,66<br>(2.270) | 43,59<br>(1.716)      | 39,12<br>(1.540)     | 1.625"—12 | 20,64<br>(0.812) | 3,35-3,73<br>(0.132-0.147) | 23,82<br>(0.938) | 36,55<br>(1.439)     | 64,29<br>(2.531) | 33,38<br>(1.314)     | 77,77<br>(3.062) |

| CAVITY    | P                | R               | S                | T                | X                |
|-----------|------------------|-----------------|------------------|------------------|------------------|
| mm (inch) |                  | Max. Dia.       |                  | Max. Dia.        | Max. Dia.        |
| C-10-3S   | 14,29<br>(0.562) | 3,18<br>(0.125) | 30,96<br>(1.218) | 13,49<br>(0.531) | 15,88<br>(0.625) |
| C-12-3S   | 22,22<br>(0.875) | 4,82<br>(0.190) | 41,27<br>(1.625) | 12,70<br>(0.500) | 20,62<br>(0.812) |
| C-16-3S   | 16,67<br>(0.656) | 6,35<br>(0.250) | 37,31<br>(1.468) | 15,88<br>(0.625) | 19,05<br>(0.750) |
| C-20-3S   | 19,84<br>(0.781) | 6,35<br>(0.250) | 50,00<br>(1.968) | 25,40<br>(1.000) | 30,16<br>(1.188) |

# C-\*\*-4 Cavity Dimensions

## Dimensions

mm (inch)



● These diameters  $\begin{matrix} \nearrow \\ \text{0,051mm (.002 inch)} \end{matrix}$  B unless otherwise specified

◎ These diameters  $\begin{matrix} \perp \\ \text{0,025mm (.001 inch)} \end{matrix}$  A unless otherwise specified

| CAVITY    | A                | B                     | C                    | D         | E                | F                          | G                | H                    | J                | K                    |
|-----------|------------------|-----------------------|----------------------|-----------|------------------|----------------------------|------------------|----------------------|------------------|----------------------|
| mm (inch) | Spotface         | +0,00510<br>(+0.0020) | +0,0510<br>(+0.0020) | Thread    | Full<br>Thread   |                            |                  | ±0,0254<br>(±0.0001) |                  | ±0,0254<br>(±0.0001) |
| C-8-4     | 30,16<br>(1.188) | 20,65<br>(0.813)      | 17,47<br>(0.688)     | 0.750"—16 | 12,70<br>(0.500) | 2,54-2,92<br>(0.100-0.115) | 18,24<br>(0.718) | 15,90<br>(0.626)     | 32,26<br>(1.270) | 14,30<br>(0.563)     |
| C-10-4    | 30,16<br>(1.188) | 24,00<br>(0.945)      | 20,62<br>(0.812)     | 0.875"—14 | 15,88<br>(0.625) | 2,54-2,92<br>(0.100-0.115) | 22,22<br>(0.875) | 19,08<br>(0.751)     | 38,10<br>(1.500) | 17,50<br>(0.689)     |
| C-12-4    | 38,10<br>(1.500) | 29,15<br>(1.148)      | 24,76<br>(0.975)     | 1.062"—12 | 22,22<br>(0.875) | 3,30-3,68<br>(0.130-0.145) | 34,92<br>(1.375) | 23,82<br>(0.938)     | 57,78<br>(2.275) | 22,25<br>(0.876)     |
| C-18-4    | 44,45<br>(1.750) | 35,58<br>(1.401)      | 31,34<br>(1.234)     | 1.312"—12 | 22,22<br>(0.875) | 3,30-3,68<br>(0.130-0.145) | 34,14<br>(1.344) | 28,62<br>(1.127)     | 62,71<br>(2.469) | 27,02<br>(1.064)     |
| C-20-4    | 57,66<br>(2.270) | 43,59<br>(1.716)      | 39,12<br>(1.540)     | 1.625"—12 | 20,64<br>(0.812) | 3,35-3,73<br>(0.132-0.147) | 44,45<br>(1.750) | 36,55<br>(1.439)     | 85,72<br>(3.375) | 33,38<br>(1.314)     |

| CAVITY    | L                 | M                    | N                 | P                | R                | S                | T                | U                 | V                | X                |
|-----------|-------------------|----------------------|-------------------|------------------|------------------|------------------|------------------|-------------------|------------------|------------------|
| mm (inch) |                   | ±0,00254<br>(±0.001) |                   |                  | Max.Dia.         |                  | Max.Dia.         |                   |                  | Max.Dia.         |
| C-8-4     | 46,48<br>(1.830)  | 12,72<br>(0.501)     | 56,13<br>(2.210)  | 14,68<br>(0.578) | 5,94<br>(0.234)  | 28,98<br>(1.141) | 5,94<br>(0.234)  | 43,25<br>(1.703)  | 5,94<br>(0.234)  | 11,13<br>(0.438) |
| C-10-4    | 53,98<br>(2.125)  | 15,90<br>(0.626)     | 63,50<br>(2.500)  | 18,26<br>(0.718) | 6,35<br>(0.250)  | 34,13<br>(1.343) | 6,35<br>(0.250)  | 50,00<br>(1.968)  | 6,35<br>(0.250)  | 14,29<br>(0.562) |
| C-12-4    | 80,64<br>(3.175)  | 20,65<br>(0.813)     | 92,07<br>(3.625)  | 27,94<br>(1.100) | 12,70<br>(0.500) | 50,80<br>(2.000) | 12,70<br>(0.500) | 73,66<br>(2.900)  | 12,70<br>(0.500) | 19,05<br>(0.750) |
| C-18-4    | 91,29<br>(3.594)  | 25,45<br>(1.002)     | 103,99<br>(4.094) | 24,60<br>(0.968) | 15,88<br>(0.625) | 53,16<br>(2.093) | 15,88<br>(0.625) | 81,76<br>(3.218)  | 15,88<br>(0.625) | 19,05<br>(0.750) |
| C-20-4    | 127,00<br>(5.000) | 31,78<br>(1.251)     | 141,27<br>(5.562) | 30,96<br>(1.218) | 25,40<br>(1.000) | 71,44<br>(2.812) | 25,40<br>(1.000) | 112,71<br>(4.437) | 25,40<br>(1.000) | 30,16<br>(1.188) |

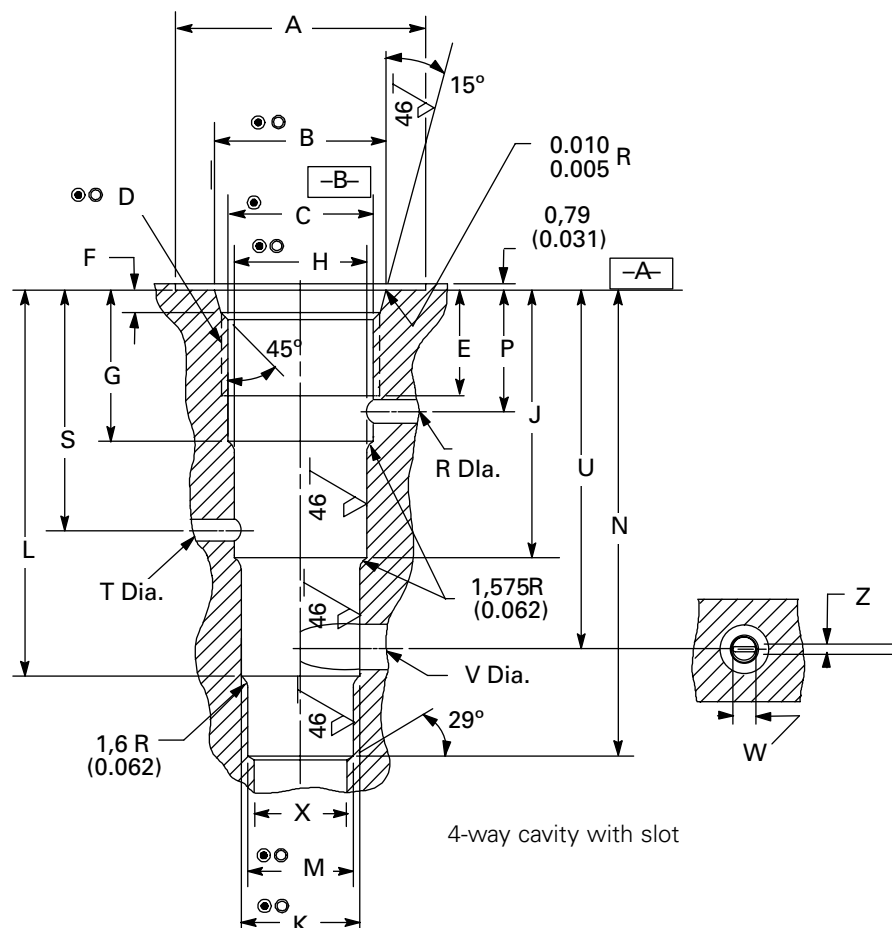
# C-\*\*-4U Cavity Dimensions



For use with  
VCB1-10/12  
Cartridge Only

## Dimensions

mm (inch)



● These diameters  $\pm 0,051\text{mm}$  (.002 inch) B unless otherwise specified

○ These diameters  $\pm 0,025\text{mm}$  (.001 inch) A unless otherwise specified

| CAVITY    | A                  | B                          | C                    | D                | E                | F                          | G                | H                     | J                | K                     |
|-----------|--------------------|----------------------------|----------------------|------------------|------------------|----------------------------|------------------|-----------------------|------------------|-----------------------|
| mm (inch) | Spotface           | +0,00510<br>(+0.0020)      | +0,0510<br>(+0.0020) | Thread           | Full<br>Thread   |                            |                  | ±0,0254)<br>(±0.0001) |                  | ±0,0254)<br>(±0.0001) |
| C-10-4U   | 30,16<br>(1.188)   | 24,00<br>(0.945)           | 20,62<br>(0.812)     | 0.875"—14        | 15,88<br>(0.625) | 2,54-2,92<br>(0.100-0.115) | 22,22<br>(0.875) | 19,08<br>(0.751)      | 38,10<br>(1.500) | 17,50<br>(0.689)      |
| C-12-4U   | 38,10<br>(1.500)   | 29,15<br>(1.148)           | 24,76<br>(0.975)     | 1.062"—12        | 22,22<br>(0.875) | 3,30-3,68<br>(0.130-0.145) | 34,91<br>(1.375) | 23,81<br>(0.938)      | 57,77<br>(2.275) | 22,24<br>(0.876)      |
| CAVITY    | L                  | M                          | N                    | P                | R                | S                          | T                | U                     | V                | X                     |
| mm (inch) |                    | ±0,00254<br>(±0.001)       |                      |                  | Max.Dia.         |                            | Max.Dia.         |                       |                  | Max.Dia.              |
| C-10-4U   | 53,98<br>(2.125)   | 15,90<br>(0.626)           | 63,50<br>(2.500)     | 19,83<br>(0.781) | 3,17<br>(0.125)  | 10,31<br>(0.406)           | 3,17<br>(0.125)  | 51,58<br>(2.031)      | 6,35<br>(0.250)  | 14,29<br>(0.562)      |
| C-12-4U   | 80,61<br>(3.175)   | 20,64<br>(0.813)           | 92,04<br>(3.625)     | 27,93<br>(1.100) | 12,70<br>(0.500) | 50,78<br>(2.000)           | 12,70<br>(0.500) | 73,63<br>(2.900)      | 12,70<br>(0.500) | 19,04<br>(0.750)      |
| CAVITY    | THREAD             | W                          | Z                    |                  |                  |                            |                  |                       |                  |                       |
| mm (inch) |                    |                            |                      |                  |                  |                            |                  |                       |                  |                       |
| C-10-4U   | All                | 15,9 (0.625)               | ø 6,3 (0.25)         |                  |                  |                            |                  |                       |                  |                       |
| C-12-4U   | SAE12<br>1/2" BSPP | 22,4 (0.88)<br>17,5 (0.68) | ø 12,6 (0.50)        |                  |                  |                            |                  |                       |                  |                       |

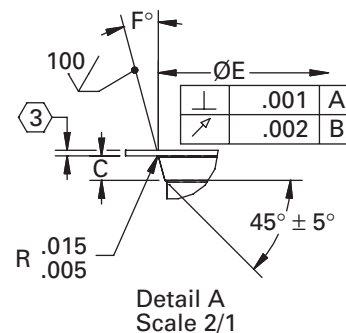
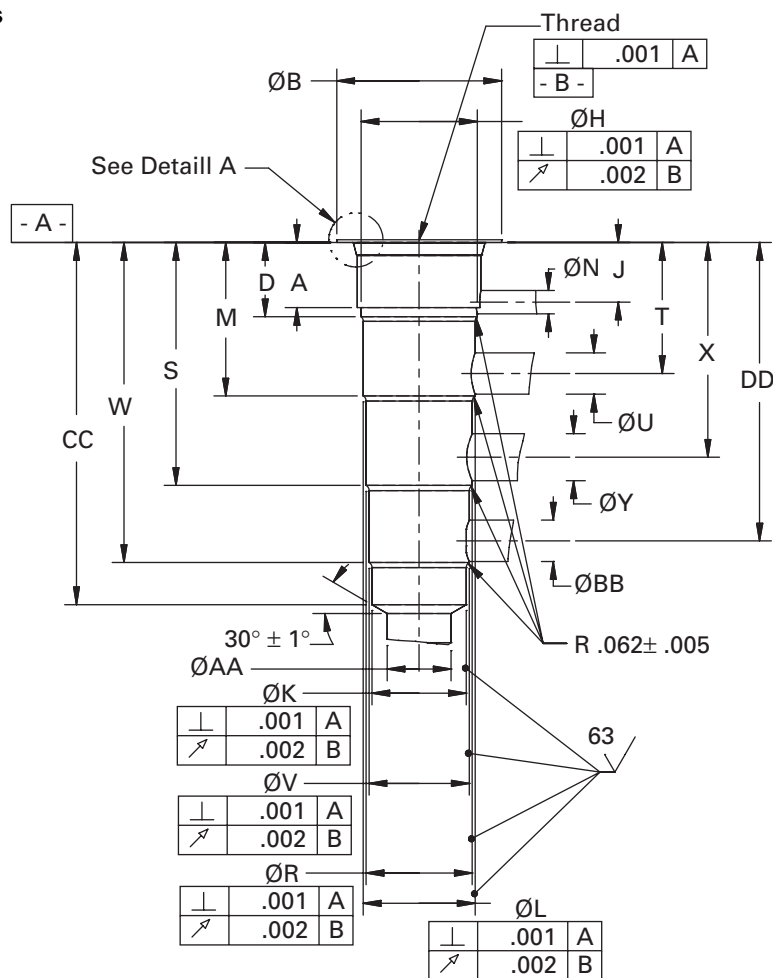
# C-\*\*-5S

## Cavity

## Dimensions

### Dimensions

mm (inch)



③ Spotface depth to be shown on detail drawing

| CAVITY    |                 |                   | A                 | B                  | C                 | D                 | E                 | F                 | H                              | K                 | L                 | M                 |                   |                   |
|-----------|-----------------|-------------------|-------------------|--------------------|-------------------|-------------------|-------------------|-------------------|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| mm (inch) | Thread          | (±0.005)          | ±0,13<br>(±0.005) | ±0,13<br>(+0.0510) | +0,38<br>(±0.005) | ±0,13<br>(±0.002) | ±0,05<br>±1°      | Min               | Max                            | (±0.0001)         | ±0,03<br>(±0.001) | ±0,03<br>(±0.005) | ±0,13             |                   |
| C-12-5S   | 1.0625"—12      |                   | 17,53<br>(0.690)  | 38,10<br>(1.500)   | 2,54<br>(0.100)   | 19,79<br>(0.779)  | 29,21<br>(1.150)  | 15                | 24,69 - 24,79<br>(0.972-0.976) |                   | 19,08<br>(0.751)  | 23,83<br>(0.930)  | 38,84<br>(1.529)  |                   |
| C-16-5S   | 1.3125"—12      |                   | 17,53<br>(0.690)  | 44,45<br>(1.750)   | 3,30<br>(0.130)   | 20,02<br>(0.788)  | 35,59<br>(1.401)  | 15                | 31,29 - 31,39<br>(1.232-1.236) |                   | 25,45<br>(1.002)  | 30,20<br>(1.189)  | 41,40<br>(1.630)  |                   |
| C-20-5S   | 1.625"—12       |                   | 17,53<br>(0.690)  | 57,66<br>(2.270)   | 3,35<br>(0.132)   | 20,02<br>(0.788)  | 43,59<br>(1.716)  | 15                | 39,12 - 39,29<br>(1.543-1.547) |                   | 33,38<br>(1.314)  | 38,16<br>(1.502)  | 44,45<br>(1.750)  |                   |
| CAVITY    | N               | J                 | R                 | S                  | U                 | T                 | V                 | W                 | Y                              | X                 | AA                | BB                | CC                | DD                |
| mm (inch) | Max             | ±0,13<br>(±0.005) | ±0,03<br>(±0.001) | ±0,13<br>(±0.005)  | Max               | ±0,13<br>(±0.005) | ±0,03<br>(±0.001) | ±0,13<br>(±0.005) | Max                            | ±0,13<br>(±0.005) | Max               | Max               | ±0,13<br>(±0.005) | ±0,13<br>(±0.005) |
| C-12-5S   | 4,78<br>(0.188) | 15,88<br>(0.625)  | 22,25<br>(0.876)  | 59,44<br>(2.340)   | 9,53<br>(0.375)   | 33,32<br>(1.312)  | 20,65<br>(0.813)  | 78,51<br>(3.091)  | 11,13<br>(0.438)               | 53,19<br>(2.094)  | 17,45<br>(0.687)  | 9,53<br>(0.375)   | 88,14<br>(3.470)  | 73,03<br>(2.875)  |
| C-16-5S   | 6,35<br>(0.250) | 16,08<br>(0.633)  | 28,63<br>(1.127)  | 65,56<br>(2.581)   | 11,18<br>(0.440)  | 35,36<br>(1.392)  | 27,03<br>(1.064)  | 86,33<br>(3.399)  | 12,70<br>(0.500)               | 57,94<br>(2.281)  | 19,05<br>(0.750)  | 11,18<br>(0.440)  | 97,69<br>(3.846)  | 80,52<br>(3.170)  |
| C-20-5S   | 6,35<br>(0.250) | 16,00<br>(0.630)  | 36,55<br>(1.439)  | 70,10<br>(2.760)   | 36,83<br>(0.562)  | 36,83<br>(1.450)  | 34,98<br>(1.377)  | 94,23<br>(3.710)  | 15,09<br>(0.594)               | 61,47<br>(2.094)  | 25,40<br>(1.000)  | 14,22<br>(0.560)  | 106,69<br>(4.200) | 86,61<br>(3.410)  |