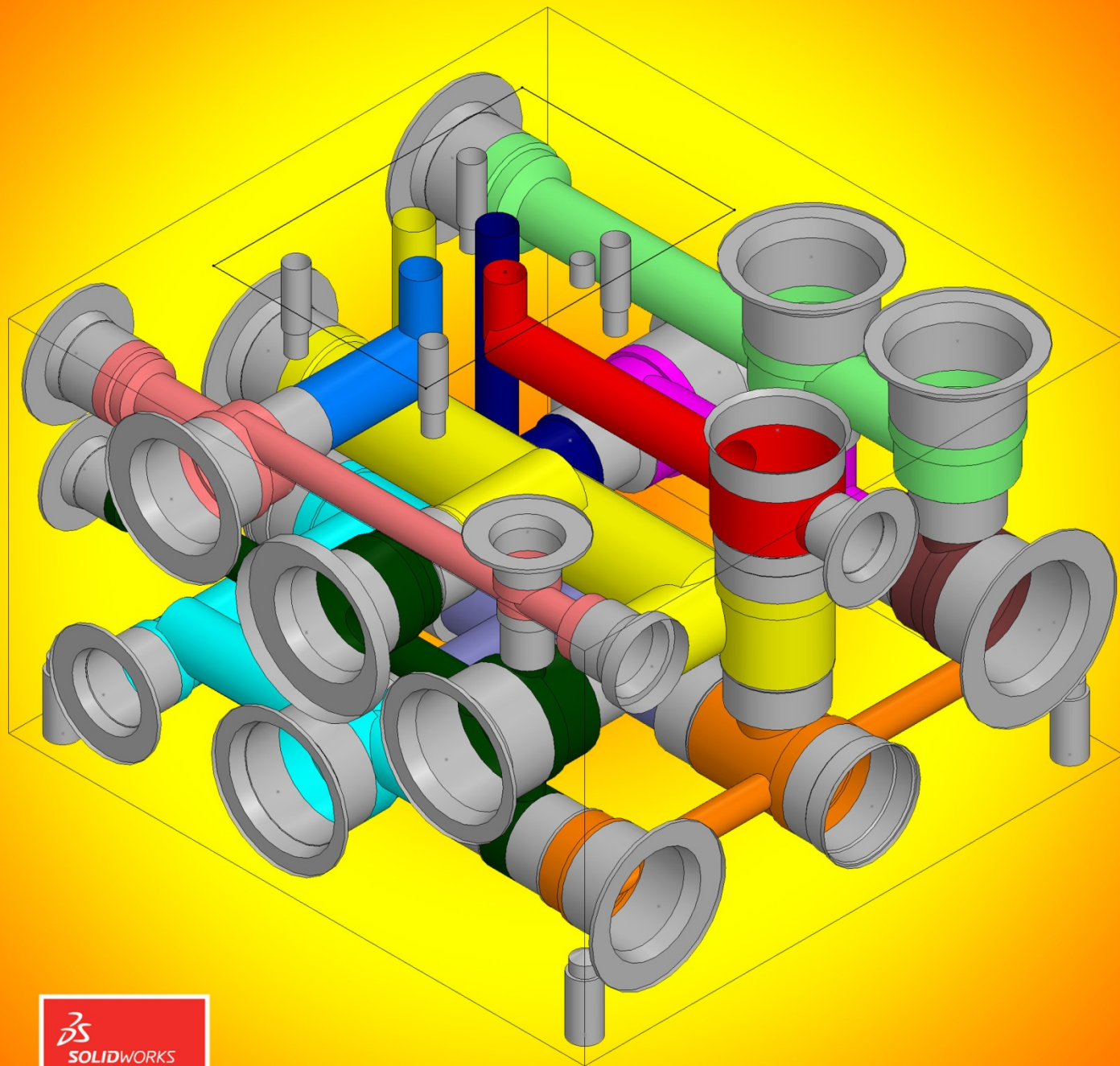


User Manual

# MDTools® Essential

for SolidWorks®



# **MDTools<sup>®</sup> Essential**

**manifold design** software for SolidWorks<sup>®</sup>

**Do more...**

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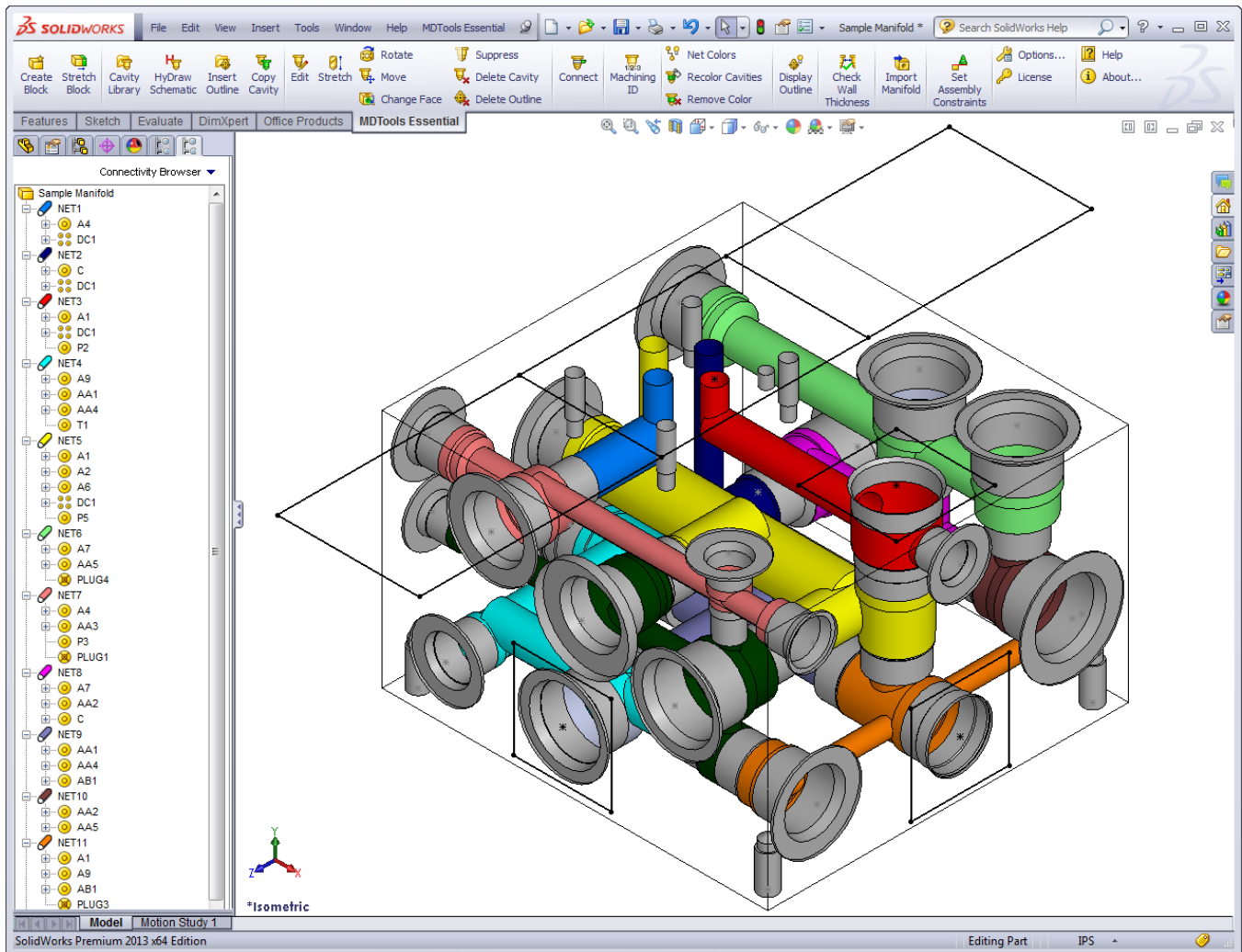


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# 1. Introduction



## VISUALIZES

Color-coded cavities and flow paths

Cavities divided into port areas and dead areas

## DESIGNS

Embedded design rules  
Color-coded flow paths  
Connections with smooth bends  
Interactive Stretch Block

Drag and move cavities using move handle  
Cavity libraries with machining details

## CHECKS

Wall thickness between two cavities

## AUTOMATES

Auto Machining Drawing and Chart

MDTools® HyDraw® Interface

## COMPREHENSIVE

Major OEM libraries included

Both cartridge and interface valves used

# 1. Welcome to VEST MDTools Essential

**MDTools® Essential**, the 3D Manifold design software from VEST provides you with power tools to automate the manifold design, checking, documentation, and modeling process within the **SolidWorks®** environment.

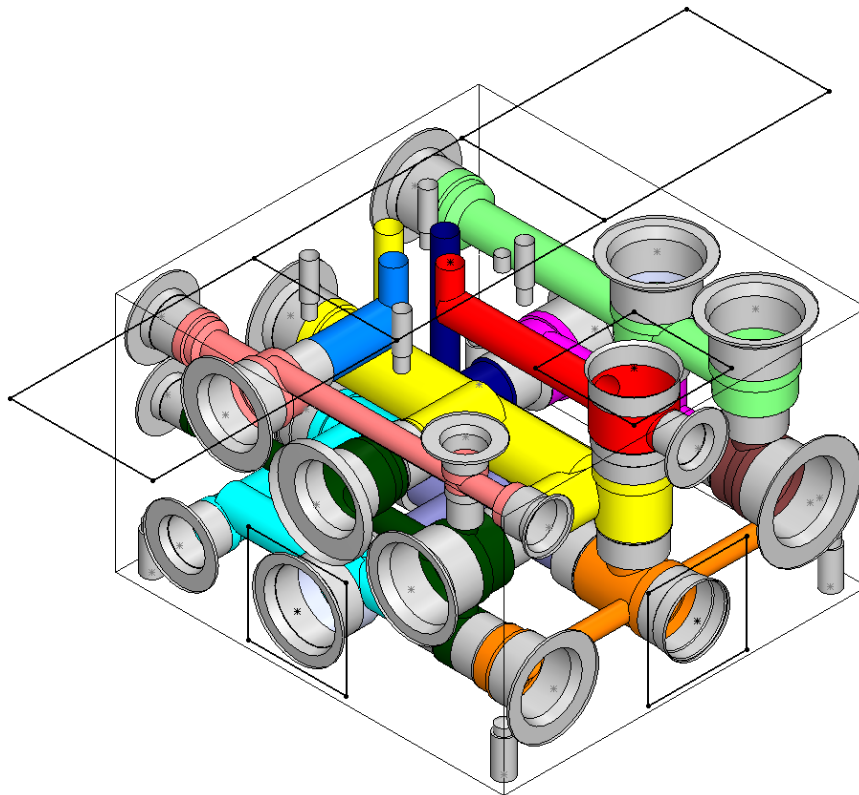
As a designer of hydraulics manifold blocks using both cartridge and interface valves, you will find MDTools Essential an invaluable tool enabling you to be more productive.

Quickly and easily design complex and error free manifolds with professional documentation; machining chart generation, and more.

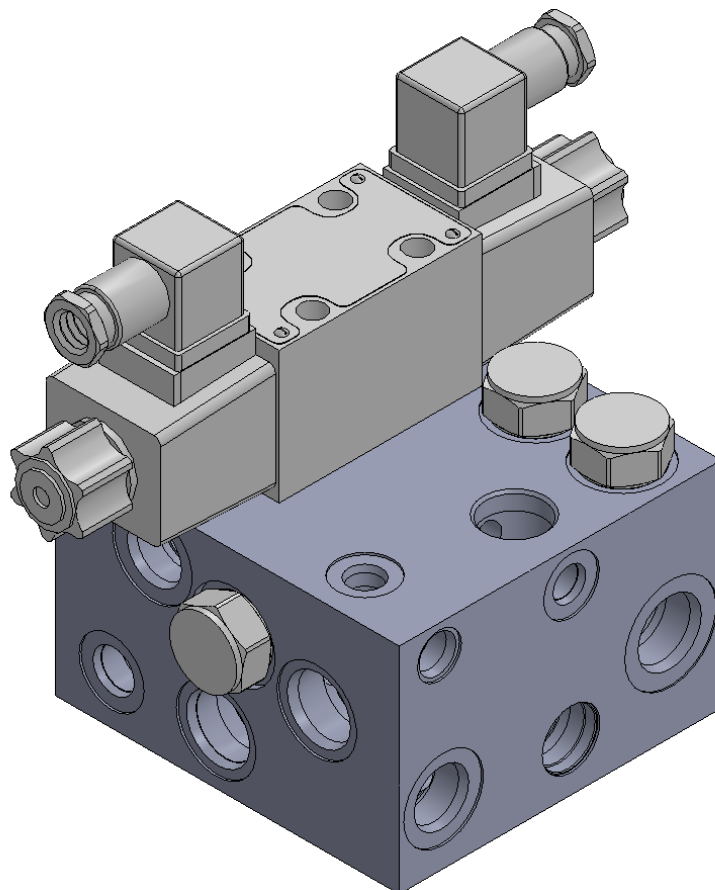
MDTools Essential provides efficient design tools to reduce your design time. Use the powerful Connect to Cavity feature to easily connect two cavities.

Color-coded cavities and flow paths give you effective visualization of the manifold internals and connectivity.

The Machining Chart command enables you to automatically extract the cavity machining data from the block model, and export the machining chart to Microsoft® Excel®.



*MDTools designed manifold*



*Manifold Assembly*

## 2. Study Guidelines

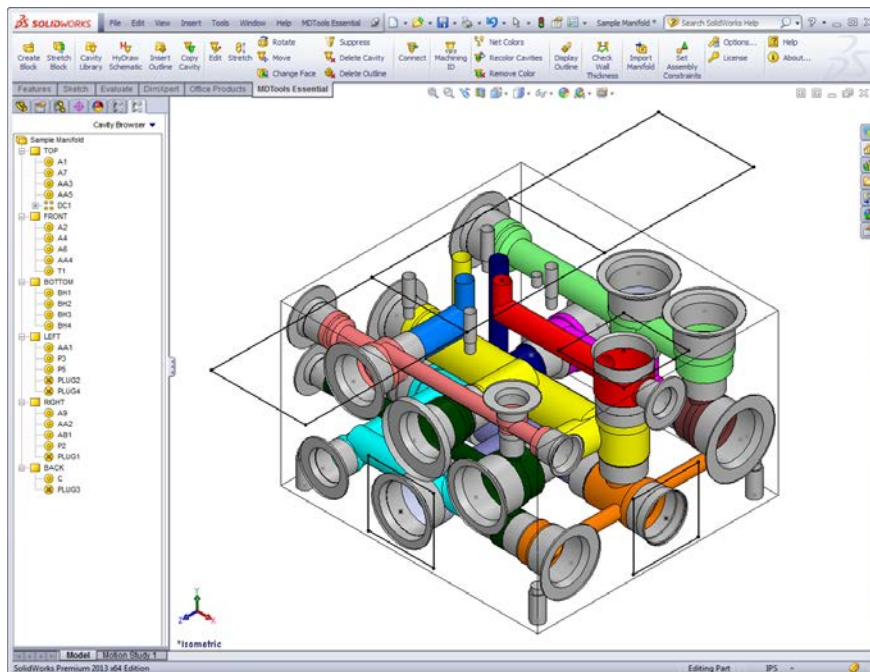
The **MDTools® Essential** User Manual provides comprehensive information on the manifold design software.

First time users of MDTools must go through the initial chapters. These chapters cover the basic concepts and help you understand the software environment.

The subsequent chapters give detailed coverage of the commands, their usage, processes, and design methodology.

The user manual can be used as a comprehensive reference to the command set and usage of MDTools Essential.

The Contents and Index listing guides you to relevant material for study and reference.



## 3. If you have a Question

If you have a question about MDTools Essential, email us at [support@VESTusa.com](mailto:support@VESTusa.com)

Please include the following:

- Version number of the software you are using.

*To see the version of MDTools on your machine, go to:*

MDTools Essential

> **About MDTools**

on the Part MDTools Essential ribbon command tab.

- Configuration of your machine.
- Exact messages, if any, on the screen. Send a screen capture, if possible.
- Description of the problem and what you were doing when the problem occurred.
- Description of how you tried to solve the problem.

## 2. Installation

Install MDTools® Essential using the installation program. The installer creates all required directories and installs MDTools Essential on your system.

### 1. System Requirements

- Intel Core i5 2.4 GHz Processor.
- 8 GB RAM.
- Microsoft Windows 7\*/Windows 8 (64 Bit) operating system.
- Microsoft Access Database Engine 2010 (64 Bit)
- Microsoft .NET Framework 3.5.
- SolidWorks 2012/2013 (64 Bit).
- Other system requirements, per SolidWorks version used.

\* Windows Home Operating System not supported

### 2. Software Installation

Insert the MDTools Essential CD-ROM in the CD drive of your system.

If Auto run is not set, then:

1. Launch the *Setup* program.  
Windows **Start...**  
> **Run...** > **Browse...**  
(Browse to E:\MDToolsEssentialStart.exe assuming E is your CD drive).
2. Select MDToolsEssentialStart.exe
3. Click **Open**.

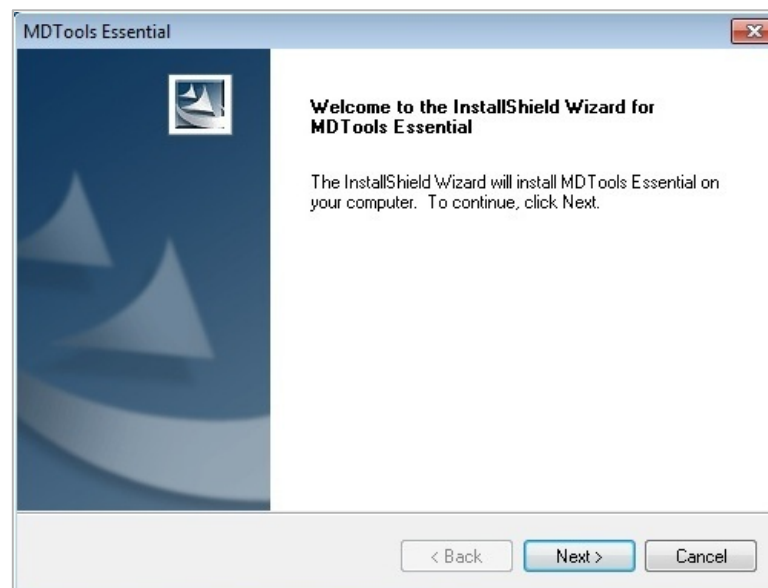
The MDTools Essential setup dialog box displays.



MDTools Essential Setup dialog box

#### Install MDTools Essential

1. Click MDTools Essential.  
The InstallShield wizard for MDTools Essential displays.
2. Respond to all the setup program prompts.  
MDTools Essential is installed on your system. The installation program automatically creates the required directories in your system.



MDTools Essential Installation Wizard

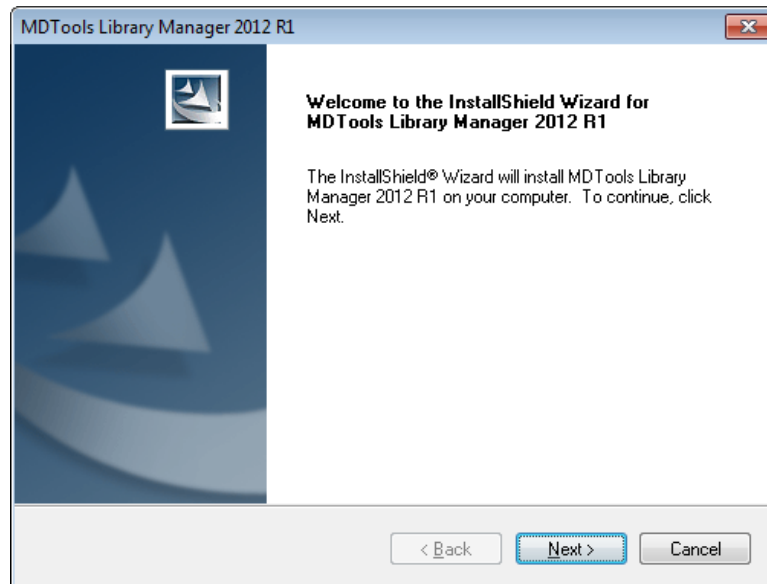


## Install MDTools Library Manager

1. Click MDTools Library Manager.  
*The MDTools Library Manager dialog box displays.*
2. Respond to all the setup program prompts.  
*The MDTools Library Manager program is installed on your system.*

### Note:

- Install both MDTools® and MDTools Cavity Library to use the MDTools software.
- Install the MDTools Cavity Library on the server to share it with your design team over a network.



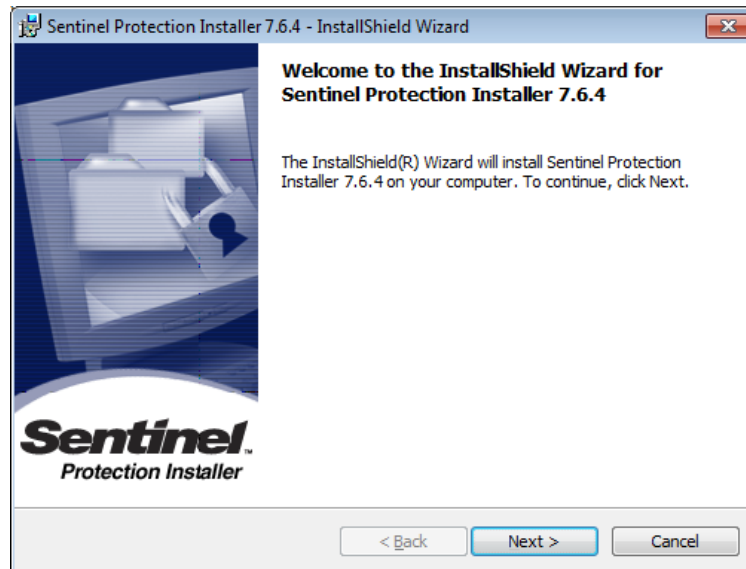
*MDTools Library Manager Installation wizard*

## Install Hardware Lock Manager

1. Install the hardware lock manager on the system you have attached the MDTools hardware lock.
2. Click Sentinel Super Pro Server.
3. Respond to all the setup program prompts.  
*The Hardware lock driver is installed on your system.*

### Note:

If you use the MDTools Network License, then install this program only on the system with the hardware lock.



*Hardware Lock Manager Installation wizard*

## Hardware Key Installation

MDTools Essential is protected with the Sentinel Super Pro key provided with the software.

Attach the Sentinel Super Pro key to the USB/parallel port of your computer.

### Note:

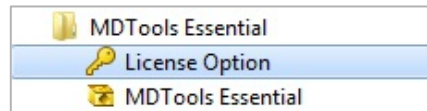
- In case of parallel port, attach the end of the key labeled 'COMPUTER' to the parallel port of your computer.
- The Sentinel Super Pro key can also be cascaded with other keys that support cascading.
- Make sure that the Sentinel Super Pro key is the last key in the chain ...farthest from the computer.

## Set License Server Path

- Start
  - > All Programs
    - > VEST
      - > MDTools Essential
        - > **License Option**

*The License Option dialog box enables you to set the MDTools® hardware lock license file path.*

*If you have a network license, you can set the IP address or the name of the computer carrying MDTools hardware lock. This enables MDTools to directly pick the license from the remote server location.*



MDTools License Option

### Note:

This option is available only in the MDTools Essential Network license version.

## Set License Option in SolidWorks Part Model Menu

1. Set the license path through the Part Model menu.
2. MDTools Essential
  - > **License Options**

*The MDTools License Options dialog box displays.*
3. Enter the server name or the IP address of the system, where the MDTools hardware lock is located.
4. Click **Apply**.

*MDTools automatically selects a license and displays the license information in the License info form.*

*If a license is selected successfully, then the Get License button is disabled and the Release License button is enabled.*

5. To release a license, click the **Release License** button.

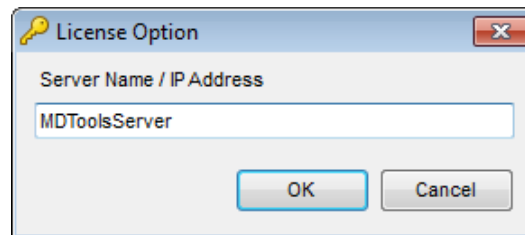
*This releases your license, the Release License option is disabled and the Get License button is enabled.*
6. To get a license, click the **Get License** button.

*If MDTools successfully gets a license, then the Get License button is disabled and the Release License button is enabled.*

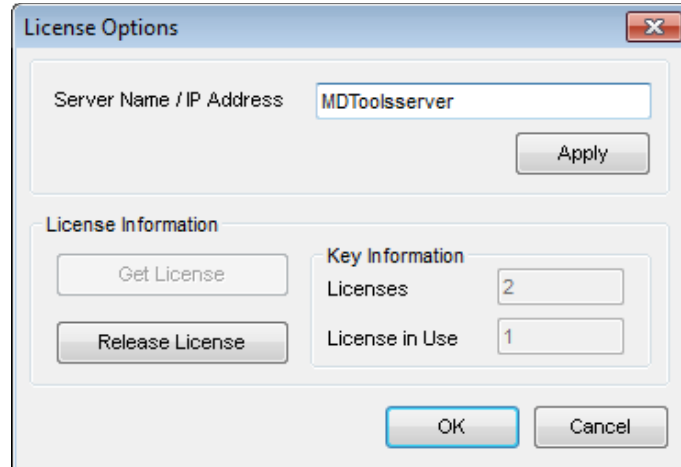
7. Click **OK** to continue.

### Note:

This option is available only in the MDTools Essential Network license version.



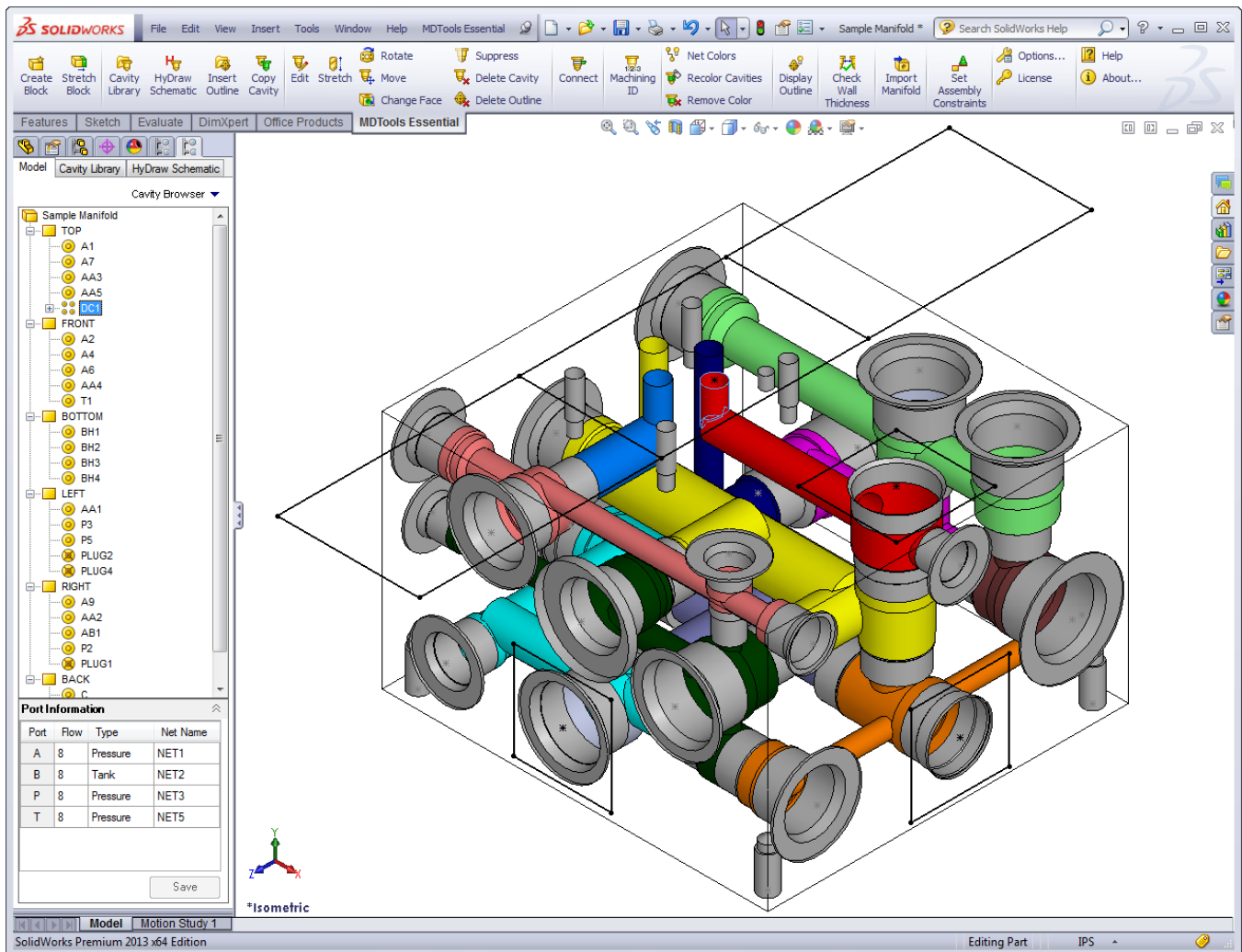
License Option dialog box



License Options dialog box

# BASICS

- 3 MDTools Workspace
- 4 HyDraw Schematic Interface
- 5 MDTools Cavities
- 6 Design Basics
- 7 Using Angle Holes



## 3. MDTools Essential Workspace

*The MDTools® Essential manifold design software enables you to design, check, draw, and model manifolds within the SolidWorks environment.*

There are two types of commands available in the MDTools Block design (Part model) commands

Ribbon menu

Drop down menu

### Note:

Part model commands are available only in the part model environment (.sldprt).

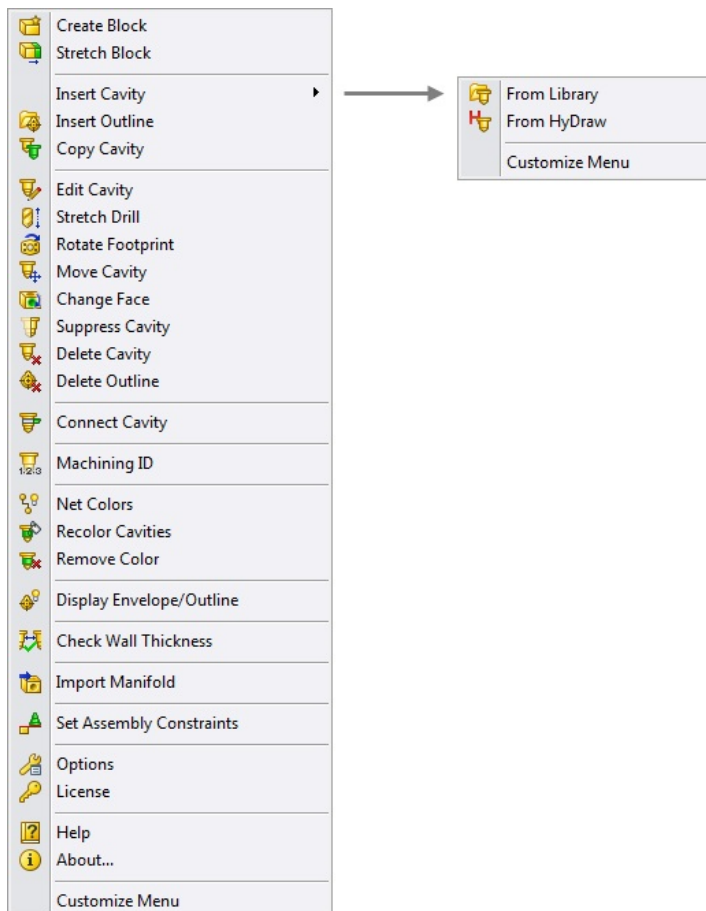
## 3.1 Block design (Part model) commands

### 1. MDTools Part Model Ribbon Menu



MDTools Ribbon Menu

### 2. MDTools Part Model Dropdown Menu {XE: "MDTools Part Model Dropdown Menu"}



### Note:

Refer Appendix for command details

### 3. MDTools Browser

MDTools® adds its own Browser tab to the SolidWorks Features' Manager tabs.

#### Browser Load Behavior

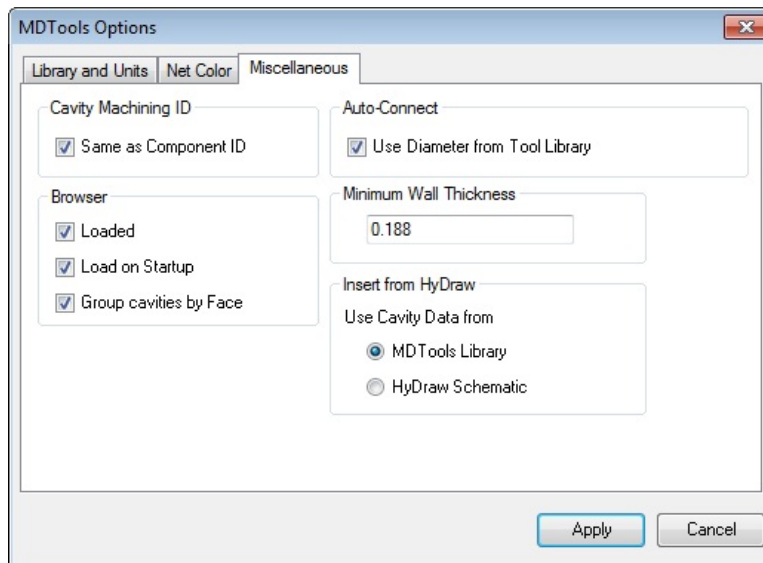
Switches between loading the browser on startup and loading the browser manually.

#### Load on Startup

1. MDTools Essential  
    > **MDTools Options**

*The MDTools Options dialog box displays.*

2. Select the **Miscellaneous** tab.
3. Check/Uncheck the Load on Startup check box in the Browser Load Behavior section, as required.
4. Click **Apply**.



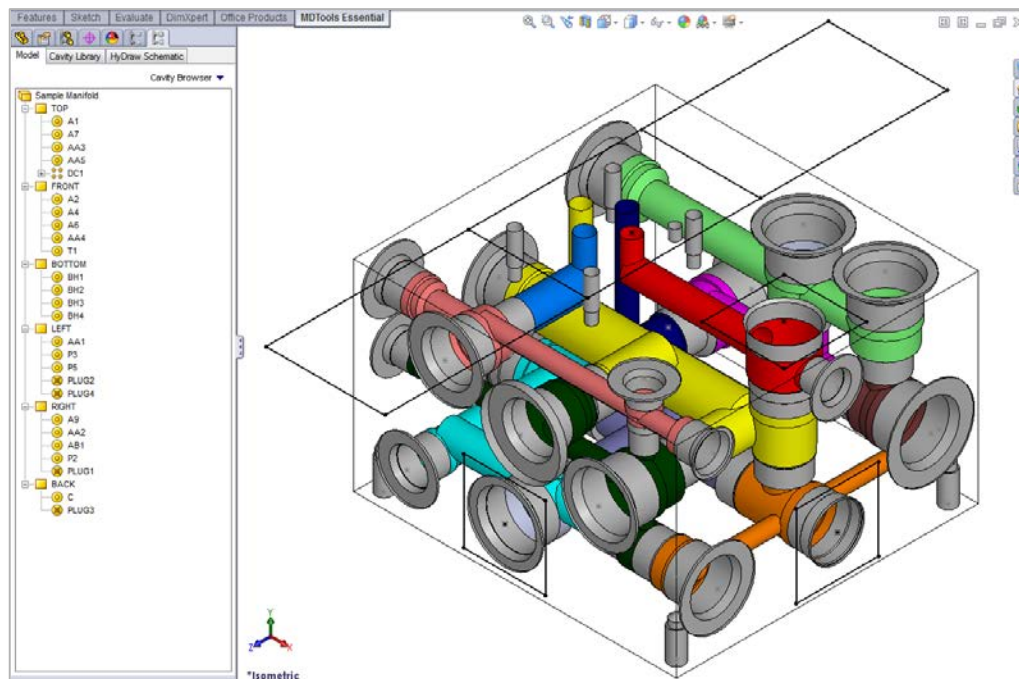
*Browser Load Behavior: Load on Startup option*

### 4. MDTools Cavity Browser

- Displays in the SolidWorks feature Manager tab
- Lists cavities on the respective face nodes
- Automatically marks construction ports with a different icon

#### Note:

Edit the port information directly in the browser.



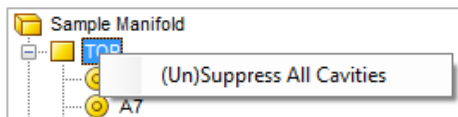
*MDTools Cavity Browser*



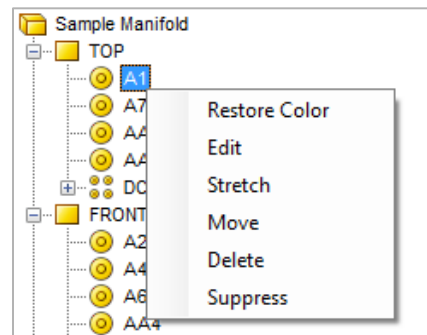
## 1. Cavity Browser Context Menu

Right click a face node or cavity node for the Context menu

Context Menu: Face Node



Context Menu: Cavity Node



## 2. Edit Port Information

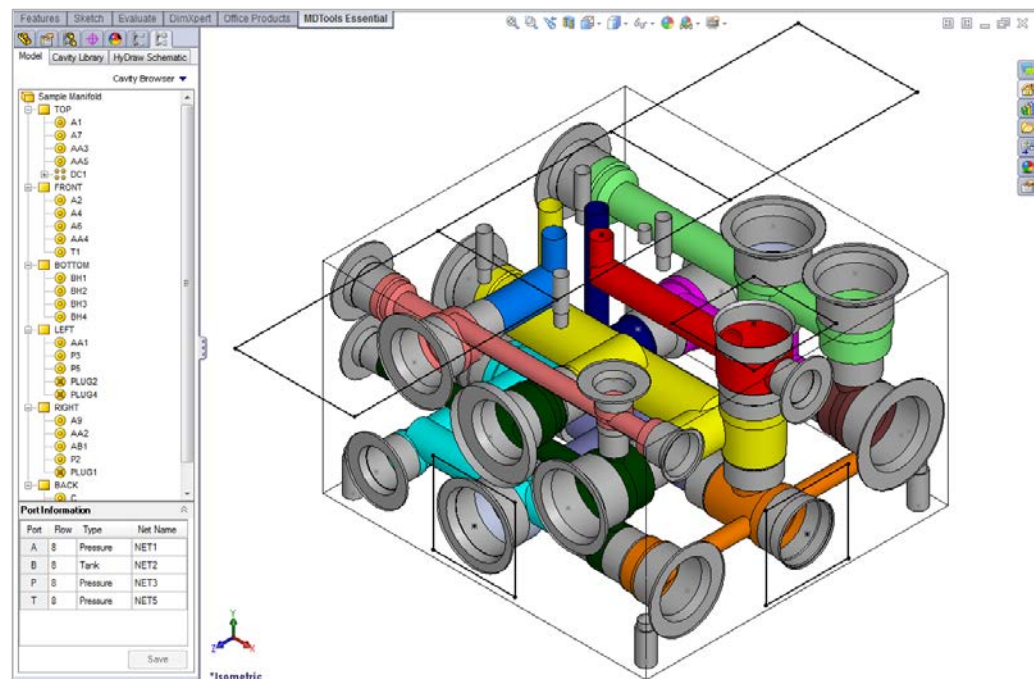
The Edit Port Information feature in the MDTools® browser enables you to view and edit the port information, such as flow, type, and Net name of the selected cavity.

1. Select a cavity/footprint node in the browser.

*MDTools displays the port information for the selected cavity/footprint.*

2. Change the **flow**, **type** or **net name**.
3. Click **Save**.

*Port information for the selected cavity/footprint is updated.*



Edit Port Information dialog box in Browser



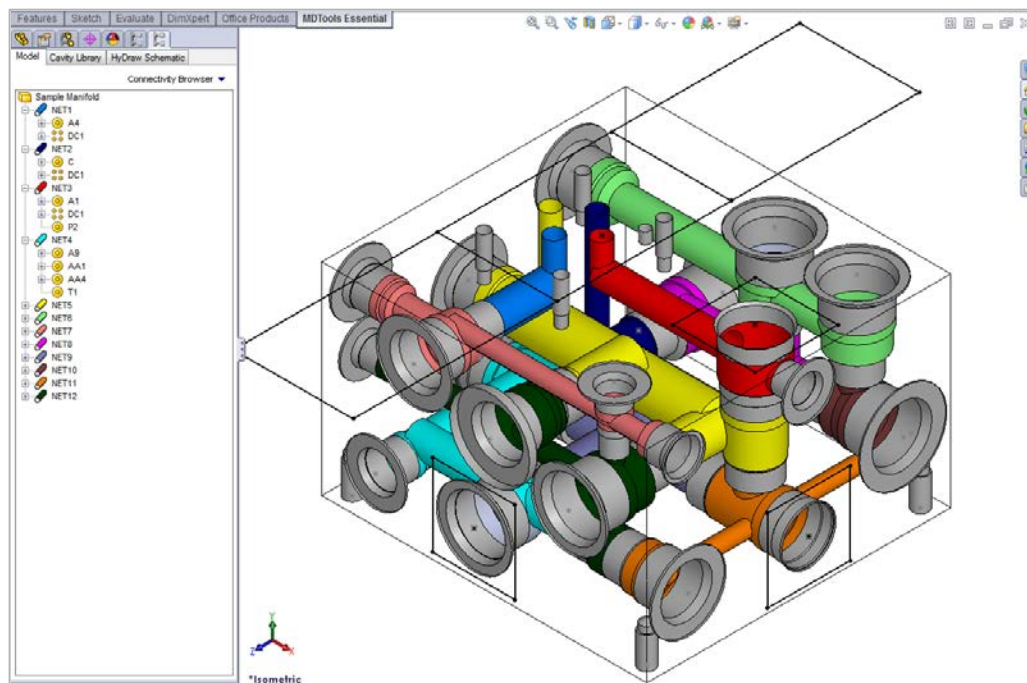
## 5. MDTools Connectivity Browser

The MDTools® Connectivity Browser in the SolidWorks, Features-Manager tab:

- Displays the Connectivity (Net) list.
- Displays all the cavities and ports in each net.
- Displays the net node in the same color of a net in the model.

Change the flow and type for the selected net.

Change the visibility and color of nets using the right-click context menu.



MDTools Connectivity Browser

### 1. Connectivity Browser Context Menu

#### Edit Flow and Type

- Displays options to edit the flow and type of the selected net.

#### Show Selected Net

- Displays the selected net with the net color and all other nets with the Dead Area color.

#### Show All Nets

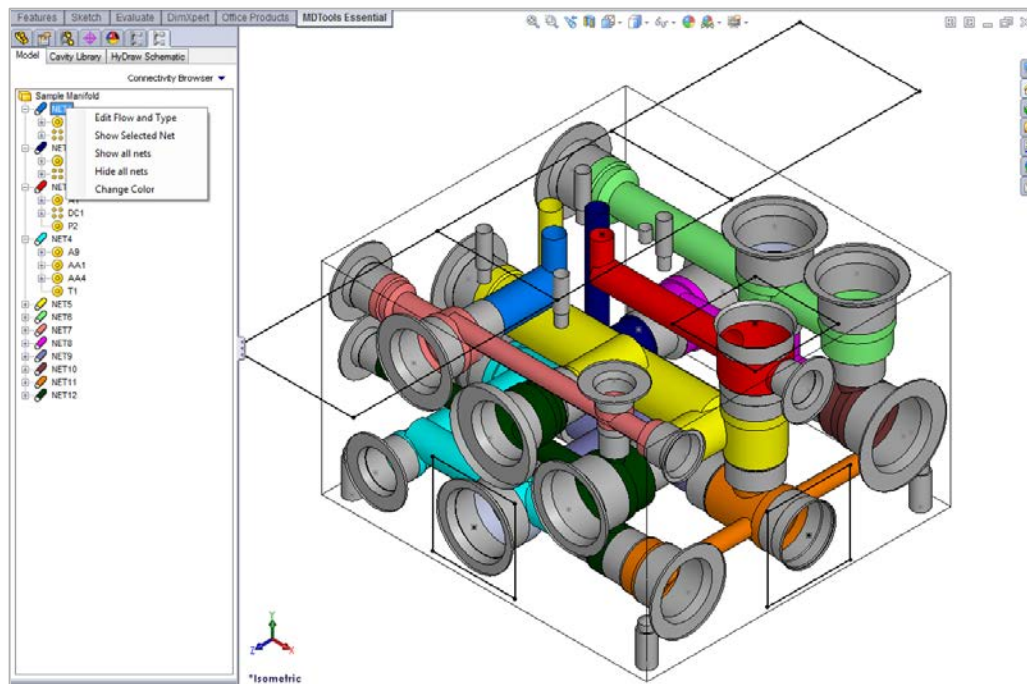
- Restores the color settings of all the nets in the manifold.

#### Hide All Nets

- Hides all the nets in the manifold by shading them with the SolidWorks grey color, default.

#### Change Color

- Enables to change the color of the selected net.



Connectivity Browser context menu

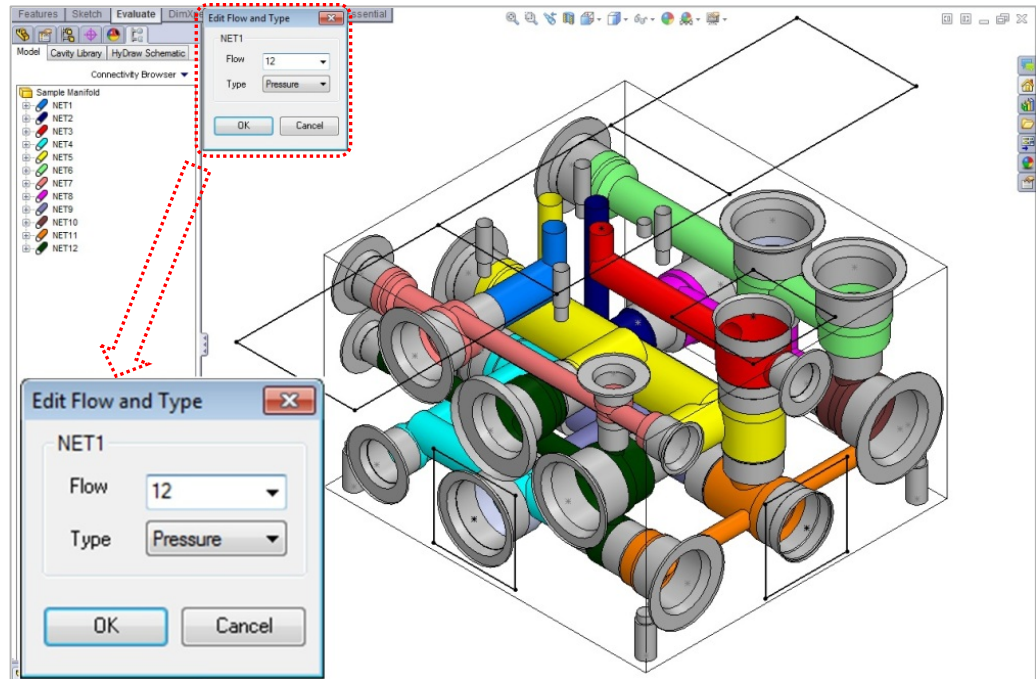
## 2. Edit Flow and Type

1. Select **Edit Flow and Type** from the context menu.

*The Edit Flow and Type dialog box displays.*

2. Enter the flow value.
3. Select the type for the net.
4. Click OK.

*MDTools updates the selected net with the specified flow and type values.*



*Edit Flow and Type dialog box*

## 6. MDTools Context Toolbar {XE: "MDTools Context Toolbar"}

Left-click the feature to view the MDTools Context Toolbar.

Context toolbar enables to quickly access commands related to the selected MDTools feature.

### Note:

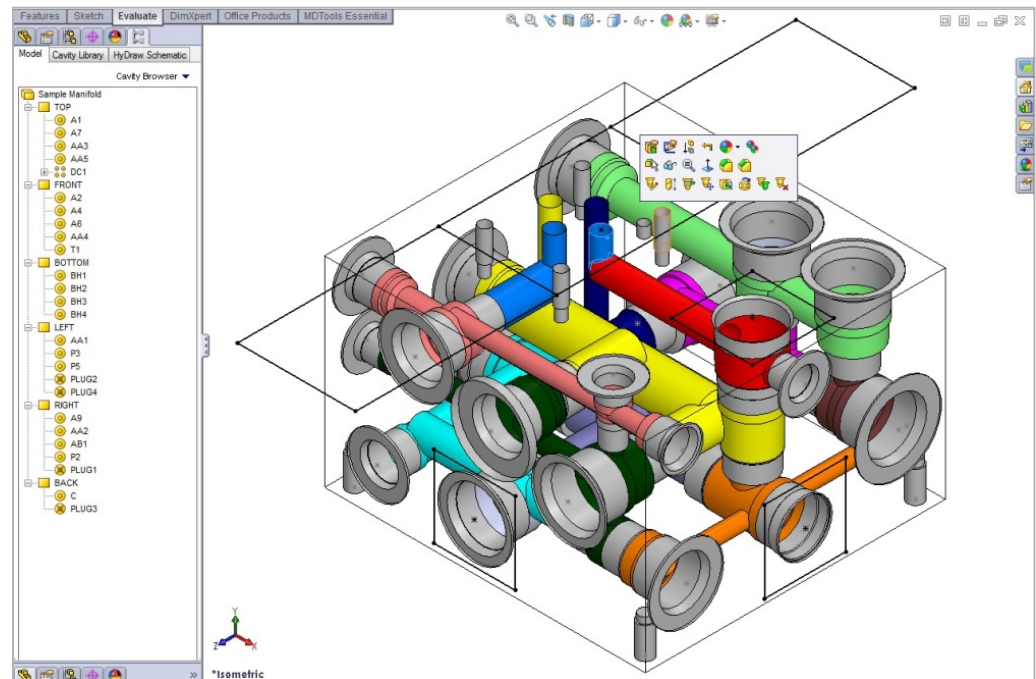
MDTools adds commands to the SolidWorks context toolbar when you select a cavity or manifold block in a model. SolidWorks commands also appear along with MDTools commands.

### Context Toolbar for Cavity

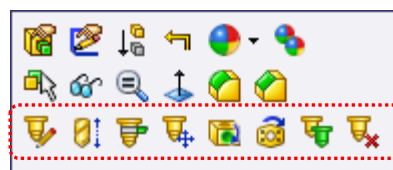
- Edit, stretch, connect cavities, move, change face, rotate (only for footprints), copy or delete selected cavity.

### Context Toolbar for Block

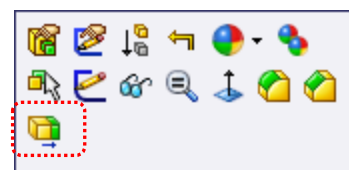
- Stretch manifold block.



*MDTools Context Toolbar*



*Context Toolbar for cavity*



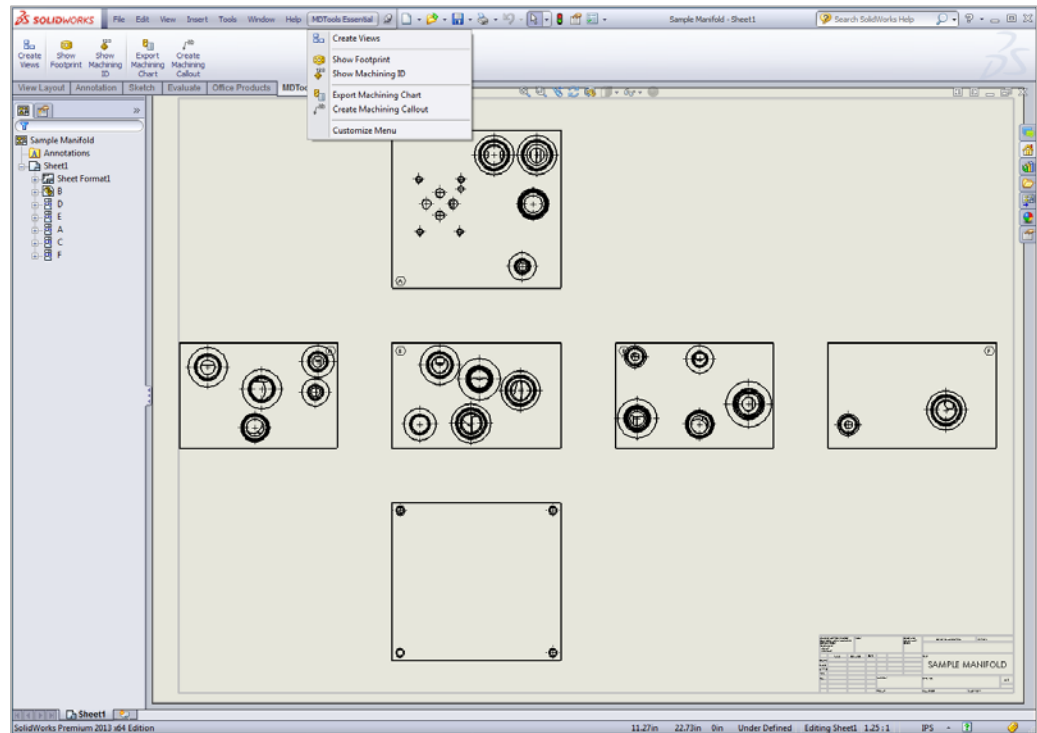
*Context Toolbar for block face*

## 3.2 MDTools Drawing Menu

Commands related to a block machining drawing creation are available only in the 2D drawing environment (.slddrw).

**Note:**

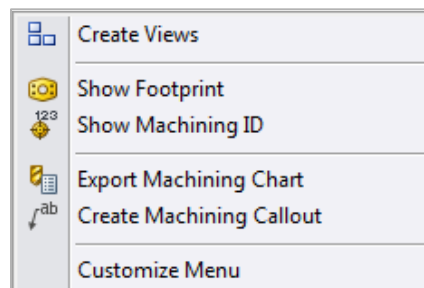
- MDTools® drawing commands work only in the SolidWorks drawing environment (.slddrw file)
- MDTools drawing commands work only if the views are created using MDTools.
- MDTools Drawing and Assembly commands can only be undone, if the model is not rebuilt after the command.



*MDTools Drawing menu*



*Drawing Ribbon Menu*



*Drawing Dropdown Menu*

## 4. HyDraw Schematic Interface

Automatically read an XML exported from a HyDraw® created schematic drawing and insert all the required cavities with connectivity information into a model.

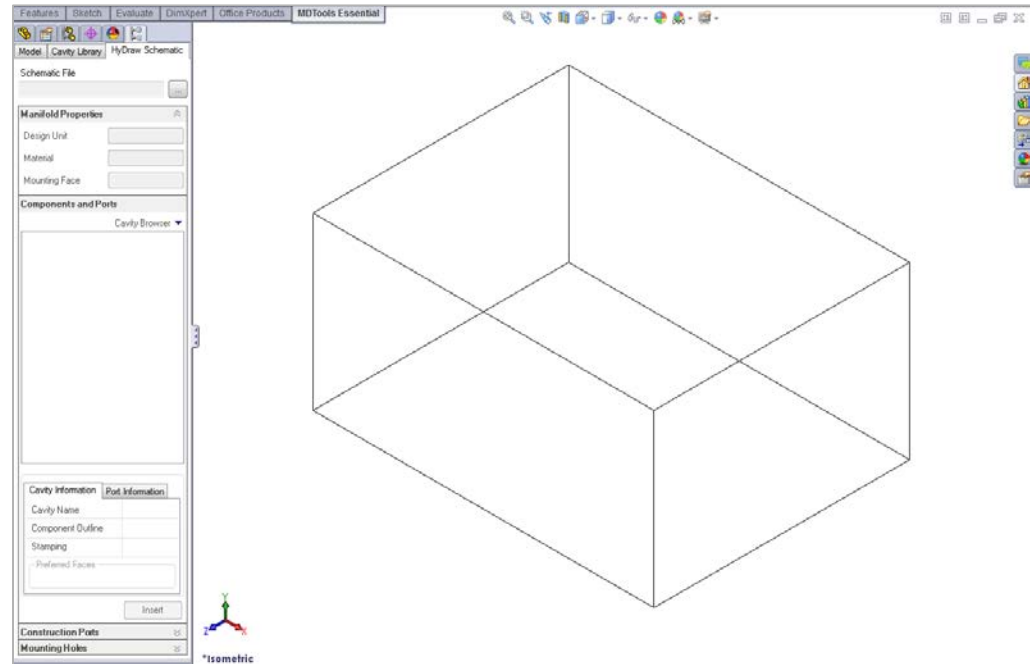
MDTools® inserts component outline and stamping text (if defined) with the cavity, automatically.

1. MDTools Essential  
> HyDraw Schematic

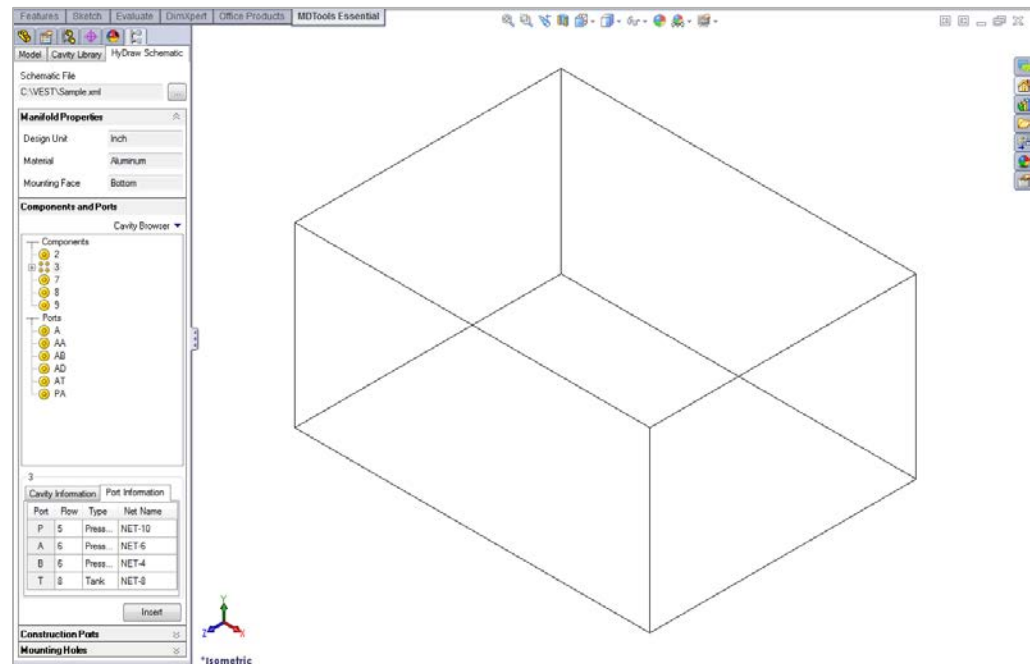
*The HyDraw Schematic tab displays in browser.*

2. Click **Browse** and select the XML exported from the schematic drawing.
3. Click **Open**.

*MDTools automatically populates the Cavity Explorer with all the components from the schematic drawing.*



HyDraw Schematic Interface

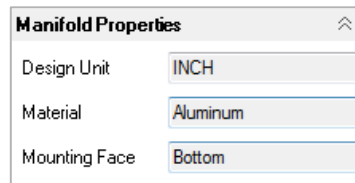


HyDraw Schematic Interface : Schematic data populated



## Manifold Properties

Manifold section displays properties of the manifold defined in the schematic, such as *Design Unit*, *Material*, and *Mounting Face*.



The Manifold Properties dialog box contains three input fields: Design Unit set to INCH, Material set to Aluminum, and Mounting Face set to Bottom.



HyDraw Schematic : Manifold Properties Section

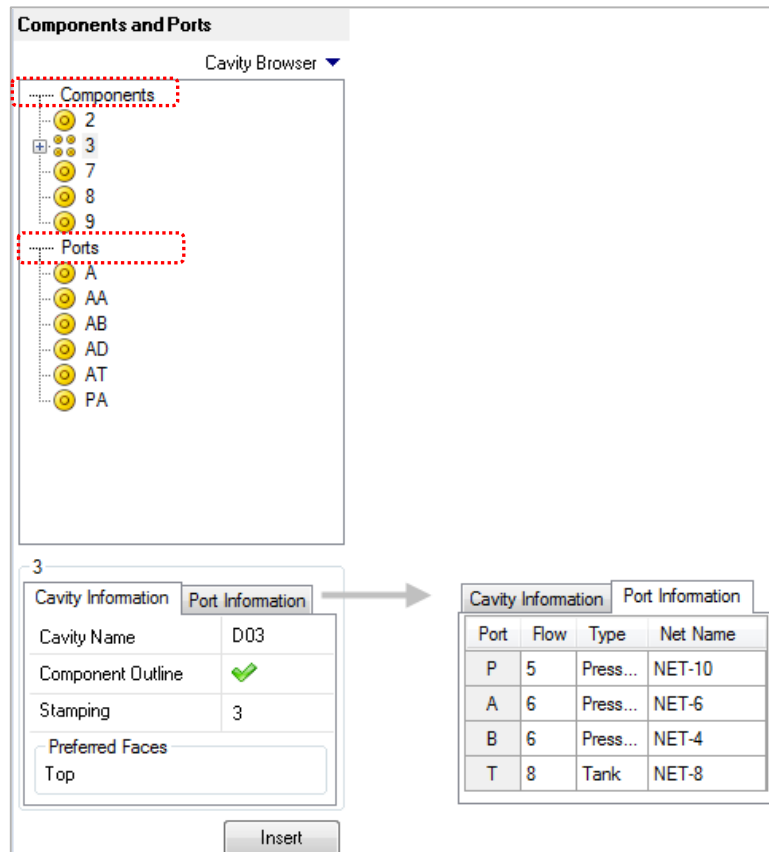
## Components and Ports

This section lists all components and external ports in the schematic.

Select a component or port from the list to view the cavity and port information.

## Cavity Information

Cavity Name	Name of the cavity in the library
Component Outline	Component outline defined for cavity,  or 
Stamping	Stamping text defined for the cavity
Preferred Faces	Preferred faces to insert the cavity, defined in schematic



The Components and Ports dialog box features a Cavity Browser dropdown, a list of components (2, 3, 7, 8, 9) and ports (A, AA, AB, AD, AT, PA), and tabs for Cavity Information and Port Information. The Port Information tab is active, showing a table of port details.

Port	Flow	Type	Net Name
P	5	Press...	NET-10
A	6	Press...	NET-6
B	6	Press...	NET-4
T	8	Tank	NET-8

HyDraw Schematic : Components and Ports Section

## Port Information

*Flow*, *Type*, and *Net Name* defined for each port in the schematic.

## Construction Ports

This section lists construction ports to be used in the design, which are defined when exporting the schematic data from HyDraw®.

- Select the Flush option to insert a flushed x-port.

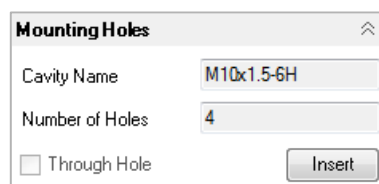


The Construction Ports dialog box shows Cavity Name as G 1/2-14, a checked Flush option, and an Insert button.

HyDraw Schematic : Construction Ports Section

## Mounting Holes

Directly insert mounting holes inside the manifold, which are defined when exporting the schematic data from HyDraw.



The Mounting Holes dialog box shows Cavity Name as M10x1.5-6H, Number of Holes as 4, an unchecked Through Hole option, and an Insert button.

HyDraw Schematic : Mounting Holes Section

# 5. MDTools Cavities

In MDTools®, all types of holes used in a manifold are called **Cavities**.

An MDTools cavity can be a drill hole, a port (SAE ports, BSP ports, NPT ports, etc.), a cartridge valve cavity, a bolt hole, locating pin hole.

## 5.1 Modeling Cavities

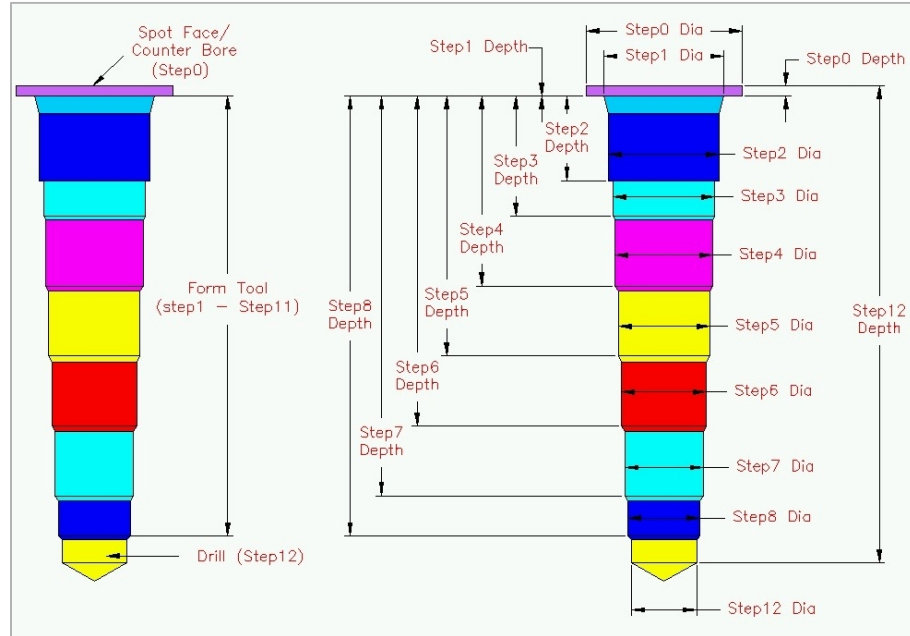
Geometry of a cavity is defined in terms of its dimensions, and its relationship with the step number and step dimensions.

Each step, which consists of cylindrical and/or a conical pair, in the cavity profile is denoted by the term 'Step' in MDTools.

Step information is analogous to a drill tool, which has the drill diameter, drill depth, and bottom cone angle of the drill.

**Note:**

- Depth for Step1 through Step11 is measured from Step0.



MDTools Cavity Geometry

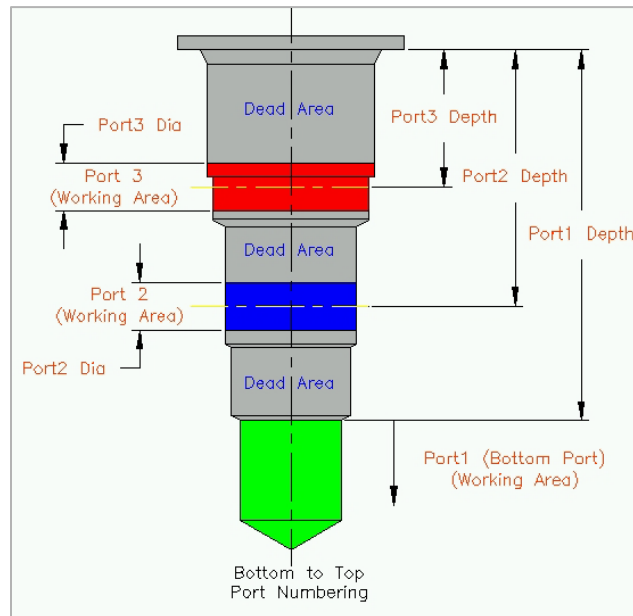
## 1. Cartridge Valve Cavities

Cartridge valve cavities are divided into working areas (port areas) and dead areas.

All the parts of a cavity other than the port areas are considered as Dead Areas.

**Note:**

Bottom port depth of a cartridge valve cavity is the starting depth of the bottom port from the spot face.



Typical 3-port Cartridge Valve Cavity



## 2. Ports

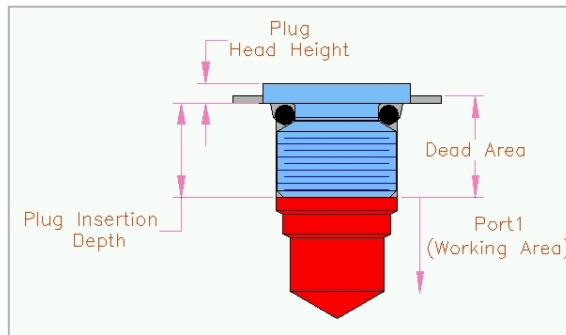
Cavities of ports are divided into working and dead areas.

Area of cavity below the insertion depth of plug/fitting is considered as Working Area.

Area down to the insertion depth is considered as Dead Area.

### Note:

- For port cavities, the plug insertion depth must be specified.
- If not specified, the complete cavity will be included in the working area during wall thickness checks.

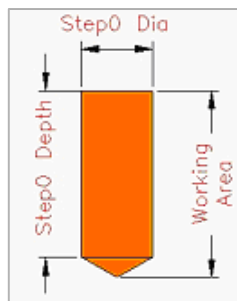


Port Cavity

## 3. Drill Holes

The complete cavity is treated as Working Area.

Hole dimensions are entered in Step0 of the cavity.



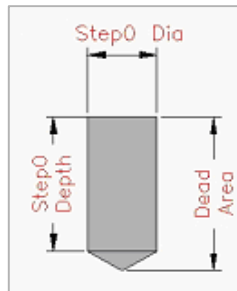
Drill Hole

## 4. Locating Pin Holes

The complete cavity is treated as Dead Area.

Hole dimensions are entered in Step0 of the cavity.

All the dimensions are fixed.



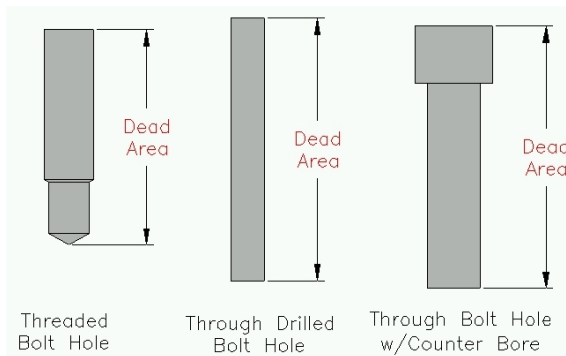
Location Pin Hole

## 5. Bolt Holes

The complete cavity is treated as Dead Area.

Three variations of bolt holes are used in manifold design.

- Threaded Bolt Hole (for mounting components on manifolds and for mounting manifolds)
- Through Drilled Bolt Hole
- Through Bolt Hole with Counter Bore (for mounting manifolds)

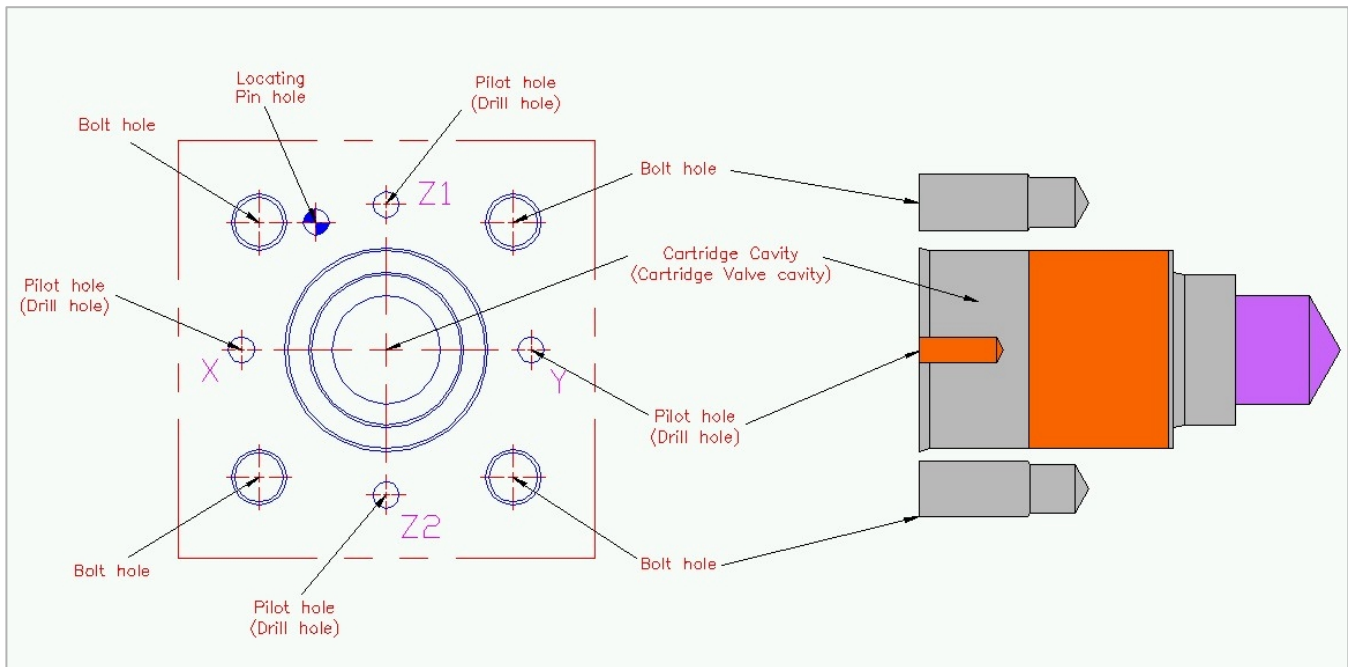


Bolt Hole

## 5.2 Footprints

*If a component in a circuit has more than one cavity, such cavities are grouped together to form footprints.*

*Footprints generally contain different type of cavities; bolt holes for mounting the component, locating pinholes for locating the component in correct orientation, and holes for different ports on the component.*



*Typical slip-in cartridge valve footprint*

## 5.3 Nets (Flow paths)

*All the valve ports and external ports that are interconnected are in various flow paths. In MDTools®, all these flow paths are called **Nets**.*

### 1. Net List

The **Net List** information is entered for each cavity in the manifold using the Browser, Edit Port information and Edit Cavity dialog box.

Each cavity or each port of a cartridge valve identifies its connectivity, per the System Circuit diagram or schematic.

## 5.4 Creating a Net List from a Schematic

MDTools® provide facilities to check a manifold design against the circuit diagram by enabling consistent naming convention, between the circuit diagram and the manifold design.

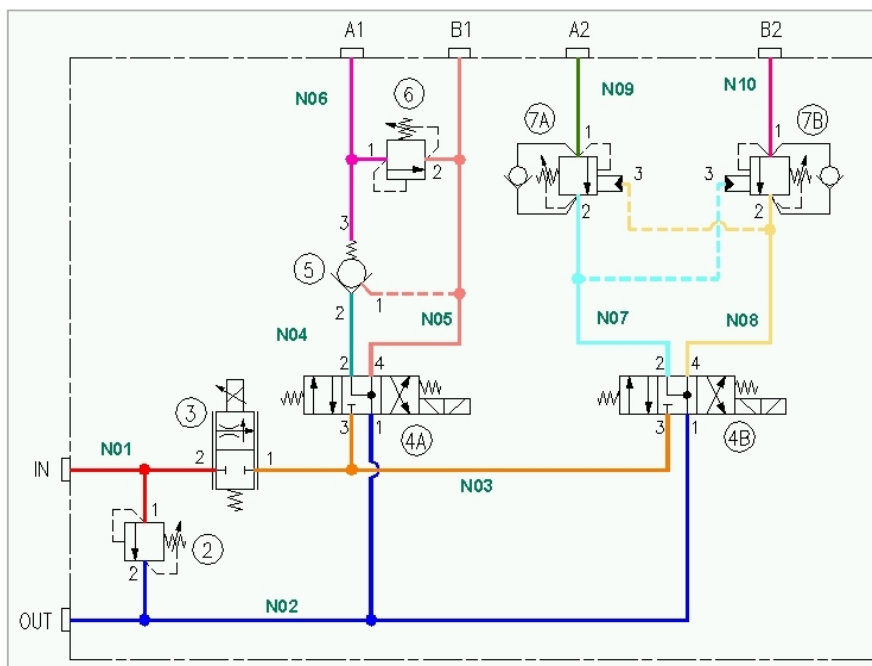
MDTools consistent naming system between schematics and the manifold encompasses:

- Component names in the schematics, with the cavity ID in the manifold.  
The component name in the schematic will be used as the component ID for the cavity on the manifold.
- Port numbering/naming in the schematic and in the manifold.
- Net lists (flow paths) in the schematic and in the manifold.

Study the method used to create a net list from a schematic and use it in the manifold design.

Observe the following for the typical schematic diagram shown on right.

- The circuit has eight components. Components 2, 3 and 6 have two ports each, components 5, 7A, and 7B have three ports each, and components 4A and 4B have four ports each.
- The manifold has six ports, IN, OUT, A1, A2, B1, and B2.
- For designing the manifold, consider these ports as components and assign the component names as the port names.



Typical schematic showing nets

Each unique path or passage in the schematic/ manifold is termed as a **Net**, and numbered serially N01, N02, N03, ..

Naming all the nets in the schematic enables precise description of the manifold passages in relation to the corresponding schematic diagram.

Observing the schematic, a Net List of connections can be made as follows:

Net Name	Component ID-Port name
N01	2-1, 3-2, IN
N02	2-2, 4A-1, 4B-1, OUT
N03	3-1, 4A-3, 4B-3
N04	4A-2, 5-2
N05	4A-4, 5-1, 6-2, B1
N06	5-3, 6-1, A1
N07	4B-2, 7A-2, 7B-3
N08	4B-4, 7A-3, 7B-2
N09	7A-1, A2
N10	7B-1, B2

The listing is interpreted as follows:  
(For example N01 and N02)

N01 (Net 1) consists of passages connecting 2-1 (port1 of component 2), 3-2 (port2 of component 3) and port IN

N02 (Net 2) consists of passages connecting 2-2 (port2 of component 2), 4A-1, (port1 of component 4A), 4B-1, (port1 of component 4B) and port OUT.

Refer the schematic and check the listing for other nets.

## 6. Design Basics

MDTools® divides cavities into working and dead areas for accurate checking of problems, such as, thread eating or connections outside the port area.

### MDTools Cavity

In MDTools, all types of holes used on a manifold are called Cavities.

An MDTools cavity can be a drill hole, port (SAE port, BSP port, NPT port, etc), cartridge valve cavity, or bolt hole.

### Modeling Cavities

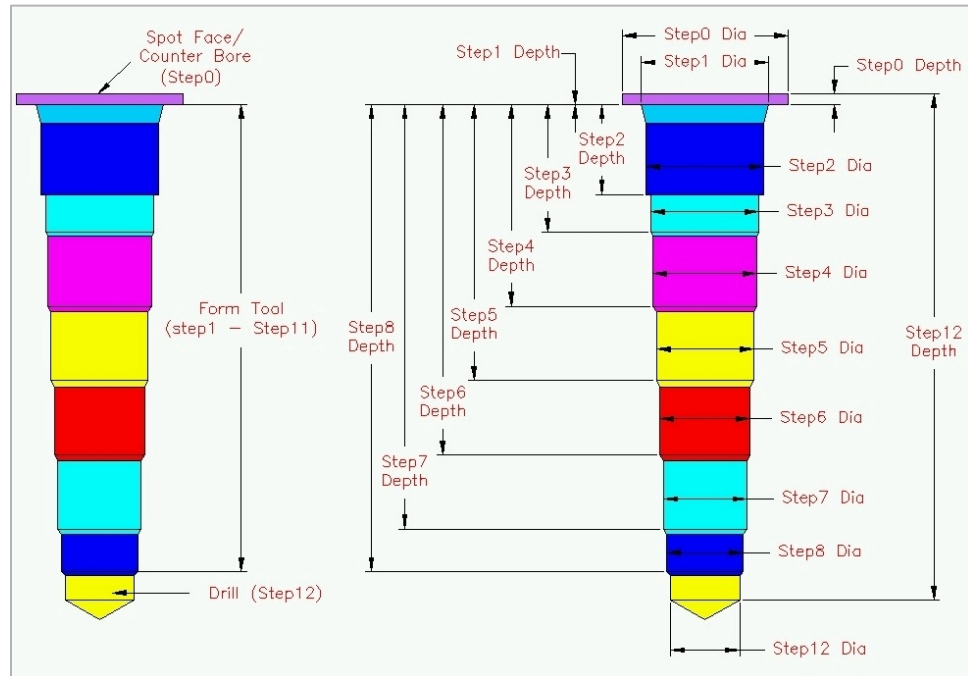
Geometry of a cavity in terms of its dimensions, and relationship with the step number and step dimensions.

Each step, generally consisting of a cylindrical and conical pair in the cavity profile is denoted by the term **Step** in MDTools.

Step information is analogous to a drill tool, which has the drill diameter, drill depth, and bottom cone angle of the drill.

**Note:**

Depth for Step1 through Step11 is measured from Step0.



Modeling MDTools Cavities

### Ports

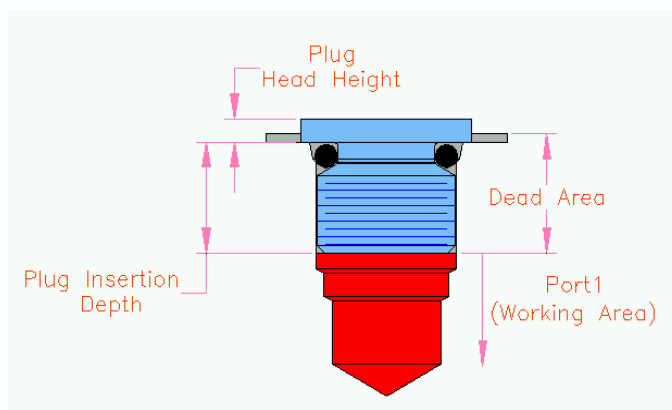
Cavities of ports are also divided into working and dead areas.

The area of a cavity below the insertion depth of plug/fitting is considered as Working Area.

The area above the insertion depth is considered as Dead Area.

**Note:**

For ports, the plug insertion depth must be specified. If it is not specified, then the complete cavity will be included in the working area during wall thickness checks.



Plug - Port: Dead Area and Working Area

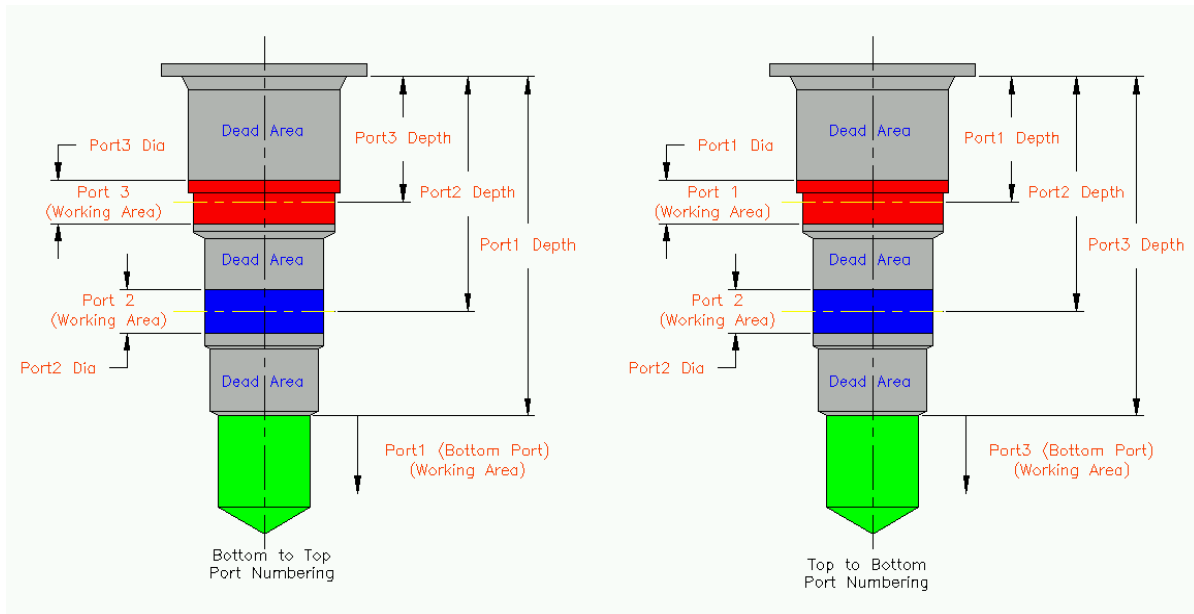
## Cartridge valve Cavity

Cartridge valve cavities are divided into working areas (port area) and dead areas.

All parts of a cavity other than the port area are considered as Dead Areas.

### Note:

Bottom port depth is the starting depth of bottom port from spot face.

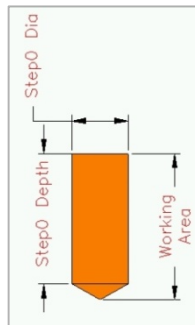


3 port Cartridge Valve Cavity

## Drill holes

The complete cavity is treated as Working Area.

Hole dimensions are entered in Step0 of the cavity.



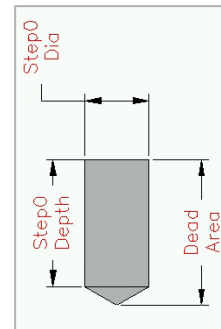
Drill Hole

## Locating Pin Holes

The complete cavity is treated as Dead Area.

Hole dimensions are entered in Step0 of the cavity.

All the dimensions are fixed.



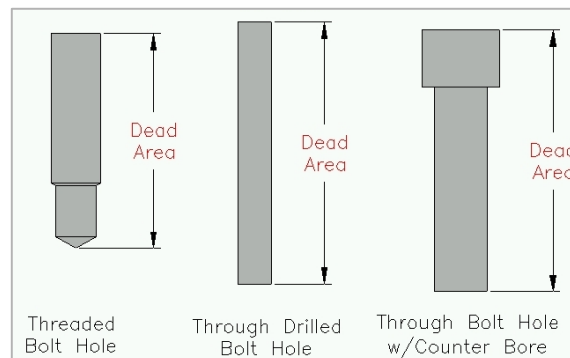
Locating Pin Hole

## Bolt Holes

The complete cavity is treated as Dead Area.

Three variations of bolt holes are used in manifold design.

- Threaded Bolt Hole (for mounting components on manifold and for mounting the manifold)
- Through Drilled Bolt Hole
- Through Bolt Hole with Counter Bore (for mounting the manifold)



Bolt Holes

## 7. Using Angle Holes

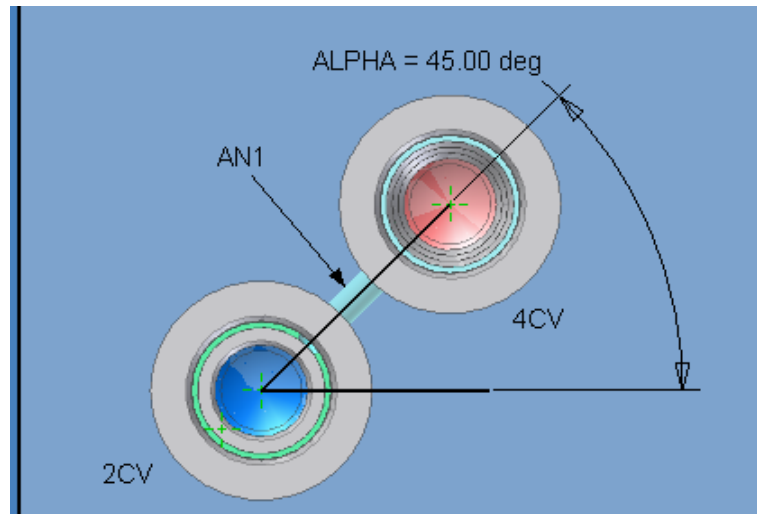
*Compact manifolds, using minimum number of cross drills are often possible using angle drill holes. MDTools® Essential is equipped to model, visualize, and design using angle holes.*

Let us see how to use the angle drill holes to create connections when designing a manifold with the help of an example.

The figure, 'Alpha' - rotation on the surface, displays two cavities, 2-CV and 4-CV, which are connected using angle drill AN1, inside cavity, 2-CV.

- Cavity 2-CV is a 2-port cartridge valve cavity.
- Cavity 4-CV is a 4-port cartridge valve cavity.
- Port2 of 2-CV is required to be connected to Port2 of the 4-CV valve.

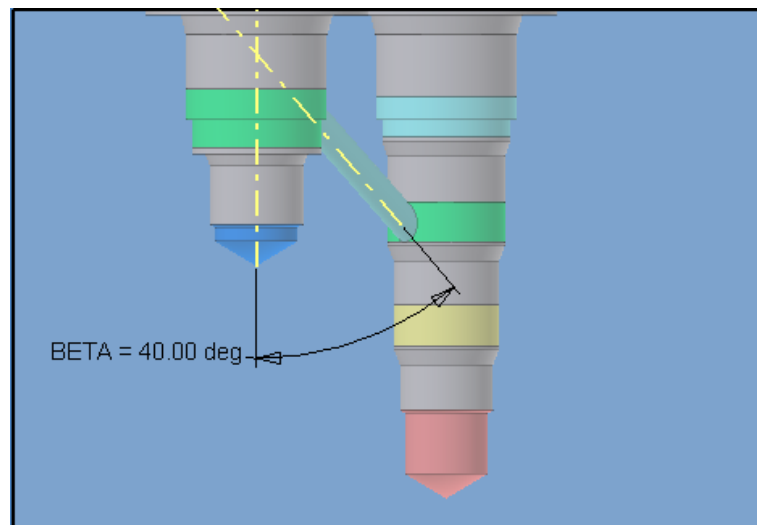
This connection is made using a compound angle drill AN1.



*Alpha - rotation on the surface*

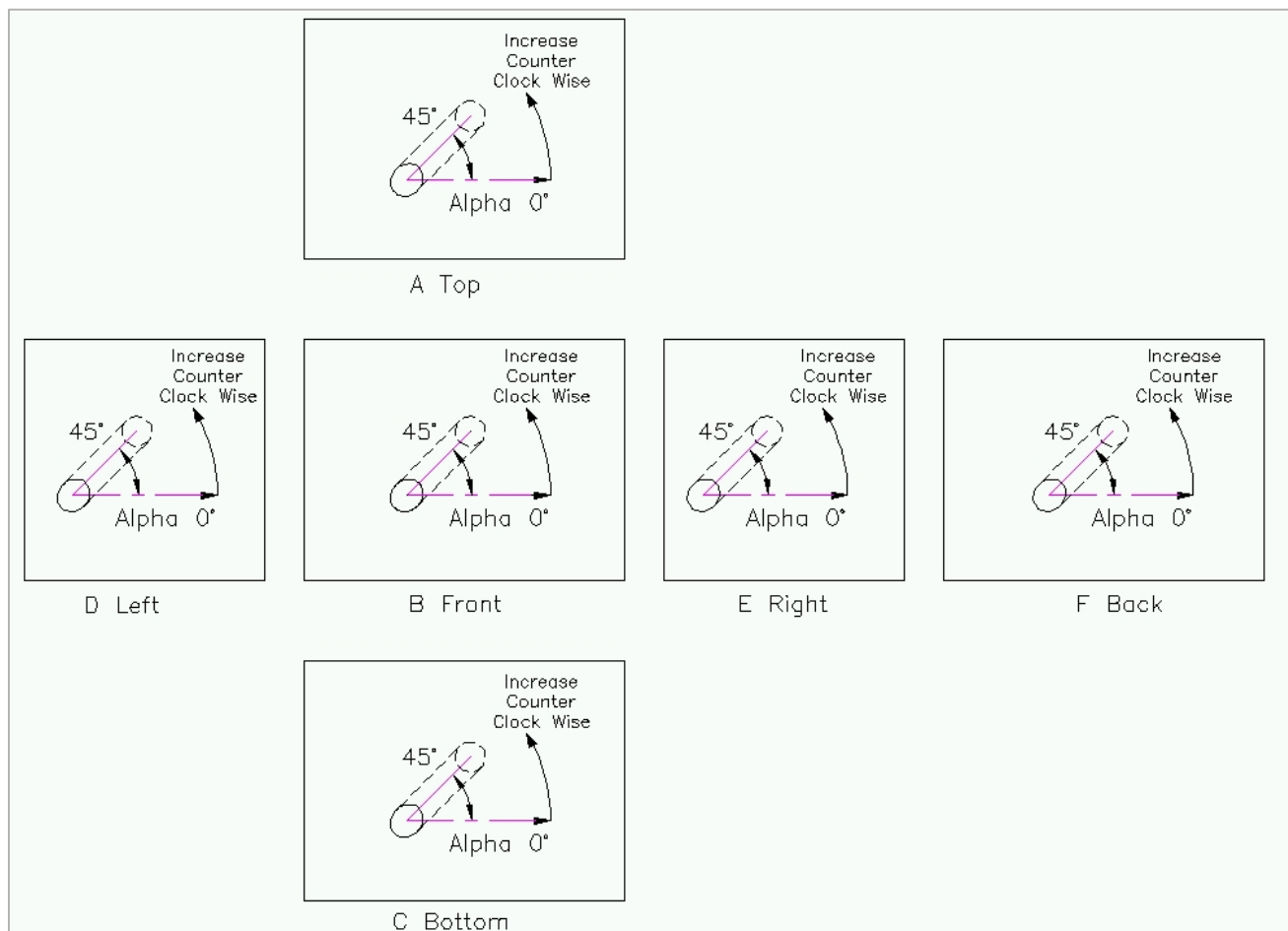
### Note:

- Alpha angle is the rotation of an angle hole on the surface.
- Angle holes with alpha angle of 0, 90, 180, or 270 are called **Simple Angle Holes**.
- Angle holes with alpha angle other than 0, 90, 180, or 270 are called **Compound Angle Holes**.
- **Beta angle** is the inclination of the angle hole from the surface normal.
- Alpha and Beta values are the values entered in the MDTools Edit Cavity dialog box.



*Beta - inclination from surface Normal*



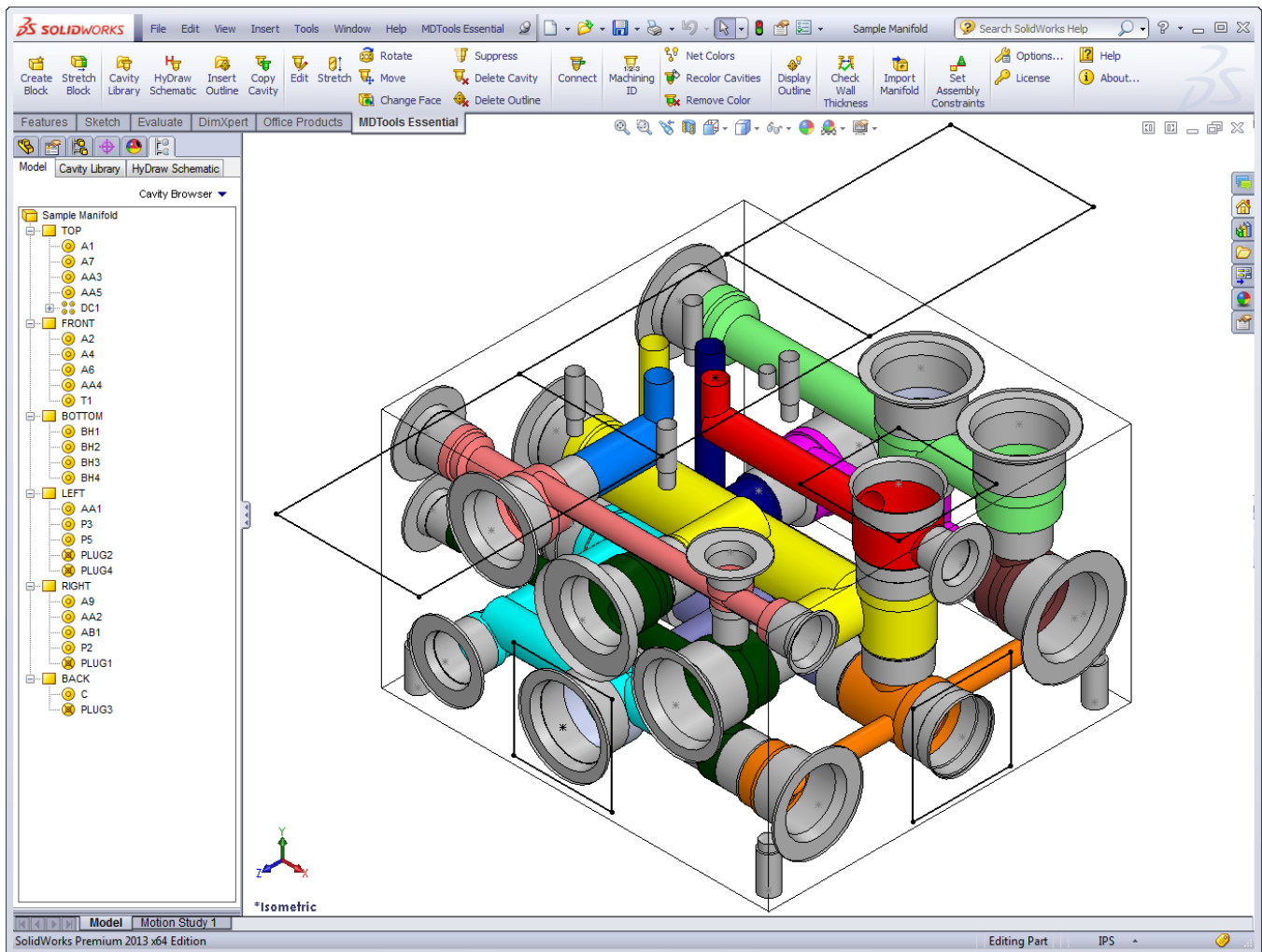


*Alpha angle convention used in MDTools*

**Note:**

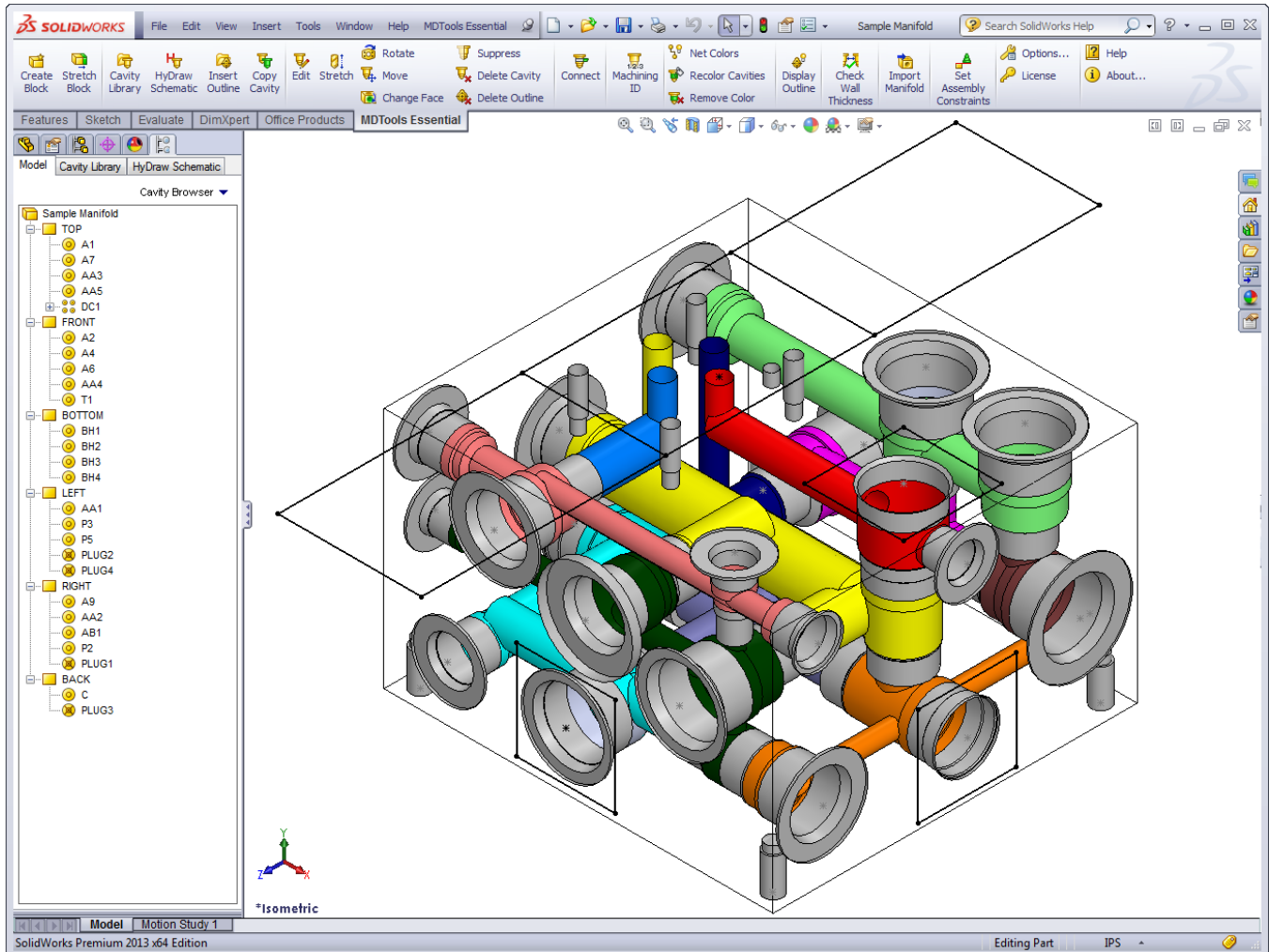
The depth of an angle hole shown in the Edit Cavity dialog box is the depth along the axis of the angle hole.

# DESIGN COMMANDS



# Block

- 8 Create Block
- 9 Stretch Block



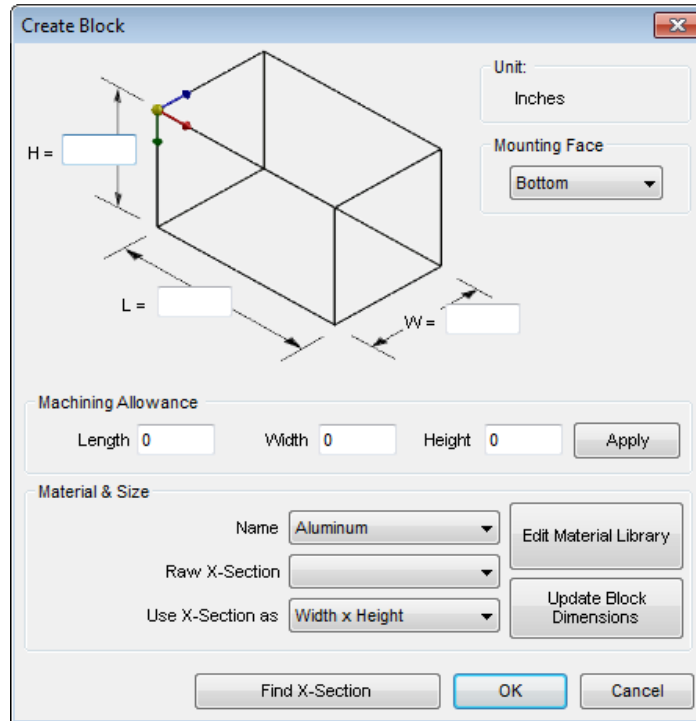
## 8. Create Block

Automatically draws the manifold block in SolidWorks drawing space, based on the required manifold length, width, and height entered; or by selection of the required material cross section from an existing material X-section database, and input of the corresponding length.

The Machining allowance values on the raw X-section can also be specified.

### 8.1 Create Block - Dimensions entered manually

1. MDTools Essential  
>**Create Block**  
*The Create Block dialog box displays.*
2. Enter the required dimensions manually.
3. Enter the manifold dimensions in the data fields:
  - **H** Manifold Height
  - **L** Manifold Length
  - **W** Manifold Width
4. Enter the machining allowance for each of the dimensions.
5. Click **Apply**.  
*The machining allowance is subtracted from the respective manifold dimensions when drawing the manifold.*

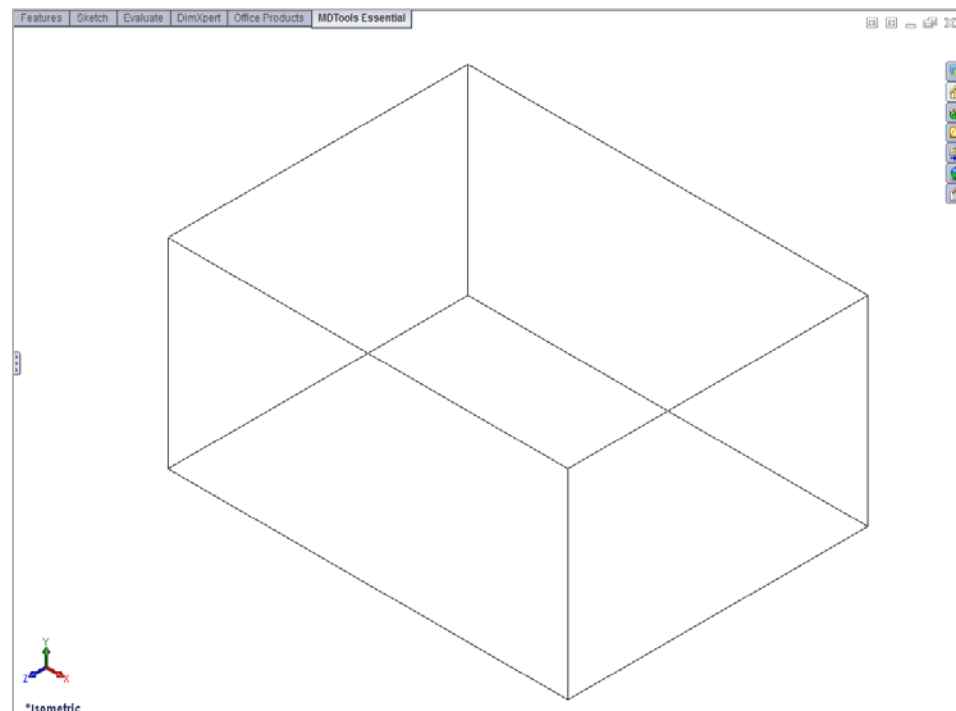


Create Block dialog box

6. Click **OK** after the required data is entered.  
*MDTools® automatically creates the block in the SolidWorks workspace.*

#### Note:

MDTools uses the following model parameters to define the block dimensions: Block Length, Block Height, and Block Width.



Block created in Drawing space

## 8.2 Create Block - using Material X-Section Libraries

1. MDTools Essential  
> **Create Block**

The Create Block dialog box displays.

2. Select the material from the **Name** drop-down menu in the Material & Size section.

The default material is Aluminum.  
You can change the material, if required.

3. Select the raw X-section from the **Raw X-Section** list of the selected material.
4. Select the required option from the **Use X-Section as** list.

You can use the X-section in any of the possible combination of length, width, and height.

5. Click Update Block Dimensions.

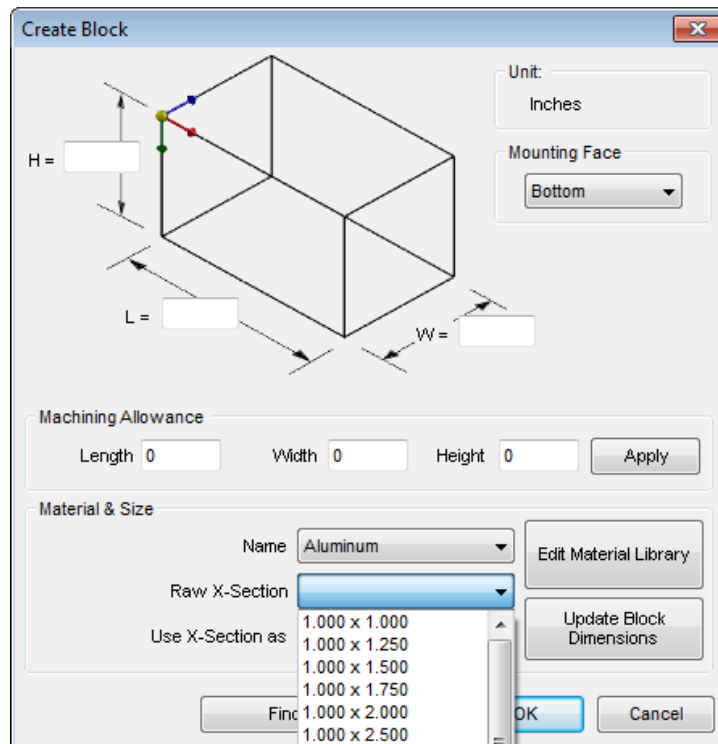
MDTools® updates the block dimensions with the selected X-section, per the selection made in the Use X-Section as option.

6. Enter the third dimension for the block.  
For example, if X-section is used for block width and height, then enter the block length.
7. Enter the machining allowance for each of these dimensions.
8. Click **Apply**.

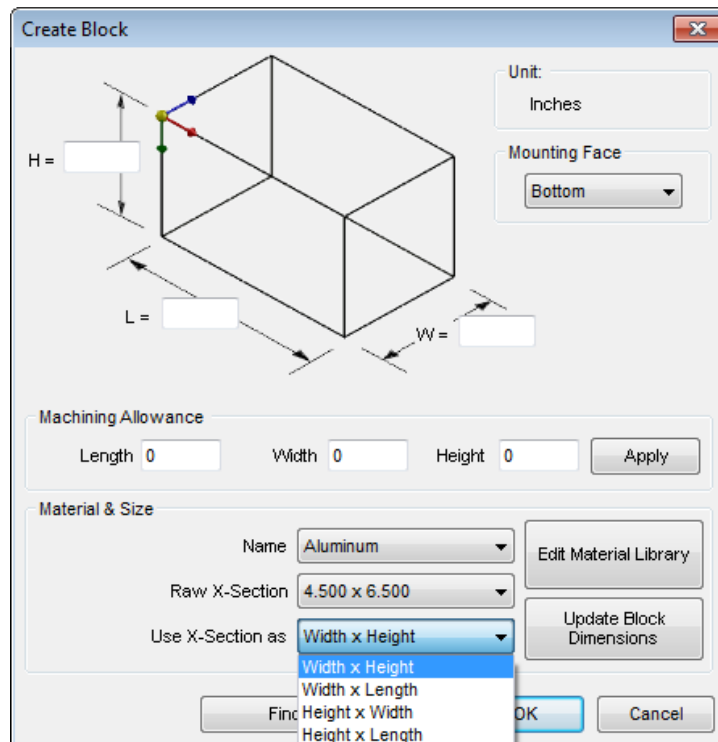
The machining allowance is subtracted from the respective manifold dimension when drawing the manifold.

9. Click **OK** after the required data is entered.

MDTools automatically creates the block in the SolidWorks workspace.



Create Block dialog box showing the material X-section dimensions



Create Block dialog box: Use X-Section as

## 8.3 Create Material X-Section Library

MDTools® enables new X-sections and material data to be added into the Material X-section library. The existing X-sections or materials in the library can also be edited.

MDTools Essential  
> **Create Block**

The Create Block dialog box displays.

- Click Edit Material Library.

The Edit Material Library dialog box displays.

### Add New Material

1. Enter the material name in the Material text box.
2. Click **Add**.

MDTools adds the new material into the library.

### Change Material Name

1. Select the name of the material you want to change from the material list.

The selected material name is displayed in the Material text box.

2. Enter the new material name in the Material text box.
3. Click **Update**.

MDTools updates the material name with the new name entered.

### Delete Material

1. Select the material you want to remove from the material library.

The selected material name is displayed in the Material text box.

2. Click **Remove**.

A message displays 'Do you want to delete selected material name?'

3. Click **Yes**.

MDTools deletes the material from the Material library.

### Note:

Click **Clear** to clear the material selection or an entry in the Material box.

The 'Edit Material Library' dialog box is shown with the 'Add' tab selected. The 'Material' text box contains 'New Material'. Below it are 'Add', 'Remove', and 'Clear' buttons. The 'Material Name' list on the right contains 'Aluminum' and 'DuraBar'. The 'X-Sections' section has radio buttons for 'Inches' (selected) and 'MM'. Below these are two empty text boxes for 'X-Section' dimensions, followed by 'Add', 'Remove', and 'Clear' buttons. At the bottom are 'OK' and 'Cancel' buttons.

Add new material

The 'Edit Material Library' dialog box is shown with the 'Update' tab selected. The 'Material' text box now contains 'Aluminum'. The 'Material Name' list on the right has 'Aluminum' selected. The 'X-Sections' list on the right now contains a scrollable list of dimensions: 1.000 x 1.000, 1.000 x 1.250, 1.000 x 1.500, 1.000 x 1.750, 1.000 x 2.000, 1.000 x 2.500, 1.000 x 2.750, 1.000 x 3.000, 1.000 x 3.500, 1.000 x 4.000, 1.000 x 5.000, 1.000 x 6.000, and 1.000 x 8.500. The 'Add', 'Remove', and 'Clear' buttons are still present. At the bottom are 'OK' and 'Cancel' buttons.

Update material name

# 1. Add new X-section

## Select a material name from the library

*A list of X-section displays in the X-Sections list.*

1. Select the unit, **Inches** or **MM**.
2. Enter the X-section dimensions in the text boxes.
3. Click **Add**.

*MDTools® adds the new X-section to the library.*

## Change X-section dimension

1. Select the X-section you want to change from the X-Sections list.  
*X-section dimensions are displayed in the text boxes for X-Section.*
2. Select the X-section you want to change.
3. Change the dimension in the **X-Section** textboxes, as required.
4. Click **Update** to save the change.

## Delete X-Section

1. Select the X-section you want to remove from the library.  
*X-section dimensions are displayed in the text boxes for X-Sections.*
2. Click **Remove**.  
*A message displays, 'Do you want to delete selected X-section?'*
3. Click **Yes**.  
*MDTools deletes the selected X-section from the Material library.*

## Note:

Click **Clear** to remove the entries in the X-Section text boxes or to clear the X-Section selection.

The 'Edit Material Library' dialog box is shown. The 'Material' field is set to 'Aluminum'. The 'X-Section' field shows '5.000 x 5.500'. The 'X-Sections' list contains various dimensions from 1.000 x 1.000 to 1.000 x 8.500. The 'Add' button is highlighted.

Add new X-section

The 'Edit Material Library' dialog box is shown. The 'Material' field is set to 'Aluminum'. The 'X-Section' field shows '2.000 x 6.250'. The 'X-Sections' list contains various dimensions from 2.000 x 4.000 to 2.500 x 4.500. The 'Update' button is highlighted.

Change X-section dimensions



## 8.4 Find X-Section

Check the availability of X-sections when you enter the block dimensions manually, i.e., without selecting a standard X-section from the Material library.

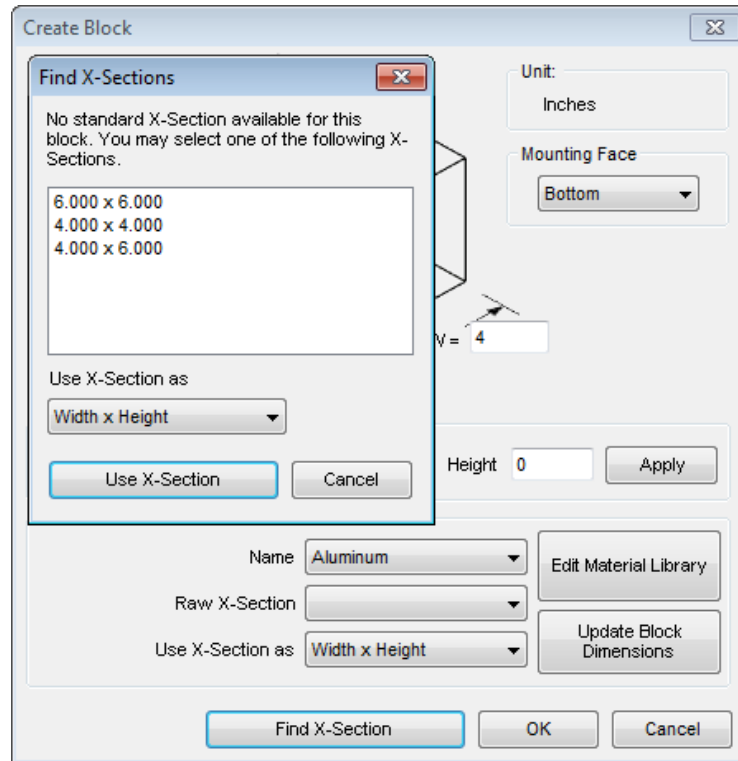
1. Select the desired material from the Material **Name** list from the Create Block dialog box.

2. Click Find X-Section.

*MDTools® checks the availability of X-sections for the block dimensions in the selected material X-section list.*

*If a standard X-section is available, then MDTools displays the X-section dimensions in a message box.*

*If a standard X-section is not available, then MDTools lists the nearest X-sections available and displays in the Find X-Sections dialog box.*



Find X-Sections dialog box

### Updating Block Dimensions

Use one of the X-sections listed in the Find X-Sections dialog box and update the block dimensions with the standard X-section.

1. Select the X-section you want to use for the block.
2. Select the required **X-section** from the **Use X-Section as** drop down.
3. Click Use X-Section.

*MDTools updates the block dimensions with the selected X-section dimensions.*

### Note:

The Create Block command cannot be undone in the SolidWorks interface.

## 9. Stretch Block

*Stretch and change the block size by dragging a manifold face in the model.  
The Snap to X-Section option enables to use material x-sections available in library.*

1. MDTools Essential  
    > **Stretch Block**

*MDTools prompts to  
select a manifold  
face.*

2. Select a face  
*The Stretch Block  
dialog box displays.*

*The select arrow  
appears on the  
selected face.*

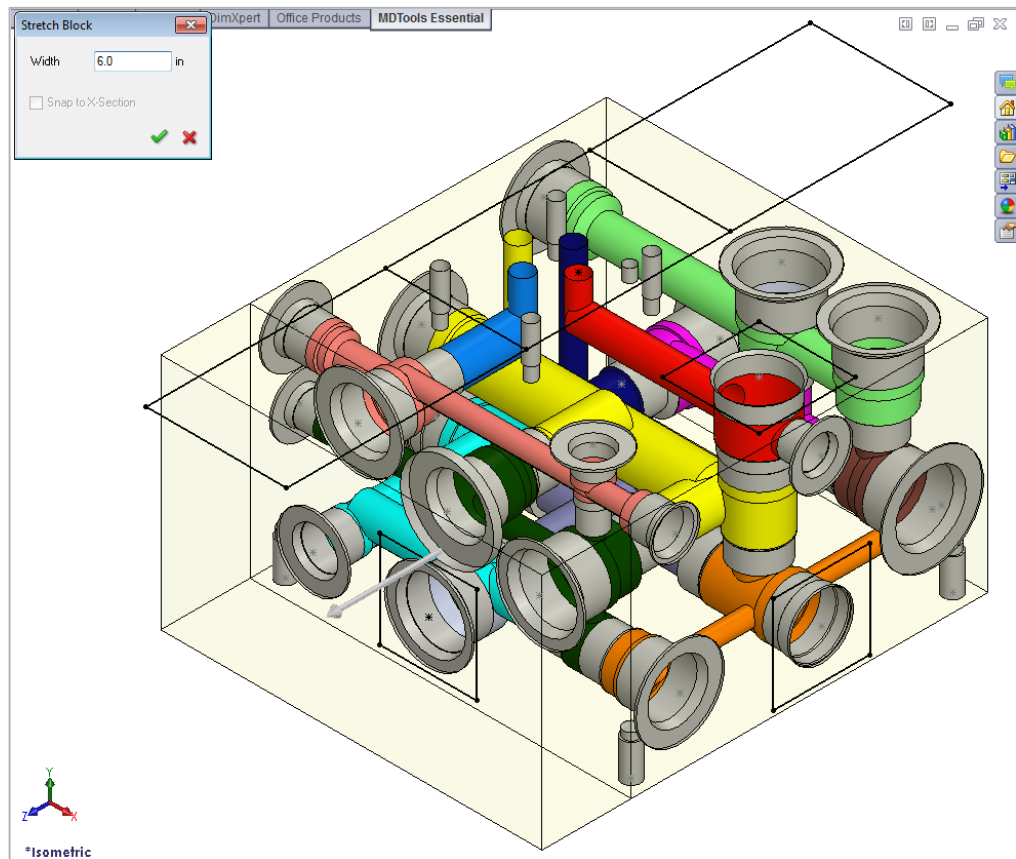
3. Select **Snap to X-Section** to snap the  
selected dimension  
to the available  
x-sections in the  
library.

4. Drag the select arrow  
in the desired  
direction to change  
the block dimension.

5. Change the value in  
textbox, if required.

6. Click **OK** to apply the  
changes.

*Location and drill  
depth of the cavities  
will be updated, if  
required.*



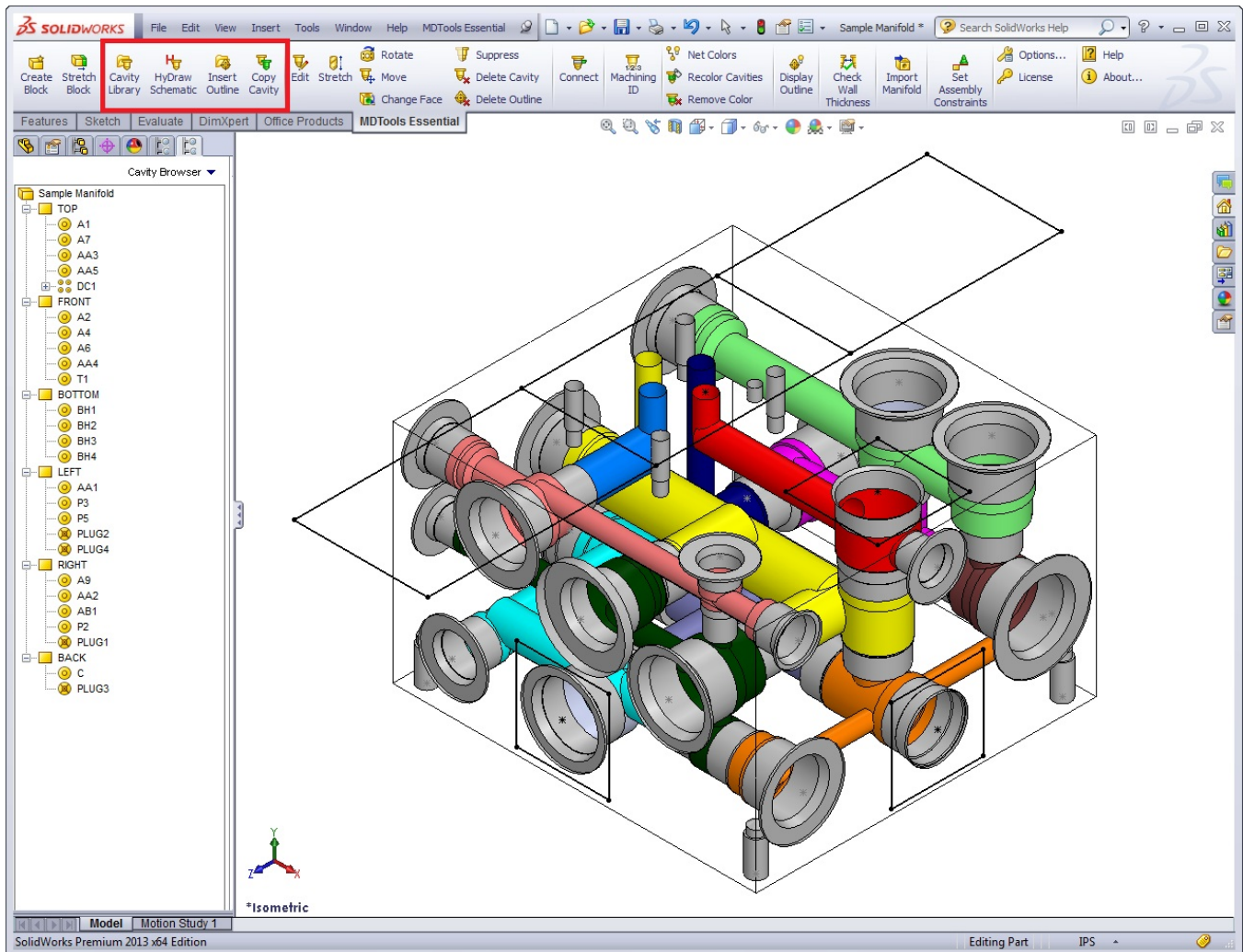
Stretch Block

### Note:

You can also edit the  
selected dimension  
directly by editing the  
value in the textbox.

# Insert Cavity

- 10 Cavity Library
- 11 HyDraw Schematic
- 12 Insert Outline
- 13 Copy Cavity



# 10. Cavity Library

Easily select and insert cavities/footprints on the manifold from a standard cavity/footprint library. Search a cavity/footprint by name. Precisely position the cavity with reference to either an edge of the block, an existing cavity, or to either one or two existing cavities on the block. Position the cavity maintaining a minimum wall thickness with an existing cavity.

## Insert Cavity/Footprint.

- MDTools Essential  
> **Cavity Library**

*The Cavity Library tab in the browser gets activated.*

- Enter a few letters of the cavity name in the **Cavity/Footprint** search text box to automatically search cavity/footprint in library.

Or,  
Select the required library from the dropdown.

*All cavities/footprints in the selected library are listed in the Cavity/Footprint Name list box.*

- Select the required cavity/footprint.  
Enter **Component ID**.

*When you insert a cavity/footprint for a component in a schematic, use the ID of the component in the schematic as the component ID for the cavity/footprint.*

*If you insert a cavity for a construction hole, then select the Construction Port option to automatically assign the component ID.*

- Enter the port information for the cavity.
- Click **Insert**.

*The Specify Cavity Location dialog box displays.*

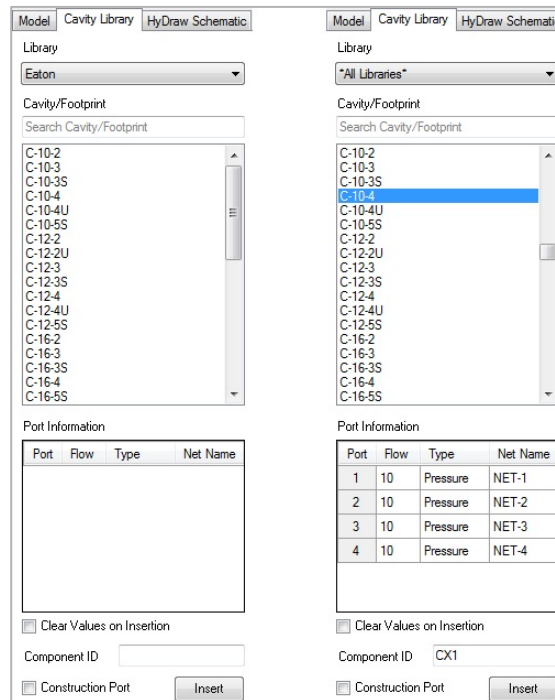
- Select the point on the manifold face, where you want to insert the cavity.

*MDTools® displays a preview of the selected cavity at the selected point on the manifold.*

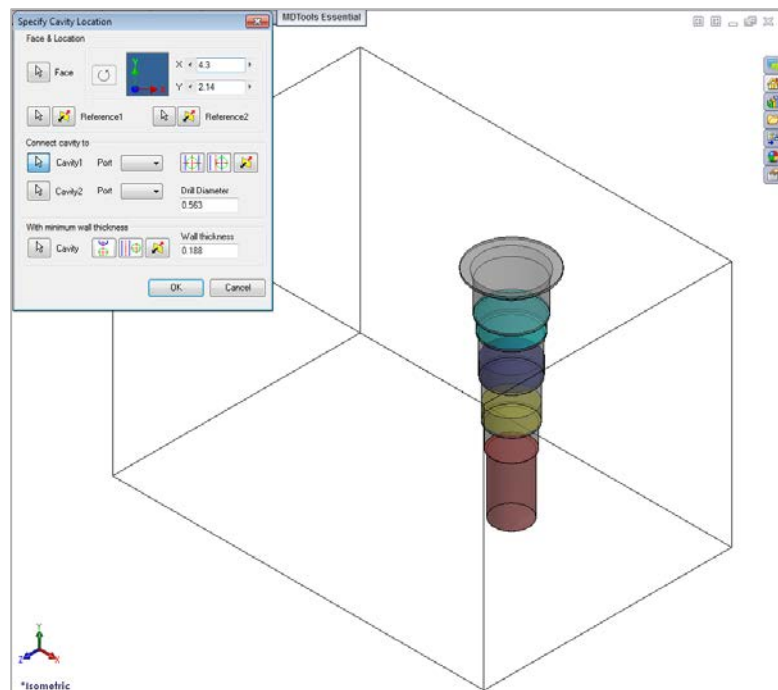
- Enter the X and Y distance from the block origin.
- Click **OK** to insert the cavity at the specified location.

### Note:

- The last selected library will be selected by default when you open the browser dialog box.
- Colored areas on a cartridge valve cavity represent the port areas.
- The Mandatory UnderCut is automatically inserted along with the cavity from the MDTools Cavity library and becomes integral profile of the cavity.



Library Tab



Specify Cavity Location dialog box

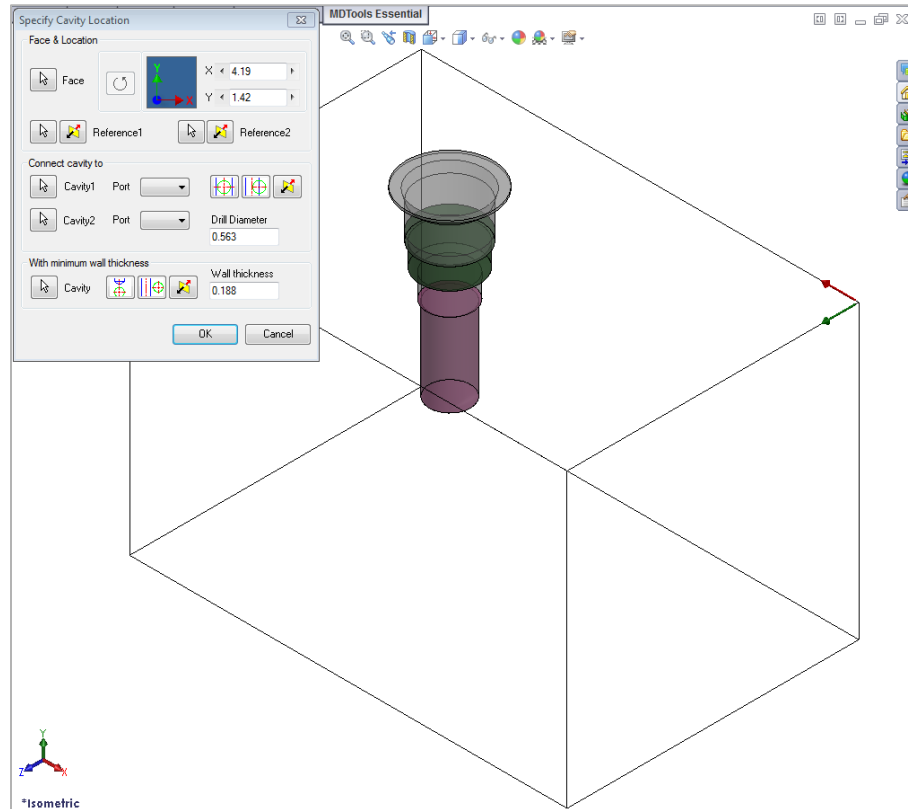
# 1. Position the cavity with reference to an edge or a cavity

1. Click the selection button for Reference1.
2. Select an edge or an existing cavity.

*MDTools® automatically relocates the origin symbol to the selected reference and updates the X and Y values, per the new origin.*

## Note:

- Select Reference2 to change the reference of both the X and Y axis.
- Click the Flip button to change the direction of axis. This flips the cavity location when a cavity is used as a reference.

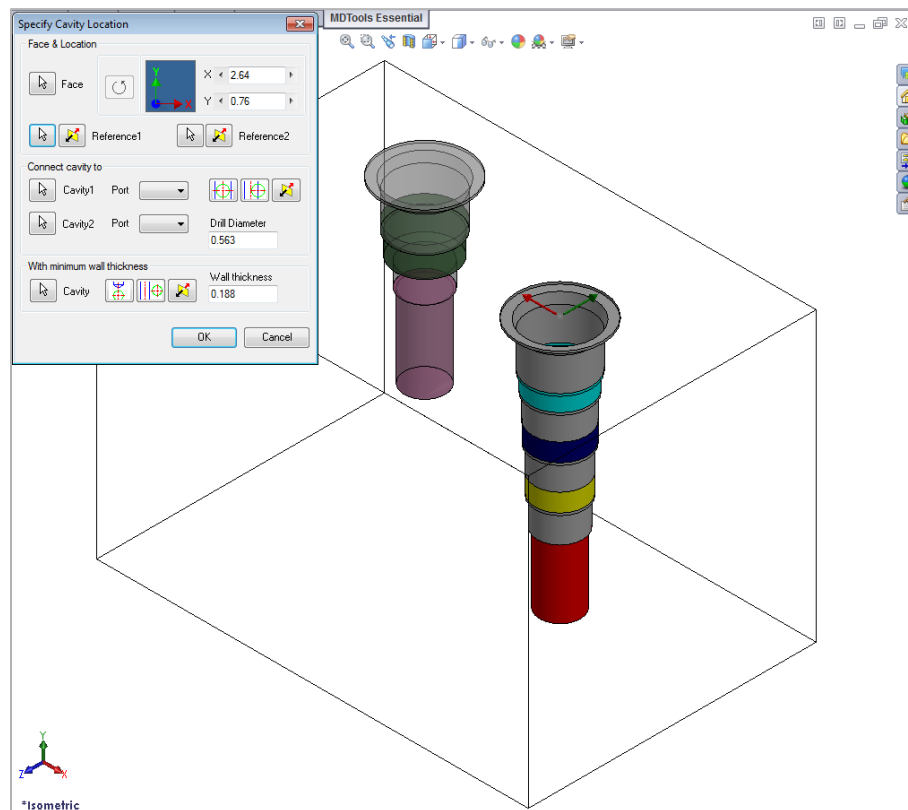


*Position a new cavity with reference to an edge*

3. Change the X and Y values to precisely position the new cavity.

*MDTools automatically updates the preview of cavity/footprint on changing the X and Y values.*

4. Click **OK** to create the cavity at the specified location.



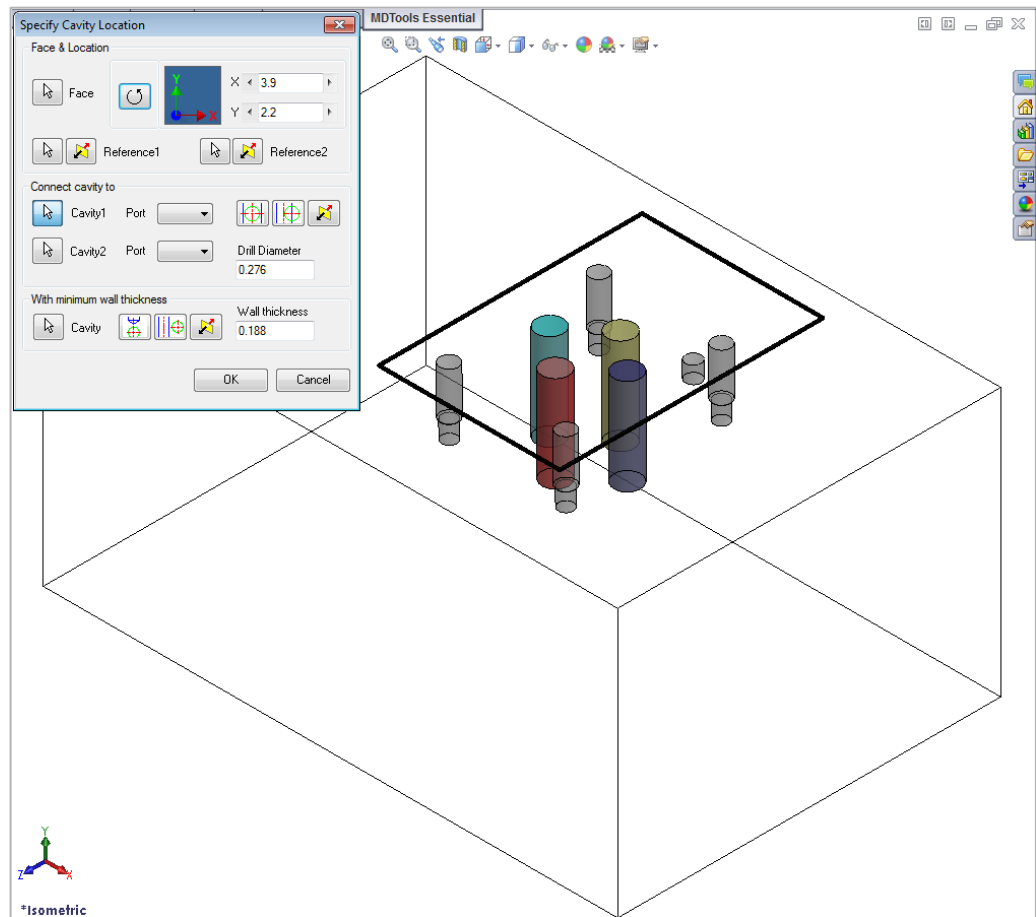
*Position a new cavity with reference to an existing cavity*

## 2. Rotate Footprint

The Rotate Footprint option in the Specify Cavity Location dialog box enables you to specify the rotation of a new footprint.

- Click the Rotate Footprint button -
- Once to rotate the footprint by 90 degrees
- Twice to rotate the footprint by 180 degrees
- Three times to rotate the footprint by 270 degrees

*MDTools rotates the footprint in the counter clockwise direction.*



*Rotate Footprint*



### 3. Connecting existing cavities

Connect the new cavity to either one or two existing cavities on the manifold.

1. Click the selection button for cavity1.
2. Select the connecting cavity1.
3. Select the connecting port on the first cavity.

*MDTools® automatically relocates the cavity to the port center and displays the drill diameter.*

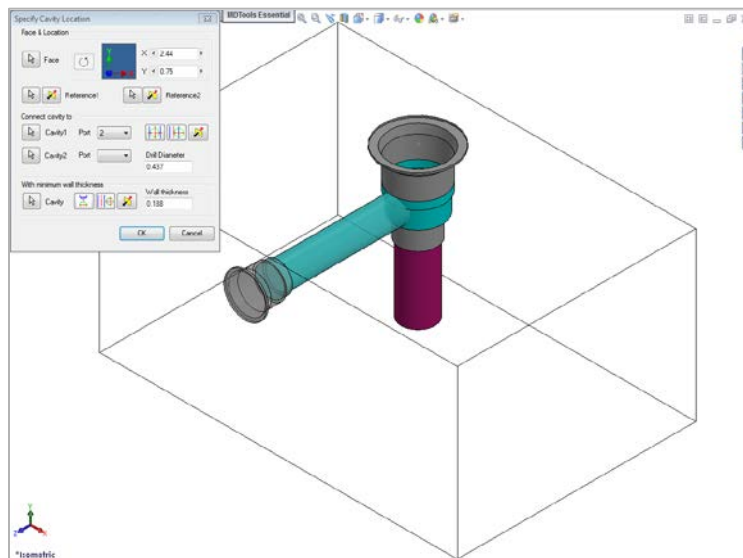
Or

1. Click the selection button for cavity2.
2. Select the connecting cavity2.
3. Select the connecting port on the second cavity.

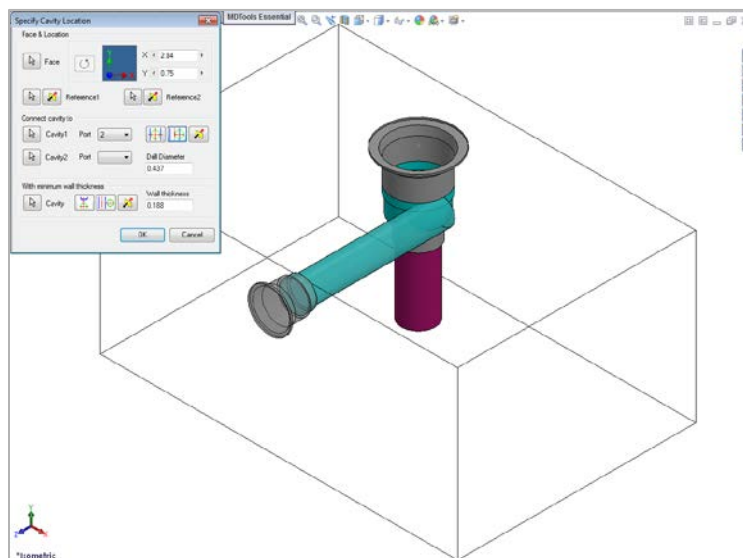
*MDTools automatically relocates the cavity to the overlapping center of the two cavity ports.*

4. Click **OK**.

*MDTools creates the new cavity at the specified location and connects the cavity to the selected connecting cavities.*



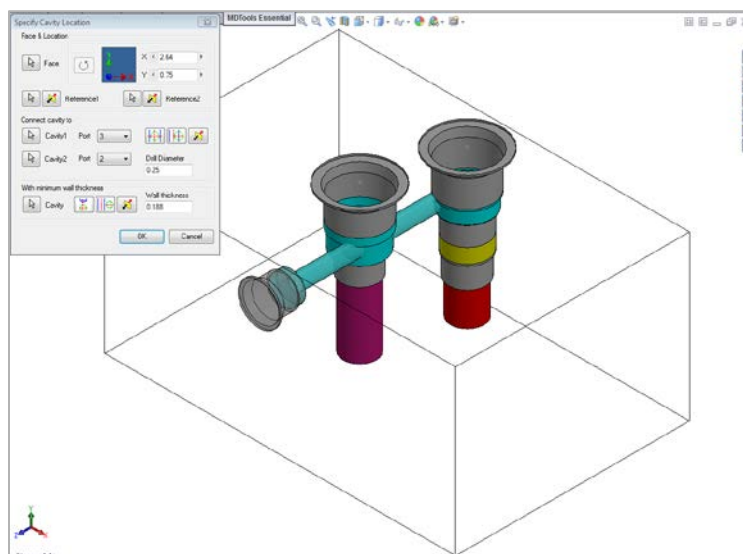
Connecting to an existing cavity



Positioning the cavity on sides

#### Note:

- Click the Relocate to side button to relocate the cavity to a side.
- Click the Flip side button to flip the sides.
- MDTools automatically selects the best drill diameter from the tooling database based on the port diameter.

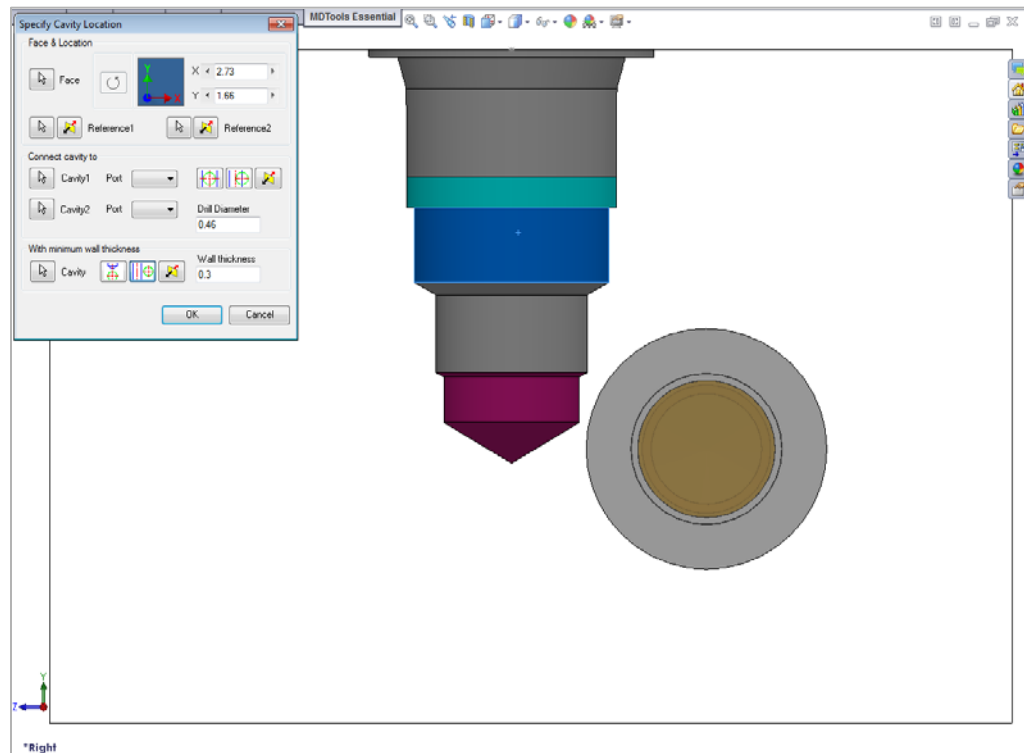


Connecting two existing cavities

## 4. Position with minimum wall thickness

Position the new cavity while assuring minimum wall thickness with an existing cavity on the manifold.

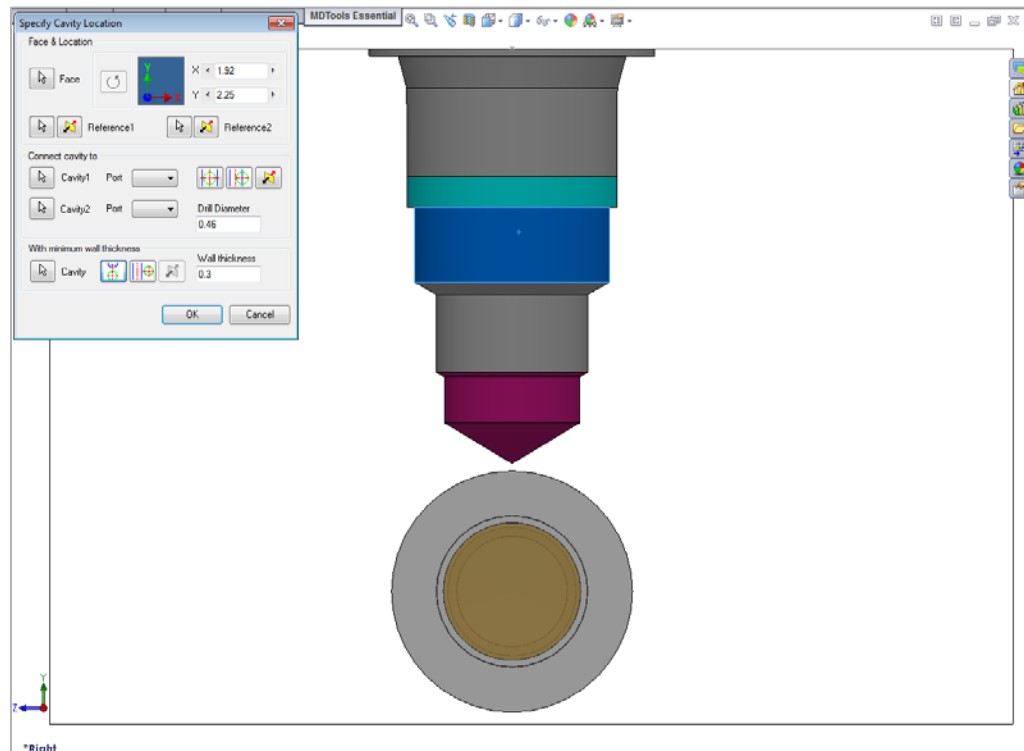
1. Click the selection button for cavity.
2. Select an existing cavity on the manifold.
3. Click the Move to side button to position the new cavity away from the selected cavity axis.
4. Click the Flip side button to change the side, if required.
5. Repeat the above steps to position the cavity with minimum wall thickness from a second cavity on the manifold.



*Positioning new cavity using the Move to side option*

### Note:

Select the Locate below cavity tip option to locate the new cavity with minimum wall thickness from the tip of an existing cavity.



*Positioning new cavity below the cavity tip*

# 11. HyDraw Schematic

Automatically read an XML file exported from a HyDraw® created schematic drawing and insert all the required cavities with the connectivity information into MDTools®.

## 1. MDTools Essential

> HyDraw  
Schematic

The HyDraw Schematic tab in the browser gets activated.

## 2. Click **Browse** and select the HyDraw schematic XML file.

## 3. Click **Open**.

MDTools populates the schematic data in the browser.

The Insert Cavity option on the HyDraw Schematic Interface dialog box enables you to insert the cavity for a selected component with the connectivity and flow information.

## 1. Select a component or external port from the list.

## 2. Click Insert Cavity.

Specify Cavity Location dialog box displays.

## 3. Select the point on the manifold face, where you want to insert the cavity.

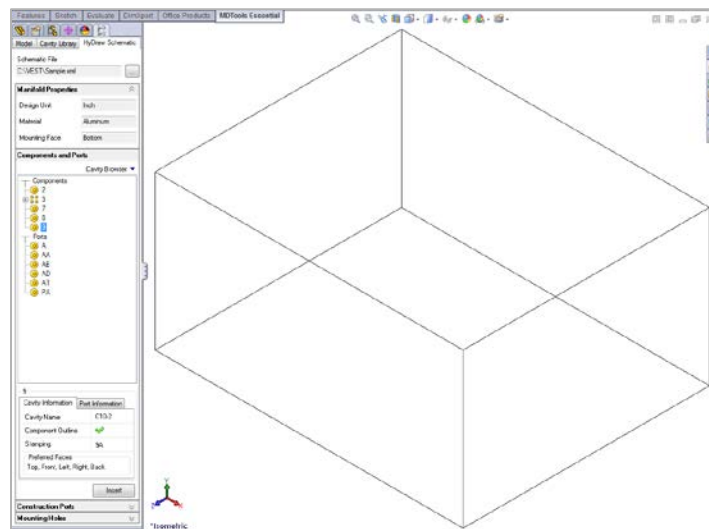
## 4. Click **OK**.

The cavity is inserted at the specified location. MDTools inserts component outline and stamping text (if defined) with the cavity automatically.

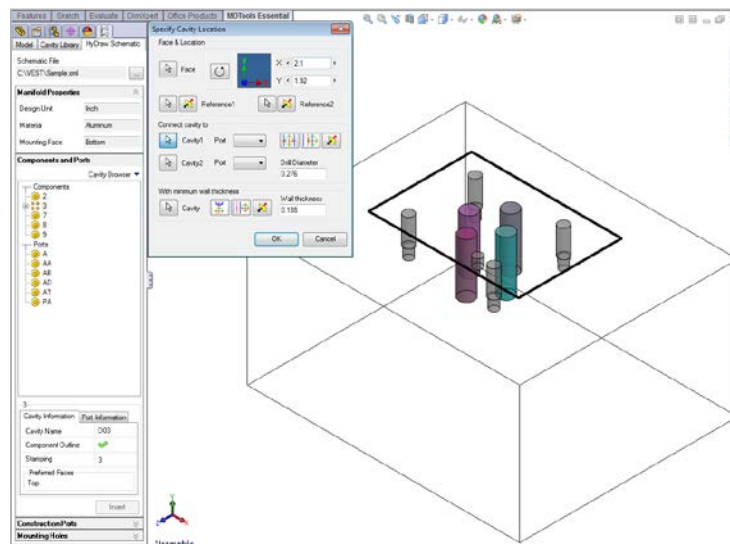
### Note:

Once a cavity is inserted in the manifold it is displayed in black against a shaded background in Cavity Explorer and Connectivity Explorer.

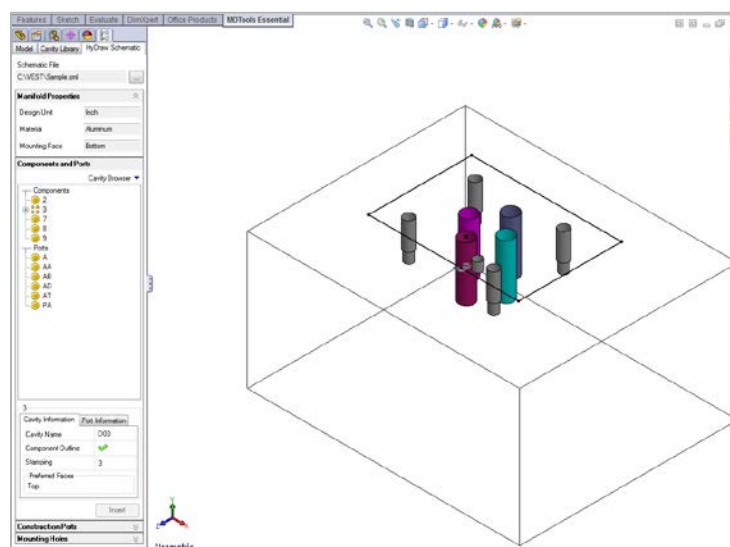
Refer Chapter 4 for more description.  
(MDTools HyDraw Interface)



MDTools HyDraw Interface : Component data populated



Specify Cavity Location dialog box



Cavity inserted with connectivity information

## 12. Insert Outline

Create the outline of a valve assembly around the selected cavities/footprints.

1. MDTTools Essential  
>**Insert Outline**

The *Insert Component Outline* dialog box displays.

2. Select the outline from the list.

MDTools® displays a preview of the selected component outline.

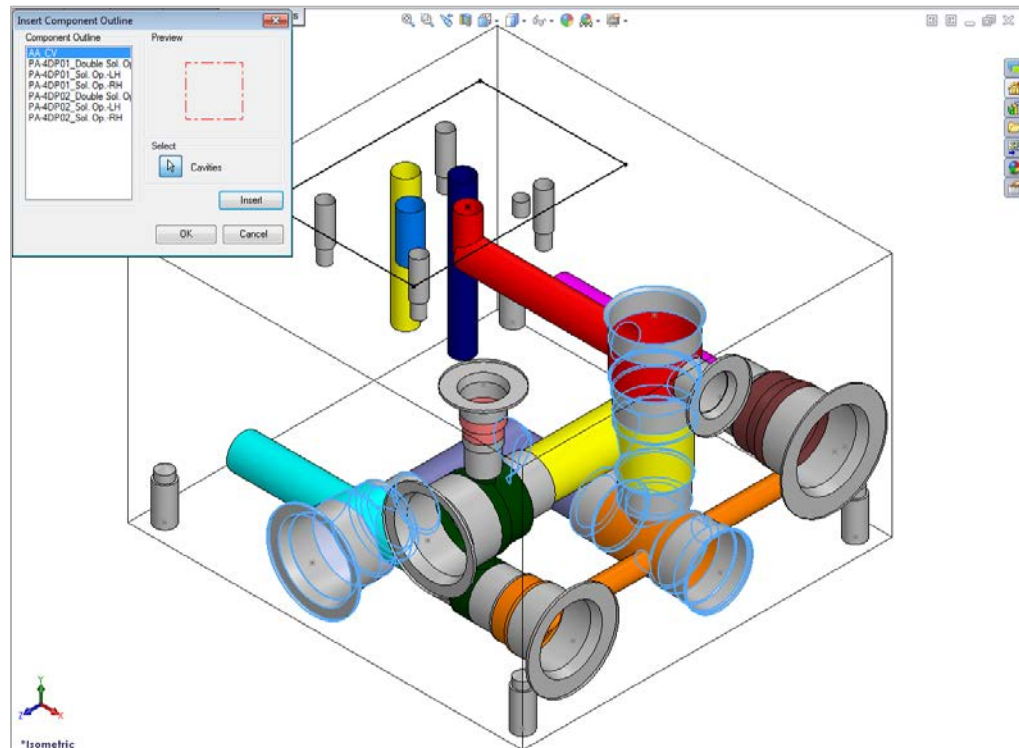
3. Click the **Cavities** select button.

When you move the cursor over a cavity, it gets highlighted. This indicates the selected cavity.

4. Click **Insert**.

MDTools creates a component outline around the selected cavities.

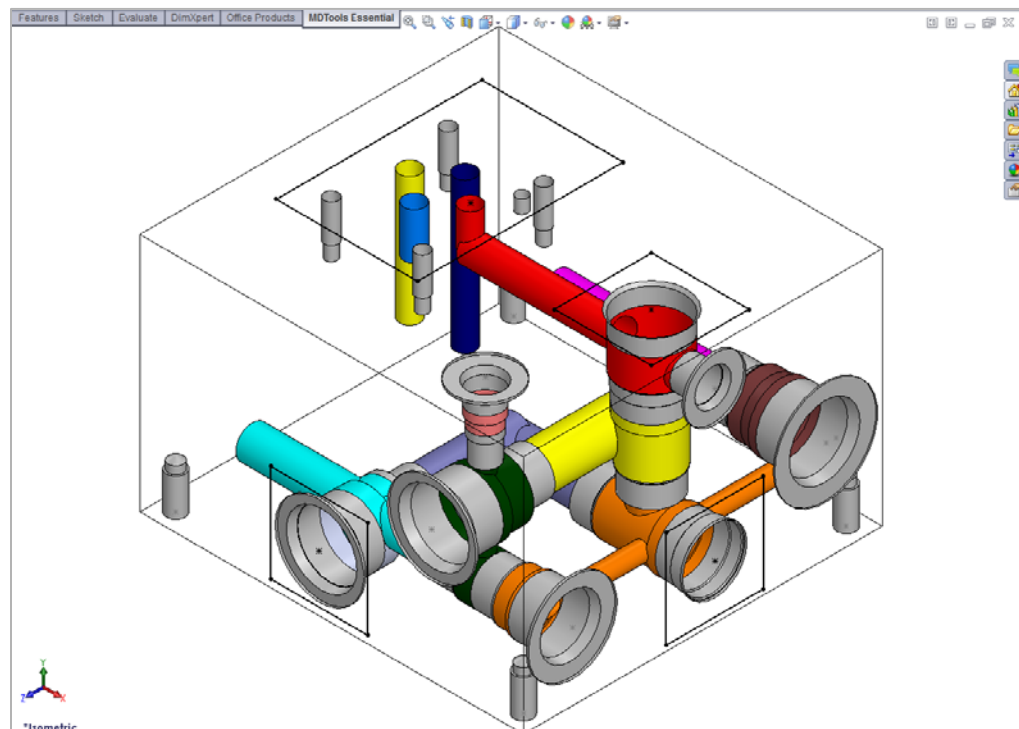
5. Click **OK**.



Insert component Outline dialog box

### Note:

Use the MDTTools Envelope Library program to create the Component Outline library.



Component outline created on the selected cavities

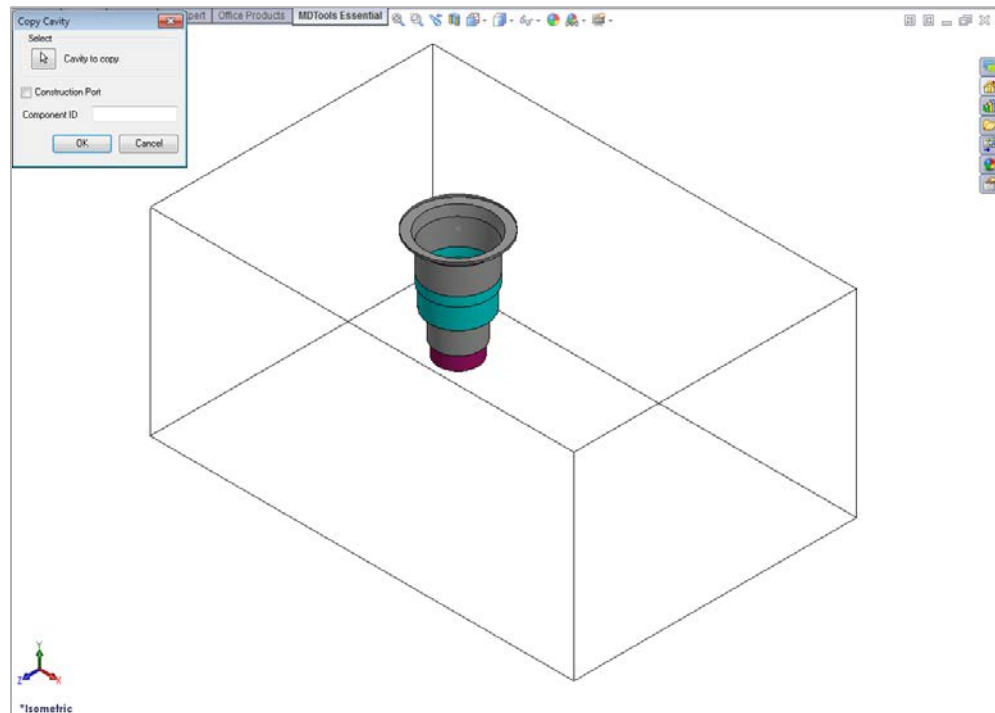
# 13. Copy Cavity

Create a copy of an existing cavity/footprint on the manifold.

All the parameters including the connectivity information are copied to the new cavity.

1. MDTools Essential  
    > **Copy Cavity**  
    *The Copy Cavity dialog box displays.*
2. Click the **Select** button and then select the cavity you want to copy.
3. Enter **Component ID** for the new cavity/footprint.
4. Select the **Construction Port** option. when a new cavity is used as a construction hole  
    If this option is selected, then MDTools® automatically assigns the component ID.
5. Click **OK**.

*The Specify Cavity Location dialog box displays.*

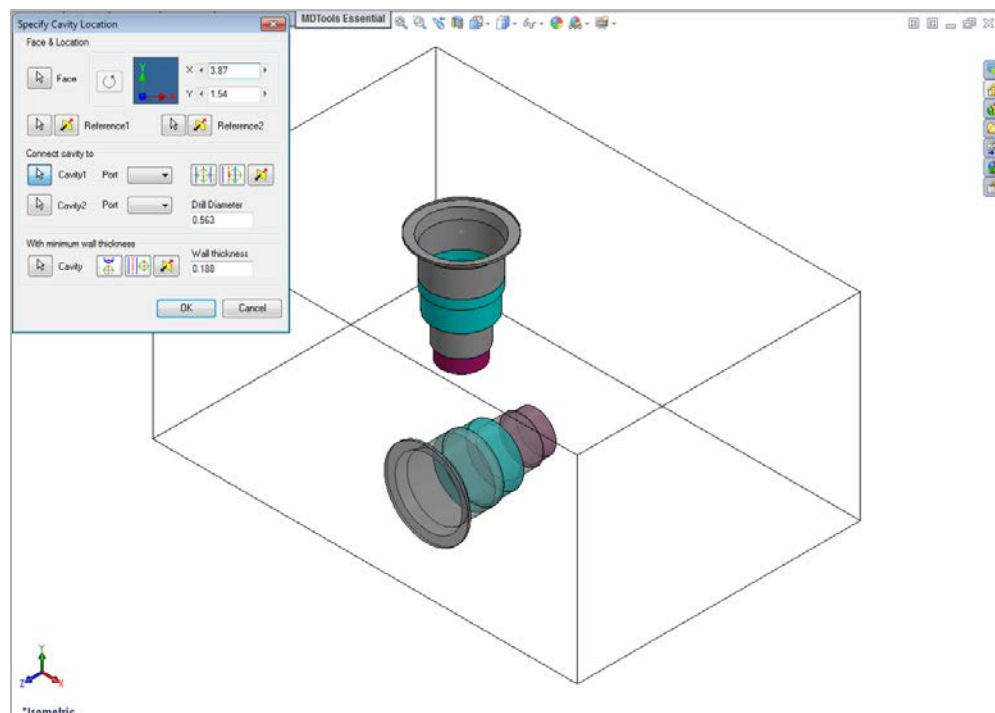


Copy Cavity dialog box

6. Select a point on the manifold face where you want to insert the cavity and pick connecting cavities.  
    MDTools displays a preview of the selected cavity at the selected point on the manifold.
7. Click **OK**.  
    MDTools creates a copy of the selected cavity at the specified location.

## Note:

- When you select a cavity on a footprint, then the complete footprint will be copied.
- When you copy a footprint, the main cavity on the footprint will be created at the selected location.



Specify Cavity Location dialog box



# 14. Edit

Change the design specific cavity dimensions inside SolidWorks.

It also enables you to select a tool (Drill or Spot Face tool) from a tooling knowledge base. This helps avoid the use of non-standard drills and spot faces.

## 1. MDTools Essential

### > Edit

The **Select Cavity:** **Edit Cavity** dialog box displays.

## 2. Select and click the highlighted cavity on the manifold.

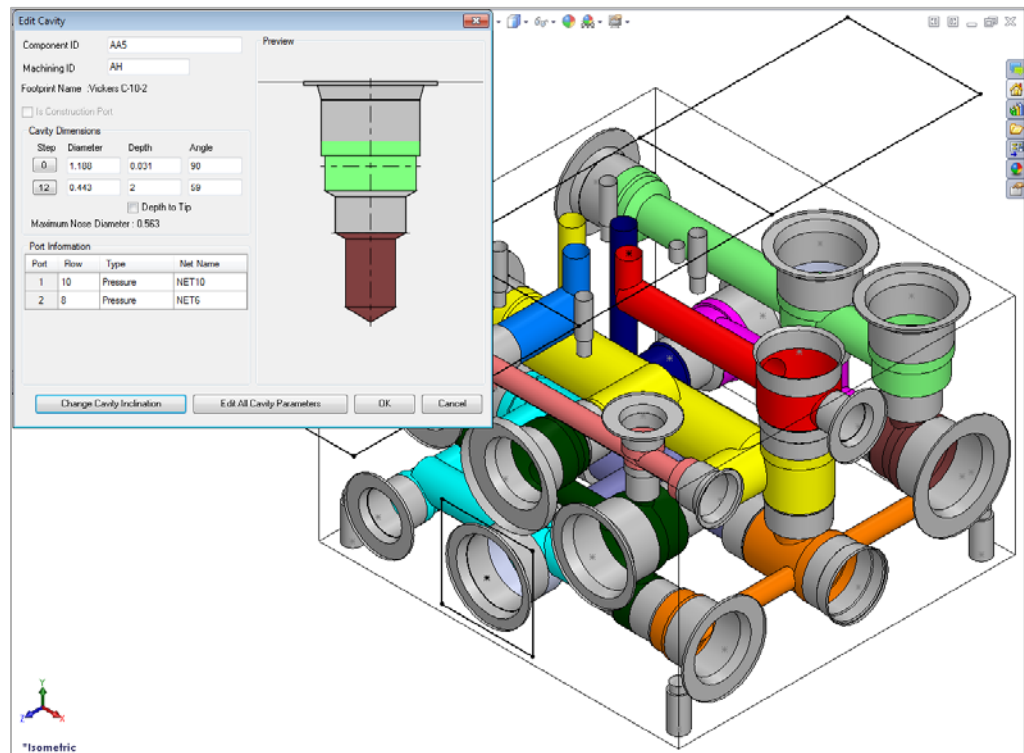
When you move the cursor over the cavity, it gets highlighted.

The **Edit Cavity** dialog box displays.

MDTools® displays the cavity preview with the design-specific cavity dimensions.

## 3. Click Edit All Cavity Parameters.

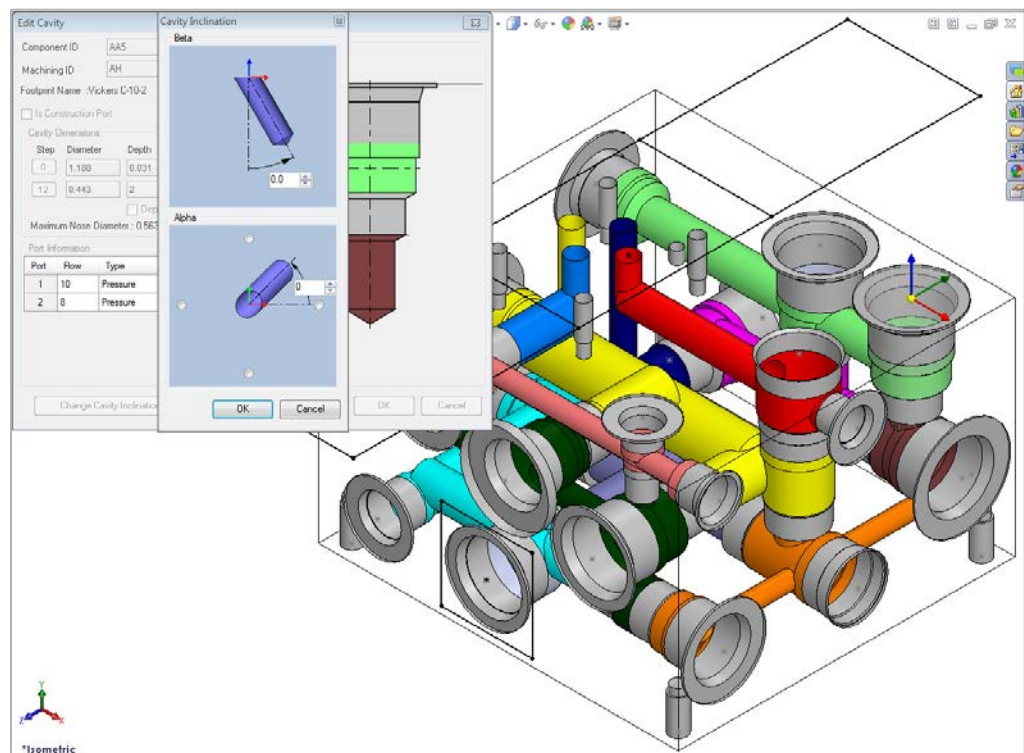
## 4. View or change all the cavity parameters.



Edit Cavity dialog box

### Note:

- Click **Change Cavity Inclination** to change the inclination of a cavity.
- Check the **Depth to Tip** option and enter the value in Step12 depth text field to specify the depth to tip value.



Angle Dimension



The **Edit Cavity** dialog box displays:

### Component ID

*The component ID for the cavity.*

### Machining ID

*The default ID is '?'.  
This ID is used to identify the hole in the block machining drawing and the machining chart.*

### Cavity Dimensions

- Spot face and drill dimensions
- Cavity Insertion angles (Alpha and Beta)

*Inclination angle is only applicable to drill holes, ports, or cartridge valve cavities.*

- Maximum Nose (Drill) Diameter

*This is a reference parameter, therefore not editable during design.*

### Port Information

- Enter flow, type, and net name for the cavity.

*When the net name is edited, the color of the cavity is updated according to the color assigned to the net.*

The **Edit Cavity** dialog box contains the following sections:

- Component ID:** AA5
- Machining ID:** AH
- Footprint Name:** :Vickers C-10-2
- ☐ **Is Construction Port**
- Cavity Dimensions:**

Step	Diameter	Depth	Angle
0	1.188	0.031	90
12	0.443	2	59

☐ **Depth to Tip**  
Maximum Nose Diameter : 0.563
- Port Information:**

Port	Flow	Type	Net Name
1	10	Pressure	NET10
2	8	Pressure	NET6

Buttons at the bottom: **Change Cavity Inclination**, **Edit All Cavity Parameters**, **OK**, **Cancel**.

**Preview:** A 3D model of a cartridge valve cavity. The top two sections are highlighted in green, and the bottom section is highlighted in red.

*Edit Cavity: Cartridge valve cavity*

## 1. Selecting Drill Diameter from Drill List

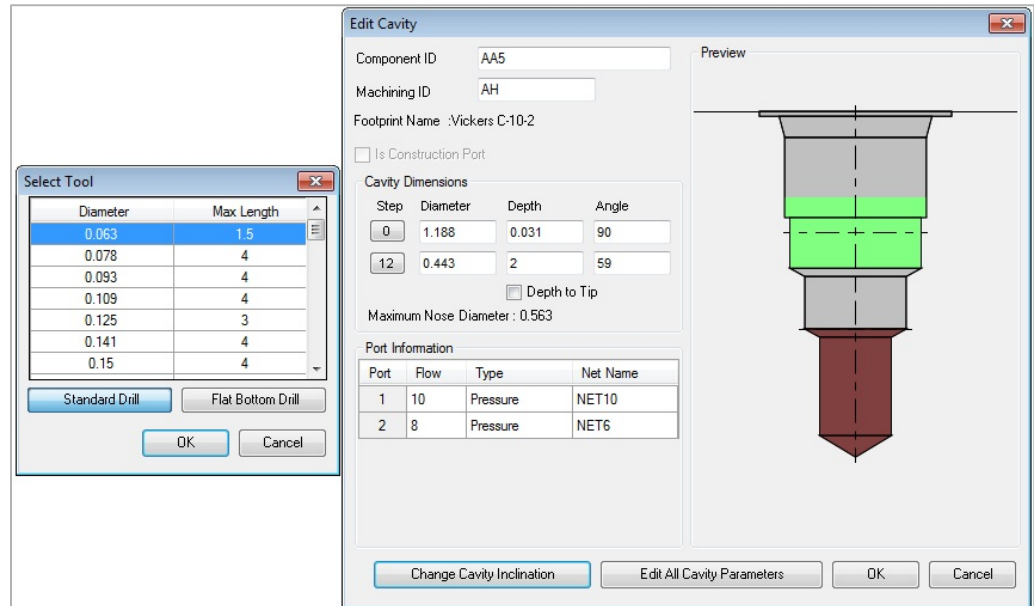
MDTools® enables you to select and use a drill from a standard drill list.

1. Click the Step 12 button before drill dimensions.

*The Select Tool dialog box displays.*

2. Select a drill from the list.
3. Click **OK**.

*MDTools updates the drill diameter of the cavity with the selected diameter.*



Select Tool and Edit Cavity dialog box

### Note:

- Click Flat Bottom Drill to view and select a flat bottom drill.
- Only drills with diameter less than or equal to the maximum allowable drill diameter of the cavity are listed.

## 2. Selecting Spot Face Diameter from the Spot Face Tool list

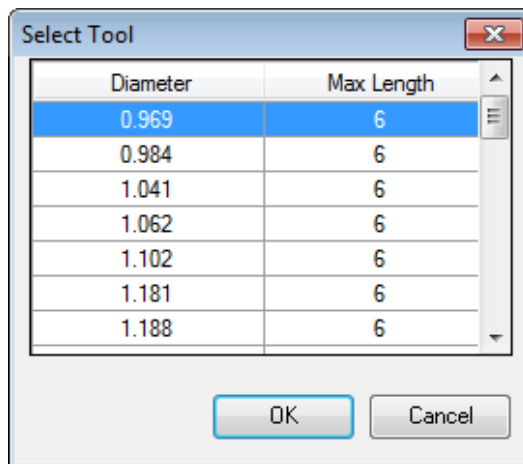
MDTools enables you to select and use a spot face from a standard spot face tool list.

1. Click Step 0 button before spot face dimensions.

*The Select Tool dialog box displays with a spot face tool list.*

2. Select a spot face tool from the list.
3. Click **OK**.

*MDTools updates the spot face diameter of the cavity with the selected spot face tool diameter.*



Spot face tool list

# 15. Edit All Cavity Parameters

View and change all the cavity dimensions and other parameters within SolidWorks. You can also select a tool (Drill or Spot Face tool) from a tooling knowledge base.

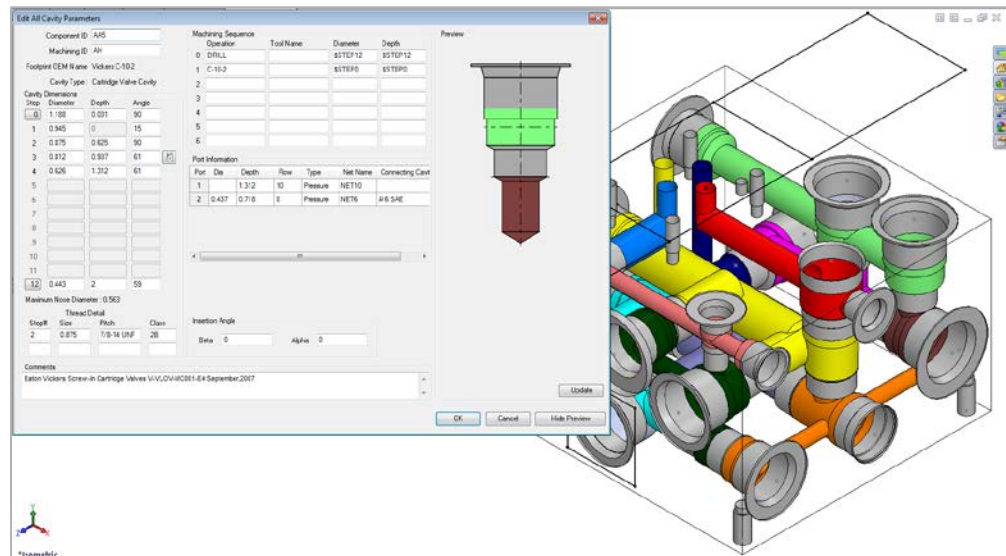
1. MDTools Essential  
> **Edit**

The *Edit Cavity dialog box* displays

2. Click Edit All Cavity Parameters.

The *Edit All Cavity Parameters dialog box* displays showing all the parameters of the cavity.

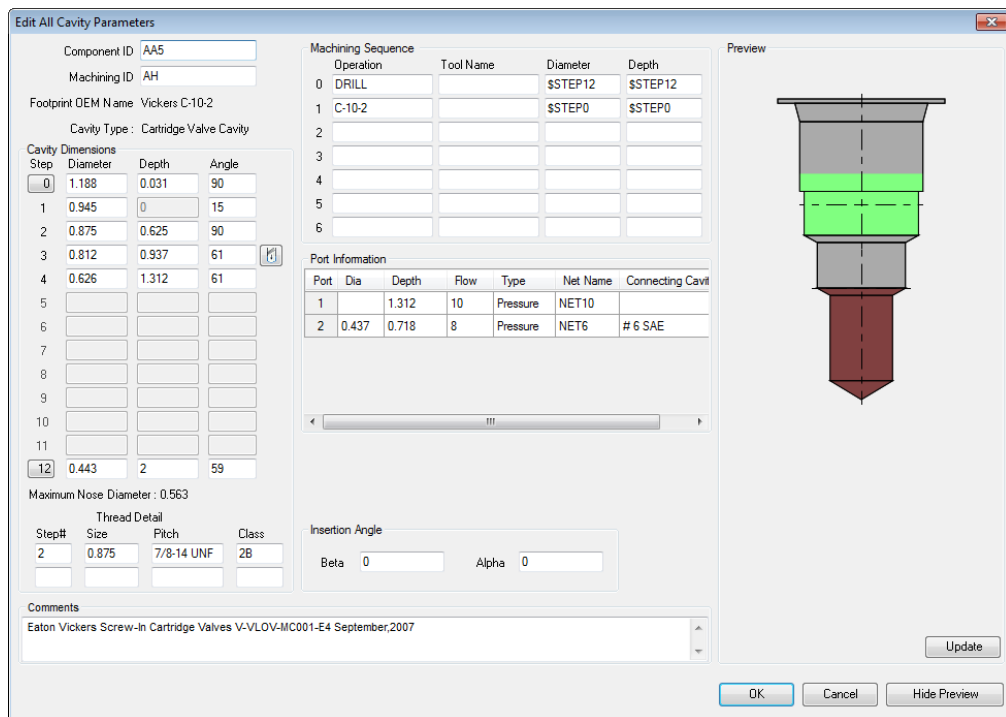
3. View the associated parameters and change the values, if required.



Edit All Cavity Parameters dialog box

The *Edit All Cavity Parameters dialog box* displays:

- Component ID  
The default cavity ID is the same as the component ID.
- Cavity Machining ID  
The default ID is '?'.  
The default ID is '?'.
- Cavity Dimensions  
Step0 through Step12 dimensions are editable.
- Maximum Nose (Drill) Diameter
- Machining Sequence
- Inclination Angle (Alpha and Beta)
- Thread Detail
- Port Information  
Only available for Cartridge valve cavities
- Plug Detail  
Only available for Port type cavities



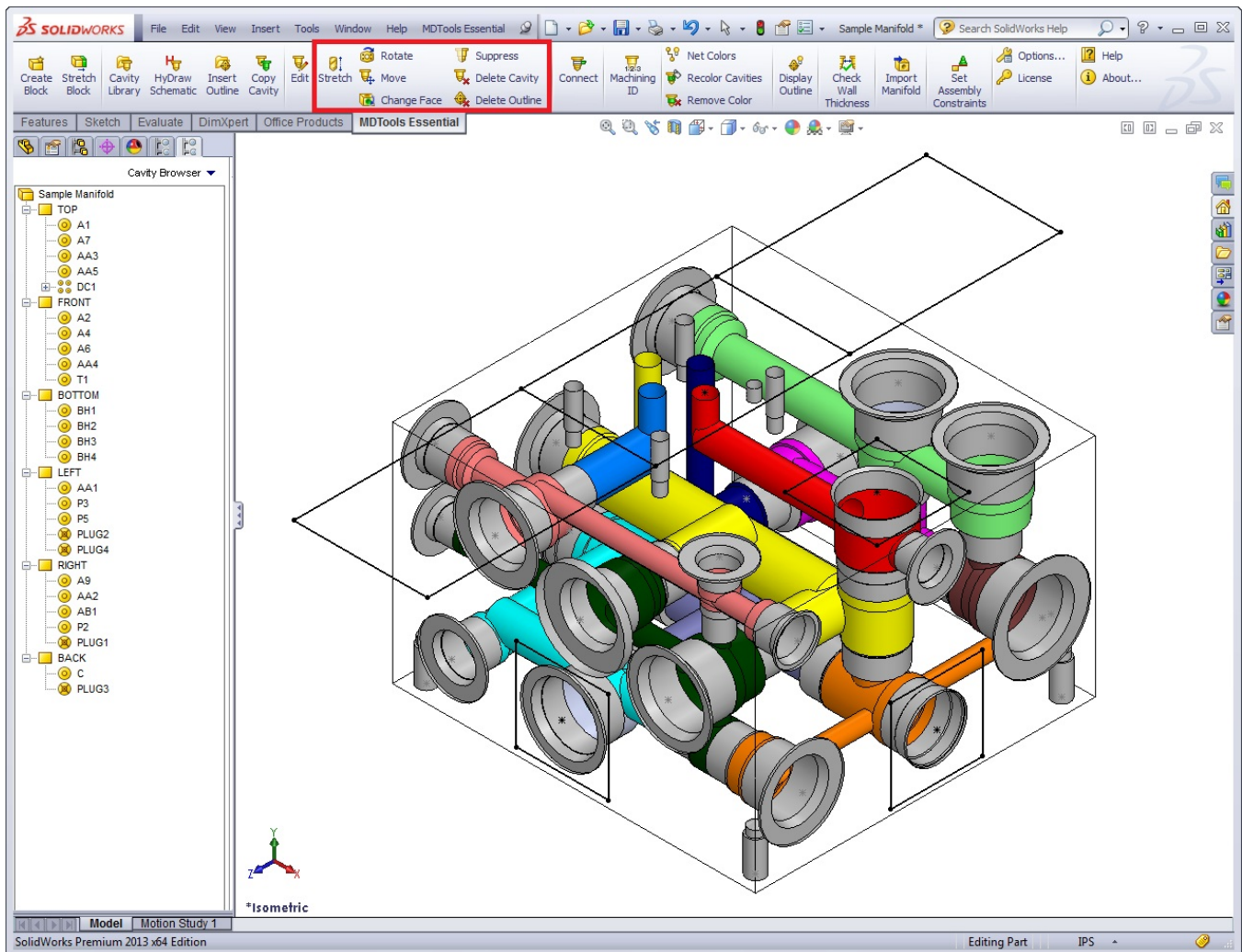
Edit All Cavity Parameters dialog box

## Note:

- You cannot add or remove a step in the cavity inside SolidWorks.
- To add a step in a cavity, use the Add Drill command. For example, to add another drill above the drill in Step12.

# Modify Cavity

- 16 Stretch
- 17 Rotate
- 18 Move Cavity
- 19 Change Face
- 20 Suppress Cavity
- 21 Delete Cavity
- 22 Delete Outline



# 16. Stretch

Stretch the drill and change its depth by selecting and dragging the cavity in the model.

1. MDTools Essential > **Stretch**

The *Stretch Drill* dialog box displays.

2. Select a cavity to stretch.

MDTools® displays the preview of the drill in the selected cavity.

The current drill depth and diameter are displayed in the dialog box.

3. Select and drag the arrow at the bottom of the cavity to the required depth.
4. Release the mouse button on reaching the required depth.

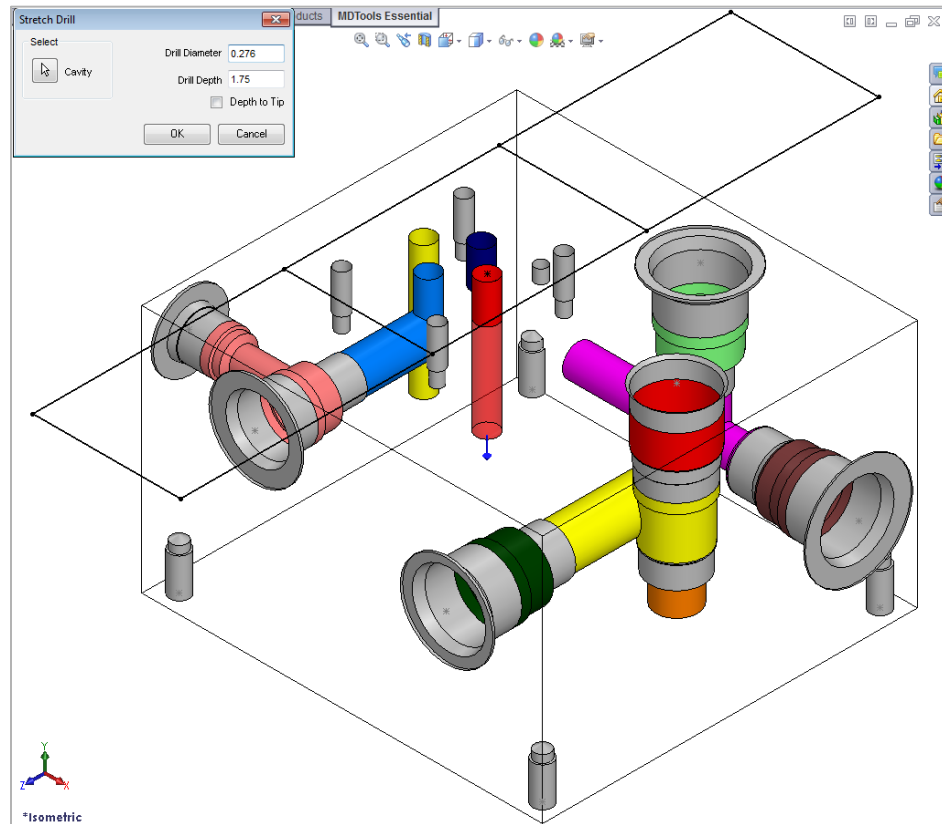
MDTools displays the new depth in the dialog box. Change the drill depth, if required.

5. Click **OK**.

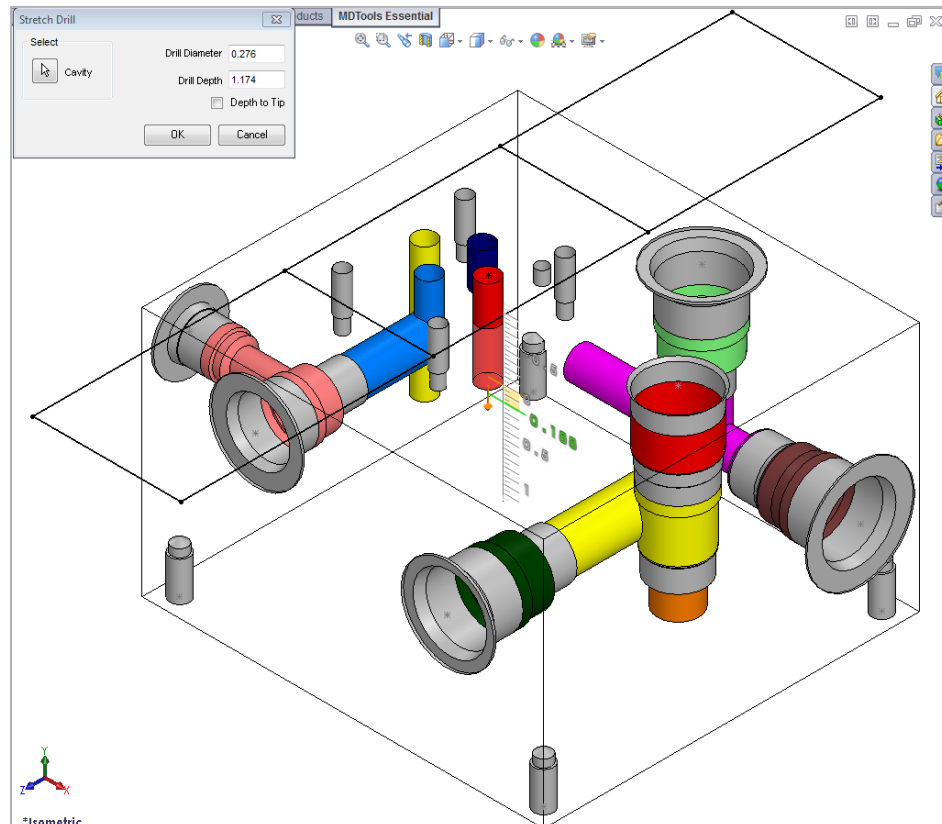
MDTools updates the drill depth and diameter of the selected cavity.

## Note:

- The drill depth cannot be increased beyond the manifold block
- To restrict the drill tip in a plane switch to a view plane parallel to that plane.



Stretch Drill dialog box



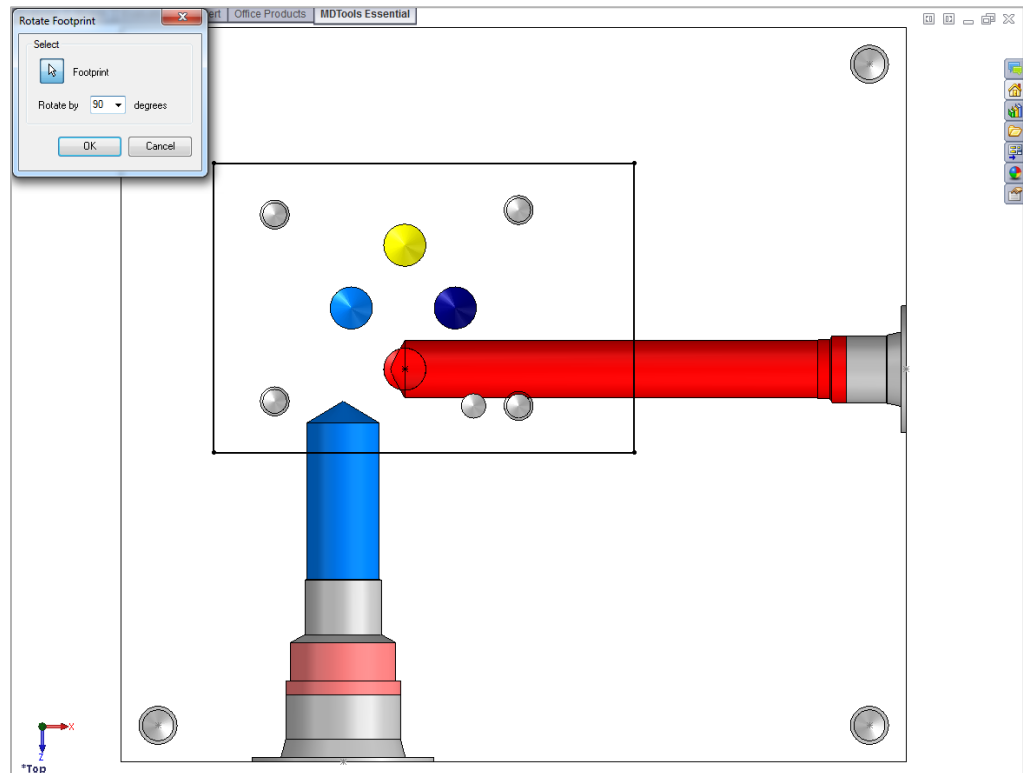
Change the drill depth by dragging

# 17. Rotate

*Rotate a footprint/cavity on the manifold surface.*

*The footprint/cavity is rotated by the specified angle, about the center of the parent cavity of the footprint.*

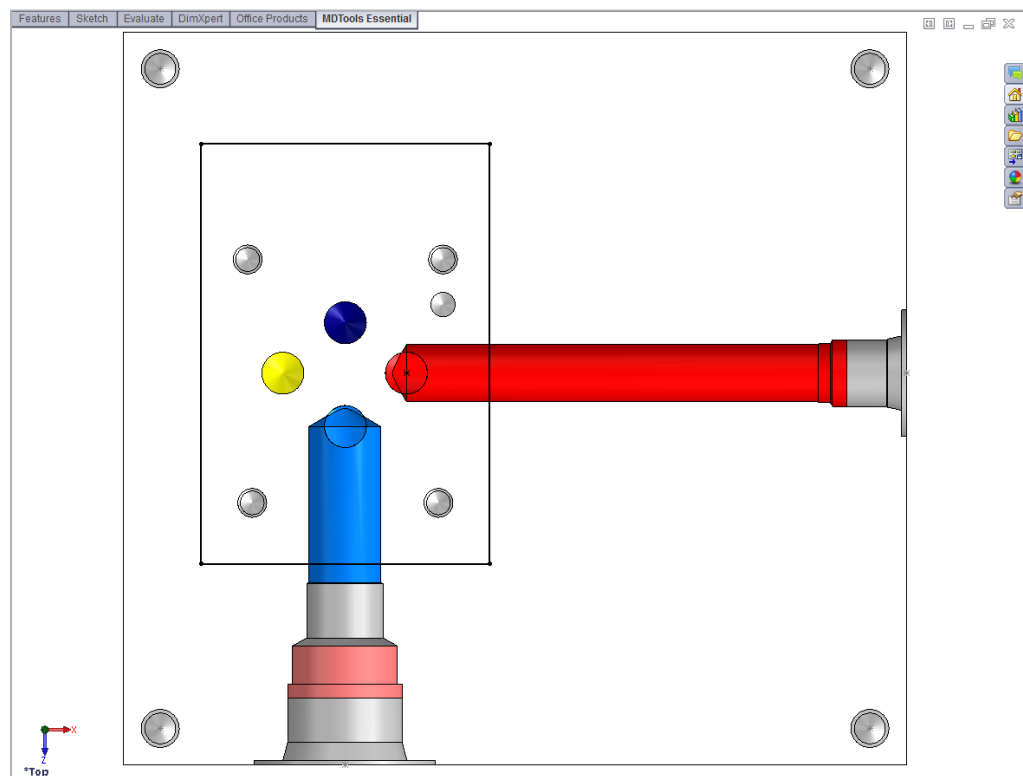
1. MDTools Essential  
> **Rotate**  
*The Rotate Footprint dialog box displays.*
2. Select a cavity on the footprint.  
*When you move the cursor over a cavity, it will be highlighted. This indicates the selected cavity.*
3. Enter the **Rotation Angle** in degrees.
4. Click **OK**.  
*MDTools® rotates the footprint by the rotation angle entered, about the center of parent cavity of the footprint in a counter clockwise direction.*



## Note:

- The parent cavity is the cavity created at the insertion point of a footprint.
- MDTools displays the center point only on the parent cavity.
- Display of the parent cavity center point enables you to identify the parent cavity in a footprint inside SolidWorks.

*Rotate Footprint dialog box*



*Footprint rotated by 90 degrees*



# 18. Move Cavity

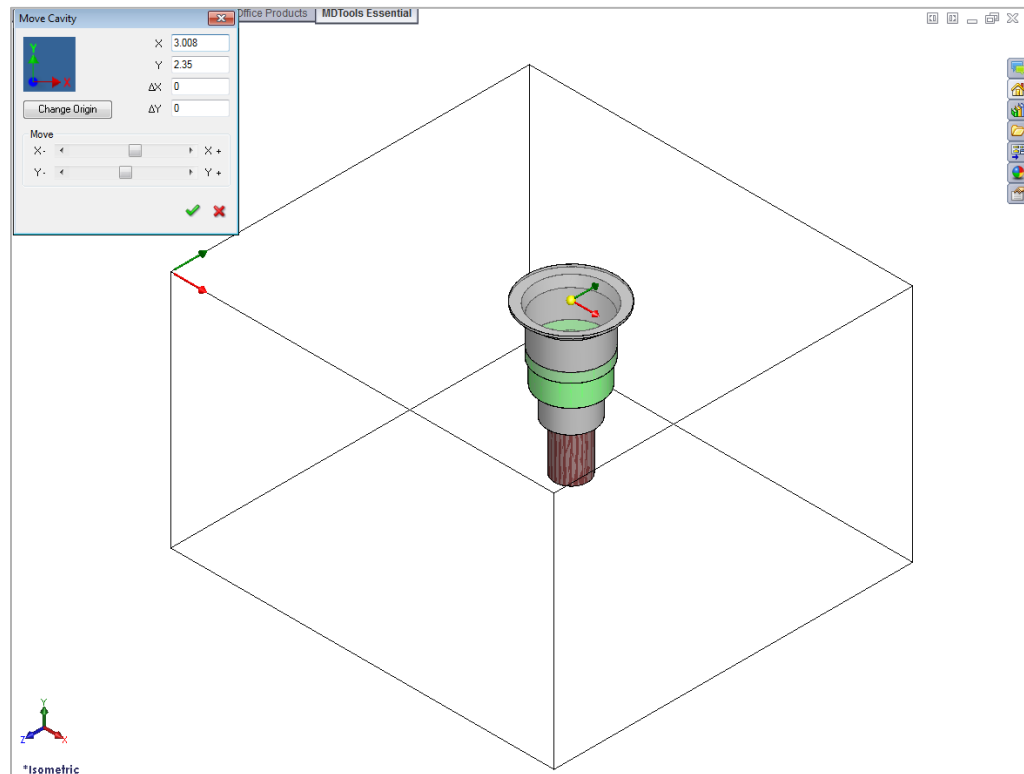
*Precisely relocate a cavity by specifying the X and Y values from the face origin. You can also move the cavity by entering displacement values (delta X and delta Y).*

1. MDTools Essential  
    > **Move**
2. Select a cavity on the manifold.

*The Move Cavity dialog box displays.*

*MDTools® displays the origin indicator on the manifold face.*

*Current X and Y values of the cavity location from the face origin are displayed in the dialog box.*



Move Cavity dialog box

## Moving by Entering X and Y

*Relocate the cavity by entering X and Y*

1. Enter X, Y, or both, as required.
2. Click **OK**.

*MDTools relocates the cavity to the new location.*

## Moving by Entering ΔX and ΔY

*Relocate the cavity by entering displacement.*

1. Enter ΔX, ΔY, or both, as required.
2. Click **OK**.

*MDTools moves the cavity by the ΔX and ΔY values entered.*

# 1. Moving by Dragging Cavity in Model

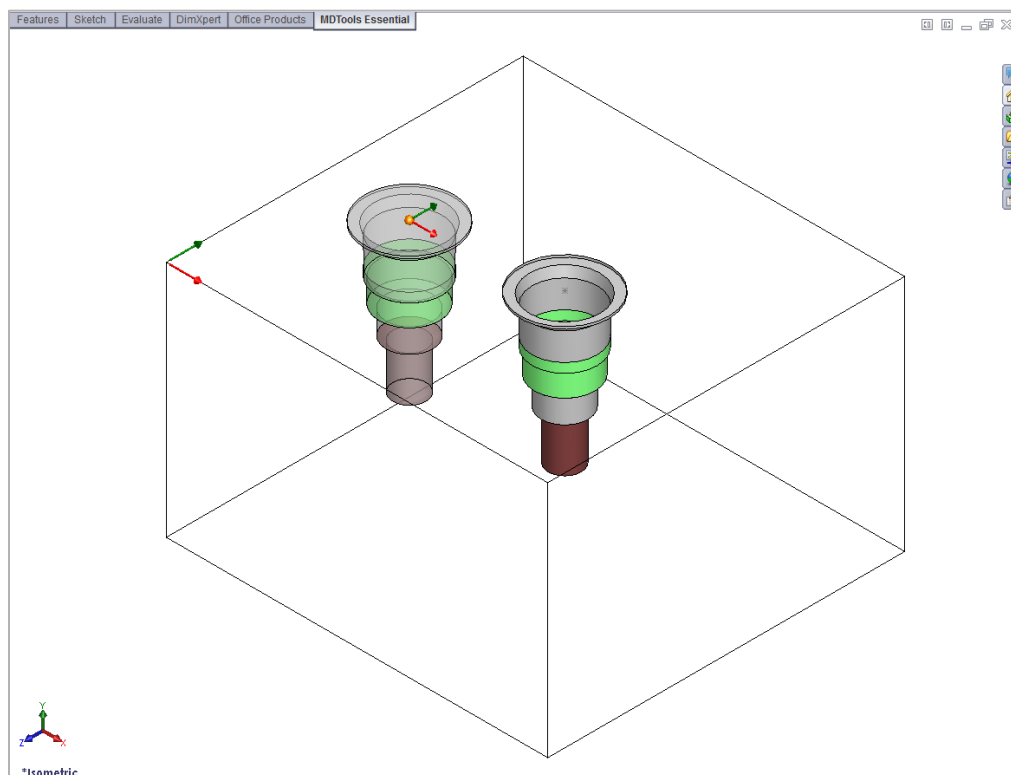
MDTools® enables you to move a cavity by dragging the cavity in the model.

1. Select cavity center displayed as a yellow dot in the model.

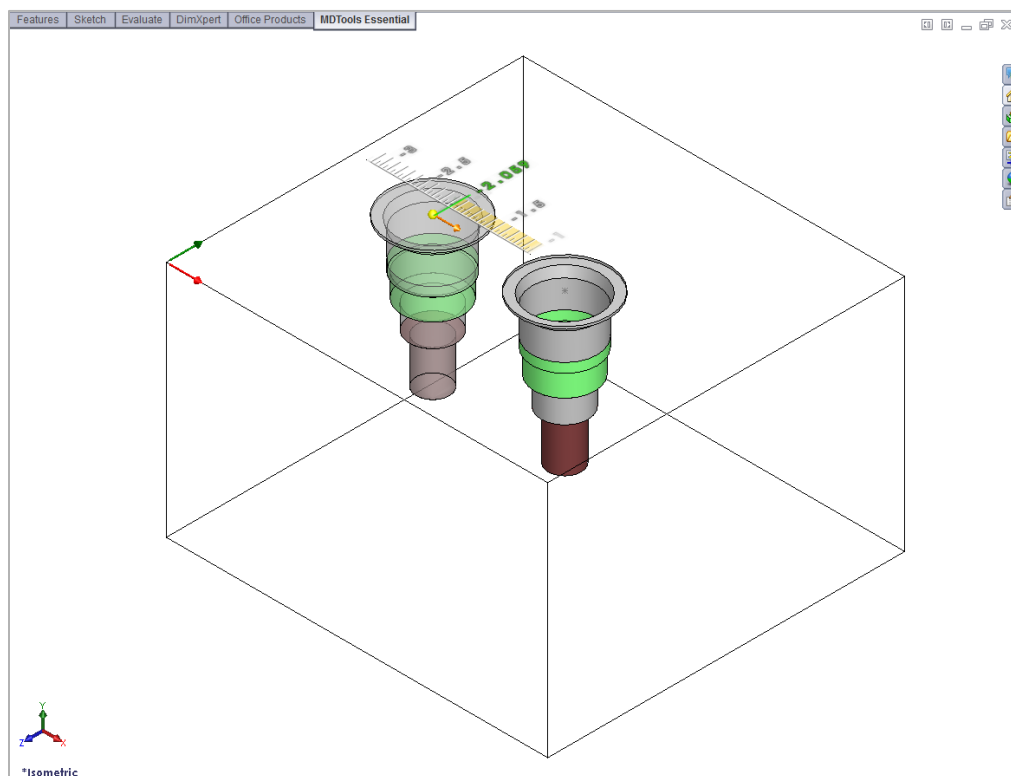
Or,

Select one of the directional arrows to move the cavity in the desired direction only.

2. Drag the cavity to the desired location.



*Moving Cavity by dragging the cavity center point.*



*Moving Cavity by dragging the directional arrow.*

## 2. Moving by Increment

MDTools® enables you to move a cavity by an incremental distance (0.05inch /1.00 mm)

- Click the scroll bar button.

For one click, MDTools moves the cavity by 0.05 inch /1 mm.

- Click the right scroll bar button to move the cavity in the +ve X/Y direction.

- Click the left scroll bar button to move the cavity in the -ve X/Y direction.

### Note:

- In case of a non-rectangular manifold, the command automatically calculates a point nearest to the origin on the face on which the selected cavity is placed.
- This is taken as the origin and X and Y vectors are also calculated accordingly. The procedure to change the coordinate system is described in the next section.

## 3. Moving the origin

Change the origin of a manifold face to move the selected cavity.

1. Click Change Origin.  
*The Change Origin dialog box displays.*

2. Select a point to make it the origin.

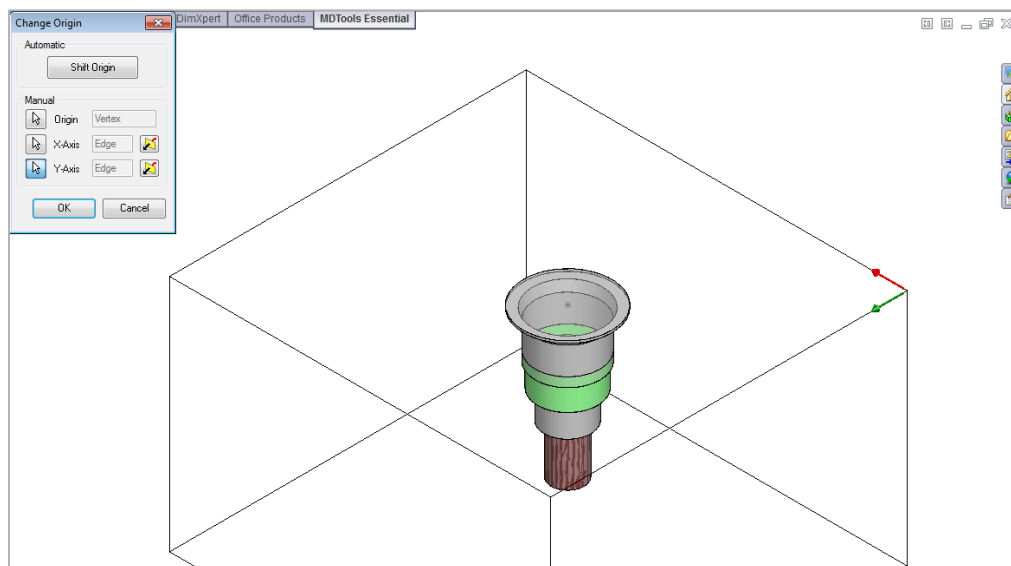
3. Click a cavity/face of a cavity to move the origin to the projection of cavity center point on the face.

4. Select the edges to make X and Y-axis.

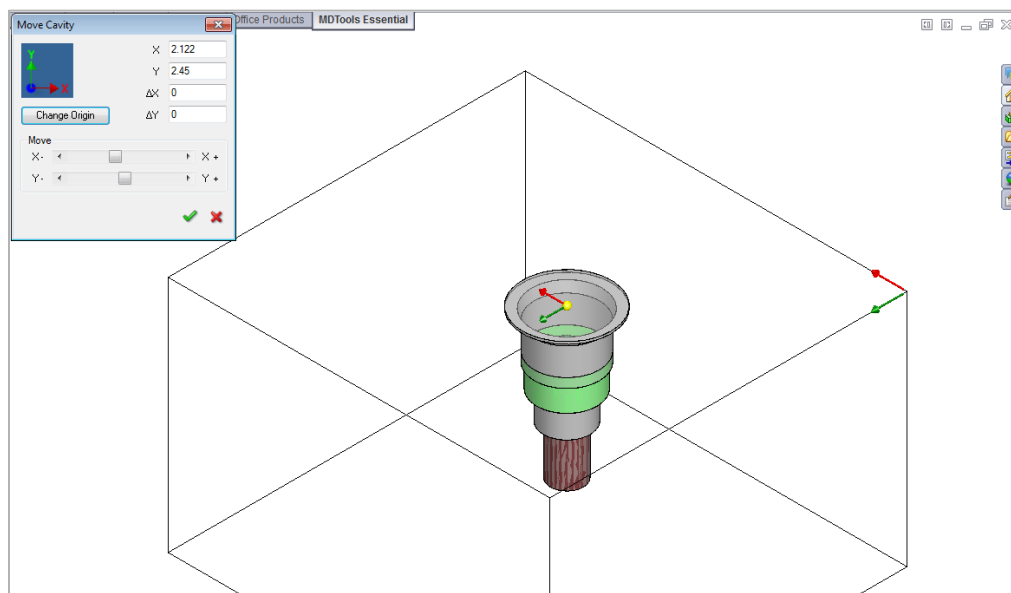
5. Flip the axis direction by clicking the corresponding flip axis button.

### Note:

In case of a rectangular manifold, the Shift Origin command can be used to automatically pick the next vertex as the origin.



Change Origin dialog box



Origin changed and X and Y values updated

# 19. Change Face

Relocate a cavity/footprint from one face of a manifold to another manifold face.

1. MDTools Essential > **Change Face**

The *Change Face* dialog box displays.

2. Select the cavity/footprint you want to relocate.

The *Specify Cavity Location* dialog box displays.

**Note:**

If you select a cavity in a footprint, then the complete footprint is relocated.

3. Select the point on the manifold face, where you want to relocate the cavity and pick connecting cavities.

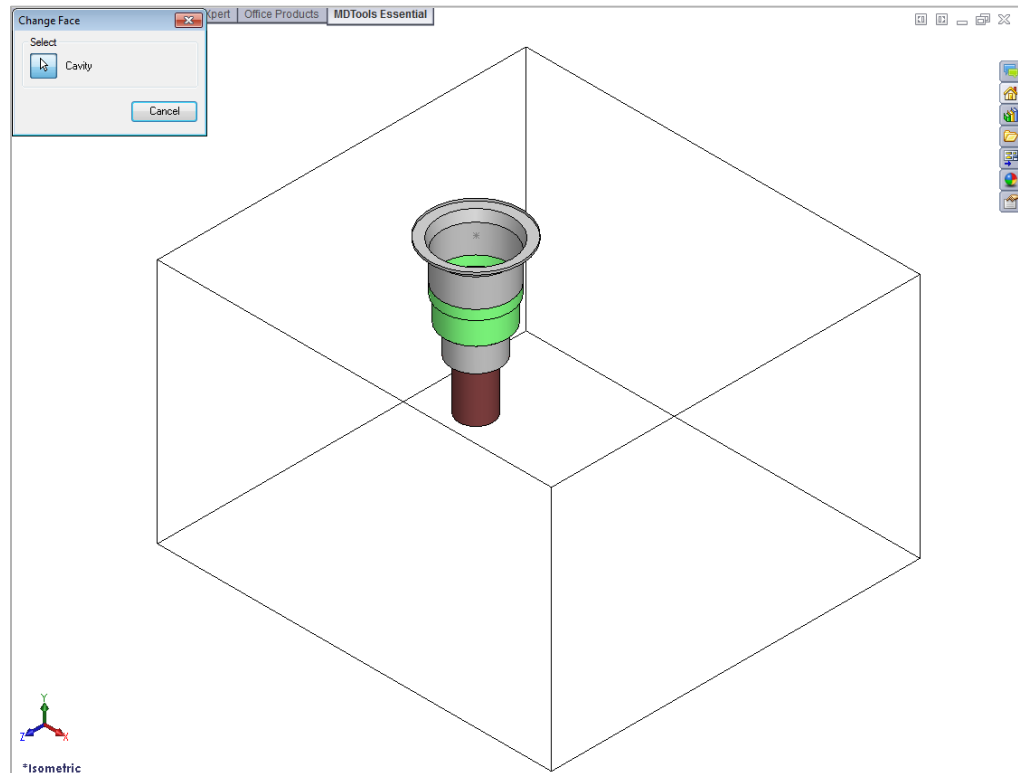
MDTools® displays a preview of the selected cavity at the selected point on the manifold.

4. Click **OK**.

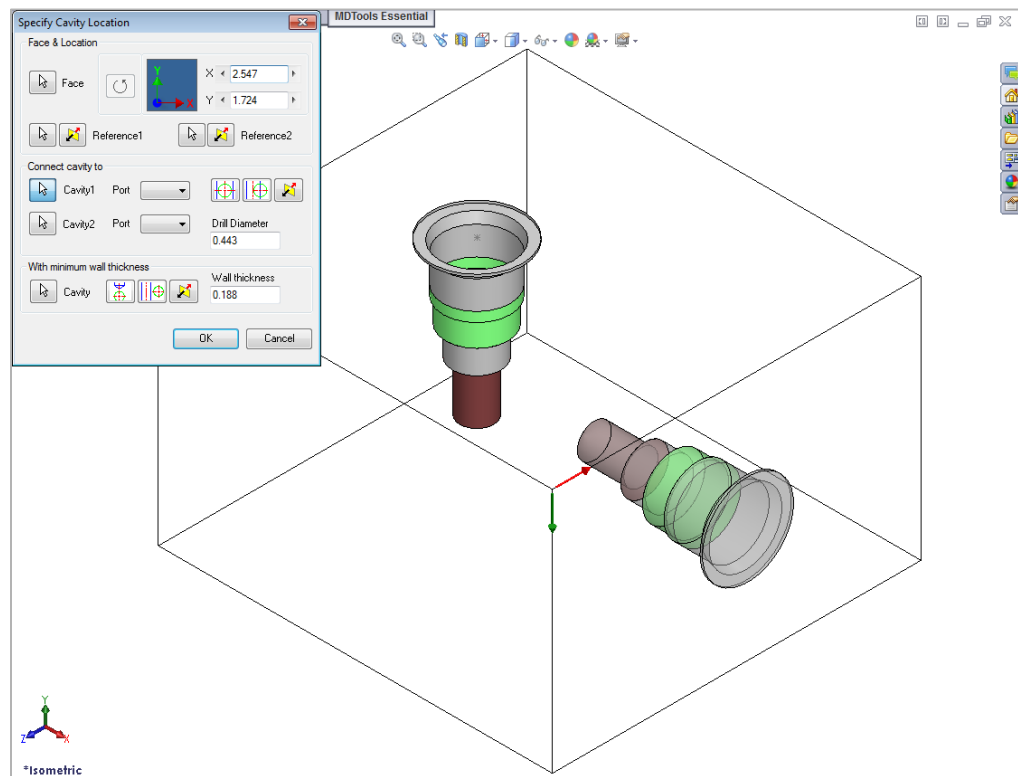
MDTools relocates the cavity/footprint to the selected location on the manifold.

**Note:**

When you relocate a footprint using the Change Face command, the parent cavity on the footprint is created at the selected location.



Change Face dialog box



Specify Cavity Location dialog box

## 20. Suppress Cavity

Suppress an unsuppressed cavity/footprint and vice versa.

When you suppress the cavity, MDTools® automatically suppresses all the features used to create the cavity.

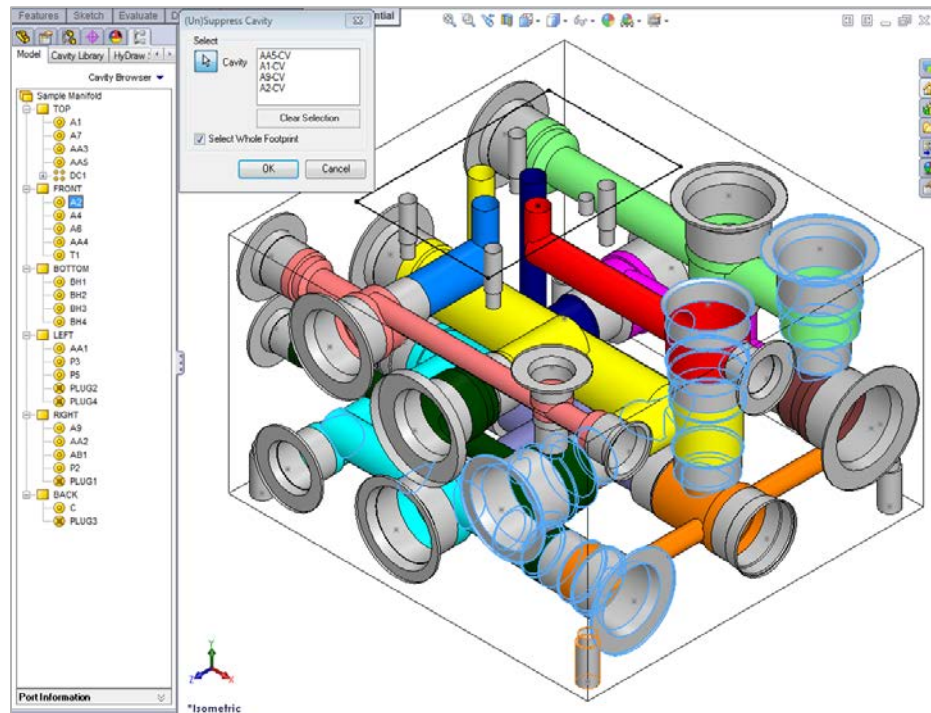
- MDTools Essential  
> **Suppress**  
The (Un)Suppress Cavity dialog box displays.

The Select Cavity option is selected by default.

### Suppressing cavities

1. Select the cavity/footprint you want to suppress.
2. Click **OK**.

MDTools suppresses the selected cavities.

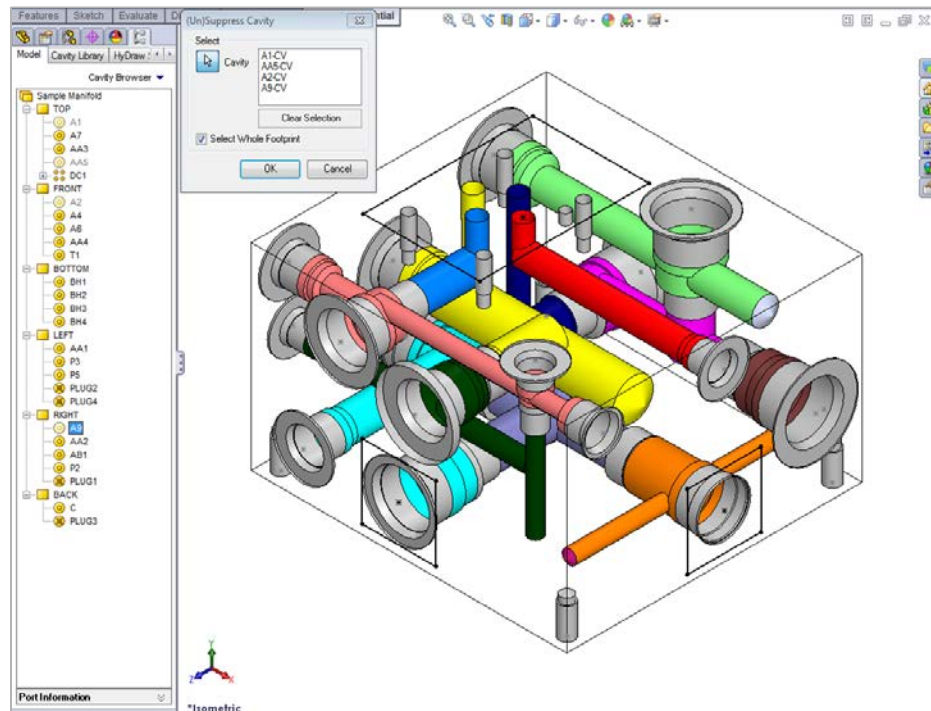


Suppress Cavity dialog box

### Un-suppressing Cavities

1. Select the cavity/footprint you want to un-suppress.
2. Select the cavity from the browser.
3. Click **OK**.

MDTools un-suppresses the selected cavities; if the cavity belongs to a footprint, then the complete footprint will be un-suppressed.



Selecting cavity to Unsuppress from the browser

### Note:

- Use the Select Footprint option to suppress or un-suppress the whole footprint.
- If the Select Whole Footprint option is not checked, then the command suppresses/un-suppresses only the selected cavity of the footprint.
- You can suppress/un-suppress multiple cavities by using this command.
- You can reselect a cavity to remove the cavity from the selection list.

# 21. Delete Cavity

Automatically delete the selected Cavities/Footprints.

MDTools® cavity consists of multiple SolidWorks features.

All the features used to create the cavity/footprint are automatically deleted.

1. MDTools Essential  
> **Delete Cavity**

The Delete Cavity dialog box displays.

2. Select Cavities/Footprints, you want to delete.  
  
When you click the cursor over a cavity, it is highlighted. This indicates the selected cavity.

You can select multiple cavities at a time and delete all the selected cavities in one operation.

You can reselect a cavity to remove it from the selection list.

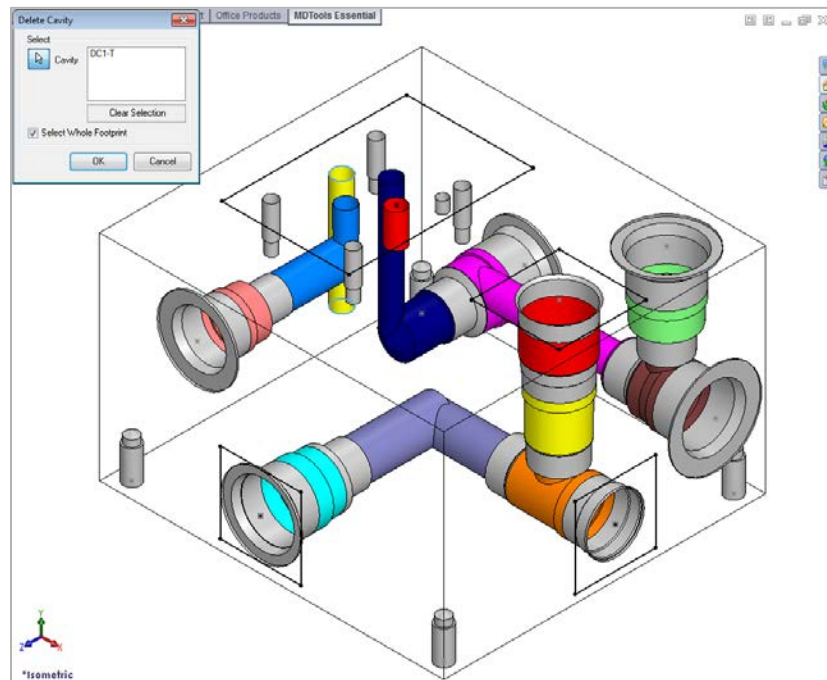
Or

Click **Clear Selection** to clear all selected cavities.

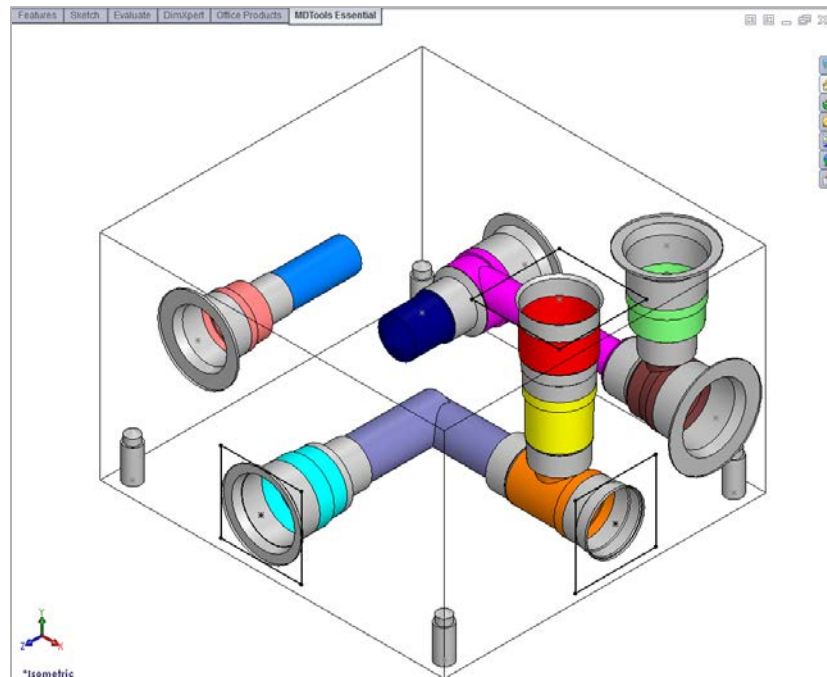
3. Select the **Select Whole Footprint** option to delete the whole footprint.

4. Click **OK**.

MDTools deletes all the features used to create cavities/footprints in SolidWorks.



Cavity highlighted after selecting the cavity



Automatically deletes whole footprint

## Note:

- If the parent cavity of a footprint is selected and the Select Whole Footprint option is not checked, the footprint is not deleted.
- If the cavity has Outline attached to it, then it will also be deleted with the cavity.



## 22. Delete Component Outline

Delete a component outline around the selected cavities/footprints that are created using MDTools®.

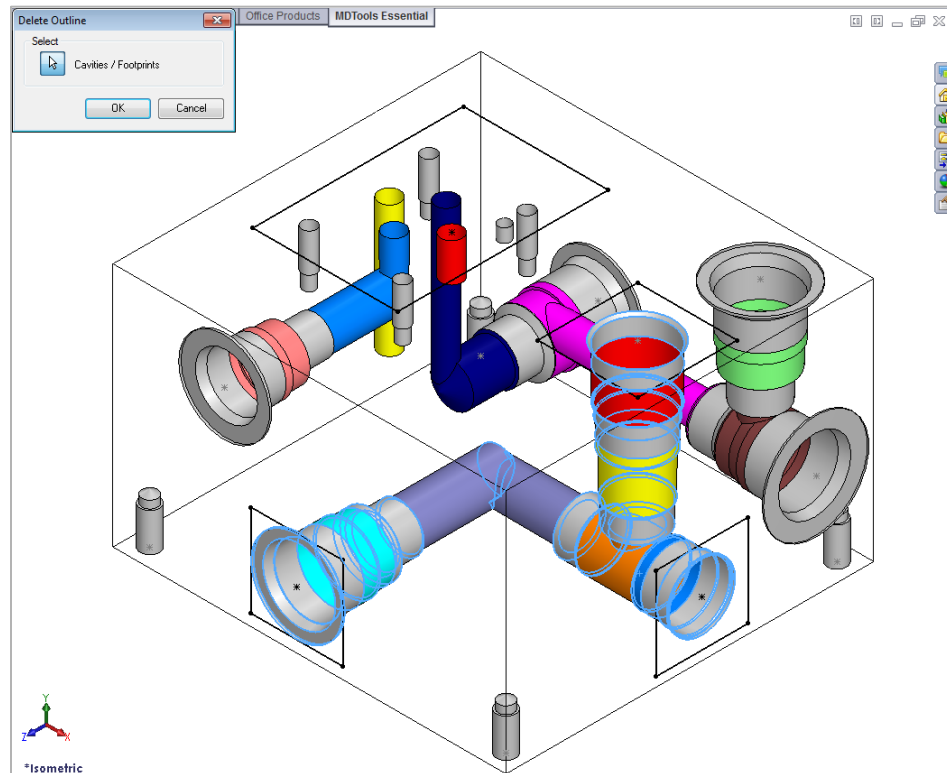
1. MDTools Essential  
> **Delete Outline**

*The Delete Outline dialog box displays.*

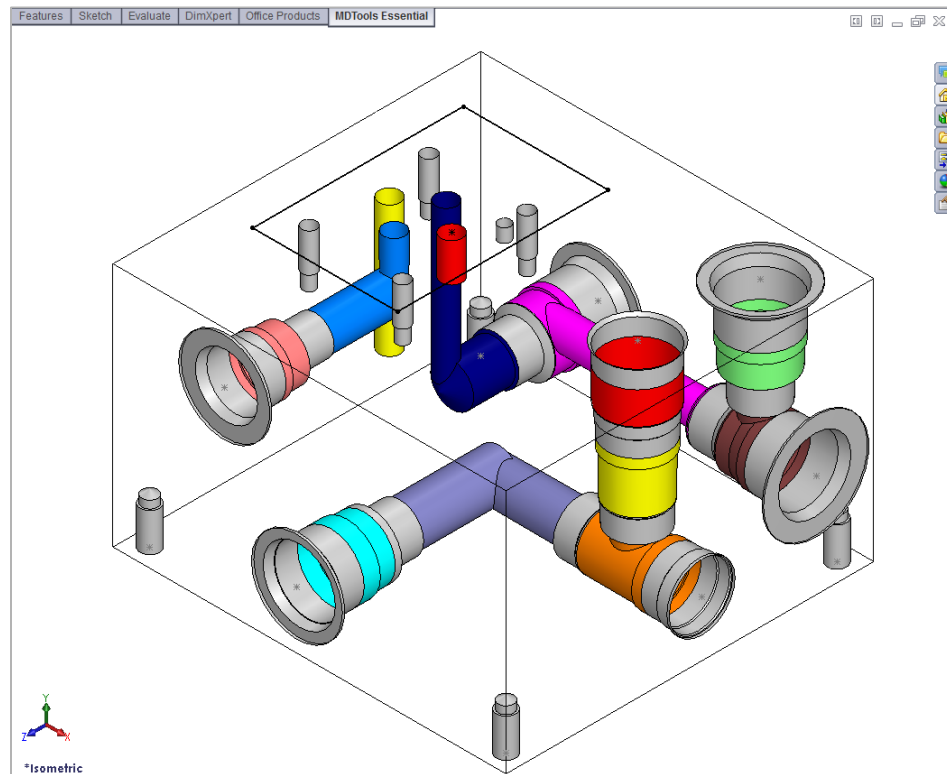
2. Select the cavities/footprints from which you want to delete the component outline.

3. Click **OK**.

*MDTools automatically deletes the component outline around the selected cavities/footprints.*



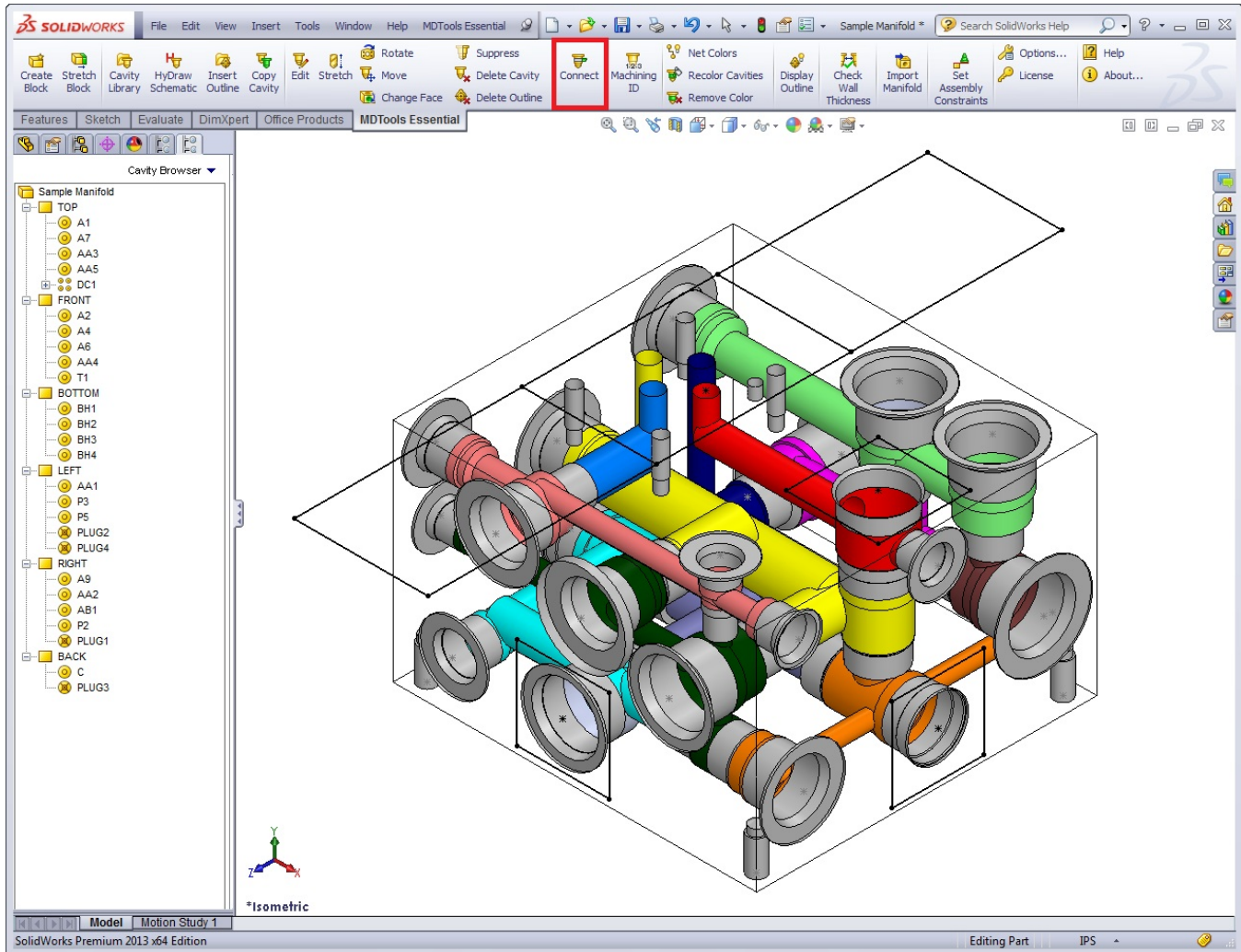
Delete Outline dialog box



Component Outline automatically deleted

# Make Connections

## 23 Connect Cavity



## 23. Connect Cavity

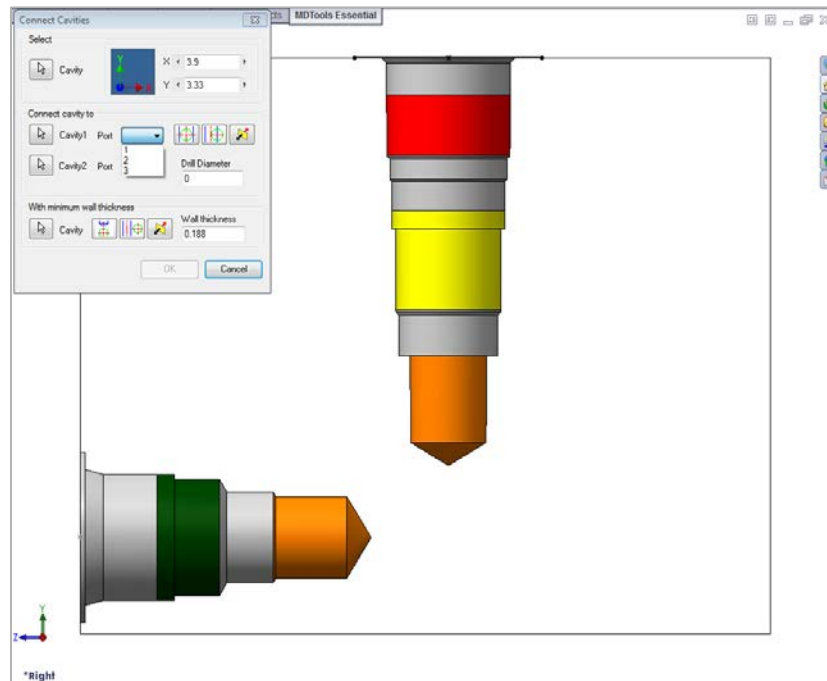
*Interactively create connections between cavities.*

*If a connection is not possible without relocating the cavity, then MDTools® automatically relocates the connecting cavity to the port center. In case of a bottom port, MDTools relocates the connecting cavity to the full diameter depth of the second cavity.*

1. MDTools Essential  
    > Connect  
    *The Connect Cavities dialog box displays.*
2. Select the cavity to connect.  
    *Select the cavity you want to move and connect to another cavity.*
3. Select connecting cavity1.
4. Select the connecting port on cavity1.

### Note:

If the connecting cavity is not a cartridge valve cavity or if you select a port area of the cavity, then port number will appear by default.

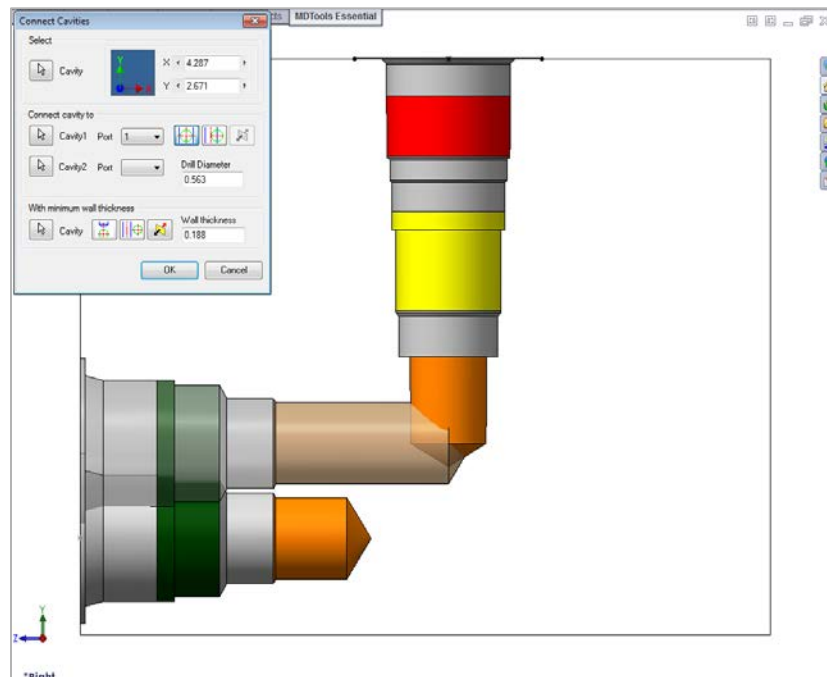


Connect Cavities dialog box

5. Click the selection button for cavity2.
6. Select connecting cavity2.
7. Select the connecting port on cavity2.

*MDTools automatically relocates the cavity to the overlapping center of the two cavity ports.*

8. Click **OK**.  
    *MDTools relocates the first cavity (cavity to connect) and updates the depth for all the cavities to create the specified connection.*



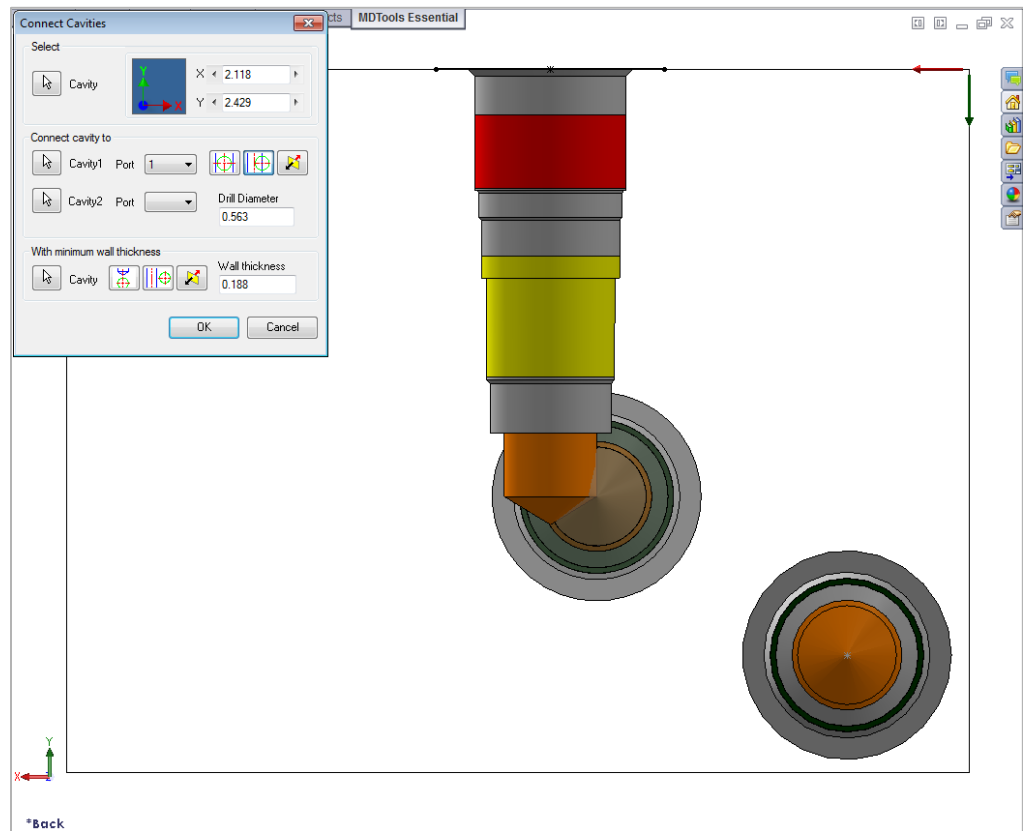
Connection Preview using the Connect Cavities command

### Note:

- MDTools automatically selects the drill diameter when you connect the cavity to a side port of another cavity.
- Net name of all the cavities are updated with the net name for the selected port on cavity1.
- If the net name for the selected port on cavity1 is not defined, then the net name for the selected port on cavity2 is used.

## 1. Position the cavity

1. Click the Relocate to center button to locate the cavity on the port center of cavity1.
2. Click the Relocate to side button to relocate the cavity to the side.
3. Click the Flip side button to flip the sides.

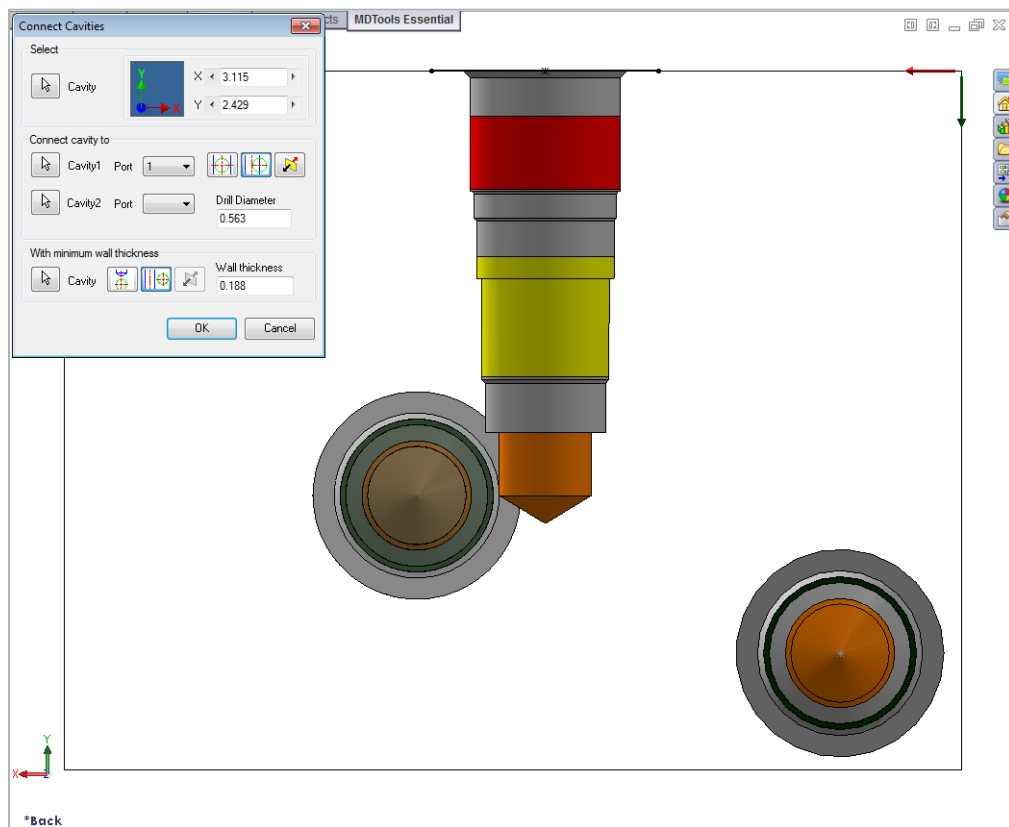


*Positioning the cavity using the Relocate to side option*

## 2. Position with minimum wall thickness

Position the cavity to connect while assuring minimum wall thickness with an existing cavity on the manifold.

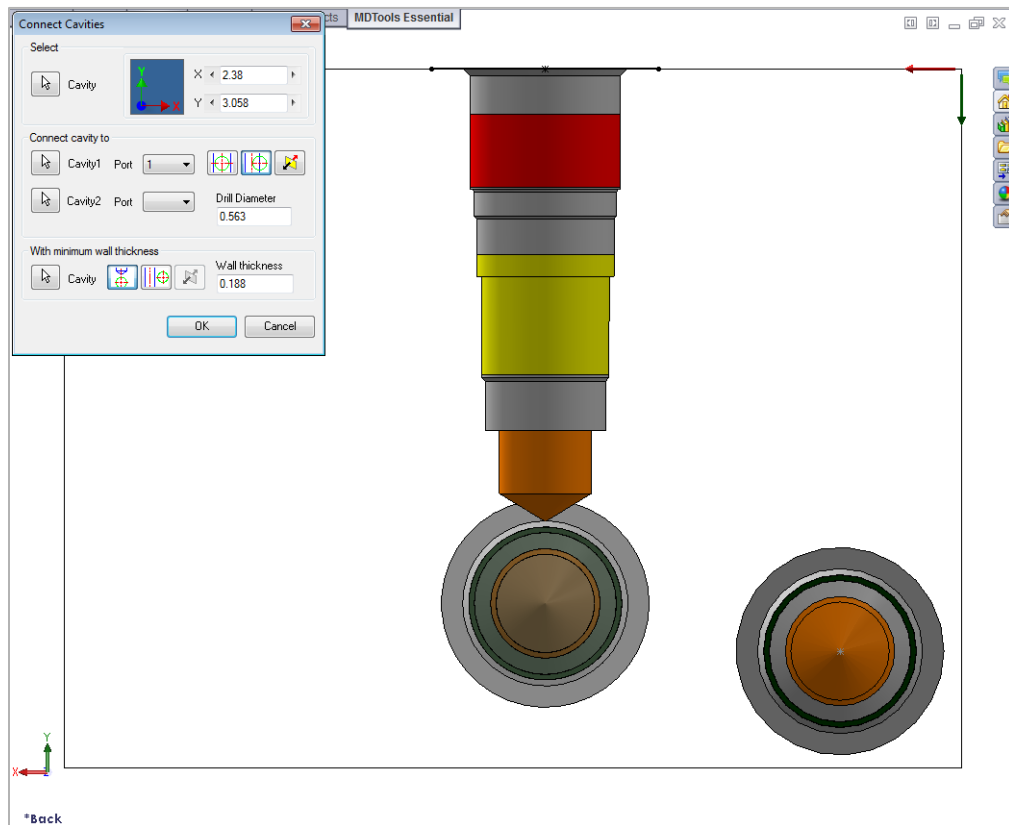
1. Click the selection button for cavity.
2. Select an existing cavity on the manifold.
3. Click the Move to side button to position the new cavity away from the selected cavity axis.
4. Click the Flip side button to change the side, if required.
5. Repeat the above steps to position the cavity with minimum wall thickness from a second cavity on the manifold.



*Positioning the cavity using the Move to side option*

### Note:

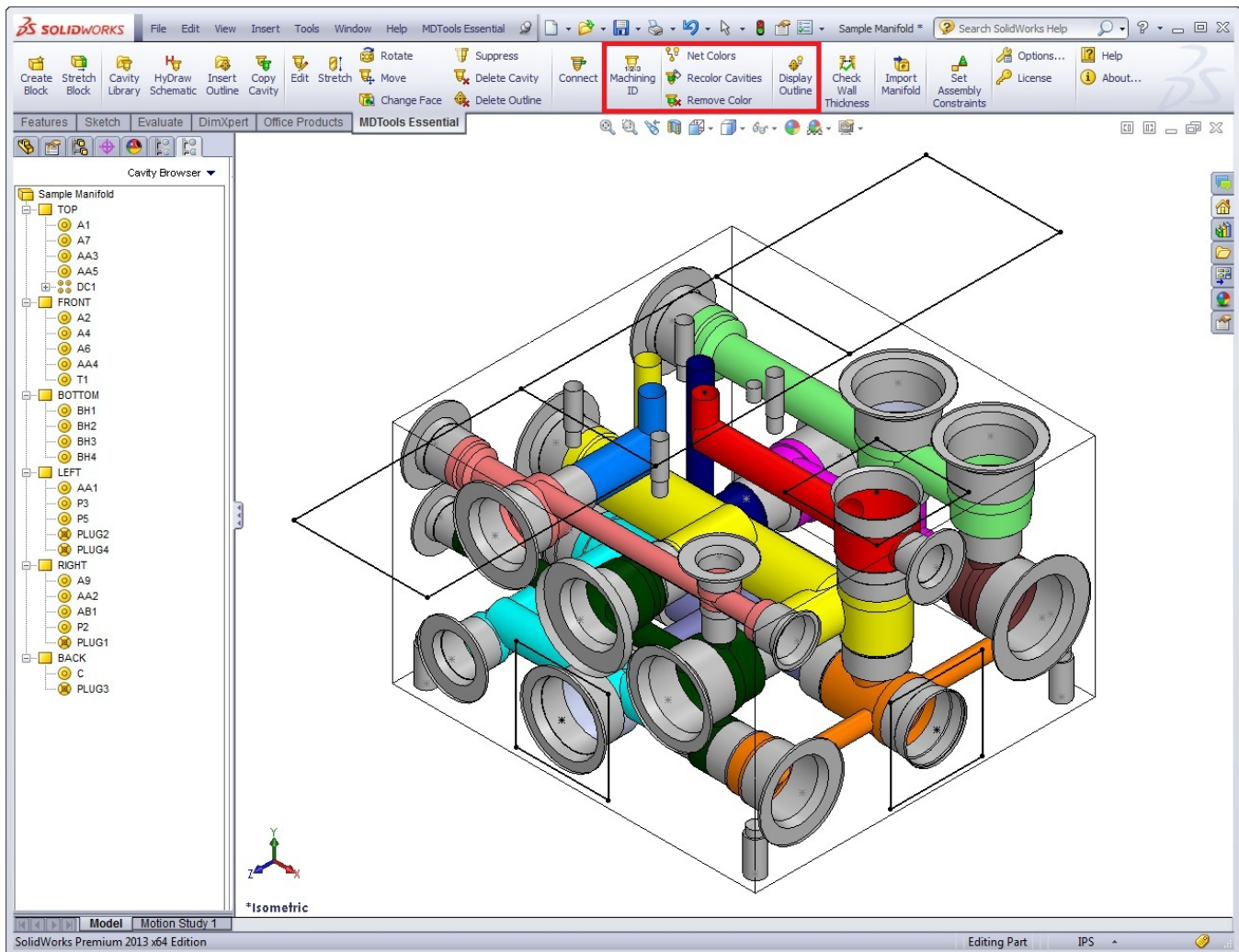
Choose the Locate below cavity tip option to locate the cavity with the minimum wall thickness from the tip of an existing cavity.



*Positioning the cavity below the cavity tip*

# Block Display

- 24 Machining ID
- 25 Net Colors
- 26 Recolor Cavities
- 27 Remove Color
- 28 Display Outline





## 24. Generate Machining ID

Automatically generate machining IDs for all the cavities on the manifold based on the diameter or distance naming options, and one of the four alternative numbering options.

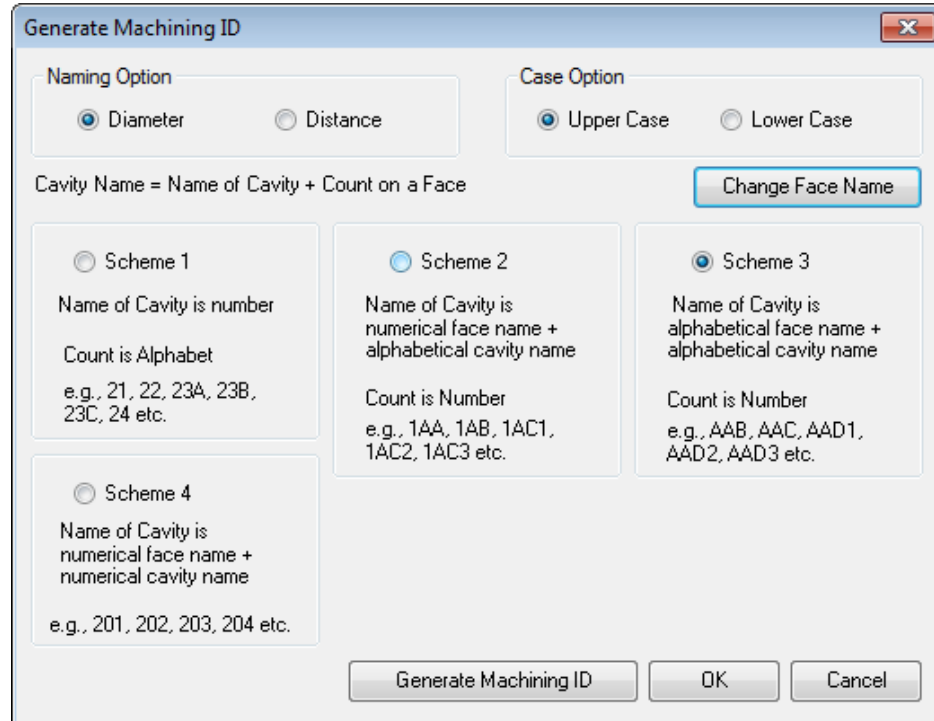
You can select between upper and lower case alphabets for cavity machining IDs.

The Generate Machining ID command depends on the following.

- The naming option selected
- The naming (numbering) scheme selected
- The face on which the cavity is located

MDTools Essential  
> **Machining ID**

The Generate Machining ID dialog box displays.



Generate Cavity Machining ID dialog box

### 1 Select Naming Option

#### Diameter

- Cavities with smaller diameters (in Step 0 or Step12) are assigned smaller numbers.
- Cavities are sorted by diameter.

#### Distance

- Cavities closer to the face origin point are assigned smaller numbers.
- Cavities are sorted by distance from the face origin.

### 2 Select Case Option

#### Upper Case

- Cavity names are displayed using upper case letters. For example, e.g. AA, AB, AC...

The default option is Upper Case.

#### Lower Case

- Cavity names are displayed using lower case letters. For example, e.g. aa, ab, ac...

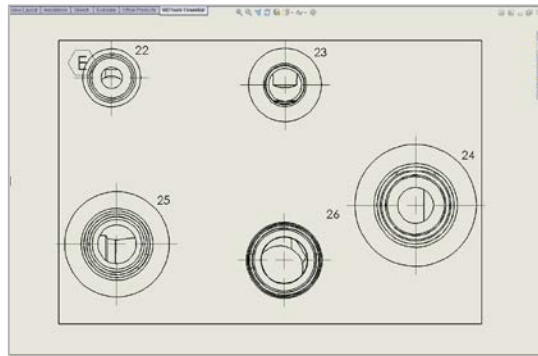
### 3 Select Cavity Naming Scheme

#### Scheme1: Number

- Name of the cavity is a number.
- Count is an alphabet and Naming Option: Diameter

*The number is incremented with each non-identical cavity found on the face starting with the cavity found with the smaller diameter on the first face.*

e.g., 21, 22, 23A, 23B, 23C, 24 etc.



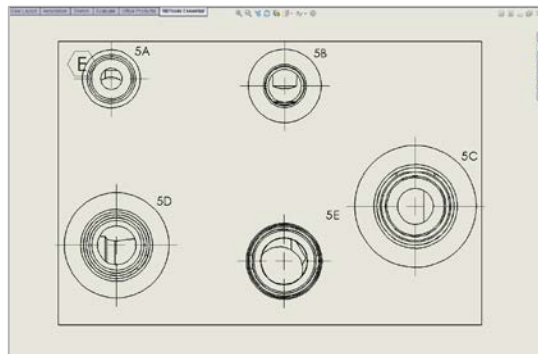
Scheme1

#### Scheme2: Number + Alphabet

- Name of the cavity is a numerical face name + alphabetical cavity name.
- Count is a number and Naming Option: Distance

*The number designates the face name; the alphabets are incremented in alphabetical order (alphabets I & O are left out) with each non-identical cavity found on the face.*

e.g., 1AA, 1AB, 1AC1, 1AC2, 1AC3 etc.



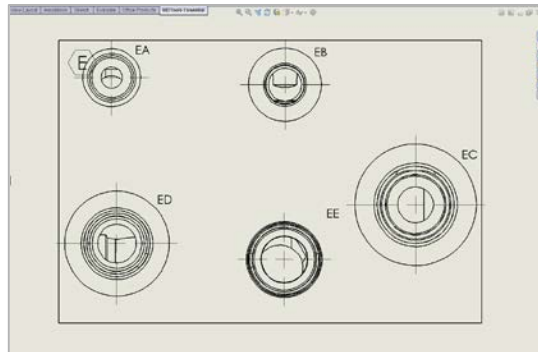
Scheme2

#### Scheme3: Alphabet + Alphabets

- Name of the cavity is an alphabetical face name + alphabetical cavity name.
- Count is a number and Naming Option: Diameter

*The first alphabet denotes the face name, the second set of alphabets are incremented in alphabetical order (alphabets I & O are not included) with each non-identical cavity found on the face.*

e.g., AAB, AAC, AAD1, AAD2, AAD3 etc.

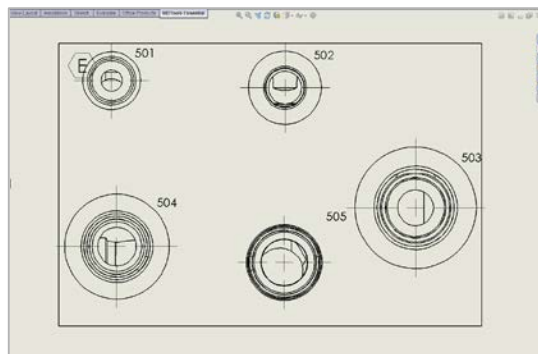


Scheme3

#### Scheme4: Count

- Name of the cavity is a numerical face name + numerical cavity name.
- Count is a number

e.g., 201, 202, 203, 204 etc.



Scheme4

### 4 Click Generate Cavity Machining ID

*MDTools® generates cavity-machining ID based on the selected option.*

*The cavities on the different faces of the manifold are named in the default order of faces i.e. A, B, C, D, E, and F.*

## 25. Net Colors

Toggle the nets (flow paths) color display between 'on' or 'off'. You can also change the color of nets inside the manifold.

### ➤ MDTools Essential > Net Colors

The Manage Net colors dialog box displays.

MDTools® automatically assigns default colors for all the nets. Net visibility shows the 'on' or 'off' status of the net.

#### Show/Hide Selected Net

Show or hide a single net in the manifold.

You can select one net at a time.

1. Select the net from the list.

MDTools displays the net name and color on the dialog box.

2. Click **Show** to display the selected net.

MDTools displays the selected net with the selected net color.

3. Click **Hide** to hide the selected net.

MDTools hides the selected net.

#### Show/Hide All Nets

Show or hide all the nets in the manifold.

4. Click Show All

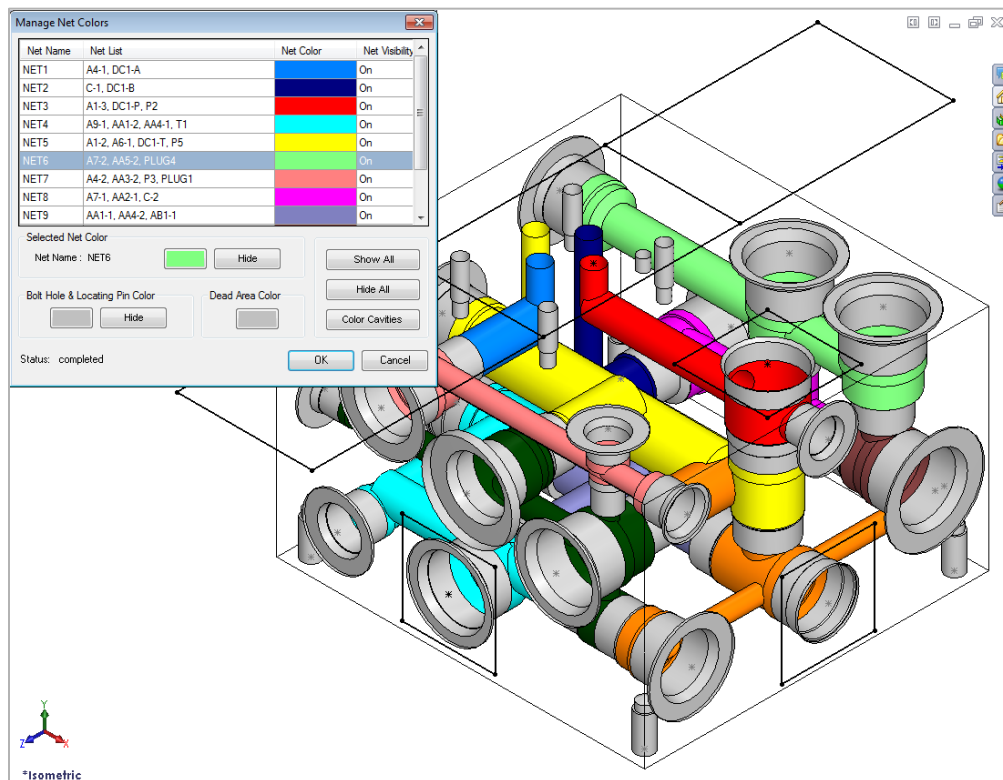
MDTools shows each net in the manifold with a different color.

#### Show/Hide Bolt Holes and Locating Pins

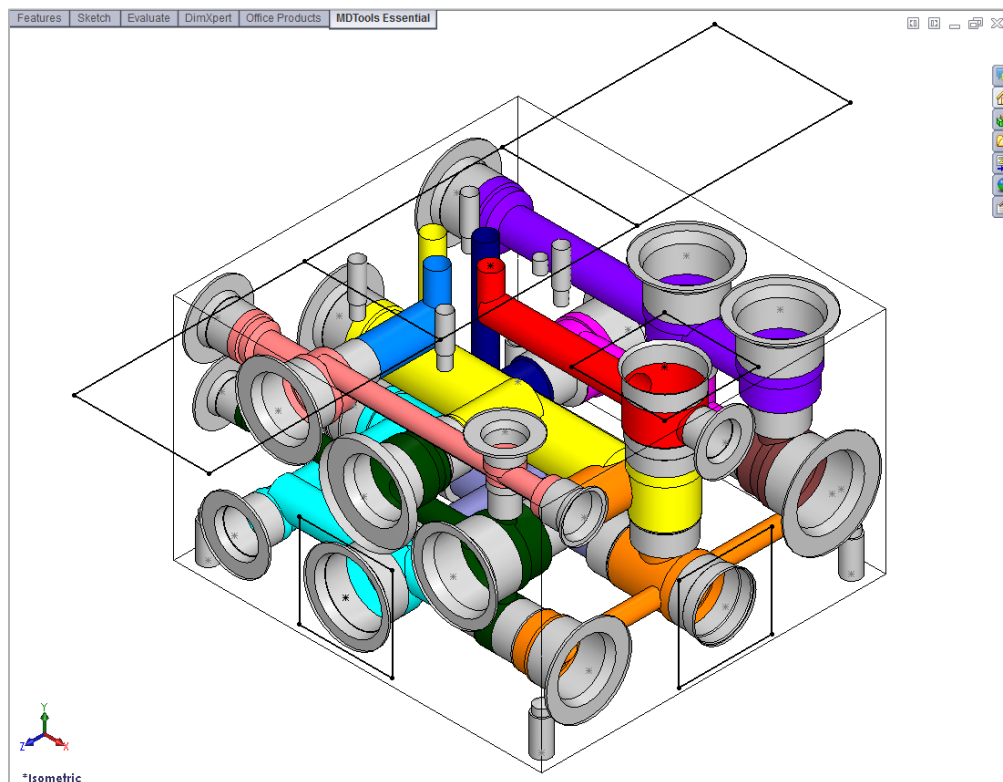
Show or hide bolt holes and locating pins color in the manifold.

5. Click the Show button in the Bolt Holes & Locating Pin Color section.

MDTools displays the bolt holes and locating pins on the manifold.



Net Display dialog box



Nets displayed with different color

**Note:**

- Use the Hide button to switch off the visibility of a single net.
- Use the Hide All option to switch off the visibility of all the nets.

**Change Color**

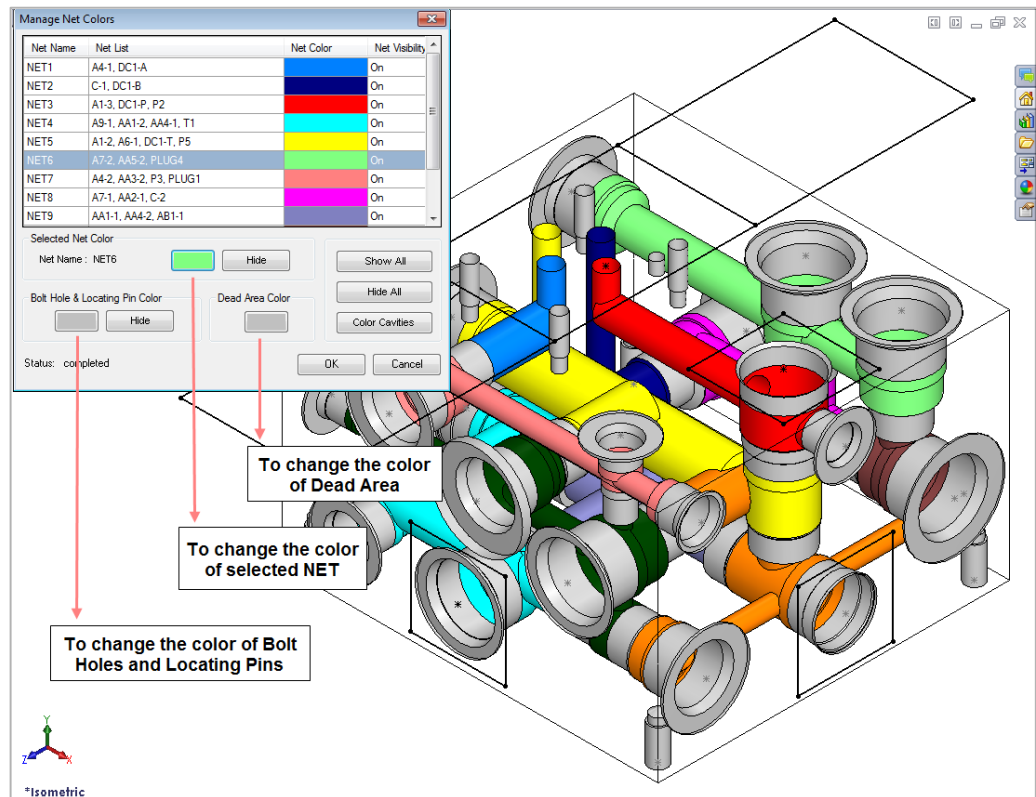
Change the color of nets, bolt holes and locating pins, dead areas in ports, and cartridge valve cavities.

- Click the **Color** button.

*The Color dialog box displays.*

**Note:**

- Click the Color button to change the net color of a selected net.
- Click the Bolt Hole & Locating Pins Color button to change the color of bolt holes and locating pins.
- Click the Dead Area Color button to change the color of dead areas in cavities.



*Manage Colors : Change color*

- Select the required color from the Color dialog box.
- Click OK.

*MDTools® automatically updates the color and the net display.*

**Note:**

You can also change the default Net colors from MDTools Options.

## 26. Recolor Cavities

*Shade or update the shading of cavities on the manifold.*

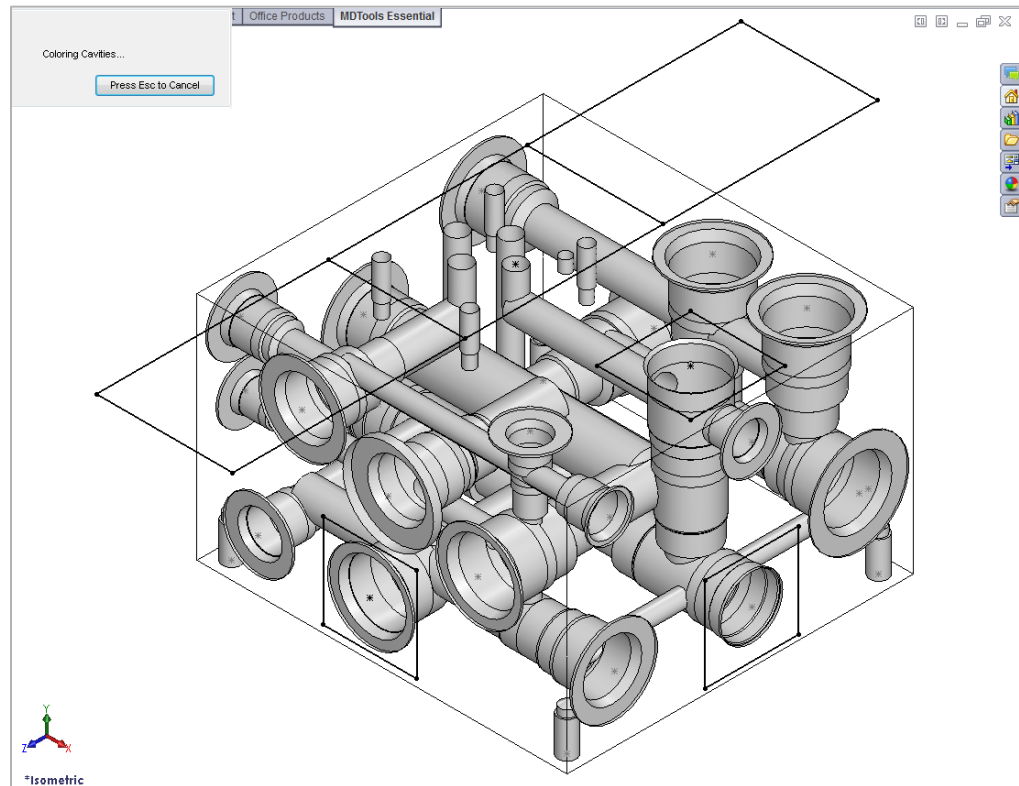
### MDTools Essential > Recolor Cavities

*The Coloring Cavities message box displays.*

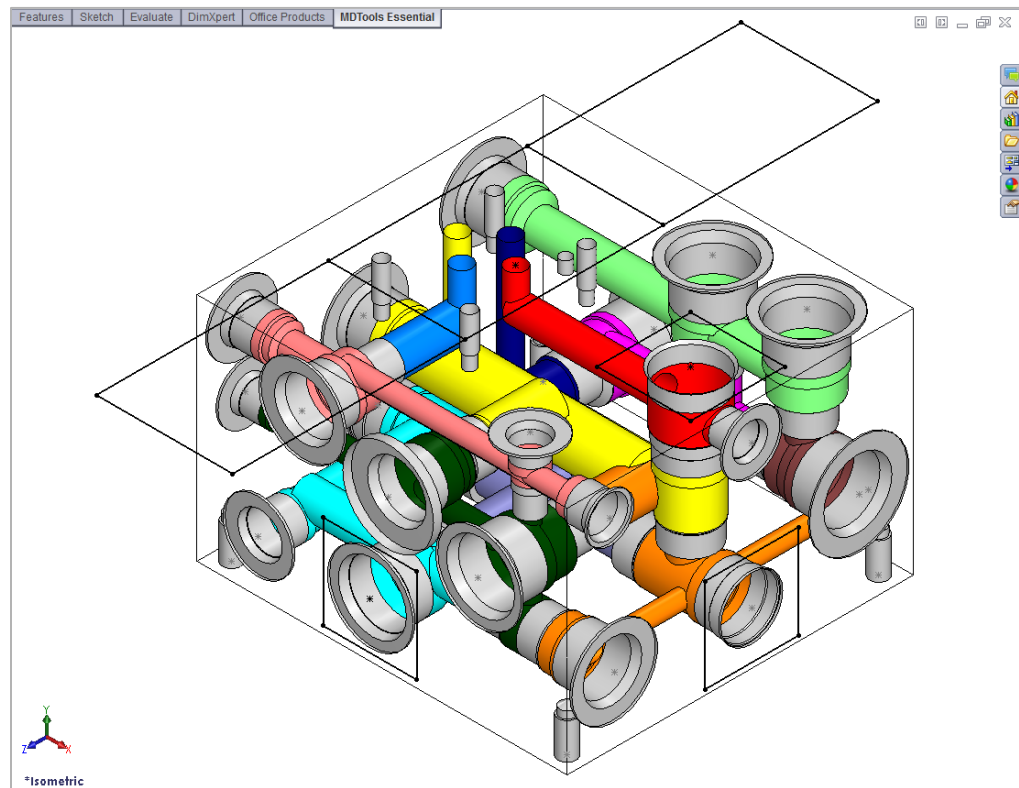
*MDTools® shades all the cavities on the manifold.*

#### Note:

You can terminate the Recolor Cavities command by pressing the **Esc** key.



*Recolor Cavities*



*Cavities shaded automatically with their net colors*



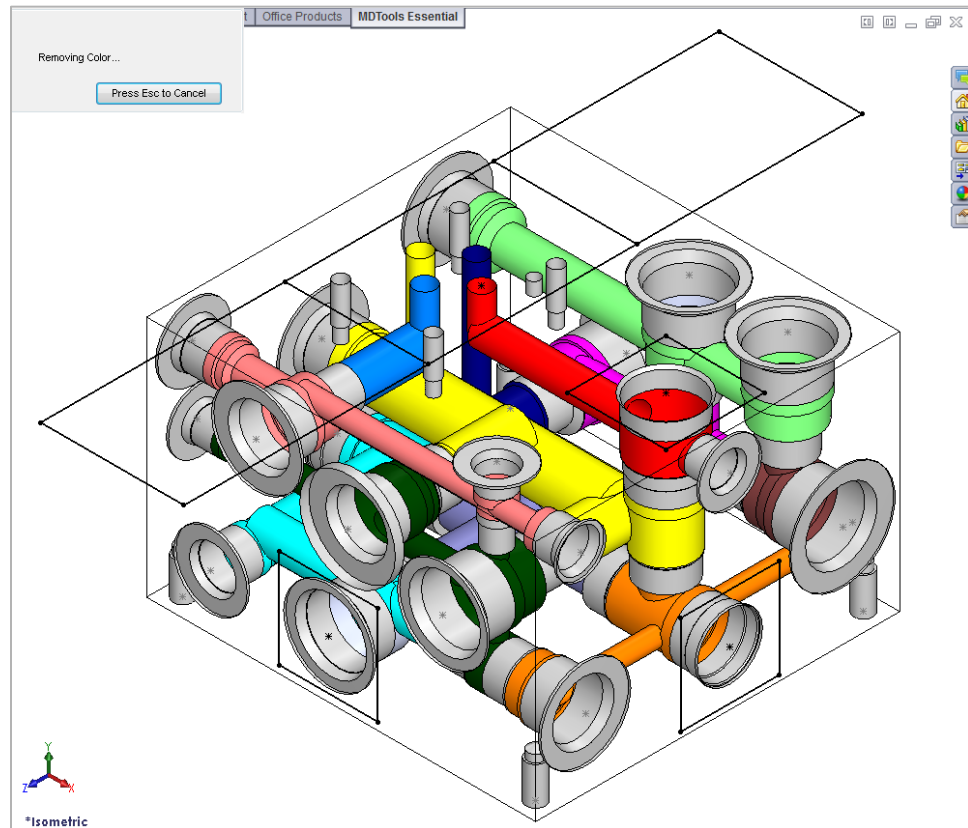
## 27. Remove Color

*Remove the shading of cavities on the manifold.*

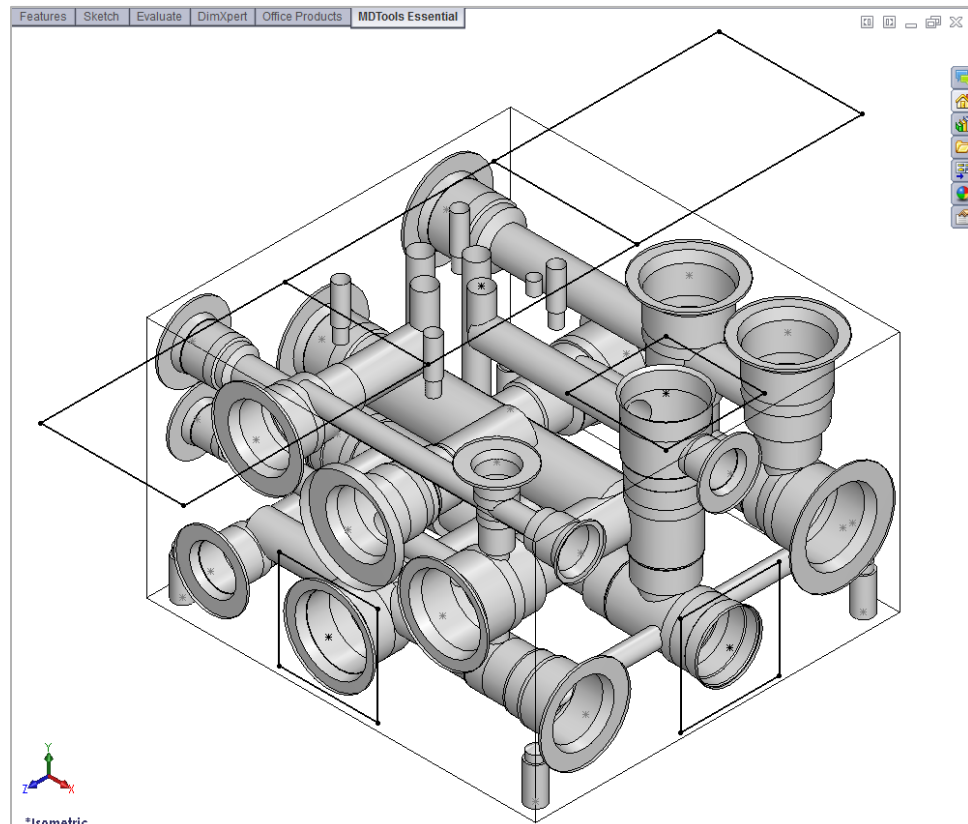
### Removing Cavity Shading

MDTools Essential  
> **Remove Color**

*MDTools removes the shading of all the cavities on the manifold.*



*Remove Color of Cavities*



*Color removed from Cavities*



## 28. Display Outline

*Toggle the visibility of component outlines and footprint envelopes on the manifold.*

1. MDTools Essential  
> Display Outline

*The Display Envelope/Outline dialog box displays.*

2. Select the Envelope type.

*Both the Assembly Envelope and Footprint Envelope options are selected by default.*

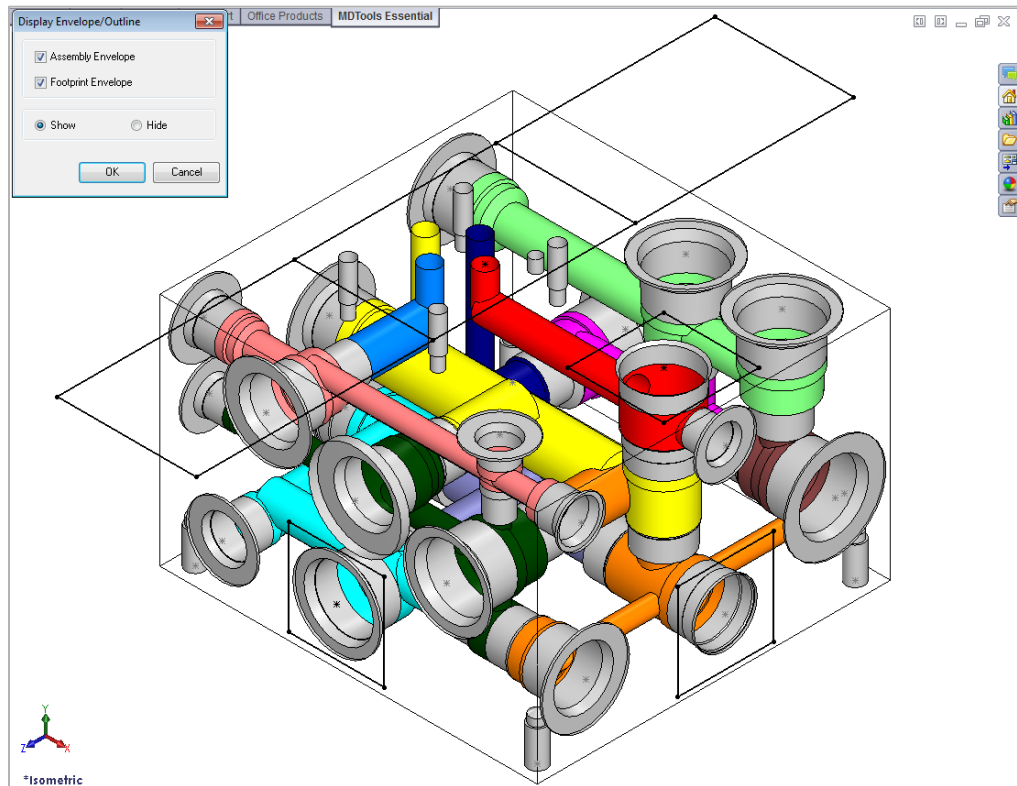
3. Select the display option.

*To turn the visibility 'off', select the Hide option. Else, select the Show option*

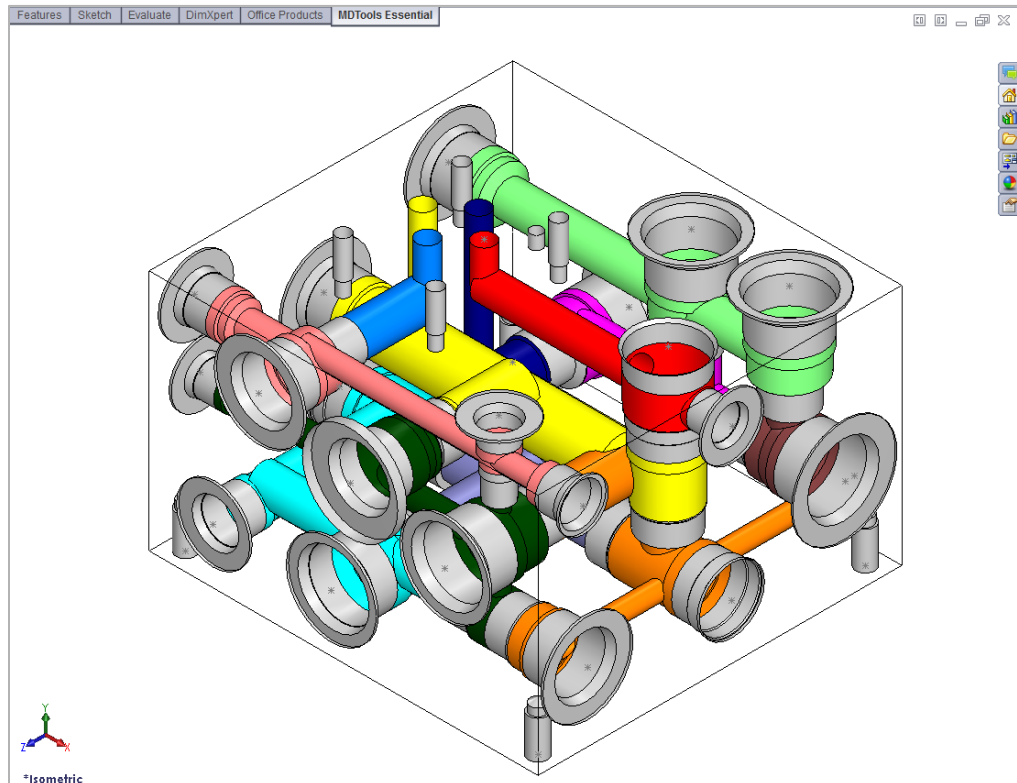
*Show is the default state.*

4. Click **OK**.

*If the Hide option is selected, then MDTools® turns the visibility of the entire selected envelope types on the manifold to 'off', else all the envelopes are visible.*



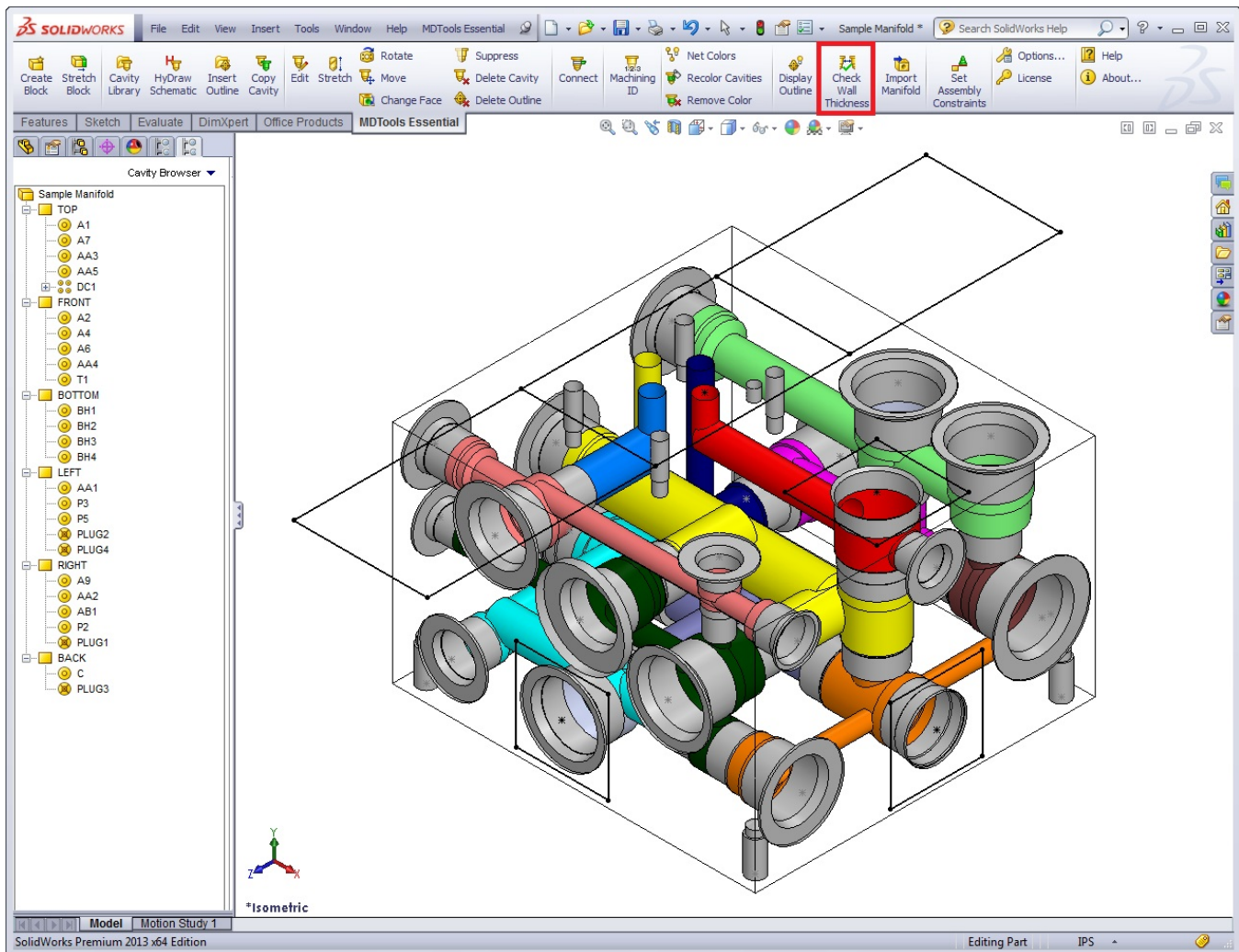
Display Envelope/Outline dialog box



Visibility of envelopes switched off

# Design Check

## 29 Check Wall Thickness



## 29. Check Wall Thickness

*Check the Wall Thickness –between two selected cavities.*

*If the wall thickness between the cavities is less than the minimum required value specified, then wall thickness check will list in parenthesis, the actual wall thickness between the cavities next to the cavity name.*

1. MDTools Essential  
> **Check Wall Thickness**

*Wall Thickness:  
Between Two  
Cavities dialog box  
displays.*

2. Enter the minimum  
wall thickness  
required.

*The default minimum  
wall thickness is  
displayed according  
to the value defined  
in MDTools Options.*

3. Select the required  
cavities for the wall  
thickness check.

4. Click Start Wall  
Thickness Check.

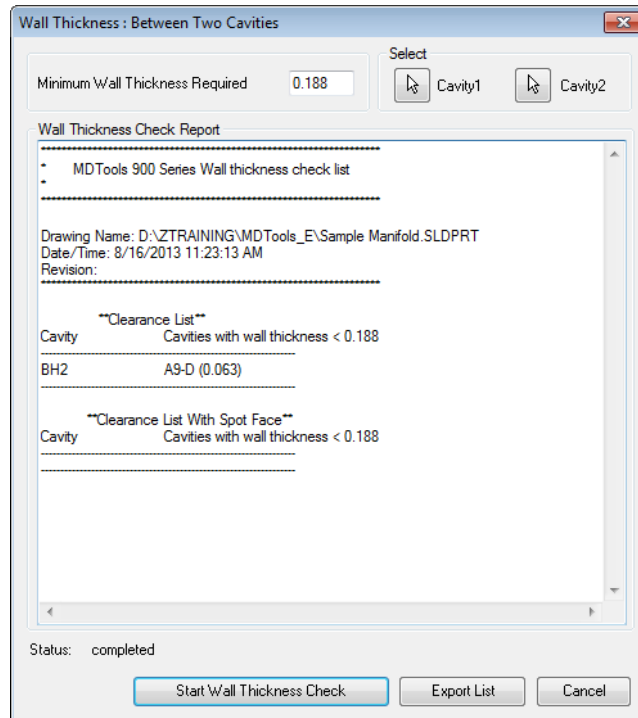
*MDTools® checks the  
internal wall  
thickness between  
cavities and displays  
the list of cavities  
with wall thickness  
less than the  
specified value.*

5. Click **Export List**  
button to save the  
list.

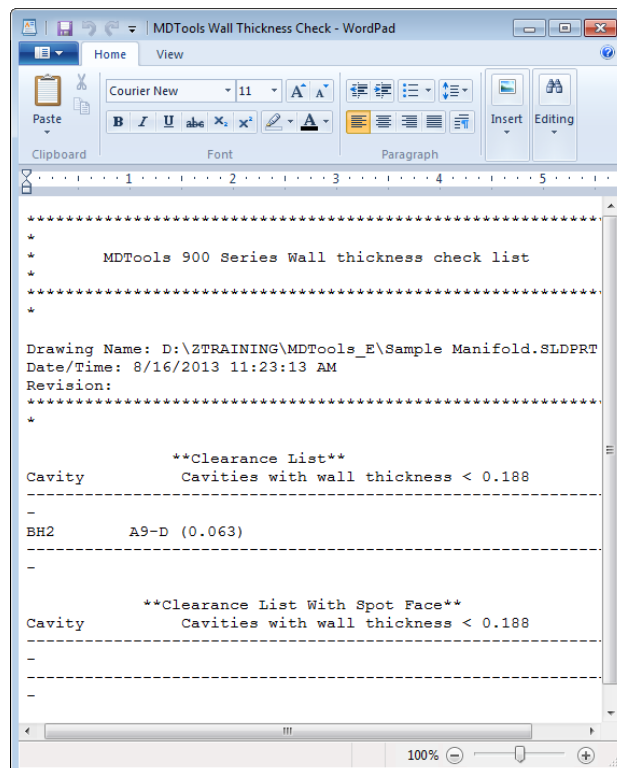
*The Save As dialog  
box displays.*

6. Enter an appropriate  
file name.

7. Click **Save** to save  
the list.



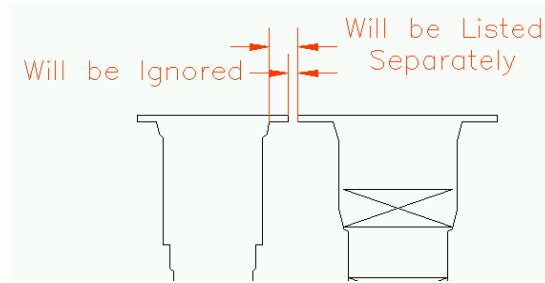
Check Wall Thickness dialog box



Wall Thickness Check Report

**Note:**

- Wall thickness between spot faces of two cavities is ignored in the wall thickness check.
- Other than the spot face to spot face clearance, clearance problems between the spot face of cavity1 and cavity2 in the manifold is listed separately.



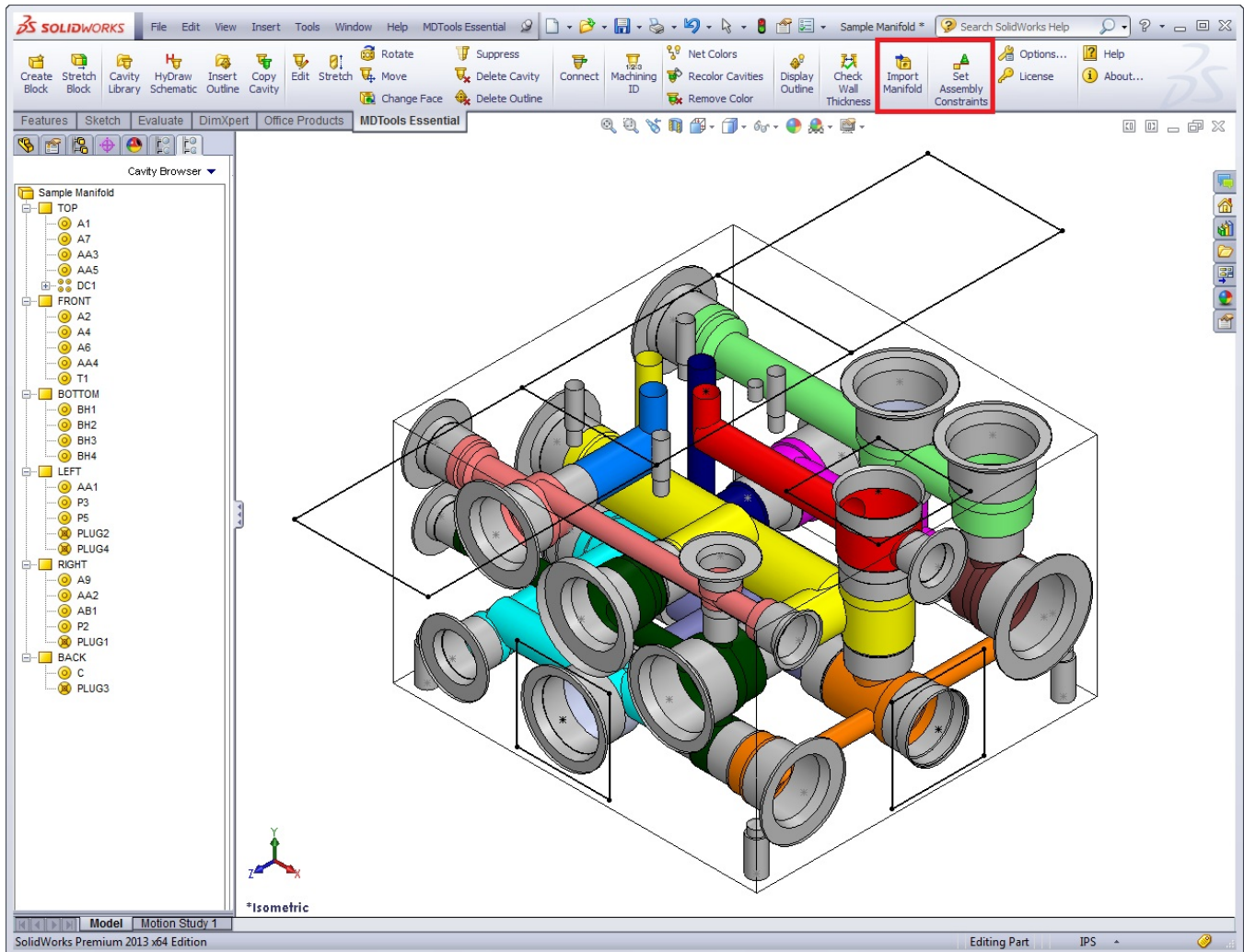
*Wall thickness between spot face*

**CAUTION!**

- MDTools® lists the minimum wall thickness between the cavities.
- If a cavity is listed in the spot face clearance list, then it is possible that the wall thickness between other parts of cavities may also be less than the minimum value specified.
- Make sure that there is enough wall thickness around other parts of cavities before making any decision regarding the clearance issues listed in the spot face clearance list.

# Miscellaneous Commands

- 30 Import Manifold
- 31 Set Assembly Constraints





## 30. Import Manifold

Import the MDTools® manifold XML file and automatically create a new manifold in SolidWorks.

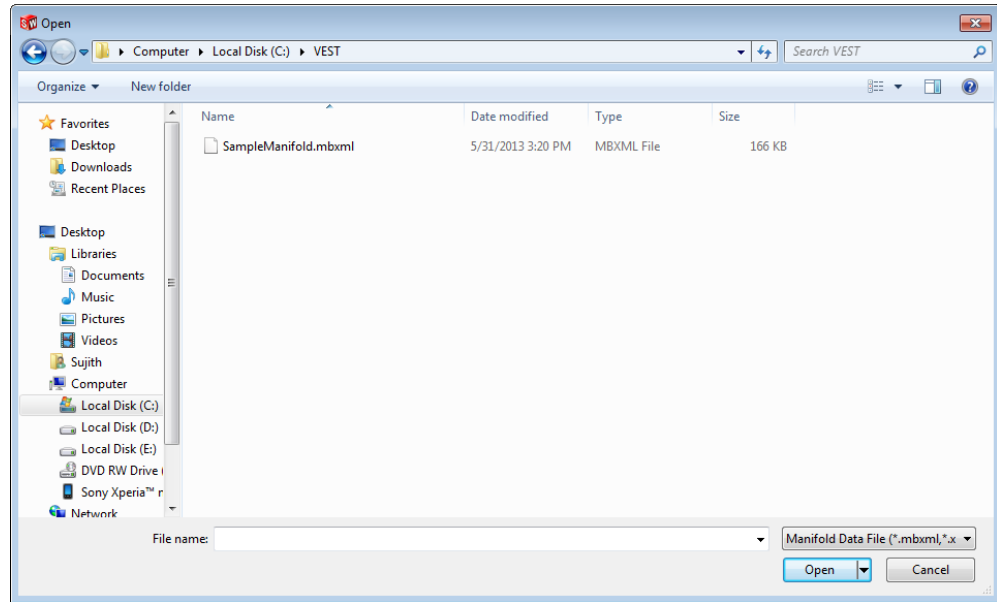
1. MDTools Essential  
> **Import Manifold**

*The Open dialog box displays.*

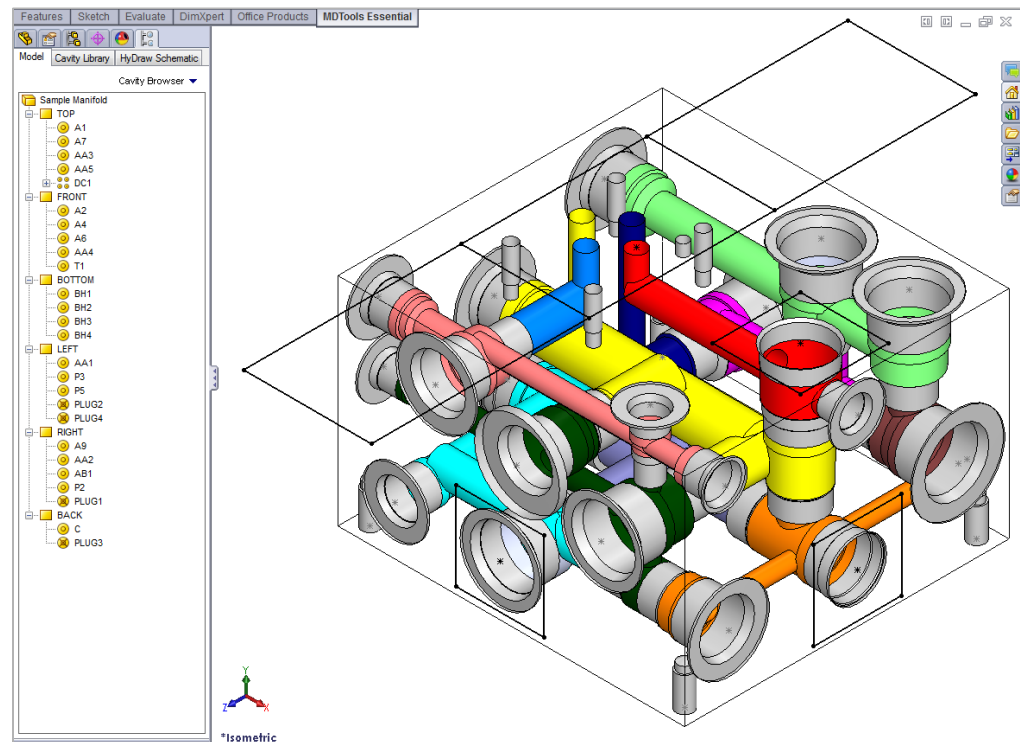
2. Select the MDTools manifold data file.

3. Click **Open**.

*The program reads the input manifold data file and creates a new manifold in SolidWorks.*



Open XML File dialog box



Imported Manifold in SolidWorks



# 31. Set Assembly Constraints

*Set all the assembly constraints on part/assembly models.*

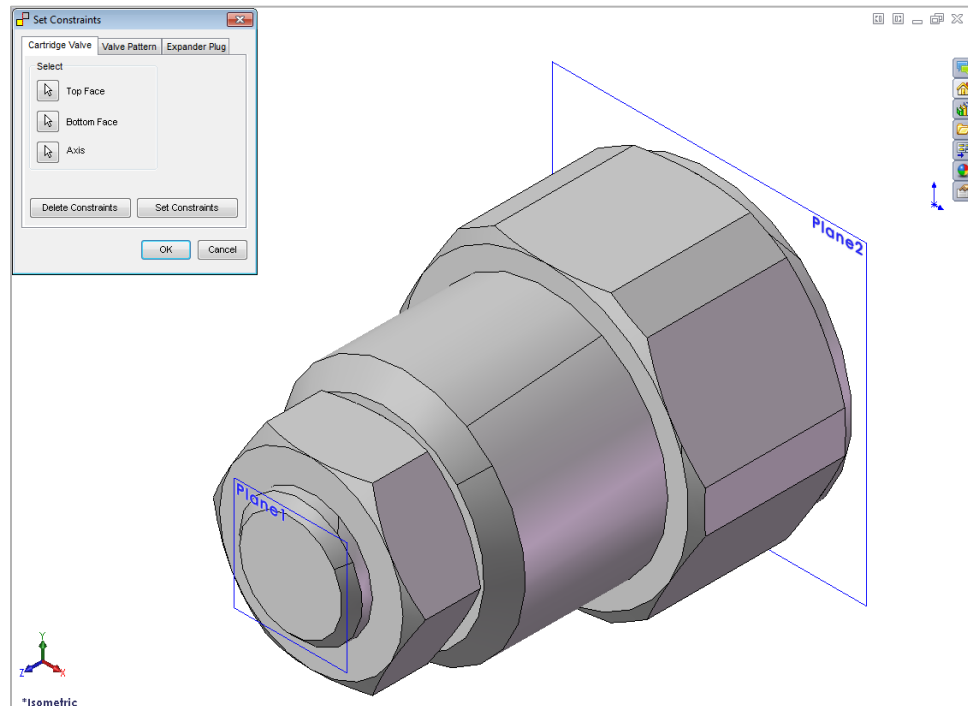
Set assembly constraints on all the part/assembly models to make them work with the Assembly Interface.

*Parts without the assembly constraints will not get assembled on the manifold.*

- Open the part/assembly model of valve in SolidWorks.
- MDTools Essential > **Set Assembly Constraints**  
*The Set Constraints dialog box displays.*

The Set Constraints dialog box contains the following tabs.

- Cartridge Valve
- Valve Pattern
- Expander Plug



Set Constraints: Cartridge Valve tab

## 1. Cartridge Valve Tab

1. Set assembly constraints for the cartridge valves, port fittings, and plugs.

*For these components, you need to specify three parameters, Top Face, Bottom Face, and Axis.*

2. Select the **Top Face** button.

3. Select a planar face as the top face.

*MDTools® automatically creates a work plane passing through selected face.*

4. Select the **Bottom Face** button.

5. Select a planar face as the bottom face.

*MDTools automatically creates a work plane passing through the selected face.*

6. Select the **Axis** button.

7. Select a cylindrical of valve body.

*MDTools automatically creates an axis line passing through the axis of the selected cylindrical face.*

8. Click **Set Constraints** to set assembly constraints.

*MDTools sets all the assembly constraints.*

*The Set Constraints dialog box closes.*

*Now, this part is ready for use with the Assembly Interface.*

9. Save the model.

### Note:

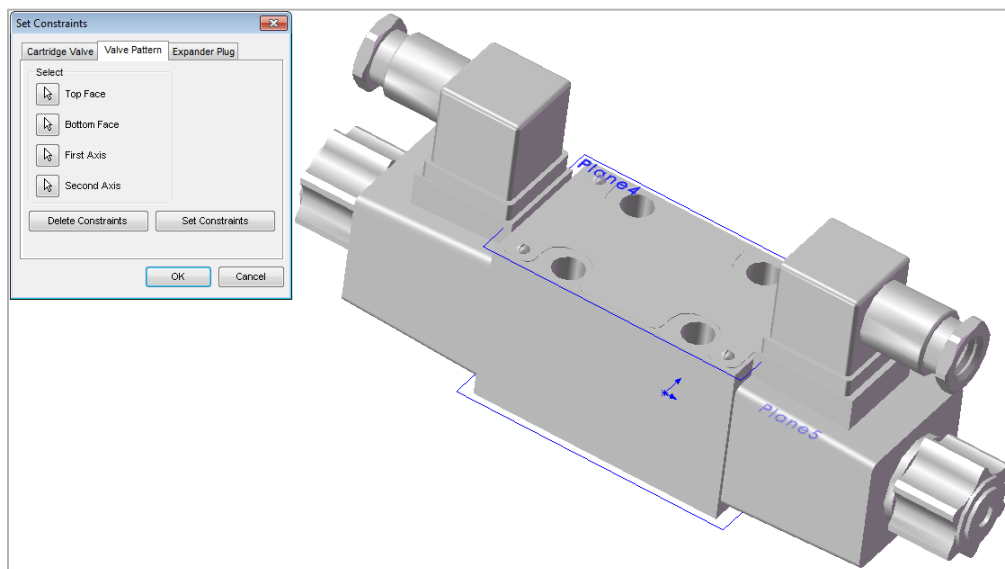
- Use this option to set assembly constraints for solenoid coils and lock nut/manual overrides on the Screw-in cartridge solenoid valves.
- Bottom work plane will mate with the spot face of cavity during assembly. So, the bottom work plane must be created on the face that needs to mate with the spot face of the cavity.

## 2. Valve Pattern Tab

1. Set the assembly constraints for the surface mounted valves, slip in cartridge valves, or flanges.

*For these components, you need to specify four parameters: Top Face, Bottom Face, First Axis, and Second Axis.*

2. Select the **Top Face** button.
3. Select the top face work plane.



Set Constraints dialog box: Valve Pattern tab

4. Select the **Bottom Face** button.
5. Select the bottom face work plane.
6. Select the first **Axis** button.
7. Select the axis passing through *LP/LP1/BH1*.
8. Select the second **Axis** button.
9. Select the axis passes through *LP2/BH2*.
10. Click **Set Constraints** to set assembly constraints.  
*MDTools® sets all the assembly constraints. The dialog box closes.*  
*Now, this part is ready for use with Assembly Interface.*
11. Save the part model.
12. Click **OK**.

### Note:

#### First Axis

- Create axis passing through the locating pin for valves with one locating pin.
- Create axis passing through the locating pin LP1 for valves with two locating pin.
- Create axis passing through the bolt hole BH1 for valves with no locating pin.

#### Second Axis

- Create axis passing through the bolt hole BH1 for valves with one locating pin.
- Create axis passing through the locating pin LP2 for valves with two locating pin.
- Create axis passing passes through the bolt hole BH2 for valves with no locating pin.

**LP1** is the locating pinhole with port application name LP1 and LP2 is locating pinhole with port application name LP2 on the footprint.

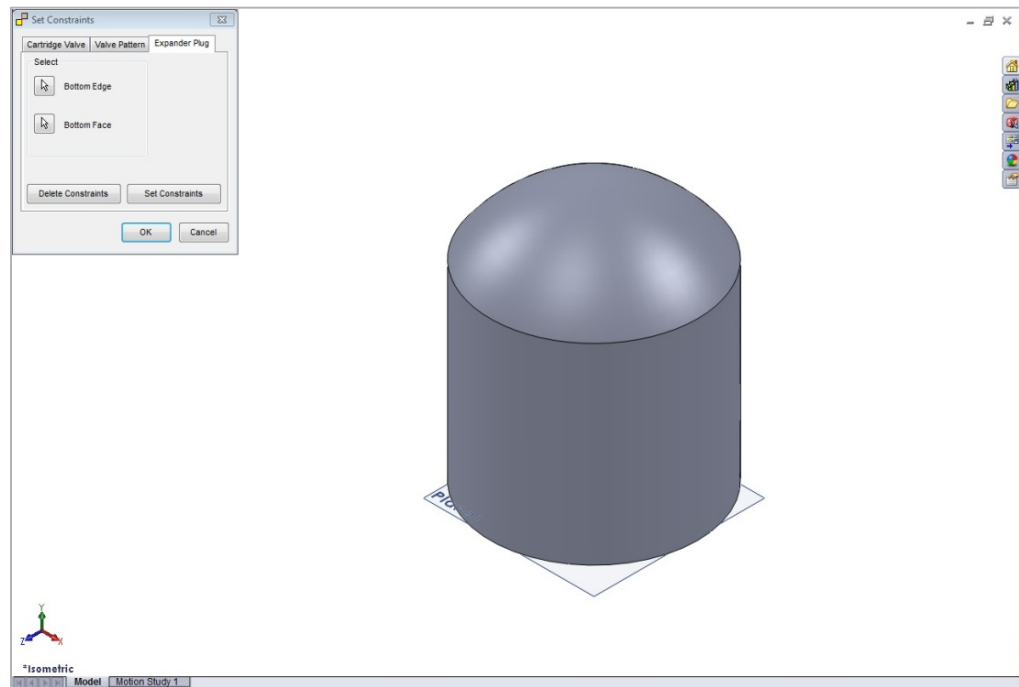
**BH1** is the bolt hole with port application name BH1 and BH2 is bolt hole with port application name BH2 on the footprint.

### 3. Expander Plug Tab

If there is no spot face in the cavity (Step0 angle is not equal to 90), then you must use the Expander Plug tab to set the assembly constraints, for example in the expander plug ports.

In such cases, you need to set only one constraint, i.e., Bottom Edge.

1. Select the **Bottom Edge** button.
2. Select the bottom edge on the model that mates with the bottom edge of Step 0 of the cavity.
3. Select the Bottom Face button.
4. Select the Bottom Plane.
5. Click **Set Constraints** to set the assembly constraints.
6. Save the part model.

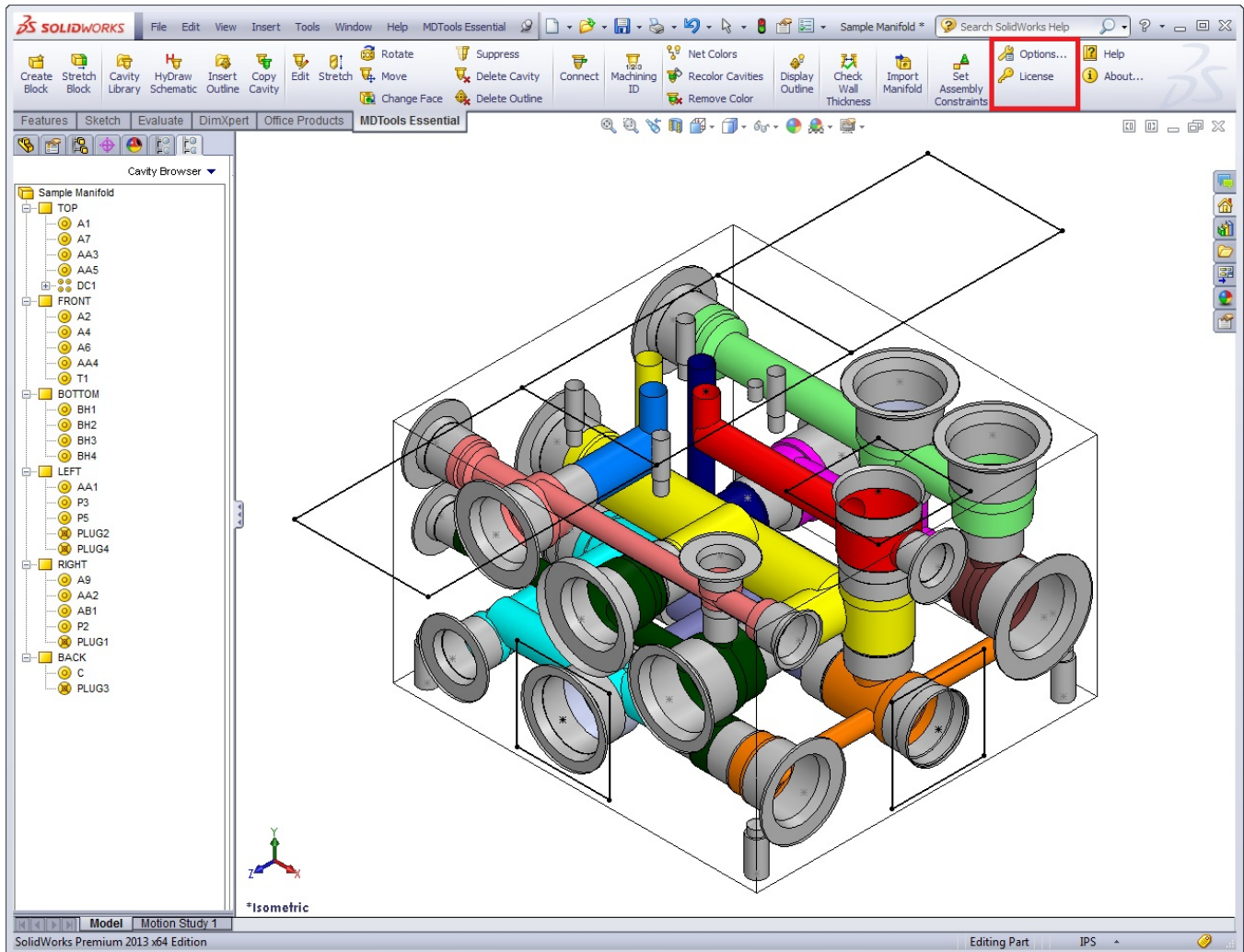


*Set Constraints dialog box: Expander Plug tab*

# MDTools Settings

32 Options

33 License



## 32.MDTools Options

Set the library path, net color, design unit and other miscellaneous options.

MDTools® enables you to share the library with all the designers in your organization so that all of them use the same data. You can easily manage changes in standards or libraries within your organization.

### MDTools Essential > Options

The MDTools Options dialog box displays.

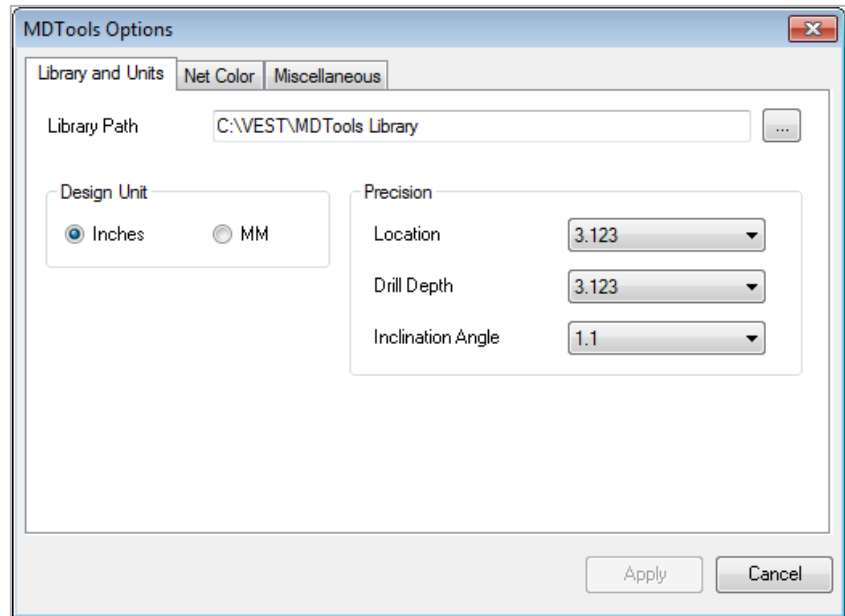
#### Units

- Design Unit: Sets the design unit. Inches or MM
- Precision: Sets the manufacturing precision for the design Location, Drill Depth and Inclination

#### CAUTION!

Set the design units before inserting the first cavity.

You cannot change the unit, if any MDTools feature exists in the manifold.



Library and Units Tab

#### Library Path

The Library Path sets the location of the MDTools library.

1. Click the browse button to search the Library Path....

The Browse for Folder dialog box displays.

2. Browse and select the folder containing the MDTools library.

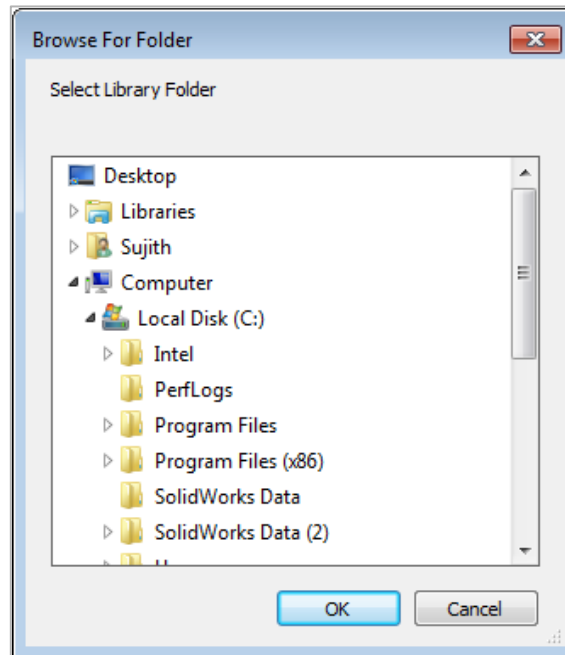
You can also change the library path by entering the new library path in the Library Path text box.

3. Click **OK** to confirm the selection.
4. Click **Apply**.

MDTools saves the change in the Library Path and Unit Settings.

5. Click **OK**.

The Browse for Folder dialog box closes.



Browse for Folder dialog box

#### Note:

Set the library path on all the systems independently.

# Net Color

## Default Color

Dead Area	Sets the color for the dead areas on the cavity
Working Area	Sets the default color of the working areas on the cavity
Bolt Hole & Locating Pin	Sets the color for locating-pin holes and bolt holes

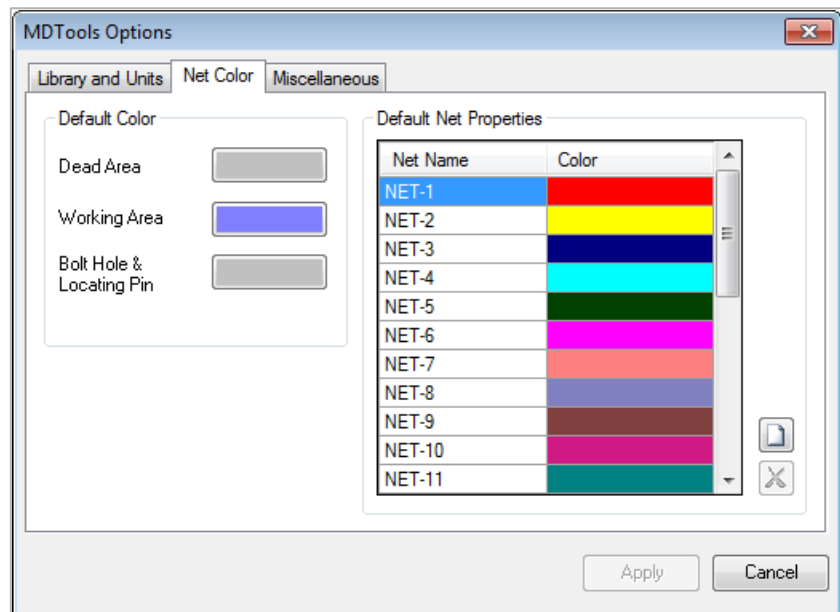
## Default Net Properties

Default Nets	View the default name and color for a number of defined nets (flow paths)
Add a Net	<p>To add a new net, click Add</p> <p>Change the default net name assigned, by clicking the newly added net name</p>
Delete a Net	To delete a net, select a net from the list and click Delete
Change Net Color	<p>Click the color band against a net name to change the color of the net name</p> <p>Click <b>Apply</b> to save settings</p>

### Note:

- Number of nets cannot be less than 25.
- MDTools® automatically assigns a new color to the newly added net.

Ensure that you use a visibly distinct color for the net.



Net Color Tab



# Miscellaneous

Cavity Machining ID	Switches between Cavity Machining ID, same as the component ID or not
Auto-Connect	Enables/Disables use of diameter available in <i>Tool Library</i> as connection diameter
Minimum Wall Thickness	Sets the default minimum wall thickness

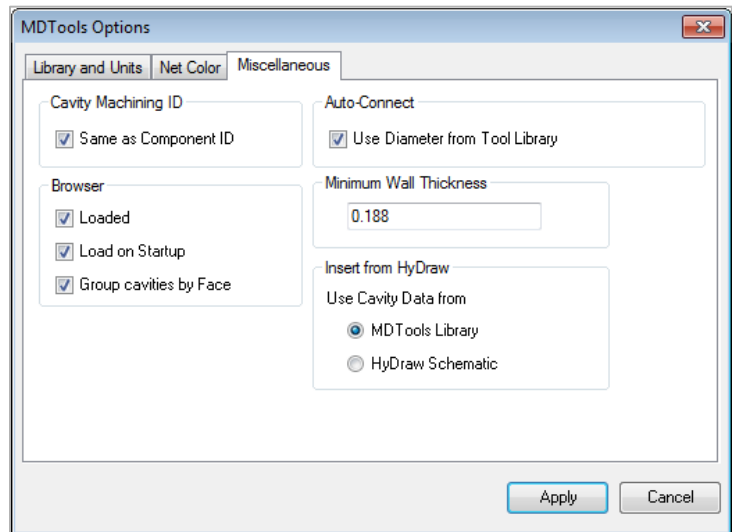
## Browser

Loaded	Switches the browser between Loaded and Unloaded
Load on Startup	Switches the browser setting between loading the browser on startup and loading the browser manually
Group cavities by Face	Switches between grouping of cavities in manifold by face or not

## Insert from HyDraw

Use Cavity Data from:

MDTools Library	Cavity inserted using geometric data available in MDTools® library
HyDraw Schematic	Cavity inserted using geometric data stored in HyDraw® Schematic XML file.

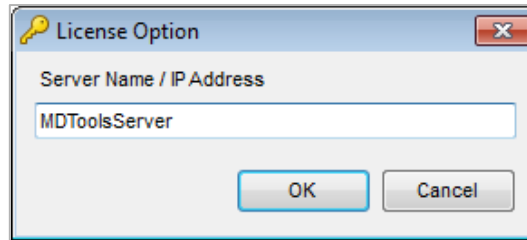


Miscellaneous Tab

## 33. License

1. Set the license path through the Part Model menu.
2. MDTools Essential  
> **License**

*The License Options dialog box displays.*

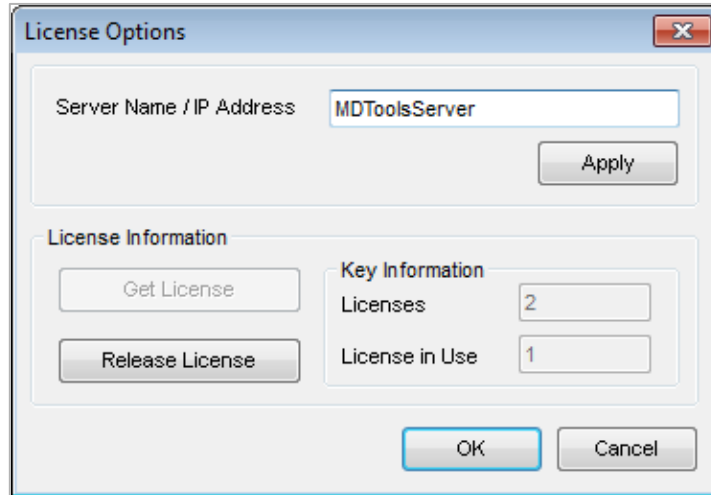


*MDTools Essential License Option dialog box*

3. Enter the server name or the IP address of the system, where the MDTools® hardware lock is located.
4. Click **Apply**.

*MDTools automatically selects a license and displays the license information in the License info form.*

*If a license is selected successfully, then the Get License button is disabled and the Release License button is enabled.*



*License Options dialog box*

5. To release a license, click the **Release License** button.

*This releases your license, the Release License option is disabled and the Get License button is enabled.*

6. To get a license, click the **Get License** button.

*If MDTools successfully gets a license, then the Get License button is disabled and the Release License button is enabled.*

7. Click **OK** to continue.

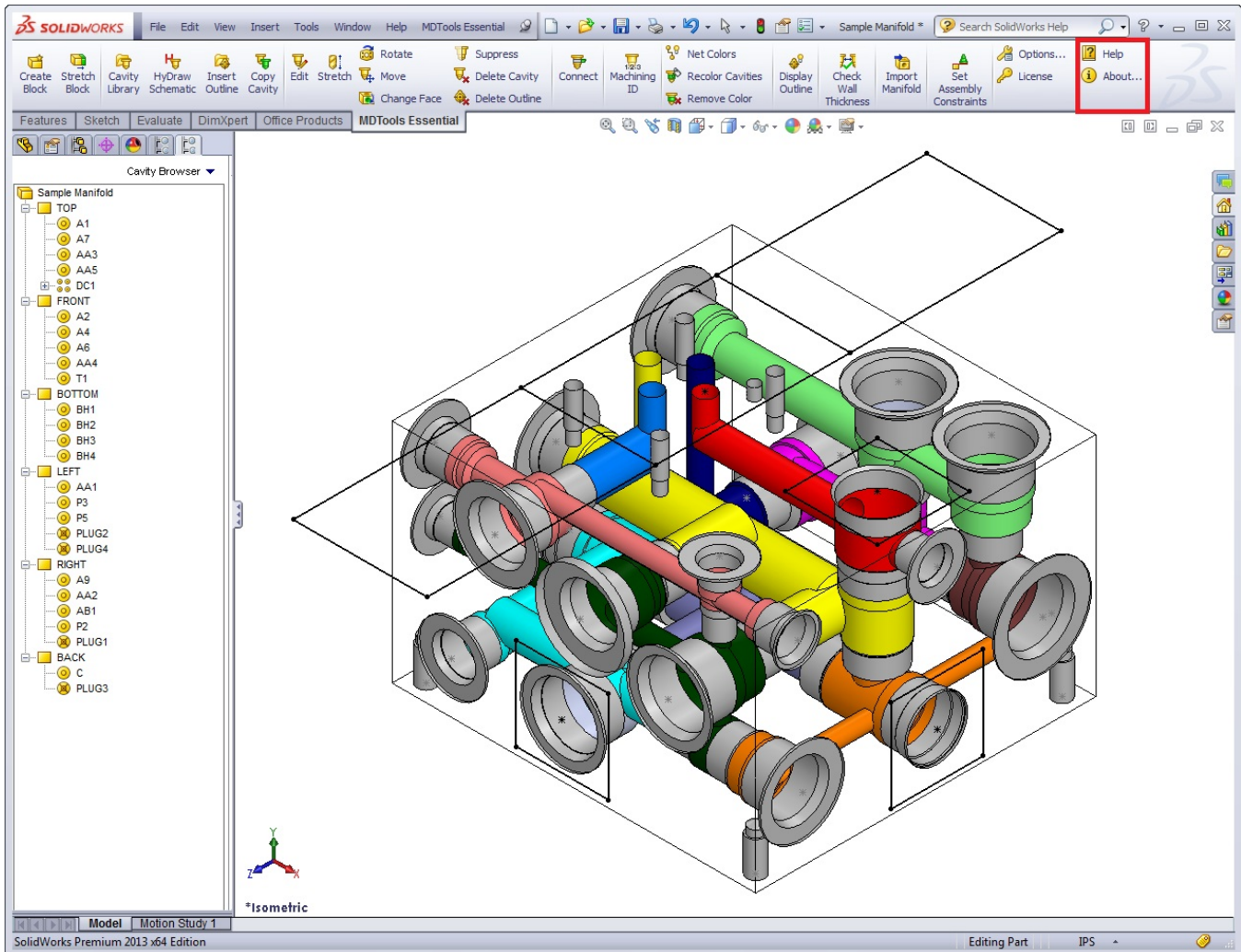
### Note:

This option is available only in the MDTools Essential Network license version.

# Help

34 User Manual

35 About MDTools

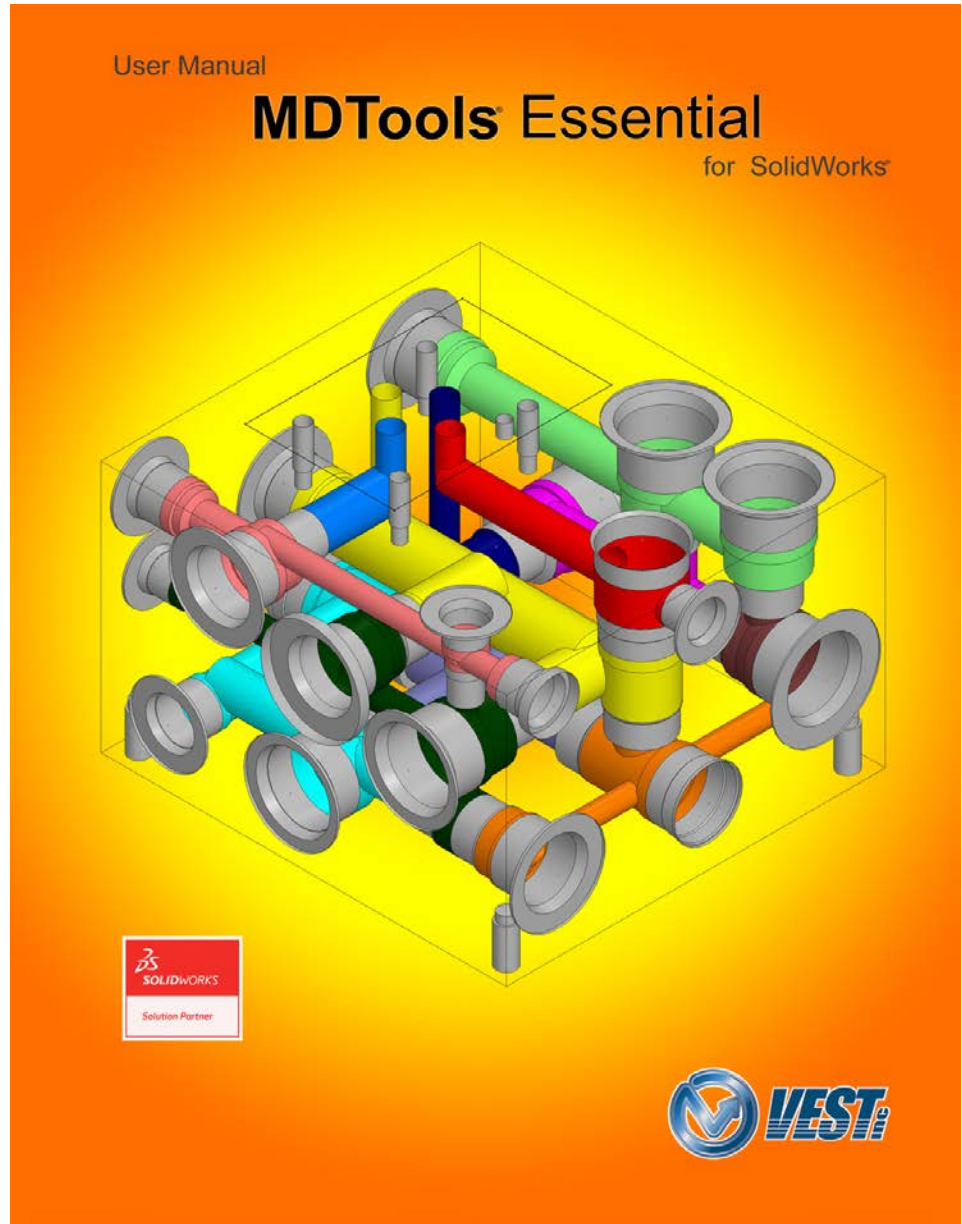


## 34. User Manual

*Open the MDTools® Essential user manual in the PDF format.*

MDTools Essential  
> **Help**

*The MDTools User Manual  
opens in the PDF format.*



## 35.About MDTools

*View the MDTools® version and build number.*

MDTools Essential  
> **About**

*The About MDTools  
Essential dialog box  
opens and displays the  
MDTools version and  
build.*



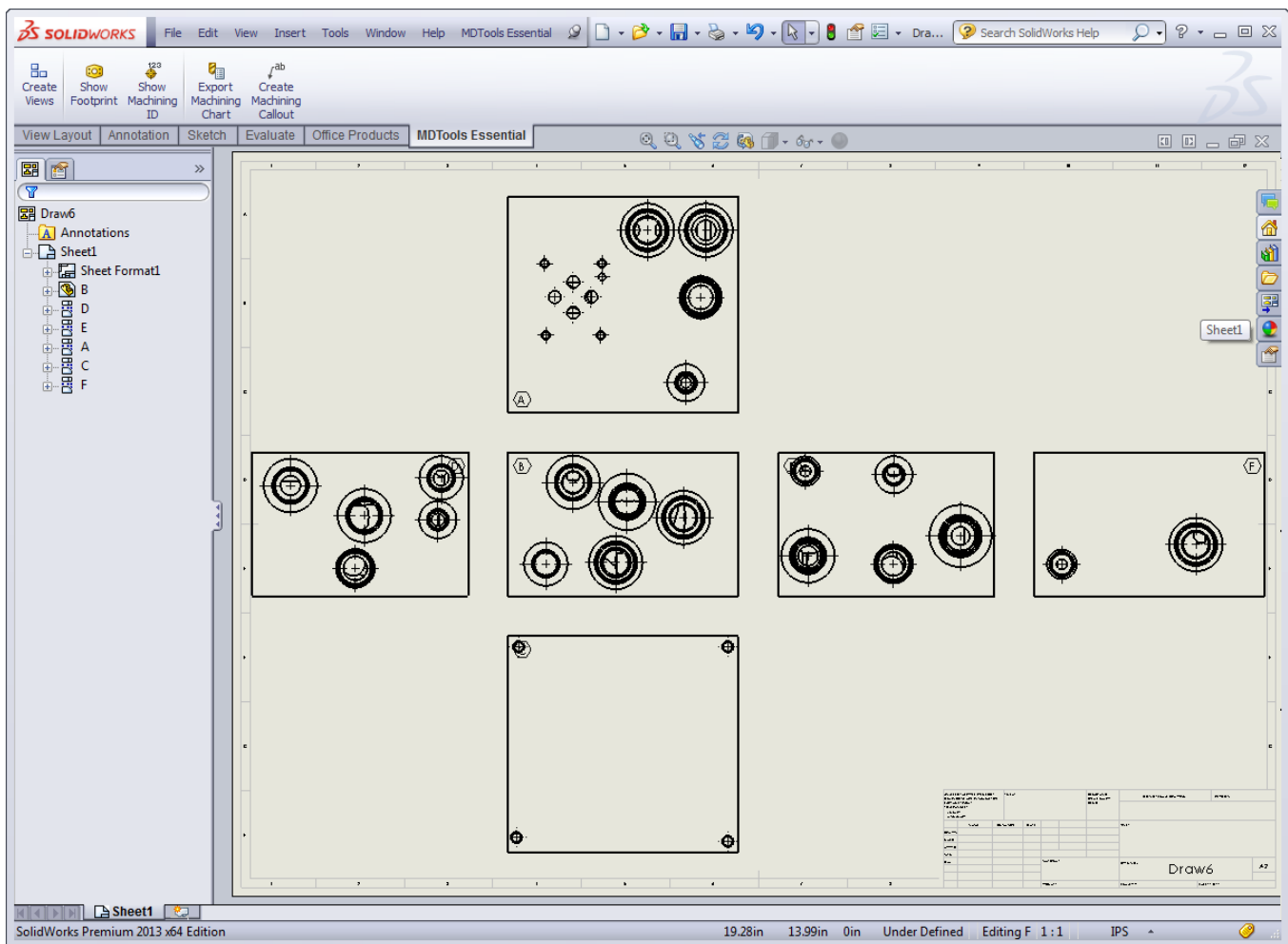
*About MDTools Essential dialog box*

# DRAWING COMMANDS

- 36 Create Views
- 37 Show Footprint
- 38 Show Machining ID
- 39 Export Machining Chart
- 40 Create Machining Callout

## CAUTION!

- MDTools® 2D commands work only if the views are created using the **Create Views** command.
- MDTools 2D commands can be undone only if the model is not rebuilt after using the command.





# 36. Create Views

*Automatically create 2D views of a manifold.*

1. MDTools Essential  
    > Create Views  
*The Create Views dialog box displays.*
2. Click **Browse** and select the block part model.
3. Click **Open**.

## Note:

- Names of the part models, which open in SolidWorks are listed in the File name drop-down list.
- You can also select the part model from the list.
- 4. Select the positioning option.

*The Auto Position option is selected by default.*

*The distance between views is automatically calculated.*

*The views are placed with the center of the front view at the center of the sheet.*

5. Deselect **Auto Position**, if you want to specify your own position style. You can pick a placement point.

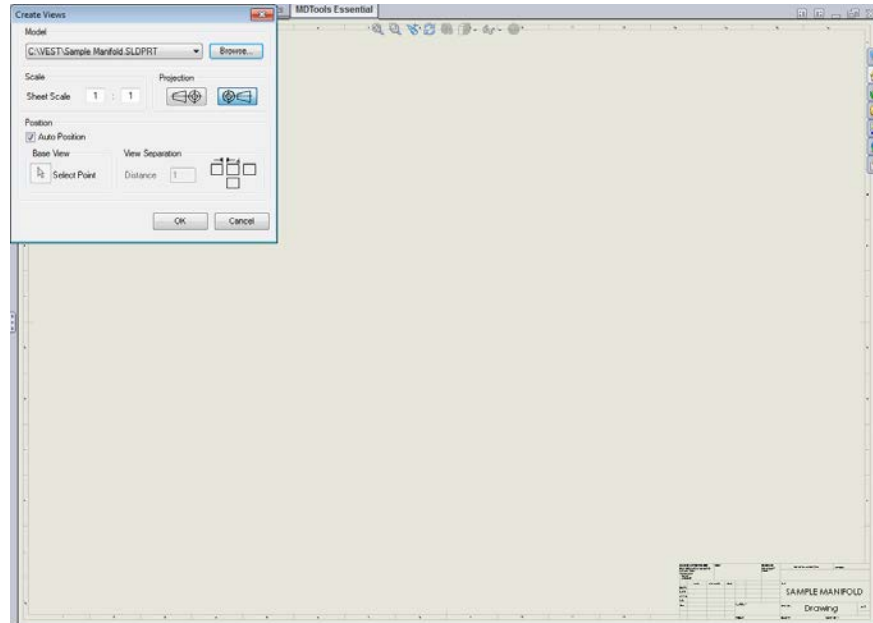
*This is the point at which the center of the Front view is placed on the sheet.*

6. Specify the inter-view distance and the scale factor.

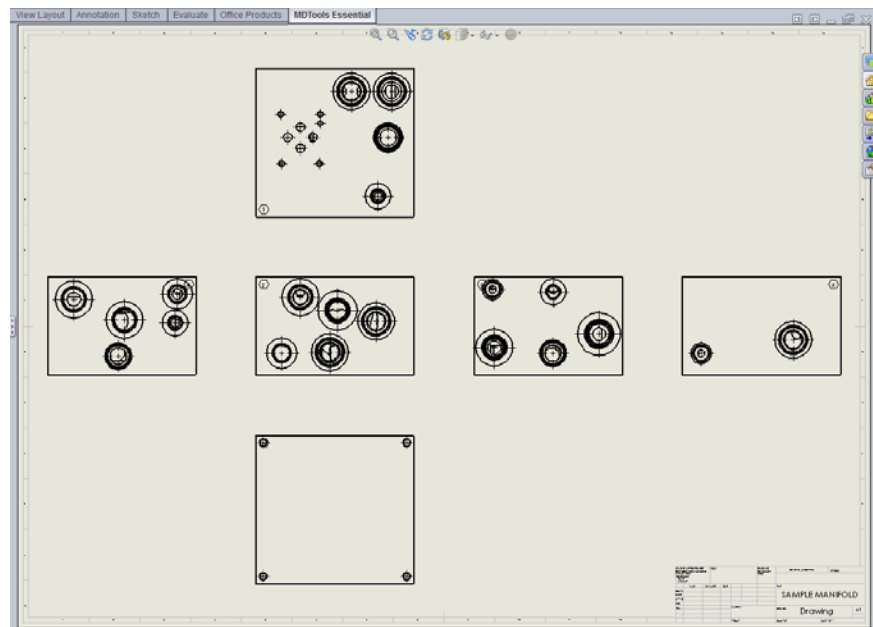
7. Click **OK**.

*MDTools® automatically names the views, per the MDTools 2D view naming convention.*

- Top view as **A**
- Front view as **B**
- Bottom view as **C**
- Left view as **D**
- Right view as **E**
- Back view as **F**



Create Views dialog box



Six views of the manifold created automatically

## Note:

The scale values in the Create View dialog box denote the sheet scale values.

## 37. Show Footprint

*Automatically displays the port application name for footprint cavities near the cavities and the envelope in the 2D drawing views.*

MDTools Essential  
> **Show Footprint**

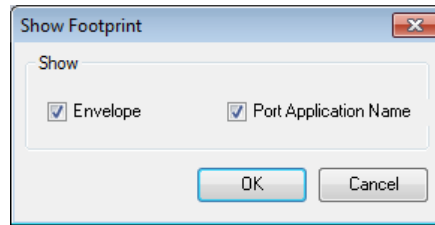
*The Show Footprint dialog box displays.*

- Select the Envelope and Port Application to display.

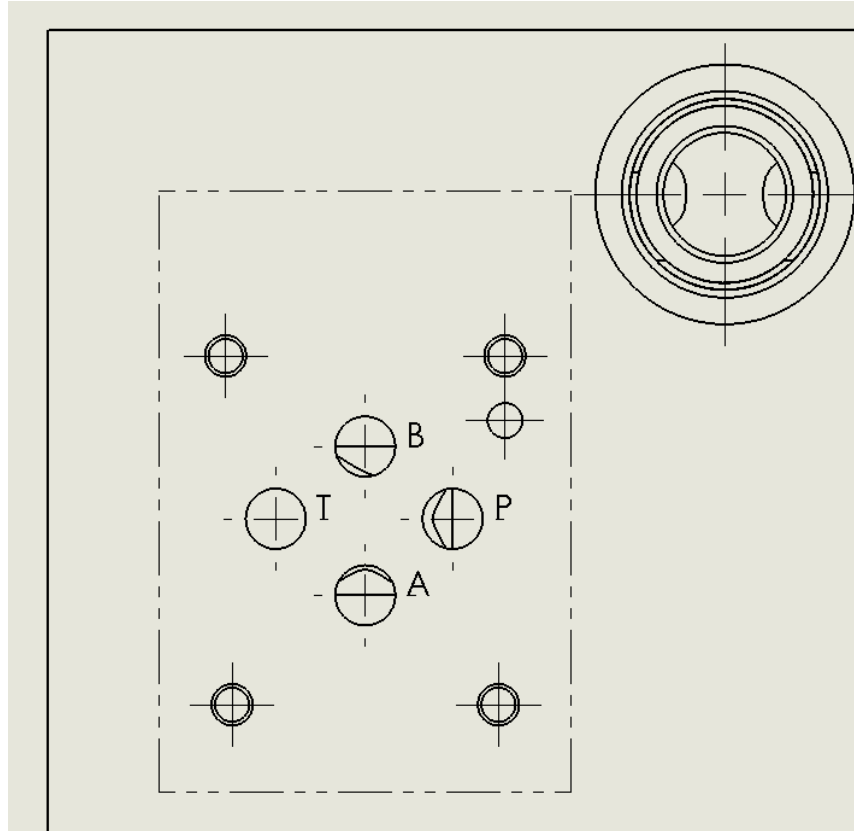
*The port application name for footprint cavities is automatically displayed along with the envelope line.*

**Note:**

- The port application name is shown next to the cavity in 2D views.
- If a footprint has only one cavity of the type Cartridge Valve/ Port or Drill Hole, then the port application name for this cavity is not shown.



*Show Footprint dialog*



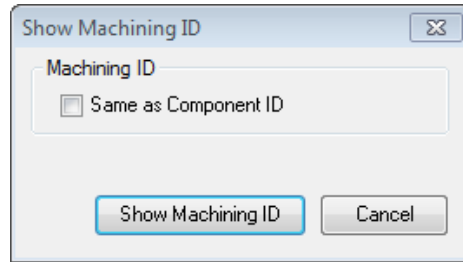
*Port application name with cavity in 2D drawing*

## 38. Show Machining ID

*Automatically display the cavity machining ID near the cavities in the 2D drawing views.*

1. MDTools Essential  
> **Show Machining ID**

*The Show Machining ID dialog box displays.*



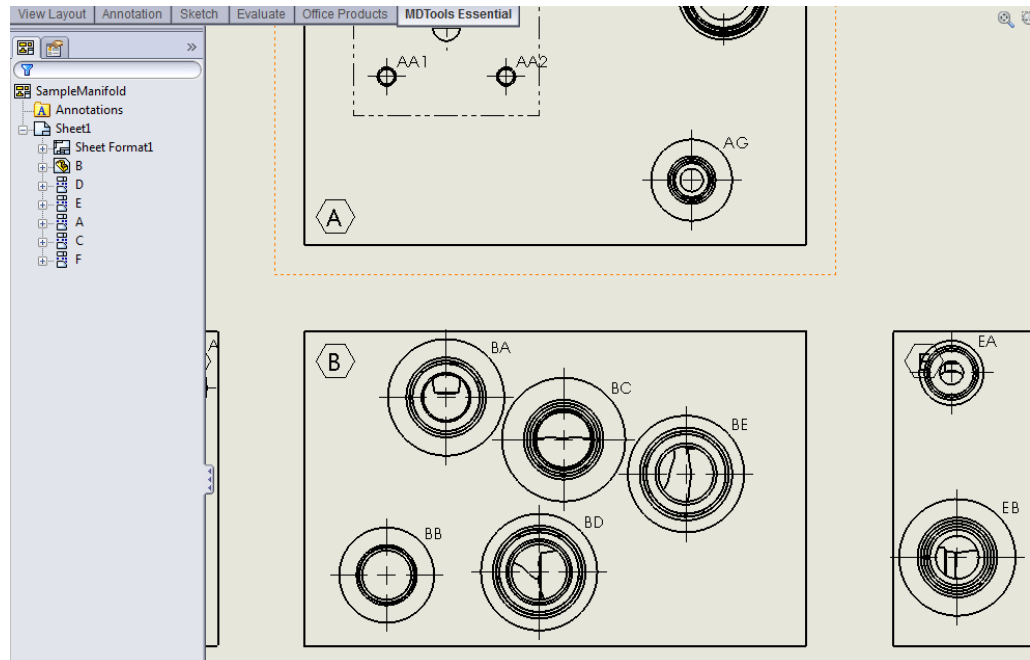
*Show Machining ID dialog box*

2. Select **Same as Component ID**, if you want to use the component ID as the cavity machining ID.

*Set the default option from the MDTools Settings dialog box.*

3. Click Show Machining ID.

*MDTools® displays the cavity machining ID near the outermost circle at 45 degrees from the center of each cavity.*



*Cavity machining ID on 2D drawing*

### Note:

- If the 2D views are created manually, then use the following naming convention for the manifold views.

Top	A
Front	B
Bottom	C
Left	D
Right	E
Back	F
- The Show Machining ID command will not work, if you do not use the view names, per naming conventions.
- If the manifold views are scaled, the machining ID text size and location are not scaled automatically. Therefore, it is advisable to first set the view scale and then insert machining ID on the views.
- If the view scale is modified after inserting the machining ID, then you need to manually delete the machining ID and recreate the IDs using the Show Machining ID command.

## 39.Export Machining Chart

Once the design of a manifold is complete and checked, the machining chart of the design can be automatically extracted from the manifold and exported into the excel Sheet.

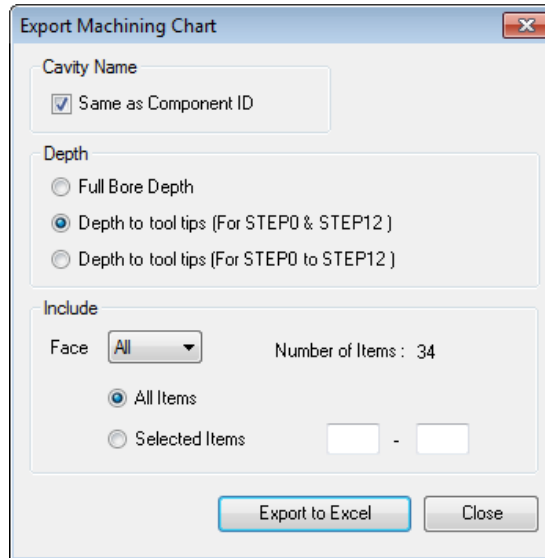
Automatically extract the machining data from all the cavities and export the machining chart.

### Exporting the Machining Chart

1. MDTools Essential  
> **Export Machining Chart**

The Loading Cavities List message box displays followed by the Export Machining Chart dialog box.

2. Select **Same as Component ID**, if you want to use the component ID as the cavity name.
3. Select Depth, as required.
4. Select a face from the Include group box, if you want to export the machining chart for any particular face otherwise select **All**. (**All** is the default option)



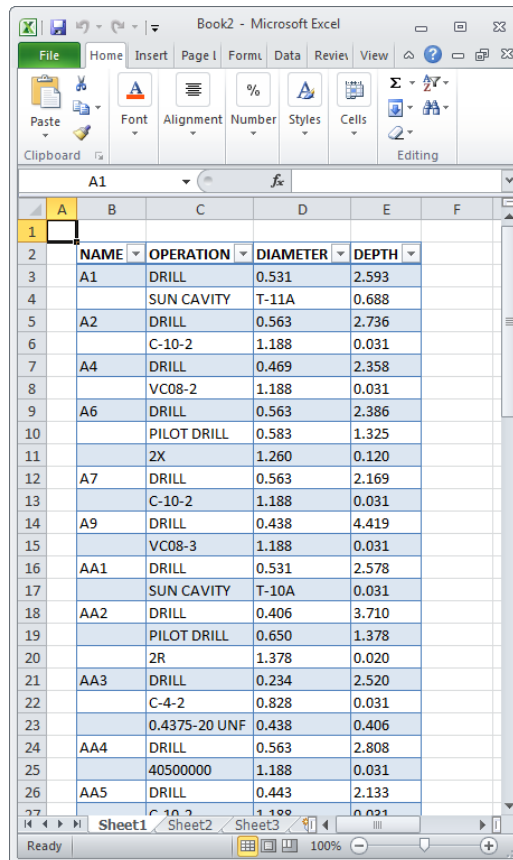
The dialog box titled "Export Machining Chart" contains the following options:

- Cavity Name:** A checkbox labeled "Same as Component ID" is checked.
- Depth:** Three radio buttons are present:
  - ☐ Full Bore Depth
  - ☒ Depth to tool tips (For STEP0 & STEP12)
  - ☐ Depth to tool tips (For STEP0 to STEP12)
- Include:** A dropdown menu is set to "All". To its right, it says "Number of Items : 34". Below this, there are two radio buttons:
  - ☒ All Items
  - ☐ Selected Items (with empty input boxes for range)

At the bottom are "Export to Excel" and "Close" buttons.

Export Machining Chart dialog box

5. Select **All Items** in the Include group, if you want to export a complete machining chart.  
Or,  
Select the **Selected Items** option and enter the start and end item index to export a list of specific item range.
6. Click Export to Excel.  
Excel sheet with exported machining chart opens
7. You can **Save** this sheet.



The Excel spreadsheet displays the following data:

	NAME	OPERATION	DIAMETER	DEPTH
A1	DRILL	0.531	2.593	
	SUN CAVITY	T-11A	0.688	
A2	DRILL	0.563	2.736	
	C-10-2	1.188	0.031	
A4	DRILL	0.469	2.358	
	VC08-2	1.188	0.031	
A6	DRILL	0.563	2.386	
	PILOT DRILL	0.583	1.325	
	2X	1.260	0.120	
A7	DRILL	0.563	2.169	
	C-10-2	1.188	0.031	
A9	DRILL	0.438	4.419	
	VC08-3	1.188	0.031	
AA1	DRILL	0.531	2.578	
	SUN CAVITY	T-10A	0.031	
AA2	DRILL	0.406	3.710	
	PILOT DRILL	0.650	1.378	
	2R	1.378	0.020	
AA3	DRILL	0.234	2.520	
	C-4-2	0.828	0.031	
	0.4375-20 UNF	0.438	0.406	
AA4	DRILL	0.563	2.808	
	40500000	1.188	0.031	
AA5	DRILL	0.443	2.133	
	C-10-2	1.188	0.031	

Exported Machining Chart in Excel

# 40. Create Machining Callout

*Automatically create leader-type cavity machining callout for all the cavities in the 2D drawing.*

*It automatically extracts the cavity machining detail from all the cavities and inserts with the leader on the cavities.*

## MDTools Essential > Create Machining Callout

*The Create Machining Callout dialog box displays.*

### Create Machining Callout for Cavities

To create the machining callout for all cavities, Click **All Cavities**.

*MDTools® inserts the leader on all cavities consisting of machining detail. It places the leader from the cavities center at an angle of 45 degrees.*

To create the machining callout for just the angle holes in the block, click **Angle Holes Only**.

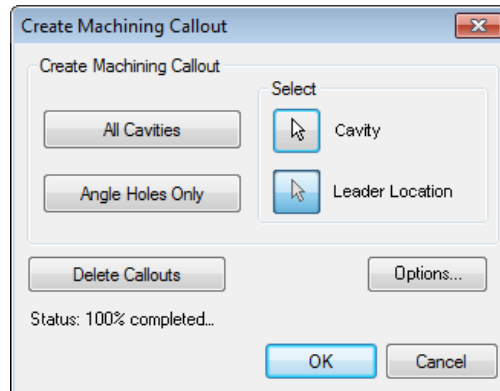
To create the machining callout for a cavity

1. Click the **Cavity** select button.

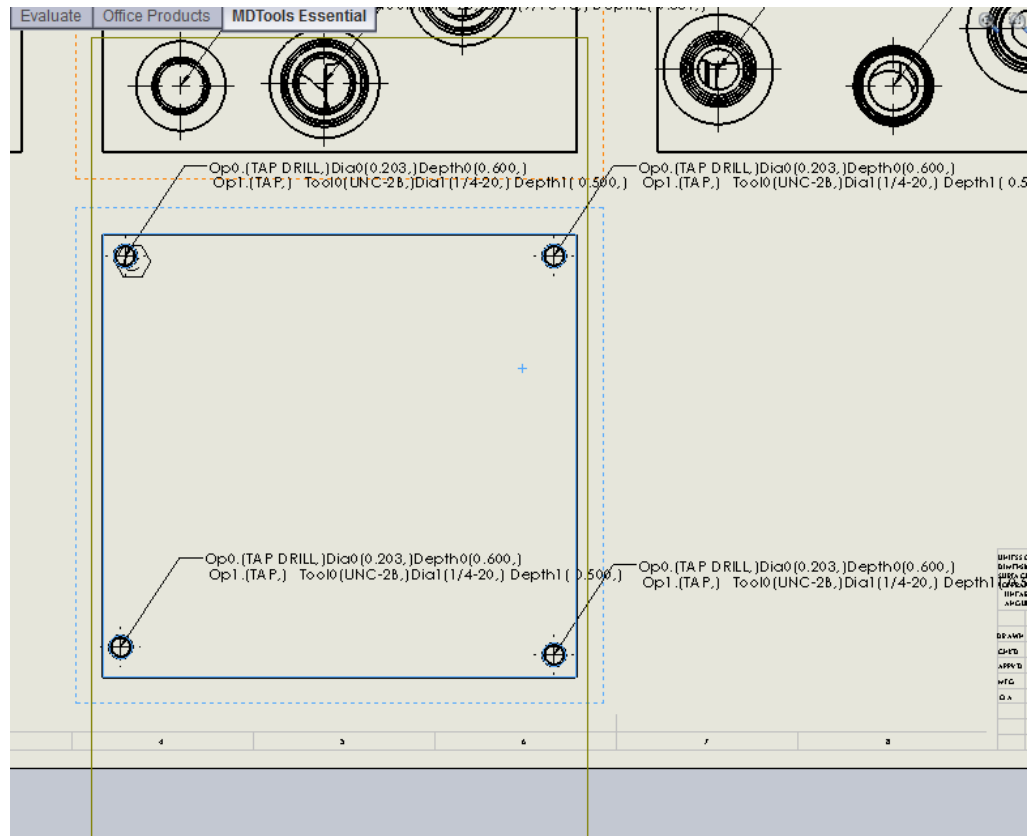
*The Select Leader point button becomes active automatically.*

2. Click the **Leader Location** select button.
3. Select the point where you want to place the leader.
4. Click **OK**.

- To delete callouts, click **Delete Callouts**.
- To move a machining detail, drag the leader endpoint to the desired location. *The text moves automatically.*



Create Machining Callout dialog box



Machining Callout displayed for all the cavities in the 2D drawing

# Configure the output of the Machining Callout

Create Machining Callout dialog box > **Options**

- Specify prefixes and suffixes for all the machining sequence rows and columns in the **Operations, Tool Name, Diameter and Depth**.
- Specify the order of the machining sequence with the options available in the **Machining Sequence** group.

*The Selected Order list shows the order in which the machining operation sequence are created for a particular row.*

*There are 7 row options available.*

*The order list is easily built by selecting a machining sequence row and clicking the up or down arrow button, in the desired order.*

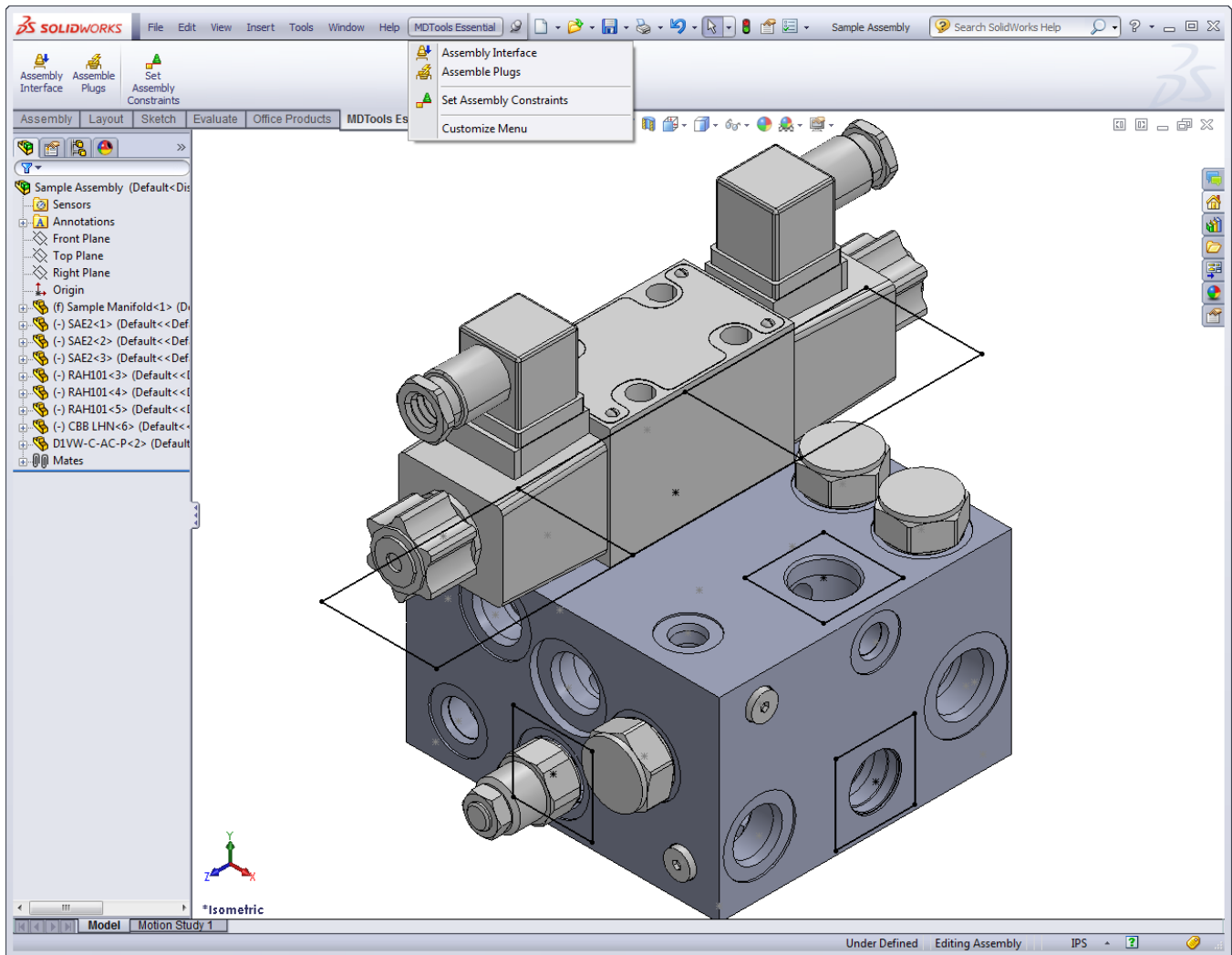
Machining Callout Setting

- Select the number of decimal places for the **Depth** and **Diameter** entries in the callout from the dropdown.
- Specify the value of text height for the callout text.
- Select the **Depth** option.
- Select the **Show Trailing Zero** option to display the trailing zero in the cavity diameter and depth.
- Select the **Simple Angle** option to show the alpha angle for the simple angle holes in the machining callout.
- Specify **Angle Prefix** for the Alpha and Beta angle to display in the machining callout. For example, /Angle:
- Specify **Beta Caption** for the Beta angle in the machining callout. For example, Beta =
- Specify **Alpha Caption** for the Alpha angle in the machining callout. For example, Alpha =.
- Click **OK** to save changes.



# ASSEMBLY COMMANDS

- 41 Set Assembly Constraints
- 42 Assembly Interface
- 43 Assemble Plugs



# 41. Set Assembly Constraints

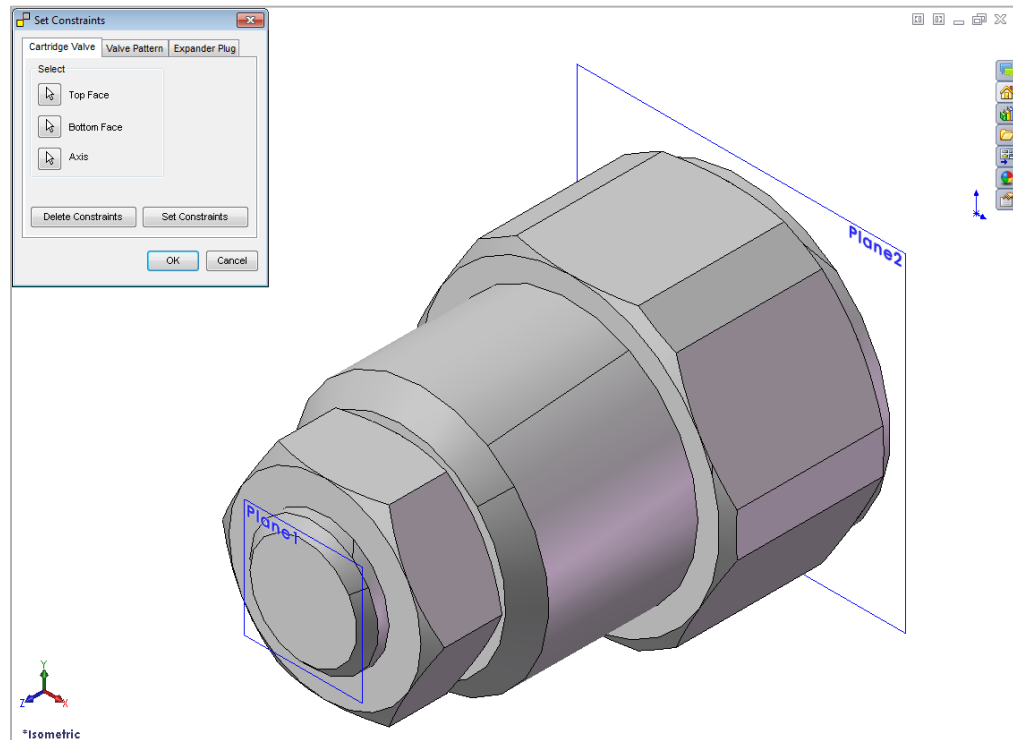
Set assembly constraints on all the part/assembly models to make them work with the Assembly Interface.

*Parts without the assembly constraints will not get assembled on the manifold.*

- Open the part/assembly model of valve in SolidWorks.
- MDTTools Essential > **Assembly Constraints**  
*The Set Constraints dialog box displays.*

The Set Constraints dialog box contains the following tabs.

- Cartridge Valve
- Valve Pattern
- Expander Plug



Set Constraints: Cartridge Valve tab

## 1. Cartridge Valve Tab

1. Set assembly constraints for the cartridge valves, port fittings, and plugs.

*For these components, you need to specify three parameters, Top Face, Bottom Face, and Axis.*

2. Select the **Top Face** button.
3. Select a planar face as the top face.

*MDTools® automatically creates a work plane passing through a selected face.*

4. Select the **Bottom Face** button.
5. Select a planar face as the bottom face.

*MDTools automatically creates a work plane passing through the selected face.*

6. Select the **Axis** button.
7. Select a cylindrical of valve body.

*MDTools automatically creates an axis line passing through the axis of the selected cylindrical face.*

8. Click **Set Constraints** to set assembly constraints.

*MDTools sets all the assembly constraints.  
The Set Constraints dialog box closes.  
Now, this part is ready for use with the Assembly Interface.*

9. Save the model.

### Note:

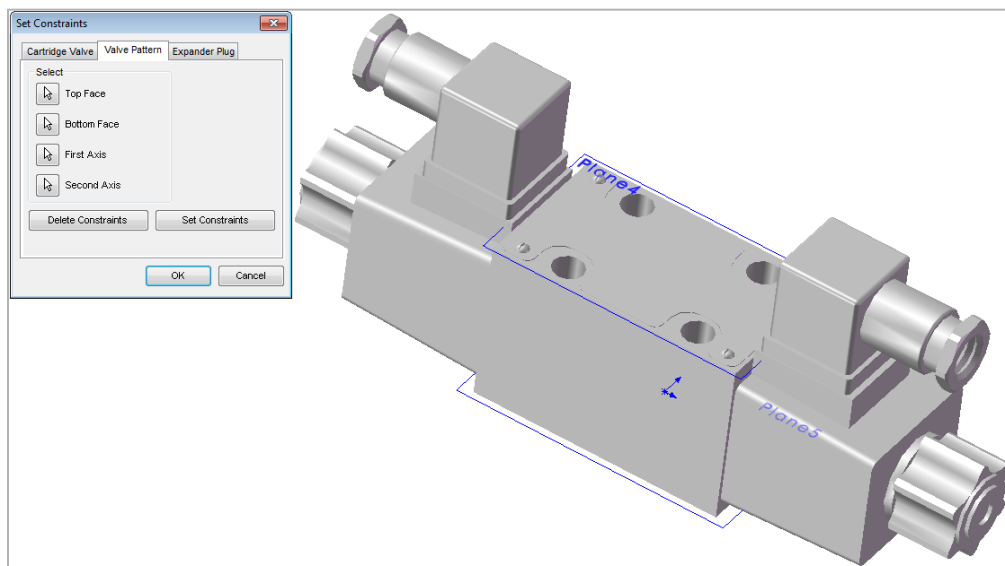
- Use this option to set assembly constraints for solenoid coils and lock nut/manual overrides on the Screw-in cartridge solenoid valves.
- Bottom work plane will mate with the spot face of cavity during assembly. So, the bottom work plane must be created on the face that needs to mate with the spot face of the cavity.

## 2. Valve Pattern Tab

1. Set the assembly constraints for the surface mounted valves, slip in cartridge valves, or flanges.

*For these components, you need to specify four parameters: Top Face, Bottom Face, First Axis, and Second Axis.*

2. Select the **Top Face** button.
3. Select the top face work plane.



Set Constraints dialog box: Valve Pattern tab

4. Select the **Bottom Face** button.
5. Select the bottom face work plane.
6. Select the first **Axis** button.
7. Select the axis passing through *LP/LP1/BH1*.
8. Select the second **Axis** button.
9. Select the axis passes through *LP2/BH2*.
10. Click **Set Constraints** to set assembly constraints.  
*MDTools® sets all the assembly constraints. The dialog box closes.*  
*Now, this part is ready for use with Assembly Interface.*
11. Save the part model.
12. Click **OK** to close the dialog box.

### Note:

#### First Axis

- Create axis passing through the locating pin for valves with one locating pin.
- Create axis passing through the locating pin LP1 for valves with two locating pin.
- Create axis passing through the bolt hole BH1 for valves with no locating pin.

#### Second Axis

- Create axis passing through the bolt hole BH1 for valves with one locating pin.
- Create axis passing through the locating pin LP2 for valves with two locating pin.
- Create axis passing passes through the bolt hole BH2 for valves with no locating pin.

**BH1** is the bolt hole with port application name BH1 and BH2 is bolt hole with port application name BH2 on the footprint.

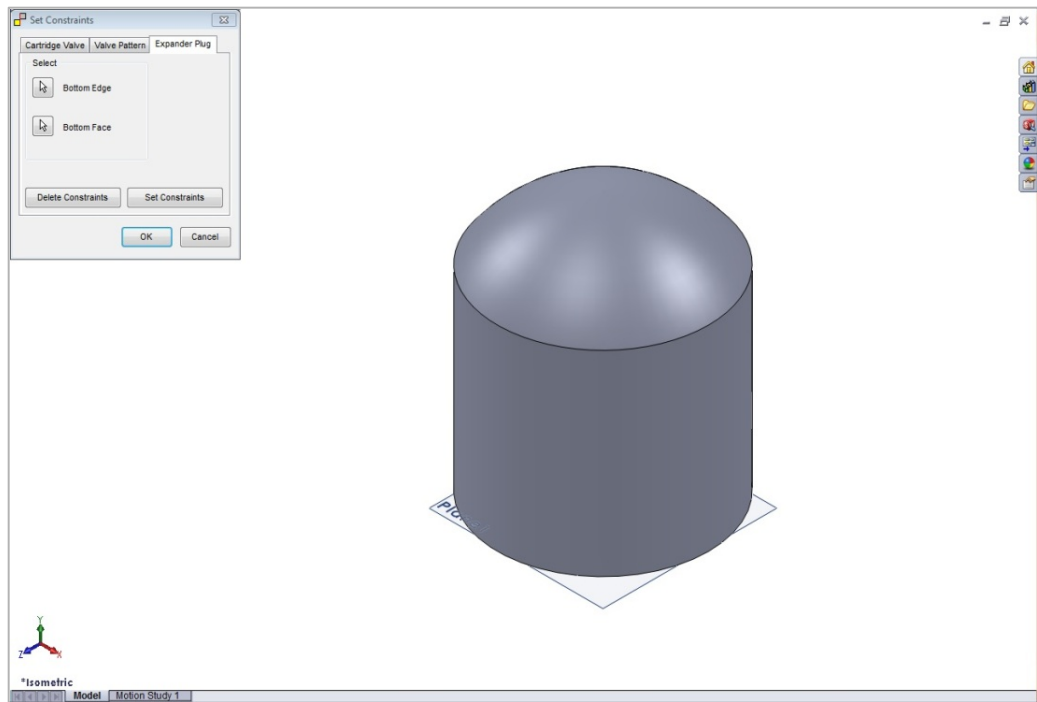
**LP1** is the locating pinhole with port application name LP1 and LP2 is locating pinhole with port application name LP2 on the footprint.

### 3. Expander Plug Tab

If there is no spot face in the cavity (Step0 angle is not equal to 90), then you must use the Expander Plug tab to set the assembly constraints, for example in the expander plug ports.

In such cases, you need to set only one constraint, i.e., Bottom Edge.

1. Select the **Bottom Edge** button.
2. Select the bottom edge on the model that mates with the bottom edge of Step 0 of the cavity.
3. Select the **Bottom Face** button.
4. Select the bottom plane.
5. Click **Set Constraints** to set the assembly constraints.
6. Save the part model.



Set Constraints dialog box: Expander Plug tab

## 42. Assembly Interface

*Automatically assemble all the components on a manifold. MDTools® automatically creates all the required constraints and assembles the components at the correct location.*

Create a new assembly drawing (.sldasm) and place the manifold into the assembly drawing using the **Place Component** command in SolidWorks.

1. MDTools Essential  
    > **Assembly Interface**

*The Assembly Interface dialog box displays.  
MDTools displays the cavity IDs of all the cavities in the dialog box.*

2. Click **Browse** and select the folder containing the part files.
3. Click **OK**.


### Note:

The library path is stored in the system registry; therefore you must have administrative privilege to save changes to the library path.

### Selecting Valves

1. Select the cavity by selecting the cavity ID.
2. Click Select Valve.  
*The Select Part File dialog box displays.*

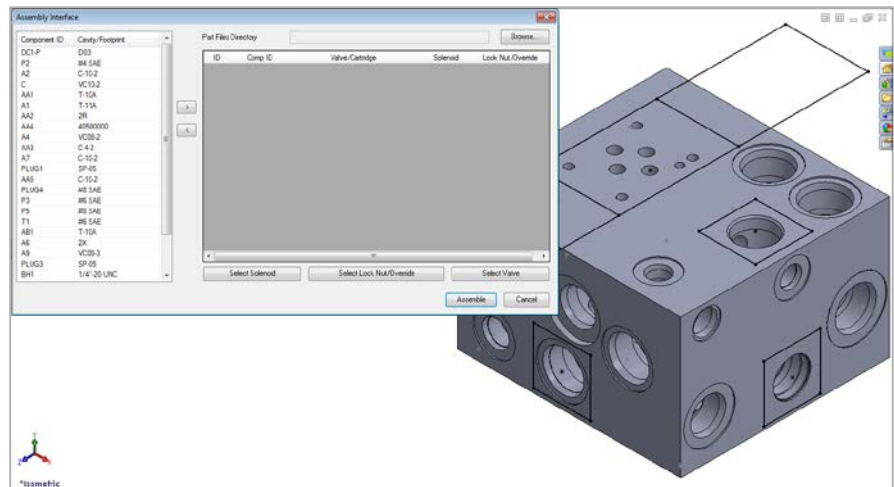
3. Select the required valve.
4. Click **OK**.  
*The Select Part File dialog box displays.*

5. Click  to add the selected cavity to the assembly list.  
*MDTools moves the selected cavity from the cavity ID list and displays the assembly details on the right side.*

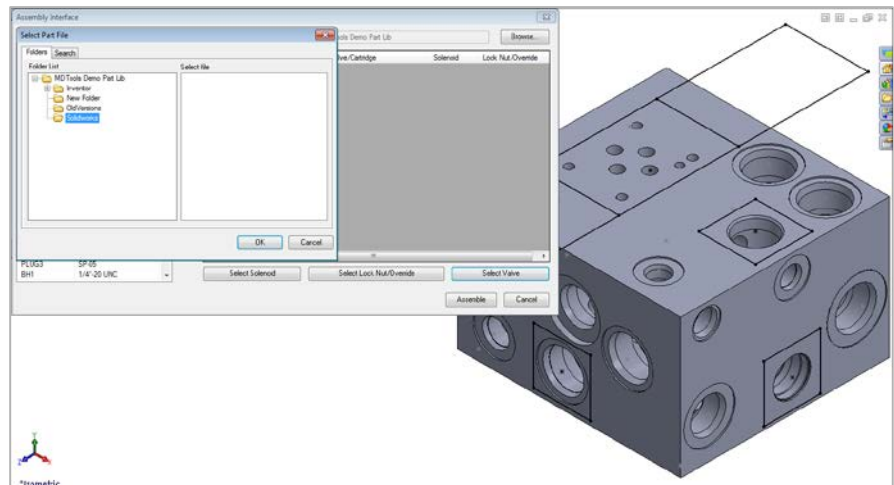
### Note:

If the selected cavity is a Solenoid valve cavity, then you should select the solenoid coil and manual override/lock nut before adding the cavity into the assembly list.

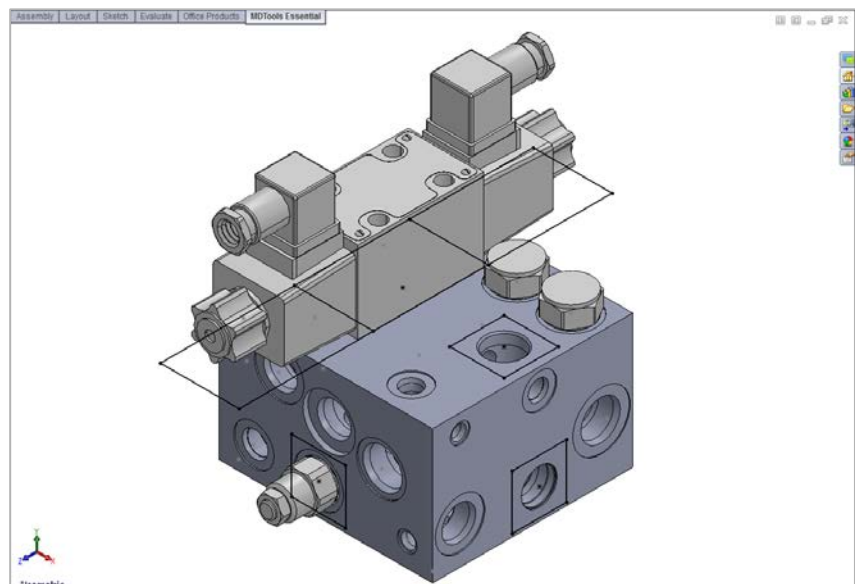
6. Similarly, select part files for all the cavities on the manifold.
7. Click Assemble.  
*MDTools® automatically assembles all the selected components at their locations on the manifold.*



Assembly Interface dialog box



Select Part File dialog box



Assembly created using MDTools


## Same Component for Multiple Cavities

When multiple cavities use the same component, you can select the component for all the cavities together.

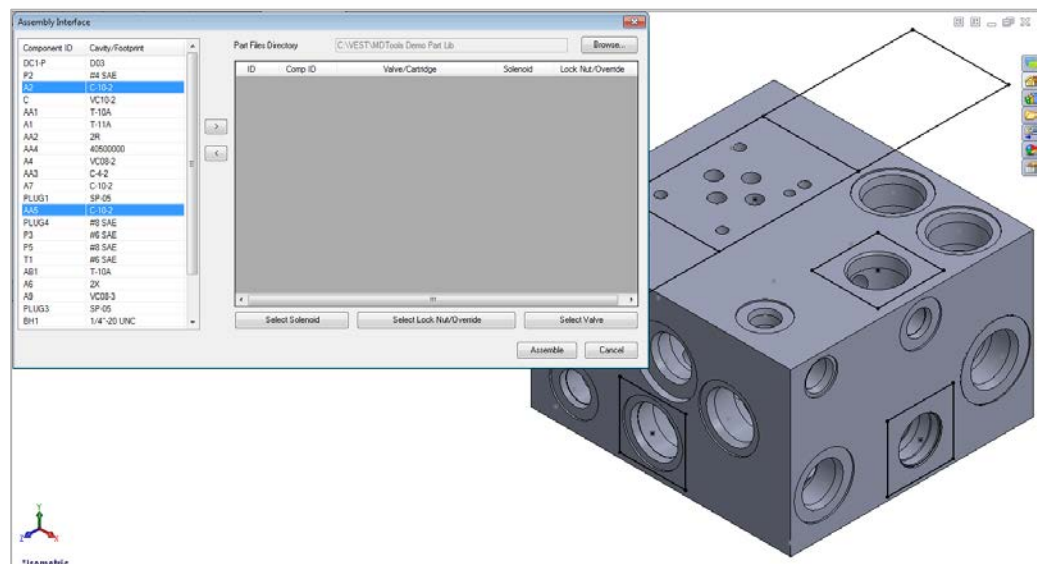
1. Select the cavities from the list, one by one.

**Note:**

Hold the **Ctrl** key to enable multiple cavity selection.

2. Select the component using the **Select Valve** option.
3. Click  to add the selected cavities into the assembly list.

*MDTools® adds all the selected cavities into the assembly list.*



*Multiple Cavity selection*

**Note:**

- Set assembly constraints on all the part models using the MDTools Set Assembly Constraints program to make it work with the Assembly Interface.
- Parts without the assembly constraints will not get assembled on the manifold.

Refer Chapter 89, *Set Assembly Constraints*, for details about assembly constraints.



## 43. Assemble Plugs

*Automatically assemble plugs on all the construction (X-Drill) ports on a manifold.*

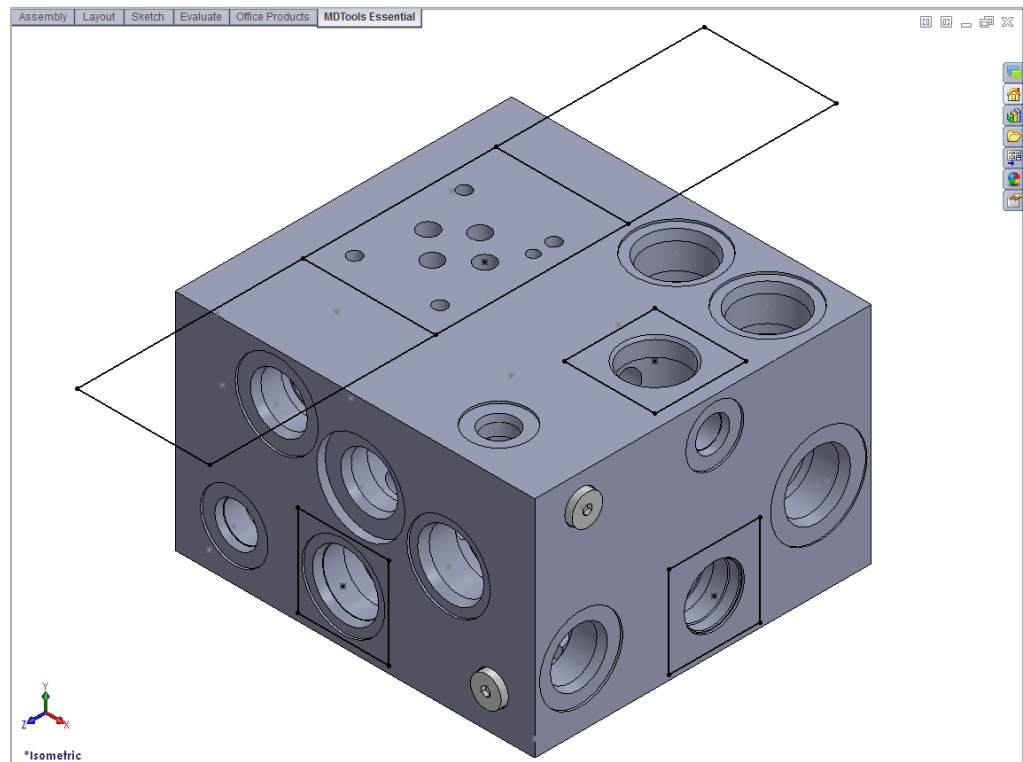
*MDTools® automatically creates all the required constraints and assembles the plugs at the correct location.*

*You can specify cavity and plug file path location using the MDTools Assembly Library.*

Open the Assembly model in SolidWorks.

MDTools Essential  
> **Assemble Plugs**

*Automatically assembles the plugs onto all the construction (X-Drill) ports, which are assigned in the MDTools Assembly Library, in a manifold.*



*Assemble the plugs on the construction ports in a manifold*

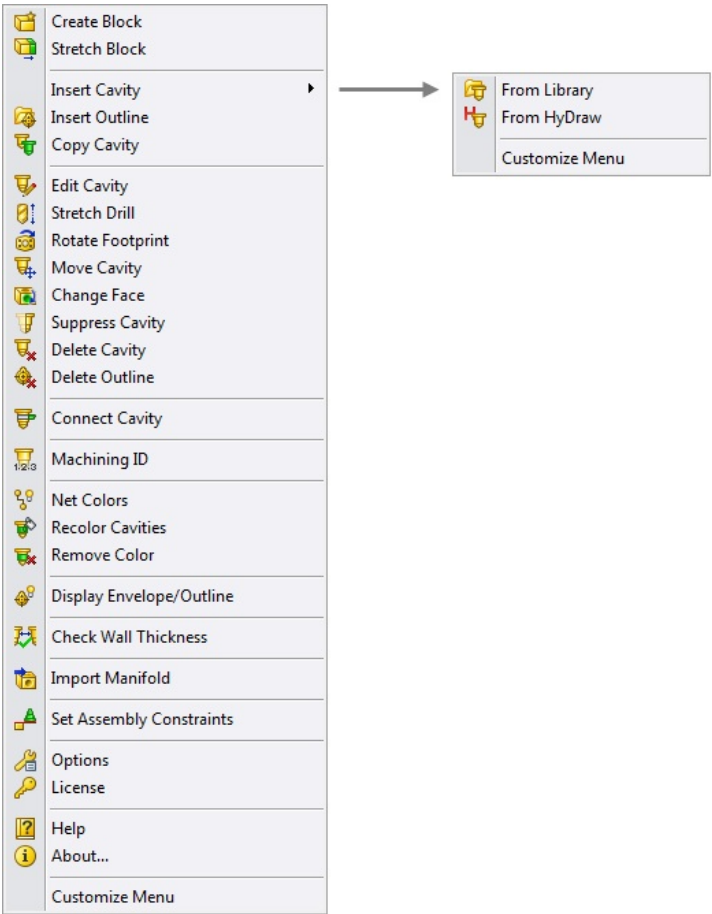
# Appendix

- 44 Ribbon and Dropdown Menu
- 45 Command Overview

# 44.Ribbon and Dropdown Menu






























MDTools Essential Part Ribbon Menu








MDTools Essential Part Dropdown Menu

# 45.Commands Overview




## 1. Part Model Commands

Icon	Command	Function	Ch
	Create Block	Creates a block.	8
	Stretch Block	Stretches the block in the specified direction.	9
	Cavity Library	Inserts a cavity or footprint from the library.	10
	HyDraw Schematic	Imports a HyDraw schematic and inserts cavities with Net information.	11
	Insert Outline	Inserts component outline for a cavity or footprint.	12
	Copy Cavity	Inserts copy of a cavity or footprint.	13
	Edit	Edits a cavity.	14-15
	Stretch	Stretches a cavity.	16
	Rotate	Rotates a footprint or a cavity.	17
	Move	Moves a cavity or footprint.	18
	Change Face	Relocates a cavity or footprint to another face.	19
	Suppress	Suppresses or Unsuppresses cavities.	20
	Delete Cavity	Deletes cavities and footprints.	21
	Delete Outline	Deletes component outlines.	22
	Connect	Creates connection between specified cavities.	23
	Machining ID	Generates machining ID for all cavities in the specified format.	24
	Net Colors	Manages net visibility and display colors.	25
	Recolor Cavities	Updates color of cavities.	26
	Remove Color	Removes color from cavities.	27
	Display Outline	Manages visibility of component outline.	28
	Check Wall Thickness	Checks wall thickness between two cavities.	29
	Import Manifold	Imports the manifold from MBXML file.	30
	Set Assembly Constraints	Sets assembly constraints to a component model.	31
	Options	Displays MDTools Options dialog box where you can configure design options.	32
	License	MDTools License option.	33
	Help	MDTools user manual.	34
	About	About MDTools.	35

## 2. Drawing Commands

Icon	Command	Function	Ch
	Create Views	Creates all views of a manifold or manifold assembly.	36
	Show Footprint	Displays port names and the footprint envelop in the 2D drawing.	37
	Show Machining ID	Displays the Machining ID for cavities in the 2D drawing.	38
	Export Machining Chart	Creates and exports manifold Machining Chart to Excel.	39
	Create Machining Callout	Creates Machining Callout for cavities in the 2D drawing.	40

## 3. Assembly Commands

Icon	Command	Function	Ch
	Assembly Interface	Interactively assembles components.	42
	Assemble Plugs	Automatically assembles construction plugs.	43
	Set Assembly Constraints	Sets assembly constraints to a component model.	41

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Circuit Design

Manifold Design

HyDraw®



MDTools®

Software

FLUID  
POWER  
TOOLS®

QUICK  
MANIFOLDS®

Services



VEST, Inc.  
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