Chapter

6

Stamping with Complex Details

In this chapter, you will learn how to use the following VBA functions to World Class standards:

- **Beginning a New Visual Basic Application**
- **Opening the Visual Basic Editor in AutoCAD**
- **Laying Out a User Input Form in Visual Basic**
- **Creating and Inserting an Image into a Form in Visual Basic**
- **Insert a Label into a Form**
- **Insert a Textbox into a Form**
- **Insert Command Buttons into a Form**
- **Adding a Copyright Statement to a Form**
- **Adding Comments in Visual Basic to Communicate the Copyright**
- **Declaring Variables in a Program with the Dimension Statement**
- **Setting Variables in a Program**
- **Assigning Values to the Variables**
- **Inputting the Code to Set a System Variable**
- **Inputting the Code to Create and Set Layers**
- **Inputting the Code to Draw in Visual Basic**
- **Using Selection Sets and Mirroring in Visual Basic**
- **Drawing Circles and Ending the Subroutine**
- **Resetting the Data with the cmdClear Command Button**
- **Exiting the Program with the cmdExit Command Button**
- **Executing a Subroutine with the cmdDraw Command Button**
- **Inserting a Module into a Visual Basic Application**
- **Running the Program**

Beginning a New Visual Basic Application

In this chapter, we will continue to learn how to use the Visual Basic Application (VBA) program to create a form and then to generate drawings automatically. We reiterate many elements of the previous lesson, but now we add the capability to add complex calculations, placing entities on specific layers, selection sets, and mirroring in AutoCAD Model Space. Eventually in following chapters, we add text and dimensions, and having multiple views of the part in Model Space.

At the beginning of every chapter, we will start a new Visual Basic Application project, use a sketch to determine the extent of what the program will do, create the form and then write the code. Once the code is finished, we will run the program and an orthographic drawing will appear on the graphical display.

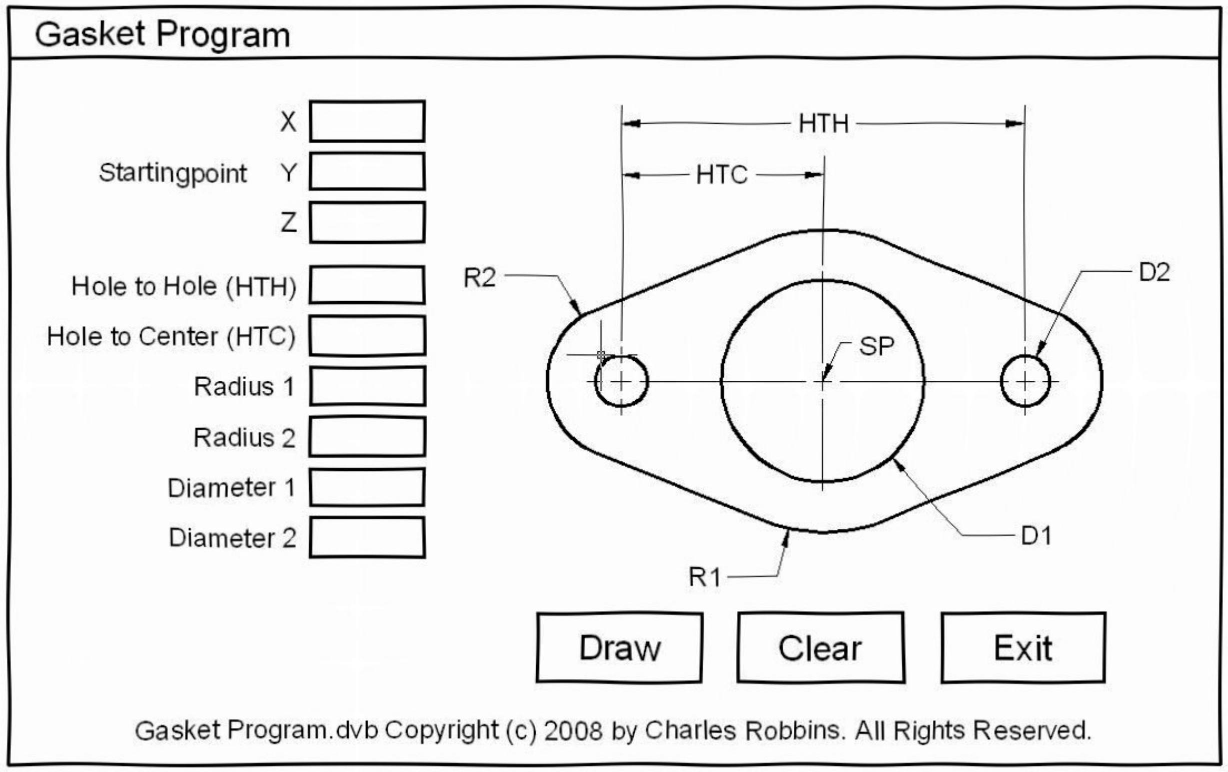


Figure 6.1 – Rough Sketch of the Gasket Form

Remember, that all programming projects begin with one or more sketches, with one portraying the part, detail, or assembly and the other being the user input form. In this Visual Basic Project, the Gasket program, we will be running a user input form inside the AutoCAD application, so we need to sketch the structure of this special dialogue box. We will name the Input form, **Gasket Program**. We will place nine textboxes on the left side of the form to key in the starting point of the gasket, the hole to hole dimension, the hole to center dimensions, radius1 (the large arc), radius2 (the small arc), diameter1 (the large hole), and diameter2 (the small hole). On the right side of the form, we will place an image of the gasket. We will have three command buttons, **Draw**, **Clear** and **Exit**. On the bottom of the form, we will write the copyright statement using another label. On this presentation, we can help ourselves by being as accurate as possible, by displaying sizes, fonts, colors and any other specific details which will enable us to quickly create the form. From the beginning of inserting the form into the project, we need to refer to our sketch. The sketch of the form is shown in Figure 6.1.

Remember, we should train new programmers initially in the art of form building. When using the editor, we insert and size the form, and selecting the Controls Toolbox, we will place all the various input tools and properly label them. Whenever we place an input tool, the properties window will display a list of attributes associated with the tool, and we will take every effort to arrange the tool by performing such actions as naming, labeling and sizing the visual input device.

Opening the Visual Basic Editor in AutoCAD

Opening the Visual Basic Editor in AutoCAD is essential to creating the program to automate the drawing process. In this version of the World Class CAD – Visual Basic Applications for AutoCAD, we are using AutoCAD 2008, but we just finished using all the programs in this text with a group programming in AutoCAD 2000. Their drawings were automatically made just as efficiently as if they were using the most recent version of the Autodesk software.

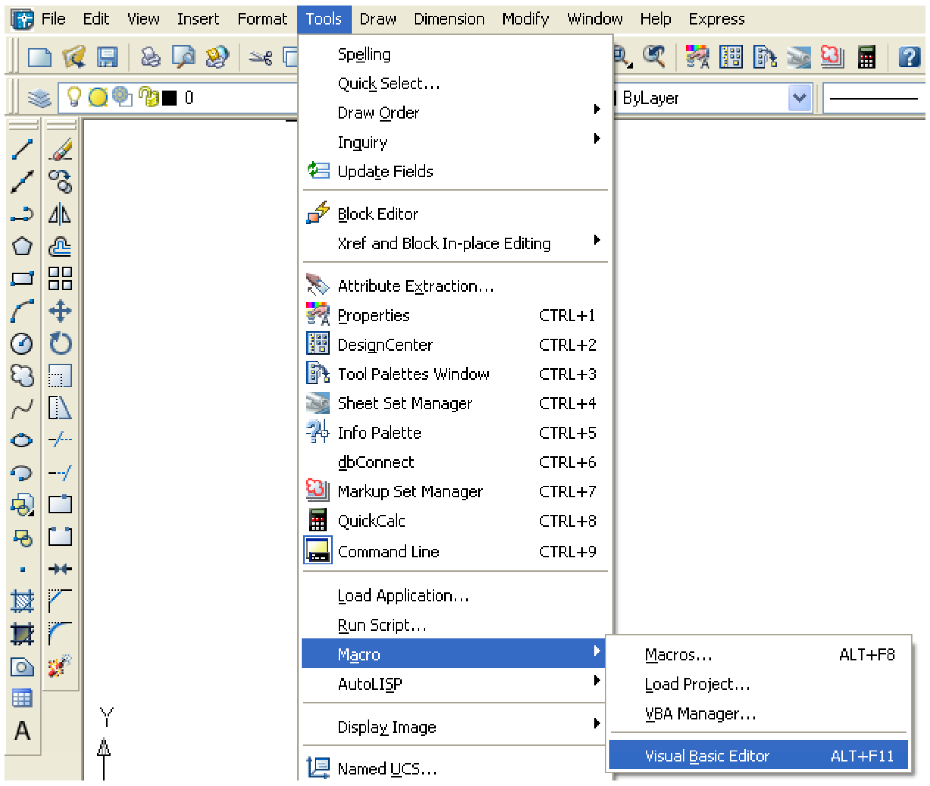


Figure 6.2 – Launching the Visual Basic Editor

Select Tools on the Menu bar; pick Macro and then choose the Visual Basic Editor. Look to the right of the phrase, Visual Basic Editor and the shortcut keys Alt – F11 is noted. For quick launching of the editor, press Alt – F11.

The Visual Basic Editor will appear on the computer desktop as a new program application. Looking down on the computer's Taskbar, we can see the AutoCAD and Microsoft Visual Basic Editor program tabs. Just single click either program tab to switch between any applications. However, if we close the AutoCAD drawing, unlike a stand alone version of Visual Basic, the Visual Basic Editor will also close.

For those individuals with previous Visual Basic experience, the Visual Basic Editor in AutoCAD has the same layout as in other VB programs. The Menu Bar contains tools for our use as well as the four toolbars shown in Figure 6.4, which are Standard, Debug, Edit and Userform. Presently, only the Standard toolbar is showing. On the left side of the workspace is the Project menu, which shows the files pertaining to this project. Below the Project menu is the Properties pane. If we remember the Properties tool in AutoCAD, using this device will be simple.

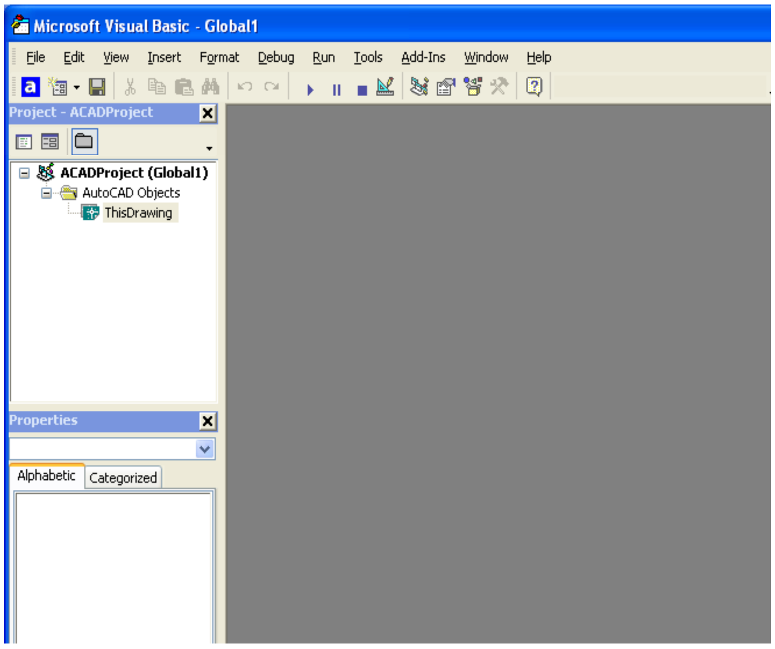


Figure 6.3 – The Visual Basic Editor

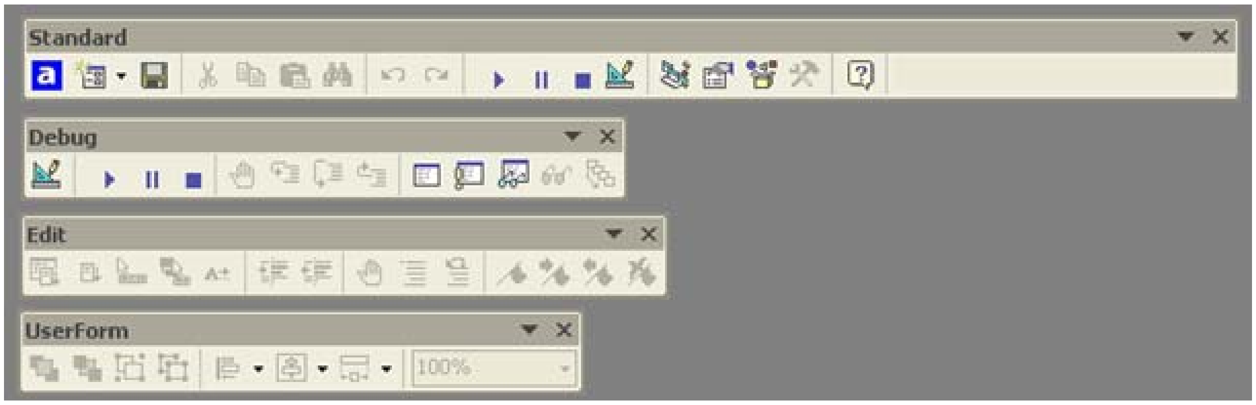


Figure 6.4 – Toolbars in the Visual Basic Editor

With the Visual Basic Editor open, select **File** on the Menu Bar and select **Save Project**. Remember, we have a folder on either the desktop or in the My Documents folder called "VBA Programs". Save the project with the filename "Gasket". The file has an extension called *dvb* which means DCL and Visual Basic programs as shown in Figure 6.5.

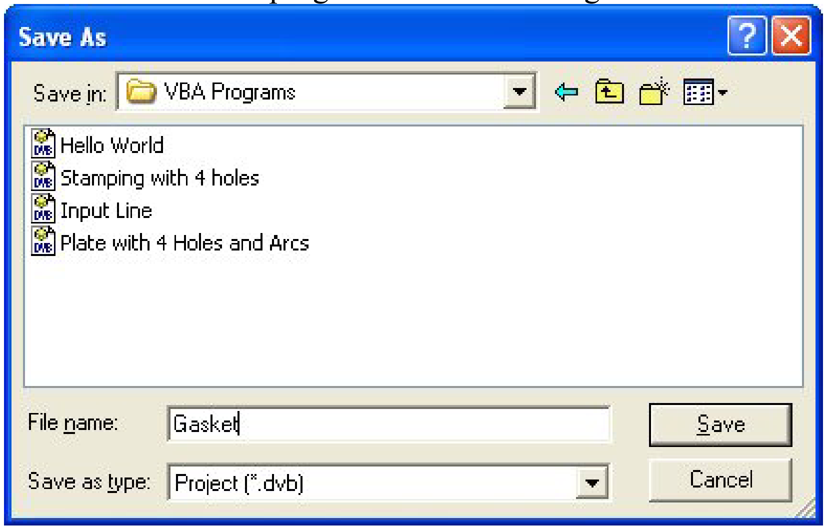


Figure 6.5 – Saving the Gasket Program

Laying Out a User Input Form in Visual Basic

Now that we have an idea of what the dialogue box in our program will look like, select the **Insert UserForm** button on the Standard toolbar to insert a new form as shown in Figure 6.6. Instantaneously, the once grey work area is changed to contain our UserForm1. A Form folder with Userform1 is now in the Project menu and the Properties pane contains the attributes associated with UserForm1. (See Figure 6.7)

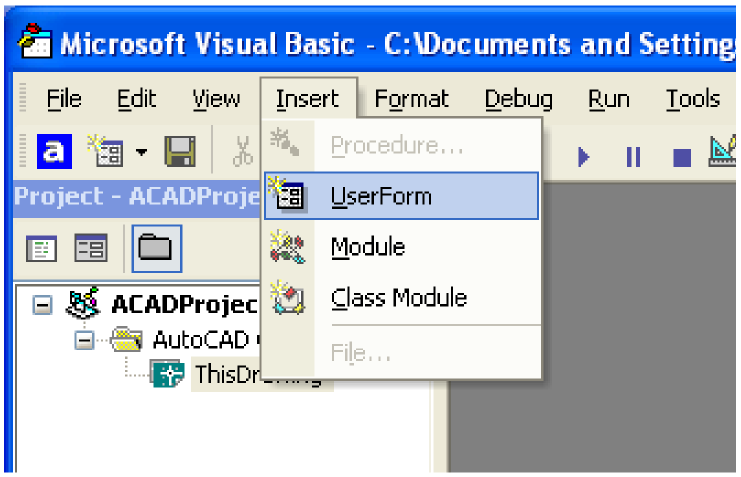
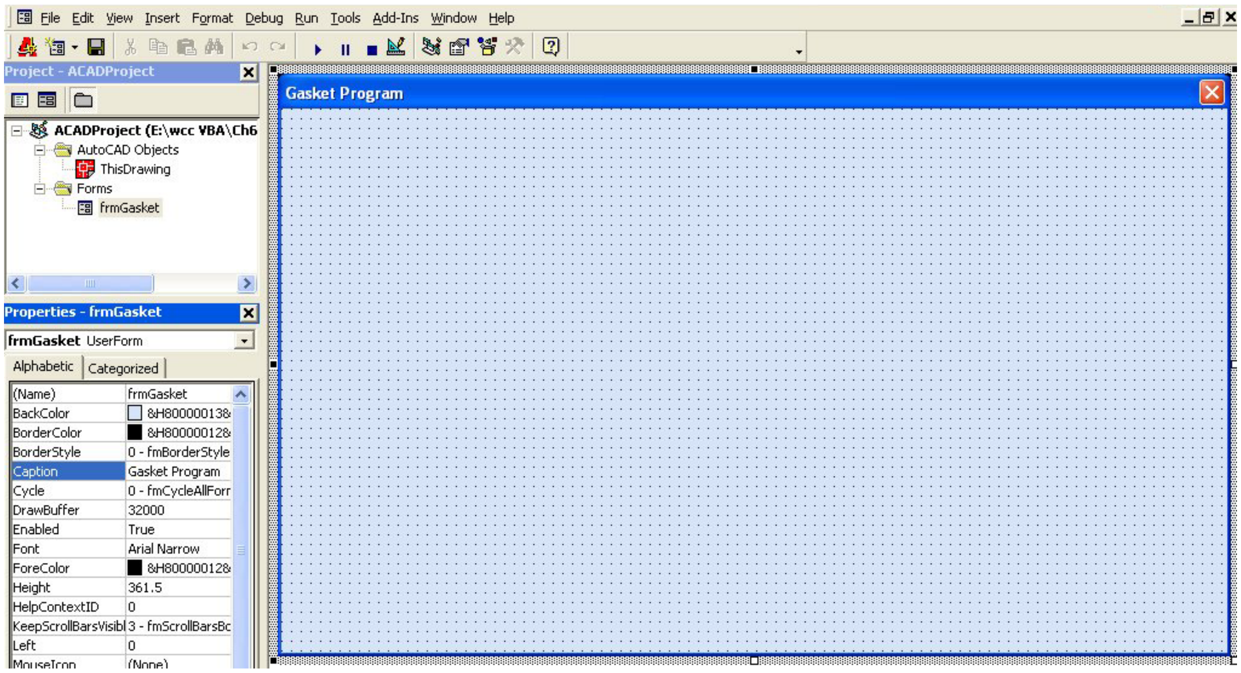


Figure 6.6 – Inserting a User Form

Change the name of the user form to frmGasket. We use the frm prefix in front of all of the form names in Visual Basic. Change the background of the form to light blue by setting the BackColor in the Properties Pane on the left side of the Visual Basic Application window to “&H80000013&”.

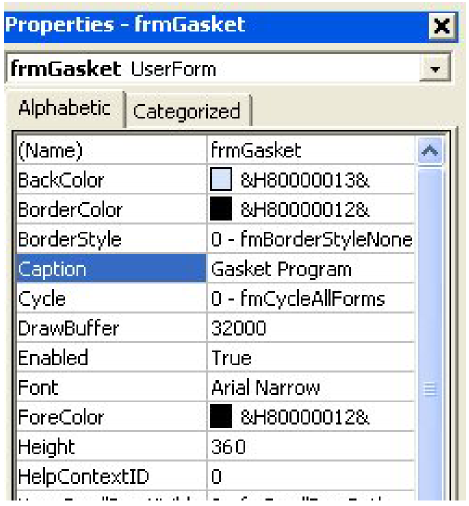


(Name)	frmGasket
BackColor	&H80000013&
BorderColor	&H80000012&
BorderStyle	0 - fmBorderStyle
Caption	Gasket Program
Cycle	0 - fmCycleAllForr
DrawBuffer	32000
Enabled	True
Font	Arial Narrow
ForeColor	&H80000012&
Height	361.5
HelpContextID	0
KeepScrollBarsVisibl	3 - fmScrollBarsBc
Left	0
MouseIcon	(None)

Figure 6.7 – Designing the Gasket Form in Visual Basic

Next, we will change the **Caption** in the Properties pane to **Gasket** to agree with the sketch in Figure 6.8. Go ahead and change the form in two other aspects, Height and Width.

Alphabetic	
(Name)	frmGasket
BackColor	&H80000013&
Caption	Gasket
Height	360
Width	500



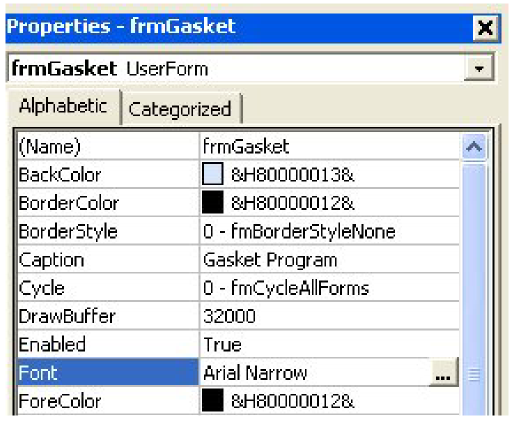
(Name)	frmGasket
BackColor	&H80000013&
BorderColor	&H80000012&
BorderStyle	0 - fmBorderStyleNone
Caption	Gasket Program
Cycle	0 - fmCycleAllForms
DrawBuffer	32000
Enabled	True
Font	Arial Narrow
ForeColor	&H80000012&
Height	360
HelpContextID	0

Figure 6.8 – Setting the Caption and other Properties

The form will change in size to the height and width measurement. The background color will change to a light blue. There are many more attributes in the Properties pane that we will use on future projects.

In previous chapters, we set the Font and Font size for the labels, textboxes and command buttons after creating those specific interfaces. If we set the Font to Arial Narrow and the Font size to 16 on the form, then all of the labels, textboxes and command buttons that we insert from the Control Toolbox will already be set to those attributes.

On the left side of the Visual Basic Editor, locate the property that controls the font and font size in the Properties window. When highlighting the row for Font, a small command button with three small dots appears to the right of the default font name of Tahoma. Click on the three dotted button to open the Visual Basic Font window.


Properties - frmGasket

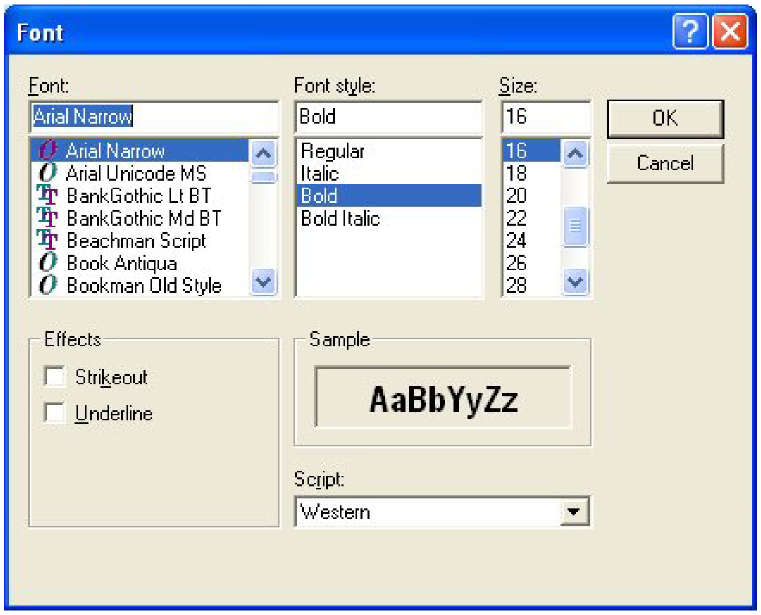
frmGasket UserForm

Alphabetic | Categorized

(Name)	frmGasket
BackColor	&H8000013&
BorderColor	&H8000012&
BorderStyle	0 - fmBorderStyleNone
Caption	Gasket Program
Cycle	0 - fmCycleAllForms
DrawBuffer	32000
Enabled	True
Font	Arial Narrow
ForeColor	&H8000012&

Figure 6.9 – Changing the Font to Tahoma

We will select the Arial Narrow font, Bold font style and 16 size for this project to agree with the initial sketch if the user input form. When we adjust the attributes for the label, these changes do not alter globally for the other objects on the form. If we wish to underline the text or phrase in the label, add a check to the Underline checkbox in the Effects section of the Font window. When we finish making changes to the font property, select the OK command button to return to the work area.


Font

Font: Arial Narrow
Font style: Bold
Size: 16

Fonts: Arial Narrow, Arial Unicode MS, BankGothic Lt BT, BankGothic Md BT, Beachman Script, Book Antiqua, Bookman Old Style
Font styles: Regular, Italic, Bold, Bold Italic
Sizes: 16, 18, 20, 22, 24, 26, 28

Effects: Strikeout, Underline
Sample: AaBbYyZz
Script: Western

Figure 6.10 – The Font Window in Visual Basic

Creating and Inserting an Image into a Form in Visual Basic

As in the last chapter, this form will have a picture of the part that we will create automatically, so we need to make a drawing of part in AutoCAD. Dimension the drawing as we do in any other drawing, but we will use the Edit Text tool to remove the actual dimension and write in the word that matches the textbox label. In Figure 6.11, we show dimensions that associate the HTH (hole to hole), HTC (hole to center), Radius1, Radius2, Diameter1 and Diameter2 textboxes with the image. When the drawing is finished, we need to save the drawing as an image file. Use the **Saveimg** command to save file on the VBA Programs folder. Create a folder named Images in the VBA Programs folder and save the file as the same name as the program for matching purposes, Gasket. We saved the file as a Bitmap with a width of 312 pixels and a height of 210 pixels.

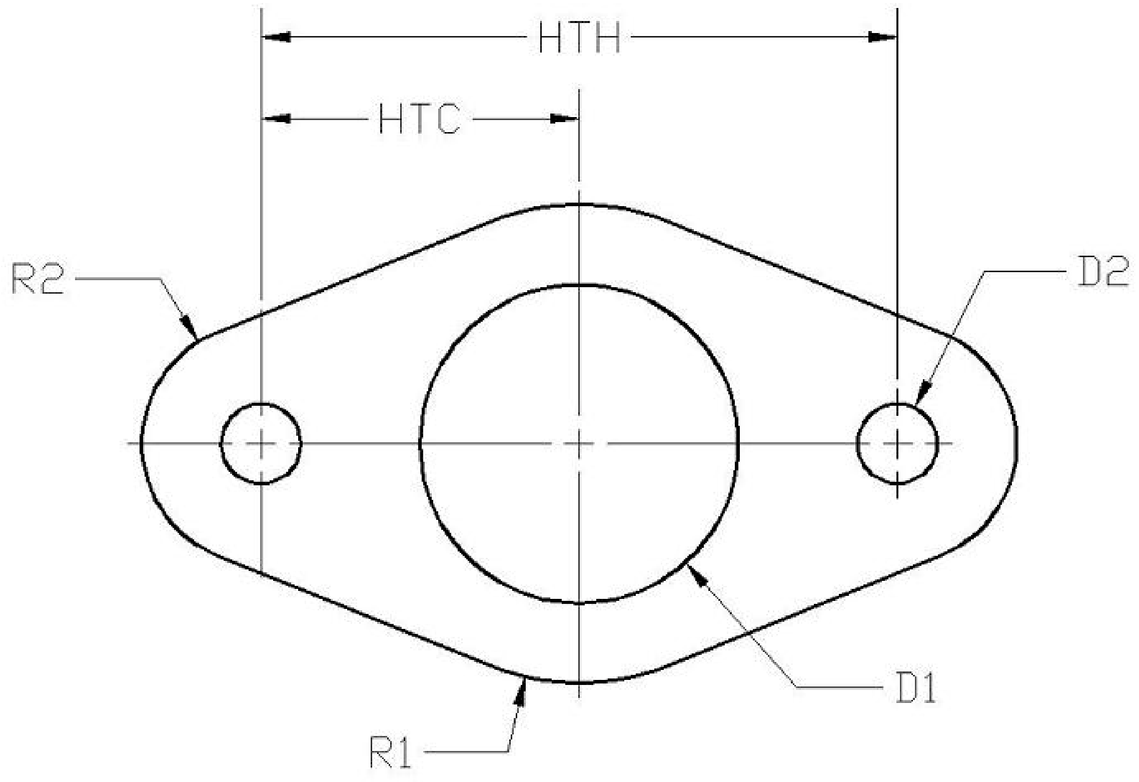


Figure 6.11 – Creating the Gasket Form Image in AutoCAD

On the control toolbox, select the Image tool and then draw a rectangular box on the form in the upper right corner as shown in Figure 6.13. After outlining the size of the image, we will direct the program to the folder and filename of the digital image. In the Properties – Image pane, select the attribute named Picture. With the mouse, select the three dot box in the empty cell to the right of Picture. The Load Picture window appears on the screen. Go to the VBA Programs folder and then the Images folder. Select the file, Gasket and it will appear in the picture frame.

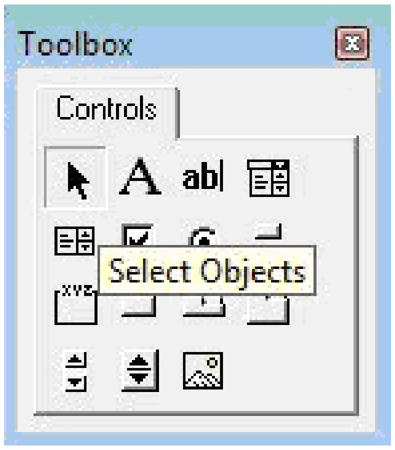
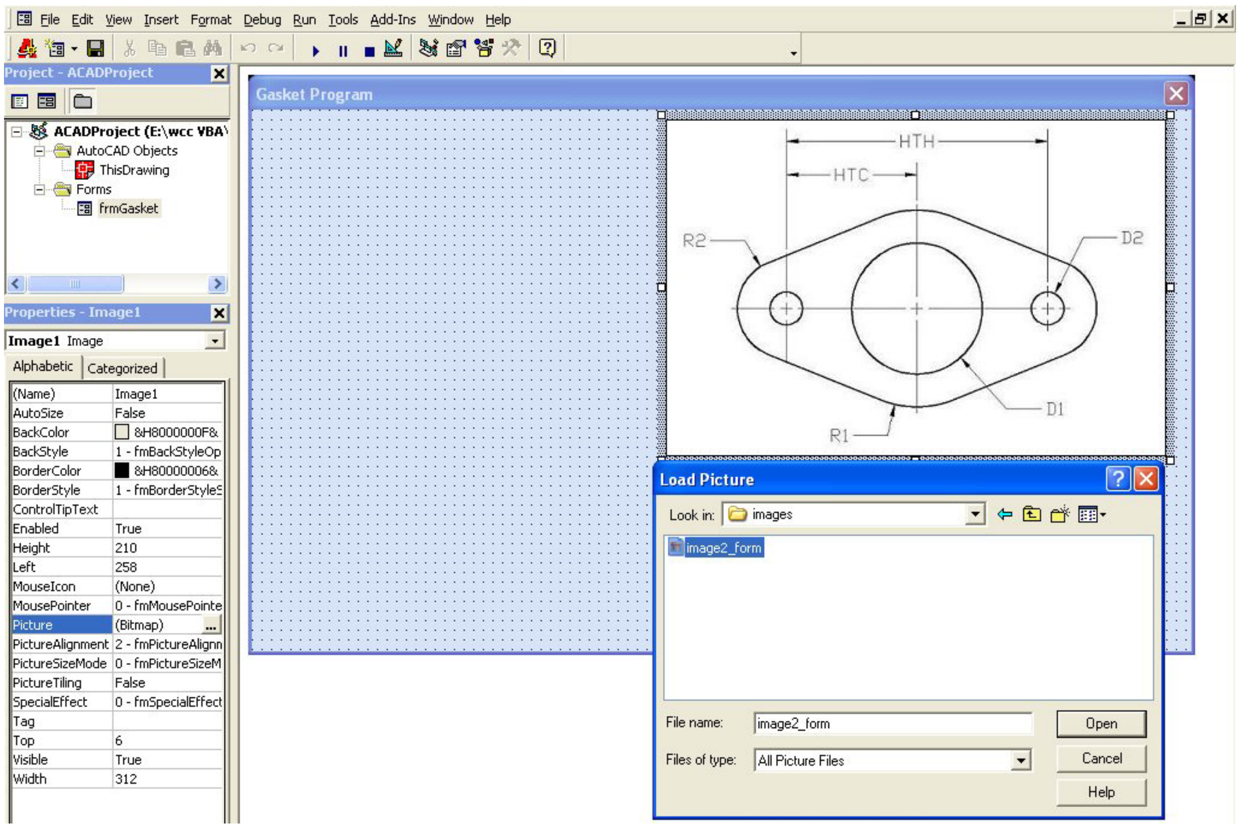


Figure 6.12 – The Control Toolbox

In the Properties pane set the image name to ImgGasket, the width to 312 and the height to 210. The image will finally appear as shown in Figure 6.14.



Properties - Image1

Image1 Image

Alphabetic | Categorized

(Name)	Image1
AutoSize	False
BackColor	&H8000000F&
BackStyle	1 - fmBackStyleOp
BorderColor	&H80000006&
BorderStyle	1 - fmBorderStyleS
ControlTipText	
Enabled	True
Height	210
Left	258
MouseIcon	(None)
MousePointer	0 - fmMousePointe
Picture	(Bitmap)
PictureAlignment	2 - fmPictureAlignn
PictureSizeMode	0 - fmPictureSizeM
PictureTiling	False
SpecialEffect	0 - fmSpecialEffect
Tag	
Top	6
Visible	True
Width	312

Look in: images

image2_form

File name: image2_form

Files of type: All Picture Files

Figure 6.13 – Placing an Image on the Form

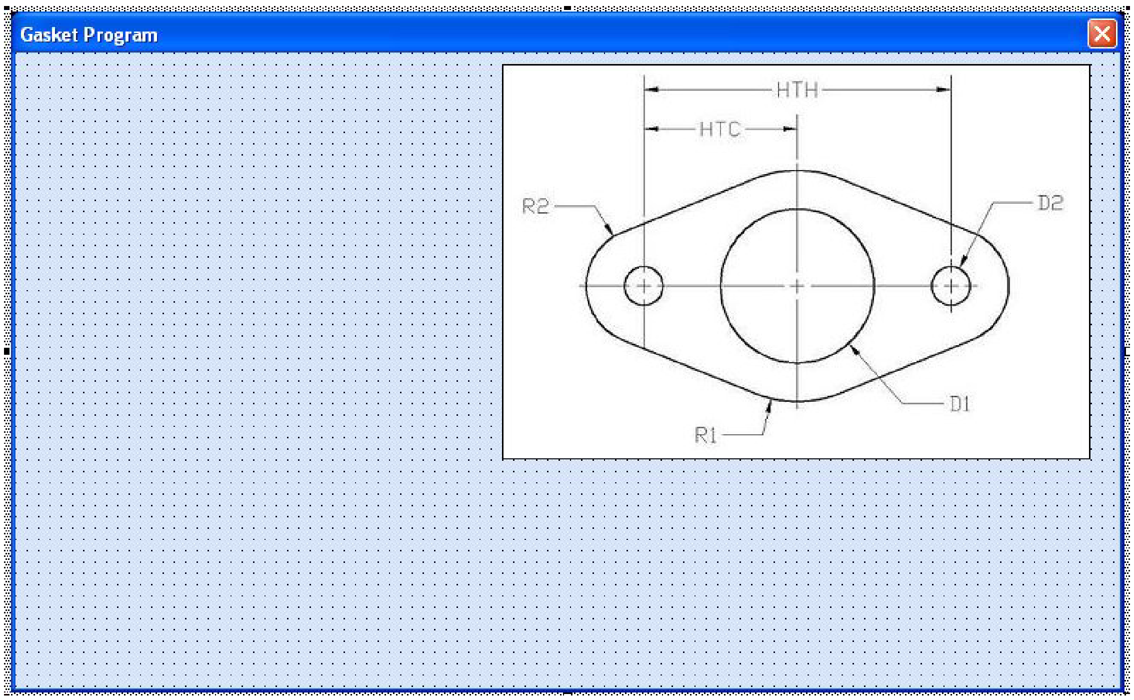


Figure 6.14 – Placing an Image on the Form

Inserting a Label into a Form

A good form is easy to figure out by the user, so when we are attempting to provide information on the window that will run in AutoCAD; we add labels to textboxes to explain our intent. Press the Label (A) button on the Control Toolbar to add a label. To size the label area, click on the upper left area of the form and hold down on the left mouse button, draw the dotted label box as shown in the sketch.

When the first label is done, the background color of the label matches the background color of the form. In many cases that effect is visually pleasing to the eye, versus introducing another color. Both color and shape will direct the user in completing the form along with the explanation we place on the window to guide the designer in using the automated programs. Use colors and shape strategically to communicate well.

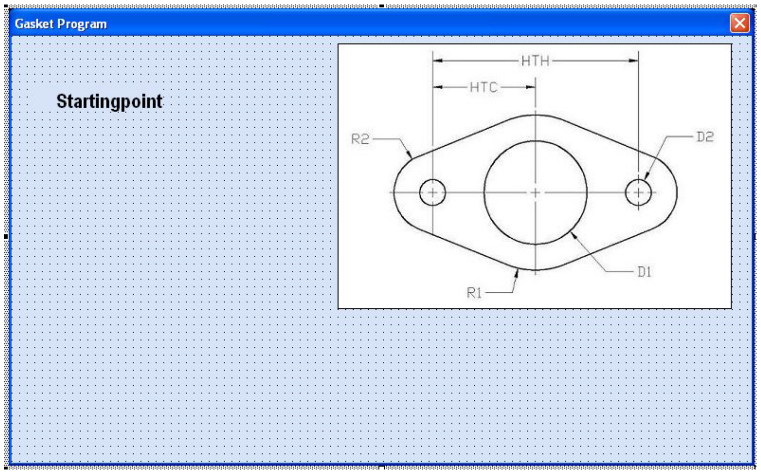


Figure 6.15 – The Finished Label on the Form

For the first label, set the name as **lblStartingpoint** and the caption as Startingpoint. The width of the textbox is 118 and the height is 18. For labels on the left side of the textbox, set the TextAlign attribute to right justification.

Inserting a Textbox into a Form

A textbox is used so that a user of the computer program can input data in the form of words, numbers or a mixture of both. Press the TextBox (ab) button on the Control Toolbar to add a textbox. To size the textbox area, click on the upper left area of the form and hold down on the left mouse button, draw the dotted textbox as shown in Figure 6.16.

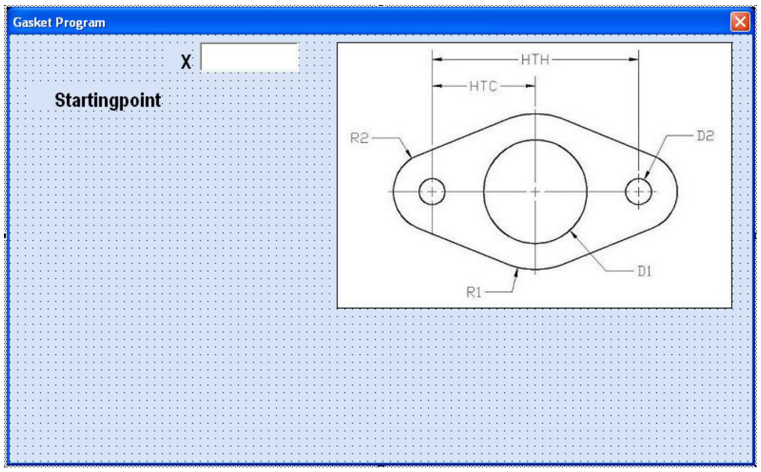
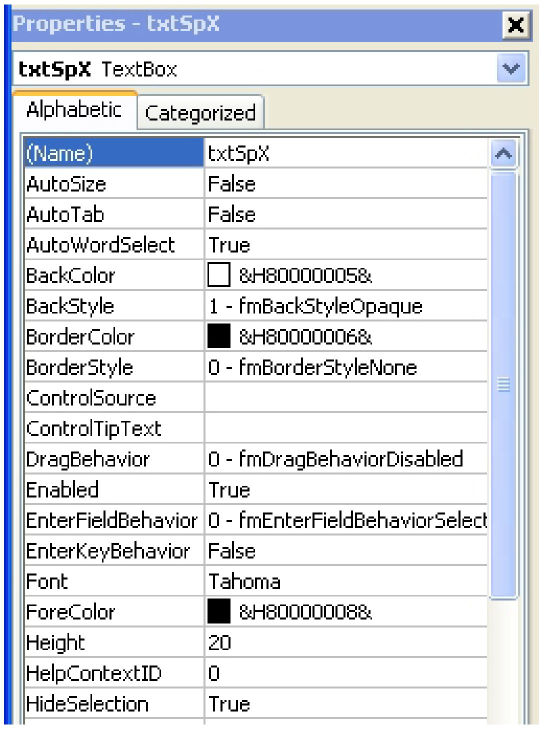


Figure 6.16 – Placing a TextBox on the Form

We will name the TextBox using the three letter prefix followed by the name or phrase of the tool. For our first textbox, the name is **txtSpX.**

Alphabetic	
(Name)	txtSpX
Height	20
Width	78

We place a Label using a common Visual Basic naming convention **lblSpX** just to the left of the Textbox. The Caption for the Label will be **X.** On all of the labels that are just to the left of the Textboxes, we will align the text to the right by setting the **TextAlign** property to right align.



Properties - txtSpX

txtSpX TextBox

Alphabetic | Categorized

(Name)	txtSpX
AutoSize	False
AutoTab	False
AutoWordSelect	True
BackColor	□ &H80000005&
BackStyle	1 - fmBackStyleOpaque
BorderColor	■ &H80000006&
BorderStyle	0 - fmBorderStyleNone
ControlSource	
ControlTipText	
DragBehavior	0 - fmDragBehaviorDisabled
Enabled	True
EnterFieldBehavior	0 - fmEnterFieldBehaviorSelect
EnterKeyBehavior	False
Font	Tahoma
ForeColor	■ &H80000008&
Height	20
HelpContextID	0
HideSelection	True

Figure 6.17 – Changing the (Name) to txtName

We will add another TextBox named **txtSpY** under the first one and the Label to the left of the textbox is called **lblSpY.** The Caption for the Label will be **Y.**

We will add yet another TextBox named **txtSpZ** under the first one and the Label to the left of the textbox is called **lblSpZ.** The Caption for the Label will be **Z.**

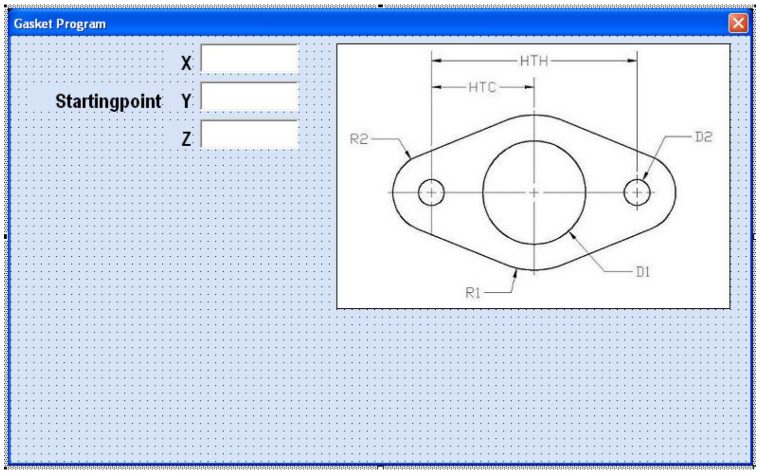


Figure 6.18 – Adding the Y and Z Textboxes

We will add six more textboxes to the form named **txtHTH, txtHTC, txtRadius1, txtRadius2, txtDiameter1,** and **txtDiameter1**. The labels to the left of the textbox are called **lblHTH, lblHTC, lblRadius1, lblRadius2, lblDiameter1,** and **lblDiameter1**. The Captions for the Labels are shown in Figure 6.19.

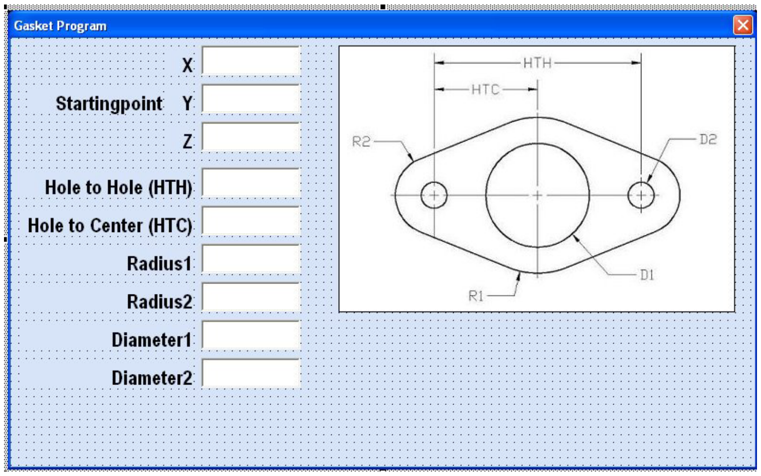


Figure 6.19 – Adding the Last Six Textboxes

Inserting a Command Buttons into a Form

A command button is used so that a user will execute the application. Press the Command button on the Control Toolbar to add a command button. To size the label area, click on the upper left area of the form and hold down on the left mouse button, draw the command button as shown in Figure 6.20.

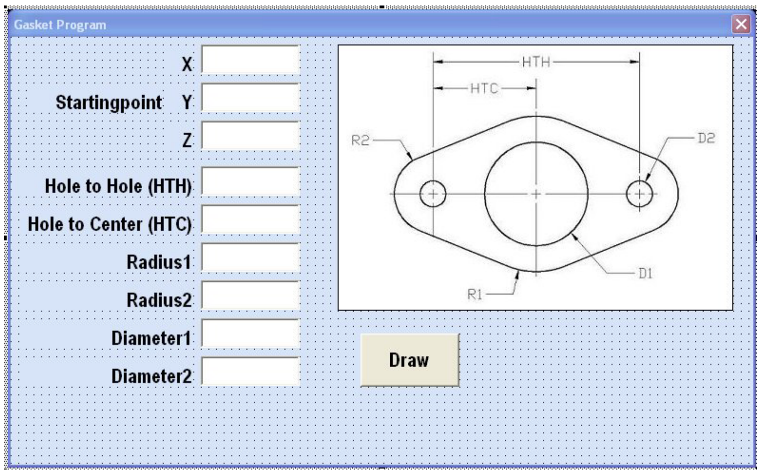
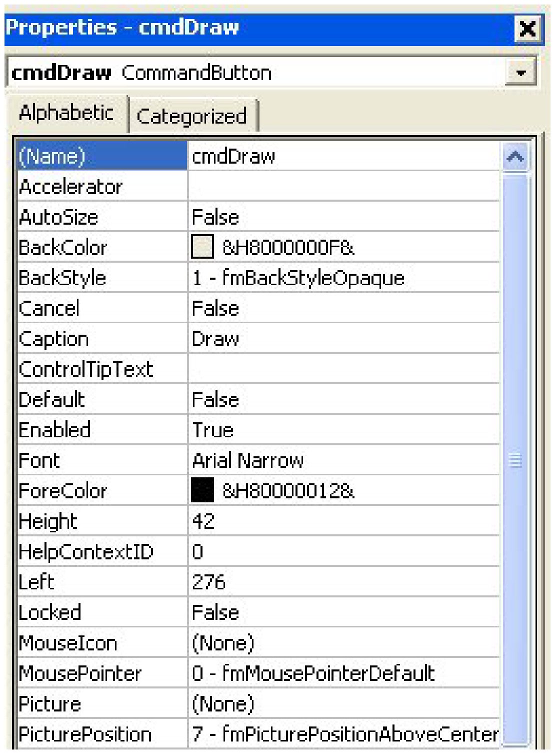


Figure 6.20 – Insert a Command Button onto a Form

We will name the command button using the name is **cmdDraw.**

Alphabetic	
(Name)	cmdDraw
Caption	Draw
Font	Arial Narrow
Height	42
Width	78



Properties - cmdDraw

cmdDraw CommandButton

Alphabetic | Categorized

(Name)	cmdDraw
Accelerator	
AutoSize	False
BackColor	&H8000000F&
BackStyle	1 - fmBackStyleOpaque
Cancel	False
Caption	Draw
ControlTipText	
Default	False
Enabled	True
Font	Arial Narrow
ForeColor	■ &H80000012&
Height	42
HelpContextID	0
Left	276
Locked	False
MouseIcon	(None)
MousePointer	0 - fmMousePointerDefault
Picture	(None)
PicturePosition	7 - fmPicturePositionAboveCenter

Figure 6.21 – Changing the (Name) to cmdDraw

The font we want for the Command Button is 18 point, Arial Narrow. When highlighting the row for Font, a small command button with three small dots appears to the right of the font name of Arial Narrow. Click on the three dotted button to open the Visual Basic Font window. Make the changes as we did before and press OK to save the property.

Add a second Command button; named cmdClear is for clearing the Starting point's X, Y, Z coordinates, Hole to Hole, Hole to Center, Radius1, Radius2, Diameter1 and Diameter2 textboxes. The third command button is to exit the program. When the user presses the Exit command button, the application closes and full control of the manual AutoCAD program returns to the user. Notice the equal spacing between the command buttons gives a visually friendly appearance.

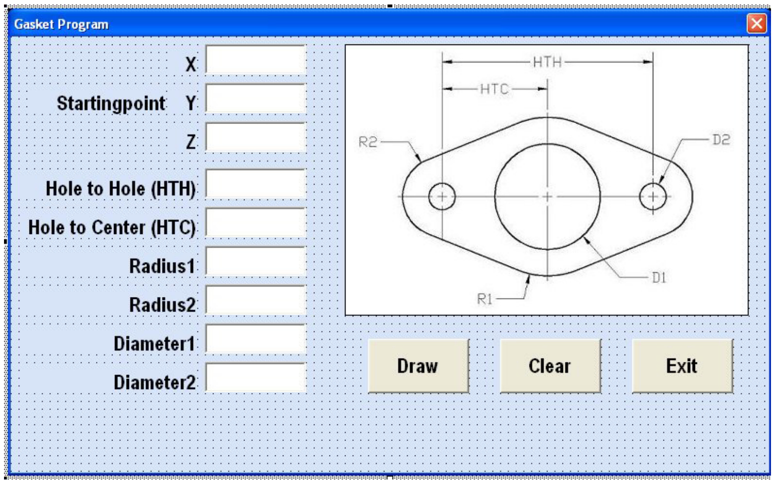


Figure 6.22 – Insert Two More Command Buttons

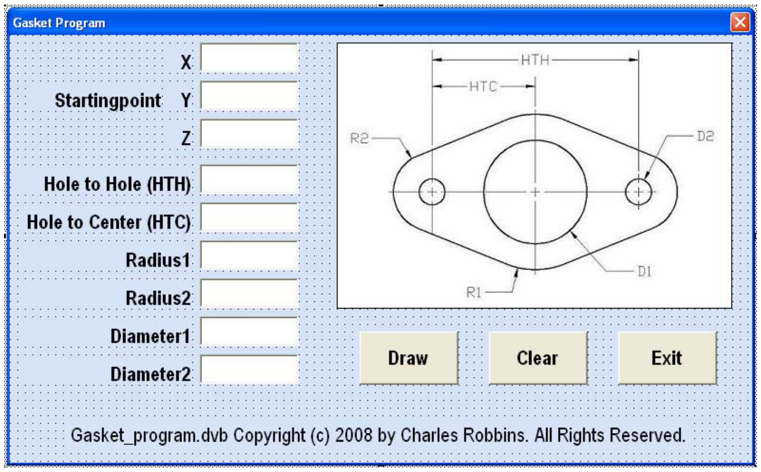
Adding a Copyright Statement to a Form

At the beginning of a new program, we will expect to see an explanation or any special instructions in the form of comments such as copyright, permissions or other legal notices to inform programmers what are the rules dealing with running the code. Comments at the opening of the code could help an individual determine whether the program is right for their application or is legal to use. The message box is a great tool when properly utilized to inform someone if they are breaking a copyright law when running the code.

Finish the form with the following copyright information.

'Gasket Program.dvb - copyright (c) 2008 by charles robbins. All Rights Reserved.

If there are special rules or instructions that the user needs to know, place that information on the bottom of the form.



Gasket_program.dvb Copyright (c) 2008 by Charles Robbins. All Rights Reserved.

Figure 6.24 – Adding a Copyright Statement

Now that the form is complete, we will begin to write the code that actually interfaces the content of the form using logic and computations to draw the stamping in the AutoCAD graphical display. We will begin the program with comments and place addition phrases throughout the program to assist ourselves or others in the future when modifying the code.

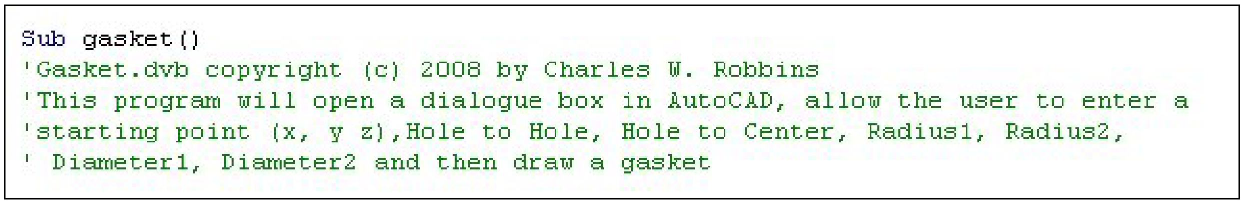
Adding Comments in Visual Basic to Communicate the Copyright

The comments we placed in the first three lines of the program will inform the individual opening and reading the code, but those user that may run the application without checking, the label on the bottom of the form with the copyright information is a great tool to alert the client to the rules of the program and what will the application do.

To begin the actual coding of the program, double click on the Draw command button to enter the programming list. At the top of the program and before the line of code with **Sub CreateGasket ()**, place the following comments with the single quote (‘) character. Remember, the single quote character (‘) will precede a comment and when the code is compiled, comments are ignored.

Type the following line of code:

```
Sub CreateGasket ()

'Gasket.dvb copyright (c) 2005 by Charles W. Robbins
'This program will open a dialogue box in AutoCAD, allow the user to enter a starting point (x, y z)
'Hole to Hole, Hole to Center, Radius1, Radius2, Diameter1, Diameter2 and then draw a gasket
```



```
Sub gasket()
'Gasket.dvb copyright (c) 2008 by Charles W. Robbins
'This program will open a dialogue box in AutoCAD, allow the user to enter a
'starting point (x, y z),Hole to Hole, Hole to Center, Radius1, Radius2,
' Diameter1, Diameter2 and then draw a gasket
```

Figure 6.25 – Adding Comments into the Code

Declaring Variables in a Program with the Dimension Statement

When we are going to use a number, text string or object that may change throughout the life of the code, we create a variable to hold the value of that changing entity. In Visual Basic, the dimension or dim statement is one of the ways to declare a variable at the script of procedure level. The other two ways are the Private and Public statements, which we will use in later chapters.

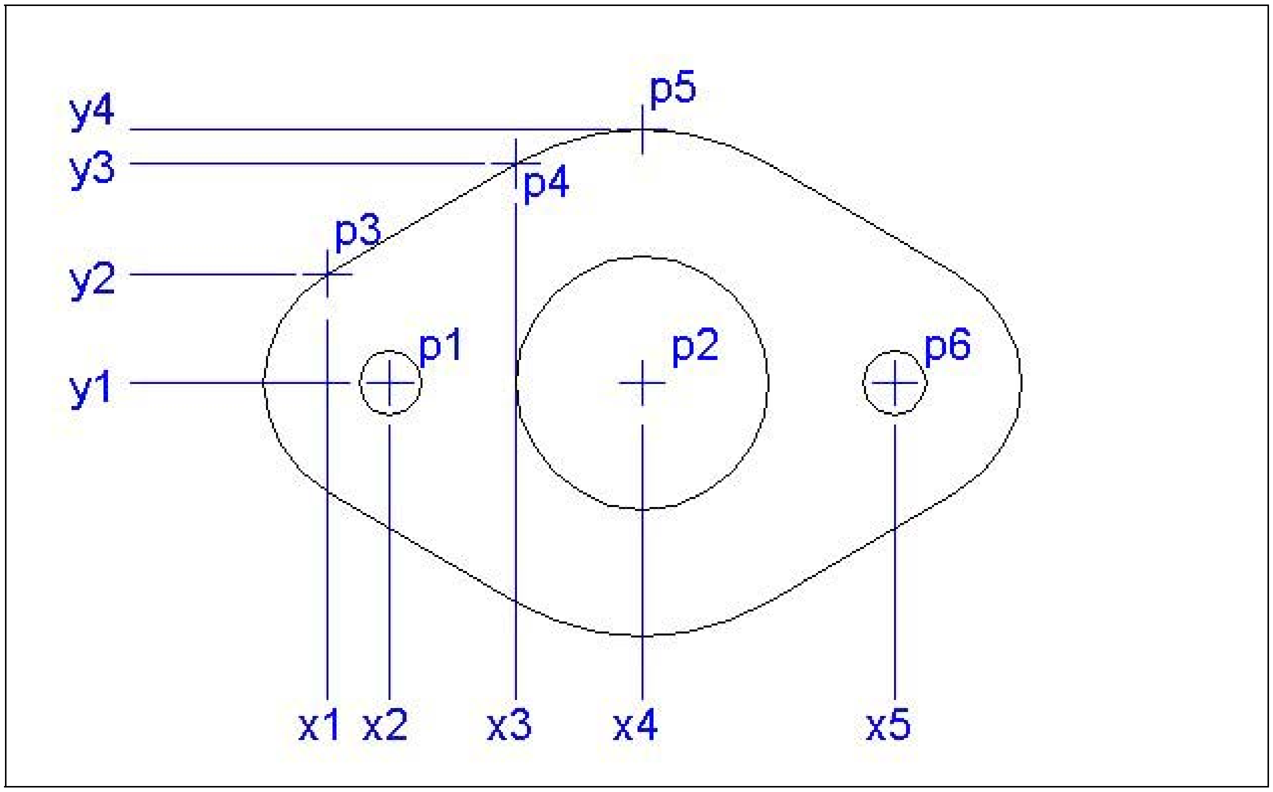


Figure 6.26 – Identifying the Variables for the Gasket Program

In figure 6.26, we have a drawing that shows an X and Y grid for each point we need to draw. In this program, we only need points 1 through 6. To create the points, we have made a grid with the values of x1 through x5 horizontally on the bottom and y1 through y4 vertically on the left. In the program, we will define point P1 as coordinate (x2, y1, z1), point P2 as (x4, y1, z1) and so forth. We have found that points are easily defined using this method and therefore explaining the algebra in the program is simpler.

In our program, we will declare a variable to enable us to draw lines, arcs and circles, a variable for each vertex and a variable for each textbox. As we can see below, the made up name **objCircle** is an AutoCAD Circle by definition and the contrived name **objLine** is a line. The **objArc** is an AutoCAD Arc. To mirror the two arcs and the line in the drawing, we have made three addition variables, **objSs1, objDrawingObject** and **objMirroredObject.** The first is for creating a selection set, the second is to hold drawing objects and the last is for mirroring the objects. We will cover the selecting and mirroring code later in the chapter.

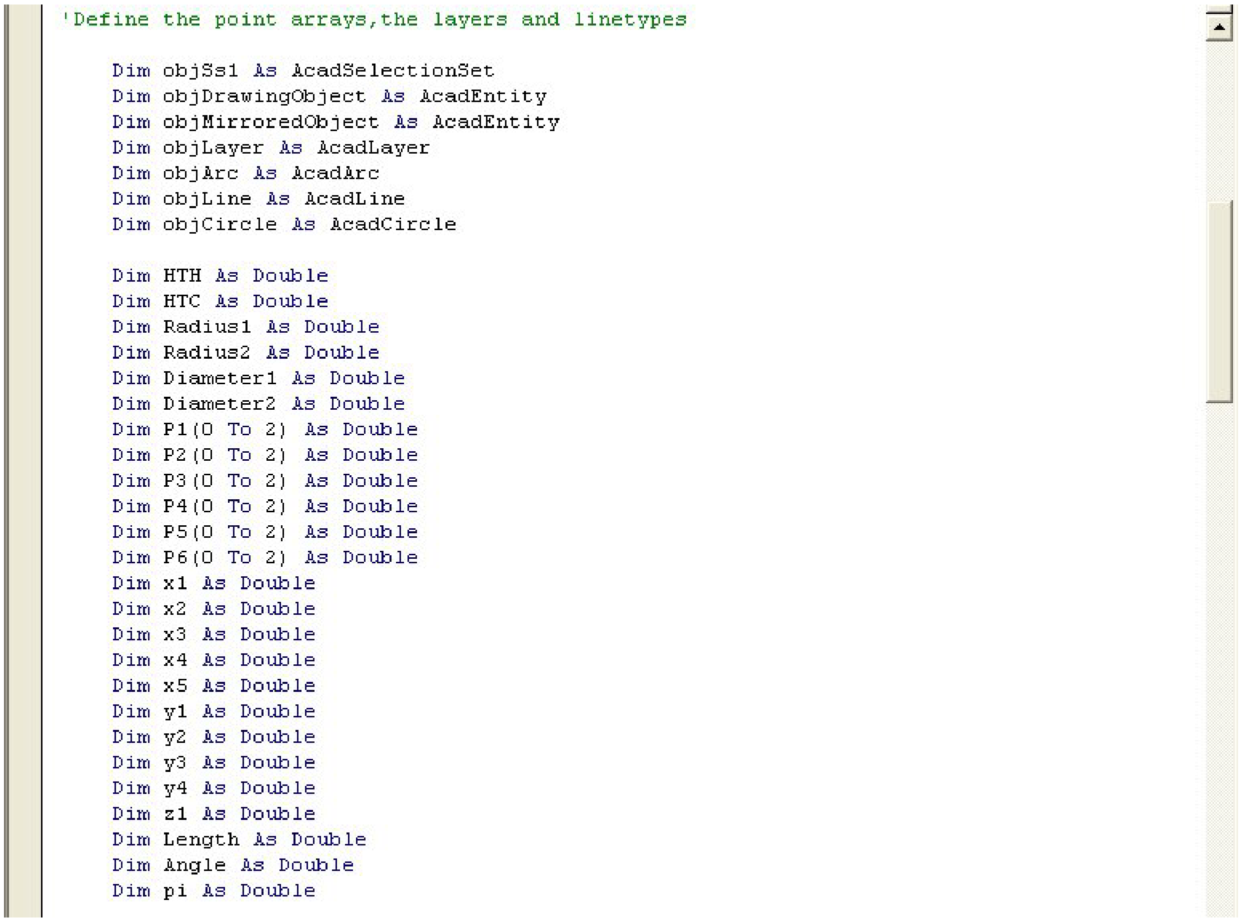
Type the following lines of code after the comment.

```
'Define the point arrays, the layers and objects

   Dim objSs1 As AcadSelectionSet
   Dim objDrawingObject As AcadEntity
   Dim objMirroredObject As AcadEntity
   Dim objLayer As AcadLayer
   Dim objArc As AcadArc
   Dim objCircle As AcadCircle
   Dim objLine As AcadLine
   Dim HTH As Double
   Dim HTC As Double
   Dim Radius1 As Double
   Dim Radius2 As Double
   Dim Diameter1 As Double
   Dim Diameter2 As Double
   Dim P1(0 To 2) As Double
   Dim P2(0 To 2) As Double
   Dim P3(0 To 2) As Double
   Dim P4(0 To 2) As Double
   Dim P5(0 To 2) As Double
   Dim P6(0 To 2) As Double

   Dim x1 As Double
   Dim x2 As Double
   Dim x3 As Double
   Dim x4 As Double
   Dim x5 As Double
   Dim y1 As Double
   Dim y2 As Double
   Dim y3 As Double
   Dim y4 As Double
   Dim z1 As Double
   Dim Length As Double
   Dim Angle As Double
   Dim pi As Double
```

Next, we declare HTH, HTC, Radius1, Radius2, Diameter1 and Diameter2 as double integers (As Double).

The vertices or points are declared as double integers (As Double) with an array of zero to two (0 to 2). The vertex P1(0) represents the X coordinate, the P1(1) represents the Y coordinate and P1(2) represents the Z coordinate. Some may think that it is a waste of time to involve the Z-axis in a two dimension drawing, but we will incorporate the Z coordinate for designers that work in all three dimensions. For everyone else, we will just enter zero (0) in the Z coordinate textbox. We will declare points P1 through P6 for the vertices in the drawing in Figure 6.26.

As discussed previously, we have given the gasket drawing problem a grid, so we declare x1 through x5, y1 through y4, and z1. To calculate the geometry of the angled line, we made two addition variables, Length and Angle. Finally, we set a variable named pi which will hold 3.14159265358979 for this mathematical constant.



```
'Define the point arrays,the layers and linetypes

    Dim objSs1 As AcadSelectionSet
    Dim objDrawingObject As AcadEntity
    Dim objMirroredObject As AcadEntity
    Dim objLayer As AcadLayer
    Dim objArc As AcadArc
    Dim objLine As AcadLine
    Dim objCircle As AcadCircle

    Dim HTH As Double
    Dim HTC As Double
    Dim Radius1 As Double
    Dim Radius2 As Double
    Dim Diameter1 As Double
    Dim Diameter2 As Double
    Dim P1(0 To 2) As Double
    Dim P2(0 To 2) As Double
    Dim P3(0 To 2) As Double
    Dim P4(0 To 2) As Double
    Dim P5(0 To 2) As Double
    Dim P6(0 To 2) As Double
    Dim x1 As Double
    Dim x2 As Double
    Dim x3 As Double
    Dim x4 As Double
    Dim x5 As Double
    Dim y1 As Double
    Dim y2 As Double
    Dim y3 As Double
    Dim y4 As Double
    Dim z1 As Double
    Dim Length As Double
    Dim Angle As Double
    Dim pi As Double
```

Figure 6.27 – Declaring Variables with Dim Statements

Remember, when selecting variable names, they should be a word or a phrase without spaces that represents the value that the variable contains. If we want to hold a value of one's date of birth, we can call the variable, DateofBirth. The keywords Date and Birth are in sentence case with the first letter capitalized. There are no spaces in the name. Some programmers use the underscore character (_) to separate words in phrases. This is acceptable, but a double underscore (__) can cause errors if we do not detect the repeated character.

Assigning Values to the Variables

After we declare the variables and before we start drawing, we will assign the variables from the input the user types in the textboxes on the launched user form and then assign values to each of the vertices in the set of construction points.

Assigning the values to pi and the variables representing the textboxes is quite easy; however doing the geometry is a challenge to some programmers. The first real math in the subroutine is computing the adjacent side of the angle using the Pythagorean theorem, where $a^2+b^2=c^2$. Except, we need to find the length of the adjacent side by computing:

$$b^2=c^2-a^2$$

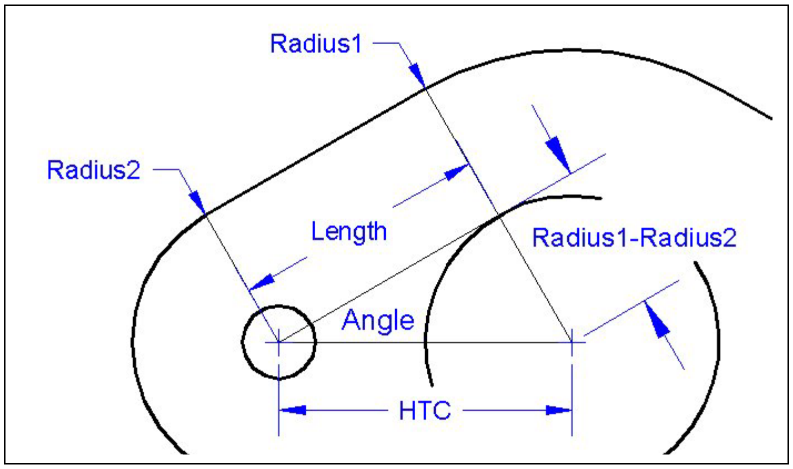


Figure 6.28 –Variables for Length and Angle

We substitute Length for b, HTC for c and Radius1-Radius2 for a. To find b and not b^2, we use the square root function **Sqr.** To square a number, we use the **^2** to take the value to the second power. Write the equation in the subroutine:

Length = Sqr(HTC ^ 2 - (Radius1 - Radius2) ^ 2)

To get the angle of the line between the arcs in the gasket problem, we will use the arctangent function **Atn.** The tangent of an angle of a right triangle is the length of the opposite side divided by the length of the adjacent side. Use parenthesis to assure the order of operations is done correctly. To find the arctangent, we divide (Radius1-Radius2) by Length using the equation:

Angle = Atn((Radius1 - Radius2) / Length)

The value of x4 is txtSpX, sy1 is txtSpY and z1 is txtSpZ, making P2 the center point of the gasket. Finding the other measurement along the X or Y number lines is quite easy, except the X and Y values for P3 and P4. Figure 6.29 shows the vertical length of a triangle as the radius times the sine of the angle plus Pi divided by 2 and the horizontal length as the radius times the cosine of the angle plus Pi divided by 2

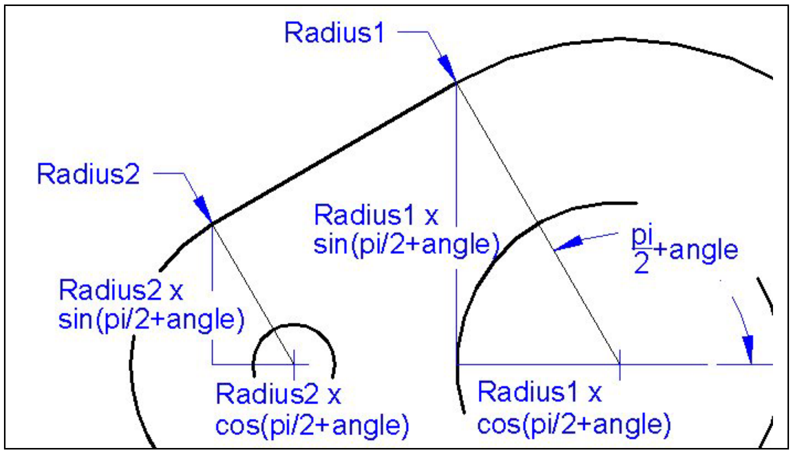

Radius1
Radius2
Radius1 x sin(pi/2+angle)
pi/2+angle
Radius2 x sin(pi/2+angle)
Radius2 x cos(pi/2+angle)
Radius1 x cos(pi/2+angle)

Figure 6.29 –Variables Defined by Sine and Cosine

Type the following code right below the declared variables.

```
'assigning values to the variables

    pi = 3.14159265358979
    HTH = txtHTH
    HTC = txtHTC
    Radius1 = txtRadius1
    Radius2 = txtRadius2
    Diameter1 = txtDiameter1
    Diameter2 = txtDiameter2
    Length = Sqr(HTC ^ 2 - (Radius1 - Radius2) ^ 2)
    Angle = Atn((Radius1 - Radius2) / Length)
    x4 = txtSpX
    x2 = x4 - HTC
    x1 = x2 + Radius2 * Cos((pi / 2) + Angle)
    x3 = x4 + Radius1 * Cos(pi / 2 + Angle)
    x5 = x4 + HTC
    y1 = txtSpY
    y2 = y1 + Radius2 * Sin(pi / 2 + Angle)
    y3 = y1 + Radius1 * Sin(pi / 2 + Angle)
    y4 = y1 + Radius1
    z1 = txtSpZ

'point assignments and math

   P1(0) = x2
    P1(1) = y1
    P1(2) = z1
    P2(0) = x4
    P2(1) = y1
    P2(2) = z1
    P3(0) = x1
    P3(1) = y2
    P3(2) = z1
    P4(0) = x3
    P4(1) = y3
    P4(2) = z1
    P5(0) = x4
    P5(1) = y4
    P5(2) = z1
    P6(0) = x5
    P6(1) = y1
    P6(2) = z1
```

The point assignments are made as we discussed previously. Just review the data from figure 6.26 and make the correct coordinate designation as shown above.

Inputting the Code to Set a System Variable

To change a system variable such as the Object Snap Mode, so the Endpoint, Midpoint or other setting cannot interfere with the construction of the orthographic view of the gasket, we will turn off the Object Snaps. Type **ThisDrawing.SetVariable "osmode", 0** and the system setting for Object Snaps will be turned off.

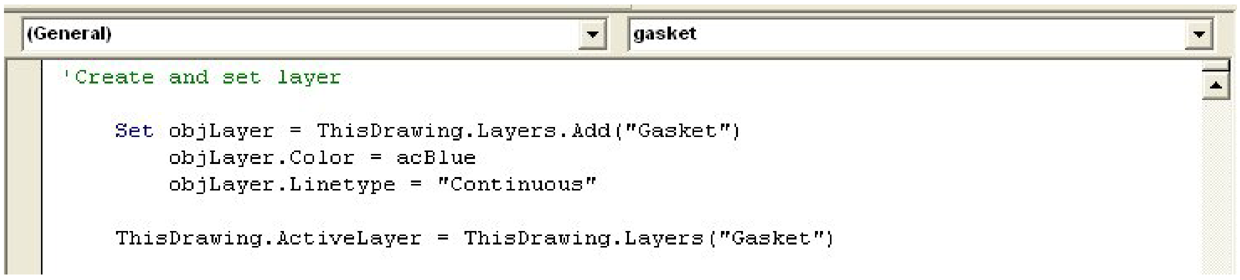
```
'Set variables

   ThisDrawing.SetVariable "osmode", 0
```

Inputting the Code to Create and Set a Layer

Many times, we will want to create a layer and then set the layer throughout a program. To create a layer, type **Set objLayer = ThisDrawing.Layers.Add** and in parenthesis place the new layer name in quotes, such as "Gasket". After making the new layer, set the layer color and linetype by typing **objLayer.Color = acBlue** and **objLayer.Linetype = "Continuous"**. We could make a layer the color green and with hidden lines if we choose.

To set the layer current, before drawing an entity, we would type:

```
ThisDrawing.ActiveLayer = ThisDrawing.Layers("Gasket")
```



```
'Create and set layer

    Set objLayer = ThisDrawing.Layers.Add("Gasket")
        objLayer.Color = acBlue
        objLayer.Linetype = "Continuous"

    ThisDrawing.ActiveLayer = ThisDrawing.Layers("Gasket")
```

Figure 6.30 –Creating and Setting an AutoCAD Layer

Inputting the Code to Draw in Visual Basic

Now we want to enter the code that will actually draw the line and two arcs in the AutoCAD Model Space. We use the Set function to draw a line by typing **Set ObjLine** and then we tell the computer that it will draw in Modelspace by adding a line from point P3 to point P4.

Go ahead and type the following comments and drawing code:

```
'Draw a line

   Set objLine = ThisDrawing.ModelSpace.AddLine(P3, P4)
```

Now, in this problem, we draw two arcs. We give the center point of the arc, the radius of the arc and then the starting and ending angles in radians. The starting point of the small arc is pi/2 + angle as we saw in figure 6.29. The ending point is pi radians which equals 180 degrees. The larger radius starts at pi/2 and ends at pi/2 + angle. After coding for a few weeks, we get used to working with radians.

```
'Draw the arcs

   Set objArc = ThisDrawing.ModelSpace.AddArc(P1, Radius2, pi / 2 + Angle, pi)
   Set objArc = ThisDrawing.ModelSpace.AddArc(P2, Radius1, pi / 2, pi / 2 + Angle)
```

Using Selection Sets and Mirroring in Visual Basic

Before we mirror the two arcs and a single line across the vertical centerline, we will select the three objects using the Select all function, First, we define a temporary selection set called objSs1 by typing **Set objSs1 = ThisDrawing.SelectionSets.Add("TempSS")** and then we select the three entities using **objSs1.Select (acSelectionSetAll).**

To mirror the three objects in objSs1, we key the following code:

```
For Each objDrawingObject In objSs1
    Set objMirroredObject = objDrawingObject.Mirror(P2, P5)
    objMirroredObject.Update
Next
```

We will always input the mirror function as shown, only changing the name of the selection set containing the entities or changing the points on the mirror line. In the next macro, we will mirror the four arcs and two lines across the horizontal centerline defined by P1 and P2. The last step in the process is to delete the selection set with **objSs1.Delete.**

```
'Mirror the line and arcs across horizontal centerline

Set objSs1 = ThisDrawing.SelectionSets.Add("TempSS")
   objSs1.Select (acSelectionSetAll)

For Each objDrawingObject In objSs1
    Set objMirroredObject = objDrawingObject.Mirror(P1, P2)
    objMirroredObject.Update
Next
objSs1.Delete
```

Drawing the Circles and Ending the Subroutine in Visual Basic

We use the Set function to draw a circle by typing **Set ObjCircle** and then we tell the computer that it will draw in Modelspace by adding a circle from the center point P2 with a radius that contains the value from the Diameter textbox divided by 2. Then we draw two more circles with the radius at center points P1 and P6.

```
'Draw the circles

  Set objCircle = ThisDrawing.ModelSpace.AddCircle(P2, Diameter1 / 2)
  Set objCircle = ThisDrawing.ModelSpace.AddCircle(P1, Diameter2 / 2)
  Set objCircle = ThisDrawing.ModelSpace.AddCircle(P6, Diameter2 / 2)
```

To end this Visual Basic subroutine, we will type a comment saying so. In the future, this will be more elaborate, but for now we will just get used to announcing the natural divisions of the script.

Type the following code:

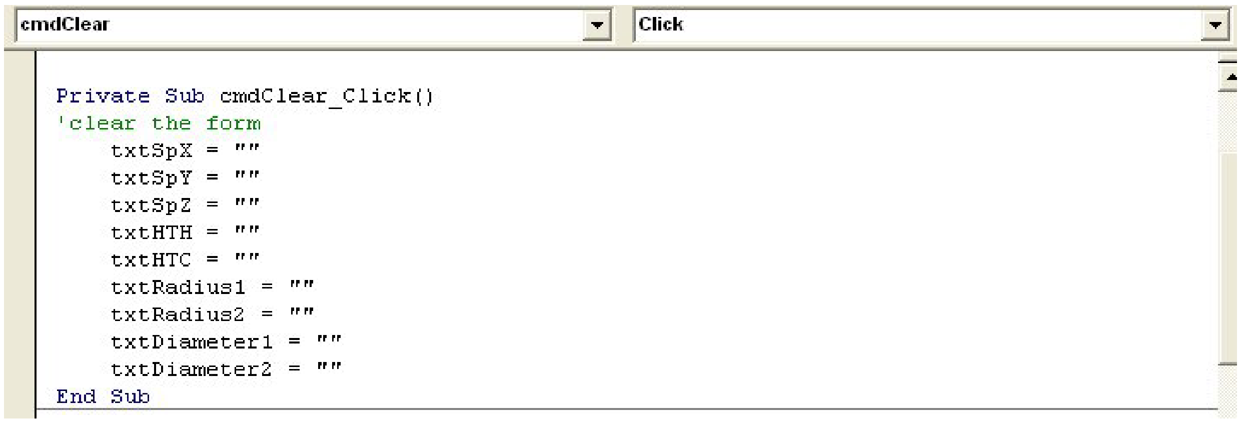
```
'End of program
End Sub
```

Resetting the Data with the cmdClear Command Button

To clear the textboxes containing the user input, we will first set the textbox for txtXcoord, txtXcoord.text property to a "0.00" entry by using the equal sign "=".This makes the property equal zero as a default. We do this also for the Y and Z coordinates. We will set the textboxes for txtWidth, txtWidth.text property to a black entry by using the equal sign "=" and the null string "", and this will make that property blank. Notice that after the control object name the dot (.) separates the suffix which is the name of the property for that object.

Key the following code as a new subroutine **Private Sub cmdClear_Click().**

```
Private Sub cmdClear_Click()
'clear the form
  txtSpX = ""
  txtSpY = ""
  txtSpZ = ""
  txtHTH = ""
  txtHTC = ""
  txtRadius1 = ""
  txtRadius2 = ""
  txtDiameter1 = ""
  txtDiameter2 = ""
End Sub
```



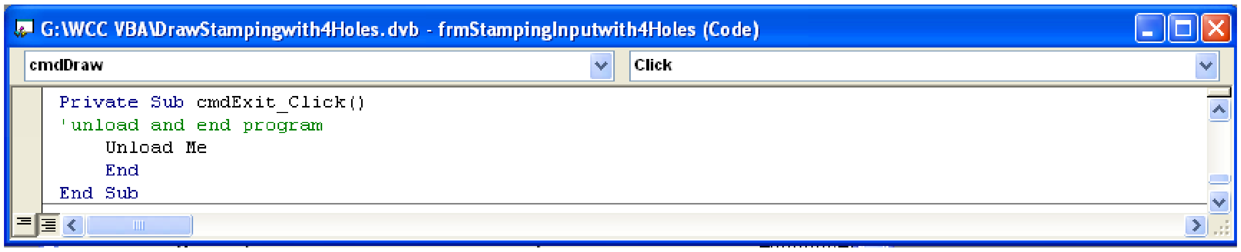
```
Private Sub cmdClear_Click()
'clear the form
    txtSpX = ""
    txtSpY = ""
    txtSpZ = ""
    txtHTH = ""
    txtHTC = ""
    txtRadius1 = ""
    txtRadius2 = ""
    txtDiameter1 = ""
    txtDiameter2 = ""
End Sub
```

Figure 6.31 – Computing the Reset Button by Clearing Textboxes

Exiting the Program with the cmdExit Command Button

To exit this program, we will unload the application and end the program.
Type the following code:

```
Private Sub cmdExit_Click()
'unload and end program
   Unload Me
   End
End Sub
```


G:\WCC VBA\DrawStampingwith4Holes.dvb - frmStampingInputwith4Holes (Code)
cmdDraw
Click

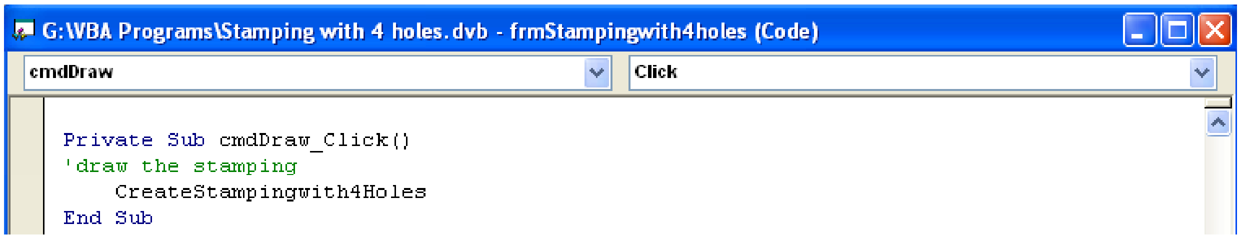
```
Private Sub cmdExit_Click()
'unload and end program
    Unload Me
    End
End Sub
```

Figure 6.32 – Coding the Exit Button

Executing a Subroutine with the cmdDraw Command Button

In this program, we use a subroutine which is executed by the Draw command button, so type the following code to execute the subroutine, **CreateGasket**

```
Private Sub cmdDraw_Click()
'draw the Gasket
   CreateGasket
End Sub
```


G:\WBA Programs\Stamping with 4 holes.dvb - frmStampingwith4holes (Code)

cmdDraw | Click

```
Private Sub cmdDraw_Click()
'draw the stamping
    CreateStampingwith4Holes
End Sub
```

Figure 6.33 – Coding the Draw Button

Written below is the entire program for creating the Gasket.

```
Sub CreateGasket()

'Gasket.dvb copyright (c) 2005 by Charles W. Robbins
'This program will open a dialogue box in AutoCAD, allow the user to enter
'a starting point (x, y z),Width, Height, Radius, Diameter, Offset1, Offset2
'and then draw a four holed stamping with arcs

'define the starting and centerpoint arrays, width, height and radius

   Dim objSs1 As AcadSelectionSet
   Dim objDrawingObject As AcadEntity
   Dim objMirroredObject As AcadEntity
   Dim objLayer As AcadLayer
   Dim objArc As AcadArc
   Dim objCircle As AcadCircle
   Dim objLine As AcadLine
   Dim HTH As Double
   Dim HTC As Double
   Dim Radius1 As Double
   Dim Radius2 As Double
   Dim Diameter1 As Double
   Dim Diameter2 As Double
   Dim P1(0 To 2) As Double
   Dim P2(0 To 2) As Double
   Dim P3(0 To 2) As Double
   Dim P4(0 To 2) As Double
   Dim P5(0 To 2) As Double
   Dim P6(0 To 2) As Double
   Dim x1 As Double
   Dim x2 As Double
   Dim x3 As Double
   Dim x4 As Double
   Dim x5 As Double
   Dim y1 As Double
   Dim y2 As Double
   Dim y3 As Double
   Dim y4 As Double
```

```
    Dim z1 As Double
    Dim Length As Double
    Dim Angle As Double
    Dim pi As Double

'assigning values to the variables

    pi = 3.14159265358979
    HTH = txtHTH
    HTC = txtHTC
    Radius1 = txtRadius1
    Radius2 = txtRadius2
    Diameter1 = txtDiameter1
    Diameter2 = txtDiameter2
    Length = Sqr(HTC ^ 2 - (Radius1 - Radius2) ^ 2)
    Angle = Atn((Radius1 - Radius2) / Length)
    x4 = txtSpX
    x2 = x4 - HTC
    x1 = x2 + Radius2 * Cos((pi / 2) + Angle)
    x3 = x4 + Radius1 * Cos(pi / 2 + Angle)
    x5 = x4 + HTC
    y1 = txtSpY
    y2 = y1 + Radius2 * Sin(pi / 2 + Angle)
    y3 = y1 + Radius1 * Sin(pi / 2 + Angle)
    y4 = y1 + Radius1
    z1 = txtSpZ

'point assignments and math

    P1(0) = x2
    P1(1) = y1
    P1(2) = z1
    P2(0) = x4
    P2(1) = y1
    P2(2) = z1
    P3(0) = x1
    P3(1) = y2
    P3(2) = z1
    P4(0) = x3
    P4(1) = y3
    P4(2) = z1
    P5(0) = x4
    P5(1) = y4
    P5(2) = z1
    P6(0) = x5
    P6(1) = y1
    P6(2) = z1
```

```
'Set variables

   ThisDrawing.SetVariable "osmode", 0

'Create and set layer

   Set objLayer = ThisDrawing.Layers.Add("Gasket")
      objLayer.Color = acBlue
      objLayer.Linetype = "Continuous"

   ThisDrawing.ActiveLayer = ThisDrawing.Layers("Gasket")

'Draw a line

   Set objLine = ThisDrawing.ModelSpace.AddLine(P3, P4)

'Draw the arcs


   Set objArc = ThisDrawing.ModelSpace.AddArc(P1, Radius2, pi / 2 + Angle, pi)
   Set objArc = ThisDrawing.ModelSpace.AddArc(P2, Radius1, pi / 2, pi / 2 + Angle)

'Mirror the line and arcs across vertical centerline

   Set objSs1 = ThisDrawing.SelectionSets.Add("TempSS")
      objSs1.Select (acSelectionSetAll)

   For Each objDrawingObject In objSs1
      Set objMirroredObject = objDrawingObject.Mirror(P2, P5)
      objMirroredObject.Update
   Next
   objSs1.Delete

'Mirror the line and arcs across horizontal centerline

   Set objSs1 = ThisDrawing.SelectionSets.Add("TempSS")
      objSs1.Select (acSelectionSetAll)


   For Each objDrawingObject In objSs1
      Set objMirroredObject = objDrawingObject.Mirror(P1, P2)
      objMirroredObject.Update
   Next
   objSs1.Delete

'Draw the circles

   Set objCircle = ThisDrawing.ModelSpace.AddCircle(P2, Diameter1 / 2)
   Set objCircle = ThisDrawing.ModelSpace.AddCircle(P1, Diameter2 / 2)
   Set objCircle = ThisDrawing.ModelSpace.AddCircle(P6, Diameter2 / 2)

End Sub
```

```
Private Sub cmdClear_Click()
'clear the form
   txtSpX = ""
   txtSpY = ""
   txtSpZ = ""
   txtHTH = ""
   txtHTC = ""
   txtRadius1 = ""
   txtRadius2 = ""
   txtDiameter1 = ""
   txtDiameter2 = ""
End Sub

Private Sub cmdDraw_Click()
'draw the Gasket
   CreateGasket
End Sub

Private Sub cmdExit_Click()
'unload and end program
   Unload Me
   End
End Sub
```

Inserting a Module into a Visual Basic Application

Insert a Module by selecting Insert on the Menu Bar and select Module as shown in Figure 6.34. In the Project Menu, double click on the Module and type the following code.

```
Sub DrawGasket ()
'draw the Gasket
   frmGasket.Show
End Sub
```

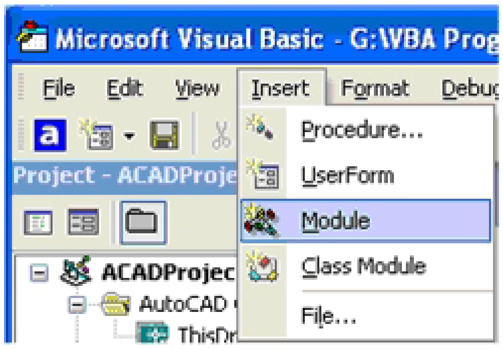
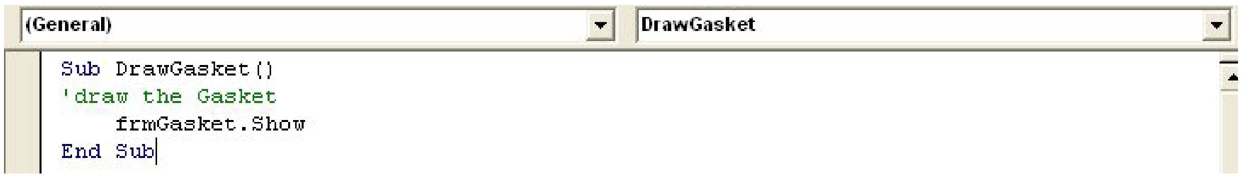


Figure 6.34 – Inserting a Module

The line of code, **frmGasket.Show** will display the form at the beginning of the program.

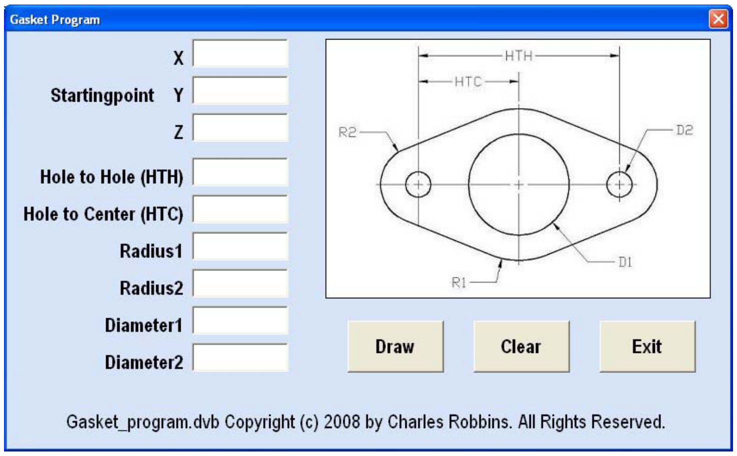

(General)
DrawGasket

```
Sub DrawGasket()
'draw the Gasket
    frmGasket.Show
End Sub
```

Figure 6.35 – Coding the Module

Running the Program

After noting that the program is saved, press the F5 to run the Gasket application. Gasket window will appear on the graphical display in AutoCAD as shown in Figure 6.36.



Gasket_program.dvb Copyright (c) 2008 by Charles Robbins. All Rights Reserved.

Figure 6.36 – Launching the Program

Type the following data or something similar into the textboxes and select the Draw Command Button to execute the program. To exit the program, press the Exit command button on the Gasket Program window. In AutoCAD, the drawing of the finished gasket will appear as shown in figure 6.38.

X	1
Y	1
Z	0
HTH	2
HTC	1
Radius1	1
Radius2	0.5
Diameter1	1
Diameter2	0.25

Figure 6.37 – Input Data

There are many variations of this Visual Basic Application we can practice and draw many single view orthographic drawings. While we are practicing with forms, we can learn how to use variables, make point assignments and draw just about anything we desire. These are skills that we want to commit to memory.

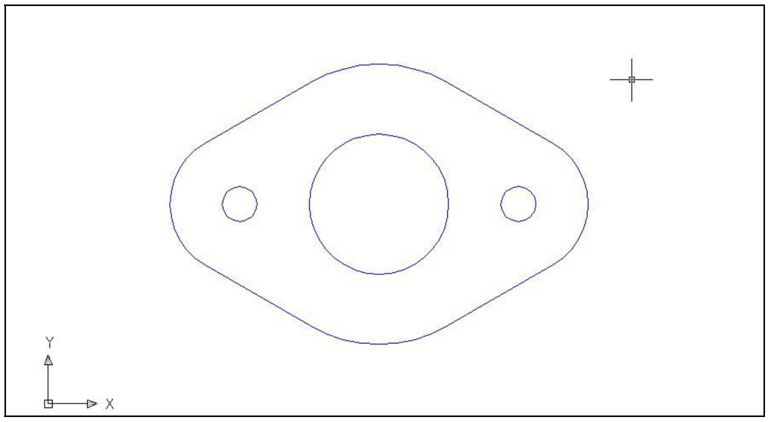


Figure 6.38 – The Finished Draw

*** World Class CAD Challenge 5-6 * - Write a Visual Basic Application that draws a gasket with three holes is executed by a inputting data in a form. Complete the program in less than 120 minutes to maintain your World Class ranking.**

Continue this drill four times making other shapes and simple orthographic views with lines and circles, each time completing the Visual Basic Application in less than 120 minutes to maintain your World Class ranking.