

# Pneumatic, Hydraulic and P&ID Diagrams

This chapter goes through the steps for creating Piping & Instrumentation (P&ID) and Hydraulic drawings but the same workflow can be applied for Pnuematics. Once your drawing is created, you can use the regular tools in the AutoCAD® Electrical software to modify your drawing.

# 10

## In this chapter

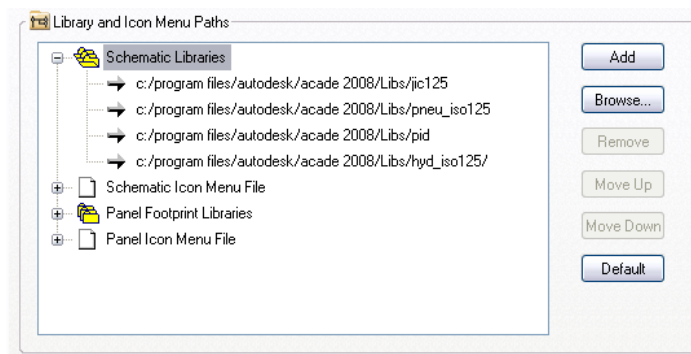
- [Setting Up Hydraulic Drawings](#)
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## Setting Up Hydraulic Drawings


Use the Project Manager to manage your hydraulic drawings. From here you can create a new drawing and modify any drawing properties.

### Create a new drawing

- 1 In the Project Manager, right-click the project name, and select Properties.
- 2 In the Project Properties ► Project Settings dialog box, click Default to switch on all paths for pneumatic, hydraulic and P&ID schematic libraries.



- 3 Click OK.

- 4  In the Project Manager, click the Create New Drawing tool.

- 5 In the Create New Drawing dialog box, specify:

Name: AEGS12

Template: *Mouse over the edit box to verify AutoCAD\_Electrical.dwt is specified*

Description 1: Hydraulic Example

Click OK.

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**NOTE** You can also Click OK-Properties to proceed to Drawing Properties dialog box if you want to set the component, wire number, cross-reference, style and drawing format settings.

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- 6 Select Tools ► Drafting Settings.

7 In the Drafting Settings ► Snap and Grid dialog box, turn on Snap and Grid and set the size of both to 0.125.

8 Click OK.



9 Click the Drawing Properties tool.

Projects ► Drawing Properties

10 In the Drawing Properties ► Drawing Format dialog box, Scale section, make sure that the feature scale multiplier is set to 1.0 inch.

11 Click OK.

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**NOTE** For metric unit, the following settings are recommended so that the wire connection points will be placed on the grids for easier drafting. Grid and Snap Size = 2.5mm; Feature scale multiplier =20 (scale factor = 20)

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12 Select Projects ► Toolbars ► Extra Libraries.

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**NOTE** You can also turn on the toolbar by right-clicking on any toolbar and selecting ACE: Extra Libraries.

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This toolbar has tools for inserting Pneumatic, Hydraulic and P&ID components.



## Inserting Hydraulic Schematic Symbols

The hydraulic symbol library in AutoCAD® Electrical includes filters, valves, cylinders, pressure switches, motors, pumps, meters, restrictors, quick disconnects, flow arrows and more. The hydraulic symbol library consists of all the hydraulic symbols and is found at *\Program Files [(x86)]\Autodesk\Acade {version}\Libs\hyd\_iso125*.

### Insert hydraulic symbols



1 Click the Insert Hydraulic Component tool.

- 2 In the Insert Component: Hydraulic Symbol dialog box, select the check box for Vertical.



- 3 In the Insert Component: Hydraulic Symbol dialog box, click the General Valves icon.



- 4 In the Hydraulic: General Valves dialog box, click Shut Off Valve Open.

- 5 Respond to the prompts as follows:

Specify insertion point:

*Select to place the valve in the upper left corner of your drawing*

- 6 In the Insert/Edit Component dialog box, specify:

Component Tag: VAL2

Click OK.

- 7 Repeat steps 1 - 3.



- 8 In the Hydraulic: General Valves dialog box, click Checkvalve Flow Left.

- 9 Respond to the prompts as follows:

Specify insertion point:

*Select to place the check valve below the shut off valve*

- 10 In the Insert/Edit Component dialog box, click OK.



- 11 Click the Insert Hydraulic Component tool.



- 12 In the Insert Component: Hydraulic Symbol dialog box, click Motors & Pumps.

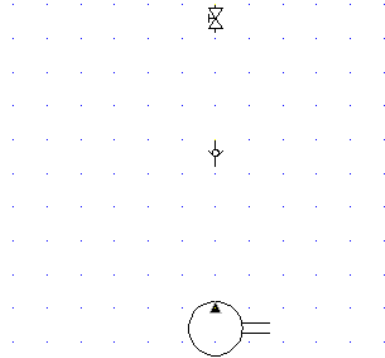


- 13 In the Hydraulic: Motors and Pumps dialog box, click Fixed Displacement.

-  **14** In the Hydraulic: Fixed Displacement dialog box, click Uni-Directional Pump.

- 15** Respond to the prompts as follows:


Specify insertion point: *Select to place the pump below the check valve*



- 16** In the Insert/Edit Component dialog box, specify:  
Component Tag: Hydraulic Oil Pump  
Click OK.

- 17** Insert another Shut Off Valve Open below the Hydraulic Oil Pump.

-  **18** Click the Insert Hydraulic Component tool.

-  **19** In the Insert Component: Hydraulic Symbol dialog box, click Filters.

-  **20** In the Hydraulic: Filters dialog box, click Filter.


- 21** Respond to the prompts as follows:


Specify insertion point: *Select to place the filter below the shut off valve*

- 22** In the Insert/Edit Component dialog box, specify:  
Component Tag: FI2

Description: Line 1: Filter

Click OK.

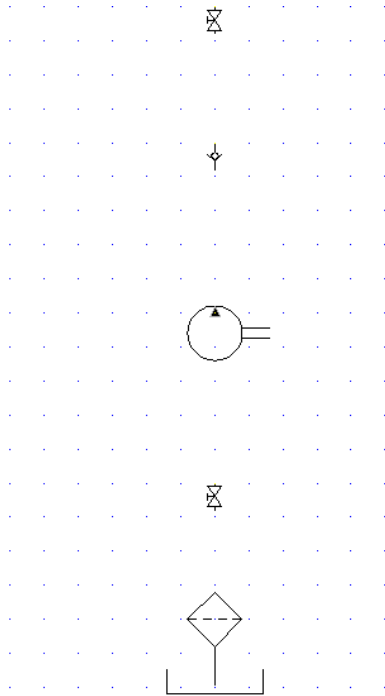
- 23  Click the Insert Hydraulic Component tool.

- 24  In the Insert Component: Hydraulic Symbol dialog box, click Miscellaneous.

- 25  In the Hydraulic: Miscellaneous dialog box, click Reservoir.

- 26 Respond to the prompts as follows:

Specify insertion point: *Select to place the reservoir below the filter*




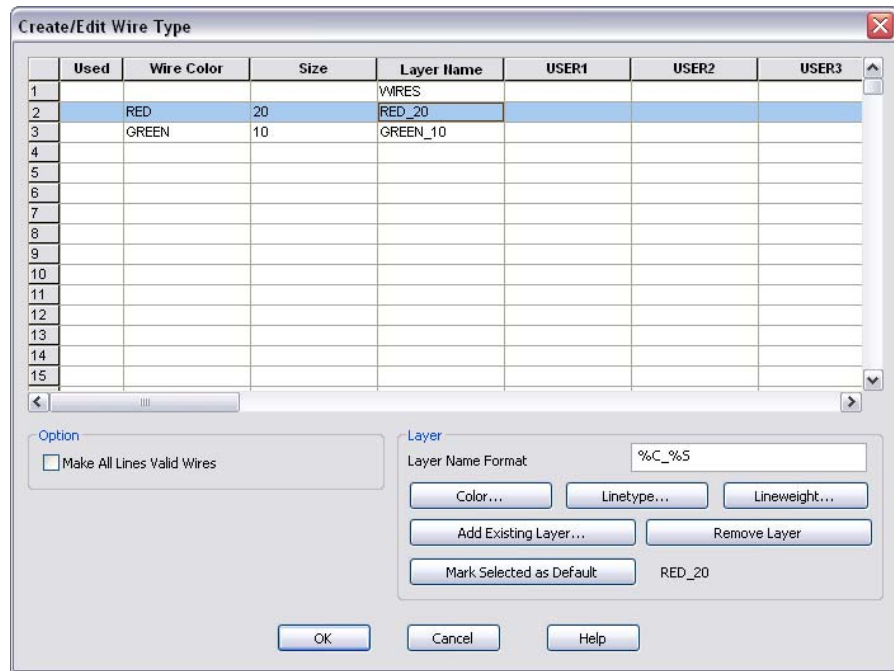
- 27 In the Insert/Edit Component dialog box, click OK.

## Creating Pipes


In the AutoCAD Electrical application, we use different types of wires to represent the type of running pipes that allows water or oil flows from one instrument to another. Let's start by setting up the type of wires for pipe runs.

### Insert wires as pipes

-  Expand the Insert Wire tool, and then click the Create/Edit Wire Type tool.  
Wires ► Create/Edit Wire Type
- In the Create/Edit Wire Type dialog box, specify:  
Wire Color: RED  
Size: 20  
The Layer Name is automatically created. The name RED\_20 is assigned to the wire layer you are creating.
- Click Color.
- In the Select Color dialog box, select red and click OK.
- Click Linetype.
- In the Select Linetype dialog box, select Continuous and click OK.
- In the Create/Edit Wire Type dialog box, specify:  
Wire Color: GREEN  
Size: 10  
Color: Green  
Linetype: Hidden2
- Select RED\_20 in the grid and click Mark Selected as Default.



9 Click OK.

10  Click the Insert Wire tool.

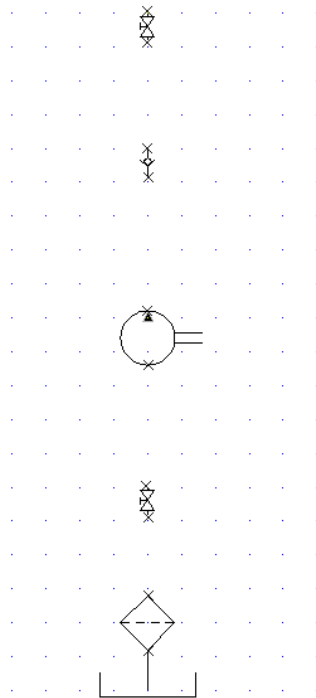
Wires ► Insert Wire

11 Respond to the prompts as follows:

Specify wire start or [wireType/X=show connections]:

*Enter X and press ENTER*





Specify wire start or [wireType/X=show connections]:

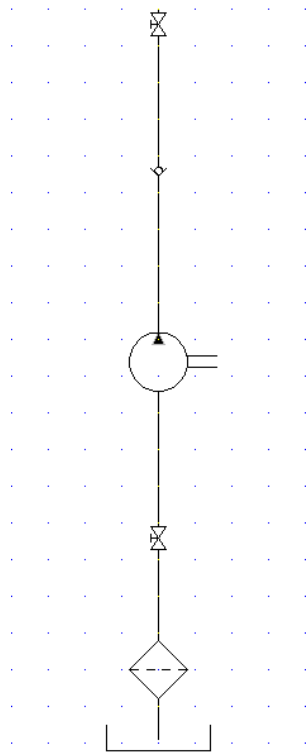
*Select the bottom of the shut off valve*

Specify wire end or [Scoot/T=wiretype, X=show connections]:

*Select the top of the check valve*

- 12** Continue inserting wires connecting the components together. Right-click to exit the command.




Your drawing should look like the following.




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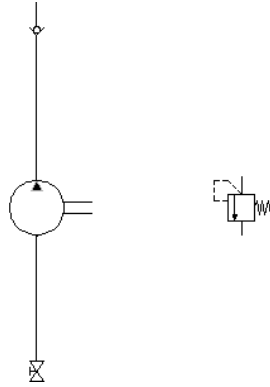
**NOTE** You can also insert the vertical or horizontal pipes first and then insert the components onto the pipe, one at a time.

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- 13  Click the Insert Hydraulic Component tool.
- 14 In the Insert Component: Hydraulic Symbol dialog box, select the check box for Vertical.
- 15  In the Insert Component: Hydraulic Symbol dialog box, click Pressure Relief Valves.
- 16  In the Hydraulic: Pressure Relief Valves dialog box, click N.C. Pressure Relief Valve with Preset -1.

**17** Respond to the prompts as follows:

Specify insertion point: *Select to place the valve to the right of the pump*



**18** In the Insert/Edit Component dialog box, specify:

Component Tag: VAL4

Description: Line 1: Pressure Relief

Click OK.



**19** Click the Insert Wire tool.

Wires ► Insert Wire

**20** Respond to the prompts as follows:

Specify wire start or [wireType/X=show connections]:

*Enter X, press ENTER*

Specify wire start or [wireType/X=show connections]:

*Press SHIFT + right-click and select Midpoint from the menu, then select the midpoint on the pipe between the pump and the shut off valve above it*

Specify wire end or [V=start Vertical/H =start Horizontal/Continue):

*Drag the pipe to the right so that it is directly above the pressure relief valve, drag the pipe down and click the top connection point on the pressure relief valve*

You now need to insert a pipe that connects the end of the valve back to the pump.

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**TIP** Make sure that Snap is turned off and that the Wire Layer is set to GREEN\_10.

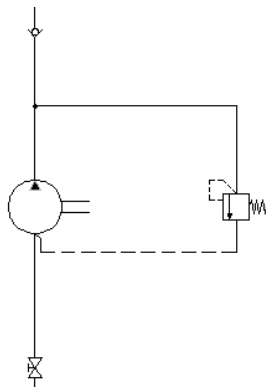
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Specify wire start or [wireType/X=show connections]:

*Select the bottom connection point on the pressure relief valve*

Specify wire end or [V=start Vertical/H =start Horizontal/Continue):

*Drag the pipe down and to the left, click the connection point at the bottom of the pump, right-click*



## Completing the Hydraulic Drawing


The rest of the hydraulic drawing consists of inserting a Pressure Gauge and Check Valve at the left side of the pump and then inserting devices (Cylinder; Restrictors; Filter; Check valve and 2-ways valve) along the top of the drawing.

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**NOTE** During insertion, clear the Vertical option in the Insert Component: Hydraulic Symbols dialog box.

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### Insert components

- 1  Click the Insert Hydraulic Component tool.



- 2 In the Insert Component: Hydraulic Symbol dialog box, click Meters.



- 3 In the Hydraulic: Meters dialog box, click Pressure Gauge.

- 4 Respond to the prompts as follows:

Specify insertion point:

*Select to place the pressure gauge to the far left (and slightly above) of the pump*

- 5 In the Insert/Edit Component dialog box, specify:

Component Tag: MTR1

Description: Line 1: Pressure Gauge

Click OK.



- 6 Click the Insert Hydraulic Component tool.



- 7 In the Insert Component: Hydraulic Symbol dialog box, click General Valves.

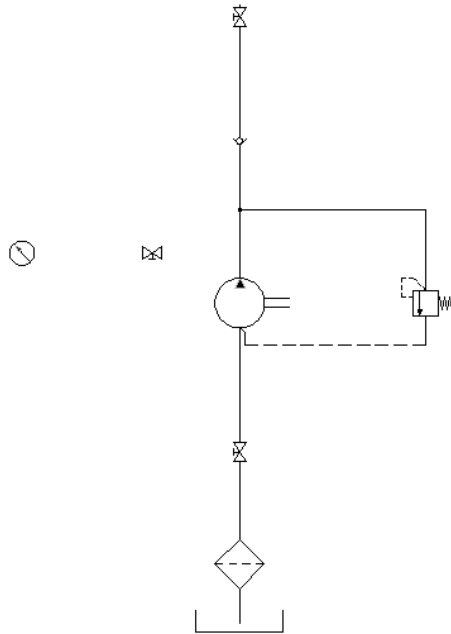


- 8 In the Hydraulic: General Valves dialog box, click Shut Off Valve Open.

- 9 Respond to the prompts as follows:

Specify insertion point:

*Select to place the valve to the right of the pressure gauge*

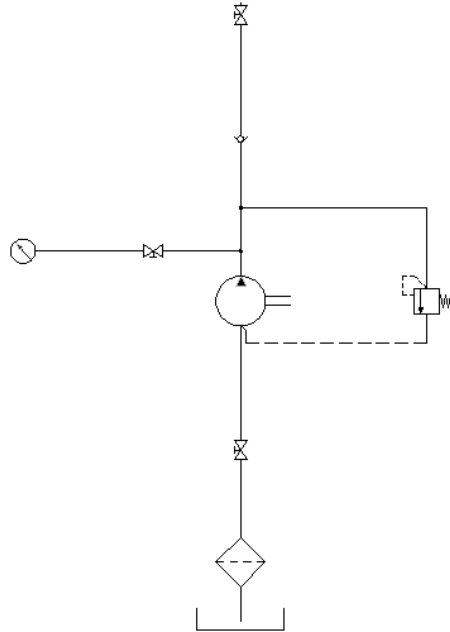



- 10 In the Insert/Edit Component dialog box, click OK.
- 11 Set the wire layer to RED\_20.





- 12 Click the Insert Wire tool.  
Wires ► Insert Wire

- 13 Respond to the prompts as follows:  
Specify wire start or [wireType/X=show connections]:  
*Select the right connection point on the pressure gauge*  
Specify wire end or [Continue]:  
*Drag the pipe to the right and click the left connection point on the valve*  
Specify wire start or [Scoot/wireType/X=show connections]:  
*Select the right connection point on the valve*  
Specify wire end or [Continue]:  
*Drag the pipe to the right and click the vertical pipe, right-click*



- 14  Click the Insert Hydraulic Component tool.
- 15 Insert and place the devices listed below as shown in the following illustration. In the Insert/Edit Component dialog box, click OK after each insertion.

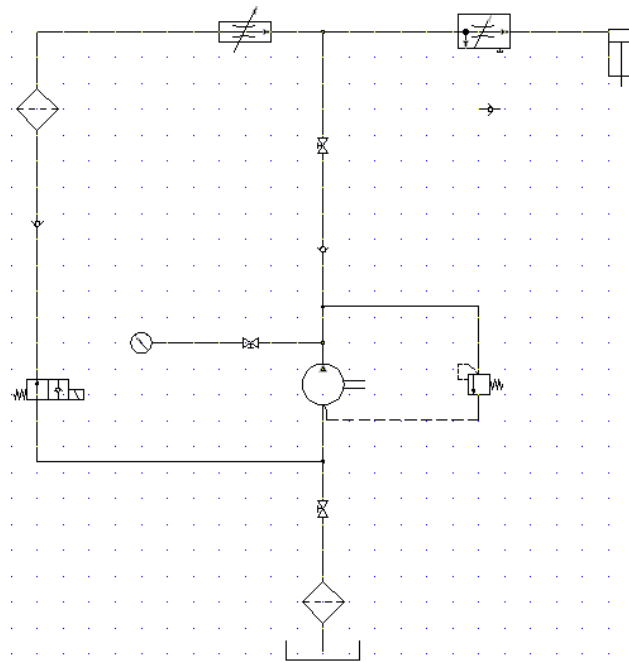
**NOTE** You can also insert the vertical or horizontal pipes first and then insert the components onto the pipe, one by one.

Icon	Symbol to Insert
	2 Way Valves ► Solenoid Spring Return -1 (insert as Vertical symbol)
	General Valves ► Checkvalve Flow Left (insert as a Vertical symbol)






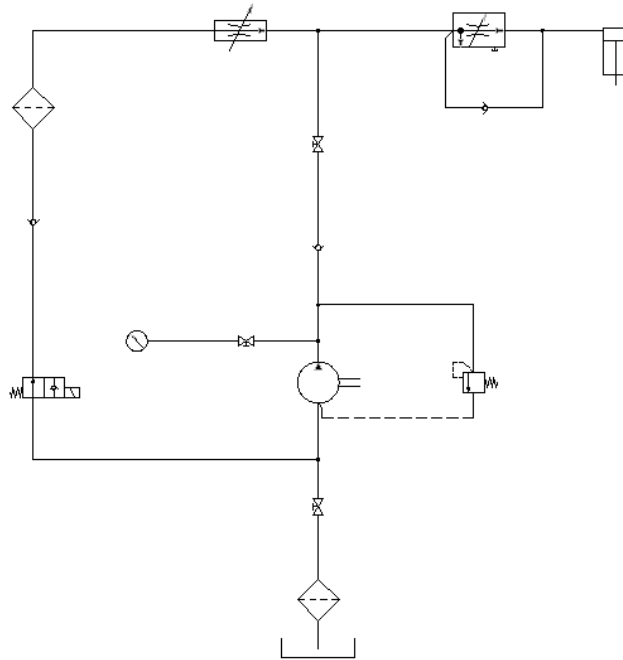




22 In the Insert/Edit Component dialog box, click OK.

23  Click the Insert Wire tool.  
Wires ► Insert Wire

24 Connect the pipes as shown.




The hydraulic schematic diagram is complete.

If you want to create a pneumatic drawing, use the Insert Pneumatic Components tool on the Extra Libraries toolbar. Refer to the pneumatic demo drawing file (*Demo03.dwg*) in the "Extra Library Demo" project.

## Setting Up Your P&ID Drawing

Use the Project Manager to manage your P&ID drawings. From here you can create a new drawing and modify any drawing properties.

### Create a new drawing

- 1  In the Project Manager, click the Create New Drawing tool.
- 2 In the Create New Drawing dialog box, specify:  
Name: AEGS13

Template: *Mouse over the edit box to verify AutoCAD\_Electrical.dwt is specified*


Description 1: P&ID Example

Click OK.

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**NOTE** You can also Click OK-Properties to proceed to Drawing Properties dialog box if you want to set the component, wire number, cross-reference, style and drawing format settings.

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
- 3 Select Tools ► Drafting Settings.
- 4 In the Drafting Settings ► Snap and Grid dialog box, turn on Snap and Grid and set the size of both to 0.125.
- 5 Click OK.
- 6  Click the Drawing Properties tool.  
Projects ► Drawing Properties
- 7 In the Drawing Properties ► Drawing Format dialog box, Scale section, make sure that the feature scale multiplier is set to 1.0 inch.
- 8 Click OK.

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**NOTE** For metric unit, the following settings are recommended so that the wire connection points will be placed on the grids for easier drafting. Grid and Snap Size = 2.5mm; Feature scale multiplier =20 (scale factor = 20)

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### Set up wire layers

- 1  Expand the Insert Wire tool, and then click the Create/Edit Wire Type tool.  
Wires ► Create/Edit Wire Type
- 2 In the Create/Edit Wire Type dialog box, click in the Wire Type #2 row and specify:  
Wire Color: RED  
Size: 25

The Layer Name is automatically created. The name RED\_25 is assigned to the wire layer you are creating.

- 3 Click Color.
- 4 In the Select Color dialog box, select red and click OK.
- 5 Click Linetype.
- 6 In the Select Linetype dialog box, select Continuous and click OK.
- 7 Click Lineweight.
- 8 In the Select Lineweight dialog box, select 0.30 and click OK.

For this example, you need to create three more wire types (two yellow wire layers and one green wire layer) using the Create/Edit Wire Type dialog box.

- 9 In the Create/Edit Wire Type dialog box, specify:

Wire Type #3

Wire Color: YELLOW

Size: 15

Color: Yellow

Linetype: Continuous

Lineweight: default

Wire Type #4

Wire Color: YELLOW

Size: 10

Color: Yellow

Wire Type #5

Wire Color: GREEN

Size: 10

Color: Green

	Used	Wire Color	Size	Layer Name	USER1	USER2	USER3
1	X			WMRES			
2		RED	25	RED_25			
3		YELLOW	15	YELLOW_15			
4		YELLOW	10	YELLOW_10			
5		GREEN	10	GREEN_10			
6							

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**NOTE** For pipe runs in P&ID drawings, you must include the different linetypes from the *acade.lin* file. You can set up the wire types for pipes at the beginning of the drawing or before creating the pipes.

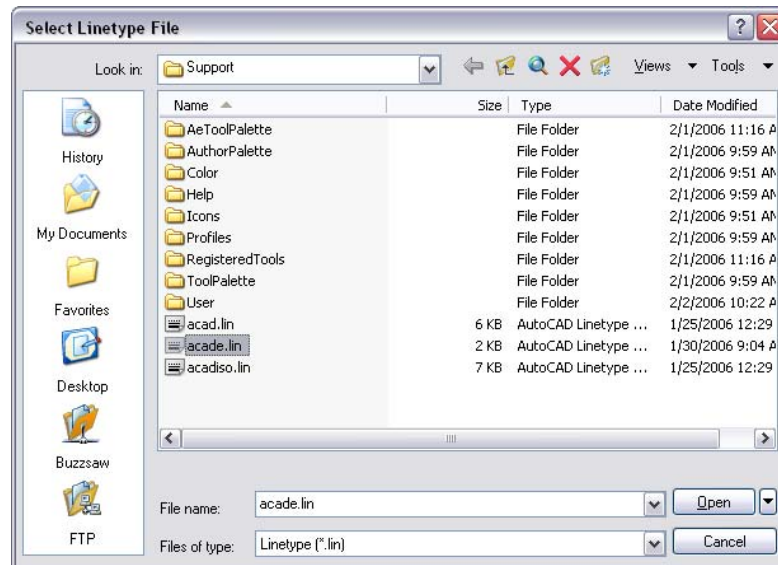
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- 10 To set the Linetype for the GREEN\_10 wire layer, click Linetype.
- 11 In the Select Linetype dialog box, click Load.
- 12 In the Load or Reload Linetypes dialog box, click File.
- 13 In the Select Linetype File dialog box, select *acade.lin* and click Open.

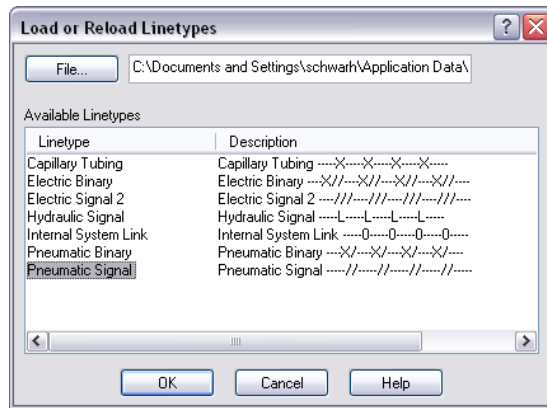
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**NOTE** The default location for the *acade.lin* file is *\Documents and Settings\{username}\Application Data\Autodesk\AutoCAD Electrical {version}\{release number}\{country code}\Support*.

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- 14 In the Load or Reload Linetypes dialog box, select Pneumatic Signal and click OK.






- 15 In the Select Linetype dialog box, select Pneumatic Signal and click OK.
- 16 In the Create/Edit Wire Type dialog box, click OK.

## Inserting P&ID Schematic Symbols

The P&ID symbol library in AutoCAD electrical includes equipment, tanks, nozzles, pumps, fittings, valves, actuators, logic functions, instrumentation, flow, and flow arrows. The P&ID symbol library consists of all the piping and instrumentation symbols and is found at *\Program Files [(x86)]\Autodesk\Acade {version}\Libs\Pid*.

### Insert P&ID Symbols

- 1  Click the Insert P&ID Component tool.
- 2  In the Insert Component: Piping and Instrumentation Symbols dialog box, click Equipment.
- 3  In the PID: Equipment dialog box, click Ball Mill.
- 4 Respond to the prompts as follows:
  - Specify insertion point:
  - Select to place the ball mill in the upper left corner of your drawing*


5 In the Insert/Edit Component dialog box, specify:


Component Tag: C-100

Description: Line 1: BALL MILL

Click OK.

6 Follow steps 1-2 above.

7  In the PID: Equipment dialog box, click Conveyors.

8  In the PID: Conveyors dialog box, click Conveyor 1.

9 Respond to the prompts as follows:

Specify insertion point:

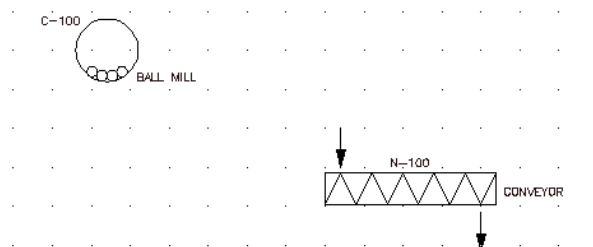
*Select to place the conveyor to the right and diagonally below the ball mill*

10 In the Insert/Edit Component dialog box, specify:

Component Tag: N-100

Description: Line 1: CONVEYOR

Click OK.



11 Follow steps 1-2 above.

12  In the PID: Equipment dialog box, click Mixer 2.

13 Respond to the prompts as follows:

Specify insertion point:

*Select to place the mixer to the right and diagonally below the conveyor*

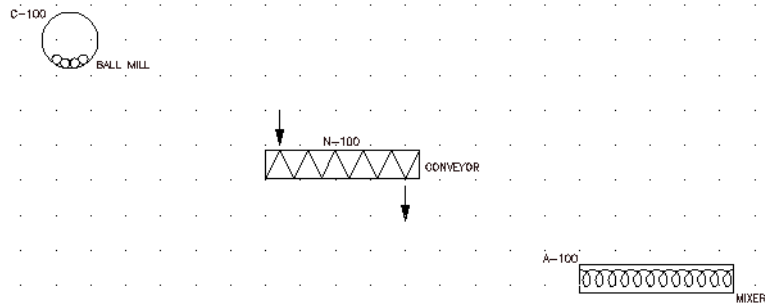


14 In the Insert/Edit Component dialog box, specify:

Component Tag: A-100




Description: Line 1: MIXER

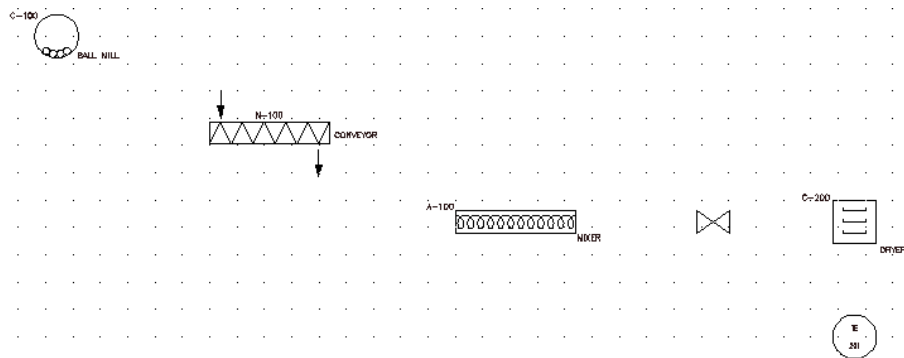
Click OK.



15  Click the Insert P&ID Component tool.

16 Insert and place the devices listed below as shown in the following illustration. In the Insert/Edit Component dialog box, click OK after each insertion.

Icon	Symbol to Insert
	Valves ► Gate Valve In the Insert/Edit Component dialog box, clear the Component Tag
	Equipment ► Dryer Component Tag = C-200; Description Line 1 = DRYER
	Instrumentation ► Discrete Instruments ► Field Mounted Component Tag = TE 201




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**TIP** Align the components horizontally and vertically using the Align tool to make inserting the pipes easier.

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## Creating Pipes

In AutoCAD Electrical, we use different types of wires to represent the type of running pipes that allow water or oil flows from one instrument to another.

### Insert wires as pipes

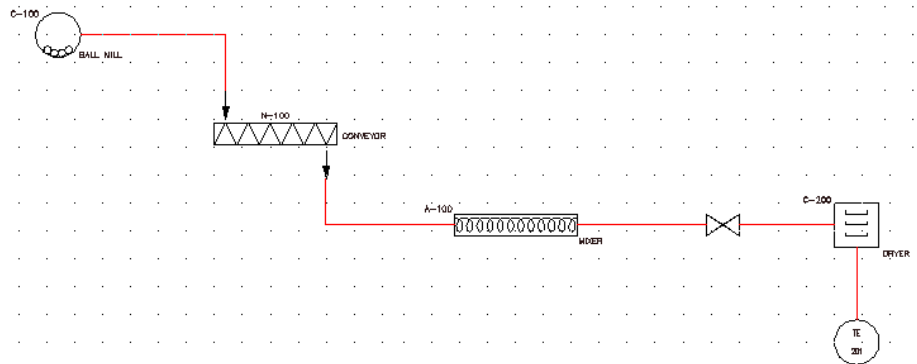
- 1 In the AutoCAD Layers toolbar, change the wire layer to RED\_25.



- 2 Click the Insert Wire tool.

Wires ► Insert Wire

- 3 Connect the pipes as shown. Right-click to exit the command.



- 4 In the AutoCAD Layers toolbar, change the wire layer to POS and the linetype to HIDDEN2.



- 5 Click the Insert Wire tool.

Wires ► Insert Wire

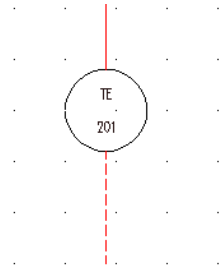
- 6 Respond to the prompts as follows:

Specify wire start or [wireType/X=show connections]:


*Select the bottom of the discrete instrument*


Specify wire end or [Continue]:

*Drag the wire down a few spaces, press ENTER*



- 7  Click the Insert P&ID Component tool.

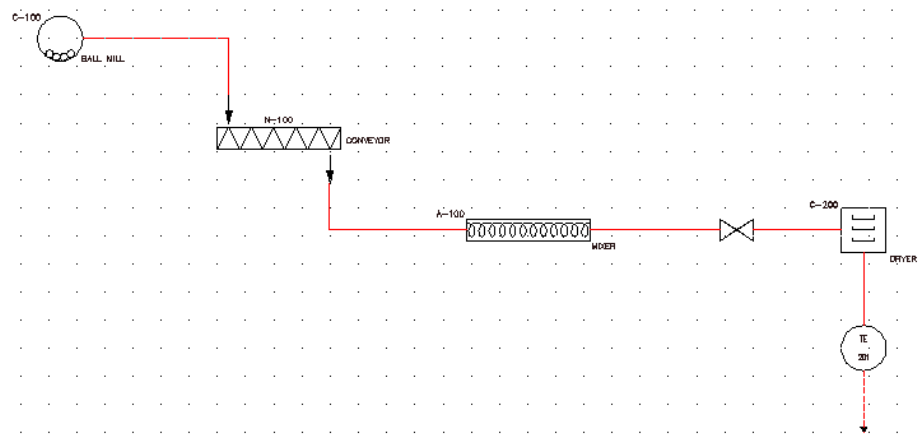
8  In the Insert Component: Piping and Instrumentation Symbols dialog box, click Flow Arrows.

9  In the PID: Equipment dialog box, click Flow Arrow Down.

10 Respond to the prompts as follows:

Specify insertion point:

*Select to place the flow arrow at the bottom of the new wire*



The P&ID diagram is complete.

If you want to see how to expand the P&ID drawing, refer to the P&ID demo drawing file (*Demo01.dwg*) in the "Extra Library Demo" project.