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Design and Drawings with Program for Tubular Exchanger

I offer design and detailed drawings of Heat Exchangers using my own program. This is a program for design and drawing of Tubular Exchanger, with user friendly dialog boxes, which is an add-on for any CAD program for developing GA drawing for Tubular Exchanger. The program asks for some parameters and then automatically draws the drawing of Tube Bundle. The software gives all minor details at Quotation Stage itself and this helps to quote in most competitive manner. It can draw a Tubular Exchanger with up to 1000 tubes. It will be extended to 2,000 tubes later. You can modify the drawing as per your style.

I have prepared a Trial program which can draw in both Foot-Inches units as well as Metric Units. To run the trial version, unzip he_trial.zip file and copy files in one folder, say heatexch. While running AutoCAD program, click on tools ->Options (or Preferences) -> Files -> + of Support File Search Path -> Add -> Browse -> Select the folder. he_trial.zip file contains he.lsp, and other program files, he.dcl, he.slb, A1.dwg prototype drawing and trial.dwg dummy drawing. At command prompt open trial.dwg drawing. Load he.lsp by appload or by typing (load "he.lsp") at command prompt. If you get message "File not found", please set up folder path settings again (or if trial is not opened). Type he and press and trial program will start. This is a fully functional program which runs for 250, 500, 750 and 1,000 tubes. The dialog boxes in trial are bit different. In trial mode you can select values of Radio Button, Image Buttons, Check Boxes and List box, but you can not change values in Edit Boxes.

Dialog Box 1 : You can select the Foot-Inch units or Metric Units for the drawing. The system variables will be set automatically to draw in either Foot-Inch or Metric Units. All inputs will also be in selected unit system.

Dialog Box 2 : Enter designer data which will reflect in the title block of drawing. Program will automatically selects date.

Dialog Box 3 : You can select Outer Diameter of Tube. It is generally 19 mm, 25 mm, 32 mm or higher. Correspondingly you select Tube Pitch. It is generally 25 mm (for 19 mm tube), 32 mm (for 25 mm tube), 40 mm (for 32 mm tube). Tube length is end to end length of tube. Tube Pitch is the distance between center lines of two tubes. Gasket width is for circular part as well as for dividing line for fixed

tube sheet and floating tube sheet. Tube extension is projection length of tube outside the tube sheet (in head portion). You can select any number of tubes from 1 to 1,000. This will be extended to 2000 tubes. You can fix gasket thickness.
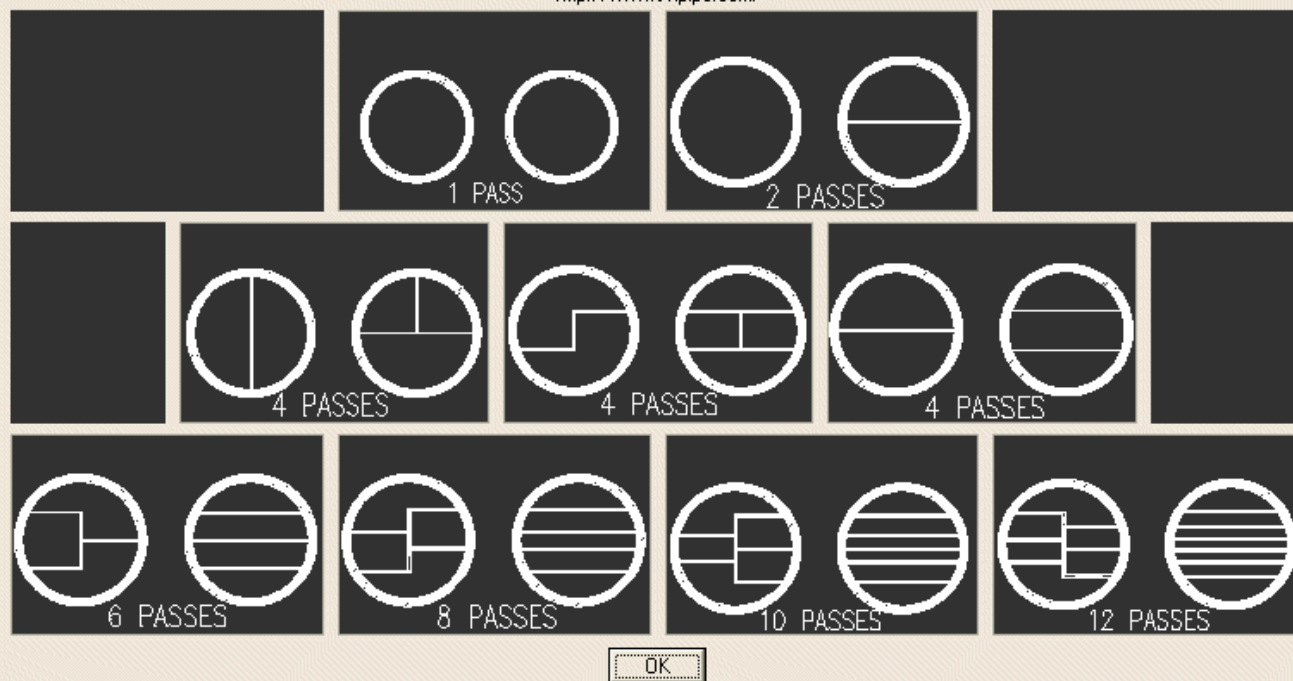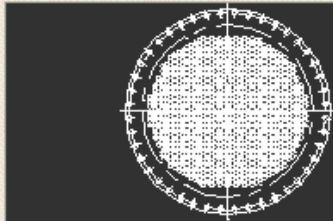

Dialog Box 4 : You can select either 1, 2, 4, 6 8, 10 or 12 passes on tube side.

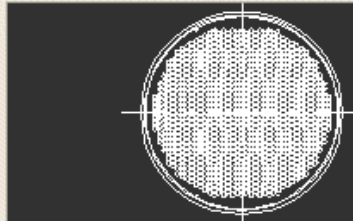Dialog Box 5 : You can select Tube sheet with flange or without flange.

Heat Exchanger Drawing

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http://www.svlpipe.com/

Choose Type of Tube Sheet

TUBE SHEET WITH FLANGE   TUBESHEET WITHOUT FLANGE

OK

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Choose Pitch of Tubes

SQUARE PITCH   TRIANGULAR PITCH

ROTATED SQUARE PITCH   ROTATED TRIANGULAR PITCH

OK

Dialog Box 6 : Once these tube parameters are fixed, you select the tube configuration. There are 4 options. You can select either Square pitch, Triangular pitch, Rotated Square pitch or Rotated Triangular pitch. Square and Triangular pitch are normally used as it facilitates cleaning of the tube externally. Configuration for different passes is shown below.
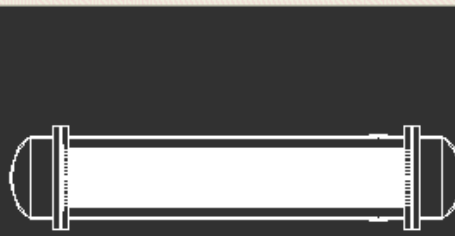
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http://www.svlpipe.com/he.htm

Type of Head

FIXED HEAD   FLOATING SHELL

Please wait... It will take few more seconds
OK

Dialog Box 7 : If it is 1 pass exchanger you can select either Fixed head or Floating Shell. In case of fixed head and floating shell, Diameter / PCD of both tube sheets will be same.

Dialog Box 7 : You can select either Fixed head, Floating head, Floating Shell or U Tube. In case of fixed head and floating shell,

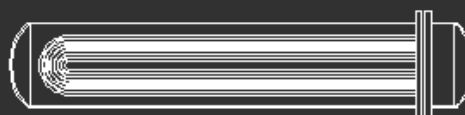## Heat Exchanger Drawing
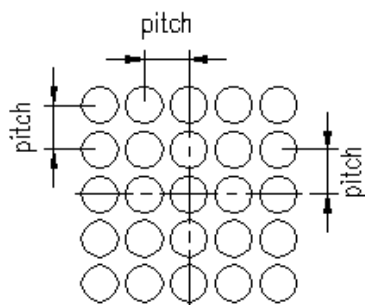
Type of Head

FIXED HEAD

FLOATING SHELL

FLOATING HEAD

U TUBE

OK

Diameter / PCD of both tube sheets will be same. In case of floating head Diameter / PCD of Right (Fixed Head) tube sheet will be smaller than that one on Left (Floating Head). In U Tube there is only one tube sheet.
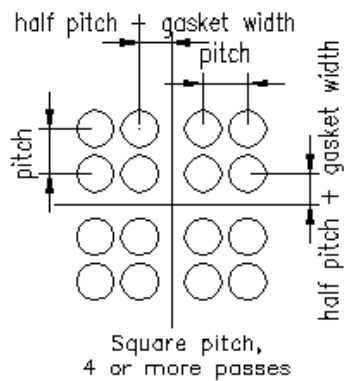

Square pitch, 1 pass

It has tubes in central line in both direction. Each tube center is one pitch distance left or right. Next tube center is one pitch distance up or down.
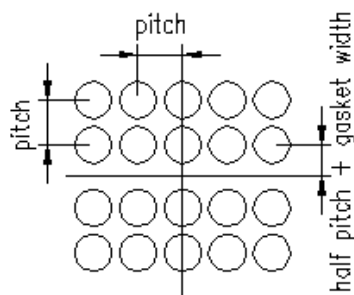

Square pitch, 2 passes

It has no tubes in horizontal central line, but tubes exists in vertical direction along central line. First vertical line is half pitch distance above or below centerline. Each tube in horizontal center is one pitch distance left or right. Next tube center is one pitch distance up or down.
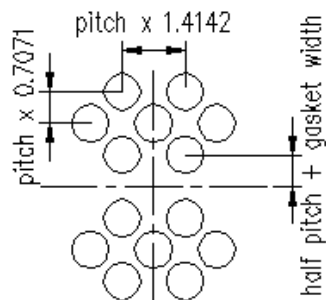
It has a no central line in horizontal and vertical direction. First line in horizontal and vertical direction is half pitch distance above or below / left or right of centerline. Next tube center is one pitch distance up or down.

**Square pitch,
4 or more passes**

Rotated Square pitch, 1 pass

It has a central line in both direction. Each tube in centerline is one pitch distance x phfact left or right. First vertical centerline is one pitch x pvfact distance up or down. First horizontal centerline is half pitch distance x phfact left or right of centerline. Second centerline in vertical direction is one pitch distance x pvfact above or below.

Rotated Square pitch, 2 passes
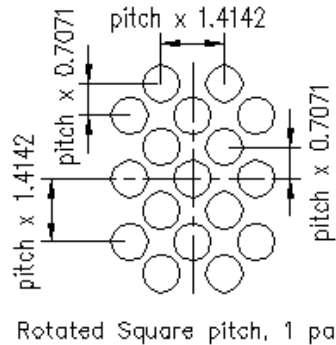
It has a no central line in horizontal direction, but exists in vertical direction. First line is half pitch distance + gasket width above or below centerline. Each tube center is one pitch x phfact distance left or right. Next tube center is one pitch distance x pvfact up or down.

**Rotated Square pitch,
4 or more passes**

It has a no central line in horizontal and vertical direction. First line in horizontal direction is half pitch distance + gasket width left or right of centerline. First line in vertical direction is half pitch distance + gasket width above or below centerline. Each tube center in horizontal direction is one pitch distance x phfact left or right. Each tube centerline in vertical direction is one pitch distance x pvfact above or below.
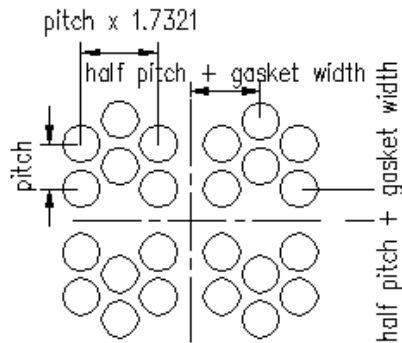
Triangular pitch, 1 pass
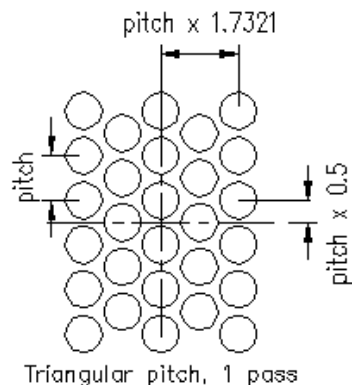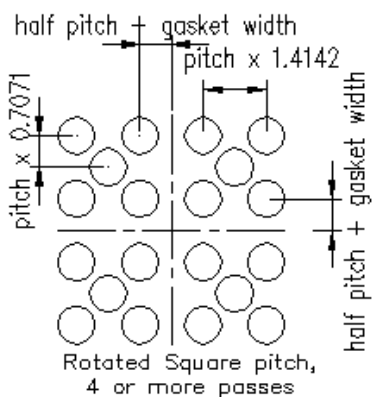
It has tubes in central line in both direction. First horizontal line is half pitch above center line. Each tube center is one pitch distance in vertical direction and pitch x 1.7321 in horizontal direction.

pitch x 1.7321

pitch
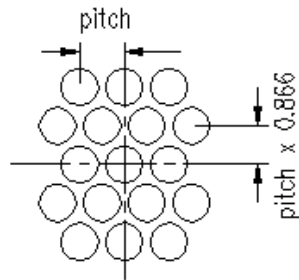
half pitch + gasket width
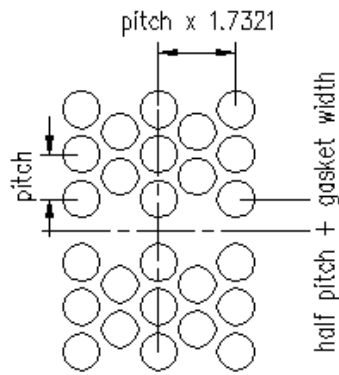
Triangular pitch, 2 passes

It has no tubes in horizontal central line but has a line of tube in vertical direction. First horizontal line is half pitch above / below center line. Each tube center is one pitch + gasket width distance in vertical direction and pitch x 1.7321 in horizontal direction.

pitch x 1.7321

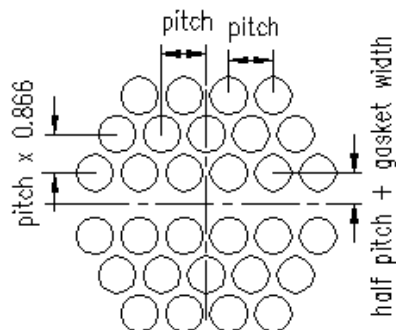half pitch + gasket width

pitch

half pitch + gasket width

Triangular pitch, 4 or more passes

It has no tubes in horizontal and vertical central line. First horizontal and vertical line is half pitch up/ down /above / below center line. Each tube center is one pitch + gasket width distance in vertical direction and pitch x 1.7321 in horizontal direction.

pitch

pitch x 0.866

Rotated Triangular pitch, 1 pass

It has tubes in central line in both direction. First horizontal line is pitch x 0.866 above center line. Each tube center is one pitch distance in horizontal direction and pitch x 0.866 in vertical direction.

pitch   pitch

pitch x 0.866

half pitch + gasket width

Rotated Triangular pitch, 2 passes

It has tubes in central line in vertical direction. First horizontal line is half pitch + gasket width above center line. Each tube center is one pitch distance in horizontal direction and pitch x 0.866 in vertical direction.

It has no tubes in central lines in both directions. First horizontal and vertical line is half pitch + gasket width above center line. Each tube center is one pitch distance in horizontal direction and pitch x 0.866 in vertical direction.

half pitch + gasket width
pitch
pitch x 0.866
half pitch + gasket width

Rotated Triangular pitch,
4 or more passes

Bellow
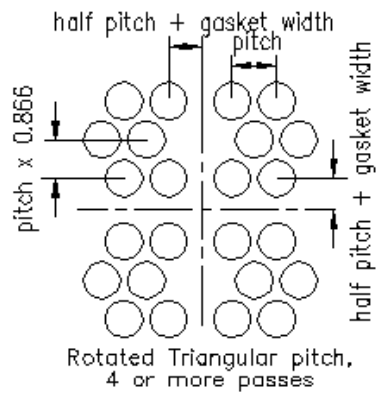
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satish.lele@gmail.com
http://www.svlpipe.com/hem.htm

Dimesion A : 150

Dimesion B : 100

Dimesion C : 50

OK

In case of Fixed Head, you can select sizes of expansion Bellow.

Covering Ring

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RING FLANGE 1   RING FLANGE 2   RIGHT FLANGE

SHELL

B | B | B   A

Dimesion A : 200

Dimesion B : 25

OK

In case of Floating Shell, you can select sizes of Floating Ring.

Tubesheet Details

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Outer Tube Limit:	1040	Shell Thickness:	22	Shell Inside Diameter:	1124
OD of Shell:	1168	Gap in OTL Shell ID:	6	Baffle Diameter:	1112

Floating Head Cover

OD of Cover Flange:	1854
PCD of Flange:	1758
Thickness of Cover Flange:	130
Number of Bolt Holes:	52
Diameter of bolt holes:	47
Length of Stud Bolt:	558
Diameter of stud bolt:	44

Floating Head

OD of Tube Sheet:	1454
PCD of Flange:	1365
Thickness of Tube Sheet:	101
Number of Bolt Holes:	40
Diameter of bolt holes:	41
Length of Stud Bolt:	431
Diameter of stud bolt:	38

Fixed Head

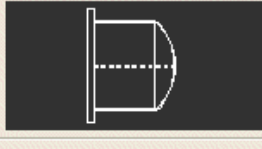|	
OD of Tube Sheet:	1454
PCD of Flange:	1365
Thickness of Tube Sheet:	101
Number of Bolt Holes:	40
Diameter of bolt holes:	41
Length of Stud Bolt:	431
Diameter of stud bolt:	38

[OK]   [Cancel]

Dialog Box 8 : In case of Floating Head, based on Number of tubes, program will indicate Outer Tube Limit, OD and PCD of tube sheet as well as number of bolt holes and diameter of bolt holes. It will indicate shell thickness and Gap between Outer Tube Limit and shell ID in Left Column and that for Fixed head in Right Column. In case of Fixed Head, only values in Left column will be shown.

Heat Exchanger Drawing

Choose Type of Head

☑ Slip on Flange

☐ Weld Neck Flange

Channel Length: 600

☑ Davit for Flange

☑ Slip on Flange

☐ Weld Neck Flange

Channel Length: 600

☐ Slip on Flange

☐ Weld Neck Flange

Channel Length: 600

☑ Davit for Flange

OK

Dialog Box 9 : You can select Heads, Type of flange and Length of channel. Also you can specify whether a davit is required for

channel flange.

DAVIT ASSEMBLY FOR CHANNEL FLANGE OF LEFT HEAD

Dialog Box 10 : Yhis indicates values for tube sheet.

Dialog Box 11 : You can select combinations of Material of Construction.

Heat Exchanger Drawing

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Material of Construction and Specific Gravity of Parts

Left Head:

Head Flange:	SA 226 Cl. 4	7.85
Gasket of Flange:	Br JA	2.00
Channel Shell:	SA 106 Gr. B	7.85
Tori Dish End:	SA 516 Gr. 60	7.85
Nozzle Neck:	SA 106 Gr. B	7.85
Nozzle Flange:	SA 105	7.85
Gasket for Nozzle Flange:	SS 304 Spiral	2.00
Reinforcing Pad:	SA 106 Gr. B	7.85
Pass Partition Plates:	SA 516 Gr. 60	7.85

Right Head:

Head Flange:	SA 226 Cl. 4	7.85
Gasket of Flange:	Br JA	2.00
Channel Shell:	SA 106 Gr. B	7.85
Tori Dish End:	SA 516 Gr. 60	7.85
Nozzle Neck:	SA 106 Gr. B	7.85
Nozzle Flange:	SA 105	7.85
Gasket for Nozzle Flange:	SS 304 Spiral	2.00
Reinforcing Pad:	SA 106 Gr. B	7.85
Pass Partition Plates:	SA 516 Gr. 60	7.85

Main Shell:	SA 106 Gr. B	7.85
Nozzle Necks on Shell:	SA 106 Gr. B	7.85
Nozzle Flanges on Shell:	SA 105	7.85
Flange Gaskets on Shell:	Br JA	2.00
Reinforcing Pad:	SA 106 Gr. B	7.85
Nozzle Stiffners:	SA 516 Gr. 60	7.85
Davit pipe:	SA 106 Gr. B	7.85
Davit PLates:	IS 2062 Gr.B	7.85

Tube Sheets:	IS 2062 Gr.B	7.85
Tubes:	A179 / A179M	7.85
Baffles:	IS 2062 Gr.B	7.85
Tie Rods:	IS 2062 Gr.B	7.85
Tie Rod Nuts:	SA 194 Gr. 2H	7.85
Baffle Spacer:	A179 / A179M	7.85
Nuts:	SA 194 Gr. 2H	7.85
Studs / Bolts:	SA 193 Gr. 2H	7.85
Saddle Supports:	IS 2062 Gr.B	7.85

You can modify MOC and Specific Gravities as per your requirements in he_text.lsp file

[OK]   [Cancel]

Dialog Box 12 : You can select Details of Material of Construction.

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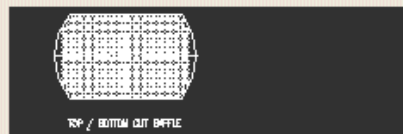
☑ Left Cut Baffle

☑ Top Cut Baffle

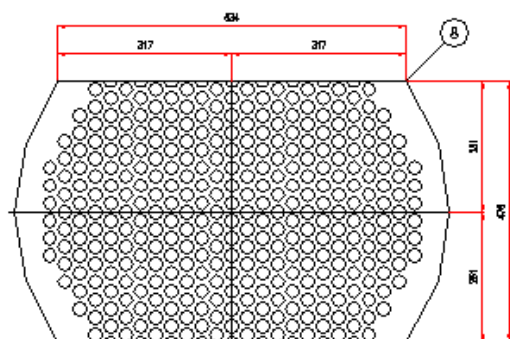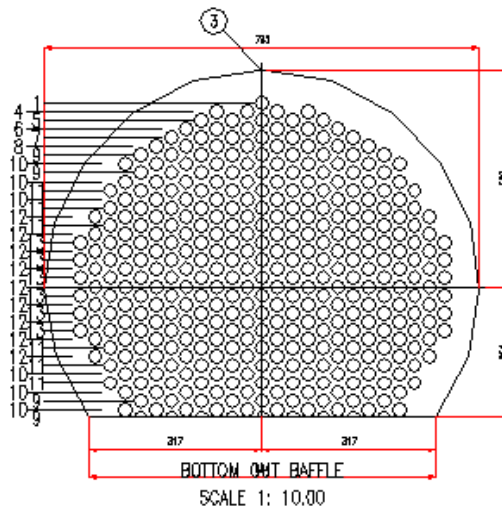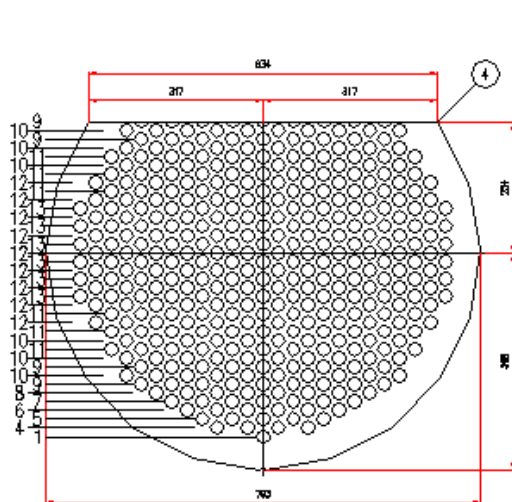☑ Top / Bottom Cut Baffle

☑ Right Cut Baffle

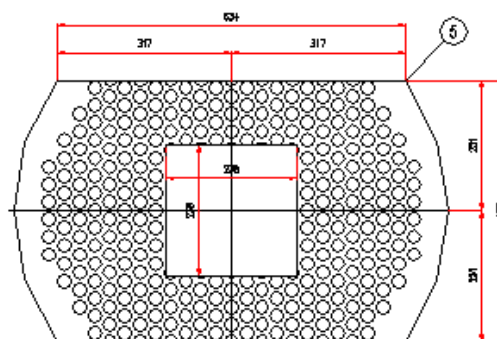☑ Bottom Cut Baffle

☑ Tie rods support plate (end baffle)

OK
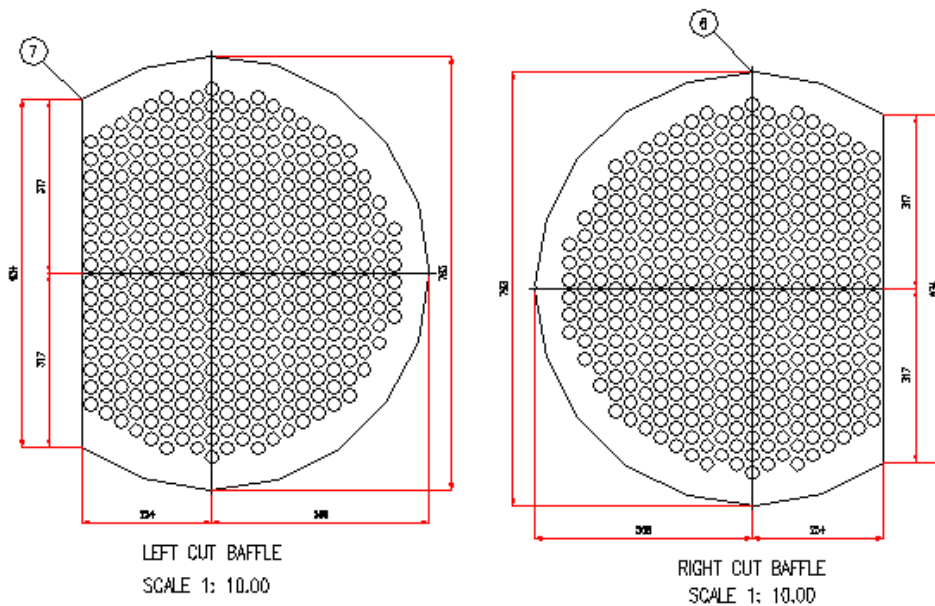
Dialog Box 13 : In this you can select 6 types of baffles.
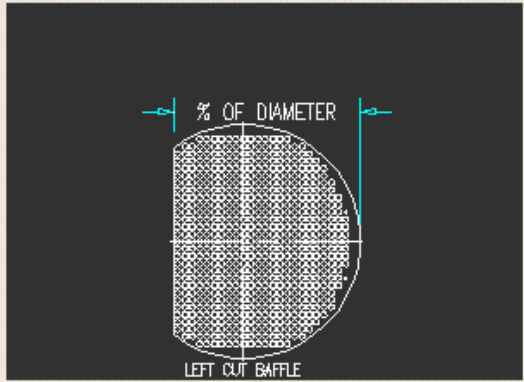

BOTTOM CUT BAFFLE
SCALE 1: 10.00

TOP / BOTTOM CUT BAFFLE
SCALE 1: 10.00

TOP / BOTTOM / MIDDLE CUT BAFFLE
SCALE 1: 10.00

LEFT CUT BAFFLE
SCALE 1: 10.00

RIGHT CUT BAFFLE
SCALE 1: 10.00

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% OF DIAMETER

LEFT CUT BAFFLE

Number of Baffles: 6

Baffle size in %: 90.00

Baffle Thickness: 6

Position of Left Cut Baffle from left Tube Sheet

□ 1 ☑ 2 □ 3 □ 4 □ 5 □ 6 ☑ 7 □ 8 □ 9 □ 10

□ 11 ☑ 12 □ 13 □ 14 □ 15 □ 16 ☑ 17 □ 18 □ 19 □ 20

□ 21 ☑ 22 □ 23 □ 24 □ 25 □ 26 ☑ 27 □ 28 □ 29 □ 30

□ 31 □ 32 □ 33 □ 34 □ 35 □ 36 □ 37 □ 38 □ 39 □ 40

□ 41 □ 42 □ 43 □ 44 □ 45 □ 46 □ 47 □ 48 □ 49 □ 50

□ 51 □ 52 □ 53 □ 54 □ 55 □ 56 □ 57 □ 58 □ 59 □ 60

OK

Dialog Box 14 : 6 Dialog boxes of these will be displayed if you select these in earlier box. You have to indicate the location of baffles.

Dialog Box 15 : In this box you can select Total Number of Baffles (these include two baffles at end, and cut baffles). End baffles are generally placed away from tube sheet for nozzle, hence you have to indicate Gap of End Baffles. Gap in Other Baffles is generally uniform. You can choose Thickness of Baffle. For Top / Bottom

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Baffle Data

Total Number of Baffles: 32

Gap of End Baffles: 570

OK   Cancel

cut Baffles, you can indicate baffle size as % of diameter. For Top / Bottom / Center cut Baffle, you can indicate vertical and horizontal % of diameter, as vacant area.

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Tie Rods Data

Number of Tie Rods: 4

Diameter of Tie Rods: 20

Length of Tie Rods: 5320

OK   Cancel

Dialog Box 16 : In this box you can select Number of Tie Rods, Diameter of Tie Rods, Length of Tie Rods will be indicated based on length of tube.

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http://www.svlpipe.com/

Maximum Number of Tubes should not exceed 500

Lines above Center:

Center Line:	25
1st Line above Center:	25
2nd Line above Center:	25
3rd Line above Center:	25
4th Line above Center:	25
5th Line above Center:	23
6th Line above Center:	23
7th Line above Center:	21
8th Line above Center:	19
9th Line above Center:	17
10th Line above Center:	15
11th Line above Center:	13
12th Line above Center:	7

Lines below Center:

1st Line below Center:	25
2nd Line below Center:	25
3rd Line below Center:	25
4th Line below Center:	25
5th Line below Center:	23
6th Line below Center:	22
7th Line below Center:	21
8th Line below Center:	19
9th Line below Center:	17
10th Line below Center:	15
11th Line below Center:	13
12th Line below Center:	7

OK   Cancel

Dialog Box 17 : The Dialog Box shows number of tubes in each row above and below center line of tube sheet. You can change these, but total tubes should not exceed number of tubes selected earlier. (The box shown is for 500 tubes.)

Dialog Box 18 : This offers you two options. Either you can write Notes that are generally written or you can select/edit each note.

Heat Exchanger Drawing

Heat Echanger Program by
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http://www.svlpipe.com/

Select/Edit or Write notes

○ Select/Edit Notes

◉ Write Notes Directly

You can modify Notes as per your
requirements in he_text.lsp file

[OK]

Notes for Drawing

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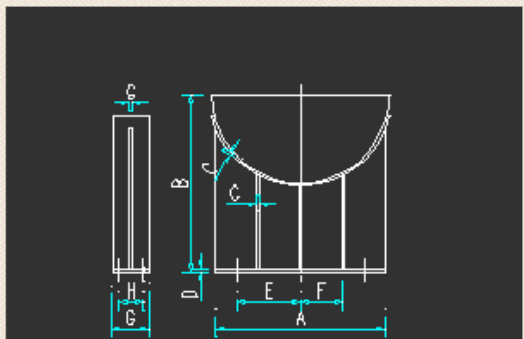http://www.svlpipe.com/

Please Select Notes :

☑ ALL DIMENSIONS ARE IN FOOT-INCHES.

☑ ALL BOLT HOLES TO STRADDLE BOTH NATURAL CENTER LINES.

☑ FOR TOLRENCES REFER SHEEL & TUBE EXCHANGER STD-7-15-0019 REV-3.

☑ HYDRO TEST SHALL BE DONE IN HORIZONTAL POSITION.

☑ UNIT TO BE MOUNTED IN HORIZONTAL POSITION.

☑ INDICATED THICKNESSES ARE MINIMUM AFTER CONSTRUCTION.

☑ FLANGES UPTO 24'' SHALL CONFIRM TO ASME B16.5.

☑ FLANGES ABOVE 24'' SHALL CONFIRM TO ASME B16.47.

☑ ALL NOZZLES 2'' AND BELOW SHALL BE PROVIDED WITH STIFFNER.

☑ STIFFNER SIZE 1 1/4'' X 1/4'' AT RIGHT ANGLES.

☑ AFTER HYDROTEST, EQUIPMENT SHALL BE COMPLETELY DRIED OUT WITH HOT AIR.

☑ BLIND FLANGES SHALL BE PROVIDED WHERE MENTIONED.

[OK]

Dialog Box 19 : If you select edit option, you can see and edit each note. If you uncheck any box, that note will be deleted. You will get 10 number of boxes with more notes.

Dialog Box 20 : You can select dimensions for Saddle Support.

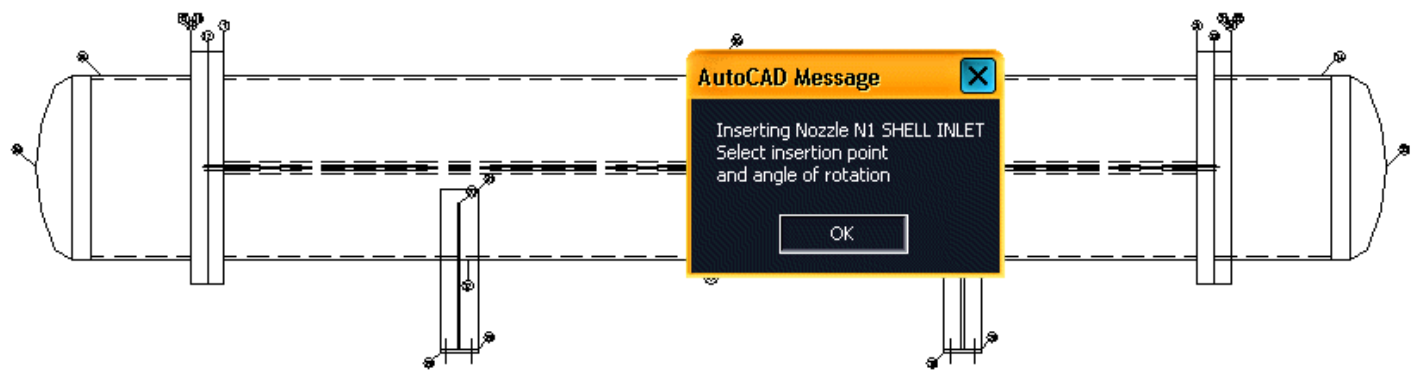Dialog Box 21 : You can select Nozzles attached to the exchanger.

Dialog Box 22 : You can select Parameters for each Nozzle attached to the exchanger. Nozzle will be drawn as detail and tags will

be given to all components. Its components will be added to Bill of Material.

Dialog Box 23 : Nozzles drawn as detail with tags and Nozzle Table.
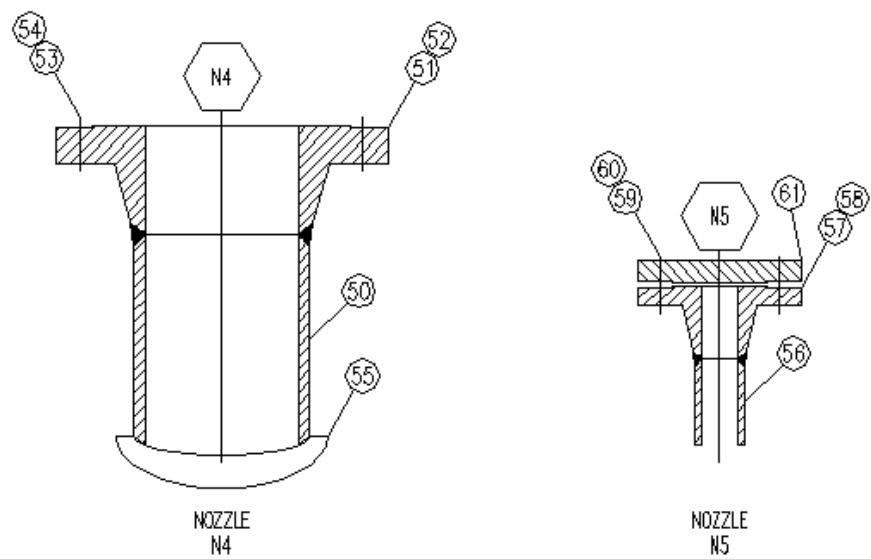
| MARK	QTY	NOZZLE			FLANGE			RF PAD		NOZZLE	WELD DET		
No	No	SERVICE	SIZE	SCH	TYPE	CLASS	FACE	OD	THK	LENGTH	TYPE	A	B
N1	1	SHELL INLET	150	80	ASME B16.5	300	WNRF	200	10	300	W2	10	10
N2	1	SHELL OUTLET	150	80	ASME B16.5	300	WNRF	200	10	300	W2	10	10
N3	1	CHANNEL INLET	150	80	ASME B16.5	300	WNRF	200	10	300	W2	10	10
N4	1	CHANNEL OUTLET	150	80	ASME B16.5	300	WNRF	200	10	300	W2	10	10
N5	1	SHELL VENT + BF	40	160	ASME B16.5	300	WNRF			150	W2	10	10
N6	1	SHELL DRAIN + BF	40	160	ASME B16.5	300	WNRF			150	W2	10	10
N7&8	2	SHELL NOZZLE CONNECTIONS + BF	40	160	ASME B16.5	300	WNRF			150	W2	10	10
N9&10	2	CHANNEL NOZZLE CONNECTIONS + BF	40	160	ASME B16.5	300	WNRF			150	W2	10	10

Dialog Box 24 : You will be instructed to insert each Nozzle attached to the exchanger. Select nearest or mid point to insert nozzle. Select angle of rotation. Irrespective of rotation, nozzle number will be displayed horizontally.
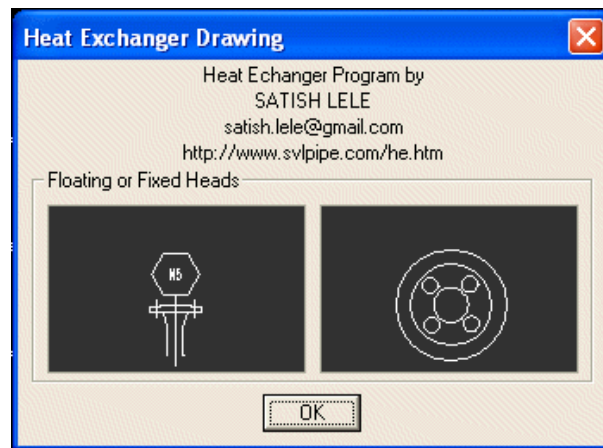
Dialog Box 25 : You will be instructed to select either side or circular Nozzle in case of smaller nozzles. Select nearest or mid point to insert nozzle.

Drawings developed by my program are as follows :
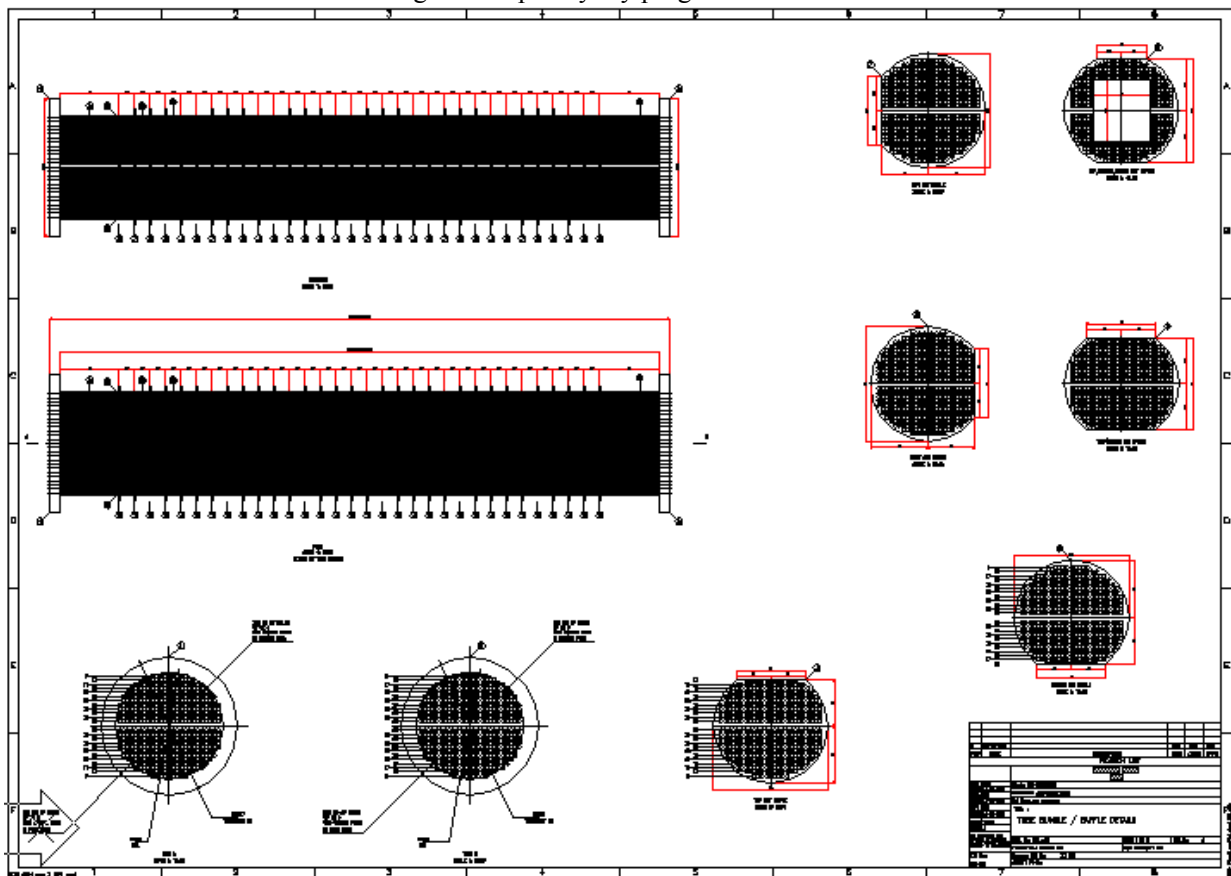
A GA Drawing of Tube Bundle and baffles for double pass Tubular Exchanger with floating head. It shows tags to each component.

A Drawing of Heads and Gaskets for double pass floating head. It shows details at bottom and it writes the notes on right.

Complete GA Drawing of Exchanger, details of saddle, Nozzles and Nozzle table. It also writes Bill of Material for each component with reference to tag number.