Piping system design between condenser and cooling tower using PDMS Software

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ABSTRACT

Numerous ventures everywhere throughout the world are utilizing funneling framework to ship liquids (fluids and gases) starting with one area then onto the next area. Already, the channeling framework configuration was finished utilizing customary methods, for example, Drafting, Technical drawing, Engineering Drawing. These procedures however they conveyed the itemizing of the channeling framework to be executed at shop floor, brought about progressively material cost, labor and furthermore caused deferrals. The present diary depicts the execution of PDMS programming for funneling framework plan among condenser and Cooling tower to an ice stockpiling production line close Kota. In the present venture work examination is made among manual and PDMS programming. The two types of gear Condenser and Cooling tower are made by utilizing natives and channeling framework likewise made according to configuration codes. The chief structure codes utilized for channeling configuration are ANSI/ASME B31.1 (Code for power funneling), ANSI/ASME B31.3 (Code for procedure funneling), ASTM A53B, ASTMA106B and API 5L(carbon steel pipe). In the wake of planning some essential perspectives on the funneling framework like isometric perspectives are presented.The PDMS programming is helpful for the channeling designers and 3D engineers to change over the 2D drawings into 3D models. With the assistance of PDMS programming the material misfortune in manufacture, labor and furthermore time are limited.

LITERATURE REVIEW

During industrialization, the channeling framework assumed a significant job due to its ease. The funneling framework is being utilized broadly now a days in Power plants, Chemical plants, Textile plants, Refineries and so forth. There is a restricted measure of research occurred in the territory of funneling structure. Coming up next are a portion of the commitments in the territory of pipe frameworks.

Severino Paulo Gomes Neto et al; [1]: In this work, the creators recreated 3d pipeline from 2d which aides in survey 3dimensional highlights. Here it changes over genuine 3d virtual data into ongoing world scene by the client .They have built up a model and evaluated strong using three perspectives and various view geometry.

Bipro Dip Mukherjee et al; [2]: In this paper the creators made an investigation on pipeline systems keen help structure and stress examination for a warm plant. They structured funneling utilizing mechanical and worldwide codes and norms. In this paper, they made investigation on the pressure, diversion and basic examination of pipeline and reasoned that, on the off chance that the proportion of pressure prompted to passable pressure is <1, at that point the structure is said to be sheltered, else we need to overhaul it once more.

Naved A. Shaikh et al; [3]: In this work the creators gave a channeling among condenser and cooling tower to have nonstop progression of water. They made fundamental reports, for example, pfd, p&id, plot plan, gear design, channeling general course of action drawing, isometrics, material take off, funneling details, siphon determination, estimations, and stress examination and so forth. The creators made a precise displayed funneling framework configuration utilizing PDMS programming.

Japheth Bunakiye Richard et al; [4]: In this work the creators have presented a defense study on oil and gas pipeline structure the executives frameworks which aides in recognizing, taking care of, and controlling of pipeline plan. This record contains general prerequisites for a pipeline plan the executives frameworks. They took a shot at various types of models and utilized those procedures and connected it on contextual analysis.

Abhishek Sharma et al; [5]: In this paper the creators clarified the fundamental comprehension of funneling, its real parts, channeling gauges, reports required in funneling. They additionally clarified how channeling structure is assuming a significant job in Power plants, Petroleum treatment facilities, Food handling unit, Chemical Plant, Textile plants and so on. They have given a general thought on channeling and how codes and gauges assume a significant job in structure.

Payal Sharma, et al; [6]: In this paper the creators planned and developed a Piping framework to play out an unequivocal capacity of any plant which lessens time , and costly exertion. By and large planning of funneling frameworks are made by International Codes and Standards. Funneling codes characterizes the necessities of structure, manufacture, and utilization of materials. Anyway this requires the pipe framework to be displayed before doing pressure investigation. These creators made a powerful plan and deliberate examination which diminishes the exertion.

Naved A. Shaikh et al; [7]: In this desk work, the creators have structured a funneling framework among condenser and cooling tower for successful water course. In this, they have utilized certain codes and norms for structuring a pipe and they made some fundamental reports like funneling and instrumentation drawing, gear design, channeling general hardware drawing, isometrics, funneling details and so on. In this the funneling is done all around effectively and precisely which diminished material misfortune in creation and labor.

T.V.V. Satyanarayana et al; [8]: In this the creators have structured flare channeling and arranged 3D demonstrating in PDMS programming according to specific codes and guidelines. They have likewise done pressure investigation in this desk work by utilizing CAESER programming. They have done pressure investigation on flare line among types of gear and made safe by giving an extension circle.

INTRODUCTION

Plant Design Management System (PDMS) is adjustable, multi-client, and multi-discipline 3D CAD programming, which is broadly utilized crosswise over different businesses nowadays. PDMS programming was created by Aveva, this product helps the funneling designers and 3D draftsmen to change over the 2D drawings into 3D models. PDMS is essentially utilized in the inland and seaward oil and gas industry. It likewise discovers its application in designing tasks, substance and procedure plants, control plants, and water treatment plants and so forth;

PDMS programming empowers us to plan 3D intuitive PC model of substance process with full shading concealed portrayal. PDMS conflict checking office guarantees free model to be created to kill extent of mistake that could emerge nearby while development. 2D building drawings which are delivered utilizing PDMS, structures sharing connects to move data from plan office to building site.

PDMS stores a wide range of information in particular database relying on the sort of information to be put away. Databases are made by manager according to the venture necessity. PDMS is part into various modules which are utilized at various stages in plant configuration process.

3.1 Design Modules

Design

Configuration is primary constructor module in which complete substance procedure is 3D displayed. Client chooses required segments from accessible determinations and indexes and positions them according to building plan. 3D model information is put away in plan database for individual site made. For example Hardware, Piping, Cabling and so forth.

SPOOLER

Spooler is utilized for pipe work spooling. In this module, pipe work configuration can be part into spools which are prepared creation. Spool information made in spooler module can be yield as isometric drawing utilizing isodraft module.

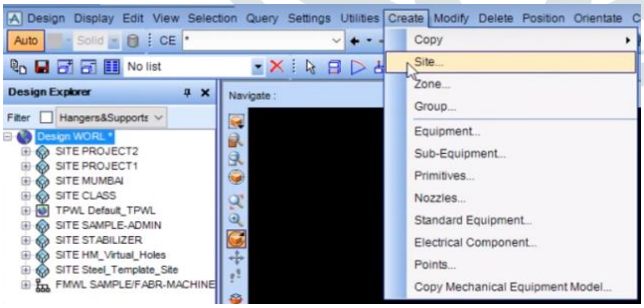

Fig 3.1 Creating site

PDMS Software begins with making site, there is no hope without making site. For instance to develop a structure it needs site to build, in the comparative method to build any gear in PDMS programming it likewise needs site.

By tapping on make toolbar , there will be a few choices untruth duplicate, site, zone and so on; among those snap site and after that name it.

Create →site

Subsequent to making site, it is important to make zone. For instance in any foundation there will be a few squares for a few offices, in a similar way PDMS is additionally having certain zones, so there is have to make one zone for one undertaking. Zone can likewise be made n the comparative way as done it in the before in making site and later name the zone.

Create → zone

Subsequent to making zone, there is have to make gear. For instance in any structure there will be a few squares for a few rooms, in a similar way PDMS is additionally having a few types of gear, so there is a need to make one hardware for one errand. Here gear can likewise be made in the comparable way as done in it in before in making site, zone and later name the hardware of course.

Create → equipment

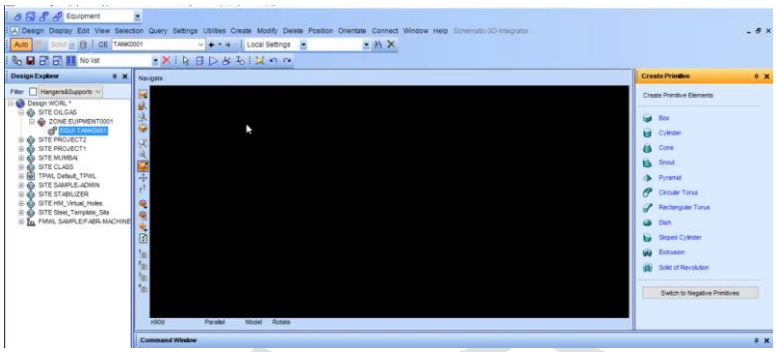

Fig 3.2 Primitives

In PDMS, natives comprises of gathering of standard types of gear like box, 3D shape, cone, pyramid, spout, dish and so forth; which are orchestrated in such a path in 3D space that they speak to the genuine article. At the point when another bit of gear is to be constructed, one of the main choices to be made is which natives will be utilized to make the portrayal required.

Create → Primitives

Create → Primitives → Box →Parameters → click.

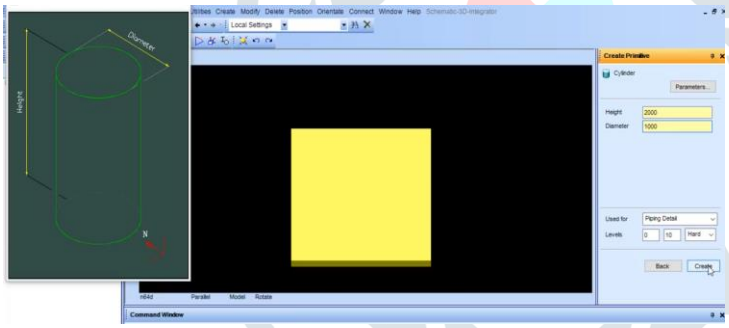

Fig3.3 Creating cylinder equipment

Chamber is fundamental hardware accessible in gear alternative, in the wake of choosing chamber gear, at that point it is important to give tallness and distance across to that chamber.

Create → Equipment→Cylinder→ Parameters → click

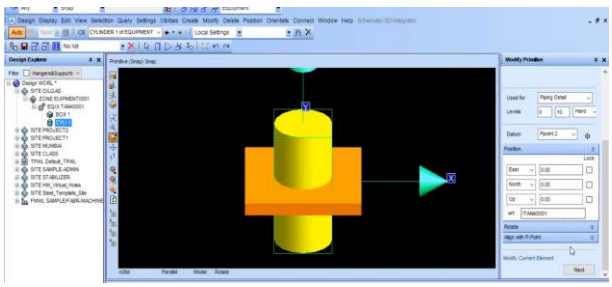

Fig 3.4 Axis symmetry

Subsequent to making chamber as indicated by its measurements, it is important to make both the tomahawks equivalent i.e.; tomahawks of both the chamber and box. Subsequent to making chamber it must be changed over into 2D by tapping on left snap and afterward choosing look north.

Connect → Primitives → Id point

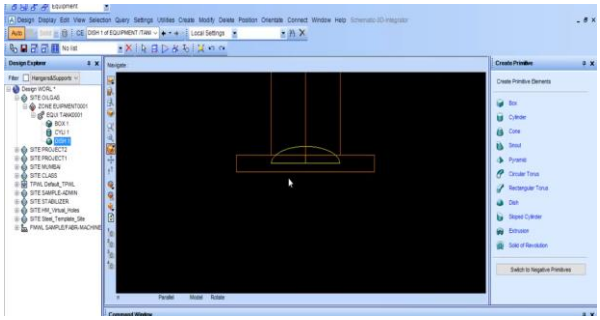

Fig 3.5 creating Dish

In the wake of making chamber, it is imperative to make dish as it keeps away from harm to the corners and furthermore for the consistent progression of liquid. Dish will be accessible in the toolbar natives, we can make dish by changing over it into 2D and later by choosing dish in natives and by giving its measurements like distance across, range, stature.

Create → primitives → dish → parameters

IMPLEMENTATION OF PDMS SOFTWARE

Presentation: PDMS is the packed phrasing utilized for "Plant Design Management System". This is a dynamic framework created to help the originators, engineers, and and also, planners. PDMS is a 3D CAD(Computer-Supported Structure Center) programming that works in a trained way to help the planning business. The product gives venture organizers a heavy vantage to modernize their vision and comprehend its measurements better.

4.1 Fundamental necessities for funneling Plan between two types of gear

1. Condenser

2. Cooling Tower

3. Funneling Framework

4. Hardware Displaying

5. Pipe system displaying

6. Programming: PDMS (Plant Structure The executives Framework)

4.1. Condenser

A condenser is a warmth trading gadget or unit used to consolidate a substance from its vaporous to its fluid state, by cooling it. There are three sorts of Condensers like air cooled, water cooled and evaporative Condensers. The condenser utilized in this undertaking is ammonium condenser which is one among evaporative condensers.

4.2. Cooling towers

A cooling tower is a glow expulsion device that rejects squander warmth to the air through the cooling of a water stream to a lower temperature. There are two sorts of cooling towers like customary Sort cooling towers, compelled sort cooling towers. The cooling tower used in this sort is evaporative, compelled draft cooling tower.

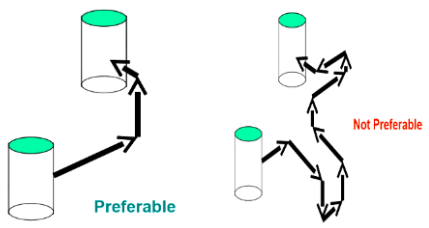

Fig 4.1 Pipe routing

A Pipe is an unthinkable thing made of metal, plastic, glass and so on implied for passing on fluid, gas or anything that streams. It is significant part for any mechanical plant, and its designing assumes a noteworthy job in a general building of a plant

4.3 Funneling Framework .

Funneling from source to goal ought to be as short as conceivable with least alter in course .It ought not ruin any typical section way infringe any hardware upkeep space.

While doing funnel directing we likewise need to consider the accompanying the Valves, strainers, instruments on the pipe ought to be effectively available. If necessary separate ACCESS Stages to be given to encourage these. Wanted area and direction of valves/instruments and other pipe segments are to be checked and kept up, similar to certain valves or strainers must be introduced in level position. Explicit necessities for instrument establishment to be checked, similar to temperature measure can't be introduced in pipe which is under 4 inch in size.

4.4. Hardware Demonstrating

In PDMS Hardware Demonstrating Makes gear with the utilization of Standard Hardware models in natives. It clarifies the formation of Electrical Hardware and furthermore gets ready gear reports

4.4.1 Gear chain of command

Gear (EQUI) components are claimed by Zones (ZONE). EQUI components may possess at least one discretionary Sub-gear (SUBE) components. The SUBE components are utilized to separate hardware into sub-parts. Both the EQUI and the SUBE components can claim Natives. Natives are the components which are shown in the 3D View to speak to the gear and go about as the structure hinders for hardware displaying inside PDMS.

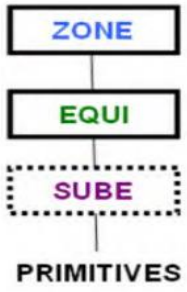

Fig 4.2 Equipment hierarchy

4.5 Pipe work demonstrating

Pipe work demonstrating depicts how PDMS is utilized for displaying Funnel work. There is a different structure chain of importance for pipe steering, as demonstrated as follows. On a fundamental level, each pipe component may claim various branches. Thusly, branches may possess various channeling parts, for example valves, reducers, tees, spines, and so on. The contrast among funnels and branches is that a branch is just considered to have two closures, while a pipe may have any number of finishes, contingent upon the quantity of branches it possesses.

4.5.1 Funneling Particulars

The structure workplaces have standard channeling details, similarly PDMS additionally has a lot of particulars from which the fashioner can choose. Every one of the segments inside PDMS must be characterized in the Index and be put in a Determination before they can be chosen. In PDMS, there are three such particulars: a1a = ANSI class 150 carbon steel A3B= ANSI class 300 carbon steel F1C= ANSI class 150 hardened steel these determinations contain every one of the fittings required for the course works out. A significant point to recall when utilizing the application is which determination is right now being utilized as the doing.

4.6 Favorable circumstances of PDMS programming

1. It encourages seeing the real model of the plant with exact measurements

2. It sets aside to 30% material expenses in contrast with the manual estimation technique.

3. Pipe conflicts, absence of room, fitting issues, and other such issues in plant configuration can be abstained from utilizing PDMS programming.

4. It gives higher degree precision contrasted with the 2D programming.

5. PDMS helps in computing the careful amount of materials to be utilized in the plant, so no additional amounts are requested, it can likewise create material take of reports.

6. Through PDMS, we can naturally run the isometric drawings of the channels for the creation reason.

7. It is generally simple to make changes to the plant structures created utilizing PDMS.

8. Backing for funneling can be effectively made in the holder and bolster module of the PDMS.

4.6.2 Utilizations of PDMS programming

PDMS programming is utilized in numerous ventures, for example, oil and gas pipe lines, oil businesses, building structure and development extends in seaward and coastal, control plants, mash producing, and has marine application too.

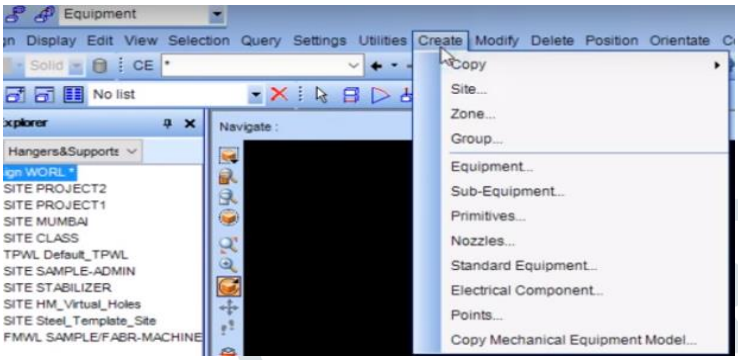

Fig 4.3 Creating site, zone, equipment, sub equipment.

In the wake of getting into the PDMS programming, make site, zone, hardware and sub gear. Anything can't be made legitimately, so here making site first and later it is required to name it, here it is naming as funneling, at that point make zone, hardware and sub gear in a similar way as done in making site.

Site, zone, equipment and sub hardware are made by the following ways

Create →Site→Zone→Equipment→Sub equipment

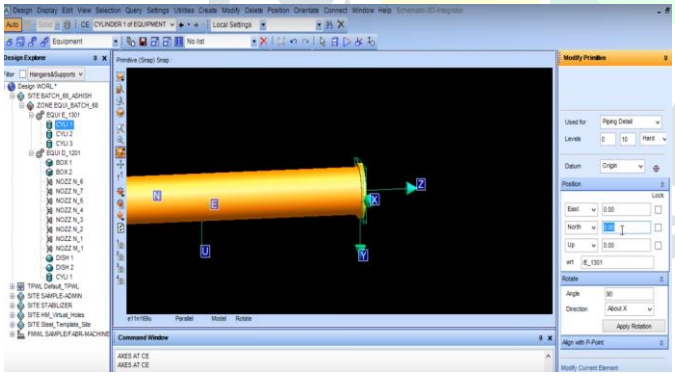

Fig 4.4 Creating Standard apparatus (condenser)

Making standard types of gear in PDMS programming are simple, in light of the fact that a significant number of the standard supplies are as of now predefined (as of now existed) in PDMS programming. There are two supplies in this venture named condenser and cooling tower. Right off the bat, we are making condenser, since condenser is standard gear, it tends to be made from the standard types of gear.

Coming up next are the means to make condenser

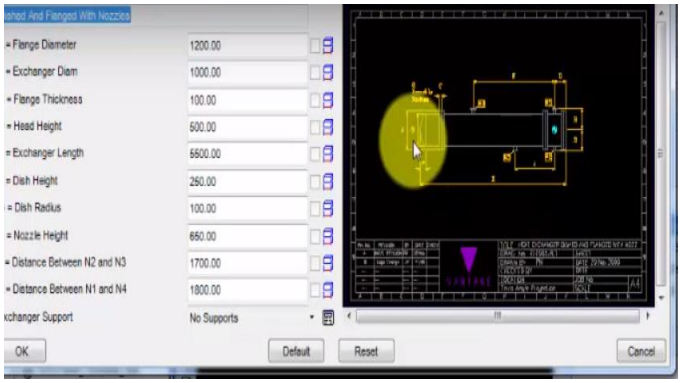

Fig 4.5 Giving dimensions to condenser

In the wake of making condenser from the standard gear, there is have to offer measurements to the condenser; here spine breadth, exchanger width, rib thickness, head stature, dish tallness, dish sweep, spout tallness and separation between two spouts N1and N2 are given.

Giving measurements is finished by the accompanying advances

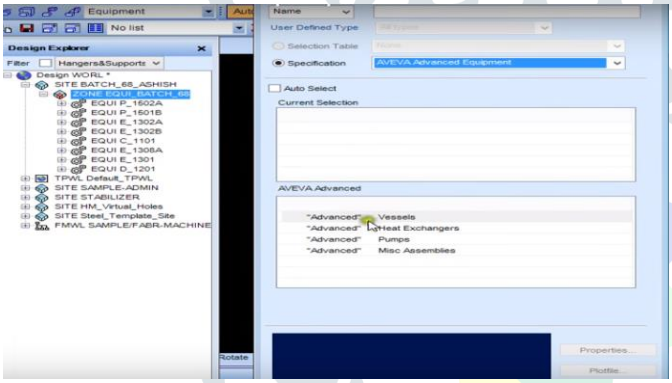

Fig 4.6 Creating Pump

Siphon assumes a significant job in any industry, in this task siphon is required for siphoning water to the cooling towers for cooling the hot gas going through the channels, so siphon is made here. Since siphon is likewise standard gear, it can likewise be made effectively by giving its measurements.

Siphon is made by the accompanying advances

pump-focus line mounted with vertical spout. In the wake of making siphon from the standard gear, it is important to offer measurements to the siphon, here we have given base plate length, base plate width, good ways from beginning to base plate, absolute separation, good ways from base to focus, spout tallness, suction spout determinations, separation spout particulars

Giving measurements is finished by the accompanying ways

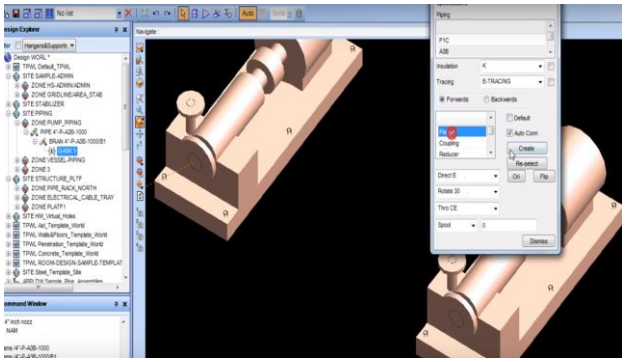

Fig 4.7 Creating Flanges To the pumps

Spines are utilized for associating channels, valves, siphons and other gear to frame a funneling framework. It likewise gives simple access to cleaning, assessment or alteration. Ribs are typically welded or screwed. Flanged joints are made by darting together two ribs with a gasket between them to give a seal.

The material of a spine is fundamentally set during the decision of the pipe, much of the time, a rib is of a similar material as the pipe. Here additionally we have utilized same material for the two funnels and ribs.

Coming up next are the approaches to make rib

Create➔Components➔Flange.

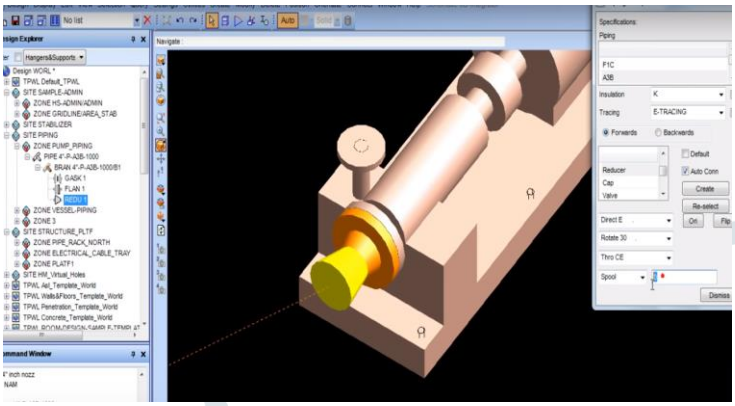

Fig 4.8 Creating Reducer to the pumps

Reducers are most widely utilized in funneling industry to diminish or grow the straight piece of run pipe. Fundamentally, reducers are of two sorts, they are concentric reducers and Unpredictable reducers. Concentric reducer is utilized to join pipe areas or cylinder segments on a similar pivot. The concentric reducer is cone-molded, and is utilized when there is a move in distance across between funnels. In this sort of reducers territory decrease is concentric and focus line of the pipe on greater end and littler end stays same. These styles are regularly utilized for vertical lines.

An erratic reducer is a fitting utilized in channeling frameworks between two funnels of various breadths. They are utilized where the width of the pipe on the upstream side of the fitting is bigger than the downstream side. Concentric reducers are utilized in this task.

Coming up next are the approaches to make reducer

Create➔Components➔reducer

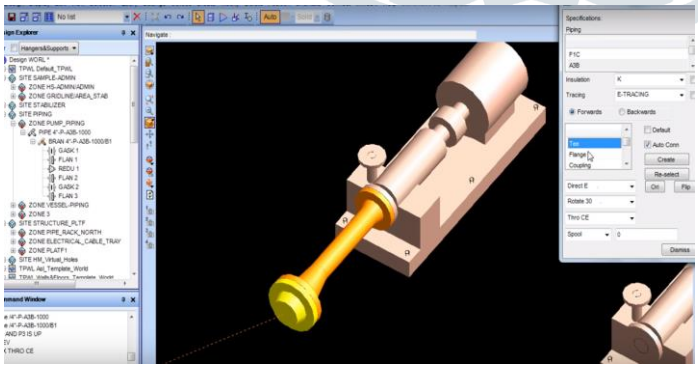

Fig 4.9 Creating Tee joint

Tee joint is a sort of pipe fitting which is T-molded having two outlets, at 90 degree to the association with the fundamental line. It is a short bit of pipe with a horizontal outlet. Tee joint is utilized to associate pipelines with a pipe at a correct edge with a horizontal outlet. Tee joint is utilized to interface pipelines with a pipe at a correct edge with the line. Here tee joint is utilized to interface the five siphons by a solitary pipeline.

Tee joint is made by the accompanying ways

Create → components → coupling → trap → tee → create → True tee ANSI B.16.9.Bw.STD ASTM A105 GRB → ok → rotate180.

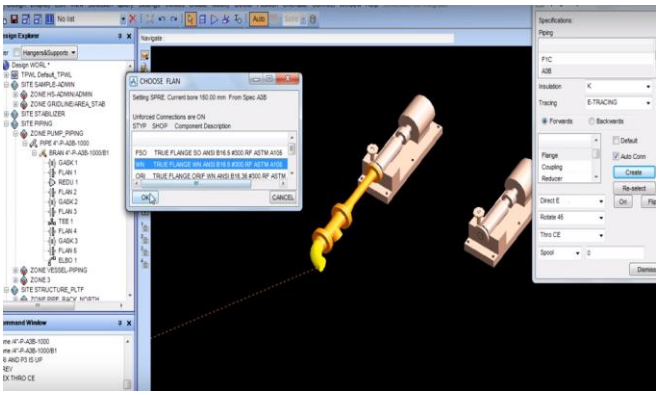

Fig 4.10. Giving Spool

Spooler in PDMS is only expanding the size of pipe by giving certain separation. Here spooler is given from siphon 1 to associate the siphon to the rest of the siphons by making tee joint over yonder. In this task we are utilizing five siphons, so we have separation as 700 cms i.e.; the good ways from the principal siphon to the last siphons.

Coming up next are the approaches to offer spooler to the siphon pipe

Create→components→bend→flange→Distance→spool.

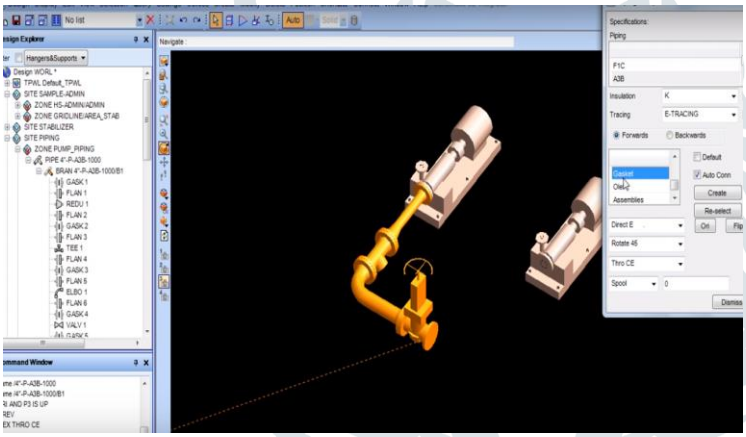

Fig 4.11 Creating Valve

A valve is a gadget that manages, coordinates or controls the progression of a liquid (gases, fluids, fluidized solids, or slurries) by opening, shutting, or somewhat blocking different ways. In an open valve, liquid streams toward a path from higher strain to lower weight.

Globe valves are straight movement valves with adjusted globular formed bodies. Since their shape is like other valve bodies, positive distinguishing proof must be made dependent on inward channeling. As of late globe valves have lost their conventional round body-shape. Globe valves have numerous preferences and disservices for clients. They have magnificent and exact throttling capacity for high-weight frameworks.

Coming up next are the approaches to make the valve

Create→Pipe→Components→Valve.

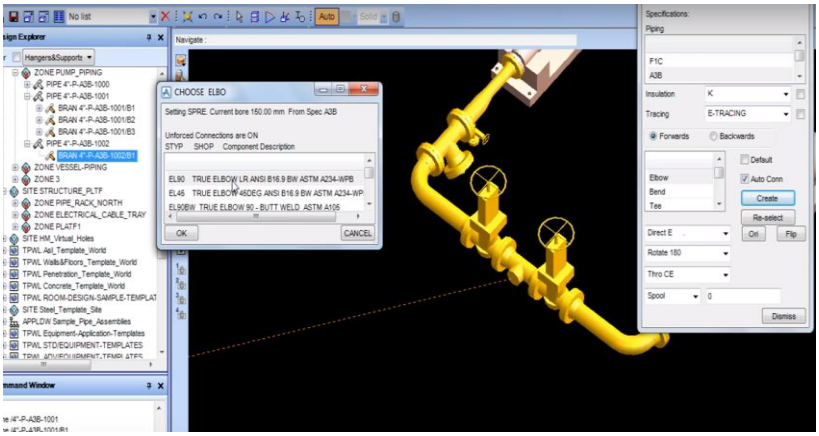

Fig 4.12 Creating elbow with Spooler

To course funneling among siphon and cooling tower, we have to spool it by making elbow. Pipe directing is significant in funneling framework, in light of the fact that by giving long pipe steering, it will take progressively material, cost and time, which at last outcomes in decline in efficiency rate.

In this venture five siphons are utilized so it is important to do it for multiple times in the middle of the valves and in the wake of finishing it comparably, the equivalent need to do it on the top side likewise additionally to make channeling among siphon and condenser.

Coming up next are the approaches to make elbow with spooler

Create→components→ bend→flange→Distance→spool.

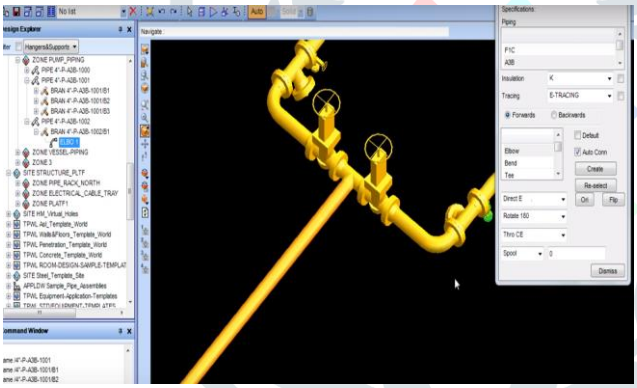

Fig 4.13 Pump with Spooler for Creating Cooling tower

Here spooler is made from siphons to make the cooling tower. Subsequent to making tee joint in the middle of the valves, spooler is given by giving certain separation here we have given 650 mm as separation, the separation for spooler will be given in the wake of making an elbow just . Right off the bat we have given 650mm as separation and afterward for staying all it is given as 600 mm , in light of the fact that the valves are mounted on top and base side of the cooling tower.

Coming up next are the approaches to make spooler from siphon to make cooling tower

Create→components→bend→flange→Distance→spool.

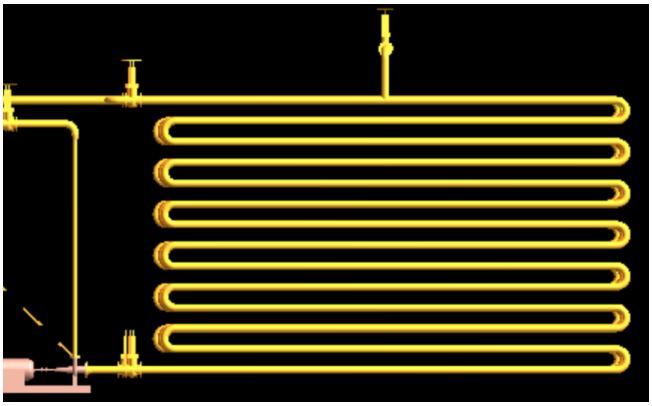

Fig 4.14 Cooling Tower

Here Cooling tower is definitely not a standard hardware, so it is made with various spoolers, elbows, rotatings and so forth; Right off the bat, pipe branch was spooled 6inches on a level plane and after that taken an elbow and pivoted it for about 180°and taken one more elbow and pivoted it about 90°, by doing it around 5 turns we will get a cooling tower. The level length of the cooling tower is 600 cms and the vertical length of the pipe is 143cms. There are 5 twists in left hand side and 6 twists in right hand side. The hole between the curves is 5cm.The kind of cooling tower utilized here is evaporative, constrained draft cooling tower. The five vertical pipes in cooling tower are associated with five distinct siphons. Siphons sucks the water from the beginning the assistance of engine and after that siphons it to cooling tower for cooling tourist passing through the channels.

5. RESULTS

From the writing audit [1], this task is taken as commencement, visited the closest ice stockpiling manufacturing plant and actualized the equivalent with some fundamental changes utilizing PDMS programming. Some essential records like isometric perspectives, and various perspectives were made for this venture.

Coming up next are a portion of the information sources that are gathered from the ice stockpiling processing plant.

S.No	Parameters	Dimensions
1.	Diameter of cooling tower pipe	0.06m or 2.6 inch
2.	Total height of cooling tower	1.4m
3.	Length of cooling tower	6m
4.	Gap between each pipes	0.05m
5.	Bend diameter	0.05m
6.	Gate Valve diameter	0.457m or 18 inch
7.	Ammonia pipe & Water pipe diameter	0.19m or 7.5inch 0.109m or 4.3inch

Tab 5.1 Measured table

Beforehand the ice industrial facility was produced by taking manual counts, by doing manual estimations more often than not and material was squandered, in this task we have structured the funneling framework utilizing PDMS programming, by utilizing this product, material misfortune is diminished in light of the fact that while picking the pipe distance across, there itself it is demonstrating whether if the pipe fits to that gear or not, thusly the material misfortune too the time additionally decreased.

The ice processing plant made with door valve which results in high weight drop, though in this task we supplanted entryway valve by globe valve which is having low weight drop and can control stream effectively.

S.No	Parameters	Obtained Dimensions
1.	Diameter of cooling tower pipe	0.0787mor 3.1inch
2.	Total height of cooling tower	1.4m
3.	Length of cooling tower	5m
4.	Gap between each pipes	0.05m
5.	Bend diameter	0.07m
6.	Globe Valve diameter	0.406m or 16 inch
7.	Ammonia pipe & Water pipe diameter	0.19m or 7.5inch 0.109m or 4.3inch

Tab 5.2. Obatined table

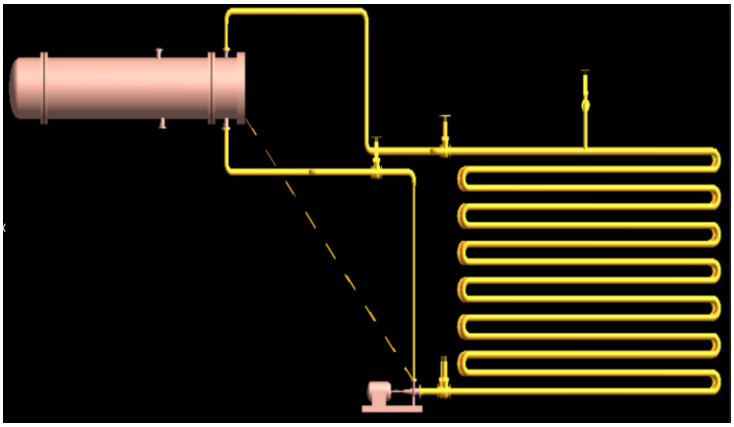

Fig 5.1 Overall view of Piping system

Beforehand the ice industrial facility was produced by taking manual counts, by doing manual estimations more often than not and material was squandered, in this task we have structured the funneling framework utilizing PDMS programming, by utilizing this product, material misfortune is diminished in light of the fact that while picking the pipe distance across, there itself it is demonstrating whether if the pipe fits to that gear or not, thusly the material misfortune too the time additionally decreased.

The ice processing plant made with door valve which results in high weight drop, though in this task we supplanted entryway valve by globe valve which is having low weight drop and can control stream effectively.

Design codes → ANSI/ASME B31.1 => Code for power piping

ANSI/ASME B31.3 => Code for process piping

ASTM A53B, ASTMA106B & API 5L=> carbon steel pipe

Some progressively intriguing materials like Inconel, titanium, chrome-moly

The isometric perspectives for the channeling framework among condenser and cooling tower are demonstrated as follows. Typically there exists four unique kinds of isometric perspectives.

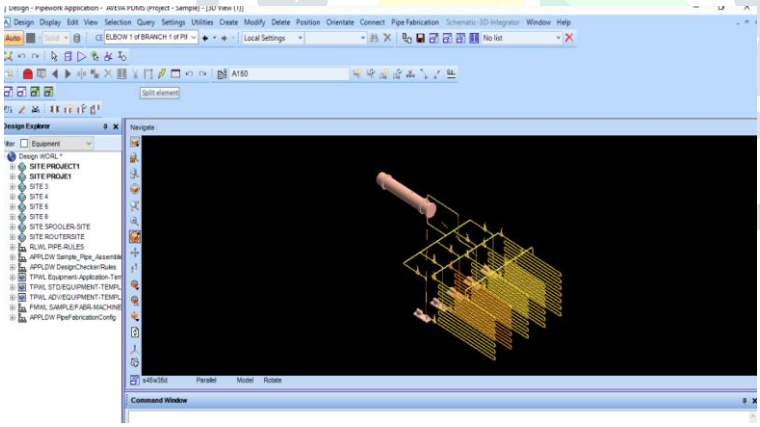

Fig .5.2. Isometric view1

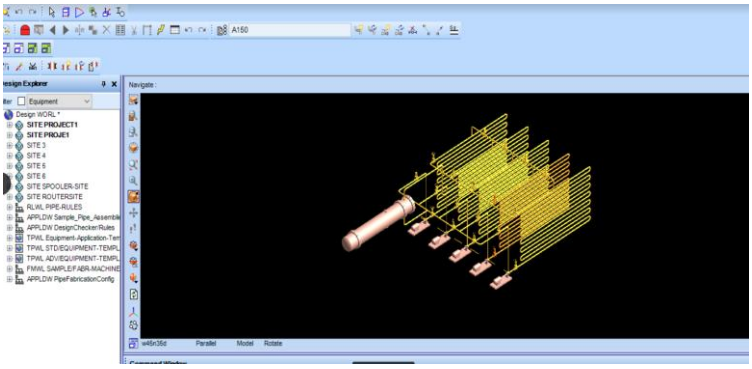

Fig 5.3. Isometric view2

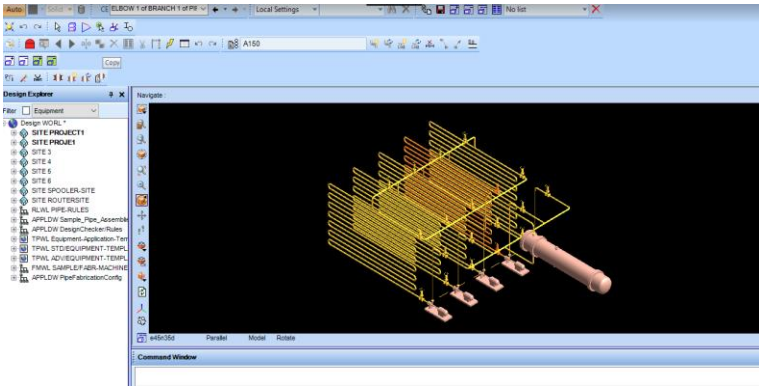

Fig 5.4. Isometric view 3

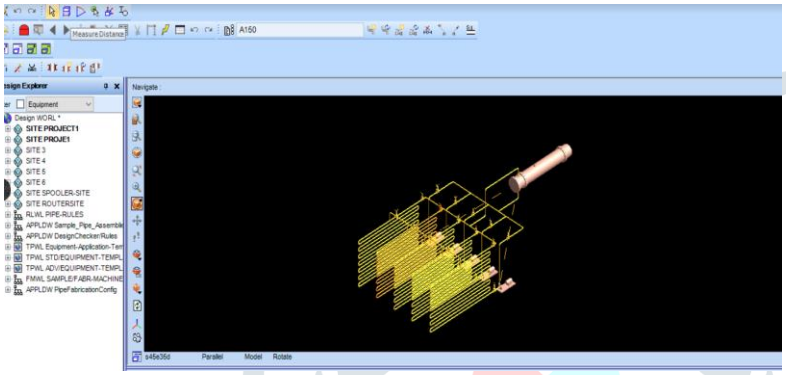

Fig 5.5. Isometric view 4

The general isometric view for the funneling framework among condenser and cooling tower is appeared above fig 5.2. This channeling framework is finished by utilizing certain codes and models. By and large types of gear in ice stockpiling plant are produced using treated steel, however here it is finished by utilizing carbon steel which is having high quality, adaptability and great consumption opposition.

Already, entryway valves were prepared in ice stockpiling industrial facility, in the present undertaking, globe valves are prepared which will have low weight drop and it very well may be shut or opened in all respects rapidly. By and large ice stockpiling production line is built utilizing trail and blunder strategy yet now by utilizing PDMS it is anything but difficult to break down and material use, time is limited.

FABRICATION MATERIALS

PT NO	COMPONENT DESCRIPTION	N.S (MM)	ITEM CODE	QTY
	PIPE			
1	ANSI B36.10 PE SWLS PIPE STD ASTM A53 GR.B	100	P-STD	39.7M
	FITTINGS			
2	ELBOW LR ANSI B16.9 BW ASTM A234 GR WPB	100	EL90	11

ERECTION MATERIALS

PT NO	COMPONENT DESCRIPTION	N.S (MM)	ITEM CODE	QTY
	VALVES / IN-LINE ITEMS			
3	VALVE GATE ANSI B16.10 #150.RF 9% NICKEL STEEL	100	GA-59	1
	PIPE SPOOLS			
	[1] [2]			

Fig 5.6 Bill of materials (BOM)

The above fig 5.6 gives the overall details of materials & primitives used like piping, fittings, valves, spools etc and their quantities.

Operating pressure = 5.7 bar

Design pressure = 14.345 bar

Hydrostatic pressure = 35.37bar

Temp of water = 35.37 bar

Cooling tower nozzle = N1U101

Code of line = 500-CWS-102-CS

Where 500 = nominal bore of pipe

CWS = Cooling water supply

102 = Line number

CS = Carbon steel—Pipe material

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