Dry Vacuum systems chemical & pharmaceutical processes

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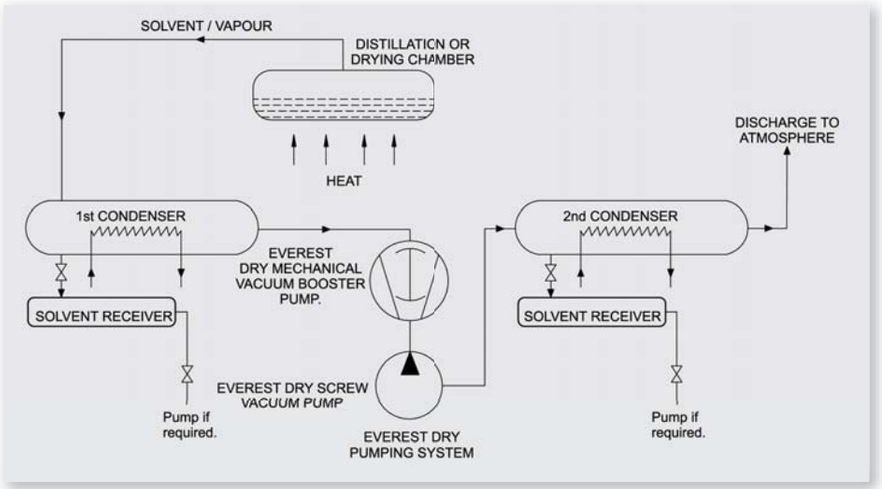
PRESSURE & VACUUM SYSTEMS

For decades vacuum pumps are. being used for the various applications in the chemical, petro chemical & pharmaceutical processes, such as in product drying, freeze drying, solvent recovery, evaporators, dehydrators, crystallizers and for other general vacuum applications such as conveying, regeneration of molecular sieves, vacuum filtration etc.

The boom in the global market in refined chemicals, medicines and other products led to the increase in the use of the vacuum equipments across all the process industries. The major concern in chemical and pharma processes is to offer vacuum systems capable of handling corrosive and toxic vapors and gases. Earlier there were limited methods in the field of manufacturing which could help in reducing the waste contents but with the changing face of the world and the technological advancements industries learnt & shifted toward the advanced technology of Vacuum Pumps. Nowadays almost 75% of the Process Industries are using the vacuum pumps and allied systems in their applications. This has helped them to reduce their waste to a large extent and increased their production d2 profitability.



Typical Solvent Recovery System Using Dry Pumping System

Talking of the conventional vacuum pumps, the following are the ones being used in the process industry:

- Liquid Ring Pumps/Water Ring Pumps
- Oil Sealed Pumps -..Rotary & Reciprocating
- Steam Jet Ejectors.
- Water Jet Ejectors

For decades, applications demanding ultimate pressure below 1 mbar, Oil-sealed Rotary Vane Pumps were the most popular solution. All of the above (wet technology) utilize liquid media that can be Oil, Water, or Steam to generate vacuum inside the given volume or the process. During evacuation there is a carryover of the process solvent/vapor which contaminates the pumping media. The treatment of this contaminated medium is a major concern and a huge investment is required to treat it to

Photo: Single Stage Dry Screw Pump with Inlet vapor trap

meet the norms of disposal set by the Pollution Control Board.

Moreover, over a period of time the continuous contamination of the liquid media inside the pump leads to the corrosion & damage to the pumps internals, resulting in lower overall efficiency of the pump thereby affecting the process performance. This demands regular maintenance and has frequent breakdowns.

DRY VACUUM PUMPS, STATE OF THE ART TECHNOLOGY.

In the late 90's, clean process requirements initiated the development of the dry vacuum pumps. In today's date they are readily available and most of the process applications use dry pumps (EVEREST DRY SCREW VACUUM PUMPS) and dry pumping packages (EVEREST SUPERVAC SERIES). Refer schematic diagram. The trend to replace lubricated pumps by dry pumps is now spreading over many other market segments. For the Pharmaceutical Industry, it has been quite easy to understand the benefits of dry pumps, in terms of cost of ownership, process contamination, up-time and effective Solvent Recovery with practically zero discharge to atmosphere. Dry vacuum systems are the changing face of the technology in the world of process industries and turns out to be the efficient, reliable & eco-friendly for Pharmaceutical, Chemical & Petrochemical Industries. The technology offers many advantages over the traditional technology of Liquid media pumps and finds its application in various process related industries such as Distillation, Drying, Evaporation, Crystallization, Deodorization, Filtration & for general purpose vacuum.

The major advantage of the Dry Screw Vacuum pumps is that they do not require any fluid (oil/water/steam) inside them for the vacuum generation. This eliminates the contamination of the process vapours and provides better recovery of the vapours thus reducing the effluent generation. The dry pumps use fewer utilities thus cutting the operational cost as compared to other traditional vacuum pumps. The vacuum levels are highly precise and the volumetric displacements are consistent giving full efficiency in the process.

A case study has been made by the team of EVEREST engineers in one of the leading pharmaceutical concern in India. The following benefits were observed where conventional steam jet ejector systems were replaced by Everest Dry Pump combination.

Following are the benefits of Dry Screw Vacuum Pump over Steam jet Ejector System:

- Better Vacuum Level achieved.
- Distillation temperature is reduced.
- Steam consumption NIL, thereby reducing load on boiler, plant & allied equipments.
- Load on cooling tower reduced drastically.
- Load on Effluent Treatment Plant is reduced.
- Reduced specific energy consumption by 30 - 35%.
- Zero start up time with option of quick start and stop.
- No vacuum fluctuation during feeding & circulation in the process.
- No loss of Solvent i.e. 100% solvent recovery enabled.
- Maintenance cost minimised as the dry pump offers robust solutions.

A study made by the team from Everest on the replacement of the Steam Jet Ejector system by Everest dry pumping system at

EVEREST DRY VACUUM PUMPING SYSTEM Vs STEAM JET EJECTORS			
Parameters	Units Of Measurement	Steam Jet Ejector System	Everest Dry Vacuum Pump System
Operating Hours	Hours/ Year	8000	8000
Steam			
- Flow Rate	Kg/Hr.	600	0
- Unit Rate	Rs / kg	2.2	0
Steam Cost	Rs /Year	1,05,60,000	0
Cooling water			
- Flow Rate	m^3/hr.	12	2.7
- Unit Rate	Rs /m^3	4	4
Water Cost	Rs /Year	3,84,000	86,400
Effluent Treatment			
- Flow Rate	m^3/hr.	0.12	0
- Unit Cost	Rs / m^3	120	120
Treatment Cost	Rs /Year	1,15,200	0
Nitrogen			
- Flow Rate	LPM/ m^3/hr.	0	40/ 2.4
- Unit Cost	Rs /m^3	6	6
Nitrogen Cost	Rs /Year	0	95,040
Power			
- Units Consumed	kW	6	8
- Unit Cost	Rs Per kW/hr	6	6
Power Cost	Rs / Year	2,88,000	3,84,000
Batch Details			
- Time		48	27
- Cost/ Batch	Rs	68,083	3,513
- Total Batches / Year	No.	166	296
- Number of Batches Increased	No.		130
- Total Savings / Batch	Rs		64,570
Additional operational Cost for the differential batches [No. of Batches Increased (130) x Cost/hr for steam jet system (1418) x Batch cycle time(48)]	Rs	88,48,320	0
Total Utility Cost/ Hour	Rs	1,418	130
Total Utility Cost/ Year	Rs	1,13,44,000	10,40,000
Maintenance Cost/ Year	Rs	20,000	45,000
Yearly Operating Cost for the Equipment	Rs	**1,13,64,000**	**10,85,000**
Operating Cost/ Month	Rs /Month	9,47,000	90,416
Dry System Cost Saving / Year	Rs	-	1,02,79,000
Dry System Cost Saving/ Month	Rs /Month	-	8,56,583
Cost Of the System	Rs	4,50,000	14,00,000
Installation Cost	Rs	-	0
Total expenditure in Runing the System	Rs	**1,18,14,000**	**24,85,000**
Savings		**about 80% over steam jet ejector**	

one of the leading Pharmaceutical Company is as tabulated below:

The above chart shows the benefits gained by the replacement of the steam jet ejector setup with the Dry Screw Vacuum Pump technology.

Though the initial investment with EVEREST Dry pumps is high but the operational cost is comparatively less resulting in shortest payback of the machine and leading to various other benefits such as less utilities, less waste disposal, better recovery of the product, thereby maintaining the quality of the product, reducing process temperatures etc. All these things lead to the eco friendly systems and highly efficient process results.

Maintanance:

Speaking about maintenance part, the maintenance of these dry systems is quite easy as compared to the traditional pumps as there is no fluid present, so frequent checks are not required to look for the contamination. These pumps only use oil for lubrication of gears which need to be checked over the prescribed period of time depending upon the properties of the lube oil used. Moreover as there are no rubbing parts inside the pump there is not much to be taken care of inside the pump, & hence the pump provides a trouble free working over years.

Safety:

Since the pumps do not have any rubbing parts inside so there is no possibility of any breakdown. Moreover EVEREST is providing the pump internals with PFA coating of 60/i in order to enable the pump to handle corrosive and harsh gases passing through as a carry over to the process. Thus in case of any condensation taking place inside the pump there will not be any problem of cavitation, leading to longer life of the pump and trouble free operation even in mildly corrosive applications.

For highly corrosive vapours, additional safety and better maintenance is required and team of Engineers at EVEREST have a solution for that as well. Similarly in case of applications where the gases have low ignition points, special accessories are provided with the pump in order to avoid any accidents in the plants.

Everest has so for supplied 100's of pump systems for a variety of applications and thus has good experience of the problems that can arise as well as the best possible solution for the same.

We are now confident in saying that:

"Everest Does not only Provide Blower's; Booster's and Pump's - We Provide Complete Solutions ".

For more information
Web: www.everestblowers.com