

製程熱能提升技術 - 低碳製程技術研討會

毅懋企業有限公司

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自我介紹

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資歷：毅懋企業有限公司- more than 20 years

負責項目：

- 真空設備 (Ejector system, Thercompressor, Scrubber)
- 水封式真空系統 (Liquid ring vacuum system)
- Feige Liquid filling system (Auto-, Semiauto)
- 槽車卸料臂 (硬管/軟管型式) · 乾式快速接頭



Schutte & Koerting Steam Ejector system

AGENDA

- Schutte & Koerting 原廠公司簡介
- Steam ejector產品原理介紹
- Steam ejector產品延伸應用
- Q & A

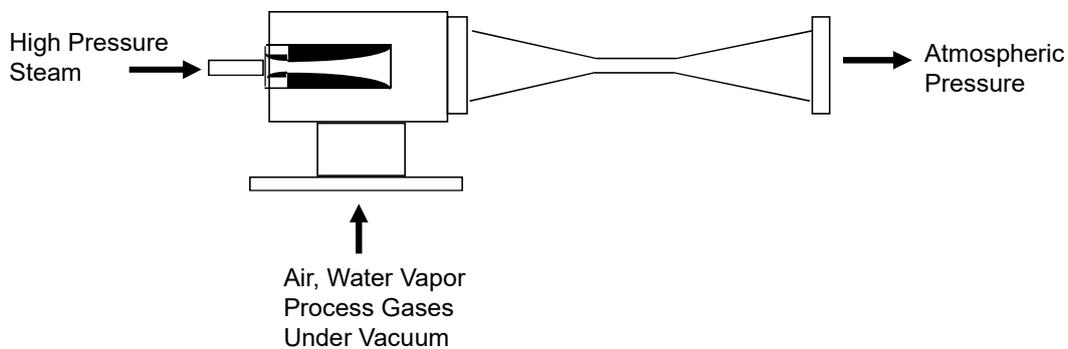
Schutte & Koerting

- Found in 1876 by Dr. Ernst Koerting & Mr. L. Schutte, named L. Schutte Co.
- 1st product: Double tube injector
- 1882 1st eductor condenser with patented.
- 1st high pressure valve up to 250Lbs. in U.S.A.
- 1903 Company reorganized to Schutte & Koerting
- 1915 1st Thermocompressor was designed.
- 2004 Company achieved ISO 9001:2008
- Products line includes ejector, eductor, condenser, valves, scrubber, nozzles, desuperheaters.
- Serves the Chemical, Petrochemical, Food, Paper, Power, Water, among others.



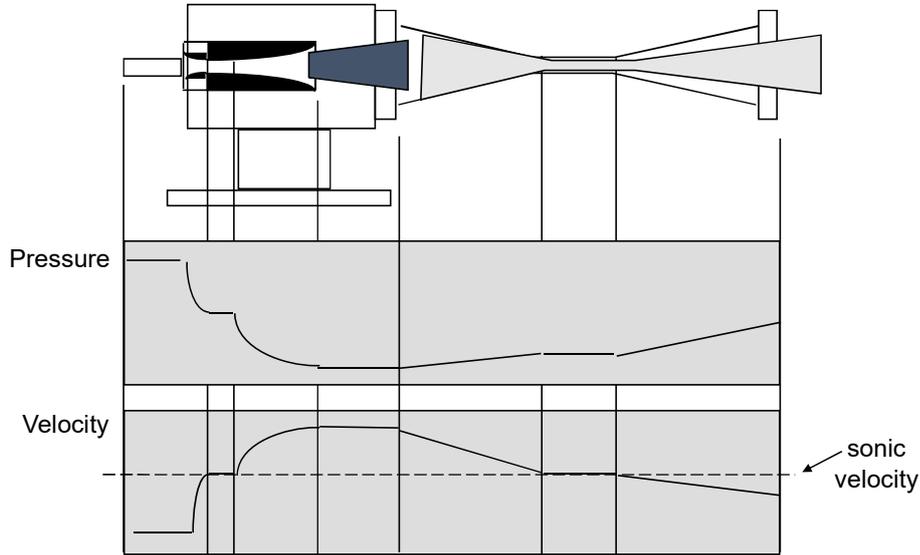
Steam Jet Vacuum Systems Principals

Steam Ejector Principles

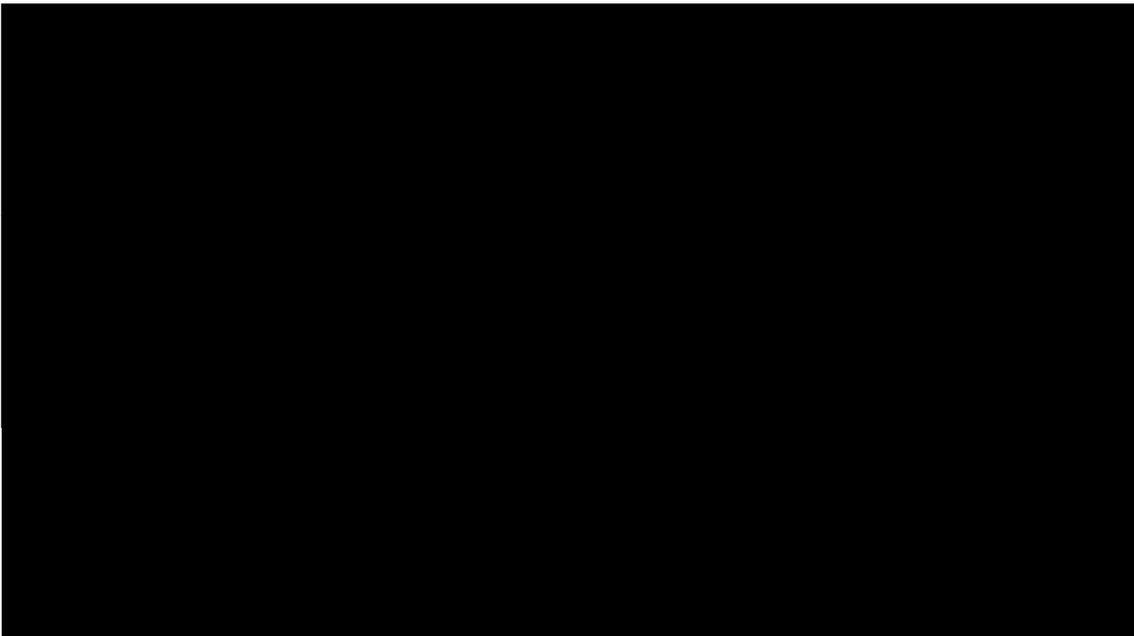


Steam Jets typically use steam as the high pressure gas, entraining air and process gases under vacuum - the discharge pressure is usually atmospheric pressure.

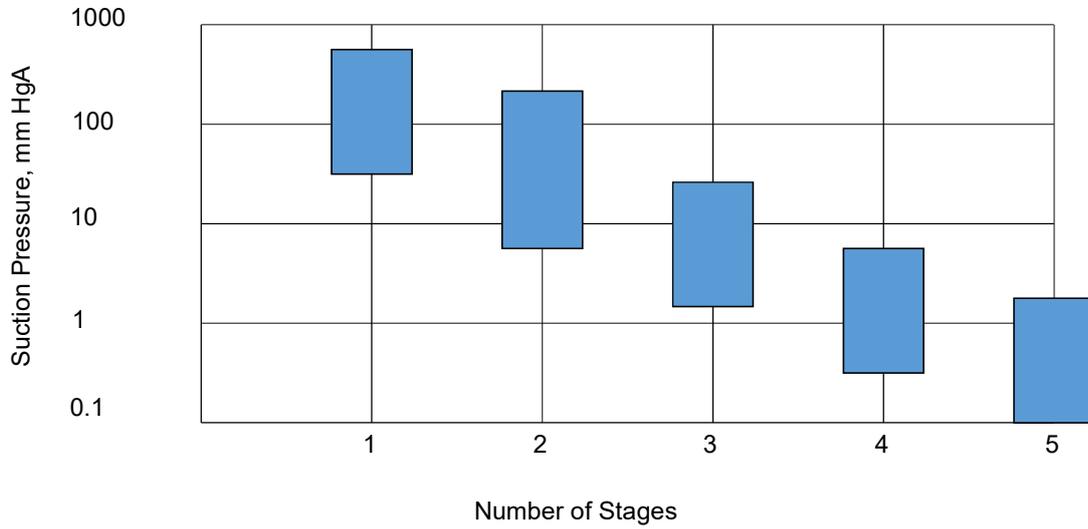
Ejector Principles Velocity and Pressure Profiles



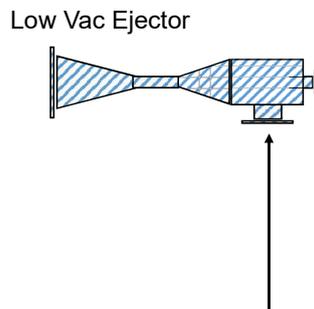
Steam Ejector working



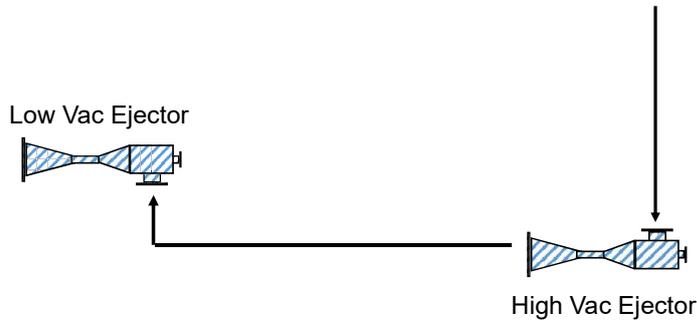
Steam Jet Vacuum Systems Suction Pressure vs. Number of Stages



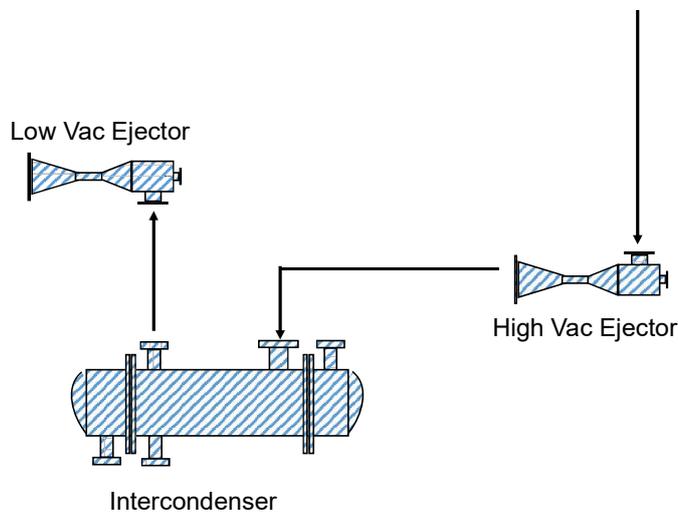
Typical 1 Stage Vacuum System



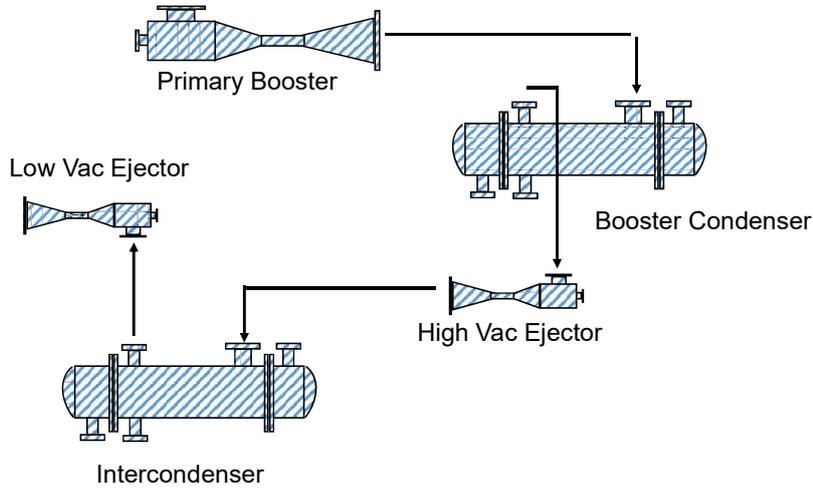
Typical 2 Stage Non-Condensing Vacuum System



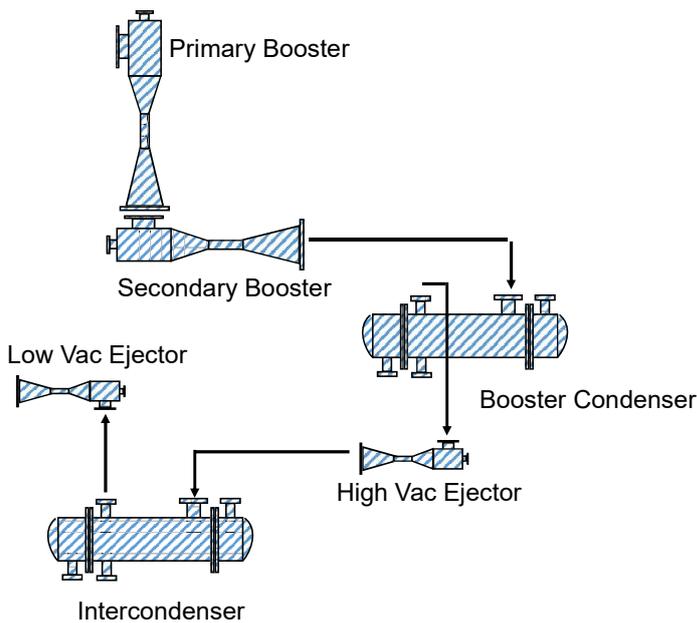
Typical 2 Stage Condensing Vacuum System



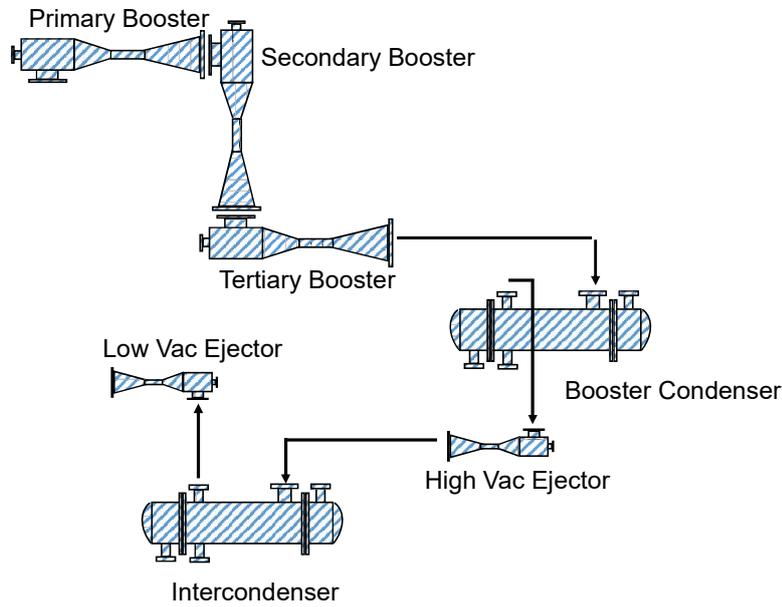
Typical 3 Stage Vacuum System



Typical 4 Stage Vacuum System



Typical 5 Stage Vacuum System



Steam table (Saturated condition)

| p mbar | p Torr | t °C | v' m ³ /kg | v'' m ³ /kg | h' kJ/kg | h'' kJ/kg | r kJ/kg | s' kJ/kg K | s'' kJ/kg K |
|-----------|-----------|---------|--------------------------|---------------------------|-------------|--------------|------------|---------------|----------------|
| 0,1 | 0,075 0 | - 42,18 | 0,001 084 | 10 660 | - 415,25 | 2 423,2 | 2 838,4 | - 1,546 3 | 10,742 9 |
| 0,2 | 0,150 0 | - 36,03 | 0,001 085 | 5 472 | - 404,03 | 2 434,5 | 2 838,5 | - 1,498 4 | 10,472 4 |
| 0,3 | 0,225 0 | - 32,24 | 0,001 085 | 3 706 | - 396,99 | 2 441,5 | 2 838,5 | - 1,468 9 | 10,313 6 |
| 0,4 | 0,300 0 | - 29,51 | 0,001 086 | 2 811 | - 391,85 | 2 446,5 | 2 838,4 | - 1,447 7 | 10,202 1 |
| 0,5 | 0,375 0 | - 27,31 | 0,001 086 | 2 269 | - 387,68 | 2 450,6 | 2 838,2 | - 1,430 7 | 10,114 5 |
| 0,6 | 0,450 0 | - 25,51 | 0,001 086 | 1 905 | - 384,23 | 2 453,9 | 2 838,1 | - 1,416 7 | 10,043 7 |
| 0,7 | 0,525 0 | - 23,99 | 0,001 087 | 1 643 | - 381,33 | 2 456,7 | 2 838,0 | - 1,405 0 | 9,985 3 |
| 0,8 | 0,600 0 | - 22,83 | 0,001 087 | 1 445 | - 378,70 | 2 459,2 | 2 837,9 | - 1,394 5 | 9,933 2 |
| 0,9 | 0,675 1 | - 21,40 | 0,001 087 | 1 291 | - 376,33 | 2 461,4 | 2 837,7 | - 1,385 1 | 9,887 2 |
| 1 | 0,750 | - 20,33 | 0,001 087 | 1 167 | - 374,25 | 2 463,4 | 2 837,6 | - 1,376 8 | 9,847 1 |
| 2 | 1,500 | - 12,91 | 0,001 089 | 600,5 | - 359,67 | 2 477,0 | 2 836,7 | - 1,320 0 | 9,580 1 |
| 3 | 2,250 | - 8,37 | 0,001 090 | 407,3 | - 350,62 | 2 485,3 | 2 835,9 | - 1,285 5 | 9,424 9 |
| 4 | 3,000 | - 5,05 | 0,001 091 | 309,3 | - 343,93 | 2 491,4 | 2 835,3 | - 1,260 4 | 9,315 0 |
| 5 | 3,750 | - 2,41 | 0,001 092 | 249,9 | - 338,59 | 2 496,2 | 2 834,8 | - 1,240 6 | 9,229 8 |
| 6 | 4,500 | - 0,21 | 0,001 093 | 209,9 | - 334,12 | 2 500,2 | 2 834,3 | - 1,224 1 | 9,160 3 |
| 7 | 5,250 | 1,886 | 0,001 000 1 | 181,32 | 7,91 | 2 505,0 | 2 497,1 | 0,028 9 | 9,107 7 |
| 8 | 6,000 | 3,767 | 0,001 000 0 | 159,74 | 15,82 | 2 508,5 | 2 492,7 | 0,057 5 | 9,058 6 |
| 9 | 6,751 | 5,454 | 0,001 000 0 | 142,82 | 22,92 | 2 511,9 | 2 488,7 | 0,083 0 | 9,015 3 |
| 10 | 7,501 | 6,984 | 0,001 000 1 | 129,21 | 29,34 | 2 514,4 | 2 485,1 | 0,106 0 | 8,976 7 |

Ejector Systems

- ADVANTAGES vs. Other Vacuum Producers
 - Low First Cost
 - No moving parts
 - Low maintenance
 - Long life
 - Reliable
 - Install in any orientation
 - Easy installation
 - Easily handles solids or liquids in line
 - May be made in wide variety of materials

Troubleshooting

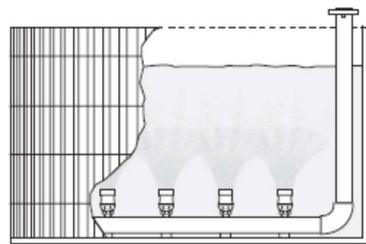
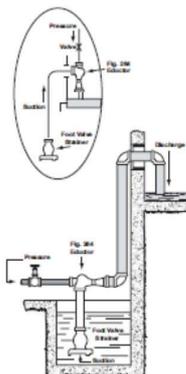
- LOW VACUUM (真空度變差)
 - Air leakage
 - Excessive System Back pressure
 - Low Steam Pressure
 - High Cooling Water Temperature
- NO VACUUM (沒有真空)
 - Clogged steam nozzles
 - Closed valves
 - Line open to atmosphere
- FLUCTUATING VACUUM (真空度浮動)
 - No steam to jackets
 - barometric leg
 - wet steam

Steam Ejector 延伸應用

- Liquid eductor, Syphon, Tank mixer,
- Tank Heater, Pipeline heater, Slurry heater
- Air Exhauster, Air compressor
- Thermocompressor
- Desuperheater
- Scrubber

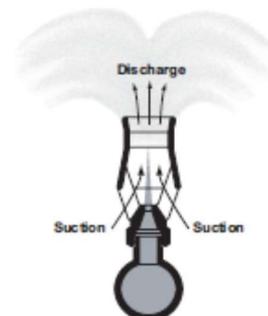
Eductor, Syphon

- Pumping Liquids
- Lifting Liquids
- Mixing Liquids
- Slurry Handling
- Dry Product Handling



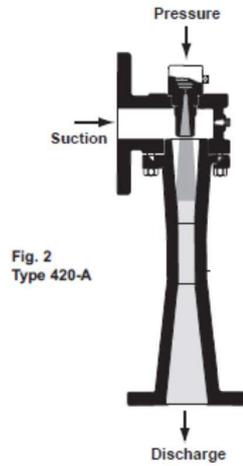
Heater

- Tank Heaters
- Pipeline Heaters
- Slurry Heaters



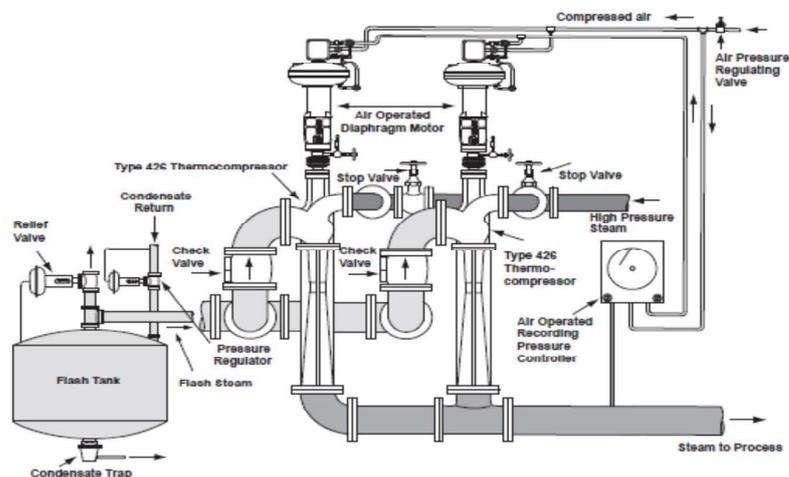
EXHAUSTERS AND COMPRESSORS

- Pump Priming
- Evacuating
- Gas Handling
- Tank Venting
- Pneumatic Handling
- Gas Mixing Stations



THERMOCOMPRESSORS

- Recovery Of Low Pressure Steam
- Tank Venting



Steam 節約說明舉例

- 使用20K steam回收2.4K廢蒸汽加壓到5K使用
- 20K steam 19Ton (NTD 857/Ton)
- 2.4K steam 17.9Ton
- 回收成5K steam 36.9Ton (NTD 848.00)

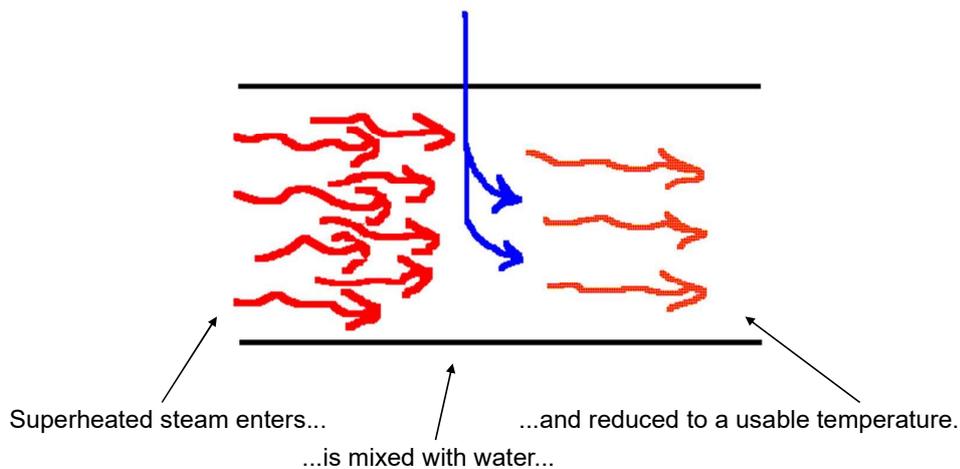
12" Ejector單價55萬

配管工程費用預估200萬

年操作8000小時

回收年限: 0.21年

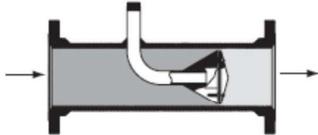
Inside the Desuperheater



DESUPERHEATERS

- Lower Superheated Steam Temperature
- Lower Superheated Gas Stream Temperature

ANNULAR VENTURI (Refer to Bulletin 6D-VC)



Type 6985 Desuperheater
Lower cost venturi-type capable of high turndown ratios. Suitable for use under wide range of conditions, including steady and variable flows. Low pressure drop. Inlet water pressure need only equal steam pressure.

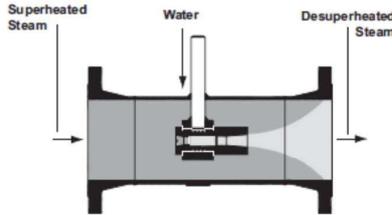
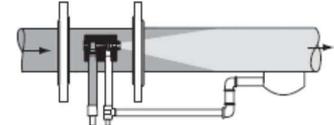


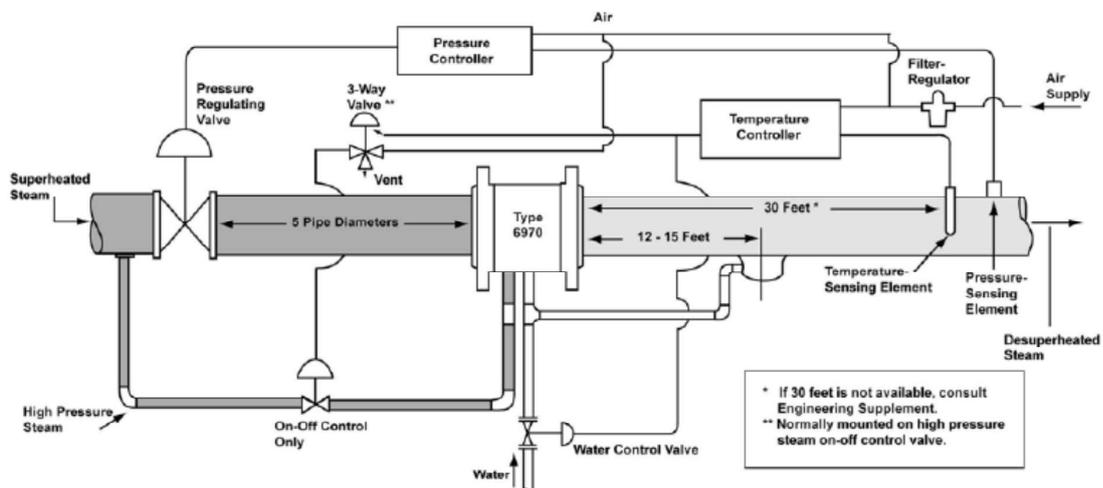
Fig. 4 - Type 6953-C fabricated atomizer is flanged and supported by customer's piping.

EJECTOR ATOMIZING (Refer to Bulletin 6D-E)



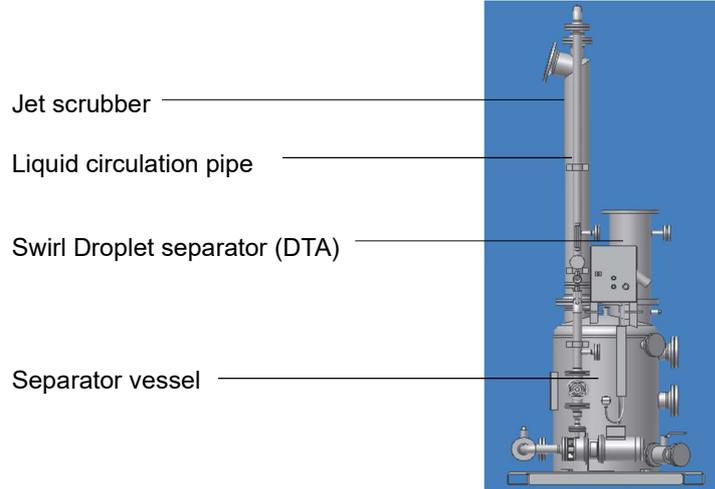
Type 6970 Desuperheater
A steam ejector, atomizing unit with water re-cycle arrangement. For applications where combined reducing-desuperheating station is required and flows vary widely. Steam flow range can be as high as 50 to 1 and greater, depending on operating conditions. Minimum atomizing steam pressure required is about 1.4 times inlet steam pressure, with low pressure drop across unit in most cases.

Atomizing desuperheaters flowchart

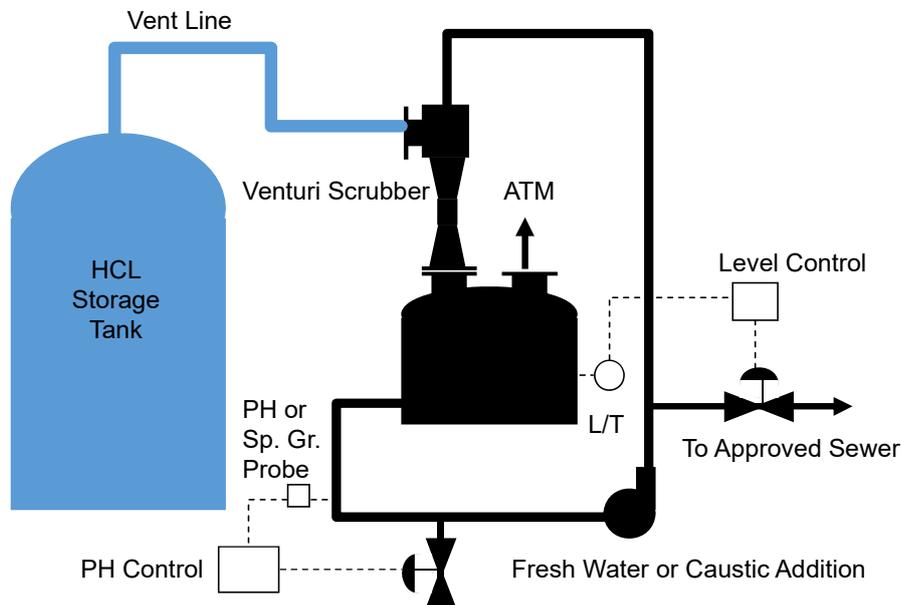


SCRUBBER

- Clean contaminated Gas
- Remove Particulated particle from Gas



HCL SCRUBBER SYSTEM



Controlling Air Pollutant Emissions via Gas Scrubbing

| Typical Gaseous Contaminants that can be Scrubbed | | |
|---|----------------------|----------------------------|
| Contaminant | Scrubbing Liquid | Typical Removal Efficiency |
| HCL | aq NaOH | 95 |
| | Water | 95 |
| NH3 | aq H2SO4 | 95 |
| | Water - once through | 95 |
| SO2 | Water - once through | 60 |
| | aq NaOH | 95+ |
| CL2 | aq NaOH | 70 |
| HN03 | Water | 95+ |
| H2S | aq NaOH | 60 |
| HF | Water | 95 |
| F2 | aq NaOH | 95 |

Controlling Air Pollutant Emissions via Gas Scrubbing

| Typical Gaseous Contaminants that can be Scrubbed (con't) | | |
|---|----------------------|----------------------------|
| Contaminant | Scrubbing Liquid | Typical Removal Efficiency |
| H ₂ SO ₄ | Water | 70 |
| H ₂ S | aq NaOH | 95+ |
| HF | Water | 60 |
| F ₂ | aq NaOH | 95 |
| H ₂ SO ₄ | Water | 95 |
| Ethanol/ | Water - once through | 95 |
| Methanol | Water - once through | 70 |
| H ₂ S | EnviroScrub* | 70 |
| | | 95+ |

* Proprietary amine based chemical manufactured by Quaker Chemical Corporation.

Thanks For Your Attention

感謝您的聆聽