

KLM

**Technology
Group**

KLM Technology Group
Engineering Solutions



KLM Technology Group

Consulting, Guidelines, and Training

Engineering Solutions

KLM

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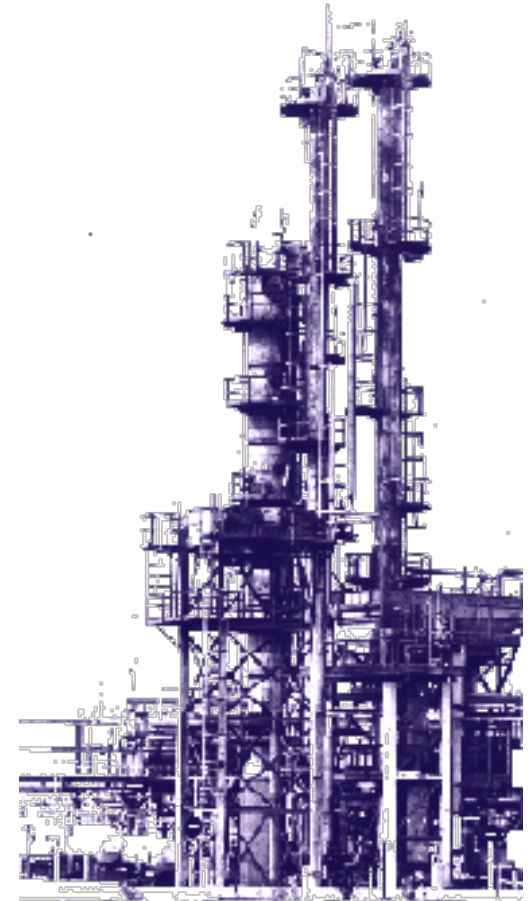
Demister Pads

Mist Eliminators



Based in USA since 1995, with offices in Florida and Malaysia

KLM is a technical consultancy group, providing specialized services and equipment to improve process plant operational efficiency, profitability and safety.



KLM Core Business

Training (75+ Training Classes)

Engineering Design Guidelines

Process Optimization Studies

Process Energy Studies

Process Safety Management

HAZOP Facilitation

Facility Siting Studies

Engineering Support

Basic Design Packages

Detailed Design Packages

Process Equipment

Random Packing

Structured Packing

Demister Pads

Heat Exchangers

Marketing

Engineering Practice Magazine

Unit Commissioning

**Distillation Equipment Inspecting
and Correct Installation**

Evaluation of Process Units

KLM Technology Group has been providing Engineering Solutions since 1997 in USA and since 2005 in Asia with our key partners and manufactures.

We have assisted small, medium and multi-national corporations to supply Practical Equipment Solutions all over the world.

USA - Malaysia – Thailand – Kuwait - UAE

India – Poland – China – Belarus- Bahrain

Indonesia – Saudi Arabia – Italy - Nigeria

Philippines – Vietnam – South Korea

New Zealand

Why should you purchase your process equipment from KLM Technology Group?

- 1. KLM is a recognized expert in Process Equipment Design.**
- 2. As Process Equipment Simulation and Installation experts, we can provide Process Guarantees, including capacity and purity. Most vendors will only provide hydraulic guarantees, not capacity and purity guarantees. A Process Study can provide a large return on investment.**
- 3. KLM only partners with high quality suppliers, often from the same factories as the Original Equipment Manufacturers (OEM).**
- 4. KLM has low overhead leading to cost savings to your team.**
- 5. KLM has senior inspectors to ensure your equipment is installed correctly**

KLM Technology Group should be your Equipment Supplier of Choice

- 1. KLM is a recognized expert in Process Equipment Design.**
 - A. The Kolmetz Handbook of Process Equipment Design is highly rated for the design of process equipment. Detailed theory of equipment design with examples.**
 - B. Higher Reliability designs gained from years of experience**
 - C. Higher Efficiently which leads to Better Products at Lower Energy Cost**
 - D. Basic and Detailed Engineering Packages**

KLM Technology Group should be your Equipment Supplier of Choice

KLM is a leading Process Equipment Design Group

General Distillation Design Guideline – 147 pages

Tray Hydraulics Design Guideline – 50 pages

Packing Hydraulic Design Guideline – 68 pages

Heat Exchanger Design Guideline – 176 pages

Reboiler Design Guideline – 70 pages

Demister Pad Design Guideline - 89 pages

Separator Design Guideline – 120 pages

Coalescer Design Guideline – 120 pages

**Over 100 Guidelines on most Process Equipment
and Unit Operations**

3. KLM only partners with high quality suppliers, often from the same factories as the Original Equipment Manufacturers (OEM).

- A. KLM vets our equipment manufacturing partners to meet the high-quality KLM Manufacturing Standards.**
- B. Many times, our partners are the same factory as the OEM.**
- C. KLM will meet you at our factory partner for an inspection.**

KLM Technology Group should be your Equipment Supplier of Choice

To further assist our partner clients, we offer new and replacement engineering equipment from the Original Equipment Manufacturers or Generic Equipment Manufacturers as requested by our partner clients.

We have provided tower internals, tower shells, heat exchangers, overhead condensers, reboilers, control systems, demister pads and pumps.

KLM Technology Group – Equipment References

- 1. Over 20 Distillation Projects**
- 2. Over 40 Heat Exchangers**
- 3. Over 25 Pumps**
- 4. Over 20 Pressure Vessels**

4. KLM has low overhead leading to cost savings to your team.

- A. The advantage for the end user is that KLM's overhead cost is significantly lower than other EPC companies and / or other equipment providers, leading to significantly lower equipment cost with the potential of higher quality, leading to the best of both worlds; high quality at a very competitive cost. Our Overhead Cost is low, and we pass the savings to your team.**
- B. Many companies have multiple offices with 100's of salespeople. This overhead can be as high as 15% of equipment quote.**

KLM Technology Group should be your Equipment Supplier of Choice

4. KLM has low overhead leading to cost savings to your team.

- C. A good engineer or purchasing manager would bid to KLM just to set the proper cost of the process equipment. Often KLM may want a small fee to bid as there are engineering hours in the bidding process – but you could save 15 to 25% on the equipment cost netting Return On Investment of thousands even if you do not purchase from KLM.**
- D. You now know from reading this presentation most bids are at least 15% or more higher than KLM might bid. Many times, the OEM will bid below cost just to keep a small company like KLM from winning the job, good for your company, and great ROI on your bidding to KLM.**

KLM Technology Group should be your Equipment Supplier of Choice

5. KLM has senior inspectors to ensure your equipment is installed correctly

- A. A large problem in many tower internal installations is incorrect installation, leading to loss of product quality, tower efficiency (higher energy), capacity and run length (plant reliability).**
- B. Many companies may not have the expertise to review the tower internal installation, because turnarounds only have every few years.**

KLM Technology Group should be your Equipment Supplier of Choice

5. KLM has senior inspectors to ensure your equipment is installed correctly

- C. KLM will provide a senior tower inspector with 75+ tower inspections, for your turnaround to assist in optimized tower performance.**
- D. KLM's Low Overhead cost will again lead to large cost saving in tower inspections.**

KLM Technology Group should be your Equipment Supplier of Choice

Process Equipment

KLM as an EPC Company can purchase from any of the major equipment Suppliers.

Distillation Equipment

Towers Shells and Vessels

Random Packing

Structured Packing

Trays

Demister Pads and Coalescer Elements

Heat Exchange Equipment

Pumps and Compressors

Coalescer Systems

KLM Core Business

Process Equipment

Distillation Equipment

Can be ordered with normal lead times or can be sources for immediate replacement

Random Packing

KLM has a stock of random packing in key Countries for Immediate replacement

Structured Packing

KLM has a stock of Structured Packing in key countries for immediate replacement

KLM Core Business

Process Equipment

Distillation Equipment

Tray Hardware

KLM has a stock of Tray Hardware in key countries for immediate replacement

Trays

KLM has the resources to order with normal lead time or source for immediate replacement

KLM Core Business

Process Equipment

Distillation Equipment

Demister Pads and Coalescer Elements

KLM has the resources to order with normal lead time or source for immediate replacement

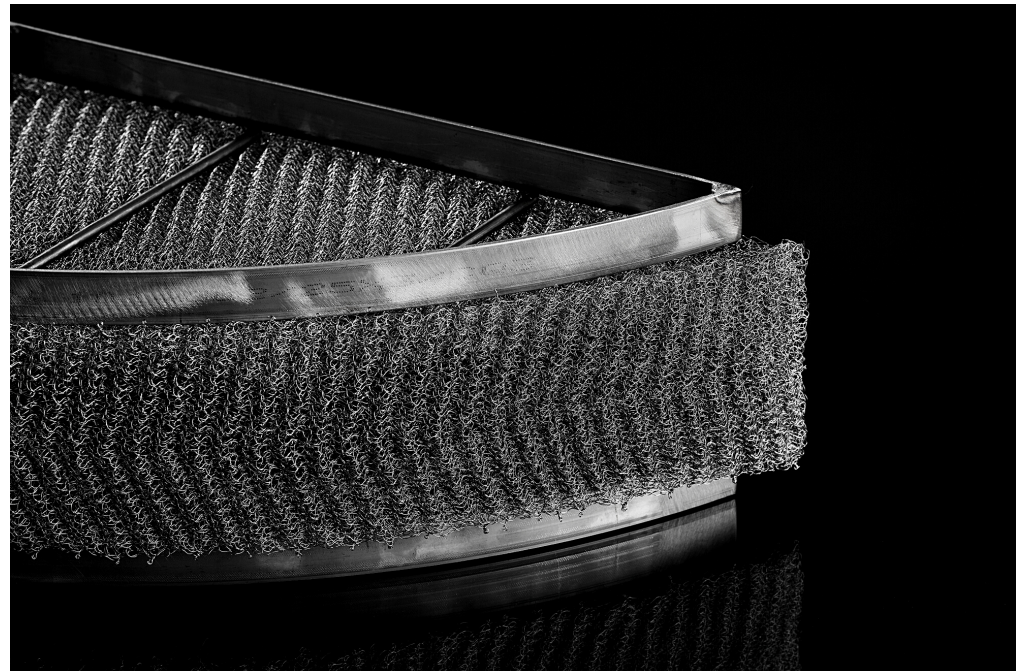


Typically, demister pads are designed very basic with limited optimization. They are sold to an EPC company at cost, to build an installed base to be able to replace often at a much higher cost.

Typical replacement cost have 200 to 400% margin; therefore, the demister pad vendor has no incentive to make the demister pad reliable or fouling resistant.

A small demister pad might be quoted to an EPC firm for USD 2,000 but quoted to an operating company for USD 8,000.

Buyer Beware.



If you are going to replace a demister pad, as with most process equipment, you should not replace in kind because it was awarded to the lowest bidder and was designed to be replaced quickly.

If you have a clean service, your demister pad should be designed to increase removal of entrained liquids as well as increased reliability.

Reliability may be increased by choosing the correct metallurgy.

Many vendors only supply stainless steel demister pads even though they know that this might be the wrong metallurgy for your application.

If you have polar liquids (water, acids, caustics) and a carbon steel vessel, stainless steel demister pads will experience bi-metallic corrosion with reduced life. Good for the vendor, not so good for the plant operator.

Reliability may be increased by choosing the correct metallurgy.



Many caustic towers have stainless steel demister pads even though it is clear this is a poor metallurgy choice.

A better choice may be a multifilament plastic

Here is a picture of an Ethylene Caustic tower with a stainless-steel demister pad. Two competing failure rates 1(Bi-metallic Corrosion and 2) Stainless-steel not caustic resistant.



**Here is an
Ethylene
plant caustic
tower, with
fouling.**

**This pad will
fail due to
pressure
drop
increases.**



Demister Pads

It is important to understand the failure cases. KLM can provide equipment designed stronger, with a higher fouling resistance and longer run length. Demister Pads have a high failure rate due to being awarded to the low-cost bidder. Good for the vendor with high replacement margins, not so good for the plant operator.



If you have a fouling service, your Demister Pad should be designed to be fouling resistance and improve removal of entrained liquids as well as increased reliability.

This can be done with the proper design of the Demister Pad.

Current designs for fouling service utilize a larger mesh to reduce fouling potential, with a loss of the removal of entrained liquids.

A better design might be to stage the mesh size. Install larger mesh in the bottom 1/3, where the fouling occurs, and a smaller mesh in the top to increase the removal of entrained liquids.

For very fouling services a chevron might be installed below the demister pad.

Mist eliminators are made up from knitted materials with interlocking asymmetrical loops of metal or plastic with typical wire diameters of 0.1 – 0.3mm.



Through careful choice of wire diameter, knitted mesh mist eliminators with extremely high free volumes (typically 98-99%) along with very high removal efficiencies and low pressure drop.

Along with wire diameter and mesh density, another important parameter in design and operation is the vapor velocity. This can be controlled by careful selection of the mesh area.

Optimal area will depend on operating temperature, pressure and pressure drop. Under normal operating conditions, 99% + removal efficiency can be achieved with a low pressure drop of less than 250 Pascals.



Demister Pads can also be manufactured using plastics for highly corrosive environments.

Ethylene Tetrafluoroethylene (ETFE) mist eliminators can withstand high temperatures of up to 260 degrees Celsius.

ETFE's chemical resistance promotes uses in corrosive environments such as fertilizer production or sulfuric acid.

Demister Pads can also be manufactured using plastics for highly corrosive environments.

Mist Eliminators may also be manufactured from other plastics, such as Polypropylene, Polyvinylidene Fluoride (PVDF) and Perfluoroalkoxy (PFA), in both a monofilament and a multifilament.

A wide range of wire mesh demister mist eliminator pads suitable for any application.

Mist Eliminator	Surface Area m2 / m3	Free Volume %	Density kg/m3	Typical Application
Type 1	1650	95	450	Very High Efficiency
Type 2	1300	95.5	350	High Efficiency
Type 3	600	97.5	195	Very High Efficiency and Clean Service
Type 4	400	97.5	195	Heavy Duty
Type 5	350	97.75	170	Heavy Duty
Type 6	300	98	145	General Purpose
Type 7	250	98.5	125	High Velocity

A wide range of wire mesh demister mist eliminator pads suitable for any application.

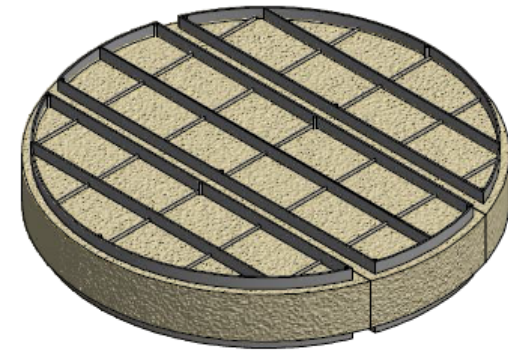
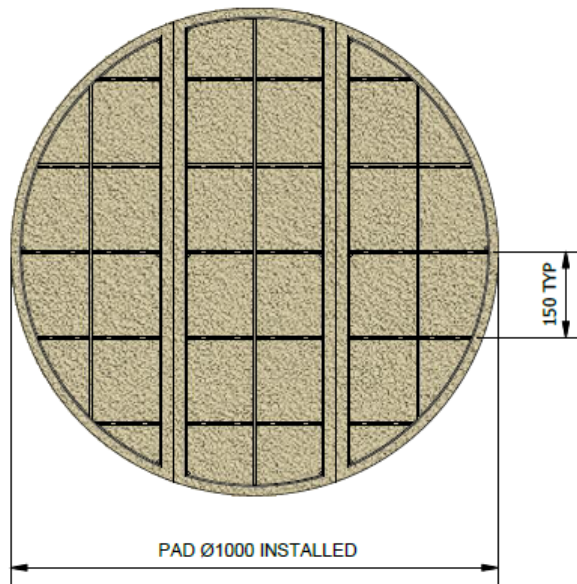
Mist Eliminator	Surface Area m2 / m3	Free Volume %	Density kg/m3	Typical Application
Type 8	200	98.75	100	Light Fouling
Type 9	90	99.4	50	Heavy Fouling
Type 10	150	99	75	Moderate Fouling
Type 11	445	98	145	High Efficiency Fine Entrainment
Type 12	400	98.5	120	Fine Entrainment
Type 13	1200	98	600	High Efficiency Fine Entrainment

Budgetary Pricing with Frame

Metallurgy	Kg	Density kg/m3	Cost USD (1 meter diameter by 150 mm height)
316 L	17	145	\$2,338.00
316 L	23	195	\$2,718.50
304 SS	17	145	\$2,060.10
304 SS	23	195	\$2,524.50
Polypropylene	8	69	\$2,156.17

Demister Pads

KLM Technology Group
Engineering Solutions



MESH PAD:

PAD THK :300mm, MESH DENSITY: 144 kg/m³
SURFACE AREA: 257 m²/m³ FREE VOLUME: 98.1%
MATERIAL: 316L

SUPPORT GRID CONSTRUCTION
PERIMETER RAILS: 25 x 3
INTERMEDIATE SUPPORT RODS: Ø6
INTERLINKING POSTS: Ø6
GRID MATERIAL: 316L

THIS DRAWING IS FOR QUOTATION PURPOSES ONLY.
MANUFACTURING DRAWINGS TO BE PREPARED ON ORDER

If you replace in kind to the original low-cost bidder vendor without a review of the best replacement you will be paying high margins, decreased plant reliability and product quality.



KLM Core Business

Unit Commissioning

Units (15+)

Tower Inspections (50+)

KLM Technology Group – Equipment References

- 1. Over 20 Distillation Projects**
- 2. Over 40 Heat Exchangers**
- 3. Over 25 Pumps**
- 4. Over 20 Pressure Vessels**

KLM Technology Group

- 1. Solid Track Record of Projects since 1995.**
- 2. Strength in Process Engineering**
- 3. Strong Partners in Mechanical Engineering and Fabrication, especially Modular Fabrication.**
- 4. Wide Range of Industries Serviced.**
- 5. Ready to assist in your next project.**



Thank You

