Air Inlet Treatment for Combustion Turbines

Pneumafil Inlet Air Filtration

Full service supplier of complete air inlet filtration systems for combustion turbines. Customers include:

- Alstom
- General Electric
- Mitsubishi
- Siemens
- others

Company Hierarchy

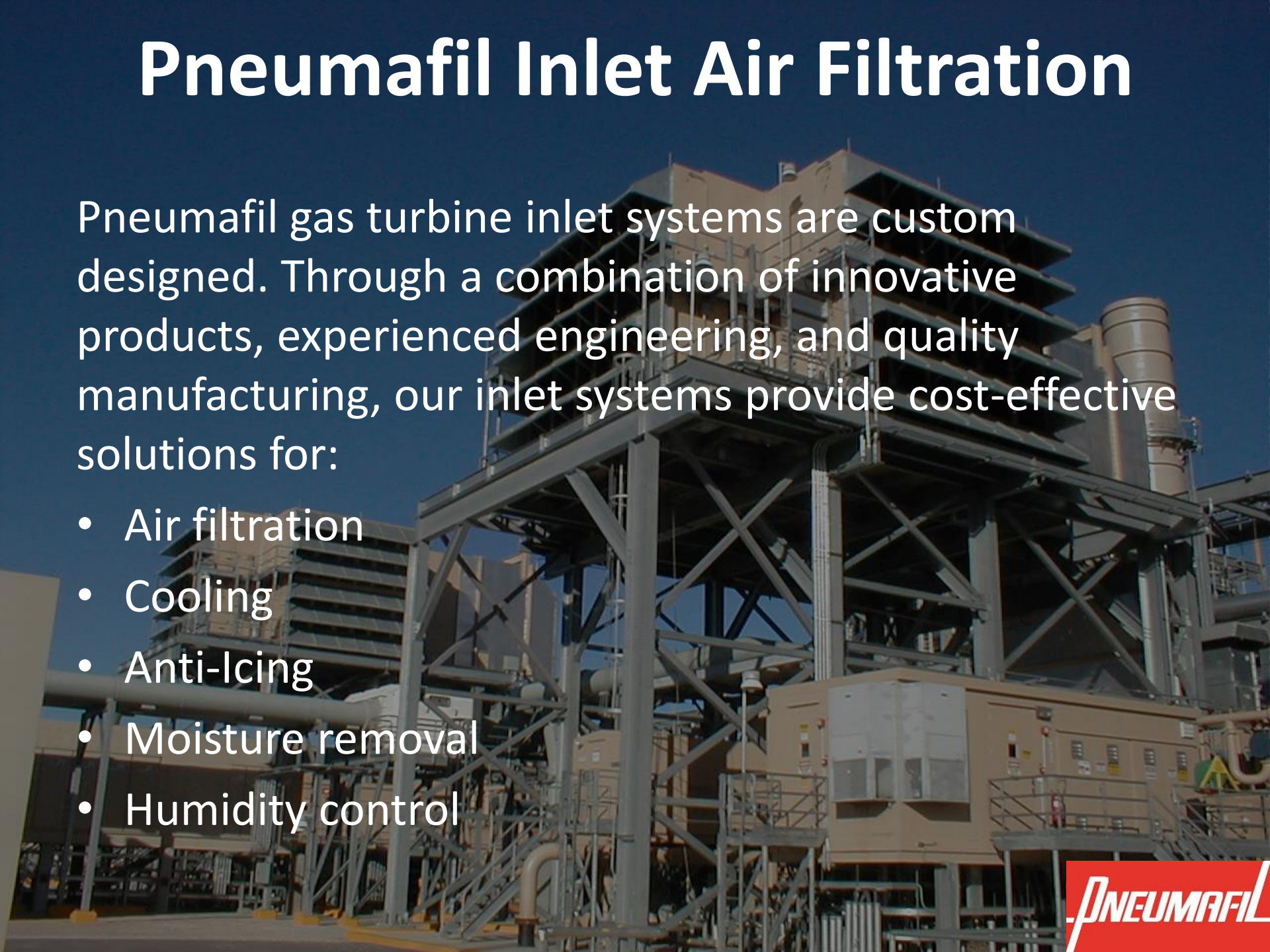
- Owned by Nederman out of Sweden
- EFT – Environmental Filtration Technologies
  - Pneumafil
  - MikroPul
  - Menardi

Pneumafil Inlet Air Filtration

Our designs and equipment have been applied on a wide assortment of turbine models including:

- Frame
  - GE - F5,F6,F7, F9
  - Siemens – V84.2, V84.3, V84.4 W501D, W501 F/G, W501
- Aeroderivative
  - LM1500, LM2500, LM6000

Pneumafil Inlet Air Filtration



Pneumafil gas turbine inlet systems are custom designed. Through a combination of innovative products, experienced engineering, and quality manufacturing, our inlet systems provide cost-effective solutions for:

- Air filtration
- Cooling
- Anti-Icing
- Moisture removal
- Humidity control

Pneumafil Air Inlet Systems

- Multi-stage static intake air systems
  - Combining a variety of filter stages, we can achieve an infinitely variable range of efficiency and performance characteristics to meet the needs of each customer's engine.
- Up Draft and Cross Flow Self cleaning systems
  - Surface loaded filters designed with self-cleaning pulsing systems that remove debris and dirt regenerating filter porosity. Designs feature updraft Twist Lock “no tools” design along with conventional cross flow filter sets

Why Inlet Air Treatment

Gas turbines are constant volume machines. Their performance can be impacted by un abated ambient conditions such as temperature, dust concentration and density. Changes can cause increased degradation in the output of the compressor and significantly reducing the amount and consistent of power generated by the turbine system.

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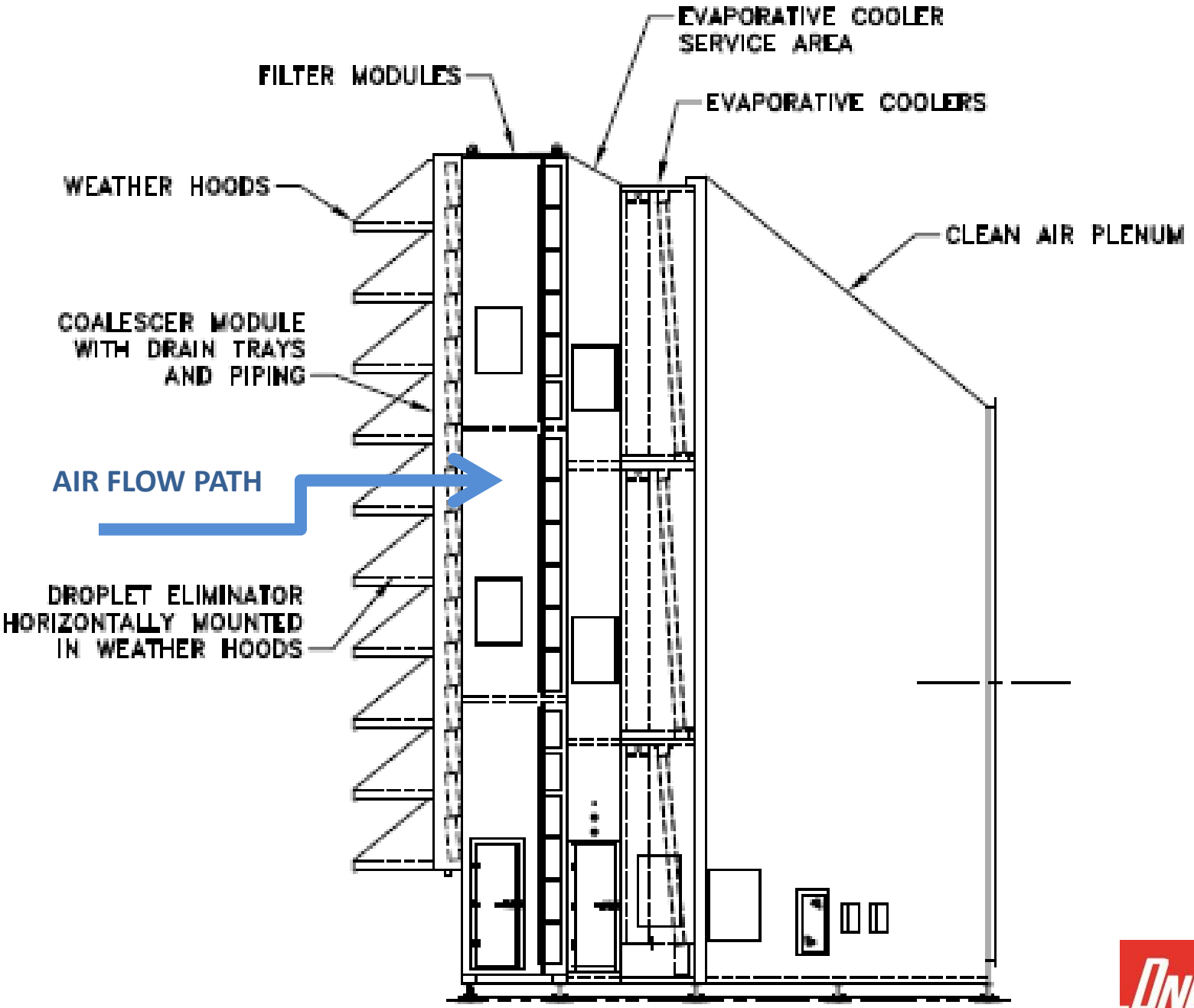
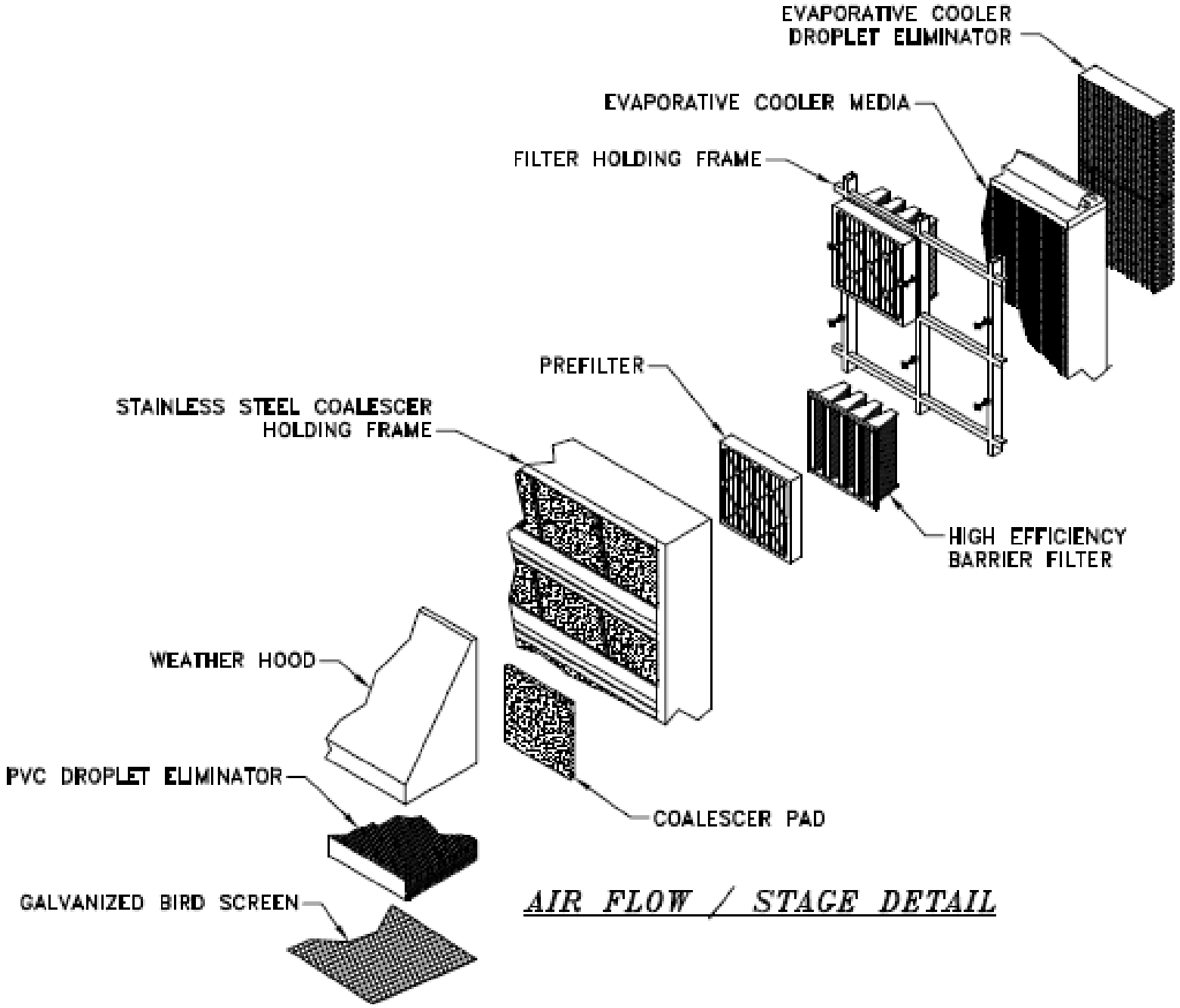
Multi Stage Air Treatment

- Weather protection
  - Ice, Snow, Rain, birds, large debris
- Coalescer
  - Remove moisture
- Evaporative cooling, Chilling, Fogging
- Anti-Icing
- Air filtration


EVAPORATIVE COOLER
SERVICE AREA
FILTER MODULES
EVAPORATIVE COOLERS
WEATHER HOODS
CLEAN AIR PLENUM
COALESCER MODULE
WITH DRAIN TRAYS
AND PIPING
AIR FLOW PATH
DROPLET ELIMINATOR
HORIZONTALLY MOUNTED
IN WEATHER HOODS



AIR FLOW / STAGE DETAIL

Example: Anti Icing Retrofit

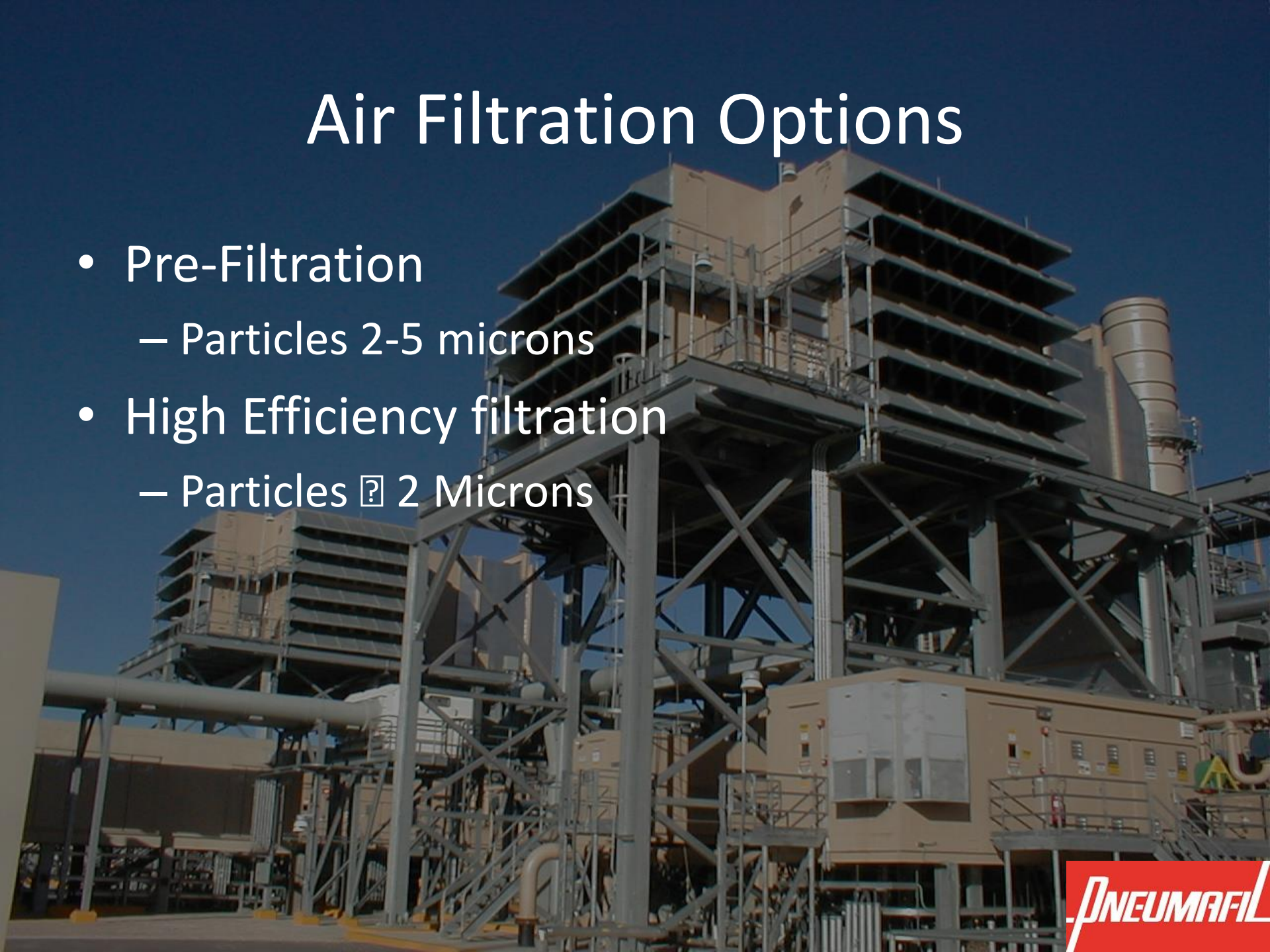
Remove the weather hoods to make way for a separate heating coil module.

Install heating coil or heating panel module


Side view of inlet housing after the heating module has been inserted and the weather hoods re-attached.

Air Filtration Options

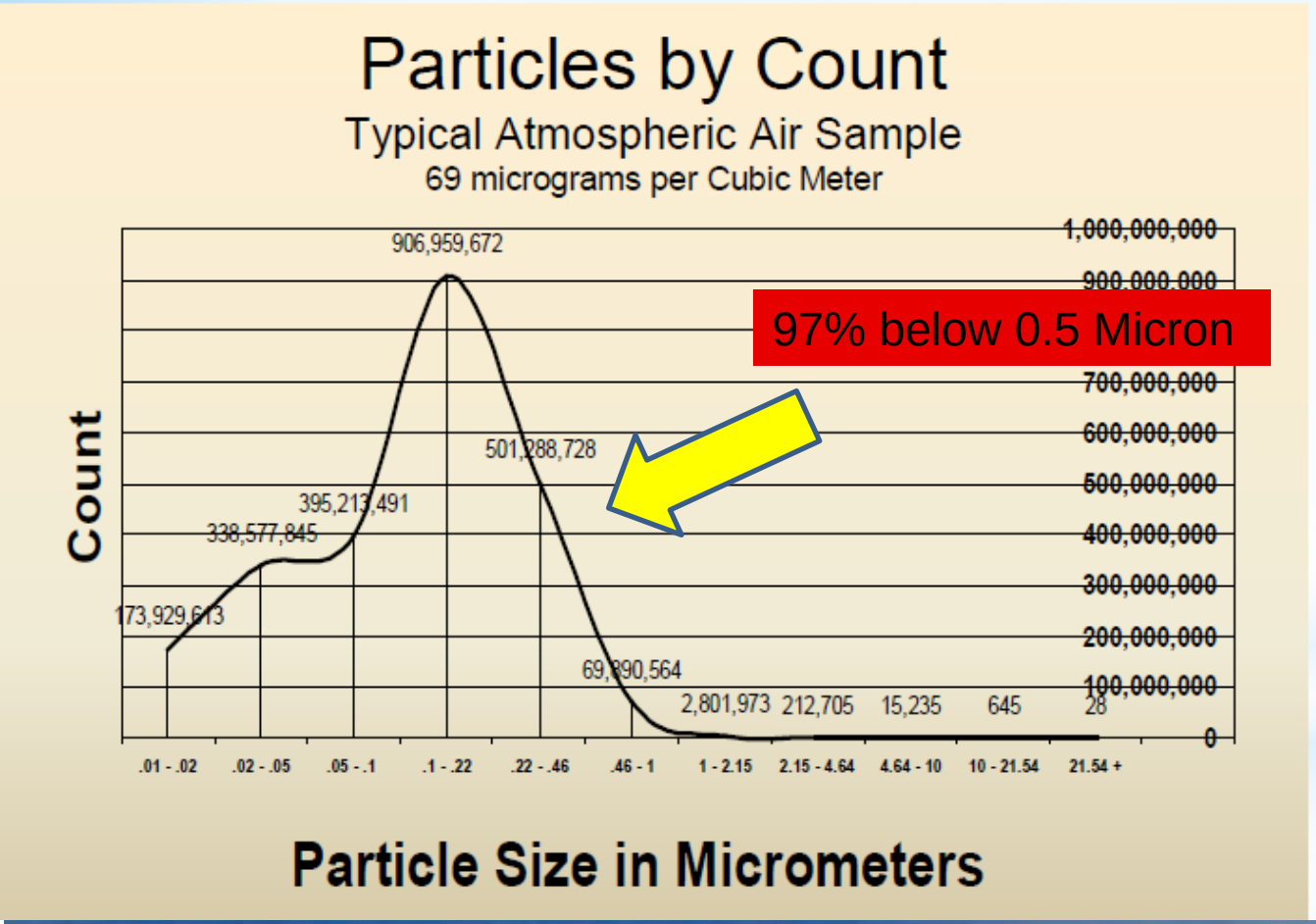
- Pre-Filtration
  - Particles 2-5 microns
- High Efficiency filtration
  - Particles ≤ 2 Microns



Pre-filtration

- Synthetic depth loading filter media.
- Available for all static filter systems and used as “wraps” when conventional pulse style systems are either ineffective or not in use.
- Capture larger particulates and debris
- Lesson the dust loading to primary higher efficiency filter
- Extends filter life

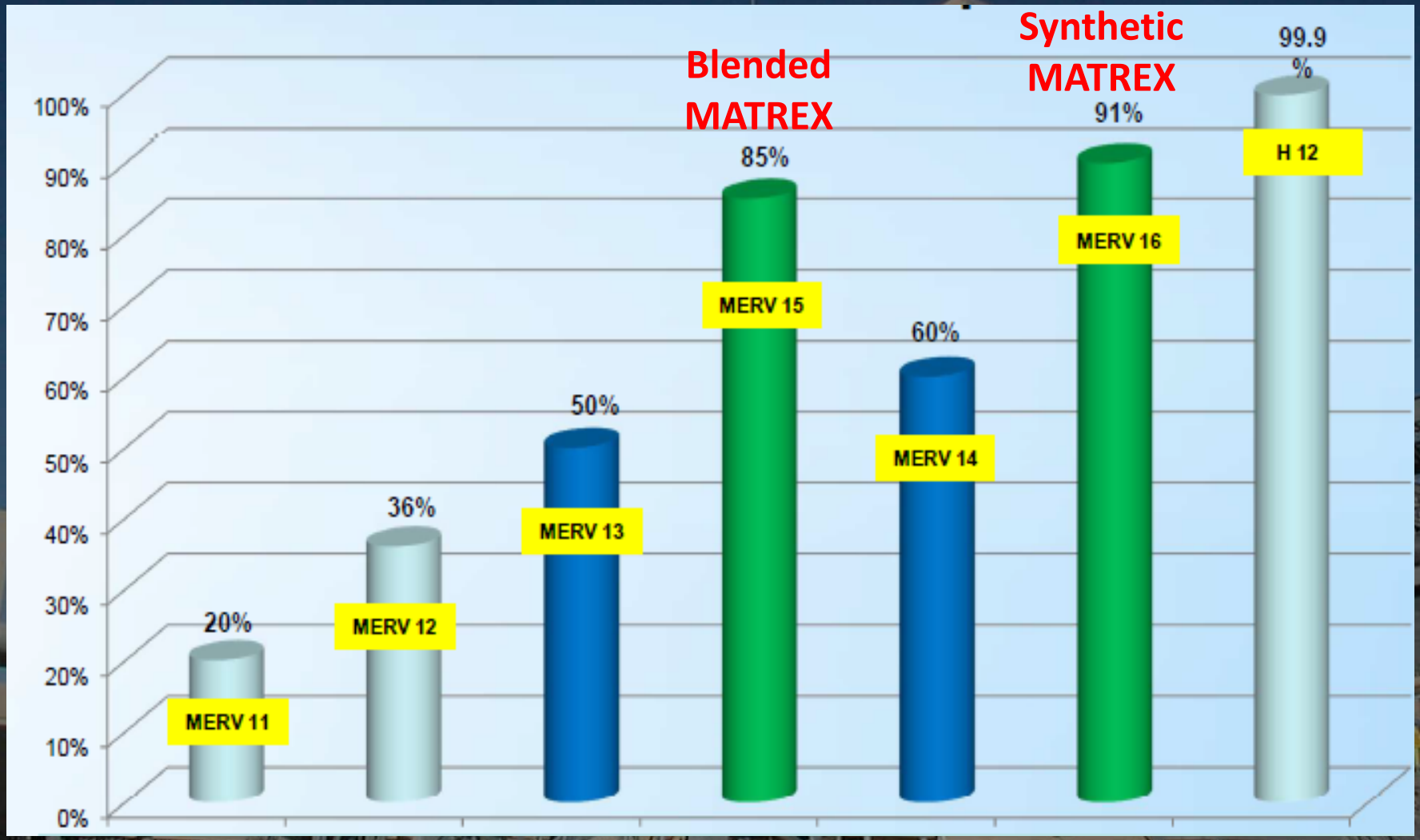
What's in the air?



100 µm = 1/10 mm
50 µm = hair
10 µm = visible
1 µm = 1/1000 mm
0.3 µm = smoke

Number 99 % < 1 µm
Weight 30 % < 1 µm

Pulse Filter Efficiencies



Fractional Efficiency of 0.3µ – 0.4µ particles

Summary

- Due to financial consideration of capital equipment contracts, filter houses may not incorporate all inlet treatments available.
- Upgrades are available
- Water/moisture is your enemy
- Very high levels of inlet air particulate filtration are available without spending 4X the cost of standard filters.
- For users… take the time to understand the filter house design you have and consider the best bang for your buck based upon plant performance.