



D-Salt™

A Gas Turbine Inlet Air Filter Accessory That Removes Corrosive Salt Particles From the Airstream

The Donaldson D-Salt™ Accessory Module removes a broad range of water soluble contaminants, regardless of the ambient humidity or particle size, from the airstream feeding a gas turbine.

Background

In marine environments, salt contaminants exist as dry particles, droplets, or a combination of both.

Salt contaminants originate as droplets that become airborne from the breaking action of ocean waves. At ambient humidities above 70%, the droplets thus formed will remain in the liquid phase. During lower ambient humidities, the salt droplets will turn into dry, solid particles when given time to evaporate their moisture.

In the humidity range of 40-70%, the behavior of sea salt contaminants is less predictable. Most compositions experience a hysteresis in this range and remain in droplet form until the humidity falls below the 40% level, while others may become dry particles within the same humidity range. The exact behavior depends upon the interaction of the salt with its associated contaminants. The makeup of the dissolved contaminants can vary both in concentration and composition from region to region, thus explaining the varying behavior in the 40-70% humidity range.

Historically, contaminants with the phase change capabilities that salts have, have eluded conventional filtration practices.

For turbine protection against corrosive and damaging salt contaminants, regardless of ambient humidity or particle size, the Donaldson D-Salt™ Filter is the solution.

Salt Migration Mechanisms

Salt contaminants can be captured on various types of conventional filter media in both the dry phase and the liquid phase. The salt capture efficiency of each phase is believed to approximate the generalized efficiency of the media for that phase. Dry salt particles load onto conventional filter media following dry particulate loading behavior:

Salt droplets, however, behave much differently than dry salt particles. Conventional media functions as a coalescer when loaded with salt droplets. Small droplets of salt contact each other and coalesce to form larger droplets.

Whether the salt is captured in a dry or droplet form, its phase while on the media is subject to the relative humidity it experiences: at low humidity levels, salt droplets dry out to form salt particles; during high humidity levels, dry salt deliquesces by absorbing water vapor from the air to form salt droplets.

The predominant mode of salt migration occurs when the salt is in a liquid phase. As a liquid, salt is free to flow through the pores of conventional media. Once the liquid salt has passed to the clean air side of

the media, it assumes a form governed by the geometry of the media in the element. Donaldson has completed testing on filter elements of several different geometries, both conical and cylindrical elements, as well as panel filters in both vertical and inclined mounting positions. Some of the forms of salt migration witnessed include droplets, foam, and a spray generated from the bursting of bubbles.

The various forms of liquid salt have differing modes of travel through a filter plenum. Larger salt droplets are the most predictable and typically follow a trajectory similar to a droplet of water. Salt foam is much lower in density and is free to travel in more intricate airflow patterns. Likewise, the fine spray droplets generated by a bursting bubble follow similar travel patterns.

How the Donaldson D-Salt™ Module Works

The Donaldson D-Salt™ Module is a second stage of filtration that is used in conjunction with a conventional gas turbine air filter assembly. The first stage assembly can be either a static or pulse type system. The D-Salt™ is placed downstream from the first stage filter and serves as a barrier to the migration of salt. It has proven to be effective in removing salt from the airstream without regard to the shape, size, or phase of the salt contaminant.

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The D-Salt™ is a proprietary design consisting of a series of horizontally placed filter elements separated by a series of inclined baffles. The baffles serve several functions. Their primary function redirects the airflow to pass vertically through the media. A secondary function collects accumulated salt droplets and redirects them to flow towards the front of the module, opposite the direction of airflow. Lastly, the baffles constitute a surface for contaminants to impact directly, providing a means for inertial separation of the larger droplets.

Donaldson D-Salt™ Media

The filter elements house Donaldson's proprietary D-Salt™ filtration media. This media employs several physical principles to prevent the migration of salt. One such feature is the pore size. The small pore size of this media ensures excellent performance on dry salt particles that may enter or form in the clean air plenum. A concurrent benefit is that the pore size contributes to the resistance of the media to droplets of salt. The surface energy of the media has been designed to further enhance its resistance to droplets of salt. These features working in combination prevent salt contaminant from migrating through the D-Salt™ media as it cycles through varying humidity cycles.

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Where to Find Us:

website: www.donaldson.com
email: filterinfo@mail.donaldson.com
or gts-europe@mail.donaldson.com

Donaldson Company, Inc.
Gas Turbine Systems
P.O. Box 1299
Minneapolis, Minnesota 55440 USA
Phone 952-887-3543
Fax 952-887-3843
Parts/Elements 800-431-0555

Donaldson Europe b.v.b.a.
Research Park Zone 1
Interleuvenlaan, 1
B-3001 Leuven, Belgium
Phone 32-16-38-3940
Fax 32-16-38-3939

Donaldson Filtration Asia Pacific Pte Ltd
No. 9, Changi South Street 3, #07-01
Singapore 486361
Phone 65-6546-4400
Fax 65-6546-4325

Donaldson Far East Ltd.
Unit A, B & C, 21/F CDW Bld.
388 Castle Peak Road
Tsuen Wan, N.T. Hong Kong
Phone 852-2402-2830
Fax 852-2493-2928

Donaldson Shanghai
Unit F2, 6/F
Zhao Feng Universe Building
1800 Zhong Shan West Road
Shanghai 200233
Phone 86-21-6440-1808
Fax 86-21-6440-1639

DI Filter Systems Pvt. Ltd.
D-44, Gulmohar Park
New Delhi 110-049 India
Phone 0091-124-629-0350
Fax 0091-124-629-0311

Nippon Donaldson Ltd.
13-2, 5-chome, Imadera
Ome City, Tokyo 198 Japan
Phone 81-428-31-6399
Fax 81-428-31-7076

Donaldson Australasia Pty. Ltd.
Lucca Rd, Wyong, New South Wales
Australia 2259
Phone 61-02-4352-2022
Fax 61-02-4351-2036

