

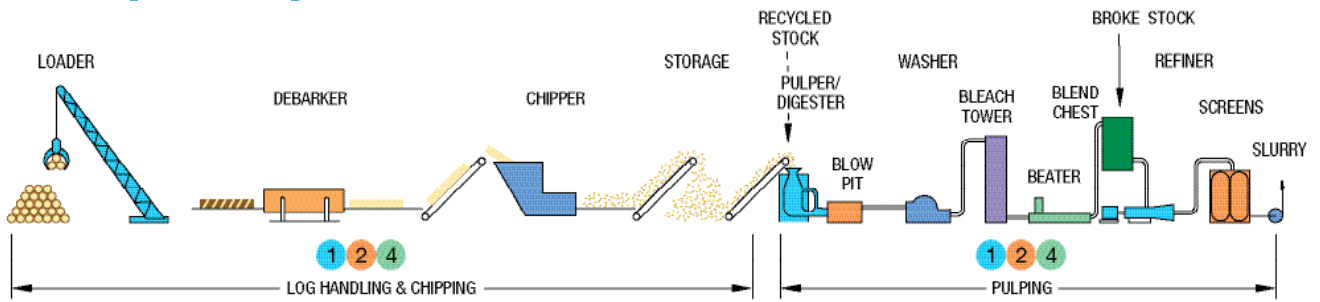
Filtration Technology *for the* Pulp & Paper Industry



Maximize Production Through Uptime.



Pulp & Paper Mill



1

T.R.A.P.™ and Air Breathers



T.R.A.P. Breathers

Water contamination causes major problems in hydraulic systems and oil-wetted machinery. The patented, innovative technology used in Donaldson's T.R.A.P. breathers utilizes a new and superior method to eliminate moisture from hydraulic reservoirs. Donaldson's T.R.A.P. breather begins removing atmospheric moisture at only 15% relative humidity. Traditional desiccant breathers are limited by fixed water holding capacity and require frequent change-outs. T.R.A.P. breather exhales moisture with every flow cycle, regenerating its waterholding capacity, resulting in longer breather life.

Air Breathers

Tank breathers are placed on hydraulic reservoirs to prevent atmospheric contamination from entering and to allow for sufficient air movement inside the reservoir. Breathers prevent particles larger than 3 microns from entering the system. This is a sensible, affordable solution for any hydraulic system.

2

Hydraulic Filtration



HPK Filter Housings

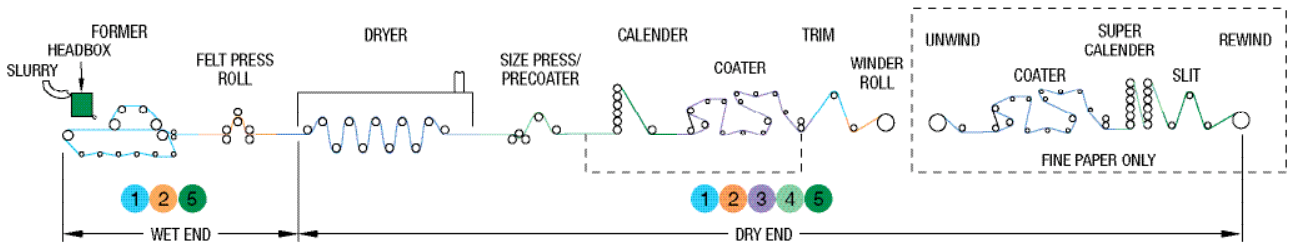
These high pressure housings are designed for strength and durability with working pressures ranging from 2000 psi to 6090 psi making them ideal for heavy-duty applications. Combined with Donaldson Triboguard filter elements they provide the premier solution.

Donaldson Triboguard™

Donaldson Triboguard line of high performance hydraulic filter elements provides 73% higher dirt-holding capacity and 47% lower initial pressure drop than traditional filters. Using Donaldson's proprietary Synteq® filter media, these filters allow higher initial cleanliness and provide superior system protection. A cost effective solution – Donaldson Triboguard filters reduce maintenance cost by extending filter life resulting in longer change intervals. This family of high performance hydraulic filters is ideally suited for demanding pulp and paper plant applications and designed to fit flawlessly in many different types of housings.

Donaldson Duramax® Spin-Ons

Donaldson's Duramax filters are the highest-rated medium pressure filters available in a spin-on configuration. Duramax are reliable, sturdy, long-lived and easy to install. Most often used as return line filters, they are designed for working pressures up to 1000 psi and static pressures up to 2000 psi. Media choices include: Synteq (Donaldson's synthetic filter media specially developed for fluid filtration) and stainless steel wire mesh for harsh environments. Offered in both single and dual-head designs to accommodate a broad range of flows.



3

PMO Systems



HRK10

The HRK10 in-line fluid filter is a low pressure, high flow filter for industrial hydraulics and other fluids like paper machine oil. It has extremely high capacity at a low pressure drop that results in extended filter life providing superior value for the customer. The HRK10 features a rugged all-steel construction, Donaldson's proprietary Synteq filter media, a twist and lift cover, and a range of multi-valve bypass choices to fit those challenging applications. The filter can easily be removed and inspected or replaced reducing precious downtime and labor. A wide variety of filter elements are available from <4 micron to 150 micron stainless steel wire mesh making this filter unit very versatile. Optional electrical service indicators can give operators an up-to-date status. Add it all up and you'll see that this is a premium filter at a very affordable price.

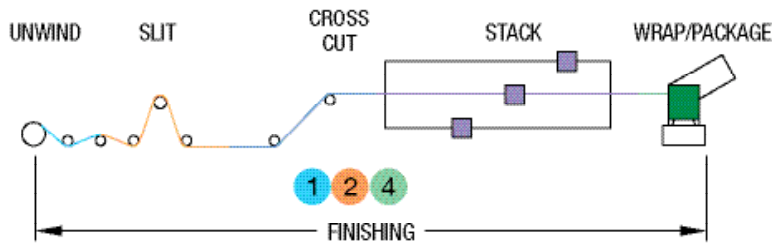
Donaldson Triboguard

See Hydraulic Filtration section.

DT-042 In-Line Hydraulic Filter

DT-042 duplex filters insure continuous filtration is maintained while servicing elements, thus avoiding machine shutdown. The DT-042 all-aluminum head design and plated steel cylinders provide a strong, durable, and dependable unit. We offer standard features like deep pleat elements for higher dirt holding capacity and our standard Donaldson Triboguard 5-layer media element construction. This technology, combined with many other standard features, is ideal for today's applications in pulp and paper plants. Five standard grades of media are offered. Thermal lockout and surge control are two key features incorporated in the differential indicators.





4

Gear Box Filtration



Filter Cart

The Donaldson Filter Cart is a convenient solution of off-line filtration, flushing and fluid transfer for in-plant machinery. The Filter Cart includes two in-series pressure filters that remove coarse/fine particulate matter. Additionally, a water absorbing element may be installed to further remove particulate matter and water. Its powerful one horsepower motor coupled with a 10 gpm pump provides efficient fluid transfer and filtration. Its rugged and durable frame enables a longer service life. Incorporating high efficiency media grades ensures a cost effective method of filtration. A safety relieve valve prevents over pressurizing and damage to the cart's pump, hoses and filters. And an overload protected switch prevents the unit from overheating. Convenience features include a rear mounted motor for better balance, a removable angled drip tray and clear braided hoses.

Filter Panels

The Donaldson filter panel is a permanent mount off-line filtration system designed to provide an economical and effective way to supplement current filtration. High efficiency media grades provide cost effective filtration to achieve and maintain desired ISO cleanliness levels. Its dual-stage filtration offers coarse/fine particle removal or install a water absorbing element to obtain particulate and water removal. The filter panel is customizable to fit your specific needs.

T.R.A.P. Breathers

See T.R.A.P. and Air breathers section.

5

Water Contamination Control



Ultrapac 2000® Regenerative Heatless Desiccant Dryers

The Donaldson Ultrapac 2000 (3-60 scfm) heatless adsorption dryers is a complete purification system including pre-filter, dryer, after-filter, control system and automatic condensate drain and silencer. All components are factory-sealed requiring minimum installation and almost instant start-up. This modular design of mechanical and electronic components reduces downtime with modular repair/replacement capability, and the compact footprint saves valuable space on the plant floor.

Donaldson Vacuum Purifiers

Donaldson Vacuum Purifiers are designed to effectively remove particulate, water, and dissolved gases from petroleum and synthetically based fluids. Removes: 100% of free and emulsified water from oils and 90% of dissolved water from oils to as low as 20 ppm; particulate to as low as ISO 12/10/9; and 90% of dissolved gases. Available in flow rates from 1 – 200 gpm, as well as NEMA 4 and 7 explosion proof with custom options. Compatible with many fluids.

T.R.A.P. Breathers

See T.R.A.P. and Air breathers section.



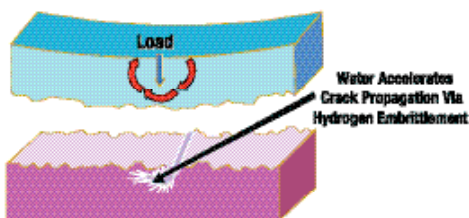
Donaldson Solves Contamination Problems In Paper Mills

As described in a technical paper presented at the 2008 TAPPI PaperCon Conference, particles and water are the two most damaging contaminants for oil-wetted machinery in paper mills (Needelman and Webb, *Controlling Water Contamination In Paper Mills - A Review*). Donaldson has engineered unique products to solve these problems.

	Water Contamination	Particle Contamination
PROBLEMS	<p>Fatigue of Paper Machine Bearings. Water accelerates up to 6 times the growth of cracks leading to spalling. Reduced bearing life and secondary damage by wear hardened steel debris.</p> <p>Gel Formation in PMO Systems. Water combines with paper machine oil additives forming gels that can foul bearing flow passages, heat exchange surfaces, and filters.</p> <p>Corrosion in hydraulic and lubricating systems. Breakage of metal structures like bearing raceways and gear teeth, leakage, greater friction and energy consumption due to rougher surfaces, and release of abrasive oxides (like rust) into systems.</p> <p>Microbial Growth in systems operating at temperatures of 60-125 °F. Free water supports the growth of bacteria and molds. Fouling slimes, acidity, obnoxious odors, respiratory and eczema health problems.</p> <p>Lubricant Failure. Free water cannot support the load between moving surfaces. High friction and energy consumption, noise, and component seizure.</p> <p>Cavitation in hydraulic pumps, servos, and nozzles. Bubbles of water vapor implode and damage metal surfaces. Loss of pump efficiency, noise, loss of spray pattern, and reduced component life.</p> <p>Oil Oxidation. Water accelerates oil oxidation, especially when metal wear debris present. Acidity, excessive viscosity, and reduced oil life.</p>	<p>Fatigue of Paper Machine Bearings. Particles initiate small cracks in bearing raceways that spread and undermine the surface, producing fatigue spalls and releasing wear hardened steel into the paper machine oil. Reduced bearing life and secondary damage.</p> <p>Abrasive Wear of hydraulic pumps, cylinders, and servo valves; gear teeth journal bearings, and dynamic seals. Leakage, high friction and energy usage, and reduced component life.</p> <p>Adhesive Wear of hydraulic pumps and cylinders, gear teeth; journal and rolling bearings. Very rough surfaces adhere to opposing surfaces in the contact zone. Excessive friction and energy usage, high heat generation, and component seizure.</p> <p>Oxidation of Hydraulic and Lubricating Oils. Metal wear debris catalytically accelerates oil oxidation. Acidity, excessive viscosity and energy usage, and reduced oil life.</p>
Donaldson SOLUTIONS	<p>Prevention T.R.A.P. Regenerable Breather Driers prevent humidity from entering systems that breathe. Fluid reservoirs breathe due to fluid volume changes and thermal cycles. T.R.A.P. removes water vapor during inhalation and regenerates during exhalation, resulting in unlimited water holding capacity. T.R.A.P. also contains a 3 micron air filter to prevent hard particles from entering systems.</p> <p>Ultracac 2000 dry air blanket for systems that do not breathe. Prevents ingress of humid air and also slowly removes water from system.</p> <p>Removal Donaldson Vacuum Oil Purifier, for removing water from PMO and other systems. Available from small portable units up to 30 gpm and greater.</p> <p>Donaldson Water Absorbing Elements for smaller circuits. Remove free and some dissolved water. Can be permanently mounted on system or installed on the Donaldson Filter Cart and deployed throughout the mill.</p>	<p>Prevention Donaldson Triboguard Filter Housings and Replacement Elements are a full line of products that handle virtually every size and type of application found in paper mills with efficiencies $\beta_{x(c)} = 1000$ where $x = <4\mu\text{m}$ to $150\mu\text{m}$. Donaldson Triboguard filter elements offer extremely long life, low energy requirements and superior performance.</p> <p>Donaldson Air Breathers prevent solid particulate from entering reservoirs. They are available in a wide variety sizes, with efficiency ratings from $3\mu\text{m}$ to $60\mu\text{m}$. These breathers also help extend the life of the fluid filtration devices.</p>

Water Contamination Problems In Paper Mills

Water & Surface Initiated Fatigue



Oil Oxidation From Water & Metals

CONDITION	HOURS : Δ TAN
CLEAN & DRY	3500 hours : 0.17
IRON	3500 hours : 0.65
COPPER	3500 hours : 0.80
WATER	3500 hours : 0.80
WATER + IRON	500 hours : 8.1
WATER + COPPER	40 hours : 11.2

Success at Liberty Paper

INDUSTRY: Paper
PROBLEM: Collapsing Competitive Filter Elements
SOLUTION: Donaldson HRK10, Donaldson Triboguard Elements

Recently, Donaldson Company was contacted by an upper Midwestern paper mill. The mill was interested in our new T.R.A.P.™ breather (moisture/dirt breather filter). The new product is most commonly used on hydraulic power units, lube circuits and gear boxes. The customer used the T.R.A.P.™ breather throughout the plant to prevent moisture from entering these critical applications with great success!

Since our initial success with the T.R.A.P.™ product, this paper mill called Donaldson and our Distribution Partner for assistance with a different application. The customer was experiencing filter collapse in existing competitive filter housings, resulting in contamination of the main lube circuit. In addition, the filtration system, using 39" competitive style housings, was inefficient and didn't offer a bypass option. The mill runs a demanding 24/7 operation with minimal shutdown opportunities, but the company

had a major maintenance shutdown (20 hours max) scheduled, which provided a narrow window of opportunity for Donaldson and our Distribution Partner to shine.

The mill found a solution in Donaldson's new HRK10 filter housings and Donaldson Triboguard filter elements. Four HRK10 units were configured in a duplex arrangement. Donaldson Triboguard B(c)5=1000 filter elements were installed and are currently achieving an ISO cleanliness level of 16/14/11. Routine oil samplings upstream and downstream continue to confirm great results.

Through the joint efforts of Donaldson Company and our Distribution Partner, we delivered an economical solution which created a new relationship and happy customer.

About Donaldson

For more than 90 years, Donaldson Company has had a single focus – providing the most effective filtration solutions on the market. In critical applications like military equipment, construction equipment, passenger airliners and power generation, it's Donaldson filters protecting equipment that must run every time!

Exceptional customer service is a hallmark of Donaldson. When you call us, a person in our headquarters answers the phone. Not

a distant call center, not an automated system. A real person, who can really find the answers you need – right now!

Donaldson sees every customer as a partner – a company counting on us to provide the best filtration solution available. It's why we provide the highest quality filter products on the market, why we offer world-class service and why you can relax knowing that Donaldson is helping protect your critical equipment.



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