DEUBLIN
HOERBIGER Rotary Solutions

ROTATING JOINTS AND SIPHON SYSTEMS

For The Paper Industry

FSU SERIES Steam Joint

The Deublin FSU Series is specifically designed to handle the demanding requirements of high-speed and high-pressure paper machines.

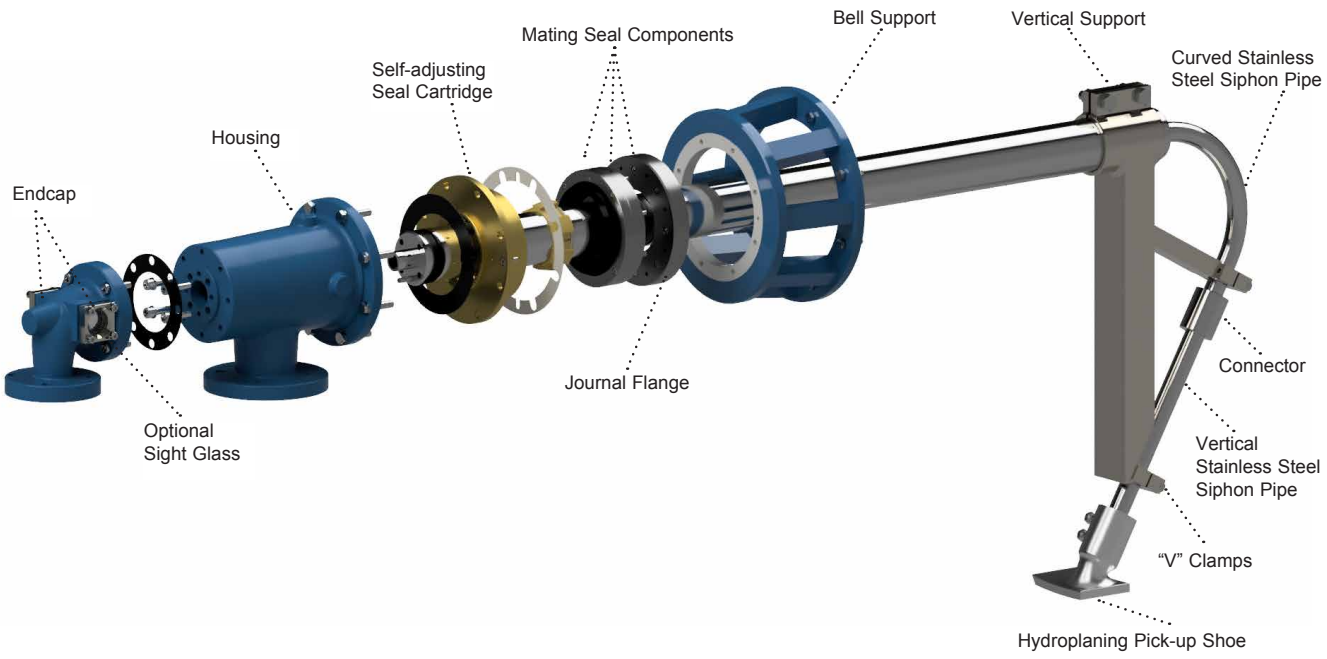
The FSU Series joint design incorporates a balanced mechanical seal instead of a pressure type seal. The balanced mechanical seal operates with significantly reduced surface friction. Additionally, the design also protects the seal from super-heated steam. These main features result in extended life of the sealing mechanism.

The Cartridge Seal design, first introduced by Deublin, allows for wear indication, faster seal changes, reduced maintenance time and less parts kept in storerooms. The two-piece metallic seal design prevents unwanted seal distortion from thermal expansion and allows for the quick replacement of the metallic seal.

The FSU Series joint is available in monoflow (steam supply or condensate return) and duoflow (steam supply and condensate return) configurations. For information on specific applications, contact your sales representative.

OPERATING DATA			
MAX PRESSURE	160 PSI	11 BAR	
MAX TEMPERATURE	400˚F	205˚C	
MAX SPEED	400 RPM	400/MIN	
MAX PRESSURE	203 PSI	14 BAR	Add-On
MAX TEMPERATURE	450˚F	232˚C	Add-On

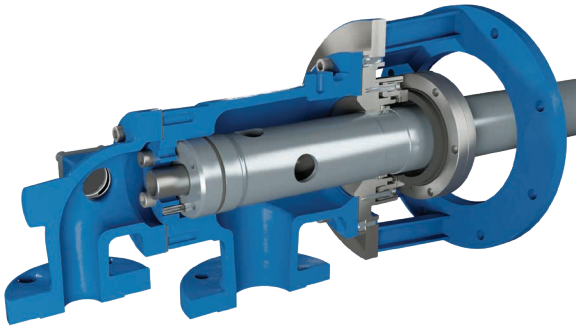
FSU + DELTASINT SIPHON Integrated Unit for Superior Performance



Working closely with world-class paper manufacturers and machine builders, Deublin revolutionized the paper industry by pioneering stationary siphon technology for removing condensate from high-speed paper machine dryer sections. Deublin stationary siphon systems have become the system of choice with many of the world's most productive papermakers.

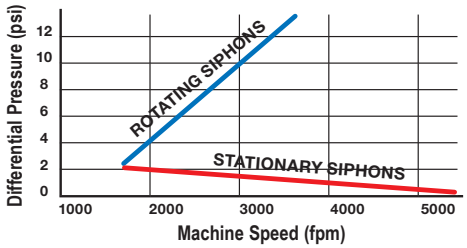
The enhanced Deublin FSU™ steam joint and stationary siphon system is engineered as a complete and integrated unit and offers several distinct advantages.

DRYING SECTION APPLICATIONS



• Flat-faced balanced mechanical seal
Designed for quick and easy installation or replacement to reduce downtime, the balanced mechanical seal extends seal life up to three years or more by reducing contact pressure on the carbon face. A seal ring wear indicator enables visual inspection to cue preventive maintenance.

• Immune to centrifugal force effects
Unlike a rotating siphon, a stationary siphon is not affected by the centrifugal force of the rotating dryer. It will remove condensate even at a differential pressure of less than 2 psi, without risking dryer flooding.



• Improved moisture profile
The FSU has a standard 60° siphon configuration that places the siphon outside the sheet edge, eliminating edge profile problems by improving the dryer temperature profile. Stubborn moisture problems are typically cured by removing the front-end siphon, installing turbulence bars and replacing the backside siphon with a dual flow FSU system.

Because the FSU stationary system is fixed in the 6 o'clock position, dryer flooding caused by improper positioning of rotary siphons is eliminated.

• No moving parts
Simple, robust design extends operating time and reduces maintenance.

• Rigid, stable support system
Two widely-spaced cylindrical and conical supports comprise a firm cantilever design with increased rigidity to minimize vertical deflection.

• Improved heat profile control for better product quality
Picking and related problems can be a result of high differential pressures. When the dryer's surface is too hot for the moisture content of the sheet, it flashes – then picks, drags and flutters out of control. Eliminating the need for high differential pressure enables better control of dryer surface temperature by adjusting the steam pressure to match the drying cycle of the different paper grades. The FSU System restores control of dryer heat profile and product quality across a wide range of paper grades.

• Hydroplaning pick-up shoe
The unique shoe design prevents shoe-to-shell contact by hydroplaning on the rimming condensate,maintaining close clearance for effective condensate removal at any speed. The hydroplaning action also produces upward pressure that acts as a third support point and reduces vibration.

• Keep pace with increasing machine speeds
With rotating siphons, higher speeds demand higher differential pressure, which produces more blow-through steam, resulting in higher bi-phase velocity. This increases wear and premature failure of the condensate hardware. The ***Deublin*** FSU stationary siphon system solves the problem!

FSU + DELTASINT STATIONARY SIPHON SYSTEM FEATURES AND BENEFITS

Features	Benefits
Flat-faced balanced mechanical seal	• Quickly and easily installed or replaced, reducing downtime and labor • Reduces contact pressure on the carbon face, resulting in longer seal life (3 years plus) • Seal ring indicator provides visual inspection for preventative maintenance
60° stationary siphon position outside sheet edge	• Eliminates wet edges • Allows use of full-length turbulence bars for improved sheet moisture at the reel
Two widely-spaced cylindrical and conical supports	• Increased siphon rigidity, minimize vertical deflection of stationary siphon
Hydroplaning pick-up shoe	• Rimming condensate creates upward lift resulting in third supporting point • Increases stiffness, minimizes siphon vibration, prevents pick-up shoe-to-shell contact

H SERIES Steam and Hot Oil Unions

The H Series is DEUBLIN'S most popular self-supported rotating pressure joint, engineered specifically for steam and hot oil applications common in the paper, plastic and textile industries.

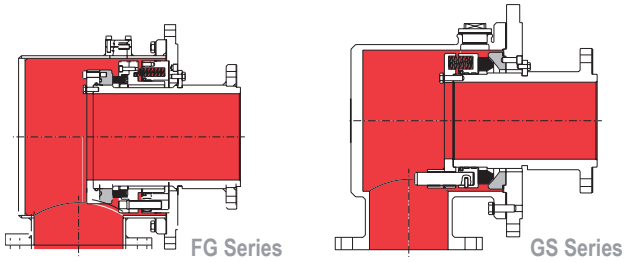
Especially suited for open gear machines, where external mounting surfaces are not available, the self-supporting design of the H Series features two widely-spaced, self-aligning carbon graphite bearings that distribute the load more evenly, reducing wear and promoting longer seal life. The high nickel and chromium content of the Ni-Resist seals provides an excellent sealing surface and resists wear due to corrosion and abrasion. The sealing surfaces can be easily reconditioned with an emery cloth.

The sealing mechanism is designed such that the carbon graphite is under compression. Carbon graphite under compression is four times stronger than in tension, so it can better withstand pressure surges and water hammering. The convex seal ring is also better suited to handle mechanical and thermal shock. Two threaded plugs (optional) in the housing located over the carbon graphite seals allow for monitoring of seal face wear.

The H Series is available in either monoflow or duoflow configuration, with flanged or threaded stainless steel rotor. The end cap of the duoflow version for steam service with a rotating siphon is available with dual sight glasses to monitor condensate flow.

OPERATING DATA		
MAX SAT. STEAM PRESSURE	150 PSI	10 BAR
MAX SPEED SAT. STEAM SERVICE	180 RPM	180/MIN
MAX SAT. STEAM TEMP.	365˚F	185˚C
MAX HOT OIL PRESSURE	100 PSI	7 BAR
MAX SPEED HOT OIL SERVICE	350 RPM	350/MIN
MAX HOT OIL TEMP.	450˚F	232˚C

OPERATING DATA		
MAX PRESSURE	150 PSI	10 BAR
MAX TEMPERATURE	365˚F	185˚C
MAX SPEED	400 RPM	400/MIN



FG & GS SERIES Joints

The FG and GS Series are externally supported joints. The seal ring assembly is attached to the rotating cylinder journal, while the counter seal is attached to the stationary joint body. The joint body is rigidly secured to the machine frame by a bell, bracket, or rod support.

While pressure-type joints use operating pressure to maintain sealing, the FG and GS use mechanical seals which lower seal contact pressure reducing wear and extending seal life. The GS utilizes spherical seal faces which compensate for the eccentricity inherent in large diameter rotating seals. Seal wear is fully compensated through designed axial movement of internal seal components. The joint body remains fixed throughout the life of the seal. Typically, one GS Series Monoflow Joint is used for steam supply and a second GS Monoflow Joint is used for condensate removal.

The FG Series Joint is a variation of the GS Series Joint with a balanced mechanical seal that increases service life and reduces wear under higher pressure conditions.

The FG series will also accommodate dryers fitted with CARB* bearings.

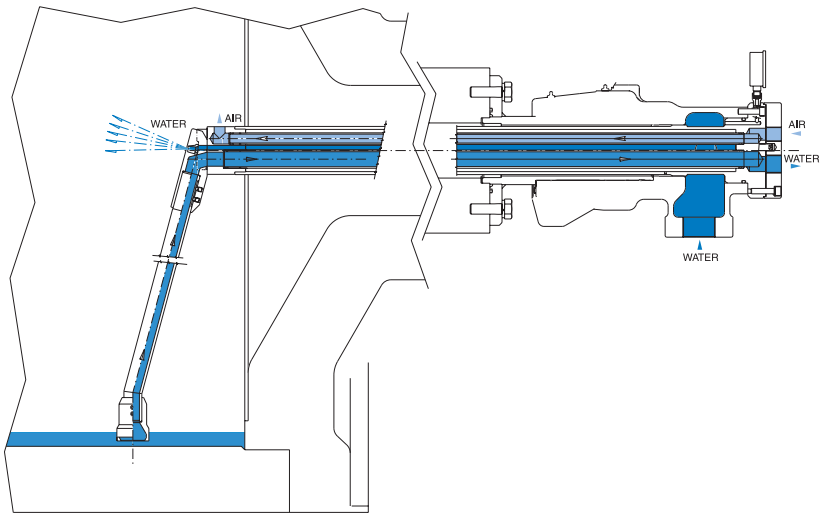
*SKF Trademark

F SERIES Cooling System Joints

The F Series joints feature a self-supported design. Its rotor is attached by a flange to the rotating cylinder journal, while the joint body is attached to stationary inlet and outlet piping. Two ball bearings support the rotor and allow it to rotate within the joint body.

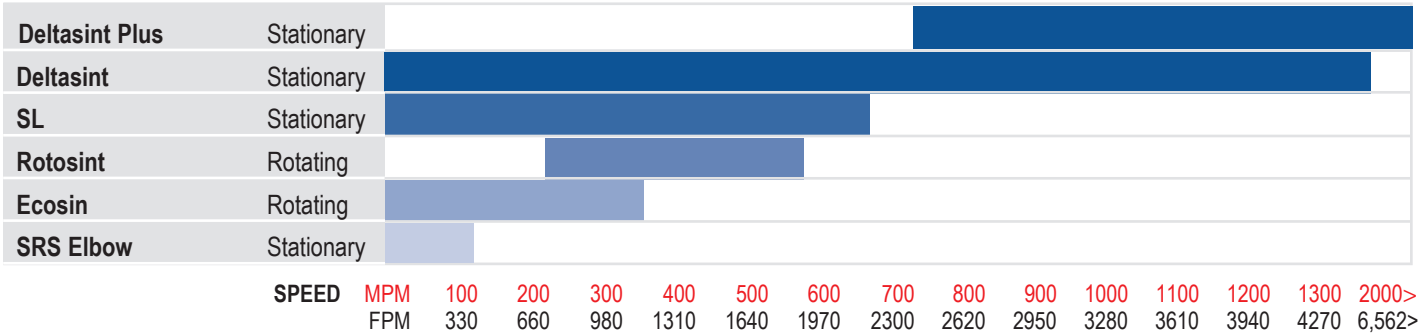
A bell-supported version is also available.

OPERATING DATA		
MAX PRESSURE	200 PSI	14 BAR
MAX TEMPERATURE	250˚ F	120˚ C
MAX SPEED	200 RPM	200/MIN



SIPHON Selection Chart

The selection chart below is for reference only. Consult ***DEUBLIN*** Engineering for assistance in the actual selection of a siphon system.



DELTASINT PLUS & DELTASINT Stationary Siphons

The introduction of the revolutionary Deltasint Stationary Siphon established Deublin as the innovative leader in siphon and joint design for the paper industry. Designed specifically to handle the rigorous requirements of high-speed paper machines.

As machine speeds continue to increase, Deublin has continued to innovate with the introduction of the Deltasint Plus stationary siphon for machines running at an excess of 4265 FPM (1300 m/min).

The Deltasint Plus stationary siphon features an upgraded vertical support to better withstand the forces of condensate at high machinespeeds. A redesigned directional siphon shoe maintains a laminar evacuation of condensate, reducing wear on the siphon components.

The Deltasint Stationary siphon family and FSU Series Steam Joint provide a combination that is rigidly supported by the machine frame. This system does not require any internal support or bushing inside the dryer to support the siphon, thereby eliminating the need for routine siphon inspections.

The Deltasint Stationary siphons are supported in the housing of the FSU Series Steam Joint at two points. The outward support is cylindrical while the inboard support is conical. The two widely spaced supports reduce vibration and deflection of the horizontal pipe. This enables the siphon to be positioned with the pick-up shoe at closer clearance from the surface of the dryer shell than traditional or previous designs. This attribute reduces the thickness of the condensate layer that, in turn, increasesthe heat transferred to the surface of the dryer.

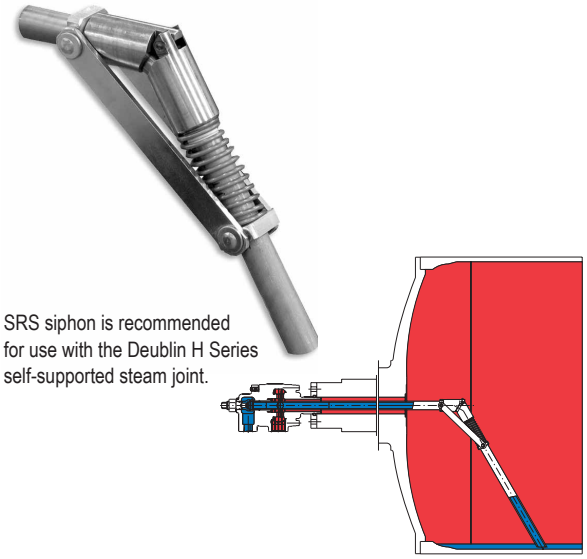
STATIONARY SIPHONS

SL™ Stationary Siphons

FOR SPEEDS UP TO 700 MPM (2300 FPM)

The SL™ is designed for low to medium speed open gear machines in which the typical condensate behavior is puddling or light cascading. The system is installed inside the dryer (thus requiring manhole access to the dryer cylinder) using a head-m ounted spider support, which utilizes an internal bushing to buttress the horizontal siphon pipe. The vertical pipe is joined by means of a heavy-duty reinforced 90° elbow that provides additional rigidity.

The special pick-up shoe has a PTFE sole to prevent damage in the unlikely event of contact with the dryer shell. The rigid mounting and protective PTFE sole enable positioning of the shoe closer to the shell of the dryer, thus ensuring effective condensate removal with minimal differential pressure and blow-through. The SL stationary siphon is recommended for use in open gear machines with the Deublin H Series self-supported steam joint.



SRS siphon is recommended for use with the Deublin H Series self-supported steam joint.

SRS™ Stationary Siphon

FOR SPEEDS UP TO 150 MPM (500 FPM)

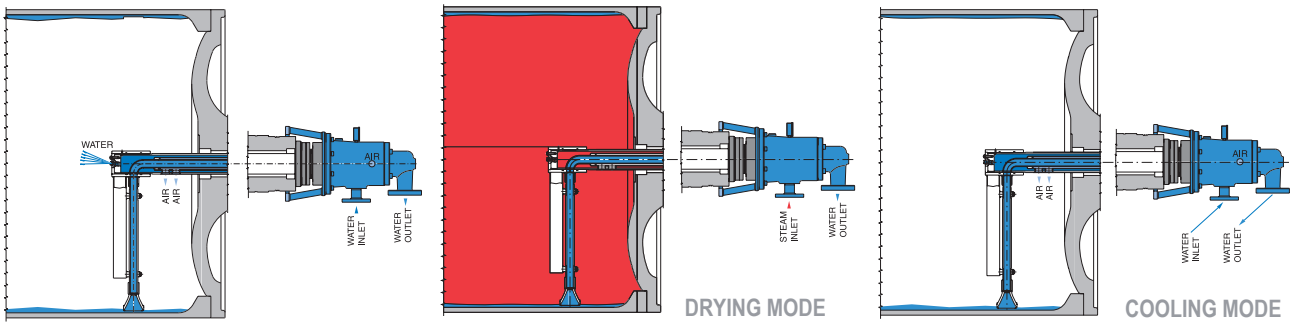
The SRS™ elbow stationary siphon is installed from the outside and requires no adjustments or positioning from the inside of the dryer. It is thus applicable to dryers without manholes. The knuckle forming the elbow is constructed from stainless steel joined by a pin. In addition, the spring maintains a fixed vertical position. Its uniform internal diameter eliminates flow restriction. Elbow stationary siphons can be used with ***Deublin*** H or HS Series steam joints with S type inner bushings.

The SRS elbow stationary siphon is furnished with a support to the horizontal pipe inside the dryer, thus reducing the cantilevered length of the horizontal pipe, dampening siphon vibration and increasing siphon and steam joint life. In addition, the siphon can be positioned closer to the dryer shell, thereby improving heat transfer. The support and siphon are installed from the outside.

SIPHONS for Cooling and Swing Cylinders

The cooling cylinder must reduce the sheet temperature uniformly across the web. To ensure uniform heat reduction, an effective cooling system introduces a mixture of cold water and air to provide the required pressure differential to evacuate the warmer water at a rate that keeps the cylinder's surface temperature constant. Removal of the warm water faces the same conditions as removal of condensate in the dryer section; i.e., like condensate, it puddles, cascades and rims. For these reasons, most of the same siphon systems are equally effective in both heating and cooling applications. ***Deublin*** also offers systems designed specially for pope reels and press rolls.

Modern paper machines often have dual-purpose (cooling or drying) cylinders. These versatile "swing" cylinders have special requirements to enable them to perform effectively in either mode. ***Deublin*** has the expertise to furnish a complete stationary or rotating siphon system to meet these requirements.

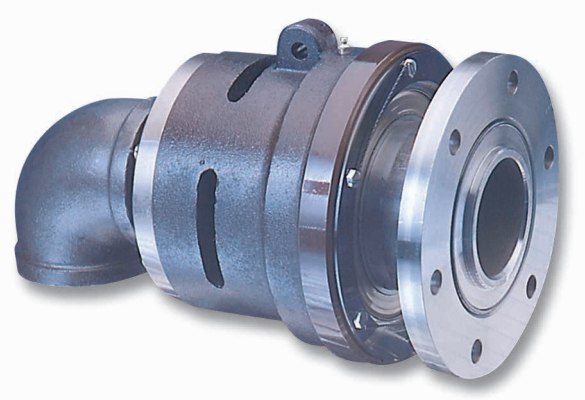


6000 SERIES Cartridge Water Unions

The 6000 Series joint is a self-supported design with the rotor attached to the rotating cylinder by means of a heavy-duty flange, while the joint body is attached to stationary inlet and outlet piping. Dual ball bearings support the housing and allow the rotor to rotate within the joint body, which remains fixed. Sealing is provided by a mechanical seal which uses a flat-faced Carbon Graphite (standard) or Silicon Carbide (ELS) steel-banded floating seal ring that mates against a Tungsten Carbide seal ring face.

The 6000 uses a balanced mechanical seal that hydraulically limits contact pressure on both sealing surfaces. The joint body remains fixed throughout the life of the seal. This reduces seal wear for longer life. Seal wear is fully compensated automatically through provision for axial movement of internal seal components, and seals are designed for quick and easy on-machine replacement.

The 6000 Series is available in monoflow and duoflow configurations.



OPERATING DATA		
MAX WATER PRESSURE	150 PSI	10 BAR
MAX SPEED FLANGED	750 RPM	750/MIN
MAX TEMPERATURE	250˚F	120˚C

>250˚F (120˚C) consult *DEUBLIN*

OPERATING DATA	Meets ANSI; optionally DIN, JIS	
MAX WATER PRESSURE	150 PSI	10 BAR
MAX SPEED	1,000 RPM	1,000/MIN
MAX TEMPERATURE	250˚F	120˚C

>250˚F (120˚C) consult DEUBLIN

F SERIES Water Union

The F Series features a balanced mechanical seal with Ni-Resist-to-Carbon Graphite seal faces. A spring-reinforced PTFE U-cup is used as a secondary seal between the floating seal and the rotor. A special labyrinth seal between the bearing and the floating seal protects the bearings and prevents media from entering the bearing cavity. For convenience, the union allows on-machine seal replacement.

The F Series also features self-supporting design. The rotor is attached by a heavy-duty flange to the rotating cylinder journal, while the joint body is attached to the stationary inlet and outlet piping. Two widely-spaced ball bearings support the rotor and allow it to rotate within the joint body, while rigidly supporting the housing relative to the rotor. Both the housing and the rotor are nickel-plated to resist corrosion. A bell-supported version is also available.

CK SERIES Thermal Oil

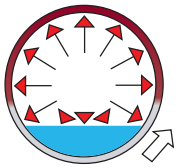
The CK Series joint is a self-supported, high temperature design. Its rotor is attached to the rotating cylinder, while the joint body is attached to stationary inlet and outlet piping. An inboard sleeve bushing and an outboard thrust bearing support the housing and allow the rotor to rotate within the joint body. Sealing is provided by balanced mechanical seals, which use flat-faced seal rings that mate against counter faces.

The CK Series relies on mechanical seals that limit contact pressure on the sealing surface. This reduces seal wear for longer seal life. Seal wear is fully compensated through designed axial movement of internal seal components. The joint body remains fixed throughout the life of the seal. All CK Series joints are duoflow units that handle both entering and exiting thermal oil.

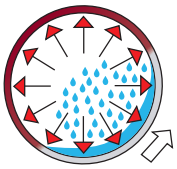
OPERATING DATA		
MAX PRESSURE	85 PSI	6 BAR
MAX TEMPERATURE	450˚F	232˚C
MAX SPEED	1000 RPM	1000/MIN

TURBULENCE BARS

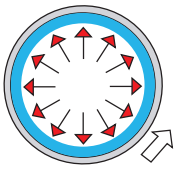
IMPROVE MOISTURE PROFILE MAXIMIZE HEAT TRANSFER



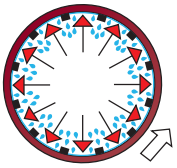
Puddling



Cascading



Rimming



Effect of Turbulence Bars

Condensate in full cascade provides the most efficient heat transfer. However, as machine operating speeds increase beyond approximately 305 MPM (1000 FPM), for 1.5 meter (5 feet) diameter dryer, centrifugal force causes the condensate to cling evenly around the shell of the dryer, a condition known as “rimming.” When this occurs, heat transfer efficiency deteriorates.

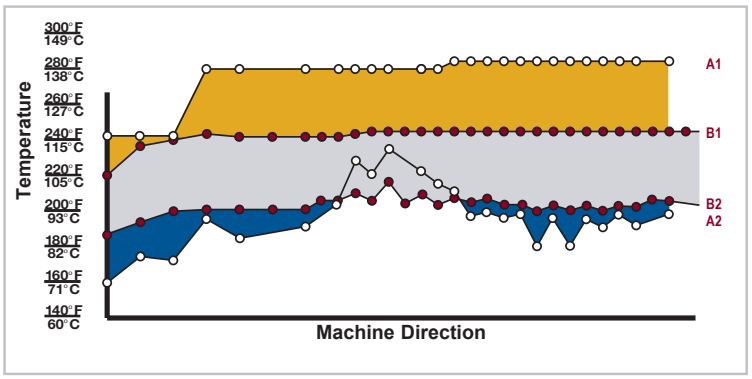
Turbulence bars form a cage-like structure around the inside diameter of the cylinder, which disrupts the rimming condensate layer, keeping the condensate turbulent even at very high speeds, thereby maintaining heat transfer efficiency. This improves the uniformity of the dryer surface temperature, ensuring an improved sheet moisture profile. The configuration, spacing and bar size determine the degree of turbulence inside the dryer shell. Turbulence bars are especially effective in combination with stationary siphons.

Deublin turbulence bars clamp securely inside the dryer’s shell, with no troublesome springs or self-tapping screws to fail. Installation is simple and easy, with no special machining or tooling required.

Deublin carbon steel bars also match the thermal expansion characteristics of the dryer vessel, to eliminate failures due to buckling, fretting and excessive wear. Stainless steel turbulence bars are recommended for cooling and swing cylinder applications.

Deublin Engineering routinely custom-designs turbulence bars for specific operating conditions.

Sample Machine Direction Average Dryer Surface Temperature with and without Turbulence Bars



A1 – Steam Temperature Before Conversion
B1 – Steam Temperature After Conversion
B2 – Average Dryer Surface Temperature After Conversion
A2 – Average Dryer Surface Temperature Before Conversion

DRYER OPTIMIZATION SEMINAR

DEUBLIN conducts dryer optimization seminars, which typically attract machine superintendents, operators, process and maintenance engineers. The program covers all aspects of dryer optimization. Case studies are presented by Mill personnel with before-and-after data.

Contact *Deublin* Customer Service for further information.

847-689-8600 • www.deublin.com • customerservice@deublin.com

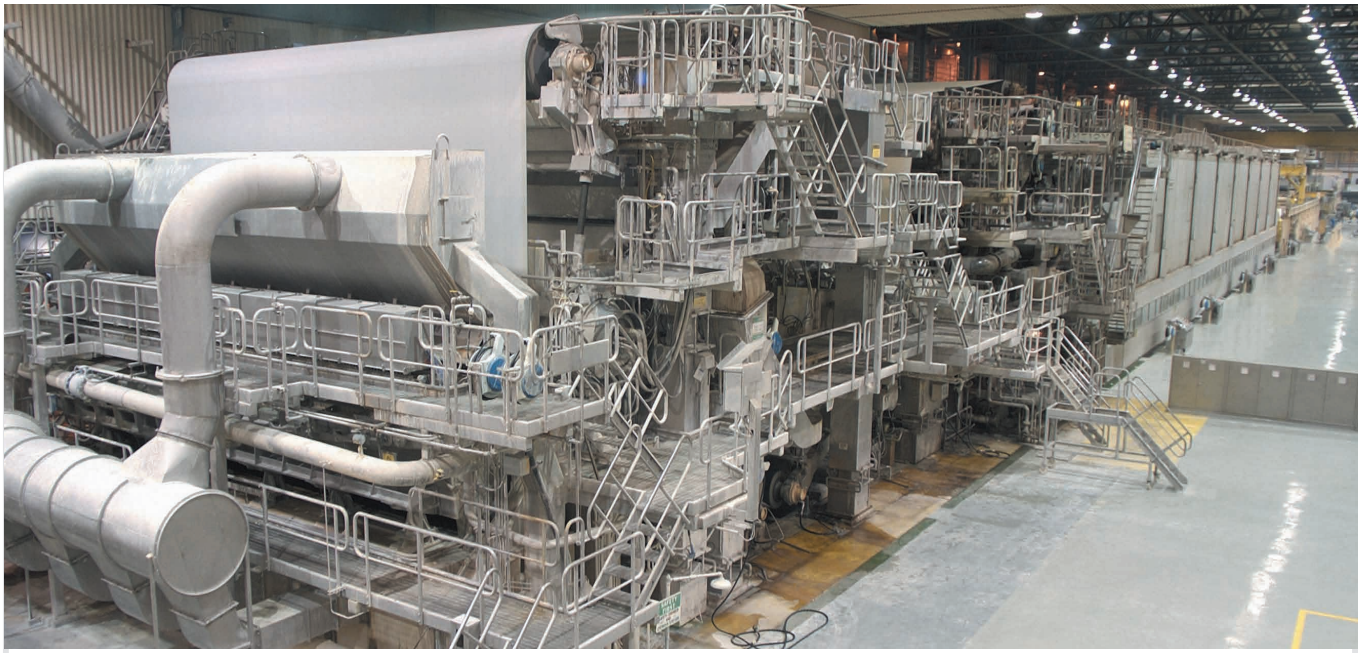
DEUBLIN PAPER ENERGY OPTIMIZATION (PEO) SERVICES

IMPROVE EFFICIENCY ENHANCE PRODUCTIVITY

The dryer section has the greatest influence on the economic viability of the entire paper production process. Yet, the dryer section is the most neglected part of the paper machine. Focusing on dryer performance improvement offers the greatest potential for improving the bottom line.

DEUBLIN provides comprehensive services for Steam Systems and Dryer Section Optimization – from equipment supply, system design and integration, installation, to diagnostics and troubleshooting.

Most older paper machines and many newer ones have steam systems that can be optimized to eliminate steam loss, enhance productivity and improve sheet quality. An optimized steam and condensate system also increases throughput, delivers lower drying costs through increased efficiency and increases profits.



- Eliminate Flooding
- Reduce High Differential Pressure
- Eliminate Steam Venting
- Eliminate Sheet Picking
- Maximize Siphon Reliability
- Maximize Seal Service Life
- Reduce High Motive Steam Usage
- Increase Drying Capacity
- Increase System Flexibility
- Improve Sheet Moisture Profile

Dryer and Steam System optimization begins with a machine audit. First, we perform a complete system assessment of your dryer section to determine how the existing dryer system is designed, built and operates under a variety of conditions. ***DEUBLIN*** engineers design around both existing and new components to properly size piping and equipment, adjust pressure loss rates, and ensure proper selection of valves and other devices to meet specific operating targets.

DEUBLIN Steam System dryer optimization services also include:

- Machine Audit
- System Design
- Installation and Integration
- Troubleshooting and Routine Service
- Diagnostics
- Reports
- Equipment Supply
- Operator Training

DEUBLIN PAPER ENERGY OPTIMIZATION (PEO) SERVICES

THERMOCOMPRESSORS

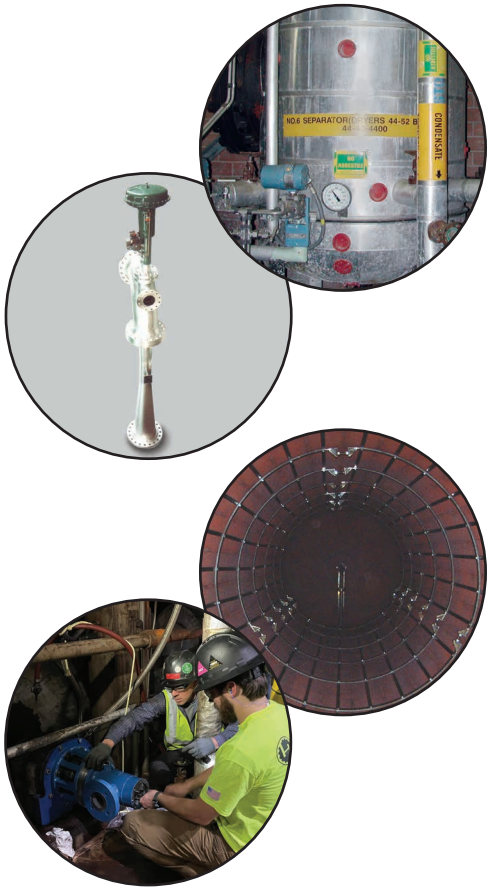
Correctly sized thermocompressors minimize motive steam usage and maintain the differential pressure set point under all machine operating conditions. Properly designed thermocompressors are especially suited for operation with a modern, automatic blow-through control strategy, widening the operational range and increasing energy efficiency.

SEPARATORS

High efficiency separators remove condensate from the blow-through steam bringing condensate carryover to an absolute minimum. This eliminates erosion of system components and increases heat transfer. Accurate and consistent blow-through steam flow measurements, critical for system control, also require the high efficiency water removal provided by these separators.

VALVES, TRANSMITTERS, CONTROL SYSTEM AND STRATEGIES

All of the system control elements must be selected and specified based on paper grades produced, furnish, steam supply constraints, operating parameters and control strategies, consistent with quality production and energy efficiency. Components are selected and applied to provide durable, reliable performance consistent with the use of the most modern automation hardware and programming. This combination will allow the papermaker to truly optimize the performance of the dryer section.



EFFECTIVE SOLUTIONS FOR OPTIMIZING PAPER MACHINESTEAM SYSTEMS AND DRYER SECTIONS

As fuel costs rise, paper producers focus on maximizing machine efficiency. Considering that the dryer section is the largest consumer of steam energy in a paper machine – typically accounting for 55% of the total machine energy cost – an optimized steam and condensate system increases production capability and improves machine efficiency, leading to lower drying costs and increased profits.

Dryer optimization solutions therefore focus on steam system and condensate removal technologies,encompassing rotating steam joints, stationary and rotating siphons and allied components that work together to:

- Reduce differential pressure, decreasing or eliminating the need for high-pressure motive steam, resulting in dramatic energy savings
- Reduce blow-through steam and hardware erosion
- Eliminate dryer flooding
- Free operators from dealing with steam system deficiencies
- Reduce requirements for energy-intensive steam by improving system efficiency and eliminating venting
- Reduce the operational impact of sheet breaks and improve overall system reliability
- Enhance product quality by improving drying uniformity and reducing sheet picking

Since no single system is universally effective, ***DEUBLIN*** offers a variety of steam joint and siphon systems to ensure maximum performance of today's high-speed paper machines under varied operating conditions.

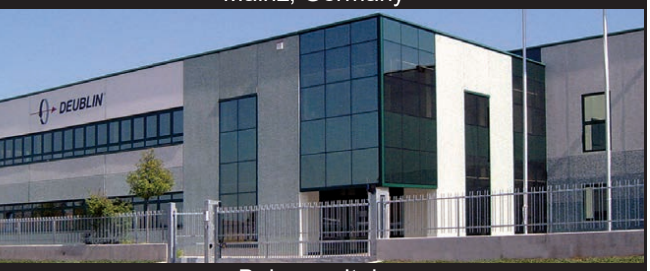
Since its founding in 1945 as a small, family-owned business, Deublin consistently has adhered to a policy of designing and building the best procucts of thier kind in the world. The result of this policy has been continuous growth through the years, and for this we are grateful to our many loyal customers.

Today, Deublin is the world's largest manufacturer of Rotary Unions, with state-of-the-art factories, technical sales and services, and local stocking in 14 countries on four continents, as well as a worldwide distribution network operating in more than 60 countries. Our global organization and extensive catalog of field-tested products ensure a precise match between each customer's requirements and an engineered solution. Deublin has been part of the HOERBIGER Group since 2019 and forms the core ot the Rotary Solution division.

We cordially invite you to visit our modern manufacturing facilities in Waukegan, Illinois, USA; Mainz, Germany; Monteveglio, Italy; Dalian, China; and Diadema, Brazil.

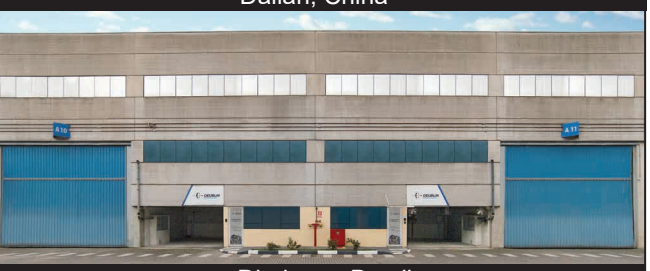
Our Global Headquarters in Waukegan, Illinois, U.S.A.


Mainz, Germany



Bologna, Italy


Dalian, China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SERVICE AND STOCK ARE AVAILABLE THROUGHOUT THE WORLD

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