

Rotating unions for steam, hot oil and water applications

Rotating unions (also referred to as rotary unions, rotary joints, rotary swivels and rotary couplings) transfer fluids from a stationary source to rotating equipment. In theory, rotating unions are simple mechanical devices. They are comprised of two main components: a stationary member that is connected to inlet pipes or hoses and a rotating component that connects to rotating machines or devices. Bearings facilitate smooth rotary motion while seals keep the fluid media in and contaminants out.



Figure 1: Rotating union for steam and hot oil. Source: Deublin Rotary unions are constructed with internal fluid passageways and are offered in various configurations. Monoflow rotary unions have one passage and only allow flow in one direction. Duoflow rotary unions contain two passages that permit fluid to flow in and out of the union. Duoflow rotary unions are typically used for heating or cooling applications.

Additionally, some rotary unions contain porting to facilitate an external siphon that is used to evacuate condensate in

a steam-heated system, or heat transfer fluid from the machine roll. Siphons can be stationary or rotary. Rotary siphons rotate with the machine roll or dryer and stationary siphons are rigidly fixed.

Steam and hot oil

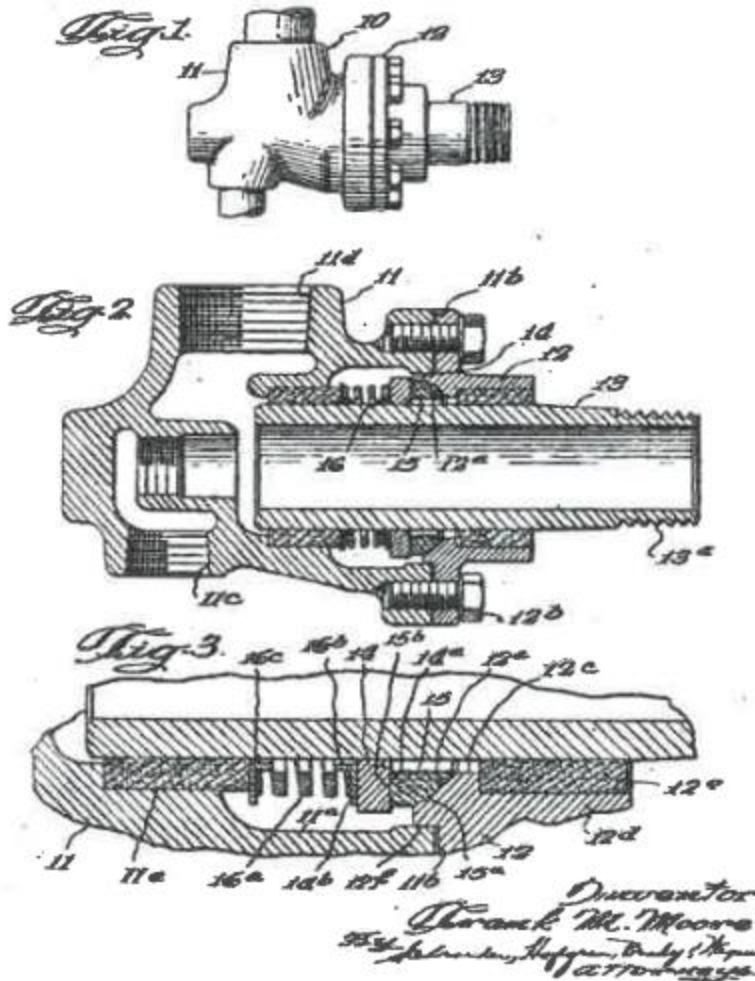
Transmission of pressurized media such as steam or hot oil found in applications such as paper and textile drying cylinders, rubber mills, mixers and calenders require a specialized union for optimal performance. Materials of construction, bearings and seals are important criteria in these demanding applications.

Rotary unions in steam applications must be able to withstand high pressures and temperatures. One such application is the dryer section in a paper machine, which consumes approximately 65% of the total machine energy cost. Optimizing the performance of steam transmission for the dryer can have a significant impact on both the quality and economics of the paper machine by improving machine efficiency and lowering operating costs. Eliminating steam loss by updating the rotary union can help in a variety of ways, including eliminating flooding, reducing high differential pressure, reducing high motive steam usage and maximizing seal service life.

May 27, 1958

F. M. MOORE
SWIVEL JOINT WITH SEALING MEANS PERMITTING
PIVOTAL MOVEMENT
Filed April 23, 1958

2,836,439



Positive sealing for hot oil is a unique challenge. When the oil weeps past the seals and mixes with oxygen, it forms coke, a hard carbon-rich solid material. If unaddressed, the coke adheres to the surfaces of the rotary union and propagates, eventually leading to failure of the union and possibly the equipment it services. If any coke formation appears, the union should be disassembled and inspected for scratches to the carbon seal rings. Damage to the seal rings could indicate that particles are in the oil.

If there are no signs of contamination, coke formation could indicate a piping problem that introduces unwanted stresses on the union or a misalignment issue between the rotary union

and the rotating equipment. Either of these problems could compromise the rotary union over time and lead to leakage or failure. It could also indicate that the rotary union is not suited for the application.

The Deublin difference – the Type C

Figure 2: Drawings from the Barco Type C patent application. Source: Deublin The Deublin Company, founded in 1945, is the world's leading manufacturer of rotating unions. Deublin manufactures a full line of rotating unions, including products specially designed for the demanding challenges of steam and hot oil applications.

Deublin acquired rotating union manufacturer Barco Seals in 2012 to add to its portfolio of rotating unions for the transmission of pressurized fluids. Barco was founded in 1908 as a manufacturer of swivels and ball joints for the railroad industry and over the years had designed and manufactured hundreds of rotating unions and swivel joints.

Among the Barco products acquired by Deublin was the Type C rotating union. The Type C was revolutionary when it was designed and patented in 1958, a claim that still holds true today. The original patent number 2,836,439 outlined the main features of the Type C:

- Carbon graphite spherical seals that allow for movement in all directions without leakage
- Widely spaced carbon graphite plain bearings for greater rigidity, longer life and less wobble and runout than competitive products

The Type C offers many advantages over competitive products for steam and hot oil applications. Manufactured with a hardened sleeve and nickel-plated end cap, the Type C provides exceptional life at high pressure.

Two widely spaced bearings, assembled with a heat shrink to place them in compression, provides a more stable system with less wobble than the single centered, free-floating bearings found in competitive products.

Whereas the seals in other hot oil and steam rotating unions are in a state of tension, the Type C seals are placed under compression. Carbon graphite is nearly five times stronger under compression than under tension. This additional strength allows the Type C to have greater resistance to shock as well as steam and water hammer.

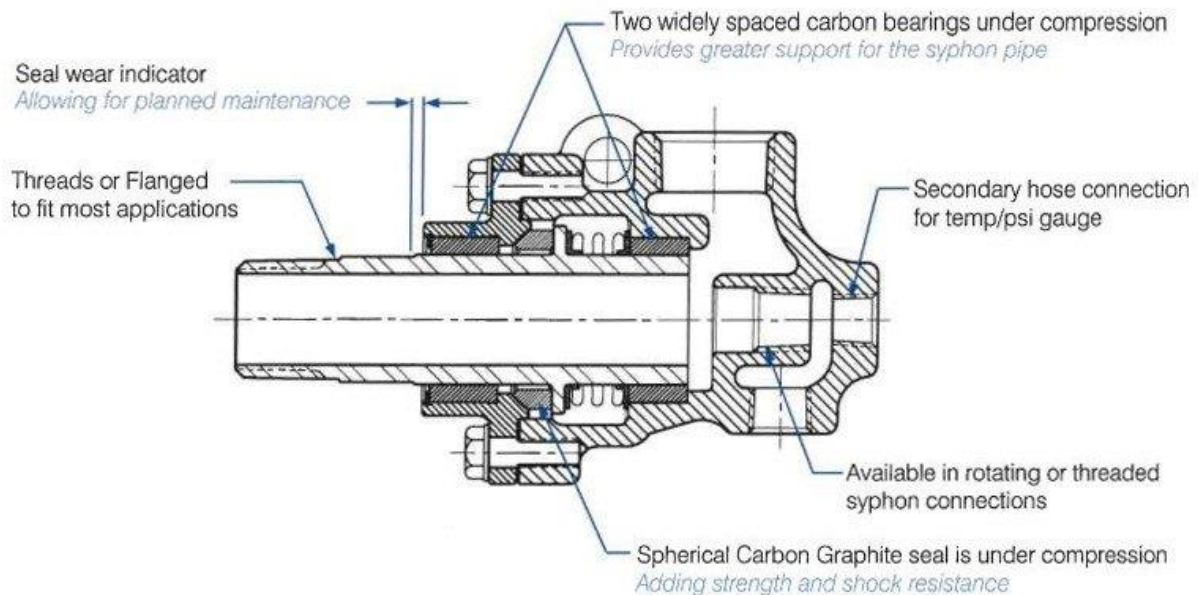


Figure 3: Type C features and benefits. Source: Deublin

Unplanned failures or shutdowns can be costly and potentially dangerous when the medium is hot oil or steam. The Deublin Type C includes a built-in external seal wear indicator that allows enough advanced notice to schedule a shutdown and perform preventive maintenance.

An additional feature of the Type C is that, unlike some competitors, the spring used to place the seals under compression is not in the flow path, which can lead to seal flutter with high-velocity flows.

Advantages of the heat shrink include securing the bearings to the housing and preventing them from dislodging.

Steam and Hot Oil Rotary Union Comparison

Design Feature	Deublin Type C	Nippon Joint	Duff Norton 8000	Kadant SX Series
Bearings	Two widely spaced, carbon graphite bearings assembled with a heat shrink to place them in compression	Two compressed carbon graphite bearings	Single centered, free-floating carbon bearing	Two carbon bearings under compression
Seals	Carbon graphite seals in a state of compression; shock-resistant	Carbon graphite seal in a state of tension; susceptible to fracture	Carbon graphite seal in a state of tension; susceptible to fracture	Carbon graphite seal
Seal Wear Indicator	Yes	Yes	Yes	No
Spring in Flow Path	No	Yes	Yes	Yes

Table 1: Steam and hot oil rotary union comparison.

Configurations

Deublin's Type C is available with a variety of configurations to suit any steam or hot oil application requirement. All Type C products feature two widely spaced carbon graphite bushings and carbon seals placed under compression.

The table below lists the available Type C configurations and general specifications. Many sizes are available within each series and model type.

Type C configurations and general specifications

Application	Model	Series #	Connection	Pressure	Temperature	Construction
Steam						
Duoflow Fixed Siphon, Ferrous	Type C	BC-54000-XX-XX	NPT Threads	Up to 250 psi (17.2 bar)	406°F (208° C)	Ferrous trim construction with iron casing, ferrous sleeve and end cap, stainless steel spring and spring guides.
	Type C	BC-54000-XX-XXB	BSPT Threads			
	Type CF	BC-54000-XX-60	Flange			
	Type CF	BC-54000-XX-62	Quick Release Flange			
Duoflow Fixed Siphon, Bronze	Type C	BC-54065-XX-XX	NPT Threads	125 psi (8.6 bar)	353 °F (178 °C)	Bronze trim construction with an iron casing, bronze sleeve and end cap, stainless steel spring and spring guides
	Type C	BC-54065-XX-XXB	BSPT Threads			
	Type CF	BC-54065-XX-XX	Flange			
	Type CF	BC-54065-XX-XX	Quick Release Flange			
Duoflow Rotating Siphon	Type CR	BC-54206-XX-XX	NPT Threads	125 psi (8.6 bar)	353°F (178°C)	Bronze trim construction with bronze sleeve and end cap for low pressure steam
	Type CR	BC-54206-XX-XXB	BSPT Threads			
	Type CRF	BC-54206-XX-60	Flange			
	Type CR	BC-54205-XX-XX	NPT Threads	250 psi (17.2 bar)	406°F (208° C)	Ferrous trim recommended for high pressure steam
	Type CR	BC-54205-XX-XXB	BSPT Threads			
	Type CRF	BC-54205-XX-60	Flange			
Monoflow, Ferrous	Type CS	BC-54100-XX-XX	NPT Threads	Up to 250 psi (17.2 bar)	406°F (208° C)	Ferrous trim construction with iron casing, ferrous sleeve and end cap, stainless steel spring and spring guides.
	Type CS	BC-54100-XX-XXB	BSPT Threads			
	Type CSF	BC-54100-XX-60	Flange			
	Type CF	BC-54100-XX-62	Quick Release Flange			
Monoflow, Bronze	Type CS	BC-54165-XX-XX	NPT Threads	125 psi (8.6 bar)	353°F (178° C)	Bronze trim construction with an iron casing, bronze sleeve and end cap, stainless steel spring and spring guides
	Type CS	BC-54165-XX-XXB	BSPT Threads			
	Type CSF	BC-54165-XX-XX	Flange			
Water						
Duoflow Fixed Siphon, Bronze	Type C	BC-54065-XX-XX	NPT Threads	300 psi (20.6 bar)	353 °F (178 °C)	Bronze trim construction with an iron casing, bronze sleeve and end cap, stainless steel spring and spring guides
	Type C	BC-54065-XX-XXB	BSPT Threads			
	Type CF	BC-54065-XX-XX	Flange			
	Type CF	BC-54065-XX-XX	Quick Release Flange			
Duoflow Rotating Siphon	Type CR	BC-54206-XX-XX	NPT Threads	300 psi (20.6 bar)	353°F (178°C)	Bronze trim construction with bronze sleeve and end cap for water and brine
	Type CR	BC-54206-XX-XXB	BSPT Threads			
	Type CRF	BC-54206-XX-60	Flange			
Monoflow, Bronze	Type CS	BC-54165-XX-XX	NPT Threads	300 psi (20.6 bar)	353°F (178° C)	Bronze trim construction with an iron casing, bronze sleeve and end cap, stainless steel spring and spring guides
	Type CS	BC-54165-XX-XXB	BSPT Threads			
	Type CSF	BC-54165-XX-XX	Flange			
Hot Oil						
Duoflow Rotating Siphon	Type CR	BC-54205-XX-XX	NPT Threads	100 psi (6.8 bar)	446°F (230°C)	Hot oil construction recommended
	Type CR	BC-54205-XX-XXB	BSPT Threads			
	Type CRF	BC-54205-XX-30	Flange			
	Type CRF	BC-54205-XX-32	Quick Release Flange			
Duoflow Fixed Siphon	Type CO	BC-54000-XX-XX	NPT Threads	100 psi (6.8 bar)	446°F (230°C)	Ferrous trim construction with iron casing, ferrous sleeve and end cap, stainless steel spring and spring guides.
	Type CO	BC-54000-XX-XXB	BSPT Threads			
	Type CFO	BC-54000-XX-30	Flange			
	Type CFO	BC-54000-XX-32	Quick Release Flange			
Monoflow	Type CSO	BC-54100-XX-XX	NPT Threads	100 psi (20.6 bar)	446°F (230° C)	Iron casing, ferrous sleeve and end cap, stainless steel spring and spring guides
	Type CSO	BC-54100-XX-XXB	BSPT Threads			
	Type CSFO	BC-54100-XX-30	Flange			
	Type CSFO	BC-54100-XX-32	Quick Release Flange			

Table 2: Type C configurations and general specifications.

Conclusion

With a wide variety of configurations, Deublin's Type C rotary joint offers superior performance for any steam and hot oil application. The widely spaced carbon graphite bearings assembled under compression provide a more stable, wobble-free system. The seals, also placed under compression, allow movement in all directions without leakage. This simple yet strong rotary union yields a more reliable and durable design with longer life than competitive products. For more on Deublin's Type C and the company's other products, go to Deublin's [website](#).