Process Technologies for Tomorrow
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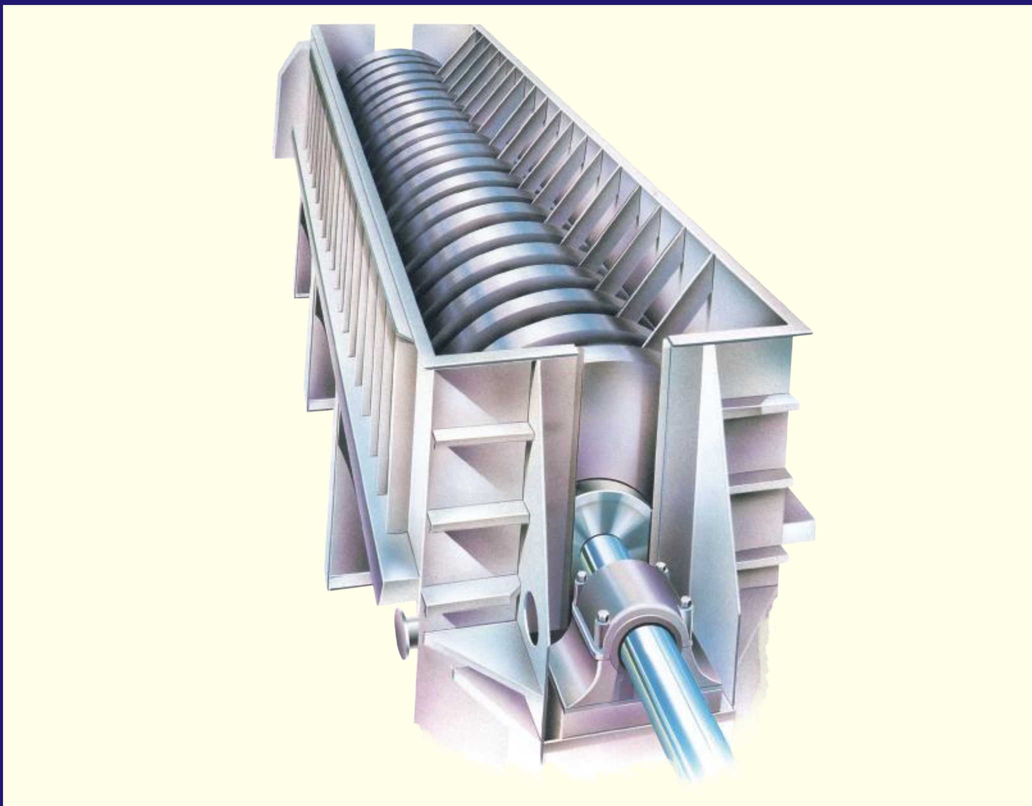
HOSOKAWA/MICRON
TORUSDISC TD



Process Technologies for Tomorrow

HOSOKAWA MICRON CORPORATION

BEPEX TorusDisc, a compact indirect heat exchanger for drying, heating, cooling and reacting

Description

The TorusDisc dryer/heater/cooler is an indirect heat exchanger, with mechanical agitation of material. It provides batch or continuous indirect heating, drying, cooling or reaction of solids, slurries, gels, filter cakes, powders and viscous materials.

The TorusDisc processor consists of a stationary horizontal vessel containing a tubular rotor with vertically mounted double-walled discs. These discs provide approximately 85 % of the total heating surface. Other heating surfaces are the rotor shaft and the inner wall of the jacketed vessel trough.

During operation, a high relative velocity between the rotating discs and the product contributes to a high heat transfer coefficient. Agitator plows or scraper bars can be added to increase exposure of new surfaces and prevent material build-up on surfaces.

These design features allow the Torus-Disc to achieve heat transfer-coefficients two to six times greater than many other indirect dryers. Its rotor speed can be set for optimum heat exchange and thorough mixing, independent of residence time. Residence time ranges from minutes to several hours, making the TorusDisc more versatile than almost any other indirect heat exchanger available today.

How the TorusDisc works

Heat tranfer fluids flow through a tubular rotor and hollow discs mounted on the rotor. Fluids also flow through the jacketed vessel containing the rotor.

Stationary agitator plows or scraper bars are located between the discs in order to achieve better mixing and to prevent material build-up on heat transfer surfaces. Transport of product is in an axial direction through the annular space between the discs and the vessel toward the discharge end, effecting high jacket heat tranfer rates. Adjustable conveying vanes are fixed to the outer rim of the discs to control conveyance.

Residence time is independent of rotor speed and is adjustable by means of an overflow weir located at the discharge end. Therefore, the unit can be operated at the best rotor speed for optimum heat tranfer.

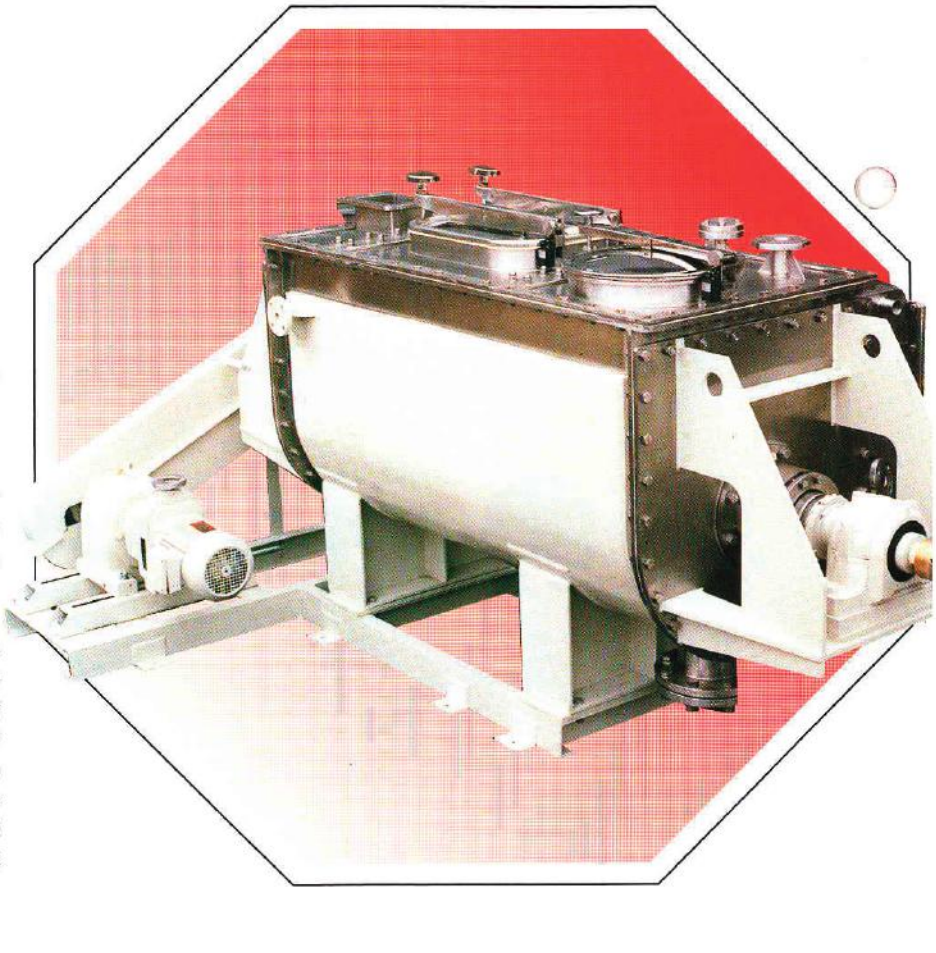
The tubular rotor and the jacket can be divided into two sections for gradual heating and cooling processes using different temperatures.

Two operating modes are possible with this unit as a dryer:

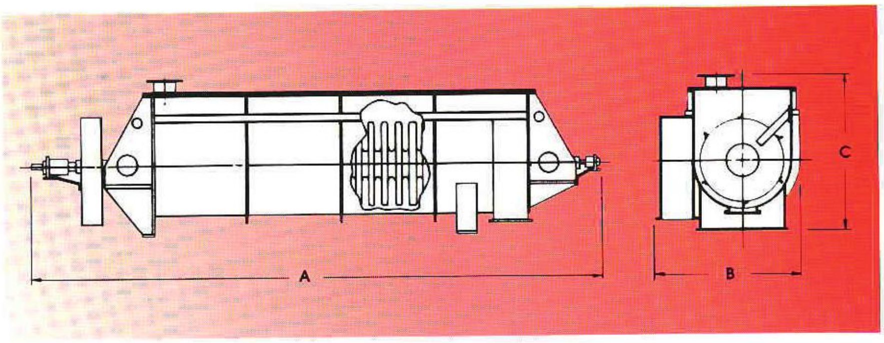
A. Indirect heat transfer alone may be used if the volatile to be dried has a boiling point below the rotor and jacket temperature. The process is normally countercurrent with a small air or inert gas sweep used to carry evaporated volatiles away from the discharge end and out the feed end of the unit.

B. A second mode of operation is with a combination direct and indirect drying system. The performance of the dryer is improved dramatically by blowing a sweep of purge gas through it. This aid the drying process in three ways:

1. The presence of the gas lowers the boiling point of the volatile.
2. Amounts of direct and indirect heats can be varied to minimize energy consumption.
3. The introduction of the gas through the bottom of the unit causes a fluidizing effect, thus improving the heat transfer coefficient between product and heating surfaces.



Specifications



Specifications TorusDisc

Model no. Ø - L	Heat transfer area m²	Nominal working volume m³	kW max.	rpm max.	Approximate dimensions in mm A	B	C
630- 2.00	10	0.5	4.0	30	3600	900	1200
630- 2.50	12	0.6	4.0	30	4100	900	1200
630- 3.15	16	0.8	5.5	30	4700	900	1200
630- 4.00	20	1.0	5.5	30	5600	900	1200
1000- 2.00	28	1.5	7.5	20	3700	1300	1600
1000- 2.50	35	1.8	7.5	20	4200	1300	1600
1000- 3.15	41	2.3	11.0	20	4800	1300	1600
1000- 4.00	50	2.8	11.0	20	5700	1300	1600
1250- 2.50	48	2.9	11.0	15	4400	1800	2000
1250- 3.15	61	3.6	15.0	15	5000	1800	2000
1250- 4.00	77	4.5	15.0	15	5900	1800	2000
1250- 5.00	96	5.6	22.0	15	6900	1800	2000
1600- 4.00	126	7.8	30.0	12	6600	2200	2500
1600- 5.00	146	9.6	37.0	12	7600	2200	2500
1600- 6.30	184	11.9	45.0	12	8900	2200	2500
1600- 7.10	208	13.4	55.0	12	9700	2200	2500
2000- 5.00	229	14.4	55.0	10	7900	2700	3200
2000- 6.30	288	17.9	55.0	10	9200	2700	3200
2000- 8.00	349	22.4	75.0	10	10900	2700	3200
2000- 9.00	393	24.9	90.0	10	11900	2700	3200
2500- 6.30	415	26.3	75.0	6	9600	3100	3700
2500- 7.10	467	29.5	90.0	6	10400	3100	3700
2500- 9.00	531	36.9	110.0	6	12300	3100	3700
2500-10.00	590	40.9	110.0	6	13300	3100	3700

Note: Based on carbon steel construction and 5 bar (g) design rotor and jacket. Figures may vary slightly for other materials and design pressures.

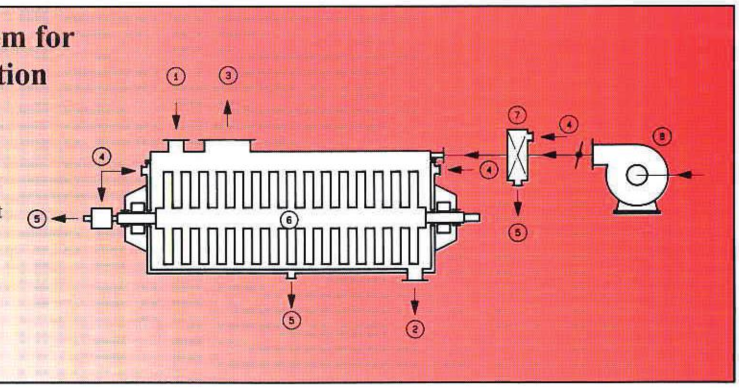
Laboratory and system development capability

To determine the configuration of the TorusDisc most suited for a particular product, we maintain a variety of units at our laboratory for testing customers' product heat transfer characteristics.

These, together with other influencing factors, are evaluated to determine the required system. We also have rental units available for pilot testing at customers plants. Technical support is available from our chemical, food and minerals processing and engineering groups.

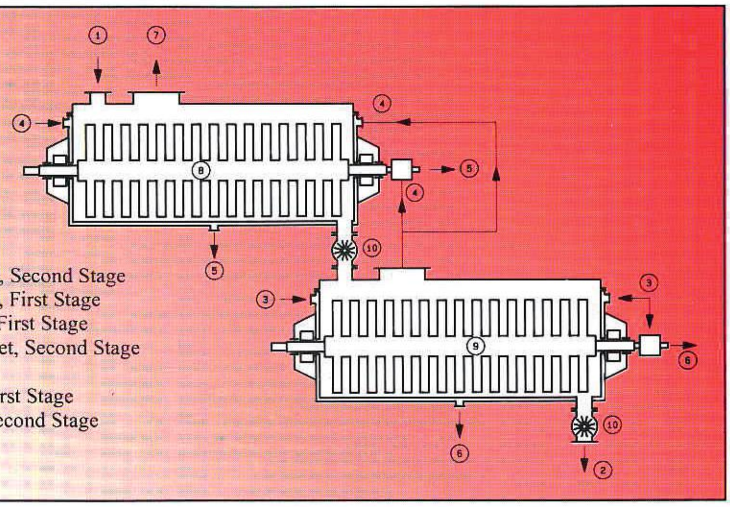
Typical applications

Standard system for water evaporation



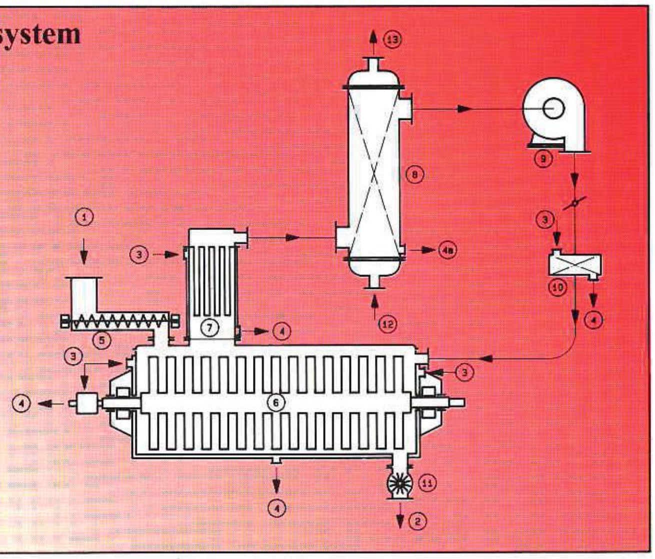
1. Feed Inlet
2. Product Discharge
3. Vapor Exhaust
4. Heating Media In
5. Heating Media Out
6. TorusDisc Dryer
7. Air Heater
8. Air Fan

Multi-effect evaporator



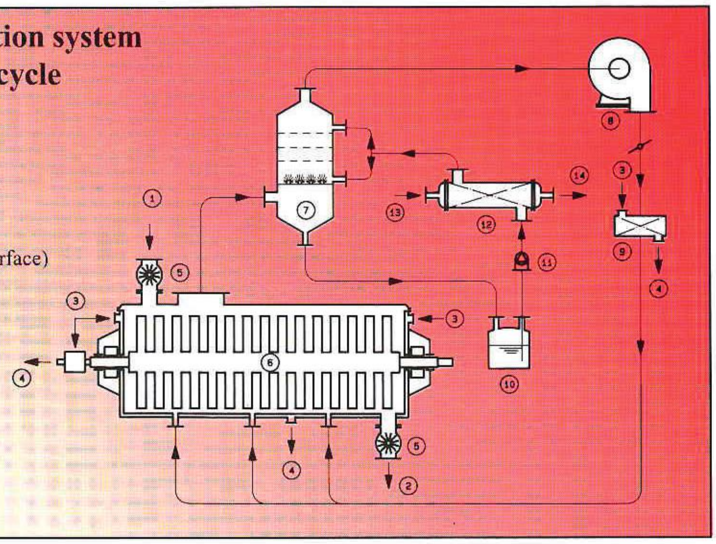
1. Feed Inlet
2. Product Discharge
3. Heating Media Inlet, Second Stage
4. Heating Media Inlet, First Stage
5. Condensate Outlet, First Stage
6. Heating Media Outlet, Second Stage
7. Vapor Exhaust
8. TorusDisc Dryer, First Stage
9. TorusDisc Dryer, Second Stage
10. Rotary Star Valves

Solvent evaporation system with inert gas recycle



1. Feed Inlet
2. Product Discharge
3. Heating Media Inlet
4. Heating Media Outlet
4a. Solvent Condensate Outlet
5. Screw Feeder
6. TorusDisc Dryer
7. Bag Filter
8. Vapor Condenser (Surface)
9. Circulating Fan
10. Gas Heater
11. Rotary Star Valve
12. Coolant Inlet
13. Coolant Outlet

Solvent evaporation system with inert gas recycle



1. Feed Inlet
2. Product Discharge
3. Heating Media Inlet
4. Heating Media Outlet
5. Rotary Star Valve
6. TorusDisc Dryer
7. Vapor Condenser (Surface)
8. Circulating Fan
9. Gas Heater
10. Solvent Reservoir
11. Solvent Pump
12. Solvent Cooler
13. Coolant Inlet
14. Coolant Outlet

Foods

Distillery and brewery waste products
Hexane extracted soybean meal
Soy protein dextrose
Corn and soybean waste products
Fish meal
Meat by-products/Rendering processes

Chemicals

Oxides
Hydroxides
Inorganic salts
Organic salts
Fine chemicals
Pharmaceuticals

Petrochemicals/Plastics

ABS
Adipic acid
Acrylics
Acetates
Polycarbonate
Polyester
Polyethylene
Polypropylene
PTFE
Terephthalic acid

Minerals

Coal
Lime
Cement
Yellow Cake

Wastes

Municipal
Refinery
Industrial

The BEPEX TorusDisc

A compact indirect heat exchanger that combines high heat transfer rates with high surface/volume ratios.

Features

Small space requirements

Space requirements are less than comparable equipment due to the large heat transfer area on the rotor. The unit has an average product hold-up of 60 to 90 % of vessel volume.

Energy efficient

A single TorusDisc can replace a large number of batch units with energy reductions as high as 75 %. It also reduces floor space and labor requirements. Results: lower cost per heat unit transferred.

The TorusDisc has a thermal efficiency of 1.1 to 1.4 kg steam per kg water evaporated, compared to efficiencies of 1.8 to 2.0 for batch cookers and steam tube dryers. The difference can mean fuel savings of 20 to 40 %.

Maximum drying efficiency

The TorusDisc can provide a combination of indirect and direct drying for maximum drying efficiency.

High heat tranfer coefficient

Rotor speed may be adjusted to provide optimum heat tranfer, regardless of residence time. The TorusDisc heat transfer coefficient generally ranges from 85 to 340 W/(m^2.K).

Product versatility

The unit can process wet cakes and slurries, even those materials requiring very long residence times. Scrapers allow processing of sticky material with thorough mixing and no product build-up. In extremely difficult cases, back-mixing of product with feed is used to provide a free-flowing bed and clean heat tranfer surfaces.

Application versatility

The TorusDisc can be used for batch or continuous heating, drying, cooling, desolventizing and reacting. It can operate under pressure or vacuum.

Low maintenance

Low maintenance costs can be expected due to the slow turning rotor (0.1 to 1.5 m/s tip speed) and the absence of large vessel seals.