

Bethlehem Porcupine Dryer

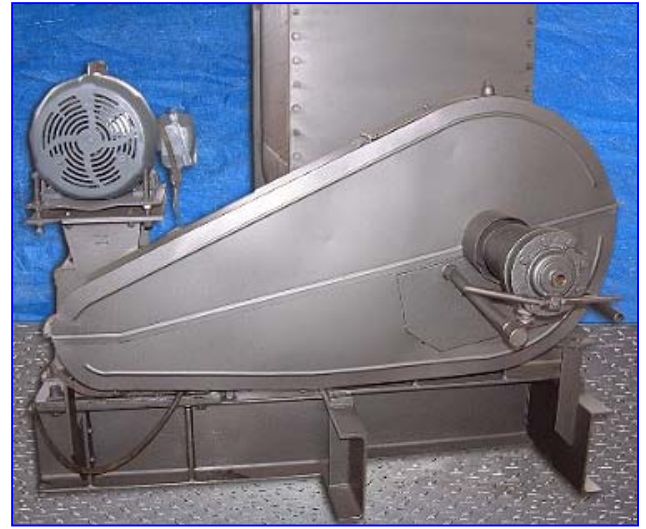
Mfg: Bethlehem Corp.

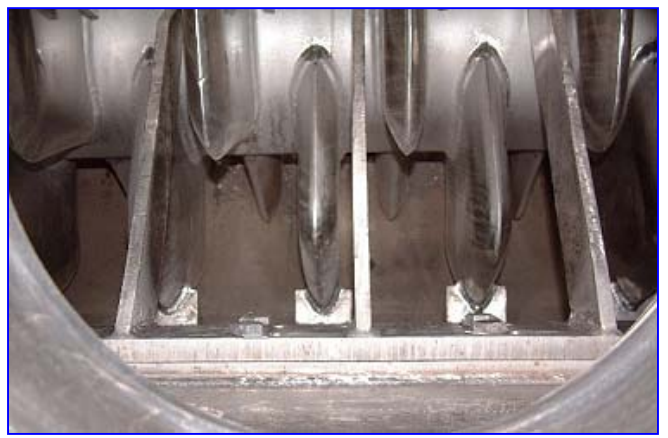
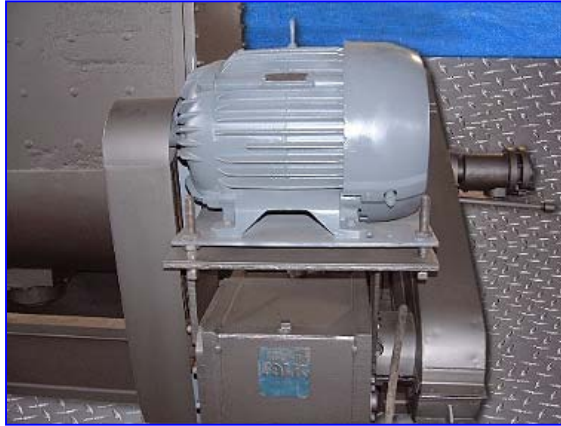
Model: 4878

Stock No. 700.1

Serial No.

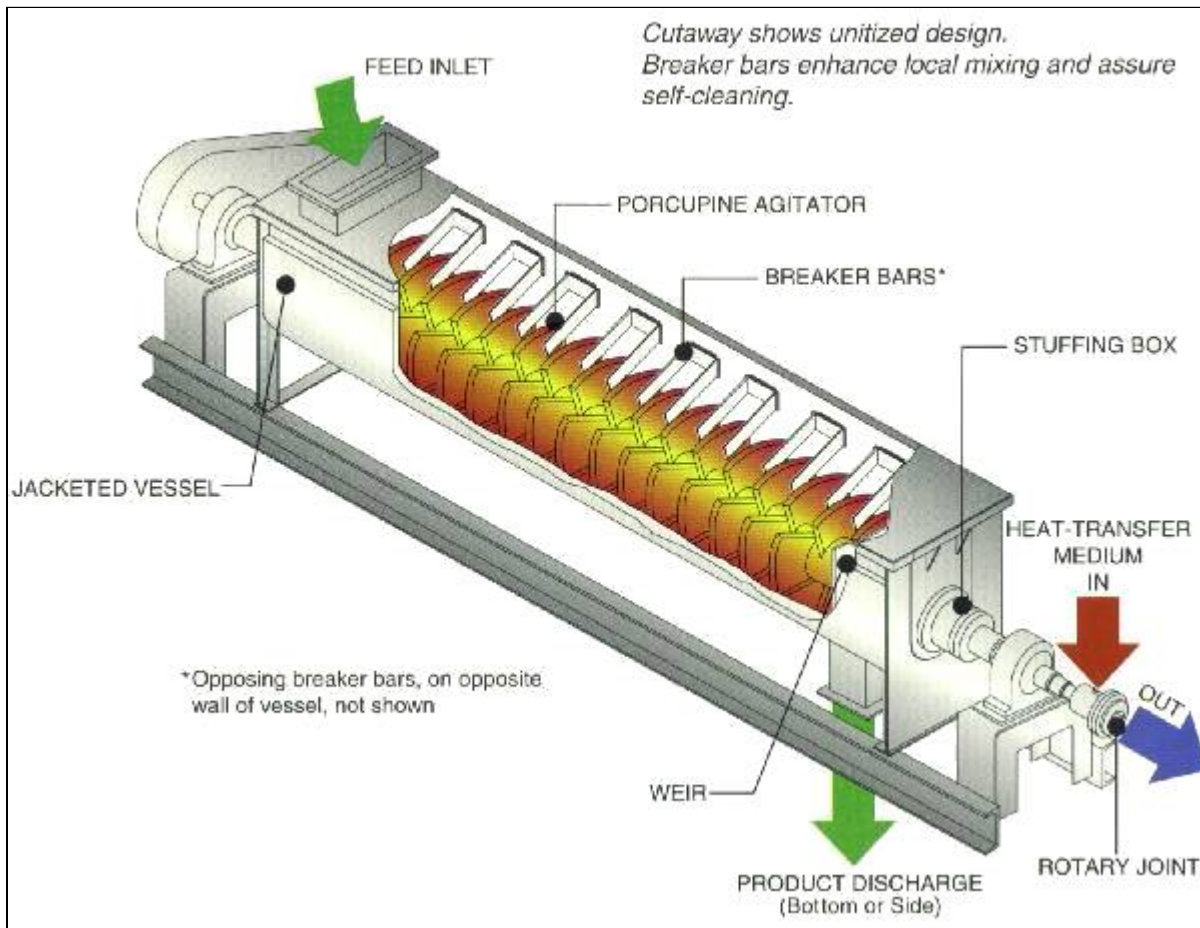
Bethlehem Porcupine Dryer. This "Porcupine" Dryer has a shell rated for 15 PSIG F/V, and an agitator rated for 125 PSIG. All of the contact parts are 316L. This unit is designed for steam or hot water. Weight: empty is 12,000 lbs. Reference dwg # 267D-4V-414, Manufacturer -Bethlehem Corp., 1979, Model NB#: 4878, Length 72 in., Diameter 30 in., Internal Vacuum Rating 55 psi. Has a dual voltage 230/460 10 horsepower motor, it has a jacketed shell as well as agitator and is made to operate under full vacuum. The batch size is in the 400 to 500 gallon range.

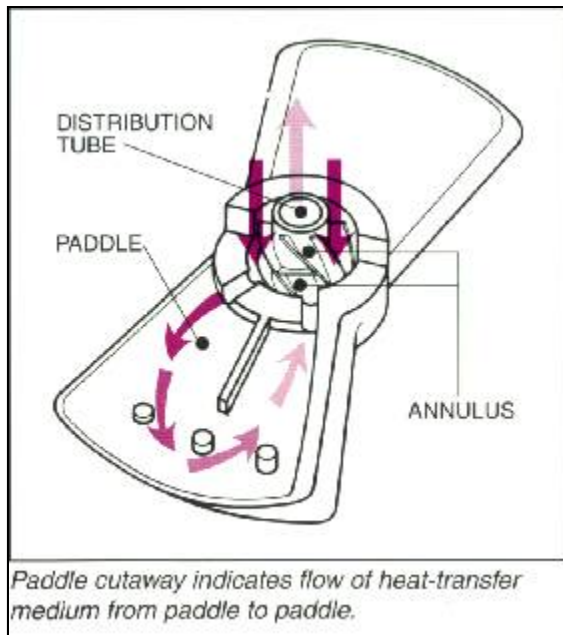




<http://www.bethcorp.com/Prod-Porcupine.html>

Indirect Heat Transfer Design Concept Bethlehem Porcupine® Processor





Problem Solving Capabilities Bethlehem Porcupine[®] Processor

FOULING:

One of the most common problems with indirect heat-transfer units is fouling of the heating surface. Breaker bars mounted on opposing side walls of the vessel promote more intense internal mixing. The differential velocity between the heated, rotating agitator and the process mass increase both heat transfer and the shear at the paddle surface. Fouling is frequently prevented by this shearing action.

Several fouling applications can be solved by internal or external recycle. With recycle, a portion of the product is mixed with the feed stream to decrease the moisture content below that at which fouling tends to occur.

SLUDGE DRYING:

Industrial and municipal sludge, dewatered by filtration (centrifuge/press/vacuum), can be dried very effectively with the PORCUPINE[®] Processor. Dried municipal sludge can be converted to steam for heating the PORCUPINE[®] Processor. Resultant fuel savings make this technique the most cost effective means of municipal sludge disposal.

Most industrial sludges can be dewatered for economic land disposal. The uniformity of product material eliminates the need for further treatment of the waste. Mass and volume reduction created by the unique agitation of the PORCUPINE[®] agitator further enhance this means of industrial sludge disposal.

DUSTING:

Dusting is created by high vapor velocities through -- or over -- solids of small particle size. High vaulted vapor space can drastically reduce the velocity of a vapor over the

process bed and allow entrained particles to settle. Low speed of the agitator combined with the ability to operate without purge gas will minimize mechanical fluidization of the bed solids. This reduces the potential for entrainment. The PORCUPINE® provides one of the highest heating surface-to-volume ratios possible.

HEAT SENSITIVITY:

The unique hollow, cut flight agitator promotes highly efficient, localized mixing. This mixing action increases the intimate contact of the processed particles with the heat transfer surface of the agitator blades promoting close temperature control for heat sensitive products, high thermal efficiency and superior product quality.

The PORCUPINE® provides one of the highest heating surface-to-volume ratios possible. The very high area-to-volume ratio results in minimum residence ("dwell") time assuring a favorable time/temperature history. Vacuum operations or sparging with an inert gas may be employed to lower the partial pressure of a solvent.

HEAT TRANSFER MEDIUMS:

With two-zone temperature processing in a single shaft, it is possible to employ counter-current or concurrent flows in a parallel-series system for the heat-transfer medium and process mass. A complete spectrum of heat transfer mediums -- from 700°F hot oil to steam, hot or cold water or a special medium -- may be used.

The Bethlehem Porcupine ® Processor

The Bethlehem Porcupine ® Processor

For drying, cooling, heating, sterilizing, reacting or low-temperature calcining.
Cylindrical, recycle or "U"-trough.
Utilizes a unique hollow cut-flight agitator.
Shortens heat transfer path.
Provides "folding action" within the process mass.

Material of Construction:

Stainless steel, carbon steel, nickel, titanium, sanitary finish, custom alloy.

Applications:

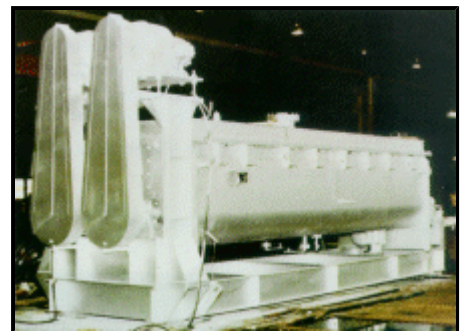
Chemical, petrochemical, mining/metallurgical, bulk food, non-metallic minerals, pharmaceuticals.

Options:

Single or dual shaft.
Choice of heat transfer media - Water, Steam, heat transfer oil or brine.
Continuous or batch operation.
Vapor Recovery System.
Fixed, hydraulic or variable speed drives.

Advantages:

High heat transfer - up to 700°F:
Up to 4 temperature zones in one unit.



Capacity:

100 LB/hr to 80,000 LB/hr

80F to 700F

Services:

Full service laboratory available.

Pilot units available to test at your facility.

Sale, lease purchase, rental fleet available.

Benefits of Porcupine Dryer Vs. Rotary Vacuum Dryer:

Increased heat transfer efficiency.

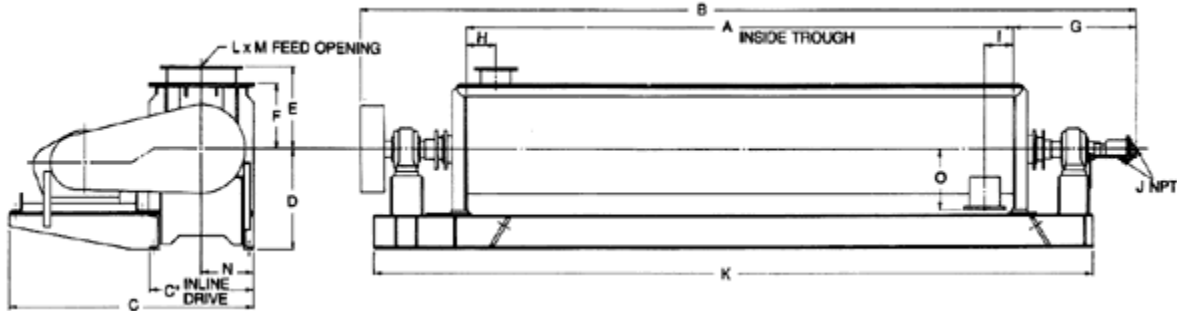
Increased mixing intensity.

Hardfacing available.

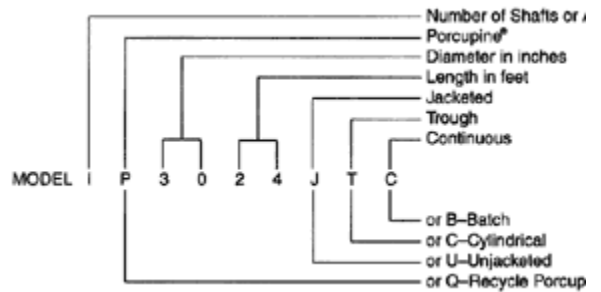
Cleaning capabilities.

The Porcupine Processor -- Sizing Parameters

**Sizing Parameters
Bethlehem Porcupine® Processor**



KEY TO MODEL DESIGNATION



STANDARD PORCUPINE PROCESSORS AVAILABLE

Agitator Dia. (in.)	Agitator Length (Ft.)	Heat Transfer Surface Area (Ft ²)		Working Volume (Ft ³)	Dimensions (Inches except as noted)														Empty Weight (lbs.)
		Agitator	Total		Total	B	C	D	E	F	G	H	I	J	K	L	M	N	
12	8	35.0	55.1	5.2	15'-2"	24	20	17	13	31	6	6	1	161	10	10	12	13	5,100
12	12	55.0	86.3	8.0	19'-2"	24	20	17	13	31	6	6	1	209	10	10	12	13	5,500
18	12	89.1	133.9	18.2	17'-9"	74	28	24	20	39	7	6.5	1.5	192	9	11	16	17	8,800
18	16	121.5	182.7	24.8	21'-9"	74	28	24	20	39	7	6.5	1.5	240	9	11	16	17	9,400
30	14	191.8	263.8	53.5	20'-7"	85	34	28	22	42	8	10	1.5	227	10	10	21	21	18,000
30	18	246.6	340.6	68.8	24'-7"	85	34	28	22	42	8	10	1.5	275	10	10	21	21	19,200
42	14	336.0	446.0	123.2	21'-6"	111	44	37	31	48	9	12	2	232	13	36	27	31	31,400
42	20	480.0	640.0	176.0	27'-6"	111	44	37	31	48	9	12	2	304	13	36	27	31	36,800
54	20	736.0	942.0	302.0	28'-1"	117	50	45	39	52	9.5	13	2.5	307	14	48	33	37	48,000
54	24	883.0	1132.0	362.4	32'-1"	117	50	45	39	52	9.5	13	2.5	355	14	48	33	37	52,600
66	20	994.0	1243.0	452.0	28'-9"	123	64	53	47	57	10	14	3	310	14	59	39	40	66,000
66	24	1198.0	1494.0	542.4	32'-9"	123	64	53	47	57	10	14	3	358	14	59	39	40	74,000

TRANSFER OF LATENT HEAT

Type Material	Solvent	Moisture Range		"U" (Btu./Hr./Ft ² /°F)
		Original	Final	
Inorganics				
Metallic Gel	Water	92.5	23	75
Metallic Powder	Water	6	0.01	110
Dolomite	Water	21	1	100
Metal Oxide	Water	30	1	150
Organics				
Pigments	Water	50	1	30
Fungicide	Water	55	1	20
Herbicide	Water	29	8.0	80
Acid	Acetic Acid	15	15	13
Sludge	Water	80		35
Plastics				
Polyethylene	Hydrocarbon	9	0.2	18
Polypropylene	Hydrocarbon	2	0.4	13
Polypropylene	Hydrocarbon	30	3	23
Polycarbonate	Benzene	90	2	10

TRANSFER OF SENSIBLE HEAT

Type Material	Bulk Density Lb./Cu./Ft.	Thermal Conductivity	"U" (Btu./Hr./Ft ² /°F)		Examples
			Cooling	Heating	
Inorganics					
	100	Good	52	59	Cement
	50	Good	20	39	Lime
	55	Good	10	28	Gypsum
	85-100	Good	60	70	Sand
	20	Poor	20	-	Activated Carbon
Organics					
	40-60	Poor	28	30	Coal Dust
	25-40	Fair	35	39	Flour

	5-10	Poor	10	10	Sawdust
	60-90	Good	48	55	Sugar
Plastics	31	Poor	19	20	Polypropylene
	47	Poor	12	12	Polyester Pellets
	23	Poor	18	18	Polyethylene