union PROCESS®

LABORATORY GRINDING MILLS

ATTRITOR®

Union Process Research And Laboratory Attritors Produce Fine And Homogeneous Dispersions Quickly And Repeatedly Under Scientific Conditions.

History

From a revolutionary idea proposed and developed by Dr. Andrew Szegvari in 1945, Attritor technology grew to become the basis for Union Process, Inc., an independent, family owned American company founded in Akron, Ohio. Today, Attritors are considered to be the most efficient grinding/dispersing systems and are used in scores of industries and research laboratories worldwide.

How Attritors Work

The Attritor is often referred to generically as a "stirred ball mill." The operation of an Attritor is simple and effective. The material to be ground is placed in a stationary tank with the grinding media. Carbon steel, stainless steel, chrome steel, tungsten carbide and ceramic balls are commonly used media. The material and media are then agitated by a shaft with arms, rotating at high speed. This causes the media to exert both shearing and impact forces on the material. The final result of this remarkably efficient process is an extremely fine material, measured in microns or fractions of microns, distributed on a very narrow curve. The laboratory Attritor works up to ten times faster than the conventional ball, pebble or jar mill. Its compact, vertical profile requires minimal space. No premixing is necessary. Adding ingredients (or taking samples) can be done at any time during the grinding.

Why A Laboratory Attritor?

Union Process customers know from experience that the Attritor is one of the most versatile pieces of equipment in their lab. It can be equipped or retrofitted easily and inexpensively with a wide variety of components and accessories. With the Attritor, users can choose wet or dry grinding, introduce inert atmospheres, operate at controlled temperatures, vary grinding speed, overcome product contamination, change media size and type, and get precise energy consumption information, all on the same machine. Results are repeatable from one test grind to another for maximum credibility. Finally, the Attritor is ideal for formulating, quality control, and scale-up studies.

Advantages Of Using A Laboratory Attritor

- Fast and efficient grinding
- Numerous options
- Flexibility
- Repeatability
- Scale-up capability
- No premixing
- Easy operation
- Low maintenance

Common Applications

- High tech ceramics
- Paints, toners, inks
- Pigments
- Tungsten carbides
- DSM (mechanical alloying)
- Food products
- Chocolate, confectionery
- Pharmaceuticals
- Chemicals
- Ferrites
- Fibers
- Paper coatings
- Metal powders
- Metal oxides
- Glasses
- Glazes
- Minerals, coal
- Agricultural flowables

On Cover: *1-S Attritor with variable frequency drive and 3 HP motor.*

Union Process Offers A Broad Line of Laboratory Mills For Virtually Any Grinding and Dispersion Application

WET OR DRY GRINDING BATCH LABORATORY MILLS

Uses Media .2 to 10mm

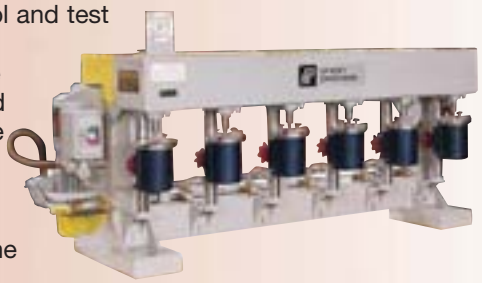
01 Series

See a complete description of the 01 Research Attritor and Accessories on pages 4-5.

Multi-Tank 01-HD Lab Attritor System

The Multi-Tank 01-HD Lab Attritor System is the ultimate set-up for quality control and test grinding requirements.

- All tanks (expandable from 2 to 6) controlled by ONE power source
- A timing belt assures that all connected Attritor shafts run at the same speed for the same period of time.



Choose standard stainless steel or a metal-free system with all tanks constructed from alumina, zirconia, or Tefzel®.

1-S Series

See a complete description of the 1-S Laboratory Attritor and Accessories on pages 6-7.

OTHER APPLICATION-SPECIFIC LABORATORY MILLS

Uses Media .3 to 1mm

DMQ-07 Wet Grinding (Continuous or Circulation)

Lab mill features Delta discs to eliminate shaft whip and mill vibration and provide greater random media motion for improved efficiency. Discs are indexed for directed, uniform media distribution.

Uses Media .2 to 1mm

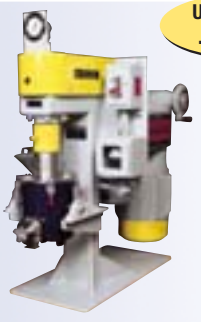
QC-100 Wet Grinding (Circulation)

Lab circulation mill for ultra-fine grinding. New, patented concept. Capacity 3 to 5 liters. Metal-free available. Scalable up to larger models.

Uses Media .5 to 3mm

HSA-1 Dry Grinding (Continuous)

A high speed lab Attritor typically used in the continuous mode for fine dry grinding applications. Discharge is through a side screen and valve. For special applications, a ceramic-lined tank is available.



Uses Media 3 to 6mm

Q-2 Wet Grinding (Circulation)

This mill is a lab version of the Union Process Circulation Attritor ("Q" machines). The mill comes complete with variable speed drive motor, tachometer, and a 5- or 10-gallon stainless steel jacketed holding tank with anchor stirrer and high speed stirrer. Metal-free systems are also available.

Uses Media 3 to 6mm

C-3 Wet Grinding (Continuous)

This vertical mill (with no shaft seals) is a lab version of the Union Process Continuous Attritor ("C" machines). It is ideal for continuous and fast grinding of large quantities of material. The C-3 can be used to reliably test and scale-up to production size continuous Attritors.

01 SERIES

RESEARCH ATTRITOR

The 01 Series Attritors offer users great flexibility as all models share the same column and interchangeable tank design. All models have water cooled jackets for cooling (or heating) and quick water disconnects for removing the tank. These mills are great research tools for formulating, testing, feasibility studies, quality control, and basic research when quantities are small. Results are repeatable. 01 Series Attritors are easy to clean and require no shaft seals.

The 01-HD and 01 Models are designed for media from 1/8" to 1/4". They have shafts with arms and run at rpms from 100 to 650 and can be used for wet or dry grinding.

The Model 01-HDDM is designed for small media ranging from .25mm (or smaller) to 2mm. These models have shafts with special UP Delta Discs (similar to those used on the Union Process DELTAMILL™) and run at rpms of 1000 to 4200. The 01-HDDM features a special one-piece cover with charging port and slurry deflection device. This mill is recommended for wet grinding only.

MODEL 01

The Model 01 is the most basic model in the 01 Series. It comes with a light duty frame, 110 volt AC motor with variable electronic speed, and no rpm reading. **A Model 01 cannot be made explosion-proof.**

MODEL 01-HD/01-HDDM

A special 01-HD/01-HDDM combination system is available. In minutes, the RPM of the shaft can be changed from slower 01-HD mode to higher 01-HDDM mode and vice versa. Simply release the belt guard (equipped with quick disconnects), move the belt to an alternative set of pulleys and replace the guard. The appropriate coupling, shaft and cover also must be changed. This system is available with either drive.

CHOICE OF TWO DRIVE SYSTEMS

All 01-HD and 01-HDDM Models are available with either of the following two drives:

1. An explosion-proof mechanical variable speed drive system with tachometer.
2. A non-explosion-proof electronic variable frequency drive system. LCD display will be programmed to show agitator RPM, motor AMPS, and motor HP being used. This can be made explosion-proof if the drive controls can be installed in a safe area away from the machine. On the machine is a mechanical tachometer and an operator station with an ON/OFF button and speed potentiometer. An optional explosion-proof readout of motor horsepower is available.

01-HD ATTRITOR
with 750 cc tank and electronic control

01 SERIES MODELS	01-HD *mechanical*	01-HD *electronic*	01	01-HDDM *mechanical*	01-HDDM *electronic*
Tank Capacity (cc)	750 or 1400	750 or 1400	750 or 1400	750 or 1400	750 or 1400
Working Capacity (cc)	250 or 500	250 or 500	250 or 500	150 or 300	150 or 300
Media Volume (cc)	380 or 760	380 or 760	380 or 760	280 or 560	280 or 560
HP	1/4	1/2	1/4	1/2	1/2
Voltage**	208/230/460 3 phase*	208/230/460 3 phase*	110 volt	208/230/460 3 phase*	208/230/460 3 phase*
Variable Drive System	mechanical	electronic	electronic	mechanical	electronic
Explosion-Proof Motor	yes	optional	no	yes	optional
Height (in./mm)	37/940	33/838	37/940	37/940	33/838
Bench Space (in./mm)	17x36/432x914	21x27/533x686	12x21/305x533	17x38/432x965	21x27/533x686
Weight (lbs./kg)	240/109	220/100	80/36	250/113	220/100

Dimensions and weights are approximate.
**On special order, a 110/220 single phase motor may be ordered.*
***60 Hz standard. 50 Hz/380 V, 3 phase available.*

Model 01 Attritor
with simplified electronic variable speed drive and 1400 cc tank.

Model 01-HD Attritor
explosion-proof with mechanical variable speed drive and tachometer.

Model 01-HD Attritor
variable frequency drive, with LCD display programmed to show agitator RPM, motor AMPS, and motor HP being used.

Model 01-HD/01-HDDM
variable frequency drive with LCD display programmed to show agitator RPM, motor AMPS, and motor HP being used.

01 Series Accessories

Many accessories are available for the 01 Series. With the basic mill, one can equip it for metal-free grinding. Note, the same tanks can be used for the 01/01-HD or the 01-HDDM modes. The 01/01-HD series can be equipped for grinding under inert gases and for cryogenic grinding. The special covers fit all tank sizes (110cc, 750cc, and 1400cc). Most parts are interchangeable. Each size tank does need its own shaft and arms, but arm lengths do vary depending upon the size of media being used. There is also a special cooling water jacket and tank with a valve at the bottom so one can discharge the slurry and even hook-up a small pump for circulation.

Please see the list below of all accessories available.

Complete assemblies are available for metal-free grinding. Cover seals available for grinding under inert gases.

A. 1400 cc silicon carbide grinding tank
B. 1400 cc silicon nitride grinding tank
C. 750 cc zirconium oxide grinding tank
D. 750 cc alumina grinding tank
E. 750 cc Tefzel®-coated grinding tank
F. 110 cc Tefzel®-coated grinding tank
G. Stainless steel cover with shaft seal for grinding under inert gas
H. 1400 cc zirconium oxide shaft/arms
I. 750 cc plastic-sleeved shaft/zirconium oxide arms
J. 750 cc plastic-sleeved shaft/tungsten carbide arms
K. 110 cc plastic-sleeved shaft/plastic arms
L. 750 cc shaft with plastic spacers and zirconium oxide discs for 01-HDDM
M. 1400 cc shaft with plastic spacers and discs for 01-HDDM
N. Adapter for quick change of 110 cc tanks
O. Side discharge valve and optional bottom plug valve for 01-HDDM

COMPLETE LIST OF ACCESSORIES

NOTE: Options that carry an "A" designation refer to Models 01 and 01-HD ONLY
NOTE: Options that carry a "B" designation refer to Model 01-HDDM ONLY

Tank Options (A) (B):

▪ Stainless steel	110 cc*, 750 cc, 1400 cc
▪ Tefzel®-coated stainless steel	110 cc*, 750 cc, 1400 cc
▪ Polyethylene	110 cc*, 750 cc, 1400 cc
▪ Alumina	750 cc, 1400 cc
▪ Zirconium oxide	750 cc, 1400 cc
▪ Silicon nitride	750 cc, 1400 cc
▪ Silicon carbide	750 cc, 1400 cc

**Available in "A" only.*

Agitator Arms (A):

The following arms can be installed in either stainless steel, plastic coated, or zirconium oxide shafts:

- Colmonoy®*
- Plastic coated, steel reinforced*
- Silicon nitride
- Stainless steel
- Tungsten carbide
- Zirconium oxide*

**Available for 110 cc tanks.*

Agitator Disks (B):

- Hardened tool steel
- Hardened stainless steel
- Plastic
- Zirconium oxide

Covers (A):

- 2-piece aluminum, stainless steel or plastic
- 1-piece stainless steel with simplified, mechanical shaft seal with gas inlet, outlet and charging port
- 1-piece stainless steel with Teflon floating seal, charging port, and vent for grinding in liquid nitrogen (cryogenic grinding)

Discharge Valves:

- (A) Cooling water jacket with bottom discharge valve-requires special tank with openings
- (B) Cooling water jacket with side discharge valve and optional bottom plug valve-for stainless steel tanks only

Special (A):

- Adapter for quick change of 110 cc tanks (polyurethane or stainless steel)

Pumps For Circulation (A) (B):

- Air driven, explosion-proof
- 110V, 1/4 HP, variable speed
- 110V, 1/4 HP, variable speed, explosion-proof

1-S SERIES

LABORATORY ATTRITOR

MODELS 1-S, 1-SC and 1-SD

The 1-S Batch Attritor is a versatile, reliable, rugged laboratory-size machine designed to meet virtually all lab grinding and dispersing needs—either wet or dry. It allows easy and precise scale-up to production size equipment with reproducible results from batch to batch. It is also suitable for small production or pilot plant work.

The 1-S also is available in two additional configurations for specific applications.

- 1-SC — designed for use with tungsten carbide media and supplied with tungsten carbide arm sleeves.
- 1-SD — equipped for dry grinding, includes a metering valve or ball valve and stainless steel cover with floating brush seal for dust control. For continuous operation, disks are added to the shaft.

The Models 1-S, 1-SC, and 1-SD are designed for media ranging from 1/8" to 3/8" and run at rpms of 100 to 500. All share the following features:

- Variable shaft rpm.
- Adjustable agitator shaft height to accommodate different size grinding media.
- Bottom discharge grid with valve for easy sampling and discharge.
- Tank slides forward and tips 90° for media discharge and fast cleaning.
- Jacketed for cooling (or heating).
- Quick disconnects for cooling water.

MODEL 1-SDM

The Model 1-SDM is designed for grinding media ranging from 0.25mm to 2mm. The 1-SDM has a shaft with special UP Delta Discs and runs at rpms of 300 to 2000. It has its own frame, and its tanks are not interchangeable with 1-S, 1-SC or 1-SD models. It has a side discharge screen and valve, and the tank tilts for ease of cleaning. The 1-SDM comes with a special stainless steel one-piece cover with charging port. It does not require a shaft seal.

The Model 1-SDM is available with either a stainless steel, alumina- or zirconium-lined tank. Agitator disks are available in tool steel, stainless steel, plastic or zirconium oxide.

1-S ATTRITOR
with electronic variable speed drive and optional cover seal

CHOICE OF TWO DRIVE SYSTEMS

All models in the 1-S Series are available with either of the following two drives:

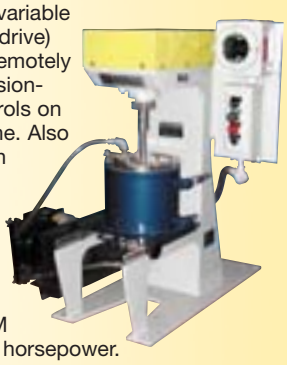
1. An explosion-proof mechanical variable speed drive system with tachometer.
2. A non-explosion-proof electronic variable frequency drive system. LCD display will be programmed to show agitator RPM, motor AMPS, and motor HP being used. This can be made explosion proof if the drive controls can be installed in a safe area away from the machine. On the machine is a mechanical tachometer and an operator station with an ON/OFF button and speed potentiometer. An optional explosion-proof readout of motor horsepower is available.

1-S SERIES MODELS	1-S/1-SC/1-SD *mechanical*		1-S/1-SC/1-SD *electronic*		1-SDM *mechanical*	1-SDM *electronic*
Tank Capacity (gal./liters)	1.5/5.7	2.5/9.5	1.5/5.7	2.5/9.5	2.9/11.0	2.9/11.0
Working Capacity (gal./liters)	0.8/3.0	1.1/4.2	0.8/3.0	1.1/4.2	0.8/3.0	0.8/3.0
Media Volume (gal./liters)	1.0/3.8	1.5/5.7	1.0/3.8	1.5/5.7	1.25/4.7	1.25/4.7
HP-standard use	2	2	3	3	5	5
HP-(SC) for tungsten carbide media	2	3	3	5	—	—
HP-(SD) for dry grinding	2	3	3	5	—	—
HP-(SD) for mechanical alloying	3	5	5	5	—	—
Voltage*	230/460v 3 phase	230/460v 3 phase	230/460v 3 phase	230/460v 3 phase	230/460v 3 phase	230/460v 3 phase
Height (in./mm)	47/1194	47/1194	41/1041	41/1041	60/1524	60/1524
Bench Space (in./mm)	28x50/711x1270	28x50/711x1270	24x40/610x1016	26x44/660x1118	29x52/737x1321	29x46/737x1168
Weight (lbs./kg)	750/340	850/386	600/272	650/295	1600/726	1400/635

Dimensions and weights are approximate.
**60 Hz standard. 50 Hz/380 V, 3 phase available.*

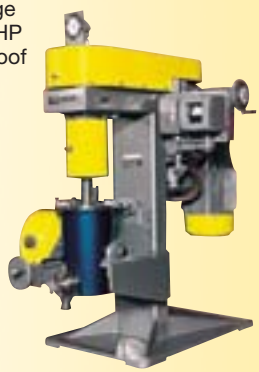
Model 1-SD Attritor
with feeder system and ammeter—explosion-proof.

Model 1-S
with VFD (variable frequency drive) mounted remotely with explosion-proof controls on the machine. Also shown with electrically driven pump for circulation. Optional readout of motor RPM and motor horsepower.



Model 1-S
with variable frequency drive, sealed cover and CE marked for Europe.

Model 1-SDM Attritor
with discharge valve and 5 HP explosion-proof mechanical variable speed drive motor.



1-S Series Accessories

Many accessories are available for the 1-S. With the basic mill, one can equip it for metal-free grinding, for grinding under inert gases, and for cryogenic grinding. Most parts are interchangeable. Each size tank has its own arm sizes but the 1 gallon, 1-1/2 gallon and 2-1/2 gallon tanks share the same shaft size. For all covers, one size fits the 1-1/2 gallon and 2-1/2 gallon, and one size fits the 1/2 gallon and 1 gallon. Bar grids are interchangeable for tanks made from the same material. One size bar grid fits the 1-1/2 and 2-1/2 gallon tanks, and another size bar grid fits the 1/2 and 1 gallon tanks. A pump is available to duplicate the circulation process in the production-based Attritor.

There is also an adapter available to allow the use of the 01-HD series tank sizes on the 1-S. There is also a special top assembly available to convert the 1-S to a circulation type Q system. A special jacket design to ASME pressure vessel code is available. Normal pressure rating of jacket is 10 psig.

Please see the list below of all accessories available.

Complete assemblies are available for metal-free grinding. Cover seals available for grinding under inert gases.

A. Tungsten carbide-sleeved arm
B. Zirconium oxide-sleeved arm
C. Plastic-sleeved arm
D. Polyurethane-sleeved arm
E. Stainless steel cover with shaft seal for grinding under inert gas
F. Stainless steel discharge grid with 1/32" openings
G. Plastic discharge grid
H. Stainless steel discharge grid with 1/8" openings
I. Plastic-sleeved shaft/zirconium oxide arms
J. 1-1/2 gal. stainless steel tank with stationary arms
K. Stainless steel sample vessel for discharging under inert gas

COMPLETE LIST OF ACCESSORIES

Tank Options
- Stainless steel – 1/2 gal., 1 gal., 1-1/2 gal., 2-1/2 gal.
- Stainless steel with stationary arms – 1-1/2 gal., 2-1/2 gal.
- Alumina-lined - .4 gal., 8 gal., 1.1 gal. and 1-1/2 gal.
- Zirconium oxide-lined - .4 gal., 8 gal., 1.1 gal. and 1-1/2 gal.
- Silicon carbide-lined – 1-1/2 gal.
- Silicon nitride-lined – 1-1/2 gal.
- Rubber-lined – 1/2 gal., 1 gal., 1-1/2 gal., 2-1/2 gal.
- Tefzel®-lined - 1/2 gal., 1 gal., 1-1/2 gal., 2-1/2 gal.
- Polyurethane-lined – 1/2 gal., 1 gal., 1-1/2 gal., 2-1/2 gal.

Working capacity for 1/2 gal. tank is 1 quart.
Working capacity for 1 gal. tank is 1/2 gal.

Agitator Arms:
Following arms can be installed in either stainless steel or plastic-coated agitator shafts:
- Tool steel (hardened)
- Stainless steel (440C)
- Colmonoy®-faced stainless steel
- Plastic sleeved, steel reinforced
- Transformation toughened alumina sleeved
- Polyurethane coated
- Silicon nitride sleeved
- Tungsten carbide sleeved
- Zirconium oxide sleeved
- Specially configured "L" arms available in stainless and tool steel
- Special bottom-lifter arms

Covers:
- 2-piece aluminum, stainless steel or plastic
- 1-piece stainless steel with simplified mechanical shaft seal, with gas inlet, outlet and changing port
- 1-piece stainless steel with floating Teflon or brush seal and charging port
- 1-piece stainless steel with floating seal, charging port, and vent for grinding in liquid nitrogen (cryogenic grinding)

Bottom Valves:
- Stainless steel ball valve (standard)
- Dry grind metering valve (cannot seal for inert gas use) (standard for dry grind)

Discharge Grids:
- Hardened tool steel
- Stainless steel
- Plastic
- Zirconium oxide
- Tungsten carbide-faced stainless steel

Grids come with a choice of the following openings: 1/8", 3/32", 1/16", 1/32" or 1 mm, .5 mm or .4 mm

Special:
- Stainless steel sample vessel for discharge under inert gases complete with site glasses
- Adapter for 1-S to hold 01-HD 750 cc or 1400 cc tanks (includes shaft reducer to enable standard 01-HD shafts to fit 1-S coupling)
- Special top assembly to convert to a Circulation ("Q") Attritor

Pumps For Circulation: Same as 01 SERIES

The Union Process Advantage

From years of experience in designing and building thousands of Attritors for use all over the world, Union Process people have developed the "know-how" to custom-design the Attritor to specifically meet your requirement — whether in the lab or in the field. Union Process maintains a very well equipped laboratory and pilot plant to simulate actual production conditions. Skilled technical service representatives are always available for consultation. When required, a representative will visit the customer's facility.

Experience. Technical "know-how." Service after the sale. That's the Union Process advantage. At Union Process, customer satisfaction is our number one goal.

Grinding Media

Union Process carries a full line of the highest quality grinding media available to meet your particular needs.

Laboratory Testing Facilities

Part of the wet grinding lab with 01-HD and 1-S Attritors

Union Process maintains a complete laboratory with all the machines described on page 3 for testing customers' materials. In addition, its pilot plant facilities contain mid-size and full-size production machines for customers to conduct scale-up studies or make test product. Particle size is determined through a laser defraction instrument, surface area analyzer, x-ray sedigraph, and Fisher Subsieve, as well as the usual grind gauges, sieve tests and microscope.

Contact Union Process for more information on our Wet and Dry Grinding Production Attritors and Small Media Mills.

Dry Grinding Production Attritors

Continuous Attritors

Wet Grinding Production Attritors

Circulation Attritors

SDM Series Small Media Mill

DMQ-MILL™ Small Media Mill

1925 Akron-Peninsula Road, Akron, Ohio 44313-4896
Phone: (330) 929-3333 • Fax: (330) 929-3034
E-mail: unionprocess@unionprocess.com
www.unionprocess.com

Form No. 905-5M