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Bead beater homogenizers Ultrasonic Homogenizer

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Suitable and Unsuitable depends on the type of sample or extractions being crushed. Consider before purchasing.

Selection guide

Constant temperature incubator shaker
CO₂ incubator shaker

Shaker
Mixer
Rotator
Stirrer

Bead beater homogenizers
Ultrasonic homogenizer

Aluminum block bath
Minimize bath

Water bath
Shaking water bath
Immersion cooler

Hybridization oven
Constant temperature chamber

Centrifugal concentrator
Cold trap

Freeze dryer
Electrophoresis and blotting apparatus

Constant temperature water circulating system [Chiller]

Appendix

Appendix

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Bead beater homogenizers

**Beads crusher
μT-01N**



**Beads crusher
μT-01**



**Beads crusher
μT-12**



Powerful Bead Crushing without freezing various biological samples in Microtubes.

Page	Model	Suitable sample shapes and Throughput
P.086	μT-01N	·Solid (with/without buffer) 0.1 - 0.2g/2mL Microtubex1
	μT-01	
P.087	μT-12	·Solid (with/without buffer) 0.1 - 0.2g/2mL Microtubex12 または0.2 - 1g/5mLtubex2

Powerful Crushing simultaneously 48 samples frozen with liquid nitrogen. Rigid samples, Proteins weak to heat denaturation, RNA, etc. Optimum for Extraction.

Page	Model	Suitable sample shapes and Throughput
P.090	μT-48	·Solid (Liquid nitrogen freezing) 0.1 - 0.2g/2mL Microtube × Max. 48 1 - 2g/Stainless steel-made strong crushing vessel × 4

Frozen sample crusher

**Freeze Crusher
μT-48**



Multipurpose spin down mixer

**Bug Crasher
GM-01**



Double Role for Vortex and Spin down. Also simple crushing using beads and Metal crushers. Very Reasonable for samples known hardness.

Page	Model	Suitable sample shapes and Throughput
P.093	GM-01	·Solid (With buffer) 0.1 - 0.2g/2mL Microtubex12

Ultrasonic Homogenizer

**Ultrasonic Homogenizer
VP-050N**



**Ultrasonic Homogenizer
VP-300N**



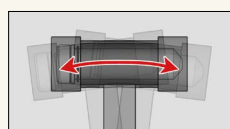
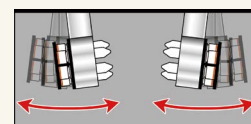
For Solubilization of cells expressed protein and Emulsification of samples. Also Random fragmentation of Genomic DNA. Automatic tuning and easy operation. Various Operation modes according to the condition of sample.

Page	Model	Suitable sample shapes and Throughput
P.094	VP-050N	·Liquid(suspension), 0.1 - 10mL
P.095	VP-300N	·Liquid(suspension) 10 - 250mL(standard) 0.1 - 500mL(use optional parts)

[Bead crushing by μ T Series]

Beads and Metal crushers collide by shaking and the samples crushed. The crushing effect depends on the strength and the number of collisions (also important using suitable size of beads).

All μ T Series are Horizontal shakers as shown in the figure below but rather μ T-01/01N make the number of collisions by increasing the shaking speed and μ T-12 makes the collision strength by increasing the amplitude. The former for microorganisms and the latter for tissue fragments. In the latter case, the advantage that heat generation due to friction relatively small (there is Tube holder with excellent cold insulating). Besides, as this series is strong crushing power, frozen crushing and crushing samples adding radical drug such as Phenol not recommended as consideration of the risk of breakage of tubes.

 μ T-01/01N μ T-12

Features	Applications	Crushing method	Shaking speed and width	Page
<ul style="list-style-type: none"> Outstanding stability even high speed shaking at 4600r/min. For one (1) sample 2mL Micro tube (Throughput 0.2g). With Speed memory (1 x Setting). 	<ul style="list-style-type: none"> Crushing of Microbes (bacteria, chlorella, yeast) and Insects. Crushing of Cells, Tissues and Organs of animals and plants. Crushing of Tablets and Resin pellets (with low viscosity). 	Crushing by strongly striking the sample with Beads or Metal crushers by shaking in loose arc (freezing and phenol not recommended).	<ul style="list-style-type: none"> 2000 - 4600r/min (Stepless setting) Shaking width: small 	P.086
<ul style="list-style-type: none"> Outstanding stability even high speed shaking at 4600r/min. For one (1) sample 2mL Micro tube (Throughput 0.2g). With Timer (6-step setting). 	<ul style="list-style-type: none"> Crushing of Microbes (bacteria, chlorella, yeast) and Insects. Crushing of Cells, Tissues and Organs of animals and plants. Crushing of Hair for analysis and Tablets etc. 		<ul style="list-style-type: none"> 2500 - 4600r/min (6-step setting) Shaking width: small 	
<ul style="list-style-type: none"> Powerful crushing with speed 3200r/min and large amplitude. Up to 12 tubes of 2mL Microtubes. 5mL can also be used. The throughput are 0.2g/2mL and 1g/5mL Microtubes. 			<ul style="list-style-type: none"> 1800 - 3200r/min (8-step setting) Shaking width: large 	P.087

[Frozen Crushing with μ T-48]

Put Metal crushers and sample in the tube and freeze the whole holder with liquid nitrogen and set it in this product and crush it quickly before it is melted. Unlike μ T-01 series and μ T-12, teeth and bones and inanimate samples such as rubber can be crushed with strong crush force by vertical longitudinal shaking with vibration and quietness slightly sacrificed and the embrittlement of freezing (recommended to use a strong stainless steel crushing vessel when crushing these rigid samples). Frozen crushing also effective in suppressing sample decomposition and denaturation by frictional heat.

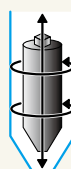


Freeze the whole holder with excellent cold insulating with liquid nitrogen

Features	Applications	Crushing method	Shaking speed and width	Page
<ul style="list-style-type: none"> Crushing of frozen sample in a vessel with liquid nitrogen 2mL Microtube or Dedicated metal container are used The throughput is 0.2g to 2g (Depends on the vessels) 	<ul style="list-style-type: none"> Crushing of Yeast, Mold, Tissue piece of animals and plants Crushing of bones, teeth and limbs of small animals Drying plants or Crushing frozen leaves and petals Crushing of Wire covering and Plastics, Asbestos sample etc. 	Crashing the frozen sample by colliding it to Metal crushers with vertical shaking.	<ul style="list-style-type: none"> 0 - 2500r/min Vertically reciprocal shaking. 	P.090

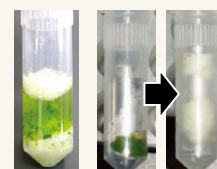
[Bead Crushing with GM-01]

When the sample put in the tube with Beads or Metal crushers and stirred with this product they will rub against each other to produce a grinding (or extrusion of the contents) effect. Soft tissue such as Arabidopsis leaves can be crushed mildly. Freezing is effective for RNA. Not suitable for Crushing Rigid samples or Animal tissue (μ T-01, μ T-12 or μ T-48 recommended).



← Motion of Vessel holder part and Metal crusher

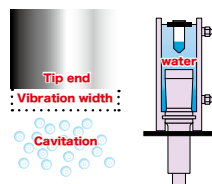
Leaves frozen by liquid nitrogen → Broccoli flower buds did not completely crushed with Zirconia beads but at least the pigment extracted.



Features	Applications	Crushing method	Stirring force and Centrifugal force.	Page
<ul style="list-style-type: none"> 2-in-1 Bench-top equipment to handle Stirring and Spin down Capacity: 12pcs x 1.5/2 mL Micro tube Possible for Beads crushing of E. coli and soft samples. 	<ul style="list-style-type: none"> Crushing of Microbe (nearly same hardness as E. coli and Blue-green algae) Drying plants or Crushing frozen leaves and petals Spin down in Ethanol precipitation of DNA 	Crushed by strongly mixing the sample and beads by High-speed reverse agitation. The grinding effect when Metal crushers. Possible for Freeze crushing.	<ul style="list-style-type: none"> Stirring force : 10 steps (Level 1 to A) (Effective of Level is equivalent to that of Delta Mixer at 2600r/min.) Centrifugal force: 500 - 4500r/min (Max. 1300 x g) 	P.093

[Ultrasonic crushing with VP Series]

When the tip of chip vibrates in the liquid this vibration is transmitted through the liquid in the form of compression waves due to the repetition of pressure difference and innumerable bubbles are generated that are nucleus of gas and particles. These bubbles are generated under low pressure and collapsed under high pressure (called Cavitation) but during collapse they impact and fracture surrounding particles from all directions. "Ultrasonic-type Homogenizer" generates this cavitation efficiently and uses that for Crushing etc. In principle Ultrasonic Crushing can be used on only objects that are present in liquid phase or through the moisture.



In Cup horn (left figure), Shock waves generated by cavitation crush the sample inside vessel by being transmitted. Although the crushing power lower than when chips brought into direct contact the advantage that they can be broken noncontactly.

Features	Applications	Crushing method	Transducer normal output and Oscillation frequency	Page
<ul style="list-style-type: none"> Handy type for small volume. The throughput is 0.1 to 10mL. Easy tuning completed in about 5 seconds. Auto power operation to adjust output automatically during use. 	<ul style="list-style-type: none"> Disruption and Solubilization of E. coli that protein expressed. Random fragmentation of Genomic DNA. Homogenization and Emulsification of samples. 	Crushing or Homogenization due to cavitation generated by immersing the vibrator (chip of tip) in liquid sample.	<ul style="list-style-type: none"> 10 - 40W 19.5 - 20.5kHz 	P.094
<ul style="list-style-type: none"> High output type using with stand. Standard throughput is 10mL to 250mL. Easy tuning completed in about 5 seconds. Oscillation function and various operation modes according to the tip used. 	<ul style="list-style-type: none"> Disruption and Solubilization of E. coli that protein expressed. Random fragmentation of Genomic DNA. Emulsification of samples. Non-contact sonication with Cup horn [option]. 		<ul style="list-style-type: none"> 50 - 200W 19 - 21kHz 	P.095

As nucleic acid is fragmented even in any disruption method, not suitable for extraction of genomic DNA.

Selection guide

Constant temperature incubator shaker
CO₂ incubator shaker

Shaker

Mixer
Rotator
Stirrer

Bead beater
homogenizer
Ultrasonic homogenizer

Aluminum block bath
Minimize bath

Water bath
Shaking water bath
Immersion cooler

Hybridization oven
Constant temperature chamber

Centrifugal concentrator
Cold trap

Freeze dryer

Electrophoresis and blotting apparatus

Constant temperature circulating water system [Chiller]

Appendix

Beads crusher μ T-01/01N

Strong crushing and High stability by High speed pendular swinging.
A model equipped with Shaking speed stepless setting and Memory function is newly lined up.

Microtubes that are used with Beads crushers --> P.088



Features

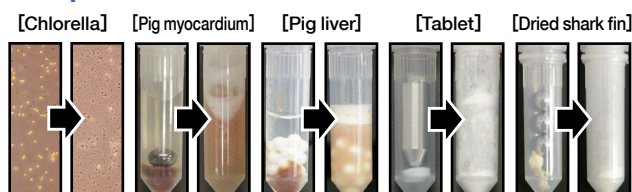
- Outstanding stability even high speed shaking at 4600r/min
- For one simple 2mL Micro tube (Throughput 0.2g)
- Stainless steel beads and Metal crusher can be used

Applications

- Crushing of Microbes (bacteria, chlorella, yeast) and Insects
- Crushing of Cells, Tissues and Organs of animals and plants
- Crushing of Tablets and Resin pellets (with low viscosity)

Examples

These are no more than a few examples.



Beads crushing method

This method is adapted to extract nucleic acids, proteins and residual substances from biological/environmental samples. Nucleic acids are often fragmented and basically served for PCR templates and not suitable for genome extraction. Used for human DNA identification, drug toxicological examination from human hair, seed quality examination, examination of BSE and Johne's disease, investigation of soil microflora etc. and also sample preparation for spectroscopic analysis for resin.

Model	μ T-01	μ T-01N
Crushing method	Crushing beads with pendular swing method.	
Shaking speed (*1)	2500 to 4600 r/min (6-step setting)	2000 to 4600 r/min (Stepless setting: per 100r/min)
Capacity	1pc x 1.5/2.0 mL Screw cap microtube (*2)	
Applicable beads	Nonmetal beads, Stainless steel beads, Metal crusher (*1) (*3)	
Ambient temperature	5°C to 35°C (No condensation)	
Speed memory	-	1 x Setting
Timer	6-step setting (5, 10, 15, 30, 45, 60 seconds)(*1)	-
Safety devices / functions	Braking when cover open during operation. Motor stopping when cover open, Motor overcurrent protection,	
Dimensions / Weight	175(W) x 280(D) x 160(H)mm, Approx. 5kg	
Power supply	AC100 to 240V/0.5A	

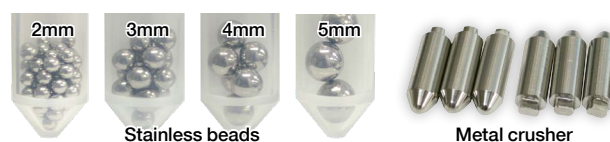
(*1) Set below 4000 r/min and 15 seconds when using Metal crusher.

(*2) Outer diameter below 11mm of the body of Microtubes can be used. Refer Recommended Microtubes on 88page.

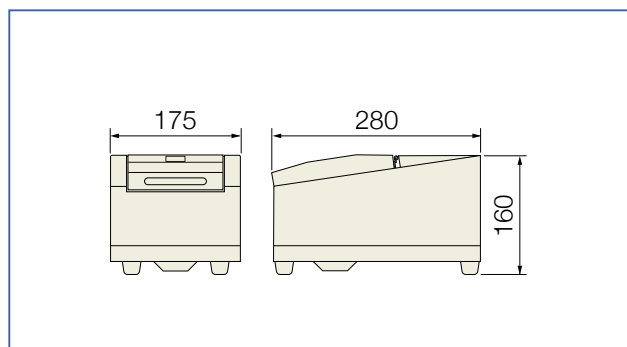
(*3) Stainless steel beads and Metal crusher are available as an option. Marketed Glass and Zirconia beads can be used.

(*4) An actual shaking speed might be slower than that of specs due to load.

Optional parts



Dimensions (μ T-01 and μ T-01N common)



Product Name/Model	Remarks
Stainless beads ϕ2mm	70g (approx. 2100pcs)
Stainless beads ϕ3mm	150g (approx. 1300pcs)
Stainless beads ϕ4mm	150g (approx. 560pcs)
Stainless beads ϕ5mm	150g (approx. 280pcs)
Mixed Stainless beads	ϕ 2pcs/20g, 3pcs/40g, 4pcs/40g, 5pcs/50g
Metal crusher	2mL Microtube (Conical bottom) 6pcs
Zirconia crusher	2mL Microtube (Conical bottom) 3pcs

*Stainless beads and Metal crusher are made of stainless steel

Beads crusher μ T-12

Strong crushing by High speed pendular swinging for various samples. 5mL tubes can be used. Suitable for Molecular biological applications. Low heat generation due to friction.

Microtubes that are used with Beads crushers --> P.088 The data of temperature of crushed samples with this unit --> P.091

Features

- Powerful crushing with speed 3200r/min and large amplitude.
- Up to 12 tubes of 2mL Microtubes. 5mL can also be used
- The throughput are 0.2g/2mL and 1g/5mL Microtubes

Applications

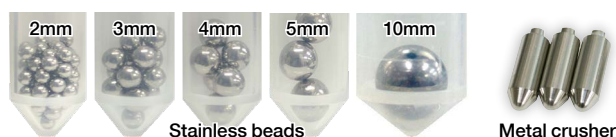
- Crushing of Microbes (bacteria, chlorella, yeast) and Insects
- Crushing of Cells, Tissues and Organs of animals and plants
- Crushing of Hair for analysis and Tablets etc.

Optional accessories: Microtube holders



Model	Product Name/Model
TH-0206	1.5/2.0mL Screw cap Microtube 6pcs-Holder
TH-0203	1.5/2.0mL Screw cap Microtube 3pcs-Holder for cold storage. The cold-keeping property of sample can be increased with keeping it in the refrigerator (The screw might be loosen at below -20°C. Be sure to not refrigerate directly the microtube at below 0°C).
TH-0501	5.0mL Screw cap Microtube 1pc-Holder "WATSON® Self-standing mailing microtube" (2332-15) recommended. Unsuitable for Eppendorf tubes.
TH-0501EP	5.0mL Screw cap Microtube Holder for Eppendorf

Optional parts



Product Name/Model	Remarks
Stainless beads ϕ 2mm	70g (approx. 2100pcs)
Stainless beads ϕ 3mm	150g (approx. 1300pcs)
Stainless beads ϕ 4mm	150g (approx. 560pcs)
Stainless beads ϕ 5mm	150g (approx. 280pcs)
Mixed Stainless beads	ϕ 2pcs/20g, 3pcs/40g, 4pcs/40g, 5pcs/50g
Stainless beads ϕ 10mm	150g (approx. 36pcs)(*)
Metal crusher	2mL Microtube (Conical bottom) 6pcs
Zirconia crusher	2mL Microtube (Conical bottom) 3pcs

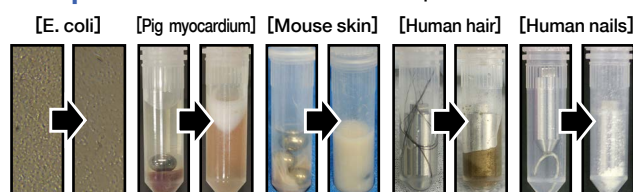
(*)For 5mL Microtubes •Stainless beads and Metal crusher are made of stainless steel



μ T-12 with Optional Microtube holders

Examples

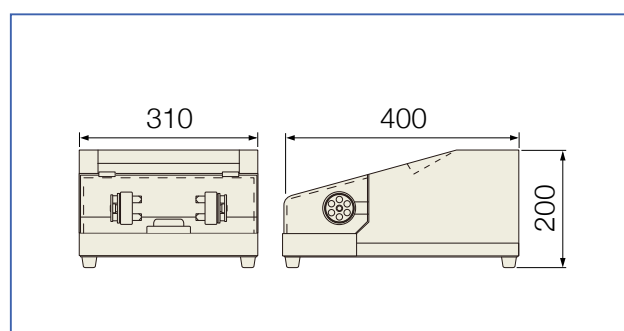
These are no more than a few examples.



Model	μ T-12
Crushing method	Crushing beads with pendular swing method.
Shaking speed	1800 to 3200 r/min (8-step setting) (*1)
Capacity	1.5/2.0 mL Screw cap microtube: Max. 12pcs (*2) 5.0mL Screw cap tube: Max. 2pcs (*3)
Applicable beads	Nonmetal beads, Stainless steel beads, Metal crusher (*4)
Ambient temperature	5°C to 35°C (No condensation)
Timer/Memory	1 to 300 seconds (Per 1 second setting. Up to 2 parameter setting can be memorized)
Safety devices/functions	Braking when cover open during operation, Motor overcurrent protection
Dimensions /Weight	310(W) x 400(D) x 200(H)mm, Approx. 15kg
Power supply	AC100 to 240V/4A

(*1) Set below 2500 r/min and within 30 seconds when using Metal crusher and 5mL Tubes.
(*2) Refer Recommended Microtubes on 88page. Maximum 12pcs when using Metal crusher.
(*3) "WATSON® Self-standing mailing microtube" (2332-15) recommended.
(*4) Stainless steel beads and Metal crusher are available as an option. Marketed Glass and Zirconia beads can be used.

Dimensions



Microtubes for Beads crushing

μ T-01/01N/12

Recommended tubes for large size Beads and Crashers in combination.

① WATSON(Japan) made 1392-200 for less than ϕ 3 mm beads (Crush of Bacteria and Yeast).

② Scientific Specialties (US) made 2641-0B for ϕ 4.5 mm beads or Metal crushers

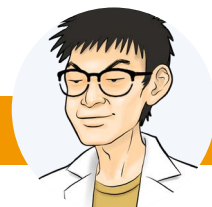
(Animals and Plants cell and Rigid samples).

* WATSON® 1392-200 could be used depending on some speed. See for details below.



[Useable Impact-resistant tubes] Shatter Resistant 2.0 mL Tube & Cap Scientific Specialties (US) made

Strength test of this impact-resistant tubes has resulted that they were not damaged even if they were shaken with ϕ 5 mm Stainless steel beads and Metal crushers in μ T-01/ μ T-12. (See following "Details for Scientific Specialties-made Microtubes"). In fact, this tube is slightly difficult to tell whether the sample can be crushed well due to its color white translucent so WATSON® 1392-200 is recommended if you prefer a tube with highly-visible inside. Please note WATSON® has speed limitation. (See following "Limitation on WATSON® 1392-200"). This tube is recommended with crushing of rigid tissue or plant seeds.



μ T-01/01N

Detail for Strength test of Scientific Specialties Inc.-made Impact-resistant tubes.

Above 5pcs each were tested under conditions of ϕ 5 mm Stainless steel beads, Shaking speed 4600 r/min, 60 seconds and No solvent.

ϕ 5 mm stainless steel beads	5	4	3	2	1
No solvent, 4600r/min, 60 seconds shaking	Barely passed	Passed	Passed	Passed	Passed

1 to 5 pcs of ϕ 5 mm stainless steel beads even without solvent were not damaged with shaking at the maximum speed.

Metal crusher can be used at "4000r/min with 15 seconds" as the limitations.

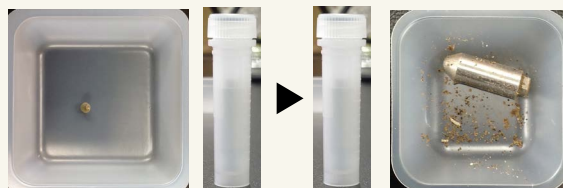
[Scientific Specialties Inc.-made tube: Crushing of Chicken breast meat 100mg]

ϕ 5 mm stainless steel beads x1, Half solvent, 4600r/min, Crushing for 30min



[Scientific Specialties Inc.-made tube: Crushing of 1pc of okra seed]

Metal crusher, No solvent 4000r/min, Crushing for 15min



μ T-12

Detail for Strength test of Scientific Specialties Inc.-made Impact-resistant tubes.

More than 10 tubes were tested under conditions 1pcs of ϕ 5 mm Stainless steel beads, shaking speed 3200r/min, 30 seconds and no solvent. Each tube was not damaged.

ϕ 5 mm stainless steel beads	1	Metal crusher	1
No solvent 3200r/min, 60 seconds shaking	Passed	No solvent 2500r/min, 30 seconds shaking	Passed

Data on the temperature of samples when crushing

μ T-01/01N

Limitation on WATSON 1392-200

Please note that in Watson 1392-200, there are limitations on the number and speed of beads when using ϕ 4.5 mm Stainless steel/Zirconia beads and/or Metal crushers. Even animal tissue such as poultry could be crushed sufficiently under the limitations.

WATSON 1392-200 is recommended if you prefer a tube with highly-visible inside to Scientific Specialties Inc.-made tube with impact resistant.

- Please note use only 1 pc of ϕ 4.5mm stainless steel/zirconia beads as using 2pcs or more of those make the tube broken.
- Crushing at below 3000 r/min when there is no solvent.
- The solvent fully filled up to the volume can be shaken at the max. speed 4600 r/min.

[ϕ 5 mm stainless steel beads \times 1, 60 sec]

r/min	4600	4200	3600	3000	2500
no solvent	Failed	Failed	Failed	Passed	Passed
Half volume of solvent	Failed	Passed	Passed		
Full volume of solvent	Passed				

[ϕ 5 mm zirconia beads \times 1, 60 sec]

r/min	4600	4200	3600	3000	2500
no solvent	Failed	Failed	Failed	Passed	Passed
Half volume of solvent	Passed				
Full volume of solvent	Passed				

[Metal crusher, 15sec]

r/min	4600	4200	3600	3000	2500
no solvent	Failed	Failed	Failed	Passed	Passed
Half volume of solvent	Passed				
Full volume of solvent	Passed				

AVAIL: No damage were found all of 10pcs or more tested N/A: When even 1pc out of 10pcs is damaged

μ T-12

- Please note use only 1 pc of ϕ 4.5mm stainless steel/zirconia beads as using 2pcs or more of those make the tube broken.
- Crushing at below 3000 r/min when there is no solvent.
- The solvent half filled up to the volume can be shaken at the max. speed 3200r/min.
- Use Metal crusher at below 2200r/min or less or with solvent.
- Use impact Impact-resistant tubes for rigid samples such as Seeds and Dry matter.

[ϕ 5 mm stainless steel beads \times 1,60 sec]

r/min	3200	3000	2800	2600
no solvent	Failed	Passed	Passed	Passed
Half volume of solvent	Passed	Passed		
Full volume of solvent	Passed			

AVAIL: No damage were found all of 10pcs or more tested
N/A: When even 1pc out of 10pcs is damaged

[WATSON 1392-200:Crushing of Chicken breast meat 100mg]

ϕ 5 mm stainless steel beads \times 1
Half solvent, 4200r/min, Crushing for 30seconds



μ T-12

Data on the heat generation of samples when crushing in μ T-12

In Crushing of samples with beads in μ T-12, we found that the sample temp did not rise even when the sample of RT were broken. The heat generation can be further reduced by pre-cooling the sample and/or the sample below RT can be kept with the holder for cold storage (TH-0203) after crashing it.

Vessels	Bead types and Shaking conditions	Temperature inside the vessels before shaking	Vessel temperature inside after shaking for each holder	
2.0mL Screw cap Microtube	ϕ 3mm zirconia \times 15 water 0.5mL Shaking for 60 seconds at 3200 r/min	+23.5°C	6pcs-holder	+27.8°C
			3pcs-holder for cold storage (Pre-chilled at +4°C)	+22.5°C
			3pcs-holder for cold storage (Pre-chilled at -10 °C)	+16.3°C
	ϕ 3 mm stainless steel \times 15 water 0.5mL Shaking for 60 seconds at 3200 r/min	+23.5°C	6pcs-holder	+25.8°C
			3pcs-holder for cold storage (Pre-chilled at +4°C)	+23.2°C
			3pcs-holder for cold storage (Pre-chilled at -10 °C)	+17.0°C
	ϕ 5 mm stainless steel \times 2 water 0.5mL Shaking for 60 seconds at 3200 r/min	+23.0°C	6pcs-holder	+25.1°C
			3pcs-holder for cold storage (Pre-chilled at +4 °C)	+22.9°C
			3pcs-holder for cold storage (Pre-chilled at -10 °C)	+17.5°C
	Metal crusher \times 1 no solvent Shaking for 30 seconds at 2500 r/min	+23.3°C	6pcs-holder	+29.3°C
			3pcs-holder for cold storage (Pre-chilled at +4°C)	+24.3°C
			3pcs-holder for cold storage (Pre-chilled at -10 °C)	+19.2°C
5.0mL Screw cap Testtube	ϕ 5 mm stainless steel \times 15 water 2.0mL Shaking for 60 seconds at 2500 r/min	+23.3°C	+25.4°C	

- The sample temp. before and after shaking measured with thermocouple in each condition.
- After shaking, the sample temp. with stainless steel beads rose about 2°C and that with zirconia beads and Metal crusher rose about 4°C and 6°C respectively.
- The sample temp. was almost constant before and after shaking when using 3pcs-holder for cold storage with sufficient pre-cooling in a refrigerator (4 °C).
- The sample temp. dropped by about 5°C on average compared to before shaking when using 3pcs-holder for cold storage that was fully precooled in the freezer (-10°C).
- Do not cool 3pcs-holder for cold storage at temp below -20 °C. Might causes the screws get loosen by a metal shrinkage.
- Do not use tubes that have been cooled directly at negative temp. The tubes will be easily broken.

Freeze Crusher μ T-48

Powerful crushing of frozen samples with liquid nitrogen. 48 samples can be treated simultaneously. Optimum for extracting hard samples, proteins susceptible to heat denaturation, RNA, etc.

Example of various frozen crushed samples including inanimate objects. --> P.091-092



Features

- Crushing of frozen sample in vessels with liquid nitrogen
- 2mL Microtube or Dedicated metal container are used
- The throughput is 0.2g to 2g (Depends on the vessels)

Applications

- Crushing of Yeast, Mold, Tissue piece of animals and plants
- Crushing of bones, teeth and limbs of small animals
- Crushing of Wire covering and Plastics, Asbestos sample etc.

The procedure of freeze crushing Work gloves are worn when freezing the sample with liquid nitrogen in the photo but use gloves suitable for handling liquid nitrogen in actual use.



Put the specified amount (below) sample and metal crusher into the vessel.



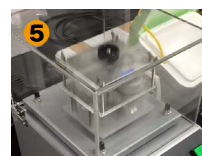
When a vessel requires holder, attach it in the holder.



Soak and freeze in liquid nitrogen until bubbling ceases.



Quickly attach to the μ T-48 main unit.



Close the hood, Check the time and shaking speed and Start crushing.



After crushing, take out the crusher and proceed to the next process.

Adapted to various samples with 3 types vessel holders

Adapted to various samples with 3 types vessel holders. Powerful crushing of frozen samples with liquid nitrogen. Living tissues and organs, Hard tissues such as bones etc. and also some inanimate samples such as rubber and plastic can be crushed. Adapted to Marketed 2mL tubes and Dedicated stainless steel crushing vessels.

Recommended shaking speed in each crushing sample.

- Stainless steel strong crushing vessel: Up to 1000r/min
- Metal crusher: Up to 1200 r/min
- Crushing beads: Up to 1600 r/min

Shaking speed more other than above speed might cause breakage of tubes, vessels. Thus, be sure to observe the shaking speed above.

Optional accessories: Vessel holders



Product Name / Model / Remarks

①48pcs-Holder for μ T-48 TH-0248T

1pc of Holder (Capacity : 48pcs of 2.0mL round bottom Microtubes) and 100pcs of Metal crusher come as a set.

②3pcs-Holder for μ T-48 TH-0203T

4pcs of Holder (Capacity : 3pcs of 2.0mL round bottom Microtubes), 24pcs of Metal crusher and Rack come as a set.

③Stainless steel-made strong crushing vessel TH-SPT

Crushing vessel 4pcs, Dedicated crusher and Rack come as a set. Suitable for samples that cannot be crushed by Microtube with Metal crusher. Larger amount of samples can be crushed than that of Microtube.

USER'S VOICE

Very useful when extracting substances susceptible to denaturation and degradation of RNA and proteins.



Model	μ T-48
Crushing method	Vertically reciprocal shaking.
Shaking speed (*1)	0 to 2500 r/min (*1)
Capacity	2.0 mL Microtube: Max. 48pcs (*2)(*3) Stainless steel powerful crushing vessel : Max. 4pcs (*3)
Timer	1 to 999 seconds
Safety devices/ functions	Holder attachment detection switch, Cover opening detection switch
Dimensions	220(W) x 310(D) x 315(H)mm
Weight	Approx. 10.0kg
Power supply	AC100V/1A

(*1) Around 1200r/min should be necessary and sufficient condition to crush the sample in actual use.

(*2) Eppendorf "Safe-Lock Tube 2mL" is recommended.

(*3) Microtube and Stainless powerful crushing vessel are available as an option.

Example ① Freeze crushing of various samples including inanimate samples.

Embrittlement by freezing enables strong crushing.



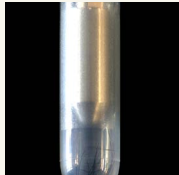


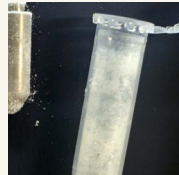
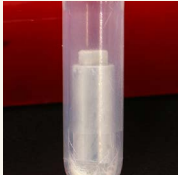
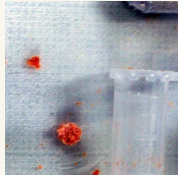










The freeze crushing with μ T-48 also suitable for Obligatory anaerobe samples.

Freeze Crusher μ T-48 --> P.090

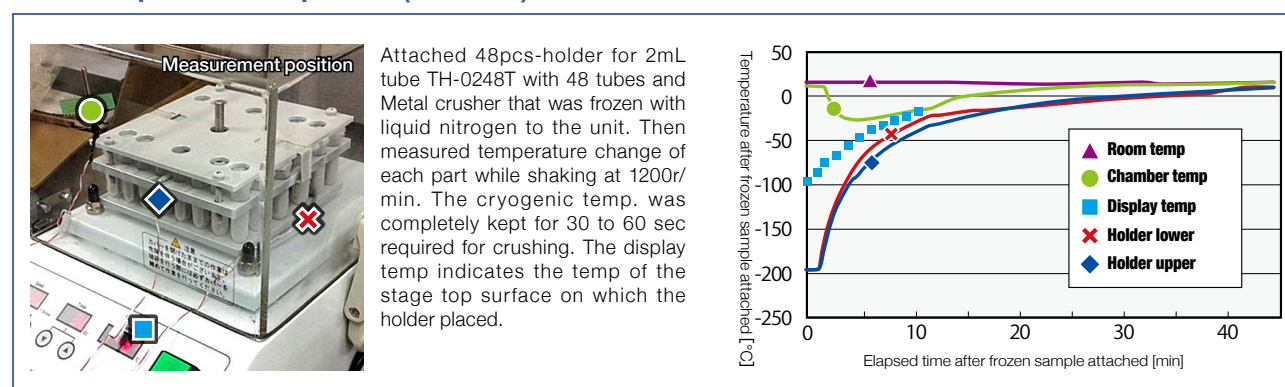


Test results

- Freezing method Immerse the vessels with sample and crusher into liquid nitrogen (2.0 mL: Vessel holder) and freeze them.
- Rushing time 30 sec (Further 30 sec if not completely crushed).
- Judgment whether sample crushed. Whether powder form or nearly it (Cut samples to any size that can be put in vessels).
- Vessels Safe-Lock tube 2.0mL.....Marketed product(Eppendorf made)
Metal crusher.....Included in Optional 48pcs-holder for μ T-48 (used in this experiment).
Stainless steel-made strong crush vessel VesselsOptional parts(Dedicated crusher comes with).

Chicken thigh	Human hair	Human nails
 	 	 
Vessels :Safe-Lock tube 2.0 mL Sample volume : 0.1 g Shaking speed :1200 r/min Crushed with: Metal crusher	Vessels :Safe-Lock tube 2.0 mL Sample volume :0.1 g Shaking speed : 1200 r/min Crushed with: Metal crusher	Vessels :Safe-Lock tube 2.0 mL Sample volume :0.2 g Shaking speed : 1200 r/min Crushed with: Metal crusher
Mouse skin (with body hair)	Mouse heart	Mouse tail
 	 	 
Vessels :Safe-Lock tube 2.0 mL Sample volume :0.2 g, Shaking speed : 1200 r/min Crushed with: Metal crusher	Vessels :Safe-Lock tube 2.0 mL Sample volume :0.2 g Shaking speed : 1200 r/min Crushed with: Metal crusher	Vessels :Stainless steel-made strong crush vessel Sample volume :1g Shaking speed : 1000r/min Crushed with: Dedicated crusher
Hypocotyl of Radish	Okra seeds	Hard rubber (Polychloroprene)
 	 	 
Vessels :Safe-Lock tube 2.0 mL Sample volume :0.2 g Shaking speed : 1200 r/min Crushed with: Metal crusher	Vessels :Safe-Lock tube 2.0 mL Sample volume :2 Shaking speed : 1200 r/min Crushed with: Metal crusher	Vessels :Stainless steel-made strong crush vessel Sample volume :2g Shaking speed : 1000r/min Crushed with: Dedicated crusher

Frozen sample/Holder temperature (Reference)



Example ② Freeze crushing of various samples including inanimate samples













Freeze crushing of Plastic samples using Freeze crusher μ T-48 with Stainless steel-made strong crush vessel.

Freeze Crusher μ T-48 --> P.090



Results and Examination

We tried some crushing of samples such as polystyrene, polypropylene and polycarbonate that were well known. Each result is as follows.

Shaker	Polystyrene ① : Fair		Polystyrene ② : Fair		Polystyrene ③ : Excellent	
						
Mixer Rotator Stirrer	Sample shape and volume : ϕ 6 mm ball shaped, 1g Shaking speed : 1000 r/min Crushing time : 300 sec		Sample shape and volume : ϕ 6 mm ball shaped, 0.4g Shaking speed : 1000 r/min Crushing time : 300 sec		Sample shape and volume : 10 mm square chip shaped, 0.5 g Shaking speed : 1000 r/min Crushing time : 180 sec	
	Polypropylene ① : Good		Polypropylene ② : Good ?		Polycarbonate : Poor	
Bead beater homogenizer Ultrasonic homogenizer						
	Sample shape and volume : 10 mm square chip shaped, 0.5g Shaking speed : 1000 r/min Crushing time : 150 sec		Sample shape and volume : 10 mm square chip shaped, 0.5 g Shaking speed : 1100 /min Crushing time : 300 sec		Sample shape and volume : 10 mm square chip shaped, 0.5 g Shaking speed : 1000r /min Crushing time : 300 sec	










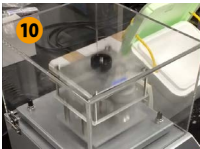

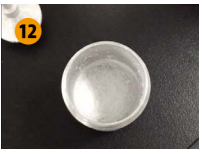
Polystyrene were able to be powdered completely (③). However, in case of ϕ 6mm ball- shaped sample, there were large fragments remained at certain rate even after trying with different amount and crushing time (①②). It seems that ball-shaped sample remain uncrushed if it is stuck in upward of the crusher.

The result suggests that the shape of sample is better to be chip like shape(or tablet like shape) Polypropylene was crushed into fine fragments although it was not crushed into powder (①).

In order to improve (although the shaking speed limit is exceeded when using a strong crushing container), when it is performed at 1100 r / min for 5 minutes, it becomes fine but braided piece of cotton (②). At this stage, it becomes difficult to collect unless suspended in a solvent. Polycarbonate proved to be difficult to crush. Even if the shaking speed was reduced to 1100 r / min or reducing sample amount, the result of this experiment was that only a small amount of powder was produced and the chip shape remained almost unchanged.

Freeze crushing procedure when using stainless steel-made strong crushing vessel

Adjustable plier is useful for taking in and out of Stainless steel-made strong crushing vessel (referred to as crushing vessel) into liquid nitrogen. Be sure wear leather gloves when touching frozen crushing vessel or the vessel holder that has become cold by contacting the frozen vessel. Be sure ventilate the room well when using liquid nitrogen as there is risk to get Anoxia unknowingly because the vaporized liquid nitrogen becomes huge volume of nitrogen gas.

					
					
<p>Place the crushing vessel that taken out and take it by gloved hand.</p> <p>Place the crushing vessel on the unit and put the lid of mounting rack.</p> <p>Secure the lid of rack with the black-colored knob.</p> <p>Shaken at prescribed speed and time.</p> <p>After the shaking is complete open the lid and check inside it. *4</p> <p>Completed if the sample is crushed satisfactory. *5</p>					

*1. Desirable to use the minimum-sized polystyrene foam container that the required number crushing vessels can be immersed to minimize the amount used of liquid nitrogen.

*2. The processing capacity of the crushing vessel is 1.2g per 1pc while better to make it to 0.5g per 1pc for plastic samples (Up to 1g polystyrene easily that can be crushed by freezing).

*3.Wait for at least 2 minutes after the boiling is settled out to freeze the sample in the crushing vessel sufficiently.

*4.The crushed sample might stick to the crusher so tap it with the inner wall of vessel to drop it.

*5. If the crushing is insufficient return the crusher to the unit to freeze it again and shaken.

Bug Crasher GM-01

2-in-1 Equipment to handle Vortex and Spin down. Also can be used for crushing with beads and metal crusher. Very reasonable for samples whose the hardness known.

Features

- **2-in-1 Bench-top equipment to handle Stirring and Spin down**
- **Capacity: 12pcs x 1.5/2 mL Micro tube**
- **Possible for Beads crushing of E. coli and soft samples.**

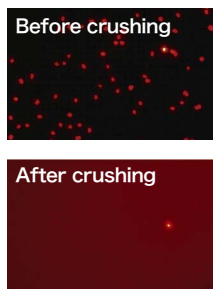
Applications

- **Crushing of Microbe (nearly same hardness as E. coli and Blue-green algae)**
- **Drying plants or Crushing frozen leaves and petals**
- **Spin down in Ethanol precipitation of DNA**

Crushing of Microbe

When crushing E. coli, Yeast, Blue-green algae, etc. and extracting DNA and proteins, mixing-stirring of the sample with glass and zirconia beads. After crushing, spin down can be done as it is. In the case of RNA, making sample frozen is effective.

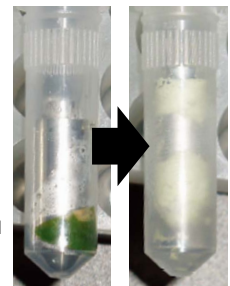
Photo: Fluorescent microscope image of Blue-green algae. Experimental data provided by Tokyo University of Pharmacy and Life Sciences, Faculty of Life Science.



Crushing of plant tissue

Tissues such as soft plant leaves can be crushed with zirconia beads or optional Metal crusher. In the case of RNA, making sample frozen is effective.

Photo: Photo: Freeze crushing of Eustoma leave. Experimental data provided: Akita Prefectural University, Faculty of Bioresource Sciences



Ethanol precipitation by Spin down function

The advantages of this unit is that number of simultaneous processing and the efficiency outperform those of crushing with mortar. 12pcs 1.5/2.0 mL Microtubes can be loaded (Max. 6pcs when using Metal crusher due to its weight) and both Stirring and Spin down can be performed. Although Spin down function is Max. 1300 xg, possible for Ethanol precipitation of nucleic acids.

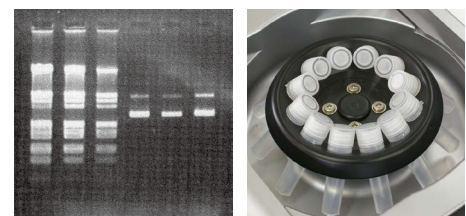


Photo of Electrophoresis is the comparison results for Ethanol precipitation and Centrifuge.

Model	GM-01
Stirring method	High-speed inversion
Stirring force adjustment	10 steps (Level 1 to A) *Effective of Level A is equivalent to that of Delta Mixer at 2600r/min.
Centrifugal speed	500 to 4500rpm (Setting per 500rpm)
Centrifugal force	Max. 1300xg
Ambient temperature	0°C to 40°C
Operation mode	Switchable Stirring/Centrifuge Continuous/Timer/Flush in Each mode.
Capacity	12pcs x 1.5/2.0mL Microtube (Self-stand and Screw type can be used) * Up to 6pcs when using Metal crusher.
Timer	0 to 50sec/1min to 99hr50min (Pauses when lid is open)
Digital display	Stirring level/Rotation number and Time/Centrifugal force
Safety devices/functions	Braking when lid open during operation. Motor stopping when lid open during stop
Dimensions/Weight	210 x 268 x 176mm, Approx. 3.5kg
Power supply	AC100 to 240V/0.5A

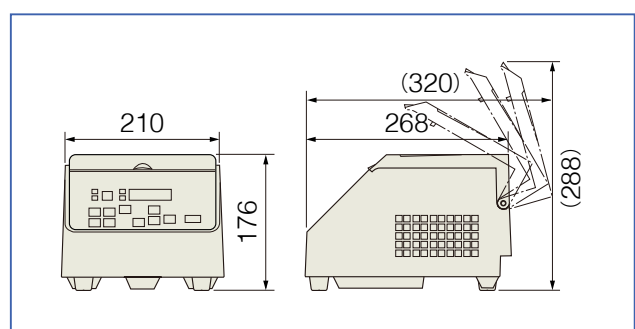
* Since the crushing force mildly, not suitable for crushing animal tissue. When crushing animal tissue Beads Crusher on 86-87page recommended.

Optional parts

Product Name/Model	Remarks
Metal crusher	For 2mL Microtube (Conical bottom), $\phi 7.5 \times 23$ mm, 6pcs

*Metal crusher is made of stainless steel SUS304.

Dimensions



Ultrasonic Homogenizer VP-050N

Automatic tuning and easy operation. Various operation modes according to the condition of samples. Small hand-held type suitable for small-volume samples. For disruption of E. coli etc after expression of protein.



VP-050N with Stepped Micro Tip

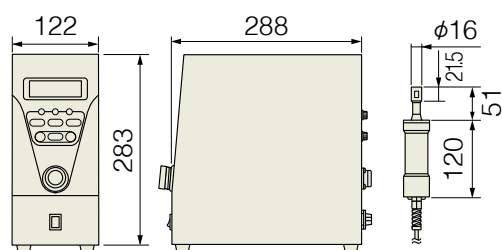
Automatic tuning and Operation mode

The automatic tuning before use is completed in about 5 seconds just pressing the button. Possible for Timer operation and Program interval operation. Equipped with PWM operation mode that automatically adjusts the output according to the viscosity change of the sample and POW operation mode that performs stable oscillation when the sample viscosity and temp. change are small.

Model	VP-050N
High frequency output	Maximum 50W
Transducer normal output	10 to 40W
Oscillation frequency range	19.5 to 20.5Hz
Turning	Automatically
Operation mode	PWM operation: Automatic output adjustment according to viscosity change of sample POW operation: Stable oscillation when change in viscosity or temp are small
Other functions	Timer operation (1sec to 120min) Programmed interval operation (ON: 3 to 60sec, OFF: 1 to 60sec)
Display	Real time output value %, Output value setting %, Output value when oscillation start (%), Oscillation frequency
Configuration	Main unit, Converter (Horn/Oscillation switch integrated)
Oscillation switch	Equipped in both Main unit and Converter (Optional foot switch can be used)
Dimensions	122 x 288 x 283mm
Weight	Approx. 4.5kg
Power supply	AC100 to 240V/1A

- Optional step type Micro Tip required for use.
- The chips for the former model VP-5S cannot be used.
- The chips for this model can be used in former model VP-5S.
- The chips for the former model VP-5 cannot be used.

Dimensions



Features

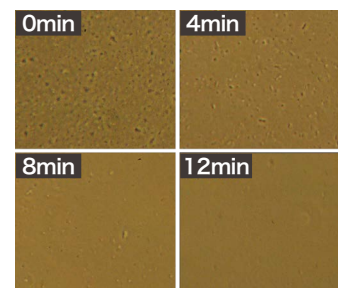
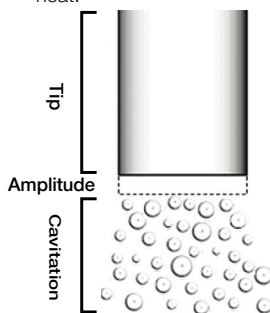
- Handy type for small volume. The throughput is 0.1 to 10mL
- Easy tuning completed in about 5 seconds
- Auto power operation to adjust output automatically during use

Applications

- Disruption and Solubilization of E. coli that protein expressed.
- Random fragmentation of Genomic DNA
- Homogenization and Emulsification of samples

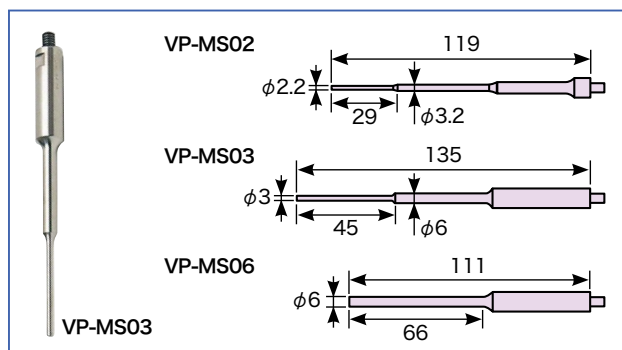
Sonication

The vibration of tip causes a cavitation of innumerable bubbles in the liquid to disrupt the object. The advantage is that the object can be disrupted uniformly. On the other hand, Intermittent operation or Ice-cooling of the sample is recommended as the sample might generates heat.



Disruption of 1mL E. coli (VP-MS03 used)

Optional accessories



Product Name/Model	Remarks
φ2mm Stepped Micro Tip VP-MS02	Throughput 0.1 to 10mL
φ3mm Stepped Micro Tip VP-MS03	Throughput 0.25 to 10mL
φ6mm Stepped Micro Tip VP-MS06	Throughput 2 to 10mL
Foot switch VP-FS01	Compatible with VP-300N

(*Microtubes (0.5/1.5/2.0 ml) can be used with φ2mm and φ3mm.

• Each material of Chip is Titanium. Replace Chips if necessary due to the consumable.

• Compatible with Former models (VP-5S/15S/30S/60S). Confirm Chips that can be used in the instruction manual.

Ultrasonic Homogenizer VP-300N

Easy operation. High output is suitable for large volume samples. Used with the stand. Various options such as Cup horn makes it possible for Non-contact sonication.

Features

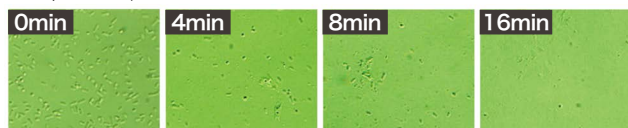
- High output type using with stand. Standard throughput is 10mL to 250mL.
- Easy tuning completed in about 5 seconds
- Oscillation function and various operation modes according to the chip used

Applications

- Disruption and Solubilization of E. coli that protein expressed.
- Random fragmentation of Genomic DNA. Emulsification of samples.
- Non-contact sonication with Cup horn [option]

Oscillation and Operation mode

Optimal oscillation is done by setting the chip used on the screen. PWM operation mode that automatically adjusts the output according to the viscosity change of the sample. POW operation mode that performs stable oscillation when the sample viscosity and temp. SEN operation mode that controls the output so that the value of oscillation sensor inside constantly (Effective for Sonicating for a long time with optional continuous disruption cell)



Disruption of E. coli 35ml (50ml Centrifuge tube and $\phi 12$ mm standard horn used)

Optional Please be sure to read the next page for the combinations.

Product Name/Model	Remarks
$\phi 12$mm Standard horn VP-HN12 *standard accessory of VP-300N	For 10 - 250mL sample (*). This product includes VP-ET12
$\phi 20$mm Standard horn VP-HN20	For 25 - 500mL sample(*). This product includes VP-ET20
$\phi 12$mm Tip VP-ET12	For Replacement when consumed
$\phi 20$mm Tip VP-ET20	For Replacement when consumed
$\phi 12$mm Extender VP-EX12	L 100mm version of VP-ET12
$\phi 20$mm Extender VP-EX20	L 100mm version of VP-ET20
$\phi 3$mm Tapered Micro Tip VP-MT03	For 1 - 10mL, Tip diameter $\phi 3.5$ mm
$\phi 5$mm Tapered Micro Tip VP-MT05	For 2 - 10mL, Tip diameter $\phi 5$ mm
$\phi 6$mm Tapered Micro Tip VP-MT06	3 - 10mL, Tip diameter $\phi 6.6$ mm
Coupler VP-CP01	For connection with Stepped Micro Tip
$\phi 2$mm Stepped Micro Tip VP-MS02	For 0.1 - 10mL, Tip diameter $\phi 2.2$ mm
$\phi 3$mm Stepped Micro Tip VP-MS03	For 0.25 - 10mL, Tip diameter $\phi 3$ mm
$\phi 6$mm Stepped Micro Tip VP-MS06	For 2 - 10mL, Tip diameter $\phi 6$ mm
$\phi 38$mm Cup horn VP-CH38	Enables processing without contact
$\phi 51$mm Cup horn VP-CH51	Enables processing without contact
Continuous crashing cell (For $\phi 12$mm) VP-CC05	Enables Flow-through processing (Approx. 19 L/h)
Continuous crashing cell (For $\phi 20$mm) VP-CC06	Enables Flow-through processing (Approx. 19 L/h)
Dedicated stand VP-ST30	Almost required in VP-300N
Absorption silencer VP-SB01	No need to stand when use
Foot switch VP-FS01	Foot switch

(*In E. coli, considering the efficiency, the throughput ideally around the described median. When it reaches Max amount, processing takes time (approx 15 min with about 35ml for crushing of above 90% in $\phi 12$ mm, approx 40 min with 250 ml).

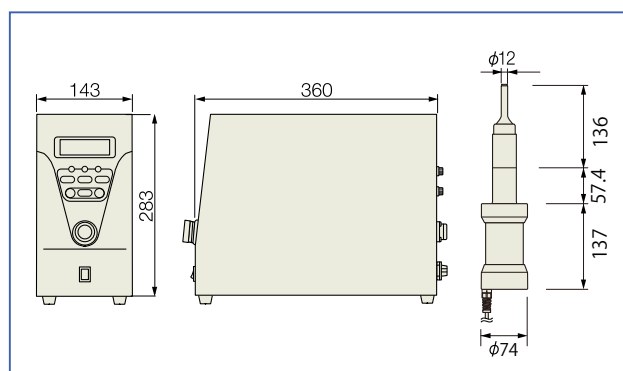
● Protuberances not included in Dimensions. ● Vessels of photo not included.



Model	VP-300N
High frequency output	Maximum 300W
Transducer normal output	50 to 200W (*)
Oscillation frequency range	19 to 21Hz
Turning	Automatically
Operation mode	PWM operation: Automatic output adjustment according to viscosity change of sample POW operation: Stable oscillation when change in viscosity or temp are small SEN operation: Controls the output so the value of oscillation sensor inside constantly
Other functions	Timer operation (1sec to 120min) Programmed interval operation (ON: 3 to 60sec, OFF: 1 to 60sec)
Display	Real time output value %, Output value setting %, Oscillation frequency, The tip used, Operation mode
Configuration	Main unit, Converter, $\phi 12$ mm Standard horn (Pre-installed Tip)
Oscillation switch	Equipped in Main unit (Optional foot switch can be used)
Dimensions / Weight	143(W) x 360(D) x 283(H)mm, Approx. 6.7kg
Standard accessories	Standard horn ($\phi 12$ mm: VP-HN12), Tip ($\phi 12$ mm: VP-ET12)
Power supply	AC100V/5A

(*) The upper limit varies depending on the horn and the tip used.

Dimensions



Optional accessories for Ultrasonic homogenizer VP-300N

Variety options such as Chip, Cell combined with Standard horn and Stepped Micro Tip (Compatible with that for VP-050N) combined with Couplers for are available in VP-300N. Current Chips for VP-300N can be used with former model VP-15S/30S. (Except for Couplers and stepped Micro Tip)

Stepped Micro Tip for VP-050N combined with Couplers can be attached to convert for VP-300N. Use it when a chip that is thinner than Tapered Micro Tip required. It is consumed gradually by use.



**Stepped Micro Tip
VP-MS02/03/06**



**Coupler
VP-CP01**
(Attach by removing the standard horn)



Various optional accessories can be chosen according to samples and vessels in VP-300N.

VP-300N with Converter



**Standard horn
VP-HN12/20**
(Attach any of the following)



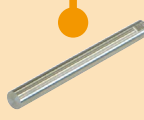
**Continuous crushing
cell VP-CC05/06**
(Cover on top of tip)

Attach it Standard horn equipped with chip so as to cover that to process the sample continuously while flowing it on the gap inside. It has a double structure and prevents temperature rise by flowing cooling water.
** Pump or Cooling water circulator required for flowing sample.*

**Tip
VP-ET12/20**

(Comes with Standard horn)

This is attached on the Tip of Standard horn and will be gradually consumed by use so it should be replaced regularly (Comes in Standard horn)



**Extender
VP-EX12/20**

This is used when processing the sample in deep vessels (e.g. Separatory funnel) that standard horn/chip cannot reach the sample. Attach it on Standard horn. It will be consumed gradually by use.
** It cannot be immersed deeply in liquid. The immersible part is up to 2cm to 3 cm from the chip (Total length 10 cm).*



**Tapered Micro Tip
VP-MT03/05/06**

(Only VP-HN12 can be attached)

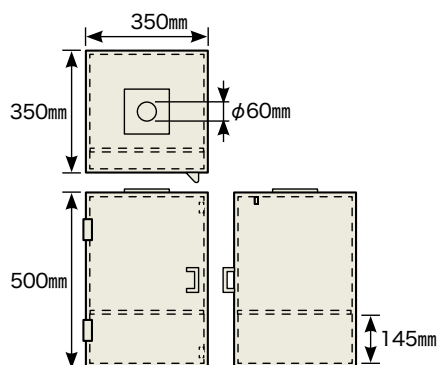
This is used to process samples in thin and deep vessels that the sample cannot not be put inside it. It is attached to Standard horn and will be consumed gradually by use.



**Cup horn
VP-CH38/51**

This is attached to an inverted converter and process the samples that the vessels float while circulating water in the cup indirectly without contact. 2 kinds of Cup horn in size (Connection dia. without distinction).
** Pump or Cooling water circulator required separately.*

Absorption silencer Dimensions



Absorption silencer VP-SB01

The converter is fixed to the top surface for crushing process internally to make the offensive resonance noise lower during ultrasonic oscillation.

** Continuous crushing cell and/or Cup horn cannot be used.*



**Dedicated stand VP-ST30
(with Converter)**

This is used to fix the converter (Absorption silencer and Stand required in VP-300N). Prepare a telescopic table etc. on that the sample vessels being placed if necessary.