



RETSCH SPECIAL ADAPTER

GUIDELINES FOR SPECIAL ADAPTER & GRINDING BALLS FILLING

LARGER PLASTIC TUBES

I Falcon tubes 50 ml, 30 ml wide mouth bottles

FALCON TUBES 50 ML – ADAPTER 22.001.0020, FIT ONLY IN MM 400, MAX 8 SAMPLES PER BATCH

Sample	Amount	Balls	Time & frequency	Important!	For what?
Cell suspension – yeast, bacteria	25 ml	Glass beads, 0.75-1.5 mm, 25 - 30 ml	3-7 min 30 Hz; 20 Hz for protein extraction	FIRST put in the glass beads, then the cell suspension!	Hardened stainless steel: 35 g
Cell suspension - microalgae	20 ml	Glass beads, 0.1-0.5 mm, 40 ml	0.5-3 min 30 Hz; 20 Hz for protein extraction	Enough cell suspension – not like “dry” sand”, enough glass beads → to get enough movement and shearing	
Tissue like liver, muscles, lungth	15-30 g	4 x 20 mm stainless steel balls	3-5 min 30 Hz	Fill up with a buffer! Without, the homogenization is difficult, and tube may break! 4 large balls are required for same reasons, no small balls!	Zirconium oxide: 110 g Hardened stainless steel: 145 g Tungsten carbide: 275 g
Dried plants like cannabis flowers	4 g	2 x 15 mm stainless steel	3 min 30 Hz	Sample must be dry and not too oily	Hardened stainless steel: 235 g Tungsten carbide: 440 g
Dry soil or similar “softer” samples	50 g	3 x 20 mm agate	1-2 min 25 Hz	without stones!	Zirconium oxide: 275 g Hardened stainless steel: 365 g Tungsten carbide: 690 g

Adapter 22.001.0015 (till 2023) fits in old model MM 400, but not in the new one launched in 2023;

The new adapter 22.001.0020 fits also in old MM 400 model

NO cryogenic grinding in those tubes as they break

Do not use tubes more than 1 x!

WIDE MOUTH BOTTLES 30 ML – ADAPTER 22.001.0021, FIT ONLY IN MM 400, MAX. 8 SAMPLES PER BATCH

Sample	Amount	Balls	Time & frequency	Important!	For what?
Tissue from surgeries	Material from a puncture	1 mm glass beads, 5 ml	210 s, 30 Hz	Addition of 20 ml sterile water or buffer	Wash off intact bacteria in order to plate them → personalized diagnostics
Tissue liver like liver, muscles, lungth	Max 15 g, max 5 mm pieces	14 x 10 mm stainless steel balls	3-5 min, 30 Hz	Fill up with buffer to allow for good movement off sample and balls	DNA, RNA, Protein analysis, other analytics like tumor markers
Quartz sand or similar	10 ml	3 or 5 mm stainless steel balls, 10 ml	2 min, 30 hz	Max 1-1.5 mm sample particles	Standard analytics

Additionally both cell disruption applications from the 50 ml Falcontube applications from table above

→ please recalculate all amount to 30 ml volume in this case

Adapter 22.001.0016 (till 2023) fits in old model MM 400, but not in the new one launched in 2023;

The new adapter 22.001.0021 fits also in old MM 400 model

NO cryogenic grinding in those tubes as they break

Do not use tubes more than 1 x!

EPENDORF TUBES

I 1.5 Eppendorftubes, 2 ml Eppendorftubes, 5 ml Eppendorftubes

SINGLE USE TUBES (EPENDORF) 1.5 OR 2 ML WITH SNAP CAP

I **Adapter 22.008.0005**, fit in MM 200, MM 400, MM 500 vario (all six positions); max 10, 10 or 30 samples per batch

I **Adapter 22.008.0014 (former 22.008.0008)** fit in MM 400, MM 500 vario (upper and lower positions, NOT in the middle- here can adapter 22.008.0005 placed), max 20 or 40 (plus 10 additional in middle row with adapter 22.008.0005) per batch

I **Adapter 22.008.0012**, fit in MM 500 nano/control, 36 samples per batch

I **Adapter 02.706.0303**, fit in CryoMill, 6 samples per batch

Sample	Amount	Balls	Time & frequency	Important!	For what?
Cell suspension – yeast, bacteria	50 % of the vial	Glass beads, 0.75-1.5 mm, 50 % of the vial	3-7 min 30 Hz; 20 Hz for protein extraction	First fill in the glass beads, then the cell suspension!	RNA or DNA extraction, only small sample volumes are required
Cell suspension - microalgae	40 % of the vial	Glass beads, 0.1-0.5 mm, 80 % of the vial (really this much! Cell suspension penetrates the bead bed, so it fits!)	0.5-3 min 30 Hz; 20 Hz for protein extraction	Enough cell suspension – not like “dry” sand”, enough glass beads → to get enough movement and shearing	Protein extraction or metabolomics → 50 ml falcons are beneficial as larger sample amounts are required
Tissue like liver, muscles, lungth	Few mg	2-4 mm stainless steel balls (or zirconium oxide), 30 % of the tube volume	3-5 min 30 Hz	Fill up with a buffer! Without, the homogenization is difficult. Size of the balls appr. 3 x larger than sample size!	DNA, RNA, Protein analysis, other analytics like tumor markers
Dried insects	Fill after adding the balls	2-4 mm stainless steel balls (or zirconium oxide), 30 % of the tube volume	3-5 min 30 Hz	Insects loose volume while pulverized, add enough sample	Diverse analytics

Additionally all screw cap 1.5 or 2 ml single-use caps → important: Cap plus ring are max 7 mm in height to fit in MM 400 or MM 500 vario

Max 4 mm balls in 1.5 ml single-use vials, max 7 mm balls in 2 mm single-use vials

Careful when performing cryogenic grinding – plastic single use tubes can break easily – max 20 Hz, max 30-60 min grinding time, risc remains!

Think about using the 2 ml stainless steel tubes 22.749.0014

SINGLE USE TUBES (EPENDORF) 5 WITH SNAP CAP

I **Adapter 22.008.0010** fit in MM 400, MM 500 vario (upper and lower positions, NOT in the middle), max 10 or 30 per batch

Sample	Amount	Balls	Time & frequency	Important!	For what?
Secret or mucus	Up to 3 ml	2-3 x 5 mm balls, zirconium oxide	1.5-2.5 min, 30 Hz		Further diagnostics of tough sputum for example without risc of cross contamination, no cleaning
Tissue like liver, muscles, lungth	Few mg	2-4 mm stainless steel balls (or zirconium oxide), 30 % of the tube volume	3-5 min 30 Hz	Fill up with a buffer! Without, the homogenization is difficult. Make sure that the max size of the sample fits to the ball size (which should be 3 x larger)	DNA, RNA, Protein analysis, other analytics like tumor markers
Dried insects	Fill up the tube after adding the balls	2-4 mm stainless steel balls (or zirconium oxide), 30 % of the tube volume	3-5 min 30 Hz	Insects loose volume while pulverized, therefore enough sample should be in	Diverse analytics

Additionally both of the cell suspension applications of the table above (1.5 or 2 ml single-use tubes) → adapt the volumes to 5 ml!

No screw cap 5 ml single use tubes can be used!

Max 4 mm balls can be placed in the 5 ml single-use tubes!

Careful when performing cryogenic grinding – plastic single use tubes can break easily – max 20 Hz, max 30-60 min grinding time, risc remains!

Think about using the 5 ml stainless steel jars 01.462.0290

SMALL STEEL VIALS / JARS

I 2 ml stainless steel vials, 5 ml jars for adapter

2 ML STAINLESS STEEL TUBES 22.749.0008

I **Adapter 22.008.0014 (former 22.008.0008)** fit in MM 400, MM 500 vario (upper and lower positions, NOT in the middle), max 20 or 40 per batch

I **Adapter 22.008.0012** fit MM 500 nano/control, max 18 per batch

I **Adapter 02.706.0360** fit in CryoMill, max 6 per batch

Sample	Amount	Balls	Time & frequency	Important!	For what?
Pharmaceutical tablet	4 pieces a 4 mm	1 x 7 mm stainless steel	1.5 min at 30 Hz	Samples with liquid cores need to be crushed cryogenically	API analysis
Tissue, cryogenic	3 x 4 mm	4 x 5 mm tungsten carbide	10 min pre-cooling of the fully loaded adapter, 3 cycles a 0.5 min grinding at 30 Hz and 5 min intermediate cooling	2 balls first in the tube, then the (pre-cooled) sample, than the other 2 balls above the sample gives good results Tungsten carbide balls required for good homogenization	Tumor markers

Max. ball size is 7 mm → thus harder sample materials should be max 2-3 mm, softer materials max 4 mm

5 ML STAINLESS STEEL JARS 01.462.0290

I **Adapter 02.706.0351** fit in MM 400, MM 500 vario, max 8 or 24 per batch

I **Adapter 02.706.0304** fit in CryoMill, max 4 per batch

Fits in new MM 400 model 20.715.0001, does not fit in old MM 400 models!!! → Ask service to exchange grinding stations if required

Same for MM 500 vario → fits in machines with Index B from October 2023

Max 10 mm balls fit in the 5 ml steel tubes

Handling same as 5 ml standard jars



2 ml stainless steel vials



5 ml jars inclusive adapter

MULTI CAVITY JARS

4 x 10 ml, 2 x 25 ml

JARS 2 X 25 ML CAVITY OR 4 X 10 ML CAVITY 01.462.0536 AND 01.462.0537

Jars fit in MM 500 nano or control

Sample	Amount per cavity	Balls per cavity	Time & frequency	Important!	For what?
Pharmaceutical tablet	1.5 g	12 x 7 mm stainless steel	9 cycles with 1 min grinding at 30 Hz and 1 min break	In principle, the multi-cavity jars give same results than 10 ml or 25 ml jars for MM 400, the cavities are also comparable to each other → good reproducibility. Keep in mind that the two 10 ml cavities more towards the machine center get a bit less energy input → thus slightly coarser particles.	Plant ingredients
	4 g	35 x 7 mm stainless steel			
Pharmaceutical tablet	1.7 g	1 x 12 mm stainless steel	5 min at 30 Hz		Further analysis
	7 g	4 x 12 mm stainless steel			

The multi-cavity jars can also be used for standard wet grinding according to the rules (filling level with small balls 60%, appropriate liquid amount)

10 ML PMMA JARS (BEING USED IN MM 400 FOR RMAN IN-SITU SPECTROSCOPY), FIT ALSO IN MM 500 VARIO

- Add max 10 mm balls
- Steel, zirconium oxide or agate balls commonly used
- Depending on the sample and the use, the jars get blind quickly
- They are not thought to be used for a long time!

PLANETARY BALL MILL ADAPTER FOR GLASS VIALS → PM 100, PM 300, PM 400, NOT IN PM 200

1.5 ml GC glass vials, 20 ml GC glass vials

PLANETARY BALL MILL ADAPTER FOR GLASS VIALS

- Adapter 01.462.0540 for 24 x 1.5 ml GC glass vials
- Adapter 01.462.0541 for 7 x 20 ml GC glass vials
- Fit in PM 100, PM 300 and PM 400

Sample	Amount	Balls per cavity	Time & frequency	Important!	For what?
API and Co-Former	Some µg in 1.5 ml vial	2-4 x 3 mm stainless steel, or zirconium or agate	Usually longer than 30 min, up to several hours	Max speed for 1.5 ml GC glass vials PM 100 → 550 rpm PM 300 → 500 rpm PM 400 → 400 rpm Usually a few drops solvent are added	Co-crystal screening
		1/3 volume filled with 3 mm steel balls, or zirconium or agate			
	Sample and liquid filled appr to half the 20 ml glass vial (after the balls are in)	3 x 5 mm steel balls , or zirconium or agate		Max speed for 20 ml GC glass vials PM 100 → 350 rpm PM 300 → 300 rpm PM 400 → 250 rpm	
		1/4 volume filled with 3 mm steel balls, or zirconium or agate			

The adapters are used mainly for mixing at low to moderate speed for co-crystal screening!



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