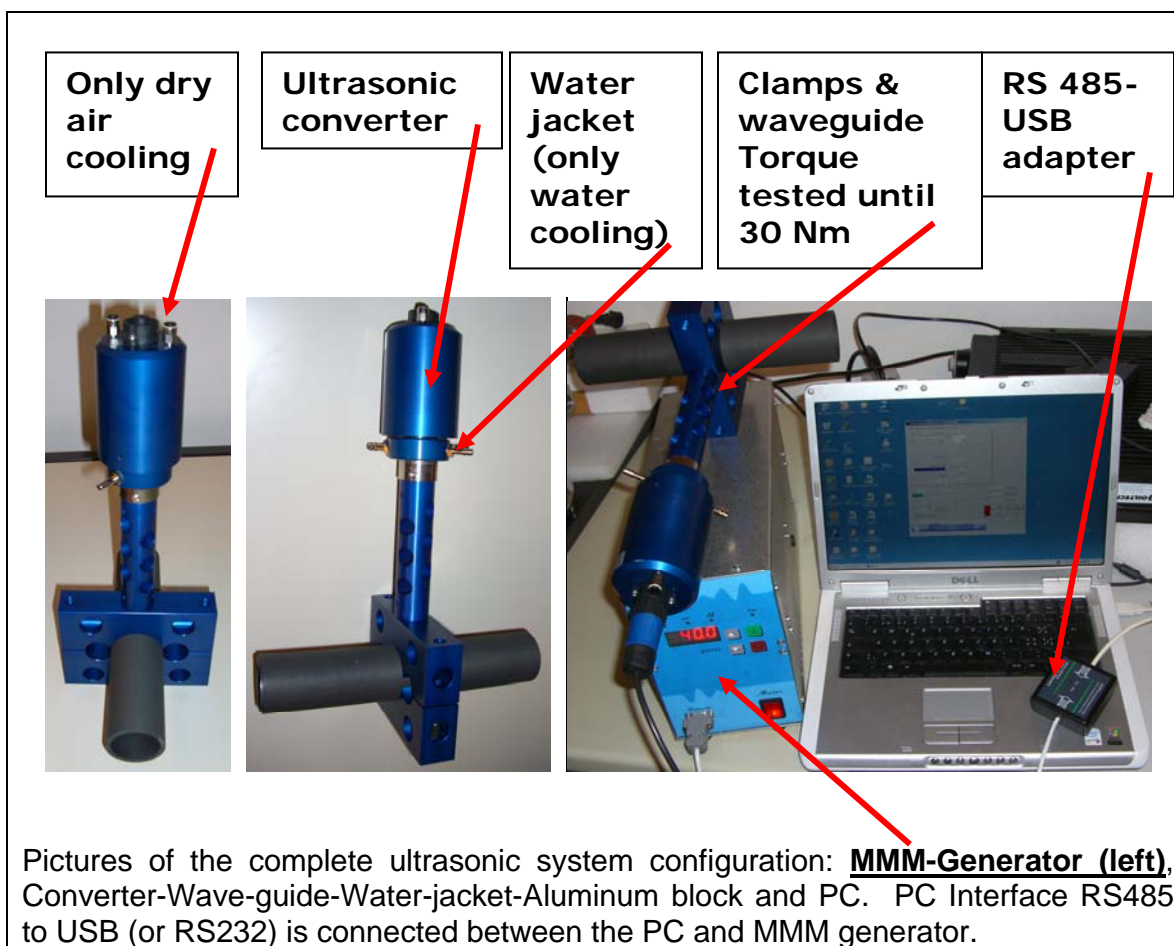


ULTRASONICALLY ASSISTED POWDERS COMPACTING IN A GRAPHITE TUBE



Client should use his own PC. Software [mpi_ix.exe](http://www.mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/) for the MSG.1200.IX should be installed (download software here:

http://www.mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/).

Do not forget to install drivers (software) for USB, Generator-to-PC-interface. Drivers can be downloaded from here:

http://www.mastersonics.com/documents/mmm_basics/mmm_power_supplies/rs485-USB-adapter-software/

The idea behind making holes in the vibrating aluminum clamps is to make such aluminum blocks more flexible, more elastic and to reduce metal rigidity in order to facilitate vibrations and increase amplitude on the contact surface with the graphite tube. Every circular hole (in clamps and waveguide) is reacting as a kind of mass-spring oscillator (with relatively high mechanical quality factor), this way facilitating complex vibration of the aluminum clamps.

Converter should be strongly fixed (by screwing) to one side of aluminum clamps (always using the waveguide between the converter and aluminum clamp), this way taking care that vibrations on the graphite tube will be uniformly distributed and maximized.



Pictures presenting ultrasonic converter with water jacket (upper part), wave-guide (middle part) and aluminum clamps on the graphite tube (bottom). Since graphite tube could be fragile, apply fastening of clamps, slowly, symmetrically and gradually (on both sides) until reaching **30 Nm torque** value (use proper torque wrench; -not presented on the pictures here). For fixation (screwing, unscrewing) of converter and wave-guide use here presented wrenches.

In operation, the biggest care should be taken to keep constant low temperature on the ultrasonic converter (always below 50 degrees Celsius). Water jacket should be connected to a water flow in order to keep aluminum wave-guide cold and to stop heat penetration from aluminum block towards converter. Certain forced air flow should be realized inside of the housing of the ultrasonic converter in order to keep converter cold (using pressurized, filtered dry air: dust particles smaller than 5 micrometers).

Usually, when generator settings are well made, when mechanical fixation is sufficiently strong, and when aluminum clamps are properly fixed, converter will not generate heat, or better to say that temperature on the converter body would increase very slowly. Significant heating of the converter parts is always indicating that MMM generator settings are not well made, or that there is a problem in mechanical assembling (parts are not strongly fixed). In such situations, stop the generator, reduce the operating power and search for new settings (later you will see what are good settings found in MPI lab).

When new settings are found, ultrasonic power could be increased. Aluminum clamps and graphite tube will take so much of ultrasonic power as acoustic loading conditions would allow. Generator is able to deliver 1200 Watts (and converter can accept 3000W), but in most of situations (like this one you have) aluminum clamps would take significantly less ultrasonic power because of acoustical loading conditions, acoustic impedances, geometry etc. In your case you could expect operating power levels which are in the range of 100 W, maybe 200 W.

You should experiment (with low power settings; -around 20%) in no-load open-air conditions in order to find the best generator settings and best loading of aluminum clamps and graphite tube.

All metal-to-metal joints (contact surfaces) realized by screwing should be clean, without any particles and dry (no water between contact surfaces) in order to avoid bad acoustic coupling and destruction of contact surfaces. If you intend to make new aluminum parts, the best aluminum for ultrasonic applications is AL-7075.

After creating regular operating conditions (vibrating graphite tube with some powders inside), generator settings should be again readjusted, since initial mechanical oscillating system would change by presence of different loading conditions and different added masses.

Do not apply maximal power settings of the generator, because after certain power level, increasing the power would start producing negative effects, non-linear oscillations, clipping and heat (and graphite tube will brake).

For putting the generator in operation and making proper generator settings (learning process), please download the instructions here (very important, read carefully, go step by step, do not neglect something):

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/instructions-for-first-time-users-ix-generators.pdf

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/ix-single-converter-settings.pdf

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/ix-single-converter-settings.pdf

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/um_msg_ix_yf_2005.pdf

Read also all documents from here:

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/

If under certain settings generator starts going into overloading state (stopping operation), reduce the power and slowly and systematically change some of setting conditions. Do not force repeatedly the generator to go often in overloading conditions, because this way you would damage the generator, converter and/or mechanical parts.

Above given instructions are generally valid for all MMM and IX generators (like your generator). Details regarding settings and optimal conditions would always be different, depending on operating conditions, geometry of oscillating objects, loading conditions etc. Here given general instructions are good to get basic knowledge and experience regarding how to operate MMM generator and how to make setting, but in client's real operating conditions, **the same, here given instructions should be**

applied creatively and with intellectual flexibility (meaning client should find new set of best operating conditions that are similar, but maybe not identical to here described settings).

Good initial generator settings for oscillating aluminium blocks (for vibrating given graphite tubes) in no-load conditions, found in MPI laboratory during initial testing are (see below):

DDS,

Frequency: Best operating frequency in this case is 18.46 kHz, when operating in no-load conditions.

Sweeping: Keep at 0.020 kHz. Later experiment using other values (always below 0.100 kHz).

POWER: 10% to 40%. Start with low power 20% in air, no-load conditions (or around 30% or less). Work at minimum power that is producing good results, linear, smooth and stable oscillations, and minimal heating on the converter parts. In loaded situation power should be readjusted.

Current: set max. current to 3 A,
PWM-period 0.030s, **PWM-ratio** 100% (period irrelevant when ratio = 100%).

FSWM: best 0.317 kHz. (Later experiment with other values), **FSWM-ratio** 50%,
FSWM-period 0.010 s.

DMMM,

Q-factor: 20 to 50 (also good until 100),

Frequency correction: 38 to 90 (experiment with other values),

Amplification factor: 55 (experiment with other values below 100).

Ultrasonic power: 500 (also good below 500). Carefully and prudently if you increase until 999 Work at minimum power that is producing good results, linear, smooth and stable oscillations, and minimal heating on the converter parts.

In loading, operating conditions, above-given initial settings should be readjusted to rich maximal ultrasonic activity (start the tuning process again, slowly and step by step).

Inox ultrasonic generator control panel

DDS | Power | FSWM | DMM | US power

Frequency DDS

min max

Sweeping

min max

DC current

DC voltage

DC power

COM9 Connect

Start Write

Stop Read

Exit

Software release -SR102

MPInterconsulting

Inox ultrasonic generator control panel

DDS | Power | FSWM | DMM | US power

Power

min max

MAX Current

min max

PWM period

min max

PWM ratio

min max

DC current

DC voltage

DC power

COM9 Connect

Start Write

Stop Read

Exit

Software release -SR102

MPInterconsulting

Inox ultrasonic generator control panel

DDS | Power | **FSWM** | DMM | US power

FSWM range
min max 0.317 kHz

FSWM ratio
min max 50 %

FSWM period
min max 0.010 s

0.00 A DC current

263 V DC voltage

0 W DC power

COM9 Connect

Start Write

Stop Read

Exit

Software release -SR102

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Inox ultrasonic generator control panel

DDS | Power | FSWM | **DMM** | US power

Q factor
min max 55

Frequency correction
min max 38

Amplification factor
min max 49

0.00 A DC current

263 V DC voltage

0 W DC power

COM9 Connect

Start Write

Stop Read

Exit

Software release -SR102

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