OPEN FRAME GENERATORS DRIVING PIPE CLAMP-ON REACTORS with OW GENERATORS

POWER RELATED QUESTIONS:

QUESTION: “How can I make the relationship with the operating ultrasonic power given to the load and power-related parameters of the MMM software control. There are: Ultrasonic Power graduated 0 to 4095, and the Power graduated 0 to 100%. What are the correspondences with output ultrasonic power?”

ANSWER: The settings are mutually dependent and it is not possible to give a simple answer about the load-delivered power because it is dependent on the system set up (parameter settings) and the attached load (all acoustic elements). In the end the only way to have an accurate measurement of input power is through an external power meter as detailed in an explanation below. Generally speaking the Ultrasonic Power setting (0 – 4095 steps (=) 0% to 100%) is controlling the system load, or ultrasonic-frequency-current, and the Power setting (0% – 100%) is controlling the system input voltage (on the low frequency, main supply side: 230 VAC, 50 HZ). The resulting power is a non linear function of the two settings so it is difficult to make a simple calculation or estimation of the delivered power. Of course, we know that certain generator is able to deliver, for instance, 600 Watts of continuous power and 3000 Watts of pulsed power (when operating in PWM mode), meaning that loading such generator with certain ultrasonic load would theoretically and practically limit the ultrasonic loading power to something less then 600 W continuous power, and less than 3000 W of pulsed power (but we can not precisely and without power measurements say which power is really being delivered to the load). Each load is able to receive certain maximal amount of power (because of its specific electromechanical properties, impedance and frequency matching etc.), and it could happen that whatever we would try to do (setting all power parameters to maximum), we would not be able to deliver more power than load is accepting. For instance, it could happen that 600 W generator would deliver only 50 watts to certain load, and still produce very good ultrasonic effects. It would be useless to insist on increasing operating, load power of certain well-operating load, after we reach its optimal, best operating conditions, since later we would only produce electrical, mechanical and thermal losses (by increasing electrical power), and in reality we would notice that generator and load are not following our power-increasing settings. It could also happen (seldom situations) that generator would still operate certain load even if we set all power regulations to minimum (to zero). This is the case when a load is well designed and perfectly tuned, and able to oscillate on very low power. Since MMM generators have internal current and voltage sensors (for purposes of power and frequency regulations), there is always certain low level threshold (in control electronics), where from practical point of view we consider output power as zero, but in reality we still have certain output load current and load voltage (and certain low level output power is being delivered to such load). The reason for such low level operations is mostly related to the fact that MMM generators are designed and regulated to cover maximum number of well known ultrasonic applications, and in cases if somebody would apply some other, unknown ultrasonic load, which is out of implemented conditions, we would notice such unusual effects.

QUESTION: “Why I'm limited to 50% for the power.”

ANSWER: In some cases, when certain ultrasonic load is tuned and adjusted in our laboratories we are suggesting to a client not to drive such specific load more than certain maximal power level (tested and confirmed as a safe operating level). The fact is that the specific load design will limit the optimum Power settings. Not every load is able to accept any amount of ultrasonic power. There is always an upper power limit for a specific load, and if the delivered ultrasonic power is set below that limit, the load would perform linear oscillations. If we insist to increase delivered acoustic power to the same load, non-linear mechanical vibrations would be generated, we would notice output mechanical and electrical amplitude clipping, appearance of non-harmonic oscillations and increased heat generation of system mechanical parts and transducers, and eventually the system could be damaged. If we connect a sufficiently large load (e.g. more transducer clamps) to accept the maximum power from the generator (and to spread it to the larger surface) then we could simply turn the settings to full value and the system would generate up to 600 watts of continuous power. With two clamps the system is lightly loaded and can only accept a certain amount of power efficiently. If you drive the system with higher power beyond this optimum point you will start to generate mechanical and electrical losses with no benefit to the liquid material under treatment. In fact you will likely reduce the effectiveness of the acoustic system by over driving. If the system power is pushed too high you may over-stress and damage to the mechanical components, possibly damage the transducer, and may cause fault conditions in the generator. If one wants to make a test with a full 600 watts of power we must introduce more transducer pipe-clamps to increase the load (what will also increase the total volumetric power).

When properly tuned our OW model generators are designed to give the maximum amount of Active Power to the load. The PC software feedback indicators use internal current and voltage signals to give relative power feedback for optimizing the system setup to new loads. These software indicators show only relative scaling and our OW generator models do not have an internally implemented power meter. If an internal power meter is required for future business in your application we have designed such circuits for other generator models that can be implemented on this generator for a moderate incremental cost. However making very accurate measurements for new applications where input power measurement is critical, an external and more expensive laboratory-quality power meter should be used.

For accurate power measurement the electrical input power entering into the generator can be measured using a high quality Low Frequency power meter (at the generator input, between main supply and generator). If the power meter is of high quality, it will be able to measure: Active Power, Reactive Power and Apparent power (all related to 230 VAC, 50 Hz input). Here, the best or optimal solution is to maximize the Active power and minimize the Reactive power. The system design, tuning, and subsequent power distribution involves many factors including acoustic matching, liquid properties, load properties, inductive compensation. Higher Active power will mean that more energy would be given to acoustic load.

Furthermore, if you have a good High Frequency power meter, you can measure how much high frequency power is given to the transducers/converters. Again, with the right equipment it will be possible to measure Active, Reactive and Apparent high frequency electrical power given to transducers/converters. Only the amount of Active high frequency power will be given to the liquid, and make acoustic liquid processing and liquid heating. Here is the best to achieve maximal Active power and minimal Reactive high frequency electrical power, which is given as an electrical input directly to transducers/converters. How well the power is given to transducers/converters would depend on many factors including power and impedance matching, inductive compensation, acoustic load properties. Active power will in its last step make liquid heating, and Reactive power will heat the generator and transducer components.

Calorimetric measurements of the amount of heat energy generated in liquid will indicate how much of Active electric power introduced to the ultrasonic transducers would be transformed into real or Active acoustic power given to liquid processing (mutually directly proportional and coupled values). Usually a small amount of the Active Power energy is also dissipated on heating some of the solid elements of the acoustic load (Pipe-Clamp, Pipe Fittings, etc.).

TEST OPTIMIZATION:

In cases of liquid processing applications, using calorimetric measurements with our pipe clamp system or any other reactor type based on MMM technology should give you a good measure for making the optimum power settings of the generator and to see how much of Active power is dissipated in liquid medium. We recommend that you test with the Ultrasonic Power set at 2000 and then measure with the power level at 40%, 50%, and 60% to see if you are getting incremental active power delivered to the liquid. Please discuss the results with us.

COMPARISON TO OTHER SYSTEMS:

Making a direct power output comparison of our system to the other system you have tested may be difficult in simple terms. If the other system is using tuned probe elements in a flow cell arrangement then they are delivering a somewhat different kind of ultrasonic energy and would be like comparing apples to oranges. High power probes are capable of delivering very high surface power energy (high amplitude and high pressure) to a focused area normally to the tip of the probe. An analogy would be to compare this high energy probe to a blow-torch where high heat energy is focused on a small area. Such high power ultrasonic probes are very good for making very high pressure acoustic reactions, breaking apart large material flocks, and creating focused cavitation in a limited volume. We also make such systems using one of our 4,000 watt fixed frequency generators in waste water processing where breaking and damaging the particles is important. If you are working with food products you need to take care that you are not damaging important elements and characteristics of the food with such focused power.

In contrast our Pipe-Clamp technology is delivering the power energy over a larger surface area (the pipe walls) compared to the small probe tip surface. Our Pipe-Clamp system is distributing power more evenly across a larger active surface and that means cavitation is generated in a much larger volume. Consequently our system should make better liquid degassing and larger volume processing.

In the end the best measurement of comparative performance is the end result. Which system makes better degassing without damage to the material under treatment? The problem I now see is that you must try to operate both systems at comparable power levels to make an evaluation.

If you have any questions about our above technical reply please don't hesitate to contact me. In the meantime please respond to my 3 questions. We are very interested to solve all of your problems and make the best possible test.