INSTRUCTION MANUAL

FISHER SCIENTIFIC

Model 550

Sonic Dismembrator

Fisher Scientific Company

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SONIC DISMEMBRATOR
Instruction Manual

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SAFETY PRECAUTIONS

Read All Instructions Before Installing or Using Equipment

Your new Torbeo Ultrasonic Processor has been designed and tested to assure maximum operator safety. However, no design can completely protect against improper usage which may lead to bodily injury and/or property damage. For total safety and equipment protection, read the instruction manual carefully before attempting to operate this equipment. Follow all operating procedures and observe the following safety precautions.

WARNING !!

- High voltage is present in the generator (power supply), convertor and high frequency cable. Do NOT attempt to remove the generator cover or convertor case.

- Do NOT touch any open cable connections on the unit while the power is turned on.
- Do NOT operate generator with convertor disconnected from high voltage cable.
- The generator must be properly grounded with a 3-prong plug. Test electrical outlet for proper grounding before plugging in unit.
- Install the unit in an area free from excessive dust, dirt, explosive or corrosive fumes and protected from extremes in temperature and humidity.
- NEVER immerse the convertor in liquids of any kind, or let condensed moisture or liquid drip into the convertor.
- NEVER grasp an activated horn or touch the tip of a vibrating probe, it can cause severe burns and tissue damage.
- Do NOT allow the tip of a vibrating horn or probe to touch the countertop or any other hard surface. It could damage the probe or overload the generator.
- Avoid touching the bottom or sides of a glass or plastic container with a vibrating probe. It could crack or shatter the glass and melt the plastic tube.
- Turn off the power switch, unplug the generator, and disconnect the power cord from the back of the generator before attempting to replace the fuse.
- Refer to the following Safety Inspection Procedures on page 4.

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SAFETY INSPECTION PROCEDURES

Safety precautions regarding the operation and handling of high voltage equipment is prominently indicated in the instruction manual. This letter serves as a safety reminder to the operators to visually and physically inspect the unit to insure optimum and safe performance. This inspection should be scheduled as a routine maintenance procedure, and done with the generator turned OFF, and the unit unplugged from the AC power source.

As with any product of this kind, some applications are more severe than others, resulting in our equipment being subjected to harsh environments and aggressive handling. Long exposure to acid or caustic fumes will result in corrosion of metal parts or components. Check the rear of the generator, convertor, and cables for any signs of rust or discoloration. If discoloration is found, move the generator away from the source of the contaminant.

Periodically examine the high voltage cable, which attaches the convertor to the generator, for signs of damage. Inspect the cable's insulation for cracks, kinks, wear and burn marks, and check the end connectors for signs of pulling, fraying or breakage due to extended use or rough handling. Replace the cable immediately if damage to the cable is present.

Should the convertor/cable assembly be subjected to misuse, such as dropping or a severe pulling force on the wire itself, the cable must be inspected as above.

Should the unit not function properly, shut the unit off and inspect the cable as above BEFORE any other action is taken.

DO NOT USE A CABLE WITH BROKEN END CONNECTIONS, EXPOSED WIRES, CRACKED OR FRAYED INSULATION. HIGH VOLTAGE IS PRESENT IN THE CABLE AND MAY POSE A SHOCK HAZARD. DO NOT TOUCH THE CONVERTOR ASSEMBLY UNTIL THE POWER SWITCH OF GENERATOR IS IN THE OFF POSITION AND UNIT IS UNPLUGGED.

If the operator is in doubt as to the condition of the unit, call 800-645-9846 to speak with a customer service representative for prompt attention.

The cable assembly should not be used to carry the convertor or to pull it toward the user. Make certain that the cable always has slack and is never tensioned. Move the generator and convertor assembly closer to one another to accomplish this. If this is not possible, contact your supplier to obtain a longer cable.

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SPECIFICATIONS

Generator:

Dimensions:	19 cm W x 47 cm L x 29.5 cm H (7.5" x 18.5" x 11.6")
Weight:	6.3 Kg (14 lbs) for 110V; 7.4 Kg (16.5 lbs) for 220V
Input Voltage:	115/220 VAC nom.; 60/50 Hz
Full Load Current:	10 amps at 115V; 7.5 amps at 220V
Fuse Rating & Type:	10 amp at 115V; 8 amp at 220V (fast acting fuse)
Voltage Tolerance:	±10% nominal voltage
Output Voltage/Freq:	1500 Vrms (max) / 20 kHz (nom.)

Convertor:

Dimensions:	20.3 cm L x 6.4 cm Dia. (8" L x 2.5" Dia.) without Horn
Weight:	0.9 Kg (2 lbs)
Materials:	Aluminum case and front driver

Standard Horn:

Dimensions:	12.7 cm L x 3.8 cm Dia. (5" L x 1.5" Dia.) Tapered to 12.7 mm Tip Dia. (0.5")
Weight:	0.45 Kg (0.5 lbs.)
Materials:	Titanium Alloy

Environmental:

Pollution Degree:	one (1)
Temperature Limits:	50°F - 110°F (10°C - 43°C)
Barometric Pressure:	Unlimited

NOTE: In high vacuum areas, additional cooling provisions may be needed. Contact the manufacturer.

Accessories:

Use only accessories and probes listed in the catalog by the manufacturer as suitable for use with this appliance. Do NOT attempt to fabricate ultrasonic tooling or accessories unless approval has been obtained from the manufacturer in advance.

I. INSTALLATION

A. Inspection

Your new Ultrasonic Processor has been thoroughly inspected, tested, and carefully packaged before leaving the factory. Upon receipt, carefully inspect the shipping carton for any signs of damage. Unpack the unit from its shipping carton and inspect carefully for any damage in transit. Check the contents against the packing slip (check the packaging material carefully for small items before disposing). Claims for lossed or damaged items sustained in transit must be made directly to the shipping company immediately (within 48 hours of delivery). Report any missing components to your supplier. **Do Not Operate Damaged Equipment**. Retain all packing materials for future shipment.

B. Power Requirements

For power requirements, check the label on the back of the unit.

1. For 115V, the generator requires a single phase, three wire, 115V/60hz power supply, unless otherwise specified, and two 10 amp fast acting fuses.

2. For 220V, the generator requires a single phase, three wire, 220V/50hz power supply, unless otherwise specified, and two 8 amp fast acting fuses.

NOTE: ONLY use IEC approved fuses, model GDB10 for 110V and GDB8 for 220V. Do NOT use "slow blow" fuses or fuses rated above the amperage noted.

WARNING

The electrical line cord is equipped with a 3-prong grounding plug. Do not, under any circumstances, remove the grounding prong. The plug must be plugged into a mating 3-prong grounding type outlet.

C. Placement of Equipment

Place the Generator in an area that is free from excessive dirt and dust, explosive or corrosive fumes. A fan maintains safe operating temperature in the generator by circulating air over the electronic components. Therefore, the generator must be placed so that the air intake on the rear panel is not blocked. Inspect the air intake grill periodically, to insure it is free from debris. Clean and inspect the air intake grill periodically to keep it free from dust and debris.

D. Cleaning Instructions

The Generator and Convertor may be cleaned using Windex or similar acid-free cleaning solution and an anti static cleaning cloth. Horns and probes should be cleaned using isopropyl alcohol.

II. OPERATION

A. Principles of Ultrasonics

The generator (power supply) converts conventional 50/60 Hz AC line power to 20 kHz electrical energy which is fed to the convertor where it is transformed to mechanical vibration. The heart of the convertor is a lead zirconate titanate (piezoelectric) crystal which, when subjected to an alternating voltage, expands and contracts. The convertor vibrates in the longitudinal direction and transmits this motion to the horn tip immersed in the liquid solution. Cavitation results, in which microscopic vapor bubbles are formed momentarily and implode, causing powerful shock waves to radiate throughout the sample from the tip face. Horns and probes amplify the longitudinal vibration of the convertor; higher amplification (or gain) results in more intense cavitational action and greater disruption. The larger the tip of the probe, the larger the volume that can be processed but at lesser intensity.

The convertor is tuned to vibrate at a fixed frequency of 20 kHz. All horns and probes are resonant bodies, and are also tuned to vibrate at 20 kHz. Intense cavitation after a prolonged period will cause the tip of the horns and microtip probes to erode. Erosion will cause a slight variation in frequency. It is important that the probe is retuned by following the tuning procedure.

B. Description of Major Components

1. **GENERATOR** (or power supply) - includes all operating controls and indicators, and separable three-wire grounded line cord, fuse, external power control jack, high frequency cable connector.

   a. Microprocessor Controller - a programmable microchip which provides precise control of output power, processing time, and cyclical pulsing of power. It integrates the Digital Timer with the PULSER Cycle Timer to provide timing, pulsing and elapsed time displays.

   b. Digital Timer - this microprocessor based feature permits precise timing of sample processing in one second increments from one second to ten hours. The total desired processing time is set using the pressure-sensitive keypad. Both the total processing time and elapsed sonication time are displayed on the LCD screen. A Start/Stop control initiates or reinitiates timed sonication. A Pause control halts sonication or allows for manual pulsing. The total preset processing time is unaffected by pauses or pulsing, whether by hand or with the Pulser Cycle Timer.

   c. Pulser Cycle Timer - also microprocessor based, this feature permits the application of ultrasonic energy to the sample on a pulsed basis. Pulse ON and OFF times are adjustable in 0.1 second increments from 0.1 seconds to 1 hour. Pulsed sonication allows for intermittent heating and cooling of the sample in order to avoid excessive heat build-up to occur. It also allows for particulates to settle back under the tip.

2. **CONVERTOR** (or transducer) - includes the piezoelectric crystals, housing, and black front driver (first stage of acoustic amplification) with a ½" - 20 threaded hole for horn attachment. A separate high-frequency cable is also furnished.

3. **HORN** (or probe) - a 5" L x 1½" W resonant body that steps down to a ½" diameter probe tip. The horn serves as the second stage of acoustic amplification. It includes a removable or solid tip, a ½"-20 stud for attachment to the convertor, and external threads around the body for attachment of accessories (e.g. Flow Cells). The Horn is available in three standard sizes of ½", ¾", or 1" as determined by the horn's tip diameter (larger diamenter horns are available). In addition, each horn comes in three different tip configurations: Tapped horns have a replaceable Flat Tip; Solid horns do not have a replaceable tip; and Sapphire tipped horns have a 1/16" thick sapphire disk bonded to the tip of a solid horn.

a. Flat Tips - a ¼" thick, radiating surface attached to the probe end of the horn. The flat tips will erode with use and are replaceable. The tips are matched to horns of equal diameter (i.e. ½", ¾", or 1" diameter).

b. Microtip™ Probes - attach directly to the end of the 1/2" dia. tapped horn in place of the flat tip. The Microtip probes are tapered down to a narrow point and serve as the third stage of acoustic amplification. They are used to process small sample volumes of less than 20mL.

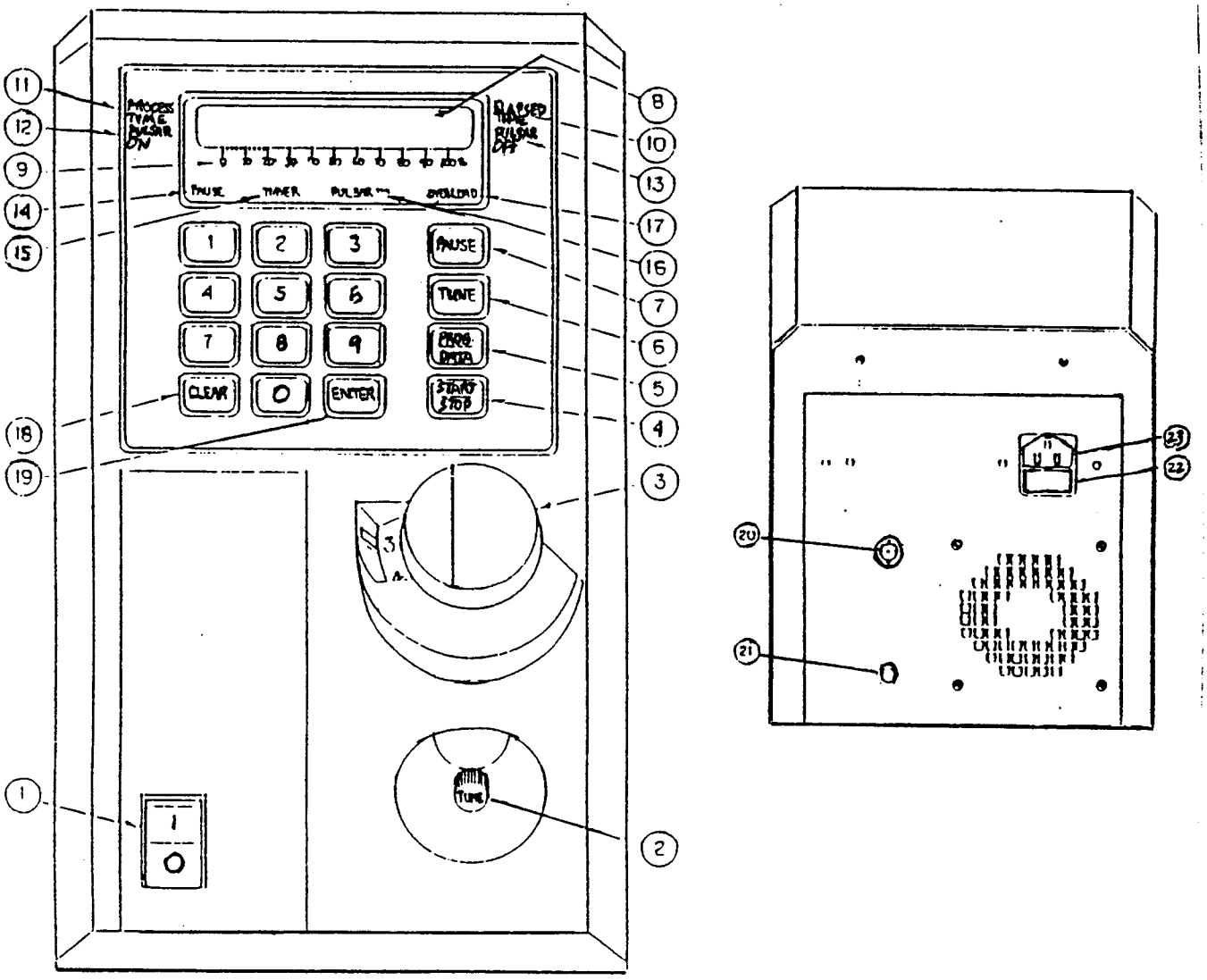
c. Extenders - Half-Wave and Full-Wave Extenders are used to extend the length of a horn and provide longer reach when needed. Extenders attach directly to the end of any tapped horn of equal diameter. They are straight sided (not tapered or stepped), and are available in lenths of 5" and 10" or longer.

d. Cup Horns - attach directly to the convertor in place of the standard horn. The Cup Horn has a 2" or 2½" diameter radiating surface with an attached clear acrylic sleeve. The sleeve of the Cup Horn is filled with water (or liquid) and samples are place within. The Cup Horn is used to process multiple samples without direct probe contact, and functions much like a high intensity ultrasonic bath.

e. Stepped Microtip Probe - The Stepped Microtip Probe consists of two parts, an upper section and a lower section. The upper section is used in place of the standard horn, and the lower section attaches directly to the upper section. The lower section has three "steps" in it that narrow the probes diameter from ½" to ⅛" diameter. The stepped Microtip is used in place of a tapered Microtip when a longer reach and narrower profile are required, such as when processing samples in long, narrow test tubes (e.g.12mm x 75mm).

f. Flow Cells - Flow Cells are used for continuous in-line processing applications, and for processing batches larger than 4 liters (I Gal.). The smaller flow cells thread directly onto the standard diameter horns (½", ¾", 1") using the threaded section on the body of the horn. The larger flow cells clamp onto specially designed Flanged Horns using quick-release clamps.

C. Controls Diagram



Controls Index

1	Power Switch	14	Pause Indicator
2	Tuning Control Knob	15	Timer Indicator
3	Amplitude Control Knob	16	Pulser Indicator
4	START/STOP Key	17	Overload Indicator
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6	TUNE Key	19	ENTER Key
7	PAUSE Key	20	SHV Cable Connector
8	LCD Display Screen	21	Footswitch Jack
9	Power Output Display	22	Fuse (10 amp/115V)
10	Elapsed Time Display		(8 amp/220V)
11	Process Time	23	Power Cord Receptacle
12	Pulser On Time		
13	Pulser Off Time		

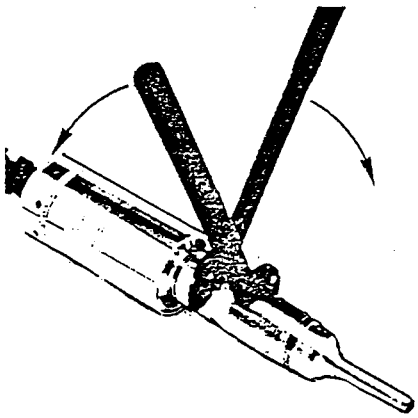
D. Function of Controls and Indicators

INDEX NO.	DEVICE	FUNCTION
1	Power Switch	Turns electrical power ON (I) and OFF (O) to the generator. The switch lights up when the power is turned on.
2	Tuning Control	Adjusts the frequency of the generator to match that of the convertor in order to optimize efficiency and performance.
3	Amplitude Control	Controls the amplitude of ultrasonic vibration at the horn tip
4	START / STOP Key	Starts and Stops sonication in continuous or programmed mode, and resets the timer in programmed mode.
5	PROG / DATA Key	Initiates programmed mode by first allowing selection of memory location (Mem 0-9), and then begins entry program for Timer and Pulser modes. Entries are displayed on the LCD screen.
6	TUNE Key	Begins tuning mode by engaging tuning circuit. Display screen will indicate "Tuning ....Probe Active".
7	PAUSE Key	Allows manual delay by "freezing program" during timed cycle
8	LCD Display Screen	Backlit LCD displays the following parameters and user prompts
9	Power Output Display	A bar graph indicates power output as a percentage of maximum available power (i.e. 30% output = 0.3 x 600, or 180 watts)
10	Elapsed Time Display	Indicates actual elapsed (on) time of sonication
11	Process Time	Displays total preset sonication time (1 sec. to 10 hrs. maximum)
12	Pulser on Time	Indicates preset pulse ON time from 0.1 sec. to 1 hr. maximum
13	Pulser off Time	Indicates preset pulse OFF time from 0.1 sec. to 1 hr. maximum
14	Pause Indicator Lite	Indicates sonication is being manually delayed during processing
15	Timer Indicator Lite	Indicates that timer is preset for programmed operation
16	Pulser Indicator Lite	Indicates that unit is programmed for pulsed operation
17	Overload Indicator	Red light indicates that more power is being demanded than generator can supply or that unit requires tuning or servicing.
18	CLEAR Key	Clears previous or erroneous entries.
19	ENTER Key	Enters (or stores) data in program memory
20	SHV Cable Connector	Connects convertor cable to generator
21	Footswitch Jack	Allows external timer or remote ON/OFF control of sonication
22	Fuse (10 amp 115V) (8 amp 220V)	Circuit breaker protects generator from electrical overload
23	Power Receptacle	Connector for power cord from wall outlet to generator

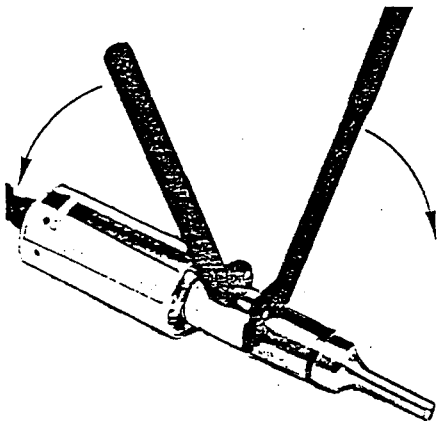
E. Removal (Attachment) of Horns and Tips

Proper care and cleanliness of horns and tips is essential for good performance and long service. Clean all mating faces, studs, and threaded holes with alcohol and allow to dry. When connecting horn to convertor or tip to horn, thread by hand until all joints mate smoothly. If resistance is met, avoid cross threading and rethread by hand. Do not force the threads by wrenching. When using wrenches, apply an even and firm pressure to tighten all joints.

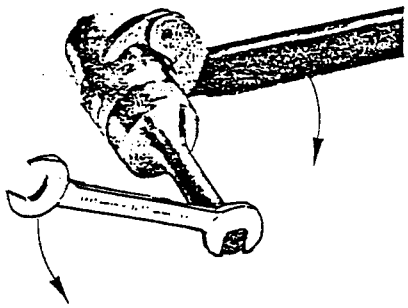
The radiating face of replaceable tips and solid horns is subjected to intense bombardment by shock waves from cavitation implosions. Roughening the surface area accelerates the rate of erosion. The radiating face can be smoothed with fine emery paper. If allowed to erode further, until pitted, the horn or tip will be damaged beyond repair. Do no file, grind, or lathe down tips, horns, or mating surfaces. Retune unit after smoothing tip. Flat tips badly burred by improper wrenching should be replaced. A bad joint is indicated by severe heating at the joint. This is indicated by a rising or an off-scale meter reading or by the inability to tune.



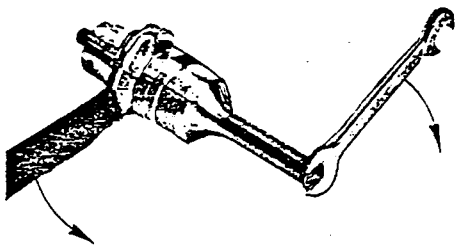
HORN REMOVAL



HORN TIGHTENING

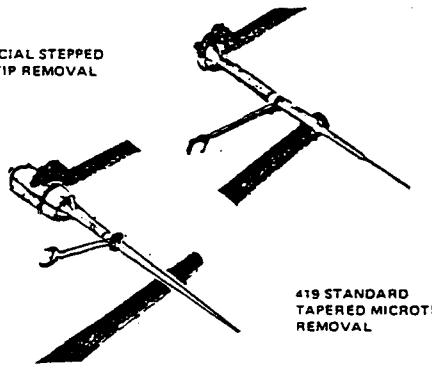


TIP REMOVAL



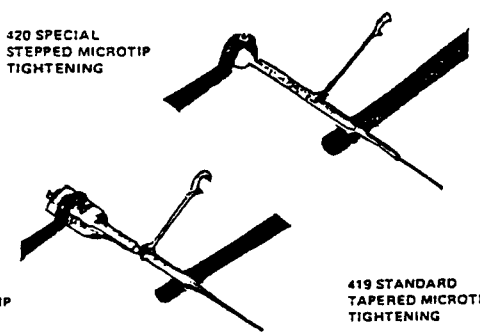
TIP TIGHTENING

420 SPECIAL STEPPED MICROTIP REMOVAL



419 STANDARD TAPERED MICROTIP REMOVAL

420 SPECIAL STEPPED MICROTIP TIGHTENING



419 STANDARD TAPERED MICROTIP TIGHTENING

F. System Setup and Operation

CAUTION: If the generator has been left in a cold environment for a prolonged period of time, do not operate the unit until it has warmed up to room temperature. Turn the power switch on, with the Amplitude Control Knob on zero, 20 minutes before using to warm-up the electronics faster.

1. Check to make sure that the Power Switch on the generator is turned OFF.

2. Turn the Amplitude Control Knob counter clockwise to setting zero.

3. Connect either end of coaxial High Frequency Cable to SHV connector on rear panel of generator, and connect other end of cable to SHV connector on the convertor. Push the connectors on and turn the chrome rings ¼ turn to secure the connectors.

4. Connect Power Cord to receptacle on rear of generator and plug into a grounded power outlet.

5. Mount the convertor and horn into sleeve on top of the Sound Enclosure, or use a laboratory stand and large finger clamp to hold the convertor and horn in position. **NOTE:** Do Not hold or clamp the convertor by the black portion or by the horn itself, only support the convertor by clamping around the broad (chrome-plated) section.

6. The horn and its flat tip were assembled and attached to the convertor at the factory, but we recommend that you check the tightness of the horn and flat tip by using the wrenches provided and refering to **Section E** of this manual on **page 11.**

7. The generator has been pretuned at the factory prior to shipment, but we recommend that you check the tuning of the unit by referring to the **Tuning Instructions** on **page 13** of this manual.

8. If you will be using a tapered **Microtip™ or extender** for sample processing, then remove the flat tip on the end of the horn by using a pin spanner wrench to hold the horn and the 7/16" open end wrench to loosen the flat tip (the wrenches are included with your unit). Then hand tighten the Microtip or extender onto the end of the horn and tighten securely with the wrenches provided (see **page 11**).

CAUTION: A loud, high piercing sound emanating from the horn or probe indicates that one of the components is loose or possibly cracked. STOP processing immediately. Turn off the generator and check the tightness of the horn to convertor, and flat tip to the horn; or the tightness of the Microtip or extender to the horn. Retune the generator and try running unit again. If the loud noise persists, or if you have difficulty in tuning the unit, then contact your supplier for assistance.

WARNING!! An insufficiently tightened horn, probe or tip will inhibit tuning and might cause damage to the circuitry and mating parts. NEVER assemble or disassemble the probe by holding the convertor in a vise. ALWAYS use the tools provided and place a firm mat or towel underneath the convertor and horn to prevent slippage and damage. Avoid pressing sides of Microtip down into countertop when tightening with wrenches (see section E on page 11 for Horn Removal and attachment instructions).

9. When using a footswitch, plug line-jack into the Footswitch Connector on rear panel of generator. Make sure that the plug is inserted fully. **NOTE:** To safeguard the fuse against failure, always switch the power supply off before connecting or disconnecting the footswitch plug.

G. Tuning Instructions - (for standard horns and probes)

To assure optimum operation, tune the generator in accordance with the following procedure each time a horn, probe, or tip is changed, and periodically thereafter (about once per week) to maintain proper tuning.
All tuning should be done with the probe in air. The horn or Microtip should not be immersed in liquid or come in contact with the work surface when tuning. Support the convertor by using a sound enclosure, or a sturdy lab stand and large finger clamp. **Clamp only around the broadest section of the convertor** and NOT on the black front driver or by the horn itself.

When operating with liquids at extreme temperatures, first immerse the probe in the sample liquid for a few minutes to equalize the temperature of the probe, then remove the probe from the liquid and tune quickly with the probe in air.

1. Turn AMPLITUDE CONTROL KNOB counter-clockwise to zero.

2. Press POWER SWITCH to ON (up) position. The switch will illuminate.

3. When the prompt (for tuning procedure, refer to manual) appears, press the TUNE key. The Screen will read: (TUNING - - - PROBE ACTIVE).

4. Turn the Amplitude Control Knob to a setting of 3.
   a. Note the position of the Bar Graph on the LCD Display as you turn the knob.
      Do Not allow the reading to exceed 50%. STOP if the reading reaches 50% and proceed to step 4b.
   b. Rotate the Tuning Knob clockwise or counter-clockwise until a **minimum reading** is obtained (usually less than 10%). Do Not force the tuning knob past its stops.

5. Turn the Amplitude Control Knob to a setting of 6 **(Note: If using a Microtip or an extender, Do Not exceed a setting of 5,** tune at 5, skip step 6, and proceed to step 7).
   a. Again, note the position of the Bar Graph and do not exceed a reading of 50%.
   b. Rotate the tuning knob to obtain a minimum meter reading (less than 10%).

6. Repeat steps 5a & b at a setting of 10 and minimize the meter reading one last time.

7. Press the STOP key and turn the Amplitude Control Knob back to Zero.

YOUR GENERATOR IS NOW TUNED

H. Special Tuning Instructions For: Microtip™ Probes, Extenders, and Cuphorns

Microtip Probes:
Follow steps 1-5 in the above tuning procedure but **do not exceed the Microtip limit of 5** on the Amplitude Control Knob. Tune with the probe in air and avoid touching the probe to any hard surface. Tune as quickly as possible (<30 seconds). Prolonged operation in air or exceeding the Microtip limit may cause the Microtip to fracture.

Extenders:
Half-Wave and Full-Wave extenders should not be used above an amplitude setting of 5, unless they are being used in a pulsed mode with short bursts of power (i.e. environmental soil testing, Method 3550). For continuous operation or extended pulsing, follow steps 1-5 of tuning procedure but **do not exceed an amplitude setting of 5**. For short pulsing cycles, tune accross the full power scale following steps 1-7 of the tuning proceedure.

CUPHORNS:
Do not tune cuphorns with liquid in them. Tune cuphorns before adding water, or by first draining filled cuphorns down to the lower outlet fitting. Tune the cuphorn according to the Tuning Instructions on page 12. Then refill the cup with liquid and run the cuphorn at a medium to high amplitude setting for 3 to 5 minutes to degass the liquid and remove any air bubbles trapped within the central hole of the cuphorn. **Cuphorns work best at amplitude settings between 5 and 8.** At these settings more cavitaional energy is transmitted into the samples placed within the cup.

To proceed to run the unit in continuous mode, simply immerse the probe in your sample, press the START key and adjust the amplitude setting to the desired intensity level. To run the unit in a programmed mode, simply press the PROG/DATA key, select a memory location, and then press the START key to run the selected program. If the unit has not yet been programmed with the desired timing and pulsing parameters, then follow the instructions on pages 15-16 to program the unit as desired.

Before operating the ultrasonic generator:

First	Check the condition and tightness of the horn and tip with the wrenches provided.
Second	Support the convertor and horn by using a Sound Enclosure or a lab stand and large finger clamp. Secure the convertor around the broad (chrome-plated) section and NOT by the black section or by the horn itself. NEVER allow the horn or probe to touch the workbench or other surfaces.
Third	Check the tuning of the instrument to insure efficient operation by following the tuning instructions on page 13.

I. Programming Instructions

A. Continuous Mode Operation

1. Turn generator on by pressing "I" on Power Switch, switch will illuminate when power is on

2. Press **TUNE** to tune, or press **CLEAR** to select Programmed Mode or Continuous Mode

3. a. Press **START** for Continuous Operation, or
   b. Press **PROG** for Programmed Mode (refer to Programming Instructions below)

   Note: Before processing sample in continuous mode, first lower probe into sample and then adjust amplitude setting for desired intensity, avoid foaming the sample by adjusting the intensity (amplitude) setting, and by adjusting the probe's immersion depth.

4. Press **PAUSE** if you want to interrupt processing; Press **PAUSE** again to resume processing

6. Press **STOP** to end processing of sample

7. To turn generator off, press "O" on Power Switch, switch will no longer be illuminated

B. Timed and Pulsed Mode Operation

1. Turn generator on, power switch will illuminate

2. Press **TUNE** to tune, or press **CLEAR** to select operating mode

3. Press **PROG/DATA** to select programmed mode; Display will show program screen and memory location {Process Time 0:00:00 PROG,START,CLEAR Elapsed Time
   Pulse On 00:00.0 (MEM. 0) 00:00.0 Pulse Off }

4. Select a memory location by pressing any number on the keypad from 0 to 9

5. Press **PROG** key a second time to begin programming the selected memory location

6. Enter the **Process Time** from one second (0:00:01) to ten hours (9:59:59) using the keypad (e.g. press 1, 0, 0 for 1 minute of processing time; Press 1, 3, 0 for 1½ minutes)

7. Press **ENTER** to save your entry in memory; Display will switch to Pulse On data screen

8. Enter **pulse on** time from 1/10th second (00:00.1) to one hour (59:59.9), and press **Enter** (e.g. press 1,0,0 for 10 seconds of pulse on time; Press 5 for 0.5 (½ sec.) pulse on time

9. Enter **pulse off** time from 1/10 th second (00:00.1) to one hour (59:59.9), and press **Enter** (e.g. press 1,0 for one second of pulse off time: Press 5 for 0.5 (½ sec.) Pulse off time

10. Press **START** to begin processing sample as programmed, but first lower the probe into your sample and adjust amplitude setting to desired intensity level (avoid foaming of the sample).

11. Press **PAUSE** if you want to interrupt sample processing, then press **PAUSE** again to continue

12. Press **STOP** to end processing of sample. The program timer will automatically reset itself

13. Press **DATA** if you wish to review the program parameters in selected memory location

14. Press **"O"** on the Power Switch to turn generator off, switch will no longer be illuminated

C. Timed Mode Only

To operate in a Timed Mode only, simply press **CLEAR** and **SAVE** for the "pulse on" time. After turning generator on:

1. Press **TUNE** or press **CLEAR**

2. Press **PROG** and select memory location

3. Press **PROG**, enter total Process Time from 0:00:01 to 9:59:59 and press **ENTER** to save

4. Press **CLEAR** and then **ENTER** to enter zero for the pulse on time (microprocessor will automatically enter zero for pulse off time)

5. Press **START** to begin processing continuously for the time duration entered

6. To review parameters, press **DATA**

D. Pulsed Mode Only

To operate in a Pulse Mode only, simply press **CLEAR** and **SAVE** for the "process time". After turning generator on:

1. Press **TUNE** or press **CLEAR**

2. Press **PROG** to select memory location

3. Press **PROG** to begin data entry

4. Press **CLEAR** and **ENTER** to enter zero for the process time

5. Enter **PULSE ON** time from 00:00.1 to 59:59.1 and press **ENTER** to save

6. Enter **PULSE OFF** time from 00:00.1 to 59:59.1 and press **ENTER** to save

7. Press **START** to begin processing in a pulsed mode with no time limit (you must press the **STOP** key to end processing)

8. To review parameters, press **DATA**

J. Overload Indicator

The generator unit is designed to deliver high power to the convertor/horn combination on a continuous basis. However, under certain extraordinary conditions, the amount of power supplied might endanger the circuitry to the point of failure.

In order to prevent unnecessary downtime, an overload protection feature has been built into the generator. When the output power exceeds design specifications, the overload light will flash, the output will be disabled, and the following screen will appear: "OVERLOAD REFER TO MANUAL". If this should occur, proceed with steps 1 - 8 given below.

1. Shut the unit off using main power switch.
2. Remove load from horn (flow-cell) or liquid.
3. Check tightness of horns and/or tips. NOTE: Remove tips and clean threads before tightening threads.
4. Check horn for cracks or excessive erosion.
5. Turn on generator and follow instructions. If horn/tip cannot be tuned, replace and retune.
6. Check all electrical connections.
7. Reduce pressure of load, if applicable.
8. If all preceding fails to rectify problem, consult your supplier.

K. Applications, Techniques, and Tip Care

The Ultrasonic Liquid Processor will break cells, bacteria, spores or tissue. It can prepare on emulsion down to 1/100 of a micron, homogenize "immiscible" liquids, polymerize some materials, de-polymerize others, and accelerate chemical reactions. By virtue of this instrument, faster and more efficient extraction of serums, toxins, enzymes, and virus from organic sources is also made possible. Cavitation breaks down cell structure rapidly, allowing the desired material to pass into the processing medium before the cell contents undergo any substantial chemical change. It is also an excellent degasser.

TIP CARE

The probe tip may be sterilized either by immersing in boiling water or in a detergent bactericide such as Staphene and a disinfectant.

Before each experiment, place the probe tip in water or alcohol and turn the power on for a few seconds to remove residue. It also can be sterilized using alcohol with the power on.

The sides and end of the tip must NEVER be allowed to come in contact with anything but the solution. When using a microtip, the stress resulting at the point of contact with the vessel could cause the microtip to fracture. Standard probes will not fracture if they come in contact with the vessel, but can damage the vessel.

Touching the vessel wall with the tip will reduce power slightly and release tiny glass and titanium particles which may gray the solution. The particles will form a thin dark grey layer on centrifuging but will usually have little effect chemically.

Cavitation erosion will reduce power output without showing up on the generator meter reading. Existing erosion will increase the rate of future erosion. The smoother or shinier the tip, the better. After every 5 or 6 hours of use, the tip should be polished with fine emery cloth or filed for a few seconds.

Proper care of the probe is essential for dependable service. The intense cavitation will, after a prolonged period, cause the tip to erode, and the power output to decrease without showing up on the power monitor. The smoother and shiner the tip, the more power will be transmitted into the liquid. Any erosion of the probe tip will increase the rate of future erosion. For that reason, it is recommended that after every 5 or 6 hours of use, the tip be examined, and if necessary, polished with a fine emery cloth. Since the probe and tip are tuned to vibrate at a specific frequency, it is most important that only the contaminated surface be removed. If tip wear is excessive, replace the tip.

PROBE DEPTH

Immerse the probe tip not less than 1 to 1½ tip diameters into the solution, without touching the bottom. This depth rate applies to the ½" horn; immersion depth can be less for larger horns and may have to be more for smaller probes used at higher intensity.

FOAMING AND AEROSOLING

Insert the tip deep enough below the surface of the liquid to insure there is no aerosoling or foaming. Aerosoling and foaming generally occur when the tip is not immersed far enough into the solution. Lowering the power and increasing sonication time will usually reduce aerosoling; in sever cases, use an aerosol cap or sealed atmosphere treatment chamber. In organic materials, protein release from cell material acts like a wetting agent and tends to promote foaming. Lowering the tip in the solution, increasing power, and reducing solution temperature will normally prevent foaming. For severe foaming, use a narrower processing vessel, use a vessel with an irregular inner surface (such as the Cold Shoulder Cooling Cell), or increase effective viscosity by concentration or by adding glass beads. Once foaming occurs, shut off power or reduce it below cavitation before proceeding. It may be necessary to use a centrifuge or high vacuum to reduce a tenacious foam. If foam persists, the sample may have to be discarded.

LIMITATIONS

Viscous solutions and high concentrated liquids can be a problem to sonicate. The maximum limit of viscosity is 8,000 cP and 15% concentration by weight. If the liquid is so thick that it will not pour or circulate easily, or if 25 micron glass powder will not settle to the bottom quickly, it is too thick and cannot be processed effectively.

KEEP SAMPLES COOL

Intense ultrasonic processing causes the liquid temperature to elevate especially with small volumes. Since high temperature reduces cavitation, the liquid should be kept as cold as possible. This can be accomplished by immersing the sample vessel in an ice-salt-water-alcohol, or by using a water-jacketed processing vessel through which very cold water or alcohol is circulated. To minimize temperature elevation, use the PULSAR™ Cycle Timer or pulse by hand in short, quick bursts.

PROCESSING TISSUE

Whenever possible, the tissue should be diced very small to permit movement within the liquid. Freezing followed by powdering could also be resorted to, if this procedure is not detrimental to the experiment.

Large samples should first be liquified in a high speed mechanical blender for about 10 seconds. If sub-cellular particles are desired intact, the amplitude control should be set low and the processing time increased.
Since the greatest concentration of energy is immediately below the probe, it is imperative that the sample be kept as close to the tip as possible. Liquids are easily processed because the free moving cells circulate repeatedly below the probe. Solid materials, however, have a tendency to be repelled by the ultrasonics. To alleviate this problem, the vessel should be large enough to accommodate the probe, yet small enough to restrict sample movement.

If the probe has to come in contact with a solid sample, use a standard ¾" (20mm) diameter stainless steel centrifuge tube cut to 3" (70mm) length. Do NOT use a glass tube.