PARTS WASHERS

Operator and Maintenance Manual

BTU Benchtop Ultrasonic Cleaner

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1. Warnings

Warning Symbols

Danger

Indicates an imminently hazardous situation, which, if not avoided, could result in death or serious injury. This signal word is to be limited to the most extreme situations.

Warning

Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

Caution

Indicates an imminently hazardous situation, which, if not avoided, could result in minor or moderate injury.

High Voltage

The HIGH VOLTAGE symbol means that failure to follow this safety statement MIGHT result in personal injury or death.

SAFETY PRECAUTIONS

The following *safety precautions* should be observed when operating this equipment.

WARNING: Utilize this equipment with accordance to the manual and good safety practices. Failure may result in poor equipment performance, personnel injury or death, or equipment damage.

WARNING: USE ONLY WATER OR WATER-DETERGENT MIX IN CLEANING CHAMBER. NEVER USE FLAMMABLE SOLVENTS (FIRE OR EXPLOSION COULD RESULT) OR CARBON TETRACHLORIDE (PRODUCES TOXIC FUMES).

CAUTION: Never use ultrasonic cleaning console as a sink. Under no circumstances should waste water be poured into it as the water could overflow the drain and damage delicate components.

CAUTION: Incorrect voltage can damage the generator. Do not operate the equipment unless the correct voltage is available.

CAUTION: Never operate unit without at least 6 inches of water in the cleaning chamber. Failure to observe this precaution could damage the equipment.

WARNING: Do not operate this equipment for other than its intended use. The system is intended for cleaning components with water and an aqueous, non-flammable, detergent.

Ground fault circuit protection shall be provided at the time of installation.

WARNING: Hearing protection is required for the user of this equipment.

This equipment is intended to be utilized indoors in an ambient temperature of 50°F to 95°F.

The benchtop systems are all protected by splashing water and debris to a rating of IP 23.

This system contains one power cord that is required to be attached to a properly rated three wire fusible disconnect with a grounding connection capable of handling twice the rated current. The wires are colored as follows: black - hot / ungrounded, white - return / grounded, green & yellow - protective earth. The system also contains one drain valve for tank content drainage. The drain can be plumbed into a facility drain or remaining unplumbed for added mobility on draining locations.

Recommend the use of NRTL approved electrical plug for use with this system. Select the appropriate plug for the voltage and current rating of the unit as per the respective national standard. When the plug is installed, make sure the wires are cut so that the protective earth is the last to take the strain. Electrical plugs should be installed only by a certified electrician.

2. Specifications

	BTU0812-A	BTU1114-A	BTU1420-A
Overall Width	16	18	24
Overall Length	18	21	24
Overall Height	15.5	16.5	19.5
Tank Width	12	14	20
Tank Length	8	11	14
Tank Depth	10	11	14
Working Depth	9	10	12
Total Volume of Liquid (gallons)	4.2	7.3	17
Working Volume of Liquid (gallons)	3.7	6.7	14.5
System Electrical Supply Requirements* (Volts)	120	120	120
System Electrical Supply Requirements* (Amps)	6.8	9.5	18
Generator Electrical Supply Requirements* (Volts)	-	-	-
Generator Electrical Supply Requirements* (Amps)	-	-	-
Ultrasonic Power* (Watts)	250	500	750
Frequency of 5300 Series Generator* (kHz)	40	40	40
Heater Power* (Watts)	500	500	1000
Estimated Heat up Time**	1.4 hours	2.5 hours	2.7 hours
Maximum dB Level*	85	85	85
(*) Dependent on selected options (**) 70°F-140°F change of temperature with stainless steel lid on machine. Heat up times can be shortened by turning on the ultrasonics at 100% intensity during heat up time.			

Other voltages / phases are available: 120V / 1PH, 240V / 1PH

All systems will work with either 50 Hz or 60 Hz.

Fuse Schedule

		Fuse						
		F1				F2		
Type	**Model**	**Volts**	**Amps**	**Acting**		**Volts**	**Amps**	**Acting**
BTU Benchtop Series		Ultrasonic Fuse				Heater Fuse		
	BTU0812-A	250	4	Fast		250	6	Fast
	BTU1114-A	250	6	Fast		250	6	Fast
	BTU1420-A	250	10	Fast		250	10	Fast
* All fuses have the cartridge style form factor								

3. Principles of Operation

The ultrasonic generator transforms AC line power to a specified signal (rated in kHz) that drives a piezoelectric converter/ transducer. This electrical signal is converted by the transducer to a mechanical vibration due to the characteristics of the internal piezoelectric crystals.

The vibrations are transferred from the piezoelectric converters to the high-grade stainless-steel tank via the transducers bonded directly to the tank. This vibration is what powers the ultrasonic cleaning process.

The Vibrations cause small vacuum cavities that are formed. These vacuum cavities grow with each vibration until they reach a critical point where can no longer hold their size thus collapsing, or imploding, during compression. This continuing rapid process, called cavitation, is responsible for the scrubbing effect which produces ultrasonic cleaning.

4. Description of Components

BTU1114-A

Generator

The cleaning systems are powered by the ultrasonic generator. The generator supplies the specified signal (25, 40, 68, 132, or 170 kHz) to the transducers. The high efficiency of the generator ensures the maximum cleaning power delivered to the tank without excessive power loss due to heat buildup.

Transducers

The transducers are made up of the piezoelectric converter and the Vibra-Bar that is directly bonded to the stainless steel tank.

Tank

The tank is made from high grade stainless steel. This is critical because of the immense stress that the stainless steel is subjected to during the ultrasonic process. The high grade stainless steel also aids in transferring the ultrasonic signal into the liquid medium.

Lid

Protects from getting contaminants into the liquid when not in use and insulates the liquids' heat when not in use.

Controls

The controls are on the tank itself. The complexity of the controls and their capabilities depend on the options that have been selected by the customer in each system.

5. Preparation of Use (Getting Started)

- Carefully unpack the parts of the system. Check the shipping forms to ensure that you have all the components of the system. If the packaging or the system is damaged, immediately contact your shipping provider.
- Place the system in a clean dry place free of dust and water spray (Dust and water that gets into the generator may cause electrical damage to the system). Ensure maximum airflow to keep the internal components operating at peak performance.
- To safeguard the fuse(s) against failure, always switch the power supply to the off position before connecting or disconnecting the power cord.
- The power cord(s) supplied by Graymills Corporation must be used. If it does not match your wall outlet, use a universal adapter that is appropriate to your country. If your power cord is damaged, contact Graymills Corporation customer service department for a replacement.
- Fill the tank with liquid (a good rule of thumb is to fill the tank to ¾ full). To protect against overflow, allow space in the tank for the water displacement of the items that are to be placed in the tank (**DO NOT** turn on the system without filling the tank with liquid). If a pump is present, prime the pump by forcing liquid into the drain. Continue to prime the pump until the air bubbles stop coming out of the return line.
- Use the chemical in accordance with the manufacturer recommendations. After cleaning one or two items, you may choose to alter the chemical ration as required, depending on the condition and quality of the liquid being used and how heavily soiled the items being cleaned are. Chemicals that are used in this ultrasonic cleaning system must be compatible with 304 and 316L stainless steel. The warranty will be immediately void if a chemical attack to the stainless steel occurs.

6. Operating Instructions

- For first start up of the cleaning system, follow the instruction under "**5. Preparation of Use (Getting Started)**" section of this manual.

- Turn the "Main Power" to the "ON" position (**Do Not** turn on the ultrasonics without having liquid in the tank, doing so will damage the ultrasonic transducers).

- Your system comes equipped with a digital controller for managing the temperature and timers. The temperature of the system will automatically be maintained based upon the set temperature. Setting the timer will allow for precise control of the length of the ultrasonic cleaning cycle. Below is additional information regarding the operation of this controller.

Fig. 02 – Front panel

Display: Shows the measured variable, symbols of the configuration parameters and their values / conditions.

TUNE Indicator: Stays ON while the controller is in tuning process.

RUN Indicator: Indicates that the controller is enabled to operate.

OUT Indicator: Indicates the instantaneous state of the control output.

A1 Indicator: Signalize the output state of T1.

Tapping the '**P**' key will cycle between pages. There are four pages in total:

1. Current Temperature (Red) & Set Temperature (Green)
    - Use the **arrow keys** to adjust set temperature
2. Current Temperature (Red) & Time Remaining (Green)
    - Press '**F**' key to start the timer. Pressing '**F**' while the timer is running will stop the timer and cause it to reset.
    - The default units for the timer is Hours:Minutes
3. 't1' (Red) & Time Remaining (Green)
    - Use the **arrow keys** to adjust set time
4. Run Mode

- Use the **arrow keys** to adjust setting. Setting to 'yes' will enable the temperature control and timer functionality. Setting to 'no' will disable said functions.
- Allow the temperature of the liquid to reach the desired level before attempting to clean items.
- (**Do Not** turn on the heater without liquid in the tank, doing so may damage the heater).

- Place the item to be cleaned into a basket and then/or into the tank. Be sure to completely submerge the item to be cleaned into the liquid. Ensure that there is no voids (air bubbles) on the item as the ultrasonic process will only work in the liquid medium. On average, 60 – 120 seconds of immersion time is all that is required to thoroughly clean the average job. Some cleaning job times may vary depending on the amount and type of material to be removed. **NOTE: When first learning the capabilities of the system, do not leave items unattended in the ultrasonic tank for periods longer than (4) minutes. The system may damage painted surfaces if allowed to remain in the ultrasonic bath for extended periods of time. Longer cleaning times can be used after thorough testing has been completed.**

- Remove the item from the ultrasonic tank that was cleaned. Inspect for acceptable level of cleanliness. Repeat cleaning cycle if required.

- Turn the "Main Power" to the "OFF" position.

7. Accessories

- Pump and Filter w/ Stand (Option) - Circulates the liquid and filters contaminants, extending the useable life of the liquid.

- Basket (Option) - The basket is made to fit each machine. In assists in placing items in the tank without placing your hands in the liquid. It also assists in holding small items together.

8. Techniques for Optimizing Cleaning Results

There are seven factors related to successful ultrasonic cleaning:

1 Time
2 Temperature
3 Chemistry
4 Proximity to the transducer/part fixture design
5 Ultrasonic output frequency
6 Watts per gallon
7 Loading - the volume (configuration) of the part being cleaned

TIME:

Typical cleaning times may vary tremendously - how dirty is the part and how clean is clean. As a place to start, a normal trial period is two to ten minutes, since very few parts are sufficiently clean within a few seconds. Pre-cleaning may be required to remove gross contamination or to chemically prepare the parts for a final clean. Some applications require more than one ultrasonic cleaning stage to complete the required cleaning. Ultrasonic agitated rinsing is required in some cases to remove the wash chemicals more thoroughly.

TEMPERATURE/CHEMISTRY:

Temperature and chemistry are closely related. Generally, ultrasonic cleaning in an aqueous solution is optimum at 140 degrees °F. Some high pH solutions will require the temperature to be higher to enhance the synergistic effect of the chemistry. Check the specifications of your chemical with the manufacturer.

The following should be considered the main components of aqueous ultrasonic cleaning chemistry:

A. Water - hard, soft, DI or distilled
B. pH
C. Surfactants
   Wetting agents
   Dispersants
   Emulsifiers

Saponifiers

D. Optional ingredients
   Sequestrants
   Inhibitors
   Buffering agents
   Defoamers

THE CHEMICAL FORMULATION MUST CONSIDER ALL OF THE ABOVE CHARACTERISTICS.

Some chemicals that are designed for spray cleaning, or that include rust inhibitors, are not suitable for ultrasonic cleaning.

PROXIMITY TO THE TRANSDUCER:

The procedure for ultrasonic cleaning is generally as follows: Put parts in basket and place basket through three or four process steps; ultrasonic wash, spray rinse (optional), immersion rinse, dry. Some parts loaded in baskets can mask or shadow from the radiated surface of the ultrasonic transducers. Most ultrasonic cleaning systems are designed for specific applications. Bottom mounted transducers or side mounted transducers are decided upon during the process design stage. Automated systems must specifically address the location of the transducers to insure uniformity of the cleaning. Some parts require individual placements to separate the part for cleaning or subsequent processes. Some parts require slow rotating or vertical motion during the cleaning to insure critical cleanliness.

ULTRASONIC OUTPUT FREQUENCY:

Many technical articles claim that high frequencies penetrate more and lower frequencies are more aggressive. The majority of the ultrasonic cleaning that is done in industrial applications today uses 40 kHz as the base frequency. Lower frequencies, such as 20 - 25 kHz, are used for large masses of metal, where ultrasonic erosion is of little consequence. The large mass dampens or absorbs a great amount of the ultrasonic cleaning power.

WATTS PER GALLON:

In general, smaller parts, requiring more critical cleaning, require higher watts per gallon to achieve the desired level of cleanliness. Most industrial ultrasonic cleaning systems use watt density from 50 - 100 watts per gallon. However, there is what is known as "the large tank phenomenon", which indicates that tanks over 50 gallons usually require only about 20 watts per gallon. The only explanation available is a point of diminishing returns with regard to ultrasonic power.

LOADING:

Loading of the part(s) to be cleaned must be considered, with regard to the shape and density. A large dense mass will not allow internal surfaces to be thoroughly cleaned (i.e., metal castings). A rule of thumb for loading is that the load by weight should be less than the weight of half the water volume, i.e., in 5 gallons, approximately 40 lbs. of water, the maximum work load should be less than 20 pounds. In some cases, it is better to ultrasonically clean two smaller loads, rather than one larger load.

The above information is not meant to give all the details to utilize ultrasonic cleaning techniques. This information is to help the process designer gain some insight into the variables of industrial ultrasonic cleaning.

Other suggestions on proper optimization of the ultrasonic cleaning system.

- Read and follow all instructions in this manual.
- Follow all instructions on the chemical that is to be used in the ultrasonic cleaning system.
- Test the cleaning capabilities of the system after each change in liquid (dilution of chemical ratio, adding chemical, changing of liquid).
- Locate the ultrasonic cleaning system in a dry, dust free area. Dust and/ or water particles may diminish/ damage the electronics of the generator.
- Maintain a maintenance log to ensure proper care of the equipment.
- Turn off the equipment after each use.

9. Maintenance

POWER

Be sure to depress the main power button and unplug the system prior to any servicing of the unit. Disregarding this step may lead to electric shock.

WARNING

This machine utilizes high voltage to operate the ultrasonic transducers. Only trained and qualified personnel should attempt any repairs or servicing of the ultrasonic components.

NOTE:

Be careful when cleaning the ultrasonic tank to not scratch or abrade the ultrasonic radiating surface, as this will reduce the life of the radiating surface.

Preventative Maintenance

The design of your equipment eliminates the need for elaborate preventative maintenance procedures.

- After each use, you should wipe down your machine with clean water and towels.

For Generators:

- Blow out the internal parts of the generator with an air hose. Careful use of air pressure may be used to remove dirt from critical areas. Periodically check the generator air intake for buildup of dust and/ or debris. Recommended maintenance cycle is 3 months or 500 hours. For environments that has a lot of dust and/or debris, check more periodically.

GENERAL MAINTENANCE

- To prevent build-up of contamination on tank walls; reducing the cleaning capabilities, it is advisable to periodically drain the tank solution and wash out the tank. Use paper towels and clean water.

- Blow out dirt and dust from the fan using an air hose or compressed air (Do not open the generator without expressed permission of Graymills Corporation. Doing so will immediately void the generator's warranty).

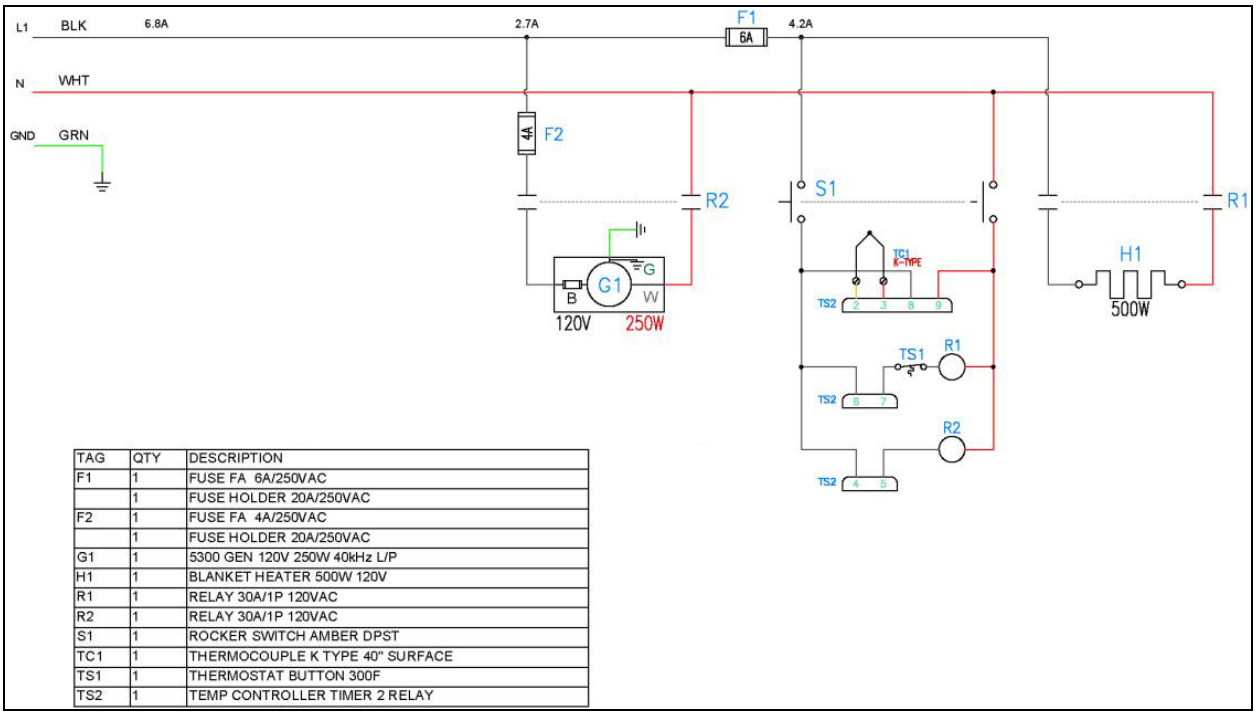
- Check plumbing components for abnormal wear and tear.

10. Troubleshooting

- There is not any power to the unit.
    1. Ensure the power cord(s) are plugged into its proper voltage supply.
    2. Press the "Ultrasonics" switch to the "ON" position.
    3. If the above did not solve the problem: Call the Graymills customer service department for assistance.
- The Ultrasonics does not run.
    1. Ensure the generator power cord(s) are plugged into its proper voltage supply.
    2. Press the "Ultrasonics" switch to the "ON" position.
    3. If the above did not solve the problem: Call the Graymills Corporation customer service department for assistance.
- The liquid does not heat up.
    1. Ensure the tank power cord is plugged into its proper voltage supply.
    2. Press the "Heat" switch to the "ON" position.
    3. Rotate the heat knob clockwise (If applicable).
    4. If the above did not solve the problem: Call the Graymills Corporation customer service department for assistance.
- The pump does not work (only applicable with external filtration)
    1. Attach all plumbing parts to their proper locations.
    2. Make sure that the pump has been "Primed" and that there is liquid in the tank.
    3. Ensure the pump power cord is plugged into its proper voltage supply.
    4. Press the "Pump" switch to the "ON" position.
    5. If the above did not solve the problem: Call the Graymills Corporation customer service department for assistance.

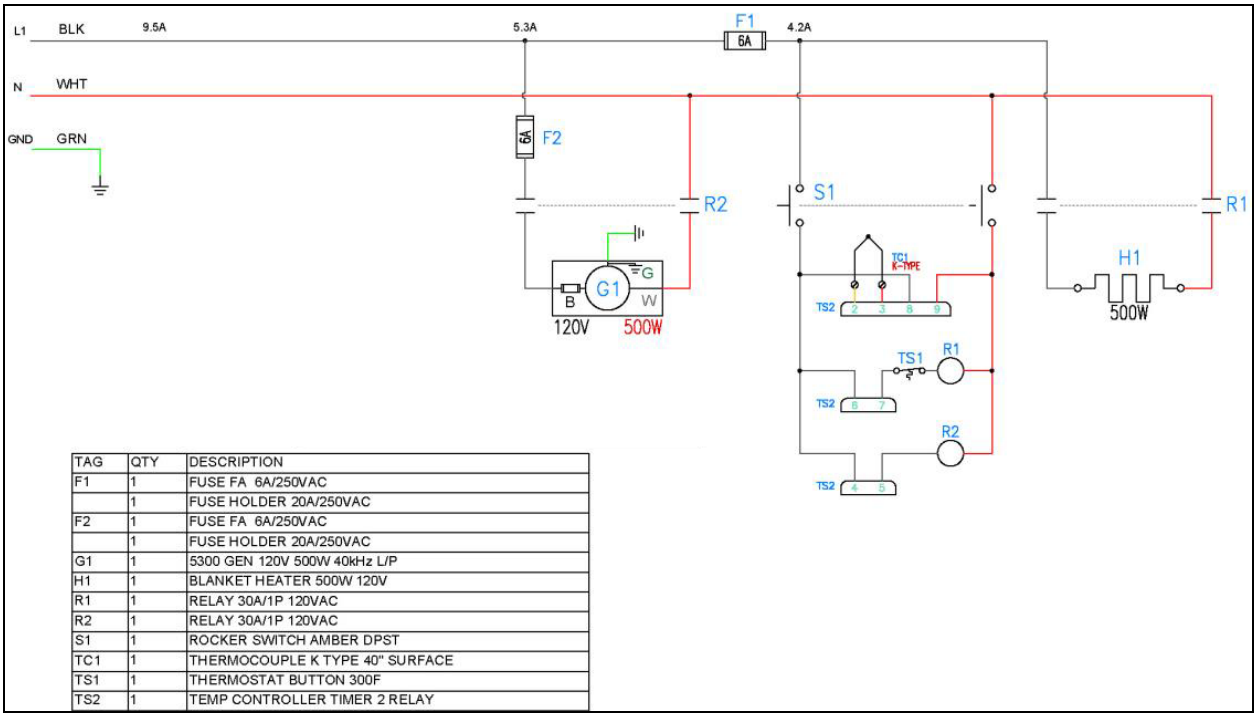
11. Diagrams and Drawings

BTU0812 Wiring Schematic



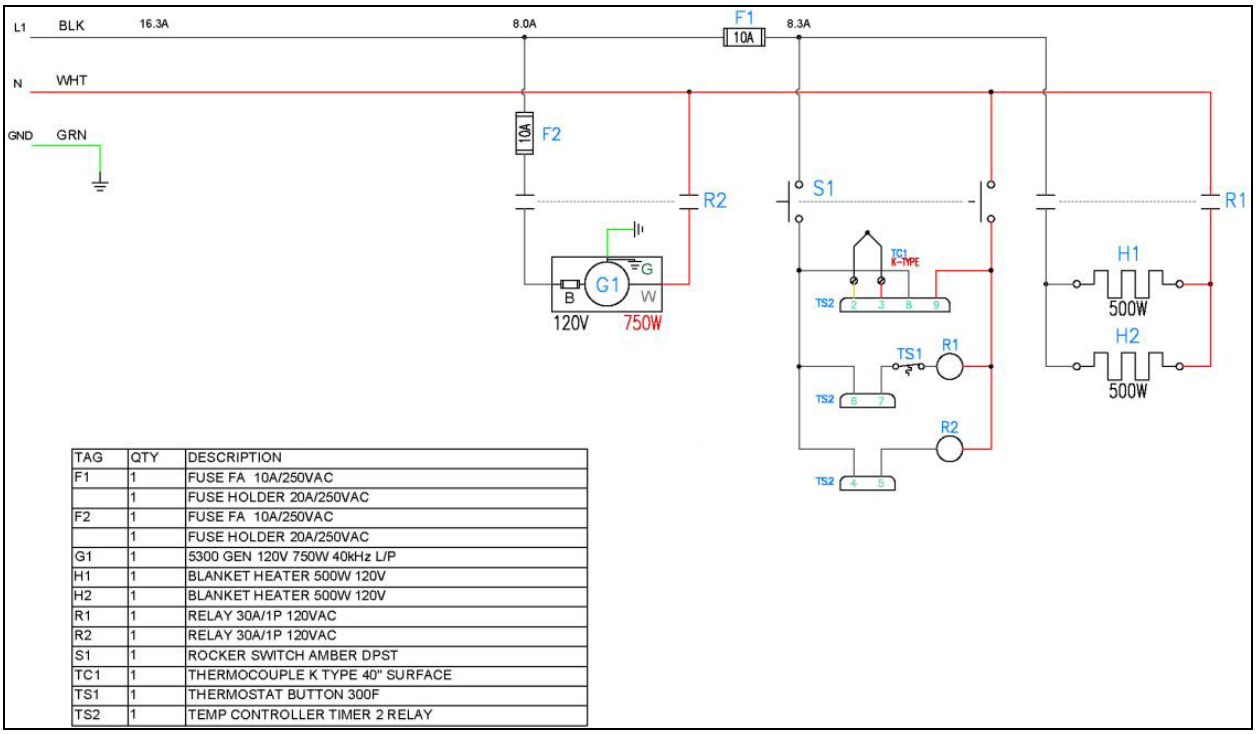
TAG	QTY	DESCRIPTION
F1	1	FUSE FA 6A/250VAC
	1	FUSE HOLDER 20A/250VAC
F2	1	FUSE FA 4A/250VAC
	1	FUSE HOLDER 20A/250VAC
G1	1	5300 GEN 120V 250W 40kHz L/P
H1	1	BLANKET HEATER 500W 120V
R1	1	RELAY 30A/1P 120VAC
R2	1	RELAY 30A/1P 120VAC
S1	1	ROCKER SWITCH AMBER DPST
TC1	1	THERMOCOUPLE K TYPE 40" SURFACE
TS1	1	THERMOSTAT BUTTON 300F
TS2	1	TEMP CONTROLLER TIMER 2 RELAY

BTU1114 Wiring Schematic



TAG	QTY	DESCRIPTION
F1	1	FUSE FA 6A/250VAC
	1	FUSE HOLDER 20A/250VAC
F2	1	FUSE FA 6A/250VAC
	1	FUSE HOLDER 20A/250VAC
G1	1	5300 GEN 120V 500W 40kHz L/P
H1	1	BLANKET HEATER 500W 120V
R1	1	RELAY 30A/1P 120VAC
R2	1	RELAY 30A/1P 120VAC
S1	1	ROCKER SWITCH AMBER DPST
TC1	1	THERMOCOUPLE K TYPE 40" SURFACE
TS1	1	THERMOSTAT BUTTON 300F
TS2	1	TEMP CONTROLLER TIMER 2 RELAY

BTU1420 Wiring Schematic



TAG	QTY	DESCRIPTION
F1	1	FUSE FA 10A/250VAC
	1	FUSE HOLDER 20A/250VAC
F2	1	FUSE FA 10A/250VAC
	1	FUSE HOLDER 20A/250VAC
G1	1	5300 GEN 120V 750W 40kHz L/P
H1	1	BLANKET HEATER 500W 120V
H2	1	BLANKET HEATER 500W 120V
R1	1	RELAY 30A/1P 120VAC
R2	1	RELAY 30A/1P 120VAC
S1	1	ROCKER SWITCH AMBER DPST
TC1	1	THERMOCOUPLE K TYPE 40" SURFACE
TS1	1	THERMOSTAT BUTTON 300F
TS2	1	TEMP CONTROLLER TIMER 2 RELAY

12. Component List

- Tank
- Generator
- Pump and Filter
- Lid

BTU Models

Pump and Filter Stand

13. Warranty

Graymills Corporation warrants that the equipment manufactured and delivered, when properly installed and maintained, shall be free from defects in workmanship and will function as quoted in the published specification. Graymills does not warrant process performance, nor assume any liability for equipment selection, adaptation, or installation.

Warranty does not apply to damages or defects caused by shipping, operator carelessness, misuse, improper application or installation, abnormal use, use of add-on-parts or equipment which damages or impairs the proper function of the unit, and modifications made to the unit. Warranty does not apply to expendable parts needing replacement periodically due to normal wear and tear.

A new Warranty period shall not be established for repaired or replaced materials or products. Such items shall remain under Warranty for only the remainder of the Warranty period of the original material or product.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY. GRAYMILLS CORPORATION MAKES NO OTHER WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEED THE AFORESTATED OBLIGATION ARE HEREBY DISCLAIMED BY GRAYMILLS CORPORATION AND EXCLUDED FROM THIS SALE. Graymills warranty obligations and Buyer remedies (except to title), are solely and exclusively stated herein. In no case will Graymills be liable for consequential damages, loss of production, or any other loss incurred due to interruption of service.

Graymills' obligation under this Warranty shall be limited to:

1. Repairing or replacing (at Graymills sole discretion) any non-conforming or defective component within one year from the date of shipment from Graymills.
2. ULTRASONIC EQUIPMENT – On parts cleaners equipped with ultrasonics, the ultrasonic transducers are guaranteed against cracking, depolarizing or

becoming detached from the radiating surface for a period of ten (10) years from the date of shipment from Graymills. This warranty does not cover transducer failure that results from operating the equipment with insufficient liquid in the tank as evidenced by inspection by Graymills.

3. Repairing or replacing (at Graymills sole discretion), components supplied by, but not manufactured by Graymills, to the extent of the warranty given by the original manufacturer.
4. This warranty does not cover rusting of a mild-steel parts cleaner used with aqueous (water-based) materials. On ultrasonic equipment, the finish of the stainless steel tank interior or the immersible transducer radiating surface is excluded from this warranty as erosion of these surfaces occurs normally during the course of operation.

Buyer must give Graymills prompt notice of any defect or failure.

If you believe you have a Warranty claim, contact Graymills at (773) 248-6825. Any return material must have an RMA number on the outside of the package and shipping prepaid or shipment will be refused. Graymills will promptly examine the material and determine if it is defective and within the Warranty period.

Parts List

Part #'s	Replacement Parts
791-92578	Blanket heater for Benchtop
771-93820	Thermostat button for blanket heater
791-94109	Digital Thermostat Controller (TCS-4010)
791-94110	Digital Timer
791-92340	Lit amber rocker switch
791-94111	Rocker switch
791-94112	3 position switch green - for timer
780-94113	Fuse (4A)
780-94114	Fuse (6A)
780-94115	Fuse (10A)