Branson Vapor Degreasing System

Models BSD and BLD Degreasers

Operation and Maintenance Manual

IMPORTANT SERVICE LITERATURE

Forward to Your Service Department

BRANSON

BRANSON ULTRASONICS CORPORATION
Eagle Road Danbury, CT 06810-1961 (203) 796-0400

Introduction

Thank you for buying a Branson product.

This Branson Degreaser is one of several new degreasers added to our product line.

All of the degreasers have been designed for easy loading and unloading and reduced overall energy consumption. They all incorporate as standard features - low-voltage controls and process indicators, ultrasonic sump temperature control, automatic cooling flow shutdown and electronic thermostats to control safety shutdown; as well as a large number of options to give you greater process flexibility.

Branson Degreasing Systems, their accessories, solvents and replacement parts are marketed through our worldwide distributor network. There are Branson Sales and Service offices in most major cities throughout the United States, Canada, Europe and Asia.

Our customers are always assured of convenient local service and quick delivery. For product information, literature or application assistance, consult your Branson distributor or the Branson office nearest you.

We always make sure that you receive the best possible service from the Branson equipment you have purchased.

WARNINGS

All personnel using the Branson Degreasing System should read and thoroughly understand this manual, as well as familiarize themselves with the precautionary instructions pertaining to the use and handling of solvents. If necessary, contact the solvent manufacturer for recommendations regarding the use and handling of his solvents.

Failure to follow these warnings may result in serious personal injury or property damage.

KEEP THE COVER ON WHEN THE DEGREASER IS NOT IN USE.

ALWAYS WEAR EYE PROTECTION, GLOVES AND PROTECTIVE CLOTHING when handling solvent.

THE THERMOSTATS HAVE BEEN FACTORY SET FOR THE SOLVENT SPECIFIED ON THE LABEL LOCATED NEXT TO THE THERMOSTATS. If you wish to change solvent, contact your Branson representative or your solvent supplier for the correct thermostat setting.

ALL CLEANING SOLVENTS ARE TOXIC TO SOME DEGREE. Do not allow solvent vapors to exceed the safe maximum allowable concentration. When in doubt, consult published safety regulations concerning the solvent being used.

DO NOT EXPOSE ANY HALOGENATED SOLVENT OR ITS VAPORS TO THE HIGH TEMPERATURES EXISTING IN OPEN FLAMES AND EXPOSED ELECTRIC HEATING ELEMENTS because the solvent may decompose to toxic and corrosive substances. Install the degreaser in a well ventilated room, away from glowing electric heating elements, open flames or welding operations.

DO NOT ALLOW SOLVENT TO COME IN CONTACT WITH THE BODY. Solvent above 140°F (60°C) and solvent vapors above 160°F (71°C) can cause burns. With prolonged or frequent contact, solvent removes the natural oils from the skin. Use eye protection, gloves and protective clothing. Use a rack, basket or tongs to insert or remove parts from the degreaser.

BEFORE ADDING SOLVENT, SHUT OFF THE HEAT and allow the vapors to collapse to prevent vapors being forced out of the degreaser.

ALWAYS ADD SOLVENT TO THE ULTRASONIC SUMP and allow it to overflow into the boiling sump. Be certain that the solvent which is being added is the same as the solvent already in the degreaser.

DO NOT INHALE OR TAKE SOLVENT INTERNALLY because either could be fatal.

DO NOT BRING SOLVENT INTO CONTACT WITH HIGHLY ACTIVE METALS such as sodium, potassium and barium.

DO NOT ALLOW SOLVENT TO BECOME OVER-CONTAMINATED.

SOLVENTS CAN BREAK DOWN AND BECOME ACIDIC when exposed over prolonged periods to reactive metals such as magnesium, aluminum, zinc and beryllium. When cleaning parts made of these materials, analyze the solvent frequently to determine if it has broken down. Failure to comply with this recommendation will result in damage to the equipment and could void the warranty covering it.

THE EXHAUST VENTILATOR SHOULD NOT EXCEED 20 m&2/(m&2min.)= 65cfm/ft&2 of degreaser area unless it is necessary to meet OSHA requirements. Branson has an optional exhaust system available that meets the EPA operating requirements stated above.

ELECTRICALLY LOCK OUT THE DEGREASER BEFORE PERFORMING ANY MAINTENANCE and place an OUT OF SERVICE sign on the unit. Do not work on the degreaser while the solvent is hot and/or the electrical power is on.

FLOW CONTROL DEVICES MUST ONLY BE CONNECTED ON THE INLET SIDE OF THE DEGREASER, NEVER THE OUTLET. Failure to comply with this warning may result in deformation or rupture of the water separator cooling chamber due to excessive water pressure.

THE DEGREASER MUST BE WIRED TO A FUSED DISCONNECT in accordance with the National Electrical Code and any applicable state and local electrical codes. Wiring directly into the main power disconnect box is recommended. Ground properly to prevent shock hazard.

THE BRANSON CHILLER MUST BE CONNECTED TO A SEPARATE POWER SOURCE AND IN OPERATION FOR AT LEAST SIX HOURS BEFORE OPERATING THE DEGREASER.

CONTENTS

SECTION 5

LIST OF ILLUSTRATIONS

OVERVIEW

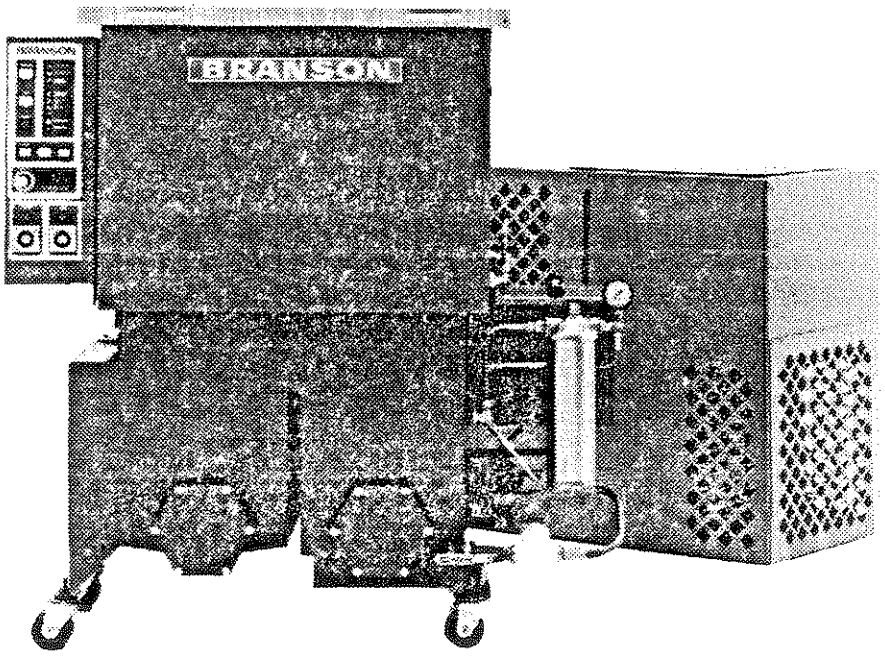
The Branson Degreasing System

Branson BSD and BLD Degreasers* are an integral part of the Branson Degreasing System, which also includes the Branson Chiller and the TDR Series Automated Transport System (Figure 1-1).

Designed with control panel accessories such as digital temperature indicators and spray timers, the new Branson Degreaser includes optional equipment such as spray manifolds, hand sprays and TDR and chiller hookups to meet varying and constantly changing customer requirements.

Electronic thermostats located at key points in the degreaser provide built-in operational safety. Equipment malfunctions are sensed instantly by the control panel and a system shutdown immediately begins.

When used and maintained as indicated in this operating and service manual, Branson Degreasers will assure economical, consistant cleaning results and process control.



Branson BSD Degreaser

Companion Branson BC Chiller

Figure 1-1: Branson Degreasing System

*BSD - Branson UltraSonic Degreaser, BLD - Branson Liquid Degreaser

BASIC CLEANING THEORY

Vapor Degreasing

Vapor degreasing is a cleaning operation involving the exposure of workpieces to vapors released by a boiling solvent. Typically, items to be cleaned are suspended in an area of the cleaning tank called the vapor zone, just above the boiling solvent sump (Figure 2-1).

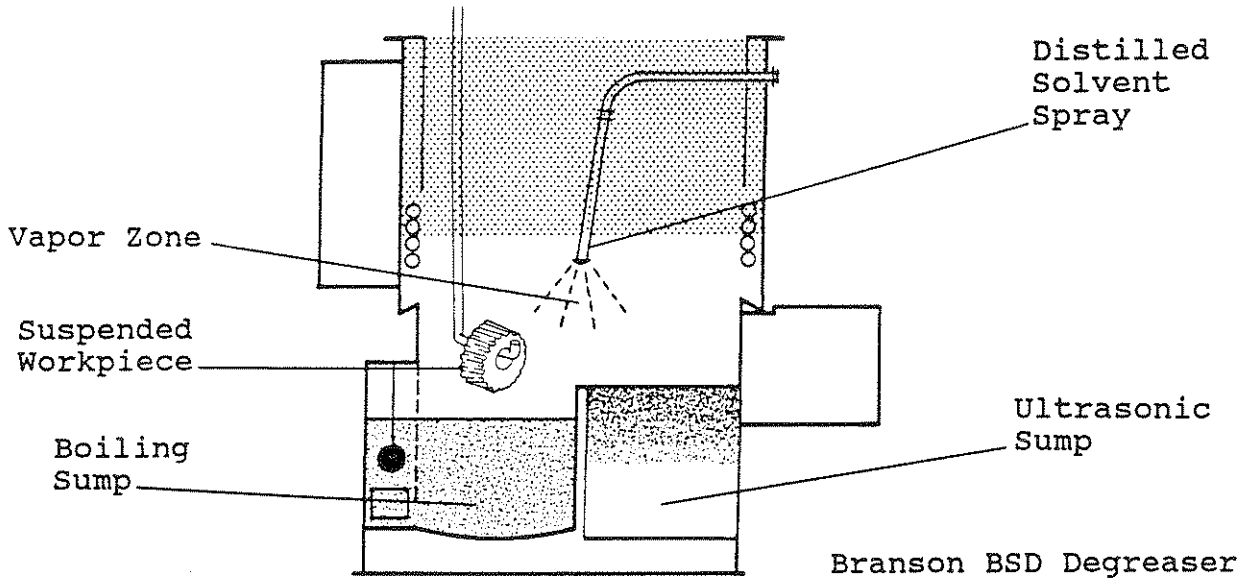


Figure 2-1: Basic Vapor Degreasing Technique

Within this heated atmosphere, vapors touching the surfaces of the comparatively cool workpiece are condensed into pure solvent. Solvent-soluable contaminants are dissolved and particulates are flushed away as the solvent runs off the workpiece. This cleaning action continues until the parts, which are gradually warmed by the vapor, reach the vapor temperature. Whereupon condensation ceases. This is the basic cleaning principle used for the Branson BSV (solvent vapor) degreaser.

A number of additional cleaning operations are typically used beyond this basic cleaning cycle:

- The workpieces may be flushed with a pure distillate spray upon entering the vapor zone at the beginning of the cleaning cycle. This loosens gross contaminants and flushes them into the boiling sump. Hand held sprays may be used for manual cleaning operations while spray manifolds allow fully automated cleaning.

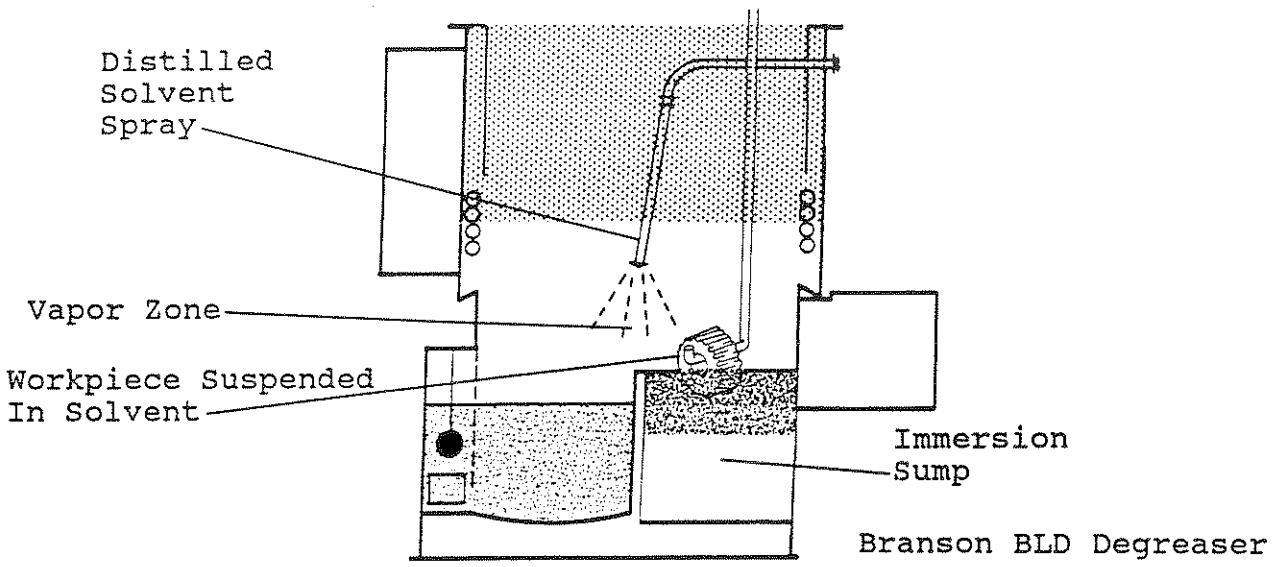


Figure 2-2: Immersing Workpiece in Warm Solvent

- The soiled workpiece can be submerged in a warm solvent immersion sump, as is done in the Branson BLD immersion-vapor-spray degreasers (Figure 2-2).

- Ultrasonics can be added to the immersion sump to enhance the cleaning action (Figure 2-3).

  Since the immersion-ultrasonic sump is kept below the vapor temperature, the parts are cooled when they are immersed. They are then lifted into the vapor zone for a final vapor rinsing.

  As before, condensation continues until the parts reach the vapor temperature. They then enter the freeboard zone above the vapor zone warm and dry.

- Parts can also receive a spray rinse after being removed from the immersion/ultrasonic sump. This dilutes and flushes away any contamination which might have been carried out of the cleaning sump and cools the part to insure a complete final vapor rinse.

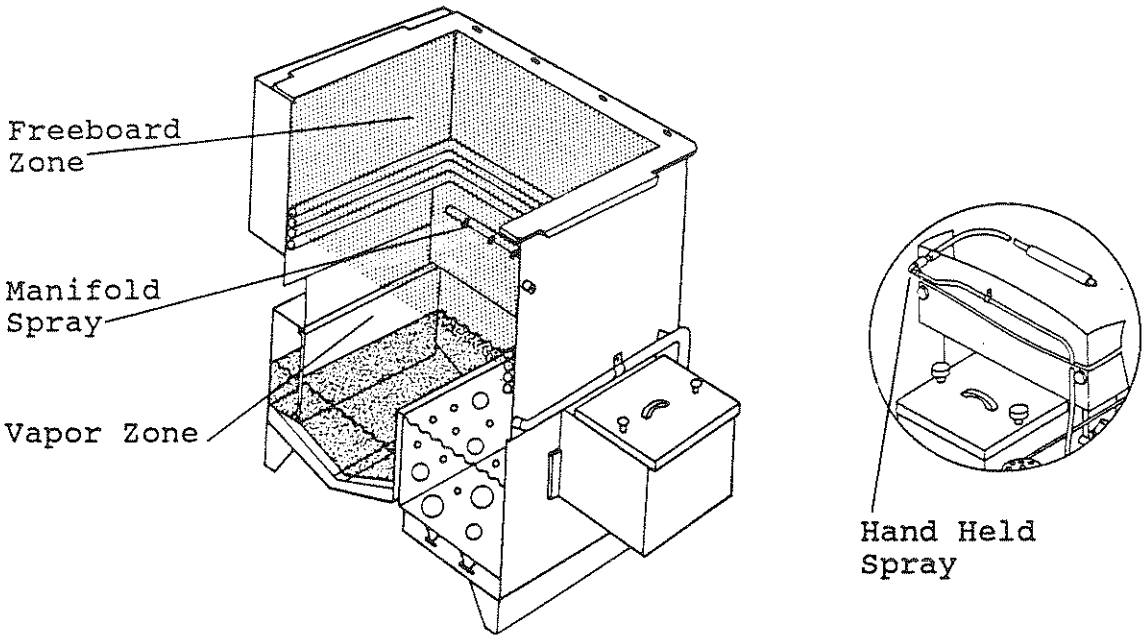


Figure 2-3: Ultrasonic Immersion-Vapor-Spray Technique

The Solvent Cycle

The boiling sump heaters are the source of energy for all vapors in a vapor degreaser. These heaters are immersion type and virtually all the energy consummed by the heaters is used to generate vapors.

Some of the vapors condense on the workpieces during the initial and final vapor rinses. A small percentage condense on the tank walls and are treated as energy losses. The rest are captured by the condensing coil for recycling.

As condensate drips off the condensing coil, it is collected in the condensate trough. To insure safety, the condensing coil is made at least twice as large as is required to condense all the vapors generated by the degreaser. It is partially exposed to the atmosphere and condenses moisture from the air. The water condensate mixture is conducted by the condensate trough to the separator/desiccator (Figure 2-4).

The separator/desiccator operates on the principle that water is only slightly soluable in solvent. Being less dense than solvents, it floats to the top where it is collected and can be drained off at regular intervals.

Cooling the separator/desiccator speeds the separation process and reduces the amount of water dissolved in the distillate.

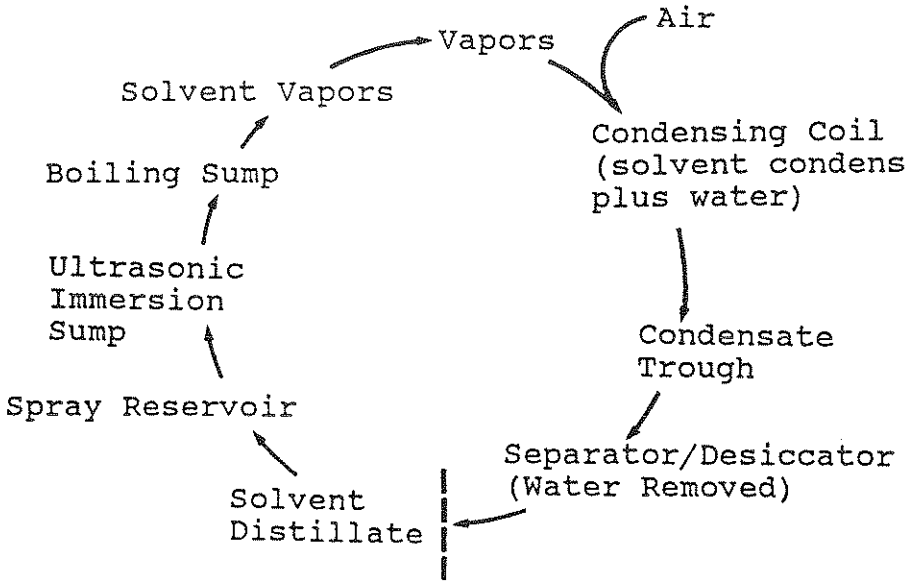


Figure 2-4: The Solvent Cycle

Some solvents are blends which may contain alcohol or other substances which are soluable in water. With these solvents, the traditional gravity water separator should not be used, since the blended agents would be drained off with the water and the solvent composition would change over time. Contact your solvent supplier to determine which system (separates/dessicator or gravity water separates) is most suitable for your choice of solvent.

In this case, the solvent/water mixture must be passed through a bed of desiccant which selectively adsorbs water but not the blending agents or solvents. After passing through the separator/desiccator, the solvent enters a reservoir where it is available for spraying.

All the dirt which is washed off during the cleaning operations eventually enters the boiling sump either directly or by overflowing from the immersion/ultrasonic pump. Because only clean vapors ever leave the boiling sump, all contamination concentrates there.

When the spray reservoir is full, the distillate overflows into a tube and is conducted to the immersion/ultrasonic sump. In a BSV the solvent enters the boiling sump directly and the cycle is complete.

In a BLD or BSD, the immersion/ultrasonic sump continuously receives clean distillate from the separator/desiccator which forces dirty solvent over a weir and into the boiling sump. (Figure 2-5).

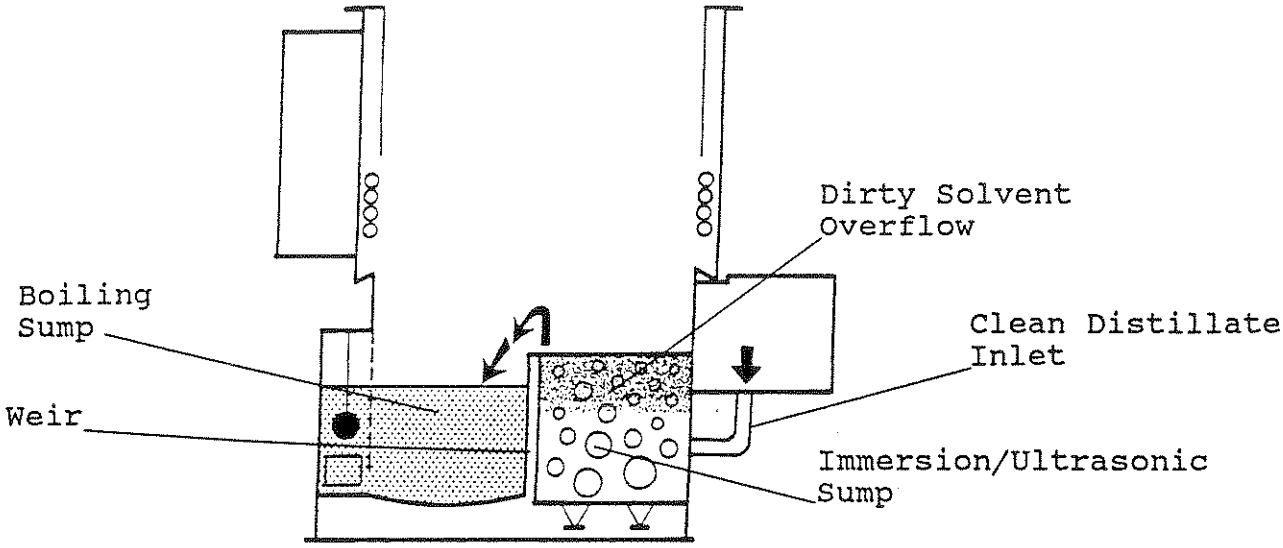


Figure 2-5: Immersion/ Ultrasonic Sump Cleanup

This automatic solvent purification process functions at full capacity while the degreaser is idling (operating without work being processed) and at a lower rate when work is being processed.

Degreasers are designed to industry standards to provide at least one turnover (one complete sump volume replacement) each hour.

The solvent in the BSD ultrasonic sump is further cleaned and cooled by pumping it through a filter in the recirculation system (optional on the BLD degreaser).

Solvent Losses

Gradual solvent loss is inevitable in any vapor degreasing system. There are three sources of solvent losses - leaks, dragout, and diffusion to air.

Leaks can be difficult to locate because the hot solvent evaporates almost immediately upon contact with the air. They can be completely eliminated by proper inspection and repair procedures.

Dragout losses are an inevitable part of processing workloads. A very thin film of solvent adheres to every surface which leaves the vapor zone. This film evaporates upon contact with air and is lost. While these losses can be significant, they are small compared to the losses which can result from poor carrier design and work handling procedures.

Improper carrier design includes large flat areas, pockets, poor drainage and improper part orientation. Branson is available for technical consultation if assistance in designing an efficient carrier is required.

Improper handling (removing the parts before the final vapor rinse is complete) causes liquid solvent to be carried out (dragout). Automated parts handling devices such the Branson TDR Series Automated Transport System can be programmed to allow adequate vapor rinse times to minimize this factor.

Diffusion losses are the result of solvent vapors being in contact with air at the vapor air interface. Some solvent diffuses into the air and is carried away by air currents. These losses can be minimized by reducing air currents within and around the degreaser.

Internal currents can be controlled by insuring that there is adequate distance between the top of the vapor zone and the degreaser rim. This is called the freeboard zone (Figure 2-6).

As a rule, the freeboard zone height should never be less than 75% of the tank opening width at its narrowest point. The BSD series degreasers all have freeboard ratios of 100% for reduced solvent losses.

The degreaser cover prevents room air currents from entering the opening and should be kept closed whenever workloads are not being processed. The Branson slide drop cover is always

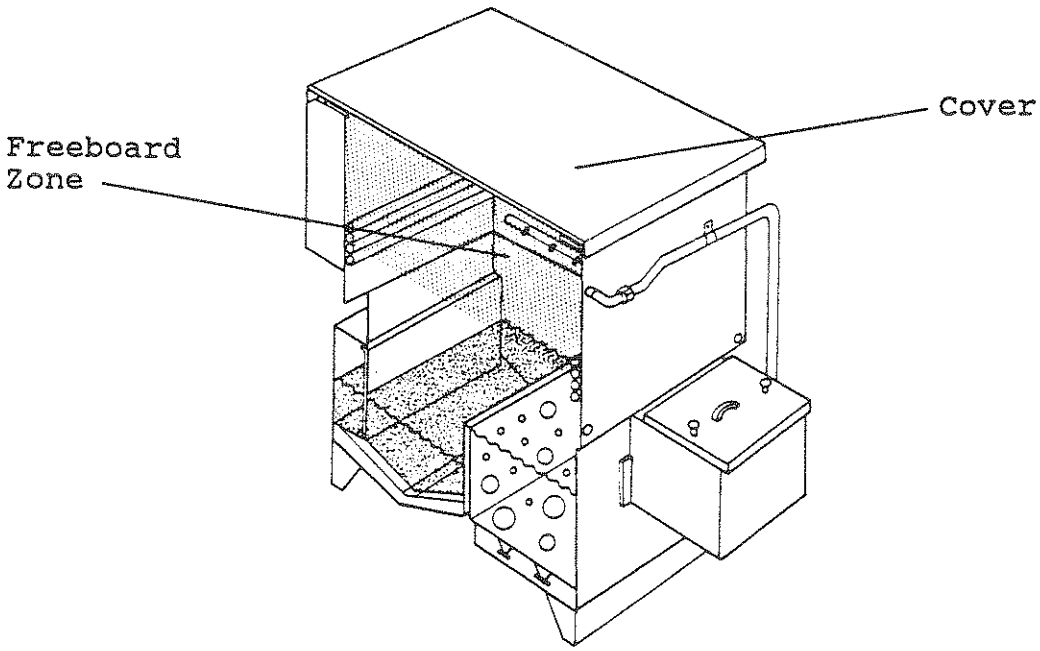


Figure 2-6: The Freeboard Zone

conveniently available and easy to operate. It does not cause the 'piston effect' which happens with hinged or lift off covers.

A similar effect is produced whenever a workload enters or leaves the degreaser. If the load moves too quickly, massive turbulance is created which causes solvent vapors to mix with air and be lost through diffusion. Branson TDR Series Automated Transport Systems are designed to move at speeds which minimize this problem.

Spraying, while essential for some cleaning processes, also causes large amounts of turbulence and should be used only as necessary.

Minimizing solvent losses is a matter of good design and proper operation. The Branson Degreasing System has been designed to be solvent efficient, and with options such as the Branson TDR Series Automated Transport Systems, solvent losses are further reduced. Operator error is the largest source of needless emissions. It can be eliminated by use of the the TDR while increasing process control. With the increased concern for solvent emissions, proper operator training and automated systems are the two most effective and immediately available sources of solvent emission reductions.

Safety Considerations

All solvents are hazardous to human beings to some extent. (See Solvent Lists for specific hazard data on selected solvents.) Safety devices to protect both the operator and the equipment are an integral part of Branson degreaser equipment (Figure 2-7).

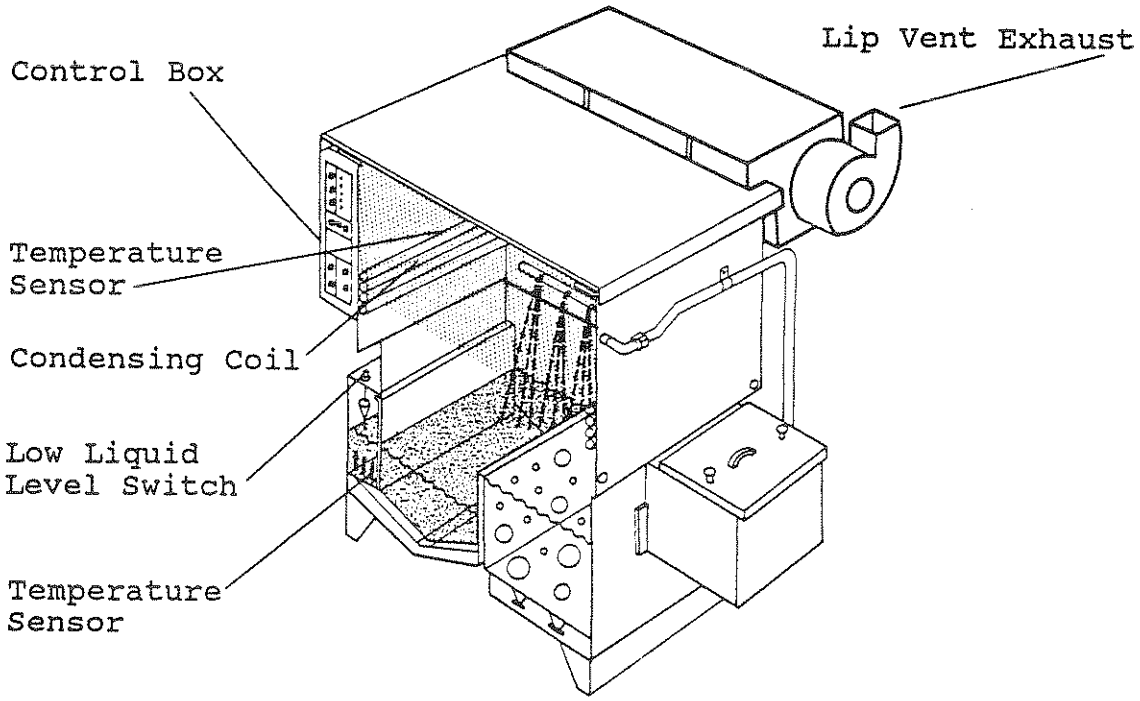


Figure 2-7: Branson Degreaser Safety Devices

- Branson BSD series degreasers use 24 VAC controls (as a safety feature) to minimize shock hazards.

- The lip vent exhaust option is designed to draw low velocity air across the degreaser opening so that the operator does not breathe the diffused solvent vapors which are in the air coming out of the tank. It is not intended to be a capture system for solvent reclaimation.

- The condensing coil prevents the escape of solvent vapors by condensing them. In order to function, it requires a constant flow of cold water. If the flow is interrupted, a flow sensor shuts off the heat to collapse the vapor blanket.

- If the coolant becomes too warm to effectively condense the solvent, a temperature sensor located on the water outlet also shuts off the heater. If these safeties should fail and the vapors rise above the condensing coil, the high vapor safety located on the top of the coil will then shut the heat off.

- Branch circuit fusing and controls prevent operation without sufficient solvent in the boiling sump. Fuses protect wiring in the event that a peripheral device such as a pump should fail or that a short circuit should develop.

- If the solvent level in the boiling sump should become too low, the heater would be exposed and overheat. Solvents break down in the presence of high temperatures and can form acids and other hazardous substances. To prevent this, Branson degreasers are equipped with a low liquid level switch which shuts off the heat before the heaters are exposed.

- The boiling sump concentrates all of the contamination which is removed from workpieces. Many contaminants become flammable above certain concentrations. The degreaser monitors the amount of contamination by sensing the associated change in the boiling temperature of the solvent. When the temperature exceeds a preset value, the heat is shut off and a warning light turns on. The temperature sensor also acts as a back-up for the low liquid level switch. It will react to the temperature rise which is associated with an exposed heater.

- A thermostat monitors the vapor level and prevents spraying if it is too low. Spraying should not be done above the vapor blanket since it would mix air and vapors and cause large solvent losses.

Cooling

A degreaser is a thermal machine in which all the energy which is supplied as electricity eventually ends up as heat which must be removed from the system. Water cooling is used in all Branson BSD series degreasers to remove this heat.

In locations where adequate supplies of cold water are not available, a Branson BC series chiller should be connected to transfer the heat to the atmosphere. A chiller offers several advantages over direct expansion refrigeration systems:

- It can be remotely located so that heat is not released in the work area. This definitely improves operator comfort and also can significantly reduce loads on air conditioning systems.

- The minimum temperature of the cooling coils can often be raised to above the dew point of the air so that moisture condensation is eliminated. This reduces the load on the water separator and desiccator.

- Branson chillers communicate with the degreaser and can be controlled from the degreaser control panel.

Ultrasonic Degreasing

Ultrasonic vapor degreasing incorporates both ultrasonic immersion cleaning and conventional vapor degreasing. This combination is especially advantageous when:

- Cleaning involves stubborn organic soils such as mold release agents, wax and impregnated grease.

- An excessive amount of particulate contamination is present on the workpiece.

- The application involves components with inaccessible surfaces, blind holes and intricate passageways.

- Critical cleaning is required for high reliability components such as printed circuit modules and hybrid microcircuits.

- Replacement of a relatively toxic solvent is desired, by switching to a safer, less agressive solvent plus ultrasonics.

The mechanism of ultrasonic cleaning is cavitation which consists of the formation and collapse of countless tiny cavities or vacuum bubbles in the liquid. Alternating patterns of high and low pressure are formed as sound waves are transmitted through the solvent.

During the period of low pressure the internal pressure of a gaseous cavity (or bubble) will cause it to grow beyond its stable size. When followed by a high pressure the expanded cavity will implode (collapse) violently. A strong scouring action is created that can dislodge even tenacious soils. Cavitation occurs throughout the tank and even into hidden recesses and crevices penetrated by the liquid.

Fresh solvent or solvent which has not been used recently will have large amounts of air dissolved in it. Ultrasonics will gradually degas the liquid by forming tiny bubbles of gas which grow and eventually rise to the top. Depending on the condition of the solvent, temperatures and the size of the tank, this may take from a few moments up to an hour to accomplish.

During ultrasonic startup, there will be an initial period of intense activity which will quickly diminish as degassing begins. When degassing is complete, the ultrasonics will assume normal levels of sound and visible activity. Degassing must be completed before attempting to process workpieces.

The temperature of the solvent affects both cavitation quality and chemical cleaning action. Both usually can be improved by increasing the operating temperature. There is an ideal temperature at which cavitation intensity is the greatest which varies with the solvent used. Beyond the ideal temperature, cavitation steadily diminishes until, at the boiling point, it stops altogether - because the bubbles created immediately fill with vapor, preventing their violent collapse.

Using a Still

When a still is connected to a degreaser, all contamination eventually ends up in the still in much the same manner as it accumulates in the boiling sump when the degreaser is used alone.

This means that the boiling sump is essentially clean and can be used for cleaning parts. Large amounts of turbulence are created by the boiling action which are able to dislodge many soils.

Since the degreaser does not become as contaminated, it needs to be cleaned less often. It can be kept in operation while the still is being cleaned for continued productivity.

Solvent vapors contain a small amount of contamination which is proportional to the amount of contaminant in the boiling sump. By concentrating the contamination in the still, the degreaser vapors remain cleaner.

The output from a still is piped into the degreaser distillate reservoir, where it becomes available for spraying operations. It also can be used to speed immersion sump cleanup.

SYSTEM DESCRIPTION

A description of the Branson BSD/BLD Series Degreaser System (Figure 3-1) follows.

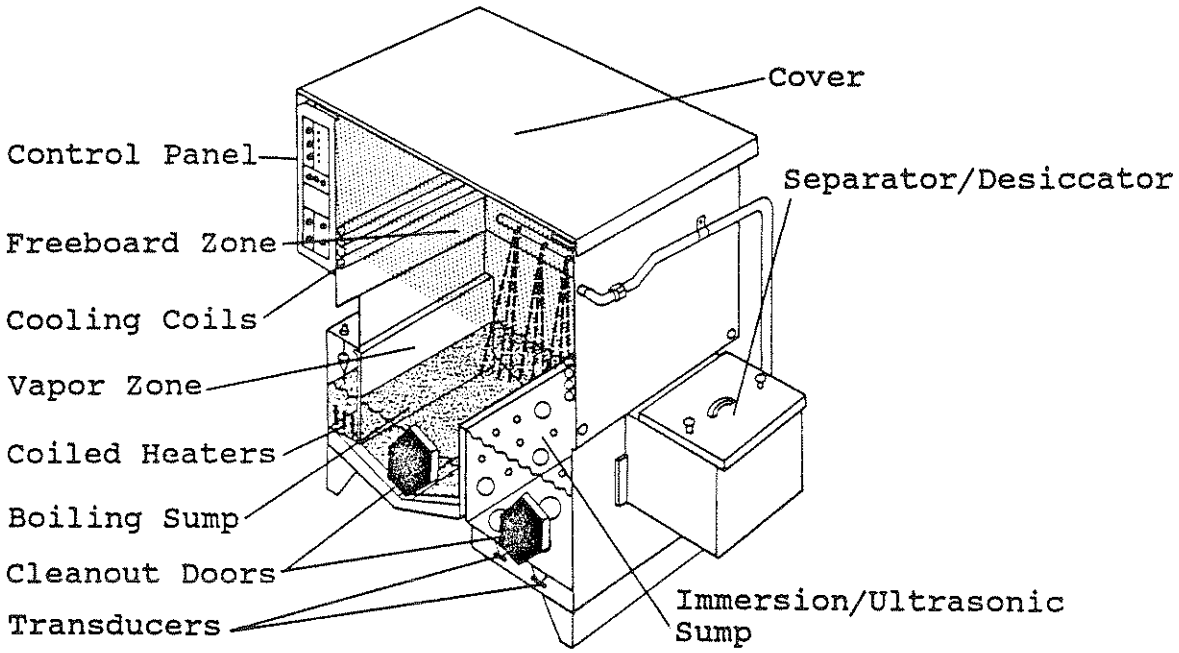


Figure 3-1: The Branson BSD/BLD Series Degreaser System

Boiling Sump

The vapor degreasing cleaning cycle starts in the boiling sump. The sump serves as:

- The collection point for gross contamination and oil.
- Source of solvent vapors.

The BSD/BLD Series boiling sump is constructed with an offset area containing coiled immersion heaters which produce a vigorous rolling boil that generates solvent vapors.

These vapors saturate the volume of the degreaser from the top of the liquid surface to where they condense on the cooling coils. It is in this vapor blanket over the boiling sump where the workpieces receive their first vapor rinse.

Gross particulates and oils are removed from the parts and deposited in the boil sump. The sump has a sloped bottom to facilitate cleanout and an easily removed cleanout door.

Ultrasonic/Immersion Sump

The precision cleaning of workpieces takes place in the ultrasonic/immersion sump. This sump is separated from the boiling sump by a one inch wide air gap weir which prevents heat transfer from the boiling sump.

Clean, dry, freshly distilled solvent is continually supplied to this sump from the water separator.

The BLD immersion sump is used to flood the parts with clean solvent. While in this sump, the parts are cooled below the boiling point of the solvent. When raised out of the solvent and suspended in the vapor zone, the parts receive a final rinse.

The BSD ultrasonic sump has Branson transducers bonded to the outside bottom surface. These transducers are among the most efficient energy converters in the industry and are available in either 40 Khz or 25 Khz versions. By matching the number and array to the tank size, the BSD Series is able to achieve the most effective balance between cleaning action and energy consumption.

The power to the transducers is supplied by highly reliable Branson Series 7000 generator elements. Precision cleaning is accomplished by immersing the parts in the sump where the ultrasonic cavitation cleans the surface. As with the BLD, the parts are cooled, withdrawn to the vapor zone and given a final vapor rinse.

The ultrasonic/immersion sump has a cleanout door which is identical to that of the boiling sump.

Vapor Zone

The vapor zone contains the pure, saturated solvent vapors generated in the boiling sump. The vapor zone's height is the same as the sump working depth. This reduces solvent losses by allowing the workpieces to be moved between sumps without leaving the vapor zone. The workpieces also can be sprayed within the vapor zone with dry distillate from the water separator.

Condensing Coil

The condensing coil maintains the vapor blanket within the degreaser. It is constructed of thin walled stainless steel tubing for long-life and good heat transfer. The coil is wound around the periphery of the degreaser and recessed so that it does not interfere with the processing area.

Water and/or antifreeze are the only cooling mediums used in the BSD/BLD Series degreasers. The coil has been designed at twice the capacity required by the worst case solvents with a safety factor for most commonly used solvents.

Freeboard Zone

The freeboard zone extends from the top of the vapor zone to the top opening of the degreaser. The freeboard is expressed as the percentage ratio of the height of the freeboard zone to the width of the degreaser opening at its narrowest point.

A minimum 75% freeboard ratio is recommended for the safe economical use of a degreaser. All Branson BSD and BLD degreasers have 100% freeboard to minimize solvent losses.

Slide Drop Cover

The BSD/BLD Series has a unique sliding cover attached to the unit. It pulls forward, folds down and hangs in front of the degreaser when not in use. The cover is constructed of stainless steel and is lightweight so that it can be easily opened and closed.

Control System

The Control System (Figure 3-2) combines an easy to understand and operate control panel with sophisticated process indicators. It allows the worker to operate the degreaser without the extensive training required by microprocessor based systems.

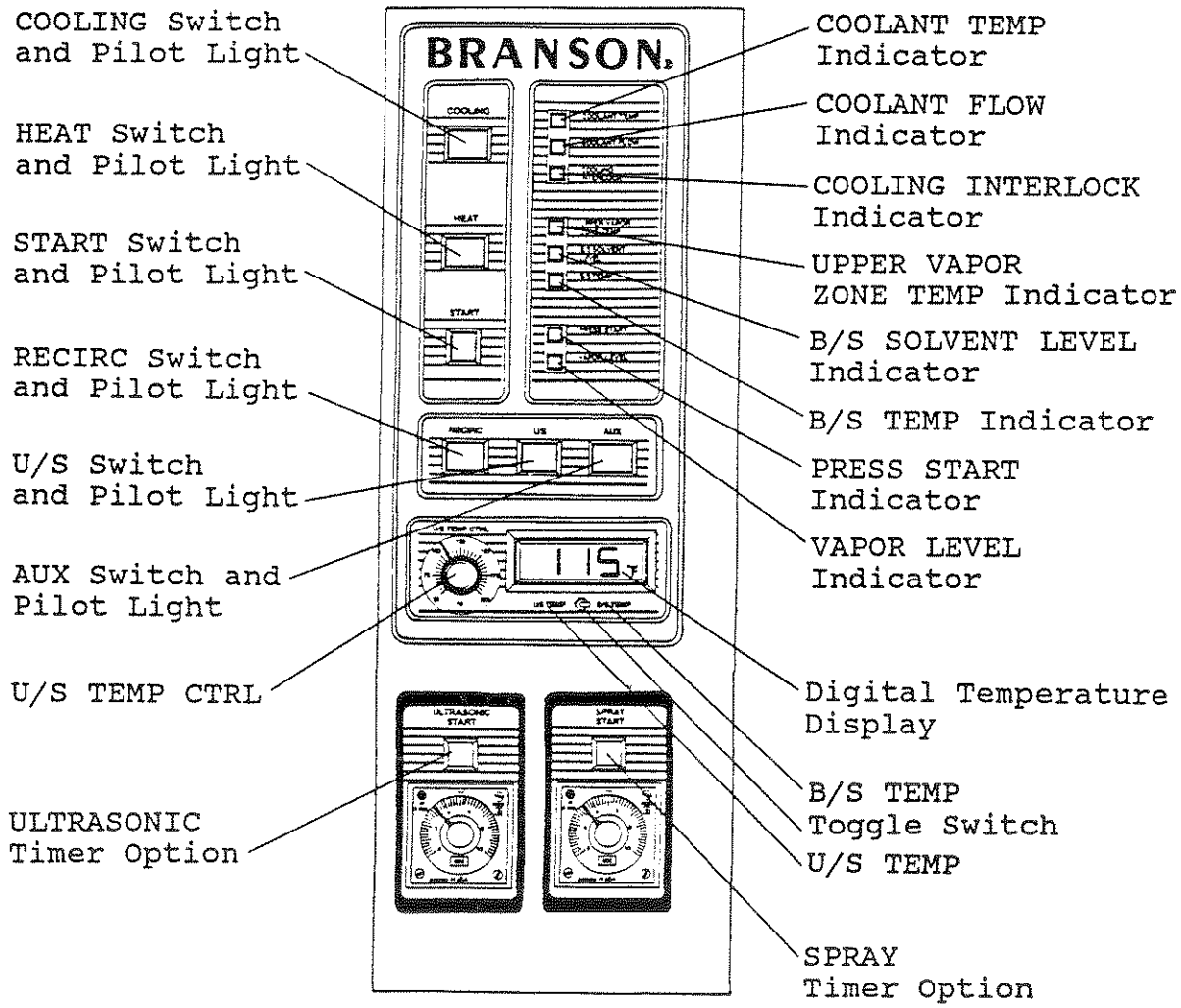


Figure 3-2: The Control System

Three clearly labeled switches - COOLING, HEAT and START - are required to start the machine.

Three additional lighted switches - RECIRCULATION, ULTRASONICS and the optional AUXILIARY - control the other functions.

All controls are low voltage (24 volts). A comprehensive set of sensors shuts off HEAT if a failure occurs or if an unsafe condition exists and the corresponding indicator will light.

The indicators are:

- COOLANT TEMP
- COOLANT FLOW
- COOLING INTERLOCK
- UPPER VAPOR ZONE TEMP
- B/S SOLVENT LEVEL
- B/S TEMP

When all the safeties have been satisfied, PRESS START will light, indicating that the degreaser can be activated by pressing START.

VAPOR LEVEL indicates that the vapors are below the condensing coil and work should not be processed. It also interlocks with the spray system to prevent spraying when the vapors are low.

On BSD models and on BLD models with the recirculation feature, an immersion/ultrasonic sump temperature control maintains the temperature of that sump to $\pm 2^{o}F$.

When all the safeties have been satisfied, PRESS START will light, indicating that the degreaser can be activated by pressing START.

A state of the art thermister temperature controller contains the boiling sump over-temperature safety, the high vapor safety and the ultrasonic temperature control.

A control dial labeled U/S TEMP CTRL located on the control panel regulates the ultrasonic sump temperature setting.

Control Options

A digital readout option which displays the temperatures in the immersion/ultrasonic sump and the boiling sump is available. The display (U/S TEMP, B/S TEMP) is toggled between the two sumps by a switch on the control panel. The digital readout can be set to display either degrees Fahrenheit or Centigrade.

Timer options may be installed to control ultrasonics or sprays. The timers are adjustable (.05 seconds to 100 hours). They are activiated by pressing ULTRASONIC START or SPRAY START and reset automatically after timing out.

The auxiliary function option provides a 208/230 volt, 5 amp, 1/3 hp, fused controlled output for customer use. It can be operated by the AUX switch on the control panel, a remote

controlling device which may be connected to terminals on the main relay board, or by a TDR if the TDR option is purchased. Any combination of controls may be used.

The TDR interconnect option connects the degreaser to the Branson TDR series robots. It allows them to control the sprays, ultrasonics, and auxiliary functions. An additional set of connections is available within the degreaser control box for special requirements.

Separator/Desiccator

The Branson Separator/Desiccator (Figure 3-3) consists of a separator/desiccator chamber, a reservoir and a water cooling chamber.

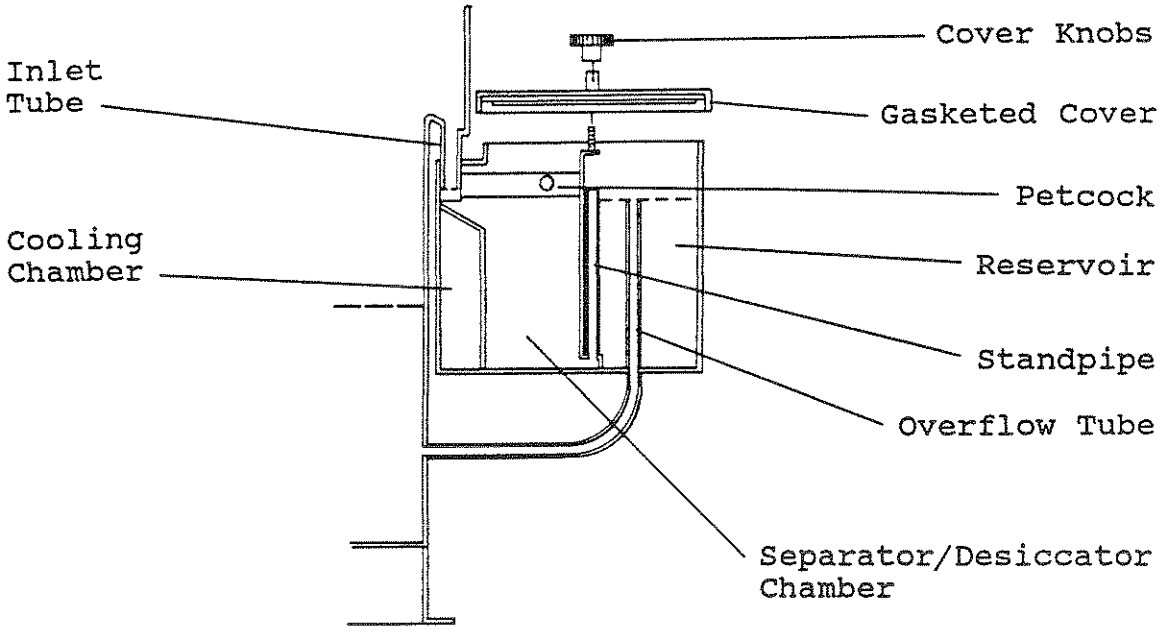


Figure 3-3: Separator/Desiccator

Distillate enters the system through the inlet tube which extends below the surface of the solvent to minimize disturbance of the water layer. As the distillate is cooled by conduction from the cooling chamber, dissolved water is released and floats to the surface to form a water layer. The water is drained periodically by opening the petcock located on the front of the water separator.

When the system is used as a desiccator, a nylon bag containing desiccant fills the separation chamber. The solvent which enters the system must pass through the desiccant before passing into

the reservoir. The bag acts as a filter which prevents desiccant from leaving the separation chamber. The liquid level in the separation chamber is maintained by a standpipe.

The reservoir contains clean dry distillate which may be used by either the Hand Spray Option or the Spray Manifold Option. It has adequate capacity for all normal spray operations. The maximum level in the reservoir is controlled by the overflow tube. Excess distillate is returned to the immersion/ultrasonic sump.

A gasketed cover prevents the escape of vapors and is easily removed to replace desiccant or clean the separator.

Recirculation System Option

The recirculation system (Figure 3-4), standard on BSD units and optional on BLD units, includes a pump, filter, heat exchanger and a strainer.

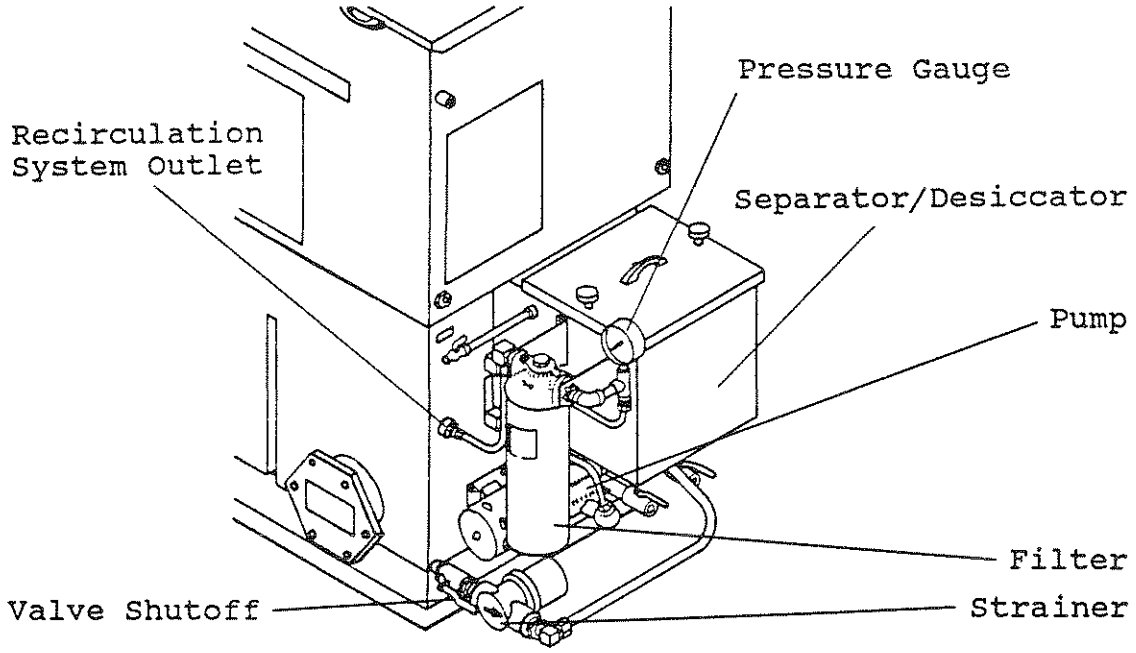


Figure 3-4: The Recirculation System

The purpose of the system is to remove particulate contamination from the solvent in the ultrasonic/immersion sump and to maintain precise temperature control for improved ultrasonic efficiency. The solvent flow is as follows:

Warm solvent is drawn from the sump through the recirculation system inlet, and pumped through the strainer. Large chips and debris are trapped by the strainer. The solvent is then pumped through the heat exchanger located in the separator/desiccator where it is cooled. It is then filtered and returned to the immersion sump.

The recirculation system takes the warm solvent out at the bottom of the sump and returns cooled solvent near the top of the sump. This insures a good mixing of the solvent to guarantee an even temperature profile within the sump and to keep particulates from redepositing on work in process.

The sealless magnetic drive pump, made of RYTON, is compatible with most solvents and offers long-life and trouble free operation. The pumps have been matched to each model of the degreaser series to insure maximum turnover rates without excessive turbulence that could cause unwanted vapor condensation on the sump liquid surface.

The standard filter supplied with the system is a 10 micron wound cartridge contained within a brass housing.

A pressure gauge is supplied on the inlet side of the filter to monitor pressure drop as an indicator of contamination and a need for cartridge replacement.

The valve located at the system inlet can be closed to facilitate strainer cleaning and filter replacement without draining the sump.

The entire system has been designed to be serviced from the front or side of the unit. The standard plumbing of the system is copper and brass with stainless steel available as an option. Heaters and electronics for immersion/ultrasonic sump temperature control are part of the recirculation package.

Hand Spray Option

The hand spray option (Figure 3-5) which is available in brass or stainless steel, may be used to manually wash parts before immersing them in the ultrasonic tank or to give them a cold rinse with pure distillate before the final vapor rinse. As a pre-wash, the hand spray can dislodge and flush gross contaminants so that they fall into the boiling sump. This keeps the ultrasonic sump cleaner.

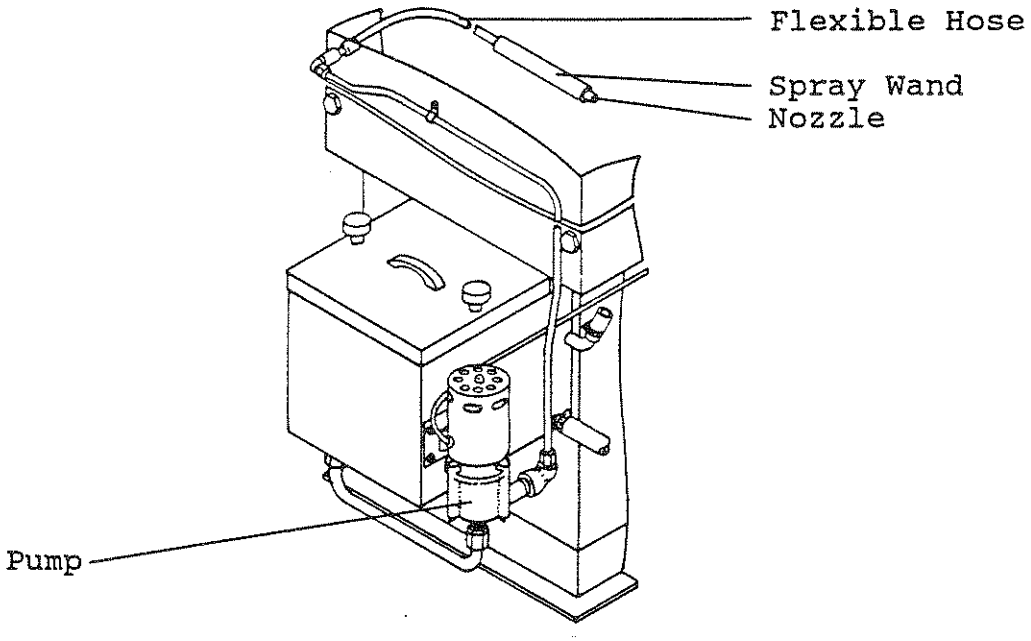


Figure 3-5: Hand Spray Option

The hand spray option, when used for final rinsing, flushes away the residues left by ultrasonic cleaning and cools the workpieces so that the vapor rinse is more effective.

The pump draws pure dry distillate from the spray reservoir. It is a magnetic drive sealless pump with RYTON wetted parts. The solvent is pumped through connecting plumbing to a flexible hose which allows the spray to be directed onto the parts by the operator.

The spray wand insulates the hand from hot solvents. The nozzle sprays with a narrow cone pattern to give good coverage and direction without large amounts of overspray which would cause excessive solvent losses.

The hand spray option is manually controlled by a low voltage foot switch, or by an optional timer. Do not use the TDR to control the hand spray. The low vapor thermostat, located behind the control box, is interlocked with the spray controls to prevent spraying if the vapor level is below the condensing coil.

Spray Manifold Option

The spray manifold option (Figure 3-6) is used to automatically wash parts before immersing them in the ultrasonic tank or to give them a cold rinse with pure distillate before the final vapor rinse. As a pre-wash, the spray can dislodge and flush gross contaminants so that they fall into the boiling sump. This keeps the ultrasonic sump cleaner.

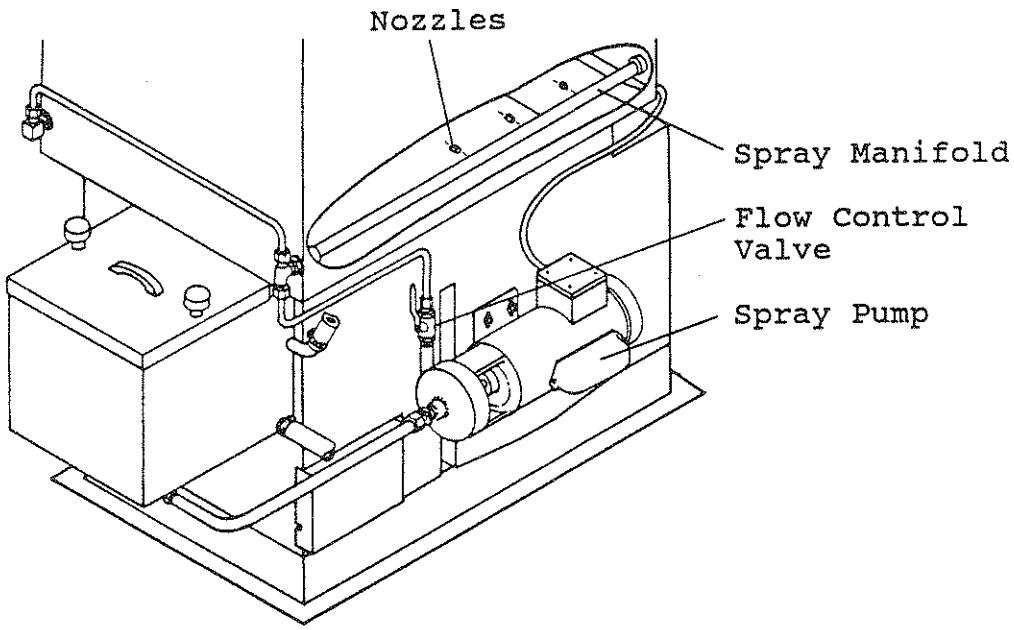


Figure 3-6: Spray Manifold Option

When used for final rinsing, the spray manifold option flushes away residues left after ultrasonic cleaning, and cools the parts so that the vapor rinse is more effective.

The spray pump draws pure dry distillate from the spray reservoir. It is a 1/3 horsepower close coupled centrifical pump with mechanical shaft seals. It is equipped with a flow control valve to reduce pressures and flows which are greater than should be used in an open top vapor degreaser.

The connecting plumbing can be either brass and copper or stainless steel.

The spray manifolds are installed beneath the condensing coil so that they are always in the vapor zone. They can be mounted so

that they cover either the boiling sump or the ultrasonic sump and may be rearranged in the field to accommodate different cleaning requirements.

The nozzle arrangement is designed to provide total coverage of the sump. The nozzles spray a square pattern and have a flow rate of about .3 gpm each. Maximum spray duration is limited by vapor zone collapse (25 seconds), however, the reservoir has a capacity for about one minute of spraying.

The spray manifold option is controlled by a low voltage foot switch. An optional timer is available. The spray manifolds also may be operated by a Branson TDR Series Automated Transport System for totally automated production. Any combination of controls may be used.

Digital Temperature Indicator Option

The digital temperature indicator option (Figure 3-7) displays the temperature of the boiling sump and the immersion/ultrasonic sump. A switch toggles the readout between the sumps.

The meter is shipped from the factory fully calibrated and indicating temperatures in °F. It can be set to read °C.

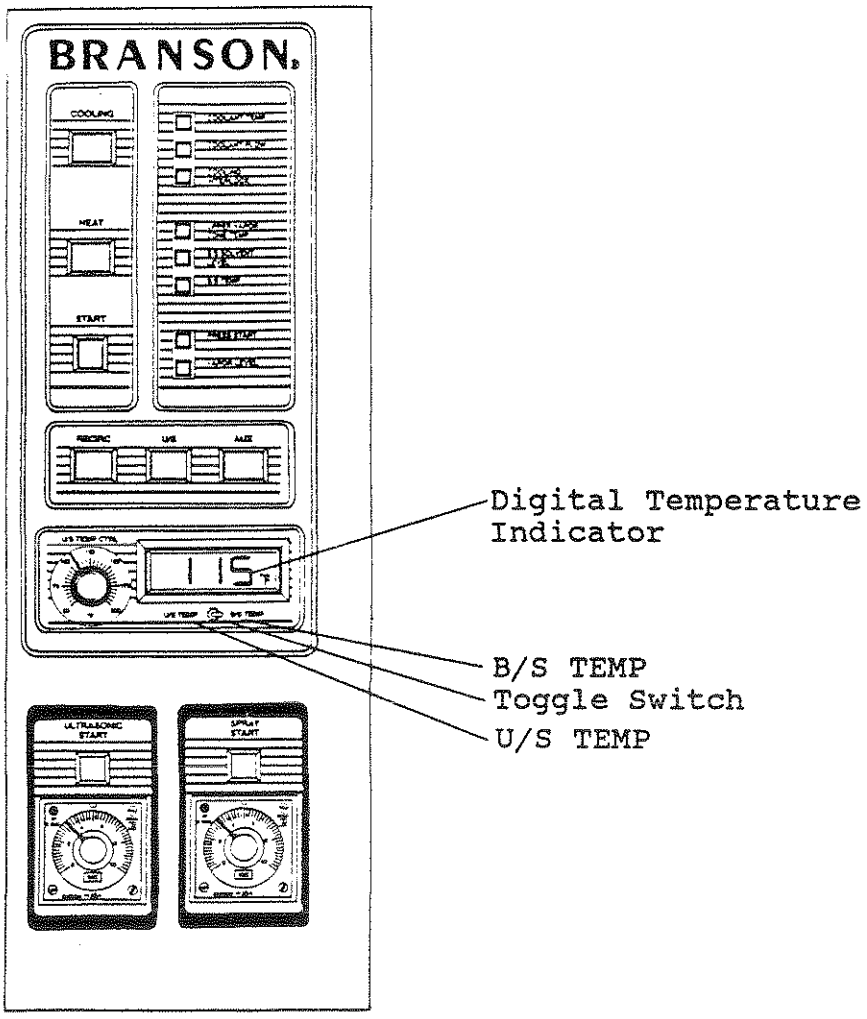


Figure 3-7: Digital Temperature Indicator Option

SOLVENT LIST

Group	Solvent	Boiling Point	Pump Gasket**	Desiccant
1	Arklone E*	97.7°F	V	
	Blaco-tron TCM*	97.3°F	V	
	Blaco-tron TMC*	97.7°F	V	
	Blaco-tron TMC Plus*	97.1°F	V	
	Freon TMC*	97.6°F	V	
	Genesolv DM*	97.7°F	V	
	Genesolv DMC*	97.1°F	V	
	Blaco-tron TMS Plus*	103.0°F	B	Yes
	Freon TMS*	103.5°F	B	Yes
	M-Clene D*	104.0°F	V	
	Methylene Chloride	102.6°F	V	
2	Arklone A*	112.1°F	V	Yes
	Arklone A-M*	112.1°F	V	Yes
	Arklone AS*	112.1°F	V	Yes
	Blaco-tron TA* #	108.0°F	B	Yes
	Blaco-tron TE*	112.3°F	V	Yes
	Blaco-tron TE Plus*	113.0°F	V	Yes
	Blaco-tron TES*	111.0°F	V	Yes
	Freon TA*	110.5°F	B	Yes
	Freon TE*	112.3°F	V	Yes
	Freon TES*	111.9°F	V	Yes
	Genesolv DA* #	112.1°F	B	Yes
	Genesolv DE*	112.3°F	V	
	Genesolv DES*	112.0°F	V	
	Arklone P*	117.6°F	B	
	Blaco-tron DI*	115.7°F	V	
	Blaco-tron TF*	117.6°F	B	
	Freon TF*	117.6°F	B	
	Genesolv D*	117.6°F	B	
6	111 Trichlorethane	162.0°F	V	
	Chlorethene VG*	165.0°F	V	
	Prelete*	164.0°F	V	
7	Trichloroethylene	188.0°F	V	

* Registered Trademark

Spray mainifold option requires TEFLON seals. Contact Branson Service Department.

Boiling points are at sea level with an ambient temperature of 70°F.

**Pump Gaskets: B = Buna N, V = Viton

Solvent Groups 6 and 7 require high boiler spray safety thermostat (Branson PN 386-031).

MATERIAL SAFETY DATA SHEET INFORMATION

Every shipment of solvent you receive should include an updated, current MATERIAL SAFETY DATA SHEET.

If it does not, or if additional information is required, contact the solvent manufacturer before using the solvent. The MATERIAL SAFETY DATA SHEETS that follow are SAMPLES and for general reference only.

U.S. DEPARTMENT OF LABOR

Occupational Safety & Health Administration

MATERIAL SAFETY DATA SHEET

SECTION I

MANUFACTURER'S NAME: E. I. du Pont de Nemours and Company, Inc.	EMERGENCY TELEPHONE NO.: (302) 774-2421
ADDRESS (Number, Street, City, State, and ZIP Code): Freon® Products Division, Wilmington, Delaware 19898	
CHEMICAL NAME AND SYNONYMS: Trichlorofluoroethane & Methylene Chloride	TRADE NAME AND SYNONYMS: Freon® TMC Solvent
CHEMICAL FAMILY: Halogenated Hydrocarbon	FORMULA: CCl_2FCClF_2 and CH_2Cl_2

SECTION II HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS: Methylene Chloride	9.5	100	NON-METAL COATING OR FLUX		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)

SECTION III PHYSICAL DATA

BOILING POINT (°F.)	97.2	SPECIFIC GRAVITY ($H_2O=1$) g/cc @77°F	1.42
VAPOR PRESSURE (mm Hg.) 77°F	500	PERCENT VOLATILE BY VOLUME (%)	100
VAPOR DENSITY (AIR=1)	4.9	EVAPORATION RATE (CCl = 1)	0.3
SOLUBILITY IN WATER Wt % @ 77°F	0.66		
APPEARANCE AND ODOR: Colorless Liquid - Slight Solvent Odor			

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used): None	FLAMMABLE LIMITS: None	LEL	UEL
EXTINGUISHING MEDIA: Nonflammable			
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARDS: None			

NOTICE FROM DU PONT

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE 140 (Calculated ACGIH) TWA 600 (OSHA)*

EFFECTS OF OVEREXPOSURE
Light-headedness, giddiness, shortness of breath, possible narcosis, possible cardiac arrhythmias at high concentrations.

EMERGENCY AND FIRST AID PROCEDURES
Inhalation: Remove to fresh air, call a physician. Do Not Give epinephrine or similar drugs.

Skin or Eye Contact: Flush with water.

SECTION VI REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		Open flames or high temperatures
	STABLE	X	

INCOMPATABILITY *(Materials to avoid)*
Alkali or alkaline earth metals-powdered Aluminum, Zinc, Beryllium, etc.

HAZARDOUS DECOMPOSITION PRODUCTS
Hydrochloric and hydrofluoric acids - possible carbonyl halide.

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Ventilate area-especially low places where heavy vapors might collect

WASTE DISPOSAL METHOD
Reclaim by distillation

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*
Use air mask with independent supply in high concentrations.

VENTILATION		
	LOCAL EXHAUST: When large amounts are released	SPECIAL
	MECHANICAL *(General)*: Especially in low places	OTHER

PROTECTIVE GLOVES	EYE PROTECTION
When handling liquid	When handling liquid

OTHER PROTECTIVE EQUIPMENT

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Store containers in a clean, dry area. Do not heat above 125°F.

OTHER PRECAUTIONS

Vaporization of excessive amounts of this product can deplete or replace oxygen necessary for breathing. In confined/enclosed spaces or areas with little ventilation, this may be hazardous to health. Exposure to high concentrations of this product may induce cardiac arrhythmias in some individuals.

Reviewed: 5/83

Exposure to industrial solvents presents a threat to the health, productivity, and efficiency of workers in many occupations. Organic solvents, which are used to dissolve materials like oils, greases, and resins, have widespread industrial applications and are incorporated in a variety of products including paints, varnishes, lacquers, adhesives, plastics, textiles, waxes, and polishes. They are also used in cleaning, degreasing, and drying operations. Since over-exposure to solvents may cause adverse health effects, proper precautions must be taken and adequate controls implemented to protect the worker.

Health Problems With Use

The solvent or mixture of solvents being used, the amount of exposure, and the duration of the exposure all affect hazard potential. One should avoid inhaling vapors and having skin contact with any organic solvent. All organic solvents may have some effect on the central nervous system and inhalation of vapors is the principal mode of entry. Although certain solvents can be absorbed through contact with the intact skin, the most common result of skin contact is dermatitis (inflammation of the skin). Accidental swallowing of solvents is rare.

Excessive inhalation of solvent vapor may cause impairments such as lack of coordination or drowsiness, which have no discernible permanent effects on health, but which may increase the risk of accidents. In other cases, over-exposure may result in serious damage to the blood, lungs. liver, kidneys, nervous system, or gastrointestinal tract, particularly if the more toxic or irritating solvents like benzene, carbon tetrachloride, carbon disulfide, or formaldehyde are used.

Benzene is well known for its effect on the blood-forming tissue of the bone marrow and there is strong evidence to suggest a link between benzene exposure and leukemia. Inhalation of carbon tetrachloride may affect the normal functioning of the brain and cause dizziness, headaches, fatigue, drowsiness, and — in instances of severe exposure — unconsciousness. Extensive or continued over-exposure to the solvent have, in some cases, resulted in liver and kidney damage. Chronic exposure to carbon disulfide may cause damage to the motor nerves, which control the voluntary movements of the body. Formaldehyde vapors are extremely irritating to the mucous membranes of the nose and throat and high exposures lead to inflammation and edema (swelling) of the passageways to the lungs. Skin contact with organic solvents may cause a dermatitis, the severity of which can range from simple irritation to actual skin damage. Even the mildest solvents can dissolve the natural protective barriers of fats and oils, leaving the skin subject to disabling and possibly disfiguring dermatitis and opening the way to serious infection.

Control of Exposures

Means to control exposures to solvents include the substitution of less toxic solvents, local exhaust ventilation, proper work practices or procedures, protective clothing and respirators, and good personal hygiene.

Substitution of a solvent that is less toxic or that evaporates less quickly may be effective in reducing hazard potential. For example, the substitution of methyl chloroform for carbon tetrachloride has decreased the hazards in many cleaning and degreasing operations. In some cleaning operations, detergents and water can be used instead of solvents. Consideration should be given to using less toxic and volatile solvents in other processes. The substitution of a less toxic solvent does not imply that a health hazard has been eliminated, however; it means only that a worker is less likely to suffer ill effects.

Local exhaust ventilation is an effective way of preventing solvent vapors from entering the worker's breathing zone by removing vapors at their point of origin. Although some solvents are less toxic than others, good safety practices dictate that care be exercised in the use of any organic industrial solvent. Solvent containers must be covered

U.S. Department of Health Education and Welfare
DHEW (NIOSH) Publication No. 77-139

when not in use and leaks or spills must be cleaned up immediately. Mechanical devices to move parts to and from the solvent container should be used whenever possible in cleaning operations. Proper work practices and procedures are important in limiting solvent exposures.

Since some solvents can be absorbed through the skin, and all tend to remove natural lubricants, perhaps causing dermatitis, protective clothing such as gloves and aprons should be worn to prevent skin contact. Barrier creams also may offer some degree of protection. If there is a possibility that solvents may be splashed into the eyes, eye protection such as safety glasses, goggles, and/or face shields should be worn. Approved respirators can be used for short or intermittent durations or emergency exposures. They should not be used as a regular means of protection against solvent vapors as exhaust ventilation is usually required.

Good personal hygiene practices are essential whenever solvents are used, as the skin should always be protected. The skin should never be washed with any organic solvent. Splashes should be washed off the skin as soon as possible. Clothes should be changed if they become soaked with solvents, since prolonged skin contact can cause more serious problems.

Management's Responsibilities

Employers should recognize that organic solvents can be a threat to the health and safety of employees. They should set up appropriate work procedures and provide necessary controls. Operating guidelines should be established for the selection, use, and handling of solvents. Employee training and education programs should be instituted. Any complaints or erratic behavior on the employees' part which may be the result of solvent exposure, should be quickly investigated. Good housekeeping should be practiced throughout all solvent storage and handling areas.

Employees' Responsibilities

Employees should be aware of the health and safety problems associated with the use of organic industrial solvents and should follow these general rules as well as other company safety rules issued to protect them on the job.

1. Avoid breathing solvent vapors.
2. Avoid skin contact.
3. Use all exhaust systems.
4. Use all available protective devices and equipment.
5. Avoid using solvents around hot metal surfaces or flames. Most solvents are flammable or combustible, and some may break down to form poisonous gases when exposed to hot surfaces or flames.
6. Do not smoke in areas where solvents are used or stored.
7. Clean up and report any spills immediately.
8. Avoid working with solvents in confined, unventilated areas.
9. Report all ill effects and skin disorders.
10. Practice good personal hygiene habits.

☆ U S GOVERNMENT PRINTING OFFICE: 1978— 760-090/78

U.S. Department of Health Education and Welfare
DHEW (NIOSH) Publication No. 77-139

SPECIFICATIONS - DEGREASER MODEL BSD/BLD 1216		
Overall Dimensions: Vapor Zone: Boiling Sump: Ultrasonic Tank:	LxWxH LxWxD LxWxD LxWxD	44-1/4" x 27-1/4" x 43-1/4" 25" x 16" x 12" 12" x 16" x 12" 12" x 16" x 12"
Total Solvent Capacity:		26 gallons
Freeboard to Width Ratio:		1.00
Recirculating Pump Flow Rate:		2.2 gallons per minute
Distillation Rate: (at no load, with Freon TF - ambient temperature 70°F (21°C) - 230 VAC)		16 gallons per hour
Spray Pump Flow Rate: (optional)		.3 gallons per minute
Cooling Water: (at no load, with Freon TF -ambient temperature 70°F (21°C) -230 VAC)		1.5 gallons per minute at 60°F
Load Capacity: (at no load, with Freon TF -ambient temperature 70°F (21°C) -230 VAC)		600 lbs. of steel/hour
Water Separator Capacity: Desiccant Capacity: Reservoir Capacity:		1.3 gallons 9 lbs. 1.5 gallons
Ultrasonic Generator Power Output: Operating Frequency: Transducers:		 360 watts 40 KHz (40,000 Hz) (25 KHz optional) Piezoelectric (12)
Companion Chiller:		BC150 (standard heat)
Operating Temperature:		55°F to 100°F With Freon TMC, 55°F to 90°F

(continued)

SPECIFICATIONS - DEGREASER MODEL BSD/BLD 1216

- ELECTRICAL LOADS				
Volts	200	208	220	230
Phases	1	1	1	1
Cycles	50	60	50	60
BSD WITH NO OPTIONS - STANDARD HEAT				
B/S Heater Type*	C	C	C	C
B/S Heater Watts	3698	4000	3658	4000
U/S Heater Watts	608	656	728	800
Total Watts	4831	5181	4911	5325
Nominal Amps	25	25	23	24
BSD WITH NO OPTIONS -LOW HEAT				
B/S Heater Type*	A	A	A	A
B/S Heater Watts	1890	2045	2290	2500
U/S Heater Watts	608	656	728	800
Total Watts	3023	3226	3543	3825
Nominal Amps	16	16	17	17
BLD WITH RECIRCULATION - STANDARD HEAT				
B/S Heater Type*	C	C	B	B
B/S Heater Watts	3698	4000	3658	4000
U/S Heater Watts	608	656	728	800
Total Watts	4431	4781	4511	4925
Nominal Amps	23	23	21	22
BLD WITH RECIRCULATION - LOW HEAT				
B/S Heater Type*	A	A	A	A
B/S Heater Watts	1890	2045	2290	2500
U/S Heater Watts	608	656	728	800
Total Watts	2623	2826	3143	3425
Nominal Amps	14	14	15	15
BLD WITH NO OPTIONS - STANDARD HEAT				
B/S Heater Type*	C	C	B	B
B/S Heater Watts	3698	4000	3658	4000
Total Watts	3718	4020	3768	4020
Nominal Amps	19	20	17	18
BLD WITH NO OPTIONS - LOW HEAT				
B/S Heater Type*	A	A	A	A
B/S Heater Watts	1890	2045	2290	2500
Total Watts	1910	2065	2310	2550
Nominal Amps	10	10	11	11

Option Leads:
- Hand Spray: 208/230 volts, 1 amp
- Spray Manifold: 208/230 volts, 4 amps
- Lip Vent Ex: 208/230 volts, .5 amps
- Auxiliary: 208/230 volts, 5 amps resist, 1/3 hp (max)

*Heater Type:
- A - 2.5 KW - 230 V
- B - 4 KW - 230 V
- C - 4 KW - 208 V

SPECIFICATIONS - DEGREASER MODEL BSD/BLD 1620		
Overall Dimensions:	LxWxH	52-1/4" x 31-1/4" x 52-1/4"
Vapor Zone:	LxWxD	33" x 20" x 14.5"
Boiling Sump:	LxWxD	16" x 20" x 14.5"
Ultrasonic Tank:	LxWxD	16" x 20" x 14.5"
Total Solvent Capacity:		54 gallons
Freeboard to Width Ratio:		1.00
Recirculating Pump Flow Rate:		4 gallons per minute
Distillation Rate: (at no load, with Freon TF - ambient temperature 70°F (21°C) - 230 VAC)		32 gallons per hour
Spray Pump Flow Rate: (optional)		.3 gallons per minute
Cooling Water: (at no load, with Freon TF -ambient temperature 70°F (21°C) -230 VAC)		3 gallons per minute at 60°F
Load Capacity: (at no load, with Freon TF -ambient temperature 70°F (21°C) -230 VAC)		1200 lbs. of steel/hour
Water Separator Capacity: Desiccant Capacity: Reservoir Capacity:		2.3 gallons 15 lbs. 2.9 gallons
Ultrasonic Generator Power Output: Operating Frequency: Transducers:		 720 watts 40 KHz (40,000 Hz) (25 KHz optional) Piezoelectric (24)
Companion Chiller:		BC300 (standard heat)
Operating Temperature:		55°F to 100°F With Freon TMC, 55°F to 90°F

(continued)

SPECIFICATIONS - DEGREASER MODEL BSD/BLD 1620

- ELECTRICAL LOADS					
Volts	208	230	380	315	460
Phases	3	3	3+N	3+N	3
Cycles	60	60	50	50	60
BSD WITH NO OPTIONS - STANDARD HEAT					
B/S Heater Type*	C(2)	B(2)	A(1),B(1)	D(2)	D(2)
B/S Heater Watts	8000	8000	5950	6512	8000
U/S Heater Watts	1230	1500	1375	1633	1500
Total Watts	10255	10525	8350	9170	10525
Nominal Amps	34	31	17	15	15
BSD WITH NO OPTIONS -LOW HEAT					
B/S Heater Type*	A(2)	A(2)	A(2)	H(2)	H(2)
B/S Heater Watts	4090	5000	4580	4070	5000
U/S Heater Watts	1230	1500	1365	1633	1500
Total Watts	6345	7525	6970	6728	7525
Nominal Amps	18	20	11	12	10
BLD WITH RECIRCULATION - STANDARD HEAT					
B/S Heater Type*	C(2)	B(2)	A(1),B(1)	D(2)	D(2)
B/S Heater Watts	8000	8000	5950	6512	8000
U/S Heater Watts	1230	1500	1375	1633	1500
Total Watts	9355	9625	7450	8270	9625
Nominal Amps	34	31	17	14	15
BLD WITH RECIRCULATION - LOW HEAT					
B/S Heater Type*	A(2)	A(2)	A(2)	H(2)	H(2)
B/S Heater Watts	4090	5000	4580	4070	5000
U/S Heater Watts	1230	1500	1365	1633	1500
Total Watts	5445	6625	6070	5828	6625
Nominal Amps	17	20	11	12	10
BLD WITH NO OPTIONS - STANDARD HEAT					
B/S Heater Type*	C(2)	B(2)	A(1),B(1)	D(2)	D(2)
B/S Heater Watts	8000	8000	5950	6512	8000
Total Watts	8020	8020	5970	6532	8020
Nominal Amps	34	31	17	14	15
BLD WITH NO OPTIONS - LOW HEAT					
B/S Heater Type*	A(2)	A(2)	A(2)	H(2)	H(2)
B/S Heater Watts	4090	5000	4580	4070	5000
Total Watts	5010	5020	4600	4090	5020
Nominal Amps	17	19	11	9	10

Option Leads:
- Hand Spray: 208/230 volts, 1 amp
- Spray Manifold: 208/230 volts, 4 amps
- Lip Vent Ex: 208/230 volts, .5 amps
- Auxiliary: 208/230 volts, 5 amps resist, 1/3 hp (max)

*Heater Type:

A - 2.5 KW - 230 V	E - 5 KW - 208 V
B - 4 KW - 230 V	F - 5 KW - 230 V
C - 4 KW - 208 V	G - 5 KW - 460 V
D - 4 KW - 460 V	H - 2.5KW - 460 V

SPECIFICATIONS - DEGREASER MODEL BSD/BLD 2024		
Overall Dimensions: Vapor Zone: Boiling Sump: Ultrasonic Tank:	LxWxH LxWxD LxWxD LxWxD	64-1/8" x 35-1/4" x 63-1/4" 41" x 24" x 17" 20" x 24" x 17" 20" x 24" x 17"
Total Solvent Capacity:		98 gallons
Freeboard to Width Ratio:		1.00
Recirculating Pump Flow Rate:		4 gallons per minute
Distillation Rate: (at no load, with Freon TF - ambient temperature 70°F (21°C) - 230 VAC)		57 gallons per hour
Spray Pump Flow Rate: (optional)		.3 gallons per minute
Cooling Water: (at no load, with Freon TF -ambient temperature 70°F (21°C) -230 VAC)		6 gallons per minute at 60°F
Load Capacity: (at no load, with Freon TF -ambient temperature 70°F (21°C) -230 VAC)		2000 lbs. of steel/hour
Water Separator Capacity: Desiccant Capacity: Reservoir Capacity:		3.6 gallons 28 lbs. 4.4 gallons
Ultrasonic Generator Power Output: Operating Frequency: Transducers:		 1080 watts 40 KHz (40,000 Hz) (25 KHz optional) Piezoelectric (36)
Companion Chiller:		BC500 (standard heat) BC300 (low heat option)
Operating Temperature:		55°F to 100°F With Freon TMC, 55°F to 90°F

(continued)

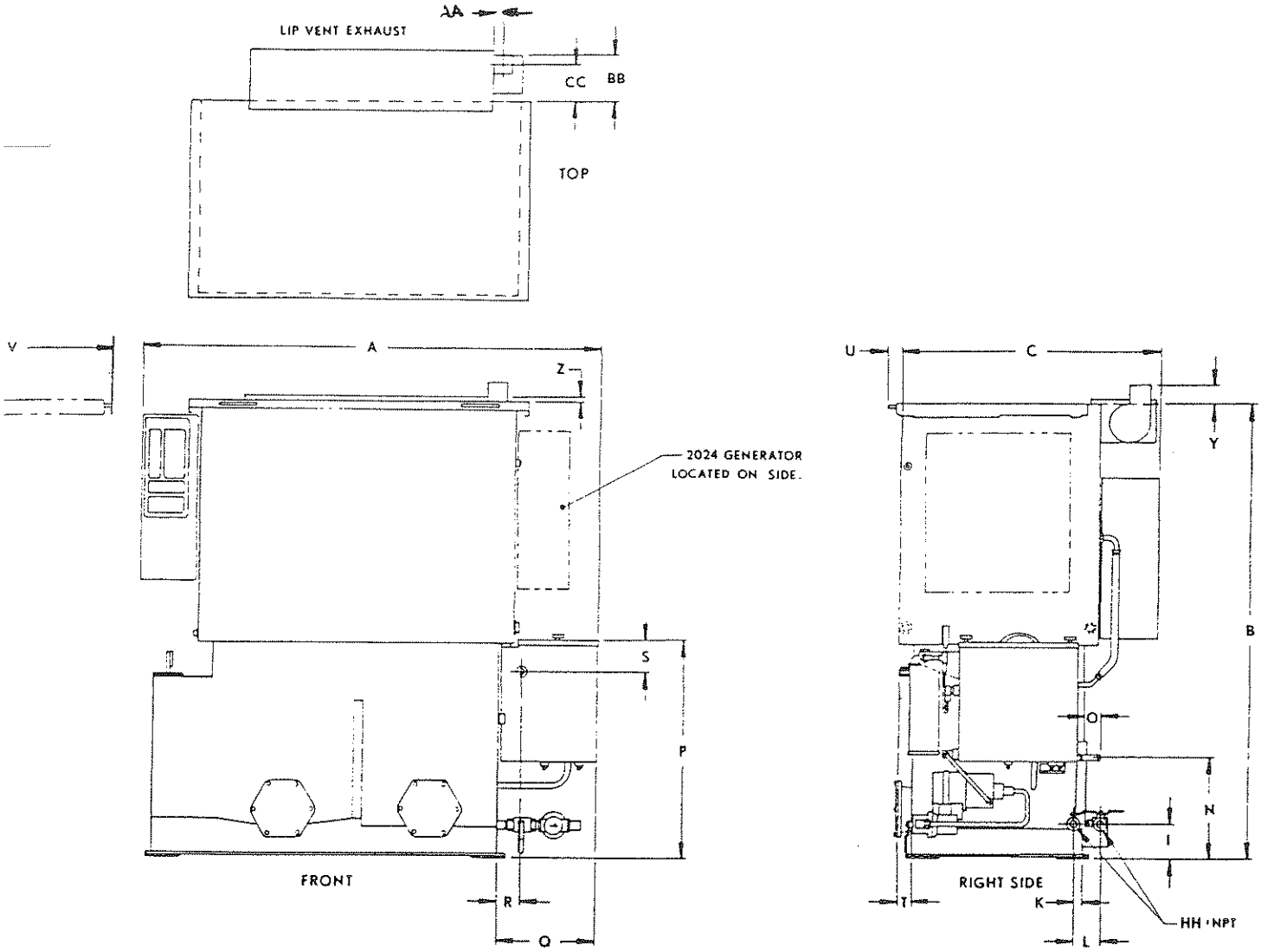
SPECIFICATIONS - DEGREASER MODEL BSD/BLD 2024 - ELECTRICAL LOADS

- ELECTRICAL LOADS					
Volts	208	230	380	415	460
Phases	3	3	3+N	3+N	3
Cycles	60	60	50	50	60
BSD WITH NO OPTIONS - STANDARD HEAT					
B/S Heater Type*	C(1),E(2)	B(1),F(2)	B(1),F(2)	G(3)	D(1),G(2)
B/S Heater Watts	14000	14000	12808	12210	14000
U/S Heater Watts	1640	2000	1820	2180	2000
Total Watts	17165	17525	16153	15915	17525
Nominal Amps	51	48	32	27	24
BSD WITH NO OPTIONS -LOW HEAT					
B/S Heater Type*	A(2),B(1)	A(3)	A(3)	H(3)	H(3)
B/S Heater Watts	7361	7500	6870	6105	7500
U/S Heater Watts	1640	2000	1820	2180	2000
Total Watts	10526	11025	10215	9810	11025
Nominal Amps	36	32	25	18	17
BLD WITH RECIRCULATION - STANDARD HEAT					
B/S Heater Type*	C(1),E(2)	B(1),F(2)	B(1),F(2)	G(3)	D(1),G(2)
B/S Heater Watts	14000	14000	12808	12210	14000
U/S Heater Watts	1640	2000	1820	2180	2000
Total Watts	15765	16125	14735	14515	16125
Nominal Amps	45	43	25	27	21
BLD WITH RECIRCULATION - LOW HEAT					
B/S Heater Type*	A(2),B(1)	A(3)	A(3)	H(3)	H(2)
B/S Heater Watts	7361	7500	6870	6105	7500
U/S Heater Watts	1640	2000	1820	2180	2000
Total Watts	9126	9625	8815	8410	9625
Nominal Amps	30	26	19	18	14
BLD WITH NO OPTIONS - STANDARD HEAT					
B/S Heater Type*	C(1),E(2)	B(1)F(2)	B(1),F(1)	G(3)	D(1),G(2)
B/S Heater Watts	14000	14000	12808	12210	14000
Total Watts	14020	14020	12828	12230	14020
Nominal Amps	42	35	20	17	17
BLD WITH NO OPTIONS - LOW HEAT					
B/S Heater Type*	A(2),B(1)	A(3)	A(3)	H(3)	H(3)
B/S Heater Watts	7361	7500	6870	6105	7500
Total Watts	7381	7520	6890	6105	7500
Nominal Amps	23	19	11	9	10

Option Leads:	Hand Spray:	208/230 volts, 1 amp
	Spray Manifold:	208/230 volts, 4 amps
	Lip Vent Ex:	208/230 volts, .5 amps
	Auxiliary:	208/230 volts, 5 amps resist, 1/3 hp (max)

*Heater Type:

A - 2.5 KW - 230 V	E - 5 KW - 208 V
B - 4 KW - 230 V	F - 5 KW - 230 V
C - 4 KW - 208 V	G - 5 KW - 460 V
D - 4 KW - 460 V	H - 2.5KW - 460 V



S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
2	1-1/2	1-3/4	16-7/8	29-7/8	16-3/4	1	3/4	1-1/2	9-5/8	11	3-3/8	3	5/8	5/8	1/2	5/8	5/8
3-5/8	1-1/2	1-3/4	20-7/8	41	20-7/8	1-3/4	3/4	2	9-5/8	12-5/8	3-3/4	4-5/16	5/8	5/8	3/4	3/4	3/4
4-1/2	4	1-3/4	24-7/8	52-7/8	24-7/8	1-3/4	3/4	2-5/16	4	12	4-3/8	7	5/8	5/8	1	3/4	3/4

Figure 4-1
Degreaser Outline

WARNINGS

All personnel using the Branson Degreasing System should read and thoroughly understand this manual, as well as familiarize themselves with the precautionary instructions pertaining to the use and handling of solvents. If necessary, contact the solvent manufacturer for recommendations regarding the use and handling of his solvents.

Failure to follow these warnings may result in serious personal injury or property damage.

KEEP THE COVER ON WHEN THE DEGREASER IS NOT IN USE.

ALWAYS WEAR EYE PROTECTION, GLOVES AND PROTECTIVE CLOTHING when handling solvent.

THE THERMOSTATS HAVE BEEN FACTORY SET FOR THE SOLVENT SPECIFIED ON THE LABEL. If you wish to change solvent, contact your Branson representative or your solvent supplier for the correct thermostat setting.

ALL CLEANING SOLVENTS ARE TOXIC TO SOME DEGREE. Do not allow solvent vapors to exceed the safe maximum allowable concentration. When in doubt, consult published safety regulations concerning the solvent being used.

DO NOT EXPOSE ANY HALOGENATED SOLVENT OR ITS VAPORS TO THE HIGH TEMPERATURES EXISTING IN OPEN FLAMES AND EXPOSED ELECTRIC HEATING ELEMENTS because the solvent may decompose to toxic and corrosive substances. Install the degreaser in a well ventilated room, away from glowing electric heating elements, open flames or welding operations.

DO NOT ALLOW SOLVENT TO COME IN CONTACT WITH THE BODY. Solvent above 140°F (60°C) and solvent vapors above 160°F (71°C) can cause burns. With prolonged or frequent contact, solvent removes the natural oils from the skin. Use eye protection, gloves and protective clothing. Use a rack, basket or tongs to insert or remove parts from the degreaser.

BEFORE ADDING SOLVENT, SHUT OFF THE HEAT and allow the vapors to collapse to prevent vapors being forced out of the degreaser.

ALWAYS ADD SOLVENT TO THE ULTRASONIC SUMP and allow it to overflow into the boiling sump. Be certain that the solvent which is being added is the same as the solvent already in the degreaser.

DO NOT INHALE OR TAKE SOLVENT INTERNALLY because either could be fatal.

WARNINGS

DO NOT BRING SOLVENT INTO CONTACT WITH HIGHLY ACTIVE METALS such as sodium, potassium and barium.

DO NOT ALLOW SOLVENT TO BECOME OVER-CONTAMINATED.

SOLVENTS CAN BREAK DOWN AND BECOME ACIDIC when exposed over prolonged periods to reactive metals such as magnesium, aluminum, zinc and beryllium. When cleaning parts made of these materials, analyze the solvent frequently to determine if it has broken down. Failure to comply with this recommendation will result in damage to the equipment and could void the warranty covering it.

THE EXHAUST VENTILATOR SHOULD NOT EXCEED 20 $m^2/(m^2 min.) =$ $65 cfm/ft^2$ *of degreaser area unless it is necessary to meet OSHA requirements. Branson has an optional exhaust system available that meets the EPA operating requirements stated above.*

ELECTRICALLY LOCK OUT THE DEGREASER BEFORE PERFORMING ANY MAINTENANCE and place an OUT OF SERVICE sign on the unit. Do not work on the degreaser while the solvent is hot and/or the electrical power is on.

FLOW CONTROL DEVICES MUST ONLY BE CONNECTED ON THE INLET SIDE OF THE DEGREASER, NEVER THE OUTLET. Failure to comply with this warning may result in deformation or rupture of the water separator cooling chamber due to excessive water pressure.

THE DEGREASER MUST BE WIRED TO A FUSED DISCONNECT in accordance with the National Electrical Code and any applicable state and local electrical codes. Wiring directly into the main power disconnect box is recommended. Ground properly to prevent shock hazard.

THE BRANSON CHILLER MUST BE CONNECTED TO A SEPARATE POWER SOURCE AND IN OPERATION FOR AT LEAST SIX HOURS BEFORE OPERATING THE DEGREASER.

GENERAL

Unpacking and Handling

Normal precautions in unpacking and reasonable care in handling should be used to avoid possible damage to the degreaser. A visual inspection of all external controls and surfaces should be conducted to detect any damage which might have occurred during shipping.

The freight carrier is responsible for damage to equipment during shipment. If damage has occurred, notify the freight carrier immediately to establish proper basis for claim.

Selecting a Location

Install the degreaser in a location where there will not be excessive drafts and allow at least eight inches (20 cm) of clearance at the rear of the degreaser.

Install the degreaser away from hot electric heating elements, open flames and welding operations. Degreaser solvent and solvent vapor can decompose to form toxic and corrosive substances when exposed to high temperatures.

Utility Requirements

The exhaust ventilator should not exceed 20 $m^2/(m^2 min.)$= 65cfm/ft^2 of degreaser area unless it is necessary to meet OSHA requirements.

Branson has an optional exhaust system available that meets the EPA operating requirements stated above.

Water and Drainage

The degreaser requires a constant supply of clean, cold water (40°F to 60°F/4.5°C to 15.5°C and adequate drainage facilities:

Degreaser Model 1216 - 1.5 gpm
Degreaser Model 1620 - 3 gpm
Degreaser Model 2024 - 6 gpm

Water and drainage requirements can be disregarded if the degreaser is equipped with a Branson chiller. Consult your Branson representative if another chiller is to be used. Refer to Section 4 for Electrical Requirements.

Connecting the Unit

The locations of electrical, plumbing, air and mechanical connections are shown in Figure 5-1.

Water Connections

Hose connections for 5/8" I.D. (3/4 I.D. 1620/2024) hose are provided at the inlet and the outlet. The unit may be hard plumbed by removing the hose fittings and attaching plumbing with 1/2 NPT connections.

To connect the degreaser:

1. Using the appropriate hose or tubing, connect the degreaser water inlet WATER IN to a cold water outlet or to the chiller SUPPLY connection.

On units without chillers, connect a water shut-off valve between the water source and the degreaser.

Warning: Flow control devices must only be connected on the inlet side of the degreaser, never the outlet. Failure to comply with this warning may result in deformation or rupture of the water separator cooling chamber due to excessive water pressure.

2. Using the appropriate hose or tubing, connect the degreaser water outlet WATER OUT to a free flowing drain (without back pressure) or to the chiller RETURN connection.

Electrical Connections

Warning: The degreaser must be wired to a fused disconnect in accordance with the National Electrical Code and any applicable state and local electrical codes. Wiring directly into the main power disconnect box is recommended. Ground properly to prevent shock hazard.

The Branson chiller must be connected to a separate power source and in operation for at least six hours before operating the degreaser.

This precaution allows the heaters in the compressor to heat the oil and help prevent slugging. It allows the chiller to operate at optimum temperature and insures maximum longevity. It is recommended that the chiller main disconnect circuit breaker be in the ON position at all times.

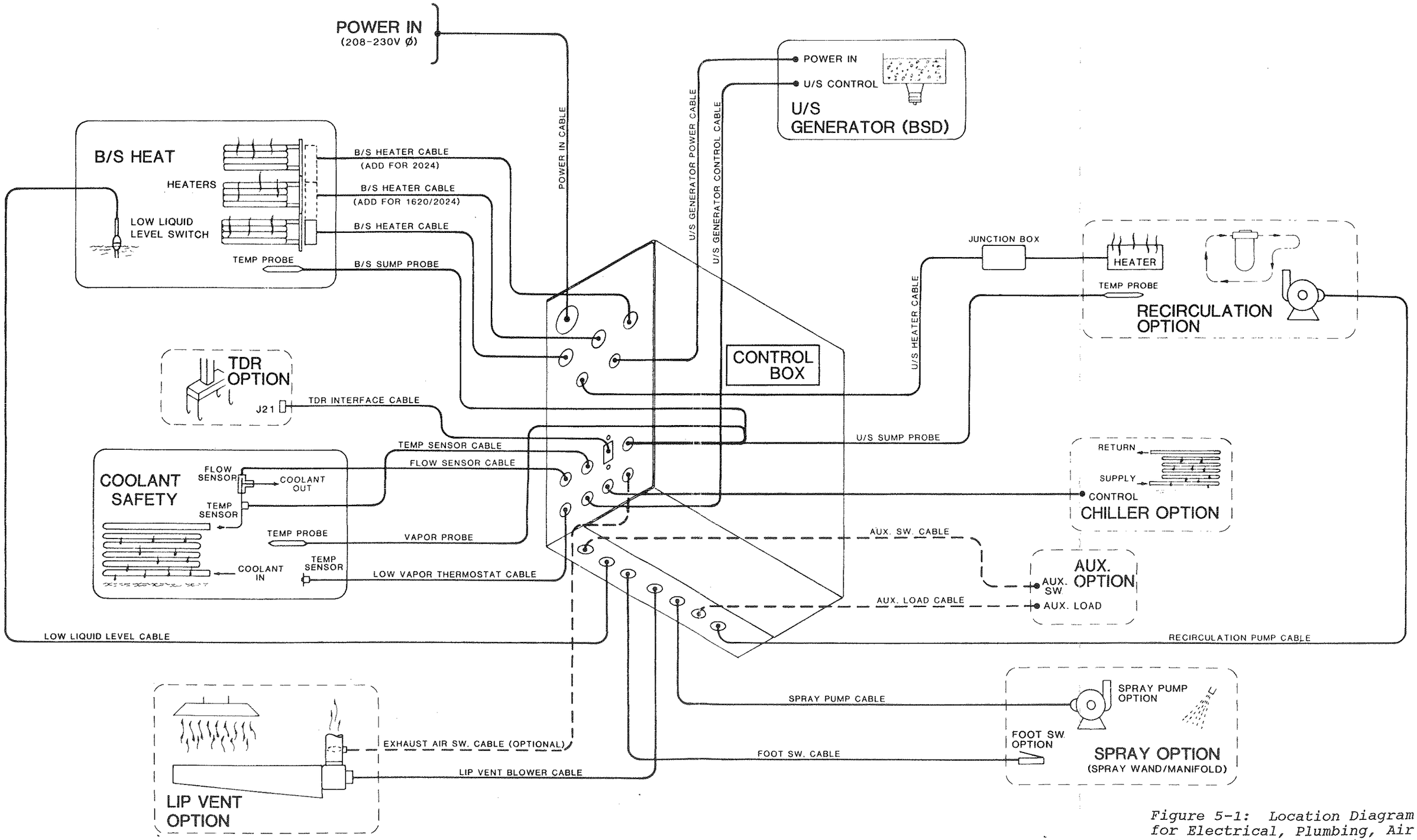


Figure 5-1: Location Diagram for Electrical, Plumbing, Air and Mechanical Connections

To connect the degreaser and chiller:

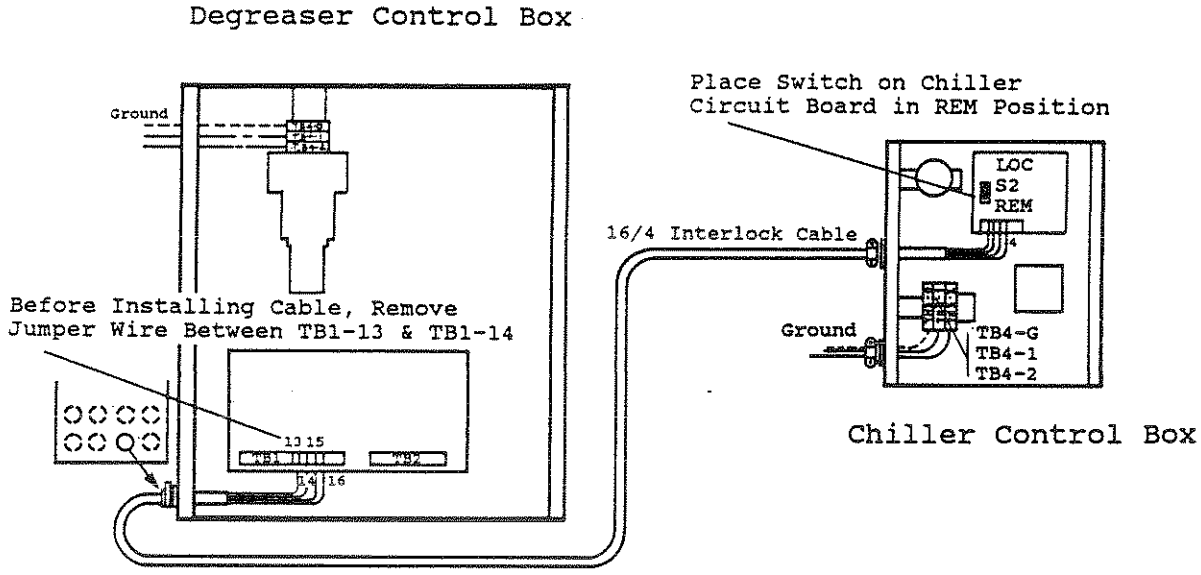
1. Check the line voltages. They must agree with the voltage ratings specified on the degreaser or chiller.

2. Wire the degreaser and chiller into the power supplies. (Figure 5-1)

3. Connect the chiller control cable (Figure 5-2)

Exhaust Air Connections

Connect an air duct to the optional Lip Vent Exhaust. Refer to Figure 5-1 for duct sizes.



INTERLOCK CABLE CONNECTIONS		
COLOR	DEGREASER	CHILLER
Red	TB1-13	TB1-3
Green	TB1-14	TB1-4
White	TB1-15	TB1-2
Black	TB1-16	TB1-1

TB1-13,14: COOLING INTERLOCK
TB1-15,16: CHILLER ENABLE

Figure 5-2: Chiller and Degreaser Installation Wiring

Solvent Setup

Six items in the degreaser are solvent dependent:

- temperature controller solvent group setting
- ultrasonic sump temperature setting
- spray safety thermostat ratings
- recirculation system gasket selection
- desiccation/water separation
- brass/stainless plumbing type selection

The temperature controller has been factory calibrated and should not require any adjustments. However, if you wish to use a solvent other than that specified at the time of purchase, the temperature controller must be reset. The spray safety thermostat or the recirculation gaskets also may have to be changed.

To make a solvent change, contact your Branson representative or Branson Ultrasonics Corporation.

Always wear eye protection, gloves and protective clothing when handling solvent.

To set up the degreaser for solvent (Figure 5-3):

1. Set the COOLING, HEAT, RECIRC, U/S and AUX switches to OFF.

2. Close all drain valves.

3. Open the recirculation inlet valve.

4. Loosen the air vent screw located on top of the filter cartridge.

CAUTION: Failure to loosen the air vent screw will result in premature pump failure and will void the pump warranty.

5. Check the solvent warning label on the back of the control box to determine the solvent specified at the time the degreaser was purchased. If it is not the same contact your Branson representative or Branson Ultrasonics Corporation.

6. Slowly pour the solvent into the ultrasonic tank until it is half full.

7. Set RECIRC to ON.

A mixture of air and solvent will seep out of the air vent, followed by a steady flow of solvent. Allow the solvent to discharge for approximately five seconds, then tighten the air vent screw securely.

8. Set RECIRC to OFF (button out).

9. Add more solvent if necessary.

The solvent should fill the ultrasonic tank and overflow into the boiling sump. There should be approximately eight inches (20 cm) of solvent above the heating coils.

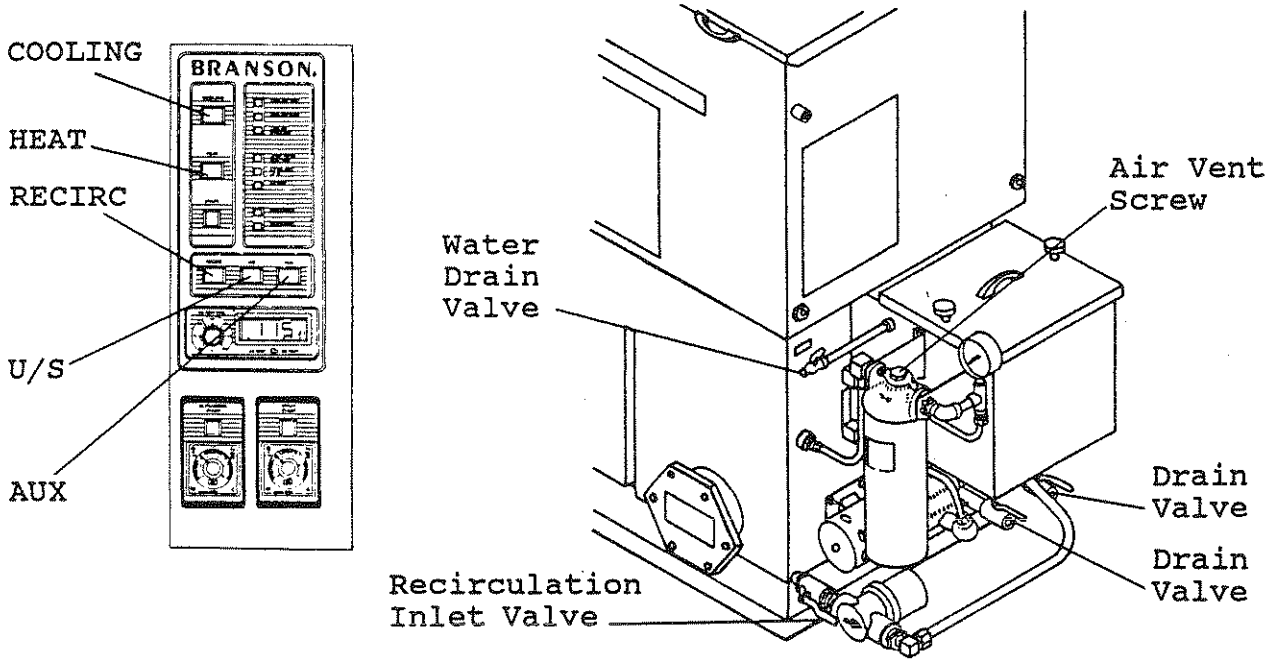


Figure 5-3: Solvent Setup

Initial Start-up Inspection

Before starting the degreaser, the operator should do an initial start-up inspection as follows:

1. Check the system for leaks.

Solvent leaks are very difficult to locate as the solvent evaporates upon exposure to air. A very small leak can result in significant solvent losses.

2. If the solvent requires desiccant:

a. Remove the separator/desiccator cover and place a desiccant bag in the separator/dessicator chamber.

b. Refer to the specification tables in section 4 for the approximate amount of desiccant required.

c. Fill the bag with desiccant to 1/4 inch below the top of the weir.

d. Replace the cover.

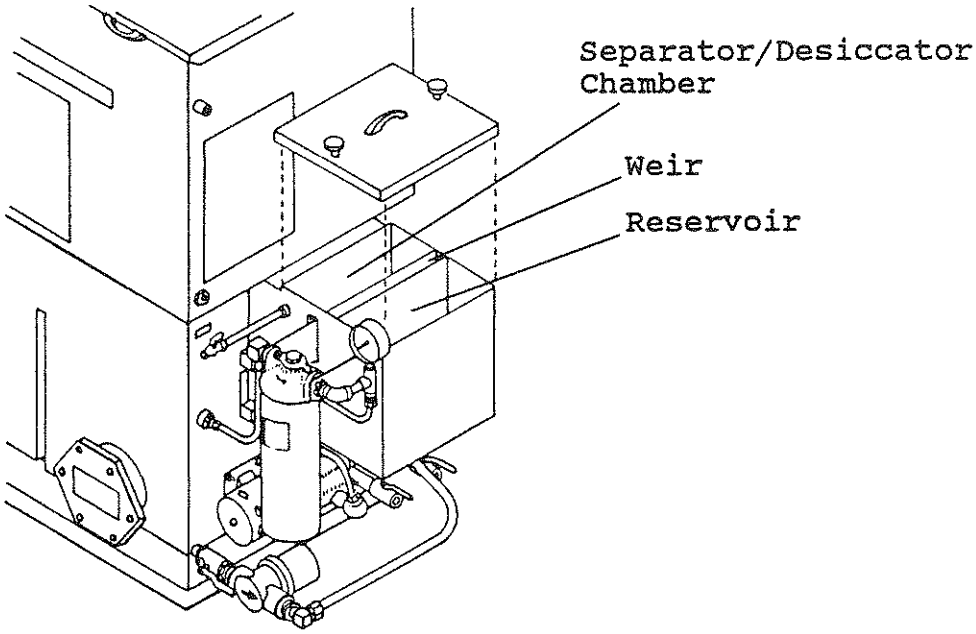


Figure 5-4: The Separator/Desiccator

3. Start-up the degreaser using the START-UP PROCEDURE in this section.

4. As the separator/desiccator and reservoir fill with distillate, the liquid level in the boiling sump will decrease. Remove the separator cover so that the reservoir level can be seen. When the reservoir is full, replace the separator cover, turn off the degreaser and allow the vapors to collapse. Slowly add solvent to the ultrasonic sump so that it overflows to fill the boiling sump to the proper level.

Locating the Controls and Indicators

The control panel (Figure 5-5) located on the left side of the degreaser, contains all the operator controls except the footswitch which is used on spray options. All controls are low voltage for operator safety.

COOLING Switch and Pilot Light	Energizes the chiller (optional), lip vent exhaust (optional), and the degreaser safety devices. COOLING lights when the three cooling indicators COOLANT TEMP, COOLANT FLOW, COOLING INTERLOCK have been satisfied.
COOLANT TEMP Indicator	Lights when the temperature of the coolant leaving the condensing coil reaches 85°F. Resets when temperature drops to 70°F.
COOLANT FLOW Indicator	Lights when the coolant flow leaving the condensing coil is less than .5 gallons per minute.
COOLANT INTERLOCK Indicator	Active only on units with the optional Branson chiller. Indicates when the chiller malfunctions or when it is disconnected from power.
HEAT Switch and Pilot Light	Becomes active when COOLING starts. used in conjunction with START to energize heaters, ultrasonics and spray circuits. Lights when heat is on. UPPER VAPOR ZONE TEMP, B/S SOLVENT LEVEL, B/S TEMP must be satisfied in addition to the COOLING indicators before PRESS START lights.
UPPER VAPOR ZONE TEMP Indicator	Lights when the temperature when the temperature above the condensing coil exceeds 95° indicating that there is a failure in the vapor control mechanisms.
B/S SOLVENT LEVEL Indicator	Lights when the solvent level in the boiling sump falls below the safe point, indicating that solvent must be added.
B/S TEMP Indicator	Lights when the temperature of the solvent in the boiling sump exceeds a preset value. Indicates that the solvent in the boiling sump is contaminated and should be replaced.
START Switch and Pilot Light	Starts the degreaser once all the safeties have been satisfied and all indicators except PRESS START and VAPOR LEVEL are off.

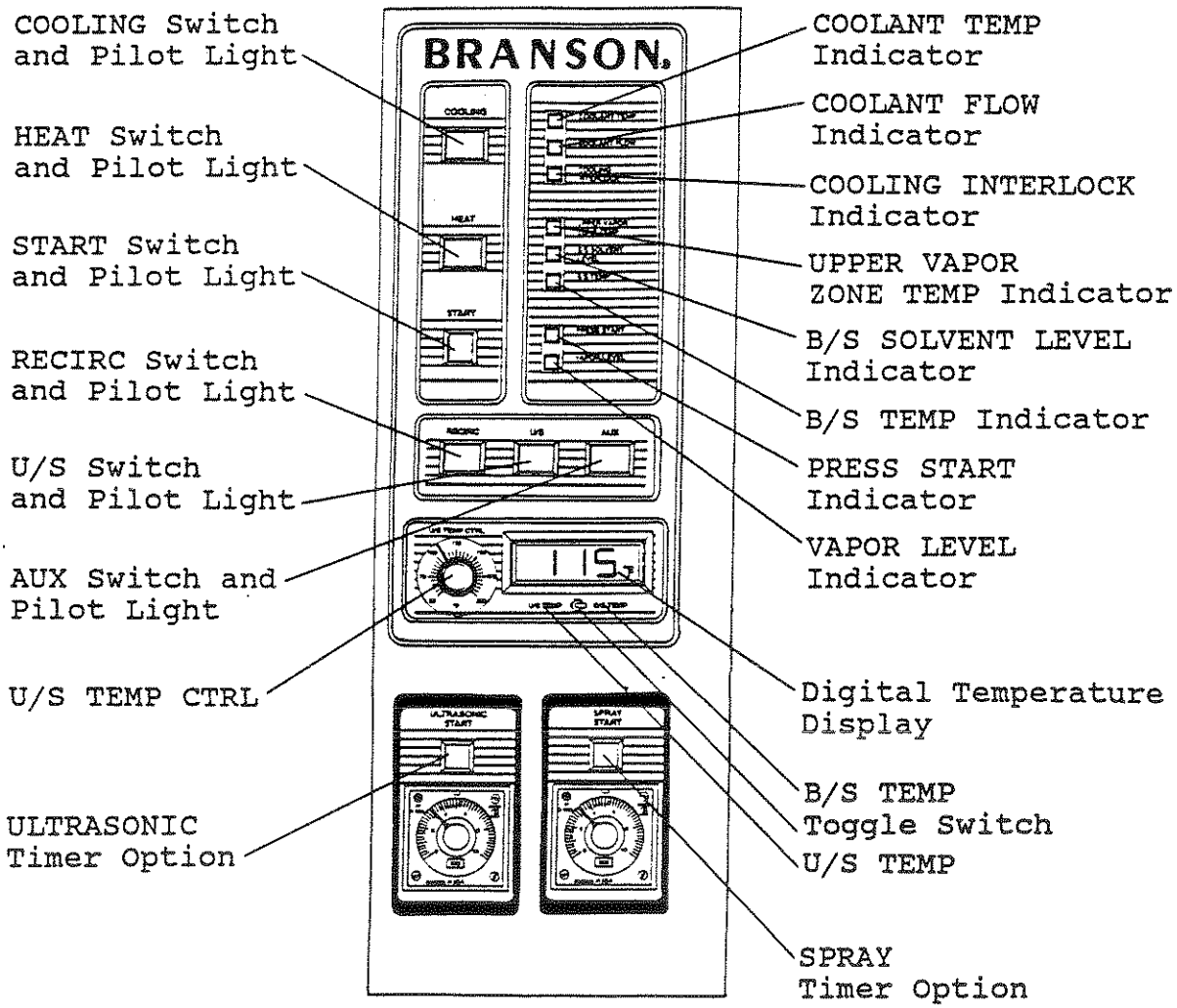


Figure 5-5: The Control Panel

RECIRC Switch and Pilot Light	Energizes the recirculation pump. May be operated when all other controls are off for overnight sump cleanup. Lights when the recirculation system is on. (Standard on the BSD, optional on the BLD.)
U/S Switch and Pilot Light	Engergizes the ultrasonics. Operates only when HEAT is on. U/S lights when ultrasonics are operating, whether controlled by the switch, timer or TDR interconnect option. (Used on BSD only.)
AUX Switch and Pilot Light	Provides 208/230 volt, 5 amp, 1/3 hp fused power for customer specified requirements. Lights when function is operating, whether controlled by the switch, timer or TDR interconnect option.
U/S TEMP CTRL	Sets the temperature of the immersion/ ultrasonic sump. (Standard on the BSD and part of the recirculation option on the BLD.)
Digital Temperature Display	Indicates the temperature of the boiling sump and the immersion/ultrasonic sump in degrees Fahrenheit or Centigrade. (Optional on all units.)
U/S TEMP - B/S TEMP Toggle Switch	Switch toggles the digital temperature indicator between the ultrasonic sump and the boiling sump. Switch lever points in the direction of the active sump. (Part of the digital readout option.)
ULTRASONIC Timer Option	Operates the ultrasonics for a specified period of time.
ULTRASONIC START Switch	Starts the ultrasonic timed cycle. The ultrasonics start when the switch is pressed. Timing begins when the switch is released. The ultrasonics stop when the timer times out. The timer resets automatically. Operates in parallel with the U/S switch so that if either is on, the ultrasonics operate.
SPRAY Timer Option, SPRAY START Switch	Operates the spray manifolds or hand spray for a specified period of time. It is connected in parallel with the foot switch.

PRESS START Indicator	Lights to indicate that all the above safeties have been satisfied and the heaters are not operating. Signals that the degreaser may be started by pressing START. PRESS START light is off when heaters are on.
VAPOR LEVEL Indicator	Lights when the vapors are below the condensing coil. Indicates that the sprays are inhibited and that the degreaser is not ready to process work.
FOOT SWITCH	Controls the optional hand spray option or the optional spray manifold option. The pump operates when the switch is pressed.

OPERATION

General Cleaning Process

Since many different types of parts or configurations of parts exist, it is recommended that a Branson sales engineer be contacted prior to equipment start up to assist in planning the cleaning cycle for maximum safety, economy and cleaning efficiency.

The most common cleaning sequence is as follows:

. immersion in a boiling sump or spraying over a boiling sump
. immersion in a rinse sump
. final vapor rinse

Branson BLD Degreasers (Figure 5-6) offer the option of a manifold spray and timed on/off cycle for semi-automated processes. In addition, the Branson BSD Degreaser offers the advantage of (optional timed) ultrasonics in the immersion sump for a precision cleaning, and substantial time savings not obtainable by conventional vapor degreasing.

Branson also offers its TDR Series Automated Transport System which optimizes the cleaning process. It can be programmed to maximize process control and repeatability. In addition, by reducing operator variability, entrance and exit speeds as well as vapor zone residence times are standardized, controlling the biggest source of needless emissions.

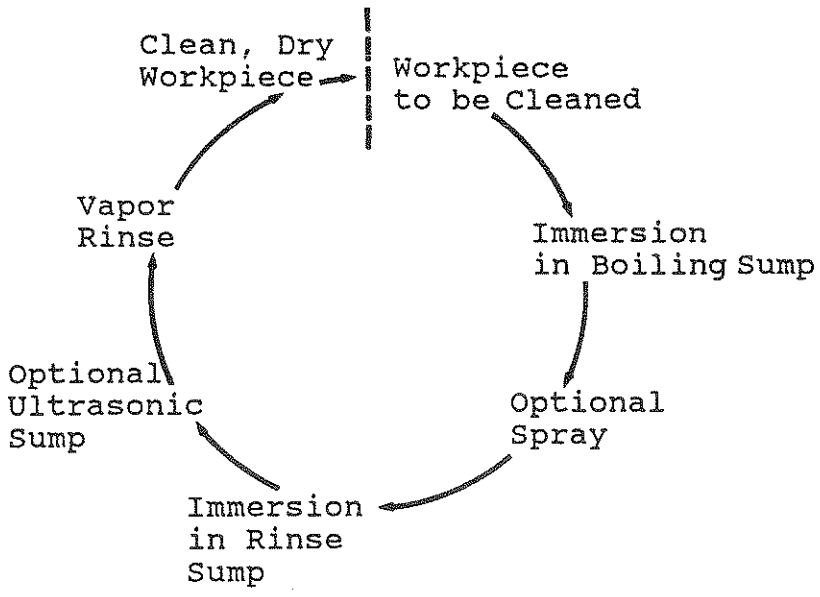


Figure 5-6: The Cleaning Cycle

General Operating Recommendations

CHECK THE SOLVENT LEVEL PERIODICALLY. The solvent level should be two inches below the weir in the boiling sump and the immersion/ultrasonic sump should be completely full. If additional solvent is required, add the solvent to the immersion/ ultrasonic sump, not the boiling sump.

ONCE A DAY, DRAIN THE WATER OUT OF THE SEPARATOR/DESICCATOR If the degreaser is used on a continuous basis, drain more frequently.

CHECK THE FILTER PERIODICALLY. Change as required. During initial operation, check the filter cartridge on a daily basis until a schedule can be established.

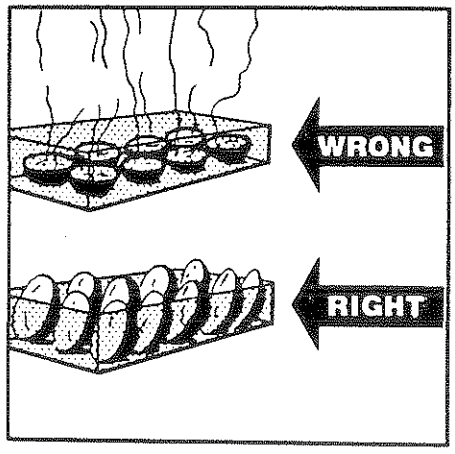
On the BSD and BLD (with recirculation option) Degreaser Series, a pressure gauge is provided on the inlet side of the filter. Record the pressure at initial startup and then monitor and record the pressure and filter cartridge condition daily.

A daily record kept over a period of time can be used to monitor the filter without the inconvenience of opening the filter assembly to check the cartridge while the degreaser is in operation.

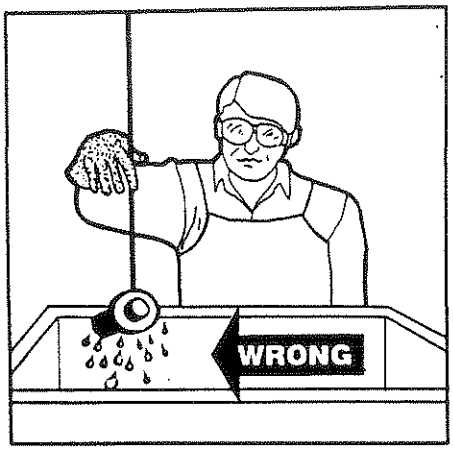
THE RECOMMENDED MAXIMUM VERTICAL RATE OF ENTRY AND EXIT OF WORK IS 11 FEET PER MINUTE. Higher rates will disrupt the vapor zone and cause high solvent losses and unnecessary contamination of atmosphere.

DO NOT OVERLOAD THE DEGREASER. Two smaller loads can be cleaned more effectively in less than the time required to clean one large load.

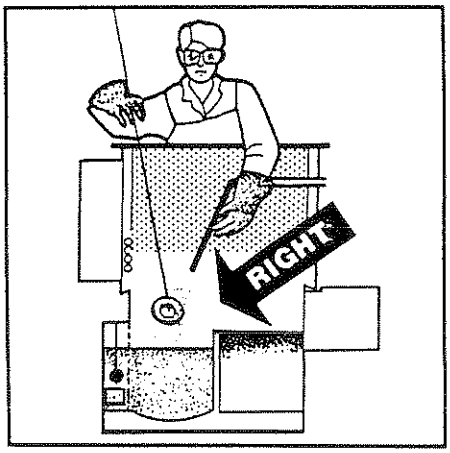
POSITION THE WORKPIECES PROPERLY. Workpieces to be cleaned, whether in baskets or suspended by racks or hooks, must be positioned to permit adequate draining. Retention of solvent in pockets, recesses or blind holes will result in excessive solvent dragout, sharply increased process costs and contamination of atmosphere.



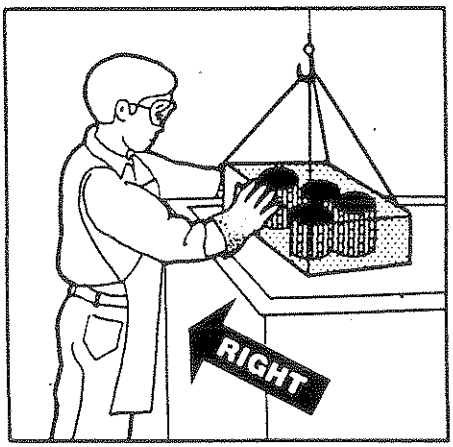
THE WORK LOAD SHOULD STAY IN THE VAPOR ZONE UNTIL CONDENSATION STOPS. Work withdrawn too soon will come out wet with solvent, which escapes into the workroom air, contaminates the atmosphere and causes solvent losses.



AVOID UNNECESSARY SPRAYING. Spraying with the hand spray or manifold spray (optional accessories) should be in the vapor zone. Keep the spray nozzle below the vapor level. This prevents the vapor from being forced out of the degreaser and into the workroom air.



AVOID LEANING OVER AN OPEN DEGREASER, and breathing rising solvent vapors unnecessarily.



Pre-Operation Procedure

1. Check for signs of leakage and obvious damage.

2. Close the drain valves. The handles should be perpendicular to the valve body.

3. Check the solvent level. Add additional (correct) solvent if needed.

4. If solvent is dirty, replace the solvent in the boiling sump.

5. Open the recirculation valve. The handle should be parallel to the the valve body.

Start-up Procedure

If, during the start-up procedure, safety indicators and switches other than those noted below light, a problem is indicated. (See Section 7 - Troubleshooting Guides.)

1. Press COOLING.

COOLING will light, and the chiller and the lip vent (optional) will start.

If COOLING does not light, check the safety indicators.

If the COOLANT TEMP light is on, this indicates that the chiller is still bringing the coolant temperature down. Wait (about 2 minutes) for the COOLANT TEMP light to turn off.

If the unit does not have a chiller:

Turn on and adjust the water flow rate (specified for water at 60°F). Consult your Branson Representative if your water is warmer.

Degreaser Series 1216 - 1.5 gpm
Degreaser Series 1620 - 3 gpm
Degreaser Series 2024 - 6 gpm

2. Press HEAT.

PRESS START will light. If the degreaser is cold, VAPOR LEVEL also will light indicating that the vapors are below the condensing coil and that the degreaser is not ready to process work. This is normal. Continue start-up procedures.

3. Press START.

The PRESS START light will turn off and the HEAT light will come on.

4. Press RECIRC to start the recirculation pump.

5. Wait. Before work can be processed, the vapor zone must be established and the ultrasonic sump must come up to operating temperature. The VAPOR LEVEL light will turn off when the degreaser is ready to be used.

6. If the degreaser is equipped with the digital readout option, the ultrasonic sump temperature or the boiling sump temperature may be monitored by switching the display toggle switch to U/S TEMP or B/S TEMP.

7. Press U/S to energize the ultrasonics. The ultrasonics only work when HEAT is on.

If the solvent is fresh or has not been used for some time, it must be degassed. Some of the ultrasonic energy fed into the ultrasonic tank when the ultrasonic generator is first energized is consumed in expelling air from the solvent (degassing).

The bubbles formed during this degassing period act as an energy sink which may adsorb energy from the sound field. This means that solvent that has not been used for some time must be allowed to degas before full ultrasonic cleaning efficiency is realized. When working with solvent remember that:

- the sump should be brought to operating temperature before degassing.

- initially, cavitation will be intense. This intensity will decrease within ten seconds and will reappear only after the degassing phase has completed. Degassing will normally take about 15 minutes.

Operating Procedure

1. Place the workpieces to be cleaned in a basket or carrier.

Parts to be cleaned whether in baskets or suspended by racks or hooks, must be positioned to permit adequate draining. Blind holes and pockets should be oriented horizontally so that they fill with solvent for proper cleaning and yet drain adequately. Retention of solvent in pockets, recesses or blind holes will result in excessive solvent dragout, sharply increased process costs and contamination of atmosphere.

2. Lower the basket into the vapor zone above the boiling sump and hold it there until the condensation stops.

3. The workpieces may be immersed in the boiling sump for more vigorous cleaning.

4. Keeping the basket within the vapor zone, transfer it to the immersion/ultrasonic sump.

5. Make sure that the workpieces to be cleaned are fully immersed. If using a BSD degreaser, turn on the ultrasonics for a more vigorous cleaning which will remove caked-on greases, sludge and particulates. As the cleaning process takes place, slowly agitate the workpieces up and down to allow trapped air to escape and provide for more consistent soil removal.

6. If the spray option is being used, the parts may be sprayed after initial vapor cleaning, after immersion in the boiling sump or after ultrasonic/immersion cleaning.

7. Slowly lift the basket into the vapor zone and hold it in place until the condensation stops.

8. Slowly lift the basket into the freeboard area and drain any solvent left in the workpieces (i.e. cup-shaped parts) back into the boiling sump.

9. Slowly lift the basket out of the degreaser.

The workpieces will be clean and dry.

Shutdown Procedure

1. Replace the cover.

2. Turn off U/S and RECIRC.

3. Turn off HEAT.

Wait. Allow COOLING to remain on until the vapor zone has collapsed. This minimizes chances of vapors escaping from the machine.

4. Turn off COOLING.

If it is necessary to re-energize a degreaser equipped with a chiller, wait at least two minutes before turning COOLING back on. Ignoring this caution may cause fuse failure.

Turn off water supply on units without chillers.

5. Drain water from water separator. Close petcock.

Daily Preventive Maintenance

Daily preventive maintenance by the degreaser operator consists of those inspections and tasks which should be performed routinely while operating the equipment - or at least on a daily basis. They require only basic hand tools.

Inspections

Before starting the degreaser:

1. Remove degreaser cover.

2. Check for signs of leakage or damage.

3. Close all the drains.

4. Check the solvent level.

5. Open the recirculation valve.

While operating the degreaser:

1. Monitor sights, sounds and smells which signal equipment malfunctions.

2. Monitor recirculation pressure gauge to determine filter replacement requirements.

3. Monitor solvent level in the boiling sump.

After completing the operation:

1. Replace the degreaser cover.

2. Turn off all switches.

3. Turn off cooling water supply.

4. Drain water from separator/desiccator and check desiccant.

Adding Solvent

- *Before adding solvent, shut off the heat and allow the vapors to collapse to prevent vapors from being forced out of the degreaser.*

- Add solvent whenever B/S SOLVENT LEVEL lights or when the boiling sump level is obviously low. Always add solvent to the ultrasonic sump and allow it to overflow into the boiling sump.

- Be certain that the solvent which is added is the same as the solvent already in the degreaser.

- The solvent should come to two inches below the weir.

- Add solvent before starting the degreaser to minimize the disruption of work flow.

Separator/Desiccator

The water which accumulates in the separator chamber should be drained at least once a day. Open the petcock and drain the water into a suitable container. The water can be disposed of down any drain.

If desiccant is being used, check to see if it needs changing. It requires changing if any of the following conditions are observed:

- The desiccant level is below 1/4 inch from the top of the weir. (Add enough desiccant to bring level to 1/4 inch below weir.)

- Free water can be seen standing in the separator/desiccator chamber.

- The vapors in the degreaser have become cloudy, indicating that water has entered the degreaser.

- Workpieces have water spots.

Recirculation System

Daily preventive maintenance of the recirculation system consists of the following:

Monitoring the filter pressure:

The degreaser operator must monitor pressure readings to establish a clean filter base line for reference. When the pressure rises significantly (3-5 psi) above this reading, the filter should be replaced. A visible drop in flow rate will determine the absolute maximum allowable pressure.

Observing the flow rate:

Reduced turbulence on the ultrasonic sump surface is caused by a low recirculation flow rate, indicating that the filter needs to be replaced.

Cleaning the pump strainer:

Clean the strainer daily (more often if required by workpieces being processed). Large chips and debris are trapped by the strainer when the warm solvent, drawn from the sump through the recirculation system inlet, is pumped through it.

MAINTENANCE

Periodic Inspection and Maintenance

The periodic inspection and maintenance tasks which follow are to be performed in addition to the operator procedures outlined in Section 5.

Monthly:

Every month (or more frequently if required by the workload):

1. Drain the degreaser.
2. Clean the pump strainer.
3. Change the filter cartridge.
4. Clean the boiling and ultrasonic sumps.
5. Oil the recirculation and hand spray pump motors.

Recirculation System Maintenance

Since centrifugal pumps do not create any suction, it is important for solvent to be free flowing and always present in the line. The pumps used in Branson equipment must not be allowed to run dry. If the impeller becomes jammed, disassemble the pump. Remove the obstruction, and then reassemble the pump.

Monthly routine oiling of the recirculation and hand spray pump motors is required. A few drops of oil should be applied to the oil port located at each end of the motor.

Cleaning the Strainer

Check the strainer (Figure 6-1) at least once a day (more frequently if required by the workload). Ignoring this precaution will void the pump warranty.

To clean the strainer:

1. Turn recirculation inlet valve to OFF.
2. Place catch pan under strainer.

Approximately one pint of solvent will drain when the strainer is opened.

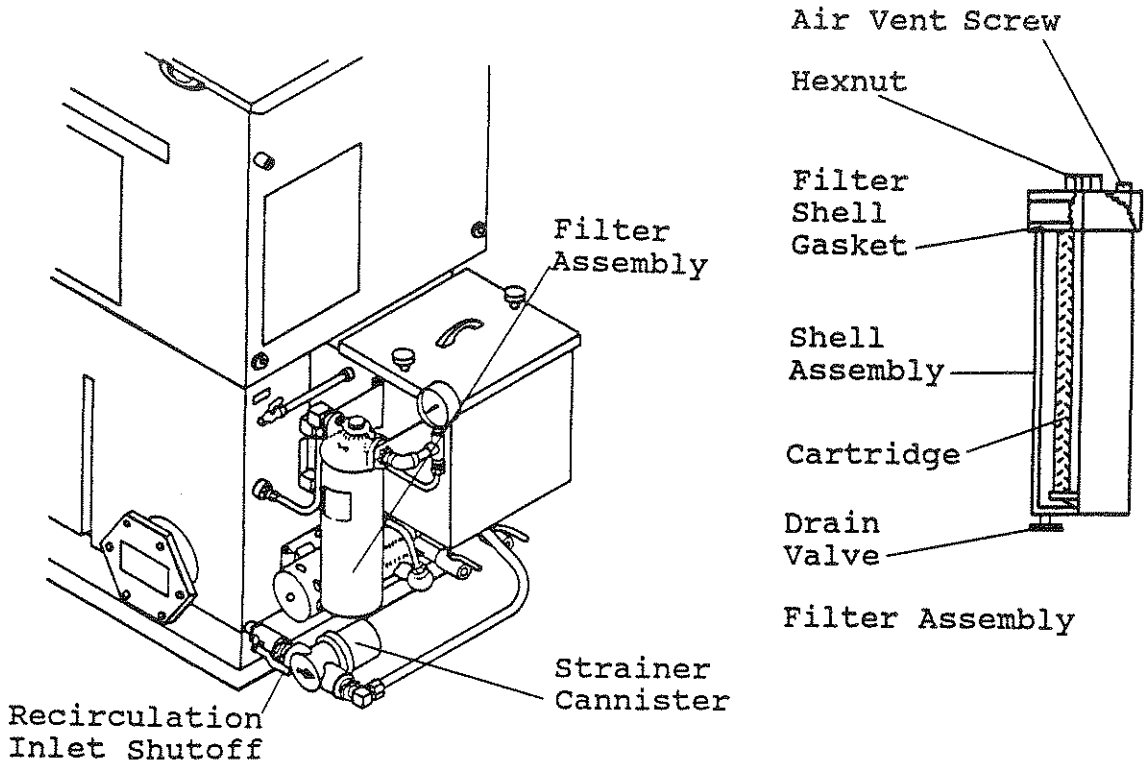


Figure 6-1: The Recirculation System and Filter Assembly

3. Unscrew strainer cannister.

4. Clean strainer screen.

5. Reassemble the strainer making sure the gasket is in place. DO NOT OVERTIGHTEN.

6. Filter the solvent caught in the catch pan and return it to degreaser.

7. Turn recirculation inlet valve to ON.

8. Bleed the recirculation system.

Bleeding the Recirculation System:

1. Fill the sumps with solvent.

2. Loosen the air vent screw located on the top of the filter cartridge.

3. Set RECIRC to ON.

A mixture of air and solvent will seep out of the air vent followed by a steady flow of solvent. Allow the solvent to be discharged for approximately five seconds.

4. Tighten the air vent screw.

5. Turn RECIRC to OFF.

Replacing the Filter Cartridge

The filter cartridge (Figure 6-1) must be replaced whenever it becomes contaminated or clogged. There is no absolute time limit when the filter cartridge is considered contaminated.

The operator must monitor pressure readings to establish a clean filter base line. When pressure rises significantly (3-5 psi) above this reading, the filter must be replaced.

To replace the filter cartridge:

1. Turn the recirculation inlet valve to OFF.

2. Place a clean metallic container under the filter.

3. Open the bottom drain and allow housing to drain.

4. Remove the cap nut. Tap shell lightly to remove from cover.

5. Remove and discard the spent cartridge.

6. Clean the inside of the filter shell and install a new cartridge.

7. Check the filter shell gasket and replace if worn or torn.

8. Fit the top edge of the shell into the groove, seating the body edge against the gasket. Tighten the cap nut.

9. Close the bottom drain and slowly open the inlet valve to resume normal operations and tighten the vent screw.

Caution: Do not reassemble filter by spinning body cannister. This may lead to damage of the shell gasket causing leakage. TIGHTEN CAP NUT ONLY.

10. Turn the recirculation inlet valve to ON.

11. Bleed the recirculation system. (See Bleeding the Recirculation System.)

12. Pour the solvent collected in the container back into the boiling sump.

Separator/Desiccator Maintenance

Operating as a Water Separator:

No maintenance (other than draining the water daily) is required when the separator/desiccator is operated only as a water separator.

Operating as a Desiccator:

The function of the Desiccator is to extract water from solvents containing non-fluorocarbon components (See Solvent List).

When these solvents are used in the degreaser, the gravity water separator should not be used. Non-fluorocarbon components mix with the water as it separates and change the chemical composition of the solvent.

A bag filled with desiccant placed in the separator/desiccator chamber selectively adsorbs the water while letting the solvent pass through to the spray reservoir. The desiccant is capable of adsorbing 14% of its weight in water.

To determine the amount of water present in the solvent, use the following test procedure:

1. Remove a 100 ml solvent sample from the spray reservoir and place it in a stoppered bottle.

2. Add one teaspoon of Tel-Tale Indicating Silica Gel to the solvent sample and stopper tightly.

3. Shake the bottle for one minute and then set it aside for thirty minutes.

4. Change the desiccant if the gel shows a pink tinge.

Sampling Frequency

It is recommended that this test procedure be performed twice every working shift until a base line is established. For example:

> After testing the desiccant two times per shift and changing the desiccant three times, it can be determined that the SHORTEST desiccant life is four days and the LONGEST desiccant life is six days.
>
> Revise your testing schedule. Test on the third day and then daily until the desiccant is in need of changing.

If free water can be observed in the separator/desiccator chamber, then the desiccant should be changed regardless of the test results. The desiccator has been designed with a safety factor to insure dry solvent even though the desiccator has reached effective capacity.

Factors Affecting Rate of Desiccant Exhaustion

1. Ambient humidity
2. Moisture introduced on work load
3. Temperature of condensing coil

Regenerating Exhausted Desiccant:

1. Drain the separating chamber.
2. Remove the bag containing the desiccant.

It can be immediately replaced with fresh desiccant and the degreaser can be restarted.

3. Allow the solvent to drip from the molecular sieve (desiccant).

The molecular sieve (desiccant) must be allowed to thoroughly dry at room temperature. Spread out a layer of desiccant no more than one inch deep in a flat container and allow the Freon and methanol to evaporate overnight.

Never put the desiccant into the oven until the Freon and methanol have evaporated completely. Freon and methanol can become corrosive and explosive when exposed to high temperatures.

4. Remove water by baking for about four hours in an atmospheric oven at 400^{o}

Filling the Desiccator:

1. Place the desiccator bag into the separator/desiccator chamber.

2. Slowly add desiccant until the chamber is filled to 1/4 inch below the weir separating it from the reservoir.

No liquid should be visible in the separator/desiccator chamber except around the solvent inlet. (See Section 4-Specifications, for amount of desiccant required.)

3. Fold the top of the bag over the desiccant and replace the cover.

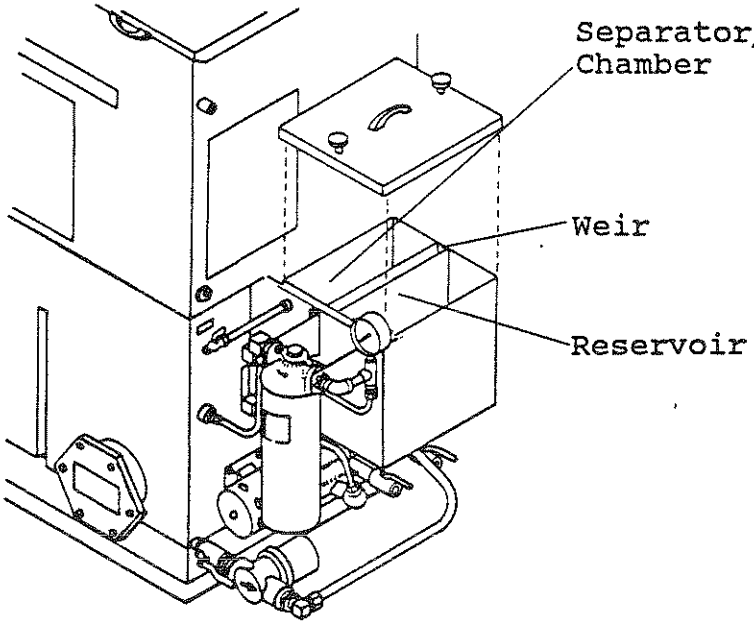


Figure 6-2: The Separator/Desiccator

Cleanout Recommendations and Cautions

Always consult the manufacturer of the solvent being used for contamination information, safe distillation practices and proper storage procedures.

DO NOT BOIL SOLVENT BEYOND THE CONCENTRATION OF CONTAMINATION AT WHICH THE MIXTURE COULD BECOME FLAMMABLE. Consult the manufacturer for safe contamination limits.

Solvent vapors can cause serious personal injury or death by asphyxiation.

- *BEFORE cleaning the equipment, thoroughly ventilate the degreaser with a fan, compressed air or a blower exhausting outside the building.*

- *Persons entering the equipment MUST wear a harness and lifeline, and approved respiratory protection (self-contained breathing apparatus or hose/mask operating from a remote source of breathing air).*

- *A second person must be present at all times.*

ELECTRICALLY "LOCK OUT" THE POWER SUPPLY BEFORE CLEANING THE UNIT AND PLACE AN "OUT OF SERVICE" SIGN ON THE UNIT.

Cleanout Frequency

The importance of degreasing equipment cleanliness cannot be stressed enough since it is essential for the safety of the operator, the economy of operation and the effectiveness of the process.

The frequency of cleaning is determined by the volume of work being processed and the type and amount of soil being removed. At a minimum, degreasers should be boiled down and drained when the contamination level reaches about 25%. When the contamination is oil, this can be determined by the boiling point of the solvent/oil mixture.

Each contaminent affects the boiling point of degreasing solvents differently, also, the maximum allowable percent of a particular contaminant in the solvent and the associated rise in boiling point can vary significantly. Check with the solvent manufacturer for information on the effects of a particular contaminant and at what percent concentration the solvent mixture becomes flammable.

SOLVENT	APPROXIMATE BOILING POINT OF SOLVENT/OIL MIXTURE WITH 25% OIL CONTAMINATION
Methylene Chloride	110°F
1, 1, 1 Trichloroethane	175°F
Trichloroethylene	195°F
Trichlorotrifluoroethane	125°F

Cleanout Procedure

It is recommended that the solvent manufacturer be consulted to determine the best method of checking the solvent acidity. The solvent should then be checked routinely since contaminants are sometimes acidic and solvents can break down under certain conditions and become acidic.

Cleaning the Degreaser:

1. Check the solvent acidity following the instructions provided by the solvent manufacturer.

3. Drain and transfer solvent in the rinse sump to a storage tanks.

4. Set the ultrasonic sump temperature to its minimum setting.

5. Set the degreaser to ON and boil the solvent in the boiling sump. Do not transfer this dirty solvent to the storage tank.

6. Drain the solvent which accumulates in the rinse sump.

7. Turn the degreaser to OFF when the solvent in the boiling sump is 1/2" above the heaters (if the safeties have not already turned the degreaser off).

8. Drain and transfer the spray reservoir solvent to a storage tank.

9. Drain the separator/desiccator and boiling sump residues into a transfer pan or container.

10. Dispose of the contaminated solvent following the manufacturer's instructions and in accordance with federal, state and local regulations.

11. Place a catch pan under the cleanout door to catch the small amount of solvent which will be trapped in the bezel .

12. Turn your face away from the cleanout door opening, and remove the cleanout cover.

Follow the cleanout recommendations and cautions. SOLVENT VAPORS CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

13. Remove all the dirt, sludge and metal chips from the sumps through the cleanout doors, without entering the degreaser.

Most contaminents may be removed by brushing with a stiff brush and rinsing with solvent. Hardened or caked-on sludge may have to be scraped with a paint scraper or similar tool. Do not damage corrosion-resistant finishes.

Do not use a carbon steel wire brush on stainless steel tanks or plumbing components. If rags or other adsorbent materials are used, be sure to dispose of them properly.

14. Remove and clean the heaters if they are coated with contamination. To do so:

    . Disconnect the degreaser from the power source.

    . Loosen the strain relief screws on the heater cables.

    . Remove the nuts from the heater cover and slide it up the heater cables.

    . Mark the cables so that they can be reinstalled in the same locations.

    Before removing the heaters, note the location of each one. The heaters must be reinstalled in the same places from which they were removed.

    The length of the heater is an indication of its wattage. The fuse sizes in the control box are matched to the heaters. Changing the heater arrangement can cause fuses to blow and can upset the electrical balance of the system.

    . Remove the wires from the heaters.

    . Remove the nuts from the heaters.

    . Pull the heaters out through the cleanout door.

15. Brush out the condensate trough and check to make such that there are no obstructions to stop condensate flow.

16. Brush condensing coils, walls and tank bottoms to remove all accumulated residue and scale.

17. Carefully clean the liquid level control and boiling sump temperature sensor probe.

18. Clean the separator/desiccator.

19. Follow acid degreaser cleanout procedures if the solvent tested positive for acid.

20. Clean the strainer and replace the filter cartridge.

21. Reinstall all the components.

22. Close the drain valves and refill with solvent.

23. Reset the ultrasonic sump temperature control if it was changed while draining the sumps.

24. Check for leaks.

25. Restart the degreaser (See Startup Procedure), making sure to bleed the recirculation system.

Acid Cleanout Procedure

A degreaser that has gone acid, can be neutralized and repassivated. Complete removal of all solid residue from the degreaser and all associated plumbing and equipment is vital to avoiding recurrance of the acid condition.

All exposed surfaces of the degreaser pipes, fittings, valves, separator/desiccator, still and storage tanks must be neutralized, with special attention being taken on corners and weld seams. To do so:

1. Using a medium stiff bristle brush, scrub the degreaser using a 5% baking soda and water solution (approximately 1/2 lb. per gallon).

2. Rinse the system (including plumbing and associated equipment) thoroughly with water to flush out all residue.

3. Scrub the unit (especially corners and weld seams) with STA-CLEAN* or with a solution of one part OAKITE 33* to six parts water.

4. Flush the solution through all the pipes, fittings, valves and separator/desiccator.

5. Neutralize all treated surfaces using a 5% baking soda and water solution (approximately 1/2 lb. per gallon) if OAKITE 33 was used in step 3.

6. Rinse the system (including plumbing and associated equipment) thoroughly with water to flush out all residue.

7. Drain all the cavities and dry out the system before adding solvent.

8. Refill the system and resume normal operation.

**STA-CLEAN is a stainless steel cleaner made by Leedal Inc. 2929 S. Halstead Street, Chicago Illinois 60608.*

OAKITE 33 is a product of Oakite Products, 50 Valley Road Berkley Heights, New Jersey 07922.

CAUTION: OAKITE 33 contains an acid. Avoid contact with eyes and skin. Wear appropriate eye protection, gloves and protective clothing.

RECOMMENDED SPARE PARTS LIST

Branson recommends the stocking of spare parts which are consummed in use (desiccant/filters) may be lost or damaged during maintenance (gaskets) or are one-time use safety devices (fuses). Items which are required for changing solvents are also listed.

The life expectancy of all other components is considered to be the same as the degreaser's. Contact your Branson service representative if non-listed parts are required.

CONTROLS

Description	Order Number
Fuse 5A 1/4 x 1-1/4 3AG 230 VAC	000-135-005
Fuse 1A 1/4 x 1-1/4 3AG 230 VAC	000-135-035
Fuse 10A 1/4 x 1-1/4 3AB 230 VAC	000-135-040
Fuse 5A SB 1/4 x 1-1/4 MDA 230 VAC	000-135-057
Fuse 10A 13/32 x 1-1/2 KLK 600 VAC	000-135-106
Fuse 15A 13/32 x 1-1/2 KLK 600 VAC	000-135-108
Fuse 20A 13/32 x 1-1/2 KLK 600 VAC	000-135-110
Fuse 25A 13/32 x 1-1/2 KLK 600 VAC	000-135-112
Thermostat (Spray Safety-Low Boiler)	000-386-025
Thermostat (Spray Safety-High Boiler)	000-386-031

RECIRCULATION SYSTEM

Description	Order Number
Filter Cartridge DCCSC-10	000-138-004
Filter Nut Gasket	000-142-001
Filter Nut Gasket O Ring 119N-219-7	000-142-002
Filter Shell Gasket	000-142-005
Teflon Filter Screw Gasket	000-142-006
Filter Shell Gasket	000-142-007
Filter Drain & Air Vent Screw Gasket	000-142-008
Strainer Gasket 3/4 Viton Green	000-142-030
Strainer Gasket 3/4 Buna N Black	000-142-033

SEPARATOR/DESICCATOR

Description	Order Number
S/D Cover Gasket 1216	000-142-162
S/D Cover Gasket 1620/2024	000-142-164
Desiccant Bag 1216	000-265-500
Desiccant Bag 1620	000-265-502
Desiccant Bag 2024	000-265-504
Desiccator Test Kit	000-870-901
Molecular Sieves Desiccant (5 lbs)	000-950-555

TANK

Description	Order Number
Cleanout Port Gasket O Ring Viton 2-357-V747-75	000-342-140

PLASTIC BUCKET STRAINER GASKETS

Degreasers and Stills ordered for use with Freons® TF, TA or TMS use BUNA N BLACK gaskets in the plastic bucket strainer.

Description	Order Number
Bucket Strainer 3/4" size Buna N Black	100-142-033
Bucket Strainer 1" size Buna N Black	100-142-034

Degreasers and Stills ordered for use with Freons® TMC, TE and TES, III Trichloroethane, Perchorethylene and Methylene Chloride have VITON GREEN gaskets in the plastic bucket strainer.

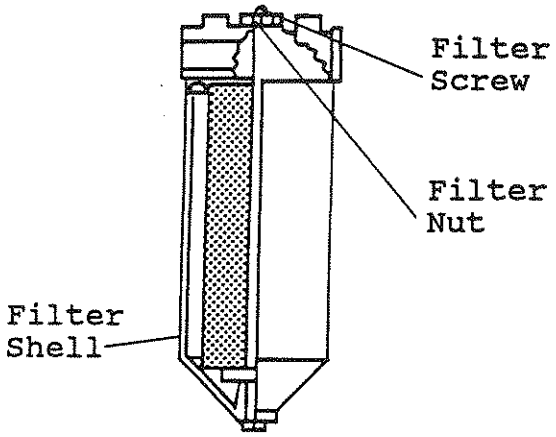
Bucket Strainer 3/4" size Viton Green	100-142-030
Bucket Strain 1" size Viton Green	100-142-031

FILTER/DESICCATOR

Your Degreaser or Still is equipped with one of two types of filter/desiccator. Each type requires different gaskets.

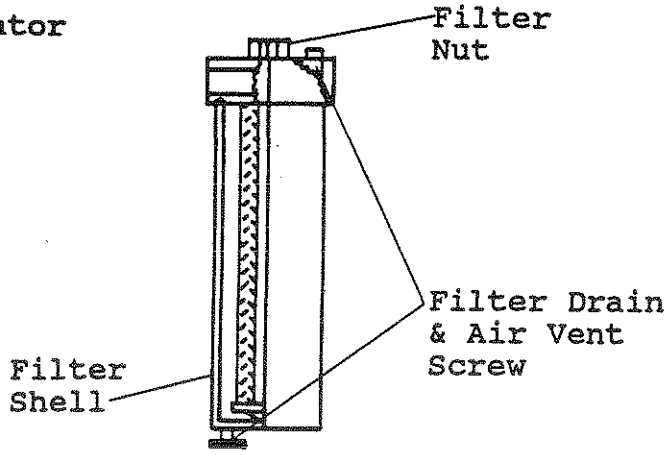
Full-Flow Filter Desiccator

Description	Order Number
Filter Nut	142-001
Filter Shell	142-005
Filter Screw	142-006



Filter Equipment Filter/Desiccator

Description	Order Number
Filter Nut	142-002
Filter Shell	142-007
Filter Drain & Air Vent Screw	142-008



TROUBLESHOOTING GUIDE

The troublshooting guide which follows is intended to assist qualified maintenance personnel to isolate faults in the Branson BSD and BLD Series Degreasers. A basic knowledge of electricity is assumed.

Fault isolation procedures should be performed before calling Branson service personnel for assistance. They insure that the repairman has the correct tools and parts with him to correct the problem.

FAULT ISOLATION AND REPAIR SHOULD ONLY BE ATTEMPTED BY QUALIFIED PERSONNEL. MANY PROCEDURES REQUIRE ACCESS TO LIVE ELECTRICAL CIRCUITS WHERE MISTAKES CAN RESULT IN SEVERE SHOCK OR DEATH.

TROUBLESHOOTING GUIDE - COOLING AND HEAT

STEP	ACTION	RESULT	SOLUTION
1	Press COOLING.	COOLING pilot light is on.	COOLING safeties OK. Go to step 33.
		COOLING pilot light is off.	COOLING problem. See step 2.
2	Check COOLANT FLOW.	COOLANT FLOW indicator off.	COOLANT FLOW OK. Go to step 10.
		COOLANT FLOW indicator on.	COOLANT FLOW PROBLEM. See step 3A.
3A	Check flow direction.	Flow switch at outlet of coil.	Flow direction OK. Go to step 3B.
		Flow switch at inlet of coil.	Switch inlet/outlet hoses to reverse flow.
3B	Does system have chiller?	No.	See step 8.
		Yes.	See step 4.
4	Check chiller power switch.	Power switch is off.	Turn power switch on.
		Power switch is on.	See step 5.
5	Check COOLING INTERLOCK indicator.	COOLING INTERLOCK indicator is off.	Flow switch or coolant circulation problem. See step 6.
		COOLING INTERLOCK indicator is on.	Chiller problem. See step 13.
6	Disconnect chiller. Connect to house water. Adjust water flow to 1 gal/minute. Check COOLANT FLOW indicator.	COOLANT FLOW indicator is off.	Flow switch and circuitry OK. Chiller pump or flow problem. Check pump and hoses.

cont.

STEP	ACTION	RESULT	SOLUTION
6 cont.		COOLANT FLOW indicator is on.	Possible flow switch problem. See step 7.
7	Jumper TB1-17 to TB1-18. Check COOLANT FLOW indicator.	COOLANT FLOW indicator off.	Replace bad flow switch.
		COOLANT FLOW indicator on.	Internal circuitry problem. Call Branson.
8	Check water flow. Should be 1 gal/min minimum.	Less than 1 gal/min.	Customer supply problem.
		More than 1 gal/min.	Possible bad flow switch. See step 9.
9	Jumper TB1-17 to TB1-18. Check COOLANT FLOW indicator.	COOLANT FLOW indicator off.	Replace defective flow switch.
		COOLANT FLOW indicator on.	Internal circuity problem. Call Branson.
10	Check COOLANT INTERLOCK.	COOLANT INTERLOCK is off.	COOLANT INTERLOCK OK. See step 23.
		COOLANT INTERLOCK is on.	See step 11.
11	System has Branson chiller.		See step 12.
	System does not have Branson chiller. TB-13 and TB-14 should be jumpered.	TB-13 and TB-14 are jumpered.	Problem with internal circuitry. Call Branson.
		TB-13 and TB-14 are not jumpered.	Install jumper.
12	Check chiller power switch.	Chiller power switch is off.	Turn power switch on.
		Chiller power switch is on.	See step 13.

TROUBLESHOOTING GUIDE - COOLING AND HEATING

STEP	ACTION	RESULT	SOLUTION
13	Check chiller SYSTEM light.	Chiller SYSTEM light is off.	See step 17.
		Chiller SYSTEM light is on.	See step 14.
14	Check for proper connections between degreaser and chiller:	Not correctly connected.	Install correctly.
		Connections OK.	See step 15.
15	Disconnect wires from degreaser TB1-13 and TB1-14. Jumper TB1-13 to TB1-14.	COOLANT INTERLOCK indicator is on.	Internal degreaser circuitry problem. Call Branson.
		COOLANT INTERLOCK indicator is off.	See step 16.
16	Reconnect cable to to TB1-13 and TB1-14. Disconnect cable from chiller TB1-3 and TB1-4. Connect continuity meter across TB1-3 and TB1-4. Make sure COOLING switch is on and chiller is powered.	Circuit remains open.	Internal chiller circuitry problem. Call Branson.
		Circuit is closed.	Replace defective interconnect cable.
17	Check chiller coolant light.	Chiller coolant light is on.	Check coolant level in reservoir. Fill if low. If coolant level OK, replace liquid level switch in chiller.
		Chiller coolant light is off.	Coolant level OK. See step 18.

STEP	ACTION	RESULT	SOLUTION
18	Check POWER IN at chiller. Should match nameplate voltage.	POWER IN is not same as nameplate voltage.	Customer power supply problem.
		POWER IN is same as nameplate voltage.	See step 19.
19	Check fuses in chiller TB3-1 and TB3-2 (also TB-3 on 3-phase systems).	Fuses are blown.	Replace fuses.
		Fuses OK.	See step 20.
20	Check for proper connections between degreaser and chiller:	Not correctly connected.	Install correctly.
		Connections OK.	See step 21.
21	Switch chiller S2 LOCAL/REM switch to LOCAL.	Chiller system light is off.	Internal circuitry problem. Call Branson.
		Chiller system light is on.	See step 22.
22	Switch chiller S2 to REM. Disconnect cables from degreaser TB1-15 and TB1-16. Connect continuity meter across TB1-15 TB1-16.	Circuit is open.	Internal degreaser circuitry problem. Call Branson.
		Circuit is closed.	Defective interconnect cable. Call Branson.
23	Check COOLANT TEMP indicator.	COOLANT TEMP indicator is off.	COOLANT TEMP OK. See step 30.
		COOLANT TEMP indicator is on.	See step 24.

COLOR	DEGREASER	CHILLER
Red	TB1-13	TB1-3
Green	TB1-14	TB1-4
White	TB1-15	TB1-2
Black	TB1-16	TB1-1

STEP	ACTION	RESULT	SOLUTION
24	Jumper TB1-19 to TB-20.	COOLANT TEMP indicator stays on.	Internal circuitry problem. Call Branson.
		COOLANT TEMP indicator is off.	See step 25.
25	Test cooling safety thermostat. It must meet opening and closing parameters: - remove thermostat from degreaser. - connect ohm-meter across connections. - place thermostat in container of cold water (70°max.). - resistance should be near zero. - thermostat should open at 85°±6°F. - slowly decrease water temperature. - thermostat should close at 70°±6°F.	Does not meet opening and closing parameters.	Replace defective cooling safety thermostat.
		Meets opening and closing parameters.	See step 26.
26	Check coolant temperature at water separator inlet. Temperature must be less than 70°F.	Temperature less than 70°F.	Water flow is too low. If water cooled system, open valve. If chilled system, check pump and circulation flow rate.
		Temperature more than 70°F.	See step 27.

STEP	ACTION	RESULT	SOLUTION
27	Does system have chiller?	No chiller.	Water supply too warm. Purchase Branson chiller.
		Yes	See step 27A.
27A	Check chiller thermostat setting	Setting too high.	Lower setting.
		Setting OK	See step 28.
28	Check ambient air temperature. Chiller requires less than 100°F.	Air temperature too high.	Call Branson.
		Air temperature OK.	See step 29.
29	Check air filter for cleanliness.	Air filter is clogged.	Replace filter.
		Air filter is clean.	Chiller problem. If Branson chiller, call Branson.
30	Check fuses F1, F2, F3 on main relay board.	One or more are blown.	Replace fuse (s).
		Fuses OK.	See step 31.
31	Check all phases of degreaser input power and connections.	One or more phases are zero or low voltage.	Customer power supply problem.
		Voltage OK.	See step 32.
32	Check jumper on main relay board from TB1-21 to TB1-22.	Jumper is missing.	Replace jumper.
		Jumper is OK.	Internal circuitry problem. Call Branson.
33	Press HEAT.	PRESS START indicator is on.	HEAT is OK. See step 44.
		PRESS START indicator is off.	See step 34.

STEP	ACTION	RESULT	SOLUTION
34	Check B/S SOLVENT indicator.	B/S SOLVENT LEVEL indicator is not on.	Solvent level OK. See step 37.
		B/S SOLVENT LEVEL indicator is on.	Check solvent level in B/S. Add solvent if necessary. See step 35.
35	Manually raise float on liquid level indicator.	B/S SOLVENT indicator goes off.	Float or shaft is dirty or leaking. Clean or replace float and shaft as appropriate.
		B/S SOLVENT indicator is on.	See step 36.
36	Jumper main relay board TB1-11 and TB1-12	B/S SOLVENT stays on.	Internal circuitry problem. Call Branson.
		B/S SOLVENT goes off.	Replace liquid level indicator.
37	Check B/S TEMP indicator.	B/S TEMP indicator is on.	See step 38.
		B/S TEMP indicator is off.	B/S TEMP OK. See step 40.
38	Check solvent level.	Solvent level is low.	Add solvent and check liquid level switch for possible malfunction or sticking in UP position.
		Solvent level OK.	See step 39.

STEP	ACTION	RESULT	SOLUTION
39	Check solvent for contamination.	Solvent is contaminated.	Change solvent and attempt to restart degreaser.
		Solvent is clean.	May be incorrect solvent. Check check solvent group switch setting against solvent chart. Call Branson.
	The degreaser temperature controller has been preset at the factory and should not require any adjustments. If a solvent other than the one specified at the time of purchase is to be used, contact your Branson representative or Branson Ultrasonics Corporation prior to changing.		
40	Check UPPER VAPOR ZONE TEMP indicator.	UPPER VAPOR ZONE indicator off.	PRESS START bulb may be dead. If PRESS START turns on, call Branson to replace bulb. If PRESS START does not turn on, call Branson.
		UPPER VAPOR ZONE indicator on.	See step 41.
41	Check if vapors are above top coil of degreaser.	Vapors are below top coil.	False indication of high vapors. See step 42.
		Vapors are above top coil - possibly caused by:	
		Force of spraying may be driving vapors above the coil.	Reduce force of spray. Always spray below vapor line.
		Cooling system failure and defective safeties.	Call Branson.
42	Measure air temperature.	Temperature is less than 95°F.	Defective or improperly adjusted temperature controller or probe.
		Temperature is more than 95°F.	See step 43.

STEP	ACTION	RESULT	SOLUTION
43	Check temperature probe. It should touch condensing coil for good performance.	Probe not making good contact with coil.	Call Branson.
		Probe is making good contact.	Defective or improperly adjusted temperature controller or probe. Call Branson.
44	PRESS START indicator is on. Press START.	HEAT indicator is off.	If boiling starts after a short delay, HEAT indicator bulb is burned out. Replace. If boiling does not start, there is an internal circuitry problem. Call Branson.
		HEAT indicator is on. Boiling starts after short delay.	Heating and cooling are OK.
		HEAT indicator is on. Boiling does not start.	See step 45.
45	Check B/S fuses on TB4.	Fuses are blown.	Replace fuses.
		Fuses OK.	See step 46.
46	Check connections from TB4 to heaters.	Connections defective.	Repair connections.
		Connections OK	See step 47.
47	Check voltage across heater terminals.	No voltage across heater terminals.	Internal control problem. Call Branson.
		Normal voltage across heater terminals.	Replace defective heaters.

TROUBLESHOOTING GUIDE - OPERATIONAL CHECKS

STEP	ACTION	RESULT	SOLUTION
1	During normal operation, the HEAT indicator turns off and PRESS START lights. No other indicator is on. Press START.	HEAT indicator is on.	Momentary power outage. Safety has tripped and reset. Start degreaser. If safety trips again, follow TROUBLE-SHOOTING GUIDE - COOLING AND HEAT.
		HEAT indicator is off.	Internal circuitry problem. Call Branson.

Operate the degreaser (HEAT indicator on) before performing the following operational checks. See TROUBLE-SHOOTING GUIDE - COOLING AND HEAT for non-operational equipment.

2	Check to see if solvent is boiling.	The solvent is not boiling.	See TROUBLESHOOTING GUIDE-COOLING AND HEAT, steps 1-47.
		Solvent is boiling.	See step 3.
3	Check for adequate vapors.	Vapors OK.	Boiling OK. See step 9.
		Vapors inadequate.	See step 4.
4	Check to see if all heaters are working.	All heaters are working.	Heater circuitry OK. See step 8.
		One or more heaters are not working.	See step 5.
5	Check heater fuses.	One or more fuses are blown.	Replace blown fuse.
		Fuses OK.	See step 6.
6	Check connections from TB4 to heaters.	Connections not OK.	Repair connections.
		Connections OK.	See step 7.

STEP	ACTION	RESULT	SOLUTION
7	Check voltage across heater terminals.	No voltage across heater terminals.	Internal control problem. Call Branson.
		Normal voltage across heater terminals.	Replace defective heaters.
8	Circuitry to heaters is OK. Check line voltage against identification plate voltage.	Voltage is different.	Heater ratings are improper for user voltages. Call Branson.
	Voltage and heaters are OK, but vapor losses may be excessive and can be due to one of the following reasons. Check:		
	- if frequent heavy loads are being processed.	Vapor blanket collapses.	Small, lighter loads properly timed, will reduce vapor loss.
	- excessive spraying being done.	Vapor blanket collapses.	Keep spraying to a minimum.
	- if there is excessive recirculation and a cold U/S sump.	Vapors condense on cold solvent surface.	Reduce recirculation flow rate and set U/S thermostat to warmer.
	- if operator is not waiting until the degreaser reachs normal operating conditions.	Vapor blanket not established.	Wait until the degreaser reaches normal operating conditions.
9	Check if vapor level is above condensing coil.	Vapor level high, but heat does not shut off.	Cooling system failure and defective safeties. Call Branson.

STEP	ACTION	RESULT	SOLUTION
10	Solvent losses are excessive. Check:		
	- for leaks (small leaks mean large losses.	Excessive solvent loss.	Repair leaks.
	- for drafts or air currents across top of degreaser.		Prevent drafts.
	- solvent traps caused by improperly designed parts or baskets.		Redesign baskets and reposition parts.
	- inadequate final vapor rinse.		Vapor rinse until condensation stops.
	- for excessive spraying		Avoid prolonged spraying.
	- tank not covered when idling.		Cover tank when not in use.
	- separator/desiccator not covered.		Keep S/D covered.
	- loads being moved too quickly.	Excessive solvent loss.	Move loads slowly.
11	Ultrasonic sump is too cold 30 minutes after startup.	Ultrasonic temperature setting is OK.	See step 12.
	Check if U/S TEMP CTRL knob is set at desired temperture.	Not set at correct temperature.	Reset U/S TEMP CTRL.

TROUBLESHOOTING GUIDE - OPERATIONAL CHECKS

STEP	ACTION	RESULT	SOLUTION
12	Check calibration of U/S TEMP CTRL: - measure actual sump temperature. - remove control box cover and observe DS2 on U/S TEMP CTRL. - turn U/S TEMP CTRL knob until DS2 just turns on. - temperature on knob should be the same as measured sump temperature.	Temperatures are not the same.	Temperature controller or probe is defective or out of calibration. Call Branson.
		Temperatures are the same.	Temperature Controller OK. See step 13.
13	Check heater operation.	Heater operates.	Problem with excessive cooling by recirculation system. Call Branson.
		Heater is not operating.	See step 14.
14	Check U/S heater fuses.	Fuse is blown.	Replace fuse.
		Fuse OK.	See step 15.
15	Check voltage at heater junction box.	Voltage is 200-240 VAC.	Replace defective heater.
		Voltage is 0.	Wiring problem. Call Branson.

STEP	ACTION	RESULT	SOLUTION
16	U/S tank running too hot. Check:	Temperature too high.	
	- if cooling water is too warm.		Call Branson.
	- if recirculation is not being used to remove heat.		Use recirculation system.
	- if ultrasonics are on constantly.		Use ultrasonics intermittently.
17	Check for water in the boiling sump as indicated by cloudy vapors. Check:		
	- for water on parts.	Water in sump.	Remove water from sump: - turn degreaser off. - place bags of desiccant in boiling and U/S sumps. - agitate to adsorb all free water. - remove bag.
	- separator/desiccator not being drained regularly.		
	- exhausted desiccant.		
	- leaking coolant.		
	- dripping pipes or leaking roof.		
	Check condensing coil for operation below dewpoint.	Excessive water condensation.	Increase temperature setting on chiller to above dewpoint if possible.

TROUBLESHOOTING GUIDE - ULTRASONIC CHECK

STEP	ACTION	RESULT	SOLUTION
HEAT indicator must be on before ultrasonics will operate.			
1	Press U/S switch. U/S indicator will not light. May be due to one of the following reasons. Check:		
	- for defective switch.	Switch defective.	Replace switch.
	- for defective light bulb.	Light bulb defective.	Replace light bulb.
	- defective circuit.	Circuit defective.	Call Branson.
2	Ultrasonics will not operate. May be due to one of the following reasons. Check:		
	- if fuses on TB4 are blown.	Fuses blown.	Replace fuses.
	- if U/S generator power cable not connected.	Cable not connected.	Repair connections.
	- if U/S generator control cable not connected.	Cable not connected.	Repair connections.
	- if there is an internal wiring fault.		Call Branson.
	- if there is a generator or transducer fault.		Call Branson.

TROUBLESHOOTING GUIDE - ULTRASONIC CHECK

STEP	ACTION	RESULT	SOLUTION
3	Ultrasonic activity very low. Check:		
	- if degassing incomplete.		Allow 30 minutes for degassing.
	- if U/S temperature improperly set.		Set to recommended temperature.
	- if there is low line voltage.		Add boosting transformer. Call Branson.
	- if there is a generator or transducer fault.		Call Branson.
4	Ultrasonic sump is noisy when operating. Check U/S temperature.		Set to recommended temperature. Keep cover in place when not processing work. Operate U/S only when required.

TROUBLESHOOTING GUIDE - RECIRCULATION SYSTEM

STEP	ACTION	RESULT	SOLUTION
1	Press RECIRC switch. RECIRC does not light. Check:		
	- for power to the degreaser.	No power.	Turn on degreaser. If nothing lights, see TROUBLESHOOTING GUIDE -COOLING AND HEAT, step 1.
	- for defective light bulb.		Replace light bulb.
	- for defective switch.		Replace switch.
	- internal circuitry problem.		Call Branson.
2	Pump does not run. Can be due to one of the following reasons. Check:		
	- for blown F4-F5 fuses.		Replace fuses.
	- for defective connection from pump to TB2-TB7-8.		Repair connection.
	- for defective internal circuitry.		Call Branson.
	- for defective pump.		Replace pump.

TROUBLESHOOTING GUIDE - RECIRCULATION SYSTEM

STEP	ACTION	RESULT	SOLUTION
3	Pump runs but flow is zero or low. Can be due to one of the following reasons. Check:		
	- for closed shutoff valve.		Open shutoff valve.
	- air locking pump.		Place metal catch pan under pump. Loosen wing nuts on pump housing until solvent drains. If solvent will not drain, apply slight strain to pump inlet tube. Tighten wing nuts.
	- for clogged filter.		Due to high pressure on gauge. Replace cartridge.
	- for clogged strainer.		Clean strainer.
	- for air locking filter.		Bleed filter.
	- for low voltage.		Add boosting transformer. Call Branson.

HEAT indicator must be on, VAPOR LEVEL indicator must be off before troubleshooting sprays.

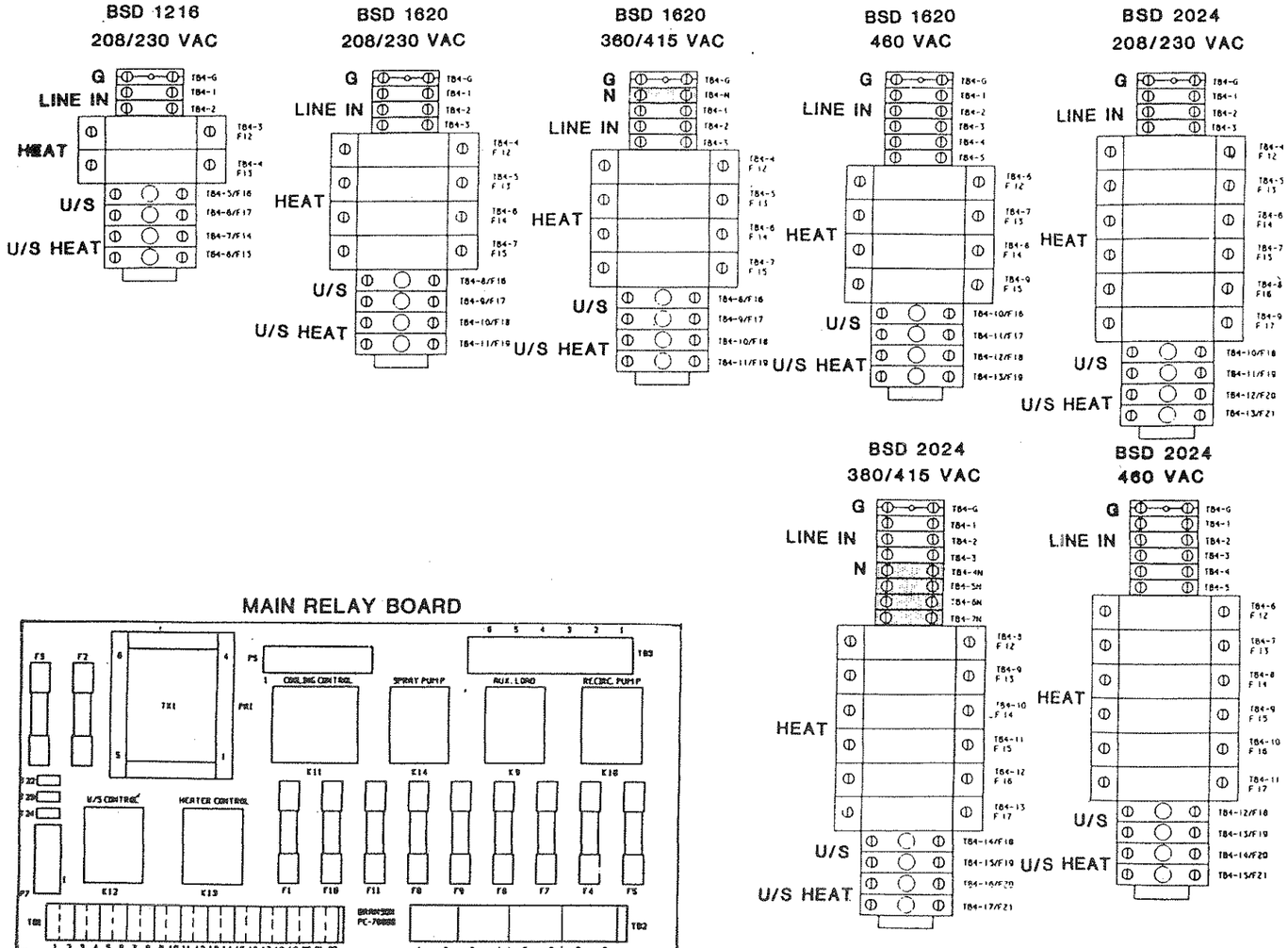
4	VAPOR LEVEL indicator does not go out within 15 minutes. Check:		
	- for defective thermostat.		Replace thermostat.
	- for low vapors.		See TROUBLESHOOTING GUIDE - OPERATIONAL CHECKS.
	- for defective internal circuitry.		Call Branson.

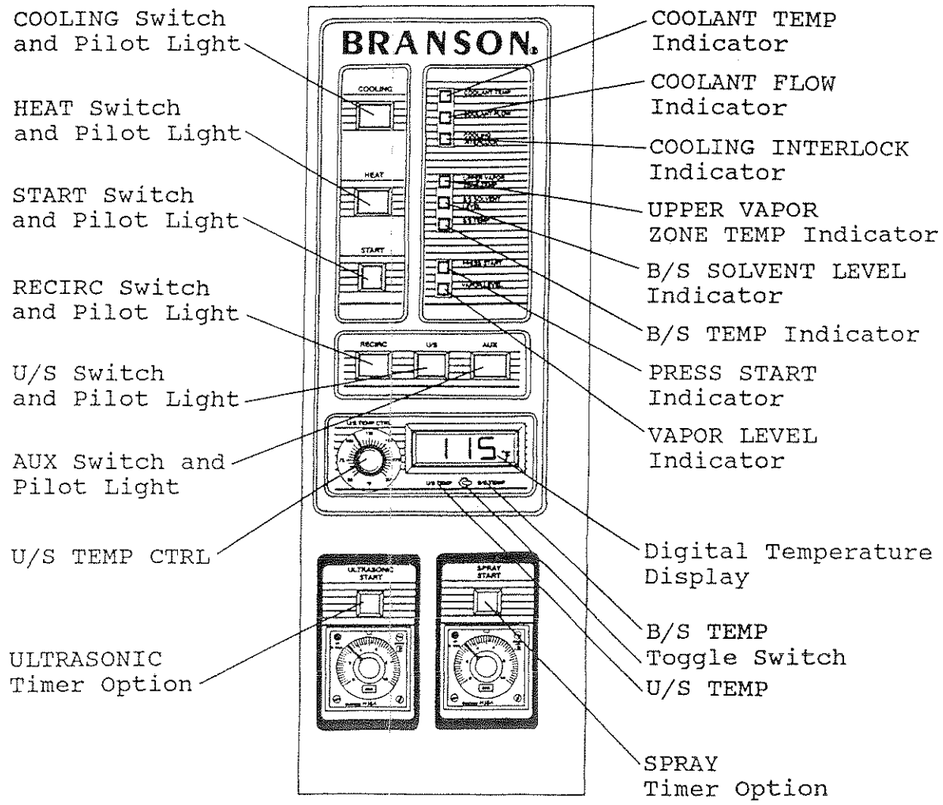
STEP	ACTION	RESULT	SOLUTION
5	Spray pump does not operate. Check:		
	- for blown F8, F9 fuses		Replace fuses.
	- for defective foot switch.		Replace foot switch.
	- for defective pump.		Replace pump.
	- for defective internal circuitry.		Call Branson.
6	Hand spray has low volume. Check:		
	- for clogged nozzle.		Clean nozzle.
	- inadequate distillate in reservoir.		Add distillate.
	- defective pump.		Replace pump.
	- low voltage.		Add boosting transformer. Call Branson.
7	Hand spray has poor spray pattern.	Nozzle is clogged.	Clean nozzle.
8	Spray manifold has low volume. Check for improperly adjusted flow control valve.		Adjust flow control valve.
9	Spray manifold has excessive spray volume or force. Check for improperly adjusted flow control valve.		Adjust flow control valve.

TROUBLESHOOTING GUIDE - RECIRCULATION SYSTEM

STEP	ACTION	RESULT	SOLUTION
10	Spray manifold nozzles not over correct sump.	Nozzles are over wrong area.	Spray manifold not assembled properly. Reassemble.
11	Spray manifold nozzles are not giving good coverage.		Spray manifold is not aimed in proper direction. Reset nozzles.

BSD CONTROL BOX CONNECTIONS

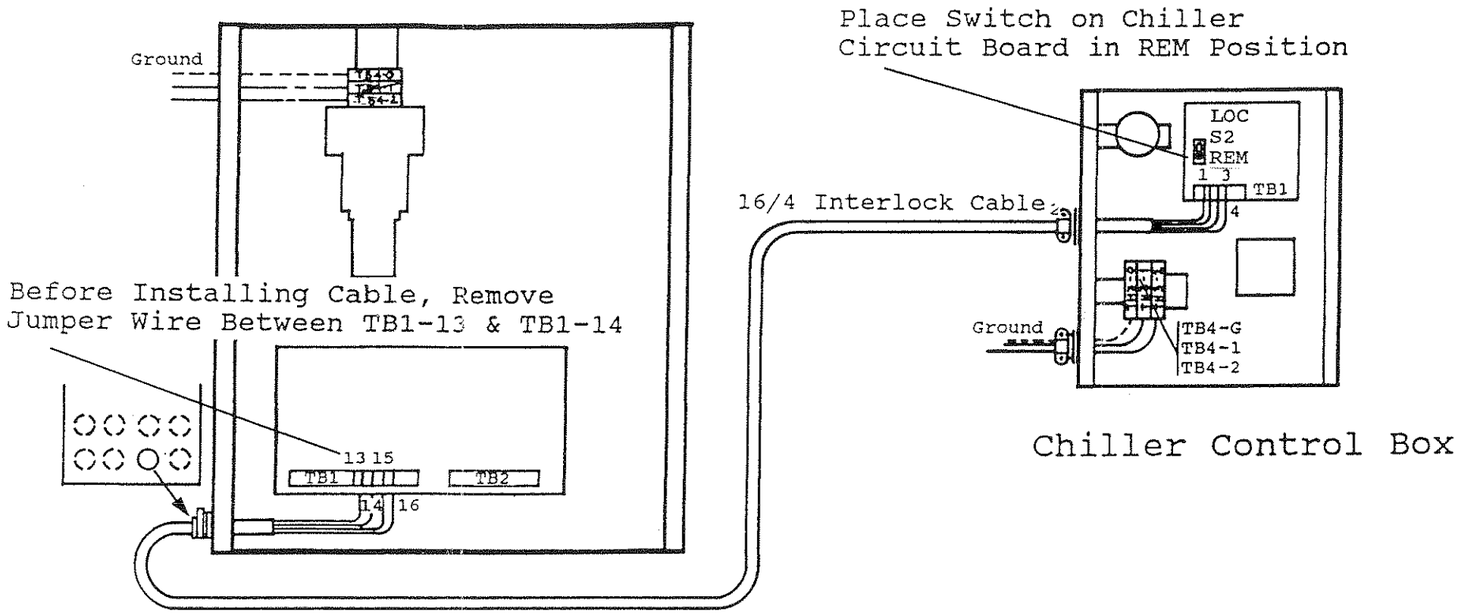




The Control Panel

Figure 7-1
Control Panel
Main Relay Board
BSD Control Box Connections

Degreaser Control Box



Chiller Control Box

INTERLOCK CABLE CONNECTIONS		
COLOR	DEGREASER	CHILLER
Red	TB1-13	TB1-3
Green	TB1-14	TB1-4
White	TB1-15	TB1-2
Black	TB1-16	TB1-1

TB1-13,14: COOLING INTERLOCK
TB1-15,16: CHILLER ENABLE

Figure 7-2
Installation Wiring
for Degreaser Unit

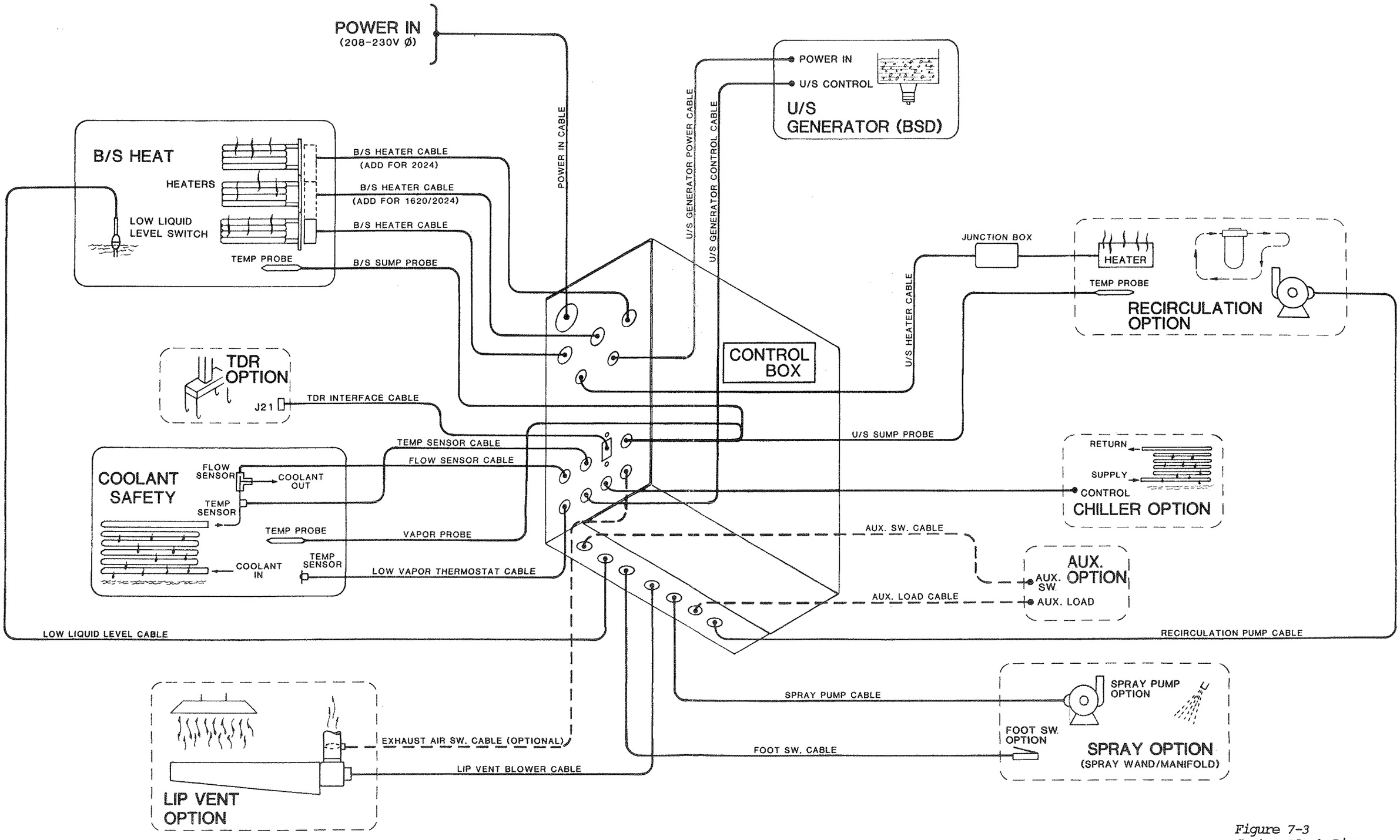
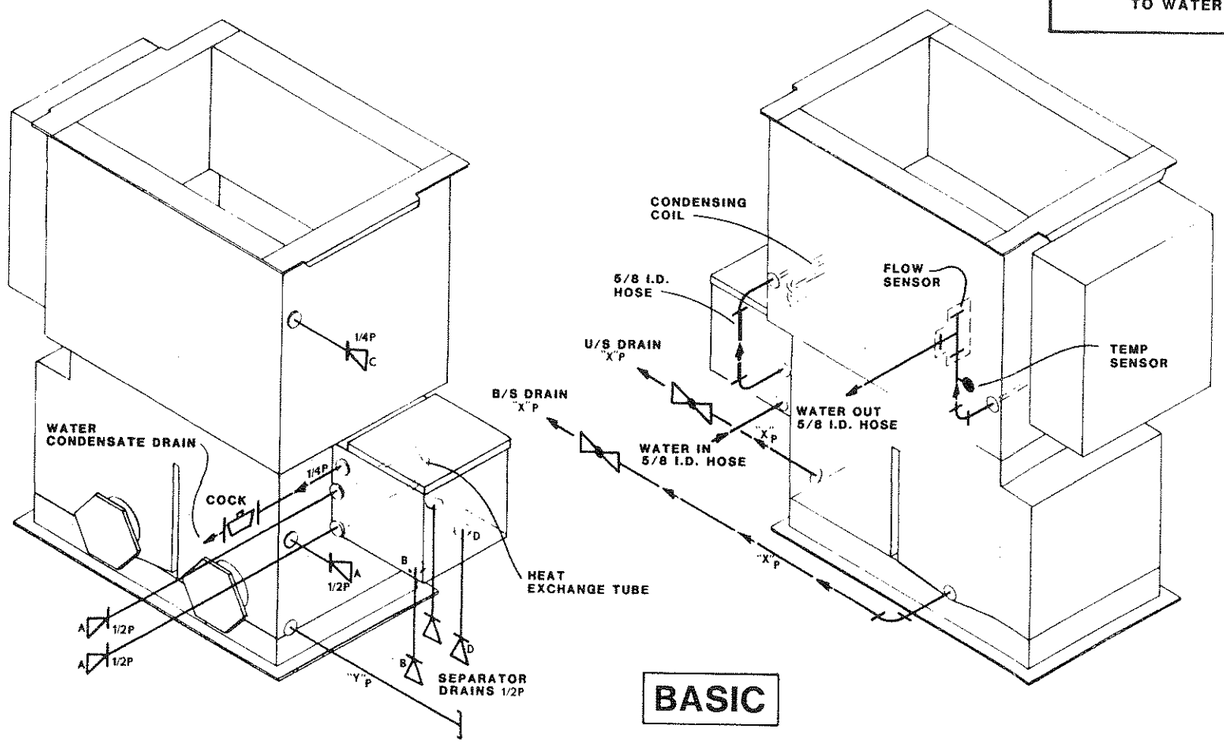


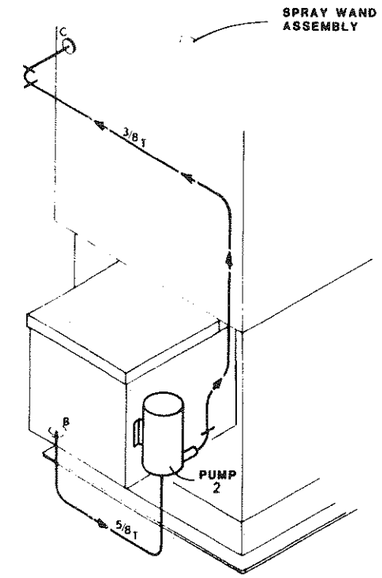
Figure 7-3
System Block Diagram

NOTES:

1) TO CONNECT STILL TO DEGREASER, DELETE PLUG -B- OR -D- AND CONNECT STILL(OUTLET), CONNECT STILL(INLET) TO B/S DRAIN OF DEGREASER.
2) TO CONNECT CHILLER TO DEGREASER, CONNECT CHILLER(SUPPLY) TO WATER IN AND CHILLER(RETURN) TO WATER OUT OF DEGREASER.

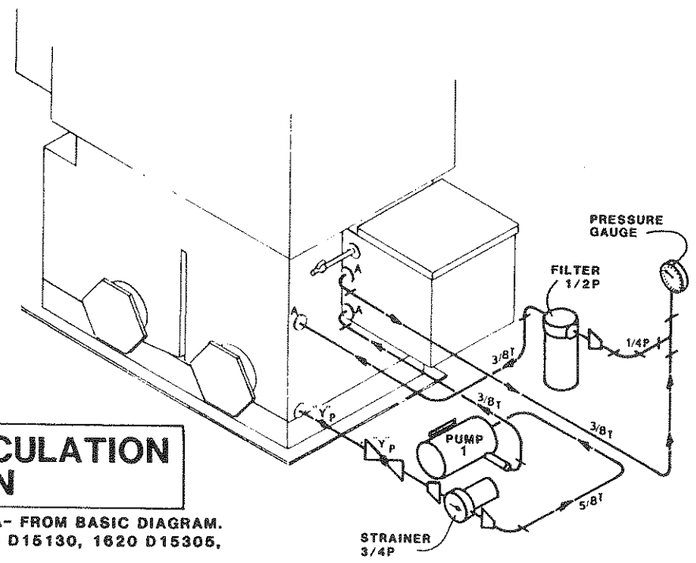


BASIC



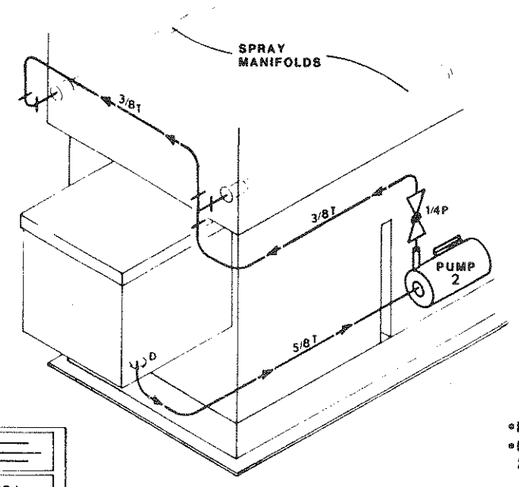
SPRAY WAND OPTION

- DELETE PLUGS -B- & -C- FROM BASIC DIAGRAM.
- REF. DRWS. 1216 D15126, 1620 D15308, 2024 D15408.



RECIRCULATION OPTION

- DELETE PLUGS -A- FROM BASIC DIAGRAM.
- REF. DRWS. 1216 D15130, 1620 D15305, 2024 D15405.



SPRAY MANIFOLD OPTION

- DELETE PLUG -D- FROM BASIC DIAGRAM.
- REF. DRWS. 1216 D15141, 1620 D15307, 2024 D15407.

PIPE LEGEND

SYM	1216	1620	2024
"X"	1/2 - P	3/4 - P	1 - P
"Y"	1/2 - P	3/4 - P	3/4 - P

Figure 7-4
Plumbing Diagram

TROUBLESHOOTING GUIDE - TIMER

Before troubleshooting the Timer option, be sure that basic functions are operating properly using the standard controls:

Set the timer as follows:
- Set MODE SELECTOR to D.
- Set UNITS INDICATOR to SEC.
- Set RANGE SELECTOR to 0-10.
- Set TIME CONTROL to 5 (approx.).
- When troubleshooting, turn off basic function control.
- Turn on degreaser.
- Low Vapor Indicator must be off for spray timer checks.

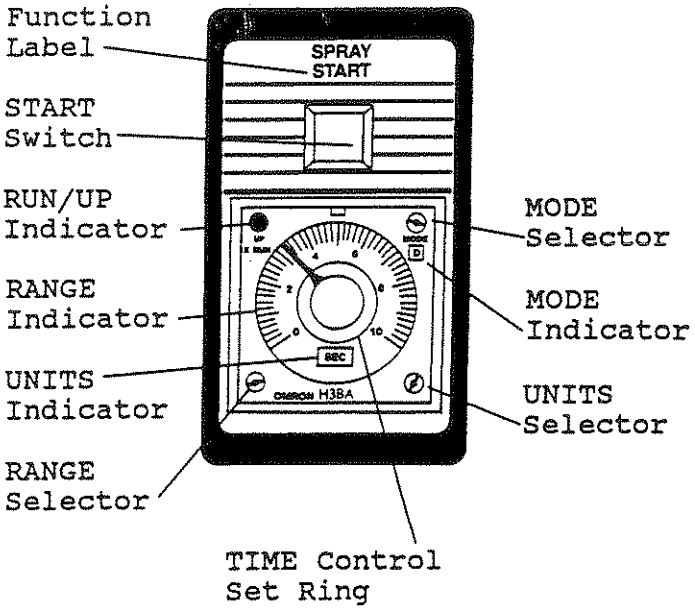


Figure 7-5: Timer

STEP	FAULT	REASON	SOLUTION
1	RUN-UP indicator does not flash. Function does not operate.	Defective connections.	Repair connections.
		Defective timer.	Replace timer.
		Defective START switch.	Replace start switch.
	Wrong function operates.	Improper Connection.	Connect to proper socket on control panel circuit board.

TROUBLESHOOTING GUIDE - DIGITAL READOUT

Degreaser must operate normally before troubleshooting digital readout option.

STEP	ACTION	RESULT	SOLUTION
1	Digital Readout does not work. Check:		Replace unit.
	- for defective meter connections.		Replace connections.
	- for defective indicator.		Replace indicator.
2	Indicator does not show desired Fahrenheit or Centigrade reading.		Move switch on back of indicator to other position.
3	Temperature displayed not accurate.		Needs calibration. Call Branson.
4	Indicates B/S temperature when U/S temperature is selected.		Turn selector switch over and reinstall.

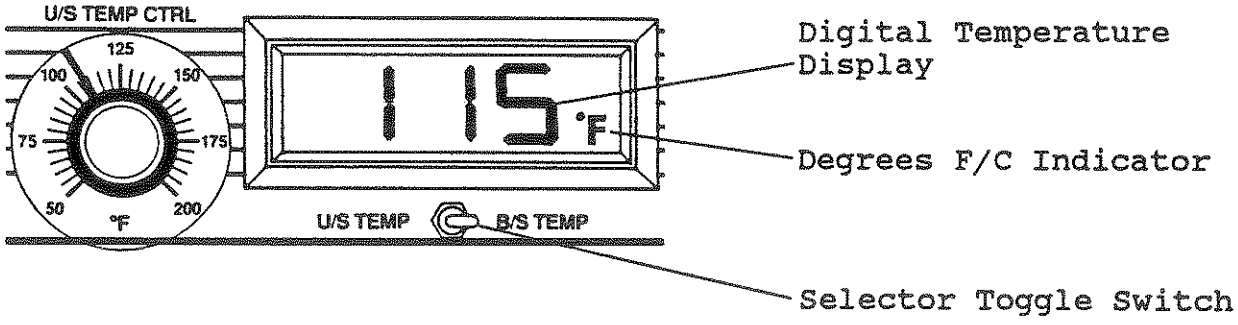


Figure 7-6: Digital Readout

RETURN OF EQUIPMENT - DOT REGULATIONS

Under Federal Regulations, Department of Transportation 49CFR, parts 100 to 177, and the OSHA RIGHT TO KNOW section of the CHEMICAL HAZARD COMMUNICATION (29 CFR 1910, 1200) OSHA 3084, certain requirements must be met before returning equipment that uses hazardous chemicals. Chemicals which are listed in one of the following sources are to be considered hazardous in all cases:

- 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA)
- Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment, American Conference of Governmental Industrial Hygienists (ACGIH)

In addition, chemicals which have been evaluated and found to be a suspected or confirmed carcinogen by the following sources are to be reported as such to:

- National Toxicology Program (NTP), Annual Report on Carcinogens
- International Agency for Research on Cancer (IARC), and Monographs
- 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances, Occupational and Health Administration (OSHA)

The following steps must be taken before returning the equipment:

1. Completely drain the equipment (including the plumbing) of all solvents or solutions and remove all residue.
2. List the solvents or solutions used, plus the contaminents found in the unit and include material safety data sheets (MSDS) for each one.

Both the carrier and Branson Ultrasonics Corporation have the right to refuse to accept delivery of the equipment unless these steps are taken.

AUTHORIZED BRANSON SERVICE CENTERS

CALIFORNIA
Branson Ultrasonics Corporation
12955 East Perez Place
City of Industry, CA 91746
(818) 369-3938

CALIFORNIA
Branson Ultrasonics Corporation
780 Trimble Road, Suite 405
San Jose, CA 95131
(408) 946-7933, 946-7944

CANADA
Branson Canada
705 Progress Avenue, Unit 27
Scarborough, Ontario, Canada
(416) 431-4411
Telex 06525402

CONNECTICUT
Branson Ultrasonics Corporation
Eagle Road
Danbury, CT 06810-1961
(203) 796-0400
Parts (203) 796-0492
Service (203) 796-0575
Telex 643102

FLORIDA
Paragon Electronics
11075 N.E. 6th Avenue
Miami, FL 33161

GEORGIA
Branson Ultrasonics Corporation
6090 McDonough Road
Norcross, GA 30093
(404) 448-9377

ILLINOIS
Branson Ultrasonics Corporation
541 West Golf Road
Arlington Heights, IL 60005
(312) 981-0178

JAPAN
Branson Ultrasonics Corporation
Takeshiba Building, Suzuegumi-WH
1-15-8 Kaigan
Minato-Ku Tokyo 105 Japan
(011) 81-3-434-1421
Telex 781-2424070

MASSACHUSETTS
Branson Ultrasonics Corporation
59 Commerce Way
Woburn, MA 01801
(617) 938-8172

NETHERLANDS
Branson Europa B.V.
Energieweg 2
P.O. Box 9
Soest, Netherlands
(011) 31-21-551-5551
Telex 844-43086

PENNSYLVANIA
Branson Ultrasonics Corporation
501 Office Center Drive, Suite 10
Fort Washington, PA 19034
(215) 628-4559

SOUTH CAROLINA
Sound Services
3111 Port Clear Drive
Fort Mill, SC 29715

TEXAS
Alpha Omega Electronics Corp.
2821 National Drive
Garland, TX 75041
(214) 271-5569

BRANSON ULTRASONICS CORPORATION GUARANTEE

When used in accordance with written instructions and under normal operating conditions BRANSON manufactured productrs are guaranteed to be free from defects in material and workmanship for one (1) year from the invoice date. Any unit which proves defective during the stated period will be repaired or replaced, at the sole discretion of BRANSON, f.o.b. Danbury, Connecticut, provided the defective part is returned properly packed with all freight charges prepaid to the BRANSON factory located at Eagle Road, Danbury, Connecticut or to a designated repair center.

BRANSON'S liability, whether based on warranty, negligence or other cause, arising out of and/or incident to the sale, use or operation of the equipment, or any part thereof, shall not in any case exceed the cost of repair or replacement of the defective equipment and such repair or replacement shall be the exclusive remedy of purchaser and in no case shall BRANSON be responsible for any and/or all incidental or consequential damages including consequential damages arising out of commercial loss.

This guarantee shall not apply to:

- Complete assemblies such as pumps and refrigeration units purchased from other manufacturers and incorporated into BRANSON products. In case of failure of these assemblies, BRANSON will honor the specific guarantee terms of the individual manufacturer involved.

- Cavitation erosion of tank and transducer surfaces which is a normal occurrence and develops over time in the operation of ultrasonic cleaning equipment.

- Equipment subjected to misuse, improper installation, alteration, neglect or accident.

This guarantee is limited to the original purchaser and is not transferrable.

No warranties expressed or implied have been made other than those stated herein. *BRANSON HEREBY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.*

LIST OF REPAIR AND MAINTENANCE MANUALS