

HESS MACHINES

OZONE GENERATORS

INSTALLATION & OPERATIONS MANUAL



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Hess Machine International is a division of Ozone Solutions Inc.



THANK YOU

For the purchase of a Hess Machine International ozone disinfection unit. This booklet contains instructions pertaining to the installation of your generator and ozone injection tank. Proper installation is the first step in achieving overall satisfaction and long-life of your unit.

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IMPORTANT SAFETY INSTRUCTIONS, READ AND FOLLOW ALL INSTRUCTIONS.

Read this manual completely before attempting installation.

SAVE THESE INSTRUCTIONS.

SECTION 1: SPECIFICATION SHEETS

OZONE GENERATOR

	H-50	L-100	L-200	L-200	L-300	L-400
GENERATOR						
Injection Tank	T-150	T-150	T-150	T-300	T-300	T-300
System Number	HT-50	LT-100	LT-150	LT-200	LT-300	LT-400
FLOW RATES						
Gallons per Minute	30	60	90	120	180	240
Gallons per Hour	1800	3600	5400	7200	10800	14400
Gallons per 8 Hours	14400	28800	43200	57600	86400	115200
Gallons per 24 Hours	43200	86400	129600	172800	259500	345600
Liters per Minute	114	557	341	454	681	908
Liters per Hour	6813	13626	20439	27252	40878	54504
Liters per 8 Hours	54504	109008	163512	218016	327024	436032
Liters per 24 Hours	163512	327024	490536	654048	981072	1308096
YIELD						
Ozone Yield (lb/day)	0.5	1.0	2.0	2.0	3.0	4.0
Ozone Yield (g/hour)	9.5	19.0	38.0	38.0	57.0	76.0
DIMENSIONS (INCHES)						
Generator Width	16	28	30	30	31	31
Generator Length	37	60	68	68	61	61
Generator Height	45	44.5	48	48	45	45
Generator Weight (lbs)	210	260	365	365	535	705
Shipping Width	24	32	40	40	42	42
Shipping Length	42	70	72	72	72	72
Shipping Height	50	48	54	54	65	65
Shipping Weight (lbs)	360	470	550	550	7550	920
ELECTRIC						
Volts	120/220	120/220	120/220	120/220	220	220
Cycle (Hz)	60/50	60/50	60/50	60/50	60/50	60/50
Current (Amp)	10	15	20	20	20	40
Phase	1	1	1	1	1	1
Plug in Electrical Cord	Yes	Yes	No	No	No	No
Electrical Fused Disconnect	No	No	Yes	Yes	Yes	Yes
High Current Brk. (Amp)	5	10	20	20	30	(2) 25
High Voltage Trans (kVA)	0.5	1.0	2.0	2.0	4.0	4.0
AIR						
Max Air Flow (scfm)	0.05	1.0	2.0	2.0	3.0	4.0
Max Air Flow (scfh)	30	60	120	120	180	240
Dryer In Feed (psi)	80	80	80	80	80	80
Dryer Outlet (psi)	13	13	13	13	13	13
Air Compressor (HP)	0.5	0.75	1.0	1.0	1.5	1.5
Desiccant Cell (In)	6	6	9	9	12	12
Moisture Indicator	Yes	Yes	Yes	Yes	Yes	Yes
COOLING WATER						
Required Flow (gph)	5	10	20	20	25	25

SECTION 1: SPECIFICATION SHEETS

INJECTION TANK

	T-150	T-300
INJECTION TANK		
Matching Ozone Generator	H-50 / L-100 / L-200	L-300 / L-400
Combined Model Number	HT-50 / LT-100 / LT-150	LT-200 / LT-300
Tank (gal)	150	300
Volumes (liters)	568	1136
MAXIMUM FLOW RATES		
Gallons per Minute	90	240
Gallons per Hour	5,400	14,400
Gallons per 8 Hours	43,200	115,200
Gallons per 24 Hours	129,600	345,600
Liters per Minute	340	908
Liters per Hour	20,439	54,504
Liters per 8 Hours	163,512	436,032
Liters per 24 Hours	490,536	1,308,096
DIMENSIONS (INCHES)		
Tank Diameter	31	44
Tank Diameter with Valve	35	50
Tank Height	85	85
Tank Weight (lbs)	375	510
Shipping Width	40	60
Shipping Length	85	90
Shipping Height	40	55
Shipping Weight (lbs)	655	680
ELECTRIC		
Volts	110/220	110/220
Cycle (Hz)	60/50	60/50
Current (Amp)	10	10
Phase	1	1
PLUMBING		
Untreated Water Inlet FMIP (in)	1.5	2.0
Treated Water Outlets FMIP (in)	2.0	2.0 / 3.0
Overflow Outlets FMIP (in)	2.0	2.0
Off-Gas Vent FMIP (in)	1.0	1.5

SECTION 2: INSTALLATION

OZONE GENERATOR

1. Uncrate and check for damages. If any damages are noticed, report immediately to Hess Machine International and the freight company.
2. Ozone generator should be located in a cool, dry area.
CAUTION: The generator electrical and pneumatic systems are not designed to be in an ozone enriched environment and may be detrimental to the life expectancy of certain components.
3. Connect main power.
CAUTION: Check for proper grounding and connect in accordance with local electrical codes.
4. Connect cooling water supply line on the solenoid valve side of the connection manifold, on the back of the unit (omit for H-25).
CAUTION: Cooling water must maintain a chlorine residual of 0.
5. Connect cooling water drain line to the connection manifold, on the back of the unit and run to drain (omit for H-25).
6. Connect ozone line at the connection manifold, on the backside of the unit. The line should be run vertical for a distance of 5 feet, at that point install the ozone check valve, with arrow pointing up. Continue to run the line in a vertical direction until it is at a higher point than the highest point of the ozone injection tank. This is done to insure no water will be able to siphon back to the ozone generator.
CAUTION: Ozone line must be made of ozone resistant materials.
7. Install glass dielectric and contact brush into stainless steel dielectric shell.
8. If your unit has a factory installed air compressor you may omit this step. If you do not have a factory installed air compressor, connect air supply line on the back side of the air dryer, this will be the fitting adjacent to the high pressure gauge.
CAUTION: Air supply must be oil free and dry.
9. With all of the above steps complete, you are ready to power up the unit, set the gauges and check for proper operation.
 - Turn on main power
 - Set high pressure at 80 psi
 - Set low pressure at 13 psi
 - Set air flow meter in accordance with the size unit you have:

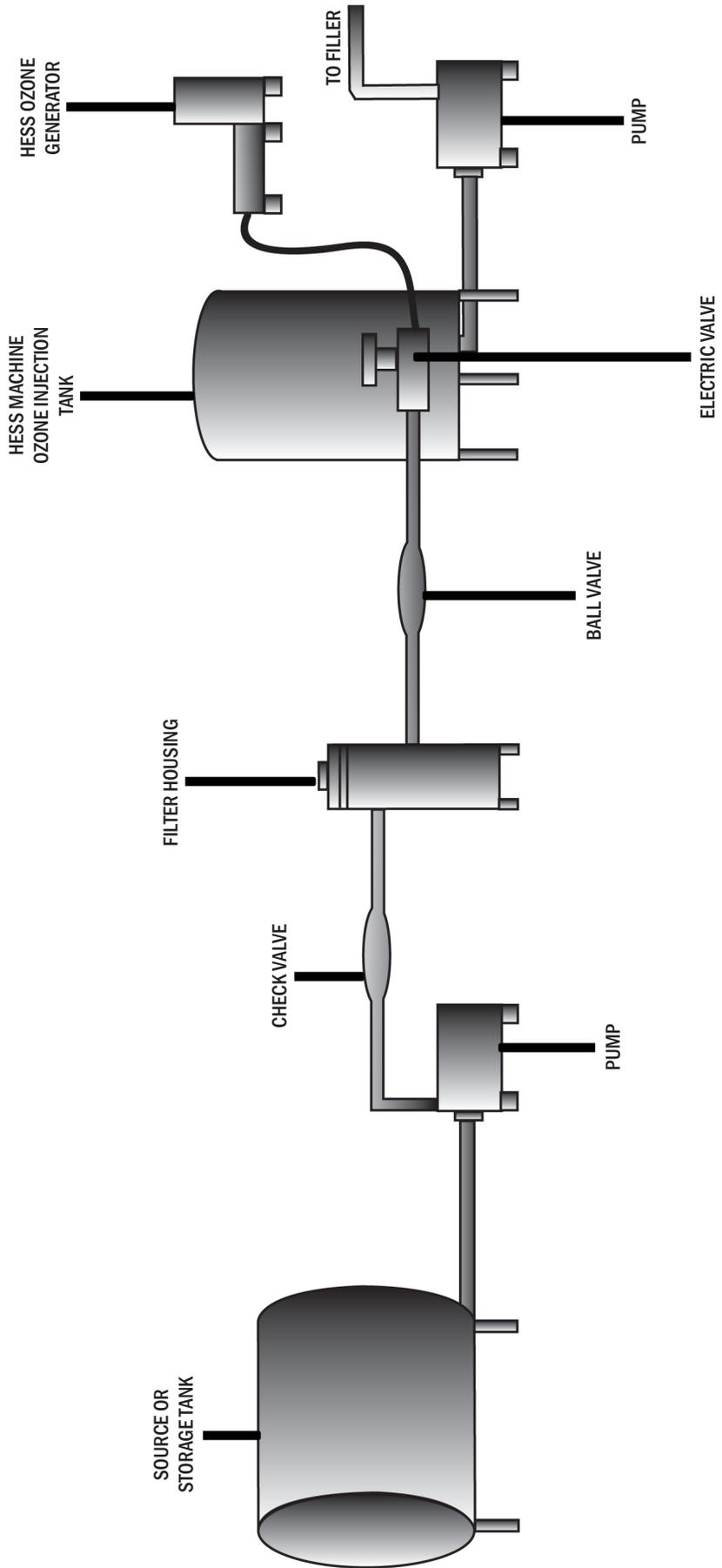
H-25	15 scfh
H-50	30 scfh
H-100	60 scfh
H-200	120 scfh
H-300	180 scfh
H-400	240 scfh
 - Turn on cooling water and set in accordance with the size unit you have:

.51 ppd	5 gph
11 bpd	10 gph
21 bpd	20 gph
31 bpd	25 gph
41 bpd	25 gph

NOTE: H-25 has no cooling water. Due to the dissimilar temperatures of cooling water, the gph units expressed are a starting point. For optimum performance, dial variable transformer to the desired setting, after the unit has run for 20 minutes, adjust water flow until the dielectric outer shell is slightly warm to the touch (approx. 100° F). Do not allow the shell to condensate or get hot.
CAUTION: All doors must be closed and cooling water flow turned on before turning on high voltage.
 - Dial variable transformer to the desired setting.
 - Check ozone residual.
CAUTION: Disconnect main power before servicing unit.

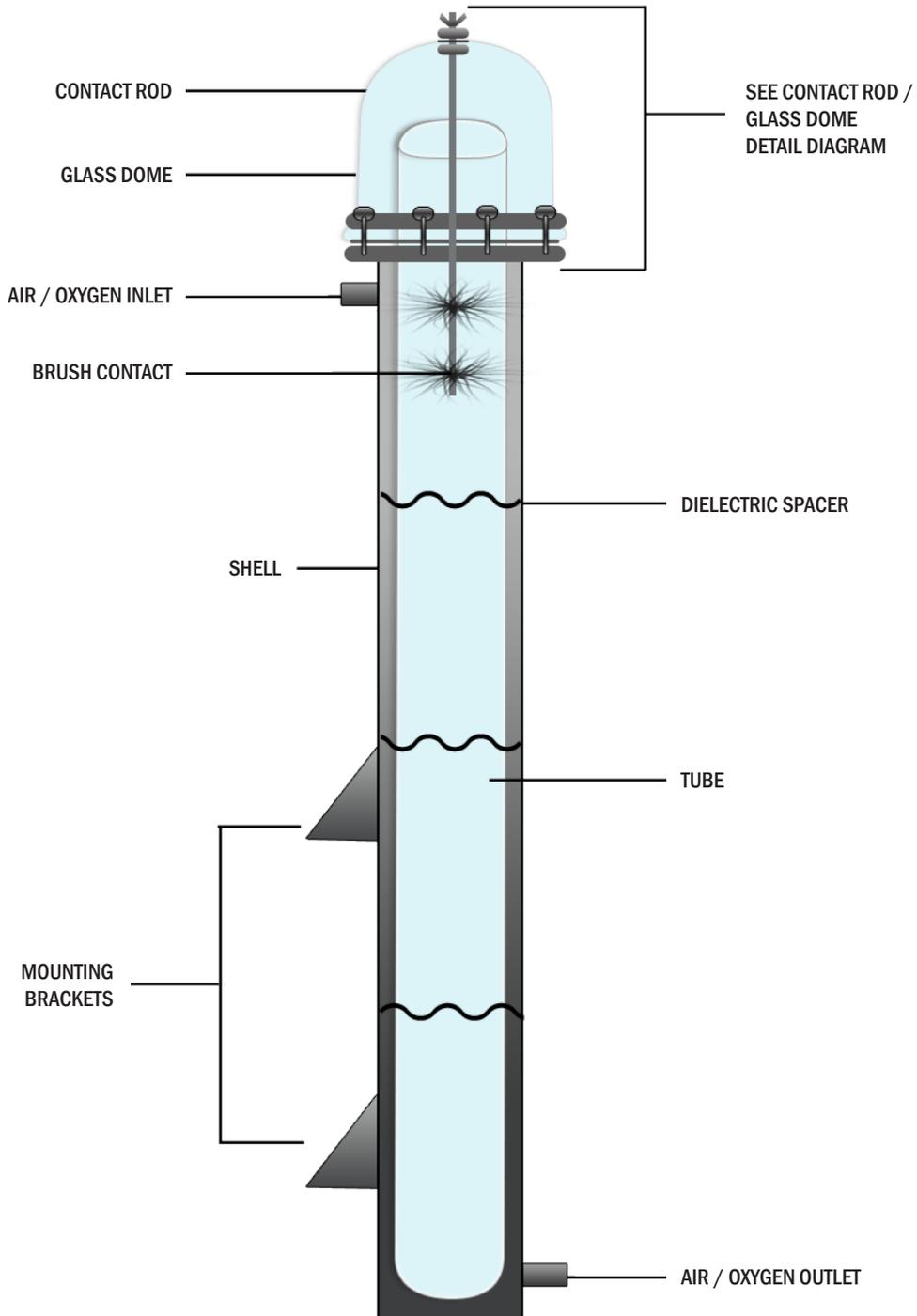


TYPICAL INSTALLATION



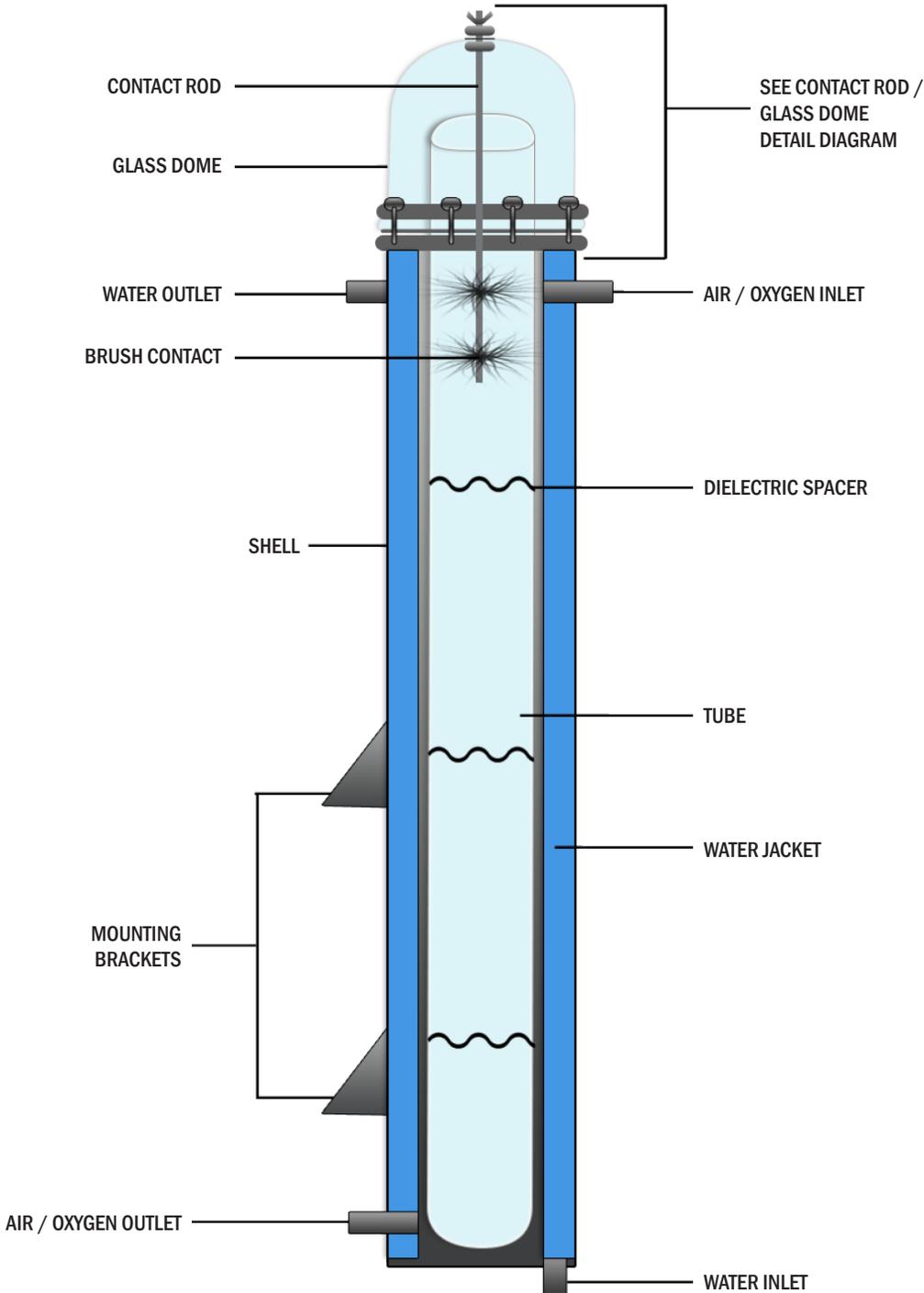


AIR COOLED DIELECTRIC ASSEMBLY



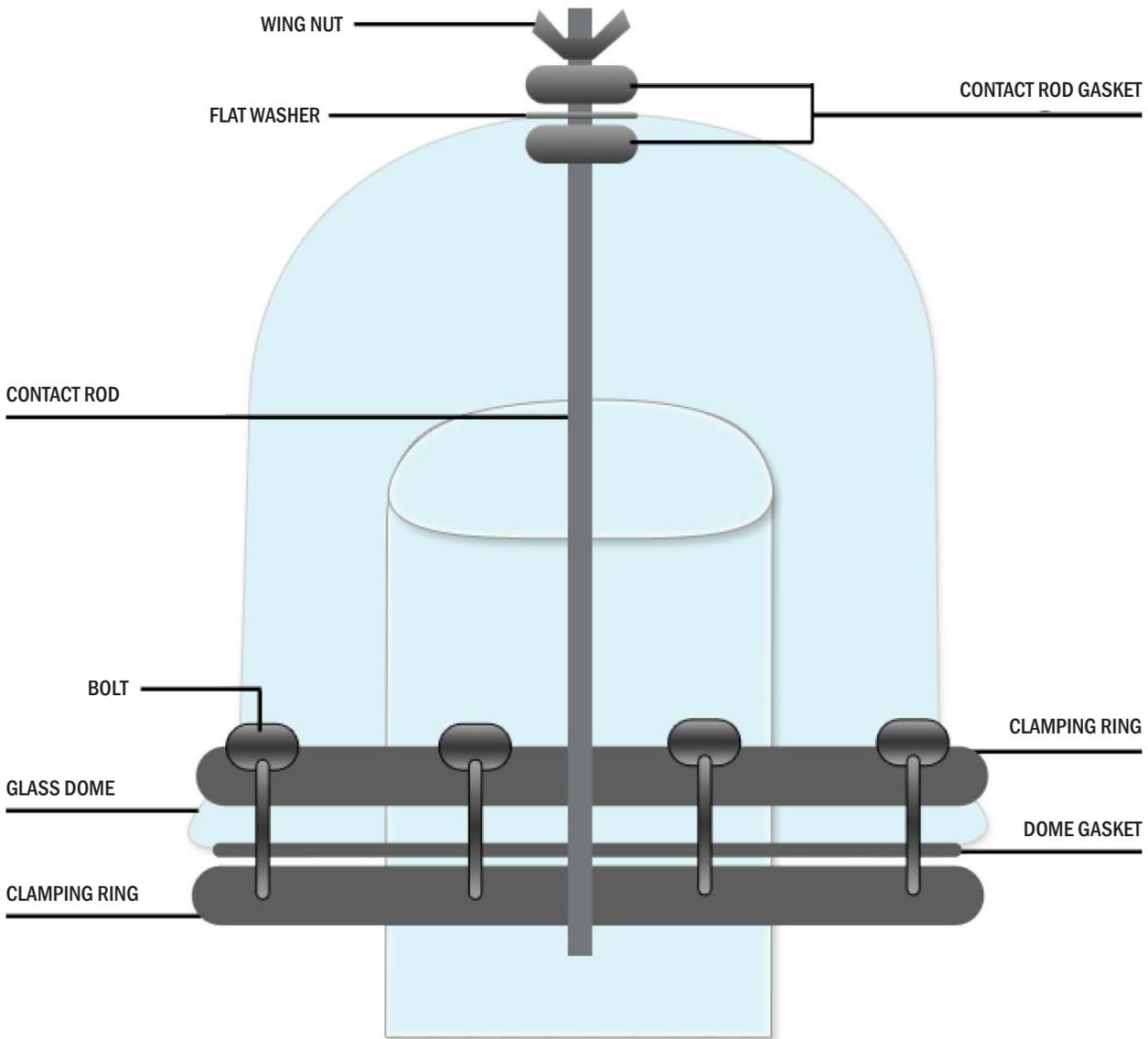


WATER COOLED DIELECTRIC ASSEMBLY





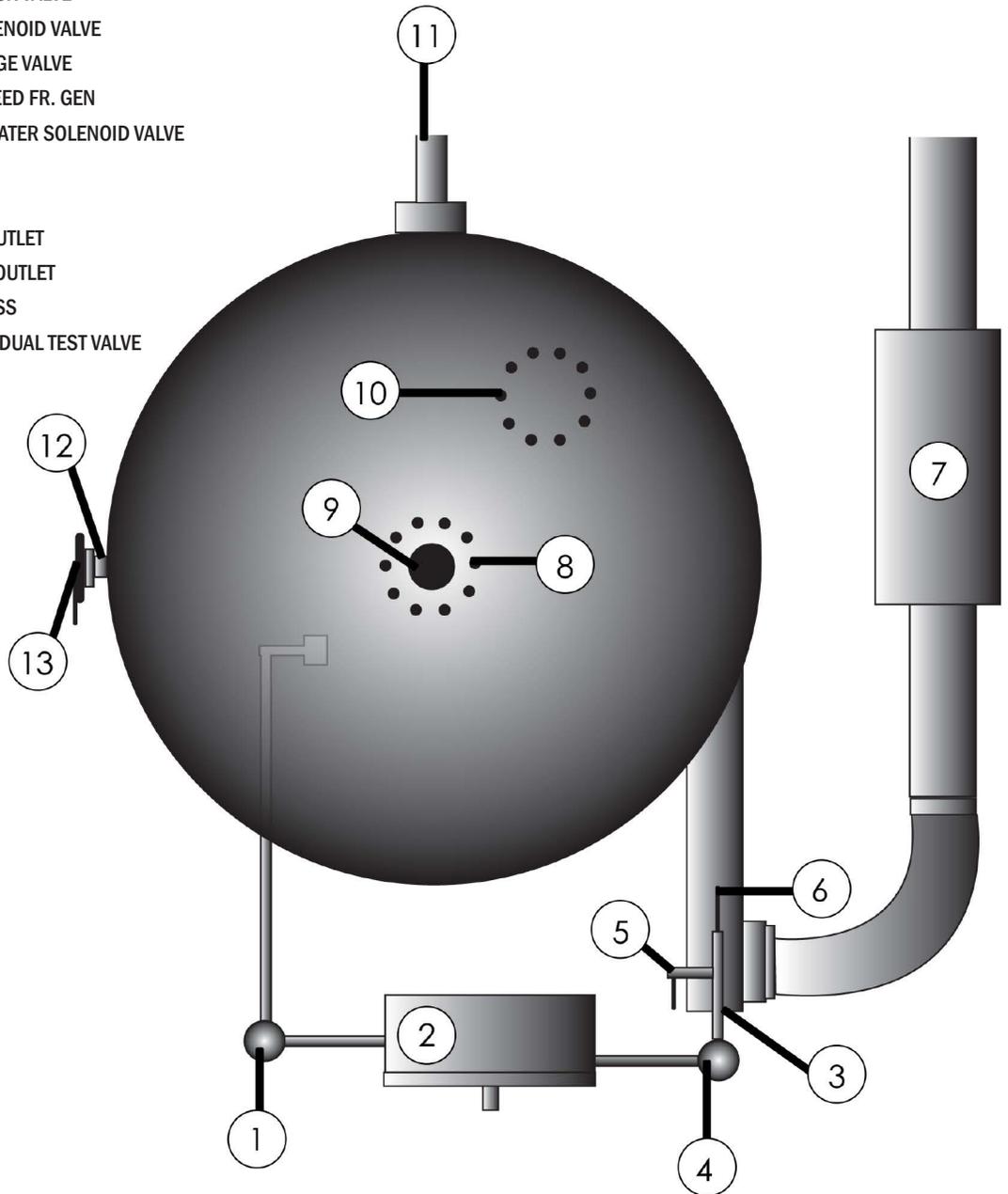
CONTACT ROD / GLASS DOME DETAIL





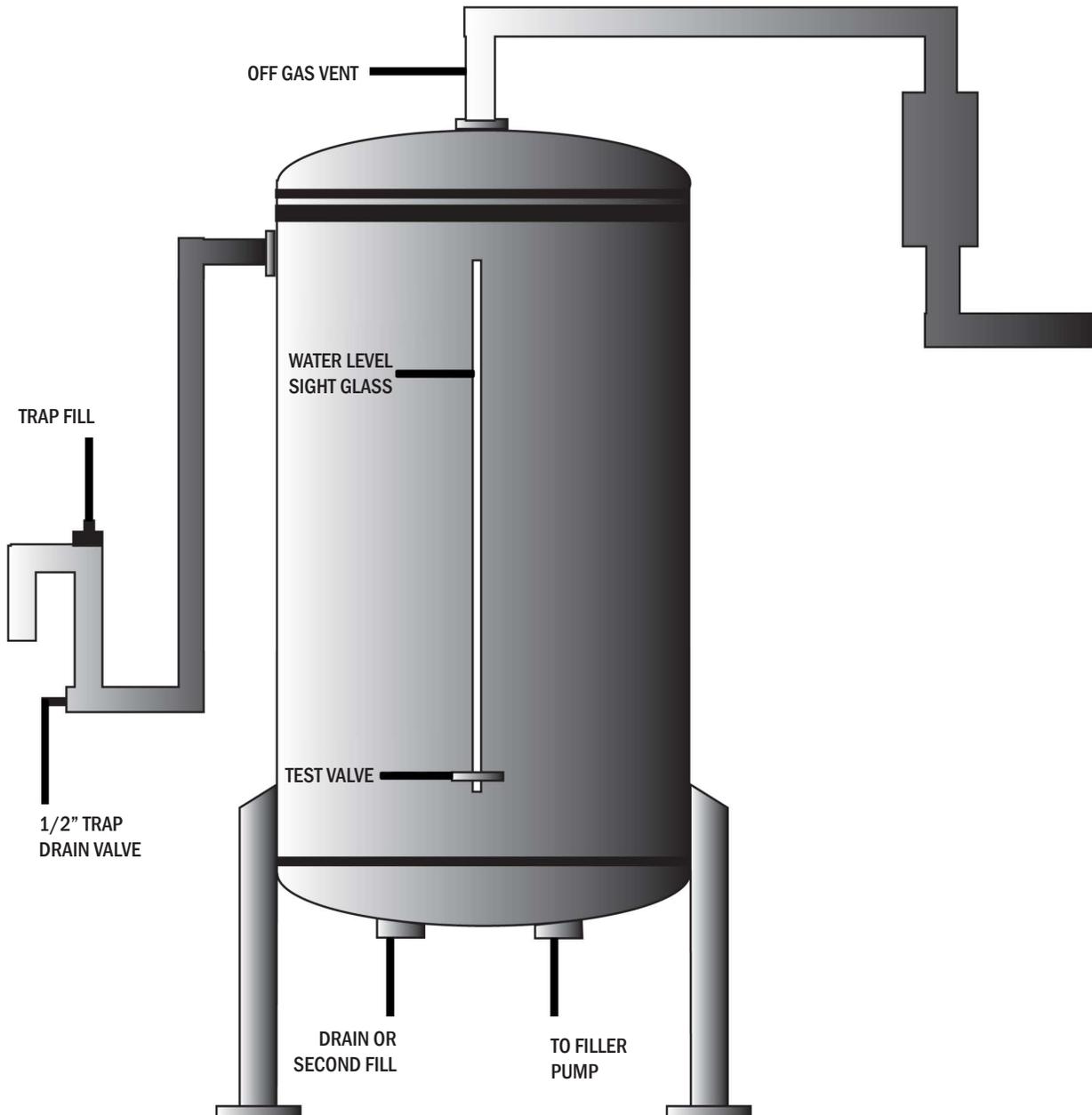
TANK ASSEMBLY

1. LEVEL CONTROL
2. CONTROL PANEL ON/OFF
3. OZONE CHECK VALVE
4. OZONE SOLENOID VALVE
5. OZONE PURGE VALVE
6. OZONE IN FEED FR. GEN
7. PRODUCT WATER SOLENOID VALVE
8. DRAIN LINE
9. VENT LINE
10. PRODUCT OUTLET
11. OVERFLOW OUTLET
12. SLIGHT GLASS
13. OZONE RESIDUAL TEST VALVE





TANK ASSEMBLY



SECTION 2: INSTALLATION

OZONE INJECTION TANK

1. Uncrate and check for damages. If any damages are noticed, report immediately to Hess Machine International and the freight company.
2. The ozone injection tank should be the last treatment before bottling.
3. The ozone injection tank can be operated in two different ways.
 - Placed above the filler, utilizing gravity flow to the filler.
 - Placed on the floor, utilizing a pump to convey the water to the filler.
4. Install a ball valve on the inlet side of the line feeding to the injection tank. This is done in order to fine-tune the volume of flow that is filling the tank.

CAUTION: The in feed flow should be slightly higher than the maximum usage of the filler.
5. Install ozonated product water discharge line, located on bottom of tank.
6. Install drain line, located on bottom of tank.
7. Install off gassing vent line. Located on the top of the tank, the vent line fitting is 1" or 1-1/2", depending on the size of tank that you have purchased. Install tank vent filter as shown on page 11.

CAUTION: The filter should be installed in a warm area. This should keep any trapped condensation from freezing and blocking off the vent. It is also advisable to mount the filter as shown (page 11) in order to keep any condensation trapped in the filter from dripping back into the tank.
8. Install the overflow line, located on the backside of the tank near the top, it is a 2" fitting (page 11).

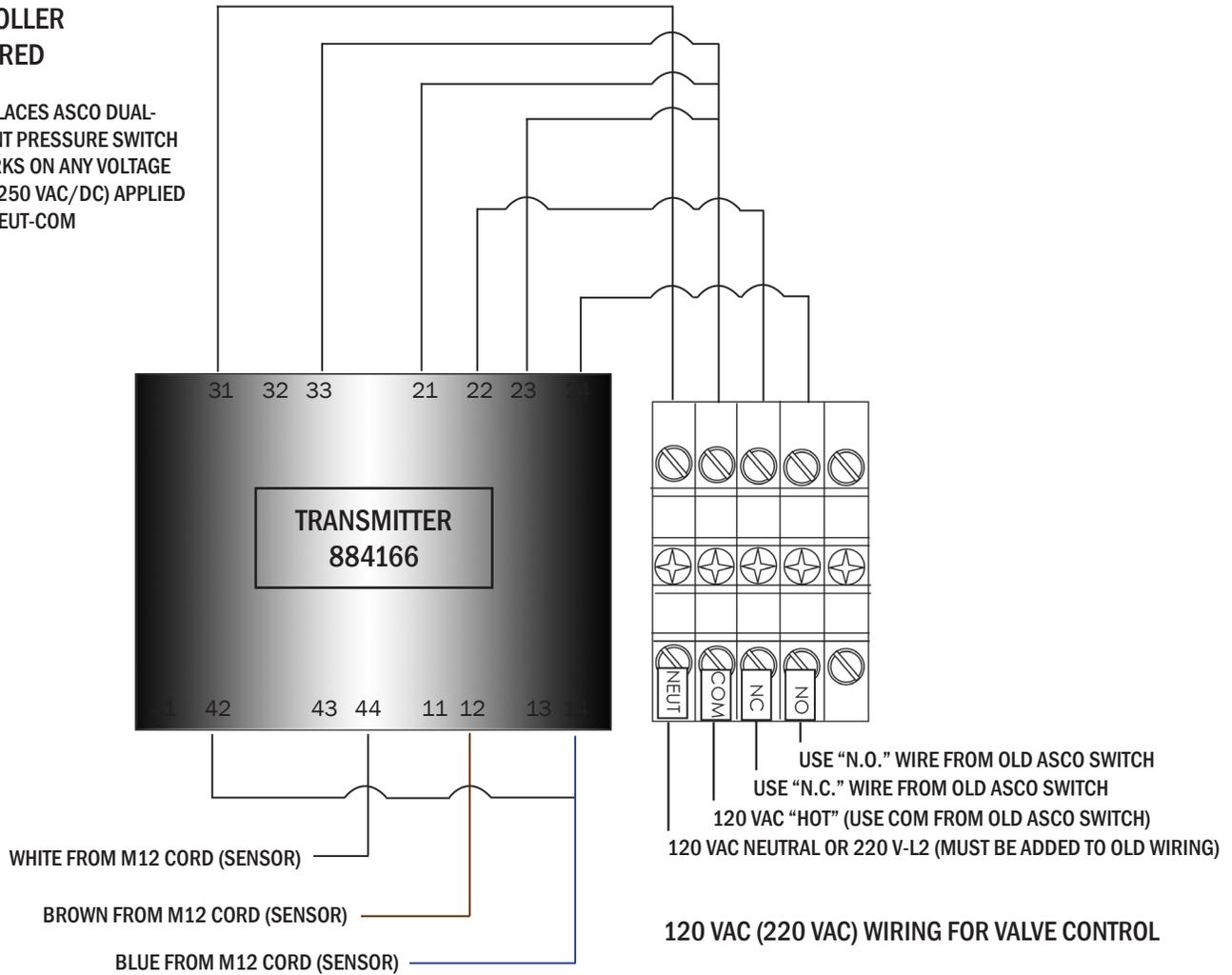
CAUTION: The installation of a water trap here will allow the tank to overflow in a situation where the level control is not working properly; also it does not allow gas to flow into the room.



LLS-3 LIQUID LEVEL SWITCH CONTROLLER / WIRING DIAGRAM

CONTROLLER PRE-WIRED

- REPLACES ASCO DUAL-POINT PRESSURE SWITCH
- WORKS ON ANY VOLTAGE (24-250 VAC/DC) APPLIED AT NEUT-COM



INSTRUCTIONS:

1. Remove existing ASCO pressure switch and install the new pressure sensor at the same port.
2. Install the controller on the panel next to the existing SS Switch Box.
3. Add a White (neutral) and Green (ground) wire to the conduit that was disconnected from the ASCO switch and connect the conduit to the new controller.
4. Route sensor cord to sensor and connect.
5. Power up system.
6. If operation is incorrect, swap the NC and NO wires to reverse the function.

SECTION 2: INSTALLATION

LLS-3 LIQUID LEVEL SWITCH CONTROLLER

SIGNAL CONDITIONER PROGRAMMING

ADV. SET	No	Default
IN. TYPE	Volt	Sensor Type
V. RANGE	0-10	Sensor Range
IN	Unit	“Screen” and “Setting” Designations are Backwards
DEC. P	111.1	Decimal Point Replacement
DISP. LO	0.0	Display
DISP. HI	100.0	Display
REL. UNI	Disp	
R1. FUNC	Setp	R1 Controls, NC Terminal at Connections (fill)
R1. CONT	NO	R1 Controls, NC Terminal at Connections (fill)
R1. SETP	28.0	R1 Controls, NC Terminal at Connections (fill)
ACT. DIR	Decr	R1 Controls, NC Terminal at Connections (fill)
R1. HYST	24.0	R1 Controls, NC Terminal at Connections (fill)
ON. DEL	0.0	Do Not Use Delay
OFF. DEL	0.0	Do Not Use Delay
R2. FUNC	Setp	R2 Controls, NO Terminal at Connections (drain)
R2. CONT	NO	R2 Controls, NO Terminal at Connections (drain)
R2. SETP	52.0	R2 Controls, NO Terminal at Connections (drain)
ACT. DIR	INCR	R2 Controls, NO Terminal at Connections (drain)
R2. HYST	24.0	R2 Controls, NO Terminal at Connections (drain)
ON. DEL	0	Do Not Use Delay
OFF. DEL	0	Do Not Use Delay
ANA. OUT	Curr	Not Used
O. RANGE	4-20	Not Used
WAIT!	(Uploading to Memory)	

SECTION 3: OPERATION

OPERATING PARAMETERS:

OZONE GENERATOR / IN LINE INJECTION TANK

1. Once your ozone generator has been installed, this guide will help you determine that your generator is operating properly and help insure it has a long trouble free life.
2. The high-pressure feeding into the air dryer should read a constant 80-85 psi.
3. The air dryer should blow off out of the bottom of the unit every 30 seconds, alternating towers each cycle. After the blow off, there should only be a slight seepage from the bottom of the tower that just blew off, the opposing tower should have no seepage.
4. The air dryer moisture indicator should be a blue/ purple color after a couple hours of operation. If the moisture indicator turns white it is an indication of a malfunction of the dryer.
5. The low-pressure regulator should run at a constant 13 psi, whether yo have flow or not, showing no leakage at the weep hole.
6. The scfh gauge should be set at:

H-50	30 scfh
L-100	60 scfh
L-200	120 scfh
L-300	180 scfh
L-400	240 scfh

 when the tank is filling. When the tank is full and not calling for ozone, the scfh gauge should read 0. The low-pressure relief valve should start blowing off at 20 psi.
7. When the circuit breaker on the front panel is energized the red light will come on.
8. When dialing up the variable transformer you will notice a blue/purple corona when looking through the glass dome as the dial reaches approximately 50 as indicated on the dial. It is normal to see some arcing inside the dome as the dial approaches 100.
9. With the variable transformer running at maximum, the transformer voltmeter should read 120 V on a 120 V machine and 240 V on a 240 V machine.
10. With the variable transformer running at maximum, the amp meter on a 120 V machine should read approximately as follows:

H-50	5 amp
L-100	8 amp
L-200	17 amp
11. With a variable transformer running at maximum, the amp meter on a 220 V machine should read approximately as follows:

L-100	5 amp
L-200	10 amp
L-300	15 amp
L-400	20 amp
12. The safety circuit will shut off the high voltage and the red light indicator, if one of the panel doors is opened or with the loss of in feed cooling water pressure.
13. The cooling water flow rate should be set to allow the stainless steel dielectric outer shell to be slightly warm to the touch both winter and summer. Do not allow the tube to get hot or condensate.
14. The injection tank in feed should be adjusted slightly faster than the filler is using water. For optimum performance the tank should not be starting and stopping quickly.
15. The injection tank water and ozone should start and stop simultaneously. The green light is on when filling, the red light is on when full.

SECTION 3: OPERATION

START UP PROCEDURE

1. Turn on the main electric supply, set pressure gauge to 80 psi and adjust the post dryer pressure gauge to 13 psi.
2. To install, check the cooling water is operating and set the flow rate to the following approximate levels shown below. Variation may be required depending upon incoming water temperature (page 3).
3. Close ozone line purge valve (1/4" stainless steel ball valve) that is located next to the injection module on the injection tank.
4. Make sure all doors and panels are closed securely on the generator. Turn on the circuit breaker on the front panel, which will also illuminate the red light.
5. Dial voltage regulator to appropriate level to achieve the desired ozone residual in the water.
6. Turn on product water and fill injection tank.
7. Check ozone residual in the product water at the following locations:
 - Sight glass tube on the injection tank
 - Line filler
 - After the product has been bottled

MODEL	GALLONS PER HOUR	LITERS PER HOUR
H-50	5	19
L-100	10	38
L-200	20	76
L-300	25	95
L-400	35	133

SHUT DOWN PROCEDURE

1. Turn off product water.
2. Dial voltage regulation back to zero.
3. Turn off ozone circuit breaker switch.
4. Open 1/4" stainless steel ball valve to purge system.
5. Allow air compressor to run for an additional 3 to 4 minutes.
6. Check moisture bowls for proper drainage.

SECTION 4: MAINTENANCE

AIR FED OZONE GENERATOR

(With short run or very humid conditions of operation, it may be necessary to clean the ozone generators more often.) Air coming into an ozonator contains roughly 89% nitrogen, 21% oxygen and trace amounts of dust, water vapor and other gases. The air preparation system (consisting of an air dryer, filters, etc.) is designed to remove dust and water vapor from the feed air. Air passes through the air preparation system and enters the ozone generator shell. In the shell, some of the generated ozone reacts with nitrogen gas in the air to form nitrogen pentoxide (N₂O₅). Nitrogen pentoxide by itself is not a problem, but if the air is moist, it reacts with the water vapor to form nitric acid (HNO₃). The nitric acid then deposits on the generator shell and piping, causing corrosion of the metal surface and possible contamination of product water (raising conductivity).

1000 OPERATING HOURS

1. Disassemble and clean the ozone dielectric as described below.
2. Replace dome gaskets.
3. May vary with conditions - Clean or replace the air intake filters on the sides of the compressor.
4. Replace moisture bowl filter.
5. Replace dielectric spacers.

2000 OPERATING HOURS

1. Do all of the same items as described in the 1000 hour interval.
2. Replace low-pressure regulator diaphragm, inspect all other associated o-rings and replace if needed.
3. Change solenoid valves at bottom of the heatless air dryer.
4. Check desiccant cells on top of the dryer, screen should not depress more than 1/4" and show no signs of dust.



SECTION 4: MAINTENANCE

AIR FED OZONE GENERATOR

DISASSEMBLY AND CLEANING DIELECTRIC

1. Remove plug from electrical outlet or disconnect power to unit.
2. Remove high voltage connector on top of glass dome on dielectric. Take off top nut only.
3. Remove bolts holding dome-bearing ring to flange on dielectric shell.
4. Lift off dome and bearing ring together. Do this carefully. The contact rod should pull out of the plug on the brush assembly inside of the glass dielectric. If the dielectric comes out with the dome, lift dome until the dielectric can be held and pull them apart and remove dielectric from shell.
5. When the dielectric is removed it should have 4 spring spacers on it. If any of these remain in the shell remove them.
6. Use clean cloth moistened with warm soapy water to clean outer surface of dielectric and the inner surface of the stainless steel shell. Do not clean the inside of glass dielectric beyond clear glass.
7. Clean inside and outside of glass dome, dome gasket, flange on end of shell and high voltage bushing on the transformer (hot water works very well).
8. If water is used, all parts must be thoroughly dried. Moisture in the ozonator will reduce efficiency.
9. When dielectric is out of shell, check that the ozone outlet in the end of the shell is clear. If deposits have been carried into the ozone outlet line it will be necessary to remove lines and flush with hot water. Dry thoroughly before replcing. If deposits are excessive, replace with new tubing.

REASSEMBLY

1. With dielectric in shell, position new dome gasket on flange of shell and insert dome with dielectric brush on contact rod. Insert into die making sure contact rod and brush are connected and brush is in the coated area.
2. Secure dome with bolts and reconnect high voltage conductor.
IMPORTANT: When securing the dome, tighten the bolts gradually and evenly to prevent the dome from cracking.
3. Run compressor and check for air leaks.

SECTION 4: MAINTENANCE

OXYGEN FED OZONE GENERATOR

1000 OPERATING HOURS

1. Replace particulate filter in the oxygen generator.

2000 OPERATING HOURS

1. Replace particulate filter in the oxygen generator.
2. Replace dome gaskets.
3. Replace dielectric spacers.
4. Replace coalescing filter oxygen generator.
5. Replace low-pressure regulator diaphragm, inspect all other associated o-rings, replace if needed.
6. Replace flow meter stem on the bottom of the scfh gauge.
7. Install new dome gaskets.
8. Clean dielectric.
9. Disassemble and clean the ozone dielectric as described on the next page.



SECTION 4: MAINTENANCE

OXYGEN FED OZONE GENERATOR

DISASSEMBLY AND CLEANING DIELECTRIC

1. Remove plug from electrical outlet or disconnect power to unit.
2. Remove high voltage connector on top of glass dome on dielectric. Take off top nut only.
3. Remove bolts holding dome-bearing ring to flange on dielectric shell.
4. Lift off dome and bearing ring together. Do this carefully. The contact rod should pull out of the plug on the brush assembly inside of the glass dielectric. If the dielectric comes out with the dome, lift dome until the dielectric can be held and pull them apart and remove dielectric from shell.
5. When the dielectric is removed it should have 4 spring spacers on it. If any of these remain in the shell, remove them.
6. Use a clean cloth moistened with warm soapy water to clean the outer surface of the dielectric and the inner surface of the stainless steel shell. Do not clean the inside of the glass dielectric beyond the clear glass.
7. Clean the inside and outside of the glass dome, dome gasket, flange on the end of the shell and the high voltage bushing on the transformer (hot water works very well).
8. If water is used, all parts must be thoroughly dried. Moisture in the ozonator will reduce efficiency.
9. With dielectric out of the shell, check that the ozone outlet in the end of the shell is clear. If deposits have been carried into the ozone outlet line it will be necessary to remove lines and flush with hot water. Dry thoroughly before replacing. If deposits are excessive, replace with new tubing.

REASSEMBLY

1. With dielectric in shell, position new dome gasket on flange of shell and insert dome with dielectric brush on contact rod. Insert into die making sure contact rod and brush are connected and brush is in the coated area.
2. Secure dome with bolts and reconnect high voltage conductor.
IMPORTANT: When securing the dome, tighten the bolts gradually and evenly to prevent the dome from cracking.
3. Run compressor and check for air leaks.

SECTION 4: MAINTENANCE

SCHEDULE

OZONE GENERATOR

The following preventative maintenance schedule is recommended to ensure the optimum performance of the unit and to prevent the inconvenience of a sudden, unexpected failure. Please reference the exploded view drawings in the Replacement Parts section to identify specific part numbers for your model.

1. **REPLACE FILTER ELEMENTS:** Replace the inlet and outlet filter elements every 6-12 months depending on the quality of the compressed air source. PUREGAS stocks replacement elements for all of the filters offered with its products.
2. **SOLENOID VALVES ON PHF, PHCA AND PCME MODELS:** Replace the plunger and base of the solenoid valves every two (2) years. PUREGAS offers a Solenoid Repair Kit (P2004498S) for this procedure. Two (2) kits are required for each dryer or adsorber being serviced.
3. **REPLACE OR REPACK DESICCANT TOWERS:** Replace or repack the desiccant towers every five (5) years. Please see the following exploded view drawings to determine the tower part number required. Please note that the repack option is only available for the PHF, PCDA and PCME models. Replacement towers are available for all other models.
4. **CHECK VALVE AND O-RINGS ON PHF, PCDA AND PCME MODELS:** Replace the check ball, check spring and o-rings for PHF, PCDA and PCMA models every six (6) years. PUREGAS offers a Maintenance Kit (P200499S) for this procedure. One (1) kit is required per dryer or adsorber. This kit contains two (2) Solenoid Repair Kits, two (2) Check Balls, two (2) Check Springs and an assortment of O-Rings.

The sizing of the purge orifice is also important to the performance of a PSA system. The orifice must be large enough to admit sufficient air to purge the off-line tower, but not too large to be wasteful of the dry or purified air. Please note that the operating pressure is closely associated with the orifice sizing, since both the orifice aperture dimension and pressure determine the quantity of purge air.

The purge orifice size of a particular unit is indicated by the last 2-3 digits of the model number (found on the product label). The orifice number of the PHF, PCDA and PCME models are also stamped on the top of the purge orifice itself. For the PCR, PMD and TOC models, the orifice size is stamped on the outlet shuttle valve body.

The outlet flow should be regulated with a throttle valve and measured with a flow meter to ensure the capacity of the dryer or adsorber is not being exceeded. PUREGAS offers flow meters with built-in flow control valves for this purpose.

IMPORTANT: Each compressed air dryer and adsorber is sized for specific operating conditions. If additional flow is required or the operating pressure decreases, the output performance will be negatively affected unless the orifice diameter is changed appropriately. Depending on the magnitude of the change, the size of the desiccant chambers may also need to be increased. Please consult the product sizing charts or contact the factory for information.

SECTION 4: MAINTENANCE

SCHEDULE

OZONE GENERATOR

At the beginning of each purge cycle there will be an audible exhaust through the solenoid valve. This sound can be made quieter by the use of purge mufflers (standard on most models) or a sound suppression kit for virtually noiseless operation. Please contact PUREGAS for more information on this option.

The exhaust stream may also be piped to a remote location. If this is done, it is important that the exhaust piping is oversized to prevent back-pressure on the purge stream; restricting the purge flow will prevent full regeneration of the desiccant chamber and lead to reduced performance.

The heat of absorption and the operation of the solenoid valves will cause the unit to become warm to the touch. This is normal.

To prevent potential electrical shock, the timer cover should be removed for maintenance until power is disconnected from the unit. Likewise, the unit should be completely depressurized prior to service.

SECTION 5: TROUBLESHOOTING

OZONE GENERATOR

SHORT CIRCUIT: A short circuit occurring anywhere in the ozonator system will cause the ozonator circuit breaker to open and the red light to go out. Reset breaker by turning switch off, dialing voltage to zero and restarting equipment.

VOLTAGE SURGE: Occasionally the circuit breaker will trip on a starting surge, even when a short does not exist. To overcome this, put the variable voltage control in full counter-clockwise (zero) position before starting the ozonator, then turn the control up to desired voltage.

CIRCUIT BREAKER WILL NOT RESET: Check all safety latches on all doors. If the latches are not closed properly, the circuit will be broken.

LOCATING THE TROUBLE IN THE OZONATOR CIRCUIT: If the circuit breaker is found tripping during normal operation, or if the breaker is tripping repeatably on starting, there is probably a short circuit in the system.

NOTE: If the doors and top panels are open, special care should be taken that the unit is off and unplugged. The high voltage conductor and its connecting points carry approximately 15,000-20,000 volts.

1. Check primary circuit for shorts or grounds. If none are found, the trouble is probably in the high voltage circuit. If high voltage circuit is within 2" (5 cm) of any metal part of machine, the high voltage current could be jumping to ground. Adjust conductor to maintain at least 2" (5 cm) clearance from any grounded metal part.

2. To isolate trouble in ozonator circuit, first disconnect all ozone dielectrics from the transformer by removing high voltage conductor from the transformer and dielectrics. If circuit breaker trips without dielectric connected to transformer, then rheostat or transformer is defective. Remove primary side to transformer then test. If the circuit breaker does not trip, then the problem is not the transformer, but it is with the rheostat. If circuit breaker does not trip the trouble is in the ozone dielectric. Connect one (1) dielectric to transformer. If circuit breaker trips and the unit has more than one (1) dielectric, then the trouble is in one of the other dielectrics. Follow this same procedure to isolate the bad dielectric.

- Trouble inside the dielectric chamber is usually confined to either a cracked dielectric or an excessive build-up of scale deposits.
- Remove and examine all dielectrics closely for a crack throughout which could cause a grounding arc. A crack may only be slight or can appear as a pinhole and close inspection is necessary to detect it.
- Excessive build-up of deposits could be caused by operating the ozonator with moist air or by an excessively long time between cleanings. If cleaning schedule has been maintained, check pressure gauge on dryer for proper pressure. If pressure is low, check all piping and equipment for leaks and check dryer o-rings for proper operation. See dryer manual for details.

SECTION 5: TROUBLESHOOTING

OZONE GENERATOR

LOSS OF AIR FLOW OR FLOW CONTROL

If air flow unit drops off rapidly or cannot be controlled by the air regulator, check the following:

1. If the solenoid core assembly on the dryer sticks or burns out, a large amount of air will be exhausted through the bottom of the solenoid valves on the dryer. This can be checked by feeling the exhaust port in the bottom of each stem on each solenoid valve. Normal flow through these ports can just barely be felt (only one port is exhausting at a time - see dryer section).
2. Check o-rings and examine for damage (see dryer operating instructions).
3. Check all piping, joints and gaskets with soapy water for leaks.
4. Check ozone outlet piping from the ozone chamber. If the deposit that builds up in the ozone dielectric shell is excessive, some of the deposit may be carried into the ozone lines and restrict or block them. Blocked lines can be cleaned with hot water under pressure (If the line is completely blocked, the only outlet for the ozone will be through the pressure relief valve. This may damage the relief valve and may make it inoperative.). If the cleaning schedule is maintained, the deposits will not build up to this extent unless the dielectric chamber is operating on moist air (see dryer section).
5. If trouble exists that cannot be located by any of the above procedures, contact the Services Department of Hess Machine International.

SECTION 6: PUREGAS HEATLESS AIR DRYER

INSTALLATION

INSTRUMENTATION:

The primary purposes of instrumentation in the system are process control and troubleshooting. The instruments shown in the Recommended Installation Diagram are therefore in most cases optional, but their initial cost will be quickly justified through improved process stability and problem analysis.

A simple, inexpensive means of measuring the moisture content of the outlet air stream can be accomplished with a vial of color-changing crystals. PUREGAS offers such an accessory, which can be mounted directly to the dryer or adsorber. The crystals will change from a dark blue (dry) to pink (wet) depending on the moisture content in the air stream.

For sensitive or remote applications, PUREGAS manufactures an electronic humidity alarm, which continuously tracks moisture levels and helps prevent costly repairs caused by moisture damage. It features simultaneous audible and visual alarms, as well as open- and closed-circuit conditions for integration into a control system.

ELECTRICAL CONNECTIONS AND TIMER:

Before wiring, check the product label for electrical characteristics. Although standard electrical characteristics are 115 Volts 50/60 Hz or 230 Volts 50/60 Hz, most products are also available in 12 V_{DC} and 24 V_{DC}.

There is no electrical overload protection in the product and it should be wired into a protected circuit. While standard on some units, an 8-foot, 3-wire grounded power cord is available as an optional accessory for all products. The unit can be grounded by attaching a wire to a timer assembly bracket screw. Please see the Wiring Diagram that follows.

As previously described, the solid state timer controls the switching of the solenoid valves, which in turn direct the air through the unit. All timers are designed with a one-hour memory; if power is interrupted, the dryer will resume operation at the same point in the cycle when the power is restored.

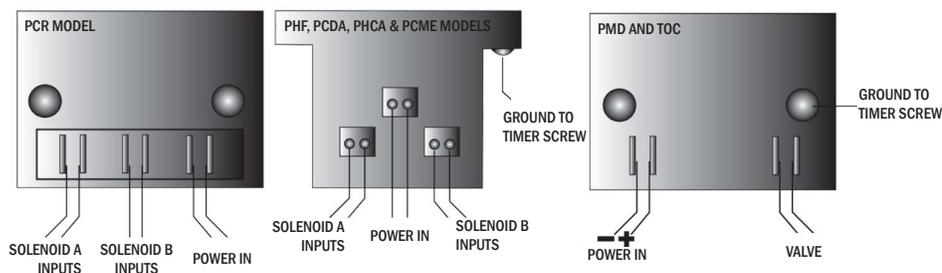
The standard timer for the PHF and PHCA models simultaneously switches the solenoid valves every 30 seconds (for a total cycle time of 1 minute). The timer used on the PHFR, PCDA and PCME models maintains the same cycle, but allows a repressurizing period of 3.75 seconds prior to switching chambers. Repressurizing helps minimize the outlet pressure and flow variation as well as a desiccant shock as the flow switches from one chamber to the other.

The PCR model also utilizes a repressurizing timer. It maintains a 2-minute cycle, with a 20-second repressurizing period prior to switching towers. The PMD and TOC models follow a standard 1-minute cycle like the PHF300A model.

The timer wiring diagram for all models are shown below.

OPERATING PRESSURE AND SIZING:

Most PUREGAS models are designed to operate at pressures up to a maximum of 150 psig. The only exceptions are the PMD and TOC models, which have a maximum operating pressure of 125 psig. It is important to note that all models based on PSA technology will achieve better performance at higher operating pressures. Therefore, any pressure regulation should be done downstream of the dryer or adsorber.



SECTION 6: PUREGAS HEATLESS AIR DRYER / AIR COMPRESSOR

PUREGAS HEATLESS AIR DRYER (SEE NEXT PAGE)

The heatless air dryer consists of two cells that alternate every 30 seconds. Each chamber then purges itself with an audible exhaust. DO NOT plug or restrict the air exhausts, and if orifices are replaced, they should be replaced in matched pairs. Under normal operation, the unit becomes warm and does not indicate a malfunction.

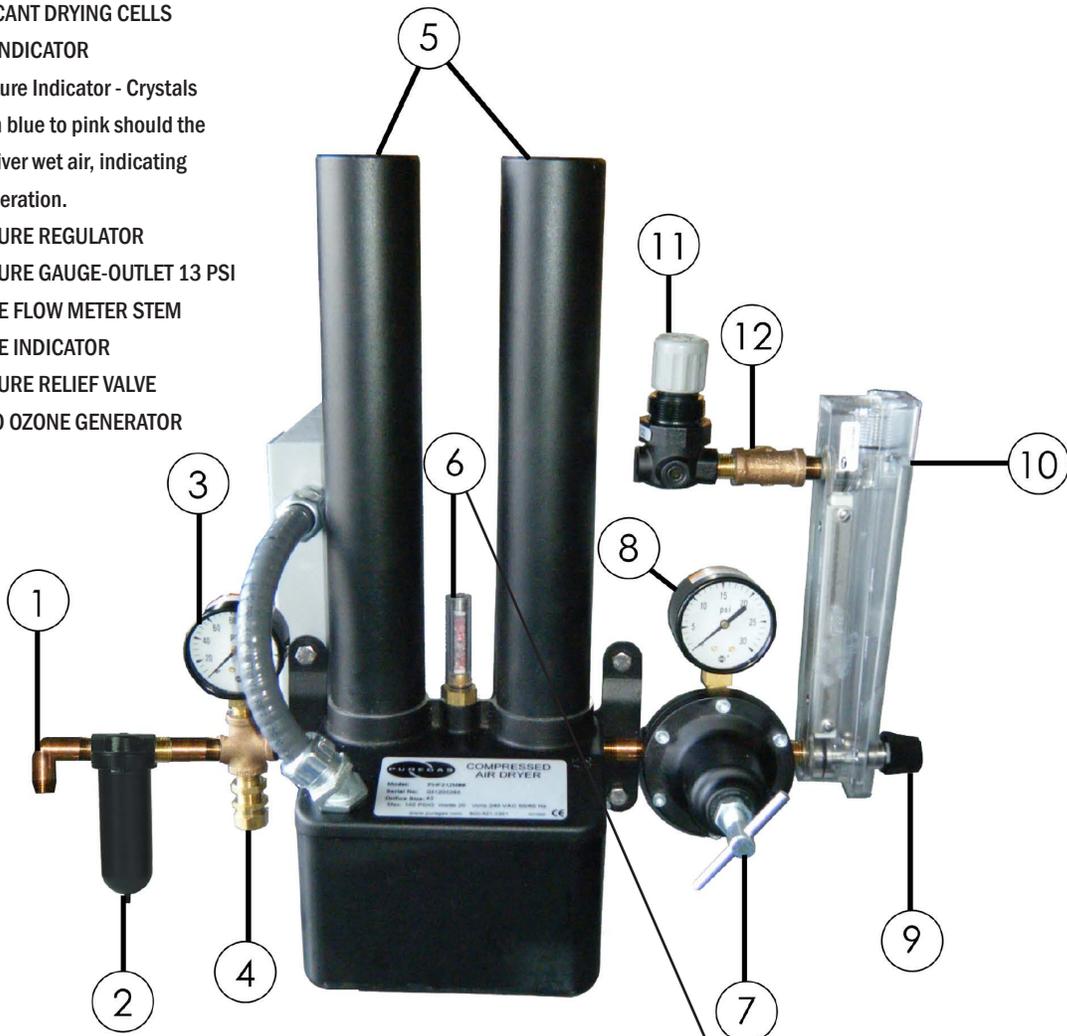
Please refer to the following maintenance instructions, troubleshooting guide, parts list and diagram for more information about the PUREGAS Heatless Air Dryer:

1. **FIELD ADJUSTMENTS:** No field adjustments are necessary after a PUREGAS Heatless Air Dryer has been installed in accordance with these instructions. No lubrication is required on the instrument.
2. **6 MONTH CHECK:** It is recommended that at six-month intervals the unit be thoroughly inspected. Inspection should include audible inspection for proper chamber reversal and purge and visual inspection for excessive dirt or oil fouling and for desiccant attrition. This involves removal of the air manifold cover and of the desiccant chambers. Annual inspections should be more thorough and should also include removal of the solenoid valves and the purge orifice glands to inspect for excessive wear or deterioration of valve parts or the check valve balls as well as for possible plugging of the purge orifice.
3. **PURGE ORIFICE:** As the orifices are critical parts in determining the performance of a dryer, the user should not try to increase the orifice by drilling a larger hole. Instead, orifices of the proper size should be obtained from the factory.
Purge orifice glands are screwed into the manifold beneath the desiccant chambers. To change orifices, unscrew the chambers using a standard 7/8" socket wrench.
4. **CYCLE TIMER:** The cycle timer can be replaced in the field.
5. **DESICCANT:** Improper packing of the desiccant chambers can cause channeling of the gas stream and improper purification. For this reason **NO ATTEMPT SHOULD BE MADE TO REPACK DESICCANT CHAMBERS IN THE FIELD.** Replacement chambers should be obtained from your local authorized distributor.
6. **REPLACEMENT PARTS:** Contact your local authorized distributor for replacement parts. Refer to the Exploded View of the PUREGAS Heatless Dryer and PUREGAS Heatless Air Dryer parts list on the next page for corresponding numbers.



PUREGAS HEATLESS AIR DRYER

1. AIR INLET
 2. MOISTURE BOWL
 3. HIGH PRESSURE GAUGE INLET 80 PSI
 4. HIGH PRESSURE RELIEF VALVE
 5. TWO DESICCANT DRYING CELLS
 6. MOISTURE INDICATOR
- NOTE: Moisture Indicator - Crystals change from blue to pink should the air dryer deliver wet air, indicating improper operation.
7. LOW PRESSURE REGULATOR
 8. LOW PRESSURE GAUGE-OUTLET 13 PSI
 9. SCFH GAUGE FLOW METER STEM
 10. SCFH GAUGE INDICATOR
 11. LOW PRESSURE RELIEF VALVE
 12. AIR FLOW TO OZONE GENERATOR



SECTION 6: PUREGAS HEATLESS AIR DRYER

TROUBLESHOOTING

UNIT DELIVERS WET AIR:

1. **IMPROPER OPERATING CONDITION:** Adjust operating conditions.
2. **SOLENOID CORE SPRING BROKEN:** Remove solenoid valve, inspect core assembly. Spring should be seated on core and not broken. Replace if necessary.
3. **PURGE ORIFICE PLUGGED:** Remove, inspect and clean orifice. Do not force wires through critically drilled holes. Use air gun to clean.
4. **SOLENOID COIL BURNED OUT:** Remove cover, place iron or steel material (screwdriver or nail) on exposed end of solenoid base to feel the magnetic effect indicating proper operation.

NOTE: Each coil should be energized for 30 seconds.

5. **IMPROPER OPERATION OF CYCLE TIMER:**
 - Check the power supply. If the correct voltage is not present between L1 and both of the L2 terminals, check the wiring and protective devices supplying power to the dryer.
 - Dryers with the DC solenoid valves should alternately have DC voltage between L2 and DC1 and between L2 and DC2. Replace the timer if voltage is present at either DC terminal continuously or not at all
 Timer Input: 120 VAC Timer Output: 53 VDC
 Timer Input: 240 VAC Timer Output: 106 VDC
 - Refer to Solid State Timers for timing cycle information.

6. **DESICCANT CONTAMINATION OR ATTRIBUTION:** Inspect outlet airline for indication of excessive oil. Check operation of dropout filter. Remove chamber from manifold and depress perforated disc at open end of chamber. If it can be depressed more than 1/4" from retaining ring, replace chamber or have it repacked.

EXCESSIVE DROP IN OUTLET PRESSURE:

1. **IMPROPER OPERATING CONDITION:** See remedy under "Unit Delivers Wet Air."
2. **SOLENOID COIL BURNED OUT:** See remedy under "Unit Delivers Wet Air."
3. **IMPROPER OPERATION OF CYCLE TIMER:** See remedy under "Unit Delivers Wet Air."
4. **CHECK VALVE BALLS SEATED IMPROPERLY:** Remove check balls and springs and inspect for excessive wear or damage. Replace if necessary.
5. **PLUGGED AIR PASSAGES:** Check inlet and outlet air passages and piping for blockage.
6. **DESICCANT CONTAMINATION OR ATTRITION:** See remedy under "Unit Delivers Wet Air."

SOLENOID VALVE CHATTER:

1. **SOLENOID VALVE DEFECTIVE:** Replace solenoid valve.

SECTION 6: PUREGAS HEATLESS AIR DRYER

TROUBLESHOOTING

PROBLEM A: EXPECTED OUTLET DEW POINT OR PURITY IS NOT MET

MODEL	POTENTIAL CAUSE	VERIFICATION	CORRECTIVE ACTION	
A1	All	Current operating conditions do not match the unit's specifications	Verify that the actual operating pressure and inlet/outlet flow rates match the specified performance of the unit. Contact the factory if you require sizing data for your model.	Reduce the outlet flow requirements, increase the operating pressure or resize the dryer by increasing the orifice size and/or the size of the desiccant towers.
A2	PHF PCDA PCME PHCA	Sealing surface of solenoid valve core deteriorated, resulting in air leakage	Remove and inspect solenoid valve core by unscrewing valve assembly from bottom of manifold.	Purchase Solenoid Repair Kit from PUREGAS and replace solenoid core and base.
A3	All	Desiccant tower contamination	Check inlet filtration for proper operation and inspect outlet air line for evidence of oil.	Replace or repack desiccant towers. Replace or install proper inlet filtration. See Maintenance section for details.
A4	PHF PCDA PCME PHCA	Desiccant tower attrition	Remove chamber and depress perforated disc at open end of tower.	If perforated disc can be depressed more than 1/4" from the retaining ring, replace or repack desiccant towers.
A5	All	Solenoid coil burned out	Listen for a distinctive "click" when the solenoid is energized.	Contact PUREGAS for a replacement Solenoid Valve Assembly.
A6	All	Inlet air temperature exceeds specified maximum	Inlet air temperature should not exceed maximum for operating conditions (usually 70 °F or 100 °F).	Reduce inlet air temperature or resize dryer.
A7	All	Purge orifice plugged	Remove and inspect purge orifice.	Clean hole of debris using an air gun. Do not force a wire through the critically drilled orifice.
A8	All	Timer defective	Measure the output voltage from the timer, as per the cycle and voltage of your model. See Maintenance section for more information.	Replace timer if defective.
A9	All	Purge flow restricted	Check the mufflers or purge piping for excessive back-pressure.	Replace mufflers or oversize piping for purge (if so equipped).

PROBLEM B: EXCESSIVE PURGE FLOW OR BLOWDOWN

MODEL	POTENTIAL CAUSE	VERIFICATION	CORRECTIVE ACTION	
B1	All	The purge orifice size is larger than what is required for the current operating conditions	Verify that the orifice size corresponds to the actual operating pressure and flow rate. Contact the factory if you require sizing data for your model.	Resize the dryer by replacing the orifice(s) with a smaller size.
B2	PCR PMD TOC	Inlet or outlet shuffle disc not shifting	Verify that the actual operating pressure and inlet/outlet flow rates match the specified performance of the unit. Contact the factory if you require sizing data for your model.	Line pressure too low at inlet: Increase the operating pressure or resize the purge orifice for the new conditions.

SECTION 6: PUREGAS HEATLESS AIR DRYER

TROUBLESHOOTING

PROBLEM B: EXCESSIVE PURGE FLOW OR BLOWDOWN CONT'D

	MODEL	POTENTIAL CAUSE	VERIFICATION	CORRECTIVE ACTION
B3	PCR PMD TOC	Inlet or outlet shuffle disc not shifting	Depressurize the system, remove shuttle valve assembly and check for damage or contamination of inside the valve body.	Replace or clean valve body and disc. Check condition of inlet filtration (A6) and desiccant (A3).
B4	All	Timer not operating properly	Check for incoming voltage fluctuations caused by inductive devices (eg. electric motors) on the same circuit.	Supply line voltage from another source.
B5	All	Timer defective	Measure the output voltage from the timer, as per the cycle and voltage of your model. See Maintenance section for more information.	Replace timer.
B6	All	Air leaks	Remove electrical power from unit while it is pressurized. Check purge ports and joints for significant leaks using soapy water.	Repair as necessary using Teflon tape or thread sealer.
B7	PHF PCDA PCME PHCA	Check valve ball not seated properly	Remove desiccant towers, orifice plugs and inspect condition of check ball and spring for excessive wear or damage.	Replace check ball and spring.

PROBLEM C: EXCESSIVE PRESSURE DROP ACROSS UNIT

	MODEL	POTENTIAL CAUSE	VERIFICATION	CORRECTIVE ACTION
C1	All	Current operating conditions do not match the unit's specifications	Verify that the maximum flow rate for the unit is not being exceeded. Contact the factory if you require sizing data for your model.	Reduce the outlet flow rate.
C2	All	Dirty or obstructed filter element	Check service life indicator on top of filter (if equipped) or inspect filter elements surface for coating of dirt or condensate.	Replace filter element.
C3	All	Desiccant tower contamination	Check inlet filtration for proper operation and inspect outlet air line for evidence of oil.	Replace or repack desiccant towers. Replace or install proper inlet filtration.
C4	All	Plugged air passages	Check inlet and outlet air passages and piping for blockages.	Clear restrictions.
C5	All	Solenoid coil burned out	Listen for proper purge cycle. Once removed from the unit, the magnetic field from coil can also be checked with a screw driver or nail.	Contact PUREGAS for a replacement solenoid valve assembly.
C6	PHF PCDA PCME PHCA	Check valve ball not seated properly	Remove desiccant towers, orifice plugs and inspect condition of check ball and spring for excessive wear or damage.	Replace check ball and spring.
C7	All	Timer defective	Measure the output voltage from the timer, as per the cycle and voltage of your model. See Maintenance section for more information.	Replace timer.

SECTION 6: PUREGAS HEATLESS AIR DRYER

MAINTENANCE

GENERAL INFORMATION

When properly installed and operated, PUREGAS compressed air dryers and adsorbers are designed to deliver years of reliable service without minimal attention. Most recommended maintenance procedures can be easily and quickly performed in the field without the need for specialized tools or skills.

ANNUAL INSPECTION:

Although optional, an annual inspection of the dryer or adsorber is recommended for critical processes to anticipate potential failures. This inspection should include the following checks:

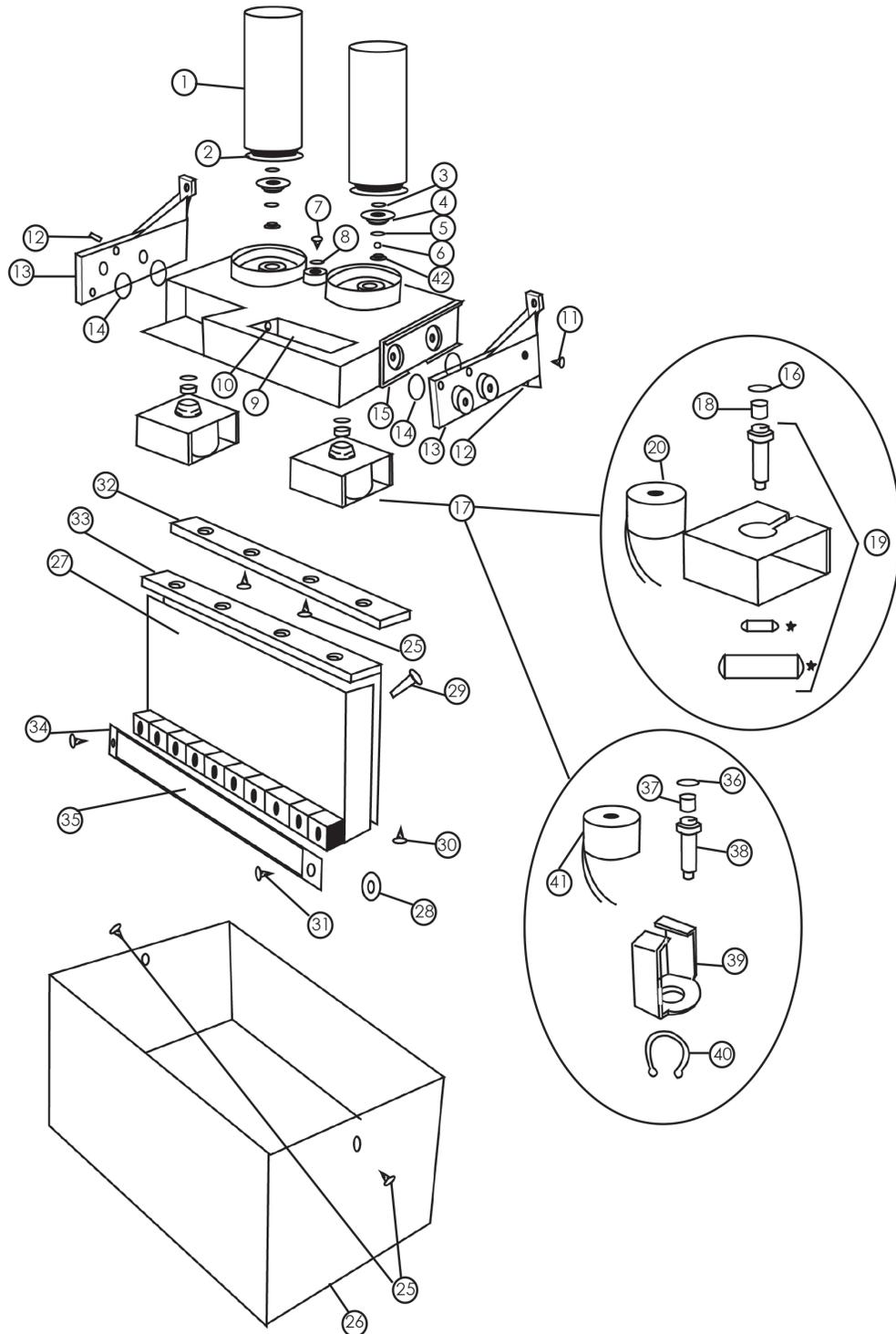
1. **CYCLE TIMER:** Listen for proper desiccant tower cycling. See the “Electrical Connections and Timer” section of this manual for information on the timing cycle of your model.
IMPORTANT: Shut off the air supply and depressurize the system before attempting the following maintenance checks.
2. **DESICCANT TOWERS:** Remove the desiccant towers and visually inspect their inlets for excessive dirt or oil fouling, which would indicate possible contamination of the desiccant chambers. If contaminated, replace the desiccant chambers or return them to PUREGAS (or an authorized distributor) for repacking. Please note that repacking the towers is not available for all products. No attempt should be made to repack the chambers in the field since improper packing can cause channeling of the air stream and lead to reduced performance.

IMPORTANT: Removal and inspection of the desiccant chambers should NOT be necessary for at least 3-5 years, if the system includes properly functioning and maintained inlet particulate and coalescing filters with automatic drains.

3. **SOLENOID VALVES:** For the PHF, PCDA and PCME models only, inspect the sealing surface on the solenoid valve plunger. This requires unscrewing the solenoid valves from the bottom of the manifold. A deteriorated surface will lead to air leakage and reduced performance. If necessary, replace the plunger and base of the solenoid valve assembly by requesting a solenoid valve kit from PUREGAS (or an authorized distributor).
4. **PURGE MUFFLERS:** Remove the mufflers from the solenoid valves and check for excessive drop by blowing through the muffler. The muffler should be replaced if significant back-pressure is sensed.
5. **FILTRATION:** Inlet and outlet filters must be kept clean for efficient filtering. A visible coating of dirt on the element's surface or an excessive pressure drop (greater than 5-6 psig), indicates that replacement is needed. See the “Replacement Parts” section in this manual for information on replacement elements for all current filters. For older filters, please see the “Product Support” section of the PUREGAS website (www.puregas.com) for more information.



PUREGAS HEATLESS AIR DRYER PARTS DIAGRAM



SECTION 6: PUREGAS HEATLESS AIR DRYER PARTS LIST

CODE	A	B	C	D	E	F	G
MODEL	All	HF200A	HF204A	HG300A	HF300B	HF304A	HF304B

ITEM #	PART NUMBER	USED ON DRYER	QTY PER DRYER	PART DESCRIPTION
1	P-22-403-6	A	2	Desiccant Chamber 6" Length (includes Item 2)
	P-200-403-9	A	2	9" Length - Painted
	P-200-403-12	A	2	12" Length - Painted
	P-200-403-20	A	2	20" Length - Painted
2	P-400-312-924	A	2	O-Ring - 1.720 ID x 0.118 W
3	P-400-313-110	A	2	O-Ring - 0.362 ID x 0.103 W
4	P-200-404(-)-*	A	2	Purge Orifice Assy. (includes Items 3 & 5)
5	P-400-312-908	A	2	O-Ring - 0.644 ID x 0.087 W
6	P-400-375	A	2	Ball, Check Valve
7	P-400-307-4	A	1	Plug, Hex
7A	P-200-405	A	1	Moisture Indicator (includes Item 8), Optional
8	P-400-312-904	A	1	O-Ring - 0.351 ID x 0.072 W
9	P-300-737	A	1	Nameplate
10	P-400-322-1	A	2	Drive Screw #4 x 3/6" Type U md. hd., st. st.
11	P-400-361-2	A	6	Screw #10 - 24 x 5/8", Pan. Hd.
12	P-400-320-3	A	2	Pipe Plug, 1/4" - 18 Socket Hd.
13	P-300-497P	A	2	Mounting Bracket - Painted
14	P-400-313-116	A	4	O-Ring - 0.731 ID x 0.103 W
15	P-300-495P	A	1	Air Manifold - Painted
16	P-400-313-018	B, C	2	O-Ring - 0.739 ID x 0.70 W
17	P-400-308-DC1	B, C	2	Solenoid Valve - 53 VDC (120 V, 50/60 Hz Dryers)
	P-400-308-DC2	B, C	2	Solenoid Valve - 106 VDC (120 V, 50/60 Hz Dryers)
	P-400-589-DC1	D, F	2	Solenoid Valve - 53 VDC (120 V, 50/60 Hz Dryers)
	P-400-589-DC2	D, F	2	Solenoid Valve - 106 VDC (120 V, 50/60 Hz Dryers)
	P-400-590-DC1	E, G	2	Solenoid Valve - 53 VDC (120 V, 50/60 Hz Dryers)
	P-400-590-DC2	E, G	2	Solenoid Valve - 106 VDC (120 V, 50/60 Hz Dryers)
R18	P-400-308-12	B, C	2	Core Assembly
19	P-400-308-13	B, C	2	Base Assembly
20	P-400-308-DC11	B, C	2	Coil 53 VDC
	P-400-308-DC12	B, C	2	Coil 106 VDC
25	P-400-361-1	A	4	Screw #6 - 32 x 8/8" Pan. Hd.
26	P-300-505-2P	B, C, D, F	1	Air Manifold Cover - Painted
26A	P-300-640-P	E, G	1	Air Manifold Cover - Painted
27	P-06521-F1	B, D, E	1	Solid State Timer - 120 V, 50/60 Hz
	P-06521-F2	B, D, E	1	Solid State Timer - 240 V, 50/60 Hz
	P-06500-F1	C, F	1	Solid State Timer - 120 V, 50/60 Hz
	P-06500-F2	C, F	1	Solid State Timer - 240 V, 50/60 Hz
	P-06501-F1	G	1	Solid State Timer - 120 V, 50/60 Hz
	P-06501-F2	G	1	Solid State Timer - 240 V, 50/60 Hz
28	H-NK01-OHC-R5	A	2	Nut - Keps 8-32
29	H-SB83-OHC-10	A	2	Screw 8 - 32 x 1" BH
30	H-SB83-0FC-04	A	2	Screw 6 - 32 x 1/4" BH
31	H-SB83-0FC-02	A	2	Screw 6 - 32 x 1/2" BH
32	P-06496	A	1	Plate - Adapter - SS Timer Bracket
33	P-06497	A	1	Bracket - Mtg - SS Timer
34	P-06499	A	1	Cover Terminal
35	P-06498	A	1	Decal - Terminal Cover
36	P-06723	D, E, F, G	2	O-Ring - 0.850 ID x 0.045 W
37	P-400-589-12	D, F	2	Core Assembly
	P-400-590-12	E, G	2	Core Assembly
38	P-400-589-13	D, E, F, G	2	Base Assembly
39	P-400-589-DC14	D, E, F, G	2	Frame
40	P-400-396-1	D, E, F, G	2	Rings - Retaining
41	P-400-589-DC11	D, E, F, G	2	Coil 53 VDC
	P-400-589-DC21	D, E, F, G	2	Coil 106 VDC
42	P-300-507	A	2	Spring - Check Valve (Note: 2)

When ordering parts, always state the dryer model number and serial number.

* Orifice number must be specified. This can be obtained from existing unit or from sizing chart.



SAFETY DATA SHEET FOR OZONE
FORMERLY MSDS

1. PRODUCT IDENTIFICATION

PRODUCT NAME: Ozone

COMMON NAME / SYNONYMS: Triatomic Oxygen, Trioxygen, O3

OZONE GENERATOR MANUFACTURER / SUPPLIER: Ozone Solutions
451 Black Forest Road / Hull, Iowa 51239
712.439.6880 / www.ozonesolutions.com / tinfo@ozonesolutions.com

PRODUCT USE: This SDS is limited to ozone produced in gaseous form on site by an ozone generator, in varying concentrations, in either air or aqueous solutions, for the purposes of odor abatement, oxidation of organic compounds or antimicrobial intervention, in a variety of applications.

2. HAZARD IDENTIFICATION

GHS CLASSIFICATIONS

PHYSICAL	HEALTH	ENVIRONMENTAL
Oxidizing Gas	Skin Irritation - Category 3 Eye Irritation - Category 2B Respiratory System Toxicity - Category 1 (Single & Repeated)	Severe

WHMIS CLASSIFICATIONS (WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM, CANADA): C, D1A, D2A, D2B, F
Source: CCOHS CHEMINFO Record Number 774

3. COMPOSITION

CHEMICAL NAME	Ozone
COMMON NAMES	Triatomic Oxygen, Trioxygen
CHEMICAL FORMULA	O ₃
CAS REGISTRY NUMBER	10028-15-6

4. FIRST AID MEASURES

ROUTE OF ENTRY	SYMPTOMS		FIRST AID
Skin Contact	Yes	Irritation	Rinse with Water
Skin Absorption	No	NA	NA
Eye Contact	Yes	Irritation	Rinse with Water, Remove Contacts
Ingestion	No	NA	NA
Inhalation	Yes	Headache, Cough, Heavy Chest, Shortness of Breath	Remove to Fresh Air, Provide Oxygen Therapy as Needed

For severe cases, or if symptoms don't improve, seek medical help.

5. FIRE FIGHTING MEASURES

Ozone itself is not flammable. As a strong oxidant it may accelerate, even initiate, combustion or cause explosions. Use whatever extinguishing agents are indicated for the burning materials.

6. ACCIDENTAL RELEASE MEASURES

Turn off the ozone generator and ventilate the area. Evacuate until ozone levels subside to a safe level (<0.1 ppm).

7. HANDLING AND STORAGE

Ozone must be contained within ozone-resistant tubing and pipes from the generation point to the application point.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

OSHA PERMISSIBLE EXPOSURE LIMIT	8 hour TWA 0.1 ppm
ANSI / ASTM	8 hour TWA 0.1 ppm, STEL 0.3 ppm
ACGIH	8 hour TWA 0.1 ppm, STEL 0.3 ppm
NIOSH	ELCV 0.1 ppm Light; 0.8 ppm Moderate; 0.5 ppm Heavy; Light, Moderate, Heavy Work TWA <=2 Hours, 0.2 ppm Immediately Dangerous to Life or Health 5.0 ppm

RESPIRATORY PROTECTION: Use full face self-contained breathing apparatus for entering areas with a high concentration of ozone.

ENGINEERING CONTROL: Use ozone destruct unit for off gassing of ozone.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Gas	pH	NA
MOLECULAR WEIGHT	48.0	Decomposition Temperature	NA
APPEARANCE	Clear at Low Concentration, Blue at Higher Concentration	Evaporation Rate	NA
ODOR	Distinct Pungent Odor	Flash Point	NA
ODOR THRESHOLD	0.02 to 0.05 ppm; Exposure Desensitizes	Auto-Ignition Temperature	NA
MELTING POINT	-193 ° C / -315 ° F	Relative Density	NA
BOILING POINT	-112 ° C / -169 ° F	Partition Coefficient	NA
VAPOR PRESSURE	> 1 atm	Flammability	NA
VAPOR DENSITY	1.6 (Air = 1)	Explosive Limits	NA
SOLUBILITY IN WATER	570 mg / L at 20 ° C 100% O3; 0.64 at 0 ° C	Viscosity	NA

10. STABILITY AND REACTIVITY

Ozone is highly unstable and highly reactive. Avoid contact with oxidizable substances. Ozone will readily react and spontaneously decompose under normal ambient temperatures.

11. TOXICOLOGY INFORMATION

ROUTES OF EXPOSURE	Inhalation, Eyes, Skin Exposure
EFFECTS OF ACUTE EXPOSURE	Discomfort; including headache, coughing, dry throat, shortness of breath, pulmonary edema; higher levels of exposure intensify symptoms. Possible irritation of skin and / or eyes.
EFFECTS OF CHRONIC EXPOSURE	Similar to Acute Exposure effects, with possible development of chronic breathing disorders, including asthma.
LC₅₀	Mice 12.6 ppm for 3 hrs / Hamsters 35.5 ppm for 3 hrs
IRRITANCY OF OZONE	Yes
SENSITIZATION TO OZONE	No
CARCINOGENICITY (NTP, IARC, OSHA)	No
REPRODUCTIVE TOXICITY, TERATOGENICITY, MUTAGENICITY	Not Proven
TOXICOLOGICALLY SYNERGISTIC PRODUCTS	Increased susceptibility to allergens, pathogens and irritants

12. ECOLOGICAL INFORMATION

The immediate surrounding area may be adversely affected by an ozone release, particularly plant life. Discharge of ozone in water solution may be harmful to aquatic life. Due to natural decomposition, bioaccumulation will not occur and the area affected will be limited.

13. DISPOSAL CONSIDERATIONS

Off-gassing of ozone should be through an ozone destruct unit which breaks ozone down to oxygen before release into the atmosphere.

14. TRANSPORT INFORMATION

NOT APPLICABLE, as ozone is unstable and either reacts or decomposes and must be generated at the location and time of use.

15. REGULATORY INFORMATION (Source: EPA List of Lists)

SARA TITLE III SECTION 302 EHS TPQ	100 lbs
SARA TITLE III SECTION 304 EHS RQ	100 lbs
SARA TITLE III SECTION 313	> 10,000 lbs used / year

16. OTHER INFORMATION

Half-life of ozone in water at 20 ° C = 20 minutes; in dry still air at 24 ° C = 25 hour; decreases significantly with increase in humidity, presence of contaminants, air movement and / or increase in temperature.

Preparer: Tim McConnel and Stacey Eben, Ozone Solutions 5/1/2012 (layout revision (2/13/2018))

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WARRANTY

Hess Machine International (hereafter known as the Seller) warrants the Hess Machine Ozonator (hereafter known as Equipment) to be free from defects in material and workmanship for one year after the date of delivery, when the Equipment is used in accordance with the Seller's instructions and under normal production conditions. In the event of defects in material or workmanship, Seller's liability and responsibility will be limited, at Seller's option, to repairing or replacing such defective articles at no cost to the Purchaser. Seller shall not be liable to Purchaser for any other damages incurred by Purchaser as a result of such breach or warranty including, without limitation, loss of profits, consequential damages, incidental damages, delay damages, any additional expenses incurred in replacing defective goods or any other special damages. The express warranty provided above is exclusive and is given in lieu of all other warranties, expressed or implied. Seller disclaims any other warranties, express or implied, including a warranty of fitness for particular purpose and warranty of merchantability. Purchaser acknowledges that it is not relying on Seller's skill or judgement to select or furnish goods suitable for any particular purpose. There are no warranties, which extend beyond the description on the face hereof. Purchaser further acknowledges that certain parts of the Equipment must be periodically replaced in the course of routine maintenance as a result of ordinary wear and tear. Purchaser acknowledges and agrees that the need for any such replacement does not constitute a "defect in material or workmanship" as that term is used herein.

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