BRANT STEEL
PRODUCTS LTD.
WELDING AND METAL FABRICATING SPECIALIST

Manufacturers of
fleetline
HOT WATER BOILERS

Family Owned & Operated

FLEETLINE AQUA-MATIC SERIES
HOT WATER BOILER

NATURAL GAS - OIL - PROPANE

INSTALLATION AND SERVICE MANUAL MUST BE LEFT WITH HOME OWNER.

These instructions have been reviewed by ETL.

ITS/ETL Listed and tested to the following standards:
- CSA - B140.7.1-1976, UL-726 (Seventh Edition) - CSA - B140.0M87
- CSA-B212-93, ASHRAE 103-1993/1996
- CGA-4.9-1969, ANSI-Z21.13b-1994
- CGA-P.2-1991, ASHRAE 103-1993/99-01

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To the Consumer

The new Fleetline Aqua-Matic Series Hot Water Boilers were designed to achieve the highest efficiencies possible without condensing. Condensing heating appliances have inherent problems that include higher maintenance and reduced product life span. The new Aqua-Matic series of boilers can utilize fuel oil, natural gas and propane gas for producing efficient residential heating and reduce the production of "Green House Gases." The Aqua-Matic series boilers were designed for easy service access that contributes to longer product life and the maintenance of efficiencies in the 85% plus range. The homeowners' satisfaction is our first concern and we thank you for choosing an efficient Fleetline boiler.

Sincerely,

Mark Offenhammer
President

The Aqua-Matic Series Fleetline Boilers have been tested and certified to conform to the following standards: CGA-4.9-1969, ANSI-Z21.13b-1994, CGA-P.2-1991, ASHRAE 103-1993/1996.

Fuel Oil: CSA B140.7.1 1976, CSA-B140.0M87, UL 726 (seventh edition) CSA-B212-93, ASHRAE 103-1993/1996.

Commitment to Quality

Brant Steel is proud to be able to supply the high quality Fleetline Aqua-Matic Boiler to the North American marketplace. We are confident that the purchase of the Fleetline Home Comfort Package will provide years of efficient, economical, trouble-free operation.

"Quality remains long after the price is forgotten." The Fleetline boiler is a high efficiency residential heating appliance with maximum energy utilization efficiency, without the maintenance and operations problems and high purchase and installation costs of condensing boilers.

Fuel cost savings can only be achieved by matching the Fleetline boiler to the true heat loss of your residence. During the past decades, the trend towards improving wall and ceiling insulation levels and eliminating air infiltration by caulking and weatherstripping, has made most existing heating appliances oversized; some as high as 200%! When you purchase a Fleetline home comfort system your new appliance will be sized on the basis of a new heat loss calculation. This will ensure that your new Fleetline home comfort system will deliver efficient heat to match your actual heating demand.

We want to provide you with maximum comfort levels combined with fuel cost savings.

The following are useful bits of information presented under a series of sub-headings.

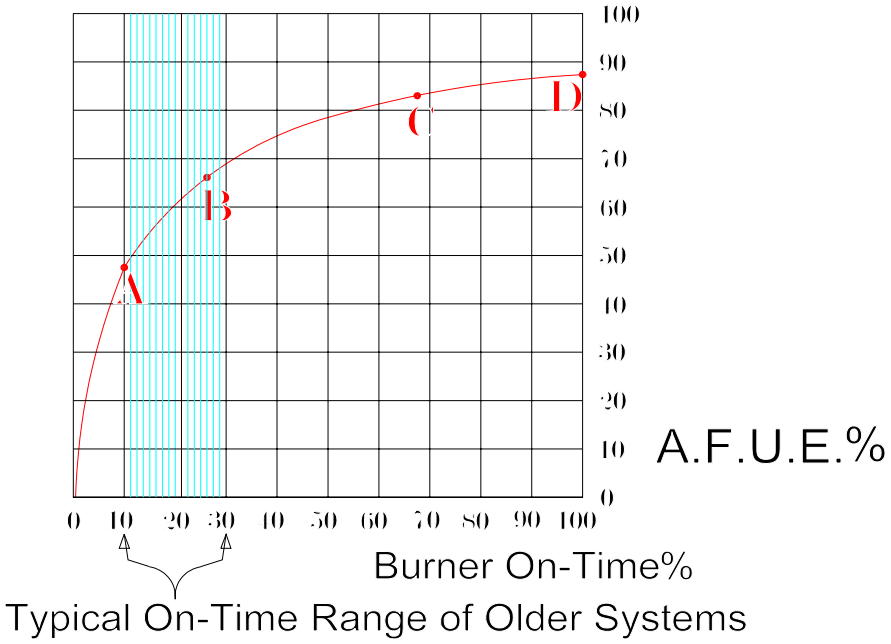
Annual Fuel Utilization Efficiency (A.F.U.E.)

The A.F.U.E. is a measure of the heating appliance's ability to extract heat from oil or gas, determined over a full heating season. The A.F.U.E. increases as the burner on-time increases until it reaches "steady-state efficiency" - ***the efficiency of the appliance measured when the burner is running.*** Any time the burner cycles on and off, the A.F.U.E. drops because of "off-cycle" losses. The A.F.U.E. drops most sharply when the heating plant operates between 10 and 30% burner on time. An increase in the percentage of burner on-time improves the A.F.U.E.

Boiler Sizing

Most existing heating systems are oversized. Reducing the firing rate of the new boiler results in longer burner on-times, increased A.F.U.E. and provides significant savings for the consumer. The improved A.F.U.E. of the Fleetline Boiler is in direct relationship to the changing positions on the "Burner On-Time/A.F.U.E. Curve" shown. Instead of operating between points A and B as in older installed systems, the new Fleetline Boiler will operate between points C and D when it is matched to the heat loss of your home.

BURNER ON-TIME / A F U E CURVE:



Through wall venting

To provide you with a totally efficient, reliable heating system and eliminate off-cycle losses, brick, block or masonry flues can be eliminated and a side wall vent system may be utilized. The Fleetline Aqua-Matic series boiler has been certified for direct vent. Eliminating the barometric damper or draft hood from the installation of *forced draft direct vent systems.* This also allows lower input rates and lower gross stack temperature because of the flue gas dilution before the exhaust is discharged to the outdoors.

Vertical Venting

The Fleetline Aqua-Matic Boiler may be vented up a chimney or other vertical vent as per the installation codes.

The boiler flue connector to the chimney should not exceed a length of 10 feet. Insulated vent connectors should be used to improve the inlet temperature at the base of the vertical vent. No barometric damper or draft hood should be installed in the vent system.

For chimney heights up to 30 feet, a stainless steel insulated liner shall be used. The riser insulation shall be 1" thick and chicken wire wrapped for installation inside the chimney.

A base stainless steel tee shall be installed at the base of the chimney liner and may be installed in the basement if there is sufficient rise from the furnace. The connector pipe shall be connected to the furnace and the tee with standard insulated vent adapters.

Air for Combustion

The Fleetline boiler must have an assured supply of combustion air. A dedicated outside supply of air through an installed duct or pipe should be connected on or near the burner air inlet. The combustion air duct must have direct access to the outdoors and have a rain hood and screen installed at the outside wall. A 1/4 inch x 1/4 inch screen is the appropriate size mesh.

Where the boiler is to be installed within a home where the operation of exhaust fans, attic fans, kitchen ventilation systems, new high efficiency clothes dryer or fireplaces may create severe ***negative*** pressures and unsatisfactory combustion and venting, special provision should be made for additional make-up air to supply the other air requirements.

INSTALLATION INSTRUCTIONS

General Comment

The Fleetline boiler is a quality, efficient oil or gas fired heating appliance, which must be installed and serviced by a trained service technician in accordance with all local codes and building ordinances.

Gas Codes:	Canada - CAN CGA B149 1 & 2
	United States - National Fuel Gas Code ANSI Z233-1
Oil Codes:	Canada - CSA B139
	United States - NFPA-31

Freight Claims

All units should be inspected for damage upon arrival. Concealed damage claims should be filed against the carrier by the consignee. The carrier is responsible for taking prompt action on all damage claims!

Heat Loss Sizing

A complete heat loss calculation of the residence that is receiving the new boiler should be completed. Alternatively, the "K" factor sizing method, which uses past energy consumption based on the efficiency of the old appliance and local weather data, can be undertaken. ***Replacement heating appliance installations should not use the existing appliance exclusively, for determining the size of the new appliance.*** Recent research indicates that existing installed appliances are often over-sized, resulting in excessive energy consumption. The HRAI heat loss calculation method or the international boiler radiation IBR method should be completed on a new home installation.

The boiler should be located on a dry solid non combustible level surface preferably as close to the vent inlet as possible. Vent connector lengths over ten feet do not reflect good installation practice. It is good practice to raise the boiler 24" to 36" above the finished floor to facilitate ease of service and shorten piping requirements.

Clearances for Service and Combustible Materials

Service access to the boiler must be adequate. The easier the service access, the higher the quality of service the unit will receive. Service clearances should be a minimum of 24 in. from the front, 24 in. from the rear and one side and, 6" in. from the other side.

The minimum installation clearances to combustible materials are:
18 in. from rear; 8 in. from front and one side; 2 in. from other side; and 1 in. from vent connector if it is insulated. *Remember if you do not leave adequate room for service it is very difficult to maintain the boiler in an efficient manner.*

Draft Regulator/Draft Hood

The Fleetline boiler is installed without a barometric draft regulator or draft hood as the boiler is equipped with a burner capable of operating against a positive over-fire pressure.

Vent System Draft

The installation of a Shirvent MVP 100 will ensure that you will have sufficient draft for safe and proper operation of the Fleetline Boiler.

Combustion Air Supply Sizing for High Efficiency Boiler with No Barometric Damper or Draft Hood

10.16 cm	80,000 BTUH to 100,000 BTUH	4" diameter
12.7 cm	100,000 BTUH to 150,000 BTUH	5" diameter
15.2 cm	150,000 BTUH to 190,000 BTUH	6" diameter

The air intake pipe must be capable of withstanding damage and kinking. Double wall aluminum flex supported and with long radius bends is recommended. The maximum length of pipe should be 25 ft (7.6) meters where outdoor air temperatures may be severe below 0^0F (-17.7°C) then it may be necessary to insulate the combustion air supply duct to retard the condensation on the outside of the pipe that may drip on to the floor or the boiler.

SPECIAL NOTE: This boiler is approved for use with propane, No. 2 fuel oil, and natural gas. Never us gasoline or crankcase oil, which may contain gasoline, as fuel for the heating appliance.

Never attempt to burn garbage or paper in the heating unit and remove paper and rags from around the unit. For your safety, do not store or use gasoline or other flammable vapour or liquids in the vicinity of this or any other heating appliance.

Circulation System

Before connecting the new boiler to an existing steel piping system that is over 40 years old, the system should be flushed to prevent scale/sludge from returning to the boiler. If the present system is being converted from a gravity open system, this is a must item. If a high pressure test of the existing hydronic system is necessary, the boiler itself must not be exposed to the pressure test. Isolate the boiler during the test.

Piping

The Fleetline Aqua-Matic Series is a low mass boiler and care should be taken to ensure that a high volume of water shall not be allowed to flood the boiler from a high volume standing cast iron system. The high volumetric flow will cause combustion problems from cool surface flame impingement.

Boiler Replacement and Service Caution to Ensure Performance

The replacement of old large cast iron boilers and large steel boilers with new modern compact efficient boilers (sometimes called low mass) can cause problems from excessive corrosion being produced with low operating water temperatures. Combustion by-products in fuels produce acidic sulphur oxides which corrode cast iron and steel surfaces, when the oxides condense in a water solution on the boiler surfaces. The water dew point on the inside surfaces of a boiler is 120°F (49°C) for fuel oil burning and 140°F (60°C) for natural gas. The amount of acid compound in the combustion process is dictated by the fuel. However, the presence of chlorides in the combustion air greatly increases the rate for the production of mild acid compounds that are very active on cast iron and steel surfaces.

The safest operating temperature range for modern boilers, proven conclusively by tests, is 160°F (71°C) to 210°F (99°C). Allowing the boiler water temperature to drop below 160°F (71°C) is asking for increased rates of corrosion due to the acid becoming more corrosive due to dilution with water condensate. The production of corrosion from cold flame temperatures can lead to rapid water condensate. The rapid production of corrosion from cold flame temperatures can lead to severe boiler plugging and then to premature boiler failure.

The following step-by-step procedure should be followed for connecting your new Fleetline boiler to an existing circulation system:

1. Connect the boiler return and supply pipes to the main circulating system as selected. Install a manual shut-off valve on both the return line and supply line and on the boiler by-pass loop. The by-pass loop is a must on all standing cast iron radiation systems. This eliminates flooding (cold return) on a low mass boiler and gravity flow during off cycles.

2. A.S.M.E. Boiler Code requires feed or make-up water to be introduced to the piping system and not directly to the boiler. Pressure reducing valves should be installed and adjusted to 15 psi cold water.

3. Maximum operating water temperature 210°F (99°C).
   Maximum operating water pressure 15 psi.

4. Pressure relief valve must be piped from the boiler and downward to within 6 in. of the floor to avoid the potential for accidental face and body injuries.

5. An expansion tank, circulating pump and automatic bleeds must be part of the system.

6. See typical piping diagrams in the appendix.

7. If the expansion tank is an extrol or bladder tank the pressure should be set between 10 psi to 15 psi in accordance with the height of the system above the boiler (ie.) two storey cast iron standing system is normally 15 feet. Two storey baseboard fin convector is normally 12 feet above the boiler.

Wiring

All external wiring must conform to existing electrical codes laid down by the authorities having jurisdiction. In the United States these are the B.O.C.A. Codes 2001.3 and 2001.2.3. In Canada, they are the C.S.A. standard C22-1 and the Canadian Electrical Code.

1. Field connections should be protected with a 15 amp rated fusetron.

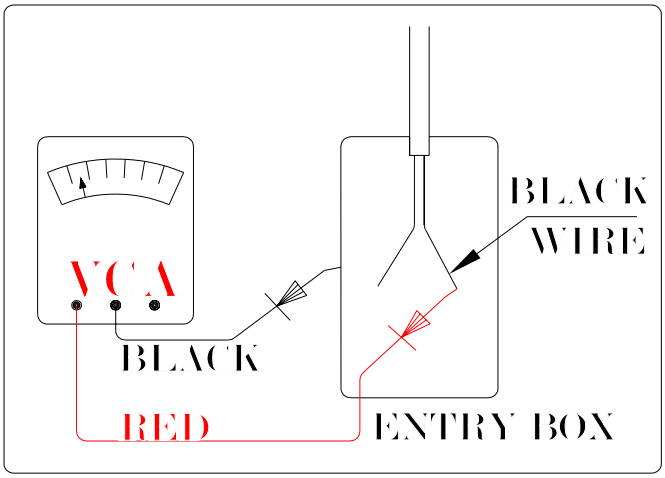
2. Install a separate fused disconnect switch as required so power can be shut off for servicing.

3. Ground the boiler to the water piping, unless the water supply is plastic.

4. Install the room thermostat or relocate the room thermostat away from cold drafts, air currents, lamps, televisions or sunlight. Set the heat anticipator on the thermostat at 0.2 amps, if applicable, or to match the operating control. Connect the thermostat leads to the circulation pump operating control or aquastat as applicable. See wiring diagrams.

Checking for Polarity

The burners used on the Fleetline boilers have solid state control systems. This means that they are sensitive to the proper connection of the hot and neutral power lines. The controls will be damaged if the two lines are reversed.
Do Not Depend on the wiring at the boiler being properly colour coded.



1. Set your volt meter to line voltage.
2. Place one prong on your grounded electric entry box and one prong on the black wire.
3. Read the voltage.
4. If the voltage is zero, check the white. If line voltage shows, reverse the 115 volt leads entering the boiler junction box

If a meter is not available, a tattle light can be used.

Gas Piping

1. Connect gas piping according to ANSI Z223.1 or CAN GGA-B149 and all local codes that are in place.

2. The burner and its individual shut off valves must be disconnected from the gas supply piping system during any pressure testing of that system in excess of 1/2 inch PSIG (3.45 KPA).

3. A gas boiler for installation in a residential garage must be installed so the burner and the ignition source are located not less than 18 inches (45.7 cm) above the finished floor. The boiler must be located or protected to avoid physical damage from vehicles (ie) raise boiler 48 inches (122 cm) above floor when the potential for damage is severe.

4. The gas supply pressure as shown on the rating plate should be between 5 IN WC. and 9 IN WC. for natural gas and 11 IN WC. for propane gas.

5. A 1/8" N.P.T plugged tapping accessible for a test gauge connection is located on the manual gas shut off valve.

   The supply pressure should not be allowed to vary as this will effect the input to the boiler burner.

   For installations above 2000 feet (610M) pressure adjustment or orifice change may be required. Check with gas supplier as to BTU content of gas supplied at altitude.

Fuel Oil Supply System

Obtaining optimum performance from your new Fleetline boiler requires that the fuel supply system is in good working order.

1. An old (i.e. in excess of 15 years) fuel supply line should be replaced with new copper tubing. This will ensure a clean fuel supply.

2. Fuel supply lines must be absolutely airtight. Use only flared fittings and oil resistant pipe dope on all threaded tank connections. Check all joints and threaded fittings for leaks. Use a vacuum gauge to proof the installation.

3. Leave the existing felt filter, normally found at the tank, in place. Double filtrations is an added benefit. Fit the fuel suction line with a high quality paper throwaway cartridge type strainer; 5 micron to 10 micron maximum rating. The paper filter cartridge should be mounted on the casing of the boiler. This allows a flexible fuel line to be connected with adequate slack for easy removal of the oil burner without disconnecting the fuel lines.

4. Install disc type valve in the suction line of a two pipe fuel system.

5. A shut-off gate valve must be installed in the fuel supply line located at or near the oil storage tank in compliance with local codes. The shut-off valve, spindle packing should be checked for tightness to eliminate potential air leaks into the fuel delivery system. ***Always keep the valve shut off if the burner is shut down for an extended period of time. Tag burner to indicate fuel supply is closed and remove fuse from electrical circuit to eliminate improper operation due to lack of fuel.***

6. A return fuel line must be used on an installation where the fuel level of the tank is always below the level of a burner. The return line must be equal to the suction line. The minimum size oil line should be 3/8 in. copper tubing. For runs up to 25 feet (7.6M) 1/2" for runs over this length.

7. Use fuel storage tanks bearing the label of Underwriters Laboratories and Accessories prescribed by local codes.

The preceding covers the basic installation of the new Fleetline Aqua-Matic series oil and gas boilers. Basic wiring and piping arrangements are in the Appendix for your individual installation requirements. Burner installation and set up instructions are in burner manuals for the set up of the burner of your choice.

The Appendix also includes the basic rating charts for the boiler both oil and gas and the commission procedure.

Check the Ceramic Combustion Chamber

The combustion chamber has been factory installed. Before installing the burner, check the chamber for damage. The position is 2 3/4" from the mounting plate to the front edge of the combustion chamber. This measurement is important. It allows the combustion head of the burner to be protected from high temperatures. (Refer to burner manual for insertion length)

WARNING: DO NOT TURN ON THE BURNER UNTIL YOU HAVE CHECKED THE POLARITY.

Combustion Chamber Curing

Some moisture and binders remain in the ceramic combustion chambers after fabrication. It is important to clear the chamber of these residues before testing. If you smoke test before curing -the instrument will fill with condensate and require complete servicing. To cure the chamber run the unit for 3 consecutive 3 minute cycles using the post purge as the "off-time". The exhaust will have a pungent odour and produce a white cloud of steam.

Testing the Unit

To provide a high level of customer comfort and unit operating efficiency, each unit must be tested after the installation has been completed.

Required Test Equipment

- $C0_2$ analyser or 0_2 analyser with Co capability
- Draft Gauge (Manometer)
- Fuel Pressure Gauge (oil)
- Smoke Tester (oil)
- Stack Thermometer
- Thermometer for domestic water test
- Volt Meter or Tattlelite

Carbon Dioxide or 0_2 Test

During every new start-up and after every burner service call, a $C0_2$ or 0_2 test should be taken. All of our testing including the approval testing yielded $C0_2$ levels between 13% and 14.5% for oil and 9.5% - 11% for gas.

A Smoke Test is also necessary. For oil the acceptable reading is zero to a slight trace.

All tests should be performed after the burner has been operating for 10 minutes or the boiler water and the piping system is up to temperature.

The $C0_2$ or 0_2 level can be adjusted upward by closing the air shutter, to obtain the higher levels of $C0_2$ recommended. The position of the turbulators on the assembly is very important and should be checked to ensure accuracy of set-up. See charts in Appendix for all set up guidelines on the Fleetline Boilers.

Pump Pressure (Oil)

All burners will be shipped with the pump pressure set at 160 p.s.i.g. It is good practice to check this setting at the time of installation.

WARNING: The Riello oil pump does not have standard pipe threads on the oil gauge port. Use the adapter supplied with the unit. Using standard fittings will result in oil leaks that cannot be repaired. Riello have an excellent pressure gauge available, compatible with their burner.

FLEETLINE AQUA-MATIC BOILER

COMMISSION PROCEDURE

Before the contractor installing the boiler leaves the installation location the contractor should complete this commission check list to verify the work is completed and the necessity for call backs will be eliminated.

1. ____ Is the system filled with water?
2. ____ Is the air purged from the system?
3. ____ Are the automatic air vent caps open?
4. ____ Have the oil burner supply lines been checked for leaks?
5. ____ Has the gas line been pressure tested and tagged?
6. ____ Has the burner (oil or gas) been tested with final tests using combustion test instruments.
7. ____ Have all safety and operating controls been cycled to verify operation and then set at normal operating temperatures?
8. ____ Has the anti scald valve been temperature tested to confirm maximum supply water temperature at 130^0F.
9. ____ Verify no system leaks when unit is operating at selected temperature.
10. ____ When the boiler is connected to free standing cast iron radiation, finned base board convectors or in floor multi-zone systems, ensure boiler is bypassed and a system circulating pump, plus expansion tank is installed.
11. ____ Proof operating controls, return all settings to normal after proofing controls.
12. ____ Open feed water valve to set operating system pressure at 12 psi, drain if above, when unit is at full operating temperatures.

Customer: Name_____

Address (Street)_____

Town or City_____ Postal Code _____

Installation Date Completed_____

Commission Test Completed _____

Heating Contractor Name_____

Address_____

Telephone _____

Technician's Signature_____

License Number_____

Leave with customer including installation manual. Verify commission steps with home owner before leaving job site.

FLEETLINE

AQUA-MATIC BOILER

Thank you for selecting a Fleetline Aqua-Matic Boiler for heating and domestic hot water requirements. We are proud to introduce this new state of the art product to the market place. We have combined existing proven components with a control package that will produce for you efficiency and total heating comfort. This match will provide many years of trouble free performance.

HOMEOWNER'S OPERATING TIPS

Have your Fleetline boiler serviced and checked by a licensed and trained heating professional annually to maintain efficiency.
Your Fleetline Aqua-Matic Boiler is supplied with either a power gas burner or a power oil burner.

For your safety do not store combustibles, or flammable materials near your Fleetline Aqua-Matic Boiler.

Do you have sufficient combustion air?

An assured supply of combustion air is required for safe efficient combustion. A direct combustion air connection to your burner is the best solution.

IF THE BURNER FAILS TO OPERATE

First check the following:
1. Check your thermostat; turn it up well above your normal room temperature settings.
2. Check your master on/off switch, is it on?
3. Check your electrical service panel for blown fuses or tripped breakers.
4. If you have fuel oil check your supply of fuel.

If the burner has shut down on safety the burner reset button will flash red on your burner. Press the reset button once only. If you do not obtain a restart call for service.

If your gas burner has locked out turn the power off on the control box, allow 30 seconds to elapse, and then turn on. If the burner fails to start call for service.

For Service, Call:_____

Phone:_____

FLEETLINE AQUA-MATIC SERIES
BOILER RATINGS

FUEL OIL

Burner Model	Nozzle *	Pump Pressure PSI	(F) Input (BTUH)	(G) Air Setting	End Cone	Turbulator Setting	Co_2	(H) Gross Stack 0°F	0°C	(K) EFF. SS.
Beckett	.65 60°	160	100,028	33	F0	-	12.7	300	148.0	88
AFG	.75 60°	160	120,034	37	F0	-	13.6	333	167.2	88
	.85 60°	160	140,890	45	F3	-	13.6	352	177.0	87
	1.10 60°	160	183,386	85	F6	-	13.6	400	204.4	85
Carlin	.65 60°	160	105,169	.70	-	.75	13.1	305	151.6	89
EZ1	.75 60°	160	121,134	.75	-	.75	13.2	333	167.2	87
	.85 60°	160	141,874	1.00	-	1.00	13.5	378	192.2	86
	1.10 60°	160	182,830	1.25	-	1.10	13.7	372	188.8	86
Riello	.65 60°	160	101,280	2.5	-	0	14.1	286	141.1	89
BF5	.75 60°	160	120,264	3.1	-	0	13.7	299	148.3	88
	.85 60°	160	132,816	3.5	-	2.	13.3	335	168.3	86
	1.10 60°	160	177,829	7	-	3.5	12.8	373	189.4	86

NOTES:

* Brass nozzles lowest temperature during long firing tests. Nozzles - Delevan W - Danfoss B - Hago B - Monarch R

F. Test fuel 34.70 API gravity
Input varies due to nozzle and end cone temperatures during tests

G. All air gate settings with outdoor air intake connection in place

H. All tests conducted with boiler supply water at 180°F (82.20°C)

K. For field set up maximum Co_2 13.5% 0_2 2.6% 0 smoke

FLEETLINE AQUA-MATIC SERIES
BOILER RATINGS

NATURAL GAS **PROPANE**

Burner	Type of Gas	Manifold IN.WC.	Orifice	Turbulator	Air Gate	Input BTUH
Carlin	N	3.5	20	-	3/4	70,000
G3B	N	3.5	14	-	1 1/2	100,000
	N	3.5	7	-	2 1/4	120,000
	N	3.5	3	-	3	150,000
	P	3.5	30	-	3/4	70,000
	P	3.5	25	-	1 1/2	100,000
	P	3.5	20	-	2 1/4	120,000
	P	3.5	16	-	3	150,000
Riello 40	N	0.70	-	0	1.40	70,000
	N	0.85	-	1	1.75	100,000
	N	0.91	-	2	1.80	120,000
	N	1.20	-	2	2.25	150,000
	P	0.90	-	0	1.60	70,000
	P	1.16	-	0	1.75	100,000
	P	1.38	-	2	2.30	125,000
	P	1.85	-	2	2.50	150,000

Test Set Up Natural Co_2 10.8% Co Ø
Propane Co_2 13.8% Co Ø
All tests completed at 180°F (82.2°C) water temp.

APPENDIX

SERVICING THE FLEETLINE AQUA-MATIC BOILER

To only be done by licensed, trained & experienced heating contractors.

The Fleetline boiler should be cleaned and serviced on an annual basis, by a licensed & trained heating professional, with special care taken to ensure the vent system is air tight and not allowing combustion products to enter the residence.

Boiler Heat Exchanger

Clean and vacuum all heating surfaces and flue collector box. Check boiler surfaces for corrosion to ensure the surface temperatures are above condensation temperatures. If surface corrosion is noted balance boiler water flow to maintain temperatures above 160°F (71°C) minimum.

Burner

Check and clean the entire assembly. The electrode settings should be confirmed as on specification.

Check gas valve confirm pressure 3.5" wc.
Check pump pressure 160 psi minimum sitting on the oil burner.
Check limit control for boiler safety.

Complete combustion efficiency tests with accurate test equipment. For oil the smoke test should be completed twice-one minute after start up (cold surface smoke) and after 10 minutes minimum run or boiler water temperature is above 160°F (71°C).

Circulator

Oil motor if required. Test circulator for adequate flow. Allow boiler to operate till limit is achieved with circulator off. Start circulator and the supply pipe above the flow control valve should change temperature instantaneously. When the impeller is not providing adequate flow, the flow control valve cannot be forced open to a maximum flow position. If the system has zone controls open one zone to confirm pump capacity.

The pipe valves and circulation system should be inspected for leaks. The expansion tank should be tested and the terminal units should be bled and tested for air.

TROUBLESHOOTING GUIDE

When burner is locked out on safety - trouble light on, ***press the reset button once only.*** Then call your authorized service source. **See burner manual for more troubleshooting guides.**

TROUBLE: BURNER DOES NOT START

SOURCE	PROCEDURE	CAUSES	REMEDY
Thermostat	Check thermostat settings.	Thermostat set too low.	Turn thermostat up.
	Jump TT terminal on operating control. If burner starts, fault is thermostat circuit.	Open thermostat wires.	Repair or replace wires.
		Loose thermostat connectors.	Tighten connection.

TROUBLE: BURNER DOES NOT START, CONT'D...

SOURCE	PROCEDURE	CAUSES	REMEDY
Thermostat		Faulty thermostat.	Replace thermostat.
		Thermostat not level.	Level thermostat.
		Dirty thermostat contacts.	Clean contacts.
Power	Check boiler disconnect switch and main disconnect switch	Switch open.	Close switch.
		Tripped breaker or blown fuse.	Reset breaker or replace fuse.
Operating Control	Check for line voltage between the black and white leads. No voltage indicates no power to the control.	Limit control switch open. Open circuit between limit control and disconnect switch. Limit line voltage or power failure.	Check limit setting (210). Jump terminals - if burner starts replace control. Repair circuit. Call utility company.
Burner	See burner service manual.		

OIL TROUBLE: BURNER STARTS BUT DOES NOT ESTABLISH FLAME

SOURCE	PROCEDURE	CAUSES	REMEDY
Oil Supply	Check tank for oil.	Empty tank.	Fill tank.
	Check for water in oil tank using a dip stick coated with litmus paste.	Water in oil tank.	Strip tank of water exceeding 2 in. in depth.
	Listen for pump whine.	Fuel supply valve closed.	Open valve.
Oil Line and Filter	Open pump bleed port and start burner. Milky oil or no oil indicates loss of prime. Listen for pump whine.	Air leak in fuel system.	Repair leak-use only flared fittings. Do not use Teflon tape on oil fittings. Replace filter cartridge. Clean strainer. Repair oil line.
		Oil filter plugged.	
		Plugged pump strainer.	
		Restriction in oil line.	
Oil Pump	Install pressure gauge in port of fuel pump. Pressure should be 160 psi minimum.	Pump discharge pressure set too low.	Set pressure at 160 psi minimum.

TROUBLE: BURNER STARTS BUT DOES NOT ESTABLISH FLAME

SOURCE	PROCEDURE	CAUSES	REMEDY
Nozzle	Inspect nozzle for plugged orifice and distributor slots and specifications.	Plugged orifice or distributor.	Replace nozzle with nozzle specified.
		Plugged nozzle strainer.	
		Poor spray pattern.	

TROUBLE: BURNER STARTS BUT DOES NOT ESTABLISH FLAME, CONT'D...

SOURCE	PROCEDURE	CAUSES	REMEDY
Nozzle	Inspect nozzle for correct size and specifications.	Incorrect nozzle installed.	Install correct nozzle.
Combustion Air Adjustments	Check air gate. Check turbulator setting.	Air gate open too far. Turbulator open too far.	Decrease air gate setting. Decrease turbulator opening.

TROUBLE: BURNER FIRES BUT FAILS ON SAFETY

SOURCE	PROCEDURE	CAUSES	REMEDY
Poor Fire	Inspect flame for shape, uniformity of color and stability.	Unbalanced fire. Excessive draft. Insufficient draft. Too little combustion air.	Replace nozzle with specified nozzle. Reduce draft setting. Increase draft. Increase combustion air.
Heat Exchanger	Read draft over the fire with a long probe inserted through the inspection port. Should not exceed +0.03 in. W.C.	Plugged heat exchanger or plugged chimney.	Clean out heat exchanger. Repair and have chimney relined.

TROUBLE: BURNER FIRES, BUT THEN LOSES FLAME

SOURCE	PROCEDURE	CAUSES	REMEDY
Poor Fire	Inspect flame for stability and color.	Unbalanced fire. Excessive draft over 0.15 in. W.C. Too little combustion air.	Replace nozzle with specified nozzle. Reduce draft setting. Increase combustion air.
Oil Supply	If burner loses flame prior to the burner locking out, fault is in fuel system.	Air leak in fuel system. Water in oil tank. Fuel supply valve closed. Restriction in oil line. Plugged fuel filter. Plugged pump strainer.	Repair leak-use only flared fittings. Strip tank of water exceeding 2 in. in depth. Open valve. Clear oil line restriction. Replace filter cartridge. Clean strainer.
	Cold oil. Outside storage	Unheated boiler area.	Discuss with oil supplier.
Combustion Air	Reduce combustion air supply. Install pressure gauge in gauge port of fuel pump. Pressure should be 160 psi minimum.	Too much combustion air. Pump discharge pressure incorrectly set.	Close air gate and turbulator to raise CO_2. Set pressure at 160 psi minimum.

TROUBLE: BURNER FIRES, BUT THEN LOSES FLAME, CONT'D...

SOURCE	PROCEDURE	CAUSES	REMEDY
Excessive Draft	Take a draft reading. Draft should be 0.15 in. W.C. max.	Incorrect draft setting.	Reduce draft setting. Install draft regulator if necessary.
Poor Flue Gas	Insert test probe into heat exchanger tube. If reading is greater by 1/2% or more, sample was being diluted near flue box.	Leak in flue system.	Sample gas in boiler shell. Seal flue system leak.
Nozzle	Inspect nozzle for plugged orifice and distributor slots.	Plugged orifice or distributor. Plugged nozzle strainer. Poor spray pattern.	Replace nozzle with specified nozzle. Install 5 micron paper filter to protect burner.

TROUBLE: BURNER FIRES BUT PULSATES

SOURCE	PROCEDURE	CAUSES	REMEDY
Draft	Take a draft reading. Draft should be 0 or -0.01 in. W.C. minimum.	Down drafts. Insufficient draft. Excessive draft -0.15 in. W.C.	Install aerocowl vent cap. Increase draft setting or resize vent system. Reduce draft, install draft regulator if necessary.
Combustion Air	Inspect installation for combustion air provisions.	Improper installation.	Provide opening that freely communicate with outside.
Oil Supply	Bleed pump; inspect for air leaks or water contamination.	Air leak in fuel system. Water in oil tank.	Repair leak-use only flared fittings. Strip tank of water exceed 2 in. in depth.
Pump	Install pressure gauge in gauge port of fuel pump. Pressure should be 160 psi minimum.	Pump discharge pressure incorrectly set.	Set pressure at 160 psi.
Nozzle	Inspect nozzle for plugged orifice and distributor slots.	Plugged orifice or distributor. Plugged nozzle strainer. Poor spray pattern.	Replace nozzle with nozzle specified on burner housing. Install 5 micron paper filter to protect burner.
Heat Exchanger Restriction	Read draft over the fire with a long probe inserted through the sight door. Should not exceed +0.03 in. W.C.	Plugged heat exchanger.	Clean out heat exchanger.

TROUBLE: INSUFFICIENT HEAT

SOURCE	PROCEDURE	CAUSES	REMEDY
Circulator	Check if circulator is operational.	Coupling worn or broken.	Replace coupling.
		Circulator binding.	Replace circulator.
		Circulator motor burned out.	Replace circulator motor.
		Impeller worn.	Replace circulator.
		Wiring from operating control defective.	Repair wiring.
		Operating control defective.	Repair or replace operating control.
	Check if circulator is correct size.	Circulator too small.	Replace with proper circulator.
	Check if circulator is up to speed; check if voltage to circulator is sufficient.	Circulator defective.	Repair circulator.
		Insufficient voltage.	Call utility company.
Thermostat	Check thermostat settings.	Settings too low.	Increase setting.
	Check thermostat location.	Wrong location due to heat build-up.	Move thermostat to a better location.
	Check thermostat calibration.	Out of calibration.	Recalibrate.
Flow Valve	Check flow valve for sticking in partially closed position.	Flow valve not operating fully.	Clean or replace flow valve.
Radiation	Check for air in terminal units.	Terminal units airbound.	Bleed terminal units.
	Check to see if radiators are sized properly.	Terminal units inadequate.	Install adequate radiation.
Boiler	Determine structure heat load.	Boiler too small.	Additional heating capacity required.
Piping	Check to see if piping is sized properly.	Piping inadequate.	Install adequate piping.
Heat Exchanger	Check heat exchanger for soot or scale accumulation.	Insufficient heat transfer.	Clean heat exchanger.
Burner	Check gas pressure.	Insufficient valve pressure.	Replace gas valve.
	Check pump pressure with pressure gauge.	Insufficient pump pressure.	Increase pressure to 160 psi. minimum.
Nozzle	Check nozzle for size and spray angle.	Wrong nozzle installed.	Install specified nozzle.
	Check nozzle for plugged orifice, scored surface.	Nozzle underfiring.	Replace nozzle.

TROUBLE: TOO MUCH HEAT

SOURCE	PROCEDURE	CAUSES	REMEDY
Circulator	Check to see if operating control is working properly.	Circulator does not stop running.	Repair operating control.
Thermostat	Check thermostat settings and calibration.	Thermostat set too high. Thermostat defective. Thermostat out of calibration.	Reset thermostat. Replace thermostat. Recalibrate.
Flow Valve	Check to see if flow valve is operating properly.	Flow valve dirty and stuck. Flow valve defective.	Clean flow valve. Replace flow valve.

TROUBLE: INSUFFICIENT DOMESTIC HOT WATER

SOURCE	PROCEDURE	CAUSES	REMEDY
Storage Tank	Analyze capacity vs. usage.	Insufficient coil exchanger capacity.	Clean and repair coil.
Operating Control	Check operating control setting.	Setting too low.	Set operating control to 180°F (82°C).
Heat	Inspect coils for fouled surfaces and/or flow restrictions.	Flow restrictions. Fouled surfaces on heat exchanger.	Remove restriction. Clean heat exchanger surfaces.

TROUBLE: HIGH NET STACK TEMPERATURES

SOURCE	PROCEDURE	CAUSES	REMEDY
Nozzle	Check pump pressure with pump gauge.	Nozzle overfiring due to high pump pressure.	Reduce pump pressure to 160 psi minimum.
Heat	Check boiler surfaces for soot or scale fouling.	Boiler exchanger fouled.	Clean boiler exchanger.

AQUA-MATIC BOILER

VENT INSTALLATION INSTRUCTION

DVK 3" O

Only approved venting components shall be used. The maximum length of vent connector flex double walled pipe is 6.1 m (20.0 ft). The combustion air supply 10.16 cm. (4") should not exceed 7.62M (25.0 ft.)

The vent connector must be one continuous piece from the appliance vent connector to the terminal vent connector.

The insulated vent connector is listed for 1-0" clearance to combustibles after 91.4 cm (36") from the appliance vent connector to the terminal connector. The terminal is co-axial and requires zero clearance to combustibles as the flex is insulated.

After selecting a suitable location for the vent terminal, use a $9^3/4'$ *hole* saw to create *the opening. The wall* thickness required for the terminal is a minimum of 4" and a maximum of 10". The terminal plate without the clamp is then slid over the terminal. The position of this plate is fixed by a stop on the terminal. The terminal can then be placed in the opening. Use suitable caulking to seal the opening and fasten the plate to the structure with stainless steel screws. The interior side of the terminal must be supported no less than 6 inches from the exterior terminal plate. Use the terminal plate with the clamp to mount the terminal to this support. Fasten the plate to the structure with screws and tighten the clamp.

One end of the flex vent is then screwed to one vent adapter using GE 106, Dow Corning 736 Heat Resistant Sealant or Permatex 26B High Temp. RTV Silicone Gasket. Note that this is a multi-start, left hand thread, with one thread twice the width of the others. Therefore, care must be taken to ensure that the correct threads are engaged before tightening in a counter clockwise direction. The gear clamp can then be tightened. Be careful not to over tighten causing the vent to collapse. The vent can then be cut to length using a hacksaw. Ensure that there is enough length to form large radius bends no smaller than 1 ft. (0.3m) in radius.

The other vent adapter is then installed using the same method. Tighten gear clamps.

The combustion air intake connection 4" 0 should be brought to the cabinet of the Aqua-Matic Boiler and connected to the intake port on the burner air box. Remember to complete your tests after installation.

Fuel Oil

The installation must conform to the CSA B 139 code in Canada and the NFPA code in the United States. Local codes may take precedent.

Placement of the vent must ensure that it shall not terminate:

a) directly above a paved sidewalk or a paved driveway that is located between two buildings and that serves both buildings;

b) less than 7 ft. (2.13m) above any paved sidewalk or any paved driveway;

c) within 6 ft. (1.8m) of a window, door, or mechanical air supply inlet to any building including sofit openings;

d) above a gas meter/regulator assembly within 3 ft. (0.9m) horizontally of the vertical centerline of the regulator;

e) within 6 ft. (1.8m) of any gas service regulator vent outlet or within 3 ft. (0.9m) of a fill tank vent or an oil tank inlet;

f) less than 1 ft. (0.3m) above grade level;

g) within 3 fit. (0.9m) of the combustion air inlet to the direct vented appliance or within 6 ft. (1.8m) of the combustion air inlet for any other appliance;

h) within 6 ft. (1.8m) of the property line;

i) underneath a veranda porch or deck;

j) so that the flue gasses are directed at combustible material or any opening of surrounding buildings that are within 8 ft. (1.8m);

k) less than 3 ft. (1 m) from an inside corner or an L-shaped structure;

l) so that the bottom of the vent termination opening is less than 1 ft. (0.3m) above any surface that may support snow, ice or debris;

m) so that the flue gasses are directed towards brickwork, siding, or other construction in such a manner that may cause damage from heat or condensation from the flue gasses.

Natural Gas

The installation must conform to the B 149.1-00

Direct vent appliances

The terminal shall be located in accordance with the requirements of Clause 7.14.8.

7.14.8

*A **vent*** shall not terminate:

(a) directly above a paved sidewalk or paved driveway that is located between two single-family dwellings and serves both dwellings;

(b) less than 7 ft. (2.1m) above a paved sidewalk or a paved driveway that is located on public property;

(c) within 6 *ft.* (1.8m) of a mechanical ***air supply*** inlet to *any* ***building;***

(d) above a meter/regulator assembly within 3 *ft. (900* mm) horizontally of the vertical centre-line of the regulator vent outlet to a maximum vertical distance of 15 *ft. (4.5m).*

within 3 *ft. (900* mm) of any gas ***service regulator*** vent

outlet; less than 1 *ft.* (300 mm) above grade level;

within the following distances of a window or door that can be opened in *any building,* of any non-mechanical ***air supply*** inlet to *any* ***building,*** or of the ***combustion air*** inlet of any other ***appliance.***

(i) 6 in (150 mm) for inputs up to and including 10 000 Btuh (3kW);
(ii) 12 in (300 mm) for inputs from 10 000 Btuh (3 kW) up to and including 100 000 Btuh (30 kW); and
(iii) 3 *ft. (900* mm) for inputs exceeding 100 000 Btuh (30 kW); and

(h) underneath a veranda porch, or deck unless

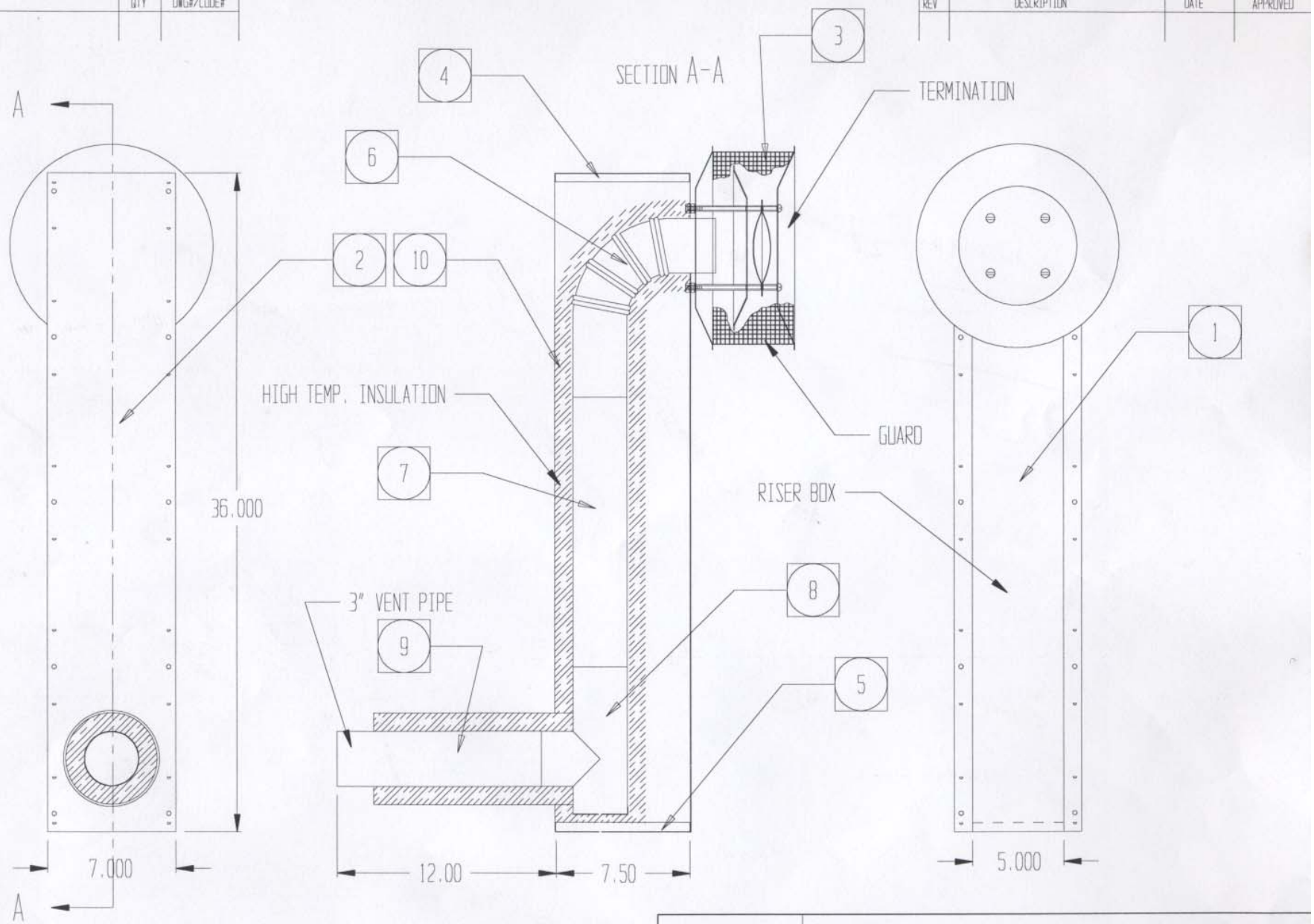
(i) The veranda, porch, or deck is fully open on a minimum of two sides beneath the floor, and the
(ii) distance between the top of the *vent* termination and the underside of the veranda, porch, or deck is greater than 1 ft. (300 mm).

BILL OF MATERIAL

PT #	DESCRIPTION	QTY	DWG#/CODE#

REVISIONS

REV	DESCRIPTION	DATE	APPROVED



MATERIALS - 26g 304 STAINLESS STEEL

ALL DIMENSIONS IN INCHES

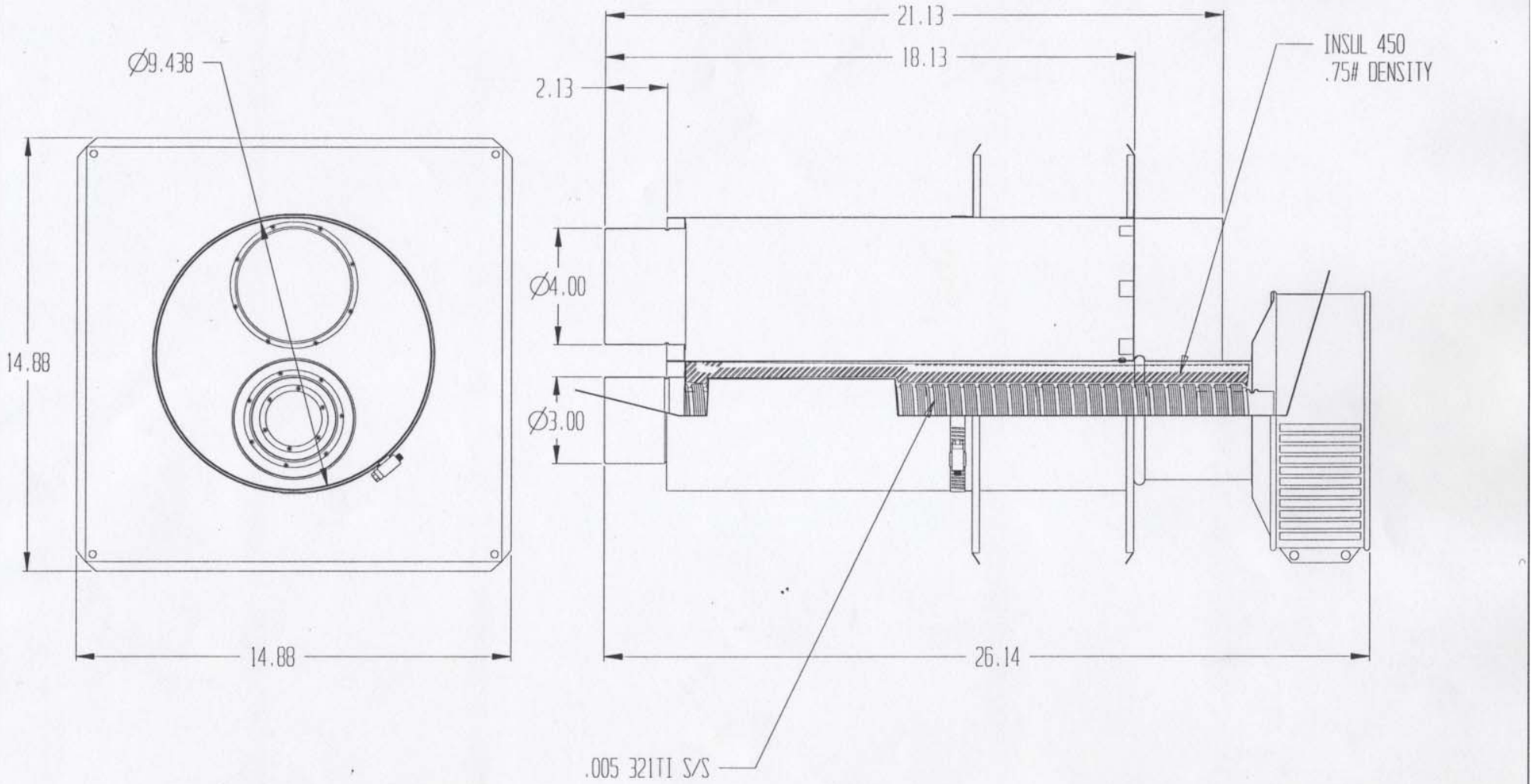
Flexmaster Canada Ltd.

3" OIL VENT RISER

DRAWN BY W.GODDERHAM	SCALE NTS	TOL. N/A	DWG NO. A6000296	REV 0
DATE 21/09/95	MATERIAL AS NOTED		CHECKED BY	PRODUCT# 620ILRIS03

ALL DIMENSIONS IN INCHES

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

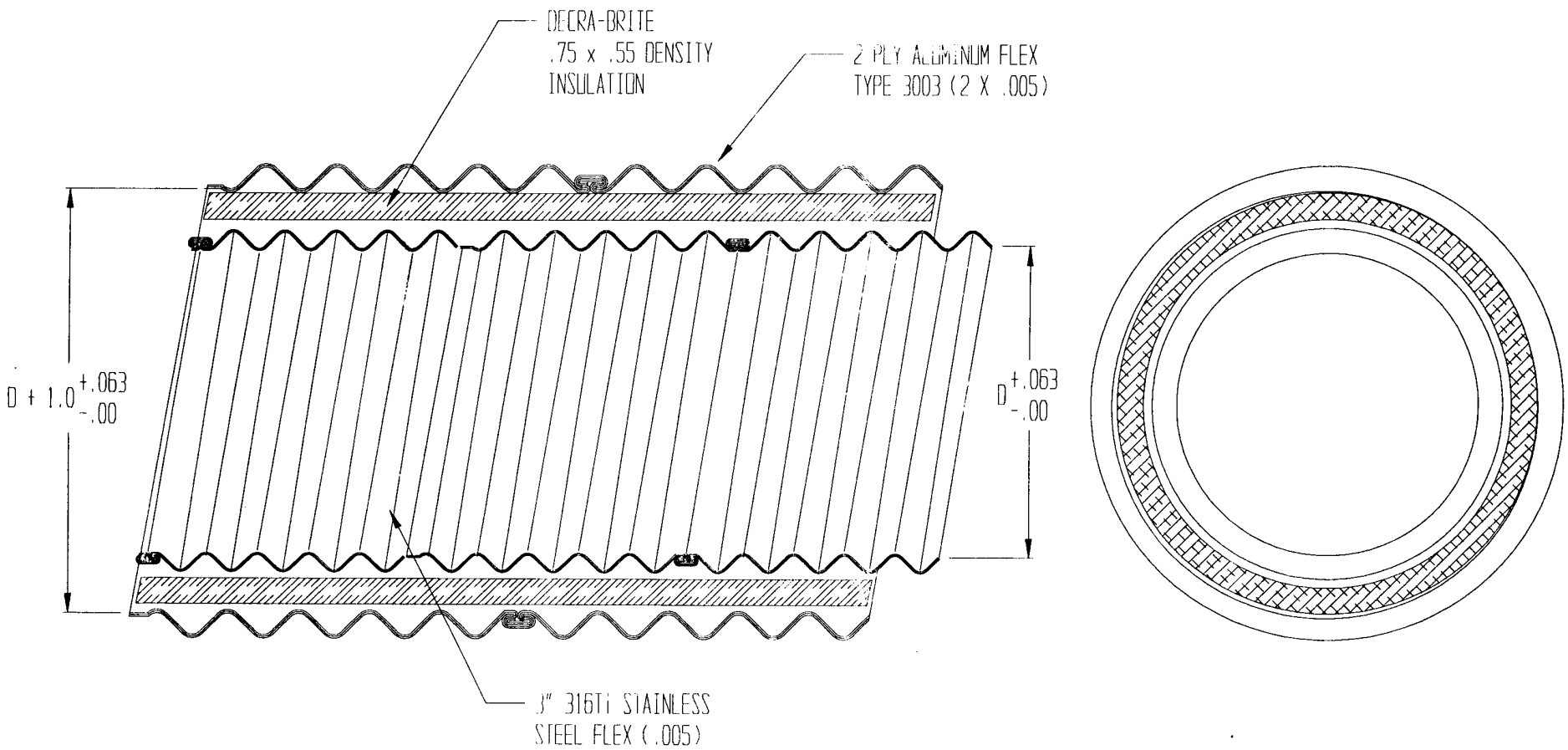


Z-FLEX®

OIL/GAS TERMINATION

DRAWN BY ML	SCALE N.T.S.	TOL. AS NOTED	DWG NO. A6000989		REV 0
DATE 04/07/03	MATERIAL 26g 304 S/S		CHECKED BY	ASSEMBLY# 20ILTRM503	

REV	DESCRIPTION	DATE	APPROVED



D = 3" THRU 8"

STANDARD LENGTHS - 10', 15' 20'
CUSTOM SIZES AVAILABLE UPON REQEST

ALL DIMENSIONS IN INCHES

Flexmaster Canada Ltd.

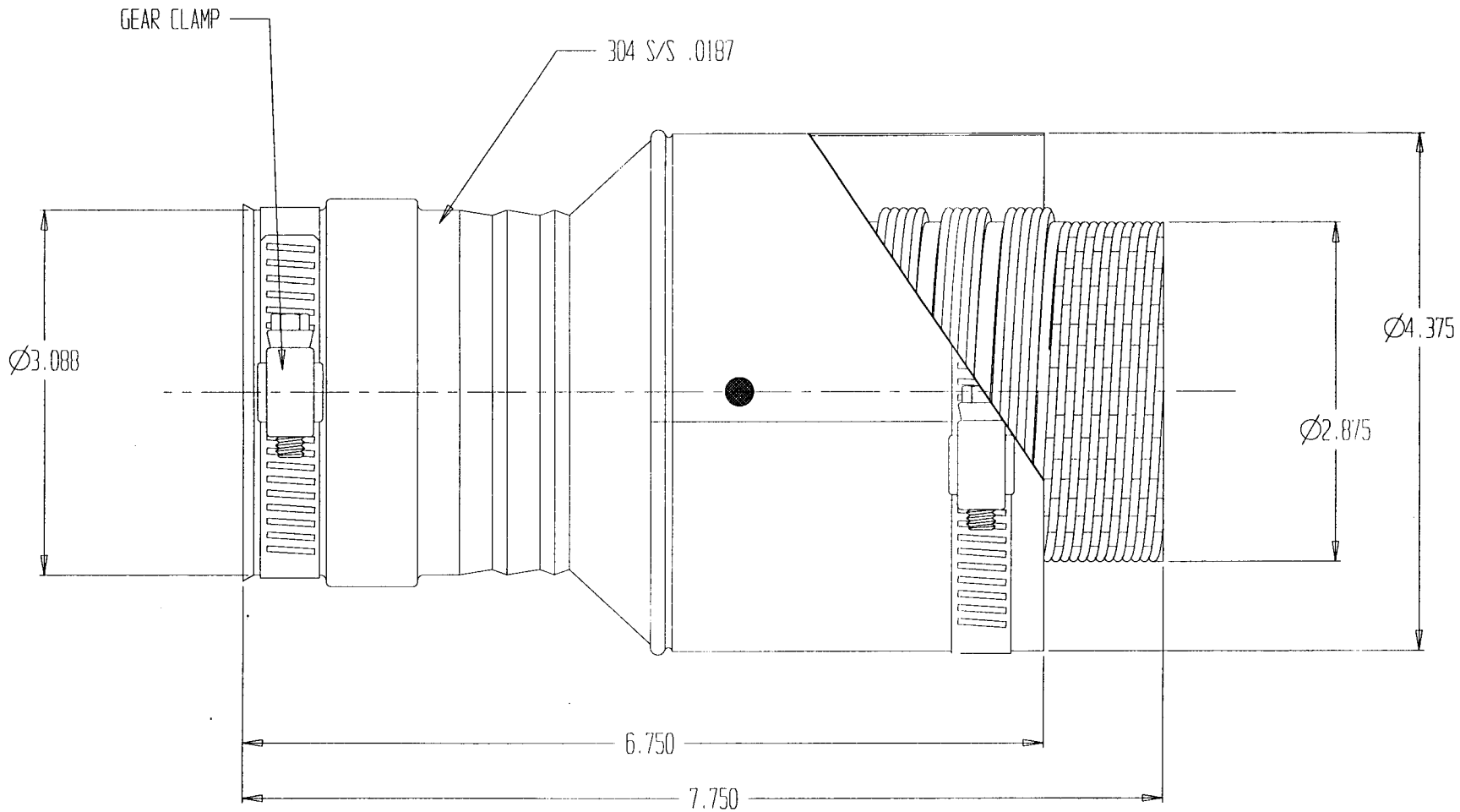
OIL/GAS VENT FLEX ASSEMBLY

DRAWN BY	W.GOODERHAM	SCALE	NTS	TOL.	N/A
DWG NO.	A6000295	REV	0		
DATE	21/09/95	MATERIAL	AS NOTED	CHECKED BY	
PRODUCT#	20ILVNT----				

BILL OF MATERIAL			
PT #	DESCRIPTION	QTY	DWG#/CODE#

ALL DIMENSIONS IN INCHES

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



Z-FLEX®

OIL/GAS CONNECTOR

DRAWN BY	SCALE	TOL.	DWG NO.	REV
ML	N.T.S.	AS NOTED	A6000989	0
DATE 06/03/03	MATERIAL AS NOTED		CHECKED BY	ASSEMBLY# A6000989

BRANT STEEL PRODUCTS LTD. URGES ALL INSTALLERS OF DOMESTIC HEATING BOILERS TO PREVENT

Thermal shock.

By reading this article you will understand our concern. In a previous mailing, this message may have been unclear. Please contact Mr. Mark Offenhammer if you have any further questions.

Phone (519) 756-5700
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E-mail : fabricate@brantsteel.com
Web www.brantsteel.com

by John A. McAuley, Jr.

It truly amazes me that the boiler industry still has thermal shock problems! I have written several articles on the subject through the years. The American Boiler Manufacturers Association has publicly warned of the dangers of thermal shock. Yet, year after year, I come in contact with it.

Why? My idea is that the boiler manufacturer produces a boiler which is competitive and acceptable to the market, and then they sell it to the contractor. After all they've been selling the same boiler for fifty years, why redesign it now?

The contractor has bid a specified job, which was designed by a Professional Engineer. The P.E. approves the equipment so the contractor is off the hook. The boiler the contractor has submitted is either the least expensive he could find or old Joe (the boiler salesman), is an old friend and he's been installing Joe's boiler for years.

The engineer most likely doesn't even really know what thermal shock is. He is designing a complete mechanical system. He has to size boilers, chillers, pumps, piping, ducts, and design a control system. They are expected to know everything, many think they do, however in reality no human is perfect and knows all. There is just too much to know in the mechanical business.

The person selling the boiler is a manufacturer's representative. He represents one boiler manufacturer and believes his boiler will perform wonders. To him, it is undoubtedly the best piece of equipment for every job. He is paid a commission and has a quota to fill, filling this quota becomes his main concern. Many times he is a salesman first and a technical person last.

Last, but not least, comes the customer! Everyone he is dealing with has an excellent reputation: The job looks beautiful to him when it is completed. Within a few years, however, the boiler starts to crack, usually in the spring or fall. Everyone has been paid and they are all off on other jobs by now. The customer is naturally irate, so in come the attorneys.

Who's fault is it? Everyone, except the customer!

I can understand something which is new and strange happening. Sometimes we have a problem with a system which is due to something weird, which no one has seen before.

That is not the case with thermal shock. If there is a contractor, manufacturer, sales representative, or engineer who says he has never come in contact with thermal shock, I would question his credentials.

We come in contact with at least six thermal shock problems a year in the Washington, D.C. area alone. We have never failed to remedy the cause of the thermal shock and leave the customer operating properly.

One particular problem I remember was a boiler which was piped in backwards for over twenty years! This customer had replaced tubes on a monthly basis for over twenty years! I cannot believe that all of the other people who had been in the boiler room during this twenty year period didn't investigate the problem. (Maybe they just didn't know what to look for. I hope that is the answer versus they didn't care.)

We are all individuals serving the customer in our various trades, or professions. However we have a group obligation to give that customer a quality job. I cannot believe that so many people can be lacking the pride in their profession which should be the top priority.

Thermal shock is a very simple problem. It occurs mostly on hot water steel boilers; however, steam boilers may be shocked also. The following are the visible signs of a possible thermal shock problem:

1. Cracked furnace tube, usually in the rear
2. Cracked tube sheet, again the rear one
3. Cracked tubes where they meet the rear tube sheet
4. Weeping water around the tubes where they are rolled into the rear tube sheet
5. Continuous mud leg stay bolt leaks

A boiler is no more than a big piece of steel. If it has proper water treatment, and is operated properly, it should last almost forever.

The boiler tubes should be good for twenty years.

Periodic leaking means something is wrong and should be investigated. It is usually not the boiler that has the problem; rather it is something external which causes the boiler to leak. The two major and most common causes of

thermal shock are: rapid entering of cold water into the boiler or overfiring a cold boiler.

The signs of thermal shock normally show up on the hottest part of the boiler. In the case of a scotch marine type, it will be at the rear where the hot gases make their turn from the furnace tube into the first row of tubes. In a water tube boiler, it will be on the lower half of the boiler on the combustion chamber tubes. In a brickset, firetube type it will normally be the staybolts in the mud legs, or the mud leg inside corners.

In a steam boiler thermal shock will normally occur in two ways-firing a cold boiler in high-fire or the condensate returning to the bottom rear of the boiler too cold. However, the incidences of thermal shock in steam boilers are not many.

In hot water boilers, the greatest cause, by far, is the three-way, system temperature control valve. In the spring and fall, our system may have water as low as 100 degrees in it. Boilers operate at 180 degrees, as an average. When system temperature starts to drop, the three-way mixing valve opens up to allow 180 degree boiler water into the loop to bring up the temperature. This 180 degree boiler water is replaced with 100 degree system water. It is like a glass being taken out of a hot dishwasher, and placing an ice cub in it-it cracks.

How do we prevent this from happening? There are two methods.

The first is to install a blend pump, sized large enough to bring the return water up from 100 degrees to no less than 40 degrees lower than the operating temperature. This pump must be sized for the worst case scenario and be piped between the boiler supply and return. The further away from the boiler inlet that you can tie in the line the better; this will give you more time to mix the water before it enters the boiler.

The second method would be to install a probe near the boiler inlet, in the path of the incoming water. This control would act as a limiter and protect the boiler from sudden rushes of cold water. When the temperature we are sensing drops more than 40 degrees below operating temperature, we would close the three-way valve from taking boiler water regardless of the loop temperature. This may cause a slight delay in bringing up the loop temperature but the boiler will not be damaged.

Honeywell manufactures a four-way valve, through its Central line which is designed with a probe in the boiler for exactly this purpose. This system is very successful if installed properly.

Why don't control manufacturers concern themselves with this problem? They design the temperature control system only-the boiler isn't their problem. Why don't the boiler manufacturers concern themselves with the problem? Their boiler will operate fine if there is a twenty degree system drop and the boiler is operated at 180 degrees.

The problem is that in today's market everyone is concerned with energy conservation and building temperature control. Every new building has a temperature control system which resets system temperature based on outside temperature and occupancy.

Why should a boiler be designed to operate as they did twenty years ago? Why shouldn't the control manufacturer be concerned with damage to the boiler, isn't it part of the system?

The problem of firing a cold boiler at maximum input is easily remedied. Install a low-fire hold control on every boiler, not as a customer option. This is no more than an aquastat that holds the boiler in low-fire until a certain water temperature is reached. Then it will allow our automatic controls to take over and the boiler will go to *high-fire.* If the boiler goes down in the middle of the winter, it will, of course, take a little longer to bring the system up to temperature, but the boiler won't be damaged.

On smaller applications on/off pump operations are the worst enemy. If we install a time clock, or outdoor reset, on a pump alone, we are doing no favors for the customer. When the pump has been off for any period of time, and it cycles on, we will dump cold water into the boiler. The boiler has to get shocked!

Some boiler manufacturers return the water to the bottom rear of the boiler. We should always return to the top of the boiler, and hopefully flow to the front first. The front of the boiler is the coolest as far as the fireside gases go. The top also has more space in *which* to mix the water before it hits the tubes and tube sheets.

It seems that some manufacturers are so tuned into steam boilers that they cannot simply reverse the inlet and outlet for a hot water boiler. Most manufacturers do reverse the tappings for hot water boilers, but there are still some that do not.

I sincerely hope that the day will come when this problem is realized by all parties involved and that we take better care, as a group, to give our customers what they deserve-a good quality job that will last for years, relatively maintenance free.

W E L D I N G & M E T A L F A B R I C A T I N G S P E C I A L I S T S

BRANT STEEL PRODUCTS LTD.

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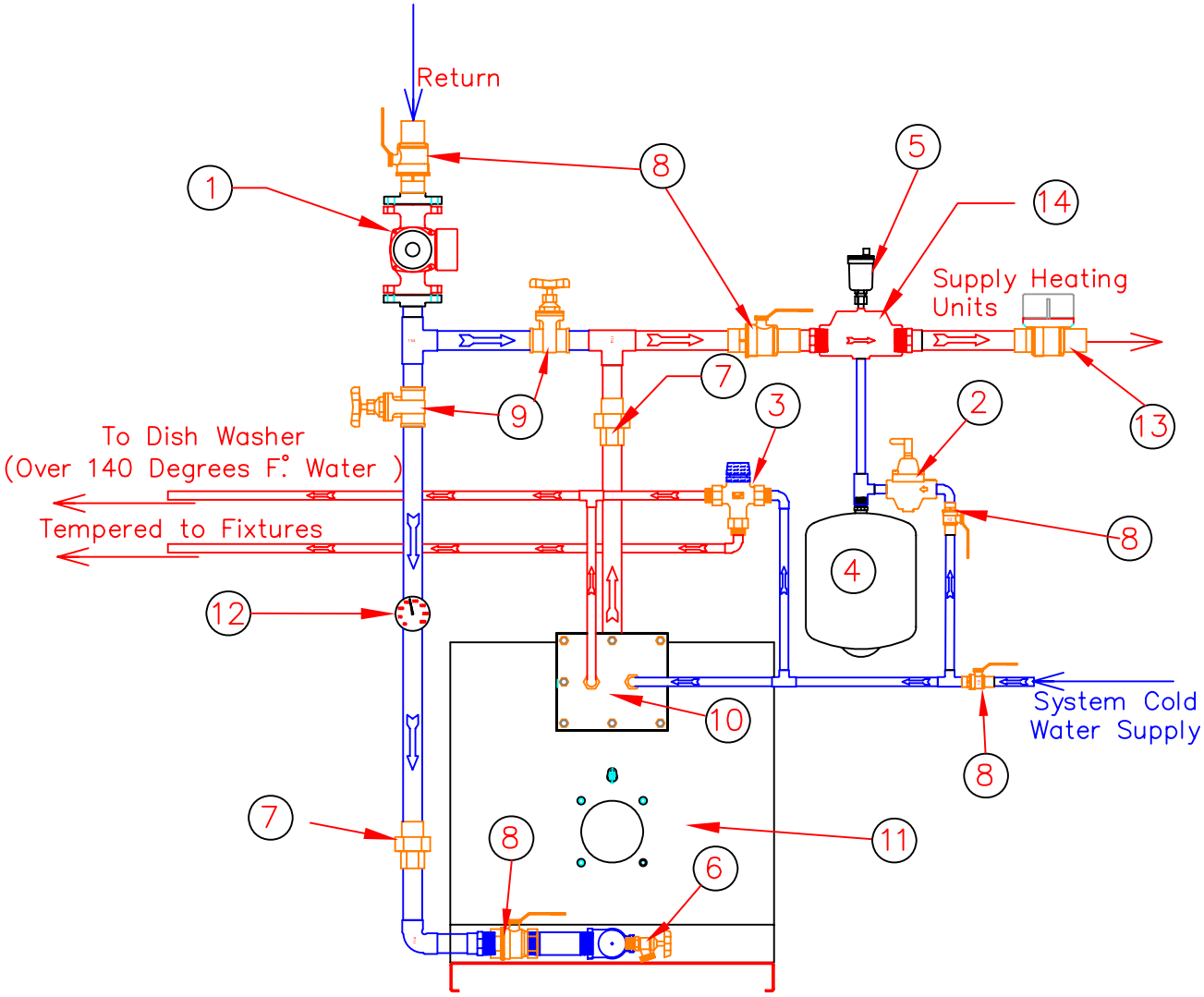
Fleetline Boiler Piping with by pass



1. Circulating Pump
2. System Fill Valve (12–15 PSI)
3. Thermostatic Mixing Valve
4. Expansion Tank
5. Vent Valve
6. Boiler Drain Valve
7. Union
8. Ball Valve
9. Gate Valve
10. Instantaneous Water Heater / Domestic Coil
11. Heat Generation Source (Fleetline Boiler)
12. Return Water Temperature Gauge
13. Zone Valve
14. Air Trap

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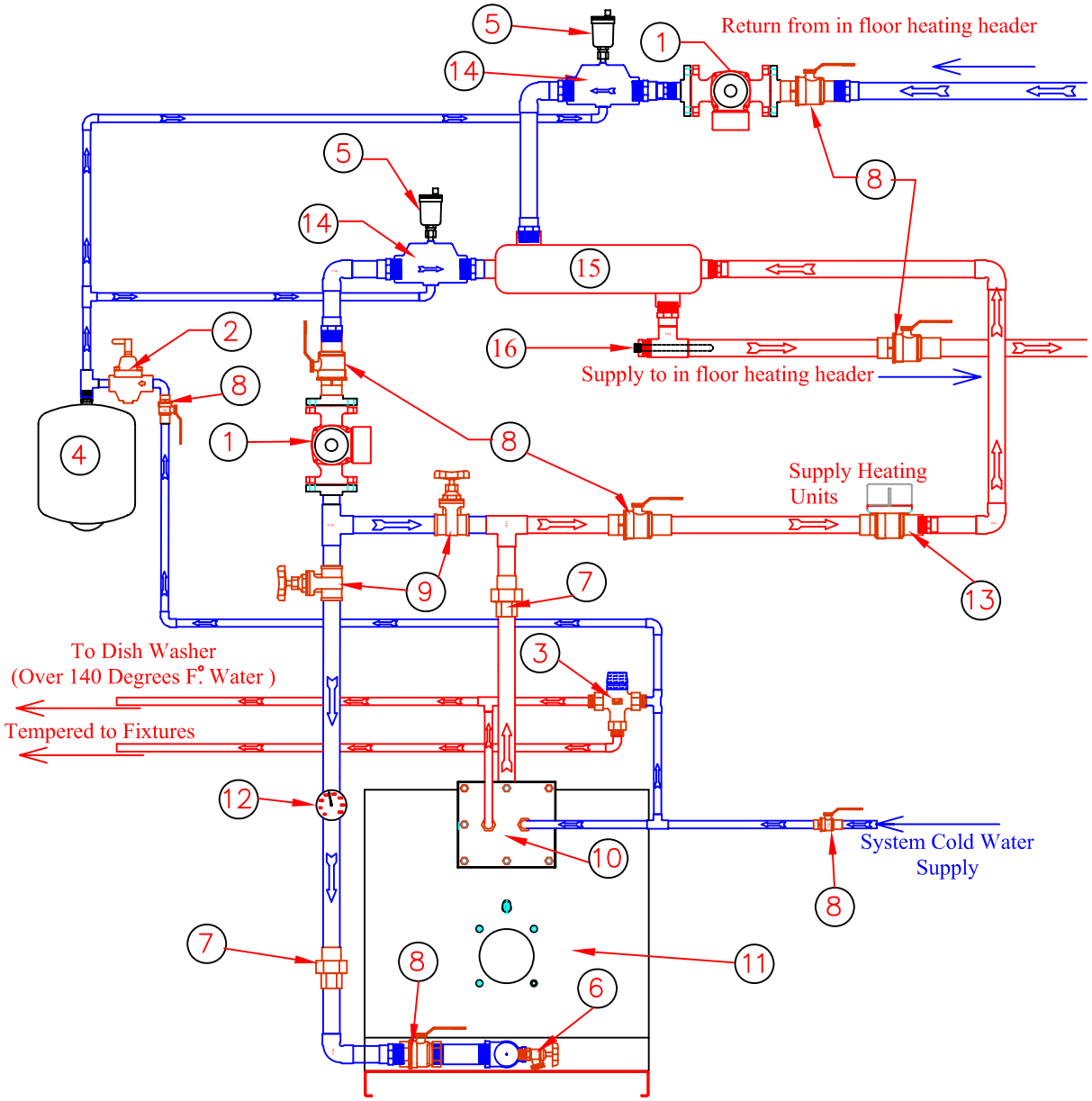
Piping with by pass and Heat Exchanger



1. Circulating Pump
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3. Thermostatic Mixing Valve
4. Expansion Tank
5. Vent Valve
6. Boiler Drain Valve
7. Union
8. Ball Valve
9. Gate Valve
10. Instantaneous Water Heater / Domestic Coil
11. Heat Generation Source (Fleetline Boiler)
12. Return Water Temperature Gauge
13. Zone Valve
14. Air Trap
15. Heat Exchanger
16. In Floor Heating Aquastat
    Between 80 F° and 110 F°

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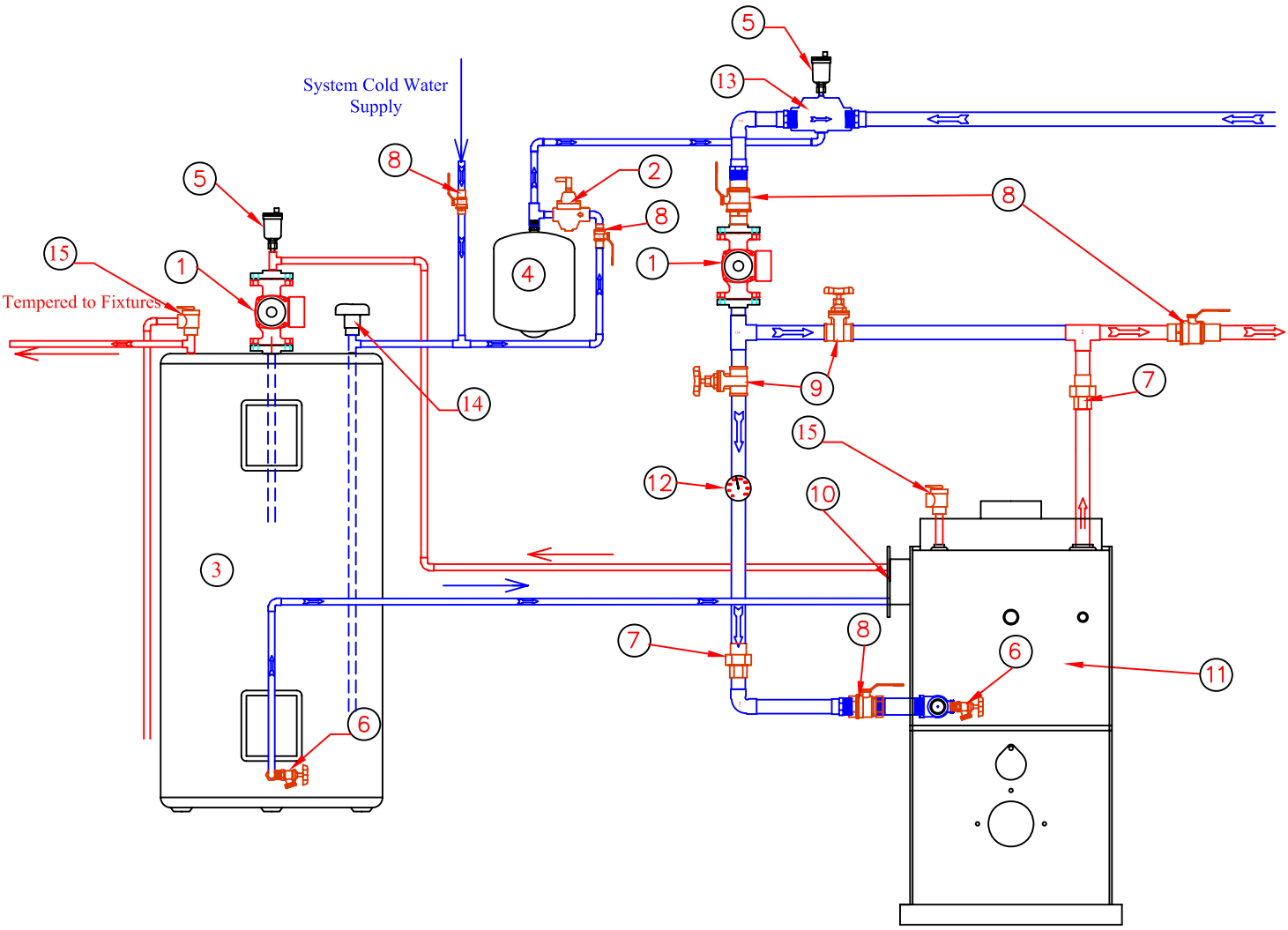
Boiler Piping with by pass and Booster Tank



1. Circulating Pump
2. System Fill Valve (12-15 PSI)
3. Storage Booster Tank
4. Expansion Tank
5. Vent Valve
6. Boiler and Booster Tank Drain Valve
7. Union
8. Ball Valve
9. Gate Valve
10. Instantaneous Water Heater / Domestic Coil
11. Heat Generation Source (Fleetline Boiler)
12. Return Water Temperature Gauge
13. Air Trap
14. Vacuum Breaker
15. Pressure Relief Valve

Rev. Date Jul 1 2003

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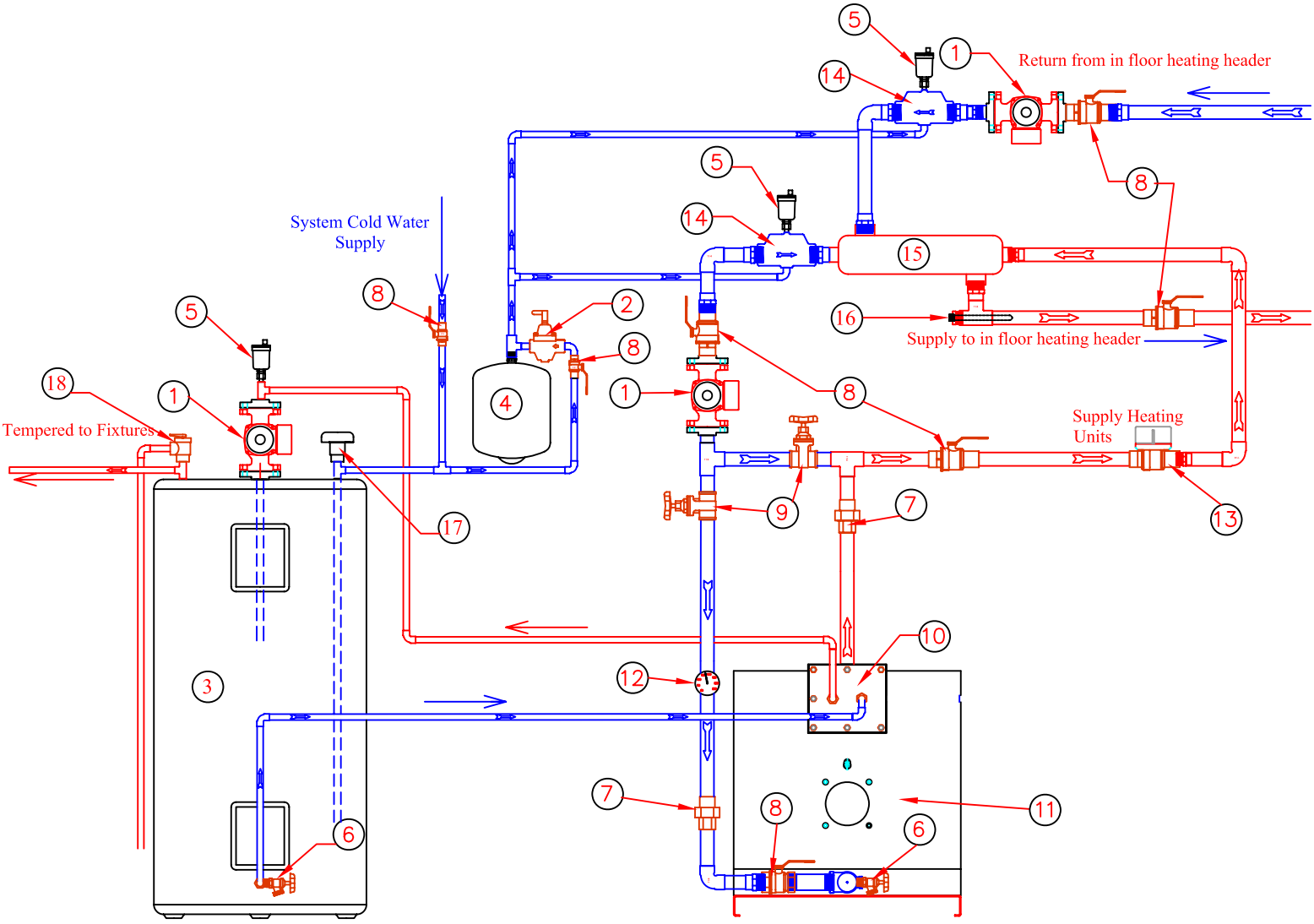
49 Craig Street, Brantford, Ontario N3R 7H8 519.756.5700 Fax: 519.756.1742 fabricate@brantsteel.com www.brantsteel.com

Boiler Piping with by pass and Heat Exchanger and Booster Tank



1. Circulating Pump
2. System Fill Valve (12-15 PSI)
3. Storage Booster Tank
4. Expansion Tank
5. Vent Valve
6. Boiler and Booster Tank Drain Valve
7. Union
8. Ball Valve
9. Gate Valve
10. Instantaneous Water Heater / Domestic Coil
11. Heat Generation Source (Fleetline Boiler)
12. Return Water Temperature Gauge
13. Zone Valve Opt.
14. Air Trap
15. Heat Exchanger
16. In Floor Heating Aquastat
    Between 80 F° and 110 F°
17. Vacuum Breaker
18. Pressure Relief Valve

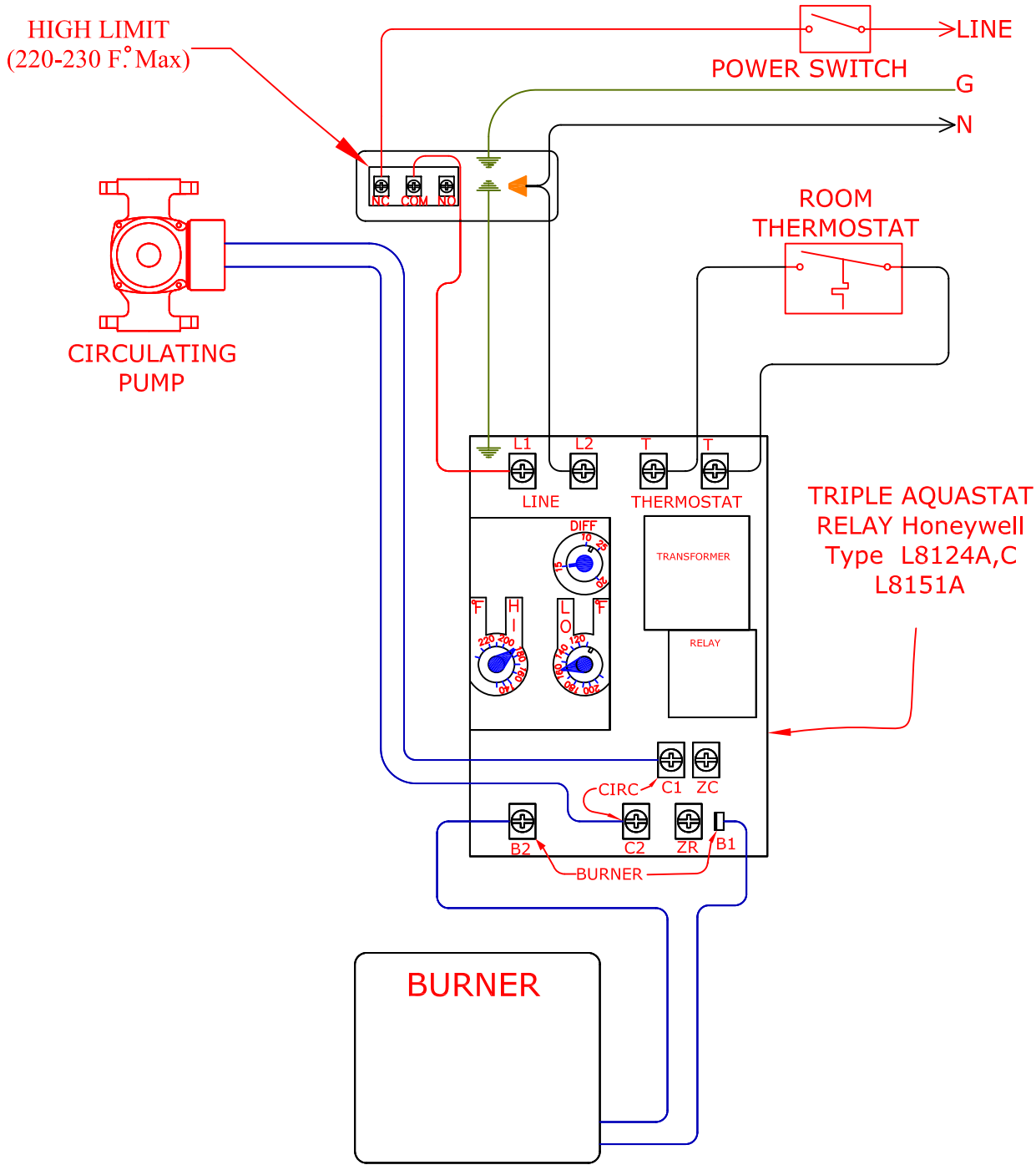
Rev. Date Jul 1 2003

W E L D I N G & M E T A L F A B R I C A T I N G S P E C I A L I S T S

BRANT STEEL PRODUCTS LTD.

49 Craig Street, Brantford, Ontario N3R 7H8 519.756.5700 Fax: 519.756.1742 fabricate@brantsteel.com www.brantsteel.com

Fleetline Single zone Wiring Drawing



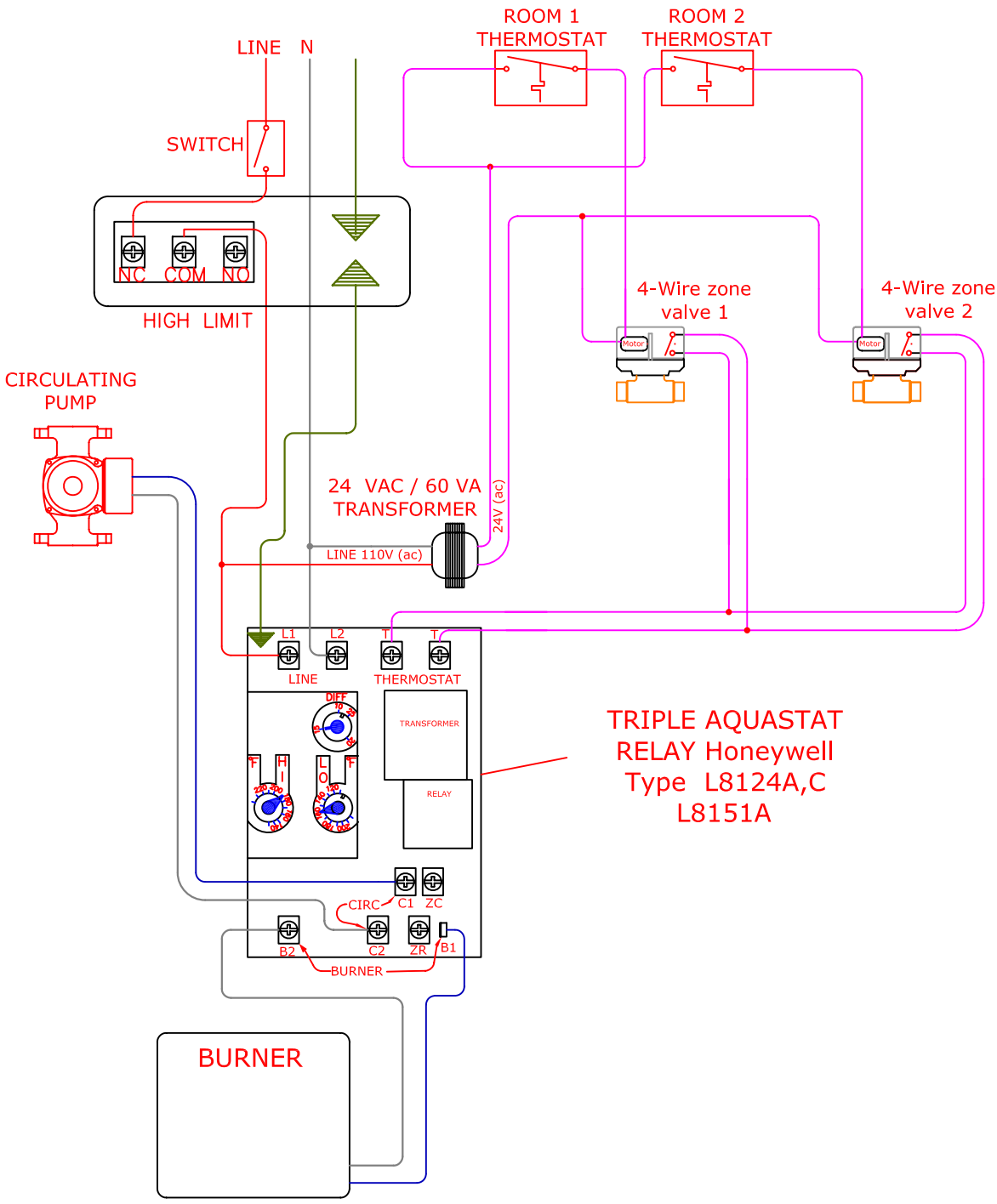
Rev. Date May 28 2001

W E L D I N G & M E T A L F A B R I C A T I N G S P E C I A L I S T S

BRANT STEEL PRODUCTS LTD.

49 Craig Street, Brantford, Ontario N3R 7H8 519.756.5700 Fax: 519.756.1742 fabricate@brantsteel.com www.brantsteel.com

Fleetline Boiler Wiring For 2 Zone Drawing

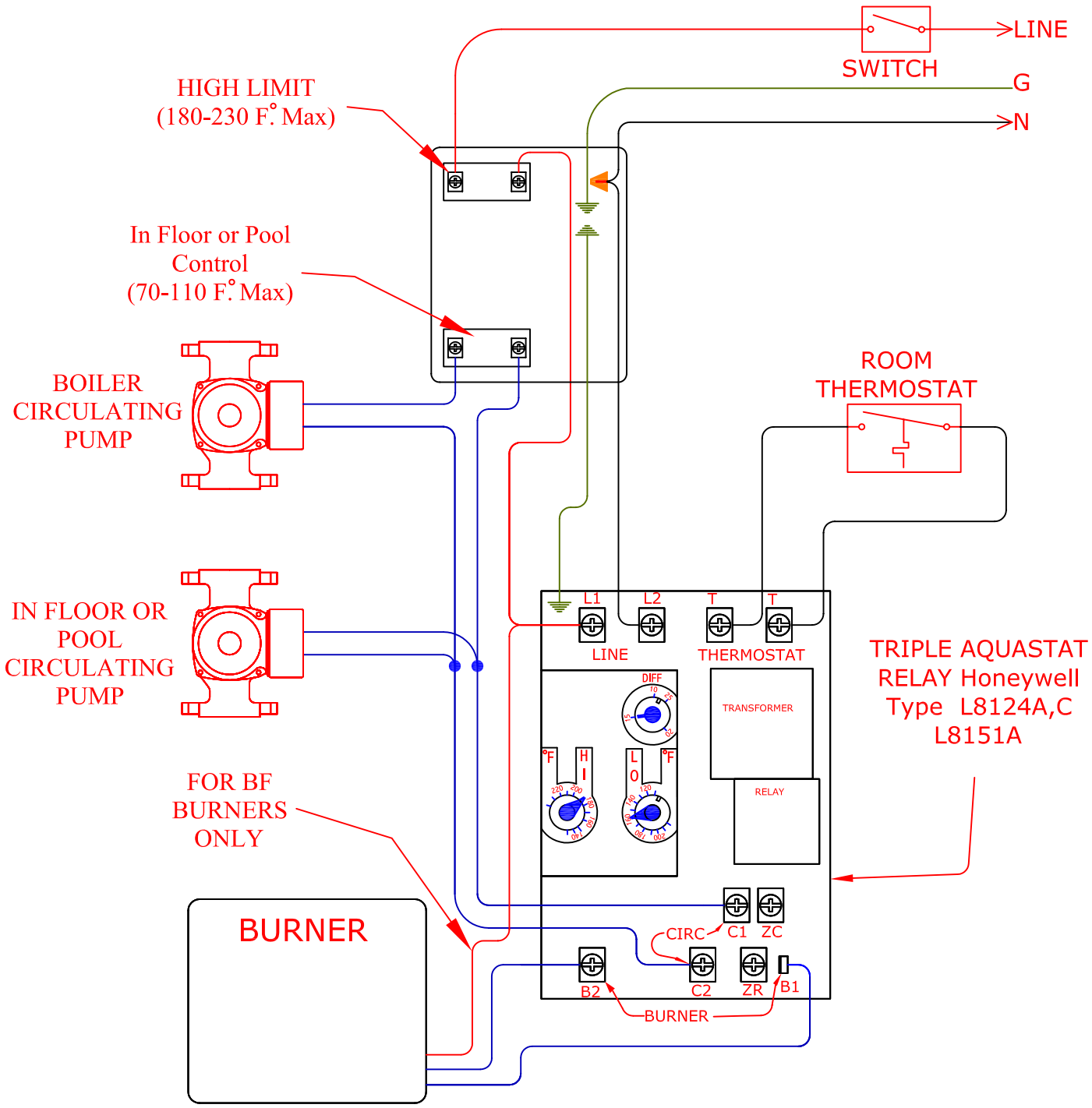


W E L D I N G & M E T A L F A B R I C A T I N G S P E C I A L I S T S

BRANT STEEL PRODUCTS LTD.

49 Craig Street, Brantford, Ontario N3R 7H8 519.756.5700 Fax: 519.756.1742 fabricate@brantsteel.com www.brantsteel.com

Fleetline Single zone Floor or Pool Control Wiring Drawing



Rev. Date Jul 1 2003

PRODUCTS - Fleetline Hot Water Boilers, Bakery Ovens & Proofers, Heat E Exchangers, e eKOCOMFORT Products.
SERVICES - Product Development, Custom Fabrication & General Machining, Bakery E Equipment Service.
CUSTOM FABRICATION - Forming, Rolling (to 10ft.). Shearing, Flame and Plasma Cutting, Metal Stamping (200 t ton) and Spray Painting.
WELDING - Robotic, Spot, Mig and Tig Welding f for all t types of metals and repairs.
DESIGN AND MANUFACTURE CUSTOM METAL PRODUCTS - FAMILY OWNED AND OPERATED

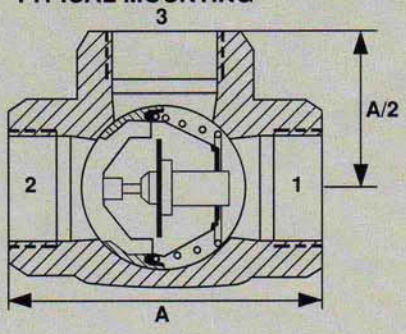
ESBE
THERMIC VALVE TV

ESBE **Thermostatic** Bypass valves type TV are designed to allow boilers to reach their optimum operating temperature quickly and to prevent cool/cold return temperatures from affecting them.

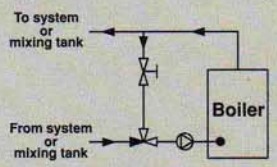
OPERATION/INSTALLATION:
Whether installed near the boiler outlet or inlet, the thermostat within the "TV" valve allows full flow through the bypass until the predetermined temperature is reached.
Supply Mounting: On the supply, the "TV" will allow flow of hot water to the system or indirect heater when the boiler outlet reaches 160 degrees Fahrenheit (72 degrees Celsius). At approximately 180 degrees Fahrenheit (82 degrees Celsius) most of the flow is directed to the system. Between 160 degrees Fahrenheit and 170 degrees Fahrenheit, the "TV" bypasses some supply water to mix with return water keeping operating temperatures high.
Return Mounting: On the return, "TV" allows full bypass until the return temperature reaches 140 degrees Fahrenheit (60 degrees Celsius). "TV" will begin opening while maintaining a 140 degree Fahrenheit minimum return temperature. When return temperatures reach approximately 158 degrees Fahrenheit (70 degrees Celsius) most of the flow will be through the system.

START UP: With the balancing valve on the bypass fully open, operate the boiler until it reaches it's normal operating temperature. If hot water does not automatically flow to the system *then* adjust (throttle) the bypass balancing valve until flow (hot water) to the system is established. If flow is already to the system, no adjustment is required.

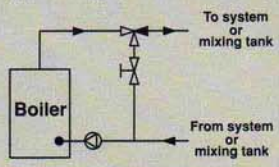
TYPICAL MOUNTING



Typical return valve mounting



Typical supply valve mounting



TECHNICAL DATA:
Temperature Ranges:
Standard: Supply mounted 160 °F/72 C
Return mounted 140 °F/60 C
Optional: Special order requested.

Type	Code No.	Size	Opening temp.	A	A/2	Cv	Weight
461 A	065 B 8920	1" NPT (Female × Female)	180 °F/72 °C	4.2	2.1	10.5	3.3 lb.
462 A	065 B 8921	1 1/4" NPT (Female × Female)	180 °F/72 °C	4.5	2.25	16.4	4.4 lb.
463 A	065 B 8922	1 1/2" NPT (Female × Female)	180 °F/72 °C	4.7	2.35	20.0	5.3 lb.
464 A	065 B 8923	1" NPT (Female × Female)	140 °F/60 °C	4.2	2.1	10.5	3.3 lb.
465 A	065 B 8924	1 1/4" NPT (Female × Female)	140 °F/60 °C	4.5	2.25	16.4	4.4 lb.
466 A	065 B 8925	1 1/2" NPT (Female × Female)	140 °F/60 °C	4.7	2.35	20.0	5.3 lb.

Max. operating pressure: 85 psi / 6 bar Max. operating Temperature: 230 °F (110 °C)
MOUNTING: "TV" can be installed in any position. An adjustable balancing valve (or ball valve) must be installed on the bypass.

Danfoss Automatic Controls
4971 Mercantile Road
Baltimore, Maryland 21236
USA
Telephone: (410) 931-8250
Telefax: (410) 931-8256

Danfoss Mfg.Co. Ltd.
1230 Lakeshore Road East
Mississauga, Ontario, L5E 1E9
Canada
Telephone: (905) 274-2311
Telefax: (905) 274-4009

clean
comfortable
efficient
versatile

comfortable living...all year long

You'll appreciate a Fleetline Home Comfort System no matter what time of year! If you've never considered heating your home with hot water before, now is the time to take a serious look.

Aside from offering a comfortable, healthy environment in your home, there are many advantages to heating with hot water. The abundant supply of hot water means you do not need a separate water tank for dishes, showers and laundry. While providing the main source for heating your home, Fleetline hot water boilers also give you options such as in-floor radiant heat, snow melt systems, pool heating and more.

Before you get out that blanket on a cold wintery day, run out of hot water in the shower or find your feet getting cold, talk to us about an economical Fleetline Home Heating System.

clean
comfortable
efficient
versatile

20 YEAR BOILER Warranty

Aqua-Matic

advanced heating boiler

ENERGY STAR

F-Series

2 in 1 heating system

- Fleetline boilers have earned a reputation for being reliable, economical and efficient from thousands of satisfied customers coast to coast.
- Continuous economical hot water for your family's needs from our internal water heater/tankless coil
- Internal stainless steel baffles for maximum heat transfer & efficiency
- Triple aquastat for energy conservation on ALL our boilers
- Meets A.F.U.E. standards
- Reliable production quality control and innovative features
- Excellent for new homes, retrofit or replacement
- Multi-firing range provides flexibility of the boiler's output
- Fuel choices: fuel oil, natural gas or propane
- Heating your home with hot water can provide a healthier environment for the entire family
- Ceramic fibre fire chamber for better and more environmentally friendly combustion
- Up to 89% combustion efficiency
- Easily serviced
- All controls are conveniently located on the boiler
- Internal water baffling to ensure even flow through the entire boiler, for better efficiency
- Small footprint means it fits in very small spaces

SINCE 1960

fleetline

HOME COMFORT STARTS HERE

fleetline BOILER SPECIFICATIONS

Aqua-Matic

FUEL OIL

Burner Model	Nozzle*		Pump Pressure PSI	(**) Input (BTUH)	EFF SS
Beckett AFG	.65	60°	160	100,028	88
	.75	60°	160	120,034	88
	.85	60°	160	140,890	87
	1.10	60°	160	183,386	85
Carlin EZ-1	.65	60°	160	105,169	89
	.75	60°	160	121,134	87
	.85	60°	160	141,874	86
	1.10	60°	160	182,830	86
Riello BF5	.65	60°	160	101,280	89
	.75	60°	160	120,264	88
	.85	60°	160	132,816	86
	1.10	60°	160	177,829	86

* Brass nozzles lowest temperature during long firing tests.
Nozzles: Delevan W - Danfoss B - Hago B - Monarch R

** Test fuel 34.70 API gravity

GAS

Burner Model	Input BTUH
Carlin EZ gas Natural or Propane	70,000
	100,000
	120,000
	150,000
Riello 200 Natural or Propane	70,000
	100,000
	120,000
	150,000

Natural Co_2 11.8%
Propane Co_2 13.8%
All tests completed at 180°F (82.2°C) water temperature

DIMENSIONS

Dimensions (in)			Supply & Return	Boiler Water Capacity (Gallons)	Bare Boiler Weight (Lbs.)
Height	Width	Depth			
24”	24”	30”	1.25”	21	350

ENERGY STAR

C ETL US LISTED

F-Series

FUEL OIL

Model	Input U.S. GpH		Gross Out BTU HR x 1000		Aero	Riello	PSIG	Nozzle				Net Output Sq.Ft.
	Aero	Riello	Aero	Riello				Aero	Riello	Angle 60° Aero	Angle 60° Riello	
F-9	.50	.57	59	67	F-AFC-2X	40-F3	130	.50	.50	R	W	225
F-10	.65	.66	76	78	-2X	F3	175	.65	.50	Q	W	425
F-11	.85	.89	99	104	-2	F3	140	.85	.75	AR	W	547
F-12	1.00	.99	115	115	-2	F5	175	1.00	.75	Q	W	647
F-13	1.10	1.08	127	125	-2	F5	160	1.10	.85	Q	W	708
F-18	.85	.90	101	107	-2	F3	145	.85	.75	Q	W	550
F-19	1.00	1.02	118	122	-2	F5	145	1.00	.85	Q	W	650
F-20	1.10	1.20	132	141	-2	F5	145	1.10	1.00	Q	W	713
F-21	1.25	1.26	147	149	-3	F5	160	1.25	1.00	AR	W	833
F-22	1.35	1.39	160	161	-3	F5	160	1.35	1.10	AR	W	906
F-23	1.50	1.48	169	173	-4	F5	140	1.50	1.25	AR	W	990
F-24	1.75	1.65	197	191	-4	F10	175	1.75	1.25	AR	W	1160

* No heavier than No. 2 Furnace Oil — Electrical rating 120 Volt, 60 Cycle, less than 12 Amps
Maximum working pressure 30 PSI water — Certified for use with type “L” vent

DIMENSIONS

Model	Dimensions (in)			Flue Dia.	Chimney Size	Return & Return	Boiler Water Capacity (Gallons)	Bare Boiler Weight (Lbs.)	Heating Surface (Sq.Ft.)
	Height	Width	Depth						
F9-13	36	22	22	6	8x8x20	1”	16	280	13
F18-24	42	22	22	7	8x8x20	1.25”	25	350	20

CSA SA

Verified for Energy Performance

INTEGRATED ēKOCOMFORT HOME COMFORT SYSTEM

Brant Steel Products, the manufacturer of the **FLEETLINE BOILER**, is part of the **ēKOCOMFORT**™ group of manufacturers responsible for the design and production of the Canadian Government recognized ‘**Integrated Home Comfort System**’.

For more information, please contact us at 519-756-5700

SINCE 1960

fleetline

HOT WATER BOILERS

Due to our continuous efforts to provide you with the latest in technology, specifications are subject to change without notice.

Manufactured in Canada by

BRANT STEEL PRODUCTS LTD.

49 Craig Street, Brantford, Ontario N3R 7H8
Telephone: 519-756-5700 Fax 519-756-1742
email: fabricate@brantsteel.com
website: www.brantsteel.com

MAY/05 - PRINTED IN CANADA

WARRANTY FOR FLEETLINE AQUA-MATIC HOT WATER BOILERS

FIRST FIVE YEARS: Brant Steel warrants that its boilers are free from defects in material and workmanship for five years from date of original installation. Brant Steel will repair or replace, free of charge and FOB Brantford, the heat exchanger or any component manufactured by Brant Steel found to be defective for a period of five years. Controls, burner, or other mechanical or electrical parts which are not manufactured by Brant Steel are not warranted by Brant Steel but are warranted by their respective manufacturers. This is usually for a period of one year from date of installation.
NOTE: ANY PART WHICH IS REPLACED UNDER WARRANTY CARRIES ONLY THE UNEXPIRED PORTION OF THE ORIGINAL WARRANTY.

SIXTH THROUGH TWENTIETH YEARS: Brant Steel warrants that the Fleetline boilers are free from defects in material and workmanship for the sixth through twentieth years from date of installation. If any shells are then found to be defective, Brant Steel will repair or replace, FOB Brantford, the original shell on a pro rated schedule.
Owner pays current list price less:

- -6th year 50%
- -7th year 40%
- -8th year 30%
- -9th year 20%
- -10th year to 20th year 10%

OWNER'S RESPONSIBILITIES:
1. Provide for proper installation and that a pressure relief, and on closed systems, pressure reducing valves are provided.
2. Have boiler serviced and checked annually by a licensed and trained heating professional, to prolong proper operation and service.
3. Insure that boiler is installed with the approved burner and venting and that installation conforms to all local codes and ordinances by a heating contractor whose primary business is the service and installation of heating equipment.
4. This warranty does not apply to boilers which are subject to misuse, abuse, neglect, alteration, accident, excessive temperature or pressure, thermal shock, corrosive water or atmosphere, or use other than as part of a hot water heating system.
5. Will be responsible for return of faulty components to Brant Steel in Brantford, Ontario freight prepaid.

BRANT STEEL WILL NOT BE RESPONSIBLE FOR:
1. Components that are part of the heating system, but were not manufactured by Brant Steel as part of the boiler.
2. The workmanship of the installer of Fleetline boilers. Furthermore, this warranty does not assume any liability for unsatisfactory performance caused by improper installation.
3. Any costs for labor to remove and/or replace the faulty component.
4. Improper burner application or adjustments, control settings, care or maintenance.
5. Boilers damaged from oxygen repeatedly entering the heating system due to leaks or use of non-oxygen barrier tubing being used.

THIS WARRANTY DOES NOT EXTEND TO ANYONE EXCEPT THE FIRST PURCHASER AT RETAIL AND ONLY WHEN THE BOILER IS IN THE ORIGINAL INSTALLATION SITE.

IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY SHALL BE LIMITED TO THE DURATION OF THE EXPRESSED WARRANTY. BRANT STEEL EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY.

For prompt warranty service, notify the installer, who, in turn, will notify the distributor from whom he purchased the boiler. Warranty card must be returned by the installer or the owner for registration.

----------DETACH HERE AND RETURN FOR REGISTRATION----------

FLEETLINE BOILER WARRANTY REGISTRATION FORM

TO BE COMPLETED BY INSTALLER OR CUSTOMER AND MAILED WITHIN 30 DAYS

Customer: Name _____

Address _____

City _____ Postal Code _____

Heating Contractor Name _____

Address _____

City _____ Postal Code _____

Date Installed: _____ Model No. _____ Serial No. _____

BACK

RETURN COMPLETED WARRANTY REGISTRATION CARD TO:

BRANT STEEL PRODUCTS LTD.
49 CRAIG STREET
BRANTFORD, ONTARIO
N3R 7H8

Postage

Brant Steel Products Ltd.
49 Craig Street
Brantford, Ontario
N3R 7H8

FRONT