

**BVTE3900**

**Technical Manual**

**Version 003**

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**BRUKER**

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# Safety

# 1

The following general safety instructions must be observed during operation, service and repair of this instrument.

## ***Protective ground***

**1.1**

---

To minimize shock hazard the instrument must be connected to an electrical ground. Do not use extender cables without earth conductor. Do not disconnect the protective ground inside the instrument.

## ***Repair and adjustment***

**1.2**

---

Ensure that the instrument is disconnected from the AC power supply before the covers are removed or fuses are replaced, otherwise dangerous voltages are accessible.

For fault finding the AC power supply may require reconnection. This may only be carried out by skilled personal who are aware of the hazard involved.





# Description

# 2

## **Introduction**

## **2.1**

The BVTE3900 (P/N W1208962) is a cooling system for high temperature NMR probes.

It works in conjunction with a temperature controller (BVT3000 or BVT2000) with an «E» thermocouple input, and allows to work at high temperature (above 150 °C).

It can be used as well for standard or even low temperature.

The system has a cooling circuit, power electronics and safeties.

The cooling system comprises a cooling liquid tank and a circulating pump and safeties to prevent probe overheating.

The power electronics is mainly composed by a power booster driven by the digital temperature unit BVT3000. This unit is fully controlled by the driving unit temperature unit. The power electronics provides the power to the heater according a command signal issued by the BVT3000. When the BVTE3900 is connected to the BVT3000 and switched on the power stage of the VTU is disabled.

The power booster is by-passed when used with BVT2000.

A special version of the BVTE3900 called BVTE3900 LTE (P/N : W1209799) is available, see chapter "**Option LTE" on page 31**.

It is intended only for low temperature applications. This system avoids freezing of the probe housing. It works with a BVT3000 or a BVT2000.

## **Description of the BVTE3900**

## **2.2**

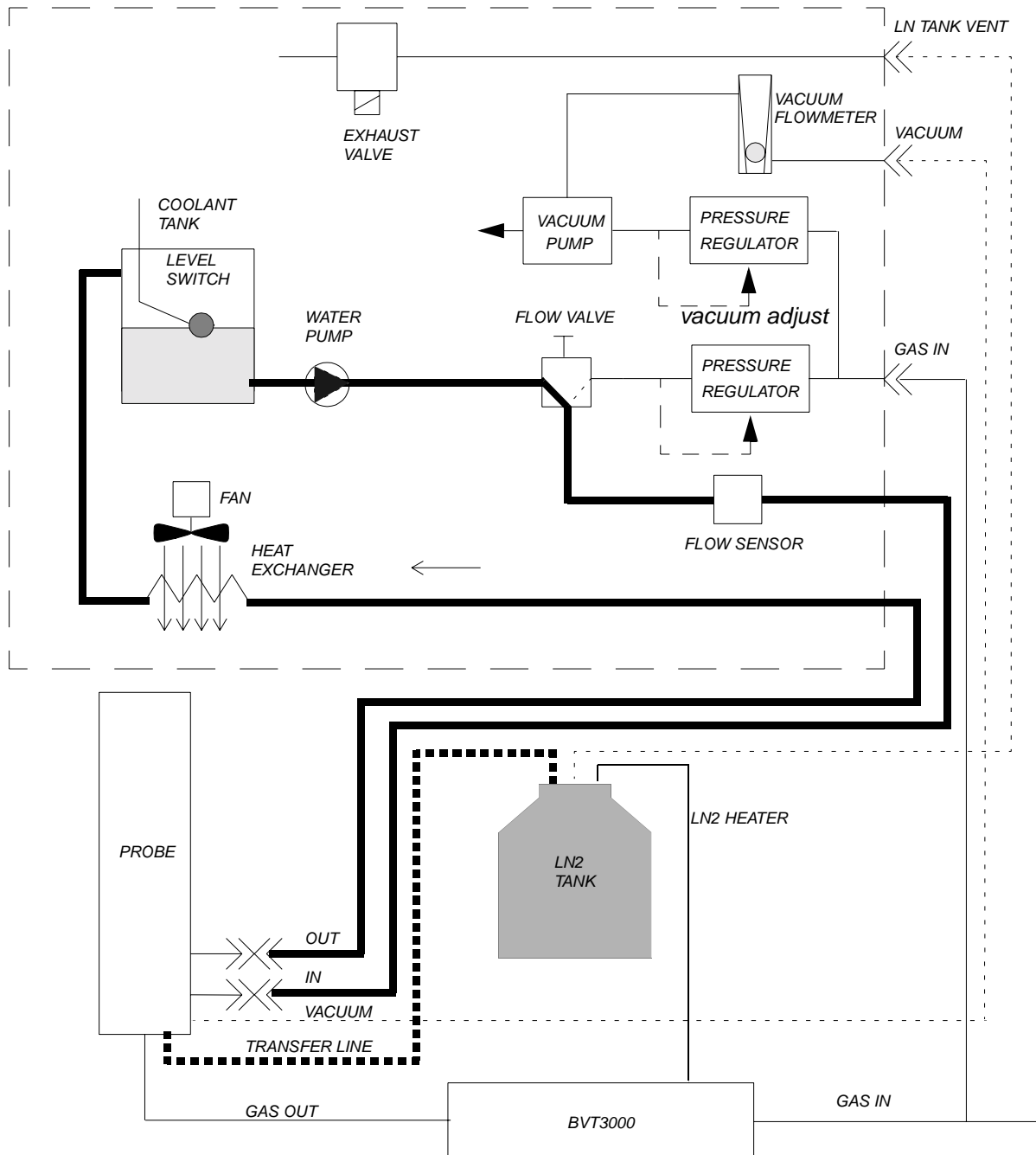
### **Coolant circuit**

### **2.2.1**

A tank contains 5 litres of coolant. The circulating pump is on when the line switch is on and the liquid level is correct in the tank. A flow sensor monitors continuously the flow. The coolant coming back from probe is air-cooled by an heat exchanger with fan.

# Description

Figure 2.1. Liquid and gas circuit



## Power booster

## 2.2.2

A main printed circuit is the power booster for the heater. It can deliver up to 500 watts heating power.

A main toric transformer supplies the electronics and the thyristor bridge.

The heater is turned on when the relay is closed. When an overheat fault (overheating of heater by missing gas flow or safety thermocouple break for example) occurs the relays turns off and heating is stopped.

The thyristor bridge, for heater power control, is placed on the case with a heat sink. The voltage delivered to the heater is filtered by a coil to reduce voltage ripple.

On the front panel, a red led lights when the heater is on when using a BVT3000.

Figure 2.2. BVTE3900 power electronics block diagram

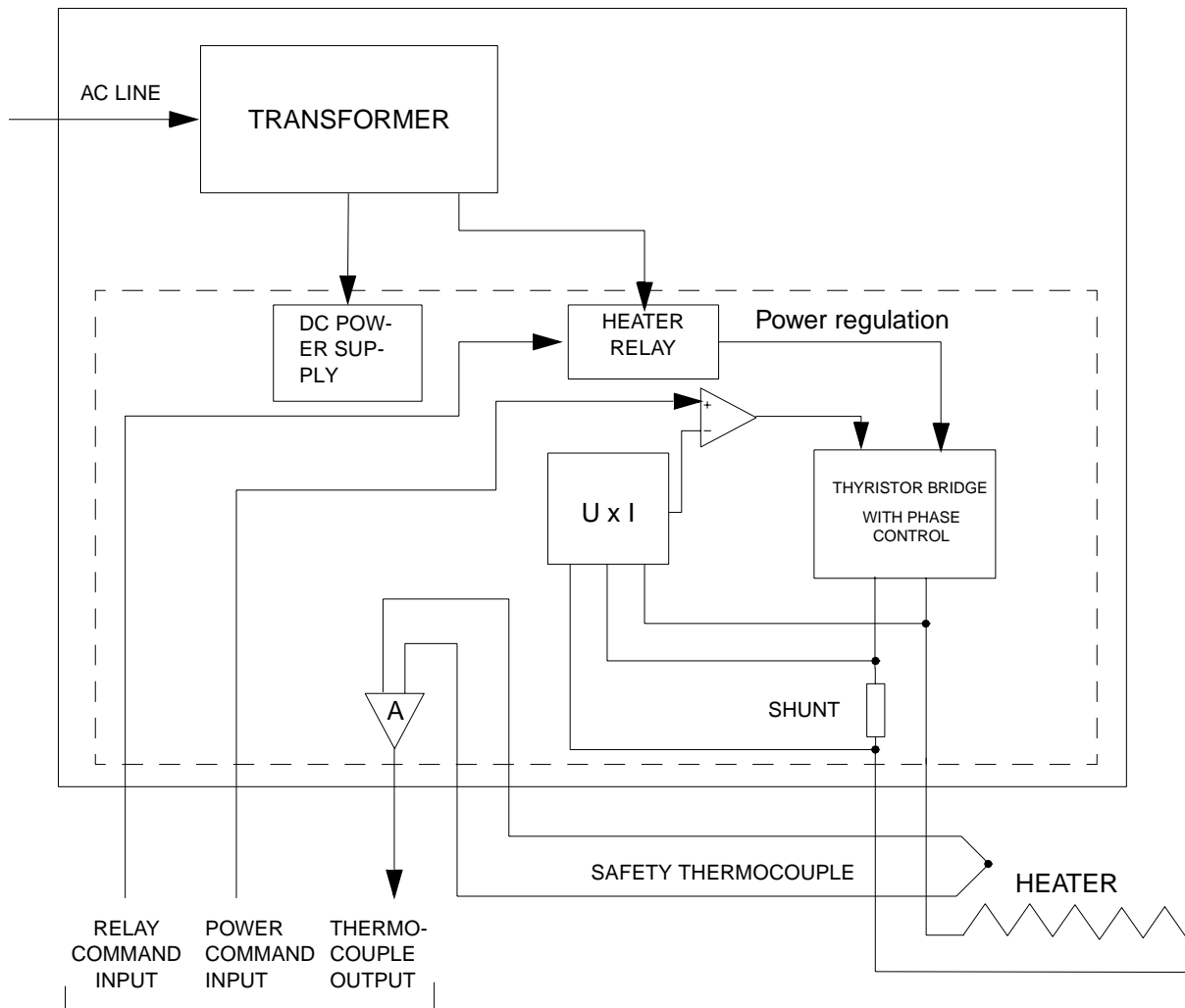
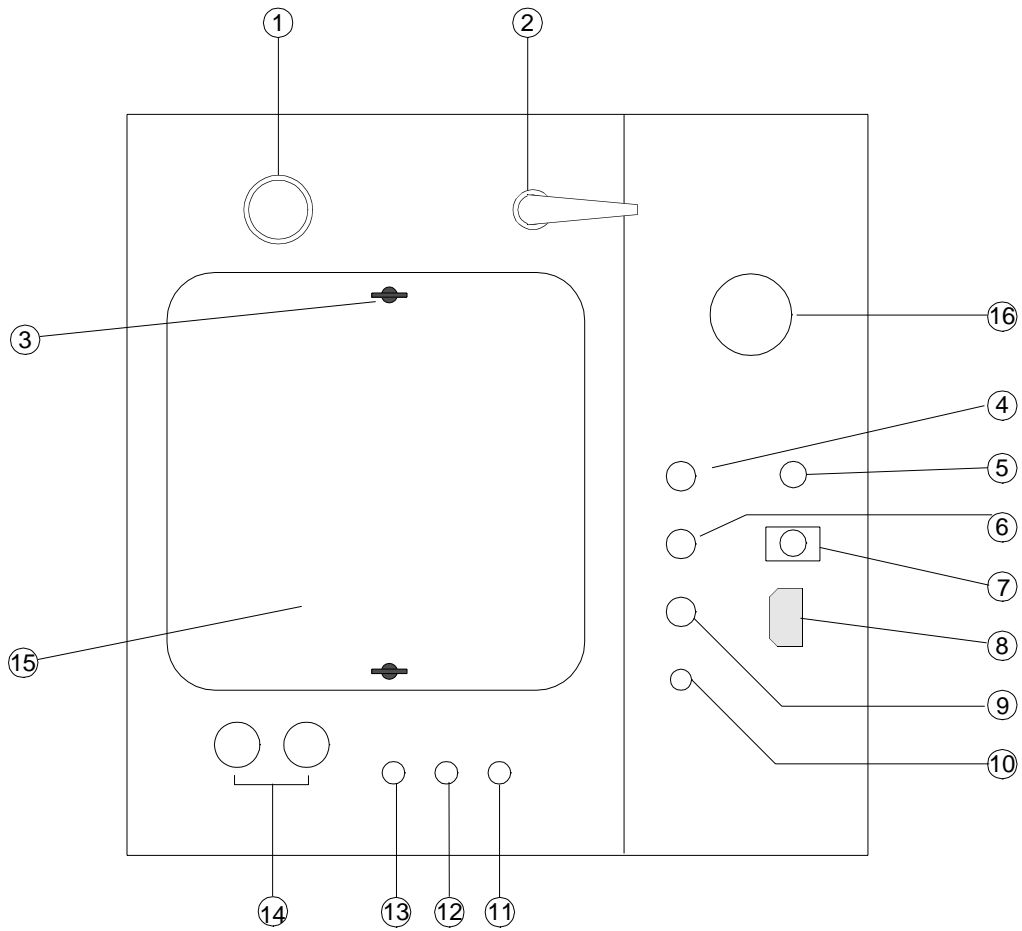
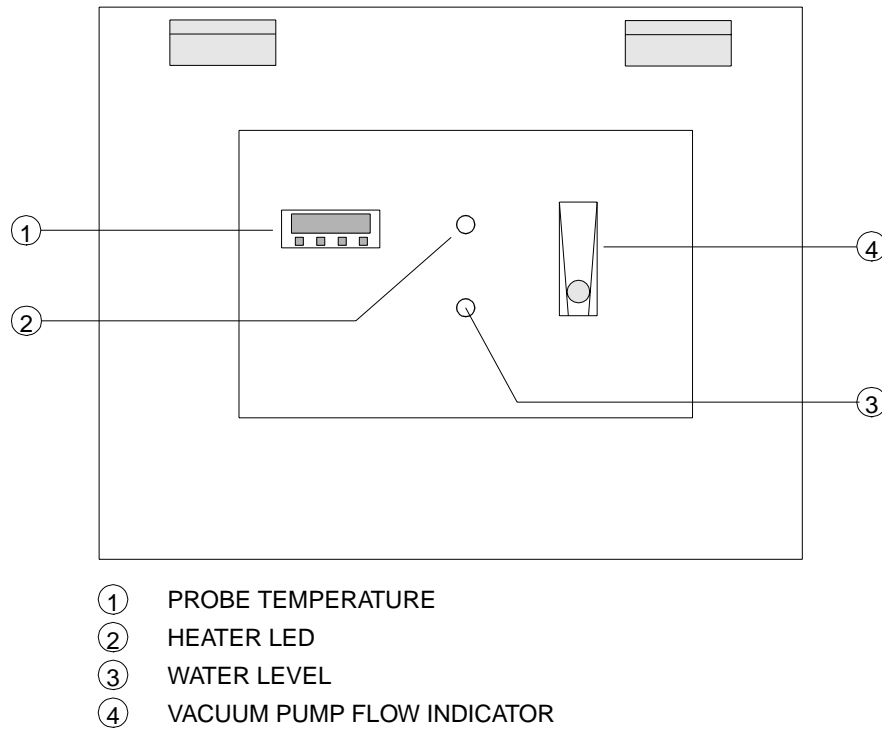


Figure 2.3. BVTE3900 top view



- ① VACUUM ADJUST
- ② FLOW VALVE
- ③ TANK COVER SCREWS
- ④ Pt100 PROBE
- ⑤ PUMP AND FAN FUSE
- ⑥ BVT3000 CONNECTOR
- ⑦ BVT2000 HEATER
- ⑧ MAINS
- ⑨ PROBE HEATER
- ⑩ LEVEL SWITCH
- ⑪ LN TANK VENT
- ⑫ VACUUM
- ⑬ GAS IN
- ⑭ WATER HOSES
- ⑮ TANK
- ⑯ FLOW SENSOR

Figure 2.4. BVTE3900 front view



## Installation

## 2.4

Open the cover top of the system, cables and hoses are inside.

The BVTE3900 includes flexible hoses approximately 7 meters long. Connect the two water hoses to the high temperature probe. The hoses are marked «IN» and «OUT», connect them on the probe plugs with the same mark.

Connect the mains cable.

Connect the Pt100 sensor on probe.

Connect the heater to probe and BVTE3900.

Connect compressed air on gas in nipple. The compressed air (approx. 6 bar) is for driving the venturi vacuum pump and draining the liquid circuit.

Connect the vacuum pump hose to the probe.

### *Using a BVT3000 with BVTE3900*

2.4.1

Connect the cable between BVT3000 (plug marked BVTB3500 on front panel) and plug unit.

The BVT3000 must be equipped with a «E» thermocouple input connector, and this sensor must be selected in the temperature controller configuration. This thermocouple type is installed in high temperature probes.

For very high temperature experiment up to 600 °C (878K) it is necessary to **close two jumpers (JP11 AND JP12)** on the main board of BVT3000 (board W4P110276C). They select the higher overheating temperature threshold.

Inside the BVTE3900 connect the 2 «FASTON» plugs of the heater output cable to make the connections A-C and B-D as shown in figure "***BVTE3900 wiring diagram***" on page 22 (bottom).

The heater **CONNECTOR 1 must be installed** on the top panel.

This configuration is normally factory set.

### *Using a BVT2000 with BVTE3900*

2.4.2

A slight change of the internal wiring in BVTE3900 is necessary.

Step1) Dismount the cover plate which holds all plugs. The plug (9) "PROBE HEATER" must be dismantled from the cover plate and the cable disconnected from the printed circuit and removed.

Step 2) The spare plug located at the end of the cable attached to plug (7) "BVT2000 HEATER" must be installed at same place.

Step 3) Disconnect the wires with "FASTON" terminations near the plug (7) and make the connection of the wires A to E and B to F as shown in figure "***BVTE3900 wiring diagram***" on page 22. They are coming from the right side near the electrical fan.

Step 4) Install then the special heater cable between the BVT2000 and the BVTE3900 (part number W1100628). Connect it on the rear side of BVT2000 plug marked "HEATER" and plug (7) "BVT2000 heater" on BVTE3900.

Connect, if necessary, the "E" type thermocouple coming from probe on the "E" input on rear side of the BVT2000 and select the same thermocouple type in the temperature controller configuration.

When this wiring is done, the BVT2000 provides the heater power. The heater led is now disabled. The safeties included in BVTE3900 become active (coolant flow and probe heater overheating monitoring). In case of a failure or problem, it means that the safety thermocouple signal loop is open which turns off immediately the heater in the BVT2000.

### *Filling up the coolant*

2.5

The tank must be filled with approximately 5 litres of coolant. The cooling is a mixture of pure water and ethylene-glycol. The system is delivered with 3 cans which must be poured in the tank (we recommend GLACELF from ELF, BRUKER part

number 58477). This coolant gives a protection against corrosion of the cooling system and production of algae in the water.

Inside the tank a mark shows the upper level of coolant.

***The coolant must be changed every year.***

### ***Drain the tank***

**2.6**

- Turn off the power switch.
- Turn the flow valve on position «DRAIN». Wait a few minutes until you hear a bubbling in the tank, during that the time the purge of the probe head is carried out.
- Turn the flow valve now on position «FLOW»
- Disconnect flexible hose «IN» from probe.
- Put the hose's end in a bucket and start the pump. Wait until the tank is empty. When the cover of the tank is removed from tank, the safety level switch disables the pump. To enable pumping lay the top cover backwards.
- When the tank is empty, switch off the BVTE3900. Turn the switch on position «DRAIN» for a while, the rest of liquid in the hose will be drained.

### ***High temperature operation***

**2.7**

- See first the technical manual of your high temperature probe.
- The cooling liquid circuit must be connected on probe.
- Turn the flow valve on position «FLOW».
- Switch on the BVT3000 and BVTE3900. The pump starts and coolant circulates through the probe.
- The purpose of the vacuum pump is to extract the hot gas from the probe in order to reduce temperature gradient along the sample tube. Adjust the vacuum with the knob located on top. Set the flow rate to approximately 500 litres/hour (flowmeter ball at 1/3 of full scale).

### ***Low temperature operation***

**2.8**

- The BVT3900 is suitable for working at low temperature. Making water circulating in the probe avoids freezing of the probe head.
- The top of the LN2 evaporator tank is equipped with a cap. The cap must be removed and the flexible hose must be coupled to the LN vent nipple. In that way the tank is always at atmospheric pressure whenever the BVTE3900 is switched off to avoid freezing of probe when the BVTE3900 is off, while the evaporator is on.
- Connect the transfer line from LN tank to probe.
- Connect the LN2 heater on BVT3000.

## Description

- Switch on the BVTE3900.
- Start VTU sample temperature regulation.
- In low temperature operation, the purpose of the vacuum pump is to avoid the sample tube from being lifted by the N2 gas flow. Adjust vacuum pump to 500 l/h (flowmeter ball at 1/3 of full scale).

### **Probe dismounting**

**2.9**

- Turn off the power line switch to stop the pump.
- Turn the switch on position «purge». Wait 3-5 minutes, during that the time the purge of the probe head is carried out. See section **"Drain the tank" on page 15**.
- Remove the connectors and hoses.

### **Safeties**

**2.10**

The following safeties prevent probe overheating when working at high temperature. In case of fault a relay opens the signal path of the heater safety thermocouple.

1. The right water level in the tank is indicated when the green led on front side lights. A low level in the tank disables the pump.
2. A water flow sensor monitors the water flow. When the flow is too low or missing it switches off the heater.
3. A Pt100 sensor measures the temperature inside the probe. When the temperature exceeds a threshold (320 K) it switches off the heater.
4. The safety thermocouple located on heater measures the temperature of the heater resistor. Missing gas flow while heating will produce an overheating that switches off the heater.

If a fault occurs and switches down the heater, check the system (water level, gas flow etc.) and restart the heater.



## Connectors

2.11

## Heater connector

2.11.1

Figure 2.5. Probe heater connector (front view)

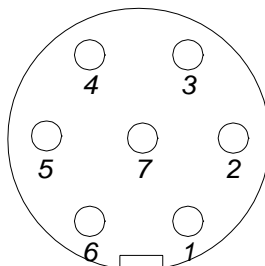


Table 2.1. Probe heater connector pin assignment

PIN	SIGNAL
1 & 2	heater +
3	safety thermocouple +
4	safety thermocouple -
5 & 6	heater -
7	gnd

Figure 2.6. BVT3000 connector (front view)

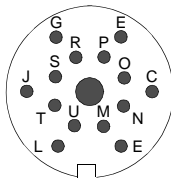


Table 2.2. BVT connector pin assignment

PIN	SIGNAL NAME	DIRECTION	COMMENT
A	+5V	I	digital VCC input
C	NC	---	reserved
E	gnd_BTO	I	isolated GND for BTO2000 (reserved)
G	+15 v_BTO	I	isolated +15V for BTO2000 (reserved)
J	NC	---	reserved
L	dgnd	I	digital GROUND input
M	sda	I/O	I2C bus data line
N	scl	I/O	I2C bus clock line
O	power control	I	0 to 10 volt heater power control input
P	pgnd	I	power ground
R	pgnd	I	power ground
S	thermocouple	O	safety thermocouple output
T	b_relay	I	heater relay command input
U	b_connected	O	«LOW» when BVE3900 is powered on

Figure 2.7. Probe PT100 connector (front view)

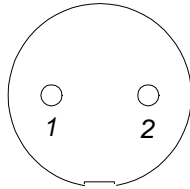


Table 2.3. Probe PT100 connector pin assignment

PIN	SIGNAL
1	PT100 +
2	PT100 -

Figure 2.8. Level switch connector (front view)

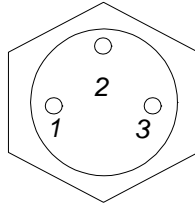


Table 2.4. Level switch connector pin assignment

PIN	SIGNAL
1	switch
2	switch
3	nc

Figure 2.9. BVT2000 heater connector (front view)

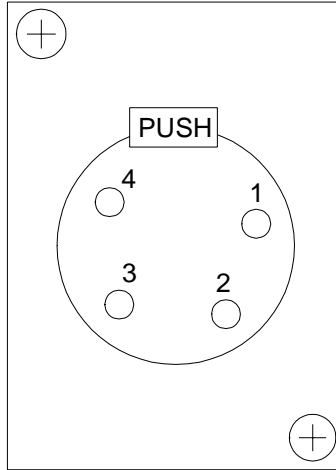
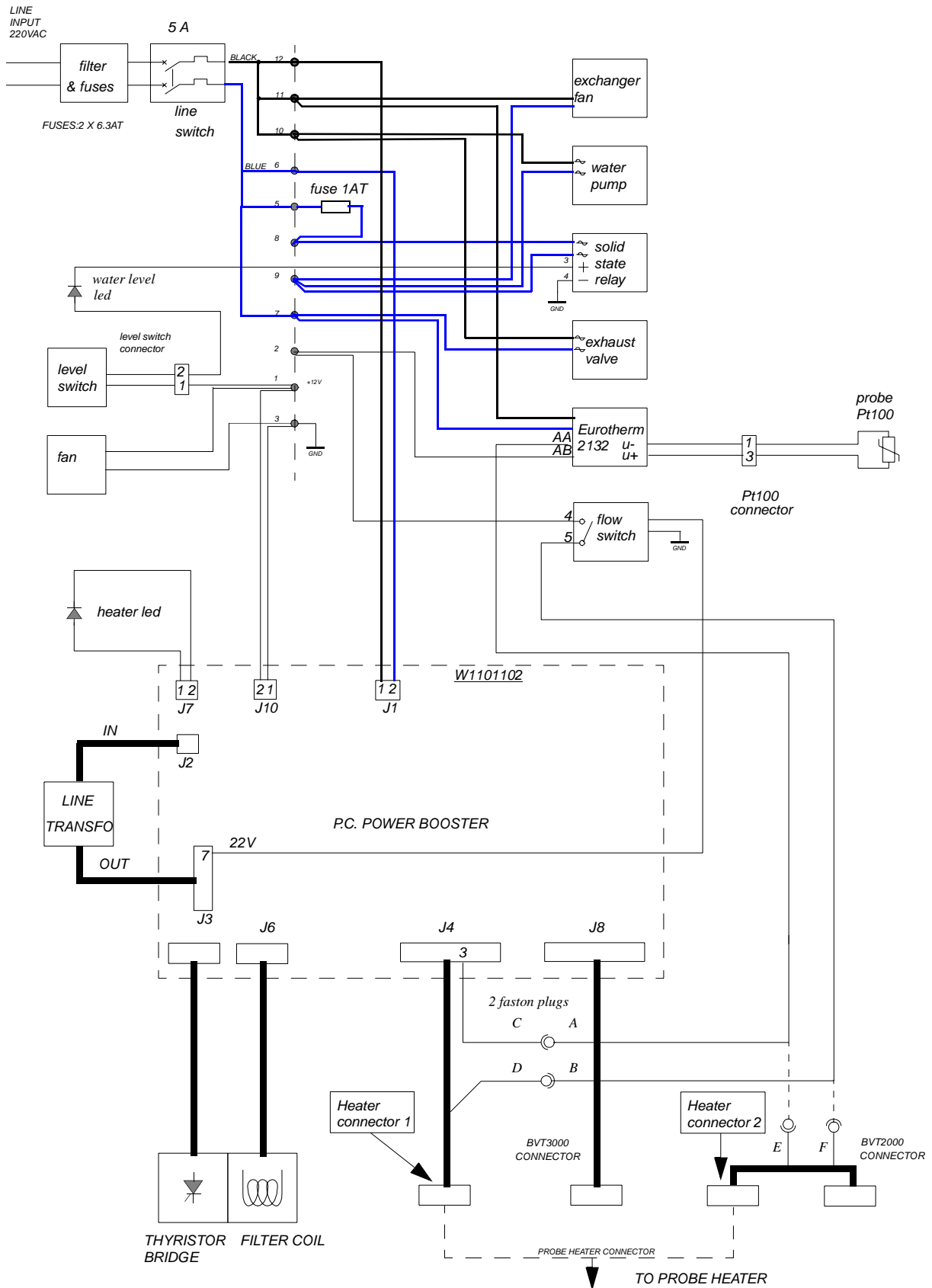


Table 2.5. BVT2000 heater connector pin assignment

PIN	SIGNAL
1	HEATER
2	SAFETY THERMOCOUPLE
3	SAFETY THERMOCOUPLE
4	HEATER

# Description

Figure 2.10. BVTE3900 wiring diagram



# Technical specifications

# 3

## Specifications

## 3.1

Table 3.1. Specifications

<b>Heater power</b>	500 W maximum
<b>Heater resistance</b>	8 ohms
<b>Driving unit</b>	BVT3000 or BVT2000 with «E» thermocouple input
<b>Weight</b>	60 Kg for basic system
<b>Dimensions</b>	560 mm (W) x 500 mm (H) x 560 mm (D) aluminium case
<b>Voltage requirements</b>	220 V + / - 10%, 50/60 Hz 6.3 A fuses on mains
<b>Power consumption</b>	220V/5 amp maximum at full heating power
<b>Operating temperature</b>	0 to 50 °C
<b>Gas supply</b>	. 4 to 10 bar compressed air . 750 l/h at 4 bar compressed air for 500l/h suction
<b>N2 gas supply</b>	500 l/h for heating

Some important electronic functions are fuse protected. To replace a blown fuse, ensure that power is removed before opening the case. Faulty fuses must always be replaced with the same type.

The fuses are located on the printed circuit.

Table 3.2. Power booster fuses values

Fuses	Value	Protection for
F1	0,5 AT	+15 V
F2	0,5 AT	- 15 V
F3	10 AT	heater

Figure 3.1. Booster fuses locations

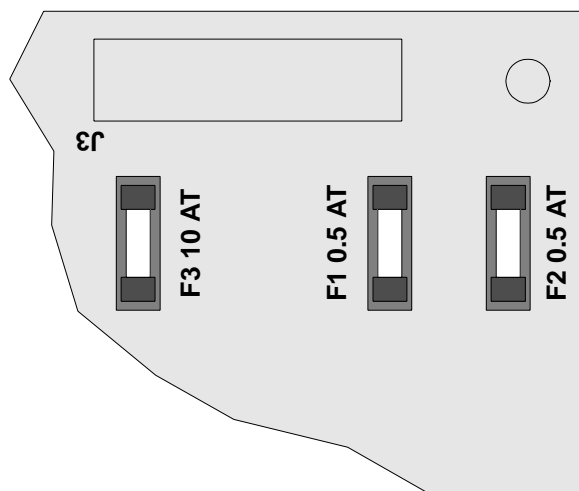


Table 3.3. System fuses values

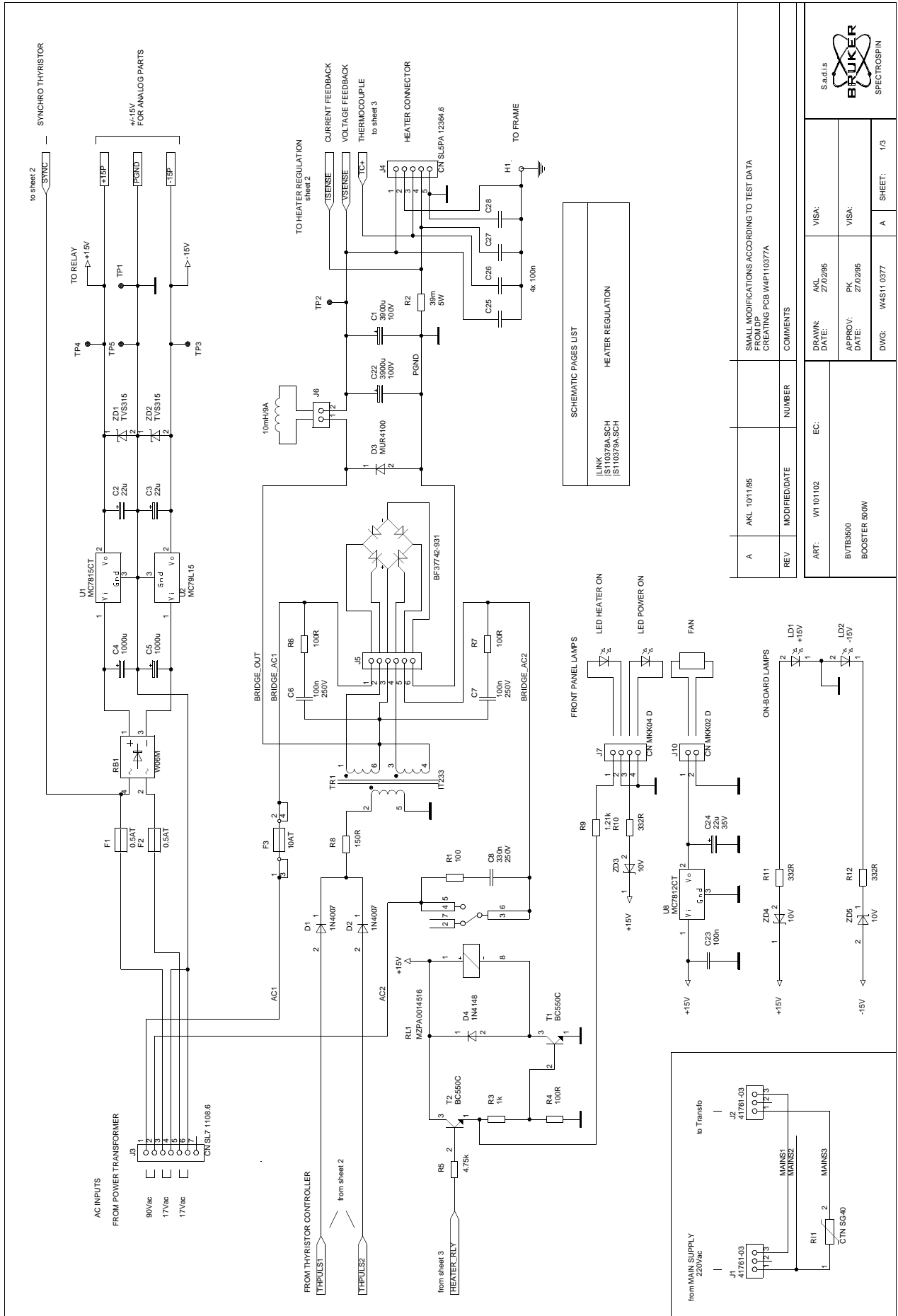
Value	Protection for
5 AT	mains
1 AT	pump and fan



# ***Schematics***

# **4**

Figure 4.1. BVTB3500 Booster 500W



LINK  
S110378A SCH  
S110378A SCH

HEATER REGULATION

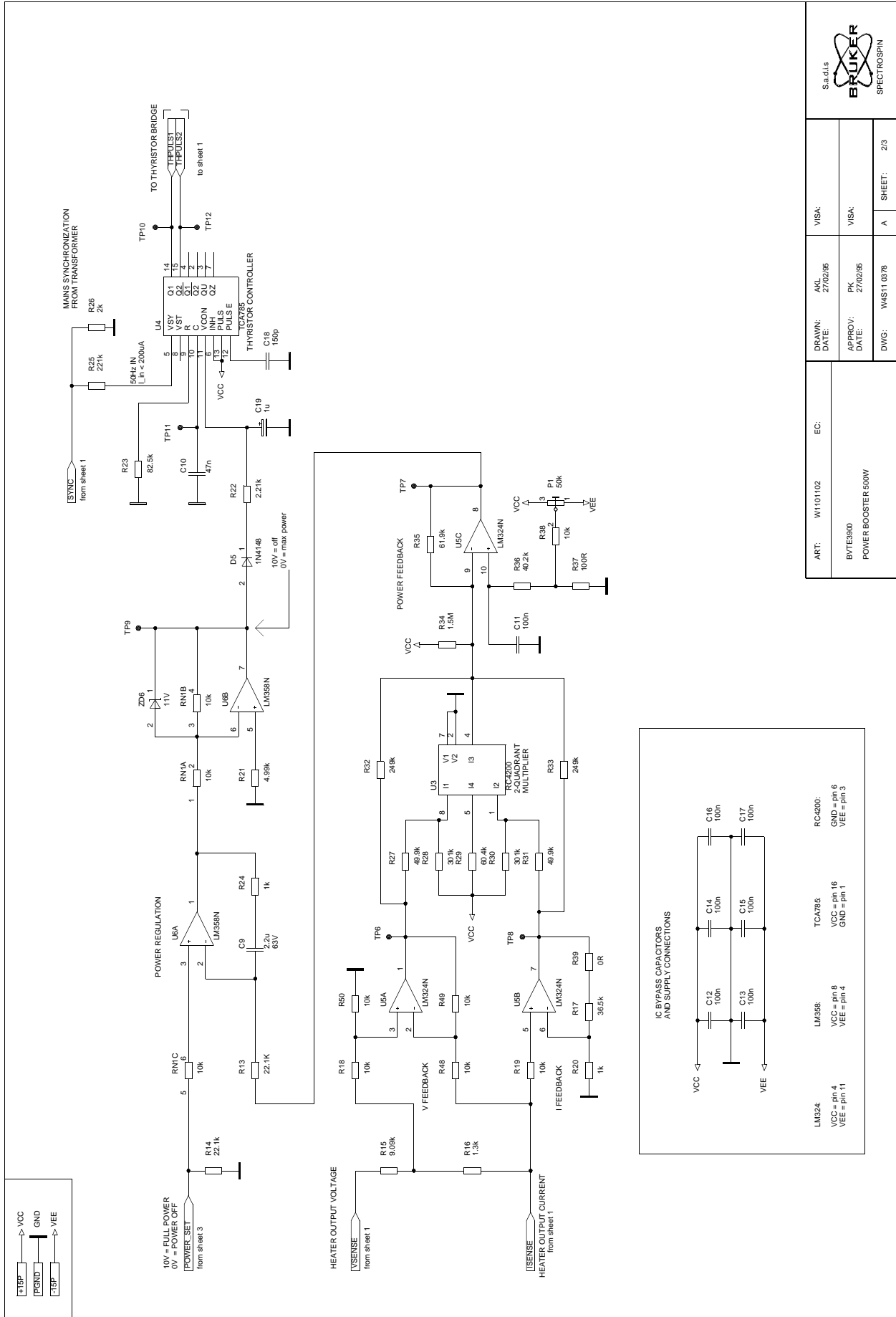
REV	MODIFIED/DATE	NUMBER	COMMENTS
A	AKL 10/11/05		SMALL MODIFICATIONS ACCORDING TO TEST DATA FROM DP CREATING PCB W4P10377A

ART:	W1101102	EC:
BVTB3500		
BOOSTER 500W		

DRAWN:	AKL	VISA:		
DATE:	27/02/95			
APPROV:	PK	VISA:		
DATE:	27/02/95			
DWG:	W4S11.0377	A	SHEET:	1/3



Figure 4.2. BVTE3900 Power booster 500W



ART: W1101102	EC:	DRAWN: AKL	VISA:
BVTE3900	POWER BOOSTER 500W	DATE: 27/02/95	DATE: 27/02/95
APPROV: PK		DATE: 27/02/95	
DWG: WAS11 0378	A	SHEET: 2/3	



Figure 4.3. BVTB3500 Booster 500W

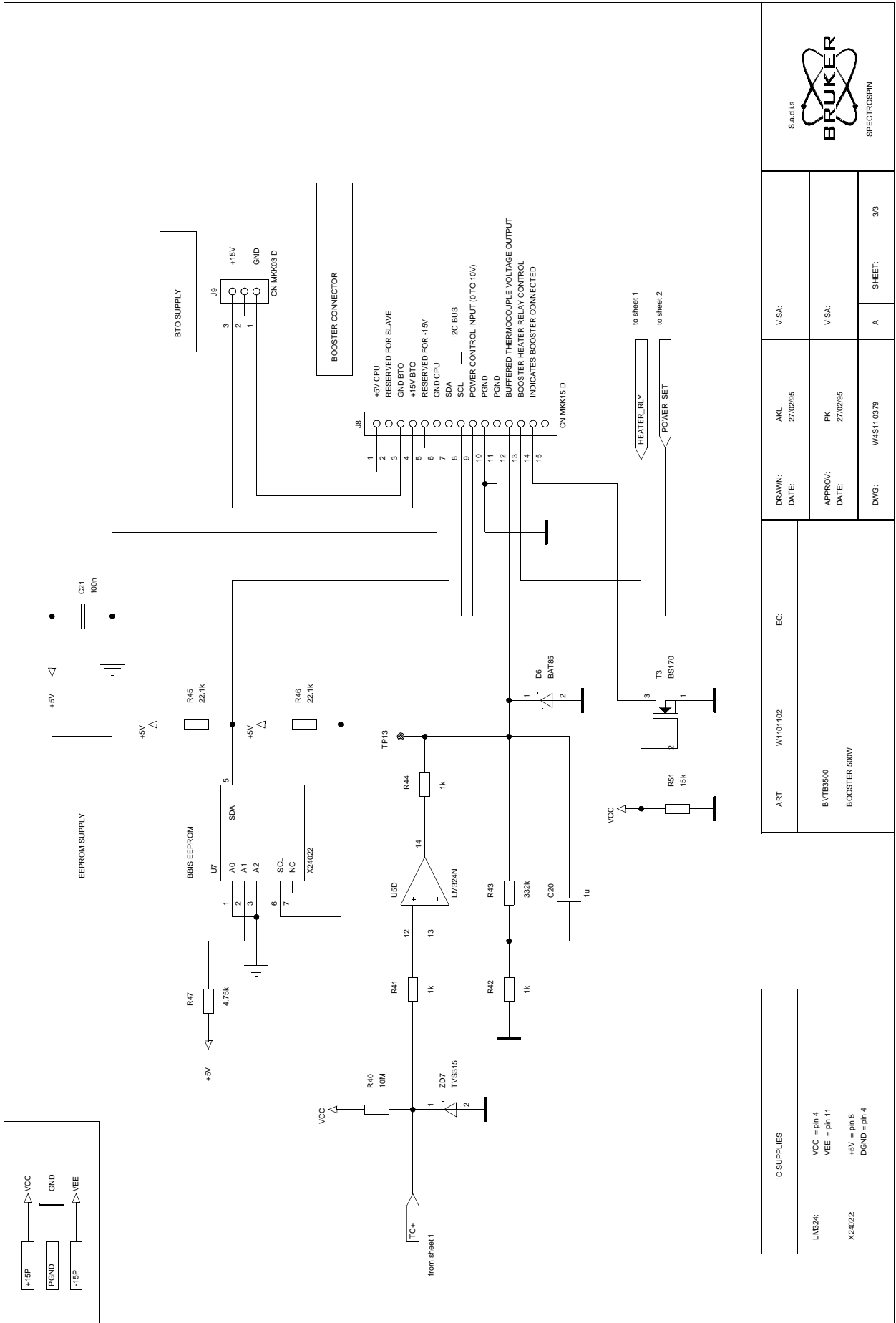
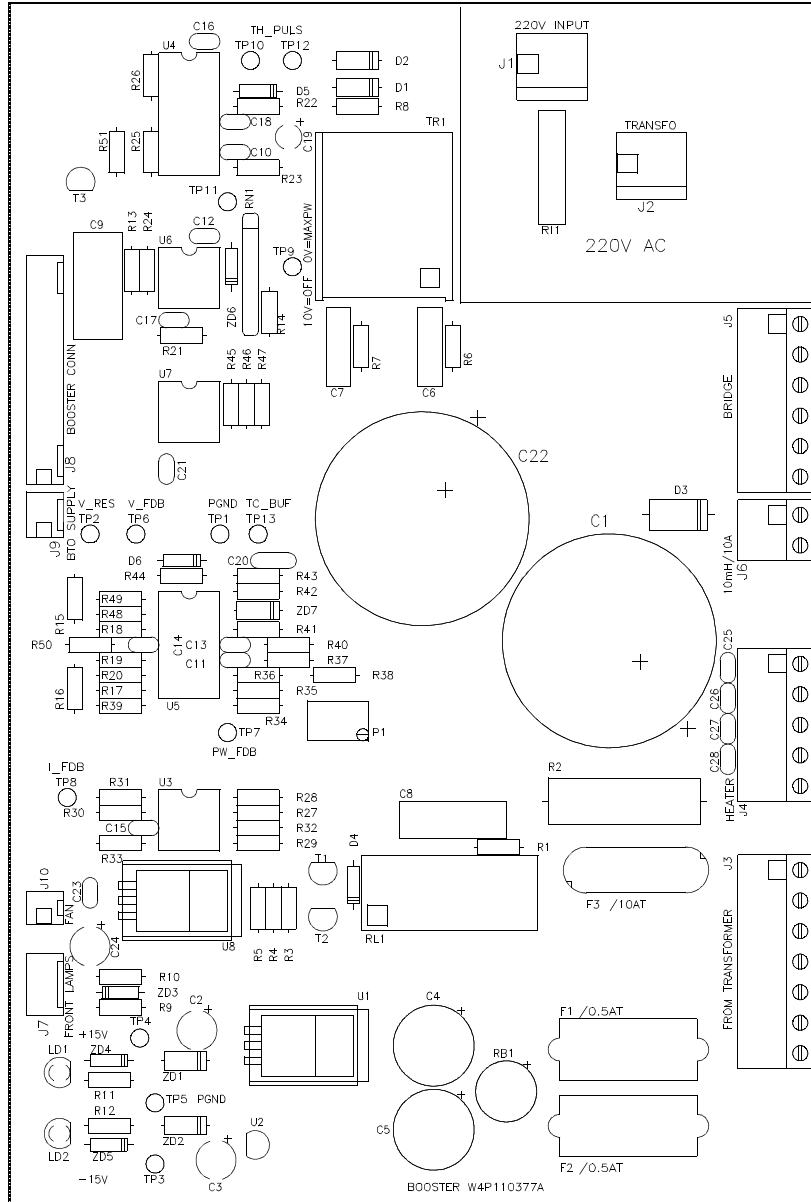


Figure 4.4. BDTc Booster 500W Location



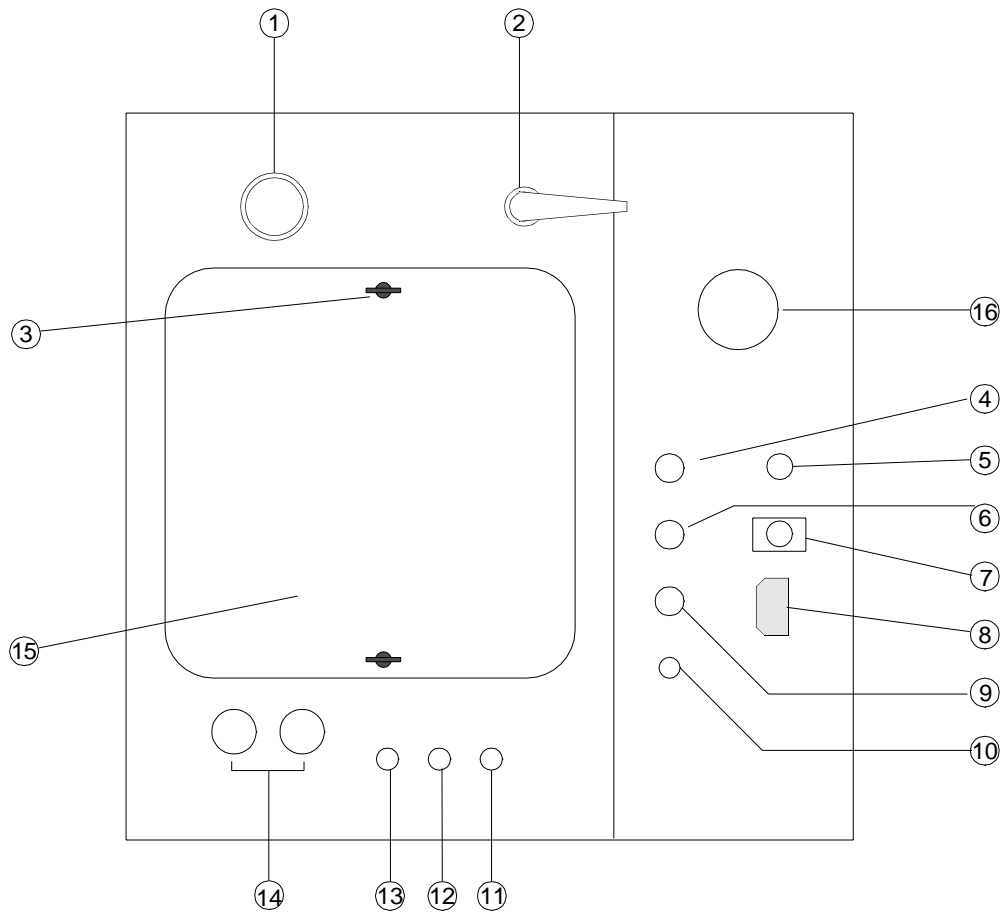
ART NR : W1101102	EC :	DRAWN : RC	VISA :	S.q.d.i.s
BDTC BOOSTER 500W CI :W4P110377A		DATE : 30/11/95	VISA :	BRUKER
		APPROV : PK	VISA :	SPECTROSPIN
		DATE : 30/11/95		
		DWG NR :W4L110377	A	SHEET : 1/1



# ***Option LTE***

# **5**

Figure 5.1. BVT3900 LTE Top View



- ① VACUUM ADJUST
- ② FLOW VALVE
- ③ TANK COVER SCREWS
- ④ Pt100 PROBE
- ⑤ PUMP AND FAN FUSE
- ⑥ BVT3000 CONNECTOR
- ⑦ BVT2000 HEATER
- ⑧ MAINS
- ⑨ PROBE HEATER
- ⑩ LEVEL SWITCH
- ⑪ LN TANK VENT
- ⑫ VACUUM
- ⑬ GAS IN
- ⑭ WATER HOSES
- ⑮ TANK
- ⑯ FLOW SENSOR



Figure 5.2. BVT3900 Lte Front View

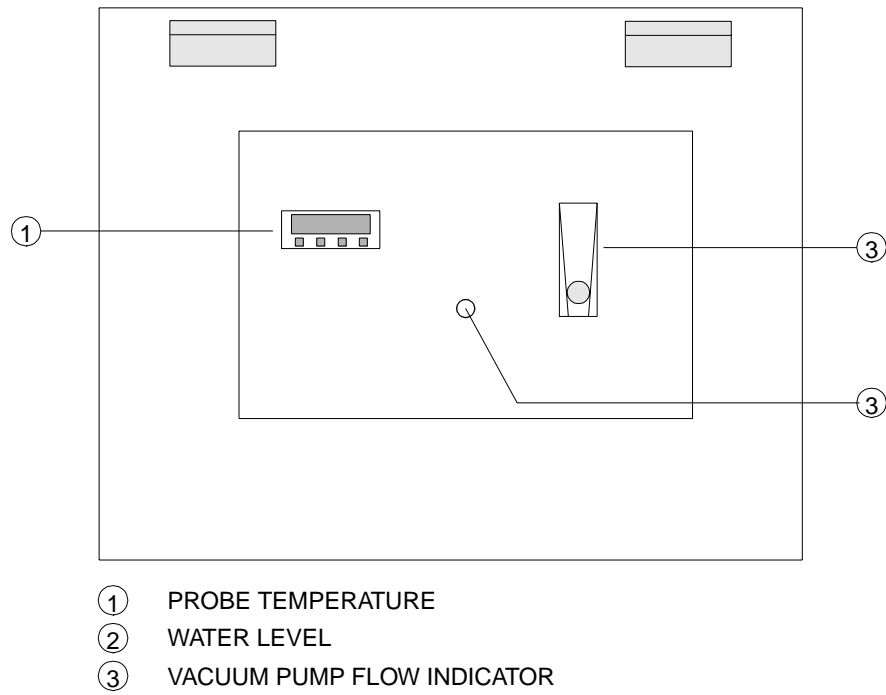


Figure 5.3. BVT3000 heater connector (front view)

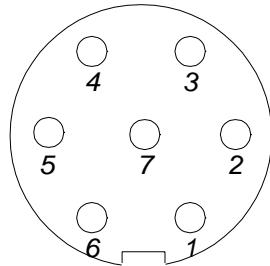


Table 5.1. Probe heater connector pin assignment

PIN	SIGNAL
1 & 2	heater +
3	safety thermocouple +
4	safety thermocouple -
5 & 6	heater -
7	gnd

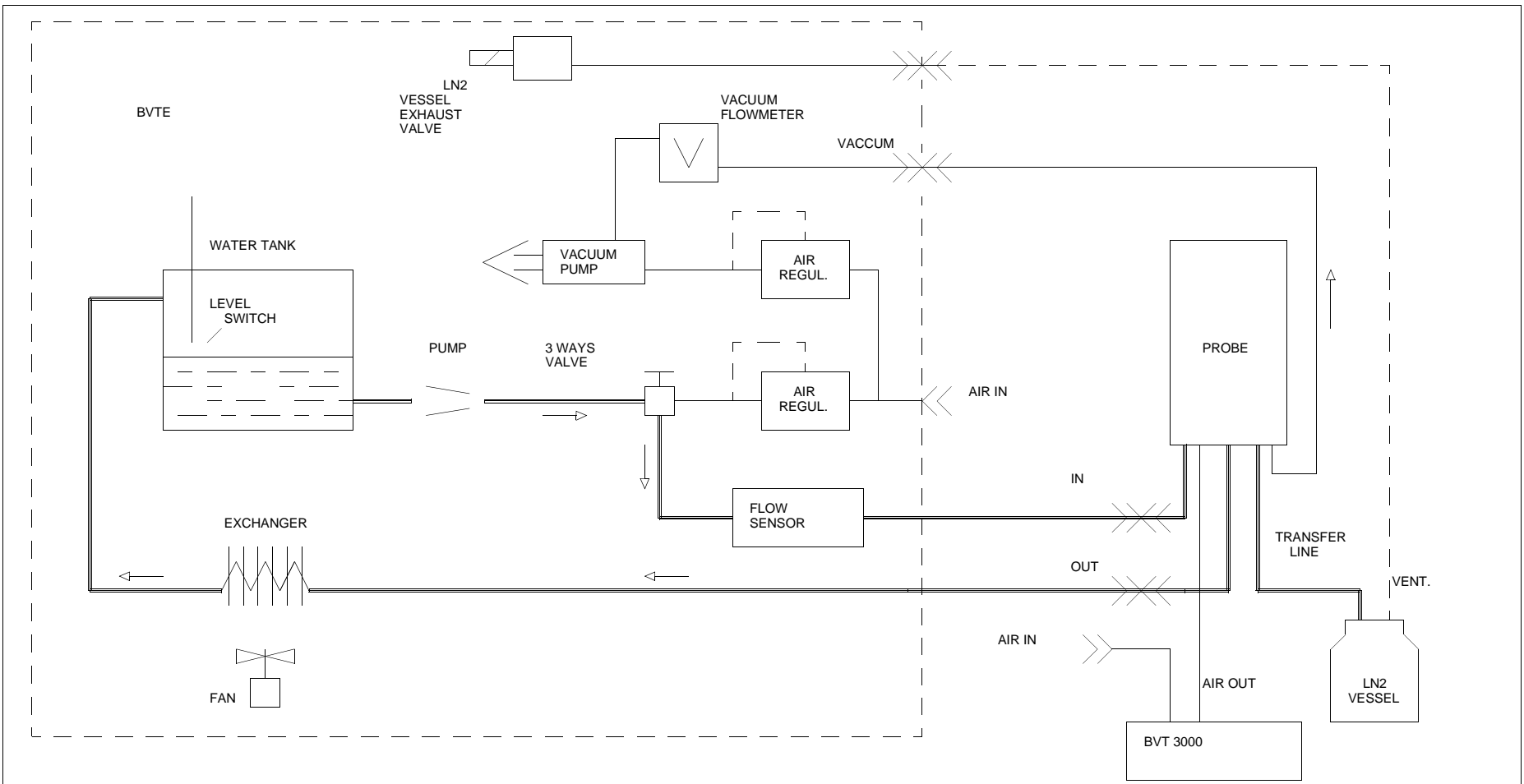
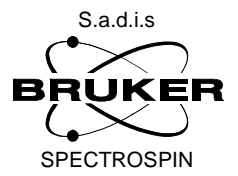


Figure 5.4. BVT3900 LTE Liquid + air circuits

REV	MODIFIED/DATE	NUMBER	COMMENTS		
	ART: W1208962	EC:01	DRAWN: RRO	VISA:	
			DATE: 15/07/96		
	BVTE 3900		APPROV: PB	VISA:	
			DATE: 15/07/96		
			DWG: W3L12 4546	SHEET: 1/1	

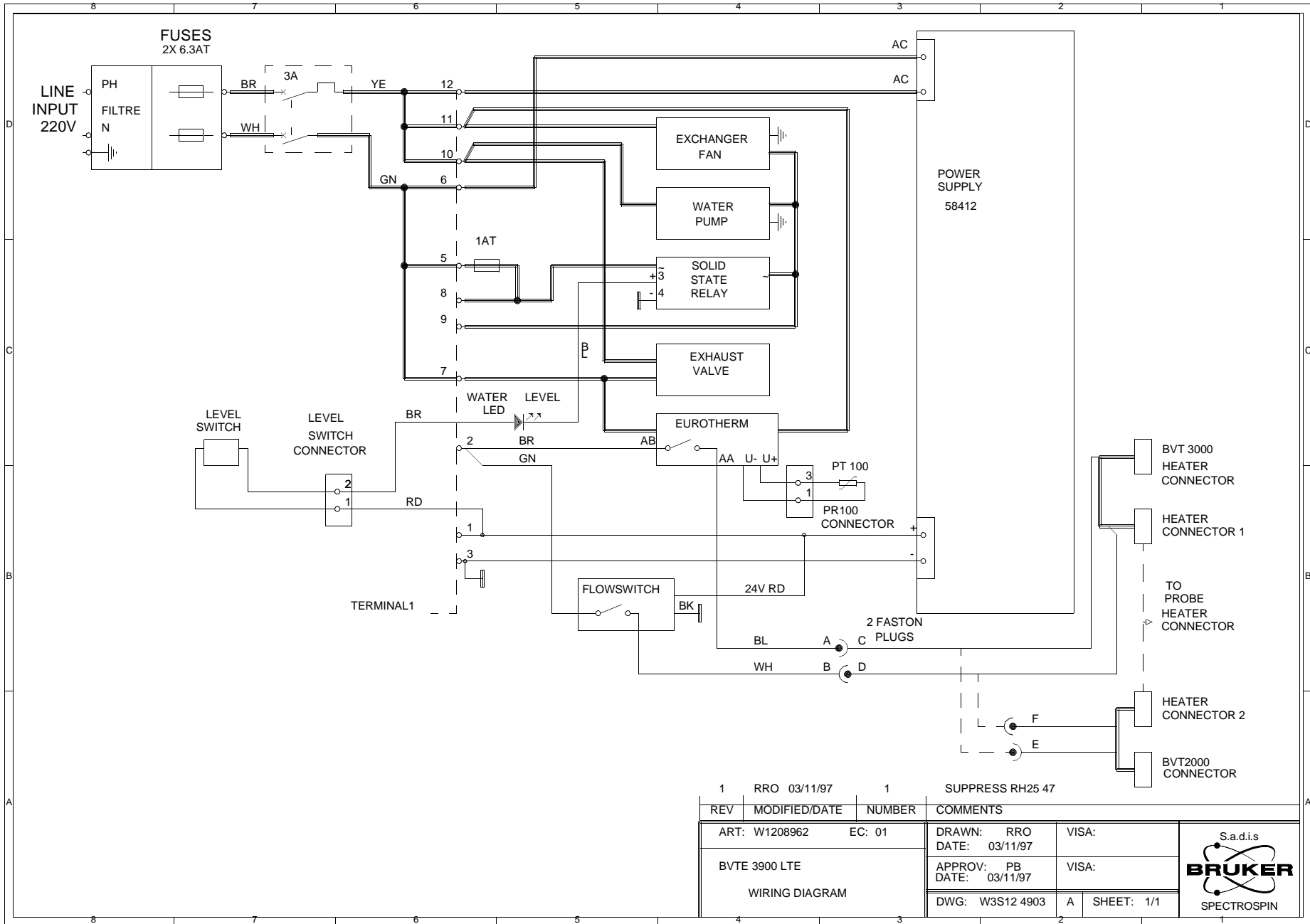
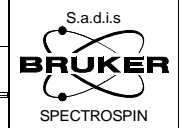


Figure 5.5. BVT3900 LTE Wiring diagram

1	RRO 03/11/97	1	SUPPRESS RH25 47
REV	MODIFIED/DATE	NUMBER	COMMENTS
	ART: W1208962	EC: 01	DRAWN: RRO DATE: 03/11/97
	BVT3900 LTE		APPROV: PB DATE: 03/11/97
	WIRING DIAGRAM		DWG: W3S12 4903
		A	SHEET: 1/1



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