ON - 900 Oxygen / Nitrogen determinator
OH - 900 Oxygen / Hydrogen determinator
ONH - 2000 Oxygen / Nitrogen / Hydrogen determinator

ELTRA
Analyzers made in Germany

SERVICE MANUAL ON/OH-900, ONH-2000

ON-900

OH-900

ONH-2000

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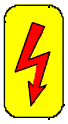
The analysers ON - 900, OH - 900 and ONH – 2000 are of equal design.
The service manual is therefore common for all three types.
The only difference between them is the tubing and the chemicals. See 4.3

NOTE :

Servicing should only be done by a person with profession, who has mastered the servicing and maintenance of this device, as well as having further qualifications, especially in the field of electronics and physics.

We ask the users of this Service Manual to inform us about any possible mistakes. We would also appreciate any suggestions for supplements and improvements to this Service Manual.

CAUTION ! 

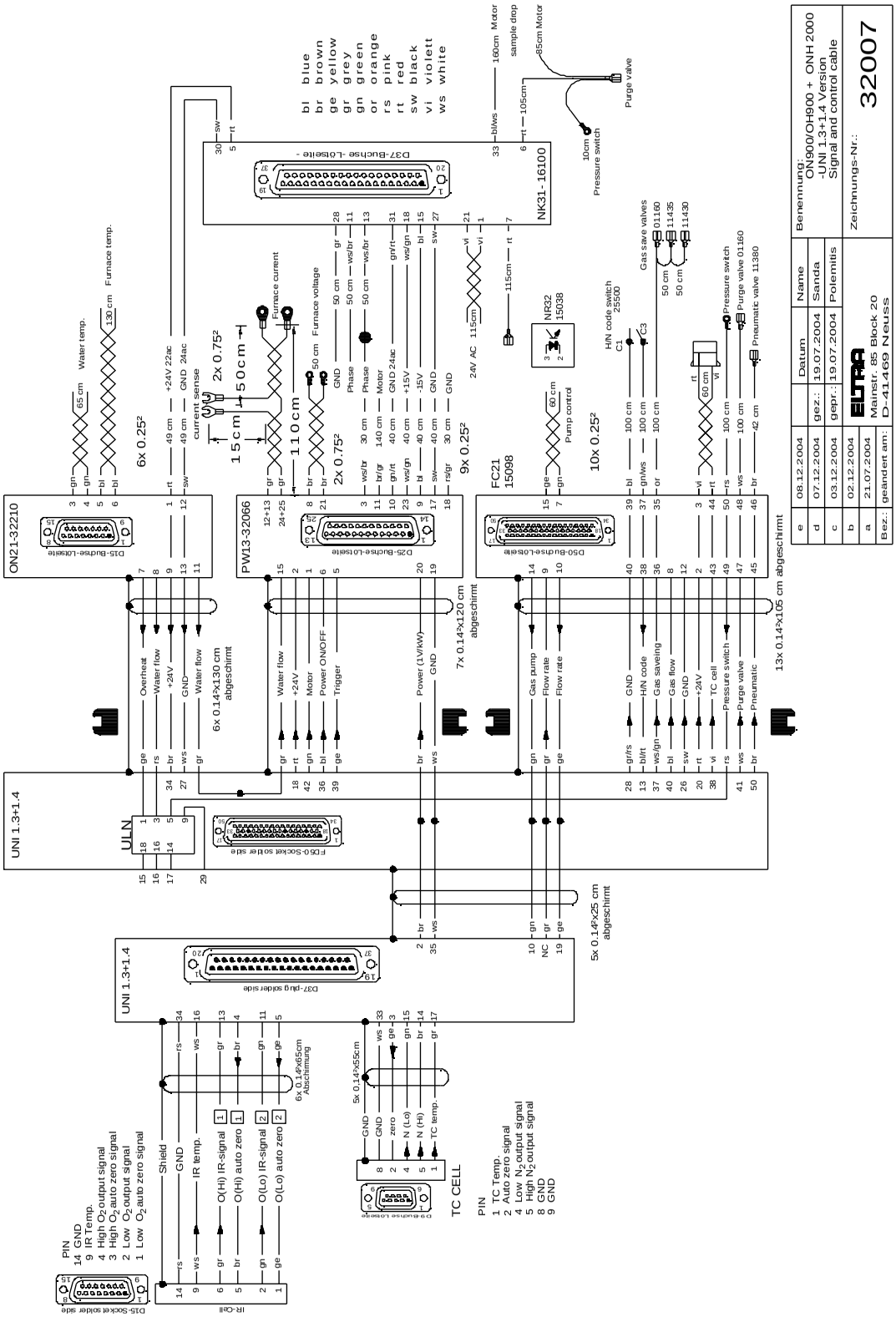
Before opening this device, always unplug the main power !

SERVICE MANUAL ON / OH-900 and ONH-2000

0.1 Overview of the ON/OH-900; ONH-2000 modifications:

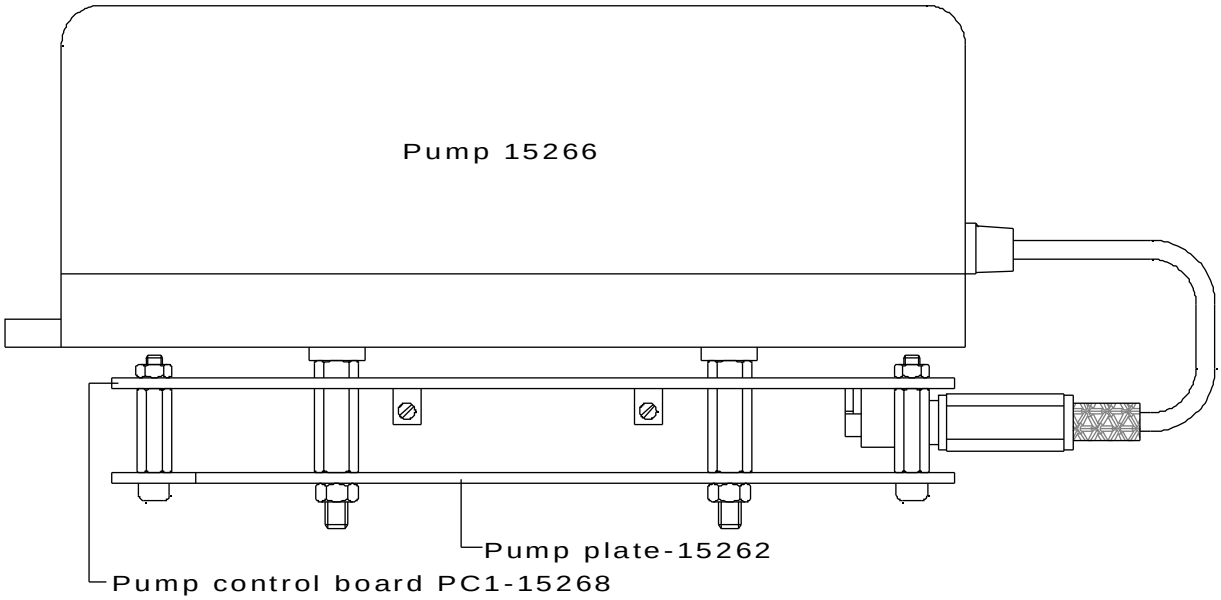
Up to S/N 1500xxxxxx

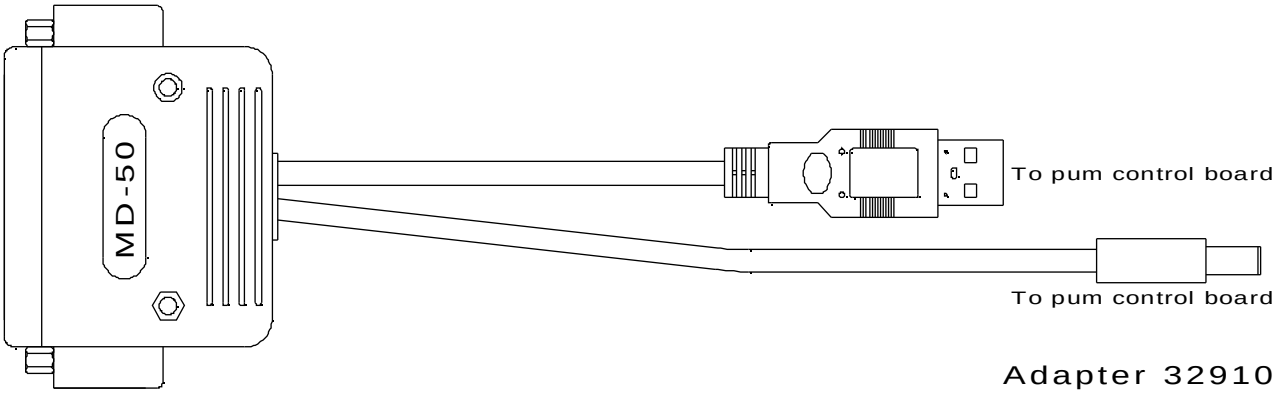
The electronic unit is replaced by the board UNI 1.3 and the electronic rack is removed.
The corresponding wiring diagram is **32007**.
The modification took place in the second half of 2004.



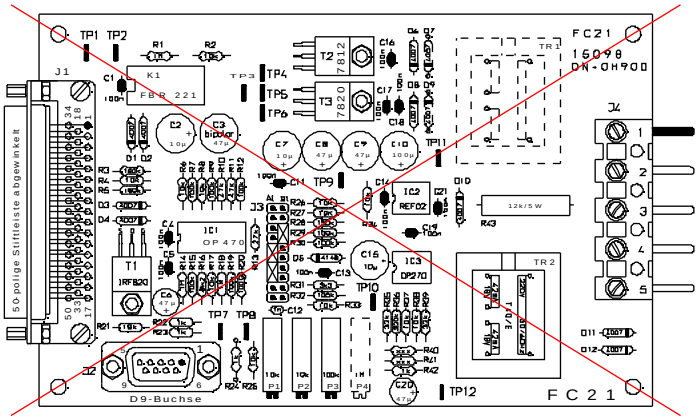
ON-900 from S/N 1738xxxxxx
OH-900 from S/N 1811xxxxxx
ONH-2000 from S/N 1771xxxxxx

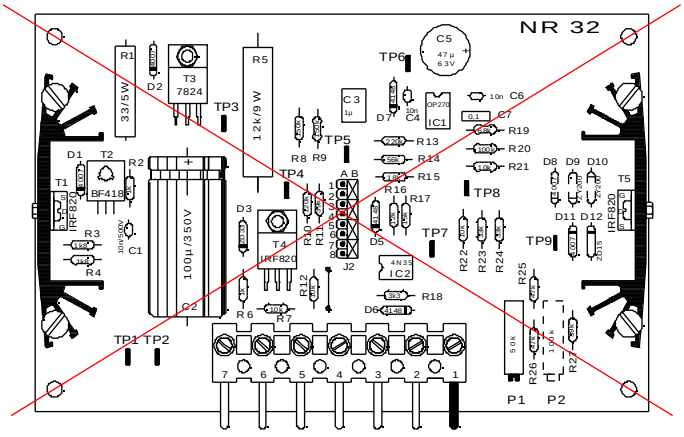
The pump has changed along with a pump control board and a adapter as shown below.



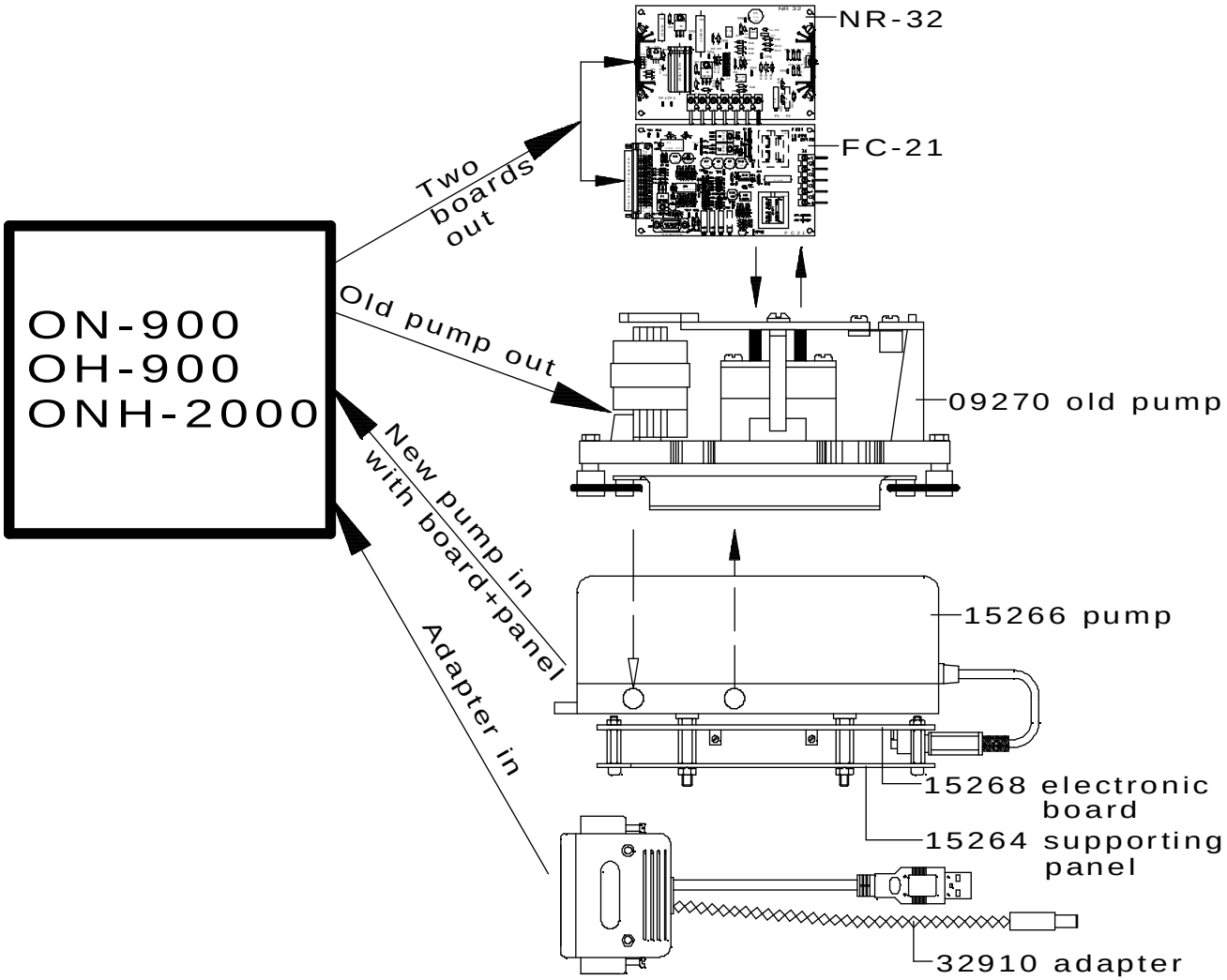


The boards FC21 and NR32 are replaced by the board 15268.



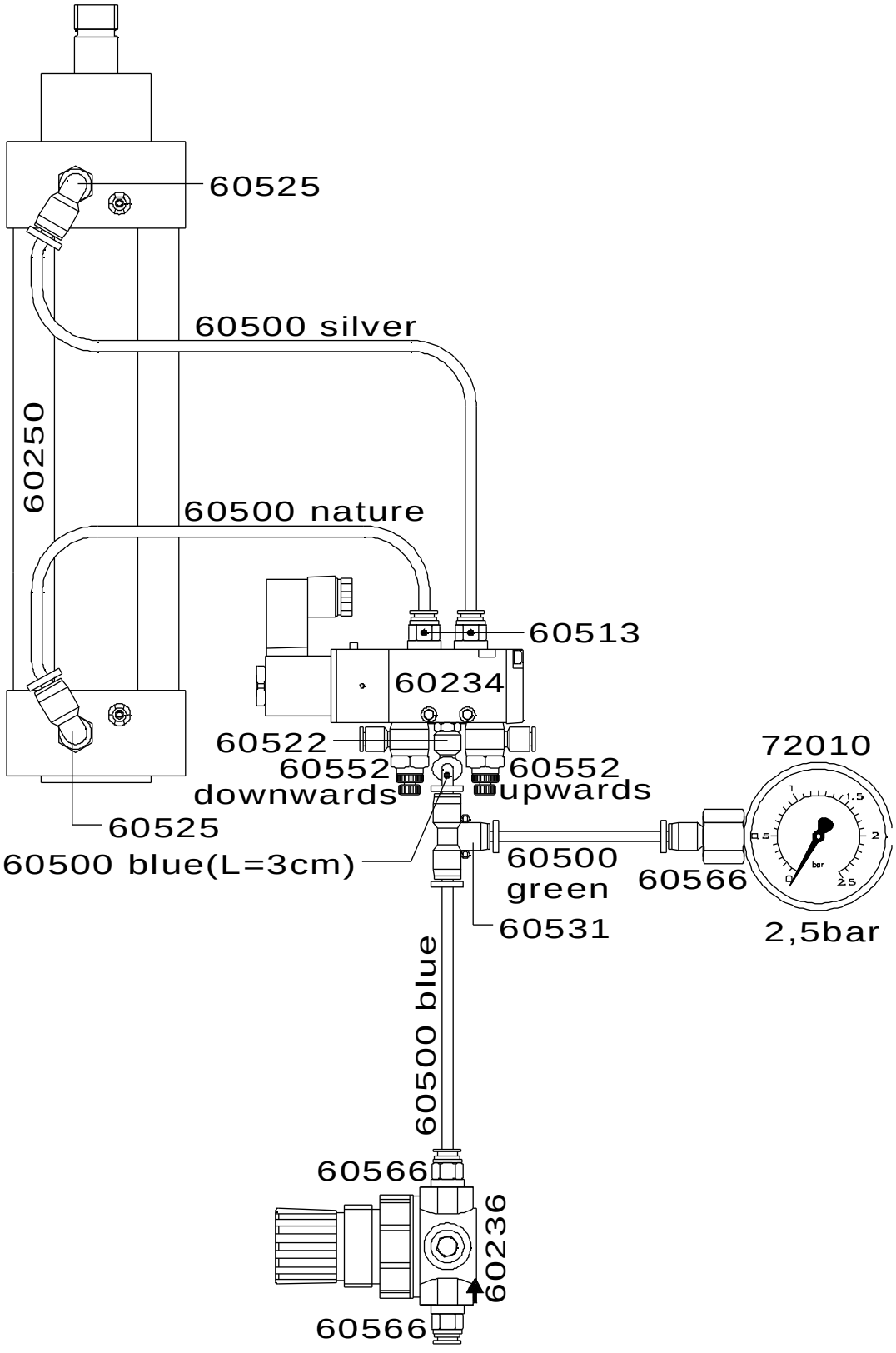


The old pump is change with the new pump as shown below.



Ordering numbers:
15264-Pump plate
15266-Pump
15268-Pump control board PC1
32910-Pump adapter

From end of the year 2007 the ON/OH-900 and ONH-2000 are equipped with the new pneumatics.



1 FAULTS

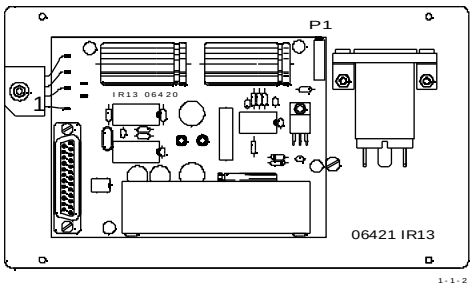
1.1 IR-cell test displays: ++++ see 2. 3

If the range is higher than
10 V ++++
then the problems are as follows:

1) **Too much contamination:**
There are one or more indication ranges and they are too high.

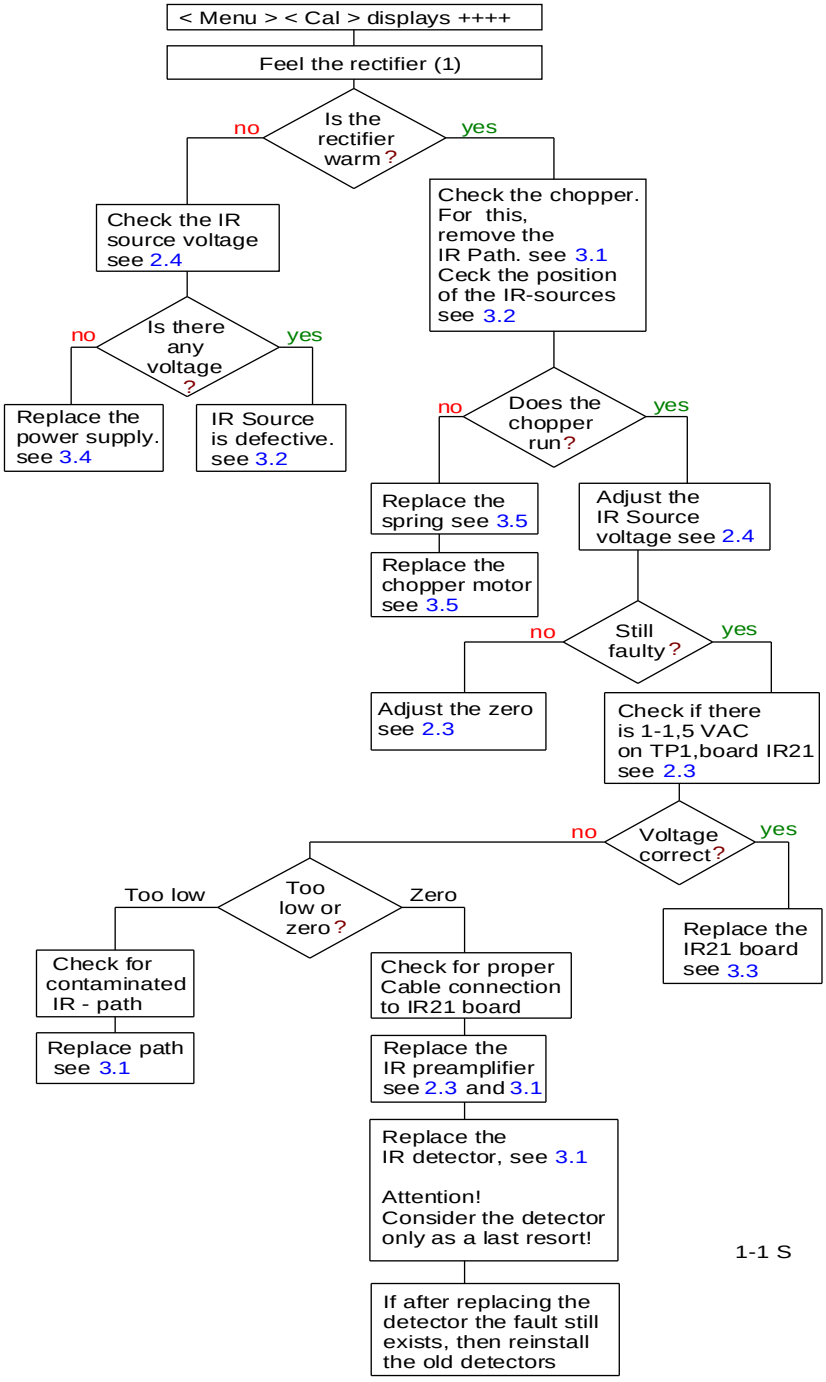
2). **The IR–sources:**
The sources are bent or de-adjusted through transport. See **Remark:**

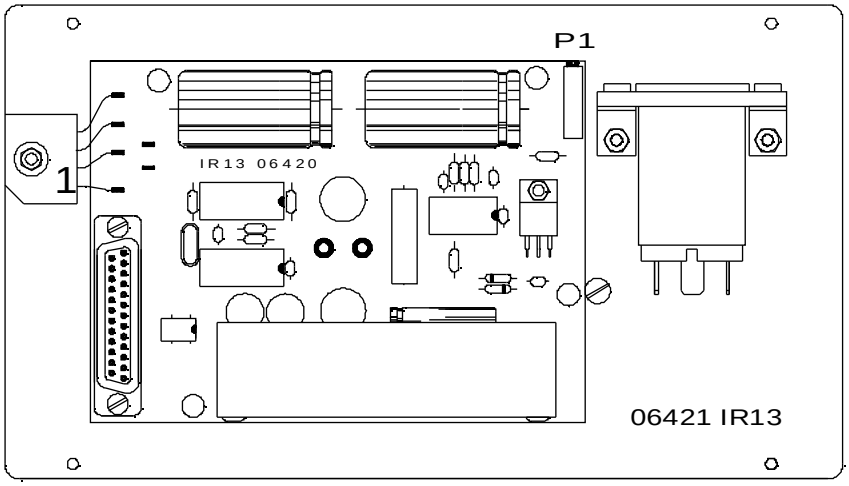
3**)**. **Chopper:**
The chopper is not running although the path is not contaminated and the IR-source is ok.



Remark:
In most cases the problem is in the IR-sources or in the power supply. During a rough transportation the IR-sources may be bent causing the problem. See 3.2. We experienced that this is very popular for the new IR-detector and preamplifiers.
We can only help if you send us a copy of the flow diagram of this chapter, after drawing a line along the path you followed according to the condition you found.
Asking for detectors, preamplifiers and boards without following this diagram, is useless.

also after five minutes of oxygen flow:





1-1-2

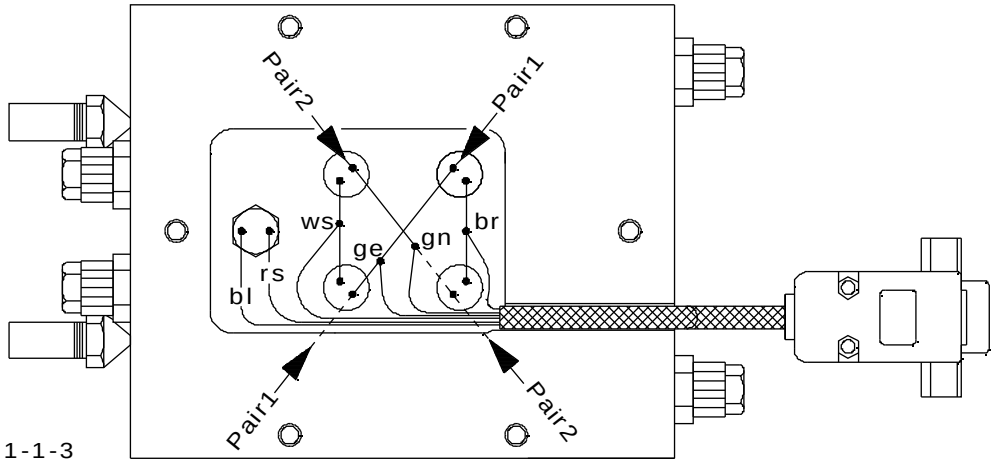
- Touch the rectifier **(1)** of the **IR-cell**, it should feel warm (about **45℃**).
  (The analyser does not need to be turned off, nor must the infrared rack be removed).
- If the rectifier is cold (room temperature), you should check the **IR-source** voltage, see **2. 4** .
- If there is no **IR source** voltage, replace the power supply, see **3. 4**
- If there is IR source voltage, but the rectifier **(1)** is cold, then the IR source is defective.
  Since the IR sources are connected in series, the rectifier is cold, even when just one of the IR sources is defective.
- Open the infrared rack, remove the **IR source** (see **3.2**), and identify the defective part by resistive measurement.
  Non defective **IR sources** have a resistance of only **1 Ohm**, while defective ones have a much higher or unmeasurable resistance.

CAUTION!
When setting new **IR sources**, CO_2 can be produced during the first warming up.
Therefore, all points of the adjustment instructions (see **2.3**) should be carefully followed through.

- **If the rectifier (1) is warm**, then check if the chopper motor is at a standstill. To do this, an **IR path** must be unscrewed.
  Through the bore holes in the chopper motor housing, the chopper blades should be be visibly rotating.
  The cause for a chopper motor that doesn't run are usually the springs (see **3. 5**) that were built in before September 1993 .
- Exchange the spring-type for a newer type. The motor itself should turn anyway, even when the chopper blade is not mounted. If not, the motor is defective.
- Theoretically, the circuit **board IR21** may also be at issue. This is, however, very unlikely if more than one channel is not functioning in a multi-channel device.

TC-cell check displays ++++ or -9.99 (see 2 .12)

If the test of the TC-cell still shows ++++ or - 9.99 after 5 minutes of carrier gas flow, check the flow rates first (see 2 .12) .

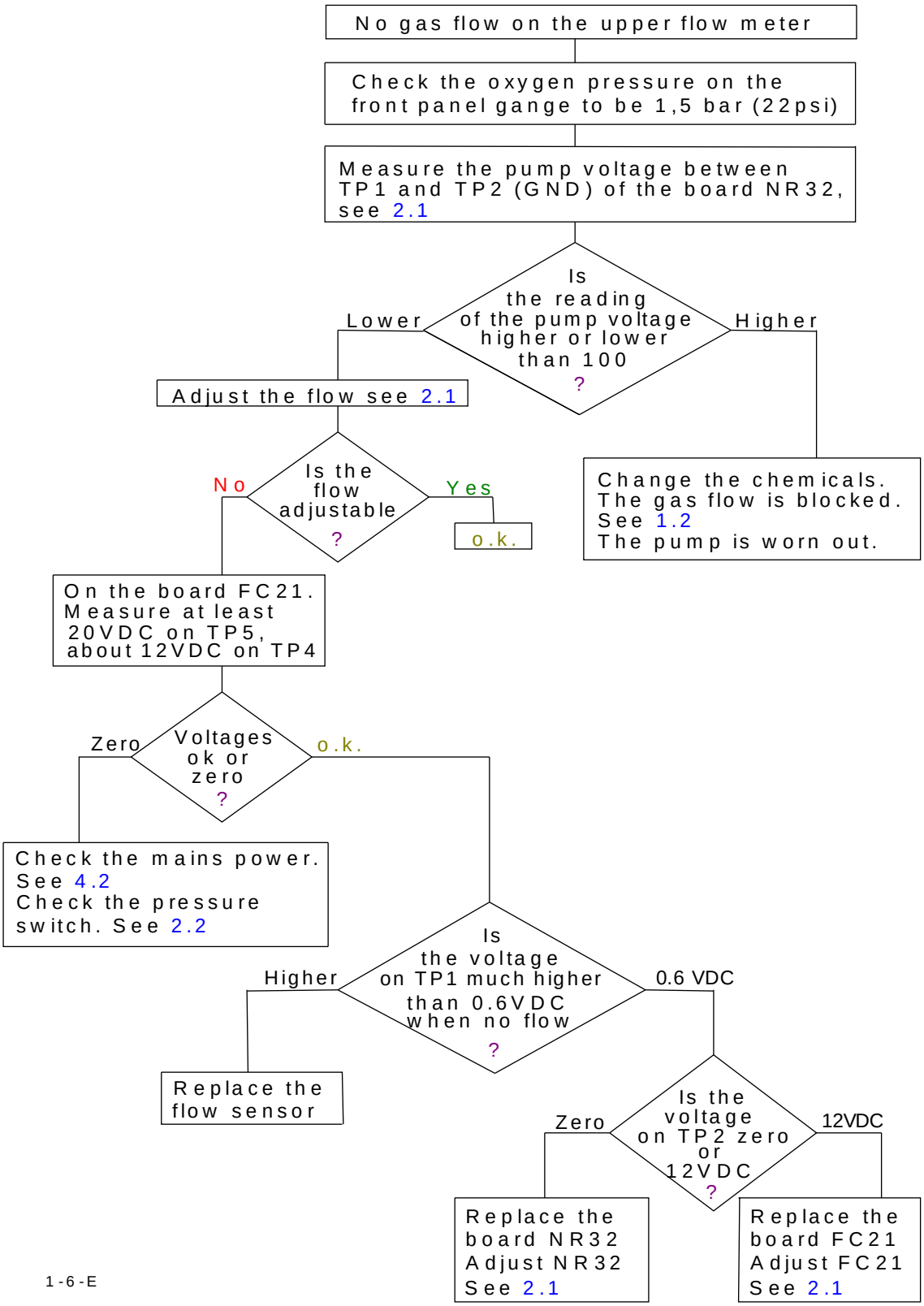


If they are OK, watch the zero baseline of the nitrogen channels and adjust them if necessary.
If it is not possible to get a straight baseline by using the jumper and trimmer (see 2 .12), check the resistance of the thermistors.
Unplug the connector of the TC-cell and open the metal block of the TC-cell.
Connect an ohmmeter across each thermistor (don't open any connection).
The expected reading should be approximately 5-6 KOhm.
In case you should measure more than 14 KOhm across one specific thermistor, then that thermistor is faulty and must be replaced.

CAUTION :

The thermistor is a small part inside of the glass ball, in the middle of the wire.

1.2 No gas flow



1.3 The flow rate is not stable

Please note: The gas flow in consideration is read on the right-side flow meter.

Vibrations of the ball inside of the flow meter is not a sign of an unstable flow rate. This is an effect of the weight of the ball and the compressibility of the carrier gas in a small tube.

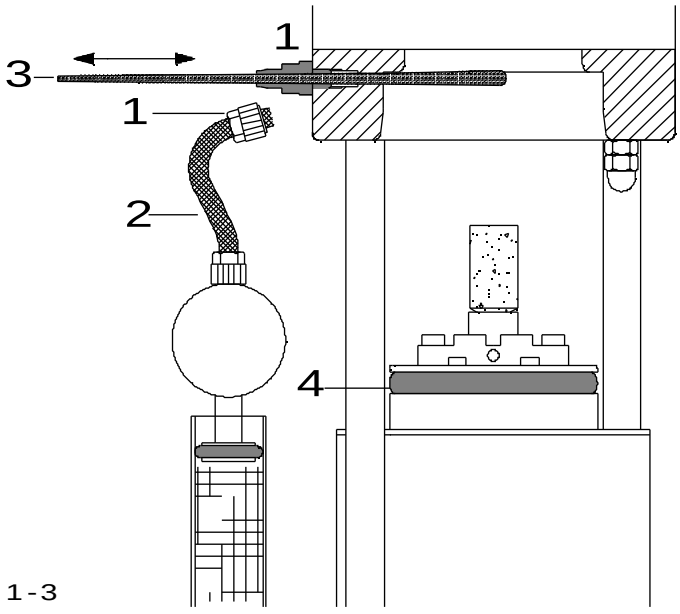
The flow rate is only unstable, if the average position of the ball becomes higher or lower.

First check the vacuum at the inlet of the electronic flow controller. It should be higher than 50 mbar. If it is not, check the tubes from furnace to flow controller.
If the vacuum is higher than 50 mbar, check the tubes following the flow controller.

Check the complete tubing from the furnace outlet up to the analyser outlet.
Otherwise change the flow controller.

Caution:
It has happened several times already, that the outlet of the furnace was blocked by silicon grease. Due to an excessive greasing of the surface of the O-ring (4) of the lower furnace closure, some of the grease can land onto the furnace outlet hole (1), causing its blockage.

In this case open the furnace,
remove the tube (2) from the furnace outlet (1)
and pass a pipe cleaner (3) through the
fitting (1) into the furnace area to
make sure that the hole is
completely free.

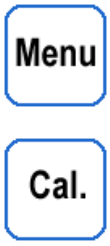


1-3

1.4 The base line of the TC cell cannot be adjusted to zero

The baseline control of the TC-cell is different from the one for the IR-cell.
The values for the "low" and the "high" nitrogen (or hydrogen, depending on the instrument) channels are produced by two different gain stages within one amplifier connected to the TC detection cell.
The automatic base line control regulates the zero signal of the "high nitrogen" gain stage. Only the high channel zero value appears on the display .

If the zero value of the "low nitrogen (hydrogen)" channel is out of range, the electronic board cannot control this signal to zero. In this case check the "high nitrogen (hydrogen)" signal with



If the signal of the high channel is higher than ±0.4V, the low channel is out of range.

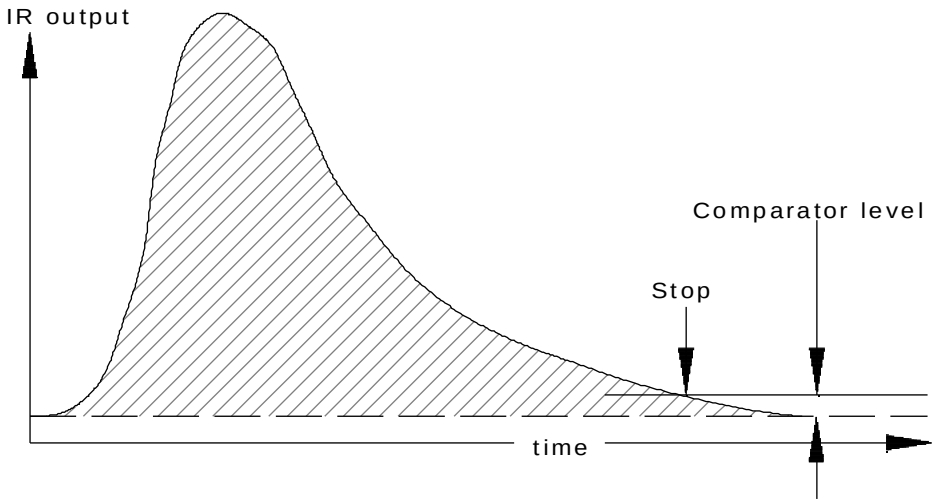
CAUTION :

Look for the reason of this drift! Adjust the flow rates or the thermostabilization, if necessary.

If there is no fault, adjust the signal of the "high nitrogen (hydrogen)" channel to zero manually, see **2 .12**

1.5 Analysis time too long

The instrument stops the analysis automatically, once the peaks of all activated ranges have descended to the comparator level, (see drawing below).
The comparator level is an artificial zero level which can be adjusted and it is normally just above the baseline.



If after a preset time, the signal stays higher than the comparator level, the analyser stops and calculates the result. But this result may be inaccurate, because the peak wasn't completely recorded.
With

you enter the menu for setting the comparator level.
The standard values for sensitive channels are 250 to 300 for the "low channel",
and 50 to 100 for the "high channel".

Before increasing the values check the following:

- Thermostabilisation
- Flow rates
- Blank value (a large blank value is a sign for a physical or chemical fault)
- Check for gas leakage.

If above functions are OK, it is possible to increase the comparator level by 100 units.

1.6 High blank value

It is impossible to avoid blank values, because oxygen and nitrogen are contents of the air. But this blank value should not be higher than 5 to 10ppm.

Otherwise try the following :

- Increase the flow rates to 40 / 70 l/h
- Fasten the electrodes
- Clean the furnace
- Use a gas precleaning furnace, filled with copper

  Connect a computer to watch the blank value peak and start an analysis without any sample.

- In some cases a small air volume remains in the threads under the lower electrode. Screw the lower electrode out and fill a small amount graphite powder in. Screw the electrode in. Repeat this procedure until it needs some force to screw the electrode complete in.

- If the base line of the detectors is unstable due to insufficient mains voltage (less than 200V AC), connect a voltage stabilizer (see **3.14**).

1.7 Erratic results

The only way to check the repeatability, is to analyse standards. Watch the standard deviation attested in the certificate of the standards.
Self-made standards are a cheap option to check the calibration in the user's range.

The following faults cause erratic results :

- Insufficient flow rates
- Wrong or highly inconsistent blank value of the carrier gas
- Damaged electrodes
- Bad contact – see **1. 24**

Check the electrodes and the flow rates first.
Delete the blank value as follows

Enter the channel number as required

Start analysis

To abort the blank value analysis press

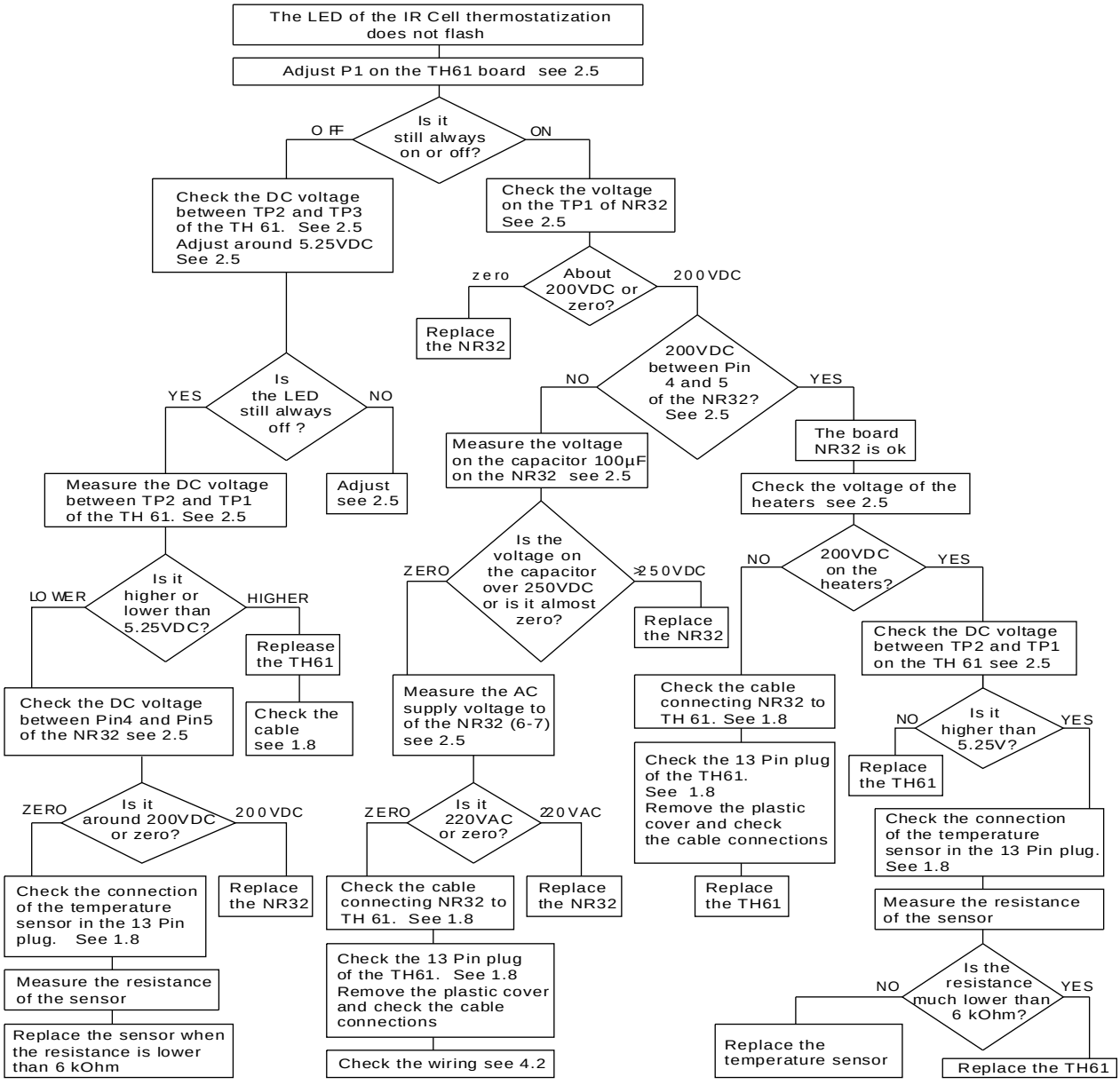
Run five analyses cycles without sample, by entering 1000 mg manually.
The blank value should be 5 to 10 ppm. Otherwise see **1. 6**.

Analyse a standard sample 5 times.
The standard deviation should be better than 1% or ± 3 ppm, whichever is higher.

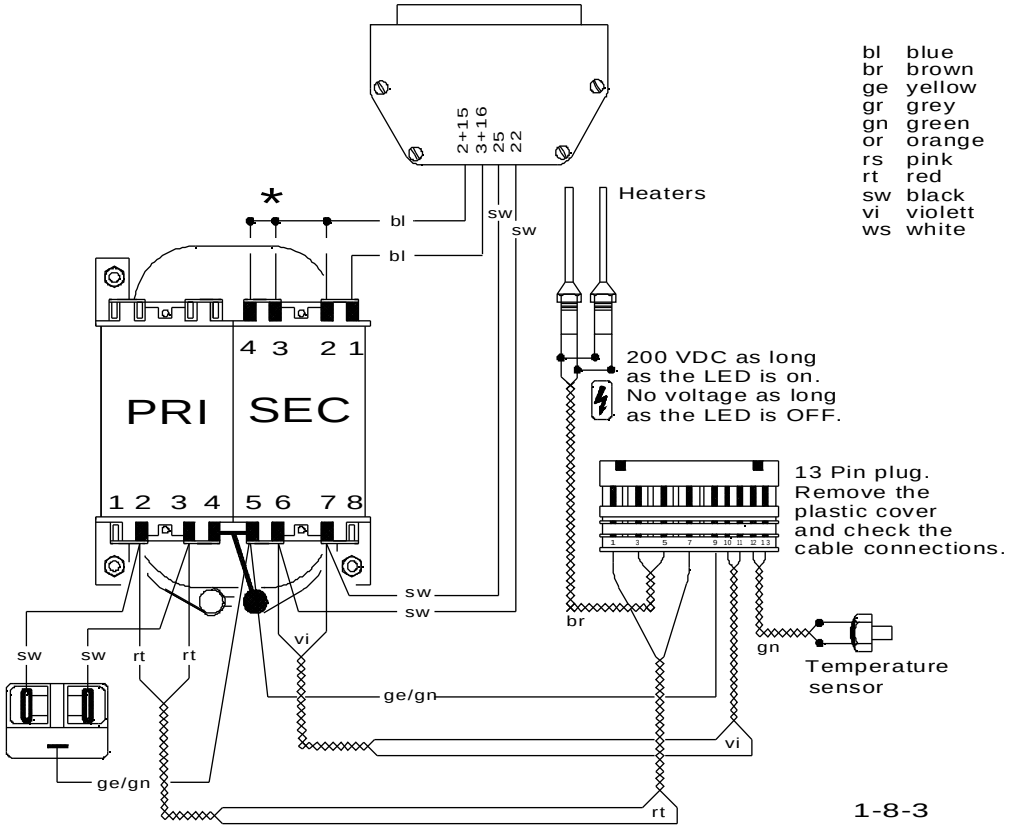
1.8 The LED for the temperature regulation of the infrared cell or the thermoconductivity cell does not flash :

■ A) IR - Cell

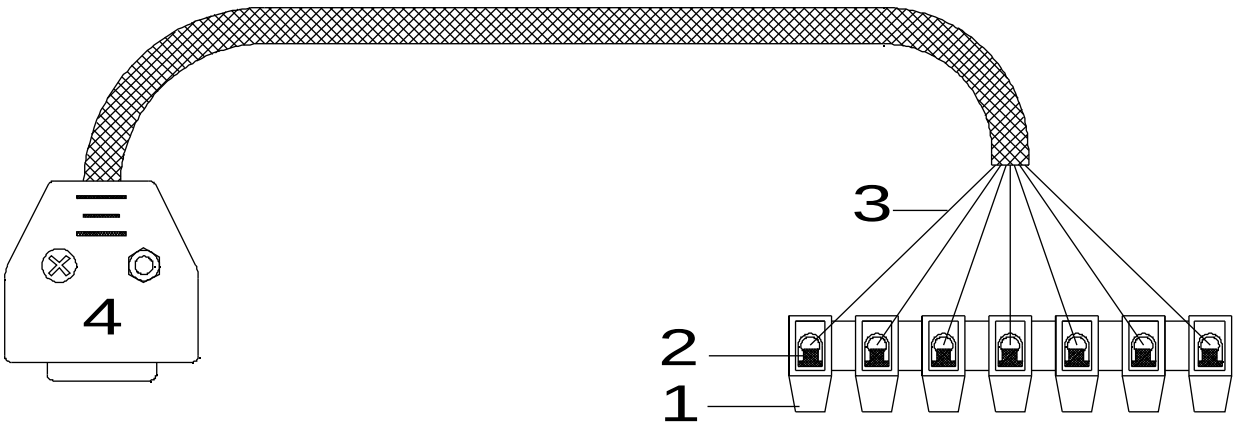
For detailed explanation, see **2. 5**



1-14



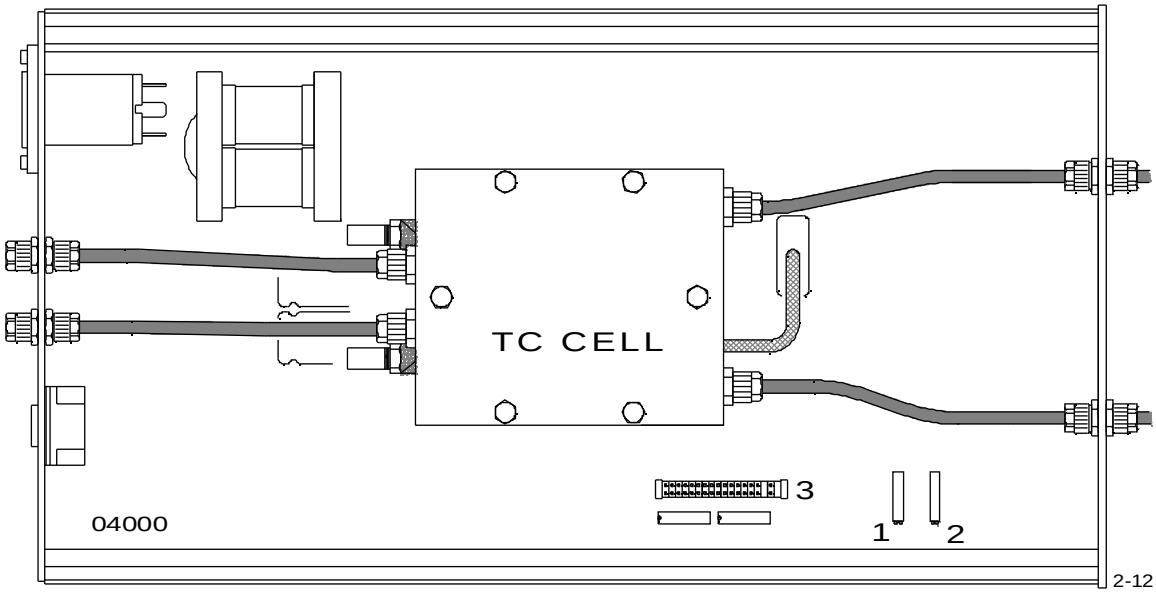
- Check that the cable is well connected to the plug, and that there are no short circuits between the contacts in the **13 pin plug**.



1-14-2

- Inspect the **spring contact (2)** on the connector **(1)**.
- One of the contact threads **(2)** could have failed, or one of the connections (3) could be **disconnected**.
- A look inside the plug **(4)** is **recommended**.

B) TC - Cell



The set point is adjusted with trimmer No.1, turn clockwise to increase the temperature.

If the LED is not flashing 2 minutes after increasing the set point, exchange the cable to the board TH 61 with the cable to the IR cell.
Check the board TH61 as described for the IR cell.

CAUTION :
The temperature's influence on the baseline of the TC cell is very high. Wait until the baseline is stable before analysing. Use a computer to check the baseline.

1.9 No analysis start

The start of the analysis depends on many factors:

- Carrier gas pressure
- Stable baseline of all active channels
- Active baseline control of the electronics unit
- Water flow must be detected
- Furnace temperature below high alarm limit

If the analyser starts the analysis after a long time - say about 4-5 minutes - after pressing pressing

then interrupt the analysis by pressing

Check the zero baseline with

Adjust the baseline to zero if necessary, see **2.12**.

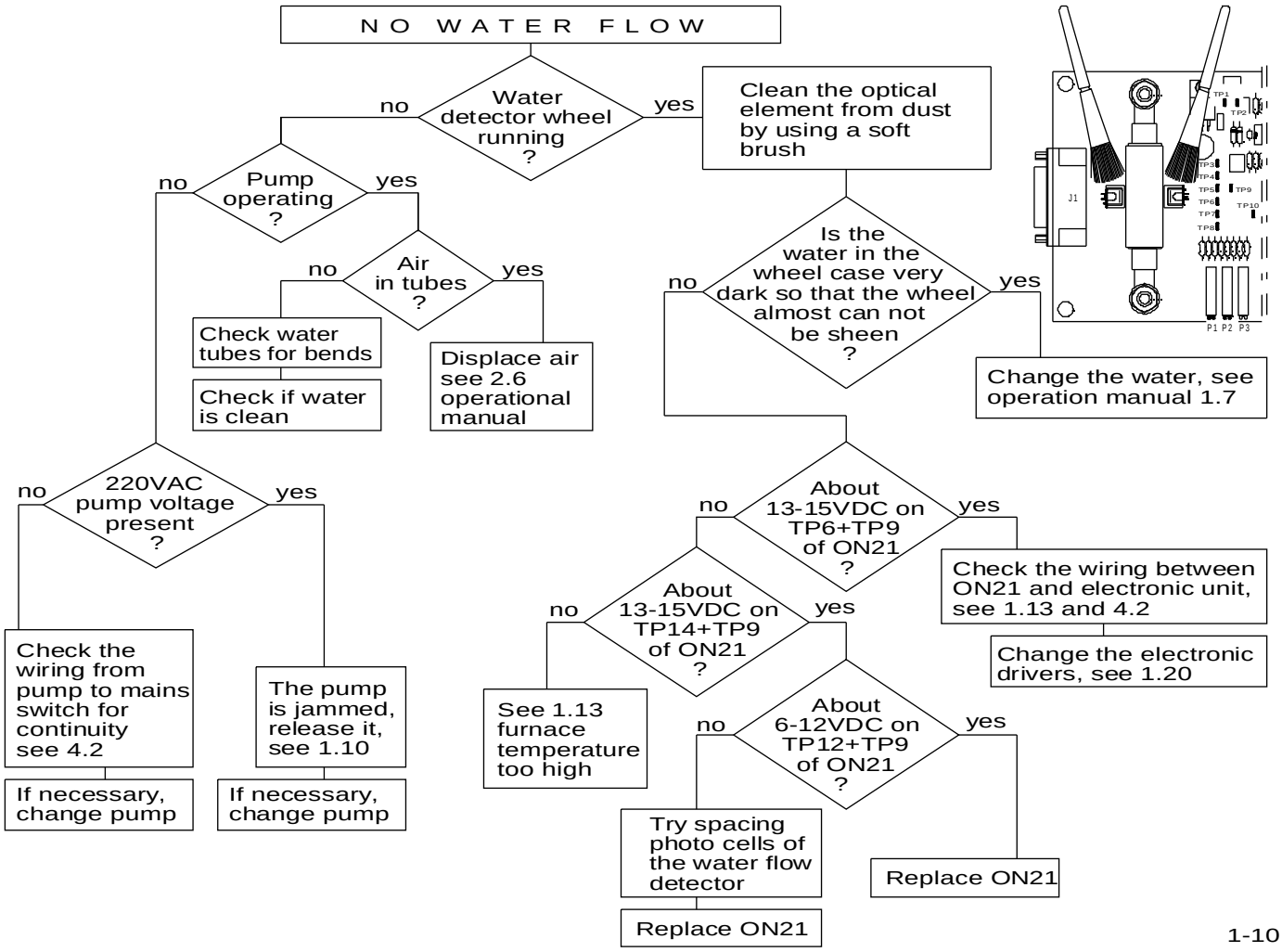
Check the gas flow see **2. 7** , or increase it to 40 / 70 l/h.

The instrument should start the analysis within a maximum of 30s after pressing the START-button with furnace in open condition, ignore the stability of the baselines. Try this method if the analyser does not start with the closed furnace.

1.10 The message "No Water Flow" appears on the display

The message "No Water Flow" appears on the display, if the water flow detector on the board ON21 cannot recognise the flow (detector wheel not rotating).

The pump can be checked for operation, by removing the screw in the middle of its front plate. This way one can see whether the pump shaft is rotating or not.



1-10

The water pump is jammed:

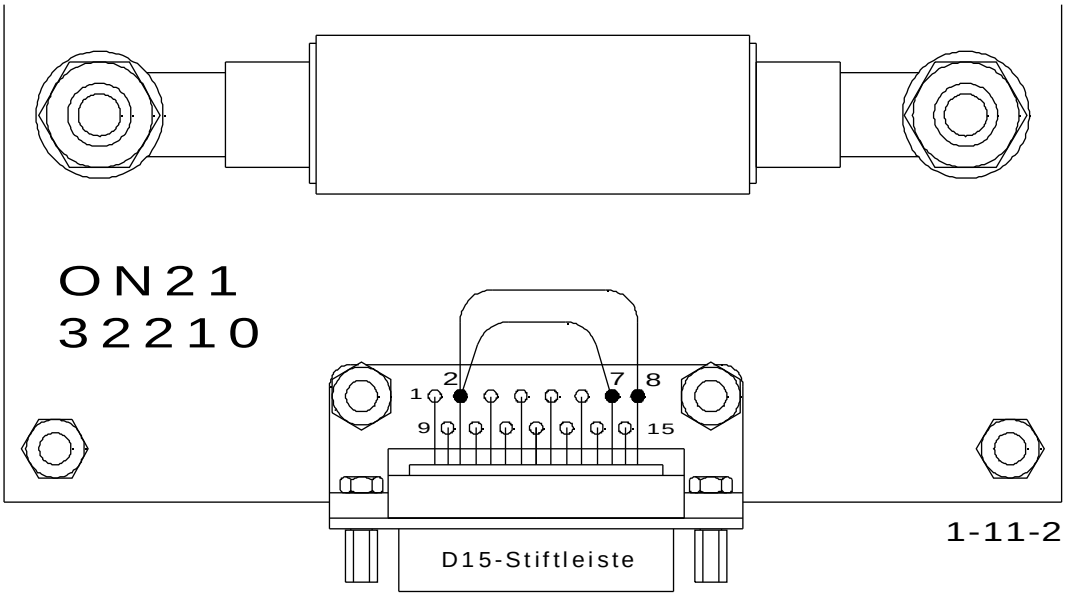
If the cooling system is inactive or dry for a long period of time, it could occur that the water pump doesn't start as it should, when the main switch is set on pos. 2.

The following instructions will assist you in solving the problem:

- Remove the right-hand side panel of the analyser.
- Remove the screw on the housing of the water pump.
- The screw that appears next is coaxial to the internal pump shaft, rotate it and the jammed shaft will be loosened. Up to 10 rotations may be needed to restore working order.
- Re-install in reverse order.

Please note:
If the message „No water flow“ appears because of dirty water or a failure of the board, it is still possible to use the analyser, until a spare part is avaible.

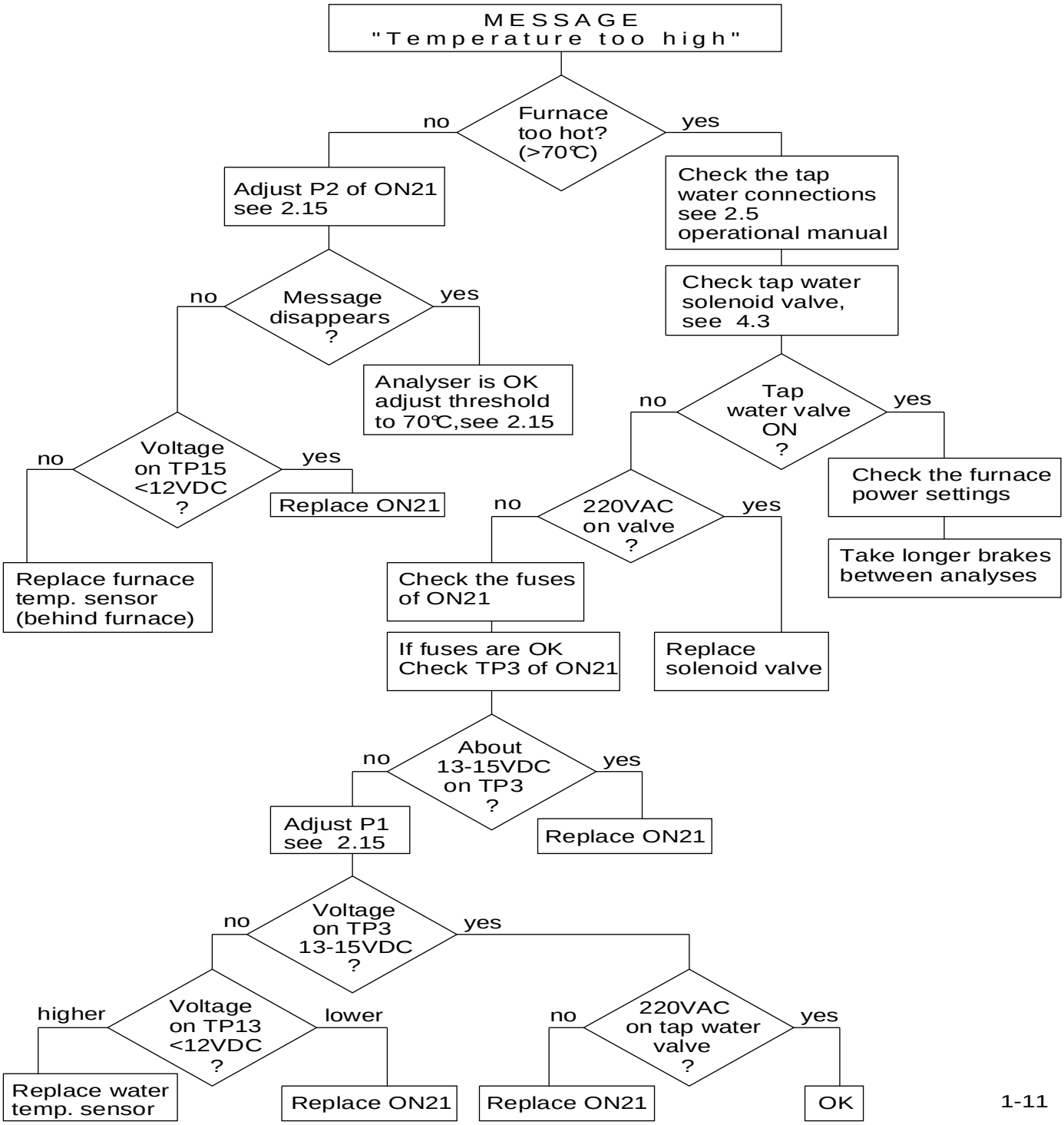
1. Turn the main switch to position 0
2. Connect pin 2 with pin 8 of the 15-pin connector of ON21
3. Turn the main switch to position 2



CAUTION :
By-passing the safety circuit can cause more damages!
Analysing without a water flow can damage the furnace!

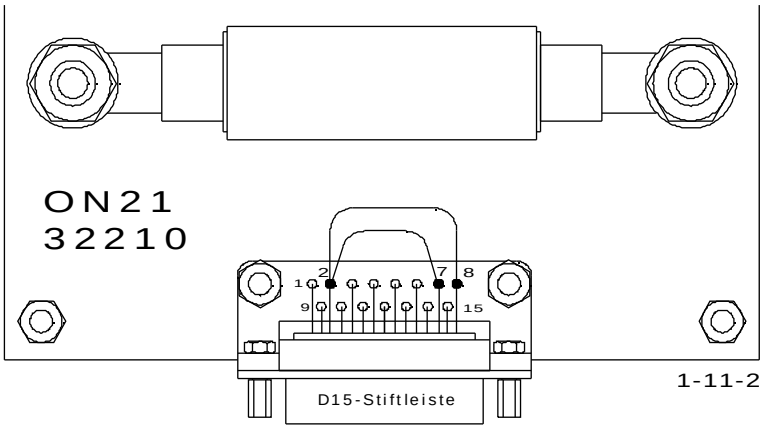
1.11 Furnace block temperature too high

The message "Temperature too high" appears on the display when the temperature of the furnace block is higher than 70°C. The furnace stop s operating.



1-11

If the detector wheel is rotating regularly, yet the „no water flow“ message appears, or if the furnace temperature message appears because of a fault on the ON21 board, then it is still possible to use the analyser, until a spare part is avaible.



1. Turn main switch to position 0
2. Connect pin 2 with pin 7 and pin 8 of the 15-pin connector of ON21
3. Turn the main switch to position 2

Caution
By-passing the safety circuit can cause more damages.
Analysing without sensing the furnace temperature can damage the furnace.

1.12 The base line of the TC cell is negative (see 2.12)

The instrument must work for min. 5 minutes on position 2, until the baseline is stable at nearly 0 Volts. If the baseline is lower than -1 V, maybe some air remained in the reference side of the TC cell. The reference flow is much lower than the analytical flow.

In this case it is necessary to purge the reference side:

- Open the right side cover of the instrument
- Close the gas tube of the furnace gas inlet three times for 2 seconds.
- Close the right side cover of the instrument

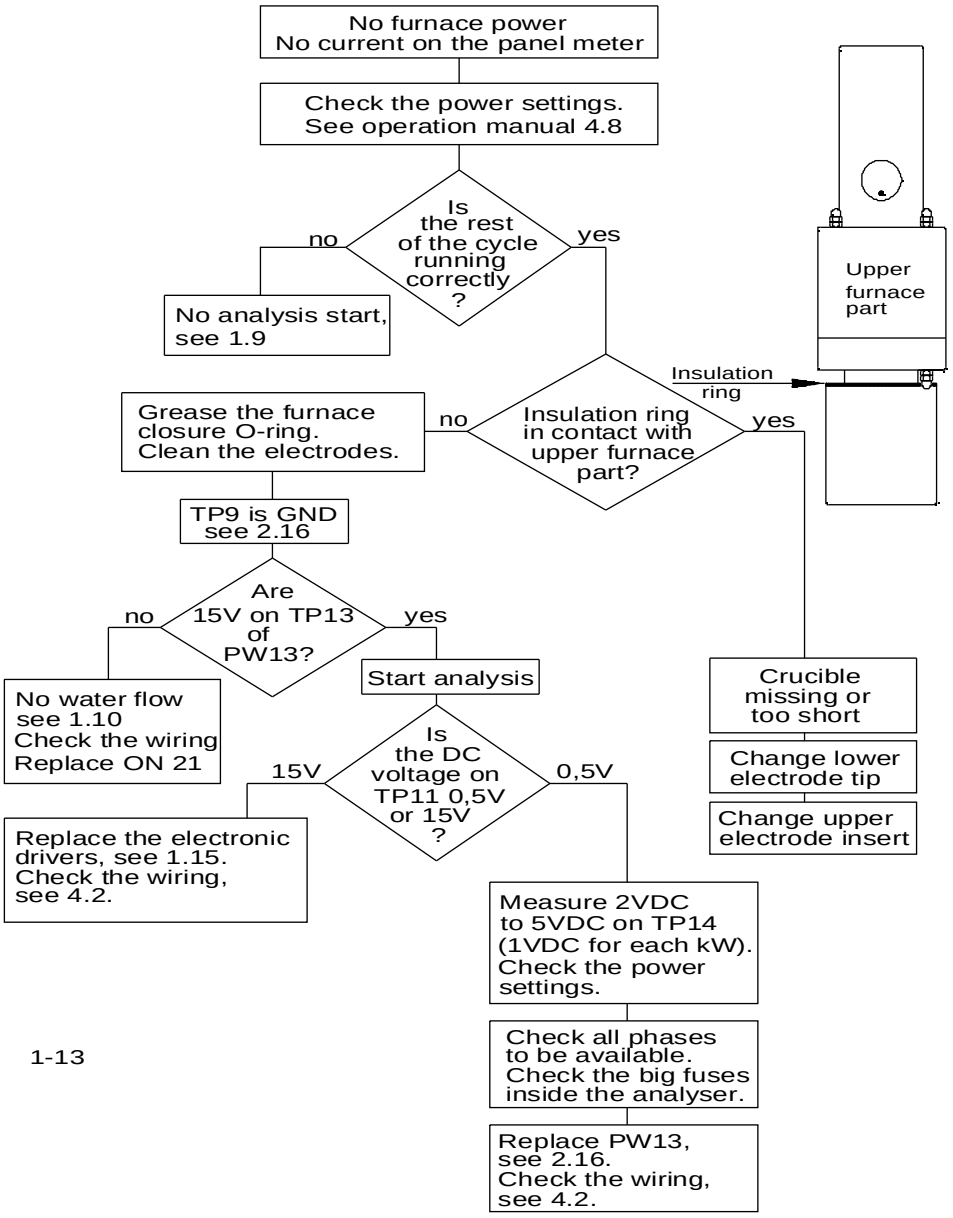
Two minutes after this procedure the baseline should stay nearly at zero. Otherwise check the thermistors.

1.13 No furnace power during the analysis

If only the furnace power stops, but the rest of the cycle sequence continues normally, it is not very likely that this is a problem of the software. It could be a too low main power voltage compared to the set power.
NOTE: If the phase angle control has to give the full (180°) when trying to keep the set power, the power will completely be switched off. This is done by the power control board without any software involvement. It is made on purpose to protect the furnace in case of any exaggerated settings by the operator or due to software or electronic unit failures. Also any wrong results due to power deviations on the furnace resulting from a too low mains power voltage will be avoided.

In order to find out wether it is a software problem or a too low voltage, enter a lower power. If the furnace power is not interrupted anymore, the voltage was too low for the previous higher power.

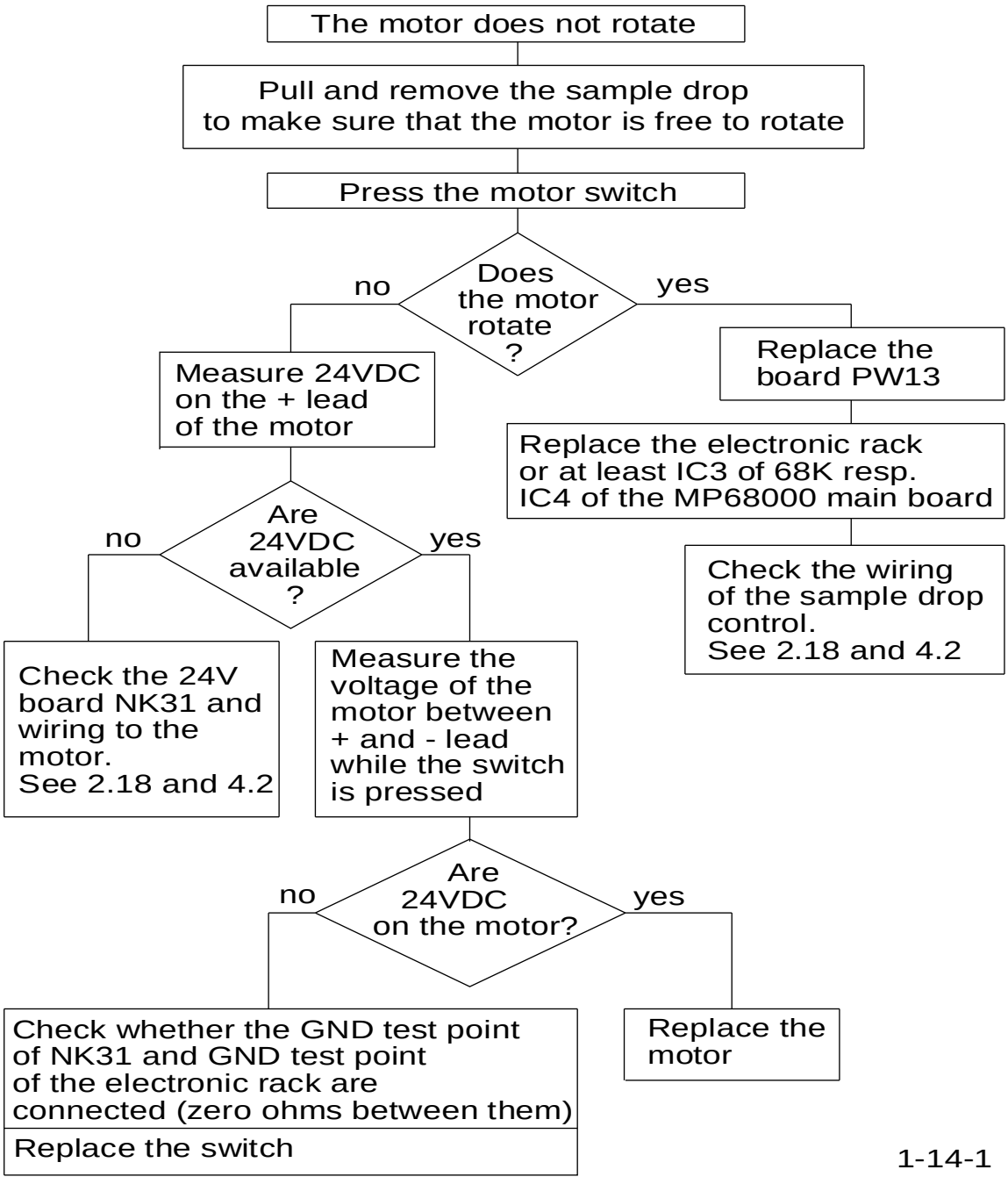
For detailed explanation, see **2.16**.



1-13

1.14 The sample drop motor does not rotate

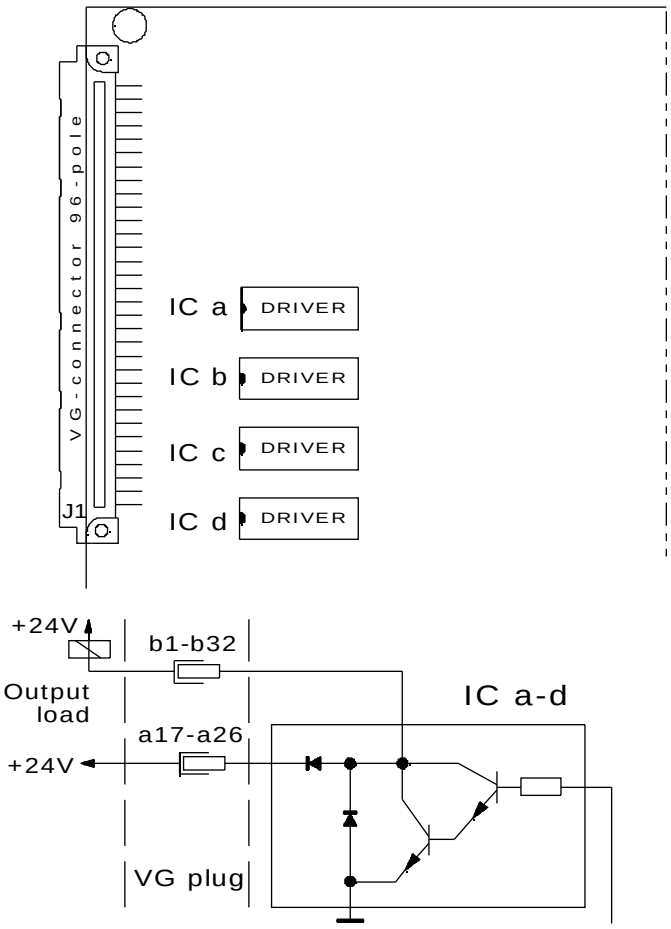
Short form : (For detailed explanations, see **2.18**).



1-14-1

1.15 Malfunctioning of the electronic drivers:

IC 2, 3, 4 and 5 are electronic driver integrated circuits, found on the mother board inside the electronic unit.
Their type No. is ULN 2803 or TD 62083.



1-6

These ICs act as a power switch, in order to energise solenoid valves inside the analyser, see **4. 3**;
or to send control signals, see **1.2**, **1.13**, and **1.14**

Operation range of the driver ICs.

Depending on the fault location, the following driver ICs need to be replaced:

IC b: Furnace start (see **1.13** and **2.16**), purge valve (see **4. 3**)

IC c: Motor for sample drop (see **1.14** and **2.18**), furnace open / close (see **4. 3)**

IC d: Furnace on / off (see **1.13** and **2.16**)

1.16 Noise or drift of the infrared baseline

The symtoms are noticeable on the display and especially on the monitor of the attached PC, when either rhythmic or sporadic jumps of the zero line are present.

- The cause for a rhymthic swinging is the chopper motor.
  Replace the chopper motor, see **3. 5**.

Causes for noise are:

- The pre-amplifier,
  replace, see **3. 1** and **2.3**
- The infrared detector,
  replace, see **3. 1** and **2.3**
- A fault on the circuit board IR21,
  replace, see **3. 3**
- The power supply fluctuates,
  see **3. 3** and **3. 4**
- The IR source is defective,
  see **3. 2** and **1. 8**.

1.17 Furnace cut-off during analysis

If this fault occurs, then set the furnace power to a lower level e.g. analysis power 2 KW (setting 200) and analysis power 1 KW (setting 100), see Operation Manual 4.8.

Try a new analysis, if the problem no longer exists, then the fault could be the following:

- Furnace temperature too high, see **1.11**
- No or insufficient cooling water, see **1.10**
- Power transformer inside the analyser has been arranged for 400 V / 3 phase, but the mains is 220 V / single phase. Rearrange transformer accordingly, see **3.18**

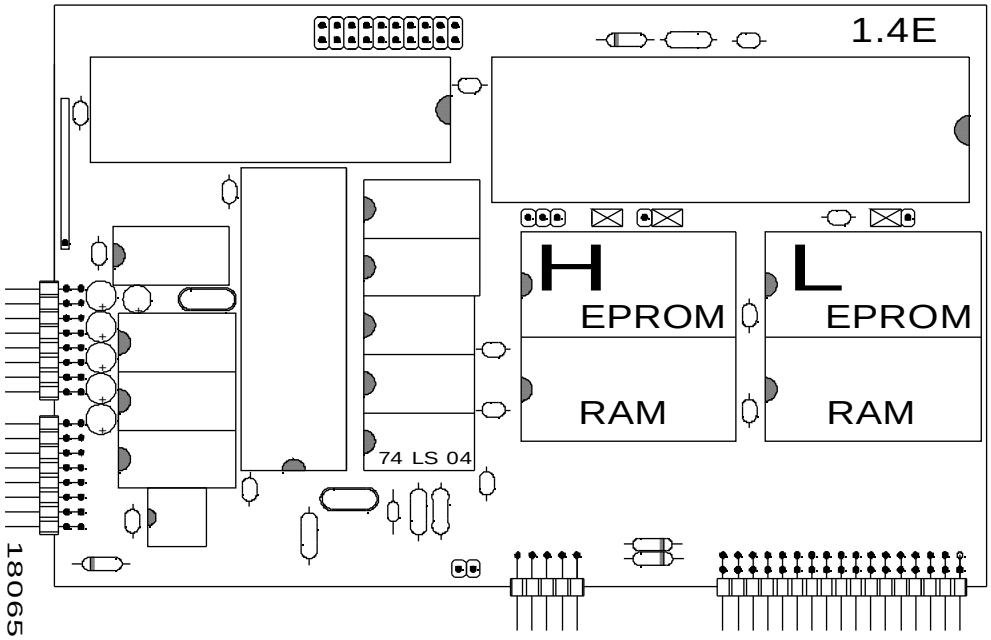
1.18 Beeper responding

The built-in beeper of the analyser responds due to the following reasons:

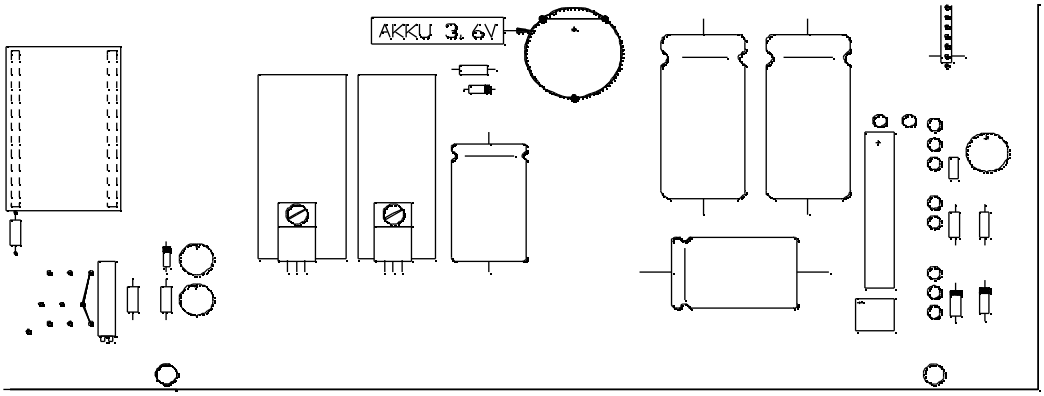
- When trying to analyse without entering the weight sample
- Furnace temperature is too high
- No or insufficient cooling water

At request the beeper can be made to respond every time when an analysis is completed.

1.19 Saved data is lost



- Make sure that a **74 LS 04** is present.
- At this location only an **LS**-Type has to be installed.



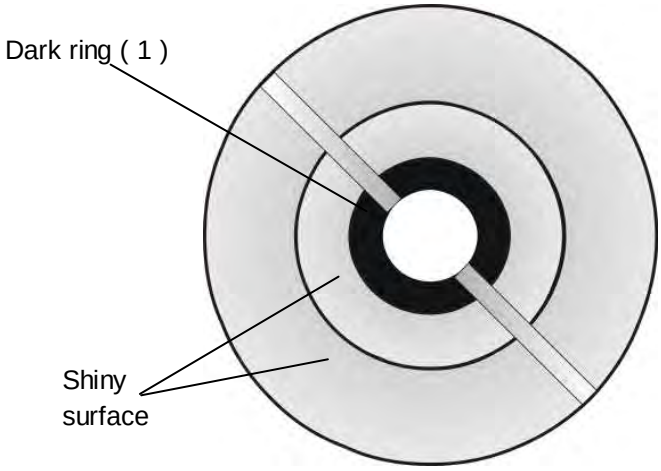
- Replace the accumulator (accu in diagram), when the accumulator will not charge after the power has been switched on, and after installing the **74 LS 04**
  Once the analyser is switched off and the **accu** didn't charge **data will be lost !!!**

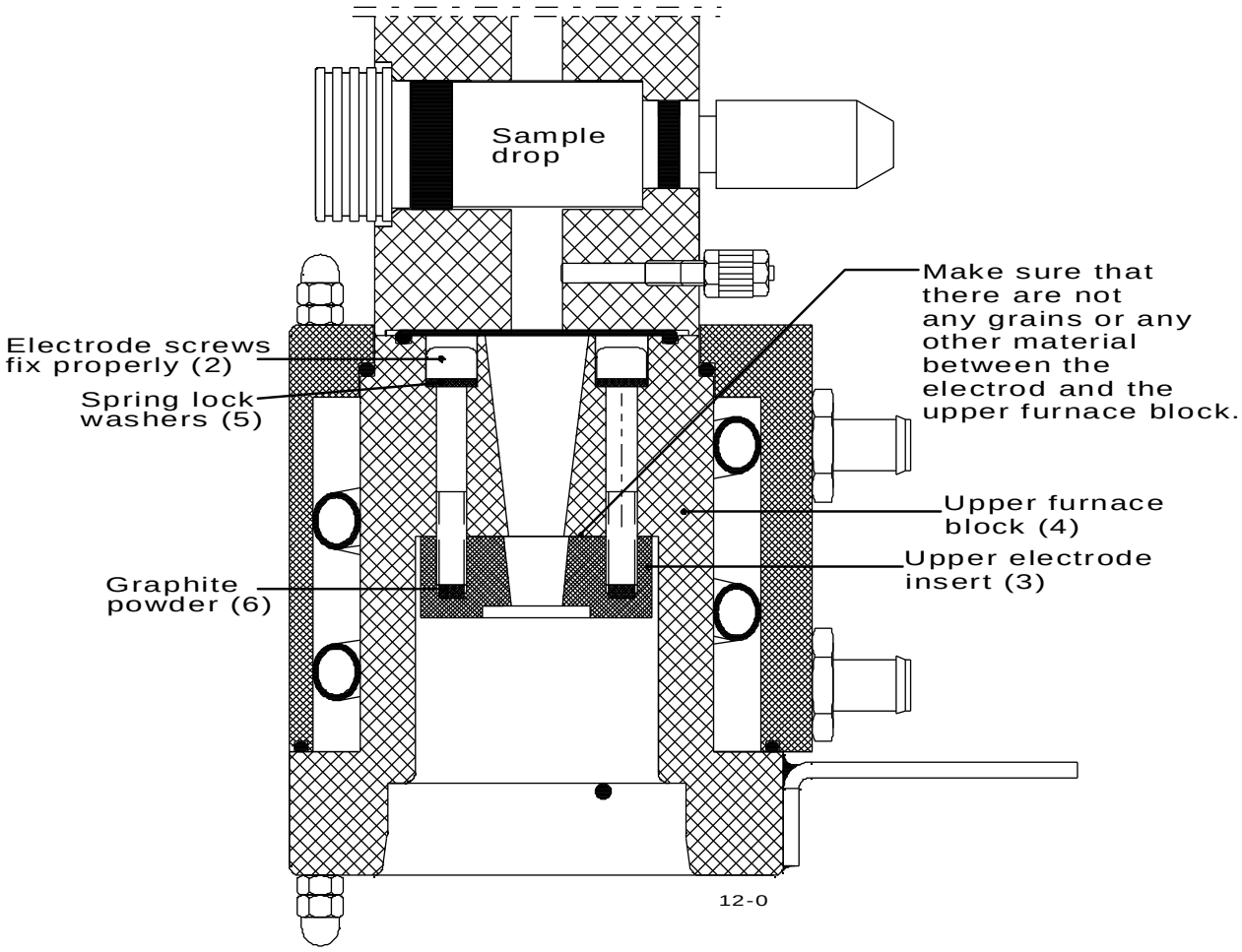
  The data that is meant here is the data that is saved in the accumulator-buffered **RAM** area. It consists mainly of the calibration factors, the **blank values**, and the **linearity factors**, which are entered via the keyboard. See 2. 9
  The **linearity factors**, which were **programmed** in our **company** when the device was manufactured, are saved in the **EPROM**, they don't get lost.
  After turning on the power again (with an empty accumulator), those default linearity factors that are saved in the **EPROM's** are the current values. Therefore, you should note any **linearity factors** that you enter via the keyboard, in case the accumulator gets empty.

1.20 The upper electrode gets dark:

It is normal when the surface of the upper electrode insert that gets in contact with the crucible, darkens. This dark surface builds a ring (1) of a few milimeters width around the hole of the electrode. All the rest of the electrode surface keeps the original shiny surface of the nickel coating, so that after cleaning from the graphite dust it looks like a new electrode, except the a.m. ring that touches the crucible.
But if the complete surface of the electrode gets dark, this means that the whole electrode has been overheated.
If the power settings are still the same as they used to be before when the electrodes didn`t overheat, or if the settings are not higher than advised in the applications of the operation manual, the reason of overheating must be a bad thermal (and bad electrical) contact to the upper furnace block, caused by:

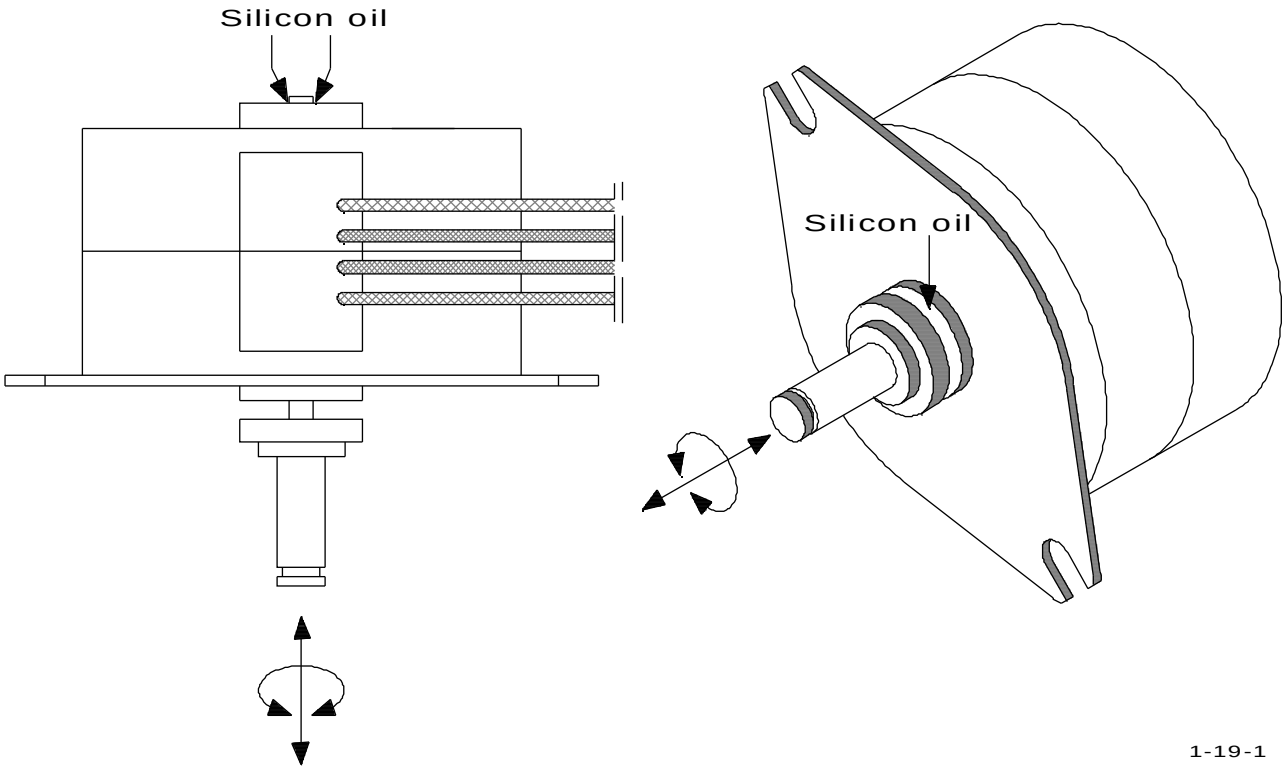
a) not properly fixed screws (2),
b) grains or any other parts between the electrode (3) and the upper furnace block (4), or
c) the spring lock washers (5) are missing or
d) there is too much graphite powder (6) in the thread of the electrode underneath the screws. The graphite powder is used to fill the volume underneath the lower end of the screws (2) eliminating any air enclosures.





1.21 The chopper motor doesn`t rotate:

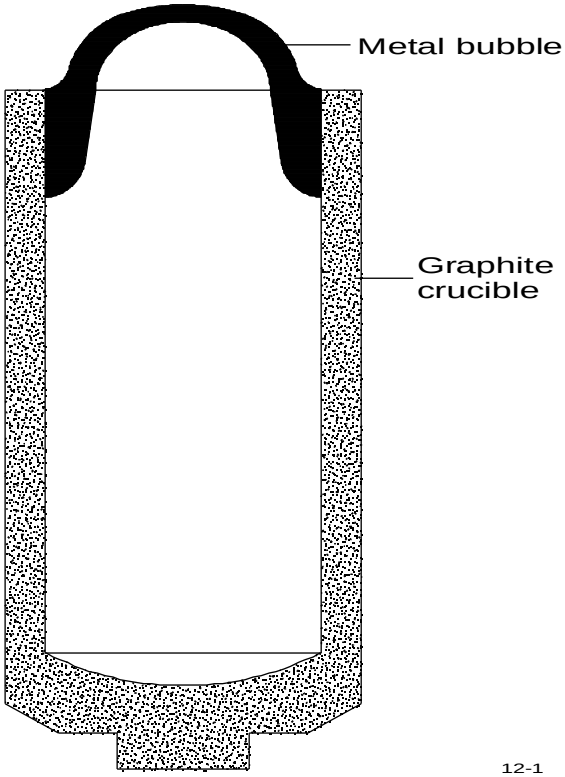
In most cases the reason is that the grease of the bearings becomes dry.
You can feel a resistance when you try to turn the shaft by hand.
In this case the problem can be solved by lubricating using silicon oil.
Dip a piece of wire into a flask of silicon oil and apply as shown below.



In order to spread the oil into the space between shaft and bearings, turn the shaft and move it in axial direction at the same time. The use of mineral oil is not suggested, because mineral oils become dry and hard after a long time of operation. If no silicon oil is available, use silicon spray. Silicon grease is also gut for this purpose, and it is also available in laboratories, however, it could be very difficult for the grease to penetrate the space between shaft and bearings.

1.22 The samples make bubbles:

It depends on the material and on the quality of accellerators. One of our customers who used to analyse titanium without problems, suddenly got the problem that the metal in the crucible was building a bubble. The bubble climbed up to the top of the crucible and the metal was sticking on the upper electrode insert after opening the furnace. The reason was a new quality of nickel baskets. They were softer than his previous ones. This indicated that the quality was different. After using baskets of the previous quality, the problem was solved.



1.23 Spare parts kits:

Common spare parts kit for all analysers

92610	Tube of grease	1
11064	Reagent tubes 280mm x 16mm	2
11480	Adjustable flow restrictor	1
15087	Gasflow meter 300 l/h	1
15095	Gasflow meter 600 l/h	1
18175	Electronic unit	1
72010	Pressure gauge 2,5 bar (37.5 psi)	1
11035	Cooling fan	1
11492	Inlet pressure regulator	1
11390	Oxygen solenoid valve	1
35310	Pressure switch	1
05067	IR path for high carbon	1
05068	IR path for sulphur	1
05150	IR path connector with window source side	1
05160	IR path connector with window detector side	1
05260	IR path tube (80 to 320 mm)	1
05275	Infrared preamplifier	1
06005	Infrared electronics board IR 21	1
06741	Infrared electronics board IR 41	1
06032	Infrared detector with CO_2 filter	1
06034	Infrared detector with SO_2 filter	1
06421	Infrared power supply assembly IR13	1
06675	Infrared power supply assembly IR45	1
06058	IR Temperature control board TH61	1
06630	IR Temperature control board TH62	1
15037	IR Temperature regulation board NR32	1
11408	Pressure switch	1
15063	Gasflow sensor 300 l/h	1
05042	Chopper motor	1
05065	Chopper motor	1
05048	Infrared source (emitter)	1
05060	Reflector	1
75120	Spring	1
75130	Retaining washer	1
75190	Washer	1
18150	Printer interface-cable	1
18160	Balance interface-cable	1
18171	PC-cable	1
73020	Transparent tube	5m
73030	Black tube id = 4 od = 5	5m
73040	Black tube id = 6 od = 9	1m
90290	Copper oxide	100g
11062	Reagent tubes 160 x 16mm	2
21120	Quartz tube for purification furnace	1
15083	Gasflow meter 15 l/h	1

72020	Gauge 10 bar/140 psi	1
78010	Mains power switch	1
11380	Pneumatic valve	1
16110	Power supply board NK 32	1
77140	HF-filter 250 V	1
15098	Gas flow control board FC 21	1
71004	PLOTON Windows software (for OH/ON 900)	1
71006	PLOTCS Windows software (for CS 500/800)	1
70280	O-ring 18 x 2 VT for chopper motor	2
70330	O-ring 21 x 2 VT for infrared source	6
70120	O-ring 3.4 x 1.9 VT furnace cleaning rods (CS 800)and for furnace platform	1
70150	O-ring 6 x 2.5 VT	1
70210	O-ring 8 x 3.5 VT for catalyst tube (CS 800)and for reagent tube (OH/ON 900)	1
70230	O-ring 9 x 3 VT for reagent tubes and dust filter	1
70320	O-ring 20 x 5 VT for dust filter(CS 800) and for furnace glass tube (CS 500)	1
70350	O-ring 29 x 5 VT for dust filter (CS 800)	1
70370	O ring 34 x 3 VT for dust filter (CS 800)	1
70380	O-ring 35 x 5 VT for combustion tube (CS 800) and for furnace internal (CS 500)	1
70390	O-ring 38 x 5 VT for furnace (CS 800)	1
70285	O-ring 19 x 3 VT for furnace ON/OH 900 (top)	1
70405	O-ring 47.2x 5.7 VT for furnace closure ON/OH	1
70410	O-ring 48 x 3 VT for furnace internal (CS 500)	1
70415	O-ring 62 x 3 VT for furnace ON/OH 900 (centre)	1
70425	O-ring 90 x 2.5 VT for furnace ON/OH (bottom)	1

Spare parts kit for OH-900 / ON-900 / ONH-2000

90190	Graphite crucibles od=12.65mm h=24.35mm	200
91100	O_2/N_2 steel pin standards (one gram each)	100pins
91000	O2 copper pin standards (one gram each)	100pins
31345	Upper electrode insert	1
31250	Upper electrode insert	1
31360	Graphite tip	1
31365	Graphite tip holder	1
80927	Set of fuses	1
33490	Water temperature sensor	1
33500	Water pump	1
33600	Tap water valve	1
72030	Tap water valve	1
15085	Gasflow meter 130 l/h	1
77410	Panel meter 5A	1
77411	Panel meter 5A	1
32066	Power control board PW 13	1
32210	Water temperature control board ON 21	1
77051	Thyristor block	1
01160	Purge solenoid valve	1
78055	Motor for sample drop	1

90270	Schütze reagent	100g
15098	Flow control card FC 21	1
15038	Pump control card NR32	1
77460	Micro switch	1
33440	Water level tank	1
09270	Gas pump	1
15115	Gas flow sensor	1
32450	Braid	1
77480	Clamps for water hose	5

1.24 Unstable current:

If during power periods the current is unstable, it is an indication for a bad contact. The power control of the analyser keeps accurately constant **power,** i.e. current multiplied by voltage. A possible bad contact having a relatively high resistance will increase the voltage so that the current will be accordingly reduced in order to keep constant power. However, this constant power is shared between the crucible and the bad contact that is heating up. Therefore in this case, although the (total) power is unchanged, the crucible temperature decreases while a contact area heats up.

Possible places for a poor contact are:

- The surface of the upper electrode that touches the crucible. It can be

  a) not clean. Clean with a metal brush or with polishing material, like abrasive foam. Don't use pastes. Final cleaning with solvent.
  b) worn out . Replace it.

- The upper surface of the electrode and the surface of the furnace where the electrode should properly touch is not clean or grains are sticking on this surface. Check carefully and clean as describesd in a) above.

- The holes of the upper electrode, where the four screws are screwed in, are not free, so that the screws cannot be screwed in deep enough. In this case the electrode will not be properly pulled by the screws to be pressed on the furnace block surface. Clean properly the holes of the electrode to make sure that the screws can be screwed deep enough in the electrode.

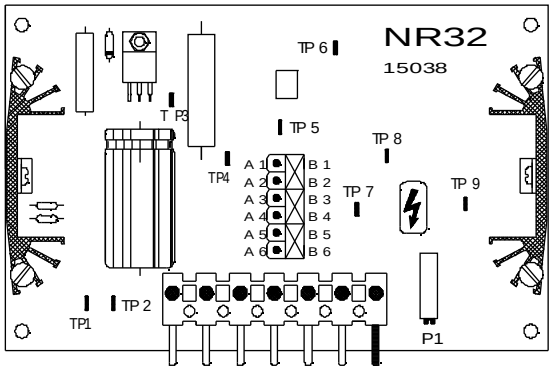
- The graphite tip is worn out. Replace it.

- The graphite tip holder is not properly srewed on the lower furnace block. Check and take same measures for cleaning and for making free the holes for the screws like in case of the upper electrode as described above.

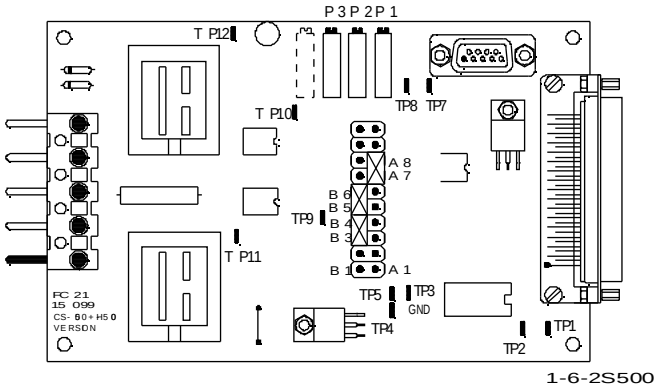
- The high current braid connecting the furnace with the high current transformer are not properly connected. Drive properly the big screws connecting the braids to the furnace and to the transformer (two screws for each braid).

2 ADJUSTMENTS, TEST AND FUNCTION EXPLANATION

2.1 Gas flow controller adjustment and jumper settings:



The jumpers of the pump control board **NR 32** are set
B1-B2 B3-B4 B5-B6



The jumpers of the flow control board **FC 21** are set
B3-B4 B5-B6 A7-A8

- Make sure the **gas pressure** is available.

- Set the main power switch to **pos. 2**
  Read 1.5 bar carrier gas pressure on the pressure gauge of the analyser.

- Adjust the required **gas flow** with **P1** of the **FC 21**. Read the flow rate on the upper flow meter of the analyser. The flow rate is usually between **10 l/h** and **15 l/h**.

- Select **1000 VDC** (resp. 750 VDC) multimeter range and connect it between **TP1** and **TP 2** of the **NR 32.**

- Adjust a **minimum** voltage with **P1** of the **NR 32.**
  The minimum is usually between **90 VDC** and **100 VDC**.
  Adjust slowly to enable the flow to stabilise to the set value of the flow.

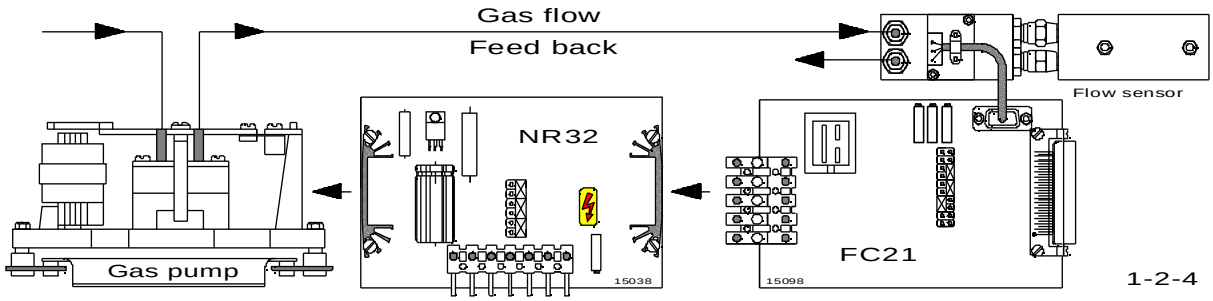
- Connect the multimeter between **TP8** and **TP3** (GND) of the **FC 21**. Range **20 VDC**.
  Adjust **5.5 VDC** with **P2**.

.

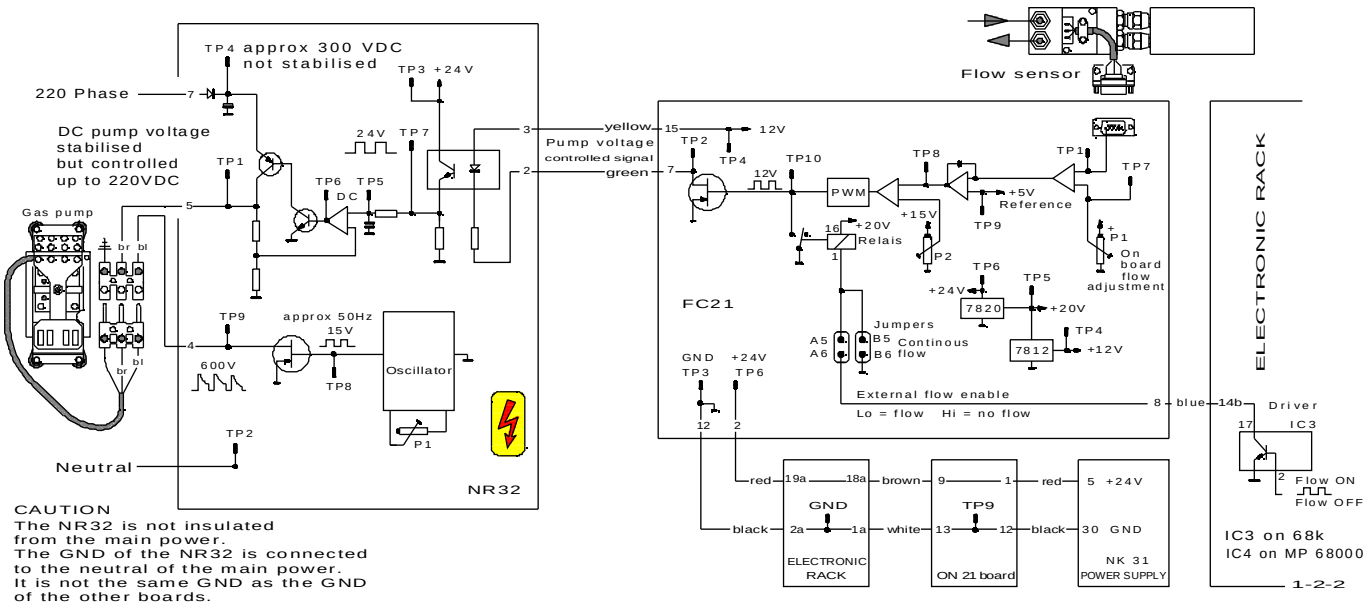
Detailed explanation of the flow controller.

The flow controller consists of four main components:

1 The flow sensor,
2 The flow control board **FC21**,
3 The pump control board **NR32**,
4 The gas pump.



- The **flow sensor** senses the flow. The board **FC21** compares the sensor **output voltage** with the set point of the flow.
- The **output** of the **FC21** controls the board **NR32** which is generating a variable supply voltage for the **pump**.
- The **feedback** from the pump to the **sensor** is provided by the **gas flow**.
  In this control loop, the power of the pump is **automatically** regulated to keep the sensor output at a **constant** value which corresponds to the set point.



- The flow sensor, measured on **TP1** of the **FC 21**, has an **output** voltage of about **5,2 VDC** for an OH-900 (10 l/h) and about **6,5 VDC** for an ON-900 (15 l/h), depending on the flow, but also, and especially, on the number of ranges (IR-cells) of the analyser. **TP3** is **GND**.
  Please note: without flow, the voltage on **TP1** is not **0V**, but about **0.65 V**.

- The flow rate is adjustable with the potentiometer **P1** of the **FC 21**.

In the regulated, stable condition the voltage on **TP8** should preferably be **5.5 V.**
If this voltage was **5 V**, then the flow would reach the adjusted value immediately after setting the main power switch to **pos. 2**
When **5.5 V** are adjusted, see **2. 1** , the flow starts from a low value and reaches the set value within a few seconds.
The following stage is a Pulse **Width** Modulator **(PWM).**
The average output voltage of the **PWM** can be measured on **TP 10** with a multimeter, in the range of **20 VDC**.

The usual average **voltage when the flow is regulated is about** 4 VDC**.**
This **PWM** signal controls the board **NR 32** through an **optical insulator**.

CAUTION ! High voltage !

The circuit of the **NR32** is powered directly from the main.
It is **not** insulated with any transformer. The DC output voltage of the **NR32** is controlled by the **FC21**.It can be measured on **TP1** of the **NR32**. The ground is **TP2**.

Caution:
The ground of the **NR32** is **not** the same as the ground of the **FC 21** and as the ground of all the other boards inside the analyser.

The **output DC** voltage of the **NR 32** (**TP1**) is, with nominal flow, between **90 VDC** and **100 VDC**.
The **NR32** circuit can supply an **output voltage**, ranging from **zero** to **maximum** about **200 VDC**.
When this voltage reaches about **200 VDC**, the analyser displays a warning, because the pump has almost reached **max**. **power**.

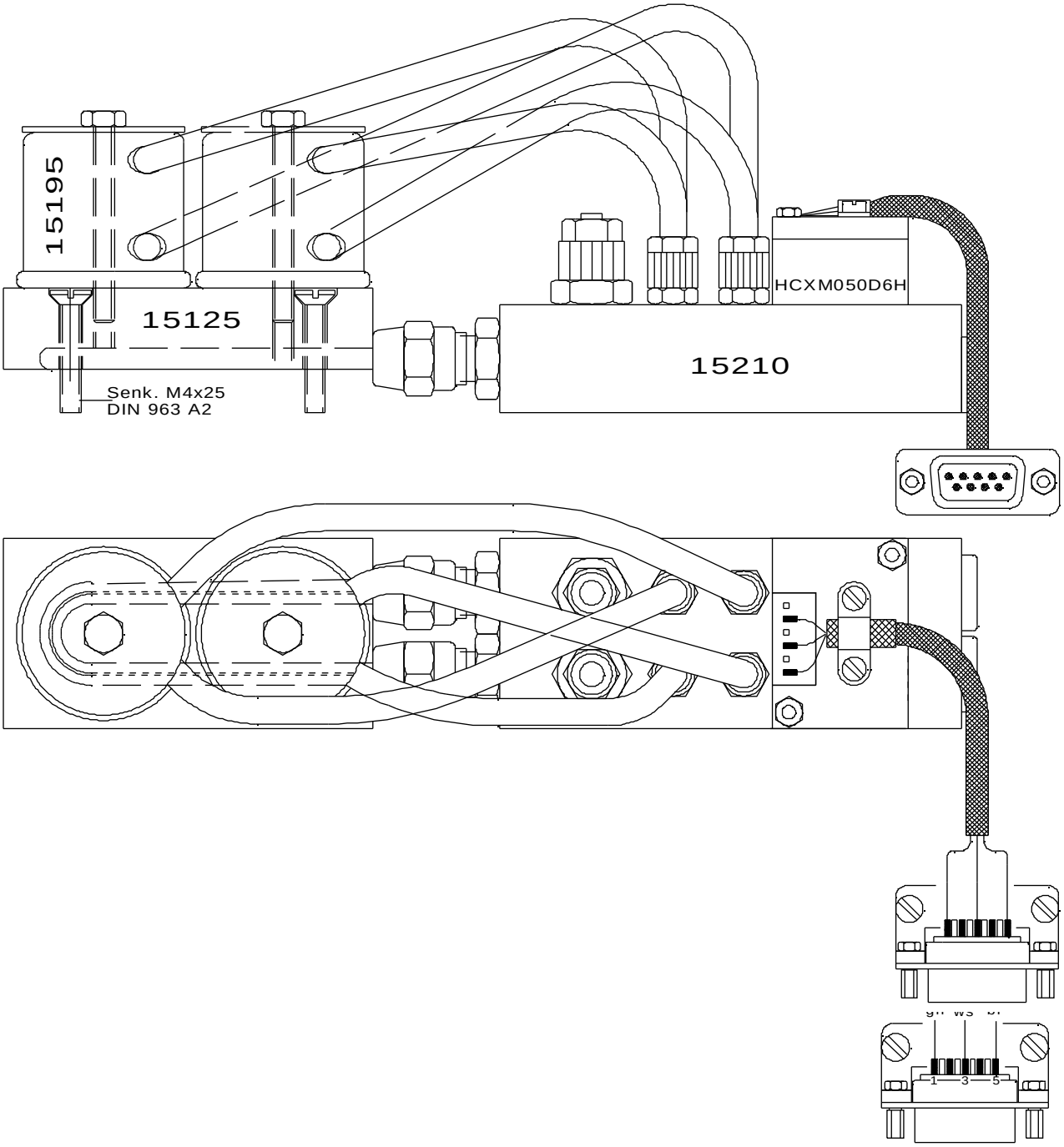
One end of the **coil** pump is connected to the **DC output** of the **NR 32**.
The other end of the coil is connected to a switching **transistor** of the **NR 32**.
This transistor is switched **ON** and **OFF** by an oscillator.

This way the pump **is supplied with a square shaped** AC voltage**.**
The frequency is about **50 Hz**, it is the operating frequency of the pump.
The **frequency** is adjustable with **P1** of the **NR 32**, in order to set **exactly** the best frequency for each individual pump, see **2. 1.**

C A U T I O N ! High voltage !

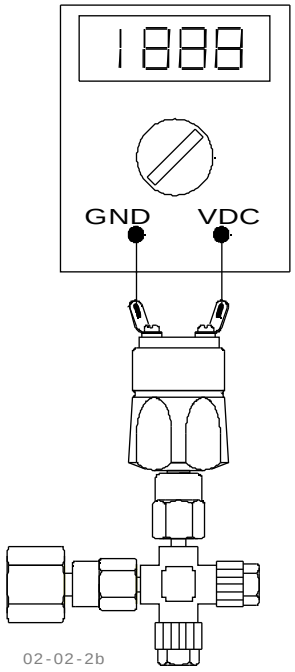
The **voltage** at the end of the pump coil reaches **600 V peak**, because of the inductively of the coil. It can be measured on **TP9** with a **scope**, however, this is **not advisable** for safety reasons.

Remark:
Due to a few failures of the flow sensors, almost exclusively on the ON/OH/ONH at customers who regularly treat their samples with acid and on ON-900 analysers using chutzes reagent, we concluded that the reason of the failures should be of chemical nature i.e. acids and schutzes reagent damage the sensor.
The solution is to prevent the analysis gases to get in contact with the sensors. Therefore the sensor ports are connected with long tubes to the gas flow system. There is no gas flow through the sensor tubes but only the pressure is sensed by the sensor.
In case of failure of a previous version sensor, it is advisable to replace it by the new version. In this case the part numbers of the complete assemblies should be used for ordering 15210 for block with sensor element and the plate 15125 with two tube coils 15195. The new flow sensor can not be used as a replacement for the older flow sensor consisting of a rotameter and an optical element.



2.2 Pressure switch:

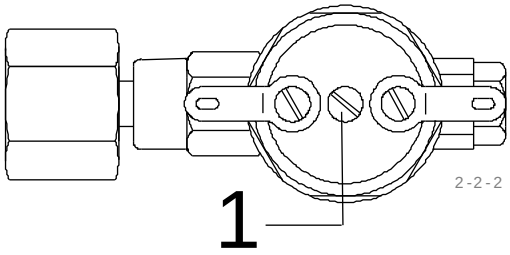
The pressure switch should be adjusted to about **1 bar** (15 psi); this means that under **1 bar** (15 psi) , the contact is open (no contact), and over **1 bar** (15 psi), the contact is closed (turned on).



- In installed condition and with the analyser turned on (power switch set to **pos. 2**), there should be a voltage of **24 VDC** when the pressure is under **1 bar** (15 psi). If the pressure is over **1 bar** (15 psi), then the voltage should be **zero**.

ATTENTION ! Measure this with a high-impedance digital voltmeter!
Do not cause a short circuit while measuring, or else the electronic drivers will blow!

- If necessary, the oxygen pressure can be adjusted to **1 bar** (15 psi). This can be read at the upper pressure gauge of the analyser.



- The switch point can be set by turning the screw **(1)**
- If the switch is turned off **(24 V)** when the pressure is at **1 bar** (15 psi), then the screw **(1)** should be turned counter clockwise until the switch turns on, measuring the power until it reaches **zero** volt.
- If **zero volts** are measured when the pressure is at **1 bar** (15 psi), the screw **(1)** should be turned clockwise until the voltage goes to **24 V**.

2.3 Infrared zero-baseline, control and adjustment:

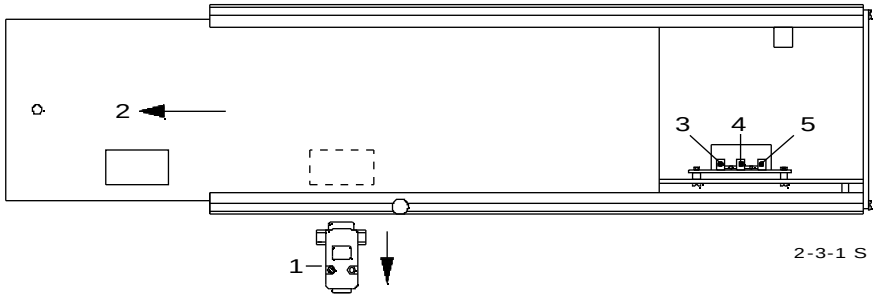
The infrared cell zero-baseline is normally controlled by the electronic and is automatically set to **zero**.
The auto–zero control should be **disabled** in order to control and adjust the infrared cell zero-baseline manually. This way the electronics will have no influence. This can be done by pressing the **< Menu > and < Cal >** keys.
The voltage exiting the infrared channel should be shown as in the following example:

- 0.13
- 0.21
- 0.18

The displayed numbers refer to the IR-cell output voltage:

The upper number refers to the **voltage of channel1**
The middle number refers to the **voltage of channel2**
The lower number is valid for the **voltage of channel3** (if there is a channel 3).

The channel numbers can be shown on the display by pressing: **< Menu > < 5 >**
Return by pressing **< CLR >**.
If at least one voltage exceeds +3.0 volts, then the **zero-signal** needs to be adjusted.



- To adjust the zero signal, push the left cover plate **(2)** of the infrared cell about **10 cm** towards the back.
  With a small screwdriver, adjust the trimmers **(3 / 4 / 5)** in the infrared rack, so that the numbers shown on the display are between **+ 0.20** and **- 0.20**.
  The adjustment should preferably be carried out while the **carrier gas is flowing**.

  If the zero level (between + 0.20 and - 0.20 volts) cannot be reached, and if more than two adjustments were recently carried out, then the problem could be:
- Contamination of the **IR-paths**, see **3. 1**
- bending of the **IR-source** after rough shipment of the device, see **3. 2**
- insufficient **supply voltage** for the **Infrared**, see **2. 4**

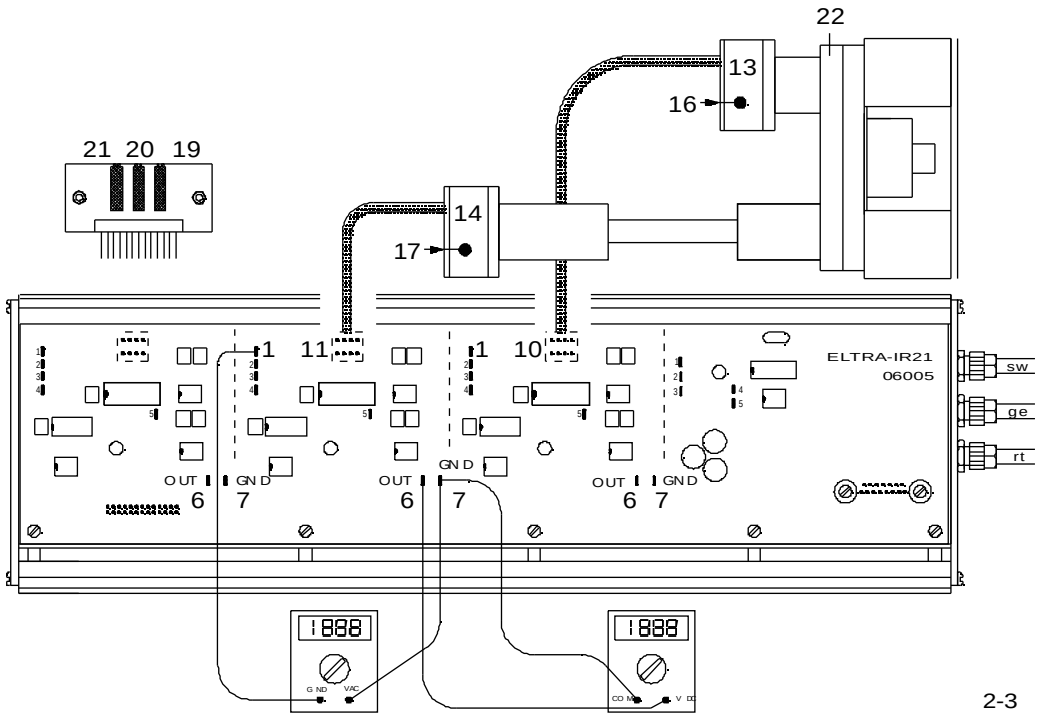
  The stability of the displayed numbers should be better than ±0.01:
- Normally, the second digit after the decimal point does not change, or it may fluctuate up and down by only **1**, since this could be actually on the rounding point.
  If the fluctuations are larger, then there is a major degree of **noise**, see **1.16**.
  The drift should also be very small. Within **10 minutes** the second digit after the decimal point should not change more than **1**.
  The drift should first be checked when the analyser has been switched on (power switch on **setting 1**) for at least **one hour**, better would be **two hours**, and an **oxygen** flowed for about **10 to 15 minutes** (Power switch on **setting 2**).

In case the drift is too large:

- Check the temperature regulation, see **2. 5**
- Unstable power supply, see **2. 4**
- Defective IR source, see **3. 2**
- By pressing the < CLR > key, you can end the test.

- **Notice :**
  In case of a serious defect, if the output voltage of the infrared cell is more than 10 volts, ++++ is shown on the display.

Adjusting the infrared cell



The connection sockets of the measurement channels **(10 / 11)** are predetermined on the circuit board **IR 21**.
The position of the **IR paths** on the path plate **(22)** is open, and can be changed according to the layout of the measuring ranges.

10	Connection for **O**-channel
11	Connection for low **O**-channel
13 / 14	Pre-amplifiers for **O** and low channel
16 / 17	Adjusters for pre amplifiers
19 / 20 / 21	Zero fine adjustment for baselines.

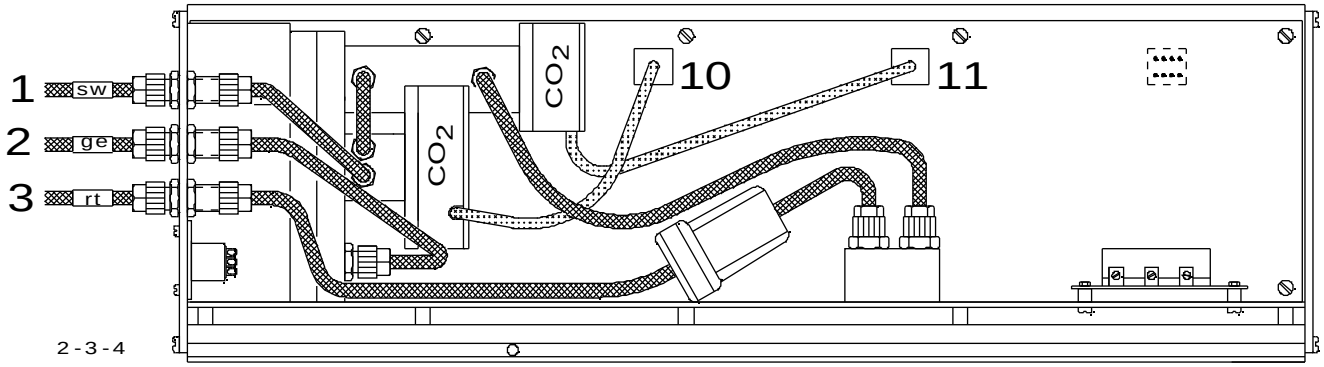
- Each channel is adjusted separately.
- Set the trimmers **(19 / 20 / 21)** in the middle of their range.
- Connect a digital voltmeter on the **outlet 6** and the **ground 7**
  (measuring range **200 V DC**)
- Adjust 0 volts DC by adjusting the preamplifiers **(16 / 17)**

- Turn the trimmer clockwise for lower voltage, counterclockwise for higher voltage.
- After the zero adjustment, the voltage on test point 1 should be about **1 to 1.5 volts AC** (measuring range **2 V AC**).
- Install the infrared cell in the analyser.
- Restore the carrier gas flow.
- After **30 to 60 minutes**, further adjust the zero by turning the trimmers **(19 / 20 / 21)**.
- To adjust the zero, the < **Menu** > and < **Cal** > keys are pressed
- Press the < **Cal** > key again to return to analysis.
- On the temperature regulation card, check if the LED flashes, so that it is on half the time and off the other half, see **2. 5**

ATTENTION !

When the test signal fails on **test point 1**, this can be due to the **8-pin connector (10 / 11)** that connects the pre-amplifier to the **IR21 board** not being correctly connected.

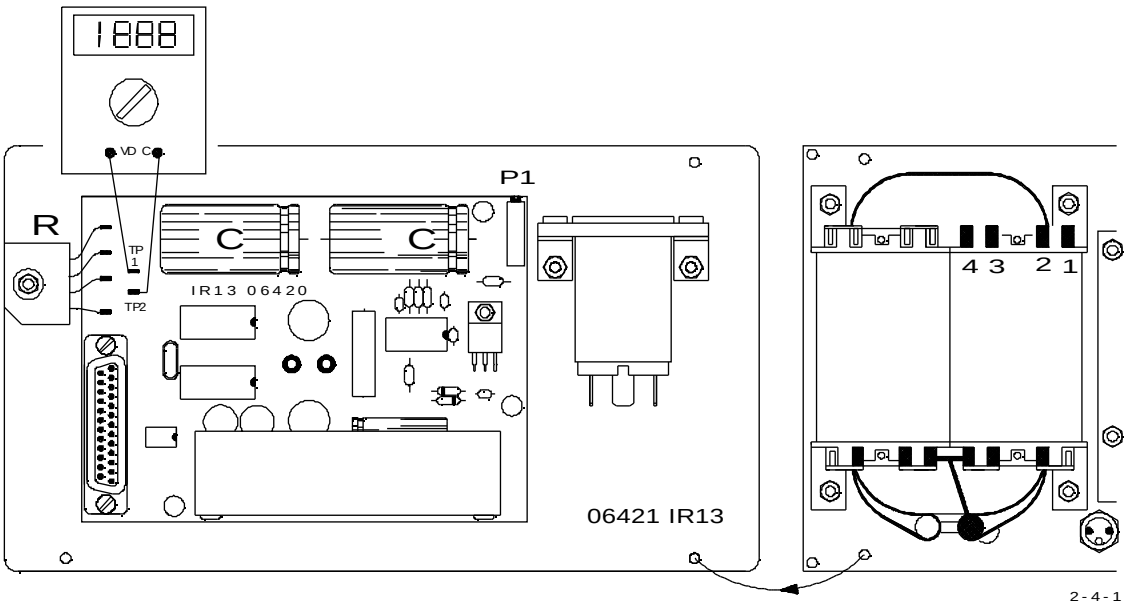
Remove, **turn 180°**, **and replace** the 8-pin-connector and measure again.



1	**black**	marked tube connection
2	**yellow**	marked tube connection
3	**red**	marked tube connection

- When reinstalling the infrared cell into the analyser, you must pay **attention** to the color markings of the tubes and their connections.

2.4 IR source voltage setting:



IR source voltage to be measured between TP1 and TP2 on IR 13 board.

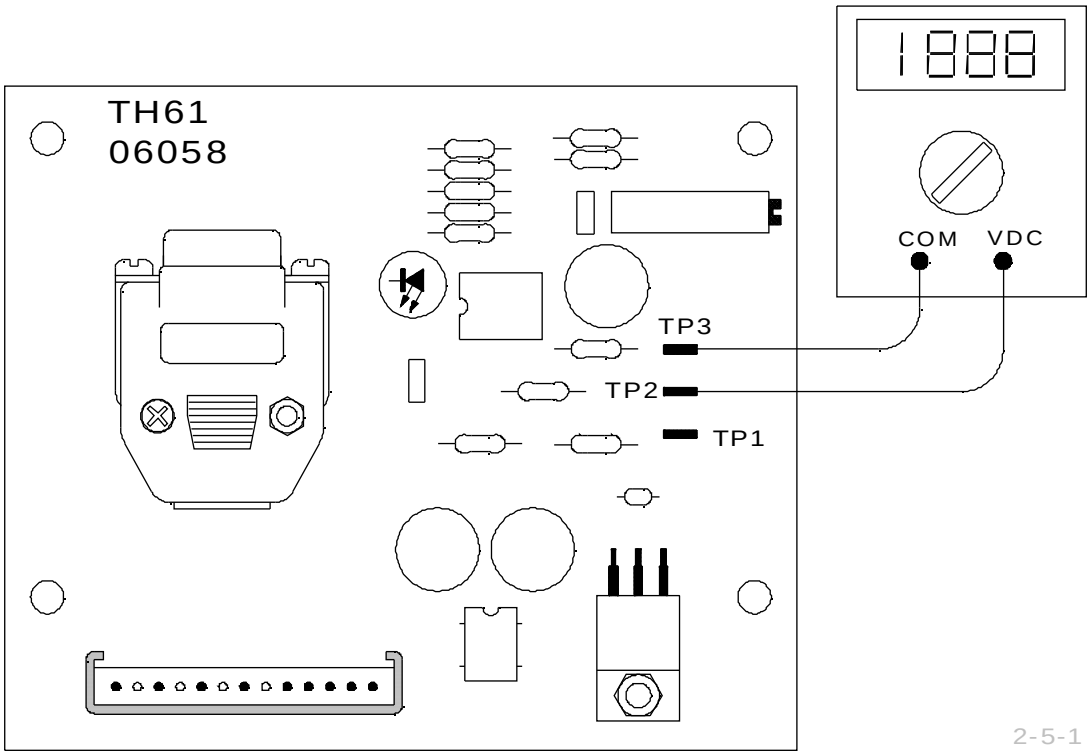
2 V DC for 1 channel device
4 V DC for 2 channel device
6 V DC for 3 channel device
(2 Volts DC for each IR source)

Transformer connections:

1 : always connected (common)
2 : soldering location for 1 channel device
3 : soldering location for 2 channel device
4 : soldering location for 3 channel device

- Set above voltages through **P1**
- The voltage of the capacitor **C** must be about **5 to 6V higher** than the **voltage of the IR sources** measured on the **a.m. test points**.
- If the voltage of **C is too low**, either the **transformer** is not correctly connected, or the **rectifier R** is out of order.

2.5 Temperature regulation of the IR-cell:



The adjustment should preferably be done only when the analyser, and the infrared cell have been in operation for at least **one hour**.

- If the **LED** is always off, adjust **P1** on the **TH 61** board clockwise for **higher temperature set point**.

- If the **LED** is always on, adjust **P1** counter clockwise for **lower temperature set point**.

  In case the **LED** is already blinking, adjust the flash rate of the **LED** to 50% duty circle.

ATTENTION!

- The effect of the readjustment will appear in a **few minutes**, as soon as the temperature has changed to the **new setting**.

- The voltage on **TP1 (TP2 = GND)** does not correspond to the actual temperature of the **IR-cell**, but it corresponds to the power needed to keep the **IR-cell** at a constant temperature.

- When the environmental temperature goes **down**, the heaters of the **IR-cell** need **higher power** to keep the temperature of the **IR-cell** constant. In this case the **voltage** will go **higher**.

- **The opposite happens when the** temperature **in the laboratory goes** higher**. The** IR-cell **heaters need** less power **to keep the temperature constant, so that the** voltage **will become** lower**.**

- The adjustment of the **IR-cell** should be done, if possible, when the laboratory has the **average temperature of the year**. The set point of the **IR-temperature** should then be adjusted with **P1** so that the voltage in stable condition measures 6 volts.

- For readjusting, turn **P1 clockwise** when the voltage to is too low; when the voltage is too high turn **counter clockwise**.

- **Caution:** After you have turned **P1** several times, the **voltage** will be **out of range**. This is normal. When turning **P1,** you enter a new **set point** of the **IR-cell temperature** which is at that moment different to the **actual temperature** of the cell.

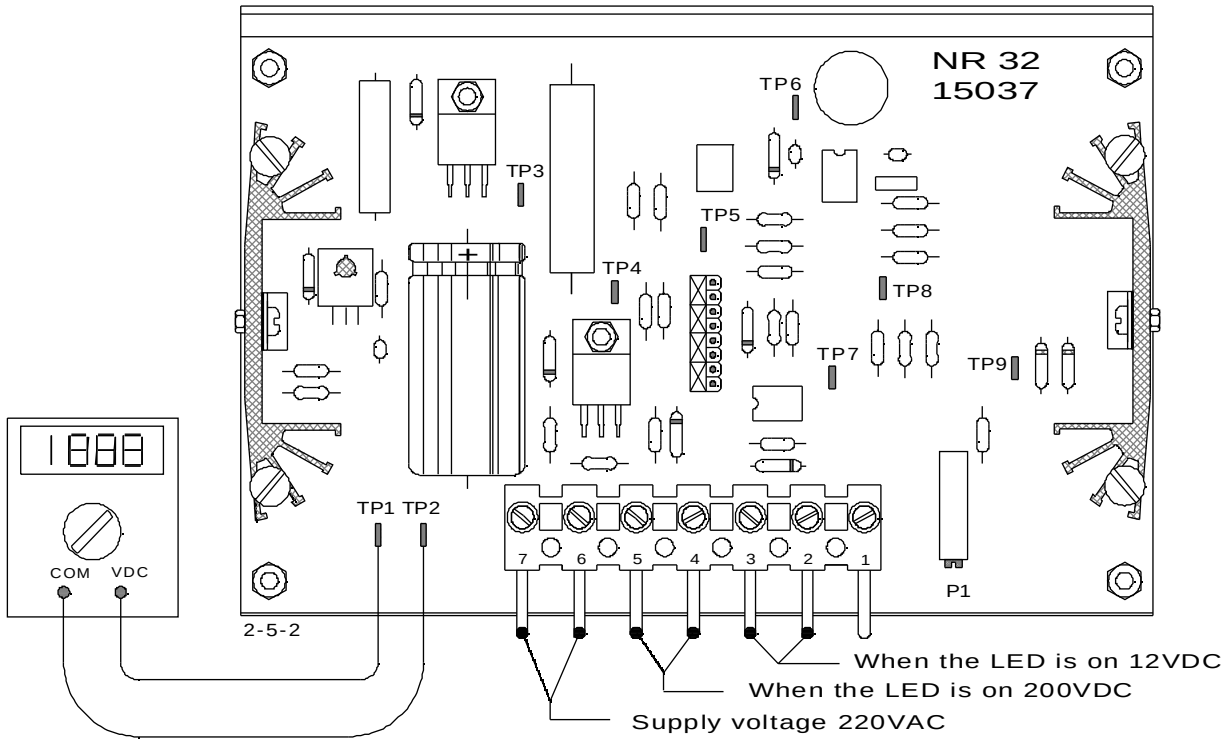
- The **temperature control circuit** will give **full power** to the **heaters** (in case you have set a higher temperature) or the circuit will **completely shut down** the **power** to the heaters, if you have adjusted a **lower temperature set point** than the actual temperature.

- After about **10 minutes** the temperature will reach the new adjusted level, and the **voltage** will come back to **remain stable at the new level**.

- This is the voltage level which corresponds to the power to keep the **IR-temperature** stable at the new level.

- If the **LED** still doesn't start blinking , adjust **P1** on the **TH 61**, until there is about **5.35 VDC** present between **TP2** and **TP3**.

- If the **fault** still remains, despite adjusting the **TH 61**, then check the board **NR 32**, according to the following instructions.

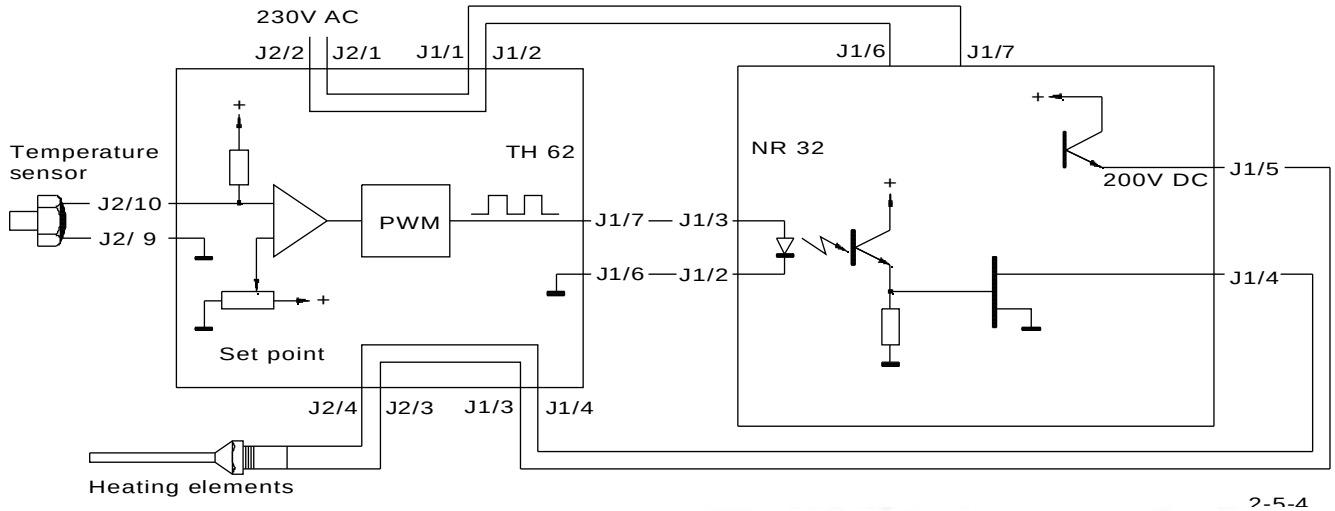


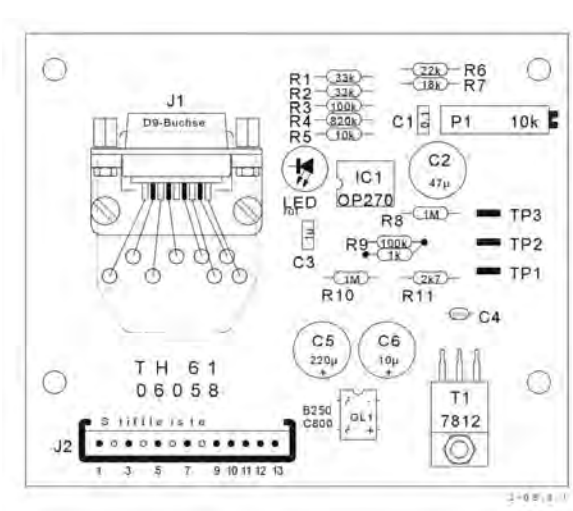
CAUTION! ELECTRICAL HAZARD !

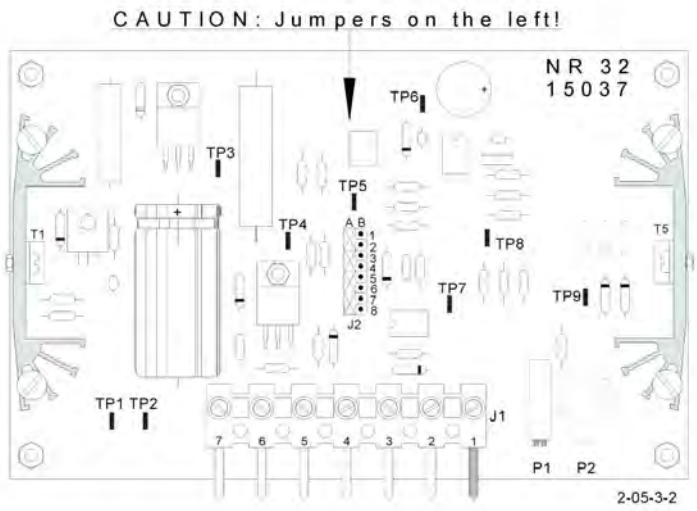
- You should be able to measure **200 V DC** between **TP 1** and **TP 2 (GND)** of the **NR32** board; otherwise the board is faulty.
- This requires that **220 V AC** comes through the connectors **6** and **7**
- If there is no **220 V AC**, then there could be a bad contact in the plug.
- The voltage for the **infrared cell** heating elements, comes from the connections **4** and **5** of the **7 pin plug**, measure the voltage on the screws, without disconnecting the plug.
- As long as the **LED** is on, there is **200 V DC** between **4** and **5**.
- As long as the **LED** is off, there is **no voltage** between **4** and **5**.

  If there is no **voltage** between **4** and **5**, then the **NR 32** is faulty. Replace it, according to **3. 6**.
- The above sentences extend to the board **TH61**. From there they feed the heating elements.

General description of the infrared cell temperature regulation:







This system consists mainly of the following components:

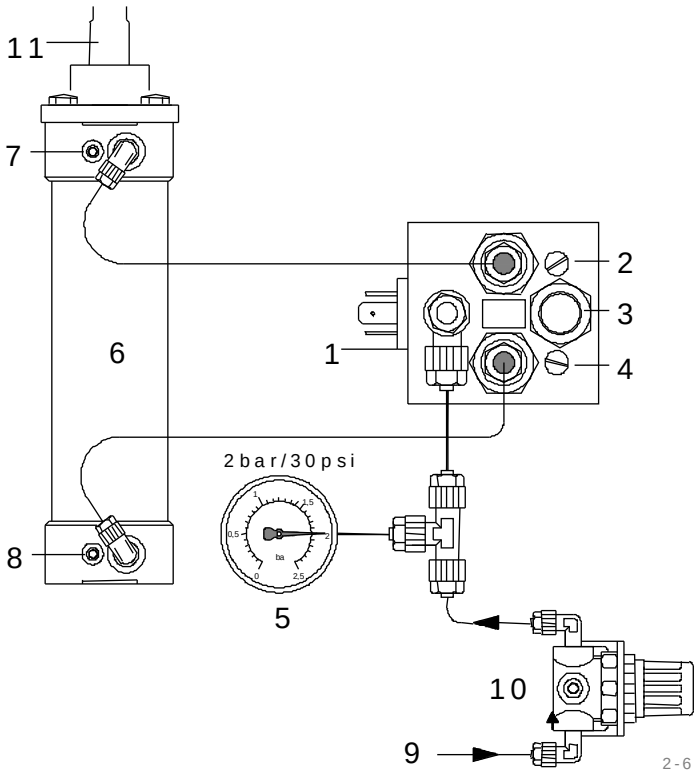
- The temperature sensor
- The temperature control board **TH 61**
- The power stage board **NR 32**
- The heating elements

The temperature sensor feels the temperature of the infrared system, and sends the signal to the temperature control board **TH 61**.

The **TH 61** compares this signal with a set point value. The resulting value drives a pulse width modulator. The **LED** of this board shows the function of the modulator.

The modulated signal further drives and power stage of the **NR 32 board**; the power signal returns to the **TH 61** board, from there it finally goes to the heater elements.

2.6 Pneumatics for furnace lift:



1 Pneumatic valve
2 **Upward speed regulator**
3 Muffler
4 **Downward speed regulator**
5 Pressure gauge max. 2.5 bar (30 psi). (Lower gauge on the front panel)
6 Pneumatic cylinder
7 **upper** cushioning
8 **lower** cushioning
9 Compressed air inlet 4 to 6 bar (60 - 90 psi)
(on the rear panel on the **right** hand side)
10 Pressure regulator
11 Furnace lift

- The pressure regulator **(10)** needs to be adjusted first.
  After removing the side panel on the right-hand side of the analyser, the pressure is set by pulling and rotating knob **(10)**, until the correct value of 2 bar is displayed on pressure gauge (lower gauge on the front panel).

- The upward speed of the furnace lift **(11)** is set with the screw **(2)**.
  The speed of the final travel before the upper stop is set with the screw **(7)**.

- The downward speed of the furnace lift **(11)** is set with the screw **(4)**.
  The speed of the final travel before the lower stop is set with the screw **(8)**.

  CAUTION !
  When the screw **(7)** for final upward travel is too tightly screwed, it can happen that the furnace doesn't close (speed = zero).

2.7 Flow rates:

Analyse- and purge flow must be adjusted manually, because the furnace is an open system.

The total flow into the system is shown in the left flow meter on the front panel.

The standard flow gets into the furnace through the gas inlet between upper electrode and sample drop. The analytical flow is sucked by a pump on the outlet of the furnace. The remaining carrier gas purges the sample in the sample drop.

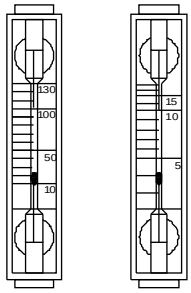
The purge flow is activated with opening the furnace during the outgas phase. This flow gets into the furnace through the furnace outlet, so that only pure carrier gas flows in the analyser.

Adjust the gas flow as follows:

- The main switch **(G)** is on pos.2
- The furnace is closed (piston up). If not, close the furnace and wait for 10 seconds.
- Adjust the lower regulator **(D)** until the left flow meter **(A)** shows 30 l/h
- Open the furnace
- Adjust the upper regulator **(C)** until the left flow meter **(A)** shows 50 l/h
- Close the furnace

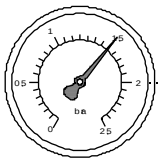
If the above settings are unstable, increase both flows by about 10 l/h.

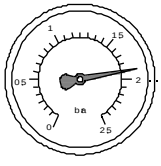
- Adjustment of the flow meter **(B)**, see **2.1**

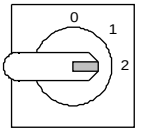



C


D


E


F



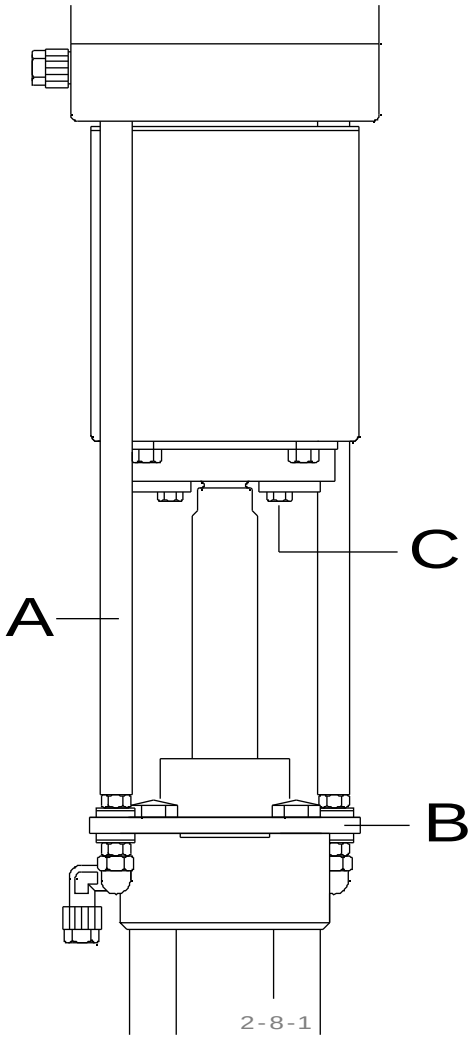
G

2.8 Furnace lift adjustment

The purpose of this adjustment is to ensure that the furnace can lift and fit correctly into the upper chamber.

To adjust, open the furnace and loosen the screws **(C)**, the furnace is now free to move horizontally.
Close the furnace, the furnace aligns itself as it moves into the upper chamber.

Fasten the screws **(C)** again.



2.9 Linearization:

The linearization of the analyser is done in the factory by the taking into operation and does not need to be repeated by the customer.
You therefore have to be discouraged from experimenting with the linearity.
The following description is only advised if the number of channels is increased (see **3.12**), or if the range of a channel has to be changed (for example by installing a longer or shorter IR path).
The infrared cell is basically nonlinear; meaning that its output voltage is not proportional to the CO_2 concentration.
It is therefore necessary to correct this nonlinearity electronically, by means of the software, in order to obtain accurate results.
The exact characteristic curve must be individually determined for each measurement channel, and then fed into memory.
A so-called „linearity factor“ is transferred to the analyser, by means of its keyboard, in order to determine the slope of the characteristic curve, (see next pages).
After feeding in a (new) factor, a high and a low standard sample are analyzed, to check for accuracy.
If, after the test, the measurement results of the low standard sample are not correct, a new linearity factor is fed in and the test is repeated.

Procedure

1) Analyse the high standard
2) Note the result (by hand or on the printer)
3) < **Cal** > < **1** > < **Channel Number** >
4) < **Standard Value** > < **Enter** >
5) < **Result** > < **Enter** >
6) Analyse the low standard
7) If the result (from 6) is too low, then the linearity factor should be higher.
8) If the result (from 6) is too high, then the linearity factor should be lower.
9) < **Menu** > < **.** > < **Channel Number** >
10) < **New Factor** > < **Enter** >
11) < **Nr** > < **New Factor** > < **Enter** >
12) Repeat from # 1)

Approximate standard samples for linearization and calibration:

Channel 1 : Oxygen (low) **Linearization factor: approximate value 23000**
Concentration: 40 ppm O Sample weight: 1000 mg
Concentration: 200 ppm O Sample weight: 1000 mg

For successive calibration, 200 ppm O is used as the standard.

Channel 2 : Oxygen **Linearization factor: approximate value 21000**
Concentration: 200 ppm O Sample weight: 1000 mg
Concentration: 1000 ppm O Sample weight: 1000 mg

For successive calibration, 1000 ppm O is used as the standard.

When the true factor is closely approaching, by using the above methods, an exact determination can be derived in the following way: Rather than only one analysis, three separate analyses are performed. Then the arithmetic average is taken.

1) Analyse the high standard three times.
2) Note the arithmetic average.
3) < **Cal** > < **1** > < **Channel Number** >
4) < **Set Value** > < **Enter** >
5) < **Result** > < **Enter** >
6) Analyse the low standard three times.
7) If the arithmetic average (from 6) is too low, then the factor should be higher.
8) If the arithmetic average (from 6) is too high, then the factor should be lower.
9) < **Menu** > < **.** > < **Channel Number** >
10) < **New Factor** > < **Enter** >
11) < **Nr** > < **New Factor** > < **Enter** >
12) Repeat from # 1)

2.10 Balance programming:

Basic settings for all types of balances:
2400 Baud
No parity
Send continuously

Please note:
We are not responsible for balances that have not been delivered through our company.

The below setting is only a general guideline. Some balances may have a different data or cable configuration and may therefore fail to communicate with the analyser. The balance supplied by **Eltra** is a Sartorius, model **BP61** or **BP61S**. The balance is programmed **(always with 3 digits)** in our company, in order to establish a good communication with the analyser.

Should any problems arise, then please follow the next instructions:
At first switch the balance off by **pressing** I/⏻ and follow the steps below.

1) Switch the balance on, by **pressing** the **TARE** button by **holding** it down. Then **press** the **on/off** button. I/⏻ **Release** first the I/⏻ and then **TARE**.

2) Selecting the first programming mode, **113** (to stabilise the vibration) by **pressing** ⊙ the first digit No. will appear on the display. Change the digit No. by **pressing** CAL **Repeat step 2 until the No. 113** has been **inserted** then, store with a **short press** on the **TARE** button.

1) Selecting the 2nd programming mode **515** (2400 Baud)
Same usage as in step 2) and don't forget to store with TARE (short press)

2) Selecting the 3rd programming mode **614** (continuous data sending)
Same usage as in step 2) store again with TARE (short press)

5) After the programming has been done, it is **IMPORTANT** to **hold** the **TARE** button again until the display shows a row of **88888888** and then release the **TARE** button and the balance is ready for operation.

The correct settings:
113 to stabilise the vibration
515 2400 baud
614 continuous data sending

CAUTION:
The balance model **BP61** has a switch to **enable / disable** the programming mode. The switch, when shifted to the left, **disables** the programming mode.

2.12 TC zero baseline adjustment:

With the keys

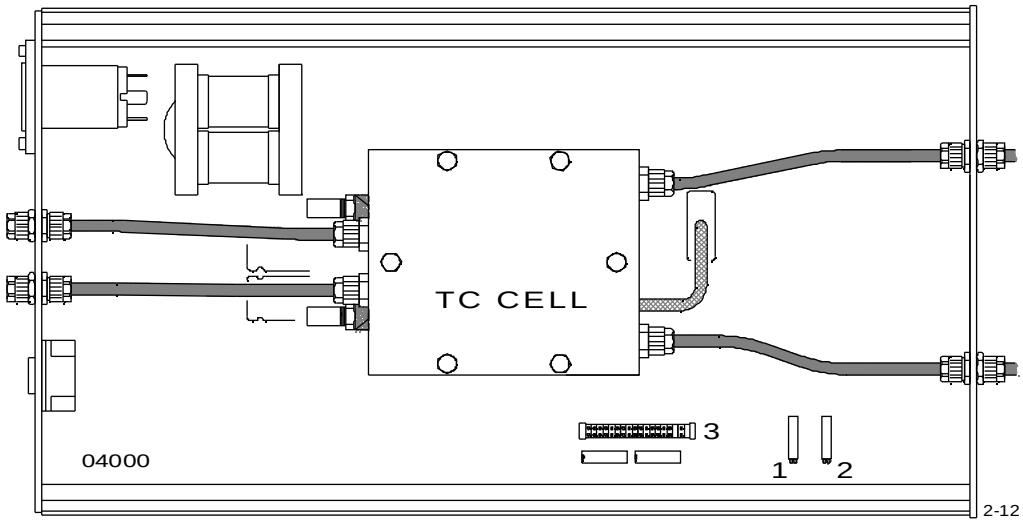
Menu

Cal.

the zero baseline of all channels is shown in the display.

The value of the third channel is the baseline of the high nitrogen channel. The value of the sensitive channel is 20 times higher.

An adjustment is necessary, if the value of the high nitrogen channel is higher than **±0.2V**. The zero baseline of the sensitive channel is not displayed.



Adjust as follows:

- Type **MENU CAL**
- Turn trimmer **2** in a central position
- Search with jumper **3** a value close to **0**
- Adjust exactly to **0** with trimmer **2**

2.13 Diagnostic printout:

By pressing the

< **Menu** > < **.** > < **0** >

keys, a diagnostic report will be printed out on paper.

Attention !

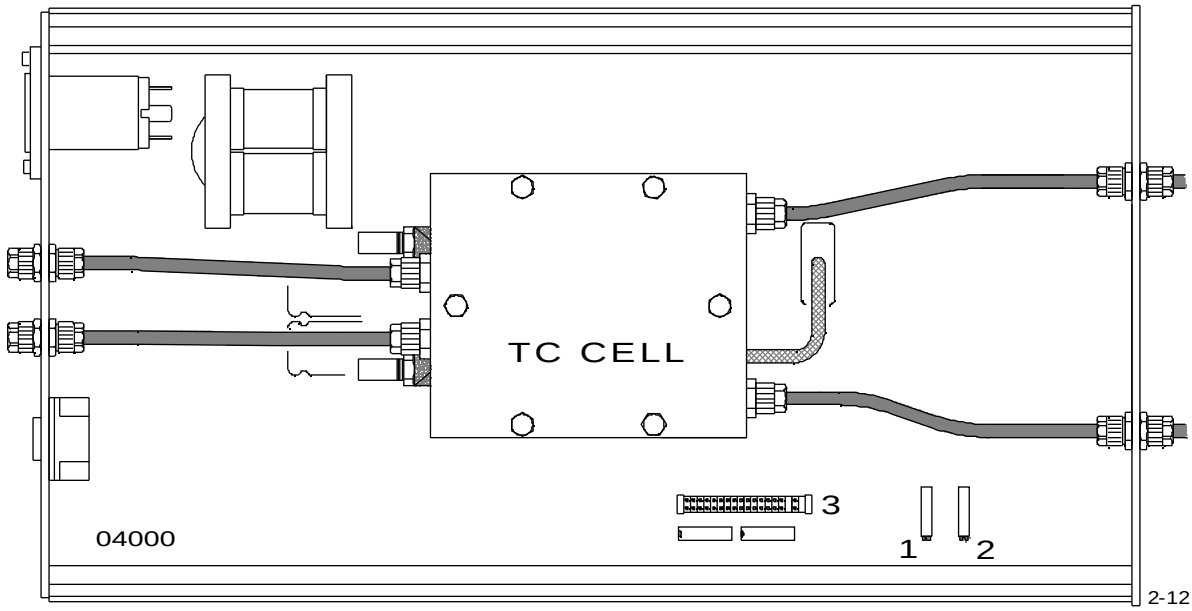
The printer port must be activated, with :

< **Menu** > < **3** > < **1** > < **Enter** >

This report should be faxed to **ELTRA** if interpretation or further instructions are needed.

2.14 Temperature regulation of the TC Cell:

The thermostabilisation of the TC cell is similar to the IR cell.



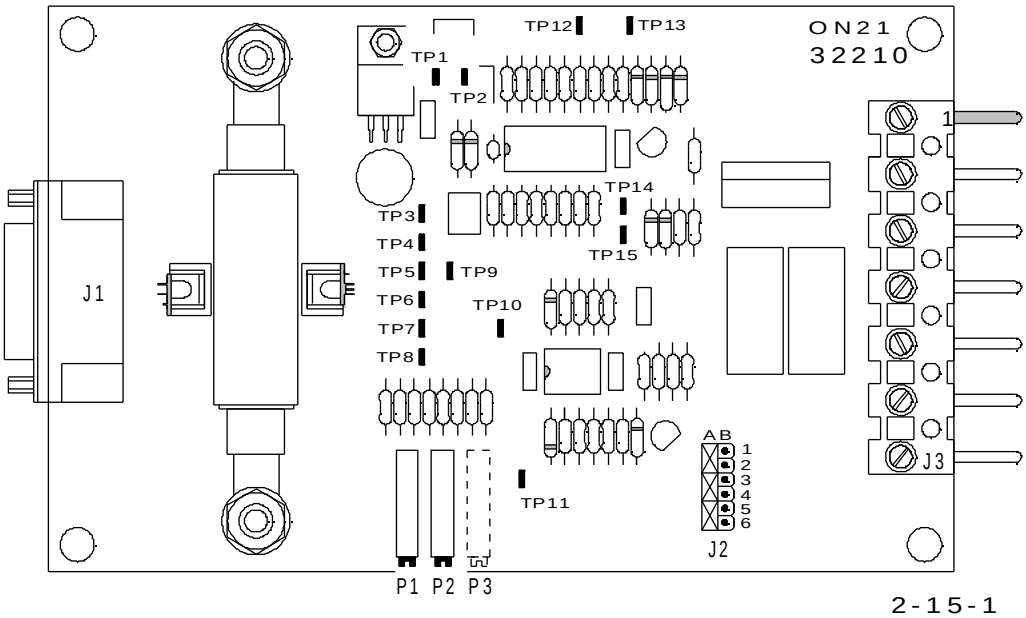
Adjust the set point of the thermostabilisation with trimmer No.1.
Turn clockwise to increase the temperature.

Caution :

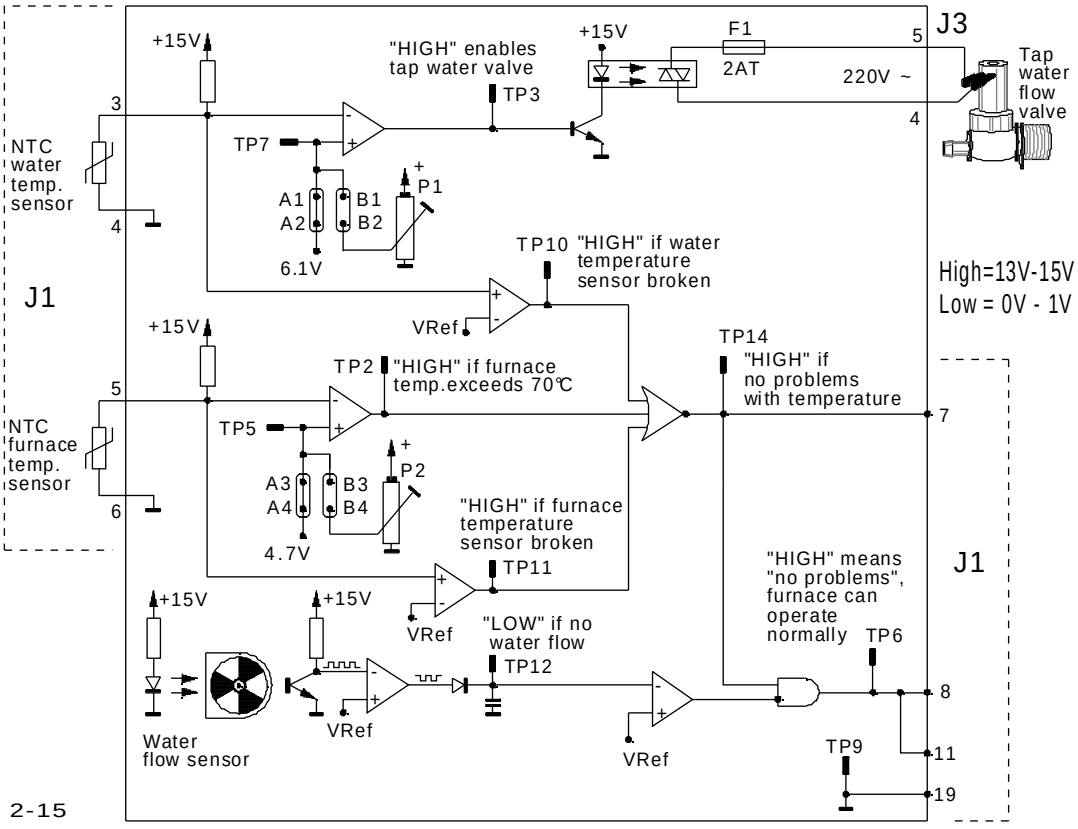
The influence of the temperature on the baseline is very high. Wait for the stabilisation after every adjustment.

2.15 Water flow and furnace temperature sensing board ON21:

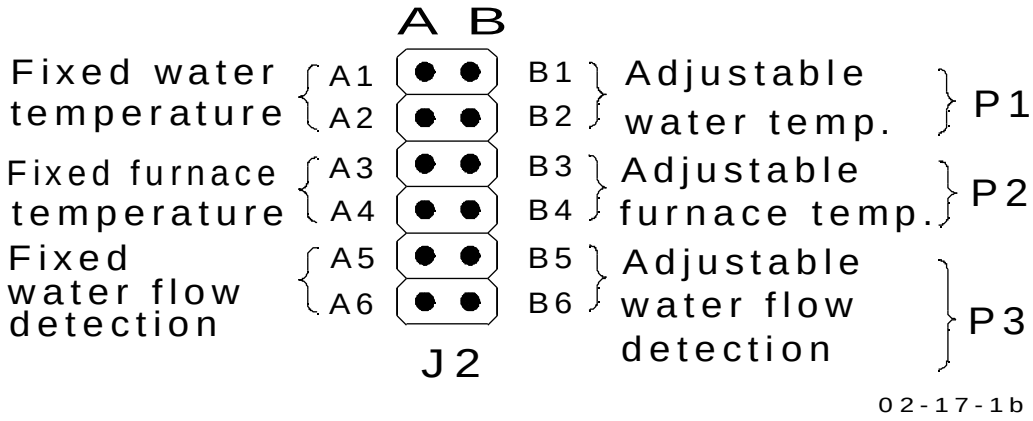
The **board ON21** is responsible for the temperature response of the tap water valve, the high temperature alarm of the furnace and the detection of the cooling water flow.
Do not change the settings of the temperature without checking the error massages.
Too high temperatures damage the furnace.



2-15-1



2-15



All the jumpers of **J2** are set by the manufacturer.
However, adjustments are possible if necessary; for example if the furnace and the water inside the barrel feels too hot.

Water temperature threshold adjustment

- Remove the jumper from **A1-A2** and install it on **B1-B2**
- Connect multimeter between **TP7** and **TP9** (GND). Range 20 VDC.
- Turn **P1** counter-clockwise for lower water temperature threshold.
  Turn clockwise for higher temperature threshold.
  The correct temperature is approximately 40℃ in th e barrel.
  The voltage on **TP7** for fixed temperature is about 6.1 VDC.
  Note: The higher the voltage on **TP7**, the lower the water temperature threshold.

Furnace temperature threshold adjustments:

- Analyse with a power of 8 KW (setting = 800) without the tap water connected till the message "temperature too high" appears on the display. This error message should appear once the temperature of the furnace has reached about 70℃.
  The furnace cools down very fast, after the tap water is connected.
  If the error message doesn´t appear at about 70℃, then:
- remove the jumper from **A3-A4** and install it on **B3-B4,**
- connect a multimeter between **TP5** and **TP9** (GND). Range 20 VDC
  The voltage on **TP5** for fixed temperature threshold is about 4.7 VDC.
- Turn **P2** counter-clockwise, for the error message to appear at lower furnace temperature. Turn clockwise, for the error message to appear at higher furnace temperature.
  Note: The lower the voltage on **TP5**, the higher the furnace temperature at which the error message „temperature too high“ appears.

Detailed explanation :

The board ON 21 contains three circuits.

- One of the circuits senses the cooling water temperature. The sensor is attached to the T-piece of the water hose. If the water temperature exceeds the threshold value, a solenoid valve will be energised, in order to pass tap water through the coil of the primary water flow in the tank. If the water temperature of the secundary water flow (through the furnace) exceeds a certain level, or if the water temperature sensor is broken, the analyser gives a warning on the screen for too high water temperature. At the same time the furnace power will be switched off, see also **1.11**.

- The second circuit checks the temperature of the furnace block (not the temperature of the crucible).

  The temperature sensor is attached to the rear of the upper furnace block (inside the analyser). If the temperature of the furnace block exceeds the threshold value, the furnace power will stop and a message for too high temperature will appear on the screen, see also **1.11**.

- The third circuit on the **ON 21** is for detecting the water flow. A part of this circuit is the plastic wheel on the board **ON 21**. This wheel is turning when there is enough secondary water flow, which is created by the water pump.

  When the analyser receives the command to start the analysis, the software first checks the water flow wheel on the **ON 21**.
  If the wheel is turning, and all the other preconditions are fullfilled, then the furnace power will start. If the wheel is not turning, the analysis will not start, and the message „No water flow“ will appear on the screen.

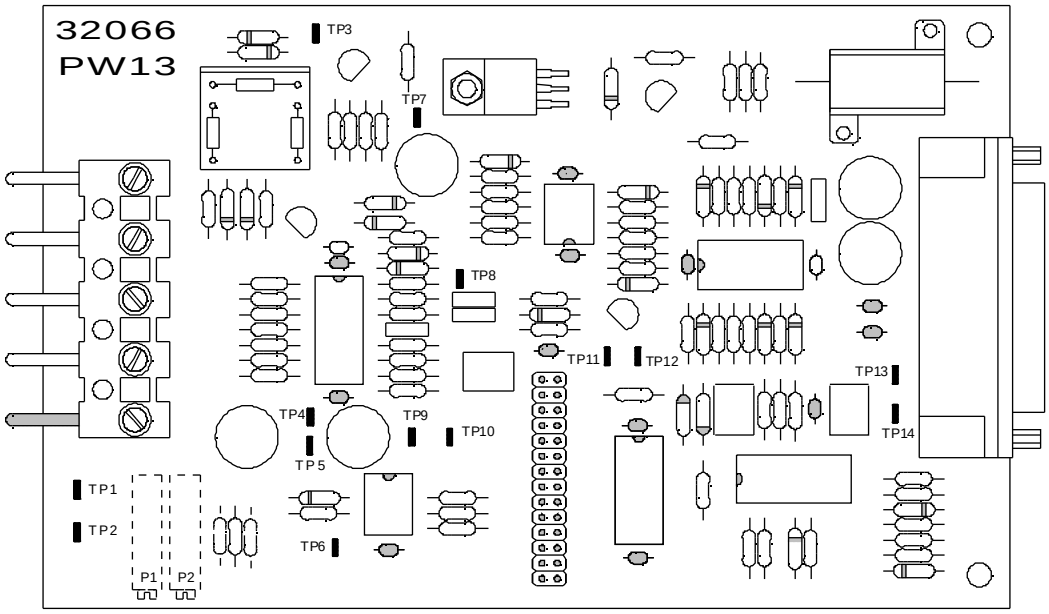
  The sensing of the wheel is done by a photo diode and a photo transistor.
  An adjustment is not necessary, so that **P3** which was meant for adjusting, is no longer installed on the **ON 21**. Only when the water is very dirty, then there will be a warning, even if the wheel is turning, see also **1.10**.

2.16 The furnace control board PW13

The current of the furnace is controlled on board PW13 .

The furnace current is detected by means of two current transformers and transferred to an amplifier in the board PW 13. The electronic rack sends the set point to this amplifier, too. The voltage on the primary side of the big furnace supply transformer is controlled, so that the feedback signal from the current transformers and the set point from the electronic rack are equal.
The feedback signal depends on the magnitude of the furnace current.

To adjust set point and furnace current use trimmer **P1**.

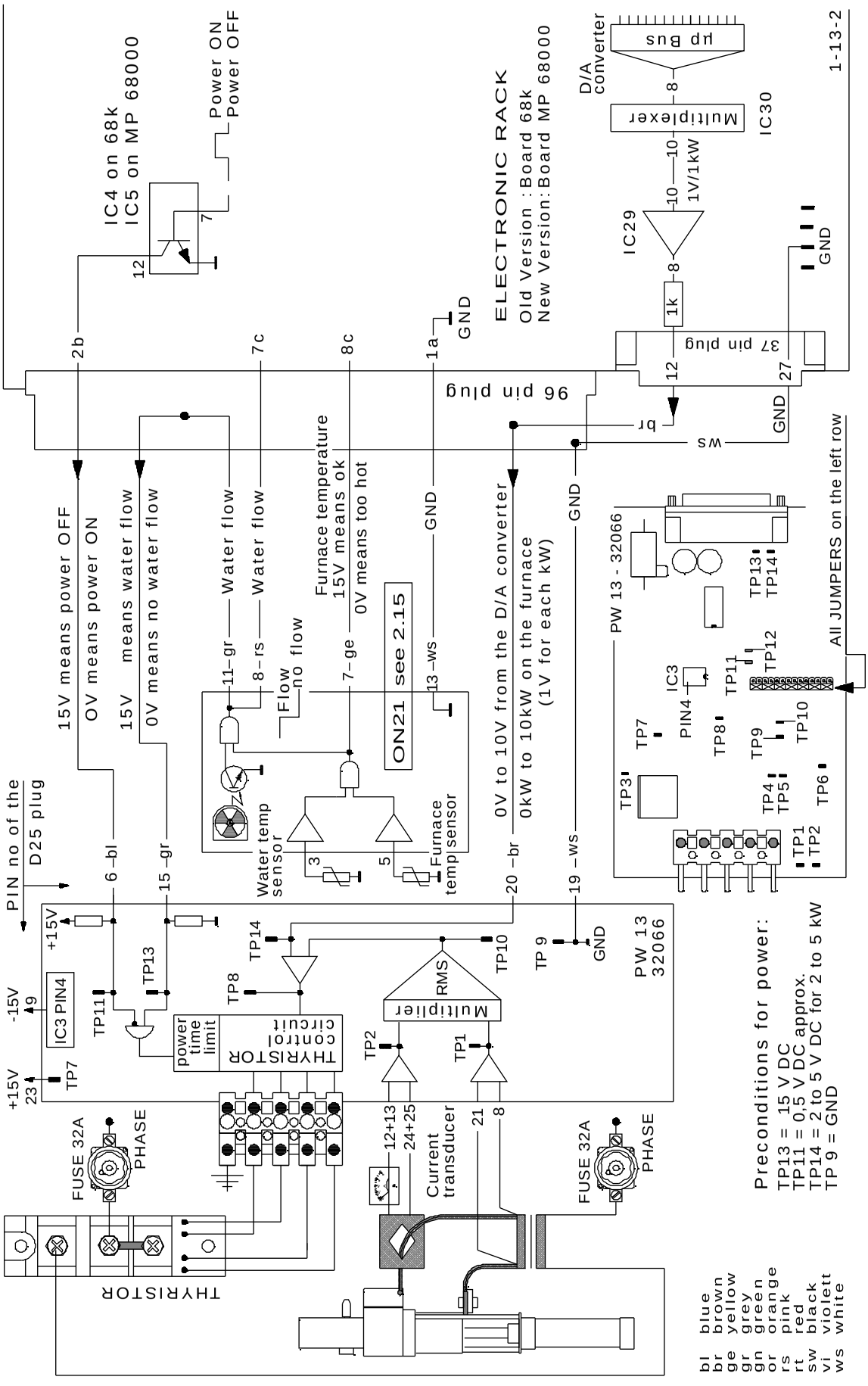


2-16-3

Enter an outgas power of 5.3 KW (setting = 530) in the menu.
Start the analysis. Turn trimmer P1 during the outgas phase so that the ampere meter on the front panel shows 4A.

This adjustment is only necessary in case the PW 13 has been replaced.

Detailed explanation of the furnace control system:



The furnace power is controlled by the software of the electronic rack.
The electronics send a digital command for starting the power and an analogue voltage for setting the power level.
These commands are controlling the board PW 13, which is the furnace control board.

The digital command for starting the power is a digital "Low".
It can be measured on TP 11 of the PW 13.
TP 11 is connected to pin 6 of the 25-pin plug of the PW 13. This signal comes from pin 26 of the 96-pin plug of the electronic rack.

The analogue signal for setting the power level can be measured on TP 14 of the PW 13.
TP 14 is connected to pin 20 of the 25-pin plug.
The signal comes from pin 12 of the 37-pin plug on the electronic rack.
One volt DC corresponds to one KW.
The usual range of the furnace power varies between 2 KW and 5 KW, depending on the application, which means the usual range of the control voltage is between 2 V DC and 5 V DC.

The above mentioned commands, however, are not sufficient to have power. An important precondition to power the furnace is the water flow. Without water cooling the furnace will overheat. The message for the presence of water flow is given by the board ON 21, transferred to pins 11 to 15 of the PW 13 and can be measured on TP 13 of the PW 13.
15 V DC on TP 13 means water flow, zero volts means no water flow.
When this voltage is zero, the thyristor control circuit of the PW 13 will be inhibited and the furnace power will be off.

The water flow message of the ON 21 is also transferred to the electronic rack (Pin 8 of the ON 21 to pin 7c of the 96-pin plug of the electronic rack).
If this voltage is zero, the analysis cycle will not start and the message of the water flow will appear on the display of the electronic rack. The digital and analogue commands for the furnace power will not be released by the electronic rack.

This way there is a dual protection for the furnace: Firstly, there are no power enabling signals from the electronic rack to the PW 13; and secondly, the thyristor control circuit is directly disabled by the ON 21.

2.17

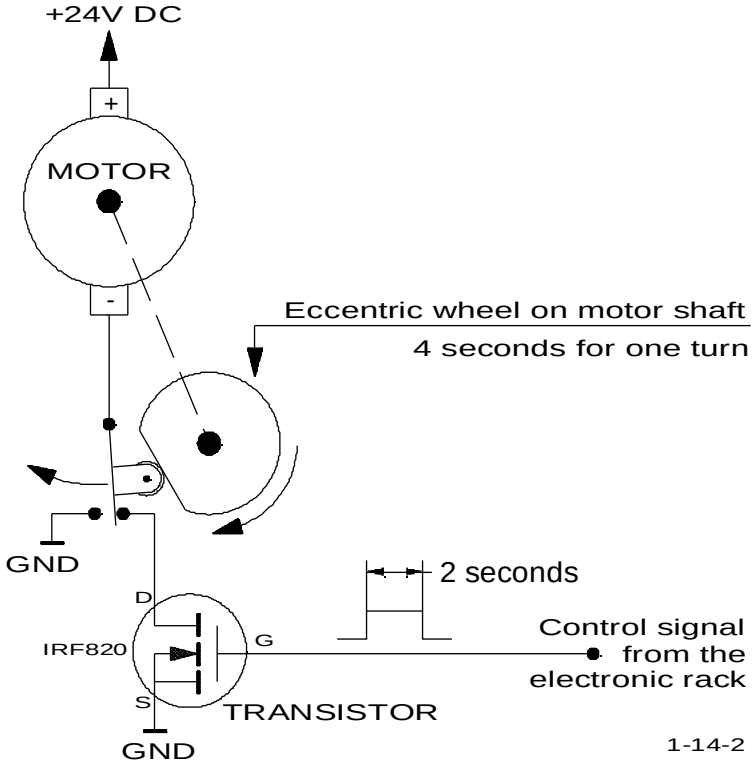
2.18 Sample drop motor and the motor switch adjustment

Detailed explanations

This description applies to the case of an analysis cycle running correctly, which means from the operation of the < START > button to the end of the analysis; when the results appear on the PC screen or the printer. During that time the sample drop motor has performed a full rotation.

Way of operation

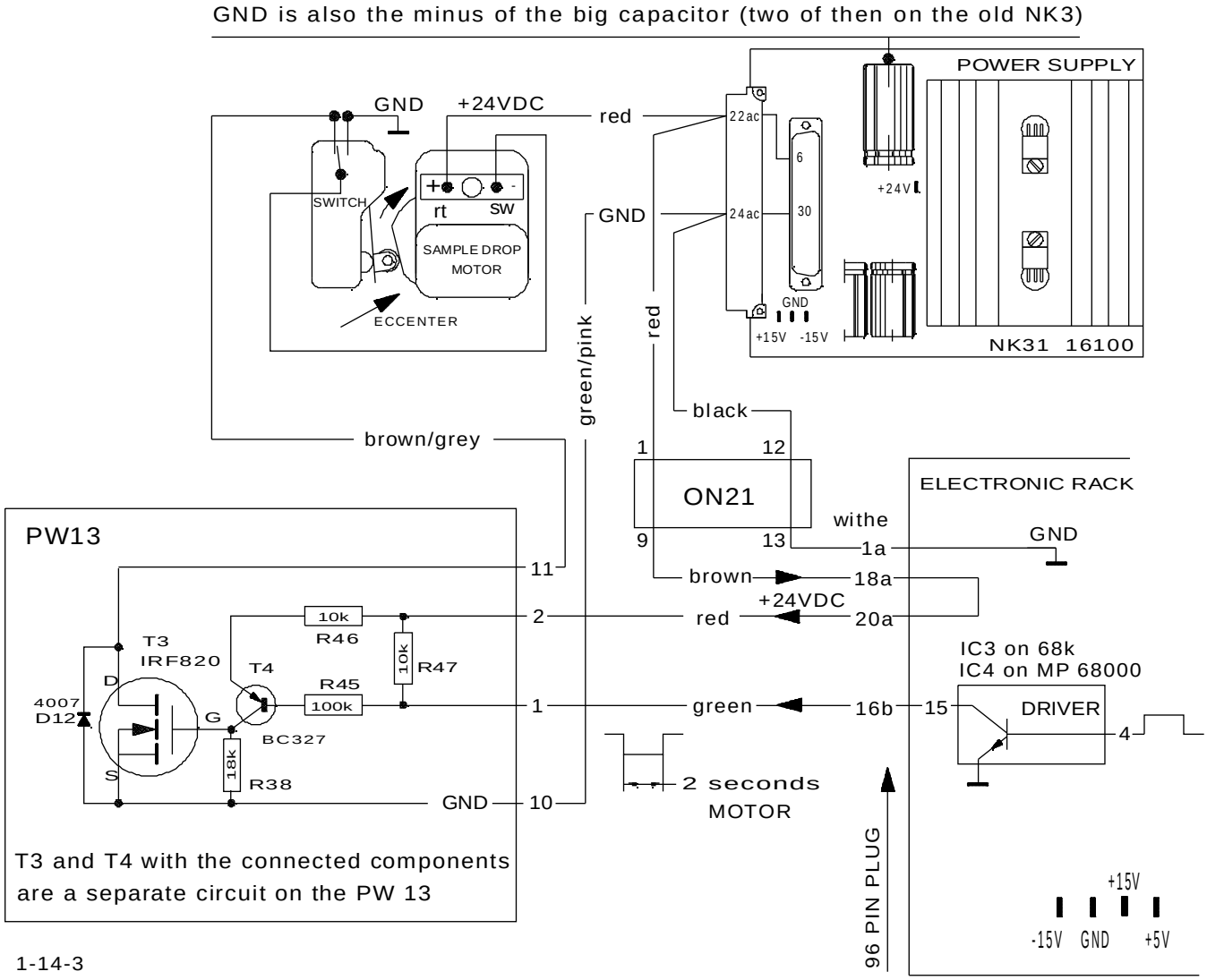
This simplified diagram shows the sample drop system and related circuit

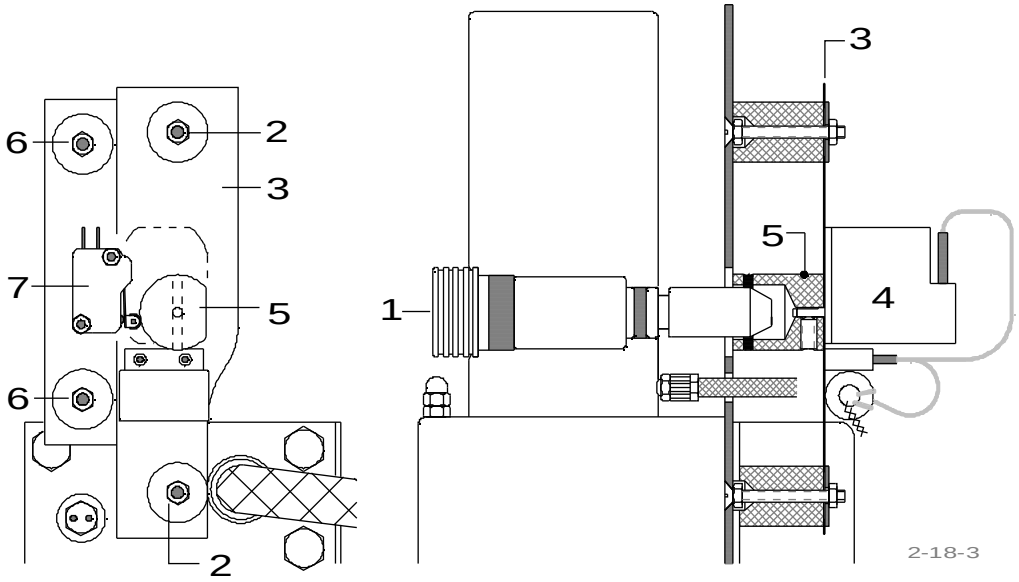


The PLUS connector of the sample drop motor is directly connected to +24V DC.
When the time is right for the sample drop motor to turn, the transistor is activated by the electronic rack software.
The switching transistor connects the MINUS lead of the motor to GND.
The motor starts turning, and shortly thereafter the eccenter of the motor shaft presses the switch.
From now on the motor is connected to GND via the switch and not through the transistor.
Before the motor makes a full turn, the transistor is deactivated by the electronic controller.
The motor keeps on turning, still connected to the GND via the switch.
When the motor has made a full turn, the eccenter will release the switch.
The MINUS connector of the motor is now disconnected from the GND and it is connected to the transistor again.
The transistor, however, is no longer activated, so that the motor stops turning.

The detailed circuit is as follows :

See also **4. 2** wiring diagrams 32165 resp. 32167 and 32140.





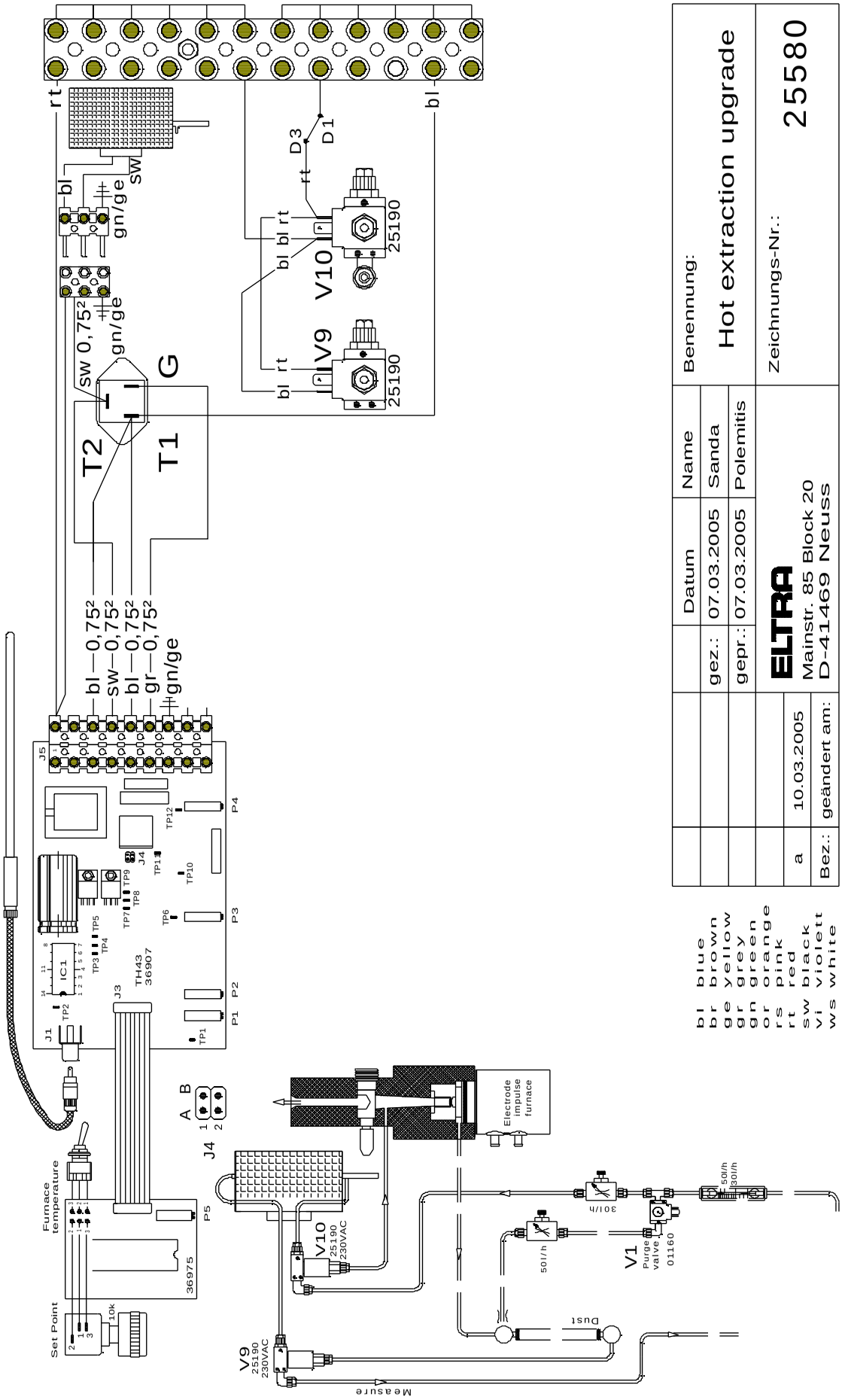
Positioning the sample drop motor

- Remove the right-side panel of the analyser
- Loosen the nuts (2)
- Move the motor bracket (3) until the sample drop unit on the furnace (1) and the cam (5) are well aligned
- Re-tighten the nuts (2)

Positioning the motor switch

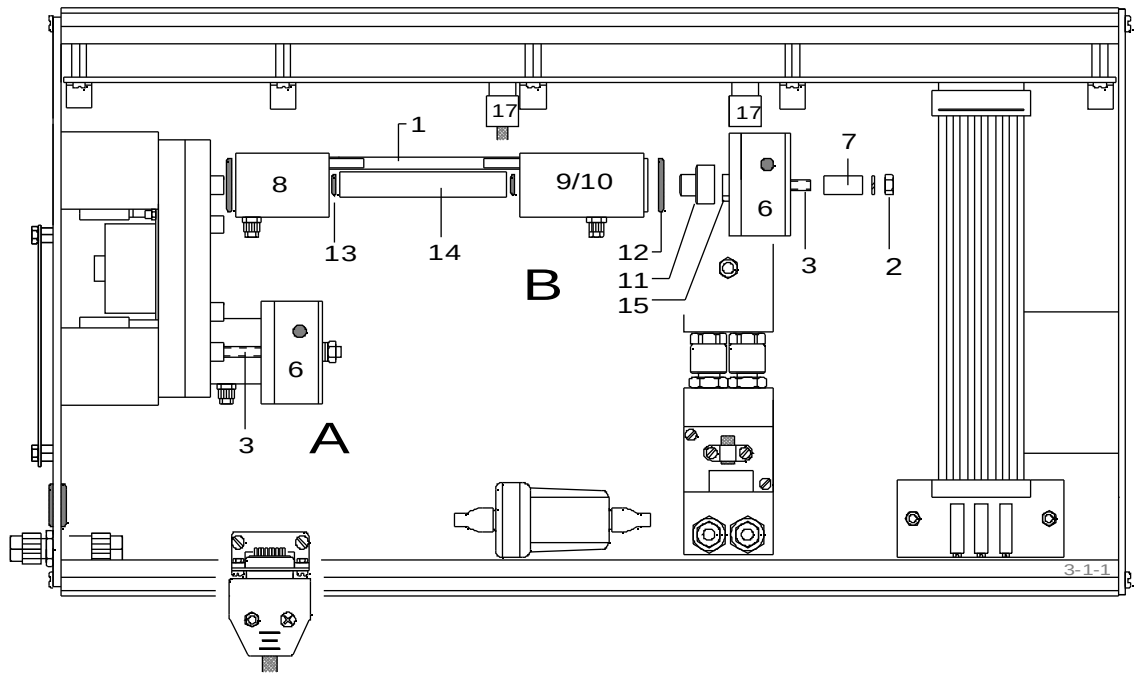
- This adjustment can only be done once the above positioning is correct
- Loosen the nuts (6)
- In order to adjust the position of the motor switch (7) next to the sample drop motor, it is necessary to ensure that the cam (5) is turned to the position shown in the drawing. This means that the switch must rest on the round edge, not on the flat edge of the cam (5)
  This is achieved by setting the mains switch, first to position 0 then to position 1. Watch the cam (5) rotating; when it reaches the required position, set the mains switch back to position 0.
- Move the switch to the right until it is fully compressed, then loosen it a bit (about 1mm), by moving it to the left. It is important **not** to hear the „click“.
- Re-tighten the nuts (6).

2.19 Hot extraction upgrade



3 Servicing

3.1 IR paths, cleaning and replacing

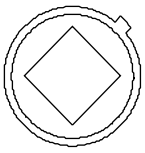


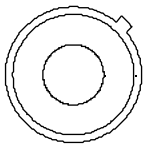
- Unscrew and remove the tubes (1) from the IR paths.
- Remove the nuts (2) (Size: 7) in doing this, the screw thread (3) should be held tight to prevent it from turning with the nut.
  Take out the pre-amplifiers (6) together with the distancing box (7).
- Clean the paths with a cleaning solution, e.g., ethanol.
- With a two part path, such as (B), the windows can be cleaned on the inside by the use of a cotton swab.
- With single part path, such as (A), the path is filled with ethanol and, after a few minutes, oxygen is blown into the empty path and will dry it out.

  Soiling which can accumulate from the analyses of materials that contain a lot of sulphur and moisture, or hydrogen can be very difficult to clean. In such cases, the paths should be replaced.

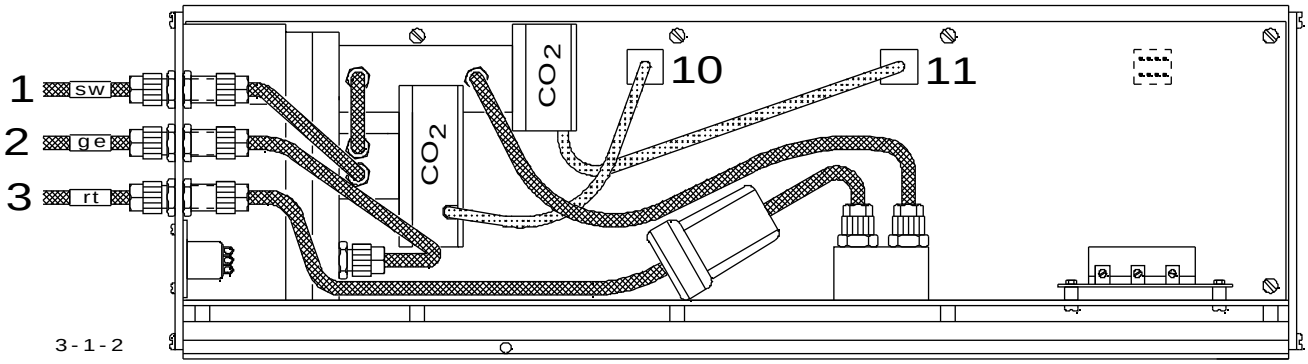
- Before reassembling the paths, the screws (3) should be screwed in by hand in order to ensure that they are screwed into the holes.
- Assembly of the paths follows is made in reverse order from the removal.
- After reinstallation, adjustments according to **2. 3** are recommended in all cases.
- If the plugs (17) of the pre-amplifiers (6) are to be replaced, see **2. 3**

How CO_2 detectors (used for the O-channel) can be recognized:

Initial option:  Square window without any type number.

Later option:  Round window with type No.: 407M36-611.

- In case the infrared detectors are to be replaced, you can recognize them as described above.

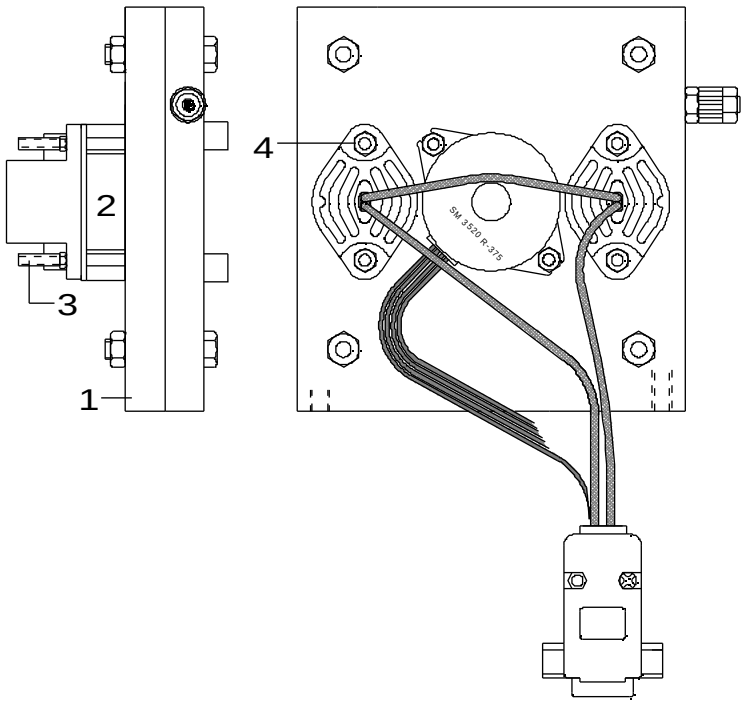


1	black	marked tube connection
2	yellow	marked tube connection
3	red	marked tube connection

- In reinstalling the infrared cell unit in the analyser, you must pay attention to the color markings of the tubes and their connections.

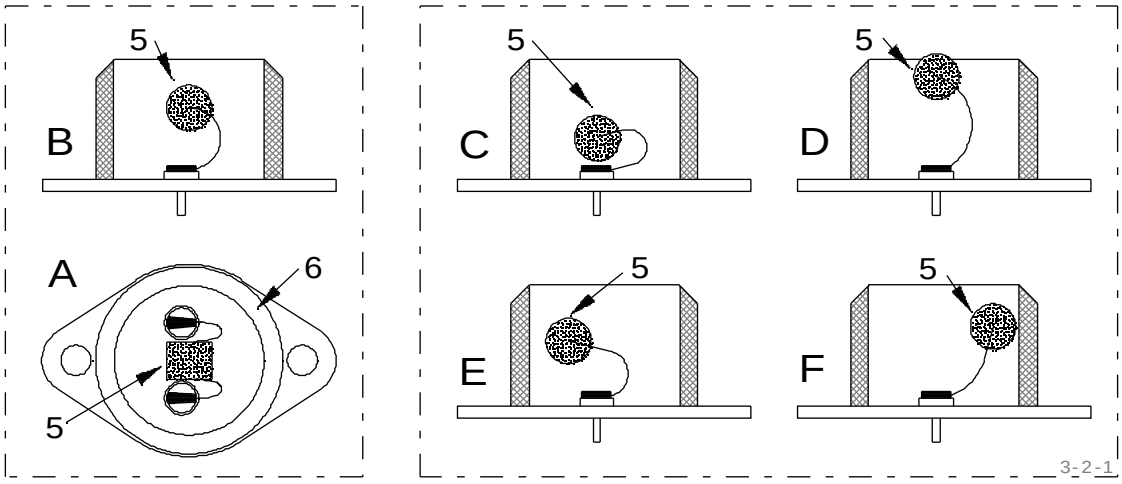
3.2 IR Source

- The IR sources **(2)** are fastened with the screws **(3)**
- For installing or removing the IR source **(2)**, the complete chopper motor assembly **(1)** together with the mounted paths and pre-amplifier, should be removed from the infrared unit, see 3. 5
- In order to remove the IR source, it suffices that the nuts **(4)** are removed (5.5 mm wrench).
  In doing this, the screws **(3)** should be held so that they do not turn with the nuts.
  The chopper motor housing **(1)** does not need to be unscrewed.
  The chopper motor housing **(1)** also does not need to be unscrewed when installing the IR sources **(2)**.



4-1-1

CORRECT **WRONG!**



3-2-1

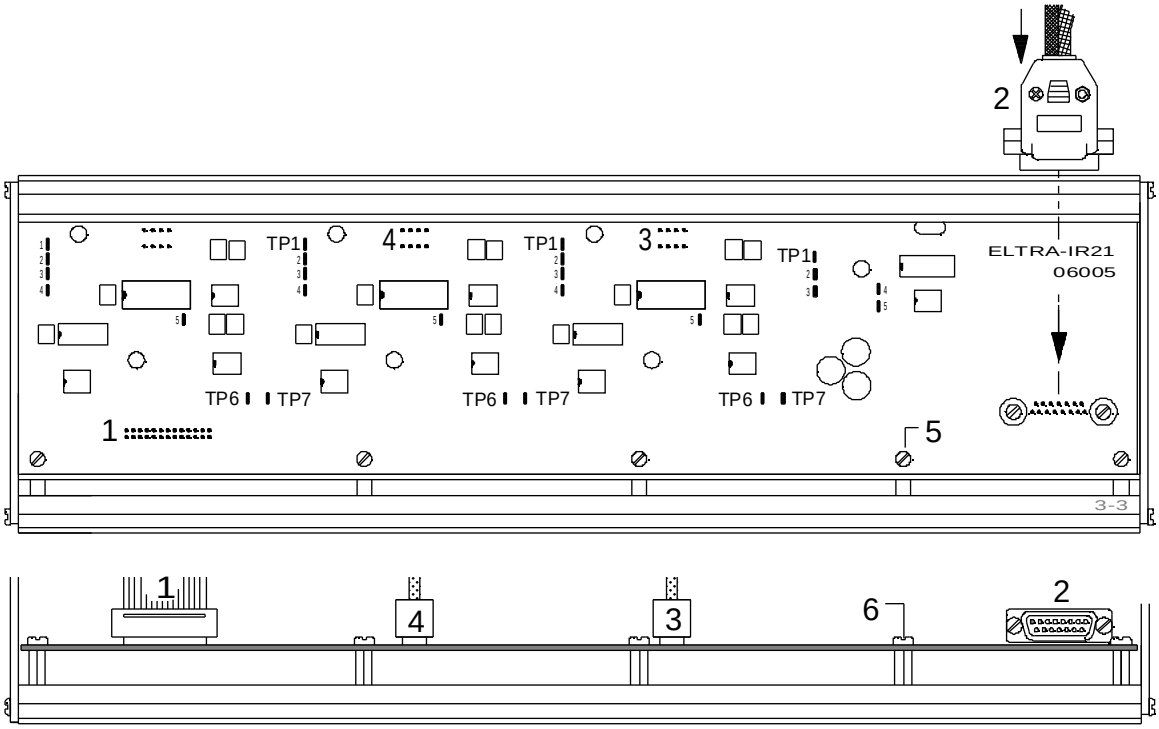
CAUTION !

The IR source **(5)** itself should be in the middle of the ring **(6)**
(this is without considering the location of the soldered connections, which are not centered).
See above drawing: **A** and **B** are correct, **C, D, E** and **F** are wrong.
Avoid moving the IR source back and forth, try placing it correctly the first time.

- After re-assembling the infrared cell, adjust according to 2. 3

3.3 Infrared electronics

The complete signal processing for all channels is handled through the circuit board IR21. In the event of a failure, the entire circuit board should be exchanged.

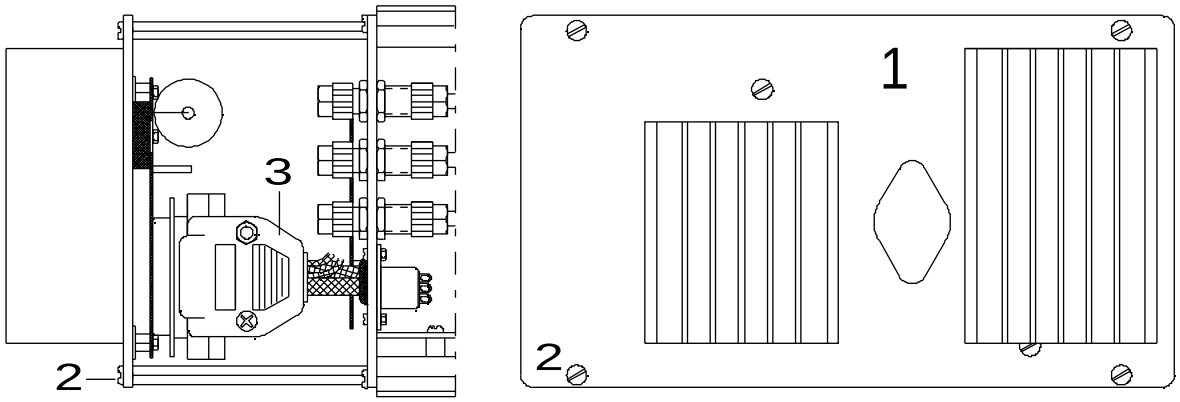


- The plugs (1 / 2 / 3 / 4) should be unplugged.
  The 10 screws (6 and 7) should be removed.
  On the IR21 - circuit board, no adjustment is needed. You should, however, check the adjustments on the infrared cell, as in **2. 3**.
  The IR21-circuit board is malfunctioning, when the correct signal can be measured at test point 1; while the signal at test point 6 cannot be adjusted to zero, see **2. 3**.

3.4 Infrared power supply

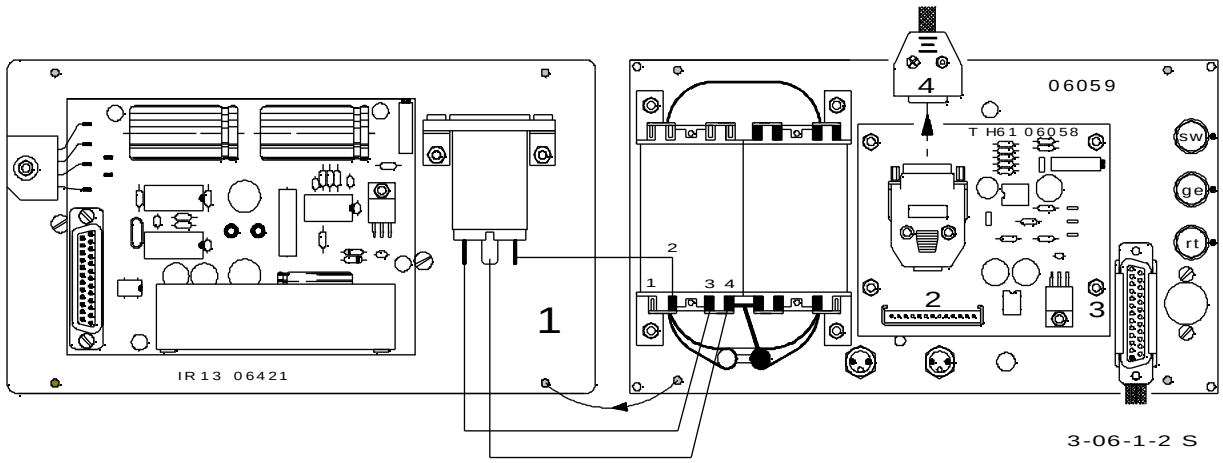
- The power supply (1) is a complete unit, which is regarded as a single spare part.
- If there is a failure, the entire module (1) is replaced.
- In order to keep costs down, exchange modules are offered.

Replacement :



3-4-1-1

- The four fastening screws (2) for the power supply unit are removed.
- The plug (3) is removed.

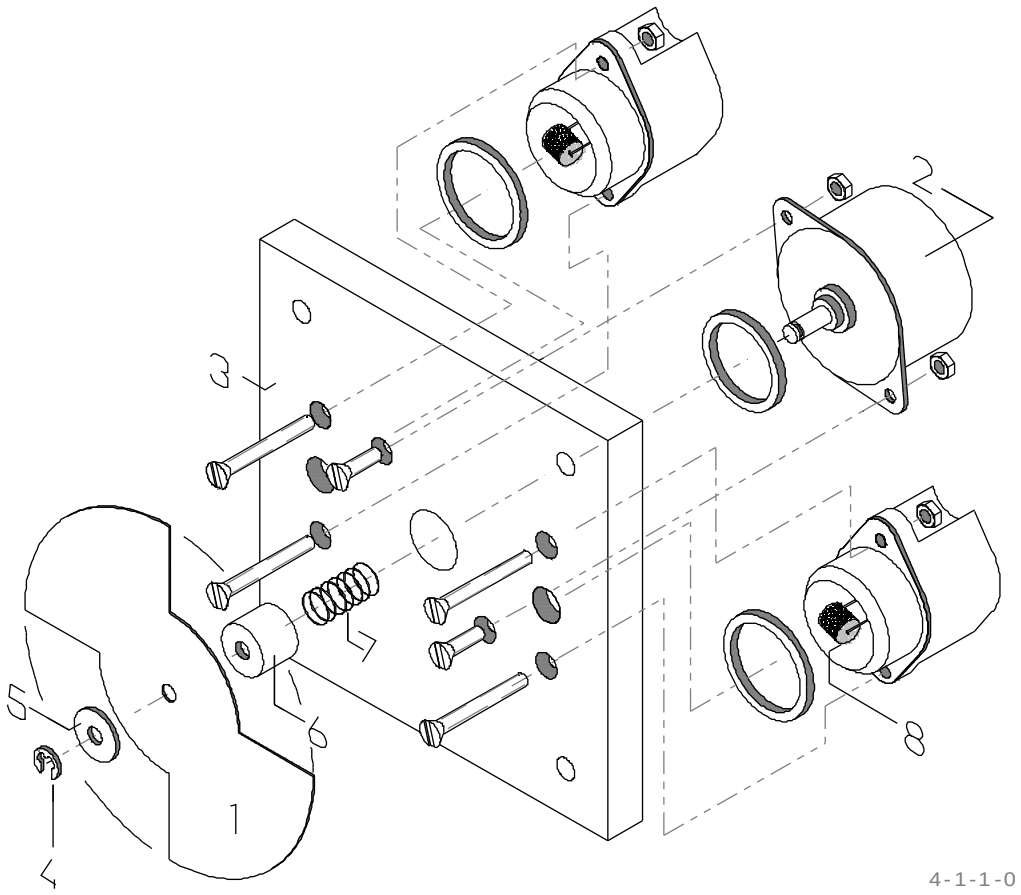


3-06-1-2 S

- The power supply unit (1) is turned.
- The wires (4) are separated from the power filter (5) (unsoldered).
- The new power supply unit (1) is installed in the reverse order.
- It is suggested that adjustments are made according to **2. 4**.

3.5 Chopper

see 3. 1

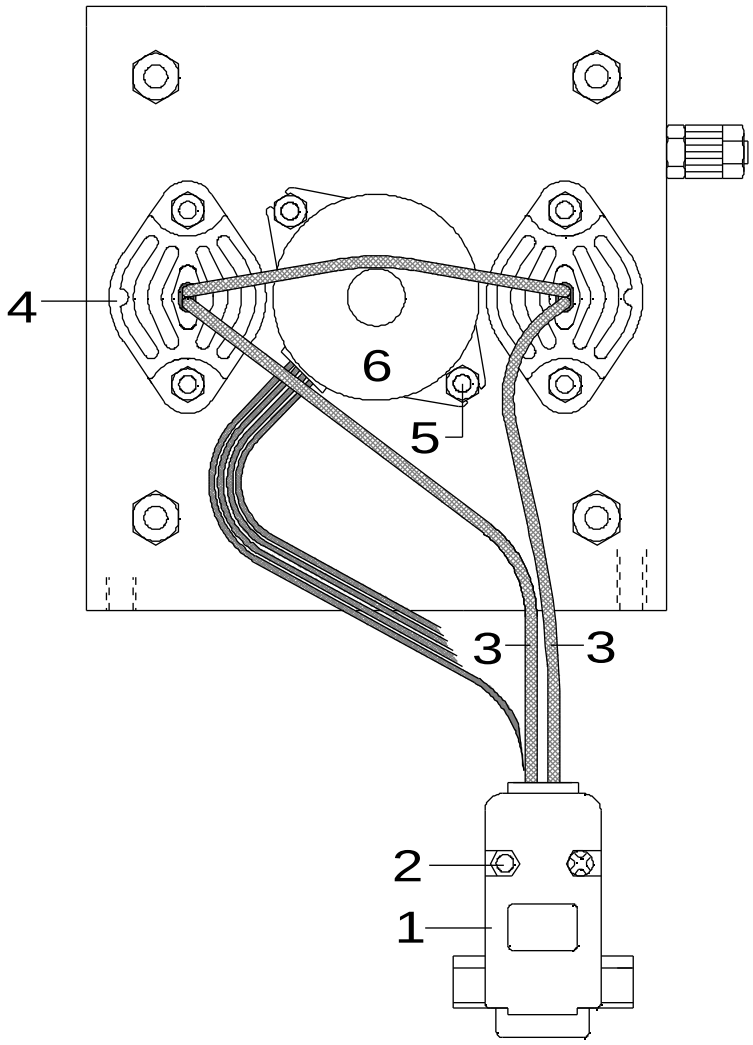


The chopper blade (1) is fastened to the motor.
In order to dismount the motor from the mounting plate (3),
the chopper blade must first be removed.

- The safety ring (4) is removed.
- One after the other, the washer (5) (there could be two), the chopper blade (1), the cylinder (6), and the spring (7) are removed

- Reassemble in reverse order.

CAUTION !
Before re-assembling check the position of the IR source (8) and, if necessary, center its position (see 3. 2). The heating wire is not very elastic, therefore do not move it back and forth, you rather should correctly position it the first time.



4 - 1 - 1

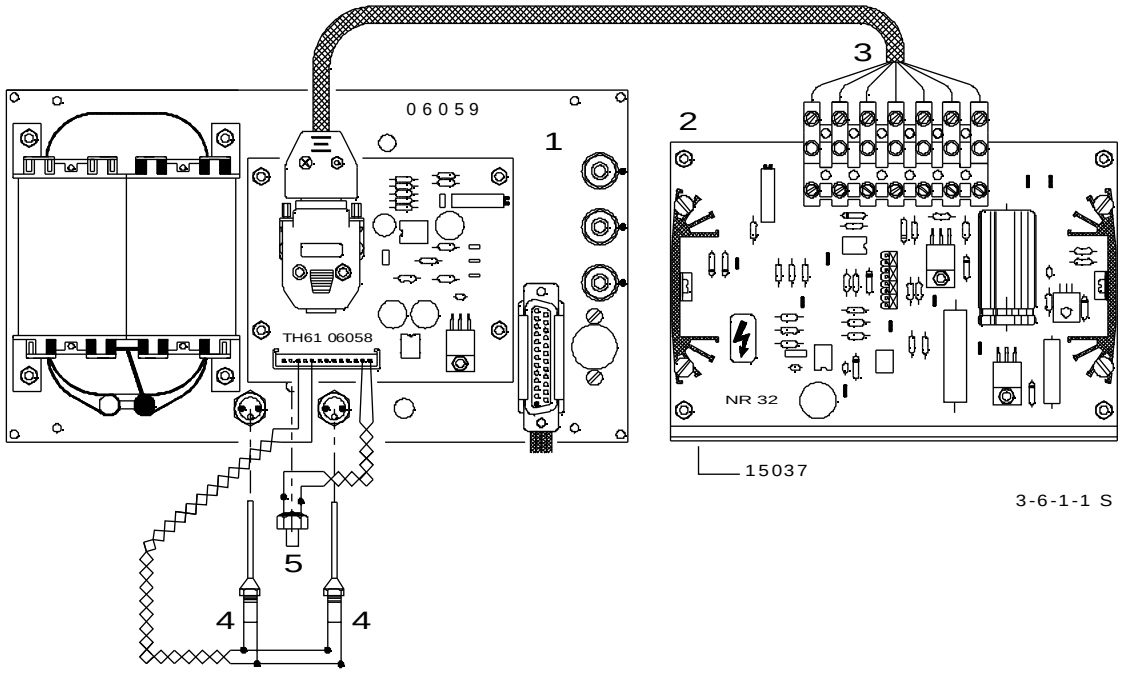
- The plug (1) is disassembled by unscrewing the screws (2).
- The cable (3) of the IR sources (4) are then unsoldered from plug (1).
- The bolts (5) are unscrewed.
- The new motor (6) is bolted on.
- The IR source cables (3) are then soldered to the plug (1).

CAUTION !

Due to the high current for the IR sources, the solder joints must be very well made. Inside the plug (1) two pins are soldered together to form one connecting point. Two such connecting points are present in the plug (1). Each of the two cables (3) are soldered to each connecting point. Polarity is irrelevant.

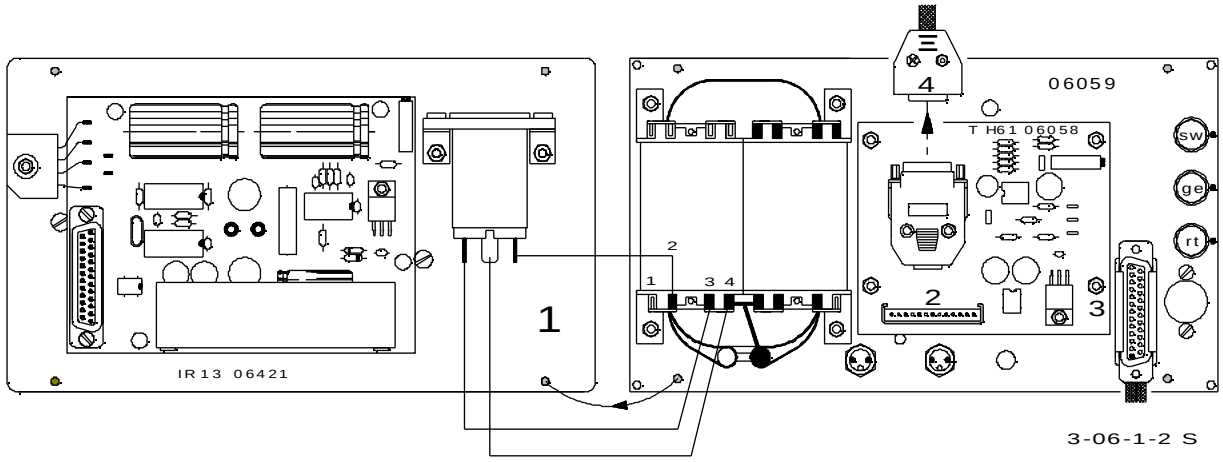
- Afterwards, the chopper blade is refastened, see 3. 5.
- This is reassembled in the reverse order.
- After installing, the infrared cell should be adjusted, see 2. 3

3.6 Infrared cell temperature regulation



- The temperature regulation of the infrared cell is made up of the circuit boards TH 61 (1) and NR32 (2), the connecting wire (3), the temperature sensor (5), and the heaters (4).

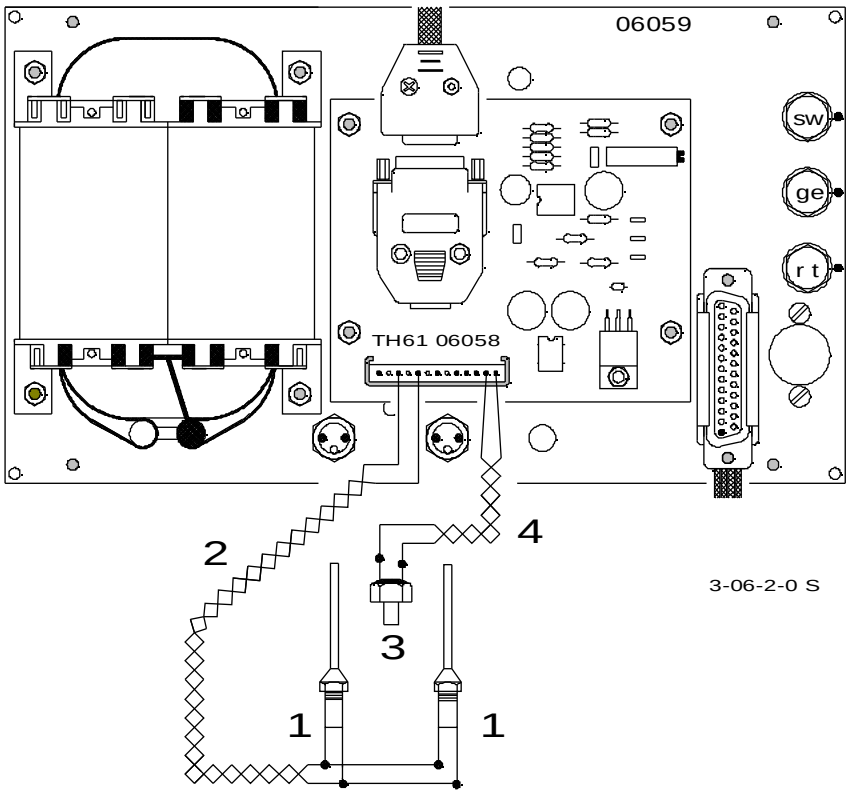
Replacing the TH 61:



- The plug (4) should already have been removed during the removal of the infrared cell from the analyser.
- Unscrew and remove the power supply module (1), see **3. 4**
- Disconnect the plug (2).
- Remove the four nuts (3).
- Re-assemble in reverse order.
- Make adjusts to the unit according to **2. 5**.

Replacing the heaters

- Unsolder the cable (2).
- Cut the silicon gel away from the heaters (1).
- Pull out the heaters (1).
- Insert new heaters and smear with thermal conducting paste
  (in case there is none available, silicon grease can be used).
- Solder the cables on.
- Secure the heaters against falling out with silicon gel.



Replacing the temperature sensor

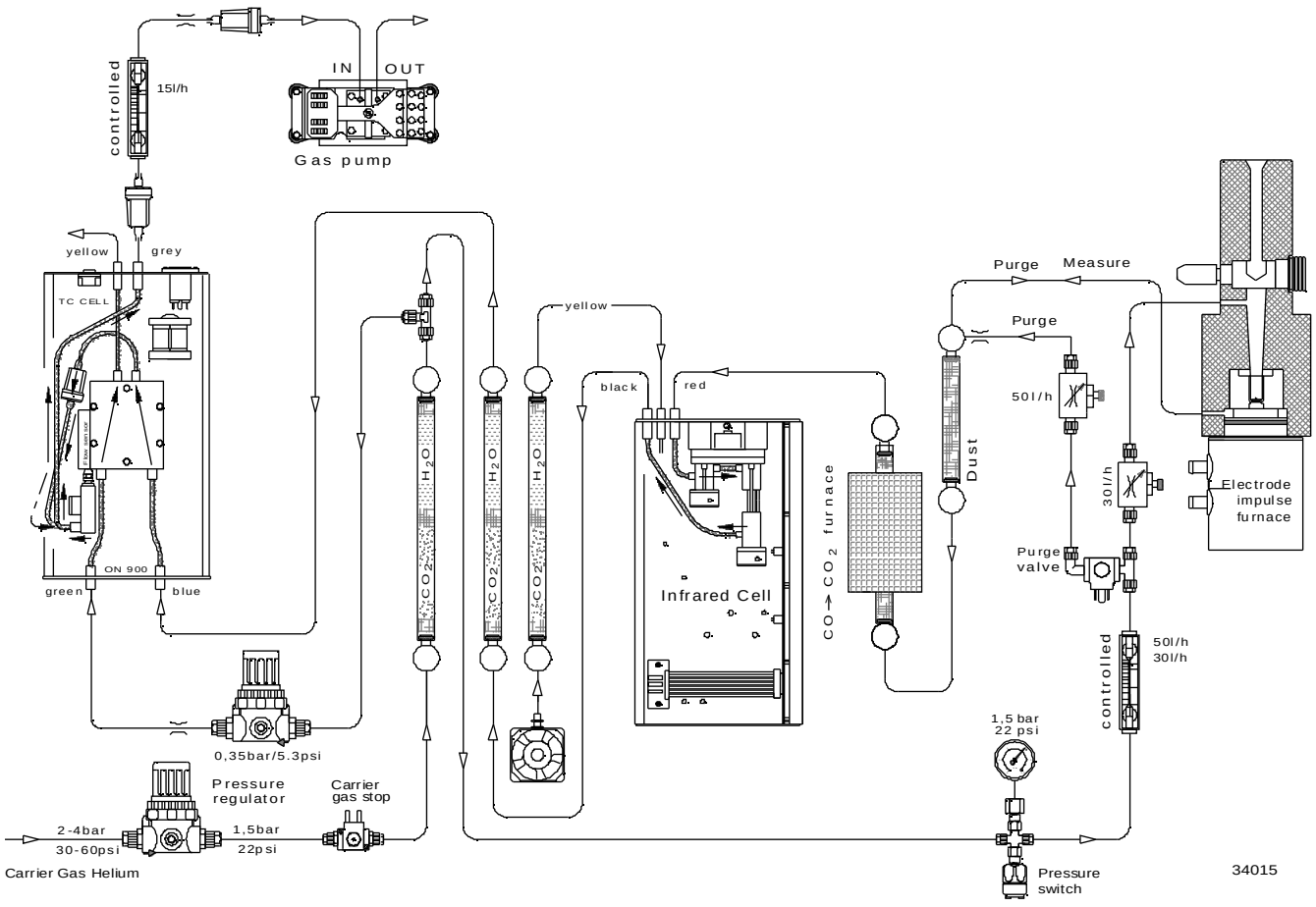
- Unsolder the cables (4).
- Cut away the silicon gel from the temperature sensor (3).
- Screw in the new temperature probes.
- Solder the cables (4) on.

CAUTION !
The threads are of aluminium. Therefore, screw in the probes very lightly.

- After replacing the temperature sensor, adjust according to 2. 5.

3.7 Checking for leaks

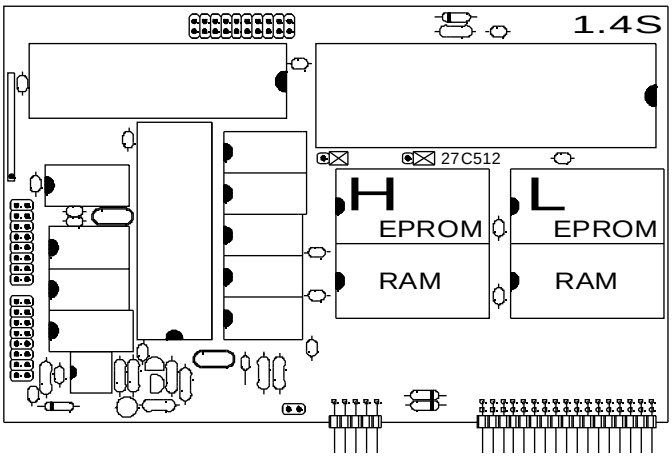
- Turn the main switch to position 0 or 1
- Disconnect the tube of the furnace outlet.
- Connect a vacuum meter to the free end of the tube.
- Disconnect the tube of the pump inlet.
- Suck 300 mbar on this tube and seal it.
  The pressure gauge should be stable for at least 30 sec.
- If the system is leaking, repeat above test by squeezing each single tube along the gas system, until the leakage area is located. (see drawing below)



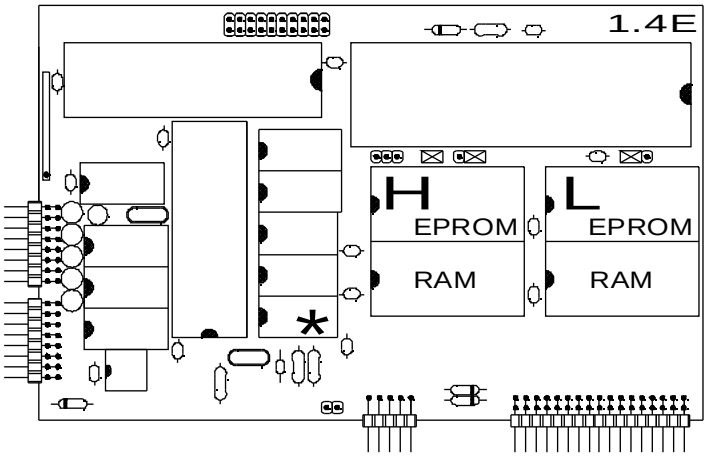
3.8 Replacing the EPROMs

- Set the power switch to pos. 1.
- Open the furnace.
- Pull out all plugs from the electronic unit
- Open the left side of the analyser.
- Unscrew the electronic unit.
- Pull out the electronic unit.
- Take out carefully, with the aid of a screwdriver (using it as a lever), the two EPROMS from the CPU board (see figure).
  Insert the new EPROMs according to the H and L identification (see figure) and be sure the positioning is correct by comparing the marks.
- Clear the memory, see **3. 9**.

Important: When installing 27C512 EPROMS, check that the jumpers are connected as shown in the drawings.
If the instrument has an older card, follow the first drawing; otherwise follow the second drawing.

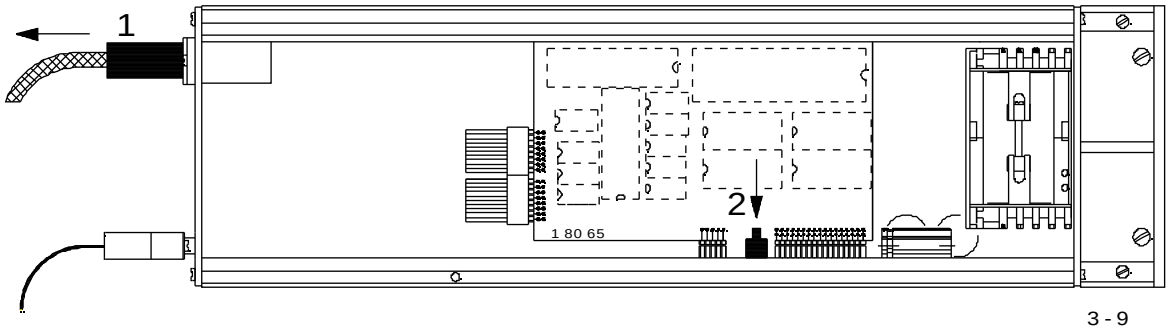


18060



18065

3.9 Clearing the memory



- Set the power switch to setting 1
- Open the furnace
- Detach the left hand cover of the analyser
- Detach the power plug (1) from the electronic unit
- Press the reset key (2) on the base plate of the electronic unit for at least 30 seconds
- Restore the unit to its original condition
- Recalibrate.

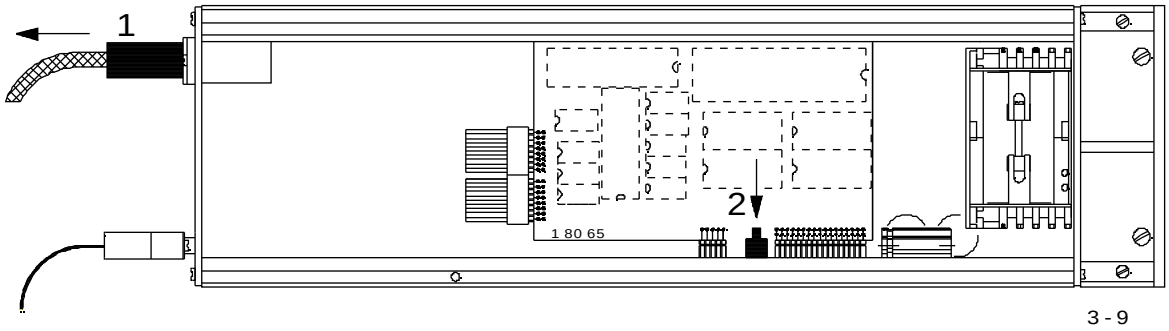
3.10 Electronics reset

Should problems with the electronics come up:

- Press STOP

If the problem remains:

- Turn the power switch to pos. 1
- Open the furnace
- Disconnect the cable (1) from the electronic unit for 10 seconds and plug back in.



Should the problem remain :

see 3. 9 " Clearing the memory "

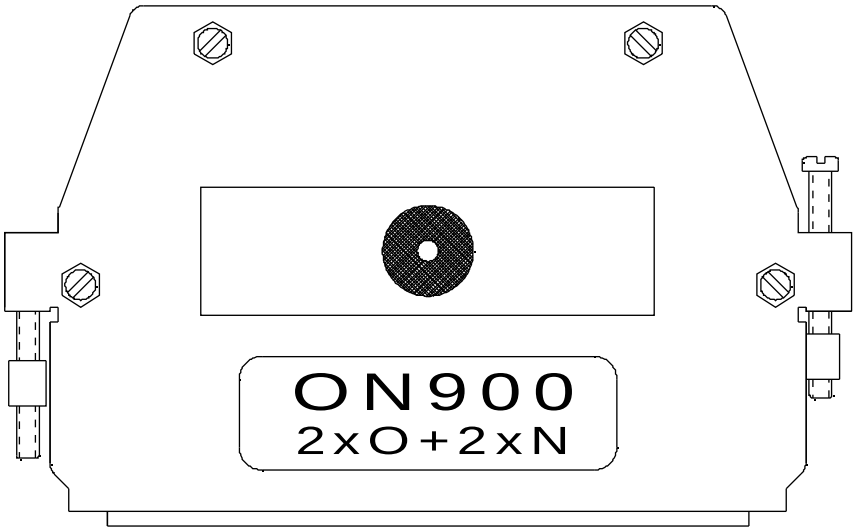
3.11 Coding of the channels

ON-900

The coding is done inside a 96-pin VG connector. The pins 27 through 32 are used for this purpose.

For every channel combination, the pins at row A and row C are interconnected as follows:

Labels on the connector, according to the instrument type.



3-11

Instrument version:	**Connections a with c inside the connector:**	**Code No. (shown on display during initialization)**
1 x O	32,nc,30,29,28,nc	22
2 x N	32,31,nc,nc,28,nc	26
1 x O + 2 x N	32,nc,nc,nc,28,nc	2C
2 x O	nc,nc,30,29,28,nc	23
2 x O + 2 x N	nc,nc,nc,nc,28,nc	2F

Caution :

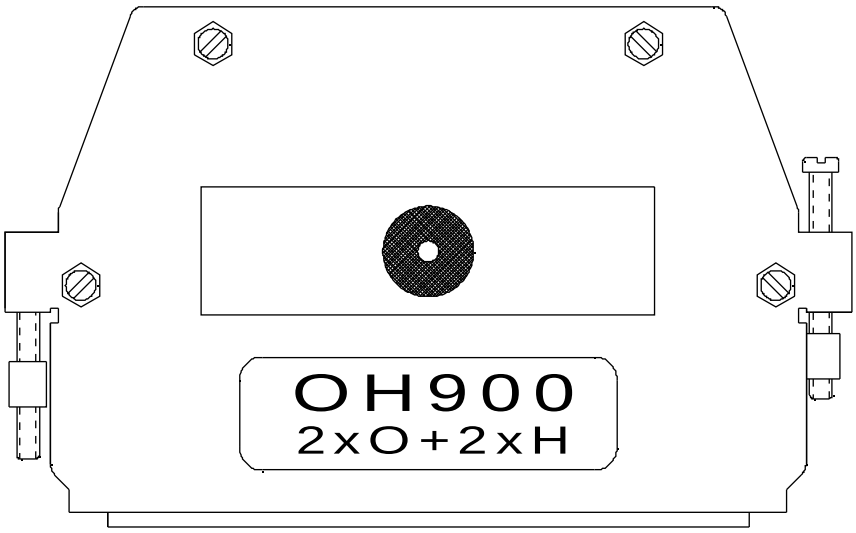
The electronics unit takes notice of the new coding once the power is switched on.

OH-900

The coding is done inside a 96-pin VG connector. The pins 27 through 32 are used for this purpose.

For every channel combination, the pins at row A and row C are interconnected as follows:

Labels on the connector, according to the instrument type.



3-11

Instrument version:	**Connections a with c inside the connector:**	**Code No. (shown on display during initialization)**
1 x O	32,nc,30,29,28,nc	22
2 x H	32,31,nc,nc,28,nc	26
1 x O + 2 x H	32,nc,nc,nc,28,nc	2C
2 x O	nc,nc,30,29,28,nc	23
2 x O + 2 x H	nc,nc,nc,nc,28,nc	2F

Connect also 5c with 28a for all above versions (otherwise the ON versions will appear).

Caution :

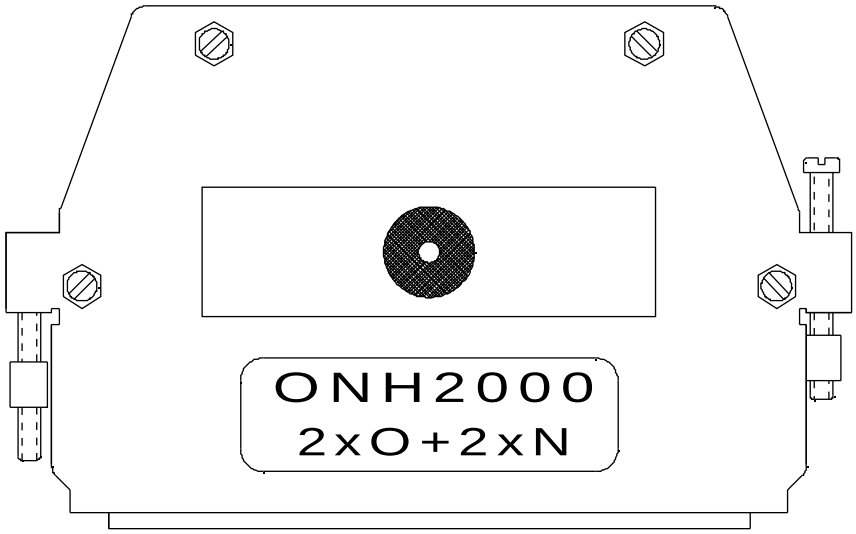
The electronics unit takes notice of the new coding once the power is switched on.

ONH-2000

The coding is done inside a 96-pin VG connector. The pins 27 through 32 are used for this purpose.

For every channel combination, the pins at row A and row C are interconnected as follows:

Labels on the connector, according to the instrument type.



3-11

Instrument version:	**Connections a with c inside the connector:**	**Code No. (shown on display during initialization)**
1 x O	32,nc,30,29,28,nc	22
2 x N, 2 x H	32,31,nc,nc,28,nc	26
1 x O + 2 x N; 1 x O + 2 x H	32,nc,nc,nc,28,nc	2C
2 x O	nc,nc,30,29,28,nc	23
2 x O + 2 x N; 2 x O + 2 x H	nc,nc,nc,nc,28,nc	2F

Remark:
In case of 2 x H, 1 x O + 2 x H and 2 x O + 2 x H the ON / OH switch of the front panel connects additionally 5c with 28a (change from N to H).

Caution :

The electronics unit takes notice of the new coding once the power is switched on.

3.12 Adding on new channels

It is quite easy to add one or two oxygen channels to the instrument. The IR-cell has to be build in or modified:

- IR-source
- IR-path
- Detector
- Preamplifier
- Board IR21 with 2 channels
- Chopper

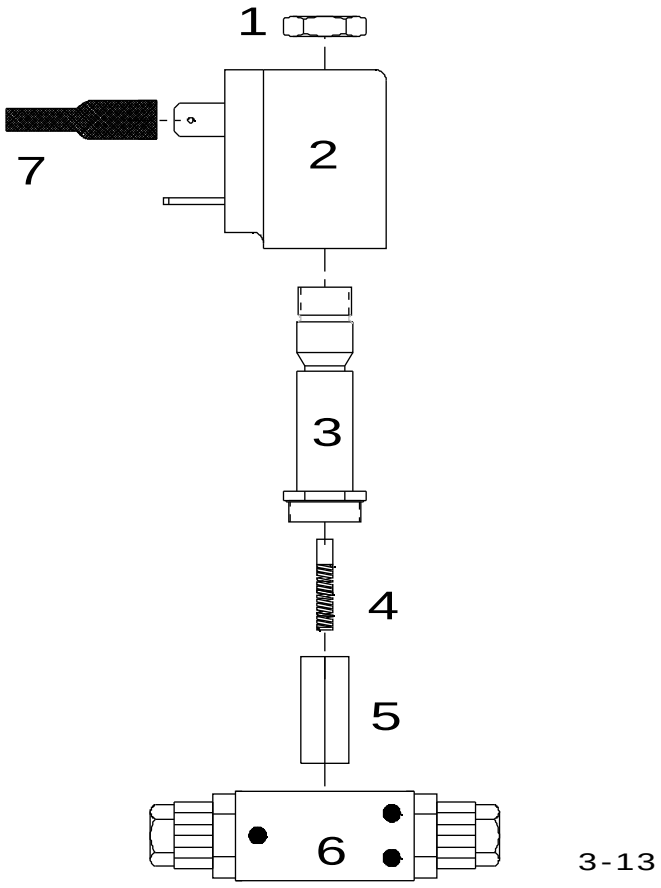
With a new IR-cell, the chopper purge system must be installed.

It is very complicated to add a TC cell for nitrogen channels to an oxygen instrument. The carrier gas changes, a purge and reference flow must be installed. The electronics and wiring must be modified.
This work should be done in the factory. Otherwise ask for more information.

The following components may be needed, when adding more IR cells:

05257: Chopper housing, with one IR source and motor
05254: Chopper housing, with two IR sources and motor
05066: IR path: oxygen high
05067: IR path: oxygen low
06005: Printed circuit board IR 21
06032: Infrared receiver with CO_2 filter

3.13 Cleaning the solenoid valves



Only with the 2/2 valve

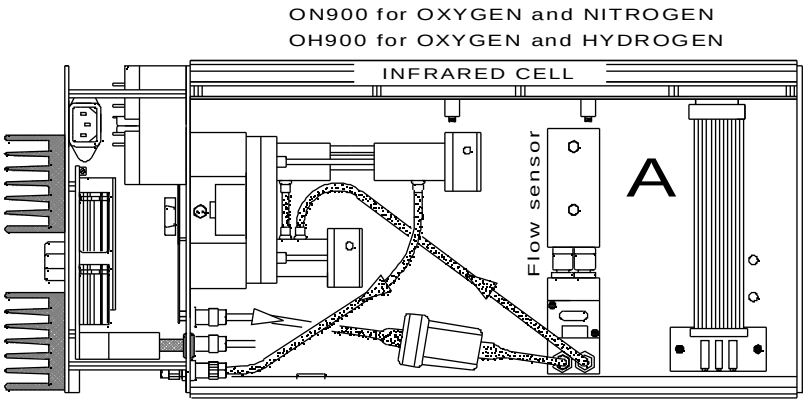
- Turn the power switch to pos. 1, or best (safest) to pos. 0,
- You can unplug the power plug as well
- Remove the connector (7)
- Unscrew the nut (1)
- Remove the coil (2) (only with the 2/2 valve)
- Unscrew (counter-clockwise) the hexagon screw on the armature housing.
- Remove the armature (5) (only with the 2/2 valve)
  Careful ! Do not lose the spring (4)
- With oxygen pressure or compressed air, clean the inside of the armature housing (3), as well as the armature (5) and re-assemble the solenoid valve.
  With the furnace closed and renewed oxygen pressure, check to ensure that the solenoid valve is sealed, see **3. 7**.

3.14 Replacing the flow sensor

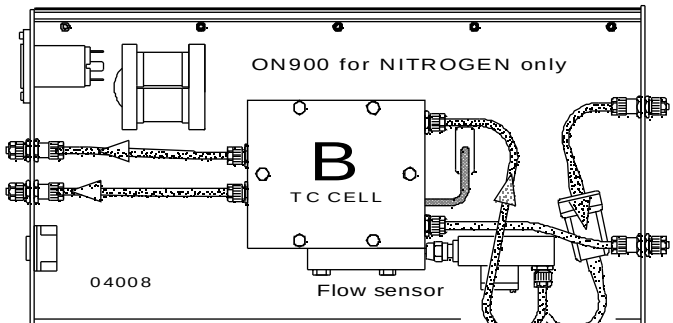
Locating the flow sensor:

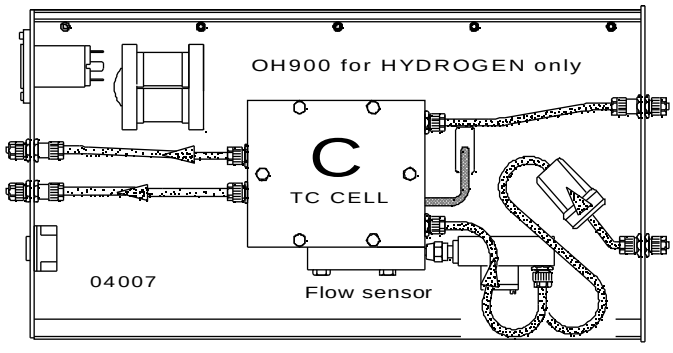
Valid for Serial Numbers from 0450xxxxxx up to 0724xxxxxx

Flow sensor situated inside the infrared cell



Flow sensor situated inside the TC cell

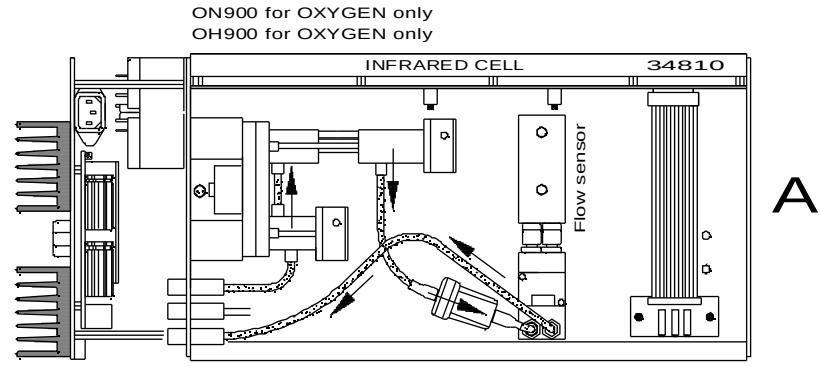




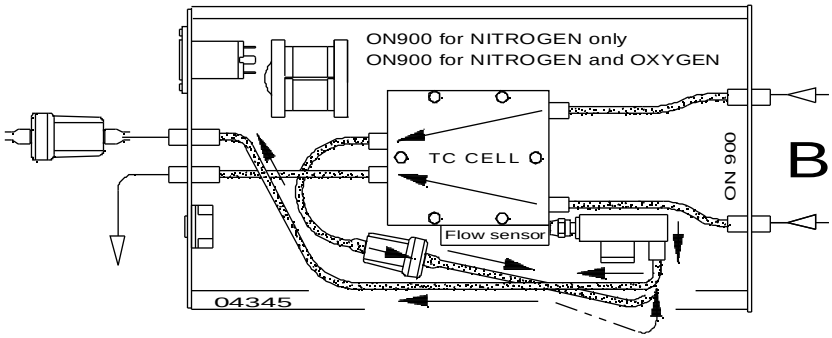
03-14

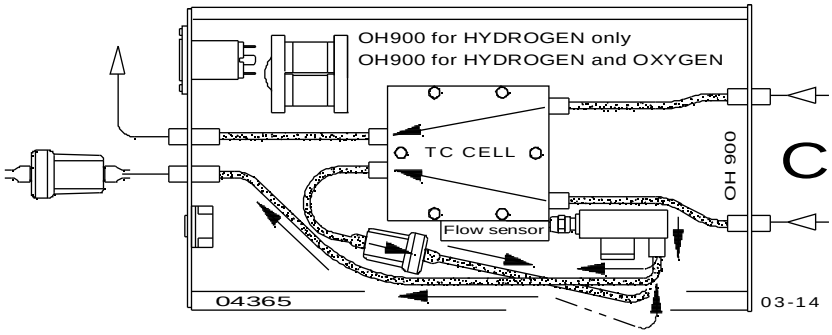
Valid for Serial Numbers higher than 0725xxxxxx

Instruments for **oxygen only** have the flow sensor **inside the infrared cell**



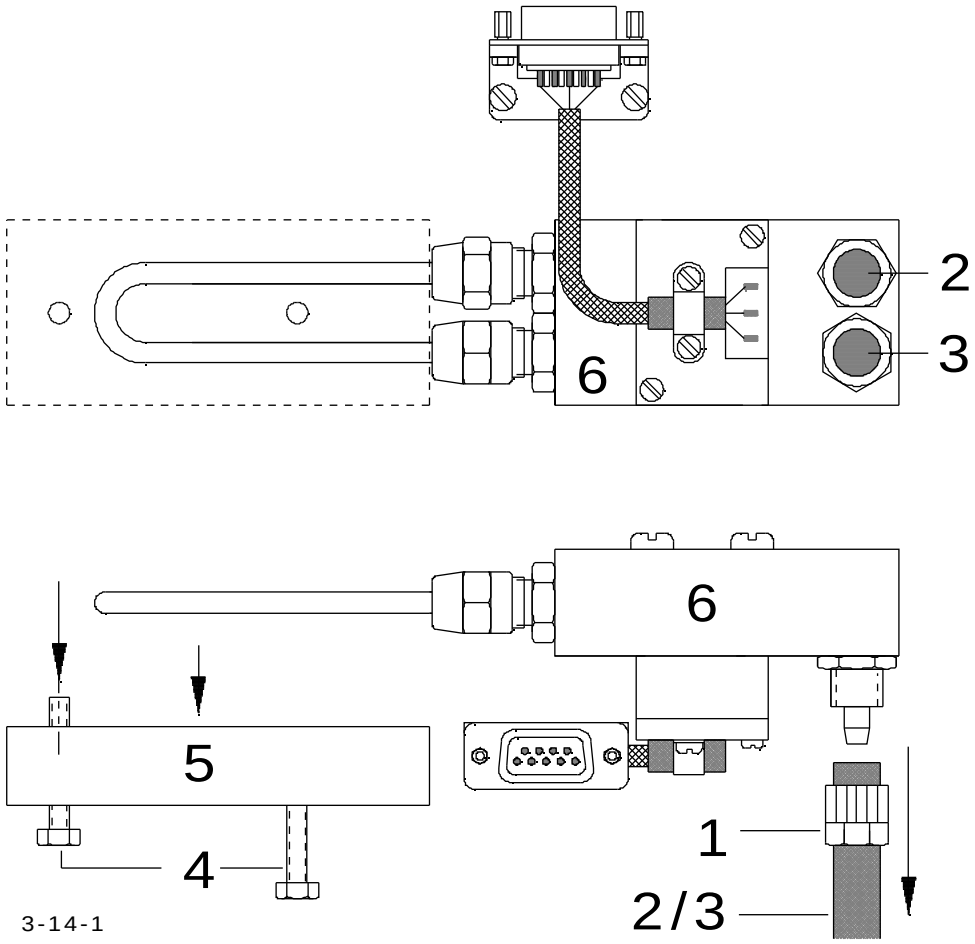
All the other instruments have the flow sensor **inside the TC cell**





Depending on the type of the instrument, the flow sensor may be found either inside the infrared rack, or inside the temperature conductivity rack (see above drawings).

Replacing the flow sensor:

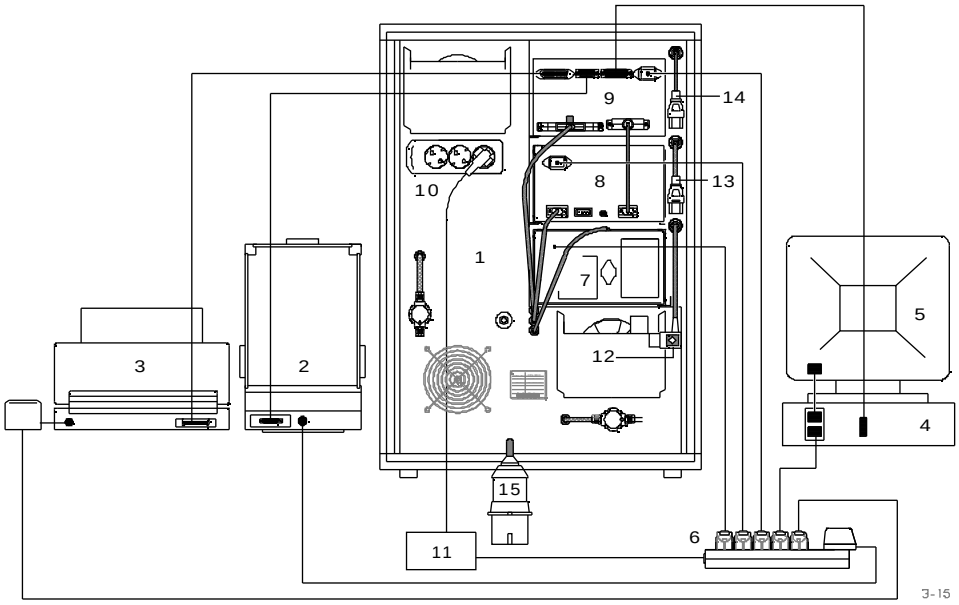


- Remove tubes (2) and (3) from the flow sensor (6), by loosening screws (1).
- Disconnect the 9 pin plug
- Remove the screws (4), remove the block (5); now the flow sensor (6) is loose.
- Replace the flow sensor (6), re-install in reverse order.

- Finally adjust the flow rate (see **2. 1**).

3.15 Installing an AC power stabilizer

When the power sinks below 180V AC (also when only a short interruption), a stabilizer is recommended.
The analyser can draw during combustion up to 20A, in some cases up to 30A.
The maximum current depends on the furnace current you have chosen.
It is not necessary to stabilize the controlled furnace current.



1 Analyser
2 Balance
3 Printer
4 Computer
5 Monitor
6 Power strip
7 IR-cell
8 TC-cell
9 Electronics unit
10 Triple plug
11 Voltage stabilizer
12 Original IR power cable
13 Original TC power cable
14 Original electronic power cable
15 Mains power link

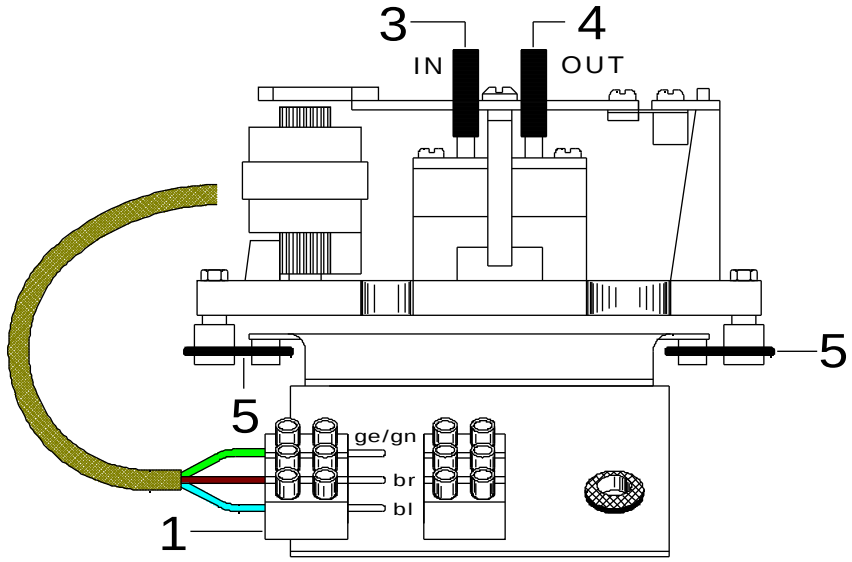
It is sufficient if the electronics unit (9) the infrared cell (7) and TC cell (8) is protected by the stabilizer (11). This is simple to do, as units (7 / 8 / 9) use standard plugs.
It is then advisable to protect the balance (2), the printer (3) and the computer (4) with a stabilizer (11).

- The stabilizer (11) is plugged into the triple plug (10) (rear of the analyzer).
- The electronics unit (9), the infrared cell (7) and the TC cell (8) are plugged into a power strip (6), using a normal power cable (the device cable).
- The original power plugs (12 / 13 / 14) of the units (7 / 8 / 9) are simply unplugged and left hanging.

In cases when the voltage of the power line is always too low and may, even temporarily, be lower than 200 VAC, a simple transformer can be used instead of a stabilizer.
The power of the transformer should be at least 100 VA. The primary voltage should be 220V to 240V. The secondary voltage should be about 20V higher than the primary voltage. For example Pr 220V / sec 240V or Pr 230V / sec 250V.

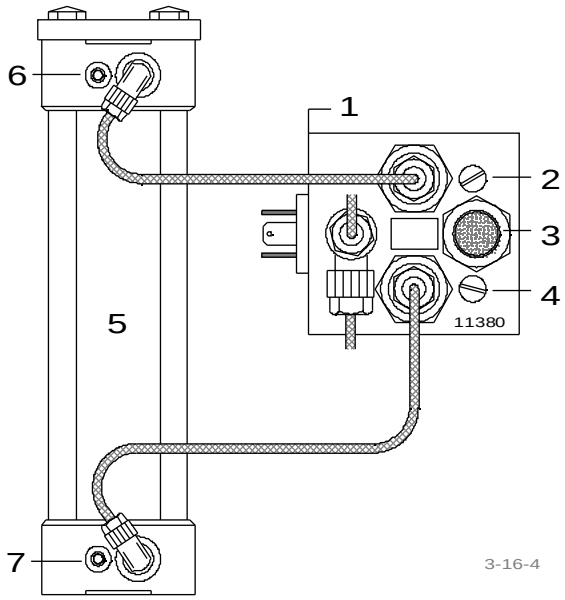
3.16 Replacing the gas pump

- Switch off the instrument and pull the main power plug
- Disconnect the plug **(1)** of the pump
- Disconnect the tubes **(3)** and **(4)** from the pump
- Remove the four plastic rings **(5)**, remove the pump
- Reinstall pump in reverse order

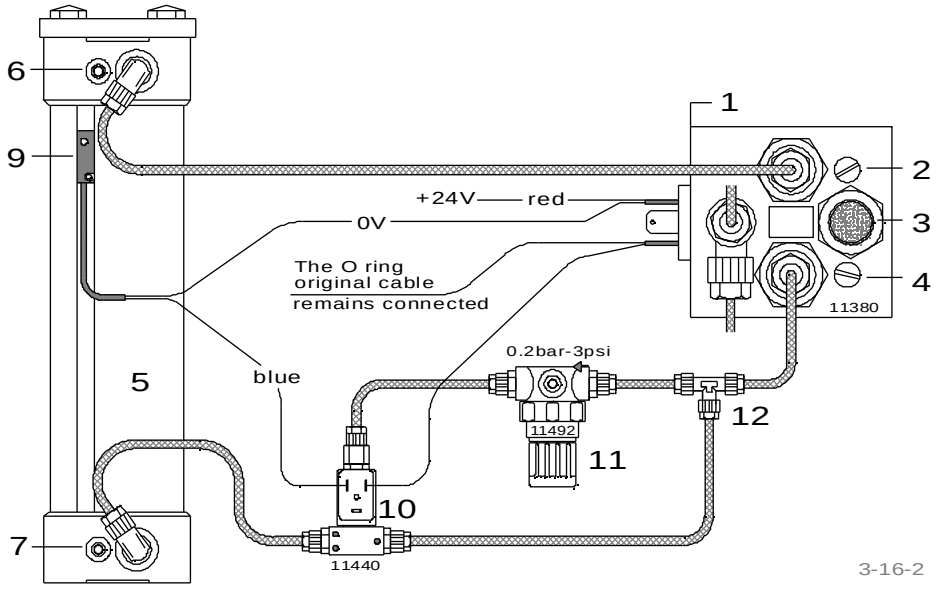


3.17 Additional safety features for furnace pneumatics (optional)

This is the standard pneumatics for the furnace piston drive.

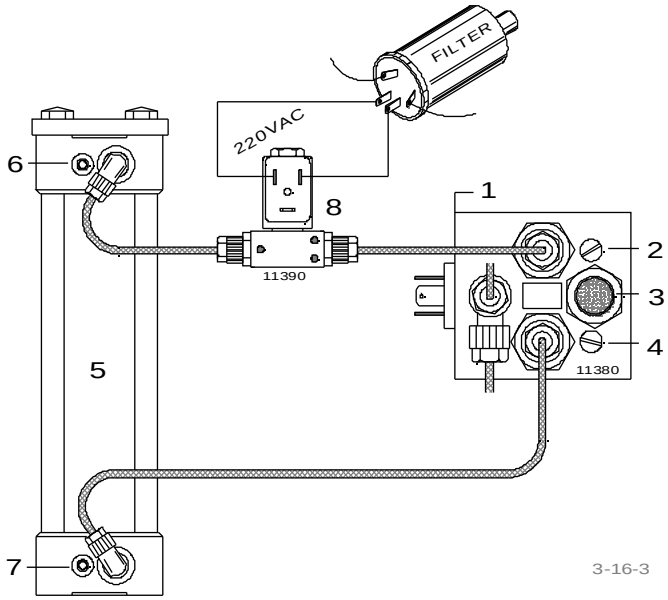


A more controlled upward movement of the furnace piston is obtained this way:

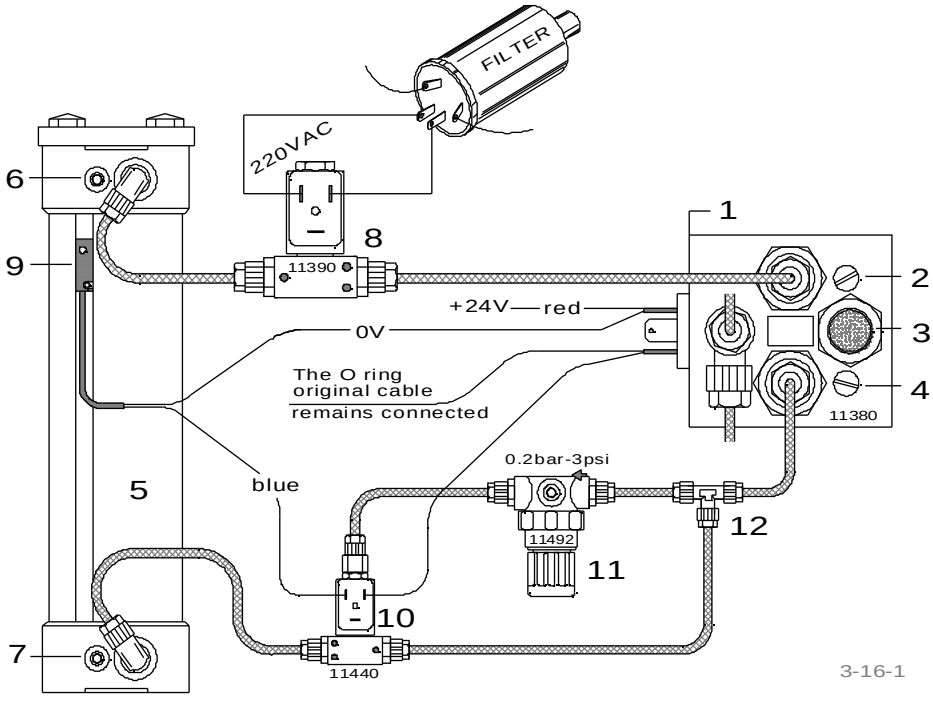


When upgrading the standard pneumatics with the magnetic switch (9), the solenoid valve (10), and the pressure regulator (11), the furnace piston will go up with a very low pressure (no danger), and finally it will close at full pressure.

Requirement: the furnace has not to be moved in case of a power failure.



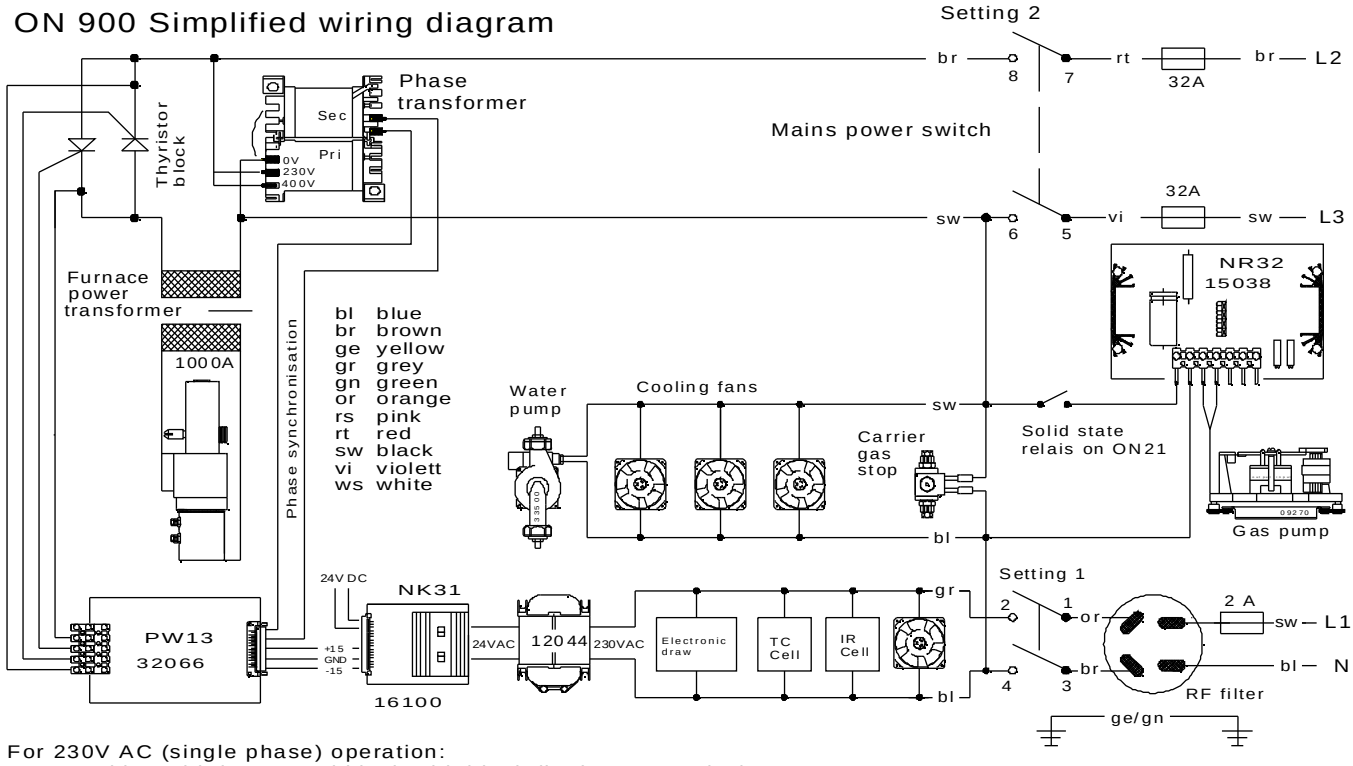
By adding a solenoid valve (8) and connecting the coil directly to 220 V AC, the piston won´t change position in case of a power failure. If the piston was down, it will remain down; if it was up, it will remain up in case of a power failure.



Both safety features can be combined, by means of the above upgrade circuit

3.18 230V / 400 V operation

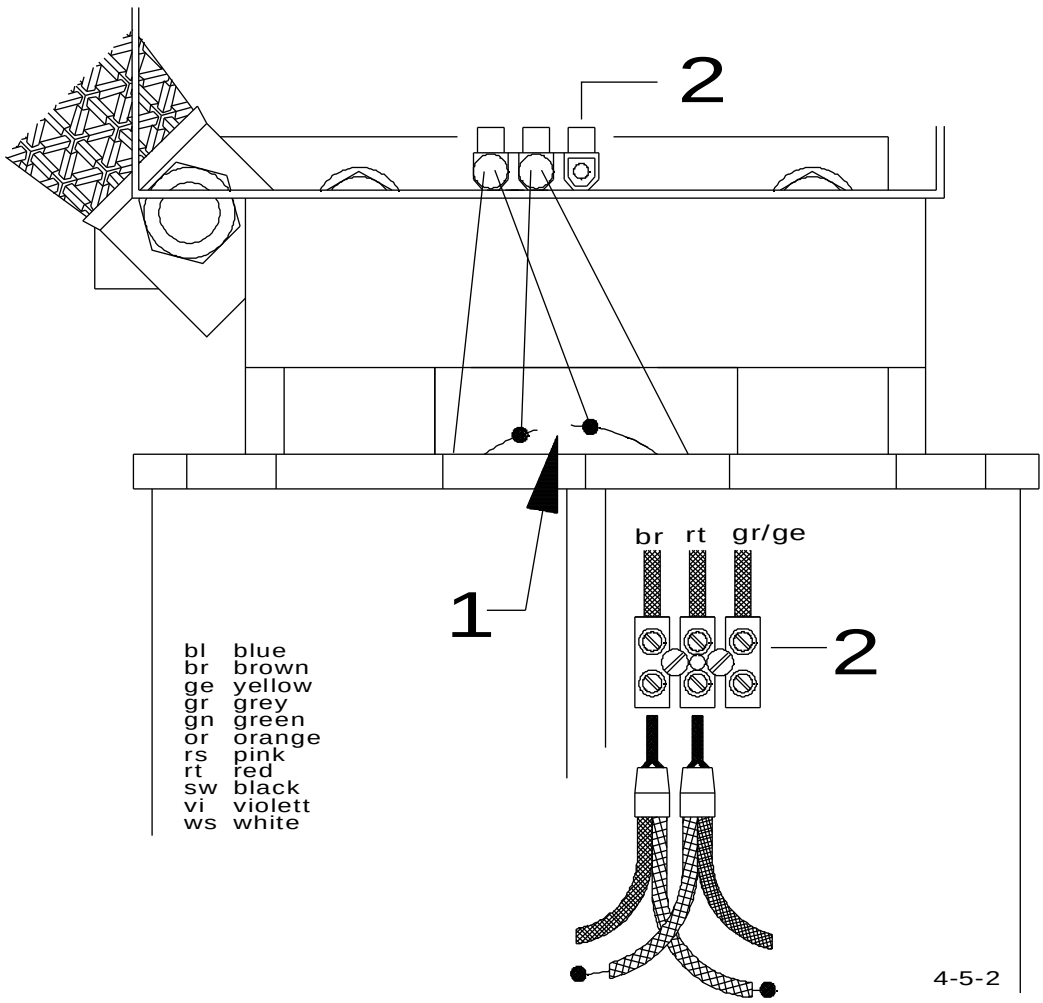
The analyser is usually operated on 3 phases and neutral.



The transformer for the furnace is powered by two of the three phases (400 V).
The third phase and neutral are used to supply the rest of the analyser with 230V,
(electronic unit, detectors, fans etc.).
However, if there is only one phase available, then the analyser can be changed for single phase operation.
If necessary, this conversion can be done at the customer´s site.

Converting the analyser to single phase (230 V) supply:

- Disconnect the mains plug and open it up
- Connect both black cables together to the 230V phase
- Join the brown and the blue cable and connect them to the neutral
- The yellow / green cable is of course connected to earth
- Rearrange the connection of the power transformer, according to the following instructions:



The transformer has two primary windings.
For 400V operation, the two windings are connected in series.
For 230V operation, the two windings must be connected in parallel the following way:

- Cut the common wire (1) between the two primary coils
- Join the two resulting ends to the connector (2), according to the above drawing; in order to obtain a parallel connection of the two transformer coils.

3.19 Upgrading of analysers with electronic rack for using the new Windows software:

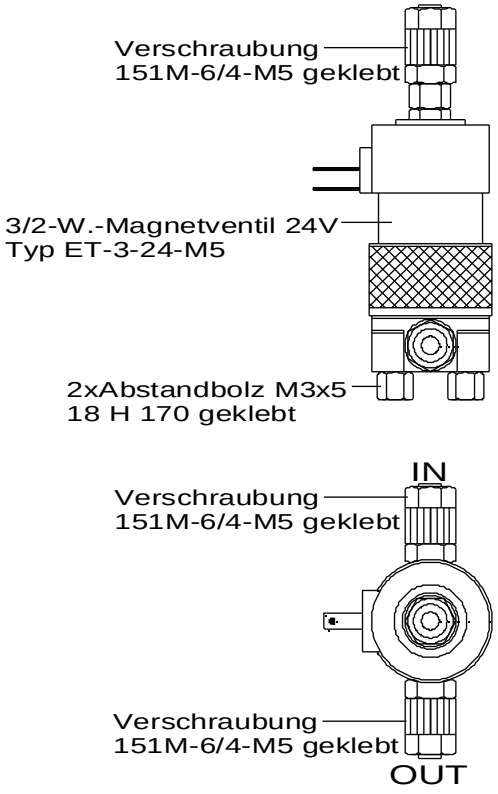
Late analysers equipped with the new flow sensor (pressure transducer) can easily be upgraded as follows:
' Remove the electronic rack.
' Install the new hardware at the same place.
' Connect the adapters and the new cables for PC and balance.
' Install the front frame and the rear frame.

Upgrading of older analysers equipped with the previous flow sensor (rotameter in the IR-cell) is theoretically possible but practically difficult. The new software is made for the latest versions of analysers with the electronic flow sensor and with two oxygen inlets furnaces. Therefore, older analysers can not run with the new software, unless the analyser is first modified to correspond to the later version. This means replacement of the wiring, new HF board, new upper furnace part with two oxygen inlets and modifications of the tubing and new flow sensor in the IR-cell.

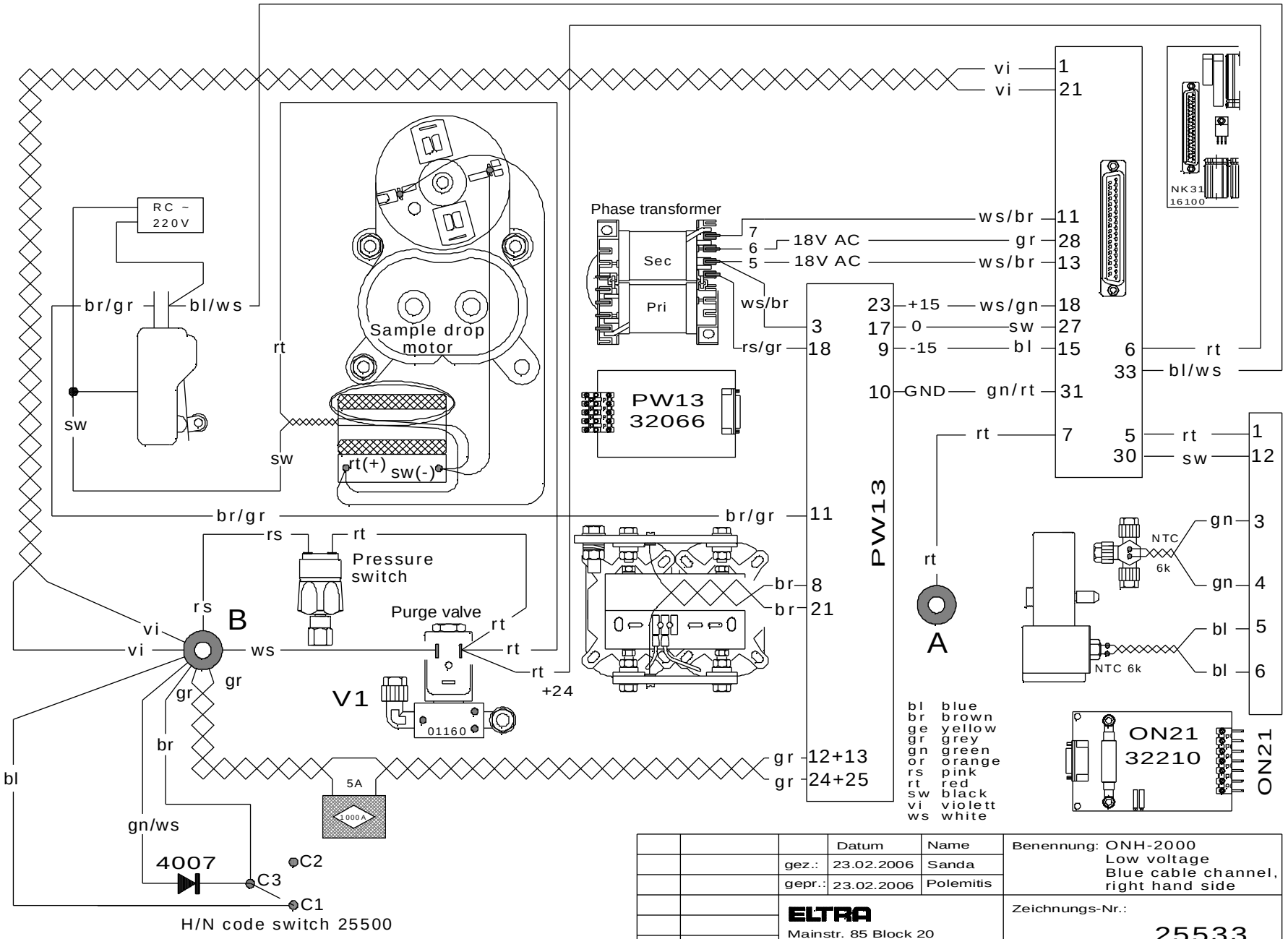
3.20 Replacing V7 and V8 by stainless solenoid valves:

Caution:
The old **V7/V8** are operated with **220V AC** while the new stainless **V7/V8** have to be energized with **24V DC**. This requires modifications as discribed below.

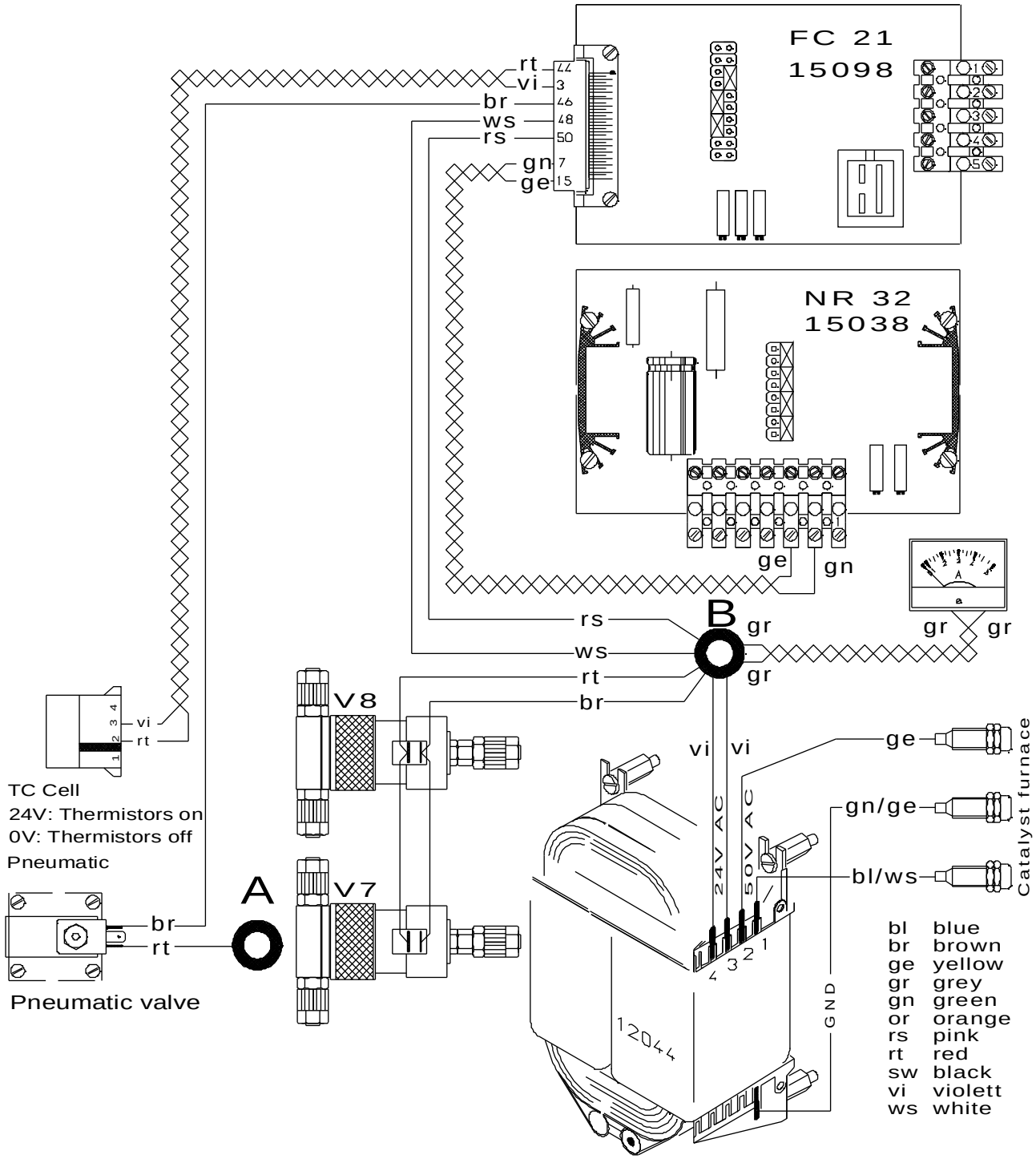
' Cut and remove the two short, red and blue wires connecting the old **V7** and **V8** with each other.
' Disconnect from the valves (from **V8**) the two long red wires and connect them with each other. They connect now only **V5** + **V6** with the ON/OH switch (lead 3)
' Disconnect and completely remove the blue cable connecting the old valves with the power distributor.
'Remove the old **V7/V8** and replace them by new stainless **V7/V8** according the schematic **25024**. Take care of the lables **IN** and **OUT** on the valves to comply with the drawing **25024**. Connect them according the drawings **25545** and **25533**.
According to these drawings the two new valves **V7/V8** have to be connected with a red cable to **+24V** (at the pressure switch lead). The other leads of the **V7/V8** coils are connected to the lead **C3** of the **ON/OH** switch with a blue cable. One diode **1N4007** has to be installed in between **C3** of the **ON/OH** switch and the green/white cable that was originally directly connected to **C3**.
' Connect all plastic tubes the same way as they were connected on the old valves. See also the drawings **11-7** till **11-12**, chapter **4.2**.



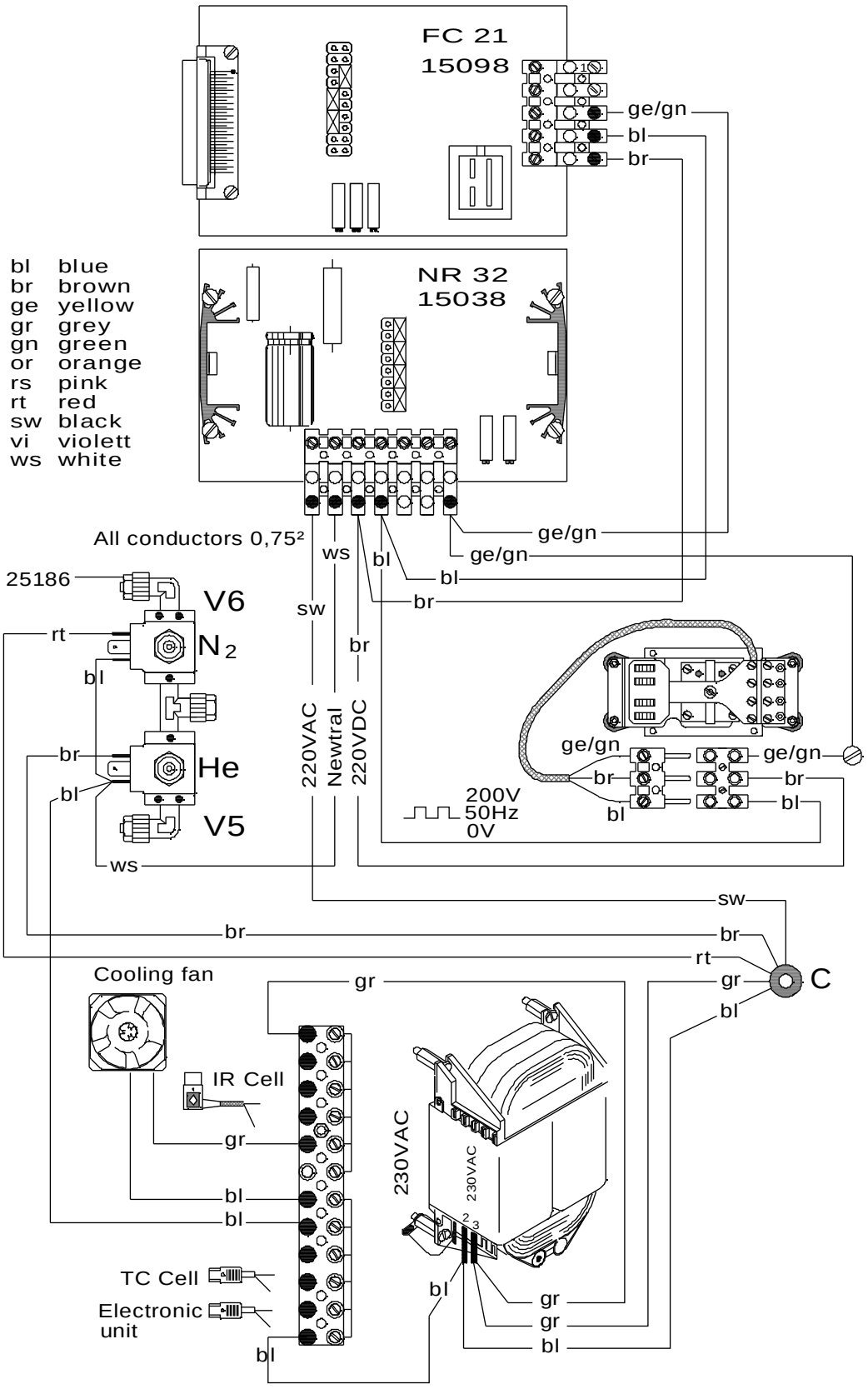
			Datum	Name	Benennung:
		gez.:	23.02.2006	Sanda	V7; V8 - ONH2000
		gepr.:	23.02.2006	Polemitis	
		ELTRA			Zeichnungs-Nr.:
		Mainstr. 85 Block 20			25195
Bez.:	geändert am:	D-41469 Neuss			



			Datum	Name	Benennung: ONH-2000 Low voltage Blue cable channel, right hand side
		gez.:	23.02.2006	Sanda	
		gepr.:	23.02.2006	Polemitis	
		ELTRA Mainstr. 85 Block 20 D-41469 Neuss			Zeichnungs-Nr.: 25533
Bez.:	geändert am:				



			Datum	Name	Benennung:
		gez.	22.02.2006	Sanda	ONH-2000 Low voltage wiring, blue cable channel, left hand side
		gepr.	22.02.2006	Polemitis	
		ELTRA Mainstr. 85 Block 20 D-41469 Neuss			Zeichnungs-Nr.: 25545
Bez.:	geändert am:				



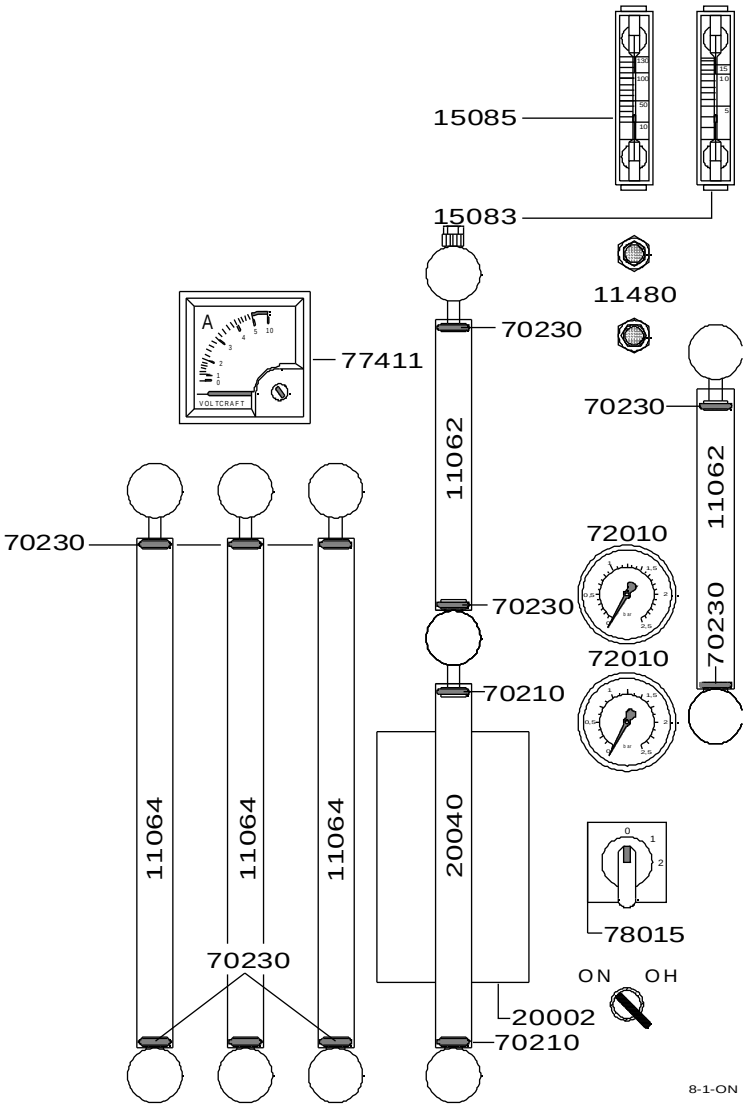
			Datum	Name	Benennung: ONH 2000
		gez.:	23.02.2006	Sanda	Mains power wiring,
		gepr.:	23.02.2006	Polemitis	black cable channel,left hand side
		ELTRA			Zeichnungs-Nr.:
		Mainstr. 85 Block 20			25562
Bez.:	geändert am:	D-41469 Neuss			

4 Miscellaneous

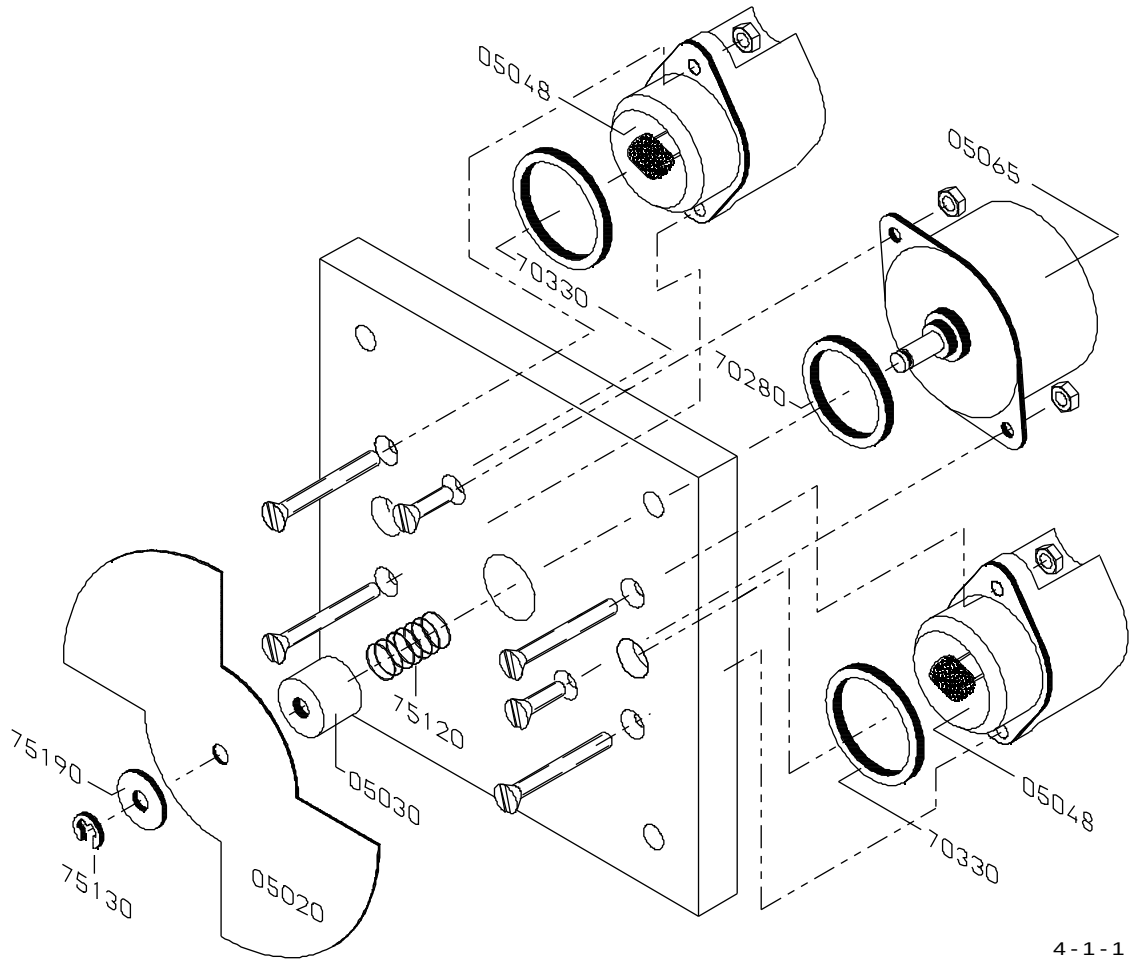
4.1 Ordering numbers

Front panel:

11062	Reagent tube
11064	Reagent tube
11480	Adjustable restrictor
15083	Gas flow indicator 15 l/h
15085	Gas flow indicator 130 l/h
20000	Catalyst furnace
20040	Catalyst tube
70210	O-ring
70230	O-ring
72010	Pressure gauge
77410	Panel meter 5A
78015	Mains power switch

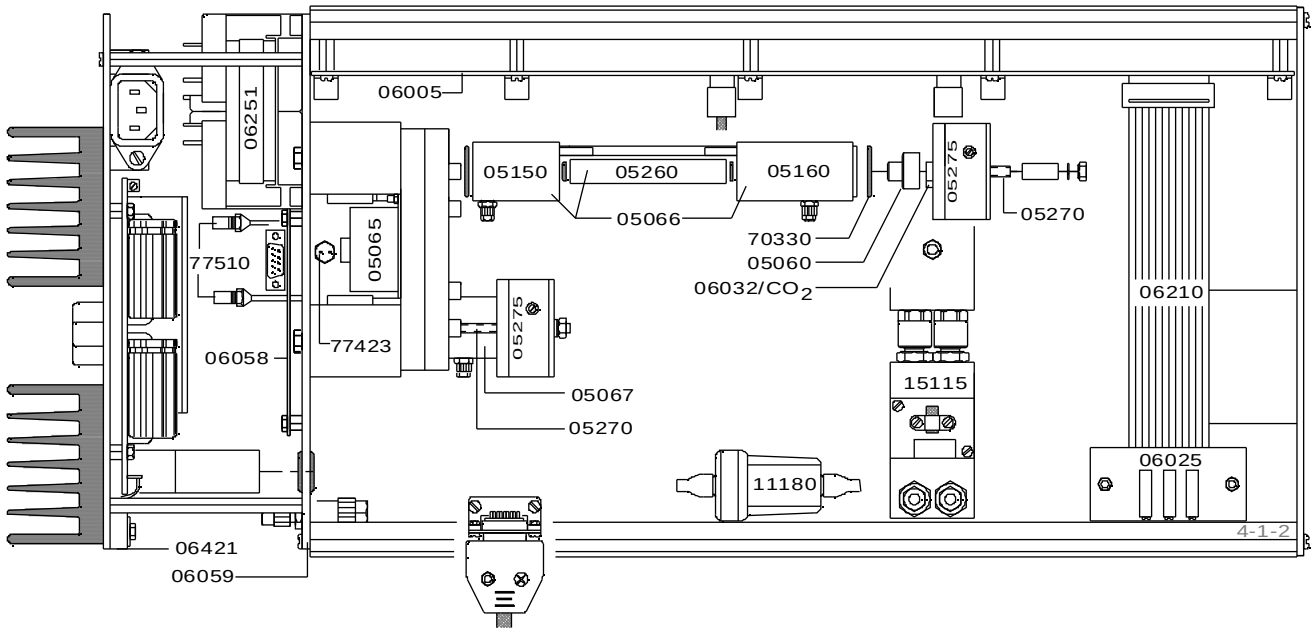


Chopper assembly



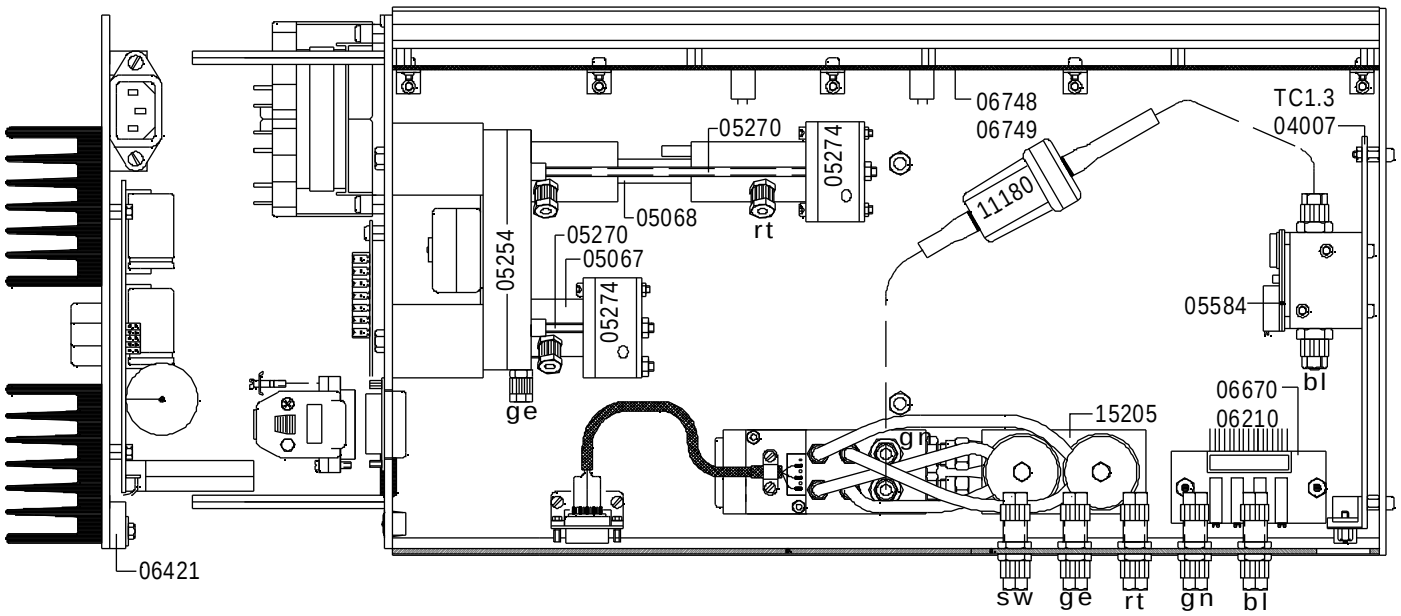
05020	Chopper blade
05030	Chopper blade holder
05065	Chopper motor
05048	Infrared source (emitter)
70280	O - ring
70330	O - ring
75120	Spring
75130	Retaining washer
75190	Washer

INFRARED - CELL



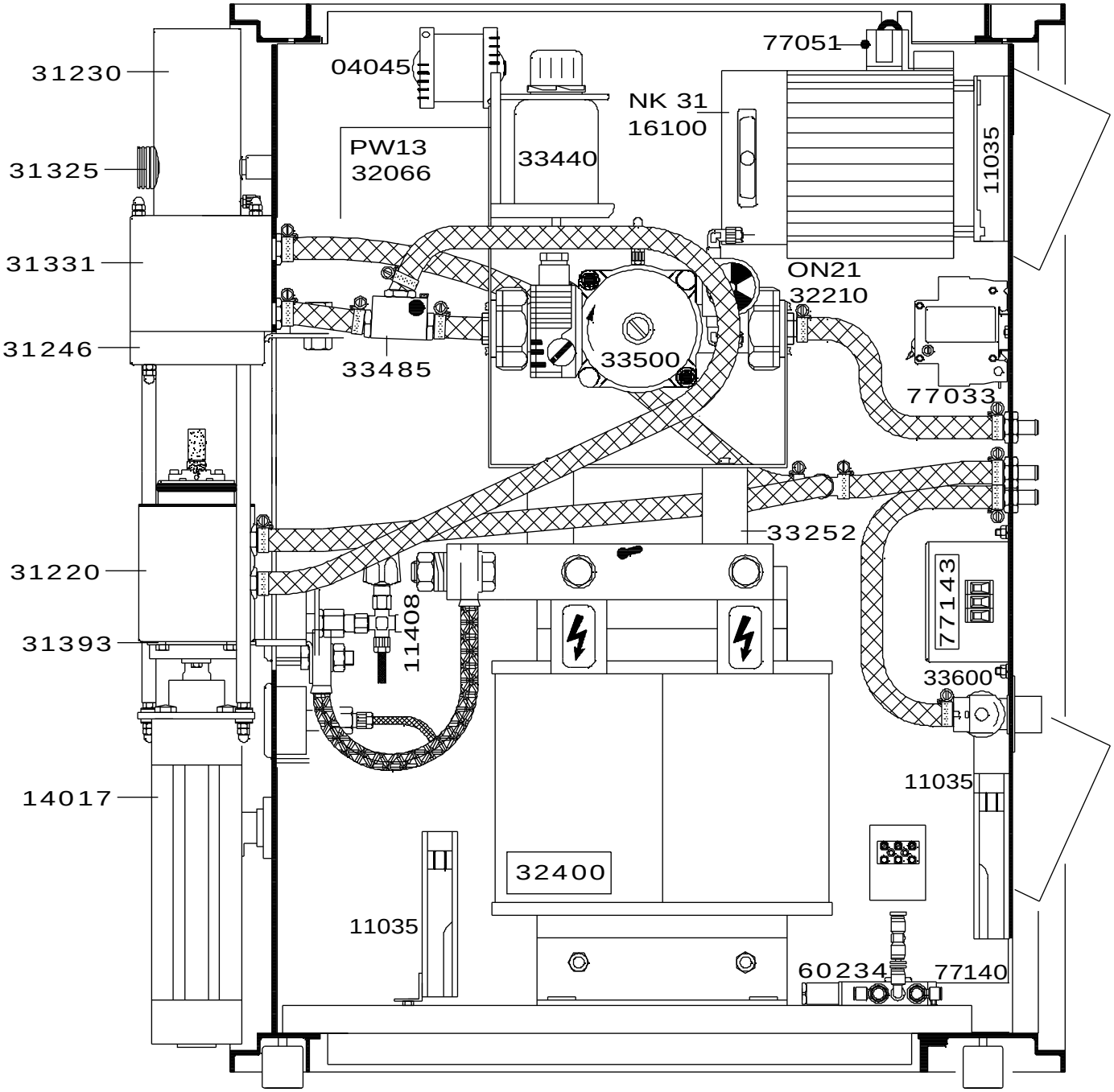
05065	Chopper motor
05060	Reflector
05066	IR path for low oxygen
05067	IR path for high oxygen
05150	IR path connector with window source side
05160	IR path connector with window detector side
05260	IR path tube (advise the length)
05270	Threaded rod (advise the length)
05275	Infrared preamplifier
06005	IR 21 Infrared electronics board
06025	IRT zero adjustment board
06032	Infrared detector with CO_2 filter
06058	Temperature control board TH 61
06059	Rear panel with components
06210	Cable
06251	IR cell transformer
06421	Infrared power supply assembly
11180	Filter
15115	Gas flow sensor
70330	O - ring
77510	Heaters for IR - cell
77423	Temperature sensor for IR - cell

IR/TC - CELL



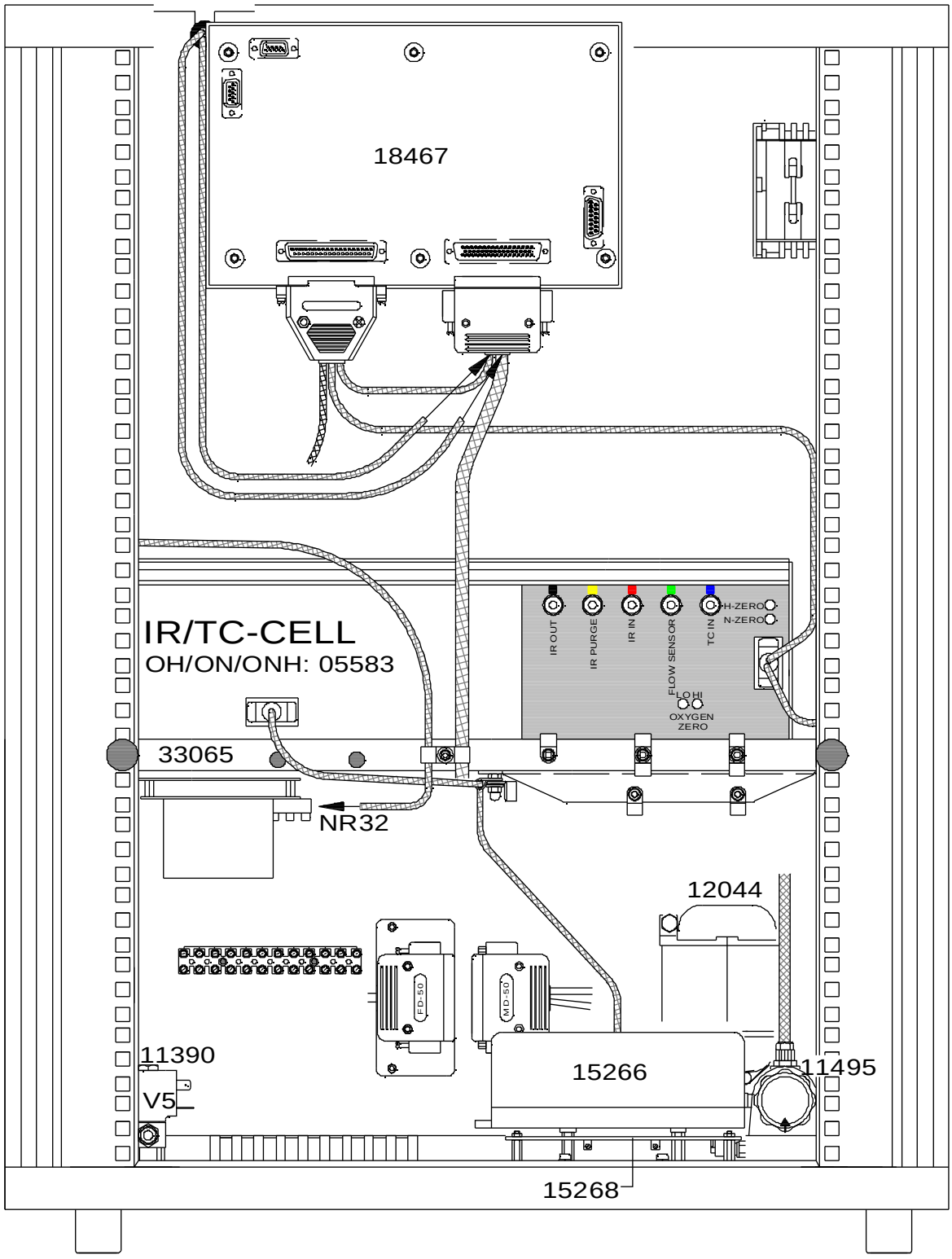
04007	TC board TC1.3
05067	IR path for high oxygen
05068	IR path for low oxygen
05254	Chopper housing
05270	Threaded rod (advise the length)
05274	Infrared preamplifier
05584	TC sensor
06210	Cable
06421	Infrared power supply assembly
06670	IRT zero adjustment board
06748	Infrared electronic board IR41(2channels)
06749	Infrared electronic board IR41(1channel)
15205	Gas flow sensor

Analysator – Trafo Seite



04045	Transformer	32066	Power control board PW 13
11045	Blower	32210	Water temperature control board ON 21
11408	Pressure switch	32400	Transformer
14017	Pneumatic cylinder	33440	Water level tank
16100	Power supply board NK32	33485	Water temperature sensor
31220	Lower furnace assembly	33500	Water pump
31230	Upper furnace part	60234	Pneumatic valve
31246	Combustion chamber	77033	Circuit breaker 32A
31325	Sample drop mechanism	77051	Thyristor block
31331	Abdeckung Wasserkühlung	77140	HF-filter 250 V

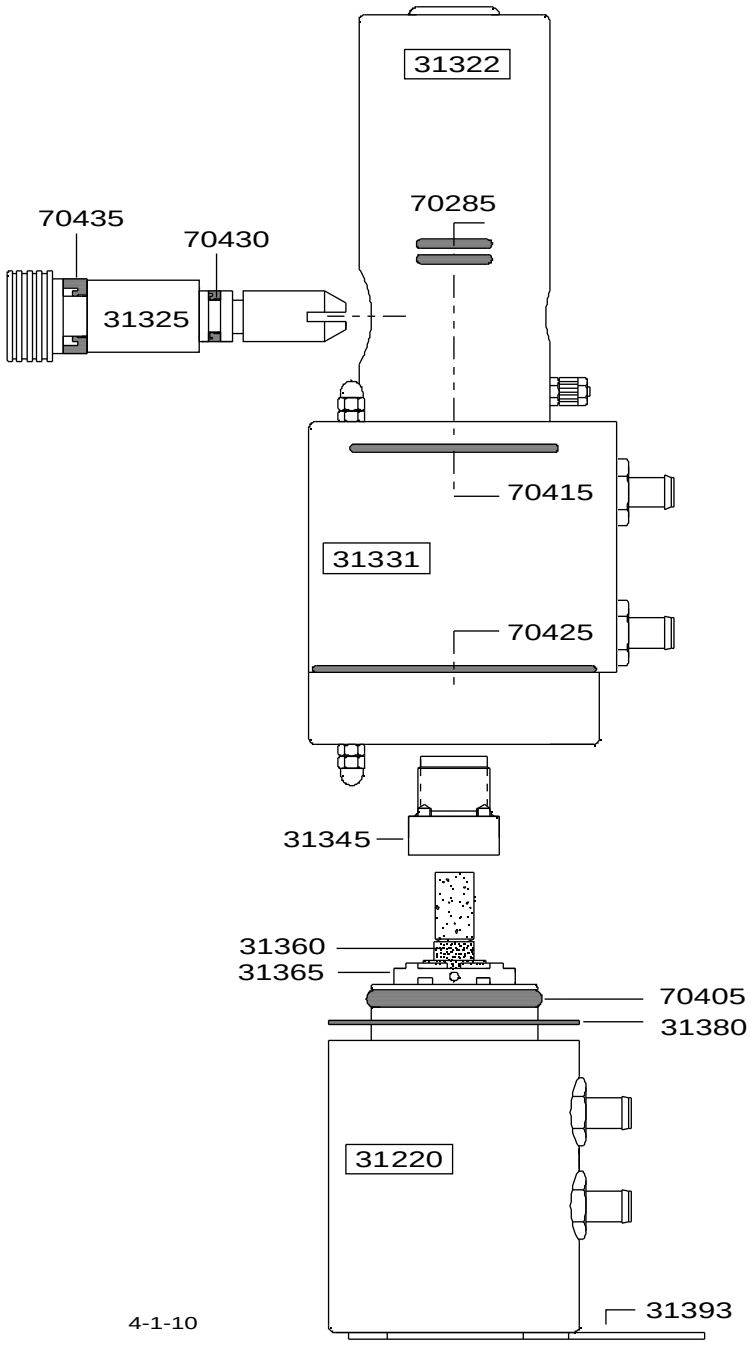
Analysator – IR/TC cell side



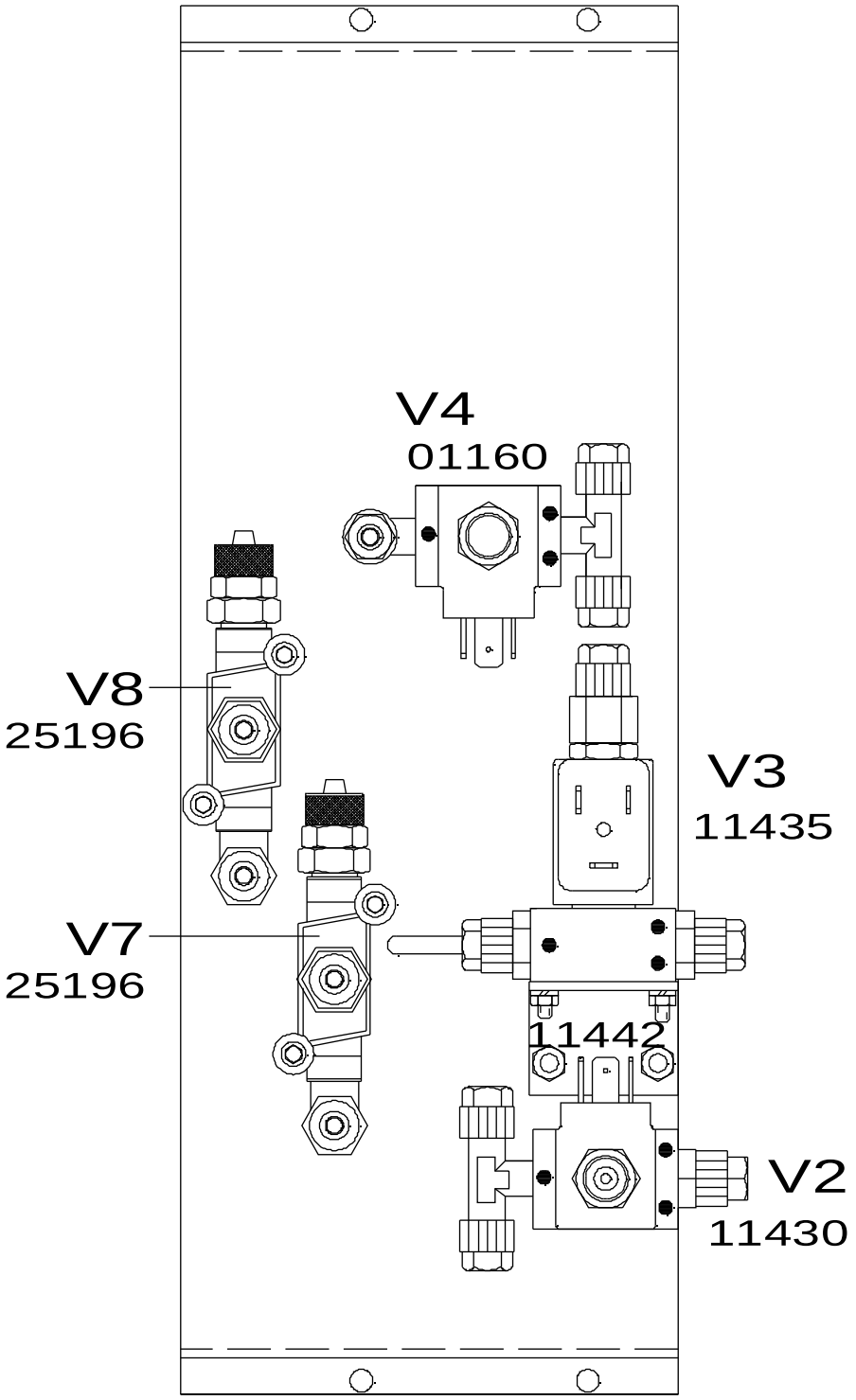
05583	IR/TC cell
11390	Gas valve
12044	Transformer
15037	Voltage stabiliser board NR32/IR version
15266	Gas pump
15268	Pump control board PC1
18467	Microcontroller board UNI

FURNACE up to Ser. No. 0724

31220	Lower furnace assembly
31322	Upper furnace part
31325	Sample drop mechanism
31331	Cooling cover
31345	See wearing parts
31360	Graphit tip
31365	See recommended parts
31380	Isolating ring
31393	Lower power connector
70285	O - ring
70405	O - ring
70415	O - ring
70425	O - ring
70430	O - ring
70435	O - ring



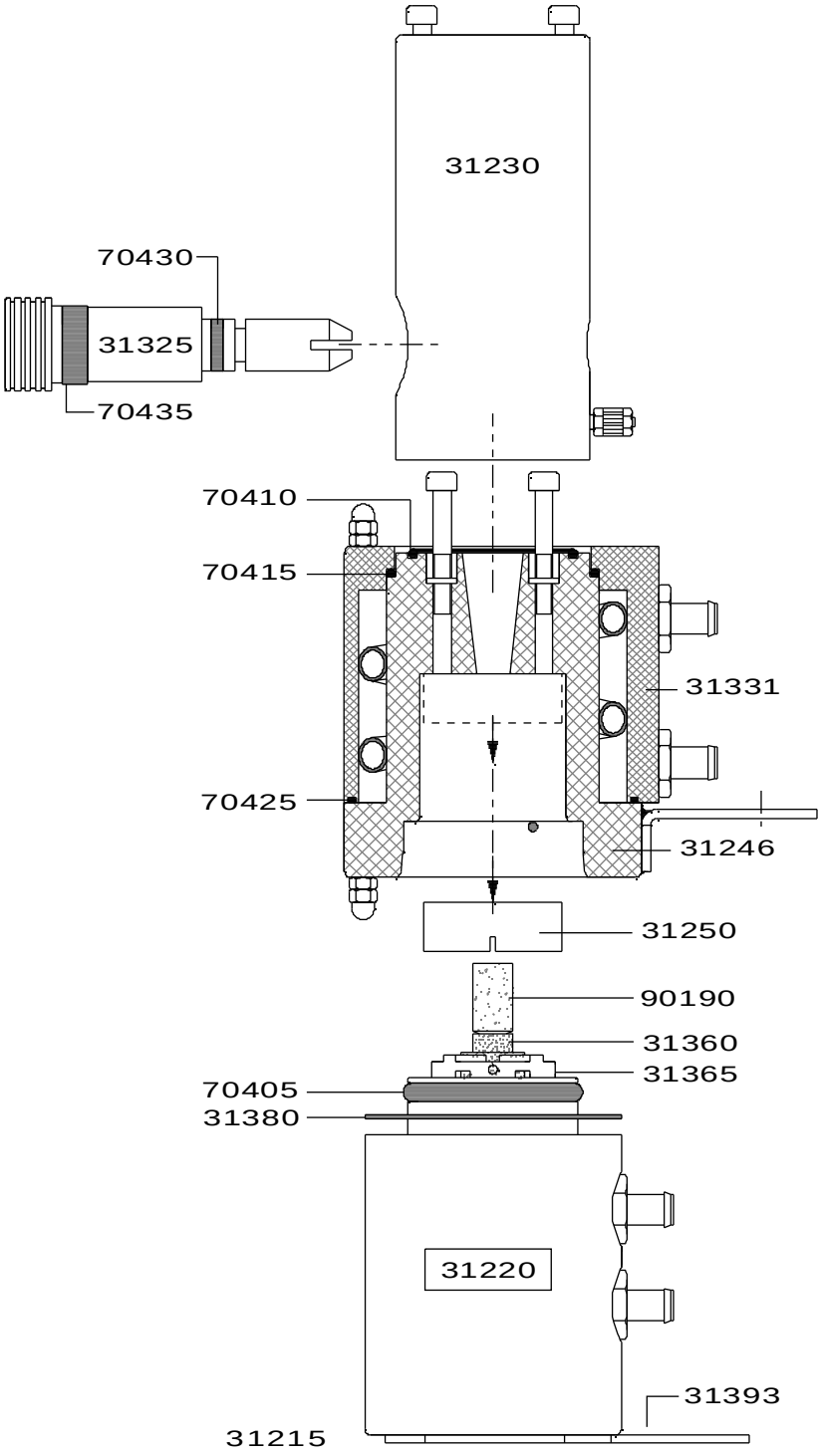
Valves plate 25026



01160	Valve V4
11430	Valve V2
11435	Valve V3
25196	Valves V7 and V8(just for ONH-2000 analyser)

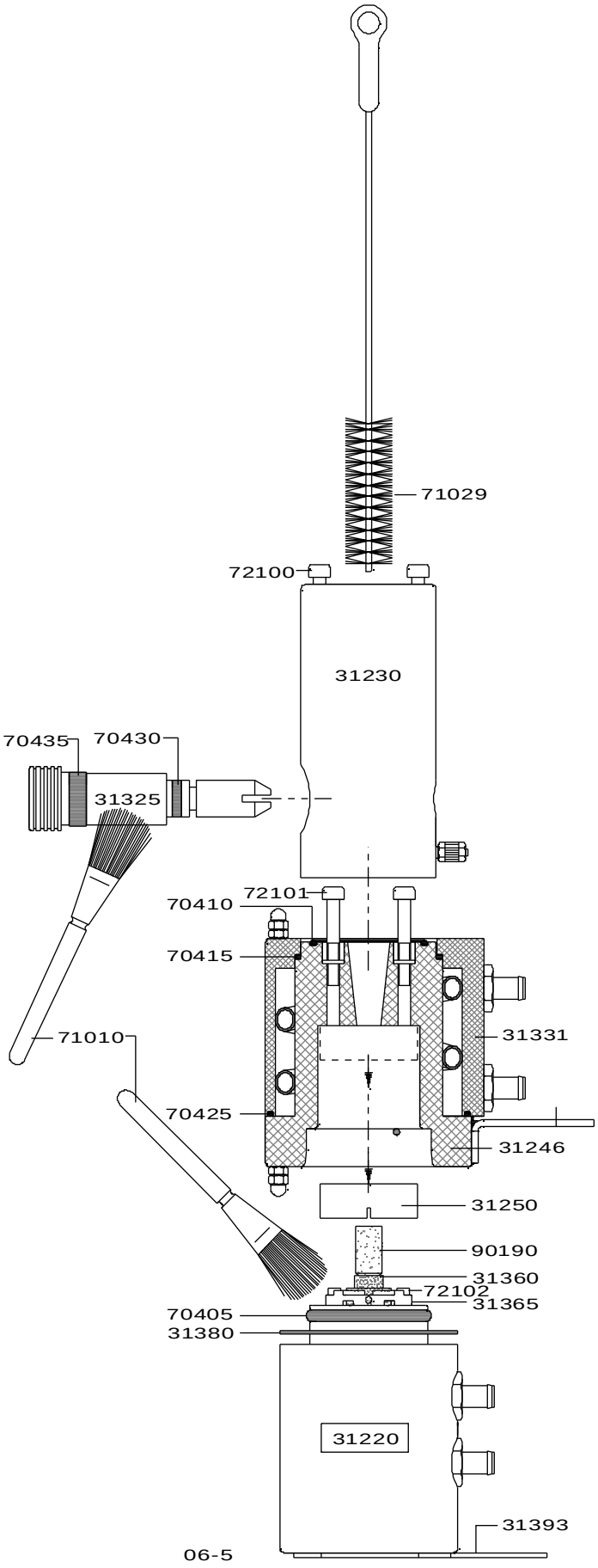
FURNACE as from Ser. No. 0725

31230 Upper furnace part
31246 Combustion chamber
31250 Upper electrode insert
31325 Sample drop mechanism
31331 Cooling cover
31360 Graphite tip
31365 Graphite tip holder
31380 Isolating ring
31393 Lower power connector
31220 Lower furnace assembly
70405 O – ring
70410 O – ring
70415 O – ring
70425 O – ring
70430 O – ring
70435 O – ring
90190 Graphite crucible

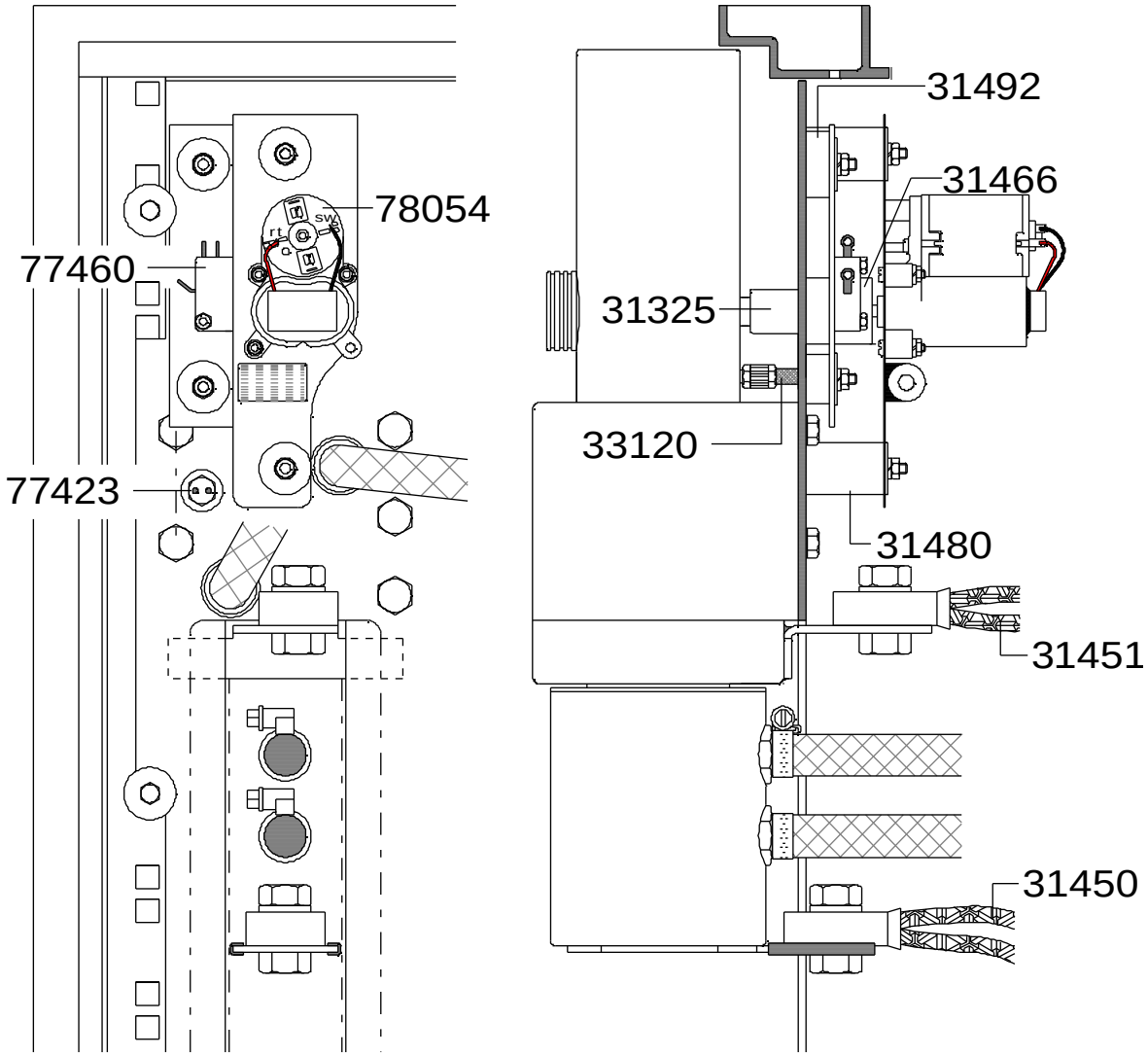


Furnace:

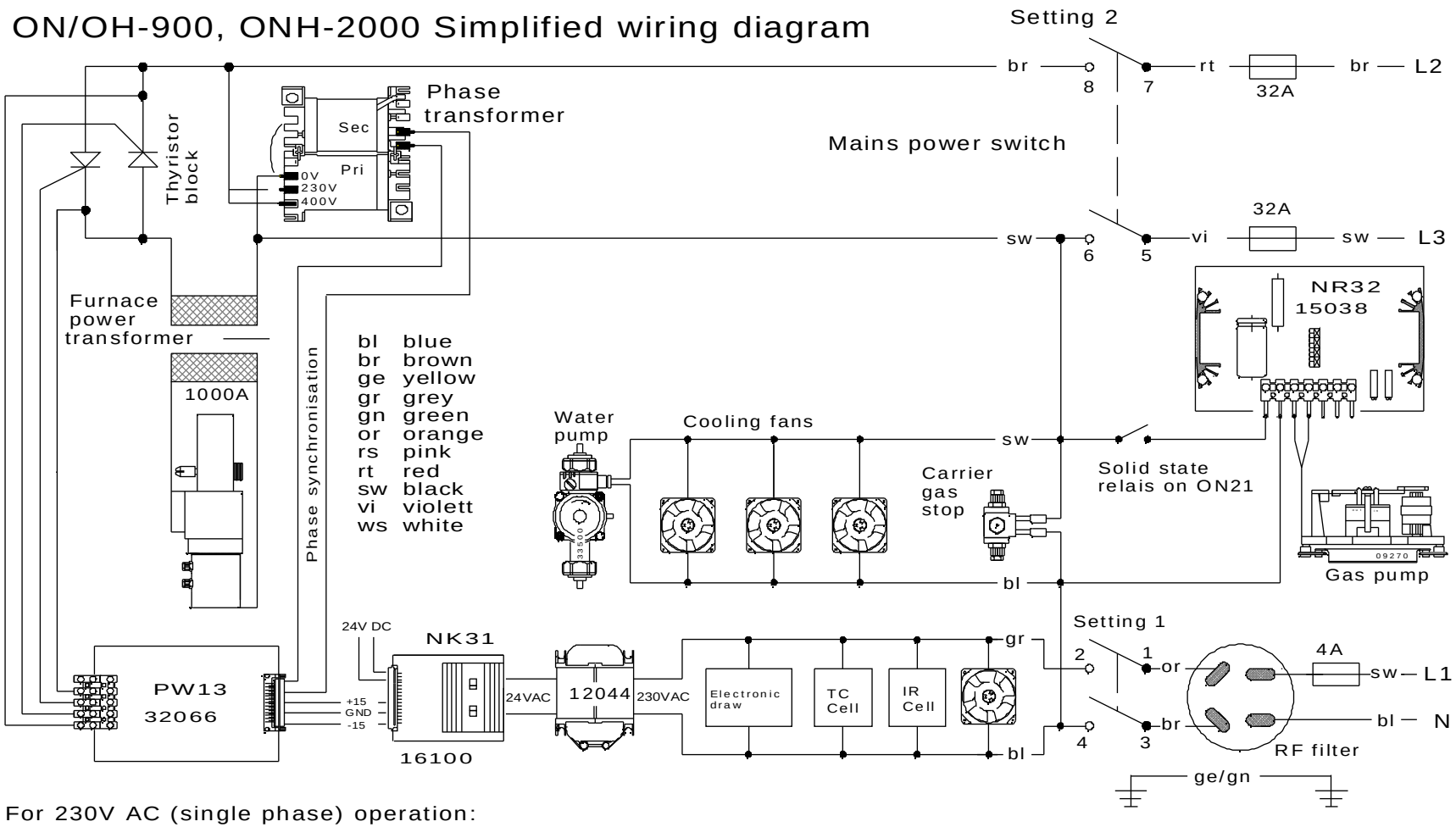
31220	Lower furnace assembly
31230	Upper furnace part
31246	Combustion chamber
31250	Upper electrode insert
31325	Sample drop mechanism
31331	Cooling cover
31360	Graphite tip
31365	Graphite tip holder
31380	Isolating ring
31393	Lower power connector
70405	O-ring
70410	O-ring
70415	O-ring
70430	O-ring
70435	O-ring
71010	Cleaning brush
71029	Furnace cleaning brush
72100	Screw
72101	Screw
72102	Screw
90191	Graphite crucible



Analyser right-hand side



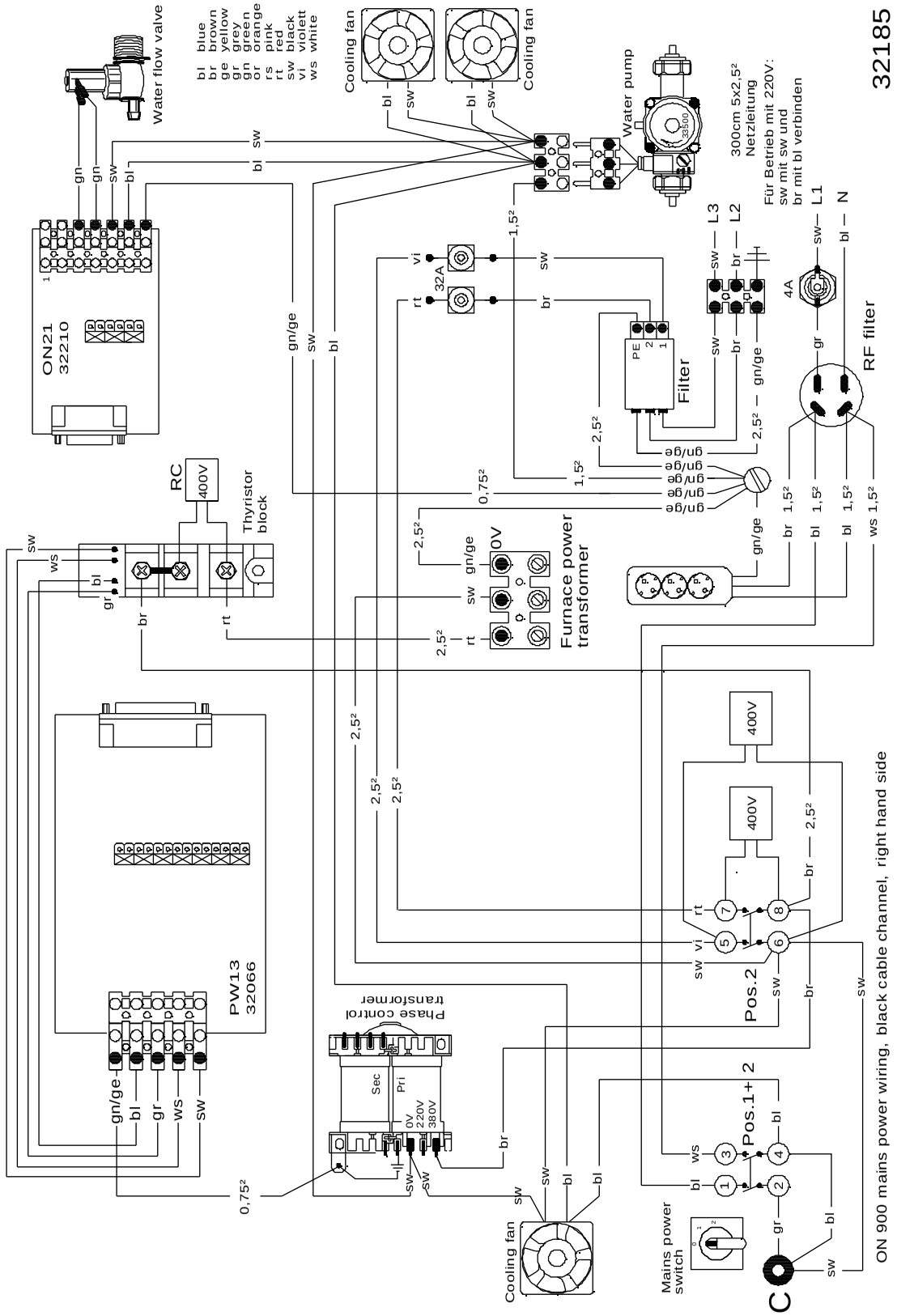
31325	Sample drop mechanism
31450	Lower bride
31450	Upper bride
31466	Eccentric wheel
31480	Support for motor bracket
33120	Tube for dust trap
77423	Temperature sensor
77460	Micro switch
78054	Motor for sample drop

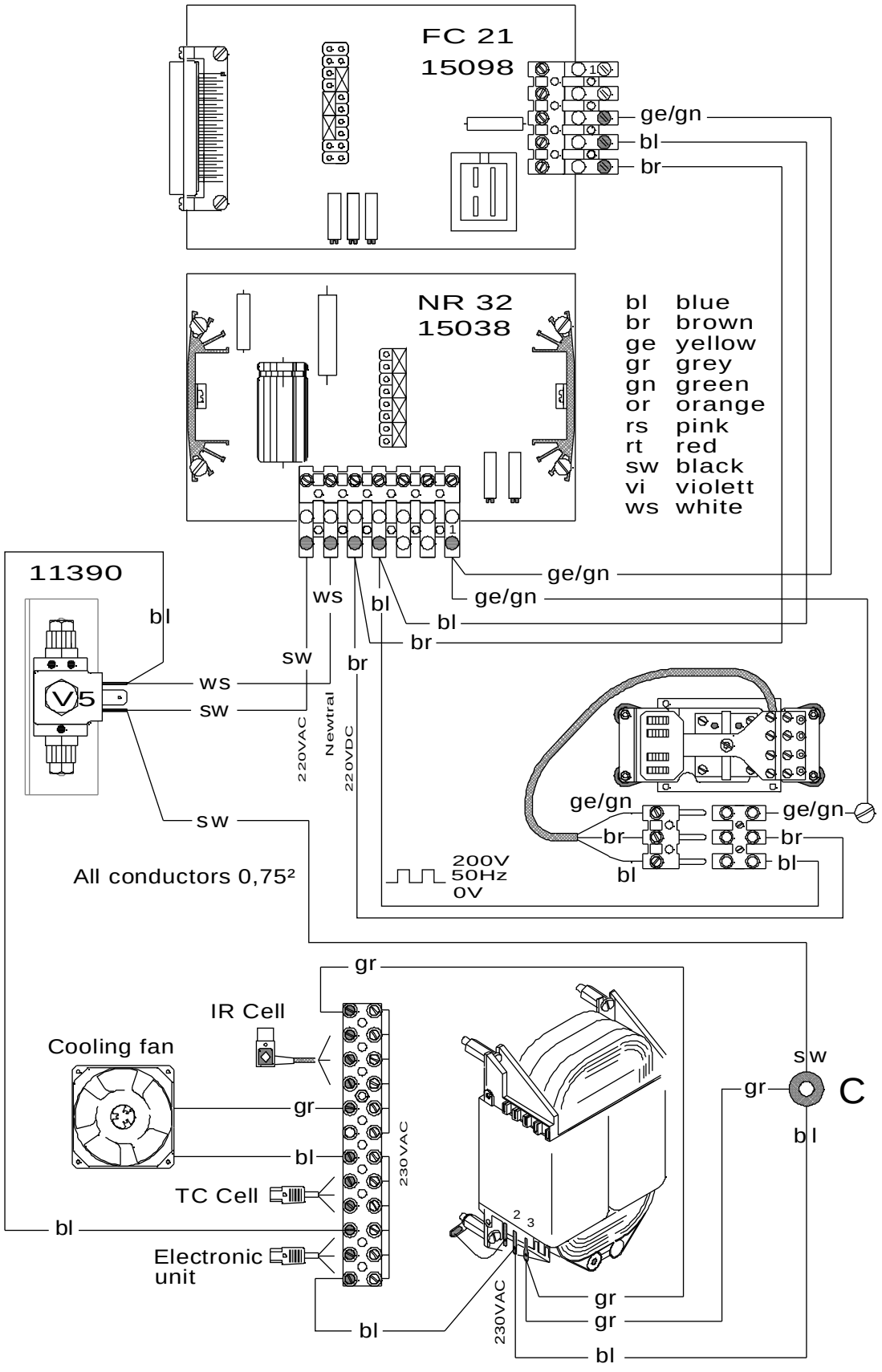


For 230V AC (single phase) operation:
Connect blue with brown and black with black (in the power plug)
Connect phase transformer to 230V
Use 1000A power transformer with 230V primery coil

32012

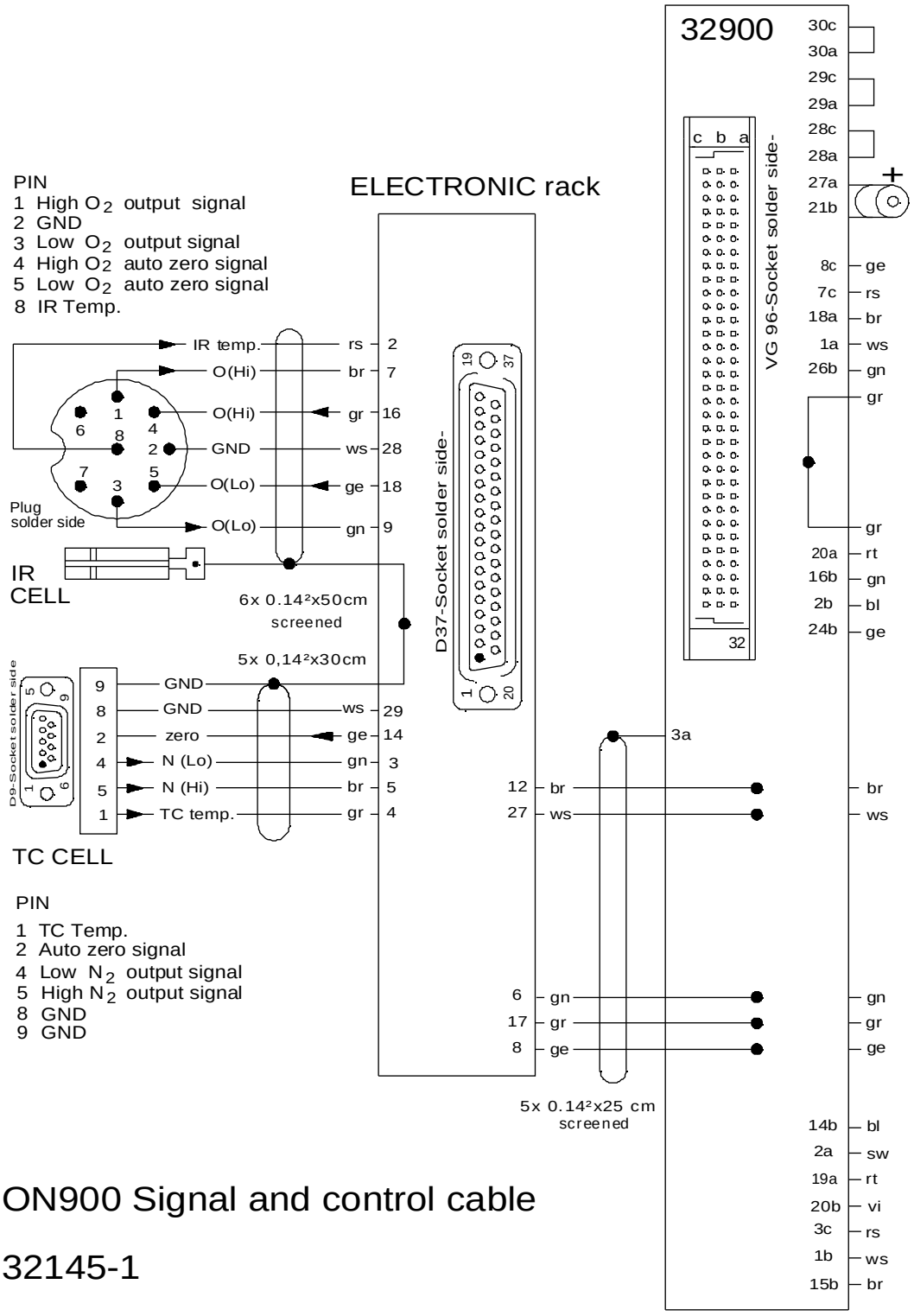
Phase power wiring





			Datum	Name	Benennung: ON 900
		gez.:	9. 3. 2001	Knipp	Mains power wiring,
		gepr.:	9. 3. 2001	Polemitis	black cable channel,left hand side
		ELTRA			Zeichnungs-Nr.:
Bez.:	geändert am:	Mainstr. 85 Block 20 D-41469 Neuss			32195

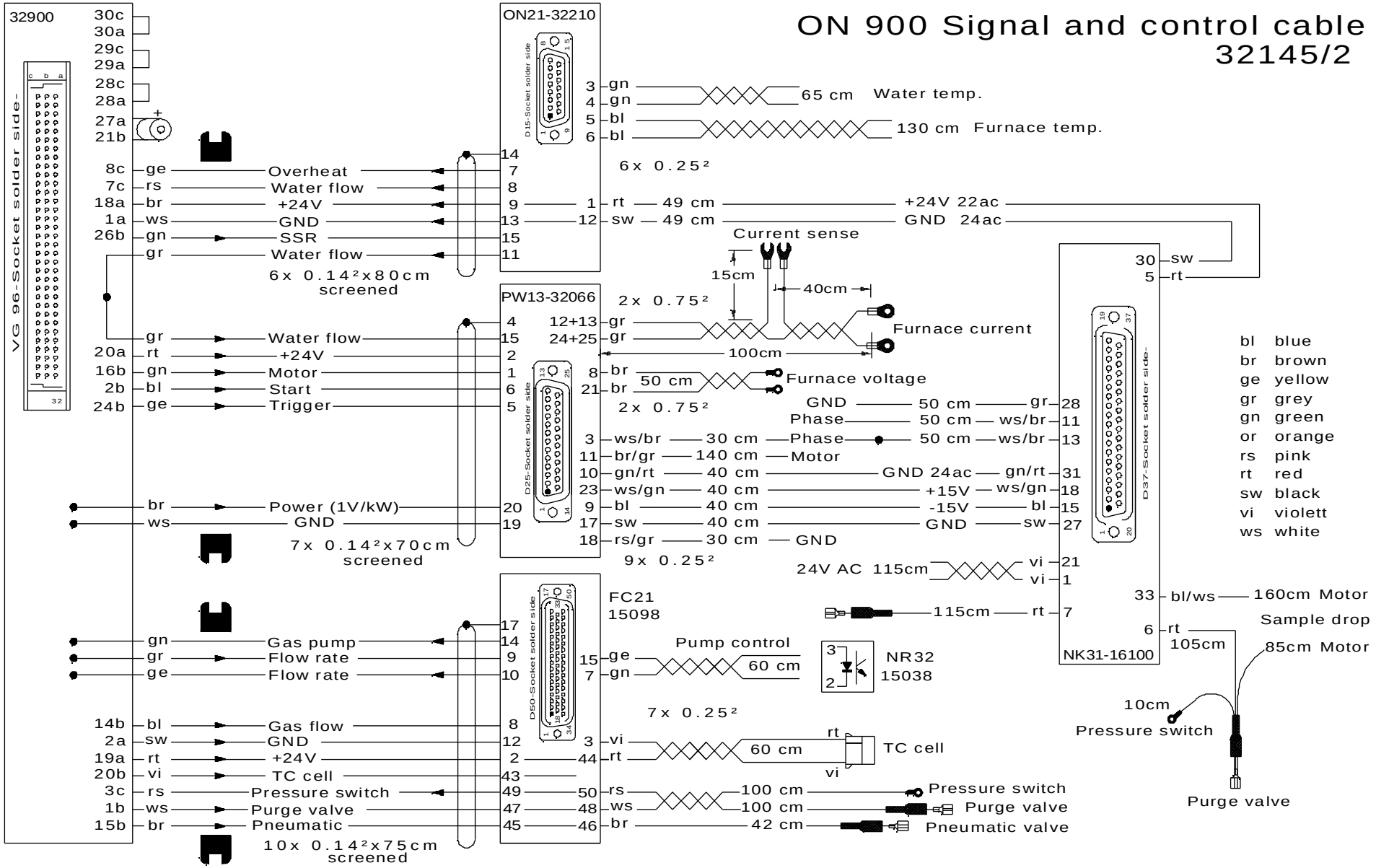
Low voltage wiring

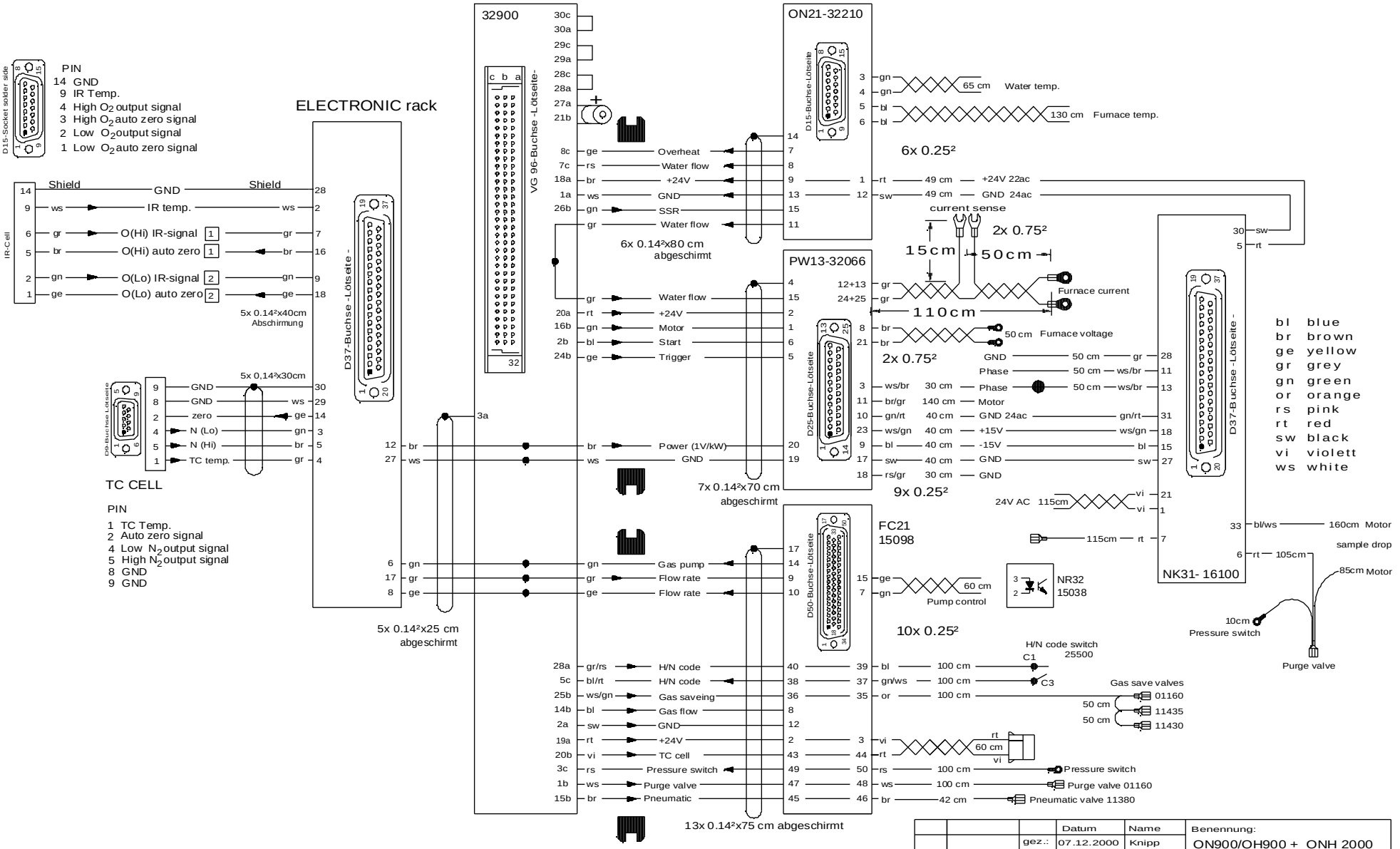


ON900 Signal and control cable

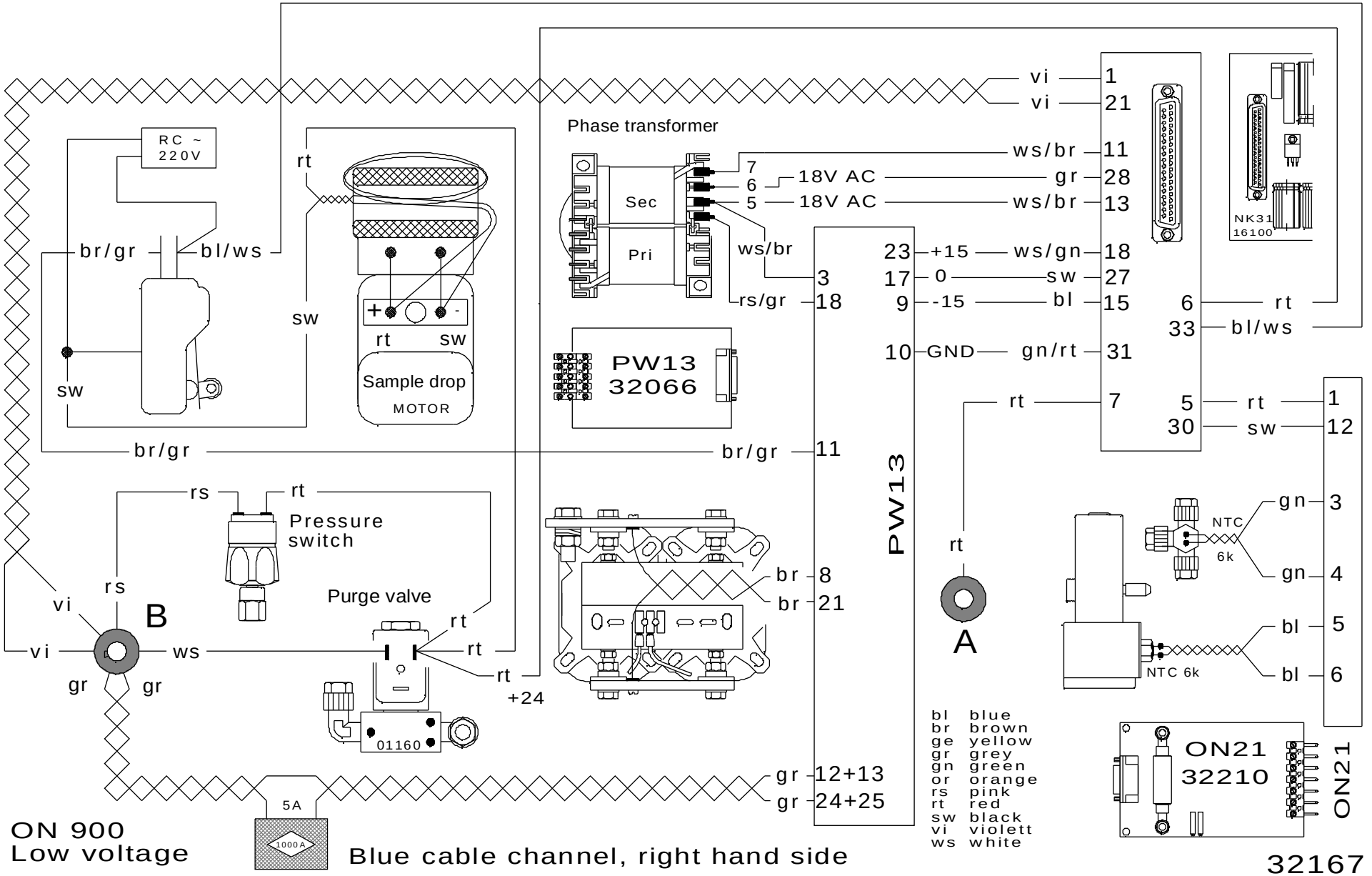
32145-1

ON 900 Signal and control cable 32145/2

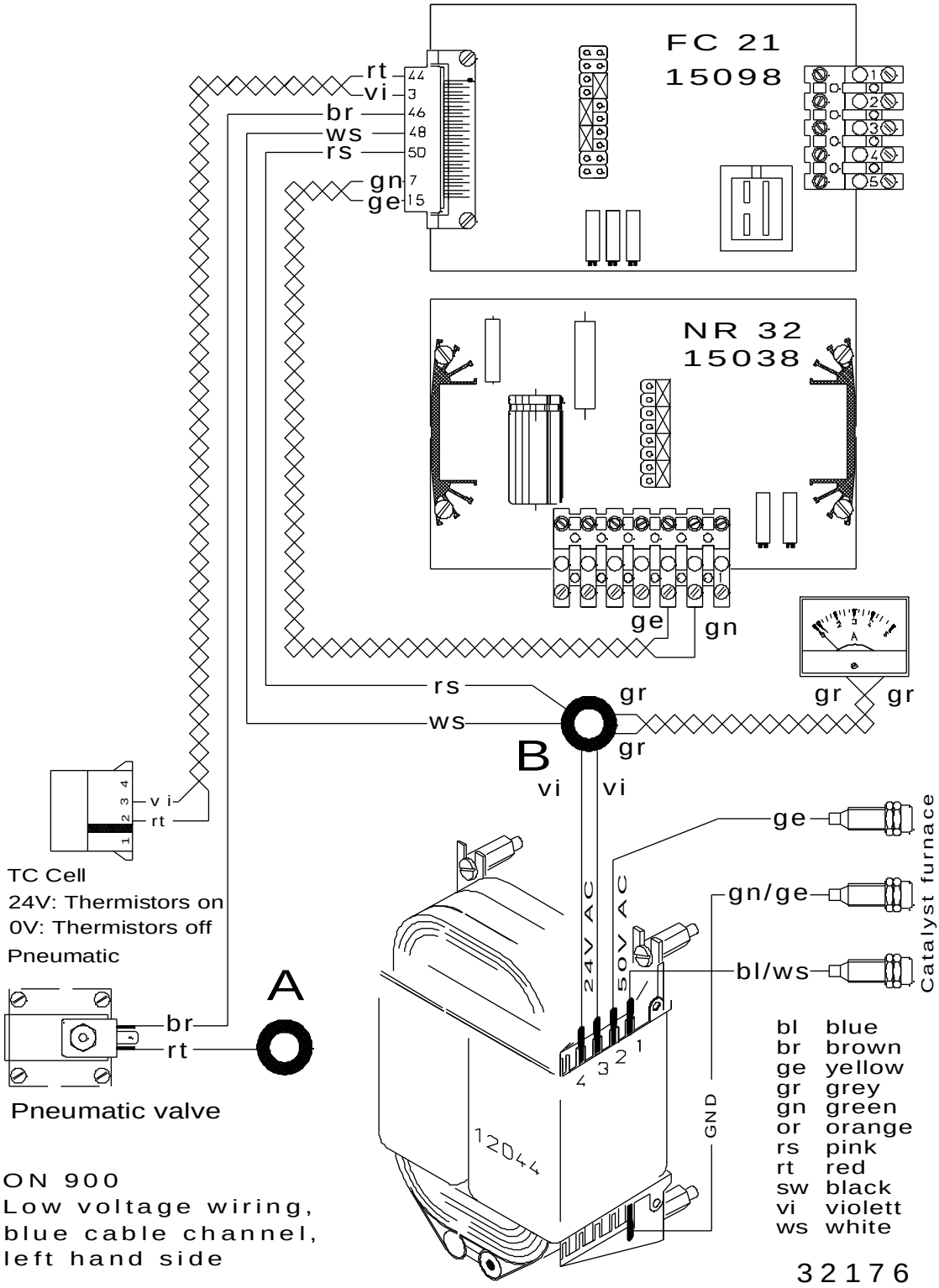




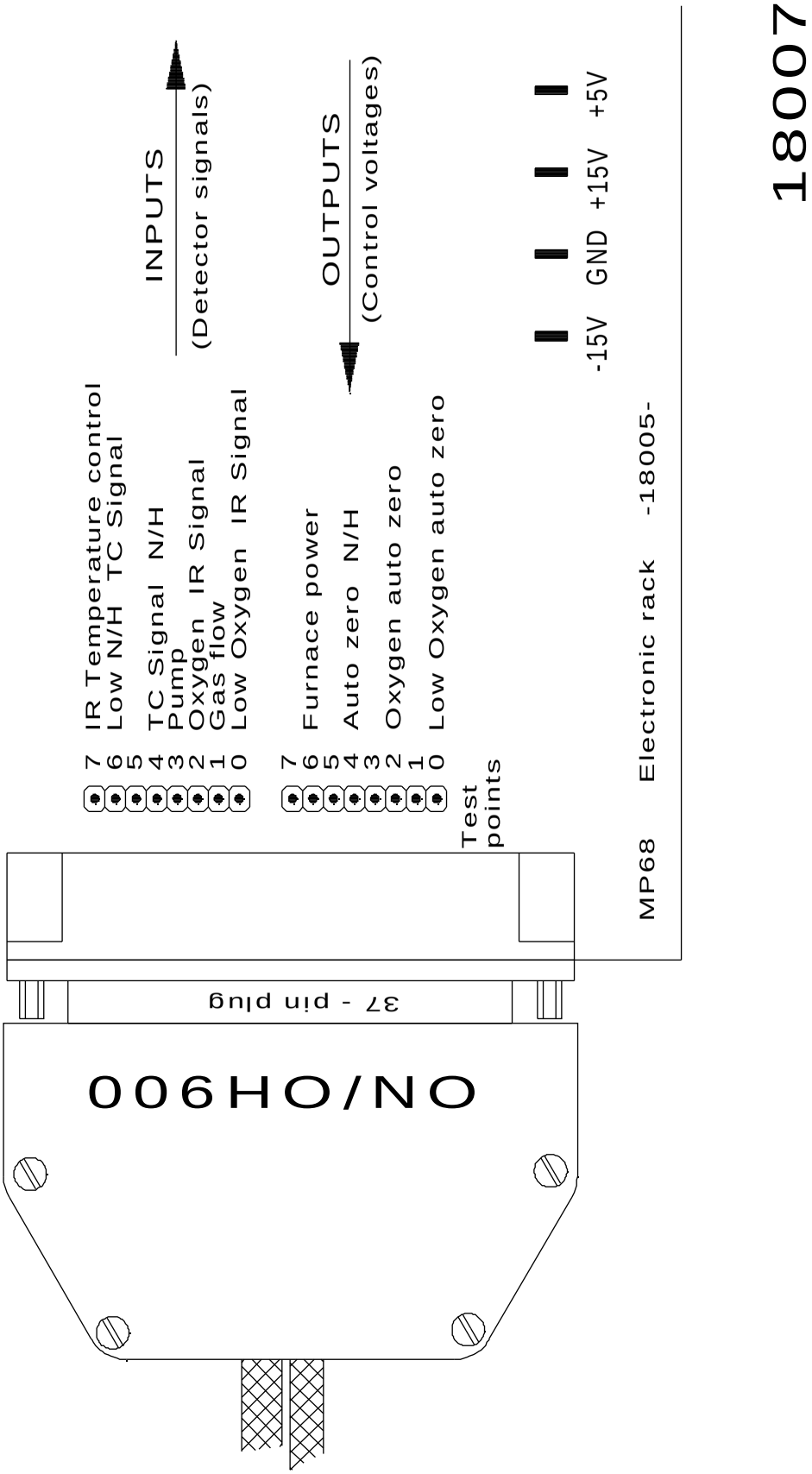
			Datum	Name	Benennung:
		gez.:	07.12.2000	Knipp	ON900/OH900 + ONH 2000
c	07. 5. 2001	gepr.:	07.12.2000	Polemitis	Signal and control cable
b	30. 4. 2001	ELTRA			Zeichnungs-Nr.:
a	11. 1. 2001	Mainstr. 85 Block 20			32006
Bez.:	geändert am:	D-41469 Neuss			



Left Side - blue cable channel -

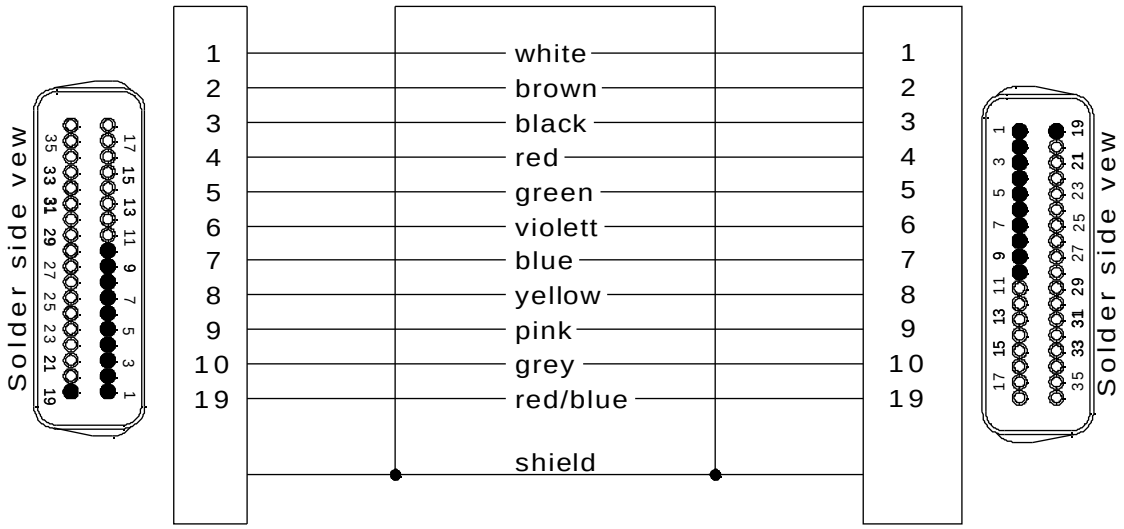


IR + TC analogue signals measured in the electronic unit

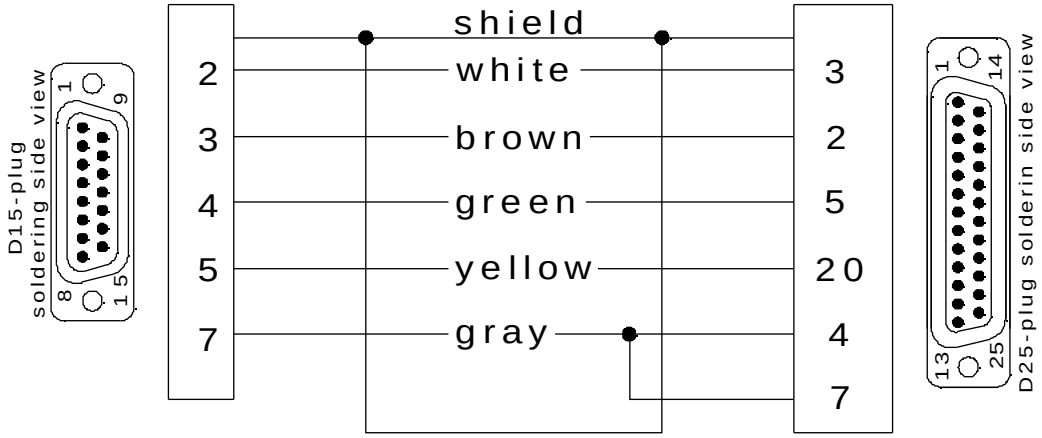


Connecting cables:

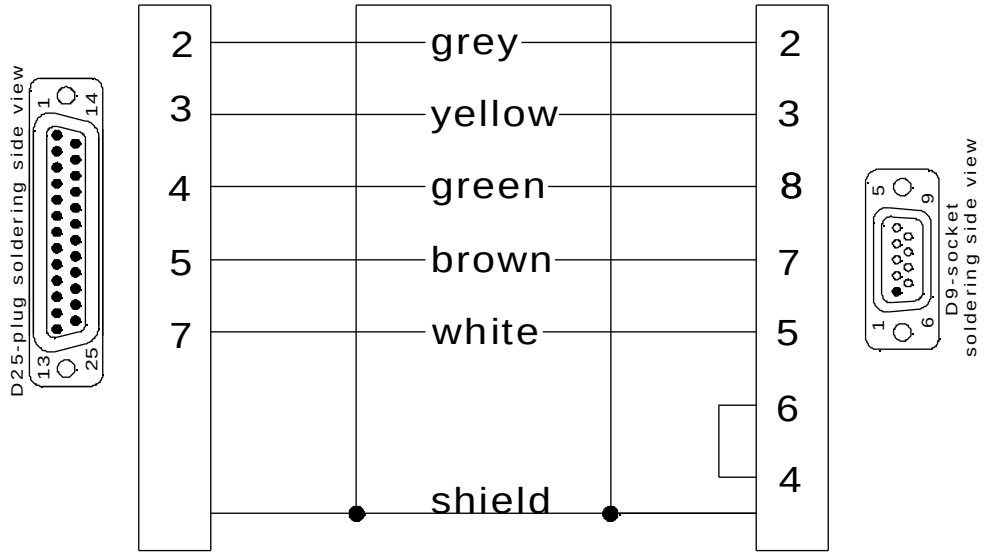
Analyser - Parallel printer



Analyser - Sartorius balance

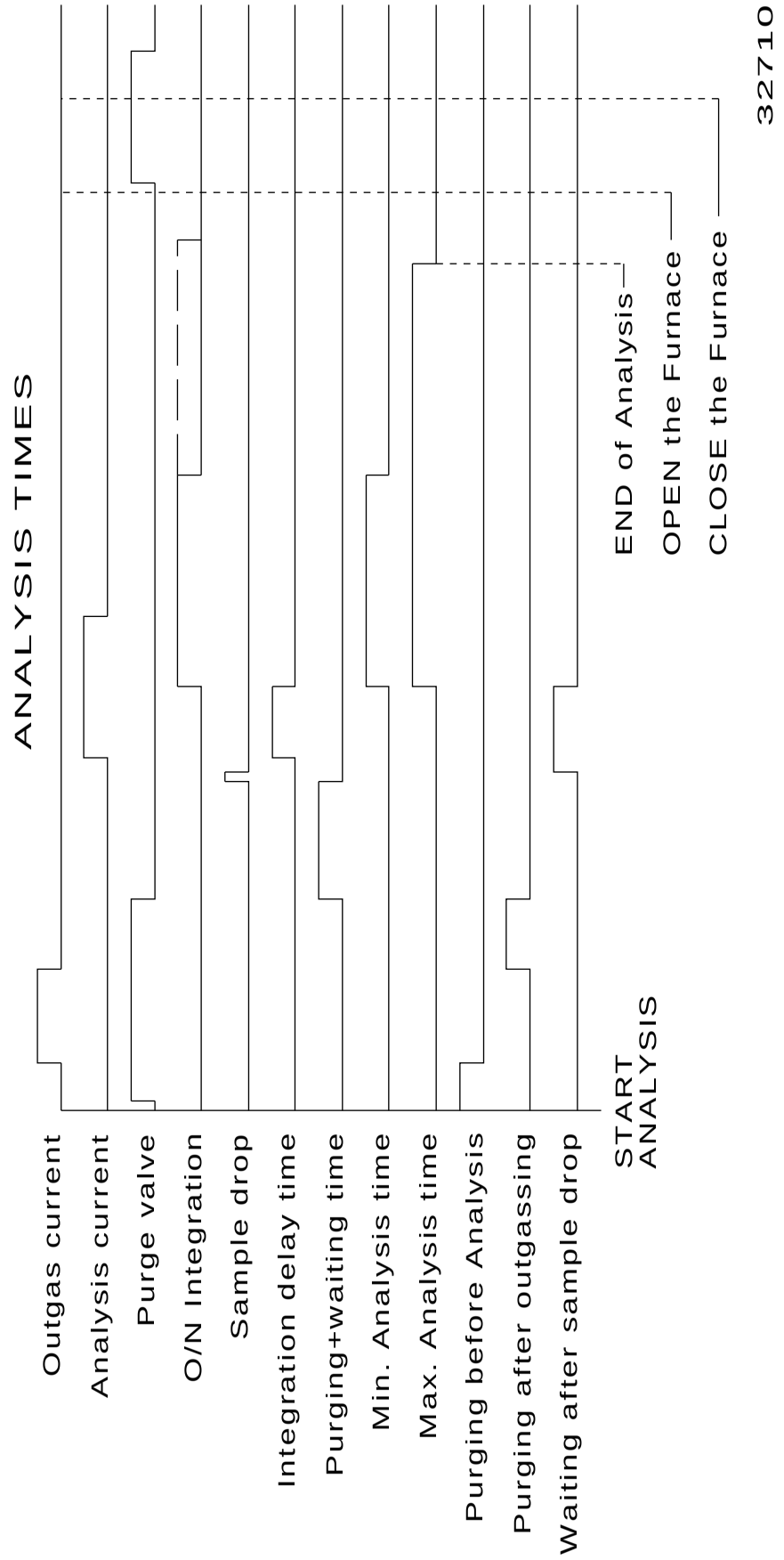


Analyser - PC

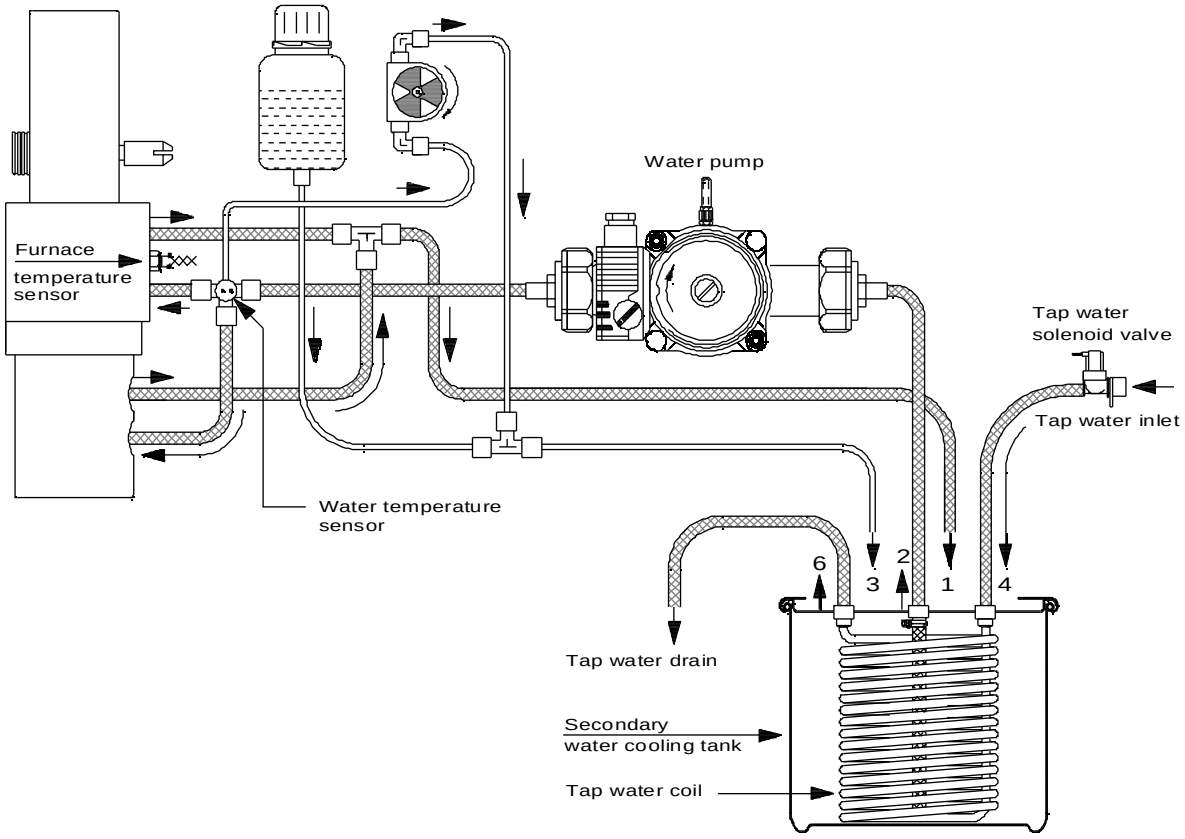


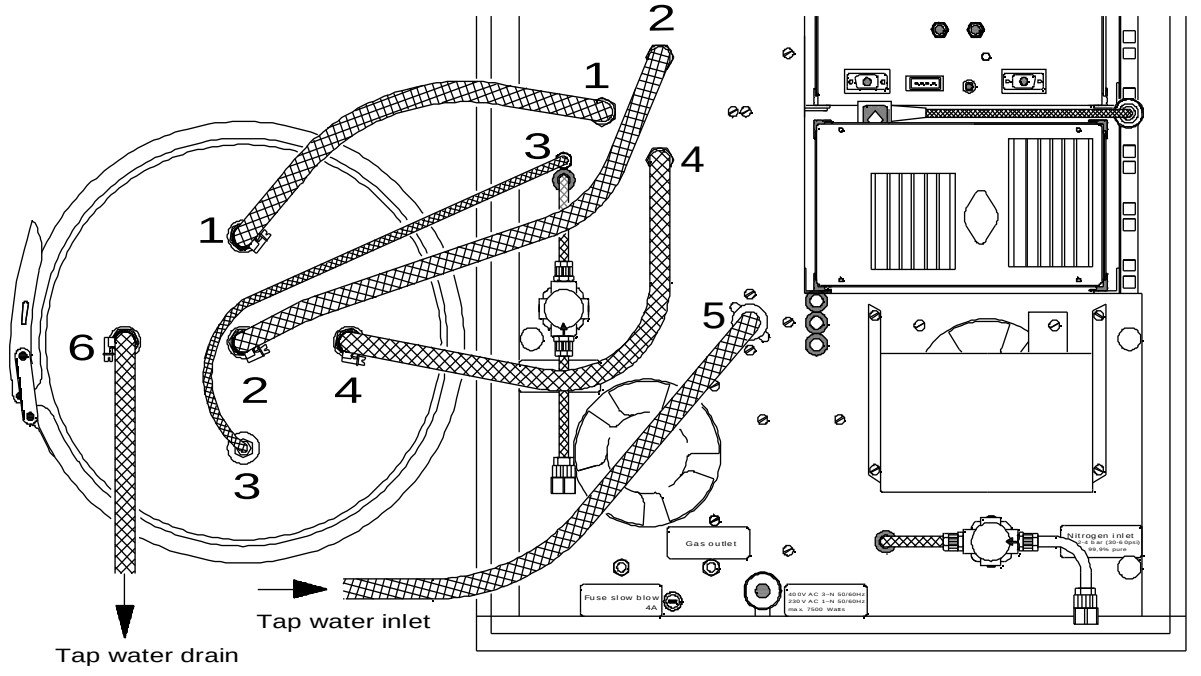
CAUTION! Connect the shield on both connector frames.

4.3 Water and gas flow diagrams, analysis sequence



Water flow circuit

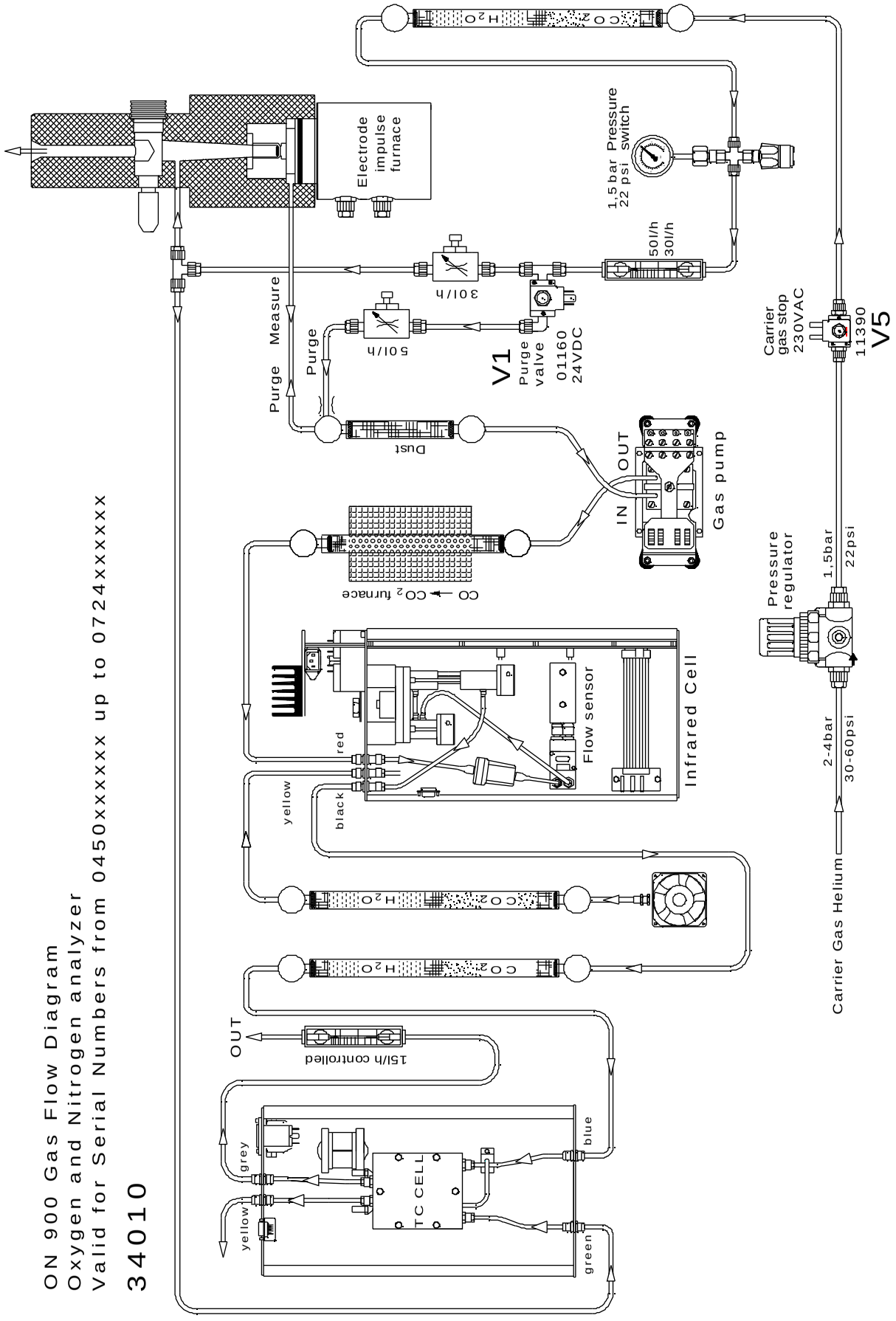




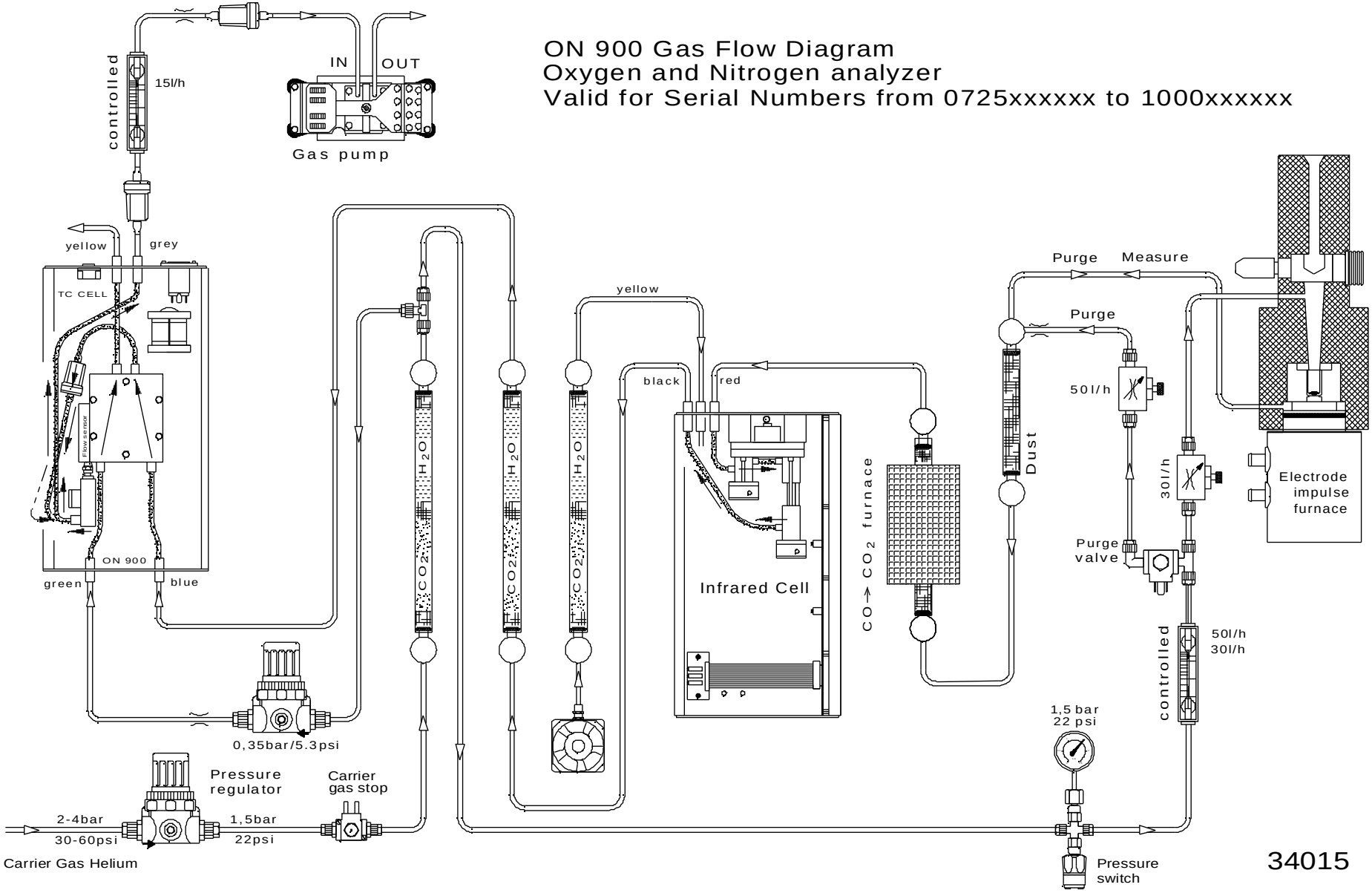
4-3-1-0

Gas flow diagrams

Older version



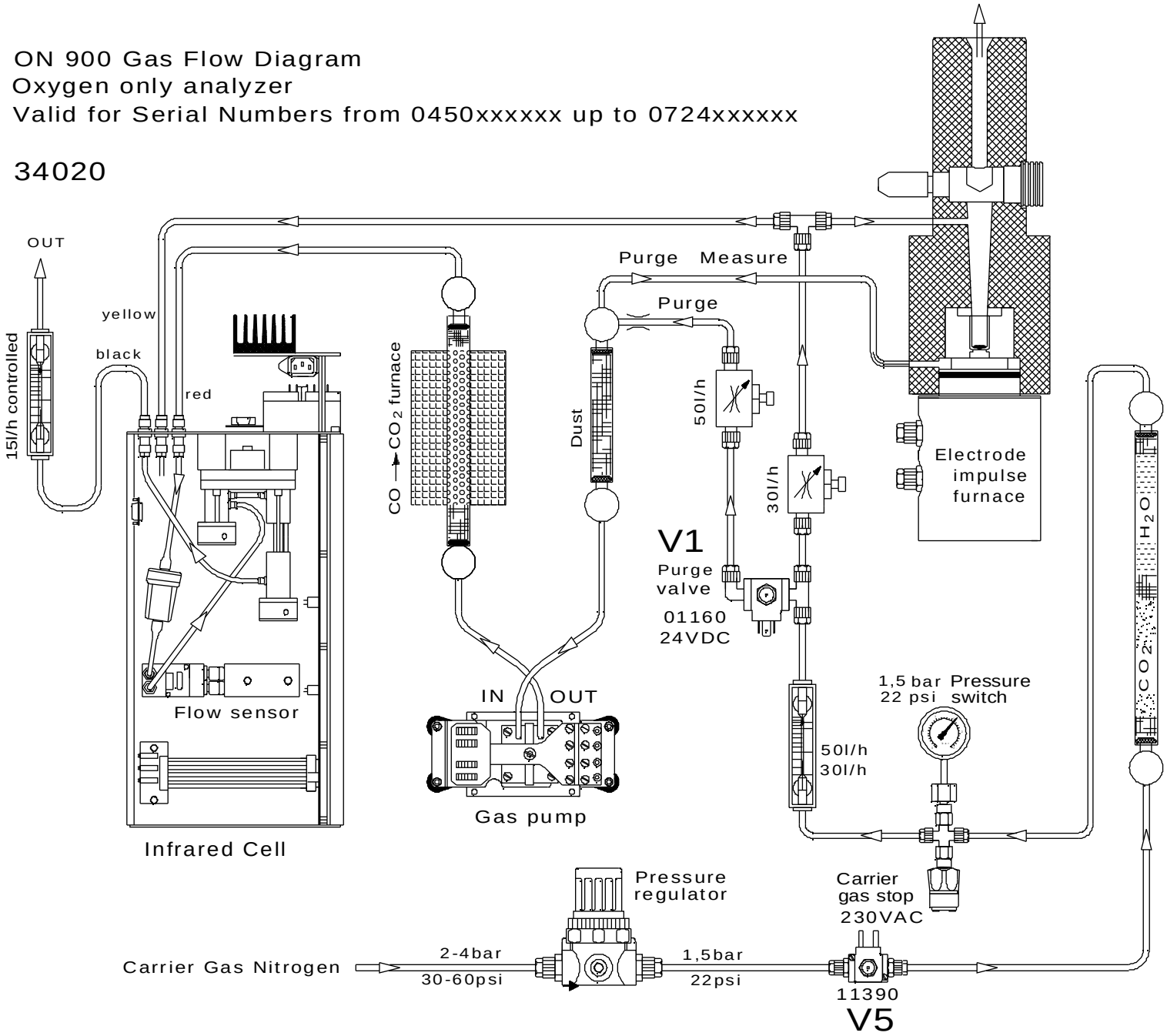
ON 900 Gas Flow Diagram
Oxygen and Nitrogen analyzer
Valid for Serial Numbers from 0725xxxxxx to 1000xxxxxx

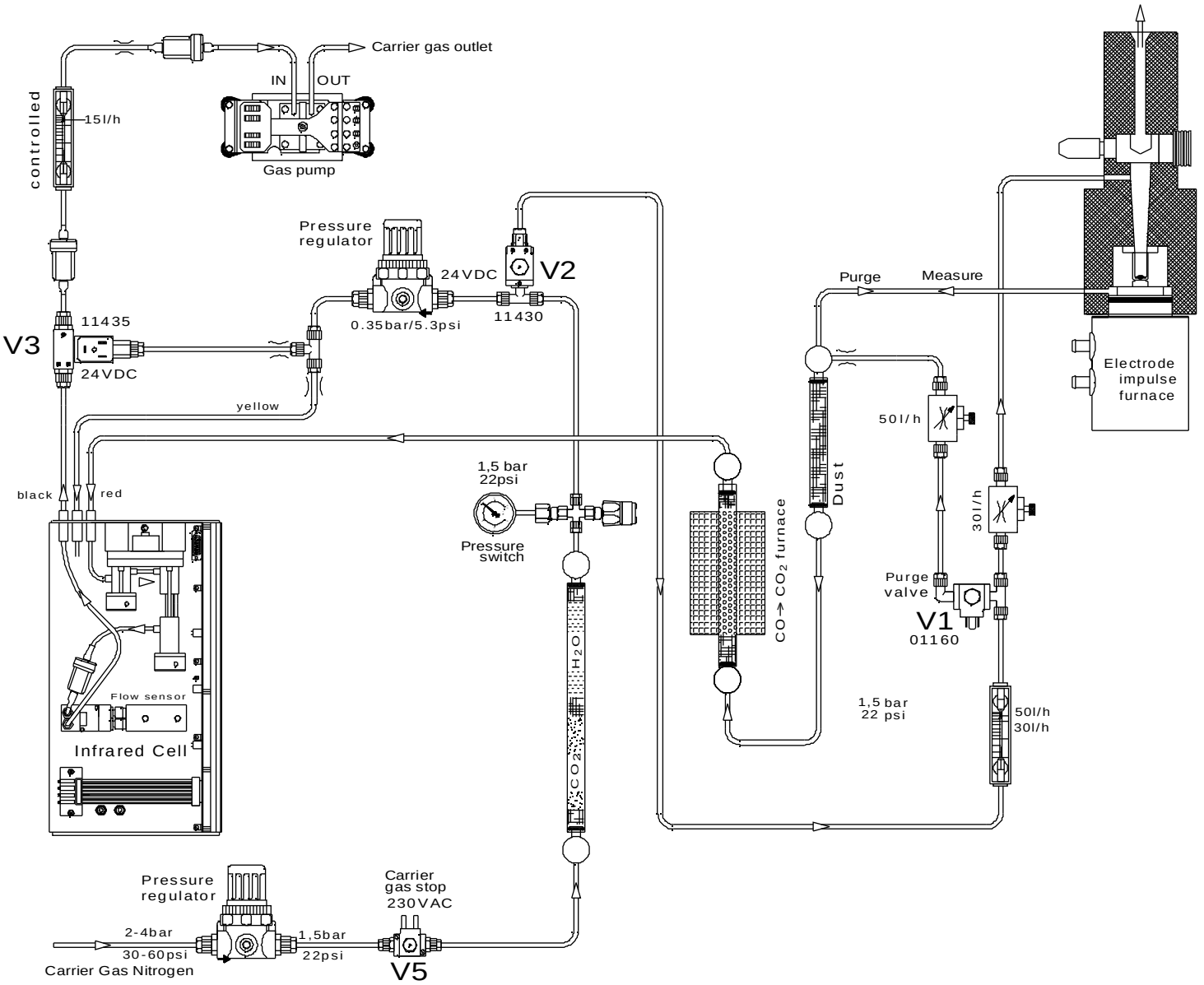


34015

ON 900 Gas Flow Diagram
Oxygen only analyzer
Valid for Serial Numbers from 0450xxxxxx up to 0724xxxxxx

34020



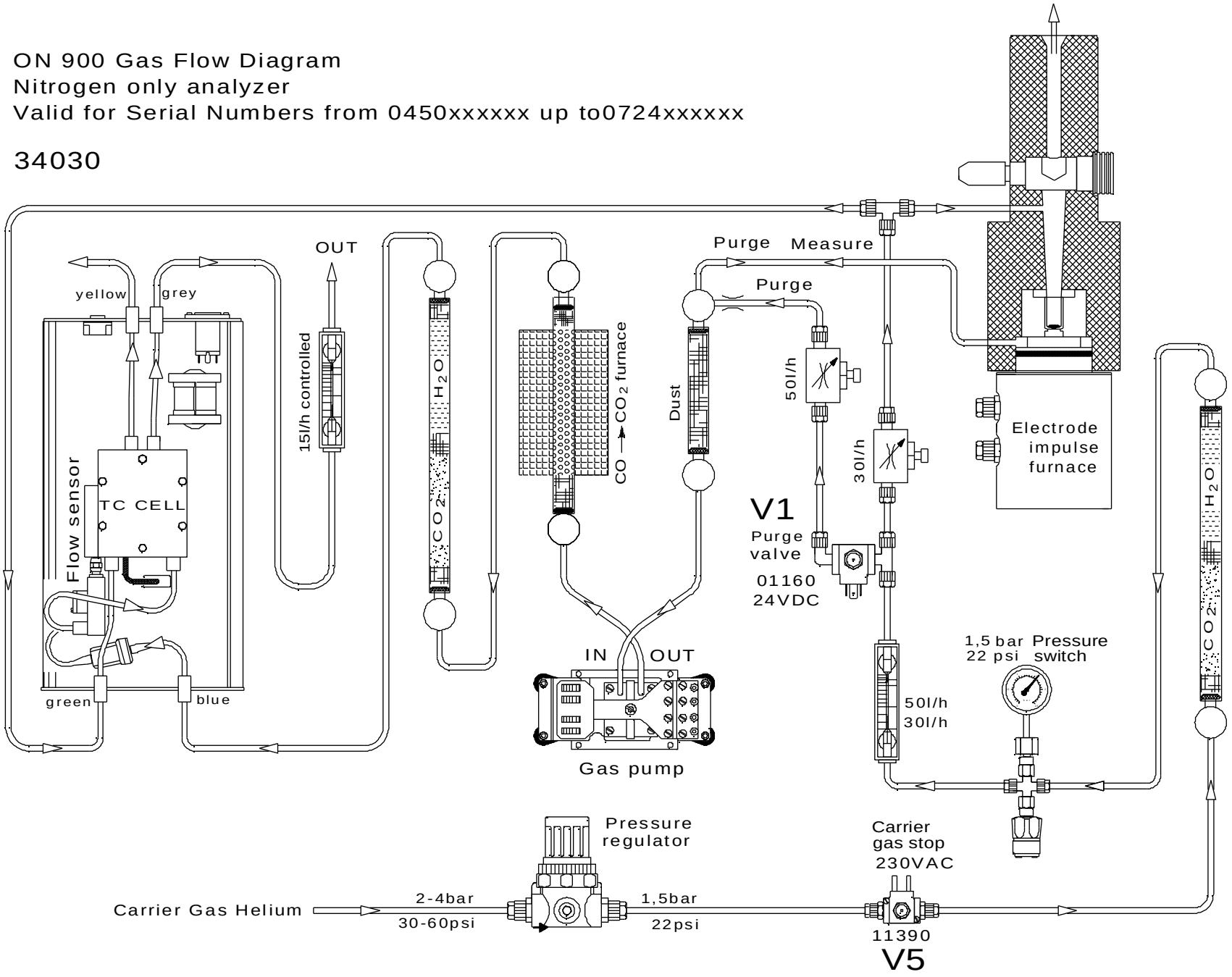


ON 900 Gas Flow Diagram
Oxygen -only analyser
Valid for Serial Numbers from 0725xxxxxx to 1000xxxxxx

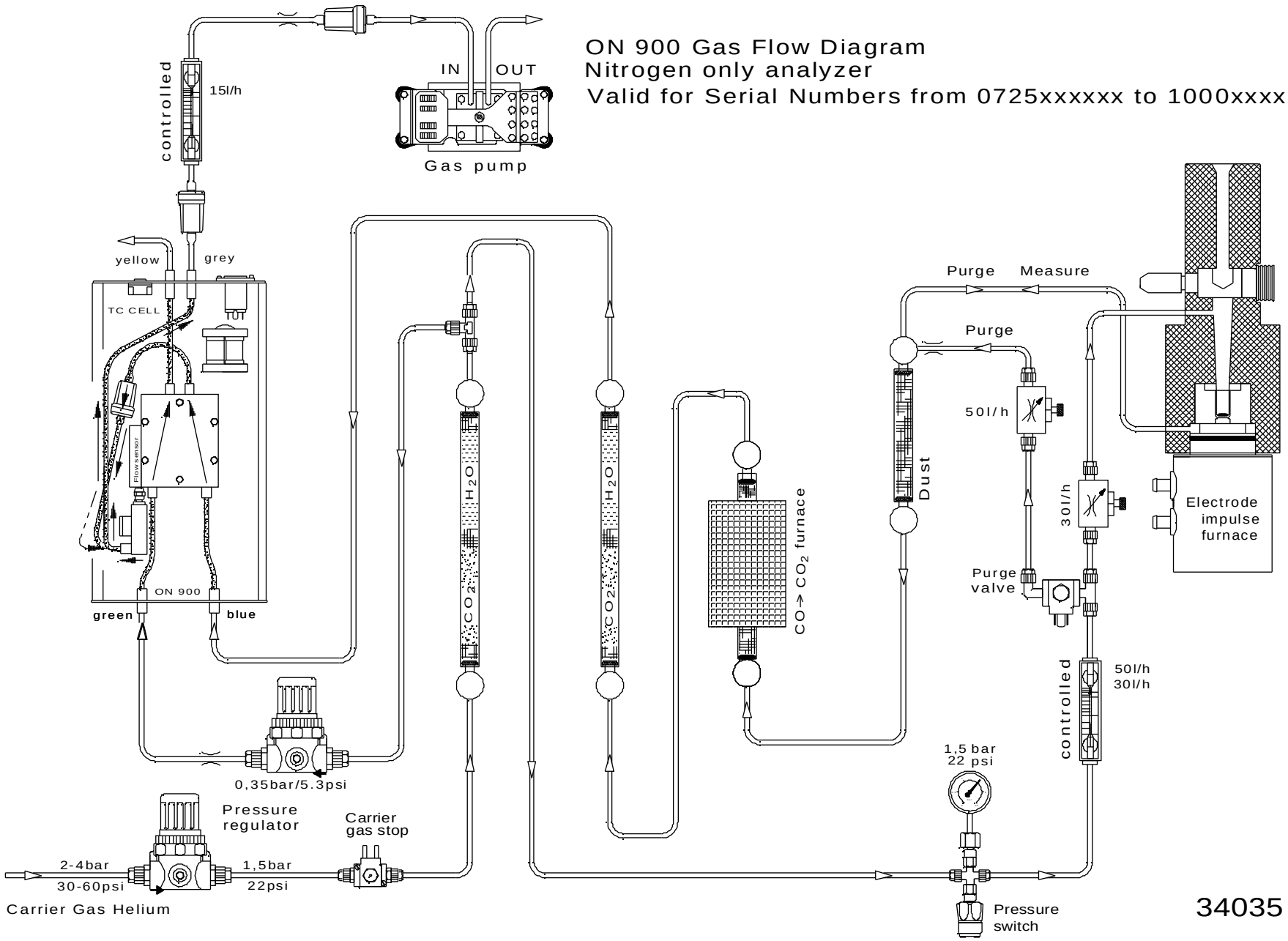
34025

ON 900 Gas Flow Diagram
Nitrogen only analyzer
Valid for Serial Numbers from 0450xxxxxx up to0724xxxxxx

34030

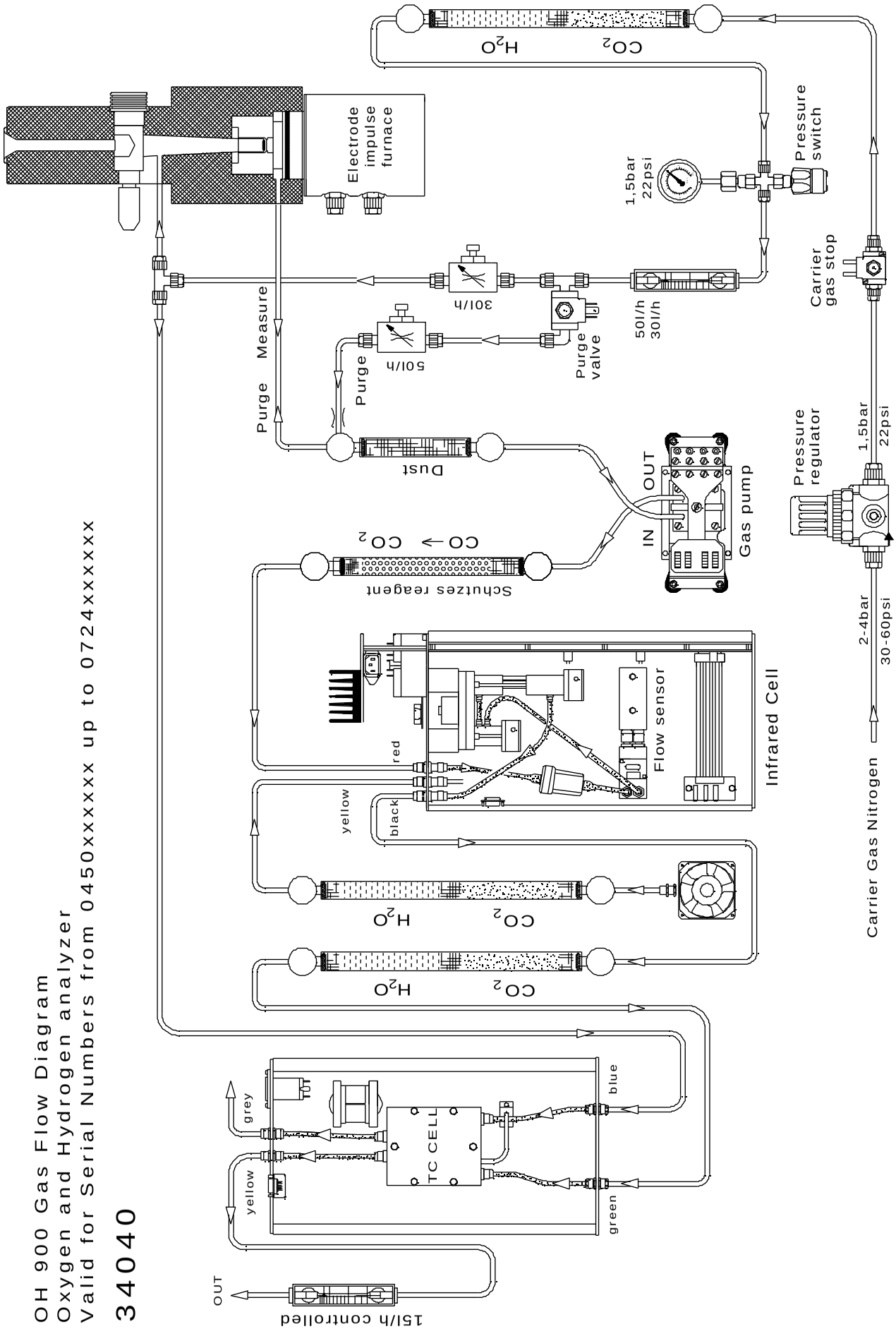


ON 900 Gas Flow Diagram
Nitrogen only analyzer
Valid for Serial Numbers from 0725xxxxxx to 1000xxxxxx

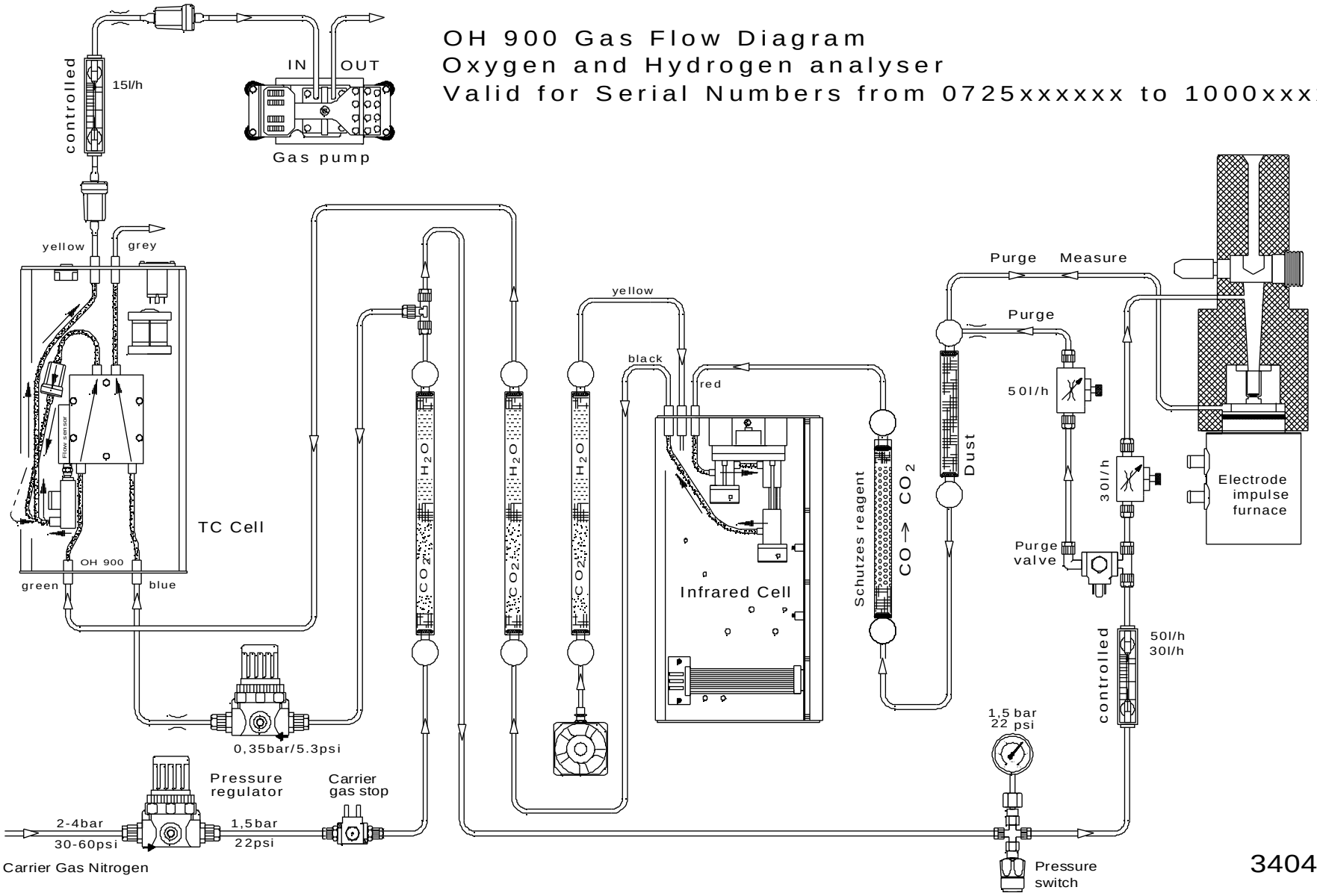


34035

Older version

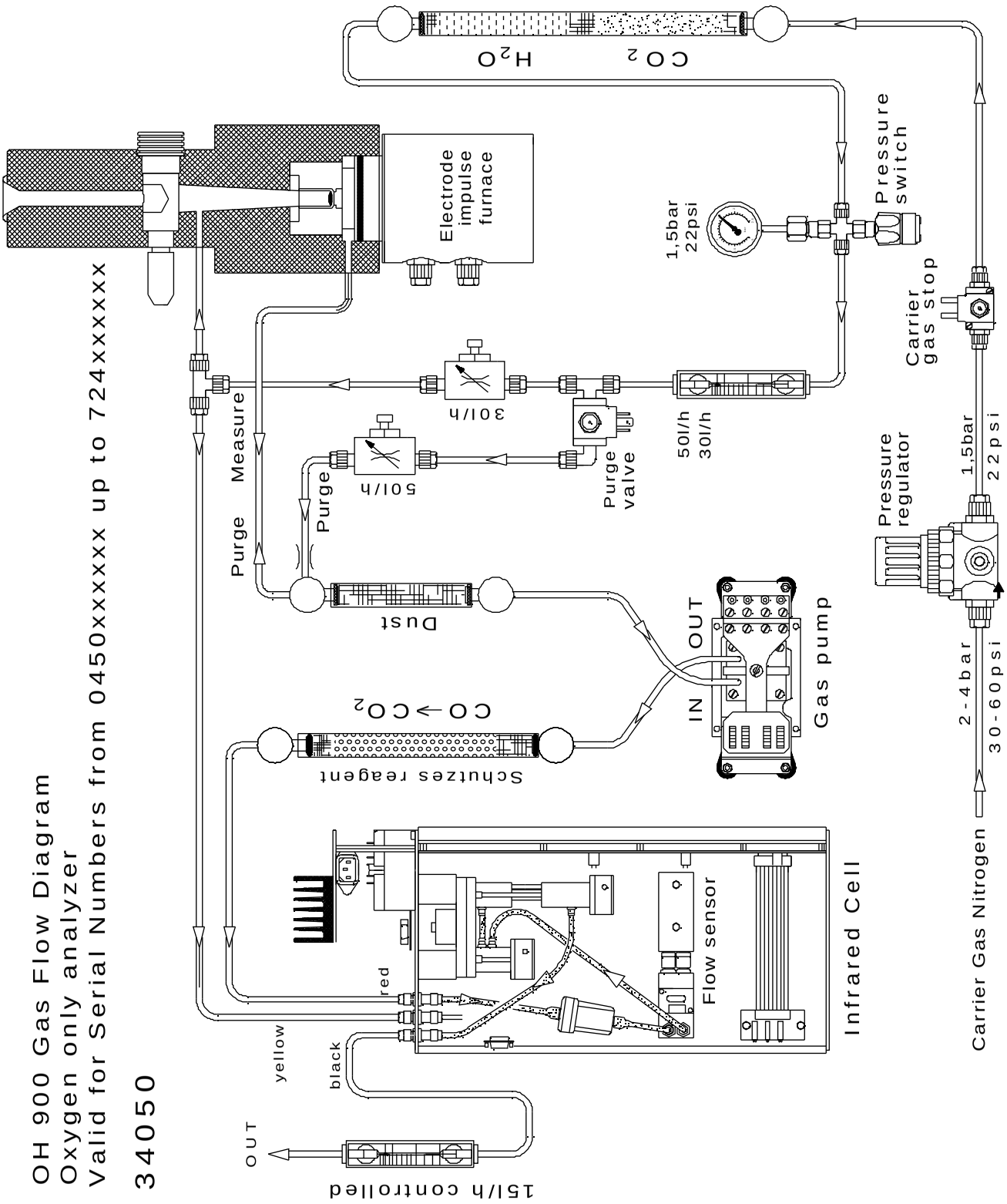


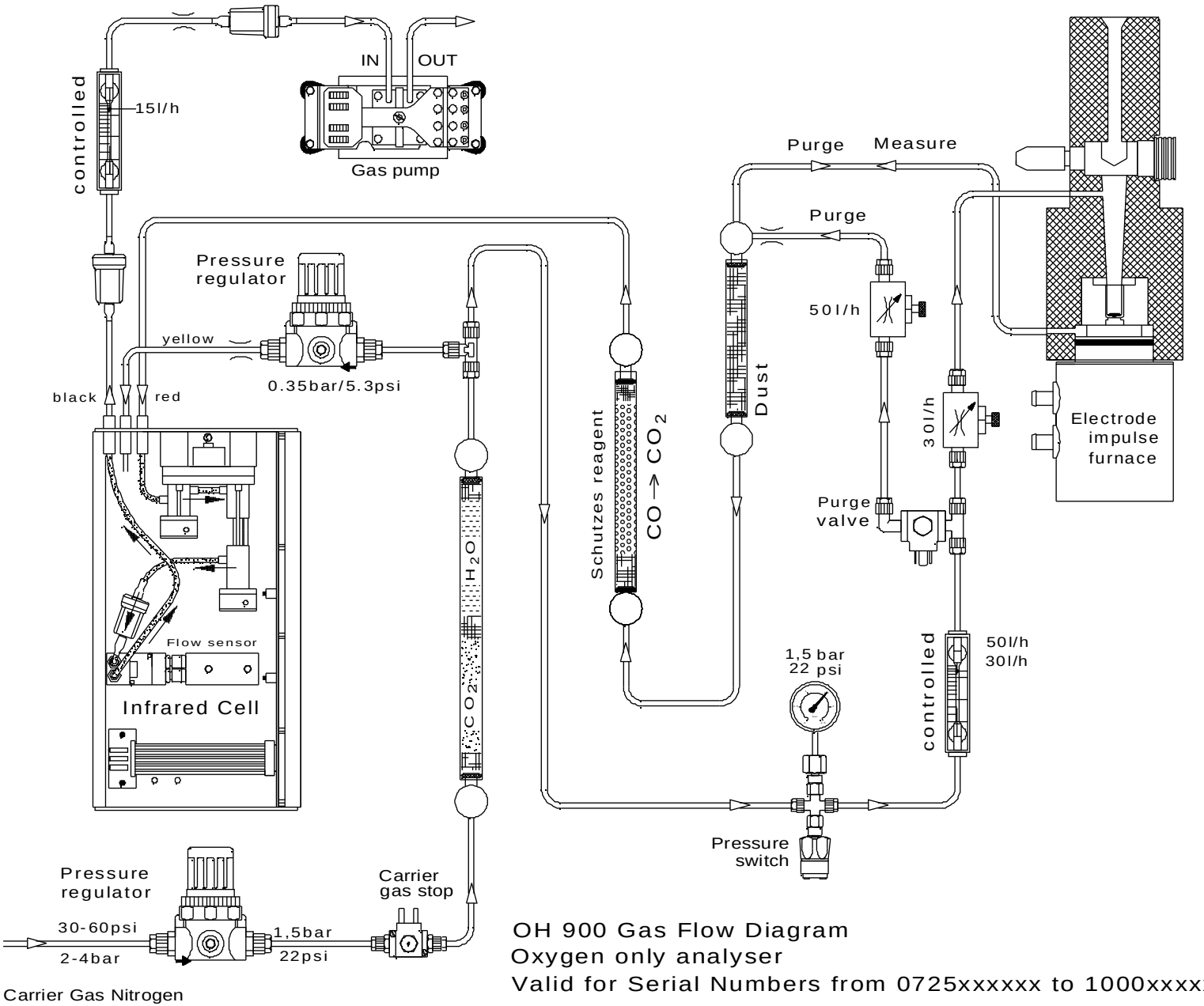
OH 900 Gas Flow Diagram
Oxygen and Hydrogen analyser
Valid for Serial Numbers from 0725xxxxxx to 1000xxxxxx



34045

Older version



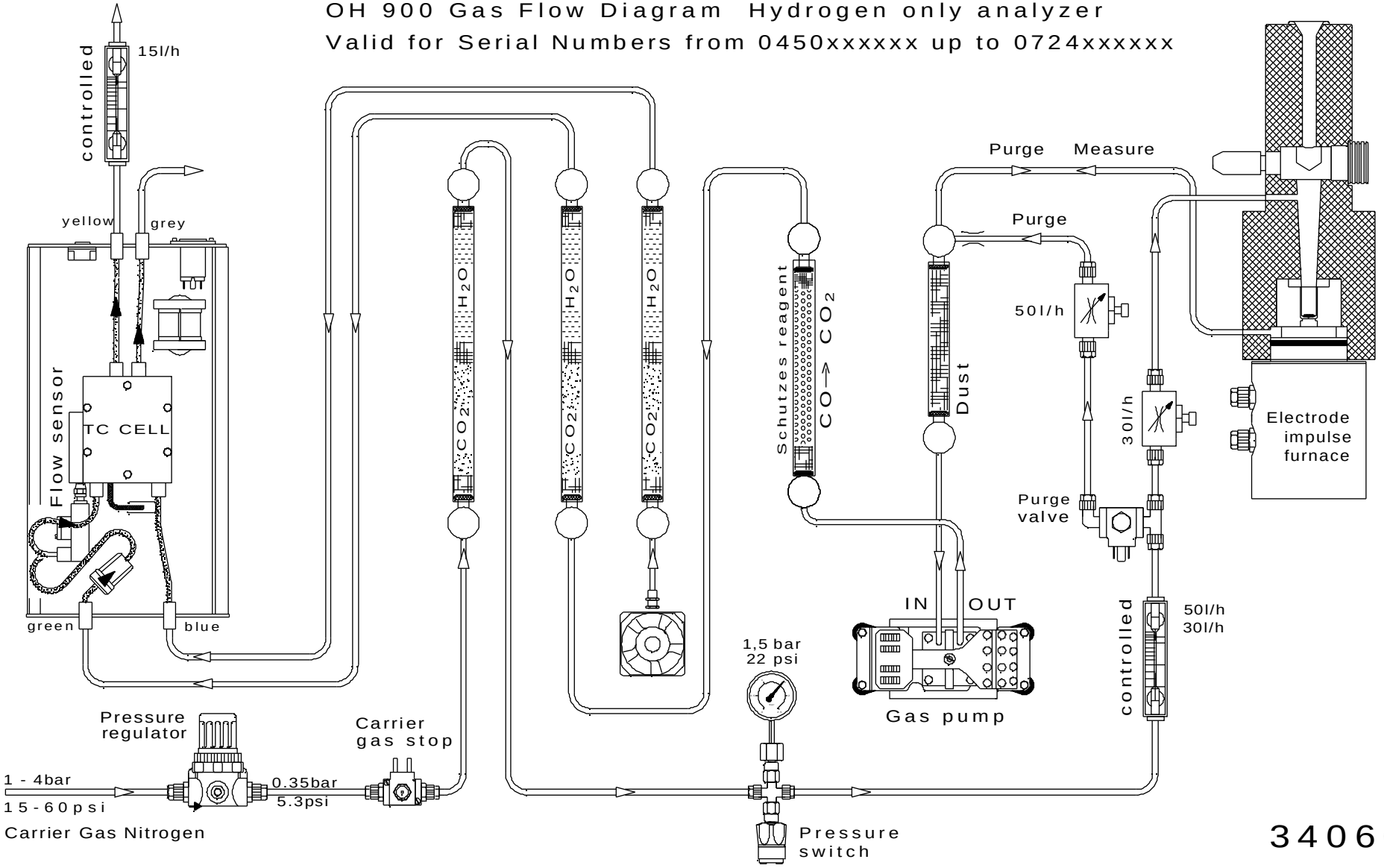


OH 900 Gas Flow Diagram
Oxygen only analyser
Valid for Serial Numbers from 0725xxxxxx to 1000xxxxxx

34055

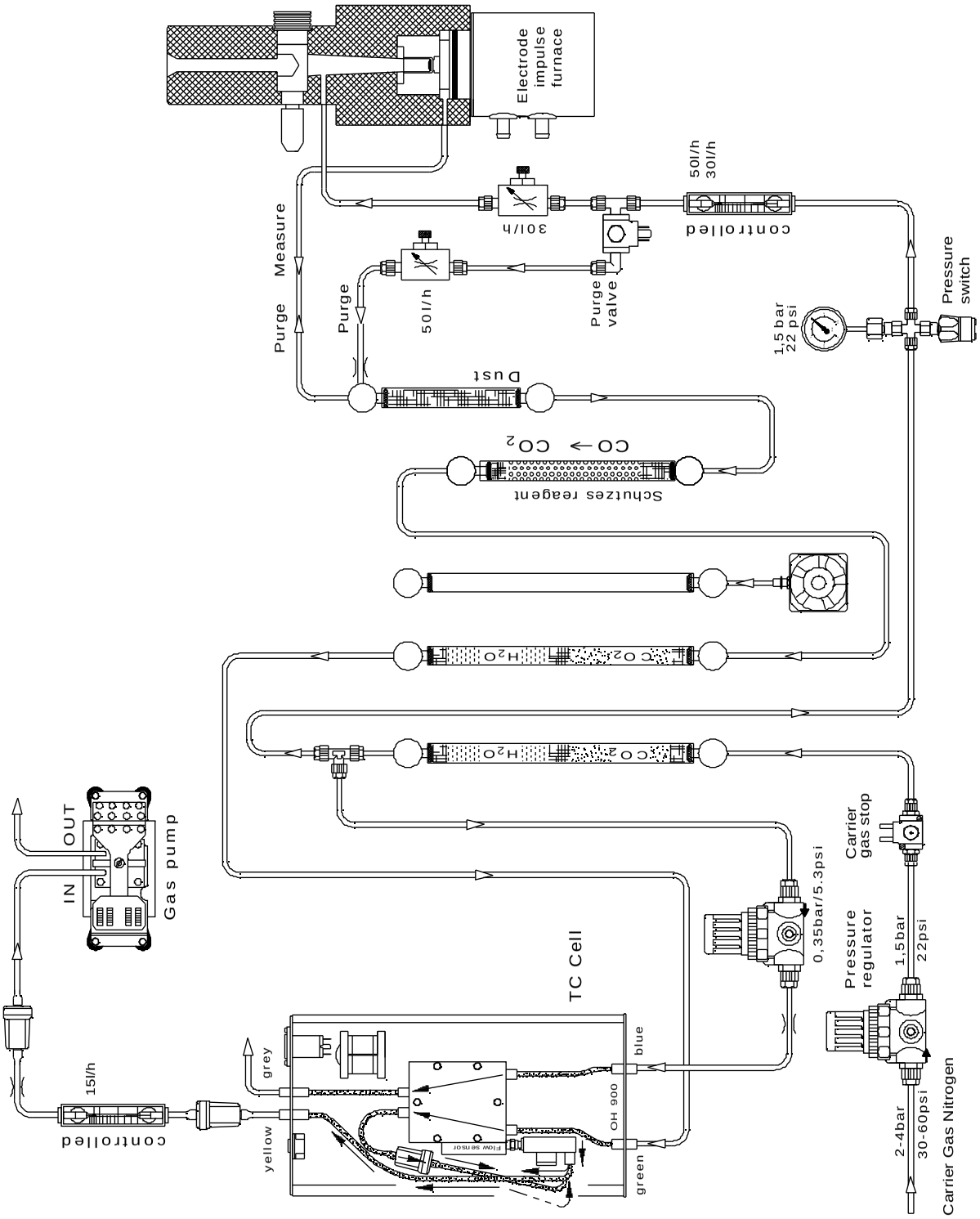
OH 900 Gas Flow Diagram Hydrogen only analyzer

Valid for Serial Numbers from 0450xxxxxx up to 0724xxxxxx



34060

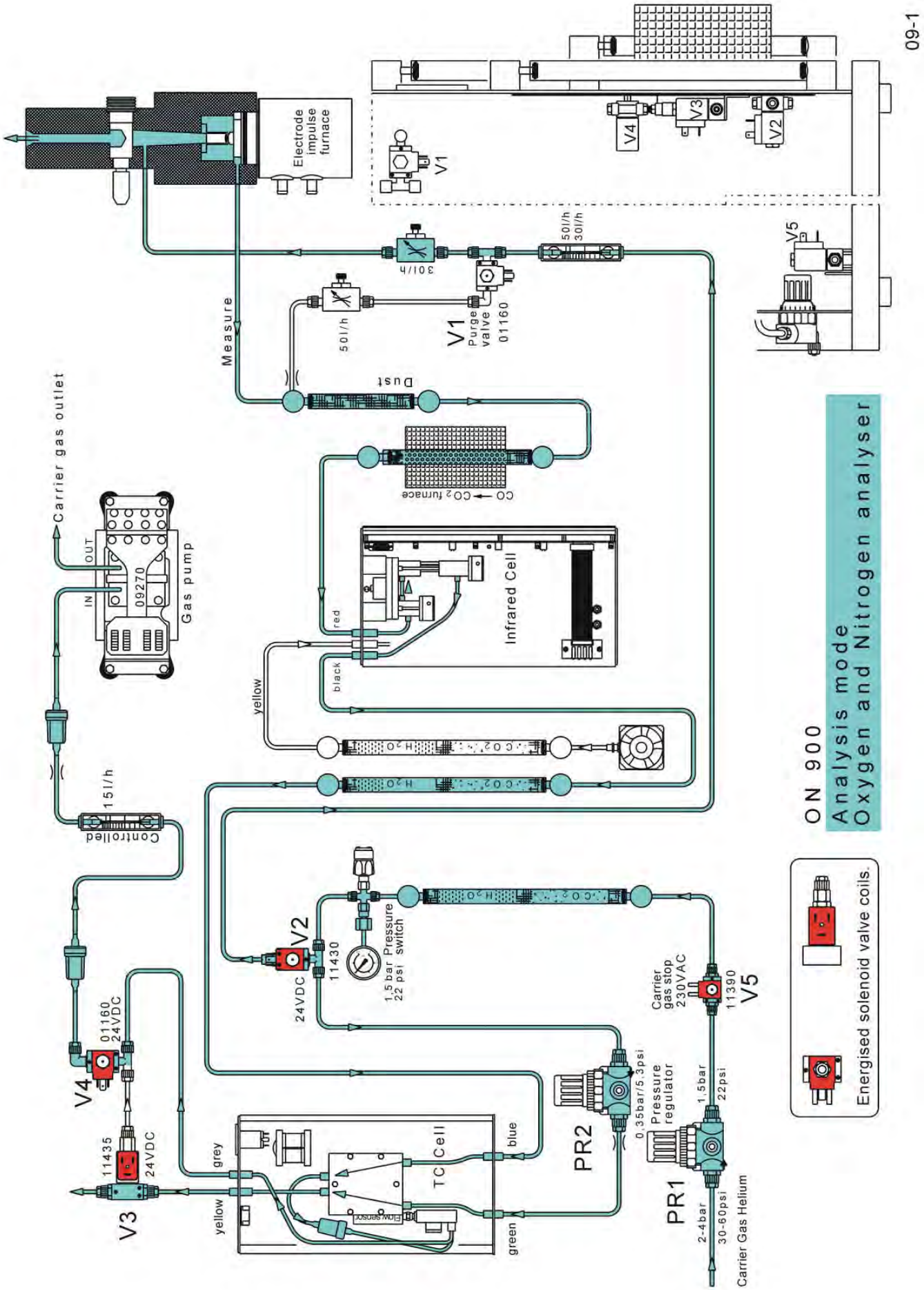
Newer version

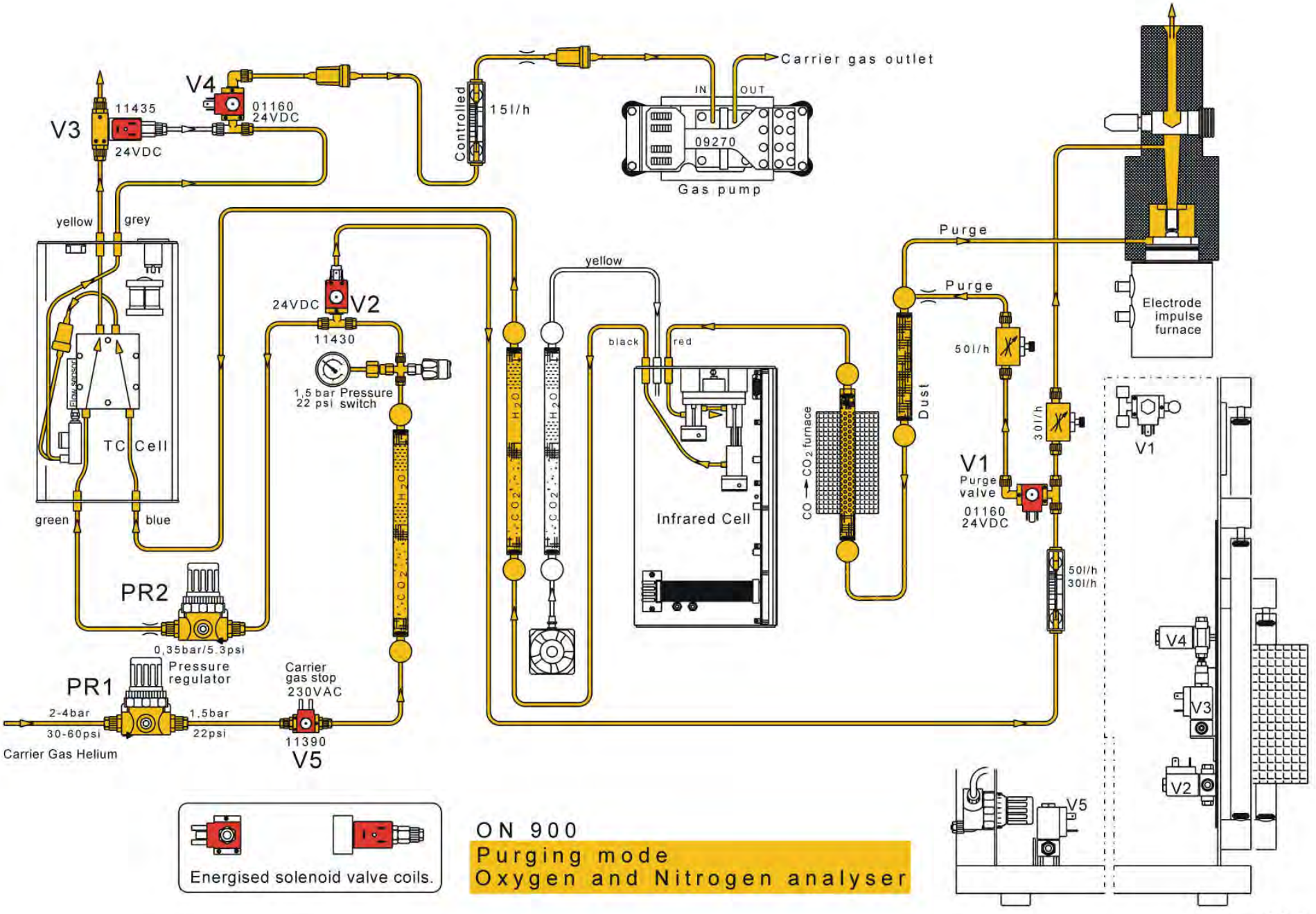


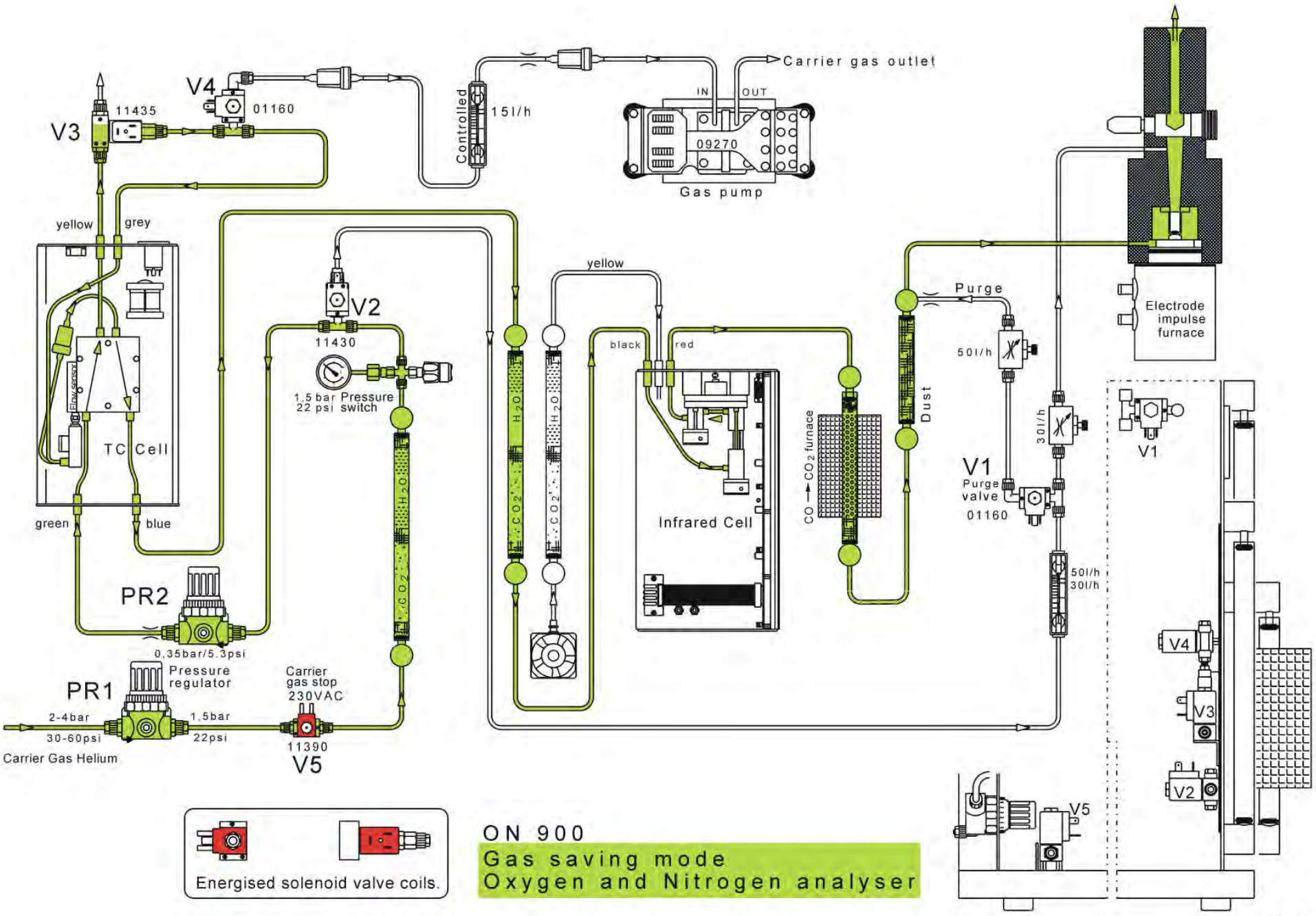
34065

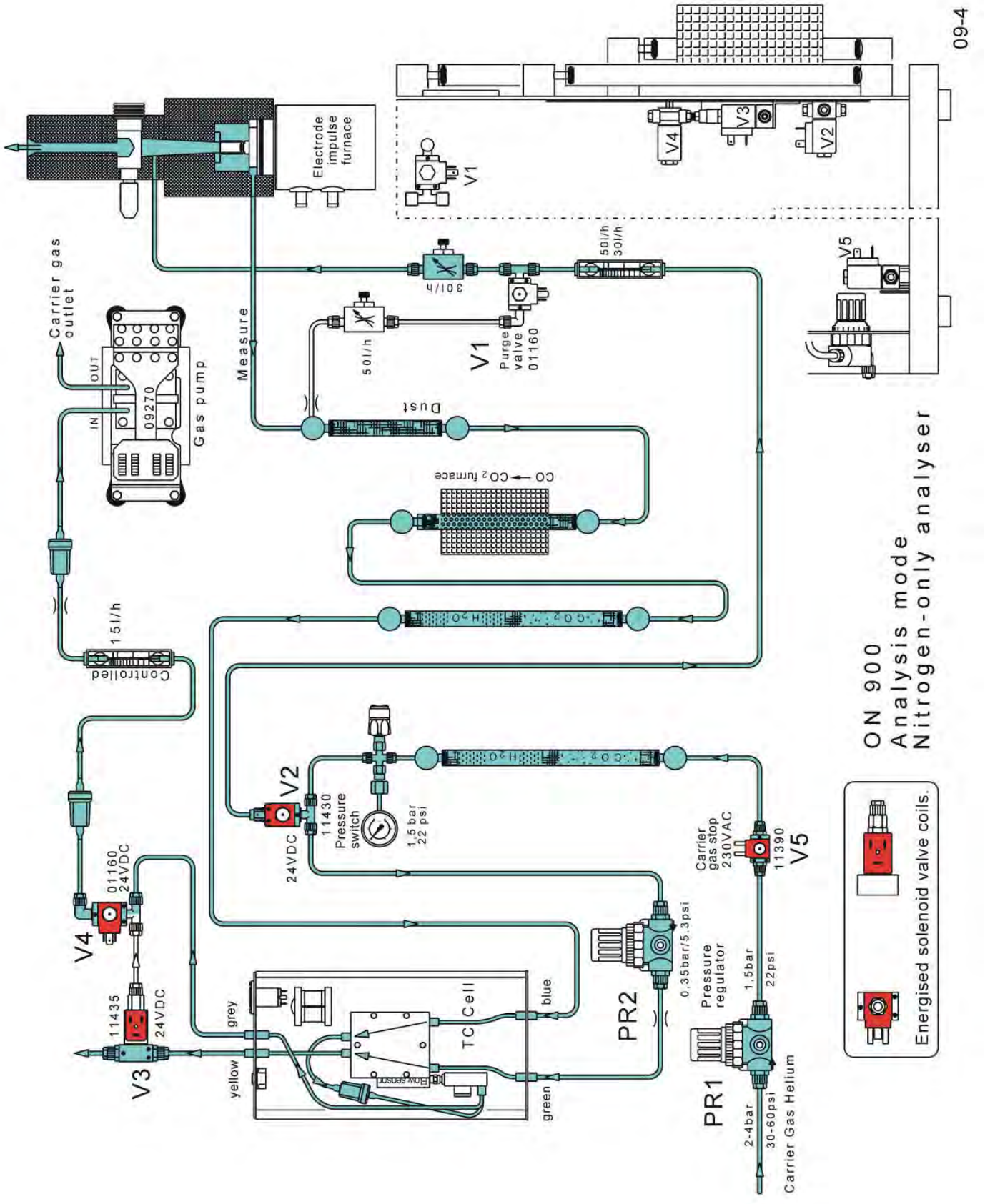
OH 900 Gas Flow Diagram Hydrogen only analyzer
Valid for Serial Numbers from 0725xxxxxx to 1000xxxxxx

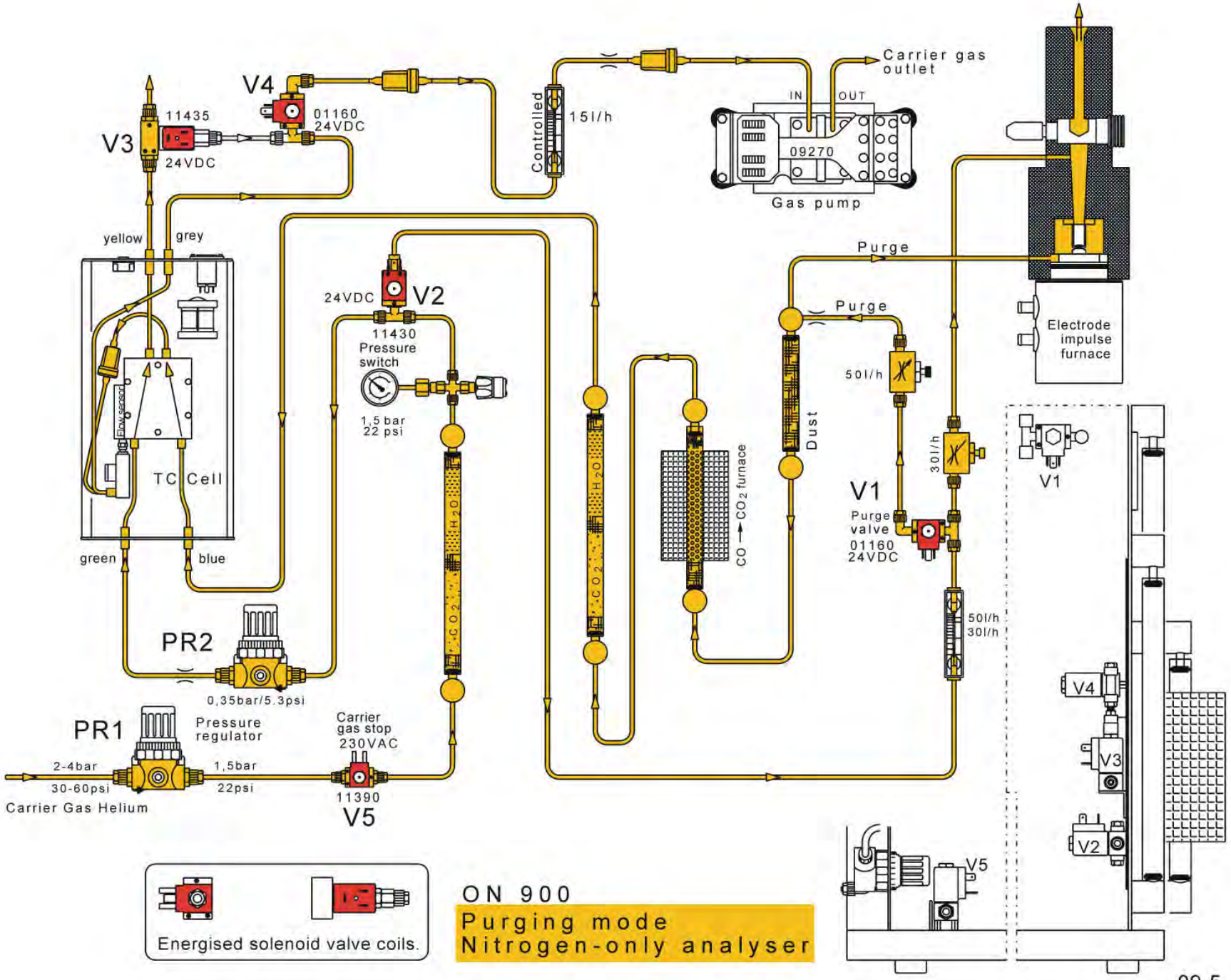
Gas flow diagrams valid for serial numbers from 1000xxxxxx

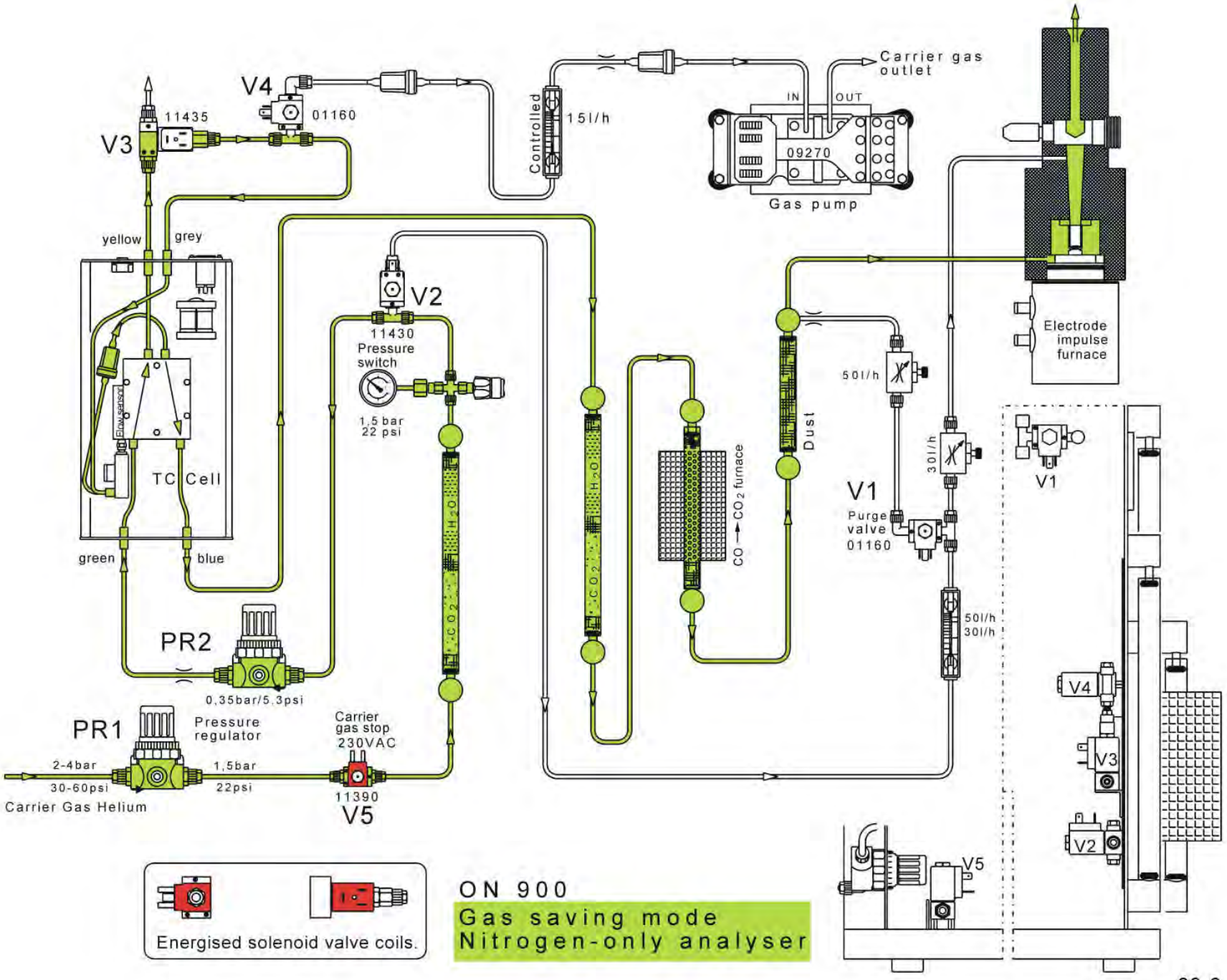


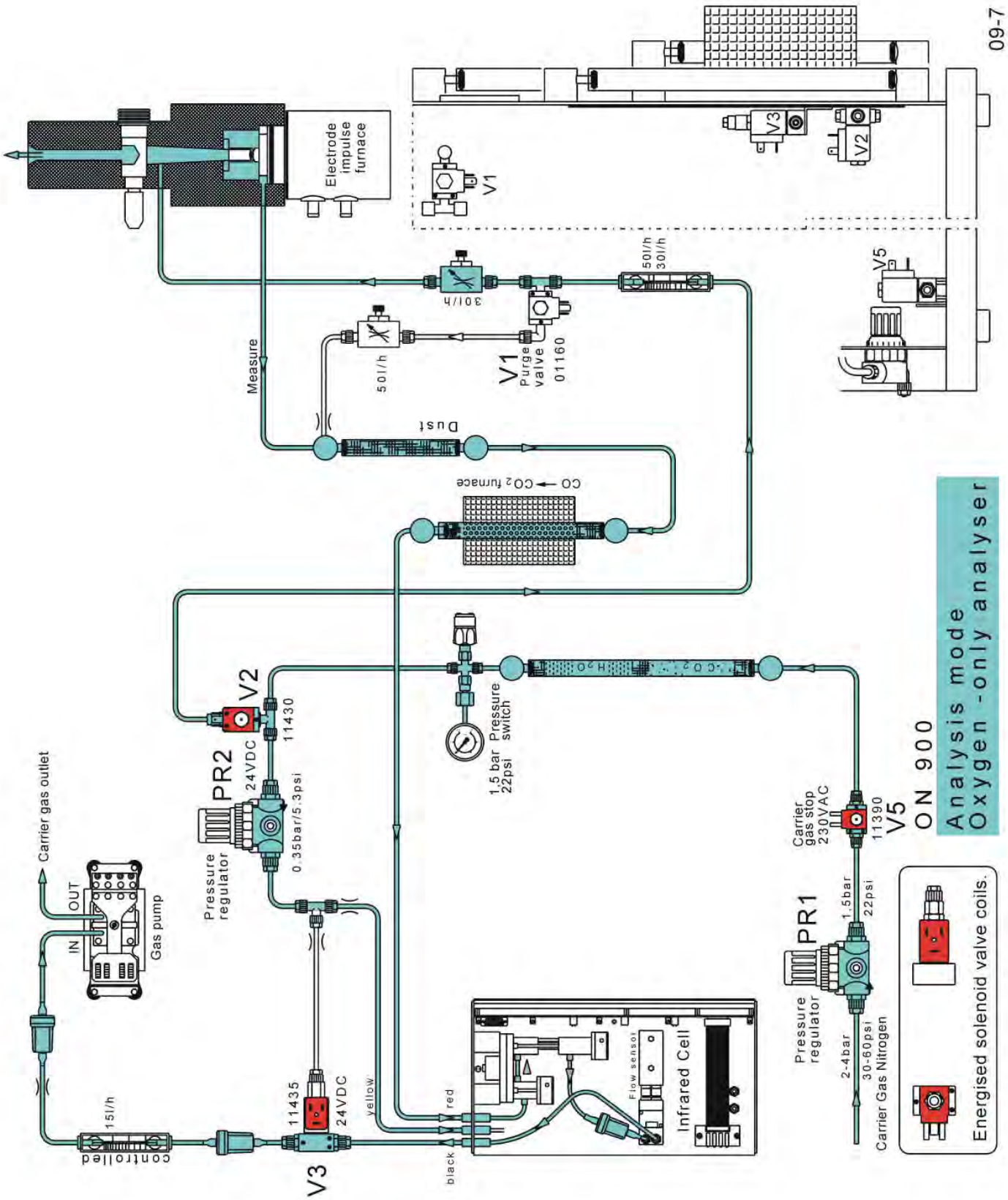


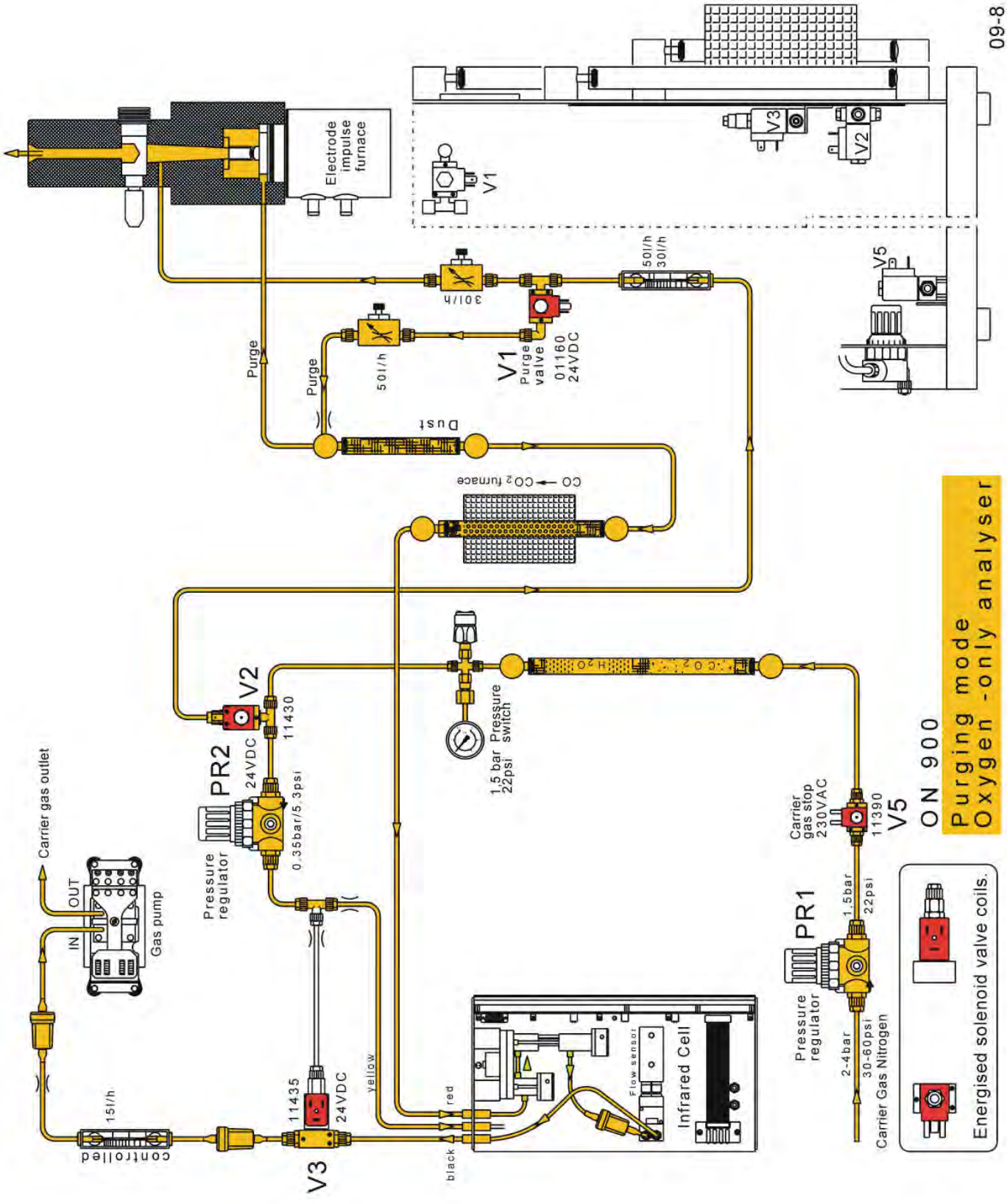


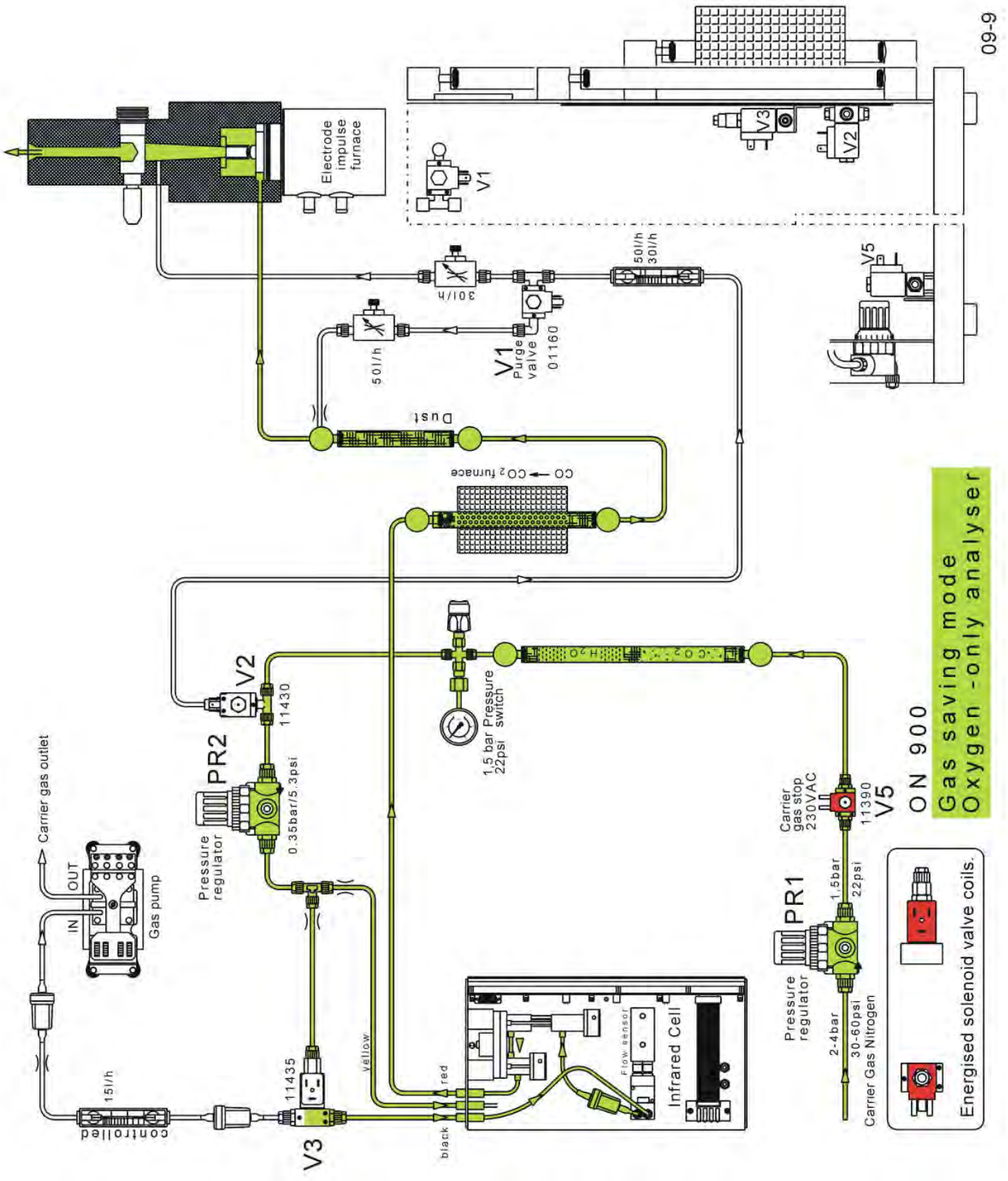

09-4
ON 900
Analysis mode
Nitrogen-only analyser
Energised solenoid valve coils.
Electrode impulse furnace
V1
V2
V3
V4
V5
Purge valve 01160
Measure
Dust
Gas pump
09270
IN
OUT
Carrier gas outlet
Controlled 1.5l/h
50l/h
30l/h
CO → CO2 furnace
H2O
Pressure switch 11430
1,5 bar 22 psi
24VDC
01160 24VDC
11435 24VDC
Carrier gas stop 230VAC 11390
PR1
PR2
Pressure regulator
0,35bar/5.3psi
1,5bar
22psi
2-4bar
30-60psi
Carrier Gas Helium
TC Cell
Flow sensor
grey
yellow
blue
green

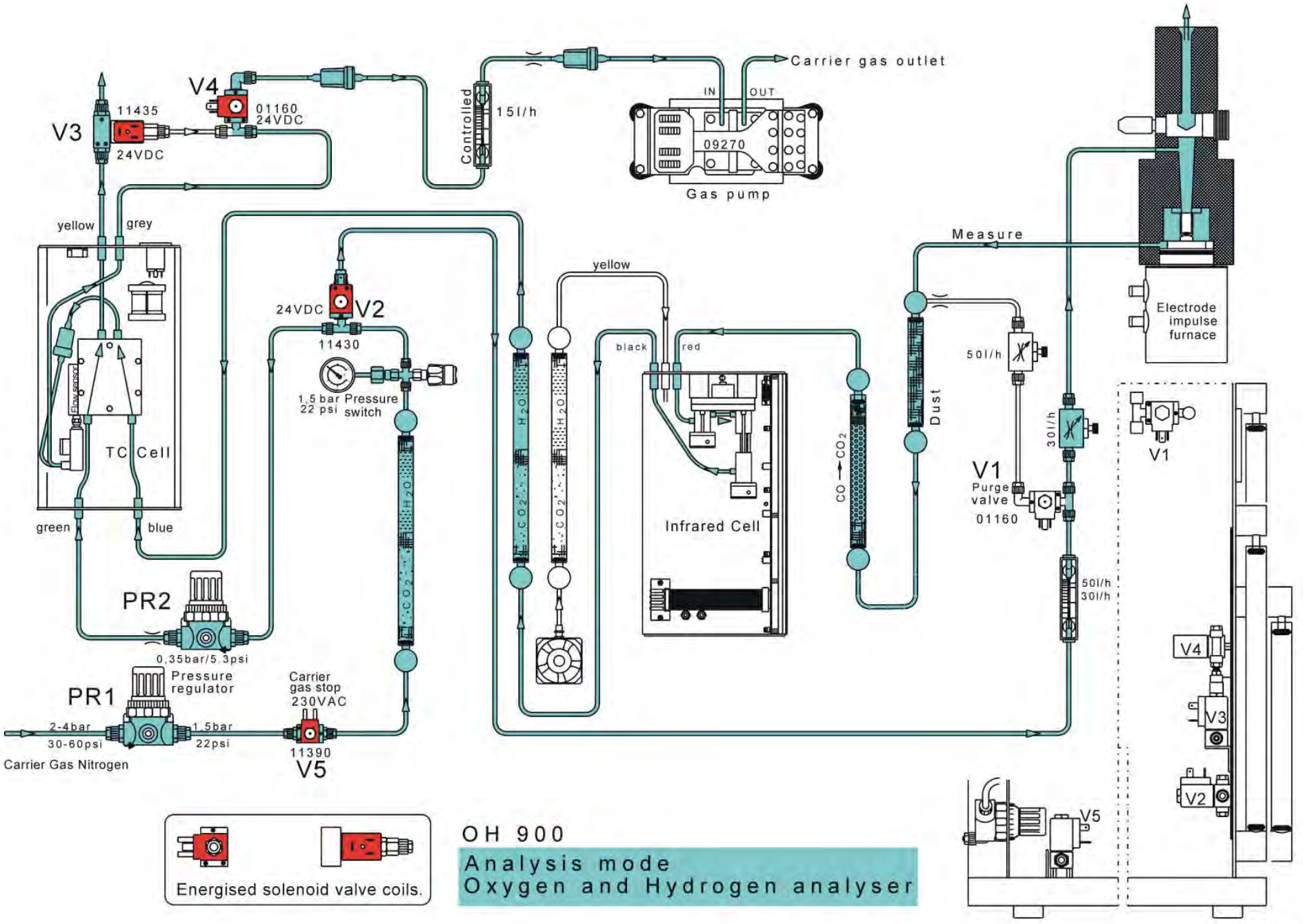


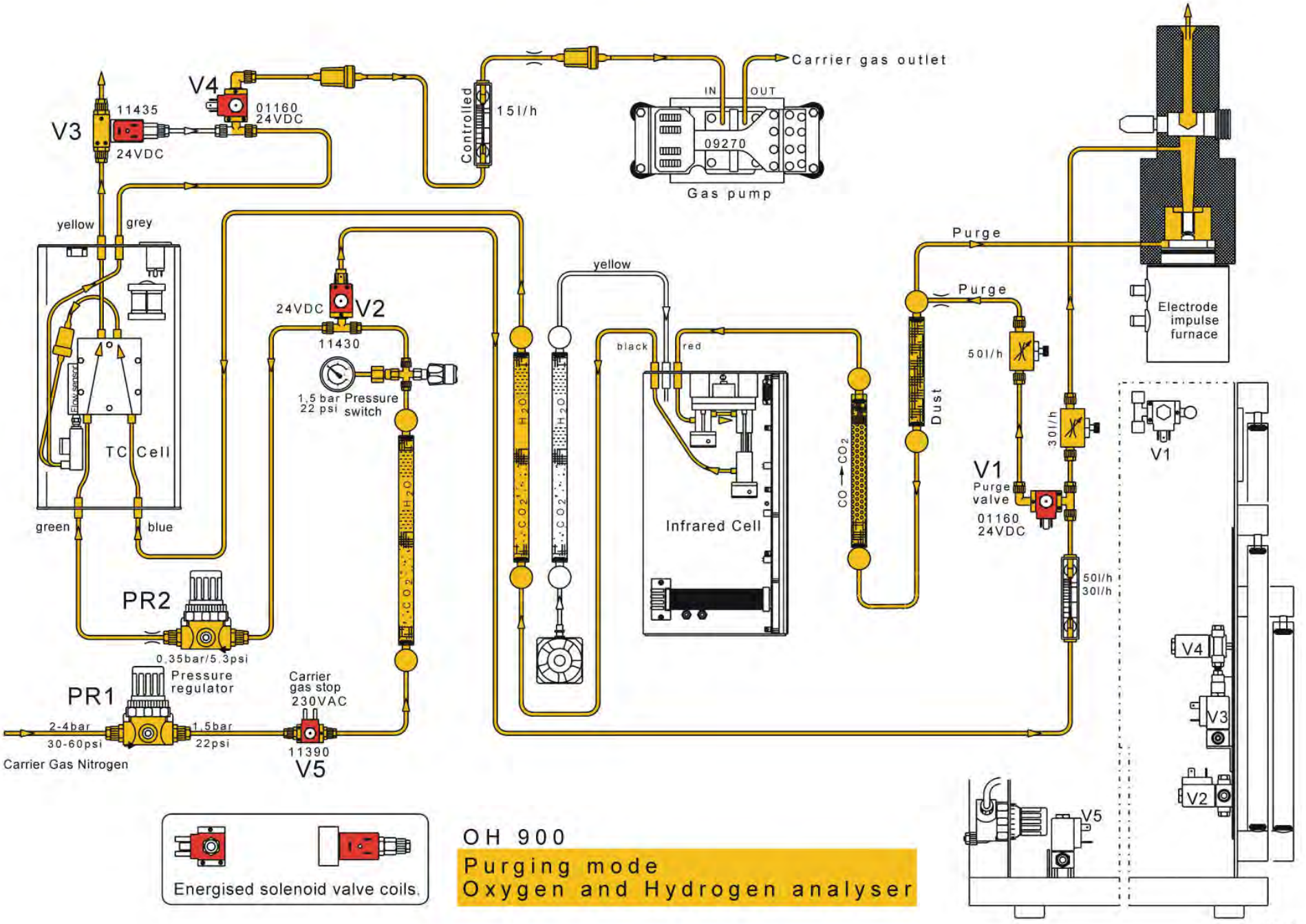


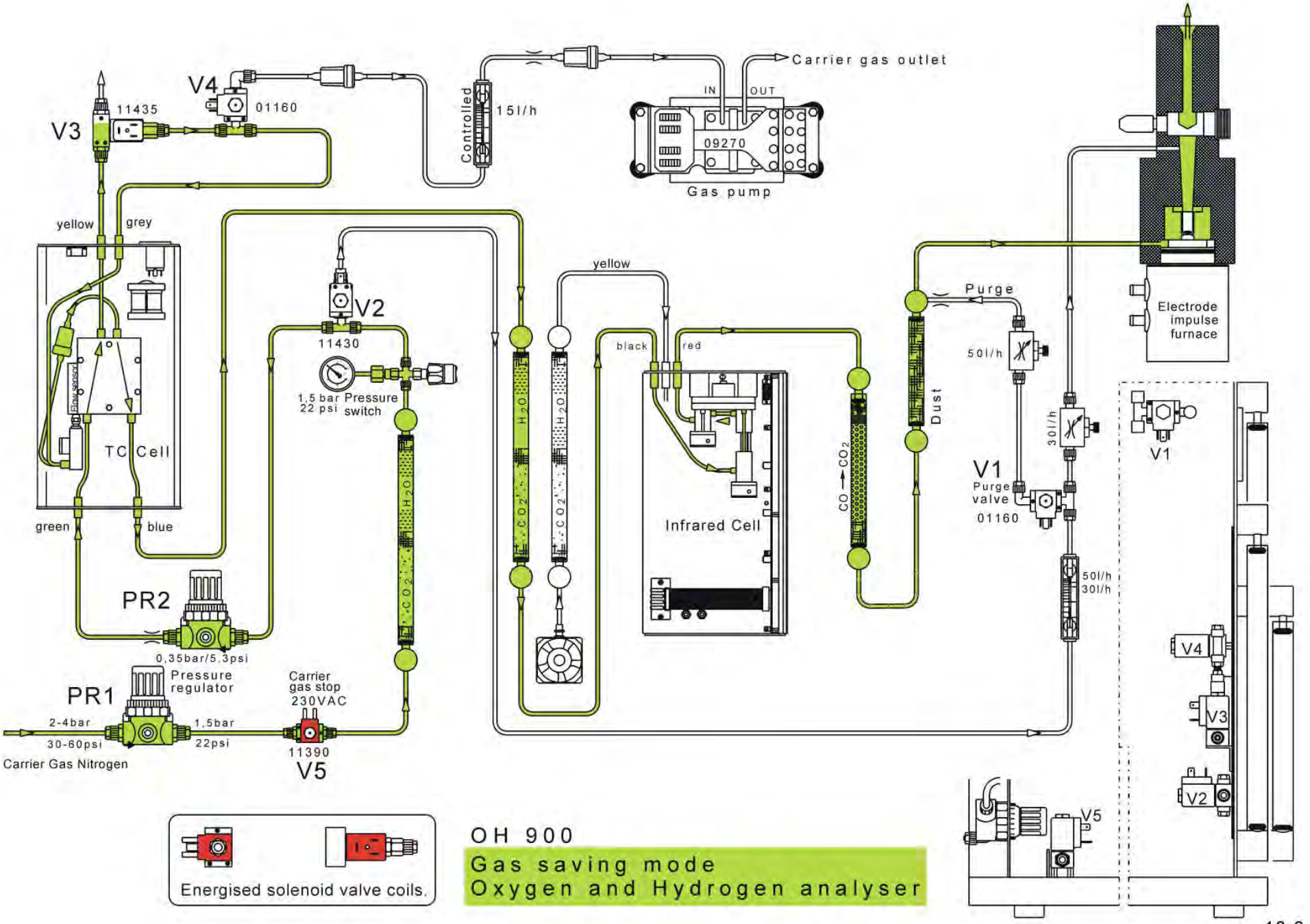

09-7
Electrode impulse furnace
V1
V3
V2
V5
50l/h
30l/h
30l/h
50l/h
V1
Purge valve
01160
Measure
Dust
CO → CO2 furnace
1,5 bar Pressure switch
V2
11430
PR2
24VDC
0.35bar/5.3psi
Pressure regulator
Carrier gas outlet
OUT
IN
Gas pump
15l/h
controlled
11435
24VDC
V3
yellow
red
black
Flow sensor
Infrared Cell
Carrier gas stop 230VAC
11390
V5
PR1
1.5bar
22psi
Pressure regulator
2-4bar
30-60psi
Carrier Gas Nitrogen
ON 900
Analysis mode
Oxygen -only analyser
Energised solenoid valve coils.

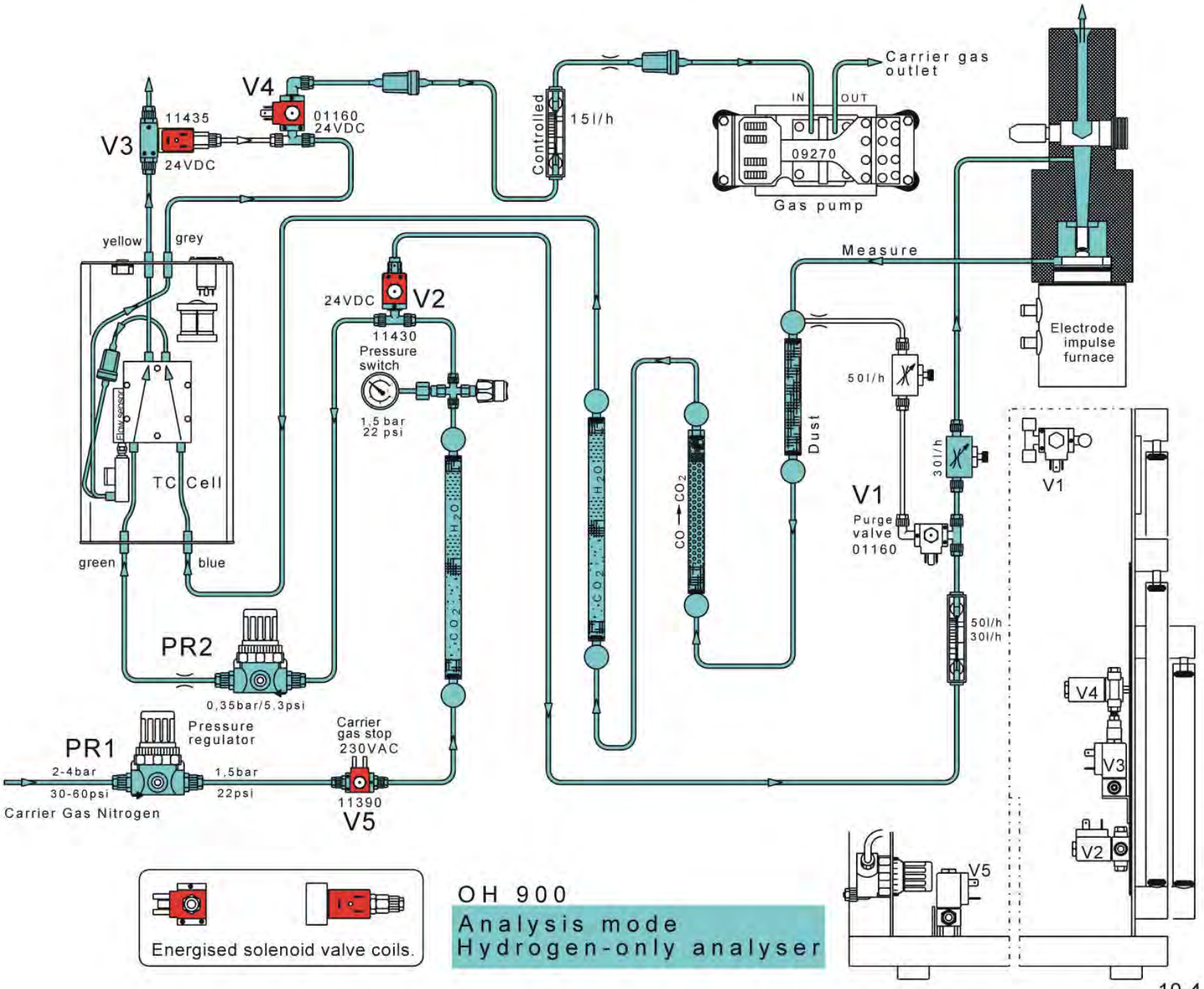

09-8
Electrode impulse furnace
V1
V3
V2
V5
30l/h
50l/h
30l/h
Purge
Purge
50l/h
V1
Purge valve
01160
24VDC
Dust
CO → CO2 furnace
1.5 bar
22psi
Pressure switch
H2O
CO2
V2
PR2
24VDC
11430
0.35bar/5.3psi
Pressure regulator
Carrier gas outlet
OUT
IN
Gas pump
15l/h
controlled
11435
24VDC
V3
yellow
red
black
Flow sensor
Infrared Cell
Carrier gas stop
230VAC
11390
V5
ON 900
Purging mode
Oxygen -only analyser
PR1
1.5bar
22psi
Pressure regulator
2-4bar
30-60psi
Carrier Gas Nitrogen
Energised solenoid valve coils.

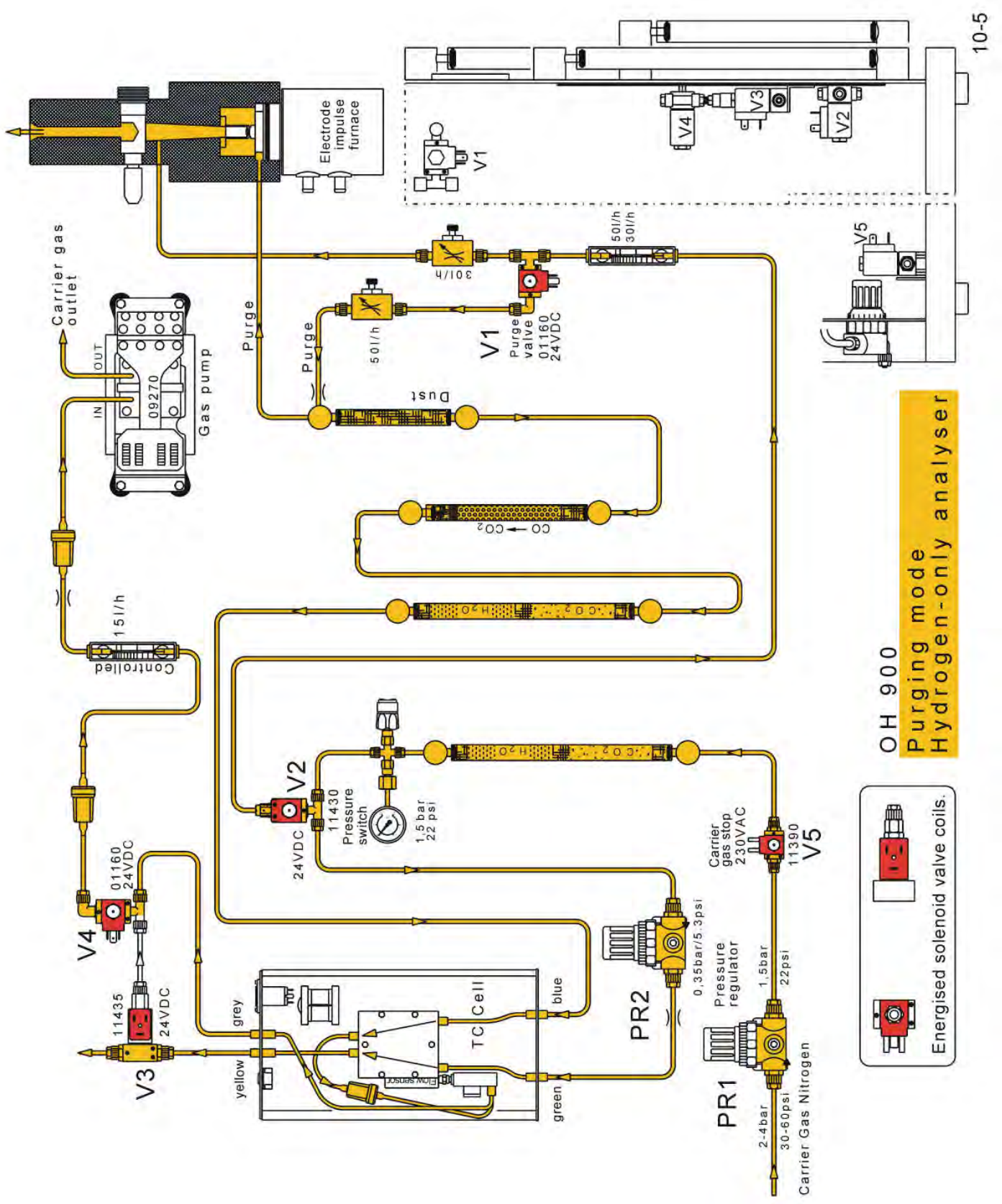

09-9
Electrode impulse furnace
V1
V3
V2
V5
50l/h
30l/h
V1 Purge valve 01160
Dust
CO → CO2 furnace
1,5 bar Pressure switch 22psi
V2
11430
PR2
Pressure regulator
0..35bar/5.3psi
Carrier gas outlet
OUT
IN
Gas pump
15l/h
controlled
11435
V3
yellow
red
black
Infrared Cell
Flow sensor
Carrier gas stop 230VAC
11390
V5
PR1
1.5bar
22psi
Pressure regulator
2-4bar
30-60psi
Carrier Gas Nitrogen
Energised solenoid valve coils.
ON 900
Gas saving mode
Oxygen -only analyser

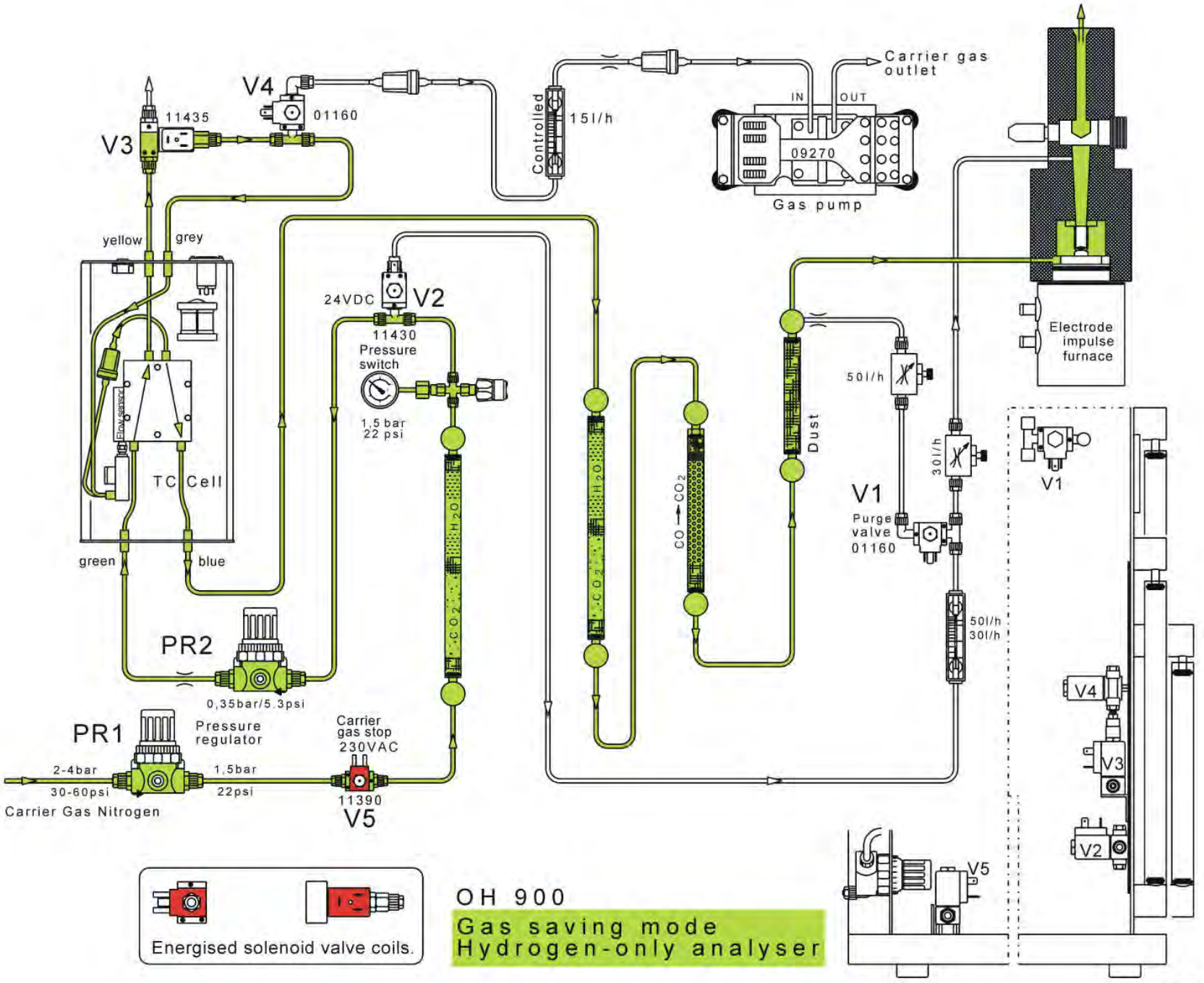


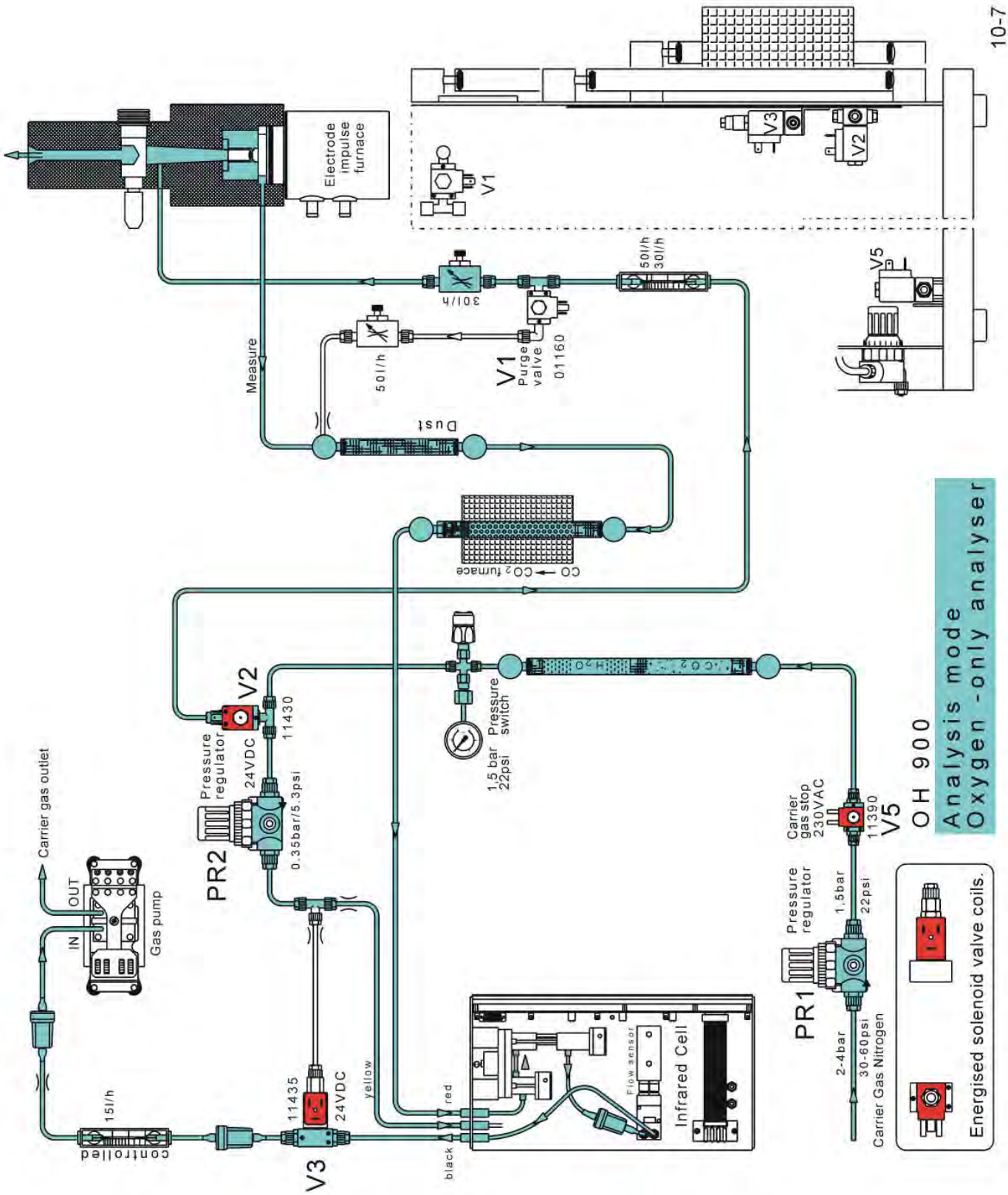


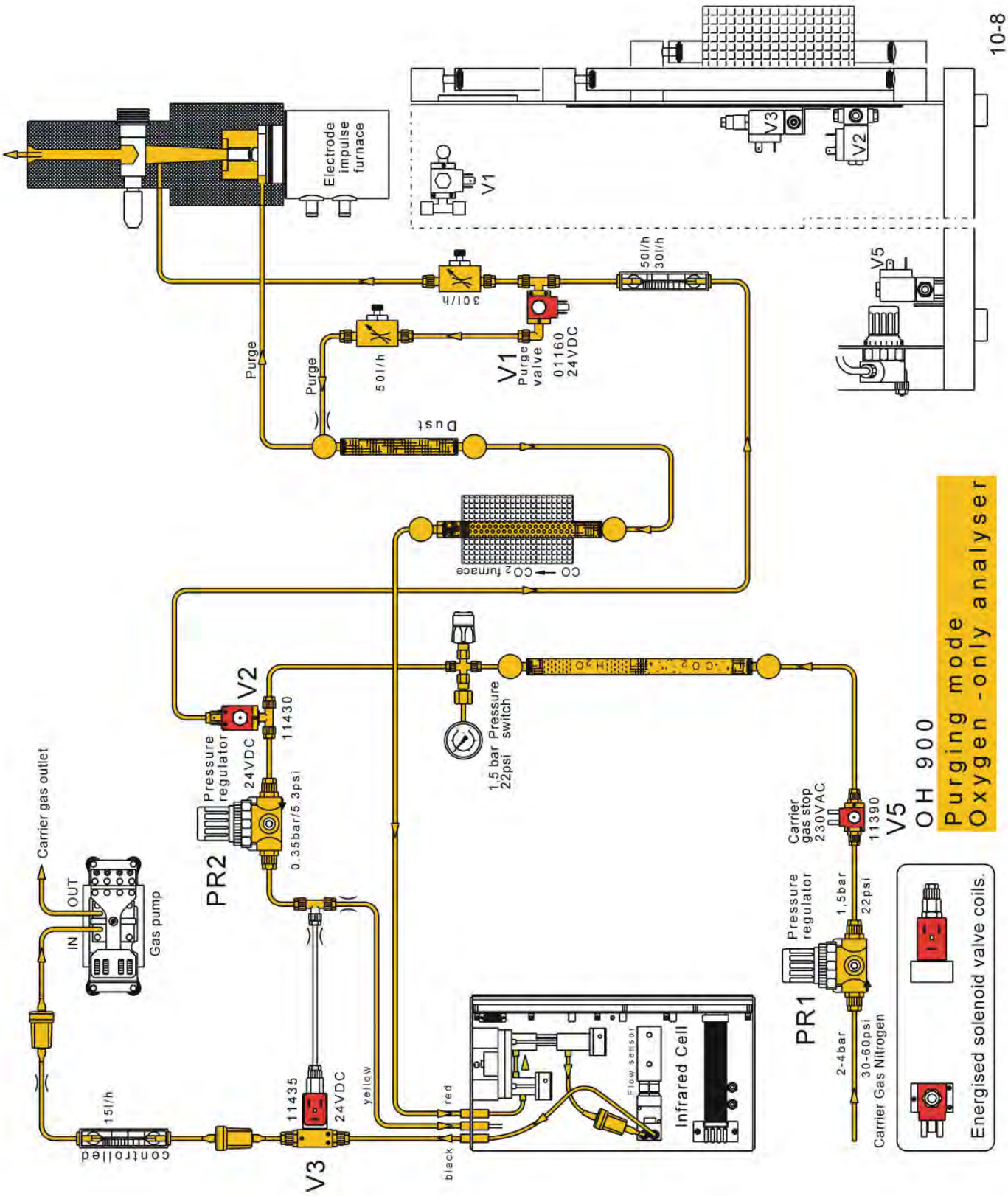


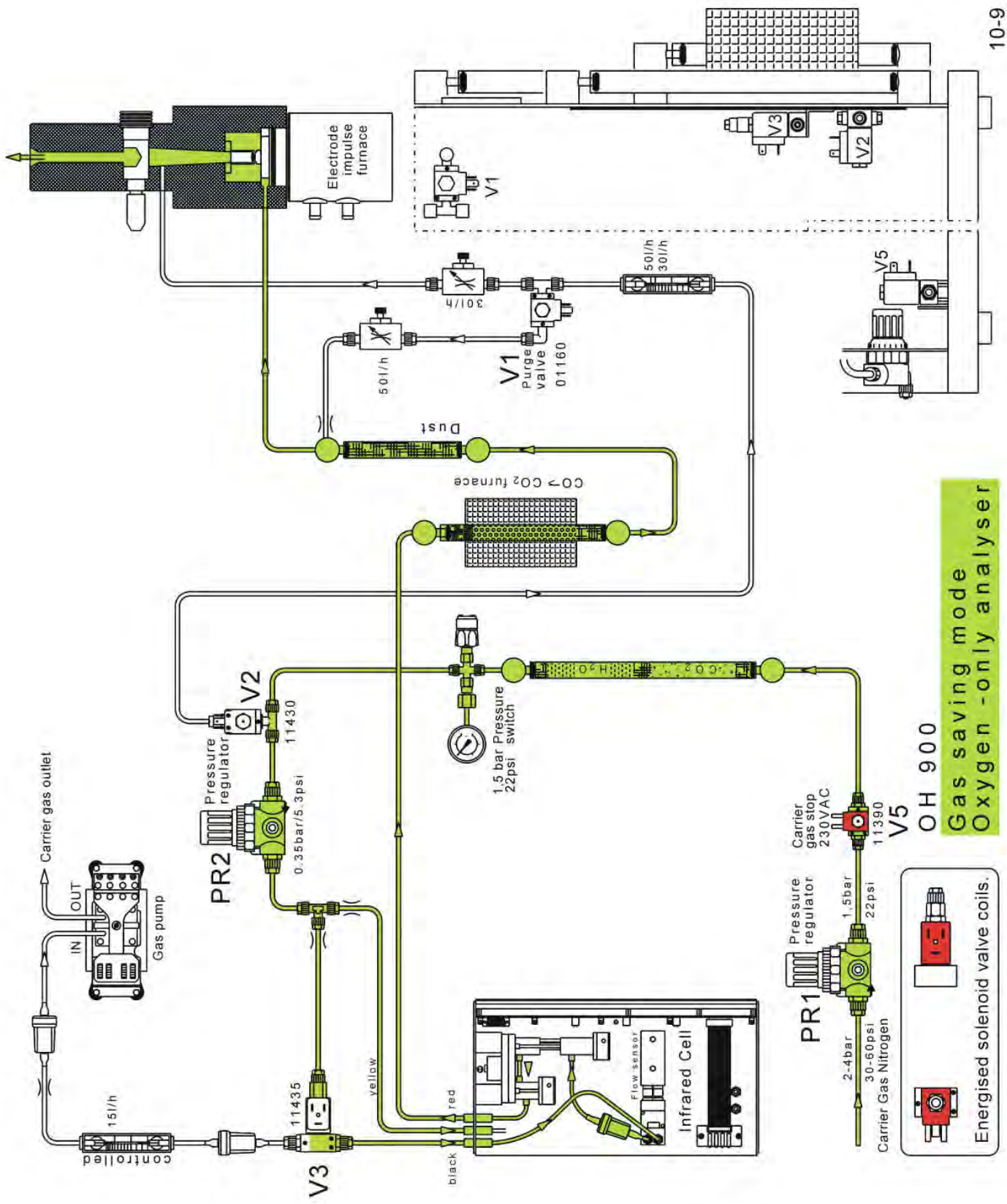


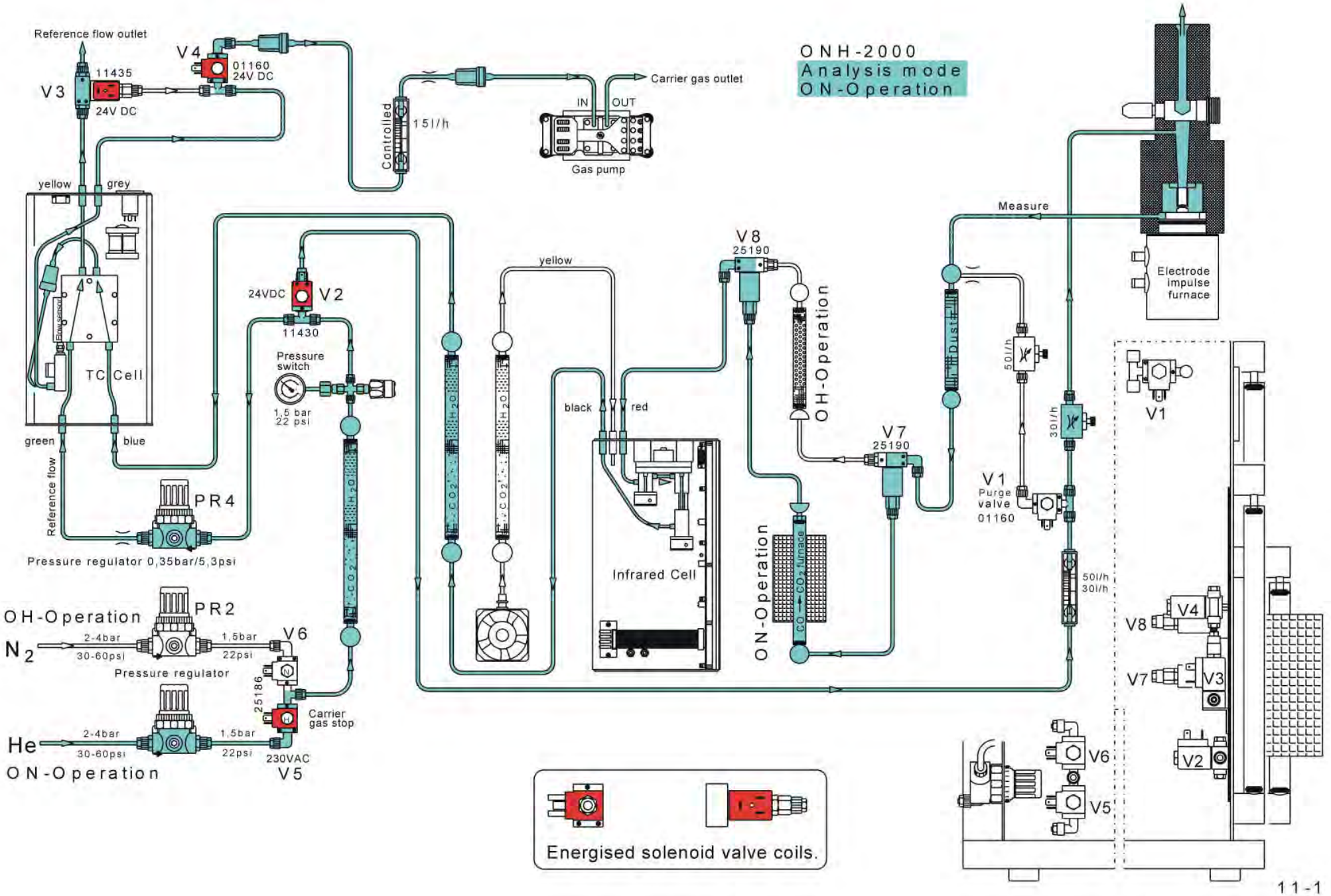

10-5
Electrode impulse furnace
V1
V4
V3
V2
V5
Carrier gas outlet
OUT
IN
09270
Gas pump
Purge
Purge
3 l/h
5 l/h
50l/h
30l/h
V1
Purge valve
01160
24VDC
Dust
CO → CO2
H2O
CO2
15l/h
Controlled
V2
24VDC
11430
Pressure switch
1,5 bar
22 psi
V4
01160
24VDC
11435
24VDC
V3
grey
yellow
TC Cell
Flow sensor
blue
green
PR2
0,35bar/5,3psi
Pressure regulator
1,5bar
22psi
Carrier gas stop
230VAC
11390
V5
PR1
2-4bar
30-60psi
Carrier Gas Nitrogen
OH 900
Purging mode
Hydrogen-only analyser
Energised solenoid valve coils.

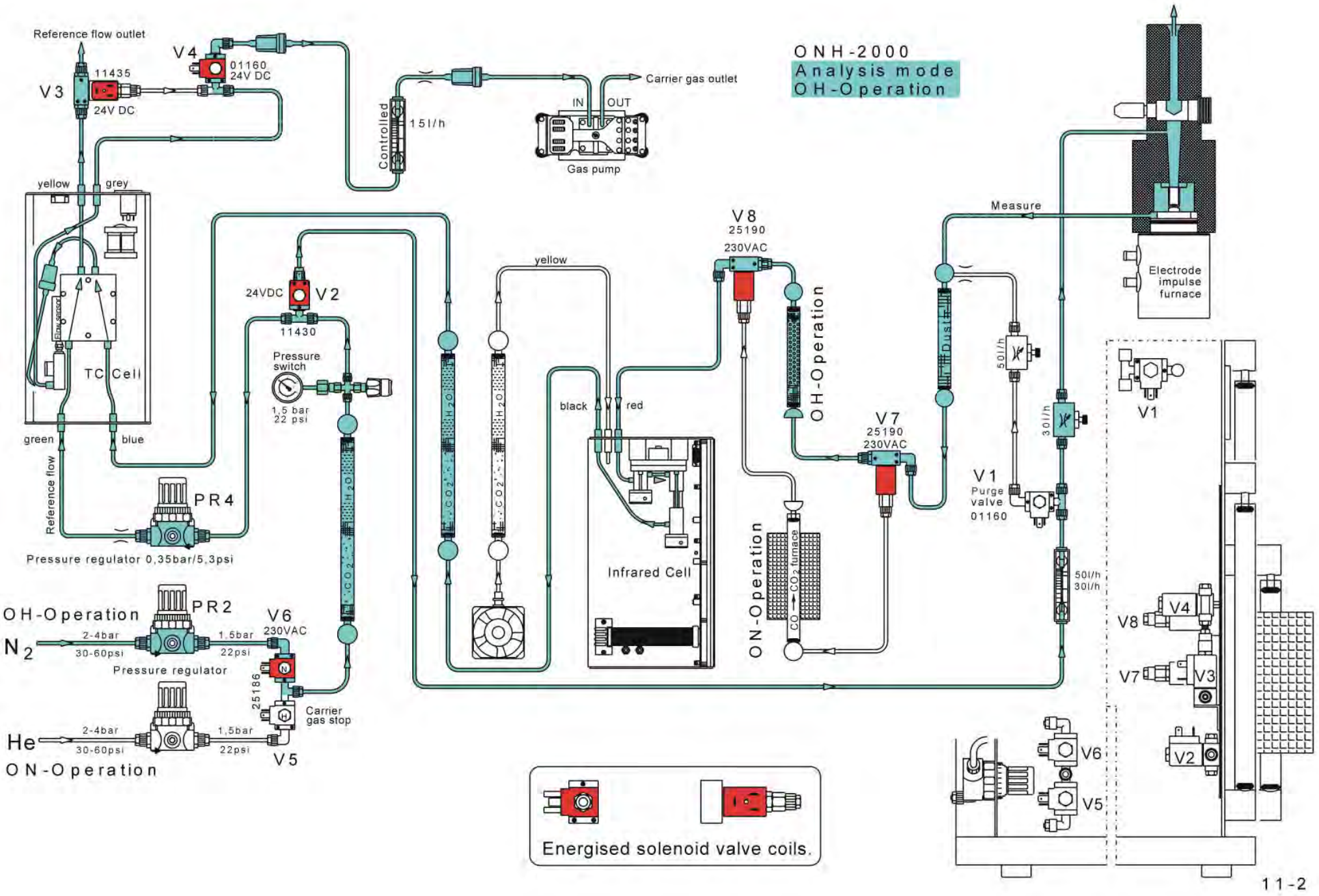


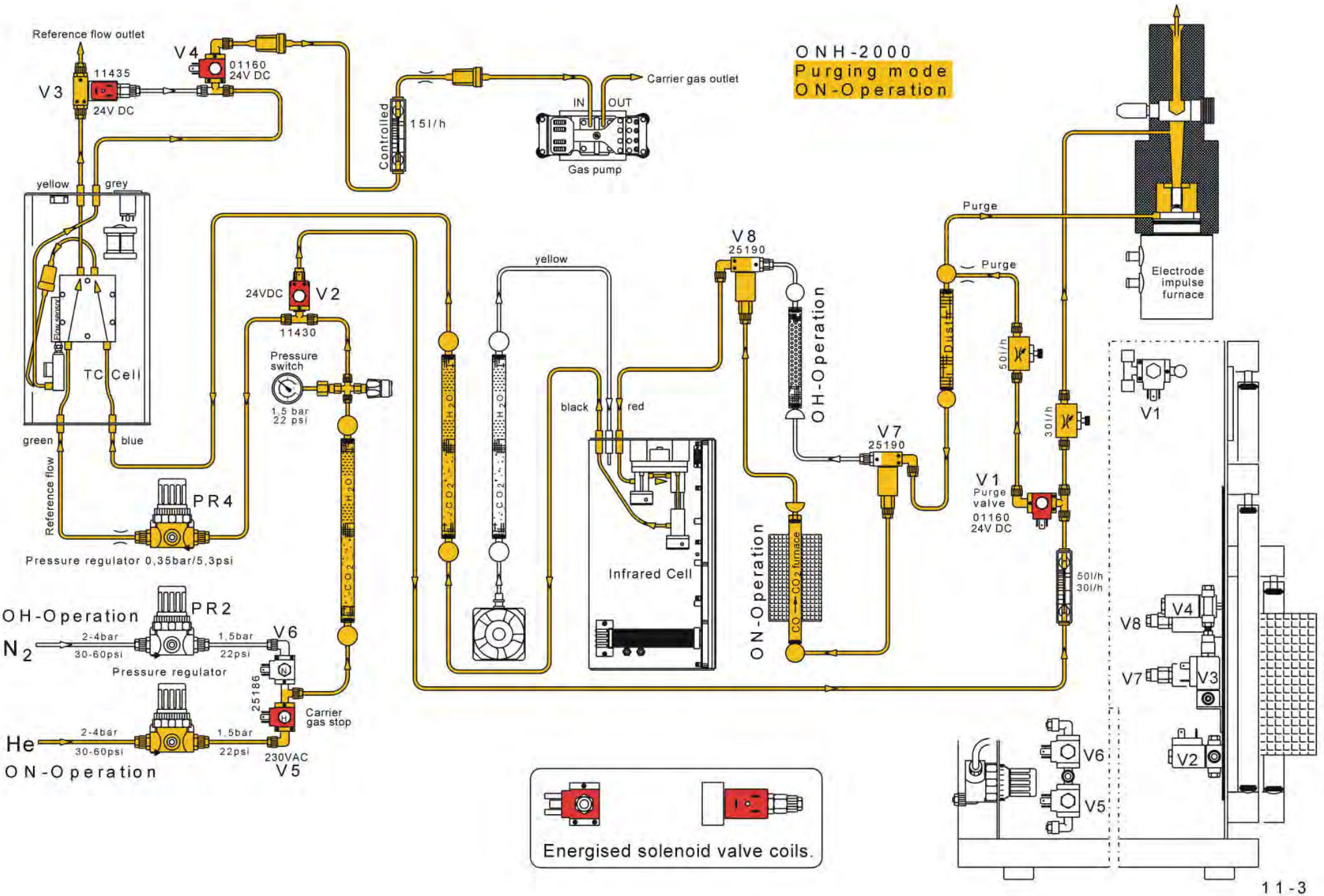

10-7
Electrode impulse furnace
V1
V3
V2
V5
50l/h
30l/h
30l/h
50l/h
Measure
V1
Purge valve
01160
Dust
CO → CO2 furnace
Pressure switch
1,5 bar
22psi
V2
Pressure regulator
24VDC
11430
0.35bar/5.3psi
PR2
Carrier gas outlet
OUT
IN
Gas pump
15l/h
controlled
11435
24VDC
V3
yellow
red
black
Flow sensor
Infrared Cell
Carrier gas stop
230VAC
11390
V5
OH 900
Analysis mode
Oxygen -only analyser
Pressure regulator
1,5bar
22psi
PR1
2-4bar
30-60psi
Carrier Gas Nitrogen
Energised solenoid valve coils.

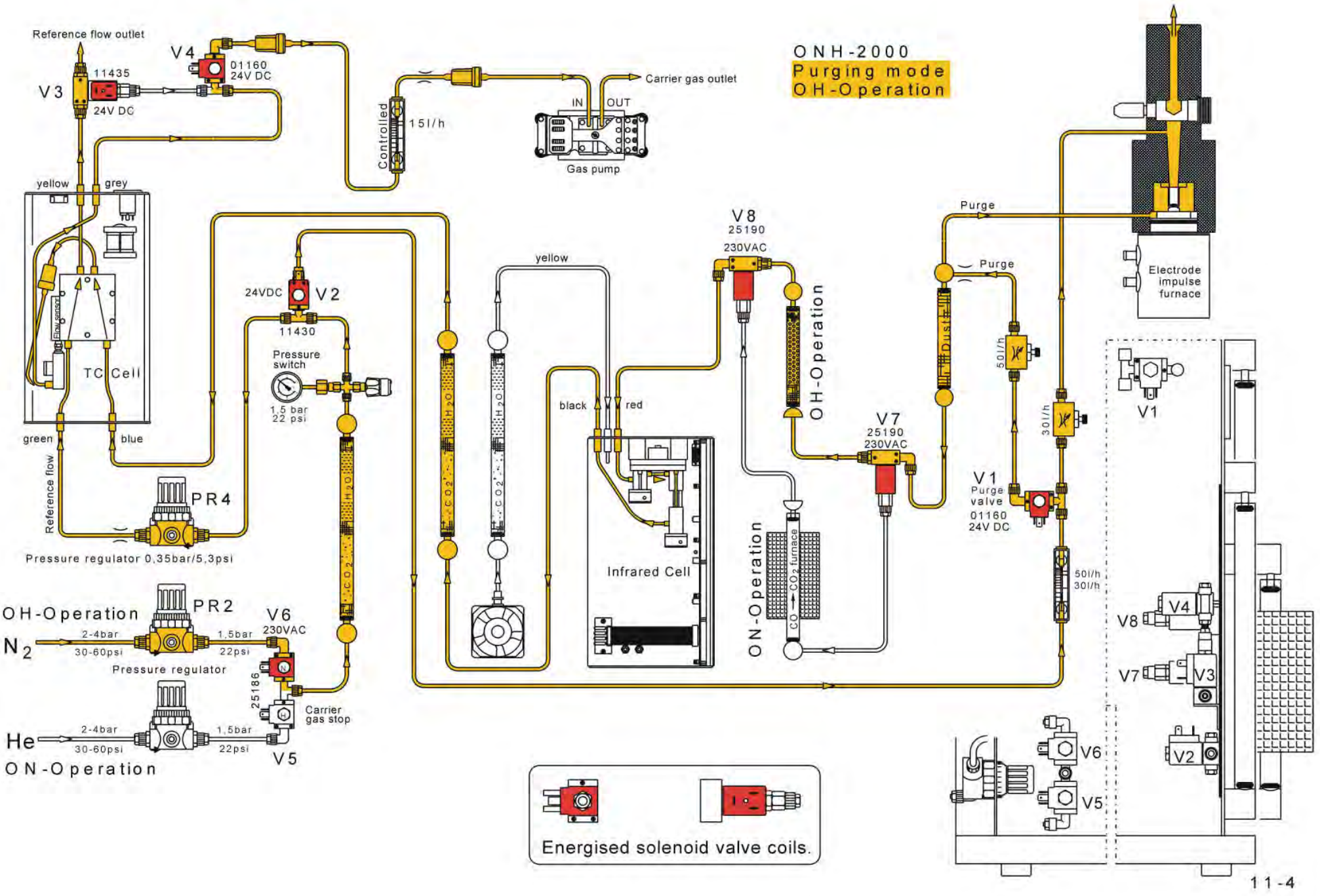

10-8
Electrode impulse furnace
V1
V3
V2
V5
50l/h
30l/h
Purge
Purge
50l/h
V1
Purge valve
01160
24VDC
Dust
CO → CO2 furnace
1,5 bar Pressure switch
V2
Pressure regulator
24VDC
11430
0.35bar/5.3psi
PR2
Carrier gas outlet
OUT
IN
Gas pump
15l/h
controlled
11435
24VDC
yellow
red
black
V3
Flow sensor
Infrared Cell
Carrier gas stop
230VAC
11390
V5
Pressure regulator
1.5bar
22psi
PR1
2-4bar
30-60psi
Carrier Gas Nitrogen
OH 900
Purging mode
Oxygen -only analyser
Energised solenoid valve coils.

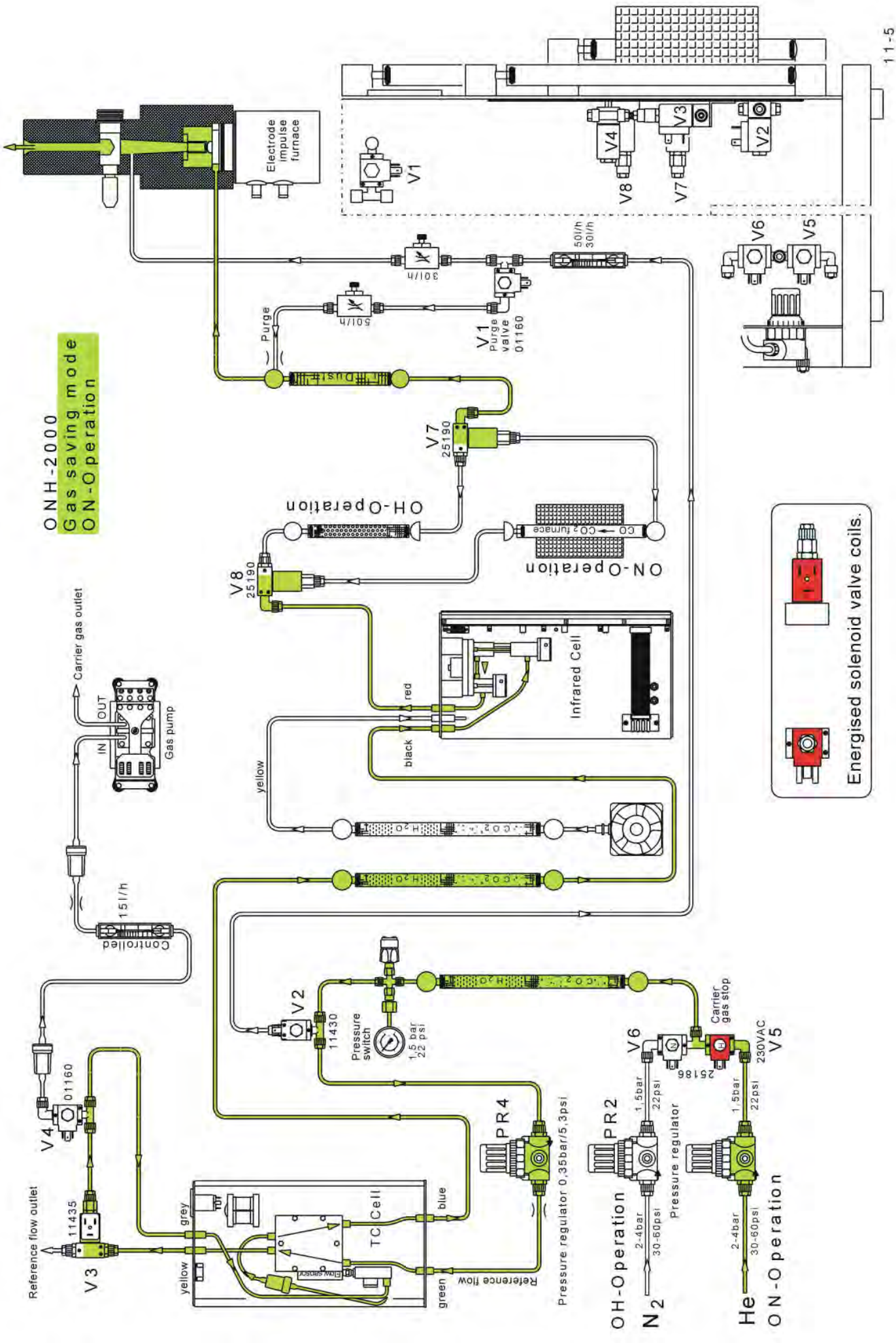

10-9
Electrode impulse furnace
V1
V3
V2
V5
50l/h
30l/h
V1
Purge valve
01160
Dust
CO / CO2 furnace
1.5 bar Pressure switch
22psi
V2
11430
Pressure regulator
PR2
0.35bar/5.3psi
Carrier gas outlet
OUT
IN
Gas pump
15l/h
controlled
11435
V3
yellow
red
black
Flow sensor
Infrared Cell
Carrier gas stop 230VAC
11390
V5
OH 900
Gas saving mode
Oxygen -only analyser
Pressure regulator
PR1
1.5bar
22psi
2-4bar
30-60psi
Carrier Gas Nitrogen
Energised solenoid valve coils.

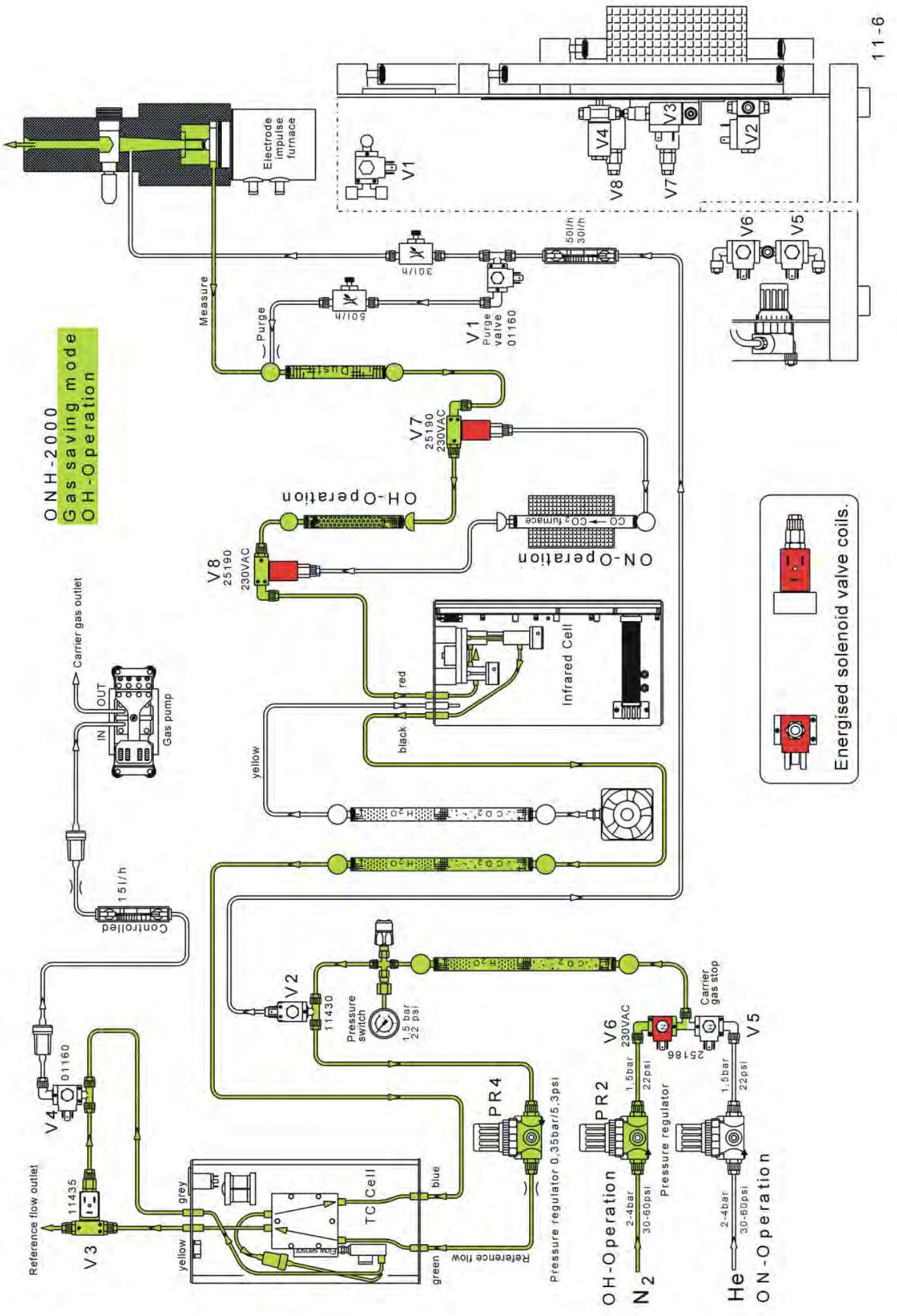




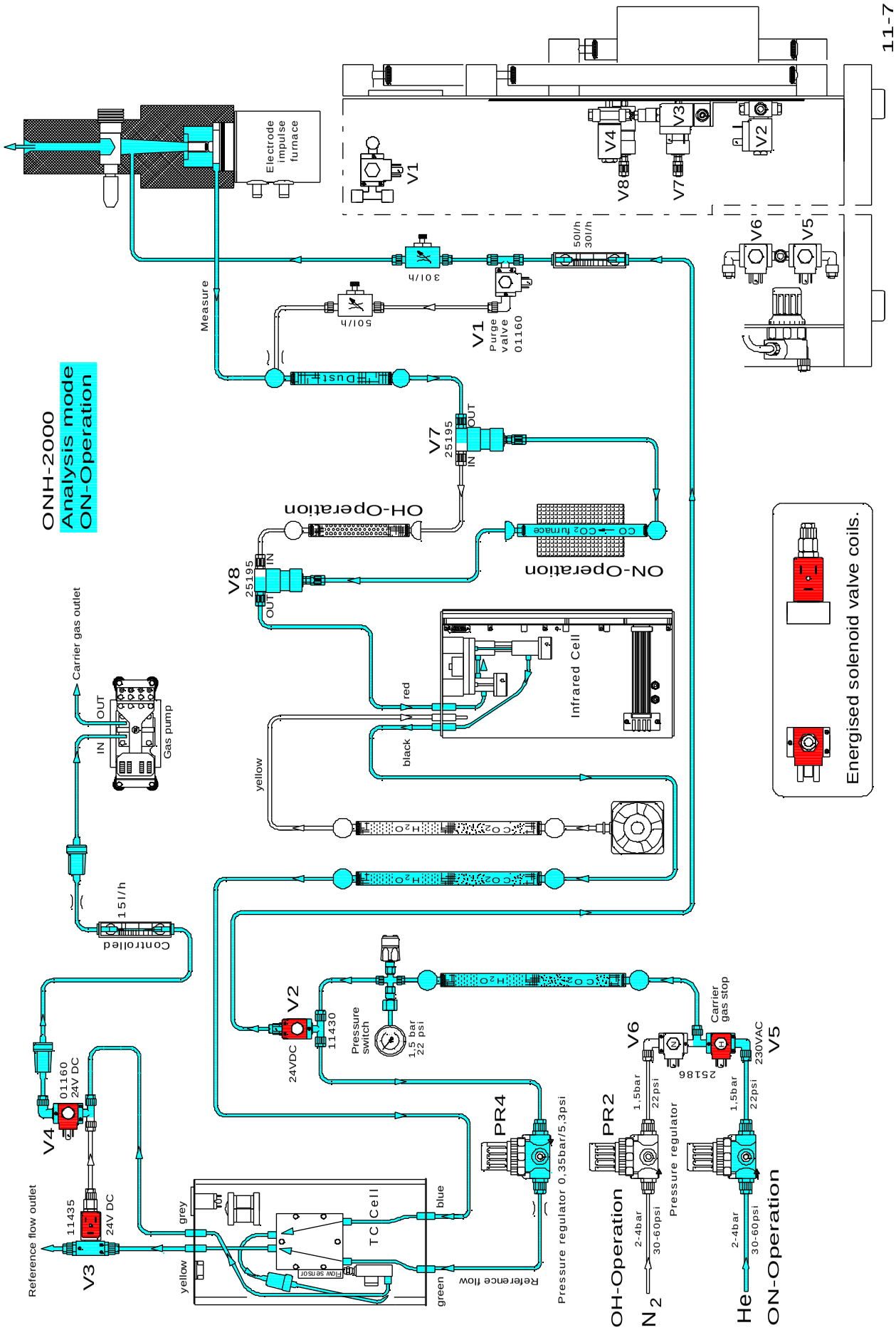


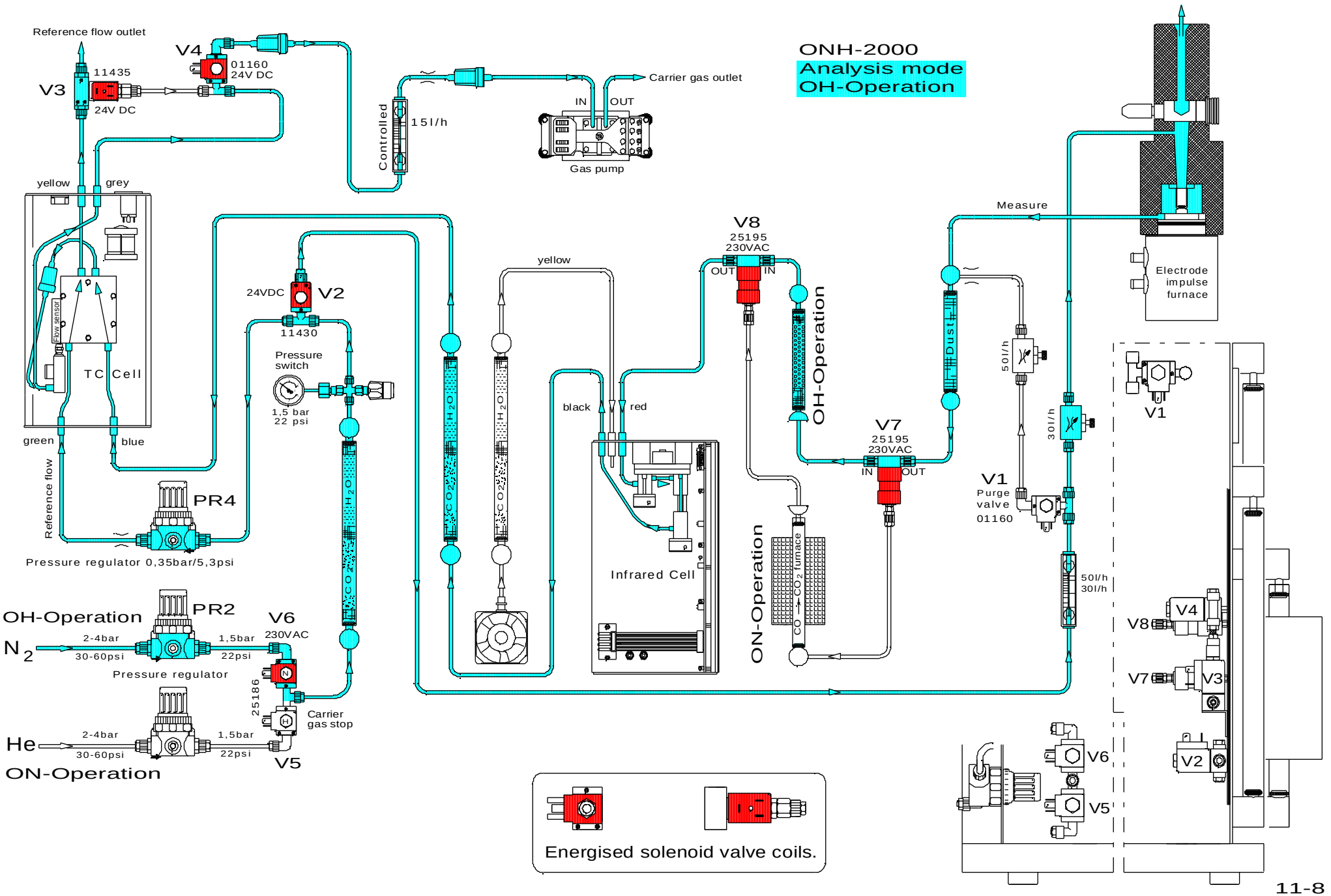


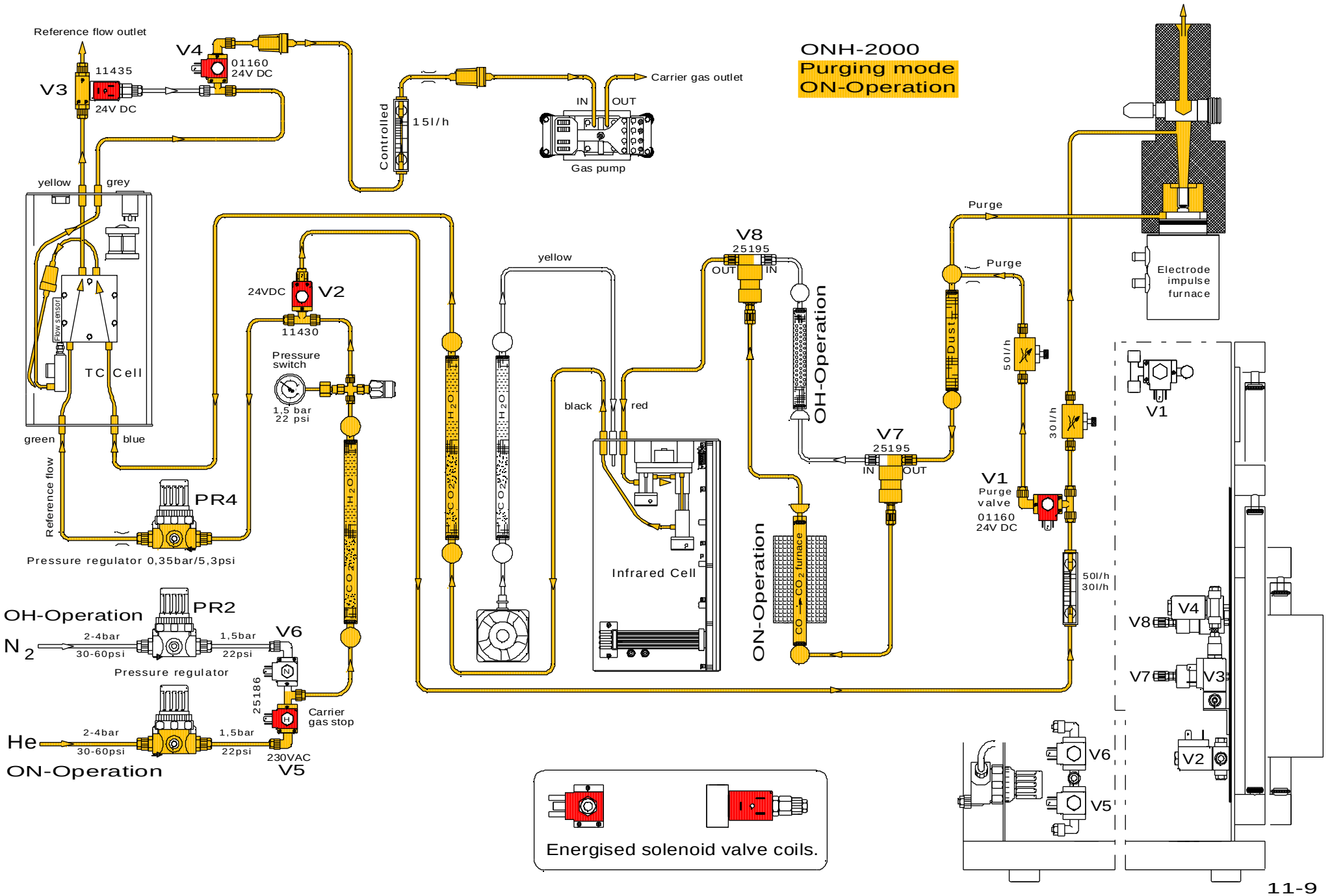

ONH-2000
Gas saving mode
ON-Operation
Electrode impulse furnace
V1
V8
V7
V4
V3
V2
V6
V5
11-5
50l/h
30l/h
Purge
V1 Purge valve 01160
V7 25190
OH-Operation
ON-Operation
V8 25190
Infrared Cell
red
black
yellow
Carrier gas outlet
OUT
IN
Gas pump
15l/h
Controlled
Energised solenoid valve coils.
V2 11430
Pressure switch
1,5 bar 22 psi
V4 01160
V3 11435
Reference flow outlet
grey
yellow
TC Cell
blue
green
Reference flow
PR4
Pressure regulator 0,35bar/5,3psi
V6 25186
Carrier gas stop
230VAC
V5
PR2
1,5bar
22psi
Pressure regulator
2-4bar
30-60psi
OH-Operation
N2
He
ON-Operation

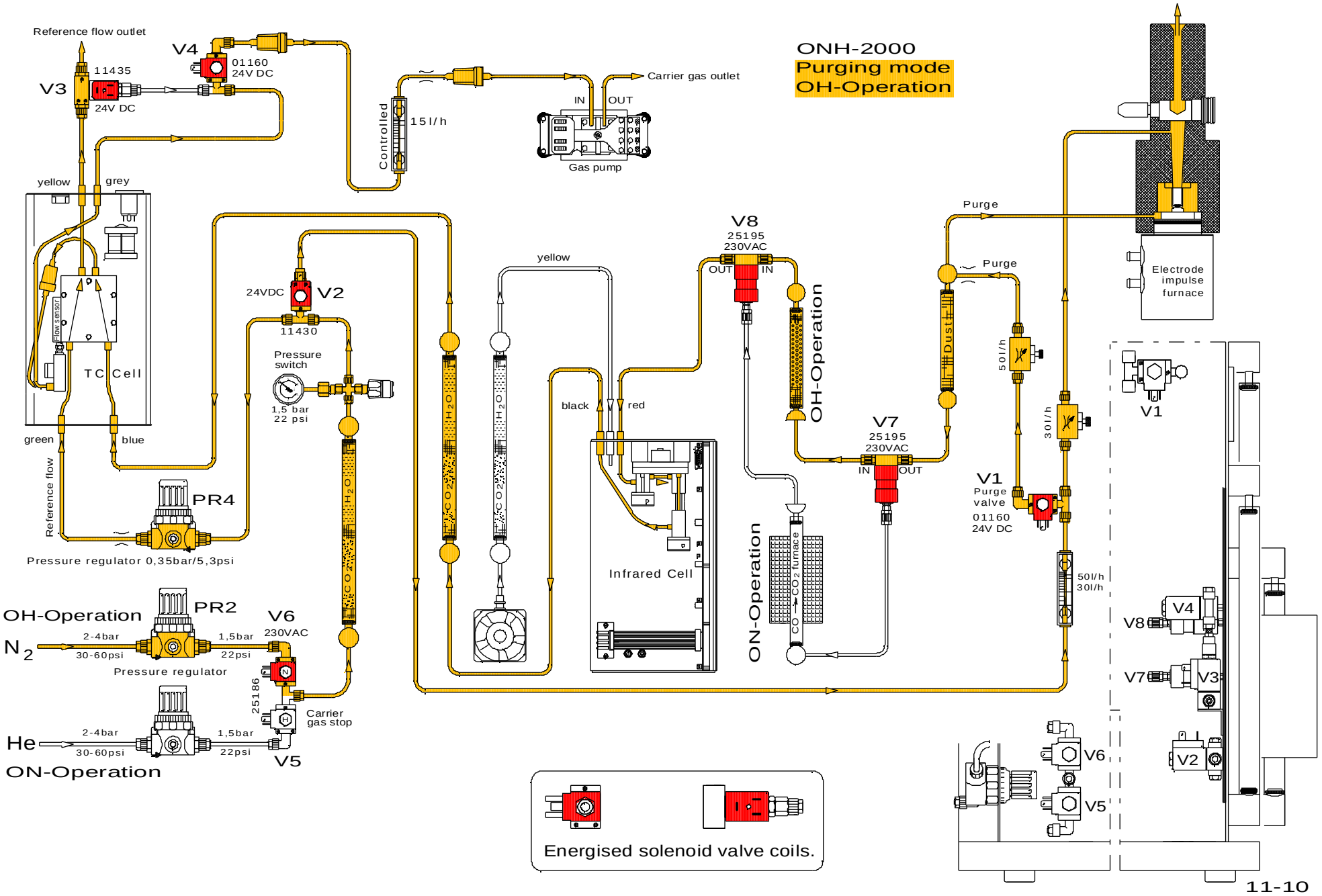

ONH-2000
Gas saving mode
OH-Operation
Electrode impulse furnace
V1
V8
V7
V3
V4
V2
V6
V5
11-6
Measure
Purge
30l/h
50l/h
50l/h
30l/h
V1
Purge valve
01160
V7
25190
230VAC
OH-Operation
ON-Operation
V8
25190
230VAC
Infrared Cell
red
black
yellow
Carrier gas outlet
OUT
IN
Gas pump
15l/h
Controlled
Energised solenoid valve coils.
V2
11430
Pressure switch
1,5 bar
22 psi
V4
01160
V3
11435
Reference flow outlet
grey
yellow
TC Cell
blue
green
Reference flow
PR4
Pressure regulator 0,35bar/5,3psi
V6
230VAC
25186
Carrier gas stop
V5
PR2
1,5bar
22psi
Pressure regulator
2-4bar
30-60psi
OH-Operation
N2
1,5bar
22psi
2-4bar
30-60psi
He
ON-Operation

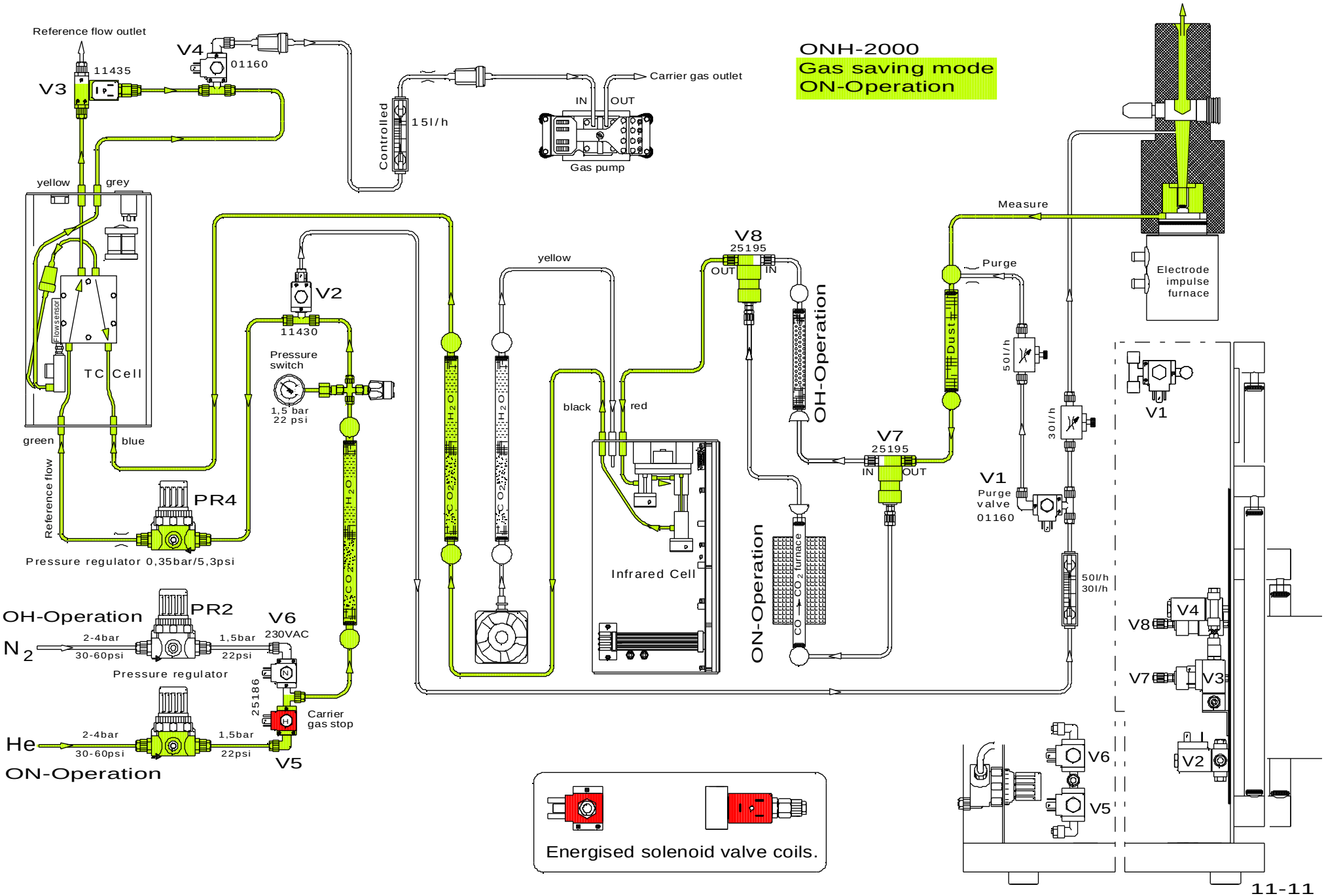
GAS flow diagrams ONH-2000 from S/N 1736xxxxxx

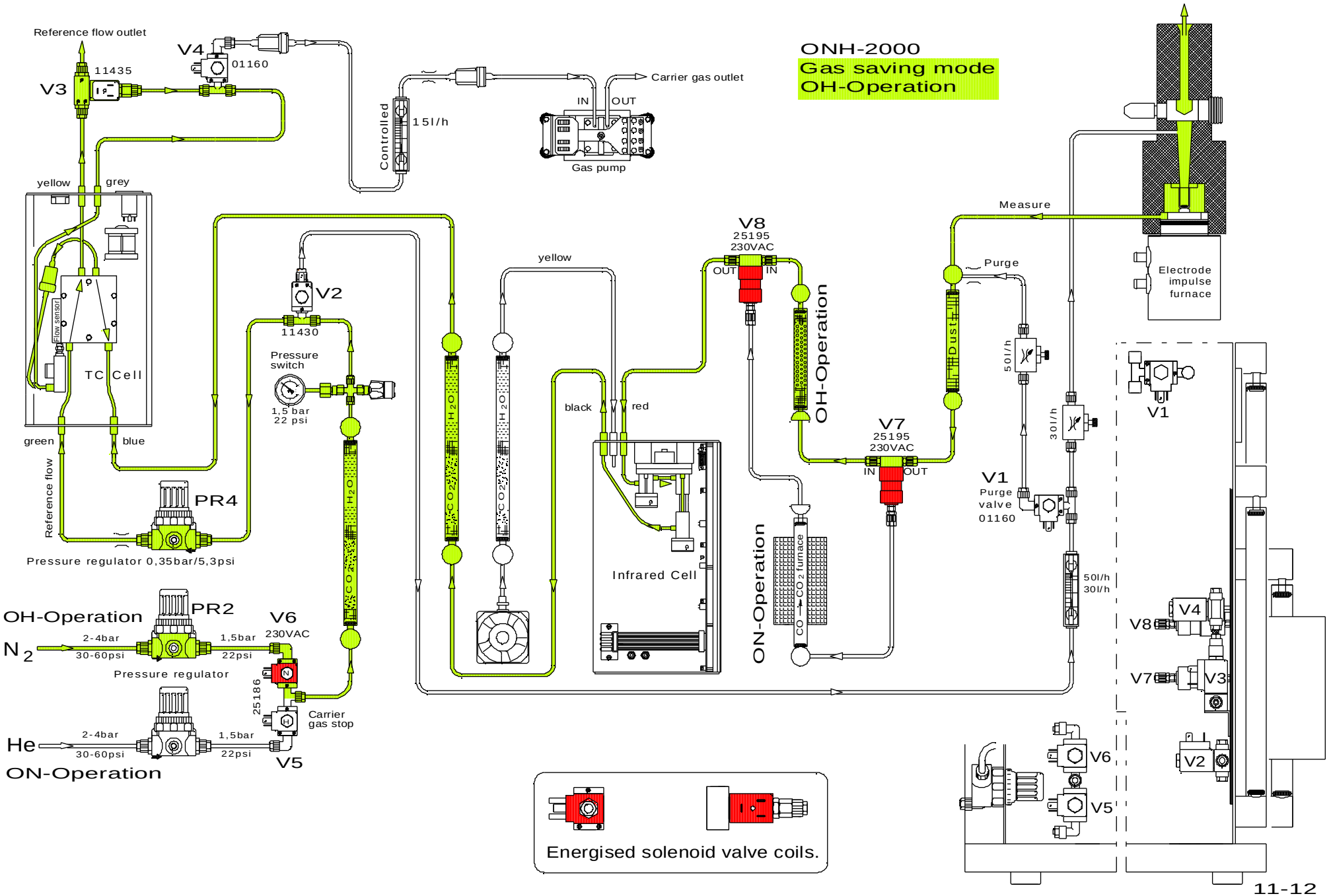




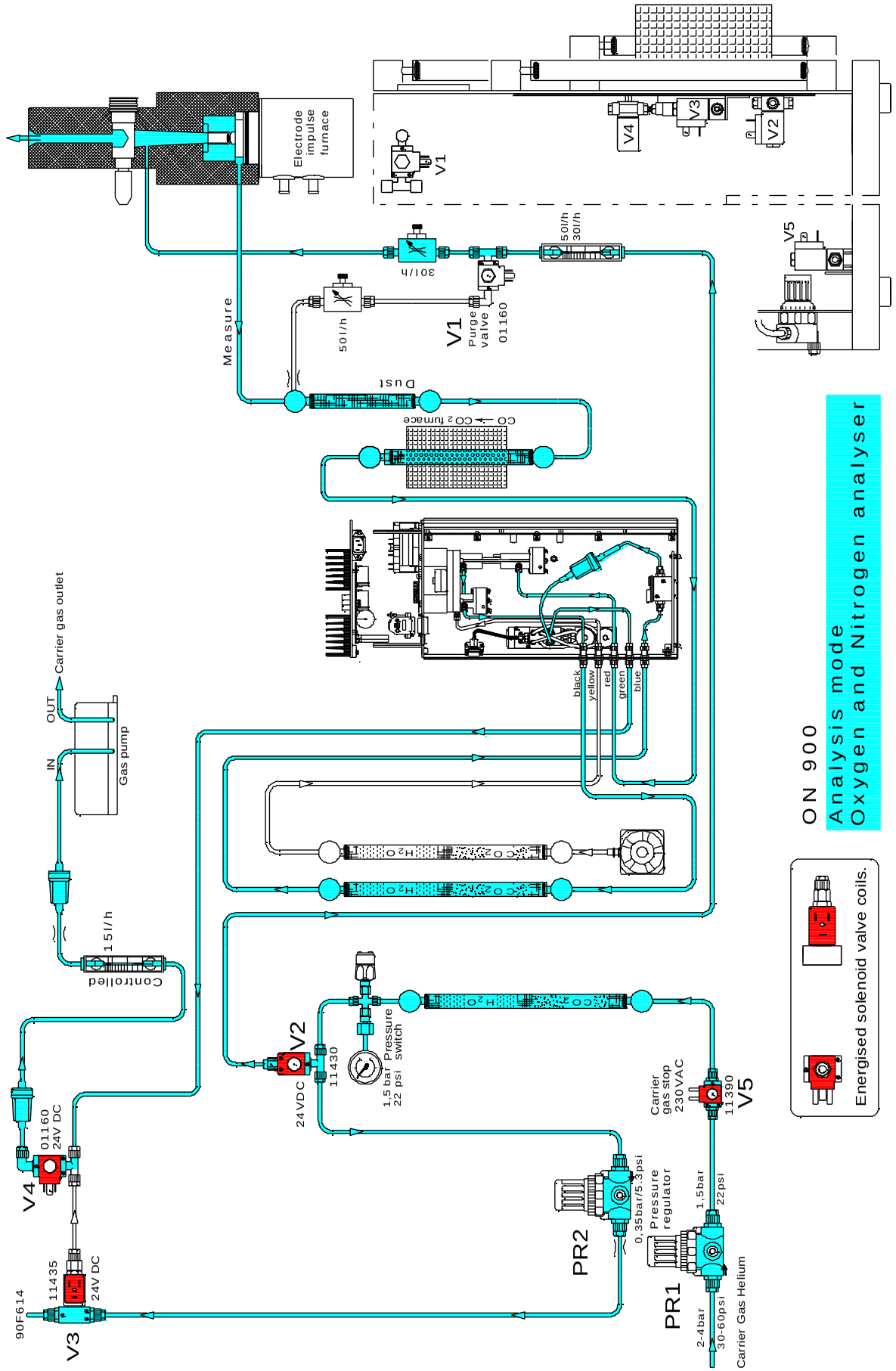


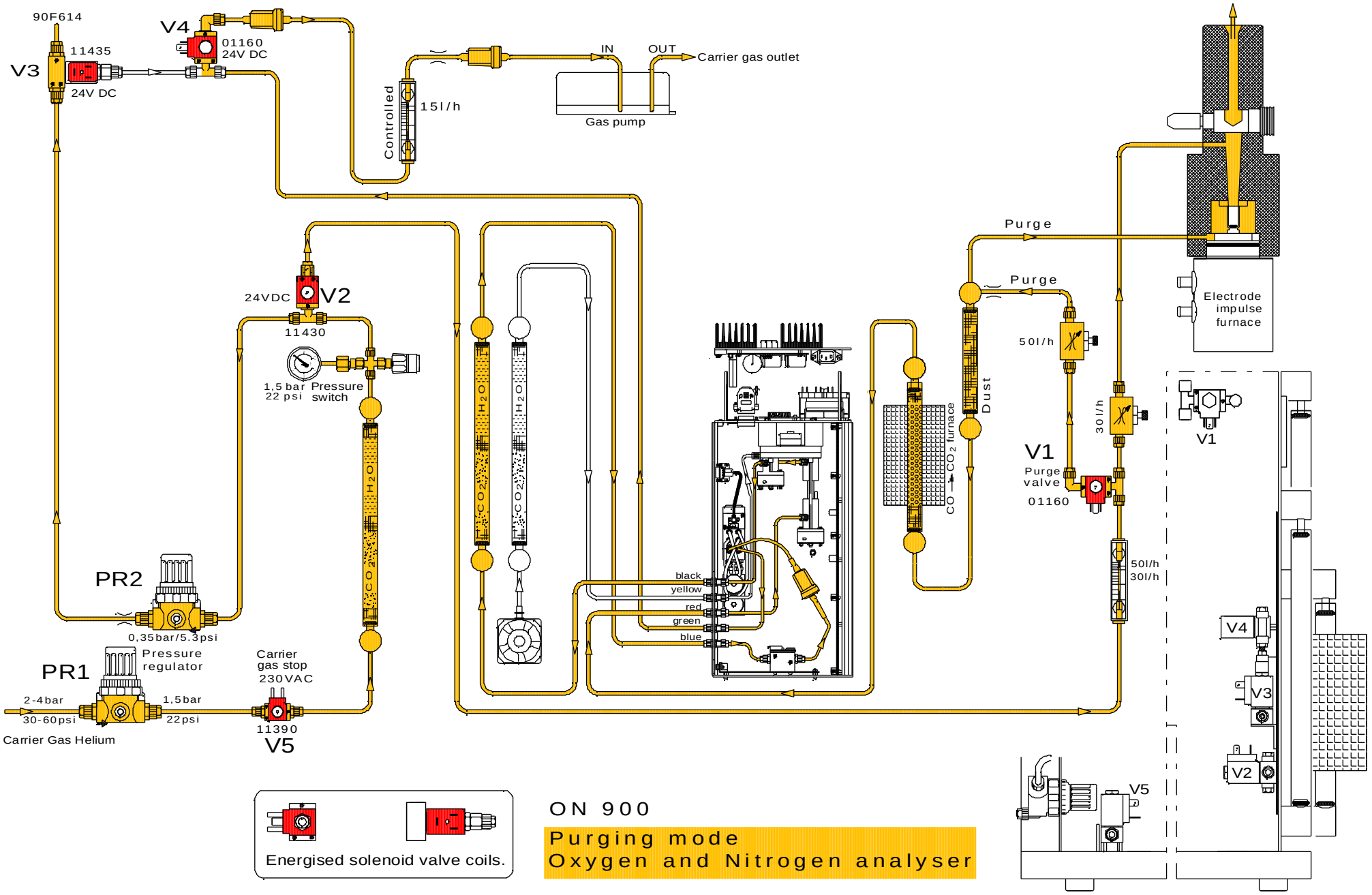






Gas flow diagrams valid for serial numbers from 2602080425

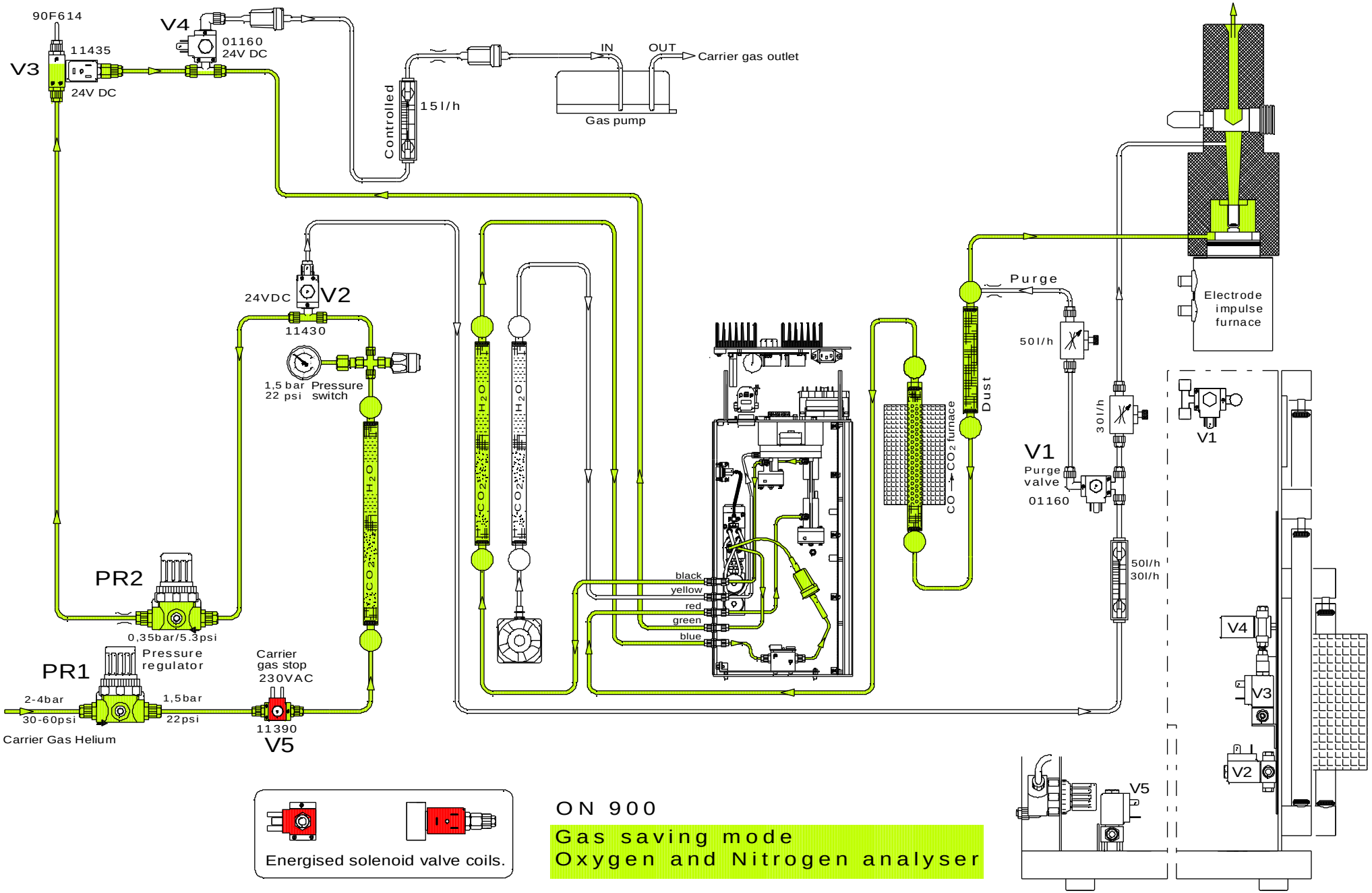


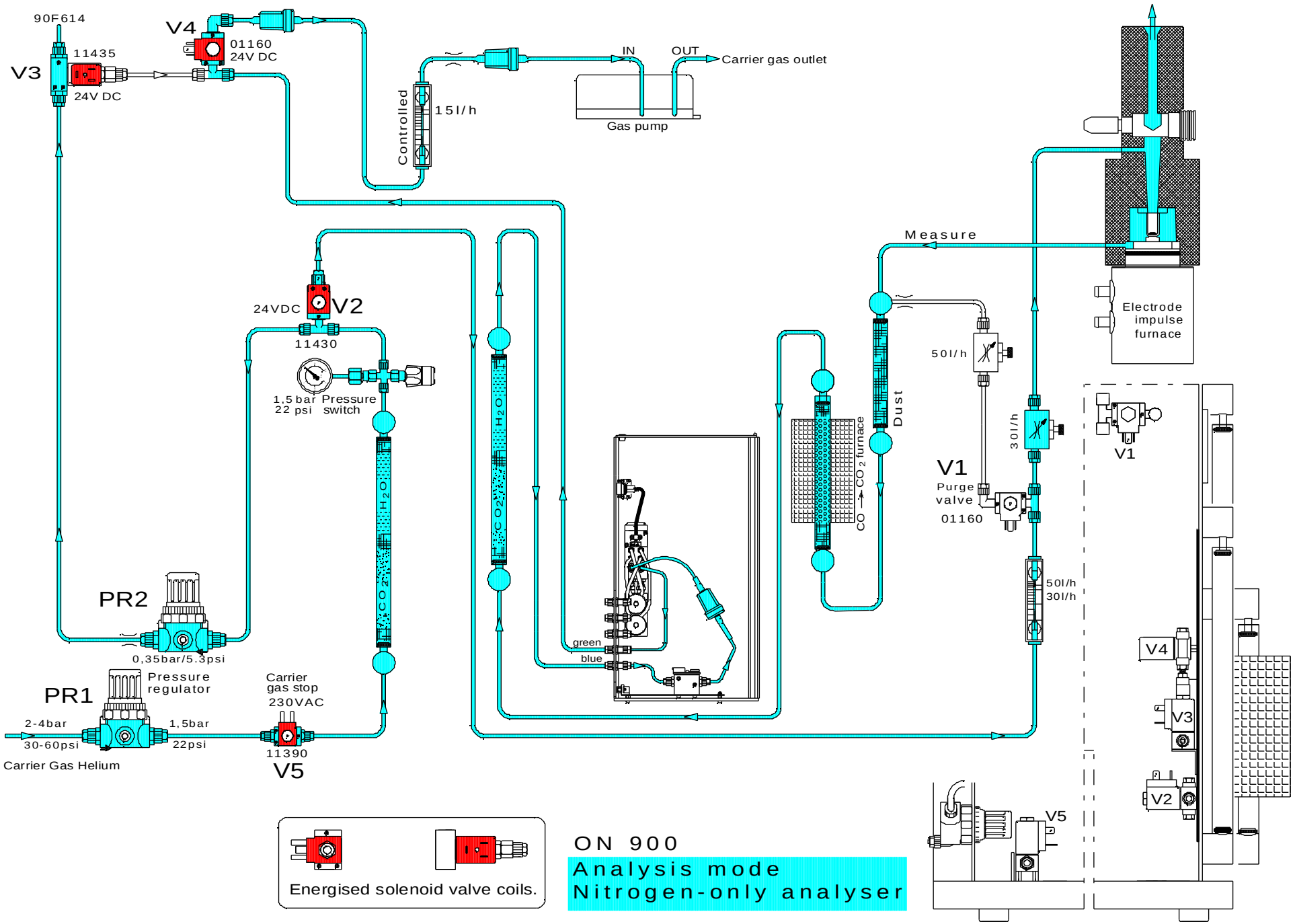


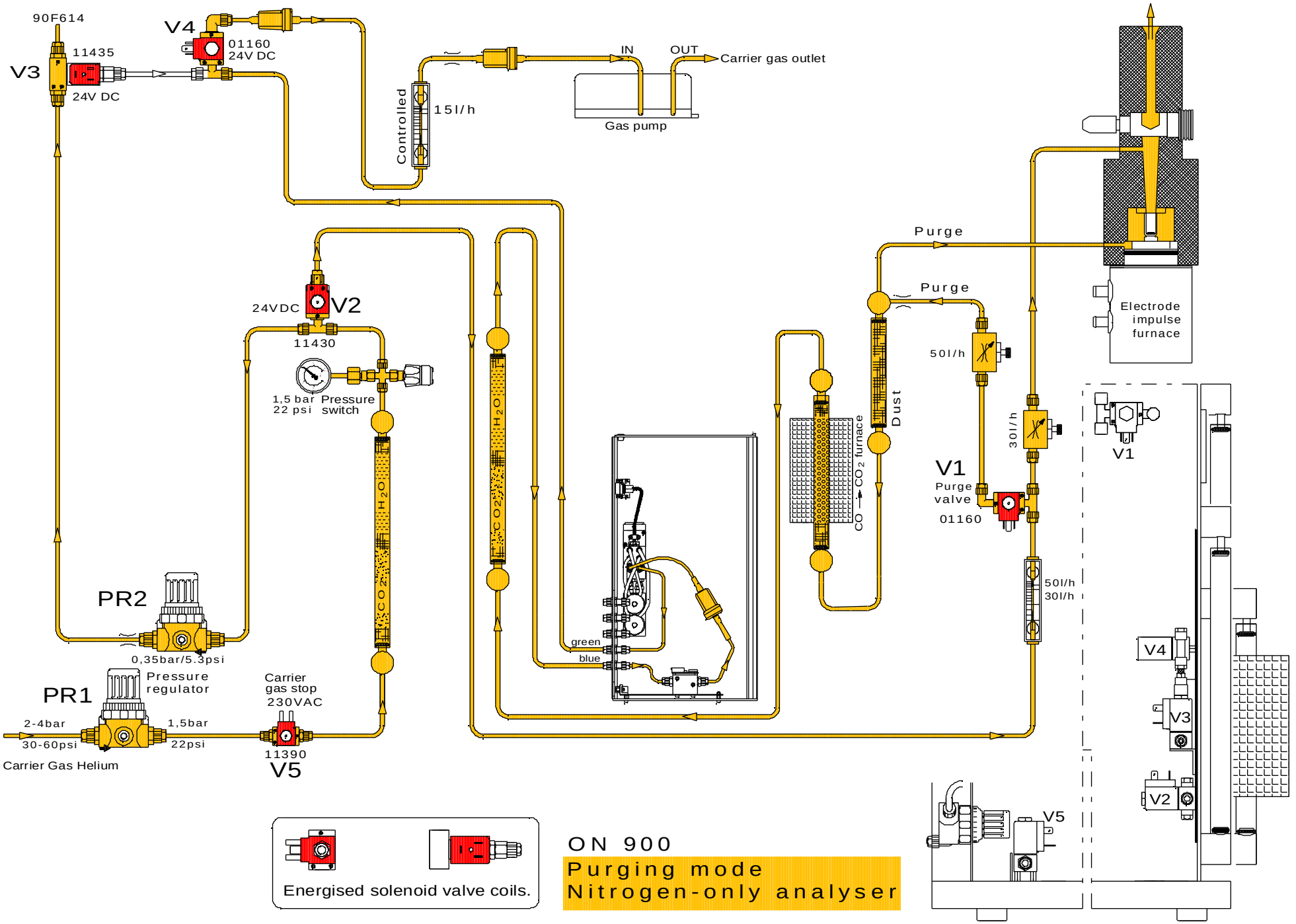
Energised solenoid valve coils.

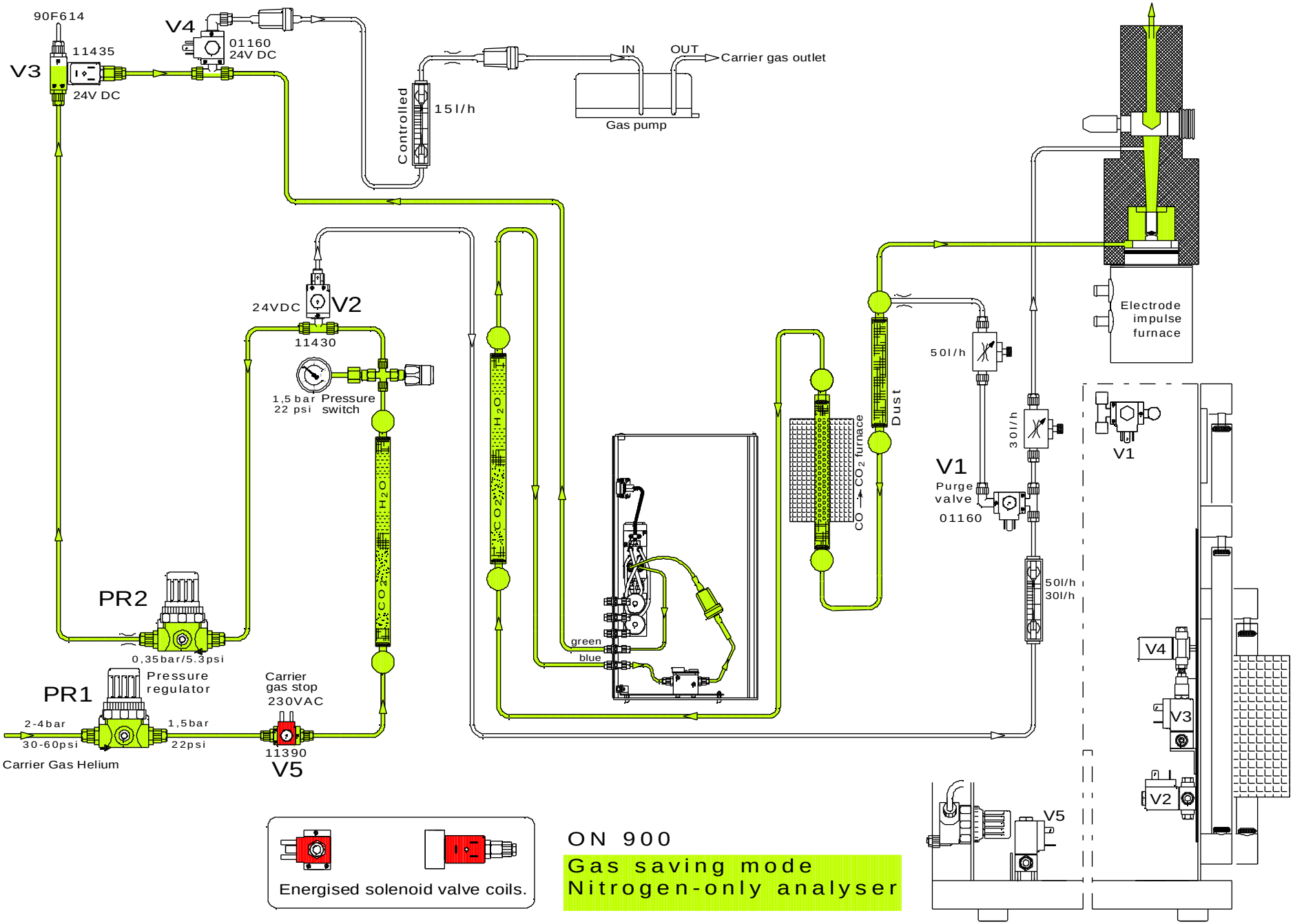
ON 900

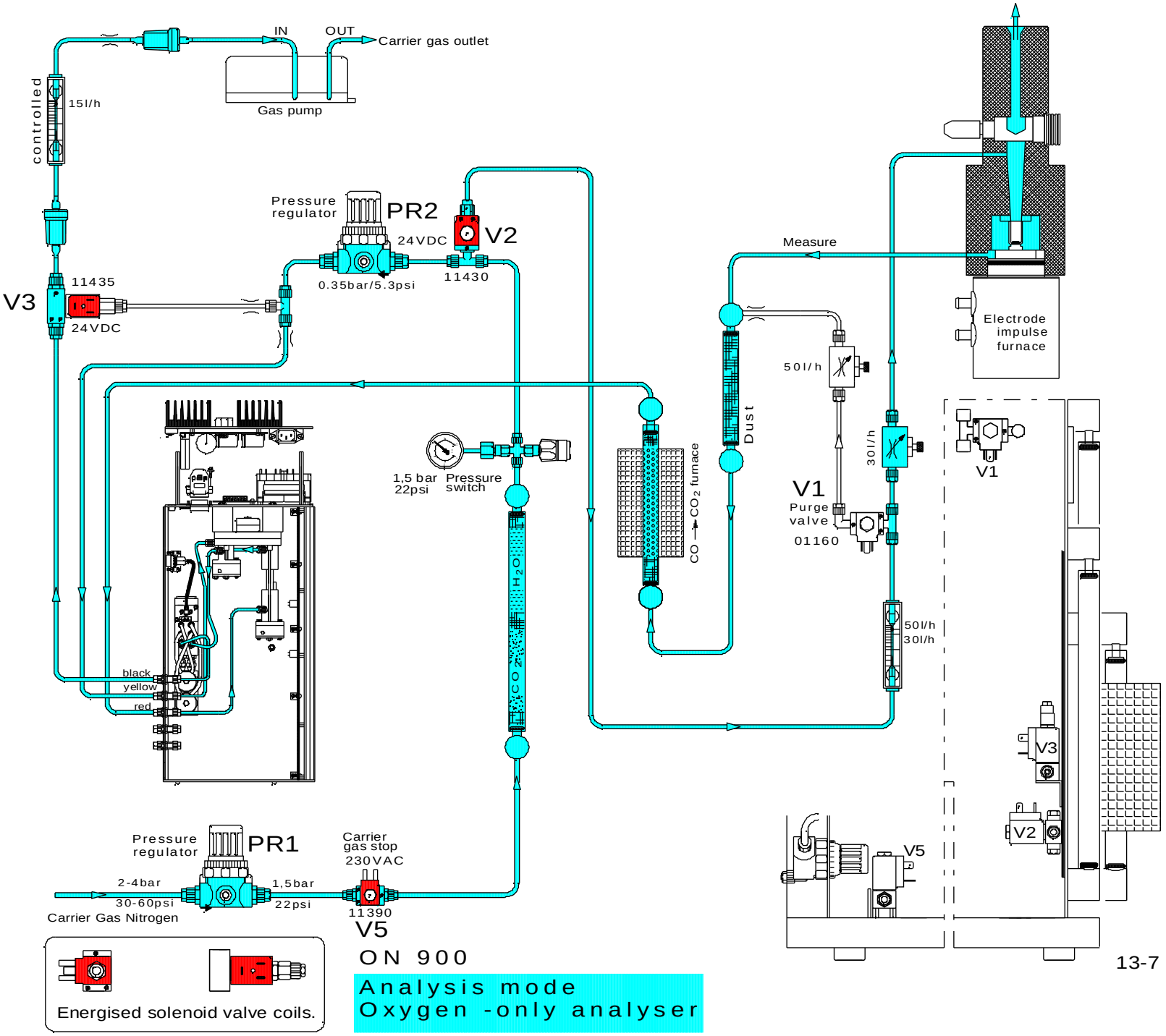
Purging mode
Oxygen and Nitrogen analyser

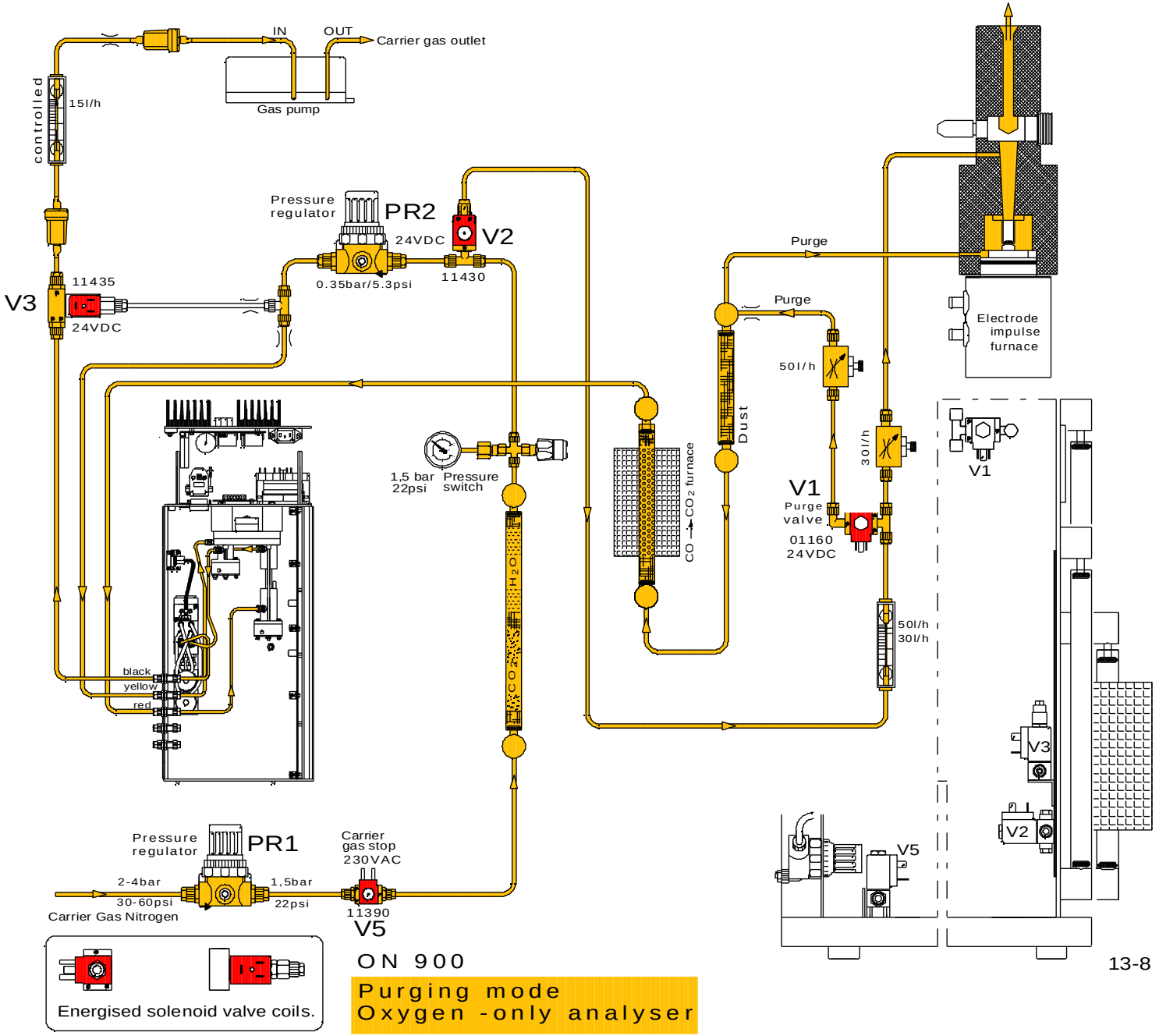


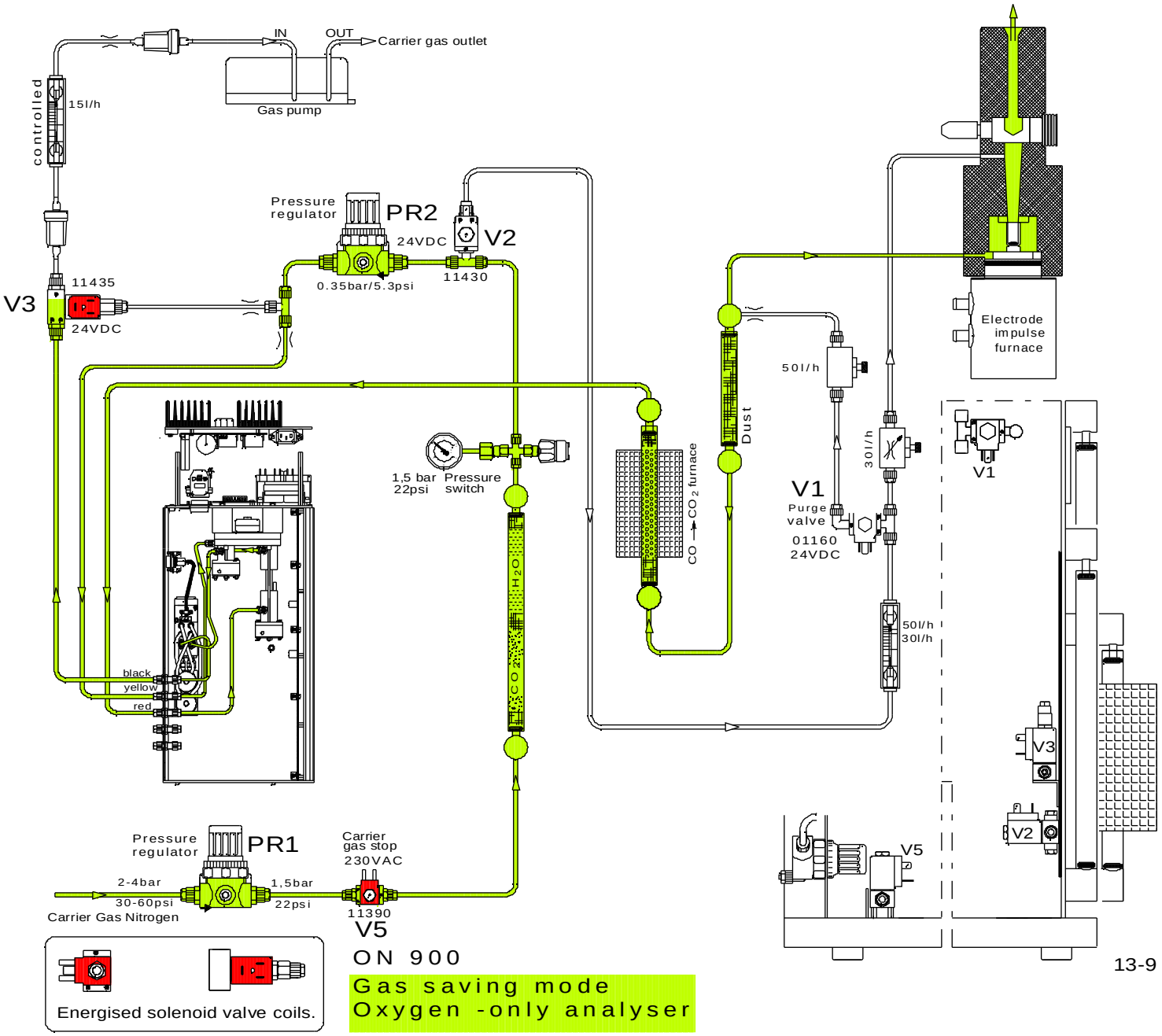




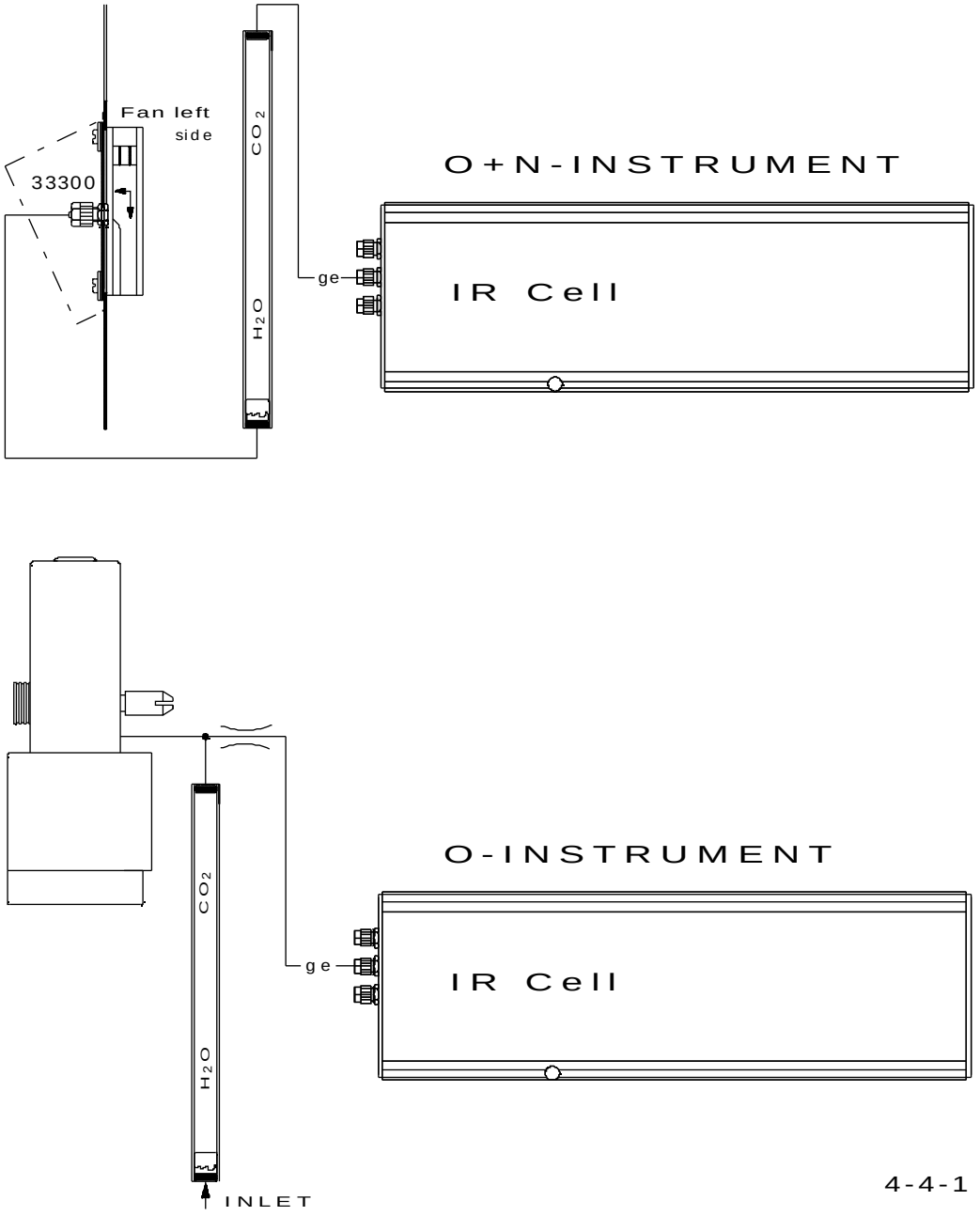








4.4 Purging of the chopper



4.5 Maintenance OH 900, ON 900, ONH-2000

- ☐ Imprint of all O-rings wider than 2 mm ?
- ☐ Is the air pressure set to 2.0 bar (30 psi) ?
- ☐ Is the carrier gas set to 1.5 bar (22.5 psi) ?
- ☐ Adjust lower furnace section (see **2.8**)
- ☐ Check lower electrode
- ☐ Is the pressure switch change set to 1.0 bar (15 psi) ? (see **2.2**)
- ☐ Does the thermostabilisation of the IR cell and TC cell work correctly? (see **2.5** and **2.14**)
- ☐ Check the cooling system for leaks
- ☐ Does the left-side gas flow meter indicate ± 30 l/h ?
- ☐ Does the right-side gas flow meter indicate ± 15 l/h ?
- ☐ Check the power regulation (see **2.16**)
- ☐ Check the water temperature cut-off system (see **2.15**)
- ☐ Check the furnace temperature alarm (see **2.15**)
- ☐ Tighten the 96-pole plug