420 Oven and Temperature Control

Heated zones

In addition to the oven, the 6890 GC has six small heated zones. To reduce the chance of hazardous electrical shocks, all are powered with 40 volt full wave rectified current instead of 120 volt AC. A total of 440 watts is available for the zones. This accommodates six 70 watt heaters. It is also possible to have up to two 150 watt heaters. Adding a 150 watt heater reduces the maximum number of heaters by one.

Heaters allowed	
70 Watt	**150 Watt**
5–6	–
3–4	1
1–2	2

These further wattage restrictions/rules apply:

- Six 70 watt heaters are allowed.
- Any combination of heaters < 225 watts per chromatographic channel (i.e., Front Inj., Front Det., and Aux 1 OR Back Inj., Back Det., and Aux 2).
- Any single zone can be 150 watts or less.

The 6890 GC will not allow configurations over 440 watts to operate. The detector zones can only be temperature programmed from a ChemStation. There are two auxiliary zones (Aux 1 and 2) and each supports three temperature ramps. There is no cooling provided for ramped zones except the oven and cool on-column inlet.

Oven ramp rates

To use the fast oven ramp rates (a 240 V power option is required), your electric service must be able to supply ≥ 200V at ≥ 15 Amp.

The highest rate that you can achieve depends on many factors, including the room temperature, temperatures of the inlets and detectors, the amount of material inside the oven (columns, valves, etc.), and whether or not this is

the first run of the day. The optional oven insert for fast chromatography increases oven ramp rates for the back column. Table 420-1 lists typical oven ramp rates.

Table 420-1 Oven Ramp Rates

	100/120 V oven ramp rate (°C/minute)		200/220/230/240 V oven ramp rate (°C/minute)	
Temperature range (°C)	**Without insert**	**With optional insert**	**Without insert**	**With optional insert**
50 to 70	75	120	120	120
70 to 115	45	95	95	120
115 to 175	40	65	65	110
175 to 300	30	45	45	80
300 to 450	20	35	35	65

Configuring the GC for an MSD

If you are installing an Agilent Mass Selective Detector, you must configure the GC to properly control the heated transfer line.

1. Press [Config][Aux], and select [1] if the MSD is installed in the front position or [2] for the back position.

2 Press [Mode/Type].

3 Use the scroll keys to select `MSD` as the Aux zone type. Press [Enter].

If you do not configure the Aux zone for MSD, Warning 101, *Invalid heater power for front (back) detector, inlet, and aux 1(2),* will appear on the GC display, and the heated zones will be set to *not installed*.

Oven temperature troubleshooting

For each problem below, the probable causes and corrective actions are listed in order of complexity/expense. The cheapest, most common, easiest to check causes are listed first with the more complex, expensive causes following.

After identifying the problem, test for the probable causes in order from top to bottom.

Problem	Probable cause	Corrective action
Oven does not heat.	Faulty fuse F1 or F2 on power supply PCB.	Check/replace both fuses.
	Oven heater is open.	Check resistance of oven heater.
	Faulty power supply PCB.	Replace power supply PCB.
	Faulty fuse F1 or F2 on main PCB.	Check/replace both fuses.
	Faulty main PCB.	Replace main PCB.
Oven does not control	Fast oven but GC configuration is for regular oven.	Check oven configuration.
	Oven flap stuck.	Check oven flap.
	Faulty main PCB.	Replace main PCB.
Oven temperature runs away.	Oven heater partially grounded.	Ensure that the oven heater is not coming in contact with the oven shell or other nearby components.
	Faulty main PCB.	Replace main PCB.
Oven temperature will not go to maximum.	Fast oven but power is 208 V rather than 240 V.	Correct power wiring in lab.

Testing resistance of the heater coil

If you believe that your heater coil is cracked or otherwise damaged and has caused an open circuit, you can check it by measuring its resistance.

To measure the resistance

WARNING Before proceeding, turn off the main power switch and unplug the power cord.

Caution Make sure you are properly grounded with an ESD strap before continuing.

1. Turn the instrument power off.
2. Disconnect the oven heater leads (P3, P4) from the AC power board.
3. Use an ohmmeter to measure resistance at the **connectors**.

Acceptable resistance ranges

Acceptable resistance ranges (in ohms) are given below. Acceptable resistances range from the nominal value for a new, cold heater to +5% from the nominal value.

Note Resistance goes up approximately 3% after heating the coil.

Nominal cold heater resistances		
	Standard oven	**Fast-ramp oven**
120 V	9.07–9.52 Ω	n/a
200 V	n/a	17.78–18.7 Ω
220 V	n/a	21.51–22.6 Ω
230 V	33.06–34.71 Ω	23.51–24.7 Ω
240 V	n/a	25.60–26.9 Ω
n/a = not available		

Cryo valve installation/replacement

A cryogenic valve allows liquid nitrogen or CO_2 to be dispersed in between the double-walled plenum of the GC oven where the fan blows the vapors into the oven itself. Follow the procedures below to install a new cryogenic valve or to replace an existing cryogenic valve or nozzle.

Installing a new cryo valve

WARNING Before proceeding, turn off the oven and let it and any heated zones cool down. Turn off the main power switch and unplug the power cord.

1. Remove the left side cover on the instrument and remove the plug for the cryo valve.

   If a manual inlet carrier is installed on the left side of the instrument, remove its left cover by removing the two bottom thumb screws, sliding the panel towards the back of the instrument and lifting it off.

2. Remove the knockout on the left side of the instrument. Use a screwdriver to pry it out.

3. Insert the cryogenic valve probe though the insulation into the oven plenum.

4. Screw the valve to the side of the GC oven using the two Torx T-20 screws provided.

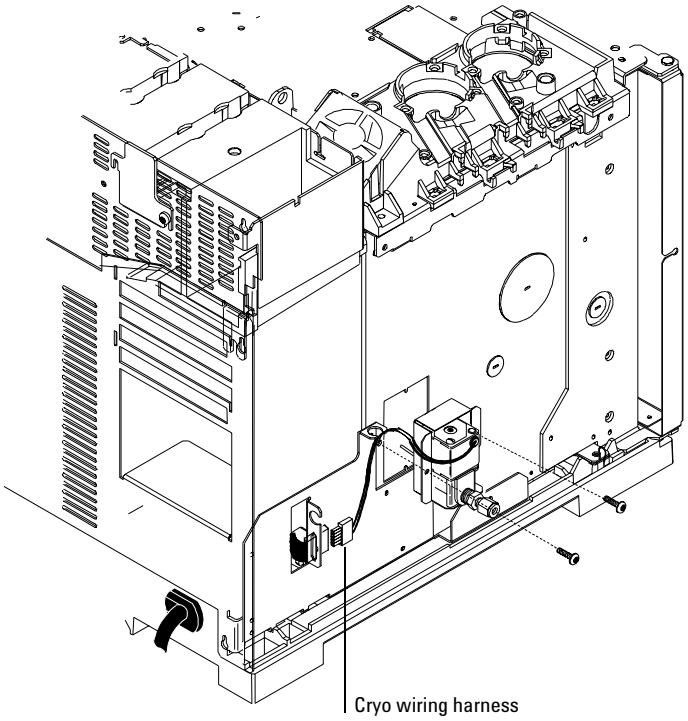

Figure 420-1 Attaching the valve box to the side of the GC (CO_2 valve shown)

5. Plumb the valve to the liquid nitrogen or carbon dioxide source.
6. Plug the cryo valve's wiring harness into the five pin connector to the left of the valve.
7. Route the cryo tubing through the cutout in the GC's side cover and reinstall the cover.

   If a manual inlet carrier is installed, route the cryo tubing out of the slot in the back of the carrier.

Replacing an existing cryo valve

WARNING Before proceeding, turn off the oven and let it and any heated zones cool down. Turn off the main power switch and unplug the power cord.

1. Remove the left side cover on the instrument.

   If a manual inlet carrier is installed on the left side of the instrument, remove its left cover by removing the two bottom thumb screws, sliding the panel towards the back of the instrument and lifting it off.

2. Shut off the cryo fluid supply and crack the valve at the supply to release any residual pressure.

3. Use a 9/16-inch wrench to disconnect the cryogenic fluid supply tube at the cryo valve.

4. Disconnect the cryo valve's wiring harness from the connector to the left of the valve (see Figure 420-1).

5. Remove the two Torx T-20 screws holding the old cryo valve and pull it straight out from the instrument (see Figure 420-1).

6. To remove the valve from the bracket, disconnect any cryo blast plumbing from the valve at the Swagelok tee. Remove the two Torx T-20 screws on the bottom of the bracket.
7. To replace the cryogenic nozzle, proceed as follows:
   a. Use a 9/16-inch wrench to unscrew the old nozzle. Discard the nozzle.
   b. Wrap the threads of the new nozzle with Teflon tape, being careful not to cover the first two threads of the nozzle.
   c. Screw on the new nozzle and tighten firmly with a 9/16-inch wrench.

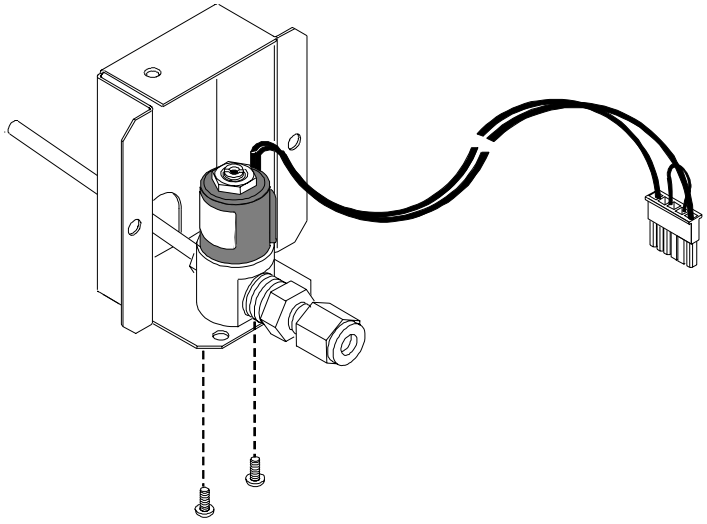

Figure 420-2 Removing the valve from the valve bracket (N_2 valve shown)

8. Insert the cryogenic valve probe though the insulation into the oven plenum.
9. Screw the valve assembly back on to the side of the GC oven using the two Torx T-20 screws.

10. If you are installing PCOC cryo blast for the front and/or rear inlet(s), connect it at this time.

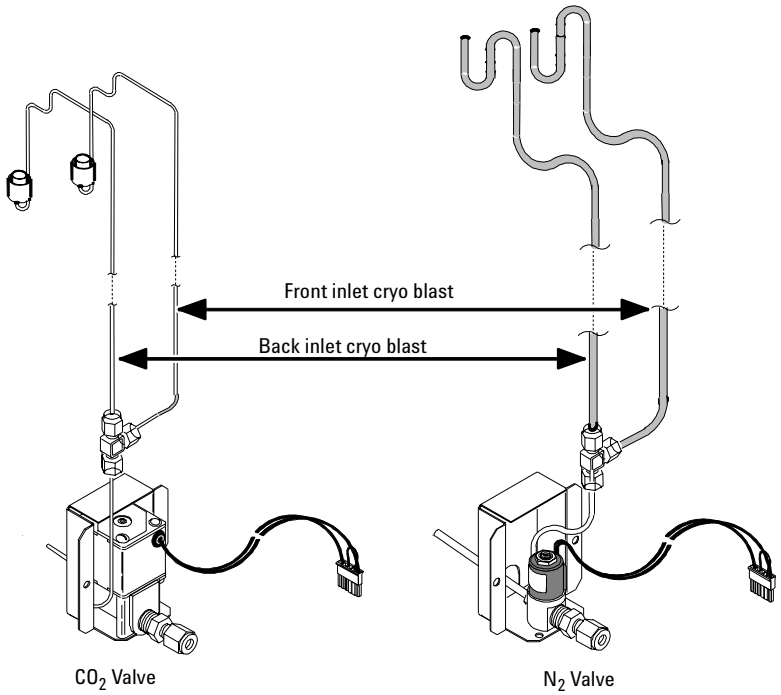

Figure 420-3 Cryo blast attachments

11. Plumb the valve to the liquid nitrogen or carbon dioxide source.
12. Plug the cryo valve's wiring harness into the connector to the left of the valve.
13. Route the cryo tubing through the cutout in the GC's side cover and reinstall the cover.

    If a manual inlet carrier is installed, route the cryo tubing out of the slot in the back of the carrier.

Replacing the oven shroud assembly

The oven heater is replaced as part of the oven shroud assembly. The oven sensor may be replaced separately.

WARNING Before proceeding, turn off the oven and let it and any heated zones cool down. Turn off the main power switch and unplug the power cord.

Caution Make sure you are properly grounded with an ESD strap before continuing.

1. Remove the GC's rear covers.
2. Disconnect the two oven heater leads (P3, P4) from the AC power board.

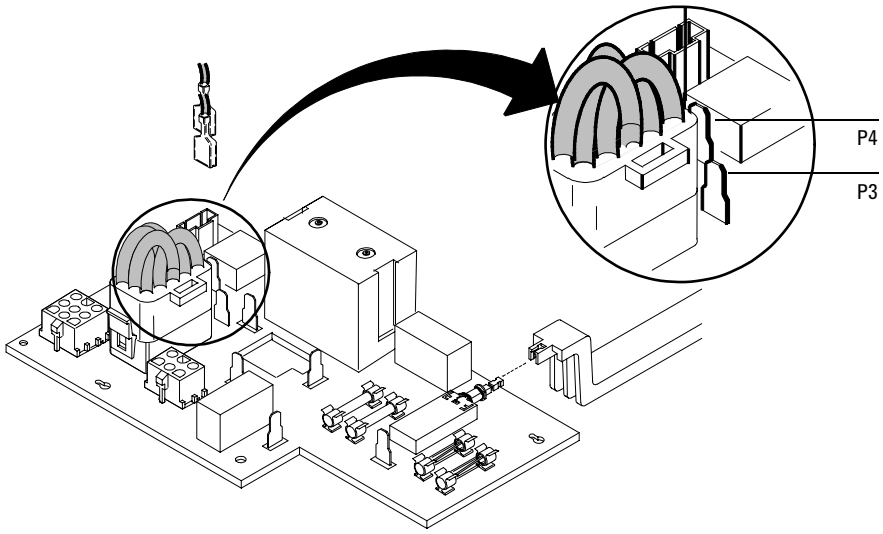

Figure 420-4 Disconnecting the oven heater leads on the AC board

3. Disconnect the sensor leads (P16) from the main PCB.

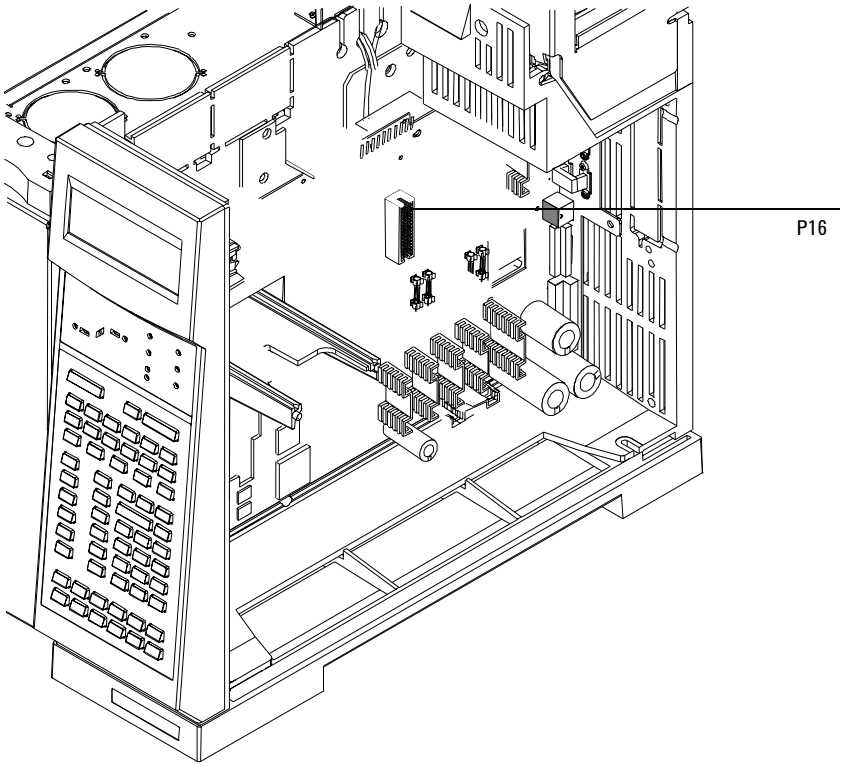

Figure 420-5 Disconnecting the sensor lead on the main board

4. From inside the oven, remove the columns, column nuts, detector fittings and other hardware preventing access to the shroud.

5. Remove the bottom two screws and loosen the top two screws on the corners of the shroud (Torx T-20). Slide the shroud down and tilt the top out and remove the shroud from the oven.

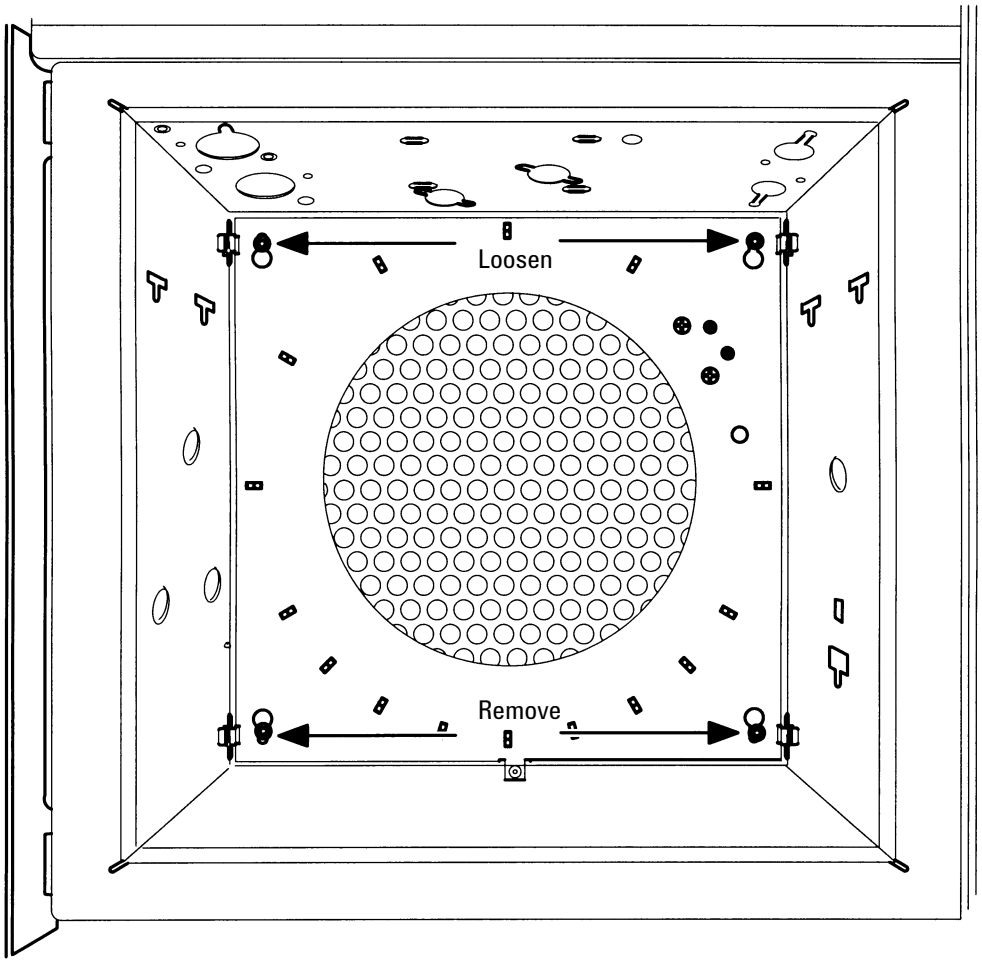

Figure 420-6 Removing the shroud

6. From inside the oven, draw the heater and sensor leads into the oven and remove the fan shroud.

7. Reassembly is the reverse of removal. Note that when reconnecting the heater leads to P3 and P4 on the AC board, either of the leads may be connected to either of the connectors.

Replacing the oven sensor

The oven temperature sensor can be replaced after removing the oven shroud.

WARNING Before proceeding, turn off the oven and let it and any heated zones cool down. Turn off the main power switch and unplug the power cord.

1. Remove the oven shroud as described in the Replacing the oven shroud assembly procedure in this section.
2. Loosen the two Torx T-20 screws securing the sensor retainer to the back of the shroud.

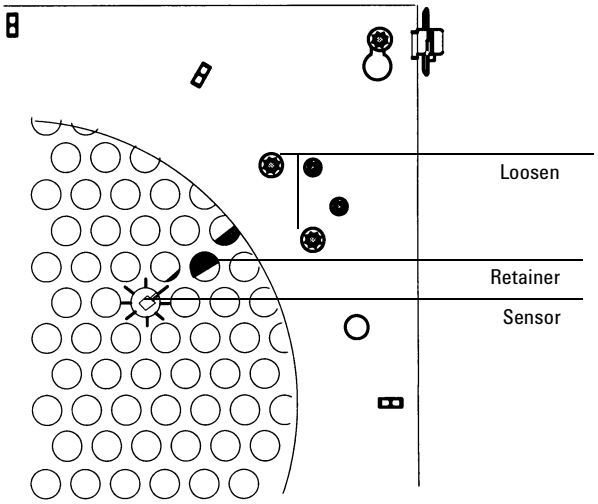

Figure 420-7 Removing the shroud

3. Slide the old sensor out of the retainer. Thread a new sensor through the opening in the rear of the oven.
4. Slide the new sensor under the retainer. One of the grill holes on the front of the shroud is stamped. Make sure that the end of the sensor is positioned behind the stamped hole before tightening the retainer.

Replacing the oven fan

WARNING Before proceeding, turn off the oven and let it and any heated zones cool down. Turn off the main power switch and unplug the power cord.

1. Remove the columns, column nuts and other hardware preventing access to the fan.
2. Remove the four Torx T-20 screws securing the fan shroud to the instrument and swing the left side of the shroud out towards you.

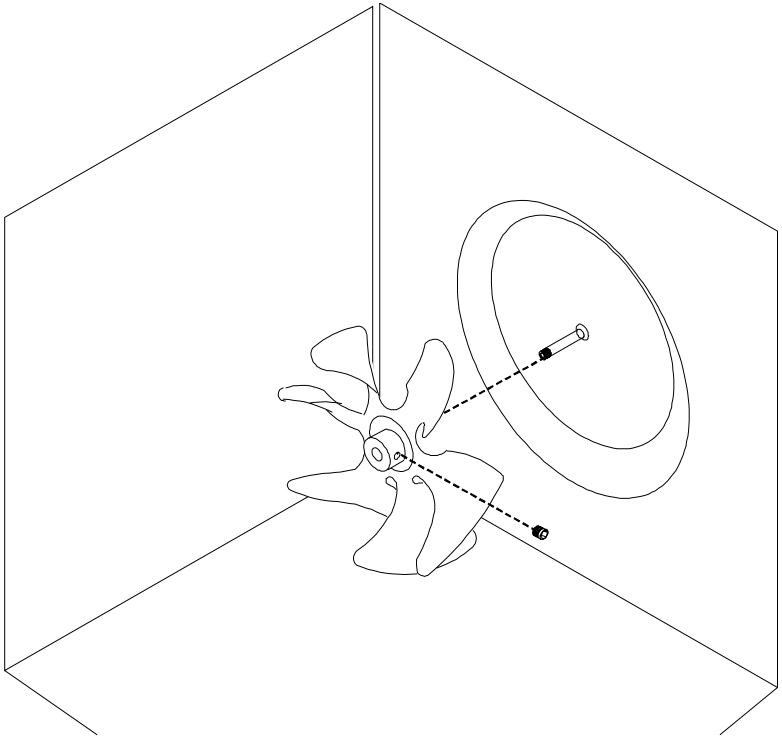

Figure 420-8 Removing the set screw on the oven fan shaft (inside oven)

3. Use a hex wrench to remove the set screw securing the fan to the motor shaft and carefully slide the fan off the shaft.
4. Reassembly is the reverse of removal.

   When installing the fan, position it so it is flush with the end of the shaft and the set screw seats on the flat part of the shaft. Check to make sure that the fan does not touch anything when rotated. If it does, reposition the fan on the shaft until the problem is corrected.

Replacing the oven fan motor

WARNING Before proceeding, turn off the oven and let it and any heated zones cool down. Turn off the main power switch and unplug the power cord.

Caution Make sure you are properly grounded with an ESD strap before continuing.

1. Turn off the GC and unplug the power cable.
2. Remove the fan as described in the Replacing the oven fan procedure earlier in this chapter.
3. Remove the rear covers from the instrument.
4. Unplug the fan motor wiring harness (P7) from the AC power board. Squeeze the tabs on the sides of the connector and pull directly up.
5. Locate and detach the fan motor ground wire using a 7 mm nut driver. It is secured to the chassis on the left side and below the fan motor as you face the rear of the instrument.
6. Use a 7 mm nut driver to remove the three nuts (and six associated washers) securing the motor to the oven.

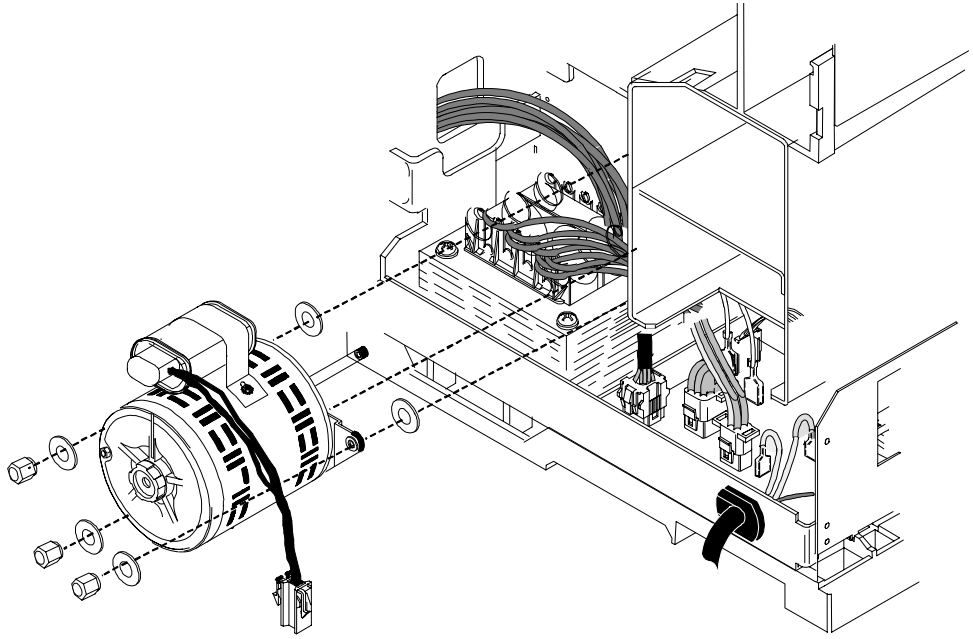

Figure 420-9 Removing the oven fan motor

7. Remove the fan motor.
8. Reassembly is the reverse of removal.

Replacing the oven flap motor

The oven flap motor regulates air flow out of the oven.

WARNING Before proceeding, turn off the oven and let it and any heated zones cool down. Turn off the main power switch and unplug the power cord.

1. Remove the left side cover and the rear covers to the instrument.
2. On the left side of the GC (when facing its front), disconnect the oven flap motor wiring harness from the main wiring harness.
3. Loosen the three Torx T-20 screws securing the flapper bracket to the instrument and lift it and the motor up and off the instrument.

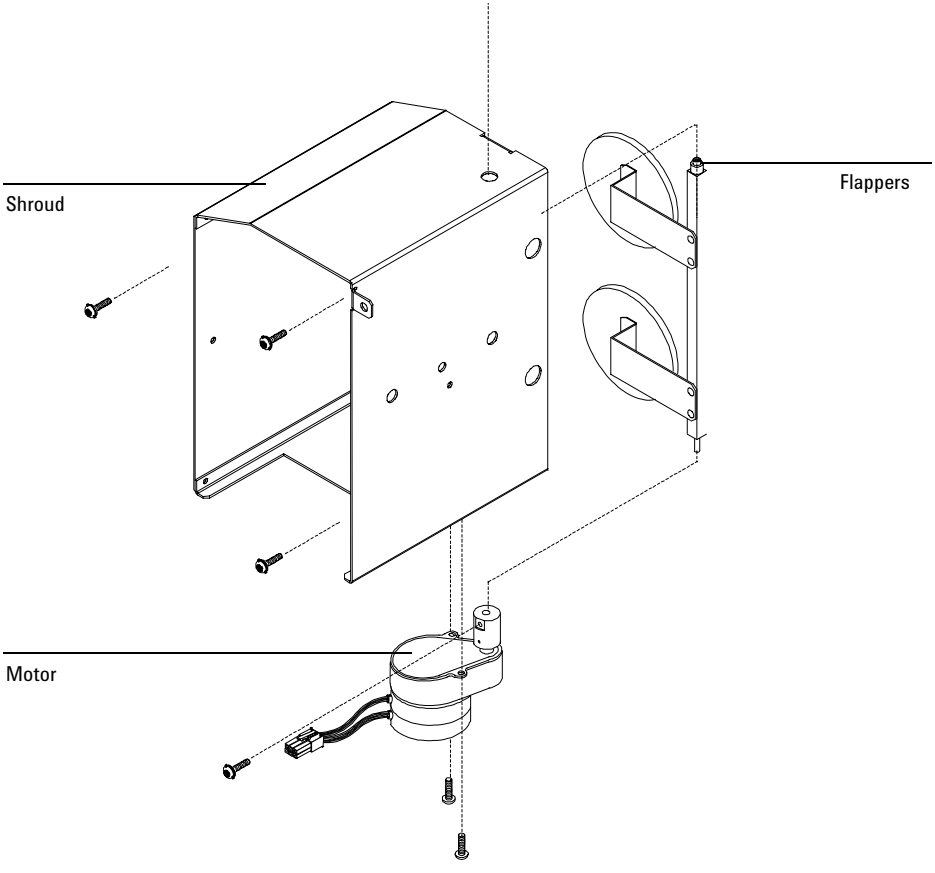

Figure 420-10 Removing the flapper assembly

4. Remove the two Torx T-10 screws securing the motor and flapper assembly to the bracket and remove the motor/flappers from the bracket.
5. Remove the Torx T-20 screw at the bottom of the flapper shaft near the flap motor and disconnect the motor from the flappers.
6. Reassembly is the reverse of removal.

Converting the oven type

A fast heating oven is standard with most 200–240 V power option GCs. A GC ordered for the United States, Canada, Switzerland, China, or Australia has the regular oven, unless it is ordered with the fast heating oven option.

The basic requirements for use of the fast heating oven are:

- The electric service must be capable of providing ≥ 200 V at ≥ 15 amperes.
- In the United States, the electric service must be 240 V.

To convert from a regular oven to a fast heating oven, or the reverse, these components must be changed:

- The oven heater (see Configuring the oven)
- Internal fuses (see section 1230)
- Power circuitry (see section 1230)

Configuring the oven

GC oven type will be properly configured at the factory. If you convert a regular oven to a fast-heating oven (or the reverse), and have the correct electric service installed, you must reconfigure the GC to use the new oven heater properly.

WARNING Do not perform this procedure unless your GC meets **all** of the criteria above. Changing the oven configuration at the keypad without making the proper hardware changes can damage your instrument and may create a fire hazard.

1. Press [Config], scroll to [Instrument], and press [Enter].
2. To change the oven type, press [.][.], then [Mode/Type].
3. Select the correct oven type (fast or regular), then press [Enter]